THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

JUNE, 1864.

JAPANNING.

The difference between japanning and ordinary varnishing is, that in the former the articles are subjected to a high degree of heat after the application of each coat of varnish. It is adapted to metal goods, wood, papier-mache, leather and other substances. It derives its name from having originally been practised by the natives of Japan, who used for the purpose a lacker or juice obtained by making incisions in the trunk of a tree growing in these islands.

This juice or lacker is exceedingly well adapted for the purpose, as it hardens very rapidly. When first collected it resembles cream, but after being exposed to the air for some hours it turns to a deep black. The Japanese add to it a fine powder composed of charred wood, then spread it evenly over the article to be japanned, and leave it in the sun to dry. Another coat is then laid on as before, and dried in the same manner, repeating the process until it has received a coating of a sufficient thickness. It soon becomes extremely hard, and is then polished with a smooth stone and water, until it is perfectly even, when it is wiped dry, and the figures for decorating are drawn thereon with a pencil dipped in varnish made of boiled oil and turpentine. When this last varnish is nearly dry, it is covered with gold leaf, or gold dust, or any metallic dust, and the whole then receives a finishing coat of varnish.

The lacquered ware of Japan and China are esteemed the best in the world. A description of the Chinese process may serve to explain the sources of its superiority.

Articles of wood are first made very dry and smooth, and then primed with a mixture of ox-gall and rotten-stone, which is rubbed smooth over the surface before the varnish is applied. The varnish is composed of 605 grains of gum-lac in 1,200 grains of water, to which are added 38 grains of oil of *camellia sasanqua*, a pig's gall, and 19 grains of rice vinegar. The ingredients are well mixed in full day-light, when the varnish gradually deepens into a brilliant black. A very thin coat of this varnish is applied with a flat hair brush, the article is left in a steamy heat, and is then rubbed down in water with a very fine pumice. A second coat of lac varnish is next applied, and the polishing is repeated, which two operations are continued until a perfectly even and brilliant surface is attained, a finer quality of lac being used for the later coats, of which there are never less than three, nor more than eighteen. The object is then ornamented by an artist who draws the design in white lead, engraves it, and fills up the details.

The article is next painted with the camphorated lac of Konary-si, which serves as a basis for the gilding. It is completed by varnishing.

The process of japanning in England differs in several respects from the above. If a black ground is required, it is first prepared with drop ivory black mixed with dark-coloured animè varnish. A coating of this is applied to the article to be japanned, then well dried in a stove, after which it is varnished three or four times, the work being well dried after each coat.

For coloured grounds, the ordinary painter's colours ground with linseed oil or turpentine, and mixed with animè varnish, affords the means of producing a variety of effects, according to the taste or fancy of the worker. Imitations of fine-grained wood, or tortoise-shell, may be produced by vermilion with a varnish of linseed oil and umber. Flake-white or white-lead, Indian-red, verdigris, vermilion, with numerous tints produced by mixtures of these colours, are suited to the japanner's purpose. All the coloured pigments used in oil or water, answer perfectly well in varnish. The colours are first reduced by the usual means of washing and levigation to the finest state possible; and the varnish being contained in a bottle, the colours are added until the requisite body is obtained, taking care to render the mixture complete by well shaking the bottle.

Copal, seed-lac, or gums animè and mastic, are the varnishes generally employed. Lac varnish is of too high a colour for delicate grounds, but is the best as respects hardness. To protect and give brilliancy to the colours, copal or animè varnish made without driers, is applied five or six times to the best work.

As japanning requires much drying between the several operations, it is very desirable to hasten the process by means of stoves heated by flues to as high a temperature as the article and varnish can bear without injury. The work also should be done in warm apartments, as cold and moisture are alike injurious; and all the articles should be warmed before applying the varnish to them. One coat of varnish, also, must be dry before another is laid on.

Japan varnishes answer much better on papier-mache than on metals. On the former the varnish becomes thoroughly incorporated with the paper, and does not flake off; but the varnish cannot sink into the metal, and often separates in flakes or scales, if the article is subject to anything like rough usage.

Wood intended for japanning must be well seasoned, cut nearly into the required forms and exposed for several days to a gradually increasing heat in the japanner's stove. The articles are then finished as to form, and again stoved, after which the cracks are stopped with putty or white lead.

A priming of size and whiting is sometimes used, which is laid on with a brush made of bristles, and left a day or two to dry; it is then made smooth by rubbing with rushes and a wet cloth. When this is quite dry the grounds are laid on, and finished as before described. This priming is considered very objectionable, as the japanning is more likely to crack than when executed directly upon the surface of the article.

For japanning works in metal, they are cleaned with turpentine to get rid of grease or oil, unless the oil should be linseed, in which case the articles are stoved until the oil becomes quite hard. The japanning then proceeds in the usual manner.

Engravings, especially prepared for the purpose upon fine paper washed with a solution of isinglass or gum, are sometimes transferred to japan work with beautiful effect.

In japanning articles of papier-mache, they are first done over with a mixture of size and lamp-black, and afterwards varnished. The black varnish for these articles may be prepared as follows:—some collophony, or turpentine boiled down till it becomes black and friable, is melted in a glazed earthen vessel, and thrice as much amber in fine powder is sprinkled in by degrees, with the addition now and then of a little spirit or oil of turpentine. When the amber is melted, the same quantity of sarcocolla is sprinkled in, and the ingredients are stirred, and more spirits of turpentine is added, until the whole becomes fluid; it is then strained clear through a coarse hair bag, pressing it gently between hot boards. This varnish mixed with ivory-black in fine powder, is applied, in a hot room, on the dried paper paste, which is then set in a gently heated oven, next day in a hotter oven, and the third day in a very hot one, and allowed to remain each time till the oven becomes cold. The paste thus varnished is hard, durable and glossy, and is not affected by moisture or even by hot liquids.

In the better class of papier-mache goods, various coats of varnish are sometimes laid on, and the article stoved after each varnishing. The article is next smoothed with pumice stone, and the artist then steps in and ornaments the work in bronze powder, gold, colours, &c., after which several coats of shell-lac varnish are added, and the article having been stoved at a heat of 280°, is polished with rotten stone and oil, and finished off by hand rubbing.

Various kinds of japanned leather, commonly termed *patent-leather*, are used by coach-makers, harness-makers, and shoe-makers. For these, carefully selected skins, as free from blemishes as possible, and curried with less grease than is required for other kinds of leather, are tacked on frames and coated with a composition composed of 18 gallons of linseed oil and 5oz. of umber, boiled nearly solid and then mixed with Spirits of turpentine and raw oil. To give colour and body to this composition, a sufficient quantity of lamp-black is added. Three or four very light coats of this composition are laid on with a knife of suitable form, each coat being dried perfectly before the application of the next coat. A thin coat of this same composition, with a sufficient quantity of lamp-black boiled in to make it a perfect black, is then laid on with a brush, and thoroughly dried as before. After being smoothed off by the use of a scraper it is ready for the varnish.

The varnish for this purpose is composed of linseed oil and prussian blue, boiled to the thickness of printer's ink, two or three coats of which, brought to a proper consistency with spirits of turpentine, are applied with a brush. After becoming thoroughly dry it is rubbed down with pumice stone until it is perfectly smooth, when the finishing coat is put on with great care, in a warm room free from dust. The frames are then run into stoves or ovens heated to 150° to 170° Fahr., so as to dry as quickly as possible, and prevent the absorption of the varnish by the leather. Great care must be used, however, not to injure the fibre of the leather by too intense heat, as is too frequently the case with American japanned leathers. The English and French leathers are much superior in this respect, and also in not being so free from grease as the American leather, whereby they retain a greater pliability, and are less likely to crack while being manufactured into the various articles for which they are required, or in after use.

The following list of coloured grounds, suitable for the japanning process, may be found useful to any who are now, or intend to be, engaged in this branch of manufacture in the Province:—

"*Red.*—Vermilion makes a fine scarlet, but its appearance in japanned work is much improved by glazing it with a thin coat of lake, or even rose pink.

Indian lake when good, is perfectly soluble in spirits of wine, and produce a fine crimson, but is not often to be obtained.

Yellow.—King's yellow, turpeth material, and Dutch pink, all form very bright yellows, and the latter is very cheap. Seed-lac varnish assimilates with yellow very well; and when they are requi ed bright, an improvement may be effected by infusing turmeric in the varnish which covers the ground

Green.—Distilled verdigris laid on a ground of leaf gold, produces the brightest of all greens; other greens may be formed by mixing King's yellow and bright Prussian blue, or turpeth mineral and Prussian blue, or Dutch pink and verdigris.

Blue.—Prussian blue, or verditer glazed with Prussian blue on smalt.

White.—White grounds are obtained with greater difficulty than any other. One of the best is prepared by grinding up flock-white, or zinc-white, with one sixth of its weight of starch, and drying it; it is then tempered, like the other colours, using the mastic varnish for common uses, and that of the best copal for the finest. Particular care should be taken, that the copal for this use be made of the clearest and whitest pieces. Seed-lac may be used as the uppermost coat, where a very delicate white is not required, taking care to use such as is least coloured.

Black.—Ivory-black, or lamp-black; but if the lamp-black, it should be previously calcined in a closed crucible.

Black grounds may be formed on metal, by drying linseed oil only, when mixed with a little lamp-black. The work is then exposed in a stove to a heat which will render the oil black. The heat should be low at first, and increased very gradually, or it will blister. This kind of japan requires no polishing. It is extensively used for defending articles of iron-mongery from rust.

Tortoise-shell ground for metal.—Cover the plates intended to represent the transparent parts of the tortoise-shell, with a thin coat of vermilion in seed-lac varnish. Then brush over the whole with a varnish composed of linseed oil boiled with umber until it is almost a black. The varnish may be thinned with oil of turpentine before it is used. When it is done it may be set in an oven, with the same precautions as the black varnish last named.

Clarifying Wines in Paris.

The number of eggs employed in Paris alone in clarifying wines is about 4,500,000. By this means a wholesome and nourishing article of food is taken away from public consumption, and its price considerably enhanced. To avoid this, certain kinds of powders are now beginning to be employed, by which wines may be clarified with equal facility and at a smaller expense.

Board of Arts and Manufactures FOR UPPER CANADA.

The final examinations of candidates, members of Mechanics' Institutes, took place on the 7th, 8th, 9th, and 10th, instant. Nineteen canditates were presented, eleven from the Whitby Mechanics' Institute, and eight from the Toronto Institute. We have not yet received the reports of the examiners, but in the meantime publish a portion of the Examination papers set for the occasion, and will give the remainder with the Examiners Reports, in the next issue of the Journal.

ARITHMETIC.

(Three hours allowed).

I. If the port wine contained in a vessel weigh 15 cwt. 3 qrs. 24 lbs., how much weight of pure water, and how much of cow's milk, would the same vessel contain, the weights of equal bulks of wine, water and milk being as 997, 1000 and 1032?

II. If the rent of a farm of 26 a. 2 r. 23 p. be £50 8s. 9d., what would be the rent of another, containing 17 a. 3 r. 2 p., if six acres of the latter be worth seven of the former?

III. Determine the expense of papering a room 12 feet high, measuring 20 feet by 15 feet, at the rate of $2\frac{1}{2}$d. per square yard.

IV. The price of .0625 lbs. of tea is 0.4583′ shillings; what quantity can be bought for £61 12s. 0d.?

V. Reduce 12 feet $4\frac{1}{2}$ inches to the fraction of a mile, and find the corresponding decimal.

VI. A. was owner of $\frac{4}{17}$ of a vessel, and sold $\frac{3}{11}$ of $\frac{2}{3}$ of his share for £$\frac{400}{33}$; what was the value of $\frac{1\frac{3}{8}}{4\frac{1}{4}}$ of $\frac{2}{5}$ of the vessel?

VII. What sum will amount to £425 19s. $4\frac{4}{5}$d. in ten years, at $3\frac{1}{4}$ per cent. simple interest; and in how many more years will it amount to £453 11s. 7d.?

VIII. Divide £45,000 among A., B., C., D., so that A.'s share : B.'s share :: 1 : 2, B.'s : C.'s :: 3 : 4, and C.'s : D.'s :: 4 : 5.

IX. Divide 4472 into parts which shall be each other in the ratio of 3, 5, 7, 11; and also £500 into parts which shall be in the ratio of $\frac{1}{2}$, $\frac{3}{5}$, and $\frac{4}{7}$.

X. Find the square root of $\frac{5}{7}$.

XI. Find the cube root of 223648543.

XII. If 12 men, or 18 boys, can do $\frac{3}{4}$ of a piece of work in $6\frac{1}{2}$ hours, in what time will 11 men and 9 boys do the rest?

XIII. Brussels carpet is 2½ feet wide, and costs 5s. per yard; Kidderminster is 3 feet wide, and costs 3s. 4½d. per yard; drugget is 4 feet wide, and costs 2s. 6d. per yard. These carpetings will last 10 years, 6 years, and 3 years, respectively; which is the cheapest, and which the dearest in wear in the long run?

BOOK-KEEPING.

(*Three hours allowed.*)

1. What is the distinguishing principle of the double entry system as compared with that of single entry?

2. What description of errors are prevented or detected by the double entry method, and to what kind of errors does it afford no check?

3. Name the principal books required in double entry for the most simple ordinary business.

4. Name the subsidiary books generally required for a similar business.

5. Prepare specimens of the foregoing principal and subsidiary books, and state the use and purpose of each.

6. Assuming that all accounts may be divided into "Personal" or "General," or "Impersonal," what does each of these classes of accounts properly represent?

7. Name the ordinary "General" or "Impersonal" accounts and the particular object of each.

8. Journalise in proper form entries of the following transactious:

Samuel Armstrong commences business with a capital of $15,000, consisting of

Cash on hand	$ 137 50
Cash in the Bank of Toronto	11,050 00
Real Estate valued at	2,500 00
A mortgage from Robert Thompson for	1,312 50
He purchases goods from the following houses:	
Wm. Boswell & Co. as per invoice	$ 1,723 27
James Keith & Co. " "	1,681 42
Jonathan Weston " "	11,600 00
Thomas Adamson " "	8,502 84
He sells goods to Robert Jones to the amount of	$ 625 00
To James Smith to the amount of	1,025 00
" Richard James " "	805 00
" Henry Johnson " "	426 00
" James Jackson " "	207 00
" Alfred Peterson " "	1,235 00
He receives cash from Robert Jones	$ 600 00
and agrees to allow a discount of	25 00
He receives from James Smith his note at three months for	1,025 00
He receives from Richard James, cash	125 00
Albert Smith's note for	300 00
and his own note for	380 00
He draws on Alfred Peterson at 4 months, and receives his acceptance for	1,235 00
He pays Wm. Boswell & Co. per cheque on the Bank of Toronto	1,650 00
and is allowed a rebate of	73 27
He accepts James Keith & Co's draft for	1,681 42
He pays Jonathan Weston by Cheque	6,000 00
and sends him his note at 6 months for	5,600 00
He pays Thos. Adamson by Cheque	3,000 00
He discounts at the Bank of Toronto	
James Smith's note for $1025, discount	10 54
Alf. Peterson's acceptance $1235 discount	17 87
The net proceeds credited to his account by the Bank being $2231 59	
He pays his Clerk's Salary	50 00
and deposits in the Bank	700 00

9. Post the foregoing transactions to their appropriate Ledger accounts.

10. What is the object of a Trial Balance?

11. What proceedings are necessary before preparing a Final Balance Sheet?

12. What is taking Stock, and on what principle is it done?

13. What facts are entered respectively to the debit and credit side of the Profit and Loss account and what does the final difference of that account exhibit?

14. Suppose a payment of Cash by Richard Jenkins has been credited to Richard James, how should the error be corrected.

15. How is the balance of the Profit and Loss account disposed of?

16. How are ascertained bad debts and expenses disposed of?

17. How are unascertained or estimated losses and deductions brought to account in the books? Give the form of the Journal Entries required in answering the three previous questions.

18. What constitutes the balance of the merchandise and stock accounts respectively?

19. What should a Final Balance Sheet exhibit?

ENGLISH GRAMMAR AND ANALYSIS.

(*Three hours allowed*).

I. How are the letters of the Alphabet divided, and what is the ground of the division?

II. Draw up a scheme of the letters, dividing them into liquids, labials, dentals and gutterals.

III. Into what classes are words divided as to the syllables they contain, and give instances?

IV. Spell the words, the pronunciation of which may be represented thus: sām, surjun, nabur, sovran, sizm, and give the derivation of each word.

V. Distinguish between simple or primative, derivative, and compound words, and give three examples of each.

VI. Write the possessive singular, and (when possible) the possessive plural of the following words: Mother, eagle, man, girl, boy, poet, John, Xerxes, sleep, sister, Moses, sun, sea.

VII. Compare the following adjectives: Great, ill, little, short, bad, near, old, valuable, pretty, bitter, modest, truthful, rough, dark, golden, triangular, supreme.

VIII. Conjugate these verbs: Fall, seek, work, teach, ride, know, grow, catch, go, forsake, keep, creep.

IX. Give the principal root of each of the following words, and two other derivatives of each: Obey, observe, depend, accomplish, subvert, fortitude, victory, Redeemer, sympathise, conversation, obliterate, exasperate, retaliate, sympathise.

X. Substitute an adverbial phrase for the pure adverb in the following:

1. I have seen him do it often.
2. He wisely resolved to stay.
3. The world is easily imposed on.
4. I will readily grant you what you want.
5. When did he go.
6. The consuls were elected annually.

XI. Correct the following, and assign reasons for the correction:

1. Burn's Tammie Shanter are a fine poem.
2. Watt's Logic is a good book.
3. For decorum sake keep out of the way.
4. You have lost more than me.
5. I saw a young and old man walking together.
6. I soon expect to have finished my work.
7. The book is one of the best that has been written.

XII. Define the following words, and bring out their meaning and application fully: Revolution, philosophy, art, religion, duty, romantic, sublime, pretty.

XIII. Put the word *still* into four sentences: as a noun, a verb, an adverb, and as a conjunction.

XIV. Write an essay on, "The busiest day of my life," or on "The longest journey I ever took," (but not on both subjects).

XV. Analyse the following sentences:

1. The sun rules by day, and the moon by night.
2. Some village Hampden, that with dauntless breast,
 The little tyrant of his fields withstood;
 Some mute, inglorious Milton here may rest,
 Some Cromwell, guiltless of his country's blood. —*Gray.*
3. Poor men's children, they, and they alone,
 By their condition taught, can understand,
 The wisdom of the prayer that daily asks,
 For daily bread. —*Wordsworth.*

XVI. *Parse* the following lines fully, assigning reasons:

Blest are they,
Whose sorrow rather is to suffer wrong,
Than to do wrong, albeit themselves have erred. *Wordsworth.*

ALGEBRA.

(Three hours allowed.)

