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SCIENTIFIC CANADIAN.

MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 7. DECEMBER, 1879. No. 12.

TECHNICAL EDUCATION AND APPRENTICE SCHOOLS.

E are glad to find that the Board of Education in the district of Ontario is awakening to the necessity of a change on the subject of education taught in our public schools, and that there is a gleam of hope that technical teaching will, in the future, receive more attention. We have, during the past year, dilated considerably upon this subject, and a few remarks on the same in the concluding number of this year's volume of the *Scientific Canadian* will not be out of place. Hitherto we have spoken of the efforts made by the Guilds of London to impart technical teaching and practical training in order that English workmen shall not fall back from the high standing which they have hitherto held in art work, machinery and tools, but that they shall have an opportunity always of keeping up with the times and hold their own against all nations.

It would appear from all that has been written on this subject by those well calculated to form a just opinion of the matter that what is particularly wanted is manual dexterity and technical knowledge to enable workmen to earn more wages and to produce better work without being at the mercy of fluctuations in trade—which always is felt most by the unpractical machinist.

A system adopted in this country that would impart real instruction in technical principles would be a great aid to many of our mechanics who serve an apprenticeship. To compete with foreign nations—and the day, we trust, is not far off when we shall be able to do so to a certain extent—it is clear that our manufactures must be better than this, and whether or not our policy is Protection or Free Trade in the future, the technical education of our artisan classes should be a *sine qua non*. What particularly is wanted in this country is that foremen should be specially trained and that there should be more practical training on the part of employees themselves, many of whom being men of capital, have found the money expecting to find in others the practical knowledge to do the work, which they have not done, and hence the cause of many failures. Nothing is more deplorable than the position of an employer who is ignorant of the practical details of his business, and at the mercy of employees whose workmanship he is unable personally to direct. The polytechnical schools of Germany afford a fair example for us to copy, under certain changes, most suitable to a free people, because in them the general intelligence of pupils is cultivated. To succeed, however, we must commence at the beginning, that is in the class of education imparted in our public schools must be changed even if we do not adopt the practice of Germany which prevents children to go forth to factories at an early age, first on half time, and then technical training would go on simultaneously with the ordinary teaching of the schools. But besides this, the rising generation of workers need more knowledge of science applied to industry, for hitherto too much has been trusted to rule of thumb. We sincerely trust this subject will receive the attention of the government, and if so most assuredly it will bear good fruits for the future.

SPECIAL ANNOUNCEMENT.

We have already announced to our patrons in our Prospectus for 1880 the great efforts we are making to render the *Scientific Canadian* particularly useful to every class of our subscribers by the addition of ILLUSTRATED SUPPLEMENT SHEETS OF TECHNICAL INSTRUCTION on nearly all the mechanical trades. We more than doubled our subscriptions last year and brought it up almost equal in ratio to our English reading population, to the circulation of many long established scientific papers.

As we fully intend, during the coming year, to push it to the utmost in every part of the Dominion, we particularly desire to call the attention of MANUFACTURERS of all MACHINERY, TOOLS, AGRICULTURAL IMPLEMENTS, WOOD-WORK, PAINTS, VARNISHES, OILS, &c., to the medium this Magazine offers for advertising, and reaching a class of readers interested in the use of all articles relating to mechanics and manufactures.

TO OUR READERS.

Although our prospectus for next year's volume fully explains the extraordinary efforts we are making to establish for the SCIENTIFIC CANADIAN AND MECHANICS' MAGAZINE a reputation for usefulness to members of every mechanical trade, we desire to say a few words of thanks to our present subscribers for their past support, and in requesting a renewal of their subscriptions we can assure them that every effort will be made to raise the magazine to as high a standard as that obtained by many of its senior contemporaries.

In one branch of support, however, we have been greatly lacking, and that is in original contributions from our subscribers of their own practical knowledge, for the benefit of their fellow-men. This branch has been found particularly interesting to readers, if we may judge of the number of communications received and published in the columns of the *English Mechanic*, and many of the American scientific and mechanics' journals, particularly the *Metal Worker* and the *Sanitary Engineer*, both published in New York. We trust, for the future, diffidence will not deprive us of many valuable hints and suggestions which we know many of our subscribers are well competent to afford. We shall in next year's issue devote a page, or more if required, entirely to Questions and Replies, and we hope that much information will be obtained from this new and attractive feature in our journal. The publication of illustrated sheets of technical instruction, with the coming volume, is a novel and most useful feature, and cannot but win for the SCIENTIFIC CANADIAN a very large increase of patronage for the coming year. The very fact that any mechanic can obtain 12 illustrated sheets of practical instruction in his own particular line of trade (equal in value to a whole work), in addition to the magazine itself, and also the *Patent Office Record*, places the SCIENTIFIC CANADIAN at the head of all monthly periodicals for general usefulness and cheapness. The SCIENTIFIC CANADIAN, in its issue for the past year, shows no less than 400 illustrations and over 1000 articles on different subjects.

By publishing so much extra information in our illustrated sheets of technical instruction, we shall also be enabled to devote much more space to the discussion of current topics, scientific progress, the manufactures of the country, its resources, and other subjects of interest; but particularly will it be our object to afford to the young information in a pleasing and instructive form, so as to render this magazine a cyclopedia of useful knowledge which should find a place on the library shelf of every family. We most particularly desire young people not to be bashful in seeking to acquire knowledge through our columns, or to be ashamed to ask a question. A celebrated Italian philosopher, being asked once how he came to acquire such a fund of information, replied: "Because I was never ashamed to ask for information when I was ignorant."

Although the return of prosperity is only just dawning upon us, yet we cannot but feel assured that the mist is clearing off the face of the land and brighter days are in store. We sincerely trust that we are entering upon a period of renewed prosperity, and hope that from the lesson of the past we may steer our course in an open sea, and avoid those rocks upon which so many of our manufacturers and business men, during the past five years, were carried by the whirlwind of speculation, shattered and lost. We heartily wish you all a happy and prosperous new year, and only ask, in return for our efforts to serve you, a return in kind.

A FEW WORDS TO APPRENTICES AND YOUNG MECHANICS.

BY THE EDITOR.

My lads, before concluding the last month's number of this magazine for the closing year, I desire to have a little talk with you, not in my character as Editor of the SCIENTIFIC CANADIAN, but as a friend interested in your welfare, and in that of our country. I wish you to think more of yourself hereafter as a body, for the prosperity of your country and its great future is depending upon the ability, perseverance and moral character of a body of men upon whom it has to rely to develope, work into shape and use its resources, and that body is represented by you. You have only to recall to memory for a moment those who have done so much for the world's progress during the past half century, and a catalogue of names will present itself to the mind of working men who have done more for mankind by their inventive genius and perseverance than all those who existed before them since the commencement of the Christian era. A host of such men I could mention to you whose names will ever have a place in the world's history, and in every language of the civilized globe. Most of these brilliant men were of humble origin, many of them were, in fact, mechanics that even never had the benefit of a common school education; but how did they rise to eminence and fame? Not by indolence and lethargy surely. A youth who can take no active interest in business or lawful pleasures, is deficient in vitality, and is to be pitied for his torpidity, rather than condemned for his wrong doing. Not by devoting spare hours to reading trashy "dime novels" and low class literature, or by frequenting billiard rooms and saloons, where a youth cannot fail, in a short time, to become demoralized both in mind and body. No, but by a steady determination to cast aside the ignoble things of life, to improve the minds by the study of works treating on their avocations whatever they may be, and a determined spirit to overcome difficulties, however hard they might at first appear. Let me give you one or two instances of this:—

Nearly eighty years ago there was a poor weaver at Cockenell, working hard to keep the thatch whole over his head, and to support a large family beside him. His name was Fallows. His eldest son, a lad with legs just long enough to reach the treadles, had to help his father to raise the needful. The lad had talent, and by-and-by about the "wee sma' hour ayont the twall," father and son might be seen together conning the youngster's lessons. In this way the lad became a good grammarian and a first-rate mathematician. By-and-by he started a village school; crept up to college at Cambridge; contested with Hershell for the office of Astronomer Royal, and lost the election by only a *single vote*. He afterwards became Astronomer Royal at the Cape of Good Hope. There he drew a plan of the southern hemisphere and stamped himself as a first of his class. He published a catalogue of the stars in 1824 and died in 1831. Another instance of what perseverance will accomplish in the face of disadvantages is that of Richard Roberts, the inventor of the self-acting mule. He was

also a very remarkable man. He began life under many bitter disappointments and disadvantages, but rose superior to them all and achieved a high position among mechanicians. His father was a shoemaker in an obscure village in Nor h Wales. For some reason Richard was never sent to school. At an early age he went to work at a slate quarry, subsequently he was employed in a canal boat, and later he held the position of servant to a gentleman in the neighborhood. It was while in the last position that the youth's latent talent was awakened. His employer was an amateur turner and the boy became fascinated by the lathe, seizing every opportunity of practicing on it until he became an expert turner. Step by step he advanced until he became an expert machinist. He then sought to improve his condition in a wider field, and walked all the way from Manchester to London, where he succeeded in obtaining employment in Mandslay's famous establishment. Soon after he established a business for himself, and ultimately became a partner in one of the most important engineering firms in Manchester. It was as a member of this firm that he effected his well-known improvements on the locomotive engine, and invented the self acting mule. Before entering into this firm he invented a gas meter; the slide lathe; the slotting machine and other engineering tools which acquired for him a high position in the world. One of his biographers, referring to that early period of his life, says: "His fly-wheel was in the cellar and his lathe upstairs in a bedroom. The strap passed through the living room of the ground floor and the power that turned the fly wheel was his wife." In the United States likewise how many examples we could point out to you of men who, from small beginnings, have achieved success by merit. For instance the case of Aaron French, who served as a blacksmith at Pittsburg, Wisconsin, and who afterwards became the proprietor of the great railway car spring manufactory, which in the year 1872 sold two thousand tons of springs.

A mechanic to succeed in life must show zeal and energy in the trade he is learning, he must have ambition likewise, and feel an interest in his work. Nothing is more common than for a lad to imagine that he can learn to be a machinist, carpenter, smith or painter, by serving two or three years in the capacity of an apprentice, and yet nothing is more false. It is work and perseverance alone that wins the golden apple—work both of brain and muscle. Whatever you have to do make it a rule in life to do it well. If you heartily wish to succeed, put into your work the same heart and life you would into a game of lacrosse or other youthful sport, it will pay you in the end. You may often feel tired and dispirited over your work; you may feel that your employer does not appreciate your efforts to improve yourself and perform his work well above an adler and careless workman at the bench beside you, but never be discouraged, all those who have gone before you and have risen to eminence and wealth, have had all these discouragements and disadvantages to contend against, therefore feel assured that by serving your employer well and faithfully, you are not only doing your duty in life, but building up profit to yourself. A good workman will always obtain employment in hard times in preference to the uncompetent and untrustworthy.

And here let me say a few words about *shop manners*. Much will be gained at the start if a youth is not only patient under provocation and uniformly good tempered, but also pleasant and agreeable in his manners. It costs nothing to be polite and politeness makes friends. We know of no place where it will pay better to show the instincts of a gentleman than in the workshop, and here we feel it our painful duty to speak of the coarseness and vulgarity which so often abounds there. He who exhibits ill-breeding while at his daily task will exhibit it wherever he goes, and it will place a mark upon him wherever he goes. We thoroughly believe in the dignity of labour, and no matter how grimy a man's trade may be, he can always be a gentleman in spirit, and as Burn's says, "a man's a man for a' that."

As the Editor of the SCIENTIFIC CANADIAN, it has been my endeavour to do my utmost, in my limited capacity, to improve through the columns of the magazine the status of Canadian mechanics. The donation of Illustrated Supplement sheets of Technical Instruction to such of our subscribers who follow trades, is an evidence of this, the value of which we trust they will appreciate. It is my desire as Editor to afford you every information within my power, and knowing how difficult it is in Canada for mechanics' to obtain trade manuals and other useful works, he will afford you every information upon application and obtain the books for you at the published price whenever practicable, all he asks in return is that you would take that interest in the work which it surely now deserves, by affording to the publishers by your subscription the means wherby to maintain a work which, under the most favorable circumstances, can only expect to obtain a limited remuneration for some years to come, that is until our English reading population is more than doubled.

PATENT INVENTIONS.

The *Scientific Canadian*, being a monthly journal cannot afford space in its columns for notices of Patent Inventions. Occasionally, however, when we have met with one of really practical utility to Canadian Mechanics, we have given an illustration or description of the same. We do not in fact consider it fair to our readers to appropriate the pages intended for their special reading to descriptions of inventions of very little practical use, although we have frequently been solicited to do so as an advertisement.

But, as a new feature to the Magazine, this we will do. We will print one or more extra pages if required, immediately preceeding the *Patent Office Record* and use them entirely for illustrations and descriptions o useful inventions taken out in Canada. Only patents of real practical use will be noticed in these pages. The cost of this method of advertising we will, on account of the benefitit may be to our readers, make very low. Inventors desiring to advertise in this form will please communicate with the Company or the Editor, who will inform them of the rate of charges.

A GREAT CONSERVATORY.—Possibly the largest private conservatory in the world is that recently completed for the King of Holland in the Schlos Park, adjoining his favorite country residence. It contains about 46,000 cubic yards of space, while its glass dome is 95 feet in height and 180 in diameter. This is flanked by two lofty towers resembling Turkish minarets in shape, which given an Oriental character to the whole structure. The hot-water pipes laid down for its heating are 15,000 feet long.

NOTICE TO SUBSCRIBERS

RECEIVING THE *Scientific Canadian and Mechanics' Magazine* THROUGH AGENTS *or* STATIONERS.

With reference to our PROSPECTUS FOR 1880, in which we state our intention to donate to each subscriber belonging to a mechanical trade, one ILLUSTRATED SUPPLEMENT SHEET of TECHNICAL INSTRUCTION, every month, relating to his own trade, we will therefore feel obliged to such subscribers as obtain the Magazine through Agents or Stationers, and whose names we know not, to notify to us the trade, of any they follow, in order that we may enter in each monthly number the proper Illustrated Supplement.

We would prefer, if convenient, that all subscriptions should be sent in direct to the office.

TO SUBSCRIBERS IN ARREARS.

We respectfully call the attention of such of our subscribers who are in arrears of payment, to the propriety of remitting to the office the amount due before the close of the current year.

The heavy expense the company is incurring by printing Illustrated Supplement sheets of Technical Instruction in every trade, twelve of which will contain as much information as many books sold at from $2 to $3, is the greatest boon to mechanics ever offered by a Mechanics' Journal. We sincerely trust, therefore, that not only will remittances be more prompt in future, but that the Mechanics of the Dominion will appreciate our endeavours to afford them and their children mechanical instruction and general knowledge in the most practical form, by liberally supporting for the future this useful magazine.

AS THERE ARE MANY WHO HAVE SENT IN THEIR NAMES AS NEW SUBSCRIBERS FOR THE COMING YEAR, WHO MAY WISH TO OBTAIN THE FIRST VOLUME OF THE MAGAZINE UNDER ITS CHANGED TITLE OF THE

SCIENTIFIC CANADIAN AND MECHANICS' MAGAZINE,

we desire to intimate that we shall have a few unbound volumes of this year remaining on hand which can be obained at the usual rate, vizt. $2. This volume is especially valuable to young mechanics, as it contains the whole of Collin's Elementary work on Machine Drawing, and illustrated by over 50 plates and as many more of minor illustrations. We have also some back numbers for the years '1873, '74, '75, '76, '77 and '78 of the Magazine under its old title of CANADIAN MECHANICS' MAGAZINE which are lacking one or two numbers, these we will dispose of for SEVENTY FIVE CENTS per volume.

These papers contain much matter of permanent interest, and are profusely illustrated; they will be found particularly useful for constant reference by every MACHINIST and MECHANICS of almost any trade, as well as to ARCHITECTS and BUILDERS. Each number contains the PATENT OFFICE RECORD of patents issued in Canada during the previous month.

OUR AMERICAN EXCHANGES.

We beg to acknowledge, with many thanks, our indebtedness to our *Exchanges* for much valuable information derived from their columns. We have given a free advertisement to several of them in our monthly catalogue of useful books and periodicals, published for the information of our subscribers, and shall always have much pleasure in recommending them to those whose business lies in the line represented by each particular paper.

New Publication.

THE MILLING WORLD AND CHRONICLE OF THE GRAIN AND FLOUR TRADE.

This new monthly journal which is published by C. A. Wenborn, 194 Main Street, Buffalo, N. Y., appears to be a work of great merit and should be taken by all Canadian millers, the subscription price is only $1 per annum. We cannot pass a higher compliment upon its merits than by giving to our milling friend two of its leading articles and an example of its editorial ability.

SHALL THE MILLSTONE BE SUPERSEDED?

The greatly improved methods of milling that in the past few years have been so universally adopted, have but stimulated a spirit of progress, and awakened a desire to attain still greater perfection in the art of flourmaking; and, in seeking new avenues for advancement in the science, it is but natural that the feasability of improvement in the methods of reducing the wheat, should be canvassed and discussed; and it is questionable if any topic now under consideration by the theoretic miller excites as lively interest, or one concerning which a greater diversity of opinions exist.

With the advent of "New Process" milling came the necessity for improved methods of reduction, or rather improvements in the devices by which the reduction of the wheat berry was accomplished, and whether the full "high grinding" system, or its modification known as "half high grinding" was adopted as the practice, important changes in the dress and suspension of the burrs were essential to the successful realization of the object sought. At first changes in the dress of the burrs were supposed to be sufficient, and innumerable "patent" dresses, and others profoundly "secret" have at various times been offered the milling fraternity as embodying everything desirable to facilitate proper granulation. The necessity for having the burrs in proper train and balance was recognized, and numberless devices were originated to ostensibly meet this requirement, but after protracted experience in the manufacture of the finest flour in the world (with one exception), the inevitable Yankee spirit of ambition to excel steps in and suggests possibly better results, by the adoption of another system, and the advisability of, or probable benefit to be derived from a change of methods is now being agitated.

In past years numerous attempts have been made to obtain a substitute for the millstone, a substitute that would not when in operation become heated, that would not need dressing so often, and under the old system of milling, that would not past so easily—but in this country very little attempt was made at the substitution of a device which should perform the function of flourmaking in a mechanically different manner, until within the past three or four years.

With a view of arriving at an intelligent decision of this vexed question, let us consider the advantages and disadvantages of the time-honored millstone, as compared with those of its (shall we say formidable) proposed rival, the roller. It is hard to part with an old and tried friend under any circumstances, and still harder, if from lack of proper championship of his good qualities he is banished to make way for one whose bad qualities may have been purposely or unwittingly concealed.

It is well to bear in mind in considering this matter, that the

roller now clamoring for recognition from the American milling public, is an approved auxiliary of the Hungarian system, and that its results in practical operation in those countries where it has been most thoroughly tried are seemingly satisfactory, although scientific tests are constantly being made to still further increase its efficiency and value.

The demand of the miller belonging to the progressive school of to-day is, that in the reduction of the wheat berry, the bran shall be kept in such large particles as to prevent its passing through the cloths in the processes of bolting, and this desirable result, it is claimed by many, cannot be accomplished by the agency of the millstone, because its tendency in operation is to rub and tear the berry apart, and as a consequence the bran is abraded and more or less reduced so that minute particles are produced which it is found impossible to prevent becoming incorporated with the flour.

Again, it is said that this rubbing and tearing action disintegrates the germ and it too passes into the flour product, causing it to assume a yellow cast, thereby injuring its commercial value.

It is further claimed by some that upon millstones all degrees of granulation are effected at a point about mid-way between the eye and skirt, and all frictional contact beyond that point is injurious, as the tendency is to produce a greater quantity of superfine flour, in addition to the liability of reducing the germ and bran.

It is urged that the amount of care and attention necessary in keeping the stones in proper condition, the power required to drive them, and their liability to derangement, more than counterbalance the difference in first cost as compared with rolls. To sum up the superiority claimed for the roller system of reduction we have,

1st. The bran and germ are better preserved.

2nd. The product in the form of middlings, semolina or flour will be freer from impurities.

3rd. The effect of the pressure is to burst the berry, and in disintegration its granular formation is preserved.

4th. The flour obtained is not in the slightest degree heated.

5th. The flour will be more absorptive, and consequently the bread made therefrom will better retain moisture.

6th. As the degree of reduction can be regulated with the greatest accuracy, the middlings can be more easily and thoroughly purified.

7th. As the point of frictional action is reduced to the minimum, there is a perceptible decrease in the quantity of power necessary to perform the operations of granulation.

8th. Their remarkable durability as compared with the millstone.

9th. The time consumed in dressing the millstone is saved.

On the other hand some advocates of the retention of the millstone urge that, where care is taken to select close burrs, they are properly dressed and the fittings as accurately and carefully constructed and arranged, equally as good if not better results will be obtained than by the employment of rolls.

It is claimed by some that the flour obtained by the roller system is coarser in texture than that produced on the millstone, and that for this reason the bread will not as well retain its moisture; that if the wheat is damp and tough it is necessary to thoroughly dry it before subjecting it to the process of reduction; that the middlings produced are not, by reason of their elongated shape, so readily purified; that the cost of operation is greatly increased; that the first cost is greater, and that much longer time is required in the operations of flourmaking.

Now, if both sides to this question can adduce substantial proofs of the accuracy of all their statements and assertions, it will be evident that

1st. Both systems are the best, and

2nd. Neither one is calculated to produce satisfactory results.

In 1876, all the great mills in Buda-Pesth had adopted the roller system of granulation, and it is to-day, probably, in greater favor than at any previous time, but the fact that in some of the mills as many as eleven grades of flour are made, would seem good ground for supposing that the system in its entirety could not be successfully introduced into this country.

The fact that constant experiments are being made there to devise other means of reduction, would also indicate that the system, although in use, leaves something to be desired.

Again that the roll is not generally taken to be, theoretically the best adapted for the first reduction, is shown by the fact that numerous cutting machines have been devised for this purpose; and, that for "finishing up" it does not satisfactorily meet the requirements of millers, is evidenced by the fact that in some of the leading mills in Austro-Hungary this operation is performed upon millstones.

A careful consideration of all the theories advanced, and facts obtainable having a bearing upon this question, leads to the following conclusions:

1st. Roller milling in a somewhat modified form might be profitably employed in this country in mills that now operate on strictly the "high grinding" plan, as in this system all operations may be performed upon rolls, except regrinding the bran.

We think it must be admitted that the cost of operation will exceed that of millstones, and certainly the first cost is greater, but, as there appears to be ample evidence that a greater percentage of high grade flour is obtainable from their use, the increased value of this product will probably more than counter-balance the objections.

The operations of reducing, scalping, purifying and bolting, consume more time, and the system demands more wetchful care and attention than that now in vogue, but if adopted, as it bids fair to be in some of our large mills, we look for the happiest results.

2nd. Rolls will be found valuable auxiliaries in half high grinding for the purpose of flattening the germ, and middlings to which particles of bran adhere.

To perform this office, we look to see them almost universally employed, as for the purpose they have yet found no worthy competitor.

In discussing the probabilities of the millstone being discarded, and the roller adopted in the United States, it must be borne in mind that mills which pursue "high grinding" are few in number as compared with those that do not.

The great mills at St. Louis, whose products find ready market at home and abroad, and other well-known and extensive mills throughout Missouri, Wisconsin, Illinois, Michigan, Indiana and other States where soft wheats are grown and milled, have not thought it economical or wise, in a commercial sense, to adopt the system of high grinding prevalent in those sections where hard wheat is obtainable, and so long as this is the case millstones will be employed and regarded with favor.

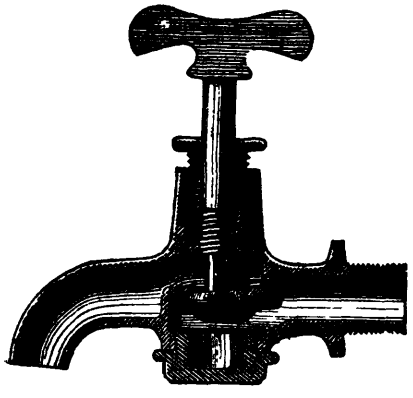
That changes will be made in them and their methods of operation, that their capabilities and value will be augmented is to be expected, as we are progressive in our ideas and aspirations, but the time when they will be entirely superseded, is, we believe, far distant.—*The Milling World.*

Messrs. Rambert and Robert are bringing out a magnificient serial publication of what I might call, the Natural History of Familiar Birds; of those birds that we know, that we love, which interest all ages, even in fancy. About sixty species are noticed, and what is certainly new, the drawings are all from nature. The authors are very severe on the inhabitants of Southern Spain, of Carsica and Italy, for their massacres of feathered friends; they slaughter with the coldest cruelty, some of the most charming species, seeing in them nothing but game. The havoc is more terrible as it is by these regions the migrations pass. The Italian markets are encumbered with robin red breasts, larks, red-wings, finches and thrushes; the nightingale is a good take also, and even young swallows. The chapter on the tomtit is peculiarly interesting. This bird is a veritable acrobat, and executes gymnastic feats on the extremity of a leaf with a marvellous dexterity—a combination of a monkey and the squirrel; but its play is hunting all the while, the eggs of caterpillars, bugs and spiders. It is terribly cruel if caged with a weaker bird—will kill it in order to suck its brains. As a parent, it is kind, and it cracks hard seeds and grains affectionately for its young. The hawk is the only bird of which tomtits have a mortal dread.

