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FOR

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BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA,

FOR THE YEAR 1866.

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* Mr. Sheldrick died during his year of office.

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JANUARY, 1866.

HEAT IN OUR DWELLINGS.

At the present season it will not be out of place to make a few remarks upon the subject of domestic heating. It is one of no secondary importance, taking into account the high price of fuel and the many sanitary consequences resulting from a proper or improper method of warming our dwellings. Economists are too apt, in their endeavours to lessen the consumption of fuel, to overlook the vast importance of having, with economy, those conditions of health and comfort without which any system of mere heating is imperfect and even dangerous; for it cannot be doubted that the foundation of those acute diseases which visit numbers of families in the spring, is laid by having the dwelling kept in an improper state during winter. That season, which ought to invigorate our frames after the relaxing heat of summer, is spent by many of those whose occupation is mostly in-doors, in a state of atmosphere more debilitating than the summer influences. How can such be expected to have sufficient vital strength to resist the prevailing diseases of spring, or the fatal epidemics which sometimes visit us in summer? Too little thought is given to this subject, and too little is generally known of those fundamental principles upon which systems of warming should be based. To get the thermometer to stand at a certain point appears to be the utmost aim of the many; and when attempts are made to introduce higher objects the most ludicrous mistakes are often made. For instance, in a report made two or three years ago respecting the heating and ventilating arrangements for certain large public buildings, we find it stated that the air for ventilation in summer should be cooled by large fans, five feet in diameter, driven by steam; a process differing only in degree from that of attempting to cool it by a heated stove; for although fans, by means of air, cool bodies of higher temperature than the air, the effect of beating upon the air itself is to heat it. The nature of heat is not generally apprehended, the distinction between heat and heated air is not usually seen, so that we find many expecting radiant heat to obey the same laws as heated air. It is much to be desired that there should be more general knowledge of those scientific principles upon which the production of heat from fuel and its proper application depend; for improved methods are brought forward under great disadvantages when the public cannot understand their principles, and frequently mar their action by improper management, and condemn really useful arrangements. Our means of obtaining knowledge upon these subjects have of late been abundantly multiplied. The brilliant discoveries and accurate calculations, relative to the quantitative measurement of heat, have placed within our reach means for determining questions which were formerly beyond our grasp; and whilst the higher class of speculative minds are applying those discoveries to the solution of sublimer problems, it is the duty of practical minds to bring them to bear upon our domestic economies; and to teach us from them how to use, most efficiently, those gifts of Providence designed for our sustenance and comfort.

When we speak of a warm apartment, what do we mean? Is its warmth indicated by the standing of the thermometer in it? No! the standing of the thermometer does not generally indicate the thermal relation between the apartment and the human body; for as a properly warmed apartment is always at a lower temperature than the human body, and is therefore constantly abstracting heat from it, the warmth or coldness of the apartment must be estimated by the slowness or rapidity with which this abstraction is effected, as well as by the extent to which it may be continued, if not counterbalanced, by the production of animal heat. So of other objects. A piece of steel at 32° is colder than wool at the same temperature; that is, it will take heat from the human body when in contact with it, more rapidly than wool. One day will be colder than another, although the thermometer stand at the same point in both, if the air be in more rapid motion. Moisture or dryness will affect the warmth or coldness of the atmosphere. The same principle applies with respect to climate. It is said that many who have gone to the west coast of Ireland, hoping from the higher average standing of the thermometer to enjoy a more genial climate, have been much disappointed—the winds and moisture from the Atlantic Ocean making the air, notwithstanding its higher temperature, more chilling to the human frame than that of lower temperatures in places more sheltered and tranquil. So also a freely ventilated apartment, at a temperature lower than the body, will be cooler than a close one at the same temperature. The standing of the thermometer shews the sum of the heating influences by which it is surrounded, but does not shew the value of their effects.

upon each other. To ascertain this we must use special means. If, for instance, we wish to know the coolness of a room, whose temperature is 60°, in relation to a body at 90°, equal to the supposed temperature of the surface of the human body, we may heat a thermometer to 90° and note the number of seconds it will take to fall say 10°; and a comparison of the result of observations under other circumstances will enable us to form a comparative estimate of the value of different heating influences upon objects at 90°. We must consider that the object of domestic heating is to counteract the chilling influences by which we are surrounded, and which would, without it, take away heat faster than the vital processes could restore it. The human body is not like an inanimate object, which will rise and fall in temperature, as the thermometer, proportionally to the amount of heating influence brought to bear upon it; but it must maintain a certain temperature, and if, owing to external influences, it is unable to do so, discomfort and evil is the result. The fact that it is the human body, and not the thermometer, which is to be affected by our heating arrangements, is too often overlooked.

An important question here arises—what is the best method of warming our dwellings? There are two modes of distributing heat available for the purpose, namely, radiation and convection. These are used either singly or in combination in all warming arrangements. An open fire in an ordinary fire place distributes nearly all by radiation, for most of the air that is warmed by it goes to the draught of the chimney. The hot air furnace distributes all by convection: its whole available heat is taken up by the air, and by it carried to the place required. Close stoves, coils of pipe heated by steam or water, and such like arrangements, distribute by both modes; part of their heat being radiated and part carried by the air which comes in contact with them. It is not generally understood that between these two modes of distribution there are remarkable differences, such as may have important effect in governing their application to particular cases. Radiant heat does not obey the same laws as heated air, the latter being subject, as other ponderable matter, to the laws of gravitation, &c., has a tendency always to rise by the pressure of colder air, and is carried off rapidly by ventilation, or by any extraneous currents which may bear upon it; but radiant heat proceeds in straight lines, in all directions, from its source, and joins itself to objects with which it comes in contact. Gravitation has no effect upon it, no wind can blow it aside, no ventilation carry it off; it can be enjoyed in an atmosphere of low temperature and corresponding density, for it will pass through dry air without sensibly warming it; in fact a joint of meat may be roasted by it in an atmosphere at the freezing point. There is one particular in their application to our present object which requires attention, it is this: in a room warmed by radiation the atmosphere will never be above the average temperature of the surrounding objects, and its density will be proportional; but in one warmed by convection, as the heating object must be hotter than the objects to be heated by it, the air upon its admission must be very hot, and therefore highly rarified, and cannot be well adapted for breathing; for the lungs filled with this rarified air will of course contain much less oxygen than when filled with denser air. Mountaineers, who live constantly in a rare atmosphere, have their lungs naturally enlarged to adapt them to their circumstances; but we who are subject, when out of doors, to an atmosphere of low temperature and corresponding density, should endeavour to avoid extreme transitions. Ordinary ventilation cannot proceed in such an atmosphere, for, as the admitted air has to impart some of its heat to the objects to be warmed, it must be hotter at its ingress than at its egress, and will, on cooling, become denser and fall to the lower part of the room, whilst the fresh hot air coming in will fill up the vacated space above; but the lower air cannot get out by openings at the top of the room, for the lighter and warmer air will be passing out there, sliding over the lower stratum and leaving it a stagnant pool below. Mr. Ruttan's special method of ventilation, however, will meet this difficulty, although few who use hot air have the sagacity to apply his principles.

To determine accurately the economy of the two modes of heating, we are satisfied that more experiments must be made. The cry passes from mouth to mouth, without proper investigation, that open fires are wasteful. An experiment recorded in this *Journal*, Vol. III., page 139, shews a result which is in no wise contemptible, but which requires confirmation by other experiments before it can be fully relied upon. The fact that a room warmed by radiation is cooler in one part than another may not be to its disadvantage; for we must consider that a place may be comfortably warm to one person and not to another, as the compensating physical power of producing heat differs in individuals, according to their health, constitution, temperament, or present employment; so that it may be desirable that a choice of situation should be afforded to all, suited to their conditions and occupations.

It would be well for us to know, accurately, the economic effect of ventilation upon the warmth of our apartments. We are unreasonably afraid of the chilling effect of fresh air. It is true that if cold air is allowed to play upon the person in concentrated currents, it causes cold and discomfort; but a sufficiently rapid change of air in a room, if properly conducted, although it be admitted cold and emitted warm, cannot, according to calculation, carry off a very large quantity of heat; as, owing to the low specific heat of air, and its extreme lightness, a large bulk of it may be warmed with very little heat. The amount necessary to raise a cubic foot of water 1° will raise 3,080 feet of air 1°; and according to the estimated heating power obtained from the combustion of one pound of good bituminous coal, it will raise 13,305 cubic feet of air 40°,—say from 30° to 70°.* This quantity of heated air would furnish a room with 18 feet per minute for 12 hours, 19 min. Its cost for heating, with coal at $8 per ton, would be four mills, or for one week about 5½ cents: that is to say, 18 feet of pure air per minute passed through a room, and raised 40° in temperature in its passage, will only absorb the heat produced by the combustion of one pound of coal in 12 hours. Allowing some margin for loss in the use of fuel, good ventilation cannot be so very costly.

We will in our next make a few remarks upon the proper combustion of fuel.

* This estimate is based upon the experiments of Desprotz, which show that 1 lb. of bituminous coal will raise 60 lbs. of water from 32° to 212°=10,800 lbs raised 1°, ÷62½. (the number of pounds in a cubic foot) = 172.8 cubic feet raised 1°, × 3,080, (the ratio of capacity for heat between equal bulks of water and air) and ÷ 40° =13,305. Other writers have given a basis which would result in 16,000 feet, nearly 25 per cent. more favourable.

EXIT FROM PUBLIC BUILDINGS.

The Russian Government has decreed that the outer doors of all churches and other public buildings shall be constructed to open outwards, so as not to endanger the safe exit of crowds during alarms of fire or other panics. This is as it should be. Public safety requires such a law as this, not only in Russia, but in all civilized countries. There is no excuse for their opening inwards, as neither appearance nor necessity requires it. It is just as easy to have them swing outwards as inwards, and as architecturally correct. The catastrophe in South America, where hundreds were burnt or trampled to death on the occasion of a Catholic cathedral taking fire during a religious performance, the loss of several lives in the same manner at the burning of a theatre in Quebec a few years ago, and various cases of a similar character in both Britain and on this continent, would seem to demand that such a law should be made here. We are not aware of any buildings in Toronto in which this plan has been adopted, but the Mechanics' Institute and the Gould-street Presbyterian church. We are glad, however, to hear that, under the advice of the architects, Messrs. Gundry & Langley, the Roman Catholic Bishop of Toronto has ordered the doors of his cathedral to be so constructed. This is wise, considering the vast crowds that attend that edifice on special occasions. Since writing the above, we notice that the Inspector of Buildings in Montreal has ordered that no public hall or theatre shall be used unless it has safe means of egress; and that the doors must open outwards. The doors of the City Hall are being altered accordingly.

SOAPSTONE, AND W. H. SHEPPARD'S SOAPSTONE STOVES.

"Soapstone, or steatite, is a more or less pure compact talc. A greenish-white translucent steatite from Potton, (C.E.) gave by analysis, silica, 59·50; magnesia, 29·15; protoxyd of iron, 4·50; alumina, 0·40; oxyd of nickel, traces; volatile, 4·40 =97·95. When pure and compact, soapstone is much used as a refractory material for lining furnaces, especially those destined for anthracite. From its softness, it is readily cut with knives and saws into the required shape, and it is infusable in any ordinary furnace heat. Slaty varieties, and such as contains crystals of spar, or other foreign materials, are, however, to be rejected, inasmuch as they are liable to split and exfoliate by heat. Steatite is also used in the construction of small portable furnaces, and of open stoves, which are made of plates of it held together by iron rods and bands. Culinary vessels are made of it; and it has also been bored for water-pipes, and used for the lining of cisterns for acid and alkaline liquids. When very strongly heated, steatite loses a portion of combined water which it contains, and becomes much harder and susceptible of a polish. It may then be colored by various solutions; and it has lately been used in this manner for the manufacture of buttons, and of some other small articles. Jets for gas-burners are also made of this hardened steatite, and have the advantage of not being liable to rust or corrosion."*

"When crystalline or in thin and flexible folæ of pearly lustre, it is commonly known as talc, of which the substance employed under the name of French chalk for removing grease spots is a variety. Meerschaum is another variety. * * * The rock is sawed into slabs and used for jambs for

* Sir W. Logan's "Geology of Canada."

fire-places, for lining stoves, or for the whole stove. After being heated it takes a good polish, and assumes an apple-green colour. The sizing rollers in cotton mills are made of soapstone. The powder is especially useful as a lubricant for the journals of heavy wheels, and is also used as a polishing material for serpentine, alabaster, &c."†

This article of soapstone, or steatite, is now being brought into extensive use in some parts of the United States, for the construction of parlour and bedroom stoves, for the consumption of either wood or coal fuel. The chief recommendation this article possesses, is, that it cannot be heated to the excessive temperature of iron, and consequently, the excessive dryness and sense of *burnt air* experienced in a room heated by an iron stove is altogether absent where soapstone is used.

Not only does the iron stove dry the air which passes over it, or comes in contact with it—frequently in an incandescent state—but, as Ure says: "As cast iron always contains, besides the metal itself, more or less carbon, sulphur, phosphorus, or even arsenic, it is possible that the smell of air passed over it in an incandescent state may be owing to some of these impregnations; for a quantity of noxious effluvia; inappreciably small, is capable of affecting not only the olfactory nerves, but the pulmonary organs."

We make these remarks to draw attention to a specimen stove recently manufactured by our townsman, Mr. W. H. Sheppard, 173 Queen Street West, who "submits the present specimen to the public as a rudimentary model, and is prepared to build them of any size, for wood or coal, and to any architectural design compatible with the principle of construction. It is built upon the German or Russian plan, having deviating partitions for retaining and utilising the heat—which principle can be carried to a large extent by increasing the height of the stove."

He says, "they are noted for diffusing a powerful heat in a constant, mild, agreeable and healthy manner," which appears to be borne out by the experience of upwards of fifty different parties, whose testimonials are now lying before us, and who generally testify to the "steady, uniform and healthy heat they emit," so "agreeable in the sick room," and so specially "grateful to persons of weak or diseased lungs."

In addition to the stove manufactured by himself, Mr. Sheppard has received and offers for sale several of "Dodge's Patent Soapstone Stoves," from the manufactory at Providence, R. I., United States.

† American Cyclopœdia.

We trust that some of our enterprising Canadian capitalists will, ere long, see that our native soapstones are brought into the market, so that we may in this be independent of foreign supples. Sir Wm. Logan says: "On the twentieth lot of the fifth range of Potton, a workable bed of it, three feet in thickness, is met with; and a locality which furnishes a steatite of superior quality, is on the twenty-fourth lot of the sixth range of Bolton;" the upper part of which are described as very pure and compact, and furnish large blocks free from flaws.

Steatite, more or less pure, is also found in several other places in Lower Canada; and Sir Wm. Logan says: "There is little doubt that workable beds, like that of Potton, will be found in many localities in the magnesium band along the outcrops of the various synclinals."

CONTRIBUTIONS.

We shall be glad to receive contributions or communications relating to any of the industrial interests of this Province, or to any new inventions, discoveries, or improvements in arts and manufactures, with wood-cut illustrations of such when obtainable; or reliable descriptions and statistics of leading manufacturing establishments, wherever located. We will cheerfully give space in the Journal for all such contributions, if found suitable for its pages.

Board of Arts and Manufactures

FOR UPPER CANADA.

SUBSCRIBERS IN ARREARS.

We have a good many subscribers two years and upwards in arrears. We are confident that it arises in most cases from oversight, owing to the smallness of the amount; but, nevertheless, the Board cannot continue to furnish it unless the subscriptions are paid. We send the present number to all such, and trust that remittances will be made during the month, if not, we shall be compelled, though very reluctantly, to discontinue sending them the Journal.

THE SIXTH VOLUME OF THE JOURNAL.

