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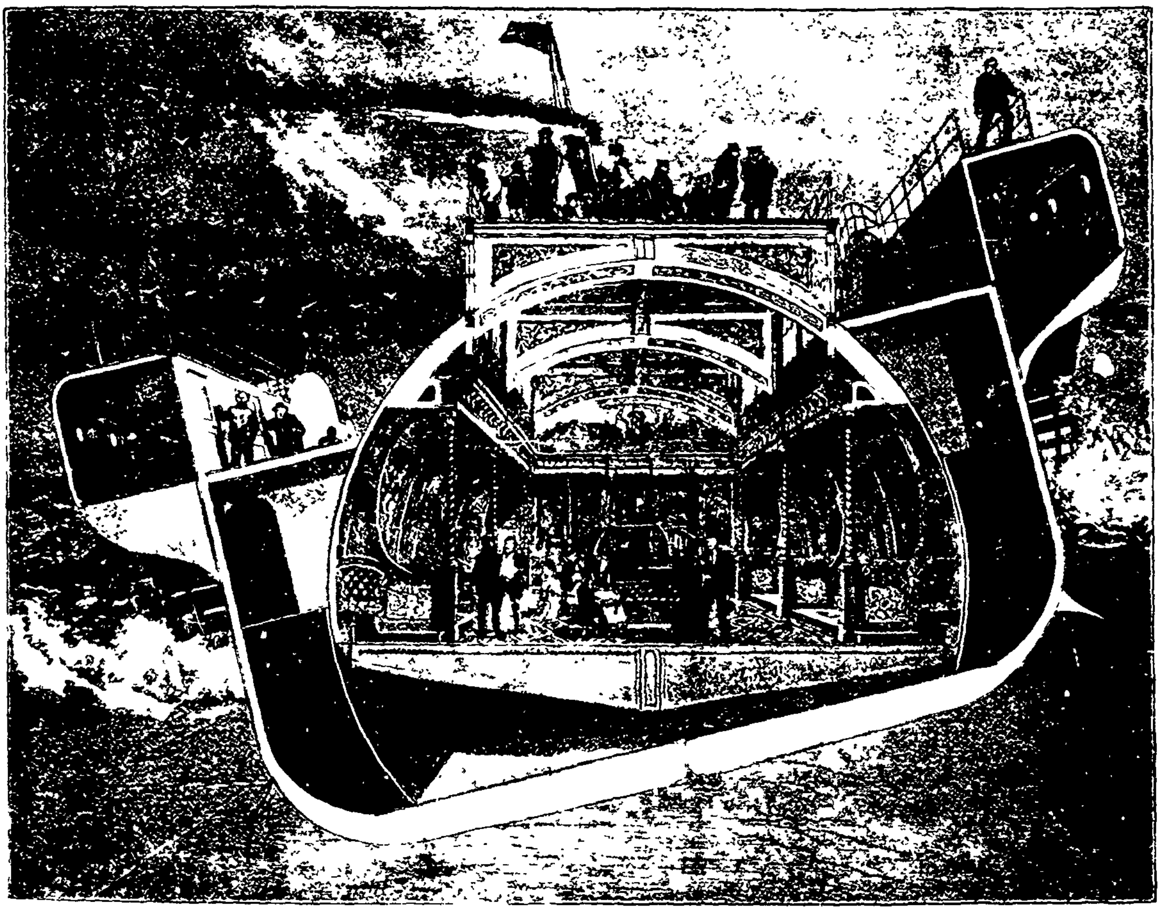


THE BESSEMER CHANNEL STEAMSHIP.—The Swinging Saloon.

A LAY SERMON ON CHURCHYARDS AND EPITAPHS.

In an hour of morbid melancholy the poet sings of earth becoming "dark with the shadows of the tombs.' It is an unnatural and repulsive idea to associate skulls and crossbones and the like horrible paraphernalia with Death, to paint him as a gaunt skeleton armed with a scythe, wandering to and fro in the world, ruthlessly mowing down youth and age. It is better philosophy and better religion to figure Death as one of God's brightest angels continually travelling between earth and heaven, bearing messages of love, with voice soft as the autumn wind, that whispers to the dying blossom. and hand as gentle as the snow-flakes that weave their shroud above the perished flower.

"Weep not for the dead, neither bemoan him," was the counsel of the prophet of old, but how difficult the task to act upon it. Bereavement mourns over the grave as if the one she loved was lying in the darkness beneath; she will not pause to reflect, to know and comfort herself with the knowledge that all that endeared the lost one,—lost only for awhile,—the nobleness of soul, the beauty of mind, go not down into the grave, but rise from the bed of death upon the wings of immortality. It is the dust alone which returns to the dust.

"The luxury of woe" has lost much of its spiritual significance, and is become grossly materialised. Nowadays it has a price in the market. We measure our grief by the length of our crape. We have establishments whose "melancholy pleasure" is to supply mourning at various rates and in various shades, so as to accommodate the wildest heartbreak and the most microscopic grief. Only at the grave do we discover what a good or amiable or noble-hearted individual the departed was. We get up subscriptions for a monumental tomb to the genius or talent that for nigh a lifetime begged a morsel of bread from us, and got a stone,—after death,—and we inscribe on it an epitaph to tell posterity how highly the departed was honoured during life, how deeply regretted after death. "False as an epitaph," is an old saying. "Here lies," is a common and equivocal commencement. There is a painting in Hampton Court, representing the Day of Judgment; the graves are open, and some of the reanimated corpses are rushing about, carrying their tombstones with them, unfortunately the artist has been beneath a tombstone for a century or two, and the idea he wished to convey is buried with him. Could it be that he supposed the dead would on the Great Day of Account use their then epitaphs as testimonials?

An epitaph is too frequently an ornamental grief, if it were not so, nothing could teach a more solemn lesson; nothing could better win the heart of man to think kindlier of his fellow-men; for all that was lovable in a friend becomes still more lovely, all that was hateful in one we deemed an enemy is robbed of ugliness when friend and enemy are laid in the grave. Death draws a curtain between us and the departed through which we see them beatified, as we see a calmer loveliness in the landscape when veiled in the golden haze of the morning.

It is a feeling of natural piety that causes us to record upon the gravestone the name and virtues of the deceased; and those that say,

> "We have no need of names or epitaphs,
> We talk about the dead by our firesides,"

are actuated by a feeling flowing from the same source. Each churchyard is a volume of Earth's great treatise on Death; its printed pages are the records on the tombstones; there are in it also blank pages—nameless graves—eloquent in their silence. Nature bends her blue eye on each hillock in the churchyard, nothing unlovely or repulsive meets her gaze; she only sees that which was once the tenement of a soul,

> "Turning to daisies gently in the grave.

It was a beautiful thought of olden Saxon piety to name the burial-ground God's Acre,—a sacred land at whose borders man should put off pride and vanity; a field never to be upturned by the plough, into which the husbandman should never cast the grain to be quickened for the sickle of the reaper; where that seed alone may be sown which is to corrupt amid corruption, and to rise incorruptible when God gathers in the harvest of time.

An epitaph being the utterance of sorrow, should be brief. The character of the individual whom it commemorates should be given, but not in detail,—a scrupulous minuteness is apt to convey the impression that the truth has not been strickly adhered to, and a multiciplity of words is generally the index of assumed sorrow. An old epigram says,

> "With most of epitaphs I'm grieved,
> So very much is said
> One half will never be believed,
> The other never read."

If the departed was a kind husband, let that be said, without noting the various domestic duties which he so lovingly discharged; if a charitable man, let the simple fact be told without turning the tombstone into a subscription list (no uncommon practice,) by detailing the various sums he gave during life, or bequeathed at death, for benevolent purposes, and astonishing future generations with the information that he was president of a soup-kitchen, or honorary secretary to a coal-distribution society; if a soldier, where is the necessity to enumerate the number of legs lost and stumps won in the cause of glory? if an author, let no "complete list of the author's works" be furnished; and let not a physician's epitaph become a "quack advertisement," recording wonderful cures he had performed during his life; in short, an epitaph should be brief, and written in language that will appeal to the hearts of all who read it. It should be free from the arrogance that appropriates heaven and eternal happiness, and, on the gravestone, boasts of the possession in words such as these:—"I am with the blessed." It should refer to the hope that stretches beyond the grave, to the uncertainty of life, and the certainty of death, and the tone of it all should teach that

> "The glories of our birth and state
> Are shadows, not substantial things,"

The more condensed an epitaph is, the better. Pope wrote for Dryden's tomb:—

> "This Sheffield raised. The sacred dust below
> Was Dryden once. The rest who does not know?"

It was not adopted. How much grander the one word that occupies its place:—

> "Dryden."

What an intensity of affection in the simple inscription:—

> "Here lies Willie,
> Aged 8 months."

The simple notice, "Here lies Willie," would have given scope for wide conjecture, but "aged 8 months" pictures at once the infant sitting on the shore of life suddenly snatched away from the murmur of the sunny wavelets. Our best epitaphs are incorporated with our literature. What need is there of quoting Milton's on Shakspeare, Ben Jonson's on the Countess Dowager of Pembroke, or Garrick's on Hogarth?

Into the subject of epitaphs written by poets for themselves there is little space to enter. That of Thomas Hood is almost perfect,—"He sang the Song of the Shirt." Thomas Campbell wished that "Author of Gertrude of Wyoming" might be recorded on his memorial stone, but his wish was not carried out. Matthew Prior wrote for himself such an epitaph as might have been expected:—

> "Nobles and Heralds, by your leave
> Here lies what once was Matthew Prior,
> The son of Adam and of Eve,
> Can Stuart or Nassau claim higher?"

In vivid contrast to this is the self-written epitaph of Robert Burns:—

* * * * * * * *

> "The poor inhabitant below
> Was quick to learn and wise to know
> And keenly felt the friendly glow,
> And softer flame;
> But thoughtless follies laid him low,
> And stain'd his name."

The age of conventional epitaphs is gone, such as "Sickness was my portion, physic was my food," &c., and "Afflictions sore," &c., the age of conventional tombstones, on which were displayed crossbones and grinning skulls and cherubs, that strongly resembled owls and parrots in their general contour, has departed and in the place of the latter we have a conventionality quite as ridiculous, quite as absurd. Who has ever entered a cemetery without being annoyed with the number of *quasi* broken pillars, torches extinguished, or about to be so, and the ewers and towels and double-handed jugs, that are suggestive of nothing but bedrooms and barber's shops?

There is a large class of well-meaning people who seem to think a gravestone without an epitaph a mere wilful waste of so much good stone, and that *with* one, or rather *by* stone, the claims of the departed to the consideration of the public are mightily strengthened, that a plain tombstone is considerably more respectable than a simple raised turf; but that a tombstone with an epitaph to boot is positively and indisputably genteel. Our burial-places are capable of great improvement. Who without a shudder can look upon a city churchyard, "a dismal place raised a few feet above the level of the street, and parted from it by a low parapet wall and an iron railing—a rank unwholesome rotten spot, where grass and weeds seem in their frowzy growth to tell that they had sprung from paupers' bodies, and struck their roots in the graves of men sodden in steaming courts and drunken hungry dens?" How different the feeling with which we enter a churchyard in the country, how reverently we gaze around the holy pile where beneath whose roof in life they congregated to worship,

"Each in his narrow cell for ever laid,
The rude forefathers of the hamlet sleep."

And yet knowledge and our reason tell us that to bury the dead in proximity to the living is to help to shorten the, in any case, brief space of time which divides one from the other.

JAPANESE VEGETABLE WAX.

The *Japan Mail* contains some further particulars respecting the preparation of the vegetable wax produced in Japan, and chiefly exported to England. This wax is obtained from the fruit, or, more correctly, berry of the wax tree. The tree, which is by no means unlike the juniper tree, flourishes more especially in the southern provinces of the empire. The fruit, which usually ripens about the month of October, is gathered when ready, and cleansed from its loose, outer husk, a process which is accomplished in large wooden vessels, with wooden malls, similar to those in use for cleaning rice. The residue product, available for the manufacture of wax, is a bean-shaped kernel of the size of a lentil, possessing an unusual degree of hardness, of a dark yellow wax colour, and offering a saponaceous exterior to the touch. The kernel is subsequently exposed in a sufficient degree to a steaming process, which deprives it of its extreme hardness, and allows of its oily properties being more easily extracted in the pressing stage. In this process, the oil is received into small earthen vessels, in which it subsequently hardens to a blueish-green mass, in the shape which it is commonly met with in home consumption.

Wax so produced is impure, and is only suitable for certain descriptions of candles and for wax-thread manufacture for home use. In order to render it merchantable for the exporter, the following refining process is resorted to:—The wax is boiled with a lye until it is brought to a perfectly fluid state, and is then drawn off into a reservoir filled with clear water, the pure wax, which floats upon the surface, being removed. The mass is then exposed to the sun's rays for a period of fifteen or sixteen days, during fine weather, for the purpose of bleaching it, at the expiration of which time the wax presents a dirty white crumbling appearance and a strong tallowy smell. The boiling and bleaching are repeated with the view of rendering the refining process still more complete, the only difference being that, instead of lye, pure water alone is employed in boiling it. The product is a clear, white powder, which, in place of its former crumbling appearance, has assumed an almost crystalline formation. The last stage of the preparation for export consists in rendering the powder a compact mass, which is effected by melting it over a fire with a little water (in order to avoid burning,) and running it off into flat vessels. The product thus obtained, and known to commerce as vegetable wax, differs exceedingly little from white bees'-wax, with which it possesses the properties of colour, brittleness, and similarity in its fan-shaped fracture in common. The only characteristic difference may be said to be in the odour, the bee's-wax giving off a refreshing aromatic scent in burning, while the tallowy smell of the Japanese wax is far from being agreeable. Vegetable wax is chiefly used in the manufacture of wax candles.

A rifle which the Evans Rifle Co., at Mechanics Falls, Me., are manufacturing, is said to be capable of discharging thirty-four shots in nineteen seconds.

50-TON STEAM-HAMMER

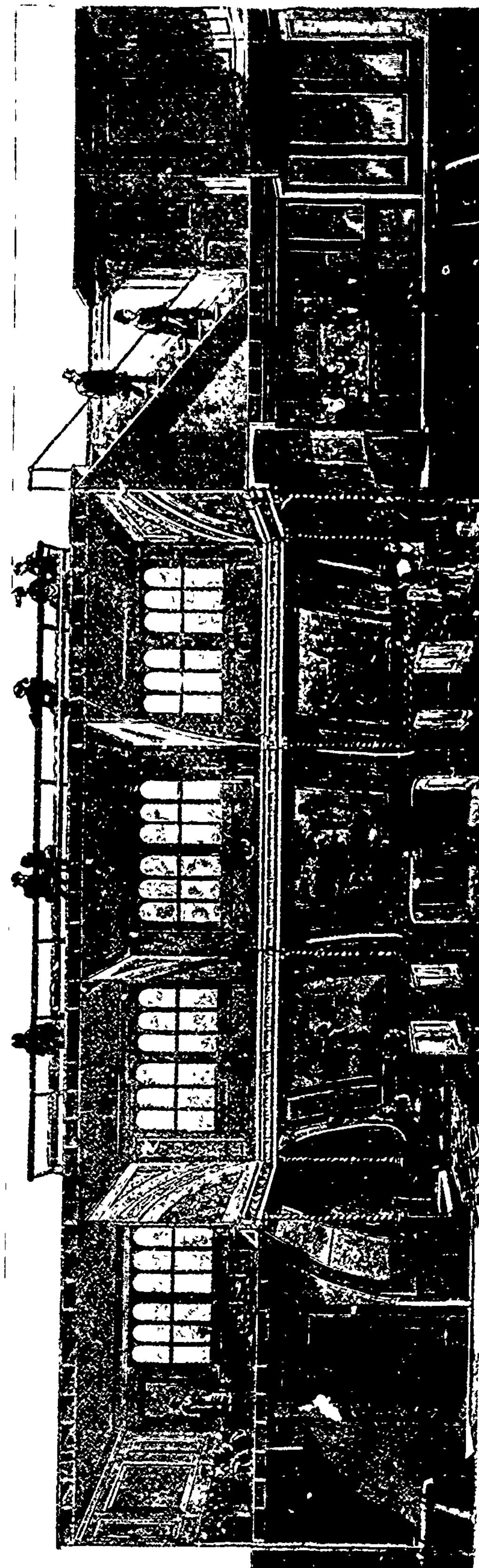
At the present time, when the large steam hammer at the Woolwich Arsenal has just been specially exhibited to the Emperor of Russia, many of our readers will regard with interest the engravings which we this week publish of a much larger hammer which has for some time past been at work at the Alexandrowski Steel Works, St. Petersburg. This hammer (of which we give an engraving from *Engineering* on page 229) was originally constructed by Messrs. Robert Morrison and Co., of Newcastle-upon-Tyne, and it was erected by them in 1866. It was then a 35-ton hammer of Messrs. Morrison's well-known pattern, the piston rod, or hammer bar, which extended through both top and bottom cylinder covers being forged in one piece with the piston, and that portion which was above the piston being flattened on two sides. As first erected, also, the arched frames shown in our engraving sprung from the ground level, their span being 30 ft., and the height of arch to underside of cylinder 16 ft. 8 in.

After the hammer had been working a short time the hammer bar began to give way, and ultimately broke, and the great expense which would have attended replacing it led Captain Kolokoltzoff to consult Messrs. Thwaites and Carbutt, of Bradford, as to the advisability of altering the hammer to one of 50 tons, and at the same time providing the hammer head with guides, the hammer bar being originally guided by its stuffing-boxes only. The result of this consultation was that Messrs. Thwaites and Carbutt submitted several designs for the alteration, and eventually that which we illustrate was carried out. According to this plan the original cylinder is retained, but the arched standards instead of springing from the ground line are now mounted on the tops of massive vertical standards 12 ft. high, the clear height under the cylinder being thus increased to 28 ft. 8 in., and room being obtained for the erection of the guides for the hammer head. The cylinder, we should state, is 6 ft. 6 in. in diameter, and the length of stroke 12 ft. 6 in., so that the whole work is of a colossal character. The height of the hammer, as altered, from the ground line to the top of the cylinder is 46 ft., while the cylinder itself is a massive casting weighing 36 tons. Each of the arched standards is 34 ft. in height, and weighs 40 tons, while the column of rectangular box section, from which each arched standard springs, is made in two parts, and weighs 37 tons, the total weight of each side frame complete from the floor line being thus 77 tons.