Messrs. Cerbeland and Dumont publish a volume of 600 pages of a work treating on the industries of France, and deploring that while there is no falling off in point of intelligence in the part of the French artisan and manufacturer, they are being cut out of their own market by the foreigner. The French are not sufficiently speculative and are timid to change old plans for new. In the matter of coal, France ranks only fourth in the production of that combustible—on a par with Belgium, though she is not deficient in coal mines. England produces as much coal as all the nations of the world together. Excepting in iron, France has to depend on the foreigner for her supply of the other metals, although she is comparatively rich in them herself. It is an English company that works the chief iron mine at Bone, in Algeria.

SIMPLE HIGH-PRESSURE TAP.

The introduction of a cheap and simple high-pressure tap would doubtless facilitate the introduction of a constant supply of water in the metropolis, by relieving the companies of the necessity for insisting upon the adoption of rather costly fittings. The illustration shows a form of tap patented by Messrs. Warner and Brown, having a cone (or it may be a disc) closing against a diaphragm or partition within the body or shell, so as to cover an aperture therein, by which, when the cone or disc-valve is removed, the fluid is free to pass. The cone or disc is carried at the end of a spindle, passing through the aperture or water way in the diaphragm or partition; there is also a screw thread formed upon the spindle, and the screwed portion is somewhat larger in diameter than the other parts. A boss is formed upon the shell or body, which has a hole through it, traversed by the



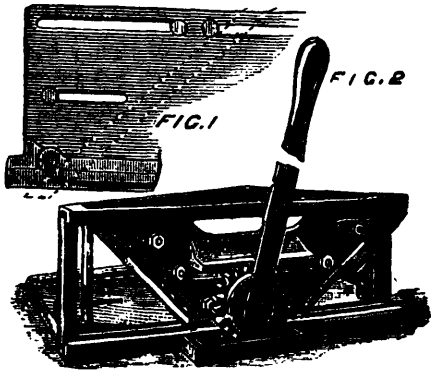
spindle, and which is tapped with a screw thread corresponding to that upon the spindle, so that the latter working in the boss as a screw in a nut draws the cone or disc to its seat. On the side of the shell or body opposite to the boss there is a hole sufficiently large to admit the cone or disc, and when that has been inserted the hole is closed by a plug screwed into it. The part of the spindle beyond the screw thread may pass through a stuffing-box formed in the boss, or it may simply have a conical collar upon it, which when the spindle is screwed in in such a manner as to remove the cone or disc from its seat, and to open the water way, comes down upon the top of the boss, forming a fluid-tight joint, preventing any escape around the spindle. In the figure, which is a section, the spindle is shown passing through a stuffing-box, but in a modification the stuffing-box is dispensed with, and a metal cone fixed on the spindle descends with it and makes a joint sufficiently fluid-tight for most purposes.

A WONDERFUL LUBRICANT.

Grease has been deprived of one of its constituents by Senor Unciti, which gives it many wonderful qualities, if we may judge from the experiments lately made at the present exhibition of applied science in Paris, France. The *Iron* says: Two open boilers, made of tinned sheet iron, were put upon two coke furnaces of equal intensity; but the bottom of one of the boilers was coated with the grease outside, so as to be in immediate contact with the flame, whereas the other was not so coated. The former began to give off steam in a quarter of an hour, and the latter not until half an hour had elapsed; whence it may be inferred that the grease increases the conductability of the metal, so that with a given quantity of fuel more water is turned into steam. A brass lubricator, of cylindrical form, filled with the grease, was then plunged into the water in the coated boiler, and, almost immediately, minute particles of the lubricant began to issue from a small hole in one end, rise to the surface, and gradually spread themselves over it. This was to show the application to the interior of a steam boiler for preventing incrustations, three grammes (about 1½ drachms avoird.) being used for each horse-power. The grease is also carried along by the steam into the cylinders, rendering any other lubrication unnecessary. Notwithstanding the cooling effect produced by the lubricator, a large body in proportion, the water in the coated boiler bubbled violently in an hour from the time of its being placed in the fire, whereas the other, not coated, did not boil in an hour and a half, when the experiment was stopped. A portion of the grease was wiped off from the bottom of the coated boiler and thrown on to the fire, when it immediately flared and was consumed. The tin bottom was as bright as before, but that of the other boiler gave evidence of the action of fire. This was to shew, on a small scale, that boiler plates exposed to the action of the fire do not become burnt. And, indeed, this fact follows as a natural consequence of the other point established, viz.: the increased conductibility given to the plates. Those who witnessed the demonstration were most astonished to see that a stick dipped in the grease made marks on the hot sides of the boiler and furnace as distinct as lines with a drawing-pen, and which did not run together, as they would have done if made with ordinary grease. So far the experiments have been most conclusive, fully bearing out the official certificate of the Spanish government; and it will be interesting to watch the result of a continued application to steam boilers on the scale of actual practice.

A NEW MITRE CUTTER.

The accompanying engraving represents an improved mitre-cutter recently patented by Mr. W. R. Fox, of Rockfall, Conn. Its construction is so simple that it can be readily understood by a glance at the engraving, Fig. 1. The cutters, which are made of the finest cast steel, are secured to a slide that moves in guides along one edge of the bed, and the slide is moved by a pinion placed between the rack on its outer side and a rack on the bed, the pinion being provided with a long lever by which cutters may be moved in either direction with force sufficient for any work that the tool is capable of doing. Upon the bed, Fig. 2, there are gauges and guide marks to which the work is adjusted. At each end of the bed and near the path of the knife there is a pivoted support for the end of the piece being squared.



The tool seems superior to the block plane, says the *Scientific American*, as it will do the work quicker and better. It is particularly useful in squaring across the end of the grain; when used for this purpose, the piece being cut may be backed up by another piece to prevent slivering. The tool is strong and well designed, and well calculated to meet the wants of wood-workers.

To Polish Iron or Steel.—For those in the metal or hardware trades who wish to obtain that beautiful deep black polish on iron or steel which is so much sought after, all that is required is to boil one part of sulphur in ten parts of oil of turpentine, the product of which is a brown sulphuric oil of disagreeable smell. This should be put on the outside as lightly as possible, and heated over a spirit lamp till the required black polish is obtained.

Metallic Laces.—Debray uses wires of German silver in the manufacture of metallic laces. He colors metallic foils for the same purpose by depositing upon them iridescent films of oxide of lead. Litharge is dissolved in caustic alkali and the resulting solution is decomposed by a current of constant intensity, the positive pole of the battery being in communication with the metallic surface to be coated.

It is stated that very large quantities of tin plates made from steel are branded charcoal and best charcoal, and so exported, and these plates, it is affirmed, are exceptionally well received, especially for stamping purposes in the United States.

On the subject of connecting a bath waste pipe, to a soil pipe on which we made some remarks, in November number of the SCIENTIFIC CANADIAN, we now add another illustration from the *Sanitary Engineer*. in the hope that plumbers will be guided accordingly.—ED *S C*

PHILADELPHIA. *Sept. 5th 1879*

Editor of The Plumber and Sanitary Engineer:

We herewith submit to you two plans of connecting bath waste pipe to soil pipe, with request that you decide which you consider the best or least objectionable.

Plan No. 1 is the usual way of connecting the bath waste to the trap, but the owner objects, saying it is wrong in principle, that every time the w. c. is used the filth will be driven up the waste pipe of the bath and cause a smell in the tub. We contend that it will not act so because one pipe is 4 inches and the other 1½ inches, and there can be but little pressure if any. We also contend that there will be no smell if fresh water is run after using the w. c. We also contend that the waste of bath flushes the w.c. trap and keeps it clean. We also contend that there is less liability of the bath to choke and yet it is as effectively trapped as if it had a separate trap.

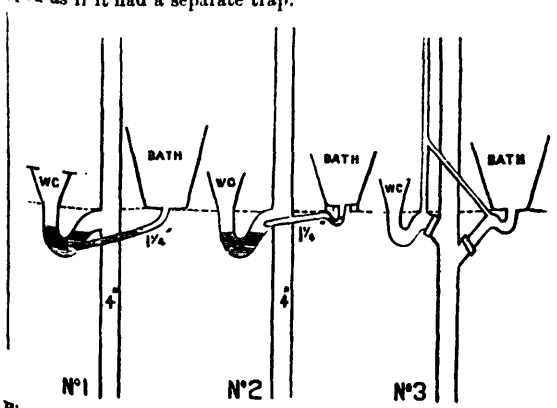


Fig. No. 2 is the owner's plan, and we object to it because—firstly, the trap is small and liable to be syphoned by the w. c.; second, he cannot flush his w. c.; third, sewer gas will be more liable to force a small trap than a large one; fourth, the trap is liable to become choked and very difficult of access to clean out. Hoping you will favor us with an early reply, we remain,

Yours, etc. H & B.

To those questions the *Sanitary Engineer* replied as follows:

"We consider Plan 2 the least objectionable, though drawing does not show the best practice. Plan No 3 is the better way.

"We gave our views of Plan 1 in our criticism of the article in the Montreal *Witness*, on Page 294, August 15th, and in reply to letter of C. E. Illsley, on page 230, issue of September 15th."

"Your objection are mainly based on a supposed defective condition of the surrounding work. With drains properly arranged, house traps would not be subjected to sewer gas pressure. Properly ventilate the trap under the bath and you will avoid syphonage. If this is not practicable, then, as the next best thing, use some of the numerous forms of traps and a deep seal."

IMPROVED METHOD OF LUBRICATION.—In a recent French invention the screw is applied to lubrication of shafts and other parts of machinery. In the case of a shaft, the oil is poured into a reservoir below, and a screw placed slantingly in the tube raises oil to the level of the shaft, whence it is distributed by channels over the breadth of the journal. The axis of the screw rests on the bottom of the reservoir, and its head turns in a bearing fixed in the tube. Motion is communicated to it from the shaft by means of gearing with helicoidal teeth. The impurities at the bottom of the reservoir are neither stirred nor carried up. The velociety of the screw is adapted to the lubrication required. If the shaft has a high velocity that of the screw is increased, so as to raise more oil beeause of the strong pressure. Thus a regular, continuous and economical pressure is obtained.

THE SPANISH INTERNATIONAL EXHIBITON.—A Freneh architect, M. Colibert, has just been charged with the preparation of the plans of the building which will be needed for the international exhibition at Madrid in 1882.

THE LAY OF THE DEMON PLUMBER.

(From the *Sanitary Engineer.*)

That much-abused yet indispensable mechanic, the plumber, is frequently held up to ridicule as well as to severe censure by writers for the press. Indeed, quite a literature has been formed having this general character. According to it, the plumber is a cold-hearted, mercenary wretch, who practices bad workmanship that he may have bills of repairs, who is elated at a severe frost which bursts pipes, because it brings his services into demand, and whose general prosperity is at other people's expense. We have much sympathy for the plumber, and frequently have reason to look upon him as a much-abused and misrepresented man. The following lay, clipped from a London paper, we, of course, believe does him great injustice. No one for a moment supposes that *our* plumbers entertain any such sentiments as are here set forth. If such ideas were entertained by them, the approach of cold weather would be a source of delightful anticipation, and we should even now see members of the trade hugging themselves and rejoicing at every indication of approaching cold as it is published in the daily bulletins of the Signal Service. Cold weather we shall undoubtedly have soon enough, and many pipes there are which will then require repairing, and many a plumber there is who will then reap the customary harvest; but hardly any of them, we are sure, will sing out loud the "Ho! and oho!" of the following lines:

It's ho! and oho! for the jolly Jack Frost,
And the pranks he plays up, to my customers' cost!
'Tis a precious ill wind as blows nobody good,
And a nipping north-easter is most to my mood;
When it freezes the cisterns, and plugs up the pipes,
Oh, I laughs till the tears from my hoptics I wipes;
For it's followed in course by the lovliest thaw,
And then there's such gammocks as never you saw;
For the men and the servint maids comes all a-blow,
From a'most every house in a'most every row,
Crying, "Come, Mr. Plumber—immejit—you *must!*
For the cistern is leaking, the pipes is all bust!
The water's all spouting, and running to waste;
We are reg'lar swomped out—do, for gracious, make haste!"
They all sing the same song, but I dordles along;
To expect *me* to 'urry *is* coming it strong!
And when I arrives, oh! the blokes and their wives,
And the slavers nigh worritted out of their lives!
Such larks! There's the water all squashin' and squirtin',
And tricklin', and streamin', and spoutin' and spirtin',
And everythink dancin', and drenchin', and dirtin',
Spilin' ceilings and walls, and the guv'nor's front-shirtin',
As he tries to stop vents, his white knuckles much 'urtin',
Which makes him use languidge—oh, ain't it diwertin';
Then the mean 'uns, as, bent upon saving a mag,
Tries botchin' the 'oles up with putty and rag!
Don't I drench *them* to rights? Don't I tip it 'em stiff?
Ain't it scrumptious to watch 'ow they boggie and sniff?
Oh, I *do* hate a stingy and meddlin' old messer!
Then I outs with my tools, with my shaveback and dresser,
My turnpin and egg iron, solder and soil,
My taller, and rosin, and white lead, and oil:
('Arf on 'em's no use, but they make a good show,
And with green 'uns that's jest 'arf the fight, don't yer know?)
Then I turns up the carpets and ile-cloths all round;
Tramps up and downstairs with a thunderin' sound;
And I arsks for a fire, and I 'ints for some beer,
And I kinks up a stink as makes Missis turn queer
If they "part." wy I sock my boye knowing and cheap;
If they don't, I turn sulky and swear at the cat—
Which *she* always comes sniffing and goes on the scare—
If they 'urries, I tells 'em to keep on their 'air;
For a job such as this is a thing as takes time.
Wy not? Easy does it, and fudgin's no crime.
Then, when they're well soaked, worried out of their wits,
And the fire nigh poked out with my irons and bits,
When the fumes of my solder has got in their eyes,
When I've sp'iled a few gimcracks with lampblack and size,
Dropped taller in lumps on the floor here and there,
And broken the back or seat of a chair,
Broke three or four bells, or may be 'arf a dozen,
When everyone's grabby and cross and 'art frozen.
Wy I manages somehow to take up a jint—
If they think it's a laster, it *may* disappint,
'Cos we've got to make hay while the sun shines, yer know,
Leastways, pile the dibs while there's frost, ice and snow.
There is lots more a-waiting, I sarves them the same,
And so, smart and lively, I keeps up the game.
Other trades may spout strong 'bout the beauties o' summer,
But a jolly 'ard winter's the time for the Plumber!

A SUBSTITUTE FOR TERRA-COTTA.—The weight and brittleness of terra-cotta are considered objections to its use in interior decoration and for household utensils and ornaments. To avoid these drawbacks a Spanish South American firm employs cotton pulp covered with a special composition, which contains a soluble varnish. Articles which are made with this material are said to be very light and strong.—*Pottery and Glass Trades' Journal.*

NOVEL STYLE OF TURBINE, WITH HORIZONTAL AXIS.

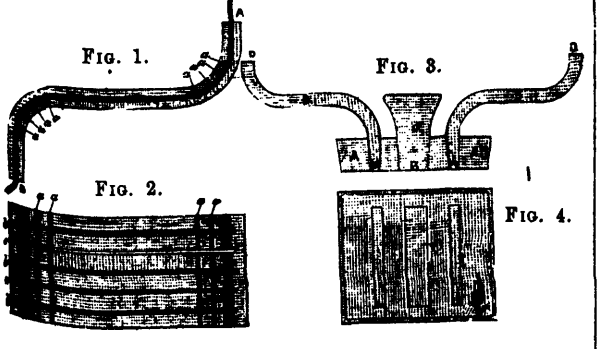
A NOVEL TURBINE ARRANGEMENT.

Turbine wheels as thus far employed, have most always been placed in a horizontal position, while in consequence the shaft was placed vertically. This may be advantageous under most circumstances, but it is often necessary to change the direction of the vertical rotating shaft into a horizontal one, and in this case some special arrangement of gearing or belts is used to effect this.

The firm of James Leffel & Co., of Springfield, Ohio, have recently commenced the manufacture of a turbine intended to be placed with its axis in a horizontal position, so as to make the special arrangement for changing the direction of the motion unnecessary. It is represented in the adjoined engraving, with its connections to the machinery to be operated. The water has access to one side of the wheel case, and its exit at the other, the shaft passing through proper packing boxes, while a workman is represented in the act of lubricating the anti-friction bearings. This shaft carries one or more driving pulleys, one of which is seen in our engraving. Its belt carries this power to the countershaft above, and from this to any other machine to be operated. It is evident that a first advantage of this arrangement is that it dispenses with the resistance unavoidably connected with gearing, or any other device intended to change the direction of rotation. Another important advantage of this new arrangement is that every part is accessible for lubrication as well as for the purpose of examination at any time ; while where gearing is used this is difficult, especially for small wheels under high heads.

THE CASTING OF SMALL STEAM CYLINDERS.*

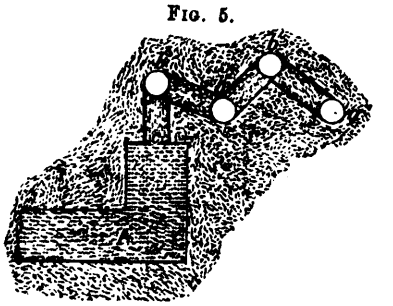
It is a difficult matter to cast perfectly a small cast-iron cylinder. The difficulty *always* lies in the moving of the port cores, due to the buoyant effect and force of the metal entering the mould. The writer has put up a 2½ by 5in. cylinder *seven* times, and then only in part succeeded in getting a good one. The entire difficulty resulting from attempting to keep the port cores in place in shallow print on the valve seat, there being an individual print for each core. A great many foundry foremen will not touch a small cylinder with separate steam-port core prints, as they have time and time again experienced the difficulty I speak of, and only succeeded in keeping the port cores in place by anchoring them with half a pound of nails, and last, but not least, to have the machinist tell them the casting is too hard in spots ; due, of course, to the chilling around the nails. Small cylinders are also very apt to be "dirty."



The writer, in his life, has had a great many small cylinders to make, and experiencing the troubles mentioned, studied up the plan here presented, and has never had any trouble since adopting it. In fact the moulding and casting of a small cylinder by this plan is a pleasure. The plan consists in forming on the valve seat of the pattern *one* large print instead of *three* separate ones. The print is somewhat larger than the seat, and ought to be nearly as deep. The port cores are made as usual in a box and pasted into the recesses of another which fits the valve seat print. This core is shown in section at *a*, Fig. 3, and should be deeper than shown to give it solidity in the print. Fig. 4 is a face view of this core. Fig. 1 is a side view of the steam port core in section, *a*, *a*, *a*, *a*, *a*, &c., are the ends of short wires (shown in elevation at *a*, *a*, Fig. 2) to prevent the vent strings A B from cutting through the corners when withdrawn. C C in Fig. 2 shows their strings, and *b*, *b*, *b*, the stiffening wires. The extent of the wiring and venting of course depend on the size of the core. The writer has tried the plan of forming the three port cores, and the one into which they are pasted in one ; but prefers making them in separate boxes, and pasting them in—less trouble arising. When they are pasted in they should be well "blacked." Blacklead, charcoal, and glue, or finely-powdered coke dust and charcoal and glue forming a good blacking which will leave smooth holes. The cylinder is moulded and cast, valve seat down, the vent from the port cores being taken off at *a*, *a*, *a*, Fig. 3, down through the drag and out at the bottom board. The vent holes left at the upper ends D, D, of the pore cores, by the vent strings, should be stopped off to prevent the metal entering the vents. The surface at I. I, of the port cores is joined by the box to fit either up against or into recesses in the central core, which in either case should just touch them, unless the plan of pasting the port cores also into the large central core is adjusted. Cylinders, up to 10in. bore, may be successfully cast in green sand, clean and solid. The mould should not be blacked or slicked. Shrink heads should be placed on each flange.

* By V. Hoon, in *American Machinist.*

Fig. 5.



A, Fig. 5, represents the flange of a cylinder, and *c* the gate. To keep the casting clean, cleaner gates should be used, as shown, *a* being the pouring gate, which should be smaller than the cleaners b^1, b^2, b_3. The object of these gates is this ; the gates *a* being kept full in pouring, the metal runs through the cut gate to b_1, where it is somewhat arrested by the change of direction. This gives time for any dirt in the iron to rise in the cleaner gate b^1, and this dirt is kept at the top of gate b^2 by the height of the iron in the pouring gate *a*.

The cleaners b^2 and b^3 act the same as b^2, the metal finally entering the mould through the cut gate *c*. The heat of the iron depends of course on the iron itself, some iron running up sharp at a less heat than others. By exercising care, first-class cylinders can be cast equal in all respects to dry sand castings. No bother with the port cores will be experienced, the openings being square and perfect. Several shops, building small engines, have adopted this plan of casting their cylinders with success. The vexation and trouble so often caused by attempting to set small, frail port cores on the same plan as larger ones, will be done away with by this plan, and I give it to your readers trusting it may be of service to a few, at least.

Books of Olden Time.—From the opening of the ninth century, parchment took the place of papyrus. Ancient books were rolled instead of being in square form, as we have them. About this time paper made from cotton and linen rags began to be made, but its manufacture was so limited that the facility for copying was not much increased. All writing material was exceedingly scarce in that age, and had the invention of printing dated earlier, it could not have made any substantial progress on this account. In many instances the only way to issue a new work was to erase the original writing from a manuscript, and then to trace another book upon the same parchment. Thus the writings on many valuable manuscripts were destroyed, and some even more valuable than those which took their place. Written language had almost perished for the want of material upon which to record the burning thoughts which were struggling for expression. The books of those days were written out by hand, and the work of the copyists was both honorable and lucrative. They were generally employed by booksellers on a salary. The rich employed favorite slaves to copy works of antiquity and of their own times, for their own libraries. Orators secured the copying of their own discussions ; and the government, of its edicts.

AN EXTRAORDINARY WAR SHIP.

The torpedo ram *Polyphemus* now being constructed by the British Government, will be, when finished, entirely different both in form and structure from any other vessel heretofore built, and her weapons of attack are such that, whenever brought into action, she must be fought differently from any other war vessel. The *Polyphemus* is to have a powerful ram bow, an efficient torpedo battery, high rate of speed, handiness, moderate size, and but small extent of surface above the water exposed to the enemy's fire, such portion of the vessel as is above the water-line being convex in form, so as to deflect any projectile that may strike it. The appearance of the vessel at sea will be that of a cylinder floating on its side and deeply immersed, tapered at the ends to form a bow and stern. The top of the cylinder will be 4 ft. 6 in. above the water-line, and will be flattened over a large portion of its area to form a deck, which deck will be plated over with steel-armor, thus covering in and protecting the ship and all her machinery and fighting appliances. The ship proper as she will thus appear will be surmounted by a light structure carrying a hurricane deck about two-thirds her length, and upon this deck will be seen a signal mast, pilot tower, boats, etc. The form under water of the *Polyphemus* is as strange as the portion above. The sides are curved cylindrically for several feet below the water line and are armor-plated to that depth. Below this point the section assumes a ∇ form and ends in a sharp angle at the keel. Consequently a cross-section of the vessel is similar in form to a peg-top. The flattened convex curvature of the upper part of the peg-top would represent the part of the vessel above water, and the lower portion, which ends in a point, would represent the part of the ship that is below water. The *Polyphemus* is 240 feet long, between perpendiculars 40 feet in breadth; load draught 20 feet. She will carry no masts or sails, but simply a pole for signalling purposes or for making observations from. She will have two pair of high-pressure compound horizontal engines with twin screw propellers. Each high-pressure cylinder will be 38 inches in diameter, and the low-pressure 64 inches. The stroke will be 45 inches. The boilers, 12 in number, will be of locomotive type, and made of steel. The engines are 5,560 horse-power, and the speed is expected to be 17 knots. The *Polyphemus* will carry no guns, except a few light shell guns and Gatlings on the hurricane deck for repeling boat or torpedo attacks. Her only weapon will be her ram-bow and Whitehead torpedoes. The ram will project 12 feet in advance of the stern of the ship, and is so placed as to strike several feet below an enemy's armor. The spur is being fitted so that it may be unstripped from the stern when not required for active use. Under the ram is a torpedo port, which will enable Whitehead torpedoes to be ejected right ahead of the ship. There are also two torpedo ports on each side amidships, for ejecting torpedoes on the broadsides. All the torpedo ports are below the water. The under-water attack will be supplemented by torpedo firing from the armored deck above water, the same as in ordinary torpedo-launches. Communication is made between the hurricane deck and the interior of the ship by openings cut through the armored deck, which openings are protected by glacis plates and armor, and by casings which are carried up to the hurricane deck. On this deck the boats are carried, and the ship is steered and worked from it. An armored pilot tower, with protected means of access to the lower part of the ship, is placed at the fore end of hurricane deck and fitted with steering wheel, telegraphs, apparatus for firing off the torpedoes, and all other appliances for coursing and working the ship. The *Polyphemus* is built throughout of steel; the frames of Bessemer, and the bottom plating of Landore-Siemens steel. The lower part of the ship has been subdivided into as many watertight compartments as possible. The cabins and accommodation for the crew will be all below the armored deck, and will be ventilated artificially, as in the iron-clad monitors. They will be lighted throughout by the electric light. An electric light will also be placed in the look-out on the polemast for reconnoitring and signalling purposes. The most novel feature in the ship is the arrangement of the keel. The bottom plating on each side, instead of ending in a keel or flat keel-plate at the middle line, is formed into a recess, or that in place of the usual keel there is a rectangular groove, 1 foot 8 inches wide and 3 feet deep, taken out of the bottom of the ship. This groove is intended to be filled with cast iron ballast up to a weight of 300 tons. The ballast will be so attached to the ship that in the event of a compartment becoming bilged, and it being necessary to lighten the ship, the ballast can be let go and dropped from any part as may be required. The draught and trim may thus be regulated to a certain extent, should the vessel be damaged in action. The ballast will be carried to keep the ship down in the water so as to prevent the deck becoming too much exposed, when in action, to the fire of an enemy, but should she become further emersed from any cause, the dropping of the ballast will relieve and lighten her. The *Polyphemus* is expected to be ready for launching in a few months.

