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WALL COLOURING, OR "DISTEMPERING."

AT this season of the year, when landlords are renovating the walls and ceilings of their houses with paint, paper or whiting, a few words on the process of colouring, whitewashing, and painting in size-colours, otherwise called "distempering," may not be out of place. The term "distempering" is not generally understood by amateurs, and the process but little understood by many painters; in fact, there are really comparatively few painters who are thorough masters of the apparently simple process of distempering. The term is generally applied to all colours mixed or diluted with water, and rendered firm or adhesive by the addition of glue or parchment size. Ceilings are ordinarily distempered and not painted. Painting in oil is too heavy in its effects for certain purposes. Ceilings require something of aerial lightness, especially in drawing-rooms, boudoirs, and such like apartments, as distinguished from the more substantial painting in oil colours.

To distemper well depends upon so many conditions that it is often very difficult, indeed, for the most experienced workman either to satisfy himself or his employer. Failure often is the result of a want of chemical knowledge; but whatever the cause, certain it is that painting in distemper colours is not always satisfactory; but, when skilfully executed, distemper work is much lighter and purer in tone than painting in oil colours. The whiteness, for instance, of distemper colours is not always satisfactory; but, when skilfully executed, distemper work is much lighter and purer than the whiteness of oil colours, and any tint that distemper will take will be purer than any corresponding tint of oil colours. It will be observed, however, that distempering, whatever may be its advantages in this respect, is not suitable to use on interior walls, which are liable to suffer from contact, or which are subject to rough usage, particularly in rooms that are in common use. In these cases flatting is absolutely essential, unless, indeed, the walls are covered with paper-hanging.

The preparation of walls for distemper is of vital importance to the ultimate result, inasmuch that if they are not properly prepared they will rarely turn out well at the finish. The first thing is to stop the suction; if this is not done, the work is apt to be more or less rough, and will gather or accumulate more colour in one part than another, and, consequently, will look shady. It will be observed, as with the first coat of paint, that some parts are glossy while others are dry dead—that is, the paint has sunk into or been absorbed on the dead parts, while on the glossy part it remains on the surface, owing to the unequal finish of the plaster work. Of course, in oil painting this is remedied by successive coats of paint. The following has been recommended as a suitable preparatory coat:—Mix about a dozen lbs. of the best whiting with water, to the consistency of paste; add sufficient parchment, or other size, to bind the colour fast; add about two ounces of alum and the same weight of soft soap dissolved in water; mix well together in a pail, and strain through a coarse cloth or a metal strainer. The colour should now be tried on paper and dried before a fire, or otherwise, in order to test whether sufficient size has been used to "bind" the colour, and to prove that the tint is what is required. The finishing coat can be laid on without disturbing the first one. The alum and soft soap contribute to this effect in a great degree, and help to form a semi-impervious coating upon which the finishing coat will work cool and without suction. Caution must be observed not to have the size too strong, as it will be very liable to chip, especially in rooms where much gas is used.

An "Experienced Workman," in a practical periodical, gives the following directions:—"In order to produce good work, two things are essentially necessary in the mixing of distemper, namely, clean and well washed whiting and pure jellied size. The whiting should be put to soak with sufficient water to cover it well and penetrate its bulk. When the whiting is sufficiently soaked the water should be poured off, which will remove any dust or foreign matter from the whiting. It should then be beaten up or stirred until all the lumps are broken, and it becomes a stiff, smooth paste. A good workman will do this with his hand, and will manipulate it until it is quite smooth; but it may be done most effectually with a broad stick or spatula, and then strained through a metal strainer. The size should now be added, and the two lightly, but effectually, mixed together. Care should be taken not to break the jelly of the size any more than can be avoided, and this may be best done by gently stirring the mixture with the hand. If the jellied state is retained intact, the colour will work and lay on smooth and level. Then size, whether made of parchment clippings, glue, or any other material, should be dissolved in a sufficient quantity of water to form a size, and will lay on better and make a better job than when the size is used hot. Colour mixed on the former plan works cool and floats nicely, while the latter works dry and drags and gathers, thus making a rough ceiling or wall, and the difference in the labour required, is very much in favour of the jellied size. A little alum, added to the distemper has a good effect in hardening, and helps to dry it out solid and even.

It is customary in some cases to give the ceiling or wall a couple of coats of oil paint previous to the application of the distemper. This stops the suction, and gives a richness to the colouring; but if, as frequently happens, the wall gets low in temperature during a continuance of cold weather, when a change takes place, the condensation is so great that the water runs down in streams to the top of the skirting, and the colouring matter thereby becomes stained.

We give the following approved rules for mixing colours in distemper:

To Make Size.—The best size for distemper colours is made from parchment clippings. These are put into an iron kettle filled with water, and are allowed to stand twenty-four hours, until the pieces are thoroughly soaked; then boil for five hours, occasionally taking off the scum. When the liquid is sufficiently boiled, take it from the fire and strain it through a cloth. If the size is to be kept for a length of time, dissolve three or four ounces of alum in boiling water, and add to every pailful. The size must be boiled again till it becomes very strong. It must then be strained a second time, put in a cool place, and it will keep for several weeks. Different kinds of size are sold at the shops, some of which are exceedingly pure and can be depended upon for general purposes.

Pink.—Dissolve in water, separately, whiting and rose pink. Mix them to the tint required, strain the colour through a strainer, and bind with size.

Lilac.—Take a small quantity of indigo, finely ground in water, and mix it with whiting till it produces a dark grey; then add to the mixture some rose pink. Mix well and strain the colour and a beautiful lilac will be the result.

Light Grey.—A small quantity of lampblack mixed with whiting composes a grey. A wide range of shades may be obtained from the darkest to the lightest grey. The lampblack should be well ground in water.

French Grey.—Take the quantity of whiting required, and soak it in water, then add Prussian blue and lake which have been finely ground in water. The quantity of each of these colours should, of course, be proportioned to the warmth of the tint required. This is a handsome and delicate colour for walls. Rose pink may be substituted for the lake, but it does not make so brilliant a colour, neither is it so permanent.

Orange.—This is a mixture of whiting, French yellow or Dutch pink, and orange lead. These ingredients may be proportioned according to taste. This colour cannot be worked except in a size jelly, as the orange lead is a colour which has a great density and will sink to the bottom, separating from other colours.

Buff.—A good buff may be produced by dissolving, separately, whiting and yellow ochre in water. A little English Venetian red should be added to give a warm cast. Mix with size, and strain as before directed.

Drab.—Dissolve whiting in water, and grind some burnt umber very fine in water. Take a quantity of each, and mix them together, (1) Grind a little lampblack very fine, and with it sufficiently stain the colour to make the tint required. (2) Dissolve, separately, some whiting and yellow ochre in water. Take a quantity of each and mix them together. Grind a little lampblack very fine, and with it sufficiently stain the colour to make the tint required. (3) Another shade may be obtained by adding a little Venetian red. By diversifying the proportions of these pigments, a great variety of colours may be produced. These are all permanent colours and may be depended upon.

Salmon.—An excellent salmon colour may be produced by dissolving whiting in water, and tinging it with the best Venetian red. A little Venetian red mixed with lime whitewash and a quantity of alum will answer very well for common purposes.

With regard to the method of laying distemper colours, it may be an accepted fact that, the sooner they dry after they are laid on the better. The best plan is to close the windows and stop the free circulation of air as much as possible, while the distemper colour is being laid on. This prevents it drying too quickly and enables the workman to lay the colour on more evenly, and with less danger of drying too quickly, and enables the workman also to lay the colour on more evenly, and with less danger of showing any piecings; but the moment the wall or ceiling is covered, the windows and doors should be thrown wide open, and as much fresh air admitted as possible. If the distemper does not dry quickly it becomes slightly discoloured and shaded. One great point to be aimed at is, of course, a level and uniform surface when dry, and this desirable result can only be obtained by the colour being laid on of a proper consistency, with proper brushes, and with every attention to equality.

When ceilings are badly stained and discoloured from the accidental overflow of cisterns, water-closets, etc., the only effectual method of treating them is to work them off with clean water and give two coats of oil paint before the distemper is applied. Other processes are adopted, but as they cannot be depended upon it is much better in the first instance to incur a little extra expense, and paint the discoloured ceiling in oil colours.

MONTREAL CITY SURVEYOR'S REPORT OF THE VARIOUS WORKS EXECUTED BY THE ROAD DEPARTMENT DURING THE PAST YEAR.

We have before us the report of Mr. Ansley, Civil Engineer and City Surveyor, which in a very plain and lucid way places before us the disbursements on the different works carried on during last year under his supervision. In the remarks made by the Surveyor on the By-laws relating to his duties he recommends that a change should be made in those laws which were made some thirty or forty years ago, and which only now exist as an obstruction and hurtful to the office and position he holds. The By-laws when made many years ago, were never intended by the framers to meet all the requirements and duties devolving upon the City Surveyor of Montreal in the present day, and the sooner they are changed or struck out of the Municipal Code the better for the city.

We have always contended that a city official if not found competent to perform his duties, should at once be replaced by a more competent man; but when we have a competent man, that he should have full power to carry out the duties of his office without any interference on the part of the city councillors or alder man, or by friends of contractors.

Of Mr. Ansley's competence and ability there cannot be a doubt; he is an old and tried servant, and we sincerely concur with him in his suggestion that the By-laws relating to the duties of his office should be at once altered, so that the spirit of the clauses may harmonise with his present duties, and leave him untrammelled in their execution.

AN ADDRESS TO THE MECHANICS OF THE DOMINION,

On the Necessity of Forming a Dominion Mechanics' Association, for Educational and Benevolent purposes.

BY F. N. BOXER, ARCHITECT AND CIVIL ENGINEER, EDITOR OF THE SCIENTIFIC CANADIAN.

"Heaven helps those who help themselves."

In placing before the mechanics of the country a short address, the writer would premise his remarks with this observation, that few in the Dominion have had better opportunities of ascertaining the disadvantages the industrial classes lie under in this country, compared with the advantages of mechanics in the United States, particularly in so far as technical education is concerned. He will not go so far as to say that there has been culpable neglect on the part of the Heads of the Educational Departments of the country, but he does assert that the present system of education in our common schools in Canada, however admirable in certain respects, is totally deficient in giving instruction in those branches of Science and Technology which are so very important to the agricultural and mechanical interests of the country.

Too much attention has been given to a course of instruction which would lead step by step to a high class of education, without considering that nineteen out of twenty of the boys who are educated at the common schools of the country are either taken from them before sufficiently advanced to enter a high school, or if they do enter it, seldom remain long enough to complete their education, but leave for pursuits where such is of little practical use perhaps to learn a trade or become a farmer. The time, therefore, spent in partially learning classics or the higher mathematics is thrown away, because their studies have been too superficial and never completed, and are, naturally enough, soon forgotten, particularly when the student has to enter into a sphere of life in which such literary acquirements are never called into action. If the time spent in unnecessary and superficial education was given to a course of practical teaching in Chemistry or Technology, such as is imparted to youth in Germany and France, how much better it would be for that portion of our people who form the most numerous and important body of the community, known as the industrial classes.

During thirty years residence in Canada, and five in the United States, in which latter period the writer visited almost every manufactory of importance in the New England States, he had opportunities that fall to the lot of few to compare—which he did with an unprejudiced mind—the superior status held by American mechanics in the eyes of their countrymen over that of our mechanics by their own people, and the advantages they obtained in point of education, public libraries and benevolent institutions; also, over us—not that the natural ability of the people is greater, for are we not nearly of the same race and of the same blood?—but because they are more united, and have long since seen the necessity of Technical Education. The facilities afforded by the intelligence of the nation for practical instruction raised up the industrial classes until they became a potent power; their representatives have a voice in Congress; they are foremost in every movement tending to diffuse education, to improve their manufactures, and perfect machinery by skill and invention. The mechanics of the United States, native born, stand high in the social class; men of the highest eminence in talent and wealth in the country have risen from their ranks. To their industry, skill and inventive genius, our neighbours, to a great extent, owe their wealth and power, and have become a great nation.

With these incontrovertible facts before our eyes, and from the certain knowledge that such great results could only have culminated from a national pride and unity among the industrial classes themselves, working together in one compact body in all matters connected with their own interests,—what is there to prevent the industrial classes of this Dominion of Canada, also, from working in unity for their own benefit, without respect to creed, politics or nationality? Nothing is wanting *but unanimity*; nothing is necessary but an effort among themselves to throw off their past apathy, and enter into a Dominion Mechanics' Association, for the promotion of their interests by insisting upon a thorough change in the education in our public schools, in which the great bulk of the mechanics are only taught to read, write and do arithmetic, and learn a smattering of subjects, forgotten as soon as committed to memory, while practical technical teaching is absolutely ignored.

As a united body, and seeking only for assistance from which great practical results would follow, the Government of the country, no matter what its politics, would be bound to give consideration to any deputation backed by such a numerous and important body of men; but, although it is but just and politic that our Government should give assistance for the promotion of technical education, the mechanics themselves must take the initiative; in all matters the first move must be made by themselves, and through their deputies they must point out what they require, and it will no doubt receive attention; but the main part of the work must, after all, be performed by themselves. "Heaven helps those who help themselves." They must put their shoulder to the wheel and lift themselves out of the rut.

We have had our experience of Mechanics' Institutes, partly assisted by grants from Government, and in what have they resulted? Either they have fallen through from want of support, or they have become mere reading rooms for merchants, clerks, and professional men. We have our Board of Arts, supported by an annual grant from Government, and what does it bring forth? We are told that it is silently working good—very silently, assuredly, for it will be long ere its voice is heard on the highest tops. In neither the Institutes or in the Board of Arts is that kind of practical teaching given which will ever be of much benefit to students.

What we require in such institutions, and in our public schools, is practical teachers; we require that teachers for the future shall be so trained at Normal Schools as to be competent to practically teach Science and Technology, and that parents should have the choice of having their children taught classics or those branches of science or mechanics which are likely to be of service to them in after life. The question of technical education would, therefore, be one of the first objects a Dominion Mechanics' Association should have to take into consideration for the future benefit of the industrial classes.

To be brief, the writer would suggest that in every city, town, and village in the Dominion, the mechanics should form themselves into an association for the promotion of useful knowledge among themselves, and for benevolent purposes, and that in each place a deputy should be appointed to communicate with some party to whom they could entrust the management of these interests. He would suggest that the name given to such an organization should be

THE DOMINION MECHANICS' ASSOCIATION.

Its objects should be:—

1st. For the formation of a Reference Library, to consist of works on Science, Manufactures, Inventions, Statistics, Machinery, Patented Inventions, &c., and that each member should be entitled to information from the same, subject to certain rules and regulations. Towards the support of this institution the Dominion and Provincial Governments should be petitioned to give annual grants for books, and also that all Municipalities should be requested to contribute a small sum annually towards the same. The formation of a Reference Library would tend greatly to the advance of knowledge.

2nd. For the promotion of useful knowledge among the various trades, and for meeting together for friendly discussion, and disseminating useful information through the columns of such scientific or mechanics' magazine as they might select for that purpose.

3rd. For forming a Mutual Benevolent Fund for sick members, widows and orphans.

4th. For the purpose of offering prizes to its own members for the best essays, designs, &c.

Of course, such an association would have to be supported by small annual contributions; the amount of such contributions would depend much upon the number of its members.

The writer trusts that the subject will receive the earnest consideration of all connected with the industries of the country. We trust that the mechanics will awaken to the importance of unity and action, and to a lively sense of their own weight and power when a united body, and of their weakness when divided. Let them place a true estimate upon their influence, when better instructed and better organized, upon the welfare of the Dominion.

The writer will be happy to receive communications, from readers of the *Scientific Canadian*, giving their views upon the subject, and from all desirous of becoming members of this Association.

TO REMOVE GLASS STOPPERS.—To move a tight glass stopper, hold the neck of the bottle close to a flame, or take two turns of a string and seesaw it. The heat engendered expands the neck of the bottle before the expansion reaches the stopper.

BOILER BRACING.

The Engineer-in-Chief of the United States Navy, in a recent report on experiments in boiler bracing, gives the result of some interesting trials on the strength of screw stay bolts. The average strain in pounds required to pull the 1 inch or 1¼-inch bolts through the ½-inch iron plate, was as follows:

WITH SUPPORTS 4 INCHES FROM CENTRE TO CENTRE.

1-inch bolt, not riveted	21,970
1-inch bolt, ordinary low conical head, three threads left through for riveting	25,147
1-inch bolt, button head; length of belt left through for riveting equal to 7-16 diameter of bolt	33,791
1¼-inch bolt, button head; length left through for riveting equal to one-half diameter of bolt	38,885

WITH SUPPORTS 5 INCHES FROM CENTRE TO CENTRE.

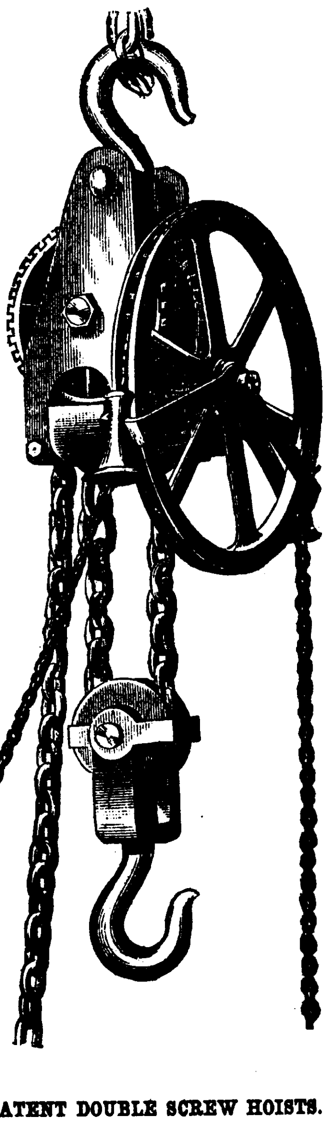
1-inch bolt, ordinary low conical head	22,137
1 inch bolt, button head; length left through for riveting equal to 7-16 diameter of bolt	31,282
1¼-inch bolt, button head; length left through for riveting equal to one-half diameter of bolt	35,812

The cause of the inferiority of the ordinary low conical head bolt is explained in the following way: It was observed that the bulging of the plates caused the lap of the rivet-head on the plate to commence giving way or break off some time before the maximum strain was reached, thus leaving more for the threads of the bolts to sustain. As the strain and bulge of the plates increased, the plate around the bolt turned downward and outward, until the threads in the plate almost entirely cleared those in the bolts, so that in almost every case there were only from one to two threads stripped or injured on the bolt when it drew out; therefore, it was deemed advisable to form the head in a different manner, and after several experiments it was decided that the rivet-head should be made as follows: First, by having as much of the bolt through the plate as could be riveted over without injury to the iron, which was, in case of the superior iron being used, equal in length to about one-half the diameter of the bolt.

ANTI-FRICTION CAR-AXLE BOXING.—A new style of car-axle boxing is now being introduced at the east which is described as follows: Two friction wheels are employed in the box, running in line, each having a seven-inch face and giving a leverage between their periphery and axle of 75% to overcome friction, one of them, 10½ inches in diameter, placed nearly over the axle, say at angle to a vertical line of the axle of about 15°; the other, six and one-half inches in diameter, is placed down on the side of the axle and operates as a shoulder wheel. By placing the wheels in this position the oblique action is largely done away with, sufficient only being retained to hold the axle in its proper place, and not allow it to come into frictional contact with the casing. The friction wheels have steel axles journalled in brass boxing. In the casing under each of these journals is an oil reservoir for lubricating the journals through waste, oil being supplied through channels extending out to edge of housing. These channels have covers to keep out dust, grit, etc. A number of advantages are claimed by the inventor over the old style of boxing: 1. That it is the lightest running known, 50% easier than the present system. 2. An important saving in lubricant, as it runs over 1,000 miles with one oiling. 3. That heating is practically impossible. 4. Greater durability than the present system, as the friction wheels having a very broad head will not cut or make indentations. This boxing is the invention of Mr. Levi H. Montrose, of Seneca, Ontario county, N. Y.

A LOCOMOTIVE ELECTRIC LIGHT.—A locomotive electric light has recently been introduced in England for railway use which is said to operate satisfactorily. It consists of a light six horse power four-wheel locomotive, with a dynamo-electric machine attached, and any electric light may be used. When the engine is moving along the line, the electric machine rotate at its proper speed, and when it is necessary to stop in order that the light may be directed on some particular spot, the driving wheels are thrown out of gear by means of the disengaging handle attached to the pinion on the crank shaft, and the machine ceases to be a locomotive, while the engine continues to move the dynamo-machine at its proper velocity. The engine is furnished with sensitive governors, so that the speed of the dynamo-machine may be accurately regulated, this being very important in order to ensure a bright and continuous light.

TO HARDEN MALLEABLE IRON.—Mix equal parts of common potash, saltpetre and sulphate of zinc, and use as directed for prussiate of potash.



BOX'S PATENT DOUBLE SCREW HOISTS.

We herewith illustrate a Double Screw Portable Hoist, recently patented by Alfred Box & Co., Philadelphia. The machine may be described as follows: A wrought-iron frame, with swivel hook to attach it to any support. A large lifting wheel, driven by the rim on either side, by two screws, and gears driven by a centre gear wheel on hand chain wheel. A base, with hardened bearings where the screw shafts run, and forming oil cup where the screws act on the lifting wheel. The latter has very deep teeth in the centre, and the large chain, passing slowly over it, makes the wear upon both scarcely calculable. A projecting stud from the base carries the hand chain wheel and the chain guide. The leverage of the two screws driving the rim of the lifting wheel, is very great indeed. The screws run in oil, fed from the oil cups which form part of the base. The large chain passes through eyelet holes in the base itself, the holes forming perfect guides to the chain, while they also keep it in place under all circumstances. The advantage claimed for this hoist by the makers are many: Its size and portability. It is short and can be used for low lifts. It weighs very little, and can be moved about easily. There is no waste of material, as every part of the machine is brought into active service, and makes it apparently very strong. There is no friction of chains or parts, and if the hoist be used inverted, the action is the same. It will sustain the load at any desired point, but will lower rapidly when once started. It is always ready for use, and can be used horizontally, or even inverted if necessary.

Technology.

TECHNICAL NOTES AND COMMENTS.—From foreign sources, we learn that the French Academy of Sciences has awarded *an extraordinary prize* of 3,000 francs to Dr. William Crookes, in recognition of his distinguished services to science by his studies in molecular physics, and his contribution to our knowledge of the properties of radiant matter.——M. Clamond, a French electrician, is reported in *La Natare* to have devised *a thermo-electric pile* upon a novel principle, which is capable of yielding electrical currents of considerable tension. A large instrument of this kind has been successfully employed to run several electric lights.——Mr. Lockyer's views, based on spectroscopic observations, of the *compound nature of the chemical elements,* appear to be steadily gaining ground. The last issue of the *Journal of Science* contains a review of Mr. Lockyer's methods and results, presumably from the pen of its editor, Dr. William Crookes, which, while not giving complete adhesion to Lockyer's views, consider them as probably correct.——The Belgian Government is reported to have decided upon the *abandonment of wooden railway sleepers,* and the adoption, instead, of those of iron, an example which, it is thought, will be largely imitated.——Recent analyses of the *anthracite coal of Valois,* Switzerland, show a very close resemblance to that of Pennsylvania. Trials with American heaters show that it can replace the Pennsylvania coal. It has also been successfully tried on locomotives.——The American Watch Company, of Waltham, Mass. has just received another order (the third) from the British Government for *a large number of watches,* intended for the use of engineers, conductors, station-masters, and other employés of the state railroads of India. This contract is a notable triumph of which the company has reason to be proud, as it was gained in open competition with foreign manufacturers. ——The recent invention of an *imitation of stained glass,* consisting in applying to the glass to be decorated thin sheets of silk paper, printed with brilliant oil colors, is favorably spoken of as giving admirable results.——*An international exhibition of earthenware,* chalk, cement, gypsum, and cement industries is announced to be held at Berlin, to open on the 29th of June, 1880, and to continue until the 10th of August following. Herr Paul Loeff is the President of the Committee of Arrangements, and may be addressed at Berlin by intending exhibitors. This same Herr Loeff, by the way, is the inventor of a pottery kiln which he took pains to inform the public in his circulars was *not* medaled at the Centennial Exhibition. ——During the past week, the Congressional Committee on the Inter-oceanic Canal has been busy listening to the arguments of De Lesseps, Captain Eads, and others, for and against the several projects that have been presented in this department. Whether any decided action in the premises will be taken is at present uncertain. The present disposition seems to be to regard the *project of De Lesseps* as a private enterprise, which, at the present time, would not warrant the interference of this government.

