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CANADIAN MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 6. JULY, 1878. No. 7.

TO OUR READERS.

FOR two years past the efforts of the proprietors of this Magazine have been particularly directed to its improvement by the selection of suitable information for its readers, and by editorial articles calculated to instruct, and to lead to the development of the resources of the Dominion. Any one who was a subscriber to this Magazine two years ago, cannot but have noticed the marked improvement that has taken place since then, in the selection of its subjects, the increased number of its illustrations, and condensed form of portions of its letter-press, by which the reader has conveyed to him nearly double the amount of useful information than was formerly contained in its pages, and it is a gratifying fact to record that we are frequently receiving from our readers, when remitting their subscriptions, expressions of their appreciation of its progress.

The great expense the Company have gone to since 1873, in publishing an ILLUSTRATED SCIENTIFIC MAGAZINE, has far exceeded the amount received in subscriptions. In the face of this loss they have maintained it, from a feeling that there are thousands in these Provinces of a scientific turn of mind, independent of those immediately interested in mechanics, who would gladly subscribe for this Magazine were its merits and usefulness only made known to them. The Editor, Mr. F. N. BOXER, will, therefore, personally interest himself this summer in introducing it more thoroughly to public notice, in the hope that the merits of the work will be recognized and receive a liberal patronage. It is the ardent wish of the proprietors to raise this publication to the standard of excellence required by Canadians, and to disseminate, through its columns, technical information to all classes; to make it, in fact, a work of utility not only to those connected with the different technical branches of science, but to the agriculturist and all youthful members of the home circle who have a taste for the study of science and mechanics. The object is to make it a work worthy of being preserved and placed on a library shelf as a valuable book of useful information and reference.

In order, however, to improve it to the extent we contemplate at the commencement of the coming year, we must endeavour to obtain, to the fullest extent, the patronage of the public, for it cannot be expected that we should publish it at a loss. We feel, however, that there is sufficient public spirit not to allow a work of so much usefulness to become depreciated from want of support, and that there are many who, although not immediately connected with technical matters, have a taste for such, and will give it their support, not only as an encouragement to home literature, but for the sake of reading the great amount of selected valuable information contained in its columns.

Certain pages in the next volume will be arranged under different headings, somewhat in the form of *Cassell's Popular Educator*, so that almost every subscriber may find a page treating on his own profession or mechanical trade. Subjects, too, of elementary instruction in civil and mechanical engineering, architecture, drawing, constructive carpentry, painters, engravers, carvers, cabinet-makers' work, &c., will be continued from number to number; thus, for instance, a carpenter will in a series of numbers obtain a complete work on modern stair-building, fully illustrated, which could not be purchased for double or treble the amount of the subscription for the Magazine alone. The value of such an arrangement must certainly be appreciated by all young members of mechanical trades desirous of obtaining a treatise on some particular work relating to his trade, which would be too expensive for his means to purchase.

But, independent of this new feature, it is contemplated to publish with each number, a SUPPLEMENT SHEET OF TECHNICAL INSTRUCTION, containing a choice of a selection of subjects. The price of these supplement sheets will cost but fifty cents extra, and will be given with the Magazine to all subscribers wishing to obtain them. They will be found very useful in the workshop, and can be bound separately, forming quite a distinct work.

With such great contemplated improvements, and with the determination to carry them into effect, if supported by the public, we leave the matter to their decision as to whether or not Canada shall be behind other countries in showing a national spirit towards the support of a Scientific and Instructive Magazine, and this important fact should be borne in mind that the information conveyed in such publications in England, France, and the United States, where such publications are nobly supported, has placed those nations far ahead of all others in arts, science, manufactures and industrial progress.

G. B. BURLAND,
General Manager.

CHINESE AND JAPAN BRONZES.

For a long time the *patina* given by the Chinese and Japanese to their bronzes has excited the admiration of Europe. The dead black especially, from which the delicate arabesques, inlaid in gold or silver, stand out, has always appeared remarkable; up to the present time, however, the method of its production has remained a secret. It is well known that in China and Japan, as there are no patent laws, various processes remain the property of a few families, and are handed down from father to son without the secret ever being made public.

The perfection to which chemical analysis has been brought at the present day makes known the secrets of Eastern nations without any inducement to have resort to stratagem for unraveling them. M. Morin, to whom were intrusted some specimens of various bronzes, submitted them to analysis, the result of which led him to form the opinion that the *patina* of black bronzes forms part of the metal, and is not due to a varnish or a superficial sulphurization, but results from the use of a bronze of rather complex nature, in which are eighty per cent. of copper, four of tin, ten of lead, two of zinc, and four of iron, gold, nickel, arsenic, and sulphur. Some of the bronzes analyzed show a portion of lead varying from ten to twenty per cent. added at the expense of the copper, and a quantity of seven per cent. of tin. Molded in very thin plates, this bronze readily takes any form given to it, and is easily worked, the *patina* appearing of itself when the finished work of art is subjected, in a muffle-furnace, to the action of a very high temperature. Unfortunately, these bronzes are very brittle, as many *virtuosi* have discovered to their cost.

Chemical analysis is, however, of little use in this case, unless it leads to synthesis. Incited by the high prices realized by black bronzes and desirous of turning to account the effects of contrast obtained by the silver or gold inlaid in a black ground, French manufacturers have made experiments on the various processes for the manufactur of bronzes like those of the East. M. Morin and MM. Christofle and Bouillet have been more fortunate than those who preceded them, having arrived at an imitation of the Japanese bronzes, if indeed they have not surpassed them, for to beauty of appearance the metal unites a strength equal to that of ordinary bronze. Starting from the principle that to be lasting and uniform a *patina* should not be a simple varnish or the result of a laying on of color, but should constitute a chemical change of the surface of the bronze; in the second place, rejecting as too fragile the lead bronzes of the Japanese to adopt the copper bronze, worked by the hammer or deposited by electro-metallurgy, the manufacturers above mentioned have presented to the *Académie des Sciences* some specimens of their work. These objects had the black, brown, red and also the green *patina* perfectly uniform; some had more than one tint on their surface, and others were inlaid with gold or silver.

The processes adopted for obtaining the ground consist of subjecting the objects to the action of chemical compounds having the oxides and sulphides of copper as their base; and the principal condition of the intensity and uniformity of tint consists not only in the choice and the purity of the substances employed, but also in the length of time occupied by the process.

If different tints be desired on the same object, it is sufficient to cover with a protecting varnish all portions of the surface except those to which it may be desired to give a certain hue; then, when this has been treated for a sufficient time, it is in turn covered with varnish while the other portions of the surface, now exposed, are subjected to the action of the chemicals, and so on for as many tints as may be required.

The inlaid enamel work which is performed by Oriental artists with so much skill and patience, and at the same time with such primitive appliances, is now executed by simpler and quicker means. The object to be inlaid is entirely covered with varnish, portions of which are removed by a graver so as to form the design; and, thus prepared, it is subjected to the action of a galvanic bath of gold or silver, which deposits the metal in the places laid bare by the graver. Another method is, however, mentioned by M. Morin. After the removal of the varnish, according to the pattern by the graver, the object is plunged into a solution of cyanide of silver. The salt is deposited on the lines from which the varnish has been removed; the object is heated in a muffle-furnace, and the metal appears on the black *patina*. Inlaid patterns of gold and silver may be obtained, in either of their natural brightness, or with a dead surface, the latter being effected by different processes of oxidation; so that, on the same object, by making use of the protecting varnish, designs in gold and silver of various degrees of lustres may be combined.—*Jeweler, Silversmith and Watchmaker*, iv, 72.

It is said upon good authority that the chief predisposing causes of insanity are the labors, sufferings, cares, and mental anxieties of men and women who are striving to obtain an honest living by hard work.

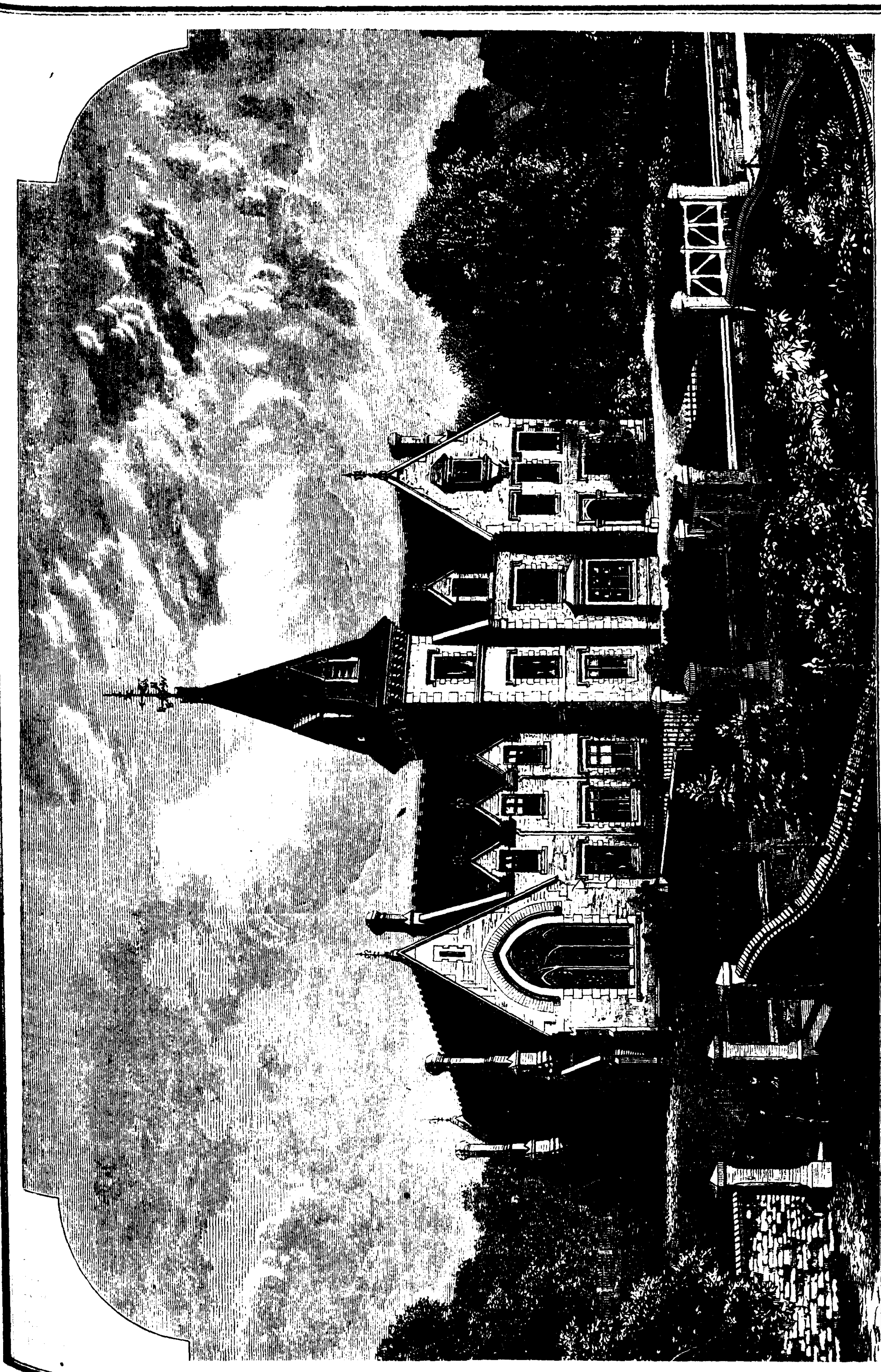
THE BONES OF MONSTERS.

WONDERFUL DISCOVERIES IN THE SANDSTONE ROCKS OF COLORADO.

"Nature has borne strange children in her day," says Shakespeare, and he is not far wrong if we may judge from some recent discoveries in the rocks of our neighborhood. While exploring some rocks in the white sandstone hog-back of the cretaceous period, near Morrison, Bear Creek—the same stratum as at Colorado Springs, a few yards west of old Colorado City—we came suddenly upon a huge vertebræ, lying at it were carved out in bas-relief on a slab of sandstone. It was so heavy that it required two men to lift it. Its circumference was thirty-three inches. We stood for some moments looking in astonishment at this prodigy, and then hunted around for more relics. Presently one of the party, a little in advance, cried out, "Why, this beats all!" At his feet lay a huge bone, resembling a Hercule war club, ten inches in diameter by two feet long. On digging beneath it a number of smaller vertebræ were discovered, and at the base of a cliff two enormous fragments, reminding one of the broken columns of some ancient temple, or a couple of saw logs lay on the ground, possible tigh bones, fifteen inches diameter at the butt end; and in the cliff above them was another fragment sticking out of the rock like the stump of a tree. With the help of a sledge-hammer and crowbar the rock was removed ar und it, and underneath lay some ribs three inches in diameter with other bones.

