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SCIENTIFIC CANADIAN

MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 8. AUGUST, 1880. No. 8.

MECHANICS' INSTITUTES.

THE leading article of the June number of this magazine contained this query: "Are Mechanics' Institutes in Ontario a Failure?" In reply to this question we have received several letters from correspondents, not intended for publication, but pointing out many disadvantages under which mechanics labour with respect to the present condition of these institutions. We could have wished that our correspondents had expressed their opinions in such a shape that we could have published them. We are, however, pleased to give insertion to a letter from Mr. Edwards, Secretary to the Association of Mechanics' Institutes, at Toronto, which may throw more light on the subject. Mr. Edwards is a gentleman who, for many years past, has taken great interest in scientific and technical matters, and naturally feels intimately concerned in the success of these institutes, with which he is honourary associated. Although he does not altogether take the same view respecting them that we have done, or consider that they are in so unsatisfactory a condition as we have stated, he appears, however, to approve, generally, with the drift of our remarks.

We think that there exists a misunderstanding with respect to the meaning of the wording of the Statute under which they are incorporated—which says for "Library Associations and Mechanics' Institutes." Now does this mean Library Asociations in connection with Mechanics Institutes—or, Library Associations independent of Mechanics Institutes, if the citizens of a town wish to establish one?—Or, does the Act mean that the two must be combined, and again is the grant by the Legislature given distinctly for Mechanics Institutes, apart from any Library Association? It is very evident that, as the matter now stands, advantage is taken in some places of the working of the Act and that, on the construction put in the words *Library Associations*. Non-mechanics consider that they have the privilege to form a Library with just sufficient mechanics connected there with to suit their object—call it a Mechanics' Institute—and draw from the Government two dollars for every one subscribed. It is very quickly done: one or more interested persons, having some influence, start to work among their friends to get up a Library Association; two or three manufacturers or well-to-do mechanics are connected with it for form sake, and, presto! the institution is formed. When working mechanics are afterwards asked to join it, they feel they have been slighted; that it is not organized as they would have wished; that its management is under the hands of a clique, and they refuse to have anything to do with it. At the same time many of these mechanics will expend more money annually in purchasing magazines and books than would have paid for their subscription to a Mechanics' Institute three-fold. It is our opinion, and always will be, that it is the duty and privilege of the manufacturers and master mechanics to take the initiative in the formation of every Mechanics' Institute, and then invite the citizens of the place to join as members of the Library, and to participate in the technical instruction given in the evening classes.

We hardly ever hear of any Library Associations unconnected with Mechanics' Institutes. We have visited many places in which libraries have been formed, open to all classes, but which have generally resulted in failure; and yet their failure was not the result of mechanics not supporting them, but owing to the want of support of the whole educated population. Had there been any Government grant to be drawn upon in aid of these Libraries, some one, probably, would have tried to keep them up. But as respects the Mechanics' Institutes of the Province of Ontario, although the Statute says for "Library Associations and Mechanics Institutes," there can be but little doubt as to the meaning of the Legislature in giving the grant, and that it was for mechanics only—that is, for the education of the industrial classes, and not for the benefit of private individuals, who desire to form a Library and Reading Room.

In further corroboration of the justness of our remarks in the article in June number, let us take a glance at the list of the 35 delegates who represented, at Ottawa, last September,—21 of the 58 Institutes receiving Government grants: We have two members of Parliament—an excellent selection—we wished there had been more; one machinist; four stationers; six ironworkers; (founders); one coal merchant; two clergymen; one soap manufacturer; one hotel keeper; one tobacco manufacturer; one carriage manufacturer, and fifteen others whose names do not appear in "Bradstreet" as having any mercantile or mechanical business.

Thus it would seem that, out of thirty-five delegates, only two appear to have been working mechanics, viz.: one master machinist and one carriage-maker — Thirty-seven Institutes sent no delegates at all to the meeting. Surely this does not look much like a success.

Now let us review the sums advanced to the Institutes in proportion to their members. We are informed the Statute provides "that for every dollar subscribed *or* "*appropriated*, by an Institute for certain specified pur-"poses, such Institute shall be entitled to receive two "dollars, up to a maximum of $400." Our correspondent presumes that, "the proportion of mechanic to non-"mechanic members is fully as great as is the proportion "of mechanic to the non-mechanic members of the "whole community." This is taking it for granted that non-mechanics, under the Act, have the same rights and privileges as mechanics.

On examining last year's return of the different Institutes, we find that Wingham received $400 for only 45 members—equal to $9.10 for each member; Kemptville received $400 for 53 members—equal to $7.52 for each member; Preston received $8,88 for 69 members—equal to $5.79 for each. Several others received from $2.50 to $5.00 for each member. Welland, with 100 subscribers, appears to have only received $102, or about $1 for each. There is something in this statement which is not clear, and requires explanation. It may be that funds in some other shape have been appropriated in order to obtain a large grant, irrespective of the number of the members of the Institute.

Very few of the Institutes appear to have made any reports, and the few that did so gave anything but a flattering statement of their affairs.

We also find, in reference to the annual report, that the percentage of books of fiction to technical works, in one Institute is as high as 85 per cent., and in several others from 50 to 80, a few from 10 to 25, and from 25 to 50. The city of Hamilton has from 70 to 75 per cent. books of fiction.

Now we will venture to assert that a large proportion of the technical works to be found on the shelves of the Institutes are either of little practical use in the present day, or are too abstruse to be understood by mechanics of limited education, or for those who desire to improve their minds by self-culture; and we further assert that many of the directors who have the selection of the books have not the requisite knowledge of the works which are most required, and that, in consequence, a large sum of money is annually expended injudiciously.

We have taken some pains to bring this matter before those with whom lie the power to place the institutions on a much better footing than formerly, and we have the pleasure to know that steps are being taken in that direction. But whatever changes are made, mechanics must distinctly understand that they must no longer be supine, but arouse themselves from their lethargy, and not wait for others to rouse them up; they must put their own shoulders to the wheel, organize themselves into a compact body to work for their own weal, their own improvement, and for the welfare of their country.

When we hear mechanics complaining of the arbitrary power shown by employers over them in manufactories, we cannot help feeling that the cause of such lies, to a great extent, with mechanics themselves. If they were a more united body and better educated, they would not only obtain, but maintain, a better social standing, and lessen the distance between the employer and the employed. The really skilful man would be rewarded; for the pressure that would be brought to bear on the manufacturer by a body of intelligent and educated class of artisans, would have such weight as to force attention.

A discrimination in the wages between the skilful and unskilful mechanic, when working at the same bench together, would have to be recognized, and there would no longer be so many of our best mechanics leaving the country for better wages.

Would that we could see the same interest taken by the industrial classes, and, in fact, by the whole community, in literature generally, technical or otherwise, as in the United States. In the New England States alone there are over 400 free libraries, supported by the municipalities and occasional donations. It is only when these institutions are made almost compulsory—that is, by corporations supporting and taxing the people for them, that they really become practically useful; otherwise, for a short season, one or two energetic men, by taking the lead in such institutions, may manage to keep them up for a few years, but they will ultimately fall through.

The city of Boston is an astonishing instance of what public spirit can do with an enlightened people. It is only about 28 years since the movement was started for the formation of a public library; in 1852 the first book was laid upon its shelves, and it now has a library of nearly 400,000 volumes, if not over that number. Two years ago its loans amounted to 1,183,991; the increase of its readers, in 1878, was 32,179. But to give an example of the appreciation of the public of the value of this noble institution—as all strangers after a fortnight's residence in the city are entitled to all its privileges, on producing references—only *one* volume, at the end of a year, was missing in one department, out of 11,723 issued. Among five branches connected with the main library, not one volume was lost from an aggregate circulation of 275,654, and in South Boston only one out of 140,677. The Boston Free Library receives its support from the interest derived from donations of its original founders, and subsequent gifts, and also from an annual appropriation of funds by the city government.

Is not such an institution, and similar ones throughout the States, well worthy of emulation by cities in Canada?

SUBSCRIBERS are requested by the Editor, when corresponding on editorial subjects, not to forward to him at the same time their annual subscriptions, but enclose them direct to the Manager, to whom all money letters should be addressed, as well as all letters relating to advertisements or business matters generally.

They are also respectfully requested to send in their arrears of subscription at the earliest date possible.

OBELISKS AS LIGHTNING RODS.—M. Le Page Renouf suggests that the ancient obelisks of Egypt may have been intended to serve as lightning conductors. The evidence is found in an inscription from the temple at Edfu, published by Brugsch-Bey in September, 1875. In the thirty-fourth line of this text "two large obelisks" are expressly said to have been constructed "for the purpose of cleaving asunder the storm-cloud of heaven."

Correspondence.

MECHANICS' INSTITUTES IN ONTARIO.

To the Editor of the Scientific Canadian:

DEAR SIR.—As the heading for the leading article in the June number of your journal, you ask the question—"Are Mechanic's Institutes in Ontario a Failure?" and then proceed to show that they are. I had carefully read your articles in the February and March Numbers, and while differing with you as to some of your statements and conclusions, I approved generally of the drift of your remarks. In the June number as in the previous articles, the date upon which you reach some of your conclusions are not correct. You assume that the Institutes have been incorporated, and that they receive aid from the Legislation, for (see June number of your journal) "the promotion of Technical information to the industrial classes only," while the Statute under which the Institutes incorporate (Chap. 72 C. S. C.) says for "Library Associations and Mechanics' Institutes;" and the Ontario Statute under which the grants are paid, provides that for every dollar subscribed or appropiated by an Institute, for certain specified purposes, such Institute shall be entitled to receive two dollars up to a maximum of $400, and that the whole $600 (or whatever the aggregate of subscription and grant may be,) shall be shown in their next annual reports to have been expended for one or more or all of the following named objects: 1st. Books of all kinds except fiction,* poetry and the drama. 2nd. For evening class instruction of their members. 3rd. For a reading-room, the expenditure for which shall not exceed one-fourth of the whole grant. 4th, Payment of the Statutory fee of 5 per cent. to this Association, in the amount received from the Legislature. To ensure the expenditure of these moneys according to law, the Statute constitutes the County High School Inspectors the Auditors and Inspectors of all Institutes in their respective counties; and, as schedules furnished by the Government, the different classes of receipts and expenditures are shown in detail and are all certified to by the Government Inspectors before an Institute can receive further aid; and as a further guarantee, copies of these certified schedules are sent in to the Minister of Education and to our Association; and if anything in them is not in compliance with the law, the respective Institutes are called upon to have the necessary corrections made before further grants can be paid. The question of basing the grants on the conditions now provided, or to base them in proportion to membership, has repeatedly been discussed at the annual meetings of the association when from thirty to fifty representatives of Institutes have been present; but no change from the systems now prevailing has been asked for; it being held that institutes in small towns and rural districts, and with a limited membership, need legislative aid even more than do Institutes in the larger cities and towns. You give as one reason why mechanics do not resort to the Institutes, that "they are not managed by their own class." I don't think that is the reason for their indifference. During the 32 Consecutive years I was in the Board of Management of the Toronto Mechanics' Institute, (10 years of which as a journeyman mechanic, and nearly nine years as its Secretary), the constitution provided that a majority of the Directors must be working mechanics and manufacturers—and such I believe is the case with nearly all the Institutes; and although we from time to time established classes in chemistry and natural philosophy, in freehand and decoration drawing, and in various other branches useful to the mechanics and each winter, also, for many a year had (free for its members) a course of from 12 to 20 lecturers—a large portion being on scientific or practical subjects, yet we never could enlist the sympathies or active co-operation of a large number of the mechanics, as members. I am satisfied this was not owing to an aversion shown to them by well-dressed men; for I have always found that the mechanic who respected himself, was sure to be respected by his fellow-members generally, no matter what their calling or profession might be; indeed, whenever we have attempted to legislate for mechanies *as mechanics*, we have found that they objected to be so legislated for; and in respect to the kind of books to be purchased, the Directors have always been more ready to purchase works of a scientific or practical character, than the mechanic members have been to read them. It will not do to say that the technical books purchased were not of the right kind, for through our Association, and otherwise, many of them have been supplied with books from H. C. Baird's and similar catalogues, English and American of the newest and best technical works, and at prices 33 per cent. cut off the regular rates. I know the complaint *has been* and often *is* made that but a very small proportion of the members of our Institutes are working mechanics, and I have myself often urged this objection, but, after all, is it not true that the proportion of mechanic to non-mechanics members is fully as great as is the proportion of mechanic to the non-mechanic members of the whole community? I think it is, and if we turn our attention to Institutes in the mother country, I believe it will be found the same; and also that wherever they have left the management or membership to mechanics alone or principally, such Institutes have soon fallen into financial difficulties and disruption. I admit that the Mechanics' Institutes of this province are none of them what they ought to be, and that many of them, are far from it; but they are not failures—many of them have an uphill fight for existence. Some of our Institutes, I know, have been the means of keeping hundreds of young mechanics, and others, from loose and dangerous habits of life, and giving them taste for study and desire for improvements; and I now have in my thoughts some few men of scientific and mechanical note in this Dominion who commenced and pursued their studies in the classes, libraries and lecture-rooms of the Institutes. During the ten years or so of the existence of the old Board of Arts and Manufactures, and the twelve years of its successes, our present association, considerable impetus has been given to evening-class instruction in the Institutes. You will see by the programme and report I send you, that our association gives annually from $20 to $40 prizes to any affiliated Institute establishing evening classes and securing a certain average attendance for the study of useful and scientific subjects—only about 12 Institutes annually succeed in securing such an attendance as to entitle them to the prizes; but other Institutes have small classes which are not reported. The income of this association is in the neighborhood of $900, and the expenditure about $250, so that about $650 per annum is available for distribution to the Institution in books of reference and in evening-class prizes. In the year 1878 we presented to each affiliated Institute a set of the 7th Edition, half bound in morrocco, of "Ure's Dictionary of Art, Manufacture, and Mining," in 3 vols; and in 1879 we gave them the 4th or supplementary volume. We have ordered for the present year's presentation, copies of Messrs. Keith Johnston's Handy Royal Atlas, and will procure the best Dominion Atlas for such as prefer it. By purchasing the Dictionary in sheets, and in getting them bound here; and in getting them all in such large quantities, we have obtained them at about 50 per cent. less than the individual Institutes could have procured them. For the past 20 years we have had arrangements with the various booksellers to supply books to the Institutes at from 20 to 30 per cent. discount, according to kinds of books. My object in writing to you is, to show that the funds received from the Government are not being to any extent misapplied by the Institutes, but are spent in accordance with the requirements of the Statute, and that much good is being done. I would also mention that by the recent amendments to the Act, it is provided that a sum of money, additional, may be appropriated by the Government to any Institute establishing a class or classes of not less than 15 members in applied Mechanics, Chemistry, Mineralogy, Botany, or any branch of the Natural Sciences. Such classes, it is hoped, will become feeders to the Ontario School of Science recently established by the Legislature.

Sincerely yours,

W. EDWARDS.

* Under new regulations not over 20 per cent. may be expended for standard works of fiction, from approved lists.

A JAPANESE PHOSPHORESCENT PAINT.—The trite aphorism, "There is nothing new under the sun," seems again exemplified by a statement to the effect that the Japanese were practically acquainted with the art of luminous painting nine centuries ago, thus anticipating the inventor of the supposedly new phosphorescent paint. A Japanese cyclopædia cites an account of a wonderful picture of an ox which left the frame to graze during the day and returned at night. This picture came into the possession of an emperor of the Sung dynasty (A. D. 676-699), who sought an explanation which none of his courtiers could give. At length a Budhist priest showed that a certain nauseous substance obtained from oysters, when ground into color material, rendered the pictures painted with the latter luminous at night and invisible through the day, the superstition arose that the animal had gone out to graze.—*Iron Age.*

IMPROVED ELEVATOR.

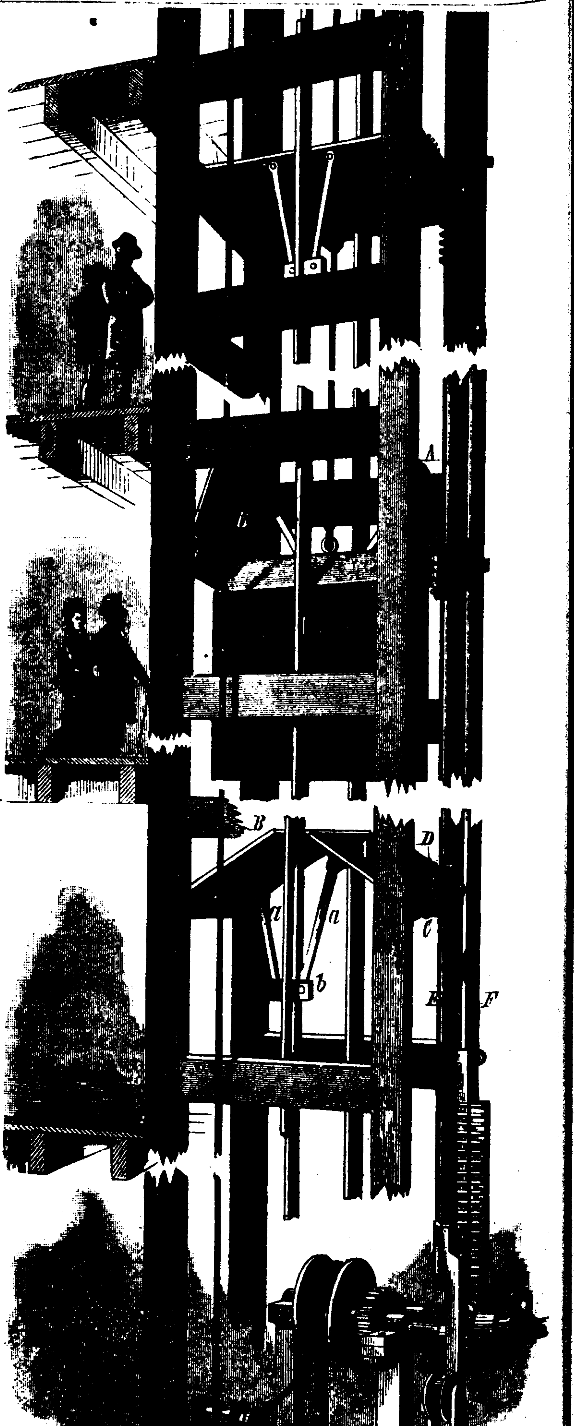
The frequency of accidents to elevators has suggested a practical field for invention, to which some of our inventors have turned their attention. By some safety is sought in pawls and ratchets in a multiplicity of ropes, and in the hoisting machinery itself; but the inventor of the device which we illustrate secures safety by automatically opening and closing the hatches as the elevator approaches and recedes from them. This plan not only secures the elevator car from dangerous falls, but it also prevents persons from falling down the hatchway, and in case of fire prevents its spread through the hatchway.

The mechanism by which this very desirable end is accomplished is both novel and ingenious. The hatchway is closed at each floor by two doors, A B, which are connected by links, *a*, with a slide *b*, moving in guides at the side of the hatchway, so that when one door is moved in one direction the other will be correspondingly moved in the opposite direction. The doors A B, are each provided with two segmental racks, C D, which are engaged alternately by racks on the vertical rods, E F, These rods extend from the top to the bottom of the hatchway, and are provided with as many short sections of rack as there are segmental racks attached to the doors.

On the driving shaft of the elevator there is a loose spur wheel, G, engaging a rack on the lower end of each of the rods, E F, so that when one of the rods moves upward the other moves downward. Upon the rod, F, in addition to the rack already mentioned, there is another rack which is engaged by a wheel having cogs in a segment of its periphery, H, secured to the driving shaft. The car is hoisted in the usaul way, and as the driving shaft revolves an intermittent vertical movement is imparted to the rack on the lower end of the rod, F, by engagement with the mutilated wheel, H. The rod, E, by virtue of its connection with the rod, F, through the spur wheel, G, is also moved vertically, but in the opposite direction.

When the car is ascending the rod, F, with its racks, is moved downwards, and its movements are timed relatively with the movement of the car, so that just before the car reaches a pair of doors the rack segment, D, on the door is engaged by one of the racks on the descending rod, F, and the doors are opened, at the same time one of the racks on the rod, E, engages one of the rack segments C, on the door below, closing the doors immediately after the passage of the elevator through the floor to which the doors belong. When the car descends the reverse of what has just been described occurs.

This invention was recently patented by Mr. James W. Evans, care Geo. F. Betts, Equitable Building, 120 Broadway, New York City, who may be addressed for further information.



EVAN'S IMPROVEMENT IN ELEVATORS.

TUBE-WELLS FOR LARGE SUPPLIES OF WATER.

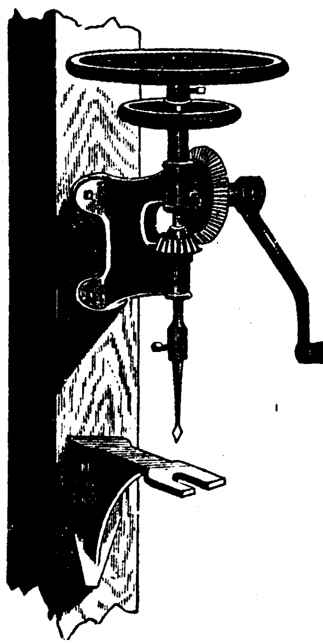
For the last eight or nine years, the leading breweries at Burton-on-Trent have obtained the bulk of their water-supplies from a number of tube-wells connected with one pump. Messrs. Allsopp & Co. pump 600,000 gallons daily from 30 3-inch wells, and Messrs. Bass & Co. 500,000 gallons from 25 tubes. Thus, in one town, two breweries are obtaining sufficient water for a town of 40,000 inhabitants. Although some of these Burton wells are within a stone's throw from the Trent, the quality, level and temperature of the water differ from those of the river-water. The town of Carmarthen, in Wales, is supplied by 10 2-inch tube-wells. In sandy soils, strainers or filters are used, which prevent sand coming into the tubes. A tube-well was sunk in very fine sand at Chiselhurst, by pumping up six barrow-loads of sand and replacing it with gravel. One advantage of the gravel filter is its imperishability, and if made sufficiently large, the velocity of the water is not sufficient to bring the grains of sand within the area acted upon by the pump. In rocks and other hard strata, the method of sinking tube-wells is similar to that employed in making artesian borings; but the mode of pumping and development of supply are entirely different from the tube-well system. Bored tube-wells can be made through any stratum and to any depth that an ordinary artesian boring can reach. The Lower Grounds, Birmingham, with their ornamental waters, fountains, and extensive gardens, derive their entire water-supply from a single 5-inch well sunk about two hundred feet deep. By means of this well, an annual saving of £300 for water-rate is effected. Two tube-wells at West Thurrock yield a daily supply of 220,000 gallons from the chalk.

—ADDITIONAL freight sheds have had to be constructed on the wharves at Montreal to meet the increasing trade at that port.

STARVING OUT CANCERS.—At a late meeting of the Leeds (England) Medical and Chirurgical Society, J. W. Teale read a case of quiescent scirrhus. The patient was an unmarried lady of 35. A cancer formed in her breast, causing retraction and ultimately loss of the nipple; it ulcerated; some axillary glands enlarged, and the patient seemed about to die. But in consequence, as it seemed, of the small quantity of food taken by the patient, the cancer was "starved." It atrophied slowly; and now, nine years after its first appearance, there was nothing but a hard cicatrix left in the breast and axilla. Cases more or less similar were related in the discussion which followed.—*Medical and Surgical Reporter.*

THE BUCKEYE HAND DRILL PRESS.

We herewith present to our readers an illustration of the Buckeye Hand Drill Press, manufactured by Messrs. A. E. Folger & Co., of Springfield, O. There has been a great demand among our blacksmiths, carriage-makers and others, for a first-class drill press at a low price. The manufacturers claim that the "Buckeye" will do as good work as any other drill made. It is said to be well and substantially made, and weighs, complete, 75 pounds, and the manufacturers say it will stand up to the hardest kind of work. The frame is cast in one piece, and is well



proportioned for strength and stiffness. The bearing for spindle, and nut for feed-screw are bored with the same tool and at the same time, thus insuring perfect alignment. The spindle is bored to receive a drill with ½-inch round-shanks, has 2⅝ inches vertical travel of feed, and drills to the centre of 17 inches circle. Any further points of interest which our readers may desire to know about, can be obtained, no doubt, by addressing the manufacturers, as above.—*Blacksmith and Wheelwright.*

CEMENTS FOR THE SHOP.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, five pounds; powdered sal-ammoniac, two ounces; sulphur, one ounce; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed and rammed tightly into the joint.

2. Take sal-ammoniac, two ounces; sublimed sulphur, one ounce; cast-iron filings or fine turning, one pound. Mix in a mortar and keep the powder dry. When it is to be used, mix it with twenty times its weight of clean iron turnings or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistence, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nutgalls (hot) and bring the two together.

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 ten 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 an egg. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.

Steam-Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it a portion is mixed into paste with linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turning Cement.—Melt one pound of resin in a pan over the fire, and when melted, add one-quarter of a pound of pitch. While these are boiling add brick-dust until by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

Wollaston's White Cement for Large Objects.—Beeswax one ounce; resin, four ounces; powdered plaster-of-Paris, five ounces. Melt together. To use warm the edges of the specimen and use the cement warm.

Gutta-percha Cement.—This highly recommended cement is made by melting together in an iron pan, two parts common pitch and one part gutta-percha stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty for glazing windows.

