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

AUGUST, 1864.

MANUFACTURE OF TURPENTINE.

The great advance in the price of Turpentine—some six hundred per cent.—arising through the war in the neighboring States, from the seceded portions of which the main supply has heretofore been obtained, has led to many enquiries as to its production and best mode of manufacture from the turpentine pines of Canada.

In answer to some queries on this subject, a respected correspondent writes:—"I am not aware that turpentine is made in Canada, but, if it is, it must be either from our Larch (*Larix Americana*), called the Tamarack, or from the Red pine (*Pinus resinora*), often called improperly Norway pine, or from the Pitch pine (*Pinus rigida*). I believe our common pine (*Pinus strobus*), of which the timber is so valuable, has little resin or turpentine in it. * * * The Balsam fir—of which the well-known Canada Balsam is the product corresponding to turpentine—is common in the Newmarket district, and in various parts of Canada; but *where* the Canada Balsam is usually made, I have no information. *Pinus rigida* is found about here, and is very abundant in some parts of the country. *Pinus resinora* yields the timber known as red pine, and abounds in the north-west, I believe."

Gray, an American author, in his Manual of Botany, also speaks of *Pitch Pine* as being saturated with resin—another variety sometimes called Yellow Pine furnishing much less resinous timber; that the *Red Pine* is usually less resinous than the Pitch Pine, and that the *White Pine* is nearly free from resin.

The European turpentine is mostly made from the *Scotch Fir*, the American turpentine from the *Pinus Australis*, or "long-leaved pine."

Canada Balsam is occasionally sold in the shops as Strasbourg turpentine, and is used in medicine; also by opticians for mounting microscopic objects, and for other purposes. It is largely imported into the United Kingdom—the quantity in 1856 reaching 17,177 lbs.

The most important use made of spirits of turpentine, as described by Chevreuil, is as an ingredient in house-painters' colours—facilitating their application, diminishing the viscidity of the oily mixture, and allowing the painter greatly to modify the appearance of his work, by varying the degrees of gloss or of dullness, and preventing the appearance of cracks which would otherwise be visible when the work is varnished; but for all common purposes the painters generally now use petroleum naphtha instead, on account of its extreme cheapness as compared with turpentine.

So as to encourage parties to attempt the manufacture of turpentine, tar and resin in Canada, two prizes for each of these articles have been added to the prize list for the next Provincial Exhibition. We hope to see several specimens exhibited, if they can be manufactured here to advantage. There is no danger of the market in Canada being over-supplied, no matter how much may be produced. The trade returns for the Province show that in the year 1859 there were imported for consumption Resin to the value of $15,571; Pitch and Tar, $7,670, and Turpentine amounting to $34,518; the total of these three items alone thus amounting to no less a sum than $57,759—besides the large quantity entering as manufactured varnishes, and in other forms.

Prior to the war, the State of North Carolina produced annually 800,000 barrels of turpentine. Their mode of procuring the crude, as described in the New American Cyclopædia, is by cutting boxes or pockets in the trees near the ground, with a long, narrow-bladed axe made for the purpose. These boxes hold from one to three pints each, and are formed by giving the axe a downward stroke, the lower lip of the box being horizontal, and the upper arched, while the bottom is from three to four inches below the lower lip. From one to three boxes are made in each tree, according to its size. The sap runs only in warm weather. The boxes are cut from November to March, one man cutting from fifty to a hundred per day. The sap begins to flow freely about the middle of March, and is collected from the boxes by means of a peculiar ladle, and deposited in barrels. The sap soon congeals so as partially to close the cellular tissues of the wood, so that in order to renew the flow, new surface must be exposed once in eight or ten days, which is done by taking off a thin shaving from above the box. The flow of sap will of course commence considerably later here than in the Southern States. A turpentine forest in the South will with proper treatment last fifty years, when the timber is felled and cut up, and roasted in a kiln so as to produce tar, of which pitch is a concentration obtained by boiling.

The stills described as in use in North Carolina differ but little from the ardent spirits stills commonly used. Their capacity is generally from five to twenty barrels, and run through about double that quantity per day; that is, a twenty barrel still will run forty barrels of sap, producing six barrels of spirits of turpentine and twenty-three barrels of rosin. Except near the lines of communication, the rosin is not considered worth the cost of freight, and is left in congealed pools of thousands of barrels; but when the rosin is to be saved, it is drawn off into vats of water, by which the chips and rubbish contained in the crude turpentine are separated from the rosin, ere it is barrelled for market.

The turpentine business is considered favourable to health and longevity. The stills in North Carolina, of which there are about 150, cost on an average about $1,500 each—a cost much larger than they could be erected for in Canada. The process of distillation has to be carried on with great caution, consequent on the inflammable nature of the article.

The *Scientific American* of July 9th contains an article and illustrations describing a new process of making turpentine, in which the whole of the wood is subjected to distillation, and a larger immediate yield is obtained. The wood is here cut into lengths of from twelve to eighteen inches, and split in pieces one and a-half to two inches square. An iron skeleton basket is filled with these pieces, and placed in a retort and closed by the cover—the joint being luted air-tight to prevent the escape of vapor. A moderate fire is kindled in the furnace, by which the oil is evaporated and passes out through a pipe into a cask, where it enters the gas-holder. The cask is supplied with a current of cold water which condenses the vapor, and the uncondensable gases are led by another pipe into the furnace, and burned as fuel. A pipe passes down from the lower end of the gas-holder down into the lower condensor, where it is coiled in the form of a worm, and surrounded with cold water, to complete the condensation. The main condensor extends below the furnace, and terminates in a cone, a pipe being provided from thence to lead off the melted rosin. After the fire has been continued from six to ten hours, certain stop cocks are closed and others opened; the heat is now increased, and the remaining pitch is expelled from the wood in the form of tar, leaving the wood charred. The illustrations require to be seen to be thoroughly understood. We shall be glad to hear from any correspondents who may be able to furnish practical information on this subject. The discovery of any new industrial product, or of a profitable mode of manufacturing our known native products, adds real wealth and prosperity to the Province, and every available means should be used to this end.

BOARD OF ARTS EXAMINATIONS.

The last number of this journal contained a Report of the late Final Examinations of the Board. The results are not all that we could desire, but still they shew an improvement on the past year, both as to numbers examined and the subjects taken up, and afford sufficient encouragement to the Board to persevere until success shall finally reward their efforts.

In 1863 there were but seven candidates, five subjects of examination, nine papers worked, and seven certificates awarded. This year the number of candidates is seventeen, and twelve subjects have been taken up for examination. The number of papers worked has been forty, of which thirty-six have been successful in obtaining certificates—six first class, eleven second class, and nineteen third class.

These examinations were established, as expressed in the printed programme, to "encourage, test, attest and reward efforts made by the industrial classes for self-improvement." When a young man or young woman leaves school and enters upon the active duties of life, the studies previously engaged in are apt to be neglected, and finally forgotten, unless some stimulus to continuous exertion is provided; or the young person who has had no opportunities for early education, or, of the most rudimentary kind, needs some inducement to lead him to devote his spare moments—it may be after arduous and toilsome labours of the day—to the improvement of his mind, and to the acquirement of knowledge that shall be of practical value to him in after life. Here the Board steps in with its system of examinations, and through the medium of the Mechanics' Institutes, indicates the studies to be pursued, obtains the services of competent examiners, who prepare the papers for working in each respective subject, and finally award to the candidates such certificates of "excellence," "proficiency," and "commendableness," as the merits of their respective papers entitle them to; and so as to secure the utmost impartiality and fairness in making such awards, the examiners are in all cases entirely ignorant of the names, or residences of the candidates.

It is to be regretted that the financial circumstances of the Board do not allow of the awarding of prizes of an actual money value to the successful candidates, as is the case in connection with the examinations of the London Society of Arts, whose system is in other respects pretty closely followed.

We would fain hope that some of our men of wealth, having the interests of the industrial classes at heart, may follow the good example set by John McDonald, Esq., M.P.P. for Toronto, in founding a *Bursary* in Toronto University College for the benefit of the sons of working men, and endow a Board of Arts EXAMINATION FUND for the benefit solely of the working classes. We fully appreciate the generosity of Mr. McDonald in making the endowment above referred to, and in the name of the working men return him thanks; but liberal as the act is on his part, it is not calculated directly to benefit to any appreciable extent those who are intending to follow mechanical pursuits—the sons of mechanics studying the learned professions will be benefitted, but not mechanics themselves, as instances are rare indeed of Graduates of Universities following any of the ordinary industrial occupations.

An endowment of such an Examination Fund as is above indicated would directly reach the parties for whom intended, and lead to such a course of private studies, or to connection with Mechanics' Institutes evening classes—which are now with so much benefit being organized in some localities—as would gradually elevate the character and capabilities of our artizans, and redound to the credit and prosperity of the Province.

On the subject of evening class instruction, we remark that employers ought to manifest a more decided interest therein than they have been accustomed to do. A large proportion of the youths in their employment are ignorant of the rudiments of useful knowledge, and will scarcely ever become intelligent workmen or respectable members of society, unless some attention is paid to their mental improvement. We often find such youths allured to places of improper resort, or lounging at street corners smoking or chewing, and expectorating tobacco juice to the annoyance of all respectable passers-by, while opportunities to acquire such knowledge as is needful to fit them for the proper fulfilment of their duties, as connected with their respective occupations, are entirely neglected by themselves, and paid no attention to by those whose duty and interest it is to look after their moral and intellectual welfare.

We have already said that we regret the inability on the part of the Board to give money prizes. If it was enabled to do so, no doubt but class instruction and the Board examinations would be more successfully carried out than they have heretofore been; but even if money prizes were given, the certificates obtained by the candidates would, in most cases, be of the greatest *real* value to them. The mason, the carpenter, the painter, and many others, holding certificates in Geometry, Mensuration, &c.; the bookkeeper in the art of Bookkeeping; and the engineer or machinist in the principles and practice of mechanics, seeking employment from those not acquainted with their capabilities, will, when once the character of the examinations has become established, find these certificates a recommendation to places of trust and pecuniary profit.

In the year 1856 the number of candidates examined by the Society of Arts was 52; since that time it has been gradually increasing, and this year 1,540 papers have been worked out by 1,068 candidates. The certificates awarded were 236 first class, 479 second class, and 507 third class; papers for which no certificates were awarded, 318. The number of money prizes awarded in addition to the certificates was 55, amounting in all to upwards of £200 sterling, and varying in amount from £1 to the "Prince Consort's Prize of TWENTY-FIVE GUINEAS," given to the candidate who for four years has obtained the largest number of first class certificates. The ages of these candidates ranged from sixteen to forty-seven years—the largest number (181) being of the age of eighteen years. The number of different industrial occupations represented by the 1,068 candidates was nearly three hundred.

The following extracts from the Annual Address of the present Chairman of the Council of the Society of Arts, furnishes the history of the origin of these examinations, and also of the middle-class examinations of the Universities of Oxford and Cambridge:—

"In 1853, when a Committee was first appointed to inquire into the state of Industrial Education, there were but three great channels of instruction—our Universities, our middle-class boarding schools, and our national and British schools. There were no means by which the very large number of youths and young men who left school at 13 or 14 years of age, and became at once engaged in business, could test the knowledge they subsequently acquired by private study, or through which they could obtain such a public acknowledgment of their industry and their acquirements as would be practically useful to them in the race for employment and advancement in after-life. Every one who hears me—having his own experience to refer to—knows the great difficulty the young men to whom I have referred must always have had in obtaining knowledge—really sound and useful knowledge—either in the hour or two in the morning before going to business, or in the evening after business. Every one knows the temptations to be resisted, the pleasures to be sacrificed, and often the ridicule to be borne, to obtain the still greater, though not so immediate pleasure, of acquiring knowledge; and yet, until this Society led the way, supported in its difficult course by the aid and counsel of the Prince Consort, no Society or Institution existed which offered to young men from sixteen years of age and upwards, a wholesome stimulus to study, or gave them the means by which their industry, their perseverance, their self-culture, could be tested and acknowledged, and brought prominently before their friends and the public.

That this or some similar system for encouraging private study after leaving school had become absolutely necessary, from the universality of education, was never so apparent as now, when the attractions of sensation novels, worthless as vehicles for conveying wholesome instruction, if not absolutely injurious, by unduly exciting feelings and sentiments calculated to lower rather than to elevate the tastes and principles of their readers, and when the temptation to devote too much time in reading the interesting and varied information contained in the daily press is considered, information conveyed in so condensed and popular a form as almost to preclude reflection, and to lead involuntarily to the adoption of the views of others rather than to the formation of individual opinions, and the tendency of which is to discourage sound and systematic study—I say that with such inducements to desultory reading, any education entered upon voluntarily, to be followed by an examination, must raise the tone of mind, elevate the thoughts, give precision to their expression, whether in writing or verbally, and induce a correctness of reasoning and of analysis, which will produce most beneficial effects in after-life.

The efforts of the Society to obtain the sanction and co-operation of the public to this novel and voluntary system of education and examination, differing so entirely from anything previously attempted, were slow, but they were sure.

Three years were spent in maturing the plan, and it was not till February, 1856, that the first regular programme was issued, nor until June of the same year that the first examination was held. There were then only fifty-two candidates. Last year there were very nearly a thousand.

Such was the effect produced by these examinations, that strength was given to a suggestion of one of our examiners, that the Universities should do for the class immediately above those for whom our examinations were intended—that which we were so successfully doing in our special sphere—and the result was the establishment of the middle-class examinations of Oxford and Cambridge, success in which bids fair to be the test by which the value of the education obtained in the private schools of the country will hereafter be measured.

Many of the objections to competitive examinations among the higher classes of students, whether at the University or at the middle-class examinations, or at the examinations for civil or military appointments, do not apply to ours.

Cramming, which is now a profession, cannot be adopted by the candidates who appear before our examiners. In the first place, they cannot afford to pay for such a system, and if they could they are so spread over the country that it would be almost impossible, except in a few large towns, to obtain the necessary help; and I believe that the honours gained by our candidates must, as a whole, be more honestly won than those by any other class. The examinations are not entered upon to gain a particular position in college, or a particular office or promotion in military or naval life, by young men most of whom have more or less money at their disposal, but by those who hope to gain the notice of their employers by great sacrifices and severe labour after their day's business is over. Such men would mostly scorn cramming. They are seeking for a test of their voluntarily acquired knowlege, not simply for a pass to some place or for promotion. The effect is therefore greater; the merit is also greater; and, class for class, in the course of time the result will be greater.

I hope, then, without wishing to disparage the exertions of any other body, I have not unfairly endeavoured to maintain the claims of this Society to the honour of leading the movement for the voluntary examination of students anxious to secure some public acknowledgment of their industry and talent.

Turning now to another view of the subject, when we consider the influence that the upper stratum of the working classes exerts over the entire body, and that the working classes form the base of our industrial fabric, too high a value can scarcely be attached to every step which encourages them to attain by their own independent exertions, and from books of their own selection, an acquaintance with sound principles of political economy, which will influence their own conduct and enable them to influence that of others.

Differences between masters and workmen, originating mostly in ignorance and misunderstanding, will doubtless be lessened by a certain number of young men voluntarily submitting, year after year, to a difficult examination to test the extent of their self-education, and thereby becoming able to appreciate, to understand, and to explain to their fellow workmen the great social and economical principles on which their success depends. The accomplishment of these great objects has been for many years past the aim of our educational proceedings."

TO OUR SUBSCRIBERS.

It is nearly four years since the Board of Arts and Manufactures for Upper Canada determined upon issuing a monthly journal, devoted to giving publicity to the transactions of the Board, and to the advocacy of the Industrial interests of the Province; and also of the interests of its Mechanics' Institutes and similar associations calculated to benefit the industrial classes.

