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CANADIAN MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 5. OCTOBER, 1877. No. 10.

SANITARY IMPROVEMENTS.

(See page 296.)

WE always hail with satisfaction any improvements in household sanitary appliances—particularly improvements in the construction of water closets—and we have anxiously looked forward to the day when some contrivance might be invented that would no longer necessitate the use of a trap to the soil pipe, and which is generally placed immediately beside the closet pan. It is, therefore, with much pleasure that we bring to the notice of our readers an improvement in the construction of water closets recently invented by Mr. Robertson, Manager of the Montreal Rolling Mills, which entirely does away with the objectionable soil-pipe trap, which, when the double valves are closed, so perfectly seals the basin against any access thereto of gas from below, that, unless they were withdrawn, it would be almost impossible for any effluvia to rise up into the room ; it has also another great advantage, viz. : that none of its working parts are likely to get out of order, as it combines great simplicity of action with durability of material, and evidently will last for years without requiring repairs.

We have examined it very carefully, and feel that we can speak highly in its favor. We are aware, too, that it has been tried in places where no other closet would keep down the foul effluvia, and its success has been perfect. We pronounce it to be a first-class closet, nearly all that can be desired, and must in time come into general use.

The inventor, in a modestly-worded circular, describes its action as follows :—

"In pointing out his improvements in Water Closets, he does not desire in the least to detract from the merits of previous inventions, but simply to show how one great objection alone, which the public have to the Trap, has been entirely overcome. The main point of complaint against the Trap has been, that it is always partially full of effeta, which, when in contact with water, decomposes rapidly, forming gases which rise up into the water closet trunk, and escape into the room whenever the closet is used. So well is this fact now ascertained, that the highest sanitary authorities in Great Britain have styled them "*cesspool abominations* ;" and yet, heretofore, no closet has been considered sanitary without having some interposition of the sort between the main pipe and the basin. This serious impediment to having a perfectly odorless closet is now completely remedied by his newly patented improvement.

The closet does away with the objectionable trap to the soil-pipe, the action being as follows : In raising the handle, both valves are simultaneously opened, and the water and effeta descend in a body towards the main sewer, leaving a vacuum in the upper part of the soil-pipe, which vacuum is immediately filled from the basin, and before any reaction can take place, the valves close, and are re-sealed with fresh water, therefore it is impossible for any gas to escape upwards. In connection with the valves are two trapped overflows, through which no effeta enters, and which are always filled with fresh water, and every time the basin is emptied fresh water is renewed in both.

But, in addition to the closet being perfectly odorless, it has other advantages, which give it a strong claim to public patronage. *First*, its cost is not any more than any first-class closet now in use *Secondly*, its great strength and simplicity of action combined, there being no wire attachments, or any complicated arrangements, to get out of order.

It has been tested and found to act in the most satisfactory manner, and in situations where other closets have entirely failed to keep down foul gases, it has proved most effectual."

In connection with this water closet Mr. Robertson has invented an AUTOMATIC SUPPLY TANK, which is quite a little gem in its line, and will entirely supersede the lumbersome overhead tank which at present occupies so much room in small closets.

This miniature tank, for ordinary use, does not occupy altogether a cubic foot of space, and can be placed on a bracket in any convenient corner of the room. It is worked by the water closet lever, and will just run out a certain quantity of water and no more—which quantity can be graduated at will—and yet is so strong that it will (according to size) resist a pressure of from 50 to 150 and upwards. It cannot get out of order, for there are no weak points about it, such as springs or wires, everything is direct acting. It is a tank, too, that can never get foul, which is one of the greatest objections to that of the present form,—which from the accumulation of impure matter at its bottom, month after month, so fouls the water that it gives off almost as poisonous gases as the closet it is supposed to wash out and purify.

Even those whose interests the adoption of this tank is likely to affect have fairly acknowledged it to be not only the best, but the cheapest closet supply yet invented. On account of the check it puts upon all unnecessary waste of water, there can be no doubt but that all water-work companies will fully appreciate the great saving of water it will effect wherever it is introduced, and should endeavor to bring it into general use.

In concluding our remarks upon this subject, we recommend our readers to peruse the following leading article from the *London Builder* on the "Encouragement of Typhoid Fever."

THE ENCOURAGEMENT OF TYPHOID FEVER.

Happily the youthful Duke of Cornwall, as the usual courtesy that regulates the descent of hereditary dignities would teach us to describe the heir of the Prince of Wales, is now reported to be out of danger. The utmost reserve was maintained, as far as possible, as to the fact that a life so important to the country had been actually exposed to serious danger. We need not dwell on any of those reasons which, at the present moment, especially render the health and well-doing of this branch of the Royal Family of unusual importance. We may content ourselves with stating the bare and naked facts, and with asking whether they are not utterly disgraceful to—we will not say merely our civilization—but our sanity? Three generations of princes—lives of which it is impossible to estimate the value (from any point of view in which one life differs from another), have been perilled, in the very palaces of the Sovereign and the Heir to the Throne, by a cause of mischief which, though subtle, is at once detectible. Whatever may or may not be yet ascertained as to the laws of propagation of disease generally, the circumstances which cause an access of typhoid fever are, at all events, known. To say that they can be, and ought to be, prevented, is merely to repeat what the conductor of this journal, and other of his fellow labourers, have been saying for more than a quarter of a century. What kind of comment on the text is furnished by the extracts from the *Lancet*, which tell us of the youthful Prince's convalescence?

When the country was stirred to its very heart by the serious illness of the Prince of Wales, and when all shades and hues of political opinion were forgotten in the general thanksgiving for his recovery, it was our hope, and that of those who cared for the public health, that the result would be a legislation of that plain, direct, efficient kind that would lead to the stamping out of preventible disease. We need not now refer to the mode in which that opportunity was wasted. But it cannot be too distinctly recorded that hesitation at that time was not on the part of the country. Neither public opinion nor Parliament would have recoiled from root and branch work at that moment. Nor can it be denied that, although the most serious danger is happily past before it was admitted to exist, there is at least as much ground at the present moment for public inquietude as was the case in December, 1871. As much! Is there not more? Do we not find that, in spite of all the exertions of those interested in sanitary reform, the unimpressionability of those who should be held responsible for neglect has allowed the Royal Palaces, the War Office, and other places which might be specified, to be preserves and breeding grounds for typhoid fever? Have we not seen the guardian of the health of the navy poisoned in the water which was his temperate beverage? Have we not seen that neither the untimely death of, perhaps, the best and wisest prince in Europe, nor the almost miraculous escape, from the same cause of evil, of his son, has been enough to make people bestir themselves; but that his grandson should have been as much exposed to attack as if typhoid fever were some mysterious disturbance beyond human cognizance as to its origin,—unexpected, unintelligible, and unpreventible?

This dead weight of heedlessness is in itself sadly discouraging. What can be said, what new considerations urged, what sense of personal interest appealed to, that shall be new? There is indeed, one aspect of the case which has not hitherto been thoroughly exhausted. If we refer to that, it is with no wish to throw blame where it is not due, or to insinuate it where we do not openly proclaim it. But it is from the sense that one only course seems to us to promise any rational expectation of a change, without the effecting of which we must be content to see the very cream and pick of our country mowed down at discretion by preventible disease, that we now speak.

We refer to the homely wisdom taught in the fable of the lark and her young ones. Parliament has been invoked, and has promised to come to the aid of the sanitary reformer. Local Boards have been invented, and certainly have shown abundant vitality, in so far as the increase of local taxation is concerned. Yet, season after season, the harvest of public safety remains unsecured. It remains that those who are responsible for the crop should take it in hand themselves.

Who are the people to do this? The question, indeed, concerns every one of us. Unfortunately the proverb comes in here, that what is everybody's business is nobody's business; and as matter of practical experience, we cannot believe that the urging of the householders at large to protect the lives of themselves, their wives, and their children, is likely to have much more effect during the ensuing decade, or quarter of a century, than it has had during the last. There are many reasons for this, but the chief of them is this. The knowledge, not as a theoretical assent to a scientific proposition, but as an intimate conviction, regulating the activity of each day's life, of the requisites and conditions of health, is a specialty. It is confined to the expert. You may write about it, print about it, lecture about it, fill the newspapers, even get a word of aid from the pulpit; but all this is of little avail as a means of giving medical knowledge to the medically uneducated. The merchant, or banker, or tradesman, or private gentleman, hears all you have to say, and goes away and does nothing. If he is moved very strongly by some disastrous death or lingering illness that has come to his knowledge, and recalls the warnings and the counsel of his doctor, or his surveyor, or of some disinterested and anxious friend, he may go so far as to say, "Dear me, how sad it is that Mr. A. should have neglected his drains! The state of the War Office is absolutely unpardonable. Somebody or other ought to be punished—the Commander-in-Chief impeached, or the contractor hanged." This is in the unusual case of interest being really awakened. But if you go a step further and say, "My dear Mr. B., have you any idea what is the state of your own drains?"—"I," is the reply—or more probably "me,"—"you don't suppose that I understand that sort of things. My people are not pigs, sir. I pay my sanitary rate, and a pretty round one it is. I pay my doctor; and if every patient has as long a bill as I find comes in at Christmas, all I can say is that no wonder doctors keep their carriages. I go to the city as soon as breakfast is over, and when I come home do you think that I am going to spoil my appetite for dinner, and to make my servants give warning, by pottering about the house-drains? No, no, my good sir, neglect in such things, I quite admit, is entirely inexcusable. I am sure we all owe a deep debt of gratitude to you, and to all those excellent men who are so disinterested as to sanitary reform; and it is a matter of the sincerest satisfaction to be told that we cannot catch cholera, or typhus, or any of those horrid diseases with Latin and Greek names, except by our own fault. But I should just like to see the face of my cook if the butler were to say,—'Master is coming to look at the sink in the back kitchen.'"

We put it to any of our readers whether this is an imaginary or exaggerated case? How is such a block to be got over? And we are taking the most favourable example, that of the reasonable man, who hears all that you have to say, who is grateful for your advice, and who really, as far as his light is concerned, agrees with you. What is the case with the majority of persons? Will not the officious friend be told, with more or less circumlocution, according to the plane of social life in which the interlocutor moves, to mind his own business? "My house infected," says Dives, "a pretty puppy you must be to say so. There is the hall door, sir, and the sooner you are outside it the better I shall be pleased." Put the thing strongly to him. Say, "My dear Mr. Dives, as I passed your back-door I perceived such an odour that I am convinced, as having some acquaintance with the subject, that you are exposed to imminent danger of typhoid fever. Besides, you cannot fail to observe how pale Master and Miss Dives are looking. Believe me, my dear sir, you are in danger,—in imminent danger." Say this, and suppose that you are a person of too much gravity and importance to be summarily characterized as a puppy, what will be the reply? Will it not be that there are no servants so cleanly, no housekeeper so particular, no lady so apt to take the slightest hint of want of sweetness in the atmosphere as those of Mr. Dives' family? That no children are more healthy, and that Mr. Alderman Dives himself nowhere enjoys so excellent an appetite as in that very house of which you are attempting to depreciate the monetary residential value?

If this is the case with persons of a grade and position in society to which the sanitary reformer looks for recruits and support in his most holy crusade, what is the case as we descend the social ladder? In an Irish market, the writer of these lines once objected to purchasing certain carrots because they were covered with the soil from which they had been extracted. "Dirt, yer hanner," said the salesman, "that's what keeps 'em fresh."—"You seem to think so yourself," was the instinctive reply. "Deed, yer hanner, and what ud we be washing for?" was the rejoinder. Wide experience comes to the conclusion that, in the case of a very large majority of the working classes, such ideas as that of the daily use of the bath, for example, are regarded either with detestation or with ridicule. A man who advocates proper ablution or proper ventilation, or any well-considered preservative of health, is regarded as either a nuisance or a fool. And even if people do not love dirt for its own sake, they love unventilated houses for the sake of warmth, and, as they think, of economy. Their noses are blunted by the constant presence of odours compared to which a trifling faint smell of sewer-gas would be a bouquet. That a smell, good or bad, should indicate the approach of death, they do not and will not believe. Help the sanitary reformer they will not; resist him tooth and nail they will. As matter of cost, as matter of custom, as matter of taste, as matter of skill,—invincible is the dislike to his interference.

To whom, then, can we look for aid? To the engineer? As far, no doubt, as the design and execution of the works necessary for that essential requisite of health, urban drainage, is concerned, it is no doubt a matter of engineering. We must bear in mind, however, that the subject is one of extreme delicacy, and cost. It is one in which opposite and inconsistent requisites have been, and often still are, loudly demanded. The subject, although it has been made matter of assiduous study by many earnest professional men, has never been so formally handed over to the investigation and the execution of engineers, as a profession, as to allow of the general determination of those primary principles and normal rules which the great difficulty of the inquiry preeminently requires. It is not, however, so much in that portion of the subject that relates to the sweetness and safety of the dwelling-house (which is the matter now under consideration), that doubts will be found to arise, as in the more distant portion of the work, where it becomes necessary to deal with accumulated sewage. Even as to this, though our progress is slow, yet there is a regular advance. The present year has enabled us to lay before our readers more than one instance of good work done in the direction of collecting facts as to positive and useful experience, and considerably limiting the field of doubt, by indicating the direction in which we have to look for further improvement. Thus, the idea that a large revenue can be obtained from sewage, as to which the wildest expectations have formerly been raised, is now almost entirely exploded. The sense of the danger that augments with collection, and that augments with delay, is becoming dominant with the engineer as well as with the physician. The plans, of which the name is legion, for making fortunes by putting expensive chemical ingredients into collected sewage, in order to "fortify" or raise the agricultural value of the product, have one by one been tried, at unrestricted expense, and found wanting; as might, perhaps, have been anticipated if the conditions of the problem had been fairly and fully stated in the first instance. In some important questions, no doubt, the best solution may be yet in suspense. But these difficulties are annually becoming less; and, as we before remarked, it is in his character of ratepayer, not in that of occupier, that they principally affect the householder.

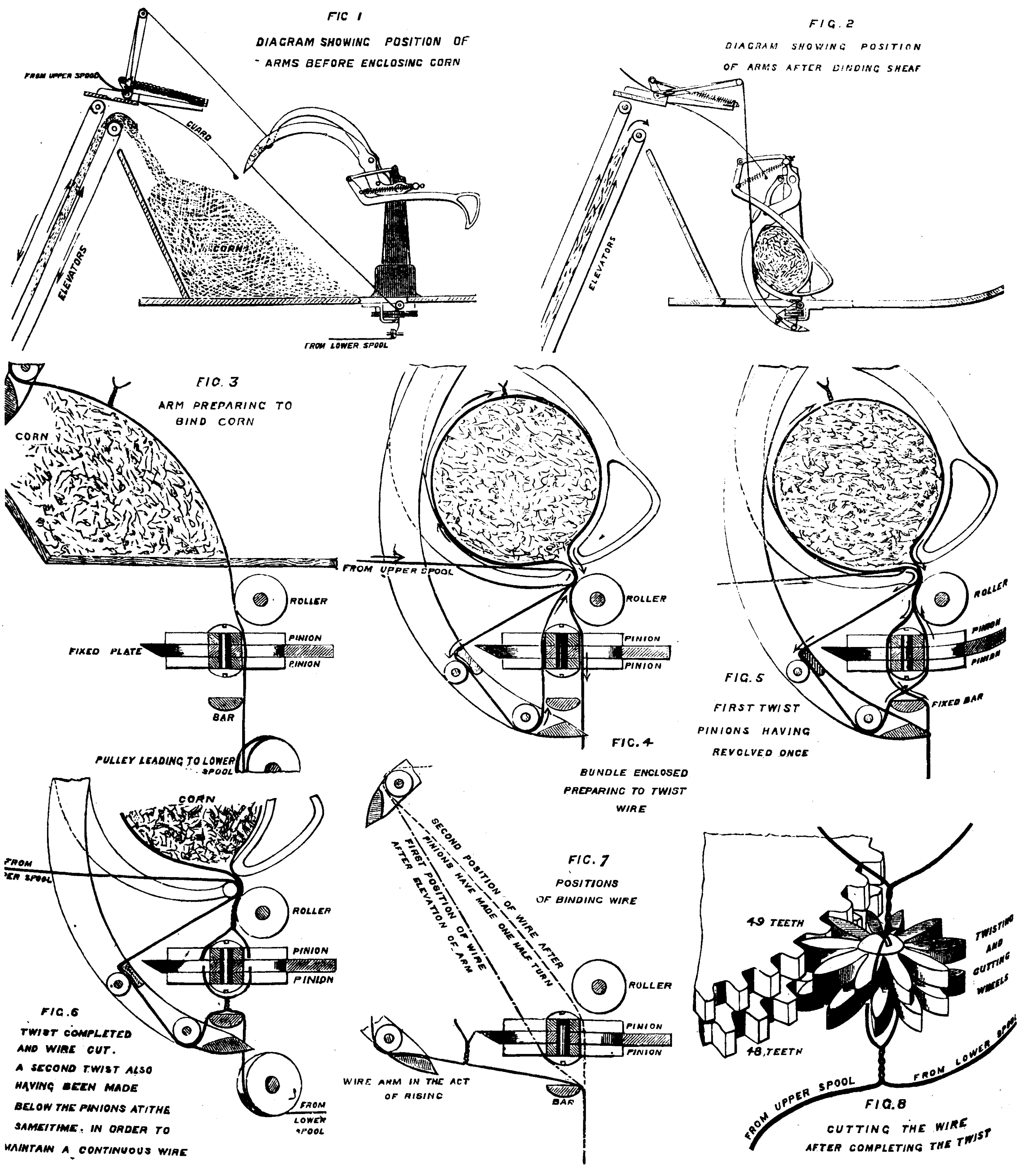
At the same time, it must be remembered that the engineer cannot act until he is duly called in. He cannot originate action. He is not responsible for the public health, or for instructing the public as to the conditions of health. Those conditions, indeed, should be either well known to him, or should be the subject of constant study. But that is the case precisely in the same way in which the doctrines of hydraulics, of the dynamic equivalent of heat, or any other branch of mechanical science, has to be known to him. If a public lecturer, or if educating private pupils, it is the business and duty of the professional man so far to become a teacher on these subjects. Otherwise he will best keep his shot for his own use, for discussion with his brother professional men. If his position and occupation be such as to lend weight to his abstract opinions, he cannot afford his time to ventilate them. If not, he possibly will not much advance the case he has at heart by appearing as a missionary. Thus whatever amount of good service we may expect, and rightly expect, from the civil engineer, we should only look in vain to that profession to enforce on the public intelligence and on the public conscience the lessons that are so seriously needed.

It is another thing with the medical man. The medical profession is the natural guardian of the public health. It is so *ex officio*. But it is more than that. A large acquaintance with many of the brightest ornaments of the medical profession, in and out of the British isles, leads to the certain conviction that the preservation of the health, not only of his patients, but of his neighbours, townsfolk, countrymen, is a motive that presses on the life of the doctor with unslumbering force. No offence need be taken by the members of any other class and calling if we attribute to our physicians and cultivated men of medical science and practice a degree of active and disinterested beneficence to which it is hard to find a parallel elsewhere. And it is to this that the appeal must now be made. It is this willing horse that we have to spur. We must call on our physicians and family doctors to do some violence to their professional or personal delicacy of feeling in the interest of the common weal. There is little doubt that, as a rule, the higher are the intellectual and professional qualifications of the physician, the less is he disposed to volunteer advice. When he is consulted, he must, no doubt, probe the case of his patient to the bottom. And so he does; and in exact proportion, as far as our own experience extends, to the real value of the time of a physician, measured by quarters of an hour, is his apparent utter disregard to the lapse of time while he is investigating the symptoms, or listening to the complaints of a patient. But here the limit is drawn. Into the circumstances and habits of that patient, unless as they bear directly on the very point of his complaint, the physician shuns to pry. At times, indeed,—all honour to them for the same,—men of large practice will put some delicate or circuitous questions as to the ability of a patient to pay golden fees without inconvenience; but solely with the view of remitting or reducing such fees in case of need. But if a man goes to consult a physician, say as to the state of his heart, the physician will not be likely to question him as to the condition of his scullery or his sink.