A NEW PORTABLE STEAM TRAMWAY.

The first of a series of experiments with a new portable steam tramway, invented by M. Decanville, and further developed by Messrs. J. Fowler and Co., took place recently in the garden of Stafford House, by the permission of the Duke of Sutherland. Among those present, all of whom appeared to take great interest in the proceedings, were the Turkish Ambassador, the Chinese Minister, the Secretary to the Japanese Legation, General D. Lysons, Sir J. M'Garel Hogg, Sir Charles Reed, and Earl Granville. The main items on which the success of portable railways seem to depend are that the weight of all the pieces, including wagons, shall be kept within such a limit that each piece can be removed by men without the aid of mechanical appliance, and that each piece shall be complete in itself without any loose bolts or spikes, or fish plates. These conditions are fully observed in the new invention. The most important advantage of this new railway is that the rails are rigidly fastened to the sleepers and joint plates; thus the line can be laid down anywhere, taken away, and relaid with great expedition and without the employment of skilled labour. Iron rails have been found not to answer, from their bending under the action of a load when laid on uneven ground, and steel has therefore been employed. The railway is perfectly portable, since it can be laid down and taken up without the help of any tool whatever. To give an idea of the facility of these operations where frequent removals are necessary —that is to say, in clearing land of beetroot or sugar cane, &c.— it is stated that four men can take up 400 yards of railway and relay them 30 yards further on in less than an hour. It is also urged as an additional recommendation to the new railway, that it is not merely suitable for being worked by steam power on a level, but that on steep inclines, or when steam power is not readily attainable, horses and camels can easily supply the necessary motive power. It is asserted that on such a line a camel could haul a load of about five tons, whereas it can only carry about 350 lbs. The railway is meant for not only agricultural but also for military purposes, and in India especially it is supposed it will be particularly useful.

HOW THE ANCIENTS ENGRAVED GEMS.

A writer in *Harper's Magazine* for September says:—We must remain as yet some little in doubt as to the methods employed by the old artists to perfect these miracles of taste. We have, however, the absolute certainty that these ancient masters were familiar with the diamond, and that their best work was made by using this, the hardest of all substances, as a tool. A splintered fragment of the diamond served as a scraping tool, and they were well acquainted with the drill. Prehistoric man worked a drill at the very commencement of his existence. A Phœnician gem—a lion attacking a bull—shows how the drill was used. A number of circular depressions are found in the gem which mark the extremities of the figures. This was done not for the sake of effect, but to show the artist the limit of his work as to depth. After the holes were sunk, the artist untied the various portions of his work by scratching. Now the use of the diamond point or splinter, fixed in a style of iron socket, allowed a certain flexibility of handling which our modern processes of gem-engraving do not permit. To-day the work is done by means of a minute rotating disc of copper, which is whetted with oil and diamond dust. On the least application of the substances to be cut to the disc, it is the disc which bites into the stone. The difference of manipulation is, then, that to-day it is the stone which goes to the tool, and not, as in olden times, the tool to the stone. It is more convenient, then, in 1879, to bring the cart to the horse. It can now be readily understood why, in modern work, time and labour being spared (the art-conception not entering for the present into the subject), why this work of to-day is inferior to the art which is past. It is purely a mechanical process now, for a rotating disc will no more draw lines which have feeling than will photographing processes paint pictures. It has been stated that we are not entirely acquainted with the methods employed by the old glyptic artists. This becomes quite evident from this fact, that their best work seems to have been both cut and polished

at one and the same time. To-day we have no tool, no substance which will accomplish this double feat. Mr. King, dwelling on the diamond point, says, "its extensive use is the great distinction between the antique and modern work."

SOME EXPERIMENTS IN BURNING SLUDGE INTO CEMENT.

Portland cement is manufactured from chalk or limestone and clay. The component parts of these materials vary very slightly, and therefore the manufacture is nearly constant. The average analysis of five large manufactories gives the following results, namely, lime, 56.21 per cent; silica 24.44 per cent; iron, alumina, 12 1 per cent.

The manufacture of Portland cement from sewage is much more precarious. Sewage, according to my experience, varies in every place and during every hour, and consequently has to be carefully watched in order that the requisite quantity of milk of lime may be added. At Burnley, on certain days, large quantities of dye water come down, on other days butchers' refuse, and once or twice we have observed the sewers full of coal tar and oily refuse. All these facts have to be carefully observed, and only after careful experiments can the quantity of lime necessary to precipitate the sewage be determined. The resultant sludge at Burnley on an average only contains 46 to 50 per cent of lime, and therefore before it is fit to be burnt into Portland cement clinker, more lime has to be added. This is done after the supernatant water has been run off the sludge deposited in the tanks. The sludge has afterwards to be passed through a pug-mill in order that a uniform compound may be obtained.

At Birmingham, where Portland cement was also made, the sewage is so capricious that a uniform manufacture could not be guaranteed. This is accounted for by the fact that at certain times very large quantities of acid from the hardware manufactories of the town are poured into the sewers.

At Portsmouth, where I have studied the sewage, which has wholly water-closet and house drainage, there is little or nothing to interfere with the manufacture of a high class Portland cement. I believe the same remark would apply to the lower Thames valley sewage. The sewage requires only a small quantity of lime to defecate it; 16 grains of quicklime per gallon is ample. The sludge I have found generally contains from 58 to 60 per cent of lime, and therefore no fresh lime would have to be added. The fact that at Portsmouth the storm-water is partially kept out of the sewers is also greatly in favor of the manufacture of good cement. And in places where the separate system is in force, and where the proportion of water-closets is large, it would be, perhaps, worth while to allow the finely suspended organic matter to subside before lining, and to treat the organic matter described in General Scott's patent.

The sludge resulting from limed sewage may also be burnt at a lower temperature than that necessary to produce Portland clinker, and be re-used to precipitate the sewage. After this has been done several times the lime becomes rich in phosphates, and may be profitably sold as a first-class agricultural lime.

As a result of my experience I have arrived at the following conclusions:—

a. The sewage of every town should be carefully watched and experimented on before any plans or estimates are made.

b. The storm-water should, if possible, be kept out of the sewers.

c. A paved town is more favorable to cement manufacture than an unpaved one.

d. That manufacturing refuse, except acids, does not materially interfere with cement manufacture.

In conclusion, I may state that the cement now being made at Burnley is much improved in quality since the manufacture began, and much has been sold. The latest tests give excellent results, Mr. Deacon, borough engineer of Liverpool, reports the tensile strain, of 695 pounds on the 1½ inch square, and that the cement passed through a sieve of 50 meshes to the inch, leaving only 7 per cent of residue. The latest test at Burnley gives 398 pounds.

A portion of a sea-wall at Portsmouth has been built with it, and it has stood this test remarkably well.

Much has been learnt since the process was first started at Burnley, and it may be fairly expected that towns will obtain purification, and at the same time will recover the greater part of the cost of so doing, by adopting this process.

CURE FOR BURNS.—An iron-foundry man recommends powdered pinewood charcoal as "a never-failing, speedy remedy" for burns and scalds.

THE FLEXIBLE SHAFT.

Although great strides have been made during the past 10 years in all kinds of machinery, the expert recognizes most of them as extensions and developments of known ideas and methods. The principles involved in the flexible shaft are, however, radically different from the principles involved in other machinery. The different stages of its growth towards perfection were so unobserved by the world at large, that when exhibited at the Centennial exhibition, it excited the greatest astonishment of every beholder. Almost all machinery is characterized by fixity in certain places of motion. The whole value of a turning lathe consists in the maintenance of its centres in a true line, and in all reciprocating machine tools, the moving portions of the mechanism are confined to fixed lines and planes. But here is a device which sets at naught the transmission of rotary motion through straight lines, and conveys it through through curves varied at the will of the operator. It upsets all our ideas of rigidity. The first "flexible shaft" was a simple coil of wire, used as a universal joint in sheep-shearing machines, dental and a limited number of light power machines. Flexibility was obtained at a great sacrifice of strength, and the coil therefore made inconveniently large.

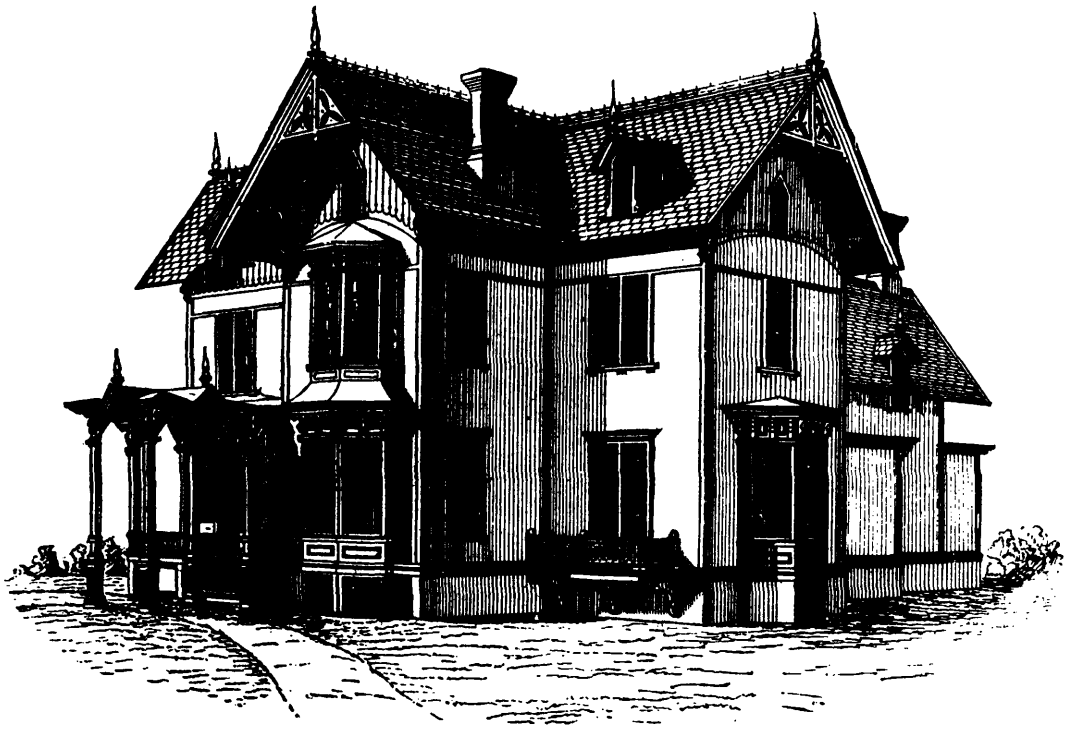
Where primitive motion was desirable the angle of torsion was too great, to correct which defect a coil of wire was wound on a center or flexible material. This was an improvement, but only to the extent of the resistance to compression offered by the filling material. The next step was an important one and consisted in two concentric coils, wound in opposite directions, instead of a single coil. By this arrangement the tendency of the outer coil to contract is met by an equal effort of the inner coil to *expand*. Flexibility was lost, however, since it required more effort to bend two coils than one. It could not be used on any but light power machines on account of its liability to kink or twist out of line, and double up into twisted loops. The shaft, too, when running at a high rate of speed, vibrated in a very curious manner, dividing into equi-distant nodes like the string of a musical instrument, and thus interfering with the proper functions of the working tool, giving it a tremulous motion impossible to control. The defects were finally overcome by enclosing the revolving shaft in a flexible *stationary* sheath or case, and at the same time the carrying power of the shaft itself was increased by making it solid all the way through, in the sense that wire rope is solid, the sheath enabling an indefinite number of bearings to be given the revolving core, preventing all tendency to kink or vibrate. As now constructed the flexible shaft is made up of a *core*, a *case* and appropriate fittings by which the two are joined, rotary motion communicated at one end of the shaft and delivered at the other.

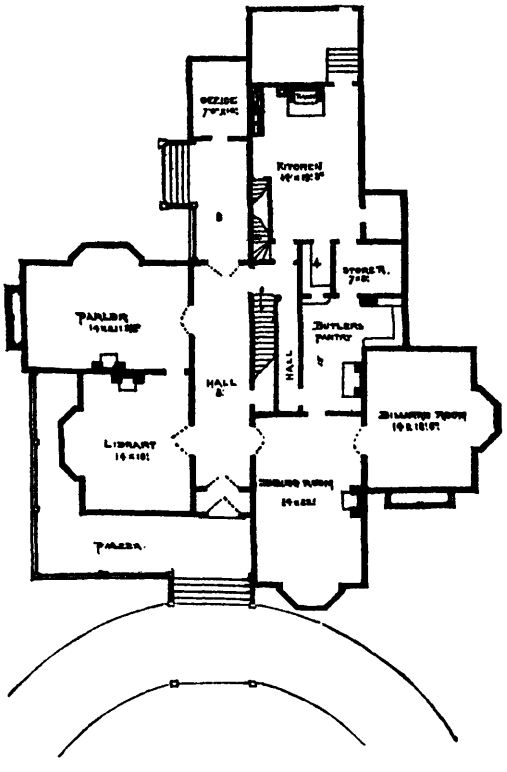
The core is composed of a series of concentric steel wire coils wound hard on each other, the direction of the pitch changing with each layer. The pitch direction of the outside layer is always such that the latter will tend to contract under strain, the shaft always running one way. The case is made of a hollow coil of square wire, with a slight groove on the outer side. This coil is covered with leather, which is prevented from slipping by the groove in the wire. The inside diameter of the case is slightly larger than that of the core, and the ends are furnished with iron ferrules, to receive the driving pulley and the hand-piece carrying the working tool.

The flexible shaft is not a special tool for a particular purpose, but a connecting link between a given power source and a multitude of tools, and its uses are very varied. It is used in light operations as well as heavier ones, particularly metal drilling. By means of a pair of idler pulleys, mounted one over the other in a weighted frame, and secondly of a pair of pulleys in a swivel frame attached to a hanger adjoining the counter-shaft, the shaft and its drill may be carried at will to any part of the shop.

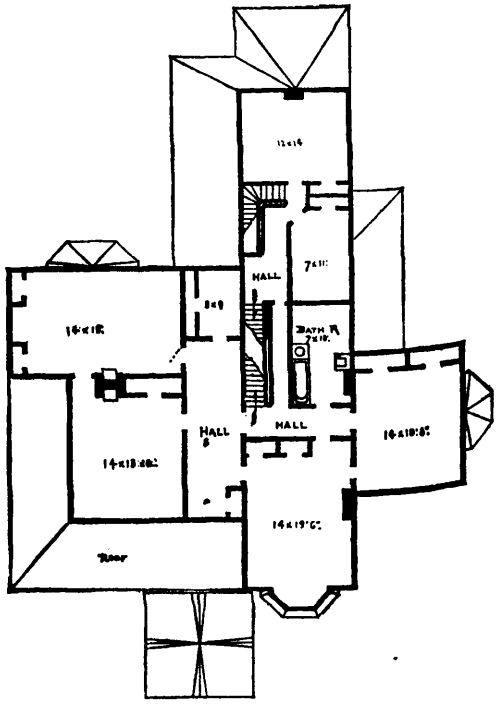
It reaches into remote corners, and is applied to manifold applications, from drilling, polishing, horse and cattle brushing, morocco finishing, even to boot blacking. A correspondent of the London *Times*, speaking of this shaft, says: "Pharaoh himself could not have been more surprised at see Moses' rod turn to a serpent than we were to see this rope-like affair eating into the planks set on all sides for it to work upon."

Surgery can justly boast of a new conquest; when an eye is severely wounded, the healthy one is in danger of being impaired by "sympathy"; to preserve the good eye, it was hitherto the practice to remove the injured one. Dr. Boucheron has discovered, that by cutting the ciliary nerves, the "sympathy" is stopped, and thus dispenses with the necessity of removing the injured organ. Forty surgeons have thus operated successfully.



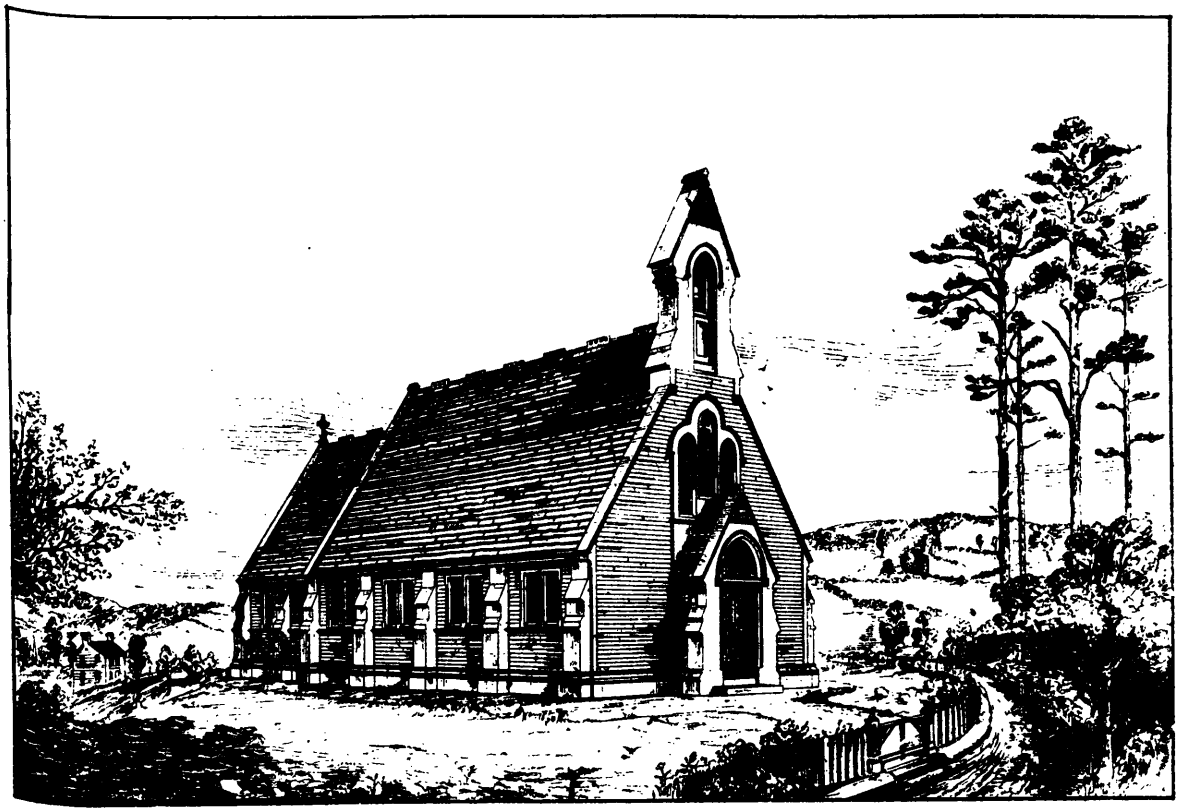


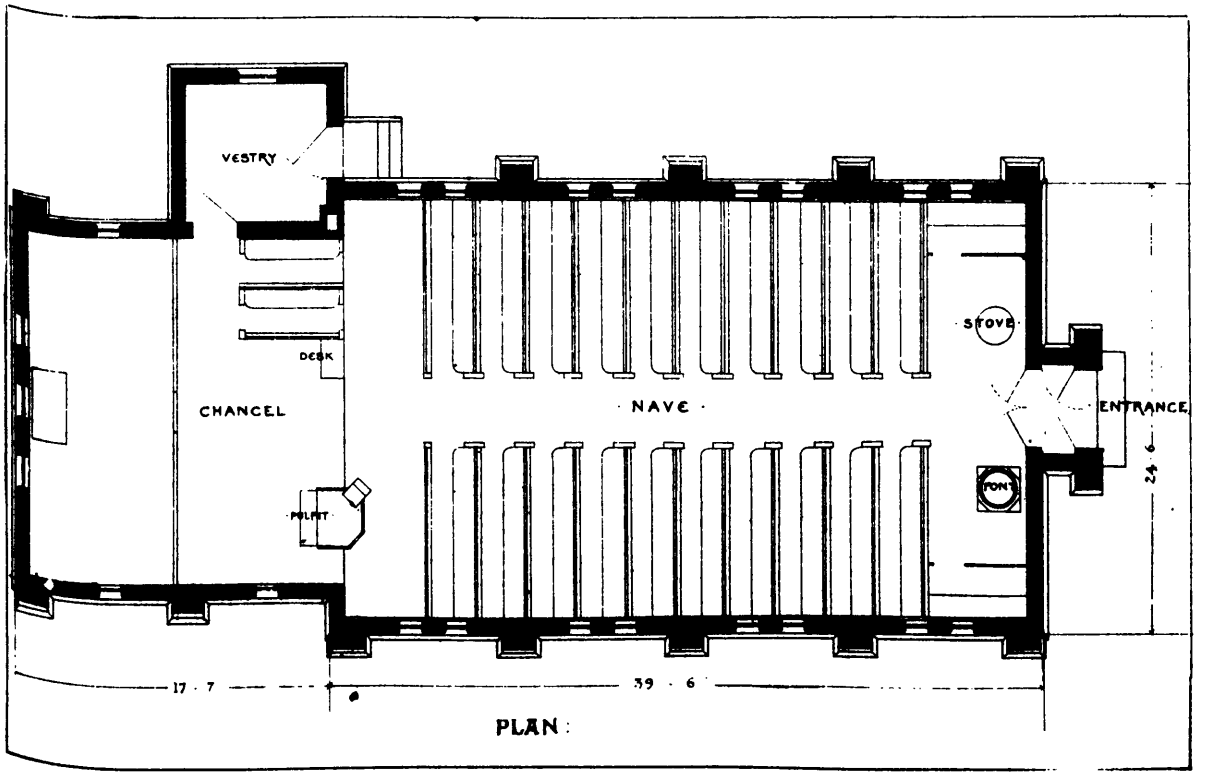
FIRST-FLOOR PLAN.



SECOND-FLOOR PLAN.

A SUBURBAN VILLA.—From the "Manufacturer and Builder."





A COUNTRY CHURCH.—From the "American Builder."

Scientific.

BORAX FOR SALTING BUTTER.

The Italian Minister of Agriculture has addressed a communication to the Chamber of Commerce of Milan relative to experiments in salting butter with borax which have been carried out at the agricultural station at Florence. From the account which appears in the *Giornale di Agricoltura*, borax would appear to have a most marvelous effect in insuring its absolute preservation. Samples of fresh butter made at the Florence station, and purposely not carefully freed of their buttermilk, were found, on the addition of about 8% of borax, to maintain their natural fine flavor, without the least change whatever, for upwards of three months. To attain this satisfactory result it is necessary that the borax should be perfectly dry and in very fine powder, and care must be taken to insure its thorough mixture with the whole mass of the butter operated on. Among the further advantages of this plan, it is noted that borax imparts no flavor of any kind to the butter, while it is entirely harmless in its nature, and also reasonably cheap. Still later experiments have shown that a very much smaller proportion of borax suffices to produce the desired effect, and also that simple solutions of the salt act quite as well as the dried powder.

It has been alleged that too much borax imparts a bitter flavor. This might be lessened by washing in water. The main point is that if borax should prove a useful preservative element for butter, meats, &c., the borax industries of Nevada might be very properly advanced.

THE NATIONAL BOARD OF HEALTH, in its circular on "Desinfectants and How to Use Them," makes a clear distinction between disinfectants and deodorizers, and disseminates the wholesome truth that "disinfection can not compensate for want of cleanliness or of ventilation." The recommendations of the board as to the disinfectants to be employed are as follows: For fumigation (that is, the purification of an infected atmosphere), roll-sulphur; for sewers, cess-pools, and the like, sulphate of iron (copperas), dissolved in water in the proportion of 1½ p unds to the gallon; for clothing, bed-linen, etc., sulphate of zinc and common salt in the proportions of 4 ounces sulphate and 2 ounces salt to the gallon. The interaction of these two compounds doubtless results more or less promptly in the formation of sulphate of sodium and chloride of zinc, which last is recognized as being the most energetic of the mineral disinfectants. The recommendation of the board to employ the zinc compound in the form of sulphate (with salt), instead of applying the chloride of zinc directly, may perhaps be explained on the ground that the sulphate of zinc is a stable salt that remains in solid form, and may be exposed to the atmosphere without change; whereas the chloride of zinc can not be preserved in solid form save in hermetically-sealed vessels, having such a powerful avidity for moisture that it rapidly liquefies by abstraction of moisture from the air. This property renders zinc chloride inconvenient to handle. By its indirect production after the recipe of the board, this objection is overcome. The board does not recommend the use of carbolic acid for general uses, for the reasons that the quality of the commercial article varies greatly, that it is difficult to determine its quality, that it must be used in comparatively large quantity to be serviceable, and that it is liable, by its strong odor, to give a false sense of security.