The rocks in the vicinity were full of fragments. Selecting one of these, we lifted off a large cap of sandstone above it and disclosed a perfect shoulder, *ulna* and *radius*, of another somewhat smaller animal, the thickness of the bones averaging about five or six inches. This, lying as it were like a beautiful sculpture on the sandstone, we succeeded in removing exactly as we found it. Several smaller bones of animals of various sizes were discovered, but as the sun was fast setting behind the mountains we deferred removing our trophies till the following day. During the night it snowed heavily, but next morning we succeeded in dragging our prizes on a temporary sled down the cliff to the road, and bringing home to the neighboring village a wagon load of bones and deposing them in a shanty, preparatory to packing them off East to Prof. Marsh of Yale College for identification. The monster to whom the bones belonged could not have been less than sixty or even eighty feet long. In the cliff above these bones, impressions of leaves were found (Dakota group) or dicotyledonous trees of very singular shape, some resembling a lyre, and others the leaves of the tulip tree, willow, conifers, &c. These trees grew probably on the shores of small islands in the cretacious ocean in which the marine monsters roamed, and not far off oysters (ostrea congesta), clams (inoceramus), baculities and ammonites, and other marine shells were found in abundance.

Along the shores of this ancient sea squatted and leapt the dinosaurus or the terrible lizards, one of whom, the lœlaps, was 24 feet long. From the length of his hinder legs, it is supposed that he was able to walk upright like a biped, carrying his head 12 feet in the air. There was another still larger, 35 feet long, and of the same habits. In the air overhead, hugh bat-like creatures (*Pterodactyls*), combining a lizard, a crocodile, and a bat, flapped their leatherly wings (25 feet from



THE ODIHAM ENDOWED GRAMMAR SCHOOL.—MR. EDMUND WOODTHORPE, ARCHITECT.

tip to tip) over the sea, plunging every now and then into the water for a fish. There were birds, too: a diver (*Perperornis*), five and one-half feet high, and some, strange to say, with spinal vertebræ like a fish, and armed with pointed teeth in both jaws. Enormous tortoises and turtles were the boatmen of the age. One discovered by Cope, in Kansas, was fifteen feet across the end of one flapper to the end of the other. Huge clams also lay scattered over those ancient shores twenty-six inches in diameter. Our saurian did not fall short of the biggest of these monsters; he could not have been less than sixty to seventy feet long, and probably either a mosasaurus or lizard allied to the clasmosaurus.

The ocean in which these creatures lived was gradually enclosed by the upheaval of the sea bottom on the west, and soon became almost an inland sea. As the elevation continued and its area was contracted, ridges would rise, isolating portions of the sea into salt lakes and imprisoning the life in them. The stronger soon destroyed the weaker, till the water by evaporation becoming shallower, all life finally died, became skeletons, and, in course of ages, fossils in sandstone.—*Colorado Springs Gazette.*

IMPORTANT TO INVENTORS.

We notice that a Patentee Exchange has been opened by Mr. Henry Shackell, at 162 St. James street, in this city, intended to afford facilities, at a reasonable charge, for the favorable display and exhibition of Canadian Patents. We have seen the premises, which are commodious and admirably adapted for the purpose, particularly as it is so centrally situated. We should think inventors will be glad to avail themselves of the use of this Exchange, and parties wishing to purchase the right to inventions will find on the shelves the Patent Records of both Canada and the United States for the purpose of reference.

In Mr. Shackell the public will find a gentleman well suited to carry out the wishes of Inventors.

HOW AMERICA CROWDS ENGLAND.

There may be a good deal of truth in these remarks, but loyalty to the British crown has been no doubt greater in the hearts of English manufacturers than that of making money by manufacturing arms for either of these combatants.—Ed. C. M. M.

In giving his impressions of America in a leading English periodical, a recent English visitor remarks that the Russo-Turkish war ought to have shown the American manufacturers that they have little reason to fear the English. So far as he had been able to learn, not a single cartridge had been made in Birmingham for either Russia or Turkey; but when he was in Bridgeport, the cartridge factories had been running day and night for months, and he saw a Russian and a Turkish commissioner in the same works. The fact was the Americans had made the rifles as well as the cartridges for both combatants. As further evidence of the threatened supremacy of American manufacturers, he noted the fact that Lowell was sending cotton cloths to Manchester, and that in our retail stores cotton goods were marked at a lower price than at which goods of the same quality could be sold at Liverpool or London. "It is the same," he said, "with the other manufacturing industries of America. The manufacturers of hardware are beating us in market after market from Hamburg to Melbourne. In Birmingham itself the merchants are importing from the United States such articles as axes, hay forks, and agricultural implements of nearly every description, sash pulleys, and small castings of very many kinds, although it is estimated that freight and other expenses add 17 or 18 per cent to the cost of the goods." — *Scientific American.*

Castor Oil as a Hair Dressing.—I use a preparation which contains castor oil for my hair, and I like it very much. It is said to be exactly the same preparation as "Rowland's Macassar Oil." I have often compared them together, and cannot detect any difference. The recipe is as follows:—Heat 4 oz. castor oil, add a little alkanet root (to colour it red) and 3 or 4 drops of attar of roses, then thin it down with 5 oz. of oil of roses.

EVOLUTION AND MATERIALISM.

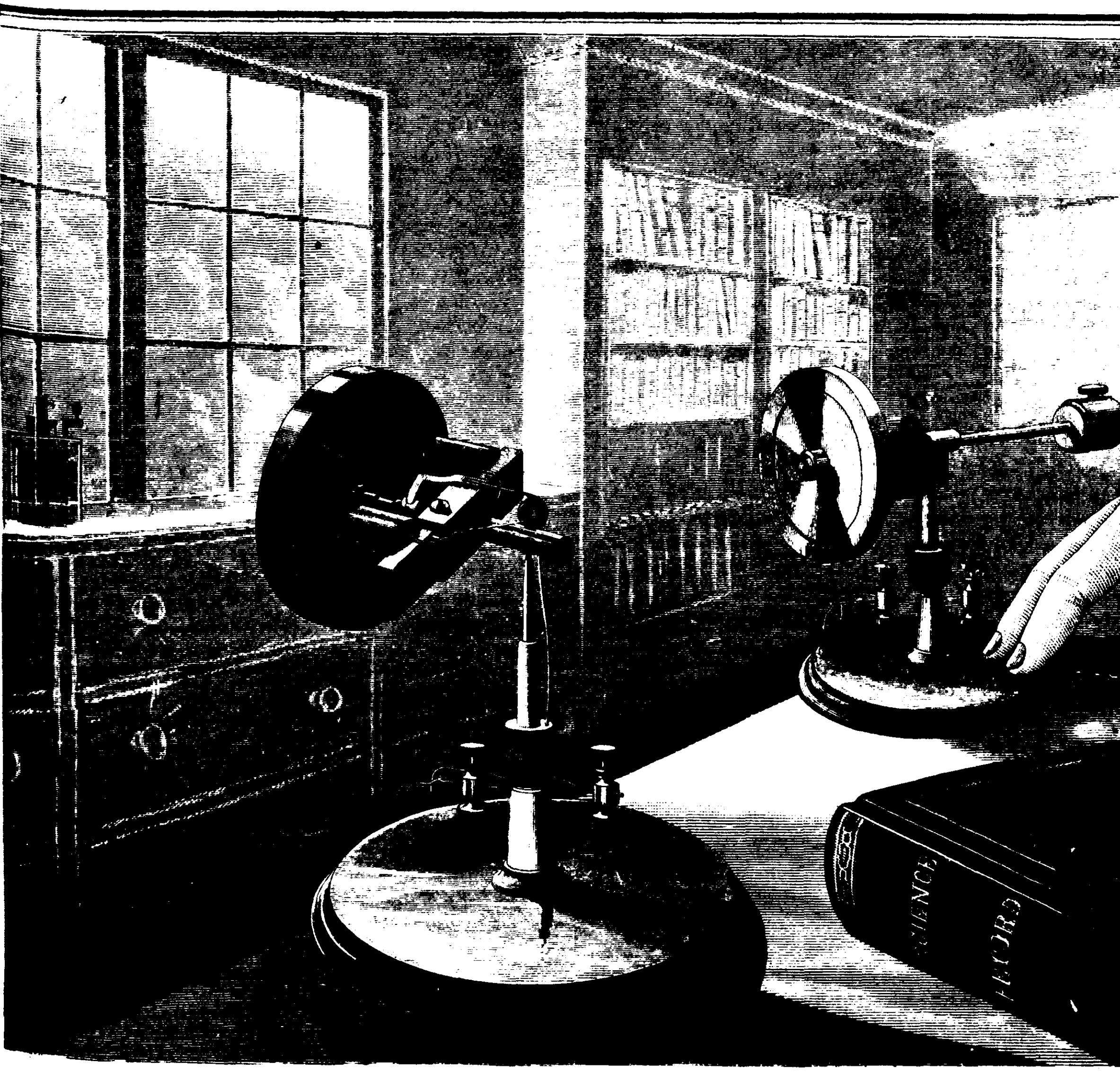
We of to-day hear so much about evolution and materialism that it is well for us to fully understand their meanings. To many they are one and the same thing. But Prof. Le Conte, of the University of California, in the current number of the *Popular Science Monthly*, very clearly shows the distinction between the two. He says: "First of all I wish frankly to acknowledge that I am myself an evolutionist. I may not agree with most that evolution advances always *cum æquo pede*. On the contrary, I believe that there have been periods of slow and periods of rapid, almost paroxysmal evolution. I may not agree with most that we already have in *Darwinism* the final form and *survival of the fittest*, the prime factor of evolution. On the contrary, I believe that the most important factors of evolution are still unknown—that there are more and greater factors in evolution than are dreamed of in the Darwinian philosophy. Nevertheless, evolution is a grand fact, involving alike every department of nature; and more especially evolution of the organic kingdom, and the origin of species by derivation, must be regarded as an established truth of science." This paragraph on evolution was quoted in our notice of Prof. Le Conte. We wish now to publish it in connection with his definition of materialism, that the contrast may clearly appear: He says: "But, remember, evolution is *one* thing, and materialism *another* and quite a different thing. The one is a sure *result of science*; the other a doubtful *inference of philosophy*. Let no one who is led step by step through the paths of evolution, from the mineral to the organic, from the organic to the animate, and from the animate to the rational, until he lands logically, as he supposes, into blank and universal materialism—let no such one, I say, imagine for a moment that he has been walking all the way in the domain of science. He has stepped across the boundary of science into the domain of philosophy. Yet the step seems so easy, so natural, so inevitable, that most do not distinguish between the teachings of science and the inference of philosophy, and thus the whole is unjustly accredited to science."

USE AND MISUSE OF CARBOLIC ACID.

In San Buenaventura there was recently a case of the misuse of carbolic acid by the injection of it into a wound. This fact has led a correspondent of the *Signal* to lay down the authorities on the use and misuse of this substance, and to call attention to a fact, which every *good* physician knows, that carbolic acid is a dangerous medicine, and must be used with the greatest care and by skilful hands. Dr. H. C. Wood, Professor of Materia Medica and Therapeutics in the Pennsylvania University, says: "The free *external* use of carbolic acid is by no means devoid of danger. Indeed, in more than one case, it has caused death. Two young men suffering from scabie [itch] applied externally each about one-half an ounce of carbolic acid in a watery solution, one of whom was soon found dead." Dr. Wood recommends as an external antiseptic 100 parts of water to 1 part of carbolic acid. The county physician, judging from the effects and from the statement given, must have used carbolic acid 50 parts, and water or olive oil 50 parts. Dr. John I. Reese, in his Manual of Toxicology, page 342, says a man was nearly killed by having an ointment applied to his body consisting of one part of carbolic acid and four of lard. Dr. D. Gross, the best authority on surgery in the United States, says: "In the performance of operations in opening abscesses, and during the removal of dressings, carbolic acid may be used as a *spray*, one part of the acid to 100 of water, the necessary manipulations being conducted in carbolic acid atmosphere, which does away with injections as formerly practiced." From the above authorities it will be seen when used externally, carbonic acid, in comparatively mild solutions, is dangerous to human life. When injected, as it was in a strong solution, so that it was taken up in the circulation, as in the case of Mr. Maddox, we can only wonder that the man was not instantly killed. The effect of carbonic acid is to arrest circulation, and to destroy the life principle in the blood. Indeed, there is no greater and more effective agent to animalculæ. One drop of carbolic acid to 599 of water makes a solution strong enough to instantly kill plant lice.

Steam boiler owners, meeting in St. Louis, have not arrived at a conclusion in regard to the hydraulic and the hammer test.

The Board of Health of New York City is having made a careful investigation of the sanitary condition of the public school buildings.



AN ELECTRICAL GYROSCOPE.

AN ELECTRICAL GYROSCOPE.

BY GEO. M. HOPKINS.

The gyroscope, though now a common toy and familiar to every one, is still a puzzle to scientists. It has been properly called the "mechanical paradox," for, while it depends on gravitation for its peculiar action, it appears indifferent to it.

To render the operation of the gyroscope as nearly continuous as possible, so that its movements may be more thoroughly studied, and to combine another influence with those that unite in the gyroscope of the common form to produce the almost miraculous phenomena exhibited by the instrument, I have applied electricity as a motive agent.

The gyroscope illustrated by the engraving has a weighted base piece, from which projects a pointed standard that supports the moving parts of the instrument. The frame, of which the electro-magnets form a part, has an arm in which is fastened an insulated cup, that rests upon the point of the standard. One terminal of the magnet coil is connected with this cup, and the other terminal is connected with the bar that connects the cores of the two magnets.