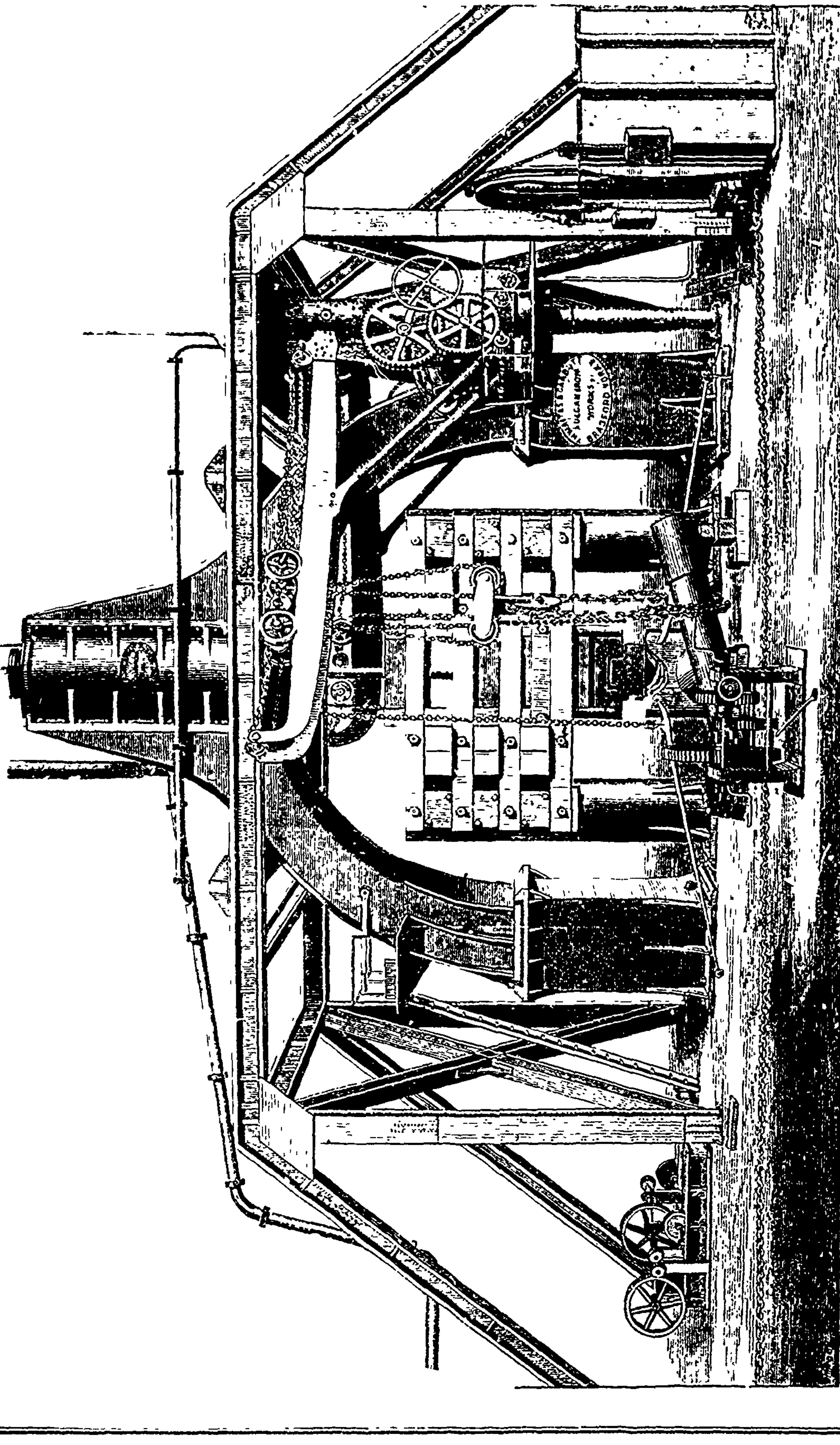
RAILWAY MATTERS.

The Burlington (Ia.) *Hawkeye* is of the opinion that when a locomotive engineer finding himself laid out on a side track for the greater part of the afternoon, wiles away the monotony of the occasion by sending his new fireman back to the next station to look after the exhaust which he claims to have lost while coming up the hill, it may be safely considered as a base attempt of a brotherhood man to put a damper on rising genius.

A large wooden bridge on what is known as the Pan Handle Railway, in the United States, was recently burned down, and the promptitude with which it was reconstructed goes to prove that if a wooden bridge is easily destroyed it is easily reinstated. Immediately after the burning of the bridge the company issued an order to Messrs Alex. McClure and Co., of Pittsburg, for the timber necessary for a new one: all the trains of the Pan Handle route were compelled to pass over the Pittsburg, Ft. Wayne and Chicago and Cleveland and Pittsburg railways as far as Steubenville, until the new bridge could be completed. Messrs. McClure and Co. immediately cleared their mills for action; and commenced on Monday morning, Sept., 21, running both saws day and night, until they had made 6½ days, in which time they cut 143,478ft. of lumber; 129,850ft. of this was cut and shipped in 4½ days to the scene of the burnt bridge. The railroad company erected the new bridge in 3½ days. The lumber for the bridge was all cut and loaded into cars from the 21st to the 24th; the last car load having been sent off at three o'clock on the morning of the 24th. The railroad company were highly gratified with the promptness with which the firm went to work, and with the unprecedently short time in which they were furnished with materials from the logs to build the entire new structure.



THE BESSEMER CHANNEL STEAMSHIP [illegible] THE SWINGING SALOON.



FIFTY-TON STEAM-HAMMER, RECENTLY ERECTED AT WOOLWICH

PRINCIPLES OF SHOP MANIPULATION FOR ENGINEERING APPRENTICES.*

By John Richards, M E London

(*Continued from page* 211.)

GENERALISATION OF SHOP PROCESSES.

Having thus far treated of such general principles and facts, connected with practical mechanics as might properly precede and be of use in the study of actual manipulation, in the workshop, we come next to casting, forming and finishing, with other details that involve manual as well as mental skill, and to which I will apply the term "processes," for want of one more applicable.

As these shop processes or operations are more or less connected, and run one into the other, it will be necessary at the beginning to give a short summary of them, stating the general object of each, that may serve to render the detailed remarks more intelligible to the apprentice as he comes to them in consecutive order.

Designing or generating the plans of constructing machinery may be considered the leading element in engineering manufactures of machine construction, the one to which all others are subordinate, both in order and importance; and is that branch to which engineering knowledge is especially directed.

Designing consists, first, in assuming certain results, and, secondly, in conceiving of mechanical agents to produce these results.

It comprehends the geometry of movements, the disposition and arrangement of material, the endurance of wearing surfaces, adjustments, and symmetry; in short, all the conditions of machine operation and machine construction. This subject will be again treated of in another section relating to shop processes.

Drafting, or drawing, as it is more commonly called, is a means by which mental conceptions are conveyed from one person to another; it is the language of mechanics, and takes the place of words, which are insufficient to convey mechanical ideas in an intelligible manner.

Drawings represent and explain the machinery to which they relate as the symbols in algebra represent quantities, and in a degree admit of the same modifications and experiments to which the machinery itself could be subjected if it were already constructed.

Drawings are also an important aid in developing designs or conceptions. It is impossible to conceive and retain in the mind all the parts of a complicated machine and their relation to each other without some aid to fix the various ideas as they arise, and keep them in sight for comparison; like compiling statistics, the footings must be kept at hand for reference, and to determine the relation that one thing may bear to another.

In the workshop, the objects of drawings are to communicate plans and dimensions to the workmen, and to enable a division of the labour so that the several parts of a machine may be operated upon by different workmen at the same time, and to enable classification and estimates of cost to be made, and records kept.

Drawings are in fact the base of shop system, upon which depends not only the accuracy and uniformity of what is produced, but also, in a great degree, its cost.

Complete drawings of whatever is made are now considered indispensable in the best regulated establishments; yet we are not so far removed from a time when most work was made without drawings, but what we may realise their importance by contrasting the present with the system that existed but a few years ago, when to construct a new machine was a great undertaking, involving generally many experiments and mistakes.

Pattern making relates to the construction of wooden models for the moulded parts of machinery.

Pattern making involves a knowledge of shrinkage and cooling strains, the manner of moulding and proper position of pieces, when cast, to insure soundness in particular parts.

As a branch of machine manufacture, pattern making requires a large amount of special knowledge, and a high degree of skill; for in no other department is there so much that must be left to the discretion and judgment of the workmen.

Pattern makers have to understand drawings throughly, in order to reproduce them on the trestle boards with allowance for shrinkage; they must also understand moulding, casting, fitting, and finishing, and should, as a department of machine manufacture, rank next to designing and drafting.

Founding and casting relates to forming parts of machinery by pouring melted metal into moulds, the force of gravity alone being sufficient to press or form it into even complicated form.

As a process for shaping such metal as is not injured by the high degree of heat required in melting, moulding is the cheapest and most expeditious of all means for shaping or forming material, for forms of regular outline, while the importance of moulding in producing irregular forms is such that without this process the whole system of machine construction would have to be changed.

Founding operations are divided into two classes, known technically as green sand moulding, and loam or dry sand moulding, the first, when patterns or duplicates are used to form the moulds, and the second, when the moulds are built by hand without the aid of complete patterns

Founding involves a knowledge of mixing and melting metals such as are used in machine construction, the preparing and setting of cores for the internal disp acement of the metal, cooling and shrinking strains, chills, and many other things that are more or less special, and can only be learned and understood from actual observation and practice.

Forging relates to shaping metal by compression or blows when it is in a heated and softened condition; as a process it is an intermediate one between casting and what may be called cold treatment.

Forging also relates to welding or joining pieces together by sudden heating that melts the surface only, and then by forcing the pieces together while in this softened or semi-fused state.

Forging also includes, in ordinary practice, the preparation of cutting tools, and tempering them to various degrees of hardness as the nature of the work for which they are intended may require; also the construction of furnaces for heating the material, and mechanical devices for handling it when hot, with the various operations for shaping, which, like casting, can only be understood when seen.

Finishing and fitting relates to giving true and accurate dimensions to the parts of machinery that come in contact with each other and are joined together or move upon each other, and consists in cutting away the surplus material that has to be left in founding and forging, because of the heated and expanded condition in which the material is treated in these last processes. In finishing, the material is operated upon at its normal temperature, in which condition it can be handled, gauged, or measured, and will retain its shape after it is fitted.

Finishing comprehends all operations of cutting and abrading such as turning, boring, planing, and grinding, also the handling of material; it is considered the leading department in shop manipulation, because it is the one where the machinery is organised and brought together. The fitting shop is also the department to which the drawings especially apply, and other preparatory operations are usually made subservient to the fitting.

Shop system may also be classed as a branch of engineering work; it relates to the classification of machines and their parts by symbols and numbers, to records of weight and the cost of cast, forged, and finished parts, and apportions the cost of finished machinery among the different departments of the works. Shop system also includes the maintenance of standard dimensions, the classification and cost of labour, with other matters that partake both of a mechanical and a commercial nature.

In order to render their study more easy for the apprentice, I will in treating of shop processes, change the order in which they are named in the summary. Designing, and many matters connected with the operation of machines, will be more easily learned and better understood, after having gone through with what may be called the constructive operations such as involve manual skill.

MECHANICAL DRAWING.

Drawing may in some regards be said to bear the same relation to mechanics that writing does to literature, but the analogy is by no means complete, a person may copy a manuscript or write from dictation about what he does not un-

* This, and the succeeding articles under the same title, were published simultaneously in the Journal of the Franklin Institute, Philadelphia, and in *Engineering*.

derstand, but a mechanical draughtsman cannot make drawings of a machine he does not understand; at least he cannot do so in the true capacity of a draughtsman and a mecnanic.

Geometrical drawing is not an artistic art so much as it is a constructive mechanical one; displaying the parts of machinery on paper, is much the same in principle and just the same in practice, as measuring and laying out work in the workshop.

Artistic drawing is addressed to the senses, geometrical drawing is addressed to the understanding. Geometrical drawing may, however, include artistic skill, not in the way of ornamentation, but to convey an impression of neatness and completeness, that has by common custom been assumed among engineers, and which conveys to the mind an idea of competent construction in the drawing itself, and also in the machinery which is represented.

Artistic effect in drawings is easy to learn, and through a desire to make pictures, the beginner is often led to neglect that which is more important in the way of accuracy and a judicious arrangement of the drawing

It is easy to learn "how" to draw, but is far from easy to learn "what" to draw; let this be kept in mind, not in the way of discouraging effort in learning "how" to draw, for this must come first, but in order that the objects and true nature of the work will be understood.

The engineering apprentice, as a rule, has a desire to make drawings as soon as he begins his studies, and there is not the least objection to his doing so, in fact there is a great deal gained by illustrating movements and the details of machinery at the same time of studying the principles. Such drawings, if made, should always be finished and carefully inked in, and memoranda made on the margin of the sheets with the date and the conditions under which the drawings were made. The sheets should be of uniform size, not too large for a portfolio, and carefully preserved, no matter what their character.

An apprentice who will preserve his first drawings in this manner, will some day find himself in possession of a souvenir that no consideration would cause him to part with.

For an outfit procure two drawing boards, 42 in. long and 30 in. wide, to receive double elephant paper, have the boards plain without cleets, or any ingenious devices for fastening the paper, and made from thoroughly seasoned timber at least 1½ in. thick.

Two boards are required, so that one may be used for sketching and drawing details, which if done on the same sheet with elevations, dirties the paper, and is apt to lower the standard of the finished drawing by what I will term bad association.

Details and sketches should when made on a separate sheet, be to a larger scale than on the elevations, by changing from one scale to another the mind is schooled in proportion, and the conception of sizes and dimensions is more apt to be based upon the finished work than the drawing itself.

In working to regular scales, such as half-eighth or sixteenth size, it is a good plan to use a common rule, instead of graduated scales; there is nothing more convenient for a mechanical draughtsman than to be able to resolve dimensions into various scales, and the use of a common rule for fractional scales trains the mind, so that the computations come naturally, and after a time almost without effort.

Use a plain T square with a parallel blade fastened on the side of the head, but not imbedded into it, in this way the set squares can pass over the square head in working at the edges of the drawing. It is something strange that a draughting square should ever have been made in any other manner than this, and still more strange that people will use squares that do not allow the set squares to come near to the edge of the board.

A bevel square is often convenient, but should be an independent one; a T square that has a movable blade is never fit for general use; combinations in draughting instruments, no matter what their character, should be avoided; such combinations, like those in machinery, are generally mistakes, and effect just the reverse of what is intended.

For set squares, or triangles as they are sometimes called, no material is so good as ebonite; such squares are hard, smooth, impervious to moisture, and contrast with the paper in colour; they will also wear longer than those of wood.

If wood squares are used, pear wood is best, because of its flexibility. A coat or two of shellac varnish improves such squares by making them smooth and preventing their derangement by moisture.

For instruments, avoid everything of the elaborate or fancy kind; such sets are for amateurs, not engineers. It is best to procure at first only such instruments as are really required, of the best make, and then to add others as necessity may require; in this way experience will often suggest modifications.

One pair each of 3½ in. and 5 in. compasses, two ruling pens, two pair of spring dividers, for pen and pencil, a triangular boxwood scale and common rule, and a hard pencil, are the essential instruments for machine drawing.

At the beginning, when "scratching out" will probably form an item in the work, it is best to use Whatman's paper, or the best roll paper, which, of the best manufacture, is quite as good as any other for drawings that are not water shaded.

In mounting sheets that are likely to be removed and replaced, for the purpose of modification, as working drawings generally are, they can be fastened very well by small copper tacks driven along the edges at intervals of 2 in. or less; the paper can be very slightly damped before fastening in this manner, and if the operation is carefully performed the paper will be quite as smooth and convenient to work upon as though it were pasted down; the tacks can be driven down so as to be flush with, or below the surface of the paper, and will offer no obstruction to the squares.

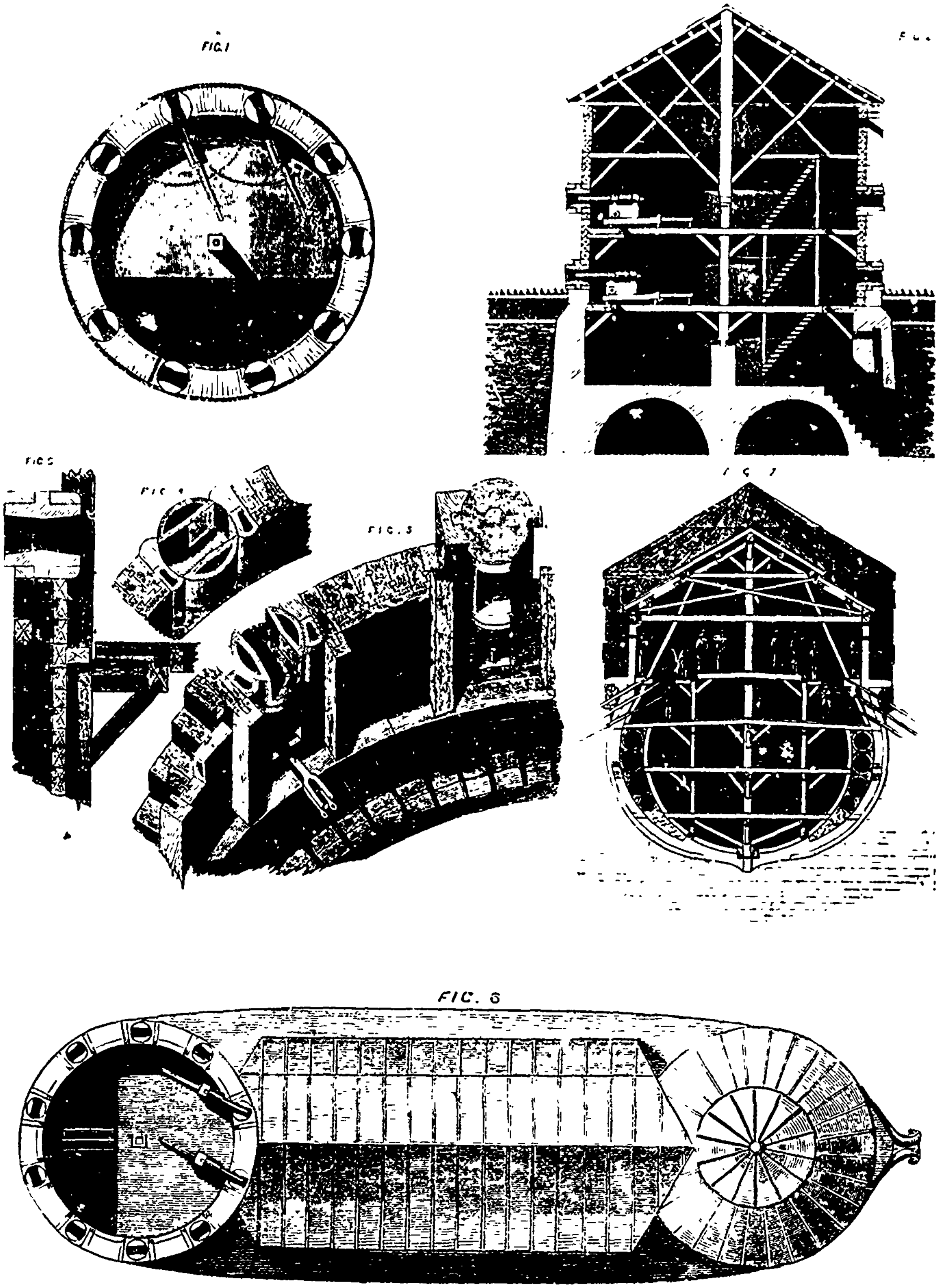
If a drawing is to be elaborate, or is to remain long upon the board, the paper should be pasted down. To do this, first prepare the mucilage, and have it ready at hand with some slips of absorbent paper about 1 in. wide. Damp the sheet on both sides with a sponge, and then apply the mucilage along the edge, for a width of ½ in., then set the edge of the board on the floor, so that it will lean against the desk at steep angles In this position the paper can be applied without assistance. Then, by placing the strips of paper along the edge, and rubbing over them with some smooth, hard instrument, the edges are pasted firmly to the board, the paper slips taking up a part of the moisture from the edges, which are longest in drying If left in this condition the centre would dry first, and the paper be pulled loose at the edges by contraction before the paste had time to dry. It is therefore necessary to pass over the centre of the sheet with a wet sponge at intervals, until the edges adhere firmly, when it can be left to dry, and will be tight and smooth. In this operation much depends upon the judgment of the learner, and much will be learned by practice. One of the most common causes of trouble in mounting is in not having the mucilage thick enough; when thin, it is absorbed by the wood or the paper, and is too long in drying, it should be as thick as it can be applied with a brush, and made from clean gum arabic or tragacanth · glue is not so good.