THE Magnitude of the Beet-Sugar industry in Europe may be gleaned from the following facts relating to the case in France: There were in that country in 1876, 530 beet-sugar factories, which produced 400 million kilograms (880 million pounds), and representing the following values:

	Francs.
Sugar, 400 million kilos	64,000,000
Molasses, 235 million kilos	26,000,000
Pulp, 1,200,000 tons	20,000,000
Manure, 900,000 cubic meters	2,700,000
Total	312,700,000

or about 62½ million dollars.

The industry in France consumes eight million tons of beet-roots, bought of cultivators in a half-dozen departments, at an annual cost of 160 million francs. It employs, in labor and in fattening, thousands of cattle, and consumes nearly 1½ million tons of coal, to say nothing of the host of collateral industries which it strengthens. It returns, as we have seen, 160 millions to the cultivators of about 200,000 hectares of land; gives back to the agriculturist a value of 20 millions in the form of cattle food, on which 200,000 head of cattle are fed during the year.

NEW THEORY OF TERRESTRIAL MAGNETISM.—The theory lately advanced by Professors Perry and Ayrton, of Japan, to account for the magnetism of the earth, and which has provoked much discussion, is thus briefly summarized in the *Phylosophical Magazine*. They find this cause in the revolution of the earth beneath the electrical charge originally and at all times present in the atmosphere. By calculation, they find that the difference of potentials between the earth and space necessary to produce a distribution sufficient to bring about all the observed magnetic effects would be represented by 54,000,000 Daniell cells. And, adds our authority, they prove that "if the earth be electrified, it must, from its very rotation, quite independently of all other bodies in the universe, be magnetic; and if it consists of a shell of iron, thick or thin, then that the law of distribution of magnetism produced by this electrical charge in mechanical rotation will be identically that given by Bist; and lastly, if the earth were wholly of iron, a difference of potentials of about 54,000,000 volts between it and space would be sufficient to produce the necessary amount of charge."

TRAVELLING STONES.—Many of our readers have doubtless heard of the famous travelling stones of Australia. Similar curiosities have recently been found in Nevada, which are described as almost perfectly round, the majority of them as large as a walnut, and of an irony nature. When distributed about upon the floor, table, or other level surface, within two or three feet of each other, they immediately begin travelling toward a common centre, and there lie huddled up in a bunch like a lot of eggs in a nest. A single stone, removed to a distance of three and a half feet, upon being released, at once started off, with wonderful and somewhat comical celerity, to join its fellows; taken away four or five feet, it remained motionless. They are found in a region that is comparatively level, and is nothing but bare rock. Scattered over this barren region are little basins, from a few feet to a rod or two in diameter, and it is in the bottom of those that the rolling stones are found. They are from the size of a pea to five or six inches in diameter. The cause of these stones rolling together is doubtless to be found in the material of which they are composed, which appears to be loadstone or magnetic iron ore.—*Virginia City Enterprise*.

DETECTION OF FICTITIOUS BUTTER.—Herr Fisher asserts that the examination of butter by polarized light with a magnifying power of about 200 to 300 diameters, affords a much more certain criterion of its purity than a specific gravity test. Examined in this way, fictitious butter shows not only the globular drops and salt crystals characteristic of genuine butter, but likewise other more or less perfectly developed crystals. The author also finds this method may be applied to the determination of different kinds of fats, inasmuch as each of these shows characteristic colors in polarized light. Mutton-tallow, for instance, always gives a blue tone; cocoa butter gives colors passing from the brightest green to the deepest red; the fat of oxen gives green and white luminous effects; while small b ight green semi-lunar and vermicular bodies appear in common light. Hog's lard shows many colors, especially red and blue—yellow, which is characteristic of cocoa-butter, being absent. For the accuracy of this abstract, we refer to the *Journal of the Am. Society*.

CARBON IN COMETS.—It is generally believed that some compound of carbon exists in comets, and it has been assumed that the bright lines in the spectra of these bodies were due to that compound being in an incandescent state. G. J. Stoney has advanced another hypothesis. He suggests that the bright lines are caused by the light of the sun falling on the compound of carbon and rendering it visible in the same way that light renders the moon, the planets, and other opaque objects visible, the vapor of carbon being opaque to the particular rays which appear as bright lines in its spectrum.

JAPANESE CEMENT.—Mix the best powdered rice with a little cold water, then gradually add boiling water until a proper consistence is acquired, being careful to keep it well stirred all the time; lastly it must be boiled for one minute in a clean saucepan. This glue is beautifully white and almost transparent, for which reason it is well adapted for fancy paper work, which requires a strong and colorless cement.

A NEW OZONE GENERATOR.

At a meeting of the New York Academy of Sciences, held a few weeks, Professor Albert R. Leeds exhibited his new form of ozone generator, by the aid of which he has been enabled to overcome the difficulty hitherto experienced by investigators of preparing ozone in sufficiently large quantities for experimental purposes. Formerly sticks of phosphorus were placed in contact with moist air in large glass carboys; and so great was the uncertainty of the process that sometimes after the lapse of several hours the operator had scarcely enough ozone to show its properties. In the new ozonator the phosphorus used is first melted under water in a watch glass, and when cool it is placed with its convex surface upward on a perforated lead tray, provided with slots, so that it may be easily introduced into a bell jar and brought to rest upon short glass rods attached to the jar a little above the rim. A bell glass thus furnished with five or six phosphorus cakes is then plunged into a glass jar containing a solution of 25 grammes bichromate of potash in 1,250 cc. water acidulated with 150 cc. sulphuric acid, so that the convex surface of the phosphorus, kept clean by the energetic action of the solution, remains exposed and ozonises the air in the jar. It is advantageous to use the phosphorus in this form, because of the rapid consumption of sticks and the consequent danger of inflammation. A series of careful experiments has revealed the fact that the temperature is a potent factor in the generation of oxone. Below 6° C. no ozone is given off; as the temperature rises the evolution of gas increases up to 24°, and from that point on it again rapidly diminishes. In consequence of this, Professor Leeds finds it advantageous to place the jar in a copper water bath, and to provide it with a thermometer, so that the apparatus may be maintained at the maximum temperature. When two jars are used in conjunction, the amount of ozone obtained is 25 per cent. greater than from one alone, but with three the increase is but slight. A great point of difficulty in the construction of ozone apparatus is in connecting the parts. Where rigid connections are allowable they may be made by the use of paraffine, and all corks through which glass tubes pass must be coated with it. Rubber is almost instantly destroyed. Fortunately Mr. Day, of New York, has succeeded in making a species of kerite, suitable for flexible connections. Tubes made of this material have now been in use for several weeks without showing the slightest signs of deterioration.

M. Gaston Bonnier has written a most interesting essay on the nectaries of plants. His aim is to invalidate the conclusions of the Darwin School; if he has failed in this, he has not the less produced many remarkable facts. The Darwinists may have erred in being too absolute, but it does not follow that the laws of the school are false, because exceptions to these laws can be adduced. The general ideas respecting nectaries, and the matters they secrete are, that they have for end to furnish to insects a saccharial matter which attracts them, and thus compel them, unconsciously, to directly fecundate or cross the flowers. The latter would be destined together and protect the nectar, to attract by their colors and their perfume, the insects, and affording them a passage in such a manner, that in penetrating into the corolla, they will deposit on the stigma the pallen with which they are charged. This view has numerous exceptions, as some plants—the *vicia*—are visited by insects for their nectar before even being in flower. A flower deficient in color, can still entice insects by its odor. Nägeli for example attracted bees on artificial flowers coated with odoriferous honey; when the latter had been consumed, the bees disappeared. M. Bonnier took four square pieces of different colored stuffs, covered them with honey, and spread them on the grass; the bees came and sucked all the same, regardless of the colors, and flew away when the honey had been consumed. But insects not the less know such and such a flower has colors indicative of a nectariferous corolla. M. Sachs says: an insect visits always a certain flower in the same manner. Bees, if a flower be closed, will tear or perforate it, in order to arrive—ever in the same direction—at the nectary. Some flowers, the geranium, digitalis, &c., are visited for their nectar after the fall of the corolla. Insects too large to penetrate into certain flowers, perforate them, to reach the nectar; such insects are not agents of fecundation, but all insects are not adapted for this latter function to all plants. The secretion of nectar varies with the weather, and following the hours of the day. If the weather be fine, the volume secreted diminishes from the morning, is least at noon, augmenting towards the night. Certain species of plants may have nectar in one country, as in Norway, and none in another, as in France. The humidity of the air and soil, increase the emission of saccharine juice, and the latter is most productive at the moment of pollenisation, and in proportion as the sugar diminishes the glucose augments. The latter feeds the ovary, which changes and swells into fruit. This alteration in the saccharine matters is due to a ferment, which acts in the same manner as the leaven of beer. M. Bonnier agrees with Bravais, that plants can re-absorb their secreted nectar.

THOSE DANGEROUS SCIENTISTS.—The New York *Herald* in its usual sardonic style, makes the following remarks in regard to the dangers to which science exposes the modern condition of this world in a religious as well as secular aspect. We reprint it for the sake of a few well deserved hits. Says the *Herald*:

"Modern science has its advantages and its disadvantages. It is all very well to tell the sun he needn't trouble himself to rise any more, because we can light up the world with electricity; but when it comes to the use of the telephone in such a way that the Christian Ministry is in danger of abolition, the matter becomes serious. In Lowell the telephone is attached to a certain pulpit and then carried into the houses of the parishioners, who sit in their easy chairs or puff away at the friendly cigar, while the voice of the preacher resounds through the room. If this thing is carried much further Othello's occupation's gone. Dr. Storrs can be hired to preach to the entire continent. Sitting in his study, he can deliver a discourse to a large bundle of wires connecting with every house this side of the Rocky Mountains, and the rest of the ministers will have to engage in some honest but respectable employment. However, there would be a compensation for even that misfortune, for Dr. Talmage would have no use for the clerical trapeze, and even Dr. Fulton would be compelled to be civil. These two advantages would make the world seem brighter, and we are almost inclined to hope that Mr. Edison may complete his invention."

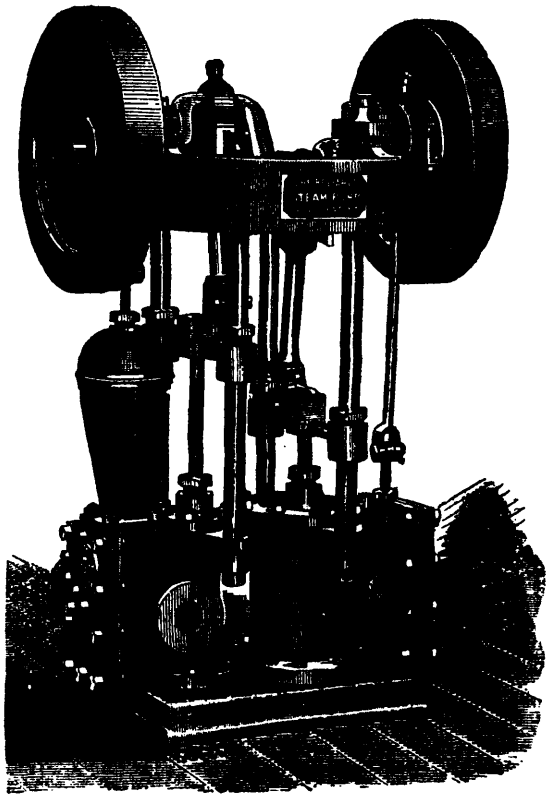
STRAW-WOOD.—To make bricks without straw was in times past deemed an equivalent for an impossibility. But to build a house without wood very nearly approaches to the ancient puzzle. In Illinois, U.S., some ingenious person has discovered a method by which straw can be used for wood as a building material, and the invention has already attracted attention. Several sheets of the ordinary straw-board, as produced in paper-mills, are passed through a chemical solution which softens the fibre. These sheets are then rolled, dried, and when hardened come out in a block impervious to water, and capable of taking a high polish. It is stated that when properly and carefully produced this straw is so like natural wood that it can with difficulty be distinguished from it. The continuous demand for timber in America will be probably lessened should this ingenious plan become generally adopted.—*Cassel's Magazine*.

A SALT EXTRACTOR.—The victualling departments of the Admiralty have under consideration a new culinary utensil destined to improve the seaman's diet on board ship, and especially his peasoup. The apparatus is termed a salt extractor, and has been constructed at the suggestion of Mr. Baden Pritchard, F.C.S., of the Royal Arsenal, Woolwich, being in fact the application of a well-known chemical process to cooking purposes. Boilings from salt beef, or salt pork, or soup that is too much salted, as it usually is on board ship, when placed in the salt extractor, and this in its turn put into cold water, will part with its salt in a few hours, and the soup thus rendered once more palatable. Special attention appears to have been called to the invention by its exhibition at the dairy show.

COAL OIL AS A PAIN-KILLER.—The efficacy of coal oil as a pain-killer is not generally known, nevertheless it has curative properties to a remarkable degree. This was illustrated by an incident which happened at the Talismine a few days ago. On Sunday afternoon a man named John Jones was sitting in the hoisting works, when a large black spider, of the venomous species, bit him on the side. It caused great pain, and the resources of the workmen were taxed to suggest means to relieve the sufferer. At length Mr. Green, the engineer, got some coal oil and applied to the affected part, when the pain ceased almost instantly, and no trouble has since been experienced from the bite.—*Amador Ledger*.

Professor Saccardo of Padua, continues his interesting experiments of artificially coloring the corolla of flowers. There is nothing new in the plan, but the matters employed are original. He simply causes the plants to drink certain colored solutions—

aniline chiefly, which, penetrating the tissues, modify color—in fact dye the nervelets and veins of the corolla. Gardeners are aware, that by mixing iron filings with the soil around hortensias the latter receive a blue tint. The roots of pansies and stocks, dipped in a solution of green aniline, become colored in their flowers in fifteen minutes. But the plant dies in the course of a week. Watering the soil with a colored solution does no good—as the earth absorbs the coloring material.



THE RELIABLE STEAM PUMP.

It is instructive to note how mechanical appliances on board ship have steadily replaced manual labour in a very large number of instances. The use of steam pumps for general purposes on board ship is now almost universal. They prove very handy for deck washing, as fire engines, and in case of sudden leakage. We might not have heard of so many crews giving out after exhausting labour at the pumps, had the wooden ships of many years back been supplied with steam pumps.

The next step from the old chain pumps were improvements in hand piston pumps, but now all these are substituted by independent donkey pumps worked by steam.

There are many descriptions of these pumps now in use, but one rule which is kept principally in view for ship pumps of all kinds, is that they must be thoroughly reliable in their action.

Some direct acting steam pumps, without fly-wheel, have been entirely disqualified for such purposes owing to their liability to hang fire during work or at starting, so that they cannot always be depended upon for prompt service when required.

In some fly-wheels pumps, too, where the piston and pump are direct acting, and the fly-wheel driven by a slot crank of a side-connecting rod, a stoppage is very likely to occur on the centres when the pump is attempted to be worked at a slow speed.

The pump we illustrate well deserves the the title of "reliable" given to it by its makers and inventors, Joseph Evans & Rons of Wolverhampton. It will be seen that the steam-cylinder and pump are mounted side by side upon a strong bed-plate, and the upper frame is supported on four wrought-iron distance columns bolted to the pump and cylinder. These bars also serve as sliding guides for the pump and cylinder cross-heads. The top frame carries two bearings, which support the two throw cranks to which the cylinder and pump connecting rods are attached.

This arrangement of crank, with its two small but heavy fly-wheels, is most efficacious in ensuring the pump from sticking on the dead centres, and we have ourselves personally inspected it only just creeping round, but still maintaining perfect regularity and reliability. This perfect regularity at a slow speed is most valuable for boiler feeding, as it is the most economical method of feeding a boiler to do so with regularity, and only supplying exactly what is required for evaporation.

The chief peculiarities of Messrs. Evans' pump is the water valve arrangement. It is not, as most frequent, a pair of series of flap, mushroom, or other lifting valves, but both the admission and exit of the water into and from the pump is effected by a slide valve operated by an eccentric from the crank shaft.

This side valve is in the form of a hollow piston sliding in a bored seating, from which the passages lead to each end of the pump respectively. The sliding motion of the piston valve causes each end successively to be put into communication, one with the section, and one with the delivery, and then *vice versa* rendering the action regular and constant.

This species of pump valve gear has several advantages. First, the valve is absolutely certain in its action, as it cannot "hang up" by reason of any obstruction or grit under it. This is often the case with lift valves of any description, and much inconvenience and stoppage are frequently caused by so simple a thing as a piece of chip getting under one of the lift valves, and thus causing the water to play backwards and forwards through the valve without effective delivery.

In thick or muddy fluids it is almost impossible to use pumps with ordinary lift valves, as they will not return to their seatings again.

Secondly, another very great advantage of Messrs. Evans' & Sons' slide valve is that the eccentric driving the said valve can be easily reversed, thus reversing the action in the suction and exhaust pipes, making the former suction delivery, and the former delivery suction. This is most important where it be desired to pump two different liquids, such as salt and fresh water, or to clear an obstruction.

There is a palm tree in South America—*papayacarica*, which possesses very remarkable properties. Its sap is a very powerful digestive agent. Digestion is a complex act. Meat is digested in the stomach; feculas, already modified by the saliva, achieve their transformation in the intestines, while fatty matters are only digested in the intestine. Hence the explanation, why some persons can digest meats and eggs without difficulty, while their stomachs are rebellious to feculent and fatty substances. Individuals on the other hand who cannot eat veal, can partake of fatty preparations and pastry without inconvenience. Thus each organ has its rôle, and on their state of health depends the integrity of digestion. Inhabitants of cities suffer most from dyspepsia, that is, from an alteration of the digestive ferment. It is to this latter class of sufferers, that Messrs. Wurtz and Bouchat have investigated the action of the *papaya*. The latter gentleman has experimented with the preparation since two years, and with success, in the hospital for Sick Children. The *papaya* is more generally known in America as the "melon tree"; the fruit is rose colored, sweet, and is eaten like an ordinary melon; the trunk and the veins of the leaves contain a bitter, milky sap or juice, which, after a short exposure to the air, emits an odor resembling rotten cabbage. The sap exudes when an incision is made in the trunk; it immediately coagulates, and separates into two parts, a more or less saluble pulp, and a limpid, colorless serum. Now if this juice, in its natural state, be placed in contact with raw meat, fibrine, the white of eggs, or gluten, it will *soften* these substances in a few minutes, and in some hours *dissolve* them at a temperature of 40 degrees centigrade. Milk is rapidly coagulated by the juice, and its caseine precipitated and dissolved. False membranes from croup, and intestinal parasites, as the tape worm, &c., are similarly disposed of in a few hours. If a beefsteak be cut up in morsels, and placed in a saucer containing some papaya juice, they will be seen to gradually disappear, to melt away as if they were lumps of sugar. Clearly the papaya contains a ferment resembling that peculiar to carniverous plants, as the drosera, nepenthes, &c. Vegetable pepsine is not exactly a novelty, but that in the sap of the papaya is stronger than what is secreted by the stomach, and possesses this superiority, that it can dissolve nitrogenous matters not only in presence of a small quantity of acid, but even in a neutral medium, or one slightly alkaline. While weak digestions have reason to rejoice, it is not less important to bear in mind, the efficacy of the preparation in the treatment of croup and of tape worm.

BAPTISMAL FONT.

The marble baptismal font shown in the engraving is from the establishment of Messrs. Struthers & Sons, Philadelphia. In simplicity and grace, in purity of sentiment and harmonious blending of ornament, it is comparable with anything we have seen.

MARBLE BAPTISMAL FONT.

From a plain octagonal base rises a slender, round shaft, on which rests a circular basin, with receding mouldings lessening toward the rim. Around the foot of the shaft are strewn numbers of pond lilies, their round, flat leaves disposed on a horizontal plane, while here and there among the group are sprays of delicate lilies of the valley, the blossoms half hidden in their sheltering sheath-like leaf. Rising above these, almost to the rim of the basin, is a sheaf of beautiful white water lilies, their long, smooth stems bound to the shaft of the columns by a ribbon band, their broad leaves and graceful flowers encircling and completely hiding the lower portion of the basin.

MEMORY IN DIFFERENT PEOPLE.

M. Delauney has made a communication to the *Société de Biologie* respecting memory as studied under various biological conditions. The inferior races of mankind, such as Negroes, the Chinese, etc., have more memory than those of a higher type of civilization. Primitive races which are unacquainted with the art of writing have a wonderful memory, and were for ages in the habit of handing down from one generation to another hymns as voluminous as the Bible. Prompters and professors of declamation know that women have more memory than men. French women will learn a foreign language quicker than their husbands. Youths have more memory than adults. It is well developed in children, attains its maximum about the 14th or 15th year, and then decreases. Feeble individuals of a lymphatic temperament have more memory than the strong. Students who obtain the prize for memory and recitation chiefly belong to the former class. Parisian students have also less memory than those who come from the provinces. At the Ecole Normale and other schools, the pupils who have the best memory are not the most intelligent. The memory is more developed among the peasantry than among the citizens, and among the clergymen than among the laity. The memory remains intact in diseases of the left side of the brain, and is much affected in those of the right, from which it may be inferred that the right side is more the seat of this faculty than the left. From a physiological point of view, memory is diminished by over-feeding, by physical exercise, and by education, in this sense, that the illiterate have potentially more memory than those who know how to read and write. We remember, moreover, better in the morning than in the evening, in the summer than in the winter, and better in warm than in cold climates. Memory is, therefore to a certain extent, in inverse proportion to nutrition, and more than that, it is in inverse proportion to evolution, since it is greatest in those individuals who are the least advanced from an evolutionary point of view—inferior races, women, children, the feeble, etc. In short, according to M. Delauney, there is an evolution of the memory, which is first sensorial, linerial and then intelligent; but memory, properly speaking, diminishes inversely as the evolution.—*Medical Press and Circular.*

BRAIN WORK AND BRAIN DEVELOPMENT.—According to the *Gazette des Hospitaux*, MM. Lacassagne and Cliquet have examined, by aid of the *conformateur*, the heads of 190 doctors of medicine, 133 rudimentarily educated, 90 illiterate, and 91 prisoner soldiers, with the following result:

		Soldiers.	
Diameters.	Educated.	Uneducated.	Prisoners.
Longitudinal...85.29	81.97	79.13	81.10
Frontal.....48.91	43.65	42.35	41.12
Parietal.....52.58	49.66	50.27	49.90

There is thus a considerable difference in favor of the doctors, and this is especially marked in the frontal measurements. Moreover, the two sides of the head are not symmetrical—in the educated the frontal region is more developed to the left, in the uneducated the occipital region is more developed to the right. The head is larger (more developed) in the case of the educated than in those of inactive intelligence. Among the educated the frontal region is more developed in proportion than the occipital; and if the difference is greater in the occipital it is very trifling, while among the illiterate it is considerable.

THE EVILS OF SMOKING IN EARLY YOUTH.—It appears that the German government has seriously taken this matter in hand, as smoking is practised to a great excess by the youth of that country, so that it has been considered to have damaged their constitution, and incapacitated them for the defence of their country. In certain towns in Germany the police have had orders to forbid all lads under sixteen years of age to smoke in the streets, and to punish the offence by fine and imprisonment. Moreover, a Belgian physician has found, during a journey of observation and inquiry, made at the request of the Belgian government, that the too general and excessive use of tobacco is the main cause of color blindness, an affection which is occasioning increasing anxiety, both in Belgium and Germany, from its influence upon railway and other accidents, and also upon military inefficiency.

A FUNGUS, similar to that which Dr. Salisbury first noticed in the blood of persons suffering from malaria, is now announced as constantly present in the blood of consumptives, and therefore is suspected as being the cause of this dreadful malady.

CORROSION OF BOILERS BY FATTY MATTERS.

The Chief of the Experimental Railway Company of France, M. A. Mercier, gives, in the *Annales des Mines*, the results of some experiments upon the changes produced by fatty matter in the wrought and cast-iron parts of engines exposed to the action of steam. M. Mercier had occasion to examine in the laboratory some hard balls taken from the cylinders of steam engines, and which were generally attributed to the use of acid lubricating oil. The balls, when crushed and digested in ether, left an insoluble residue of peroxide of iron, while the soluble part was composed of oleic acid, combined with the oxide of iron mixed with a non-decomposed oil.

A series of experiments was made to determine whether the formation of this oleate of iron resulted from the use of oil more or less rancid, having an acid reaction, or whether it was the product of the decomposition of neutral fatty matter in presence of iron and of steam at a high pressure. According to these experiments, the fatty matters have no need of being acid or rancid, nor of being heated above 212° F., to decompose steam in presence of iron, and thus produce oleate of iron, glycerine and hydrogen. Observations made upon steam engines which showed corrosion in those parts exposed to oil and steam, suggested the following experiment: An iron bucket containing wrought-iron chippings, thoroughly saturated with oil of colza previously neutralized, was left during eight days in a reservoir supplying steam to several steam hammers. At the expiration of this time there were taken from the bucket about 30½ cubic inches of very thick oil, which flowed with difficulty and omitted an odor similar to what is produced by the action of an acid on iron; the iron was strongly corroded, and the oil—colored to a dark brown and entirely soluble in ether—contained 7% of the oxide of iron. This oleate of iron oxidized rapidly on contact with air, and, like all the minimum salts of iron, gave up some peroxide of iron; when again placed in contact with iron it attacked the iron and was thus brought back to its first state of saturation. In this manner can be explained the large proportion of non-combined peroxide of iron contained in the matter found on the valve-face of an engine at Valence, upon which an observation was made.