1. Simplify $x^2-(2xy+3y^2)-\left\{2xy+(3y^2-4x^2)\right\}-\left\{3y^2-(4x^2-5xy)\right\}$. Define any signs and symbols used in the above expression. Find its value when $x=\frac{1}{3}$, $y=-\frac{1}{3}$.
 Interpret the equality $5a-8a=-3a$.
2. Multiply (1) $x^2-2xy+3y^2$ by $x^2+3xy-2y^2$
 (2) $x^{m+1}+x^m$ by x^n-x^{n-1}.
3. Divide (1) $6a^2-15b^2+24c^2-ab+2bc-24ac$ by $2a+3b-4c$.
 (2) $x^{5+p}+1$ by $x+1$ to 6 terms, and state for what values of p the division will terminate without remainder.
4. Shew that the value of a fraction is not altered by multiplying or dividing the numerator and denominator by the same quantity; and mention any operations in which this principle is used.
5. Simplify (1) $\dfrac{x^2-(a-b)x-ab}{x^2+(b-c)x-bc}$.
 (2) $\dfrac{x^3-a^3}{x^3+a^3}\times\dfrac{x^2+2ax+a^2}{x^2-2ax+a^2}$.
 (3) $\dfrac{2}{2x-3}+\dfrac{3}{2x+3}-\dfrac{8x-6}{4x^2-9}$.
 (4) $\left(1+\dfrac{2}{x-3}\right)\div\left(\dfrac{5}{x+2}-1\right)$.
6. Shew that the value of $\frac{a+c+e}{b+d+f}$ is the same as that of the fractions $\frac{a}{b}$, $\frac{c}{d}$, $\frac{e}{f}$, if they are

equal, but if they are not, that it lies between the greatest and least.

7. Find the square root of
$4x^4 + 25x^2 + 16 - 12x^3 - 24x.$

8. Solve the equations:

(1) $\frac{2x-1}{20} - \frac{x+2}{3x-4} = \frac{x+\frac{1}{3}}{10} - \frac{7}{12}.$

(2) $\left.\begin{array}{l} \frac{1}{x+y} + \frac{1}{x-y} = \frac{3}{5} \\ \frac{1}{x-y} - \frac{1}{x+y} = \frac{x+2}{x^2-y^2} \end{array}\right\}$

(3) $\left.\begin{array}{l} 2x + 3y = 19 \\ 4y + 5z = -8 \\ 6z + 7x = 11 \end{array}\right\}$

State any general principles used in solving (1).

9. Solve with respect to x the equation
$x^2 + px + q = 0$; and shew that if α, β be values of x which satisfy this equation, $\alpha + \beta = -p$, $\alpha\beta = q$.

10. Sum to 10 terms and also to n terms:
(1) $1\frac{1}{2} + 2\frac{1}{4} + 3 + \ldots.$
(2) $27 - 18 + 12 - \ldots..$

11. Find what number of terms of the series $30 + 26 + 22 + \ldots$ will make up 126. Interpret any peculiarity in the result.

12. The 3rd term of a G. S. is 4, and the 7th is $\frac{1}{4}$, find the series and the limit of its sum to infinity.

13. If a slice 2 feet thick be cut off parallel to one side of a cube, and a slice 3 feet thick parallel to another side, the bulk of the remainder is to that of the cube as 5 : 8. Find the size of the cube.

14. If $1 Canada cy. be equivalent to $1.90 U. S. cy. the value of a parcel of dollar notes partly Canadian, partly U. S. is $825 Canada cy., but if the numbers of the two kinds were interchanged, the value would be $915. Find the number of each sort.

15. Whether the number of bushels of wheat grown on a farm be 100 less than in a certain year while the price per bushel is $0.15 more, or the number of bushels be 50 more while the price is $0.10 less, the value of the crop is the same as in the first year. Find the number of bushels grown the first year and the price per bushel.

GEOMETRY.

(Three hours allowed.)

I. If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles.

II. Parallelograms upon the same base, and between the same parallels, are equal to one-another.

III. To describe a parallelogram equal to a given rectilineal figure, and having an angle equal to a given rectilineal angle.

IV. If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts, together with the square on the line between the points of section is equal to the square on half the line.

V. If a straight line be divided into two equal, and also into two unequal parts, the squares on the two unequal parts are together double of the square on half the line, and of the square on the line between the points of section.

VI. To describe a square that shall be equal to a given rectilineal figure.

VII. If one circle touch another internally in any point, the straight line which joins their centres being produced, shall pass through that point of contact.

VIII. Upon a given straight line, to describe a segment of a circle which shall contain an angle equal to a given rectilineal angle.

IX. The angle at the centre of a circle is double of the angle at the circumference, upon the same base, that is, upon the same part of the circumference.

X. To inscribe a circle in a given triangle.

XI. To describe an isosceles triangle, having each of the angles at the base double of the third angle.

XII. To inscribe a circle in a given equilateral and equiangular pentagon.

XIII. To determine that point in a straight line from which the straight lines drawn to two other given points shall be equal, provided the line joining the two given points is not perpendicular to the given line.

XIV. If from the base to the opposite sides of an isosceles triangle three straight lines be drawn, making equal angles with the base, viz., one from its extremity, the other two from any other point in it, these two shall be together equal to the first

XV. If in the diagonal of a parallelogram, any two points equi-distant from its extremities be joined with the opposite angles, a figure will be formed which is also a parallelogram.

XVI. Produce a given straight line in such a manner that the square on the whole line shall be equal to twice the square of the given line.

XVII. Prove that the square on any straight line drawn from the vertex of an isosceles triangle to the base, is less than the square on a side of the triangle, by the rectangle contained by the segments of the base.

XVIII. Find the side of a square equal to a given equilateral triangle.

XIX. If from a point without a circle two tangents be drawn, the straight line which joins the points of contact will be bisected at right angles by a line drawn from the centre to the point without the circle.

XX. Describe a circle which shall have its centre in a given straight line, touch another given line, and pass through a fixed point in the first given line.

XXI. If from any point in the diameter of a circle straight lines be drawn to the extremities of a parallel chord, the squares on these lines are together equal to the squares on the segments into which the diameter is divided.

XXII. In a given triangle, inscribe a parallelogram which shall be equal to one-half the triangle

XXIII. The square inscribed in a circle is equal to half the square inscribed about the same circle.

XXIV. If the alternate angles of a regular pentagon be joined, the figure formed by the intersection of the joining lines will itself be a regular pentagon.

Notices of Books.

"Hints on Architecture and Mechanics." By John Tully, Architect and Civil Engineer.

This treatise is prepared for the use of students in architectural drawing and machinery, and is intended to be a service to those engaged as Carpenters and Millwrights, as well as for amateurs who may wish to obtain some insight into the proportions of the "Orders" without devoting too much time to the study of Architectural Works. It will also be found serviceable to the heads of schools in explaining the rudiments of Architecture to their pupils.

For sale at Rowsell's, Maclear's, and Edwards'. Toronto, 1864.

NEW ZEALAND EXHIBITION.

We have received a circular from John Morrison, Esq., office of the *New Zealand Government Agency*, No. 3 Adelaide Place, King William Street, London, requesting us to notice an accompanying programme of an exhibition proposed to be held in the City of Dunedin, Province of Otago, New Zealand; to open on the first Tuesday of January, 1865.

The articles to be exhibited will be divided into sections of *Raw Materials, Machinery, Manufactures*, and *Fine Arts*, and will be open to competitors from all countries. We have no idea than any Canadians will send articles so great a distance for exhibition, but should they intend to do so, it will be necessary for them to communicate with the above-named agent.

USEFUL RECEIPTS.

Black Varnish for Flexible Surfaces.

Take of asphaltum, in coarse powder, 24 ounces, macerate in a flask for a day or two, with frequent shaking, in 21 fluid ounces of benzine. Decant the clear solution, and mix it with that of one or two ounces of manilla elemi, and one ounce of balsam copaiba in sufficient benzine; if necessary add more benzine to get the proper consistence.

Copper, Oxide of.

Heat to redness nitrate of copper; it is decomposed, and becomes the oxide, or *protoxide*, of copper. Used to prepare oxygen gas.

Copper, Powdered.

Immerse zinc into an acid solution of sulphate of copper. The copper will be precipitated in a finely powdered state.

Damp Walls, Remedy for.

Dissolve gutta-percha in spirits of turpentine, mix with the solution ground white lead, and apply the composition with a brush.

Scouring Drops.

Oil of lemons and spirits of turpentine, of each equal parts. Used to remove grease.

To Dye Ivory.

Red.—1. Soak it in a weak solution of aquafortis, and immerse it in liqu id carmine.

2. Boil it with Brazil wood, 1 lb., and water 1 gallon, then add alum 4 oz. and boil again.

Black.—Dip in a solution of nitrate of silver and expose to the light; or, first boil in galls and logwood, and then in iron liquor.

Green.—Dip in a solution of verdigris, to which a little aquafortis is added; or verdigris and vinegar.

Purple.—Boil in a decoction of logwood, then add alum 1 oz. to each quart, and boil again.

Yellow.—Steep in a saturated solution of orpiment in ammonia.

Blue.—Steep in a solution of salts of tartar and sulphate of indigo.

To Bleach Gutta-percha.

Dissolve gutta-percha (one part) in 20 parts of hot benzole, shake the solution with one-tenth part of freshly-calcined plaster, and set aside, with occasional agitation, for two days. The clear, pale, brownish-yellow liquid is then decanted into another vessel containing double its bulk of alcohol fortius, when the gutta will be precipitated in the form of a brilliantly white tenacious mass, which is pounded together in a mortar, and rolled into cylindrical sticks.

Scarlet Color on Wooden Figures.

Boil a little of best carmine with distilled water for four or five minutes in a glass or porcelain vessel, then add gradually some aq. ammoniæ, boil a little longer, then cool. The wood must be left immersed in this liquor for some time.

Vinegar from Watermelons.

Take ripe water-melons, scrape out the inside, press out the juice, strain, and then boil it down one half; put it away the same as other vinegar, and it will make an article equal or next to cider vinegar.

To Powder Camphor and Gum Resins.

A writer in the *Schweizerische Wochenschrift fur Pharmacie* recommends instead of the usual method with alcohol, to reduce the camphor to powder by means of an ordinary kitchen grater and separate the finest powder by sifting. The coarse pieces may be used for some other purpose. We are inclined to think that powder prepared by this method will keep better than when it has been in contact with a liquid. To obtain gum resins in powder, often a very difficult task, the same writer directs that they be triturated with a few drops of sweet oil of almonds.

Effectual Cure for the Bite of a Mad Dog.

8 drachms of gum guiacum; 8 do. Russian Castor; 8 do. assafœtida; 8 do. cinnamon; 6 oz. mouse ear; 6 ounces tormentil root. To prepare the above for use, put the mouse ear and tormentil root into three quarts of water; boil down to one quart, then add three quarts of beer; bring this to a boil, then put in all the rest; keep stirring until it boils down to a quart; then divide this quart into three equal parts; give one of these parts to the individual every morning, fasting, for three mornings in succession. This quantity is for an adult. Children of 15 years, or under, half that quantity; for a heifer or a pig the same; for an old beast, the same as for a grown person. I have taken some pains to obtain the above from Europe, where I have known it used for many years, with great success; indeed it was never known to fail. MAJOR PARKINSON.

Etching; or Engraving on Plates with Acid.

The ground is prepared by melting in a glazed earthen vessel 2 oz. of powdered asphaltum; then add 1 oz. of Burgundy pitch; melt, and add 1½ oz. of virgin wax; mix well, pour into warm water, and incorporate the whole with the hands. The plate is then warmed, the *ground* applied and distributed evenly by heat, and when cool, a bodkin, &c., is used to engrave, by removing the wax so as to expose the plates in lines suited to the sketch. The acid is then applied to bite away the exposed portion of the plate; it is prevented from acting elsewhere by the untouched wax, and when it has acted sufficiently the wax is removed and the sketch printed from.

Bordering Wax.—Burgundy pitch 3 lbs.; beeswax 1 lb.; melt, and add ½ pint of sweet oil. Pour it into waterand work it with the hands.

Etching Fluid for Copper.—1. Nitrous acid 1 part; water 5 parts; mix gradually, and add the size of a hazel nut of sal ammoniac to each pint.

2. Iodine 2 parts; iodide of potassium 5 parts; water 8 parts.

Etching Fluid for Steel.—1. Piroligneous acid and nitric acid each 1 part, water 6 parts.

2. Iodine 1 oz.; iron filings ½ drachm; water 4 oz.; digest until dissolved.

3. Hydrochloric acid 10 parts, distilled water 70 parts, chlorate of potash 2 parts. Dissolve the chlorate in water, and add the acid. Dilute with water to required strength.

Plumbago Mine in Lower Canada.

The Kingston news says, "We have been shown rich specimens of plumbago, large quantities of which have been discovered on a peice of property on the St. Maurice river, Canada East, owned by Mr. P. B. Vanasse, Quebec. The specimens are very pure, being singularly free from grit, and the mineral is obtained in larger pieces than in many of the mines now worked in England and the United States. Plumbago, or graphite, is used principally for lead pencils, in the manufacture of crucibles, as a lining of molds for delicate castings, and for stove polish. It is a valuable mineral; immense fortunes have been made for many years from the Borrowdale mine in Cumberland, England, said to produce the finest graphite in use."

BRITISH PUBLICATIONS FOR APRIL.

Baigent (F. J.) and Russell (C. J.) Practical Manual of Heraldry, 8vo	0	6	0	*Rowney.*
Binns (W. S.) Elementary Treatise on Orthographic Projection and Isometric Drawing, 18mo	0	1	0	*Longman.*
Brewer (E. C.) Sound and its Phenomena, 18mo, red. to	0	2	6	*Longman.*
British Pharmacopœia, 18mo edition	0	6	0	*Gen. Med. Coun.*
Brown (Andrew B.) Engineering Facts and Figures for 1863, cr. 8vo	0	6	0	*Fullarton.*
Buchner (Dr. Louis) Force and Matter: Empirico Philosophical Studies, cr. 8vo	0	7	6	*Trübner.*
Crabb (George) English Synonyms explained, new edit. 8vo	0	15	0	*Simpkin.*
Dwyer (John) On Hydraulic Engineering, 8vo. red. to	0	6	0	*McGlashan.*
Epps (Richard) Homœpathic Family Instructor, fcap. 8vo	0	5	0	*Epps.*
Griffith (T. W.) Elementary Text Book of the Microscope, post 8vo	0	7	6	*Van Voorst.*
Nesbitt's Practical Land Surveying, 11th edit., by Wm. Burness, 8vo	0	12	0	*Longman.*
Ramsbottom (Samuel) Book for the Manufacturers, &c., of Cotton, fcap. 8vo	0	0	6	*Simpkin.*
Ridge (Benj.) Ourselves, our Food, and our Physic, 4th edit., 12mo	0	1	6	*Chapman & H.*
Saxby (S. M.) Weather System; or Lunar Influence on Weather, 2nd ed. post 8vo	0	4	0	*Longman.*
Spencer (Herbert) Classification of the Sciences, 8vo	0	2	6	*Williams & Nor*
Stevenson (Thos.) Design and Construction of Harbors, 8vo	0	10	6	*Black.*
Tomlinson (Chas.) Rud. Treatise on Warming and Ventilation, 3rd edit., 12mo	0	3	0	*Virtue.*

INDUSTRIAL MUSEUMS IN THEIR RELATION TO COMMERCIAL ENTERPRISE.

BY THE LATE PROFESSOR GEORGE WILSON.

(*Concluded from May number.*)

III. Commercial enterprise is as much interested in sending finished products to a distanee, as in bringing raw materials to its own door. The perfected results, accordingly, of industrial art, are as much the concern of an industrial museum, as the raw materials from which they are elaborated; and so also are the machines and tools needed for their elaboration, and in effecting the useful application of the elaborated products.

A large portion, therefore, of the exhibitional galleries of the museum must be assigned—1. To such finished products as wrought iron, steel, glass, porcelain, paper, leather, cotton, linen, woollen, and silken tissues, naphtha, sugar, sulphuric acid, soap, bleaching powder, lucifer matches, and the like. 2. To all the intermediate products which intervene between such products and their raw materials; for example, between iron-ore and steel; between sand and glass; between clay and porcelain; between rags and paper; between skins and leather; between cotton wool, flax-fibre, merino-fleece, and cocoon-floss on the one hand, and chintz, linen-damask, broad-cloth, tartan, carpeting, and satin or velvet on the other; between coals and naptha; cane-juice and loaf-sugar; sulphur and oil of vitriol; palm-oil and soap; common salt and bleaching powder: burned bones and lucifer matches. 3. To the tools, machines, and apparatus required for the conversion of raw materials into finished products, such as agricultural, mining, and paper-making machinery, furnaces, mills, lathes, moulds, looms, gas-retorts stills, printing presses, and the other engines of the graphic arts, and all the manipulative implements of handicraft trades. Many of the objects of this third division would of course be shown only in model, not of their actual size. 4. Besides machines or instruments of the kind described, the object of which is to transform workable materials into wrought goods, a prominent place in the museum galleries must also be given to those forms of apparatus which are employed in the application to useful purposes of finished products, and in the exercise of what may be called the Dynamical Industrial Arts. Such instruments are pens, pencils, brushes, thermometers, barometers, compass-needles, lamps for burning solid, liquid, and gaseous fuels, the batteries and other requisites for producing and maintaining the electric light, the whole machinery of the electric telegraph, the whole apparatus of the photographer, and much else. In this department, only the *practical* forms of those instruments which it includes would be shown; such refined modifications of thermometer, barometer, electric machine, optical lens, and the like, as theory pronounces best for the purely scientific student, not falling within its province.

On the one hand, it is important that the idea of the industrial museum should be fully and impartially carried out, and that every economic art should receive its just share of illustration. On the other, it would be culpable folly to collect the same objects in adjoining or neighbouring buildings and thus needlessly multiply duplicates. The pre-eminently important art of medicine, for example, is so amply cared for by the University, the College of Surgeons, and the College of Physicians, that it would not be necessary for the industrial museum to do more than supplement in certain directions those illustrations of medicine as an art which the medical museums in the city contain. Thus the forms of electrical machine most suitable for therapeutic use, the qualities of steel best fitted for surgical instruments; the similar qualities of caoutchouc and gutta percha; the varieties of distilling and other pharmaceutical apparatus; the different kinds of glass and porcelain vessels useful in the laboratory and surgery; and some other things, would probably find a place in the museum, but the art of medicine as a whole would not be represented.

In the same way, so long as the Royal Agricultural Society and Highland Society watch over the interests of agriculture; the Royal Academy over those of the fine arts; the Architectural Society over those which occupy the builder; the Society of Antiquaries over the ancient progress of all the arts, the extent to which the industrial museum will charge itself with illustrating the scope of agriculture as an art; with collecting the pigments, marbles, bronzes, and other materials with which the painter and the sculptor work; with the accumulation of building materials; and with the acquisition of examples of the earlier and ruder stages of industrial processes, will to a great degree depend upon the limits which may hereafter be agreed to, as bounding the domains of the different societies named. Each of these bodies has a central province peculiar to itself, on which, even if it were unoccupied, the industrial museum would not intrude. Each of them has also a border-land which the museum cannot help overlapping, as it has a border-land which they unavoidably overlap. The extent to which this mutual infringement shall take place must be matter of amicable compromise. In any case an ample area, entirely its own, will be left to each institution, and all will be gainers by a wise division of the debated land.