Thumb tacks are of but little use in mechanical drawing, except for the most temporary purposes, and can very well be dipensed with altogether, they injure the drafting boards, obstruct the squares, and disfigure the sheets.

(To be continued.)

MESSRS BRANCH CROOKES, and Co., of St. Louis, U.S., are introducing a novelty in saws, invented by Mr. J. W. Branch, which is thus described:—The inventor takes a circular saw-plate and inserts about thirty small pieces of steel or iron in which is embedded a bort or black diamond The small pieces thus inserted are made fast by a steel rivet to the saw disc. The circular plate is 60in. in diameter, holds thirty diamonds equidistant around its edge, and is capable of making over 650 revolutions per minute. This plate is affixed in the same manner as a regular circular saw for woodwork, but has a rubber pipe fixed in such a manner that a spray of water is running on the side, edge, and in front of the blade as it revolves, and answers a double purpose for cooling the saw-blade and wetting the stone. The saw is fixed above a bedplate which has a feed movement with head blocks on rollers The apparatus is portable, and can be set up in quarries, as well as in shops and stone-yards.

TO DYE LEATHER BLUE-BLACK.—Take of beeswax 3 ozs., black resin 2 ozs Mix together, and then add: Prussian blue 1 oz., lampback ½ oz While the mixture is cooling, add turpentine till a suitable consistency is obtained. It should be applied with a soft rag, and the leather afterwards polished with a brush.



THE ORIGIN OF THE TURRET SYSTEM.

NOTES IN A PULMAN CAR.

THE ORIGIN OF THE TURRET SYSTEM.

Since the period of the controversy between Newton and Leibnitz as to the invention of fluxions, it has been admitted by the common consent of men of science that second discoverers deserve no honours; and since the date when our patent system brought invention into our courts, it has become a maxim in law that second inventors have no rights. Nevertheless, the history of inventive progress shows in very numerous instances—amongst which are noticeable those of the steam hammer, of water-tight bulkheads in ships, and of the very subject on which we are about to write—that second inventors do, through the force of circumstances, reap the substantial rewards that belong to first inventors whose claims have been ignored or have fallen into oblivion in consequence of their invention having been too far in advance of the state of the arts and other circumstances of the time in which they lived. If an inventor is to receive a due meed of honour and the substantial reward of wealth also, his invention must not only have the conditions of novelty and value, but of immediate and wide-spread utility in the time of the inventor himself—in illustration of which we need go no further than to recall the splendid rewards reaped by Arkwright, Watt, and Stephenson. There is, therefore, all the greater reason that when a first inventor has found something which has made a subsequent and later one famous or opulent, the claim of the first inventor should be disinterred, and the posthumous honour that belongs to him duly rendered to him when no other reward can. *Palman qui meruit ferat*, should be the motto of a journal such as ours—jealous of the rights of inventors and equally ready to expose unjust pretension. It is with this view that we desire to place upon record the following facts, which appear to us to indicate that all that has been supposed valuable or novel in the turret system, whether applied on land or afloat, and which popular intelligence very generally views as evolved within the last twenty years, and which is commonly attributed chiefly to the late Captain Coles, was in fact invented, and its advantages clearly discerned and published, if not before Captain Coles was born, at least before he had left school or college.

An octavo volume now extremely rare and difficult to be procured was published at Paris in the year 1831, the author being a M. Baltard, under the following title*:

Essai sur la Fortification et sur les Tours à Batterie tournante considérés isolément ou réunies aux ouvrages dans les places de guerre aux fronts bastionés, et dans les ports de mer—précédé de quelques considerations sur l'état de l'architecture à l'époque de la renaissance des arts et sur la propos de fortifier les villes de Paris et de Lyons. Par Baltard, architecte exadjoint de 1re classe au gens militaire. 1831. It was printed by Crapelei, Rue de Vaugirard No. 9, and contains twenty-six folded lithographic plates, which together with the text, very clearly divulge most, if not all, of the salient features of the turret system.

Mr. Baltard the author, as we learn incidentally from his work, commenced his career at least as early as 1794, in the French War Office, as one of those civil employés in the department of military works and buildings who carry out in practical detail the requirements of those engineer officers whose indispensable assistants they become — it having been found impossible in the French service that a man educated as an engineer officer should also possess the varied and practical abilities of the civil architect and builder engaged upon constructions which are essentially those of the arts of peace, though applied very differently. He appears to have been employed in this capacity during the great wars of Napoleon I., but to have retired from direct official duties probably soon after the restoration of the Bourbons, in 1815. He had long previously turned his attention to the subject of revolving turrets as an element of fortification, both afloat and ashore, and had, if not completed, made much progress with the work before us, which, however, lay unpublished until the accession of Louis Phillippe and the projected fortification of Paris and Lyons — which seems to have been mooted in this reign earlier than we in England were aware — caused him to bring forward his plans by the publication of his book. Baltard lived before the iron age. His revolving turrets are almost wholly of timber, yet ably put together. Artillery, whether on land or at sea, had reached nothing approaching its present dimensions; and Baltard's circular towers, with walls of timber 4 ft or 5 ft. in thickness, and built up in the way he has indicated, would have offered a stout resistance to the artillery fire of his own period. He worked with the only material that was possible to him but so clearly has he discerned all the conditions that belong to the system of revolving turrets, that had he lived up to the time when the state of iron manufacture admitted of the production of armour plates, we cannot doubt that he would have applied these upon the exterior of his towers, the construction of the walls of which was such as to render them highly effective as backing for such plates. Amongst the twenty-six lithographic plates which illustrate the work are to be found examples of large revolving turrets raised *en caponnière* upon the salient angles and other parts of land fortifications, and upon a large scale dominating over the central part of polygonal forts in masonry and earth-work, all the parts of which, except the dominant turret, were sunk below the *terre plaine*. These are illustrated in many forms, and their use is illustrated finally in a skeleton map of Paris and country round, upon which he has indicated the dominant points at which he suggests the application of his system of turrets to a ring of detached forts. The general idea of construction of these land towers is sufficiently indicated by Figs 1 and 2, copied from his work, and giving in plan and vertical section one of these towers, in which, as will be seen by Fig 2, two floors, one above the other, each carrying guns, are made to revolve, the walls and roof of the tower itself being fixed. The walls of these towers, as may be seen by Fig 1, and also Fig 3, were built up of wedge-shaped blocks of hard timber, laid like voissoirs transverse to the thickness of the wall, and it was proposed in various ways that they should be "joggled" or "dowelled" together, being further secured and strengthened, both internally and externally, by complete circumferential thicknesses of timbers laid in the form of wailing pieces, and covering the whole of the surfaces external and internal. The guns were proposed being brought forward in succession by the revolving platforms, so as to be discharged through the embrasures on the engaged face of the turret, and after discharge to pass on, so as to be reloaded at the rear or unengaged face. In Fig. 3, is seen, to a larger scale, the built up construction of the wall, which, as regards its end-on voussoirs, presents a very distinct resemblance to Chalmers' system of backing for armour plate. In the Fig. 3, as also in Figs. 4 and 5, is seen the construction proposed for the embrasures. These were of cast iron in heavy masses, and consisted each of an external frame forming the jaws of the embrasure, and prepared to receive a large cylindrical casting perforated through like the plug or pin of a common cock, turning upon a vertical axis, a quarter of a revolution either closing the aperture of the embrasure against the entrance of projectiles, or leaving it free and open for the discharge of the gun within the tower.

The author suggests the use of these turrets for the defence of the ditches of his sunken land fortresses, where they would be to a great extent secure from fire up to nearly the period of the final assault. Many very useful hints are to be gathered from his designs for land fortresses which it would be outside our object to enlarge upon. M. Baltard also proposes the application of these revolving turrets to coast and harbour defences, by their forming parts of a sort of double turreted monitor, as shown on plan in Fig 6, and in transverse midship section in Fig 7, the transverse section of the turrets of the two ends of the monitor being of a construction sufficiently indicated by the section, Fig. 2, substituting therein the floating hull upon which the tower is built for the masonry of that section. The vessels proposed for this service were either to be specially built, or adaptations of the hulls of existing men-of-war cut down to a lower freeboard. The turrets occupied the extreme ends, and the entire length of the ship between these was walled in and roofed, so as to afford as much protection as possible to the men who were to give motion to the whole by the large sweeps or oars—the rowers being either convicts (*forçats*) or soldiers. Both sides of the hull to above the water line had longitudinal timber bulkheads at a distance of some feet from the side of the hull, the spaces within these being occupied in great part by large cylindrical hooped vessels of thick timber running in convenient

* Essay on Fortification and on Revolving Battery Towers, viewed singly or as parts of fortified places, with bastion faces or sea fronts—preceded by some reflections on the state of architecture from the period of the renaissance in respect to the fortification of Paris and of Lyons. By Bedard, ex-adjunct architect of the first-class of the Corps Military Engineers. Paris Published by the author, 1831.

lengths for the whole length of the ship; these, so far as we can gather, were intended to be imbedded in hard resistant ballast, which should give stability to the hull by balancing the top weight imposed upon it, and at the same time aid in resisting the penetration of any shot striking near or under the water line through the inner or longitudinal bulkheads, the object of the hollow cylindrical hooped vessels being to render the hull practically unsinkable. Many and obvious as are the defects evident in these designs, it is worthy of remark how many of even the very latest suggestions of the inventors and naval architects of our own day are comprised in them, though in a form more or less elementary. In weighing the merits and defects of these designs published forty-seven years ago, just criticism will always bear in mind the state of the arts at the period of their conception — about sixty years ago — and of their publication. Iron ship-building was unknown, steam navigation practically so, the primitive oar was therefore the only means left to Baltard to give mobility to his monitors, which by their very nature did not admit with safety of the application of masts and sails — a fact which it would have been happy for many had it been recognised in the more modern days of the Captain. There is a somewhat curious parallel between the history of these designs and those for water tight bulkheads now in such universal use in iron ships, the credit of the invention of which for a length of time was ascribed to the late Mr. Charles Wye Williams, of Liverpool, who proposed their introduction in some of the earlier iron ships. Water-tight bulkheads of timber were employed in several of the ships of war of the old French marine, and are clearly shown in the engravings and described in the article on naval architecture in the great French *Encyclopedie* of Diderot and De Lambre — folio edition. All that modern skill has effected has been to substitute iron for timber in these bulkheads as respects their primary object of rendering the ship less liable to founder, though since the hull itself has been constructed of iron the bulkhead assumed an additional value and second object in increasing the strength of the fabric.

A REMARKABLE AND VERY BEAUTIFUL SHADE OF BLUE is noticeable upon many of the ancient ornaments found in the tombs of Egypt. Analysis some time since proved the color to be formed by a combination of soda, sand, and lime, with certain proportions of copper, from which substances the Egyptians managed to produce three different products—first, a peculiar kind of red, green, and blue glass; second, a brilliant enamel; and lastly, the color to which reference is above made, and which was used for painting. By synthetical experiments, M. Peligot has succeeded in reproducing this peculiar shade of blue, by heating together 73 parts of silica with 15 of oxide of copper, 8 of lime, an 3 of soda. The temperature should not exceed 800 deg. Fah., as in such case, a valueless black product is the result.

A STRIKING SUNDIAL.—A sundial that strikes the hours is not seen every day, and many persons will doubt whether such a thing has ever had an existence. A dial of this description, however, has been invented and constructed by Abbé Allegret. It is simply a modification of what is termed the solar counter, for registering the times at which the sun shines or is obscured. To effect this there are two balls, one black and the other yellow, fixed at opposite ends of a lever substained on a central pivot. When the sun shines the black ball absorbs more heat than the yellow one, and the vapour of a liquid contained in the former is elevated to a higher temperature than that in the latter. As a result the vapour leaves the one ball, and being condensed in the other, this becomes the heavier, overbalances the equilibrium, and in doing so sets free a weight, giving motion to the requisite clock-work. In the sundial referred to, a pair of these balls is fixed at every hour-mark. When the shadow of the gnomon reaches any particular hour-mark one of the balls is shaded, a preponderance of liquid enters, the ball, the lever tilts, the mechanism is set going, and a gong sounded as many times as the number of the hour to be indicated. Of course the sun must shine at the time of the hour-mark being passed by the shadow, or the time will not be struck.

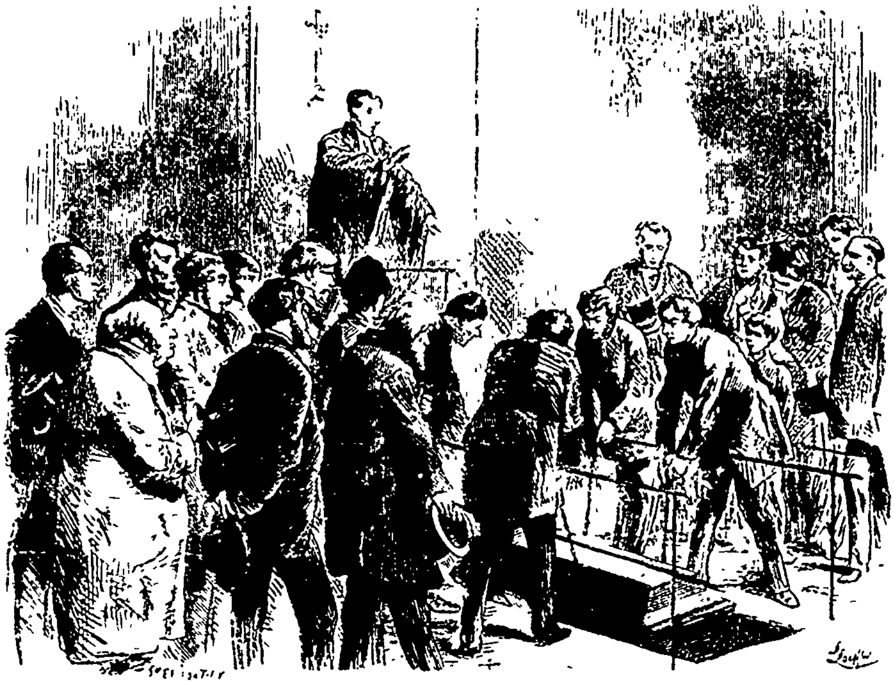
HOW CREMATION IS PERFORMED AT DRESDEN.

Nowhere has the proposal, recently revived by Sir Henry Thompson, to substitute cremation for interment, taken such a hold upon the public mind as in Germany. Already numerous cremation societies have been formed in that country and several furnaces intended for reducing human remains to ashes have been and are being constructed. On page 236, in this issue, we give a sectional view of the cremation apparatus recently erected at Dresden by the Siemens, at the request of Professor Reclam, on the model of a furnace exhibited by that firm at the Paris Exhibition of 1867. The mode of conducting the operation of cremation by means of this apparatus is thus described by Herr F. Siemens, of Dresden:

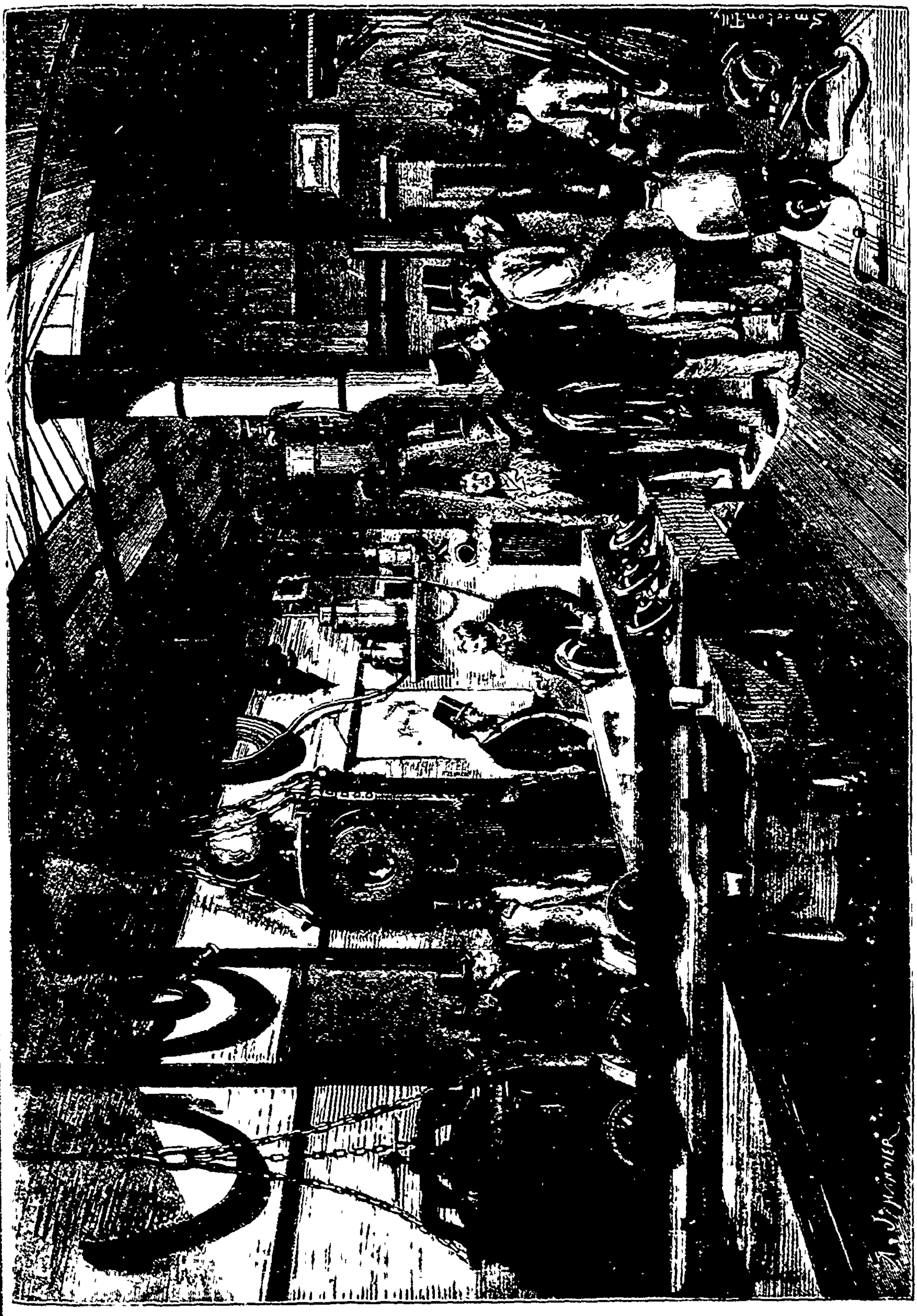
The entire apparatus consists of three distinct parts: first, a gas generator for the production of the gas necessary to heat the furnace, outside the building; secondly, the proper furnace with the furnace and cremation room, inside the building; thirdly, the pipe or flue for carrying off the product of the operation. Imagine, then, a large, handsome building, suitably constructed for the purpose for which it is intended, in the middle of which is built a furnace, out of sight of those inside the place. The funeral procession enters the edifice, as it now enters the churchyard, and the coffin is placed on a catafalque. After the usual ceremonies, the remains are lowered (as shown in the illustration) into the vault, the cover of which has been previously raised, and is immediately closed upon the reception of the coffin. The manner of performing the operation of cremation by the means of heated air is then as follows. The gas generator is so contrived that every four or six hours the fuel is replenished (apparently on some self-feeding system). The gas is then carried off, as fast as produced, through a pipe furnished with a regulator valve, into the "Regenerator," or furnace proper, where a regular current of heated air is kept up, by means of which the gas is converted into flame. This flame fills the furnace, keeping the bricks at a white heat and the receptacle for the remains at a moderate red heat, and finally escapes through a conductor leading to the chimney. As soon as the furnace is in this condition the operation may be commenced. The furnace cover is lifted, as shown in the illustration, by a man whose business it is to attend to the furnace, the coffin is lowered into its receptacle, the cover of which is fastened down, and the remains are exposed to a red heat for a longer or a shorter time, according to the physical condition and constitution of the deceased. When the body has been exposed to the heat for a sufficient length of time the regulator valve is closed and the gas shut off. The heated air streams through the furnace and speedily operates a dissolution of the more combustible portions of the now dried up body; while the bones are destroyed by the heat, the carbonic acid passing off through the chimney, and the calcareous matter remaining in the form of a fine powder, which is subsequently collected for preservation as the friends of the deceased may wish. With an apparatus such as this, Sir Henry Thompson has made several experiments. On one occasion he consumed a hog weighing 227 pounds in 50 minutes—the operation being conducted without the slightest offensive smell, or any perceptible escape of gas.

