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CANADIAN MECHANICS MAGAZINE AND PATENT OFFICE RECORD

Vol. 6. JUNE, 1878. No. 6.

THE WILD BERRIES OF CANADA.

THERE are few, perhaps, who have taken into consideration the value of the wild berries which grow so plentifully in field and swamp, and on the borders of our forests, and which, year after year, fall ungathered. There is, to the distant settler, or the less distant small farmer, quite a small source of wealth growing annually almost at his door, which could be easily collected by his children, alone, after school hours. The great drawback to these field and forest fruits being turned to any profitable account, has mainly arisen from their very perishable nature, and the distance that settlers live from market towns, or places where they could be disposed of in all their freshness. In the New England States, which are so much intersected with railroads extending up forest streams, and into the very heart of the Green and White Mountains, nearly every station agent is employed to ship the fresh plucked fruit to New York, Boston and other large towns. So that as the fruit is packed up in wood boxes, of a circular form, with strong covers—each box holds a quart—it is delivered by the Express Companies to the fruit merchants in a perfectly fresh condition; whereas raspberries and strawberries, the most delicate of our field fruits, are packed by our people in uncovered pails, and get crushed into a mass by its own weight alone, and so jolted in the transit that it is generally sour and in a state of fermentation by the time it reaches our markets.

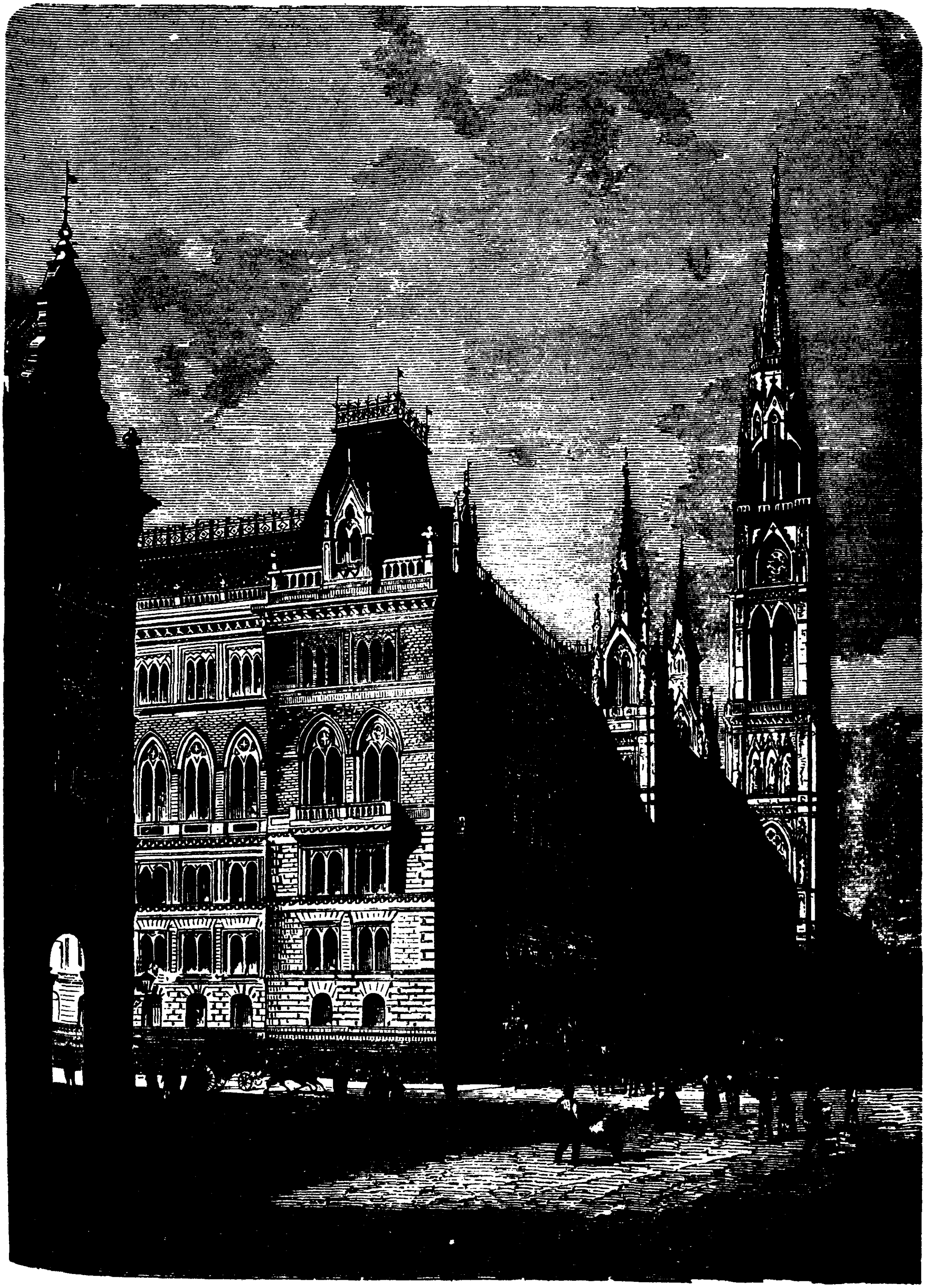
The Canadian settler not having these advantages of rapid carriage, is to a great extent helpless in the matter; and even if he knew the value of the fruit growing wild in the fields around him, almost at his very door, he is unable to benefit by what nature supplies him without labor or work to cultivate. But if from want of railroad conveyance, and knowledge as well, he is unable to take advantage of profiting by what nature produces in many sections of the country in such abundance, it is quite in the power of others to instruct him how to preserve these fruits, and send them to our markets in another form. There is no reason why these delicious berries, if preserved, or their juice made into syrups, should not form a part of our shipments to Great Britain as well as the trade recently grown up with that country in meat, fish and apples. Strawberries, raspberries and blackberries are the most perishable of our wild fruits, but if properly preserved in sugar would realize in our own markets 25c per lb.; then we have blueberries, whortleberries, cranberries, wild cherries and grapes, which could all be kept for some time fresh in their natural state, at least sufficiently long to stand a voyage of some days. The blueberry trade of the Saguenay might be turned to much more profitable account than it is at present. The first thing necessary to be done is to instruct the settler, or farmer, in the best way to preserve the fruit, in any form; this could be very well done by country storekeepers making arrangements with them for its purchase, and manufacturing it themselves into preserves or syrups, or to supply to the gatherer the necessary materials and instructions how to do so. A little experience would soon teach them the proper way to preserve the fruit, and then in a short time, we have no doubt that quite an extensive business in this line could be established, and with very beneficial results. It only requires a few enterprising men to enter into the trade with spirit, and it would soon grow into quite a business—and now is the season to give it a trial.

PHYSIOGRAPHY.

The new and shorter title for that branch of the curriculum of the Science and Art Department formerly known as physical geography, has only its shortness to recommend it; for the older title, properly understood, embraces all that can with advantage be included under the head of physiography. When Prof. Huxley first employed it to distinguish the subject of his lectures on natural phenomena in general from what was at the time understood by physical geography, the use of the term was perfectly legitimate, but nowadays physiography is simply another name for physical geography as understood by Prof. Geikie. Prof. Huxley tells us that, in his judgment, most of the elementary works upon that subject begin at the wrong end, and too often terminate in an omnium gatherum of undigested and unconnected scraps of information. The chapters on physical geography usually attached to the school-books are, in many cases, open to the charge, but their authors probably never intended to attempt to convey information of the kind which Prof. Huxley censures them for not giving. What the latter means is, perhaps, best explained by the following quotation from his preface, which we give exactly as it appears: "I do not think that a description of the earth, which commences by telling a child that it is an oblate spheroid, moving round the sun in an elliptical orbit; and ends without giving him the slightest hint towards understanding the Ordnance map of his own country; or any suggestion as to the meaning of the phenomena offered by the brook which runs through his village, or the gravel-pit whence the roads are mended, is calculated either to interest or to instruct." Prof. Huxley, then, considers that physical geography should treat of natural phenomena in general, and to assist in spreading his views he has provided teachers with an admirable textbook of the subject, based upon the lectures he delivered at the London Institution in 1869. In those lectures he endeavored to give his audience a view, in broad but accurate outlines, of the "place in nature" of a particular district in England—the basin of the Thames—treating his subject under such chapter-heading as springs, rain and dew, snow and ice, evaporation, the atmosphere, composition of pure and natural water, the work of rain and ice, of rivers and seas, of earthquakes and volcanoes, and of the slow movements of the land; the formation of land by animal and vegetable agencies, the distribution of land and water, the figure of the earth its movements, and its ruler, the sun. The "geology" is necessarily limited to that of the Thames basin, but that of other districts is introduced in the course of the interpretation of this branch of the subject. There is one great advantage in text-books from the pen of Prof. Huxley—that, although he can never be said to write down to the level of his readers, he is rarely, if ever, above the comprehension of average intelligence. The schoolboy who has learnt to understand what he reads—even if he has not learnt to spell correctly—can take up this volume, and follow its author step by step as he explains natural phenomena and their interdependence. Notes giving the etymology of words that may be new to the reader will afford all the assistance necessary, while the numerous diagrams and plates will instruct and interest. Among the charts are a map of the river basins of the British Isles, and a hyetographical map of England and Wales—a coloured map representing the amount of rainfall in different districts by the shading or depth of colour. This map is reduced from the one prepared for the report of the Rivers Pollution Commission by Mr. G. J. Symons. A tinted lithograph, showing the principal forms of clouds, gives a better idea of what is meant by the terms cirrus, stratus, cumulus, &c., than is usually conveyed by the ordinary wood engravings. The geological map of the basin of the Thames, and the contoured map of the same district, will enable the reader to apprehend the teaching of the author. Plates representing the Grand Canon and the Beehive Geyser of Colorado serve to illustrate phenomena which are not well exemplified in the Thames basin. Several other excellent illustrations are introduced in appropriate places, and it is certain that teachers will find in the book that ground-work to the introduction of a study of nature on which they may be able to build a superstructure adapted to the wants of their classes and the neighbourhood in which the lectures are given. Such a book as this might be used instead of "School-Board Readers"—at all events in the highest classes of our public elementary schools—with great advantage to the scholars, though the punctuation would need some modification to suit the habits of those who are given to "reading by stops;" but that, after all, is a small matter, on a par with the change of name from physical geography to physiography.—*English Mechanic.*

THE PROGRESS OF TELEGRAPHY.

In his address as President of the Society of Telegraph Engineers, Dr. C. W. Siemens managed to touch briefly upon nearly every branch of the subject of electric telegraphy—a feat which is becoming annually more difficult within reasonable limits. After alluding to the great increase in the number of members of the society—now nearly 1,000—Dr. Siemens made some remarks upon the progress of duplex telegraphy, which may be taken to include quadruplex, and may before long develop into a method of using six or eight pairs of instruments independently and simultaneously upon one conducting line. The success of the improved methods depends mainly, if not entirely, upon the perfect insulation and undisturbed condition of the line wire—subjects which are just now receiving much attention from telegraph engineers. Speaking of that great novelty of the day, the telephone, Dr. Siemens said that it owes its origin to the labours of several instigators, for in 1859 Sir C. Wheatstone devised an arrangement by which the sounds of a reed or a tuning-fork could be conveyed to a distance by means of an electric circuit, including at both stations a powerful electro-magnet. In striking any one of the tuning-forks differential currents were set up which caused the vibrations of the corresponding tuning-fork at the distant station, and thus communicated the original sound. It will be remembered that Prof. Dolbear has utilised this fact as a means of calling attention on a telephone circuit. In 1862 Reiss enlarged upon Wheatstone's invention, and was possibly the first to adopt the flexible diaphragm with which we have become familiar. Reiss's instrument, however, transmitted currents only of equal intensity, and was therefore incapable of reproducing the innumerable modulations of the human voice. The defects in the instrument of Reiss were remedied by Mr. Edison, who by establishing contacts with powdered plumbago, has succeeded in transmitting currents varying in intensity with amount of vibration of the diaphragm. Mr. W. H. Barlow also invented a recorder of the human voice, or logograph, which was communicated to the Royal Society in 1874, and, working on the same lines, Mr. Edison has recently produced his phonograph, by means of which the sounds can be reproduced by mechanical means. The beautifully simple instrument of Prof. Bell must, however, in Dr. Siemens' opinion, be regarded as a vast step in advance of all previous attempts in the same direction. The currents transmitted are so minute as to escape observation by the most delicate galvanometer, as the magnetic needle, however light, must be too sluggish to be moved visibly by impulses so rapid, as electro-dynamometer of extreme sensitiveness being required to render them appreciable. The rate of these reversing currents can, however, be accurately determined by means of a high-pitched tuning-fork, and Herr Röntgen, from experiments he has made, concludes that not fewer than 24,000 currents can be transmitted in one second. There is thus disclosed a rapidity of electrical transmission which is far in excess of the most sanguine expectations of telegraph electricians, and which opens out a new field for the cultivation of the ingenuity of the telegraph engineer. Dr. Siemens thinks that the telephone is capable of great improvements, and efforts should be directed chiefly towards increasing the relative amount of vibration of the receiving diaphragm, the object, we presume, being to obtain a great volume of sound. It is not impossible that the speediest way of attaining the desired result would be, not to seek to increase the amplitude of the vibrations of the diaphragm, but to utilise a series of diaphragms each adapted to reproduce its own series of sounds in the best manner. M. Trouvé has already made a step in this dieection, and as it is known that diaphragms can be dispensed with altogether, or



NEW TOWN HALL VIENNA.

may be made of wood, glass, and other substances, it would seem that a few patiently-conducted experiments must inevitably result in the discovery of a means of reinforcing or doubling the volume of the sounds reproduced by the electric pulsations in the telephone. Considering the minuteness of the electrical impulses and their high electro-motive force, Dr. Siemens considers it probable that they will be found capable of transmission to very great distances through conductors of comparatively small dimensions, if such conductors can be protected from disturbing influences. That consideration leads naturally to the question of underground line wires. The ordinary suspended wires are open to many grave objections, even when employed with the simplest instruments, for they are seriously affected by atmospheric electricity, by mutual induction and leakage where lines run parallel and are supported by the same posts, and the circuits are liable to be broken by the action of high winds and other agencies which not unfrequently cause the wires to snap, and sometimes throw down the posts. With the introduction of the duplex and quadruplex systems, as well as the telephone, it has become more than ever necessary to provide a better and more secure conductor, and from the experience gained by the Germans we know an underground wire can be worked over long circuits with ease by the most delicate instruments. Hence Dr. Siemens ventures to predict the gradual substitution of underground for suspended line wires. The construction of submarine cables occupied a considerable portion of the address, but the most important, perhaps, of the author's remarks were those in which he spoke of the deadening influence of the Government control of the telegraphs. Steady progress had been made in this country, but it is notorious that the more startling and more important innovations have come from the United States—the only civilised country in which internal telegraph communication is still in the hands of private companies. Dr. Siemens does not call in question the wisdom of the policy which dictated the purchase on public grounds of the telegraphs by the Government; but remembering, possibly, how Mr. Herring and others have been treated, he is clearly of opinion that open competition would be best, so far as the progress of telegraphic invention is concerned. The Acts regulating the work of the department allow the purchase of letters patent, whereby an interest is created in favour of particular instruments, to the prejudice of others of, perhaps, equal (some say superior) merit, and such a course is not calculated to stimulate invention. Dr. Siemens considers that the erection of lines for local and private purposes should have remained entirely outside the scope of a public department, in order that competition might have an opportunity of developing new applications, as in the case of the United States, where private and circular telegraphy is in advance of other countries. The question is one of vast importance, for there is great danger that, if the whole telegraphic work of the country is to become a Government department like the Post Office, however beneficial it may be for the general business of the kingdom, it will stifle invention, or drive inventors to other countries.—*English Mechanic.*

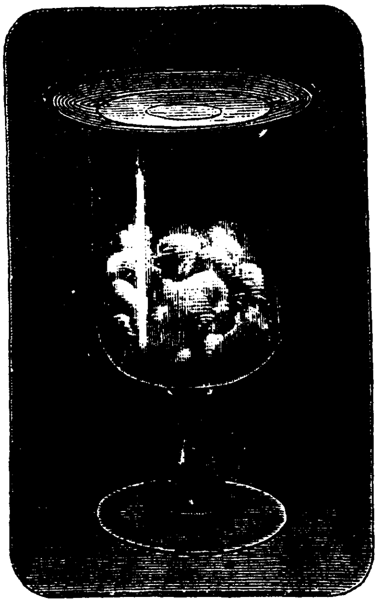
A Fortune in Toothpicks.

It seems that it was not the invention of the wooden toothpick, *per se*, that netted the inventor $50,000, but the idea of making the toothpicks out of soft, brittle wood. It it is said that, when first brought out, the toothpicks were made of hard, fibrous wood; but the inventor soon found that this would not pay, as the picks lasted too long, and he went to pine. It now takes four sound picks to get the broken end of one out from between the teeth; and it is the latter discovery that is said to have realized the inventor his fortune.

REMOVING SUBSTANCES FROM THE EAR.—Take a horse-hair, about six inches long, and double it so as to make a loop at one end. Introduce this loop as deeply as possible into the auditory canal, and twist it gently around. After one or two turns, according to the originator of the plan, the foreign body is drawn out with the loop. The method is ingenious, and at all events causes little pain, and can do no harm.—*Medical Record.*

CHEMICAL MAGIC.

A subscriber to *La Nature* communicates to that journal a simple trick, which is as deceptive as many of those per-



formed by professional "magicians." It is proposed to place the fumes of a cigarette, smoked by the operator at some distance, in a closed goblet, as shown in our engraving. The goblet is to all appearance empty, and the phenomenon of the white smoke wreaths inexplicable. But the vapors are formed by the admixture of muriatic acid and aqua ammonia, two or three drops of the former being put in the goblet, and the covering saucer being wet underneath with the latter. The quantity of the liquids is so small as to pass unperceived; but as soon as the saucer is placed on the goblet, white vapors of muriate of ammonia are formed, which closely resemble tobacco smoke.

Solid Sulphuric Acid.—The difficulty of safely transporting sulphuric acid has induced a large manufactory in Bohemia, where the Nordhausen acid was formerly produced, to ship the article in the state of the solid anhydride. The product is put up in soldered boxes of tinned iron, the solid acid having at ordinary temperatures but little action upon this metal. Besides the ease of transportation thus afforded, the high degree of concentration of the acid in this condition renders its use much more valuable than the ordinary material in certain chemical operations.—*Prof. Houston in American Manufacturer.*

How to Stain Wood.—M. Leo gives the following recipes in the *Pharm. Centralhalle:*

Yellow.—Paint with a hot concentrated solution of picric acid; dry and polish. Observe that picric acid is poisonous.

Imitation Ebony.—Paint several times with logwood extract; then treat with solution of ferric acetate (14° B.) until a proper shade is obtained.

Walnut.—Apply several times a solution of 1 part of potassium permanganate in 30 parts water. Wash, dry, oil, and polish.

Dark Walnut.—Same as the preceding, but after the final application of permanganate, treat with ferric acetate, which brings out black veins.

Mahogany.—Make a tincture of 15 grains alkanet root and 30 grains dragon's-blood with 500 grams alcohol (95 per cent) by maceration. Filter after three or four days. Paint the wood first with nitric acid, and after drying apply the tincture once or oftener, until the desired tint is obtained. To imitate the natural grain of the wood, ferric acetate may also be applied as may be found necessary.

THE Amazon river drains 2,500,000 square miles of land and is navigable for 2,200 miles from its mouth.

Cushman's Combination Lathe Chuck.*

The cuts show in detail a chuck described in the columns of THE POLYTECHNIC REVIEW, before being made known publicly. In all shops where the work done varies constantly and greatly in size and shape, it is desirable to have a "combination" chuck that can, quickly and at will, be made either concentric or eccentric (that is, with universal or independent jaws), without removal from the lathe-spindle. A good chuck should be light and strong, easy to handle, having a positive jaw-motion and a firm grip, and with no uncovered slots or spaces to let in dirt or chips. It may, in some cases, be an advantage if, when the jaws are *set* eccentrically, they can be *moved* together.

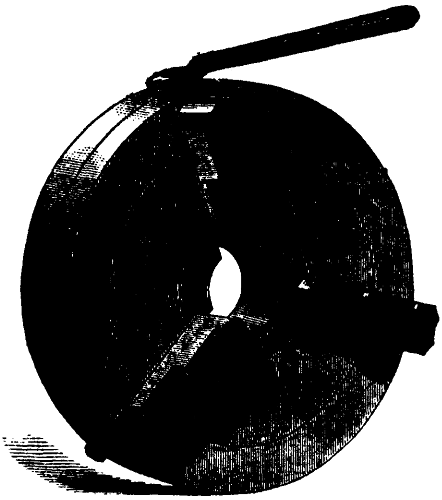


Fig. 1.

The Cushman chuck (which is made with three or with four jaws, as desired) has its jaws (which slide in radial slots on its face) long enough to completely close the slots against access of chips or dirt. Each jaw (which is three-stepped, as shown in the cuts) is reversible, so that the highest steps may be placed inwards to hold drill or reamer shanks, etc.

The foot or inward projection of each jaw is cut into a half-nut, *A* (see Fig. 2), and engages with a square-headed screw, *B*, projecting through the rim. The screw, *B*, bears below its square head, and inside the rim, a bevel-pinion engaging in a circular rack, *CC*. Turning any one screw will swerve the rack circle *CC*, and move every jaw concentrically. But the toothed ring, *CC*, rests upon a plain ring, *DD*, the periphery of which is threaded to correspond with the interior of the shell; hence, if this ring be swerved in one direction, it will be advanced towards the chuck-face, and *vice versa*. By this means the circular rack and its bevel-pinions may be meshed (as shown in Fig. 3), or unmeshed, (as seen in Fig. 4); in either

Fig. 2.

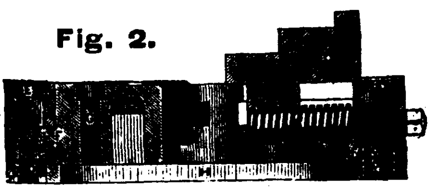


Fig. 3.

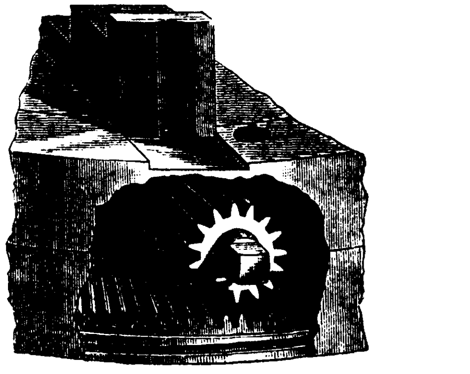


Fig. 4.

case the ring being held by a spring-catch. By pressing the thumb upon this catch the supporting ring may be turned by a knob at the back of the chuck (see Fig. 5), thus enabling the circular rack to be unmeshed and any jaw separately moved nearer to, or farther from, the center than the others, thus making an eccentric chuck. By again meshing the pinions

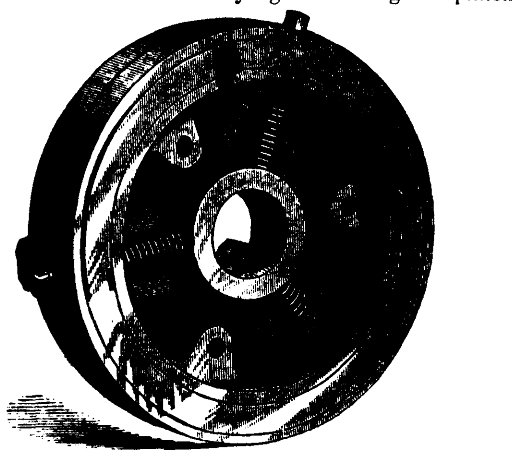


Fig. 5.

and rack, these eccentrically placed jaws may be moved simultaneously. As built, the center holes are proportionably very large; the parts are few, and of steel. *Polytechnic Review.*

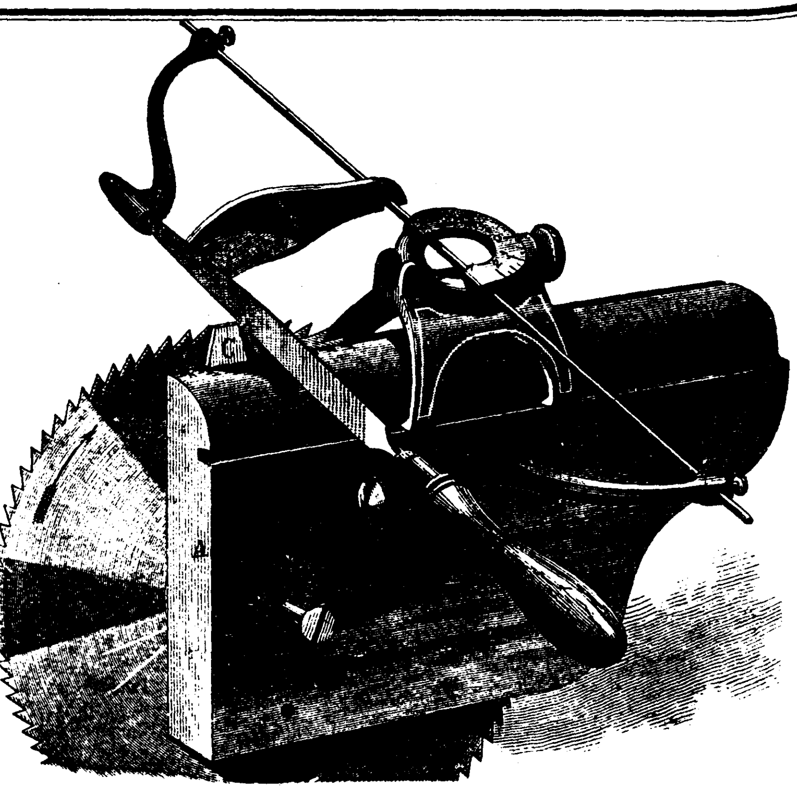
Permeability of Building Materials to Gases and Vapors.—Mm. Marcker & Berthold, of Paris, have lately made some suggestive announcements as to the permeability to gases and vapors, of various materials used for building purposes. They claim as the result of their experimental researches, that when dry bricks, sandstone, tufa mortar and cements permit vapors to pass through them, while granite, porphyry, slate, alabaster and limestone are practically quite impermeable. It will be inferred from these statements, therefore, that the cementing of cellar floors, etc., or laying them with bricks or tiles, while it doubtless will considerably increase the wholsomeness of a dwelling exposed to dangerous gaseous exhalations from sewers and the like, does not afford a complete protection. Whitewash applied to a wall, though it exerts for a considerable time a purifying chemical influence, does not afford nearly so good a protection against the passage of gases and vapors as a couple of coats of oil paint, while thick glazed wall paper reduces the permeability of mortar nearly 40 per cent. These researches teach an important sanitary lesson.

CIRCULAR SAW FILING GUIDE.