CORRUGATED BOILER FLUES.—According to *Engineering* corrugated boiler flues are rapidly coming into favor in England. More than 200 have been delivered by the makers this year, and about 150 are at present in course of construction. By repeated tests it has been shown that these flues are much stronger to resist collapse than ordinary flues of the same size and weight of metal, and it is claimed that they have enabled marine boilers to produce considerably more steam. The fact of their great advantage has been arrived at chiefly by comparing the performance of nearly similar vessels with and without corrugated flues. The former either attain higher speeds or use less fuel, the difference being very marked. Not less important than this radical improvement in boiler construction, is the fact that they have been successfully made out of steel plate, welded by a special machine. The plates are of Siemens-Martin steel, and some were as large as 15 ft. long by 8 ft. 9 inches wide. The welding of these plates is certainly a noteworthy event in the manipulating of steel. The Leeds forge company, however, are about to construct machinery for rolling solid steel tubes without weld, 4 ft. 9 inches in diameter by 9 ft. long, from seamless circular blooms, under Mr. S. Fox's patents. When a weldless and seamless steel tube of these dimensions can be made, it would seem as if the very perfection of tube-making had been reached.

THE ABSORBING POWER OF EARTH.—Without obtaining a practical test one can hardly appreciate the absorbing power of dry earth, or the leeching effect of some kind of soils. A writer says: "We once deepened a manure pit that had a blue clay bottom. This pit had been used for years, there was never less than a foot of water in it. After emptying we commenced to deepen it, expecting to find a rich black earth for a foot or two, but to our astonishment, the clay two inches below the bottom was not soiled, but looked as pure and blue as it did two feet deeper. But all kinds of soil are not as impenetrable to liquids as blue clay. By actual experience we have found that dust an inch thick over a dead animal will prevent the escape of bad smells. In hen-houses the effect is magical, preventing not only bad odors, but vermin as well. Even for old running sores and ulcerated wounds when chemical disinfectants could not be had, dry earth or dust has proved highly beneficial. The fact seems to be that neither the liquids nor gases of decaying matter can pass through two inches of earth without losing the greater part of what constitutes its peculiar characteristics, that is, its offensive or valuable portion, as the case may be. Properly used in the stables, cesspools, sink-drains, etc., dry earth will save a vast amount of valuable fertilizing matter, and prevent expensive and life-destroying disease.

TREATMENT OF SIMPLE HICCOUGH.—Dr. Grellety once saw a mother, tender and full of affection for her children, give them a morsel of sugar dipped in table vinegar whenever immoderate or too rapid repletion of the stomach or any other cause had induced hiccough. The latter ceased as if by magic. Since then the Vichy physician has very frequently employed this means on his own account, and has never found it without avail.—*The Pharmacist and Chemist.*

Sanitary Matters.

EFFICIENCY OF WATER-TRAPS.

(See page 252.)

We reprint below a portion of a paper by Dr. Carmichael, published in the *Sanitary Journal* for March, 1880.

"We now come to the much more important question. Do the organic particles, including germs, putrefactive or specific come through a sound water-trap? A simple but very crude method of examining the question consists in the microscopical comparison of water through which soil-pipe air has been aspirated, with water through which the air over the trap has been drawn. The former contained numerous organic particles of a very heterogeneous kind; in the latter no particles could be detected. This method is, however, not conclusive, as particles might readily elude observation.

"About five years ago, when experimenting on the germ theory of putrefaction, I performed the following experiment: into two glass test tubes (Fig 1), about four inches long, and having drawn-out necks, I introduced turnip infusion. The liquid in the tube was then boiled to sterilize it; and while steam was freely issuing from the drawn-out necks, a closed capillary tube, containing a putrid infusion, was passed into each tube. The body of each tube was then immediately dipped into cold water, and at the same time the neck sealed by melting it in the blow-pipe flame. The putrid infusion in the capillary tubes was then subjected to the boiling temperature for only a few seconds. The necks of the tubes were now connected by putting over each, while hot, a piece of India-rubber tubing, which adhered. A small portion of the neck of each tube was now broken off within the two tubes. In this way the whole apparatus was sterilized, except that one capillary tube in each larger tube contained putrid liquid, and the two tubes had an open connection through the india-rubber tubing. The apparatus stood for several weeks unchanged. I now violently shook one tube, so as to break the contained capillary at a constricted portion, and so inoculate the infusion. This putrefied developed a large fungus, and become muddy from the development of bacteria. I watched for some time, and daily expected to find that the germs would pass over and inoculate the liquid in the other tube; but they have not passed even in five years. This experiment, which did not turn out as I had anticipated, directed my attention to the subject of the relation of water to the behaviour of putrefactive particles. Some points in this investigation I now place before you.

"Into a glass flask, with long neck bent so as to form a trap, and also into this trap, I placed urine. Both were sterilized by prolonged boiling. The liquid in the trap, being exposed to the air, putrefied; the urine in the flask continued clear. To deal, however, more directly with soil-pipe air, the following experiments were performed. On a shelf across a window, so as to have a good light, a glass flask, having a neck bent so as to form a trap, was placed. Into the flask was put urine; in the trap, water. The neck of the flask was connected to a lead pipe joining the soil-pipe under the trap of the kitchen sink. There was an aperture in the neck of the flask, where this joined the body, for ventilation, and to permit a current of air. The urine in the flask and the water in the trap were sterilized by prolonged boiling. The aperture mentioned was closed with cotton wool while steam issued. The water in the trap being in direct connection with the soil-pipe air, in sixteen days developed fungi. The urine in the flask has continued unchanged. The experiment was started in July of last year, so that even in seven months germs have not been able to make their way from the soil-pipe through the little trap of water to the bent neck, into the urine. But, lest it might be objected that there was not a sufficient current of air to draw germs over the curve of the neck, I repeated the experiment with another flask similiarly arranged, except that it had two apertures for ventilation in the neck, and that it contained hay infusion instead of urine. A glass tube, plugged with cotton wool, projected through one aperture into the neck of the flask over the infusion. The infusion and the water were sterilized, and the apertures closed with cotton wool, as before. To the cotton-plugged tube projecting through the aperture was now attached the aspirator, which caused a current of air to rush through the cotton wool over the surface of the water of the trap, along to the neck toward the infusion, and out through the small tube. It will be seen from this arrangement, that any particles which might be dispersed from the surface of the water-trap must have been carried in the air current over to the infusion, and must have caused it to putrefy. It is still perfectly clear, although it has stood for five months. No particles, therefore, have come through that trap even in five months.

"Another flask, similar to the first mentioned of these two, containing urine in the body, and having the neck empty, was connected with the soil-pipe. This was sterilized as the others were. In a few days it began to putrefy and in a few weeks it was very foul and putrid. That in the soil-pipe air which caused putrefaction in this case was cut of by the water-traps in the other cases. These experiments seemed to me fairly conclusive; but, lest it should be objected that germs might rise from the liquid of the trap and fail to be carried over, or that an ordinary water-closet trap might behave differently from the glass one mentioned. I adopted the following methods of experiment, which I think you will consider crucial. Nitrogen bulbs (as in cut) were charged with Pasteur's solution (one of the best cultivating liquids). The liquid was boiled so as to sterilize it, and while steam was issuing, both ends were sealed in the flame. The bulbs were now wrapped in lint and placed in boiling water for half an hour, so as to insure perfect sterilization of the bulbs. The lead trap in the kitchen, already referred to, was now sterilized by placing under it, and raising so as to immerse the trap, a pot of oil heated to from 350° to 400° F. This caused the water in the trap to boil, and steam to flow out abundantly through both tubes. To one of these pipes an India-rubber tube was attached, and, while steam was issuing freely from the other end of this India-rubber, tube, one limb of the still closed nitrogen bulb was inserted into and firmly tied in it. The other still closed end of this nitrogen bulb was now inserted into the end of another India-rubber tube, plugged near its extremity with cotton wool which had been soaked in a solution of carbolic acid, and also firmly tied in. Both ends of the nitrogen bulb were now broken off (where they had been previously scratched with a file) within the India-rubber tubes. The aspirator was immediately set to work. The liquid in the bulb was now again boiled. Steam was still coming freely from the open tube entering the cavity over the trap. When this began to slacken a piece of cotton wool, which had been soaked in an etherial solution of carbolic acid, was tied over the end of this tube, and the whole apparatus allowed to cool. In this way the connection was made, while the whole apparatus was sterilized. The air, entering the cavity over the trap, was filtered by passing through the cotton wool of tube, passed through this cavity, passed out through the other tube, bearing with it, of course, any particles or gases which might come through the trap, bubbled continuously through the liquid in the bulb, and was discharged through the aspirator. The aspiration was continued for from twenty-four to thirty-six hours. At the expiration of this period the bulbs were, before removal, hermetically sealed by melting at each end, in the blow- pipe flame. The bulbs were now removed, and placed in a warm room in public work, at a temperature of from 75° to 100° F., and were left there for some months. This experiment was frequently repeated, with Pasteur's solution, hay infusion, and urine. Similar experiments were performed with flasks, arranged with two tubes passing through carbolized cotton wool in the neck, one tube entering the fluid, the other stopping short of it. Air passing over the surface of the water in the trap was, of course, caused similiarly to bubble through them. In repeating these experiments, it was not found necessary always to sterilize the trap for each experiment. When the bulb or tube was detached as described, the India-rubber tube connected with the trap remained closed at its free extremity by the hermetically-sealed portion of glass tube which had been removed from the bulb remaining in it, This was connected with a fresh bulb, still closed, under a carbolic acid solution, so as to maintain aseptic conditions. In this way experiments sometimes went on for several weeks without the renewal or the fresh sterilization of the water in the trap, which, of course, must in that time have absorbed a large amount of the impurities of the soil-pipe. The liquids in all those tubes and flasks, though kept for from two to five months at cultivation temperature have remained perfectly clear, and even when examined with a $\frac{1}{12}$ in Hartnack's immersion lens, multiplying 900 diameters, exhibited no trace of life. The conditions of these experiments seem to me crucial, and to warrant the conclusion that germs do not pass through a sound water-trap. If no germs pass through, them it is certain that no particles pass through. because the particles in a soil-pipe are putrid, and because the passage of organic particles through water necessarily impregnates them with germs. Clearly, therefore, such particles as epithelium from the bowels in typhoid fever, containing the typhoid contagium, are cut off and effectually excluded from the house by a sound water-trap. *Water-traps, are, therefore, for the purpose for which they are employed, that is, for the exclusion from houses of injurious substances contained in the soil-pipe, perfectly trustworthy.* They exclude the soil-pipe atmosphere to such an extent that what escapes through the water is so little in amount, and so purified by filtration, as to be perfectly harmless; and they exclude entirely all germs and particles, including, without doubt, the specific germs or contagia of disease, which we have already seen, are, so far as known, distinctly particulate."—*The American Architect and Building News.*

SANITATION.

That excellent journal the, *Sanitary Engineer* of New York, remarks as follows:

"The Board of Health and the City Engineer of Springfield, Mass., have adopted the substance of the " requirements for the drainage of every house," published in THE SANITARY ENGINEER for September 1st, 1879, and have officially promulgated them in a circular, which we copy below. We are gratified to find that they have met with such recognition. They were prepared with the co-operation of the best sanitary authorities in the United States, and have borne the test of examination and criticism, so that we can fairly call them The Sanitary Code for American house drainage.

"HINTS ON PLUMBING AND SEWERING—HOW TO MAKE HOMES HEALTHY, AND SAVE DOCTORS' BILLS

"[A circular prepared by City Engineer Ellis, and issued by authority of the Board of Health.]"

"The prevention of disease arising from sewer gas can only be accomplished by obedience to the following sanitary requirements:—

"'A trap should be placed on every main drain to disconnect the house from the seweror cesspool."' This trap should have a seal of not less than 1½ inches, and be furnished with a hand hole for convenience in cleaning if stopped from any cause; while if the rain water down spout is connected with the sewer just above the trap, great assistance will be rendered in preventing deposits. " Every house drain should have an inlet for fresh air entering at a point inside the main trap and carried to a convenient location *out of doors*, not too near windows." For the latter reason the down spout selected must be one running to the eaves of the main building, and *not* stopping at the piazza or at any lower point. "'Every verticle soil or waste pipe should be extended at least full size through the roof"' not less than four feet and surmounted with a plain ventilating cap of such form as not to obstruct the exit of air."'

"'No trap should be placed at the foot of vertical soil pipes to impede circulation."' "'Traps should be placed under all sinks, baths, basins, wash trays, water closets and other fixtures and as near to them as possible. All traps under fixtures 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, but always above, and in some cases it is preferable to carry them to outer air independently. If the ventilation of traps under the kitchen or basement sinks be impracticable the discharge pipe below should be ½ inch greater diameter than the trap and pipe above."'

"The safe, waste and refrigerator pipes and tank overflow pipe should *not under any circumstances* be run into any drain or soil pipe, but discharged independently into an open sink or bowl, so that the connection with the sewer shall be completely cut off.

"'Water closets should not be supplied directly from street pressure or by pipes from which branches are taken for drinking water."'

No drain should be constructed under a dwelling house except where absolutely necessary, and then it should be of cast iron, with tight joints and ventilated at each end. All drain pipes within a house should be of metal, and soil pipes of cast iron, other pipes of lead; under no circumstances is the use of cement or earthenware permissible. The joints of cast-iron pipe should be filled with melted lead and properly calked. The union of lead with iron pipes should be made by means of a soldered brass ferrule, or cast-iron sleeve; in the latter case the lead pipe put through, turned over it, and the ferrule or sleeve inserted in the hub and leaded in the usual manner. Such joints should *not* be made with putty or cement.

A not uncommon method of ventilation is to connect the main drain with the kitchen chimney; with the cold-air inlet, this gives a circulation of fresh air in the lower drain while the chimney remains heated, otherwise it is a sort of danger, but at its best, it is no assistance to the vertical pipes, which cannot be ventilated or guarded against syphonage, except by carrying out at the roof full-size and ventilating traps as directed.

These requirements all apply with equal force to connections with cesspools; and where these are used, they should be ventilated at the cesspool in addition.

THE PRINCETON DISASTER.

(*See page* 264.)

The sudden recess of Princeton College, consequent upon an outbreak of malarial fever, by which some forty of the students have been prostrated, and which has already caused several deaths, has naturally excited much discussion in public and private. The serious consequences of the outbreak, and its important bearings on sanitary progress, induced us to visit Princeton and personally investigate the circumstances of the case, for which we were afforded every facility by the college officials, and we are thus able to lay the main facts in the matter before our readers.

The history of the outbreak dates back about a month. Before that time there had been about the usual amount of sickness in the college, but attention was then specially drawn by the simultaneous illness of seven students in a private boarding-house. Examination revealed that the well from which these students drank was polluted from an adjoining cesspool. Prof. Cornwall analyzed the water and found an excessive amount of albumenoid ammonia and free ammonia.

An analysis of the water of all the wells and springs from which the students drank was then ordered. As a result ten more wells were shown to be impure. By this time the disease had begun to assert itself in the college buildings; some forty students in all were attacked, but not all at the college. Occupants of all of the buildings were seized, the least number being in old Nassau Hall, and the most in Witherspoon Hall, supposed to be the most complete of all the college buildings.

An investigation was begun by the faculty, and it was hoped prompt remedies would relieve the prevalent alarm, when the deaths of three of the patients created a panic, and so many of the students' friends wrote requesting their return home that it was finally decided to adjourn the term for a month to allay the excitement and to permit remedial measures.

Princeton is distinctively a college town, and is made up of the college buildings, the residences of the faculty, a couple of hotels, and a moderate number of private dwellings. There is no business carried on in the place, except providing for the wants of the students. The college buildings are scattered about the grounds in picturesque confusion, and are of all styles of architecture, several being of great antiquity. There are five buildings in which students sleep—Nassau Hall, built in 1756; East College Hall, erected in 1833; West College Hall, erected in 1836; Re-union Hall, erected in 1870; and Witherspoon Hall, erected in 1877.

Up to within a few years there were no sanitary features in any of these buildings. The bedroom slops were taken out by hand and emptied into small cesspools near by, while water had to be carried up in the same toilsome and primitive way. Out-door privies were used and misused, and everything about the sanitary arrangements was decidedly offensive and unsatisfactory.

Less than four years ago water closets were introduced into all the dormitories on the ground floor only, while sinks were placed in each hallway to supply water mainly for lavatory purposes. The water came from a very pure and productive spring, which is is still the source of supply, while the waste was carried into a 12-inch sewer which ran across the college grounds and down to a large cesspool, 1,200 feet distant, beside the railroad. This cesspool was 60 feet long, 10 feet wide and 14 feet deep, with an overflow pipe at one end; the bottom was open, and it was supposed that the fluids would drain off in time. There were two man-holes, tightly covered, but no ventilation either to the sewer or cesspool, except into a brick flue in the Witherspoon building and a galvanized pipe which ran up the side of one of the dormitories, close to the windows, and which had been cracked in several places by base balls or in other ways.

The cesspool had *never been cleaned* and was full to the brim. Possibly the sewer is also choked by the deposit backing up. Yet this was the sole receptacle for the sewage of some seven hundred persons, amounting to several thousand gallons daily. The drains from all the dormitories connected with this cesspool as did those from the University hotel.

In most of the buildings there was absolutely no bar to the gases produced by decomposition in the cesspool and sewer from entering the bedrooms, while the absence of ventilation for either the cesspool or sewer left no other exit for them. The waste pipes were not carried above the roof, nor was a single trap separately ventilated. The sinks were encased in wood and were used to throw chamber slops in, and as urinals; they were necessarily offensive, particularly as the halls in some of the buildings in which they were located had but little light or ventilation. Even in the handsome new Witherspoon Hall the arrangement was no better; in each hall the sink, save an unventilated trap, offered no barrier to the entrance of the cesspool air close to the doors of students' bedrooms; and in this, the newest building, the amount of sickness was greatest.

Despite the fact that, for weeks, disinfectants had everywhere been abundantly used, the odors from some of the fixtures was noisome in the extreme, particularly in the West dormitory, where two of the worst cases of sickness were found in rooms opening on halls, in which the state of the fixtures was but too suggestive of contagion.

Attempts are being made to trace the above outbreak to some primary cause, and to sift the cases into specific classes of disease. But it is enough for our purpose to show that the defective drainage of these buildings at Princeton was sufficient to have poisoned all who occupied them, and that it is simply providential that so few suffered of the many who were exposed. How the poison was first introduced has not been explained fully, but how it was spread is very evident.

Other colleges should take warning from this experience, and at once have a thorough examination made of their buildings by experts to ascertain if they are not also deficient in these matters. Immunity from such an outbreak should not by any means be considered evidence of good sanitary arrangements. It is better to shut the door before the horse is stolen.

We are informed on good authority that no pains or expense will be spared to correct all these defects, and that the trustees of the institution propose to avail themselves of the best expert advice. If they do this there is no doubt that the college will be as healthy as any in the country.—*The Sanitary Engineer.*

ANCIENT AMERICAN GIANTS.

The Rev. Stephen Bowers notes, in the *Kansas City Review of Science*, the opening of an interesting mound in Brush Creek Township, Ohio. The mound was opened by the Historical Society of the township, under the immediate supervision of Dr. J. F. Everhart, of Zanesville. It measured sixty four by thirty-five feet at the summit, gradually sloping in every direction, and was eight feet in height. There was found in it a sort of clay coffin including the skeleton of a woman measuring eight feet in length. Within this coffin was found also the skeleton of a child about three and a half feet in length, and an image that crumbled when exposed to the atmosphere. In another grave was found the skeleton of a man and woman, the former measuring nine and the latter eight feet in length. In a third grave occurred two other skeletons, male and female, measuring respectively nine feet four inches and eight feet. Seven other skeletons were found in the mound, the smallest of which measured eight feet, while others reached the enormous length of ten feet. They were buried singly, or each in separate graves. Resting against one of the coffins was an engraved stone tablet (now in Cincinnati), from the characters on which Dr. Everhart and Mr. Bowers are led to conclude that this giant race were sun worshipers.

THE EFFECT OF ELECTRIC LIGHT UPON THE EYES.—A Russian correspondent of the Paris *Temps* speaks as follows as regards the matter: "Kronstadt was the first city in Russia where the electric light was introduced into public and private buildings, and it has also been the first to discover its inconveniences. Diseases of the eyes having become more frequent, the attention of the government and of oculists has been turned towards the means of preventing these sad effects. The officer commanding the Black fleet has reported several cases of the sudden loss of sight caused by the dazzling of these lights used on board, and having an illuminating power of 14,000 candles. Dr. Lubinski, a specialist and an ordinary authority in these matters, has investigated this question, and finds that the use of blue glasses is the best protection against the Jablochkoff light. Next to this comes the gray glasses, and then the violet. Clear yellow tints, and also red, should be carefully avoided, for instead of decreasing the ill effects of the electric light upon the eye, these colors render it more injurious."

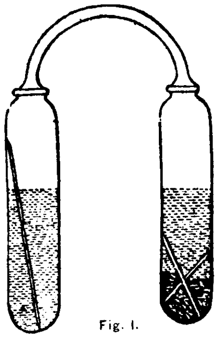


Fig. 1.

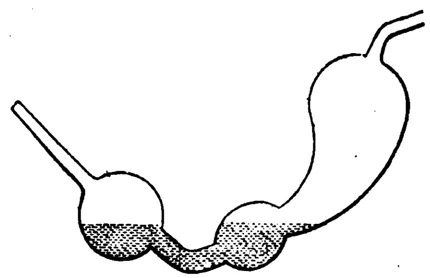
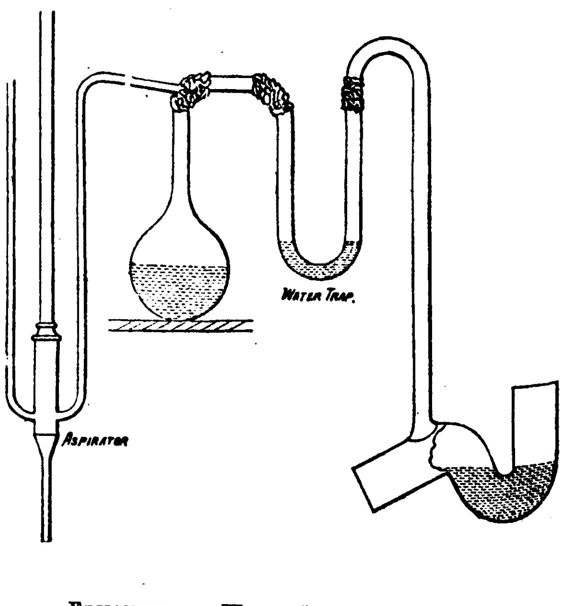


Fig. 2.



EFFICIENCY OF WATER-TRAPS.—*See page 250.*

LUMINOUS FLOWERS.—Among the elegant novelties of the hour now offered for sale on the Paris boulevards are phosphorescent flowers, which glow with a lambent light in the dark, and rival their natural tints. They are luminous by coating the petals with transparent size, and dusting them with a phosphorescent substance, such as canton phosphorus (sulphide of calcium) or Bologna phosphorus (sulphide of barium). Canton phosphorus is the best, and yields a soft yellow light. According to M. Becquerel, a good quantity can be made by mixing 48 parts of flowers of sulphur with 53 parts of calcined oyster shells, and raising them to a temperature of between 800 and 900 degrees centigrade in a crucible. After exposure to sunlight during the day, or to the electric or magnesium light, the flowers thus coated become brightly luminous in the dark.

ONE-HORSE BAGGAGE WAGGON.

In this design we present to our readers a variation from the regular express body, which, until now, has always been made with straight sills. In this cut the rockers are curved similar to those of trucks, and the rear end of the body is thereby brought five inches nearer to the ground than the front. In loading heavy freight, such as trunks, this is considered of some importance.

This style of waggon is usually made with three springs, for the reason that platform springs would make it too heavy for one horse, and add to the expense.

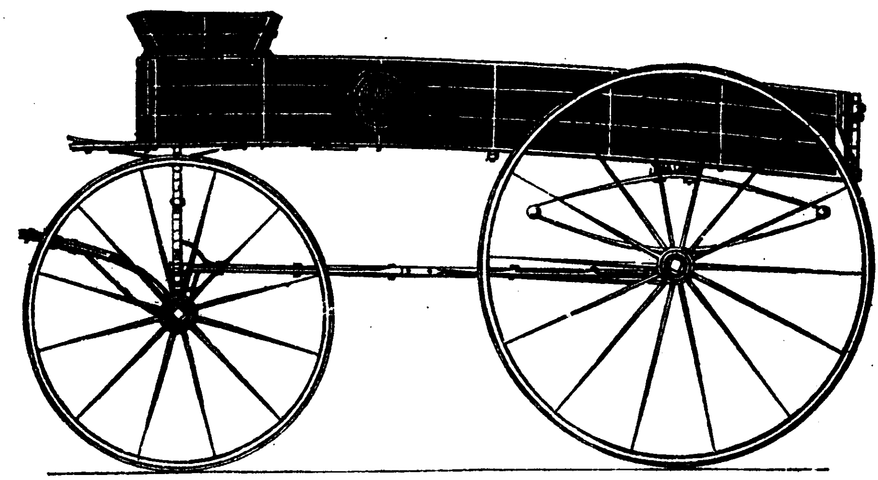
We show a wooden name-plate on the side, which is attached to the rave covered by it.