Such a collection I have supposed, of raw and workable materials, modifying agents, transforming machinery, and finished products, would prove specially instructive—1. To those ignorant of the capabilities of an industrial art, and solicitous to appreciate them; and 2. To those desirous of ascertaining the imperfections of an industrial art with a view to improve it. To the latter only will I refer. The chief and ultimate aim of an industrial museum is the improvement of the useful arts, which cease to exist, or exist only as stunted dwarfs where they do not make progress. But it is not only from the ranks of experienced workers in an art, that its improvers always or perhaps most frequently come.

We are accustomed to say that every man knows his own trade best, and to warn the shoemaker not to step beyond his last. Although, however, the improvement of particular arts must mainly be looked for from those who have inherited a special pecuniary as well as professional interest in them, still we must not forget the effect of custom in rendering men indifferent to defects, or of age in making them impatient of change; nor, on the other hand, must we overlook the influence of novelty and curiosity in exciting inventive ingenuity. The great improvers of the arts are either their devoted followers or total strangers to them; the indifferent general public prove, when they offer advice, only ignorant intermeddlers. The Huntingdon brewer, called Oliver Cromwell, could teach a military trick or two to Prince Rupert and his cavaliers. The Newcastle collier, George Stephenson, was so wonderful at engineering, that they could not make him a civil engineer. The gardener, John Paxton, because he knew nothing of architecture, became Sir John as the architect of the Crystal Palace. I am not certain, indeed, that the industrial arts have not been as much advanced by strangers as by acquaintances.

At all events, one of the chief, and I confess unexpected, obstacles I encountered in seeking to fill the industrial museum with examples of art, is the too humble estimate which men form of their own callings. I cannot persuade a shoemaker that shoes are of interest to any but shoemakers and the barefooted public, although he looks with eager curiosity at my collection of hats in all their stages. I tried in vain to induce a very intelligent glass-maker to send me certain specimens of glass, till I showed him a full series of illustrations of brush-making. His eyes brightened with interest, and he admired the ingenious and unexpected devices which an art strange to him revealed. Well, said I, be sure the brush-maker will be as much interested in your glass as you are in his brushes, so send me what I ask. I cannot, accordingly, help inferring that a stranger's curiosity will often make up for his defective experience, and that the industrial museum would secure his services for all the arts it represented.

But whether such services be rendered by experts or by novices, this at least is most certain, that not one of the great industrial arts can stand still. In proportion as they are flourishing, every day witnesses old processes altered and new ones introduced.

When the duty upon common salt was removed, and our practical chemists began to make soda from it, they threw into the air all the muriatic acid evolved from the salt. Their neighbours complained of the acid fumes, and, at immense expense, the chemists built gigantic chimneys to send the vapours nearer the stars. By and by the price of sulphur, with which they cannot dispense, rose, and they changed the construction of their furnaces so as to burn iron pyrites in them. Then the price of soda fell, and they blew up or dispensed with their tall chimneys, using instead great condensers, and converting all the obnoxious vapours into chloride of lime, or bleaching powder. Then the value of bleaching-powder altered, and they took to producing the chlorine which it contains in a new way: afterwards the oxide of manganese, which is needed for that manufacture, grew scarce, and a most ingenious method of recovering it and using it again was devised, and is in practice. Lastly, not satisfied with the quality of the soda they made, they had mounted their huge furnaces on axles, and make them revolve like barrel-churns roasting on spits, so as thoroughly to intermingle all the ingredients which, by their mutual action, produce the alkali.

This is no solitary case. Some years ago they were trying in a London court of law at the instance of the excise the question: "What is paper?" This is one of those subtle legal problems which—like that other, "What is metal?" argued between a road mender, a glass blower, and an iron founder, each of whom calls the material with which he deals metal—will multiply on our hands in virtue of the very progression of the arts which I am considering. Yet waiving the question, "What is paper?" the theory of paper-making is simpler than that of almost any other of the industrial arts, but how is it with its practice? For years I have at short intervals availed myself of the privilege of visiting the admirable paper mills in our neighbourhood. At every visit I find some great change; since I saw several of them a few months ago, important alterations have been made, and are still making. When our venerable townsman, Mr. Alexander Cowan, began paper-making, it was all made by hand, by a process so slow, that they can do now in hours what took weeks, sometimes months, before. Year after year everything has been altered. On the chemical side—new bleaching agents, new correctors of the evils of over bleaching, new sizes and ways of making sizes, new colouring matters, new modes of glazing. On the mechanical side—new machines for rag-cutting, washing, boiling, paper-weaving, sizing, drying, cutting, folding, stamping. One half the arrangements within my own remembrance are totally new, and above the horizon, newer and newer devices arise on every side.

If it is so with a comparatively simple art, how must it be with the more complex ones. The hot blast is but one accompaniment and index of the improved manufacture of iron. The Sydenham Palace is but one mark of the improvements in glass making. Coal gas is but one step in the improved use of fuel. The whole machinery of sugar-making is as novel as it is economical. Bread can be baked on an hour's notice by iron hands as cleanly as expeditious. Steam engines which almost seem intelligent, card, dye, and weave, whatever textile raw material you give them, and by and by cut it and sew it, if required.

Had we only, accordingly, the old industrial arts, thus for ever renewing themselves, the necessity for keeping pace with them would be argument enough for an industrial museum, where their progress could be watched and studied by all. But besides those elder sons and servants of mercantile enterprise—who, like the eagle, seem to grow younger as they grow older—think of the infant arts which have been born in our own day, and are younger than most of us. Each of them, a Hercules in his cradle, has already strangled serpents, and has more than twelve labours before him. Railway-making, electro-metallurgy, electro-telegraphy, and photography, may here represent those Titanic babes, who, already with mature faces, are bidding all men look to the new time-ball which they have dropped before them, and see that their chronometers are set by that.

IV. I have hitherto referred almost solely to exhibitional galleries of the museum. To render, however, their contents useful to the public, they must be carefully classified, intelligibly labelled, and described at some length in suitable catalogues.

The museum therefore must include within its walls a laboratory and workshop, where the nature of unknown substances, and the powers of new machines, may be investigated, and a library where the literature of industrial science may be available for the guidance of the officers of the institution in classifying the contents of the museum. Further an essential appendage of an industrial museum is a lecture-room, where detailed prelections may be given on the contents of the museum, and where, in addition, the various industrial arts may be expounded in relation to the laws and principles on which they are based, and may be illustrated not only by the objects in the exhibitional galleries, but by maps, diagrams, drawings, chemical and mechanical experiments, the exhibition on the small scale of manufacturing processes, and of machines at work; as well as through the medium of the other appliances employed in university and other class-rooms by teachers of the physical sciences.

All the existing industrial museums, except that at Kew, are supplemented by laboratory, library, and lecture room in the way mentioned. All three likewise have, from the first, been associated with the industrial museum of Scotland, which moreover, is the only museum of the kind, or indeed institution in the country, having a special chair of Technology attached to it.

V. Apart, however, from the importance of those supplementary institutions in enabling the curators of the museum to render it more instructive to the public, two of them, namely, the laboratory (including the workshop) and the library, may themselves be made directly serviceable to the community.

The laboratories of the industrial museums, besides affording those in charge of the latter the means of examining substances of general economic interest, are at the service of the public in two ways:—1. As schools of analytical chemistry; where for moderate fees, young men may learn the art of chemical analysis as applied to industrial objects. 2. As analytical laboratories; where likewise, for moderate fees, merchants or others may have confidential analysis made of substances whose composition they seek for their own guidance to know; and where the officers of the museums may be consulted by those engaged in legal contests, or in other transactions where the services of scientific advisers are required.

An engineering workshop, as distinguished from a chemical laboratory, has not yet been fully recognised, so far as I am aware, as one of the complements of an industrial museum, but sooner or later I cannot doubt it will be. I indulge the hope also, that it may be made serviceable to the general public, for the testing mechanical inventions, as the laboratories are for the testing chemical products and manufactures. Certainly, whether in connection with industrial museums, or with other institutions, it is very desirable that ingenious workmen and others of limited means should be able, at a moderate cost, to ascertain confidentially the value of embryo inventions before expending labour, time, and money on their perhaps unwise elaboration. Meanwhile, however, I only name the workshop as a subsidiary appendage to the laboratory.

VI. The libraries of our industrial museums, as at present organized, are chiefly intended for the officers of these institutions, including to some extent the students in daily attendance for each session. Nor is it necessary or desirable that an industrial museum should provide reading for the general public, which is, or, if it chooses, may be, well cared for in the way of libraries. But a collection of books on applied science in French, German, and English, including, the records of the patent offices or similar institutions of the civilized countries of the world, geographical, geological and the like, would greatly add to the utility of an industrial museum, if arranged in its library, so as to be accessible for reference and consultation by practical men. Such a library, it cannot be doubted, would receive many donations, and in all likelihood would prove the least costly, though not the least useful, complement of the museum.

Such then, is the fourfold idea embodied in the galleries, laboratory, library, and lecture-room, which together constitute an industrial museum. As the counterpart of this, the merchants of the world have a fourfold duty to discharge:—

1. To gather workable materials from the ends of the earth.

2. To send forth finished products, derived from those, to the four quarters of the heavens.

3. To employ the most perfect mechanical and chemical appliances which can change the one into the other, and facilitate their transmission throughout the world.

4. To encourage new arts and hope for still newer ones.

Before I close, let me indulge in two brief moralisings.

What are the ends of commercial enterprise? I will name but two;—1. The making of money. 2. The civilising of the world.

Firstly, I suppose you will not blame me for saying that the immediate end is the making of money, or for adding, that this money-making seems to me one of the most honest, innocent, and pleasant of occupations. I am not fortified in this original opinion by remembrance of any passage in Adam Smith's 'Wealth of Nations,' which indeed I never read. I am thinking of a passage in one of the writings of the poet Southey, who like myself, never lost the pleasure of money-making by having a surfeit of it. To "owe no man anything," and that it is to be worse than an infidel" not to provide for his own household, are as certainly divine precepts, as that "the love of money is the root of all evil," and that "hasting to be rich multiplieth sorrows." There is only the difference that a blessing goes with the first, and a curse with the last. Southey was right. Honestly earned wages are as true a *quiddam honorarium*, a gracious largesse, as any sum which the lawyer or physician, looking the other way, finds fall into his palm. To know that, by work of brain, or heart or hand, or rather by all together you have earned a penny, copper or golden as the case may be, which you may honestly expend on some lawful want, in gratification of some innocent intellectual taste, or æsthetical desire, for the carrying out of some moral purpose, or for the comfort of some beloved relative or friend, is one of the truest delights left to us, after the flush of early youth has passed away.

And the necessity which lies upon every man, high and low, except the uncaught thief, to serve other men, and be paid by them as his task-masters, is not the least pleasant leaf of that *Dulcamara*, which Adam found growing everywhere beyond the gates of Eden. Honourable service is the only freedom which belongs to man, and the spirit of brotherly interest and sympathy never rises higher than between the noble master, and the noble slave.

Secondly, the museum which I have been commending to you is a museum of the industry of the world in relation to ourselves. It cannot be less than this; and as this it will increase our civilization, and add to our power to civilize the rest of the world. We have deserved well of the other nations of the globe as improvers of the industrial arts, but they have deserved well of us. Tea, coffee, sugar, tobacco, opium, cinchona, cotton, caoutchouc, gutta-percha, guano, have all been bestowed upon us by distant tribes. The Chinese have taught us to weave silk, to make paper and porcelain. The Indians have shown us how to dye. The Venetians have given us the modern art of glassmaking. Our soda process is originally a French invention. The improvements, introduced into the colonial manufacture of cane-sugar are largely borrowed from the processes introduced by the continental growers of the beet-root. There is not a single invention or discovery, indeed, not excepting even the steam-engine, of which we as a people can claim more than the lion's share; and seeing that in our veins run the mingled blood of I know not how many unlike races, it would be very strange if it were otherwise.

To no one nation has been given the monopoly of genius, constructive skill and practical sagacity. All our modern arts, such as photography and electro-metallurgy, have been rapidly developed by the combined activity of quick-witted men all over the globe. Take in special illustration of this two examples. The lucifer-match, although it was born late in our own day, has this peculiarity about it, that no one, dead or living, claims its invention. Although there is nothing God-like in its name, it is as much dissociated from a human inventor as those universal instruments of art, which the ancients held to be of divine origin. And the cause of this simply is, that it embodies the productions of so many countries, and the skill of so many men, and the thoughts of so many centuries, that no individual of any nation or epoch can call it his.

The same remark applies to the electric telegraph. It belongs to no single man or nation. Volta the Italian, Oersted the Dane, Steinhill the German, Ampere the Frenchman, Faraday and Wheatstone of England, Bain and William Thomson of Scotland Morse of the United States, are but a few among the many between whom the merit of establishing the telegraph must be, though unequally, divided.

The inability, as all history shows, of any single nation to be sufficient for itself, and the teaching of the nations by each other, which each successive age sees carried further and further, furnish the sure and broad foundation of the mighty civilizing power of commercial enterprise. The vast ends which God has in view in dividing the globe amongst races so different as those which, since the secular historic period, have occupied its surface, are to us but dimly apparent. Yet we seem able to read a purpose of slowly opening up the world more and more as the centuries flow on. Not to the Egyptian, the Assyrian, the Indian, the Greek, or the Roman, but to men of our own day and generation, has the Ruler of All given the keys with which our Watts and Stephensons and Faradays have unlocked the barrier gates of the world, and made over its surface one continuous highway. Surely, without cant or pretence, I may affirm that this is the sigh of the times for you. If we refuse to interpret Chinese and other placards bearing the ambiguous statement, "No passage this way," and suffer only the announcement, "No admittance but on business," let us see, when admitted on that plea, that our business is a noble one. Once, like the raven from the Ark, we found in the days of war no rest in all the world for the soles of our feet; now, like Noah's dove, we may pluck the olive leaves of peace where-ever we will. To civilize the world through commerce, and stretch forth the hands of brethren to all the nations of the globe, is a mighty work, which God has largely given to our nation to effect, and he has laid the duty specially and honourably on those represented by you.

But why do I trouble you with my words? Was there not a parable spoken more than 1800 years ago, in answer to him who asked, "Who is my neighbour?" Did not the lawyer, the physician —even the clergyman—pass by him that had fallen among thieves, and leave the Samaritan merchant to interrupt his business journey, and help the unfortunate? Is it not curious to come across so minute a piece of ancient business-detail; the pouring of oil and wine into the wounds; the payment in ready money to the innkeeper of as much as could be spared from the scantily-filled travelling purse; the bond for further expenses which might be incurred by the sick man, and which the merchant should repay when he returned with the monies which he expected to receive? And do not all nations since call that merchant the *Good* Samaritan? Yes! and the parable was spoken by Him who, with His divine hands, handled the carpenter's tools, and in thus honouring the humblest handicraft, left us, as in all else, an example that we should follow His steps.

FRESH AIR.

From a paper by Dr. Lankaster, in the "Popular Science Review."

The pure air of the atmosphere contains four constituents, two of which are constant and two are variable. The two constant constituents are oxygen and nitrogen gases. They are in the proportion of twenty-one of the former to seventy-nine of the latter. The nitrogen is passive, remaining in an unchanged condition in the air; but the oxygen is ever being consumed and renewed. By its union with carbon, and other elements of the animal body, it maintains life. Just as it unites with the coals of the fire or the carbon of the gas and gives out heat, so it unites with the carbon of animal bodies and heats them, and they live. The result of their life is carbonic acid, which would poison the animal and the air in which it lives, were it not for the agency of the vegetable kingdom. That which is death to animals is life to plants. The carbonic acid enters the plant as a compound of carbon and oxygen; but each cell of the plant is a chemical laboratory, where invisible forces are busily at work, separating and depositing the carbon as future store for man and beast, and the oxygen is set free. The oxygen is thus restored to its home in the air once more, again to be conquered by carbon, and once more to be set free from its prison in the plant-cell, when touched by a ray of light from the sun. But not as it enters the lungs of man or animal does oxygen come forth from the plant. It has acquired new powers, and, like a giant refreshed, is more capable of action than before its repose. It has now become *ozone*. It is still oxygen, but oxygen capable of oxydizing more powerfully, of acting more vigorously than it does as it ordinarily exists in the atmosphere. Ozone is soon lost in the great ocean of air into which it is thrown, by its own activity. It is found on mountain heights, it is found by the sea-shore, and on the sea; but it is consumed by cities, by cultivated land, by forests, and by all agencies which call its vigorous action into existence. But wherever it is found, it acts favourably on the human body. The instincts of the denizens of cities and valleys have drawn them to mountain heights, and sea-shores; and the annual migrations of families to our hills and sea-sides have excited the ridicule or the reflection of those who have never attempted to solve its real cause. The air of mountains and sea-sides is doubly fresh air: it is not only pure, but ozonized, which accounts for its curative and exhilarating action on the human body. It is interesting to know that this universal instinct of benefit to be derived from residence in these positions has been confirmed by elaborate physiological experiments on the human body. It is now known as a fact, that those actions of the body which are essential to healthy life are carried on more vigorously in an atmosphere containing ozone. The great practical lesson taught by this knowledge is, the importance of securing as often as possible, change from an unozonized to an ozonized atmosphere; and it is especially important to those whose opportunities are limited, that when they are at the sea-side, they should exclude, no more than is absolutely necessary, the action of this beneficial agent on their system.*

Let us now consider the variable constituents of our pure atmosphere. These are carbonic acid gas and the vapour of water. We have seen that carbonic acid is constantly being thrown into the atmosphere by the breathing of animals. There are several other natural sources of this agent. All the putrefaction and fermentation of animal and vegetable substances is attended with the evolution of this gas. There is another natural source, and that is volcanic action, which is constantly supplying this gas. Of the gases which are thrown out from volcanoes, this is most abundant. It is one of those sources of carbon and oxygen to the surface of the earth which will account for a phenomenon not otherwise easily explained, and that is, the constant increase of organized beings on the surface of the earth. When Adam and Eve alone occupied the earth, about thirty-five pounds of carbon sufficed to organize the whole human race; but now we have 500,000,000 times that quantity in men and women alone. Add to these the domestic animals by which they are surrounded, it will be seen that the demands for carbon upon the atmosphere through the vegetable kingdom has been enormous, and has constantly increased. The never-failing supply of this carbon is volcanic action. Thus, we see that the increase of man on the earth, and his hope of multiplying in ages to come, is dependent on that action which produces volcanoes and earthquakes. Thus it is that the very phenomena which have sometimes been regarded as proofs of the wrath of God in a fallen world, are blessings, abounding with all possible goodness to the human race.

These natural supplies of carbonic acid gas are supplemented by others produced by man himself. He consumes carbon for cooking, warming, and manufacturing purposes, and it has been calculated that a thousand millions of men consume yearly upwards of 2,000,000,000,000 of pounds of carbon. This quantity is again increased by artificial fermentation, by tobacco-smoking, by lime-burning, and other sources, to a prodigious extent, when we calculate the real quantity consumed. Yet, all this carbonic acid, were it allowed to accumulate, would form but a small quantity in the great aerial ocean by which we are surrounded. In the pure air of the Alps and of the sea it forms but about a fortieth per cent., by weight, of the whole atmosphere. In the neighbourhood of towns and districts where this gas is produced, either artificially or naturally, a larger proportion of the gas is found.