Upon the top of the magnet bar a current-breaking spring is supported by a hard rubber insulator, and is arranged to touch a small cylinder on the wheel spindle twice during each revolution of the wheel.

The wheel, whose plane of rotation is at right angles with the magnet cores, carries a soft iron armature, which turns very near the face of the magnet, but does not touch it. The armature is arranged in such relation to the contact surface of the current-breaking cylinder that twice during each revolution, as the armature nears the magnet cores, it is attracted, but immediately the armature comes directly opposite the face of the magnet cores, the current is broken, and the acquired momentum is sufficient to carry the wheel forward until the armature is again within the influence of the magnet.

The current-breaking spring is connected with a fine copper wire, that extends backward as far as the pointed standard, and is coiled several times to render it very flexible, and is finally bent downward so as to dip in mercury contained in an annular vulcanite cup placed on the pointed standard near the base piece.

The base piece is provided with two binding posts for receiving the battery wires. One of the binding posts is connected with the pointed standard, and the other communicates by a small wire with the mercury in the vulcanite cup.

The magnets and wheel, and all of the connected parts, are free to move in any direction on the point of the standard. When two large or four small Bunsen cells are connected with the gyroscope, the wheel revolves with enormous velocity, and upon letting go of the magnets (an operation that requires some dexterity), the wheel sustains not only itself, but also the magnets and other parts between it and the point of the standard, in opposition to gravity. The wheel, besides rotating rapidly on its axis, sets up a slow rotation about the pointed standard in the direction in which the *under side* of the wheel is moving.

By attaching the arm and counter balance shown in the engraving, so as to exactly balance the wheel and magnets on the pointed standard, the whole remains stationary. By *overbalancing* the wheel and magnets, the rotation of the apparatus around the standard is in an opposite direction, or in the direction in which the *top* of the wheel is turning.

This gyroscope illustrates the persistency of a rotating body in maintaining its plane of rotation against the force of gravitation. It also exhibits the result of the combined action of two forces tending to produce rotations about two separate axes lying in the same plane.

The rotation of the wheel upon its axis, produced in this instance by the electro-magnet, and the tendency of the wheel to fall, or rotate in a vertical plane parallel with its axis, result in the rotation of the entire instrument upon a new axis, which is coincident with the pointed standard.

THE SHAPING OF AN IRON SHIP.

In preparing to build an iron vessel it must be first decided what she is to do, where she is to go, and how she is to be moved. The character of the coast a ship is to visit determines her shape and capacity. If she is always to keep in deep waters and to follow the great commercial highways of the world, she must be built to sail in every sea; must be ready to encounter the dangers of every climate, hot monsoons of Indian seas or the freezing storms of the North Atlantic. If she is to visit our Southern ports and rivers, she must be flat-bottomed and of light draught, that she may creep over the shallow bars in safety. If she is to ascend swift and narrow rivers, she must be provided with ample means of ventilation and shaded decks. If her way leads to Northern ports, she must be ready to ride the tremendous seas and the furious gales of the North Atlantic. If her cargo is to be coal, she will assume one shape; if cotton, quite another. If she is to have paddles, she takes one form; if a screw, quite another.

Having decided all this; having settled upon her length, depth, width, and capacity, and fixed the cost, the next step is to make the model. A cabinet-maker carefully prepares a number of pieces of choice wood of exactly equal thickness, say from four to six inches wide and from a yard to one and a half yards long. At the same time he selects an equal number of pieces of veneer of the same size, choosing a veneer of a dark color or a color contrasting with the other wood. These boards are carefully laid one over the other, with the veneer between each, and the whole is then glued together to make a solid block. Out of this block the designer shapes the model of one half of the hull of the ship. He gives this block the exact shape the future ship is to assume when seen from the side. Only a half model is made, as the two sides of the ship will be simply duplicates of the model.

Every thing depends upon the skill of the designer. The ship's speed, capacity, draught and safety depend upon the shape he gives this wooden model. Men are not taught to make models; the good designer is born, not made. The imagination that can see the future ship in the block on wood, the sure eye that can draw the exquisite lines of bow and stern, the delicate hand that can realize these lines of beauty, come not by observation. They are gifts.

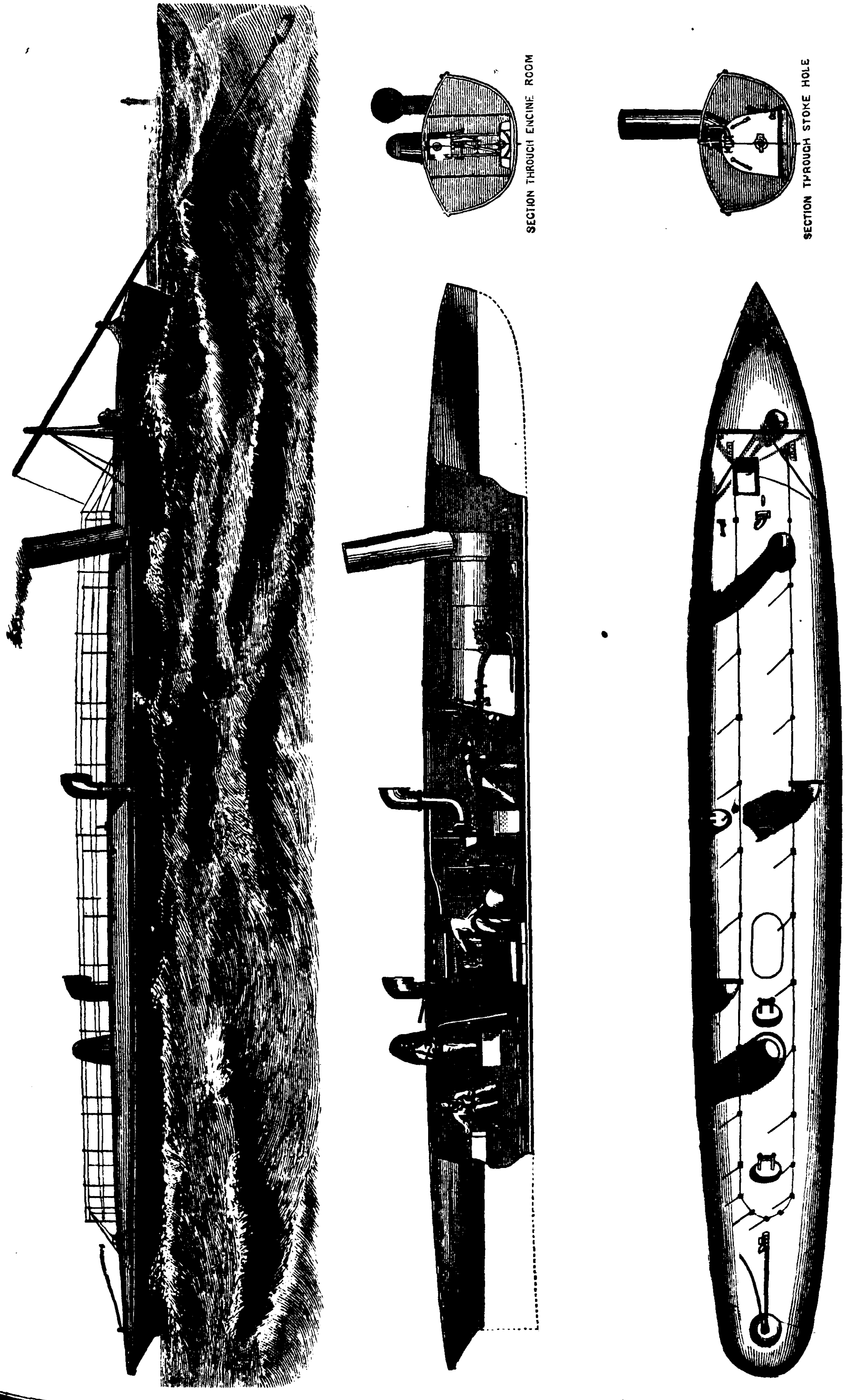
The architect making plans of houses and temples has comparatively an easy task. The drawing gives a clear idea of the appearance of the future building, and his work is perfectly plain and simple. The marine architect must combine science with beauty of form, or rather, science must be expressed in a beautiful form. The model must be an exact copy of the ship in little. He must be able to point out how deep the ship will sink in the water, how the bows will part the water in front, how the displaced water may sweep past the sides and under the stern. The model must show how deep the screw will be submerged, how far the ship may heel over under the influence of her sails or the waves in safety, and how she will be upborne from moment to moment on the ever-shifting waves. His art is the careful adjustment of forces, one against the other, the weight against the flotation or buoyancy, the resistance of the water against the power of her screw and engines, the force of the waves and wind against her own stability. The finished model is full of grace and beauty; but it comes not from the mere blending of sweeping curves and swelling lines, but from the balance of these forces. It is beautiful, because the repose of forces in equilibrium is always beautiful. Certainly, if the architect is called an artist, the model-maker is fully his equal.—*Harper's Magazine.*

RUSSIAN TORPEDO BOATS.

The engraving, which we copy from the London *Graphic*, represents the new model torpedo boat, one hundred of which were recently ordered by the Russian Government. Each boat is 75 feet in length by 10 in breadth, with a draught of 5 feet, and a speed of 22 miles an hour. They are built of steel, and divided into numerous watertight compartments, which serve the double purpose of increasing their strength and preserving their buoyancy in the event of any injury resulting from the enemy's fire. The vessel is armed with three torpedo poles of hollow steel, one at the bow, and one on each side of the boat, and the torpedoes consist of steel or copper cases containing from 40 to 50 pounds of dynamite, which would be exploded by electricity, and which is considered to be sufficient to sink any vessel afloat.

A MODE of equalizing the wear of the cylinders and pistons of horizontal engines, suggested by an English engineer, consists in making the piston-rod with a camber or upward bend, so that, when loaded with the weight of the piston and placed in the cylinder, it assumes a straight line, and transfers the weight to outside guides.

Of the corresponding members of the French Academy, Germany has 19; Great Britain, 16; Russia, 6; Italy, 2; Austria, 1; Denmark and Sweden, 4; Switzerland, 4; Belgium, 2; the United States, 3; Brazil, 1; and there are eleven vacancies to be filled.



RUSSIAN STEEL TORPEDO BOAT

WASTED POWER IN NATURE.

The more important of the unused forces of nature that could be harnessed down to do more work than we now get out of them, are the sun's heat, the winds, the rain, the tides, great river-currents, and waterfalls.

The proposition to convert into mechanical energy for useful purposes a fraction of the enormous floods of heat poured out over the earth, is by no means the visionary notion of impracticable theorists; but is, on the contrary, a problem that has seriously occupied the attention of such eminently practical mechanics as Ericsson, and others less widely known; and though thus far nothing very tangible has resulted, their efforts have, at least, demonstrated beyond reasonable doubt that the problem is susceptible of practical solution.

To convey some adequate notion of the incalculable floods of energy that await the bidding of the compelling genius of invention, we invite attention to the following well-substantiated results of scientific study applied to the subject. The French physicist, Pouillet, with the aid of elaborately refined apparatus, estimated that the earth receives from the sun in each and every minute 2247 billions of units of heat—a quantity sufficient, if converted into mechanical energy, to raise 2,247,000,000,000 × 774) pounds to the height of one foot. To come down to figures less difficult to conceive, let us confine ourselves to that portion of the solar heat that falls upon the oceans, and to that fraction of this portion that is expended in the work of evaporation. Without discussing the methods by which these calculations are made, which would lead us into far greater length than is desirable for the purposes of this sketch, we will simply state the result, that the sun raises during every minute an average of not less than 2 billion tons of water to the height of 3½ miles—the mean altitude of the clouds. To employ a more familiar form of statement, we may say that, to continuously raise this weight of water 3½ miles per minute, would require the continuous exercise of no less than 2,757,000,000,000 horse-power per minute. Here there are quantities whose magnitude is quite beyond conception, and if the believers in the solar engine shall succeed in giving mechanical expression to but the merest fraction of this superabundance, they will have succeeded in effecting quite as great an industrial revolution as that which was ushered in by the steam-engine.

Captain Ericsson has devoted much study to this seemingly impracticable problem, and has announced his unqualified belief that the solar engine is practicable. He has progressed so far as to lay down the general principles on which he proposes to construct such a motor, and which he has actually put into practice in the production of an engine that runs with perfect uniformity at a speed of 240 revolutions per minute, consuming at this rate only part of the steam made by the solar generator employed. From the very brief and imperfect accounts that have appeared, the Ericsson solar engine is composed of three distinct parts—the engine proper, the steam generator, and the concentrating devices, by means of which the feeble intensity of the sun's rays are augmented to the degree that will suffice to produce steam at a practical working pressure. He claims that this concentrating apparatus will abstract on an average during nine hours a day, for all latitudes between the equator and 45° N. or S., fully 3½ heat-units for every square foot presented vertically to the sun's rays. With 100 square feet of surface, therefore, he believes it possible to continuously develop from the sun's rays 8·2 H. P. during nine hours within the above-named range of latitude. Not to overestimate the capability of the new system, Ericsson assumes that a solar engine of 1 H. P. demands the concentration of heat from the above-mentioned surface of 10 feet square, and on this estimate he proceeds to show that, in all reasonable probability, those regions of the earth which suffer from an excess of heat will some day derive such benefits from their unlimited command of motive power as to more than counterbalance their climatic disadvantages. He proposes the solar engine for such regions only where there is steady sunshine, and maps out extensive regions, 9000 miles in length and 1000 miles wide, along the southern coast of the Mediterranean, Upper Egypt, and much of the Red Sea region, the greater part of Persia, Arabia, and portions of China, Thibet, and Mongolia, in the Eastern hemisphere, and Lower California, the Mexican plateau and Guatemala, and the west coast of South America, for a distance of over 2000 miles, as the field of the solar empire of the future. As an evidence of the sincerity of his belief in the realization of these ideas we quote the following enthusiastic passage:

"The time will come when Europe must stop her mills for want of coal. Upper Egypt, then, with her never-ceasing sun power, will invite the European manufacturer to remove his machinery and erect his mills on the firm ground along the sides of the alluvial plain of the Nile, where sufficient power can be obtained to enable him to run more spindles than a hundred Manchesters."