We are anxious to retain all our old subscribers, if possible; not from any pecuniary motives, but because we believe we give them a large mass of useful information during the year, for a very small sum of money; and we do not think they can afford to be without it at so trifling an annual cost as 75 cents. Some are not engaged in industrial pursuits, and may not be of a practical turn of mind, and therefore, may not appreciate the kind of information the Journal furnishes; but to such, if bound up into volumes, with its copious index, it may become a valuable work of reference, well worth preserving, as a record not only of late discoveries and improvements in the industrial arts and sciences, but of numerous other interesting facts and statistics of both local and general interest.

We shall be glad to receive remittances as early as convenient, as the terms of subscription are "payment in advance." Parties remitting can deduct amount of postage covering the remittance.

Old subscribers not wishing to continue, will please return to this office the present number, with name and Post Office address of party returning it.

ANNUAL EXAMINATIONS.

The Board will hold the Fourth Annual Examination of Members of Mechanics' Institutes, in the month of May or June next—the exact time of which will be stated in the February number of the Journal. As no change has been made from the programme of 1865, it is not considered necessary to take up so much space in the Journal as would be required to re-publish it in full; Institutes and intending candidates are therefore referred to the programme for the past year, as published in the Journal for December, 1864, copies of which we will endeavour to furnish to any Institutes requiring them. In the meantime we give the list of subjects of study, with other extracts tending to direct to the object sought to be attained by the Board, in establishing these Examinations, namely: to "Encourage, test, attest and reward efforts made by the industrial classes for self-improvement.

"It is suggested to pupils that they confine their attention to the subjects as tabulated; but it is not the intention nor the wish of the Board to limit their studies to any of the branches embraced in particular groups.

1.
- I. Arithmetic.
- II. Book-keeping.
- III. English Grammar and Analysis.
- IV. Geography.
- V. Penmanship.

2.
- VI. Algebra.
- VII. Geometry.
- VIII. Principles of Mechanics.
- IX. Geometrical and Decorative Drawing and Modelling.
- X. History.

3.
- XI. Trigonometry.
- XII. Mensuration.
- XIII. Practical Mechanics.
- XIV. Conic Sections.
- XV. Chemistry & Experim'l Philosophy.
- XVI. Geology and Mineralogy.

4.
- XVII. Animal Physiology and Zoology.
- XVIII. Botany.
- XIX. Agriculture and Horticulture.
- XX. Political and Social Economy.

5.
- XXI. English Literature.
- XXII. French.
- XXIII. German.
- XXIV. Music.
- XXV. Ornamental and Landscape Drawing

"These Examinations are open to all members of incorporated Mechanics' Institutes or Library Associations in Upper Canada, who are not students of any college, graduates or under graduates of any University, or certified school teachers; or who are not following any of the learned professions.

"Copper-plate certificates of three grades, printed on parchment for pocket use, or reference, will be awarded to successful candidates; indicating respectively, "Excellence," "Proficiency," and "Commendableness." A beautiful lithographed Diploma, for framing, will also be awarded to holders of first and second class certificates.

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

"The Examinations will be held at the rooms of the respective institutions reporting candidates. Instructions as to the particular evenings upon which the respective subjects will be taken up, and all the necessary forms for returns to the Board, will be furnished by the secretary of the Board, as soon as candidates are reported by any local committee."

ANNUAL MEETING OF THE BOARD.

The Annual Meeting of the Board for reception of the Report of the retiring Committee, and election of office-bearers for the ensuing year, should be held on the first Tuesday of this month (January); but as the various Municipal Elections are held at the same time, it has been usual to adjourn the meeting of the Board to the third Tuesday of the month. The Board will no doubt adopt the same course this year, of which due notice will be given by circular.

We append extracts from the act, relating to the electing and certifying of Delegates to the Board.

The *ex-officio* members are the Minister of Agriculture, Professors of Physical Science in Colleges and Universities, Chief Superintendent of Education, and Presidents of all Incorporated Boards of Trade and Mechanics' Institutes of Upper Canada.

(Extracts of Act.)

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

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

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

Since the above was in type, we have received the statutes of the last session of parliament, which contain the following Amended Act, changing the time for election of delegates to the last regular meeting of the institutes for the previous year; but as the Act has been received too late to give proper notice of the change to the Institutes, the elections for the ensuing year will, no doubt, have to be made under the old law.

AMENDED BILL.

An Act to amend chapter thirty-two of the Consolidated Statutes of Canada, respecting the Bureau of Agriculture and Agricultural Societies.

(Assented to 18th September, 1865.)

WHEREAS difficulties have been found in carrying into effect the provisions of the above cited Act in so far as it relates to the Boards of Arts and Manufactures, and it is therefore expedient to amend the same; Therefore, Her Majesty, by and with the advice and consent of the Legislative Council and Assembly of Canada, enacts as follows:

1. Notwithstanding anything contained in the twenty-second section of the said thirty-second chapter of the Consolidated Statutes of Canada, only the Professors and Lecturers of the various branches of physical sciences in the chartered Universities, and Colleges affiliated with Universities, in Upper and Lower Canada respectively, for the time being *ex efficio* shall be members of either of the said Boards; the faculty of any other institutions of learning, of collegiate rank, composed of at least five professors or lecturers, one of whom shall be a professor or lecturer upon Physical Science, may, in the month of December in each year, elect one of such professors or lecturers to represent such College or Faculty upon such Board; and the President or Principal of such College or Faculty shall certify to the Board the name of the professor or lecturer so appointed.

2. Every incorporated Society of working men in Lower Canada may elect one delegate to the said Board for Lower Canada for every twenty members on its roll, being actual working Mechanics and Manufacturers who have paid a subscription of at least five shillings each to a fund devoted by such Society to two or more of the following objects, viz.: a library, a reading room, a museum, lectures on scientific subjects, or classes in which Drawing, Mathematics, Natural Philosophy, Natural History, Mechanics, Engineering, or more than one such subject is taught; and the fact of such contributions and their expenditure on such objects shall be verified on oath by the Secretary or Treasurer of such Society in the manner provided for by the second sub-section of the twenty-seventh section of said chapter of the Consolidated Statutes.

3. Every incorporated Art Association in Upper and Lower Canada respectively, may elect annually, one delegate to said Board for Upper and Lower Canada respectively, for every twenty members on its rolls, who have paid a subscription of not less than four dollars each to its funds, such funds being devoted, after paying salaries, rents and current expenses of said Association, to the promotion of the fine arts in this Province; such contributions and their application to such object to be certified on oath, in manner and form above provided for in case of Societies of working men.

4. Notwithstanding anything to the contrary in the twenty-third, twenty-fourth and twenty-fifth sections of the said Act, such elections and the elections by the several Mechanics' Institutes and Boards of Trade in Upper and Lower Canada respectively, shall be made at the last regular meeting of such Society, Association, Institute or Board in each year.

5. Notwithstanding anything contained in the third sub-section of the twenty-eighth section of the said Act, it shall be lawful for special meetings of the said Board to be called from time to time, by notice setting forth the time and place, at, and the object or objects for which such meeting is to be held, inserted at least ten days before such meeting, in such newspapers as may be designated by resolution passed at any regular meeting of either of the said Boards.

6. The Director and principal officers of the Geological Survey (a list of whose names shall be furnished by said Director to said Boards in December of each year) shall be *ex officio* members of each of said Boards.

7. This Act shall be deemed a publc Act.

RECENT PUBLICATIONS.

British.

Beeton's Book of Chemistry. With 138 Experiments. The Non-Metallic Elements. Illustrated. 12mo. ed., pp. 123. *Warne.*—1*s.*

Beeton's Cricket Book. By Frederick Wood. With "A Match I was in." By the Author of "The Cricket Field." 8mo. bds., pp. 86. *Warne.*—6*d.*

Book-keeping for Every Business: A Manual of the Principles of Book-keeping by Single and Double Entry, adapted for Use in Schools, or Self-instruction in the Counting-house. Crown 8vo. *Watson* (Glasgow) *Kent.*—2*s.* Key, 2*s* 6*d.*

Brown. Engineering Facts and Figures for 1864. An Annual Register of Progress in Mechanical Engineering and Construction. Edited by A. B. Brown. Cr. 8vo, pp. xi—428. *Fullarton.*—6*s.*

Campin (Francis, C.E.) Engineer's Pocket Remembrancer. An Epitome of Data, Rules, and Formulæ, applicable to Civil, Mechanical, Marine, Railway and Gas Engineering, &c. 2nd edition, 12mo. cl. sd., pp. viii—198. *Atchley.*—5*s* 6*d.*

Cunningham (David) Tables for Facilitating the Calculation of Earthwork in the Construction of Railways, Roads, Canals, Dams, &c. Imp. 8vo, pp. xx—100. *Spon.*—10*s* 6*d.*

Dempsey (G. Drysdale, C.E.) Rudimentary Treatise on the Drainage of Towns and Buildings: suggestive of Sanitary Regulations conducive to the Health of an increasing Population. With Notices of the Metropolitan Drainage, and Water Supply Schemes. 3rd edition, 12mo, cl. sd., pp. vi—245. *Virtue.*—2*s.*

English Mechanic (An Annual), Vol. 1, 4to. *Office.*—4*s* 6*d.*

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Correspondence.

THE FINE ARTS AT THE PROVINCIAL EXHIBITION.

To the Editor of the Journal of Arts and Manufactures.

SIR,—In two articles in the November number of the Journal you invite discussions and suggestions from parties interested. Will you permit me to respond to that invitation, I will confine myself to the Fine Arts, as, upon that subject alone, I pretend to be qualified to offer an opinion. Both by yourself and by the judges regret is expressed that the arrangements at the late exhibition were insufficient, incomplete and unsatisfactory. The public say the same. It may therefore be safely taken for granted.

At present, there is not room to hang the pictures and drawings, nor time to do it in. More space must be provided; and, to do the pictures &c., common justice, the walls or screens, upon which they are hung, should be made level and smooth, and either neatly painted of a dull red color—far removed from any positive color, of course—or hung with drapery of that tint. This is almost universally done elsewhere, and much more than repays its trifling cost. The light should, by all means, fall from above only, if possible, and the sun-shine should be rigorously excluded as fatal to the effect of works of art. I hope I shall not appear to be asking for more than is reasonable; I am sure that every artist and amateur, who has had an opportunity of seeing exhibitions in other places, where such care has been bestowed, will agree with me. In making such arrangements, the local committee would not find it difficult, I should think, to obtain the superintendence of some person conversant with such matters. They need not be otherwise than simple enough, in practice. The barrier should not be too far off, say three feet, so that connoisseurs may be able to examine the mechanism by which the effect of the pictures &c. is produced; and that the tickets may be read easily. There should be no table or shelf, which is injurious, and of no service whatever, and prevents pictures being hung below the *line*, to which there is no insuperable objection, when space is scanty.

The pictures came from the exhibition thickly incrusted with dust and dirt—in such a condition that the last spectators must have had great difficulty in penetrating the dingy veil behind which they were hidden. It might be difficult to prevent this, but still not impossible. Watering, sweeping and ventilation might be of some service. It cannot but be highly desirable that the atmosphere should not be loaded with so much impurity, deleterious alike to the animate and the inanimate.

More *time* must be provided, but, if I may be permitted to say so, it seems too much to require that works of art should arrive so early as the previous Wednesday. The cost and loss of time to exhibitors, coming from a distance, or of persons in charge of their works, is already a matter of some consideration, and, if it were increased, would, I am afraid, deter some of them, and the exhibition would suffer. Whether it shall be determined that the judges shall perform their duty on the Saturday or on the Monday, the previous day should be soon enough. I think it may be safely said that two or three handy men, with a competent superintendent, would, with ease, classify and hang all contributions in the course of one day. There is indeed one imperative necessity—that the pictures &c. *shall be there.* Let every one therefore be peremptorily excluded which does not arrive on the previous day, or by six o'clock on the morning of hanging. There should be a *line* or ledge, a little below the level of the eye, upon which all the best works of moderate size, should be placed first. Upon these others might rest, and above those again there might, if necessary, be a second ledge from which the pictures might be made to slope forward, so as to present themselves fairly to the spectators. This arrangement would simplify the matter very much and is such as is generally adopted.

With regard to 1st and 2nd prizes being awarded to the same exhibitor, I cannot possibly interpret the present rule as applying to the Fine Arts. No two pictures or drawings ever could be "precisely similar;" very rarely at all alike, unless one were copied from the other, or both from the same original—a case hardly worth consideration. The rule does allow of exceptions, and I cannot imagine an exception being more conclusively established than by two drawings of different subjects. But it certainly seems to require explanation that not only should the present rule be differently interpreted by *different* judges, but in *different cases* by the *same* judges. I will take five instances at the late exhibition. In two of them, the judges awarded both prizes to the same exhibitor, while, in the other three, they awarded only one prize; there being, in every case, two pictures or drawings entered for competition. It may be said that in these three latter cases the judges did not consider the second drawings or pictures worthy of a prize at all. If so, I bow at once to their decision. But I can hardly think that such were the grounds on which that decision was made. It would be desirable that the true interpretation of the rule in question should be determined before another exhibition, and that interpretation obligatory upon all judges in all instances.

I am &c., PICTOR.

[In answer to our correspondent, PICTOR, we do not see that the delivery of pictures on the Wednesday previous to the exhibition could be held as an objection, as it would not be necessary for the exhibitor to attend at that early date. If sent early, the assistants in the employ of the Association would have ample time to unpack and hang the pictures, and the artist could then visit the show at whatever time most convenient.

We cannot see the propriety of giving a second prize in any case to the same artist to whom the first prize may have been awarded. We hold that prizes are given to reward merit in the producer, and therefore, if the first prize is given to an artist as meriting the distinction of standing first in his profession, the second prize cannot with propriety be awarded to the same individual, as it would in fact be declaring such artist to be in point of merit second to himself; and also unjust to the next best artist that may chance to exhibit. There is no doubt, however, but that the rule should be explicit, one way or the other, so that the practice of the judges may in all cases be uniform. His communication contains many other suggestions worthy of consideration.

We have, in answer to a request made in a former issue, received several communications from both professional and amateur artists, in relation of other features of the Fine Arts Department of these Exhibitions. Several other communications are expected, when we will give their general import in a future number of the Journal.—ED.

Selected Articles.

ON PURE WATER.

BY EDWIN LANKESTER, M.D., F.R.S.

Pure water is as necessary for health as good food or fresh air. Yet it is probably more neglected or less understood in modern times than either. I say modern times, because there is reason to believe that amongst the nations of antiquity, the Romans, at least, took more pains to obtain pure water than we do. It may be that our habit of taking water with something to flavour it, in the form of tea, coffee, sugar, salt, alcohol, or other agent, has rendered us less alive to the necessity of pure water than were people who had less means of indulging a taste for flavours than we have. Whether this be the case or not, terrible have been the inflictions on society from the neglect of a supply of pure water.

One example by way of introduction. In the year 1854 the cholera ravaged the metropolis. Up to August 31st of that year not more than twenty cases had occurred in the parish of St. James, Westminster. On that night upwards of 100 cases of cholera occurred in the neighborhood of Broad Street, Golden Square, and more than half died. The next day the disease increased, and for four days it went on. Never was so much mourning and desolation known in London since the days of the great plague. Upwards of 600 persons were killed in those five days. What could be the cause of this terrible outbreak? At first all was confusion. In the midst of the plague the late Dr. Snow accused the pump in Broad Street. It was shut up and the plague ceased. After this event the vestry appointed a committee to investigate the subject. On that committee were Dr. Snow, Dr. King, Mr. Marshall, the Rev. Mr. Whitehead, myself, and others. We investigated the whole attack from house to house. At last the fact became only too evident that wherever the water had been drunk from the pump in Broad Street between the 31st of August and the 4th of September there cholera had been the result. The pump was afterwards examined, and it was found that the well communicated with a cesspool in an adjoining house. No evidence can be more convincing than that brought forward by this committee, that the impure water of this pump was the active cause of the outbreak of cholera. I bring forward this case now as it may be a timely warning, and also as an illustration of the importance of securing, at least for drinking purposes, pure water.