The vapour of water is constantly present in the atmosphere. It is present in small quantities in the driest atmospheres, and during rain the atmosphere is saturated with it. In its largest quantities it is not an impurity. It nevertheless exercises a most important influence. The quantity of heat that falls upon the surface of the earth is regulated by the quantity of moisture in the air. Heat is conducted much more rapidly from the body in a moist than a dry atmosphere. It is, however, in the power that the particles of moisture possess in taking up and retaining organic matter and various gases, that its influence is seen in rendering the air impure. It is in damp states of the atmosphere that poisons most readily traverse its currents, and that all the destructive agents which render air impure are most rife. It is the prevailing moisture of the atmosphere of the British Islands which renders their inhabitants more liable to the injurious influences of impurities than in countries where the temperature of the air is greater, but where the prevailing moisture is less. The atmosphere, however, is not rendered impure by the less or greater quantity of moisture it contains.

Having surmised thus much of pure air, we are now in a position to judge of the nature of those impurities which render it injurious to animal life, and are more especially dangerous to human beings. We may divide these impurities into those which

* In some experiments made at Brighton, in 1862, I found in a room with the window open, that whilst ozone test-paper was readily coloured at the open window, it was not changed at all at the back of the room, showing that the impurities of the atmosphere of a room with an open window were sufficient to destroy all the ozone that entered it.

are gaseous and those which are solid, and speak first of gaseous impurities.

The first of these which I shall refer to, and which is by far the most commonly injurious, is carbonic acid gas. We have seen what are the sources of this gas, and that in small quantities it exists naturally in the atmosphere. It cannot, however, be greatly increased without danger to health. The most common source of its increase is the interior of houses and buildings where human beings are gathered together. Human beings, when placed in rooms, are constantly consuming the oxygen of the atmosphere and throwing into it carbonic acid gas; thus, if means are not taken to get rid of it, it accumulates and takes the place of the oxygen consumed. The system is thus exposed to a diminished supply of oxygen and an increased supply of carbonic acid. Although carbonic acid can be imbibed with impunity in the form of effervescing beverages, as soda-water, ginger beer, or champagne, there is no doubt of its deleterious influence when inhaled by the lungs. The destruction of English prisoners in the Black Hole at Calcutta is an eminent example. Other instances of the wholesale destruction of human life by confinement in small spaces are well known. Within the last few years the captain of a sailing packet between Ireland and Liverpool, whilst in a storm, shut down his passengers in the hold of a vessel, and when opened again, a large number were found dead. The inhalation of less quantities of carbonic acid produces a depression of the vital powers of the system, which lead to those diseases known as scrofula and consumption. In the annals of French Hygiene the case is recorded of a village in the Pyrenees remarkable as exemplifying the influence of impure air on health. The village was one built in a small valley or depression of the hill, so that there was no ventilation or entrance from the backs of the houses at all, and the doors all opened into a court formed by the houses. Though situated on the mountains and inhabited by shepherds and their families, this village was remarkable for the prevalence of scrofula and consumption, and its great mortality. Providentially, a fire consumed one side of the village, and advantage was taken of this occurrence to build the houses above, on the side of the hill. No sooner was this done than the health of the inhabitants began to improve. The change was so great that the authorities determined on pulling down the other side of the old village, and rebuilding it on the top of the hill. The consequence has been that there is now no healthier village in the district where it is situate.

The case is the same in all our towns and cities where the population is thickest, and human beings are crowded together, there disease and death prevail most. I might illustrate this assertion by the returns of the Registrar-General, and the reports of the Medical Officers of Health for London and the Provinces. In the parish of St. James, Westminster, there are three districts, in one of which there are 130 persons living on an acre, in the second there are 260 on an acre, and in the third 430 persons on the same space. In the first district there are 11 deaths only in the 1,000 every year; in the second there are 22 deaths; in the third there are 25. The death in the whole district from consumption is one in every 344 of the population. The death in the whole of London is one for every 371 of the population; but to show how fearfully the overcrowding of the third district tells on the life of the community, the death from consumption in the third district is one in every 280 of the inhabitants.

Another form in which the direct effects of carbonic acid on life is most fearfully seen, is the suffocation of children in bed. Between two and three hundred children are annually found dead in their beds in London. This suffocation occurs in various ways, but in all instances it illustrates how terrible a poison the breath of a sucking babe is, from the carbonic acid it contains. The maternal instinct of the mother leads her to care for her child; but, alas! in her ignorance, she too often destroys its life. Frequently the child is found dead on her breast, for whilst providing for its nourishment she falls asleep, and the fresh air being excluded from the nostrils of the child, it dies from the carbonic acid circulating in its frame. More frequently the child is covered over with bed-clothes to keep it warm, thus preventing the natural escape of the carbonic acid, and it is poisoned as surely as the men in the Black Hole of Calcutta. Even a handkerchief thrown over a child's face is sufficient to prevent the escape of the poisonous air, and children are smothered by the attention which is intended to keep off the flies, or a draught of air.

The evils of an accumulation of carbon acid gas are very great from the deficient ventilation of our places of public assemblage, and our dwelling-houses. Amongst public places, churches, chapels, theatres, and courts of law may be named as most exposed to the evils of an atmosphere corrupted by carbonic acid. Our places of worship are seldom constructed with any reference to the dangers that may arise from the atmosphere being contaminated with carbonic acid gas. Every available space is used for sittings, and at night they are lighted with gas, thus adding another source of carbonic acid to that of the breathing human congregation. Large and ample provision should be made in such places to allow of the escape of the noxious carbonic acid and the access of the pure oxygen. It is not the heat of these places which renders them so unpleasant to the large proportion of the audience, and occasionally sends a delicate female or aged person out fainting, or the more healthy to sleep; it is the accumulation of carbonic acid gas. There is, however, a limit to the exposure of persons to this atmosphere in the necessary conclusion of the religious services, and persons in ordinary health recover the effects of the poisoning before they are again submitted to its influence. It appears to me to be a first duty of church-wardens, deacons, or committees to whom the comfort of these places is committed, to see that persons engaged in the service of religion should not be injured by such service or prevented altogether attending a place of worship from its notorious want of salubrity.

Our theatres are more dangerous than our places of worship. There gas-light always adds its quantum of poison, and people sit for five or six hours without any change of atmosphere. Recently great improvements have been made in many of the metropolitan theatres; but, throughout the country, theatres and other places of public amusement are terribly exposed to atmospheric contamination.

Our courts of law have been perhaps less cared for than any other public buildings. This is almost unaccountable, when it is considered that they are constantly occupied by the members of an intelligent profession, whose health and life are in a great measure dependent on the freedom from impurity of the atmosphere of these places. One would be inclined to recommend, in these cases, Government interference, seeing that justice itself may not be unlikely to miscarry when a judge has to sum up or pronounce a sentence with his blood poisoned with the fumes of carbonic acid.

If we turn now to our places of business, our workshops and our factories, we shall find the same crowding and the same lighting and injurious effects much more permanent. In many of our factories, children and girls are crowded together, and little or no provision is made for ventilation. It is among the workers in these rooms that the forms of scrofula and the deadly consumption of the lungs are known to spread desolation. Many of our factories and workshops are well ventilated, but the majority are not. No law has yet been passed that will touch them. The workshops not only exist in our manufacturing districts, but in London and all our great towns. Where sedentary trades are carried on, there workmen and workwomen are collected together, almost in every case, in rooms too small, and without provision for ventilation. An examination of the returns of the mortality of any district in which there are sedentary workers will show how fearfully they suffer from consumption as compared with other classes of the community. There are, no doubt, other agencies at work; but eliminate these, and the great source of the deaths from consumption will be found in the presence of carbonic acid in the amosphere.

Another class of rooms where ventilation is frequently neglected, to the prejudice of the health of the temporary occupants, are schoolrooms. The benefit found to accrue from dischargiug children every hour for a few minutes, does not act more beneficially on their minds than it does on their bodies. The few minutes out of doors gives the children an opportunity to get fresh air, and to the judicious schoolmaster an opportunity of thoroughly ventilating the room.

But perhaps our dangers are as great at home as anywhere. The sitting-room of the tradesman, the common room of the mechanic, the drawing-room of the wealthy, and the sleeping-rooms of all, are not ventilated. Many of them are not deficient in the means of ventilation; but, as a rule, the home of the Englishman is poisoned by the gas exhaled from his own lungs. Let us take sitting-rooms first. To be sure, in very cold days in winter, when fires are in the room, and in very hot days in summer, when the windows are opened, the air is well changed. But there are the warm days in winter, when the fire is let out, and the cool days in summer, when the windows are kept close, and the whole of the spring and autumn months; and at these seasons the Englishman's sitting-room is filled with an atmosphere injurious to his health. If he has a drawing-room, the only set-off to this state of things is found in its size. If he has, however, a drawing-room, he will probably give parties or soirées; and perhaps it is on these occasions that his utter ignorance of the worth or value of fresh air will be most obvious. The drawing-room is generally lighted with gas, which is turned on to the highest point, and then the room is crowded with visitors, even on to the stairs. The atmosphere is cruelly oppressive, the guests are almost fainting; but the suggestion of an open window—of a draught—is repudiated as something offensive to the delicacy and amenities of genteel life, and fresh air is voted by all as vulgar and a bore. I am quite aware of the danger of sitting or standing in a draught, although I believe that is much exaggerated; but rooms are to be ventilated without draughts; and if not, people need not get into them. The colds you take at parties are not the result of draughts, but the very opposite. The majority of colds arise from the want of pure air, and not from cold or cold air

But we pass from sitting and day-rooms to bedrooms. It is here that everything is done to keep in carbonic acid and to exclude oxygen. What with the smallness of some rooms, the destitution of fireplaces, and windows that will not open, beds with posts and curtains, and blinds, the bed-room may be indeed called the Englishman's Black Hole. The insane fear of a draught, with the delusion that night air is prejudicial, undoes almost everything in bed-rooms at night which may be done by open-air exercise or healthful occupations in the day. The sleeping-rooms of the rich are frequently kept so close that even domestic animals would suffer, were they compelled to sleep in them, whilst those of the poor are so odious that it is almost a wonder health is every found amongst their occupiers. This terrible disregard of the purity of bed-rooms is seen everywhere: — in the hammocks of our ships, in the cottages of our labourers, in the barracks of our soldiers, and in the houses of the middle classes and the opulent. The neglect of the ventilation of bed-rooms is as common among sensible people, who flatter themselves they know the value of fresh air, as among the helplessly poor and ignorant of our population.

As for the injury done by other gases, that is so little and so exceptional that I need hardly refer to them. Wherever sulphuretted, phosphuretted, or carburetted hydrogens appear, they are indicative of the presence of other matters in the air more injurious than themselves. I shall not therefore dwell on them, but turn to the solid particles which render the air impure, and with which these gases are often associated. These solid particles are so minute that they can only be apprehended by the microscope, and many of them even by that instrument, are not sufficiently made out to be easily distinguished. They are derived from organic or inorganic sources. The organic are derived from living or dead animals and plants. The particles thus given off are exceedingly minute, and appear to be held in suspension by molecules or small particles of water. The emanations of living animals are constant. The epidermis of the skin flies off into the air, as well as particles from the lungs in the breath, so that the air where large numbers of animals exist becomes charged with such exhalations. The human body is no exception to the law. These particles are capable of decomposition, and when taken again into the living system, may be absorbed and lead to febrile disturbance in the system. These particles are given off from diseased bodies in such a state that they generate diseases in other bodies like those from which they have come. It is in this way that zymotic diseases are propagated, and scarlet fever, small-pox, measles, hooping-cough, and typhus, are all conveyed in this way.

Dead animal matter gives off also particles, not equally destructive of life, but which may, nevertheless, produce the most virulent diseases. Typhoid fever is the offspring of decomposing animal matter. The particles which produce it steal up from our drains and cess-pools, and make their way into the studies of the scholar and the chambers of royalty; no class or condition of persons are spared the influence of this dreadful poison.

Vegetable matter decomposing emits still more destructive poisons. The malaria of our own marshes, and its deadly representative in the Campagna of Rome, with the miasma escaping from the swamps of Africa and the jungles of Asia, are all of vegetable origin. Plants decomposing in contact with water yield this dreadful agent, which contaminates and renders deadly the purest of atmospheres.

Another set of particles which may come from animal, vegetable, or mineral sources, are those which we call dust. Dust is not only unpleasant—it is dangerous to life. The workers in coal are liable to disease in the lungs, from the particles of coal-dust accumulating in the lungs and producing an arrest of their functions. The same is the case with knife and scythe-grinders of Sheffield, who get the dust of iron and stone into their lungs. The workers in wool, cotton, linen, horse-hair, or any of the materials that are taken into the air in fine particles, are all liable to consumption, from the accumulation of these foreign substances in the air-passages of the lungs, and the consequent exclusion of oxygen from the blood. Even the dust of ordinary rooms, from carpets, furniture, clothes, curtains, and other things, becomes a source of impurity of air in our houses, and adds to the destruction of health which goes on from the presence of carbonic acid.

* * * * *

The question then comes, if impure air is so dangerous, how are we to render the air we breathe pure? How can we get fresh air? In the first place, every one should be impressed with the fact, that the open air must always be more pure than the air of houses, or any confined space whatever. The atmosphere in Cheapside is infinitely purer than any inhabited drawing-room at the west end of London. As far as fresh air is concerned, a party of ladies and gentlemen would be more healthfully occupied in looking at the omnibuses from the curbstones in Fleet Street than in the most elegant dining-room in Belgravia.

The night air of Houndsditch is freer from carbonic acid than the sleeping-rooms of Mayfair. Hence the importance of getting as much into the open air as possible. Children, provided they are warm, cannot be too much in the open air. It is a most merciful act to take little children from their close homes into the open parks; and this has been done in London with the greatest possible advantage. A committee of the Ladies' Sanitary Association has raised funds by which it has been enabled all the fine summer weather to send parties of poor children into the parks. Of the danger of keeping children indoors I had a good illustration a few weeks ago. I had occasion to compare the health of two streets, one a a street with well-to-do artisans, and small tradesmen, the other a tumble-down street where lodged the very poor. To my surprise, the children of the very poor were less sickly and died less than those of their better-off neighbours. On examining the mothers of these families, I got what I think was a very satisfactory explanation. The mothers of the poor children confessed that their children were seldom or never indoors; but few of them went to school, and they consequently spent their days in the street. The more opulent class kept their children out of the street and sent them to school. Of course, no rule can be laid down as to the number of hours people ought to keep in the open air, but there can be no doubt of the soundness of the advice—"Get as much as you can." Get it for yourselves, get it for your neighbours. Let the Government, let corporate bodies, let munificent individuals do what they can to tempt men and women into the parks of great towns and neighbouring fields. Above all, let there be attractions sufficient to draw men and women from the public-house, from the dancing-saloon and other vicious places where, in addition to the poisoning atmosphere, there is the poisonous drink and poisonous morality. Would that in England a taste for light refreshments could be given to the population, so that tea and coffee, with honest nutritious viands, could be substituted for the present system of drinking beer and gin—a system that annually destroys hecatombs of our hard-working, honest, intelligent artisans. It is especially on those whose occupations are sedentary and to whom fresh air is most necessary for health, that this destructive habit entails its greatest evils.

A more difficult thing to do is to keep the air of houses fresh. The multitudinous things it involves, and its apparent simplicity, are the great difficulties with which this practice has to contend. We call the act ventilation, and most intelligent people believe their houses are ventilated. If they did not they could not rest a moment. They would not lie down in their beds at peace one night if they thought the evils I have spoken of as resulting from want of fresh air were coming on their families. Nevertheless, I will put this question to them—Do you believe for one moment that with your closed windows and doors, with your brick drains or your cesspools, with your dustbins, and your dirty (I mean no ill compliment, it is too true) furniture, that the air of your rooms is pure? The air of London is dirty and impure enough, but what is it as it passess from your window crevices, the key-holes of your doors, and the tiles of your house? Dirtier and more impure than ever. If you say it is not impure, you are wrong; if you know it is impure and talk of the ventilation of your house, it is cant.

I know of no means by which a house can be naturally ventilated without superintendence, or machinery. The system of pumping into public buildings pure warm air, and pumping out the impure air is to be commended, as it secures by the same machinery both warmth and pure air. Whether anything of this kind can be done for private houses is at present very questionable. In the meantime, houses ought to be built so that an intelligent person, who understands that hot air ascends and goes out at the upper apertures of a room, and that cold air comes in from below, can so arrange that there is a perpetual flow of air through the room without creating cold by draught. This can generally be done in rooms where the window sashes come down from the top in two sides of a room, or in one side where a door opens at the other. But, alas! how many houses are thus constructed? Not one in a hundred in town or country. When they are so constructed, the sashes are not let down from the top. The bed-rooms, which have been closed up all night, are indulged with a small quantity of fresh air by a little opening from below. The consequence of all this closing of doors and windows is sickness. The children are ill in the nursery, the servants are ill in the kitchen, and the master and mistress are ill in the drawing-room. The source of this sickness is easily understood, if you recollect how large a portion of time the inhabitants of houses spend indoors, and it is precisely those who take least exercise or go out least that suffer most.

The same arrangements in houses that secure the influx of oxygen from without, and the efflux of the carbonic acid from within, also secure the escape of those solid particles which are so injurious when contained in any considerable quantity in the air. It is a well-known fact, that you may so dilute the poison of various fevers, as they escape from the bodies of those attacked, that no one shall be injured by it. If you place one patient with fever in a large ward, no other patient gets the disease, but if you place several fever patients in the same room, then every person that enters may catch the fever. So it is with the poisons of drains and cesspools. If they be well diluted in the open air nobody suffers, but let them concentrate themselves in a room and destruction takes place. I say safety is secured by ventilation in houses otherwise dangerous, but no wise man would allow his drains or cesspools to leak into his house. But how many men in a thousand see to these things? how many women? how many servants? My experience tells me very few. This accounts for the faint odours and sickening smells that so often salute you in the houses of the rich as well as the poor; of the medical man, who has yet to learn how to apply the laws of physiology to the maintaining the health of his own household, as well as the poor mechanic, who is alike ignorant of the cause of the unhealthiness of his family, and powerless to remove it if he did. And yet, how angry people look if you tell them their houses are "nuisances, injurious to health." They believe in fresh air, they talk of the advantages of fresh air, but they have yet to learn how little they have of it at home, and how much more of it they need if they would secure the health and strength their Creator intended they should enjoy."

SEWAGE AND ITS EMANATIONS.