The general dimensions are as follows: Outside length of body, exclusive of toe-boards, 7 ft. 6 in.; width on top of box, 3 ft 8 in. The sides are to have $\frac{3}{4}$-in. turn-under on each side; track, 5 ft., out to out; wheels, 3 ft. 3 in. and 5 ft. 1 in.; hubs, front, $6\frac{1}{2}$ in. diameter, $9\frac{1}{2}$ in. long; back 7 in. diameter, $9\frac{1}{2}$ in. long; spokes, $1\frac{3}{4}$ in. full; rims, 1 15-16 in.; tires, $1\frac{5}{8}$ in. tread, $\frac{5}{8}$ in. thick; axles, $1\frac{3}{4}$ in.; springs, front, 7 plates, $1\frac{3}{4}$ in. wide; back, 6 plates, $1\frac{1}{2}$ in. wide.—*Blacksmith and Wheelwright.*

SKIN GRAFTING FROM THE DEAD.

Dr. J. H. Girdner, house surgeon at Bellevue Hospital, has obtained some remarkable and valuable results in skin grafting during the past year. One patient who required such treatment refused to furnish grafts from his own arms or body. owing to the pain involved; and unwilling to ask another to subject himself to a pain which the person to be benefited was unwilling to submit to, Dr. Girdner tried the experiment of taking skin grafts from a corpse. The doctor says:

"I cut a piece of skin from a patient who died in the wards a few hours before, first taking care to enquire whether the cause of death was due to a poisonous disease or not. I then cut the cuticle into small pieces, which I laid on the granulated surface of the ulcers, and bandaged the leg up very firmly. In three days the graft began to show signs of life, a perfect union having taken place, and in a week a splendid skin, smooth and elastic, had grown over the ulcerated part, making a complete cure and leaving no scar behind. Since that time I have treated upward of fifty cases with invariable success. I have grafted the skin of an Irishman on a negro, and I have grafted the skin of a negro on an Irishman with ease. In both cases the skin lost its original color and changed its hue to suit the wearer."



ONE-HORSE BAGGAGE WAGGON.

THE HOLLWAY PROCESS IN NEW SOUTH WALLS.

The Sydney *Morning Herald* of April 22nd says: The article relating to a new discovery of a method for smelting without fuel, which we published on Tuesday, should commend itself to the attention of all persons interested in mining. Briefly stated, the principle brought into play is the evolution of heat by rapid oxidization of certain mineral substances, and notably of pyrites. In treating the pyritic ores of copper, which have been in this colony and in Queensland the principal sources of the metal, all that is requisite is to start the charge fairly in an appropriate furnace till it becomes molten. Thenceforward fuel, in the ordinary acceptation of the word, becomes unnecessary. All that is required is to feed the molten bath with more ore, which is itself fuel, provided a current or blast of air be continually forced through the fluid metal. Oxidization at a rapid rate is so maintained and enormous heat evolved, while waste products, such as sulphur, may be condensed and collected if they be found worth saving, a point only to be determined by the cost of carriage to a market. No one who has any knowledge of the history of copper mining in these colonies can doubt the influence which such a discovery should have upon the future of that branch of enterprise, if the promises made are fulfilled. At the first opening of a mine, it ordinarily happens that timber abounds close at hand. But the enormous consumption of furnaces rapidly denudes even the most densely wooded country, and it has followed in actual experience that by the time a mine has been so long worked that the attainment of considerable depths has enhanced the expenses of extracting ore, and increased economy becomes desirable in other departments, the supply of fuel has become inaccessible in the same proportion as the ore. It is an ascertained fact, for example, that a chief obstacle to renewal of operations at the Peak Downs mine is the dearness of fuel, consequent upon the distance it has now to be carted. Even at Mount Perry, where operations had been comparatively of brief continuance, the same growth of expense had begun to make itself felt. The profitableness of extensive operations, in many instances, depends upon a small margin, and in the case of mines turning out their thousands of tons of ore weekly or monthly, a few shillings one way or another in the cost per load of fuel may decide the balance of profit or loss. But the foregoing is only one, and it may be for Australia a minor, application of the discovery. The process is said to be suitable for the treatment of auriferous pyrites. If a practical application to this use be indeed attainable, the future of many goldfields in these colonies will be entirely changed. There are rich mines in scores lying abandoned because the "mundic has come in," and although the pyrites is proved by assay to be rich in gold, no profitable method of separating the precious metal from its base association has hitherto been devised which is available for application on the spot.

The Secretary of the American Iron and Steel Association reports 697 blast furnaces in the United States, with an annual capacity of 6,500,000 tons of pig iron; 382 rolling mills, with an annual capacity of 4,000,000 tons, the capacity of the rail mills being 2,150,000 tons; 11 Bessemer steel works, with an annual capacity of 1,750,000 tons, besides 11,800 miscellaneous works.

Mechanics.

ANOTHER CHAPTER ON BOILERS.

BY P. S. OF TORONTO.

(Continued from page 223.)

It is now time we should get the engine to work, the steam guage indicates 20 lbs. When she is working we will set down again and make some calculations. I want you to go down to the pumps and let out the air by opening the tap in the plunger-case, stop the outlet with your finger when the plunger comes up and remove it when it goes down, until the water comes out. The drain taps are all open, and now for the steam. I will work her a few strokes with my hand and then will let the eccentric hook fall into its place; there she goes nicely. Close the drain taps a little, and watch the water gauge, it is oscillating pretty much, the water is driving out the air from the pipes. We will now look at the exhaust; it leaves the pipe nicely in balls regularly, open the feed tap so that the water will fill the heater pipes, the steam is gaining 25 lbs., while the water gauge has run up to 50 lbs. in ten minutes, our water is down two inches below the line, we will now open the feed tap so that the water may slowly gain in the boiler, we have a good draft, and the steam is going up the boiler, is expanding but it is free, not touching anything, we are now running 30 strokes per minute, our taps are full and running into the tank in 20 minutes, the steam guage shows 50 lbs. the safety is just beginning to blow off, so close the damper. The water gauge is now oscillating between 100 and 150 lbs. every stroke, she is working very nicely, the water in the well is rising and falling every stroke. Our air vessel is six feet high, by 2½ feet diameter; put your ear to it and you will hear the valves of the pumps open and shut; see that mark around the air vessel, about ⅜ up, you can see and feel where the water and the air meet, it acts on the water better than any spring could be made had it not been for that spring or air, then we would have burst some of the joints, or burst the pipes because the water does not go into the pipes at an uniform rate, but in squirts. You ask me how much water is each pump pushing into the pipe every stroke, well we will calculate, each pump plunger is 4 inch diameter, and two feet stroke, now 2-4 =16 × 24 inches=384 cubic round inches + by 353·03 the number of round inches in a gallon=1·08 gallon per stroke for each pump × 2=2·16 × 30 the number of strokes per minute=64·8 gallons per minute × 60=3888 gallons per hour besides pushing along 1,500 yds. of water in the 4-inch pipes and rising 150 feet above the fall of the water in the well. We now find by closing our dampers, we have reduced our steam to 25 lbs., and yet she is going on the same rate, we have opened our steam valve in proportion. I would rather do so than keep up the steam to 50 lbs. and keep the dampers open so much, so as to allow the fire to burn gently and naturally, than to give full draft, to a smaller boiler and engine; we will run on less fuel; you see we are feeding with water at 150 Fah, all the time just enough to keep the water in the boiler ¾-inch below the water line, or ¼ above the upper tubes, by so doing we congenerate steam faster and with safety, because the fire does not touch these tubes, but only the gas, about 500 Fah., in the smoke box and about 350 Fah., at the chimney, while the steam in the boiler is about 275 Fah. You say to me, that is strange, the engine is now working with 25 lbs. of steam, and moving a pressure of water at 120 lbs. on the square inch. I would like to see you calculate the power of the engine, we will do so after we have oiled her a little.

Before we begin to calculate the power of the steam by horse-power, we will have a run down on the railroad of time, and history of the steam engine, and get out at the station of the year 1663, here, we find, the Marquis of Worcester has a square boiler with circular sides, bolted together at the corners, built in with brick-work, the steam from this boiler is carried to the surface of the water in the well by a pipe, which makes a partial vacuum or removes the weight of the air from that part of the surface of the water while the air is pressing on the other part of the surface of the water, and forces the water up the other pipe, for there must have been two employed in this operation; by this plan you can see what the common pump does when the handle is moved up and down; it does not do as a great many people think draw the water, it need not, it simply draws up the air from that part of the surface of the water in the pump, and then the pressure of the air on the surface outside nearly 15 lbs. at the level of the sea per square inch, forces the water up above the lower valve, while the bucket or plunger of the pump brings or forces it through another valve into the discharge pipes. If we can raise water within Ontario 28 feet with a common pump, we may consider it pretty good, but down at the sea level it can be raised 50 feet, mark the difference between raising and forcing. By this means, (or engine the marquis calls it), water was raised several feet. Forty years ago from this time, a globe-shaped boiler was made and the steam was directed by a pipe against the fans of a wheel on journals and a crank which worked a steamboat in Spain, and a drug or medicine mill for Dr. Denys Papin in England, who invented the safety valve cylinder and piston. Being assisted by several other doctors and learned men, they produced by the great help of Thomas Newcomb, a Dartsmouth blacksmith, in Devonshire, England, the first atmospheric engine; in the year 1705 the engine was used in one of the mines there for pumping out the water. This engine or cylinder only took steam under the piston and pushed it up and then it was condensed by a jet of water let in, which made a partial vacuum, the weight of the air or atmosphere pushed it down, which worked the pump by the beam fastened to the piston rod. In the year 1710 one of those engines was erected in a coal mine in Warwickshire, which employed 500 horses costing £900 per year. The steam and water taps had to be opened and shut by hand, many plans were invented and improvements made. Springs and weights soon took the place of the hands. In the year 1767, Mr. Smeaton, Mr. Brighton, and others made the safety valve lever and weight. They made a cylinder and pump 18 inches diameter each, and made the beam longer on the pump side than the piston, so as to give a longer stroke to the pump and get 10½ lbs. on the square inch on the piston, and when the water, condensed steam came out of the cylinder, it was 180 Fah. and by this means the latent heat of the steam was discovered, or better understood, that is, one gallon of water raised into steam 15 lbs., 252 Fah. will heat 5½ gallons of water from 32° up to 212°, or in other words, will heat nearly 6½ gallons of water up to boiling point. In the year 1774, Mr. Smeaton put in in Long Brenton Coal Mine a 52 inch diameter cylinder and ten feet stroke; all over Europe men's minds were working about the steam invention; in fact they had the steam engine on the brain, and, was foretold by many what great feats would be accomplished by it, in our day, as we tell what will be done by future men with electricity and other powers hidden by nature from our view. In the year 1736, James Watt was born in Greenock; at the age of eighteen he was apprenticed to a mathematical instrument maker and repairer. In those days it meant such as colleges, doctors and land surveyors. Instruments clock-work, cutlery, ship's compasses, quadrants, etc. And in the year 1757, he was appointed and admitted into the Glasgow College University as Mathematical Instrument Maker. In the year 1759, he had to repair a modal of Dr. Papin's engine, which led him to suggest improvements. In 1763, he also had to repair one of Newcomb's engine models, which led him to make experiments, by first making a separate condensing cylinder and letting the steam into it by a valve whereby the piston cylinder was cooled by the jet of water, but formed a vacuum at once and increased the speed of the engine, it then occurred to him if he put a cover on the top with a stuffing box, he could make the piston move up and down by steam, increase the pressure of the steam to two atmospheres, and also increase the speed, here he got on, as he said, the weak side of nature or her laws. To work his condensing cylinder, he had to put in an air pump which he did, and it worked well. His next move was to make a large engine (protected by his patent) for one of the Cornish mines, to draw up the water, it worked well, but he wanted more power, to draw up the water with such a heavy pump rod in a deep mine; he then thought if he could get the steam on the top of the piston, to draw it up, instead of in the bottom, to put it down, he might do better and besides he had to force the water up through a pipe attached to the pump, the weight of the pump plunger and rod would help do so; here he was forced to try what he could do with a cover; on this being done he was led to think about a different shape valve for admitting the steam into the cylinder (during all this time he had many friends in the college, Dr. Dick, Dr. Black, Mr. John Robinson and other professors gave him good suggestions). Instead of a piece of chain attached to connect the piston rod and the beam, he was forced to invent and make the parallel motion which required such a mathematical mind as he had to work out. Here we see him working and thinking about the slide valve and the cylinder, how to let the steam in and out at the same time. Mr. Gainsborough, Mr. Hornblower and others, disputing with him about the right of his patent; at this point he was obliged to invert and make the equilibrium valve, now used in mine engines, that is, to let the steam from the upper part of the piston, to the lower part to balance the weight of the pump rods in the shaft. In the year 1769, the Duke of Hamilton, Kenneil, Scotland, got an engine made for his estate, by the Carron Iron Works, which was set going to manufacture those engines by Dr. Robuck, and Mr. Watt who obtained patents for their improvements, and received ⅓ of the savings of the coal, over the former engines. In the year 1773, Dr. Robuck withdrew, and Mr. Bolton joined Mr. Watt, who also made improvements and took out patents. The engine they erected for their own use, plainly told them that a crank, the throttle valve and governor, was wanting to regulate their engine that worked their own machinery, these were added although claimed to be invented by Mr. Hulls and Washborough of Bristol. In 1778, Mr. Bolton and Watt, improved the slide, or steam valve, so as to cut off the steam, before the end of the stroke; here it was made known that steam would expand, and form a cushion or spring, in each end of the cylinder, so that the crank may pass the centre easily; also they balanced the fly wheel to the weight of the crank, piston and rod; by this means they raised the steam to 30 lbs. in the boiler and sent it in with a blow on the piston, which pushed it up ⅜ of the stroke and then it was cut off, and the expansion of the steam took it to the end of the stroke; the momentum given to the fly wheel carried the crank over the centres. The next idea with Mr. Watt was to let off the steam in the air not condensed, but this idea seems to have taken some time to work out, for his mind was so much engaged in improving his tools, and workmanship while the high pressure or non-condensing engine was being improved, the mine or condensing engine was also being improved, the valve gear was also very much altered, and clockwork piece of machinery was also invented and fastened to the beam of the engine to count the number of strokes the engine made in a month. In some of the mines, the engines had to work faster in winter, than in the dry part of summer, which caused the cateract to be invented, and put to work by this pump, which allowed the water to escape from under the plunger pole, by opening and shutting a tap so much (I have made many of them,) that the engine could be made to work one stroke, or 20 in a minute. Such was the progress of the steam engine. In the year 1786, Oliver Evans of America, contrived to put a long round boiler with one flue and a beam engine into one of the reserve boats which drew much attention to altering the wagon boiler to its present shape. In 1801 Edward Cartwright made a portable engine and attached the cylinder to the boiler on wheels. In 1802 Trevithie and Vivian put their cylinders into the boiler (to keep it warm) of their first locomotive; (those men I knew). By this time quite a number of men, and plans were engaged to save coal, and burning the smoke, for it was plainly seen and felt that there was a tremendous and useful power in fire and water being brought together, economically. 1815 Mr. Woolf introduced his high pressure engine into the mines for drawing up the coal, and sending down materials, and a few years later for letting down, and drawing up the men and their tools (I, too, have enjoyed this ride). To such a perfection is the engine now-a-days brought, that we could not carry on our business without steam, railways, steamships, steam printing presses, steam heating, steam cooking, steam music, steam men, etc. (Barnum) we must not forget, that our faithful little engine has been pumping away all the time we have been running from place to place and date to date to see how the engine has grown, to what it is. It is now time to slack our fire, for we have nearly sent up, into the reservoir, our days 10 hours work 388,800 gallons of water. I want you now to push the burnt wood back off the bars into the bricks and throw a little ashes on it, close up all the doors and dampers, open the feed taps, check the engine, open the tap or screen, blow-off tap, now the bottom one, blow through the glass, and guage taps, safety valve, and steam guage tap, see all is working well; close the blow off's, the water is clear coming out, fill up the boiler to the water line, the steam is down, and the engine is stopped, clean off all the oil and dirt; feel every journal, and note every part, open the drain taps, draw her cover or duster over her, and wish her a good night's rest. Wipe the oil cloth with a damp cloth, also the windows and paint work; we will lock up the doors and go home to supper. If you will call at my studio at seven o'clock, we will talk over other subjects. At the appointed time my little room was filled with friends. One says, "what a beautiful view you have of Lake Ontario." Yes, I have been looking at that lake for 24 years past, and could tell many things about it, but cannot now spare the time. Here is a telescope to assist your eyes? another says "what a nice little air pump." Yes I could also say much on its wonders. "Is that a telephone?" Yes! I can speak to Mrs T—— in the kitchen quite plainly. I could tell you how it is made, and much in the laws of Nature here developed, but forbear for want of time. "Is this a magic lantern?" Yes, and here are a hundred slides to look at. How small to compare with those beautiful pictures I saw you put on the sheet in the schoolroom, yes and when this noble Scientific Magazine can afford room, I will give you 50 pages on those subjects. You see that barometer and thermometer, this desk and book-case, with an hundred volumes of books. All these things I have, instead of smoke, you say you have been smoking for 20 years past, and it cost about 25 cents per week equal to $13 × 20 = $260. I too have spent about 25 cents per week for 31 years, not in smoke but what you see = $400 worth what a difference. I believe, my dear friends, tobacco is causing more blindness, insanity, head and chest diseases, than any other thing besides; drunkeness, it also leads to it. Thousands of young children are cut off for want of pure air, but the house is full of tobacco smoke and smell, and so are our streets; every place, the smoke is let off in your face, without your permisson; be sure to keep brain cool and calm, free from any stimulating fumes or drinks, you need not be afraid to read or write a few hours every day in your own little room, with pure air. A well balanced mind, healthy body, a long night's rest, then you will be ready for your engagements in the morning. Good night. Meet me at the engine house, at 6.30 to-morrow morning; at the proper time, she is set going again for another day, and we will now talk about the nominal horse-power of our clean little engine. I told you that one of the mines employed 500 horses during one year to draw up the water in leather pails and the copper, tin, lead, iron, coal etc., in wood buckets attached to a rope passing over a pulley; the work of those horses, amounted to 16½ millions of pounds, divide this number by 500 horses it will give 33,000 pounds for each horse per day, 10 hours, one foot high; 33,000 lbs ÷ 10 = 3,300 lbs. per hour ÷ 60 = 55 lbs. per minute. The pails held about 55 lbs. of water or 5½ gallons, was drawn up every minute, this is what is called the nominal horse power by Mr. Watt or 33,000 lbs. drawn up one foot, in one minute is equal to the power of a horse in the 10 hours. Some of the mines were deeper than others, suppose the mine to be 150 feet deep, and if the horse draws up 220 lbs., 20 gallons will be equal to the day's work, or 33,000 foot pounds, or pounds one foot high per day, this was said to be (by Mr. Watt, and has not yet been altered) the power of the horse, a standard measure, like a foot a yard, a bushel a ton. This work performed, cost the mine company about five shillings, $1,25 per day. Mr. Watt offered to make an engine to do the same work for less money; he then calculated the size of the engine, the work required, or water to be drawn up, and called it so many horse power. An engine he made with a 50-inch cylinder, 10 feet stroke, 10 strokes per minute, 15 lbs. pressure of steam is called 178·5 horse power 50 × 50 ÷ ·7854 = 1963·5 square inches on piston + 14 lbs. steam on the piston + 290 feet, piston moves per minute = 5,890,500 lbs. power ÷ 33;000 lbs. = 178·5 horse power; this engine was low pressure. The exhaust steam discharged into another cylinder to be condensed by a stream of cold water in a vacuum, kept free from air by the pump, the difference of air between the atmosphere and the working of the pump is by this means given to the engine, which is considered to be about 11 pounds added to the steam. For you to clearly understand what the pressure of the atmosphere is on a vacuum, we will connect this little pump to the boiler, it is one inch square with a cover on the top. The piston and rod are balanced by this cord and weight over that pulley; the piston is now at the bottom, this little tap has let out the air that was under; now let on the steam. Close that little tap, you see its takes 15 lbs. (at the sea level), Toronto 350 feet above, to raise it up, and this is the pressure of the atmosphere on every square inch, you are now if the end of the exhaust pipe were open to the atmosphere, it would press into it the same, so that it would require a higher presture of steam to push the piston down and the exhaust steam out, this is the low pressure engine. But our own nice little engine, which has been working away, is a high pressure, see how she throws out her exhaust steam in balls and equally between each stroke. I told you her cylinder is 12 inches diameter 12 × 12 round inches = 144 × 7854 square area = 113·097 × 45 steam pressure (the safety valve, you know, we set to blow off at 50lbs. and the engine and pumps. We started with 5 lbs. which leaves us with 45 lbs. for work or power,) = 5089·365lbs. on the piston multiplied by the distance, the piston moves in the cylinder, 2 ft. up and 2 ft. down = 4 ft. = 20357·46 lbs. × 30 the number of strokes the engine makes in a minute = 610723·8 ÷ 23,000 lbs = 18·567 horse power, according to Mr. Watt's rule for his engine, but we have been working with only 30 lbs. (35 on the guage) which is only = 12·34 horse power, and in 10 hours we pumped up 388,800 lbs. of water, divide this by 33,000 lbs. = 11·782 horse power, you see by this the rule is good for one foot high, but we have pushed along

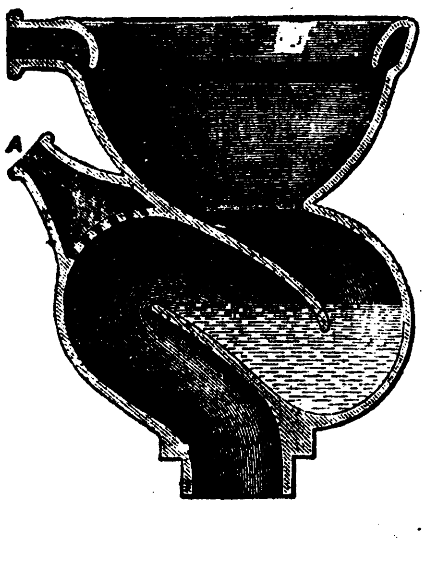
1,500 yards of water in a four-inch pipe, and up 150 ft, high. If we divide 33,000 lbs. by 150 ft. it will be 220 lbs for a horse power. If we divide our days' work 288,800 lbs. by 220 lbs., it will give our day's work equal to 1,767 horse power; from these considerations it must be very clear to you, that this rule will not make known to us the power of our high pressure engine, and that some other must be brought before us by some one, and the sooner the better. I will now show to you we have not lost any power or made any mistake in our calculations; that whatever power or pressure is put on the piston and steam, is the power. It must be found in work done, viz., the area of our piston = 113·097 square inches multiplied by the steam there. I told you our engine would work for a short time with 25 lbs., the steam valve being fully open, and the fire kept for that purpose, also she cut off 4 in. before the end of her stroke will give 20·83 lbs. for the full stroke instead of 25 lbs. for 5-6 of it, and to allow a little for drawing out the air or filling the role case and nozzle on the one side; while the other is pushing the water out from the nozzle into the main, we will allow 3 lbs only for cutting off, × by 22 lbs. = 2488·134 lbs. × 4 ft. =9952.536 lbs. this is the power of the engine up and down every stroke, with regard to the number of strokes per minute depends on the boiler-room and ability to generate steam enough to fill the cylinder so often in a minute. Now we want to find this power on the effect of the other end of our supply pipe; first the column of water 150 ft. high × 5·454 lbs. in each foot of pipe = 818·1 lbs. of water to be raised every stroke of the pump before any will run out. Secondly, the water laying in the 1500 yards = 4500 ft. of main pipe 4-inch is equal to 2 lbs. per foot = 9000 lbs. + 818·1 = 9818·1 lbs. of water every stroke of the pump. The pressure of the steam on the piston = 9952·536 9818·1 lbs. of water = 134·436 lbs. of steam over for friction or the rubbing of the water against the pipes. Here you see the whole of the power accounted for, which ought to be the rule for the power of the engine, and if you want one first find what you have to do, and then the pressure on the piston beside the moving of the engine, pump, etc. The size of the boiler you can find by the number of strokes per minute, always provide plenty of steam room, and run your steam up to 10 or 15 lbs. higher than you require, so that the fire may not be forced, but burn naturally with the dampers nearly closed. You ask me what pressure the steam leaves the cylinder? About 17 lbs. in this case, the faster you run the higher the steam ought to be; you must not forget the higher the steam the stronger the boiler cylinder, and cost more for repairs. I prefer to use steam about 50 lbs. or less, because I have found it to be less cost. We will now look into the fire, I told you we have no bridge but the bars and brickbed are on an incline from the dead plate to the back of the boiler, here is our bridge, about 6 in. between the bricks and the boiler, you see every time I put in a stick, I push back the charcoal, so that the gas may pass over it, to be burnt, our fire bars are 3 ft. 6 in. long by 3 ft. wide = 10½ square feet to perform this work it takes two cords of hard wood per six days. To-morrow we will fire up with coal, without any alterations in the fire-place. At the proper time we have a nice clean fire of ⅔ hard and ⅓ soft; you see every time I put in coal, I push back the clear burning coal and lay the new on the dead plate which allows the gas to pass over the clear burning coal; by this means we burn pretty much of the smoke, now if we had a bridge I would have a clear fire about one foot deep melting the bars and bricks; but this way we have no more than 4 or 6 in. of solid fire acting on the full length of the boiler instead of so much heat under one part, liable to burn the plate or rivets. To fire as we do and perform the same work every day it will take 1⅓ tons of coal for every six days. I have run a boiler for twenty years, and fire bars 10 like these. The engine and boiler with a little repairs is good; to-day the cost for every thousand gallons you can count for yourself (with labour 10 cents). I must not infringe on our good editor's space, in his excellent magazine just now but will bring before you other pictures, through his valuable kaleidoscope, some future day, (all questions answered for information only). Now, my dear young friends, allow me to advise you to accept of our nice little engine, as an example for our journey through life. At the end may we be able to account for every pound of privilege which has fallen to our lot. God made man upright, but they have sought out many inventions; as our first parents had the poisonous tree of the knowledge of good and evil amidst the Garden, so have we before us, good and evil for ourselves and our children to guard against evil.