As an organic being, man requires water for the performance of the functions of his life. Water is necessary to the existence of the universal world. Rocks and the inorganic substances of the earth assume their forms in obedience to the influence of water. The great physical features of the earth's surface have been determined by the action of water. As it assumes the solid, liquid, and gaseous forms under the influence of heat, it is one of the great agents of change upon the surface of the earth. Plants and animals may be regarded as organised water. There is no life upon the globe without water. Many of the lower forms of animal and vegetable life consist mainly of water. A jelly fish, weighing many pounds, was found to contain only a few grains of other constituents. All organic matters when dead lose a great portion of their weight when exposed to heat, on account of the evaporation of the water which they contain.

The life of plants and animals is maintained by the chemical changes which go on in tissues by the agency of the organic elements, carbon, hydrogen, oxygen, and nitrogen. But these elements are not conveyed into the plant or animal in their pure form. The plant takes them up in the form of carbonic acid and ammonia. Neither are these compounds taken up in their pure form. They are conveyed into the tissues of plants by the agency of water. Each drop of rain, as it descends for the nourishment of the vegetable kingdom, contains its quota of carbonic acid and ammonia, and it is the water which is absorbed, and which carries into the system of the plant these compounds. Not only are the organic elements thus carried, but the mineral constituents of plants, the salts of lime, soda, and potash, are thus conveyed. Arrest the supply of water and all nourishment ceases.

The same is the case with animals. Not only is water necessary for the constitution of their bodies, but all the substances which maintain animal heat, and which nourish the animal tissues, are dissolved and carried into the body by the aid of water. Nay, even when these substances are oxidised and changed, and are no longer fitted for the purposes of life, they are carried off from the system by the aid of water.

Man is no exception to this law. His body is composed mainly of water. The constituents of a man's body, weighing 150 pounds, might be easily divided into five parts, each of which could be placed in an ordinary-sized pail, holding 32 pints. All the solid constituents of a man's body would go into one pail, whilst the other four would contain the water. In more accurate figures, the solid constituents of a man's body, weighing 154 pounds, would be 43 pounds of solid and gaseous matter, and 111 pounds of water.

Neither the water nor the other constituents of a man's body are permanently retained. Life does not so much consist in the chemical changes which our daily food is undergoing as in the destruction of the tissues which are formed out of the food. Blood, muscle, and nerve formed to-morrow. That which to-day is available flesh is to-morrow rejected from the system. The water of the tissues is removed at the rate of from 80 to 100 ounces a day. Of this 50 ounces pass off by the kidneys, 30 by the lungs, and 14 by the skin. Of course season effects these quantities, and the larger the person and the greater the drinker, the more water is got rid of.

Not only is water necessary to the sustaining of the human body, but all other constituents are taken into the body by its agency. All our food naturally contains water. Here is the result of analyses of various articles of food. One hundred pounds contain the following quantities of water:—

Potatoes	75 lbs.
Cabbage	92 ,,
Flour	14 ,,
Rice	13 ,,
Bread	44 ,,
Milk	86 ,,
Beef	50 ,,
Mutton	44 ,,
Fish	78 ,,
Eggs	80 ,,
Cheese	40 ,,

From this list it will be seen that all our ordinary food contains water. But this is not enough to carry the various substances we use as food into the system. The sugar, the starch, the oil, the fibrin, and albumen must all be dissolved and carried into the system by the aid of water. Hence we partake of beverages. We drink tea, coffee, chocolate, beer, soup, and other fluid foods. In all these cases we are merely flavouring the water which it is necessary for us to take in order to enable the stomach to dissolve and take up the more solid forms of our food.

The quantity of water contained in the meat, bread, and vegetables of which man indirectly partakes in his food is about one-fourth of the quantity of water he requires for daily consumption. The only food which is ever substantially supplied to him, and this only in his infancy, which requires no addition of water, is milk. Potatoes contain nearly as much water as milk, and those who live entirely on potatoes require but little water. A curious proof of this was observed during the potato famine in Ireland. It was observed as a remarkable fact that in their great poverty the people of Ireland were consuming larger quantities of tea, coffee, and sugar, which might be regarded as luxuries. The increase, however, of these luxuries depended on the fact that whilst the starving people of Ireland were fed with rice, flour, and other dry food, as substitutes for the potato, they were obliged to have recourse to water for drink. As in the case of all other civilized people, they preferred their water flavoured, and partook of tea and coffee sweetened with sugar.

Water, then, being essential to the life of man, let us inquire into its natural sources and fitness for the *dietetical* uses of man. Water exists naturally upon the surface of the earth, in its interior, and in the atmosphere. The heat of the sun daily carries enormous quantities of water into the atmosphere, from whence it is precipitated upon the earth in the form of snow and rain. This percolates into the earth from whence it comes again in the form of springs, and may be reached by digging wells. Much of this water finds its way into rivers with the rain from the surface, and these empty themselves into the ocean. As the water in its course from the atmosphere to the sea dissolves all soluble matters it meets with in the earth, and these are not evaporated again, sea water is a strong solution of various salts. The principal of these is chloride of sodium. The following analysis of sea water from the German Ocean gives the other constituents:—

Solids in 100 parts of water ...... 3·15

Chloride of sodium in 100 parts of solids	77·78
Chloride of magnesium ,, ,, ,,	8·12
Chloride of potassium ,, ,, ,,	0·97
Chloride of calcium ,, ,, ,,	1·39
Bromide of magnesium ,, ,, ,,	0·47
Sulphate of lime ,, ,, ,,	3·49
Sulphate of magnesia ,, ,, ,,	6·79
Carbonate of lime ,, ,, ,,	0·56
Silicate of soda ,, ,, ,,	0·25
	100·00

The sea also contains oxygen and carbonic acid gas. Sometimes the water which passes into the earth comes up highly charged with mineral constituents. When such waters cannot be ordinarily drunk, and are supposed to be medicinal in their action, they are called *mineral* waters. Such waters have been the foundation of the reputation and fortunes of such places as Harrowgate, Cheltenham, Leamington, in this country, and Ems, Kissengen, Wiesbaden, Carlsbad, and others on the Continent. Many of the constituents which are in excess in these waters are the same as those contained naturally in the sea. Some of them, however, contain ingredients not found in the sea water in its normal condition at all, as the salts of iron and sulphuretted hydrogen.

Besides the substances enumerated, which are inorganic, sea and mineral waters contain naturally a certain quantity of organic matters, arising from the decomposition of the animals and plants which live in them.

The sources of water for the ordinary drinking purposes of man, are rain, springs, or rivers. Water obtained from these sources holds in solution certain substances, but not in so large quantities as the sea or mineral waters. Of the water ordinarily drunk, rain water is the purest. On account of its dissolving soap with facility, it is called *soft* water. When waters contain lime, they form an insoluble substance with soap, and are on that account called *hard*. As we use the word, a *soft* water is not necessarily a water containing a small amount of saline matters, but one that contains little or no lime. Rain water, as it falls from the clouds, contains no saline matters, unless we apply this term to the almost infinitesimal quantity of carbonic acid and ammonia which it is known to contain. When collected in the country in the open air, it is almost absolutely pure; but as it is usually collected for human use, it is liable to various impurities. Thus, in London and in large towns, it is collected from the tops of houses, and by the time it enters the cistern or water-butt it contains a variety of impurities. It acquires carbonaceous matters from the smoke in the air, and small quantities of carburetted and sulphuretted hydrogen, so that its flavour is very disagreeable from that cause. From the roofs of houses it also collects another quantity of impurities, and especially the dung of birds, as of pigeons, jackdaws, and sparrows, which invariably frequent the roofs of the houses in our great towns. So that rain-water, although freest from saline matters of any water, is seldom collected in such a condition as to be fitted for dietetical or cooking purposes.

The other two sources from which our great towns are supplied are springs and rivers. London with its vast population is principally supplied from the river Thames, whilst Manchester, Liverpool, and Glasgow are supplied with spring water. No general comparison can be made between the purity of spring water and river water, as some springs come up highly charged with objectionable constituents, whilst some river waters present a purity unrivalled by any spring water.

The great object of every civilized community should be to secure pure water, whether it be derived from springs or rivers. Water is so essential to life, and its deficiency or impurity may be so destructive of health, that the supply of water ought never to be dependent on individuals. Like the air which we breathe it is amongst the first gifts of God to man, and no man has a moral right to stand between his fellow-creatures and this essential of his existence, and all arrangements which exclude the poorest from a healthful supply of this agent should at once be modified. Not only, however, is there a scanty supply of this necessity in many of our large towns, but great ignorance prevails of what are the conditions which render it impure.

Water itself, the chemical compound of hydrogen and oxygen, of which we have spoken, is always pure; but it has great chemical powers and unites vigorously with other agents, dissolving them and holding them in solution. It is these substances which act injuriously on the human system, and which, not being required there, produce diseased actions in the body in order to get rid of them.

Spring and rain water do not materially differ from each other in composition. It may, perhaps, be generally stated that spring water presents a tendency to impurity from excess of inorganic constituents, whilst river water presents the same tendency from the presence of organic constituents. It should, however, be recollected that under the term spring water two very different sources of supply are indicated. In one case it is applied to springs which burst from rocks and are discharged into rills on the surface of the earth, or to water obtained from deep borings in water-holding rocks; whilst in another case it is applied to water from wells sunk a few feet into the soil, and from which water is drawn by means of pumps. Such wells are frequently sunk in the midst of towns, and are the depositories of all kinds of organic filth from the percolation of drains and surface water of the district.

In referring to the constituents, then, of spring and river waters, which are likely to render them impure, I shall speak of them together. These substances may be divided into *inorganic* and *organic*. The inorganic are saline matters which are dissolved by the water in passing through or over the rocks of the earth, whilst the organic substances are the result of plants and animals which have lived in the water, or have been introduced by the contact of the water with dead organic matter.

The following table will give some idea of the composition of rain, spring, and well water in this country:—

NAMES OF SUBSTANCES.	GRAINS IN A GALLON. 1 River Thames	2 River Severn.	3 Spring at Cheltenham	4 Well at Clapton	5 Well at Cheltenham
Carbonate of Lime	12 75	3 36	8·46	15·09	85·2
Carbonate of Magnesia.	1·02			13·97	
Sulphate of Iron	0·45	3·68	3·01	15·32	25·9
Sulphate of Potash......	0·66	1·60	0·50	6·74	4 0
Sulphate of Soda	2·00	0·45	0·50	10 77	2·0
Chloride of Soda	1·10	1·84	0·41	11·46	25·6
Chloride of Calcium	1·75				
Silica........................	0·27	0·58	0·80	0·24	0·1
Total grains in a gallon	20·00	11·21	13·68	73 59	92·8

The columns 1 and 2 give the principal inorganic constituents of two of our great rivers; 3, is a fair speciman of spring water from which the town of Cheltenham is now supplied; 4 and 5 are examples of surface wells. Much purer and much more injurious waters than these are now supplied to many of our towns. The supply from the Dee in Aberdeen contains but five grains of saline matter in the gallon, whilst the spring water from Loch Katrine supplied to Glasgow contains but three grains of impurity in a gallon; on the other hand, there are pumps in the streets of London supplying water with 200 grains of impurity in the gallon.

It may be asked here what may be regarded as the maximum of saline matter that may be taken without injury? This, however, is a difficult question to answer. At a sanitary congress held at Brussels in the year 1851 it was agreed that a good and safe drinking water should not have more than 35 grains of dissolved constituents in the gallon. This must, however, in a great measure depend on the nature of the salts, as we know that chloride of sodium and carbonate of lime are comparatively uninjurious, whilst the salts of magnesia in small quantities do harm. Various experiments of the quantities of the more common constituents of water which may be safely taken have been given. The following may be regarded as an approximation to safe quantities. It may be said that a gallon of water should not contain of

Carbonate of Lime more than	....	20	grains.
Sulphate of Lime	"	3	"
Salts of Magnesia	"	3	"
Chloride of Sodium	"	20	"
Carbonate of Soda	"	20	"
Sulphate of Soda	"	5	"

These are the ordinary constituents of water, but water from special circumstances may be rendered impure by very small quantities of other constituents. A water with very small quantities of iodide or bromide of sodium, the salts of iron, lead, copper, arsenic, or antimony, might soon become very injurious to health. The presence of large quantities of gases has also been objected to. Ordinary drinking water contains in the gallon about six cubic inches of nitrogen, 2½ of oxygen, and 5 to 7 of carbonic acid. These may be absent or in much larger extent without being injurious. There is one thing that should be recollected with regard to these gases, and that is, that they render the water sparkling to the eye and fresh to the taste, and they are entirely got rid of by boiling.

It is almost impossible for persons who have not had a chemical education, to analyse water with that degree of accuracy that would enable them to judge of any particular ingredient there is in water. Nevertheless, I think it quite possible for intelligent people so to test water as to come to a tolerable correct conclusion with regard to its purity. Most persons use their senses before drinking water. Thus its colour and transparency may be at once detected by the eye. So accustomed are we to the true colour of water, that we at once detect any departure from its natural appearance. Blue water, green water, yellow water, are immediately detected and regarded as unnatural. The transparency of water is also recognised as a natural and necessary property. Indeed, water should be at once rejected, unless its turbidity is known to depend upon some uninjurious agent. The taste of water is still more generally known. Any departure from the insipidity of water is usually detected. Such departure should be noted, and any strange tasting water should be rejected. The sense of taste is essentially connected with that of smell, and sometimes the exercise of taste and smell may tend to the detection of impurities in water. Even the sense of *touch* may be employed in the investigation of water, as the action of hard water, or water containing much lime, is very appreciable to the touch in the process of washing the hands by the aid of soap.

Organic impurities are of more importance than inorganic, as they seem to be sources of much more fatal and dreadful forms of disease. It seems to be difficult to convince many intelligent people of the danger of drinking water containing organic impurities. They refer to the practice of taking organic matter in water in the form of soup and broth, and think this is sufficient to refute the evidence that the organic matter in water can do any harm. I think the evidence that organic matter in water, under certain circumstances, is injurious and destructive to health is abundant, conclusive, and satisfactory. I gave an instance at the beginning of this paper; I now give another. In 1849 cholera prevailed in the districts supplied by two of the water companies of London—the Southwark and Lambeth Water Companies. In that year both companies obtained their supply of water from the Thames below Teddington Lock, and from parts of the river subject to great impurities. In 1853 the Lambeth Company had removed its source of supply from the river to a point above Teddington Lock. In that year cholera prevailed again in the district supplied by both companies. It was found that, during four weeks of 1853, there were 334 deaths; of these 286 deaths occurred in 40,046 supplied with water from the Southwark Company, which still obtained its supply from the impure source below Teddington Lock, whilst in 26,107 houses supplied by the Lambeth Company, there was only 14 deaths. This case was thoroughly investigated at the time by the late Dr. Snow, and the correctness of his conclusions was confirmed by the Registrar-General. In this instance there can be no doubt either that the injurious water did directly communicate the germs of the disease, or that it predisposed the inhabitants of the district who partook of it to the attacks of the poison of cholera.