SPOILING MIRRORS.

It is a fact worth knowing, but which does not seem generally understood, that the amalgam of tinfoil with mercury which is spread on glass plates to make looking-glasses, is very readily crystalized by actinic solar rays. A mirror hung up where the sun can shine on it is usually spoiled; it takes a granulated appearance familiar to house-keepers, though they may not be acquainted with its cause. In such a state the article is nearly worthless; the continuity of its surface is destroyed, and it will not reflect outlines with any approach to precision. Care should therefore be exercised in hanging. If any of our readers have mirrors which appear to be spoiling, it would be well to ascertain whether the direct sunlight strikes them. If thus exposed, they can probably be saved from further injury by simply changing their position. The back as well as the front must be protected. A small glass hung in a window, where the rays strike it behind, is peculiarly exposed. The back should always be covered where the beams are likely to touch it.

The greatest danger to looking-glasses, however, is in transporting them. Very expensive ones have been seriously injured by careless handling when merely carried across a street. The men who move furniture are seldom fully aware of these possibilities, and need to be cautioned and watched. Frequently a man or boy may be seen in the street carrying a mirror in such a way that the full glare of noon-day strikes and injures it. Owners of such articles would, as a rule, be able to keep and use them much longer if they would exercise much caution in this regard. To re-silver a pier-glass often cost as much as one-fifth of the original price of the article; while the common glass is seldom worth re-silvering.

It is also well to avoid hanging a mirror near a stove or fire-place, where the heat radiated can reach it. If this precaution is neglected, granulation is likely to occur, even in a comparatively dark room, by the influence of warmth instead of light. A lamp or gas jet, if placed too close while burning, though it may not crack the glass, will often bring about the same injurious crystalization, and will even sometime cause the amalgam to melt and run off.

A RETURNED traveler reports he saw whole caravans "bearing nothing but American petroleum" through the valley of the Euphrates.

NEW DETAILS OF TELEPHONE ARRANGEMENT.

THE SPEAKING TELEPHONE.

Great progress has been made in the introduction and application of the telephone to the practical uses of intercourse and communication since we gave a description of the Bell instrument some months ago. The workings of the instruments have been improved, and great advances have been made in methods of making them useful. Other inventors have brought out telephones which are coming into wide popularity because of their excellent qualities.

We show upon this page engravings of two telephones. One is the invention of Thomas Edison, who has achieved widest fame by his phonograph, which we expect soon to illustrate and describe. One of the main features of the Edison telephone is the employment of a carbon disk for the purpose of varying the strength of a battery current in unison with the rise and fall of the vocal utterance. He found that by vibrating a diaphragm with varying degrees of pressure against a disk of carbon, which is made to form a portion of an electric circuit, the resistance of the disk would vary in precise accordance with the degrees of pressure, and consequently a proportionate variation would be occasioned in the strength of the current. The latter would thus possess all the characteristics of sound waves, and by its reaction through the medium of an electric magnet, might then transfer them to a metallic diaphragm, causing the latter to vibrate, and thus produce audible speech. Our engraving, which is copied from one lately given by *Scribner's Monthly*, shows the arrangement of the parts of the transmitting apparatus of the Edison telephone. The carbon disk is represented by the back portion *E*, near the diaphragm *A A*, placed between the two platinum plates *D* and *G*, which are connected in the battery current as shown by the lines. A small piece of rubber tubing *B*, is attached to the center of the metallic diaphragm, and presses lightly against an ivory piece *C*, which is placed directly over one of the platinum plates. Whenever, therefore, any motion is given to the diaphragm it is immediately followed by a corresponding pressure upon the carbon and by a change of resistance in the latter, as described above. It is obvious that any electro-magnet, properly fitted with an iron diaphragm, will answer for a receiving instrument in connection with this apparatus.

Another telephone which is coming into wide use, is that invented by Mr. G. M. Phelps. The peculiar excellence of Mr. Phelps' instrument is said to consist in its distinct articulation, combined with a loudness of utterance that is not to be found in the many other forms which have been thus far brought forward. The form designed by Mr. Phelps is shown in our engraving. It consists of a polished case of hard rubber or rosewood with magnet coils and diaphragm inside. In connection with this telephone there is used a small electro-magnetic machine, contained in an oblong box, which is used as a call bell when the attention of a distant station is required. The currents which are generated by this machine by turning a crank, are conveyed by the conducting wires through the helices of a polarized magnet, or relay, and cause a hammer attached to an armature lever to vibrate against a bell, thus producing a violent ringing, sufficiently loud to be heard at a considerable distance from the machine. The points of description, which we have taken mainly from *Scribner's* detailed article on the subject, are of particular interest, because of the great numbers of this style of telephone which are being introduced in this city.—*Scientific Press.*

HEINEMANN'S TYPE-COMPOSING MACHINE.

A new form of type-composing and distributing machine has just been placed on exhibition at the Patent Invention Depot, 32 Ludgate Hill, where we recently had an opportunity of inspecting it. The apparatus is the invention of Mr. Heinemann, and it consists mainly of a type frame or case, and a movable type extractor carrying the composing-stick. The case is fixed at an angle, and is divided into a number of vertical spaces for holding the various types. Below the case is a steel slide-bar upon which the extractor works, and is free to be moved either to the right or left by the compositor. The type extractor has two handles, one fixed on the left side, and by which it is moved to and fro, and the other movable on the right, by which the process of extracting the types is performed. The operator adjusts the extractor to the letter required, in doing which he is guided by a graduate scale combined with the representation of the letters in each rack, the spaces on the scale corresponding to the letters. He then depresses the movable handle, which causes a small projecting piece at the back to engage in the space between the teeth of a steel comb, and which fixes the position of the extractor. At the same time a small piston advances forward press a type before it out of the rack into the composing-stick which is held in the receiver. On reversing the handle the type just set pushed down the distance of its own thickness in the stick to make room for the next, the extractor is released, and is passed on to the next type required. When the composing-stick is full, a spring is actuated by which a warning bell is rung. The full stick is then removed and an empty one substituted, the type being afterwards justified. There is also an arrangement for distributing the type, but which was not shown on the occasion of our visit. We were informed that there is one of these machines in use in a London printing office where 4,000 types per hour are set by it.—*Engineering.*

IMPROVED METHOD OF PLASTERING.

A Mr. Hitchings, of Stoke-Newington, England, has introduced a new method of forming ceilings and other plaster work, which he claims that for durability, saving of time, and cleanliness is unrivalled. By means of this system the plaster is prepared beforehand in slabs, which are fixed expeditiously to the joists, forming the ceiling at once as it would be when lathed and plastered with the two coats of lime and hair by the old process. The slabs or sheets are prepared in the following manner:

A layer of plaster of Paris in a moist or plastic state is spread evenly on a flat surface surrounded by raised edges of the form to produce the desired bevel of the edges of the slab or sheet, and upon the first layer of the plaster is laid a sheet of canvas or other woven fabric of proper size, or a thin layer of loose fibers, which is made to imbed itself into and adhere to the plaster. Two laths are then laid along two opposite edges of the canvas, upon which another layer of plaster is spread evenly, and before it sets a rough broom is passed over the surface of the second layer of plaster to form a key for the finishing coat. When the plaster is set, the slabs are nailed to the joists, as before mentioned, and the joints are made good with plaster of Paris. The third or finishing layer of lime and plaster is then applied to the ceiling in the ordinary way. Besides the advantages derived from rapid fixing, with the minimum of dirt and inconvenience, the new ceiling is claimed to be practically uninflammable, and very economical to put up. Moreover, unlike the old plaster ceilings, it can never become detached from the joists—in fact, besides being self-supporting, it braces and gives strength to all partitions and slight timbers, while at the same time the cost is no greater than for ordinary plastering.

A CORRESPONDENT of the London *Times* makes the suggestion that as the fees of analytical chemists are beyond the means of many, it would be well to have a few simple test papers prepared and used for various purposes. Here are some of his ideas: "Certain cards should be prepared and hung in closets, which, by changing color, would immediately betray the presence of sewer gas in the atmosphere. Other papers might be prepared for testing the purity of water, or tea, or other articles of daily consumption. The paper for testing water would immediately, should lead be present, betray its existence; the papers for testing tea would betray the presence of copper, and so forth." The writer thinks these test papers would be very inexpensive, but we have some doubt on that point, especially in the case of those—if it is possible to prepare any—which should reveal the presence of sewer gases.

WILD ANIMALS DURING DROUGHT.

The sufferings endured on account of the drouth were at times almost terriffic. The throats of the oxen were so parched that they could not low. The dogs suffered even more than the cattle. Nor are the wild animals exempt from the plague of the land.

When water becomes scarce in these thirsty plains, the whole of the wild animals that inhabit them congregate around any point that may be left, for with very few exceptions all have to drink once in 23 hours. The lions, which follow the game, are thus led to their drinking places not only to assuage their thirst, but to satisfy their hunger.

To watch one of these pools at night, as I did in the northern Massara country, is a grand sight, and one never to be forgotten. The naturalist and the sportsman can here see sights that will astonish them, and cause them to wonder at the wonderful instincts possessed by the animal kingdom.

At such watering places the small antelopes invariably drink first, the larger later on, and with them the zebras and buffaloes. After these come the giraffes, closely followed by the rhinoceros, and next the elephant, who never attempts to hide his approach—conscious of his strength—but trumpets forth a warning to all whom it may concern that he is about to satisfy his thirst. The only animal that does not give place to the elephant is the rhinoceros; obstinate, headstrong, and piglike, he may not court danger, but assuredly he does not avoid it. The elephant may drink by his side, but must not interfere with him, for he is quick to resent an insult, and I am assured that when one of these battles takes place the rhinoceros is invariably the victor. The elephant is large, of gigantic power, but the other is far more active, while the formidable horn that terminates his nose is a dreadful weapon when used with the force that he has the power to apply to it. I have been told on trustworthy authority that a rhinoceros in one of these blind fits of fury to which they are so subject, attacked a large waggon, inserted his horn between the spokes of the wheel, and instantly overturned it, scattering the contents far and wide, and aft rwards injuring the vehicle to such an extent as to render it useless.

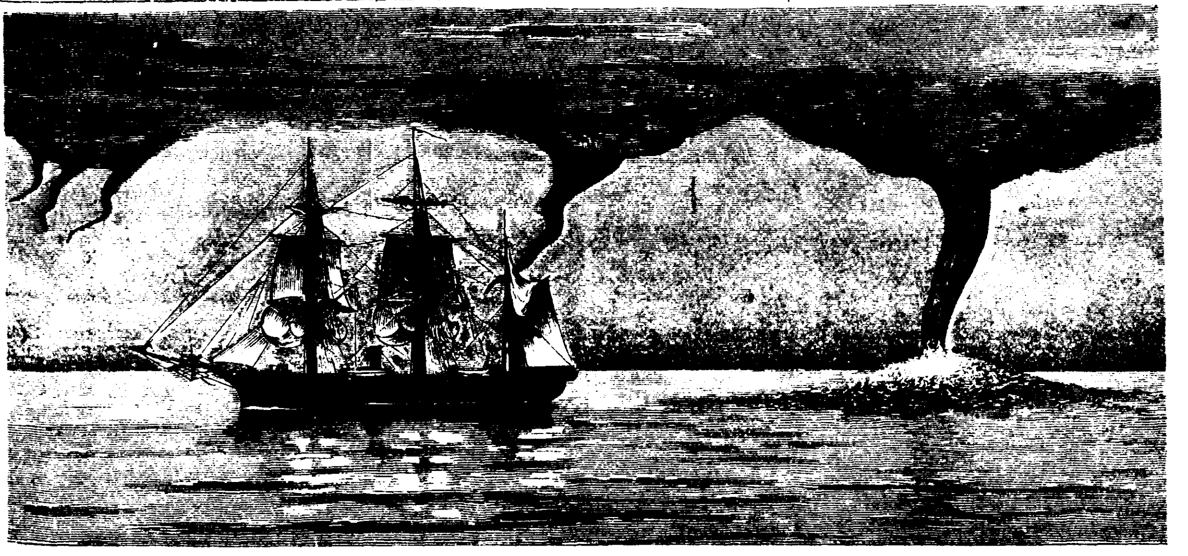
The lion is not tied to time in drinking. After it feeds it comes to water, but it never would dare to interfere with the rhinoceros or the elephant. Where the buffalo exists in numbers it is the principal pray of the lion; in other localities antelope and chiefly the zebra are its food.—*The Great Thirst Land.*

DYSPEPSIA.