The news of the day, and all political questions, were abundantly provided for by our spirited newspaper press; the mere literary reader by the numerous magazines and journals imported from other countries; agricultural and horticultural matters by our Canadian and other agricultural publications; but of journals in the interests of arts and manufactures nothing was published in the Province, and very little brought here from abroad; nor was it likely soon to be provided by private effort, as the field was too small to warrant the investment of capital in the enterprise. The Board concluded that as it would incur but little additional expense on the ordinary outlay for management of its affairs, by publishing such a journal, it could be afforded at a very low rate of subscription; and therefore determined upon issuing it at 50 cents per annum to members of mechanics' institutes, and literary and agricultural societies, and $1 to private individuals. In 1862 the subscription price to private individuals was reduced, and a coloured printed cover was also added, with a hope that the circulation would thereby be increased to about 3,000 copies per month, and nearly cover the cost of publishing. These anticipations have not been realized, the circulation only now reaching about 1,200, and entailing a loss of upwards of $600 per annum —a sum much larger than the Board can afford to lose without impairing the efficiency of its free Library of Reference, its annual Examinations, and other legitimate objects. The Board had hoped that, considering the importance of the subject, the Legislature would have increased the annual grant by a small amount, so as not only to have enabled the Committee to have continued the improved form, but also to have added to its efficiency. This has not been done. For these reasons, and others not necessary here to mention, IT HAS BEEN DETERMINED TO DISPENSE WITH THE COLOURED COVER FOR THE FUTURE, and to continue to issue it in the form of the present number, which will still be a slight improvement on that in which the first volume was issued, in 1861.

WE ASK THE INDULGENCE OF OUR SUBSCRIBERS AS TO THIS CHANGE—every number will even now cost the Board at least one-fourth more than is charged for it; and, moreover, we have no hesitation in saying, that we do not believe another so cheap a publication of a similar kind is issued in our language, or that a greater amount of valuable information for practical men, original and selected, can be found within the same number of pages of any other periodical. The Board desires this should be so—its object is not to make money by publishing, but to furnish valuable matter selected principally from British and foreign mechanical and scientific journals, of such a kind as can in no other way be obtained by our Canadian readers, except by means of an annual outlay of from one to two hundred dollars.

The *Journal* will hereafter be issued on the first instead of the fifteenth of each month, as heretofore. We shall continue to use the greatest care in making selections for its pages, so as to render it as practically useful as possible: *Patent Laws*, *Useful Receipts*, *Machinery and Manufactures*, *Practical Memoranda*, and *Statistical Information*, will each continue to have a due share of attention, while articles on *Sanitary Matters* and the laws of health, so important to all, and especially to the mechanical and labouring classes, will not be neglected.

Articles or correspondence on any new or important branch of manufactures, or on any raw materials the produce of the Province that may be suitable for manufacturing purposes, or of any new or useful invention or discovery relating to arts and manufactures, will be gladly received, and are hereby solicited for the Journal.

Woodcut illustrations and descriptions furnished by inventors or others are at all times acceptable, and will be published free of charge.

Any information required by parties living out of Toronto, that can be obtained from the Library of Reference belonging to the Board, or that may from any other source be within our reach, will be cheerfully given.

In *fine*, we solicit an increased interest in the Journal and its objects.

AGRICULTURAL ASSOCIATION BY-LAWS.

Notice is hereby given that at the next Annual Meeting of the Agricultural Association, the council will propose the amending of clause fifteen of the By-Laws, so as to give a fixed number of *Single Admission* Tickets to members, instead of *Season* Tickets.

HUGH C. THOMSON,
WM. EDWARDS, } *Secretaries.*

Board of Arts and Manufactures FOR UPPER CANADA.

MEETING OF COMMITTEE.

The Regular Meeting of the Executive Committee was held on the 28th of July. Present:—The President (Dr. Beatty), the Vice-President (Rev. Prof. Hincks), Professor Buckland, J. Shier, E. McNaughton, W. H. Sheppard, H. E. Clarke, and H. Langley.

After reading of minutes and consideration of miscellaneous correspondence and accounts, the Committee on Examinations submitted their Report, embracing details of number of candidates, &c., found in other pages of the *Journal*, and referring to gratuitous services of the Examiners; also reporting that a form of Certificate of Letter post size, is in course of being engraved and printed on parchment, which is proposed to be given to each successful candidate, for pocket reference. The Committee also reported a design from Mr. R. C. Todd, for a large Lithographed Certificate, which it is proposed to present to candidates obtaining First and Second Class Awards, in addition to the smaller certificate.

The report was adopted.

It was moved by Mr. McNaughton, seconded by Mr. Shier, and *Resolved*—That the Secretary be directed to convey the thanks of the Board to the several gentlemen who have kindly given their gratuitous services as Examiners, in connection with the late FINAL EXAMINATIONS of the Board.

It was moved by Mr. Sheppard, seconded by Mr. Shier, and *Resolved*—That Mr. Langley be added to the Examination Committee, in place of Professor Hind, who is now absent from the city; and that said Committee be requested to report a programme of examinations for 1865, at next meeting of this Committee.

It was moved by Mr. Sheppard, seconded by Mr. Shier, and *Resolved*—That the design of certificate just submitted be adopted, and lithographed at an expense not to exceed fifty dollars (in addition to cost of design); that one hundred copies thereof be printed, and the stone purchased, to be the property of the Board.

The subject of commencing a School of Design during the coming fall was introduced and discussed, when

It was moved by Mr. Shier, seconded by Mr. McNaughton, and *Resolved*—That Messrs. Sheppard, Clarke and Langley be a Committee to consider the practicability of establishing a School of Design in connection with the Board, and to report to the next meeting of this Committee.

The meeting then adjourned.

W. EDWARDS, *Secretary.*

ALPHABETICAL LIST OF THE PRINCIPAL ENGLISH PUBLICATIONS FOR THE MONTH ENDING JUNE 30.

Blanquart-Evrard (M.) on Intervention of Art in Photography, 12mo	0	1	6	*Low.*
Coke (Chas. A.) Population Gazetteer of England and Wales, sm. 4to, sd	0	2	6	*Harrison.*
Conington's Tables for Qualitative Analysis, 2nd edit., sq. cr. 8vo	0	2	6	*Longman.*
Fairbairn (Wm.) Two Lectures on Iron, and its Application to Manufacture, 8vo	0	1	0	*Lambert.*
Grammar (The) of House Planning: Hints on Plans of Cottages, &c., sm. cr. 8vo.	0	5	0	*Fullarton.*
Herschel (Sir John F. W.) Outlines of Astronomy, 7th edit., 8vo	0	18	0	*Longman.*
Lund (Thos.) Commercial Euclid; or Geometry as a Science, 2nd edit., 12mo	0	2	0	*Longman.*
Parnell (G. F.) Superficial Ready Reckoner for Casemaker's, Packers, &c., 8vo	1	1	0	*Simpkin.*
Popular Treatise (A) upon the Science of Optics, fcap. 8vo	0	2	0	*Whittaker.*
Scheerer (T.) Use of the Mouth Blowpipe, edit. by H. F. Blanford, 2nd ed., fcp. 8vo.	0	2	5	*Williams & Nor.*
Strickland (C. W.) on Cottage Construction and Design, 8vo	0	7	6	*Macmillan.*
Sutton (Thos.) Instantaneous Dry Collodion Processes, 12mo	0	2	0	*Low.*
Theory (The) of the Exchanges, Bank Charter Act, 1844, 8vo	0	10	6	*Newby.*
Weaver (Henry) Hints on Village Architecture, roy. fol., red to	0	10	6	*Spon.*
Whewell (Wm.) Astronomy and General Physics, new edit., fcap. 8vo	0	5	0	*Bell & Daldy.*

Notices of Books.

"TREATISE ON MILLS AND MILL WORK." Part I. on the principles of mechanism and prime movers, &c. Part II. on machinery of transmission, and the construction and arrangement of mills, &c. By William Fairbairn, Esq., C.E., LL.D., F.R.S., F.G.G., corresponding member of the National Institute of France; of the Royal Academy of Turin; Chevalier of the Legion of Honour, &c. London: Longman & Co.

There are very few men now living who could do that ample justice to the subjects here treated of, which makes this work so safe and reliable. Like all the author's other written works it is the result of his own actual experience; and never, perhaps, was there a more zealous and indefatigable labourer in the field of applied science.

These volumes give us an admirably written chapter on THE PRINCIPLES of mechanism, treating in the most lucid manner of general views relating to machines, elementary forms, link work, wrapping connectors, wheel work, motion by rolling contact and by sliding contact. This chapter has been furnished at the author's request by Mr. Thomas Tate, and we do not know where to find so much useful matter in so small a space. It is equally worth the attention of the tyro and of his master.

Next follow five chapters on PRIME MOVERS, on which we have the best information on all kinds of water-wheels and turbines, and so much of "hydronamics as relates to the measurement of the discharge of water and the estimation of water power, as it is necessary they should be understood by the practical millwright, in order that he may be at no loss in comparing the various forms of water machinery, calculating their power and proportioning them to their position and work." There is also a great deal of most useful tabulated matter, and some valuable plates. In this country water as a motive power is not likely to be superseded by steam, hence it is important for us to know how to construct the proper machinery for using it upon the best principles for securing *a maximum effect*, and in this the author has left us little to desire. The remaining portion of the volume treats of "the properties of steam," the results of elaborate researches prosecuted chiefly by the author; also the form, power, and strength of boilers, plans for preventing smoke, varieties of stationary steam engines, adapted for all kinds of mill purposes, in all conditions of manufacture to which they are applied, with various illustrations of the best known for those purposes. To conclude, we have a short treatise on windmills, and an appended table of experiments on Thompson's VORTEX WHEEL.

In this volume the author tells us he has "endeavoured to give a succint account of nearly fifty years experienced in the profession of a mill architect, millwright and mechanical engineer."

The first three chapters of volume second are devoted to the most interesting subject of the transmission of motion, containing, we should think, all that can be known on gearing, as pitch, strength, construction of spur, and bevel gear; resistance of shafting to pressure, torsion; coupling, shafting, engaging and disengaging gear; connections for conveying motive power to a distance from the prime movers; stopping and starting machinery without detriment to or interference with other machinery, complete lubrication; journals, transmission of power to machinery at obtuse angles by the universal joint. Mill architecture, Seraskier Halel Pacha's mill, and all kinds of mills, whether for corn, textile fabrics, oil, paper, powder, or iron, are treated of in the fullest and most satisfactory manner. Their various processes also are described, altogether making this a work of rare value. In an appendix we have the process of woollen manufacture, and armour plate manufacture. Mill owners, and those who use machinery, will find it greatly to their advantage to keep this book by them as a reliable guide in all matters on which it treats.

Professional men are too well acquainted with the name of Fairbairn to be without it. All who are within a convenient distance can peruse it in the Free Library of Reference of the Board of Arts and Manufactures.

William Fairbairn was born in Kelso, in 1789, and brought up as a mechanic at Newcastle upon Tyne. He commenced business in partnership with Mr. Lillie, in Manchester, in 1817. Possessing a mind deeply imbued with a love of science, and a mental organization eminently qualifying him to excel in his vocation, it is not surprising that in a very short time the firm was recognised as one of the first in the place. In 1836, after six years of experiment, he began building iron ships. In 1837 he read to the British Association for the Advancement of Science, of which he was one of the earliest members, an elaborate report on the comparative strength and other properties of cast iron manufactured by the hot and cold blast respectively, the result of his experiments on fifty different sorts of iron. In 1840 we find him reading another paper on iron plates for shipbuilding. In 1847 he completed and patented his "method for constructing hollow wrought iron beams suitable for mills, factories, dwelling-houses, bridges, &c." Mr. Robert Stephenson, believing him to be unequalled in his knowledge of iron, requested him to undertake the experiments preparatory to his building the great Tubular Bridge across the Menai Straits, which, happily for the interests of science, he consented to do; if he had not, the great practical sagacity of Stevenson would hardly have saved that stupendous work from being constructed upon erroneous principles. With Mr. Hodgkinson as his coadjutor, those laborious experiments—watched over by Mr. Stephenson's secretary—were followed up with patient perseverance until the most satisfactory conclusions were arrived at, and the form and other features of the bridge determined.

Thus was laid a secure basis for all future architecture in iron; and numerous iron bridges subsequently erected, iron ships, and other structures of that material, attest its soundness. Brunel found it ready to his hand, and to it the *Great Eastern* owes her prodigious strength.

"The construction of vessels exposed to *severe strains*" was the subject of a most important paper read to the British Association in 1851, containing the results of experiments on malleable iron plates, beams, and angle irons. In these experiments the plates were literally torn asunder, first in the direction of the fibre, and then across it. Perhaps no man has done more towards perfecting steam-boilers, and to him the Manchester association for the prevention of steam-boiler explosions owes its origin. For nearly half a century he had been sedulously and most successfully employed in promoting the arts of peace, and when "wars and rumours of wars" came he was prompt to contribute to the defence of his country. Iron ships of war, and their armaments, occupied much of his attention. Indeed, there are very few of the great works of the present century which do not owe something, directly or indirectly, to the genius of William Fairbairn. Whatever book relating to applied science we take up, we are almost sure to find him quoted as an authority. He has contributed voluminous and highly important papers to several scientific associations, and has been rewarded by the highest honours they could bestow.

The admirable architectural adaptation of mill edifices to the purposes for which they are designed was so apparent in the numerous factories erected according to his designs, that it was deemed requisite to secure his services as member of the Building Committee for the last International Exhibition building in London, of which, by request, he wrote a description.

Useful Receipts.

Fusible Metal.

1. *Newton's.*—8 parts bismuth, 5 lead, 3 tin; mix. Melts at 212°.
2. *Rose's.*—2 bismuth, 1 lead, 1 tin. Melts at 201°.
3. *Onion's.*—5 bismuth, 3 lead, 2 tin. Melts at 199°.
4. *Walker's.*—8 bismuth, 5 lead, 4 tin, 1 antimony. For electrotype casts.

All the above are rendered more fusible by adding a little mercury to them.

Gold Lustre for Stone-ware.

Gold, 6 parts; aqua regia, 36 parts. Dissolve: then add tin, 1 part. Next add balsam of sulphur, 3 parts; oil of turpentine, 1 part. Mix gradually in a mortar, and rub it in until the mixture becomes hard; then add oil of turpentine, 4 parts. It is then ready to be applied to a ground prepared for the purpose.

Glazes.

Common earthenware is glazed with a composition containing lead, on which account it is unfit for many pharmaceutical purposes. The following glaze has been proposed, among others, as a substitute: 100 parts of washed sand, 80 of purified potash, 10 of nitre, and 20 of slaked lime; all well mixed, and heated in a blacklead crucible, in a reverberatory furnace, till the mass flows into a clear glass. It is then to be reduced to powder. The goods to be slightly burnt, placed under water, and sprinkled with the powder.

Glaze for Porcelain.

Feldspar, 27 parts, borax 18, Lynn sand 4, nitre 3, soda 3, Cornwall china clay 3 parts. Melt together to form a frit, and reduce it to a powder, with 3 parts of calcined borax.

Glues.

Glue is the evaporated solution of animal skins. Ox hides, &c., are cleared from foreign matter and prepared for boiling; they are then dissolved by steaming or boiling, and the clear liquor being evaporated and cooled in wooden boxes, is cut with a wire, and dried on nets spread to the air.

Portable Glue.—Glue 1 lb., melt with water, add brown sugar ½ lb.; boil till thick, and when cold divide it into moderate sized pieces. Damped with the mouth, it serves to glue paper, &c., or it will dissolve in warm water.

Liquid Glue—A solution of shellac in naphtha, made as French polish, has been vended under this title. It is also called Chinese cement. Used to piece wood, glass, china, &c.

Marine Glue—Dissolve by heat 1 part of India rubber in naphtha, and when melted add 2 parts of shellac; melt until mixed. Pour it while hot on metal plates to cool; when required for use, melt and apply with a brush. A strong cement for wood, which is said to rend anywhere else rather than at the cemented part.

Solvent for old Putty and Paint.

Soft soap mixed with solution of potash or caustic soda, or pearlash and slaked lime mixed with sufficient water to form a paste. Either of these laid on with an old brush or rag, and left for some hours, will render it easily removable.

Watchmaker's Oil, which never Corrodes or Thickens.

Take olive oil and put it into a bottle, then insert coils of thin sheet lead. Expose it to the sun for a few weeks, and pour off the clear oil.

Gutta Percha.

Gutta-percha is much used in the Arts. It is soluble to some extent in coal-tar, naphtha, or turpentine, and completely so in benzole, chloroform, and bisulphuret of carbon. The first two solvents are used for applying it to boot-soles, as a paste, the others for more exact purposes. Medals are formed by pressing gutta-percha between dies, after dipping it in boiling water to soften it. In the same manner it has been used to copy printing type, and the gutta-percha afterwards had a copper fac-simile electrotype on it. For wood and metal cuts this is an easy mode of taking copies, as the copper imitations are very durable. It is very useful for taking impressions of medals, &c., for electrotyping, and is used for this purpose by amateurs.

Impressions of Medals, Casts, &c.

Make a composition of mutton suet 7 parts, white wax 7 parts, and spermaceti 32 parts. Melt the whole and pour it on the cast warmed. On cooling, the impression is found to be perfect, and may be electrotyped.