HARDENING AND TESTING.—To *really test* the hardness of the surface of metal, we must take a *new* or at least a good *dead smooth* file and apply one corner of it to a corner rather than on a flat surface of the metal to be tested, pressing the file very firmly against the work. A coarse file, even if a new one, is useless to test with. The greatest degree of hardness is obtained by plunging the red-hot steel into mercury. Steel hardened from the surface inward is hardest on the surface, while in steel that has been tempered the exterior is the softest. In the one case because the surface was cooled in advance, in the other because it was heated in advance. Files are hardened in the following mixture: 2 parts (by weight) of salt, 15 parts of rye grist, and 30 parts of burnt cow hoofs, all ground together and mixed with a sufficient quantity of water to make a pasty mass, with which the files are covered. When dry, they are placed in a fire. If, during the heating, the coating should drop off at certain places, the files are promptly withdrawn and the place exposed is covered with dry hoof powder. It is returned to the fire, where it is left until a temperature is reached which best suits the steel of which it is made. Then the file is plunged vertically into the bath, care being taken not to move them to the right or left, as that would cause warping. The bath is made in the following manner: 28 parts of salt are dissolved in about 5 parts of water, to which a handful of iron scale is added. The tongs are softened by being plunged into red-hot lead.

LARGE deposits of black sand, said to contain platinum, have been discovered near Olympia.

Plumbing.

HOUSE DRAINAGE AND SEWERAGE.

BY EZRA A. OSBORN, C. E.*

(*See page 140.*)

(*Published in the Metal Worker.*)

The introduction of water into houses and the system of drainage necessary to carry off waste, all of which comes under the head of plumbing, has become a matter of importance, inasmuch as great danger to life and health arises from gases generated in the sewers and cesspools, which we feel safe in saying, in a majority of cases, find their way into dwellings in consequence of the careless end unscientific manner in which this kind of work is done. This is, perhaps, not to be wondered at, when it is considered that in most cases this matter is entrusted to the mechanic who offers to do it for the least amount of money. The builder fails to appreciate the danger to which the occupant of the house, when finished, will be subjected in consequence of the unskillful arrangements of pipes, traps, &c. Ignorance in a matter the result of which is so frequently fatal to life, may justly be termed criminal. In order to arrive at a better appreciation of this important branch of mechanics, we desire to explain, in a simple manner, our views as to what is essential to safety in all cases where house drains are connected with sewers.

First essential: Every vertical soil or waste pipe should be extended at least full size through the roof. No traps should be placed at the foot of vertical soil pipes to impede circulation. Traps should be placed under all sinks, basins, baths, wash trays, water-closets, &c., and as near to these fixtures as practicable. All traps under fixtures, whenever practicable, should be separately ventilated, in order to guard against syphonage. Such vent pipes should not branch into a soil pipe below where any drainage enters it. In some cases it is preferable to carry it to the outer air independently. Rain-water leaders should not be used as soil pipes, and when connected with house drains they should be made of cast iron in preference to galvanized sheet iron or tin, there being less liability of corrosion. Joints should be gas and water-tight, to preclude the possibility of drain air entering open windows. No safe waste should connect with any drain, but it should be carried down independently to a point where the discharge would indicate the existence of a leak or any overflow above. No waste from a refrigerator should be connected with a drain. Unless the water supply is ample, so that it will raise to every part of the building, insuring at all times the proper flushing of fixtures and traps, a cistern should be provided, into which the water will rise at night, or into which it may be pumped. Said cistern should be large enough to hold an ample daily supply, and be kept clean, covered and properly ventilated. The over-flow pipe from it should never be run into any drain under any circumstances. The supply for drinking water should not be drawn from it, but from a direct supply—*i. e.*, direct from the street main.

Water-closets should not be supplied direct from street pressure, or by a pipe from which branches are taken for drinking water. Where the water-closets are preferred to those that are supplied from a small cistern immediately over them, then the supply should be taken to a storage tank, from which it can be conveyed to the valves on the closets, thereby ensuring an equable pressure and securing more reliability in their working.

All drain pipes within a house should be of metal in preference to stoneware, owing to the liability of the latter to crack and the difficulty of keeping the joints tight. It is best to run them along the cellar wall or ceiling with a good incline. They should never be hidden under ground, as there leaks will not be perceptible. In some places it is common to paint pipes white, so that any leakage will show itself to the most careless observer. All drains should be kept at all times free from deposit; and if this cannot be effected without flushing, special flushing arrangements should be provided, so as to effectually remove all foul matter from the house drains to the public sewers. All drains should be laid in a straight line, with proper falls, and should be carefully jointed and made water-tight. No right-angled junction should be allowed.

A drain passing under a dwelling house should be constructed of cast-iron pipes with lead calked joints, laid so as to be readily accessible for inspection. Whenever dampness of site exists, it should be remedied by laying subsoil drains, which should not pass directly to the sewer, but should have a suitable break or disconnection. Water supply and drain pipes should be concentrated as much as possible, and not scattered about a building. Horizontal pipes are objectionable.

Plumbing fixtures should not be hidden behind walls and partitions where their condition is never apparent. They ought to be made easily accessible and so situated that any leak will be readily detected. In no case should lead waste pipe be connected to iron pipe with cement or putty. Connection can be made by the use of a brass ferrule or thimble, one end of which should be caulked into the iron, and the other soldered to the lead, or a good and more economical plan is to turn the end of the waste pipe over a ring of some metal and caulk into the iron pipe. Without claiming to have exhausted this subject we have endeavored, and hope we have succeeded in our endeavors, to make easily understood the fundamental principles which should be observed in the arrangement of soil, waste and ventilating pipes, in order to secure immunity from danger by reason of allowing the poisonous emanations from sewers to pass freely into dwellings. Next in importance we remark that care should be exercised in the selection of plumbing materials as regards quality, especially water-closets and traps. The former should be so constructed as to positively prevent the back-flow of foul air or sewer gas; and the traps of such kind and shape as will be least likely to be emptied by suction or syphonage. In fact, all modern fixtures and appliances for the convenience and comfort of our homes should be thoroughly understood practically and scientifically, and so constructed that it shall be impossible for any evil to arise from sewer-drains, water-closets, basins, traps, &c. So many contrivances are based upon this one idea, it surely seems that all of them should answer the purpose of pure sanitation. Diseases caused by foul air that can be prevented requires one very essential condition, *i. e.*, cleanliness, and to become clean, all filthy matter must be cared for without offence. Now, the question is, how can this be accomplished effectually and economically? The different inventors of sanitary appliances have as many modes as there are inventors. For the purpose of bringing such articles and appliances before the public, the New Jersey State Board of Health proposed to make a public exhibit of appliances for perfecting house drainage. Upon conferring with the New Jersey State Agricultural Society (it being partly supported by the State), it was arranged to have an exhibition of sanitary appliances in full operation at the Annual Fair at Waverly. Inventors and dealers in sanitary appliances to some extent responded to our circulars, and so made the exhibit a good beginning to an important yearly display. The Board of Health not having any funds to erect the proper buildings, water supply, &c., necessary to show water, sewer and plumbing arrangements, by solicitation of said Board, E. Dunn & Bro., practical plumbers and sanitary engineers of Newark, N. J., undertook, at considerable expense to themselves, to provide for this part of the exhibit. With great diligence they prepared some specimen plumbing, as well as a complete system of house drainage, with drain and trap ventilation. It was put in full operation, in such a position that every part could be seen, the water being supplied to a tank by a Rider atmospheric pumping engine. The whole sanitary exhibit was very carefully and critically examined by a committee of ten experts, comprising professors, physicians, civil engineers, &c. For the purpose of assisting the public to comprehend how house drainage should be done, we present the system and plans as thus shown.

The diagram of this exhibit is presented herewith, and shows that a trap is placed outside of the house (which should be in a vault, of easy access for the purpose of cleaning), and close to this trap, next to the house, a ventilating pipe carried above the roof. The soil pipe is carried full size through the roof.

In connection with each line of waste and soil pipe there is a circulating air or main vent-pipe running independently to the roof, and above the soil pipe, the main vent. A branch is connected from each trap on that line, thus maintaining an easy circulation, it being impossible to syphon the traps. To understand the practical working of currents of air through these pipes, the committee had them bored, which, by the application of a lighted match, fully demonstrated the direction and force of the air currents.

It is to be hoped that from year to year various plans of house drainage, sewerage and ventilation will be thus exhibited.

The exhibit was visited by a large number of persons in and out of the State, who manifested a great interest, and were greatly pleased to have a chance to investigate a system in practical operation. The matter of house drainage and ventilation is not intended to be confined to dwellings or houses we live in, but relates to all places where people congregate or are employed, whether churches, workshops, schools, stores, depots, cars, &c.

* From the report of the New Jersey State Board of Health for 1879.

It does seem that, with the many plans of reducing the foul air and completely deodorizing all kinds of filth, any person of ordinary intelligence should live in a clean and decent manner without any legal compulsion. In our suburban houses and country places there does not seem to be any excuse for evil effects from house sewerage, privies, &c., where dry earth and ashes are always at hand. The writer, when building his house in 1852, arranged in a rude way for using marl, with a very little trouble, for privy and other filth, thereby keeping down all odors, &c. The plan works well at a nominal cost; in fact, the compost made as a fertilizer more than pays for the trouble. But many say that while their neighbors have all kinds of decaying matter about their premises there is little use of their doing much with the nuisance just alongside. We have had many such complaints, some of which have been published. It seems as if our State must take notice of such evils and by legislation have the same abated; and our Legislature make such laws as will conduce to the public good by summary abatement of filth nuisances. The sanitary care of premises is best said in a single suggestion of J. C. Bayles, author of "House Drainage and Water Service:" "The first essential condition of healthfulness is cleanliness. The shovel, the broom, soap and water, sunshine and ventilation are the agents upon which we must mainly rely in guarding against unhealthful conditions in our surroundings. How, when and where the broom, shovel and scrubbing brush need to be employed the reader must decide for himself. I can only say in a general way that anything and everything which can be properly classsd as "dirt" should be put where it belongs. It will then cease to be dirt. There are few things so dangerous that we cannot rob them of their power for mischief by putting them in their proper places."

Correspondence.

To the Editor of the SCIENTIFIC CANADIAN, Montreal.

DEAR SIR,—I congratulate you on your persevering energy in bringing before your readers, in your excellent MAGAZINE, the varied and numerous articles you presented to them last year. With regard to your sanitary articles I desire to make a few remarks on trapping pipes. Where two traps are put on one pipe, long or short, there should always be a ventilating pipe, because gas will form from the face of water in a pipe no matter if it be clean or dirty, and ought to be let off or the seal will be in danger of being broken or a weak trap become useless. Again, all main sewers should have pipes or towers rising above the buildings in the streets, and not allowed to puff up from the street gratings into people's faces as they pass by, or into their windows in summer, for the foul gas must escape by some outlet.

Long experience has taught me that the day of lead pipes, traps, tanks, etc., should have passed away long ago for service in dwelling-houses, and that cast, or wrought iron pipes, traps, etc., should be put in and serewed together, so that all traps, could be opened by the inmates of the house, cleaned and put in working order without waiting for a plumber or any other person to come at his leisure whilst the house is filling with deadly gas. If such plans were adopted, plumbers would not have such a bad reputation and a great deal of money would be saved to both landlord and tenant, besides many more people would have their dwellings fitted up with sinks, pipes traps, etc., which would add greatly to their comfort were it not for the dread of being obliged to have plumbers so often in the house.

All pipes, sinks, traps, etc., should be left fully exposed above the floor, or below the ceiling, and painted so as to be easily got at without tearing the floors, and walls to pieces. Lead pipes when boxed in or covered become a resort for vermin, dirt, and foul gas. It is well known that rats will eat a hole through lead pipes and lead traps. Within the last twenty years I have removed many tons of lead pipes, traps, etc., and put iron ones in place of them which worked well. The closet traps were of cast iron, a square box sitting on the floor, with a cover bolted on, a rubber joint, inside a bridge drops down, and, another bridge or dam stands up, which forms the trap, the hopper bolted on, not put on with putty as the plumbers do; but all faces are planed and joints made gas-tight, and easily taken apart, with a two-inch ventilating pipe carried into a chimney flue from the face of the water of each closet trap. Although our plumbers may be called "ignorant, dirty," etc., and do a great many sinful jobs, as well as carrying about with them a great many sins of the people as the goat of old did, yet I think all blunders in that line ought not to be laid to their account. Our architects are not free from many of the bad plans to be found in Montreal houses, as well as in this city, they are not the wisest of men to be found in the world. Just look at many of our fine costly houses in this city; very nicely decorated off in front or outside; showy and expensive too; but go inside and look at them, the front rooms are very nicely laid out, but what of the kitchen, and servants' rooms, where so much of the work of the house has to be done? Small, low ceilings and very dark rooms, and no ventilation. I do not feel surprised to hear of cooks being sick and the whole house being filled with gas arising from the stove or meats being cooked. Unfortunate domestics are expected to live in these dark, unventilated rooms and never get sick; they lead a life more like a criminal at hard labour than a person on whom depends the cooking of the food, as well as many of the comforts of the whole house. In these places we frequently find the plumber at work, with scarcely room to turn himself around, or light enough to find his tools; here we find him pulling down the pipe casing, brooming away rats, dirt, bones, etc., to find a hole in the lead pipe, or clearing, the choked, and running over closet. To clear it, he cuts a hole in the lead trap, hammers it up, rubs a little putty over the wound, nails up the casing, and goes away.

Such is the state of our sanitary doings in this city. Whose fault is this? Not the man who pays the rent of the house, but the man, who gives the plan and superintends the work, and who instructs the plumber how to do his work, and then throws the onus on him for all bad plans and work. Let each man, I say, bear his own sins, and both architect and plumber are to blame if poor tenants suffer from their ignorance and folly. Now, Mr. Editor, I would like to see, in your valuable MAGAZINE, a few kind words directed towards these men—the plumbers—for their future benefit and that of the public.

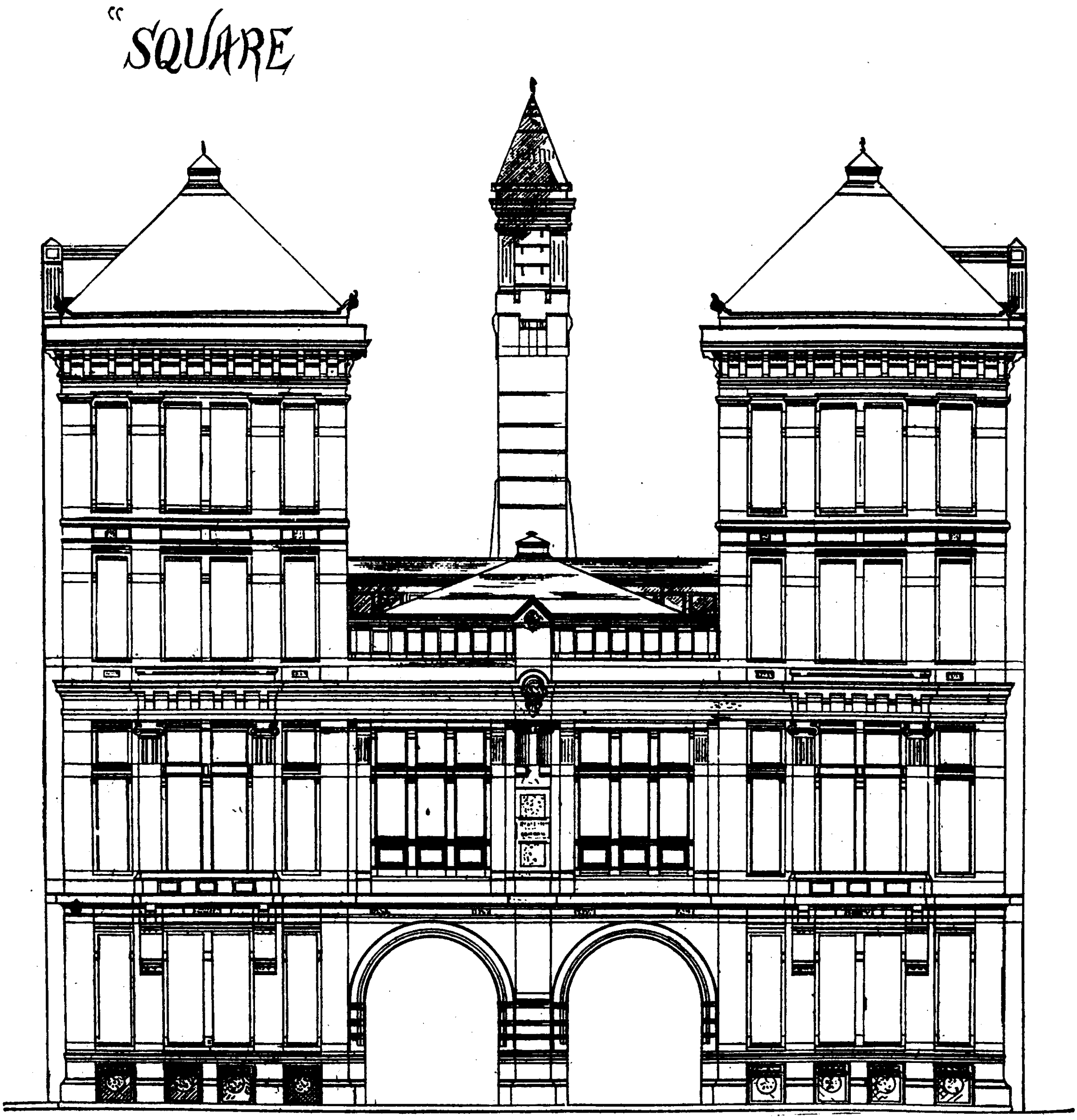
Another class of men allow me to ask you not to forget, also, to give a word of advice to is, that those poor unfortunate men who are put in very responsible positions to drive engines, for every poor mill, and engine owner, who cannot afford to pay men who understand what they are engaged to do, but men who have not been taught, but are quite willing to learn if their employer is able to teach them.

It is painful to read how often so many men and their employers and machinery are found scattered by an explosion in every direction, from the want of knowledge of the nature and power of the machine put into their hands to work, and then we are told, for our consolation, by a coroner's jury, that they lost their lives by the visitation of God, when the accident was really the fruit of ignorance. Now, sir, if employers cannot afford to pay skilled labour, and must, or will run a risk of every dollar they possess, and, perhaps, other people's money too, then I would say, Mr. Editor, that you can confer a very great boon on employer and men, if you will devote a small space of your valuable journal to their instruction, with a few simple lessons on the nature and management of the steam boiler, engine and machinery. I was much pleased to find, in your last number, a few words about Mechanics' Societies, or Mechanics from the various cities and towns joining together in one band, and circulating to each other their little mite of knowledge and experience in the columns of one recognized journal, or MAGAZINE, so that each one may have an opportunity of gathering what Canadian Mechanics are benefitting by practical taught experience and also to give each one the liberty of asking questions through your MAGAZINE, which is equivalent to receiving help or assistance from each other.

The Mechanics' Institutions to be found in our cities and towns are not generally managed for the benefit of the working mechanic. I would, therefore, advise all who wish to acquire a little practical knowledge, and make the best use of the few hours they have to spare, during the week, to fit up their own homes with a workshop and buy a few books, and have a library and an institute of their own; also to take the SCIENTIFIC CANADIAN AND MECHANICS' MAGAZINE, and read it, and ask of the Editor what they cannot get from their library, and do as I am willing to do, support such by pen and money.

TORONTO.

RESTORING THE BLACK COLOUR OF CLOTH.—It is a very common and easy practice to restore faded black colours by simply brushing them over in succession, first with a solution of logwood extract, and then a weak solution of bichromate of potash. Another way is to take first a decoction of crushed nutgalls, and then a solution of sulphate of iron. In either case the black colour is easily restored by a brush or sponge. We prefer a stiff brush

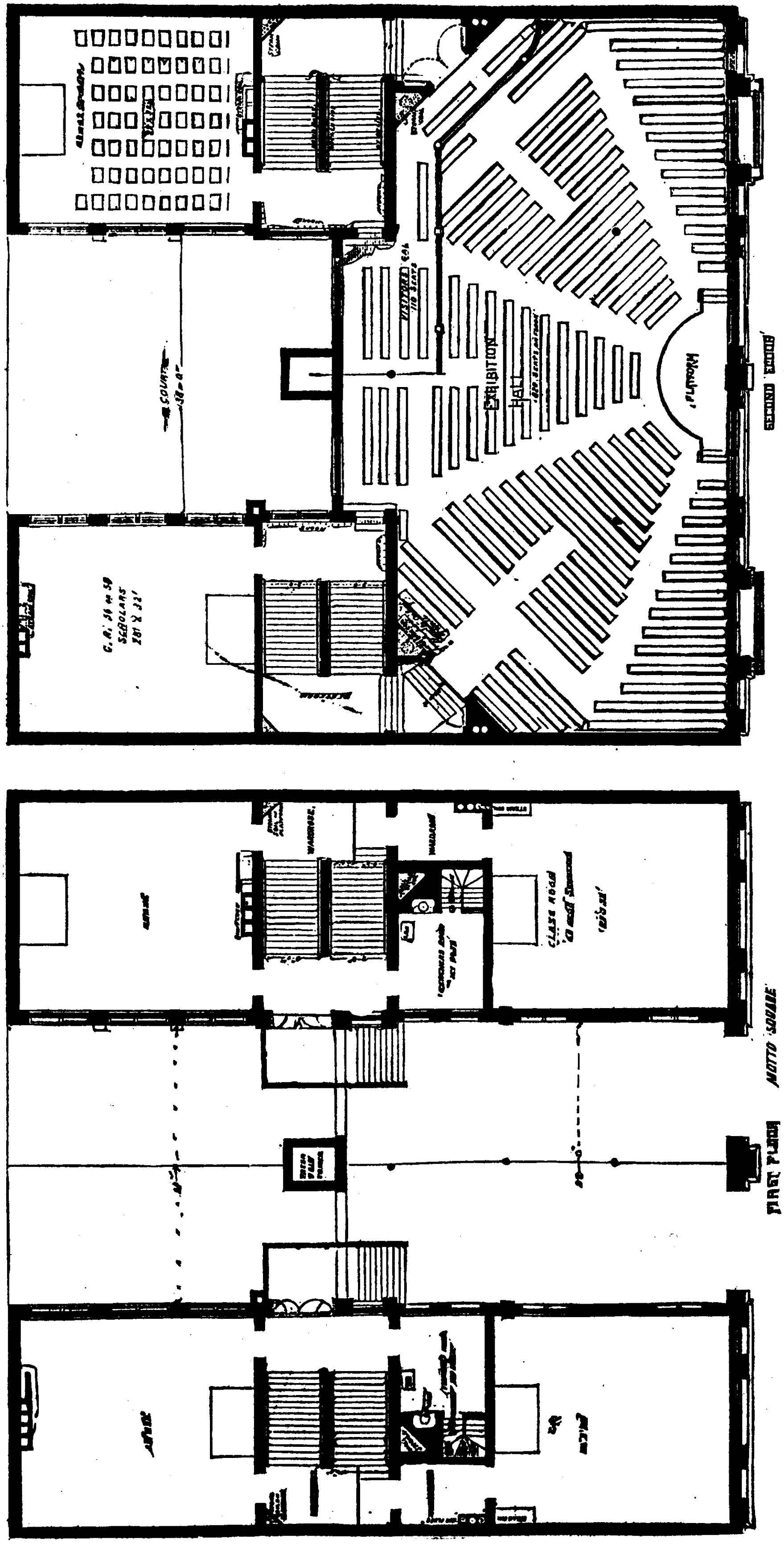


FIRST PRIZE DESIGN FOR A MODEL SCHOOL-HOUSE.
(THE PRIZES WERE GIVEN BY THE PUBLISHERS OF THE "SANITARY ENGINEER," PUBLISHED IN NEW YORK.)

Furniture Receipts.