A writer in the New York *Independent* gives the following notes en dyspepsia. When there is a failure to dissolve the food which presents itself to the different organs of digestion, either wholly or in part, we have indigestion or dyspepsia. This we have also if the process is protracted beyond the normal period. When the saliva is deficient in quantity or inferior in quality there is one kind of dyspepsia; when there is a failure on the part of the stomach to secrete the normal quantity or quality of gastric juice, there is another kind of dyspepsia; and when the fatty elements of food fail to come in contact with the pancreatic and intestinal fluids necessary to emulsify them, there is still another kind.

Dyspepsia means difficult or imperfect digestion, and it is evident that there are three varieties, depending on the kind of food concerning which the difficulty exists. There may be failure to reduce the starch to sugar, to reduce the albumen to albumenose (liquid albumen), or to emulsify the fat. These difficulties may exist singly or combined. Generally they are combined, every stage of the digestive process being faulty. This is caused in no small measure by imperfect mastication. This act being imperfectly performed, there is an insufficient amount of saliva mingled with the food, and the food is so imperfectly divided that the digestive fluids act upon them slowly on account of the small amount of surface which is exposed to their action, and in this way the whole process becomes retarded and imperfect. If "haste makes waste" in other things, it makes double waste when applied to eating. It not only causes waste of food; it causes waste of vital energy, on account of the increased demand which is made on the organs to perform a difficult task, while at the same time the system is robbed of that nourishment which, with far less expenditure of energy combined with proper mastication, it would obtain.

LIP SALVE.—Oil of sweet almonds, eight ounces; white wax, three ounces; spermaceti, three ounces; rhodium, fifty drops, and white sugar candy forms an excellent lip salve.



THE BRITISH SHIP BOXER SURROUNDED BY WATERSPOUTS.

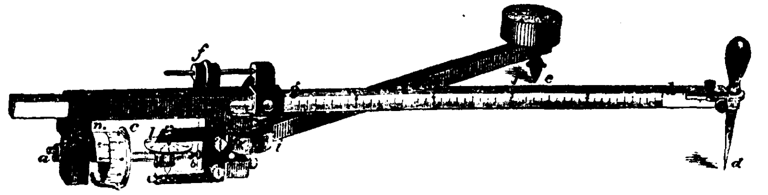
WATERSPOUTS.

The theory of the waterspout is still somewhat unsettled, notwithstanding the numerous observations which have been made. Generally it appears as a diminutive whirlwind, lasting from a few seconds to an hour, and reaching down from the under surface of a cloud to, or nearly to, the surface of the earth or sea. In the center of this whirlwind appears a slender column of water or of dense vapor, probably hollow, and the air whirling around it is sometimes an ascending, but more generally a descending current. The cloud bursts of Eastern Nevada, which have at times caused much damage, are of the latter type. Certain portions of the globe are peculiarly subject to waterspouts, which thus, like cyclones, have somewhat of a local character. Our engraving, for which we are indebted to the London *Graphic*, represents the British ship Boxer surrounded by waterspouts during a recent cruise on the west coast of Africa, when unusual facilities for studying the character of such phenomena were offered.

Forging and Tempering Iron and Steel.—The forging and tempering of iron and steel can be greatly enhanced, according to Edward Blass, or Cleve, Prussia, by dipping the metal, in whatever form, in fused salt. This dipping in salt is also well adapted for annealing steel without the oxidation of the surface. If the metal be rusted, it must be allowed to remain some time in the bath. Borax can with good effect be mixed with the salt. Metal "purified" by such an immersion is very susceptible to galvanic depositions, and can easily be coated with copper, zinc, tin, nickel, silver, etc. For iron in the spongy or powdered state as obtained from the reduction of the ores, the salt bath is especially adapted, for it augments the combination of the particles by making their surfaces free from impurities. To prepare the bath for an application as here proposed, the salt must be fused in a puddling furnace, and the iron sponge, with the addition of a flux, be added in small quantities, so as not to vitrify the salt. The iron is left in the furnace till the flux has combined with all the impurities, and formed a slag, whereupon the iron is taken out and forged together. While the iron is in the furnace, it should be constantly covered with the salt, so that oxidation be prevented. For the hardening of iron, the salt is fused in a convenient vessel and the object immersed, and from time to time a small quantity of ferrocyanide of potassa added, 1 lb. or 2 lbs. per 100 lbs. of iron. The articles, according to their thickness, are permitted to remain from 5 minutes to 30 minutes in this bath, and are then plunged in water containing, in 100 parts, 1 part of hydrochloric acid, 5 of wine vinegar, and 1 of salt. If the objects are to have a silver luster, they should be immersed for a few minutes in a mixture of three parts of wine vinegar and one of hydrochloric acid.—*Scientific News.*

Weight of Castings.—To find the weight of castings from patterns, multiply the weight of the model by the specific gravity of the castings, and the result by the ratio of shrinkage less one. This divided by the product of the specific gravity of the model and the ratio of shrinkage gives approximately the weight of the casting. The ratio of shrinkage for cast iron is 1 to 32. This is the formula given by the *Zeitschrift der Eisen und Stahl Industrie.* It is customary in our practice, however, to simply multiply the weight of the pattern by certain numbers, corresponding in the following table with the material composing the pattern; Pine wood. 14.0; oak, 9.0; beech, 9,7; alder, 12.6; pear tree wood, 19.0; cherry, 10.0. In our practice in this country, one-eighth of an inch to the foot is the usual amount for shrinkage of cast iron; in brass castings, three-sixteenths, These figures, as will be seen, differ from those of our German contemporary.—*Exchange.*

RASCALITY IN HOUSE-BUILDING.—An instance is related in *The Plumber and Sanitary Engineer*, which somewhat surpasses the ordinary experience of our citizens in the frauds in house construction. The occupants of one of a row of brick dwellings in Brooklyn complained of bad odors in the house, which had been recently built, and contained the so-called modern improvements. On examining the plumbing, it was found that the trap was too short to make a joint with the soil-pipe, and the connection had been effected by means of a short carrying-piece which was open on the upper side, and consequently permitted the free escape into the house of the gases from the pipe. But a more extraordinary discovery soon followed. Behind the pipe, and touching it, was the furnace flue of the adjoining house. From the cellar to the second story there was a clear opening in the party wall between the houses, and in this space the tin flue of one and the waste pipe of the other were inserted. The pipe, heated by the flue, of course gave off its noxious gases more abundantly. It would be difficult to devise a construction more apt to cause or communicate fire between buildings.



THE PLANIMETER.

The Planimeter.

AN INSTRUMENT FOR MEASURING AREAS AND THE CUBIC CONTENTS OF SOLIDS.

That some very useful improvements have made exceedingly slow progress in coming into public favor, or that very small causes have prevented their general introduction, is a fact that has probably come within the observation of almost every one. This remark is suggested by a perusal of what Messrs. Buff & Berger, manufacturers of engineering instruments, of Boston, find it still necessary to say on the subject of the polar planimeter. An instrument like this, invented more than twenty-five years ago, ought surely to have come into such general use by this time that nothing more need be said about it. It is, nevertheless, known to but a small portion of the fraternity, and the majority still go on in the good old way of slaving over indicator diagrams, over the calculation of the areas of water-sheds, irregular creeks and similar figures, and, last but not least, still plod on in the time-honored fashion over the computation of earth-work and similar cubic quantities. New books continue to be written on the best ways to do this sort of calculating, when to the engineer accustomed to the use of a *properly made* polar planimeter, the calculation by arithmetical labor of earth-work or of irregular areas has become a thing of the past, just as much as has the calculation of an angle by measuring the three sides of the triangle in which it is contained, since the invention and perfection of instruments to measure angles directly.

The use of the polar planimeter in measuring earth-work was first described in the "Journal of the Franklin Institute," for 1874, in an article by Clemens Herschel, Esq., who showed how stupidly the instruments up to that date had been graduated; explained the defects of the instructions that had usually accompanied them, and showed how, with the graduation then proposed, the utility of the instrument was very much increased, and how it then became capable of measuring earth-work, and other cubic quantities, with great facility and accuracy. It is due to this gentleman that Messrs. Buff & Berger have taken up the matter, and by a proper graduation of the planimeter sold by them (see illustration), and by accompanying each instrument with a plainly composed printed sheet of directions for use, have enabled any one to avail himself of its advantages.

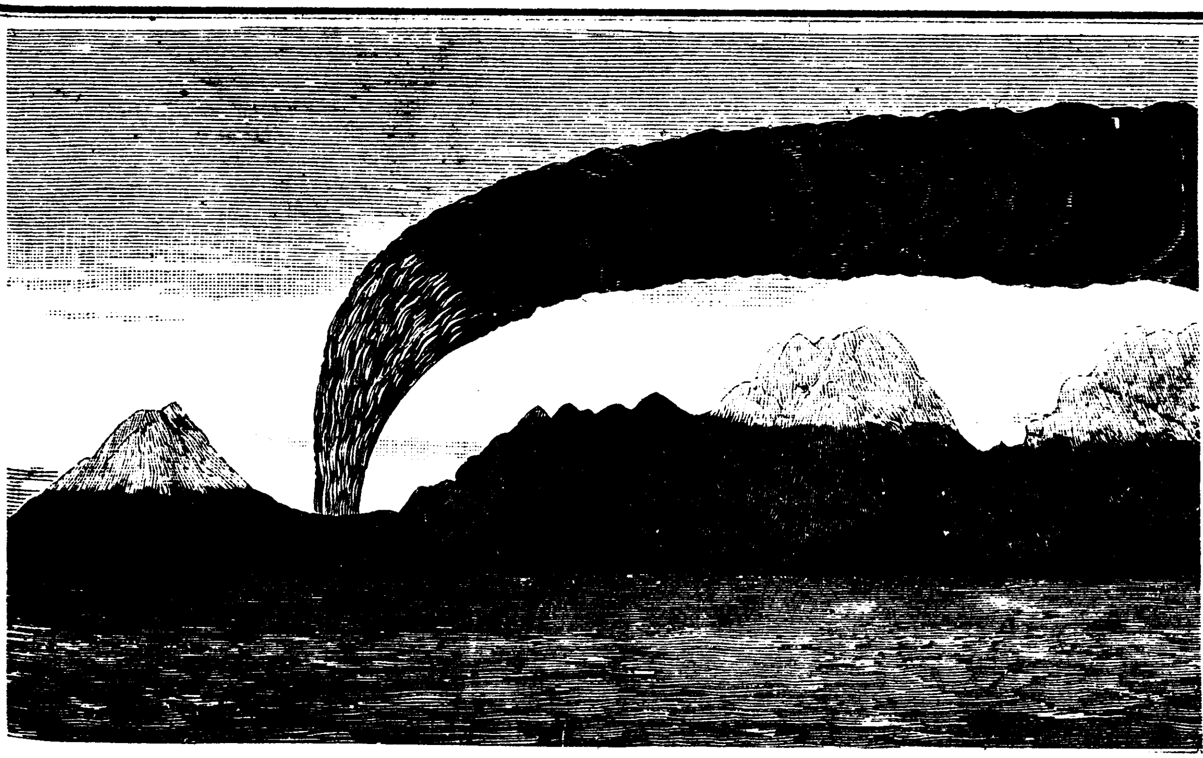
To calculate earth-work with the instrument as it is now made *does not require the plotting of any cross-section whatsoever;* nor any kind of calculation. The data are read from the note-book by one operator, and the other manipulates the planimeter: the instrument performs its own multiplications and its own additions as it goes along, and the resultant answer is given in cubic yards measured, or at least in simple multiples of such final answer. The reduction of this to the true answer, by dividing by a number like 2 or 3, is so simple a matter that it would not need mentioning but for accuracy of speech.

The main points of interest to an engineer not conversant with the instrument and its operation will be its accuracy of work, and the time saved by its use. Concerning the first, Mr. Herschel states that the accuracy of the instrument is such that a single measurement is not liable —barring carelessness or unskillfulness or gross accidental imperfections in operating—to an error greater than 0·02 of a square inch; and this error seems to be about the same, no matter what the size of the figure measured. But by "repeating" as the measurement of angles is "repeated," that is, measuring continually the same area many times, and then dividing the summation of all these measurements by the number of times the area was measured or circumscribed, the final answer may be arrived at with any desired degree of accuracy. It is only a question of *how many times* it pleases the engineer to cause the pointer to circumscribe the area to be measured.