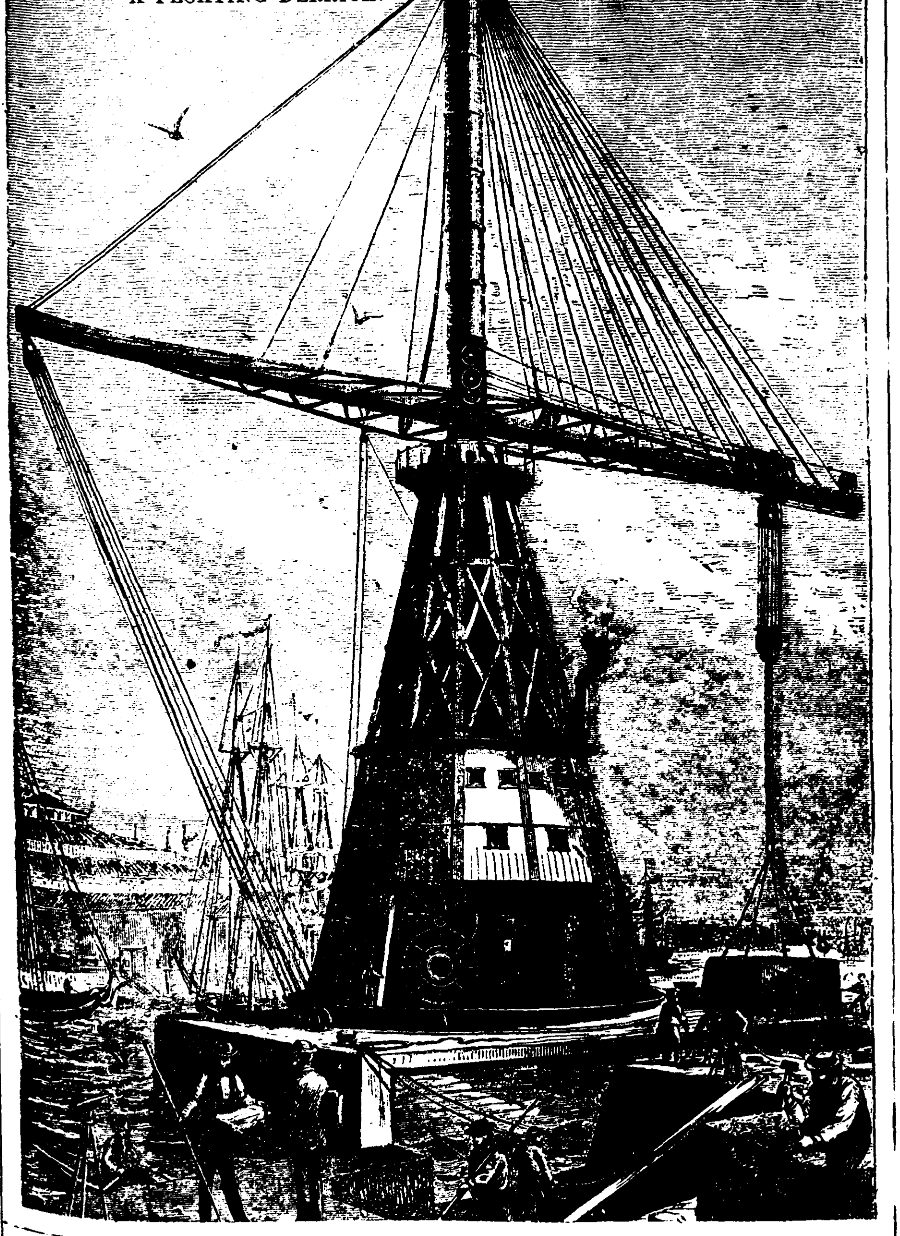
We very much fear that we shall have more and more royal, noble, and even medical victims to typhoid infection, unless the profession somewhat change their hand in this matter. It will be remembered that we are now more especially referring to the condition of connections with the sewers, and the escape into a house, or the water used to drink,—as at Marlborough House, the War Office, and the Admiralty Offices,—of that subtle and deadly gas which bears the germs of this disease, or, at least, sets up the abnormal action which ultimately takes that form. It is to be expected, no doubt, that if called in to a typhoid case, the doctor will make some inquiry; just as, if he were called in to a case of consumption, he would inquire as to the dry or wet condition of the subsoil, and the state of the ventilation. But we mean something more than this. What we wish to become the universal practice is, that when a medical man is consulted on any occasion, at his own house, or on visiting a patient, whatever be the illness, whatever the symptoms, he should make minute and searching inquiry as to the possible escape of sewer-gas, or the contamination of water; and, if he visit the patient, should not only inquire, but see for himself, what the state of things is. If one or two of the most eminent men would set the example, it would be universally followed. Those men who failed to take the trouble would by-and-by be stigmatised as heedless and unreliable practitioners. We freely admit that there would, at first, be much that would be disagreeable in the change of practice. The doctor must make up his mind to be stared at; to lose so much time in the course of the day; even to affront and, perhaps, lose patients. But what we have before said is enough to show how thoroughly we are convinced that these drawbacks would be freely borne by the majority of the profession, if once convinced that it was an unavoidable professional duty to make such searching inquiries. Nor do we for one moment doubt that in the additional success that would attend the practice of any man who adopted this course, there would very soon be found a compensation for all the discomfort. Many things that were really obscure to the physician himself would become clear to him if he made a point of overhauling the places in which his patients lived. Why do the children of such a family so often want the doctor? Why have they hoarseness, sore throats, catarrhs, want of appetite, red eyes, or a hundred other things? In the luxurious and well-appointed drawing-room to which the little things are brought down, when the doctor's carriage stops at the hall-door, the why may be very puzzling to the doctor himself. He knows, of course, what palliatives or restoratives to give, and he gives them. He prescribes, it may be, a wise course of regimen. He cures the little one for that week, and ten days after he is called in again.

But if, instead of a state visit to the drawing-room, the physician insists on seeing his patient, so to speak, *in situ*, how different will be the case. "I cannot allow Sir X. Z. to go into the nursery when it is in such confusion," says the fond mother. That is not Sir X. Z.'s view of the case. The more confusion the better, so that it results from the children making horses of

SHEAF-BINDING REAPING MACHINE.



A FLOATING DERRICK.



BRAKELL'S PUMPING ENGINES AND BLOWERS.

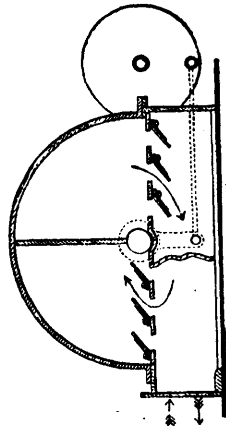


FIG. 5.

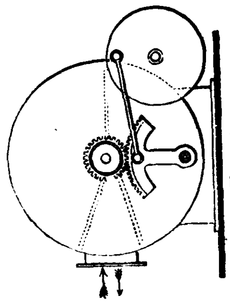


FIG. 4.

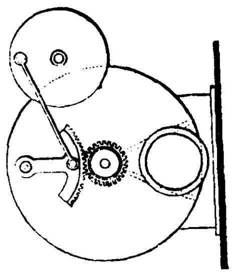


FIG. 3.

BRAKELL'S PUMPING ENGINES AND BLOWERS.

FIG. 1.

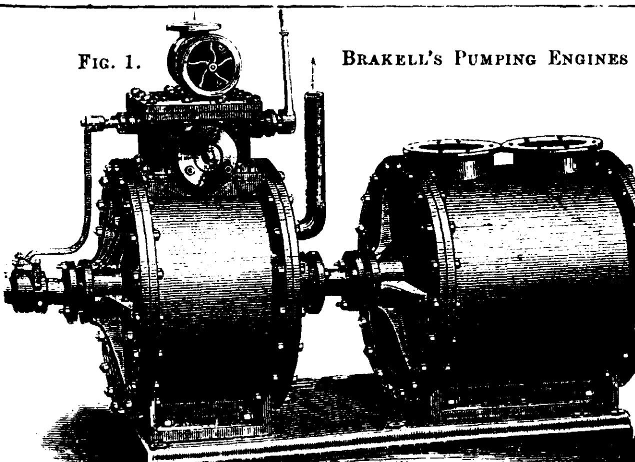
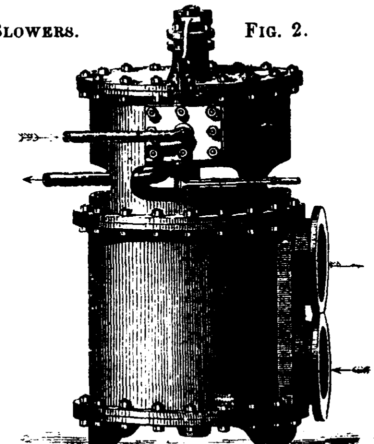


FIG. 2.



the chairs, or even tents of the scraps of carpet, which alone should be allowed in their dominions. But, ten to one, something worse than confusion will catch the eye,—or some sense,—of Sir X. Z. "What is this, nurse,—do you burn gas in the nursery?"—"Only at night, sir."—"And how long has this smell been perceptible?" "Well, I think I perceived something when we came back to town; but we keep the door open. All gas-pipes smell, sir!"—"Bring me a box of matches." The physician strikes a light and approaches it to the gas-pipe, runs it along to the joint, and a slight, fairy-like flash blows out the match. Or the hot-water pipes, carefully and conveniently laid into the night nursery, for the benefit of the bath, bring up aroung them a little jacket of foul air from the scullery or worse places. And then the closet itself,—but we need not go further. These are instances which must be familiar to us all. The little sufferer wanted the physician, indeed; but he was in far more urgent need of the gasfitter, or, rather of the quiet, decided, grave man, who should say, on going down, "My dear Mr. So-and-so, if you wish to have your children grow up healthy, send immediately to your tradesmen, and have all these matters looked to under proper advice."

One example,—and we are sure it will awaken an echo of sympathy from many a one who has learned sad lessons from experience,—may serve for all. In spite of the labours of twenty or thirty years, of books, pamphlets, leading articles, lectures, speeches, Acts of Parliament; in spite of the loss of the noblest, the brightest, the dearest from our side by this fatal and subtle poison, to the spread of which, what are to a certain extent sanitary improvements, if unwatched by a competent eye, may directly tend; how many of our palaces, mansions, public offices, are stil maintained as the seed-beds of preventible disease? We make one more appeal. Will not the eminent men who so well know the truth of what we say come forth, and endorse our recommendation; enforce it, rather, by turning advice into practice?—*The Builder.*

BRAKELL'S PUMPING ENGINES AND BLOWERS.

(See page 293.)

The accompanying illustrations show various improvements in detail, and recent adaptations of a simple pump, blower, or air compressor, designed by Mr. C. Brakell, of Westminster chambers, some illustrations referring to the earlier forms of which were given in *The Engineer* of 6th October, 1876. Fig. 1 shows the design—except that the suction and discharge are at the top instead of at the bottom—of two of Brakell's pumping engines now in course of erection for the local board of Skipton, for their sewage works. These engines are capable of raising over seven millions of gallons of sewage per day to a height of 20ft. The same figure also represents a Brakell air compressor for 15 lb. pressure per square inch; and one of similar design is now working at the Santas Chemical Works, Bethnalgreen, for 3 lb. blast pressure per square inch.

Fig. 2 shows a pumping engine with vertical shaft, as made for Messrs. John Brigden and Sons of Bridgend, South Wales, capable of raising 80,000 gallons per hour 30ft. high. The space occupied by this engine is 2ft. 6in. diameter, and 4ft. 6in. in height. A similar pump is now in hand for the South Staffordshire Mines' Drainage Commissioners.

Figs. 3, 4, and 5 show modifications of these machines as arranged to be driven by gearing, belt, or hand-power, and have, we understand, been recommended for ventilating purposes in India, to be worked by bullock-power. The mode of obtaining angular reciprocation of the flat pumping diaphragm is clearly illustrated in these diagrams, the diaphragm being seen in the vertical position in Fig. 5.

The construction of these machines admits of very large valve area, and of the application of every description of valve, such as the circular plate valve, illustrated in *The Engineer* of October 6th, 1876; also a modification of the "Perraux," or lip valve; or the flap valve shown in Fig. 5, the quick action of which is secured by steel springs of the spiral, or coil, or flat form, or by similar means. For the sewage pumps a specially designed valve has given much satisfaction, and consists of an India-rubber flap valve working loosely on a fixed brass spindle, the bearing being cast in the solid India-rubber, which is said to entirely obviate the liability of sticking or jamming, common in sewage pump valves. These valves, moreover, allow of a full opening, there being no cross-bars or ribs.—*Engineer.*

It is said that turbine water-wheels have saved three hundred million dollars worth of fuel to this country since their invention.

THE FLOATING DERRICK OF THE NEW YORK DEPARTMENT OF PUBLIC WORKS.

(See page 293.)

The derrick is originally a nautical invention, the original being the sailor's contrivance made of a spare topmast or a boom with the appropriate tackle. This simple contrivance is even now used on shipboard for masting, and for placing boilers, engines, and other heavy articles on shore. The derrick is more commonly used in the United States than in Europe, and has in consequence acquired a corresponding degree of perfection. The Floating Derrick which we herewith illustrate is "Levytyped" and described from *Knight's American Mechanical Dictionary.* This derrick is in use in the New York Department of Docks, and was built under the supervision of Mr. Newton, assistant engineer of the department. It was constructed expressly for the purpose of transporting from the work-yards the blocks of granite and artificial stone that are to form the river wall. Its lifting and carrying power is 100 tons; the float which carries the derrick is of rectangular form, 66 by 71 feet, and 13 feet in depth. The tower which supports the king-post and booms is made of twelve balks of pine, 63 feet 3 inches in length and 14 inches square. These balks or legs are stiffened from one end to the other by struts and braces; their lower ends are bolted into a heavy cast iron circle which pass through the bottom of the floor. At their upper extremity these legs are brought close together and are inserted in a cast iron cap, to which they are bolted. The tower forms a frustrum of a dodecagonal pyramid, 40 feet in diameter at the top. The front or hoisting boom of the derrick consists of two wrought iron box girders, 22 inches deep by 9¾ inches wide. These girders are made of planed plates, are spaced 24 inches asunder, and are held parallel by braces of wrought iron; on the upper and inner edges of these girders a track or slide of polished brass is fastened by counter screws. These tracks have a projector which extends a short distance downwards; the carriage is composed of two plates of iron, ⅝ of an inch thick and spaced 10 inches asunder; its length is 8 feet, its depth 3 feet. The iron boom is supported by 18 diagonal rods, 2½ inches in diameter. These converge near the top of the king-post, and are secured to it by three heavy forgings which straddle the iron cap on the top of the post.

The king-post is of wrought iron, 40 inches outside diameter. It is hollow, and its shell is three-fourths of an inch thick. It revolves in a circular casting, swinging the boom completely around.

All the machinery is placed on the float under the tower, and the levers which operate it and give the various movements are brought together on a platform 35 feet above the deck of the float, so that the person operating them acts in full view of the load that is being handled.—*Polytechnic Review.*

A Pneumatic Railway in London.—A company is now being formed, we learn from the *Engineer*, to construct a pneumatic railway between the South Kensington Station of the District Railway and the Albert Hall. The line will rise the whole way to the Albert Hall, the ruling gradient being 1 in 48. The train will be blown through the tube by an ejector, in other words, a great centrifugal pump, two feet in diameter, fixed close to the District Station, and worked by a pair of condensing engines exerting about 170 indicated horse-power. The tunnel will be of brick, and the floor will be paved. Its cross-sectional area will be 105·5 square feet; at the end of the train is fixed a screen or piston, with an area of 104 square feet, the difference being allowed for windage. The train will consist of six carriages, of very light build, the rail guage being four feet. This train will hold 200 passengers, and the total load will be thirty-two tons, or ten tons less than the weight of a single engine on the Metropolitan Railway. The maximum resistance at twenty miles an hour will be about 2,240 lbs.

Brain and Muscle.—Men who use their muscle imagine that men who use their brains are strangers to hard work. Never was there a greater mistake. Every successful merchant does more real hard work in the first ten years of his business life than a farmer or blacksmith ever dreamed of. Make up your mind to work early and late, if necessary, that you may thoroughly master every detail of the business upon which you purpose to enter. The habit of persistent, rapid work once formed, you have gained a momentum that will carry you very successfully through many a pinch in business where a less persistent worker would find it vastly easier to lie down and fail.

ELEVATORS.

(See page 296).

The increasing value of land in great cities—the necessity in some manufactures (as sugar refining, &c.), of such an arrangement and construction as will permit the continuous downward passage of the materials in process of manufacture—increased ceiling height, and the ambition of individuals and corporations to tower above their fellows—have led to the erection of buildings whose upper floors could only be reached, if stairways were the sole means employed, by an amount of muscular exertion which would be fatiguing te the most robust, and beyond the strength of the more feeble and aged. Few consider that stair-climbing necessitates an actual lifting of the whole weight through a vertical distance equal to the height of the stairs. A man weighing 160 lbs., in walking up a flight of sixteen steps, each with an eight-inch rise (corresponding to a twelve foot ceiling), in a time of twenty seconds, has lifted 1920 pounds a foot high in that time—nearly a ton weight. To climb to the top of a four-story building—say fifty-two feet vertically to the fourth floor—in ninety seconds, represents the lifting of 8300 lbs. a foot high in that time. Reduced to minute foot-pounds, this equals 5533 pounds lifted a foot high in a minute, or one-sixth horse-power.

Staircases were of course out of the question for merchandise, for which an external or an internal hoistway and tackle had long been provided; a cage being more recently substituted.

The exertion and time required to reach the upper floors of tall buildings had rendered those floors far less desirable than the lower, and had led to a discrimination in the ceiling height and in the cost and convenience of fitting which still further militated against the upper stories and materially affected the rental. Builders gradually appreciated this fact, and the shrewder ones so arranged the floors as to give a half basement and a first floor considerably above the street level—thus practically giving two first floors with an equal amount of climbing. The owners of older buildings met this in part by calling their first floor the "ground" floor, and promoting the second floor to the dignity and name of the first, and so on all the way up; a usage which prevails in New York city, but which, while it may give additional tone to the garret rooms, does not take an ounce off the foot-pounds referred to, or give the climber any more breath to say "fourth floor" than he formerly had to say "fifth." By giving the upper floors the same head-room and equally convenient and costly fittings, the discrimination against them was partly removed—after one got up there; but the work and shortness of breath remained.

Stairways as now built have the additional demerit of taking up a great deal of valuable surface-room in the most desirable portions of the building.

We find, then, that the tendency of men to avail themselves of the privilege announced in the famous expression of Hon. John M. Clayton, that right and title to land extended "heaven high and hell deep," has led to the almost inordinate extension skyward of public and even private buildings, and has more recently rendered it necessary to extend the hoist-way system to the accommodation of passengers; and in new buildings the staircases were relegated to the less valuable portions of the floor space. The earliest passenger elevators were simply a betterment of the goods cages; and the fact that their ropes sometimes parted and let the cage and contents down with a run, did not add to their popularity. Safety attachments were next in order—first in the shape of an extra rope, and later in ingenious clutches or catches, generally dependent for action upon butting, jamming, or twisting friction. These lessened the risk and fairly inaugurated the era of passenger elevators; until now-a-days a large building is considered as incomplete without one as without steam or furnace heat, and no hotel can get good rates for its upper floors unless there is an elevator to keep them up.

There was but one serious drawback to the introduction of the elevator—the necessity of employing a steam engine to do the hoisting. The minor evil of the roughness of action attendant upon the hoisting action of most of the quick-stroke winding engines prejudiced people with loose teeth and sensitive stomachs against the voyage; and the action of a quieter motion and smoother ascent became one of the longed-for innovations.

Fortunately, the power had long existed, and nothing but the newness of the application was a bar to its adaption to the purpose. This was a matter soon overcome; and we have now, in the hydraulic elevator, something more nearly approaching the public demand for a smooth and safe riding apparatus not necessitating the use of steam.

We illustrate herewith one form of hydraulic elevator, (*) having a hollow cast-iron base from which projects a cast-iron cylinder fitted with a piston, and through which base is a shaft carrying three drums, one within the base, and carrying chains attached to the piston, and the others, shown in the cut, carrying the two wire hoisting ropes of the cage, which pass down to the bottom of the cage and pass under an iron shaft there. A three way cock, operated by a wire rope from the cage, admits, cuts off or discharges the water. The rise of the piston unwinds the piston and revolves the drum shaft, causing the car to ascend. The safety attachment is a wedge brake which the breaking of either rope puts in operation by the strain on the other rope turning the shaft. There are but two stuffing-boxes—those in the sides of the base, and through which the drum-shaft passes. The piston is packed by hydraulic cup-packing of leather.

As applied to a private house, such an elevator requires a floor cutting of 3 by $2\frac{1}{2}$ feet, and should carry four persons weighing in all 600 lbs. The car is balanced by weights. The two-inch wire ropes used should carry 16,900 lbs. A piston two feet in diameter and two-foot stroke would, with sixty lbs. water pressure, raise (neglecting fractions) $3.1416 \times 144 \times 60 = 27{,}143.424$ lbs. two feet high, or 1357.6712 lbs, forty feet high, consuming

$$\frac{3.1416 \times 144 \times 24}{231} = 47$$

gallons of water. Allowing 20 per cent. for friction, the lift would be equal to 1086 lbs. forty feet high. No power is, of course, required to lower the car, as where steam is used.—*Polytechnic Review.*

(*) Made at the Burdon Iron Works, Front and Pearl Sts., Brooklyn, N. Y.

A COMMOM-SENSE PLUMB BOB.

(See page 296.)

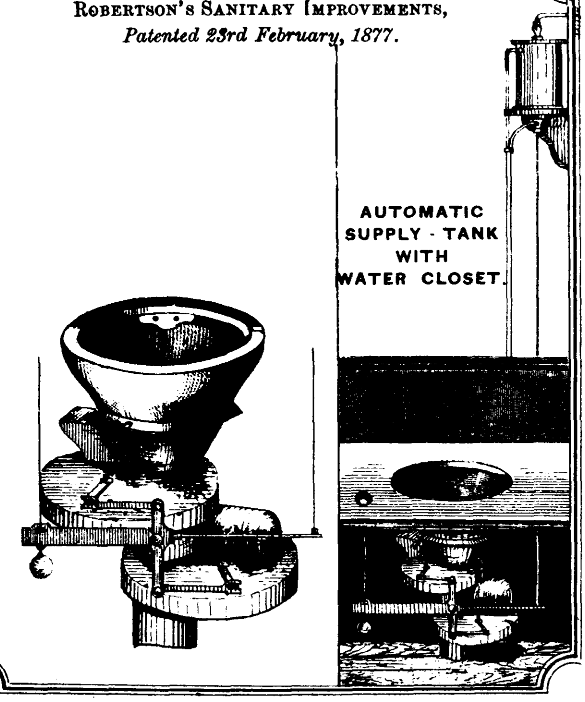
The difficulty with the plumb bobs of theodolites, etc., is not that they vibrate or swing, like a pendulum, but that they *wabble*, and do not "center" quickly. The reason of this is that the cord suspending the bob twists and untwists, and causes the latter to twirl; but this rotation causes *wabbling* solely on account of the faulty shape of the bob.

Referring to the figures: A is the ordinary pear-shaped masons' bob, where the line gives the guage; B and C are the common top-shaped forms of instrument bobs, where the point marks a centre below. All three of these bobs become "drunken" when rotated by their strings twisting and untwisting. The turnip-shaped bob shown at E will twirl at a rapid rate without wabbling; its point remaining centered. A disk, E, would twirl as steadily.

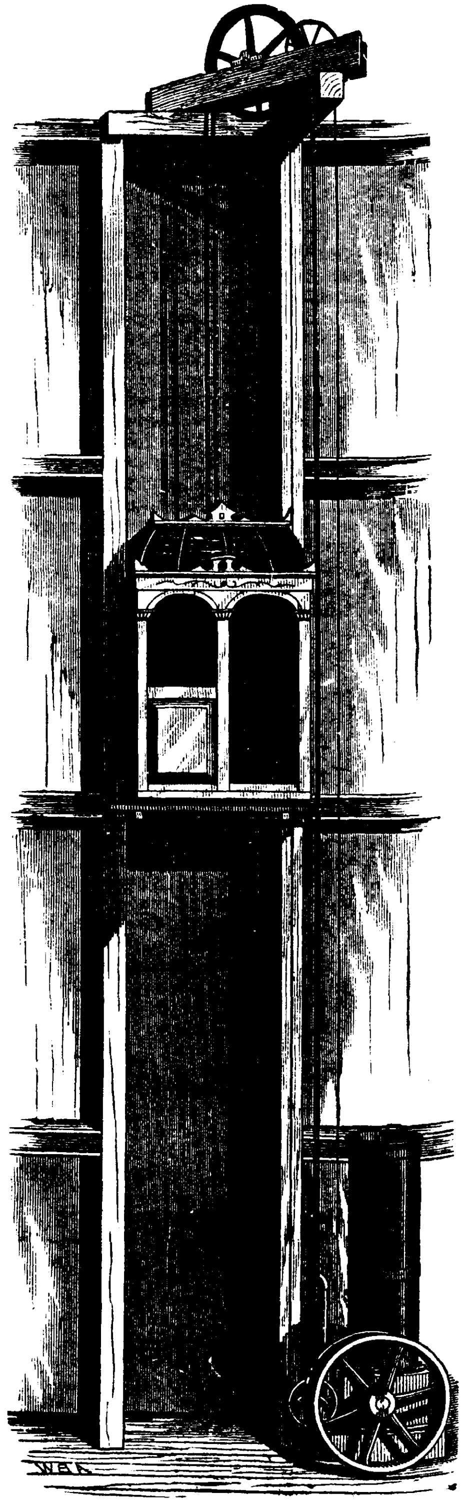
The reason is that a rotating body tends to rotate about its shortest axis. A ring, F, hung by a cord, and twirled very rapidly, will obstinately refuse to hang vertically and to rotate about its long diameter, but will, under rapid vibration, take the position shown at G, and when slowing down, or when speeding up, will "wabble." A chain ring suspended, as shown at H, will, when very rapidly twirled, spread out and keep the position shown at K. Hence the top-shaped bob, B, the pear, A, and the cone, C, will, when whirled by the untwisting cord, wabble, and their points will not remain centered; while the turnip, D, or the disk, E, will, even if the cord does twist, remain centred, and the line will be plumb.