ORNAMENTING CABINETS, ETC.—A very effective style for ornamenting cabinets, window boxes, tables, etc., is that by which the figures of the design are made to stand out in relief upon a black or coral ground, afterwards highly polished like Japanese lacquer work. A preparation is first made by dissolving the best white beeswax in spirits of turpentine until it is the thickness of copal varnish. This may be kept in a bottle until you are ready to begin the work, when you may pour out a small quantity, and mix into it a little flake white, sufficient to give it a body. Now with a fine sable pencil trace accurately the design on the white wood, which has been first made very smooth and clean, aud go over every part of the pattern, leaving only the groundwork untouched. When this is well dried, mix ivory black with parchment size, thus forming a very black kind of paint. Go over the entire surface with this paint, or, if it is intended to give it a coral coloured ground, use the sealing wax varnish, made by dissolving red sealing wax in spirits of wine. Let the whole get thoroughly dry, and if it is not well covered, give it another coat. When this is dry, let the whole work be brushed with a bristle brush dipped in spirits of turpentine, and rubbed pretty hard until the parts covered with the white mixture are left bare. The designs first traced will now become visible, with sharp clear outlines marked on the black or red ground, and will look very handsome. It must then be varnished with white varnish, and rubbed down with pumice powder until very smooth. Panels of doors, cupboards, brackets, and such a number of things in one's house can be made beautiful by such a simple process.

STAINING FLOOR.—To stain floors well, be careful first to have the boards planed smooth and even, and should there be any large divisions between or holes, fill them up with putty. With a large flat brush lay on a thin coat of common size, and, when quite dry, with another brush of the same kind, similar to that which painters use. Put on the oak stain not very thick, and if when dry, the color is not as deep as desired, add another coat. The next day, lay over the stain another coating of size, and afterwards occasionally rub the floor with a little beeswax mixed with turpentine, and polish with a brush.



FIRST PRIZE DESIGN FOR A MODEL SCHOOL-HOUSE.

(INTERIOR ARRANGEMENT.)

VARNISH FOR PRINTS, ETC.—The following varnishes are used for prints, engravings, or maps: (1) A piece of plate glass is heated, and, while yet warm, a little wax rubbed over it; water is then poured over the plate, and the moistened picture laid thereon and pressed closely down by means of a piece of filtering paper. When dry, the picture is removed, and will be found to possess a surface of great brilliancy, which is not injured by the process of mounting. (2) Boil Ohio turpentine till brittle, powder and dissolve in oil of turpentine. (3) Canada balsam and clear white resin, of each 6oz. oil of turpentine 1 quart. dissolve. (4) Digest gum sandarach, 21 parts; gum mastic, 8; camphor, 1; with alcohol, 48. The map or engraving must previously receive one or two coats of gelatine.

Another.—Take up the carpet, well smooth the boards by plane and sand paper, then apply the following stain, using a large paint brush; an old brush is best. When the stain is dry; the floor may be oiled with linseed oil, and well rubbed with an old flannel wrapped round a piece of wood, or, if preferable, may be varnished with copal varnish, or blown hard varnish. To make the stain, procure 1 oz. Vandyke brown oil, 4 oz. of pearlash, 2 drms. best dragon's blood; put the whole of the ingredients in a clean pan or jug, add five half pints boiling water, well stir the contents with a piece of wood; bottle for use. It may be used hot or cold, but will not stain a greasy surface.

FIREARMS frequently burst when the muzzle has been accidentally closed with earth, snow etc. Prof. Forbes' explanation of this fact is very simple. If the charge moved slowly, a very slight pressure of the air in the barrel would be sufficient to clear the muzzle, but as the charge actually travels with a speed greater than the velocity of sound, the resistance offered by the obstacle becomes excessive and the gun bursts. It has been demonstrated mathematically, that the pressure generated by the plug of the density of air is seven and a half tons.

COMPOSITION FOR POOL BALLS.—A good and inexpensive composition that would be hard enough for pool balls may be made as follows: Melt together over a gentle fire in an iron pot, pitch 1 part, gutta-percha 2 parts, orange shellac 5 parts; add to this 6 parts of white lead (lead carbonate) in impalpable powder, and stir until a perfectly homogenous mixture is obtained, then cast and turn out. Color with the aniline dyes mixed with dilute alcoholic solution of bleached shellac.

COATING COPPER WITH IRON.—Professor Bœtger reccommends the following solution for coating copper plates with iron. Ten parts of ferro-cyanide of potassium and twenty parts of tartrate of soda are dissolved in 220 parts of distilled water, adding a solution of three parts sulphate of iron in fifty parts of water. Caustic soda solution is then poured into the mixture until the Prussian blue formed is re-dissolved.

GILDING WRITING.—First paint the table, and let it stand for two or three days to dry, then, before writing, take some very dry white lead or whitening, put into a bag of muslin, then shake it lightly over the table where the writing is going, then blow it off afterwards. Get some quick drying gold size and write the letters with it, then put gold leaf on very lightly.

Another method:—Paint the table, let it dry, dust over with dry powdered whiting (tied up in a piece of muslin), write with old size what he want, let it almost dry, and he can put on his gold leaf; wash off the table and varnish. Paint for writing is prepared the same as any other, only you would rub it a little finer if anything.

SILVERING METALS WITHOUT HEAT.—Cleanse the metal well, cover it equally with salt water and a mixture of one part of precipitated chloride of silver, two parts of potassa alum, eight parts of chloride of sodium, and eight parts of cream of tartar. Then wash the metal with water and dry it with a soft woollen rag.

POLISH.—To put on a good polish for black walnut tables used either for hot or cold water, use a cloth cushion moistened with clear solution of 1 part shellac in about 10 parts of alcohol, applying a few drops of linseed oil to the cushion occasionally during the operation of polishing.

To put a polish on fine walnut furniture, mix with two parts of good alcoholic shellac varnish, 1 part of boiled linseed oil, shake well, and apply with a pad formed of woollen cloth. Rub the furniture briskly with a little of the mixture until the polish appears.

IVORY may be silvered by immersing it in a weak solution of chloride of silver and letting it remain till of a deep yellow colour; then take out and dip in water, after which expose to the sun's rays until black. On rubbing, the black surface will soon change to a silver.

NOTES ON BELTING.

[TEXTILE MANUFACTURER.]

The formula given below is based on the experience of engineers in Great Britain, America and France. It serves the purpose of showing what width of belt will do the required work most efficiently, and at the same time last the maximum number of years. Many engineers, more especially in this country, are content to provide belts of greatly reduced width, and of single substance instead of double; hence the frequent complaints of their stretching, breaking and lasting so short a time. As a matter of convenience and arrangement of machinery, a narrower belt than that which is shown by the generally accepted formula is often imperative; but, in the absence of any such conditions, it is questionable economy to depart materially from it. The following may be regarded as an axiom: To use a belt of ample width and substance for the work required is to secure for it a long existence with satisfaction to all concerned.

DIRECTIONS FOR CALCULATING THE WIDTH OF BELTS REQUIRED FOR TRANSMITTING DIFFERENT NUMBERS OF HORSE POWER.

Multiply 33,000 by the number of horse power to be transmitted; divide the amount by the number of feet the belt is to run per minute; divide the quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide this last quotient by six, and the result is the required width of a single-tanned leather belt in inches.

Explanations.—The figures 33,000 represent the number of pounds a horse is reckoned to be able to raise one foot high in a minute. To obtain the number of feet a belt runs per minute, find the number of revolutions per minute of the driving shaft and multiply by the circumference of the drum, which is always 3.1416, its diameter. This final division by six is because half a pound raised one foot high per minute is allowed to each square inch of belting in contact with the pulley; a pound must therefore be allowed to two square inches, or six pounds to a strip one foot long and one inch broad.

Example.—Required the width of a single belt, the velocity of which is to be 1,500 feet per minute; it has to transmit ten horse-power the diameter of smaller drum being four feet, with five feet of its circumference in contact with belt:

33,000x10=330,000 divided by 1,500=220 divided by 5=44 divided by 6=7⅓ inches, the required width of belt:

DIRECTIONS FOR CALCULATING THE NUMBER OF HORSE-POWER WHICH A BELT WILL TRANSMIT.

Divide the number of square inches of belt in contact with the pulley by two; multiply the quotient by the velocity of the belt in feet per minute; again divide the total by 33,000, and the quotient is the number of horse power.

Explanations.—The early division by two is to obtain the number of pounds raised one foot high per minute, half a pound being allowed to each square inch of belting in contact with the pulley.

Example.—A six-inch single belt is being moved with a velocity of 1,200 feet per minute, with four feet of its length in contact with a three-foot drum. Required the horse power:

6x48=288 divided by 2=144x1,200=172,800 divided by 33,000=say 5¼ horse power.

It is safe to reckon that a double belt will do half as much work again as a single one. Belting made from "Helvetia" leather is much stronger, and will bear a heavier strain than that made from ordinary tanned leather.

HINTS TO USERS OF BELTING.

1. Horizontal, inclined and long belts give a much better effect than vertical and short belts.

2. Short belts require to be tighter than long ones. A long belt working horizontally increases the grip by its own weight.

3. If there is too great a distance between the pulleys, the weight of the belt will produce a heavy sag, drawing so hard on the shaft as to cause great friction at the bearings; while at the same time the belt will have an unsteady, flapping motion, injurious to itself and to the machinery.

4. Care should be taken to let belts run free and easy, so as to prevent the tearing out of lace holes at the lap; it also prevents the rapid wear of the metal bearings.

5. It is asserted that the grain side of a belt put next to the pulley will drive 30 per cent. more than the flesh side. Experience can alone verify this; but when belts are required to be worked this way, the fact should be stated in the order, so that the riveting may be arranged accordingly.

6. To obtain a greater amount of power from belts, the pulleys may be covered with leather ; this will allow the belts to be run very slack, and give 25 per cent. more durability.

7. Leather belts should be well protected against water and even loose steam or other moisture.

8. Belts working in very wet places should be ordered to be water-proof.

9. A careful workman will see that his belts are re-dressed about every four months, by sponging the dirt from them with warm soap and water ; then drying with a cloth, and, while still damp, rubbing in castor oil or currier's grease, which will be readily absorbed, the leather being moist from washing. Castor oil has the additional advantage of preventing rats attacking the leather.

10. In putting on a belt be sure that the joints run with the pulleys, and not against them.

11. In punching a belt for lacing, it is desirable to use an oval punch ; the larger diameter of the punch being parallel with the belt so as to cut out as little of the effective section of the leather as possible.

12. Begin to lace in the centre of the belt, and take care to keep the ends exactly in line and to lace both sides with equal tightness. The lacing should not be crossed on the side of the belt that runs next the pulley. Thin but strong laces only should be used.

13. It is desirable to locate the shafting and machinery so that belts should run off from each other in opposite directions, as this arrangement will relieve the bearings from the friction that would result where the belts all pull one way on the shaft.

14. If possible, the machinery should be so planned that the direction of the belt motion shall be from the top of the driving, to the top of the driven pulley.

15. Never overload a belt.

16. A careful attendant will make a belt last many years, which through neglect might not last one.

HEATING STEEL IN THE BLACKSMITH'S FIRE.

In heating steel, two faults are especially to be guarded against. First, overheating ; secondly, unequal heating of the parts to be operated on (whether by forging or tempering). Referring to the first, many blacksmiths do not recognize that steel is burned unless it falls to pieces under the hammer blows, whereas that condition is only an advanced stage of the condition designated as *burnt*. This is the secret of their partial failure, or, that is to say, of the inferiority of their work. Others recognize that from the time a piece of steel is *overheated*, to its arrival at the stage commonly recognized as *burnt*, a constant deterioration is taking place.

In the practice of some, this excessive heating may be carried to so small a degree as not to be discernible, except the tool be placed in the hands of an operator whose superior knowledge or skill enables him to put it to a maximum of duty, less skilful manipulators being satisfied with a less amount of duty.

But in the case of stone-cutting tools especially, and of iron-cutting tools when placed in the hands of very rapid and expert workmen, the least overheating of the tool will diminish its cutting value as well as its endurance. A piece of steel that is burnt sufficiently to break under the forging hammer, or to be as weak as cast iron, will show, on fracture, a coarse, sparkling, granulated structure, and this is the test by which working mechanics, generally judge whether steel is burned or not. But it is totally inadequate as a test to determine whether the steel has not suffered to some extent from overheating. Indeed, although the grain becomes granulated and coarse in proportion as it is overheated, yet it may be so little overheated as to make no visible difference in the grain of the fracture, although very plainly perceptible in the working of the tool, if placed in the hand of a thoroughly good workman. When the results attained are inferior, it is usual to place the blame on the steel, but in the case of well-known brands of steel, the fault lies, in ninety-nine cases in a hundred, in overheating, either for the forging or for the tempering.

In determining from the duty required of it, whether a tool comes up to the highest standard of excellence, the best practice must be taken as that standard. Thus, if it is a metal-cutting tool, as, say a lathe tool, let the depth of a four-inch wrought-iron shaft down to 3¼ inches diameter, the lathe making, say, 16 revolutions, while the tool travels an inch, and making from 25 to 30 revolutions per minute. Under these conditions, which are vastly in excess of the duty usually assigned in books to lathe tools, the tool should carry the cut at least four feet along the shaft without requiring grinding.

If the tool is for stone work, let it be tested by the most expert and expeditious workman. These instructions are necessary because of the great difference in the quantity of the work turned out by very expert workmen.

At what particular degree of temperature steel begins to suffer from overheating cannot be defined, because it varies with the quality of the steel. The proper degree of heat sufficient to render the steel soft enough to forge properly and not deteriorate in the fire is usually given as a *cherry red*, but this is entirely too vague for successful manipulation, and, in practice, covers a wide range of temperature.

The formation of a scale is a much better test, for when the scales form and fall off of themselves, the steel, in fine grades of cast steel, is overheated, and has suffered to some extent, though the common grades of spring or machine steel may permit sufficient heat to have the scale fall off without the steel being worked. As a rule the heat for tempering should be less than that for forging, and should not exceed a blood red. There are special kinds of steel, however, as for example, chrome steel, which require peculiar heating, and in using them strict attention should be paid to all instructions given by the manufacturers.

Steel should be heated for forging as quickly as compatible with securing an even degree of heat all through the part to be forged, and heated as little as possible elsewhere. If this is not done the edges or thin parts become heated first, and the forging blows unduly stretch the hottest parts, while the cooler parts refuse to compress ; hence a sort of tearing action takes place instead of the metal moving or stretching uniformly.

The steel should be turned over and over in the fire, and taken frequently from the fire, not only to guard against overheating, but because it will cool the edges and tend to keep the heat uniform.

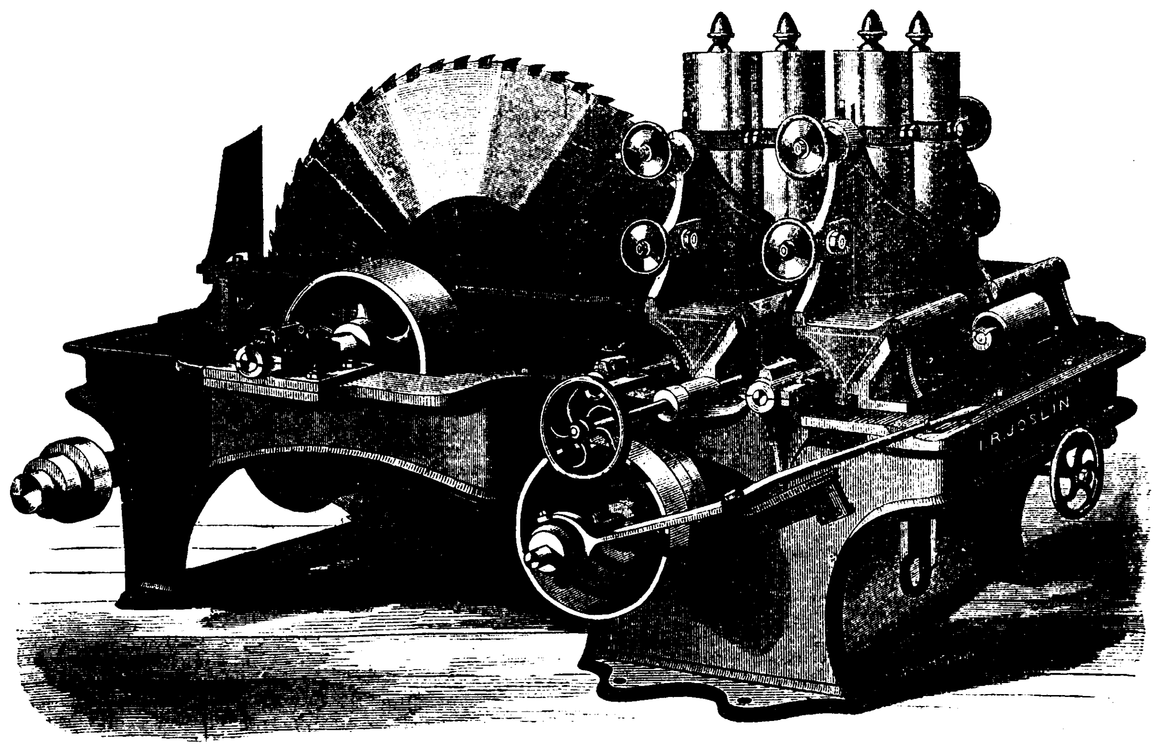
The fire may be given a full blast until the steel begins to assume redness at the edges or in the thin parts, when the blast must be reduced. If the thin part is heating too rapidly it may be pushed through the fire into the cooler coals or taken out and cooled in the air or in water, but this latter should be avoided as much as possible.

When the steel is properly heated, it should be forged as quickly as possible. Every second of time is of the utmost importance.

There must be no hesitation or examining while the steel is red-hot. nor should it be hammered after it has last its redness. There is, it is true, a common impression that by lightly hammering steel while black-hot it becomes impacted, but this only serves to make the steel more brittle, without increasing its hardness when hardened.—*Blacksmith and Wheelwright.*

A PREVALENT POPULAR ERROR.

By the burning of a Chinese wash-house in San Francisco a short time since, eleven of the occupants who were asleep in bed lost their lives. The account published in the newspapers described them as exhibiting, by the positions in which their bodies were found, the agony they suffered from the fire. As editors and reporters are considered to possess more than an average amount of intelligence and information, it appears singular that they should propagate or perpetuate such an error. It may be safely asserted as a general rule that persons who lose their lives while sleeping in burning buildings, are suffocated and die painlessly without waking, and before the flames had reached their bodies. The merest tyro knows what would be the effect of going to bed with a pan of burning charcoal in the room, or the effect of blowing out the gas instead of turning it off. An individual going to sleep under such circumstances inhales the impure air, which acts as an anæsthetic and rapidly converts the natural sleep into stupor and coma, from which there is no waking. Persons sleeping in a house which takes fire are smothered in this way by the carboniferous gas long before the fire reaches them. Their bodies or remains are found—not in the halls or stairways where they would have been had they been awakened and attempted to escape—but in bed, or in the spot which the bed had occupied, and in the very position in which they had been lying asleep. The exceptions are mostly noticeable, as when persons are seen to make attempts to escape. There is something so horrible in the idea of being burned to death that it were well for the community not to suffer needlessly from sympathy for the victims. To the relatives of persons who lose their lives in burning houses, particularly to parents whose children may die in this way, it may save a life-time of grief to know that death entered the chamber quietly and performed his task without so much as disturbing the slumbers of his victim.—*Pacific Medical and Surgical Journal.*



IMPROVED RE-SAWING MACHINE.

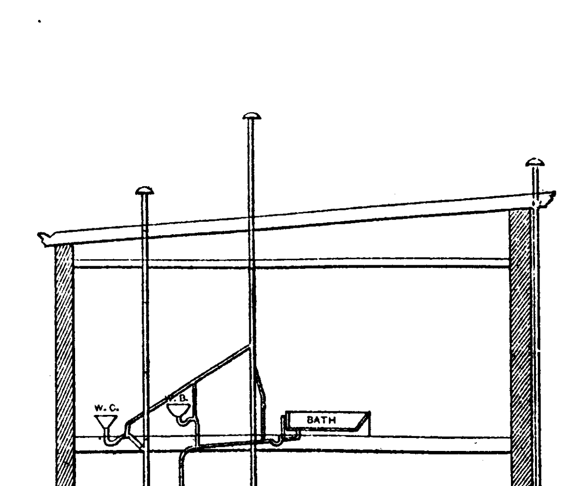
We illustrate and describe herewith the improved machine known as "Joslin's Re-Sawing Machine," manufactured by the S. A. Wood's Machine Company. The engraving represents a large and powerful circular re-sawing machine, with iron frame and 50-inch saw. It works lumber 22 inches wide and 3 inches thick, and can be made to slab from the side of stuff 4 or 5 inches in thickness. The feed is continuous, with three changes, the quickest being 85 feet per minute, and can be stopped and started without stopping the saw. The feed rolls are self centreing, or can be made rigid on either side. No springs are used about the machine, an entirely new device being used for weighting the rolls giving them all the pressure that may be required for straightening the lumber and holding it until sawed. The saw is run close up between the rolls. Guide plates or clamps are used, attached to the feed-roll stands on both sides of the saw, the clamps moving with the rolls. The clamps are not shown in the engraving, but the combination just named suffices to hold the lumber rigid until it has passed by the saw.

A device is also provided for throwing the feed rolls into position, so as to present the lumber to the saw as desired for doing different kinds of work without making any change of spreader, or other parts of the machine. This the sawyer can do while the saw is running, all parts of the feeding mechanism being devised with the purpose in view of enabling the attendant to adjust them as required without moving from the work end of the machine, and by the same device the board can be removed from the saw, if necessary. The feeding mechanism is moved across the machine by the hand wheel on the side, if desired to slab from the side of lumber and use the self-centreing arrangement referred to above. The manner in which the roll stands are connected to the slides is claimed to allow them to work perfectly free at all times.

The makers of this machine affirm that it is capable of performing a larger variety of work (with a notable saving of time) than any other re-sawing machine that is made, and that it has the advantage that any man can run it who is competent to file and keep a saw in order.

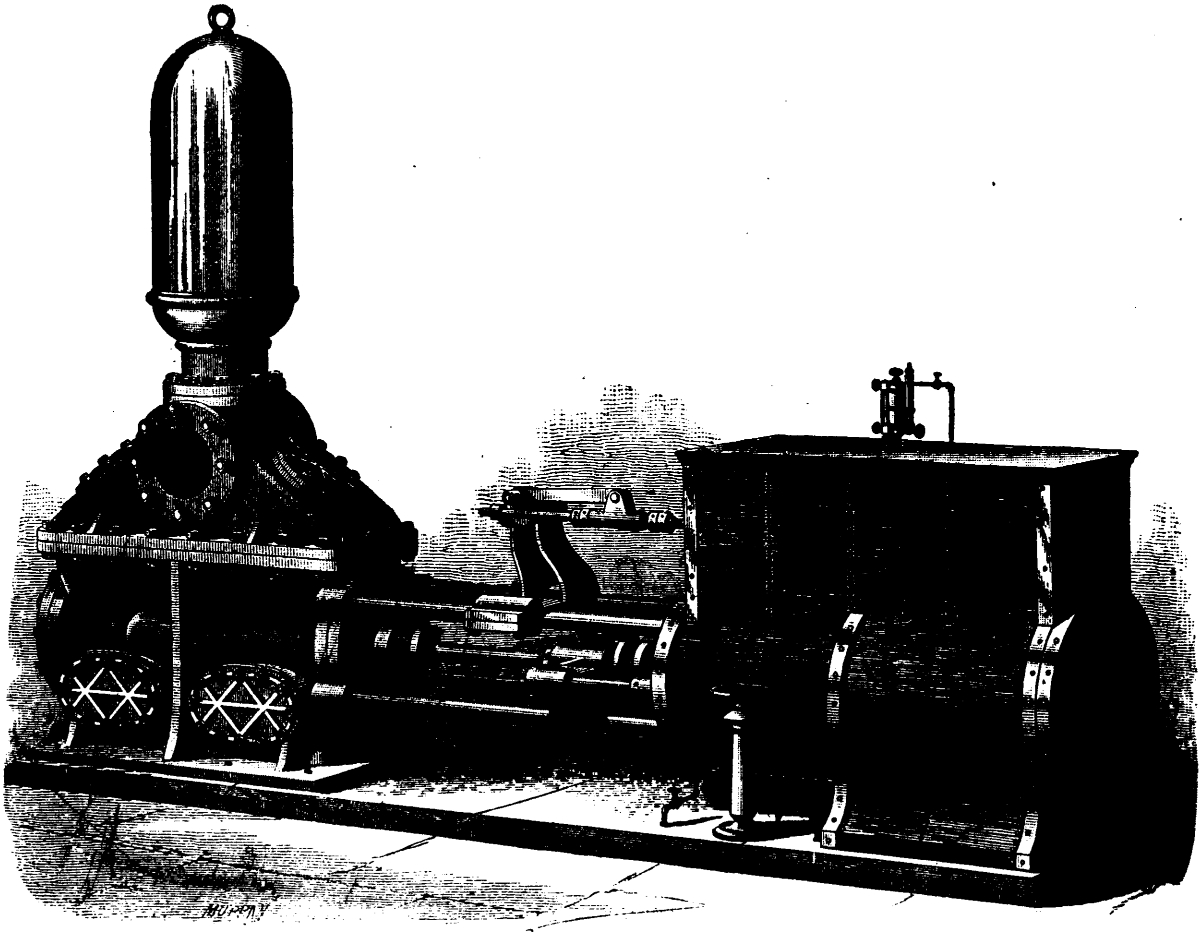
The driving pulley on saw is 18 inches diameter, 9 inches face, and should be run at 650 revolutions per minute. The makers furnish counter-shaft when desired, and supply these machines with saws adapted for special work, when this is stated.