To Petrify Wood, &c.

Take equal quantities of gem-salt, rock-alum, white vinegar, chalk, and pebbles powdered. Mix all these ingredients; there will happen an ebullition. If, after it is over, you throw into this liquid any porous matter, and leave it there soaking four or five days, they will positively turn into petrifactions.

Coffee, a Preservative of Milk.

M. Berthond writes that exactly a year ago a chemist, a friend of his, in his presence placed three vessels on his window-sill, two containing pure milk just drawn before their eyes, and the third having equal parts of the same milk and black coffee. The vessels were covered with little boards to prevent the dust from falling upon the liquids, and before the end of the day the pure milk had turned, while the mixture of milk and coffee remained in the same state. At the end of the year, that is a few days ago, the vessels were again examined, when those which had contained pure milk were found covered with all kinds of mouldy vegetation, without a trace of milk or caseous substance in them, while the milk and coffee not only presented no change of appearance, but had exactly the same taste as when fresh.

To Keep Honey.

M. Sands, Orange county, N. Y., directs to heat strained honey to the boiling point, and store it in covered jars, where it will keep without candying. To prevent danger of burning, set the vessel in which it is to be heated into another containing water.

Selected Articles.

PRINCIPLE OF IMITATION AS APPLIED TO THE DECORATIVE ARTS.

By Thomas Purdie, Esq.

The reaction which, within the last thirty years, has set in and run with so strong a current in favour of mediæval architecture has been accompanied by a taste for a similar style in furniture and decoration, in painting and in the forms of worship. The question of rituals is altogether foreign to our province. Nor is it my purpose, in the remarks which I have to bring before the Society of Arts, to discuss the relative merits of Classic and Gothic architecture, of post or pre-Raphaellitism in painting. It seems to me that no man can be a faithful apostle, or even a true loving disciple of art, until he has become truly catholic in his taste and tolerant in his practice; until he has seen the vision of the sheet descending from above, and is prepared to find beauty as well as pleasure in every style of art which has exercised the taste, the skill, and the ingenuity of man. But as the waves raised by this eruption of mediævalism into our times have flowed in ever-widening circles, over the feelings of the age, they have left their impress on objects which, *à priori*, no one could have expected they would reach. In the discussions which of late years have been carried on, on the subject of art, language has been perverted from its original meaning, ethics and æsthetics have been jumbled together, bad taste has become confounded with moral turpitude, stucco, when employed to decorate the exterior of a building, is denounced as an unprincipled sham; an ornamental casting as a falsehood, because it may resemble a carving; a composition or painted imitation of a wood or a marble, as a downright and inexcusable lie.

It is my object, by a candid examination of the subject, to try to educe some principle,—to ascertain in what cases ornamental castings and composition or painted imitations of material may be employed, without infringing the laws of propriety or good taste; or whether the use of such appliances belongs to the same category and is to be subjected to the condemnation generally awarded to such practices as the wearing of false jewellery, or the restoring by means of rouge the tints of the faded beauty.

As the text of the present discussion, and as representing that view of the question from which, after a full and I trust a fair consideration, I venture to differ, I shall quote one or two passages from a celebrated author, who is generally considered one of the soundest art-critics of the day. Between the principles of mediævalism and the practice of those imitative arts which shall come under our notice there is no absolute or necessary antagonism. I trust therefore, it may not be supposed that in supporting the one I must be held as condemning the other. In urging the toleration of certain decorative appliances, I yield to no one in admiration of the glorious structures of the middle ages, in which our forefathers have left—in a fossil form, for the study of the geologists of history,—a record of the taste, the spirit of self-sacrifice, and the religious sentiments of the age in which they lived. Indeed, it will be found that I shall arrive, in numerous instances, at the same practical conclusions with my opponents, although we may have taken different roads to get there.

Touching the false representation of material, says the talented author referred to, in one of the eloquent denunciations for which he is famous, "The question is infinitely more simple and the law more sweeping; all such imitations are utterly base and inadmissible. It is melancholy to think of the time and expense lost in marbling the shop-fronts of London alone, and of the waste of our resources in absolute vanities, in things about which no mortal cares, by which no eye is ever arrested, unless painfully, and which do not add one whit to comfort, or cleanliness, or even to that great object of commercial art—conspicuousness. But in architecture of a higher rank, how much more is it to be condemned. I may perhaps be permitted," he continues, "while I express my sincere admiration of the very noble entrance and general architecture of the British Museum, to express also my regret that the noble granite foundation of the staircase should be mocked at its landing by an imitation, the more blameable because tolerably successful. The only effect of it is to cast a suspicion upon the true stones below, and upon every bit of granite afterwards encountered."

And again, at another part of the same book:—

"The worth of a diamond is simply the understanding of the time it must take to look for it before it is found. Exactly as a woman of feeling would not wear false jewels, so would a builder of honour disdain false ornaments. The using of them is just as downright and inexcusable a lie. You use that which pretends to a worth which it has not; which pretends to have cost, and to be, what it did not, and is not—it is an imposition, a vulgarity, an impertinence, and a sin. Down with it to the ground, grind it to powder, leave its ragged place upon the wall rather; you have not paid for it, you have no business with it, you do not want it. Nobody wants ornaments in this world, but everybody wants integrity. All the fair devices that ever were fancied are not worth a lie. Leave your walls as bare as a planed board, or build them of baked mud and chopped straw, if need be, but do not rough cast them with falsehood."

I cannot agree with those who think there is no force in these arguments. They seem at first sight not a little convincing; and, coming to us with the sanction of a great name, they would have been worthy of our best attention, although they had been possessed of no other claims. But I believe that they are fallacious notwithstanding.

It will be observed that the sin is held to lie in the deception. I shall not be suspected of an intention to argue that there is no harm in a moral deception, but it may perhaps be asked on what authority the principles of ethics are in this case applied to æsthetics. The principles of ethics are founded (leaving revelation out of view) on the primary convictions of mankind, and I may assume that no one will commit the absurdity of claiming for æsthetics a higher authority. The very fact, then, that these imitations are so generally used and so much admired among an educated and a moral people, certainly affords the strongest possible presumption in their favour. As these primary convictions mainly lead men in the paths of morality, it is surely a sound conclusion that they cannot lead us far or permanently wrong, where any essential principle is involved, in matters of taste. But we shall pass from this point, and ascertain, as careful judges ought to do, on what side the best precedents can be quoted.

Now it is not unusual in disputed questions of taste—which means of course in all questions of taste—to appeal to the authority of the ancient Greeks, as the court of last resort, and I should be sorry to depart from a custom which, if not yet venerable from its antiquity, had at least the merit of being the fashion, until the taste for mediævalism to some extent supplanted that for classic art. In appealing to them we may congratulate ourselves, and perhaps the ancient Greeks too, that they do not live in modern times, for one of two things must have been the result of such a misfortune:—either we should have wanted that authorative tribunal—the wisdom of our ancestors —before which we could bring our cases for ultimate decision, or they, the ancient Greeks, must have left the Court of Chancery altogether destitute of a reputation.

Did the Greeks then allow the principle of deception in art.

It is recorded of Zeuxis, one of the greatest painters of ancient times, that the birds came and pecked at the fruit on his canvass, while one of his rivals asserted that the boy who held the basket could not be equally well painted, else the birds would have been frightened away; of Apelles, that he painted horses so truthfully that animals of their own species greeted them by neighing. Whether these stories be more worthy of belief than that of Arion and his Dolphins, we know not, but the fact of their being related, sufficiently proves that the wonderful people whose support we claim were not less alive to the power of painting than of music, and that the deceptive character of the former was reckoned one of its chief merits. In a trial of skill between Zeuxis and Parrhasius, the victory was adjudged to the latter, when his opponent, entering his studio, desired him to withdraw the curtain behind which he supposed his rival picture was concealed, the curtain itself being the picture; and Zeuxis gracefully acknowledged his defeat, saying his own picture had merely deceived birds, while the other had deceived men.

But we can appeal to an authority which many will regard with greater veneration than that of the ancient Greeks. Ornamental castings in bronze, iron, and other materials were universally employed during the middle ages, while the first use made of oil painting after its discovery in the early ages of the Christian era was to paint imitations of marble.

The work of Heraclius, a compendium of the arts as practised previous to his time, is supposed to have been written in the seventh century. In it we find elaborate instructions for preparing the surface of columns, and painting them in imitation of marbles, as if, too, this were the only artistic use to which the oil vehicle could be applied. In fact, precedents of all ages may be adduced to sanction the practice which our modern authors condemn. But it is not enough that we produce strong presumptive evidence, however conclusive that may be, in support of our views. Nor is it enough that we can appeal in their support to the practice at once of ancient and modern times. We must also show that they are just in themselves or that they rest on right principles. This we propose to do by the following method:—

1st. We shall shortly advert to that love of imitation in which the fine arts have their origin.

2nd. We shall state some cases in which deceptive imitations are admissible, as contrasted with those of a different class.

3rd. We shall name the qualities which give value to decorative appliances, and illustrate the subject by showing how far some of these fulfil the conditions required of them.

4th. We shall conclude by pointing out and illustrating the conditions which ought to regulate the use of surface coatings.

First, then, as to that love of imitation which lies at the root of the fine arts. All decorative art may be divided into three kinds with reference to its subjects, or the mode in which they are treated.

1st. The geometrical.
2nd. The conventional.
3rd. The purely imitative.

Examples of the first-class are to be found connected with every style of architecture. Almost all moresque ornamentation is geometrical, and the Greek fret may be named as affording an example of the style.

The second-class, or conventional, takes its place mid-way between the other two. It is imitative after a fashion, through which—although natural forms are not directly imitated—the spirit of the form imitated is retained, as a melody in music, in the variations which are composed upon it. The most perfect examples of conventional ornament are, perhaps, the lotus of the Egyptians, and the honeysuckle of the Greeks. All architectural ornament may be said to be either geometrical or conventional, or a combination of the two.

The third, or a purely imitative art, includes the painting of the human figure, of landscape, fruit, flowers, and all cases in which a direct representation of the object is attempted.

We cannot afford time to treat this subject fully, nor have we anything to do in the present discussion with geometrical or conventional ornamentation. Our attention will be restricted to the 3rd class which we have named, as it is only in the exercise of purely imitative art that the questions now proposed for discussion can arise.

To make a great artist, the head, the heart, and the hands must combine. He must be possessed of the three great qualities which give power over the imagination, the emotions, and the understanding. He must be possessed, first, of imagination or fancy, the power which creates, invents, or suggests, which is common to the painter, the poet, and the sculptor. Second. He must possess a sympathetic nature—that power of sympathy which teaches the heart to vibrate in unison with the true, the beautiful and the good. In simpler language, he must be possessed of taste, which has been well styled the science of the emotions, a faculty which—according as it is considered passive or active in its nature—signifies on the one hand susceptibility to the emotion, on the other, the knowledge intuitive or acquired, of those qualities in external things which are fitted to excite it in others. Third. He must possess technical knowledge and skill to enable him to express by means of form and colour the ideas which the mind has conceived. Now these three qualities of imagination or fancy, taste, and executive skill, must be found, less or more, in every work of art. Not equally.

It is not only in the highest rank of art, where human life is the subject and human form the mode of expression, that the highest faculties of the artist are called into exercise. This rank is the highest, for the simple and obvious reason that it does so employ these powers that it deals with the noblest subjects, and addresses itself to the most profound emotions of the human mind. It is in the field which these faculties open to us that art must operate if it is to assist in the great work of cultivating the intellectual powers or the moral sentiments, and in reaping the rich fruit they are calculated to bear.

But at the root of all art lies the love of imitation. To this feeling the fine arts owe their existence. Without some notice of it, therefore, it seems, no theory of the fine arts could be perfect. This love of imitation, or of representing objects by their images, whether exemplified in the tendency to imitate or in appreciating works of imitative art, is, no doubt, an original powerful sentiment or instinct of our minds. We love imitation for its own sake—not only as a means but as an end. Apart from and beyond the pleasure which we receive from such an object, for example, as a portrait, in recalling the features of the "distant or the dead, the loved or the lost," there is a pleasure in observing the resemblance between the original object and its image; a pleasure which may be traced to the same source, whether it be found in poetical imagery, in a dramatic representation, in a picture, a statue, or a simple imitation of marble.

But this love of imitation is not always associated with the highest qualities of the mind. It may be indulged in numerous instances where no original idea is expressed, or where that idea is to be found in the subject of the imitation. All such examples employ the mechanical more than the intellectual powers, and cannot therefore rank so high as works of art. They do not suggest great thoughts, but they may possess great beauty, and they may yield a rational pleasure in suggesting interesting relations between the imitation and the thing imitated.

Now, this imitation in the fine arts must be distinguished from reproduction, as well as from imitation effected either by organic or mechanical means. One receives no impression of beauty from the resemblance which the apples on a tree bear to each other. Nor would he be struck by seeing a table with a vase on it reproduced by another table and another vase. But let a painter produce these objects on his canvass, they would receive a new virtue, which, to use a popular phrase, would attract and please the eye. Where the deception is complete the pleasure is gone, because there is no image—nothing to judge of—nothing to compare.*

Having thus indicated what imitation in the fine arts means, we come, as proposed under our second head, to state some cases in which deceptive imitations are admissible as contrasted with others which belong to a different class.

But I must first explain that when, in the course of this discussion, I employ the terms deceptive or deception, they must be understood in a qualified, not an absolute, sense. Where an object is an actual deception, it can obviously afford no pleasure as a work of art, although it may give pleasure from its intrinsic beauty. Suggestion, not deception, is the object even of that art which is purely imitative. Some objects, however, admit of, or demand, more perfect imitation than others.

We purpose now to test, by a few illustrations, how far we are justified in making these imitations actually deceptive in their character, or so deceptive as to produce an illusion.

Such deceptions in that highest art which adopts human life for its subject, can scarcely be said to be possible, and so far as possible would, if practised, meet with universal reprobation. The technical and merely imitative elements would be found to obtrude themselves offensively in works where they ought to be kept in a subordinate position. But there are other and more palpable reasons for our dislike. You cannot certainly imitate a living, breathing, sentient being so as to deceive permanently, but you may succeed in producing a momentary illusion. You may model a figure in wax to imitate, with tolerable exactness, the human form and features. You may colour the skin. You may cover the lay figure with clothes. The finely-moulded contour may charm for an instant, under the belief that you look at real flesh and blood. You approach—you touch—the spell is broken—"you start, for soul is wanting there." It is a corpse—a coloured piece of corruption. This is no subject for a vulgar deceptive imitation truly. The nearer the approach made to the reality in such instances, the more offensive. Our dislike to such objects is founded on the same principle of

* See "Essai sur l'Imitation dans les Beaux Arts;" By Quatremère de Quincy.

our nature which makes us consider the ape as the ugliest of animals, because it most resembles man. The wax figure is too like life, for it only awakens a painful sense of its absence.

The general condemnation awarded to coloured statuary, although partly due to habit and fashion, may be attributed to the feeling called forth by the test which we supply. A deceptive imitation should not be attempted where, from the nature of the thing, or the impurity of the material, it cannot be rendered perfect. I may mention, as examples of this principle, the coloured friezes in the Greek court of the Crystal Palace; the coloured carved Madonnas one meets in all Roman Catholic countries, with which few of our countrymen will be found to sympathise. I can hardly exclude from the catalogue the tinted statuary shown at Kensington in the late exhibition. Of course no attempt was made with these statues to imitate nature, but what was done, if not a step in that direction, seemed to reduce the marble to the level of wax. No doubt there are other reasons for the feeling which we assume to exist, of which two may be stated. 1st. The colouring of statuary is an application to one art of the resources which properly belong to another; and 2nd, Sculpture has held the highest place in art because it appeals to intellect alone and not to the senses. The colouring of statuary, by introducing a sensual element, at once degrades it from its high position. We not merely tolerate, but admire statuettes in china coloured to the life with tolerable exactness. These, however, cannot produce an illusion, so there is no chance of their creating the feeling of disgust engendered by wax figures.

But this disgust and annoyance at the disappearance of an illusion are not always felt, even where the human figure is concerned.

Did any one ever feel disappointed at discovering the figures on the ceiling of the Parisian Bourse to be paintings merely? Did any one ever experience other feelings than those of admiration at the inventive talent displayed in those designs, the marvellous imitative power and command of the materials of art which could produce such works. The means in this case are equal to the end. These pictures are, however, imitations, not of men, but of sculpture, and as such successful. Great as designs, and executed with such exquisite skill as to fulfil all the conditions required of the material which they are intended to represent.