It is important in filing and setting saws that all the teeth have the same size, bevel, rake and pitch, and that the points are onthe same line—which line is a circular and cylinder saws a true circlelar, and in bands, and most blade-saws, a straight line. In cross-cut saws this line may be a moderately eonvex curve. Each saw should have a size and style of teeth suitable to its size and the work its has to perform.

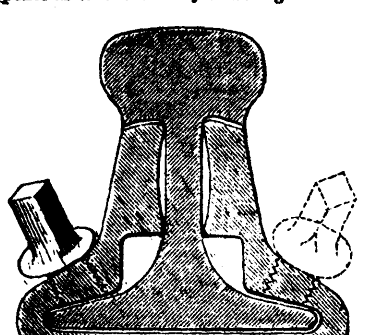
The cut illustrates an ingenious and practically valuable device* for enabling the filer to work correctly without possibility of error and without straining his eyes—there is one modification for flat-blade saws, that shown in the cuts is for joining small circular saws. It will be seen that on the guide there is an index circle divided and numbered from zero each way toindicate the bevel. The file is held in a frame having a guide wire which passes through the index ring. An index piece passing from the guide wire to the file shows at what vertical angle it is cutting, thus showing the " pitch" of the teeth.

As each tooth is filed, the frame follows. Another modification of frame is for the use of large flat files and without removing large circular saws from the mandrel. *Polytechnic Review.*



IMPROVED FISH-JOINT.

An improved fish-joint has been patented by Mr. S. Aldred, which has several features recommending it to engineers. In the first place it dispenses with the necessity for punching the rails—an operation to be avoided where possible, as much on account of the attendant expense as on the liability to damage the rail.



The new fish-plate can be adapted to the double-headed or girder rail, as well as to the flat-bottomed rail shown in the engraving. The mode of applying the fish-plate is obvious: it is slipped over the end of a rail, and another rail being placed in position the plate is made to clasp the two ends. Several methods of securing the fish-joint in place may be employed; but that preferred by the inventor is shown in the diagram. A couple of inclined holes, five-eighths of an inch in diameter are tapped in the plate, and fitted with steel stud-screws, which being forced home, effectually hold the plate, and clamp the rail down to its bearings, making a firm and elastic joint, the wings or upper portion of the fish-plate being forced against the under side of the head of rail by the action of the screw-studs on the bottom. We presume that some method of locking the studs in position will be adopted, for if not they will be liable to work loose, and though any dangerous shifting of the plate is unlikely, any looseness will inevitably tend to an exaggeration of the hammering action of the wheels on the ends of the rails.

Antidote to Snake Bites.—On the subject of snake bites, a very interesting communication has lately been received in India from an American gentleman, Mr. Koscicky, recommending the gall of rattlesnakes as an antidote for snake bite. Mr. Koscicky, who became acquainted with the antidote at Venezuela, states that it is not only cheap and infallible, but instantaneous and wonderful in its effects; crows and dogs in the last stages of the poison recovering as soon as the remedy was administered to them. The preparation of the antidote is simple: Three rattlesnakes' galls put into an ordinary wine bottle filled with 30° spirits, and allowed to stand for a week. In ordinary cases one or two tablespoonfuls are taken; in extreme cases, three to six. Mr. Koscicky recommends experiments being made in this country with other snake galls. Dr. Fayrer agrees with this recommendation, and refers Mr. Koscicky's letter to the committee at Calcutta for investigating snake poison. The idea, however, he says, is not a new one, for in the "Thanatophidia of India" the result of an experiment with the antidote is recorded; and he is of opinion that when brought to the test of scientific investigation, it will not prove more successful than the many other "antidotes" which have hitherto been tried and have failed.

American Women.—American women, says *Harper's Bazar*, take vastly better care of themselves than formerly. They have more acquaintance with hygienic laws, and hold them in far higher esteem. The days when they exposed themselves to dampness and wintry cold, in thin slippers and silk stockings; when they abstained from flannels next to the skin; when they pinched their waist to semi-suffocation; when they sacrificed comfort and health to what they conceived their appearance—these foolish and unhappy days have gone forever, have barely been known to the rising generation. Our women have no mawkish and morbid notions as to themselves; they no longer think that to be unhealthy is to be attractive; that invalidism and interestingness are synonymous; that pale faces and compressed lungs are tokens of beauty. They dress seasonably; they wear thick boots and warm clothes in bad and cold weather; they allow themselves to breathe freely, and they find their looks improved, not injured by the wholesome change. There are exceptions—many of them doubtless—but the rule is as we have described, and the exceptions are constantly diminishing. It may be safely said that all sensible women are becoming, if they have not yet become, converts to nature, and that they heed her behests, recognizing the great principle that what is not natural cannot be beautiful.

Calculations.—In a paper recently communicated to the Académie des Sciences, on the division of the circumference into equal parts, Ed. Lucas introduces a process for accomplishing a calculation in 30 hours which would have required 3,000 years of constant labour under the old methods. It would, it is stated, take more than 209,000,000 centuries, at the rate of 10 figures per second, to simply write out the numerical value of a quantity for which the expression can be written, in his formula, in less than half a second.

Effects of Sea-Water on Land.—Mr. Reinders, from one of the German agricultural experimental stations, says:—" Land that has been submerged by sea-water generally proves sterile for some time, in some cases for ten to fifteen years. This can be traced to the co-operation of the three following chemical causes, in addition to the mechanical injuries produced by the inundation:—(1) To the introduction of too great a proportion of chlorine salts; (2) To the hygroscopic property communicated to it, preventing it from drying properly; (3) From the formation of green vitriol or sulphate of iron, which is known to exert a very prejudicial effect on plant growth. Land which has thus been damaged should be drained as quickly as possible, sown with grass and clover, and allowed to rest. Experience shows that it recovers its fertility sooner if treated in this way than if cultivated all the year round as arable land."

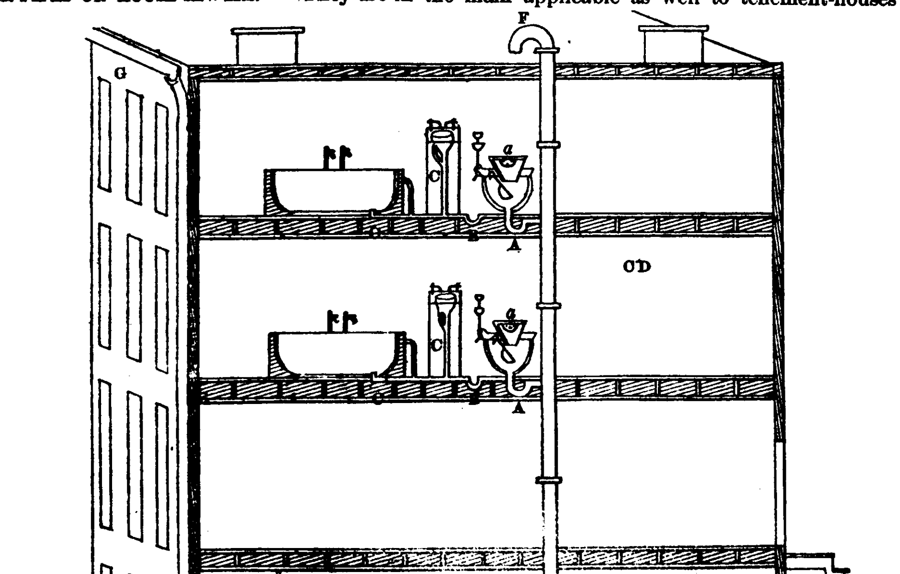
DEFECTIVE DRAINAGE OF DWELLING HOUSES.

The following report upon defective plumbing and house drainage, published by the Board of Health, New York, in August, 1877, will be found instructive to the members of the Board of Health and to the Sanitary Inspector of this city.

The subject of defective house-drainage and sewer-gas poisoning, has recently, in cities especially, been regarded with peculiar interest by sanitary officers, by medical men, and by the community at large. It cannot be denied that emanations from drains and sewers, if permitted to penetrate into dwellings, are detrimental to the health of the inmates, and liable at times to introduce specific diseases. Our people are now generally aware of this danger, and yet there is remarkable ignorance, even among the most intelligent classes, including the medical profession itself, of the manner in which these poisonous gases gain their insidious entrance, and of the methods available for their exclusion.

It is with a view of instructing the community in this regard that the following brief and simple statement has been prepared. The diagram does not pretend to represent an entire dwelling, but it exhibits all that is essential, and illustrates the vital principles of efficient house-drainage.

ABSENCE OR NEGLECT OF TRAPS IN HOUSE-DRAINS, VIZ. WASTE-PIPES, SOIL-PIPES, AND SEWER-PIPES OR HOUSE-SEWERS.



Traps (see A A A and B B B), are pipes so curved as to retain sufficient waste-water to seal them against the passage of gases.

Waste-pipes) see C C C C C and C D,) receive and conduct to the sewer-pipes waste water from bath-tubs, wash-basins, slopsinks, etc.

Soil-pipes (see C D,) drain the water-closets (see *a a a*) into the sewer-pipes.

In some houses the main waste-pipe and soil-pipe are distinct and separate, but in ordinary dwellings they are identical, as inthe cut (C D).

Sewer-pipes or house-sewers (see E,) receive and discharge into street-sewers the entire drainage of houses.

Traps, unless supplemented by other contrivances, afford little protection, becoming useless—

1st. By permeation of gases through their water when it has stood for a long time.

2d. By evaporation of said water under similar conditions.

3d. By air-pressure from street-sewers obstructed or filled to repletion.

4th. *By their contents being syphoned or sucked up*, when a vacuum is produced in their connecting drains by heavy discharges either of rain through the roof-leaders (which empty into the house-sewers) or of other water down the waste and soil-pipes (as from bath-tubs, etc.) The first two dangers are obviously to be avoided by frequent water-supplies. A remedy for the last two is *the adequate ventilation of waste and soil-pipes*. They should be extended, *full bore*, to a height of about two feet above the roof, their upper extremities being left open, surmounted by a cap, or curved downward (see F). *Every receptacle of waste-water* should be guarded by a trap (B B B). *It is important, however, that a free passage of air should take place through the waste, soil, and sewer-pipes; consequently no traps should be put at the junction of either of the first two* (i. e. K) *with the last. The requisite ventilation should be secured by a rear roof-leader emptying into the sewer-pipe* (see G G).

The house-sewer should be trapped at a point between the entrance thereinto of the waste or soil-pipe and its junction with the street-sewer (see H). *This is a most important precaution.* The best material for all drain-pipes is iron. *Every joint should be thoroughly secured and caulked with molten lead.*

The house sewer should be *an iron pipe* of 6 inches diameter. It should *never be constructed of brick and mortar*, which cannot long resist the passage of gases. Vitrified earthenware piping is less objectionable than brick, but is more liable to fracture and leakage than iron.

The house-sewer should be so laid as to either remain in sight or to be readily uncovered without digging. All the other drain-pipes *should be exposed to view* as much as possible, as when concealed, their defects may escape observation.

Yards and areas should always be *properly graded, well-paved and drained by pipes emptying into the house-sewer.*

Cellars and foundation walls should be rendered *impervious to dampness* as far as circumstances will permit. A persistently wet cellar should be provided with a separate blind drain *emptying into the trap of the house-sewer.*

Every dwelling should, if possible, be *independently* connected with the street-sewer. *No sinks or basins should be placed in sleeping-rooms.*

Privy vaults should not be permitted in the yards of private houses.

The above rules refer more particularly to private residences. They are in the main applicable as well to tenement-houses; but the latter variety of dwellings have some peculiarities.

Except in the better class of such houses water-closets are impracticable, as they will constantly be choked up with matters thrown into them by ignorant and careless tenants.

Here, therefore, the privy-vault is generally preferable. It must be well constructed, and when situated in a contracted yard bounded by tall houses it should be ventilated by a pipe of 8 inches calibre extending from a point at least 6 inches below the top of the vault to several feet above the roof of the highest adjacent building. The privy-vault should, if practicable, be connected with the street-sewer *by a separate drain-pipe of its own*, flushed by roof-leaders and yard-drainage.

These directions apply to ordinary privy-vaults. The best improved privy-vault known to this department is constructed by connecting a water-tight vault with the street-sewer by a discharge-pipe, which is provided with a movable plug so arranged that the vault can at all times be properly flushed when the plug is set in the discharge-pipe. The vault can be kept free from sewer-gases by means of a cap set over this plug dipping into the water in the vault. An iron grating should be provided in the vault to intercept large substances thrown therein.

By order of the Board.

CHARLES F. CHANDLER, *President.*

EMMONS CLARK, *Secretary.*

Japanese Paper.—Paper is extensively used in Japanese houses as a substitute for glass in the windows and sliding doors, and possesses not only the advantage of an immunity from breakage by the frequent earthquakes, but also occasions only a small loss when the house burns down, which happens often enough. Whatever may be its drawbacks, the use of paper for the above purpose is intimately connected with the system of house-building in Japan; and it will be long before it is entirely abandoned.

Wall papers are used in all the houses, and are manufactured, not in rolls, but in small sheets ornamented with all kinds of designs printed from wooden blocks, on which the pattern has been cut in relief. The colors having been mixed with some thickening paste, are applied to the block, either by means of a brush or by tamping, after which the paper sheet is laid on the block and rubbed with a flat rubber lined with the smooth bud-scales of bamboo, and used like a printer's ball. Very fine white mica powder is applied to the wall paper, and produces a metallic lustre resembling silver.

The crape-paper, which is a most perfect imitation of the real crape, is made by a very ingenious and most simple process. In the first place, that which may be called the matrix-paper is prepared by laying a moistened sheet of strong paper on a wooden board cut with fine grooves, running either parallel or crossing one another at very small angles, and by beating it with hard brushes, so as to force it into these grooves. It is then painted over with "shibu," in consequence of which operation the paper becomes so elastic that, when let go, after having been stretched out, it refolds by itself. For the production of crape several sheets of thin moistened paper are laid, alternately with sheets of the above-mentioned matrix-paper, one upon the other. The package is then wound on to a round piece of wood, and pressed several times with a strong lever, as if it were to be stripped off from this piece of wood. By means of this operation, the soft and moistened paper is forced into the folds of the matrix, and consequently folded in a similar manner. By repeating this manipulation ten or twelve times, each time unrolling it in order to change the position of the paper between the sheets of matrix-paper and by winding it again on the piece of wood, the paper becomes gradually folded in all directions, the intersecting points of all these folds producing the craped surface. Naturally, this process causes the paper to shrink considerably. This kind of craping is done with printed pictures, and also with colored papers, which are used for coiffures.

The paper imitations of leather are made in the same manner, but of stronger paper. After it has been craped, it is beaten with hard brushes into the moulds which produce the relief patterns; and these designs are afterwards painted as required with the help of "shibu," or the "Ye-no-abura," and lacquer.

Paper is also often used as a substitute for cloth, for umbrellas, rain-coats, etc., and even for dress cloth. "Shibu" and the "Ye-no-abura" are the means employed for rendering the paper waterproof. This cloth is generally made of paper alone, by beating it to make it soft, and impregnating it with gummy substances, to make it more resistant to the action of water. Another kind of cloth, called "shibu," consists of silk warp and paper woof. The paper is cut into fine strips twisted together into threads, and spooled for weaving. Paper strings, of great regularity, great strength and prettily colored, are made in a similar manner, and were formerly used in large quantities for tying up the hair. They are now only used for tying presents and other small parcels. [*Paper Trade Jour.*, vi, 21.]

Earlier Appliances in the Production of Iron.—At Greenock there is a large piece of cast-iron ordnance which is said to have been recovered from one of the wrecks of the Spanish Armada; and if this is an authentic account of its origin, and supposing it to have been manufactured in Spain, it proves the existence of appliances in that country which must have subsequently disappeared. Nearly fifty years previous to the time of the Spanish Armada, about 1543, a certain Ralph Hoge, or Hogge, of Bucksteed, in Sussex, had acquired great reputation for the manufacture of cast-iron ordnance; and "this founder," it is stated, "employed as his assistant Peter Baude, a Frenchman, whom he had probably brought over to teach him the improved method," whatever that may have been. Not long after, a covenanted servant of the Frenchman, John Johnson, excelled his master in the art of casting ordnance; and his son Thomas, in 1595, succeeded in casting 42 pieces for the Earl of Cumberland weighing 6000 lbs., or about three tons apiece. There is no record either of the exact period when the earlier blast bloomary developed into the blast furnace, and it is quite possible that the one had no material influence upon the development of the other, as the earlier apparatus produced little, if any thing, but malleable iron, and the blast furnace was exclusively employed for the production of castings. It is certain, however, that the fuel employed up to the middle of the eighteenth century was charcoal only, and that it was the rapid falling off in the supplies of timber that led to the almost total extinction of the industry, which, in the reign of Queen Elizabeth, had risen to the importance of a great export trade. Special enactments had to be enforced for the preservation of the forests; and the production of iron, which had risen toward the end of the seventeenth century to 180,000 tons, was reduced in 1740 to 17,000 tons. It was this pressure, arising from the scarcity of fuel, that became the mother of the recent discoveries and inventions in connection with the iron industries of this country. There is something inexpressibly sad in the biographies of many of the men who were the pioneers of these improvements. They frequently fell victims to the prejudice and ignorance of commercial Philistines, who looked upon their genius as madness and their improvements as impracticable.—*From "Great Industries of Great Britain."*

Bituminous Substances in Granite.—M. A. Julien communicates to the French Academy the fact of the occurrence of bituminous veins in granite in the neighborhood of Clermont-Ferrand. They were observed in a railroad cutting between Royat les Bains and Votria. The bituminous substance is occasionally black and soft, but oftener a species of dark-brown asphaltum with conchoidal fracture, which gives off in burning the characteristic odor of that substance. The veins vary in thickness from a few millimeters to 3 centimeters in diameter. So far as we are apprised, this occurrence is unique.

Another New Explosive has been devised by Prof. Emerson Reynolds, of Dublin, who lately presented a description thereof to the Royal Dublin Society. It is composed of a mixture of 75 per cent of chlorate of potassium, and 25 per cent of a substance named by the inventor "Sulphurea." When mixed as above described, the compound is a white powder, igniting at somewhat lower temperature than gunpowder, but possessing considerably greater explosive effects, and producing less of solid residuum. The new explosive, it is affirmed, has been successfully used in small cannons, but the inventor deems that its chief utility will be found in its applications to blasting, and for shells, torpedoes, and the like.

The new explosive is claimed to have, besides, the additional advantages that it can readily be made as it is wanted, requiring no skill whatever, aside from observing the proper proportions of the ingredients, while these last are quite harmless so long as they are kept apart.

"Sulphurea," we are further told, was discovered by Prof. Reynolds some ten years ago, and can be produced in any desired quantity from one of the waste products of the coal-gas works.

THE GATLING GUN IN A MAN-OF-WAR'S TOP.

THE GATLING GUN ALOFT.

In the old days of yard arm to yard arm naval conflicts, it was always customary to station good marksmen in the tops, their duty being to pick off the enemy's officers and disable the crews of the spar deck guns. Other men stationed aloft were provided with hand grenades, small explosive shells, which they threw upon the deck of the hostile vessel. The light mitrailleuse now used on men-of-war is a far more formidable means of offense than either single rifles or grenades, and, in fact, it renders impossible the working of exposed guns on any craft within the range of the hail of bullets which it projects.

Our engraving, from the London *Illustrated News*, represents an American Gatling gun as arranged for use in the main top of a British man-of-war, a significant example of the avidity with which foreign nations adopt the inventions which originate on this side of the Atlantic, especially when the same are of superior value for war purposes. The gun, as here depicted, consists of a number of gun barrels, which may be as many as ten, fixed around a main shaft, which is also combined with a grooved "carrier," to hold the cartridges, dropped into it one by one; and with a cylinder, in which are cut slots for as many gun locks as there are barrels to be fired. The whole of the above apparatus is raised or lowered, or moved to the right or left, by working a handle at the side. There is a drum fixed on the top, containing 850 cartridges, set in rows; this is so arranged as to be the feeder, by dropping the cartridges in succession into the carrier, from which they are shifted by lock action into the gun barrels, successively brought round with each revolution of the cylinder. The caliber of the gun barrels is 0·4 inch; they can be charged and fired with great rapidity, discharging five or six shots in a second. *Scientific American.*

FILTH DISEASES.

(*See page* 169.)

An ancient theory, which in our times has been revived and, we may add, established with almost the force of demonstration, associates the ultimate cause of many insidious and infectious diseases that afflict mankind, with the processes of putrefaction and decay, which dead animal and vegetable matter undergoes in passing from the complex constitution of the organized tissue to the simpler products that result from its decomposition. For some time, it was the opinion that contagious diseases were propagated by a species of malaria, which was defined to consist of organic matter in a state of *motor-decay;* and which when taken into the body through the lungs or other avenues, had the power of communicating the same condition of destructive activity to the body with which it was brought in contact. This view which originated with the great chemist Liebig, was received with very general acceptance among savans until within a comparatively recent period, when the brilliant researches of Pasteur have left no room to doubt that the substance that is endowed with infecting qualities is an organized body. He found that organized substances were contained in great abundance in the atmosphere. He proved that these organized germs really caused the phenomena of putrefaction and decomposition, by showing that vessels containing organic matter, left open to the air anywhere near the ordinary surface of the earth, were soon swarming with these organisms, and these matter itself speedily manifested the well known offensive evidences of decomposition; while the same organic matter with which nothing but carefully filtered air is allowed to come in contact, showed no traces of these organized bodies, and might be indefinitely preserved without decomposition. By these and numerous experiments of a similar nature he succeeded in demonstrating the connection of fermentation with organic growth, and that putrefaction and decay were processes depending upon the activity of living organized germs derived from the atmosphere; and in re-establishing the ancient theory that epidemic and other infectious diseases are originated and propagated by living germs, which being diffused in countless myriads from the body that has nourished them, enter the bodies of men and animals, and produce those disturbances designated by the various names of cholera, small pox, scarlet, typhoid and other fevers, diphtheria, etc., etc., by the development, within the body, of parasitic life.

The emanations from large masses of decaying vegetable matter, as from swamps and marshes, and which are generally designated as malaria, for want of a better acquaintance with their constitution, can be affirmed with certainty to be the causative agents of fevers. Animal and vegetable filth, and especially the excremental matters of men and animals, which, for want of adequate means for their speedy removal in the cities, are constantly present in greater or less quantity in proximity to dwelling places, contaminating the air and water, are the causes of frequent and fatal outbreaks of virulent diseases. These facts will be abundantly verified by the mortuary statistics of every large city. As an indication of the state of medical opinion upon this subject, the followeng extract from a report on the sanitary condition of Boston, made by a committee of its leading physicians, will suffice. The report after affirming that 25 per cent. of all the deaths of the city were traceable to causes preventable by the adoption of public sanitary precautions, declare that "*filth diseases*" occasion each year the greater part of the preventable mortality. "The diseases whose origin or transmission, are manifestly dependent upon infection by filth are typhoid fever, and certain forms of diarrhœal disease, the chief of these being cholera infantum. Certain other classes of diseases appear to owe in some measure their fatal type, their wide spread prevalence, if not occasionally their origin, to filth. We allude to scarlet fever, diphtheria, and perhaps cerebro-spinal meningitis, as well as certain exceptional forms of pneumonia. In the case of all these diseases, a partial dependence upon filth infection has been suspected, if not actually demonstrated. Moreover, it appears to be not unlikely that many other forms of fatal disease, whose origin and whose processes show absolutely no causal dependence upon filth, may nevertheless find easier victims in those sufferers whose general health has been previously undermined by filth poisoning, recent or chronic, and may owe their destructiveness in part to this powerful morbific agency. These considerations indicate that the sum total of deaths attributable directly or indirectly to filth is much greater than the yearly mortality occasioned by the manifest filth diseases would make us suppose."

Wherever the soil water, impurified by contact with unclean organic matters, sinks into the earth, it leaves behind it a moist and unwholesome residuum, and the warmer the air, the water and the soil the more energetic are its unwholesome influences. Whether the infectious matters are transferred from the soil into the well waters, or whether they enter the air directly with their gaseous products of decomposition or by evaporation, are merely incidental accidents which do not at all affect the result, since in every case, it is those who dwell upon or near such unwholesome soils who are the greatest sufferers. If the air of our dwelling houses is not frequently renewed by ventilation, or if water charged with organic impurities is permitted to saturate the soil about them, or if decomposing organic matter, (or what is the same thing, filth) is stored up in the neighborhood, or so disposed of that it is permitted to impregnate and saturate the soil about and beneath the house, or if the channels by which these offensive matters are removed from the house, as in the sewerage systems of cities and towns, are not properly constructed or guarded, the air that enters a dwelling thus environed, will be charged with disease-breeding emanations arising from the soil, or from the sewer pipes. The drinking water may become impregnated, and the unwholesome products thus introduced into the bodies of its inhabitants will, beyond all question, exert the most pernicious effects upon health, producing, according to the quantity of the exposure and individual peculiarities, consequences more or less fatal.

From the foregoing exposition of the influences of filth upon the causation of the most virulent diseases, we are prepared, when we couple the facts with the terribly filthy condition of the cities and towns of the middle ages, the utter absence of any attempt at private or public sanitation, and the almost universal poverty and wretchedness of the people, to comprehend the causes of the frequent recurrence of these frightful epidemics, which under the various names of the black death, the pest, the plague etc., on more than one occasion swept away a third of the inhabitants of Eurrope. In those benighted times, these terrible calamities were universally held to be manifestations of the displeasure of the Almighty at the sins of mankind, but the world has happily progressed somewhat since those days, and now we know them to have been the natural results of the ignorance of man; for in the centuries that have elapsed since the times when these calamities were common, the progress and diffusion of knowledge has manifested itself in a vast and universal improvement in the modes of living, and, as a natural result of the improved sanitary condition of cities and towns, these terrible scourges of the human race have happily been entirely banished from the civilized world, though they still rage with unabated virulence amongst the stagnated populations of Asia. But though much has been done to improve the sanitary condition of towns and cities by the gradual improvement of the social condition of the masses of the people, the establishment of elaborate public works, the maintenance of a more or less rigorous and intelligently conducted system of sanitary police, the introduction of numerous mechanical contrivances to provide for the removal of excreta and refuse of all kinds from the interior of private dwellings, and their rapid removal and translation through the public sewers, by means of intermediate channels, variously known as water closets, privies, sinks, soil-pipes, etc., etc., and more than all by the general diffusion of information amongst the people concerning the terrible dangers of filth infection, the general prevalence of zymotic diseases (which is the technical name by which germ diseases as a class are designated) indicates that much still remains to be accomplished, and not until their names shall have disappeared from the death lists of our cities and towns will the goal of sanitary science be attained.