Large as were the cloacæ of Rome, and wonderful as they must be considered, for the period in which they were constructed, the sewers of London not only equal them in their proportions, but surpass them in number and variety. The rapidity with which the population of the English metropolis has advanced, makes it curious to trace the effect of this, in converting what, a few centuries ago, were purling brooks and limpid streams, at which the birds of the air and the beasts of the field would drink and slake their thirst, into channels for the off-scourings of a densely inhabited district. What was then pure has now become foul: what was clear, has become dark; what was wholesome, has become noisome, fraught with the most offensive effluvia, pestilence, and death. "Anciently," says Stow, "until the time of the Conqueror, and two hundred years later, this city of London was watered—besides the famous river of Thames on the south part—with the river of the Wells, as it was then called, on the west: with a water called Walbrook, running through the midst of the city into the river of Thames, severing the heart thereof: and with a fourth water or bourn, which ran within the City, through Langbourn Ward, watering that part in the east. In the west suburbs was, also, another great water, called Oldbourn, which had its fall in the river Wells." All these "choice fountains of water, sweet, wholesome, and clear," the qualities by which the Fleet was characterized, are now covered in, and roll their feculent streams beneath this mighty city into the Thames.

> "Thither flow,
> As to a common and most noisome *sewer*
> The dregs and feculence of ev'ry land."

Considering that the ancients were comparatively speaking, almost entirely ignorant of the laws of chemistry, it might be esteemed a matter of some singularity, why they took the trouble to build in their sewers, and cover them from public view. But the Romans were a luxurious people, and no doubt, hated offensive sights as well as offensive smells. If they were ignorant of the poisonous nature of the gases which dissolving substances exhale, they could not be of the disagreeable sensations which such gases usually produce on the olfactory nerves, and consequently, in accordance with the advanced state of their arts, adopted such means as were in their power to put out of sight what they must have considered a nuisance, as disgusting to their eyes as it was repugnant to their nostrils. It must have been from a similarity of motive independent of the extending population, that our ancestors were induced to cover in the streaming sewage which polluted, with almost every species of impurity, the sweet waters which erst, in the immediate neighbourhood of their great city, regaled their eyes as one of the most cheering and one of the most indispensable necessities of their existence. That this was the case is evident from the fact that, so early as 1290, the monks of White Friars complained to the King and Parliament, that the putrid exhalations arising from the Fleet were so as to overcome all the frankincense burnt at their altar during divine service, and even occasioned the deaths of many of the brethren.

The complaint of the White Friars is startling enough, and shows to what a poisonous extent the mephitic gases of the stream had impregnated the surrounding atmosphere. The very frankincense, which would likely be made pretty strong, had been overcome by it; the white Friars died from it, as did, we have no doubt, thousands of others, neither so well housed nor so well fed, who dwelt in its vicinity. Long after this, however, the Fleet was not covered in. It was still permitted to diffuse its pestilential exhalations through the atmosphere of the rapidly-growing City, notwithstanding it had long ceased to bear vessels with merchandize as far as Fleet and Holborn Bridges, if no further. So late as 1746 only about 400 acres of the surface of the districts of Holborn and Finsbury were built upon; but in 1846, one hundred years later, there were about 1,790 acres covered with houses and streets. This vast step, taken in a hundred years, is a wonderful exemplification of the speed with which the English metropolis had grown; but the total surface which the Fleet drains of sewage in the Holborn and Finsbury districts is 4,444 acres, so that there is still much ground to be built upon, and, consequently, to swell the refuse-flood of this subterranean stream.

The above example of the deadly effects of sewer gases discloses that whether in an individual or a compound state, they are to be provided against as far as possible. Sewer miasms are all more or less deleterious, but the most dangerous of them all is sulphuretted hydrogen. This gas is known by the peculiarity of its odour, and is always produced during the putrefactive process going on in the decomposition of sewage. Its smell is so palpable that it may be discovered even when diluted with ten thousand times its bulk of air. Although little heavier than atmospheric air, in the proportion of 1,179 to 1,000, the diffusiveness of its nature is so great, that its increase of weight possess little or no influence in making it occupy a low level. It is exceedingly poisonous, and under all circumstances, will destroy life, whether it is inhaled, or absorbed through the skin, or injected into the cavities or tissues. This, then, is one of the principal gasses evolved by matter in a state of decomposition. It comes up reeking through the gratings from our sewers, in the streets; it is inhaled by the passers by, some of whom we have known to have been suddenly seized with headache on happening to stand a few minutes beside a grating, inadvertently inhaling the gas. One part of it in 1,500 of air, will immediately kill small birds, and one in 290 is, in a few minutes, fatal to rabbits and dogs. This is no doubt the gas which was so deadly to the White Friars. It discolours almost all the common metals; indeed, the salts of lead and silver are so quickly blackened, and are so sensative of its action that they indicate the presence of the gas when the atmosphere does not contain more than one part in about 100,000. These, therefore, are the tests for it.

Another dangerous gas evolved by the decaying of organic matter, is *carbonic acid*, which is found in the air of sewers to the extent of 0·5 to 2·3 per cent. The gases evolved from the sewage itself, contain of this gas about 19 per cent. Like sulphuretted hydrogen, its diffusive power is very great, although it is heavier than air in proportion of 1,525 to 1,000. It acts as a powerful narcotic, and if it be breathed in a somewhat pure condition, it will produce immediate asphyxia. "If this gas has been produced at the expense of the oxygen of the air, as happens in sewers and crowded rooms," says Dr. Letheby, "as little as 3 per cent will quickly destroy life. Expired air contains from 3 to 5 per cent. of the gas; and the tragedies of the Black Hole at Calcutta, and the round house at St. Martin's, are examples of the terrible fatal power of such an atmosphere; even the proportion of from 1·5 to 2 per cent., will cause almost immediate distress, and a feeling of suffocation." Mr. Bence Jones found that these were the proportions in the dormitories of a metropolitan workhouse, where the vitiated air proved deleterious in a more than ordinary degree; and in the atmosphere of the Wellington barracks, where the sickly troops were lodged, it was ascertained by Dr. Roscoe, that the quantity of carbonic acid at night, ranged from 0·12 to 0·14 per cent. In a crowded theatre it does not exceed 0·32 per cent. Yet are there few persons who have not felt the depressing influence of such an atmosphere. Think, then of the sewer gases which contain from 0·5 to 2·3 per cent. of it.

Ammonia is another product of putrefaction, and is one of the constituent elements of the sewer airs. It is lighter than the atmosphere in the proportion of 560 to 1,000, and is known by the peculiarity of its smell and alkaline reaction. The action of this gas is peculiarly injurious to the animal economy; and, when inhaled in a concentrated state, it produces immediate asphyxia. When somewhat diluted with air, it acts principally on the lungs; and when still more diluted, and breathed for a considerable time, it produces symptons of typhoid fever. Even if the air is charged with only a small quantity of ammonia, the continued inhalation is destructive of health. This gas, however, performs a two-fold function in the operations of this world. Than even the inhalation of ammonia in an atmosphere impregnated by it, there is another property possessed by it more dangerous still. This consists in its capacity to convey the less volatile products of putrefaction into the air. "In all probability," says Dr. Letheby, "it is the purveyor of the miasms of infected districts, as it is known to be of the fetid compounds of animal and vegetable decomposition. It was the agent which gave volatility to the putridities of the Thames, during the hot weather; and it is the medium by which the more offensive matters of coal-gas are held in suspension. Nor is it less powerful diffusing the sweet odours of plants, and the subtle constituents of many perfumes. It may therefore act for good as well as for evil."

The volatile compounds of ammonia with carbonic acid and sulphuretted hydrogen are, also, injurious; so are light carburetted hydrogen or marsh gas and coal gas, which are all present in sewers. Into these, however, we will not here enter; but we may ask, what are the dangers of the complex sewer gases themselves? From what we have already said of the properties of the individual constituents, it is evident that the complex mephitisms must be extremely injurious to the animal economy. This has been amply confirmed by experience, which has proved that they are amongst the most active poisons. One breath of the undiluted gases, will destroy life immediately, and even when they are largely mixed with atmospheric air, they quickly cause asphyxia, narcotism and death. In smaller quantities, they are less active, but not less certainly injurious; and even when further diluted with atmospheric air, they produce a general prostration of the vital powers.

Of the effect caused by the inhalation of even very small quantities of sewer miasms, M. D'Arcet, has put upon record a remarkable instance. He states that, in Paris, there was a small lodging consisting of a bed-room and ante-room, which had been successively tenanted by three vigorous young men each of whom died within a few months of his occupying the place. M. D'Arcet, was requested to examine the rooms, and ascertain the cause of the evil. He found that a pipe from the privy in the upper floor, ran down by the side of the wall near to the head of the bed where the inmates slept. The pipe was unsound, and the wall was damp from leakage of the soil into it; but there was no perceptible smell in the room when it was examined; nevertheless, M. D'Arcet had no doubt, that the deaths of the former occupants were referable to the emanations from the wall. The pipe was repaired, and from that time, the unwholesomeness of the place was cured. What can tell more strongly than this, of the evils arising from defective pipes, or bad drainage in regard to the soil of a water-closet or the sewage of a city? We could give many other examples, but this for the present, must suffice. We hope, however, we have said enough to show, how dangerous it is to live in the neighbourhood of bad drainage and sewage smells, and how necessary it is to remove all causes of offensive and injurious miasms, not only from the immediate vicinity of our private dwellings, but from the premises in which we may be conducting our daily business. In the above case, the point to be observed is, that there was no apparent cause for the death of the young men; there was no smell in the room: nothing to be seen that could indicate danger to health; yet the work of certain poisoning went silently and surely on, without exciting the slighest suspicion of the cause even in the victims themselves.—*Sanitary Reporter.*

PROSSER'S LIME LIGHT.

The Lime Light has recently been introduced, on trial, into lighthouses, where it promises to prove a formidable rival to Holmes' electric light. At the South Foreland Point, Mr. Prosser's lamp for the production of lime light was placed three years ago in the upper lighthouse. The lamp was fixed in the centre of the Fresnel apparatus, which had already been employed with the electric light, and which was adjusted to the use of a forewicked oil lamp, the burner of which was 3¼ inches in diameter. We take from the report of Professor Faraday, made to the Trinity House, on the 11th of June, last year, an account of the light, in regard to its working and success in the Upper Lighthouse at the South Foreland.

"The lamp consists of a central octoedral prism of quicklime, built up of many small pieces of lime, from chalk; it is about 3½ inches in diameter and 16 inches long. It is supported by a clock, which, when in action, lifts it perpendicularly, at the rate of one inch per hour. Eight gas jets, conveying mixed oxygen and hydrogen, are placed at equidistances around this lime, in a horizontal plane. When the gases are lighted and directed against the lime, they produce eight places of intense ignition; and as the lime core is about 11.4 in circumference, the centres of these eight frames are about 1.4 inches apart.

"The lamp practice in the lantern is very easy; the jets are easily and safely lighted and adjusted. The action then goes on for hours together without change. The clock raises the lime; draughts do not effect the light; there is apparently no circumstance present which can cause derangement, and, as far as appears by theory or practice, the lamp may be left uutil sunrise untouched, provided gas be regularly supplied from below. The lamp is easier of management than a common lamp. It is easily replaced, in case of need, by the ordinary oil lamp; and that has been done in times varying from seven minutes to ten minutes or more."

"The light produced is very white and beautiful in character, far surpassing that of oil or gas flame in its intensity, but not equal to the electric spark; but then it is much larger in dimension. It is the light of a planet, whereas the electric light is like that of a star. It streams out from the lantern over the surrounding space in great abundance.

"The good and constant condition of the lamp will depend upon the sufficient and steady supply of the gasses required. At present these are oxygen and hydrogen.

"The oxygen is made by the ignition of the native peroxide of manganese, in iron retorts fixed in a furnace, heated to bright redness by coke.

"The oxygen after being passed through a washer, is conducted to a gas-holder capable of holding 600 cubic feet of gas; it is outside the building, appears to be steady in its action, and fit for its peculiar service. The pipes conveying the gas are 1½ inches diameter outside the tower, and one inch in the tower. No inconvenience has as yet been experienced, at Westminster Bridge or elsewhere, from the action of cold on such exposed pipes. There are cocks at the gas-holder, and also in the lantern, governing the progress of the gas; the pressure upon it, when the lamp is burning, is six inches of water.

"The hydrogen gas is at present made by heating to redness a mixture of equal weights of iron borings and crushed coke-dust in iron tubes placed in a special furnace, and then passing over it a stream of steam. There are three tubes, which require only once charging for the day; and they, with the furnace, seem to do their duty very well. The gas is passed through a washer, as in the former case, and then on to a gasometer of the same size and arrangement as that for the oxygen. A sufficient supply for the nights consumption is produced in three hours.

"There is an apparatus for the generation of hydrogen by the action of diluted sulphuric acid on iron or zinc. It consists of three large earthenware bottles; it has been used, and may be used again if occasion require it. Two men were at work in the gas department.

"The whole quantity of gas burnt in the 12 hours upon the six jets is about 560 cubic feet, which is nearly at the rate of 7·7 cubic feet per jet per hour. The proportion of the two gasses is about 248 oxygen to 312 hydrogen, or 1 to 1.26; if the gases were pure it should be as 1 to 2. The introduction of the common air at the charging will account for much of this—impurity of the manganese for much more."—*Social Science Review.*

THE CHIMNEY.

As we Britons are housed and artificially accommodated, in these days of civilization and refinement, we can hardly conceive that a city, town, village, or hamlet could, at any period, have been built without the convenience of a single chimney. Yet neither Greek nor Roman had this convenience to his house. *Caminus*, however, has been translated as signifying a chimney; but, according to Beckman, it rather means a metallurgic furnace, in which a crucible was placed for melting and refining metals. Besides this, it would seem to have had other significations. One of these was a Smith's forge; and another, a hearth or a fire-place which served to warm the apartment, in which it was constructed. For this purpose, portable stoves in fire-pans were also used, and were filled with burning coals, or wood was lighted in them and when reduced to charcoal, carried into the apartments. These, however, must have been very inconvenient and troublesome modes of obtaining warmth; and it surprises us, that the inventive genius of two such nations as the Greeks and Romans, did not devise such a simple thing as a a common flue, to carry off one of the most disagreeable nuisances that can possibly afflict the inmates of a dwelling. In every apartment of a Roman house the smoke was blown about in windy weather. Everything was blackened by it, so that Vitruvius, in speaking of ornamenting and fitting up apartments, expressly says that there ought to be no mouldings or carved work, but all should be as plain as possible in those rooms in which fire is made, or many lights burned. The reason for this is because of the soot. The *imagines majorum*, or images of their ancestors, although placed in niches in the *atrium* or hall, in the houses of the great, were covered with it, and on that account were called *fumosæ*. In the dwellings of the rich, no doubt, care was taken to keep these as clean as possible; but in the houses of even the middle classes, the smoke prevailed to such an extent, that the ceilings and walls were incrusted with soot. How uncomfortable, then, must have been the habitations of the Greeks and the Romans—the classics of antiquity—when compared with those of the British! We can imagine the rheum running from the eyes of Cæsar, notwithstanding his unquestionable greatness as a man, and his mightiness as an Emperor. We can even hear the complaint of Horace, when the smoke had brought the water into his eyes in the inn at which he had happened to stop for refreshment, on a journey; and had the Nymphæ been mortal, as some mythologists think they were, and dwelt in houses instead of woods and caverns, and evergreen grottos, doubtless their lovely tresses would have sometimes smelt of the smoke which wreathed itself so abundantly amongst those of the fairest women of the Grecian and Roman capitals.

The history of the chimney is a very curious piece of archæological antiquarianism. Not many years ago, we ourselves, in a tour in Scotland, were eye-witnesses of the smoke making its way through a hole in the roof, in several cottages not many miles to the north-west of Stirling. This is the most primitive mode by which the fire-wood fumes of antiquity made their escape from the dwelling house. It was the Greek as well as the Roman mode; and was also adopted by other nations, no doubt, before even these had a name or an existence. In a Roman abode, the atrium was long the principal apartment. "It was generally more spacious than any other," says Ramsay in his "Roman Antiquity," "and existed, in some shape, in every mansion, great or small, from the earliest down to the latest times. It was always placed opposite the principal entrance, and was, in the great majority of cases, lighted by an aperture in the centre of the ceiling, open to the sky which was called *impluvium*, because the surrounding roof sloped towards it so as to conduct the rain down into a reservoir called *compluvium*, formed in the pavement below for its reception. The atrium was originally the public room, open to all members of the family, to friends and to visitors. *In the middle was placed the fire-place of the house* (focus) *where all culinary operations were conducted, the smoke escaping through the impluvium above.*"

Not until, perhaps, about the fourteenth century was a real chimney seen in England. Previous to this, the dwellings of even the opulent must have been miserable places, in so far as regards domestic comfort, when compared with that which is usually uppermost in the modern mind. In the middle of the spacious halls of our ancestors was placed the hearth, upon which stood the and-irons, where horizontally lay the ends of the brands, which by means of a heavy two-pronged fork, were arranged, in the best form, for throwing out light and heat. On the roof, over the hearth, was a turret or tower, filled with boards, disposed in such a manner, as to exclude the wind and rain, and allow the smoke to escape. "In this guant and aguish apartment," says a writer on this subject, "heated by a single fire, the company were in a position not much different from what they would be in the open air. Light was the only solace the greater number could derive from the blazing fuel; and the few who were in a situation to feel the radiant heat, were incommoded by the current of cold air, sweeping like a hurricane, along the floor towards the fire. From the height of the louver, and low temperature of the smoke, few of the buoyant flakes of charcoal found their way into the atmosphere, and the larger the bon-fire the thicker was the layer of soot deposited upon each individual. Boisterous weather, also, brought its annoyance. Had the fire been made in an open field, they might have moved to the windward of the smoke; but in the hall where could they flee from its miseries?" As it was with our ancestors before the invention of chimneys, so was it with the Greeks and Romans, who, with all their arts and learning, their fine minds, elegant tastes, lofty idealism, and beautiful forms and faces, must have presented but indifferently cleanly exteriors, after having been exposed a while to the smoke of their own dwellings.

That chimneys, however, are very ancient, cannot be doubted. DuCange, with Vossius and others, assert that apartments called *caminatæ* had chimneys, and that word appears as early as 1069. The sense in which it is used, however, is not clear. Beckman thinks that it is proved that there were chimneys in the tenth, twelfth, and thirteenth centuries, by the use of the curfew-bell of the English and the *couvre feu* of the French. The oldest certain account of chimneys, however, with which I am acquainted," says Beckman, "occurs in the year 1347; for an inscription, which is still existing, or did exist at Venice, relates that, at the above period, a great many chimneys were thrown down by an earthquake. This circumstance is confirmed by John Villavi, the historian, who died at Florence, in 1348, and who calls the chimney *punajuoli*."

The opinion of the Gottingen professor, however, is disputed by Mr. Tomlinson, who in his Rudimentary Treatise on Warming and Ventilation, says, "Winwall House, in Norfolk, which has been described as the most ancient and perfect specimen of Norman domestic architecture in the kingdom, has not only recessed hearths, but flues rising from them, carried up in the external and internal walls. Now, if Winwall House really be an Anglo-Norman edifice, its chimneys must have been built in the twelfth century, and consequently the claim of the Italians to the invention cannot be supported. The chimneys at Kenilworth and Conway were also probably erected anterior to the date of those on which the Italians rest their claim. Leland, likewise, in his account of Bolton Castle, which, he says was "finished ere King Richard the Second died," notices the chimneys. "One thing I much noted in the Hall of Bolton, how chimneys were conveyed by tunnels made on the side of the walls, betwixt the lights in the hall; and by this means, and by no covers, is the smoke of the hearth in the hall wonder strangely conveyed."