These facts appear to clearly explain the corrosions of certain boilers receiving fatty matters brought over from the cylinders by the exhaust steam, or used to lubricate the throttle valve of locomotives.

In locomotives the steam is generally taken from the upper part of the boiler by means of an immersed slide throttle valve; the oil used for lubricating the latter becomes saturated with iron, and being thus made heavier than water sinks to the bottom of the boiler where it attacks the iron plates, forming in them those excavations which are only found when feed-water is used of such purity as not to deposit the lime-scale that in most cases preserves the boilers.

The use of mineral oil, thickened if necessary with wax or parffine, for the lubrication of moving parts placed in the steam, would be without doubt a good means of preventing changes in the material of such organs.

BIG ORES.

The roots of trees appear to have power to reduce the peroxide of iron, contained in sands with which they come in contact, to the soluble protoxide. When the water which dissolves this runs into low places, where branches, twigs and leaves of trees are slowly decaying, the protoxide becomes reoxized and is deposited in the interstices of the vegetable forms left by the decomposition of the woody fiber. Thus, parts of the trees are not petrified, but ferrified; the whole beds of iron ore consist of these roots of dead vegetation. Where the ferruginous waters do not encounter masses of decomposing wood, but merely lie at rest, as in swamps and ponds, the evaporation causes the ore to be deposited in lumps, from the size of a shot to five hundred pounds weight. From the bottom of ponds these lumps can be raised with tongs, like oysters. In either form the large amount of vegetable matter which this ore contains makes the melted iron reduced from it exceedingly fluid, so that it runs into every nook and cranny of the casting mold, and reproduces it with sharp and precise outlines. When bog ores can be procured to mix with other iron ores, they produce a highly beneficial effect in the running of the furnace and quality of metal turned out; though, as a rule, they will not yield forty per cent. of metal. The pig metal obtained from them is so brittle that it breaks to pieces on being dropped on hard ground. Its weakness is in part due to its containing phosphorus, arsenic, etc. When taken from swamps, the workmen often throw into the cavities loose earth, leaves, bushes, etc., which, often within eight years, leave behind them fresh deposits of ore. The most noted places of supply for bog ore in this country are: Monmouth county, New Jersey. Piscataquis county, Main and Snowhill, on the eastern shore of Maryland. In the early part of the century much was obtained from the ponds of Plymouth county, Mass., and from Egg Harbor, New Jersey.

NEW PROPERTIES OF CARBOLIC ACID.—The chemistry of carbolic acid has recently become better understood. For instance, Staedler has shown that it is a constant constituent of the urine; Brieger has shown that it is a normal constituent of the contents of the bowels; and Baumann has discovered that it is one of the products of the putrefaction of albumen. Dr. Jay has lately discovered that it is a powerful deoxodizing agent, and shows this property by experiment. He oxidizes Guaiacum resin with potash, manganese, iodium and chlorine, and deoxodines it as well as restores it to its normal color by the addition of carbolic acid. A very curious reaction is effected by this acid upon iodine. When carbolic acid is added to tincture of iodine no perceptible change takes place, but when carbolic acid is added to tincture of iodine freely diluted with water, the fluid is almost instantly decolorized, and a compound is formed which is incapible of acting on starch and turning it blue, as free iodine does. Whence the Doctor thinks this combination might form a good antiseptic dressing for wounds. The investigations of Pasteur, Tyndall, Sanderson, Lister and others have clearly shown that putrefaction changes never take place without the presence of bacteria; and, further, that the bacteria are dependent on oxygen for their existence. The deoxidizing properties of carbolic acid would prevent the formation of bacteria.

ACTION OF SEWER GAS ON LEAD, etc.—The sanitary inspector of Dundee, Mr. T. Kinnear, has watched the effect of the gas on portions of the zinc eaves of buildings where it was striking on the under part, and found, in the course of a couple of years or so, pretty large holes eaten completely through, showing that material could not long withstand the effect of the gas. Lead is, of course, more durable than zinc, but the difference is only a question of degree, as shown by the fact, in not a few of the water-closets repaired by the officers of the department during the year, small apertures were found in the main vertical lead pipe, and in the cross or horizontal one leading from it to the trap of the closet various perforations were found on the top, indicating clearly the operation of foul air from the drain. Lead traps and soil pipes from water-closets, baths and fixed basins are all subject to wear and tear; but the traps, being burdened with the additional strain of barring the passage of sewer gas, do their work less efficiently, and for a much shorter period, than they are generally credited with, hence the necessity for proper ventilation and occasional inspection.

NEW PERCUSSION CAP FOR DYNAMITE.—Parties in Dusseldorf have devised improvements in caps for dynamite, which consist, first, in weakening the bottom of the cap, by a ring or cross; secondly, in closing the cap as firmly as possible at the top, which is effected by placing a conical copper cap within the same, provided with a hole in its bottom; and thirdly, in strengthening the sides of the cap as much as possible. Detonating caps, as is well known, serve to explode dynamite and similar substances by a strong shock and great heat. By concentrating these as much as possible towards the center of the exploding cartridge or blasting hole charge, the latter are rendered the more reliable. The conical copper cap can also be held within the outer cap by narrowing the mouth of the latter. The manner of applying the above-named principles of construction may be varied as desired according to circumstances.

LUBRICANTS.—The choice of a lubricant is frequently ill-made. Common kerosene oil is too often injudiciously used in place of a thicker or more bland oil, because the heat produced by the friction rapidly vaporizes the oil and leaves the journal dry. Crude petroleum for the same reason is fitted only for very slowly revolving journals, such as water wheels. For very heavy machinery, or for gearing, tallow and black lead rubbed up together is the best lubricant, and is also the best for wagon and carriage axles during the hot weather. For light running machinery sperm oil is the best; good olive oil, that has not become rancid and acid, is perhaps the second best, and for winter use lard oil is excellent, but is rather too drying to be a first-class lubricant. Castor oil is better for axles in the winter, and black lead with it is a help at any time.

HARDENING HOLLOW PIECES OF STEEL.

A method of hardening hollow steel articles has been patented in this country by W. Lorenz, of Carlsruhe, by which tools, dies, &c., can be rehardened many times with facility and without deterioration. In the ordinary process for hardening hollow steel articles, by which these when heated are cooled simultaneously and equally on their inner and outer surfaces, the contraction of the material cannot take place proportionately to the radially decreasing sections in the direction from the outside to the inside, and unequal tensions are thus produced in the article, whereby when the inner hardened surface once becomes worn the article is rendered useless. By the use of his invention (says the patentee) such tensions are prevented, so that hollow steel tools or dies can be re-hardened 20 to 30 times without deterioration, the action being such that the tool or die at each hardening is caused to contract in proportion to the thickness of its sides, so that when the inner surface has become worn the inner space is brought to the proper dimensions again merely by the shrinkage caused by the act of hardening. For this purpose the water for cooling is applied partially to the inner surface and partially to the outer surface, and according to the thickness of the article it is applied either simultaneously in regulated quantity to both the inner and outer surface, or first only to the outer surface and then quickly to the inner surface, or first to the inner and then to the outer surface, causing the same water that has acted on the one surface to act on the other. The hollow steel articles are for this purpose placed in specially formed receptacles, in which they rest upon their supports, so that the water flowing down through the interior can find its way underneath the lower end and up between the outer surface and the sides of the receptacle. The apparatus for carrying out the above described process consists, firstly, of the receptacle, which may be in two or more parts, according to the form of the article to be hardened; secondly, of a discharge pipe supporting the said receptacle, through which the water after having done duty is conducted away; thirdly, of a stand having a dish-shaped top for receiving any water that may overflow the sides of the receptacle, and that conducts it through channels into the discharge tube; and, fourthly, of a nozzle carried by a bracket at the top of the stand, through which the requisite water is supplied. The discharge tube is carried by a treadle pressed upwards by a spring, and in commencing operations the tube is drawn inwards by means of the treadle, thereby lowering the receptacle to allow of the introduction of the heated steel article. The tube and receptacle are then passed upwards by the spring, so as to cause either the upper end of the steel article itself or the upper end of the receptacle to abut against the end of the nozzle, the lower part of which is removable, so that nozzles of different forms corresponding to those of the steel articles or of the receptacle can be used. The upper part of the nozzle contains a valve which is screwed up or down so as to regulate the quantity of water admitted to the receptacle, and its lower end contains a loose movable stem held centrally by wings, and having a conical piece screwed on its lower end projecting somewhat beyond the nozzle, so that by screwing such conical piece farther in or out the water may either be spread on issuing from the nozzle, so as to flow both over the inner and outer surface of the steel article, or it may be concentrated so as to flow only through the interior thereof.

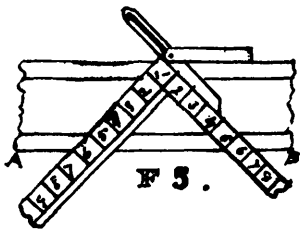
The figure shows a vertical section of the complete apparatus. Water is supplied through the pipe R to the nozzle. This nozzle is supported by three supports fixed to the dish D. Immediately below it is the receptacle S, into which the steel article to be hardened is introduced, and below this is the escape pipe, through which the water entering at R is conducted away after use. The escape pipe, together with the receptacle S, is supported by the treadle, so that by depressing the latter the pipe and receptacle are lowered for introducing the steel article, while when the latter is being operated upon the pipe and receptacle are pressed upwards so that the latter bears against the nozzle N.

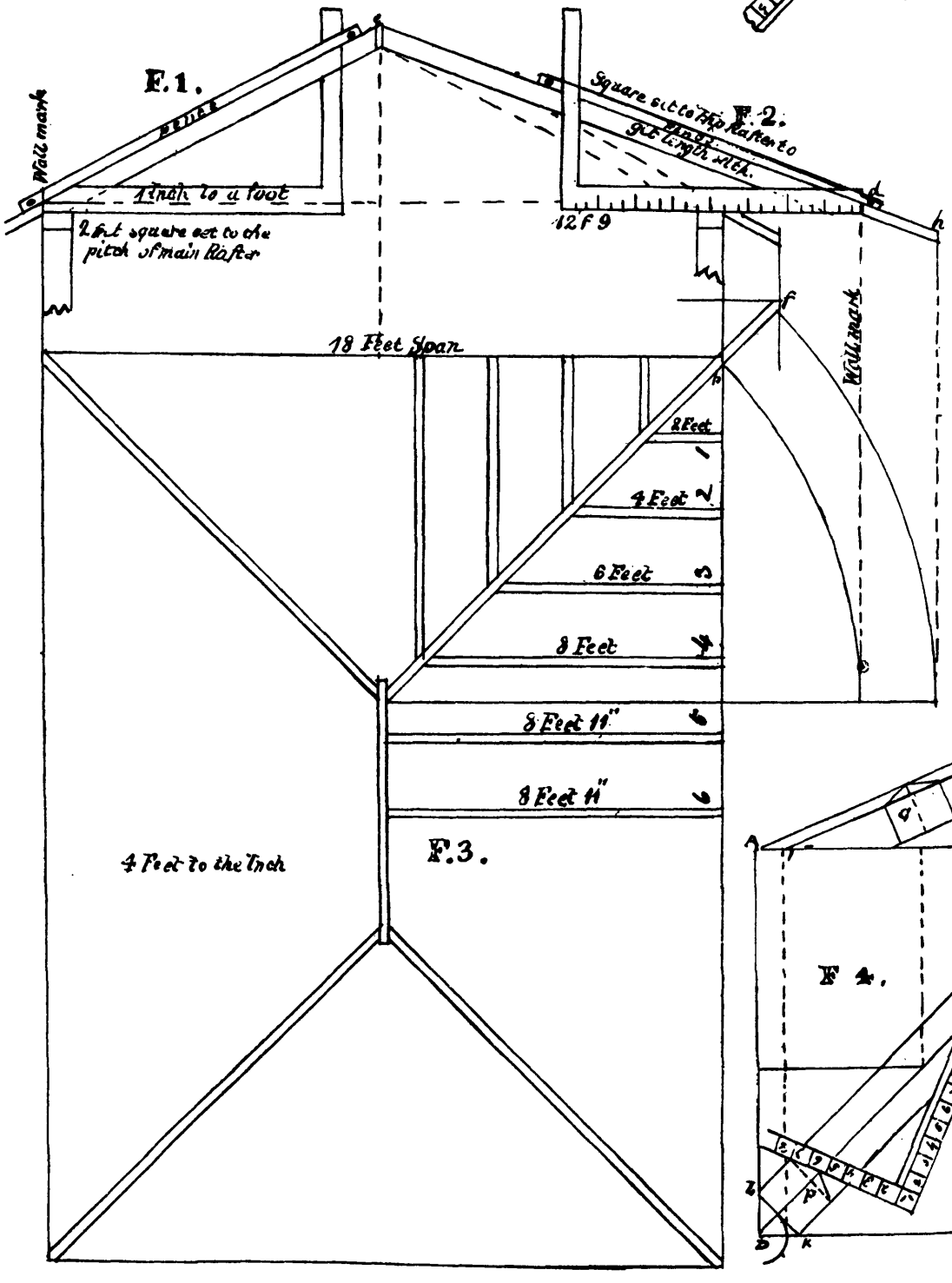
The hardening process is carried on as follows:—The steel article being placed in position as indicated, a valve is opened more or less by turning the screw up means of the handles H so as to admit a regulated quantity of water, which for simple cylindrical articles flows through the nozzle into the interior of the article, and directly into the escape pipe, while any portion required for cooling the outer surface flows over the upper edge on to the dish D, and thence through openings into a funnel attached to the escape pipe into which it flows through perforations. For steel articles of more complex configuration, such as are, for instance, used in the manufacture of metal cartridge cases, a nozzle is employed which has within it a cylindrical rod held centrally by ribs, and having at its lower end a screw thread on which is screwed a conical piece; by screwing the latter inwards or outwards the area of the annular orifice is decreased or increased, and the stream of water issuing through it is directed either more to the outer surface or more to the interior of the steel article, according as the peculiar form of the article may require. Thus in the figure the steel article is first cooled internally by the stream of water, which then partly flows underneath the bottom thereof, and up over its outer surface, escaping over the edge of the receptable, while the remainder escapes directly through the hole in the brttom of the receptacle into the pipe.

THE RAILROAD UP MOUNT VESUVIUS.—The latest report from Naples represent the railway desined to carry tourists to the top of Vesuvius as progressing fast towards completion, and the walls of the station which forms its terminus are already rising above the ground. The line is to be laid along the western slope of the mountain, and will be rather less than 1,000 yards in length. The station itself, which stands at the bottom of the volcanic cone, is 2,505 feet above the level nf the sea, and the line rises rapidly to the verge of the crater, at an incline which averages 56 feet in the 100, but reaches at its steepest part as much as 63 in 100. The construction of the railway has been a matter for serious debate, and it was only after long consideration that the projectors determined upon the system planned by the engineer, Olivieri. According to the principle adopted in this plan, the whole of the inclined plane, from top to bottom, is covered with a thick platform of wood, resting upon the lava and other crumbling soil, which would of itself be much too unsteady to form a proper bed for the sleepers. Above the cinders and detritus, of which the mountain-side is composed, the platform is like a gigantic raft, and upon it the rails will be laid with ease and regularity. The wheels of the carriages are to be so firmly attached to the rails that they can never jump or slip off, and the trains are to be drawn up by means of two steel cables worked by a steam engine stationed at the bottom of the volcano. They will also be provided with a brake so powerful that even in the unlikely case of the breakage of both cables they can be brought to a standstill very quickly, even on an incline of 50 in 100. The only difficulty which faced the projectors of the new railway was that of water-supply, for it was calculated that the expense of bringing from Resina enough water to supply the engine would run away with more than all the profits that could reasonably be expected. In order to avoid this alternative, two large reservoirs are being constructed, which are expected, even under the peculiar circumstances of the position, never to run dry.—*London Globe.*

THE ANTIQUITY OF GLASS.—The oldest specimen of glass bearing anything like a date is a little moulded lion's head, bearing the name of an Egyptian king of the eleventh dynasty, in the Slade collection at the British Museum. That is to say, at a period which may be moderately placed as more than 2,000 years B. C. glass was not only made, but made with a skill which shows that the art was nothing new. The invention of glazing pottery with a film or varnish of glass is so old that among the fragments which bear inscriptions of the early Egyptian monarch are beads, possibly of the first dynasty. It cannot be doubted that the story preserved by Pliny, which assigns the credit of the invention to the Phœnicians, is so far true that these adventurous merchants brought specimens to other countries from Egypt. That the modern art of glass-blowing was known long before is certain from representations among the pictures on the walls of a tomb at Beni Hassan, of the twelfth Egyptian dynasty, but a much older picture, which probably represented the same manufacture, is among the half-obliterated scenes in a chamber of the tomb at Thy, at Sakkara, and dates from the time of the fifth dynasty, a time so remote that it is not possible, in spite of the assiduous researches of many Egyptologists, to give it a date in years.—*Saturday Review.*

BEST ANTISEPTIC.—Prof. Klebs, of Prague, announces that the benzoate of soda is the best antiseptic in all infectiont diseases. It acts, as the experiments of the author show, very powerfully. It is claimed that a daily dose of from 30 to 50 grammes to a full-grown man will render the poison of diphtheria inoperative. The benzoate is prepared by dissolving crystallized benzoic acid in water, neutralizing at a slight heat with a solution of caustic soda, drying and then allowing the solution to crystallize over sulphuric acid under a bell-glass. Large doses do not appear to be absolutely necessary. Good results may be obtained by the daily administration of about 12 grammes.





THE CARPENTER'S STEEL SQUARE AND ITS USES.

THE CARPENTER'S STEEL SQUARE AND ITS USES.

BY F. T. HODGSON, ARCHITECT, EDITOR *American Builder*.

These papers are written especially for the consideration of apprentices. There is nothing of more importance to a young man who is learning the business of house-joinering and carpentry than that he should make himself thoroughly conversant with the capabilities of the tools he employs. It may be that, in some cases, the result could be attained much readier with other aids than the square; but the progressive mechanic will not rest satisfied with one string to his bow when others are within his reach.

The great improvement which the arts and manufactures have attained, within the last fifty years, renders it essential that every person engaged therein should use his utmost exertions to obtain a perfect knowledge of the trade he professes to follow. It is not enough, nowadays, for a person to have attained the character of a good workman; that phrase implies that quantum of excellence, which consists in working correctly and neatly, under the directions of others. The workman of to-day, to excel, must understand the principles of his trade, and be able to apply them correctly in practice. Such an one has a decided advantage over his fellow-workman; and if to his superior knowledge he possesses a steady manner, and industrious habits, his efforts cannot fail of being rewarded.

Whatever time the young mechanic may devote, while in his apprenticeship, to the acquirement of knowledge, will be like "casting bread on the waters," for, most assuredly, "it will return to him tenfold after many days."

In the illustrations of the "Square and its Uses," this month, Fig. 1 is supposed to be the pitch of a roof furnished by an architect, with the square applied to the pitch. The end of the long blade must only just enter the fence, as shown in the drawing, and the short end must be adjusted to the pitch of the roof, whatever it may be. Fig. 2 shows the square set to the pitch of the hip rafter. The squares as set give the plumb and level cuts. Fig. 3 is the rafter plan of a house 18 by 24 feet; the rafters are laid off on the level, and measure nine feet from centre of ridge to outside of wall; there should be a rafter pattern with the plumb cut at one end, and the foot cut at the other, got out as previously shown. When the rafter foot is marked, place the end of the long blade of the square to the wall line, as in drawing, and mark across the rafter at the outside of the short blade, and these marks on the rafter pitch will correspond with two feet on the level plan; slide the square up the rafter and place the end of the long blade to the mark last made, and mark outside the short blade as before, repeat the application until nine feet are measured off, and then the length of the rafter is correct; remember to mark off one-half the thickness of ridge-piece. The rafters are laid off on part of plan to show the appearance of the rafters in a roof of this kind, but for working purposes the rafters 1, 2, 3, 4, 5, and 6, with one hip rafter, is all that is required.

Fig. 4 exhibits two methods of finding the barking of the angle or hip rafter. This drawing is taken from "Gould's Wood Workers' Guide." The methods are as simple as any I know of. Take the length of the rafter on the blade, and the rise on the short blade or tongue, place the square on the line D E, the plan of the hip, the angle is given to bevel the hip rafter, as shown at F. This method gives the angle, only for a right-angled plan, where the pitches are the same, *and no other.**

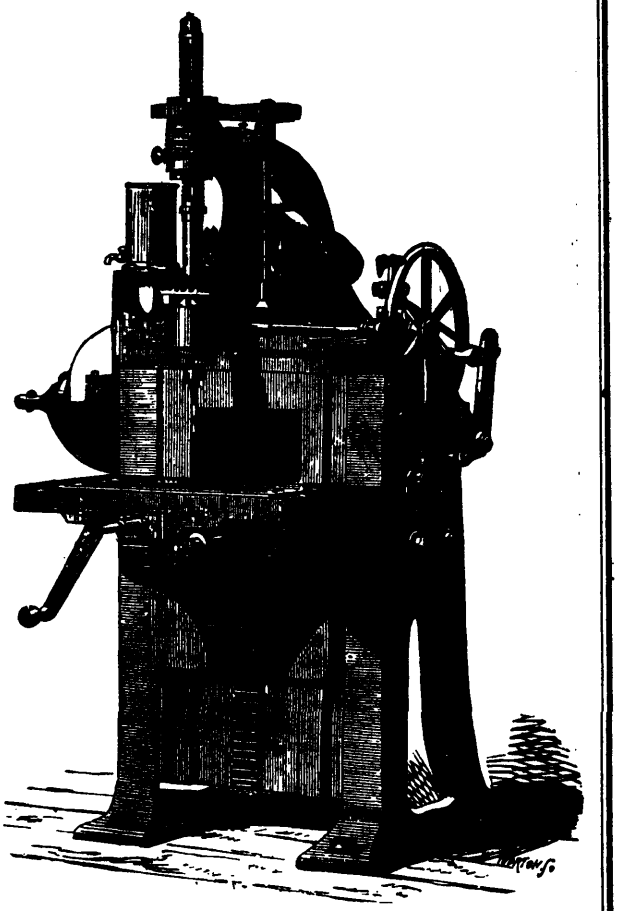
The other method applies to right, obtuse and acute angles, where the pitches are the same. At the angle D will be seen the line from the points K L, at the intersection of the sides of the angle rafter with the sides of the plan.

With one point of the compass at D, describe the curve from the line K L. Tangential to the curve draw the dotted line, cutting A H at I; draw I J parallel to A B, the pitch of the hip. The pitch, or level, will be found at G, which is a section of the hip rafter.

Fig. 5 exhibits a method of finding the cuts in a mitre box, by placing the square on the line A B at equal distances from the heel of the square, say ten inches. The bevel is shown to prove the truth of the lines by applying it to opposite sides of the square.

THE PALACE OF THE TROCADÉRO.—It has finally been decided that the Trocadéro building will be utilized by making it the home of the Ministry of Fine Arts.

* There are forms of hip roofs where none of these rules can be applied; in winding up these papers I will show a few examples, and the methods of working them.—F. T. H.



SHARP & FURNIVAL'S PATENT TRAVERSING DRILLING MACHINE.

This machine is chiefly designed to cut key grooves in shafts and railway axles, cotter holes in connecting rods and straps, piston rods, and cross-heads, valve rods, cutting out joints and shaping nuts, &c. This invention is one of the best modern labour-saving tools we have seen. It supplies a want that engineers have often experienced when cutting cotter holes in connecting rods, straps, &c., of a machine to do them with speed and perfect accuracy. This is a vast improvement on the old mode of drilling, chipping, and filing, which not only left the work finished in a very unsatisfactory manner, but was at best a slow and costly process. Messrs. Kendall & Gent, Victoria Works, Salford, Manchester, are the manufacturers.—*Birmingham Hardware Circular.*

WELDING STEEL HAMMERS.—A correspondent in the *English Mechanic* asks if it is possible to weld a face on a cast-steel hammer. The answer given is as follows: "I suppose to make it heavier; this cannot be done even with sheer steel. Many men will assert that they have seen it done many times. Files may be put together very easy and to look sound, but as to their being welded I doubt it very much. Sometimes old swords can be put together to look sound, still they are not so. Many workmen are not aware that there is a kind of steel made, called *welded cast steel; this will account for so much cast steel being* welded. I know one firm that sent an order for 100 tons of sheer steel to one of our best steel makers, and they, not having it in stock, sent welding cast steel, and it gave great satifaction, and as the order came from a Sheffield firm no doubt it was tested very severe as to its welding property. Of course, the firm it was for took it for sheer steel, and no doubt had the order been for cast steel the same would have been sent, that is if no other was on stock. I have some cast steel and I know it is the right sort, and I should like to give anybody a piece who would try to weld it. I have seen this kind of thing tried in many of our best workshops and by some of our best workmen hundreds of times, and welding files I regard as an old tale."

MICHELA'S REPORTING MACHINE.