Now let us see if we can in any manner account for the presence of matter in water which can exert such an injurious influence on the system. If we take four or five pints of water and allow it to stand for a few hours, and then decant off the clear part, leaving a small portion behind, say from two drachms to an ounce, and then place a drop or two of this remaining portion under the microscope, we shall find we have a variety of living beings. They are chiefly unicellular organisms belonging to the animal and vegetable kingdoms. The number and variety of them will give an approximation to the impurity of the water. They are of different kinds, and where the filaments of fungi and certain forms of animalcules abound there the water may be regarded as most impure. As a test example, sewer-water may be taken, and when similar organisms to those found in sewer-water abound, the specimen examined is to be most suspected. In making this investigation care should be taken to have fair samples of the water. The purest water, if exposed for a long time to the air in close vessels, or taken from pipes or cisterns which have a long time been exposed to the air, will present these organisms. The only fair way of using this test is to take a specimen of the water from the mass of the water in the river, reservoir, or other source from which the water is obtained. The purest water, even distilled water, when kept for a length of time exposed to the air, will contain the filaments of fungi and a variety of animalcules. Under any circumstances, living organisms can only be regarded as indicating the probability that water in which they are found contains organic impurities, which by their decomposition have afforded the elements on which the lower plants and animals are nourished. That they are more abundant in water contaminated with sewage and other organic impurities shows the importance of using the microscope as a test of the purity of water.

It is, however, the death of these living organisms and the introduction into water of animal and vegetable matters in a state of decomposition that renders water impure and dangerous to the health of those who drink it. Both river and spring waters are liable to these contaminations. In recent times our rivers have been rendered impure by making them common sewers of the great towns and cities situated on their banks. It is in this way the Thames has become polluted, so that the legislature first interfered and required that all water companies supplying London should obtain their supplies above Teddington Lock, beyond the influence of the sewage of London, and subsequently passed an Act for the carrying of all the sewage of London down to a point in the Thames in which it could not be brought by the tide into the river as it passed through London.

It must not, however, be supposed that all organic matter produced in rivers or thrown there remains unchanged. No sooner is organic matter placed in water than a process of oxidation commences, by which the nitrogen of the organic matter is converted into nitric acid, and the carbon into carbonic acid. This is effected by the oxygen, which is naturally found in all water exposed to the air. As long as there is sufficient oxygen in the water to oxidise the organic matter, so long the water remains free from those constituents which are injurious to health. It too often happens, however, that all the oxygen is exhausted and the organic matters enter into a state of change in which dangerous compounds are generated. What the nature of these compounds is, neither the chemist nor the pathologist has been able to demonstrate. It is, however, well known that water under these circumstances become tainted; that it gives off sulphuretted hydrogen and other stinking gases; and that, when taken internally, it produces sickness, diarrhœa, and other symptoms of disease. It does not follow that these conditions will occur at all times. In cold weather water holds more oxygen in solution than in hot weather, and it frequently happens that it is only at certain seasons that water holding organic matters in solution becomes injurious. Heat not only robs water of its oxygen, but favours the rapid decomposition of animal and vegetable matters, so that it is most frequently during the warm season of the year that water becomes injurious.

How to detect *dead* organic matter thus becomes a matter of great importance. Now, it has been found that this matter exists in water in two forms —suspended and dissolved. The suspended organic matter can be detected with the microscope. It is generally heavier than the water and settles at the bottom, although sometimes it floats on the surface. In either case it may be detected by the microscope, and is found to consist of minute, shapeless particles of animal and vegetable bodies. When these are in any appreciable quantities, the water is impure.

When the organic matters are in a dissolved state, the microscope can no longer detect them. Chemical agents must be employed for their discovery. The method adopted by analytical chemists is to weigh the total solids of the water left by evaporation, and then to incinerate the portion left, and to weigh again. The matter lost by incineration is then regarded as organic matter. There is, however, another method, which, although less accurate, is easily applied, and requires no chemical knowledge to use and appreciate. This process consists in adding a quantity of permanganate of potash or soda to the suspected water. All the permanganates have the power of giving a beautiful purple colour to water. A small quantity of permanganate has its colour thus destroyed, a large quantity of organic matter will, however, decompose the permanganate and prevent its colour from being developed, or annihilate it if it has been once established. The best method of procedure in this case is to employ a solution of permanganate of potash of a known strength. I employ a solution of five grains to the ounce of distilled water. Half a pint or a pint of the water to be examined may be then taken, and five drops of the solution of permanganate added. According to the colour left in the water will be the amount of organic matter it contains. The quantity of permanganate may be so arranged as to give an approximation to the quantity of organic matter in the water when such a quantity of permanganate has been added as to afford the slightest possible tinge. If a large quantity of permanganate has its colour thus destroyed, a large quantity of organic matter must be present. But for ordinary testing it is better perhaps to have a standard water—pure distilled water, or some water whose quantity of organic matter has been ascertained,—and then compare the colour it gives with the permanganate with the colour given by the suspected specimen of water.

By this test the impurity of water from dissolved organic matter can be ascertained with very tolerable accuracy. It should, however, be recollected that it is not applicable to water containing iron, as a very small quantity of iron will discolour the permanganate. The quantity of organic matter in waters supplied to our great towns differs from one to three or more grains per gallon. Suspicion should be aroused when the organic matter reaches two grains per gallon.

Having said thus much with regard to the nature of water and the means of ascertaining its impurities, the question may be still dealt with a little further as to the nature of the evils produced by drinking impure water. I have more particularly referred to cholera, and the evidence of a large number of other cases is most convincing as to the production of cholera by impure water. It is a question to be determined as to whether any specific cholera poison is conveyed into water which thus gains access to the individuals attacked, or whether the organic matter of the water is in such a state as to bring on a state of the system in those who drink it to predispose them to receive the poison of cholera from other sources. At any rate, our sanitary action in this case should lead us to cover both issues of the question, and protect ourselves from the direct poison of the water as well as its predisposing action.

With regard to other diseases of the bowels, there is abundant evidence on record to show that diarrhœa is produced by drinking impure water, and that such cases of diarrhœa have only ceased when pure water has been had recourse to for drinking and cooking purposes. The organic impurities are much more likely to produce this effect in warm weather, for reasons I have before alluded to; and this is the reason why diarrhœa is so much more frequent in summer, and why water should be much more carefully watched in the warm seasons of the year.

Of the various forms of contagious fever which attack the inhabitants of this country, there appears to be little doubt that the fever known as typhoid fever is propagated by means of water. Whether this fever can be produced *de novo*, by poison in water or in the air, is still a question amongst medical men; but that occasional epidemics of this fever are produced by drinking water there is no doubt in the minds of medical inquirers. Dr. Budd relates the instance of a ball at Cowbridge which was attended by from ninety to a hundred people. Of these more than one-third were laid up with typhoid fever. In this case there was satisfactory reason to believe that the water served at the ball was contaminated. Numerous instances, showing the occurrence of this disease in families after drinking impure water, are recorded, and there can be little doubt that it is one of the forms of disease that is propagated by the agency of impure water.

Another set of diseases are malarious fevers, which are known to be produced by drinking impure water. I might add a long list of other diseases which, on competent medical authority, are known to have originated in impure water. I will only allude to the attacks of parasitic animals. It is well known that various creatures inhabit the human body, especially the class of worms. A large number of worms pass their cystic or larval stage in the bodies of other animals. The eggs of these creatures are, in the majority of instances, introduced by the agency of water. Amongst the contents of impure waters the microscope reveals the eggs of the entozoa, and there can be little doubt that the germs of cystic worms and hydatids are introduced into the human system by the agency of impure water. I hope, however, that I have said enough to show how necessary it is for our welfare that pure water should be supplied for daily use, and I have now to speak of some of the practical measures that should be adopted for the supply of pure water. This question naturally divides itself into the public supply of water to towns, and the private supply of families.

With regard to public supplies of water, it will be seen that water neither from rivers nor springs is certainly pure. When water is taken from a river to supply a town, especially when the river receives sewage, every precaution should be taken to reduce the organic matter to the lowest possible quantity. It is undoubtedly desirable in a country like our own where such large masses of the community, as in London for instance, must depend on water from rivers, that the legislature should pass some stringent Act, forbidding the diversion of the drainage of our large towns into rivers at all. When it is recollected that this must eventually be a gain to the country, by compelling the deposition of the sewage in the soil, where it must necessarily become a source of wealth, it is to be hoped that there will no longer be supineness or ignorance enough to prevent legislation on this very important subject.

But even water from springs may be contaminated. Springs are often situated in highly cultivated agricultural districts, among populations utterly negligent of the distribution of the water-courses that flow through them, and may thus reach the population which they supply with water, highly charged with organic matters. It is only by proper filtration at the works, by which the water is supplied to towns, that danger can be obviated, either in the case of water supplied by rivers or springs. It is a consolation to know that through the care and intelligence exhibited by a large number of our water companies, water is now supplied to many of our large towns of an unexceptionable character. This is remarkably the case in London, where the water of the Thames, receiving the sewage of several large towns in its course, can nevertheless be supplied in a state of purity, which will bear comparison with most other large towns in England. It is necessary that a vigilant eye should be kept on the nature of this supply, and in London we are undoubtedly indebted to the monthly analysis of water supplied by the Thames companies, published by the Registrar-General, for the maintenance of the integrity of our water.

There are, however, large numbers of the population who are not within the reach of our public supplies, and who are obliged to have recourse to pumps and wells, ponds, rivers, and ditches, for the water which they drink. Such persons cannot be too cautious in the employment of the water they are compelled to take. Wherever water is of a doubtful character, then filtration should be had recourse to. The filtration of water can be effected by passing it through sand, pebbles, sandstone, sponge and charcoal. Of these agents, charcoal is most efficient. Filters made with charcoal are now manufactured on a large scale, and are, in most instances, efficient means of rendering impure water pure. Such filters should be employed when waters are of a doubtful character, and only filtered water should be used for drinking purposes.*

Where, however, filtered water cannot be had, it should be known that one of the most effectual means of purifying water is submitting it to boiling. This does not get rid of all its inorganic constituents, but it effectually destroys organic matters. It is undoubtedly insipid (which may be obviated by passing it through a gazogene), but it is better to drink the most insipid of water, than run the hazard of drinking water charged with organic impurities.

When water is otherwise good it may be rendered impure by the carelessness and indolence of those who use it. Thus a water, which drunk when first drawn from the cistern, pipe, or well in which it stands is perfectly harmless, may become injur-

* There are two classes of filters sold for public use, one of which is constructed of loose charcoal, and performs its duties admirably; whilst another class is made of charcoal more or less composed and moulded which prevents the due purification of the water.

ious by standing for days in the same vessel. It frequently happens that water-bottles, pitchers, and mugs, in which water is habitually kept, are never cleansed, and the daily deposit of organic matter at the bottom will at last become so great as to render the water putrid. It is in this way, by the negligence of servants and others, that waters otherwise free from objection are found to become tainted, and I have known attempts made to cast doubts on the quality of the whole supply of a town from individual cases of neglect and ignorance.

In these remarks on the purification of water, I have more particularly directed attention to the removal of organic impurities, as those which are most injurious to health. I would, however, refer to the fact that, when waters contain a large quantity of carbonate of lime, which is always held in solution in carbonic acid, this salt of lime may be got rid of by neutralizing the carbonic acid with pure lime. This process originally suggested by Dr. Clark, of Aberdeen, has been successfully employed to soften hard water, and may be advantageously employed both for removing the organic impurities as well as the carbonate of lime.

It should also be remembered that storing water in leaden cisterns, and conveying it through leaden pipes, may lead to a dangerous contamination with lead.

The interest of the public in pure water is not alone confined to its use as an article of diet. For cooking, washing, bathing, and manufacturing purposes the purest water is the best. Each one of these subjects might be made the topic of practical suggestions, but as my limits will not allow me to add more on the subject of pure water, I would say, in conclusion, that for all purposes for which water is employed by man, the purer it is the better it is adapted for his use.

YOUNG MEN AND THEIR READINGS.

At this season of the year, when the lengthening nights affords to our mechanics, artizans, and general toiling populations leisure and opportunities unknown to the busier and more exhausted months of summer, it may not be considered as out of place if we offer a few suggestions upon a subject perhaps not sufficiently pondered. Few there are of the class referred to, who have not the facilities, more or less, for vast mental and moral improvement; and it would seem that nothing tends with greater directness to this devoutly to be wished consummation than an enlarged acquaintance with our soundest literature. Were but a portion of the time which is so studiously devoted to less worthy, not to say questionable pursuits, but once and fairly redeemed, and turned into self-improving material, the ultimate effect upon personal and social life would be at once both marked and beautiful. And more especially does this subject assume an aspect of importance when viewed in its relation to the young men of our Church, to whose increasing moral power, and to whose growing religious influence, she is looking forward with such yearning anxiety.

Whatever tends to the expansion of the human intellect, the refinement of sensibility, and the augmentation of mind power, must be regarded evermore as a mighty moral and social force. We live in an intensely active and enquiring age, and the great cry of the mighty masses of society is, "Give us mental aliment." This anxiety is both natural and relevant, and is in perfect keeping with the original constitution of the human mind. It has also come to pass that no very vigorous intellectual life can now be lived without great indebtedness to books. If a man be known as a thoughtful, earnest, appreciating lover of books, and often asking their counsel, he will be held as a lover of wisdom; or at least, his interest in books will be considered as a pleasing sign of self-improving character. Full culture of the individual would seem impossible without the aid they alone can impart. A life of immense power, of thought and action, is ever associated with our highest literature. Books enlarge, enlighten, improve, and empower us. The mind of the writer has laid its affluence of thought, recollection and hope at our feet. We are by sweet and silent contact brought to sympathise with loftier minds; excitement, freedom, energy are the result. Old mental limits are defied, old bondages crumble, and holding high the franchise of our individual liberty we step to higher thoughts and deeper intuition; and in laying aside our old self, assume a new and sprightlier manliness. Others in offering us *their* worth reveal to us our own. Plato is mightier than Cæsar, and the pen of the thinker than embattled battalions. Thrones and coronets, palaces and pyramids, rocks and mountains, are weaker than the world's best books.

But *reading* is a work of Herculean labour, and the reader must come to his book with a purpose, strong, determined, and persevering, if he would read with the highest result. Reading, in the highest sense is as necessarily a work of labour and solitude as of earnest thought. Deep mental life seeks seclusion, hides most purposely from vulgar gaze, that alone it may struggle for a body and a development. So it is with reading; read alone we must, with pains, with patience, with oft-returning glance, for reaching full effect upon our high being. In reading a great and good book, we come in contact with a great and benevolent mind. The book itself was not a momentary growth, a mere effervescence, but the result of close bent, hard-strained, oft-foiled agony and effort. If then we would fully embrace thoughts thus painful and agonistic in their birth, it is by no means a great thing that we should patiently, earnestly, anxiously seek their mastery and appropriation. Our thoughts will never rise to the height of the author's we read, unless we are prepared to toil where they toiled, to groan were they groaned, and to writhe where they agonized.

The merely desultory reader seldom benefits either himself or others. By all he thus does he impairs his faculties, and teaches his memory to become treacherous. He reads much but knows little, his little becomes "beautifully less," until he becomes an absolute stranger to earnest and consecrated thought. His mind is always too much in haste to think, or reflect, or deliberate; he merely seeks to skim the surface, and, hence, he robs himself of the ability either to satisfy or reverse the assumptions and conclusions of others. His memory becomes inert, his imagination folds its wing, his judgment droops and wilts, he feels a momentary flash and all is gone forever.

Thus all the ends of reading are perverted; the price of knowledge, of wisdom, of endless delight is in the hands of a fool, and the poor fool has nothing to show for his pains. It is an ominous augury when a young man can sit down and devour a "New York Ledger," a sickly tale, or the "last novel," with the zest of a hungry hunter, and yet fight shy of a thoughtful and elevating book. But unhappily the rage for novels, romances, legendary tales, plays; together with comic renderings, though by professionals and even famous readers, is too general to be considered less, even in Canada, than a great social blemish. It has become a moral blight which overspreads the land; and which blasts the blossoms of virtue, withers every natural feeling and benevolent principal, every serious thought and religious purpose, and unfits the soul for everything important, dignified or divine. This "rage" has the lamentable effect of keeping the fancy awake, and the understanding asleep; of paralyzing the mind; and, after having rendered its deluded votaries totally incapable of all useful effort and painstaking practice in this life, consigns them over to irretrievable ruin in the life which is to come. There can be nothing more destructive in its nature, or in its tendencies more inimical to the best interests of the public and the individual, than this general and deeply rooted passion for books of fiction, and exhibitions of a similar character.