The contradictory opinions in reference to both the period and the country in which these important additions to domestic architecture took place, is not surprising, when we reflect on the darkness of the ages, in which it is said they occurred. When chimneys were once either invented or introduced into England, however, they soon became common; this was to be expected from the great comfort which they must have yielded to the, hitherto, smoke-dried residents of most habitations, whether in town or county. In the reign of Queen Elizabeth, they had become so highly appreciated, that apologies were made to visitors, if they could not be accommodated with rooms provided with them; and it would appear that ladies were frequently sent out to other houses happily supplied with this luxury so much desiderated even in the days of "good Queen Bess." At that time, coal had not come into fashion as a domestic fuel, from the supposition that the smoke which it exhaled, produced a deteriorating effect upon the atmosphere and was, likewise, prejudicial to health.—*Sanitary Reporter.*

Technical Chemistry.

On a Means of obtaining Bismuth, by M. Balard.

The high price of bismuth for some years past induced M. Balard to undertake the search for this metal in old type materials. When it was cheaper, bismuth entered into the composition of the alloy for printing purposes. M. Balard proposes to effect this industrial analysis in the following way:

1. Dissolve the material in nitric acid, so as to transform all the tin into metastannic acid, which isolate by filtration from the acid solution of nitrates of lead and bismuth; wash with acidulated water, dry and reduce by charcoal.

2. Into the liquid, neutralised as much as possible, plunge plates of lead, which precipitate all the bismuth in a metallic state; dry and melt with a reducing agent.

3. Precipitate the lead from the last liquid by carbonate of soda; separate, wash, dry and reduce with charcoal.

This way of operating gives the three metals in a metallic state; it may undergo several modifications for isolating the metals under another form according to the arrangement of the products. To obtain extremely pure subnitrate of bismuth, says M. Balard, it is necessary only to neutralize the liquid containing the soluble nitrates, and dilute with a large quantity of water naturally free from carbonates, chlorides, or sulphates. After again neutralising and diluting with water and repeating the operations several times, the greater part of this metal becomes isolated in the state of white bismuth.—*Journal de Pharmacie et de Chemie.*

Extraction of Auriferous Silver from its Ores, by M. J. Nickles.

Though the treatment of argentiferous ores is easy, and that of auriferous ores not very complicated, it is otherwise when the two metals are associated, for then the properties of the one prevent the manifestation of the properties of the other. If, for instance, auriferous silver is treated by chlorine water, the core immediately becomes covered with a coating of chloride of silver, which protects the rest from the action of the solvent. If this is attacked by salt water, ammonia, or hyposulphite of soda, the core becomes unmanageable, the chloride of silver dissolves, it is true, but leaves behind it a layer of metallic gold which in its turn resists the action of the solvents of chloride of silver.

After many tentative trials the simple plan occurred to the author of associating the two solvents, chlorine and chloride of sodium. He took salt water concentrated and saturated with clorine, and digested the auriferous alloy in it. By burning an ore of this kind and then washing it with the above solvent, the chlorine attacks the metallic particles, and then transforms them into chloride, which is dissolved by the sea salt.

It is thought that this solvent may serve for the treatment of ores so poor in metals as to be discarded for the ordinary extracting processes.—*Polyt. Notizblatt*, vol. xviii. p. 286.

On the Preparation of a Green Colour without Arsenic, by Dr. Elsner.

Having recently had occasion to study a pulverulent green colouring matter which he had been requested to analyse, and which was called *green cinnabar*, the author found that this matter, all shades of which could be obtained, from the lightest to the darkest, contained, various proportions of prussian blue and chromium green. This colour, applicable to the manufacture of paper hangings, will not serve for painting walls containing lime, as its action alters the tint of the prussian blue. Neither will it serve for colouring bonbons or for any other culinary purpose, because, though it contains no arsenic, it is not free from hurtful qualities. The following are the directions for obtaining the different shades:—

Make a solution of yellow chromate of potash and another of yellow prussiate of potash, then mix the two. Dissolve separately in water some acetate of lead and iron, and add this solution to the others. By precipitating the first two solutions by the third a green deposit is obtained, the tint depending on the proportions employed. It is scarcely necessary to say that the larger the quantity of acetate of lead and chromate of potash, the lighter the shade obtained.

Wash the precipitate carefully and dry it with gentle heat.

The necessary acetate of iron may be obtained in various ways, especially by precipitating a solution of acetate of lead by sulphate of iron and filtering the supernatant liquid.—*Moniteur Scientifique*, v. 382. 68.

Manufactures and Machinery.

THE PLANING MACHINE.

Woodworth.—1826.

None but a carpenter who has spent weeks of hard work in smoothing the floors of a building with a jack-plane, can appreciate the boon conferred upon mankind by Woodworth's invention of the planing machine.

This great invention was made by William Woodworth, of Hudson, N. Y., during the winter of 1826-7. The idea of substituting machinery for hand labor in dressing lumber was conceived by Mr. Woodworth in early life, but he had not sufficient funds to construct a working model, nor indeed sufficient leasure to mature the plan in his own mind. In December, 1826, he was disabled for work by having his hand injured in the machinery of a block manufactory, and during the leisure resulting from this he brought his long-contemplated invention to maturity. He finished his drawings, but several months elapsed before he was able to make arrangements for constructing a working model. At length Mr. James Strong, of Hudson, agreed to carry the matter through for one half of the invention. Steps were taken to secure a patent, and the construction of a working model was commenced. The machine was completed sufficient for trial in August, 1828, and after being tried in Hudson it was taken to the city of New York, where it was subjected to a series of experiments, and perfected. The patent was granted Dec. 27th, 1828.

This machine, like Whitney's cotton-gin and most other of those great inventions which are the product of a single mind, came complete from the head of the inventor. No material change has ever been made in the important parts of the mechanism, and the hundreds of machines that are now roaring from morning till night in their hard labor, are of essentially the same construction as the one first made from Woodworth's drawings.

A number of sharp knives are secured to the periphery of a rapidly-revolving wheel, beneath which the board is passed from end to end; the cutters in their revolutions taking off chips so short as to leave the surface perfectly smooth. When matched-boards are desired for floors or ceilings, a tongue is formed upon one edge and a corresponding groove upon the other by cutters of the proper form, secured to the peripheries of disks at the edges of the board.

The patent for this invention was twice extended, first by the Commisioner of Patents, and second by Act of Congress. The right to the second extension was sold by the heirs of the inventor for $50,000. It is estimated that the saving to the country by the machines now in operation is not less than $6,000,000 a-year.—*Scientific American.*

BEARING SURFACES.

The economical working of machinery depends upon many things—the care observed in using it, the material employed in its construction, and, lastly and chiefly, the proportions of the design; for good workmanship, material, and careful supervision may, for the purposes of discussion, be assumed. The resistance of every machine is very greatly increased or diminished according to the harmony of proportions existing between the several principal parts. The labor of the shaft, the burthen on the beam, the wear and tear of cylinders and packing rings, the duty borne by the guides in sustaining or directing the cross-head, all these points have some importance in the general economy of a steam engine. So also does want of proportion affect the performance of other machines when transferred to them, and the best test of durability, and, as a sequence, economy, is found in engines which have run for years without repairs—equal engineering skill and similar conditions being assumed for the purpose of comparison.

If we examine the V-shaped slides of a planing machine we shall find that they do not wear equally, considered through their cross-sections, and that in most cases the points which wear the most are nearest the top of the slide or at its apex. The base on each angle is always the brightest, showing that the most friction occurs at those points. One reason for this may be found in the shape of the wearing surfaces; the form is so unfavourable to lubrication that oil will not remain upon it very long, but runs down toward the lowest parts, carrying with it the dust that may have settled on the slides. Instead of making the slides in this way, it would seem a better plan to cut off the top of the triangle (considering the slide through its cross-section) so as to transfer a portion of the wear which the lower parts of the inclined sides sustain, to a flat or plane surface. By this method of construction, which is often practiced on the shears of lathes, the wear would be more equal and even, and the slides would last longer without replaning. Many makers of planing machines extend the base of the slides very much, so as to make wide and heavy bearings, and this plan has been found to answer well on large machines. We once saw a planer with slides which were semicircular or rounded on the top and they worked very badly indeed. The sides of the semicircle, if we may use such an expression, wore off much quicker than the top, and the consequence was that the surfaces in contact never fitted.

The journals of steam engines are very often made convex in their axial length, some are made concave, and still others have coned bearings to certain parts. These plans are all defective for these reasons:—the wear is unequal because the velocity of the surfaces in contact is unequal; the pressure upon the bearing is not the same throughout the surface; the lubrication is imperfect, because the oil flows from the highest to the lowest points, so that in a short time the greatest diameters are left dry unless more oil is poured on than a journal of similar size properly made should have. Any departure from a true cylindrical surface is costly to manufacture, while the use of such journals is not attended with advantages sufficiently great to counterbalance their evils except on traction engines, some parts of quick-working screw engines, or places where great strain is liable to be thrown on the parts connected—as in long connecting rods or self-propelling rods for common roads.

Quick-working screw engines, having short strokes and the crank shaft so near the cylinder-head that it makes the latter squint-eyed to look at it, wear down their gibs in the cross head (when they have any) most rapidly, and no remedy for this appears to exist but to make the gibs either of hard-wood boiled in linseed oil or else brass, disproportionately large for the area of the piston. Wooden gibs wear while the slides do not, which is a very important advantage. We have seen the gibs of a cross-head belonging to a direct-acting vertical screw engine (said gibs being of brass, about 14 inches long by 8 inches wide) worn down nearly three quarters of an inch on their face in going from this port to Savanna, Ga., in spite of all the oil that could be poured on, or attention that could be given them; it may be proper to state that the cylinder was about 50 inches in diameter and the stroke 48 inches. As an economical substitute for small brass boxes, lignum-vitæ boiled in oil or tallow is very good, and is used to some extent for many quick-running machines. These boxes last a long time and are easily replaced when worn out. A large and heavy screw engine is now building at a machine-shop in this city; the main shaft of this engine runs in cast-iron boxes well lined with Babbitt metal, but no composition of any other kind is fitted to the journal. These two metals work well together when the journals are not very large, but if we are not greatly in error this same arrangement was placed on the engine we alluded to a few lines previously, and caused so much trouble that it had to be taken out and replaced by brass boxes.

Of two evils it is far better to give too much bearing to the working parts of machines than too little, for the repairs in the first instance will bear only a proper relation to the amount of work done, while in the latter they are a continual item of expense.—*Scientific American.*

CUT NAILS.

Wilkinsons and Others.

Among the appliances which have multiplied a thousand fold the power of man in molding the substance of nature into forms adapted to the gratification of his wants, there are few that rank higher in importance than the humble little instrument which is named at the head of this article. In numbers, nails far surpass any other thing which is employed in any of the arts, and the part that they play in the construction of our dwellings, ships, furniture and other fabrics is so great that, if they were annihilated, the whole order and movement of life would be changed.

In the old plan of making nails by hand, the end of the nail rod was heated, hammered down on an anvil into the required form, pointed, cut off and headed. In the neighborhood of Manchester alone, 60,000 persons were employed in this occupation, and great numbers in all other parts of the civilized world. By the present plan of cutting the nails, one steam engine drives several machines, and each machine makes a hundred nails per minute; the workmen having nothing to do but to lay on the plates, and to put the finished nails into the kegs.

The saving of labor is also very great to those who use the nails. With the wrought nail it was necessary to bore a hole in most kinds of wood before the nail was driven; but the cut nail is so formed that it can be driven into the solid wood without danger of splitting. Probably five or ten cut nails are driven in the same time as one wrought nail. The cut nail, too, from two of its sides being parallel, and from the roughness of its edge, retains its hold more firmly in the wood.

The machinery for making cut nails is wholly of American invention, and is the result of the series of efforts by several different inventors. About the time of the close of the Revolutionary war, two brothers of the name of Wilkinson, who had iron-works in Cumberland, R. I., cut a lot of nails from some old barrel hoops—"Spanish hoops," as they were called; and these are supposed to have been the first cut nails ever made. The first patent for a nail-cutting machine was granted on the 23rd of March, 1794, to Josiah G. Person, of New York, and from that time to 1817, more than 100 patents were issued. In 1810, Albert Gallatin, Secretary of the Treasury, made an elaborate report on this subject, and he estimated that a million of dollars had been expended in bringing nail-making machinery to perfection. The machines are now models of simplicity and effectiveness, and they release a vast number of hands to be employed in the production of wealth in other forms.

The nail-cutting machine of the Wickersham Nail Company, which is really quite an interesting piece of mechanism, can now be seen in operation at the machine works of Moore, Wyman & Co., 76 Sudbury street, Boston; its simplicity and power is quite wonderful, it being capable of cutting from a twenty-inch plate of iron thirty-two two-and-a half-inch nails per second, or nine pounds of nails per minute. Of one-half-inch nails it will produce one hundred and sixty per second, cutting, heading, and pointing them at the same time, giving a point like a brad-awl, which is a great advantage over the blunt-pointed nail, that so frequently splits or mangles the work upon which it is used. This machine was patented by William Wickersham, Esq., and the principles of the inventor, we understand, can be applied to the manufacture of spikes. The company proposes to purchase the entire patent right of the machine in this and foreign countries, and also for the sale of nails made by it.—*Scientific American.*

New Process of Making Steel.

"It was discovered some time since by Deville that if oxide of iron is mixed with wrought iron, the wrought iron will melt at much lower temperature than it will without the oxide. Mr Gerhardt applies this principle to making cast-steel by heating scraps of wrought iron in crucibles, to a high degree, and then introducing into the crucibles oxide of iron, or other suitable substance containing oxygen, and immediately after the introduction of the oxide, pouring a quantity of melted pig iron into the crucibles. The oxygen of the oxide combines with a portion of the carbon in the cast iron, and the remainder of the carbon enters into combination with the whole mass to form steel. The degree of carbonizing can be adjusted to a nicety by regulating the proportion of cast iron in the mixture."

Direct Production of wrought Iron and Steel in the Blast Furnace.

A very interesting method for obtaining the above result has recently been patented by Mr. Johnson, of Lincoln's Inn Fields, England. The process consists essentially in the introduction of finely divided oxide of iron into the blast, which, of course, conveys it to the metal in the furnace. The result of this introduction of oxide is that the cast iron becomes decarbonated in the blast-furnace itself, without being placed in puddling or other furnaces. Any other oxide which acts in a similar manner may be employed with equal advantage, and other substances may be employed for the purpose of purifying the metal. The crucibles which are usually employed must undergo some modification in order to admit of the patented system being carried into execution. It is thought advisable to heat the oxide to dull rednees before allowing it to enter the blast pipe.

Maize Paper.

Over and above the abundant use which is now made of maize as an article of food, a new market is likely to be opened for this produce through the inventions for manufacturing paper and cloth out of the fibre. The *Social Science Review* says:—The Austrians are the people to whom we are indebted for this advance in science and industrial art; they have now brought the manufacture of maize paper to such perfection that nothing remains to be desired more, and although as yet they have been unsuccesful in producing a fine cloth, nothing but time is required to render that effort also perfect. Through the kindness of Mr. William Short, of Sheffield, we are indebted for specimens of the paper produced from the fibre of maize in the Vienna manufactory. The qualities vary from coarse, strong wrapping paper to the smoothest and finest writing paper. The paper glazes beautifully, but the most remarkable feature of it is its wonderful transparency. Some even moderately thick specimens are so transparent that they more than match our English prepared tracing paper, the most delicate lines being visible through it. The thicker sort equals our thick hot-pressed paper. The price of the maize paper is from a penny to twopence a quire. We shall hope soon to see the same paper manufactured in England. In the process there is no secret, nor is there anything different in principle from the manufacture of ordinary rag paper. [Specimens may be seen in the Library of this Board.—Ed. Jl.]

Spirits of Turpentine.

The very high price of spirits of turpentine resulting from the war, is causing great efforts to be made for producing it at the North. There are very large numbers of pitch-pine trees in many portions of the Northern States, and we are having inquries from correspondents of the proper mode of procuring turpentine from the trees.

The method of procuring pitch from the pine trees of North Carolina is to chop a box or pocket in the trunk of the tree. A long-bladed axe is used, the lower lip of the box is made horizontal with a deeper portion in the rear, and the upper surface is inclined; the box holding from one to three pints. From one to three boxes are made in a tree according to its size. The boxes are cut during the winter, and the pitch begins to flow about the middle of March. A thin shaving of wood must be taken from the top of the box once in eight or ten days so as to expose a fresh surface. The sap is collected by means of ladles from the boxes as they become filled, and deposited in barrels.

The spirits of turpentine is obtained by distilling the pitch in stills similar to those used for distilling ardent spirits. The article may be purified by a second distillation with caustic soda or potash. —*Scientific American.*

How to obtain Neat's Foot Oil.

The process of obtaining this kind of oil is very simple, and many farmers often throw away enough feet annually to furnish oil sufficient to keep all their harness, shoes, and leather machine belts in the best condition. By breaking a bone of the leg of a fat bullock or cow, it will be found full of an oily substance which often appears as rich and edible as a roll of excellent butter. This is neat's foot oil, and it is sometimes surprising to see how much a single foot and leg will yield when it is properly treated.

"In order to extract the oil, wash the hoofs clean —then break up the shin bones, the finer the better, and cut the hoofs and bones of the feet into small pieces. Then put them in a kettle of any kind, and pour in water enough to cover the bones. The kettle should never be filled so full that the water will boil over the top of it. The finer the bones are broken, or cut, or sawed, the sooner the oil will be driven out. Now, let the kettle be covered as tightly with a lid as it can be conveniently, and boil the bones thoroughly all day. Of course, it will be understood that more water must be poured into the kettle as it evaporates.

"The object of covering the kettle with a close lid, is to retain the heat as much as possible, and thus expel the oil from the bones. The hot water and steam will liquify the oil and expel it from the bones, when it will immediately rise to the surface of the water. Therefore it is very important that the water should not be allowed to evaporate so low that the oil that has risen to the surface of the water should come in contact with the dry hoofs and bones, as much of it will be absorbed by them, and will be lost unless it be again expelled by boiling.

"When there appears to be oil enough on the surface of the water, pour in a pailful or two of cold water to stop the boiling, or let the fire burn down. Now dip off the oil into some clean vessel, and boil them again until there is oil enough to be dipped off again. The oil that is obtained by the first boiling is purer than that which is obtained at the second or third boiling.