The Michela system of reporting and the type-writer which forms an important complement of the system have been patented in this country on behalf of A. & J. Michela and G. de Petro, of Turin. For the system and the type-writer many things have been promised, not the least valuable of which is that by its means a manipulator would be able to transmit speeches as he heard them in several different directions, and if necessary in several different languages, the latter, however, depending entirely upon the choice or necessity of receiver, who would merely have to translate the code signals. In carrying out the invention it is proposed to employ stenographic signs or characters of an elementary shape, such, for example, as the following series - — ∪ / ∩ ⊥, the whole or a portion of which are quadruplicated, so as to produce the requisite number of signs to represent without ambiguity the whole of the phonetic elements which the vocal organs are capable of pronouncing in any spoken language. Assuming that twenty elementary signs or characters are sufficient for this purpose, they are arranged on a double keyboard, each half containing ten keys, and corresponding to double the number of fingers on the human hand so that each hand may operate one keyboard, and each finger manipulate two of the keys of the same. Thus the six signs or characters enumerated may occupy the first six keys of one of the two keyboards, of which the double keyboard is composed, and the same signs or characters in the reverse order may occupy the last six keys of the other keyboard, whilst the remaining four keys of each keyboard may be occupied by four of the signs or characters in reverse order on each keyboard. There will thus be produced four series of stenographic signs or characters, which it is proposed to appropriate as follows, viz., the first series to represent the initial consonants or initial phonetic consonantal elements of syllables, the second series to denote the second consonants (in the cases where two consonants occur together), the third series, the vowels or vocal elements, and the fourth series to represent the final consonants or final phonetic consonantal elements of syllables. Each of these consonants or phonetic consonantal elements, and each of these vowels or vocal elements, is assumed to be of the numerical value of 1, 2, 3, 6, 9, or 18, or of a number formed by the addition of say two of the first five or of the first four of the before-mentioned figures, and on the keys of the double keyboard are marked the figures 1, 2, 3, 6, 9, 18, 1, 2, 3, 6, 6, 3, 2, 1, 18, 9, 6, 3, 2, 1. If, therefore, in either of the series the number of the sound to be reproduced is simple, its appropriate stenographic sign or character will be found on the corresponding portion of one of the keyboards. When it is compound it is to be reproduced by two of the keys in accordance with the component numbers forming the numerical value of the sound.

In writing with this code each syllable composed of the requisite number of phonetic elements is impressed or printed separately in a transverse direction upon a strip or web of paper, which is fed forward intermittently by the action of the apparatus. Suitable conventional signs may be employed for denoting a parenthesis and the termination of a sentence, and numbers may also be represented in a similar manner to the consonantal and vocal elements.

The mechanism of the apparatus for printing the stenographic signs or characters is divided into two parts, one of which performs the operation of printing or impressing the signs or characters upon the paper, and the other effects the automatic feed of the strip of paper upon which the said signs or characters are printed or impressed. The printing mechanism is constructed with a double keyboard, each portion containing ten keys, as above mentioned. These keys may be of a similar description to the keys of a pianoforte, or of any other suitable form, and be suspended on fixed centres at one end, and provided with guides or springs to maintain them in the proper positions.

The keys rest at or about their centres upon the ends of vertical rods connected to the front ends of a series of equal armed levers of the first order, arranged underneath and transversely to the keys, and connected at their other ends to a corresponding number of types or punches situate underneath an opening in a table between the keyboards, over which types or punches the strip of paper is drawn as it is unrolled from a suitable reel or roller. The feed motion of the strip of paper is obtained by means of a lever arranged underneath the keys, the lever being common to the whole series of keys, and receiving motion from the same simultaneously with the types or punches; the extent of motion is the same, irrespective of the number of keys operated at once. When one or more of the keys are depressed the lever acts upon a spring or weight by means of a pulley or other contrivance, in such a manner that when the key or keys rise after each impression upon the paper, a forward motion is imparted to a pawl engaging with the teeth of a ratchet wheel last on the axis of a cylinder, causing the said ratchet wheel and cylinder to rotate to the extent of one tooth at each motion of the lever. Two small rollers are maintained in contact with the cylinder referred to, and are caused to partake of its motion by friction, being pressed against its surface by a screw. The strip of paper, after receiving the impression of the types or punches as they rise through the opening in the table, is drawn between the two small rollers and the cylinder by the intermittent rotatory motion of the latter, and issues from the apparatus with the characters impressed upon it in the form of small indentations, or, if required, the characters may be printed in ink by providing suitable mechanism for the purpose. Each key corresponds to one of the characters of the system of stenography adopted, and when depressed by the finger of the operator, the key causes the corresponding type or punch to rise through the opening in the table supporting the strip of paper, and makes the required impression on the latter, a suitable pad or block being provided above the strip to afford the requisite support. The apparatus may be modified in the details of its construction and arrangement. For example, the keyboard may be situate below the mechanism, and the keys in this case may be arranged to pull the levers in lieu of pushing them. The feed motion for the strip of paper may be effected by means of a small rod secured to the common lever, which, being provided with an oblique notch, serves to actuate a small apparatus, with two arms acting upon a wheel attached to the cylinder, one arm acting during the forward stroke, and the other on the return stroke. The motion of the printed strip may also be transmitted to it in any suitable manner by clockwork or otherwise. It will be seen that the Michela system is based on a principle frequently proposed, and to a certain extent carried out by merchants. There seems no reason why it should not be utilized by reporters, if the type-writer described is a portable and practical instrument, and printers can be induced to learn the code. There would not be much difficulty with the printers, for they would prefer printed marks to written words, as they often appear in MS.; but it may be doubted whether the type-writer could be manipulated with the requisite speed, and without getting out of order.

The preservation of the sight is engaging much serious attention. Professor Javal is not far from considering that defective eyesight is due to the bad lighting of school-rooms, hence the importance of the subject, when France intends erecting thousands of new primary schools. As general rules, the light should never strike the pupil's eyes directly; it ought to enter the class-roam bi-laterally, and by windows built on a north west and north east axis, inclining if possible rather to the latter. The healthy eye requires no protecting glasses, save when travelling across glaciers or in countries full of too brilliant sunshine. The eye has a wonderful power of adaptation; thus the light of the sun is about one million times more intense than that of the full moon, and yet the eye can distinguish objects by the light of either orbs. The variations in the diameter of the pupil contribute something to this power of adaptability; it is in the retina that the sensibility of the eye resides, and which produces the faculty of contraction and expansion following light and obscurity. Reading a book under the direct influence of the sun's rays, will invariably end by producing blindness, and for a time, prevent seeing in demi-obscurity. The houses in Madrid are so protected from sun light by shutters half closed and blinds entirely drawn down, that persons entering such apartments directly from the street, can perceive nothing for eight or ten minutes, while the occupants can see quite well. Insufficient lighting is more injurious for children than adults; the pupils of the latter are less dilatable, thus compelling immediate abstention from work when darkness sets in. Also grown up persons generally patronize glasses, and if not short-sighted in youth, they rarely contract the infirmity in advancing years. It is an error to suppose that the number of windows in a school ought to be proportionate to the number of scholars. Artificial light is a cause of fatigue for many persons, as it entails a greater dilation of the pupil. The difference in intensity between natural and artificial light can be seen in the burning of a lamp during full day. A lustre with one million of candles, would still be very inferior in illuminating a room to the direct light of the sun. A well-known *littérateur* cannot work by day, unless the shutters be closed and the lamps lighted; this is owing to

the action of the chemical rays, and that yellow glasses ought to remedy. After every eclipse of the sun, oculists have an increased number of patients, who have injured their eyes by looking through imperfectly smoked glass. In one of the railway terminii of Paris, when the electric light was first employed. there was a general out-cry against its effulgency ; when it was replaced by gas, the complaints were equally loud by the employés that they were plunged in Egyptian darkness. The fatigue resulting from working by artificial light is not due to the dazzle of the flame, but to the inadequacy of the light it emits.

THE IMMENSITY OF THE STARS.

We take from *Le Monde de la Science* the following interesting "Considerations on the Stars," by Professor J. Vinot. "It is known that the stars are true suns, that some of them are larger than our own sun, and that around these enormous centres of heat and light revolve planets on which life certainly exists. Our sun is distant from us 38,000,000 leagues, but these stars are distant at least 500,000 times as far—a distance that in fact is incommensurable and unimaginable for us. Viewed with the unaided eye the stars and the planets look alike ; that is, appear to have the same diameter. But, viewed through the telescope, while the planets are seen to possess clearly appreciable diameters, the stars are still mere luminous points. The most powerful of existing telescopes, that of Melbourne, which magnifies 8,000 times, gives us an image of one of our planets possessing an apparent diameter of several degrees. Jupiter, for instance, which seen with the naked eye, appears as a star of the first magnitude, with a diameter of 45° at the most, will in this telescope have its diameter multiplied 8,000 times, and will be seen as if it occupied in the heavens at an angle of 100°. Meanwhile a star alongside of Jupiter, and which to the eye is as bright as that planet, will still be a simple demensionless point. Nevertheless that star is thousands of times more voluminous than the planet !

"Divide the distance between us and a planet by 8,000, and you have for result a distance relatively very small ; but divide by 8,000 the enormous number of leagues which represents the distance of a star, and there still remain a number of leagues too great to permit of the stars being seen by us in a perceptible form. In considering Jupiter, or any of the planets, we are filled with wonder at the thought that this little luminous point might hide not only all the visible stars, but a number 5,000 fold greater, for of stars visible to our eyes there are only about 5,000. All the stars of these many constellations, as the Great Bear, Cassiopeia, Orion, Andromeda, all the stars of the zodiac, even all the stars which are visible only from the earth's southern hemisphere, might be set in one plane, side by side, with no one overlapping another, even without the slightest contact between star and star, and yet they would occupy so small a space that, were it to be multiplied 5,000 fold, that space would be entirely covered by the disk of Jupiter, albeit that disk to us seems to be an inapreciable point.

THE WAY TO HEALTH.

The only true way to health is that which common sense dictates to man. Live within the bounds of reason. Eat moderately, drink temperately, sleep regularly, avoid excess in anything, and preserve a conscience "void of offense." Some men eat themselves to death, some drink themselves to death, some wear out their lives by indolence, and some by over exertion, others are killed by the doctors, while not a few sink into the grave under the effects of vicious and beastly practices. All the medicines in creation are not worth a farthing to a man who is constantly and habitally violating the laws of his own nature. All the medical science in the world cannot save him from a premature grave. With a suicidal course of conduct, he is planting the seeds of decay in his own constitution, and accelerating the destruction of his own life.

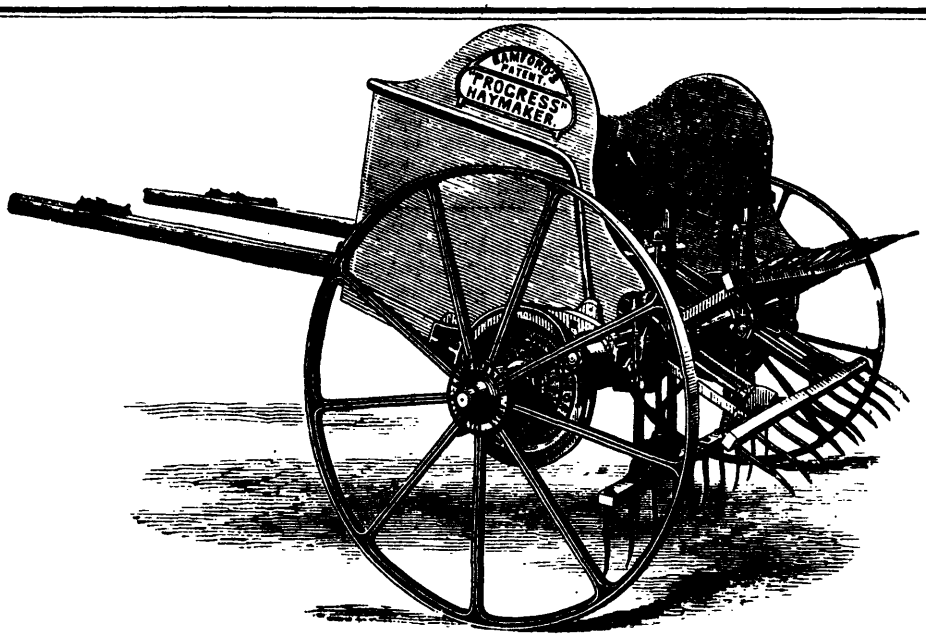
THE MICROSCOPE IN THE WITNESS BOX.

As the New York *Tribune* says, the scientific aspects of the evidence against the Rev. Mr. Hayden of Madison, Conn., for the murder of Mary Stannard, are truly remarkable ; indeed the microscopic exhibition of arsenic and the comparison of arsenical crystals show that the law has a powerful auxilliary in chemistry. After the arrest of Mr. Hayden, and the disinterment of the remains of the dead girl for examination, it was claimed that all of the arsenic which Hayden had bought was still in a box in the barn. There a box was found containing a full ounce. It was shown that the arsenic found in Mary Stannard's stomach could not have been taken from this box. At this point recourse by the prosecution was had to Prof. Dana, who visited England, studied the manufacture of arsenic, and then, by the use of his microscope on the crystals, demonstrated that the arsenic from the girl's stomach was an entirely different lot from that hidden in the barn, and that it was identical with the arsenic sold by Tyler, at the time when Hayden is known to have bought his ounce. The conclusion sought to be established is that a part of the arsenic bought by Hayden was used to poison the girl, and that the rest was flung away, and that the barn arsenic was bought elsewhere afterward merely as a blind. The crystals of the stomach arsenic are three or four times as large as those of the barn arsenic, but none of them are large enough to be visible without the microscope. Hereafter criminals will do well to recognize in science one of the agents of possible detection.

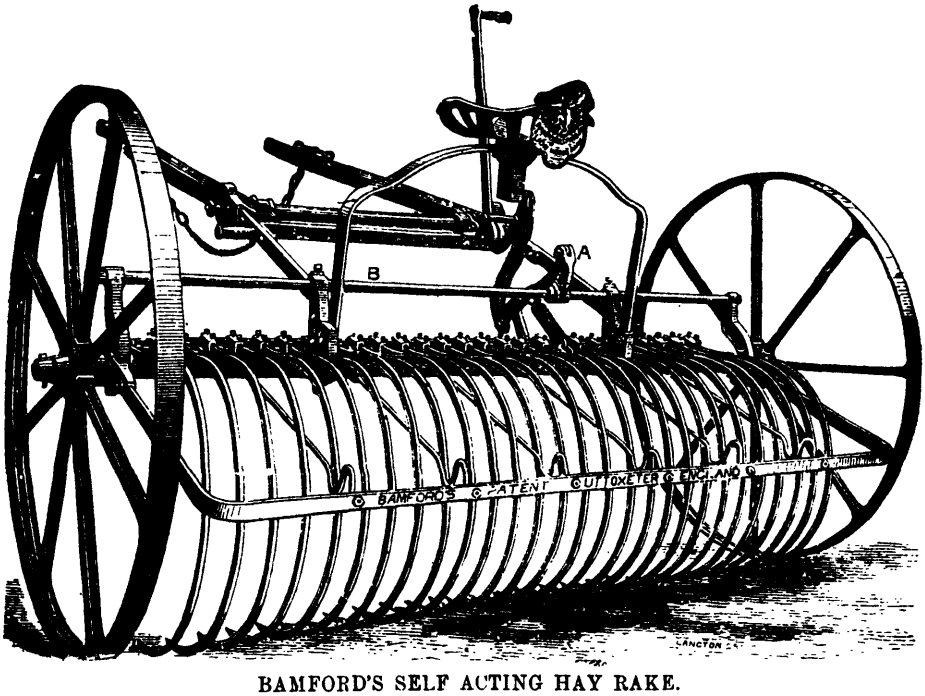
THE POISON OF THE RATTLESNAKE A FERMENT.—Hitherto the general belief has been that the poisonous matter secreted by certain species of reptiles was nothing more than a poisonous saliva, acting in the manner of ferments. M. Lacerdo has been making at Rio de Janeiro, some researches into the action of the venom of the rattlesnake, which throws much new light on the subject. His investigation shows that the saliva contains what are called figured ferments, the analogy of which with bacterides is very remarkable. From a young and vigorous *crotalus*, subjected to the action of chloroform, he obtained a drop of the venom on a chemically clean piece of glass, and at once placed it under a microscope. Almost immediately he observed the formation of a filamentous pulp in an arborescent disposition. Gradually the thickened filament, after having pushed out spores, dissolved and disappeared, and the liberated spores swelled and enlarged visibly, each of them sending out a minute tube which lengthened rapidly. After a very short period the latter separated from the first spore, and constituted another nucleus for engendering the deadly contamination. In the examination of the blood of animals killed by the bite of one of these snakes, M. Lacerdo noticed that the red globules of the blood commenced to changed by presenting some small, brilliant points on the surface, which spread with great rapidity, and ultimately the globules melted one into the other, forming a sort of amorous paste which could no longer circulate in the veins. Other animals in which that blood was injected immediately after the death of the first, expired in a few hours, presenting all the symptoms of having themselves been bitten, and their blood always showed the same alteration. M. Lacerdo concludes his memoir by stating that numerous experiments have shown that the true antidote for serpent poisoning is the injection of alcohol under the skin, or its administration through the mouth.

MIRROR PHOTOGRAPHS.—The *Deutsch Allgemeine Zeitung* makes the incredible statement that a german, named Karl Steinbach, has made an important discovery in photographv. After years of study and experiment, he has succeeded in obtaining a chemical composition, by means of which a mirror image may be fixed and sold as a photograph. With this composition the mirror surface is painted, and the back part of the mirror receives also a coating of oil. The mirror thus prepared is held before the person who is to be photographed. The oil coating evaporates, and the likeness of the person remains in natural colors on the light surface. The image, so fixed, is brought into a bath, and is exposed half an hour to the sunlight, before delivery. A nice capitalist in Peru, it is said, has acquired this invention for $400,000, and large establishments are to be formed in North and South America for carrying it out.

BORAX AND NITRATE OF POLASH FOR HOARSENESS.—These two salts have been employed with advantage in cases of hoarseness and aphonia occurring suddenly from the action of cold. The remedy is recommended to signers and orators whose voices suddenly become lost, but which by these means can be recovered almost instantly. A little piece of borax, the size of a pea, is to be dissolved in the mouth ten minutes before singing or speaking ; the remedy provokes an abundant secretion of saliva, which moistens the mouth and throat. This local action of the borax should be aided by an equal dose of nitrate of potassium, taken in warm solution before going to bed.—*La France Medicale.*



THE PROGRESS HAYMAKER.



BAMFORD'S SELF ACTING HAY RAKE.

English Agricultural Implements.

BAMFORD'S PATENT "PROGRESS" DOUBLE-ACTION HAYMAKER.

This illustration shows a new machine possessing special advantages in tedding or turning unusually heavy crops of grass. As will be seen, this haymaker is provided with a new shaped open screen which does not confine, but permits the grass to be freely circulated in the air during the process of tedding, and without loading on the axles in windy weather. It has a simple arrangement for regulating the height of forks by a spring knob placed on the front of the machine, and a new system of gearing so contrived that every bearing can be got at and instantly lubricated by an ordinary oil can. The gearing is all machine cut, thus securing the greatest ease in work and lightness of draught, while the action is placed well behind the machine, thus balancing the shafts. The machine is fitted with double lap C springs, and the main axle is solid steel. The road wheels are 4ft. high, combining strength with lightness, and they are of wrought iron. With this machine clogging is impossible. We also give an illustration of Bamford's new Patent "LION" ANGLO-AMERICAN SELF-ACTING HORSE RAKE. This rake is made as a manual rake, or combined self-acting and manual delivery. These horse rakes combine important improvements in construction with arrangements for easy adjustment. The teeth are of rolled spring steel of H section, having great capacity and strength to ensure clean raking. The axle is solid round iron, with turned ends working in chilled bushes, and the wheels are constructed on a new system, with channel iron spokes. Running parallel with the main axle is a solid round bar which is coupled to the draw bars and the seat bow, thus forming a rigid framework of immense strength, and will bear not only the weight of the driver without deflecting the axle, but also effectually resists any strain to which the rake may be subjected when working on rough ground. The leverage which is placed on the right hand of the driver is extremely light, may be easily worked

by a boy, and is adapted for either hand or foot. A new yet simple self-locking motion is introduced, which perfectly locks the teeth when raking, and admits of their free action over uneven ground. An ingenious arrangement adjusts the pitch of the teeth, and, if necessary, enables the rake to be regulated to suit horses of different heights. Both of these machines are manufactured by Messrs. H. Bamford & Sons, Leighton Iron Works, Uttoxeter, England.—*Birminghum Hardware Circular.*

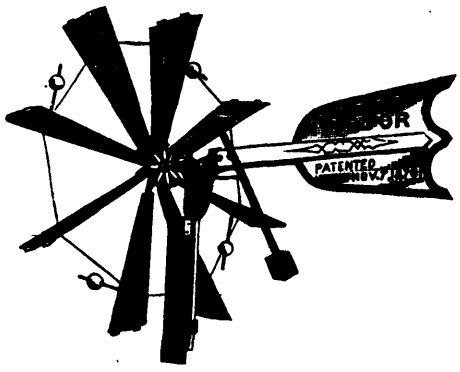


FIG. 2.—REAR VIEW OF WIND MILL.

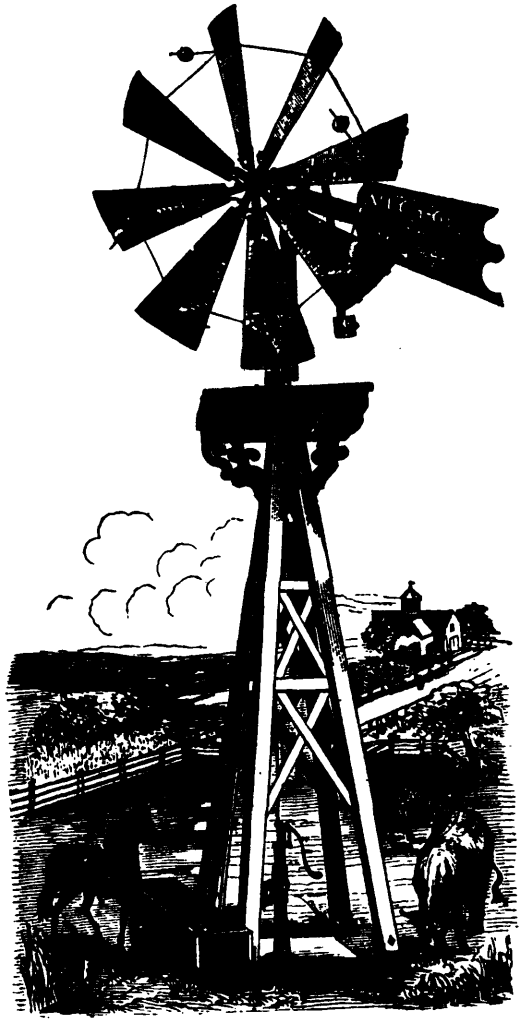


FIG. 1.—THE VICTOR WIND MILL.

NEW WIND MILL.

The annexed engravings represent a wind mill patented by Mr. C. B. Post, and made by C. B. Post & Co., of New London, Ohio. The design of the inventor has been to produce a mill that will maintain a regular speed under a varying wind pressure and to prevent damage to the mill during high winds. The wheel is composed of iron sails mounted upon iron arms, upon which they are capable of turning, and the motion of the mill is controlled by the weighted arms attached to the sails, which, by centrifugal action, turn the sails more or less toward the wind. The inventor claims that the same sail area, when presented to the wind in large surfaces, is much more effective than it is when it is divided up among small ones.

The weighted lever hung near the tail vane is connected with a sleeve that operates the sails and holds the sails to the wind until the centrifugal force of the weighted arms, projecting from the face of the sails, is sufficient to overcome the action of the lever, when the sails will be automatically adjusted to the proper angle in relation to the wind to maintain a uniform speed. By changing the adjustment of the weights the speed may be varied to suit different purposes.

The manufacturers inform us that the running parts of this mill are large and well proportioned. The crank for imparting motion to a pump is formed by bending the shaft, and it works in a slot in the pump rod. The mill swivels on a gas pipe standard, and turns easily, allowing the wheel to stand squarely to the wind. The mill is thrown out of action by means of a wire attached to the weighted lever, and it may easily be arranged so that a float in a water tank will stop the mill when the tank is full.

This mill is certainly very simple and easily made, and appears to be well designed.

THE CELLULOID MARVEL.—A capital example of these numerous industrial revolutions of which we have spoken, and which are peculiarly characteristic of America, is furnished by the new article celluloid. Although it was invented nine or ten years ago (by two brothers named Hyatt), its perfect manufacture has been regularly in practice for only about five years, and is considered to be still in its infancy ; yet immense quantities of the substance are produced ; it is converted into a wonderful variety of forms, and new modes of applying it are discovered almost daily. This composition of tissue paper, camphor, and certain chemicals is already used for billiard balls, combs, backs of brushes, hand mirrors and other toilet articles, whip, cane and umbrella handles, every kind of harness trimmings, foot rules, chessmen, handles of knives and forks, pencil cases, jewelry of all kinds, pocket-books, mouth-pieces for pipes, cigar-holders, musical instruments, doll heads, porcelain imitations, hat bands, neckties, optical goods, shoe tips and insoles, thimbles, emery wheels, shirt cuffs, collars, etc. Its use as a substitute for ivory has already exercised a world-wide effect upon the ivory industry, the falling off in the demand having been felt in the remotest regions of Africa. It has lately been introduced as a substitute for linen or paper in the making of shirt cuffs, collars, etc. It has the appearance of well-starched linen, is sufficiently light and flexible, does not wrinkle, is not affected by perspiration, and can be worn for months without injury. It becomes soiled *much less readily than linen, and when dirty is quickly cleaned* by the application of a little soap and water with a sponge or rag.