Every determined, judicious, self-improver, has faculty enough to become a good reader. His object being power, stability, force of thought, "though baffled oft," he wins the prize. Reading becomes a mighty instrument by which he throws a new complexion over his moral history, and secures to himself an ever increasing vigour of soul. Public, boundless, and unending sympathies attach to the wise and earnest reader. In no partial, circumscribed, or partizan spirit can he, without self-reproach, permit himself to live.

Books are the highest representative value of the world; and the age has gathered around us the amplest treasures of thought, and opened the proudest mines of intellectual affluence. Let our young men penetrate the surface, become familiar with the venerable and everlasting thoughts of the great Classic of our own tongue, master our mighty theological standard, and taking Isaiah and Paul by the hand scale the battlements of the loftiest truth, and touch the highest standard of the Man. We may refer to this subject again.—*Christian Guardian.*

AN INSECT SHOW.

A very interesting exhibition of insects has recently been held in Paris, in France, classified so as to show those useful to man, and those that are injurious; and as far as possible exhibiting them in the egg, the larvæ, the chrysalis, and the moth or butterfly.

Good collections thus classified, and exhibited in different sections of our country would be of immense advantage to the Farmer and Horticulturist.

Insects, and the importance of studying their habits, are thus forcibly set forth by the Paris *Moniteur*:—

"Noxious insects are to the human race what an invading army is to the territory invaded. We are assailed day and night by three hundred thousand species of insects armed with augers, pincers, and saws, which invade our fields, granaries, barns, and dwellings, and would destroy every thing before them were they not prevented. Our vines, trees, grains, and buildings are each the prey of a separate class of destructive insects. Our neighbors are subject to the attacks of twenty-six species of insects belonging to four different orders. During a period of ten years, the vine-growing districts of Macon and Beaujolais, suffered a loss of thirty-four millions of francs through the ravages of these insects. This does not appear so astounding when we reflect upon the prodigious fecundity of insects and their insatiable appetite. A female termite has been known to lay the seemingly incredible number of 86,400 eggs within twenty-four hours, being at the rate of one egg each second, and a single female of the *tenthredo pini*, if allowed to multiply without hindrance, would give birth in the space of ten years to two hundred billions of its species. The plant louse is even still more prolific. The learned Dr. Ratzburg states that the trunk of a fir tree sometimes affords shelter to 23,000 couples of the *bostrichus typographus*. In 1839, in Saxe-Altenburg, 500 acres of forest land were ravaged by the *liparis monacha*, when upward of twenty millions of insects were destroyed. In 1856, 33,540,000 beetles were collected in the environs of Inedlingburg, Prussia. Between 1813 and 1824, Provence was overwhelmed by such an immense host of travelling crickets that the authorities of Marseilles and Arles offered a reward of fifty centimes per pound for the eggs and twenty-five centimes per pound for the insects themselves, at which rates they expended 20,000 francs for eggs and 25,000 for the insects. In 1837, 38 and 39 the forests in the vicinity of Toulouse were overrun for a space of twenty-five square leagues by the *liparis dis par*. The noise made by the caterpillars in gnawing the leaves is said to have resembled that heard in silkworm nurseries. The *bombyx monacha* has been known to devastate over 200,000 acres in three or four years time. St. Augustin mentions an invasion of crickets in Numidia, whose dead bodies created a pestilence by which 800,000 persons perished. Every year the Laplanders migrate northward until they come to a region cold enough to keep off the *œstrins*, a species of gad-fly, whose buzzing alone is sufficient to strike terror into a whole herd of reindeer. Livingston states that in settling in certain parts of southern Africa, the first enemy to be ousted is a venemous fly called the *tsete*, which is more dangerous to large cattle than the lion. In South America, settlers have sometimes been obliged to use cannon in order to destroy the gigantic mounds built up by the termite. This insect, improperly styled a white ant, belongs to the same entomological order as our *libellula*.

"This insect creation is so powerful that we are only enabled to restrain it by having allies in its ranks, for fortunately a large number of these little creatures have interests indentical with our own, and, consequently, we enjoy their aid. What a reflection upon human pride! our most formidable enemy is not to be found among the lords of the animal kingdom—it is neither the lion, the elephant nor the crocodile, but a diminutive insect, or rather embryonic insects, in the shape of larvæ. We are held in check by a host of larvæ. Agricultural prosperity, and consequently, all social progress, are involved in the existence of a certain number of insects perpetually hungering after other insects. Twenty-two kinds of coleoptera, neuroptera, diptera, hymenoptera and orthoptera make the *pyrale*, or vine insect, their prey. The larvæ of the calosomus invade caterpillers' nests, pierce through their bodies, and continue to feed upon them, until they can hold no more. The larvæ of the ichneumon fly are hatched in the very body of the caterpiller, where they live until metamorphozed into *nymphœ* or eggs. A certain variety of insect called the *asile* is accustomed to watch almost continually for little butterflies, common flies, and drones, which it seizes on the wing by means of its long feet. Wherever carabes abound they speedily exterminate an insect called the *maus*, the hideous and formidable offspring of the black beetle. It is to our interest to ascertain which classes of insects are useful to man, and these should be protected and increased in number, but our farmers establish no distinction between the insects which ravage our crops and those created by Providence to prey upon and limit the number of the former. Whether useful or noxious, they all suffer the same fate as nocturnal birds of prey and insectivorous birds; muskrats, and moles among nammiferous animals, and snakes and toads among reptiles and amphibious animals. It has been calculated that the preservation of night birds would save annually from twelve to thirteen million bushels of cereals which are now devoured by rats and field mice. It may, in truth, be said that man has an enemy far more dangerous to him than those we have specified—and this enemy is his own ignorance."

Machinery and Manufactures.

Heated Air Engine.

The *Mechanics' Magazine* describes a heated Air Engine in use in London, of American origin, which differs in its mechanical construction and operation from the hot air engines heretofore constructed; as it uses the products of the heated air in direct communication with the working piston; the regulating and controlling of it being performed by the agency of improved induction and eduction valves. The other engines have only used the products of combustion to heat the air introduced by pressure into an air chamber or generator, whereby an immense amount of power has been wasted or lost, which might have been rendered available by using it in connection with the expanded atmosphere. The engine is perfectly self-contained; the air pump, cylinder, and furnace, being bolted down on a base or sole plate, and it can be moved into its position and at once started to work; whereby the loss of time incurred where foundations, &c., for boiler and engine have to be put up, is entirely saved. Its parts consist of an air pump; a furnace connected by proper passages with the air pump; a cylinder, to and from which the heated air is admitted and withdrawn by the valves and their arrangements; the beam, connecting rod, and governor, are as in an ordinary beam engine, for communicating the power to machinery requiring it; and the bed plate, or sole piece, on which the whole is bolted and supported.

The air being drawn into the pump, at the upstroke of its piston, is by its downward motion forced through the passages into the furnace, on its way to which it passes round the lower part of the cylinder to keep it cool, getting gradually heated on its way, and passes under the bottom of the furnace and enters a passage on one side of it, passing up and entering into the furnace over the burning fuel, where it mixes with the gases and other volatile products of combustion; then passes out of the furnace through a proper opening into the valve chest, whence, at the right moment, by means of the induction valve, it enters into the piston, forcing it to the end of the stroke, at which moment the induction valve closes, the eduction valve opens, the heated air escapes, and the piston is brought down to the bottom of the cylinder again, by the dead weight of it, assisted by the momentum of the fly wheel and other moving parts. Having inspected its working, the editor of the *Mechanics' Magazine* testifies to the efficiency of the arrangement.

From the drawing* and description of this engine, we should say that it is of simple construction, easily understood, and involves but little expense in skilled labour for attendance; where small power is required, it must be much more economical than steam, and obviates all apprehension of danger to life and limb from explosions.—Ed. Journal.

Making Cloth and Leather Water-proof.

Dr. F. Grace Calvert, F.R.S., F.C.S., in one of his recent lectures on chemistry applied to the arts, introduced the interesting and valuable invention of one of the most learned and eminent chemists of England—Dr. J, Stenhouse, F.R.S.—who has devised quite a new method of water-proofing vegetable and animal tissues and fabrics. Previously to his discovery, the modes of water-proofing consisted in using bees-wax and various kinds of drying oils, such as linseed, the siccation of which is enhanced by boiling them with peroxides of lead or manganese. Further, you are all aware of the extensive use which has been made of caoutchouc and gutta-percha for water-proofing purposes. Dr. Stenhouse's water-proofing material is a white solid substance, having no odor, undergoing no change through the action of the atmosphere, and which has acquired of late great popularity, by the application which has been made of it as an illuminating and lubricating agent—I mean paraffin, the discovery of which, in a commercial point of view, and its introduction into public notice, are due to Mr. Young, of Bathgate, near Glasgow, who has

* See *Mechanics' Magazine*, Dec. 1, 1865.

established one of the largest manufactories in the world for the production of this article, notwithstanding it was considered a commercial novelty in 1852. Dr. Stenhouse found that if he employed pure paraffin for water-proofing, owing to its tendency to crystallize, it would not adhere sufficiently to fabrics. He therefore conceived the happy idea of adding to it a few per cent of linseed oil, which overcame the defects presented when paraffin was employed alone, effecting a better adhesion between the water-proofing material and the textile fabrics, and rendering leathers more flexible. Dr. Stenhouse melts together paraffin oil with a few per cent of linseed, as above stated. He runs the whole into cakes, and in order to apply this water-proofing agent, he heats the cake and rubs the materials over with it, or spreads the melted mixture over the fabric by means of a brush. His process is applied with great advantage by Messrs. Silver & Co. to the water-proofing of soldiers' tents, and other materials of that class, to the great comfort of the soldiers, for, without increasing the weight of their tents, it renders them impermeable, and protects the men from rain and its attendant discomfort and danger. Another most useful application of Dr. Stenhouse's water-proofing material is the rendering of leather impermeable. By examining the specimens you will immediately see the immense advantage that cavalry will derive from having their saddles rubbed over with this preparation, as it renders the leather incapable of absorbing moisture, and enables the soldier to mount his horse after heavy rain with as much comfort as if it had remained under shelter. It also renders the soles of shoes quite impermeable, and at the same time communicates to them great flexibility, so that the boots of navvies and other similar articles are rendered far more useful and durable, as we all know that the constant wetting and drying of leather expedites in a marked manner its decay. There is one more application of Dr. Stenhouse's water-proofing to which I should wish to call your special attention, as it is of interest to the manufacturers of Manchester and of Lancashire generally. In those districts large quantities of what are called water-proofing materials are used in packing the goods, and preserving them from external wet or injury. Many of these materials are made by covering a coarse calico fabric with a coating of boiled linseed oil, but this class of packing is very imperfect, and loses its strength rapidly, especially in hot climates, owing to the fact that boiled oil absorbs oxygen and carries it on to the fiber, oxidizing it, and, thereby, soon destroying its tenacity. By applying Dr. Stenhouse's process to the fabric previously to the drying oil, not only is great impermeability attained, but the fiber, being saturated with paraffin, is preserved from the subsequent oxidation which it would undergo under the influence of the atmosphere in the presence of the boiled oil alone.

How to Cast Sugar Candies.

"What an atmosphere of dust meets us as we enter the manufactory! The shop we are in is powdered from rafter to floor with a fine impalpable powder, that reminds us of the interior of a flour mill, and the workmen are moving ghosts, even the fringes of their eyelashes are whitened to their tips, just as the hoar frost whitens every tiny fillament it can lay hold of. The dust is that of fine starch, the substance used as a matrix for a certain class of cast sugar goods. We are in that part of the factory now where those 'sweets' are made which are demi-opaque—like snow-water frozen. The sugar is not boiled to a great heat, but is allowed gently to simmer on the fire, while the molds in which it is to be cast are being prepared. This is done by spreading the fine starch over boards, quite evenly, and then inverting another board over it, studded with the forms it is intended to cast. The man we are looking at is about making annulets, or sugar rings, and as he lifts the inverted board from the smooth starch, we see that it is covered with molds of these indented rings placed at regular intervals, and as close together as they can go. Another workman now approaches with a tin receptacle filled with sugar, fitted with six spouts. With great skill and knack he pours out the sugar, and fills ring after ring indented in the starch, as fast as his arm can conveniently travel from left to right. Not a drop is spilt, the sugar standing in each ring with a slightly curved surface, just as a drop of water would do that had fallen upon dust. These starch molds are used for all those sweat-meats which contain fluid or liquor in the interior. The liquor is mixed with the melted sugar indiscriminately, and both enter the mold together, but, curiously enough, the latter instantly crystallizes on the outside of the former, and thus, by a natural law, the liquid flavoring essence becomes imprisoned. It was thought very foolish of George III. to ask how the apples got into the dumplings, but we have little doubt that the manner in which these liquors got inside the sugar plums has puzzled many a head wiser than his. The casting of these liquor sweets employs a large number of persons, and the most extraordinary molds are obliged to be invented to meet the requirements of the trade. Balmoral boots, Tyrolese hats, scissors, knives, fish, and all kind of things, animate and inanimate, are thus produced, the only limit to the design being the size and weight of each article.—*Once a Week.*

Bookbinding Presses.

It has been a standing grievance with mechanics in this country, that the appliances requisite for the successful development of local manufactures could only be had from the shops of the neighboring Republic. So injurious has this state of affairs been, that many branches of trade have been wholly neglected or only partially developed. Two causes, operating together, are fast undoing this state of things, and it will not be long we hope, before mechanical ingenuity in this country will be able to look to our own foundries and forges for the requisite appliances for a more vigorous prosecution of that skilled labor which we possess. The two dispelling causes are, greater resources on the part of machinists, and the employment of workmen of enlarged experience. We are led to make these remarks because of the successful effort of Mr. H. P. Brown to complete a set of presses for bookbinding purposes. The most important article is really a magnificent piece of mechanical skill, having all the proportions for great strength, with neatness, while the smaller or cutting press is a decided improvement on anything of the kind made either in England or America, fine iron screws being introduced instead of wooden ones. These articles have only to be seen by those who understand their use to be appreciated, and we notice the manufacture simply as a duty to our enterprising townsman and his excellent staff of workmen.—*Woodstock Times.*

Graduating Plane Stock.

A Plane has been patented in the United States, adapted to finish curved surfaces with accuracy. This plane is designed to meet an especial want. It consists of a peculiar hollow iron stock, to the bottom of which is fitted a thin highly polished steel plate, or face, so as to bend up or down from the centre, at either end, forming a convex or concave surface, as may be required, and of any desired curve. The ends of this plate are held in their places by a set screw. The cutting iron is of the usual form, and is firmly secured by lever pressure, its position being easily changed without the use of a hammer or other tool. The plane works equally well within or around a circle, or upon a level surface. The same principles are appplied to the plow and rabbet plane.

They are manufactured by R. H. Mitchell & Co., of Hudson, N. Y.

Boiler Incrustations.

The last number of *Newton's London Journal* has a long article by Lewis Thompson, M.R.C.S., which concludes as follows:—

"A few careful analyses had convinced us that this incrustation is not due to carbonate of lime; but to sulphate of lime, by which the particles of carbonate of lime are cemented together and converted into a crust. To prevent the formation of this crust, it is necessary only to destroy the sulphate of lime, which is easily done by adding 1 lb. of common carbonate of soda (washerwoman's soda) to every 300 gallons of water supplied to the boiler. This converts the whole of the lime into carbonate, which has no tendency to agglutinate, but remains as a semi-crystalline powder, that may either be collected by placing an empty vessel in the boiler, or it may be blown out at intervals in the form of milky fluid. In both cases the conducting power of the iron boiler is preserved, which not only facilitates the development of steam, but prevents the burning or oxidizement of the boiler. That it must also prevent or diminish the number of explosions is more than probable."