We cannot close this brief paper without noticing the apparent contradiction that the fatality of filth diseases is not confined, as might at first be supposed, to the crowded courts and alleys of cities, amongst the classes that are badly housed, poorly fed, and by force of circumstances, or otherwise, not over-cleanly in their habits; but on the contrary, frequently extends to the very classes that it would naturally be supposed had taken care to exercise every precaution that sanitary science could suggest to guard against the invasion of disease. The reason is to be sought for in the frequent imperfection of the connections between the private household drainage and the public sewerage, and by which the very means that have been devised and constructed at times, at great cost and labor, to protect the family against the serious influences of sewer emanations serve the purpose of carrying the disease-bearing vapors into the very living apartments. What is actually needed is a continuous and rapid translation of our house refuse from its starting points, the water closet or the sink, through the whole series of connecting channels, until it is discharged from the outlet of the public sewer, far beyond the limits of the city and beyond the possibility of doing harm. Theoretically, this is what every system of sewerage should accomplish, but if this were actually realized in practice all danger from the escape of noxious gases from sewers intc the streets or from their entry into our dwellings would be practically nullified. But the proper functions of the sewer are never realized in practice, from a variety of causes, of which we may select as most prominent, the construction of sewers of brick or other porous materials with uncemented or otherwise imperfect joints that shortly permit the sewer to act as a drain or sieve, and allow its liquid contents to percolate into and saturate the soil; the frequent insufficiency of grades to produce a proper current, the improper insertion of house drains at right angles to the sides or top of the sewers instead of being inclined towards their exit, and the entire absence of any systematic effort to secure ventilation. The several imperfections of construction first named produce the stagnation of the sewage, by the diminution of its rapidity of flow and the packing of its solid constituents by which its putrefaction and the generation of poisonous gases are assisted.* The last named defect (want of ventilation) permits these confined gases to be pent up within the sewer walls, until by accumulation, the entry of wind, or of the tide water, at the opening of the sewer, they acquire sufficient tension to force the barriers which the imperfections of sewer construction have made it necessary for us to provide, to prevent their entrance into our houses.

Could a proper system of construction be practically realized, the dangers of filth infection from our sewers would be practically obviated, for its removal and passage through the sewer would be effected before it had time to putrefy, the generation of noxious gases within the same would be reduced to a harmless minimum; a proper system of ventilation of the sewers would so largely dilute the sewer air as to permit of its being passed out into the air either directly or through properly established conduits or filters, with the result that being no longer confined but finding easy access to the outer air, the sewer air would be no longer liable to be forced back through the traps and seals of our household sewer pipes.

The subject of sanitary engineering has occupied the earnest attention of the authorities of many of the more important towns and cities of Europe; and in France, England and Germany especially the sewerage systems of many cities have been brought to a high state of perfection, with the correspondingly gratifying result of largely diminishing their respective death rates. In this country, however, the rapid growth of our cities, the rapid change of officials charged with the conduct and supervision of public works, the very inferior quality of the work generally done by public contractors, and the peculiar disposition of many of our people to do as they please, and to resent interference (thus rendering the establishment and maintenance of a uniform system, devised with the view of a harmonious cooperation of the various branches of the system, public and private, under one intelligent management, next to impossible), have combined in most cases to keep the sewage systems of many of our cities in a very imperfect condition, although every year shows a material and gratifying improvement. We may have more to add in future articles on the subject of sewage management and related topics of sanitary engineering. *Polytechnic Review.*

*Sewer gas is found to contain, carbonic acid, nitrogen, oxygen, carburetted, phosphoretted and sulphuretted hydrogen, ammoniacal compounds, and certain fœtid organic acids.

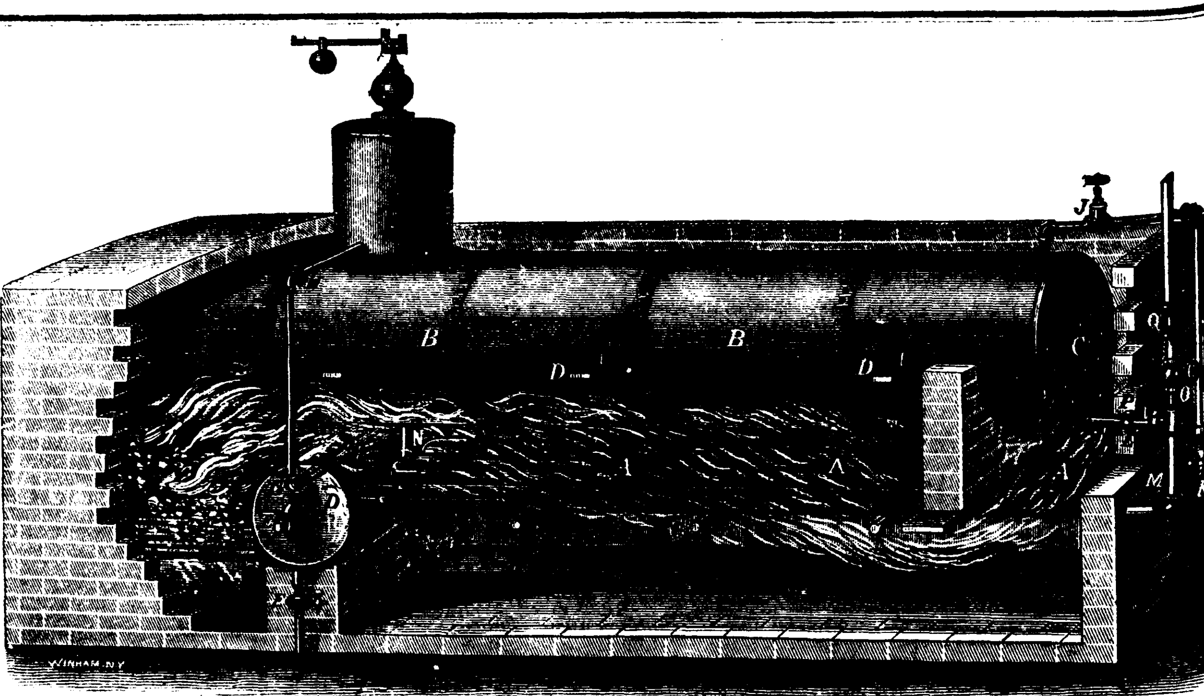
Some Uses of Glycerine.—Glycerine is said to be one of the best lubricants for machinery, especially when exposed to the air and to changes of temperature. It neither thickens nor turns rancid, neither congeals in winter nor dries up in summer. If preferred, it may be mixed with half its weight of olive oil. It does not attack metals, as many oils do.

Glycerine is a ready solvent of the aniline dyes, alizarine, and other coal-tar preparations. It tends also to preserve for a long time in a soft state the preparations of albumen, caseine, and gum used for mordanting and finishing, as its antiseptic properties keep these from becoming putrid. It is also very useful for printing colors on woolen, because it keeps the colors moist before steaming.

It is also useful in tanning, as it tends to preserve the natural weight of the skins, and keeps them from moulding or becoming brittle. The hides, lightly tanned, are plunged for twenty four hours into glycerine diluted with an equal weight of water (or to about 15° Beaumé), and are then dried.

In weaving, it is also valuable as an addition to the sizing, which never gets a bad smell, nor moulds, nor ferments. The warp never becomes brittle, even in dry weather and with open windows.

The chief adulteration of glycerine is with solution of sugar. *Boston Jour. Chem. from Le Teinturier Pratique.*



STEAD'S CIRCULATING GENERATOR FOR STEAM BOILERS.

IMPROVED CIRCULATING GENERATOR FOR STEAM BOILERS.

The principal advantages claimed for the invention herewith illustrated are a large saving of fuel, the rapid generation of steam, and increased durability of the boiler. The engraving shows the brick wall on one side of the setting broken away so as to give a clear view of the circulating apparatus and other parts underneath, and attached to an ordinary horizontal boiler. D is a riveted steel drum placed on a brick bridge wall, which is lowered so as to allow the top of the drum to be of proper height in relation to the grate and opening for the products of combustion. Through pipe, N, the water passes from the bottom of the boiler into this drum, where it is converted into steam and superheated water to a temperature higher than that in the boiler, to which it returns with great velocity through pipe H. A constant circulation is maintained and the formation of scale over the furnace thus prevented. Besides the gain in evaporation, which is a very important feature, there is also another advantage in having lime and other impurities in the water pass into the drum.

The peculiar arrangement of pipes, G and H, is such that impurities cannot return to the boiler, but can be blown out through pipe F, or if necessary, a together removed by means of the hand hole, E, which is placed at end or back of drum as may be necessary. In the rear of the drum, and extending to the back connection wall, is placed a coil of heavy lapwelded pipes, A A, which rests on bearers let into side walls ; this coil is connected with the boiler at back end by pipe, P, and at the top by pipe, J ; it is also connected with the feed pump by pipes, M O, and their branches. A deflecting wall resting on a heavy iron bearer is also built under and close to the boiler at the back end, as shown in the engraving. The combustion of gases ignited in the furnace is maintained the entire length of the boiler in the coil chamber. When the flame strikes the deflecting wall it passes through the openings between the coil pipes and returns backwards through the tubes in the boiler. The feed water for the boiler enters this coil from the heater in use or in a cold state by pipe M, and in its passage to the boiler, which is very rapid, it becomes heated to a temperature ranging from 250° to 300°.

To preserve the coil from any liability to burn, as well as to secure circulation from the back of boiler, a connection is made by pipe, P, with a pipe leading to coil, and an ingeniously constructed swing check valve, invented by the patentee of this circulating generator, is attached to this pipe. This valve is partially open when the feed pump is operating, and the water from the boiler unites with the feed water, raising the temperature of the latter to nearly boiling point before it enters the coil. When the feed water is stopped the check valve opens wide, giving unobstructed passage of the water from boiler to coil, through which, by its increasing temperature, a rapid circulation to the boiler is maintained. By opening valve K, the coil can be cleaned. (We are informed, however, that there is no liability to clog even where this precaution is neglected, so rapid and continuous is the circulation.)

The manufacturers state that the device causes a greatly increased power of boiler, "a gain of over fifty per cent being shown in some cases, due to the perfect consumption of fuel and utilization of heat, by which an evaporation of twelve pounds of water to one pound of coal is frequently attained." The circulation is claimed to be continuous, giving equalized temperature, even expansion, and contraction and freedom from scale deposit ; also rapid loosening of scale if formed in a boiler previous to the generator being attached. It is further claimed that there is additional security against explosion, inasmuch as the feed water can never enter the boiler when fired, except at a temperature almost equal to that of the water already in the boiler.

RESULTS OF THE CHALLENGER EXPEDITION.—The following observations are reported by Professor Agassiz : Where the depth is 1,800 to 2,000 fathoms inside the Windward Islands, the fauna corresponds to that of the Atlantic outside ; the animals having doubtless penetrated through the openings between the islands. All classes of the animal kingdom found in the ocean are well represented. Inside the Caribbean Sea the fauna is more specialized and characteristic. On the Challenger expedition it had been ascertained that the red clay ooze of the ocean bottom was largely a result of the decomposition of the shells of surface animals—a disintegrated portion of the limestone contained in those shells. Everywhere in the Gulf a similar deposit was found. Pelagic animals, chiefly mollusks, may be said to fill this sea from the surface to 8.10, or 25 fathoms in depth. The dredge always brings up a quantity of these half decomposed shells, and in instances where the test of proportion was carefully tried, it was found that more than half the mud consisted of shell fragments. There is no doubt that a stratum is forming at the bottom of the sea, due entirely to the coverings and hard parts of pelagic animals, which exist in swarm near the surface. On the question as to the existence of many animals in deep water, near neither the surface nor the bottom, Professor Agassiz is inclined to distrust the Challenger observations. The apparatus there used could not furnish proof as to the point whether the animals were really caught at the depth of 1000 fathoms or near the surface. The fruits of the towing net may have been gathered anywhere in its course.

In the course of this expedition the temperatures of the Gulf Stream were ascertained throughout, from top to bottom, and through the whole area. The fact had been first noticed by Dr. Carpenter that an inclosed sea, such as the Mediterranean, may have a higher temperature for its depths than corresponding depths of the ocean. The difference in that instance is 35°. It is caused by the fact that the ocean water flowing into the Mediterranean has to cross a barrier at Gibraltar; the depth there is about 500 fathoms, and the temperature at that depth is that of the sea to the east of it, the cold water at the bottom of the Atlantic either never rising so as to float over that barrier, or, if it does, being warmed to the higher temperature while in transit. The Caribbean Sea is similarly inclosed by barriers, and its waters at their greatest depth are only as cold as that of the lowest soundings on the barrier. Similar observations are on record about the Soloo Sea and other bodies of water thus marked off by submarine or surface elevations surrounding them.

EXAMINATION OF PLUMBERS AND THEIR WORK.

(*See page 169.*)

Considering the growing conviction that in large cities possessing systems of sewerage, the cause of zymotic diseases, such as typhus and typhoid fevers, cholera, diphtheria, scarlet fever, etc., is mostly to be looked for in sewer gas penetrating into the houses, and that this can be effectively prevented if plumbers only possessed the proper knowledge and common sense, it would be desirable to institute a Board for the axamination and licensing of plumbers, the same as we have for steam engineers; next to this we ought to have a Board of Inspection into the sewerage arrangement of every newly built house, and of every other house in which large plumbers' repairs have been made, the same as we have inspections of steam-boilers.

We maintain that by the ignorance and carelessness of plumbers far more people lose their lives than by the ignorance and carelessness of steam-engineers, even if we count all stationary, steamboat, and locomotive engines together. And this is a natural consequence of the status of the class of people who belong to the two professions. Steam engineers (notwithstanding there are some stupid ones, and that the profession is not as yet by no means up to the desirable standard of intelligence and refinement) are as a class intelligent and careful, while on the other hand plumbers (notwithstanding there are some intelligent men among them who have clear heads and understand their business) are as a class stupid and careless. We say this frankly, without fear of collision with them, as only the better class of plumbers do read, while the stupid and careless class do not read our journal.

Mr. Stanley, says the *Echo*, insists on calling the Congo the Livingstone, and will use that name in his forthcoming book. When Lord Houghton hinted that, notwithstanding the Stanley dictum, it would be still called Congo, he was rudely interrupted by the parent of the new name shouting, "The Continental geographers are willing to call it so; why shouldn't you?" Simply for this reason. The countrymen of David Livingstone desired to spare him no distinction, but they also wish him to be honoured in a legitimate fashion, and not by appearing in stolen plumes. It is a law of all scientific nomenclature that a name once given must remain, unless some other similar point of land or geographical feature in the same country had previously obtained the same designation. In that case it must be altered to avoid confusion. If the "Continental geographers" do not know this, it is time they made themselves acquainted with such an elementary fact in the science which they are supposed to cultivate. Were geographical names allowed to be altered to gratify the whim or the vanity of every new explorer, the map of the world would soon become an inextricable mass of confusion.

Another new use of the telephone is in the Norwegian herring fisheries. The fishing season takes place when the herrings come into the shoals to deposit their eggs; but it often happens that the fish accomplish their purpose and go back into deep water before all the fishermen can be warned. Some 120 miles of submarine cable have been laid and telephones connected with it, so that all the fishermen on the coast can be immediately notified.

The rubies recently made in Paris by MM. Fell and Fremy are described as being so like the natural gems that they cannot be distinguished from the latter by any test. They are hard enough to scratch topaz; they have precisely the same density as natural rubies; they crystallize in the same six-sided system; and their color is similarly lessened by heating them and restored upon cooling. The chemical and physical properties of the artificial gem appear to be exactly the same as those of the gem as it occurs in nature. This success of the French chemists is the more interesting from the immense comparative value of rubies. A true Oriental ruby of medium size is stated by a writer in the *Nineteenth Century* magazine to be worth ten times as much as a diamond of equal weight. One of thirty-seven carats, brought from Burmah in 1875, was sold on the Continent of Europe for fifty thousand dollars.

A recent discovery in telegraphy is likely, according to the *Student's Journal*, to cause a revolution in medical practice. Hitherto it has been necessary for country patients who wish to consult a London physician either to come to town or to send for their physician to visit their country homes. But it is not improbable that before long physicians will be able to remain in their consulting rooms and be kept advised by telegraph as to the exact state of their patients without regard to distance. It is reported that a physician, Dr. Upham, of Salem, Mass., recently demonstrated to an audience to which he was lecturing the variations of the pulse in certain diseases by causing the lecture-room to be placed in telegraphic communication with the City Hospital at Boston, fifteen miles distant; and then, by means of a special apparatus and a vibrating ray of magnesium light, the pulse-beats were exhibited upon the wall. By a judicious combination of Dr. Upham's apparatus and the telephone, a patient may possibly be subjected to a physical examination sufficient to diagnose heart and lung disease without going near the physician.

It was long supposed that the brackishness of Salt river, Arizona, was caused by the stream running over a bed of salt somewhere along its course. Its water are pure and fresh from where it heads in the White mountains to within 50 miles where it empties into the Gila. Fifty miles from its junction with the Gila there comes into it a stream of water that is intensely salt. This stream pours out of the side of a large mountain, and is from 20 to 30 feet deep. It is very rapid, and pours into the Salt river a great volume of water. Here could be easily manufactured sufficient salt to supply the markets of the world. All that would be necessary would be to dig ditches and lead the brine to basins in the nearest deserts. The heat of the sun would make the salt. Were there a railroad near the stream its waters would doubtless soon be turned and led to immense evaporating ponds. It is supposed that the interior of the mountain, out of which the stream flows, is largely composed of rock salt.

It is well known that errors are apt to be caused in astronomical instruments by the movements of contraction or expansion to which the foundations on which they rest or the buildings which contain them are subject. The observatory at Armagh, in Ireland, stands on a hill. In wet weather the instruments undergo a certain displacement which Mr. Nelson has lately endeavored to explain. At the base of the hill is a layer of clay, which expands when moist, and thereby lifts up all the mass of soil above it. Thus the true relation between the instrumental errors and the wet weather has been ascertained; but it is not always so easy to trace any connection between such observed errors and external changes. At Cape Town, in South Africa, Mr. Stone, the well-known astronomer, has noticed that certain errors in his transit instrument correspond closely with the variations in the volume of a stream near by; while similar errors are of such regular occurrence at the Greenwich Observatory, in England, that Mr. Dunkin, one of the assistants, suggests the possibility of a periodical shifting of Greenwich Hill.

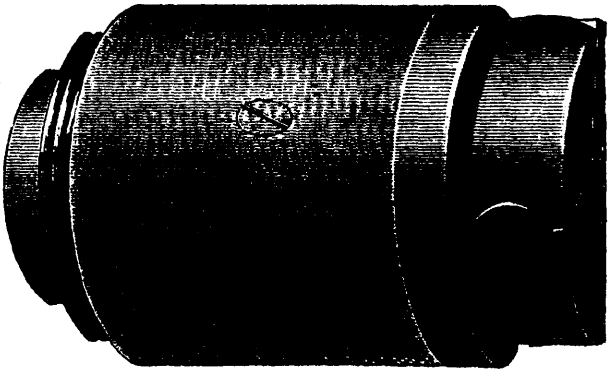
The process for using the clippings and refuse leather from saddlers' and shoemakers' shops is as follows: The leather shavings are washed clean, cut up fine and soaked in water and sulphuric acid, one per cent. of the acid being sufficient. The immersion must continue until the shavings become plastic, and the leather can then be pressed into moulds with only moderate amount of pressure. It can be rolled into thin sheets, and, though useful for many purposes, will not resist moisture. A little glycerine rubbed in will prevent its cracking.

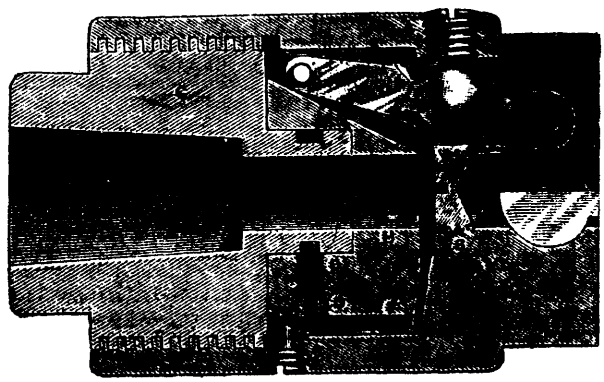
Ordinary brick-dust made from hard-burned, finely-pulverized bricks and mixed with common lime and sand, is a good substitude for hydraulic cement. The proportions used in general practice are one part brick-dust, with one lime to two of sand, mixed together dry, and tempered with water in the usual way.

THE "VICTOR" DRILL CHUCK.

(*See page 176.*)

The cuts show a drill-chuck which possesses the merit of being adjustable, self-tightening and having a strong grasping power. The clutches are flush with the face of the chuck, thus aiding in the adjustment of drills, and insuring that they will not be strained or broken by twisting or falling. The levers are enlarged and rounded at their fulcrums, forming spherical bearings which rest against adjustable set-screws, producing a sure and easy adjustment. The parts throughout are of steel.





To take the chuck apart, remove the screw C, then the chuck head G. When putting together, see that the levers stand in the same position as the follower H leaves them when removed. Then place the groove F in the follower on line with the screw C and by inserting something through the hole of the screw C, guide the follower until the levers enter it. The screw B can be removed, and a hole drilled through the head for holding long drills or wire if desired; but when used with a short or ordinary drill, the screw should be in its place to prevent the drill from pushing back, and also, to keep the inside of the chuck free from dirt. Should the chuck become worn so that it does not hold true, it can be readily adjusted by the set screws A. *Polytechnic Review.*

A TWO-STORY STREET.

A new solution of the rapid transit problem is offered by Mons. E. Regard, a French citizen of New York. It is, in brief, to afford greater facilities for passage on a street of a given width (or narrowness) by digging out part of it to a depth of six or eight feet, and over this sunken portion, at a height of three to four feet from the ground, throwing a strong roof which would serve as a foot way, a car track, or a carriage route, while the trench would also accommodate either a car-line or long-route traffic. The expense of such a system would not be great. The lower line of travel would have a head-room of 9 to 12 feet, and the advantage of being well lighted and aired, while the upper deck would be no more inaccessible than the familiar "summer roads" which, in many parts of our country, lie alongside of the main road, frequently more than four feet above or below it, and having frequent turn-out slopes. The question of drainage could very readily be settled. In the narrowest streets, of course, the plan would not serve, and in streets occupied by sewers and well-threaded with gas and water pipes there would have to be a great change made in these latter. It would have the advantage of being readily accessible, both above or below, and of not decreasing the value of property in front of which it ran. If the cars were narrow gauge (as all cars, whether for local or general traffic, should be, and will eventually be), the lateral room taken up would be inconsiderable.

LABOR.

Mr. T. Brassey, M. P., lately delivered an interesting lecture in London on "The Comparative Efficiency of British and Foreign Labor," which is condensed as follows in an English exchange:

It is asserted that English workmen have become relatively more idle and less skilled, and that the cost of production has become so great that British goods are being displaced by the exportations of rival manufacturers abroad. These complaints, however, were heard in every great seat of manufacture abroad. There had been a decline in the markets for the chief commodities of exports, which was steady, continuous and serious. The price of pig iron had fallen from 80/ a ton in 1874 to 51/6 at the close of December, 1877. In coal, tin and copper there had likewise been a great fall. But we are not alone in our misfortunes. The iron trade was also in a state of depression in France and Belgium, and in Germany it was stated to be one of the most prostrate industries of the empire. It was said that the falling off in the iron trade in England had been caused by the inflation of prices, and that that inflation was chiefly due to the rise in wages. But if we had suffered from this, the same difficulty had presented itself on the Continent. Mr. Brassey then referred to the manufacture of textile fabrics. In England, he said, the number of spindles at the end of 1874 was 39,000,000, whereas in Germany there were only 5,000,000, in Austria, 1,500,000, in Switzerland 2,900,800 and in France 5,000,000. Then the wages in England, he showed, were higher than in Saxony. Taking a factory of 64,000 spindles in England, as against one of a similar size in Saxony, the average earnings of the Saxon operatives are not more than 11/10 per week, while their English fellows, including men, women and children, earned 16/10 each, and this though the English factory hand works many hours less in the week than the German. But the German employer labors under this great disadvantage, that while the English establishment is worked with 3.1 employees to every 1000 spindles, the German requires 5.99 to every 1000 spindles, or nearly twice as many. But while he had endeavored to remove needless apprehensions for our industrial future, he was far from saying that no errors had been committed by masters and men. There were many delusions which the sharp lessons of adversity might tend to dissipate. In this point of view nothing could be more instructive than an examination of the state of the labor market in the United States. The increase of personal extravagance which prevailed in America

CHEMISTRY, PHYSICS AND TECHNOLOGY.

The Latest Fire Escape illustrated in one of our contemporaries, is an elastic air cushion, supported upon standards which rest upon springs. The springs being contained in vertical tubular posts. The rest of the device is a wagon body mounted on wheels so as to be capable of being drawn into any position where it may be required. The person alighting upon the elastic cushion is supposed to slide gently through the central opening in the same and take his (or her) place on a seat conveniently provided, to await (apparently) the arrival of the next victim. From the description of the apparatus, however, and the size of the vent through which the rescued is supposed to disappear, we opine that he (or she) would get as bad a bouncing as did the redoubtable Sancho Panza in Cervantes' happy story, before taking the stool "for the purpose hereinbefore described." *Polytechnic Review.*

Wood Pulp from Spruce.—A correspondent has sent us a sample of wood pulp made from spruce. This sample is free from chemicals and is of a very long, tough fibre. The color is of a slightly creamy tint, but is quite good for this class of pulp. We observe in the sample small shives of wood, which, after being reduced to pulp and passed through a fine screen, may disappear. This is the best specimen of pulp made from spruce that we have seen, and it denotes progress in the treatment of one of our best vegetable fibres.—*Paper Trade Journal*, vii.—84.

Improvement in Processes of Obtaining Fibre from Wood for Paper Pulp.—A patent has been granted to William R. Patrick, of Marinette, Wis., for an improvement in paper pulps. This invention relates to the manufacture of wood pulp for paper, and it consists in boiling the pulp after it has been ground, either with or without alkali, for the purpose of removing all resinous or foreign matter from the pulp. In this process for reducing wood to pulp the wood is first cut out in lengths suitable for the grinders, and these pieces are placed sidewise to the stones or grinders, to have the fibres torn off lengthwise of the wood. The wood being thus, by grinding, reduced, is called "half stuff." It is then passed direct from the grinders to a wet machine, thence into the well-known rotary boiler used in paper mills. Here is added one pound of soda ash to every one hundred pounds of wood pulp. After charging the boiler, half of which is water, the man holes are closed, and contents are boiled, not steamed, for twelve hours or more. Some stock needs no alkali, and is therefore boiled only in clear water. This boiling of the pulp is for the purpose of removing all resinous or foreign matter it may contain, also softening and removing the incrustating substance of the wood. By thus boiling the wood pulp more of it can be used in connection with other stock, and it gives a much better finish to the paper. The entire process of preparing the wood for paper pulp is as follows: The wood being cut and ground, the pulp passes from the grinding machine and is conveyed to a wet machine, similar to those used in a paper mill. This presses the water out of it. From this it is conveyed to the boiling apparatus, where it is boiled for the purposes mentioned. After boiling it is conducted to drainers, to relieve it of the water or liquid it accumulates while boiling. From here it is conveyed to the washing engine, and after being thoroughly washed and reheated it is conveyed to a stuff chest below. From this chest it is pumped to another wet machine, and immediately run into the form of board, ready to be sold as paper stock. The claimed advantages of this process are: The half stuff is taken from the grinders and treated the same as all paper-makers treat jute. It requires no extra outlay for boilers, and the common open tub, without pressure, can be used. The inventor claims the process of preparing wood for paper pulp, which consists in removing the fibres lengthwise of the wood, conveying it to a wet machine, and boiling the half stuff, either with or without alkali, for the purpose of removing all resinous or foreign matter from the pulp.—*Paper Trade Journal* vii—81.