"There will be some water among the oil which must be evaporated; therefore, put the oil in a clean kettle and heat it just hot enough to evaporate the water, and the oil will be ready for use. Great care must be exercised in heating the oil, so as not to burn it. As soon as the oil begins to simmer a little, the oil may be removed from the fire, as the water has evaporated. Water in oil, heated to the boiling point, will be converted into steam instantaneously, as may be seen by allowing a few drops to fall into boiling oil or hot lard. [This occurs from the difference of temperature at the boiling point of the two liquids, that of linseed oil being 597°.—Eds.] Let the oil be kept in a jug corked tightly, and it will be ready for use at any time for years to come. In very cold weather, however, it will require a little warming before using it."—*Country Gentleman.*

Repairing the Silvering of Looking-Glasses.

The repairing of the silvering on the backs of looking-glasses has hitherto been considered a very difficult operation. A new and very simple method, however, has been described before the Polytechnic Society of Leipzic. It is as follows: clean the bare portion of the glass by rubbing it gently with fine cotton taking care to remove any trace of dust and grease. If this cleaning be not done very carefully, defects will appear around the place repaired. With the point of your knife cut upon the back of another looking-glass around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury; a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgum to where it was cut off with the knife, and the required piece may now be lifted and removed to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton; it hardens almost immediately, and the glass presents the same appearance as a new one.—*Builder.*

Miscellaneous.

To find Interest at 6 per cent.

Multiply any given number of dollars by the number of days of interest desired; separate the right hand figure, and divide by six; the result is the true interest in cents of such sum for such number of days at six per cent. If it is required to find interest at any other rate, first find the interest as above at 6 per cent., and then for 3 per cent., deduct $\frac{1}{2}$; 4 per cent. deduct $\frac{1}{3}$; 5 per cent. deduct $\frac{1}{6}$, and the remainder is the interest. For 7 per cent. add $\frac{1}{6}$; 8 per cent. add $\frac{1}{3}$; 9 per cent. add $\frac{1}{2}$; 10 per cent. add $\frac{2}{3}$; 11 per cent add $\frac{5}{6}$; and for 12 per cent. double the amount, and you have the interest. These rules are simple for such as are not accustomed to calculate interest, and may be depended on as reliable.

The Volunteer Movement.

The following from an English Journal is in some of its particulars, quite applicable to our position and circumstances.

This movement is not only a great and a good one, but also a sanitary and an economic one. How do we make this out? It is *great* because it impresses the warlike nations of the continent with our spirit, patriotism and power, and thereby suppressing in them any notions of our supposed weakness; *good,* because it withdraws many of those enrolled in its ranks from the social-evils of the tavern; *sanitary,* because the exercise it demands for the performances of its required duties, imparts health and strength to the physical system, whilst it animates the soul with a lofty idealism; *economic,* because it withdraws nothing from the industry of the nation, being self-sustaining, and being pursued at such hours as its members are released from labour and business. "To the economists of France," says Mr. Edwin Chadwick, whilst apparently having in his view the cause by which it was orginated, "we may appeal for representations against the waste which prevails there, and justifies or provokes the like waste of the *labour stock* of surrounding nations. To them it may be pointed out for consideration, that one year's cost of each soldier would sub-soil drain five acres of land permanently, and would repay the cost in five years by extra productions; that one year's keep of every regiment would sub-soil drain more than 250 miles of road, and serve as out-falls for the sub-soil drainage of the adjacent fields, which require drainage through a large part of France. Their yield of wheat does not average more than from thirteen to fifteen bushels an acre, with all their advantages of soil and climate, ours, in the corn-growing districts being double that." What a commentary does our volunteer movement, being, as we have said, self-sustaining and, we may add, of spontaneous production, make upon the immense standing-army-system, characteristic of greater powers of the continent. The circumstances which, even in times of peace, have compelled the withdrawal of 200,000 men in Prussia, 350,000 in Austria, 40,000 in France, always in barrack or camp, besides others in reserve, are such as the economists of these great powers might well expatiate upon, for the enlightenment of their separate subjects. Returning, however to Mr. Chadwick, he says that he would venture to propose "to our gallant neighbours the complete conquest of the soil of France itself, it being, economically, a more glorious achievement to double the production on their own soil than to double the area of their dominion by conquest, even if modern civilization allowed to clear off existing owners and occupiers from the country conquered. The cost of the keep of two soldiers for a year would provide permanent works of water supply and drainage, including the substitution of water closets for the pestilential cesspools, for two houses would reduce the sickness and death-rate of the inmates of one-third. The expense of one year's keep of one-tenth of their army, taking it at 500,000 men, would render this permanent service to every house in Paris, and would annually save eight or ten thousand of the population of that metropolis from perishing by foul air diseases. So would the expense of two iron-clad steamers."

ADVICE TO YOUNG MEN OF BUSINESS.

1st. Do not undertake a business with which you are not perfectly acquainted, any sooner than you would attempt, if blind, to survey a city. First thoroughly understand what you purpose to do. Serve an apprenticeship—do anything—before taking a single step involving risk.

2nd. Never attempt a business for which you have no taste or tact. Seek to do that for which you have a natural faculty and relish. Don't aspire to be a merchaut, when you should be a farmer, mechanic, or day-laborer.

3rd, Never connect yourself in partnership with those in whom you have not perfect confidence—with those to whom you would not be willing, sick or well, at home or abroad, living or dead, to intrust all your business affairs.

4th. Never attempt to do more business than you can safely do on your capital.

5th. Avoid taking the extraordinary risks of long credits, no matter what profits are in prospect.

6th. Give no credit whatever to any one who does not possess a good moral character.

7th. Supervise, carefully, your own business, (not your neighbour's), and look after your clerks, and see that they are faithful in the performance of all their duties.

8th. Let all those with whom you have dealings or intercourse, understand, distinctly, that you will not lend yourself, for the sake of trade, to do any mean thing—anything which your conscience will not approve of.

9th. Never lend your name by indorsement or otherwise, except under most extraordinary circumstances, and then let the act be guarded with every possible security.

10th. Never allow yourself, or your partners, to draw a dollar from the concern, to invest in any "outside operation" whatever.

11th. In forming a co-partnership, insist that a limited fixed sum only shall be drawn by each partner, for personal expenses.

12th. Under no circumstances whatever deal in stocks. Don't believe any one of the thousand marvellous tales of a fortune in that direction. They are a trap and a lie.

13th. Keep all your accumulated profits in your business, so long as you owe a dollar. When you have more capital than you can use, then it will be proper to invest it outside.

14th. Borrow of banks or other sources never, if it can be avoided. If temporary assistance is needed, seek it from a tried friend or from a sound banking institution, and then return the loan, on the day fixed, with the most rigid punctuality.

15th. Have an eye on the condition of the country, its crops, and the general prospects for business, and look out sharp for the movements of politicians, who in nine cases out of ten, care more for a re-election than for our commercial interests or our national prosperity.

There are other and most important matters which should not be forgotten. Keep good company. Value integrity more than money. Live within your means. Eschew wine, theatres, and fast horses. Use no profane language. Never quarrel with a partner. Be kind, considerate, and generous to clerks, and also to your unfortunate debtors. Cultivate the friendship of all.—Do your proper share in promoting the public weal. Be a man, a gentleman, and a Christian; and you will make sure of an inheritance in this life and of untold riches in the life which is to come.—*N. Y. Tribune.*

An Ounce Weight and a Ton Weight.

An ounce weight and a ton weight of iron will fall down a pit with equal speed and in equal time. Until about 300 years ago, all the learned men in the world disbelieved and denied it. Galileo, an Italian, taught the contrary to the popular belief. The University of Pisa challenged him to the proof. The leaning tower of that city was just the place for such an experiment. Two balls were obtained and weighed, and one was found to be exactly double the weight of the other. Both were taken to the top. All Pisa looked on, and crowds of dignitaries were confident that young Galileo then obscure and despised, but honored and immortalized now, would be proved to be in error. The two balls were dropped at the same instant. Old theory, and all the world, said that the large ball, being twice as heavy as the less, must come down in half the time. All eyes watched, and, lo! all eyes beheld them strike the earth at the same instant. Men then disbelieved their eyes, and repeated the experiment many times, but each time with the same result. The little ball was big enough to destroy a theory 2,000 years old; and had it been little as a pea, it would have destroyed it just as well, or even more quickly.

But how is this? Did not the earth draw down the large ball, which was double the weight of the smaller, with double force? Did not the double weight indicate the double force? Yes, truly; but in drawing down the large ball there was a double force of resistence to be overcome, and as the two forces acted in a given proportion of the large ball, and in the same proportion on the less, the vocality of the two was equal, though in bulk they were unequal. Let us suppose there to be two wagons, one with a load of five tons, and the other ten tons, and that the unequal loads are drawn by an equal horse-power—should not their speed be equal, though their weight is unequal? No. There must be double horse-power to draw the double weight, to obtain equal speed. Let a ten-pound weight and a one-pound weight fall to the earth at the same time, and the earth must draw down the heavier weight with ten times greater force than the other that they may have equal speed, and it does so. A ton weight of iron and an ounce weight, leaving the top of a pit at the same instant, would, therefore, at the same instant fall to the bottom.—*Scientific American.*

A Titled Machinist.

Lord Oxmanton was at some manufactory, the name I have heard, but have forgotten. In walking through the works he met with the principal, who, finding him well versed in the subject, and taking him for a practical man, explained some improvements he was about to make. His lordship discovered a fallacy in the plan and predicted that it would fail, but the other was confident in his calculation and so they parted. Some time afterwards, when his lordship was walking to the House of Commons, he was accosted in the street by one who turned out to be his too confident acquaintance, and who said: "I have been often, since we last met, wishing to see you. You was right and I was wrong, and I am going to make you an offer. My engineering foreman is going to leave me, and if you will come down, and construct the work your own way, I will give you a post." "I am much obliged," replied his lordship, "but I could not accept your offer without consulting my father." "One would think you were old enough," said the other, with some scorn, "to be out of leading things. And when can you hear from your daddy?" "I can give you an answer at once, "said Lord Oxmanton, who saw his father, then Earl of Rosse, approaching. When the latter came up he was informed of the offer, and, entering into the joke, said he was quite willing his son should accept the post if it did not interfere with his parliamentary duties. "And who is he?—and who are you, old gentleman?" roughly demanded the Brummagem. "I am Lord Rosse," was the reply, "and this is Lord Oxmanton." Eventually, the latter consented to look down for a few days in Warwickshire, and give his friend the benefit of his best advice, which ended, this time, in the thoroughly successful completion of the improvement in hand.—*Bristol* (*England*) *Times*,

Shoemakers, Straighten Yourselves.

Linneaus, the founder of the science of Botany, was apprenticed to a shoemaker in Sweden, but afterwards taken notice of in consequence of his ability and sent to college. The elder, David Pareus, who was afterwards the celebrated Prof. of Theology at Heidelberg, Germany, was at one time apprenticed to a shoemaker. Joseph Pendril, who died some time since at Gray's buildings, Duke street, Manchester square, London, and who was a profound and scientific scholar, having an excellent library, was bred and pursued the trade of a shoemaker. He was descended, it was said, from the Pendrill who concealed Charles II. after the battle of Worcester. Hans Sachs, one of the earliest and best poets, was the son of a tailor, served an apprenticeship to a shoemaker, and afterwards became a weaver, in which he continued. Benedict Baundoin a most learned man of the 16th century, was a shoemaker, as likewise was his father. This man wrote a treatise on the shoemaking of the Ancients, which he traced up to the time of Adam himself. [Thus Adam was a shoemaker and Eve a tailoress —"she sewed fig leaves together"—proving truly the antiquity of these two branches of industry and skill.] To these may be added those ornaments of literature, Holcroft, the author of the Critic, and other works; Gifford, the founder, and for many years the editor of the London Quarterly Review, one of the most profound scholars and elegant writers of the age; and Bloomfield, the author of the Farmer's Boy, and other works, all of whom were shoemakers, and the pride and admiration of the whole literary world. Anthony Purver, who was a teacher of the languages at Andover, England, and who received £1,000 for his translation of the Scriptures, served an apprenticeship to a shoemaker.

The Christian Gentleman.

He is above a mean thing. He cannot stoop to a mean fraud. He invades no secrets in the keeping of another. He betrays no secrets confided to his own keeping. He never struts in borrowed plumage. He never takes selfish advantage of our mistakes. He uses no ignoble weapons in controversy. He never stabs in the dark. He is ashamed of inuendoes. He is not one thing to a man's face and another behind his back. If by accident he comes in possession of his neighbors' counsels, he passes upon them an act of instant oblivion. He bears sealed packages without tampering with the wax. Papers not meant for his eye, whether they flutter at his window or lie open before him in unguarded exposure, are sacred to him. He professes no privacy of others, however the sentry sleeps. Bolts and bars, locks and keys, hedges and pickets, bonds and securities, notice to trespassers, are none of them for him. He may be trusted himself out of sight—near the thinnest partition—anywhere. He buys no office, he sells none, he intrigues for none. He would rather fail of his rights than win them through dishonor. He will eat honest bread. He tramples on no sensitive feeling. He insults no man. If he have rebuke for another, he is straightforward, open, manly. —He cannot descend to scurrility. In short, whatever he judges honorable, he practices towards every man.

Nativity of U. S. Population.

The census returns of 1860 give the following totals of the birth-places of the free inhabitants of the United States:—

Born in the United States	23,301,403
Born in foreign countries	4,136,175
Birth-place not stated	51,883
Total free population	27,489,461

The different races and nations of foreigners in the United States are represented as follows:

Ireland	1,611,304	China	35,565
Germany	1,301,136	Holland	28,281
England	431,692	Mexico	27,466
British America	249,970	Sweden	17,625
France	109,870	Italy	10,518
Scotland	108,518	Other countries	60,145
Switzerland	53,327		
Wales	45,763	Total foreign born	4,136,175
Norway	43,995		

Copper.

The whole earth appears to be more or less impregnated with this beautiful and useful metal, and the sea contains a notable quantity of it. Copper is in great abundance in various parts of the British Isles, in Hungary, in Siberia, in Cyprus, from which island it derives its name, and whence no doubt, on account of the geographical position of the island, it was principally procured by the Romans. It is also found in China, in Australia, and in Brazil—in fact, almost everywhere. It appears, however, certain that gold and silver were known to the ancients prior to copper. According to Ezra viii, 27, "Copper was as valuable as gold." Paul, in 2 Timothy iv, 14, lays a complaint against one Alexander, a coppersmith. These are the only instances in which mention is made of this metal in the Holy Scriptures. Copper takes a rank among metals from its peculiar color, which, when pure, is of a rose-like hue. Most metals when they become rusty lose their beauty, not so, however, copper, for it changes into various shades, from pink to a beautiful crimson, as in copper bronze powder, to blue, to green; hence the artist takes it as a pigment to produce upon his canvas "the fields and the forest." In the metallic state copper possesses so many useful qualities that various metal workers find it of great service. It bears such "wear and tear" that it was adopted as money at a very early period, and retains its good name to the present time. Copper is one of the best conductors of lightning; hence it will be employed to transmit "the flash" below the restless Atlantic, in forming the submarine telegraph between England and America. This metal is so sonorous that few musical instruments can be made without it. The Handel organ and "Big Ben" of Westminster alike owe their tone to copper. Musicians, electricians, artists, and money-makers are not the only persons whose "occupation would be gone" were it not for copper. Color-makers and dyers are much indebted to it, as well as a host of others who follow the same trade as "Alexander the coppersmith."—*Piesse's Laboratory of Chemical Wonders.*

Why Bees Work in the Dark.

A lifetime might be spent in investigating the mysteries hidden in a bee-hive, and still half of the secrets would be undiscovered. The formation of the cell has long been a celebrated problem for the mathematician, whilst the changes which the honey undergoes offer at least an equal interest to the chemist. Every one knows what honey fresh from the comb is like. It is a clear yellow syrup, without a trace of solid sugar in it; Upon straining, however, it gradually assumes a crystaline appearance—it *candies*, as the saying is—and ultimately becomes a solid mass of sugar. It has not been suspected that this change was a photographic action. That the same agent which alters the molecular arrangement of the iodide of silver on the excited collodion plate, and determines the formations of camphor and iodine crystals in a bottle, causes the syrupy honey to assume a crystaline form. This, however, is the case. M. Scheibler has enclosed honey in stoppered flasks, some of which he has kept in darkness, whilst others have been exposed to the light. The invariable result has been that the sunned portion rapidly crystallises, whilst that kept in the dark has remained perfectly liquid. We now see why bees are so careful to work in perfect darkness, and why they are so careful to obscure the glass windows which are sometimes placed in their hives. The existence of their young depends on the liquidity of the saccharine food presented to them, and if light were allowed access to this the syrup would gradually acquire a more or less solid consistency; it would seal up the cells, and in all probability prove fatal to the inmates of the hives.—*Chronicle of Optics, "Quarterly Journal of Science."*

Railway Tunnels in Great Britain.

At a recent meeting of the Institution of Civil Engineers, Mr. J. S. Fraser stated that the aggregate length of the tunnels, now daily traversed by railway trains in the United Kingdom, amounts to eighty miles; and, supposing their cost to have been on an average fifteen pounds on a lineal yard, their construction must have caused the expenditure of six and a half millions sterling—equal to $400,000 per mile.

A Science and an Art.

A science is a statement of existing facts; an art, a statement of the means by which future facts may be brought or influenced. A science deals in premises; an art in conclusions. A science aims only at supplying materials for the memory and the judgment. It does not presuppose any purpose beyond the acquisition of knowledge. An art is intended to influence the will; it presupposes some object to be attained, and it points out the easiest, the safest, and the most effectual conduct for that purpose.

Advantages of Cleanliness.

A general who, in Spain, was beleaguered with his batallion, was forced to put his men upon short rations. To occupy a portion of their time, as well as to amuse them, he sent them, daily, to a neighbouring river to bathe, when he found what he had not expected, namely, that under this course of daily ablution, his men were in better force, having greater power on their shorter rations than even other men had on their full rations.—Among soldiers of the line, for whom there is only hands-and-face washing provided, the death-rate is upwards of 17 per 1,000. When sent into prisons, where there is a far lower diet, sometimes exclusively vegetable, and without beer or spirits; but where regular head-to-foot ablution, and cleanliness of clothes as well as of person, is enforced, their health is vastly increased, and the death-rate is reduced to 2½ per 1,000.

Coffee as a Disinfectant.

This berry has long been known as a disinfecting agent, but the two following experiments illustrate a mode of using it not generally adopted:—A quantity of meat was hung up in a room which was kept closed until the state of the decomposition of the meat was far advanced. A chafing dish was then put in, and 500 grammes of half-roasted coffee put on the fire. In a few minutes the room was disinfected. In another room sulphuretted hydrogen and ammonia were developed, and 90 grammes of coffee destroyed the smell in about half a minute. The best way to effect this fumigation is to pound the coffee in a mortar, and then strew it on a hot iron plate.

Newly-discovered Bone Cave.

The *Popular Science Review* says :—"In making certain excavations in the rock of Gibraltar, the engineers have come upon a very extensive cavern containing the bones of numerous extinct mammalia and of man. From what we have already heard, this grotto bids fair to throw more light upon the question of the age of pre-historic man than any hitherto examined. As yet we have had no minute description of the fossils discovered in this locality, but we have been informed that a very great number of specimens has been forwarded to this country by one of the Gibraltar authorities particularly interested in the geology of the excavation."