Le Technologiste gives an account of experiments on the value of chloride of barium for the prevention and removal of scales from boilers, where it consists principally of the salts of lime. In tubular boilers, to ascertain the amount of the chloride of barium required in any boiler, note, when an opportunity offers, the amount to which scale has collected and the time during which the deposit had been gathering; multiply its thickness in sixteenths of an inch by three-sixteenths of the heating surface of the boiler; and this product, multiplied by 1·65, will give the weight in pounds required to be used during a period equal to that during which the scale was collecting, and will be sufficient to prevent further deposit, and gradually to remove that already formed.

As an example, suppose sufficient impurities in the water used in any boiler to deposit one-sixteenth of an inch of scale in six months, the heating surface to amount to 1,000 square feet:

$$1 \times 1{,}000 \times 3{\cdot}16 \times 1{\cdot}65 = 309{,}375.$$

Or, supposing one hundred and fifty running days during the six months, about two pounds per day.

Proper Inspection for the Manufacture of Steam Boilers.

A few months ago we laid before our readers a summary of the report of the engineer of the Midland Steam Boiler Insurance and Inspection Company, and we now extract the following from the report of the chief engineer to the Manchester Association for the prevention of Boiler Explosions. In one month, he says, 373 boilers have been examined, and 98 dangerous defects met with. Three explosions had taken place in as many weeks in his district, through which one life had been lost, and four persons injured. Not one of these boilers, however, was under the inspection of the company, and competent inspection would certainly have prevented the explosions.—*The Ironmonger.*

Color vs. Tannin.

"Conceding, as all tanners do, the presence of coloring matter and *tannin* in the usual extract from bark, it may be worth while to press the inquiry a little farther and ascertain the office of each. Do we really comprehend the fact that coloring matter is distinct from tannin? Sometimes I doubt whether tanners really do comprehend this. But it is important that we not only admit the fact, but that we fully realize its significance. For the purpose of coming to a conclusion let me recommend a little experiment as follows:—Dissolve, say one pound of glue; make the glue-water as rich (strong) as possible, and then take the same quantity of pure tan liquor; let it be rich both in color and in tannin; precipitate them together, stir them for a moment, then let them stand until the leathery substance all settles to the bottom. If there shall remain an excess of tannin, draw it off and precipitate more glue water, until the glue is in excess, and then there will remain the coloring matter. Now take this coloring matter and try to tan leather, and then you will for the first time comprehend the idea that lies at the bottom of the tanners art This coloring matter will color the leather and penetrate the fibres, but it will not combine with the gelatin or glue of the hide. This will be proven by trying it on a piece of sheep or calf skin parchment. After coloring it will weigh practically the same as before submitted to the process; whereas if put into tan liquor it will increase its weight and expand its fiber and become leather—while in the first case you will have colored parchment—nothing more, nothing less. When this idea is fully understood, one of the causes of the variable gain in weight will be explained. Coloring matter is permitted to do the work of tannin. Then, too, we shall all understand how it is possible to tan leather with almost any vegetable extract—almost any weed will produce a coloring matter—which, with plenty of terra-japonica, will make a very good leather. Hence the thousand-and-one patents on all these plants. Any experiment, however simple, that will convince tanners that coloring matter is not tannin, will do, in my judgment, great service. and lay the foundation of other inquiries which will be valuable. Who can suggest a better practical form than the above? Let him speak."—*Correspondent of the Shoe and Leather Reporter.*

Artificial Ivory.

Both on the continent and in this country the manufacture of "artificial ivory" is conducted on a scale of some magnitude. The process by which the most successful imitation of natural ivory is obtained appears to consist in dissolving either india-rubber or gutta-percha in chloroform, passing chlorine through the solution until it has acquired a light yellow tint, next washing well with alcohol, then adding, in fine powder, either sulphate of baryta, sulphate of lime, sulphate of lead, alumina, or chalk, in quantity proportioned to the desired density and tint, kneading well, and finally subjecting to heavy pressure. A very tough product, capable of taking a very high polish, is obtainab:e in this way.—*Mechanic's Magazine.*

Useful Receipts.

Bronzing Tin Castings.

When clean, wash them with a mixture of 1 part each sulphate of iron and sulphate of copper, in 20 parts water; dry, and again wash with distilled vinegar, 11 parts, verdigris, 4 parts. When dry, polish with colcothar.—*Druggist's Circular.*

To Renew Velvet.

When the pile or nap is flattened, hold the parts over a basin of hot water, with the back towards the water; the pile will soon rise and assume its original beauty.

Glycerin Ointment.

Melt together spermaceti, ½ oz., and white wax, 1 drachm; put them into a stone mortar, add glycerin, 1 fluid once, oil of almonds, 2 fluid ounces, and rub them together until cold. Used for chapped hands, etc.

Pomatum.

The following receipt will furnish an excellent pomade at a moderate cost:—Two ounces of castor oil, three ounces of best olive oil, one ounce of spermaceti. Dissolve the spermaceti in an earthen jar or pipkin over a slow fire; then add the castor and olive oils. When nearly cold, stir in a small quantity of bergamot, with a few drops of oil of cloves, cinnamon, and almond mixed; or, six ounces of castor oil, six ounces of olive oil, four ounces of spermaceti, two drachms of oil of lavender, ten drops of oil of cinnamon, two drachms of essence bergamot, two drachms of essence of lemon. Melt the oils and sperm together, gradually warming them on the stove and keep stirring; when nearly cold add the scent.

To Heal Burns.

Take lime water and beat into it linseed oil. This makes the best ointment known for burns.

To Clean Oil Cloth.

Oil cloth should never be scrubbed. First sweep, then wash clean with a large, soft cloth and lukewarm water; on no account use soap or hot water, either will bring off the paint.

To Whiten Tallow.

Melt the tallow and add a little alum and saltpeter, or a little nitric or sulphuric acid.

Beef versus Brandy. A new Stimulant.

It has been found that in cases of great exhaustion, attended with cerebral weakness, produced by severe labor or any other cause, a preparation from *beef* may be used (at least partially) instead of brandy, as it exerts rapidly a stimulating power over the brain. It is thus made:—Chop up lean beef, place it in a pan and subject it for an hour or more to heat by keeping the pan in a vessel of boiling water; the fat, fiber and essence will distinctly separate. Strain the liquid portions from the fiber, and remove from it the fat by means of blotting paper. A highly aromatic amber-colored liquid, of an agreeable flavor, will remain. This is the required stimulant. Unlike common beef tea, its effect is stimulating rather than nutritious. —*Hall's Journal of Health.*

Lacquers.

Good Lacquer for brass.—Seed lac, 6 ozs.; amber or copal, 2 ozs.; best alcohol, 4 galls.; pulverized glass, 4 ozs.; dragon's blood, 40 grs.; extract of red sandal wood, obtained by water, 30 grs.

Pale Lacquer for tin plate.—Best alcohol, 8 ozs.; turmeric, 4 drs.; hay saffron, 2 scs.; dragon blood, 4 scs.; red sanders, 1 sc.; shell lac, 1 oz.; gum sanderach, 2 drs.; gum mastic, 2 drs.; Canada balsam, 2 drs.; when dissolved add spirits of turpentine, 80 drops.

Lacquer for Philosophical Instruments.—Alcohol, 80 ozs.; gum gutta, 3 ozs.; gum sandarac, 8 ozs.; gum elemi, 8 ozs.; dragon's blood, 4 ozs.; seed lac, 4 ozs.; terra merita, 3 ozs.; saffron, 8 grs.; pulverized glass, 12 ozs.

Transparent Japan.

Oil of turpentine four ounces, oil of lavender three ounces, camphor one-half drachm, copal one ounce; dissolve. Used to japan tin, but quick copal varnish is mostly used instead.

Silvering Powder for coating Copper.

Nitrate of silver, 30 grains; common salt, 30 grains; common salt, 30 grains; cream of tartar, 3½ drachms; mix, moisten with water, and apply.

Cure for Bites of Poisonous Insects.

M. de Mortillet has published in the *Sud-Est*, a Grenoble paper, a curious remedy for the sting of a dangerous insect. It is the application of the wax of the ear to the injured part. This simple remedy, he positively asserts, will cure the deadly sting of a poisonous fly, which would otherwise produce carbuncle. Whatever may be the efficacy of this treatment there can be no harm in trying, the substance being always at hand. Should it not succeed, the patient will always be in time to have recourse to a more radical treatment.

Elderberry Wine.

Elderberries, ten gallons; water ten gallons; white sugar, forty-five pounds; red tar, eight ounces; fermented with yeast in the usual manner when in the cask; ginger root, sliced, or alspice, four ounces; bitter almonds, three ounces; suspended in a bag, may be allowed to infuse in the liquor when it is fermented; they are then to be removed. Brandy may be added or not. When the wine is clear, which will be in about three months, it may be drawn off from the lees and bottled. The spices may be varied according to taste.

Cure for Neuralgia.

Some time since we published at the request of a friend, a recipe to cure neuralgia. Half a drachm of sal ammonia, in an ounce of camphor water, to be taken a teaspoonful at a dose, and the dose repeated several times, at intervals of five minutes, if the pain be not relieved at once. Half a dozen different persons have once tried the recipe, and in every case an immediate cure was effected. In one, the sufferer, a lady, had been affected for more than a week, and her physician was unable to alleviate her sufferings, when a solution of sal ammonia in camphor water relieved her in a few minutes. —*Alta Californian.*

Encaustic Process.

The following process of encaustic is given by M. Bocklin:—Moist plaster of paris is painted with water colors as usual. When the design is perfectly dry, it is painted over with a hot solution of wax and resin, and this coating is burnt in with a strong heat. The wax sinking in fixes the color, and gives together with its compound resin a solid transparent surface, which effectually protects the painting from injury by damp or dust, the colors at the same time being greatly heightened and improved.

Cure for Dysentry.

Mrs. Mackay, Naval Hospital Yard, has discovered a medical plant, the Wild Orach, commonly called Lamb's Quarters. The medical properties that belong to this simple plant are truly wonderful in curing Dysentry in children. The first trial of its virtues was proved in August last, when one of Mr. Malone's children was dangerously ill. All other medicine having failed, two teaspoonful of the decoction of the leaves of this plant stopped the vomiting in a few minutes. Since that time many families have used it in the city and country, and found it a sure remedy. The leaves can be used green or dried. A half cupful of leaves in a wine glass full of nearly boiling water, steeped for a quarter of an hour, is all that is required.—*Ex. Sun.*

Says Mencius:—"If I am treated rudely, let me examine into the cause, and if I cannot discover any sort of impropriety in my own conduct, I may disregard the rudeness, and consider him who displays it as no better than a brute, and why should the conduct of a brute disturb me?"

Gold-leaf can be reduced to the 300-thousandth part of an inch; silver-leaf to the 170-thousandth.

A Toad Undressing.

Audubon relates that he once saw a toad undress himself. He commenced by pressing his elbows hard against his sides and rubbing downward. After a few smart rubs his sides began to burst open along his back. He kept on rubbing until he had worked all his skin into folds on his sides and hips; then grasping one hind leg with both his hands he hauled off one leg of his pants the same as anybody would, then stripped off the other hind leg in the same way. He then took his cast-off cuticle forward between his fore legs into his mouth and swallowed it; then by raising and lowering his head, swallowing as his head came down, he stripped off the skin underneath until it came to his fore-legs, then grasping one of those with the opposite hand, by considerable pulling stripped the other, and by a single motion of the head, and while swallowing, he drew it from the neck and swallowed the whole.—

[This toady was a turn-coat, like others of his tribe, when they can fill their bellies by it.—EDS *American Artisan.*]

Practical Memoranda.

TABLE OF INTEREST,

PER DAY, at Six per Cent,* on any number of Dollars, from One to Twelve Thousand.

PRINCIPAL.	INTEREST.	PRINCIPAL.	INTEREST.	PRINCIPAL.	INTEREST.	PRINCIPAL.	INTEREST.
$	Mills.	$	Mills.	$	c. Mills.	$	$ c. Mills.
1	0.16	31	5.10	61	1 0.08	91	0 1 4.96
2	0.33	32	5.26	62	1 0.19	92	0 1 5.12
3	0.49	33	5.42	63	1 0.36	93	0 1 5.29
4	0.66	34	5.59	64	1 0.52	94	0 1 5.45
5	0.82	85	5.75	65	1 0.68	95	0 1 5.62
6	0.99	36	5.92	66	1 0.85	96	0 1 5.78
7	1.15	87	6.08	67	1 1.01	97	0 1 5.95
8	1.32	38	6.25	68	1 1.18	98	0 1 6.11
9	1.48	39	6.41	69	1 1.34	99	0 1 6.27
10	1.64	40	6.58	70	1 1.51	100	0 1 6.44
11	1.81	41	6.74	71	1 1.67	200	0 3 2.88
12	1.97	42	6.90	72	1·1.84	300	0 4 9.32
13	2.14	48	7.07	78	1 2.00	400	0 6 5.75
14	2.80	44	7.23	74	1 2.16	500	0 8 2.18
15	2.47	45	7.40	75	1 2.33	600	0 9 8.68
16	2.63	46	7.56	76	1 2.49	700	0 11 5.07
17	2.79	47	7.73	77	1 2.66	800	0 18 1.51
18	2.96	48	7.89	78	1 2.82	900	0 14 7.95
19	8.12	49	8.08	79	1 2.99	1000	0 16 4.38
20	3.29	50	8.22	80	1 3.15	2000	0 32 8.77
21	3.45	51	8.38	81	1 3.32	3000	0 49 3.15
22	3.62	52	8.55	82	1 3.48	4000	0 65 7.53
23	3.78	53	8.71	83	1 3.64	5000	0 82 1.92
24	3.95	54	8.88	84	1 3.81	6000	0 98 6.30
25	4.11	55	9.04	85	1 3.97	7000	1 15 0.58
26	4.27	56	9.21	86	1 4.14	8000	1 31 5.07
27	4.44	57	9.37	87	1 4.30	9000	1 47 9.45
28	4.60	58	9.53	88	1 4.47	10000	1 64 3.84
29	4.77	59	9.70	89	1 4.63	11000	1 80 8.22
30	4.93	60	9.86	90	1 4.79	12000	1 97 2.60

* To find the amount at *seven per cent.*, add one-sixth to the above rates; at *eight per cent.*, add one-third; *ten per cent.*, add two thirds.

A TABLE SHOWING THE RELATIVE VALUE OF GOLD AND U. S. BILLS.

Prem.	Value of a Cur. Dollar.	Prem.	Value of a Cur. Dollar.
101	99	126	79⅜
102	98	127	78¾
103	97	128	78¼
104	96½	129	77½
105	95¼	130	77
106	94⅜	131	76⅜
107	93½	132	75¾
108	92½	133	75⅛
109	91¾	134	74⅝
110	90⅞	135	74
111	90	136	73½
112	89¼	137	73
113	88½	138	72½
114	87¾	139	72
115	86⅞	140	71½
116	86⅛	141	71
117	85½	142	70⅜
118	84¾	143	69⅞
119	84⅛	144	69½
120	83⅜	145	69
121	82⅝	146	68½
122	82	147	68
123	81¼	148	67½
124	80⅝	149	67
125	80	150	66⅝

Statistical Information.

TRADE OF CANADA IN 1864–65.

(From the *Trade Review.*)

I. Our Total Imports.

The imports of the twelve months, ended June 30th, 1865, were:—

From.	Value.	Per cent. of Total Imports.
Great Britain	$21,035,871	$46¾ per cent.
United States	19,589,055	44 "
British Colonies:—		
In North America	511,570	1¼ "
In West Indies	209,829	½ "
France	751,667	1¾ "
Germany	386,717	¾ "
Other countries	2,136,260	5 "
Total	$44,620,469	$100

Of these imports, $4,768,478 were imports of coin and bullion, all from the United States.