P. T.
Engineer, Toronto.

A NEW WATER CLOSET.

The London *Ironmonger*, in its last issue, publishes an account of a new water-closet made by C. Winn & Co., of Birmingham. The article says:

"It is made entirely of one piece of earthenware, and a reference to the accompanying sectional illustration clearly explains the arrangement. It is trapped above the floor line, and is narrowest at the inlet, rendering stoppage scarcely possible. At the apex of this trap a deodorizing chamber is provided, to be filled with charcoal in connection with the ventilating outlet A. The area of the closet for solid matter is very small, and there are no spaces where soil can in any way lodge or accumulate. The flushing apparatus, which, it will be understood, is an independent pump, having no connection with the closet except by the inlet pipe, is of the best-known kind, and the force of water is concentrated where most required. After use, the whole of the water, soil, &c., passes from sight. We understand these closets are giving great satisfaction wherever fixed. The firm also make another on the same principle, called a shop-closet, having a strong grating over the outlet, which prevents the loss of anything thrown in by accident."



A water-closet made in this form has some very important advantages, especially in the fact that the whole of the trap is smooth and without joints to catch soil or other solid matter. In effect, this closet is identical with an ordinary hopper, depending, as it does, entirely upon the one trap for its security. In some portions of the Eastern States the hopper is in great favor. It certainly does very well, and gives much greater satisfaction than could be expected. From the description, we judge that an unusually violent flush of water is obtained by means of a special pump. This, in connection with the form of the basin and trap, would effectually empty the latter at each discharge.

NEWLY-DISCOVERED NERVOUS ENERGY.—During the past year, Dr. Brown-Sequard has often noticed that the irritation produced by a transverse section of the base of the brain produces opposite effects upon the nerves which are before and behind the section. Following the lead of these indications, he finds that some parts of the nervous system are able, when irritated, to produce a sudden notable augmentation of the properties, or of the motion or sensitive activities, of other parts of the system.—*Comptes Rendus.*

NEW THEORY OF THE FORMATION OF HAIL.—Colladon supposes that the heavy rains and the hail-storms which follow them produce, by the very effect of their fall, a vertical wind due to the air which they draw from the upper regions of the atmosphere by their own friction. This vertical wind, which extends from the cloud to the ground, necessarily leaves behind it a partial vacuum, which produces an influx of air during the whole continuance of the storm.—*Les Mondes.*

TOM THUMB HOT-AIR ENGINE.

One of the great wants of the day is a motor for small machinery, which shall avoid the danger and inconvenience of steam. This is accomplished in the Tom Thumb caloric engine, recently patented, which makes use of the expansive force of heated air alone. Its success is based on employing a comparatively low temperature—250° to 300° Fah.—producing a pressure of four to five pounds per square inch, and operating on a broad diaphragm piston of relatively short stroke. The piston is formed of two circular metallic discs, having between them a flexible diaphragm composed of a layer of vulcanised gum elastic sheet, and over this externally a layer of canvas, which protects the gum and prevents it from yielding to pressure. A clamp ring attaches this diaphragm air-tight to the rim of a dish-shaped vessel, so as to allow of a motion in the piston to the extent of about one-third its diameter. This is the working cylinder, from which, it may be observed, the boring and fitting, as well as friction incident to the ordinary arrangement, are quite eliminated. The piston box forms the upper member of the machine, the connection of piston and crank being apparent in the engine. The central part, the heater, is a tight metallic box, the interior heating surface of which is greatly increased by numerous thin plates or ribs cast in connection with the bottom and rising almost to the top nearly the whole length. The heat being applied to the bottom of the box, the lower edges of these ribs are virtually in the fire, and thus the whole are readily kept at a suitable temperature.

At the bottom is another piston box similar to the first, but larger, and having its piston below, with a valve in it opening inward. This is the air pump, and it is connected with one end of the heater by a pipe which has an automatic valve at the lower end, opening upwards. As this piston descends it fills the box with air, which in ascending is forced into the heater, and the valve in the pipe prevents its return. The other end of the heater is connected with the upper piston box or motor by a pipe always open, the two thus forming one chamber.

The operation of the machine is thus: The heater being filled with expanding air, the motor piston is forced upward, and just before it reaches the highest point a tappet on one of the cross-head guides raises a lever, pivoted on the outer frame, which lever in rising forces upon a valve in the bottom of the motor box, opening a communication with the outer air, and consequently the pressure subsides, allowing the piston to descend. Soon after the main crank passes the top centre two long cranks on the ends of the shaft, connected with the crosshead of the lower piston by slotted rods, suddenly collapse the air-pump, blowing out the hot air from the heater and motor box through the now open valve in the bottom of the latter, and supplying its place with fresh cold air. The latter motor piston now descending presses and closes the latter valve, and the fresh air is confined between it and the valve below the heater, to be at once expanded for another stroke. The action of the air-pump not being against any pressure, little power is consumed in it. Like other caloric engines, it is single-acting, and the pulley serves also for a flywheel. The internal capacities of the air-pump and heater are equal, and about three times that of the motor vessel. This is important in order to obtain sufficient pressure at a temperature so low as not to injure the motor diaphragm—the gum being vulcanised to bear about 300° Fah. The simplicity and cheapness of construction of this machine will recommend it for a great variety of purposes. An engine suitable to propel a sewing-machine is about twenty-five inches high by thirteen wide, and heated by an oil or gas stove. An engine forty-five inches high is a quarter horse-power, while the full horse-power is six feet high by three feet wide. For further information address J. Jenkins, No. 3 South Tenth street, Philadelphia, Pa.

EARTHQUAKES.—Prof. Palmieri, of Rome, has been lecturing recently on the possibility of foretelling earthquakes, and has expressed the belief that they will yet be foretold about three days in advance of their occurrence. If they can be anticipated in season, a great saving of life and property will be ensured. We are mainly so free from these convulsions of nature in this country that we hardly realize how very calamitous they have and continue to be in other quarters of the globe. It is estimated that 12 or 13 earthquakes, more or less destructive, take place annually; and it has been acertained that the surface of the earth is never free from sensible evidence of constantly active earthquake agencies. No land entirely escapes; but volcanic districts are the most frequent sufferers. Beginning with these, they have been known to pass beneath sea and land from one hemisphere to another until one-eight of the entire surface of the world has been disturbed. In the city of Antioch, (Syria,) 250,000 persons are said to have been killed in 526, a crowd of strangers having been present at the festival of the Ascension. This was the most terrible earthquake on record. In the great Lisbon earthquake (1755,) 60,000 people perished in six minutes. The rumbling subterranean sound was immediately followed by the shock, which threw down the principal portion of the city. The sea retired and returned in a wave 50 feet high. The adjacent mountains were so violently shaken as to be rent and hurled in fragments into the valleys below. Thousands of persons fled from the falling buildings to the marble quay, just finished at great expense, when the quay suddenly sank; the waters closed over it; boats, vessels, and human beings were drawn into the whirlpool, and not one of the bodies rose to the surface. Over the spot the sea stood 600 feet deep, burying the greater portion of the life and wealth of the capital. The extent of the surface of the earth shaken by the agitation was four times greater than the whole of Europe. In Calabria, at the end of the last century, 40,000 lives were swallowed up by an earthquake. As many as 13,000,000 of human beings have, it is calculated, been lost by such convulsions. Egypt has probaby been less visited by them than any other country, but a serious earthquake took place there in 1740, and Holland, notwithstanding its loose alluvial soil, has felt their influence. The earthquake at New Madrid, Mo., (1811,) is the most important known in this republic. That was one of the few examples of the incessant quaking of the ground, far from any volcano, for several successive months. For 300 miles, from the mouth of the Ohio to that of the St. Francis, the ground rose and sank in vast undulations; lakes were formed and drained; the surface burst open in fissures, from which mud and water were thrown to the height of 60 or 70 feet. All theories as to the cause of earthquakes agree about the connection between them and volcanoes. The existence of a molten fluid mass in the centre o the earth is generally conceded; hence the generation of immense quantities of elastic gases from such a vast source of heat would naturally produce explosive force enough to create earthquakes. The latest, and perhaps the most satisfactory theory, has been put forward by the Rogers brothers, who regard the direct cause of earthquakes as the actual pulsations of the fluid beneath the crust of the earth, propagated like great waves of translation from prodigious ruptures, produced by tension of elastic matter, and floating forward on its surface the superimposed rocky crust of the globe. This theory harmonizes with the phenomena of earthquakes, and is remarkably confirmed by the structure of many mountain ranges.—*New York Times.*

COPPER MINING IN NEWFOUNDLAND.

It may not be generally known to the readers of the *Engineering and Mining Journal* what large quantities of copper ore have been shipped from Newfoundland, especially during the last four or five years. We condense the following from a letter from the special correspondent of the Montreal *Gazette*, dated St. John's, Newfoundland, May 19th :

Bett's Cove copper mine was opened in 1874, under the management of Mr. Ellershausen ; it yielded, in the first four years, 102,400 tons of ore, the value of which was 512,000*l*. The price of copper ore fell to a very low figure towards the close of the year 1878, and a new mine was opened by the Bett's Cove Company at Little Bay, where ore could be extracted at a very moderate expense. Mining operations at Bett's Cove have been since carried on upon a comparatively moderate scale. A staff of 150 or 200 miners was still kept at work, and with remunerative results. Some of the pillars of ore left for the support of the roof along the various galleries were latterly removed as their contents were of great value. When nearly the whole of these pillars were removed, in one particular portion of the workings, on Wednesday, May 5th, just before dusk, those on the surface noticed some alarming symptoms : the ground began to shake, stones rolled down from the cliff and plunged into the lake below. In a few seconds, with an awful crash, the whole top of Bett's Cove Hill fell in, leaving a yawning chasm more than 100 feet deep, where before was solid rock. As the catastrophe had been foreseen, no one was in the workings beneath, all the miners then under ground being in a safe portion of the mine. The machinery which had formerly stood on the portion of the surface which sank had all been removed. Great masses of valuable ore were exposed and rendered accessible, which could only have been reached by great expenditure of time and money. Operations will now be resumed on a larger scale, and a very considerable shipment of ore from Bett's Cove, during the summer, is anticipated.

LITTLE BAY MINE.

This mine was opened in August, 1878, and the anticipations regarding its productiveness have been more than realized. Since the shipping season closed, in December, 1870, about 650 men have been employed, and these have brought to the surface, during the winter, close on to 12,000 tons of good ore, which is now ready for shipment. The first cargo of 200 tons was despatched three days ago. A considerable increase of the working force has been made ; and now that the fine weather has opened, operations will be greatly facilitated. It would be safe to predict that ere the shipping season closes, 15,000 or more, probably 20,000 tons of ore additional, will be extracted, making a total for the year of over 30,000 tons. As the workings deepen, the ore improves in quality, and the extent of the deposit seems even greater than was at first supposed. The Robert's Arm Mine, worked by Mr. Ellershausen on his own account, is also very promising, and extensive works have been erected there. The new mine at Seal Bay, owned by Messrs. Browning & Son and others of St. John's, and leased by them to a wealthy English company on a royalty, promises to equal any of its predecessors. The preliminary operations carried on during the winter are now completed. Various other mining locations are awaiting their turn for examination. Since the first discovery of copper here in 1864, sixteen mines have been opened. Of these, two have been abandoned, five have suspended working from a variety of causes, one is but partially worked, and eight are now in full operation. Mr. Howley, assistant geologist, estimates the total area of the perpentine formation in the island at 5,000 square miles. In his Geological Report for 1875, after a survey of the mining region, Mr. Murray says : "I feel bound to state that the experience of the late investigation convinces me, more than ever, that many of the northern parts of this island, and the great bay of Notre Dame in particular, are destined to develop into great mining centres, should capital and skilled labor be brought to bear in this direction." It must also be borne in mind that copper is not the only mineral found in this island. Lead has been discovered at various places, especially along the west coast ; the equivalent of the auriferous rocks of Nova Scotia are found here, although gold has not yet been discovered ; while in the carboniferous region of Bay St. George and Grand Lake, coal-beds of greater or less extent are known to exist. Borings were made last summer in the neighborhood of Grand Lake, and with such encouraging results that the government has ordered them to be resumed this year. Thus the prospects of an extensive mining industry in Newfoundland are of a very encouraging character. The progress of copper-mining around Notre Dame Bay is steady. Tilt Cove mine, the workings of which have been suspended from year to year, owing to a misunderstanding between the owners, Messrs. Bennett & McKay, is to be sold next month, by order of the Court of Equity. There are immense deposits of ore there, and should it be purchased by an enterprising individual or company, it is likely we shall hear of extensive operations, requiring a large number of workmen.

NEW MAP OF NEWFOUNDLAND.

Our Provincial Geologist, Alexander Murray, C.M.G., F.G.S., has just brought out a splendid map of Newfoundland, on a large scale, published by Edward Standford, London. The results of the latest explorations have been embodied in this map ; the routes of the electric telegraph lines, of the projected line of railway from St. John's to St. George's Bay, of "Harvey's Road" from Bay of Islands to the Southwest Arm of Notre Dame Bay, which was recently surveyed, are all accurately laid down. The whole of the Labrador coast from the most recent Admiralty surveys is also depicted. Mr. Murray's name is a sufficient guarantee of its accuracy. The price is four dollars.

A REMARKABLE SURGICAL OPERATION.

For about a year a little girl, ten years of age, has been a patient in the Country Hospital, Chicago, suffering from a burn so extensive that the ordinary treatment by skin grafting hopelessly failed to effect a cure. It was, therefore, decided to try the experiment of transplanting a large section of skin partially detached from a healthy subject, the girl's twelve year old brother consenting to be flayed for his sister's sake. Drs. Lee and Feuger conducted the operation, which is described as follows by a reporter of the Chicago *Tribune :* A curious box had been constructed under the supervision of Dr. Murphy. It resembled nothing more than a pair of scissors opened out, except that one part was about four inches higher than the other. On one face of the cross the little gril was laid face downwards. On the other the boy lay on his side so that his leg crossed his sister, the part of the thigh from which the skin was to be taken being just over the burn of the girl. The children were kept unconscious during the entire operation by the use of ether, and two assistants constantly directed the vapor of carbolic acid on the wounds of both the boy and the girl. The surgeons then cut from the boy's thigh a leaf of skin four inches wide, five inches long, leaving it attached by the under side. The wound of the girl was then cleaned of its decaying matter. The flap of the boy's skin was then laid on the wound and stitch to the outer edge of the skin about the wound, without cutting the edge, which rendered it still a part of the boy's fleshy covering. This was done to secure the vitality of the boy for the skin which is expected to grow to be a part of his exhausted sister. The boy's wound was ugly in appearance, but the skin had been separated, or dissected, so nearly that it will be easy to heal over by the usual process of grafting. The children, as they lay in this position, were so bandaged that they could not possibly tear the flap of skin or move from their position. Thus their dual existence begun, which will last for about three weeks. By that time the success of the operation may be known. During that length of time the boy's vital forces will be in a measure transferred to the assistauce of his sister, and, at the end of that time, it is hoped that the transplating will be complete and the skin firmly grown on the burned portion. The flap is not quite large enough, and, before the skin is finally severed from the boy, a still further portion will be dissected and applied to the remainder of the wound. The little girl's pulse dropped considerable toward the close of the operation, but she was revived by the application to the nostrils of a cloth dipped in brandy. The operation was a success as far as it went, and, if nature takes hold in the manner expected, the brave boy can congratulate himself on having saved his sister's life.

THE "CASA DEL CENTENARIO" AT POMPEII. The Naples correspondent of the *Daily News* writes : "The house which has begun to be excavated at the celebration of the centenary of Pompeii, and is, therefore, called 'Casa del Centenario,' and from which I then saw three skeletons dug out, has proved to be the largest hitherto discovered, and is of peculiar interest. It contains two atria, two triclinia, four alæ or wings, a calidarium, frigidarium, and tepidarium. It occupies the entire space between three streets, and most likely a fourth which has yet to be excavated. The vestibule is elegantly decorated, and its Mosaic pavement oramented with the figure of a dolphin pursued by an sea-horse. In the first atrium, the walls of which are adorned with small theatrical scenes, the pavement is sunk and broken, as if by an earthquake, and there is a large hole through which one sees the cellar. The second atrium is very spacious with a handsome peristyle, the columns—white and red stucco—being twenty-six in number. In the centre is a large marble basin, within the edge of which runs a narrow step. On the pedestal at one side was found the statuette of the Faun which I lately described. The most interesting place in the house is an inner court or room, on one side of which is the niche, with tiny marble steps, often to be seen in Pompeian houses. The frescoes on the walls are very beautiful. Close to the floor runs a wreath of leaves about a quarter of a yard wide with alternately a lizard and a stork. Above it, about a yard distant, droop, as if from over a wall, large branches of vine or ivy and broad leaves like those of the tiger-lily—all very freely, naturally, and gracefully drawn. At each corner of the room a bird clings to one of these branches. Then comes a space—bordered at the top by another row of leaves—in which is represented a whole aquarium, as if the room were lined with tanks. There are different sorts of shells and aquatic plants laying at the bottom of the water, and swimming in or on it all kinds of fish, jelly-fish, sepias, ducks, and swans, admirably sketched with a light yet firm touch. The ripples made by the swimming ducks are indicated, and one duck is just flying into the water with a splash. On each side of the niche this amusing aquarium is enlivened by a special incident: To the left a large octopus has caught a monstrous muræna (lamprey)—which turns round to bite—in its tentacles; to the right a fine lobster has pierced another muræna through and through with its long, hard feelers, or horns. These creatures are painted in the natural colors very truthfully. On the left of the room, above the fishes, are two sphinxes, supporting on their heads square marble vases, on the brim of each of which sits a dove. Behind the niche, and on the left of the the room, runs a little gallery with a corridor underneath, lighted by small square holes in the border of hanging branches. The wall of this gallery behind the niche is decorated with a woodland landscape, in which, one side, is represented a bull running frantically away with a lion clinging to its haunches; on the other, a horse lying struggling on its back, attacked by a leopard; all nearly the size of life. On each side of the doorway is painted, respectively, a graceful doe and a bear. The other rooms are also very beautiful; one with a splendidly elegant design on a black ground; in another a small fresco representing a man pouring wine out of an amphora into a large vessel. The bathrooms are large and elegant, the cold bath spacious and of marble. In one room a corner is dedicated to the *lares* and *penates*, and in the fresco decoration, among the usual serpents, etc., I notice the singular figure of a Bacchus or bacchante, entirely clothed with large grapes. In one of the Mosaic pavements is a head of Medusa, the colors very bright and well preserved. As some of the rooms are only excavated to within two or three feet of the floor, it is possible that many valuable ornaments or statuettes may yet be found, as everything indicates that this splendid house belonged to some rich citizen."

Meat Bread.—M. Scheurer-Kestner has discovered the remarkable fact that the fermentation of bread causes the complete digestion of meat. He found that a beefsteak cut into small pieces, and mixed with flour and yeast, disappeared entirely during the process of panification, its nutritive principles becoming incorporated with the bread. The meat would also appear capable of preservation for an indefinite period in its new state, for loaves of meat bread made in 1873 were submitted to the French Academy of Science, when not a trace of worms or mouldiness was observable. At the beginning of his experiments, M. Scheurer-Kestner used raw meat, three parts of which, finely minced, he mixed with five parts of flour and the same quantity of yeast. Sufficient water was added to make the dough, which in due time began to ferment. After two or three hours, the meat disappeared, and the bread was baked in the ordinary manner. Thus prepared, the meat-bread had a disagreeable sour taste, which was avoided by cooking the meat for an hour with sufficient water to afterwards moisten the flour. The meat must be carefully deprived of fat, and only have sufficient salt to bring out the flavour, as salt by absorbing moisture from the air would tend to spoil the bread. A part of the beef may be replaced with advantage by salt lard, which is found to improve the flavour. The proportion of meat to flour should not exceed one half, so as to insure complete digestion. Bread made with a suitable proportion of veal is said to furnish excellent soup for the sick and wounded.

Recent Discoveries at Pompeii.—The recent excavation of a house in Pompeii, which is perhaps the largest and best preserved of all antique dwellings known, has excited the greatest interest. The building, two stories high, contains a double atrium and tablinium. In the middle of the spacious peristyle there stands an oramental fountain. A complete bath has also been found which doubtless will throw much light upon questions of arrangement. It is this part of the complex Roman dwelling-house upon which the opinions of archæological authorities have hitherto been most at variance. The decorative paintings of the interior have been executed with great taste and are well preserved. Those of the second story, representing marine animals, are especially interesting. The frescoes of the two wings of the building show scenes of animal life, like those so much in vogue about the advent of the Christain era, and known from many examples previously discovered in the buried cities. These excellently preserved works, so characteristic of the time and place in which they were executed, cannot but add valuable illustrations to the history of Roman painting. They are said to markedly betray the influence of great art. An early publieation of the plan and details of the house is promised by the Archæological Society.

Avoidance of Vibration with Machinery.—Mr. W. H. Delano, in a paper read before the British Institution of Civil Engineers, spoke of the use of asphalt for the foundation of machinery, notably for those running at high speeds, the asphalt having the valuable quality of absorbing vibration. This was instanced in the case of a car disintegrator, which being mounted in a pit lined with bituminous concrete, was worked at 500 revolutions per minute, without sensible tremor, whereas with the former wooden mountings on an ordinary concrete base, the vibration was excessive, and extended over a radius of 25 yards. At the Paris Exhibition of 1878, there was shown a block of bituminous concrete, weighing 46 tons, forming the foundation of a Carr disintegrator, used a flour-mill, and making 1,400 revolutions a minute, a speed which would have been impracticable on an ordinary foundation. Extensive applications of the material for this purpose are made in France, especially in connection with steam engines and steam hammers.

British Railroad Accidents.—The *Railroad Gazette* is authority for the statement that in the year 1879 there were no less than 1,032 persons killed and 3,513 injured on the railroads of Great Britain. In this country, on the other hand, in spite of our reputation for recklessness, our railroads are responsible in the same time for only 180 deaths and 644 injuries to persons. This showing our contemporary holds to be highly creditable to American railway management.

It must be admitted, in making such a comparison, that the condition of things in the two countries is very different since on the railways of Great Britain there is naturally a much greater concentration of traffic both of passenger and goods; but, on the other hand, the immense extent of the railway lines operated in this country interposes a correspondingly greater difficulty in keeping the road-way in good condition, so that the comparison is not an unfair one.

Removal of Strong Odors from the Hands.—Ground mustard, mixed with a little water, is an excellent agent for cleansing the hands after handling odorous substances, such as cod-liver oil, musk, valerianic acid and its salts. Scale pans and vessels may also be readily freed from odor by the same method. A. Huber states that all oily seeds, when powdered, will answer this purpose. In the case of almonds and mustard, the development of ethereal oil, under the influence of water, may perhaps be an additional help to destroy foreign odors. The author mentions that the smell of carbolic acid may be removed by rubbing the hands with damp flax-seed meal, and that cod-liver oil bottles may be cleansed with a little of the same, or olive oil. —*Druggists' Circular*.

Healthy Property of Onions.—The healthy property of onions has never been fully understood. Lung and liver complaints are certainly benefited, or cured by a free consumption of them, either cooked or raw. Colds yield to them like magic. Don't be afraid of them. Taken at night, all offence will be gone by morning, and the good effects will amply compensate for the trifling annoyance. Taken regularly they promote the health of the lungs and digestive organs. An extract made by boiling down the juice of onions to a syrup, and taken as a medicine, answers the purpose very well, but fried, roasted or boiled onions, are better. Onions are a very cheap medicine, within everybody's reach, and they are not by any means as "bad to take" as the costly nostrums a neglect of their use may necessitate.

Carriage Building.

DRAFTING.

PRACTICAL APPLICATION OF THE ART TO EVERY-DAY WORK.

It is hardly possible in a series of articles designed for general reading, in a paper like the *Blacksmith and Wheelright*, to treat exhaustively of so comprehensive a subject as drafting. Our object in these articles as set forth at the beginning, has been to show the usefulness of drafting as applied to any and all of the mechanical trades. Accordingly, we have described tools and the means to be pursued for home practice, restricting ourselves to hints rather than attempting to convey specific instructions. If we have succeeded in interesting any of our readers in the subject sufficiently to induce them to commence its study in earnest, employing for the purpose some of the many carefully prepared text-books on drafting now to be bought, we shall have accomplished as much as was reasonable for us to expect. Before proceeding further, however, for there are many other points in drafting to which we may call attention with advantage to our readers, it is well for us to glance at some of the practical applications of drafting in every-day work; applications which may be made even though the student has but a limited knowledge of the art.

Constructing an article on paper, rather than in material is an advantage in many ways. In the first place, to make an accurate drawing of any article, however simple, necessitates, a familiarity with all the parts and details of that article, and, therefore, any one who does make such a drawing, becomes thoroughly familiar with its construction and its requirements in all particulars. In the next place, constructing an article upon paper, by which, of course, we mean carefully preparing a scale drawing of it, is very much cheaper than constructing it in material. A person thoroughly familiar with drafting tools and with a draftsman's method, is able to construct on paper, so far as planning and proportioning parts are concerned, to almost as good a purpose as though he worked in the material of which it is built. Hence, all experimental work should be performed upon paper rather than in the wood or iron as the case may be.