In conclusion, we may quote the words used by Professor Gottfried Kinkel at the cremation meeting held at Zurich in March last. His argument should appeal strongly in favour of cremation to those who, as in the case with many in Montreal, have had frequent cause for complaint owing to the unchecked and repeated desecration of the resting places of their dead —a desecration shameful beyond words when conducted, as in this city, at the instance and under the auspices of the civic authorities.

"It is not our wish to use compulsion in the introduction of any new practice. There is nothing to prevent those who may desire it from being laid to rest in the bosom of the earth I should look upon it as a horrible thing if one were to make the idea of death yet more unbearable to some people by saying to them 'You must submit to cremation whether you will or no' But it is a still more horrible thing if the State is to say to the man who wishes his remains to be consumed 'You must and shall be buried in this hired lot, and when it seems good to the authorities you shall be removed to make room for another.' Sooner will he trust to cremation for a sure and untroubled resting place for our dead."



HOW CREMATION IS PERFORMED AT DRESDEN.



MR BAZIN'S NEW MODEL FOR STEAMSHIPS.

Mechanics' Magazine.

MONTREAL, NOVEMBER, 1874.

ILLUSTRATIONS:

CONTENTS:

SIR SAMUEL BAKER'S ANTI-SLAVERY EXPEDITION.

Sir Samuel Baker's new book which has been looked for anxiously for some little time has at last appeared and is as readable and full of interest as his others works on African travel. Few travellers have ever succeeded in placing the records of their researches and adventures before the public in so inviting a form as Sir S. Baker. Our illustrations on page 240, are from the work itself, *Ismailia*. The first engraving represents Mr. Higginbotham, accompanied by Dr. Gedge and the English party, together with all the Egyptian mechanics, on their way across the desert in charge of the steamers and machinery, carried by some thousand camels.—The following description will explain the second engraving, "Liberation of Slaves." On a certain occasion a vessel hove in sight, apparently laden with corn in bulk, and, it was stated, with ivory beneath the corn. Colonel Abd-el-Kader, a zealous subordinate of Baker's, feeling suspicious, thurst a steel ramrod into the corn. A smothered cry followed, and presently he dragged to light a negro woman. Further discoveries disclosed a hundred and fifty human beings, boys, girls and women, packed like herrings in a barrel. One young woman was sewn up in the lower part of the sail attached to the main-yard. Sir Samuel Baker gives an interesting account of the manner in which he disposed of these captives. — The third engraving represents a night attack made by a hippopotamus on the boats. With one blow he capsized and sank the zinc boat, with its cargo of flesh, and then he seized and splintered the dingy into fragments. Though Baker fired shot after shot at him, he returned to the charge, and it was not till after a long time that he was killed.—"The Forty Thieves" were a corps of forty-six picked men, half black and half white. They were so nicknamed owing to their light-fingered character, but eventually they became a model of morality. In the last engraving they are depicted in the act of advancing to meet the attack of the slave-hunters at Fatico. The slave-hunters had treacherously opened fire on Baker's troops, and as he had already had several men wounded, he called the "Forty Thieves" together, and ordered the bugler to sound the bayonet charge, whereupon the enemy took to flight. They were pursued four miles, and more than half of the party were killed.

ARTIFICIAL AND ADULTERATED BUTTER.

A very large amount of butter that is not all butter is stated to be constantly produced now, here and in Europe. The products are not all alike and vary considerable in excellence. Some of these we have seen, and they looked well, tasted well and were probably just as wholesome as pure butter. Still there was a difference both in appearance and flavour. Considerable quantities of this butter have been shipped to Liverpool from Canada, but the merchants there have learned to detect it now, and it is said to be difficult to sell. English dealers are stated to be shipping it to the United States whence probably it finds its way to the South.

The chemical detection of adulterated butter is by no means an easy matter. Mr. John Horsley, however, furnishes to the *Chemical News* the results of some recent experiments, which were directed toward the detection of meat fats mixed with butter, and therefore the process indicated will prove useful both to those suspecting such adulteration in genuine butter, as well as to others who are not sufficiently expert to distinguish the artificial from the inferior qualities of the real article.

Fresh butter is permanently soluble in methylated ether of specific gravity 0·730 at the temperature of 65° Fah. With the view of determining whether any other substance contained in the butter could be precipitated from it, Mr. Horsley first placed 25 grains of the fresh material in a test tube with 1 dram of methylated ether, in which ready solution took place. Thirty drops of methylated alcohol, 63o over proof, were added, and the whole agitated, but nothing was precipitated. The experimenter then mixed 10 grains of fresh butter with 15 grains of mutton fat, and added the liquids as before, when, in less than half an hour, the fat was precipitated, the heat of the room being 68o Fah. Lard, beef, mutton, and tallow fats, properly melted together in proportions of 60 grains of butter and 40 of fat and stirred until cold, can each, by a similar operation, be precipitated in a few minutes. As much as 30 per cent. of the fat first used has thus been recovered. This is a simple and direct way of dealing with such adulterations, and is superior to the process of estimating the butyric acid. It should be observed, however, that crystalization of butter out of the ethereal solution at a lower temperature than 65o must not be mistaken for the fats precipitated by the alcohol alluded to, since the butter, besides being so much lighther, occupies the upper layer, and is different in character and easily remelted by the application of the warm hand for a minute or so.

Our illustration on page 237, is from the London *Graphic*, and is entitled "Notes in a Pulman Car." Pulmans are now thoroughly established on the Midland line and are making their way on others. In fact their introduction has perhaps excited more popular interest in England than any subject since the Tichborne trial. Since the recent abolition on some English lines of the second class carriages the Pulmans have become the first class, and the old first class, the second class carriages.

STEAM *VERSUS* FIRE IN MINES.

The employment of steam at West Pittston, Pensylvania, in subduing the fire at the Empire mine, has resulted in a triumphal success for the Lehigh and Wilkesbarre Coal Company The fire originated at the boilers which were situated at the head of slope No. 5, which leads from old abandoned mines down to newer workings, while the old slope leading to the surface served merely as an upcast used for ventilation only. Here stood a wooden stack, which, on the night of December 31st, of last year, was discovered to be in flames, while at the same time the timber supports in the old workings on each side of the slope had served to extend the flame in all directions through the abandoned chambers. The arrival of officers and men was met by a torrent of flame sweeping through 1000 ft. of slope, from a level 356 ft. below. Water was poured into the slope from a reservoir, and also turned on from the lower end of the boiler feed pipes, while every effort was used to cut the air from the flames. But the entire slope falling in three hours after this plan was adopted, and the fruitless efforts to substitute a steam-pump worked from the mine engine below, showed plainly that only the most rapidly-planned and promptly-executed methods on a large scale could save the engine-house and the boiler gangway, which, if lost, would lose everything.

In order to conquer the flames and prevent their spreading to the other workings a slope was driven from the surface 160 ft. through an exceedingly tough clay, and divided into downcast and upcast.

In fifteen days the old slope was reached, and a plank "manway" was held by continually playing the water upon it until one of stone was built and pushed through in sections, by which the crossing of the burning slope was effected.

In every chamber below the intense heat crumbled the outside of the pillars, which kept the masses of glowing coals perpetually supplied. Here "manways" were built beside each pillar only by continually playing water upon them, with the men working in a temperature of 170 deg., while from the rising of black damp, five minutes was the maximum limit of stay. Of 800 men employed in fighting the fire not one life was lost. As the fans could not be stopped a moment, signals were adopted for warning if one gave way. This was essential since the current of air and smoke had two miles to traverse before emerging from the mine.

All the machinery, lumber, and stone for "manways," supporters, and walls were brought over the most mountainous roads in the depth of winter, while the outside water that had been available was soon frozen solid, and the mine water, which rapidly corroded the machinery and hose, had to be used over and over again.

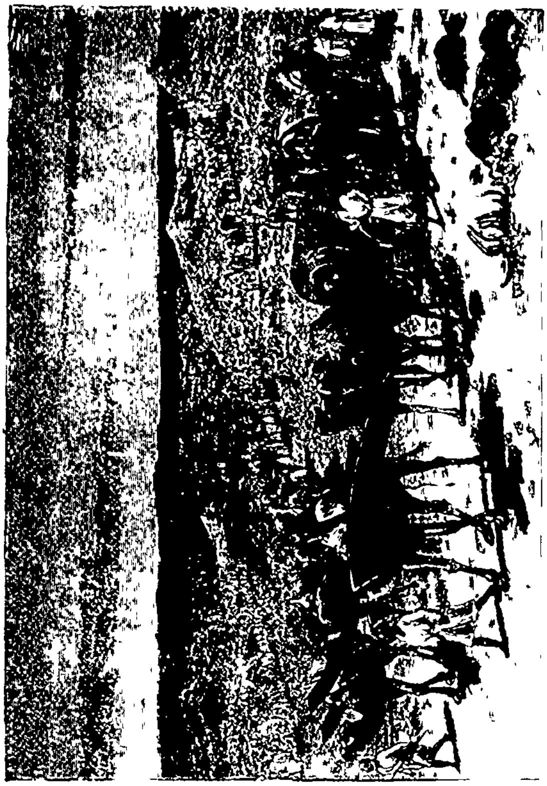
At the close of February the fire had been nearly enclosed when the tokens that the roof of the old workings would soon fall, caused the refusal of the men to remain in the mine, fearing the concussion of the air, but the fall proved so gentle that the watchers were unware of the occurr , and when the men returned it was found that the fire had extended to double its original dimensions, while air currents were reversed, and connecting passages flooded or closed, which gave rise to the dilemma that if the fans were kept working it would be feeding the flames, while to stop them was certain death to the workmen.

At this juncture, the mine manager, Mr. Lewis S. Jones, urged the trial of steam, and tested it in spaces still enclosed with such success that a wall was soon completed, entirely surrounding the old workings; all cave holes packed with clay, and steam from eighteen boilers driven down through pipes by May 1st. At that time the test thermometers registered 176 deg., while, within four weeks, the lower stratum was cold. It is proposed, however, to continue the steam until January 1st to provide against all possibility of further danger.

It is astonishing how severely Nature enforces the Divine edict that by the sweat of man's brow shall he obtain bread. The Irishman was becoming a second Italian lazzarone, living on potatoes which produced themselves almost without labour — when suddenly Nature stepped in and stopped it all by cutting off the potatoes and compelling him to work at growing something else. In the same way here in the valleys of the St. Lawrence and Richelieu Rivers, the farmers kept on growing crop after crop of wheat until they had also cultivated the insects which feed on it to such an extent that wheat became soon as scarce as it before had been universal The same chain of circumstances is now repeating itself in central Europe. The culture of the vine has gradually grown there to immense proportions. In France alone the agricultural and commercial interests involved in this product are estimated at $750,000,000 yearly. This great production is now suffering a most severe attack from a little insect hardly visible to the naked eye. The Phylloxera vastatrix, this little enemy, is making such devastation among the vineyards, that their very existence is threatened, and, with them, an industry which pays yearly, into the revenue of one European country alone, a revenue of about $8,000,000. There is now almost no part of Europe in which the pest has not made its appearance. On page 252, we illustrate the appearance of a vineyard, near Cette, in France, attacked by Phylloxera, and also three figures of the insect itself magnified about 5000 times. Fig. 1, represents a winged female; Figs. 2 and 3, views of a wingless female insect seen from above and from below. These insects are carried to new untouched vineyards, by the wind. Arrived at a new feeding ground they bury themselves in the earth and multiply so rapidly that, attacking the vines about their rots, they very soon in spite of their small size, spread devastation and ruin over a large surface of the country. No perfect remedy has yet been found for the plague, although the French Government has offered a reward of $50,000 to the discover of a cure. The only remedy at all successful so far is the submersion of the vines for a short period. This attacks the pests by drowning them out, as they multiply and feed under the surface of the ground. If submerging turns out to be a perfect remedy it will be another instance of the great benefits to be derived from artificial irrigation.

We illustrate this month on several pages the manufacture of tobacco as pursued in Paris. Tobacco is used to an enormous extent in France, the consumption in Paris alone mounting to an annual value of 40,000,000 francs. We are compelled to defer a short description of the processes employed till next month.

Not long since we gave our readers an illustration of the steamer "Castalia," one of the two new types of steam ferries for service between England and France. On pages 225, and 228, will be found illustrations of the Bessemer, the other type. She has been already fully described in these columns, as to her plan and mode of construction. We hope soon to be able to inform our readers as to the relative merits of the rival boats, as decided by actual service.

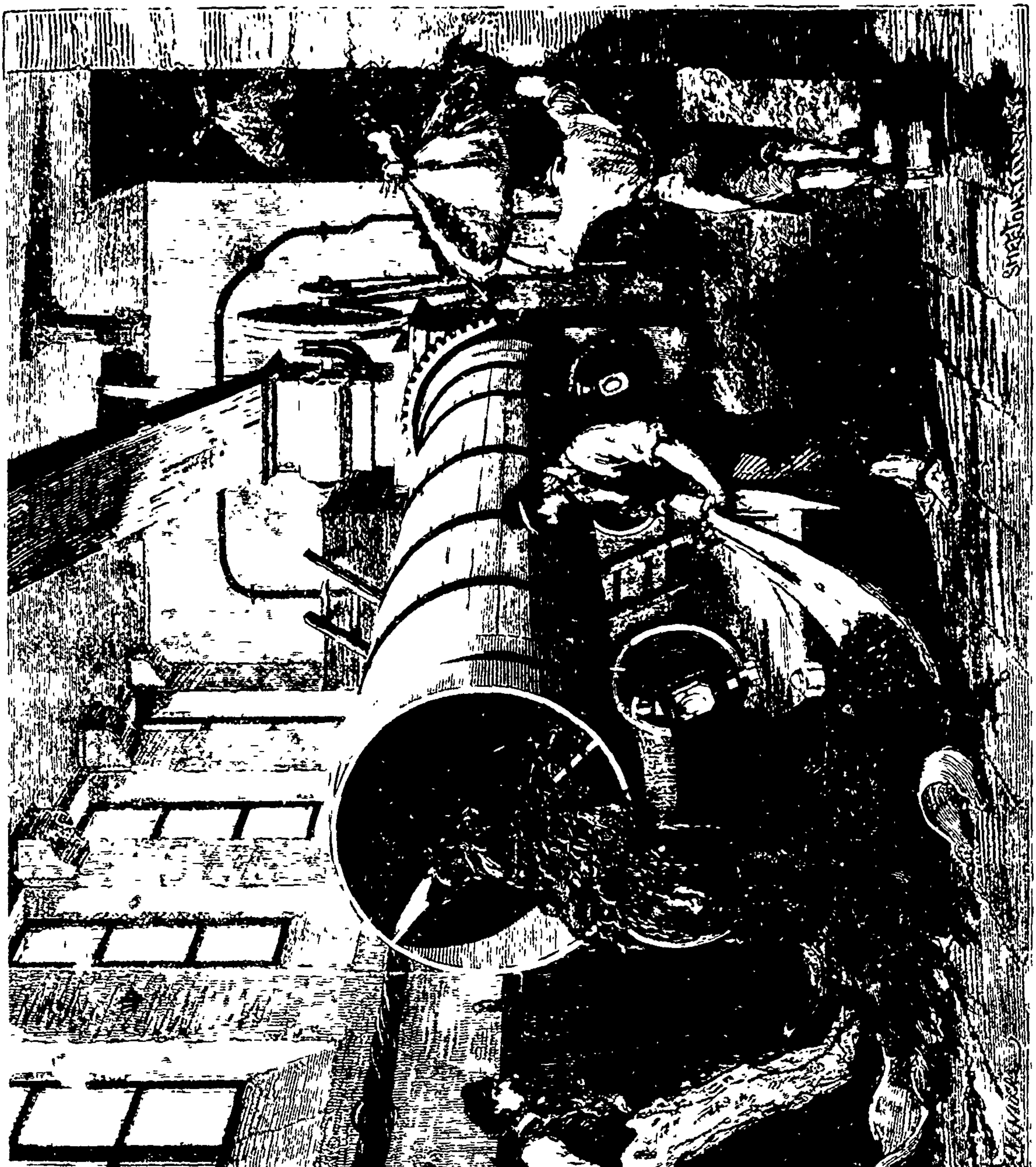


THE CAMEL TRANSPORT OF [illegible]

THE SLAVE HUNTERS' ATTACK ON FATIKO — THE ADVANCE OF THE 'FORTY THIEVES.'

LIBERATION OF THE SLAVES — THE CAPTURE OF THE SLAVE BOAT.

SIR SAMUEL BAKER'S ANTI-SLAVERY EXPEDITION.



TOBACCO MANUFACTURE IN FRANCE.—DAMPING THE LEAF.—MACHINERY.

M. Bazin, a well-known French engineer has recently brought to a somewhat successful conclusion, some investigations into the possibility of increasing the speed of vessels. This could only be done in one or two ways — either by increasing the power exerted or by diminishing the resistance. The latter was aimed at by Mr. Bazin and he claims, by his device, to have so far done away with the friction of the water on the hull as to have very materially increased the speed attained without increasing the power employed. His invention consists in replacing part of the hull by movable revolving surfaces between which and the water there will be almost no friction.

Our illustration on page 237, represents a visit made by the Grand Duke Constantine, of Russia, to M. Bazin's establishment. The proposed form of the hull may be seen in the model on the left of the engraving. As yet the principle is in the experimental stage but the inventor proposes to construct, very shortly, two vessels on his model which will solve the question. One of these vessels will be a river steamboat to carry one hundred and fifty passengers and which is expected to attain a speed of thirteen knots with engines of 170 horse power. The other will be a steamship for Atlantic service of 2200 tons burthen, which, with engines of 1500 horse power will attain a speed of at least twenty knots and thus reduce the passage from Havre to New York to a matter of less than six days.

Our illustration on page 249, is a striking contrast to the last new cannon. It represents a colossal cannon cast about 200 years ago by Rajah Gopaul of Tanjour. This monster gun is 24 feet long and 3½ ft. in diameter. It was raised on to its carriage and worked by means of eight rings four on each side—two only remain now on the side represented in our engraving. The gun is said never to have seen any active service, but it has often been fired and the report made itself heard at a distance of ninety miles. The balls used were of granite, some of which remain peacefully beside the gun which will probably never again be fired.

ART SCHOOLS IN SOUTHERN GERMANY.

BY SCHELE DE VERE.

In one of the most beautiful parks of the Old World there rises on a slight eminence, a vast building, presenting to the south a line of immense windows, and filled in winter with the magnificent old orange trees of the Royal Gardens. Hence its name of the Orangerie, by which the good people of Stuttgart, the capital of Wurtemberg, designate the noble structure. During the summer months of the year 1872, however, the building contained treasures of vastly greater import for the little kingdom than the costliest exotics and the rarest plants of the world. Every five years an exposition is held there of a special class of schools, the usefulness of which cannot be well over-rated, whether we look at the tangible results shown in this great hall, or at the influence they exercise on the taste and the wealth of the people.