Such works as these, the numerous painted *bassi rilievi* and other similar works in the Louvre and elsewhere, the paintings of De Witt and his followers receive from the world generally, notwithstanding the denunciations under which they labour in common with all deceptive imitations, the meed of approbation which they so fully deserve.

How stands the case as to landscape? Framed pictures we may pass over as affording no illustration of our subject. It would be a rare talent which would enable one to paint a landscape so as actually to produce an illusion when placed within a few yards of the spectator. But no illusions are more perfect than those of the scene painter. Are panoramic painted views, such as those of London, as seen from the top of St. Paul's, or of Paris, as seen from the Pantheon, to be forbidden delights in order to satisfy the requirements of this new theory, because possibly the spectator may have difficulty in persuading himself that he is looking on a flat surface? I have seen, as every one may have seen who has visited sunny Italy, what might have been a dismal court-yard changed into a paradise by the skill of the painter. In the foreground, instead of a blank dreary wall, wood and water and green fields. In the distance a picturesque range of mountains, with the sunlight striking through the gorges and tipping the far-off summits with its golden radiance. But who, on walking towards those mountains and finding they were merely painted on the boundary wall not fifty yards distant, the wall itself being built so as to form their rugged silhouette, experienced other emotion than that of pleased surprise at the skill which could produce so marvellous an effect by means of painting. And are we to be told that all such art is base and inadmissible. "What! because thou art virtuous shall there be no more cakes or ale, and shall not ginger be hot in the mouth." Must the pent up denizens of our cities be compelled to gaze on a blank dreary gable or into a dismal court, when he has a desire to look on brighter and more lively things, or to dwell among the horrors of Erebus, when the painter's brush, like the wand of a magician, may transform the scene into the Elysian fields?

Now I know it will be asserted that such art as I describe is not high art. Let me admit the truth of the assertion. I have already said that art is great only as it employs the intellectual faculties. The laws of perspective are now well known, and the application of them is so far mechanical. But all men are not Wilkies, nor Paul de la Roches, nor Turners, nor Roberts, luckily, or else we should have everybody producing works of high art, with nobody to buy them. It is to be feared that in such circumstances the only employment for an artist would be akin to that of Vishnu—the contemplation of his own perfections, an occupation, profitable it may be, for gods in whom humility is no virtue, who neither eat nor wear clothes, nor beget children, but not for men who do all three, and who, to be estimable, must be humble withal.

But no reasonable man would deny to an artist the right of exercising, for his own profit, and for the pleasure of his fellow-men, such talents as God has given him, merely because they are not so transcendant as those of the great masters we have named.

The fact is, as I have already indicated, this crusade against deceptive imitations, though neither essentially pre-Raphaellite nor mediæval in its character, is a phase of the fashion which has exhibited itself, and is running its course in architecture, painting, and religion. Strange practical paradoxes into which theorists are sometimes dragged, into what adhesive and traitorous quagmires of delusion and absurdity are men frequently carried when they take to ride stiff necked hobbies. I have seen pictures of the pre-Raphaellite school in which the imitation was carried so far as to be startlingly deceptive. An imitation of what? Literally of withered leaves and straws, painted with a greater amount of care and finish than had been bestowed, in the same picture, on the human face divine, *so* startingly deceptive that it seemed as if the straw had been packed in between the glass which covered the picture and the panel on which it was painted. Yet men who denounce all imitations as sinful, who cannot find terms sufficiently strong in which to condemn the man who spends his time and gains his livelihood by imitating the delicate veining or the rich and varied colouring of a marble, exhaust the English language for words to sound the praises of a school which admits of such puerilities.

But deception is allowed in many cases besides painting. What is that which forms the charm of novel-writing but its deceptive character? It would be a new style of objection to Robinson Crusoe, that no one could read the book without feeling persuaded that it narrated facts, or to Sir Walter Scot's delineations of Baillie Nicol Jarvie and Dominie Sampson, that through their verisimilitude, they, the creatures of an imaginative brain, had taken their place as historical personages? What is the source of the delight we take in dramatic representations? Among all the objections which have been urged against the stage, did any one ever hear it asserted that actors in their professional capacity are deceitful above all men, and desperately wicked! Could it be said that Macready was an unprincipled scoundrel, because no one could see him perform without believing him to be animated by the passions which his words expressed? Over and above the interest of a drama which, although badly performed, may to some extent sway the feelings, the deceptive character of its representation forms its chief interest, and in its appeal to the imagination constitutes the performance a work of art. We admire the acting of a man who personifies a passion, while we might disregard or despise one actually under its influence.

What would Carlyle say if arraigned before the bar of public opinion for the form which some of his great works have taken? If he were charged with imposing on the public the belief that his Sartor Resartus was founded on a volume he had received of Professor Teufelsdröckh, from the press of Stillsweigen und Geschellschaft, of the town of Weissnichtwo; if it were stated in aggravation of his crime that he was an old offender; that the effect of the deception which in this case he had practised—to use the identical words employed in denouncing that class of imitations which we are now engaged in defending—was to cast a suspicion on the existence of his Abbot Sampson and the genuine Chronica Jocelini de Brokelonda, and on every bit of genuine history afterwards encountered. Do not let it be supposed that these cases are irrelevant. They are truly in point, and they are fair illustrations. The sin which is denounced is the so-called deception, common to them all, and the consideration of it as exemplified in such cases may prepare us for its admission in those others which are to come more immediately under our consideration. It must be observed that these dramatic representations and these works of fiction, like painted marbles, deceive only those who have not knowledge or penetration enough to detect the imposition. In this case, if the deception be the crime, the balance of argument, according to the views of our opponents, is in our favour. The painting contains internal evidence to reveal its true nature, while the real character of the acting, or of such writing as that in which Carlyle indulges, must be ascertained from certain conventionalities known only to the initiated, or from extraneous sources.

Immediately we shall come to some cases where the deception is not so admissible. But before doing so let us take an example from the highest and noblest of all the fine arts—that art which appeals not merely to our business and our bosoms, but to that region of man's nature which forms the seat of his most exquisite delights—the stomach. It has been well remarked of gastronomy and astronomy that the former is the more noble science, that a philosophic cook who discovers a new dish is a greator benefactor of his species than a man who discovers a new star, because we have more stars than we can ever make use of, while it is impossible ever to have too great a variety of dishes. We require, therefore, no apology for drawing an illustration from so noble a science.

Let us suppose that Goldsmith's country parson, "passing rich on forty pounds a year," from the produce of his garden to manufacture an effervescing beverage and dignify it with the name of champagne. I apprehend he would not be guilty of a sin either against morality or good taste, in partaking of it himself, or in sharing it with his friends, if it pleased their palates. But woe to the nobleman or wealthy merchant who should attempt to palm such an article on his guests. They would receive it as a villanous compound, suspect their host of poisonous designs, and take care to have "unfortunately contracted a previous engagement" on all future occasions when they received his invitations. Mock turtle, though utterly destitute of the dignity which appertains to the original dainty whose noble name it bears, and in fact, without aristocratic pretensions of any kind; and it may be even somewhat plebeian and vulgar in its origin and connections, is not yet wholly proscribed, and may be met with occasionally in respectable society. But let any one conceive, if he can, the position which a Lord Mayor would occupy, who, to save the contents of his purse or the digestive organs of his guests, should supply the sham instead of the real article at his inauguration banquet.

There is here, however, not a question of sin or no sin, but of consistency or inconsistency, of propriety or impropriety. In furnishing an imitation, instead of the genuine article, there is, in the cases I have supposed, no intention of deceiving any body. The original delicacies are used for certain good or pleasing qualities they possess; the same good qualities you simply reproduce in the imitation, for good qualities are real things and cannot be imitated. It is even so with imitations of materials, for the same or similar motives exist for using them.

What, then, is the conclusion of the whole matter? The sin or offence, where it exists, is ever to be found in the motive. Thus the host who passes off his gooseberry and mock turtle as genuine; the novelist and essayist who writes with the actual design of falsifying history; the citizen who paints his garden wall to make believe that he is proprietor of a vast demesne; the householder who decorates his halls in painted marbles to impose on his friends and acquire a cheap dignity, is guilty of telling or acting a lie. But everyone knows that such cases do not exist. In dramatic representation, in works of fiction, in all examples of imitative art, although the intention is not to deceive, the deceptive nature of the representation forms a legitimate appeal to the imagination. In imitations of favourite dishes, prepared to please the palate, and in imitations of materials to please the eye, the one class is used on account of their beauty, the other on account of certain good qualities which render them desireable. In this view neither can be considered deceptive, nor even imitative, for the beauty of the one class of object and the good qualities of the other are undeniable realities.

We have thus considered a few cases in which the deceptive character of the objects seems to be unobjectionable. But when we come to discuss the question of false jewellery we find that it stands on altogether a different footing.

Precious stones are worn not for their beauty alone. If they were so, then the false would serve the purpose equally well, and no stigma would attach to their use, for they are quite as beautiful as the real, and, indeed, it is difficult to tell the difference between the two, for even connoisseurs are apt to be deceived in such matters.

Gems are worn on account of the dignity they confer as objects of cost. Hence the counterfeit meet with condemnation from all persons of education and refinement. A woman who wears false jewels intends that they should pass for that which they are not. She is a pretender to a rank and position to which she has no claim. She is guilty of a vulgarity—an impertinence—a sin if you will —from which everyone with sense and propriety would instinctively shrink.

There is a palpable fallacy contained in an argument which places in the same category imitations of objects which are used solely or chiefly on account of their beauty, and those which are used solely or chiefly on account of their suggesting ideas of cost. A fancy wood or marble is an example of the former—a precious stone, of the latter. You may deceive by making an article which possess little real value resemble a costly one, but to speak of deceiving as to beauty is a simple absurdity. The appearance of cost and value may exist without reality—the appearance of beauty and the reality are one and the same thing.

Such a thesis as that which we have been disputing could not be maintained consistently throughout, so we find it stultified by the admissions of its author. "Gilding," he says, has "become, from its frequent use, innocent. It is understood," he says, "for a film merely, and therefore is allowable to any extent." I cannot admit the abstract justice of the doctrine contained in this passage, for it would go far towards justifying any practice, however absurd, which might happen to have the sanction of antiquity, and it is certainly altogether at variance with the principle on which imitations are condemned by the same author. According to this doctrine, gilding must at one time have been wrong. But that which is originally wrong can never be made right by repetition. On the contrary, it is common to hold that what is here advanced as a palliation can only serve as an aggravation of the offence.

It is hoped that we have already found sufficient justification for using imitations of materials, such as fine woods and marbles, in all legitimate situations; but this passage, if we could avail ourselves of it, and if justification were needed, would afford all that could be desired, for the use of these imitations has been for a long period so common, that however deceptive they may be, they will seldom, if ever, pass for aught else than what they are.

These remarks on gilding betray a total misconception as to what decoration really is. Decoration is a thing of surface not of construction, although the construction will frequently indicate what the decoration ought to be. You have no more reason to suppose that a thing is solid gold because it is gilded on the surface, than to suppose that a lady is silk because her outer garment is composed of that material, or that you would find the downy surface or the delicate tints of the peach at whatever point you might intersect it. The apology, therefore, tendered for gilding is not only superfluous, but of a character which could not have been accepted had an apology been necessary.

This brings us to point out, as we proposed to do under the third division of our subject, the qualities which give their value to decorative appliances. These, which we name in the order of their importance, are—

1st. Beauty.
2nd. Durability, and
3rd. Costliness.

We have just been speaking of gilding. For its employment we require no other apology than the possession of the above-named qualities, and in this respect it stands on precisely the same footing with almost all other decorative appliances, cement or plaster, metallic coatings of bronze, silver, or gold, paint, silk, veneers in wood, marble, or freestone. Our principle is of universal application. A lady makes the dress which is to be seen of silk, her under garments of a cheaper and less showy material. You veneer a plain, inexpensive wood with one of a richer hue and of a more expensive quality. You coat your brick or rubble walls with cement, with paint, with ashlar stone, or with marble. They are understood to be mere coatings, thicker or thinner as the case may be. Zinc is coated with bronze, bronze with silver, and silver with gold, and in doing this we simply follow a natural instinct, and the example which nature herself has given us.

We shall now try how far stucco and scagliola, or painted imitations of marbles possess these three qualities of beauty, durability, and expression of cost.

First, as to stucco. It seems to be felt necesary that some expedient should be adopted for adorning the unsightly brick buildings of which such a town as London is chiefly composed. This is effected by the material under discussion, either by an entire coating, or by means of projecting facings, thus adding force to the outlines and principal features, and contributing to the composition, those elements of light and shade so essential to the beauty of architecture, and in which brick buildings are generally so deficient. It certainly is not the fault of bricks that they are not ornamental, seeing they can produce such buildings as the Ospidale Maggiore of Milan, the Certosa of Pavia, or even such examples of street architecture, as those recently erected in Cheapside, which are now daily arising around us. But the ornamental bricks, or terra cotta, used in the construction of these buildings, being simply moulded as is the stucco or cement, are liable to precisely the same condemnation. Brick architecture of such a character would leave nothing to be desired, but it is to be feared the expense will interfere with its general adoption. The expedient usually resorted to for getting rid of the dull uniformity and flatness of brick erections, that of bands, lozenges, and squares of various colours, seems to me as barbarous as the tattooing of the savage and of precisely the same nature. The lines and forms seem to destroy the contour of the building by substituting stronger markings than those which are presented by the solids and vacuities, they withdraw attention from the principle architectural features—from the form and outline of the building which give it character and expression, and in which, as in a face, the beauty ought chiefly to be found.

Stucco, then, supplies a want—in cases where stone is not to be had or where it is too expensive for general use. In regard to its possession of the three qualities we have named; in beauty it is nearly equal to stone, because it admits of the same identical forms, and if properly treated the difference between the two surfaces is scarcely appreciable: in durability it is, of coures, inferior to stone. But such beauty and such durability as it does possess are absolute qualities, and in regard to these stucco does not occupy the position of an imitative material, for it is obvious that beauty and durability do not admit of imitation. As to expression of cost, stucco expresses more cost than plain unadorned brick, and less than stone. It is, therefore, a less noble material than the latter, so that its use will be restricted by the conditions to be afterwards stated.

We may here remark, in passing, that so long as stucco remains unchallenged as a decorative appliance for interiors, it will be difficult to show why it should not be employed—subject, of course, to conditions—on exteriors also.

Scagliola and painted imitations of marble stand on precisely the same footing. Their beauty arises from various sources. One of these is inherent, due to the colour shades and veining, which, constituting the loveliness of the real object, are found, only in a less degree beautiful, in the representation. The second source of beauty is the taste, skill, and ingenuity displayed in the execution of the imitation, which the practised eye at once detects, while a third class of beauty may be discovered in the deceptive character objected to, and which forms, we hold, a legitimate appeal to the imagination. No doubt such imitations are wanting in beauty of the highest class; they do not engage the greatest faculties of the artist, they do not suggest great thoughts, but such beauty as they do possess is derived from sources which are quite legitimate.

In durability they are, of course, much inferior to real marbles, although greatly superior to most other styles of painting in use for internal decoration. From the smoothness of the varnished surface they are easily cleansed, and at the end of thirty years will be found to have suffered less from tear and wear than plain paint would have done in a third of that time.

As expressive of cost they are of no mean value, though from their inferiority in this respect to the originals, they will be excluded from use in many cases by one of the conditions I shall specify.

I now proceed to lay down and illustrate the last division of my subject—the conditions which ought to regulate the employment of surface coatings. These are—

1. That they be not employed to imitate a material where the original itself would be out of place.

2. That no object be painted or otherwise made to imitate one material which, from its form, construction, or application, is obviously or necessarily composed of another.

3. That no inferior surface coating be employed where we should expect one more expensive, and no imitation where we are entitled to find the real material, or where the discovery of an imitation would create disappointment.

Everyone may supply himself with illustrations. For example; as to the first condition. Imitation marble should never be used on such positions as ceilings, where the construction is obviously a wooden one; nor on shop-fronts in crowded thoroughfares, where the real material would be destroyed as soon as exposed, and where it would therefore be out of place.

In illustration of the second condition, we may mention that elaborate delicate carvings should not be painted to represent granite, nor iron columns like wood or marble where these materials are unfit for the duty in the way of support otherwise, which the iron has to perform.