"Cut and try" rules are but expedients and are resorted to only by men who know of no better plan. The art of drafting obviates the necessity of all such methods and contributes a degree of certainty to mechanical work obtainable by no other means. The mechanic, furnished with a careful drawing of any article he is required to make, has an intelligent guide before him by which he is able to manage his work in all its parts. By a drawing, again, a person is able to study the effect of shape and the beauty of design, and the expediency of certain features of construction. He is enabled to show the relative proportion of parts before completing any portions of them. However, the advantages of drafting are so thoroughly understood by intelligent mechanics, that arguments are hardly necessary. A glance at the method of working out a scale drawing will be of interest to our readers in this connection. We shall address ourselves to the young mechanics. Suppose, for example, in looking over the files of the *Blacksmith and Wheelwright*, you see a design of a buggy or of a waggon, or of some peculiarly designed vehicle of some other name, which you would like to reproduce in material; or suppose you have an order for some special shaped vehicle, the original of which has appeared in a catalogue or in some periodical. The first step that suggests itself is a working drawing. The original sketch of the article may be to some scale, but for your purpose you want a drawing to a larger scale. You may want a new drawing by reasons of variation in size. You consider all these points and decide what fraction of full size you will make it. You may conclude it is best to have it an inch to the foot, or perhaps three inches to the foot. Some parts of it may be full-sized, but the general view should be to scale. The manner of working and the principles involved are the same whether for scale-drawings or full size, so we will not attempt to particularize. There are two general views which you require in your scale-drawing—an elevation and a plan. We give an example of these two views in the accompanying illustrations.

Having decided to what fraction of full size you will work and using for the purpose a triangular scale of the kind shown by fig. 4 in the article published in the April number, which also described its use, your first step will be to construct the elevation. You may find it desirable to use a little different style of wheel, or a little diffirent size of wheel from that indicated in the small drawing by which you are working. Draw the wheels as you propose to use them. You may substitute a different shaped body because you are able to buy bodies ready made. In your scale draft, make the body of the kind you propose to employ. Show every part upon the drawing as you are able to construct it. Having the several portions placed side by side as they will appear in the finished work, you can judge of the effect to be produced, from the drawing almost as well as though the finished article were before you.

After having thus made the elevation, as shown in fig. 1, you next require the plan, as shown in fig. 2. This is made to the same scale as the elevation, and the several parts in the two drawings correspond, as may be seen by comparing the two engravings. Besides showing the axles at right angles to the body, it is desirable to show the position of the front axle as it will appear when turned. It is necessary for you to note just how these parts will appear in the different positions in which they may be placed after the article is completed. Show the axle when shipped, by dotted lines, or, what is just as good, by using a different colored pencil. By this means you locate the striking plates upon the side bars of the waggon, and all other parts whose position is determined by the working of the article.

It is unnecessary for us to go into further details. Our object is accomplished by references of the most general character. Nor need we say much as to the means of using the drawings after they are made, because such drawings in the hands of the intelligent mechanic suggest their own use. If the builder has himself worked out the drawings he will, perhaps, make less use of his lines than of the knowledge of requirements which has been communicated to his mind by making the drawing. If the drawing is made by some other one than the builder, then it becomes the guide to which he works. He will work to it as he would work to written instructions of any kind.

We are aware that in carriage and wagon making, save only in some of the largest and most completely equipped establishments in the country, the use of drawings is quite exceptional. There are very few who understand the art of making drawings, and almost as few who understand the use of drawings after they are prepared, but such a state of affairs is no argument and has no special bearing upon the question. The use of drawings is in carriage-making omitted, not because they are unnecessary, but because the state of the art is not sufficiently advanced.

We venture to say that there has been more attention paid to the draftsman's art in carriage building in the past few years than ever before, simply because the means and the knowledge have been brought into more easy reach. We further believe that the employment of this useful adjunct is on to increase rather than that it is going out of use.

In the boundaries of newspaper articles, as we have already said, it is impossible to give more than a general account of drafting in its application to any particular business. We have, therefore, purposely avoided technicalities, and have shaped our remarks with respect to the interests of the general reader, rather than in a way to give special information to the mechanic. Before closing, however, we will offer a suggestion to the student or young mechanic.

We have said that one of the advantages to be derived from making a scale drawing of any article is the thorough familiarity with all the parts of a machine acquired in the act of drawing it. Accordingly no better means for the beginner in any line of trade, for becoming familiar with things, can be suggested than making careful drawings of them. Let him construct and plan and design on paper in his leisure moments. He will then acquire a desirable proficiency in drafting which some time will stand him in good stead, and he will also acquire a thorough familiarity with the objects with which he is associated. The young blacksmith may know, in a certain sense, all about ironing a waggon, but take him away where he can see no waggons; put him in a shop with forge and tools and iron, and tell him to shape a set of irons for a waggon, and he will most likely be lost. The general shape of each individual piece will doubtless be in his mind, but it will be intangible, and unless he has had long practice it will be an impossibility for him to reproduce in the metal any of the parts with any considerable degree of accuracy. On the other hand, if that same apprentice had practiced at drawing, which is, as we have said, really constructing the article upon paper, he would have so impressed on his memory the shape of every iron going upon a waggon that it would be comparatively easy for him to reproduce the pieces, even though no model or suggestions were at hand. If the "Young Mechanic," therefore, will occupy his spare time with pencil and paper, and square and drawing board, in constructing buggies, carriages, wagons, or, what is better, individual parts of each of these articles; if he will familiarize himself with wheels and hubs.

bodies and seats, springs, and all the other parts, that go to make up his work, he will be rewarded by more rapid advancement than if he learns simply by the old plan. Let it ever be borne in mind that one of the great advantages to be derived from drafting is a definiteness of conception, a positive knowledge of parts, and that this last is worth all that it costs in materials and labor, independent of the usual results attempted. The use of the drawings in the shop is not to be overlooked; but to many of our readers, it is, of necessity, a secondary matter.—*Blacksmith and Wheelwright.*

To "dry" linseed oil without boiling it, add to old oil about two per cent, of borate of manganese, and heat in water bath to at most 225° Fahr., stirring well.

A CURIOUS PHENOMENON.

The *Plain Dealer*, of East Kent, Ontario, states that a curious and inexplicable phenomenon was witnessed recently by Mr. David Muckle and Mr. W. R. McKay, two citizens of that town. The gentlemen were in a field on a farm of the former, when they heard a sudden loud report, like that of a cannon. They turned just in time to see a cloud of stones flying upwards from a spot in the field. Surprised beyond measure they examined the spot, which was circular and about 16 feet across, but there was no sign of an eruption nor anything to indicate the fall of a heavy body there. The ground was simply swept clean. They are quite certain that it was not caused by a meteorite, an eruption of the earth, or a whirlwind.

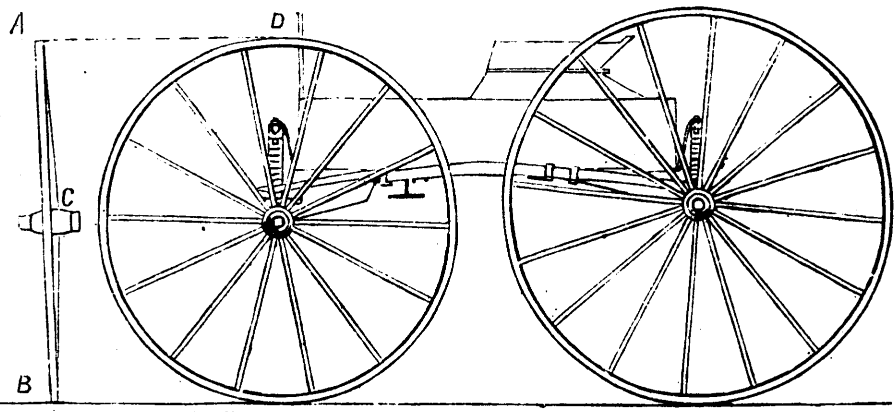


Fig. 1.—A SCALE ELEVATION (Half-inch to the Foot) OF AN OPEN BUGGY.
A B shows End Elevation of Wheel.

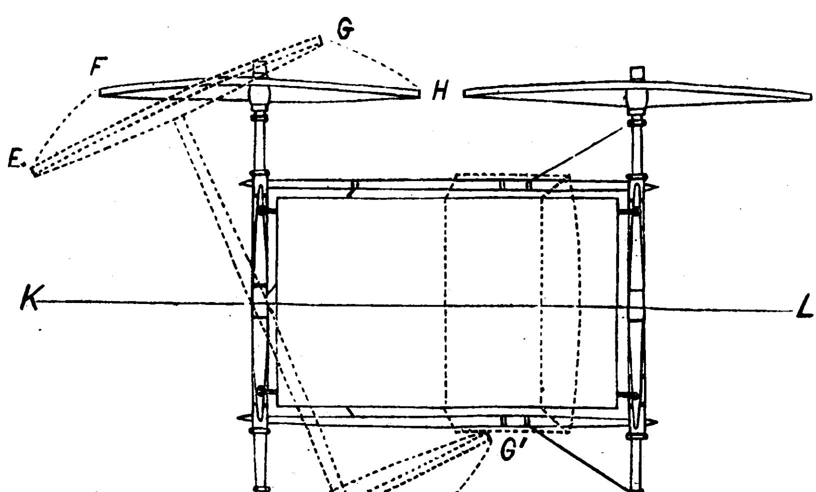


Fig. 2.—PLAN (Half-Inch to the Foot) OF OPEN BUGGY SHOWN IN FIG. 1.
Dotted lines show plan of seat, and position of forward axle when turned.

Scientific Items.

THE TAY BRIDGE DISASTER.

The London *Times* makes the following editorial comments on the report of the Tay Bridge Investigating Committee; "The Tay Bridge, it appears, was simply blown down by a violent gale of wind while a train was passing over it. This is the net result of the enquiry when disengaged from its technical details. The bridge was not strong enough to bear the strain imposed upon it, and it gave way in consequence of the inherent weakness and defects of its structure. The remoter causes which brought about this result were numerous and far-reaching. First, the spans af the bridge were enlarged beyond the original design in consequence of difficulties encountered in connection with the foundations. Then, for the same reason, piers consisting of cast iron columns were substituted for the piers of brickwork originally proposed. Moreover, the casting of these columns was very slovenly and imperfect; they were found in many instances to be of unequal thickness, and the boltholes connecting the various sections together, as well as those in the "lugs" to which the cross-braces were attached, were all merely cast and left conical instead of being properly drilled and reduced to a cylindrical form. Thus, the cross-braces, on which the whole strength of the structure depended as regards resistance to lateral pressure, were very imperfectly fastened, and, by consequence, ill calculated to bear the strain imposed upon them. Such being the initial defects of the bridge, its practical supervision was entrusted to a person very imperfectly qualified, in the judgment of the court, to undertake such a responsibility. What defects he observed he did his best to remedy promptly; but he does not seem to have been sufficiently alive to the serious indications of weakness and danger shown in the loosening of the ties of the cross-braces, to the effect of which, as seems most probable, the disaste must be immediately attributed. In fact, it is impossible to resist the conclusion that the bridge was an unsafe structure from the very beginning. A weak and slender bridge is built in a peculiarly exposed situation; no attempt is made to calculate the possible effects of wind-pressure or to provide against them; the structure is gradually weakened by excessive speeds, by stress of weather, and by the original fault of the materials used, and the defects are very inadequately remedied by a superintendent imperfectly qualified for such a task; a gale of wind comes, a train on the bridge is exposed to it, and the whole structure gives way at it weakest point. It is very difficult to admit that such an assemblage of causes and effects is rightly to be called an accident."

THE FALL OF THE TAY BRIDGE.

The first point ascertained by the discovery by the divers of a part of the wreck of the train is, that the bridge did not fall before the moment when the train was upon that portion that fell. If so, the idea of an independent destruction of the bridge by the gale, and of the leap of the engine and train into the chasm, must be definitey abandoned. Next, it is in evidence that the train was proceeding at a foot pace of three miles or thereabouts per hour. The theory of a violent concussion of the engine against the girder must, therefore, be given up. It would be too much to declare it impossible for the train to have left the rails (provided as they were with guards) at that speed; but it is extremely improbable that such was the case. We have thus to regard the girders that gave way as supporting a slowly moving weight of some 80 or 100 tons, distributed over about the length of one span of the bridge. As far as the weight is concerned, this would have added to the stability of the bridge, unless so considerable an amount of oscillation had been set up as would have passed the limit of safety where the bridge unloaded. We are thus led to regard the bad effect of the train on the bridge as mainly limited to the addition of a surface of some 2,000 to 2,500 feet to the resisting area of one or two girders at a time.

The actual shock caused to either unloaded or loaded girder by the fury of the storm is less easy to estimate. A pressure of fifty-five pounds per square foot is said in Knight's Encyclopædia of Engineering to have been actually registered at Glasgow Observatory; but the measurement of pressure is one thing, and the exceptional fury of a pulsating gust up a funnel like that afforded by a river valley is another. We will not attempt at the moment to estimate the maximum pressure. But we shall probably be within the mark in taking a minimum force of forty-five pounds per square foot. The are exposed by the girders is given at 7,615 superficial feet. But as this is not plain surface, but iron-net work or lattice, a large deduction must be made from that sum. On the other hand, the wind that rushed through one interval might strike another bar of the girder. If we allow one third of the exposed area to be resisting surface, we shall have again in round numbers 2,500 superficial feet. On this estimate the presence of the train on the bridge just about doubled the resistance offered to the wind; or, in other words, halved the resisting power of the bridge. And the lateral force to which a girder or an equivalent length out of two continuous girders, was exposed, was more than 100 tons rating as laterally displacing pressure. Keeping still to round figures, which it will be easy to correct if necessary, we find that the train had arrived at a point between the fourth and fifth piers when the collapse occurred. This is shown by the position of the wreck. The width of the piers was twenty-seven feet, and the width between the centres of the iron columns which stood on them was of course less. The height from the water to the rails is given at ninety-two feet, and above this was the thickness of the roadway and the depth of the girder. It follows that the effect of the force of the wind to tip the structure sideways was resisted by only three elements of stability. Of these one was the continuity of the girder; one was the weight of the bridge; the third was the disposition made to tie down the superstructure to the earth, so as to check a disposition to tip over.

The value of the first of these elements may hereafter be calculated; the second may be taken at under 400 tons for the span of bridge and train. The resistance would be exactly balanced by such a force as we have above estimated,—namely, a lateral pr ssure of 100 tons, acting with a leverage of four to one, directed to pull up the windward columns supporting the girder, the base of the leeward column acting as a fulcrum. In this case the stability of the bridge would have depended solely on the continuity of the side girders, and on the provision for holding down the girders to the earth. This latter provision, however, seems to have been omitted. It may, of course, prove that such was not the case; but no mention is made of holding-down bolts. Had an iron plate been built at the bottom of each cylinder, with bolts of adequate diameter keyed below it, and brought up through the concrete and masonry, to tie the superstructure and prevent a sidelong tipping over on its narrow base, the bridge in all probability would have been safe. Now we are told that "the sixth pier had been neatly cut across as by a knife, only a small piece of the lower portion of the iron columns remained on the masonry, which had been started and showed cracks in several places." "The fifth pier showed signs of a terrific wrench; the top coping-stone was literally cracked and torn to pieces. The iron columns lay like so many matches." Here, then, we see the point of yielding. The "clean cut" on the sixth pier must have been due to the "way" on the yielding girder by the time the motion reached that spot, the splintered work on the fifth pier betraying the struggle where the structure first yielded. Thus the point of yielding was the attachment of the iron-work to the piers—strong and substantial, no doubt, if regarded as intended to resist weight and vibration, but, so far as the accounts go, not secored in such a manner to the bottom of the masonry as to bind all together in one homogeneous structure and offer an adequate resistance to lateral displacement. —*Pall Mall Gazette.*

Electro-Deposition as a Substitute for Casting.—We find in the London *Nature*, an interesting reference to the process of electro-deposition lately referred to in this department of the *Journal*, and which, in the hands of an electro-metallurgical company of Brussels, promises to become a practical substitute for casting in the production of bronze statuary. Our contemporary confirms our previous statement that this company had succeeded in producing a colossal statue of Van Eyck by the deposition of copper electrically upon the clay model. The same authority notices a simple procedure by which the production of bronzes on a small scale may readily be carried out. Take any plaster figure or group, boil in stearine, then coat well with black-lead, and place in the copper bath as in ordinary electrotyping. Attach a very weak battery and deposit very slowly a thin coating of copper. Then remove from the bath and bake in an oven until the plaster model shakes out in dust. There remains now only a thin coating of copper shell of the model. Varnish this on the outside to prevent further deposition there, and replace in the bath with a much stronger battery power. The copper will now deposit on the inside, and when the same becomes thick enough the process is finished.—*Engineering Journal.*

WHY THE NEEDLE POINTS IN A NORTHERLY DIRECTION.

Prof. Patterson, Superintendent of the United States Coast Survey, writes as follows in answer to an inquiry by a gentleman as to the reason why the needle points in a northerly direction:

DEAR SIR:—Your note is duly received, and in answer I beg to state that the reason why the needle points in the northerly direction is that the earth in itself is a magnet, attracting the magnetic needle as the ordinary magnets do; and the earth is a magnet as the result of certain cosmical facts; much affected by the action of the sun. These laws have periodicities, all of which have not as yet been determined.

The inherent and ultimate reason of the existence of any fact in nature, as gravity, light, hear, etc., is not known further than it is in harmony with all facts in nature. Even an earthquake is in perfect harmony with, and the direct resultant of the action of forces acting under general laws.

A condensed explanation in regard to the needle pointing to the northward and southward is as follows: The magnetic poles of the earth do not coincide with the geographical poles. The axis of rotation makes an angle of about 23°, with a line joining the former.

The northern magnetic pole is at present near the Arctic circle, on the meridian of Omaha. Hence the needle does not everywhere point to the astronomical north, and is constantly variable within certain limits. At San Francisco it points about 17° to the east of north. and at Calais, Maine, as much to the west.

At the northern magnetic pole a balanced needle points with its north end downwards in a plump line. At San Francisco it dips about 63°, and at the southern magnetic pole the south end points directly down.

The action of the earth upon a magnetic needle at its surface is of about the same force as that of a hard steel magnet, 40 inches long, strongly magnetised, at a distance of one foot.

The foregoing is the accepted explanation of the fact that the needle points to the northward and southward. Of course no ultimate reason can be given for this natural any more than for any other observed fact in nature.

C. T. PATTERSON,
Supt. U. S. Coast Survey.

BENEFITS OF A TECHNICAL EDUCATION.

At the inaugural lecture in connection with the City and Guilds Institute, of London, Professor Ayrton spoke lately of the improvement science can effect in the trades and in the condition of workmen, and, in the course of his remarks said: "It must sometimes have puzzled you to understand why a successful professional man, one who has no manual skill, no strength of limb, earns, by his work, so much money, and what is higher, so much fame. It must sometimes have struck you as, at the very least, rather hard that while you are toiling from morning to night, day after day, to gain only enough to live on, another, by the mere efforts of his thought, amasses a fortune. But you, no doubt, regard it as quite fair that a skilled mechanic should receive higher wages than a navvy. For you say that although he has eyes and arms like yourself, and is, perhaps, the stronger of the two, still you can use your powers with a skill of which he knows nothing. Now, just as he has muscular strength, which, when cultivated, means wealth to himself and his country, so, you have brain power, which only requires education to fit it to do useful work. But, you will say, am I not forgetting you have all been to school, and have received an education at least as good as is given in the board-schools. Consider, however, what is taught in these schools where masses have to be educated Is there time to teach reflection, to foster the reasoning power? Is there that training given you which should make you unwilling to follow any special routine method in your trade unless you are convinced it cannot be improved on? And can you expect it to be otherwise when the boys and girls leave at twelve or thirteen years old, when the main object of the teacher who is paid by results, is to cram the young until they are heavy enough to drop through the examining machine, when occasionally the teaching is necessarily confined to the three R's, solely because the government inspector finds that other subjects are—well, a little beyond his limited attainments. Again, what is the feeling boys and girls have at the national schools? If they succeed in their lessons, they look forward to becoming pupil-teachers; but if prizes do not fall to their share, they feel that teaching is not for them, and fall back on a trade; but how very few, if any, ever look to their studies as a means of making them educated workmen, instead of mere copying machines. The consequence is that, when a lad is first apprenticed, he is merely an errand boy, or fag; being fit, in fact, for little else. Subsequently, he is posted in one of the departments of the manufactory, his instructor being the man under whom he works; but this man man having his own work to attend to, has not time to teach; and even were it not so, he could only show the manual operations. When the piece of work on which the apprentice has been engaged is finished, it has to pass the foreman of the department; generally, a man who, through honesty, sobriety, and manipulative skill, has risen from the ranks of the workmen, and whose education has been of a character similar to those around him. The foreman's duties, of course, leave him no time, even if he were competent, to give instruction, and thus the lad goes on, probably working, quite mechanically, at only one small branch of his trade. In time, he becomes a journeyman; he may become a foreman, to govern others. Thus the "rule of thumb," viz., each man working as his shopmates do, proceeds, and thus ignorance of principle has been carried on from one generation to another. And things go on remaining very much as they are, merely because we have never seen them otherwise.

THE NEW TAY BRIDGE.—The North British Railway Company have lodged the plans for the rebuilding of the Tay bridge, as required under the Parliamentary notices. The whole bridge, from shore to shore, has been reduced in height, so that over the middle of the fairway, where the high girders fell, the height of the girders above high-water mark, ordinary Spring tides, will be reduced from 88 feet to 57 feet. The spans in the southernmost portions of the bridge still remaining are not to be altered in width, but the 13 wide spans of 245 feet, which were in the centre of the bridge before it fell, are to be narrowed to about one-half the width by the introduction of additional piers. The first five 245-foot spans, counting from the south end of the present gap, are to be divided into 10 spans of 109 feet each, and will be at the height of 57 feet above high water, ordinary Spring tides. Between the fifth and sixth fallen piers there will be two spans 100 feet wide and 57 feet in height; between the sixth and eighth fallen piers four openings 109 feet wide and 57 feet in height; between the eighth and ninth fallen piers two spans 100 feet wide, and gradually falling in height from 57 feet to 54 feet 9 inches; then from the ninth fallen piers to the first standing pier on the north side there will be eight openings 109 feet in width, and gradually falling in height from 54 feet 9 inches to 43 feet. The spans of the portion of the bridge still standing at the north end are not to be altered in width, but the girders are to be lowered to suit the falling gradient of the line toward the north shore, the height of the large bow-string girder being reduced to about 26 feet, and the similar girder over the esplanade to about 18 feet. It is not proposed to make a double-line bridge, but the new piers to be erected in the middle of the river will be of such a width as will be sufficient to carry a double line of rails should that be deemed necessary. As the result of the recent inquiry into the causes of the fall of the bridge, power will be asked to enabled the company to stop the traffic from crossing the bridge when the weather may be too severe as to cause reasonable apprehension of danger.—*Pall Mall Gazette.*

TYNDALL'S DEFINITION OF THE BRAIN.—The human brain, according to Prof. Tyndall's recent definition, is the organised register of infinitely numerous experiences received during the evolution of life, or rather during the evolution of that series of organisms through which the human organism has been reached. The effect of the most uniform and frequent of these experiences has been successfully bequeathed, principal and interest, and have slowly mounted to that high intelligence which lies latent in the brain of the infant. Thus it happens, says Tyndall, that the European inherits from 20 to 30 cubic inches more of brain than the Papuam; thus it happens that faculties, as of music, which scarcely exist in some inferior races, become congenital in those that are superior; thus, too, it happens that out of savages unable to count up to the number of their fingers, and speaking a language containing only nouns and verbs, arise at length Newtons and Shakespeares.

DRILLING GLASS.—Stick a piece of stiff clay or putty on the part where you wish to make the hole. Make a hole in the putty the size you want the hole, reaching to the glass, of course. Into this hole pour a little molten lead, when, unless it is very thick glass, the piece will immediately drop out.

THE SOUTH AFRICAN DIAMOND FIELDS.—Advices received from Port Elizabeth state that the value of the diamonds exported from the South African diamond fields last year was £3,685,610, as compared with $3,084,711 in 1878.

THE PRINCETON DISASTER. WITHERSPOON HALL.

See page 251.

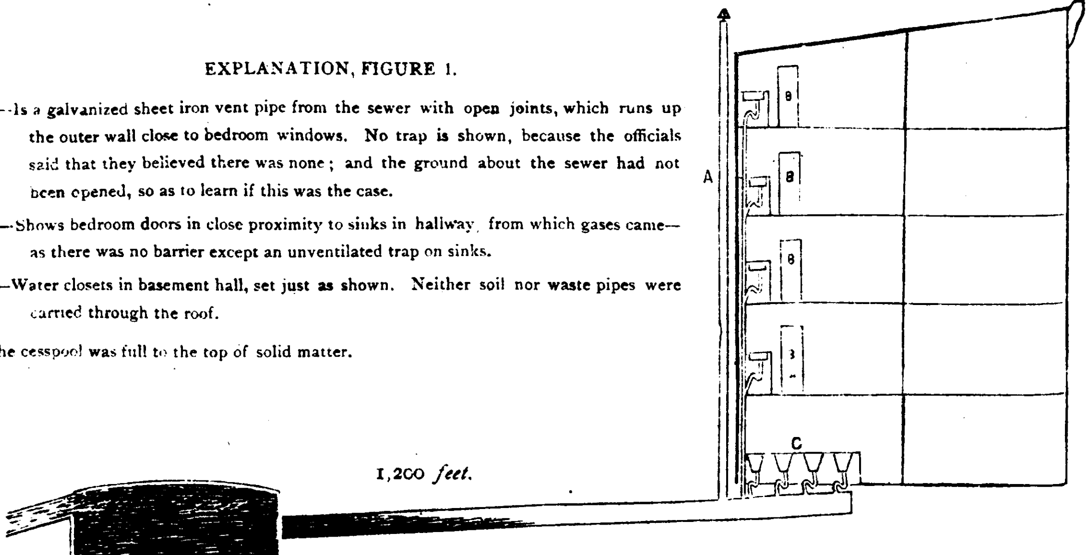
EXPLANATION, FIGURE 1.