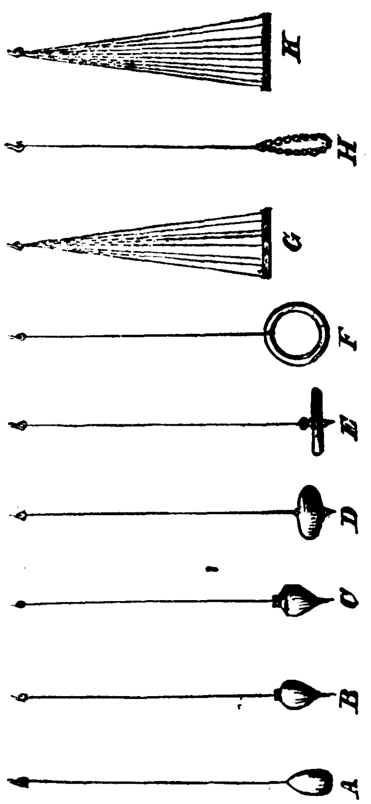
A New Fire Extinguisher.—A new fire-extinguishing chemical compound has been lately devised, which, in its application for extinguishing fires, is quite different from the fire-annihilators in general use. The new composition is a mixture of chemicals which, on being ignited, evolve sulphurous acid and carbonic-acid gases, which fill the apartment or building, producing an atmosphere which smothers combustion. A successful trial of this invention was recently had in front of the City Hall, Philadelphia. A board-shanty, 13 feet square and 10 feet high, was erected to represent an apartment, and furnished with a door, window, and a stove-pipe coming through the roof. The interior was coated with tar. On a bench were placed seven basins containing benzine, coal oil, and naphtha. In one corner was a 10 lb. box of the extinguishing compound, with a fuse attached to it running round the walls, on the self-igniting plan. The combustibles were set on fire, and in an instant the interior was one sheet of flame, bursting out through the door, window, stove-pipe and every aperture. A few moments after the compound was ignited, the gases that were generated therefrom instantly subdued the flames, and in less than half a minute the fire was entirely extinguished. The new substantance is called "Reec's Compound Fire Extinguisher."

Robertson's Sanitary Improvements,
Patented 23rd February, 1877.



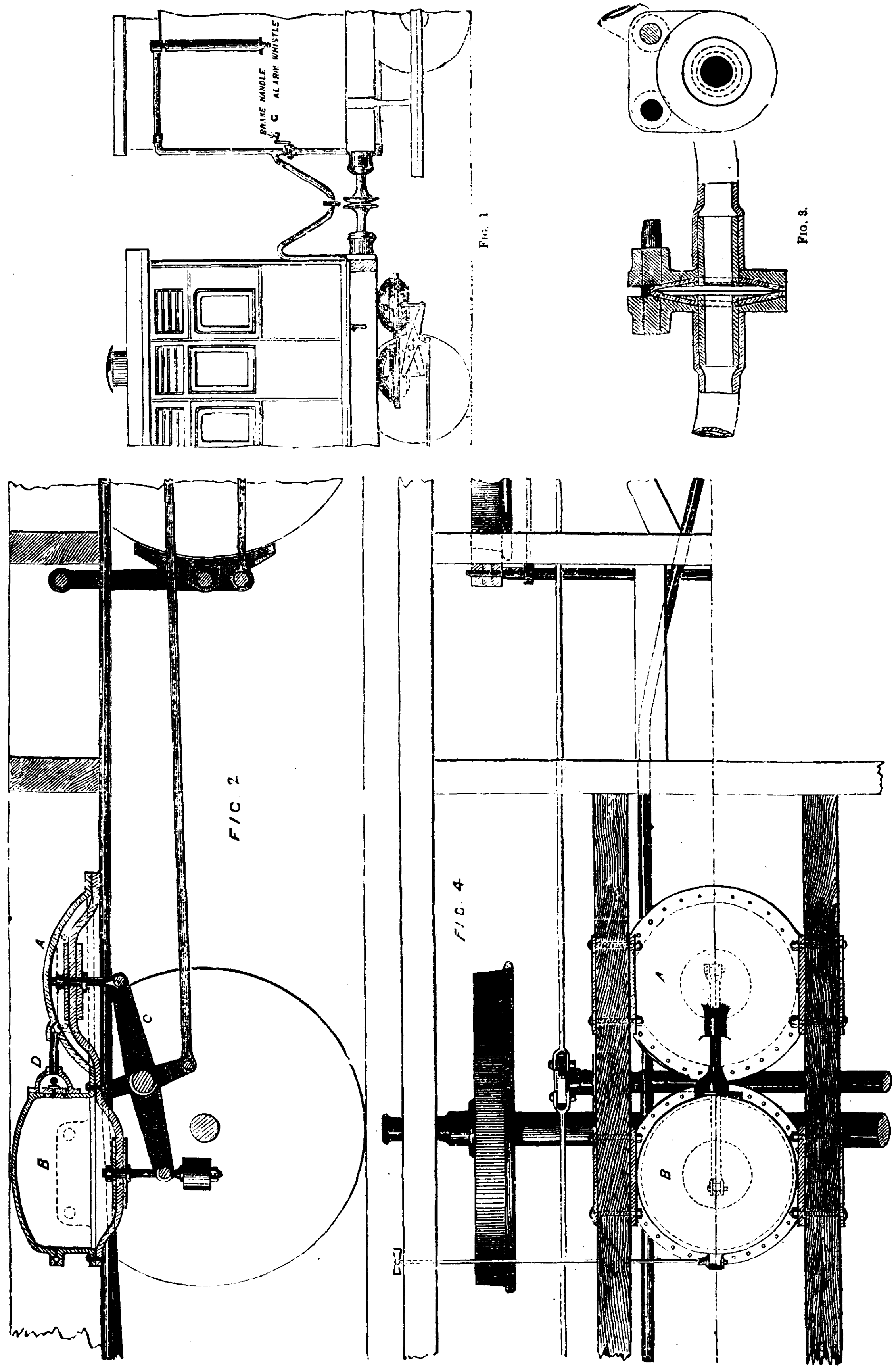
ELEVATORS.





A Common-Sense Plumb Bob.

SANDER'S AUTOMATIC CONTINUOUS VACUUM BRAKE.



SAUNDER'S AUTOMATIC CONTINUOUS VACUUM BRAKE.

(See page 297.)

In our report of the excursion of the Institution of Mechanical Engineers to Swindon on the 27th ult., reference was made to some trial stops made with the Sanders automatic brake which was fitted to the train by which the members were conveyed from Bristol to Swindon. This brake was illustrated rather more than twelve months ago, but by a misinterpretation of the manuscript the name of the inventor was incorrectly given. We now give the necessary illustrations to show clearly the general design and construction of the brake as applied to the train above referred to. The action of the brake is as follows: The two drums A B, Figs. 2 and 4, are exhausted, and act simultaneously on the two opposite ends of the lever C, the lower portions of the drums, to which the lever connections are fixed, being of India rubber, and, in the action of the brake, taking either of the positions shown in Fig, 2. The area of the drum A being greater than that of drum B, the pressure of the atmosphere on A pulls the lever into the position shown for keeping the brake off; but when air is admitted into the pipe along the train by the driver, or by either of the guards, or by an accidental separation of the carriages, the power of drum A is destroyed, and the pressure of the atmosphere on drum B is then free to act independently on the lever, to reverse its position, and instantly to apply the brake. Just before starting it is necessary to withdraw the air from the pipes and drums throughout the train. This is done by the driver, by means of a steam ejector conveniently placed on the engine. On the train being set in motion, the ejector is shut off, and the vacuum is then maintained by a long-stroke pump, which is worked from the engine crosshead. A vacuum gauge is placed before the engine driver, by which he can at all times see what vacuum he has, and any defect in any part of the brake arrangements is immediately shown by this gauge, so that it is impossible that anything can be wrong without the knowledge of the driver. He cannot, therefore, be at any time deceived by it. Air can be admitted into the pipe along the train, for the purpose of applying the brakes, by simple cocks G, as seen in Fig, 1, one of which is conveniently placed within reach of the driver on the engine, and of the guards on each brake van. In Fig. 3 is illustrated, on a larger scale, the coupling shown on Fig. 1 between the ends of two carriages, on the piece of flexible pipe placed above the carriage couplings out of the way, and where it is very unlikely to meet with any harm. This coupling is simply held together by the cross strain thrown upon the pins on the top part of it, and by the vacuum. In the van is shown an alarm whistle, which consists of a brass cylinder, with a whistle at the bottom, and in which is a weight made air-tight. When the train is in motion and a vacuum existing, the weight is forced to the top of the cylinder by atmospheric pressure; but as soon as the vacuum is destroyed, either purposely or by accident, the weight immediately commencing to descend forces the air out of the bottom of the cylinder, and blows the whistle.—*Engineer*.

GERMAN PATENT OFFICE RULES.

We have received a copy of the following preliminary rules which are to be observed until complete rules are issued by the Patent-office, under the new German law. Specifications and drawings must be lodged in two copies. The paper for the application and specification must be 33 centimetres by 21 centimetres in size. Of the drawings one copy must be made on white thick, and smooth drawing paper 33 centimetres long and 21 centimetres wide, or 33 centimetres long and 42 centimetres wide, or 33 centimetres long and 63 centimetres wide, the drawing and all the writing must be executed in Indian ink in absolutely black lines, without colours or shading by the brush. The drawing must be surrounded by a simple marginal line at the distance of 2 centimetres from the edge of the paper. This line has also to enclose all the writing. The signature of the applicant is to be placed in the lower right-hand corner. At the top of the sheet a space of at least 3 centimetres in width is to be left within the marginal line for the number, date, and title of the patent. The second copy of the drawing may be a tracing of the main copy on tracing cloth. In the same the use of colours is allowed and even desired. The drawings must not be folded nor rolled. Measures and weights, if indicated, must be given according to the metric system. We believe a scale in such measurements is expected to be added. Powers of attorney may, until further decision, be lodged without attested signatures, but they must give the representative full authority to do all that is needful to prosecute the application.

SHEAF-BINDING REAPING MACHINE.

(See page 292.)

The trials of sheaf-binders exhibited at the recent Liverpool Show, and intended to compete for the gold medal of the society, which is offered for "an efficient sheaf-binding machine, either attached to a reaper or otherwise," commenced yesterday—Thursday—on a farm belonging to Mr. William Scotson, at Aigburth, near Liverpool, about 10 acres of wheat and five acres of oats having been reserved for the purpose. Originally there were entered for trial machines belonging to eight exhibitors at the show. Three of the firms, however, did not send their machines for exhibition at Liverpool, while it is further to be regretted that the only two machines shown there by which the binding process is performed with string or yarn have been withdrawn from competition, leaving but three machines, all of which are constructed for binding with wire, to be tried. They are the following:—Harvester and sheaf-binder attached, manufactured by Mr. C. H. M'Cormick, of Chicago, U.S.A., price £60; harvester and binder, manufactured by Mr. Walter A. Wood, of Worship-street, London, price £60; harvester and automatic self-binder, manufactured by Messrs. D. M. Osborne & Co., of St. Anne-street, Liverpool, price £50.

Wood's machine we illustrated in our impression for January 14th, 1876, and we now illustrate the M'Cormick machine. We shall illustrate Messrs. Osborne's machine in an early impression.

The binding apparatus is fixed at the side of the reaping machinery. The corn as cut is delivered by an endless band to the elevators, shown in Fig. 1, by which it is raised and delivered under the guard on to the platform. Fig. 1 also shows the general form of the binding arms and their position before enclosing a sheaf. The standard carrying the binding arm has a reciprocating movement imparted to it, by which it is moved from the position shown in Fig. 1 to the various other positions shown successively in Figs. 2, 3, 7, &c. To put the machine into work the wire from the upper spool is threaded into the main arm, as shown, and jointed to the wire from the lower spool brought up from under the twister, as shown in the upper part of Fig. 7. The main arm may now be supposed to have moved to the position shown in Fig. 3, and is about to descend through the slot in the platform and to take position shown in Fig. 4, at which position the thumb I—seen also in other Figs.—has moved and passed the upper part of the wire, or that from the upper spool, in between the teeth of the twister, so that the two parts of the wire are between opposite teeth in the twister. The standard now begins to return to the position shown in Fig. 1, and in its rectilinear movement the teeth of two wheels shown in Fig. 8 engage in a rack by which they are revolved, and in their revolution they move the two steel wheels which form the twister and the cutter, a differential movement being given to them by the difference in the number of teeth in the main wheels, so that the twister teeth gradually overlap after several revolutions by one revolution of the main wheels. As seen in Fig. 4 the sheaf is inclosed, both parts of the wire are in the twister teeth, and the latter now begin to revolve.

Fig. 5 shows the position after the first twist, and Fig. 6 shows the twist completed, and the wire cut off, the wheels having assumed the position shown in Fig. 8, and the standard having nearly returned to the position of Fig. 1. Fig. 2 shows the position of both arms after the sheaf is bound, but before it is released. Each successive sheaf passes the last one off the platform. Now it will have been seen that the wire has been joined by twisting above and below the twister, so that though cut off in one place the wire is by the join continuous from lower to upper spool, as seen in Fig. 6. When the arm begins to rise again, the lower wire as seen in Fig. 1 is pulled to the position as seen in the lower part of Fig. 7, and as the arm still rises, the wire is pulled in between the twister teeth, as shown by the light dotted lines. Now it becomes necessary to get the wire to the position shown in the dark dotted lines, or to that shown in Fig. 3, and to effect this the twister wheels receive a half revolution, obtained by the meeting of a projecting arm and two studs on the main cog-wheels during the latter part of the return movement of the standard, which it will be seen carries all this mechanism. The projecting arm thus gives the wheels a push farther round. The wire is now in the position shown in Figs. 1, 3, and 7, and the whole is ready to recommence the binding operation. Our illustrations are so complete, that complicated as mechanism of this class is necessarily, we believe our readers will fully understand its action.—*The Engineer*.

BROWN.—Various tones may be produced by mordanting with chromate of potash, and applying a decoction of fustic, of logwood, or of peachwood.

AMERICAN AGRICULTURAL MACHINES IN ENGLAND.

(See page 300).

The American harvesting and mowing machines have acquired a character and celebrity of their own in the English market, and Mr. William Anson Wood's name has frequently appeared amongst the successful competitors in our trials at agricultural and other shows.

The American machines are distinguished by their exceptional lightness and the graceful flow of lines in their design, doubtless owing to two principal points, namely:—that American cast iron is much tougher and more reliable for machinery subject to shock than the English material; and that the American crops are invariably light and require but a light machine. These machines have now been found, with a few modifications, suitable for English crops.

Foreign agriculturists complain of the cumbersomeness of the English ploughs, reapers, &c., as compared with the American, and probably because Continental and Colonial crops much more nearly agree in character and lightness with American than with English crops. Our manufacturers might, with advantage, consider that foreign crops will not suit themselves to English made machines; they might learn better the altered conditions abroad and in new countries, and build their machines to suit light and straggling crops.

The machine of which we give an illustration is Mr. William Anson Wood's self-raking reaper or harvester. The rakes are fully under the control of the driver, to rake or leave on the platform. They are driven round their vertical standard by a bevel wheel beneath, which gears into another smaller bevel on a horizontal counter-shaft. This counter shaft gears by a pinion into the main driving inside spur wheel on the main axle, and at the same time is arranged to drive the cutter-bar direct. The whole gearing is of a simple description.

The rakes may be set to automatically rake any one, two, three, or all out of the four, by means of small movable rollers, which can be adjusted without delay or inconvenience, and a movable switch in the cam motion determines whether the rakes shall deliver the sheaf or lift clear of the platform.

Mr. M. Anson Wood adopts an optional adjustment of the rakes in exactly the opposite manner to most of the other manufacturers. His system is to set the rakes automatically, to rake with as few as are likely to be wanted—variable at any moment by a slight alteration of the rake rollers—and thus the driver can make any dummy-rake clear the platform and deliver the sheaf when desired, and can at the same time, by pressing a foot-lever, convert either rake into a dummy, thus giving absolute control of them at all times. The proportions of materials used in the construction of this implement could hardly be safely attempted in English castings, except by the use of special mixtures.

The fingers and teeth have a peculiar pitch, calculated to pick up beaten or fallen grain, and the sweep of the rakes is also low and well suited to aid this effect. The cut is also very low unless required to be heightened for rough ground, and it would be useful to know for English crops, where straw is valuable, that the stubble left by this machine may be less than 1 inch in height.

The finger-guards are of malleable iron, and can be replaced in a moment in case of breakage. They can also be titled or lifted at the machine end, and by the driver without leaving his seat. The whole cutter bar and platform may be raised about 12 inches by descending and lifting the outside carrying wheel. This will enable the machine to travel comfortably over the worst stubble, lumps, or rough ground.

The driving wheel is a large one, and the outside carrying wheel has the advantage of being placed in a line with the axis of the main wheel. This arrangement will add materially to the ease of draught of the machine especially on hill sides, and in turning corners. In other machines where this point is not attended to, a castor wheel has to be employed to prevent the earth being turned up by the outside wheel dragging through the ground.

This machine has lately obtained a medal from an agricultural exhibition in Italy. The balance of Anson Wood's reaper upon the draught is carefully adjusted, so that there is no appreciable side strain upon the horses' collars; a strain which has often been found distressing to draught horses. It is said that on this point alone this machine has proved superior to many of the best English machines, and that for this advantage only it has obtained orders in preference to English implements. If such be the case, it is time that the English makers should look to this point.

The platform and rakes of this machine fold up vertically into a snug and compact form, and the machine is securely held in position for either travelling at speed along the road, or for packing in small space for transport. The outside carrying wheel has another loose bracket axle pin, which may be bolted to the bottom edge of the vertical platform for conveniently and safely carrying the machine for running on the road.—*Iron.*

ARTIFICIAL STONE.

The advantages claimed as secured by the use of Béton or concrete, for house-building purposes, are: 1st, increased strength; 2d, greater durability; 3d, reduced cost; 4th, greater expedition; 5th, superior damp-resisting qualities; 6th, greater facilities and economy for ventilating, warming, and applying improved sanitary arrangements; 7th, being vermin-proof; 8th, its proof against fire and adaptability to fire-proof construction.

Under the first head it has been proved that almost all the ordinary building stones and bricks succomb under test with concrete. The strength of ordinary brick or stone walls cannot be measured by tests of separate blocks, because the chief weakness is in the mortar joints, from which the best (that is, the monelithic) system of concrete building is free.

The lowest estimates of comparative strenght show concrete to be three times stronger than brick-work. Of course there must be great variation of strenght in different kinds of material used for mixing with the cement, but there is a very large margin in favor of concrete with every kind of material employed for the purpose. As to durability, chemical analysis proves that ancient lime and modern cement concrete have identically the same qualities, the durability of both being assured by ultimate crystalization.

Experiments have proved that the induration of cement is continuous, and instead of deteriorating with age it becomes harder and stronger. Thirdly, the economy of concrete is as decided as its many other advantages, it being from 30 to 50 per cent cheaper.

Where concrere is used instead of stone, the walls are so much thinner that the same house room may be obtained on a smaller area of ground, or more house room on an equal area of ground and for an equal surface of walling.

As to expedition in construction, it has been proved that cement concrete walls may be safely built at a rate of progress that cannot be considered safe for ordinary brick or stone walls.

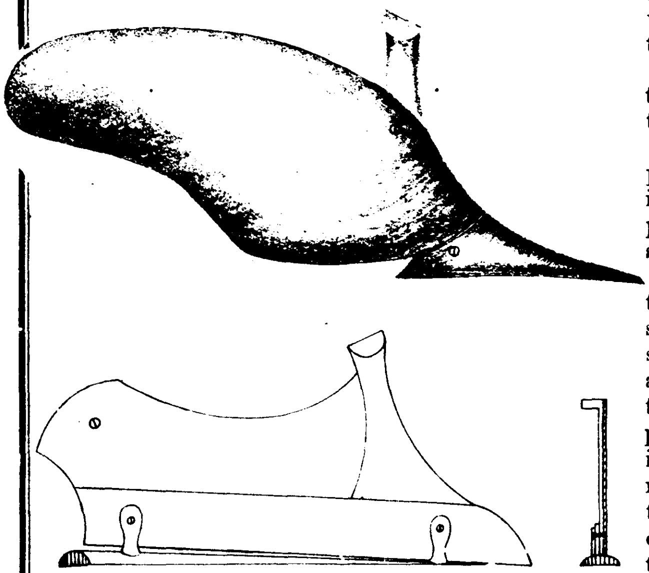
The greatest saving of time, however, effected by concrete building is due to the fact that a concrete house is perfectly dry as soon as built, and can be inhabited at once with safety. During the progress of setting, which occupies only a few days, cement exudes all moisture in excess of that required for hydration and induration, and will not absorb moisture from the atmosphere.

Fifthly, good cement concrete is practically damp-proof; concrete, in the next place, affords greater facilities for fire-proof construction than any other material, although much must depend upon the aggregate of which it is composed; concrete merely vitrifies on the surface when exposed to the most intense heat. In concrete walls ventilating and air flues can be formed with the greatest ease; no pipes are required, and the value of the conconcrete saved pays for the slight extra trouble in forming the flues. In monolithic concrete building there are no mortar joints, and vermin have no chance to find an entry or an abiding-place.