The Strength of Steel Castings.—M. Gautier, in a paper lately read before the British Iron and Steel Institute, gave an account of some remarkable experiments with artillery produced from steel fabricated without blows, or, in other words, metal which had been simply cast, tempered and reheated. A tube 8 inches in diameter was made with a hole 5 inches in diameter so as to leave but 1¼ inch of metal on the outside. Nothing was done besides tempering and reheating, after which the tube was grooved, and a screw head adapted to carry the breach. Twenty shots were first fired with 9 pounds of powder and a 40-pound shell, then 10 shots with a shell weighing 47 lbs., and thereafter the charges of powder were successively increased by one-fourth of a pound every 10 shots, the shell remaining identical until the one hundredth shot was finally fired as the conclusion of the trials. On examination no fissure of any kind in the metal was discovered, and the deformation of the chamber was found to be not so much as half the average of that in forged steel tubes. Previous to this test several pieces of the metal were cut perpendicularly from the axis of the tube. The average results, as recorded, of four trials made according to the manner thus described, were as follows: Limit of elasticity, in tons, per square inch, 22.35; charge of rupture, 39.67; lengthening, per cent., 12.47.—*Iron Age, March* 14.

Trial of Armor Plates.—The Sheffield *Independent*, in a recent issue, gives some interesting facts in regard to tests made of a compound iron and steel plate by John Brown & Co. on the system patented by Mr. Ellis. This plate has been tested by the War Department at Shoeburyness with excellent results. The plate measured 8 feet by 6 feet 6 inches, and was 9 inches thick, the steel face and iron back being equal in thickness. The plate was fired at under the ordinary conditions of test adopted by the war office, without any backing, with the 7-inch gun and a full charge of 30 pounds of powder. The first shot was fired at near the top edge, about equidistant from each side, and two subsequent ones lower down, within about 2 feet of the first. The average indentation was about 6 inches, the effect by the three shots on the back of the plate being only a slight crack made by the first shot, which was caused probably by its proximity to the edge of the plate. There were several fine cracks on the face, but none deeper than the thickness of the steel, and there was not even a sign of separation between the iron and the steel. To give an idea of the advantage of these compound plates, it must be understood that a similar shot against an iron plate would have produced double this penetration, that is to say, the shot would have penetrated the full thickness of the plate, and nearly to the extent of the bulge raised at the back, with considerable damage to the back of the plate. In a steel plate the same shots would have produced cracks the entire thickness, thus breaking up the plate. As only about one-fourth of the plate was experimented upon, it is intended to use it for further tests with a 9-inch gun.

The Annealing Temperature of Metals.—It is an interesting fact that this has never been exactly determined. All that is known about it is that there is a fixed and rather narrow range of elevated temperature peculiar to each metal, without the limits of which annealing does not take place, and that the absolute mean temperature for each metal seems to be greater in some proportion as the fusing temperature of the metal itself is higher. Platina, when hard from wire-drawing or lamination, is not annealed under an intense white heat; wrought iron, at about a bright red, in some sorts not before a yellow heat; copper, at a low cherry red, and in case of metals of a very ready fusibility, such as tin and lead, their annealing temperature appears to be so low that the heat involved in them by conversion of mechanical force in laminating or wire-drawing, is sufficient to keep them annealed, that is, they cannot be hardened by such processes. It is this curious fact that explains the well-known peculiarity in rolling sheet lead or "drawing" lead pipes by the older methods, namely, that the rolling or drawing can be accomplished by less total expenditure of power if performed fast than much more slowly.—*Iron Age.*

The Organic Origin of Limestones.—Prof. W. C. Williamson has lately given definiteness to the long cherished belief of geologists, that the great rock masses of limestone that enter into the composition of the earth's shell had their origin in the gradual accumulation of the remains of microscopic organisms. His observations were directed to the task of studying limestones in which no trace of these organic remains were visible, and has been fortunate enough to have for a specimen a slab of rock containing a large chambered shell. Outside of this fossil the limestone slab, the evidences of the organic constitution of the rock was barely distinguishable, the relics of the microscopic shells being only faintly recognizable here and there; but within the large shell they were found in excellent preservation, the body of the latter having resisted the disintegration action of the percolating water, containing carbonic acid and other solvents, sufficient to protect the delicate remains of these microscopic organisms from the solution and disappearance which they suffered outside of it. The dense texture of most of the limestones, which frequently exhibit no trace of their organic origin, can readily be explained to result from the metamorphism which the rock masses undergo by the solvent action of meteoric water containing carbonic acid, which, in time, more or less completely disintegrates the delicate shelly relics of which they are composed, and gradually renders the whole texture of the rock homogeneous and uniform even to the microscope.

Geological Evidences of Evolution.—We see that the geological record, so far as it goes, is more authentic and credible than any uninspired history, since it contains no personal equation, is the product of no prejudice, passion, or partial view, which color all human histories, but is automatic and necessarily true; that the earlier chapters of this history, those which contain the records of the beginning of life, are for the most part obliterated and ineligible; that there are many gaps in the narrative which doubtless will be, but up to the present time have not been filled; and thus that the record consists of a series of chapters, more or less disconnected. The evidence is conclusive that the earliest fauna and flora of which we have any knowledge consisted of fewer elements, and those of simpler structure than in any succeeding age. Also that there has been a constant and progressive increase in the variety of animals and plants, and in the complexity of their structure. This progress of life is so evident and general that we cannot resist the conclusion that it is the expression of law; in other words, that it is the operation of forces as distinctively determinative as those which produce and guide the motions of the heavenly bodies. The parallelism of the progress of life through the geological ages with that of the growth of an individual from a germ, is so close that most students of palæontology are inspired with the conviction that the life forms of the different ages are links in a connected chain; in other words, that the latter forms are derivations from those which preceded them. This is evolution, and therefore most geologists are evolutionists, and they believe that evolution is not only exemplified in the progress of life, but that it is a law of nature.—*Prof. J. S. Newberry.*

For the detection of resin in shellac take 5 grains of shellac finely powdered and boil with 15 grains of petroleum benzine. The dissolved portion is evaporated and weighed. If the residue be greater than 10 per cent. of the shellac, such excess is due to the presence of resin. Another method is to take 25 grains shellac and boil the same with 2.5 grains of caustic potash and 50 c. c. of water until all is dissolved. If the shellac be pure, the solution is of a red color and transparent when held to the lamplight, and contains muddy portions in the upper strata, which are easily separated on agitation. The shellac adulterated by means of resin forms a thick deposit, not easily broken up by shaking. This precipitate can be washed with water, and boiled in 2.5 per cent. hydrochloric acid: this, when dried, melted and weighed gives, when multiplied by 1.25, approximately the quantity of resin contained.—*Oesterr Ungar Tischler u. Drechsler Ztg.*

Vienna Bent Woodware.—The growing popularity of this style of furniture, first brought to the notice of the American public at the Centennial, will doubtless give interest to a brief description of the methods of making it. The industry is conducted chiefly in Moravia and Hungary, but promises to become very general. Articles of this description are remarkable for their neatness, clean finish, light lines, great strength, and the fewness of their joints; this latter point being usually accomplished by bending the wood used so as to necessitate as few pieces as possible; thus, an ordinary chair contains, according to this method, only six pieces besides the cane seat, and is said to be an article which has no superior in its way. For this kind of furniture, beech is the only sort of wood used, it being found excellently adapted for the purpose. The trees being felled, the tops are removed and made into charcoal, for use in the glass works; the trunks are sawed into planks of suitable thickness by gang saws, and the planks are in turn ripped up with circular saws into square pieces for turning. If intended for the back and hind legs of a common chair, which are composed of only one piece, the square piece of proper length is put into a kind of gauge-lathe, which does its work very rapidly, and varies the size where needed. The ordinary dowel lathe is used for pieces of uniform size, such as the hoops, which are placed inside of the leg to stay them, instead of straight pieces or rungs, and the hoops are so placed so that the feet cannot rest upon them. After being rounded as required, the wood is steamed in the green state for 24 hours, in boilers adapted to the purpose, when it is taken out and bent to the shape desired, on a cast iron frame, by hand. If intended for the seat, the piece is first strapped with iron on its outside, so that the bending shall be a process of compression, lengthwise rather than an expansion. It is then attached by one end to a pattern fastened to a turn-table, the other end being held by a chain wound upon a drum, to which is applied a brake, so as to regulate the tension with which the piece is delivered to the pattern; the turn-table is then set in motion, and winds the wood on its own form. If designed for a scroll, the pattern may be complicated and in several pieces, which are put in place at the proper time in the progress of the rotation; for a double scroll, two of the tension bands are employed.—*Iron Age, March* 14.

Practical Uses of Sawdust.—The *Œsterr.-Ungar.-Tischler u. Drechsler.-Ztg.* refers to the increasing utilization of saw-dust for the production of a variety of articles of utility and ornament. The general method consists in producing a plastic mass, composed of two-thirds sawdust of common hard woods, and one-third glue or resin as a binding material (occasionally with some gypsum). This mass composed, say, of fine sawdust, asphalt powder, and ox blood, after thorough mingling is filled into suitable brass moulds, where it remains for 24 to 36 hours exposed to a considerable pressure, and gradually heated until the water moisture has evaporated and the mass is made homogeneous throughout by the fusion of the asphalt. In this way are produced beautiful and permanent basreliefs and a variety of articles for wood ornamentation, imitation of ebony, piano keys, doorknobs, brush handles, knife handles, etc.

Sawdust is also used in the manufacture of oxalic acid, and of artificial vanillin, and more recently mixed with the mortar for house plastering, to prevent the fine hair-like cracking of the plaster.

Unpleasant Peculiarity of Toughened Glass.—We have already recorded in the Review instance, of the peculiar disposition of vessels made of the so-called tempered glass to disintegrate with a violence, and without apparent external cause. Prof. Ricard, in the *Polytechnische Notizblatt*, records in substantiation of this statement, the case of a child's drinking glass, of "indistructible" glass, which, while standing empty upon the dining table, and without visible cause, or contact of any person, or approach of a light, suddenly exploded with a loud report, and scattered its fragments disintegrated to the size of a lentil about the entire room.

Prof. Ricard notices that instances of this kind in the laboratory and the household are numerous, and believes that the property may manifest itself with such violence as to become a source of personal danger to those using such vessels.

He qualifies this remark, however, by the statement that the so-called *Hart-glas* of Siemens which is made under pressure, is free from this dangerous peculiarity.

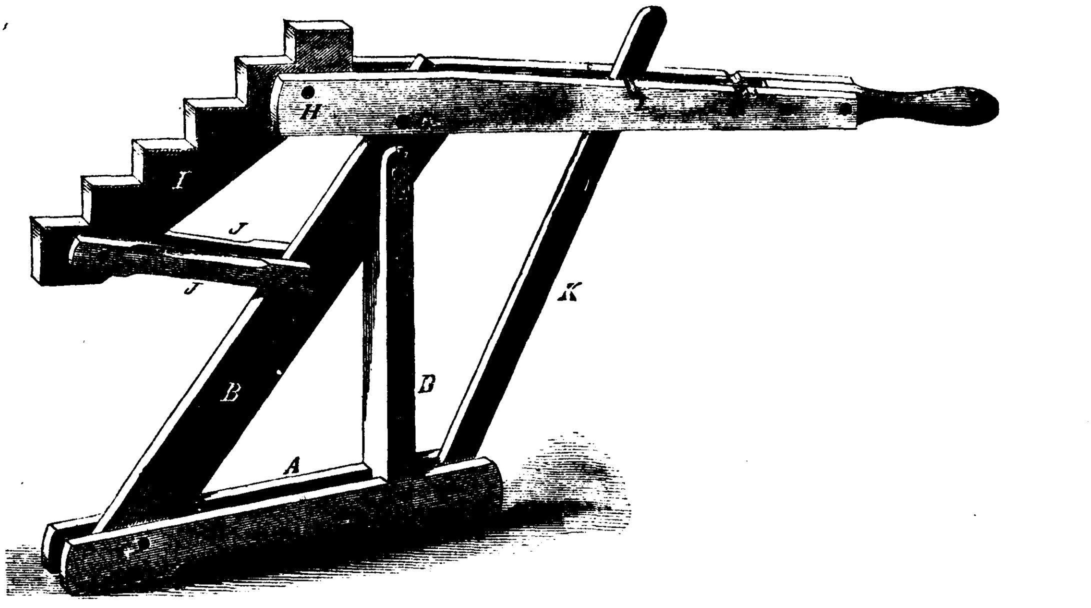
Utilizing a Desert.—Our Commissioner of Agriculture proposes to make the date a staple American product in the now useless desert regions of Arizona and Southern California. Seed from Egypt has been planted, and more is coming.

California will show at the Paris Exhibition, a gilded pyramid, twenty feet square at the base, and nearly seventy feet high, to represent the 7,000,000 cubic inches of gold that have been produced on the Pacific Coast. The State will likewise show her mineral wealth by a display of 500 tons of minerals.

The Pictet ice-machine which has for some time been running successfully at No. 530 West street, New York, has been sold to a Virginia company. The cost of manufacture on a small scale was about $1.80 per ton. On a large scale the patentees of this system (employing anhydrous sulphurous oxide gas) claim that it can be made at $1 a ton.

Metallic Freight Cars.—There are now in use on the Chicago, Burlington and Quincy Railroad some 20 box cars of the La Mothe pattern. At a distance they bear much resemblance to the ordinary wooden railroad car; but on approaching nearer the difference is at once discernible. The same trucks are used as on other cars, the manufacturers furnishing at present the car bodies alone, or mounted on such trucks as a railway company may desire. The bodies are made of boiler tubing and steel rods. The sills are of 2½-inch tubing; the top framing of soft steel rods, united without joints or bolts, and forming a combination of strength and lightness. The box cars are covered with sheet iron, united by lap and groove (no rivets), and lined inside with a light felting of paper. The interior is lined with very thin lightwood; the purpose of the paper and wood lining is to preserve an even temperature with the car, and it is claimed that these cars are thus rendered cooler in summer and warmer in winter than the ordinary box car. Externally the metallic box is neat in appearance—much more so than the wooden car. It is susceptible of any amount of ornamentation, and passenger cars built in this way can be made very handsome. The weight of the bodies of these cars is from 8200 to 8800 lbs. With the truck they weigh from 17,000 to 18,000 lbs.—nearer the former figure than the latter. The average weight of the wooden cars of the Chicago, Burlington and Quincy Railroad is 20,050 lbs. It should be noted that the newer cars, such as are now built entirely of wood, average over 21,000 lbs. As between them and the La Mothe cars there is therefore a difference of nearly 4000 lbs. in favor of the latter. In addition to the saving in dead weight, the metallic cars have a greater carrying capacity. The ordinary car load is 10 tons; the La Mothe cars will carry 15 tons easily without danger.—*Iron Age, March* 14.

A pair of Siberian hares has arrived at the Jardin d'Acclimatation in Paris. The peculiarity of these animals is that they are gray in summer and white in winter. The French naturalists want to ascertain what effect the temperate climate of France will have on this change of color.



ROWLAND'S IMPROVED LIFTING JACK.

IMPROVED LIFTING JACK.

We illustrate here a new and simple lifting jack, applicable to all kinds of vehicles. The base, A, supports an inclined bar, B, and standard, D. The lever, F, has its fulcrum at G, in bar B, and extending forward is pivoted to the notched bar, I, which is connected by the bar B, by the short bars J. It will be evident that when the lever, F, is operated the notched bar will be raised or lowered. The axle of the vehicle rests upon one of these notches according to the height of the axle. K is a bar which is pivoted to the base, and which extends upward above the lever, F. It carries a pin, L, which, when the jack is loaded, falls into one or the other of the recesses, M, in the top side of the lever, and thereby holds the load. When the load is to be lowered the rear end of the lever, F, is depressed to release the pin, when the bar, K, is thrown forward with the foot. The lever is then allowed to rise and release the jack. The device is strongly and inexpensively constructed.—*Scientific American.*

To Render Corks Air and Water Tight.—The *Chemiker Zeitung* suggests the use of paraffin as the best method of making porous corks gas and water tight. The method of impregnation suggested is simply to allow the corks to remain for about five minutes beneath the surface of melted paraffin in a suitable vessel, the corks being held down either by a perforated lid, wire screen or similar device. Corks thus prepared can be easily cut and bored, have a perfectly smooth exterior, may be introduced and removed from the neck of a flask with great ease, and make a joint with the flask that is a perfect seal.

IRON is a dangerous ingredient in fire brick. When a brick containing iron is exposed, even at a low temperature, to gases containing carbon, part of the carbon is deposited near the iron. This has often not only caused the brick to lose its cohesion, but may even burst it so as to throw down the iron walls of furnaces and the linings of flues.

THE relations between M. Pasteur's discoveries concerning the development of germs, and the progress of modern surgery were discussed by the Paris Academy of Sciences a few weeks ago. In the course of the discussion, M. d'Abbadie, the explorer of Abyssinia, remarked that there was a saying among the natives along the shore of the Red Sea that a wound to be healed should remain in contact with the air; and in that region he found

THE late experiment in the introduction of Salmon into Australia, made by Sir Samuel Wilson, has so far proved successful. Fully one-half of the ova which were received from California hatched successfully.

CAST iron pipes fifteen inches in diameter and three-quarters of an inch thick will sustain a head of water of 600 feet. One of oak two inches thick and of the same diameter will sustain a head of 180 feet.

TO DETECT fraudulent balances, after an equilibrium has been established between the weight and the articles weighed, transpose them, and the weight will preponderate if the article is lighter than the weight, and contrawise.

WITHIN the last few months the French physicits have succeeded in liquefying acetylene, ethyl, hydride, marsh gas, nitrogen dioxide, oxygen, nitrogen, hydrogen and atmospheric air. These were the last of the miscalled "permanent gases."

WE might save at least one-fifth of our bread and one-third of our meat. So long as we insist on our bakers supplying our table with snow-white bread, so long must the miller eliminate from the flour its most nourishing part. This part approaches, in chemical constitution, that of flesh.

FORMS of living matter are numerous beyond all computation, the diameter of which is not more than 1-40,000 of an inch! Allow some dry hay to remain two days in water, then filter and leave it two more days, and it will swarm with living creatures, each one having a separate organization.

WHEN wood is employed as a fuel it ought to be as dry as possible. To produce the greatest quantity of heat it should be dried by the direct application of heat. As usually employed it has about twenty-five per cent. of water mechanically combined, the heat necessary for evaporating which is lost.

MR. John Watson, F.R.A.S., read a paper at the meeting of the Newcastle Chemical Society, on the utilisation of sewage and the purification of rivers, in which he stated that a small quantity of dilute hydrochloric acid was sufficient to precipitate the most noxious sewage, and leave the supernatant water pure.

A GOOD cement is formed when shellac is dissolved in a concentrated solution of borax. Albumen of egg mixed with quicklime makes a very strong cement, but does not resist water effectually; it is employed to unite pieces of spar and marble ornaments to which moisture has little access. Coppersmiths use a similar compound for securing the edges and rivets of boilers, but in this case blood is substituted for the white of an egg.

CONSTRUCTIVE CARPENTRY.

CONNECTIONS BETWEEN BEAMS WHEN THEY CROSS ONE ANOTHER.

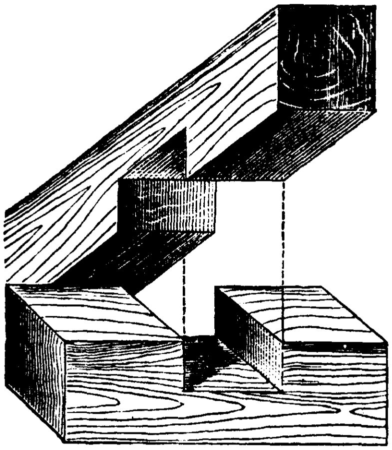


Fig. 23.

THIRD PART.

CONNECTING CROSS TIMBERS.

If both the timbers project beyond the point of crossing, the simple connection represented by Fig. 23 is customary. If the timbers have equal thicknesses, each is cut into half its thickness. If the thickness differs, the weaker beam is cut less, or not at all, according to the strain it has to bear, and the heavier beam is only cut far enough to let in the other. Of course this is only done when the surfaces of the beams must be flush; if this is not the case, and the surfaces do not need to be flush, it is of course better not to weaken them by cuts, but to connect them with bolts or bands.

If one of the pieces does not extend beyond the other, the best joint is the so-called dove-tail, represented in Fig. 24 in perspective, and in Fig. 25 in section; in this way the end of the beam most subject to decay when exposed, is entirely hidden and protected, especially when the joint is made to fit snugly.

If the beams are only joined at the ends, and do not project beyond, it is well not to make the cut surfaces parallel to the sides, as then they easily slide off one another by the least longitudinal strain, but to make them slanting, as in Fig. 26, or with a notch, as in Fig. 27; the latter can not be pulled apart by a longitudinal strain, except by breaking the wood, while Fig. 26 is only safe against such a strain when the joint is heavily loaded, or inserted in a wall preventing its expansion by sliding.

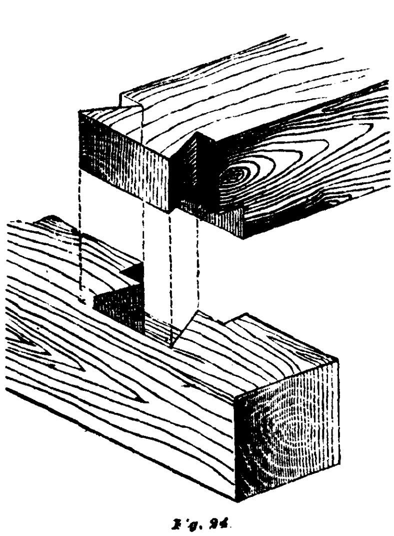


Fig. 24.

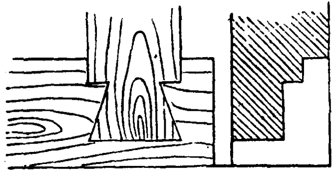


Fig. 25.

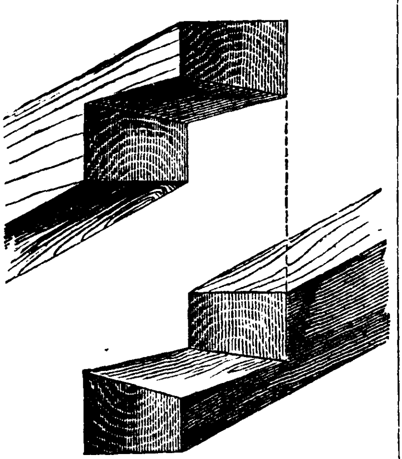


Fig. 26.

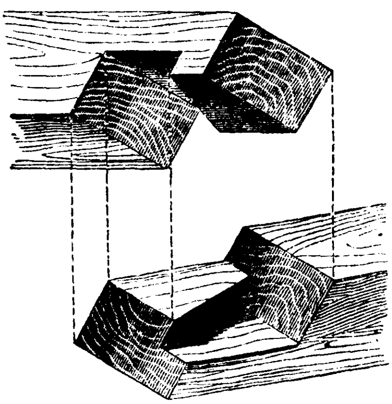


Fig. 27.

Profitable Industries the Best.

BY E. J. NIEULAND.

Among imported articles which can be manufactured much cheaper in the United States than in Europe, is corn syrup, or so-called glucose. Ten years ago this syrup was unknown in this country. In 1867 the importation commenced, and has increased every year at an enormous rate. Corn syrup is (under different names) largely consumed by confectioners, fruit preservers, wine and liquor dealers, and for table use. It is manufactured from potatoes, corn, wheat, and other cereals.

The profits connected with the manufacture of corn syrup are simply enormous. Foreign glucose is charged with 20 per cent duty and about 20 per cent freight. This great advantage to the home manufacturer is enhanced by the fact that the raw material in the United States is far cheaper than in Europe; a bushel of corn in Illinois costs from 30 to 60 cents, in New York 85 cents, while the European manufacturer of glucose and grape sugar has to pay $1.25 for the same quantity.

The French capitalists who invested money in lace-making, divided in one year 50 per cent profit, which divided in following years increased. Fifty per cent dividend is the lowest profit which can be expected from the manufacture of corn syrup, as proved by statistics. The only trouble is to find a man able to manufacture the article, and, as far as known to me, there is only one man in the United States who possesses this capacity. "Without the encouragement of a Colbert," that man and his friends invested a few thousand dollars in the erection of miniature machinery, with which he proved, in the presence of leading New York merchants and others, the feasibility of making first-class corn syrup in the United States. Since 1869 he has tried to come into connection with parties willing to establish such a company, but although money was abundantly offered for railroads, silver and coal mines, and wildcat enterprises, no capital could be found for manufacturing this article

Our capitalists are undoubtedly willing to make safe and profitable investments; nevertheless it is very difficult to reach them, as it seems that our bankers and brokers are giving their coöperation exclusively to wall street securities and insecurities. It is under these circumstances that I call upon them with the suggestion that one of the main causes of the increasing pauperism, is the insufficient encouragement given by capital to home industry, and that the best way to diminish this now increasing evil is to invest capital in such enterprises as can give labor to the greatest possible numbers.

Forests and Rain-Falls.

The old question of the influence of forests on the amount of rain received by the soil is revived in a communication to the French Academy of Sciences, by MM. Fautiot and A. Sartiaux who have been experimenting in the forest of Halatte, measuring the amount of rain-fall during six months of 1874 at two places about 1,000 feet apart, one being covered with trees and the other open. The figures they obtain show that the forest received a larger quantity of rain in the proportion of about twelve to eleven. The only valid argument of a theoretical character bearing in the same direction is, so far as we know, that of M. Dausse, quoted in this communication as follows: "Rain is formed when a warm and humid wind comes in contact with a strata of cold air; and since the air of forests is colder and more humid than that of the open, rain must fall there in greater abundance. The difference shown by these experiments confirms, indeed, to some extent, the argument referred to; but it by no means supports the popular impression that the removal of forests exercises a direct effect in diminishing the amount of rain-fall over large districts. A result far more important is the change produced in the flow of streams. Forests check evaporation and retain for a longer period both the snow and the rain, furnishing a steady supply to the streams and preventing, to a large extent, sudden freshets. When forests have been mostly removed, the smaller streams, which have furnished available water-power for mills and factories, are likely to become so irregular in their flow as to be apt to produce great inconvnience. It is, however, the distribution rather than the total amount of rain-fall which is thus affected.