From time immemorial the people of Southern Germany have exhibited rare talents for the higher branches of mechanical arts. No traveler through Swabia and the lands on the Rhine can help being struck with the exquisite beauty of villas and villagers' houses, while railway-stations, and even the flag-keepers' little huts, are often real master-pieces of architecture, and loaded with a profusion of admirable wood-carving. Swiss carvings are familiar to most of us; but the wealth of ornamentation with which the modern houses of Germany are decked is a matter of wonder and admiration to all new-comers. From majestic Berlin in the north to the smallest village in the south these new structures show in every feature of their architecture a master's hand; lintel and coping, window-frames and cornices, are cunningly carved by skilful stone-masons; front and sides are covered with fresco-painting in subdued colors and classic patterns; and in suitable places, over the wide entrance-gate or in well-arranged medallions, the sculptor finds room for a noble statue or a portrait-bust. Nor is this love of ornament limited to the great and the rich; the humble house has its galleries with richly-carved railings and graceful cornices, and even the vintner's modest hut in a cucumber field has its few titbits of rich coloring and delicate carving.

The skill which has placed all these sources of enjoyment, these etchings of beauty which remain "a joy forever" to the educated eye, within reach of all, is the result partly of an innate love of the beautiful granted from on high to most Southern nations, and partly of an admirable system of education which finds its expression in the above-mentioned exhibition. For long years the little kingdom of Wurtemberg has been famous among German principalities for its Sunday drawing-schools, frequented by mechanics of all degrees, from the youthful apprentice to the hoary master. Here, during the hours not devoted to divine services, volunteer teachers, enthusiasts for their art, met their volunteer pupils, and taught them drawing in all its various branches. The time was necessarily very limited, and hence, for many years, no real artistic skill could be obtained in these schools except by a few rare children of genius. The hard, coarse work of the week often destroyed the delicate touch required for holiday labors, and the eye alone could be permanently benefited.

It was not until the year 1854 that the general interest felt in this kind of instruction by men of influence and far-seeing statesmen on one side, and by the eager, ambitious mechanics of town and country alike on the other side, led to the establishment of regular evening or night schools for the same purpose. It was a noble sight to watch the weary artisan and the hard-working mechanic come hither after a day's incessant labor still anxious to improve, to learn, and to benefit others as well as himself. Youths of barely fifteen, sturdy men in the full vigor of their strength, and old, gray-haired masters, all met here as humble pupils to teach the stiff fingers new and rare skill, to train the eye to perceive unsuspected beauties, and to reproduce with the brush or the burin, the hammer or the saw, the masterpieces of great artists. The schools were over-crowded; soon one hundred and twenty-five such institutions sprang up in the small kingdom; the indispensable expenses of room rent, gas, models, etc., were cheerfully borne by the eager learners, and ere long the results appeared in every town and every village. Low, dark huts were replaced by bright, cheerful houses; dirty mud-walls reappeared as bright, stuccoed surfaces, to which a few sparing bits of color gave light and beauty; the low door with its stone seat displayed a modest garland or well carved flowers, to take in winter the place of the vine and the clematis; and neat little summer-houses arose, as if by magic, in every garden. Far greater of course, was the change in towns and cities, where entire new quarters were built in the improved style of architecture, giving the mason, the painter and the sculptor ample opportunity to display their newly-acquired skill But the most cheering encouragement came when the great London Exhibition revealed to the astonished multitude the beauty and the skill displayed in the workmanship of mechanics trained in these Wurtemberg schools, when prize after prize was obtained by their pupils, and when finally, sensible Englishmen actually sent their most talented workmen to learn the secret of such great success, the joy and the pride of the people knew no bounds.

The immediate effect was the extension of the facilities heretofore offered only at night and during a few Sunday hours Every school in the land, above the humblest, arranged a large hall, which was kept open on one day of the week to all who chose to avail themselves of the opportunity. Then winter courses of six months' duration were added for the benefit of laborers whose work ceased with the fine season. Finally a class of special schools sprang up, under the name of Fortbildungs Schulen—literally schools for further advancement—to which all had free access who wished to profit by its instruction and who were willing to pay the small fee required. For, as in the excellent public schools of the kingdom, so in these technical schools also, the principle was adhered to that he who could must pay, since no one values much what is given away without price. Those really unable to pay even the small fee required here and in all public schools find no difficulty in being admitted gratuitously; and then education may be said to be virtually free throughout the land, from the village-school to the universities. In the case of the industrial school the state pays one-half of the expenses, and the community in which the school is placed the other half, and nothing can speak more forcibly of the usefulness of these instructions, and the good sense of the people in appreciating their worth, than the fact that there are now four hundred such Fortbildhungs schools in operation.

It was soon found that the eagerness with which instruction was sought, and the endless varieties of subjects for which pupils called, required a subdivision in the general purposes of those schools. They divided in the larger schools, into a mercantile department, where book-keeping, the laws of exchange (very complicated on the Continent), modern languages, telegraphing, etc., were taught, and an industrial department for geometry, physics, chemistry, mechanics, and the so called fine arts. What deserves special praise is the fact that, with a view to the true interests of the other sex, special schools of this kind are established for married and unmarried women, and the benefits arising from the source of lucrative employment thus opened to deserving and well-qualified women can hardly be over-rated.

Every five or six years all these Fortbildungs schools unite in holding a general exhibition, such as was held in 1872 in the city of Stuttgart. Separate alcoves are allotted to each district and within the narrow compass each town or village has again its small space to itself. Here are shown not only the best that each school can boast of, but the actual working-books, drawings, and daily tasks of the pupil, inscribed with his name This creates naturally an eager competition; district vies with district, school with school, and pupil with pupil. The exhibition is visited by thousands; the king and his court never fail to inspect every part of it minutely; anxious friends and relatives crowd around the tables of their native place; artists and masters of every handicraft come from abroad to see and to learn; and foreigners examine with growing interest these works of humble, unlearned workmen. No branch of mechanical industry is wanting in this admirable collection, from the horseshoe to the artistic bronze, from the mason's rough centre-stone, to the sculptor's bust. The lock smith shows his new combination lock, and the draughtsman his new patterns for calicoes and silks. Models abound in wax and in clay, in stone and in precious metals. The younger pupils content themselves with faithful copies of masterpieces, but many an exhibitor of barely fifteen already ventures to send his newly-invented problem in mixed mathematics, his original model of carving, or an etching of his own invention. In the purely ornamental department, female pupils excel naturally by native taste and a keener sense of the beautiful, and many are thus trained to compete with experienced artists for the very lucrative places of draughtsmen in great factories. Nor are the domestic wants neglected; cooking for the house and brewing for the multitude, the making of inlaid floors for the parlor and the building of palaces and great institutions, are all thoroughly taught, as well as the art of the landscape-gardener, the horticulturist, and the florist. Agriculture alone is excluded, as that is taught in special schools, such as Hohenheim, which have already obtained a world wide reputation.—*Appleton's Journal.*

TREATMENT OF TIN SCRAPS.

In the manufacture of tin ware it is said about 6 per cent. of the whole of the plates employed disappears in the form of scraps. The enormous trade in sardine boxes produced at Nantes, in 1869, nearly 400 tons of scrap; Birmingham produces some twenty tons per week; and Paris fifty to sixty tons per month. A small quantity of these scraps has always been used in various ways, such as the addition of a small quantity to the pig-iron intended for steam cylinders; another small portion was treated by concentrated sulphuric acid, or a solution of caustic potash, but no one treated tin scrap on a large scale until a short time since.

The utilisation of a waste substance is like the saving of the penny, it helps to keep the pound unbroken, and the best method of utilising such a large product as tin scrap becomes a matter of importance. The subject has been treated in the journals within a short period, but M. Kuenzel has taken up the subject in an exhaustive manner in the *Berg und Uttannannische Zeitung*, which demands attention. The article is of considerable length, but we shall give the purport of it in the shortest space consistent with intelligibility.

The mode employed comprises four chief operations — (1) treatment of the scraps by means of boiling in water acidulated with hydrochloric and nitric acid, until all the tin is dissolved; (2) precipitation by means of zinc, of the tin contained in the above solution, and washing of the precipitate; (3) solution of the precipitated tin in hydrochloric acid, and crystallisation of the chloride of tin; (4) utilisation of the iron scraps when despoiled of the tin.

1. Care in buying tin-plate scrap is one of the first essentials in a financial point of view. Good tin scraps contain from 5 to 9 per cent. of tin. Of course, the thinner the plate the greater is the amount of tin. French tin plate has 1½ to 2 per cent. more tin than English, as the plates are rougher, but it is very important to remember that the French tin is often, probably almost always, mixed with lead, a fact which may be ascertained by wiping the tinned article with a clean handkerchief, when, if lead be present, it will show itself. If the lead exceeds 10 per cent. of the tin, the scraps should be refused, as they are more difficult to treat, and leave the iron in a worse condition. Lacquered tin boxes, like those used for French sardines, give bad scrap, for the lacquer has to be destroyed by heat, which reduces the amount of tin recovered. Sometimes the scrap does not contain more than 2 to 4 per cent. of tin instead of 6 per cent., besides being mixed with lead. Galvanised iron (*fer zingué*) should also be rejected. When not packed, scrap tin is very difficult to carry, a tent-on truck will not hold more than three to four tons; the best way, if possible, is to pack the scrap in old barrels or cases, and ram it down well. In France the scrap is made up into packets by being rammed into a wooden mould, rather broader at top than at bottom, and holding one or two cwt.; the packet is then fastened round with iron wire. The scrap thus packed must be well separated, or many pieces will stick together, and the action of the acid will be materially impeded.

2. The solution used to dissolve the tin is composed of one part of raw nitric acid and ten parts of raw hydrochloric acid At first wooden vats, holding about three cubic metres were used, but the acid destroyed them rapidly. The best vessels are those of stoneware, or vats of wood or of brick dressed inside with a hot mixture of one part of sulphur and two parts of sand. At the bottom of the vat, which should contain at least one metre cube, a vulcanite pipe is introduced through which steam may be introduced from a boiler. The vat, or back, is nearly filled with scraps, a three-meter vat will hold about 600 or 700 kilogrammes, the mixture of acids is then poured over the scrap, and water added to about four-fifths of the height of the scraps; the steam is then introduced till the solution completely covers the scraps, and is continued until the whole of the tin disappears from the upper scraps, and hydrogen ceases to be disengaged, showing that the solution has become neuter. The boiling takes generally about half or three-quarters of an hour. A cock at the bottom of the vat allows the liquid, which contains all the tin, a certain quantity of chloride of iron and of chloride of lead when the tin is not pure, to run off into a receiver into which nearly all the chloride of lead is precipitated by cooling. For the treatment of 1000 kilos. of scraps, containing 5 to 6 per cent. of tin, the average quantity of acid employed is 300 kilos. of hydrochloric, and 30 kilos. of nitric, diluted with 3½ to 4 cubic metres of water, of which a small quantity is used to wash the iron left in the vat, but which is saved for the next operation. The iron is then removed by means of forks, and made up into packets of various sizes, according to the purpose intended. These must not be kept in heaps, for they oxidise rapidly, and the heat thus produced will even heat them to redness. A heap of about 100 tons was once burned in this way. For the treatment of three tons of scrap in twelve hours, six or seven vats, of about three cubic metres capacity each, are employed.

3. The solution cooled in the receptacle already mentioned is now transferred to a large wooden or brick cistern, filled with old zinc-plate or scraps, which precipitates the tin, and also any lead which remains in the solution. This process should not produce any gas, as that would show the solution to have been too acid, and cause a useless loss of zinc. From time to time a small quantity of the solution, slightly acidulated by means of sulphuretted hydrogen, is tested to ascertain if the precipitation is complete. The operation is generally effected in two hours. When terminated, the solution is run off from the bottom, through a filter made of sailcloth, which stops any of the tin precipitate which may be floating, and the liquid is of no further use. The zinc is then moved about to cause as much of the tin as possible to fall to the bottom, and the solution from another boiling is then introduced. This operation is repeated until this vat or cistern is one-third or half filled with tin. About sixty-five to seventy-five parts of old zinc are required to precipitate 100 parts of tin Theoretically, it should only require fifty-five parts, and the overplus must be attributed to an excess of acidity and to the oxides of zinc and lead generally present in the old zinc.

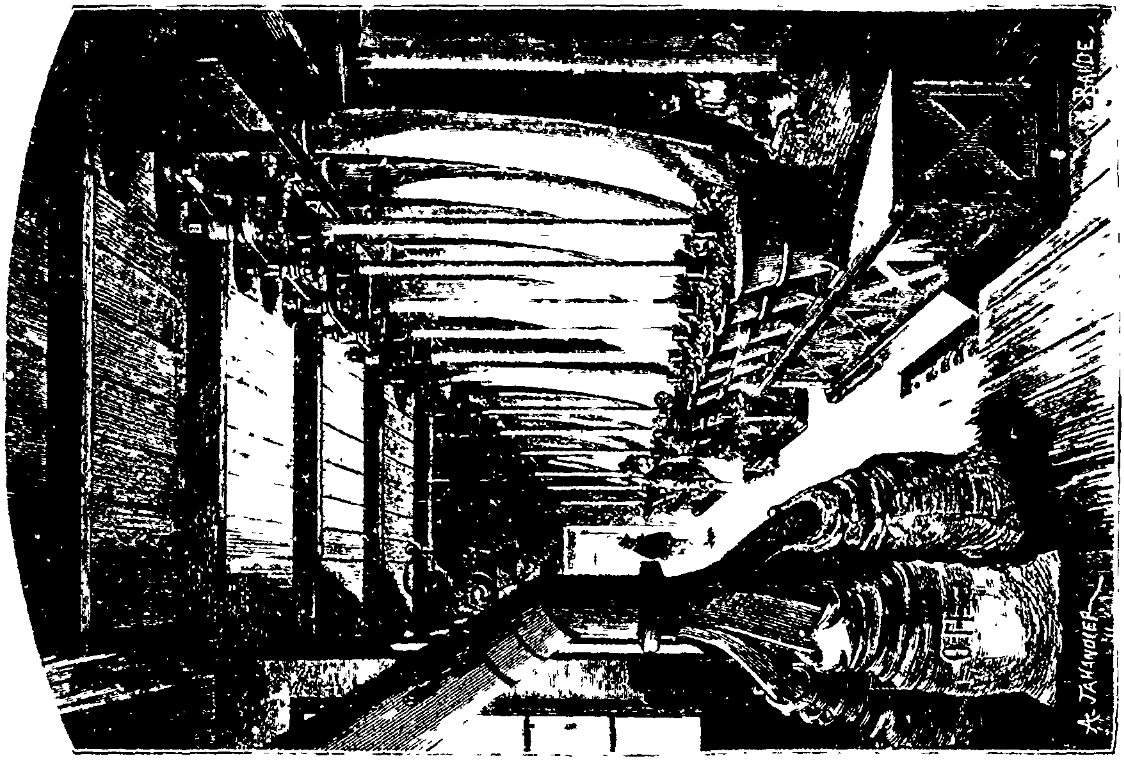
The precipitate obtained, which is mixed with fragments of zinc and tin solder from the old zinc, is taken out of the vat and thrown on a metal sieve with holes about three or four 25ths of an inch in diameter, and a stream of water being directed on the sieve, the precipitate is carried on to a sailcloth filter. On the metal sieve will be found scraps of tin-plate not affected by the acids, and some tin solder; the former is thrown into the boiling vat, the latter cast into ingots for sale. The precipitate is washed in the filter, as long as any trace of iron remains, and is then placed in canvass sacks, and the water squeezed out by means of a screw or hydraulic press. The precipitate is employed in making chloride of tin; it is well to dissolve it in hydrochloric acid as soon as it is taken out of the press, or, at any rate, to sprinkle it with it, as otherwise the tin oxidises rapidly, and the oxide will not afterwards dissolve in the acid. It is far more advantageous to convert the precipitate into chloride than to cast it in metallic ingots, as the former being very finely divided is worth much more in the market. The mode of making crystalised chloride of tin is too well known to require description. The treatment of the residues insoluble in hydrochloric acid is important. These residues consist principally of chloride of lead and oxide of tin. These have

TOBACCO MANUFACTURE IN FRANCE.—Washing Presses.

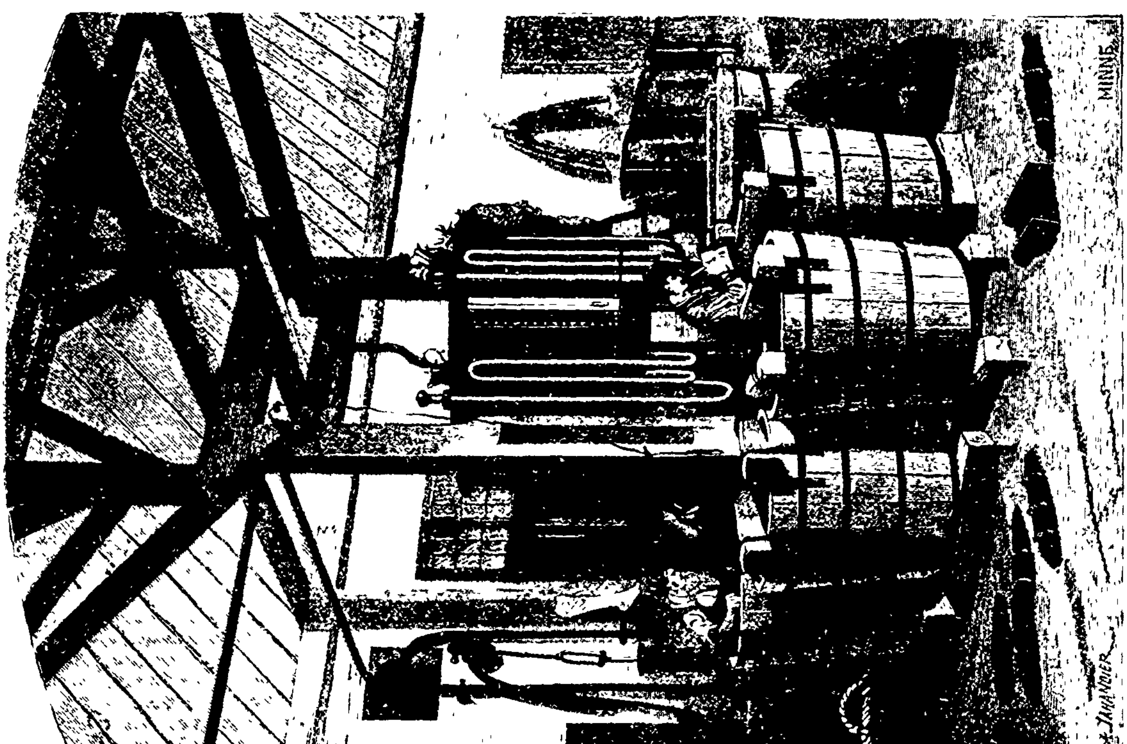
TOBACCO MANUFACTURE.—Cutting off the Stolds.

been successfully treated in a small Belgian zinc oven, in which the residue is made of a red heat in six retorts, arranged in two lines, and inclining forwards at a considerable angle, after being mixed with twice its own weight of fine poor coal. If the residue contain sufficient chloride of lead all the tin will be transformed into volatile chloride, which condenses in the retort, and metallic lead is also formed, partly in the neck of the retort, and partly mixed with the residue at the bottom, from which it is separated by washing. If there is not sufficient chloride of lead in the residue, some must be added from the receptacle, described in paragraph 2.