The monolithic principle on which Béton structures can be made gives the material great advantages over other constructions. Monolithic arches have no thrust, and walls can therefore be lighter. Béton can be used to encase stone piers, to line arches, and preserve masonry from disintegration.

A New Mode of Felling Trees.—Amongst other applications of electricity by man is that of felling trees. An American gentleman a few years ago patented a process of this kind. Two gentlemen in Bombay have also patented a similar method, and which they recently submitted to public experiment. The plan, as detailed by a local paper, is simple. The two ends of the copper wires of a galvanic battery are connected with platinum wire, which, of course, instantly becomes red-hot, and while in that state it is gently see-sawed across the trunk of the tree to be felled. At present no platinum wire has been made thick enough to withstand the continual friction; but when this is done, it is calculated that a tree, which at present takes two hours to fell, will come to the ground by this process in fifteen minutes. The method has this advantage, that there is no waste of wood and no sawdust.—*Farmer.*

PATENAUDE'S IMPROVEMENTS ON PLOUGHS.



IMPROVEMENTS ON PLOUGHS.

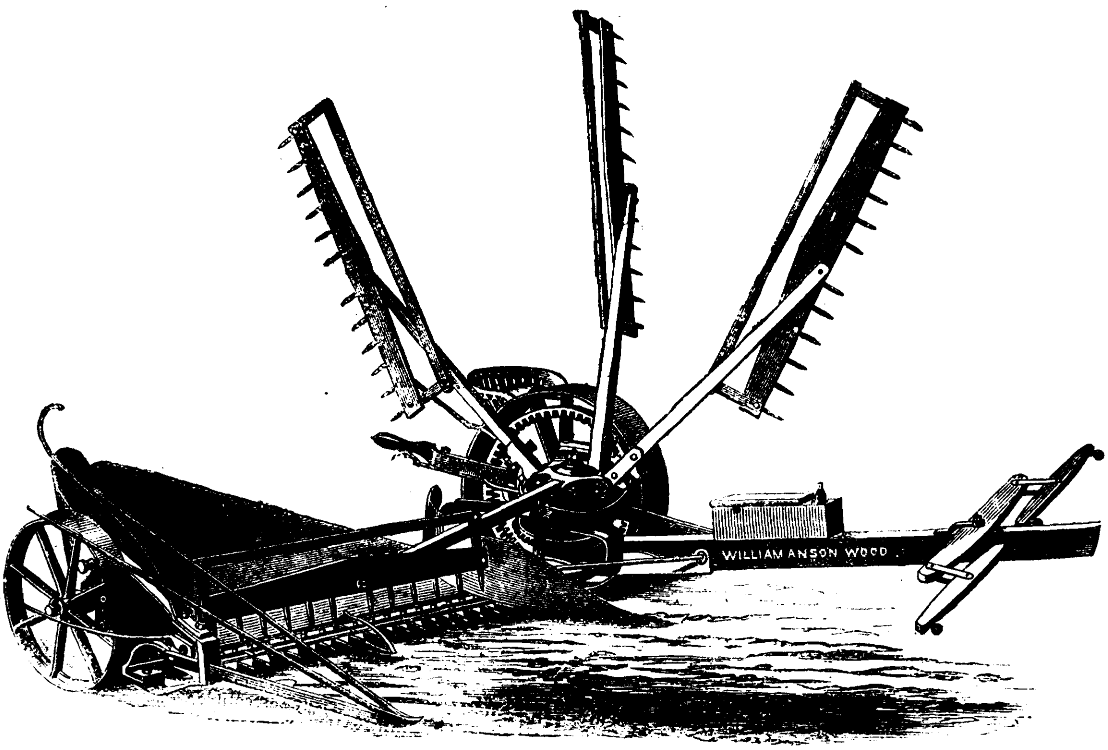
When economy in these hard times is the order of the day, we feel much pleasure in drawing the attention of agriculturists to an improvement on steel ploughs, of which we give an illustration on this page. The invention consists:

First, giving a certain contour to the mould-board of the plough by which friction is considerably reduced, and the sod laid completely over in regular forms.

Secondly, the land-board is constructed out of two plates, the outer part being of steel. This is one point in the invention interesting to farmers, as upon the steel plate becoming worn it can be replaced with another at a small cost.

The *Third* part of the invention relates to the construction of the *sole*, which, instead of being cast with the skeleton in a solid piece, is detached, and affixed to the skeleton with screws. The object of having the sole in a separate piece is that when the point of the sock of the plough becomes worn, it has a tendency to throw the plough out of the ground, and this is obviated in lowering, by means of screws, the heel of the sole so that the rear part of the plough is thrown up and the toe of the sock depressed, thus bringing the sole and the toe of the sock into a horizontal line; by this arrangement the sock can be made to wear longer and more uniformly.

The patentee is Mr. N. F. Patenaude, manufacturer of ploughs, Sorel, P.Q.



SELF-ACTING REAPER.

REEVE'S PNEUMATIC EXCAVATOR.

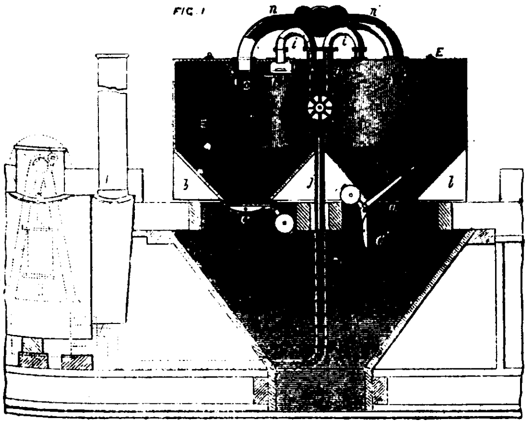


FIG. 1

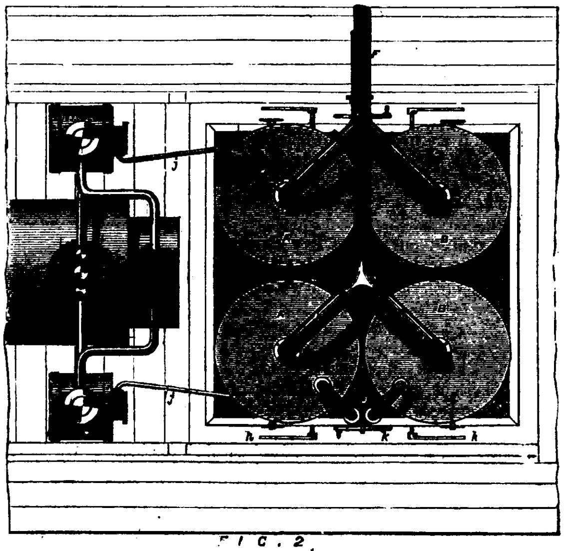


FIG. 2.

FIG. 4

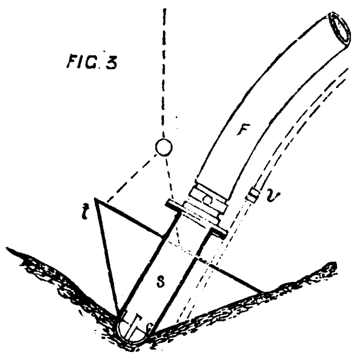


FIG. 3

REEVE'S PNEUMATIC EXCAVATORS.

(See page 301.)

The rapid extension of the use of iron cylinders for the foundations of bridges, and of masonry wells for those of quay-walls, and buildings, renders a simple process of excavation a matter of much importance. The application of pumps for raising water-borne materials has now been sufficiently tested to remove it from the list of modern inventions under trial. In all applications hitherto, however, of the pump to this purpose, a difficulty has arisen from the admission of sand and grit into the valve chambers, frequently causing delay and damage. In Reeve's pneumatic excavator, which we now illustrate, this difficulty has been entirely obviated by the separation of the sand tanks from the air pump, and the use of an automatic safety check valve *m*, Fig. 1, which prevents the materials from overflowing into the exhaust pipe when the tank is full.

As lately employed at the Tay Bridge the apparatus consists of four wrought iron drums or tanks A B, Figs. 1 and 2, mounted upon a barge, and connected in pairs to obtain constant action with two air pumps. In our illustrations, which show the apparatus as fixed in a barge, A B are tanks of a cylindrical form, having a conically shaped bottom, opening at *a*, through which the materials are discharged. Gussets *b b* serve to strengthen the tank and also act as feet, by means of which the tank may be secured as required. The discharge opening *a* is provided with a door G, made tight by a ring of india-rubber, secured between two circular iron discs. The method of connection of the valve or door with the lever enables the door to adjust itself when closed, so as to bed equally around the discharge opening. This door may be opened or kept open, or be closed when necessary, by means of a hand lever *h* fixed on a cross-shaft. One pipe *i* passes through the cover of each tank A B. Both pipes *i i* are connected with a three-way cock D, the shell of which is cast with three branches—the lower branch for connection with pipes *j*, which are in communication with air pumps. In the interior of each tank, and immediately below the mouth of the pipe *i*, is mounted a valve *m*. A block of wood *m* is arranged to slide upon rods which are secured to the cover of the tank. A disc of india-rubber is secured to the upper surface, or let into the top of the block. When the materials rise so high within the tank that the block becomes partly immersed, it floats, and if the influx continues it is raised until it closes the pipe. An indicator E shows the height of the material in the tank. The curved pipes *n*, which are attached to the trunk F, are provided at their lower end with valves *o* for closing them during the emptying of the tank; these valves are commanded by the handwheel *q*. The trunk F, Fig. 2, forms the suction pipe, the end of which is provided with the nosepiece shown at Fig. 3, and which may be moved about to any part of the caisson, as shown in Fig. 4, taken from a sketch made on the spot, showing the sinking of one of the fourteen large circular caissons, 31 ft. in diameter, for the centre spans of the Tay Bridge.

The action of the apparatus may be described as follows:—One of each pair of the tanks A is in communication with the air pump and with the trunk F. In the other tank the valve *o* is closed, and communication with the air pump is shut off by the valve D. The pump will create a vacuum in the tank A, and the mud, gravel, and matters associated with water are sucked through the pipe *s*, Fig. 3, and ascending through the trunk F, flow into and through the pipes *r* and *n* into the tank. When the tank is sufficiently filled, the hand-wheel *k* is turned so as to shut off the communication with the air pump, and air is admitted to the interior of the tank by air inlet cocks *u*, Fig. 1. The valve *o* now closes, or is or has been closed, and the door *c* opens and permits the matters to discharge themselves from the tank. Supposing the tank B to be empty, and its door *c* to be shut when tank A is full, the wheel *k* may be at once turned to connect the tank B with the air pump, so that the latter tank commences to fill whilst the other tank is discharging, or the plug of the valve D may be first turned into position to establish a communication between the two tanks before opening the cock *u*, whereby a partial vacuum is at once formed in the tank B. The two tanks are thus filled and emptied alternately. To facilitate excavation or dredging at comparatively great depths a jet of compressed air may be admitted into the mouth of the aforesaid suction pipe by a pipe shown by dotted lines *r* in Fig. 4. Two men and a boy are required for each barge, and the quantity raised per working day of ten hours averages upwards of 400 tons. Under favourable circumstances the cost per yard, including the services of a driver, has been found to be about eight pence. In many cases, however, it will be possible to dispense altogether with the driver, and thus to reduce the cost very considerably.

The apparatus, being entirely contained within one barge, can be towed or warped into harbour during a gale, or moved from place to place with the utmost facility. No staging or expensive fittings are required. When employed upon wall or quay foundations the machine can be set upon a truck running along a line of rails by the side of the trenches. In sinking caissons or cylinders in ordinary situations by this method it is not necessary to pump out the caisson, or place an engine boiler and air lock on the top to maintain a bell full of compressed air in the bottom, as under some of the present systems. Nor is it necessary to leave spaces in the caisson or shafts for the passage of men and materials; but the masonry may be built up almost solid, thus dispensing with the necessity for weighting, and rendering the settlement rapid and uniform, while the centre of gravity is kept as low as possible. When long cylinders of small diameter have to be sunk in a strong tideway it is not necessary to employ greater lengths than will suffice to maintain the upper edge a few feet above the river bottom to prevent the sitting up of the cylinder from the action of the river currents. If not in use for dredging purposes the machine may be used as a lift pump.

For cleansing the old nooks and corners of docks, harbours, and canals, where the ordinary ladder-dredgers cannot approach, this machine offers much assistance, and is a great advance upon the primitive "bag and spoon" now generally used for such purposes. One hundred and forty-two cylinders have been sunk solely by this method at the Tay Bridge, varying in size from 6 feet to 31 feet in diameter, and penetrating in some cases 25 feet below the river bottom in 50 feet of tidal water. It has also been adopted by the contractors for the Severn Bridge, and by the North British Railway Company in filling in the space behind the new Dundee esplanade with sand sucked up from the bed of the river Tay. In this latter instance the sand has been drawn from a distance of 800 feet from the pumps.

Although called a sand pump, the apparatus will raise any material which is either fluid, or in a dry state, or capable of being made waterborne, such as grain, gravel and sand, peat, mud, silt, clay, and soft chalk. The two latter substances are, it is stated, rendered sufficiently fluid to rise freely into the pump by the explosion of small grouped charges of either dynamite or lithofracteur, the effect of these explosives being to convert the material into a slimy mud, and not, as with the harder rocks, to shatter them into splinters. After a few shots the strength of these charges can be calculated to a nicety, so as in no way to endanger the caisson. The inventors claim that this apparatus affords facility in starting work and economy in working, great speed and regularity in sinking without weights, portability, makes staging unnecessary, and that it has a wide range of applicability. The excavator is, we understand, now being employed to raise a sunken vessel full of sand at Fraserburgh, N.B., and will shortly be tried on a large scale for the elevation of grain from ships' holds.—*Engineer.*

AUSTRALIA AND AMERICA.—A correspondent writing to *The Times* from Sydney, says: — "Our appearance at Philadelphia has drawn the attention of American manufacturers to us in a most marked and unexpected degree. A country that, like New South Wales, is rolling in wealth, must be a country that is able to buy, and a country that is able to buy is exactly the country that American manufacturers have been anxiously looking out for. Our representatives at Philadelphia have come back strongly impressed with the fact that there are many things the Americans can supply us with advantage. Our Government has an offer from Messrs. Baldwin & Co., to furnish a locomotive engine for about £1,000 less than the cost of an English engine, and to leave the payment open until the engine has been thoroughly proved and approved. A Pullman's sleeping car and an ordinary passenger car have already been ordered, and American wheels, axles, rails, and brakes are strongly pressed on our accceptance. As our Governement engineers are all of the English school, American novelties will have a hard battle to fight to win official acceptance, but the demand for economy in railway construction and working is so great that people and Parliament will press on the Minister for Public Works a fair trial for any American novelties that may seem to be suited to our wants. The English manufacturers, therefore, who have hitherto supplied us, must look to their laurels."

A SHIP FLOAT has lately been put in use in England, says *Engineering*, by means of air bags to support the ship within the dock or float which are distended by air-compressors worked by engines. Any part of the ship's bottom may be reached by removing one or more bags.

CHEMISTRY, PHYSICS, AND TECHNOLOGY.

To Oxidize Silver.—Dissolve 100 grammes sulphuret of ammonia in 1 litre hot water. Dip the article into the solution for a few moments, rinse in cold water, and scratch with a wire brush.—*Papier Zeitung*, v, ii, 472.

Waterproof Leather.—Melt 1 litre of boiled linseed oil, 155 grammes of suet, 46 grammes wax, and 32 grammes resin together over a slow fire, and apply it to the leather with a brush while warm. This composition keeps the leather very soft. The English fishermen have long been using it. They can remain in the water for hours ere it penetrates through the leather. The only thing new in the compound is the addition of wax and resin to the fatty matter.—*Bay Ind. und Gew Blatt.* v. xix, 212.

Pressed Bricks from Blast Furnace Slag.—We are informed by the *Würt Gwblt.* that pressed bricks heve been made from blast furnace slag by Eng. F. Dopfer. To the powdered slag 42 per cent. silicic acid, 37 per cent. gypsum, 10 per cent. clay, 5 per cent. oxide of iron, 3 per cent. magnesium, 1½ per cent. sulphur, and various other materials mixed with lime are added. The mixture is given the common brick form in a steam press and after drying in the air for three months are ready for use. The daily production of the presses are about 8,000 bricks. The cost at Wasseralfingen is 32 marks per hundred (probaby 1000, Ed.)—*Industrie Zeit.*, xxix, 288.

The Work of Desolation.—Within ten years, no less than 12,000,000 acres of forest have been cut down or burned over in the United States. Much of the timber is used for fuel, twenty-five cities being on record as consuming from 5,000 acres to 10,000 acres each. Fences use up much timber, and railway sleepers require the product of 150,000 acres per annum. The amount of pine and lumber timber yet standing in the forests of the timber States is estimated at 225,000,000 feet. The sum of 144,000,000 dollars is invested in the timber industry, employing 200,000 men.

The Composition of Chinese Gongs has been found by the analysis of many specimens to be as follows :

Copper	82·00	parts.
Tin	17·00	"
Iron	1·00	"
Nickel	traces.	"

The last-named metal can only be discovered by operating upon several grammes of the alloy.

Chinese Gold Lacquer.—An excellent imitation of the celebrated Chinese Gold Lacquer may be prepared by melting two parts of shellac and one of copal, so as to form a perfect fluid mixture, and then adding two parts of hot boiled oil. The vessel is then removed from the fire, and ten parts of oil of turpentine gradually added. To improve the color an addition is made of a solution in turpentine of gum gamboge for yellow, and gum dragon for red. These are to be mixed in sufficient quantity to give the desired shade. The Chinese apparently use tin-foil to form a ground upon which lacquer varnish is made.—*Boston Jour. Chem.* xii, 5.

Preservation of Wood.—*The Ind. Blätt.* in speaking of the well-known methods of preserving posts and wood which are partly imbedded in the earth, by charring and coating with tar, says these methods are only effective when both are applied Should the poles only be charred wi hout the subsequent treat ment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depth which the absorbing properties of the charcoaled surface would insure.

Wood that is exposed to the action of water or let into the ground should first be charred, and then before it has entirely cooled be treated with tar till the wood is thoroughly impregnated. The acetic acid and oils contained in the tar are evaporated by the heat and only the resin left behind, which penetrates the pores of the wood and forms an air-tight and waterproof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay affects the wood first and where the break always occurs when removed from the earth or strained in testing.—*Maschinen Constructeur*, xxiv, 279.

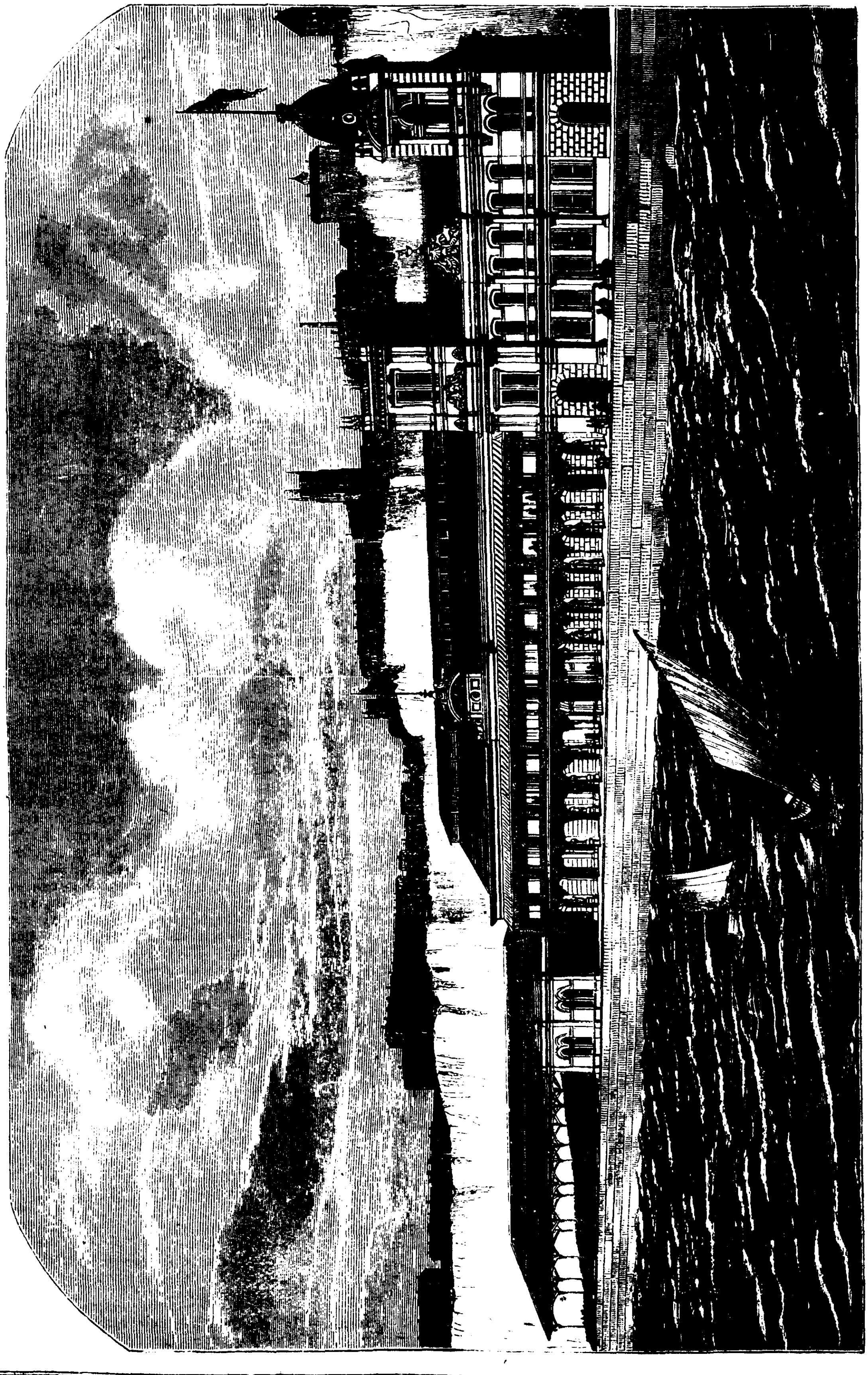
Oil Polish.—Linseed oil is a good polish, but must be continually rubbed. As also, mix spirit of (hartshorn) ammonia, vinegar, and linseed oil.