Artificial Stone.—A Mr. Carr has patented a process for the manufacture of a cheap and indestructible artificial stone. He finds that a mixture of fat lime slacked to powder with clay reduced to an impalpable powder by calcination at a cherry-red heat, when subjected to a high pressure, has the property of hardening rapidly under water, and exhibits a degree of durability proportionate to the pressure it has undergone.

South American Trade. — Already Mr. Fraiick, who went to South America as the special Postal Commissioner, has accomplished important results by his trip. He has secured the removal of the freight discrimination of $14 a ton from Panama to Callao against American in favor of English goods, and he has also concluded an agreement with the Peruvian government for the establishment of postal communication with the United States under the Berne Postal Union.

PATTERN-MAKING.—X.

By Mr. Joshua Rose.*

It has been already remarked that the operations of the moulder are, to a large extent, predetermined by the pattern-maker; hence it becomes necessary that the latter shall have a knowledge of foundry work, otherwise he is likely to make the patterns very expensive and awkward to mould. In learning the trade, an apprentice is usually put to work and distinctly instructed as to the required form of his work without knowing anything of the reasons therefor. In this way he attains a practical knowledge of how different classes of patterns should be, or are, usually made; but it takes him years to become an expert mechanic, for the reason that, having learned by rote, he is incapable of meeting new conditions to the best advantage, until his experience has included both observations in the foundry and, in some cases, consultations with foundrymen. Before entering, therefore, into the method of putting together different kinds of pattern work, it will be well to take a glance at the foundry, and examine the contrivances and the operations of the workmen, so that our operations in pattern work may be intelligently made from the beginning.

The floor of the foundry first demands our attention. It is composed of a layer of moulding sand of sufficient depth to imbed patterns of the size usually cast in that foundry. For exceptionally large work, there is usually a place where the natural earth has been excavated to a greater depth; the cavity is filled with moulding sand. This place is usually within easy reach of the crane (which commands almost every part of the floor) and the threshold of the melting furnace or cupola. We next observe the capacious oven for baking cores and drying moulds for such special work as may require these operations; but the particular contrivance with which the pattern-maker has now to concern himself is represented in Fig. 64. It is called a flask, and is composed of two or more parts (two only being shown in the engraving.) The lower part is called the nowel, and the upper the cope. Each part is simply a strong rectangular frame of wood or iron. The sides, being continued past the rectangles, are roughly shaped for use as handles. The cope is provided with several crossbars, which embrace the pattern as it were, being roughly shaped like it in contour and approaching it in size, being about half an inch larger all round. These bars, by their adhesion, support the body of the sand in the cope, and in this they are frequently assisted by nails driven in nearly half way into them. When an intermediate part is used with the two parts shown in Fig. 64, the contrivance is called a three-part flask; with two intermediates it is called a four-part flask, and so on. As the cope is provided with crossbars, so also the intermediates, having to lift a ring of sand, are provided with wings; that is to say, as much crossbar as will extend from the sides to within about half an inch of the pattern. The parts are guided, in their position one to the other, by taper pins on one part fitting into eyes fixed to the other part, as shown in Fig 67, in which the cope is shown with the side having the two pins exposed to view, while the opposite side of the nowel, having one eye, is visible. In many cases and for large work, the nowel is dispensed with, and the foundry floor is used in its stead, in which case the cope is guided to, and retained in, its place by stakes driven into the floor sand, as shown in Fig. 65, so that, when lifted to admit of the pattern being drawn from the mould, the cope may be returned again to its exact proper and former position. In Fig. 66, A represents the pattern whose impression in the floor sand, at M (Fig. 65), forms part of the mould. B (Fig. 65) represents the cope; for the word cope is usually applied to the upper part of the mould as well as to that portion of the flask which contains it. The top print, C, of the pattern, has formed its impression in the cope at P. R (Fig. 66) is a round taper peg, which leaves a hole in the cope at r, through which hole the molten metal is poured. It also leaves an indentation at r′; and from this latter a gutter is made by the moulder to communicate with the mould, M, as shown. The stakes referred to above are marked S. The dots, shown around the impression of the top pattern print, C, in the cope, are small holes made in the sand (after the moulding is finished) by a piece of fine wire, and are for the purpose of giving vent to the air and gases which must escape when the metal is poured in.

It will be seen that, when a mould is made in the flask we have described, it can perform no further duty until the casting has been made; for every mould, therefore, we require a flask, and hence the pile of these appliances we always see in a foundry. For light work, however, a comparatively modern and greatly improved device has come into general use. It is termed a snap flask, each part having a hinge at one corner and a latch at the diagonally opposite one; so that, after the mould is made, it can be detached from the perfected mould and can be used to make another. Sometimes, though rarely, it happens that a casting is required of such form that the patterns cannot be constructed so as to be moulded with a flask of the ordinary kind. The flask requires to come to pieces and the mould to be parted sideways; this adds greatly to the labour of the moulder, and the pattern-maker should so construct the pattern as to avoid this whenever he can devise any means of so doing. Even when the pattern is moulded in the floor, the mould is sometimes of necessity made to part on one or more of its sides, and these partings are termed drawbacks. An example of this class of work will be given hereafter.

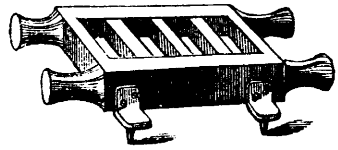


FIG. 64

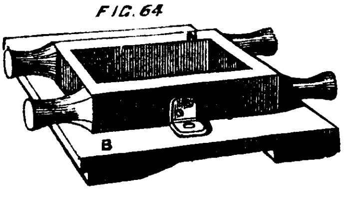


FIG. 65

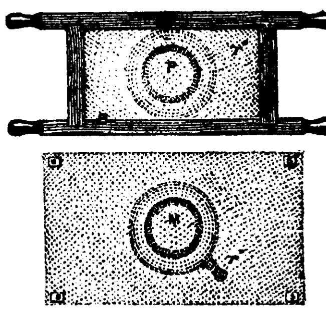


FIG. 66

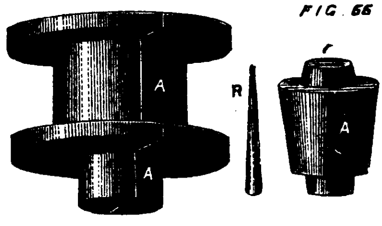


FIG. 67

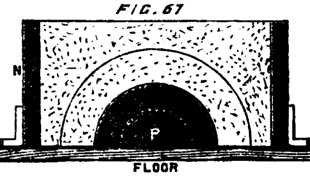
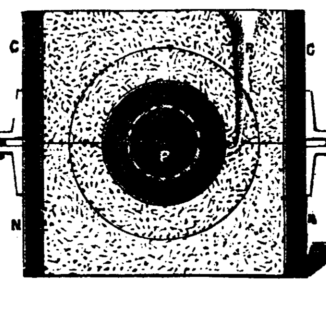


FIG. 68



By matching the operations of a moulder, we shall observe that, in the case of a solid pattern—that is to say, a pattern not made in halves—he always endeavours to have as little of the pattern in the cope as possible, and in this respect the pattern-maker should supplement his efforts. The reason is obvious: the cope has to be lifted while as yet there has been no opportunity to loosen the pattern in the mould. It is true that, in some cases, a bar is passed through the cope and driven into the pattern, and by rapping it the loosening is accomplished; but it is not well to have recourse to such an expedient, because, wherever the bar passes, the cope is damaged, and must be mended; and when a mould has to be mended, it is doubtful if the correct form, such as the pattern would have given it, will be left. Furthermore, it is all work in the dark; for the effect or extent of the rapping cannot be scrutinised, and it may therefore produce an undue distortion in one direction, while in another it may not have been effectual. Perhaps the bar may have descended at a place in the pattern where it is comparatively weak, from crossgrain of the wood or from some other cause. This measure is, therefore, on account of these difficulties, seldom resorted to; and it may be generally disregarded in the calculations of the pattern-maker. The cope, then being, as we may say, a dead lift, and with nothing to guide the operator in moving it, either horizontally or vertically, any part of the mould contained in it is much more liable to break down than is the other part of the mould. In extracting the pattern from the lower part of the mould, the eye lends to the moulder great assistance. The pattern can be loosened in the sand before extraction, and is furthermore less cumbersome to handle than is the cope: all of which circumstances tend to preserve the lower part of the mould from damage during the extraction of the pattern. Rapping a pattern tends to alter the form of the mould from that calculated upon. A circle becomes slightly oval, a square becomes an oblong, and so on: and this cannot in most cases be avoided, because it is necessary to rap the pattern so as to enable the moulder to extract the pattern without drawing out the sand with it; all that can be done in this direction is to rap the pattern as little as possible, and equally in all directions.

When a flask nowel is used, the labour involved in making a parting of the mould is facilitated. Fig. 64 shows a board cope and nowel for an ordinary straight parting; but it is evident that the parts of the flask may be made to show a crooked, a curved, or irregular line at the joint, if it is required, in which case the bed board must be made of similar conformation. The process of moulding with a flask independently of using the floor, instead of a flask nowel, is illustrated in Figs. 67 and 68. If it be required to mould the pattern illustrated in Fig. 66, which his made in halves, the joint being denoted by the line, A A, one of the halves is taken and laid with its flat face upon the moulding board, B, shown in Fig. 67. The nowel, N, is then placed upon the board, so that the half of the pattern will be in about the middle of the flask nowel. Sand is then rammed tightly in the nowel; and when the latter is filled with the sand, it is turned upside down, showing the flat face of the half pattern, the rest of the half pattern being imbedded in the sand. The other half of the pattern is then placed upon the one in the sand, its proper position being determined and regulated by pegs fitting into holes, provided in the first part, to receive them. The next operation is to put on the cope, as shown in Fig. 68, the taper pins being fast to the cope lugs shown on the sides, fitting into holes provided in the nowel lugs, similarly shown, serving to hold the cope in position and prevent it from moving. The cope is then filled with sand, lightly rammed, the taper pin, R, Fig. 65, being inserted to leave in the mould the hole, R, Fig. 68, through which to pour the melted metal. The cope is now lifted vertically; and as the pattern is made in halves, the top half lifts with the sand in the cope. In some cases a screw is fixed into the top half of the pattern, the head of the screw projecting into the cope: the object being to insure that the top half of the pattern shall lift with the cope. The next procedure is to extract the two halves of the patterns from the moulds, and perform any trimming or repairing that the mould may require, after which the cope is again placed upon the nowel, and the mould is complete, ready to have the metal poured in.

Delicate Test for Vapors of Mercury.—*Comptes Rendus* says that paper impregnated with mixed chlorides of platinum and palladium give a brown coloration when exposed to vapor of mercury. It is found by this test that mercury volatilizes even when frozen. Salts of gold and silver are sensitive also, but not to the same extent. The scientific and industrial applications are evident.

REVOLUTION IN ARCH-BUILDING.

The masonry arch is a comparatively late invention. We find no trace of it among the structures of the ancient Egyptians, while in the five classic orders of Grecian architecture—the Tuscan, Doric, Ionican, Corinthian, and Compositum—the structure over the columns is not supported by arches resting on the columns, but by straight tablatures. Even in most of the original Roman temples, of which the ruins are found in Italy, the arch is avoided; they appear first to have used it in their viaducts, while it reached a greater development in the middle ages, when in the Byzantine style the semicircular arch was as prominent a feature as the pointed arch in the Gothic style, which reached its highest development in the Middle Ages.

But with all that, it must be confessed that the application of the theory of arches has made less progress than any other branch of practical engineering, as well in regard to the most favorable form under given circumstances as in regard to the maximum of stability combined with the minimum of material employed.

Among the mysteries of the ancient masons the construction of arches was one, and the methods used to give them stability, although they consisted of separate and comparatively small stones, and even bricks, was a wonder to the ignorant mass, and was kept an inviolate secret by pass-words and grips. These have later obtained a symbolic meaning, and being infused with the spirit of the mysteries of the ancient Egyptian priests, and other secret orders, have been the source from which modern Freemasonry has been evolved; while that which was the greatest secret has become public property.

But notwithstanding the latter fact, our practical methods have not been improved, and we have confined ourselves to taking the old arches as models, increasing only their thickness and weight, until they became very expensive, and sometimes even weak by reason of their excessive weight, or inversely, they have been made so light that weakness resulted from an insufficiency in the quantity of material, so that they came down under the load they should have been able to carry. These features have in many cases been kept secret instead of the details and causes being published for the benefit of all interested, hence the world has derived little benefit from the disastrous experiences of which the parties causing them were justly ashamed, and hence held their peace when they should have confessed for the benefit of mankind.

The great difficulty in improvement in construction consists in the fact that our theoretical engineers stick to the old books, with no attempt at improvement, having no opportunity for experiment, while our builders and contractors follow their blind leaders. But few engineers are willing to step out of the beaten paths. Timidity and the want of a full precedent prevent advancement or the adoption of new ideas. What improvement have we made since the times of Vitruvius, whose works on mortar are a standard to this day? How many centuries did it take before the brick was made without straw.

From one-third to one-half of the material in our present structures is wasted, and is only used to cover faulty construction or poor workmanship. Much of the material used in our arches simply tends to overthrow them. We can only hope for improvement in construction when the exigencies of a new material call for experiment. Such experiments have been made by the N. Y. Stone Contracting Company, of Third avenue and Sixth street, Brooklyn, N. Y., who have devoted much time to this purpose. We give on this and the opposite page some of their arches as illustrating certain models of engineering construction.

There is perhaps no material so well adapted for engineering purposes and to show skill in construction as beton or the best quality of concrete. This is owing to the fact that we can in this material have a homogenious structure without the elements of weakness, caused by different materials, uneven settlement, or dependence for its stability on friction.

The accompanying cuts, Figs. 1, 2, 3, and 4, show arches constructed by this company. Figs. 5 and 6 are plans proposed for an underground double-track railway. Fig. 1 is particularly remarkable for its lightness, it probably being the lightest arch in this country. Its span is 31 feet, the versed sine 5 feet; the thickness of its brick walls 3 feet at the base and 2¼ feet at the top. This arch was constructed in 1872. The dimensions of these arches are given on the cuts.

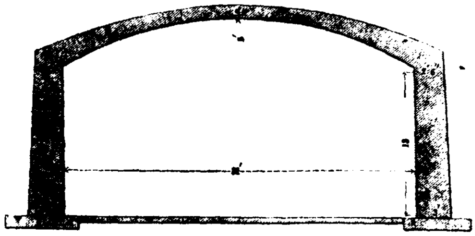


Fig. 1.—Section of Beton Tomb, Span 31 Feet.

Fig. 3 is a large hollow arch, adapted as a substitute for floor beams; it was executed for the Art Museum in Central Park, New York, to a length of 9 feet.

Beton is cheaper than brick or stone, from its requiring less in quantity and only just where it is needed—there is no waste. It is stronger than our brick or sandstones, supporting a strain of from 8,000 to 10,000 pounds; white brick carries but 2,000 pounds, and one-quarter of a brick structure is common mortar. Beton monoliths have no weak joints; there is no unequal settlement. They can be erected with great rapidity. The material is water and fire proof. Its application bids fair to be of great engineering importance.

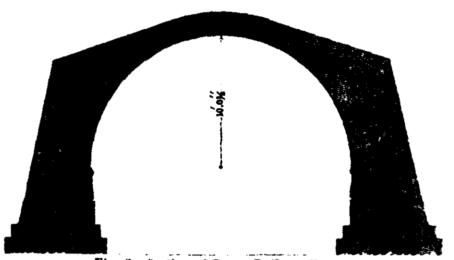


Fig. 2.—Section of Beton Railway Tunnel.

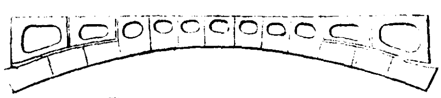


Fig. 3.—Section of Beton Floor Arch.

Nothing prevents its exclusive use in certain classes of construction but the natural hesitation to adopt anything new. The greater the improvement in machinery, art, and science, and the longer the stride of advancement, the slower has been its acceptance. The history of steam, the telegraph, the planing-mill, and the printing press are but instances of the battle and struggle required to start anything that accomplishes a sweeping change, whether it be labor-saving or otherwise, much in advance of former habits and appliances.

We congratulate a company that in so few years have been able to show so many monuments of the endurance of a new material.

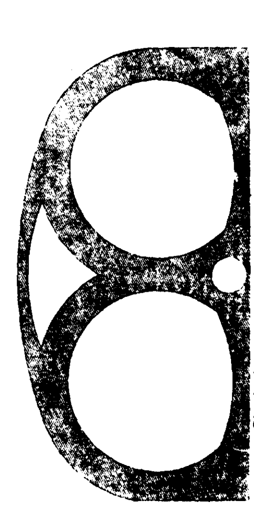


Fig. 6.—Section of Beton Double Railway Tunnel.

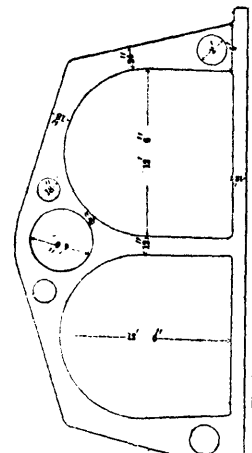


Fig. 5.—Section of a Beton Double Railway Tunnel.

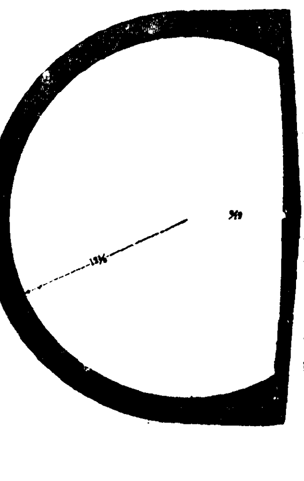


Fig. 4.—Section of a Beton Single Railway Tunnel.

Paper Lace is now being made in Germany, which rivals the genuine thread lace in beauty of texture and finish. Some of it is elegant and very deceptive.

Technical Education.—The Goldsmiths' Company, with a view to the encouragement of technical education in the design and execution of works of art in the precious metals, have resolved to give an annual prize of £50 for the best design, and also £50 for the best model of some article in gold and silver, which, when manufactured, shall exceed 30 ounces in weight; an annual prize of £25 for the best execution and workmanship of some such article; three prizes of £25 each for the best design, model, and execution of some article of less weight than 30 ounces; and prizes of £35 each for the best specimens of chasing or *repousse* work and engraving. Objects of jewellery and personal ornaments are not to be the subjects of design. All the specimens sent in will probably afterwards be publicly exhibited. The competitors must be British subjects, and the objects must be delivered before November next. The company have also resolved that a travelling scholarship of £100 per annum may be awarded to a student who has shown exceptional talent, and who shall have obtained a prize for design for three successive years, in order to enable him to study art in the precious metals on the Continent.

Explosion Temperature of Nitro-glycerine.—The temperature developed by the explosion of nitro-glycerine has not as yet been determined with accuracy; but as the combustion in the case of gunpowder is, under ordinary inflammation, nearly perfect, and the elevation of temperature approximately known, the temperature of the gases from exploded nitro-glycerine may be roughly estimated. According to the *Revue Industrielle*, a volume of gunpowder produces, at the ordinary temperature, 190 volumes of gas. Owing to the heat produced, this gas occupies about four times the above-mentioned volume, or about 760 volumes of gas are produced immediately after the explosion. A volume of nitro-glycerine produces 1,300 volumes of gas at the ordinary temperature, and, admitting that the heat produced by the explosion is two and one-half times that produced by gunpowder, this volume would be increased to 13,000 volumes.

Iron and Steel Castings.—A somewhat novel method of producing iron and steel castings has been patented in the United States by Mr. A. J. Nellis, of the Pittsburgh Agricultural Works:—"In the ordinary method of making steel castings," says the *American Manufacturer*, "it is necessary for the steel to be very high in carbon, in order to be fluid enough when melted to run into a fine casting, and the excess of carbon is removed after the casting is made by a process of annealing which requires from ten to twenty days. By Mr. Nellis' method of making castings, low carbon steel, or ordinary tool steel, may be employed if desired. The mould in which the casting is formed is impregnated with combustible materials, which take fire the instant that the melted steel comes in contact with the mould. An intense heat appears to be generated, which retains the steel in a perfectly fluid condition till it reaches the smallest corners of the mould, and an agitation is caused by which all air and confined gases are allowed to escape from the metal, thereby making the casting free from blow-holes. We have been shown ploughshares and other small irregular-shaped castings made by it, which appeared perfectly sound, and on breaking them the fractured surfaces showed no signs of blow-holes. Pieces were broken off from one ploughshare, and without any previous annealing or other treatment, were heated and welded together so perfectly that the weld could not be distinguished. One piece was drawn down and made into a chisel, and another into a pocket-knife. The latter was tempered and ground, and the edge was so sharp that it would cut a fine hair. The ploughshares made by this process can be forged into any shape required by an ordinary blacksmith, or after it is entirely worked out he may draw it down into tools or cutlery. If the new process succeeds as well as it promises to do, we may soon see steel castings largely used instead of wrought iron or steel forging for all difficult shapes."

A Mile of Coal.—During the last year the output of coal in the British Islands amounted to 132,000,000 tons. A popular notion is that a great part of the crust of the earth is becoming used up by mining operations, and that if the soil that has been dug out of our mines were piled up it would make quite a mountain range. Let us reduce this to figures also. A cubic mile is equal to 147,198 millions of cubic feet, and, allowing 29½ cubic feet of coal *in the solid* to weigh a ton, we get just 5,000,000,000 tons of coal in one cubic mile, and this is a greater weight than all that has yet been raised in the British Islands. According to the most reliable statistics, the end of 1878 will about just complete the first cubic mile of coal, exclusive of waste in mining. If our fuel had been stored in mountain heaps on the surface instead of being buried in the bowels of the earth, a very small mountain range indeed would have been equivalent to all the coal fields available to man in the whole of our earth.—*Nautical Magazine.*

A Great Arid Desert.—Recent explorations in Australia show that, in addition to an extraordinary lake of salt water in the center of the country which blights thousands of square miles of territory in its vicinage, there is beyond an arid desert of greater extent than any other in the world, on which there is neither animal or vegetable life to be found, and even on the borders nothing but the driest sage brush can be seen. An attempt was made to survey this sand sea at its supposed narrow part, and after traveling 300 miles the camels showed signs of exhaustion, and a return became absolutely necessary; but habitable ground was not reached before several of these supposed monarchs of the Sahara dropped dead. It is thus shown that only the western part of Australia can be utilized as a refuge for thousands of Europeans who are seeking homes in the new country, that more than half of the island continent will not support men or animals, and hence that the limit of population can already be approximately estimated.

Geological Significance of the Challenger Discoveries.—At the last meeting of the Liverpool Geological Society, Mr. T. Mellard Reade, C.E., F.G.S., read a paper, in which he pointed out the geological bearings of the information gathered be the Challenger expedition by deep-sea soundings and dredgings. As is well known from these physical observations, the basins of the great oceans are occupied in their lower depths with ice-cold water extending over the whole northern and southern latitudes, and consequently under the equator. This Mr. Reade considered to be a remarkable physical fact, and proved that the secular cooling of the earth must be exceedingly slow, as the heat of the earth, apparently, did not influence the temperature of these vast ocean tracts, which are fed with cold water from the poles. It was also pointed out that the temperature of the ocean, decreasing with the depth, was the opposite to that of the solid earth, in which observations in mines and wells prove a general but varying increase of temperature downwards, so that at a zone 3,000 fathoms from the surface the temperature of the water is at freezing point; while on the land, in cases where the increase is 1° per 60ft., on the same zone the temperature would be considerably above that of boiling water. Not the least interesting of the discoveries announced is that of the ocean bottoms below 2,000 fathoms being occupied generally—nay, almost universally—with a deposit of red clay containing pieces of pumice and nodules of peroxide of manganese, together with sharks' teeth and ear and other bones of whales, while the depths not exceeding 2,000 fathoms are largely occupied with foraminiferal ooze. These facts, it was considered, truly inferred a very great age for the present oceans, as, from a calculation which cannot be detailed here, Mr. Reade considers it will take a minimum of 20,000 years for a deposit of foraminiferal ooze of an average depth of 1ft. to accumulate over the whole of the area occupied by it; while the red clay, the result of the decomposition of volcanic produce, must be an exceedingly slow accumulation, probably not at the rate of one-tenth that of the ooze, but this rate it is, at present, difficult to calculate. Notwithstanding the enormous age this gives to the Atlantic and Pacific oceans, it is, on the other hand, impossible to resist the conclusion, from other evidences, that the bottoms of these oceans have more than once been land. The bearings of these discoveries on the probable age of the earth are therefore obvious.

Wire Tacks and Clout Nails.—We have received from Mr. Gorse, of Lichfield-street, Birmingham, some specimens of his wire tacks and clout nails, which are among the most satisfactory we have ever seen or used. Even in the smallest sizes they are finished with a care and accuracy seldom met with in hand-made nails of the ordinary fashion, and they enter wood with such ease and precision that it is a pleasure to use them. Their cheapness is an additional recommendation, and many people will be surprised how they can be produced for the money.

Forging and Tempering Iron and Steel.—The forging and tempering of iron or steel can be greatly enhanced, according to Herr Edward Blass, of Cleve, Prussia, by dipping the metal, in whatever form, in fused salt. This dipping in salt is also well adapted for annealing steel without the oxidation of the surface. If the metal be rusted, it must be allowed to remain some time in the bath. Borax can with good effect be mixed with the salt. Metal "purified" by such an immersion is very susceptible to galvanic depositions, and can easily be coated with copper, zinc, tin, nickel, silver, &c. For iron in the spongy or powdered state, as obtained from the reduction of the ores, the salt bath is especially adapted, for it augments the combination of the particles by making their surfaces free from impurities. To prepare the bath for an application as here proposed, the salt must be fused in a puddling furnace, and the iron sponge, with the addition of a flux, be added in small quantities, so as not to vitrify the salt. The iron is left in the furnace till the flux has combined with all the impurities, and formed a slag, whereupon the iron is taken out and forged together. While the iron is in the furnace it should be constantly covered with the salt so that oxidation be prevented. For the hardening of iron, the salt is fused in a convenient vessel and the object immersed and from time to time a small quantity of ferro-cyanide of potassa added, 1lb. or 2lb. per 100lb. of iron. The articles, according to their thickness are permitted to remain from 5min. to 30min. in this bath, and are then plunged in water containing, in 100 parts, 1 part of hydrochloric acid, 5 of wine vinegar, and 1 of salt. If the objects are to have a silver lustre, they should be immersed for a few minutes in a mixture of three parts of wine vinegar and one of hydrochloric acid.