The machines manufactured by the S. A. Woods, Machine Co., 91 Liberty street, New York.—*Manufacturer and Builder*.



House Drainage System, by E. Dunn & Bro., of Newark, N. J.

(See page 134.)



BLAKE'S IMPROVED COMPOUND PUMPING ENGINE.

The pumping engine shown in the accompanying engraving, and which will be recognised by many of our mechanical readers, has acquired a high reputation at home and abroad as a simple, inexpensive and effective water-works pumping engine. It is direct-acting, and so devised as to secure the advantages to be derived from the expansion and condensation of the steam used. In point of economy in fuel, and in general running expense, the makers of this engine claim for it a close approximation to that of the much more expensive and complex rotative and Cornish pumping engines in general use in large cities. For town use, where such large outlays as will be demanded for the last named, cannot be afforded, this improved compound engine would seem to be specially well adapted, by reason of its many advantages, chief among which are moderate cost, simplicity of parts, general economy of operation, and comparative high duty.

The engraving shows an improved direct-acting compound pumping engine made by the George F. Blake Manufacturing Co., of New York and Boston, of the following dimensions: High-pressure steam cylinder, 18 inches diameter; low-pressure cylinder, 36 inches diameter; water cylinder, 20 inches diameter; stroke, 36 inches; capacity at average speed, 2,000,000 gallons of water per diem.

An arrangement peculiar to this engine, controls the pumping operation so perfectly, that the annoyance and injury caused by jar and concussion (so common in direct-acting pumps) is entirely obviated. The water cylinder is built so that the suction valves are below and the delivery valves above the pump barrel. The feature of direct and roomy passages for the water to flow through, together with large area of valve openings, reduces water to a minimum.

The compactness and simplicity of all the parts of this pumping engine are salient points, and will no doubt strike the reader with favor in glancing at the engraving. It will also be noticed that no air pump is shown connected to the engine. This feature, or rather the absence of the usual arrangement of connected air pumps, is certainly an advantage, as by the use of an independent condensing apparatus, the engine is relieved of a certain amount of drag—which means a saving of power.

Water-works boards and engineers fully appreciate the importance of having a compact yet well-designed engine. In the Blake compound pumping engines no costly engine houses or massive foundations are necessary, while the economical advantages resulting from the expansion and condensation of steam are very effectively obtained without the complications of parts, such as cranks, fly-wheels, working-beams, journals, connecting-rods, etc., of the rotative or Cornish pumps. The steam valves are absolutely positive—that is to say, the operation at any speed, under any pressure, is perfectly continuous, and the engine is never liable to stop in the centre.

The London *Engineering*, in giving a critical report on the Blake pumping engine, says: "The result of this ingenious combination of steam valves is a perfect continuous action without any dead point, and which is attained without any complex internal arrangement. Of the excellent working of the Blake pumps at extreme ranges of speed and pressure, we are enabled to speak from personal observation, affording ample foundation for the opinion we have before expressed, that they will not fail to establish for themselves as high a reputatiou in England as they have in America."—*Manufacturer and Builder.*

Cement for Leather Belting.—One who has tried everything says that after an experience of 15 years he has found nothing to equal the following: Common glue and isinglass, equal parts soaked for 10 hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.—*Amateur's Handbook.*

Mechanics.

PUTTING UP SHAFTING.

The writer once had the putting up of considerable shafting, and the following are some of the data respecting the same, the rules and formulas found in text-books being insufficient to form a correct opinion by. The writer found that 800 pounds, acting on the end of a 12-inch lever, would twist off a wrought-iron shaft one inch in diameter. The *length* of the shaft had no influence on the breaking or twisting-off force, or torsional strength of the shaft, though on the length depended the torsional elasticity. The speed of a shaft controls its size, that is, if a one-inch shaft is large enough to transmit a given force at 50 revolutions per minute, a shaft running at 100 revolutions per minute will transmit the same force, its *area* being one-half of the one-inch shaft. This is plain enough when one remembers that the surface of a pulley on the smaller shaft travels *twice* as far in the same time that a similar surface on a similar pulley on the lower shaft travels, and hence needs transmit but half the force, to equal the force through half the distance.

Suppose we have a factor of safety of 4, this will allow of our continuing a force of 200 lbs. (800 ÷ 4 = 200) on the end of our 12-inch lever. That is, 200 will be a safe load. Now, if we wish to find the *area* of a shaft, to transmit 10 H. P. at a speed of 300 revolutions per minute, over a 24-inch pulley, we multiply 33,000 feet (one H. P.) by 10 H. P., obtaining 330,000, which, divided by the number of feet the run of the pulley passes through per minute (6.28 ft. + 300 revolutions), will equal the strain on the end of a lever equal to the radius of the pulley. In the case supposed, the radius of the pulley equals 12 inches, the size of the one for comparison. If it had not it would have been necessary to reduce it to 12 inches, that is, the effect the force would have at 12 inches. This force, whatever it may be, then being divided by 200 (the safe load on a one-inch shaft) will equal the area of the needed shaft, that is, it will equal the area in units of the area of a round shaft one inch in diameter—7,854-10,000ths of a square inch.

To reduce the radius of the pulley, whatever it may be, to the standard of the unit of comparison—12 inches—suppose the pulley was 40 inches in diameter, the radius is 20 inches. If the force as found were 50 lbs., we would multiply the 20 inches by 50, and divide the product by the length of our standard lever, 12 inches. The result being the weight necessary at the end of a 12-inch lever that would be equal to the force or strain on the belt over the pulley. For instance, let us take the conditions of the case given : Number of feet raised one foot high in *one* H. P. × 10 = 330,000. Circumference of pulley = 6.28 feet, which multiplied by 300 = 1,884 feet per minute, that the rim of the pulley moves through ; 300,000 ÷ 1,884 = 175.15, that is 175.15 lbs. is the constant strain on the belt, because 175.15 lbs. through 1,884 feet = 10 H. P. = 330,000.

This steam is transmitted to the pulley which acts as a lever, equal to the radius of the pulley, tending to twist off the shaft. The radius of the lever in this cone is 12 inches, which happens to be the same as our lever of comparison.

Thus we have a force of 175.15 lbs. acting on the end of a 12-inch lever ; 200 lbs. on the end of a 12-inch lever was, as previously stated, a safe load for a one-inch round shaft ; 175.15 ÷ 200 = .875 = $\frac{7}{8}$ of the area of a shaft one inch in diameter = .6872 of a square inch, and would be a trifle over nine-tenths of an inch in diameter.

Thus, so far as torsional strength is concerned, a one-inch round iron shaft will transmit with safety 10 H. P. ; but there is another feature of the question to be looked after, and that is the lateral stiffness of the shaft.

A one-inch shaft, five feet between hangers, will be deflected from a straight line 9-64ths of an inch by a pull of 28 pounds midway between hangers, while a pull of 56 pounds will cause a deflection of $\frac{1}{4}$ of an inch. However, there are few shafts of two inches and under that are not constantly deflected $\frac{1}{4}$ when transmitting power, especially if the pulley is midway between the hangers. The deflection of shafting is approximately represented by the general law that deflection increases as the cube of the length, and inversely as the cube of the diameter. Thus, if we should leave but $2\frac{1}{2}$ feet between hangers, the deflection would be $(2\frac{1}{2})^3 = 15.6$ and $5^3 = 125$, and $125 \div 15.6 = 8$, therefore the deflection at $2\frac{1}{2}$ feet between hangers would be 8 times less than it would be 5 feet between hangers. A $1\frac{1}{2}$-inch round shaft, 10 feet between hangers, will be deflected 9-16ths at the center by 56 pounds.

A three-inch shaft, 10 feet between centres, would be deflected a trifle more than 1-16th at the centre by a pull of 56 pounds. The remedy for deflection is more bearings, setting the pulleys as close as possible to bearings, and speeding the shaft up. Small shafting will not break, nor twist off when put up in accordance with the above data.

Many dollars have been thrown away in putting up large and slow-running shafting, which is so expensive at first cost, liable to break for want of alignment and excessive weight. The lighter shafting is by far the most economical in every respect—first cost is less, expense of putting up and keeping up is less, and has a longer life, and runs with less friction.

How many of your readers would be surprised to see a two-inch shaft taking off 1000 indicated H. P. ? A great many, I think. Still, I have in mine just such a shaft, which has been doing the above amount of work for eleven years, and which was put in to take the place of a four-inch shaft, which had broken repeatedly. I believe I am correct in saying that there is no necessity for a line shaft larger than two, or two and one-half inches in any shop or manufactory in the United States. The shaft mentioned above as taking off 100 H. P. made less, I think, than 200 revolutions per minute. The shaft might easily be reduced in area one-half and more by doubling the speed. There are a great many shops, now running with three and four-inch shafting, that might make a few dollars by selling the same and replacing it with one and three-fourth and two-inch shafting. It will be well to remember the following : Never put up a slow-revolving shaft when a fast one will do as well (and that is nine cases out of ten). Increase the bearings, as such increase does not affect the friction, and increases the life of the shafting.—*V. Hook in American Machinist.*

HARDENING AND TEMPERING AT ONE OPERATION.

Steel hardens when suddenly cooled from a red heat, and whether the heat be extracted by immersion in water or other matter, is of no consequence, so long as it is extracted with sufficient rapidity to effect the hardness. The degree of hardness depends first upon the temperature to which the heated steel is raised ; and, secondly, upon the rapidity with which the heat is extracted. Water is the medium mostly used for this purpose, but it is a well-known fact that if water of a sufficient degree of soapiness is not employed, the steel will not harden.

It is obvious, however, that the degree of soapiness may be so varied as to either prevent the steel from hardening or to have no practical effect upon the hardening. It is also obvious that it is possible to obtain a degree of soapiness that shall give to the steel any required degree of temper, and thus temper the tool without having to harden it at one operation and temper it at another, which would dispense with the hardening process and thus save both time and fuel, as well as oil or other material ordinarily used for the tempering. That tempering processes will ultimately be based upon this principle there can be no doubt, the difficulties (which will be explained presently) being so slight as to be easily overcome.

In my last communication I described one method of tempering at one operation, and I have now to describe another method which has been employed by the Monitor Sewing Machine Company to temper their small spiral springs.

In this process the steel is heated to the usual degree and cooled in a mixture of milk and water. The proper proportions of milk to water would undoubtedly vary with the quality of the milk, hence it must be arrived at by trial. The more milk the lower the temper, all other things being equal, and conversely the less milk (in a given quantity of water) the higher the temper. The proper mixture once attained, the tempering can be carried on very expeditiously, but it is apparent that such a process is more suitable for tempering in quantities than for single pieces, especially when the grades of steel may be variable.

The difficulty in obtaining uniform results lies in the difficulty of heating the pieces to an exactly equal temperature before dipping them, for it is found that a very small difference in the heat of the steel makes a wide difference in the degree of temper obtained, but it may be stated positively that with a uniformity of heat the best of spring tempering may be obtained.

In this connection, there arises the question whether a good spring temper may not be obtained by heating the steel to a low red heat and mixing a lesser quantity of milk therein (the requisite quantity to be determined by experiment). If such is the case, as seems highly probable, the process is expedient in the heating part of it. This would leave the steel tougher, while, at the same time, it would obviate the liability of burning the steel.

The easiest method of heating would, in this case, be to employ a flux heated to the required temperature.

For a higher grade of temper, such as is represented in color tempering by the shades of yellow and light brown, it is probable that it would be necessary to heat the steel to the usual degree for the hardening process, but even then it would require an experiment to determine the proper temperature.—*Joshua Rose in Blacksmith and Wheelwright.*

SPEED OF LINE SHAFTS.—The tendency at the present time is to increase rather than to diminish the speed of line shafts. Good practice is to run shafts for machine shops at 120 revolutions per minute; for wood-working machinery, at 250; and for cotton and woollen mills, at from 300 to 400 revolutions. Hollow or pipe shafting has been made to run very satisfactorily at 600 revolutions per minute. This kind of shafting, however, is too costly, to be generally introduced. These speeds are not too high for successful practice. Belts can be run safely at 500 to 600 feet per minute; but on say 6-inch pulleys, lose about two-fifths of their cohesion by centrifugal force, and are a little uncertain in driving action. Ordinary cast-iron pulleys are safe also at these speeds, if well made and not too large. A 4-foot pulley should not be run over 400 revolutions per minute, according to the experience of a good engineer; but with wooden rim, properly made, a higher speed may be run with safety. We mention speeds in connection with pulleys and belts, because these are more liable to be affected by high velocities than shafts are, the belting losing pulley contact, and the pulleys losing cohesion by reason of the contrifugal force developod by high speeds.—*Mechanic and Builder.*

DO NOT BURN YOUR TIRES IN WELDING.—A correspondent of the *Wheelwright and Blacksmith* writes under the above head as follows: I would like to call the attention of carriage-smiths to a great evil that many fall into when welding tires, viz.: of allowing the tire to burn on each side of the lap while taking a heat. Many smiths fail to take into consideration the fact that it is impossible to heat a piece of iron two inches thick, especially when it is formed of two pieces of equal thickness, one placed upon the other, as quickly as one of half the thickness could be heated, and hence, having lapped their tire, the full force of the blast is thrown upon it. As a result, the tire is put into service with a weakness at each side of the weld, caused by being burnt while the weld was being brought to the required heat. That there is not a particle of need for such carelessness every smith knows, no matter how poor a workman he may be. Give your weld a gradual heat; attend to it yourself and not throw the responsibility upon your helper. Have a clean lot of coal and under all a clean fire, and you will never lose a good customer by having him discover a rotten place in his tire, causing it to break when far from a forge.

A NEW PROCESS FOR ETCHING ON COPPER.—From the London *Photographic News* we glean the following particulars of a new process for etching on copper, which has the merit of simplicity. A copper plate is first coated with bitumen on the turning-table, in the same manner as in "photo-zincography." When the coating is quite dry, an impression from a lithograph stone on transfer-paper is applied to it, which leaves behind a picture in fatty ink on the bitumen surface. The plate is then dusted with fine bronze powder, which adheres only on the inked portions, rendering them very opaque. The plate is now exposed to the light, which renders the portions of the bitumen coating not covered by the powder insoluble. Then a solvent for bitumen is applied, which removes the bitumen beneath the powdered parts, laying bare the copper surface in those parts corresponding to the picture. The copper plate can now be etched with per-chloride of iron or other etching liquid, and when sufficient depth has been reached the operation can be stopped and the whole plate cleaned. The process is said to be well adapted for line work.

EDGE-LAID BELTS.—According to Leigh, a better method of producing a broad belt than the usual American double leather belting sewed together—a method by which the article can be made with the greatest ease, of any thickness or width, perfectly equal in texture throughout, and alike on both sides—consists in cutting up the hides into strips the width of the intended thickness of the belt, and setting them on edge, these strips to have holes punched in them about one-eighth of an inch in diameter and one inch apart; nails, made of round wire, clinched up at one end for a head and flattened at the other, are used for fastening the leather strips together. Each nail is in this case half the width of the intended belt, and after the strips are all built upon the nails, the ends of the latter are turned down and driven into the leather, thus making a firm strap, without any kind of cement, splicing or similar treatment. When a strap made in accordance with this plan requires to be tightened, it is only necessary to take it asunder at the step lines of the splice, cut off from each end of the strap what is required, and piece up again with wire nails or laces, going entirely through the strap.

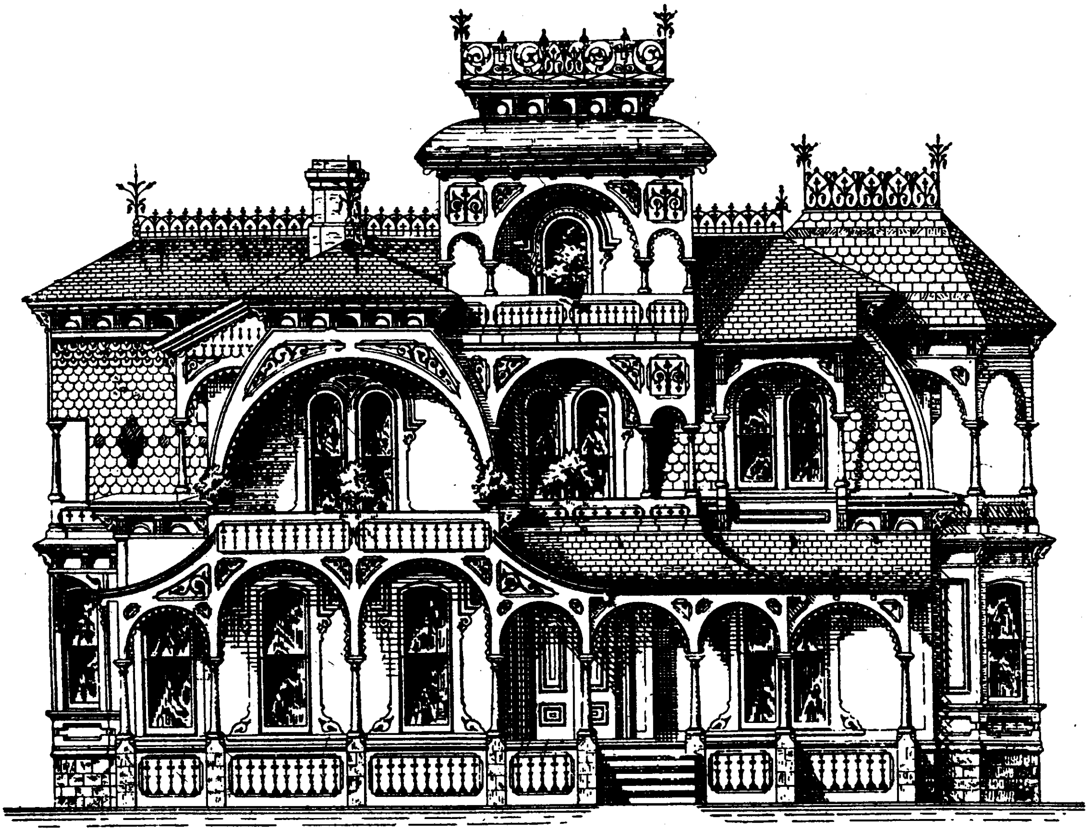
A LOG RAILROAD.—A log tramway or railroad in use by the Richardson Bros., at their mill, south of Truckee, is a very ingenious piece of machinery. Logs, ten inches to a foot in diameter, are hewn round and smooth and their ends couple together by iron bands. These logs, laid side by side upon graded ground for a distance of perhaps three miles, from the track. Of course the road looks quite like an ordinary railroad track, except that logs are used instead of rails and the ties are at much greater intervals. The wheels of the engine and cars are concave on the outer surface, and fit the curve of the logs. The power is applied to a wheel in the middle of the forward axle on the engine. The most remarkable loads of logs are hauled upon the cars. and the affair is a decided success. It is very cheap, its construction is simple, it is not easily damaged, and its operation is all that could be desired. By means of this log railroad the Richardson Bros. are enabled to get their logs to the mill from the forest, three miles distant, at a cost far less than it is ordinarily done.—*Truckee Republican.*

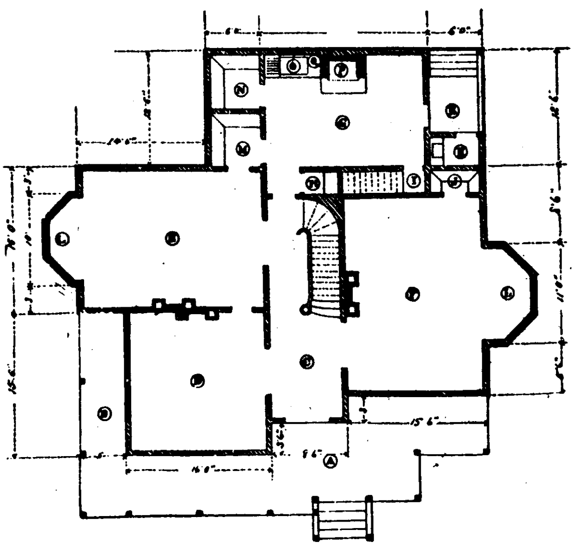
DEADENING NOISES OF WORKSHOPS.—To those who carry on any operations requiring much hammering or pounding, the following, from the *Workshop Companion*, will be a great relief. 1. Rubber cushions under the legs of the work bench. *Chamber's Journal* describes a factory where the hammering of 50 coppersmiths was scarcely audible in the room below, their benches having under each leg a rubber cushion. 2. Kegs of sand or sawdust applied in the same way. A few inches of sand or sawdust is first poured into each keg; on this is laid a board or block upon which the leg rests, and around the leg and block is poured fine dry sand or sawdust. Not only all noise, but all vibration and shocks are presented; and an ordinary anvil, so mounted, may be used in a dwelling house without annoying the inhabitants. To amateurs, whose workshops are usually located in dwelling-houses, this device affords a cheap and simple relief from a very great annoyance.

THE MARINE BICYCLE.—Quite a sensation was created on the the river recently by the exhibition of what Mr. Urch, the inventor, calls the "marine bicycle." It is constructed after the catamaran style; the length of this one, which is built at an experiment only, is 25 feet; the two boats are each six inches wide and six inches in depth, and about three and a half feet apart, and held in position by wooden bars. In the centre is placed the bicycle, and from it extends aft an iron rod eight feet long, to which is attached the propellor; this is between the boats, and the present power, which will be greatly improved, gives her speed enough to beat any dory on the river. The steering gear consists of a rudder on each boat, and the machine answers the helm quickly, considering its length. One good point is that it can be stopped almost instantly, when under full speed. It will probably be one of the most popular river amusements.—*Portsmouth Gazette.*

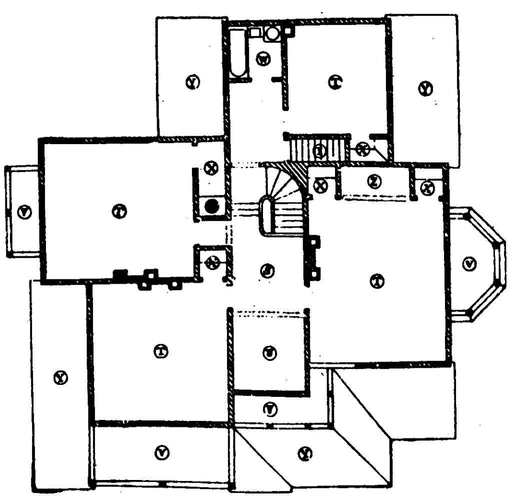
WOOD-CENTERED car wheels, which are used in very large numbers for the passenger cars of English and Continental railways have been found unequal to the duty enforced upon them by the higher strains due to the use of continuous brakes. Mr. Cleminson, an English engineer, has sought to render them fit for service under existing circumstances by changing both the construction of the nave and bars. The latter is now made with a number of arms extending to within a short distance of the tire, which do not prevent a close fitting of the wooden segments. He has also improved the ordinary method of tire fastenings by having the tire formed with a groove for the retaining ring. The main advantages claimed for wooden-centered wheels are a decreased wear of axle and tire, claims which seem to be borne out by comparative experiments made in French and German woods.

RULE for finding the weight necessary to put on a shaft valve lever, when the area of valve, pressure, etc., are known: Multiply the area of the valve by the pressure in pounds per square inch; multiply this product by the distance of the valve from the fulcrum; multiply the weight of the lever by one-half its length; then multiply the weight of the valve and stem by their distance from the fulcrum; add these last two products together, subtract their sum from the first product, and divide the remainder by the length of the lever; the quotient will be the *weight* required.