* * * * *

The following table shows the extent of our Import Trade since 1850:—

Years.	Total Imports including coin and Bullion.	Coin and Bullion.	Duty collected.
1850	$16,982,069	$222,367	$2,462,583
1851	21,434,791	489,933	2,949,756
1852	20,286,493	none.	2,957,055
1853	31,981,436	"	4,114,707
1854	40,529,325	"	4,899,005
1855	36,086,169	"	3,525,782
1856	43,584,387	"	4,508,882
1857	39,430,598	"	3,925,051
1858	29,078,527	675	3,381,390
1859	33,555,169	19,248	4,437,846
1860	34,447,935	35,504	4,758,465
1861	43,054,836	3,304,675	4,768,193
1862	48,600,633	2,619,694	4,652,749
1863	45,964,493	4,652,287	5,169,173
1864	23,882,216	2,475,504	3,068,368
1864–5	44,620,469	4,768,478	5,663,378

(Following the above tables are a series showing the Imports classified under the different rates of duties, which, combined, give the following result for 1864–5.)

Imports from	Value.	Duty.	Pressure of Tariff.
Great Britain	$21,035,871	$3,452,872	16¾ per c.
British N. America	511,570	72,962	14 "
West Indies	209,329	95,170	15 "
United States	14,820,577	1,126,864	7½ "
France	751,667	162,799	21½ "
Germany	386,717	77,979	20 "
Other countries	2,136,260	674,732	31½ "
Total	$39,851,991	$5,663,378	14¼ per c.
Add Coin & Bullion	4,768,478		
And we have	$44,620,469	as in Table I.	

The *Review* in commenting on the above, says,

"We have been favouring the United States to an extraordinary degree, in comparison with other countries; contrary to the assertions of those Americans, who have attacked until they have succeeded in abolishing the Treaty of Reciprocity, under which their trade with us has grown so large."

Population of France.

The French Government has just published the statistics of the census of 1861, from which it appears that the population of the Empire was then 36,717,254. Of the population over 87½ per cent. are Roman Catholics. There are 802,339 Protestants, 79,964 Jews, 12,095 of sects not Christian, and 11,834 whose religion is not stated. A curious fact, showing the disinclination of the French to emigrate appears in the volume, viz: that out of the nearly 37,000,000 of the French population there were less than 4,000,000 found domiciled out of the departments where they were born.

British Emigration.

A report of the British Emigration Commissioners informs us that, since the year 1814, 5,700,000 persons have emigrated from the United Kingdom, of whom 3,450,000 have gone to the United States, 1,225,000 to British North America, and about 868,000 to the Australian colonies. It will be seen by these figures that the Republic has absorbed nearly three times as many as have settled down in our own provinces.

Indian Tribes in the United States.

By statements from the Indian Bureau of the Department of the Interior, it appears that the total number of Indians within the limits of the United States territories, is 314,622. The larger tribes are as follows:—Choctaws, 17,000; Cherokees, 19,730; Creeks, 25,000; Sioux, 27,423.

British Iron Mail Steamers.

Thirty-five iron steamers, most of them monster ones, will be added to the fleets of the mail steam-packet companies this year. Twenty four are already afloat and eleven are building. Thirty of them are screws, and five paddle-wheels. These are the class of vessels that will have to be depended on as a Marine Police for the protection of British commerce, and the punishment of pirating vessels of the enemy, in case of a war between Britain and any other country.

Wells in the Sahara Desert.

Up to the year 1860, fifty wells had been sunk by the French in the Great Sahara Desert, producing 7,920,000 gallons of water per day.

Miscellaneous.

Ancient and Modern Engineering.

The *Practical Mechanic's Journal*, in an introduction to an article on recent improvements in contractor's plant, says:—

"To modern men, that is to say, to the most civilized and learned races of man, and within the last two centuries only, belongs the power and the glory of having conferred *motion* upon insensate matter, and, with motion, obtained command of the *force* that produces it—of force detached in fragments from the great cosmical machine indirectly and by the agency of pure intellect, as distinguished from that compelled by the action of the will from our own muscles or from those of others. Apart from this, there is much less to exalt the most modern over the most ancient structural engineering than is commonly supposed. Two words, in fact, comprise the germ of all modern engineering improvement—coal and steam. Iron and coal together have given us steam power, and every advance that we hourly make in the many-sided improvements and applications of the latter, will be found preceded by advances in the manufacture and treatment of iron, or by making more plentiful or by the economizing of fuel. At this moment, who shall set limits to or appraise the future value of what steel in every shape—in masses of any size and as cheap as iron—and liquid coal fuel have in store for the coming generation? In enormous magnitude, in grandeur of conception, and all that makes majesty and perfection in execution, numbers of the oldest monuments of the world contrast favorably with our latest and greatest engineering works. The tanks of India and Ceylon, with their gigantic *bunds*, though so old that the very names of the men who planned and constructed them are often unknown, stand advantageously in comparison with the greatest reservoirs made in Europe. Before the Heraclidan blood was known in Greece, its inhabitants had drained a great lake district by a tunnel in limestone, the ruins of which are no mean competitor to that of Mont Cenis. The cyclopean masonry of Holyhead or Portland, in its huge, uncouth, and grand fifteen-tun blocks, is excelled by that which sits unmoved by earthquake, and from which the tool marks have not been removed by thirty centuries, in the walls of Baalbec and Tadmor. The obelisks and lintels of Luxor, of Karnak, of Philæ, nay, of our own Stonehenge, are of blocks to quarry and to elevate which might make a reputation even now. At Syracuse, in Greece, in Egypt, we find the quarries out of which such blocks have come, wrought with as much or more skill, and upon as vast a scale as those of Caen, Portland, or Peterhead. What amongst the earthworks or masonry of our own railways, or of the still more remarkable works of some of those of Europe or of India, can we point to in magnitude more impressive than the Birs Nimrood, or the Pyramids of Thebes, or even than the mighty raths of Northern Europe, or the terraced mounds of Mexico, Texas, and Central America? And to pass from mere size to evidence of skill, may not the tombs and minars of India, the rock-sculptured cave of Elephanta, the stately walls of Persepolis, the domed treasury of Atreus; or, in far later days, the aqueducts and bridges of the Romans—Alcantara, the Pont du Gard, the mole of Pozzuoli, the minster towers and spires of medieval Europe—match the best that we have done to-day? Of taste, the æsthetic element of skill, we need say nothing. The ancients are our confessed masters, without the necessity of glass domes and the 'Board of Trade' order to prove that we cannot even imitate them."

Prevention of Foul Air from Sewers.

The effluvia which escape from sewers, in the very attempt to ventilate them, are of a very pernicious character, and have often been productive of mischievous effects. M. Robinet, a French chemist, has devised a very effective means of freeing the sewers from them. His plan has already been carried out on a small scale. He proposes that the furnaces of factories shall derive their supply of air from the sewers; the latter will thus be emptied of their mephitic gases, which will be destroyed by combustion, fresh air from the atmosphere supplying their place. He calculates that if the combustion of only 70,000 tuns of coal can be thus economized annually in Paris, or only a tenth part of what is burned there, the sewers will be supplied with about 140,000,000 cubic feet of fresh air (that is, more than seven times their contents) daily.—*Mechanics' Magazine.*

[This is a better plan than that practiced in New York, which is to exhaust steam into the sewers; and which, as may be seen in Fulton, Spruce and other streets, drives the foul air out of the sewers and into the streets and buildings. If, instead of this, the foul air were sent through the fire; and if, as Mons. Robinet says, it would thereby become purified from offensive odor, it would be a great relief, as we too well know, having been annoyed by foul air from sewers bubbling up through the waste-pipes of washing basins, when the steam engines were vigorously exhausting their steam into the sewers. In 1835 or 1836 a friend of ours, in a private letter, suggested that the smoke nuisance might be abated by drawing the smoke from houses through sewers by powerful exhausting engines on all sides of a city—only those to the leeward to work at any time. Of course there would be no outlet of foul air from the sewer, except on the leeward side. But very large sewers would be required, and the system would be very costly. But it is easy to see that it would insure a more perfect ventilation than is practicable at equal cost on the old plans; and the air prawn into the houses would not be mixed with smoke, sewer-gas, and the other impurities now sent into the atmosphere in the city.

Probably five thousand lives and fifty thousand cases of sickness might yearly be saved in New York by a perfect system of ventilation.]—*Eds. American Artisan.*

Manufactures and Agriculture.

The intimate dependence of agriculture, for its enlargement and compensation, upon the establishment of manufactures is well put in the following extract from the new official volume of statistics compiled from the last Federal Census, by Mr. Kennedy, late Superintendant of the Census. Mr. Kennedy says:

"To enter upon any discussion respecting the relative importance of interests which hold such intimate relations, with such indispensable independence reciprocally as agriculture and manufactures, the one augmenting the prosperity of the other, neither flourishing with the other languishing, would be profitless. To every observer the fact is evident that lands enhance in value in proportion to the capital expended in manufactures, and that negligence and barrenness disappear in proximity to riches and population. The poor acre, with its rocks and tangled thickets, becomes transformed, by the presence of the factory or iron works, into a productive garden of greater value than fourfold its quantity of the most fertile valley distant from the avenues to the market. In truth, farming lands, everywhere, fertile as they may be, would possess but little value were it not for the consumption of their surplus produce either as food to sustain a commercial and manufacturing population, or as raw materials in the arts and manufactures, and, other things being equal, it will be found that the prices of lands and the value of their products vary in proportion to the cost of transporting the latter to the place of consumption. These prices are not controlled so much by distance as by the cost of carriage, as we see illustrated in the efforts of railroads and other means of conveyance, which deliver at a profit to the producer those articles which, transported by ordinary means, would cost more than the value of the crop in market, and this results from the enhanced worth of products occasioned by increased consumption, and the return freight in articles of manufacture, a process constituting the greater portion of commerce.

The system of agriculture, as pursued at present, with its labor-saving machinery, could no more continue without the aid of mechanic arts, than it would pay without the absorption of its products by manufactures, or than manufactures could thrive independently of the products of agriculture or the consumption of mechanical productions by the farmer, and so inseparably are they identified in interest, that with the spindle at rest, and the anvil ceasing to ring, the plough must inevitably stop in the furrow.—*Maine Farmer.*

Poisons in Daily Use.

Poisons are introduced into the system by various means. They are often concealed in food by the ignorant cook or housekeeper, and as ignorantly partaken of by herself and others. Pickles are often poisoned by being scalded in brass or copper kettles: it makes them look green, but that greenness renders them poisonous. Brass or copper vessels ought not to be used for any purpose, unless they are previously scoured very bright; it is better for health to avoid their use for cooking purposes. Brass wash-dishes ought never to be used; they cause sore eyes, eruptions, etc Water is poisoned by being conveyed in lead pipes, or standing in pails painted in the inside. Milk is poisoned by using such pails for milking. Cheese is often poisoned in the same way, and by using, in its manufacture, brass, copper, or wooden tubs painted inside.

Ignorance often places a deadly weapon in our choicest article of food, but selfishness often conceals a greater. It manufactures and commends poisons for others in many temptingly disguised forms. Candies, toys, and cakes are ornamented or coloured with various poisons. The blending of colors in various ways, in candies, and on cakes, makes them attractive to the eye but destructive to the health of those who use them. Cakes ornamented with colored dust, candies colored in such nice style, toys so highly attractive to children, cause decayed teeth, canker, intestinal inflammation, nauseating headache, colic, spasms, and often convulsions. Confectionery may be prepared without coloring material, so as to be wholesome. Gay colors are made of poisonous materials, that ought never to be introduced into food or drinks.

Wall-paper—ornamented with beautiful green, pretty yellow, and lively red—often diffuses, through sleeping and sitting rooms, an atmosphere impregnated with a poisonous vapor, that causes headache, nausea, dryness of the mouth and throat, cough, depression of spirits, prostration of strength, nervous affections, boils, watery swellings of the face, cutaneous affections and inflammation of the eyes. These occur in more serious forms in apartments that are not constantly and thoroughly ventilated.—*Home Journal.*

Diet in Relation to Health

A writer in one of the leading English magazines, in reviewing a new book upon this subject says:

As to diet, many of the regulations are excellent, chiefly because they prescribe wholesome food and moderation. But many are absurd, and all are without the illumination of intelligent principles.

Let us glance at one or two. "There is no circumstance," says Sinclair, "that seems to be more essential than to permit only a small quantity of liquid food," and Jackson also says, "The less one drinks the better." It is rare that reasons are assigned, and when they are assigned, they are usually on a par with this: "Liquids are apt to swell the body and encourage soft unhealthy flesh." On the strength of this physiological ignorance, certain strict limitations are prescribed, in defiance of common sense, which assures us that different individuals need different quantities of liquid as of solid food, and that the same individual needs different quantities at different periods. Once placed beyond the reach of the seductions of the palate, the simple rule of "drink when you want and as much as you want," will of itself suggest the needful limitations. Physiology tells us plainly enough not only why liquids are necessary, but how all superflous quantities are got rid of. The superstitions about "swelling" and "soft flesh" are unworthy of notice.

An interdict is also placed against hot drinks, which, if directed against tea and coffee so hot as to scald the mucous membrane, is rational enough, but is simply absurd when directed against hot in favour of cold drinks; the aroma of tea and coffee, are produced only by this application of heat, and consequently the same stimulating effect is considerably diminished when they are allowed to get cold.

Great diversity prevails as to the kinds of drink permitted. Some interdict tea, others only green tea; some will not hear of coffee: others allow mild beer but protest against the bitter. Whoever very closely examines the evidence, will probably admit that the excessive variations in the conclusions prove that no unexceptionable evidence has yet been offered. By this we mean that the evil effects severally attributed to the various liquids were no direct consequences of the actions of such liquids, but were due to some other condition. The man who laid the blame of intoxication on "that knuckle of ham," was not so far wrong as his laughing audience imagined; for, although the ham might have given him an indigestion, but would not have made his gait unsteady and his demeanour maudlin had there been no "stiff tumbler" to wash the ham down, neither perhaps would that tumbler have been taken had there been no ham to wash down. Be this as it may, we often lay the blame of a restless night on the tea or coffee, which would have been quite inoffensive taken after a simple dinner, or at another hour. When a man uniformly finds a cup of tea produce discomfort, no matter what his dinner may have been, nor at what hour he drinks it, he is justified in saying that tea disagrees with him; if he finds that the same effect follows whether he take milk or sugar with his tea, then he has a strong case against the tea itself, and his experience is evidence as far as it goes. But we should require a good deal of evidence as precise as this before impugning the wide and massive induction in favour of tea which is drawn from the practice of millions. Had tea in itself been injurious, had it been other than positively beneficial, the discovery would long ago have been made on a grand scale.

The same may be said of coffee. Both tea and coffee may be harmful when taken at improper times, and a little vigilance will enable each person to decide for himself when he can and when he cannot take them with benefit. But for the man in tolerable health there is no necessity for him to trouble himself about such matters. He should not take very strong tea and coffee except in very small quantities, especially at night, simply because they are stimulants; but if he need them, they are as beneficial as any that can be taken.

Success in Business.

"Economy in business is, as most persons are aware, of great importance. It is known, from reliable data—derived from the Court of Bankruptcy, &c.—that nearly one half of the failures among men of business arise from extravagance, from ostentation, from rivalry, from a love of ease and self-indulgence; one quarter from speculation; leaving only a fourth part for the rest; and these only a small portion can be termed unavoidable. This is encouragement for the careful and industrious, and it ought to be a warning to others—particularly to those who waste their time and spend their money in drinking—a vice which, if men, when young, do not acquire would never in after-life be even a temptation, to them. What misery has been brought on the world—ruin in business, loss of character, disease, wretchedness of families, beggary, crime, starvation—by this one vice of drunkenness! If young men value their hppiness in this world and the next, they should by all means avoid a love of drinking."—*From Hand-Book for the Man of Business.*

Rosin in Lard.