Isthmus Canal Project.—Lieutenant Wyse, of the French Navy, reports favourably on his official explorations of the Isthmus of Darien, with a view to the project of an interoceanic canal. He believes that it could be most easily executed directly from the valleys of the Tupisa and Tiati to the Gulf of Uraba, and would not require any locks. Another line surveyed connects the valley of the Tuyra (a river flowing into the Pacific, and of which the Tupisa is an affluent) with the Caquirri, flowing into the Gulf of Uraba; but this would need five locks, each with a rise or fall of more than 30ft., and also a short tunnel. Lieutenant Wyse estimates the cost of the proposed work as not excessive.

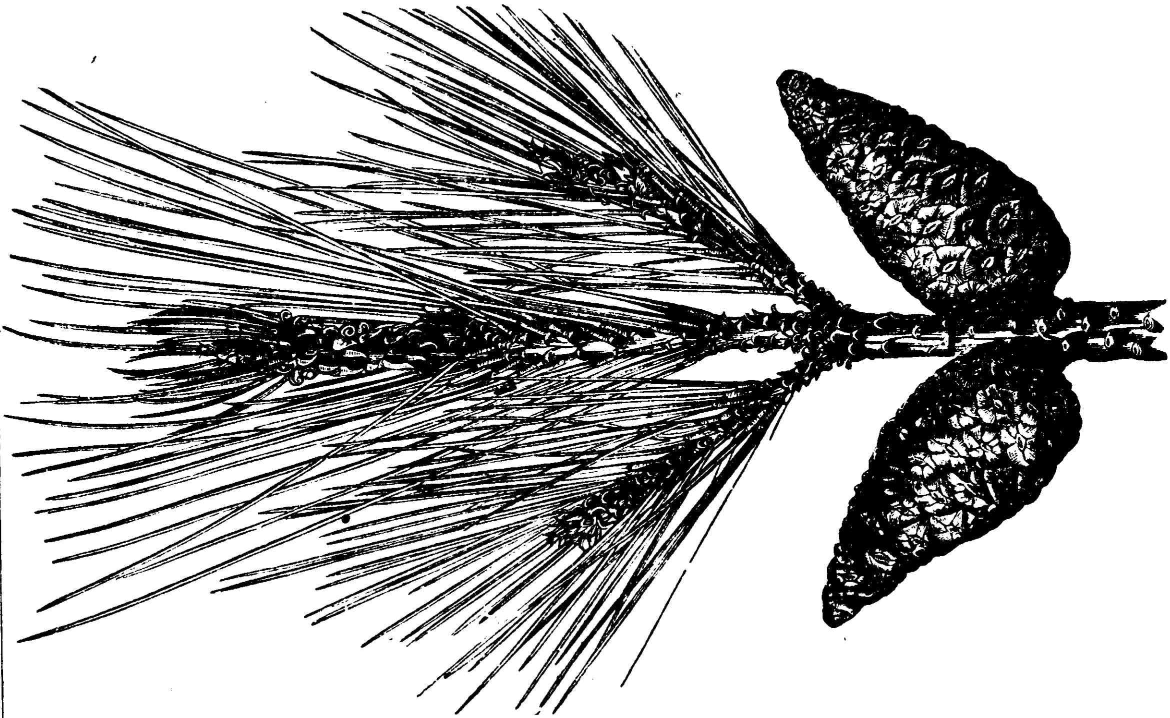
Plain and Galvanized Iron Wire.—The *Telegraphic Journal* says that in reply to a communication addressed to them by Mr. G. B. Prescott, the well-known American electrician, a number of the European telegraph administrations have, without exception, given the result of their experience as in favor of galvanized wire on the score of ultimate economy. It appears from these reports that the duration of non-galvanized wire for telegraphic purposes in Europe is from 15 to 20 years. Galvanized wire that has been in use some 25 years gives little sign of deterioration.

Moths in Carpets.—The carpet moth makes his favorite home about the bindings and corners of the carpet. If this is an ingrain or three-ply fabric, successful war may be waged on him by wringing a cloth out of hot water, laying it over the bindings and edges, and ironing with as hot an iron as can be used without scorching. This will destroy both the moths and their eggs, and after a few such visitations they disappear. But this steaming and ironing process is not effectual with Wiltons, Moquettes, or any heavy carpetings. The heat cannot thoroughly penetrate them, and ironing injures the pile of the velvet. Still, it is best to draw the tacks occasionally, and lay the edge of the carpet over—one side only, or a part of a side, at a time—and steam and iron it on the wrong side. Then, beside this, the floor should be wiped as far under as the arm will reach with a cloth wrung out of strong and hot Cayenne tea; and before re-nailing, the binding and edge of the carpet should also be wiped with it, rubbing them hard. Some have recommended sprinkling salt round the sides of the room before nailing down the carpet, but we should think this objectionable, as the salt absorbs moisture from the air and may thus cause too much dampness.

Britain's Importation of Food.—A late issue of the London *Times* contains an interesting compilation of statistics, showing the aggregate sum expended by England for food from abroad, from which we glean that the amount paid in the year 1877 to foreign nations for corn, cattle and meat was $484,308,685, to contrast with $435,646,930 in 1876. For live stock the sum disbursed was, in 1877, $30,078,450 as against $36,301,515 in the preceding year,—the prices paid being somewhat lower last year than the year before. The sums for fresh meats were much larger, consequent upon the shipment from the United States and Canada of quantities of beef and carcasses of mutton. The total sum paid for foreign stock alive and dressed was, in 1877, $86,568,370; in 1876, it amounted $96,152,275. For corn, the sum paid last year was $315,961,120; in 1876, $257,673,240. Foreign butter cost in 1877, $47,691,525; cheese, $23,840,266; and eggs, $12,362,406, to be compared, respectively, with $48,513,120, $21,257,140, and $13,051,655 in 1876. The British demand for American butter and cheese is constantly increasing.

THE CURLY-HAIRED ANTELOPE.

Very little is known of this antelope in its wild state. Siebold, in his "Fauna Japonica," calls it *antelope créssue*, and mentions that it is known to the Japanese by the name of "Nik," but that it is rarely found, and only then in the highest mountains of the Island of Niphon and Sikok. The appearance of the animal would indicate that it is a hardy inhabitant of a mountainous country.



THE PYRENEAN PINE.

THE PYRENEAN PINE.

The foliage of this tree is very distinct, quiet unlike that of any other conifer. The leaves are in twos, of a beautiful grass-green color, and from 6 inches to 7 inches in length. It can easily be distinguished from other pines on account of the deep yellow coloured bark on its young shoots ; the cones are about 2½ inches long, rather egg-shaped, on short footstalks, sometimes in twos, but mostly solitary. It is found on the Pyrenean mountains, where it forms extensive forests. This tree is highly ornamental, especially when young, its fine, upright-growing, light green leaves, and the orange coloured bark on the terminal shoots being its most striking and beautiful features during that stage ; but when older, it assumes a coarser habit of growth ; its branches become stout, widespreading, and straggling, and altogether its general appearance is far from attractive. This pine has never been very extensively planted, on account of its scarce use in the trades, and the difficulty in procuring seed true to name. The wood is of inferior quality. We copy the illustration from the *Garden*.

The superintendent of the manufacture of febrifuges from cinchona, in India, is called the Government Quinologist. He reports that out of some three millions of cinchona trees of various species now growing in India, five-sixths belong to the species *succirubra*. This yields a medicine which has become known as the cinchona febrifuge, and is efficient in the treatment of the common fevers and ague, but is less generally valuable than quinine. It has proved impracticable, however, to grow the best quinine-producing tree (*C. officinalis*) successfully. Mr. Wood, the quinologist, states that the *succirubra* febrifuge is now being produced to the amount of four thousand pounds a year ; but in the Blue Book submitted to Parliament last year, it was estimated that the existing plantations could supply ten thousand pounds annually. Even this would not satisfy the demand in India. The bark of the *succirubra* contains quinine, but with so many other alkaloids that its separation would be too expensive. The white powder which forms the febrifuge extracted from it turns brown in a little while. It is frequently administered in lemon-juice which dissolves it. The government of India has shown much wisdom in its endeavor to make the country yield the most potent remedy for the fevers in which it is so prolific.

To give a purple color to ivory soak it in a solution of salt ammoniac put into four times its weight of nitrous acid.

Mallet has discovered that a wire placed east and west and traversed by an electric current, suffers an apparent alteration in weight, due to the effect of the earth's magnetism upon it.

THE VICTORIA REGIA.

(*See page* 186.)

The two engravings given herewith represent the grandest of all water lilies, the immense Victoria Regia. In cultivation the plant is an annual, with a fleshy root stock, from which are produced leaves from six to twelve feet in diameter. These are fixed to the petiole by the centre, and have a margin turned up as a border, as shown in fig. 1, from two to three inches high, giving the leaf the appearance of a huge tray. Their upper surface is of a rich green colour and studded with small prominences. The lower surface, purple or violet, is traversed by ridge-like veins, which divide the whole into compartments, while both veins and stalks are covered with spines or prickles. These enormous leaves are capable of sustaining a large water fowl, and by placing a board upon them to distribute the weight they will hold up a child of ten years of age. The flower is of two days' duration and is exceedingly fragrant. It is cup-shaped, and measures from twelve to sixteen inches across. In cultivation the plant requires a tank 20 or 30 feet across and from 3 to 4 feet deep, with special arrangements for heating the wa er to 80° or 85°. It is indigenous to the river Amazon and tributaries.

Scientific American.

THE PEARLY ALOE.

(*See page* 186.)

One of the most ornamental of the large tribe of aloes, numbering some 200 distinct species, is the *Haworthia Subulata*, generally called *aloe margaritifera*, or pearly aloe, of which the annexed engraving is a representation. It has a very short stem, and leaves which are flat above and convex below ; in short, triangular in shape and rounded towards the tip. The leaves are covered with a number of white, horny tubercles, which resemble pearls, and give the name to the species. The flowers are greenish, with whitish lobes marked with a green line, and are grouped together in a terminal spike. The beauty of the aloe, however, resides in the leaves, he flowers being, comparatively speaking, insignificant. It is by no means difficult to grow, nor any of the genus to which it belongs ; the best soil for it, says J. C. in the English *Garden*, is a mixture of three parts loam and equal parts of leaf mold and sand, and it likes good drainage and partial shade in a cool greenhouse.

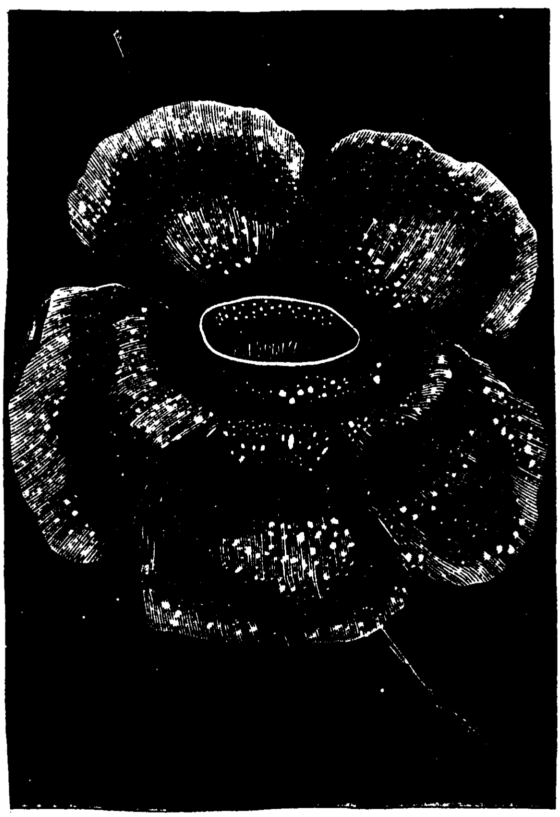
A hard cement is formed of iron borings and salt water and a small quantity of salt ammoniac with fresh water.

The presence of a very small porportion of carbonic oxide is sufficient to render the atmosphere poisonous, although its effect may not be indicated by any action of flame.

THE PEARLY ALOE.

Fig. 1.—LEAF OF THE VICTORIA REGIA.

Fig. 2.—THE VICTORIA REGIA.



THE RAFFLESIA.

THE LARGEST FLOWER IN THE WORLD.

(See page 186.)

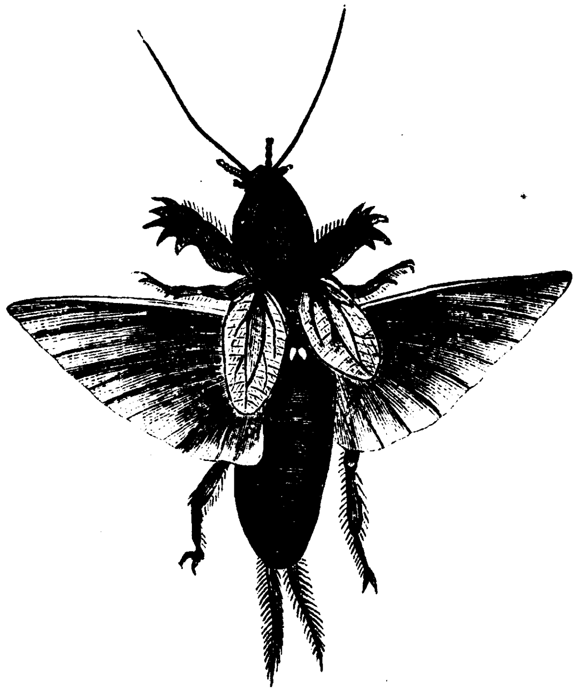
The wonderful flower represented in our engraving is that of the *Rafflesia Arnoldi*, a plant discovered by Dr. Arnold in the Island of Sumatra some sixty years ago. The various species now known are all parasitic, not, however, to the branches of other plants, but to the roots. Entirely destitute of leaves and green in color, these singular vegetables are provided with scales or bracts which conceal and envelope the flower previous to opening. A swelling beneath the bark of some huge surface-appearing root of a large tree announces the coming of a flower. Soon the bark splits, and the bud, resembling the head of a young cabbage, bursts, showing five great lobes which open and roll back slightly on the edges. Then a circular ring appears surrounding a deep cup, in the center of which is the ovary. Below the edges is a kind of gallery wherein are numerous stamens in which is located the pollen, the fecundating action of which it is impossible to comprehend unless it be assumed that insects intervene for its transportation.

The remarkable feature of the flower is its colossal size, the largest species, here represented, being 39 inches in diameter. The central cup holds six quarts of liquid, and the total weight of the flower is over 15 lbs.

The *Rafflesia patina* of Java is somewhat smaller in size. The brick red color of the pertanthus, as well as the lighter spots which it is sprinkled, give to the flower a curious flesh like appearance. The cup and the central plateau carrying the stamens are of a dark red, while the odor of the plant is almost meat-like. In Java, the natives regard the flower as sacred, and the priests prepare from the tannin which it contains an astringent mixture useful in cases of hæmorrhage.

THE MOLE CRICKET.

This insect is one of the most curious of all the *orthoptera*, to which order earwigs, crickets, grasshoppers, cockroaches, locusts, and the strange looking leaf and stick insects also belong; it is widely distributed over the world, from the torrid zone to the arctic circle; allied species inhabiting Java, China, Australia, Van Diemen's Land, North



and South America, and even Melville Island. It has been variously called eve-churr, churr worm, jarr worm, and crocker, names derived from its peculiarly jarring song; also fen cricket, earth crab, and mole cricket, the last being by far the most appropriate, and that by which it is generally known. With its powerful fore limbs it burrows underground, raising ridges in its progress. Its shape is long and cylindrical (a full-grown specimen measures $2\frac{1}{2}$ inches in length by barely half an inch across the thorax), just that best fitted for locomotion through long narrow galleries; its color is a rich, dark, velvety brown of various shades, its thorax is very hard, and so formed that the head can be withdrawn into it, much after the manner of some tortoises; its whole body is covered with fine down. It has a long sensitive pair of antennæ or horns projecting in front of its head, and another pair on its tail, projecting backwards, also very sensitive; and as it moves with equal facility either forwards or backwards, should danger threaten from front or rear, it is ready to escape without turning round, an operation which would be difficult or almost impossible in its narrow tunnels. Like all the crickets and grasshoppers, its nearest allies, its hind legs are formed for jumping; though perhaps not often employed for this purpose, they form the ordinary locomotive organs of the animal, both below and on the surface of the ground; the middle pair being comparatively weak, while the fore pair are carried raised up.

The fore limbs are rarely used in walking, but are the tools with which the insect burrows. They bear a very close outward resemblance to the fore pairs of a mole.

LATHE TOOLS AND TOOL POST SLOTS.

For the performance of a large quantity of work by the lathe, no greater necessity exists than for heavy turning tools. The numerous attempts of thirty and of ten years since to use cutting points for turning have all ended in practical failure. No nicety of shape or fitness to meet the exact requirement for easy cutting of metals will recompense for want of material, both in continuity and in mass, to conduct away the heat of the cut and of friction on the cutting surfaces. The smallest working tool for turning iron should be $1\frac{1}{4}'' \times \frac{3}{4}''$ steel in the shank, the slot of the tool post of the lathe, which swings 10" only over the ways, should take this dimension easily; $1\frac{3}{4}'' \times 1\frac{1}{8}''$ steel is not excessive for tools for the thirty inch lathe, where profitable return for use of the lathe is expected. The posts themselves, with their griping screws and bearing rings, can hardly be too heavy, while they can easily be too weak. For a 48 inch lathe it does not harm to have the slot in the post $2\frac{3}{4}''$, or $3'' \times 2\frac{1}{2}''$, or $2\frac{1}{2}''$, with a two inch screw. The refinement of spring tools for heavy cuts or for long cuts without re-sharpening, are well enough for tool rests with **V** slides, or lathes where the ways have **V**'s; but neither excellence of workmanship, nor speed of running, nor heavy cuts, will result from makeshifts of lathes, or of turning tools, however well the makeshifts may be contrived.

Discomforts of the Sick.

Those only who have passed weary days and wakeful nights in weakness and pain on a bed of sickness, with powers of endurance enfeebled, and every form of physical and mental sensibility acutely active, can comprehend the multitude and misery of the discomforts which beset the sick. Noise in its hideously infinite variety; creaking boards, which no deftly-made screw has been devised to secure; rattling china and ware, not yet replaced by ingeniously-devised substitutes—perhaps the old wooden bowl and platter on dumb waiter for food, and articles partially protected with rubber for general use; falling coals and cinders, surely preventable by the employment of wooden tongs and silent ash-pans; harsh door fastenings, possibly avoidable by special apparatus constructed for use with locks temporarily fastened back; glaring lights, that irritate the wakeful, and make the dozing dream and start; puzzling shadows, or lugubrious darkness, evils instantly remediable if only it were possible to secure a soft and shaded light. These are a few of the surface grievances of the first stage of illness, when the head aches, the faculties of hearing and sight are preternaturally intensified, and a morbid fancy extracts suffering and bewilderment from every disturbing circumstance, however small.

Then comes the stage of helplessness, when the sick person lies in the paralyzing grip of his malady, perhaps unconscious or delirious, and those about want all the aids which skill and thought can bring to their assistance to minister to his necessities safely, promptly, and with the least distress or disturbance to the patient and his surroundings. It is seldom possible to say precisely how little or how much the surroundings of a seemingly unconscious person affect him. In this period of an illness, apparatus, contrivances, and arrangements of every class, for the ministration of comforts to the sick, play a not unimportant part in the treatment, and should be so regarded. It is discouraging to observe the meager results of the enterprise bestowed by designers and producers of appliances useful in this phase of sickness. For example, a thoroughly efficient feeder suitable for use in the case of an adult does not exist, and expert nurses revive the old-fashioned butter boat. A shaded hand lamp, of no greater weight than may be borne on a finger, and so contrived that the light will fall at the point required, without assailing the eyes of the patient, is not yet devised. Complicated and costly beds, quite out of the reach of any middle class family, and therefore available only for the wealthy, or the fortunate inmates of hospitals, alone meet the requirement of cleanliness without discomfort. The like is true of nearly all the apparatus for the relief of pain by change of posture, and for securing immunity from pressure, or steadiness in a particular position. The rich and the poor are provided, but not the multitude in narrow circumstances with small and inelastic financial resources.

The stage of convalescence is in many respects the most trying of all. It is then that petty annoyances, such as arise from noises, draughts, smoke, foul vapors, bad or ill managed light, improperly cooked food, nauseous remedies administered in uncleanly and uncomfortable cups or glasses, knives, forks, and spoons that turn over with a clatter, things that fall or are readily knocked down, irritating wall papers, hard, lumpy, or too soft beds, burdensome or cold bedclothes, beds that can only be put in order with labor and confusion. There is scarcely an article or piece of apparatus for the sick chamber which is not obviously susceptible of improvement, and would not repay the thought expended upon it, if placed within reach of families with small incomes, who feel the cost of comfort in sickness. None of these matters are beneath the consideration of the medical practitioner. In no small proportion of cases they are relatively of high moment. It is neither wise nor safe to leave the care of such details to nurses, whether trained or domestic. The physician should be able to direct those in charge of the sick what to provide, where to obtain all necessary appliances, and how to use them when at hand. This is a matter of more than common importance, and it is with the view of reminding the profession and the producers of special apparatus—efficient and inexpensive—of the conspicuous part their enterprise should play in minimizing the discomforts of the sick, we bring the subject under notice.—*Lancet.*

Poisonous India-Rubber Toys.—A. F. Taylor, Ph. D., of Andover, Mass., sends us the following note :—

Prof. B. Tollens, in the Journal of the Berlin Chemical Society, of November 13, 1876, calls attention to the injuriousness of many of the articles manufactured from caoutchouc, which, among other impurities, contains a very large per cent. of zinc oxide. In the rubber nipples of milk bottles for children, this has often been found to be the case, and so much attention has been called to this fact that the manufacture of these nipples containing zinc oxide has to a great extent ceased.

But more recently suspicions have been aroused concerning the quality of children's toys, dolls, animals, etc., made from rubber. One case, in which a child, having one of these dolls, had had it for some time in its mouth, grew sick, and the doll, laid in vinegar, became covered with an incrustation (without doubt zinc acetate), led to direct investigation. In 0.7825 gramme of such a doll 0.4446 gramme zinc oxide was found, or 60.58 per cent. Another portion gave, after being subjected to a red heat, 62.64 gramme of ash, yellow while hot, white on cooling. In the ash besides the zinc were traces of lime, iron, and phosphoric acid. From another doll which had been warranted "harmless," 57.68 per cent. of ash were obtained, consisting almost wholly of zinc oxide.

It is not at all improbable that the sickness of the child, particularly the severe vomiting, was caused by the zinc oxide, and it is to be wished that the manufacture and sale of such articles containing zinc oxide should be prohibited. *Boston Jour. of Chem.* xi, 87.]

Rapid Transit in Paris.—Paris is traversed by nine great highways of travel in the direction of east to west, while three only serve as means of communication in the direction of north and south. To relieve the latter, Mr. Louis Heuzé proposed the construction of an elevated railway, which at the same time is to serve as a connecting link between the different depots of the great railways which centre in Paris. The designs, as published in the *Revue Industrielle*, are decidedly more ornamental than those of the Gilbert Elevated Railway, which they approach most in character.—*Iron Age.*

A New Grate Bar is attracting attention in England. The bar is of an angle section, the top portion, which forms the grate on which the fire rests, being provided with a number of diagonal slots, giving a uniformly distributed admission of air throughout the whole grate surface. This arrangement facilitates the complete combustion of the fuel, smoke being entirely prevented and the whole of the heat-producing portion of the coal consumed in the furnace. The bars are so light in section that they cost no more per square foot of fire grate surface than ordinary fire-bars, while at the same time they are much more durable. The bar seems designed on sound common-sense principles.—*Iron Age, March* 14.

The Proper Speed for Circular Saws.—The *Lumberman's Gazette* says: "Nine thousand feet per minute—that is nearly two miles per minute—for the rim of a circular saw to travel may be laid down as a rule. For example: A saw, 12 inches in diameter, 3 feet around the rim, 3000 revolutions; 24 inches in diameter, or 6 feet around the rim, 1500; 3 feet in diameter, or 9 feet around the rim, 1000 revolutions; 4 feet in diameter, or 12 feet around the rim, 750 revolutions; 5 feet in diameter, or 15 feet around the rim, 600 revolutions. The rim of the saw will run a little faster than this reckoning on account of the circumference being more than three times as large as the diameter. Shingle or some other saws, either riveted to a cast-iron collar or very thick at the centre and thin at the rim may be run with safety at a greater speed.—*The Millstone.*

Improved Propagation by Cuttings.

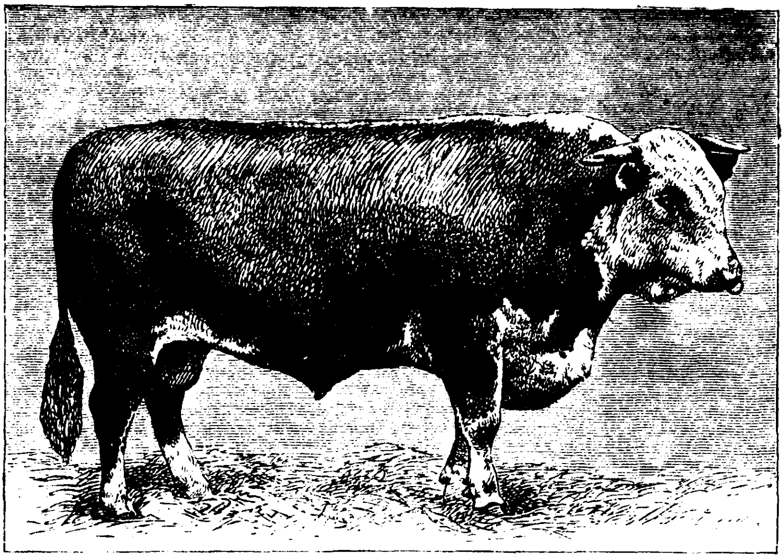
Peter Henderson described last winter, in the *Agriculturist*, an improved mode he was then using for the propagation of geraniums. His object was, in the first place, to avoid the exhaustion of the parent plants by the removal of cuttings abruptly; and, secondly, to make sure work. He takes the young shoot which is to be used as a cutting, and snaps it short, leaving it hanging by a small portion of the bark.

This shred is sufficient to sustain the cutting, without any material injury from wilting, until it forms a callus, which precedes the formation of roots. In from eight to twelve days it is detached and potted in two and three inch pots. It is rather less shaded and watered than ordinary cuttings, and forms roots in about eight to twelve days more. Last fall Mr. Henderson propagated about 10,000 plants of the tricolor class without losing one per cent. With the common method he thinks he would have lost fifty per cent. This mode is applicable to the abutilon, begonia, carnation, cactus, lantana, oleander, etc., by using young unripened shoots. If the shoot does not break, but simply bends to a knee, a knife may be used for cutting about two thirds through.