FUSING METALS WITHOUT FIRE.—A remarkable discovery has been made by Jacob Reese, of Pittsburg, Pa. He says he is able to melt instantly a bar of cast-steel one inch in diameter—which cannot be fused in less than five minutes in the highest furnace heat attainable—simply by throwing against it a column of air having a velocity of 25,000 feet a minute. The instant the air touches the metal fusion takes place. He says further : "By furnace heat it requires many hours, and sometimes many days, to anneal metals. By a recent discovery which I have made, I can anneal bars of iron or steel at the rate of one foot per second, thus increasing the ductility of the metal 100%, without the use of other fuel than that contained in the metal itself. I simply unlock the occluded (latent) heat. It becomes sensible and enlarges the metal, and by the method of doing this the enlargement is made permanent, that is, it does not contract to its original limit.

NEW METALS.—Eleven new metals have been discovered within the last two years which have received the following names : Davium, morsandrium, phillipium, ytterbium, decipium, neptunium, lavæsium, norwegium, uralium, scandium and thaumasitic.

CARE IN EMPTYING STEAM BOILERS.

In regard to emptying and blowing-off steam boilers, a French comtemporary gives the following useful hints: "Those who possess externally fired boilers, working only by day, have all observed that the fire being covered by night, and the doors closed, the pressure rises during the night, often sufficient to open the valves. This shows that the masonry, being at a much higher temperature than the boiler which it envelops, imparts to it some of its heat. The same effect of heating the boilers is produced, to a less degree it is true, but nevertheless to some extent on the outer jacket of internally fired boilers. It is, consequently, injurious to empty boilers soon after having stopped them, because after emptying, the plates would be heated by the action of the masonry. It is well to admit a current of air through the flues some hours after the stoppage of the generator, and not to empty it before the flues become cooled to a temperature below 300°. When the flues are not too hot, no serious inconvenience is experienced in emptying the boiler undsr pressure. We do not say at high pressure, as for a boiler the pressure of which would be 10 pounds, the temperature of the water being 304°, a greater quantity of steam would be generated during the process of emptying; we think at a pressure of 2 pounds the boiler could very well be emptied. In internally fired boilers, as there is no masonry to cool in the furnace tubes, it would be well to admit the current of air intended to cool the masonry behind the boiler, as in this case the furnaces would be cooled more rapidly than the jacket. We have sometimes seen owners empty their boilers almost immediately after the fires have been extinguished, clean them with cold water as soon as they were empty, and keep up a current of water so that the workmen might work there. Boilers of small dimensions sometimes resist such treatment, but in large boilers it will be seen that unequal contractions must take place, causing the rivets to burst."

AN INCREDIBLE INVENTION.

The *American Manufacturer* reports the invention of a gas machine, for which so much is claimed as to make it incredibly wonderful. It is said to have been patented by J. T. Guthrie, of Leesburg, Ohio, to utilize the gas from bituminous coal otherwise lost with the smoke through the flues and chimneys. The machine is said to be very simple, and can be attached to a common cooking or heating stove. The advantages claimed for it are, that any person can handle it easily, the same fuel used to cook the breakfast producing an abundance of pure gas, sufficient to illuminate the house during the night, without any expense whatever. Mr. Guthrie also claims the right of attaching it to furnaces, grates, and any and all places where coal is used for fuel and heating purposes. It is said that he proposed to the Commissioners of the Cincinnati Exposition to light the entire exposition building with as good and pure a quality of gas as can be produced in the city gas works, and this by using the same fuel that heats the boilers of their power engine, without the cost of one cent for the fuel. It is also said that this invention is in successful operation in Leesburg, that the inventor is visited daily by hundreds of people to see the wonderful machine, and that all, so far, bear testimony to its wonderful merits and general utility. The inventor claims that good, pure gas can be produced by the machine at a cost not to exceed 20 cents per 1,000 cubic feet, and earnestly invites practical men from all parts of the country to come, see, and examine the working of his invention.

IMPROVEMENT IN LAMPS FOR STREETS.

A new system of improved street lighting by gas has been tested at Bristol, England. "The present burner is retained, but the light is divided into two jets, between which and placed in each street lamp is suspended a double convex lens, forming a powerful reflector, and the result is found to be an increase of lighting power to the extent of 50 per cent. Ordinary batwing burners are used, and the only care required to insure a perfect light is a nice adjustment of the suspended lens, so as to get the right focus and a full reflection of the light. When this is secured the jets, even at a distance, are very brilliant, and have the appearance of globes of light." It is said that they illuminate the foot-paths between the lights with much of the effectiveness of the electrical light, while the amount of gas consumed is no more than by the present system. Bristol is to put the system into general use.

In one sense it is true that the two burners do not take more gas than the one which they replace; but it must be remembered that two small burners do not give as much light as one larger one would burning the same amount of gas. The more economical method of applying this invention, and one which would not require alteration of the burners, would be to use two lenses, hanging one on each side of the burner. The best lens for this purpose would be such as are used in street cars for concentrating the rays of light used. The statement that the double convex lens is a powerful reflector is only partially true, we think. Although we have often silvered one side of convex lenses and used them for the purpose of concave mirrors, we do not find them even then very powerful as reflectors, and do not think, unless the lens used is of a very large size, that its reflecting powers would be found to be a very valuable means of increasing the brilliancy of the burner in the street. The theory of the increase of light is that the lens concentrates a great deal of light that would otherwise be sent upward or wasted upon the houses, and directs it along the streets, where it is most wanted.

A REMARKABLE RAILROAD.

The Mount Washington railroad is a marvel of engineering. It is three miles in length, and rises 8,625 feet, or one foot in four. The principal feature of the railroad is the cog-rail in the centre of the track. On each driving-shaft of the engine is a cog-wheel. The teeth catch the cogs in the centre rail, propelling the car up the mountain. The boilers of the engine are inclined downward, and when on a steep grade are quite horizontal. Every locomotive takes one car, and is provided with a double set of driving-wheels, that any danger from breakage of machinery is prevented. The ascent requires one hour and a half, and one could step off and on at any point. The track is strongly built, and is daily inspected by the men continually employed to police it. In ascending, persons in the forward car have their feet on a level with the heads of those who sit aft near the engine, which, going up, is the propelling power, and going down, the repelling force.

The steepest point is Jacob's ladder, a trestle 30 feet high and 300 feet long, the grade 1,604 feet to the mile, or thirteen and one-half inches to the yard.

DUCTILE ZINC.—In order to remove from plates and other forms of zinc its natural rigidity and consequent frangibility, which render it difficult to work and greatly limits the range of its use, Mr. James Eade, of Waltham New Town, proposes to subject it to special treatment. Supposing sheet zinc is the material to be treated he prepares a bath of linseed oil, and into it he plunges the zinc plates, subjecting the same to the action of oil while in a state of ebullition for 30 minutes, more or less, according to the thickness of the metal; he then removes the plates from the bath, and after the oil is drained therefrom he cleans their surfaces, when they will be ready for the market. Plates treated after this manner will be found to possess great ductibility, and to be capable of receiving and retaining a high polish; they may be employed in lieu of lead or pewter at a great reduction of cost for a variety of purposes, as, for example, the linings of sinks and cisterns, and the covering of counter and other surfaces requiring a protective metallic covering. It is proposed to treat other articles than plates in a similar manner to that above described to facilitate the working of the same into various forms.

A "TEA 'BUS."—An American is about to carry out the railway dining-car system in a novel direction. He has designed, especially for the use of Londoners, a "tea bus." In this vehicle there will be every accommodation for "five o'clock tea." It is expected that the 'bus will be a great favourite with ladies, who will take advantage of it not merely for shopping purposes, but also as a pleasant way of spending the afternoon and having agreeable chats with each other over their teacups. A narrow table runs along the middle of the vehicle, and behind the seats there will be room for the conductor to wait on the tea-drinkers. Water will be boiled in a little apparatus beneath the seat of the driver, the tap being inside the 'bus, so that kettles may be filled without difficulty. The ties of the wheels are to be india-rubber to prevent unpleasant jolting, and the springs of the carriage will be adjusted on an entirely new and improved principle, ensuring the complete ease and comfort of its occupants. With a plentiful supply of biscuits and bread-and-butter the scheme may prove a success, but the 'bus will have to be driven with extreme care, for the horrors of a collision in the street will be greatly enhanced by broken crockery and boiling water.—*Pall Mall Gazette.*

Miscellaneous.

HEATING AND VENTILATING RAIL CARS.—The Pennsylvania Railroad is experimenting with a new system of heating and ventilating cars, invented and perfected by its mechanical engineers at Altoona. The system used to accomplish the desired end is by means of heated water passing through pipes. In the baggage car of the train is located a portable engine, in which hard coal is used, thus avoiding both dust and smoke. Two pipes are on one side of the boiler, above the lowest gauge-cock, running through the car floor. To one of these pipes is attached a 1¼in. steam hose pipe, passing down to the rear car and going around it and returning back to a pipe on the other side. Into this is pumped the hot water, passing through and back again into the boiler, so that the same stream of water is constantly used. Near the door of each car is attached an elbow, going up into the car, along the box at the side, and then under the seats, forming a loop, at the end of which is a register, and over it a galvanised-iron cover, thus preventing the heat from rising directly underneath. Beneath each seat are four boxes which catch the cold air, and this passing up into the car over the water pipes, diffuses the hot air, casting it to the top, where it goes out at the ventilator, and keeps a constant stream of pure air passing through the car. In case of separation or breakage the supply can be checked and another connection effected. The apparatus banishes dust, and in addition to thoroughly heating and ventilating the cars, gives room for eight more passengers in each car.

Jupiter at present shines with astonishing brilliancy; yet its light is not peculiar to itself, it is reflected. That colossal planet is 309 times heavier than our earth, and 1,230 times its superior in volume. Were it surrounded by a vast ocean, a steamship sailing at the rate of 14 knots an hour night and day, while able to make the tour of our globe in three months, would take nearly three years to circumnavigate Jupiter. And yet the leaf of a tree can obscure him from our vision; a fly alighting on the glass of a telescope, seems to swallow him. After Venus, Jupiter is the most brilliant of all the planets; his diameter is eleven times greater than the earth's, and his surface equal to 114 of our globe's. And yet the diameter of Jupiter is ten times less than that of the sun's! The materials of which Jupiter is compared are lighter than those of our earth's, but attraction being greater, they weigh more heavily. It takes Jupiter nearly 11 years and 11 months to revolve round the sun, yet it diurnal rotation is effected in ten hours—five hours day and five night. There are no seasons in Jupiter, all is an eternal spring, and four moons marry their light to illuminate him. If inhabitated, it must be by extra-terrestrial beings.

RENEWING THE EYE.—From recent experiments made by Mr. Philipeaux, a French oculist, it appears that the optic organ has the same capabilities of reconstruction as the bones. M. Philipeaux undertook to discover whether on completely emptying the eyes of young rabbits and guinea-pigs.the vitreous humour would be reorganized and whether even the crystalline would be reproducted. With this view he conducted his operations, always, of course, taking care not to touch the crystalline capsule, for experience has shown that in order for an organ to regenerate, a part of it must be left in its place. It seems that a month after the mutilation was made, M. Philipeaux was able to see that the eyes which had been emptied, were filled afresh, and that the crystaline was reconstituted. He operated on 24 animals, and in every cases the mutilated eye revived. How far similar results would be obtainable with the human eye does not appear. If the same regenerating power is found to be in general, a decided improvement may be possible in the treatment of certain injuries and diseases of the eye.

ANIMAL RUBBER.—An insect which produces a species of india rubber has been recently discovered in the district of Yucatan, Central America, by an American explorer. It is called Neen, and belongs to the Coccus family; feeds on the mango tree, and swarms in these regions. It is of considerable size, yellowish brown in color, and emits a peculiar oily odor. The body of the insect contains a large proportion of grease, which is highly prized by the natives for applying to the skin on account of its medicinal properties. When exposed to great heat the lighter oils of the grease volatilize, leaving a tough wax behind which resembles shellac, and may be used for making varnish or lacquer. When burnt this wax produces a thick semi-fluid mass, like a solution of india rubber, and it is expected that this glutinous liquid will be very valuable for cementing and waterproofing.

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

A RACE WITH THUMBS ON THEIR FEET.—Mr. Tremlett, the British Consul at Saigon, in his report this year, mentions as a remarkable peculiarity of the natives of the country that they have the great toe of each foot separated from the others, like the thumb of the hand, and it can be used in much the same manner, though not to the same extent. This distinctive mark of an Annamite is not, however, usually seen in the vicinity of Saigon, but is now confined to the inhabitants of the more northern section of the empire, where the race has remained more distinct. This peculiarity is the meaning of the native name for the Annamite race; and that the name and peculiarity are of great antiquity is shown by the mention in Chinese annals 2,300 B. C. as that (or those) of one of the "four barbarian" tribes that then formed the boundaries of the Chinese Empire.

"BUSINESS EMBARRASSMENT!—You call it embarrassment, do you!" said old Cashinhand, banging his fist down upon a newspaper with a column headed with that title. "You call it business embarrassment, for these young Dashrounds to rush into business with ten thousand dollars borrowed capital apiece, and come out of it in five years with both their wives owning twenty thousand dollars houses, solitaire diamonds and good wardrobes, and themselves and families living at the sea-shore while their creditors are getting twenty cents on the dollar! I tell you, sir, in my time that sort of embarrassment would have put them behind the jail bars, and it would be a confounded sight better for the business community if it did now—for at least it would prevent some of you aiders and abettors in this kind of embarrassment giving any more credit to these embarrassed pretenders." —*Com. Bulletin.*

DOMESTICATION AND BRAIN GROWTH.—At the recent meeting of the British Association, Dr. Crichton Browne gave an address on the influence of domestication on brain growth. He had found by experiments that domestication had greatly reduced the brains of the duck, and he argued that men, like ducks, might be fed and housed, fenced about, and exempted from participation in the life struggle, until, like the ducks, they would depreciate in mental capacity. Their bodies might increase in size and succulence, but their brains would become straightened and withered. Disease and luxury crippled the brains. It was as true as ever that men were perfected through suffering, toil, and conflict, and it was not through affluence and comfort that genuine civilization was attained. It was the civilization, not merely the domestication, of mankind that must be aimed at.

THE HYDROMOTOR.—The *Scientific American* gives an illustrated description of a novel form of motor, invented by Dr. Fleischer, of Kiel (Germany), and applied by him to ship propulsion. The principle of the motor is the reactive water jet, a device not new in itself, but which, our authority asserts, this inventor has materially improved. The engraving shows a vessel propelled by two water-jets, without the aid of paddle-wheels, propeller, engines, or rudder. The discharge-nozzles are swiveled so that they may be directed this way or that, and so control the direction of the vessel. The motor, as applied to the *Pellworm* (a vessel 75 feet long, 12 feet beam, flam-bottomed and drawing 3½ feet of water), propels her at the rate of six knots her hour, and develops 25 horse-power, or about 40 per cent of the power of the steam used.

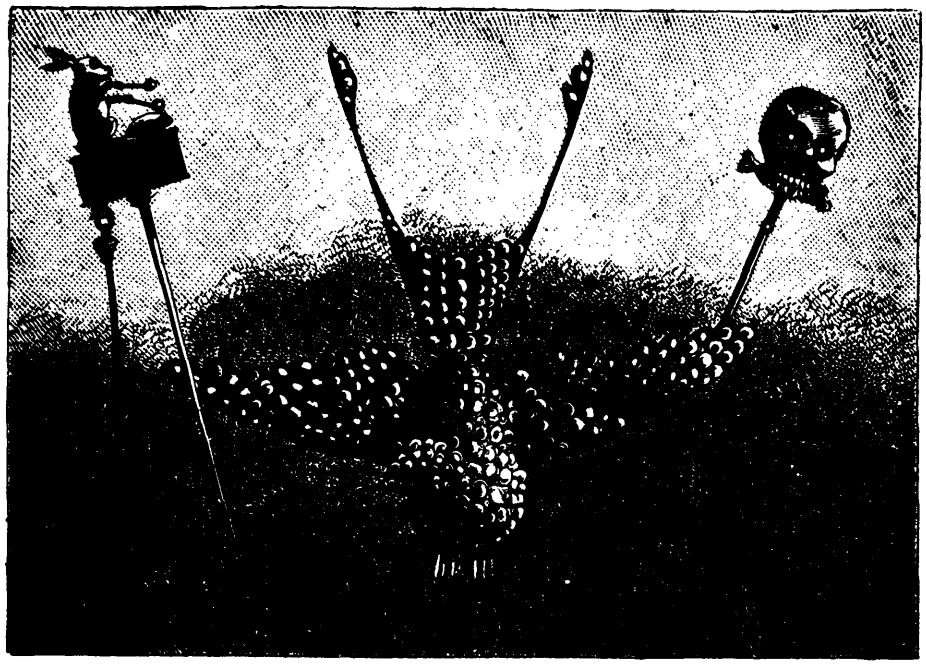


FIG. 1.—FRENCH ELECTRIC JEWELRY.

FIG. 2.

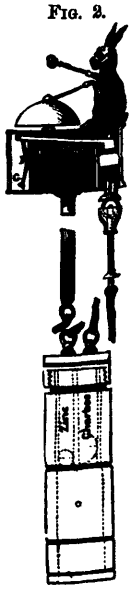


FIG. 2.—THE SCARF PIN.

ELECTRIC JEWELRY.

Among the specialties for which the French are noted there is nothing more curious than the electric jewelry, several specimens of which are shown in the accompanying cuts, which we take from *La Nature*.

The scarf pin represented in the left-hand figure consists of a small golden rabbit holding a liliputian mallet in each paw, with which it beats a roll on a small golden gong. The right-hand figure represents a golden skull, with movable diamond eyes and an articulated jaw. This is also a scarf pin, and its eyes and jaw are made to move in a singular manner. The bird shown in the center of the engraving is an ornament for the head dress. It is of gold, thickly studded with diamonds.

These pieces are connected by a fine concealed wire with a small battery carried in the vest pocket. When the battery is made to operate, the rabbit will strike the gong, the bird will move its wings, and the skull will roll its eyes and gnash its teeth.

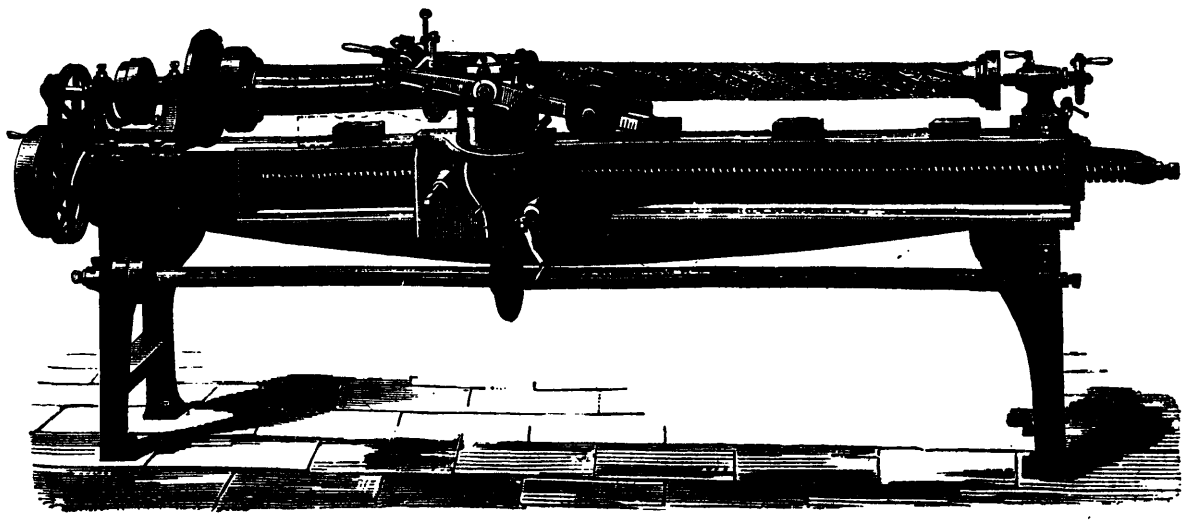
The battery consists of a zinc and carbon couple contained in a hermetically closed vulcanite case, the zinc and carbon occupying the upper half of and the exciting fluid the lower half of the case. When the case is in a vertical position the exciting fluid does not touch the zinc or carbon, but when it is inverted or placed horizontally, the fluid comes into contact with the zinc and carbon, and the current traverses the coils of the diminutive magnets, which operate the mechanism of the pieces. The arrangement of the internal parts of both battery and scarf pin will be understood by reference to Fig. 2. The mechanism is much like that of an ordinary vibratory electrical bell.

ARTIFICIAL PRECIOUS STONES.—Two French chemists, MM. E. Fremy and Feil, have discovered a method of making, in large quantities, precious stones which rank in value next to diamonds. Such an announcement would naturally have the effect of exciting dealers in precious stones, since this method must enable a large quantity to be thrown upon the market; and as their value depends, not upon intrinsic worth, but upon the law of supply and demand, it must necessarily decrease the value of this class of goods.

Be this as it may, the experiment has been tried with success, and of it is a matter of interest to our scientific inventors, we give the method by which they are produced. The principle is based upon that of separating the argillaceous clay slowly from its usual combination with silicic acid as it is found in nature everywhere, by bringing to bear upon it a substance of stronger affinity for the acid. By this means small crystals of argillaceous earth are formed in the fiery liquid. and which, in the course of further separation, grow slowly. Quantities of this fiery "mother liquor," as it is called, weighing from 30 to 50 pounds. were kept in a fiery liquid state in M. Feil's glass factories for two or three weeks, and the experimenters were therefore enabled to test the matter thoroughly and conclusively. Oxid of lead was used to separate the argillaceous earth from the silicic acid, and to accomplish this a mixture of equal parts of pure porcelain clay and red lead was made and placed in a fire-proof clay crucible, and exposed for weeks to an intense heat. It was then taken out and allowed to cool. When the crucible was destroyed, they found two strata above a glassy one; the glassy structure contained the most beautiful clusters of round crystals, which were found hard enough to cut rock crystal, or even the very hardest topaz.

VEGETABLE IVORY PLANT.—The *Colonies and India* furnish some interesting particulars respecting the so-called "vegetable ivory" which is now so much used as a substitute for ivory. The vegetable ivory used is the produce of a species of palm found wild in South America and Africa. Inside the hard shell is the white kernel, which, being softer than ivory and easily carved, as well of readily dyed, and being less brittle than bone, is largely used in making buttons, etc. The unripe fruit consists of a green sheel, containing a watery fluid, which, as the nut ripens, gradually thickens, until it becomes a pulpy mass and eventually hardens into solid matter. The water, though bitter to the taste, is wholesome, and often render invaluable service to travelers who cannot otherwise obtain water to drink. The trees on which the fruit grows is unlike an ordinary palm, having little or no stem, and drooping downwards, especially when the branches are over-weighted with the six or seven bunches of nuts, each contoining siz or seven seed, enclosed in thick, heavy shells and outer sheath, and weighing altogether from 20 to 24 pounds.

ORNAMENTING GLASS.—A recent French invention for decorating glass objects so as to produce metallized effects consists in substituting a reducing gas or vapor, such as hydrogen or common coal-gas, for the air by which it is now blown into moulds or shaped by hand. By this artifice, the salts of the metallic oxides which have been added to the glass in the course of its manufacture, are reduced, and metallized effects more or less varied and intense are produced, according to the composition of the glass. It is apparent that the process is applicable to a wide range of glass manufacture. One of the most beautiful of these effects is produced by inclosing a thin layer of gold-leaf between two layers of glass, and subsequently expanding the glass so as to break up the gold into infinitesimal fragments, which, remaining disseminated throughout its mass, produce a most brilliant spangled effect—like that presented by the mineral substance known as *aventurine*.



ARBEY'S CARVING ATTACHMENT FOR LATHES.

CARVING ATTACHMENT FOR LATHES.

The carving attachment shown in the engraving is from the shops of M. Arbey, of Paris, France. It is intended to be affixed to common lathes for the purpose of grooving, channeling, and ornamenting columns, balusters, table legs, and similar articles of irregular shape. The carving attachment is placed on a travelling carriage, and supported on an adjustable cylindrical standard, to which the balanced arms of the cutter shaft are pivoted, the latter being revolved by a pulley and belt connection with a travelling pulley of the cutter actuating shaft. The cutter shaft is movable on its bearings by a level handle, while the pulley is retained by a clutch connection with a fixed brace of the weighted arms, and it is raised or lowered by means of a curved arm and guide roller passing along the pattern of the form. When a table leg or other object is held in position of rest in the lathe, the cutting tool passes longitudinally along the same, and works out in it a groove or channel. The dividing disk being turned for the distance of one subdivision after each channel is completed, the next channel is then produced by the return motion of the carriage. By turning the object slowly in the lathe, simultaneously with the revolving and traversing motion of the cutter, helicoidal channels or grooves are formed. For grooving conical parts, the cutter shaft is guided along an inclined guide pattern, or its axis is placed at an angle to the longitudinal axis of the lathe. The cutter adjusts itself to the shape of the object, and carves, by its uniform forward motion, an ornamental groove of equal depth throughout the entire length. For the purpose of pearling or doing other ornamental carving, the cutting tool is guided to the work by a handle, while the object is turned in the regular manner by the dividing disk, so that the pearls may be formed at uniform distances.