A—Is a galvanized sheet iron vent pipe from the sewer with open joints, which runs up the outer wall close to bedroom windows. No trap is shown, because the officials said that they believed there was none; and the ground about the sewer had not been opened, so as to learn if this was the case.

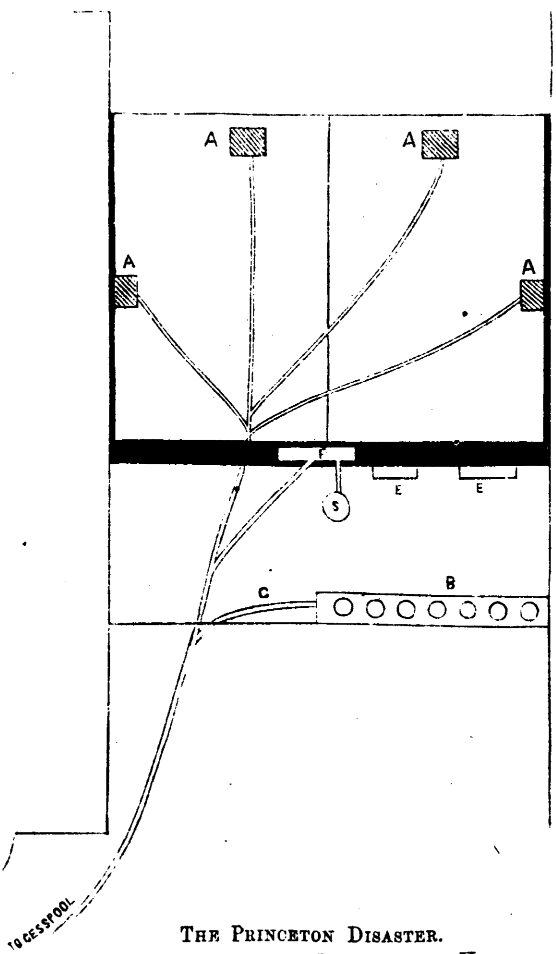
B—Shows bedroom doors in close proximity to sinks in hallway, from which gases came—as there was no barrier except an unventilated trap on sinks.

C—Water closets in basement hall, set just as shown. Neither soil nor waste pipes were carried through the roof.

The cesspool was full to the top of solid matter.



WEST DORMITORY.



THE PRINCETON DISASTER.
PLAN OF DRAINAGE IN WITHERSPOON HALL.

DESIGN FOR SWISS COTTAGE, COSTING $3,000.

The design on the opposite page exhibits the construction combining or uniting wood and brick, and known as "brick nogging," and affords agreeable contrasts in this style of architecture, as well as in the Elizabethan, Jacobean, James I epochs, and some other styles, and is always a substantial and handsome way of building.

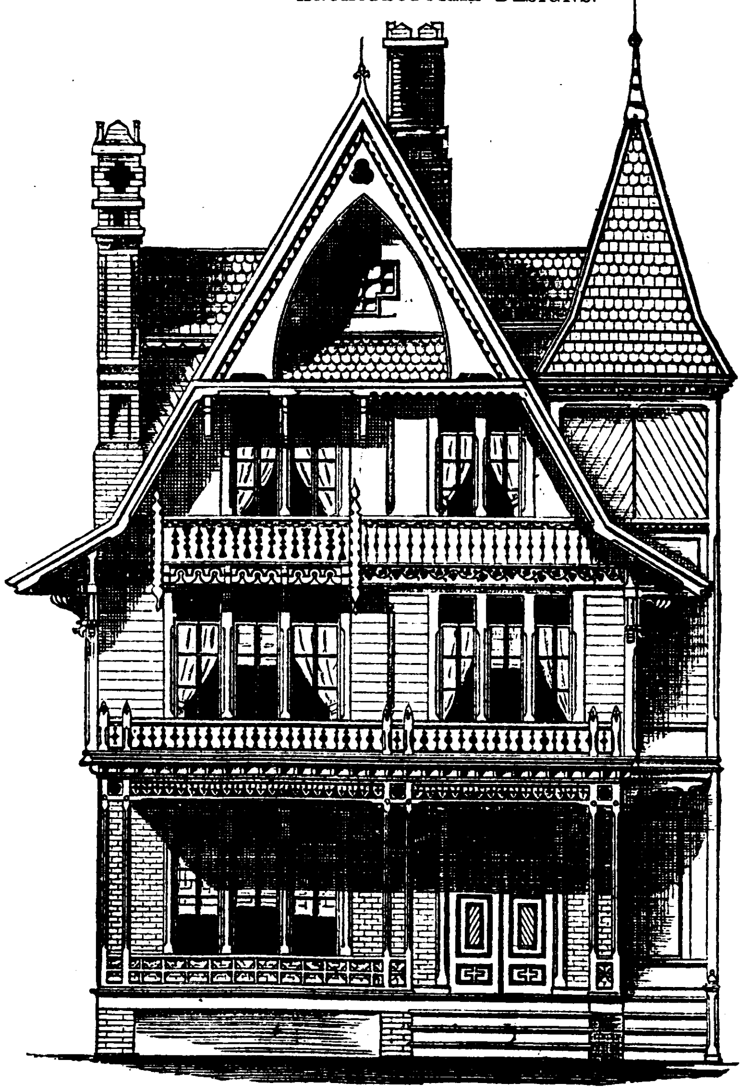
The character of the exterior details and the interior finish correspond, and the former are shown with sufficient clearness in the elevation to require no explanation. The arrangement of the interior is worthy of special attention, being most convenient in every part; on the first floor there is the parlor, 12 × 12 feet, and back of this a dining-room of the same size, and in the rear of the latter, extending out into a bay-window, is a sewing-room. The kitchen is 12 × 12. On the second floor there are four bed-rooms of the following respective dimensions: 12 × 12 feet, 9 inches; 8 × 12 feet, 9 inches; 8 × 12 feet, 9 inches; 7 + 8 feet, 9 inches. There is also a bath-room and water-closet on this floor, 7 + 8 feet. Each room is provided with ample closets, a feature that will be appreciated by housekeepers. The third story has five rooms of similar size.

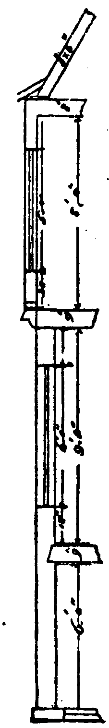
The walls of the first story are built hollow, and receive the plaster directly upon the brick. The door and window trimmings are 4½ and 5 inches, framed and put up in pilaster form. The hall and dining-room are wainscoted with redwood and yellow pine in alternate sections and panels. The staircase in the lower hall is also built of these woods. The parlor is finished white with china gloss and gold bands; the hall in gray and brown. The upper rooms are finished in neutral tints of varying shades of color. All mantel breasts are exposed, and faced with pressed and molded bricks of various and suitable tints, suited to the furnishings of the rooms, and provided with marble and slate shelves. The openings are segment and semi-circular, headed with spandrels and arches set with art tiles.

The rooms are separately ventilated, and except in the parlor and dining-room, the furnace heat is supplied through the front openings. Patent radiating backs and low grates are supplied to the parlor, dining-room, and sewing-room; fire-places, with ash shutes, to the cellar.

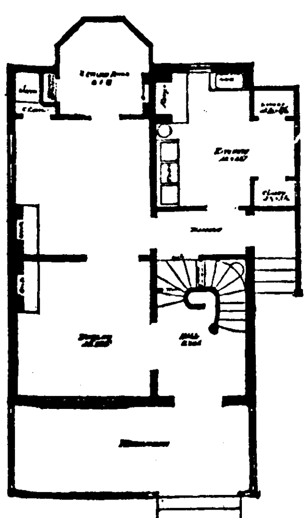
The exterior is painted bronze gray and umber color.
—*Manufacturer and Builder.*

ARCHITECTURAL DESIGNS.



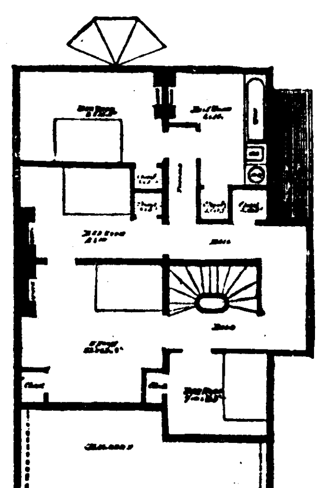


FRONT ELEVATION.



DESIGN FOR A CHEAP COTTAGE.

(From the Manufacturer and Builder.)



FIRST STORY.

SECOND STORY.

Mechanics.

ALLOYS OF IRON.

M. Pourcel, at the late meeting of the British Iron and Steel Institute, said: Tungsten alloyed with steel appears to harden without detracting from its toughness, but I doubt much whether the advantage gained compensates for the cost. Tungsten is also said to add to the magnetic power of steel, but of this I have no experience. In steel supplied to a Cornish mining company from Sheffield for borers, I found as much as 10% of Tungsten. As far as fracture goes, this alloy is the most beautiful of all steels.

I have no experience as to the effect of tin on steel, but a bar of iron made from tin-plate shearings, from which the tin had been to a considerable extent removed, was extremely red, short and unweldable; the amount of tin contained in this sample was 0.15%. Lead and zinc, when added to a bath of steel, are simply volatilized, without producing any effect except that of half choking the melters.

Chromium gives great hardness, but at the same time causes brittleness, and may be put down as useless.

The effect of copper upon steel seems to be greatly exaggerated in most metallurgical works; it is generally stated to cause more red shortness than the same amount of sulphur. In some experiments made at Landore, it was found that 0·10% of copper produced no appreciable effect on the quality of steel; and even when the amount was increased to 0.30%, only a slight cracking on the side of the bloom was observable. This question is, perhaps, more important than appears at first sight. One possible difficulty that soft steel manufacturers will have to contend with will, no doubt, be the scarcity of manganese ores suitable for the manufacture of ferro-manganese, and many good ores might be rejected on account of the presence of copper, a very frequent companion of manganese. At the present time ferro-manganese containing 5% of copper would certainly be unsaleable, although, in my opinion, it could be used with impunity.

In conclusion, I may remark that any comparisons made by me of the merits of the two great processes for making steel—*i. e.*, the Bessemer and Siemens—would doubtless be considered prejudiced; but I believe it is now generally conceded that for soft steel the latter carries off the palm, and this I attribute to the complete elimination of the silicon, to the mixture of different brands of pig, and to the absolute certainty with which the carbon in the finished steel can be controlled.

MOLECULAR CHANGES IN IRON AND STEEL WIRE.

A novel and important communication has been made by Prof. Hughes, the well-known inventor of the microphone, to the Society of Telegraph Engineers on the molecular changes which take place in iron and steel wire. He discovered, accidentally, about a short time since, that iron or steel wire, after being dipped for a short time say two minutes, in a solution of sulphuric acid and water, becomes exceedingly brittle and will not bear bending, the metal becoming "rotten." This is not due to mere corrosion of the surface or skin of the metal, because the wire broke even after the outer layer had been carefully removed. The brittle wire shows no change of magnetic conductivity when tested by the induction balance, such as would be the result of heating, straining, tempering or corroding. There is reason to believe that the suggestion made Mr. A. Chandler Roberts, that the brittleness is due to absorption of hydrogen by the iron, is the true cause of this peculiar phenomenon. If the wire is immersed in very weak acid, it takes about 30 minutes before it is brittle; when, however, an amalgamated zinc plate is dipped into the same solution and connected to the wire so that a voltaic element is formed, giving off abundant hydrogen at the surface of the iron, the full effect is produced in a minute, owing apparently to the absorption of the hydrogen by the wire. In the latter case, too, the presence of the zinc protects the iron from the action of the acid, and, therefore, demonstrates that the brittleness is not due to a mere surface corrosion. Mr. A. Chandler Roberts has heated the brittle wires of Prof. Hughes in vacuo, and has found that they occlude or absorb about twenty times their volume irrespective of the "natural gas" in the metal, which amounts to three to ten volumes of hydrogen and carbonic oxide.

DRY DOCK FOR HALIFAX.—Advices from England state that plans and specifications are nearly completed for a dry dock in Halifax harbor, to be larger than any now in America, which is to be built by an English company, at a cost of $1,000,000.

CUTTING COLD STEEL WITH SOFT IRON.

The development of heat by friction has been long known. For some time it has also known that the operation of rolling and rubbing had the effect of changing the molecular structure of iron and steel. These operations will toughen and compact cold iron, and will harden and condense steel. Some time since Mr. Jacob Reese, of Pittsburg, Pa., had occasion to construct a machine for cutting bars of cold hardened steel. For this purpose he mounted a disc made of soft wrought-iron upon a horizontal axis, so as to be rotated with great velocity. With any moderate speed no cutting was produced. But, on giving the disc such a speed of rotation as to cause the periphery of the disc to move with velocity af about 25,000 ft. per minute (nearly five miles,) the steel was rapidly cut, especially when the bar to be cut was slowly rotated against the disc. Sparks in a steady stream were thrown off. At first it was supposed that the steel was simply rubbed or ground off; but on examinine the pile of accumulated particles beneath the machine, they were found to be welded together in the shape of a large cone, similar to the stalagmites in the limestone caves; they were nearly like the spikes of frost as formed in winter on Mount Washington, and ilustrated at Troy meeting. Real fusion takes place. The steel is melted by the swiftly-moving smooth edge of the soft iron disc, but the disc itself is but little heated. The bar of steel on each side of the cut receives but slight heat, and the ends are left with a fine smooth blue finish. By this process a rolled, polished and hardened steel bar of two or three inches in diameter, may be cut in two in a few minutes. The soft metal disc of iron used was about 42 inches in diameter and three-sixteenths of an inch thick. The particles fly off in a thick jet of steam apparently white hot, through which the naked hand may be passed without injury, and a sheet of white writing-paper held in the steam for a minute is not burned or colored in the least. They glance off without burning the hand, having assumed the condition which causes the spheroidal state of liquids. The explanation of this curious phenomenon lies in the fact that the very rapidly rotating iron disc causes great number of particles of iron to come in contaat with comparatively very few particles of steel every particle of which has to withstand the impact of thousands of thousands of iron particles; it thus give way to superior numbers, this impact at the same time developing heat enough, not only to melt the detached particles of steel, but to bring it in the spheroidal state.—*Manufacturer and Builder.*

USING WORN-OUT THREE CORNERED FILES.

There is scarcely a shop of any kind in the country in which three-cornered files are not used and worn out, what to do with them is a question. They find their way to the scrap heap too often before their time.

When worn out they are generally thrown aside as worth but very little except for old steel, but their sphere of usefulness need not end here.

Probably one of the most curious uses to which such a file can be put, is that it can be made into a very good glass cutter. Grind the sides flat, but shape the point curved or convex. To use it, hold the tool so that one of these sharp, rounded edges will bear upon the glass, and with a little pressure draw it steadily over the glass. The result is a slight scratch or cut, and by using a little force the glass will break where this scratch is seen.

If the teeth of an old file be removed by grinding and the taper shape be preserved, it will make a passable hand reamer. If the point be made obtuse or "stunt," it forms a convenient substitute for a hand countersink. If the tool is put in a hole that is to be enlarged, it will be observed that there is an equal bearing at the three points, which gives a steady hold on the metal to be removed. Now turn the tool a little so that it will cut. Observe the position and shape of this cutting edge. To the initiated it will present about the same form as that of the cutting edge of the tool used by machinists to cut iron in the lathe.

Old files also make very serviceable scrapers when carefully ground. Flat files may be made over into useful cutting tools by grinding. We remember seeing a long time ago, a very nice hunting knife which had been made, by grinding alone, from a worn-out half-round file. Not needing a thin edge, the great hardness was no drawback. It was one of the handsomest and neatest tools of the kind that we have ever seen. By taking a little thought, a great many things of value may be made from old scraps of good metal which are usually thrown upon the waste heap to rust out.

SILVERING BY COLD RUBBING.

Make paste by thoroughly grinding in a porcelain mortar, out of the light,

Water	3 to 5 oz.
Chloride of silver	7 oz.
Potassium oxalate	10½oz.
Salt (common table)	15 oz.
Sal ammoniac	3¾oz.

Or,

Chloride of silver	3½oz
Cream of Tartar	7 oz.
Salt (common)	10½oz.
Water to form a paste.	

Keep in a covered vessel away from the light. Apply with a cork or brush to the clean metallic (copper) surface, and allow the paste to dry. When rinsed in cold water the silver presents a fine frosted appearance, the brightness of which may be increased by a few seconds immersion in dilute sulphuric acid or solution of potassium cyanide. The silvering bears the action of the wire brush and of the burnishing tool very well, and may also be "oxidized." Should a first silvering not be found sufficiently durable after scratch brushing, a second or third coat may be applied. This silvering is not so adhering or white on pure copper as upon a gilt surface.

For the reflectors of lanterns the paste is rubbed upon the reflector with a fine linen pad; then, with another rag, a thin paste of Spanish white or similar substance is spread over the reflector and left to dry. Rubbing with a fine clean linen rag restores the lustre and whiteness of the silvered surface.

The paste is sometimes mixed directly with the whiting and left to dry, or until nearly dry, then rubbed down as described.

THE NEW PATTERN BLAKE CRUSHER.

In almost all work requiring the use of a crusher, a degree of uniformity in the product, in respect to fineness or coarseness, is desirable; and it is desirable, also, that the uniformity shall be maintained without frequent manipulation of the machine. The manufacturers of the above crusher claim that in the old machines the wear of the toggle-ends and their bearings is so rapid that a frequent drawing up of the "wedge" or the insertion of longer toggles is necessary in order to maintain in any good degree a uniform distance between the jaws, and a consequent uniformity of product. In the improvement to which reference is made, there being no wear of toggles or their bearings, there is but little change in the distance between the jaw-plates. It will be understood, however, that, when a change is desired in the fineness or coarseness of the product, it can be effected by substituting in the usual way longer or shorter toggles. In the 15 x 9 New Pattern crusher, the pitman (single casting) weighs nearly 1,000 pounds. This immense mass of iron has, of course, to be actually lifted at every revolution of the fly-wheels. The proper number of revolutions of this machine is officially given as 250. It is easy to see that a large amount of power must be consumed in throwing this weight of nearly half a ton of iron upward and around, at the rate of 250 times a minute. For the improved machine, the wrought-iron pitman weighs less than 200 pounds.

Another improvement consists in the use of friction-rollers under the journals of the main shaft—a device which very largely reduces the amount of power required to drive the machine. Patents for several of the improvements are pending; while in others, patents have already been allowed.

CHERRY HEAT WELDING COMPOUND.

The Cherry Heat Welding Compound is designed to supersede borax for welding purposes, and is said to be not only superior to borax but valuable for many purposes for which borax is useless. Less heat is required in welding with this compound, and, consequently, a considerable saving in time and coal attend its use, enough, the manufacturers of the compound say, to more than cover its cost in many cases. It is also said to be a perfect protection to steel from any degree of heat obtainable in a smith's forge, and by its aid many forgings of steel can be made at one heat which, without it, would require three or more heats. It is claimed, also, to possess the quality of restoring "burnt" steel perfectly. The manufacturers present an array of testimonials which must convince any one that their compound has merit of a high order. A descriptive circular can be obtained by addressing the agents, C. S. & T. C. Mitchell, 41 Dey street, New York.

COAL DUST EXPLOSIONS

At the meeting of the Royal Society, of England, March 13th, a paper was read "On the Influence of Coal Dust in Colliery Explosions," by W. Galloway; communicated by Robert H. Scott, F. R. S. The paper described various experiments in proof of Mr. Galloway's now well-known theory of colliery explosions, the first being made with a very simple apparatus consisting of a continuous pipe about 18 in. in diameter, which conducts a small portion of the return air from the point at which it is injected into the atmosphere by the ventilating fan to a convenient spot on the level of the surface, where it escapes as a strong current, amounting to 1,251 cubic ft. per minute. About 6 ft. from its point of exit a lamp can be placed in the centre of the current, and at a distance of about one ft. still nearer the origin there is a means of allowing coal dust to fall into and mix with the passing air. It is found that when the coal dust is added, the air becomes instantly inflammable showing that all the return air in the workings may be easily brought into the same condition by a sudden disturbance, such as that caused by a local explosion of fire-damp. The second experiment was intended to illustrate the effects of an explosion of fire-damp in a dry mine containing coal dust. The only means of avoiding the dangers due to the presence of coal dust in mines appears to be to carefully and constantly water the roadway leading to and from the working places. "It is very interesting to be able"—says *Nature*—"to mention a fact in connection with watering the roadways, which, although not mentioned in Mr. Galloway's paper, is well worthy of a place here, viz., that the Abercarne explosion ramified through every part of the workings, which were exceedingly dry and dusty with theexception of one district from which it was entirely cut off by 200 yards of a very wet roadway, and that the men in the latter district not only escaped unhurt, but hardly felt the explosion. The wetness of this roadway was due to natural causes.

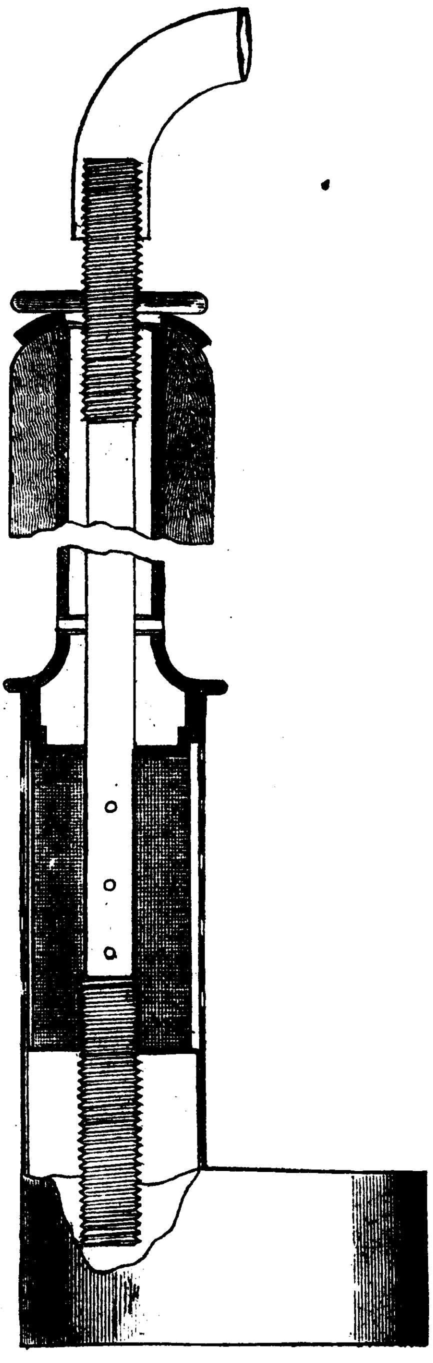
THE WEAR OF STEEL RAILS.—The first engineer of the Rhenish railway, which has the longest experience in steel rails, has made a calculation, according to which the average duration of steel rails, where 24 trains pass over them every day, is 30 years, while that of iron rails, with a traffic of 17 trains, is 11 years. Steel rails, according to this calculation, last four times as long as iron rails, although they are but one-third more expensive. According to other experiments made in Germany, it is calculated that the mean duration of rails of Bessemer steel is about 16 years. On the other hand, it appears that 10 years of trial between Boulogne and Minden have shown that the renewels were, during that period, 70.7 p.c. for fine grain iron rails, 66.3 p.c. for cement steel, 33.3 p.c. for puddled steel, and only 3.4 p.c. for Bessemer steel, indicating that the latter class of rails would last longer than 16 years. There are, however, some faults to be found with this rail. The engineers of the Kaiser Ferdinand Northern line state that Bessemer steel is less capable of resisting concussion, and that, when sudden friction has caused heating of the rails, with rapid cooling from snow, injurious molecular changes are apt to occur.

BRONZING IRON.—To 1 pint of methylated finish add 4 ounces of gum shellac and ½ ounce gum benzoin; put the bottle in a warm place, shaking it occasionally. When the gum is dissolved, let it stand in a cool place two or three days to settle; then gently pour off the clear into another bottle, cork it well and keep it for finest work. The sediment left in the first bottle, by adding a sufficient quantity of spirit to make it workable, will do for the first coat or coarser work when strained through a fine cloth. Next, get ½ lb. of finely ground bronze green; the shape may be varied by using a little lampblack, red ochre or yellow ochre; let the iron be clean and smooth; then take as much varnish as may be required and add the green color in sufficient quantity; slightly warm the article to be bronzed, and with a soft brush lay a thin coat on it. When that is dry, if necessary, lay another coat on, and repeat until well covered. Take a small quantity of the varnish and touch the prominent parts with it; before it is dry, with a dry pencil lay on a small quantity of gold powder. Varnish all over.

—NAPOLEON THE FIRST said that agriculture was the body and soul of the empire, and in the height of his glory he gave the subject attention and encouragement, and established in France a department of agriculture. From the start given to this great art, the nursing mother of all the arts, France has become the richest and one of the most powerful and prosperous among the people of the earth; 39 out of every 40 of her population, according to statisticians, do not spend their income, but lay something by.