Cleopatra's Needle is likely to decay in the British climate. The Luxor red syenite obelisk has suffered more in 36 years in Paris than in as many centuries in Egypt. It has become covered with a thin white film of kaolin.

The Hereford Breed of Cattle.

The white-faced, brownish-red cattle, known as Herefords, are one of the old established breeds. They have an excellent reputation as beef cattle and as milkers. For both of these useful purposes they are well adapted, by reason of their remarkably quiet disposition, which is evinced by their mild eye and placid deportment. A contented, docile animal is a profitable feeder, as little of its food is spent in nervous excitement, or accompanying restless action. For this contentment the Hereford is conspicuous amongst the best classes of cattle, if indeed it does not surpass every other competitor for the favor of the feeder, the dairyman, or the butcher. This breed is second only to the Shorthorn as a beef animal, when kept under equally favorable circumstances, but when placed in somewhat inferior keeping, it is preferable to it. For second-rate pastures, and in the hands of farmers who do not wish to feed up to very great weights, the Hereford will excel the Shorthorn. When used for the purpose of grading up inferior native stock, bulls of this breed are sometimes preferred to the Shorthorns, and they are becoming very popular in Colorado for this purpose. Since the extreme popularity of the Shorthorn during the past few years, the Hereford has fallen into the background, along with every other sort of beef-stock; but now that this Shorthorn excitement has passed away, each race of cattle has a fair chance to take whatever position in the public favor it may deserve, or can attain and keep. The Herefords are, therefore, now being brought into notice, and will, without doubt, acquire many friends among those breeders who are engaged in improving the coarse native cattle. There are now many good herds in different parts of the United States. One town in Illinois, viz., Beecher, Will County, has the distinction of possessing three herds, owned by T. L. Miller, who exhibited some fine animals at the Centennial, Wm. Powell, and Thomas Clark. Another good herd is owned by G. S. Burleigh, of Mechanicsville, Iowa. There are one or two herds in Ohio. At the New England Fair, these herds, owned in the State of Maine by C. A. McKenney, Munroe; G. E. Shores, Waterville; J. S. Hawes, South Vassalboro; G. and G. Underwood, of Fayette, received premiums.



HEREFORD BULL, "LITTLE BILL."

The Hereford Bull, of which we give a portrait taken from the "Agricultural Gazette," is owned by an English breeder, Mr. E. J. Lewis, of Breinton. This bull, named "Little Bill," took the second prize at the Herefordshire Agricultural Society's meeting. The portrait is copied from a photograph, and therefore is a faithful representation of what the animal really is. The breed is noted for the excellence of its flesh, in which the fat and lean are intermingled, and not placed so much in layers, as in the fat Shorthorn. There is a smoothness and roundness about the carcass, which is well shown by this portrait, and which indicates profitable cutting up, with little waste or offal. The cows are generally good milkers, and yield good butter, and the calves are hardy and grow rapidly, when properly cared for. The regularity of color and form is very close in this breed, and a well-bred herd will differ very little in their markings. The white face is the most distinguishable feature.

Oxford-Down Sheep.

The Oxford-Down ram, whose portrait, copied from a photograph, is given on this page, has a history that is interesting to American readers. The ram is the "Royal Liverpool," and the first-prize animal in his class at the Royal Agricultural Society's show at Bath. This ram, with three others, all the property of Mr. Treadwell, of Winchendon, England, are the progeny of the ram "Freeland," also owned by Mr. Treadwell. "Freeland" is now in the possession (although not the property) of Mr. T. S. Cooper, of Coopersburg, Pa., Mr. Cooper having rented the ram for the coming season from Mr. Treadwell, for the sum of 85 guineas, or nearly $450. This ram has received many first prizes, and his offspring have also been successful prize-winners. For the four rams above referred to, Mr. Cooper offered $2,000, which their owner declined. This fact indicates the value placed upon these animals in England, where the Oxford-Down has become very popular. In this country it is rapidly becoming a favorite sheep, occupying a place midway between the short and long wools, as regards fleece, and an equal one at least as regards mutton, with the Cotswold. In some respects the mutton is preferable to that of the Cotswold. Mr. Cooper, who has the ram "Freeland" now in his possession, is one of our most enterprising breeders, and has imported some of the best stock now in this country. In procuring the best possible Oxford-Downs, he is doing this excellent breed only fair justice, for although it has already made a good start here, and several good flocks are now owned in the country, yet there is room for some of the best blood to keep up the standard of quality, if not to advance it.

OXFORD-DOWN RAM, "ROYAL LIVERPOOL."

THE PRODUCTION AND DISPOSAL OF EGGS.—An egg contains more nutriment than any other substance of the same weight. At the same time, the market price of eggs is comparatively lower than that of flesh. A pound of eggs is also produced at a less cost than a pound of flesh. Considering the importance of the poultry products of the country, there is by no means sufficient regard paid to them. The stock of profitably productive poultry, as compared with the whole quantity kept, is small. As compared with the whole, the number of hens that produce 100 eggs in a season, is small in proportion. Yet 150 eggs are frequently laid in a year by hens of the improved breeds, and by common hens that are well fed and kept. The preparation of eggs by a recent invention for drying or, as it is called, "crystalizing" them, a process in which the work is done by machinery, has very largely increased the market for them. The dry product is imperishable, and, when packed in tin boxes, may be shipped to the most distant countries, or carried on ships through the longest voyages. No doubt this new use for eggs will increase the demand for them when the manufacture has become thoroughly established, and that it will be a profitable business for farmers to keep better poultry and improve, so far as possible, their present methods of keeping their fowls. Suggestions to this end will be found every month in the *American Agriculturist*.

New Process of Steel Casting.

We read in the *American Manufacturer* an account of a new process of making irregular shaped steel castings such as plow-shares, out of fine tool steel, any desired percentage of carbon, without annealing, as in the ordinary "steel casting" processes. It is the invention of Mr. A. J. Nellis, of the Pittsburg agricultural works. In the ordinay method of making steel castings, it is necessary for the steel to be very high in carbon, in order to be fluid enough when melted to run into a fine casting, and the excess of carbon is removed after the casting is made by a process of annealing which requires from 10 to 20 days. By Mr. Nellis's method of making castings, low carbon steel, or ordinary tool steel, may be employed if desired. The mold in which the casting is formed is impregnated with combustible materials, which takes fire the instant that the melted steel comes in contact with the mold. An intense heat appears to be generated, which retains the steel in a perfect fluid condition till it reaches the smallest corners of the mold, and an agitation is caused by which all air and confined gases are are allowed to escape from the metal, thereby making the casting free from blowholes. One theory of the action of this process is that the combustion of the materials with which the sand is impregnated consumes all the oxygen of the air within the mold, and the remaining gases have no "affinity" for the steel. The plow-shares made by this process can be forged into any shape required by an ordinary blacksmith, or after it is entirely worn out he may draw it down into tools and cutlery. If the new process succeeds as well as it promises to do, we may soon see steel castings largely used instead of wrought iron or steel forgings for all difficult shapes. Mr. Nellis also has a patent on the mold used for his steel castings, which obviates the trouble experienced with iron molds, of the melted steel adhering to them on all sides, and causing shrinkage cracks, and has all the advantage which iron molds possess of durability and permanence of form. The molds are made chiefly of iron, but with inserted sections of sand. These sections do not adhere to the casting, and shrinkage can take place without hindrance, avoiding cracks or internal strains.

Candy and Teeth.—*Hall's Journal* comes to the rescue of our candy-loving little ones, and says it is not true that sugar and candies are of themselves injurious to the teeth or the health of those who use them; so far from it, they are less injurious than any of the ordinary forms of food when employed in moderation. It would be a strange contradiction in the nature of things, if sugar and candy in moderation should be hurtful to the human body in any way, for sugar is a constituent of every article of food we can name. There is not a vegetable out of which it cannot be made, not a ripe fruit in our orchards which does not yield it in large proportions, and it is the main constituent of that "milk" which is provided for the young of animals and men all over the world. But to use this information intelligently and profitably, it must be remembered that sugar is an artificial product, is a concentration, and that if used in much larger proportions than would be found in our ordinary food, as provided by the beneficent Father of us all, we will suffer injury. We should never forget that the immoderate use of anything is destructive to human health and life, if persevered in. The best general rules to be observed are two: First, use concentrated sweets at meal times only; secondly, use them occasionally and in moderation.

A simple contrivance has been adopted in some Russian and German rail-rolling mills, with a view to cutting the rails always of exactly the same length. The glowing rails are looked at through a dark glass; when they have cooled to a certain temperature they can no longer be perceived. Using a dark blue or orange-yellow glass, *e.g.*, the rails may still be at a red glow, when the light radiated from them disappears in the dark glass. It may be considered that the light from two rails observed through the same dark glass disappears at the same temperature, and thus one is guided to cutting the rails while in this similar state, each rail after rolling being allowed to cool till it can no longer be seen at a given distance through the dark glass; thus they can all be cut of the same length. Of course the certainty of the observation is a little affected by variations in the general illumination (dark and bright weather, &c.), but glasses of various shades of colour can be used according to the occasion. The principle has other applications—*inter alia*, a simple and convenient pyrometer may be constructed on it.

Among the vegetable wonders to be exhibited at the Paris Exposition this year will be a section of a trunk of a tree which was 90 metres high, from the forests of the Mississippi. This section has a circumference of about 20 metres. It may give some idea of the difficulties of navigation which are often encountered in the great American rivers through the falling of such trees into the stream. A number of myrtle and citron trees are to be sent from the small principality of Monaco, and in the park of the Champs de Mars will also figure Italian poplars and chestnuts.

M. Förster, of Munich, has recently determined, with a Pettenkofer apparatus, the excretion of carbonic acid by a large number of children, from the sucking stage up to ten years, and he finds that for 10 kilogrammes body weight they always excrete about 10 to 12 grammes CO_2, or nearly three times the quantity given by adults in similar circumstances. Hence a comparatively larger supply of food is required for maintenance of the body in children than in adults.

To Prevent Honeycomb in Castings.—Mr. John Bourne, C. E., of Mark Lane, London, has patented a device to prevent honeycombing in castings, by which he extracts from the metal, while in the molten state, the gas or gases by which the honeycombing is produced. The removal of the gases may be effected by the aid of any mechanical means capable of producing rarefaction, such as a common pump, an exhausting jet of steam or other fluid, the hydrostatic gravitation of a column of the molten metal itself, or any other exhausting expedient, by which a vacuum more or less perfect is produced. The molten metal must be exposed to the action of the vacuum in such a manner as to insure the disengagement of the gas from the metal, and for this purpose he submits the metal to the vacuum preferably in a state of minute subdivision. This may be accomplished by allowing the molten metal to run through perforations in a fire-clay block into a tall cylinder, within which a vacuum is maintained. By thus subdividing the metal, and discharging it in the form of a metallic rain into an exhaust chamber, the gases are separated from the metal, and are sucked away by the pump or other extractor in communication with the exhaust chamber. He remarks that it is not intended to subdivide the molten metal (without the aid of a vacuum), for the removal of the gases, nor to attempt to suck away the gases from a vessel filled with molten metal by producing a vacuum above the metal, as the hydrostatic pressure of the metal itself would, under such circumstances, retain the gases within the metal, notwithstanding the existence of the vacuum above it; but he extracts the gases by the conjoint action of the vacuum and of the subdivision, as above explained, or by analagous or equivalent means embodying the same conditions.

Hints for the Wakeful.

If you connot get sleep when you first go to bed, says *Hall's Journal of Health*, give orders to be waked up at daylight, get up promptly, do not sleep a wink during the day, go to bed at your regular time, with directions to be waked as before; in a week you will find that you can go to sleep promptly, but then be careful to get up as soon as you wake in the mornings, thus you will soon find out how much sleep your system requires, and act accordingly. Always avoiding sleeping in the daytime; for if you require seven hours sleep, and spend that much in sleep at night, what ever time you spend in sleep during the day must be deducted from that seven hours, or you will soon become wakeful again. If you wake up in the night, either go to bed two or three hours later or when you wake, get up, even if it be but one o'clock in the morning, and do not sleep a moment until your regular hour for going to bed; and if you go to bed regularly, get up as soon as you wake, and do not sleep in the daytime, you will find out in less then a week how much sleep you require, then act accordingly. Nature loves regularity, and the four hours sleep from ten to two, is worth six hours after twelve o'clock. The great rule is, retire at a regular early hour and get up always as soon as you wake, if it is daylight. If persons have force of will enough to keep from going to sleep a second time, it is greatly better to remain in bed ten or fifteen minutes after waking up, to think about it, and enjoy the resting of that kind of feeling of pleasurable tiredness which comes over us on waking, especially if we have taken more exercise than usual the previous day, or have been kept up later.

The Law of Rest.

William Walter Phelps recently made an address on the American habit of hard work before a meeting of physicians and surgeons. Among other things, he said: We are a nation without contentment, without rest, without happiness. In a feverish race, we pass from the cradle to the grave—successful men, to whom life is a failure. Our boys leave the university, when English boys leave their school. Our merchants leave their trade, retiring to some more dignified or honorable work, as they believe it, at an age when the German merchant first feels the master of his trade. We are always anticipating the future, forcing the task of a whole life into part. Worse, we are not content with doing a year's work in a month in our own calling, but we must do enough in all other callings to win distinction there. In other lands it is enough to be a lawyer, physician, clergyman, merchant. Here we are nobodies unless we fill the sphere of all human occupations. He must be a statesman, and know political science as if already in office. He must be an orator, and ready to persuade and instruct—a wit, to shine at the dinner-table—a literateur, a critic. There is too much human nature in man for this to mean anything except a discontented life and a premature death. And the remedy?

Correct public opinion. We must honor the man who faithfully does his task, whatever it be. Not the task, but the faithfulness with which it is done, must be the measure of the honor. Then men will be content with their father's house or their father's trade. This will give us that family association which is a sure pledge of good conduct and patriotic love. This will give us too that traditional aptitude which alone gives great mechanical excellence. It will not be a bad time for American manufacturers when we find stamped on them, what Mr. Griffis finds on Japanese bronzes—"Done by the ninth bronzer in this family." Then men will keep the occupation of their youth for their age, and having leisure, will build the foundations broad enough to withstand bankruptcy. Then men will seek excellence in other callings, and not compete with the excellent in other callings. Then men will alternate labor with rest, and obey the law which God has written on creation—God, who Himself rested after toil—God, who shrouds the earth with the night, that it may take its daily sleep—God, who speaks to the torrent to stop at once amid its maddest plunge.

How Poisons Are Spread.—Mr. G. Owen Rees, Consulting Physician to Guy's Hospital, London, has called public attention to some unexpected sources of arsenical poisoning. The green calico lining of bed-curtains has been found to have produced, for months, severe symptoms, which were treated as those of natural disease, without benefit to the patient. When the curtains were removed the patients at once recovered their health.

Rat-Proof Paint.—Mix finely powdered glass with pitch or coal tar and rosin, and paint your grain bin with two coats, and it will be too much for rats' teeth. They don't like the tar, and the sharp glass is still more disagreeable.

Wearing the Beard.

Hair is nature's protector against cold. Our beneficent Creator does nothing in vain. Rowland says on this subject: "It may be safely argued as a general physiological principle that whatever evinces a free and natural development of any part of the body, is, by necessity, beautiful. Deprive the lion of his mane, the cock of its comb, the peacock of the emerald plumage of its tail, the ram and deer of their horns, and they not only become displeasing to the eye, but lose much of their power and vigor. And it is easy to apply this reasoning to the hairy ornaments of a man's face. The caprice of fashion alone forces the Englishman to shave off those appendages which give to the male countenance that true masculine character, indicative of energy, bold daring and decision. The presence or absence of the beard, as an addition to the face, is the most marked and distinctive peculiarity between the countenances of the two sexes. Who can hesitate to admire the noble countenance of the Osmanli Turk of Constantinople, with his un-Mongolian length of beard? Ask any of the fair sex whether they will not approve and admire the noble countenance of Mehemet Ali, Major Herbert Edwards, the hero of the Punjaub, Sir Charles Napier, and others, as set off by their beard? We may ask with 'Beatrice,' 'What manner of man is he? Is his head worth a hat, or his chin worth a beard?' I have noticed the whiskers and beards of many of our most prominent physicians and merchants encroaching upon their former narrow boundaries, while it is well known that not a few of our divines have been long convinced of the folly of disobeying one of nature's fixed laws; but hitherto their unwillingness to shock the prejudice of their congregations, has prevented them from giving effect to their convictions. The beard is not merely for ornament, it is for use. Nature never does anything in vain; she is economical, and wastes nothing. She would never erect a bulwark were her domain unworthy of protection, or were there no enemy to invade it."

The History of Diphtheria.

We recently quoted some pertinent suggestions concerning this disease from an address delivered by Dr. Maxon, of Syracuse, New York, and published in the *Journal of Chemistry*. There are also matters connected with the history of the disease which teach lessons. The annual flooding of the Nile in Egypt, affording, with the moisture thus produced, a generation and mingling of marsh and animal miasms, with the various imprudences of the Egyptian people, may readily have originated this disease. Asia Minor, probably the next most predisposed country and people, was next invaded, as might have been expected. Then, in its turn, the south of Europe, burdened with the imprudences of the third and fourth centuries, with its influx of the northern hordes upon the Roman empire. Later still, central and northern Europe, distracted with the turmoils and degraded by the pollutions of the dark ages, became ripe for it. Finally, other parts of the world, including America, had become sufficiently predisposed; and the United States, having either produced it or received it from the Old World, has hence suffered a due share of its ravages down to the present time.

Every step of the progress of this disease has thus been invited, and every epidemic or endemic has had its cause; no case ever having occurred anywhere, unless contracted by the contagion from another patient, without some general or local cause—usually *local* and discoverable—from which may have emanated animal as well as marsh miasms or poisons. The fact of its increased prevalence in our own country may very likely be due, in part at least, to the more artificial mode of treating children, its more common victims. For it is a shameful fact that, as a result of modern fashion, few children now, among all classes, have proper clothing or covering for their limbs; and a still smaller number take their food with strict regularity, abstaining from it between meals, as well as from candies and other injurious and indigestible trash, as they should. A radical reform in these respects, together with cleanliness and an avoidance of the pollutions in and about dwellings, barns and out-houses, with proper sewerage, would greatly diminish the number of cases as well as the malignancy of this and all other putrid diseases. Such a rational and proper course, persevered in for a reasonable time, would doubtless render them extinct, or some of them at least.

If all interested in this matter would, instead of regarding it as a visitation of God, set about inquiring into and removing the causes, very much might and would thus be speedily done to eradicate this disease. For, though God has established laws that control results, He has not directed nor ordained that nuisances and pollutions should be left where they will tend to produce disease.

Treatment for Corns.—The *Druggists' Advertiser* handles this painful subject as follows: Keep the feet clean by frequent ablutions with warm water, and wear easy, soft boots or shoes. Without the latter precaution, corns will generally return, even after they appear to have been perfectly removed. After soaking the feet in warm water for a few minutes, pare the corns as close as possible with a sharp knife, taking care not to make them bleed. Place upon the part affected a small, circular piece of leather or buckskin, spread with some emollient plaster and having a hole in the center corresponding to the size of the corns. They may now be touched with nitric acid by means of a small glass rod or wood tooth-pick, due care being taken not to allow the liquid to come in contact with the neighboring parts. Repeat this process daily, until the offender be sufficiently softened to admit of removal.

Scarlet Fever by Mail.—A medical correspondent of the London *Telegraph*, a few weeks ago, gave the following account of such a case: "A lady residing in the country wrote to inform a friend in this neighborhood (East Sheen) that she was occupied in nursing her daughter suffering from scarlatina. The friend, after reading and burning the letter, gave the envelope in which it was contained to one of her children to play with. Ten days later I was requested to see the same child, when the diffused red rash over the skin, elevated temperature, and ulcerated tonsils clearly pointed to the nature of the malady with which I was called upon to deal. From inquiries that I have since made, I am satisfied that unless the disease originated *de novo* it could be traced to no other source of infection than the unfortunate envelope previously mentioned. Preventive medicine is always better than curative. I would therefore suggest that all communications not absolutely necessary written from an infected house be interdicted, and then when received, both letters and envelopes be immediately consigned to the nearest fire."

Drain and Ventilate.

We refer to these subjects very often in this column, and fitly, because they are the corner stones in the preservation of health. The *Polytechnic Review* thus presents the subject: Wherever the soil water, impurified by contact with unclean organic matters, sinks into the earth, it leaves behind it a moist and unwholesome residuum, and the warmer the air, the water and the soil, the more energetic are its unwholesome influences. Whether the infectious matters are transferred from the soil into the well waters, or whether they enter the air directly with their gaseous products of decomposition or by evaporation, are merely incidental accidents which do not at all affect the result, since, in every case, it is those who dwell upon or near such unwholesome soils who are the greatest sufferers. If the air of our dwelling houses is not frequently renewed by ventilation, or if water charged with organic impurities is permitted to saturate the soil about them, or if decomposing organic matter (or what is the same thing, filth) is stored up in the neighborhood, or so disposed of that it is permitted to impregnate and saturate the soil about and beneath the house, or if the channels by which these offensive matters are removed from the house, as in the sewerage systems of cities and towns, are not properly constructed or guarded, the air that enters a dwelling thus environed, will be charged with disease-breeding emanations arising from the soil or from the sewer pipes. The drinking water may become impregnated, and the unwholesome products thus introduced into the bodies of its inhabitants will, beyond all question, exert the most pernicious effects upon health, producing, according to the quantity of exposure and individual peculiarities, consequences more or less fatal.

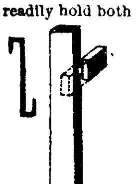
The Oldest Human Relic in the World.

In the Etruscan Vase Room of the British Museum is to be seen the skeleton of one Pharaoh Mykerinus, decently incased in its original burial-clothes, and surrounded by fragments of the coffin, whereon the name of its occupant can be easily read by Egyptologists, affording conclusive evidence that it once contained the mummy of a king who was reigning in Egypt more than a century before the time of Abraham. The proof is thus explained in the *Gentleman's Magazine*, April, 1806: "About two years ago Herr Duemichen, a German explorer of the monuments of Egypt, following up the indications pointed out by M. Mariette, a distinguished archæologist, discovered on the buried walls of the temple of Osiris, Abydos, a large tablet containing the names of the ancient Pharaohs from the time of Mizraim, the grandson of Noah and founder of the Egyptian monarchy, to that of Pharaoh Seti I, the father of the well-known Rameses the Great, including thereby the chronology of nine centuries, viz., from B. C. 2300 to B. C. 1400. This tablet, by far the most important yet discovered, has been compared to the sculptured figures of the kings of England, at the Crystal Palace, from William the Conqueror to Her Majesty Queen Victoria. Astronomical evidence, moreover, enables us to determine the time of two important epochs in the history of Egypt, one of which is connected with our present subject. Sir John Herschel has fixed the age of the Great Pyramid of Ghizeh to the middle of the twenty-second century B. C. The tablet of Abydos shows that the Pharaoh whose bones we now possess succeeded the builder of the Great Pyramid with only two intervening kings. We are therefore warranted in assuming that the remains of Pharaoh Mykerinus belong to the age to which we have assigned them."

Harness Polish.—Take of mutton suet, two ounces; beeswax, six ounces; powdered sugar, six ounces; lampblack, one ounce; green or yellow soap, two ounces; and water, one-half pint. Dissolve the soap in the water, add the other solid ingredients, mix well, and add turpentine. Lay on with a sponge, and polish off with a brush.

Aids in Fence Building.

One man, alone, finds it a difficult job to build a board fence, inasmuch as one pair of hands can not readily hold both ends of a twelve-foot board, and nail one end at the same time. By using the hooks shown in the accompanying engraving, this work may be easily done by one person. In the figure is shown a hook and guard for holding the end of the board that comes next to the finished panel. It is so made that, when hung upon the top of the fence post, the board rests upon the hook, and can not slip off. Then the other end of the board is nailed, the middle is nailed, and then the end held upon the hook. The hook is then moved for the next place. To hang the rest of the boards, hooks, such as shown at the left, may be used, of various lengths to suit the different spaces between the boards. The uses of these are too obvious to need description.



FENCE HOOKS.

An Important Discovery.

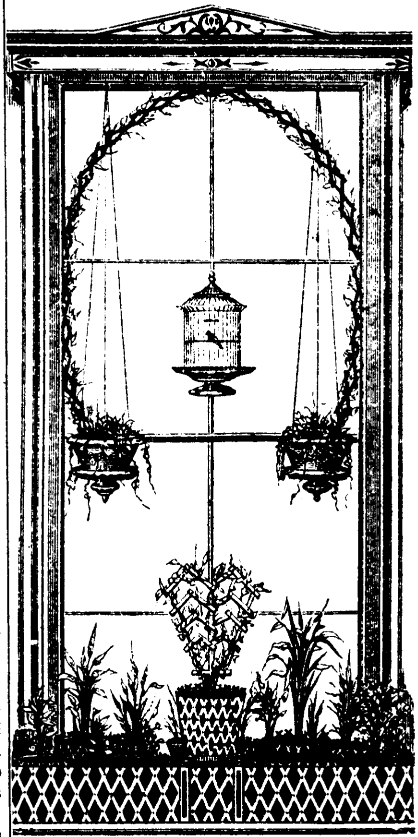
One of the most important discoveries of recent date is that of a method of protecting iron surfaces from injury by oxidation. If the discovery is as stated by Prof. Barff in a lecture delivered before the Society of Arts, London, its value can hardly be estimated in any hasty view of the matter. If the means are afforded us of rendering all kinds of iron work, however much exposed to the weather or to corrosive vapors and liquids, practically indestructible and permanent at trifling expense, it is one of the greatest triumphs of modern chemical research. It is well known that iron, when exposed to the action of water or moist air, begins to rust, a film of ferrous oxide being in the first place found upon its surface; this rapidly takes up more oxide from the air, and sesquioxide is formed; the latter compound gives up some of the oxygen to the unchanged metal beneath it, and the fresh ferrous oxide thus produced slowly unites with more oxygen, which traverses the layer of sesquioxide overlying it, and thus in time the whole mass of iron crumbles to a reddish-brown powder, the sesquioxide of the metal. In this way the iron utensils and implements found in ancient buried cities have been destroyed. In most instances not a particle of unchanged iron remains when these implements are discovered, but the mass of adherent oxide retains the form, and with careful handling may be preserved for years, as has been done with those taken from the buildings of Pompeii.

The great disadvantage in the use of iron has been its appetite, so to speak, for oxygen; and now if this disadvantage is removed, if its open mouth is closed, the economic and sanitary benefits resulting will be very great. Professor Barff's method is not of the nature so often resorted to, namely, the use of paints, varnishes, etc., but is based on the principle of producing such chemical changes on the surface of the metal as will prevent the ingress of free oxygen to the mass. He covers the surface with a layer of ferroso-ferric or magnetic oxide of iron, which is intermediate in composition between the two oxides mentioned above. This he accomplishes by exposing the metal to the action of intensely superheated steam. By this action it becomes covered with a black film of magnetic oxide which adheres to it even more firmly than the metallic particles adhere to each other, and is sufficiently hard to resist a file. Iron thus protected has been long exposed to the action of moisture and corrosive acids without change, and is practically unoxidizable by any agent. The process is cheap and can be conducted to any desired extent.