In the Scientific Convention at New Haven, Prof. Olmstead stated that rosin added to lard gives it a degree of fluidity not before possessed by the lard, and also prevents the latter from forming those acids which corrode metals—copper and brass for example.

Several important practical applications result from this property Its use for lubricating surfaces of brass or copper has already been alluded to. It is equally applicable to surfaces of sheet iron. I have found a very thin coating, applied with a brush, sufficient to preserve Russian iron stoves and grates from rusting during summer, even in damp situations.

I usually add to it a portion of black lead, and this preparation, when applied with a brush, in the thinnest possible film, will be found a complete protection to sheet iron stoves and pipes. The same property renders the compound of lard and rosin a valuable ingredient in the composition of shaving soap. The quality of shaving soap is greatly improved by a larger proportion of oil than is usually employed, so as completely to saturate the alkali; but such soap easily becomes rancid when wet with water and allowed to remain damp—as it commonly is when in use.

If a certain proportion of this compound is added to common Windsor soap (say one-half of its weight) the tendency to grow rancid is prevented.

A very soft and agreeable shaving compound, or cream, may be made by steaming in a close cup a cake of any common shaving soap, so as to reduce it to a soft consistency, and then mixing intimately with it half its weight of our resinous preparation, adding a few drops of some odoriferous substance. The same compound forms an excellent water-proof for leather.—*Scientific American.*

Magnesium as the positive Element of Voltaic Batteries.

M. Bultinck, of Ostend, has communicated to the Academy of Sciences a note on the use of magnesium instead of zinc as the positive element of voltaic batteries. In order to compare the electro-motive force of magnesium with that of zinc, he employed two pairs of wires, one pair consisting of a wire of copper and one of zinc, and the other pair of a wire of silver and one of magnesium. On plunging the first-mentioned pair of wires into distilled water, having first connected them with a multiplying galvanometer, the needle of the galvanometer, at the moment of the immersion of the wires, moved 30 degrees, and after the immersion had lasted five minutes still marked 10 degrees. On similarly treating the silver and magnesium pair of wires, which were of exactly the same dimensions as the copper and zinc pair, at the moment of immersion the needle of the galvanometer deviated 90 degrees, and five minutes after immersion it remained stationary at 28 degrees. Having thus found the electromotive force of a silver and magnesium couple to be three times that of a copper and zinc couple, M. Bultinck became desirous to construct a large battery with magnesium as the positive element, but not being able, for the moment, to obtain magnesium in any other form than that of thin wire, he had to be content with making a "galvanic chain," of the kind associated with the name of M. Pulvermacher. Having constructed such a chain of silver and magnesium, he found that when simply moistened with pure water it would produce all the effects the production of which by an ordinary Pulvermacher's chain requires that the chain be moistened with either a saline or an acid solution. We knew prievously that magnesium possesses greater electromotive force than any other known metal capable of being obtained in quantity; the new fact brought to light by M. Bultinck is that a battery in which magnesium was the positive element would not need an acid to excite it, but could be excited by water only.—*Mech. Mag.*

Seeing through Water.

The *Edinburgh Review* says:—"Currents in the very bed of a river or beneath the surface of the sea may be watched, as Mr. Campbell informs us, by an arrangement that smugglers used in the old days. They sank their contraband cargo when there was an alarm, and they searched for it again by the help of a so-called marine telescope. It was nothing more than a cask with a plate of strong glass at the bottom. The man plunged the closed end a few inches below the surface, and put his head into the other end ,and then he saw clearly into the water. The glare and confused reflections and refraction from and through the rippled surface of the sea were entirely shut out by this contrivance. Sealhunters still use it. With this simple apparatus the stirring life of the sea bottom can be watched with great distinctness. So far as this contrivance enables men to see the land under the waves, movements under water closely resemble movements under air. Sea weeds, like plants, bend before the gale; fish, like birds, keep their head to the stream, and hang poised on their fins; mud clouds take the shape of water clouds in the air; impede light, cast shdows, and take shapes which point out the directions in which currents flow. It is strange, at first, to hang over a boat's side peering into a new world, and the interest grows. There is excitement in watching big fish swoop like hawks out of there seaweed forest after a white fly sunk to the tree tops to tempt them, and the fight which follows is better fun when plainly seen. Mr. Campbell suggested plate glass windows in the bottom of a boat; it would bring men and fish face to face,and the habits of the latter could be leisurely watched."

Petroleum as Fuel.

A correspondent of the *Scientific American* says: At well No. 37 they were burning crude oil for fuel, and used two and one half to three barrels per day. As oil is worth about $2 net, the cost is $5 to $6 per day. Wood or coal would cost two or three times as much. A pan is placed on the ash-pit containing a layer of broken brick or other porous earthy material. A pipe with an elbow on the end, to turn the mouth up, leads from a reservoir and delivers the oil slowly over the middle of the pan, in suitable quantities, regulated by a cock.

The Secret of Success

The basis of success in all occupations which involve the relations of employer and employed is, that the employer should have an accurate knowledge of the work to be done, what it consists in, how to do it, and how long it should take. A man of business who neglects this places his interests entirely in the keeping of irresponsible agents, and, human nature being what it is,arrives in due time at insolvency. This is why the self-made man, the man who has been sternly initiated into the whole mystery by having himself stood in the ranks of the employed, outstrips those who seem to start so fair from the vantage-ground of education and capital, and builds a fortune where these kick one down. And the mistress of a household who neither understands what a servant's duties are (except perhaps, those which affecting her immediate comfort, force themselves upon her notice), still less how and when they may be best fulfilled, will certainly not get them fulfilled in the best manner, or by the smallest number of hands, and hence will manage, or rather mismanage, her income in a wasteful, ineffectual manner. This is a certain inevitable result.

The Aurora Borealis explained.

An editor in Illinois thus describes the origin of this celestial phenomenon:

"When the molofygistic temperature of the horizon is such as to caloricize the impurient indentation of the hemispheric analogy, the cohesion of the borax curbistis becomes surcharged with infinitesimals. which are thereby deprived of their fissural disquisitions. This effected, a rapid change is produced in the thorambumptel of the gyasticutis palerium, which causes a convulcular in the hexagonal antipathies of the terrestrium aqua verueli. The clouds then become a mass of deodorumised speculæ of cermoculæ light, which can only be seen when it is visible."

A New Combustible.

"I see the mention of a new combustible, invented by a gentleman who very appropiately bears the name of *Stoker*. It appears to be very pure charcoal, finely ground, and made into a paste with starch. The paste is then molded into cakes or balls of different sizes. and then dried. When perfectly dry these may be lighted with a lucifer match, and will continue to burn steadily, like German tinder, without giving flame or smoke. The combustible is intended for heating urns, chafferettes, etc."—*Paris Correspondent of Chemical News.*

Independence vs. Impudence

There is no trait in a workingman's character which commands more ready respect than a manly independence. This is true of employer as well as apprentice boy. A man of known independence is treated with respect and consideration by those holding superior positions; and why? Simply because that any treatment short of proper will not be endured. The independent man knows his rights aud dare maintain them.

Independence is always founded upon ability; the workman feels his capacity to sustain his position without cringing to the frowns of elevated incapacity, or bowing submissively to purse-proud, ignorant, employers.

Independence, while demanding proper treatment for its possessor, dare, at the same time, give the same to all others, irrespective of position. An independent man, while demanding an apology where one is required, has the manliness, if in error, to make one himself to either superior or inferior.

Independence, like all genuine meritorius traits, is liable to be counterfeited, and its counterfeit presentment is impudence, which is always founded upon just the reverse of principle, from which springs true independence.

Impudence is always the signboard of ignorance; the impudent workman knows not what treatment he should receive from his employer, or how in return, he should behave towards him, but thinks that a saucy tongue is always in order, and that, upon all occasions, it is proper for him to show the little respect he has for his employer or his fellow workman. This is to be regretted from the effect it has upon those just entering life as mechanics; they invariably consider the least restrictions upon their actions as meriting insubordination; the impudent, incompetent, is made their beau ideal of what an independent man ought to be, while the unostentatious worth of the really independent man is looked upon as a truckling fellow, one who will suffer in preference to assuming a self-defense. A greater mistake is never made than when impudence is considered a mark of moral courage, for the two are never found in the one person, while true, unostentatious independence is allied to and accompanied by true courage.

Impudence is ever trying to hide its defects by bluster and assumed worth, knowing well that if it could be turned inside out that it would be found to be utter worthlessness; while independence is satisfied to let time and circumstances define the true bearing of all minor questions.

Men, as well as apprentices, should bear in mind that impudence is not independence; also, that while an impudent man is never independent, an independent man is never impudent.—*Fincher's Trade Review.*

The Great Pyramid.

The Great Pyramid required for its construction twenty years, and the labor expended upon it has been estimated as eqivalent to lifting 15,733,000,000 cubic feet of stone one foot high. If, in the same manner, the labor expended in constructing the London and Birmingham Railway be reduced to one common denomination, the result is 25,000,000,000 cubic feet more than was lifted for the Great Pyramid, and yet the work was performed in less than five years. The number of men employed in the building of the pyramid was, according to Herodotus, one hundred thousand; in the latter case the work was performed by about twenty thousand.

Where Fat and Flesh come from.

They come from the earth and the atmosphere, collected by vegetation. Grass contains flesh; so does grain. The animal system puts it on from these. Vegetation then is the medium through which the animal world exists; it can exist in no other way. When grass or grain is eaten, the flesh constituents are retained in the system; so also the fatty substance—that is, the starch and sugar from which fat is made. Some grains have more flesh than others; so of the qualities that make fat. In a hundred parts of wheat, according to Piesse, are ten pounds of flesh; in a hundred parts of oat meal nearly double that amount. Hence oats are better for horses on account of their flesh-forming principle, rather than fat, as muscle is what a horse wants. For fattening purposes, however, corn and other grains are better.

When flesh itself is eaten, the system but appropriates what is already formed, but would as readily take it from vegetables as from flour. The flesh-making principle—or the flesh itself, in its constituents—goes to form cheese in the dairy; the starch, &c., butter. Hence it is that some people assert that cream has little influence in cheese, farther than to enrich it; for cheese and butter are entirely distinct. The same kind of food is equally good for the production of either. This is a point of considerable interest, and is not yet fully explained—indeed, is yet in its infancy, and a plant in its different stages of growth has a different effect. The fat of the plant is held in reserve for the seed; nothing is wasted in leaves, wood, &c.; the precious seed must have it. Hence, when this takes place, the stalk is comparatively worthless to what it is prior to the change. And the fat cannot be appropriated so well in the seed as when it is diffused through the stalk. Tender herbage, therefore, is the best; and when secured before the direction of the oil takes place, so much the better will be the hay.—*Coleman's Rural World.*

Luminous Hats.

A man has just taken out a patent for luminous hats. They would, he says, preserve the wearers from being run over by cabs at night, and would, to some extent, enable the saving of the lighting of streets with gas to be effected.—*London Paper.*

Influence of Tobacco on the Brain.

It has been proved that the increase of lunacy in France has kept pace with the augmentation of the revenue from tobacco. From the years 1812 to 1832 that tax produced 28,000,000, and the lunatic asylums of the country contained 8,000 patients. The tobacco revenue has now reached the sum of 180,000,000, and there are no less than 44,000 paralytic and lunatic patients in the various hospitals devoted to their accommodation. This parallel has been drawn by M. Jolly and laid before the Academy of Science. The last words of his speech on that occasion are worth recording in this age of universal smoking: and young boys, to whom this pernicious practice has not yet become second nature, would do well to reflect, ere it be too late, on the frightful warning the above statistics contain, as well as on M. Jolly's words. He says:—"The immoderate use of tobacco, and more especially of the pipe, produces a weakness in the brain and in the spinal marrow which causes madness.

Titanium.

This most valuable metal has hitherto been found in only small quantities: it is of the greatest service in hardening iron, and rendering it steel-like, or rather of a harder character than steel, and at the same time more flexible. It is said to render the surface of rails almost everlasting, and that it is almost free from oxydization. We understand that a company is being established for mining it extensively, and that it is likely to lead to great results in the manufacture of the world in various shapes and forms of metallic structure for which iron and steel are not so appropriate as they are when mixed with new metal.—*Technologist.*

Milk and Zinc.

Vessels made of zinc should never be used for holding milk, as when milk is allowed to repose in contact with this metal a lactate of zinc is formed, as well as a compound of casein and oxide of zinc, both of which are extremely injurious if taken into the system. A solution of sugar, which stood a few hours in a zinc vessel, was found to contain a considerable quantity of salts of that metal.—*London Engineer.*

Visit to Henry Ward Beecher's Farm.

This farm is at Peekskill, Westchester county, New York, about two miles from the railroad station. It contains forty acres of excellent land, and is pleasantly situated with a southern aspect, commanding an extentive and most charming panoramic view of the Hudson river, the high and surrounding mountains, such as no one knows better how to appreciate and enjoy than the rural-loving owner himself.

When Mr. Beecher purchased the place, a few years ago, there was scarcely a fruit tree of any value upon it. Now there are two thousand five hundred choice fruit trees, most of them already beginning to bear. He has erected a large model barn, but as yet occupies the humble cottage he found upon the place, though he has made important additions and improvements.

Mr. Beecher is converting the place to a great extent, excepting an extensive lawn in front of the house, into a fruit and vegetable farm. He has nearly an acre filled with Delaware and Iona grape vines. And as the trees are yet small, he has raised among them this year between seven and eight hundred barrels of onions.

Around his little cottage Flora reigns in all her glory. There is the greatest profusion of all the choicest flowers, and the whole atmosphere is redolent with their sweet and mingled perfumes.

The barn and out buildings are well stocked with fine horses, oxen, choice breed cows, swine, fowls, &c. This autumn, Mr. Beecher has been making many improvements in the draining of his lands and adding to the value and attractiveness of the place.

The influence of a farm conducted like this, though all farmers may not be able to adopt all the improvements that have been made, must be of the greatest benefit to the agricultural and horticultural interests of any community. And Mr. Beecher is really a benefactor to all the farming, as well as religious interest of the country.—*Cor. Boston Journal.*

A New Process of making Soda.

Mr. A. G. Hunter, of Rockliffe Hall, near Flint, has achieved a discovery which seems likely to lead to a most valuable modification in the process of making soda. It has long been known that caustic baryta will separate the sulphuric acid from a solution of sulphate of sodium, forming therewith an insoluble precipitate of sulphate of barium, and leaving caustic soda in solution. The decomposition of sulphate of sodium by caustic baryta is thus a far simpler and readier process than its decomposition by Leblanc's method; but caustic baryta has hitherto been, and is still, far too costly to permit of its use for the decomposition of sulphate of sodium on the great scale. Many attempts have been made to obtain it at a cheap rate from sulphate of barium, or "heavy spar," which is a sufficiently abundant natural product, but they have all been utter failures, and hence inventors have sought sedulously for some other and cheaper reagent, capable of acting, as regards sulphate of sodium, in the same way. Mr. Hunter has found a very cheap one indeed. He has discovered that lime, by far the cheapest of all alkaline bodies, will separate the sulphuric acid from sulphate of sodium in solution, provided that the solution, after the lime has been added to it, be subjected to a pressure considerably exceeding that of the atmosphere. He states that "either hydraulic, steam, or mechanical pressure" will answer equally well. Unless the application of the necessary pressure, on the large scale, should prove to be attended by greater difficulties than there seems any reason to anticipate, his discovery will revolutionize the soda manufacture; and by-and-by, all the carbonate of sodium produced will be obtained by the direct combination of caustic soda with carbonic acid, the caustic soda being obtained by a process embracing only two operations: (1) the decomposition of chloride of sodium, or common salt, by sulphuric acid, as in Leblanc's process; and (2) the decomposition of the resulting sulphate of sodium by lime.—*Mechanics' Magazine.*