Colouring Metals.—Metals may be coloured quickly of a cheaply by forming on their surface a coating of a thin film and sulphide. In five minutes brass articles may be coated with any colour, varying from gold to copper red, then to carmine, dark red and from light analine blue to a blue-white, like sulphide of lead, and at last a reddish white, according to the thickness of the coat, which depends on the length of time the metal remains in the solution used. The colours possess a very good lustre, and if the articles to be coloured have been previously thoroughly cleaned by means of acids and alkalies, they adhere so firmly that they may be operated upon by the polishing steel. To prepare the solution, dissolve one half ounce of hyposulphite of soda in one of water, and add one half ounce of acetate of lead dissolved in half pound of water. When this clear solution is heated to from 190° to 200° Fah., it decomposes slowly and precipitates sulphide of lead in brown flakes. If metal be now present, a part of the sulphide of lead is deposited thereon, and according to the thickness of the deposited sulphide of lead, the above colors are produced. To produce an even colouring the articles must be evenly heated. Iron treated with this solution takes a steel-blue colour ; zinc, a brown colour ; in the case of objects, the first gold colour does not appear ; lead and zinc are entirely indifferent. If instead of the acetate of lead, an equal weight of sulphuric acid is added to the hyposulphite of soda, and the process carried on as before, the brass is covered with a very beautiful red, which is followed by a green (which is not in the first scale of colours mentioned above), and changes finally to a splendid brown with green and red iris glitter. This last is a very durable coating, and may find special attention in the manufactures, especially as some of the others are not very permanent. Very beautiful marble designs can be produced by using a lead solution thickened with gum tragacanth on brass which has been heated to 210° Fan., and is afterwards treated by the usual solution of sulphide of lead. It may be used several times.

Steam Cars on City Streets.—John D. Imboden has perfected a system that is said to work well ; we append a description taken from the Philadelphia *Times :* The engine is an independent sub-motor—a complete machine in itself, and can be attached to any of the present horse cars. It is simple, easily handled, cheap, and, better than all, causes no discomfort to passengers, it being out of their sight, smell and hearing. It has its own frame work, wheels and springs, carries its coal, water and engineer, and sustains half the weight of the car and passengers, the other half being carried by a single pair of car wheels, just in front of the rear platform. The car body is pivoted at its front end, on the engine, resting on the bed plate and springs over the boiler. The engine has four driving wheels, with a wheel base of only four feet, and, owing to the simple pivoted connection with the car body, it is capable of curving freely. The boiler is horizontal, with simply a vertical furnace and steam dome under the driver's seat, which is outside the front of the car. The "test" car has been made the same size as that of an ordinary horse car, so as to demonstrate thoroughly that in order to convert the latter into a locomotive, nothing is necessary but to take off its front wheels, put this handy little engine in their place, and nail up the front door. The interior and the rest of the car can be left intact. The new car occupies four feet less street space than one of the dummies now in use on Market street, and ten feet less than the horses, they being dispensed with.

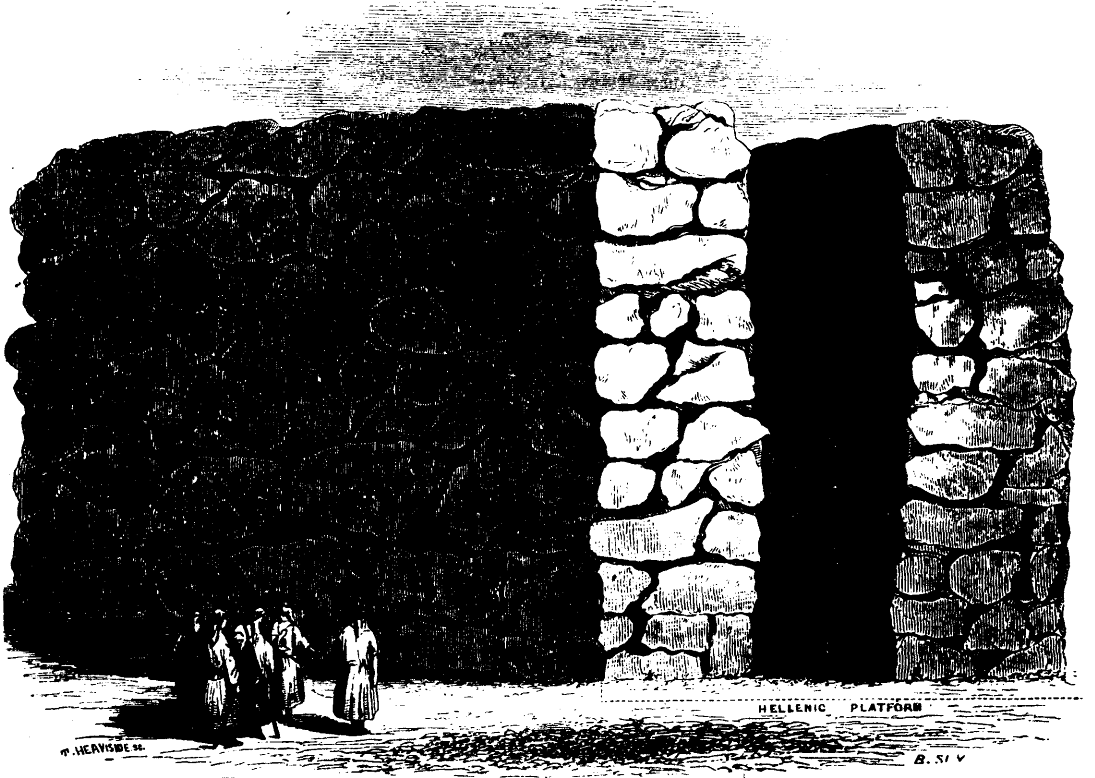
The Cossacks and Science.—An English writer shows how the Cossacks may apply science in the present war, as follows ; "In a belt around their waists they carry a few pounds of gun cotton or dynamite, and with this highly destructive explosive they may work incalculable harm. A small charge of gun cotton placed simply upon rails and fired with a fuse suffices to blow several feet of the iron to a distance of many yards, thus rendering the railway unserviceable on the instant. A trooper may dismount, place a charge at the base of a telegraph pole, fire it, and be in his saddle again within 60 seconds. Wires may thus be cut and communication stopped in the heart of an enemy's country by fearless riders, while the lines of railway are entirely at their mercy. Even light bridges and well built stockades may be thrown down by the violent detonation of compressed gun cotton, and forest roads considerably obstructed by trees thrown across, which are never so rapidly felled as when a small charge of this explosive is fired at their roots."

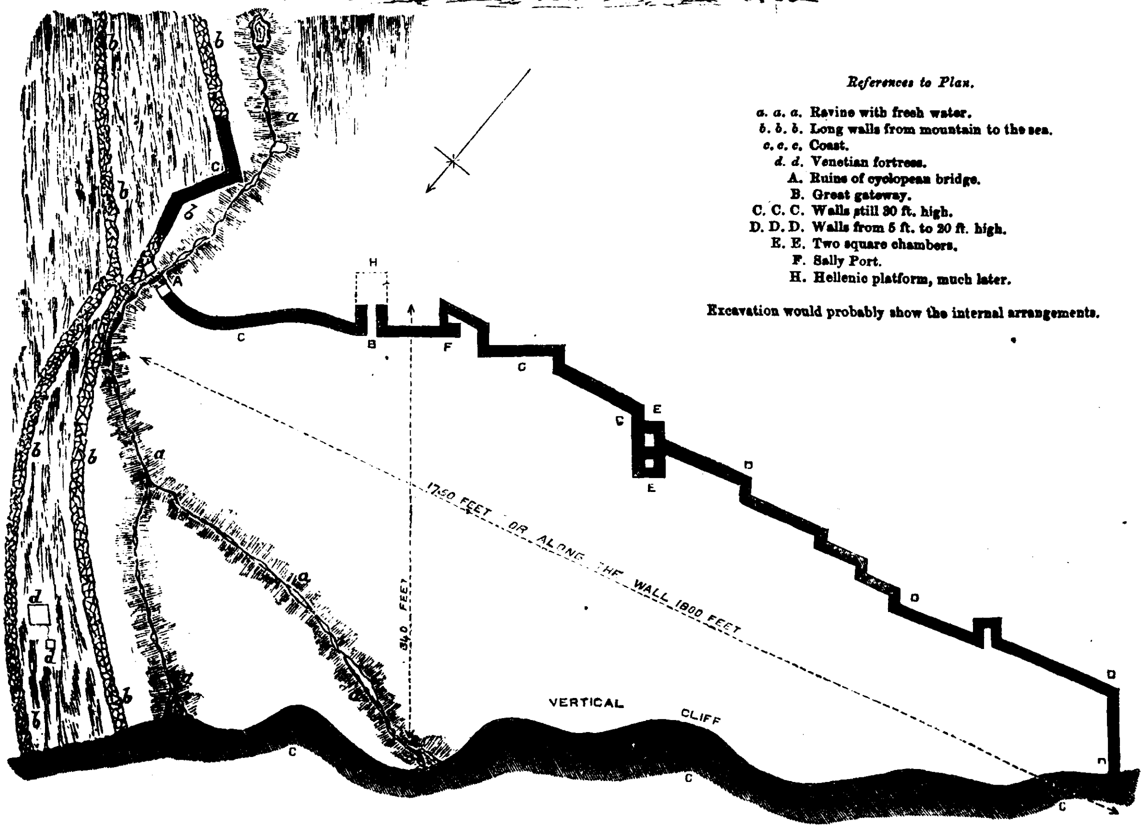
New Sponges.—No less than five new varieties of sponges were discovered by Dr. Meyer, at the Philipine Islands and New Guinea, during his recent travels in the Eastern archipelago.



PROPOSED SKATING RINK, BATHS, AND AQUARIUM, MARGATE, ENGLAND.

THE FAMILY FRIEND.





CYCLOPEAN FORTRESS ON THE ISLAND OF SAMOTHRACE, ON THE COAST OF THRACE.

HINTS TO INVENTORS.

The following extract from a small pamphlet, published by Messrs. Barlow & Co., Patent Solicitors, London, entitled: *Five Minutes' Advice Respecting Patents for Inventions*, we commend to the serious attention of all persons contemplating taking out Patents. The remarks are equally applicable to persons contemplating to take out patents in this country:

"There are to be found every day persons who for the first time in their lives consider themselves inventors: that is, they imagine they have discovered something not previously known. Snch persons are of all ranks and classes: peers, clergymen, doctors, lawyers, manufacturers, farmers, tradesmen, artisans: and in numerous instances they have little or no practical acquaintance with the art of manufacture to which their inventions relate. It may be that the clergyman has hit upon a new fire-arm, the lawyer devised a new form of hydraulic press, or the farmer in his leisure hours worked out improvements in looms, or that the nobleman has invented improvements in locomotives or steam fire engines. In such cases there is, of course, a lack of that practical knowledge of the subjects treated of, that alone can warrant the securing a Patent without hesitation or consultation with any experienced person. It is not to be assumed that the inventions of amateurs or non-practical men are to be despised or mistrusted, for experience teaches that men who have been treading in a beaten track for years are distanced by others who, as it were, see at a glance how to invent or improve. An idea of much value sometimes strikes a person suddenly, which never occurred to those who had had more frequent opportunities of observing what was required. However, this will be granted by most persons practically acquainted with inventions—that caution is necessary in order to guard against the chimera which are oftentimes conceived by imaginative men, and which when pursued bring loss and vexation to themselves as well as to others. Obviously the first duty is to endeavour to ascertain if the idea be really an invention, in the sense of being something new and commercially useful. At the very outset of this inquiry the Inventor is confronted by this difficulty: viz., that he cannot prudently disclose the nature of the matter to the very persons who, from their knowledge of the art or trade, could best give him the informations he requires. Common sense shows the folly of disclosing his secret, or supposed secret, to those who have the means and perhaps the inclination to put into profitable use themselves the secrets confided to them. Neither can he in general safely construct a model to test the efficacy of the improvement when that is applicable. What is he to do, then? The more his mind dwels on the subject, the more he is convinced of its feasibility; the more he reads, the more he is confirmed in a belief in its novelty. Without developing the secret, he may inquire of friends or acquaintances as to the probable success of the plan or arrangement he has thought of, and, as generally happens in such cases, he is assured of its value and importance, if, as they sceptically say, "it can be accomplished." We need not describe what is often done under such circumstances, for generally an injudicious course is adopted. It will be more to the purpose to consider what ought to be done. There can be no possible harm in first of all endeavouring, by every means short of disclosing the secret, to ascertain the novelty and utility of the idea, or when practicable of experimenting and testing; and when these things have been done, the next step should be to take an opinion."

AN ILLUMINATING CANNON SHOT.

One of the most simple and ingenious contrivances, for the purpose of investing a fleet with a zone of light through which no enemy could pass without being observed, has been devised by M. Ferdinand Silas, of Vienna, whose experiments with life-buoys at Portsmouth have been reported in these columns. M. Silas' inextinguishable lightning shell is similar to a common shell, can be made to fit any gun, and can, accordingly, be projected to any distance. The projectile consists of three parts, one within the other. Within the shell proper is a lining of wet sponge, and within this is a glass bottle, which fills the whole cavity; the bottom of the shell unscrewing to admit of its entrance. This bottle is filled with various charges of phosphide, none of which, however, is to be less than ten pounds. A small channel is bored through the sharp point of the shell in order to allow the air to mix freely with the wet sponge, and there are a couple of apertures in the head which are plugged with wooden stoppers covered with leather. Through the movable bottom of the shell a steel striker is inserted, which is filled with a spring, and communicates with the glass bottle within. When the light shell is fired, the spring striker is driven forward by the explosion like a glass check and so breaks the bottle; the water contained in the jacket of sponge then penetrates through the broken glass and saturates the phosphide; phosphuretted hydrogen is immediately generated in large quantities, by the pressure of which the stoppers are forced out and two streams of illuminating matter are poured upon the sea. The light burns with great brilliancy for a considerable time, and is claimed to be inextinguishable.—*London Times.*

FISH FROM AN ARTESIAN WELL.—At a recent meeting of the San Francisco Academy of Sciences, specimens of fish, supposed to be trout, were presented, accompanied by a letter from Thomas R. Bard, of Hueneme, Ventura county, California. They were thrown up from an artesian well 141 feet deep near that place. The well, which is nearly 300 feet deep from high water mark, was bored in 1871, and ever since has thrown out immense quantities of freshly spawned fish in April and May. The first fish this year were observed in March. The well is capped, having three two-inch apertures, from one of which people were in the habit of filling barrels of water for household uses. In that way the presence of fish was discovered in 1872. The cap was removed and fish were ejected in incredible quantities, until the cap was replaced. The fish are said to be of various sizes, the largest about an inch in length. The nearest stream where fish are found is Santa Paula Creek, twenty-five miles from the well, but it empties in the Santa Clara river, at a point twenty miles distant.

THE London papers tell of an interesting race between an express train and a carrier pigeon from Dover to London. The bird and the train left Dover at the same moment, and the train ran to London, without stopping, at the rate of sixty miles an hour. The pigeon beat the train to London, a distance of seventy-six and one-half miles, by twenty minutes.

AN invention for the protection of ships' sides from the effects of torpedoes has just been submitted by the officers of Chatham Dockyard to the Lords of the Admiralty, the inventor being a member of one of the lower branches of the service, and it is now receiving the careful consideration of their lordships. The invention consists of a protecting screen or shield, which can be lowered or raised in less than five minutes; it completely envelopes the whole of the bottom of the ship, and is of sufficient substance to resist any torpedo. One of the chief points of the invention is that it can be raised in so short a time and stowed in a snug position on the top sides of any ironclad, and without in any way interfering with the firing of the guns.

CURIOUS PHENOMEN OF HEAT.—M. J. Olivier reports the following experiment: A square bar of steel, about 15 milimeters thick, and about 70 to 80 mm. long, is grasped firmly by the operator, one hand being placed at the center of the bar and the other at the end. The free extremity is pressed strongly against a rapidly revolving emery wheel. In a few minutes the rubbed extremity becomes hot, the hand at the center of the bar feels no heat, but the hand at the remote extremity becomes so hot that the operator is obliged to loosen it.

THE SEAL.

(See page 308.)

The common seal belongs to the *phocidæ*, distinguished by their aquatic habits, for, although they breathe like other mammals, yet they pass half their time in the water. Their feet are transformed into fins, and are used in a similar manner as the fish uses its fins. The hind legs of the seal are compressed close against the body, and look like a tail; when on land the movements of the seal are very awkward, but it can scuttle along at a good rate. Both the fur and the oil of the seal are extensively used by civilized nations, and the destruction of seals has become so great that it is feared, if prompt measures are not taken, the animal will become extinct. To preserve it from cold the seal has a thick layer of fat just below the skin; the most delicate part of the seal is the nose, and the animal is soon killed if hit with a bludgeon or other thick instrument on that part of the head. The seal is very intelligent, and is capable of great attachment to the person who feeds it. The seal feeds on fish and molluscs, which it eats while in the water. To prevent the water getting in at the nose and ears, the animal is furnished with small valves that open and shut. The teeth of the seal are admirably fitted to grasp its finny prey; the molars are covered with angular points, and the canine teeth are very sharp and powerful. The skin of the common seal is very beautiful, and mottled all over with black. When looking at a seal in the face it reminds you of a dog, especially a Newfoundland, so mild and pensive is the expression of the eyes. The length of the animal is from four to five feet. The common seal used to be a common animal in the north of England, but now it is much scarcer.

The Harp Seal

is so named from the resemblance of the black marks on its back to the ancient harp. The seal undergoes a variety of changes during its life; the first year the fur is white, the second year it changes to greyish yellow, the third year it changes to grey, the fourth year the grey is marked with several darker shades, and the fifth year the fur has the black harp-like marks upon it. The length of the animal is from seven to eight feet. The harp seals congregate together, and when engaged in sleeping or feeding they appoint a sentinel to look over and give notice of the approach of danger. Notwithstanding this precaution they are often taken by the wary hunters, who creep round the sentinel without his perceiving them, and then attack the sleeping herd. The harp seal does not have many young ones at a birth, sometimes only two. The female builds a snow hut above the breathing hole she has made in the ice, and in this brings forth her young. This little snow house often serves as a guide to the hunter, who enters inside it, seizes the young one, and waits with his harpoon till the mother appears, and then captures her. The range of the harp seal extends over Greenland and Iceland, but two or three solitary specimens have been captured in the north of England, especially in the Orkney Islands.

THE AGE OF THE SUN AND FIXED STARS.

In a recent communication to the American Philosophical Society on the relative ages of the sun and certain fixed stars, Prof. Kirkwood comes to the following conclusions:—(1) The history of the solar system is comprised within 20 or 30 millions of years. (2) From the fact that the larger component of Alpha Centauri radiates twice as much light as the sun, while the mass of the former is less than that of the latter, we infer the probability that our solar system is more advanced in its physical history. (3) 61 Cygni seems to have reached a greater degree of condensation than the sun; since, on the hypothesis of equal density, the surface of the larger member is one-third that of the sun, while the intrinsic light is less than one-ninth. (4) The companion of Sirius seems to have reached a stage of greater maturity than the sun, while the contrary seems to be true of the principal stars.—*English Mech.* xxv, 533.

DESTRUCTIVE INSECTS AND PARIS GREEN.—The objections made to the use of Paris green used for the purpose of destroying the potato-bug has been met satisfactorily through the investigations of the agricultural editor of the *Tribune*. He says that it has been proved that there is no trace of arsenic in the potato-tuber, though there should be more applied to the tops than is necessary to protect them from the ravages of the beetle or its grub; and that other crops may be raised on the same soil without any trace of arsenic in them. He concludes thus: "Therefore, it can be unhesitatingly affirmed that no harm will result from the proper use of this substance for the protection of the potato even so far as regards the effects that may be produced on the crop itself, or on other crops following it." Particular care must be exercised in inhaling such a poisonous substance. When the powder is dusted it should not be allowed to come into contact with any sore or abrasion of the skin. Children should not be allowed to play in a field recently dusted. All these dangers can be avoided by the method of sprinkling plants with water holding the powder in suspension, which is perhaps the best mode of applying the poison — a teaspoonful of it in every two or three gallons of water is said to be sufficient. As these dangers may thus easily be avoided, it is folly that an important crop need be ruined because the only effective protection against its enemy is found in the use of this poisonous substance. The preventive is more effectual against the grub than against the beetle.

RED INK.—According to the *Paper and Printing Trades Journal*, a superb red ink is obtained by a solution of eosin (an aniline product). This ink has a brilliant red colour, much finer than that made from ammoniated cochenille, and is free from the blue tinge which the latter possesses. By using the so-called red or scarlet instead of the eosin, a yellow tone is given to the ink. The ink flows freely from the pen, and can, by adding gum arabic and glycerine, be made to copy.

THE HAMSTER—(*cricetus vulgaris*)

(See page 308)

Is in size about as large as the brown rat, but considerably thicker in the body and shorter in the legs, the tail being from 2½ to 3 in. in length. Colour.—On the back and upper portions of the body are three pretty large white patches, the one nearest the shoulders being in all cases the largest. Its muzzle is whitish with a reddish tinge on the cheeks, but this species will sometimes vary in general colour. The male is always larger than the female.

The hamster is a native of Austria, Silesia, and other parts of Germany, Poland, Russia, and the extremely southern confines of Siberia.

These little animals live in burrows, and dig always in an oblique or slanting direction, downward to the depth of 3ft. or 4ft. These burrows consist of several compartments, which are apportioned some to the parents, and others to the young members of the family. They also reserve one or two of these little cellars for their store room, which they stock abundantly with food before the winter sets in.

For food they exist chiefly on grain, roots of sundry descriptions during the cold months, but in summer they feed on green herbs as well, and indeed it has been said that they will not ignore a smaller animal, but will prey upon it if very hard pushed for food. During harvest time the hamster is extremely busy collecting grain for his winter store, and will journey great distances in search of provisions. To facilitate the transportation of his food, nature has provided him with two pouches in the inside of each cheek. On the outside of these are membranes, smooth and shiny, while the insides are lined with a great many glands, which continually secrete a certain fluid, to preserve their flexibility and to enable them to resist any accidents which may be occasioned by the roughness or sharpness of particular grains. Males never live with the females, neither will they assist in the construction of their burrows. When the hamster digs his burrow deep into the earth, he invariably spends the winter in a state of torpidity, never once coming up to the surface of the earth. In fact, his dormant state is of such a lethargic nature that its animation is entirely suspended, and an electric shock may be given without arousing it.