First-Floor Plan.



Second-Floor Plan.

AN AMERICAN DESIGN FOR A COUNTRY VILLA.

ARCHITECTURE.

STONE AND FRAME COUNTRY VILLA

The designs and details illustrated on this and the two following pages are of a residence erected in Westchester county, N. Y. occupying a position which overlooks the Sound on the road from Bartow to City Island. There are many features of the building which are unusual, and therefore interesting, especially as regards the treatment of the exterior. The cellar and basement are built of very solid masonry, a superior building stone of a light granite color being found on the grounds. To give variety to the stone-work above the water table, the corners of the building and window and door openings are laid in face brick, the red color of which forms a fine contrast with the gray tint of wall. Above the first story the building is substantially frame, though for the sake of continuing the stone effect a light green slate is used for the siding, and the roof is covered with black slate (Chapman's). The woodwork in the gables is made heavy in effect with thick verge boards, and scroll-sawed panels at the apex of each, backed up behind to increase the strength and allow the figure made by sawing to be left in the solid. Each gable is cut to a different design. The chimneys above the roof are built with red and black bricks and encaustic tiles, representing monogram of owner, &c. The porches are laid with narrow yellow pine floors; have turned columns, chamfered brackets, plates, rafters &c., all the structural parts of roof showing underneath finished. The westerly end of the porch on south side is glassed in for conservatory. The painting of the exterior is done in the main with dark brown color, to harmonize with the gray stone, brick and green slate. The columns, chamfers, brackets, &c., are picked out with other colors, chiefly Indian red, for relief.

On the plan of interior, A represents the entrance hall, made in old-fashioned style like a room, with a cosy fire-place in it, stained glass-windows, &c. The wainscoting of this hall is made high, with the top member forming a shelf all around it; the cornice and centre piece are also of wood. This room is fitted up in ash. B, is the library, which is also the parlor. At each side of the entrance door of this room, as shown by the dotted lines, a book-case is built in. The mantel and all the trimmings of this room are in walnut. The dining-room is fitted up in chestnut and ash, with ash and walnut floor, paneled wainscot, fixed bouffé at one end, and Caen stone and tile mantel-piece opposite. This fire-place is arranged for an open wood fire, and immediately over it, above the mantel is the window shown on the plan, which is filled with one sheet of plate glass. The faces of this chimney breast to the ceiling are covered with light buff and chocolate colored tiles, and there are introduced in it, as well as in the bouffé opposite, many hand-painted tiles by Messrs. Ward, of original design, of bud and flower patterns of unusual excellence. D, is a room designed to be used as a private office or library; this is fitted up in oak. The triple window of this room has rolling Venetian blinds. E, the staircase hall, is in ash same as the entrance hall. The staircase has a square chamfered and carved newel with ball at top, close string, squared chamfered balusters and double-hand rail. The floor of this and the entrance hall is covered with ash and walnut bordered floor. F, the pantry, is fitted with butler's sink, cupboards, &c., complete. From the plan the room might appear a dark one, but it is not so, the window shown by staircase throwing its light across into the pantry, and there being a skylight in addition immediately over the butler's sink. G, is the billiard room, fitted up in birch. H, the kitchen. K, conservatory. L, piazzas. On the second and third stories are nine bedrooms. with closets, &c., the bath-room and an attic. These are trimmed in pine, plain chamfered work. All the rooms of first story are fitted in separate and distinct designs, no two being alike. The mantel-pieces, with the exception of that in the dining-room, are of wood, made to order from designs, matching the other woodwork of the respective rooms. All rooms have inside blinds—hard wood on first story, pine on second. The floors of the house are made double, the second layer in all rooms not described for walnut and ash being in yellow pine throughout the first and second story.

The cellar of the house (not shown as subdivided on plan) is fitted up with store rooms, refrigerator and wine-room, furnace apartment and laundry. All the masonry and carpentry of this building are done in the strongest and most substantial manner, and the plumbing and heating apparatus is fitted up with all modern improvements. Many things about the work are of a more costly character than is usual, the entire outlay for all, including heating, plumbing, fire-places, &c., being about $14,000; but the main features which give the building its exterior effects are comparatively inexpensive.

PAINT IN WOOD.

Very effective work can often be done in water-colours on wood, and it is an art which has many devotees. Some artists, says the *Art Interchange*, have acquired great success in the painting of birds on wood, and have most faithfully reproduced the fineness and delicate tracery of feathers and plumage, but the ordinary worker had best confine his powers to more simple subjects, and material of all sorts will not be found wanting. It requires great care, cleanliness and nicety, and otherwise good work is often marred by carelessness in these particulars. When white wood is employed, which is generally the best for beginners to use, the following method may be followed. Supposing a piece of chestnut, which in its natural state is very white to have been taken, first draw the design either sketching or tracing it, and taking care not to lean too heavily upon the pencil. Then clean the wood carefully with a crumb of bread, keeping a piece of paper under the hand so that the wood shall not be soiled in any way. If this cleansing process is put off until the design is painted, the colour is apt to come off in rubbing.

The same necessity for the wood being perfectly clean exists when it becomes necessary to polish it. Mix the colors to be used with Chinese white, which will prevent their sinking into the wood, and renders them opaque. Brilliancy is given to the colouring also by this use of body colour. Being now ready to paint, begin with the dark shades, reversing the order set down for transparent colors. After working up the different lights, finally put in the high lights. Colours such as Vandyke brown and crimson lake can be used, although dark colors, for they become bright and add much to the brilliancy of the picture when it is varnished. Use the ordinary water-color brushes as they are better adapted for painting on wood. The painting finished, it should be polished in the following manner:—Pass a coating of patent white size over the entire wood, and after it is thoroughly dry, repeat the operation. Then when this second coat is dry apply the varnish with a large soft brush, working it regularly lengthways, or from top to bottom, and when this is dry, apply another coating, working from side to side. Continue this process alternately until the desired polish is obtained. White spirit varnish is the best to use.

Panel painting, which is one of the most popular forms of painting on wood, is executed as ordinary oil painting on any smooth, well-seasoned and close-grained wood, such as pine, beech, oak or chestnut. The wood may be left plain or gilded, and so much of the surface as is not to be covered by the design, may be worked into a diaper pattern if desired. There are two ways of preparing the wood for painting, the old method being to gild the surface of the wood itself, so that the grain may be seen through the colour, the new method being to cover the wood with a composition upon which the gilding is laid, and as this is perfectly smooth, no grain whatever will appear. The former is, perhaps, the more artistic, the latter is the prettier of the two. Prepare the wood as follows:—Put on three or four coats of a mixture of whiting and warm size, sufficiently thin to lay on with a brush, and when dry rub gently with pumice stone and water until quite smooth. Lay on a coating of gold with a camel's hair brush, and after drying, add another coat of very thin size. Upon this is laid the gold leaf and another coat of size to protect it, and the panel is then ready for painting. There is a form of panel decoration now quite general, consisting of squares of wood the size of tiles, inlaid as borders or dados. When they form a dado, four squares together may make the pattern, or it may be arranged in diagonal or perpendicular lines.

The squares may be of gilt or plain wood, or both alternately, and painted in a continuous design, or with a bird, flower, butterfly or conventional figure on every other one. Wood painting in monochrome is scarcely decorative or distinct enough for complicated subjects. If borders were employed, however, made by painting any light wood with oak brown in a conventional pattern, or if the squares be made of light wood and painted in the same way, this would serve the purpose. Above all, the greatest care must be taken not to overdo or confuse decoration. If the wall above is to be painted in panels, the dado must be plain, only its color must harmonize with the rest of the space. If the dado itself be decorated, the wall above should have some scattered flowers upon it. A dado of one pattern, and a wall of another, are ugly to say the least. If decorative art is to fulfil its mission, it must be harmonious, peaceful and restful, and every hue and feature in a room should add its mite to the formation of and harmonious whole. This principle must be borne in mind in wall or panel painting, as well as in other forms of decoration, and if everything is made subservient to it, good results should follow.

Engineering and Miscellaneous.

A New Preservative Process, of very general applicability for preserving plants and animals, has been devised by Herr Wickerscheimer, preparator in the Zoötomical Museum of Berlin, and has been deemed of such value that the patent has been purchased by the Prussian Government and given to the public. The procedure was presented and described in detail before one of the late meetings of the Academy of Natural Sciences, of Philadelphia, where it attracted considerable attention. The following is an abstract of the specification of the inventor: "I prepare a fluid, with which I impregnate the object to be preserved in different ways, according to its nature or the purpose I have in view. The bodies of men and animals preserved by this process retain perfectly their form, color, and suppleness, so that we may take sections from them years afterward, for the purposes of science or of criminal justice. Under its operation, corruption, and the insalubrious odours produced thereby, cease. The muscular tissue presents, on cutting it, a condition like that of a fresh body. Finished preparations of selected parts, as the ligaments, lungs, intestines, etc., preserve their softness and flexibility, and the hollow parts may be even blown out. The parts of bugs, crustaceans, and worms remain movable, without exception. The colours may be made to remain perfect, if it is desired, in animal as well as vegetable bodies. The preserving fluid is prepared as follows: In 3,000 grams (45,500 grains) of boiling water, dissolve 100 grams (1,550 grains) of alum, 25 grams (387 grains) of common salt, 12 grams (186 grains) of saltpetre, 60 grams (930 grains) of potash, and 10 grams (150 grains) of arsenious acid. To ten quarts of the neutral, colourless, and odourless fluid, add four quarts of glycerine and one quart of methyl alcohol. The process of preservation, which is applicable to the dead bodies of men, dead animals, and vegetables, as well as to single parts of the same, consists, to speak generally, in soaking them and impregnating them with this mixture. If the preparations are to be preserved dry, they are kept in the fluid for from six to twelve days, according to their size, then taken out, and dried in the air. The ligaments of skeletons, the muscles, crustaceans, bugs, etc., will then remain soft and pliable, so that all the natural movements can be produced on them at any time. * * * * If it is desired to preserve smaller animals, like lizards and frogs, and vegetables, with their colours unchanged, they should not be dried, but should be kept in the fluid. If bodies of men or beasts are to lie for a considerable time before being used for scientific purposes, it is enough to infect [inject? —Ed.] them with the preservative fluid. For this purpose, I apply, according to the size of the object, one and a half liters (about three pints) of the fluid for a child of two years, and five liters (or quarts) for a grown person. The muscles will appear then, even after the lapse of years, fresh when cut. If the infected [injected?] bodies are kept in the air, they will lose their fresh appearance, and the epidermis will become somewhat brown, but that may be avoided if the body is rubbed on the outside with the fluid, and is then kept shut up in an air-tight case. The last method is recommended in the case of corpses which are to be kept for sometime before they are buried, when, instead of having the usual stiff look, the features and color will seem fresh and unchanged, and the bodies will not have a trace of odour. * * * * The treatment in different cases is governed by circumstances, but the composition of the preserving fluid is always the same."

An Improved Method of Remaining Under Water for a considerable time—from twenty minutes to an hour—without the encumbrance of the apparatus at present used by divers engaged in sub-aqueous work, is described by Dr. B. W. Richardson, a well-known writer on topics pertaining to sanitary engineering. The method in question does away with the drawbacks and dangers of the present apparatus in common use, by dispensing entirely with the air-tubes and pumps now employed. The new process was exhibited at the "Royal Polytechnic Institute," in London, where it was closely examined by Dr. Richardson, who makes substantially the following report of it in London *Nature*:

The peculiarity of the method consists in the diver taking a full supply of air-food down with him, which dispenses with pumpimg, no help being needed, except a signal man and cord. Mr. Fleuss, the inventor, showed the apparatus in operation. He descends into the water in an ordinary diver's dress, consisting of helmet, breast-plate, and common water-tight armings and leggings. On his shoulders he carries a weight of 96 pounds and on his boots 20 pounds.

A light cord is attached to the helmet for signaling to the attendant above. Before the mask is closed and the helmet adjusted, an "ori-nasal mouth-piece," with a breathing-tube of an inch bore proceeding downward, is firmly tied over the mouth and nose.

Dr. Richardson makes the statement that he was witness of, and carefully observed, two experiments, and that the diver assured him that when under water he breathed as freely and easily as when in the air. The duration of these two experiments was respectively twenty minutes and one hour.

The assertions of the diver were confirmed by his appearance and condition at the end of the longest experiment. He moved about on the floor of the tank, picked up coins, and could lie down and get up without difficulty. The exact mode by which breathing is effected, though evidently very simple, is still kept a secret by the inventor; but, whatever it may be, it is manifestly carried on wholly within the apparatus, so completely, in fact, that not even the *expired air* is visible in the water.

Dr. Richardson concludes that these facts demonstrate that, without any assistance from above, a man without any previous experience in diving can take down with him sufficient oxygen to live there easily for an hour. The diver is reported to have asserted that, but for the cold, he could easily arrange to stay down for four hours. He is also credited with the statement that depth would make no difference as to breathing within the apparatus. Dr. Richardson is quite enthusiastic over the practical possibilities of this invention. He concludes that, if a man can thus take his stock of breathing material with him, and live for hours without external access to air, he may extend the field of his industries and investigations into the deep sea, or into the most rarified atmospheres; into mines filled with choke-damp, or amid the suffocating smoke of conflagrations, without fear of consequences.

The Tunneling of the Simplon.—From the present indications, the St. Gothard tunnel will not have long to boast the proud distinction of being the most notable work of engineering on the continent of Europe, as the same reasons which called it into existence will most probably give birth to another and even greater rival in the projected tunnel through the Simplon.

The object to be secured by this work is to establish a more direct line of communication between France and Italy than is now afforded by the Mont Cenis route, and thus to retain for France the bulk of the traffic, which, it is feared, will be diverted from the latter route by the more direct St. Gothard route. The Simplon tunnel, if ever completed, would be not less than 12 miles in length, as compared with the 9½ miles of the St. Gothard, and 7½ miles of the Mont Cenis tunnel. The Simplon project is being strongly urged, and its actual undertaking in the near future seems to be quite probable.

Shop Cleanliness.—The clear thinking fouuder of Methodism said that "cleanliness is next to godliness," and if the axiom is not the basis of Methodism it is the basis of method. If there is anything that collects dirt—attracts dirt—faster than a tramp, it is machinery, and it is the worst of ill usage that limits the life of machinery. Some time ago the management of a certain railroad ordered a cessation of the cleaning of its locomotives, with a view to save the cotton waste, labor and time used. The experiment was not successful. There is no machine from a locomotive to a watch, but needs occasional cleaning. Dirt interferes with motion and destroys material. It is a constant annoyance to the workman in the shop as well as the woman in the house. But in the shop there is danger added to annoyance. The danger arises from the presence of heaps of refuse, iron and steel chips and shavings, oil and waste, either of them inflammable alone, and combined are the source of more than one "incendiary" fire. Under favorable conditions—heat and moisture—a heap of chips from the machine shop will generate hydrogen gas in sufficient quantities to take fire when mixed with atmospheric air. Of course, the oil and fragments make a perfect tinder box of such debris. The shop sweepings should be placed under cover awey from valuable property, and the shop and its tools should be kept clean, if for no other reason than that of comfort.—*Ex.*

The Weight of Cast Iron.—The following letter is clipped from a late number of *Iron*, of London: "I shall be glad if any correspondent can inform me if there is any reason to suppose the weight of cast iron was greater 60 or 80 years ago, as manufactured then, than it is now, or not? The School of Naval Architecture at this time takes cast iron in its calculations as weighing 447 lbs, to the cubic foot, but I find in Sir Howard Douglas' work on Gunnery that the size of cannon balls about

1815 infers a greater specific gravity for them. Thus, as given in his book :

9 lb. cannon ball was of	4,00 in. diameter.		
18 " "	5,04	"	
32 " "	6,11	"	

Now the weight of spherical bodies is in proportion to the cube of their diameters, and calculating according to that rule I find the actual weight of these shot would be only 8,69 lbs., 17,22 lbs, and 20.70 or considerably less that than their reputed weight, unless the castings were of greater specific gravity than is now reckoned. A difference of $1\frac{1}{4}$ lb. in a 32-lb. ball is of consequence, and could scarce arise from any mistake in so expert and learned an author as Sir Howard, who is precise to a fault."

Stephen Roper gives the following rule for finding the safe working pressure of steam boilers : Multiply the thickness of the iron .56, if single riveted, and .70, if double riveted ; multiply this product by 10,000 (safe load) ; then divide the last product by the external radius (less thickness of iron) ; the quotient will be the safe working pressure in pounds, per square inch. Example :

Diameter of boiler, 42 inches.
Thickness of iron, $\frac{3}{8}$ of an inch.

2 ÷ 42
21 external radius.
.375
20.625 internal radius.

Thickness of iron, $\frac{3}{8}$ = .375
.56 single riveted.
.21000
10000 safe load.
20 625 ÷ 2100.00000
101.81 lbs. safe working pressure.

Surgery by the Electric Light.—Dr. Berkeley Hill, of London, recently operated for vesico-vaginal fistula in University College, while the vagina was lighted up by Coxeter's application of the glowing platinum wire. The apparatus consisted of a fine wire twisted into a knot. Through this knot was sent a continuous galvanic current, strong enough to maintain the wire at a white heat. The wire was enclosed in a glass chamber, which was itself also enclosed in another glass cover. Through the space between the glasses, a current of water was allowed to flow, in order to preserve a low temperature around the light. A strong light was maintained for over an hour, close to the margin of the fissure, without impeding the operator's manipulations.

Paper Boxes.—By a recent invention, paper boxes are made in Boston directly from paper pulp. The boxes are turned out of any size or shape perfectly seamless and of uniform thickness. After drying, the boxes are run through a second machine at the rate of 60 per minute, receiving, under a pressure of 4,000 pounds, such embossing as may be necessary. From the time the paper stock is taken from the bales until the perfect box is turned from the machine, manual labor is entirely avoided. By the use of one set of these machines, 30,000 boxes can be produced per day, at less than one-third of the lowest market price of hand-made goods, and doing the work of 200 hands as the process is ordinarily conducted.

A Chance for Inventors.—There has been less inventive genius displayed in the production of machinery in the pottery business than in any other branch of manufacture under the sun. The creation of pottery is almost entirely dependent upon the manual skill of the operative potter, and the only improvement that has been made in 4,000 years is in the substitution of steam power for the hand and foot in revolving the "jigger" and throwing wheel.

Recovery of Tin from Tin-Plate Scraps..—According to a patent by Larocque, tin scraps are mixed with finely powdered charcoal and one-half per cent. of salt, and placed in a kettle that can be closed, supplied with a horizontal perforated diaphragm in the middle. The upper portion is then heated red-hot, whilst the lower is cooled with water, when the tin melts, and runs through.

To Restore Old Oil-Paintings.—Take the painting out of the frame, lay it on a table, face up, and keep a wet cloth on it for two or three days, changing or cleaning the cloth as often as it becomes soiled. When the painting is clean, wash it with a sponge or brush dipped in oil. This is much better than varnishing.

Cabinet Work.

PRACTICAL HINTS.

Clamping Picture Frames.—An excellent arrangement for fastening the corners of picture frames can be made in a few minutes, which, if we are to believe a correspondent, will be all that can be desired, and answer admirably in the case of frames that will not bear marring on the edges. Take a piece of wood 9 in. or 10 in. long and $2\frac{1}{2}$ in. square, and rebate one angle $1\frac{1}{2}$ in. deep and wide, then round off the opposite angle, and cut into four pieces of equal length. Having accurately mitred the frame, lay it upon the bench and put one of the pieces of wood at each corner, the rebate, of course, fitting upon the angle ; next wind a piece of quarter-inch cord twice around the frame over the corner pieces, and tie it at one corner. Then take four pieces of smooth wood 6 in. long and twice as thick as a carpenter's pencil, insert them between the cords, one on each side of the frame, and by twisting the cord with them it can be made as tight as desired ; and having seen that the mitres are good and that the frame does not wind, lay it upon the bench and pull out the bits of wood without disturbing the cord or corner pieces, lift out the frame, put a little glue upon the mitres, and replace as quickly as possible in the same position as before. Now replace the pieces of wood and give the cord a few turns, adjust the angles, and tighten up. Braces can then be put across the corners on the back of the frame, or, where the edges will admit, a saw kerf can be made in the corners and a piece of veneer glued in.

Imitation Ebony.—The following is a useful receipe for imparting to oak a black color that shall make it resemble ebony. The wood is immersed for forty eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood docoction prepared as follows :—Boil 1 part of best logwood with 10 parts of water, filter through linen and evaporate to a gentle heat until the volume is reduced one half. To every quart of this add from 10 to 15 drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained.

To Clean Engravings.—Put the engraving on a smooth board, cover it thinly with common salt finely pounded ; squeeze lemon-juice upon the salt so as to dissolve a considerable proportion of it ; elevate one end of the board, so that it may form an angle of about 45 or 50 degrees with the horizon. Pour on the engraving boiling water from a tea-kettle until the salt and lemon-juice be all washed off ; the engraving will then be perfectly clean, and free from stains. It must be dried on the board, or on smooth surface, gradually. If dried by the fire or the sun it will be tinged with a yellow color.

Black Walnut Stain for Pine.—Put pulverized asphaltum into a bowl with about twice its bulk of turpentine and set where it is warm, shaking from time to time until dissolved ; then strain and apply with either a cloth or a stiff brush. Try a little first, and if the stain be too dark, thin it with turpentine. If desirable to bring out the grain still more give a coat of boiled oil and turpentine. When the wood is thoroughly dry, polish with a mixture of two parts shellac varnish and one part boiled oil Apply by putting a few drops at a time on a cloth and rubbing briskly over the wood.

Gilding—Black and Gold Work.—The incised lines and ornaments receive several coats of size (boiled parchment cuttings) and whiting. They are allowed to dry, and touched up with a chisel or gouge, and then receive a coat of "oil gold size" ; and when that is tacky the gold leaf is dabbed on in small pieces with a large camel-hair pencil, wetted first to make the gold adhere. When the gold is dry, wipe off bits gently with cotton-wool ; hold the gold on a little "hod" with a screen around three sides of it to prevent the gold leaf blowing away.

Painting in Sepia on Wood.—Rub the wood carefully with fine emery or sand paper, and this will make the color spread evenly instead of with the grain. You cannot work with too much color on your brush ; the amount necessary must be tested by the way it spreads. If it runs too much, mix a little gum arabic with it. White wood is the best to use. The prepared sepia can be used with a pen. Use any good steel pen, or what is technically called a mapping pen.

ASTRONOMY: THE VASTNESS OF TIME.

THE EARTH FIVE HUNDRED MILLION YEARS OLD.

In the third of these lectures Professor Proctor showed the immensity of time, past and future, as revealed by astronomy. The first general topic considered was the age of the earth. From the different geological features of the earth's surface, it has been calculated 100,000,000 years have been consumed in the formation of its crust. Such is the estimate formed by Crowe and accepted by Sir Charles Lyell. Taking up the investigations of physicists on this subject, and from experiments by Bischaff, it is found that the time during which the earth was cooling from a temperature of 2,000° to 200°, some 350,000,000 years must have elapsed. And then prior to this again, there was a long period of time when the earth was in a nebulous condition ; so that a fair estimate of the world's age may be placed at 500,000,000 years. This is considered as erring rather to the side of deficiency than to that of excess. Notwithstanding this enormous lapse of time, the speaker spoke of the earth as being one of the most shortlived of the planets. Comparing it with Jupiter, on the principle that the larger a body is, so its period of cooling will be prolonged, it is calculated that it will be 3,500,000,000 years before the larger planet reaches the stage at which our earth is. Ten times as long must pass before the sun reaches a similar condition. As for the moon, it is but 420,000,000 years since she was in this relative period of her existence. The earth will, in 1,000,000,000 years, reach the same stage of planetary decripitude as is at present manifested by the moon.

The nebular hypothesis of Laplace was then explained. Originally all the system was star-drift and then a dense gaseous mass, which, assuming the shape of a huge disc, began to whirl about its centre. As the motion increased and the mass concentrated, a ring of matter was thrown off at the outer edge. This ring, in course of time, broke up into fragments. After a while these fragments aggregated into one body, and thus the outermost planet was formed. In the same way, the inner planets took their shape ; ultimately the great mass in the centre formed the sun around which the entire system revolved.