In regard to the third condition. We have said that decorative appliances are valued for three qualities—their beauty, durability, and expression of cost. We may assume that the rank or wealth of the person who owns a work of art, or who makes use of a decorative appliance, will not alter our estimation of its value or fitness, so far as these are imparted by the two first named qualities, beauty and durability. Our ideas on these points may be said to be absolute, except in so far as they are liable to be changed with regard to beauty by the influence of fashion.

But the third quality we have named is to be considered in a different light. The fitness or unfitness of a work of art or of a decorative appliance, considered with reference to expression of cost, falls to be determined by the rank, wealth, and social position of the person who owns or makes use of it.

The question involved, then, in the discussion of the third condition, under which we assert that imitative appliances may be used, is perhaps, in this view, not strictly æsthetical. We shall give one or two illustrations of our principle.

If we should find in the cottage of an agricultural labourer a figure, say of the "Dying Gladiator," we should receive it as an evidence of great taste, although the statuette should prove to be of zinc electro-plated with bronze. Such an object would be out of place in the possession of a rich collector; but, if I mistake not, few connoisseurs even would be sufficiently purist in their tastes to object to the same figure in bronze plated with oxydised silver, If I might venture to express an individual opinion, I should say there is no more beautiful appliance in use at the present day for coating bronzes. Probably even a zinc bronze-electroplated figure, if large and applied to a useful purpose, such as holding a light, might be found unobjectionable in a similar situation. In a nobleman's mansion, or even in a royal palace, our feelings would not be shocked if we were told that the gold dinner service we were admiring was not solid gold, but silver gilt, while we should feel it to be the essence of meanness if the noble or royal possessor had resorted to the cheap expedient of having dishes plated on nickel instead of genuine silver. One admires the beauty of the colossal statues which adorn the throne room in Residenz of Munich without regarding the material of which they are composed. No doubt our respect for them would be much enchanced, whatever we might think of the wisdom of the monarch who had them cast, if we were made aware that they were solid masses of gold. But as no one probably ever indulged in this belief, so nobody was ever disappointed when told that the substance is bronze, and the gold which meets the eye a superficial coating merely. Perhaps the mind may be the better prepared for the gilding of bronze by the knowledge of the fact that its colour is but a lacquer, the bronze itself but a hollow sham, a pretender to solidity, representing bones, flesh, and skin; when it is skin *et pratœrea nihil.* If the idea of a figure being mere skin and bone exposes it to contempt, what is to be said of one which is skin only without even the bones.

I have thought it necessary to direct attention pointedly to this custom of coating a common cheap metal with metal more attractive, as well as more expensive in the view of ascertaining whether it is a practice which can be indulged in with propriety, and on what principle; because it is not merely an important branch of the general question we are considering, but because it involves important material interests and has been treated at considerable length by various modern writers on art who are recognised as authorities, and who have arrived at what seem to me to be false conclusions on the subject.

The third condition which I would impose on the use of deceptive coatings, and which I will now repeat, seem entirely to meet the case.

That no inferior coating be applied to a surface where we should expect one more expensive, and no imitation where we are entitled to find the real material, or where the discovery of an imitation would create disappointment.

This mode of viewing the subject brings us back to the question which we have already so far discussed—of worthiness or unworthiness, of propriety or impropriety.

We have a right to expect that every one will support with dignity the rank and position which God has assigned him in the world. No man can do this who resorts to shabby and cheap expedients in his ordinary business even, much more in matters of taste and ornamentation. But shabbiness and cheapness are relative terms. We do not expect our bourgoisie to veneer their walls with real marbles, although we have all seen such finishings. In King's houses in all parts of Europe they exist. The interiors as well as the exteriors of the old Venetian palaces were so decorated. In the residences of many even of the smaller German potentates, and in the mansions of the wealthier of our own citizens, a few examples are to be found. One has therefore a right to expect our own royal residences and public monuments to be decorated with the noblest materials. One could scarcely be reconciled to the idea of having the noblest apartments in the palaces of the Queen of England decorated with imitations of rich materials. Our opponents may condemn such incongruities wherever they are fouud, and in any reasonable terms they choose, for there is no doubt in such positions they would be worthy of all condemnation. If costly materials and costly works of art are to be found anywhere, surely it ought to be found in the palaces of that monarch on whose dominions the sun never sets. Genuine gooseberry and mock turtle at a lord mayor's feast would seem absolutely virtuous by the comparison.

Even these rules, however, will not admit of too rigid application. In many instances the work, from want of previous arrangement, is put into the hands of the decorator in a state which leaves him little choice in the matter. Besides, the use of such decorative appliances as a painted imitation of marble frequently affords the means of introducing a mass of rich broken colour in situations where a flat uniform tint would be ruinous to a composition. Of these means even Raphael did not scruple to avail himself in the decorations of the Loggie. The use of such appliances may therefore be occasionally justifiable, where too rigid an application of our rule would exclude their use.

In fact, we cannot, in all matters of taste, establish such unchangeable canons as those which settle the principles of morality. In matters of taste there are many things essential, and there are many things of little moment. Within the region of æsthetics there is a vast debateable land where individual preferences have free scope for exercise. Within this region it is impossible to ignore or set aside the influence of fashion, whose code, for the time being, is as inexorable as the laws of the Medes, though, unlike those laws, it is ever inconsistent and ever changing.

In matters of personal adornment, deceptive expedients have always been less or more in vogue. The Greek ladies, jealous, it may be presumed, of the beauty which they discovered in the low foreheads of certain of the inferior animals, and anxious to rival it in their own persons, invented a species of wig to conceal the upper part of the forehead, and bring the hair as nearly as possible down to the eyes. The faces of the Roman ladies, having been properly softened and prepared by means of a bread poultice plastered over their features, were daily, after it was washed off with asses' milk, brought by means of paint to rival the hues of the lily and the rose. In these days of ours we complacently accept the improvement in our personal appearance effected by the operations of the dentist, and do not grumble at their deceptive tendency. Perhaps their manifest usefulness may in some degree leaven the vanity which frequently induces the patient to submit himself to the operator. In the style of dressing her hair, although woman has found out many inventions since the time of the Greeks, still must her flowing locks be rendered fuller and more flowing by foreign aid. Fiction has still to be added to fact that she may realize her ideal, though that is not the ideal of 2,000 years ago.

We are not so tolerant of paint. It is not so easy to define that principle which admits of one lady making herself more charming by adding pounds of hair to the supply which nature has bestowed upon her, and which denies to another, animated by precisely the same amiable motive, the privilege of making up for nature's deficiencies by the use of rouge. Perhaps if the paint were applied after the manner of the Cherokee Indians, so as not to deceive anybody, it might satisfy the æsthetical scruples of some of our friends of a certain school.

Sir Joshua Reynolds says, in one of his Royal Academy discourses, "If a European, when he has cut off his beard, and put false hair on his head, or bound up his own natural hair in regular hard knots, as unlike nature as he can possibly make it, and after having rendered them immovable by the help of the fat of hogs, has covered the whole with flour put on by a machine with the utmost regularity; if, when thus attired, he issues forth and meets a Cherokee Indian, who has bestowed as much time at his toilet, and laid on with equal care and attention his yellow and red ochre on particular parts of his forehead and cheeks, as he judges most becoming; whoever of these two despises the other for his attention to the fashion of his country, whoever first feels himself provoked to laugh, is the barbarian."

Now, no doubt there is a right and a wrong in most of these matters, which may be discovered when the search is worth the trouble, but it does not follow that what is right now must be right in all time. We speak not here of fashions which change without apparent reason.

Ten years hence it is possible that gold and silver, now so highly prized as decorative appliances, may, in consequence of a depreciation in the value of the precious metals, have become vulgar and common-place; but the great principles which ought to guide the artist or decorator will ever remain the same.

In the region of man's inner nature lies a mine, inexhaustible to him who can trace the deep workings of the human soul and embody them in visible form. There must the artist seek the principles which are to guide him in the exercise of his profession. "Custom, the Queen of the World," has a vast dominion, and her subjects are slaves. But these are the unthinking and vulgar. The man of original independent genius will disdain to wear her fetters, or to sacrifice essential principles at her command. Somewhat he may concede, in matters non-essential, out of deference to the powers that be. But as "deep answereth unto deep," he will ever intuitively recognise permanent and intrinsic excellence, and in all matters where essential principles are infringed, will abjure the transient fashions of the day.

The yield of gold in Australia and New Zealand for 1863 is near $40,000,000.

THE RESTORATION OF THE APPARENTLY DROWNED.

The following are the new rules issued and recommended by the *Royal National Life Boat Institution*, to which it desires to draw the attention of medical men, and of all who may have opportunities to assist in the restoration of the "apparently drowned."

I.

Send immediately for medical assistance, blankets, and dry clothing, but proceed to treat the patient instantly on the spot, in the open air, with the face downwards, whether on shore or afloat; exposing the face, neck, and chest to the wind, except in severe weather, and removing all tight clothing from the neck and chest, especially the braces.

The points to be aimed at are—first and immediately, the restoration of breathing; and, secondly, after breathing is restored, the promotion of warmth and circulation.

The efforts to restore breathing must be commenced immediately and energetically, and persevered in for one or two hours, or until a medical man has pronounced that life is extinct. Efforts to promote warmth and circulation beyond removing the wet clothes and drying the skin must not be made until the first appearance of natural breathing. For if circulation of the blood be induced before breathing has commenced, the restoration to life will be endangered.

II.—To Restore Breathing.

To clear the throat.—Place the patient on the floor or ground with the face downwards, and one of the arms under the forehead, in which position all fluids will more readily escape by the mouth, and the tongue itself will fall forward, leaving the entrance into the windpipe free. Assist this operation by wiping and cleansing the mouth.

If satisfactory breathing commences, use the treatment described below to promote warmth. If this be only slight breathing—or no breathing—or if the breathing fail, then—

To excite breathing.—Turn the patient well and instantly on the side, supporting the head, and excite the nostrils with snuff, hartshorn and smelling salts, or tickle the throat with a feather, &c., if they are at hand. Rub the chest and face warm, and dash cold water, or cold and hot water alternately on them.

If there be no success, lose not a moment, but instantly.

To Imitate Breathing.—Replace the patient on the face, raising and supporting the chest well on a folded coat or other article of dress.

1. *Respiration.*—Turn the body very gently on the side and a little beyond, and then briskly on the face, back again; repeating these measures cautiously, efficiently, and perseveringly about fifteen times in the minute, or once every four or five seconds, occasionally varying the side.

[By placing the patient on the chest the weight of the body forces the air out; when turned on the side this pressure is removed, and air enters the chest.]

On each occasion that the body is replaced on the face make uniform but efficient pressure with brisk movement, on the back between and below the shoulder blades or bones on each side, removing the pressure immediately before turning the body on the side. During the whole of the operations let one person attend solely to the movements of the head, and the arm placed under it.

The first measure increases the expiration, the second commences inspiration. The result is respiration or natural breathing, and, if not too late, life.

While the above operations are being proceeded with, dry the hands and feet; and as soon as dry clothing or blankets can be procured, strip the body and cover, or gradually reclothe it, but taking care not to interfere with the efforts to restore breathing.

III.

Should these efforts not prove successful in the course of from two to five minutes, proceed to imitate breathing by Dr. Silvester's method, as follows:—Place the patient on the back on a flat surface, inclined a little upwards from the feet: raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder-blades.

1. INSPIRATION.—Draw forward the patient's tongue, and keep it projecting beyond the lips; an elastic band over the tongue and under the chin will answer this purpose, or a piece of string or tape may be tied round them, or by raising the lower jaw, the teeth may be made to retain the tongue in that position. Remove all tight clothing from about the neck and chest, especially the braces.

To Imitate the Movements of Breathing.—Standing at the patient's head grasp the arms just above the elbows, and draw the arms gently and steadily upwards above the head, and keep them stretched upwards for two seconds. (By this means air is drawn into the lungs.) Then turn down the patient's arms, and press them gently and firmly for two seconds against the sides of the chest. (By this means air is pressed out of the lungs.)

Repeat these measures alternately, deliberately and perseveringly, about fifteen times in a minute until a spontaneous effort to respire is perceived, immediately upon which cease to imitate the movements of breathing and proceed to induce circulation and warmth.

IV.—TREATMENT AFTER NATURAL BREATHING HAS BEEN RESTORED.

To promote Warmth and Circulation.—Commence rubbing the limbs upwards, with firm grasping pressure and energy, using handkerchiefs, flannels, &c. (By this measure the blood is propelled along the veins towards the heart.)

The friction must be continued under the blanket or over the dry clothing.

Promote the warmth of the body by the application of hot flannels, bottles or bladders of hot water, heated bricks, &c., to the pit of the stomach, the arm-pits, between the thighs, and to the soles of the feet. If the patient has been carried to a house after respiration has been restored, be careful to let the air play freely about the room. On the restoration of life, a teaspoonful of warm water should be given; and then if the power of swallowing has returned, small quantities of wine, warm br ndy and water, or coffee should be administered. The patient should be kept in bed, and a disposition to sleep encouraged.

General Observations.—The above treatment should be persevered in for some hours, as it is an erroneous opinion that persons are irrecoverable because life does not soon make its appearance, persons having been restored after persevering for many hours.

Appearances which generally accompany Death.—Breathing and the heart's action cease entirely, the eyelids are generally half-closed; the pupils dilated; the jaws clenched; the fingers semi-contracted; the tongue approaches to the under edges of the lips, and these, as well as the nostrils are covered with a frothy mucus. Coldness and pallor of surface increase.

Cautions.—Prevent unnecessary crowding of persons round the body, especially if in an apartment.

Avoid rough usage, and do not allow the body to remain on the back unless the tongue is secured.

Under no circumstances hold the body up by the feet.

On no account place the body in a warm bath, unless under medical direction, and even then it should only be employed as a momentary excitant.

Machinery and Manufactures.

THE ACID TEST FOR IRON.

There are hundreds of instances in practical life when it is of the utmost importance to quickly form an accurate estimate of the quality of a sample of iron or steel. A suitable testing machine is perhaps a hundred miles off. Even with such an apparatus within reach, the operation of testing the breaking strength and elongation of the specimen is tedious and expensive, and is always a matter requiring much delicate manipulation, more especially when dealing with specimens on a small scale. Recourse is perhaps had to the old blacksmith's test for wrought-iron. A nick is cut on one side of the bar with a cold chisel, and it is bent over the edge of an anvil. Bundles of leaden-gray fibres are held to indicate a good, tough, soft iron, and other appearances at the fracture are taken as showing a cold-short, or a hot-short, or a harsh, hard iron. It is evident that the whole operation is most uncertain in its results. Skilfully manipulating the bar, and bending it slowly, can often show a fibrous fracture in a comparatively inferior material. On the other hand, a few he ıvy sudden blows will often break off short a very good fibrous bar. If anything be proved with respect to iron, it is that what is termed a crystalline fracture may be obtained from any bar, however "fibrous," if it be only broken suddenly. We are, therefore, driven to observe the appearance of the fracture itself, and of the longitudinal arrangement of the fibres, or, more properly speaking, the arrangement and kind of the hammered or pressed down crystals of which a forged or a rolled bar in reality consists. There are certain difficulties in doing this. In the first place, the mere skin of oxide which forms itself on the external surface of a bar while cooling in the air, effectually masks the appearance and arrangement of the fibres when viewed longitudinally. To file down or cut off this skin in the lathe, would greatly distort and change these appearances, and the abrasion and compression exercised during these operations would fill up the interstices and structure we wish to observe. For it is quite certain that upon, *cæteris paribus*, the size and arrangement of the crystalline fibres, depends the quality of wrought iron. The fracture of highly refined iron, Bowling or Low Moor, for instance, shows a mass of small crystals like those in refined sugar. Coarse bad iron is always indicated by the appearance of large crystals, appearing to the greatest perfection in the centre of the bar. A piece of puddled bar shows a confused woolly mass of fibres. And, lastly, a tough piece of, perhaps, No. 3 bar, would show the fibres carefully combed, or freckled, or beaten out, into a series of fibres, running parallel to the longitudinal length of the bar. Of course, all these appearances are infinitely varied, in accordance with the infinite variety of makes and qualities. But the joint products of the elongations into the ultimate breaking strengths will be found to be in very close accordance with the molecular structure; that is to say, the real working qualities will be found to closely correspond with the way in which the bar has been manufactured. According to this, a skilful and practised examination—perhaps aided by a lens—of the fracture ought to show us very closely the quality of the iron.