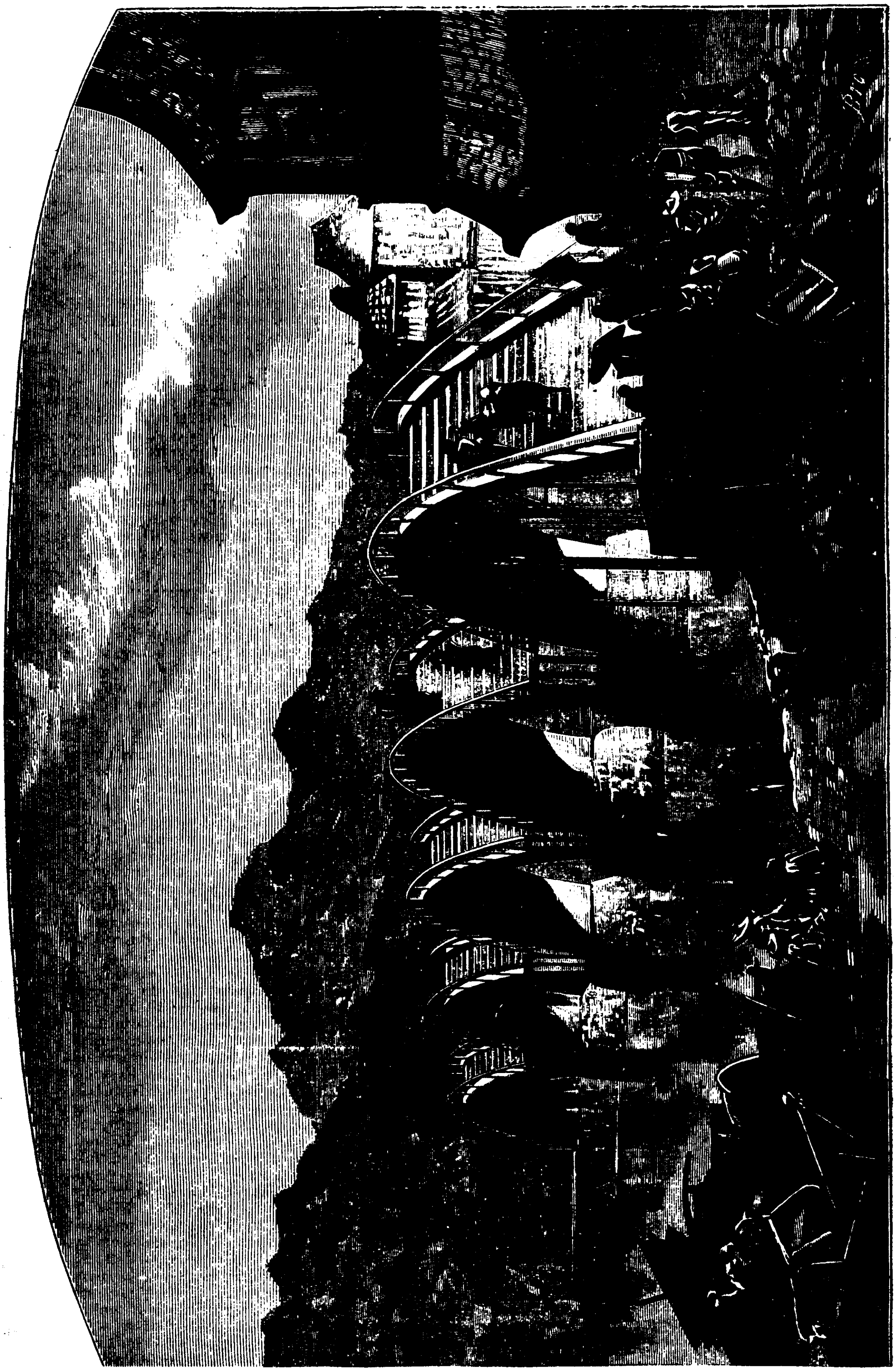
The female breeds three times a year, and produces five or six at a birth; the young grow rapidly, and are speedily turned out of doors by the parents to look out for themselves.

The hamster is a fierce and very unsociable little animal, and when attacked will make a fierce and obstinate resistance. They will prey upon and attack any animal smaller or weaker than themselves, and they will even go so far as to give battle to their own species. Their destruction of grain is excessive, and in one year in Gotha, 11,564 skins were delivered at the Hotel de Ville where the creature was "proscribed" for its destructive propensities, the following year 54,429 was the total number of skins obtained, while a year later no fewer than 10,139 victims were stripped of their jackets. The hair of the hamster is very closely united to the skin, and it is only with great difficulty that it can be pulled off.

This has the effect of making the skins highly prized by the people of eastern countries, more so in particular with the Chinese, who annually import enormous quantities of these skins. Having a very unpleasant smell, the fur is not used by Europeans.

SEALS.

THE HAMPSTERS.



A CURIOUS BRIDGE AT IWAKUNI, JAPAN.

THE IWAKUNI BRIDGE, JAPAN.

(See page 309.)

The *Illustrated Adelaide News* gives an illustration of a very curious bridge, in existence near the town of Iwakuni, Japan. The structure is simply a series of arches from pier to pier, but instead of filling up the space between the arches to the tops, or bridging across from summit to summit, and thus providing a straight and level pathway, the designer has placed steps on the arches themselves, so that the traveler is obliged to ascend and descend five eminences to make the crossing. This extraordinary structure is three hundred years old and is regarded as one of the natural curiosities. The supporting pillars are of stone, and the superstructure of wood.

DOMESTIC HINTS

To Cleanse Jewelry.—Use hot water and a clean brush; rub a little soap on the brush, then dip it into powdered borax and scour well; rinse in hot water, and rub dry with a clean towel, or chamois is better.

Green Corn Pudding.—Grate the corn from four good sized ears; add one pint milk, two well-beaten eggs, and a piece of butter the size of an egg, salt and pepper to taste. Stir three tablespoonfuls flour in a little cold water, add it to the rest, beat all together, and bake an hour.

Blackberry Wine.—To ten quarts of blackberry juice put one quart of water, three pounds of A sugar, one-eighth of an ounce of tincture of ammonia; let them boil up, then strain, and when cold put in one quart of pure French spirit; mix thoroughly together. Let it remain in a cool place; it will be ready for use in a few days. Do not bottle it until after a year or so, and keep cool all that time, otherwise it may ferment and spoil.

To Detect Adulteration in Vinegar.—Procure ten cents worth of chloride of Barium, and add 20 drops to a wine-glassful of vinegar. If the vinegar is free from sulphuric acid it will cause no change in its appearance, but if not it will become milky in color, and if allowed to stand will precipitate a sediment resembling lime. Two-thirds of the vinegar sold is thus adulterated, and its effects are very injurious. No one should neglect to use this simple test.

Graham Custard Pie.—One quart milk, two eggs, half a cup of Graham flour. Beat the eggs and stir all together. The Graham flour sinks to the bottom of the pie dish as the custard bakes, and forms a good crust. It may appear to be soaked, as custard pie crust often is, but it is not in the least "clammy." It dissolves easily in the mouth, and is entirely digestible. A pleasant cream pie is made from the same recipe, leaving out the eggs and using creamy milk or thin cream.

Crushed Wheat.—Cracked wheat on the breakfast tables of the best hotels is now a standard dish, and it figures largely on the tables of many families. When properly cooked—not made a mush of—it is not only healthy and nutritious, but decidedly palatable. Many do not know how to cook it, and hence spoil it in the attempt. But our particular business just now is not with "cracked" but with "crushed" wheat. The whole grain is crushed in such a manner as to retain all its particles. Nothing is lost or sifted out. It cooks more readily than the cracked grain, has more gluten, and all the sweetness and flavor of the wheat. I cook it just as I do oatmeal; having a quart or two of boiling water on the fire, stir in two handfuls of grain for each quart of water; boil rapidly for twenty minutes, stirring frequently to prevent its adhering to the bottom of the kettle; then let it simmer over a slow fire for ten minutes, covered tightly. I like it better when cool; the gluten forms a jelly, and when moulded makes a handsome dish for the table.

Making Speech Visible.—At a meeting held at Salem, Mass., a lecture on "Visible Speech" was delivered by Prof. Graham Bell, who, by means of the drum in a human ear cut from a dead subject, has succeeded in producing a phonantograph. The ear is placed in the end of an ordinary speaking trumpet; on speaking into the trumpet the drum is set in motion; this moves the style; the style traces the effect on a plate of smoked glass; and by means of camera the curves and lines can be exhibited to a large number of spectators. The five vowels make five different curves; and, according to Mr. Bell, there is no such thing as a sound or tone pure and simple, but each is a composite of a number of tones; and the wavelets by which these are produced can also be shown on a screen. Tables of the various symbols have been drawn up, and found useful for educational purposes, as was demonstrated by a young deaf and dumb pupil from the Boston institution, who interpreted the symbols at sight.

THE DEW OF HEAVEN.

The insensible vapour, whose birth is in the evaporation from the earth's surface, appears again on the earth in its first and softest way, as dew. Several recent observations on this phenomenon will be full of interest to our readers. We must not forget, as I have often remarked, that the insensible deposition of water from the atmosphere is not confined to the *surface* of the soil. Wherever the atmospheric air can freely penetrate, there the deposition of the dew, under favourable circumstances, takes place. This, also, often occurs in the interior of the soil, when evaporation is taking place from the surface. The amount of the dew deposited upon the soil has been estimated by Dr. Dalton to be equal to five inches per annum, or about 500 tons of water per acre. Less dew is usually formed during the first than in the second portion of the night. The amount of water deposited in dew varies at different seasons and localities. Autumn, as Mr. Steinmitz observes, is remarkable for its heavy dews, owing to the depression of the temperature during the nights. These are sometimes so abundant as to admit of measurement in the rain-gauge. In one night, towards the end of September, Luke Howard got one hundred of an inch of water from the dew, and in the last six days of October eleven-hundredths from copious dews and mists. We must not then forget that dew is only one form in which the aqueous vapour of the atmosphere is deposited on the earth for the service of vegetation. The driest soils contain about 10 per cent of moisture. We know that when soils are dried in a temperature of 212 deg., and exposed on their surfaces to air saturated with moisture, they absorb very considerable portions of water. Suppose a soil which weighs about 1000 tons per acre is pulverised so as to be freely permeable by the atmosphere, and that such a soil, after being thoroughly dried, is exposed to the air, then we find from the experiments of Schubler that it will absorb water, in twenty-four hours—

If a sandy clay, equal to	....	26 tons
If a loamy clay, "	....	30 "
If a stiff clay, "	....	36 "
If a garden mould, "	....	45 "

The inquiry is closely connected with the good effects produced in most soils by deepening and pulverizing them. Well-pulverized soils absorb much more dew than when suffered to remain close. "Sands," observes Mr. Josiah Parkes (*Jour. R. A. S.*, vol. v., p. 132), "appear to be powerful attractors, and in some countries to depend altogether on the nightly deposition of moisture for the support of their vegetation. It is to the copious dews that we have in a great measure to attribute the productiveness of the meadows bordered by rivers. The atmosphere in the neighbourhood of currents of water becomes more highly charged with aqueous vapour than those of the upland. A moisture is deposited from it, in such places on the grasses during the night, in globules of dew; hence the French expression that a river bedews (*arrose*) is more correct than the English one, that it *waters* a country. In India the deposition of dew near to rivulets, when all around is perfectly dry, is very remarked." Colonel Sykes (*Trans. Roy. Soc.*, 1850, p. 354) remarks that, "when at Poona, in September and October, if there was no deposition of dew anywhere else, it was yet found on the banks of rivulets and the Mota Mola river; but 15 to 20 feet from the water were the limits of the deposition." If, however, the efforts of the husbandman in deepening and pulverizing his soil tend to the increasing their supply of atmospheric moisture, his labours in another direction sometimes diminish it. "It is evident," says Dove, "that a vigorous vegetation produces rain, which, on the other hand, nourishes again that vegetation, and that the senseless destruction of forests very often has destroyed the fertility of the soil. Previous to 1821, Provence and the department du Var possessed a superfluity of brooks and springs. In that year, the olive trees, which formed almost forests, were killed by frost, and they were cut down to the root in 1822; since which time the springs dried up, and agriculture suffered. In Upper Egypt, the rains, eighty years ago still abundant, have ceased since the Arabs cut down the trees along the Valley of the Nile towards Libya and Arabia. A contrary effect has been produced in Lower Egypt, through the extensive plantation of trees by the Pasha. In Alexandria and Cairo, where rain was formerly a great rarity, it has since that period become much more frequent." "The proportion of forest or woodland required for an agricultural country, in order to ensure a regular and sufficient rainfall without violent storms, has been estimated," observes Mr. Steinmitz (*Sunshine and Showers*), "at 23 per cent. for the interior, and 20 per cent. near the coast. This estimate by Rentzsch related to Germany; but in England the proportion, according to the same authority, is only 5 per cent., and even this is reduced by

Sir Henry James, the head of the Ordnance Survey Department, to 2½ per cent. This is certainly a very small proportion, and below that of every other country, the next lowest being Portugal, which has very little woodland." "In Italy the removal of forest," observes Professor Ansted (*Jour. R. A. S.*, vol. iii., N.S. p. 79), "has introduced the sirocco, the effect of which is unfavourable to life of all kinds, and many of the crops have suffered thereby." Near Ravenna, a pine forest, extending for about twento-two English miles, being cut down, the sirocco was introduced, but was got rid of when the wood was allowed to grow again. In other parts of Italy, where the wood was cut down during the time of the French Republic, to enable the manufacture of iron to be carried on, the result was at once seen in an increased severity of climate, the maize no longer ripening. The forests have since been restored, and the climate is restored also. In Belgium favourable results have been obtained by the planting of trees on the right bank of the Scheldt, where large tracts of land, formerly waste, have been rendered fertile. The produce of the plains of Alsace, in the east of France, has suffered since the forests of the Vosges were removed; and the centre and south of France have felt the influence of the *misiral* and other injurious winds only since the forests of the Cevennes have been removed. The cultivation of certain plants and trees has thus become difficult or impossible where it was once easy and natural; and as this has taken place within the period of history, and has followed the disforesting in every case where observation has been made, there can be little doubt as to the cause. Although it is difficult to verify with precision the extent of these changes of climate where accurate and detailed observations are wanting, still the testimony of experience and the comparison of historic accounts point to such a change in Europe within the last thousand years. These conclusions are fully justified and confirmed by such tabular statements as exist, and are not contradicted by any.

Tapeworm.—Last summer I paid a visit to my brother in Chicago, U.S., (age 40), and found that he had been suffering for a year from some unknown cause. He had become extremely thin, and complained of pains in the stomach. He had been under treatment by one of the best doctors for several months, gradually getting worse. I induced him to visit the Exposition at Philadelphia, remaining there two months; he became worse and tape-worm became evident, passing every few days, several inches at a time. I consulted several medical authorities, who recommended various remedies; but all agreed upon the merits of an infusion of pumpkin seed—the seed to be fresh, and taken from the ordinary field pumpkin, and not the finer garden varieties; a strong boiled infusion of this, half a pint to be taken on an empty stomach—having gone twelve hours without food—a dose of castor oil to be taken half an hour after the infusion. Some recommended the infusion to be made with milk, others with simple water. My brother had no faith in such simple remedy, so although I prepared the infusion, I could not get him to take more than a wine glass-full, or to try it upon an empty stomach. He went to Cincinnati, became worse; he was unable to leave his room without fainting, and having to be carried up stairs. Two of the best physicians were called in, who said the case was nearly hopeless. They gave him turpentine compounds on a fasting of twenty-four hours, he had then convulsions and fainting fits, but no relief. Again, as a last hope, after two weeks' repose, they gave him a very large dose of some compound containing turpentine; this nearly killed him, but did not kill the worm. He was seuseless for several days, and his death daily expected. His friends had heard of an old German barber, who had cured many of this terrible disease; they visited his shop in the suburbs (Newport), and he offered to undertake the case for 25 dollars (five pounds), no cure, no pay. My brother was carried to the barber's shop, laid down on the sofa, and the barber commenced at once to make his secret infusion in his kitchen. In half an hour he brought up about half-pint of dark-looking stuff, smelling and tasting like pumpkin seed, perhaps with coffee; this was taken, and in two hours 130 feet of tape-worm, together with its head, had passed, or been expelled. This was in last February, and now my brother is comparatively well, and attends to his daily business duties. Thus a charlatan of a barber succeeded where the medical profession failed. The barber's remedy is his secret, which he is not inclined to divulge, but we are all firmly convinced that its active power was pumpkin seed. In any case, whatever was the remedy used, it proves that this horrid disease can be cured, and that by simple remedies.

NEW TRINITY CHURCH, BOSTON.

(See page 312.)

We present a view of Trinity Church, which was built by the congregation of the Rev. Phillips Brooks to replace that destroyed in the great fire, and which was dedicated on the 9th of February last. Including the furniture, organ, etc., the total cost was $750,000, and the whole property was consecrated to Christian worship without the incumbrance of one cent of debt. The building which was erected by Messrs. Gambrill & Richardson, of New York, occupies a triangular bit of ground, with rear on Clarendon Street, and front on the irregular square which lies before the new Art Museum. On Clarendon Street and the north corner of the irregular triangle stands the chapel and vestry-room, connecting with the main building by a series of pillared or "cloistered" ways.

The design is in the pure French Romanesque style—the plan that of a Latin cross, with a semi-circular end to the chancel. Its most noticeable feature is a central tower, which, so far as the church architecture of this country is concerned, is unique. The original design of the tower was a square, with turrets at each corner, not unlike the tower as at present, but surmounted by an octagonal lantern, also of stone-work, rising some fifty feet higher. To reduce this great weight, therefore, the idea of the octagonal tower was abandoned altogether, the thickness of the curtain walls of the square tower made correspondingly less, and the design of the completed tower as now seen was adopted.

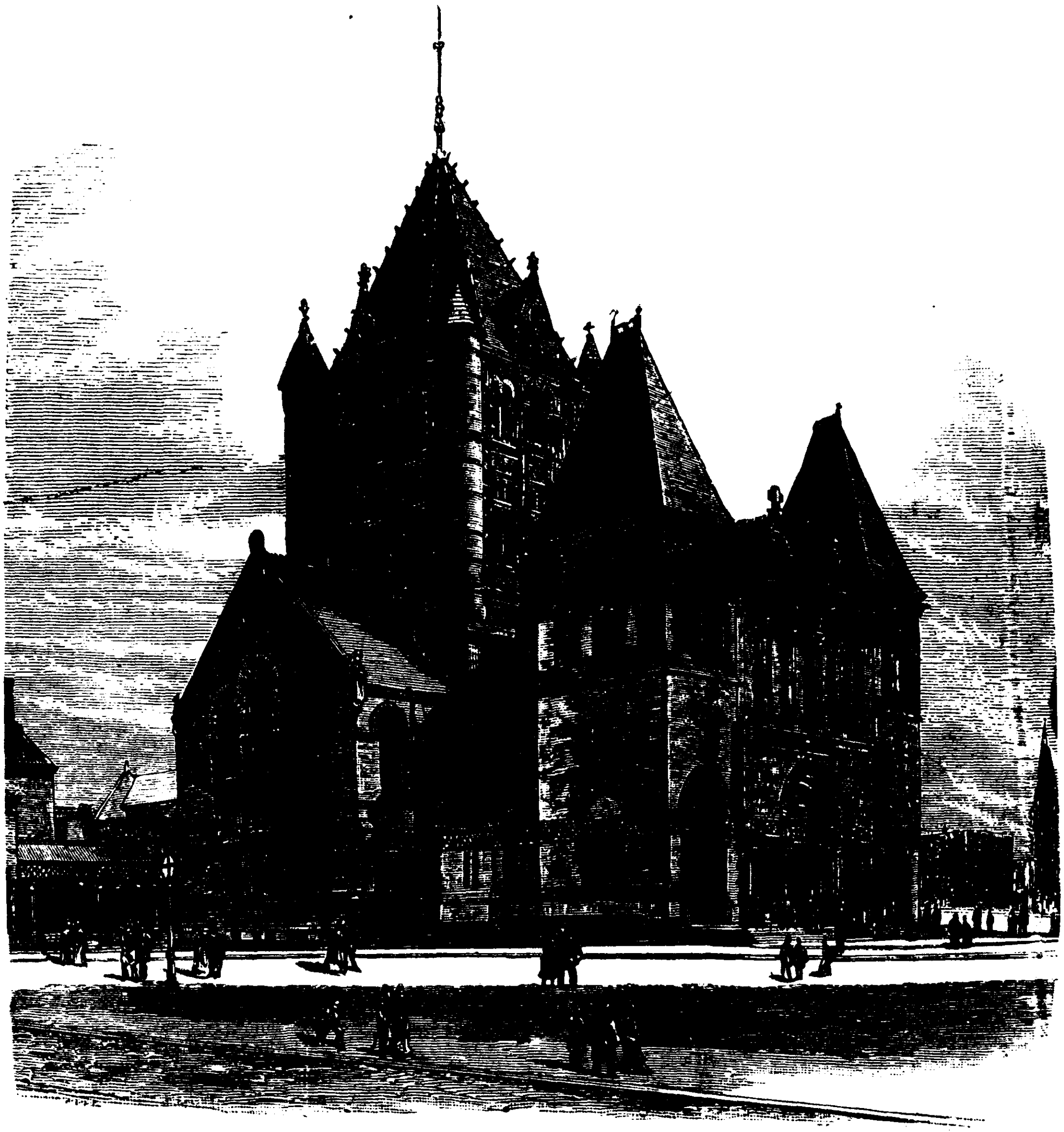
Exteriorly the church is a most imposing object. The central tower, while massive and grand in its proportions and construction, is nevertheless light and graceful in effect, and a pleasing picture for the eye to rest upon. Besides this are two smaller bell-towers on the front of the church, which add much to the general effect.

The effect within the church is also very imposing. The nave joins with the great central space under the tower by one of those fine horseshoe arches, typical of Moorish architecture, while its companion arch above the apse is seen beyond.

The finest effects are, as a matter of course, produced in the central tower, for its great space affords the utmost facilities for artistic display. It is lighted by twelve large stained-glass windows, which afford an ample volume of light to reveal all the beauties of the decorator's art. The ceiling is paneled, and painted in antique blue, highly decorated in green and gold. The four upper corners of the tower are ornamented with the symbols of the four Evangelists—the bull for St. Luke, the winged lion for St. Mark, the angel for St. Matthew, and the eagle for St. John. The arches above the windows are filled with scriptural subjects, such as the "Good Shepherd," the "Flight into Egypt," etc. At the base of the columns, which come down flush with the bottoms of the tower windows, heads of biblical characters are painted. The cornice is very richly gilt and relieved with broken greens. Below this are several borders, and then a broad gold band encircling the tower. Beneath this band, on the east side of the tower, are figures of St. Peter and St. Paul, with groups of two angels on each side of the figures. On the north side are figures of Moses and David—the former bearing the tablets of the law, and the latter the harp, and these are supported by single angels. On the south side are the prophets Jeremiah and Isaiah, also supported by angels. The west side is at present left plain, but will be eventually filled with appropriate subjects. The figures are respectively fifteen feet high. They are painted in colors, directly upon the plaster, as is the custom in the best churches on the continent.—*From Frank Leslie's Illustrated Newspaper.*

Specks before the Eyes.—Cease to trouble yourself about the specks and you will probably fail to see them, especially if you find something to do and do it keeping yourself in as good health as you can.