Similarly, in the revolutions of the as yet nebulous planets, their satellites were thrown off. The asteroids may be considered as fragments which, for some cause or other, never aggregated together ; perhaps they were thrown off and too widely separated to come together again. Laplace, however, seems to have overlooked one agency in the formation of the world, and that is the meteoric showers. Some 4,000,000 of these fall during each year, and about 10,000 tons of this material are annually accumulated by the earth ; but, in comparison to its bulk, this is but a trifling addition. In the past, it is probable that the meteoric showers were both greater and of more frequent occurrence. By the combination of the nebular hypothesis and the theory of meteoric aggregation, Professor Proctor thought that the earth's formation was accounted for. Thus, in the countless ages of time past, we and our surroundings are but particles of the same matter that then drifted through the enormous distances of the infinite space.

The ages of the planets was next taken up. Jupiter, Saturn, Uranus, and Neptune represent a later formation than do those planets nearer the sun. The two former planets, so similar in many respects, are hundreds of millions of years younger than the earth. The rings of Saturn, it is presumed, will, in time, break and become condensed into satellites. Jupiter is surrounded by great masses of clouds of a very light density, far within which the real planet is supposed to exist. Coming to the planets nearer by, the moon, with its deep chasms and its great mountains, was described. The dark plains, once supposed to be seas, are in reality the beds of former oceans now absorbed by the lunar crust. The intense blackness of the shadows cast by the moon are indicative of the absence of any atmosphere that it might possess

If any planet is of the same, or nearly the same, age as the earth, it is Venus. Mars is older. Mercury is a great deal older still, and the oldest of all her companion planets, the moon. He said that Venus has an atmosphere about as dense as the atmosphere of the earth, and must have a large water service ; Mars has about an equal area of land and water, and must have an atmosphere. The moon represents what the earth will be in the future. It has neither water, clouds, nor atmosphere. But, as the earth is eighty-one times larger than the moon, while it has thirteen times as much surface, it will require about 2,500,000,000 years for the earth to arrive at the present condition of the moon. Following out this theory, we greatly reduce the number of planets on which it is possible for life to exist. In our solar system we have only the earth, possibly Venus, and, it may be, some of the satellites.

THE VICTORIA REGIA SURPASSED.

If our Golden Gate Park Commissioners propose to sustain their eminence as introducers of the majestic in floriculture, they must lay their Victoria Regia aside and open correspondence with the authorities at Florence, Italy. For we read in a European exchange that Signor E. Beccari, an Italian, has recently discovered, in Sumatra, a plant which he names *Conophallus titanum*, the flowers of which completely obscure the blossom of the Victoria Regia. According to the published description of this plant, the swell of the spathe is 32½ inches in diameter, and the naked portion of the sphadix measures no less than 5½ feet. The color of the spathe is a brownish purple-red, and that of the sphadix a dirty yellow, as is generally the case with flowers which, like the *Conophallus* and the *Rafflesia*, attract by their peculiar odor, insects and animals feeding on carrion. The tuft of this plant, of which at first Beccari only succeeded in finding one specimen, was 3½ feet in circumference, and so heavy that two strong men could scarcely manage to carry it ; its single leaf had a stalk 10½ feet long, and 35 inches in circumference at its base. The leaf stem is smooth, green, and thickly covered with circular white spots. The three branches into which this stem divided at its upper end were as thick as a man's leg, and by repeated subdivisions form a spread over 9 feet long, supporting a leaf whose superficial surface exceeds 15 square yards. The stalk of the fruit is about the same thickness as the leaf stem, and in the example found by Beccari the fruit-bearing portion of it was 20 inches long by 30 inches in circumference, and thickly covered with olive-shaped fruit of a reddish color. Some seeds of this plant, which Beccari sent over to Italy, have been cultivated in the hot-houses of the Villa di Sesto at Florence, and the young plants springing from them are said to be growing fast.

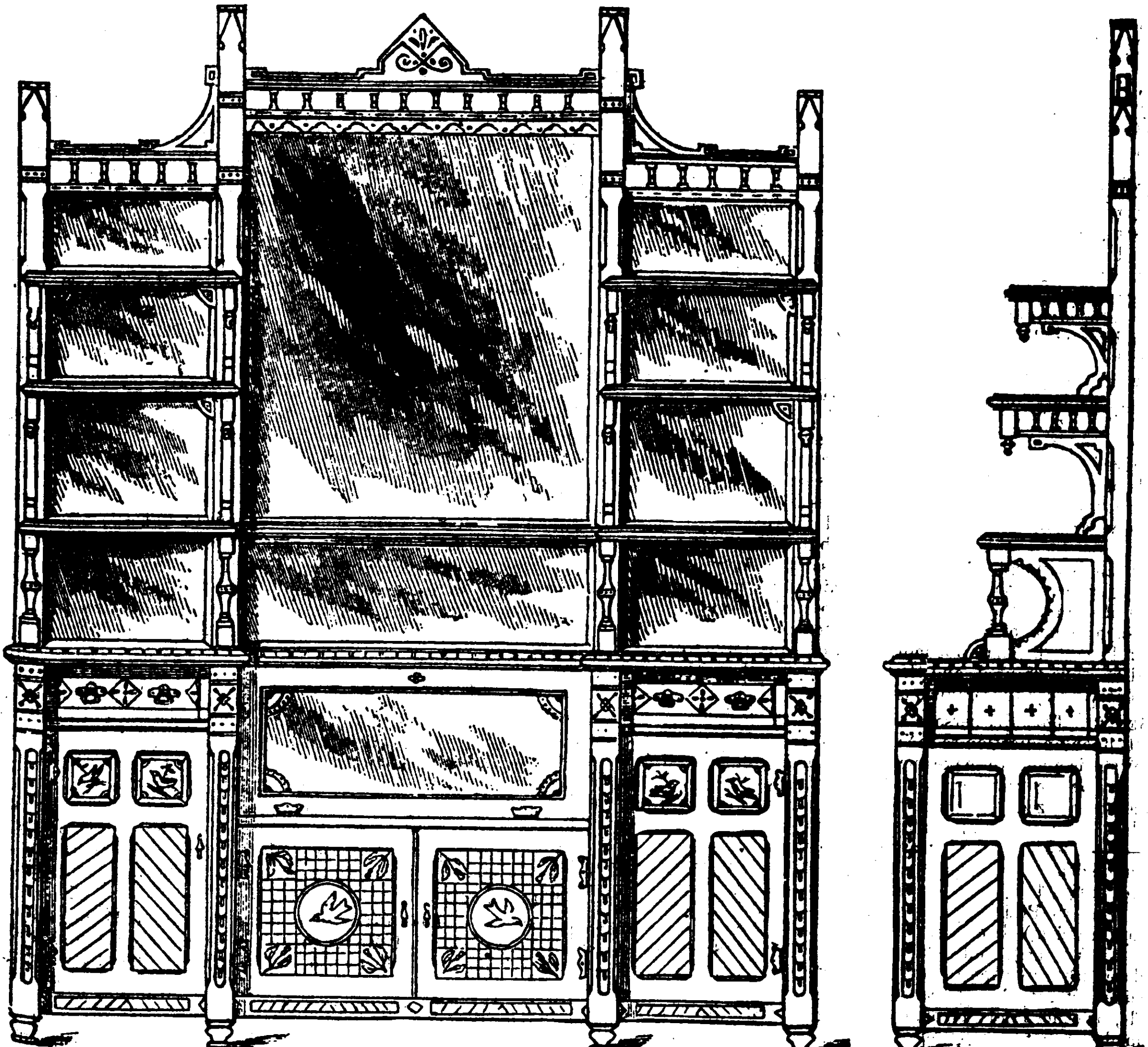
FROZEN MEAT FROM THE ANTIPODES.

Last November, a ship was laden in Australian ports with fresh meat for England, which it was expected would be kept from decay by a freezing process. Our last English mails bring accounts of the arrival of this ship at London and interesting details of the voyage and its results. It may be said in a word that the effort yielded success, and that meat slaughtered in Australia in November last was served on London tables, during the first week in February, in good, fresh, palatable condition. This certainly is one of the most notable events of the century.

The vessel chartered for this experiment by the Australian Government was a steamer, and her course lay through the Suez Canal and the Mediterranean. The work of shipping began on November 18th, at Sydney. The beef was taken in at a temperature of 70° Fah., and that on this day the maximum temperature in the meat chamber in the ship was 26° and the minimum 2° Fah. On November 29th, the ship left Sydney, the temperature of the sea-water being 69°, the maximum in the chamber 28°, and the minimum 16°. Four days were passed at Melbourne, where more sheep were taken in. Here the temperature of the sea-water was 61°, the maximum in the chamber on December 4th being 32°, and the minimum 6°. Leaving Melbourne on December 6th, the temperature of the sea-water rose on some days to 83°, while the highest point reached by the thermometer in the chamber was 26°, and the minimum 5°. At Aden, January 7th, the temperature of the sea-water was 78°, the maximum in the chamber 21°, the minimum 5°. At Suez, January 14th, the temperature of the sea was 62°, the maximum in the chamber 23°, and the minimum 3°. At Gravesend, February 1st, the temperature of the water was 40°, the maximum in the chamber 27° and the minimum 9° During the voyage, however, the machine was only worked for about five hours a day. No difficulty was experienced during the voyage through the Indian ocean and by the Suez route, though naturally some has been apprehended, 23 days being spent in the tropics.

Concerning the condition of the meat when it reached the London butchers' stalls, all reports which we have received agree. It was frozen solid, and when first taken to the stalls "sawed up like so much stone." In appearance it was excellent. It sold readily, and samples cooked for the purpose of satisfying experts and reporters were pronounced very good, in some respects equal to the freshly slaughtered beef and mutton of the English butchers.

This result was gained by a process of freezing induced by the compression and expansion of air by the aid of a steam engine and air pumps. The freezing processes by the use of chemicals are regarded unfavorably by ship-owners, because of the anticipated danger to the vessel and its general cargo; but the compressed air process is unobjectionable.



SIDEBOARD.

DESIGN AND WORK IN CABINET FURNITURE.

The present design is for a sideboard, after the present revival of the mediæval or early English style. It is intended to be made of oak, and every part of solid wood, veneering being entirely discarded. The article is 7 ft. long, 2 ft. deep, and 9 ft. high; the sideboard, without back, being 3 ft. 6 in. high. In construction, as will be seen, there are six posts or pillars, 3 in. sq., so disposed that two pedestals are formed, 2 ft. on face and 2 ft. on gable. The gables are pieces of panelled work let into the posts front and back. The two doors on the pedestals have the same arrangement of panelling as gables, the square panels at top being gilt and painted. Over these doors are drawers, 5 in. deep on the face.

The central portion, which is 3 ft. in width, has a shelf midway; the lower part having two doors. These give access to a plate chest within, which has an additional door which folds downwards, being hinged at the bottom. This plate chest is lined with green frieze cloth. Over the plate chest is a frame glazed with plate glass and hinged at the bottom, and having a lock which bolts into the top. This is a receptable for articles of silver or other goods the owner may wish to show, yet keep free from dust. The two pedestals are furnished with the usual drawers and trays.

The top of the sideboard is composed of one piece of wood, 1¼ in. thick; this is clamped underneath with ¾ in. wood, the clamp being molded into a quarter-round and the 1¼ in. top into a splay molding.

The back is simply a series of shelves and mirrors, all the mirrors being bevelled at the edges. The central mirror is 3 ft. 6 in. high and 3 ft. 3 in. broad. The pillars forming the framework of the back are 2½ in. square, and checked to receive the glass. The shelves are all 1 in. thick, and molded fronts and ends, with a splay on top, and a small cavetto underneath. The supporting brackets are all 1 in. thick, and the square pendants, with turned drops, 1½ in. thick.

The small balusters on top of the back are 2½ in. long and 1 in. thick, and these, together with those supporting the first shelf, are ebonized by being dipped in logwood and iron liquor. They are, after dry, put into the lathe, smoothed with flour paper, and polished.

As to the decoration, the lines on the panels and other parts are sunk channels and gilt. The decorated panels have their whole surface gilt, and the subjects afterwards painted by hand. The hinges and other mountings are of that sort called mediæval. It may be mentioned that all interior work in this sideboard, not exposed to view, is constructed of pine, as also the back to the mirrors, which is one entire piece of panelled work let into the outermost pillars. Following this sideboard will be shown a dining table, settee, and other articles of dining-room furniture. —*A. Cabe, in Design and Work.*

TIMBER CULTURE.

We have frequently, in past numbers, called attention to the advantages of encouraging the growth of timber in Canada, and to the necessity of a law being passed to limit the wilful destruction of our forests.

The following Act of Congress, approved June 14th, 1878, is well worth the notice of the Dominion Government:

AN ACT to amend an act, entitled "An Act to encourage the growth of timber on the Western Prairies."

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, That the act entitled "An Act to amend the act entitled "An Act to encourage the growth of timber on Western Prairies," approved March thirteenth, eighteen hundred and seventy-four, be and the same is hereby amended so as to read as follows: that any person who is the head of a family, or who has arrived at the age of twenty-one years, and is a citizen of the United States, or who shall have filed his declaration of intention to become such, as required by the naturalization laws of the United States, who shall plant, protect, and keep in a healthy, growing condition for eight years ten acres of timber, on any quarter section of any of the public lands of the United States, or five acres on any legal subdivision of eighty acres, or two and one-half acres on any legal subdivision of forty acres or less, shall be entitled to a patent for the whole of said quarter section, or such legal subdivision of eighty or forty acres, or fractional subdivision of less than forty acres, as the case may be, at the expiration of said eight years, on making proof of such fact by not less than two credible witnesses, and a full compliance of the further conditions as provided in section two: Provided. That not more than one quarter of any section shall be thus granted, and that no person shall make more than one entry under the provisions of this act.

SEC. 2. That the persons applying for the benefits of this act shall, upon application to the register of the land district in which he or she is about to make such entry, make affidavit, before the register, or the receiver, or the clerk of some court of record, or officer authorized to administer oaths in the district where the land is situated; which affidavit shall be as follows to wit: I.———, having filed my application, number———, for an entry under the provisions of an act entitled, "An Act to amend an act entitled 'An act to encourage the growth of timber on the Western Prairies," approved———, 187—, do solemnly swear (or affirm) that I am the head of a family (or over twenty-one pears of age), and a citizen of the United States (or have declared my intention to become such); that the section of land specified in my said application is composed exclusively of prairie lands, or other lands devoid of timber; that this filing and entry is made for the cultivation of timber, and for my own exclusive use and benefit; that I have made the said application in good faith, and not for the purpose of speculation, or directly or indirectly for the use or benefit of any other person or persons whomsoever; that I intend to hold and cultivate the land, and to fully comply with the provisions of this said act; and that I have not heretofore made an entry under this act, or the acts of which this is amendatory. And upon filing said affidavit with said register and said receiver and on payment of ten dollars if the tract applied for is more than eighty acres, and five dollars if it is eighty acres or less, he or she shall thereupon be permitted to enter the quantity of land specified; and the party making an entry of a quarter section under the provisions of this act shall be required to break or plow five acres covered thereby the first year, five acres the second year, and to cultivate to crop or otherwise the five acres broken or plowed the first year; the third year he or she shall cultivate to crop or otherwise the five acres broken the second year, and to plant in timber, seeds, or cuttings the five acres first broken or plowed, and to cultivate and put in crop or otherwise the remaining five acres, and the fourth year to plant in timber, seeds, or cuttings the remaining five acres. All entries of less quantity than one quarter section shall be plowed, planted, cultivated and planted to trees, tree-seeds or cuttings, in the same manner and in the same proportion as hereinbefore provided for a quarter section. Provided, however, that in case such trees, seeds, or cuttings, shall be destroyed by grass-hoppers, or by extreme and unusual drouth, for any year or term of years, the time for planting such trees shall be extended one year for every such year that they are so destroyed: Provided further. That the person making such entry shall, before he or she shall be entitled to such extension of time, file with the register and the receiver of the proper land office an affidavit, corroborated by two witnesses, setting forth the destruction of such trees, and that in consequence of such destruction he or she is compelled to ask an extension of time, in accordance with the provisions of this act: And provided further. That no final certificate shall be given, or patent issued, for the land so entered until the expiration of eight years from the date of such entry: entry; and if, at the expiration of such time, or at any time within five years thereafter, the person making such entry, or, if he or she be dead, his or her heirs or legal representative, shall prove by two credible witnesses that he or she or they have planted, and, for not less than eight years, have cultivated and protected such quantity and character of trees as aforesaid; that not less than twenty-seven hundred trees were planted on each acre, and that at the time of making such proof that there shall be then growing at least six hundred and seventy-five living and thrifty trees to each acre, they shall receive a patent for such tract of land.

SEC. 3. That if at any time after the filing of said affidavit, and prior to the issuing of the patent for said land the claimant shall fail to comply with any of the requirments of this act, then and in that event such land shall be subject to entry under the homestead laws, or by some other person under the provisions of this act: Provided. That the party making claim to said land, either as a homestead settler, or under this act, shall give at the time of filing his application, such notice to the original claimant as shall be prescribed by the rules established by the Commissioner of the General land office; and the rights of the party shall be determined as in other contested cases.

SEC. 4. That no land acquired under the provisions of this act shall, in any event, become liable to the satisfaction of any debt or debts contracted prior to the issuing of the final certificate therefor.

SEC. 5. That the commissioner of the General Land office is hereby required to prepare and issue such rules and regulations, consistent with this act, as shall be necessary and proper to carry its provisions into effect; and that the registers and receivers of the several land offices shall each be entitled to receive two dollars at the time of entry, and the like sum when the claim is finally established and the final certificate issued.

SEC. 6. That the fifth section of the act entitled "An Act in addition to an act to punish crimes against the United States, and for other purposes," approved March third, eighteen hundred and fifty-seven, shall extend to all oaths, affirmations and affidavits required or authorized by this act.

SEC. 7. That parties who have already made entries under the acts approved March third, eighteen hundred and seventy-three, and March thirteenth, eighteen hundred and seventy four, of which this is amendatory, shall be permitted to complete the same upon full compliance with the provisions of this act; that is, they shall, at the time of making their final proof, have had under cultivation, as required by this act, an amount of timber sufficient to make the number of acres required by this act.

SEC. 8. All acts and parts of acts in conflict with this act are hereby repealed.

Approved June 14, 1879.

FLOATING ISLAND.

Among the many natural curiosities of Tuolumne county it is not generally known that there is a "floating island." Up in the "Siskiyous," lying like a pearl in the great mountain chain, is Squaw lake, a beautiful sheet of water, now utilized by a mining company as a reservoir. For many years the lake has been a favorite and delighful resort for fishing parties, and contained nearly in its centre an island, comprising about an acre of ground, covered with luxuriant grass and a growth of willow and alder. It was never dreamed that the pretty little island was not terra firma, but when the bulkhead across the outlet of the lake dammed up its waters, the island rose slowly until it had been elevated fully 16 feet above its original level. It would be a question for the naturalist rather than the geologist to determine the age of this floating island, as it is evidently made up entirely of decayed vegetation. Perhaps at some remote period the roots of a tree, uptorn by the mountain storm, drifting out in the lake, formed the nucleus from which the island has grown, but it seems singular that it should have remained anchored and unchangeable in its position. The locality is much frequented by pleasure seekers who will hereafter notice the increased elevation.—*Jacksonville Sentinel.*

POPULAR CONFIDENCE IN SCIENTIFIC DISCOVERY.

The popular public mind in its attitude towards scientific progress and discovery has undergone a wonderful change in the last five or ten years. The great facts in science brought to view by the labors of investigators, so long as they had no special practical bearing upon the affairs of every-day life, were regarded with little interest, and made no deep impression upon the mind or belief of the general reader. Statements were made in the newspaper regarding this and that new facts brought to light in some department of science or art, but the news was seldom thought of or talked about in the homes of the people in the country or city.

Important and wonderful discoveries, like the spectrum analysis of new chemical elements, or new asteroids, have interested men within the circle of those engaged in research, but outside few have taken the trouble even to inquire as to the importance or significance of the new acquisitions to human knowledge. A class of discoveries, however, which seemed to involve religious beliefs or theological dogmas quickly attracted popular attention, and brought about a fierce war of words. Mr. Darwin, when he published the results of his studies and discoveries upon the origin of species became at once a marked man and an object of popular attack. He might have been the discoverer of fifty new stars, and his name would hardly have been known beyond the circle of his associates and scientific investigators generally. His views, now almost universally admitted and adopted in the world of science, continue to be derided and combatted by theologians and laymen, and in some instances with considerable sharpness and ability. The popular confidence, so far as it is influenced by such writers, does not rest with Mr. Darwin. The stupendous problems involved in astronomical science, and upon which it rests, puzzle and bewilder the popular mind, and but a kind of half assent is given to them. When the astronomer states in a public assembly that the sun is distant 92,000,000 miles, a majority are tempted to inquire, "How do you know that?" or when he states further, that the orb is enveloped in a vast covering of incandescent hydrogen and other forms of matter, the unspoken reply is, "it may be so." We hesitate not to say that if astronomers and mathematicians had not been able to foretell eclipses, occulation of stars, approach of comets, etc., the great facts and principles of astronomy would have occupied in the popular mind a place scarcely higher than the astrology of the ancients.

The former state of indifference and doubt has now been broken, and the pendulum swings far the other way. The popular mind is ready to believe devoutly almost anything which men of research offer for consideration. The impossible, which once was observed in every direction, now has faded from view, and science seems to work miracles as did the apostles of old. The full establishment of the telegraph in all parts of the world immensely increased the popular respect for science; but when to this are added the telephone, microphone, audiphone, phonograph, electric lighting and the numerous other recent triumphs of science and art, the possibilities of scientific accomplishment have no longer a limit. There is a danger that this extreme development of faith may lead uninformed persons into errors through misapprehension, or extravagant claims of inventors and experimenters. Owners of gas stocks and other kinds of property supposed to be influenced by new discoveries should be cautious about sacrificing their securities in consequence of what is published in the newspapers. There are still many fallacies in the world claimed to be the outgrowths of science, and a wise discrimination and reserve should be maintained in all actions based upon what is claimed as new in science and art.—*Boston Journal of Chemistry.*

NOVEL MODE OF PRESERVING A MAN'S REASON.

A curious story is going the rounds of the English newspapers of an exhibition in the show windows of one of the leading jewelers of Vienna. The object of attraction is a brooch magnificently studded with gems, in the middle of whose chasing is enclosed the most singular of centres—four common, old, bent and corroded pins. This brooch is the property of the Countess Lavetskofy. The pins have a history of course. Seven years ago Count Robert Lavetskofy, as the story runs, was arrested at Warsaw for an alleged insult to the Russian Government. The real author of the insult, which consisted of some careless words spoken at a social gathering was his wife. He accepted the accusation, however, and was sent to prison.