GAS SOLDERING IRON.

The advantage of a soldering iron which can be kept at the desired heat without being placed in the fire from time to time, is evident, and several attempts have been made to utilise gas for the purpose. One of the most recent of these, the invention of Mr. J. Hamilton, of Hamilton, is described in the following:



—Soldering "irons" constructed according to this invention, comprise an outer metallic casing enclosing an inner casing of wire gauze; the copper head, or soldering-iron proper, is fitted in one end of the outer casing, and the inner gauze casing is supplied by a perforated pipe or gas-burner, and India rubber or other flexible tube, with coal or illuminating gas from the other end, which end also serves as a handle, the gas-pipe having an outer covering of wood, or other non-conductor of heat. The outer casing is provided with a number of fine slits or openings, to insure the necessary supply of air to maintain combustion of the gas within the casing. The action is as follows:—On gas being supplied and fired, it burns on the exterior of the gauze casing, after the manner of the action of the Davy lamp; the iron is not only kept hot as long as necessary, but the degree of heat may be varied at will; the tinning is not injured by overheating, nor is the iron smoked or soiled, so obviating necessity of frequent use of files or rubbing, whereby the copper head is rapidly worn away. This construction of soldering iron is specially applicable for use on spires, roofs of high buildings, and in mines, the gas necessary to supply the heat being obtained from a portable gas-bag or bladder.

SHIP BUILDING IN NOVA SCOTIA.

At Kingsport, Mr. P. R. Crichton has two ships of 1,400 tons each on the stocks, one nearing completion, the other in an advanced state.

At Avonsdale, two ships of 1,200 and 1,400 tons respectively are being built, one nearly ready for launching.

At Canning, Messrs. E. Bigelow and Sons have just launched a fine vessel of 1,200 tons. She is to load at West Bay, Parrsboro', with deals.

At Eatonville, Messrs. D. R. & C. F. Eaton have a large ship nearly completed, and have a contract for another which they will commence as soon as the present one is launched.

At Hantsport, Messrs. Churchill & Co. have a ship of about 1,800 tons in an advanced stage. This firm have also a small steamer nearly ready to launch. She is a very fine model, and bids fair to be a fast boat. She is to have a pair of engines, cylinder 8 in. diameter, 10 in. stroke each. Having extraordinary facilities for carrying on this branch of business, the firm is anxious to secure contracts for a class of small, fast-sailing steamers.

Mr. J. B. North, of Hantsport, is buying a large quantity of timber, and expects to put on a ship of large tonnage during the present month.

At Spencer's Island, a ship of about 1,200 tons is in course of construction for Messrs. Bigelow & Sons, of Canning.

"I AM THE MONARCH OF THE SEA."—The complete monopoly that England enjoys of the steam-service of the North Atlantic, with reference to this country, is shown by reference to the statistics of navigation as reported in the blue book for 1879.

From these statistics it appears that since the year 1870 the British steam tonnage has increased from 1,111,375 to 2,508,102 tons while the sailing tonnage has decreased, during the same time, from 4,503,318 to 4,013,187 tons. These figures it may be incidentally remarked, indicate that a gradual revolution is taking place in the ocean carrying-trade, in which steam is steadily displacing sails. The statistics further show that, while the amount of foreign commerce clearing at British ports since 1874 has barely held its own, that of Great Britain has increased about 84 per cent. As regards the United States, the clearances of steam shipping from England to the U. S. rose from 1,445,000 tons in 1875, to 2,448,000 in 1879. The total arrivals and clearances of steam vessels from the port of New York, during the month of April just passed, show the state of affairs perhaps more pointedly.

The arrivals from all foreign ports were 110 British steamers to 21 American; and clearances were 102 British to 18 American. Here it is to be noticed, that of the American steamers all were engaged in the West Indian, Mexican, and South American trade, and not a single one was bound for a European port. Save and except the four steamers of the "American line" running from Philadelphia to Liverpool; the British have the monopoly of the North Atlantic, and are masters of our carrying-trade.

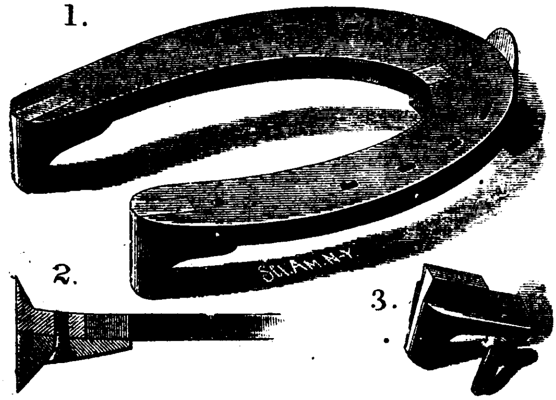
CONDITIONS INJURIOUS TO SIGHT IN SCHOOL CHILDREN.—Prof. Raux mentions the following: Air vitiated by animal emanations, vegetable or mineral dust, the smoke of various combustibles, especially tobacco, in which nicotine exists. Temperature too high or too low, and sudden changes or drafts. Clothing too tight, particularly at the neck or waist. Position with the head and body too much bent forward during labor with the eyes. Premature study, excess of reading, etc. Alcoholic excesses. Use of the eyes and brain immediately after eating. Habital constipation, cold feet and everything which tends to produce congestion of the head. Immorality, especially during childhood and youth. We might assign a cause still more potent than any of the foregoing, viz.: a deficiency of light.—*Detroit Lancet.*

IMPROVEMENT IN HORSESHOES.

Our engraving represents an improvement in horseshoes recently patented by Mr. Gelos L. Potvin, of Alpena, Mich. Lumbermen, contractors, horse-railway companies, and others who, in the prosecution of their various enterprises, employ large numbers of horses, are only too well aware of the great expense attending keeping their horses well shod under the present system of farriery, not only in the amount of shoes used and the labor to reset them, but in the valuable time lost in having the animals shod, and the loss by laming many valuable animals caused by the neeessity of taking off the shoes every time a calk becomes worn out or broken, thus requiring the hoof to be pared down till scarcely anything remains to nail the shoe to.

This invention is designed to obviate the necessity of taking the shoe from the horse's foot when it needs recalking.

It will be admitted that if a teamster can recalk a set of shoes in ten minutes on the road, in the woods, or in the barn, he will have made a saving for his employer.



POTVIN'S IMPROVED HORSESHOE.

Fig. 1, which is a perspective of the shoe, shows the extreme simplicity of the improvement. In the heels of the shoe there are slots in which the dovetail studs of the heel calks fit snugly; the toe calk is set in a similar manner, and each calk is secured by a screw, as shown.

Fig. 2 and Fig. 3 represent the calk in detail, and the screw used in fastening is shown in Fig. 3.

These shoes can be manufactured as cheaply as the ordinary ones, as the calks can be made of malleable iron.

KILLED BY A METEOR.—The *South Australian Register* for April 3, quotes the *Littleton Times* as stating that as David Meisenthaler, a well-known stockman of Whitestone township, was driving his cows to the barn about daylight a short time ago, he was struck by an aërolite and instantly killed. It appears as if the meteor had come from a direction a little west of south, and fell from an angle of about 60°, for it first passed through a tall maple, cutting the limbs as clean as if it had been a cannon-ball, and then struck him apparently on or under the shoulder, passing clean through him obliquely from below the right shoulder to above the left hip, and buried itself about two feet in the soft black ground. The poor man's head and legs were injured, but the greater part of his body seemed to have been crushed into the earth beneath the terrible aërolite, which was about the size of a common patent bucket, and apparently of a rough, round shape. It appeared to be formed of what is called iron pyrites.

The electric light on the City of Berlin has given such general satisfaction that it has been permanently adopted for lighting the saloon, steerage and engine-room, and will soon be supplied to the other vessels of that line.

THE FORCE OF TREE GROWTH

The disruptive power of tree roots, growing in the crevices of rocks, is well-known. Masses of stone weighing many tons are often dislodged in this way from the faces of cliffs, and no one gives them more than a passing glance. When, however, the sanctity of the tomb is invaded, despite the graven warning of the occupant, the case is very different, and superstitious people are apt to think there must be something in it more than accident and the unconscious expression of the resistless force of growing vegetation.

The engraving herewith is copied from a photograph sent to us by a European correspondent, of a grave in the Garten churchyard, in Hanover, Germany, the invasion of which by a birch tree has been the occasion of much wonderment by country people, who came from great distances to examine it.

The monument, so unfeelingly disrupted, was erected in 1782, and bears on its base the following inscription: "This grave, which was bought for all eternity, must never be opened." A chance birch seed, lodging in a crevice of the monument, has displayed the irony of nature in slowly yet surely thwarting the desire of the person who designed it for a perpetual memorial. All the joints are separated, the strong iron clamps are broken, and the birch tree has embraced the upper block, which weighs about one and a quarter tons, and the tree is driving its roots below, gradually but surely tilting the structure.

ARTIFICIAL RESPIRATION.—The *Medical Press and Circular*, 1880, informs us that in a recent communication to the French Academy, Prof. Fort raises again the question of premature interments. One fact he mentioned is, that he was enabled to restore to life a child three years old, by practicing artificial respiration on it for hours, commencing three hours and a half after apparent death. Another case was commuicated to him by Dr. Fournal, of Billancourt, who, in July, 1878, reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water 10 minutes, and the doctor arrived one hour after asphyxia. Prof. Fort insists also on the utility of artificial respiration in cases of poisoning, in order to eliminate the poison from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia, Prof. Fort has not yet determined, but his general conclusion is that it should be maintained perseveringly for several hours.

Miscellaneous.

FACTS USEFUL AND CURIOUS.*

The greyhound runs by eyesight only, and this we observe as a fact. The carrier pigeon flies his 250 miles homeward by eyesight—namely, from point to point of objects which he has marked; but this is only our conjecture. The fierce dragon-fly, with 12,000 lenses in his eye darts from angle to angle with the rapidity of a flashing sword, and as rapidly darts back, not turning in the air, but with a clash reversing the action of his four wings, and instantaneously calculating the distance of the objects, or he would dash himself to pieces. But in what conformation of the eye does this consist? No one can answer.

A cloud of 10,000 gnats danced up and down in the sun, the minutest interval between them, yet no one knocks another headlong upon the grass, or breaks a leg or wing, long and delicate as these are. Suddenly, amidst your admiration of this matchless dance, a peculiarly high shouldered, vicious gnat, with long, pendant nose, darts out of the rising and falling cloud, and settling on your cheek, inserts a poisonous sting. What possessed the little wretch to do this? Did he smell your blood in the mazy dance? No one knows.

A carriage comes suddenly upon a flock of geese, on a narrow road, and drives straight through the middle of them. A goose was never yet fairly run over, nor a duck. They are under the very wheels and hoofs, and yet somehow they contrive to flap and waddle safely off. Habitually stupid heavy and indolent, they are nevertheless equal to any emergency.

Why does the lonely woodpecker, when he descends his tree and goes to drink, stop several times on his way, listen and look round, before he takes his draught? No one knows. How is it that the species of ant, which is taken in battle by other ants to be made slaves, should be the black, or negro ant? No one knows.

The power of judging of actual danger, and the free and easy boldness which results from it, are by no means uncommon. Many birds seem to have a most correct notion of a gun's range, and while scrupulously careful to keep beyond it, confine their care to this caution, though the most obvious resource would be to fly right away out of sight and hearing, which they do not choose to do. And they sometimes appear to make even an ostentatious use of their power, fairly putting their wit and and cleverness and antagonism to that of man, for the benefit of their fellows. We lately read an account, by a naturalist in Brazil, of an expedition he made to one of the islands of the Amazon to shoot spoon-bills, ibises and other of the magnificent grallatorial birds, which were most abundant there. His design was completely baffled, however, by a wretched little sandpiper that preceded him, continaully his tell-tale cry which at once aroused all the birds within hearing. Throughout the day did this individual bird continue his self-imposed duty of sentinel to others, effectually preventing the approach of the fowler to the game, and yet managing to keep out of the range of his gun.

Medical Uses of Eggs.—For burns or scalds nothing is more soothing than the white of an egg, which may be poured over the wound. It is softer, as a varnish for a burn, than collodion, and, being always at hand, can be applied immediately. It is also more cooling than the "sweet oil and cotton," which was formerly supposed to be the surest application to allay the smarting pain. It is the contact with the air which gives the extreme discomfort experienced from ordinary accidents of this kind, and anything which excludes air and prevents inflammation is the thing to be at once applied. The egg is also considered one of the best remedies for dysentery. Beaten up slightly, with or without sugar, and swallowed at a gulph, it tends, by its emollient qualities, to lessen the inflammation of the stomach and intestines, and by forming a transient coating on those organs, to enable nature to resume her healthful sway over the diseased body. Two, or at most three, eggs per day would be all that is required in ordinary cases; and, since the egg is not merely medicine, but food as well, the lighter the diet otherwise, and the quieter the patient is kept, the more certain and rapid is the recovery.

The hair is much abused in its relations to healthfulness and growth. Pulled, twisted, torn, burned into a friz, and besmeared by all sorts of ungents and lotions, it is a wonder that baldness is not really the rule instead of the exception among those who most prize its beauty—the female sex. And it is equally neglected, if not abused, by most physicians, many of whom, while heartily condemning the thousand and one preparations well known to be not only injurious to the hair, but dangerous to the general health, show their total neglect on this part of their cure by relinquishing it to barbers and quacks. The treatise before us admirably fills a long-tolerated gap in the literature of the subject, which should not only be welcome to all physicians for whom it is a scientific treatise, while for the general reader it is also an entertaining work on the manners and customs of dressing the hair by all nations in all ages.

An Artful Wasp.—Mr. Seth Green, writing to the *New York World* of May 14, says that one morning when he was watching a spider's nest a wasp alighted within an inch or two of the nest, on the side opposite the opening. Creeping noiselessly around towards the entrance of the nest the wasp stopped a little short of it, and for a moment remained perfectly quiet; then reached out one of his antennæ he wiggled it before the opening and withdrew it. This overture had the desired effect, for the boss of the nest, as large a spider as one ordinarily sees, came out to see what was wrong, and to set it to rights. No sooner had the spider emerged to that point at which he was at the worst disadvantage than the wasp, with a quick movement, thrust his sting into the body of his foe, killing him easily and almost instantly. The experiment was repeated on the part of the wasp, and when there was no response from the inside he became satisfied, probably, that he held the fort. At all events he proceeded to enter the nest and slaughter the young spiders, which he afterwards lugged off one at a time.

Trouble at St. Gothard.—The newspapers of the day record the fact that continued difficulty is experienced at the tunnel from the soft stone which gave such trouble when first met with, as we recorded at the time. The vaulting is reported to have given way several times, and it has required the greatest care and constant staying with timber to prevent the passage-way from closing entirely. It was thought that a wall of granite, six feet thick, would support the superincumbent mass, and this has been lately finished; but the last reports assert that even this is giving way, and that the engineers are sorely puzzled to meet the difficulty, which now seriously threatens to retard the completion of the tunnel. The geologist of the work has expressed the opinion that the trouble may be obviated by making a wide curve, to get around the soft rock instead of going through it. This would necessitate considerable timbering and an entire reconstruction of that part of the tunnel, which would entail much delay. Still later accounts report briefly, that the difficulty has been overcome—without, however, stating how.

Oatmeal for Breakfast.—In the last five years the consumption of oatmeal in this country has probably increased 20-fold. People differ so much in their likes and dislikes that we do not insist upon anybody eating oatmeal because somebody else does, but the great growth of its popularity is beyond doubt. Generally the Irish and Scotch meal have been considered best, but they sell comparatively high, and persons well acquainted with the subject say that Akron meal of Ohio is just as good. Oatmeal should be well cooked. As it is usually made a breakfast dish, it may be soaked over night, and then boiled like mush for, say, half an hour, while the other part of the breakfast is getting ready. No doubt it is more wholesome eaten plain, but the temptation to use various "dressings"—generally cream and sugar—is too strong for any except very firm health-seekers. But where these are eaten it should be, as the friends say, "in moderation."

Source of Muscular Power.—.—The theory has been adopted by many physiologists of late years that the muscular system of a fully developed man, or other animal, in health, is merely a perfected mechanical apparatus which accomplishes work like a machine, not at the expense of its own substance—replacing it by the assimilation of food, but using the food directly, converting it into force without transforming it into muscle. Dr. Flint, however, in a recent work, examines this theory and gives the results of a series of observations by himself and others having for their object to test its correctness. After the most careful tests practicable, his conclusions are in opposition to the theory of direct food conversion, and lead him to adhere to the older assumption of muscular waste and repair, the muscles being their own source of power.

A Large Hoisting Engine.—The new hoisting engine, which is now being built for the Calumet and Hecla mines, will be 3,800 horse power, one of the largest ever constructed in the United States, and capable of doing sufficient work to a depth of over 4,000 feet.

CAUTION IN EATING.

1. Of course don't eat too much. The digestive fluids are limited in quantity. All above enough is undigested, irritating and weakening the system, and often causing paralysis of the brain by drawing on the nervous force more rapidly than it is generated.

2. Dont eat between meals. The stomach must rest, or it will sooner or later break down. Even the heart has to rest between the beats.

3. Dont eat a full meal when exhausted. The stomach is as exhausted as the rest of the body.

4. Don't take lunch at noon and eat heartily at night. The whole digestive system needs to share in the rest and recuperation of sleep. Besides, the tendency is to put a full meal into a weakened stomach.

5. Don't substitute stimulus for food=like many women who do half a day's work on strong tea or coffee. As well in the case of a horse, to substitute the whip for oats.

6. Don't havn a daily monotony of dishes, Variety is necessary for relish, and relish is necessary to good digestion.

7. Don't eat blindly. There can be nothing in the body—muscles, membranes, bones, nerve, brain—which is not in our food. One article furnishes one or more elements, and another, others. We would starve on fine flour. Some articles do not nourish, only warm.

8. Eat according to the season—one-third less in summer than in winter. In the latter fat meat, sugar and starch are appreciated, as being heat-makers; in the former, milk, vegetables and every kind of ripe fruit.

9. Eat with cheer. Cheer promotes digestion; care, fret and passion arrest it. Lively chat, racy anecdotes and innocent gossip are better than Halford sauce.

CONSTIPATION.

It is doubtful if consumption numbers as many victims as are stricken down by the various diseases that result from habitual constipation. True consumption is an inherited disease. It may remain always dormant, but when aroused to action, decay commences at a point circumscribed and gradually extends—until arrested—until so much of the lungs become involved that vital action ceases. The evils of constipation result from inattention to the calls of nature, and usually commence with children whose habits are not closely looked to by their parents. The processes of nature are always active while life last. When effete matter is retained a moment beyond the time its expulsion is demanded, the system commences its efforts to get rid of it. When the natural egress is checked, the absorbents carry the more fluid portion of the poisonous mass into the circulation, and it becomes diffused throughout the body. The more solid or clay-like portion is forced into the lower rectum where it becomes firmly impacted, thus cutting off the circulation in the small blood vessels, causing painful engorgement known as piles and hemorrhoids. A continuance of these troubles often results in fissure, fistula or cancer. The trouble is seldom confined here. As a result of the blood poisoning we almost invariably find more or less dyspepsia, with decided derangement of the functions of the heart, liver and kidneys, accompanied by headache and nervous debility, often verging on paralysis.

Persons of sedentary habits are most subject to constipation and its sequences. Before the plan of treatment devised by M. Nelaton was introduced, habitual constipation was a disease of far more serious import than at the present time. All physicians admit that cathartics afford only temporary relief, and catharsis cannot be induced except by stimulating the bowels with irritants, and as this irritative process gradually weakens their peristaltic action, the relief from them steadily diminishes until disease of some vital organ sets in and terminates life. Relief from injections is just as pernicious, with the added danger of strictures of the rectum. With these facts in view, M. Nelaton commenced his investigations, which resulted in proving beyond question that in all uncomplicated cases of constipation, the obstruction exists solely in the lower portion of the rectum, and within reach of local remedies. For the radical cure of the various diseased conditions, he invented "Nelaton's Suppositories." It is said they succeeded beyond his own expectations. But in old and severe cases their use must be persisted in until the cure is complete.—*Hall's Journal of Health.*

GREECE spends more than 5% of her whole revenue in education.

ONE HUNDRED YEARS UNDER WATER.

Mr. J. W. Dutton, the constructing engineer of the celebrated Dufferin Palace, in Quebec, recently presented a journalist with a cane and a pencil holder made of the wood of the vessel "L'Original," which was sunk before Quebec in the year 1756. In a letter accompanying his gifts Mr. Dutton says:—The "L'Original" was built just below the Citadel, scarcely a quarter of a mile from where Montgomery fell 19 years later. For those days she was a large vessel, but in this age a 1,000-ton vessel is not much to tell of. She was built of oak timber, which must have been brought from France, as none of the Western oak forests had been cut into, it being impossible then to bring the timber down. The vessel was built of the best timber and iron, but she was fated never to do much execution for her country, as shortly after being launched she was sunk, just opposite where she was built.

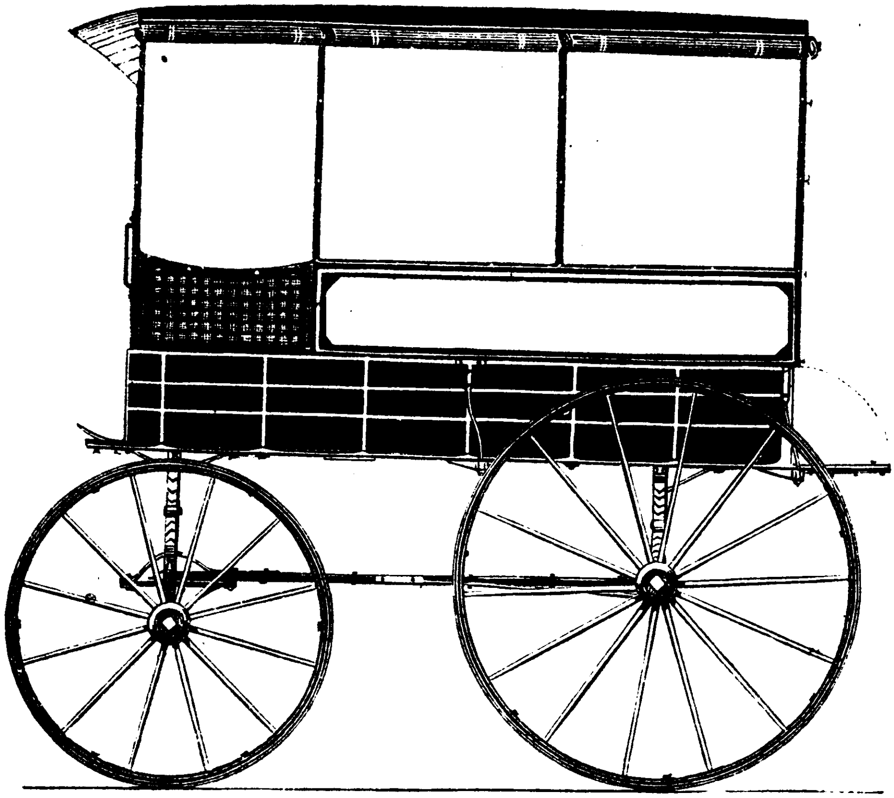
There she lay until last summer, when she was raised and towed to shore. She sank in September, 1756, so that she had laid under the waters of the St. Lawrence about 123 years. In spite of her long immersion, when they first attempted to raise her it was found impossible, on account of her being sunk in the mud, and it was equally impossible to tear her to pieces, as the oak was as solid as on the day she went down. The only thing that was gone was the iron, in places where it had been exposed, and this had completely rusted away. After several vain attempts to stir her, a diver was sent down, who fired a heavy charge of dynamite under her. This broke her up somewhat but it was only after many explosions and two years' hard work that she was finally got rid of.

The wood was eagerly sought for, and now it is almost an impossibility to get a piece of it large enough to make anything of any value. The frigate was the last relic of the old French government, having been built under the superintendence of the Intendant Bigot. She laid in 90 feet of water, and while she has been there many are the changes that Quebec has seen —as well in manners and customs as in men. When she was removed there were found to be over 100 anchors of all sizes and many hundred fathoms of chains entangled with her. These were, of course, raised, and in some instances claimed, but most of them were sold by the government to satisfy expenses.

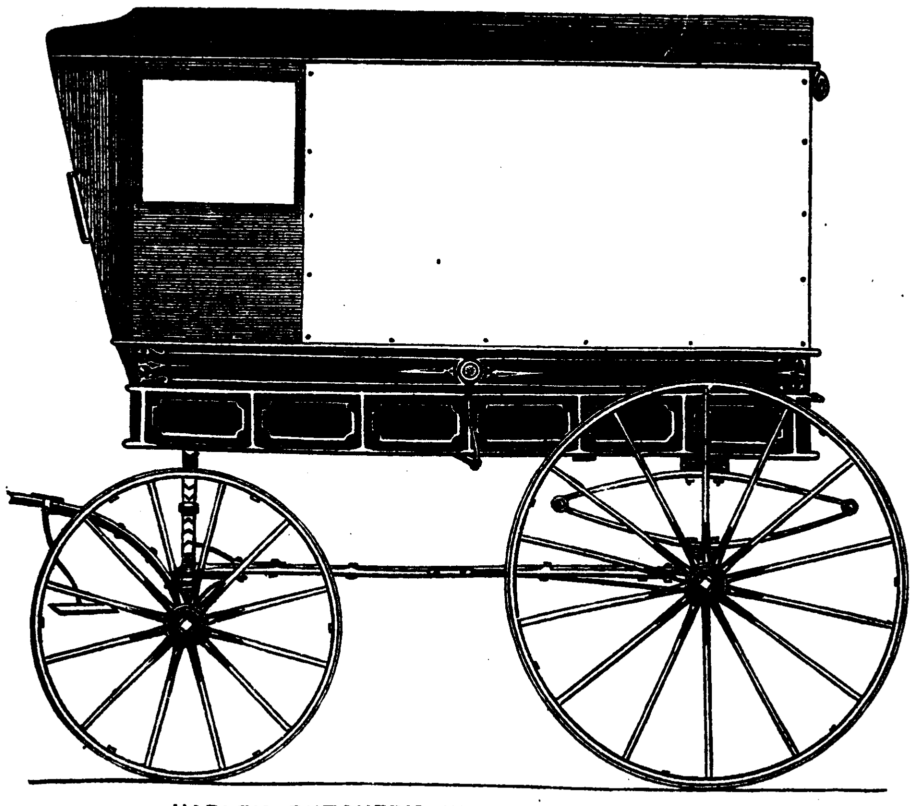
A MONSTER CLIP.