The time saved by the use of the polar planimeter is well illustrated by the following example from Mr. Herschel's practice: A rectangular 40-acre lot of flats had scow-loads of mud dumped upon it irregularly. It was then surveyed, and soundings taken all over it: more mud was then dumped upon it irregularly from scows; and then required the number of cubic yards left upon it by the last lot of scows. Both the old and the new set of soundings were written in figures upon a plan of the lot, all of them reduced of course to one grade; then from this plan of the soundings, the required quantity was calculated by the planimeter *twice* in one afternoon. The total quantity was over 40,000 cubic yards. The calculation was made by two different persons—one first taking the instrument, and the other the soundings, and then reversing; and the true answers agreed within a small fraction of one per cent. *The Scientific American.*

TO RESTORE OLD, FADED AND ILLEGIBLE WRITING.—The restoration of writing that has become faded and illegible can be accomplished quite satisfactorily, where the ink employed has been an iron ink, by one or the other of the following methods, which are suggested by V. Bibra: Moisten the paper or parchment with a solution of sulphide of ammonium, applied best by means of a brush. Remove the surplus sulphide by rinsing in water and dry the document by pressure between sheets of absorbent paper. Writing restored in this manner, however, is disposed to fade again after the lapse of several weeks. A better plan, recommended by the same writer, is to apply, in the same manner as above, a concentrated tannin solution, which is then to be removed by washing in water, and the document dried as before. Writings thus restored show no disposition to lose their intensity for a number of months. The above recipes are, of course, only applicable to iron inks.—*Journal für Prakt. Chem.*

A Mastic for Fastening India-Rubber to Metals is obtained, according to the *Druggists' Advertiser*, by steeping gum lac, in the form of pulverized scales, in ten times its weight of concentrated ammonia. A transparent mass is thus obtained which at the end of three or four weeks becomes fluid without the use of warm water. This substance applied on India rubber, becomes hard and completely impervious to liquids or gases.



RECENT ERUPTION OF MOUNT HECLA.

Our engraving is from a sketch taken by Capt. Ambrosen, of the Danish mail steamship Valdemar, for the London *Graphic*, and exhibits a singular phase of the recent eruption. On the morning of March 24, about five o'clock, while steaming along the coast from Reykjavik, on the way to the Faroë Isles, those on board the Valdemar witnessed a great volcanic eruption. It appeared to be in a valley about five miles from Hecla, at a point about 1,500 feet above the level of the sea, or 3,500 feet below the summit of Hecla. The flames mounted to an immense distance into the air, apparently about twice the height of the mountain itself. The wind was blowing freshly from the north, and driving the flames and ashes in a southerly direction. The illustration shows the appearance it presented from the sea. About fourteen days previously sharp shocks of earthquake had been felt all over the island, and eruptions had continued more or less since that time. According to the London *Echo*, there are twenty-five more or less active volcanoes, some being mere *solfataras*, in Iceland, the most turbulent of which is Hecla. After the great eruption of 1845, the most terrible on record in Iceland, the augitic ashes cast up so covered the grass and other fodder that nearly all the cattle on the island died.

One of the most interesting uses to which the telephone has been successfully adapted is as a means of communication with divers at work beneath the water. Heretofore, a simple pull on a line has been the sole means which the workman engaged in this hazardous profession has been provided with to signal to those above, who hold his life in their hands, his desire to ascend to the surface.... M. Brequet, in a communication to the French Academy, says, with the aid of the string telephone, that all points of the telephone, handle, binding-screws, shell, etc., as well as the plate, may be used to communicate sounds, so that by attaching a string to any part of the Bell Telephone, and employing a parchment membrane, we may readily converse with a person using the Bell, and by attaching several string telephones, several persons may simultaneously hear the messages. The *Scientific American*, commenting on the above, states, that "to render string telephones more practically useful, M. Brequet fixes to the center of the membrane two or several strings meeting there at an angle. The sound carried by one of them is propagated by all the others. A thread is also passed through the centers of the membranes, which then serve as supports for long, straight lines. A sort of relay is also formed by means of a brass cylinder with two membranes, to which strings are connected. This method of extending the string telephone has been in use in this country for the last three years." W.

The New Volcano in Peru.—A Peruvian newspaper, the *Bolsa*, says that extraordinary phenomena have been observed in connection with the "Corpuna" volcano in the Province of Castilla, which have caused great alarm among the population. The immense banks of snow which have crowned its summit from time immemorial have suddenly melted away with such rapidity as to cause torrents to rush down the sides of the mountain, washing out immense quantities of stones and earth. The river below, being unable to contain the great body of water so suddenly added to it, overflowed its banks, causing great damage and distress. A great chasm or lateral crater next opened on one side, throwing out volumes of smoke and steam as well as tongues of flame, which were distinctly visible at night, accompanied with loud subterranean rumblings. It had never been supposed that the Corpuna was or could be a volcano, and there is no tradition that it was ever in a state of eruption. Nor within the memory of man has its crown of snow ever been absent.

Solidification of Carbon Bisulphide. — M. Mercier finds that if bisulphide of carbon be added to a mixture of a drying oil and protochloride of sulphur at the moment of mixing, it is entangled in the jelly formed by the oil and protochloride. With boiled linseed oil and 10 per cent. of the protochloride a transparent elastic mixture can be obtained containing 70 per cent. of bisulphide of carbon. The substance ignites only with difficulty, and loses the contained bisulphide but slowly.

Fig. 1.—HEATHERTON TOWERS, NEAR GRAHAMSTOWN.

Fig. 2.—BIRDS MUSTERING.

OSTRICH FARMING IN SOUTH AFRICA.

We present a series of illustrations, taken from the *Illustrated London News*, of this new and profitable industry in South Africa. They are from photographs taken on the estate of Mr. A. Douglass, near Grahamstown, who was the originator of ostrich farming, and is the largest ostrich proprietor. Ten years ago Mr. Douglass obtained three wild birds, and afterwards eight more. As soon as he found they would lay in confinement, he began his experiments in artificial hatching. This attempt met with but little success for three years, till he invented the patent incubator, the success of which has become renowned. By its means he has increased the eleven birds to 900, and these and others, becoming dispersed throughout the colony, have made ostrich farming, next to wool and diamonds, the most important industry of South Africa.

Mr. Anthony Trollope's recently published book on "South Africa" contains the following description: "Mr. Douglass is, among the ostrich farmers of the colony, about the most successful, and the first who did the work on a large scale. He is the patentee for an egg-hatching machine or incubator, which is now in use among many of the feather growers of the district. Mr. Douglass occupies about 1,200 acres of rough ground, formerly devoted to sheep farming. The country around was all used not long since as sheep walks, but seems to have so much deteriorated by changes in the grasses as to be no longer profitable for that purpose. But it will feed ostriches.

"At this establishment I found about 300 of those birds, which, taking them all round, young and old, were worth about £30 apiece. Each bird fit for plucking gives two crops of feathers a year, and produces on the average feath-

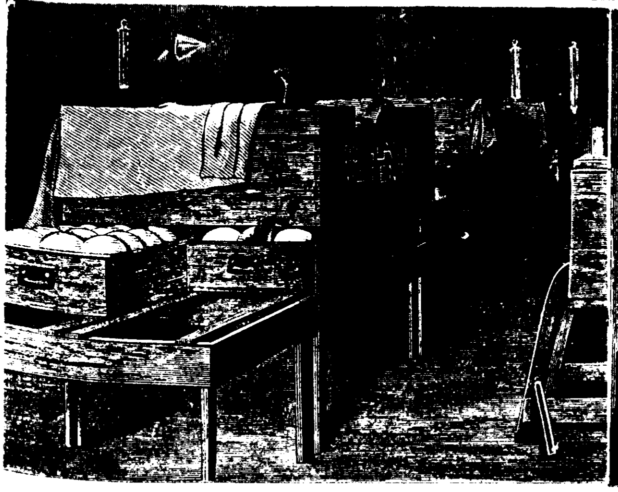


Fig. 3.—THE INCUBATING ROOM.

Fig. 4.—HELPING OUT A WEAK ONE.

Fig. 5.—THE FEATHER ROOM.

Fig. 6.—COOLY WITH YOUNG BIRDS.

Fig. 7.—A BIRD SITTING.

Fig. 8.—FINDING A NEST.

ers to the value of £15 per annum. The creatures feed themselves, unless when sick or young, and live upon the various bushes and grasses of the land. The farm is divided out into paddocks, and, with those which are breeding, one cock with two hens occupies each paddock. The young birds—for they do not breed till they are three years old—or those which are not paired, run in flocks of thirty or forty each.

"Ostrich farming without the use of an incubator can never produce great results. The birds injure their feathers by sitting, and at every hatching lose two months. There is, too, great uncertainty as to the number of young birds which will be produced, and much danger as to the fate of the young bird when hatched.

"The incubator is a low, ugly piece of deal furniture, standing on four legs, perhaps eight or nine feet long. At each end there are two drawers, in which the eggs are laid with a certain apparatus of flannel; and these drawers, by means of screws beneath them, are raised and lowered to the extent of two or three inches. The drawer is lowered when it is pulled out, and is capable of receiving a certain number of eggs; I saw, I think, fifteen in one. Over the drawers and along the top of the whole machine there is a tank filled with hot water, and the drawer, when closed, is screwed up so as to bring the side of the egg in contact with the bottom of the tank. Hence comes the necessary warmth. Below the machine and in the center of it a lamp or lamps are placed, which maintain the heat that is required. The eggs lie in the drawer for six weeks, and then the bird is brought out.

"All this is simple enough, and yet the work of hatching is most complicated, and requires not only care, but a capacity of tracing results which is not given to all men. The ostrich turns her egg frequently, so that each side of it may receive due attention. The ostrich farmer must therefore turn his eggs. This he does about three times a day. A certain amount of moisture is required, as in nature moisture exudes from the sitting bird. The heat must be moderated according to circumstances, or the yolk becomes glue and the young bird is choked. Nature has to be followed most minutely, and must be observed and understood before it can be followed. And when the time for birth comes on, the ostrich farmer must turn midwife and delicately assist the young one to open its shell, having certain instruments for the purpose. And when he has performed his obstetrical operations he must become a nursing mother to the young progeny, who can by no means walk about and get his living in his earliest days. The little chickens in our farmyards seem to take the world very easily; but they have their mother's wings, and we as yet hardly know all the assistance which is thus given to them. But the ostrich farmer must know enough to keep his young ones alive, or he will soon be ruined; for each bird when hatched is supposed to be worth £10. The ostrich farmer must take upon himself all the functions of the ostrich mother, and must know all that instinct has taught her, or he will hardly be successful.

"The birds are plucked before they are a year old, and I think that no one as yet knows the limit of age to which they will live and be plucked. I saw birds which had been plucked for sixteen years, and were still in high feather. When the plucking time has come, the necessary number of birds are enticed by a liberal display of mealies—as maize or Indian corn is called in South Africa—into a pen, one side of which is movable. The birds will go willingly after mealies, and will run about their paddocks after any one they see, in the expectation of these delicacies. When the pen is full, the movable side is run in, so that the birds are compressed together beyond the power of violent struggling. They cannot spread their wings, or make the dart forward which is customary to them when about to kick. Then men go in among them, and, taking up their wings, pluck or cut their feathers. Both processes are common, but the former, I think, is most so, as being the more profitable. There is a heavier weight to sell when the feather is plucked; and the quill begins to grow again at once, whereas the process is delayed when nature is called upon to eject the stump. I did not see the thing done, but I was assured that the little notice taken by the animal of the operation may be accepted as proof that the pain, if any, is slight.

"The feathers are then sorted into various lots; the white primary outside rim from under the bird's wing being by far the most valuable—being sold at a price as high as £25 a pound. The sorting does not seem to be a difficult operation, and is done by colored men. The produce is then packed in boxes, and sent down to be sold at Port Elizabeth by auction."

Fig. 1 is a view of Hatherton Towers, the residence of Mr. A. Douglass, in the Fish River Valley, eighteen miles from Grahamstown

Fig. 2 is the scene of mustering the birds, which run in flocks in large inclosures. The one where our view is taken is 3,000 acres, with a troop of 240 birds in it. Here, once a week, they are all hunted up by men on horseback, armed with large boughs of thorn, to keep the birds off, as many are very savage, and their kick is dangerous. One man will be observed in front, with a pack horse, loaded with Indian corn, to lead them.

The incubating room is shown in Fig. 3. It is a large building so constructed as not to be affected by change of weather. Here several incubators are at work; in one an egg can be seen just broken through. On the top of the machines are the birds' sleeping places, all heated. The drawers are represented as when lowered and drawn out, to show them; when again pushed in, they are lifted and fastened by large screws beneath them.

In Fig. 4, Mr. Douglass is represented in the act of helping a weakly bird out of its shell. By certain signs discovered by himself it can be told to an hour when the bird is ready; but it often happens that the bird cannot pierce the shell, and unless helped would die.

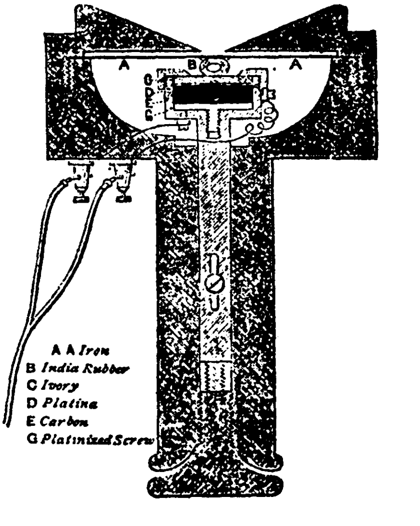
Fig. 5 is the interior of the feather room. We are informed that the birds are plucked twice a year; that is, the tail and the primary wing feathers, which are the only white feathers, are plucked, and the secondary wing feathers, which are the long black feathers. These are all taken from the bird. In this room the feathers are sorted into various qualities, tied up in bunches, and packed in cases ready for shipment to London.