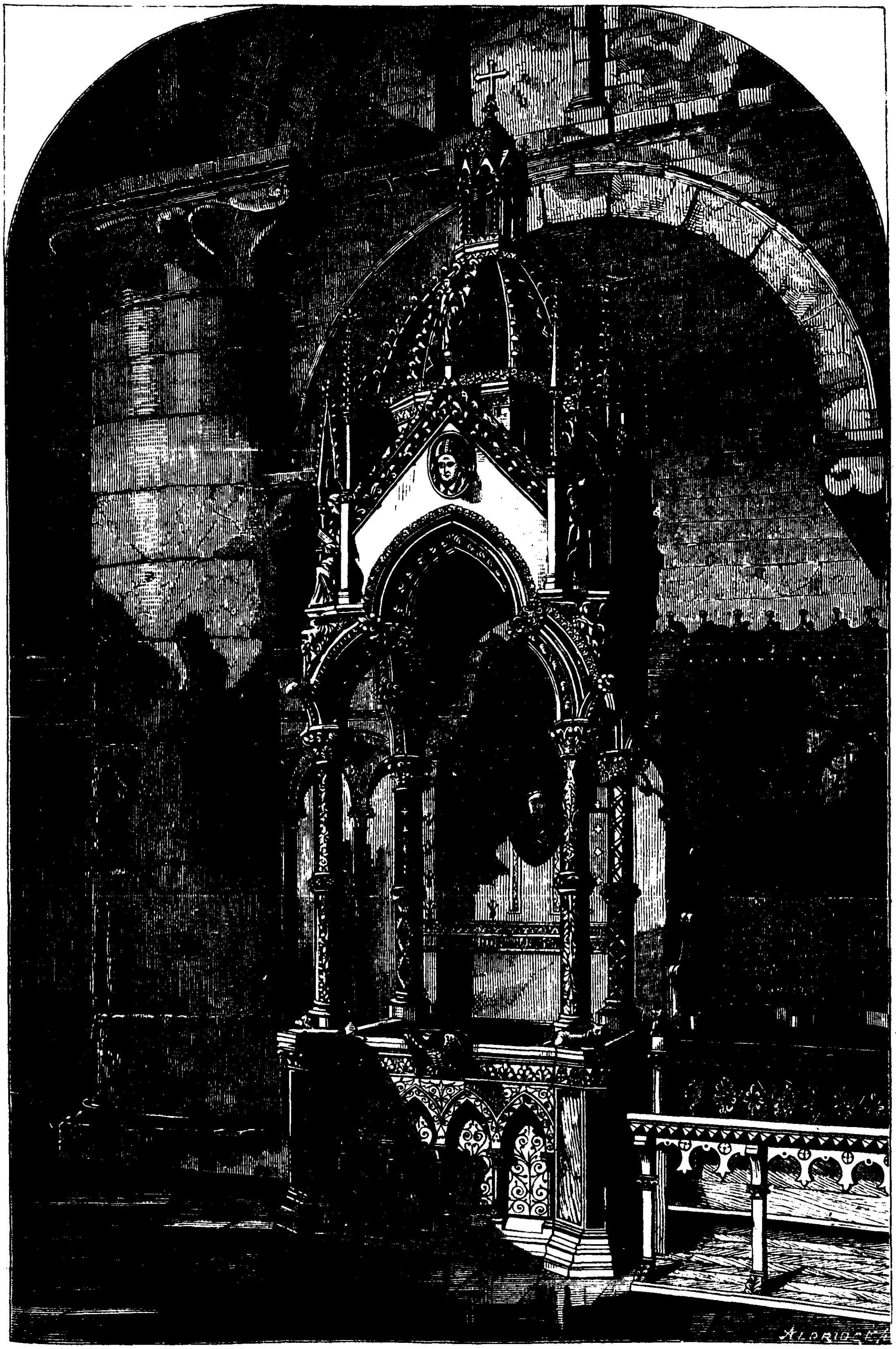
A recent traveller states that the elephant emits four distinct sounds, each of which expresses a certain state of feeling or thought. The first is an acute and whistling cry, produced by a blast sent through the trunk; the animal thus shows his contentment. To indicate surprise or alarm he makes with his mouth, a noise which is like *pr-rut, pr-rut.* A sound like that of a trumpet, and given with force, indicates anger. When the elephant is furious, or when he rushes on an assailant, the sound changes to a hoarse below, or a terrible cry. The fourth sound denotes discontentment or distress; it is frequently repeated by the animal when seperated from the rest of the herd, tired, famished, or too heavily loaded; it may be imitated by *urmph, urmph.*



NEW TRINITY CHURCH, NEW YORK.

Manufacture of Portland Cement.—An English exchange says that an important improvement in the manufacture of Portland cement has been patented by Messrs. White, of Swancombe, by which a better quality of material is obtained and the cost of manufacture is considerably reduced. For this purpose they take chalk and clay in the natural state in which they are found, and without the admixture of water they obtain an intimate mixture of these materials by placing them together into a hopper, from which they pass to a series of pairs of crushing rollers. The materials as they leave the hopper have first to pass through a pair or pairs of fluted crushing rollers, from which they pass to other pairs of plain rollers, placed closer and closer together, and running at increased surface speeds. By this means the materials are reduced to a thin sheet, the chalk within which is in a thoroughly disintegrated state and mixed with the clay. After the materials have thus been crushed and mixed together by means of rollers, they may be molded into bricks to be burnt in any ordinary manner, no fuel being mixed up with the materials of which the cement is composed.

Matches.—The extent to which the manufacture of matches is carried can be but faintly indicated by means of figures. The demand for them in Great Britain is, on an average, eight daily for each individual; in Belgium, nine per head; and for Europe and North America, the entire average is six to every inhabitant. To meet this demand matches are produced by the million, and the wax taper before division in small pieces, is measured by the mile. It is stated that one pound of phosphorus is sufficient for 1,000,000 matches, though the proportion varies greatly. In France there are consumed for this purpose 70,000 pounds of phosphorus every year. The largest makers are in Austria, two of whom use twenty tons of phosphorus per annum, and produce nearly 45,000,000,000 matches. One firm in New York uses annually 700,000 feet of choice white pine timber, 100,000 pounds of sulphur, and 150 tons of straw-board for their boxes. Large quantities are exported from the United States to the East and West Indies, China, South America, and other countries. At the census taken here in 1870 there was found to be 75 establishments engaged in the business, and the value of the product for that year was $3,540,000.—*Popular Science Monthly.*



THE BISHOP'S THRONE, OXFORD CATHEDRAL.

THE BISHOP'S THRONE, OXFORD CATHEDRAL.

WILBERFORE MEMORIAL.

(See page 313.)

The Bishop's throne in Oxford Cathedral, of which we give a view, is erected to the memory of the late Bishop Wilberforce. It is composed of walnut-wood. At the four corners of the canopy are figures of Matthew, Mark, Luke, and John, with the signs under them, and a portrait of the bishop is on the throne. The work was executed by Messrs. Farmer & Brindley, from the designs of Sir Gilbert Scott, R.A. The stalls are also new.

A REFORM IN POMPEII.

M. Viollet-le-Duc recounts, in the *Journal des Débats*, a visit he has recently made to Pompeii. The entrance to the ruins of the antique city is now, it appears, by a *tourniquet*. "As for this *tourniquet*," remarks M. Viollet-le-Duc, "I bless it and venerate it. If you knew what Pompeii was before its establishment,—a mass of nests peopled with brigands ; robbers making money out of every wall, every stone. Some had seized the house of Diomedes and the Way of the Tombs, others received a retribution at the villa of Cicero. The Forum, the public baths, Jupiter's Temple, that of Fortune and Mercury, of Augustus, were guarded by another group of collectors. Others came to seek you, and dragged you, against your will, to the other end of the city, amidst a heap of cinders and *débris*, and with shouts, to the amphitheatre, where you arrived, covered with dust, and cursing the monuments, the ruins, the paintings, and the discoveries.

There existed then also another kind of speculation, which specially appealed to the Anglo-Saxons. It consisted in digging in making researches *scavi a posta*, that is, for the visitor and in his presence. The fraud was long tolerated. A boy would hid under the ashes a false bronze or terra-cotta, which a companio would soon rake out, to the joy of the ignorant stranger. I w fortunate enough once to be witness of a piece of admirabl patience and heroic *sang-froid* on the part of a gentleman a whom such a homage had been rendered. During the operation of the digging, he awaited with imperturbable phlegm (he was an Englishman, it appears), then when the object sought for saw the day, he gave the zealous searcher the finest kick that I have ever seen. The young *birbante* rolled over in the *lapillo*, amidst the laughter and cries of joy of his own comrades. As for the gentleman, he turned his back on the scene and continued his visits.

Now, the *tourniquet* guarantees one agaist all this thievery. For two francs you are maater of Pompeii for a whole day if you like. Each visitor or group of visitors is accompanied by an old soldier, polite and discreet, who serves as a guide,—at least, for the order to follow and the direction to take. The greatest silence, the most minute cleanliness reigns everywhere, and each person can admire at ease the curious and charming picture which is offered by Pompeii and its magnificent frame, little changed since the time of Pliny, for there still stand Vesuvius, Capræ, and Misena."

A Model Railway Saloon.—The Great Eastern Railway is now running a new saloon, which has been built at the company's works, Stratford. This carriage is divided into five compartments, the one at each end being for servants and luggage respectively. The former is very conveniently furnished with green Utrecht velvet seats and backs, hat-nets, &c., and has a bell communication with the body of the saloon, which is apprroached therefrom through an antechamber furnished with a morocco lounge and a falling-leaf table, making a very convenient divan. This chamber lead through a sliding-door into the body of the carriage, which consists of a spacious saloon trimmed with maroon morocco, and enlivened with the elaborate floral devices and gilt mouldings with which the ceiling is adorned. The furniture and fittings are satinwood, and consist of a couch, settee, arm-chairs, and a folding-table, at which ten persons can be conveniently seated, the floor being covered with a rich Brussels carpet. The remaining compartment (which is at the luggage end of the vehicle, and is entered from the saloon opposite to the sliding door leading from the ante-chamber) is fitted up with every convenience as a lavatory. The floor is tesselated wood, and the walls are covered with flock paper painted two shades of green, the ceiling being relieved with gold moulding. Tha carriage is built of teak, varnished, and is carried on two bogie under-frames, with an arrangement of springs calculated to give the greatest possible ease in travelling, and it is reported a perfect success.

EQUESTRIAN STATUE OF H.R.H. THE PRINCE OF WALES.

(See page 317.)

The equestrian statue of the Prince of Wales, of which we give a view, is presented by Sir Albert Sassoon, to the city of Bombay. It is the work of Mr. Boehm, and will be an ornament to the city. The figure is about 10 ft. high, the horse in proportion, and it will have a polished granite pedestal, with the arms of His Royal Highness, a shield, with the inscription of occasion and donor, &c., and two bronze panels in relief ; one, "The Arrival of the Prince at Bombay" (staff, functionaries, and Indian chiefs are portraits). The subject of the other has only lately been decided. It will represent a different subject from that proposed at first, and at the time when the woodcut was made (and too late for change). It is to be the school children of Bombay greeting the Prince. The subject was named by the Town Council of Bombay, to whom, with His Royal Highness' sanction, Sir Albert Sassoon left the choice, in preference to the one formerly proposed, of giving the colours to the Bombay Marine Regiment. The whole affair. will entail a cost to Sir Albert Sassoon of about 10,000*l.*, none of which is subscribed, but solely borne by him alone.—*The Builder*.

Receipts for Making Skeleton Leaves.—Dissolve 3oz. of washing soda in two pints of water, boil, and add 1½oz. of slaked quicklime. Boil for ten minutes, settle, and pour off the clear liquid for use. Bring this to the boil and during ebullition add the leaves. Put on the lid and boil for about an hour, adding water occasionally to make for loss. Take out a leaf and rub it between the fingers under water. If the skin and pulp separate easily, the leaves are ready ; if not, boil for some time longer. Having cleaned the skeletons, bleach them in a solution of bleaching powder, a teaspoonful to the pint, adding about a teaspoonful of strong vinegar to liberate the chlorine. Let them remain in this for about ten minutes. Wash in water, and float them out on pieces of paper. N.B.—Take care the soda solution touches the fingers as little as possible, it may remove their epidermis as well as that of the leaves.

No. 2. Dissolve an ounce of caustic soda in a quart of rain water made hot, then immerse your leaves (those of rose, holly, vine, pair, westeria, beach, poplar, &c., are the best ; oak hazel, walnut, and resinous leaves generally are more difficult), for 12 to 36 hours; do not expect, however, to arrive, without some disheartening experience, at any commendable perfection.

First dissolve four ounces common washing-soda and two ounces of slaked quicklime in a quart of boiling water and boil for about fifteen minutes ; when the solution is cool pour off all the clear liquid, in which boil the leaves for an hour ; after gently boiling you must rub off the cellular matter with your finger and thumb beneath cold water.

Soak the dried leaves for some days in a dilute solution of chloride of lime, previously filtered. More recent receipt from the *Chemical News* :—First dip the leaves in boiling water, then immerse them in dilute sulphuric acid, containing 10 per cent to 30 per cent of the acid, according to the delicacy or coarseness of the leafy structure. In a day or two use a pretty stiff bristle brush to the leaves, adding drop by brop a little saturated solution of bichromate of potash.

Anthracite Coal Discovery in New Brunswick.—A thirteen-foot seam of anthracite coal has been discovered at Mace's Bay, Charlotte County, New Brunswick, twenty-eight miles from St. John, the bed cropping out on the shore. It has been inspected by a New York mining engineer, and analyzed by Mr. Harrington, of the Canadian Geological Survey, who finds in it fifty-eight per cent. of fixed carbon, about five per cent. of volatile combustible matter, and thirty-seven per cent. of impurities. A company is being formed to work the property, to erect piers, etc., at an early date.—*Monetary Times.*

Cough Mixtures.—Tincture of hops, 4drms. ; syrup of red poppies, 3drms. ; diluted sulphuric acid, 1drm. ; mucilage of gum arabic, 2oz. ; mix. Two teaspoonsful every three or four hours. Syrup of poppies (white) ; spirit of sweet nitre ; syrup of squills ; of each equal parts. A teaspoonful three or four times a dap in a little water. No. 3—Emulsion of sweet almonds, 7oz. ; tincture of hops, 4drms. ; syrup of balsam of tolu, 4drms. ; oil of aniseed. 15 drops. A teaspoonful every three or four hours.

Cough Mixture.—Syrup of tolu, syrup of squills, and ipecacuanha wine, twopennyworth of each : dose, half a teaspoonful when cough is troublesome. Tried and found good. No. 2. compound tincture of bark, tincture of tolu, sweet spirit of nitre, and paregoric elixir, twopennyworth of each ; dose, one teaspoonful when cough is troublesome.

THE MANUFACTURE OF NEEDLES.

(See page 316.)

Needles are most usually made from steel, though the cheaper and coarser varieties are made of iron wire, which in the course of manufacture becomes converted into steel. The first operation is to wind the wire upon large reels of from fifteen to eighteen feet in diameter. The large coil so obtained is next cut into two portions by means of powerful shears, and these two bundles are further reduced by the same means and the use of a proper guage, to pieces of double the length of the future needles. In this way one workman can produce in an hour 40,000 of these pieces, or shafts as they are technically called, equivalent to eighty thousand needles. This rate of production has been greatly exceeded by the introduction of automatic machinery.

The shafts now undergo a process of straightening, and to this end are gathered into bundles of five to six thousand pieces, upon which strong iron collars are slid. These bundles are slightly heated in order to soften the metal, and are then inserted between two plates of steel, the lower one of which is fixed while the upper one is made to swing about an axis. These plates have longitudinal grooves for the reception of the iron collars, so that the pressure is mainly and properly exerted upon the wires alone. The next operation consists in pointing the shafts at both ends. Grindstones of fine-grained sand stone are used with this view, rotating by means of belts with a velocity of about two thousand revolutions per minute. The workman, according to the fineness of the wire and the skill he possesses, takes one or two dozen or more shafts at a time and spreads them out upon the stone, giving them a slight rotary motion by means of his thumb and forefinger. In order to prevent the formation of rust the grindstone must be kept dry so that quite a quantity of stone and metal dust is produced, rendering the operation one not unattended with considerable danger to the health of the workmen. After this sharpening operation the mode of procedure branches off into two different methods, the first and older one being to cut the shaft at this stage into components, while the one more recently brought forward continues the operations upon the double needles until very near the concluding steps. We will begin with the former method, being the one at present most extensively pursued.

The divided shafts, after leaving the shears as such, have their blunt ends flattened preparatory to the formation of the eye. This operation is conducted with great rapidity upon a small iron anvil. The workman takes a few dozen needles by their pointed ends, spreads them out fan-shape upon the anvil, and strikes several light and rapid blows with his hammer, flattening the heads of five or six at each blow. The ends, having been rendered too hard by this procedure for the following operation, have first to be heated and slowly cooled.

The eye is formed either by punching or piercing, never by drilling in the true sense of the word. In punching, the flat end of the needle is first placed upon a vertical steel point and struck with a hammer. Into the depression thus formed a steel punch is placed and the hole completed by another blow. A few taps about the punch then finishes the eye. The two stages of this operation are shown in Figs. 2 and 3. The delicacy of such manipulation, especially in the case of very fine needles, is really surprising and can scarcely be acquired by other than children, who attain an incredible degree of skill and rapidity. Their favorite trick of forming an eye in one end of a human hair and threading it with the other is no doubt familiar to all.

The idea of piercing the eye originated in England. The machine employed is shown in Fig. 4, and will be readily understood. A lever worked by hand lowers the steel point and drives it through the end of a needle placed properly beneath. The needles after receiving the eye have next to be provided with the grooves serving to guide the thread to the hole. This is accomplished by means of a file which, at the same time, removes any burrs or other irregularities that may still be remaining.

We will now go back a step in order to describe the second and improved mode of bringing the needles to the stage where we here stop.

The shafts, after being sharpened, are not divided as in the former instances, but are introduced whole, one by one, into a small stamping machine. They here are made to undergo the following changes by one stroke of the heavy die, both sides being acted upon at once. The central portion is flattened, the two longitudinal grooves in which the eyes are to lie are formed, together with a notch which is to assist later in separating the needles, and any numbers, letters, or other marks which the latter are to bear. Both eyes are formed at the same time by means of the piercing device shown in Fig. 5, after which the double needles are strung upon cords, and passed to a workman who files the whole string at once, breaks the shafts in two, and finally rounds their heads. Hardening of the needles made from steel wire then follows, the iron ones being converted into steel by means of the process of cementation (Fig. 6).

The next stage of the manufacture—scouring and polishing—is about the most tedious and troublesome of all, though several millions of needles are worked up at once. The needles are arranged in parallel layers upon pieces of coarse, strong cloth mixed with sharp sand or emery, moistened with oil, usually linseed, and, after the mass is sufficiently large, rolled up into bundles of about eighteen inches in length by four in diameter. Twenty or thirty of these bundles, each containing about half a million of needles, are placed in a scouring mill and rolled back and forth under heavy pressure for about twelve or eighteen hours. The filthy looking mass is then removed from the bundles and stirred about in a large drum full of sawdust, which removes the oil, dirt, and sand, and leaves the needles already pretty bright. These are then separated from any adherent sawdust by means of an air blast, and are again submitted to the scouring operation. This is repeated for about ten times, finer grades of sand and emery, binoxide of tin, rouge, or bran being successively used. After this the needles undergo a thorough washing in warm soap water, and are dried in sawdust, which completes the cleansing process.

The common cheap varieties are then hastily gone over again with a piece of cloth or soft leather, after which the broken and otherwise defective ones are removed, and the rest properly assorted and arranged. The better classes of needles undergo various additional manipulations. To begin with, their points are gone over again more carefully, the rough treatment in the scouring mill being very apt to render them blunt. They are held about twenty-five at a time against a cylindrical or prismatic grindstone (Fig. 7), at the same time being slowly rotated by the fingers. In order to prevent the fraying or cutting of the thread against the possible rough edge of the eye, these latter are gone over again with a rapidly rotating fine steel drill. This operation is shown in Figs. 8 and 9, the latter giving a clearer view of the mechanism employed.

England and Germany are the two principal countries engaged in the needle manufacture. Redditch is the needle-producing centre in England, and enjoys in its own special branch of manufacture as high a reputation as do Sheffield and Manchester in theirs. The largest factories in Germany are situated at Ichtershausen, in Thuringia, at Aix-la-Chapelle, and turn out, in the course of a year, respectively about three hundred and fifty millions and one hundred and fifty millions of all grades.

The earliest needles were "square eyed," that shape being the most readily produced. Drill eyed needles, after many unsuccessful attempts, were first brought out in 1826. The burnishing machine, in which the needles are on a steel wire to which rapid revolution is imparted, was introduced two years later. By this, a beautiful finish is imparted to the eye. The process of hardening them in oil was introduced in 1840, water having been previously used for this purpose, which caused a large proportion of them to become crooked, requiring the services of a large number of workmen to straighten them. These being thrown out of employment by the introduction of the new process, made a riot, and drove its introducer out of town ; but it was generally adopted. A similar disturbance had taken place in 1830, on the introduction of the stamping machine. The machine for pointing is of still more recent introduction.

Artificial Ivory.—1st. That now most in use is the white cellulose, being a solution of gun-cotton in alcohol and ether—in fact, a dried up collodion, colored white with zinc-white. 2d. Dupré, of France, simply uses papier-maché and gelatin. If it is required to have it white, the best and clearest glue is used, and zinc-white added ; but of course any color may be added. This material is said to be strong, hard, and elastic enough for billiard-balls. 3d. We give the following prescription as we find it. Two parts of caoutchouc are dissolved in 36 parts of chloroform, and the solution is saturated with pure ammonia gas. The chloroform is then distilled off at a temperature of 85° C. The residuum is mixed with phosphate of lime or carbonate of zinc, pressed in a mold, and dried. When the phosphate of lime is used, the product possesses the nature of the natural ivory ; this composition possesses the proper proportions of lime and of phosphate, and the caoutchouc takes the place of the organic material of the ivory. The other parts of the natural product are of little importance.

THE MANUFACTURE OF NEEDLES.

Fig. 9.—THE DRILL BENCH

Fig. 5.—PIERCING THE EYES.