The appearance of fractures has indeed been, from time immemorial, a means whereby practical men have been guided in their estimation of iron. There are, however, several circumstances that in many cases interfere with a good examination of the internal structure in this way. Certain impurities, such as silicate of protoxide of iron, are worked up with it. It is also evident that a true longitudinal view cannot be obtained of the fibres without some means of clearing them, which means should, at the same time, not interfere with, or alter their position to one another. If, therefore, instead of mechanical means, we have recourse to chemical agency, we have what is wanted in this case. Now, this plan of using an acid solution in order to fully develop to the eye the external structure of iron, was actually proposed and carried out by the late Professor Daniell as long ago as 1817. It was used in practice, within our own knowledge, some seven years ago. Mr. Kircaldy, however, appears to believe that he has made a new discovery in proposing this means for developing the structure of iron, but it is evident that Mr. Kircaldy's surprise is uncalled-for, "that such a simple mode as that just described, of examining the texture of iron, had not occurred to any of those individuals who have expressed their opinions for and against the supposed change from a fibrous to a crystalline structure." The action of the acid is also not merely confined to clearing away the "surrounding impurities," it, at the same time, fully develops the crystals, as different facets are influenced by a greater or less extent by the action of the acid. As Dr. Percy says, in his late work on Iron and Steel:—"After fusion, iron is highly crystalline, and even a small button, weighing only an ounce or two, may present, on fracture, large, bright cleavage planes, and its surface will always exhibit distinct crystalline markings when slowly acted upon by dilute hydrochloric or sulphuric acids. *This etching action is not, as some might suppose, due to the interposition of foreign matter symmetrically diffused through the mass.* Many examples of the apparent development of structure by the action of solvents might be mentioned. *The crystalline structure in all such cases pre-exists, and is merely rendered manifest by the etching process.* Different faces of the same crystal are found to be attacked in different degrees by the same solvent; and Professor H. Rose informed me long ago that an excellent illustration of this fact was presented by a crystal of quartz when exposed to hydrofluoric acid. Similar faces were acted upon with equal intensity. But what is true of quartz, which is rhombohedral, would not necessarily be true of iron, which is cubical, unless the crystals of the latter presented original and derived faces, as in the cubo-octahedron." The action of the diluted acid would be more especially valuable in exposing the longitudinal arrangement of the fibres. Not merely to wrought-iron but also to steel and cast-iron, may this plan of developing the structure be applied. There can be no doubt that it would throw great light upon many questions, both of a practical and of a more purely scientific description. We should probably find that some of the chief qualities of Bessemer iron and steel are due to the equable and even structure acquired by fusion. This would appear from a consideration of Professor Daniell's paper, which is admirable of its kind, and is one of those that, as Bacon says, deserve to be "chewed and digested," and "to be read wholly, and with diligence and attention." In this paper "On the Mechanical Structure of Iron developed by Solution, and in the combination of Silex in Cast iron," published in the second volume of the extinct Quarterly Journal of the Sciences and the Arts, Prof. Daniell says:—"Although mathematical solids were not discovered by a solution of iron, yet a difference of structure was plainly discernible in the different varieties submitted to the experiment, which is well worthy of attention. A cube of *gray cast-iron* of a granular fracture was immersed in diluted muriatic (now known as hydrochloric) acid. When the acid was separated, it was taken out and examined. The size of the cube did not appear to be at all diminished, owing to a soft, spongy substance which had not been acted upon. This was easily cut off in large flakes with a knife. . . . . ." The texture of the iron, of course, could not be learnt from this covering; but the metal, having been submitted to repeated solution, the quantity of residuary matter gradually decreased, and the surface being scrubbed with a brush, was found to be covered with small irregular ridges, which, when examined with a magnifier, presented the appearance of bundles of minute needles.

A mass of *bar iron*, which had undergone all the operations of puddling and rolling, was next submitted to the experiment. When the acid was saturated, it presented the appearance of bundles of fasces, the fibres of which it was composed running in a parallel and unbroken course throughout the length. At its two ends, the points were perfectly detached from one another, and the rods altogether so distinct as to appear to the eye to be but loosely compacted. We here see the effect of working and of successive heats on the arrangement of the crystals, and, as a consequence, on the ultimate strength of the bar. A merely puddled bar would have shown a compressed mass of fibres; and an infinite variety of qualities would lie between these two extremes. The description by Professor Daniell of his highly worked bar finds a close counterpart in the appearance of "very fine and straight long hairs or threads lying closely together," found by a late observer in a bar of the same kind.

The next subject of examination "was a specimen of *white cast-iron* of a radiated fracture. The first thing worthy of remark was that it took three times as long to saturate a given portion of acid as the two preceding specimens. Its texture, when examined, differed very much. It appeared to be composed of a congeries of plates, aggregated in various positions, sometimes producing stars upon the surface, from the intersection of their edges. It exhibited altogether a very crystalline appearance, but no regular fascets were discernible.

A small bar of *cold short iron* was next selected; it was exceedingly brittle, and its fracture presented bright and polished surfaces much resembling antimony. Its texture, however, when subjected to solution, proved to be fibrous, but not so perfectly so as the first specimen of bar iron. The course of the fibres was very much broken, the acid having dissolved out small cavities which cut them short. It was a square bar, and the alternate sides were more acted upon than the others, so that the fibres would appear to have been flattened." How much significance there is in the fact that cavities can be excavated in cold-short iron by immersion into diluted acid! A rod of *hot short iron* presented at the end of the operation a densely compacted mass of very small fibres, perfectly continuous. The congeries were twisted, but the threads preserved their parallelism.

A portion of a gun-barrel was submitted to the experiment. The metal was remarkably free from particles of an extraneous nature. The texture proved to be fibrous, but the threads were not regular or straight. They were generally disposed in waved lines, and the whole together was very compact. We here see one of the reasons that a "twist-welded" gun barrel is stronger than a common "skelp-welded" barrel. The twist allows the extra strength always found in the direction of lamination of a plate to be employed in resisting the circumferential tension caused in the barrel by the explosion of the powder. A similar advantage is gained in spirally welded or in spirally riveted boilers. A mass of steel just taken from the crucible in which it had been fused was subjected to the action of muriatic (hydrochloric) acid. It was of a radiated texture, the upper surface being markrd with rays which proceeded from the centre to the circumference. It was readily acted on by the solvent, and when withdrawn, presented a highly crystalline arrangement. It appeared to be entirely composed of very bright and minute plates, which reflected in every direction. The *laminæ* were very thin, and there was not order discernible in their mutual positions. A specimen of cast-steel which had been subjected to the action of the tilting hammer, of a very fine granular fracture, was next examined. It was not easily acted upon, even by strong muriatic acid, and it required the addition of a small quantity of nitric acid to effect its decomposition. When the acid was saturated the metal presented a compact appearance; nothing of a fibrous structure was visible; but in one or two places, where the acid had acted with most energy, it had detected the edges of *laminæ*, which appeared to form plates of the extent of the whole surface.

The blade of a razor of Wootz steel presented the same appearance, differing in nothing except three large notches in the back at right angles to the edge.

The blade of a razor of an inferior description presented a fibrous texture of waving lines. Deep notches in the back, similarly placed, were likewise visible in this. It was sufficiently evident, that the fibrous texture of the razor was owing to the admixture of the iron, and to the imperfection of the process for converting it into steel.

A bar of steel of an even grannular fracture was broken into two. The two pieces were heated in a furnace to a cherry red. In this state, one of them was plunged into cold water, and the other allowed very gradually to cool by the slow extinction of the fire. They were then both placed in muriatic acid, to which a few drops of nitric acid had been added. The last was readily attacked, but it required five-fold as much time to effect the saturation of the acid as the first. When the solvents had ceased to act they were both examined. The tempered steel was exceedingly brittle, its surface was covered with small cavities, like worm-eaten wood, but its texture was very compact, and not at all striated. The untempered steel was easily bent and not elastic, and it presented a fibrous and wavy texture. There cannot be a doubt about the great value, if properly carried out, of the acid test. It will expose, as we have ourselves noticed, in a most remarkable way, the texture of a slab fagoted up out of different qualities and kinds of iron. Any defective welding together of the parts was at once shown forth in tell-tale lines, and the different numbers of the iron composing the fagot were clearly indicated. The facility and ease of manipulation of this test, and the small cost at which it can be carried out, ought to render it of frequent adoption by the practical man; while to those who strive to pierce below the surface of things, it might afford a means of arriving at the truth of many obscure questions with regard to the structure, and consequent value, of iron.—*Mechanics' Magazine.*

CAST IRON BOILERS.

* * *

The progress of the steam engine has been isochronous with the progress of the iron manufactures of the world. With each improvement in the means of obtaining oower for raising ores, for draining pits, and for blowing furnaces, we find that enterprising men adventured upon new schemes. It is not to much to say that, in return, the steam engine has profited largely by every advance in the art of working in iron. These advantages and benefits have been reflective so far, and it is likely that such will continue to be the case so long as iron is forged, or steam used to supply motive power to the machines which forge it; but we must expect, on looking back to the past, to find that, in the infancy of the art of working in iron, expedients which we would now regard as very exceptional, were commonly resorted to in the construction of steam machinery, and, perhaps, in no department is this fact more apparent than in the history of the development of steam generators.

The first engines ever made were employed in the mining districts, and it is by no means easy to say in what district first. As this is a question of little importance, however, we need not dwell on it. When the first wrought-iron generator was made is a matter of more interest. Savary used cast iron; Newcomen, his successor, used wrought iron; but it is worth noticing that, while Savary raised steam of 30 lbs. to 45 lbs. above the atmosphere, Newcomen never employed pressures of more than 1 or 2 lbs. In the first place, as his engine did not work by the direct action of the steam, higher pressures would have availed him nothing; and, in the second, it is extremely doubtful if any wrought-iron boiler could in his day have been made tight under high pressures. With the introduction of low pressure steam, we find that many strange schemes for the construction of boilers were produced, all intended to obviate the difficulties of working in plate iron. Thus, Watt proposed boilers made of wood hooped, with a cast-iron furnace within; and others, boilers of stone; or lead, or copper, which last should be brazed, were actually used. In fact, until the comparatively recent introduction of the locomotive engine, it was by no means easy to procure wrought-iron boilers tight under high pressures; for low pressures, they soon became popular in the mining districts, and old punching and shearing machines, of a pattern now seldom or never used, once employed in their repair or construction, may still be seen lying neglected and overgrown with grass and weeds by the roadside in the "Black country."

There is an old French proverb in existence, which, being translated, says that we always return to our first love; and it is by no means unlikely that this will be verified in boiler engineering. At one period it is beyond question that cast-iron boilers were habitually used for generating very high pressures, and they were used simply because the material possessed constructive advantages which were not then believed to reside in wrought iron; and if these advantages are found to reside in it still, under a principle of construction modified to meet existing demands, there is surely no good reason why it should not be habitually employed. Cast iron is really far better adapted to meet the ordeal of fire and water to which a boiler is exposed, than the best wrought-iron plate ever manufactured. As to strength, we all know, or we all ought to know, that that is a matter of proportion quite as much as a matter of material. There is nothing like practical illustration for bringing such truths home to the mind. Let us suppose, then, the case of two boilers, one made of plates half an inch thick, the other of plates one quarter of an inch thick: if each of these boilers is, say, six feet in diameter, the first-mentioned will possess as nearly as may be, double the strength of the other if we neglect all considerations connected with the process of riveting. In order to render both of equal strength, it is only necessary to reduce the thinnest of the two, to half the diameter of the thickest. In the same way it is certain that a cast-iron tube of a given diameter may be made quite as strong as one made of wrought iron of the same thickness, provided their diameters are proportioned the one to the other in the ratio of their tensile strength. It is only a fallacy to consider cast iron as a material wholly unsuitable for the construction of generators in the abstract; and, even in the practical, there is no difficulty whatever in adopting such a system of construction as will enable cast iron to excel wrought, in all those qualities which constitute a thoroughly efficient generator for even the highest pressures.

That the arguments adduced against the use of cast iron are many and powerful, we do not pretend to deny; but that they are invariably applicable; or that, in other words, it is impossible to devise a boiler which shall elude these objections, is false. We daily see cast iron employed to carry enormous pressures with the utmost confidence. Water mains are abundant 30 in. in diameter, carrying pressures due to heads varying from 100 to 240 ft., or from 50 to 120 lbs. to the square inch. Its tensile strength may always be brought, in one sense, up to that of wrought iron, by using enough of it. It has thus beaten wrought iron in the form of guns many times. Indeed, it is still doubtful if the best guns which Sir William Armstrong can turn out on his system, equal the Rodman cast-iron ordnance in their power of endurance. There are two methods of increasing the strength of any vessel, or, in other words, its powers of resisting either internal or external pressure. The one consists in increasing the thickness; the other in reducing the diameter of the globe or cylinder tested. As a boiler has something more to do than passively withstand a certain pressure, like a water main,—having to transmit heat freely, in order that it may not become oxidized or "burned,"—it is obvious that cast-iron can only be employed in the form of small tubes or chambers' inasmuch as larger vessels should necessarily be of such a thickness that heat would pass through them very slowly indeed; but this fact in no way militates against either the safety, efficiency, or economy of a generator. Perhaps the present system of employing wrought-iron boilers of colossal dimensions in our every-day practice, has been productive of more injury to property, and of a greater loss of life, than can be fairly laid at the door of the engineer on any other grounds. To Dr. Alban, of Plau, in Mecklenburgh, is due the credit of first enunciating the grand principle that, "*all boilers should be so constructed that their explosion may not be dangerous.*" In order to carry out this principle, it is absolutely necessary to adopt some method of construction by which the water and steam space shall be subdivided as much as possible. We will not here dwell on the objections urged from time to time against water-tube or "tubulous" boilers. We may probably treat of such generators at another time; at present it is sufficient to say that these objections are many and well-founded—so well-founded that such boilers have never become popular as yet, and it is very improbable that the constructive difficulties which now render them exceedingly expensive ever will be overcome; while from the nature of their form, and the material of which they are made, they have hitherto been found not only costly to make, but difficult to maintain at any price in fair working order, on a large scale.

Within the last few months a boiler has been brought under the notice of the public which really appears to be so thoroughly efficient that we should scarcely do our duty as journalists did we not call the attention of our readers to it. At the entrance to the Patent Museum, at South Kensington, stands a strange-looking arrangement, very unlike a boiler at first sight; nevertheless, from a combination of such arrangements, is built up the "Harrison," or, as it has sometimes been called, the "bomb shell" boiler—an American invention, which has been used most successfully at the Messrs. Hetheringtons' Manchester, for the last two years. As its name bespeaks, the generator is built up of a great number of spheres, each of only 8 in. diameter and ⅜ths of an inch thick, cast in groups of four and bolted together into slabs by through rods. Each sphere communicates freely with its fellows by means of necks cast on them, which at once serve to connect them, and to establish the communication. A certain number of these slabs are placed in communication, side by side, in a suitable brick-furnace, or rather oven, in such a manner that the heat may be most advantageously applied to them. We do not here purpose entering into details—it is enough to say that this cast-iron boiler has proved itself in every respect a thoroughly efficient, safe, powerful, and economical generator. Nor has it been tested on a small scale. A Harrison boiler of 200 horse power is working daily at the Messrs. Hetheringtons'; two or three of smaller size are at work in London and its neighbourhood, and others are in course of erection. Thus, then, we find that in the heart of one of the most enlightened manufacturing cities in England, or in the world, wrought iron stands a fair chance of being superseded by cast iron for the purpose of making boilers. Verily *revenous a nos premier amours*. Nor is this to be wondered at. Wrought-iron plate invariably falls a victim sooner or later to the insidious tooth of corrosion. From this evil cast iron, as a boiler, is almost practically exempt, while its small first cost as a material, the ease with which it can be worked, and the great strength which it really possesses when properly treated, point it out as adapted for the construction of a very large class of stationary boilers, in cases where weight and space are matters of little importance, as compared with safety, economy, and moderate first cost.—*Mechanics Magazine.*

New Steam Pump.

A steam pump, intended for feeding boilers, of a very novel construction, is now at work at Messrs. Kittoe and Jackson's, Compton-street Clerkenwell. This pump has neither fly wheel, crank shaft, nor connecting rod. It is very unlike anything else of the kind in existence, is extremely simple, and will run at any speed up to 200 strokes or more, per minute, with ease and certainty. This pump, from its extremely small size for a given power, and its great simplicity, seems admirably adapted for feeding every description of steam boiler without exception. It may be said to take an intermediate place between the ordinary feed pump and the injector, possessing many advantages common to both.