Fig. 6 shows a coolie with his lot of young birds. It should be explained that to each lot of about thirty birds a man is told off, who from sunrise to sunset goes about in the lucerne fields with them, cutting up the lucerne for them, or breaking bones for them, and finding them gravel and water. They become immensely attached to the nurse.

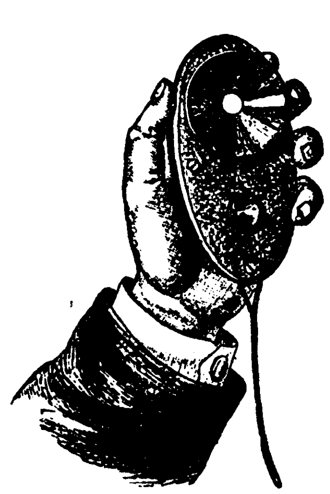
Fig. 7 shows a bird sitting upon her nest. The hen sits by the day, the cock by night, except in wet weather, when the cock will remain on day and night, being evidently afraid to trust his wife.

Fig. 8 represents "a find." It is often a serious matter to find the nests; the bird is in anger at being disturbed, and if a male bird, would soon send horse and rider flying to escape his furious kicks.

Hydrophobia.—The *English Mechanic and World of Science* for March 22d contains a brief note on the successful treatment of hydrophobia by the inhalation of oxygen gas. A young Russian girl was bitten by a mad dog. Nitrate of silver was immediately applied as a caustic, and at the end of eight days the cicatrization was complete, but, nevertheless, seventeen days afterward, symptoms of hydrophobia appeared. Three cubic feet of oxygen were then inhaled by the patient, and in a few hours the symptoms disappeared. Two days afterward, however, they reappeared, but succumbed to a fresh inhalation of oxygen for three quarters of an hour. A slight difficulty of breathing was removed by the use of mono-bromide of camphor, continued for three weeks. The patient entirely recovered.—*Prof. Houston in American Manufacturer.*



EDISON'S TELEPHONE.



PHELP'S TELEPHONE.

NOTES ON THE TELEPHONE.

BY L. L. DUERDEN.

When an iron armature approaches the poles of a permanent magnet on which insulated wire is wound, a current of electricity is thereby induced, and flows in one direction through the insulated wire; and when the armature is moved from the poles of the magnet a similar current flows through the wire, but in a reverse direction; and conversely, if the currents thus produced be passed through insulated wire wound on another permanent magnet, the armature of the second magnet will move in the same time as the first, but not necessarily in the same relative direction, as that will depend on the relative polarity of the magnets.

In the Bell telephone, the iron diaphragm which serves as an armature is caused to move directly to and from its permanent magnet, by minute concussions of air, from the speaker's throat. As these concussions are necessarily limited in their ability to move the diaphragm, it follows that if the slight movement thus produced could be used to properly control a power (in the same manner as the slight movement of the slide valve of a steam engine controls the admission of steam to its cylinder), instead of directly producing it, a much more powerful telephonic result could be obtained.

With this object in view, after several experiments, I constructed a transmitter on the principle shown in the engraving, in which A represents a metal speaking tube, having a membrane B of gold beater's skin, in the centre of which the sewing needle, C (metallically connected to the fine wire D, which is soldered, at D', to the speaking tube A), is secured by sealing wax. The end C', of the needle is hooked, so as to clip the short pieces of very fine platinum wire E. One pole of the galvanic cell S is connected with the metallic post A', to which the speaking tube A is soldered, whereby the end C' of the needle becomes the negative terminal of the battery S; and the positive pole P has two wires, F and K, connected with it; the wire F, leading through the telephone M, to one end of the platinum wire E, and the wire K leading through the telephone N to the other end of the wire E.

By this arrangement there are two courses open to the galvanic current from the end C' of the needle to the positive pole of the battery S; and when the resistance of each course is the same, the current divides itself equally between the two; but as the platinum wire E has great resistance to the current, the least movement, in either direction of its arrow, of the end C' of the needle, will make the course towards which it moves the one of the least resistance, and the same movement increases the resistance of the other course; so that the relative difference in the resistance of the courses appears to be in proportion to the square of the resistance that is thus produced by the movement of the hooked end C' of the needle.

Now the voice of the person who is speaking at the mouth of the tube A, causes the membrane B to move to and fro in either direction of its arrow, and the length and speed of these movements differ as different words are uttered; and as the needle C is rigidly secured to the membrane B by sealing wax, its end C' copies the length and speed of the movements of the membrane, and by like movements in either direction of its arrow directs a current to the wires, F or K, which corresponds in power to the varying length of these movements. The wire E should be stretched, and the hooked end C' must have an upward tendency, so as to keep it in uniform contact with the wire E.

The instrument as above described serves simply as a transmitter, and by careful adjustment at C', and speaking in an undertone, the sounds through the telephones M N were almost articulate. Singing in an ordinary tone would break contact at C'; but the results obtained were sufficient to encourage the construction of another instrument, and if better results are obtained I shall be happy to describe it.—*Scientific American.*

SAND AS FOUNDATION MATERIAL.—One of the best possible foundations is sea sand; at least so long as it is not interfered with. The man who built his house upon the sand was not quite the lunatic that many worthy people suppose. Under ordinary circumstances, his abode was just about as secure as his neighbour's upon the rock. Unfortunately, however, one stormy night an unexpected flood came, and next morning his want of forethought was made apparent. So long, therefore, as sand is uninfluenced by running water it is safe. Sink, however, a well near, and you at once undermine its security. Nothing is more treacherous than sand when allied with water. In harbour works heavy piles (driven many feet into the sand) lifted and thrown up high and dry on the adjoining beach by a single night's gale. Sand has many curious properties. Its incompressibility is well known. A paper cylinder filled with sand will sustain a surprising load. One of the London Polytechnic experiments, a few years ago, was to bury an egg in sand within a sort of enlarged cupel mold, and then to pound the die vigorously; on afterwards emptying the sand, the egg was found uninjured. The ancient Egyptian engineers, it is surmised, must have used sand extensively for some purposes for which we employ timber. Mr. Dixon supposes Cleopatra's Needle, and the various monoliths of similar character, to have been raised into a vertical position by means of hillocks of sand.

EVEN in Siberian waters, at the bottom of the lakes, rivers and seas, the temperature remains at 40°.

SIXTY-five of the victims of the Ashtabula Bridge disaster have been paid for at an average price of $500 each.

THE manufacture of toughened glass has been brought to such perfection that objects of all kinds can now be made from it.

TO KEEP moisture from clouding a mirror or the glass of an optical instrument, wipe it off with a soft cloth, slightly moistened with glycerine.

IN 1874, there were enumerated 173 processes and apparatus for preserving wood which had been patented or described since 1700; since 1874, the list has been largely extended.

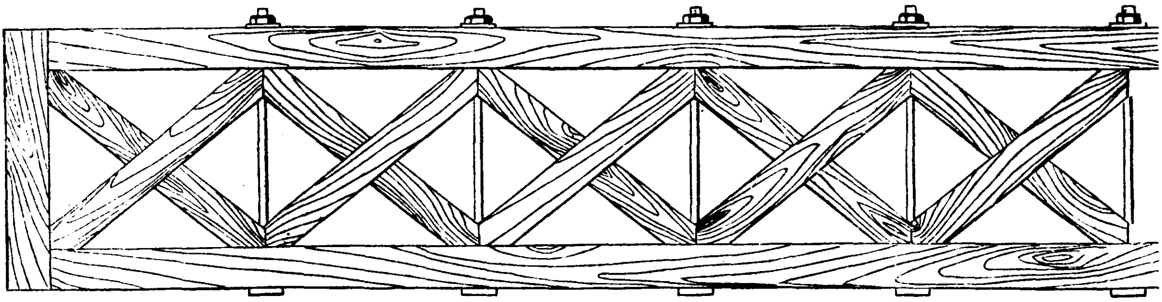


Fig. 52.

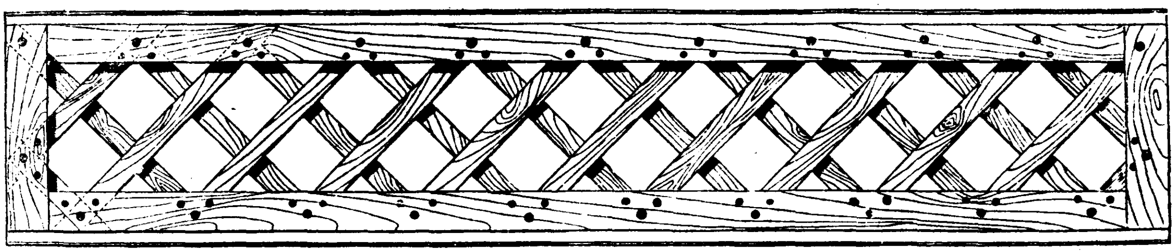


Fig. 50.

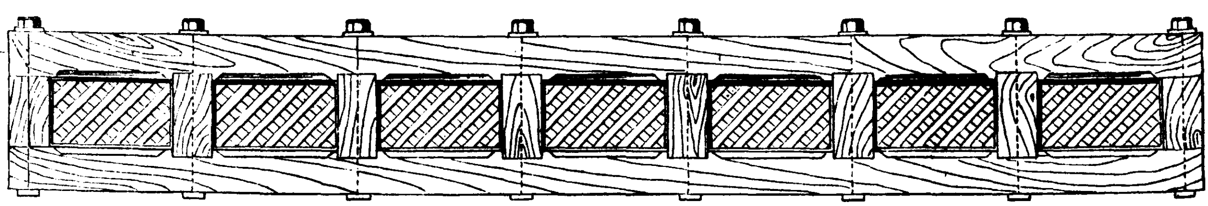


Fig. 49.

Fig. 53.

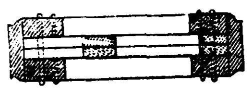


Fig. 51.

CONSTRUCTIVE CARPENTRY.

COMPOUND BEAMS.

As the resistance of a beam against a load from above increases in the simple ratio of the width, and in the ration of the square of the hight, there is a great advantage in increasing the vertical dimensions; to place the beams unconnected, one on the top of the other, only increases the strength in the simple ratio of the hight, two beams having double the strength of one, whether laid next to one another or above one another; but if in the latter case they are rigidly connected, the strength of two beams will equal four times that of the single beam. The strength can even be further increased when the beams are connected at a distance, as represented in Fig. 49, when, by filling up the spaces between the vertical connected studs and screw-bolts with proper designs, the beam may be given an ornamental appearance. Such beams are often seen in large halls, and are sometimes even used for small bridges.

In Fig. 50 the screw-bolts and studs of Fig. 49 are left out, but the upper and lower beam, placed at a distance of about twice the hight of each, are connected by oblique trusses, similar to those filling up the openings in Fig. 49, but on a larger scale, so as to secure a perfectly rigid connection and proper strength. In Fig. 51 this combination is seen on edge, or rather section, passing through the pins, which hold the oblique trusses in place.

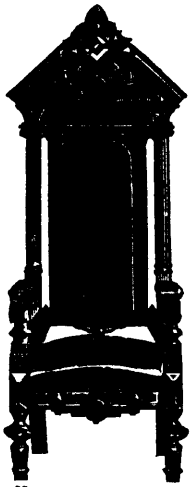
We cannot however recommend the latter combination (which we have copied from a recent German architectural work), as the difference between extension and compression strain has not been properly regarded, while the pins as here used are very unreliable and weak. The reader will become convinced of this by referring to the two excellent articles on bridge building by an esteemed contributor, Mr. Dudley Blanchard, to be found in our Jan. and Feb. numbers for 1874.

Fig. 52 is a better combination in all respects; the braces are not kept connected by mere transverse pins, but are kept rigidly in place by long screw-bolts, of which Fig. 53 represents a cross-section through one of these bolts. Fig. 12, on page 34, Vol. VI., gives a similar combination, the strength of which depends also on the vertical screw-bolts, passing through the whole depth of the combination; but in this the wood is replaced by cast-iron; however, the whole structure as represented in Fig. 12, can also be executed in wood with rod-iron screw-bolts, on the principle shown in the present Fig. 52 and 53.