By this invention the use of iron for many applications must be greatly increased. It does away with the enameled iron culinary utensils, so liable to be poisonous, and also "tin ware," so called. Iron plates protected by the magnetic oxide will be used for a large number of purposes where the more costly copper is now used. Perhaps more important than all, the discovery will break up the use of "galvanized iron" water pipes, by which so many individuals and families have been poisoned. It gives us a cheap, safe, water conduit pipe, which has long been needed and sought for. If no practical difficulties arise in the manufacture—and none are anticipated—it cannot be long before the great benefits of this discovery will be realized by every community in the civilized world.—*Journal of Chemistry.*

Rapidity of a Pigeon's Flight.

According to the London newspapers, there was lately an amusing experiment to test the flight of carrier-pigeons against the speed of a railway train. The following is the account given of this curious race, which took place on the 13th of July: "The race was from Dover to London, between the continental mail express train and a carrier-pigeon conveying a document of an urgent nature from the French police. The pigeon was of the best breed of homing pigeons, known as "Belgian voyageurs." The bird was tossed through a railway carriage window, by a French official, as the train moved from the Admiralty Pier, the wind being west, and the atmosphere hazy, but with the sun shining. For upwards of a minute the carrier-pigeon circled round to an altitude of about half a mile, and then sailed away towards London. By this time the train, which carried the European mails, and was timed not to stop between Dover and Cannon Street, had got up to full speed, and was proceeding at the rate of sixty miles an hour towards London. The odds at starting seemed against the bird; and the railway officials predicted that the little messenger would be beaten in the race. The pigeon, however, as soon as it ascertained its bearings, took the nearest homeward route, in a direction midway between Maidstone and Sittingbourne, the distance, "as the crow flies" between Dover and London, being seventy miles, and by rail seventy-six and a half miles. When the continental mail express came into Cannon Street station, the bird had been home twenty minutes, having beaten Her Majesty's royal mail by a time allowance representing eighteen miles."



DESIGN FOR WINDOW GARDENING.

Automatic Clock.—An automatic clock is described by Herr Helling, in which the winding machinery is operated by the alternate expansion and contraction of glycerine, or other suitable liquid. A piston, on the surface of the glycerine, is so connected with ratchet wheels and toothed racks, that motion in either direction will wind up the weight. The inventor thinks that the contrivance will be especially valuable for self-registering meteorological instruments.

The fact that American manufactures are admitted free into the kingdom of Hawaii, while heavy duties are imposed upon those of Great Britain, would seem to leave no reason why the latter should enjoy an almost undisturbed monopoly, especially in the items of machinery and agricultural implements. The increasing exports of sugar and molasses from Hawaii, a very large proportion of which is received at San Francisco, and the statement by the American minister to Hawaii that America has allowed the great advantages for the introduction of its manufactures to remain unimproved, have directed attention to the subject which may result in the opening up of a flourishing trade there, and the driving of British manufacturers from the field.

English Japanners and the Japanese Goods.

Those English japanners who have always taken an interest in their industry, regarding it much as an art rather than as a trade, have long desired to emulate the Japanese product. They have dissected the article with the keenness of an analytical chemist, and they believe they know pretty much how it has been got up. Their chief difficulty, however, has been the materials with which the Japanese have had to work. The grain, the lightness and the solidity of the wood used, together with the varnishing, the bronze, and the coloring are not known in Europe. The wonderfully polished surface of the Japan goods has evidently been obtained without the costly aid of the delicate hand of the woman-worker, by which alone the best polish upon English goods is secured. The Japanese has only had to apply his beautiful japan and put his blank into the sunlight, and all the resplendent polish, as well on the back as on the front of the tray, would seem to be the result The raised surface of what looks like solid bronze adornment is believed by the best artists in this country to have a white metalliferous base, secured by a material not available here —the bronze and the coloring, as they appear to the eye, having been subsequently applied, but only lightly. We all know that it was "Foley the Fiddler" who rifled the Swedes of the secret of making slit rods, and that it was another Englishman, now an American ironmaster, and at the present moment in this country, who by a personal visit to iron-mills in Siberia succeeded in obtaining for Transatlantic makers the secret of making Russian sheets. There are japanners now in England who, were they a little younger, would not hesitate to run the risk—for risk it still is—of finding their way into the Japanese manufactories in which these marvels of execution are turned out. The problem, however, still remains unsolved. Even should he succeed in getting all the information which he might desire, could he obtain the materials, and, having obtained them, could he in his ovens make up for the absence of the Eastern sun? However, we are not inclined to despair, for we do not think it improbable that the entire secret will be by-and-by revealed. The Japanese could, perhaps, be prevailed upon to send us shipments of the finest of their timber, got from the maple and the evergreen oak, together with a plentiful supply of their varnish or lac tree; and, seeing that it is now the ambition of almost every Japanese artist to get to Europe, little difficulty would be experienced in enticing Japanese artists over to this country.—*English Exchange.*

Explosions in Coal Mines.—Three papers on the relations of atmospheric pressure and coal dust to explosions of fire-damp, and on the best means of preventing them, are given in a recent number (vol. xi.) of the *Annales des Mines.* The French Academy has appointed a committee consisting of MM. Daubrée, P. Thenard, and Berthelot, to act with a committee of engineers in studying remedial measures.

VARNISH, AND THE MATERIALS USED IN ITS MANUFACTURE.

By Z. T. Anstett, Ph.G.

A great many varieties of varnish are produced now in order to satisfy the demand for its use in the various special branches of industry, and are in almost all cases made by the solution of various resins in some solvent which will evaporate after the article is applied, thus leaving the resin deposited on the surface as a thin and even coating. The characteristics of a good varnish are that it should remain brilliant after the evaporation of the liquid medium, and present a dry, hard surface, instead of a greasy and tarnished one. It should also adhere closely to the surface to which it is applied, and not be liable to scale off when it becomes dry, even after the expiration of a long time; beside these qualities, it should become as hard as possible, without becoming brittle.

The principal solvents used in the manufacture of varnish are linseed oil, oil of turpentine, and alcohol, and the chief resins used are copal, amber, mastic, sandarac, lac, elemi, dammar, anime, and caoutchouc. Besides these, gamboge, aloes, dragon's-blood, and saffron are used as colouring matter.

Varnishes are classified as ether spirit varnishes, volatile oil varnishes, and fixed oil varnishes. Ether varnishes are very little used. Spirit varnishes are usually made with alcohol, and are produced in great variety. The best spirit varnish is made by simply digesting the resin in the alcohol, allowing it to evaporate in the sun or shade to the proper consistency; but this plan is too slow to satisfy the exigency of our modern industry, though it produces a varnish having the least amount of colour. A more rapid process is heating the varnish over a water bath or the fire, and this changes the colour very materially, but being the most rapid process it is generally employed. Oil of turpentine is the volatile oil generally used in the manufacture of varnish, and it is chiefly used in copal varnish. Spirit varnishes are injured by being kept too long, while turpentine varnishes, on the contrary, are improved by keeping, a more intimate union taking place between the resin and the oil. Linseed oil and poppy oil are sometimes used with copal or amber to make fixed oil varnishes, and this class, although slower in drying than the others, leave more residue, and are therefore more durable and better adapted for resisting the action of the elements. For interior work they are also considered the best, where colour is no objection, since they can be washed over without injury. Oxide of lead (litharge) is sometimes used to facilitate drying.

Copal being harder to dissolve than most resins, a special process is employed in manipulating it. The resin is first melted over an open fire till perfectly liquid, when linseed oil, heated to about 400° F., is added, and then oil of turpentine, to bring the varnish to the proper consistency. The linseed oil does not combine with the resin, but simply mixes mechanically with it, having the particles separated so as to combine with the oil of turpentine, which should be added slowly so the mixture can take place by degrees. The state of the weather must be taken into consideration when making varnish, since when it is damp they absorb sufficient moisture to greatly impair their brilliancy. The consumption of varnish is now very great, and constantly increasing, which is due to the greater number of purposes to which it is applied, while the increase of wealth naturally develops the taste for articles of luxury. The taste, too, for the use of natural woods in our houses and furniture, and the consequent discarding of the use of paint, have much to do with increasing the consumption of varnish. To give the reader some idea of this business, I will simply give the statement of one manufacturer as furnished to me. This factory consumes annually over 600,000 pounds of copal and shellac, and over 300 000 gallons of alcohol, linseed oil, and oil of turpentine, producing, with other ingredients of less consequence, nearly 400,000 gallons of varnish.—*Druggists' Advertiser.*

Home Topics.

BY FAITH ROCHESTER.

The Preparation of Coffee.

I have just now read the recipes for making coffee, given in "Common Sense in the Household." I have written some good words about this receipt book, but I can not advise young housekeepers to follow Marion Harland's directions for making coffee. I think that any one who cares for the finest flavor of coffee—that "delicious aroma" which escapes so easily—would prefer to see a common tin coffee-pot on the table, containing the infusion just as it had reached the point of perfection over the fire, rather than have the hot coffee poured into another coffee-pot, however rich or handsome, before serving. I do not know how the beverage can be turned into a silver, china, or britannia coffee-pot without considerable waste of aroma. By many coffee drinkers the aroma is valued more than the "body." Such persons do not like to have the coffee boiled at all. Care should be taken to preserve the "aroma" while endeavoring to secure good "body." As the latter is secured by boiling, while the former escapes with the steam during the boiling process, it is a good idea to reserve a portion (say one-third or one-fourth) of the coffee prepared for the pot, (with egg or otherwise), while boiling the rest of it, putting it into the coffee-pot as that is drawn away from the hottest part of the stove or range, to some position where it will keep hot without boiling. There are various patent coffee-pots or coffee-filters, made with a special view to the preparation of clear and excellent coffee, without any especial art on the part of the cook.

How to make the coffee turn off from the grounds *clear*, is a puzzle to some inexperienced or stupid cooks. I suppose that the most common course is to clear the coffee with egg. Some crush the whole egg, and mix the ground coffee with it, shell, yolk, and white together. Others use the white and shell, leaving out the yolk. This is Marion Harland's direction, and she advises us to *beat* the white of egg first. I don't see the need of it, and I never could imagine what good the shell does. Many of the eggs which come from market, and as many which come from our own hen's nests, are decidedly soiled upon the surface, and should be washed before going into any food or drink. That is one reason why I should leave out the shell.

The principle involved seems simple. The more finely the coffee is ground, the more thoroughly can its properties be extracted by a brief boiling. But the finer the ground coffee is, the less does it incline to settle to the bottom of the coffee-pot, and the "muddier" is the beverage, unless some art be used to "settle" the coffee. Break an egg at one end so as to pour out the white, retaining the yolk in the shell. Mix the white well with the ground coffee, and if it is not sufficient to wet it all, add just enough water to dampen the whole, stirring it thoroughly together. Put this into the coffee-pot, and pour boiling water over it, (one pint to each two tablespoonfuls of coffee, Miss Beecher says; Marion Harland says one quart of water to half a pint of ground coffee, afterwards adding a cup of cold water); and the egg is immediately cooked, so as to retain all of the fine coffee grounds in its meshes. If this is properly done, no addition of cold water or anything else after boiling, is necessary to produce clear sparkling coffee. I have often admired the work of the egg in clearing coffee, as I have removed the spongy ball of egg and coffee when cleaning the coffee-pot. It is evident that many housekeepers do not see the philosophy involved in this use of egg, or they would never for a moment suppose that the egg would clear the coffee satisfactorily if put into it at any time after the coffee and boiling water are put together. You want to bind the coffee grounds together with egg, not to add boiled egg to the beverage. Put in the yolk of egg if you like, but it is of no more use than so much water. I prefer to stir it well into the thickening for my cream or milk gravy, where it adds richness and nourishment, and beauty.

We can not always get an egg to settle coffee with, and few of us possess a French filter, or even an "Old Dominion" coffee-pot. This thing you can do—and I have done it many a time—tie the coffee grounds loosely in a thin bag. If the ground coffee is tied up in a tight bag, the water is slow in penetrating and extracting the properties of the coffee. When I use a thin, loose bag for the coffee, I stop up the nose of the coffee-pot, to retain the aroma as much as possible. If the coffee is ground coarsely it will settle itself, if allowed to stand without boiling a few minutes before serving, and then turned out without shaking. The addition of a half tea-cup of cold water when it is removed from boiling, will settle the grounds, but nothing is quite so good and sure as white of egg, if one can not use a good patent coffee-pot.

Professor Blot, in his cook-book, directed the use of water which had *not been previously boiled*, as soon as it reached the boiling point. For breakfast coffee he advised four tablespoonfuls for a quart of water, for strong coffee eight spoonfuls to a quart, and for "black coffee" one pound to a quart. It is this "black coffee" which is used, I suppose, in making the celebrated

Cafe-au-lait.

This is black coffee added to boiled milk—a tablespoonful to a cup of boiled milk, making a strong cup of unusually delicious coffee, famous all over the world as French coffee. The milk must be new and nice, and slowly simmered to a thick creamy richness. In France it is sweetened with beet sugar. Mrs. Stowe says that this coffee is so black and strong as to be "almost the very essential oil of coffee." There is significance in the name of this drink, suggesting that the coffee should be added to the milk, not the milk poured into the coffee. I wonder if any one ever tried both methods without learning the great superiority of the former.

Browning the Coffee.

To make good coffee, it is essential to have the coffee beans evenly and sufficiently browned or roasted, without burning. They are spoiled if roasted until black, but a yellowish-brown is not right. A rich, dark, chestnut-brown is the right color. There are patent contrivances for roasting coffee, but I have not proved their merits. The beans should first be looked over, then put into a spider or dripping pan, and placed in a moderately hot oven, or upon the top of the stove. They brown evenly with less stirring if placed in the oven, than when over the stove, but this advantage is offset by the danger of forgetting the coffee entirely when out of sight in the oven. It must be stirred often.

Coffee and Health.

I seem to see the Editor shaking his head as he comes to this, but I will give you a few of my own thoughts on this subject, if I may be allowed. He shall have his coffee to the end of his days if he wishes it; and I, when he breakfasts here, will prepare for him most cheerfully, the best cup of coffee I can make from such materials as I can obtain.

But I shall be careful how I aid any young person to acquire the habit of coffee drinking. It certainly is perfectly safe, so far as health is concerned, to live without tea or coffee, either, or both. For many persons it is not safe to use either. Both tea and coffee possess medicinal properties. I see that Dr. Smith, in "Foods," speaks of them as "in some respects *antidotes to each other*," though he does not class either among "poisons." He relates, however, that drinking an infusion made from two ounces of coffee, caused him to fall to the floor and remain unconscious for several minutes. But I did not wish to treat the matter scientifically. I frequently hear persons who have no knowledge of the properties of coffee, assign as a reason for giving up coffee, that they found it injurious to them.

Only the other day a lady was telling me her new way of making coffee, from a mixture of scorched wheat-bran and molasses, and half the usual quantity of coffee. She told me why she made this instead of the strong coffee formerly used. First, the hired man complained of dizziness, and said he must give up coffee. He had learned by previous experience, that the dizziness came from the use of coffee. Soon after, the lady's husband complained of a frequent steady pressure upon the brain, which made it almost impossible for him to read at times. To the suggestion that it might be his coffee, he replied that "it was impossible, as he had always used coffee."—"But you will not get any more," his wife answered, "until I have found out whether coffee causes the trouble."—When the coffee was withdrawn from the daily bill of fare, the trouble in the head ceased. When the needs of a large family seemed to require that coffee be supplied, she found that coffee made of wheat-bran mixed thick in molasses and scorched, with a little real coffee added for flavoring, made a drink quite as acceptable to the family as the old coffee of full strength. But none of her children drink even this, and we were agreed in believing that they will never regret not having accustomed themselves to coffee in their early years. I feel sorry for the children who become attached to tea and coffee before they reach years of discretion. I have known girls and boys in their teens, who could not relish a breakfast, however good, unless they had coffee.

I see how the coffee drinkers (tea drinkers too, but now I happen to be writing about coffee) dote upon their beverage, and sometimes seem to pity me because I eat my food without feeling the need of any fluid to wash it down. But I secretly pity every one of them. I can make a good, satisfactory meal wherever I happen to be, and at any time of day, from bread and milk, or crackers and apples.

GERANIUMS AND SNAKES.—We lately read an account of a mining locality in Calaveras county being infested with snakes. In this connection we may observe that the report is that every species of snake may be permanently driven away from an infested place by planting geraniums. In South Africa the Caffir people thus rid their premises of snakes. A missionary of South Africa had his parsonage surrounded by a narrow belt of geraniums, which effectually protected the residence from any kind of snake. A few yards away from this geranium belt a snake would occasionally be found. It is well known that the whole geranium genius is highly redolent of volatile oils—lemon scented, musk scented, and peppermint scented. What, therefore, is a very pleasant nose-gay for man is repungent to the serpent tribe.

LATHE TOOLS AND TOOL POST SLOTS.—Robert Briggs writes for the *Polytechnic* some hints on lathe work which are of general interest. For the performance of a large quantity of work by the lathe, no greater necessity exists than for heavy turning tools. The numerous attempts of 30 and of 10 years since to use cutting points for turning have all ended in practical failure. No nicety of shape or fitness to meet the exact requirement for easy cutting of metals will recompense for want of material, both in continuity and in mass, to conduct away the heat of the cut and of friction on the cutting surfaces. The smallest working tool for turning iron should be 1¼″ × ¾″ steel in the shank, the slot of the tool post of the lathe, which swings 10″ only over the ways, should take this dimension easily; 1⅞″ × 1⅛″ steel is not excessive for tools for the 30 inch lathe, where profitable return for use of the lathe is expected. The posts themselves, with their griping screws and bearing rings, can hardly be too heavy, while they can easily be too weak. For a 48 inch lathe it does no harm to have the slot in the post 2¾″, or 3″ × 2½″, or 2½″, with a two inch screw. The refinement of spring tools for heavy cuts or for long cuts without a re-sharpening, are well enough for tool rests with V slides, or lathes where the ways have V's; but neither excellence of workmanship, nor speed of running, nor heavy cuts, will result from makeshifts of lathes, or of turning tools, however well the makeshifts may be contrived.

HOW POISONS ARE SPREAD.—Mr. G. Owen Rees, Consulting Physician to Guy's Hospital, London, has called public attention to some unexpected sources of arsenical poisoning. The green calico lining of bed-curtains has been found to have produced, for months, severe symptoms, which were treated as those of natural disease, without benefit to the patient. When the curtains were removed the patients at once recovered their health. The beautiful pale-green muslin, largely used for ladies' dresses, has been found to contain not less than 60 grains of the arsenical compound known as Scheele's green, in every square yard. He suggests that, in order to prevent much of the nausea, vomiting, headache, inflammation of the eyes, etc., from which so many suffer, there be a prohibition of the manufacture of such deleterious fabrics. Red scarlet, and mauve-colored fabrics are not always free from arsenic. He adds that the agitation of skirts in danc-

Electrical Resistance of Trees.—M. Moncel recently reported to the Academie des Sciences on a series of experiments upon the conductability of trees. He finds a resistance, when the leaves are the points of contact, equivalent to from 200,000 to 400,000 kilometres of telegraph wire. In moderately large trees, at a height of seven or eight metres on the trunk, it is about 3,000 kilometres.

Some Facts about Norway. — According to recent official statistics, the average duration of life in Norway is 5·8 years longer than in Sweden, and 10 years longer than in Belgium. Public and gratuitous education is compulsory in Norway from the eighth to the fifteenth year. The work of children in factories has to be regulated so that they can perform the exercises of communal schools. Norway has one complete university, in which are 46 professors, 10 assistant professors, and 831 students. The exportation of wood, chiefly pine and fir, amounts to nearly 2,500,000 cubic metres annually, with a value of 6 dols. per cubic metre. The silver mine of Königsberg produces annually about 5,000 kilogs. of pure silver. Norway is the principal country for production of nickel; it furnishes more than one-third of the total production. The last census gave the figure of 78,703 persons (families included) who lived by fishing, or 4·6 per cent. of the entire population. Norway has 493 kilometres of railway, and 11,581 kilometres of telegraph wires.

Kitchen Dresses.

Neat, plain calico wrappers are quite popular for kitchen use. They are easily made with a sewing machine, and can be ironed with less trouble than other dresses. They are becoming to most women, and can be worn as loose and comfortable as you please. But they have disadvantages which make themselves apparent to working women, especially to those who wash and iron their own clothes. They annoy me by bursting off the skirt buttons, or breaking out the button holes, as I take some of the divers shapes required in waiting upon the vari-

TO CURE A FELON.—The London *Lancet* suggests the following simple treatment for felons: As soon as the disease is felt, put directly over the spot a fly-blister about the size of the thumb-nail, and let it remain for six hours, at the expiration of which time, directly under the surface of the blister, may be seen the felon, which can instantly be taken out with the point of a needle or a lancet. A piece or adhesive plaster will keep the blister in place.

POISON IN ARTIFICIAL FLOWERS. — Danger from picric acid lurks not only in colored stockings. The material is used for coloring in the manufacture of artificial flowers, and a well-defined case of poisoning therefrom is reported from New York. Mary Dougherty, aged 13, who had been employed a few months in a flower manufactory, has just died. Her death is attributed to poison which is supposed to have been communicated to the girl's system by the material with which she worked. The case needs to be carefully investigated to the end, that the exact character and effects of picric acid may be made known. Men who dye the cloth, which Mary Dougherty and other girls have made into flowers, receive no harm from working bare handed in the liquid. It is alleged sickness among the workers in the colored goods is the exception. Some organizations must be more susceptible to the influences of picric than others, or Mary Dougherty's death must be traceable to other causes. It is to be hoped the case will be carefully examined.

REMARKABLE SURGERY.—Robert F. Hurlbut, private secretary of Governor Bishop, of Ohio, has just had his tongue amputated near the root. The chin was sawed in twain and the jaws spread apart in order to take out the diseased tongue. The work was done in a comparatively short space of time, and the patient was comfortable and conscious in less than an hour. Next day Mr. Hurlbut walked across the room, and wrote his wants upon paper. He is not permitted to attempt to speak, and, of course, could not do so if he desired. The physicians think he will be able to articulate audibly in the course of time. Thus far the difficulty has been to give nourishment, which has been done by injection. Glass tubes have been secured, and hereafter nourishment will be given by that means until the soreness in the mouth is somewhat subdued. Mr. Hurlbut had a cancer at the root of his tongue. A like operation for the same cause was recently performed at one of the hospitals in Albany, but the patient died a few days subsequently.

In Breslau, a successful attempt has been made to erect a paper chimney. The one erected was about 50 feet high. By a chemical preparation the paper is rendered impervious to the action of fire or water.

MAKING TOILET SOAP.—The cheaper English soda cannot produce a fine soap of this kind; it is best to take the purest German soda. It costs about twice as much, but then it is 95°, while the commercial English soda is only from 80° to 83°, and impure, which is fatal for the production of a good article. In order to make caustic lye, quicklime is added in equal parts to ordinary German soda, and only half the quantity (always by weight) to the crystallized German soda. *The Preparation of the Lye.*—Dissolve the soda in water, or in a weak lye of about 20° Beaum., the remnant of a former operation; then mix the quicklime with water to a broth and add it to the soda solution, boil for two hours, and let it stand over night to cool and deposit. The clear lye, which may be 10° or 12° Beaum., is then drawn off and concentrated by evaporation over a fire until it shows 34°; let it again cool and settle, and put it in bottles or covered iron vessels so as to keep out the air, because otherwise it will rapidly absorb carbonic acid and lose its causticity. The lye being ready, you have the choice between various kinds of fats, such as cocoa-nut oil, almond oil, palm oil, olive oil, beef tallow, mutton suet, lard, etc. The cheapest kinds of fats make the worst soaps, and *vice versa*; 10 pounds of lye of 36° are sufficient to saponify double that weight of fat. The latter is melted, and then half the amount of lye (5 pounds) introduced and well agitated for about an hour, while the temperature is not raised above 150° Fah.; after one hour the other 5 pounds of lye are added. A pasty mass is thus formed by the union of the two ingredients, and this mass should be perfectly homogeneous, and increase in consistency every hour, until at last it is ready to be poured into the frames. If perfumed soap is wanted, the scent is introduced before pouring. The next day it is fit to be cut, pressed and stamped; if this is postponed it may become too hard and brittle for this operation. Many manufacturers prefer to use mixed fats, such as olive oil and tallow. But there is no doubt that the cocoa-nut oil makes the best soap; next to this almond, palm, and olive oils; while mutton suet and lard make ordinary soap, especially when used with English soda. The kinds of perfume to be added, and the amount of the same, is entirely a matter of taste and opinion, therefore it is unnecessary to give a recipe for the same, as they differ in various prescriptions. The usual perfumes are, for bitter almond flavor, nitro benzole, called oil of Myrbane; this is a very cheap and common perfume. The next are oils of sassafras, of musk, of roses, of bergamot, of cloves, of cinnamon, of neroli, of roses, etc. The quantities needed are very small.

Cheese and the Microscope.

At the last meeting of the San Francisco Microscopical Society, Mr. E. J. Wickson, editor of the *Pacific Rural Press*, asked the attention of the members to a slide containing sections of ordinary full cream cheese and cheese made by introducing oleomargarine into skimmed milk. He described the process of making oleomargarine cheese, namely, by removing the cream from the milk, and then stirring in liquid oleomargarine to supply the fat removed in the cream. The mass is agitated and rennet enough added to form a curd quickly before the oil can separate from the skim milk. The aim of the process is to form an emulsion of oil and a menstruum of soluble casein, like that which exists in natural milk. This process has succeeded so well that chemical analysis has shown the artificial cheese richer than the genuine, and so great an improvement on skimmed cheese that large quantities are sold in New York and shipped to Europe. Mr. Wickson stated that he had studied this artificial cheese with the microscope, and found that the emulsion made by the cheese-maker was not nearly so perfect as that made by nature in the cow, and therefore it was easy for a microscopist to distinguish between the two products. In the slide which was shown the two sections of cheese were in juxtaposition. The cheese made from full cream milk was seen to be of close texture, and the natural fat was incorporated in the substance. The oleomargarine cheese showed cavities of irregular shape in which the artificially introduced fat was imprisoned when the curd formed. The difference simply consists in the results of an imperfect emulsion in which the fat exists in masses rather than in globules, as in milk. Mr. Wickson remarked the difference between the cavities usually formed by gas in full milk cheese and those which held the oil in oleomargarine cheese. He stated that he first pointed out the characteristics of the two makes of cheese, and regarded the microscope as an infallible detective of the true qualities of cheese.

THE gross aggregate value of lead produced in Missouri in 1876, is stated at about $2,500,000.