Auriferous Quartz.

Geologists are divided in opinion as to the origin and deposition of gold. Some suppose it to be due to sublimation by means of internal igneous action, whilst others attribute it to aqueous and other surface action. It was stated at the last meeting of the Geological Society, that the quartz matrix in which gold is found imbedded in Australia, and other gold bearing countries, has little of the character of ordinary veins, and is commonly found to be stratified with, and comformable to, the adjacent beds. Quartz veins, on the contrary, are found at all angles and in planes forming all degrees of inclination with the beds which they intersect. Gold, in common with all other metals, is found disseminated through rocks of various kinds very often in slaty and schistose rocks, and in the Brazils, gold occurs disseminated through the micaceous oxide of iron. Those large and profitable deposits of gold, however, which offer such temptations to the miner in California and Australia, are usually found in quartz rock; and this quartz rock, as before explained, does not occur in veins, but as stratified laminæ, having the same inclination as the beds above and below it. Every well-ascertained fact is a step in knowledge, and it may be expected that this peculiarity of the mode in which auriferous deposits occur may throw some further light on their origin.

Preservation of Gum and Starch Paste.

The paste made by gum tragacanth and gum arabic, which is so extensively used by the apothecaries in this country, acquires, particularly during the warm season, a very unpleasant and even offensive odor in consequence of fermentation, which soon commences on exposure to the air. Oil of cloves, alum and other essential oils and salts are frequently added to counteract this tendency, with but partial success, the volatile oils merely hiding to a certain degree the offensive odor developed, and retarding the fermentation incompletely. For some time past I have availed myself of the antiseptic property of creosote, which may be added to these parts recently made, until its odor is faintly apparent. The result is their perfect preservation, no offensive odor being disengaged, and their adhesiveness is not impaired by keeping them for months.—*John M. Maisch, in American Journal of Pharmacy.*

Scraps of Science.

One of the most wonderful achievements of astronomers is the weighing of the bodies comprising the solar system.—The mass of the sun is 359,551 times greater than that of the earth and moon, and 700 times greater than the united masses of all the planets.

A flash of lightning on the earth would be visible on the moon in a second and a quarter; on the sun in eight minutes; on Jupiter (when furthest from us) in 25 minutes; on Uranus in two hours; on Neptune in four hours and a quarter; on the star Vega, of the first magnitude, in 4,000 years; yet such stars are visible through the telescope!

La Place, the great French astronomer, says:—"I have ascertained that between the heavenly bodies all attractions are transmitted with a velocity which, if it be not infinite, surpasses several thousand times the velocity of light." His annotator estimates that speed as being eight millions of times greater than that of light.

The circumference of the earth is 25,000 miles. A train travelling incessantly night and day, at the rate of 25 miles an hour, would require six weeks to go around it. A tunnel through the earth, from England to New Zealand, would be nearly 8,000 miles long.

The barking of dogs is an acquired hereditary instinct, supposed to have originated in an attempt to imitate the human voice. Wild dogs, and domestic breeds which have become wild, never bark, but only howl. Cats which so disturb the inhabitants of civilized countries by their midnight "caterwaul," are, in their wild state in South America, quite silent.

The dark races of men have less nervous sensibility than the whites. They are not subject to nervous disease; they sleep sound when sick; nor does any mental disturbance keep them awake. They bear surgical operations much better than the whites.

A certain species of fungus has been known to attain the size of a gourd in one night; and it is calculated that the celules of which it is composed must amount to forty-seven thousand millions. If it grows in twelve hours, this would give four thousand millions per hour, or more than six millions per minute.

How to View the Sun through the Telescope.

To use the full aperture of the telescope is of paramount necessity either in viewing the sun or planets. If the extinction of the light is effected by coloured glasses, the best combinations I have yet found are—first, that of two plane glasses of a shade between brown and violet, with one of a grass-green hue interposed; or second, of two green glasses, with a blue one coloured by cobalt between them. These allow scarcely any rays of the spectrum to pass but the yellow and less refrangible green; and they cut off almost all the heat. The perfection of vision is attained by using only the extreme red rays; but glasses which transmit these cannot be used on account of the heat they allow to pass. Whatever combination of glasses be used, they are, however, apt to crack and fly to pieces through the heat which they do intercept.—*Sir John Herschel in the Quarterly Journal of Science.*

Action of Fire on a Corpse.

When fire is applied to a living body a blister filled with liquid is soon raised, and if the heat be continued the epidermis is destroyed. But when the same heat is applied to a dead body the epidermis rises in the form of a blister, which is filled with vapour, and which presently bursts. This test has been proposed by M. Martin de Cordoux, to ascertain whether a person is really dead before the body is interred. In performing the test, the author recommends a small flame, such as the flame of a match, to be applied for a short time at about half a centimetre from the skin.

Lighting Gas by Electricity.

Many attempts have been made from time to time to effect the simultaneous ignition of a great number of gas jets by the aid of electricity. Thus all the lamps, not alone in a single street, but in an entire district, might be lighted in a single instant of time, and in addition to the convenience of such an arrangement, an actual saving of gas would be effected, because, now, certain lamps have to be lit too early in order that others may not be lit too late. In theatres, concert-rooms, churches, &c., it is obvious that great advantages would follow on the successful employment of any system of electrical simultaneous ignition.

Hitherto this has been proposed to be effected by a wire running from jet to jet, the circuit being partially interrupted by the introduction of a filament of platinum in proximity with the orifice through which the gas issues. This filament becomes red hot when a strong current of electricity is transmitted through the wires, and thereby lights the gas. One or two other expedients have been adopted, but hitherto with very partial success. But, although the simultaneous ignition of a number of jets cannot be effected with certainty, it seems far from improbable that the ubiquitous lucifer will be superseded by very simple and elegant arrangements. At a recent meeting of the Franklin Institute, Philadelphia, Messrs. Cornelius and Baker exhibited a very beautiful method of lighting gas by means of frictional electricity, arranged for use with a bracket, two portable lighters, and a table light, all being simple in arrangement and readily kept in order. These instruments are constructed upon the principle of the electrophorus. The electric bracket is arranged with a brass cup in the form of a vase, resting upon the bracket, with a connecting piece of hard rubber. This cup is lined with lamb skin covered with silk, and contains the hard rubber electric piece which corresponds in form to the inside of the cup. A coiled covered wire connects the brass cup with a wire attached to the burner, and terminating just above the burner. In order to light the gas, the stop is turned, the hard rubber piece lifted partly from the cup, thus liberating the spark and lighting the gas. The Portable Lighter consists of the same vase or cup, with the addition of a non-conducting handle. When the brass cup is lifted from the electric piece and held to the conducting wire of the burner, the gas is immediately lighted. Another portable instrument, called the Double Air-Tight Electrophorus, consists of two metallic tubes, each closed at one end, and connected together at the other, with a non-conducting ring of hard rubber, the inside being lined with lamb skin. A hard rubber rod is placed within them, the length of one of the tubes, and fitting them so as to move somewhat freely from end to end. When the movable piece inside is allowed to fall to one end, and the tube is raised to the connecting wire of the burner, this piece changes its place again, falling into the tube held by the hand. The spark leaves the upper end of the tube at the same time and lights the gas. The Table light Burner consists of the same instrument arranged upon a pivot regularly attached to the pillar light. The subject is worth the attention of gas engineers here, and we feel little doubt that simple, inexpensive, and elegant little instruments of the kind we have described would soon become popular among us.—*Building News.*

Coal Dust for Fuel.

In the coal mines of Charleroi, in Belgium, 800,000 tuns of coal dust have accumulated, impairing the working of the mines, and M. Dehaynin, Jr., and another company are working on this coal dust. After having it pulverized and freed of all strange matter, by machinery, this dust receives the forms and dimensions the best adapted for heating locomotives, by agglomerating eight parts of coal tar to ninety-two parts of coal dust. This mixture heated to 300 to 350 degrees, with superheated steam, becomes a paste, which is mechanically and powerfully pressed into cylindrical or rectangular forms, and, after having been cooled, solid, compact cylinders, of about five inches diameter, and weighing eighteen pounds, or prismatic blocks of about five and a half by seven and twelve high, and weighing twenty pounds, are obtained. These blocks which are very nearly the same density and weight of the solid coal, and they burn without giving obstacle to the circulation of air through the grate. This new combustible is warranted not to give more than six per cent. of ashes, and is now in great demand by railroad companies, on account of its greater heating power, and its being actually cheaper than the black coal. M. Dehaynin, Jr., and the other company manufacture now, annually, 255,000 tuns of this agglomerate.

Spectral Characters of Indium.

Messrs. Reich and Richter, the discoverers of this new metal, states that its presence is indicated in the spectroscope by two blue lines, one of which, the brighter, corresponds to division 98 of the scale, and the other to 135. In some cases this mode of analysis becomes unnecessary, as the instant the indium salt is placed in the flame of the Bunsen lamp, it communicates to it a bright violet tinge which they consider to be sufficiently characteristic.

Electricity produced in Factories.

At the last sitting of the Paris Academy of Sciences, a paper by M. Loir was sent in by the Minister of the Interior, in which the author endeavoured to show that a quantity of electricity was produced in large factories, and might be turned to account by means of the straps which generated it by their friction in communicating motion to the machinery.

Absinthe Poison.

"Some decidedly marked symptoms distinguish simple alcoholic intoxication from intoxication by the aid of absinthe liquor. Those abuse the latter poison experience stupefaction and terrifying hallucinations, and the enfeebleness of the intellect advances with extreme rapidity. These clinical differences suggest the supposition that absinthe by itself exercises a special action. In order to verify this hypothesis, I have sought to isolate, by the aid of experiments on animals, the poisonous effects due to absinthe from those which result from alcohol.

"Pretty numerous facts, observed on dogs, and rabbits which have been made to swallow the pure essence of absinthe leave no room to doubt the poisonous action of this substance.

"The essence of absinthe, in doses of 2 and 3 grammes, induces trembling, stupor, insensibility, and all the appearances of a profound terror. If the dose is raised to 5 and 8 grammes, it leads to convulsions like those of epilepsy, with involuntary evacuations, froth on the lips and stertorous respiration. These symptoms pass off, and do not result in death.

"These experiments appear to me worthy of interest, and prove that the absinthe liquor exercises a double toxical action which explains its effects on the nervous system."—*La Science Pour Tous.*

Artificial Production of Monsters.

A series of experiments have been made by M. Barthelemy on monstrosities, both artificial and natural, among the lepidoptera. He performed his experiments chiefly on the chrysalis, and endeavoured to cause modifications similar to those obtained by covering the eggs of birds with varnish. On covering the chrysalis with oil, it was found that they died before completing the metamorphoses; but on covering either the thoracic or abdominal part with wax, a retardation of development was perceived, but this was much greater with the thoracic parts. The cephalic part of the nervous system was much retarded in development, but the other parts of the ganglionic chain appeared to be developed as usual. He succeeded also in suppressing the development of the generative organs.

Process for Estimating the Value of Milk.

Take a known weight of the milk, heat it to boiling, then put it in a bottle, and allow it to cool to 12° or 15° (R.). Then shake the bottle until the butter separates, which can be removed, drained, and weighed. This simple operation twice repeated will give satisfactory results.—*Hozerman, Archiv. der Pharm.*, November, 1863.

Temperatures at which Metal boil.

These have been hitherto determined by means of an air phyrometer, but M. Becquerel has adopted another method for their determination. The instrument he employs is a thermo-electric pile, and with it he found that the following metals boil at the following degrees Fahrenheit: cadmium 1328; zinc 1,688; silver 1,681; gold 1,879; palladium 2,517; platinum 2,690. It is of some importance to state that certain of these figures are lower than those obtained by M. Becquerel, when using the air pyrometer.

A Scrap for Shoemakers.

Perhaps it may not be generally known that the reason why many shoemakers do not work on Mondays originated in the following tradition:—While Oliver Cromwell was encamped at Perth, he received intelligence of the death, by suicide, of John Monday, one of his most zealous and active partizans, who lived at a village a little to the north of Damhead. Out of respect to the momory of John, his patron (Cromwell) offered a reward in Perth, to the person who should compose the best eulogy on the death of Monday.—Among the claiments for the promised reward was a worthy son of St. Crispin, belonging to the "Fair City," who sent in the following quatrain:—

"Blessed be the Sabbath day,
And curs'd be wordly pelf,
Tuesday will now begin the week,
Since Monday's hanged himself."

Cromwell was so well pleased with this that the reward was not only granted him, but he also directed that the shoemakers should have henceforth the Monday of each week as a holiday—*American Artizan.*

Poison Bottles.

Poison bottles and poison corks, poison caps and poison stoppers, have all successively been tried, with the object of preventing careless or sleepy nurses from giving medicines out of the wrong bottles and thereby poisoning their patients; but they are all open to the objection that when the liquid for which they have been originally used is exhausted, the very nice looking bottle is generally replenished with eau de cologne, tincture of senna, or such like innocent compounds, and the object of having a peculiarly contrived bottle is thereby defeated. Perhaps the most unobjectionable of all these attempts to substitute a mechanical contrivance for ordinary caution and common sense, has been recently brought forward by Mr. Thonger, before the Pharmaceutical Society. It consists of a patent label having a border of sand-paper round it, thus appealing strongly to the sense of touch, which is presumed will warn the holder that danger is near. These labels are applicable to dispensing bottles and to the smallest phials, and possess an advantage over any other contrivance, as they can be stuck on any vessel, and as readily removed when the poisonous contents are done with, and the bottle is required for something else.—*Chronicle of Chemistry in the Quarterly Journal of Science.*

Pepsine from the Pancreas.

A lecture by Dr. Corvisart contains a hint for the makers of pepsine. The Doctor removed the pancreas from a man who died suddenly after inhaling chloroform, cut it into small pieces, and shook them up with 400 grammes of cold distilled water. After filtration, one portion of this liquor was rendered slightly acid with hydrochloric acid; another portion was made alkaline with potash, and the third part was left as it was. The digestive power of each was then tested with fibrin and albumen, the mixture being kept at about 40° C., and in every case the digestion was rapidly effected.

French Cement.

A certain quantity of india-rubber scraps is carefully melted over a clear fire in a covered iron pot. When the mass is quite fluid, finely powdered lime, having been slacked by exposure to the air, is to be added by small quantities at a time the mixture being well stirred. When moderately thick, it is removed from the fire and well beaten in a mortar, and moulded in the hands until of the consistence of putty. It may be coloured by the addition of vermilion or other colouring matter. It answers well for fixing on the glass tops of large preparation jars, but if moderately strong spirit be used a little air must be permitted to remain in the jar.

This cement is very valuable for mounting large microscopical preparations. The principal advantages are—that it never becomes perfectly hard, and thus permits considerable alteration to take place in the fluid contained in the cell without the entrance of air, and it adheres very intimately to glass, even if it be perfectly smooth and unground. If a glass cover is to be affixed to a large cell containing fluid, a small piece of the cement is taken between the finger and thumb and carefully rolled round until it can be drawn out into a thread about the eighth or tenth of an inch in thickness; this is applied to the top of the cell, before introducing any fluid, and slightly pressed down with the finger previously moistened. It adheres intimately. The preservative fluid with the preparation are now introduced, and the cell filled with fluid, which indeed is allowed to rise slightly above the walls. The glass cover, rather smaller than the external dimensions of the cell, and slightly roughened at the edges, is to be gently breathed upon, and then one edge is applied to the cement, so that it may be allowed to fall gradually upon the surface of the fluid until it completely covers the cell, and a certain quantity of the superfluous liquid is pressed out. By the aid of any pointed instrument a very little cement is removed from one part, so that more fluid may escape as the cover is pressed down gently into the cement. The pressure must be removed very gradually or air will enter through the hole. A bubble of air entering in this manner may often be expelled again by pressure, or it may be driven out by forcing in more fluid through a very fine syringe at another part of the cell, but it is far better to prevent the entrance of air in the first instance. The edge of the glass cover being thoroughly embedded in the cement, the small hole is to be carefully plugged up by a small piece of cement, and the cell allowed to stand perfectly still for a short time, when it may be very gently wiped with a soft cloth. The edges of the cement may be smoothed by the application of a warm iron wire, and any superabundance removed with a sharp knife. A little Brunswick black or other liquid cement may be applied to the edges for the purpose of giving the whole a neater appearance.

Sumac.

(Sumac *Rhus Glabrum*) has a large quantity of tannic acid in its leaves and bark, and is consequently useful in tanning leather.

Torpor produced by Artificial Means.

A scientific German publication states that among other curiosities, Dr. Grusselbake, professor of chemistry at the University of Upsal, has a little serpent which, although rigid and frozen as marble, can, by the aid of a stimulating aspersion, discovered by the Doctor, be brought to life in a few minutes, becoming as lively as the day it was captured, now some ten years ago. Dr. Grusselbake has discovered the means of benumbing and reviving it at his pleasure. If this principle could only be carried out for man as well as for reptiles, death would lose its empire over mankind, and we should preserve life as the Egyptians preserved their mummies. Dr. Grusselbake's process is nothing more, apparently, than simply lowering the temperature, just to that point where the cold produces a complete torpor without injuring any of the tissues. In this state the body is neither dead nor alive, it is torpid. The professor has laid his scheme before the Swedish Government, and proposes that a condemned criminal shall be handed over to him for the purpose of experiment? The savant purposes, if he can only get his man, to benumb him as he benumbs his little serpent, for one or two years, and then to resuscitate him from apparent death by his "*aspersion stimulante*"; verily, this German philosopher is a wonderful fellow, and the Swedish Government should let him have a criminal by all means.

New Method of Colouring Woods.

The surface to be coloured is smeared with a strong solution of permanganate of potash, which is left on a longer or shorter time, according to the shade required. In most cases five minutes suffice. Cherry and pear-tree woods are most easily attacked, but a few experiments will serve to show the most favourable circumstances. The woody fibre decomposes the permanganate, precipitating peroxide of manganese, which is fixed in the fibre by the potash simultaneously set free. When the action is ended, the wood is carefully washed, dried, and and afterwards oiled and polished in the ordinary may. The effects of this treatment on many woods is said to be surprising, particularly on cherrywood, to which a very beautiful reddish tone is communicated. The colour is in all cases permanent in light and air.—*Dr. Wiederhold, Neues Gewerb. für Kurhessen*, 1863, s. 194.

A New Grafting Wax.

One pound of rosin, five ounces of 95 per cent. alcohol, one ounce of beef-tallow, one table-spoon of spirits of turpentine. Melt the rosin over a slow fire, add the beef-tallow, and stir with a perfectly dry stick or piece of wire. When somewhat cooled, add the turpentine, and last, the alcohol in small quantities, stirring the mass constantly. Should the alcohol cause it to lump, warm again until it melts. Keep in a bottle. Lay it on in a very thin coat with a brush. In a room of moderate temperature, the wax should be of the consistence of molasses. Should it prove thicker, thin it down with alcohol. It is always ready for use, is never affected by heat or cold, and heals up wounds hermetically.