4. When only a small quantity of tin scrap is treated daily, and sulphuric acid can be obtained cheap, it may be advantageous to convert the iron from which the tin has been recovered into sulphate, but not when large quantities are dealt with. At Liége about four tons of tin scrap have been treated daily which would give about twenty tons of sulphate of iron. Such a quantity could not be placed advantageously in Belgium. It was necessary, therefore, either to find other applications or remove the prejudice against such scrap iron. This scrap, made up into compressed packets, yields, with a loss of 20 to 25 per cent., an extremely brittle iron, but which may be rolled hot, and then presents an excellent surface. The demand for this was, however, small. Another method which succeeded better was to make up the scrap in bundles of about 10 lb. each, and to introduce them into the puddling-furnace to the extent of from 10 to 20 per cent. of the charge. The packets



TOBACCO MANUFACTURE.—[illegible]



TOBACCO MANUFACTURE.—MECHANICAL WASHING.

should be put in when the iron is most covered with scum. This scrap iron exerts an especially favourable influence on pig containing much phosphorus, the puddled iron gains in quality, and the production is notably increased in quantity. White pig-iron of excellent quality has been obtained by smelting this scrap in a reverberatory furnace, mixed with turnings of grey pig to the extent of two to five. About 800 tons of this iron scrap have been sold in England, but for what purpose is not stated.

The cost of treatment on the basis of the price of iron in 1869-70, less the general expenses, is given as follows:—1 ton of tin scrap, 60 fr.; 30 k. of hydrochloric acid, 9 fr.; 30 k. nitric acid, 15 fr.; 35 k. old zinc, 10 fr. 50 c.; labour, 20 fr.; fuel, 2 fr. 50c.. total, 117 fr. Result.—50 k. tin precipitate, 150 fr.; 800 k. scrap iron, 24 fr , total, 174 fr.

The industrial result depends upon the yield of tin, and, consequently, upon the careful purchasing of the scrap, for at the prices of iron in 1869-70 a yield of 3 per cent. of tin would not cover the cost of the operation.

THE GUNS OF THE THUNDERER.

The armament of H.M.S *Thunderer* is to be of a type vastly superior to that of the *Devastation*, and will consist of four 38-ton guns, originally intended for land service, but which have now been completed as naval guns, in the gun factories of the Royal Arsenal at Woolwich The whole four are now ready for issue, with the exception of fitting elevating patches, &c. &c.; but one has been finished even in this, and in all other respects, and will be despatched to Portsmouth so soon as its carriage has been fitted The engraving on page 249 is a faithful representation of the improved "*Enfant Terrible.*" A comparison of its majestic proportions with those of the pigmy 7-pounder mountain gun which our artist has introduced beneath will enable the reader to form some idea of its actual size. The shells and cartridges for both guns will be seen standing between the wheels of the trolly on which the 38-ton gun rests. The 7-pounder is, it will be remembered, the weapon which gave such excellent results in the Abyssinian war. The dimensions of the 38-ton gun are as follows:—Length, 19ft ; diameter at the thickest part of the breech, 57½in.—being 1½in more in this respect than the 35-ton gun; diameter of trunnions, 13in ; length of bore, 16ft. 6in.; calibre, 12in The rifling has an increasing twist from nothing at the breech to one turn in 35 calibres at the muzzle. The number of grooves is 9 The cartridge and projectiles are for the present at least—to be similar to those of the 35-ton gun, viz., of 100 lb. and 700 lb. respectively. It will thus be seen that an additional length of 3ft. has been given to this gun as compared with that of the original "Infant." Such an increment in this respect cannot be otherwise than an immense improvement. It is an acknowledged fact that, with the latter, a considerable quantity of the charge is blown out at the muzzle of the gun unconsumed, although, partly with a view of obviating such a difficulty, the weight of the powder employed has been reduced to a minimum. The evident cause of this is the impossibility of obtaining ignition of the cartridge throughout its entire mass in the momentary space of time that elapses before the projectile leaves the muzzle, owing to the extreme shortness of the bore, which is only 13ft. 6in. in extent. But with the new gun ample space is afforded for the expansion of the powder-gas waves, and for the combustion of the charge, which, it is anticipated, will be entirely accomplished. Thus it may confidently be expected that better results will be obtained from actual practice with this weapon, both as regards range and penetration, than were arrived at it the trials already made with the 35-ton gun. The latter was proved capable of penetrating wrought iron plates 14in. thick, as well as a backing of 18in. of timber, and a skin of 1½in. plate, at 500 yards; also of piercing, and very nearly of penetrating, wrought iron plates 15in. thick, with a similar backing, &c., at 200 yards. It penetrated 12in. armour and a similar backing up to 1700 yards. The 38-ton gun will probably penetrate 16in. of armour-plate, with a corresponding backing, at a distance of 1000 yards, as the addition of the 7 lb. or 8 lb of powder to the charge—which was before wasted—must of course make a sensible difference in the amount of energy produced. Every effort has been made to finish the four guns for the Thunderer with the greatest possible celerity, as it is intended to mount two of them in a turret directly it is ready to receive them, and to institute a series of experiments with a view of ascertaining their powers of range and other qualifications.

It must not be imagined, however, that the idea of completing the remainder of the 38-ton guns, with a calibre of 12½in , has been abandoned. The experimental trials which have only just been concluded with the original "Woolwich Infant," increased in length to 19ft., re-tubed, and bored out to a calibre of 12½in , have, we understand, been eminently satisfactory in their issue. It is true that the enormous charge proposed, viz., 170 lb. of pebble powder, were never actually attempted to be employed, as even with 140 lb., the heaviest charge attained, 10 lb. of that amount were blown out at the muzzle, still, nevertheless, a marked increase of power was observable as consequent on the enlarged calibre, and much valuable information was obtained in regard to the vexed question of exceptional pressures. It was clearly established that the occurrence of such pressures could be avoided by increasing the size of the grains of powder used in making up the cartridge, and consequently decreasing the rapidity with which the powder was ignited. In order to ascertain this, cubes of powder 1¼in., 1½in., and 2in. square we employed, the largest of the three natures producing the b[illegible] esults. Hence it is probable that the 12½in. gun, if finally adopted, will have a cartridge of some 130 lb. of pebble powder consisting of such cubes. The projectile will be of 800 lb. weight, as in the experimental trials alluded to. Should this be done, there will even then be a trifling loss of powder, as although the quantity blown out at the muzzle will be less than would be the case with a charge of 150 lb., still there must be an appreciable quantity which escapes in this manner. Indeed, it will always be so, and the only thing that can be done to remedy the evil is to the lessen it as much as possible. Lengthening the gun to an indefinite extent would not cause every grain to be consumed, and the loss of initial velocity occasioned by such a proceeding would be very serious. This fact has been clearly demonstrated during the past few months by a series of experiments made with an 11in. gun, purposely constructed with a bore having the extravagant length of 20ft. Portions of this gun were cut off from time to time after various sized charge had been tried, in order to ascertain accurately what was the precise length of tube or bore required. It was found that no corresponding advantage was gained by unduly increasing the length. There is only one point on which we cannot help expressing a regret The probable is now that two natures of 38-ton guns will shortly exist, one of which will have a calibre of 12in , and the other of 12½in., instead of one only.

To Prevent Rusting.—Boiled linseed oil will keep polished tools from rusting if it is allowed to dry on them. Common sperm oil will prevent them from rusting for a short period. A coat of copal is frequently applied to polished tools exposed to the weather. Woolen materials are the best for wrappers for metals. Iron and steel goods of all descriptions are kept free from rust by the following:—Dissolve half an ounce of camphor in one pound of hog's lard, take off the scum, and mix as much blacklead as will give the mixture an iron colour. Iron and steel, and machinery of all kinds, rubbed over with this mixture and left with it on for twenty-four hours, and then rubbed with a linen cloth, will keep clean for months. If machinery is for exportation, it should be kept thickly coated with this during the voyage.

On October 16th a special train on the Central Railroad of New Jersey, consisting of engine No. 97, one baggage and two passenger cars, made the run of 74 miles from Eastern to Jersey City in one hour 28½ minutes, including four stops, the actual running time being one hour 24½ minutes, making average speed over 52½ miles an hour. It is claimed that the 16¼ miles between Annadale and Somerville were run in 14¼ minutes. Engine No. 97 has 17in. by 22in. cylinders, driving wheels 5ft. 10in. diameter. The road-bed and track over which this run was made is in most excellent order, among the best in the country.

SCIENTIFIC NEWS.

M Giffard, of injector fame, has invented a method of fitting railway carriages which eliminates oscillation. The carriage is suspended by powerful springs at each end, and at the trials recently made in the presence of some members of the French Association for the Advancement of Science, the carriage was found to be so steady that reading and writing could be easily carried on

The United States Government is erecting a standard pressure guage at the Smithsonian Institute. It will have a one-inch column of mercury 150ft high, and it will be possible by it to accurately test gauges to a pressure of 800lb. per square inch.

An instrument for detecting colour-blindness has been introduced into Germany. It consists of a disc the centre of which is divided equally into black and white. Outside this circle there are three rings—the inner one half red, half green; another violet and red; and then the outer of violet and green. To the green-blind, the middle ring will appear grey; to the red-blind, the outer ring; and to the violet-blind, the inner ring

At a recent *séance* of the Paris Academy no fewer than eleven communications were received relating to the destruction of Phylloxera. A letter from a vineyard proprietor proposed sowing tobacco-seed among the vines; he had found this an effectual remedy, in the case of artichokes, for destroying an aphis which [illegible] ked the roots. Hemp and *Daturæ stramonium* were proposed as preferable to tobacco, on account of fiscal restrictions on the latter. One suggestion was to destroy the insect by electrical discharges. A committee of the Linnæan Society of Bordeaux have pronounced, as the result of their researches, that the Phylloxera is not the cause of the disease, but an effect of an organic malady attributable to five causes, which they specify (exhaustion of soil, inclement seasons, bad choice of stocks, and bad treatment, &c) They state that while Phylloxera is an effect, it may aid in deteriorating the vine.

The prize offered for the best circular saw at the Cincinnati fair, 100 dols in gold, was awarded to Messrs. Emerson, Ford and Co, of Beaver Falls, Pa. There were nine contestants, and the work done by each saw was remarkable for excellence and rapidity A Cincinnati contemporary says that Messrs. Emerson and Co's solid tooth saw, "when it struck the te.. log, showed its real metal. It took in the situation most beautifully, making the sparks fly gaily at every entrance into the tough poplar, but was steady and kept right down to actual work all the time, making sixteen good boards, 10 by 20, in two minutes and forty-four seconds, on 3½in. feed, and coming out cool as a cucumber. The oak log was then placed upon the carriage, and the saw proved that its appetite had merely been sharpened by the poplar. It cut twelve oak boards, 12 by 15, in one minute and forty-three seconds, all No. 1 lumber. This is the crowning feat of the test so far."

In a letter to M Chevreul, M. Volpicelli, of Rome, mentions some experiments he made with regard to the statement of a physician of some reputation, that if a magnet were brought near a nervous subject, the magnetism troubled him in various ways and affected his health. M. Volpicelli suspected imagination (and not magnetism) was the cause. Invited to experiment on a nervous patient in one of the hospitals M. Volpicelli presented, in place of a magnet, a piece of [illegible]n quite free from magnetism. The patient, immediately on seeing it, went into convulsions. Again, a magnet was put in the hand of an individual having nervous disease; in a few minutes he was so excited that it had to be removed. This same individual was engaged to preside at a scientific meeting; so M. Volpicelli took the opportunity of secretly introducing, beforehand, very powerful magnets into his chair, into the drawer of the table, and under the feet During the séance, which lasted more than two hours, the chairman had no nervous trouble, and after the meeting was over, he declared, on M. Volpicelli making inquiry, that he was in perfect health; only when informed about the magnets, he showed at once surprise and fear, as if he were not sure about being quite well. Thus, M. Volpicelli found his views confirmed.

The ash of the better coals of the American carboniferous age appears to be derived wholly from the plants which formed them. According to analyses by many chemists—quoted by Professor Dana, in the last edition of his "Geology"—made on lycopods, ferns, equiseta, mosses, conifera, &c., there is in them an average quantity of silica and alumina, such that if the plants were converted into coal it would amount to 4 per cent, of the whole, and the whole ash would be 4·75. Many analyses of bituminous coal show but 3 per cent. of ash, and 4·5 is an average. Hence it follows.—(1) That the whole of the impurity in the best coals may have been derived from the plants (2) the amount of ash in the plants was less than the average of modern species of the same tribes, (3) the winds and waters for long periods contributed almost no dust or detritus to the marshes. In that era of moist climate and universal forests there was hardly any chance for the winds to gather dust or sand for transportation.

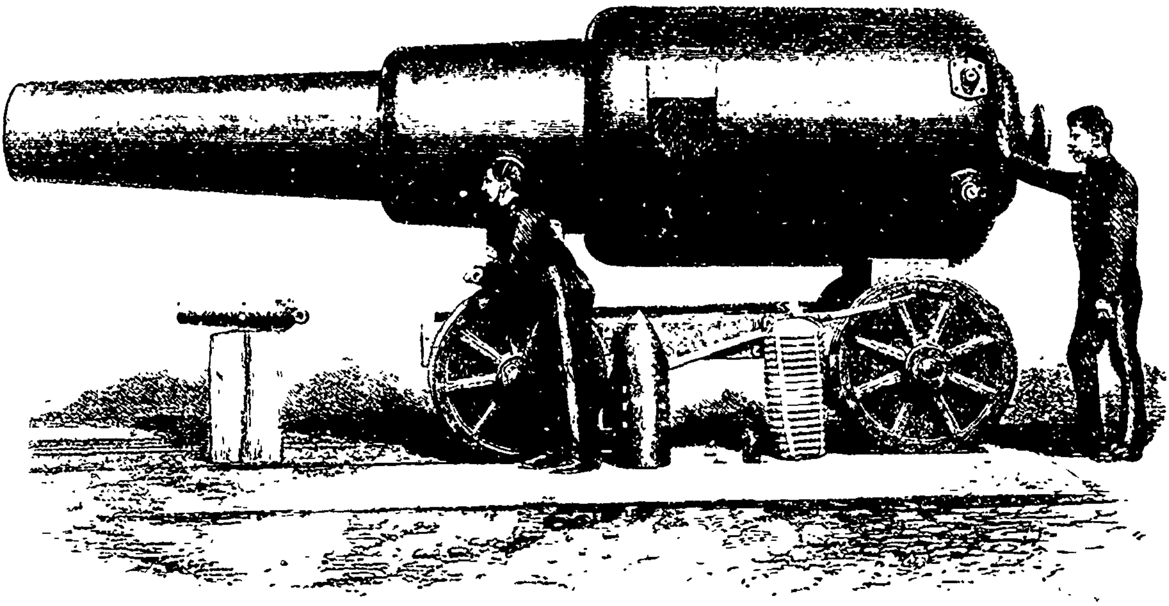
To make Imitation Gold—Take of pure copper, 100 parts; zinc or preferably tin, 17 parts; magnesia, 6 parts, sal ammoniac, 3·6 parts; quicklime, 1·8 parts; tartar of commerce, 9 parts The copper is first melted, then the magnesia, sal ammoniac, lime, and tartar are added, separately and by degrees, in the form of powder; the whole is now briskly stirred for about half an hour, so as to mix throughly, and the zinc is added in small grains, by throwing it on the surface and stirring until it is entirely fused, the crucible is then covered, and the fusion maintained for about 35 minutes. The surface is afterwards skimmed, and the alloy is ready for casting. It has a fine grain, is malleable, and takes a splendid polish. It does not corrode readily, and for many purposes is an excellent substitute for gold. When tarnished, its brilliancy can be restored by a little acidulated water.

Fever Germs—In a recent contribution Dr. Lionel S. Beale writes—Some of us have long been studying these things, and by working carefully with very high magnifying powers at tissues in which the changes induced by fever germs had been effected, we have been able to learn much concerning the nature and origin of certain disease-carrying particles. I have shown that by the rapid growth and multiplication of the living matter of the healthy tissues, as occurs in every case of inflammation and fever if it reaches a certain degree of intensity, morbid living matter results. By observing within the microscopic limit, in which the apparent size of an object may be increased to about 5000 diameters, I am able discern the origin of a disease-producing living particle. Arguing, then, from facts which have been established in the course of careful and prolonged investigations into the nature of these poisons, I am led to the conculsion that all the fever-poisons of man and the higher animals are closely allied as regards their essential nature. All arise by degradation from the living matter of and in the body itself. They are not microscopic fungi, nor are they derived from them, neither are they bodies which have been formed or evolved in the world outside.

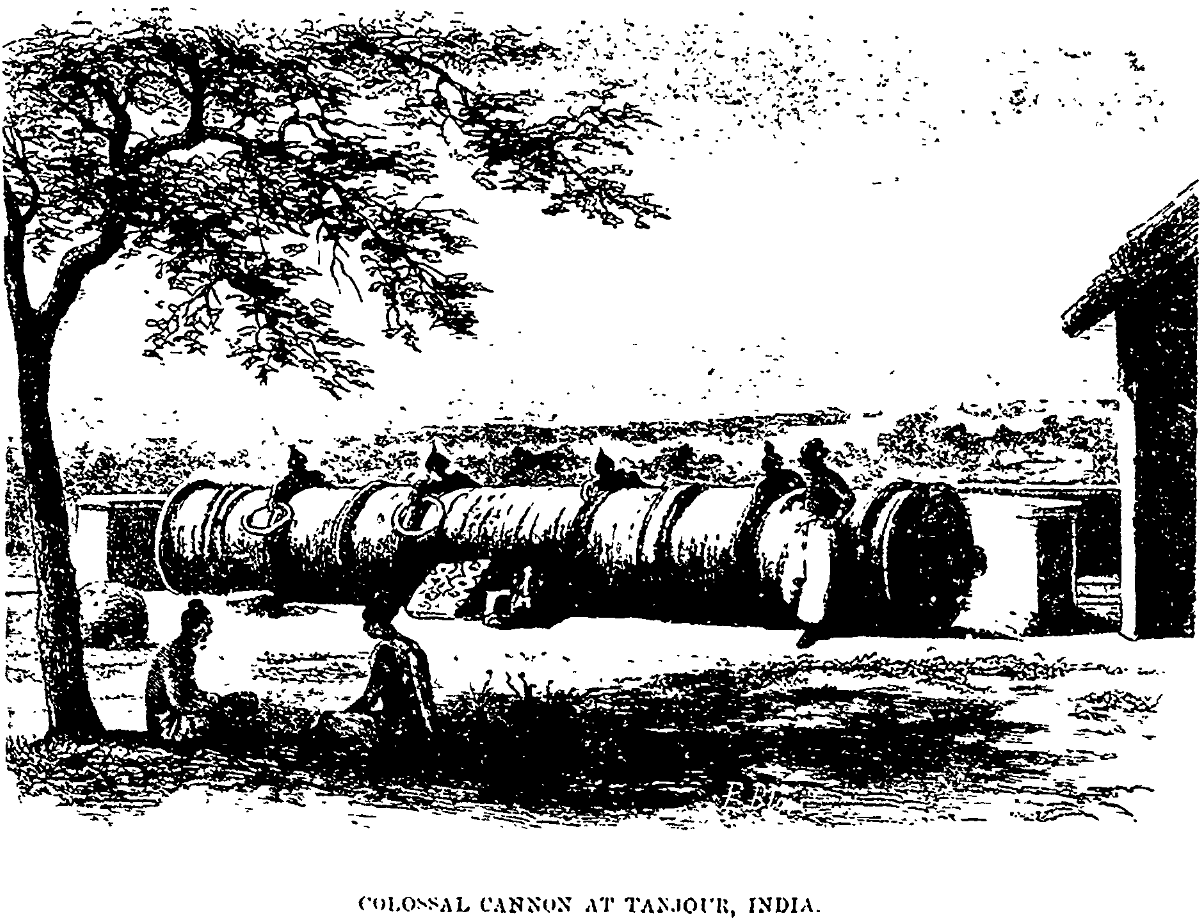
Forty or fifty of the most prominent telegraphers in America, as well as many other prominent men interested in the science, met in Chicago on the 12th ult., and organised the American Electrical Society. Its objects are. The interchange of knowledge and the professional improvement of its members, to advance electrical and telegraphic science, and the establishment of a central point of reference. The constitution adopted provides that the annual meeting shall be held on the third Wednesday of October at a place designated by the executive committee, and that the head-quarters of the society shall be Chicago.