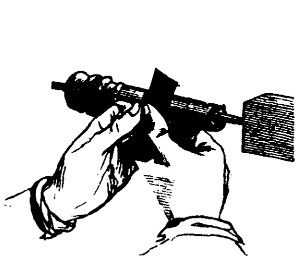


Fig. 7.—RE-SHARPENING.

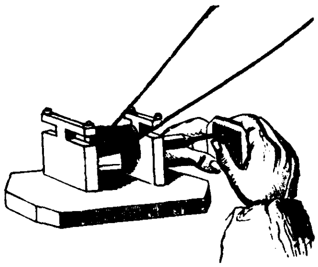


Fig. 8.—DRILLING.

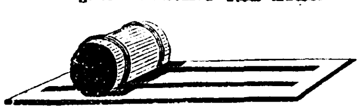
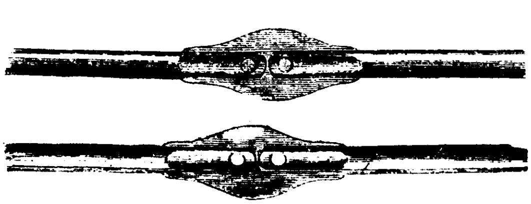


Fig. 1.—STRAIGHTENING THE NEEDLES.



Figs. 2 and 3.—PUNCHING THE EYE.

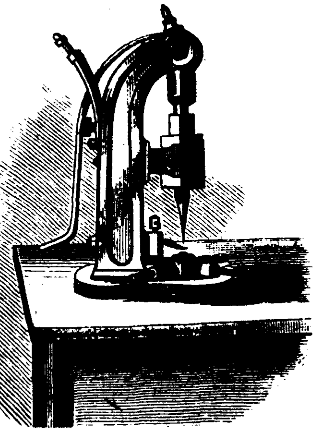
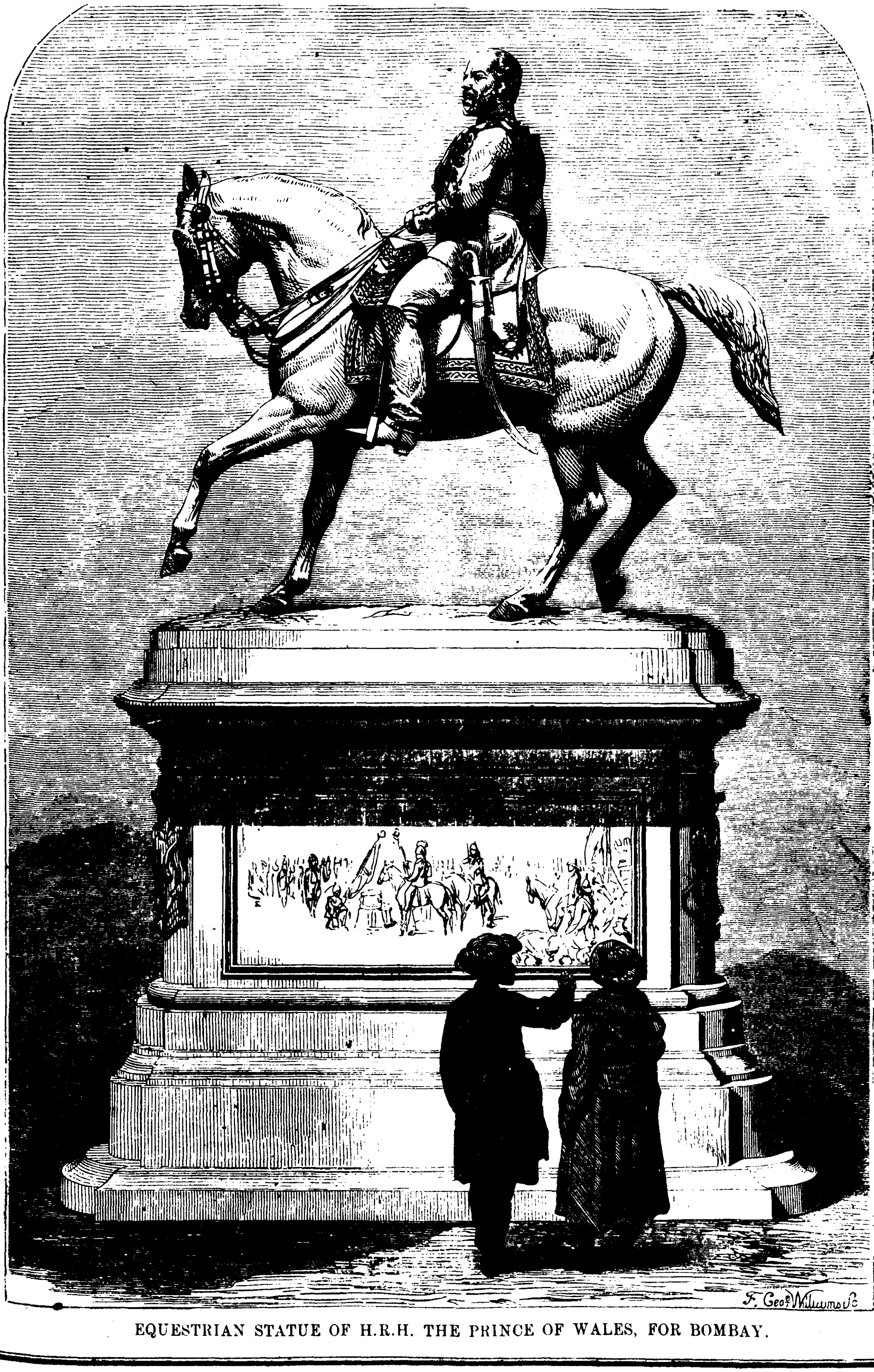


Fig. 4.—MACHINE FOR PIERCING THE EYE.



EQUESTRIAN STATUE OF H.R.H. THE PRINCE OF WALES, FOR BOMBAY.

PHOTOGRAPHIC PORTRAITURE MADE EASY.

By C. J. P. Handey.

Author of "Puzzle Writing," &c., &c.

Instructions.

Pictures produced by the agency of light are called photographs, whether taken on glass or paper. These are divided into two classes—negatives and positives; negatives being pictures with the lights and shades of the object reversed, while positives represent the lights and shades as in nature.

Pictures taken on glass are called positives, which are complete in themselves. The negative process is that pursued when the intention is to produce a paper proof. Paper portraits are not obtained like positives, by one operation in the camera, but a negative is taken from which the copies are procured by photographic printing. To take a portrait on glass—either a negative or positive—requires five operations. First, giving the glass plate a collodion coating; second, exciting the glass plate; third, exposure in the camera; fourth, developing the latent image; fifth, fixing the picture.

Apparatus.

A camera is the first requisite. The most convenient form consists of two portions of boxes, one sliding within the other.

The double-combination lens is used for portraiture. It consists of a set of three glasses, mounted in a brass tube, with a rack and pinion adjustment.

A camera stand is requisite, which should be from four to five feet high. A tripod stand, with a screw to fix the camera with, is the best.

A porcelain bath is required to hold the silver solution for exciting the collodionized plate.

One or two graduated glass measures, to measure the solutions, estimated by fluid measure.

A set of scales and weights for weighing the chemicals.

Two or three porcelain dishes, for holding solutions of silver, toning bath, &c., &c.

A printing frame will be required, after taking a negative picture, to produce the paper copies.

A few packets of different-sized glass, a piece of wash-leather, and a linen cloth, will complete the requisites.

Dark Room.

It will be necessary for the success of the second, third, and fourth operations in producing a collodion picture, that they should be performed in a dark room. The best and easiest way will be to obtain a small room or closet with a window, and to cover the window with several sheets of yellow paper, which will exclude the chemical rays. A table or shelf should be fixed under the window, and a pail kept at the side, containing water for washing the pictures.

If a glass room cannot be had, the photographer must arrange an apartment according to his means. In selecting a room, he must bear in mind that it should not only have a good side light, but a sky-light, if possible. In taking a portrait, the sitter should not be opposite the window, but a little behind it—a more even focus is thus secured.

A proper background is of some importance. A white wall will do very well, but something a shade darker will be better.

In focussing the lens have the stand and camera placed seven or eight feet from the sitter. The better to observe the image, a dark cloth is thrown over the camera and head of the operator. The proper attitude of the person sitting for the portrait must be left to the taste of the operator. Allow the sitter time to get seated, and accustomed to the light, before removing the cap off the lens. And now, having concluded these preliminary remarks, we will proceed to take a picture.

Positive Process.

Chemicals.—The most important chemical used in photography is collodion. As it is extremely volatile, it should be kept in a stoppered bottle.

Exciting Bath.— Nitrate of silver, 2 drachms: distilled water, 4 ounces; iodized collodion, 6 minums. Filter before using.

Developing Solution.—Protosulphate of iron, 2 drachms; acetic acid, 2 drachms; methylated alcohol, 2 drachms; water, 10 ounces.

Fixing Solution.—Cyanide of potassium, 2 drachms; water, 6 ounces. This solution will keep for months without losing its strength.

Manipulation.

The Collodion Coating.—Having selected a piece of glass, entirely free from blemishes, and quite clean, hold it as level as possible by the left-hand corner, then, in the centre, form a good pool of collodion. Slant the glass so that the collodion may cover all portions, taking care that it does not touch the hands. Pour the superfluous quantity back into the bottle. The glass is now ready for immersion in the silver bath, which is called

Exciting the Plate.—The manipulation may be conducted in daylight up to this point; but as the immersion of the collodionized plate renders it sensitive to light, recourse must be had to a dark room. Having the silver solution ready, place the prepared glass on the dipper, and immerse in the solution. When the plate has remained in the bath about a minute it should be withdrawn, then immersed for half a minute longer, then drain the glass plate, place it in the dark slide of the camera, and proceed with the third operation—

Exposure in the Camera.—Assuming that the camera has been prepared, and the image properly focussed, remove the ground glass screen, and insert the slide containing the plate. Desire the sitter to keep perfectly still, and look at some dark object; then take the cap off the lens and allow the plate to be exposed for twenty or thirty seconds, then close the shutters of the dark slide, and return to the dark room to

Develop the Picture.—Having excluded all white light from the dark room, remove the glass plate from the slide. Holding it by the left-hand corner, proceed to pour on the developing solution. Begin by pouring on at one edge, inclining the plate so as to enable the liquid to flow uniformly over the surface. The first effect will be the appearance of white lights, then the half tones, and, finally, the darker shades. When this is obtained, the plate must be thoroughly washed. It can then be passed on to the next and last operation—

Fixing the Picture.—Having well washed the picture, the door of the dark room may be opened to observe the action of the fixing agent. Pour this mixture over the plate until the creamy appearance is dissolved. When this is the case, it must be again washed and set on edge to dry. As the picture is now finished, it should be varnished with jet varnish, which should be poured on the plain side of the glass. In mounting the picture, put it into a gilt mat and preserver; and when finished, the lights and shades will be shown to perfection.

Negative Process.

Chemicals.—Negative collodion differs slightly from positive in the preparation of the iodized solution.

Exciting Bath.—Nitrate of silver, 2 drachms; distilled water, 3½ ounces; iodized collodion, 3 minums.

Developing Solution.—No. 1. Protosulphate of iron, 1 drachm; acetic acid, 2 drachms; methylated alcohol, 2 drachms; water, 4 ounces. No. 2. Pyrogallic acid, 13 grains; citric acid, 15 grains; distilled water, 4 ounces.

Fixing Solution.—Cyanide of potassium, 2 drachms; water, 5 ounces.

Manipulation.

The Collodion Coating is applied in the same manner as for positives, and then

Sensitized, which is accomplished by immersion in the nitrate bath. The plate should remain in the bath from two to three minutes. When the collodion surface presents a nice even film, drain off the excess of silver, and lay the glass plate carefully in the dark slide, taking care not to allow any specks of dust or dirt to get near it. It is then ready for

Exposure.—After exposing the plate for the necessary time, which will be double that required for a positive, proceed to

Develop.—Having removed the dark slides into the dark room, pour the developer, No. 1, evenly over the plate. As the picture will appear suddenly, it must be watched. Continue the action of the iron developer until there is fear of the dark shadows becoming veiled. When the glass plate has been washed, pour into a measure—which must be perfectly clean—sufficient of the developer No. 2 to cover the surface of the plate, to this add ten minums of the silver bath. This micture must be used immediately by pouring it over the plate. When sufficiently intense, the surface must be again washed. It is now ready to be

Fixed, using the cyanide solution. This is to be poured over the plate in the same manner as the developer, and the surplus rebottled. It should now be thoroughly washed to remove all traces of chemicals, which, if allowed to remain, would eventually spoil the picture. The negative will now require to be

Varnished.—The most convenient varnish for a tyro to use is amber or crystal varnish; it is simply poured on the plate, and then drained off at the lower end.

Printing Process.

Chemicals.—Exciting bath: nitrate of silver, 120 grains; distilled water, 2 ounces.

Toning Bath.—Acetate of soda, 30 grains ; carbonate of soda, 10 grains ; chloride of gold, 1 grain ; distilled water, 4 ounces. This solution will keep for a considerable length of time, and may be used over and over again until the gold is thoroughly exhausted, when more must be added, if again required.

Fixing Bath.—Hyposulphate of soda, 1 ounce ; distilled water, 10 ounces. This solution may be made up for a fortnight before using, as it is much better for keeping. It must not, however, be used a second time, but a fresh one made for every batch of prints.

MANIPULATION.

Sensitizing.—Filter the silver solution into a shallow dish, then take a piece of albuminized paper, cut to the size, and, holding the two ends, let the centre drop until the albumized face touches the solution ; then lower ends, and leave the paper floating. When it lies flat, and ceases to curl up, it should be removed, and, when perfectly dry, it may be psssed on to the next operation.

Printing the Positive.—Take a printing frame and remove the back board ; then lay the negative in the rabbits of the frame with the collodion side upwards, and cover the face with a sheet of sensitized paper, replace the back board, turn up to the frame, and expose to the light. When the desired strength of picture is obtained, remove the paper, and proceed with the

Toning Process.—Having removed the prints into a dark corner of the room, wash them in several changes of water to remove the nitrate of silver. They are now ready for the toning bath, therefore immerse them in a porcelain dish, filled with the solution. When the colour of the prints change from a brown to a purple black, remove them to the last operation, the

Fixing Process.—The pictures are immersed in the hyposulphate solution for about five minutes, then washed in running water for at least ten minutes. As the fixing solution will greatly reduce the depth of the print, it should be over-printed, to allow of the reduction, else the detail of the picture will be entirely lost.

Mounting Prints.—Starch is the most suitable adhesive substance. It is prepared by mixing a small quantity with sufficient boiling water to work into a stiff paste.

Apply the starch to the back of the picture by means of a brush, then carefully lower the prints on to the card, lay a piece of blotting paper over it, and rub to expel the air bubbles. When nearly dry, place under pressure for a few hours. The picture is now finished.

CONCLUDING REMARKS.

In purchasing apparatus, it is advisable that the tyro should be accompanied by one who is experienced in such matters ; any mistakes as to the quantity and quality of the articles required is thus prevented.

The camera may be made either square, oblong, or bellows body, according to taste. The former is considered the most serviceable and the cheapest.

The lens may be had without a sack and pinion if desired. A better focus, however, is obtained by having the rack adjustment ; it is also much easier to work, and it is not liable to shift when the cap is removed. Some lenses are provided with diaphragms or stops, but as these are rather expensive, I should advise the young tyro to make his own, which he can easily do by cutting different sized holes in several pieces of stiff cardboard, and then making them to fit the interior of the lens tube. These diaphragms, it must be borne in mind, are only to be used on certain occasions, as, for instance, when the sun is shining, the light of course is much too powerful for the open aperture of a lens. It is, therefore, requisite that it should have a stop inserted in order to retard the rapid action. A diaphragm with an opening of about one inch diameter will be sufficiently large for a quarter-plate lens.

Camera stands are made of various shapes and material ; the one most recommended is the plain ash tripod, that being both light and useful, and the most portable.

The sensitizing bath should not measure less than seven by five inches, as that is the proper size for quarter-plates.

The graduated measures should hold at least five and ten ounces respectively.

The funnel may be either six or eight inches in diameter, with a long, narrow neck.

The toning and fixing dishes should be as large as possible, in order to allow the prints plenty of room, and preventing them adhering to each other.

Chemicals may be purchased in small quantities, but it is not advisable to buy collodion in less quantities than five ounces, as it is extremely volatile, and soon loses its power of action.

Nitrate of silver may be bought either in crystals or blocks ; the former is preferable, as it can be obtained in smaller quantities than the latter, which is only sold in one ounce boxes.

Hyposulphate of soda, protosulphate of iron, and methylated alcohol are exceedingly cheap, as are also most of the other chemicals.

The tyro must be very careful—when using cyanide of potassium—not to allow the least drop to enter any cuts in the flesh, for, being a most deadly poison, it is likely to cause death, if the part is not immediately washed in warm water and the poison thereby removed. As cyanide possesses an odour something like peppermint, it is advisable not to place it within the reach of children.

The silver bath should be filtered at least three times before using ; this will ensure the removal of every particle of collodion.

The toning and fixing baths, after being made up, should be allowed to stand for at least four-and-twenty hours before being used. The longer these solutions are kept the better they work.

If the tyro wishes to become a first-class portrait taker, he must study the following rules, and strictly adhere to them :—

RULES.

1. Never allow any one but the sitter to be present when taking a portrait.
2. Always make it a rule to have a place for everything, and everything in its place.
3. Never open the door of the dark room when exciting or developing a plate.
4. The camera and dark slide should be dusted out every morning previous to being used.
5. Never allow any one to meddle with your apparatus, as it is very easily put out of order.
6. Do not handle your sitter more than you can help, but tell him in what position you wish him to stand, and he will pose himself much better than you can.

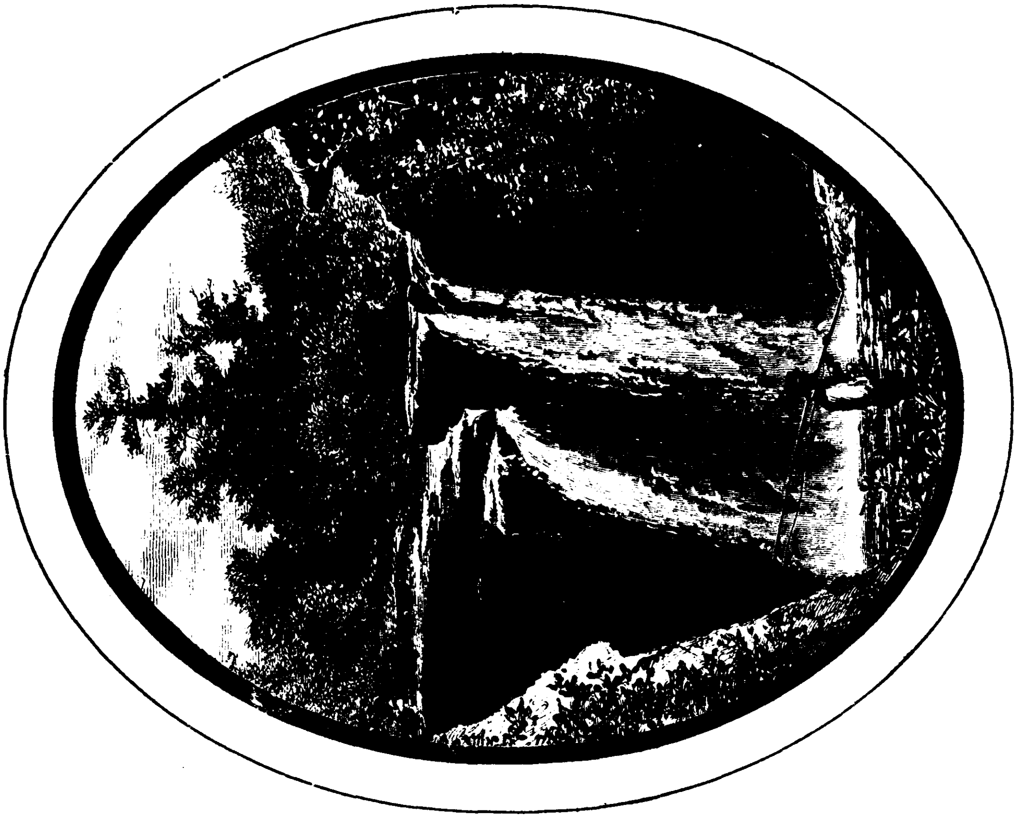
PHOTOGRAPHIC REQUISITES.

The following is a correct list of all articles required in photographic portraiture : Square mahogany camera, double combination lens, tripod stand, screw stand, screw top, porcelain bath and dipper, two graduated glass measures, set of scales and weights, a glass or porcelain funnel, one deep and two shallow dishes, a tent, printing frame, a packet of quarter-size glass, some filtering paper, a wash-leather, and a linen cloth, negative and positive collodion, crystallized nitrate of silver, protosulphate of iron, glacial acetic acid, methylated alcohol, chloride of gold, hyposulphate, carbonate, and acetate of soda, cyanide of gotassium, distilled water, &c.

OUR THREE CATS.—We have at the present time, in our possession, a very pretty black-and-white cat, which answers to the name of "Mitten." It is so named because it has four black legs, with little white pads, like so many mittens. It is a small cat for its age, but a cat everybody admires. If you are sitting on a chair, and make a long low whistle, she will run up to you, lick your face, and then bite the tip of your nose, in a playful manner. If you also shake your fingers at her she will bite and scratch your hand in a most savage manner. She is very quick in her movements, and sometimes when she is put in a great temper she will look more like a tiger, and will spit and swear in a most awful manner ; among her accomplishments she has attained the art of jumping and will jump a great height if you hold your arms for her. Some little time back she had four kittens ; at the same time her mother, who is a beautiful black-and-white cat like her daughter, only she has a black nose and her daughter a white one.

A SLIGHT MISTAKE.—The following anecdote has been associated with the name of a well-known clergyman's helpmeet in Scotland. The minister has been entertaining at dinner a clerical friend from some distance. The evening was unpropitious, and the friend was invited to remain during the night, and the friend accepted the invitation. They walked together for some time in the manse-garden. At dusk, the minister asked the visitor to step into the house, while he would give directions to his man-servant to get his friend's conveyance ready in the morning. As the stranger entered the manse, the minister's wife mistook him for her husband in the twilight ; she raised the pulpit-bible, which chanced to be on the lobby table, and bringing the full weight of it across the visitor's shoulders, exclaimed emphatically, "Take that for asking that ugly wretch to stay all night !"

Buskill Falls, Delaware.



Red Mill Falls, Black River, Elyria.