Few Englishmen have any idea of the magnitude of the operations carried on by the leading Australian sheep farmers, and the labor and expense attendant on the working of a large station. Some statistics of the shearing at Burrawang, one of Mesrs. Edols & Co.'s stations in New South Wales, may be of interest. The past season's shearing lasted ten weeks, and was finished the first week in December, by which time 206,123 sheep had been deprived of their fleeces. To do the work of a hundred shearers, in addition to the station hands, were employed, and in a single day as many as 8,316 sheep were shorn, The aggregate yield was 2,515 bales of dumped wool, each bale averaging 3 cwt. 3 qrs. in weight, so the gross weight of the station fleeces was no less than 466 tons. The fleeces of the rams averaged 8½ lbs., of the wethers 6½ lbs., and of the breeding ewes and lambs 3 lbs. 15 oz., the average weight of each of the 206,213 fleeces, of which 54,000 were taken off lambs, being only an ounce under five lbs. the wool was well grown, sound and free from burr, and though Messrs. Edols & Co. have in previous years shorn 8,000 more sheep, the number of bales this year is 150 in excess of the yield of any former season. The clip is the largest yet recorded in New South Wales, and much of the great success of this station is due to the attention paid by the manager, Mr. Dennis to the proper classing of the sheep. The labor and care required for the proper carrying out of the work at a station of this size can only be appreciated, by those who have visited our Australian colonies, but the figures will suffice by themselves for some idea to be formed of it. They will also convey some slight impression of the advantages to accrue to the colony by the extension of its railway system.

THE LARGEST HAILSTONES.—It has hitherto been supposed that the report of the Bombay *Gazette*, quoted in London *Nature*, of a hail-storm occurring last March at Dharwar, during which hailstones fell that measured 9 or 10 inches in circumference, was the most remarkable case on record. It has since appeared, however, on the authority of the *Iowa Weather Service Bulletin*, that during the month of April, 1880, thunderstorms occurred in that State, during which hailstones fell measuring 12 inches in circumference.

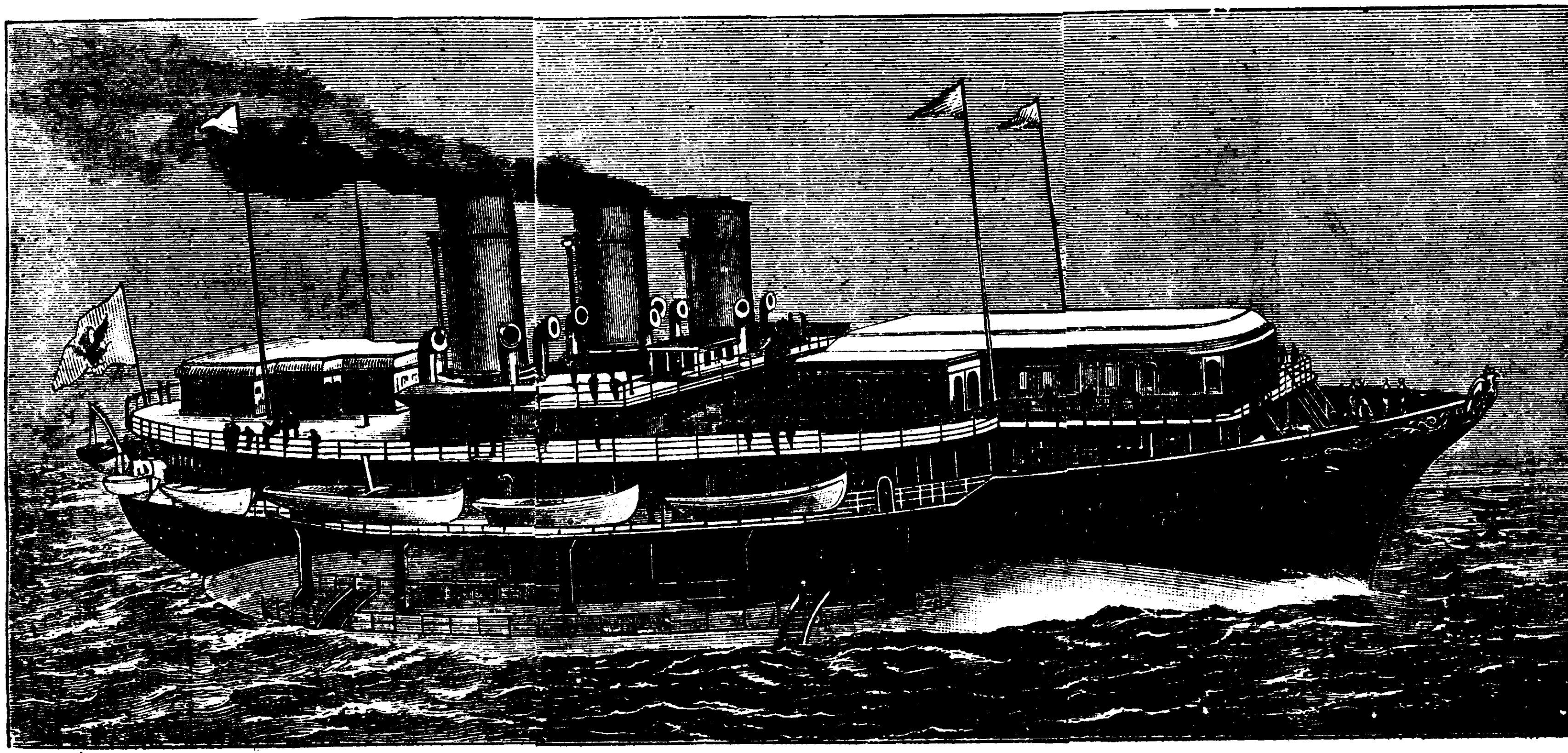


NEW YORK PEDLAR'S WAGON.
Scale one-half inch. See description.



HARLEM BUTCHER'S WAGON. *Scale one-half inch.*

DESIGNS FOR WAGGONS.



THE "LIVADIA."

The "Livadia," the new Russian imperial yacht, was launched from the building yard of Messrs. John Elder & Co., Govan, near Glasgow, on July 7. She is the latest development of ideas that may fairly be said to be revolutionary and subversive of all established principles of shipbuilding, and of which the earlier specimens are found only in the circular ironclads of Admiral Popoff. Speaking roughly, the "Livadia" must be imagined as a broad and shallow oval, half submerged, and carrying on her surface extensive lofty and sumptuous saloons and other apartments. It resembles a vessel of the ordinary kind, reposing upon a white air cushion. Its principal dimensions are: Length, 260; breadth, 150 feet; depth, 50 feet; tonnage, 11,609; and displacement, 4,000.

Miscellaneous.

HOW TO USE GLUE.

The following practical hints on the preparation and use of glue are from the London *Furniture Gazette* :

All the glue as received from the factory requires the addition of water before it will melt properly, and every addition of water (while the glue is fresh made) will, up to a certain point, increase the adhesiveness and elasticity ; and it is the duty of every man who uses glue to find out just where that point lies, as it is possible to melt glue and have it so thick that after it is dry or set it will be so brittle as not to adhere to the wood. Some glues will bear more water than others, but all will bear more water than usually falls to their share, and that too, with a greater increase in the quality of the work.

For glue to be properly effective, it requires to penetrate the pores of the wood, and the more a body of glue penetrates the pores of the wood the more substantial the joint will remain. Glues that take the longest to dry are to be preferred to those that dry quick, the slow-drying glues being always the strongest, other things being equal.

For general use, no method gives so good results as the following : Break the glue up small, put into an iron kettle, cover the glue with water and allow it to soak 12 hours ; after soaking, boil until done. Then pour it into an air-tight box ; leave the cover off until cold, then cover up tight. As glue is required, cut out a portion and melt in the usual way. Expose no more of the made glue to the atmosphere for any length of time than is necessary, as the atmosphere is very destructive to made glue.

Never heat made glue in a pot that is subjected to the direct heat of the fire or a lamp. All such methods of heating glue cannot be condemned in terms too severe.

Do not use thick glue for joints or veneering. In all cases work it well into the wood in a similar manner to what painters do with paint. Glue both surfaces of your work, excepting in the case of veneering. Never glue upon hot wood, or use hot cauls to veneer with, as the hot wood will absorb all the water in the glue too suddenly, and leave only a very little residue, with no adhesive power in it.

A "FILLER" OR POLISH FOR WOOD.

(1.) Four parts of white wax are added to 3 parts of oil of turpentine, and the whole is heated in a flask or bottle, immersed in hot water, until the wax is liquefied and almost dissolved. It is then allowed to cool, and when it begins to turn white and to harden 2 parts of strong alcohol are added, under stirring. This mixture is applied by means of a woollen cloth and through friction. The alcohol may be increased to 4 parts, but the friction must then be continued for a longer time.

(2.) One pint of linseed oil, together with 2½ oz. of alkanet root, are heated to boiling in a clean pot over a slow fire, and kept at a gentle boil for about two hours. When cool, the mixture is applied in a thin layer to the wood, and after the lapse of 24 hours well rubbed in.

(3.) The best polish, particularly for fine wood, is milk ! After all dust and dirt have been carefully removed, good fresh milk is applied to the wood and well rubbed in with a woollen rag, until all moisture has disappeared. This must be repeated several times, and in the case of new utensils should be done once a week. Milk has this advantage that its fatty substance answers the same purpose as linseed oil, and its other constituents act as a filler while it leaves no disagreeable flavor. For some light-colored woods sublimed sulphur with boiled oil makes very good filling.

One ingredient, however, is necessary in all of the above processes, without which success will not be attained, and this ingredient is *adeps cubitalis*, vulgo "elbow-grease."

A VIKING'S SHIP.—The New York *Times* says that an exceedingly interesting archæological discovery has recently been made in a tomb from the eighth or ninth century in Sandeherred, in Norway, namely, a completely outfitted and well-preserved Viking skiff. The king who, a thousand years ago, was put to rest here, had the good idea to take along with him into the grave, not only his slaves, his horses, and his arms, but also his ship ; and there it now stands, 75 feet long, with a mast 22 feet high, with the shields of the crew hanging along the railing, with its canvas and rigging in order, with all its implements in place, just as it was hauled up from the sea, when, for the last time, it brought back its master. The Viking skiff has been as great a puzzle to the archæologist as was formerly the Roman trireme. It was known that the Vikings crossed the Atlantic on the same vessels on which they ran up the Seine as far as Paris ; that they often dragged overland, for a distance of several miles, the same vessels on which they afterwards carried away great numbers of slaves, great weights of metals, and bulky cargoes of apparel, provisions, timber, etc. But how such a vessel was constructed and how it was manœuvered nobody understood. There are descriptions of these vessels in the Icelandic Sagas and in the pages of the Latin historians from the period between the seventh and the twelfth century. There is also a pictorial representation from the eleventh century on the celebrated tapestry of Bayeux, in Normandy—and embroidery with woollen thread on stiff canvas, showing the embarkation of William the Conqueror for England. But the picture gives only the general outline, and the descriptions, which are incidental with the historians, mention only some specialties or singularities. Thus, an intelligible and complete idea of this skiff has for a long time been a great *desideratum*, but by the above discovery the gap in our knowledge has at once been filled in the easiest and most perfect manner.

MILK FOR FOWLS.—A correspondent of the *American Poultry Yard* gives the following bit of experience. A neighbour of ours, whose hens, to our exasperation, kept laying on when eggs were forty-five cents per dozen, while ours persistently laid off during the same season, on being questioned, revealed the fact that his hens had a pailful of skimmed, perhaps clabbered, milk each day, and no other drink. On comparing notes we each found that our management of our fowls was almost exactly alike, with this single difference,—a difference that put many a dollar to the credit side of his ledger, while our own was left blank during the same period ; and this thing had been going on for years, with the result always in favour of a milk diet. In cases where milk is very plentiful, and only a portion is needed for fowls, it would be well, say once a week or oftener, to give the milk in form of curd, by heating it until the whey separates from the more solid portions. This is very nutritious, and its constituents so nearly resemble the white of the egg that egg formation must naturally follow its use. Let no one hesitate to take from his waste milk whatever his hens will use, assured that they will yield five times over the returns that swine or any other stock would give for the same amount.

ALUM IN BREAD.—Ostensibly, baking powders, for the most part, have for a basis cream of tartar and carbonate of soda ; but cream of tartar itself is notoriously subject to adulteration, insomuch that it is kept by wholesale dealers in distinctive grades, the lowest being grocers'—commonly adulterated with an earth which contains alum—the kind retailed to mix with an equally impure carbonate of soda as extemporized baking powder for home-made bread. To discover whether bread is adulterated with alum, soak a portion in water, and add to the water, in which the bread has been soaked, a solution of chloride of lime, a little at a time, carefully stirring ; if alum is present the mixture will be pervaded with milkiness, otherwise the liquid will remain limpid. To detect alum in flour is more difficult. The only safe course for housekeepers is to use flour and baking powders of known brands ; to eschew all extemporaneous baking powders especially ; and use such only as are known to be chemically pure and free from all injurious substances. And in this connection, without any reflection on such as have not been brought to our notice, we feel fully warranted in recommending the brand we have long used in our own household—the "Royal Baking Powder"—which we have frequently examined, and always without finding any impurity whatever.

AN IMPROVED CATTLE CAR.—A St. Louis man has patented a new cattle car. The peculiarities of the invention consist in placing the stock in four racks lengthwise of the car. The racks in each end of the car stand facing each other, and a combination water-tank, trough, and hay-box extends crosswise the car and under the heads of the cattle. Chains or belting fastened to the floor pass up between the stock and are attached to a shaft overhead, which, being turned, draws them tight and holds each animal in place. Water and feed is carried for a trip of four days, and stock can eat, drink, lie down, and rest without the train stopping. Reversing the shaft the stays fall off and drop down. The water-tank is on a roller, and can be easily moved to the end of the car. The car is then ready knof idarny of freight.

USING CEMENTS.

Quite as much depends upon the manner in which a cement is used as upon the cement itself. The best cement that was ever compounded would prove entirely worthless if improperly applied. Many complaints in regard to the quality, both of cements and glue, arise from neglecting proper precautions in their use. The following rules must be rigorously adhered to if success would be secured :

1. Bring the cement into closest contact with the surfaces to be united. This is best done by heating the pieces to be joined in those cases where the cement is melted by heat, as in using rosin, shellac, marine glue, &c. Where solutions are used, the cement must be well rubbed into the surfaces, either with a soft brush (as in the case of porcelain or glass), or by rubbing the two surfaces together (as in making a glue joint between two pieces of wood).

2. As little cement as possible should be allowed to remain between the united surfaces. To secure this the cement should be as liquid as possible (thoroughly melted if used with heat), and the surfaces should be pressed closely into contact by screws, weights, wedges or cords until the cement has hardened.

3. Plenty of time should be allowed for the cement to dry or harden, and this is particularly the case in oil cements, such as copal varnish, boiled oil, white lead &c. When two surfaces, each half an inch across, are joined by means of a layer of white lead between them, six months may elapse before the cement in the middle of the joint has become hard. In such cases a few days or weeks are of no account; at the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part any where else than at the joint. Hence, when the article is to be used immediately, the only safe cement are those which are liquified by heat and which become hard when cold. A joint made with marine glue is firm an hour after it has been made. Next to cements that are liquified by heat are those which consist of substances dissolved in water or alcohol. A glue joint sets firmly in 24 hours ; a joint made with shellac varnish becomes dry in two or three days. Oil cements which do not dry by evaporation, but harden by oxidation (boiled oil, white lead, red lead, &c.) are the slowest of all.

WHAT TO DO IN CASES OF DIPHTHERIA.

In the first place, as diphtheria is a contagious disease, and under certain circumstances not entirely known, very highly so, it is important that all practical means should be taken to separate the sick from the well. As it is also infectious, woollen clothes, carpets, curtains, hangings, etc., should be avoided in the sick room, and only such material used as can be readily washed.

All clothes, when removed from the patient, should be at once placed in hot water. Pocket-handkerchiefs should be laid aside, and in their stead soft pieces of linen or cotton cloth should be used, and at once burned.

Disinfectants should always be placed in the vessels containing the expectoration, and may be used somewhat freely in the sick room ; those being especially useful which destroy bad odors without causing others (nitrate of lead, chloride of zinc, etc.) In schools there should be especial supervision, as the disease is often so mild in its early stages as not to attract common attention ; and no child should be allowed to attend school from an infected house, until allowed to do so by a competent physician. In the case of young children, all reasonable care should be taken to prevent undue exposure to the cold.

Pure water for drinking should be used, avoiding contaminated sources of supply ; ventilation should be insisted on, and the local drainage must be carefully attended to. Privies and cess-pools, where they exist, should be frequently emptied and disinfected ; slop water should not be allowed to soak into the surface of the ground near dwelling-houses, and the cellars should be kept dry and sweet.

In all cases of diphtheria fully as great care should be taken in disinfecting the sick room, after use, as in scarlet fever. After a death from diphtheria, the clothing disused should be burned or exposed to nearly or quite a heat of boiling water.

The body should be placed as early as practicable in the coffin, with disinfectants, and the coffin should be tightly closed. Children, at least, and better adults also in most cases, should not attend a funeral from a house in which a death from diphtheria has occurred. But, with suitable precautions, it is not necessary that the funeral should be private, provided the corpse be not in any way exposed.

Although it is not at present possible to remove at once all sources of epidemic disease, yet the frequent visitation of such disease, and especially its continued prevalence, may be taken as sufficient evidence of insanitary surroundings, and of sources of sickness to a certain extent preventable.

It should be distinctly understood that no amount of artificial "disinfection" can ever take the place of pure air, good water and proper drainage, which cannot be gained without prompt and efficient removal of all filth, whether from slaughter houses, etc., public buildings, crowded tenements or private residences. —*From the Circular of the Massachusetts State Board of Health.*

FLASHING ROOFS.

The enclosed sketch shows a method of flashing a roof ; for example, that of a bay window against a brick wall. First turn up the tin of the roof against the wall with narrow tongs ; and cut out the mortar about three quarters of an inch deep, cutting the pieces to the proper shape, let them come down close to the roof, the upper edge being turned into the wall. Commence at the bottom letting the second course lap over the first about 1½ inches and so continue up the roof. Wedge in above the brick in order to fasten the pieces in place with dry pine wedges Then point up the joints with mortar.

A PRACTICAL ROOFER.

TO KEEP WAGON TIRES ON THE WHEEL.

A practical mechanic suggests a method of so putting tires on wagons that they will not get loose and require resetting. He says he ironed a wagon some years ago for his own use, and, before putting on the tires, he filled the felloes with linseed oil, and the tires have worn out and were never loose. This method is as follows : He used a long cast-iron heater, made for the purpose ; the oil is brought to a boiling heat, the wheel is placed on a stick, so as to hang in the oil, each felloe an hour. The timber should be dry, as green timber will not take oil. Care should be taken that the oil is not made hotter than a boiling heat, or the timber will be burned. Timber filled with oil is not susceptible of injury by water, and is rendered much more durable by this process.—*Factory and Farm.*

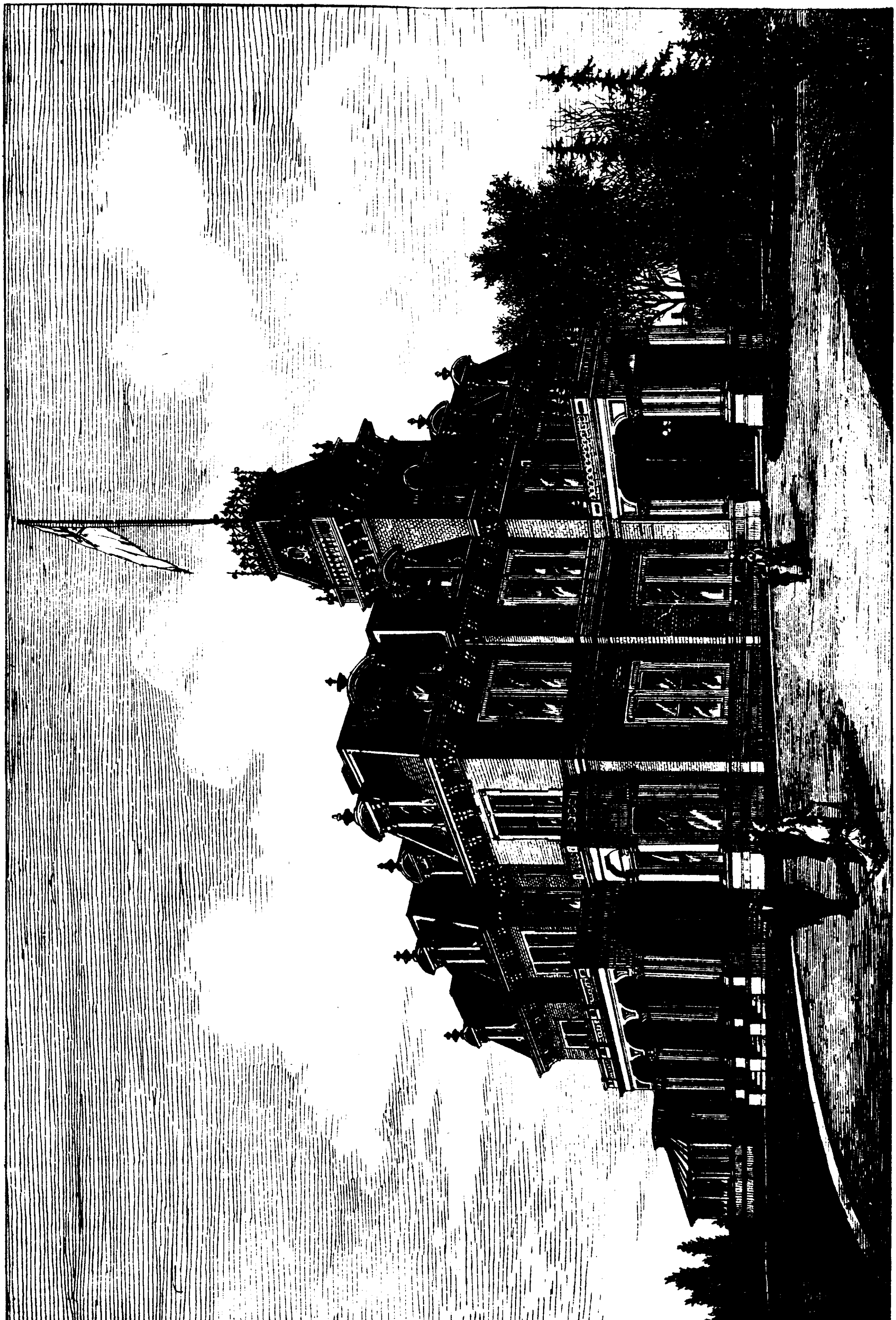
A RUSSIAN SHIP-CANAL.—It is officially announced that the Russian Government has commenced the construction of a ship-canal between Cronstadt and St. Petersburg, so that vessels arriving at the former place can proceed directly to St. Petersburg, thus avoiding the transhipment of freight by lighters. The canal will be about 300 feet in length, and will be deep enough for vessels drawing 20 feet of water. It is expected that the work will be completed in 1883, but next year it will be available for vessels drawing 16 feet of water. The principal branch of the canal will divide the island of Caunoniers and rejoin the River Neva within sight of the Island of Gontonien.

TO MAKE SELF-SHARPENING HORSESHOES.—Self-sharpening horseshoes are made by the simple expedient of rolling a steel plate in the centre of the iron from which the shoe is made, so that the calks of the shoe have a hard steel centre, and as the soft iron wears away by use the sharp steel is left to prevent slipping.

BONE GLASS.—After extracting phosphorus from bones, a glass can be formed from the residue which consists of lime and phosphoric acid, the ordinary kinds of glass being composed of sand and potash, soda, lime and alumina. Bone glass can be worked as readily as any other glass ; it has the valuable property of not being attacked by fluoric acid.

AN EXPLOSIVE ALLOY.—M. Debray, at the last meeting of the French Academy, exhibited an alloy which, when heated, will explode. "A five-franc piece made of it and held near a gas-flame, will detonate to the astonishment and alarm of the holder." It is composed of one part of rhodium and two or three of lead, heated in a crucible to a high temperature.

OREGON DISCOVERIES.—There are reports prevalent that highly important discoveries of placers and quartz veins have been made in Yamhill Co., Or. ; the former in Moore's valley, and the latter on the north fork of the Yamhill river, near Daniel's mills.



GOVERNMENT HOUSE, TORONTO.