A Japan Bronze.—A bronze which has lately been discovered to be much in use in Japan, has been found to be composed of 5 parts of tin and 10 of lead to 100 of copper. It is cast generally in thin sheets like slates, upon which beautiful designs in silver may be incrusted as follows:—The plates are covered with a varnish upon which the designs are graved with a style, the plates are then plonged into a suitably prepared bath to receive a deposit of silver upon the graved lines. When a sufficient deposit has been formed on the parts from which the varnish has been scratched, the plates are placed in a muffle furnace, in which the bronze, turns black and the silver remains white and brilliant, showing up beautifully by the contrast.

TOBACCO MANUFACTURE IN FRANCE.—Cutting the Leaf and Rolling Cigars.



38-TON RIFLED GUN FOR H. M. S. THUNDERER



COLOSSAL CANNON AT TANJOUR, INDIA.

DOWN AN AMERICAN SILVER MINE.

A writer in a late number of the *Virginia Enterprise* says that a day or two since he and a friend took a run through some of the upper levels of the Belcher mine. Our particular business on this occasion did not take us below the 1100-feet level. We might have gone 400 feet deeper—might have visited the 1200, 1300, 1400, and 1500-feet levels. Hank Donnelly, foreman of the mine, who was our guide on the trip, offered to escort us through the steaming regions below, but, as we have said, our business lay above. We do not propose in this article to speak of the ore breasts, ich stopes and chambers, and all that sort of thing; we mean merely to mention some of the sights met with while we were rambling about in the vast cavernous recesses of the upper portions of the mine. It is not dark and dismal below, as many suppose. The long drifts are lighted up by candles placed at regular intervals. These drifts, and the broader galleries, running in all directions, somewhat resemble the streets and alleys of some old fashioned, overcrowded village—some village seated in a confined place, where it is crushed out of shape. Our underground streets are not wanting in life. As we pass along the highways and byways of the underground regions we meet with the people of the place at every turn.

There are employed in this one mine between 750 and 800 men—a sufficient number to populate a town of considerable size. Men meet and pass us, all going about their business as on the surface, and frequently a turn brings us in sight of whole groups of them. We seem to have suddenly been brought face to face with a new and strange race of men. All are naked to the waist, and many from the middle of their thighs to their feet. Superb muscular forms are seen on all sides, and in all attitudes, gleaming white as marble in the light of the many candles. We everywhere see men who would delight the eye of the sculptor. These men seem of a different race from these we have seen above—the clothes wearers. Before us we have the Troglodytes—the cave dwellers. Our mind runs back to the time when the human race housed in caverns not alone far up the Nile, as the ancients supposed, but in every land, at a certain stage of their advancement in the arts of life. Not unfrequently, while travelling along some lonely passage, we were confronted by a man of low stature, huge beard, and breast covered with shaggy hair, who came sliding down out of some narrow side drift, and for a moment stood and gazed curiously upon us as though half inclined to consider us intruders upon his own peculiar domain On such occasions we would not have been much surprised to see the man before us cut a caper in the air, brandish a huge stone axe and advance upon us with a wild whoop.

Way stations are frequently encountered during our underground travels. These are large rooms fitted up off at one side of the principal drift and usually not far from the main shaft. Here are barrels of ice water, tin dippers and cups hanging about on nails, and probably boxes of candles and other stores. We are always glad to come to one of these stations and go for the dipper without any one telling us that it is a good thing to do. About these stations we always find a number of the Troglodytes They come for water and stop a short time to hear the news of the mine; for the station is near the mine incline, up and down which regularly run trains of cars and which is the Central Pacific of the region and connects the lower regions with the surface. These men gaze contemptuously upon us, as being men wearing shirts, and then betake themselves to their own peculiar regions along the several streets and alleys leading thereto. On the 1100-foot level we took a "near cut" through the wilderness. This is a place to make the hair stand upon the head of any clothes-wearing man. It covers about ten acres of worked-out ground. One sees here something of the great pressure of the superincumbent earth. The large timbers are crushed down, splintered and twisted; chambers originally square are squeezed into a diamond shape and their roofs touch the floor in the centre; solid piles of square timbers are pressed into pancakes, winzes and chutes are telescoped, ladder-ways once spacious are crushed out of all shape and now can hardly accommodate a cat—all is confusion confounded. Yet through all this we must find our way. It not a little resembles the track of a tornado in a timber country—what is called a "windfall." When we have a windfall we do not want one of this kind. In places are immense caverns where all the timbers are gone, and great flakes of clay and rock lean out from the walls and composedly look down upon the trembling passer-by. One is afraid to sneeze lest he may bring these down upon his head.

Sociable rats dwell in this fearful region. Sitting down upon some fallen timbers to rest, several of these quadrupedal inhabitants came about. Hearing our voices as we for a time remained stationary, these fellows naturally concluded that we had something to eat, and came to look out for their share. They got up on the ends of the timbers, cocked their heads this way and that, as they gazed inquiringly about. Evidently they did not understand it at all. Why we should be sitting there talking with no dinner pails in sight puzzled them not a little. They always flock about the miners when they sit down to eat, and always get their share of what is going.

A ride on the "giraffe" was a new experience to us. This giraffe of the miners is merely a large car made to run on an incline track. The wheels in front are low, and those behind high. Thus the body of the car stands as level as that of a car on an ordinary track. This incline stands at an angle of [illegible] deg., and the track laid in it is of ordinary railroad iron. The car plying to and fro carries about 8 tons of ore At the front is a seat, much the same as the driver's seat on an omnibus Here is seated the conductor of the train. There is room for three on the seat, and mounted upon it we took our first ride upon a giraffe. The car is drawn up by a heavy wire cable, and it goes up like lightning—so that the timbers at the sides pass each other so quickly as to resemble a fine-toothed comb To look ahead and see before you 100 yards of steep steel rails, up which you are rushing at whirlwind speed may be exciting, but is the reverse of natural. Up this queer railroad you are thundered through the caverns of the Troglodytes till you reach the bottom of the vertical shaft, when they transfer you to a cage, rush you up a shaft, and shoot you out at the top, as the "Red Gnome" in the play is shot up through the star trap in the stage floor.

ARTIFICIAL BUTTER.

According to reports from Paris, the question of producing cheap artificial butter has been practically solved, for the sale of a substitute for butter has been authorised by the authorities.

The new butter is called by the name of Margarine Mouriès, after the inventor, M. Mège Mouriès. The process by which it is produced is not published, but it is stated in a report of M Boudet to the Conseil d'Hygiène that no difference can be discovered by analysis between this and ordinary butter.

M. Mège first made a careful study of ordinary butter, and, it is said, found the means of copying nature with the same elements that compose ordinary butter, but at the same time eliminating the germs of corruption which chemistry has pointed out. The new butter is declared to be incorruptible, and going twice as far as ordinary butter. It has been adopted by the Council of Health, the sale of it authorised, the Minister of the Interior has ordered it to be used in the public institutions, and, by way of anti-climax, the Octroi officers charge the same tax on its coming into Paris as on ordinary butter.

This invention is put forward as a boon to the people of Paris, who are extremely fond of butter, and whose delicate cookery depends in a great degree upon it; but the price had become so high as to be prohibitory for poor people. The new preparation is of course much cheaper than real butter. Within a few years the price of butter has ranged from about three to eight shillings per kilogramme; the present average price is about four shillings; the price of the artificial butter is 1s. 10d. to 2s.

The butter is manufactured by a company, which has seven establishments, employing four hundred workmen. A warehouse has been opened in the Rue du Pont Neuf, near the great central market of Paris, and the sale of the new article is said to be already very large. It is of course to be understood that the above account is merely the announcement of the inventor, and that no opinion as to the merits of the preparation can be expressed here.

REPORT OF WALTER SHANLY, ESQ., C. E, ON THE CAUGHNAWAGA SHIP CANAL.

(*Continued from page* 223.)

While touching thus generally on the improvement of the navigation between Kingston and Montreal, I would note that the Lachine canal having to serve the trade of both rivers, would seem to demand a different mode of treatment from what may be properly applicable to the other links in the chain, and should, therefore, be "contrived a double debt to pay," by giving it additional width and duplicated locks

With such views, then, as to the depth fully and best suited for our river improvement I recommend that the Caughnawaga canal be planned for ten feet of water on the mitre-sills; and in closing my remarks on this most important subject of canal enlargement and extension, I would record my conviction that it will be as great a mistake to limit our lake navigation to vessels of twelve feet draft, as by giving the Welland canal that much clear depth only we practically do limit it, while Buffalo will be bidding against us with the immense odds of two feet greater draft in its favour, as it will be to seek for more than ten feet in the river. The money that would be needlessly expended in attempting to obtain twelve feet draft below Prescott would far more than pay for the difference in cost between fourteen and twelve feet in the Welland.

Next—as to the uses, and, as I believe, certain effects of connecting our St. Lawrence and Ottawa navigation directly with Lake Champlain, I have always thought the Caughnawaga canal an essential and naturally necessary link in—and, therefore, a blundering omission from — our general canal system. The object of constructing those immensely costly works, which, take one year with another in the quarter of a century in which they have been in use, have never yet earned their living, should have been to do all the business they could possibly attract and were capable of doing; not to use them merely to subserve the interests of one particular locality; but to secure to all Canada her natural right—a right inherent in her waters—of being the carrier of the products of half the continent almost. Had the Caughnawaga canal been made, as it should have been made, immediately following Mr. Mills survey in 1848 we would all these years have been doing a large carrying trade for the New England States instead of a limited one only for Montreal: doing an immense forwarding business in place of what, in comparison with what we might have had, has been, and even yet is, an insignificant one. In New England "The West" has its steadiest customer. In good years or bad she buys Western-grown cereals all the same; not raising enough off her own soil, all the way from Maine to Connecticut to feed her population for, probably, one month out of the twelve. New England has, so to speak, no cereal crop. Her capital and labour are embarked in other lines of industry better suited to her condition and resources.

The breadstuffs and salted provisions, of which the Eastern States are such large consumers, reach their markets mainly by way of Albany, and are mainly transported that far by water — Lakes and New York canals. Another portion descends the St. Lawrence to Ogdensburg and is there, as at Albany, transferred to the rail. Doubtless, also, a considerable quantity goes by steamer from Baltimore and Philadelphia to Boston, and other "Down East" ports. The distribution through the interior of the country is wholly by rail, of course.

That these commodities could be laid down more speedily and at lesser transportation charges in Lake Champlain by way of the St. Lawrence and Caughnawaga canals than they could reach the New England border by way of Ogdensburg or Albany, is simply an incontestable proposition. The bulk of the business now takes the Erie canal route, and compared with it the Caughnawaga could certainly show a gain in point of time of not less than three days, and in point of expenses of not less than 25 per cent., as between Chicago and Albany on the one hand, and Chicago, and, say, Burlington on the other. New England will have her food supplies from the West whether we carry them for her or not, but assuredly she will not object to our carrying them, provided we can do the business with better despatch and more cheaply than others can, and the producers in the West will be equally ready on the same conditions to entrust the transportation business to Canadian carriers.

And now a word about New York trade. Montreal merchants have always urged what has always seemed to me a senseless and unreasoning antagonism to the Caughnawaga canal project. They have argued that its construction by Canadians would be a suicidal act—tapping Canadian trade to send it away to New York. From Caughnawaga to Montreal is a short nine miles. From Caughnawaga to New York a round four hundred Is the harbour of Montreal, I would ask —the means it affords for the handling and shipping of grain and all other freights; the business capacity and enterprise of her merchants and shipmasters, and everything else all around pertaining to Montreal—are all these essentials to a great seaport city so utterly wanting, I repeat, that it will pay better for the vessel laden with Western products arrived in Lake St. Louis to head southwards and worm its way through some 400 miles of canal, lake and river to New York rather than drop quietly down ever nine miles of water-surface to Montreal, where she can be alongside as good, as big, and as seaworthy a ship as New York would have to offer her, in fewer hours than it would take days to reach the latter port, and at a twentieth part of the expense? To such a question Montreal people, Board of Trade included, have over and over again, in effect and emphatically, answered "Yes, that is just what would happen: our trade would be tapped and we would die of inanition." They forget, or else have never thought, or known, that the trade which they cry would be turned away from them never was "theirs," and that none of what you and I and a few others would like to see enriching Canadian waters has ever, save in mere driblets, come any nearer to our doors than Oswego, to the trade of which place the Welland canal has hitherto ministered quite as much as to that of the St. Lawrence. With the "cut-off" point for New York transferred from Oswego to Caughnawaga, Montreal would be in a position to "tap" New York business instead of New York tapping hers.

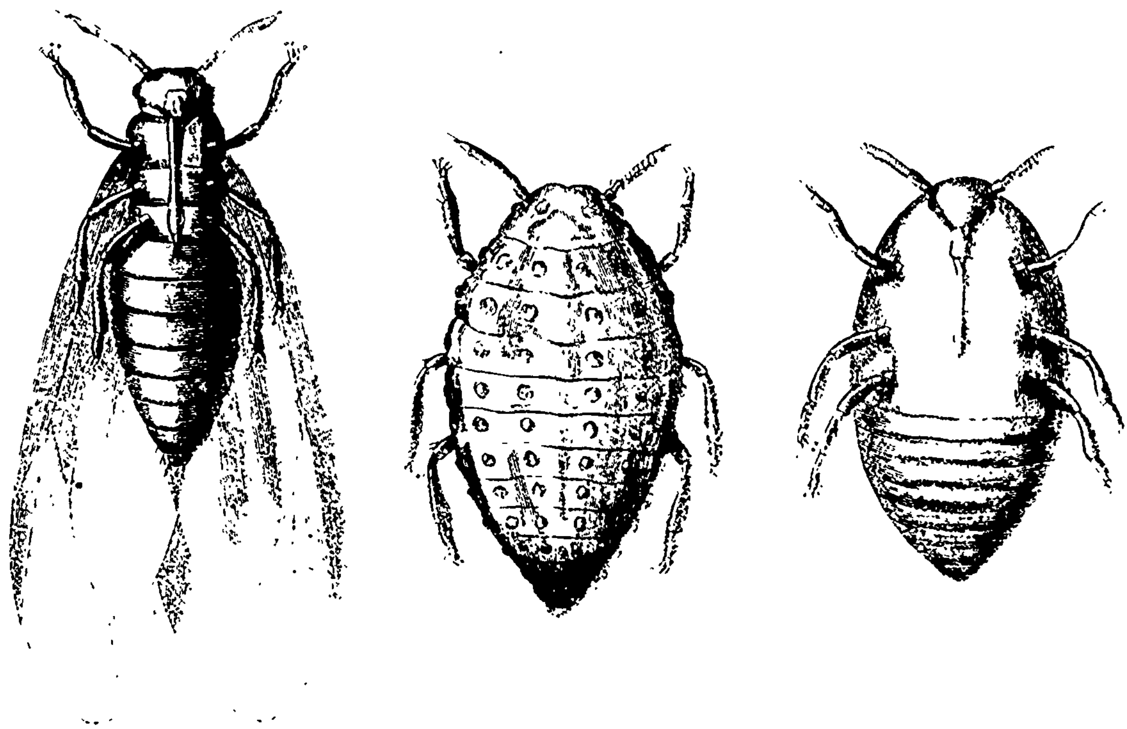
However the export trade of Montreal may grow, New York will none the less continue to increase and flourish, and the only way in which we of Canada can have part or lot in her prosperity will be by carrying for her what she will have brought to her any-how, and in our capacity as carriers it will be possible for us to make gain for ourselves from her n cessities With direct navigable access from the St Lawrence to Lake Champlain, Western New York interests, directly opposed to ours in all things, could no longer hinder the enlargement of the Northern Canal (Whitehall to the Hudson) because the city of New York would find it absolut ly necessary to take the benefit of the cheapest transportation route on the continent by meeting us in Lake Champlain When that time comes, then for one vessel we now meet dotting the surface of our great river at long intervals apart, all the way from Prescott down, we will espy ten, all doing good to the country as they pass along, putting in at one river port for fuel, at another for provisions, and, in one way or another, "leaving money" everywhere—even in the form of wages, for all craft, wheresoever owned, will, then as now, be largely manned by Canadian crews.

The lifelessness of our waters between Lake Ontario and Montreal is noted by all observant tourists, and the reproach will never be wiped out so long as the idea prevails and is acted on that Canadian carrying business must be limited to what of Western products Montreal can take and dispose of to her sole advantage. When we begin to carry for all comers, and we will begin, for it is the destiny of the river and those who rule it, Montreal will quickly learn that she has been living in error for a quarter of a century (the age of our canals), and that the more business we can induce down the St. Lawrence, whatever its seaward destination, the better it will be for the country, and consequently, for the commercial capital of the country. Montreal can well afford to cease opposing, if she will not aid, the Caughnawaga canal enterprise.

In opposing it her people act as though her advantages as a seaport were purely adventitious and only to be maintained by placing unnatural restrictions on the carrying capacity of those great waters through the means of which it mainly is that Canada is to continue to increase in wealth, distinction, and importance.

I have frequently heard it argued in discussions on this question of international carrying trade that the navigation

RAVAGES OF THE PHYLLONERA IN A FRENCH VINEYARD.



PHYLLOXERA VASTATRIX.—Magnified about 5000 Times.

DWARFED PINE TREE.

laws of the United States would for ever prevent our reaping commensurate benefits from the expense attending the extension of our canal system southward. Members of more than one administration have used that argument against adopting the Caughnawaga canal project as a Government work. I would allow no such phantom to "stop the way." If by opening a channel into Lake Champlain we can accomplish what I have endeavoured to foreshadow above—the cheapening of the transportation of breadstuffs and, so, raising their value at the place of production—the United States navigation laws will be looked after at home. We can leave that little matter, whether we are to have a general Reciprocity Treaty or not, to be attended to by the Grangers and their friends.

I have not, while writing this letter, had means of access to such recent statistics as would enable me to enter into detail on the sources and probable amount of revenue on which the "Caughnawaga Ship Canal Co." may reckon for making the taking a direct financial success, but drawing its sustenance, as it would, from both of Canada's great rivers—the St. Lawrence with its almost illimitable grain trade, the Ottawa, with its immense lumber business, and all the minor classes of traffic growing out of and increasing with the two greater ones—returns sufficient to pay handsomely on the cost of a ten-foot navigation may, I believe, be hopefully and confidently looked for.