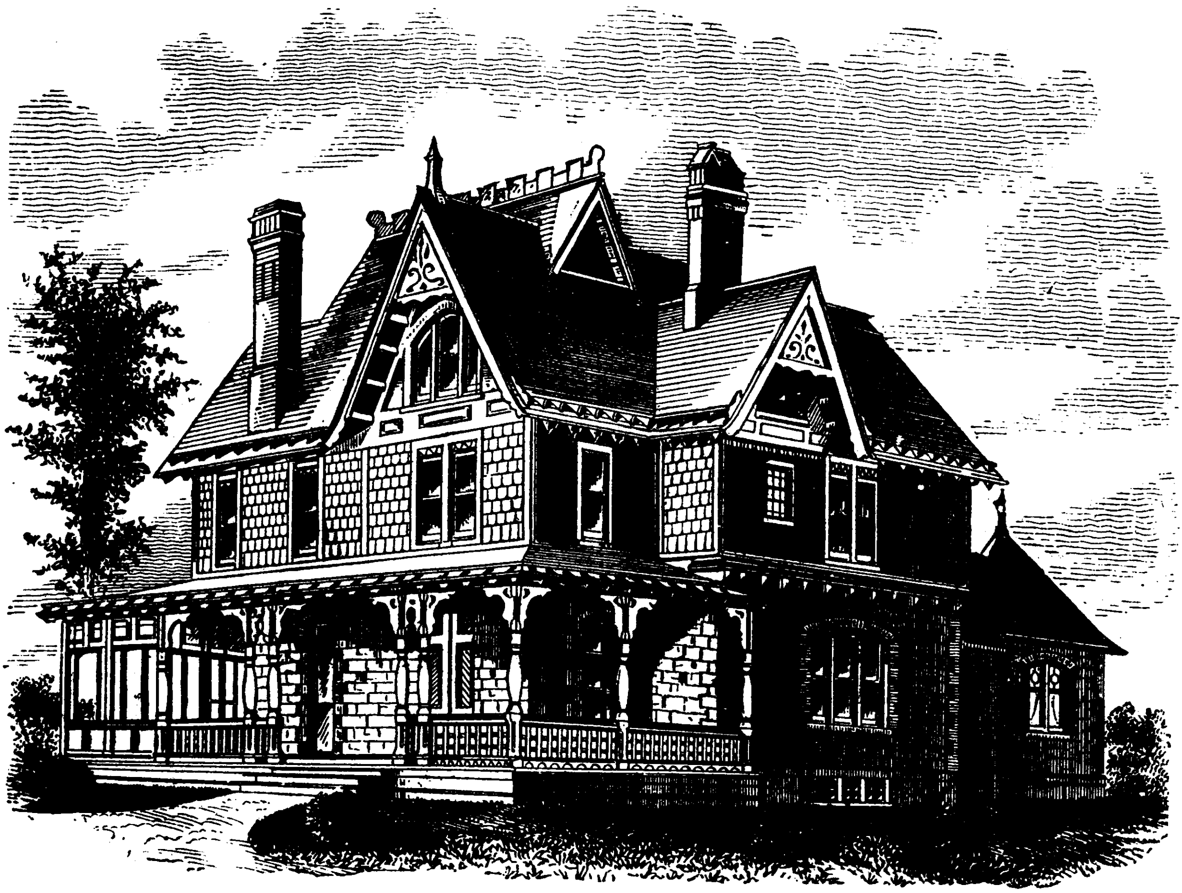
In one of these lightless dungeons in which the Czar is said to be fond of confining his Polish subjects, the unfortunate martyr for his wife's loose tongue spent six years. He had only one amusement. After he had been searched and thrown into a cell, he had found in his coat four pins. These he pulled out and threw on the floor; then in the darkness he hunted for them. Having found them, perhaps after hours and even days, he scattered them again. And so the game went on for six weary years. "But for them," he writes in his memoirs, "I would have gone mad. They provided me with a purpose. So long as I had them to search for, I had something to do. When the decree for my liberation as an exile was brought to me, the jailer found me on my knees hunting for one which had escaped me for two days. They saved my wife's husband from lunacy. My wife therefore, could not desire a prouder ornament."

ABOUT LEAP YEAR.

Leap Year, or Bissextile, is defined in the dictionary as "every fourth year, and so called from its leaping a day more that year than in a common year; so that a common year has 365 days, but a leap year 366; and then February has 29 days, which in common years has but 28." A popular and ready way of finding leap year, is to divide the year of our Lord by four. The year 1880 is a leap year; but is every year that can be divided by four a leap year? A year is exactly 365 days, 5 hours, 48 minutes, 49 seconds, and 7-10th of a second. Julius Cæsar, about 45 years before Christ. fixed the astronomical year at 365¼ days exactly. To fit the civil reckoning with the astronomical, a day in February, the sixth before the calends (the first day of every month among the Romans) of March (Sextilis), was to be repeated in that fourth year; and each fourth year was thus to be Bissextile; hence the name of Bissextile given to leap year or years of 366 days. It was as if the 23rd of February were reckoned twice over. But this was too much by 11 minutes, 10 seconds, and 3-10ths of a second. Pope Gregory found in 1582 that from the Council of Nice in 325 there had been an over-reckoning of ten days. To correct this error, he decreed that the 5th of October that year should be the 15th October; and there being still an overplus of 18 hours, 37 minutes, and 10 seconds in a century, to keep correct with the stars for all time to come, he ordered that every centurial year that could not be divided by four (1700, 1800, 1900, 2200, etc.) should not be Bissextile or leap year, as it otherwise would have been. The years 2000, 2400 etc., would still be leap years. It was not until 1752 that the Gregorian calender was adopted in England, and is not adopted in Russia even yet. An Act of Parliament was passed in that year, enacting that the third of September should be reckoned the 14th and that three of every four of the centurial years should, as in Pope Gregory's arrangement, not be leap years. The year 1751, like the years preceding, had commenced in England on the 25th of March; the A. D., therefore, ought to have changed on the 25th of March following. But it was changed earlier, in order to be in accordance with continental nations. The English year 1751 was never completed; from the 1st of January, 1751, they called it 1752. The year 1751, therefore, lost the whole of its months of January and February, and the twenty-four first days of March. Lord Chesterfield, who had proposed the measure in the House of Lords, was very near falling a victim to the anger of the mob. They followed him about, shouting, "Give us our three months back again!"

THE COMING WAR SHIP.—Prof. Lœwenthal, a German, thinks that the coming war ship will be made of India rubber. His idea is to make the entire hull of rubber one foot in thickness, strengthened below the water line by a light steel frame. The vessel will be driven by an ordinary steam engine, and will have no masts. At the bow will be a projecting spar, to which torpedoes will be affixed, and the entire crew, including the helmsman, will be on the lower deck out of the range of shot. When a cannon ball strikes the India-rubber ship, it will pass directly through it above the heads of the crew, and the hole made by it will instantly close. Paying no attention to such futile attacks, the India-rubber vessel will steam towards her adversary and explode her torpedo. The doomed vessel will instantly sink, while her elastic destroyer will be driven hundreds of yards backwards by the recoil following the explosion. Such a vessel, says the inventor, could destroy all the navies of the world, and after her work was done she could be made as strong as ever with the aid of two or three bottles of cement.

POLISHING TEAKWOOD FRAME.—To polish a teakwood frame, you must first wash it with a solution of common washing soda; let that dry, give it a second coat, then polish simply with boiled linseed oil.

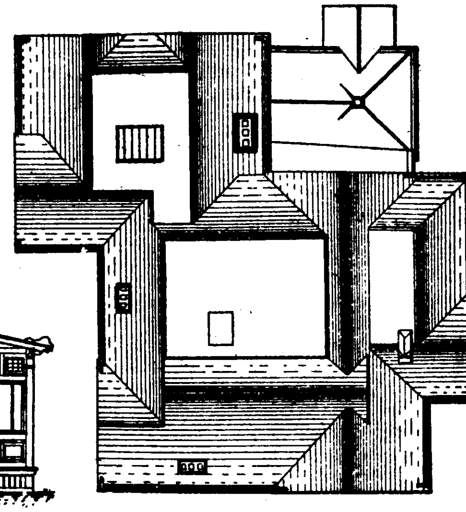


STONE AND FRAME COUNTRY VILLA.

Side Elevation, A.

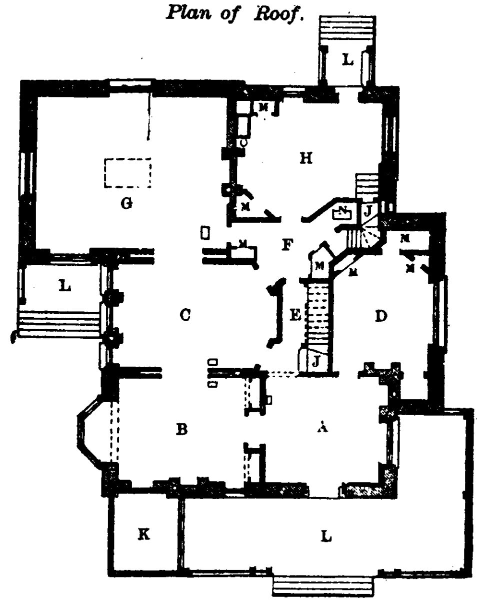
AN AMERICAN DESIGN FOR A STONE AND FRAME COUNTRY VILLA.—(From *Carpentry and Building.*)

Side Elevation, B.



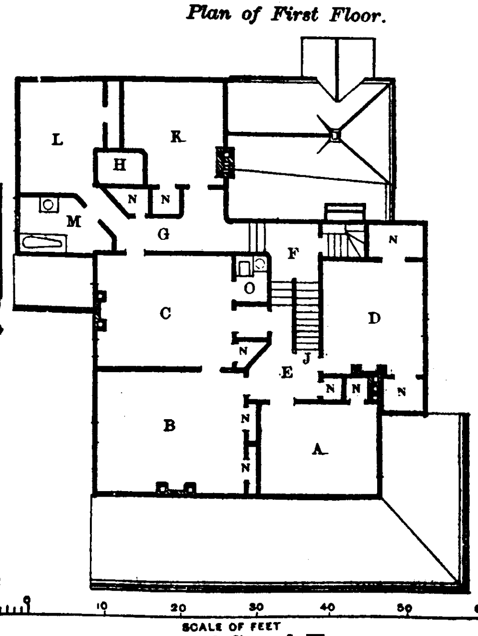
Plan of Roof.

Front Elevation.



Plan of First Floor.

Rear Elevation.



Plan of Second Floor.

Scientific.

INSTINCT THE RESULT OF INHERITED ACTIONS UNCONSCIOUSLY PERFORMED.

Most naturalists, writes Mr. Charles Darwin in *Nature*, appear to believe that every instinct was at first consciously performed; but this seems to me an erroneous conclusion in many cases, though true in others. Birds, when variously excited, assume strange attitudes and ruffle their feathers; and if the erection of the feathers in some particular manner were advantageous to a male while courting the female, there does not seem to be any improbability in the offspring which inherited this action being favoured, and we know that odd tricks and new gestures performed unconsciously are often inherited by man. We may take a different case, (which I believe has been already advanced by some one), that of young ground birds which squat and hide themselves when in danger, immediately after emerging from the egg; and here it seems hardly possible that the habit could have been consciously acquired just after birth without any experience. But if those young birds which remain motionless when frightened were oftener preserved from beasts of prey than those which tried to escape, the habit of squatting might have been acquired without any consciousness on the part of the young birds.

This reasoning applies with special force to some young wading and water birds, the old of which do not conceal themselves when in danger. Again, a hen partridge, when there is danger, flies a short distance from her young ones and leaves them closely squatted; she then flutters along the ground as if crippled, in the wonderful manner which is familiar to almost every one; but, differently from a really wounded bird, she makes herself conspicuous. Now, it is more than doubtful whether any bird ever existed with sufficient intellect to think that if she imitated the actions of an injured bird, she would draw away a dog or other enemy from her young ones; for this pre-supposes that she had observed such actions in an injured comrade and knew that they would tempt an enemy to pursuit.

Many naturalists now admit that, for instance, the hinge of a shell has been formed by the preservation and inheritance of successive useful variations, the individuals with a somewhat better constructed shell being preserved in greater numbers than those with a less well constructed one; and why should not beneficial variations in the inherited actions be preserved in like manner, without any thought or conscious intention on her part any more than on the part of the mollusk, the hinge of the shell of which has been modified and improved independently of consciousness.

TRANSMITTING COLOURS BY TELEGRAPH.

Dr. H. E, Licks, of Old South Bethlehem, Pa., after three years' labor, claims that he has perfected an instrument by which forms and colours can be sent by wire the same as words are sent. He calls the instrument a diaphote. The word diaphote, from the Greek, *dia* signifying through and *photos* signifying light has been selected as its name, implying that the light travelled through or along a wire. He read a paper on his invention before a scientific society.

The diaphote consists of four essential parts, the receiving mirror, the transmitting wires, a common galvanic battery and the reproducing speculum. The Doctor gave a detailed account of the many experiments undertaken to determine the proper composition and arrangement of the mirror and speculum. In the diaphote exhibited, the mirror was 6 inches by 4, and had 72 fine wires, which were gathered together in one about a foot back of the frame, the whole being finely wrapped with an insulated covering, and on reaching the receiving speculum each little wire was connected to a division similarly placed as in the mirror. From a common galvanic battery wires also ran to each diaphotic plate, and thus a circuit was formed which could be closed or not at pleasure. The theoretical action of the instrument appears now to be the following: The waves of light from an object are conducted through the ordinary camera, so that they fall on certain of the divisions of the mirror when the electric circuit is closed. The light and accompanying heat produce momentary chemical changes in the amalgam of the mirror—which consists of a peculiar compound of selenium and, chromium. These changes modify the electric current and cause similar changes in the corresponding partitions of the remote speculum, thus reproducing a similar image, which, by a second camera, may be readily seen by the eyes or thrown upon a screen. Dr. Licks explained how the proportion of selenium in the mirro and speculum should be scientifically adjusted to the size of the divisions and the resistance of the electric circuit, so as to avoid blending of the portions of the reproduced image. This he said, had been the problem which had caused him the most difficulty, and which at one time had seemed almost insurmountable.

At the close of the paper an illustration was given of the powers of the instrument. The mirror of the diaphote, in charge of a committee of three, was taken to a room in the lower part of the building and the connecting wires laid through the halls and stairways to the speculum on the lecturer's platform. Before the mirror the committee held, in succession, various objects, illuminuting each by the light of a burning magnesium wire, and simultaneously on the speculum appeared the secondary images, which for exhibition to the audience were thrown on a screen considerably magnified. An apple, a penknife and a trade dollar were the first objects shown; on the latter the outlines of the Goddess of Liberty were recognized, and the date of 1878 was plainly legible. A watch was held five minutes before the mirror, and the audience could plainly perceive the motion of the minute hand on the screen, but the movement of the second hand was not satisfactorily seen, although Prof. Kannich, by looking into the camera, thought that it was there quite perceptible. An ink bottle, a flower and part of a theatre handbill were also shown, and when the head of a little kitten appeared on the screen, the club testified its satisfaction by a most hearty applause. After the close of the experiments the scientists extended their congratulations to Dr. Licks, and the President made a few remarks on the probable scientific and industrial applications of the diaphote in the future. With the telephone and the diaphote it may yet be possible for friends separated by the wide Atlantic, to hear and see each other at the same time; to talk, as it were, face to face.

EDISON'S LATEST.—The *Herald* is authority for the statement that Mr. Edison has found time in the intervals of his work on the electric light to make a remarkable discovery in another field. The industry which Mr. Edison proposes this time to revolutionize is the metallurgy of the precious metals. The *Herald* informs us that Mr, Edison has discovered a method by which "he can extract a greater amount of gold from the rejected residuum or tailings of auriferous quartz or sand than is obtained by the present processes from the virgin rocks." To state it differently, Mr. Edison proposes, according to this account, after the ore has been treated by the usual processes of milling and amalgamating, and has yielded up from 75 to 90 per cent. of its gold, according to the care with which it has been worked to take the refuse and extract from it at merely nominal cost—anywhere from $50 to $1,400 per ton. Mr. Edison may possibly have discovered the philosopher's stone by which to transmute baser substances into gold; but on any other supposition, the statements made by the *Herald* reporter are too ridiculously extravagant to merit serious consideration. It is by permitting omnivorous newspaper men to scatter such statements as the above broadcast without denial as emanating from him, that Mr. Edison is, to say the least, not adding to his reputation.——Dr. C. Siemens has reached some curious conclusions respecting the influence of the *electric light on vegetation*. He finds that the growth of plants is considerably promoted when they are continuously exposed to the alternate action of sunlight and the electric light. This, he holds, proves that plants do not require rest, that their growth can be materially hastened by giving them the benefit of the electric light at night, and that the electric light will produce chlorophyll in the leaves of plants, and promote their growth. In lecturing on this subject, Dr. Siemens illustrated his subject by placing some budding tulips in a strong electric light, which, in about 40 minutes, caused the buds to open out in full bloom.

CONCERNING carbon bisulphide, which has, for some time past, been gradually attaining to a state of importance in the useful arts, Prof. Mallet gave some interesting facts in his review recently, of the industrial applications of chemistry, published in the *American Chemical Journal*. After noticing that, in the ordinary practice of manufacture, a large quantity of free sulphur is covered over with the sulphide, which requires to be separated by means of subsequent refining, and recommending, to avoid this, the passage of the mixed vapors through a second and even a third retort containing glowing carbon, he gives a number of interesting facts respecting its industrial uses. At first, this compound was used in the arts almost solely by the manufacturers of rubber; but it has lately acquired considerably increased importance, as furnishing the means of dissolving out fats and oils from various materials which could not be treated with equal advantage in any other way. Thus, for example, from oil-seed cakes, from the marc of olive-oil pressing, from woollen rags and waste, from cotton waste used in wiping machinery and packing stuffing-boxes and the like, and from bones from which gelatine and phosphates are afterward to be made, large quantities are extracted. It has also come to be used to some extent in the manufacture of the sulpho-carbonates used for the destruction of the phylloxera.

THE OBSERVATION of the circulation of the blood in living creatures has always been regarded as the most interesting and instructive sight that the microscope could afford. The delicate membrance of the foot of the frog has hitherto afforded the microscopist the most convenient subject for this beautiful demonstration of Harvey's discovery. Perkinje's experiment, by which an observer is enabled to observe the circulation in his retinal blood-vessels, has hitherto been the only method known of actually showing the circulation of the blood in the human subject. Dr. Huber, of Greifswald, it may interest our readers to know, has lately described a simple experiment by which it is possible for an observer to see the circulation of the blood in the blood-vessels of another person. Dr. Huber fixes the head of the subject to be examined in a frame not unlike that used by photographers, on which is fixed a holder for the microscope and lamp. He then draws down the lower lip of the subject upon the stage of the instrument with its delicate inner surface upward for inspection, throws a strong light on the same with a condenser, and focuses the microscope, provided with a low-objective, down upon the delicate network of blood vessels, which can be seen there even with the naked eye. By this simple means the circulation can be observed with the greatest ease and perfection. the value of this novel and beautiful experiment in the study of the abnormal conditions of the blood, presented in various diseases, it is anticipated, will be very great, and important results are expected to flow from it. Huber distinguishes his new process by the terrible name of "cheiloangioscopy."

CRUDE PETROLEUM AS A REMEDY IN CONSUMPTION.—Dr. M. M. Griffith, of Bradford, Pa., reports some astonishing results obtained by the administration of crude petroleum to consumptives. He claims that out of twenty-five cases of well marked tuberculosis so treated twenty are to all means of diagnosis cured; the rest have been materially benefited and none have been under treatment more than four months. The nausea attending the use of ordinary crude petroleum led him to adopt the semi-solid oil that forms on the casing and tubing of wells. This, made into three to five grain pills by incorporating any inert vegetable powder, was administered from three to five times a day in one pill doses. This first effect, he says is the disappearance of the cough ; night sweats are relieved, appetite improves, and weight is rapidly gained. It is to be hoped that Dr. Griffith has not mistaken some self-limiting phase of throat or bronchial disorder for true consumption of the lungs ; also that continued trial of the alleged remedy will justify the high opinion he has formed in regard to its efficacy.

A CURIOUS ACOUSTICAL ILLUSION.—M. Plumaudon, of the Puy de Dome observatory, has pointed out a curious acoustical illusion which some of those who use a pair of telephones in receiving may have observed. With a single telephone held, say, to the right ear, the transmitted voice appears to come from a distance to the right ; while with a telephone held to the left ear, it seems to arise from the left of the listener. With a telephone to each ear, if one ear be less sensitive than the other, or if the telephone be held farthest from that ear, the voice shifts to the side of the other ear ; and if both ears hear alike and both instruments are equally near their respective ears, the voice apparently proceeds from in front of the observer.

ELECTROTYPING WITH IRON.—Herr Bottger describes a process for steeling copper plates by electrolysis. One hundred parts of ferrous-ammonia sulphate, together with 50 parts of sal-ammoniac, are dissolved in 500 parts of pure water, a few drops of sulphuric acid being added to acidulate the solution. The copper plate is connected to the negative pole of a battery of two or three Bunsen elements, an iron plate of equal size being employed as an anode. The solution is maintained at from 60° to 80°. The deposit of iron is of a hard, steel-like quality, and is very rapidly formed.

A DRY coating for basement walls may be made as follows : Take 50 pounds of pitch, 30 pounds of resin, 6 pounds of English red, and 12 pounds of brickdust. Boil these ingredients, mix them, and stir them thoroughly, then add about one-fourth the volume of oil of turpentine, or enough to make it flow easily, so that a thin coating may be laid on with a whitewash or paint brush. Walls thus coated are proof against dampness.

THE NEW METEORITE

The *Scientific American* in its issue of March 6, gave a brief account of a new meteorite, discovered near Chulafinne, Ala., by Mr. John F. Watson, and now in the posression of Mr. Edison's expert mineralogist, Mr. W. E. Hidden, of Newark, N. J.

We now copy for our readers a side view of this interesting object, and give a representation of the Widmannstaettian figures which it exhibits. Upon analysis of the meteorite, its constituents are found to be approximately as follows : Iron, 82 per cent. ; nickel, 7 per cent. ; phosphorus about the same as ordinary steel ; and of copper and carbon only a trace. It is about as hard as copper, and exhibits about the same tenacity under the cutting tool.

This in common with other metallic accrolites is very heterogeneous, as indicated by the marked figures developed on the polished facet by the action of ultric acid. Mr. Edison suggests that "These lines are without doubt a map of the streets of the New Jerusalem.

Meteorites of this size (31 lb.) are not extremely rare, and they have been found of all sizas, weighing from a few ounces to 25 tons. It is now generally conceded that these strange bodies fill the places between the orbits of the planets and swing around the sun like so many miniature worlds, until by unexplained causes they are brought within the attractive influence of the larger planets, when they gravitate toward the superior body.

Kepler's idea that there were more small bodies flying about in space than there are fishes in the ocean, seems to find support in modern discoveries.

HYDROGEN AS A CONDUCTOR OF HEAT.

A very interesting experiment is described as follows : "A very simple method of showing that hydrogen is a better conductor of heat than other gases, which is probably due to its metallic character, is described by Carl von Than. Two strong copper wires, several inches long, are held parallel to each other, but not in contact, by slipping over them two short pieces of glass tube, one an inch from the end, the other in the middle, and filling the tubes with plaster of Paris. The short ends of the wire are bent twice at right angles, so as to be an inch apart at the ends, and are connected by a very fine platinum wire. The wires are kept in a vertical position by clamping the second tube to a retort-holder or other support. The longer ends of the wires are bent apart and attached to the poles of a battery of three or four cells. The wires being insulated from each other, the current passes through the fine platinum wire, heating it red-hot. If a bell-jar of hydrogen be held over it, thewire ceases to glow, because heat is conducted so rapidly away. On bringing it into the air it begins to glow."

In connection with this we remark, that experiments showing that a platinum wire made red-hot in the air by an electric current, will cool down when placed in an atmosphere of hydrogen, is a very old one ; second, that the method above described to make the experiment is objectionable, for the reason that when a bell-jar of hydrogen is brought over the wire, the latter comes first in contact with the mixture of air and hydrogen, always present at the lower edge of an open bell-jar filled with hydrogen, forming an explosive mixture which the red-hot platinum wire may ignite, and soon burns up the hydrogen in the jar, bringing the experiment to a premature end.

A better way and one that we always used when making this experiment before our classes in physics (some 20 years ago), was to take a wide glass tube, open at both ends, in which were inserted corks, each perforated with two holes, one for the conducting copper wire and one for a short glass tube, for the inlet and outlet of gases ; the conducting copper wires were connected interiorly by a spiral of platinum wire, and one of the glass tubes exteriorly attached to a rubber hose, for the supply of gas. When the platinum spiral is made red-hot by the electric current, and hydrogen is introduced through the tube, the red-hot wire may ignite the mixture of hydrogen and air and blow out the corks, therefore we always first introduced carbon-dioxid (carbonic acid gas, so as to displace the air with its oxygen ; when the tube was filled with this gas and the spiral in full glow, the hydrogen was let in, the heat diminished, and the spiral lost its glowing appearance. By the re-admission of the carbon-dioxid it became glowing again.

The experiment may be varied and made more striking by passing through one of the corks two glass tubes, one for hydrogen and one for carbon-dioxid, when the platinum spiral may be made hot and cold in succession by admitting carbonic acid or hydrogen gas alternatively.—*Manufacturer and Builder*

Fig. 1.—Bird-houses made from Old Cans.

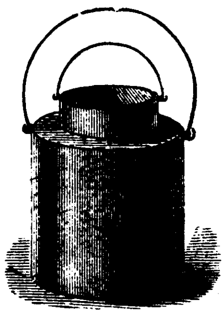


Fig. 2.—Glue Pot.

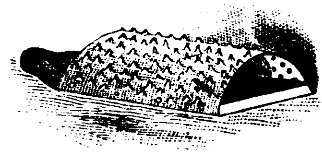


Fig. 3.—Bread Grater.

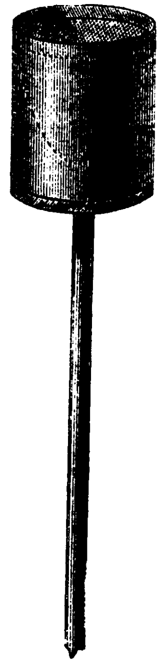


Fig 4.—Fruit Gatherer.