The adjustability of the cylindrical standard, in connection with the balanced cutter shaft and handles, admits of the convenient and accurate handling of the carving attachment, so that a large variety of ornamental work may be accomplished on this machine quickly and economically.

A Substitute for Porcelain Capsules.—A German chemist states that ordinary crockery vessels may for most purposes be used instead of the expensive porcelain capsules of the laboratory. The glaze on some of the former is superior to that on most of the ordinary porcelain vessels, and while they cannot be used for operations requiring the applicaton of direct heat, they will answer well for making certain ferric, and other compounds which readily stain or attack the porcelain laboratory ware commonly found. Moreover, the crockery ware can always readily be obtained, while the porcelain ware is not obtainable in suitable sizes.

PATENT AUTOMATIC SELF-SUSTAINING LIFT.

An excellent contrivance for use in hotels, warehouses, &c., to which was awarded a silver medal. The wood-cut shows the principle of the invention as applied to a sack lift or hoist. The advantages of this self-sustaining patent lift are obvious, as the raising and lowering of the cage or weight are effected entirely by the endless rope, while the danger of the cage or weight running wild, a very frequent occurrence in lifts at present in use, is completely overcome. This feature renders it invaluable, as its working will allay the constant dread of accidents where lifts are necessary. It is impossible to over-estimate the value of the Automatic Lift, as its principle can be applied to every operation where the lowering of great weights is required to be under the absolute control of the machine itself, and not of the operator. These lifts are strong and well made, and applicable to a variety of purposes for saving time and labour. Messrs. Thos. Thomas & Sons, of Merthyr Tydfil and Cardiff, Wales, England, are the manufacturers.

Medicinal Effects of Onions.—A mother writes to an *English agricultural journal* as follows: "Twice a week—and it was generally when we had cold meat minced—I gave the children a dinner which was hailed with delight and looked forward to. This was a dish of boiled onions. The little ones knew not that they were taking the best medicine for expelling what most children suffer from—worms. Mine were kept free by this remedy alone. It was a medical man who taught me to eat boiled onions as a specific for cold in the chest. He did not know at the time, till I told him, that they were good for anything else." The editor of the journal adds: "A case is now under our own observation in which a rheumatic patient, an extreme sufferer, finds great relief from eating onions freely, either cooked or raw." Dr. G. W. Balfour, in the Edinburgh *Medical Journal*, records three cases in which much benefit was afforded patients by the eating of raw onions in large quantities. They acted as a diuretic in each instance.

Sanitas.—Russian turpentine and water are placed in huge earthenware jars, surrounded by hot water. Air is driven through the mixture in the jars continually for three hundred hours, the result being a decomposition of the turpentine, and the formation of a watery solution of the substance, to which Dr. Kingsett, the discoverer, has given the name of "Sanitas." After evaporation, the substance, as sold in tin cans, is a light brown powder, of a pleasant taste and odor, and capable in a very remarkable degree of preventing or arresting putrefactive changes. This new disinfectant has been in use for some time in England, and is highly spoken of. It is said to have a pleasant odor, is not poisonous, and does not injure clothing, furniture, etc. For household uses it would seem to be well adapted.

COMPARATIVE MORTALITY OF RICH AND POOR.

Dr. Drysdale, Senior Physician to the Metropolitan Free Hospital, called attention in the Social Science Convention, recently in session at Manchester, England, to the comparative mortality of rich and poor. How came it, he asked, that in Great Britain, in the face of improvements in every direction in the domain of hygiene, there still remains a death-rate in our cities ranging from 30 down to 20 per 1,000 of the population annually? If we look to one city, London, for instance, we find that, with all the advances recently made in that wonderfully healthy city, the death-rate was actually 22.2 per 1,000 in 1856, and in 1876 a little higher, or 22.3. Many persons have asked, on reading such figures, "What is the use of medical science if it can effect nothing more than this?" The real cause of the non-effect of the countless hygienic advances was indigence. Villerme, the French medical writer on hygiene, found some 30 years ago, that persons over 40, if in easy circumstances, had a death-rate of only 8.5 per 1,000, whilst the mortality in a similar class among the poor was more than double, or 18.7. He also showed that in Paris, there died, between the years 1817 and 1836, 1 inhabitant in 13 in the 13th arrondissement, chiefly inhabited by the poor, and but 1 in 63 in the second or rich quarter.

The most accurate statistics ever compiled on this subject are from the pen of C. Ansell, Jr., entitled "Statistics of Families of the Upper and Professional Classes," published in 1874. The author collected information concerning 48,044 children of the well-to-do classes in England and Wales, including members of the legal, clerical and medical professions, as well as that of the nobility and gentry. He found, from these inquiries, that in the first year of life, only 80.45 per 1,000 deaths occurred among the infants of the easy classes in this country, as against 149.49 among the children of the general population. The death-rate then, of the children of the comfortable classes being 80 per 1,000 in their first year, we found it to be 240 per 1,000 in cities like Manchester and Liverpool, and as high as 300 in the poorer quarters of our cities, and in Berlin actually 500. From one to five years of age, 46.84 children of the upper classes die of 1,000 born, and as many as 113.69 in the general population. During the remainder of early youth from 5 to 20, the difference is not marked; but 65.47 per 1,000 deaths occur among the richer classes, as against 74.04 in the general public. Between 20 and 40 there die among the richer classes, 125 per 1,000, and 124 among the general population; and between 40 and 60 there die 147 per 1,000 among the rich, against 168 among the general population. The general result of this calculation shows that the average age at death is, among the rich in England and Wales, 55 years, whilst it is not probably 35 among the artisan class; so that Mr. Ansell estimates that in one year there die in England and Wales, under the age of 60, 368,179 per ons, which figure should only have been 216,048, if the population had all been in easy circumstances. Thus some 142,000 deaths annually in England and Wales are due to indigence. Health is very imperfectly secured in the lower grades even of respectable citizenship. The public registers have demonstrated that mortality and diseases diminish with every rise in the scale of wealth.

INSECT STINGS.—The pain caused by the sting of a plant or insect is the result of a certain amount of acid poison injected into the blood. The first thing to be done is to press the tube of a small key from side to side, to facillitate the expulsion of the sting and its accompanying poison. The sting, if left in the wound, should be carefully extracted, otherwise it will greatly increase the local irritation. The poison of stings being acid, common sense points to the alkalies as the proper means of cure. Among the most easily procured remedies may be mentioned soft soap, liquor of ammonia (spirits of hartshorn), smelling salts, washing soda, quicklime made into a paste with water, the juice of an onion, tobacco juice, chewed tobacco, bruised dock leaves, tomato juice, wood ashes, tobacco ashes, and carbonate of soda. If the sting be severe, rest and coolness should be added to the other remedies, more especially in the case of nervous subjects. Nothing is so apt to make the poison active as heat, and nothing favors its activity less than cold. Let the body be kept cool and at rest and the activity of the poison will be reduced to a minimum. Any active exertion whereby the circulation is quickened will increase both pain and swelling. If the swelling be severe, the part may be rubbed with sweet oil or a drop or two of laudanum. Stings in the eye, ear, mouth or throat sometimes lead to serious consequences. In such cases medical advice should always be sought as soon as possible.

IMPROVEMENT IN SHIPS.—A nautical invention has recently been brought out in France. The invention consists in forming the upper portion of the bulwarks of ships, of loose sections, composed chiefly of hollow, thin metallic tubes, divided into compartments by diaphragms, the sections to be about 12 feet long; these are to be divided into a number of compartments of suitable form, and provided with projections on their under sides, so as to be fitted on to the place of the top rail of the bulwarks, serving as a substitute therefor. These sections, when immersed in the water, would form so many pontoons, and, being provided with cords and loops along their sides, would, in the event of the ship going down, be lifted out of their place by the action of the water. It is likewise proposed to construct the seats on the deck in the same manner, and underneath every seat, and along the entire length of the bulwarks, other floating tubes may be provided. In the case of sea-going vessels, the bulwark tubes are fitted with holes, rings or slots, so that in case of foundering they can at once be joined together either before or after taking to the water.

THE RAIN TREE.—Some travellers in Columbia, South America, in traversing an arid and desolate tract of country, were struck with a strange contrast. On one side there was a barren desert; on the other a rich and luxuriant vegetation. The French Consul at Loetto, Mexico, says that this remarkable contrast is due to the presence of the "Tamai caspi," or the rain tree. This tree grows to the height of 60 feet, with a diameter of three feet at its base, possesses the power of strongly attracting, absorbing and condensing the humidity of the atmosphere. Water is always to be seen dripping from its trunk in such quantity as to convert the surrounding soil into a veritable marsh. It is in summer especially, when the rivers are nearly dried up, that the tree is most active. If this admirable quality of the rain tree was utilized in the arid regions near the equator, the people there, living in misery on account of the unproductive soil, would derive great advantages from its introduction, as well as the people of more favored countries where the climate is dry and drouths are frequent.

CHLORATE OF POTASH FROM THE DEAD SEA.—Chemical analysis having long ago shown that the waters of the Dead Sea in Palestine are rich in chlorate of potash, a company has been formed, and already commenced operations, to extract this salt from its waters. It is stated that in this way chlorate of potash can be obtained 30 per cent. cheaper than by the cheapest process thus far known; and as there is an increasing demand for this salt, it is a safe and profitable investment. In order to save fuel, which is scarce in those regions, the works are kept in the most active operation during the dry season, when the water is low and the river Jordan does not dilute them much, the water level varying considerably, and consequently the concentration. This body of water, of course, contains the soluble ingredients from the heights surrounding the whole water-shed, of which the rains have made a lye, and solar evaporation has concentrated in that sea.

CARE OF THE TEETH.—Rare, indeed, do we find a person of 30 years of age with a sound set of teeth. Far more often do we find young lads and girls of 10 to 16 years of age whose teeth are mere shells of decaying tissue, rotting away with almost visible rapidity, depositories of decaying particles of food, and the source of contaminating elements which deteriorate digestion, and offensive odors which contaminate the breath. In connection with this, it is said that there are 12,000 dentists in the United States, who annually extract 20,000,000 teeth, manufacture and insert 3,000,000 artificial teeth, and consume about three tons of pure gold, to say nothing of the enormous quantity of mercury, tin, silver and other metals used as "fillings" for carious teeth. We have this upon the authority of *Good Words*, and can only add that judging from the vulcanized rubber required for gums and plates, the rubber-tree cultivation must needs be assiduous.

A NEW THERAPEUTIC AGENT.—A new method of treating cancerous growths, tumors, etc., consists in subjecting the parts to a stream of hot, dry air. This is proposed and has been successfully applied by Dr. G. A. Keyworth, of England. By means of a foot-bellows he caused air to pass through a glass vessel containing calcic chloride, then through a heated iron tube, and thence directed the hot, dry air against the surface of a cancerous sore. The treatment was continued for an hour, the effect being to relieve the pain and cause the parts heated to shrink and dry up very considerably. It is believed that this new method will prove valuable when proper appliances are employed to maintain and direct the supply of the air.—*Scientific American.*

PAINLESS DEATH.—In one of his lectures Prof. Tydall spoke of the great probability that entire absence of pain accompanied death by lightning. It is popularly supposed that an impression made by the nerves, a blow or puncture is felt at the precise instant it is inflicted, but such is not the fact. The seat of sensation is the brain, and intelligence of the injury must be transmitted to this organ through a certain set of nerves, acting as telegraph wires, before we become conscious of pain. This transmission or telegraphing from the seat of injury to the brain takes time, longer or shorter, according to the distance of the injured part from the brain, and according to the susceptibility of the particular nervous system operated on. Helmholtz, by experiments, determined the velocity of this nervous transmission in the frog to be a little over 85 feet per second, in the whale about 100 feet per second, and in man at an average of 200 feet per second. If, for instance, a whale 59 feet long were wounded in the tail, it would not become conscious of the injury until half a second after the wound had been inflicted. But this is not the only ingredient in the delay. Is is believed that in every act of consciousness a determined molecular arrangement of the brain takes place, so that, besides the interval of transmission, a still further time is necessary for the brain to put itself in order or its moleculars to take up the motions or positions necessary for the completion of consciousness. Helmholtz considers that one-tenth of a second is required for this purpose. Therefore, in the case of a whale, one second and one-tenth would elapse before an impression made upon its caudal nerves could be responded to by a whale 50 feet long.

DISCOVERY OF A COLOSSAL STATUE AT GAZA.—At Gaza, on the 6th ult., an Arab was quarrying stone at a place about four and a half miles distant from the town, and unearthed a marble figure of a man. The following are the dimensions given by an Arab eye-witness, namely: "Three feet from top of head to end of beard; 27 inches from ear to ear; from top of forehead to mouth, 13½ inches; from shoulder to shoulder, 54 inches; from crown of head to waist, 81 inches; and 54 inches the circumference of the neck; the total height is 15 feet. The hair hangs in long ringlets down upon the shoulders, and the beard is long, indicating a man of venerable age. The right arm is broken in half, while the left arm is crossed over the breast to the right shoulder, where the hand is hidden by the drapery of a cloak covering the shoulders." I presume the statue is nude, though this fact is not stated. There is no inscription either on the figure or on the pedestal, and the latter is a huge block, carved in one piece with the god. It was found in a recumbent position, buried in the sand upon the top of a hill near the sea, evidently removed from its original site, which is unknown. Its estimated weight is 12,000 pounds. The Pasha of Jerusalem has ordered a guard to watch this interesting relic of ancient art, and prevent any injury by the fanatics of Gaza. Judging merely from the "long hair and long beard," and the position of the left hand, I should be disposed to assume that it is an Assyrian monument commemorative of their invasion of Palestine. But it is premature to conjecture until further and more precise particulars can be had from Gaza.—*Jaffa Correspondence of N. Y. Herald.*

PLIOCENE MAN.—Prof. J. D. Whitney has lately published an interesting memoir summarizing the results of the discoveries of the Geological Survey of California respecting the antiquity of the human race. His memoir is entitled "Human Remains and Works of Art of the Gravel Series," and the more important of his conclusions are given below. Prof. Whitney affirms that the discoveries and investigations of the California survey have demonstrated the clear and unequivocal proof, beyond any possibility of doubt or cavil, of the contemporary existence of man with the mastodon, fossil elephant, and other extinct species at a very remote epoch as compared with anything recorded in history. That man existed in California previous to the cessation of volcanic activity in the Sierra Nevada, to the epoch of the greatest extension of the glaciers in that region, and to the erosion of the present river canons and valleys, at a time when the flora and fauna differed entirely from what they are now, and when the topographical features of the State were extremely unlike those exhibited by the present surface. That the discoveries in California and elsewhere (notably in Portugal and India), present a strong body of evidence going to prove the existence, during an immensely long period, of the human race, in its primitive condition. That, so far as we know, there is no evidence of the existence of any primordial stock from which man may have been derived, so far back, at least as the Pliocene. Man, thus far, did not essentially differ from what he is in past-pliocene and recent formations.

THE OBSERVATION OF THE CIRCULATION OF THE BLOOD in living creatures has always been regarded as the most interesting and instructive sight that the microscope could afford. The delicate membrane of the foot of the frog has hitherto afforded the microscopist the most convenient subject for this beautiful demonstration of Harvey's discovery. Perkinje's experiment, by which an observer is enabled to observe the circulation in his own retinal blood-vessels, has hitherto been the only method known of actually showing the circulation of the blood in the human subject. Dr. Huber, of Greifswald, it may interest our readers to know, has lately described a simple experiment by which it is possible for an observer to see the circulation of the blood in the blood-vessels of another person.

Dr. Huber fixes the head of the subject to be examined in a frame not unlike that used by photographers, on which is fixed a holder for the microscope and lamp. He then draws down the lower lip of the subject upon the stage of the instrument, with its delicate inner surface upward for inspection, throws a strong light on the same with a condenser, and focuses the microscope, provided with a low-power objective, down upon the delicate net-work of blood-vessels, which can be seen there even with the naked eye. By this simple means the circulation can be observed with the greatest ease and perfection. The value of this novel and beautiful experiment in the study of the abnormal conditions of the blood, presented in various diseases, it is anticipated, will be very great, and important results are expected to flow from it. Huber distinguishes his new process by the terrific name of "cheiloangioscopy."

SPURIOUS COLORING OF WINE.—Mix together equal parts of diacetate of lead and the wine to be tested, well shake and filter. If the wine be pure the filtrate will be quite clear, but if colored with aniline it will be more or less colored, according to the amount of coloring present. Another method is to add a solution of caustic potash, in sufficient quantity to neutralize the acid. If the wine be pure it will first produce a bright red coloration, then after a short time turn to bottle-green, and then to a brownish green, but no precipitate is formed; but if the wine has been artificially colored the following colorations will be produced:

Wine colored with	Color produced
Elderberries	Purple
Logwood	Reddish Purple
Mulberries	Purplish
Beetroot	Red
Litmus	Light Violet

A good test for logwood is to evaporate the wine to dryness, and then add hot water with a little alum, which will produce a blue coloration if the wine has been colored, but will have no effect if the wine be pure.—*English Mechanic.*

SILVERING MIRRORS.—An improvement in silvering mirrors, by which excellent results are obtained, and which at the same time spares the workmen the danger of exposure to the effect of mercurial vapors, has just been accorded a prize of 2,500 francs by the French Academy. The inventor is M. Lenoir, and his procedure is substantially as follows: The glass is first silvered by means of tartaric acid and ammoniacal nitrate of silver, and then exposed to the action of a weak solution of double cyanide of mercury and potassium. When the mercurial solution has spread uniformly over the surface, fine zinc dust is powdered over it, which promptly reduces the quicksilver, and permits it to form a white and brilliant silver amalgam, adhering strongly to the glass, and which is affirmed to be free from the yellowish tint of ordinary silvered glass, and not easily affected by sulphurous emanations.

PRIZE FOR ESSAY ON DIPTHERIA.—The Empress of Germany has offered a prize of 2,000 marks ($500) for the best essay on diptheria. The conditions are that the writer is to bring forward important *new* facts as to the essential nature (*das Wesen*) of the disease, especially with regard to the infectious matter which propagates it, its dissemination, and the means of arresting its progress. The essays may be written in German, English or French, and must be sent to Prof. v. Langenbeck, Berlin, N. W. 3 Roonstrasse, on or before December 15th, 1880. The committee which will award the prize consists of Professor Klebs of Prague, Liebreich and Virchow of Berlin, von Nageli and Oertel of Munich, and Thiersch of Leipsic. Each essay is to have a motto corresponding to a similar motto on a sealed envelope containing the author's name.

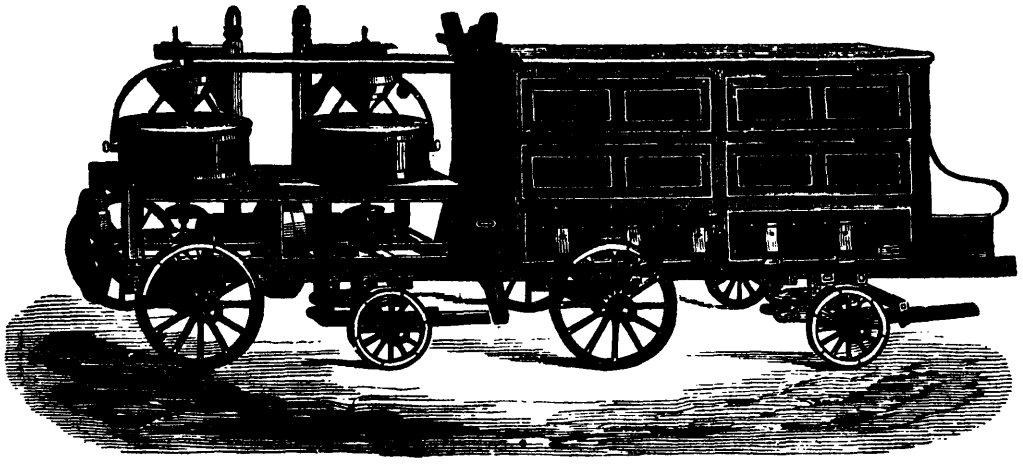


FIG. 2.—PORTABLE MILL.

FRENCH HORIZONTAL FLOUR MILLS.

The mills exhibited at the late Exhibition in Paris by Messrs. Bresson, Fanchon & Co., of Orleans, are novel in several particulars. The stones are arranged so that they lie parallel to each other, and they are arranged so that they may yield when subjected to sudden jars or shocks. This avoids serious damage to the mill, and prevents the heating of the stones and grain. The grain is drawn in through the eye of the stone, and equally distributed between the stones by an apparatus which also furnishes cool air for the spaces between the stones, which cools both the stones and the grain. A cast iron case incloses the stones, leaving an air space all around them, in which air currents are produced by a blower at the top of the casing. These mills are provided with conveniences for removing and replacing the stones, and they are compact and efficient.

The stationary mills shown in Fig. 1 are supported by a strong cast iron frame, and the portable mills, Fig. 2, are supported by a substantial waggon frame. The bolting box is connected with the mill and has no special shafting, but takes its power directly from the shaft that drives the stones.—*Scientific American.*

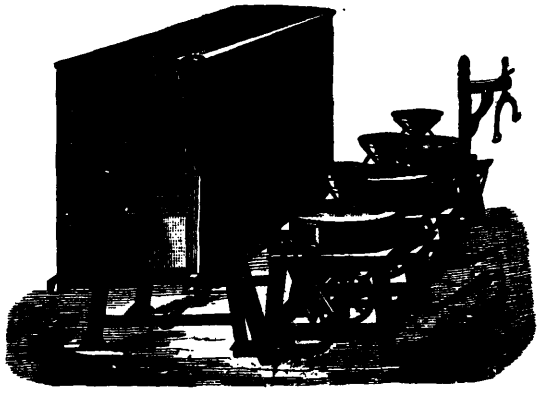


FIG. 1.—STATIONARY MILL.

JAPANESE PAPER.

Many varieties of paper are made in Japan, and all from the bark of trees. The best, and that most generally in use, is produced from a shrub called there Kozou (*Broussonetia papyrifera*), which grows to a height of about two metres and a half. It was introduced from China, and is now cultivated throughout Japan for this express purpose. It is ordinarily planted as a sort of hedge along the fields, the roots being about two feet apart. After a short time the branches interlace and form a very efficient protection against cattle. Under favorable conditions it sends out shoots three metres long each year, and it is said to produce as much as 1,800 kilos. of bark per hectare annually. The manufacture of the paper is conducted as follows: The stem and branches are laid in water for a fortnight, and if the water is stagnant the bark becomes gradually detached; if running, the outer coating, which is useless, is carried away. The interior layer is then peeled off in strips, combed, washed and dried, and put away if not to be used immediately. This is the raw material, and to convert it into paper it is subjected for three or four hours to the action of hot water and steam, which renders it soft; then it is pounded and vigorously beaten with knotty sticks. A sort of pulp is thus produced, which can be made as fine as is requisite. It is mixed with water in a vat, and taken out in the mould of the paper to be made. The Kozou paper is very strong, particularly in the direction in which the fibre extends. Owing to this property, the Japanese can employ their paper in many ways unknown in Europe. For instance, they use it instead of glass for their windows, bandages for wounds, pocket-handkerchiefs, cords, thread, etc. When a still stronger paper is required, the mould is again dipped in the pulp, but in a direction at right angles with the first operation, so as to have the fibre crossed, when it becomes extremely strong. This process is sometimes repeated three or four times until a product is obtained which is used for covering umbrellas, packing goods, making cloaks for travellers, etc. In these cases the paper is oiled and thus made impermeable to moisture.

We are glad to believe, says the *American Architect*, that Lord Dufferin's scheme for the use of Niagara Falls is more likely to be carried out than Dr. Siemens's or Sir William Thompson's. The joint commission of the State of New York and the Dominion of Canada met on the ground not long ago to discuss the proposition to which we have before referred, for securing the lands about the falls to be maintained by the two governments as a perpetual park, free from private encroachment. The commissioners had apparently no difficulty in deciding that the grounds needed the care of the governments to protect the scenery from disfigurement or destruction; and find themselves substantially agreed, we understand, as to the manner in which the thing should be done. It is expected that they will meet again in November, and render a decisive report, with a scheme for carrying out the project. This action comes none too soon. The degradation of the surroundings warrants the New York *Times* in saying that already "the superb adjuncts of the fall scenery, on both the American and Canadian sides of the chasm, have been robbed of much of their original beauty and grandeur. Where picturesque groves once stood, unsightly mill-sheds and rickety drinking booths now appear. On the Canadian side, only a few stunted trees remains to remind the visitor of the old-time forests. Year after year the change goes on, the rocks are covered with the signs of quack medicine men, every prominent outlook is crowned with the booth of some vagabond peddler, and the grand old trees, once the pride of the neighborhood, are being cut down to build mill-races or supply with fuel some petty factory." The vexatious exactions of people in possession of the approaches to the falls have done as much as anything to win the public mind to the idea of protection; but a still more serious argument is the need of securing the falls against the ravages of speculators, who would ruin them for the sake of mechanical uses, or of savants who itch to convert them to some scientific toy.

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