When, some few years back, Canada rose to the dignity of a Dominion, those who believe that her future was largely dependent for its greatness on the uses to be made of her unrivalled lakes and rivers specially welcomed that clause in the programme of Confederation which foreshadowed the early and complete utilization of our water-highways. But the "word of promise" then given "to the ear" has been "broken to the hope." With a material advancement in almost every other direction such as Canadians may well be proud of, our canals to-day are just where and what they were then and for twenty years before. Liberal almost to lavishness in our appropriations for all other classes of public works the noblest portion of our heritage has been treated with an approach to indifference and neglect. "Millions for railways, not one cent for navigation" would not inaptly characterize what has been our policy of expenditure. We stand ready to pledge the credit of Canada to its utmost borrowing capacity in pursuit of phantom railways to the Pacific, or any where else, but can scarce spare a thought — or a dollar — for the improvement of the river. In all the leading journals of the country, railway questions command columns of editorials, where the Welland canal could hardly obtain lines. I am of those who hold that for railways, as national undertakings, we have for the present at all events, done our whole duty, and that we will best consult the future of Canada and best promote the development of her magnificent resources by henceforward, for a time, directing our thoughts, energies, and means in improving and perfecting to the fullest measure of its capacity that which, in all its natural aspects certainly, is the grandest system of internal navigation in the world.

Yours, very truly,

W. SHANLY.

JAPANESE DWARFED TREES.

The Chinese and Japanese have a great fancy for dwarfing trees This they do by such means as horizontal grafting (of which we have some specimens in our collection) and by studiously withholding more nourishment then will barely keep the plant alive. We present, here with, an engraving from the *American Garden* of a species of Pine (Pinus densiflora, var. albifolia) which has been thus dwarded. This plant—at least one hundred years old—is only about four feet high, while the trunk is nearly equal in diameter to the vase in which it is grown—about twenty inches—so that the rate of growth has not exceeded four-tenths of an inch per year. The patience and perseverence of three generations of men in growing and caring for such a plant is marvellous. Although we may consider the result absurd we must give them credit for the skill they exhibit in controlling or bending Nature to their whims or caprices.

MODE OF MAKING FIRE-ENGINE HOSE WATER-TIGHT.

The *Bayerisches Industrie und Gewerbeblatt* contains a proceeding, which has been patented in Bavaria, for rendering hose of fire-engines completely water-tight, so as to withstand the greatest pressure. The hose are, after they have been cleaned and dried, impregnated with a mixture of 100 parts of glycerine of 24 ° B. and 3 parts of carbolic acid, which may be done either by drawing the hose through the liquid, or, better still, by brushing it well in. Thus treated, the hose are said to preserve a certain degree of dampness, without, however, being liable to rotting in the least degree, and so suffering detorioration in quality and durability. The brass fittings of the hose are attacked only imperceptibly by the acid contained in the composition; but even this may be easily prevented by giving them before impregnation a coating of weak shellac varnish, or by greasing them well with tallow. The hose, which are said not to leak in the slightest degree, must be cleaned every time they have been used, dried, and impregnated anew with the liquid. The previous drying of the hose is, however, not necessarily essential, more especially in winter, when drying is slightly difficult; it suffices to let the water run well out of the hose. As frost does not affect the mixture, hose prepared in the above manner, do not freeze easily at low temperatures. This fact makes the suggestion one worth consideration in Canada.

A PRELIMINARY meeting of railway servants engaged in the passenger departments of the London and North-Western, Lancashire and Yorkshire, Manchester, Sheffield, and Lincolnshire, and Manchester South Junction and Altrincham lines, was held on Thursday evening, the 5th inst., at the British Fleet, Oldfield-road, Salford, to take into consideration the best means of ameliorating their present condition, when it was revolved to hold an aggregate meeting on Sunday, the 15th inst. in Manchester, in order to decide as to what further means should be adopted towards the object in view.

A SELF-PROPELLING TRAM-CAR.

We recently devoted a brief paragraph to a preliminary notice of this invention, patented in March last by Mr. Leveaux, and relating to an apparatus or automatic means of imparting motion to carriages on tramways, railways, and other roads, and we now resume the subject with the purpose of detailing all the features of this automatic motive power, as illustrated in the engravings on page 256.

Even if the time had not passed when the question of whether or not tramways should be permitted in urban thoroughfares might be regarded as open to discussion—for we take it that tramways, urban and suburban, have passed from the sphere of speculation into the domain of fact, and become a permanent institution of the period, notwithstanding the objections of "carriage people"—the invention of Mr. Leveaux would possess substantial claims to consideration, as exercising a preponderating influence in favour of the adoption of tramways, to the full comprehension whereof it is necessary that the primary and essential conditions of the question should be fully stated and thoroughly understood. These may be very briefly summarised.

The facilities for public intercommunication in urban and suburban localities, by the public thoroughfares, are of three kinds, omnibuses, tramways, and cabs or the like vehicles plying for hire, all equally dependent for motive power on horses —a condition which is not of encouraging aspect, either in the present or the future, in view of certain contingencies, such as, *e.g.*, the increase in the price of horses, and the cost of their keep; the possibility of an equine epidemic, such as has occurred in America, or a strike among the drivers, hard-worked and underpaid. It is an undoubted fact that the working of tramway cars by horses is not only severe, in tasking the powers and shortening the working life of the horses, but is a very heavy tax upon their earnings. Nevertheless, it is equally certain that, as yet no mechanical power has been devised or applied so as to supersede them, in spite of several hopeful and promising projects for steam tramway cars, &c., which have, however, failed to bear fruit practically hitherto, and the great desideratum of a suitable motive power has so far remained unsupplied.

It may be broadly assumed that whatever mechanical motor may be adopted, it should, having regard to the safety of the public, and the other traffic uses of horses, fulfil certain conditions: it should be thoroughly under control, and exerted only along a prescribed course; also noiseless, so far as practicable, and not emetting any objectionable humming, puffing, hissing, whirring, whistling, clicking, clatter, or noise calculated to be a nuisance and cause fright; there should neither be any visible smoke, steam, or vapour, nor any annoying and unpleasant chemical odour, gas, fumes, or vitiated air. Moreover, it would be well to have no boiler, generator, tank, or receptacle for inflammable liquid, involving risk of explosion. As regards the extent and duration of its exercise, the power need not exceed in capability the ordinary working speed of the present conveyances, nor be exerted throughout long distances or periods.

Whatever degree of success may hereafter be attained by steam, gas, heat, petroleum, or other engines, in the realisation of the above conditions, we are at present disposed to consider Mr. Leveaux's, invention as alone substantially attaining the same. Its principle consists simply in the application of coiled springs wound up by machinery, and acting in uncoiling through suitable intermediate gearing, upon the running wheels of the tramway car. Although up to quite a recent date, the conception of springs applied to the generation of power has been limited to watches and clocks, mechanical toys, &c. and has been developed on no scale practically larger, so far as we know, than in the well-known self-coiling shutters, yet this is clearly only a question of power and degree, affecting simply the conditions and capabilities of the manufacture, which have indeed, in effect, presented the only difficulties to be overcome.

In application to the ordinary form of tramway-carriage, a portion of the space below the floor of the car is utilised for an arrangement of a series of drums or barrels, containing the springs, which may be arranged transversely in two groups or sets, suitably inter-connected, so as to form one continuous volute, acting to generate revolution of the driving-wheels, and thus effect propulsion of the car. At the terminal, or other intermediate stopping stations the means of winding up and recoiling the springs, by any suitable fixed steam-engine or other prime-motor, are to be provided, rotary motion being communicated by shafts under the roadway to vertical spindles and geared wheels, which being thrown into temporary connection, for the purpose, with the spring-barrel, will coil the springs until the requisite tension power is obtained. The means of effecting this temporary connection of the prime-motor with the carriage-mechanism may obviously be varied, without affecting the principle of thus providing stored-up power, self-contained, whereby the car may be automatically propelled. Adequate brake power is also provided so as not only to control and arrest, when requisite, the spring-power, but to hold it in complete suspension when the car is stationary: and furthermore, an arrangement of clutches is interposed between the spring-barrels and the driving-wheels, whereby the uncoiling motion of the springs, which is constant in one direction only, may be transformed into an ultimate variable rotary motion, given out in opposite directions as needed, for reversing the direction of propulsion of the car.

In the accompanying engravings fig. 1 represents an ordinary tramway car in side elevation, fitted up with this self-propelling appliance, and showing the mechanism for winding up the coiled springs applied thereto. In fig. 2 is shown an inverted view or plan of the underside of the car-framing and mechanism; the sectional plan of the spring-barrels or drums and gear connected therewith appearing in fig. 3; while fig. 4 demonstrates in elevation, as applied to such a tramway carriage, the mechanical arrangement proposed for employment in winding up the springs.

Fixed horizontally and transversely beneath the carriage flooring and situated at about the centre of its length, are two series or groups of hollow drums or spring barrels, A, A1, fitted on to sleeve-shafts, carried on fixed axles, B, B1; in each group there are five barrels, but any less or greater number of barrels may be employed, as may be convenient and requisite. Simultaneous operation of all the springs in both groups may be secured and maintained; or, on the other hand, action may be limited to the springs of one series only; the arrangement and details being as follows.

A winding-shaft, C, is fixed in bearings in the cheeks or side plates, D, fitted to the underside of the carriage-framing, which carry also the drum-axles, B, B1. On the shaft, C, is keyed a pinion, c, geared into a spurwheel, a, affixed to the spring-barrel, 1, the first of group A. The spring-barrels, 1 and 2, are loosely mounted on a sleeve on shaft B, and severally connected thereto by means of coiled springs, whereof the coil for the barrel 2 is in the reverse direction to that for the barrel 1; the barrels 3 and 4 are similarly carried by, and reversely connected to another and independent sleeve on the same axle. Connection between the barrels 2 and 3 is effected by a pin, b, at the periphery of the barrels, which thus acts alternately as a driver, to transmit the coiling power from the prime-motor, passing through spring-barrel, 1, or *vice versa*, to give out the power of tension stored up in the coiled-springs, when acting in their turn as prime-motor. A similar pin, b, also connects spring-barrels 4 and 5, whereof the latter is mounted on and connected with a separate sleeve, and carries a spur-wheel, a1, engaging in another like spur-wheel, a2, affixed to the spring-barrel, 6, the first of the second group or series, A1, carried on the axle, B1; the arrangement and connection of the spring-barrels, 6, 7, 8, 9, and 10, constituting the second group are precisely similar; and the last barrel, 10, of the series is provided with a spur-wheel, e2, engaging into the intermediate gearing actuating the driving-wheels.

Centrally located between B and B1 is a supplementary axle, E, also carried in the side-plates, D, and serving to carry a loose pinion, e, engaging in the spur-wheels, e1, e2, which are respectively mounted on shafts, B and B1, so as to run loose; the wheel, e1, is connected with the spring-barrel 1, by means of a pawl and ratchet, just as in the case of e2, and 10. Friction-brakes, h, thrown in and out of action by brake-rods, H, H1, extending forwards and backwards to the opposite ends of the car, and by lever handles, and operated by bevel-gearing, as shown in fig. 2—are fitted on the peripheries of the spring-barrels 1 and 10, so as to act as detents for the prevention of the running down or uncoiling of the springs of both groups, when in action; or otherwise, when released, to permit them to exercise their tension-power.

The counter shaft, F, carried in bearings in side-plates, D, serves to transmit the spring-power and rotary motion to the axle C, of the driving-wheels, by the medium of spur-gearing, f, f1, f2. Upon this driving axle are two pinions, g, loosely mounted, and having clutch-teeth on their boxes, formed to receive respectively the teeth of a pair of clutches, g1, sliding on feathers on the shaft G, and actuated by the clutch-rods, g2. These constitute the reversing gear, for forward motion, the pinion into which the wheel, f1, gears, is thrown into action, the transmission of power being direct, for reversal to backward motion, the spur-wheel, f2, is put in action, driving an idle pinion g3, gearing into the adjacent pinion, g, and running loosely on a shaft, g4, having its bearings in radius rods, g5 respectively pendent from shafts, P, G, and thus transmitting opposite rotation to G. It will be understood that the terms "backward" and "forward" are only relative, and that motion may be imparted to the car in either direction indifferently.

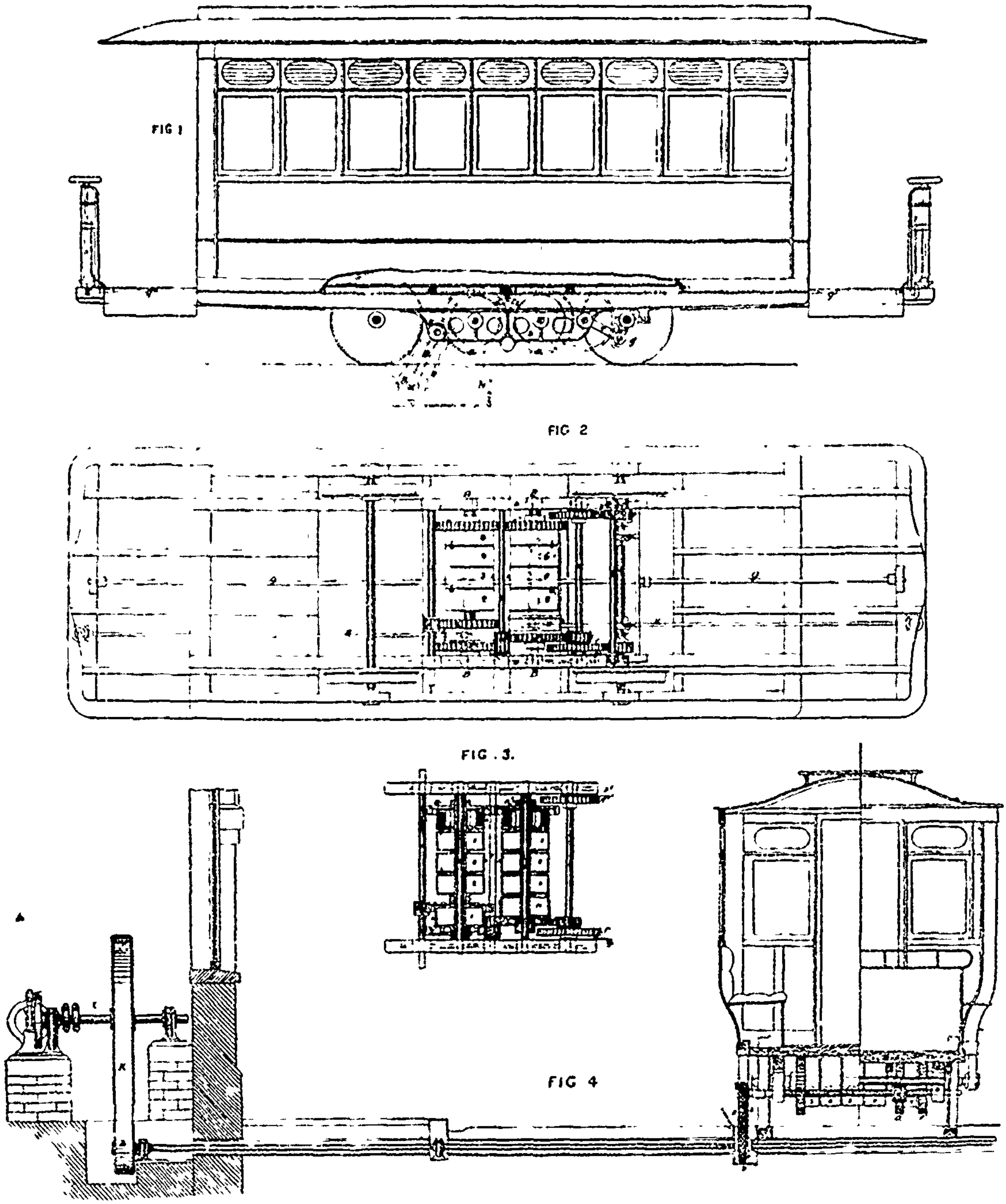
In case the barrels, 1 and 10, are both released from the friction-brakes, h, both groups of springs exert their power through their respective spur-wheels, e1, e2, upon the pinion, f. If, however, the brake be put in action on the barrel, 10, only, the tension-power of group, A1, is transmitted back by spur-wheels, a2, a1, in aid of group, A, and the spur-wheel, e, by the pinion, e, and e2, now acting as an idle-wheel drives the pinion, f; on the other hand, if the barrel, 1, be held by the brake, and 10 be free, the action of the springs is transmitted in the reverse direction to the wheel e2, which thus receives and transmits the whole combined propelling power.

The winding-up of the spring-barrels is effected, as explained, by engine power, located at suitable intervals along the track, as may be convenient for the run, or at special stopping places. In fig. 4 the stationary engine, I, and fly-wheel, K, drives by belt the pulley, L, fixed on horizontal shaft, M, carried in bearings, enclosed in a metallic tube or casing, beneath the roadway, and extending across the tramway track, close alongside whereof a covered box, N, is sunk in the roadway, enclosing a chain-wheel, O, affixed on the shaft, N. The endless pitch-chain, P, passes round O, and a second chain-wheel, Q, carried on a pair of radius arms, R, supported on M. The axle of Q is fitted with a sleeve so shaped as to connect with the winding-axle, C, of the tramway car, and thus give the requisite motion thereto. On the arrival of a car at any station requiring to have its spring-tension renewed, the chain-wheel, Q, is raised into position, connected with the shaft, C, and the spring-barrels are wound up by the engine, which being done, Q is disconnected, and depressed into its original position. A friction-coupling or other like appliance may be introduced at any suitable and convenient part of the apparatus, to prevent over-winding.

The crucial point of the whole system clearly relates to the size and power of the springs, the arrangement adopted, of connecting together the springs alternately by their arbours and peripheries, practically unites all the separate springs of the two groups into one continuous coil, exerting the power of each individual member of the series (supposed of equal strength), but exerting that power through a proportionately longer period. The power and duration of the springs must be adequate for the maintenance of the requisite maximum (though limited) speed for a period or journey of sufficient length.

Now it has been computed that the actual tractive force, requisite to overcome the resistance of a tramway car weighing gross 5 tons, is 60 lb. on the driving wheels, corresponding to 720 lb. on the periphery of the spring barrel; 24 lb. and 288 lb. respectively correspond to a gross weight of 2 tons; and in like proportions for intermediate weights. So far as previous experience goes, a spring 6 lb. in weight, exerting a direct pressure of 105 lb., may be taken to represent the maximum in size and power of such steel springs. Under the stimulus applied by M. Leveaux's researches, the steel manufacturers of Sheffield, by special and improved plant, annealing ovens and appliances, have turned out springs 50 to 60 feet long, capable when duly coiled of exerting a pressure of 800 lb. to 900 lb., without permanent set. In France also, still driving bands, with great elasticity, are made 100 yards in length, so that the question of the possibility of obtaining springs of the requisite size and power is practically solved.

Having satisfactorily tested the principle in a working model, to one-sixth scale, on a small temporary tramway of considerable length, M. Leveaux has had all the necessary mechanism and appliances made by a well-known firm of en-



SELF-PROPELLING TRAM-CAR.

gineers, so as to fit up a tramway car, or cars for actual trial upon some of the lines of metropolitan tramways in London, for which, indeed, the arrangements are now nearly complete, so that the practical working of the system will speedily receive a thorough public demonstration. The Edinburgh Tramways Company have also, as we learn, entered into an arrangement for satisfactorily proving the power and utility of the system, and the invention is calculated to attract careful and attentive consideration in all quarters, both at home and abroad. We have ourselves had opportunities of seeing the potentialities of the principle, both in the model and in full working size; and even in view of the sweeping change in the tramway system which is involved in its complete success and adoption, we cannot withold the conviction that all the important practical difficulties have been effectually surmounted, reducing its practical realisation to mere matters of detail. The working of the springs is entirely free from noise, perfectly smooth, easy, and effective, and completely under control, for application, cessation, and reversal. As an automatic motive power, free from all objection from other and contemporaneous kinds of traffic, and calculated to supersede entirely the necessity for the employment of horses, with all its concomitant cruelty and inconveniences, it appears to us to open up an encouraging and satisfactory prospect to the directors and shareholders of tramway companies, and to supply the means for the fullest development of intercommunication in urban and suburban districts.—*Iron*