A Large Casting.

On Tuesday afternoon of this week the largest quantity of molten metal ever poured into one mould in this Province was melted in the moulding shop of the Dundas foundry, and run into an immense mould which had been prepared for an anvil bed for the steam hammer to be used in the rolling mills at Hamilton. The castings when finished will weigh sixteen tons, but in order to provide against all contingencies considerable over twenty tons of metal had to be melted and poured. The running of the metal after everything had been prepared was but the work of about ten minutes, and was witnessed by a large number of spectators, who were no doubt gratified with the sight. We are safe in saying that there is not another foundry in Canada, either east or west, where facilities are possessed for the successful turning out of such immense castings, and we believe that no casting of a similar weight was ever before made in the Province, which fact must be very gratifying to Mr. Gartshore, the enterprising proprietor.—*Dundas Banner.*

Green Cheese.

The one grand error in American cheese making, is the want of care in not ripening the cheese before it is sent to market. We all know there is considerable difference between a Baldwin apple in the fall and after it has been kept a few months to ripen. The curd is the green apple, the cheese the ripened fruit. If you were going to send hay to market you would not send the green grass fresh from the field, and yet you often sell your cheese when it is as green as grass.

In the Cheshire dairies of England, so celebrated for cheese—none is ever sold until it is six months old. The cheeses are kept in a moderately warm room until thoroughly ripened and cured, with that outside mold so indicative to a practical eye of a rich, fine flavored, ripe cheese.—*Genesee Farmer.*

Paraffine.

Paraffine is always produced by the distillation of organic substances at temperatures below a red heat; bituminous substances yield the largest amount of paraffine; but it may be readily obtained by distilling wax with lime. The oil which comes over solidifies, and the paraffine may be obtained by pressure between folds of bibulous paper. In the distillation of coals, it occurs as one of the last products, concentrating itself in the last portions of the heavy oils, which sometimes become so thick as to solidify below 80°. This constitutes what is commonly called "paraphinized oil," in the language of patent processes.

The paraffine is separated from the oil by cold, and by a centrifugal apparatus, then melted and run into tin moulds, afterwards subjected to cold pressure first, and finally pressed when warm, and treated with 50 per cent. of oil of vitriol, which destroys the coloring matter, and lastly with a potash lye; it is then again melted and run into moulds.

It has great stability—sulphuric acid, chlorine, and nitric acid, below 212°, exert no action upon it. Its property of not being acted on by acids or alkalies, renders it suitable for stoppers for vessels holding such liquids; also for moulds for galvanoplastic purposes, where the metal is not intended to cover, as a substitute for fat now used.

Paraffine melts at 116° (Regnault,) 111° (Kane,) and by several experiments made with care at 108°. It boils at 700°, and then begins to undergo decomposition; it dissolves sparingly in alcohol (4 per cent.,) but is very soluble in camphene, and in ether, and may be purified by treatment with these last two liquids. It burns in the air with a clear white flame, but requires a draught or large supply of air to prevent sooting; as a candle material, it requires a glass shade to produce complete combustion. It is a ready solvent of some resins, gutta percha, and caoutchouc, with which it unites in all proportions, and destroy its elastic property. As it contains no oxygen, it might be used for the same uses as benzule for preventing exidizable metals from contact with the air. From not uniting with acids and alkalies it received its name (from parum affinis,) and this property has been applied to make paraffine paper, for holding caustic alkaline samples. It might also form a tubing substance to transmit caustic gasses or vapors. It is to costly, as yet, to supersede white wax, in the manufacture of candles.

Petroleum Oil Lamp.

A new adaptation of petroleum has been made by Mr. J. Turner Hall, gas engineer to the London and North-Western Railway Company, Edge-hill Station. The great illuminating power of petroleum is generally acknowledged, but objections have been urged to its extended use owing to the accidents which have resulted from it from time to time. These casualties have, however, been attributed to the employment of the oil in its crude or partially and imperfectly prepared state, and to the lamps in which it was burned not being adapted to the purpose. M. Hall directed his attention to mineral oils for signal purposes and the lighting of railway stations, and after a series of experiments has succeeded in constructing a signal lamp and lantern in which petroleum may be used with perfect safety, and a brilliant and uniform light be obtained. The light is not affected by gusts of wind. It is already in successful operation in several of the stations on the London and North-Western Railway. In addition to its employment for railway signals it may also be used for lighting coal and other mines, lighthouses, and similar places. It is said that whilst the new petroleum lamp gives a large excess of illuminating power, the actual cost as compared with other oils is less by upwards of 50 per cent.

English v. Swedish Iron.

Experiments of an important nature have been made at the fortress of Calberg, in Sweden, upon the respective-merits of armour-plate made in England, France, and Sweden. Messrs. John Brown & Co., of Sheffield, sent two plates, one 12 feet by 2 feet 6 inches, and one 6 feet by 3 feet 8 inches. Messrs. Petin, Gaudit, & Co., of Lyons, sent two plates, each of 7 feet 6 inches by 3 feet 3 inches. The Montala Ironworks Company, of Sweden, sent two plates of 12 feet by 2 feet 6 inches, and one 6 feet by 3 feet 8 inches. All the plates were 4½ inches in thickness, and then bolted to a teak target backed with iron plating, and supported by a massive stone pier. The two upper plates in the target were the French, and each was secured by 11 bolts. The next plate below was the longest, Swedish, and this was secured by 29 bolts. Below this was a tier of two short plates, one Swedish and one English, each secured by 24 bolts, and the lowest plate was a long English, secured, like the Swedish' by 29 bolts. Each plate received six shots from the ordinary 68-pounder naval gun. The French and Swedish plates broke to pieces, and the English plates remained uninjured and free from cracks. The shots used were of Swedish iron, and exhibited great toughness as compared with the shots used in the English service—the core or centre of the shot, after striking, being of double the weight of the core of the English shot. —*Army and Navy Gazette*

Improvement in Ships' Compasses.

The Scientific American is "informed that Mr. L. G. Vassallo, late of the Austrian navy, but now an officer in the service of the United States, has made an inprovement in ships' compasses, which consists in constructing a sun-dial upon the compass. The hours are engraved upon the glass cover of the compass, and the gnomon is hinged at its lower end so that its inclination may be adjusted to correspond with the latitude. In 1849 we bought a portable compass and sun-dial constructed on this plan in a German toy-shop for 18" cents.

Flax for Manufacturing Purposes.

Flax is getting into extensive use in Wisconsin for manufacturing purposes. At Milwaukee there are exhibited specimens of flax white as snow, and also coloured with the most brilliant hue; calico made of fifty per cent. of flax; cotton flannel, one-half flax; felted cloths, and a variety of other manufactures of which flax is a component part. As handsome an article of broadcloth is manufactured from this cottonized flax as could be desired.

Mechanical Hair-Brusher.

A correspondent, writing from England, gives the following description of the sensation produced by the new mechanical hair-brusher:—"When I went in to get my hair brushed, and sat down before the glass, and been tucked in as usual, with bib and dressing-gown, the hair-dresser took up one of his circular brushes and hitched to the revolving band over my head: In a moment I felt a silent fanning, as if some monstrous butterfly were hovering over me; this was the air of the twirling brush, which caught my hair up and laid it down, and travelled all over my head with incessant gentle penetration. It crept down my whiskers and searching my beard with the same tender and decided effect. There was no scratching, not even of the neck and ears, but the skin of cheeks and chin was reached and swept. It was a new sensation. I felt as if I should like to be brushed continuously for a month.

A New Process of Engraving.

A M. Dulos has recently invented a new process of engraving, which is described by the *Moniteur Scientifique*, as follows:—A copper plate, on which the design has been traced with lithographic ink, receives, by the action of the pile, a deposit of iron on the parts untouched by the ink; the ink having been removed by means of benzine, the white portions of the design are represented by the layer of iron, and the black by the copper itself; the plate is then plunged into a bath of cyanide of silver, under a galvanic current, and the silver is deposited on the copper only. In this condition mercury is poured over the plate, which attaches itself to the silvered portions only, appearing in relief, and taking the place of the lithographic ink. Then take, in plaster or melted wax, an imprint, the cast of which, presenting the counterpart of the projections of mercury, gives a kind of copperplate engraving. This cast has not sufficient strength to bear the press; but by metallising the mould, and depositing upon it, electro-chemically, a layer of copper, we obtain an exact reproduction of the original projections of mercury, and, in some sort, of a martrix by means of which impressions of the plate may be produced *ad infinitum*.

For typographic engraving (figures in relief), the plate of copper should receive, on leaving the hands of the designer, a layer of silver, deposited only on the parts untouched by the lithographic ink; the ink is removed by benzine, the surfaces first covered by the design are oxidised, and the treatment above described is continued. At the end of the operation the raised portions of the electro-chemical plate intended for the impression will be found to correspond with the tracing of the design, and the hollow portions with the thickenings raised about the design by the mercury.

This process, which is the starting-point and the basis of M. Doulos' invention, has led him to the discovery of some more simple methods, which have led to important practical results, the fusible metal or amalgam of copper substituted for mercury giving rapid and remarkable perfect results.

Diameter of a Circle from which a Square or Hexagon can be made.

Workmen are often puzzled to find the diameter of a circular piece from which to make a square or hexagon of given size. The following rules are correct for the square:—Multiply the length of a side by 1·414213 and the product will be the diameter. For the hexagon multiply the distance across at right angles to the sides, by 1·1547 and the result will be the diameter. A slight allowance in excess should be made in order to insure sharp corners.

Practical Memoranda.

WEIGHT OF IRON.*

Square Iron.		Round Iron.	
Size.	1 ft.	Size.	1 ft.
Inch.	lbs.	Inch.	lbs.
1/4	0·2	1/4	0·2
3/8	0·5	3/8	0·4
1/2	0·8	1/2	0·7
5/8	1·3	5/8	1·0
3/4	1·9	3/4	1·5
7/8	2·6	7/8	2·0
1	3·4	1	2·7
1 1/8	4·3	1 1/8	3·4
1 1/4	5·3	1 1/4	4·2
1 3/8	6·4	1 3/8	5·0
1 1/2	7·6	1 1/2	6·0
1 5/8	8·9	1 5/8	7·0
1 3/4	10·4	1 3/4	8·1
1 7/8	11·9	1 7/8	9·3
2	13·5	2	10·6
2 1/8	15·3	2 1/8	12·0
2 1/4	17·1	2 1/4	13·5
2 3/8	19·1	2 3/8	15·0
2 1/2	21·1	2 1/2	16·7
2 5/8	23·3	2 5/8	18·8
2 3/4	25·6	2 3/4	20·1
2 7/8	27·9	2 7/8	21·9
3	30·4	3	23·9
3 1/8	33·0	3 1/8	25·9
3 1/4	35·7	3 1/4	28·0
3 3/8	38·5	3 3/8	30·2
3 1/2	41·4	3 1/2	32·5
3 5/8	44·4	3 5/8	34·9
3 3/4	47·5	3 3/4	37·3
3 7/8	50·8	3 7/8	39·9
4	54·1	4	42·5
4 1/8	57·5	4 1/8	45·2
4 1/4	61·1	4 1/4	48·0
4 3/8	64·7	4 3/8	50·8
4 1/2	68·4	4 1/2	53·8
4 5/8	72·3	4 5/8	56·8
4 3/4	76·3	4 3/4	60·0
4 7/8	80·3	4 7/8	63·1
5	84·5	5	66·8
5 1/8	88·8	5 1/8	69·7
5 1/4	93·2	5 1/4	73·2
5 3/8	97·7	5 3/8	76·7
5 1/2	102·2	5 1/2	80·3
5 5/8	107·0	5 5/8	84·0
5 3/4	111·8	5 3/4	87·8
5 7/8	116·7	5 7/8	91·6
6	121.7	6	95·6

Flat Iron.		
Thick.	Width.	1ft.
in.	in.	lbs.
1/4	1	0·8
1/4	1 1/4	1·1
1/4	1 1/2	1·3
1/4	1 3/4	1·5
1/4	2	1·7
1/4	2 1/4	1·9
1/4	2 1/2	2·1
1/4	2 3/4	2·3
1/4	3	2·5
1/4	3 1/4	2·7
1/4	3 1/2	3·0
1/4	3 3/4	3·2
1/4	4	3·4
1/4	4 1/4	3·6
1/4	4 1/2	3·8
1/4	4 3/4	4·0
1/4	5	4·2
1/4	5 1/4	4·4
1/4	5 1/2	4·6
1/4	5 3/4	4·9
1/4	6	5·1
3/8	1	1·3
3/8	1 1/4	1·6
3/8	1 1/2	1·9
3/8	1 3/4	2·2
3/8	2	2·5
3/8	2 1/4	2·9
3/8	2 1/2	3·2
3/8	2 3/4	3·5
3/8	3	3·8
3/8	3 1/4	4·1
3/8	3 1/2	4·4
3/8	3 3/4	4·8
3/8	4	5·1
3/8	4 1/4	5·4
3/8	4 1/2	5·7
3/8	4 3/4	6·0
3/8	5	6·3
3/8	5 1/4	6·7
3/8	5 1/2	7·0
3/8	5 3/4	7·3
3/8	6	7·6
1/2	1	1·7
1/2	1 1/4	2·1
1/2	1 1/2	2·5

* Hazlett's Hand-book.

Temperature at which Metals Volatilize.

The temperature at which the metals volatilize has been hitherto usually determined by means of an air pyrometer, but M. Becquerel has adopted another method for their determination. The instrument he employs is a thermo-electric pile, and with it he found that the following metals boil at the following degrees Fahr.: cadmium 1,328; zinc 1,688; silver 1,681; gold 1,879; palladium 2,517; platinum 2,690. It is of some importance to state that certain of these figures are lower than those obtained by M. Becquerel, when using the air pyrometer.

Land Measure.

Every farmer should have a rod measure—a light stiff pole—just 16½ feet long, for measuring land. Ascertain the number of rods in width and length of a lot you wish to measure, and multiply one by the other, and divide by 160 and you have the number of acres, as 160 square rods make a square acre. A little practice will enable any one to step a rod at five paces which will answer very well for ordinary farm work.

Statistical Information.

Measures and Weights of China, Japan, and India.

In China the foot is the unit of length, divided decimally, but there is also in use what is known as the merchants' foot, and which is equivalent to 0·33837 metre (or yard). The road measure is the *li*, which is equal to 575·5 metres. For weight there is the *pikot*, which contains 100 *katles* of 16 *tales* each, and is equivalent to 133⅓ English pounds avoirdupois. The *katte* equals, therefore, 1⅓ English pound avoirdupois.

The unit of length in Japan is the *sasi*, divided decimally, and which is equal to 0·303 metres; there is also the ell, or *kupera sasi*, equal to 0·379 metre. For weight there is the *moume*, equal to 1¾ grams; the *moume* is divided into 10 *pun*, and 16 *rin*. All revenues of the Daimios are estimatep at so many ko-koos of rin. This is merely a standard of value, just as a pound sterling is with us, and does not give any clue to ascertaining the quantity of land these territories may contain. The standard of superficial measure is a *tsoobo*, being about 6 ft. square, or, in exact terms, the side is 5 ft. 11¾ in., and contains, therefore, an area of 35·35 square feet, instead of 36 ft. In referring to the size of a farm or tract of land, an *itham*, containing 300 *tsoobo*, is the measurement generally mentioned, and one *il-than* of good rice land is calculated to produce 1,600 *its-go*, or about 532 lbs. weight avoirdupois, of clean rice, at one cropping. The native 1 lb. weight is divided into 160 equal parts, of which 120 make 1 lb. avoirdupois. The smallest Japanese grain measure is an *its-go*, which contains 5⅓ lbs. avoirdupois of clean rice. In a tabular form, their weights may be shown as follows:—

1 Its-go	=	1-3rd lbs.
10 Its-go (1 Isoho)	= ...	3 1-3rd
10 Isoho (1 Itho)	= ...	33 1-3rd
10 Itho (1 Its'ko-koo)	= ...	333 1-3rd

The weights and measures of India are remarkably diverse, and puzzle the British residents to an enormous extent. In Bombay the unit of length is the *haht*, equivalent to 0·45719 metre, and in Calcutta the fathom, or four *hahts*. The road measure is the *coss*, equal to 1828·767 metres; for land measure they have the *biggah*, which contains 20 *cottahs*, or 6,400 square *hahts*, and is equivalent to 13,37755 *ares*. The new bazaar weight is the *tola*, equivalent to 10.66375 *grams*. The *mahnd* has 40 *sihrs*, 320 *tolas*.