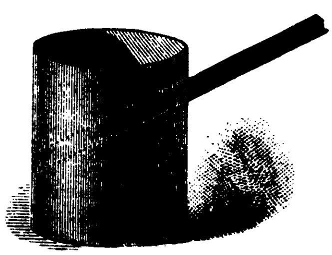


Fig. 5.—Bailer.

Fig. 6.—Flower-pot.

Fig. 8.--Hanging Log.

Fig. 7.—Hanging Flower-pot.

NEW USE FOR OLD TIN CANS.—*(See page 158.)*

Fig. 11.—Rockery.

Fig. 10.—Plant Standard, filled.

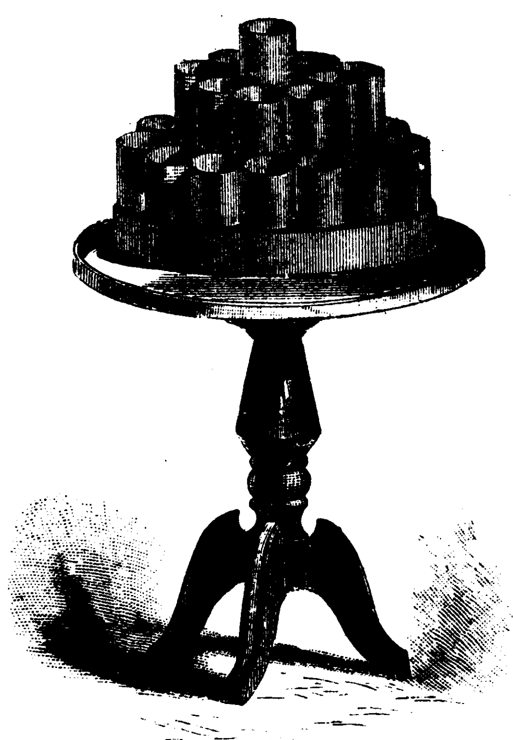


Fig. 9.—Plant Standard, empty.

Fig. 12.—Vase.

NEW USE FOR OLD TIN CANS.—*(See page 158.)*

NEW USES FOR OLD TIN CANS.

BY A. W. ROBERTS.

I give below the result of an extended experience in the utilization of tin cans, such as are used by the million by packers of fruits and other articles. These cans, after serving their original purpose, are usually thrown into obscure corners, battered and rusty, a nuisance to every one.

By the method given below these troublesome articles are made useful and even ornamental, such articles as flower-pots, hanging baskets, bird-houses, etc., being produced from them with little trouble or expense.

The cans were prepared in the following manner: Procuring a large dishpan, as much asphalt was melted in it as it would hold with safety. Into the boiling asphalt the cans were dipped; as each can was taken out it was rolled in dry sand, to give it a natural ground color; without the sand the effect of the black asphalt coating would be sombre and out of keeping with the color of the surroundings. To give some of these bird-houses a still more picturesque effect they were rolled in the ordinary dry packing moss used by florists and wood mosses; also short dry twigs, small cones, and burrs were fastened on the cans. In this way very nice effects of color were produced. It is a well known fact that birds avoid brilliant or artificial colors; for this reason greens, grays, browns, and neutral tints are best for bird-houses. Where cans had been opened so that the top piece was still attached by a small piece of metal, it was bent down so as to form a rest for the birds when feeding their young, or a porch or rain screen over the entrance. All these little points when carried out gave character, variety of form, and completeness. The different ways of fastening and suspending the bird-houses are shown in Fig. 1. I sometimes fastened branches of vines over the bird-houses to more thoroughly obscure them.

A glue-pot, a grater, a fruit gatherer, and a bailer, shown respectively in Figs. 2, 3, 4, and 5. The glue-pot, Fig. 2, was made in the following manner: Selecting an empty two pound can, enough tin was cut away to admit of an empty one pound can. This inner can projected one inch above the top of the one pound can, and was held in position by four wooden pegs, which were slightly tapering, so as to bind. Holes were made in the shoulders of the cans, through which wire bails were fastened.

Fig. 3, a bread grater, is so simple that it hardly needs describing. Out of a piece of one inch board a holder was shaped on which a perforated piece of tin was fastened. This piece of tin consists of a side of a fruit can flattened out. Tines were then drawn diagonally over it for guides when punching in the holes. The tin was laid on a piece of wood, in which a hole had been made of the exact depth required for the uniform projection of the burred cutters of the grater. The tin was then nailed to one side of the holder and bent over in as perfect a curve as possible to the other side, when it was again fastened.

Fig. 4, a peach gatherer, was made by attaching a circular piece of board to the end of a long pole and fastening to this a can. Inside of the can there was a bag to receive the fruit without bruising. The bag was sewn inside of the can through a circle of small perforations. The rim of the tin was sharpened, so that when pressed against the stem of the fruit it would cut through it.

Fig. 5 shows a liquid measure or a water bailer. A hole is made in a can two inches below the edge; through this hole a handle is inserted which presses against the opposite side and is secured with a nail or screw.

Fig. 6 represents a fruit can converted into a respectable looking flower pot. The can to be operated on was first dipped in the hot asphalt. A piece of well-seasoned white birch bark was cut out of the same height as the can and sufficiently long to reach around it. This piece of bark was so shaped that it flared out from the bottom of the can, leaving considerable space between the can and the bark. This space was filled in with hot asphalt. For ornamentation of the pots burrs of the liquid amber, black alder, and acorns were used. A hole must always be made in the bottom of the pots for the drainage of surplus water.

Fig. 7 is a hanging pot, planted with ferns. This was also covered with white birch bark, fastened on the straight sides of the can with asphalt. Three wires, by which it was suspended, were fastened to the rim of the can. In using cans for flower-pots or hanging baskets care should be taken to thoroughly coat the insides and outsides with the asphalt; this secures the tin from rusting.

Fig. 8, a hanging log, was made by partially telescoping two cans together, after the opened end had been entirely removed. A section of the side of each can was cut out, to leave an opening for the reception of the soil and plants. The cans were then heavily coated with asphalt, particularly where the cans joined, so as to strengthen the joint. Barks of chestnut and oak trees were used for covering the cans.

Fig. 9 is a standard for plants and flowering bulbs. Having secured an old centre-table, two cheese boxes of different sizes were placed one on top of the other, the smaller one on top. Around the side of the lower box fruit-can flower pots were ranged, above these ranged another circle of pots, which stood on top of the largest cheese box and against the side of the smaller one. On top of the smallest box more pots were placed, so that but little of the cheese boxes could be seen. All the pots were ornamented with burrs, cones, lichens, or barks. The spaces left between the boxes were filled in with wood mosses. Around the rim of the table was nailed hooping from a flower barrel. The inner angle formed by the hooping and the top of the table was patched with putty. Over the entire top of the table, the hooping, and the putty, hot asphalt was applied with a brush. This rendered the top of the table watertight, so that when watering the plants water could not run on the floor. A hole bored through the top of the table afforded an escape for surplus water. The cheese boxes were coated inside and outside with asphalt, to prevent them from warping. The open space between the first circle of pots and the rim of the table was filled in with earth, on top of which moss was built up to the first circle of pots. The plants used were tradescantia, German ivy, English ivy, vincas, saxifrage, hyacinths, and calla lily.

Fig. 10 show the complete plant standard. In hanging baskets, pots, and standards, where the plants are planted closely together and in a comparatively small bulk of soil, they require frequent watering and occasional applications of liquor manure. Our fowls provide us with a very fair article of "domestic guano," from which we make good liquid manure of sufficient strength by mixing one shovelful to a barrel of water. Still there is danger in a too generous use of liquid manure; if too strong or too frequently used the tender roots of the plants are injured and the leaves begin to fall.

Fig. 11 is a fern rockery for table or Wardian case. For the rockwork the most picturesque of rocks in form and color were selected. The rocks were fastened together with plaster of Paris, which was mixed with dry colors, grays and browns predominating. As fast as the plaster was applied sand was thrown on it. The effect of the coloring and sanding of the plaster was to destroy its whity glaring look, and to harmonize it with the general colors of the rock work. The cans used for the flower-pots were first wrapped in wet paper, to increase them in size, before applying the plaster against them when building up the rock work. In a few hours the paper wrappings had so dried that the pots were easily withdrawn, after which the paper was removed and the pots put back in their places.

Fig. 12 is a vase for dried grasses and autumn leaves, which was constructed as follows: To the top of a broken-off lamp standard of glass was fastened a fruit can that had been previously dipped in asphalt. The outside of the can was then carefully covered with selected lichens and tufts of "sealing wax moss." Shells and parts of pine cones were used for ornamentation.

THE TRANSMISSION OF SCARLET FEVER BY MILK.—A report has been issued by the Local Government Board on a sudden outbreak of scarlet fever at Fallowfield, near Manchester, England. The outbreak included 35 persons, belonging to 18 families, and of the individuals who suffered, not less the 24 were attacked within 36 hours, between Sunday morning and Monday evening. Dr. Airy was directed by the Local Government Board to investigate this outbreak, and the results of his investigation are, says the *Lancet*, given in the report now before us. The outbreak was quite local, and the different details elicited tended to the general result that the infection had been distributed to the families through the agency of a particular milk supply. The facts bearing on this point do not well admit of any other interpretation. The question of the mode in which the milk could have become infected was not so fully cleared up, but it is shown that one of the milkers on the dairy-farm lodged in a farm house where scarlet fever was present at the time when the milk presumably became infected, and it is suggested that the infection was communicated to the milk, in some way undetermined but not inconceivable, through his agency. The report throughout is of very considerable interest, and forms an important contribution to our knowledge of the *mechanism*, if we may so write of certain of the observed phenomena marking the progress of infectious diseases.

Domestic Matters.

SPRAINS,

Or strains of the joints are very painful, and more tedious of recovery than a broken bone. What we call flesh is *muscle*; every muscle tapers down to a kind of string, which we call cord or sinews. The muscle is above the joint, and the sinewy part is below it, or *vice versa*, and the action is much like that of a string over a pulley. When the ankle, for example, is "*sprained*," the cord, tendon, or ligament (all mean the same thing) is torn in part or whole, either in its body or in its attachment to the bone, and inflammation—that is, a rush of blood to the spot—takes place as instantly as in case of a cut on the finger. Why? For two reasons. Some blood vessels are ruptured, and very naturally pour out their contents; and second by an infallible physiological law, an additional supply of blood is sent to the part to repair the damages, to glue, to make grow together, the torn parts. From this double supply of blood the parts are overflown, as it were, and push out, causing what we call "*swelling*"—an accumulation of dead blood, so to speak. But dead blood cannot repair an injury. Two things then, are to be done, to get rid of it, and to allow the parts to grow together. But if the finger be cut, it never will heal as long as the wound is pressed apart every half hour, nor will a torn tendon grow together if it is stretched upon by the ceaseless movement of a joint; therefore, the first and indispensable step, in every case of sprain, is perfect quietude of the part; a single bend of the joint will retard what Nature has been hours in mending. It is in this way that persons with sprained ankles are months in getting well. In cases of sprain then, children who cannot be kept still, should be kept in bed, and so with many grown persons.

The *swelling* can be got rid in several ways; by a bandage, which, in all cases of sprain should be applied by a skillful physician—otherwise mortification and loss of limb may result. A bandage thus applied keeps the joint still, and keeps an excess of blood from coming to the part, and by its pressure, causes an absorbtion of extra blood or other extraneous matter.

Another mode of getting rid of the swelling is to let cold water run on the part injured for hours.—*Journal of Health.*

SPRING COMPLAINTS.

We eat about one-third more in winter than in summer, because we not only have to repair the wear and waste of the system, but we eat to keep the body warm; a portion of the food is converted into fuel; we must keep a bodily warmth of 90° or 100° winter and summer, but it is easy to understand, that, as the thermometer is at 40 in winter and 80 in summer, less fuel is required to sustain the natural temperature in warm weather; if in defiance of this, we pile on the fuel, a wreck and ruin is as inevitable as the blowing up of a steam engine, if double the necessary quantity of steam is constantly generated.

For awhile after the opening of spring, we have the appetite of winter, and not using our knowledge, we indulge it as extensively; and thus generating more heat than is needed, we soon begin to think "we are feverish," in other words we are too warm, but instead of making less fire, we begin to tear down the walls of our bodily house, by taking off our winter clothing, and thus add another cause of disease and death. In a short time, however, nature comes to our aid, and to save us, takes away our appetite; but we, taking this as an evidence of declining health, decide upon one of two thtngs; either to eat without an appetite—which is expressively denominated as "*forcing it down*"—or we decide upon taking a tonic, forgetting that nature can neither be forced nor coaxed with impunity. The effect of eating without an appetite, or forcing an appetite by the use of tonics, is the same, that is, the introduction of more food into the stomach than nature requires, than there is juice to digest it; for although you may take a tonic which whets the appetite, it does no more; it does not increase the amount of gastric juice, for nature supplies it only in proportion to the needs of the system and if she gave as much when 20° of heat were required as when 60° were necessary she would commit a great blunder—this she never does when unmolested. Then we have more food in the stomach than there is gastric juice for; more wheat than there are mills to grind it; more work than there are workman to perform. But nature has not "a lazy bone in her," but goes to work to do the best she can; the food is digested, but not thoroughly; it is ground up, but not perfectly; the work is done, but it is badly done; hence an imperfect material for making blood is furnished; and an impure blood, an imperfect blood is inevitable. The best remedy for spring diseases of whatever name, is—eat less.—*Journal of Health.*

WHAT IS A COLD?

On a less authority than the London *Lancet* would the theory be credited that the resolve of a person not to take a cold is ample protection against having one. "It is startling to discover," says the *Lancet*, "how little we know about the commoner forms of disease. For example, a 'cold.' What is it! How is it produced, and in what does it consist? It is easy to say a cold is a chill. A chill of what part of the organism? We know by daily experience that the body as a whole or any of its parts may be reduced to considerably lower temperature than will suffice to give to man a cold if the so-called chill be inflicted upon the surface suddenly. It is then the suddenness of a reduction of temperature that causes the cold? It would be strange if it were so, because few of the most susceptible of mortals would take cold from simply handling a piece of cold metal or accidental contact with ice. The truth would seem to be that what we call cold taking is the result of a sufficient impression of cold to reduce the vital energy of nerve centres presiding over the functions in special organs. If this be the fact, it is easy to see why nature has provided the stimulus of a strong fit of sneezing to ouse the dormant centers and enable them at once to resume work and avoid evil consequences. This explains why the worst effects of cold do not, as a rule, follow upon a 'chill' which excites much sneezing. Shivering is a less effective convulsion to restore the paralysed nervous energy, but in a lower degree it may answer the same purpose. The shivering that results from the effect of a poison on the nervous centres is a totally different matter. We speak only of the quick muscular agitation and teeth chattering which occur whenever the body is exposed to cold and evil results do not ensue. It follows from what we have said that the natural indication to ward off the effects of a chill is to restore the vital energy of the nerve centres, and there is no more potent influence by which to attain this object than a strong and sustained effort of the will. The man who resolves not to take cold seldom does.'

Care of Children.—Every mother should know that very young children often suffer for the want of fresh, cold water. This they should have every two hours, and more frequently, if they become restless and fretful. Fretfulness is generally caused by great thirst. While making a voyage at sea some years ago, I was greatly disturbed by the incessant crying, or moaning of a child, during the first few days of the journey. The child was about one year old and very delicate. I suggested to the mother that it wanted water. She said that it never, to her knowledge, tasted water, as she thought it dangerous to give to children so young. I assured her she need have no fear. I directed that it should have water every hour, a little at a time, until it became accustomed to it. This was given it, and during the rest of the voyage, of five or six days, I never saw a better or happier child. I believe the child's health was permanently impaired by the constant thirst that during its short life had been consuming it.

Leprosy in America.—The *Commonwealth* in a late issue remarks: "The medicals journals see danger ahead from the leprosy which has been introduced into this country. Quite a number of unmistakable cases have been reported from the Southern States, and the disease is disagreeably common among the Chinese in California. On the coast of New Brunswick there are several colonies of lepers. Physicians who have had good opportunities of investigating the character of the disease are of opinion that it is contagious in the full sense of the term. It is nearly sure to spread to the same extent that leprous subjects freely associate with uncontaminated persons. Some salubrious little island in the Gulf of Mexico ought to be set apart for these unfortunates people, to which every new case of leprosy should be promptly transported. Immediate and complete isolation has always from the most ancient periods, been held to be the only safe way of treating the loathsome complaint."

Personal Habits and Health.—The importance of personal habits as affecting health can hardly be over-estimated. Hundreds of cases can be cited of noted persons of the most feeble constitution who by care were able to prolong their lives and accomplish wonderful labors in spite of almost continuous illness. The Jews are said to be the longest-lived people, because of their strict attention to hygiene as directed in the Mosaic law. If a man by taking thought cannot add a cubit to his stature, he may at least lengthen his days very materially by prudence. Any one can prolong his or her life beyond the average term of years by simple attention to hygienic laws.

NEGLECT OF THE EYE.

Whatever an ounce of prevention may be to other members of the body, it, certainly, is worth many pounds of cure to the eye. Like a chronometer watch this delicate organ will stand any amount of use, not to say abuse; but when once thrown off its balance, it very rarely can be brought back to its original perfection of action, or, if it is, it becomes ever after liable to a return of disability of function or the seat of actual disease. One would have supposed from this fact, and from the fact that modern civilization has imposed upon the eye an ever-increasing amount of strain, both as to the actual quantity of work done and the constantly increasing brilliancy and duration of the illumination under which it is performed, that the greatest pains would have been exercised in maintaining the organ in a condition of health and the greatest care and solicitude used in its treatment when diseased. And yet it is safe to say that there is no organ in the body the welfare of which is so persistently neglected as the eye.

I have known fond and doting mothers take their children of four and five years of age to have their first teeth filled, instead of having them extracted, so that the jaw might not suffer in its due development and become in later years contracted, while the eye, the most intellectual, the most apprehensive, and the most discriminating of all organs, receives not even a passing thought, much less an examination. It never seems to occur to the parents that the principal agent in a child's education is the eye; that though it gains not only in sense of the methods and ways of existence of others, but even the means for the maintenance of its own; nor does it occur to the parents for an instant that many of the mental as well as bodily attributes of a growing child are fashioned, even if they are not created, by the condition of the eye alone.

A child is put to school without the slightest inquiry on the part of the parent, and much less on the part of the teacher, whether it has the normal amount of sight; whether it sees objects sharply and well defined, or indistinctly and distorted; whether it be near-sighted or far-sighted; whether it sees with one or two eyes; or finally, if it does see clearly and distinctly, whether it is not using a quantity of nervous force sufficient after a time not only to exhaust the energy of the visual organ, but of the nervous system at large.—*Dr. Edward G. Loring.*

LIGHT IN THE HOME.

The eminent English writer, Dr. Richardson, produces in one of our cotemporaries, an article called "Health at home," which is replete with wisdom. A most important point, and one on which he dwells, is the fact that so many people are afraid of the light. "In a dark and gloomy house you never can see the dirt that pollutes it. Dirt accumulates on dirt, and the mind soon learns to apologize for this condition because the gloom conceals it." Accordingly, when a house is dark and dingy, the air becomes impure, not only an account of the absence of light, but from the impurities which are accumulated. Now, as Dr. Richardson cleverly puts it, we place flowers in our windows that they may have the light. If this be the case why should we deprive, ourselves of the sunshine and expect to gain health and vigour? Light, and plenty of it, is not only a purifier of things inanimate but it absolutely stimulates our brains. It is in regard to sick rooms that this excellent authority is particularly impressive. It used to be the habit of physicians in old times to sedulously darken the rooms, and this practice continues to some extent even to-day. In certain very acute cases of nervous disease, where light, the least ray of it disturbs in over exciting the visual organs, this darkening of the room may be permitted, but ordinarily to keep light out of the room is to deprive the patient of one of the vital forces. Children or old people condemned to live in darkness are pale and wan, exactly like those plants which, deprived of light, grow white. Darkness in the daytime undoubtedly makes the blood flow less strongly and checks the beating of the heart, and these conditions are precisely such as bring constitutional suffering and disease. The suppession of the light of day actually increases those contagious maladies which feed on uncleanliness. Dr. Richardson states: "I once found by experiment that certain organic poisons, analogous to the poisons which propagate these diseases, are rendered innocuous by exposure to light."

To Restore Old Oak.—Take oxalic acid 2 oz.; dissolved by friction in one quart of cold water. If the oak has been varnished, it must be scraped clean before using the acid.

WHY TEETH DECAY.

Upon a careful review of the opinion and experiments of our best investigators, says Dr. S. M. Prothro, in a paper read before the Tennessee Dental Association, it is conclusive that there are but two active agents in the process of dental caries, namely the action of acids and the development of a vegetable parasite, *Leptothrix buccatis*. By actual experiments it is demonstrated that it does not require strong acids to separate the phosphoric and carbonic acids from the lime contained in the tooth substances. Even water that contains carbonic acid will dissolve the calcareous salts. And it seems from a circumstance that transpired under the eye of Mr. Spence Bate, that water alone can dissolve the teeth.

A lady having two sets of artificial human teeth, placed one set in water to preserve it till she had worn out the other. At the expiration of seven years, the set that she had kept in the water was as much corroded as the one she had worn in her mouth. This case corroborates a statement made by Wedl and Heider, that at the end of ten days fungi had attacked the enamel and dentine of the teeth that had been kept in pure water, and that in a few weeks the tissues were pierced with holes like a sieve.

All mineral as well as vegetable acids, act promptly upon the teeth. "In forty-eight hours acetic, citric and malic acids will corrode the enamel so that you may scrape a great portion of it away with the finger-nail." Acid tartrate of lime, having a greater affinity for the lime of the tooth than for its base, will rapidly destroy the enamel.

Grapes in forty-eight hours, will render the enamel of a chalky consistence. Vegetable substances are inert till fermentation takes place and acetic acid is formed. Sugar has no deleterious effect, only in the state of aceteus fermentation. Animal substances exert no injurious effect until putrefaction is far advanced.

Skeleton Leaves.—The following method has been communicated to the Botanical Society of Edinburgh, by Dr. G. Dickson: A solution of caustic soda is made by dissolving three ounces of washing soda in two pints of boiling water, and adding one and a half ounces of quick-lime previously slaked; boil for ten minutes, decant the pure solution and bring it to the boil. During ebullition, add the leaves, boil briskly for some time, say an hour, occasionally adding hot water to supply the place of that lost by evaporation. Take out a leaf, put it into a vessel of water, and rub it between the fingers under the water. If the epidermis and parenchyma separate easily, the rest of the leaves may be removed from the solution and treated in the same way; but if not, the boiling must be continued for some time longer. To bleach the skeletons, mix about a drachm of chloride of lime with a pint of water, adding a sufficient acetic acid to liberate the chlorine. Steep the leaves in this until they are whitened (about ten minutes), taking care not to let them stay in too long; otherwise they are apt to become brittle. Put them into clean water, and float them out on pieces of paper. Lastly, remove them from the paper before they are quite dry, and place them in a book or botanical press.

—The London *Lancet* draws attention to the value of chloride of lead as a deodorizer. The manner of its use is to dissolve half a drachm of nitrate of lead in a pint of boiling water, and pour this solution into a bucket of water in which two drachms of sodic chloride (common salt) has been dissolved. After chemical action has taken place, the clear, supernatant liquid is an odourless, saturated solution of chloride of lead. If this solution be thrown into a sink, vault, or closet, from time to time, the disagreeable odours will be destroyed in a short time. Cloths wet with this solution, and hung in fever wards, are said to keep the atmosphere sweet and healthy.

Arrowroot for Infants.—Dr. Routh says, in his Infant-feeding and its Influence on Life: "I cannot conceive of anything more injurious than arrowroot feeding. I believe that it is a cause of death of many infants." Dr. Davis says, in the *Virginia Medical Monthly*, that there is, perhaps, no error more common than that of administering to the infant arrowroot, corn starch, tapioca, or other starch foods. Not till after dentition is *diastase* secreted by the salivary glands, and starch food remains in the stomach and intestines non-assimilable as a foreign substance, only disposed to irritate the delicate membranes.—*Louisville Medical News.*

Black Varnish for Iron.—A durable black and shining varnish for iron is made by adding to oil of turpentine strong sulphuric acid, drop by drop, stirring until a syrupy precipitate is formed.