It will be seen from the foregoing that the advocates of a universal metric system have some work before them.

The Public Debt of the United States.

The Secretary of the Treasury furnishes, in answer to a resolution of the Senate, a statement of the public debt of the United States to June 14, 1864, making the total amounts as follows:

Debt bearing interest in coin,	$837,941,091 80
" bearing int. in lawful money,	379,700,802 58
Debt on which int. has ceased,	370,170 09
Debt bearing no interest,	501,383,104 41
Total	$1,719,395,168 88
Annual interest in coin,	$50,823,672 45
Annual interest in lawful money,	20,876,057 71
Total interest,	$71,699,730 16
10-40 bonds,	$70,239,250 00
Three year 7-30 notes,	118,577,650 00
U. S. notes outstanding,	432,041,330 00
Fractional currency outstanding,	21,031,948 85

The remainder of the debt bearing no interest is mainly unpaid requisitions.

English Peals of Bells.

We have now in London and different parts of the United Kingdom about 14 peals of twelve bells; 50 peals of ten bells; 600 peals of eight bells; 700 peals of six bells; and about 400 peals of five bells; and a great number from one bell to a chime of four bells; and all these peals of five to peals of twelve bells cost each from £300 to upwards of £2,500. So you see what a merry ringing island England is; and a melodious peal of bells is perhaps not less captivating than the finest toned instrument ever yet invented.—*Builder.*

The Cost of the British Army.

A return, pertinent to the recent discussions on the cost per man of the army, has been made by the War Office, showing the amount allowed each soldier for, say, beer-money, clothing, fire, forage, and other allowances. The annual cost of a gunner, sapper, or private, in the following corps is:—Royal Horse Artillery, 55*l.* 6*s.* 1½*d.*; Life Guards, 68*l.* 16*s* 8½*d*; Horse Guards, 63*l.* 14*s.* 2½*d*; Cavalry of the Line, 52*l.* 11*s.* 3½*d*; Royal Artillery (Infantry,) 32*l.* 6*s.* 11½*d*; Royal Engineers, 31*l.* 5*s.* 3¾*d*; Military Trains, 31*l.* 15*s.* 9¾*d*; Foot Guards, 28*l.* 17*s.* 8¾*d*; and Infantry of the Line, 26*l.* 3*s.* 5⅓*d*

Gas in London.

There are 13 metropolitan gas companies in operation, who realized in 1862 profits amounting to £558,403; total capital engaged £5,783,815, so that the return for the year averaged 9·69 per cent. The quantity of coal used by all the companies was 848,979 tons.

Indian Railway.

A great public work has been brought to a successful termination in the completion of the Bombay, Baroda, and Central India Railway. On the 1st of June this line of railway was to be opened without interruption from Bombay to Ahmedabad, for passenger traffic; and immediately after the rain, for goods traffic. The most fertile province of India is thus brought in speedy communication with India's chief sea-port and emporium of trade.

French Locomotives.

According to a recent official document, the number of locomotives in France is 2,751, not including those belonging to the Orleans Railway Company, which possesses 400.

Miscellaneous.

New Method of taking Portraits.

A new era in portraiture is predicted from the discovery of a Mr. Swan, who presents a solid, life-like likeness of any one, inclosed in a cube of crystal. The effect of the new process is to exhibit the subject of the portraiture with life-like verisimilitude, in natural relief. You take up a small case, and look through what appears to be a little window, and there stands or sits before you, in a pleasantly-lighted chamber, a marvelous effigy of a lady or gentleman, as the case may be. The projection of the nose, the molding of lips, and all the gradations of contour, are as distinct as if an able sculptor had exercised his skill; but the hair and the flesh are of their proper tint, and the whole thing has a singularly vital and comfortable look. Indeed, were it not for the reduction in size, it would be difficult to avoid the belief that an actual man or woman, in ordinary dress, and with characteristic expression, was presented to your eye. The "Swan system" is about to be introduced into this country.—*Scientific American.*

An Oil Lake in Trinidad.

There is in Trinidad, only a mile from the coast, a basin of ninety-acres, filled with asphalt, yielding seventy gallons of crude oil per tun. There are also springs of asphaltic oil in the neighborhood, and large pitch banks off the shore. It is estimated that the lake is capable of producing three hundred million gallons of oil, and forty or fifty gallons are considered equal to a tun of coal. The *Trinidad Colonist* publishes a *memoire* by Mr. Stollmeyer, of Port of Spain, proposing the use of this liquid fuel for oceanic steam navigation: and he states that he has been, at various times, for these three years, suggesting this employment of a distillate from the pitch lake of Trinidad. To oil a ship would not take above a tenth of the time it takes to coal her, if pipes were employed, and the oil would not take above a fourth of the space occupied by coals. He recommends that it be applied at once as auxiliary to coal, by throwing jets over the burning mass, but contemplates, eventually, upright tubular boilers, the liquid fuel to be supplied as fast as it can be converted into flame. Of course, the North American oil springs are another source of supply.—*London Times.*

Oil Springs, C. W.

This place may now be considered to be fairly starting on the high road to prosperity. The clouds which have gathered so thickly around us for the past few months are now begining to disperse, and the bright bow of promise and hope begins to appear. Hitherto every discouragement has beset us, every difficulty surrounded us, and to the minds of many all hope was cut off; so that for a time all energy was paralyzed, and all enterprise discouraged. But a new impetus has been given to the oil trade and we now confidently look forward to the time, not far distant, when it will assume the high position which was once promised. Government has at last lent an ear to our wants, and granted us its assistance. This alone is a matter of great importance and encouragement; but however much governmental assistance we may have, if we do not help ourselves, the assistance of government will not avail us anything. This the oil men very well understand and are acting on that principle. They are determined to leave nothing undone which may be necessary to secure a large supply of oil. Being fully satisfied that oil exists in immense quantities below any depth yet reached, it was only necessary to receive that encouragement in the way of protection which we have so long sought after, to stimulate them to renewed exertions in the prosecution of their search for oil. That protection being now granted, operations on a large scale will at once be commenced. Indeed they have already commenced. Besides the "test well" which is about to be sunk by the Joint Stock Company we hear of several private enterprises which will be conducted on a scale of equal magnitude. Prominent amongst these is the well which Col. Elliott has already commenced. He intends to drill until he gets oil, however deep that may be. Another company from Pennsylvania have already commenced operations on a large scale and design to sink a well deep enough to thoroughly test their land. Besides these there are numerous wells going down in various localities, the depth of which will probably be determined by the success which attends what is known as the "test wells."

Another encouraging feature of our affairs is, that the yield of oil is constantly on the increase.

The prospect of remunerative prices induces many, who would not otherwise work their wells, to resume operations. There are many old wells here that will pay to work at present prices, which have been lying idle during the late dull season. These will soon be in active operation.

On the whole, prospects are brighter at this moment for the future of Oil Springs, than they have been for the last ten months, and we confidently look for a season of prosperity such as has never before been witnessed in the Oil Trade of Canada. —*Oil Springs Chronicle.*

Spontaneous Combustion.

It is a fact better ascertained than accounted for, that fixed oils, when mixed with any light kind of charcoal, or substances containing carbon, such as cotton, flax, or even wool, which is not of itself inflammable, heat by the process of decomposition, and after remaining in contact some time, at length burst into flame. This spontaneous combustion takes place in waste cotton which has been employed to wipe machines, and then thrown away and allowed to accumulate into a heap. We have known an instance of the kind in a manufactory for spinning worsteds, where the waste wool, or "slubbings," as it is termed in Yorkshire, was thrown into a corner and neglected. It then heated, and was on the point of bursting into flame, when the attention of the workmen was directed to the heap by the smoke and smell. In cotton mills the danger exists in a still greater degree, and it is believed that the destruction of many cotton factories has been occasioned by this means. The cause of this peculiar property of fixed oils deserves more attention than has hitherto been paid to it.

Petroleum 2,300 Years ago.

The collecting of Petroleum is generally regarded as a modern discovery made by Drake. But Herodotus, who lived 2,300 years ago—about the period of prophet Malachi—speaks of the collection of Petroleum in the island of Zante, on the western coast of Greece. Dr. Chandler, in the early part of the present century, visited Zante and found an oil well in full operation, thus confirming the narrative of Herodotus. The Patriarch Job had undoubtedly visited that well or some other one, a flowing well at that—otherwise he would not of thought of the "rock pouring out rivers of oil."—*Oil Trade Review.*

The Great British Coal Oil Case.

Our English exchanges contain full reports of the important case of Young *vs* Fernie, which involves the originality of James Young's patent for distilling parafine or kerosene oils from Boghead and other coals. A large amount of evidence has been taken on both sides of the case, and numbers of chemists and experts have testified—some on the side of Young and others on the side of his opponent. What renders this case important is that some of the most widely known chemists express the conviction that Young's invention was really novel, while others equally eminent declare it to have no novelty whatever, and that his process had been used many years before his patent was granted. The decision of the court in this was regarded with much interest, for business operations of great magnitude are involved in the result.

The hearing of this *cause celebre* was spun out to THIRTY-FIVE DAYS, when both sides being exhausted, the Vice-Chancellor delivered a lengthy and elaborate judgment, the synopsis of which, was—"I find in favor of the plaintiff on all the four issues, and the defendant is to pay all the costs as they are taxed."—*Oil Trade Review*

The Machinery of the Human Body.

Very few mechanics are aware how much machinery there is, in constant action, in their own bodies. Not only are their hinges and joints in bones, but there are valves in the veins, a force pump in the heart, and curiosities in other parts of the body equally striking. One of the muscles forms an actual pulley. The bones which support the body are made precisely in that form which has been accertained, by calculations and experiments, to be the strongest of pillars and supporting columns—that of hollow cylinders.

A Skilful Colored Mechanic.

Prof. A. W. Smith, of the Naval School, Newport, R. I., exhibited at our office, a few days ago, a very ingeniously-constructed miniature steam engine and boiler of about 6-fly power, we should judge, which was designed and constructed by Benjaman Boardley—once a slave in Maryland. Attracted by the mechanical genius and skill of Boardley, a few gentlemen clubbed together and purchased him of his owner and gave him his liberty. He soon found employment in the Naval Academy, and under Prof. Smith he now has the sole charge of the philosophical apparatus of the institution.—*Scientific American.*

Eggs in Photography.

The *Scientific American* says:—"We are informed by Professor Seely, editor of the *American Journal of Photography*, that more than 1,200 dozen of eggs per week are used in New York and vicinity for albumenizing paper for photographs. A great deal more than this quantity of albumen is thrown away every week in the blood of the animals slaughtered for this market. Could some plan be devised for separating the albumen from the blood it would be a very valuable discovery."

Correct Speaking.

We advise all young people to acquire, in early life, the habit of correct speaking and writing, and to abandon, as early as possible, any use of slang words and phrases. The longer you live, the more difficult the acquisition of correct language will be; and if the golden age of youth, the proper acquisition of language, be passed in its abuse, the unfortunate victim of neglected education is, very properly, doomed to talk slang for education. Every man has it in his power. He has merely to use the language which he reads, instead of the slang which he hears; to form his taste from the best speakers and poets of the country; to treasure up choice phrases in his memory, and habituate himself to their use, avoiding, at the same time, that pedantic precision and bombast which show the weekness of vain ambition rather than the polish of an educated mind.

A Caution to Boys.

Boys, use no profane language, utter no word that will cause the most virtuous to blush. Profanity is a mark of low breeding and the tendency of using indecent and profane language is degrading to your minds. Its injurious effects may not be felt at the moment, but they will continue to manifest themselves to you through life.

They may never be obliterated; and when you grow up, you will find at your tongue's end some expression which you would not use for any money. And this expression was learned when you were a boy. By being careful on this point you may save yourself much mortification and sorrow.

"Good men have been taken sick and become delirious. In these moments they have used the most vile and indecent language. When informed of it, after a restoration to health, they had no idea of the pain they had given to their friends, and stated that they had learned and repeated the expression in childhood, and though years had passed since they had spoken a bad word, the early, impressions had been indelibly stamped upon the mind."

Think of this, ye who are temped to use improper language, and never let a vile word disgrace you. An oath never falls from the tongue of the man who commands respect.

Honesty, frankness, generosity, and virtue are noble traits. Let these be yours, and we shall not fear. You will then gain the esteem and love of all.

The Magnesium Light.

The magnesium light is richer in actinic power than any other artificial light known—is so rich, indeed, in chemical rays, that the sun itself, when unobscured by fog or cloud, exceeds only by 34 times the chemical power of a magnesium flame having the same apparent diameter as that which the sun presents. The result is that by the light produced by the combustion of magnesium wire, such as is now being sold at 3d. a foot we are able to obtain, in any weather, and at any hour of the day or night, much better photographs than can ever be obtained in this country by sunlight, except on such clear and sunny days as occur in this climate but very rarely indeed. Magnesium will thus render us henceforth independent of the sun for photographic purposes, and will, moreover, enable us to obtain photographic pictures of places—such as the interiors of caves and mines, the passages in the interior of the Egyptian pyramids, and the like—into which the sunlight never enters nor can enter. But it is not in actinic power alone that the magnesium light exceeds all other artificial lights yet produced. For the purpose of artificial illuminations generally it is without a rival. A very thin magnesium wire will give off, in burning, as much light as a very powerful electric light, is soft and diffusive, and does not in the least dazzle or pain the eyes. It is, moreover, of the purest white, so that all colours, even to the most delicate tints, are seen in it as perfectly as in sunlight, while a magnesium lamp has over both the electric lamp and the ordinary gas-light the advantage that it can be carried about as readily as a candle. A still greater advantage—one, indeed, of immense importance—which the magnesium light has alike over gas, and over any kind either of oil-lamps or of candles, consists in the circumstance that magnesium, in undergoing combustion, gives off no deleterious vapours, nor, indeed, any vapours of any kind. Instead of its burning, as gas, candles, and oil do, into aqueous vapour and carbonic acid, with a greater or less admixture of sulphuretted hydrogen, and other furniture-destroying, plate-tarnishing, and health-injuring compounds, the only product of the combustion of magnesium is a harmless solid, the oxide of magnesium, or magnesia All this points to the magnesium light being likely to come extensively into domestic use, while its great brilliancy would seem to render it eminently adapted for use in light-houses. In all probability its price will not long be an obstacle to either of these two applications of it; for even now, while the manufacture of magnesium is not yet three months old, the light from magnesium is but little more costly, quantity for quantity, than that from "composite" candles, seeing that two and a half ounces of magnesium will give forth, during combustion, as much light as 20lb. of the best stearine.

Moral Courage.

Have the courage to cut the most agreeable acquaintance you have when you are convinced that he lacks principle. A friend should bear with a friend's infirmities, but not with his vices.

Have the courage to show your respect for honesty, in whatever guise it appears; and your contempt for dishonesty and duplicity, by whomsoever exhibited.

Have the courage to speak your mind when it is necessary you should do so, and hold your tongue when it is prudent to do so.

Have the courage to speak to a friend in a "seedy" coat, even though you are in company with a rich one, and well attired,

Have the courage to wear thick boots in the winter, and insist upon your wife and daughters doing the same.

Have the courage to obey your own conscience, at the risk of being ridiculed by men.

Have the courage to own you are poor, and disarm poverty of its sharpest sting.

Have the courage to discharge a debt while you have the money in your pocket.

Have the courage to prefer comfort and propriety to fashion, in all things.

Cultivation of Tomatoes.

There is scarcely a vegetable, unless it be the potato, that enters so largely into consumption by the masses of the people as the tomato. They are not only eaten through the summer and fall in the various styles of dressing, but are put into cans and jars and preserved for winter use. They are as easily cultivated as any vegetable and yield profusely if a little care is devoted to their culture. The *Culturist* has some remarks on the culture of tomatoes which are worthy of attention. It says "there is a diversity of opinion in regard to the culture of tomatoes. Some prefer to allow the vines to cover the ground at will; others prefer trelisses or frames. The French method is as follows: As soon as a cluster of flowers is visible, they top the stem down to the cluster, so that the flowers terminate the stem. The effect is, that the sap is immediately impelled into the two buds next below the cluster which soon push strongly and produce another cluster of flowers each. When these are visible, the branch to which they belong is also topped down to their level and this is done five times in succession. By this means the plant becomes a stout dwarf, bushes not above eighteen inches high. In addition to this, all the laterals whatsoever, are nipped off. In this way the ripe sap is directed into the fruit, which acquires a beauty, size and excellence, unattainable by any other means."