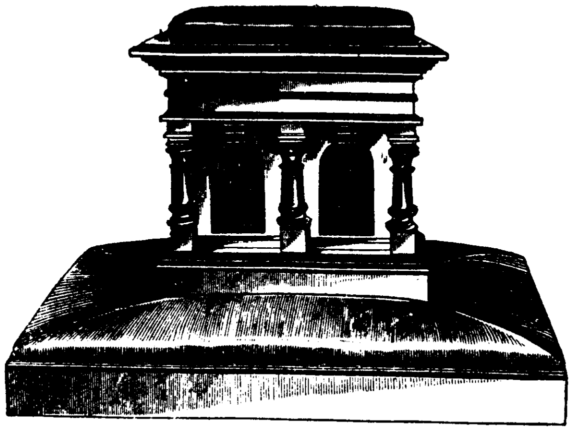
THE BED-BUGS IN SWALLOWS' NESTS.—During a late trip to the western Territories, Prof. Leidy, while watching some cliff swallows passing in and out of their mud-built nests, was told that these nests swarmed with bed-bugs, and that people would not usually allow the birds to build in such places, because they introduced bed-bugs into the houses. He collected a number of the bugs from the swallows' nests as well as from the houses. The latter were found to be the true bed-bug; the former the *Cimex hirundinis*. The bugs infesting the bat and pigeon have likewise been recognised as a peculiar species with the name of *C. pipistrelli* and *C. columbarius*. The habit of *C. hirundinis* was found to be similar to that of *C. lectularius*, the bed-bug in the fact that the bugs during the day-time would secrete themselves in the crevices of the boards, away from the nests. After sunset he had observed the bugs leave their hiding places and make their way to the nests. From these observations it would appear as if the bugs peculiar to these animals (swallows and men) did not reciprocally infest their hosts.

THE famine now prevailing in the northern provinces of China, and which must continue at least six months longer, is being marked by fearful horrors. In one town a man opened a shop for the sale of human flesh, and did a good business in cannibalistic joints and roasts till the local Mandarin caused the shopkeeper to be arrested and beheaded.

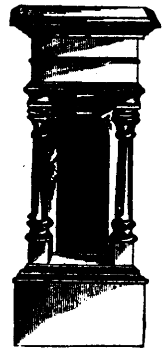
FURNITURE DESIGNS.



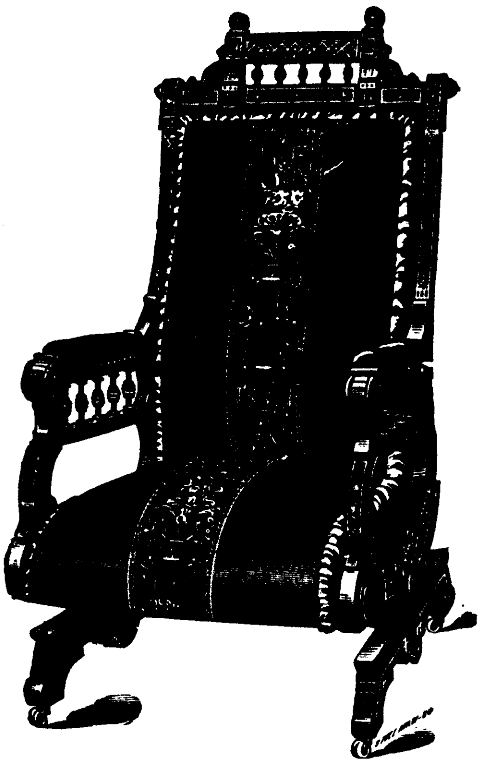
No. 1. Lodge Chair.

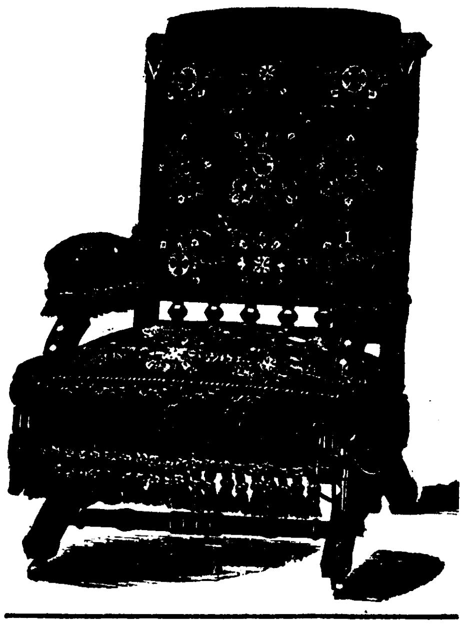


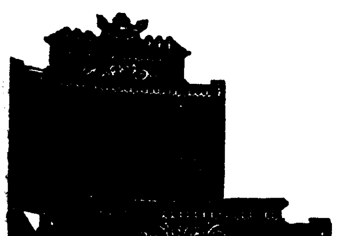
Masonic Altar.

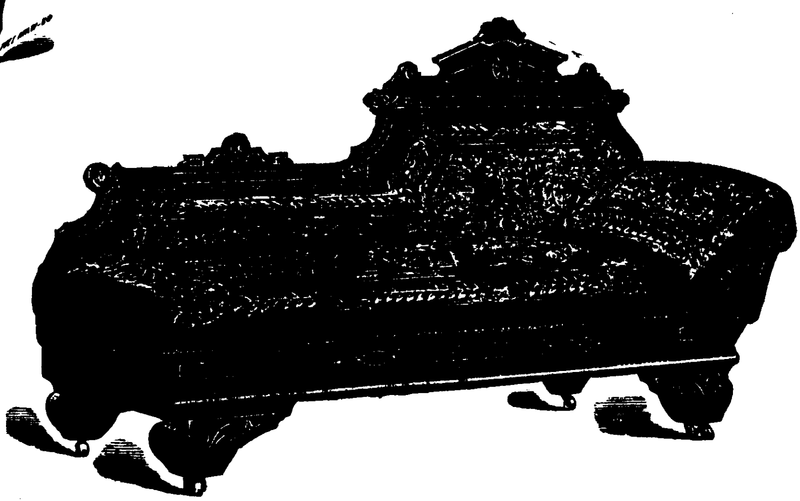


No. 3. Pedestal.









EXPORTS OF FURNITURE AND COFFINS.

The following remarks, which we have taken from the *American Cabinetmaker*, are very illustrative of our remarks in previous numbers of the MAGAZINE respecting the advantage it would be to this country if our manufacturers would look more to a foreign market for the sale of so many articles that could be manufactured out of our valuables as well as by the Americans.

The Dublin *Farmer's Gazette* says of American manufacturers: We are indebted to our ingenious brothers at the other side of the Atlantic for a vast variety of "Yankee notions" in the shape of inventions. They have supplied us with machines for sewing, washing, knife cleaning, egg beating, cinder sifting, apple paring, window cleaning, and many others, from nut crackers to quartz crushers. These we have utilized and appreciated. But it is not only in patented inventions that our American cousins have befriended us. A new trade has lately grown up between Europe and America, which must sooner or later be felt, in an important branch of native industry. It is not generally known, but such is the fact, that American upholsterers are now exporting to Great Britain and the Continent large quantities of ready-made furniture, from kitchen chairs and tables to the most elegant accessories of the drawing-room. The facility with which these objects are turned out is almost marvellous. The native woods of America are easy to work, and susceptible of a fine polish. The wood applicable to the better class of furniture is so abundant that it is wholly superfluous to use veneers. The consequence is that the objects are manufactured solid, and bear much more wear and tear than articles of a similar class made in England. The prices are also much more reasonable, because skilled labor is to a great extent dispensed with, and cheap machinery is substituted for manual dexterity. But it is not only in the matter of household furniture that competition is to de dreaded. The Americans are now sending us window sashes, doors, skirting boards, panel work, wainscots, and all descriptions of joinery. With this assistance, the builder may regard with more composure strikes among the carpenters. But our transatlantic friends do not limit their interest to the living only. Their far seeing benevolence takes notice of us even in death; for American coffins (vastly superior to the home-made article) are to be had in the market at prices little more than half of those charged by native undertakers.

GAS EXPLOSIONS.—There has lately been quite an epidemic of this sort of accident. A good many cases have been publicly reported, and others, which were not sufficiently serious to be mentioned in the newspapers, have come to our private knowledge. Can it be that the work of various incompetent or unscrupulous plumbers has just begun, through lapse of time, to reach that degree of unsoundness when inferior metal or bad solder gives way, and allows the gas to escape? If so, householders had better keep a bright look out for more explosions. Of course, the proximate cause of these disasters is that when people smell gas they bring a light to see what is the matter, instead of first opening all possible doors and windows; but the original cause, in nine cases out of ten, is, without doubt, due to careless or dishonest gasfitting. Water-joint pendants are probably the cause of a small percentage of accidents, and here the advice of "A Gas Manager" comes in opportunely, namely, that such pendants should have the water with which they are filled sealed up securely, as it were, by a coating of sweet or rape oil. Such pendants, he also says, if drawn down during the evening should be pushed up again before going to bed. It is a moot point whether it is safer to turn the gas off at the meter at night or to leave it "on." We are speaking here of private houses, for in hotels it would be manifestly inconvenient to turn the gas off, and there are probably many such establishments where that invisible but powerful agent has been "on" ever since the fittings were first laid down. The chief advantage of turning off is that the joints are relieved for a large part of the twenty-four hours from a pressure which necessarily tends to their injury; the chief disadvantage of this plan is that, unless the turner-off has access to all the burners, one of them may be left at "full cock," and hence at dusk next day, when the gas is turned on, a serious escape may take place. Our own opinion is that, unless the master of the house is a most watchful and methodical man, he had better not turn off his gas at the meter.

ROYAL JEWELS AT THE PARIS EXPOSITION.—The English crown diamonds have been sent to the Paris Exposition, and are valued at $85,000,000. They are in a strong iron chest and are guarded by eight sentinels day and night. A diadem of 86 diamonds of various sizes has in the middle the Koh-i-noor, alone valued at $320,000. There is also a collar of 108 diamonds, in the center of which is an emerald, said to be the purest and most beautiful known. A second diadem is a blending of diamonds and emeralds. In the centre is the large Kaudavassy diamond, valued at $60,000. It would be rated at a higher sum only for a slight defect. These, and many other jewels of the kind, belong to the English Crown. A portion is used by the Princess of Wales on special occasions; the others are reserved for the Queen. The Kaudavassy was formerly the eye of a one-eyed Hindoo deity, and has been only lately added to the collection. The French Commission are constructing a strong room for the State jewels. According to the *Journal des Debats*, it is about 12 feet deep and 10 feet or 11 feet square. The sides of the pit are thickly cemented, and it has a double iron floor, with pipes, by means of which it can be flooded in case of fire. The jewels will be exhibited in a glazed case of beautiful workmanship, a casket worthy of the gems; this will be let down into the space below immediately the Exhibition doors are closed, and covered with a heavy iron trap door, upon which two especial guardians will place their camp beds.

ELECTRICITY AND RHEUMATISM.— To "Sigma." — I was not treated by electricity. In some cases I should say that electricity might be usefully employed, though my faith in its action in rheumatism is limited. I may say I have not been treated at all, but have been my own doctor, except during the acute stage, in which, of course, I could do nothing, and required medical attendance to keep watch against the disease attacking the heart. For some months I endured much pain because, besides every joint in the body being affected, the stomach was constantly attacked, and there was constant pain round about the heart apparently, but really, no doubt, in the muscles among the ribs. Happily, I have got rid of all these, and the pains in the joints seem to slowly diminish, and so give some hope of driving the enemy out in time. The treatment I have adopted is, in essence, that sketched in my letters referred to, using little medicine except when its use was indicated, and that little being—podophyllin, when the liver seemed sluggish; carbonate of potash more frequently, with small doses of iodide of potassium when pains sharpened, and bromide when they took the form of persistent headache. Local pains I met with wet bandages and flannel wrappings, followed by douches of gradually colder water and rubbing with good Turkish towels. The main point, however, is careful management of the general health; as much exercise as possible within the limit of fatigue; as much open air as possible when the weather is fine; nutritious diet of the simplest character; daily washing and rubbing of the whole body, with frequent Turkish baths of a simple character, such as one can manage at home easily enough. In fact, every care should be taken to give the internal organs fair play, and to get the skin into wholesome active condition; avoiding chills carefully, and wearing flannel by day, and sleeping on, or rather in, a blanket by night. This latter I believe to be most important, and to do much towards checking or preventing the sciatica, which usually accompanies rheumatism. The most effective way I have found of applying all these had been at the seaside in warm weather, selecting a bracing tonic location, and bathing regularly, not in the cold damp boxes provided for the purpose, but at some open part where, after a few minutes in the water, and the following rub down, I could lie peacefully on the warm sand, and let the sun and air do their work in bringing the skin back to a more natural condition than our civilised clothing gets it into. This of course implies either a companion or a perfect familiarity with the water; the latter is almost essential for such a case; and, for my own part, till the weakness and pain of rheumatism warned me that I must not trust to my own powers, I was as much at ease in the sea as on the land, and have, in fact, gone to sleep floating on a warm calm day. Possibly this may make sea bathing more useful to me than to others, who would not have the same sense of enjoyment in it.

THE Dutch scientific expedition now exploring the interior of Sumatra, has discovered forest vegetation so thick that it is absolutely impervious to the rays of the sun.

THE land of the arid region of the United States is about four-tenth of the whole country, including Alaska, and within it are found great deposits of gold, silver, iron, coal, and many other minerals.

POLISHING SHIRT-BOSOMS.—Selma wishes me to tell her "how to give a glossy appearance to shirt-fronts and collars, such as they have when new."—I can tell you, Selma, how to make the starch, but a great deal depends upon the ironing. Make a quart of starch the usual way, but see that it is very smooth and very thoroughly boiled. While hot, stir into it a piece of spermaceti, about as large as a hickory nut; then add a tablespoonful of gum-water, and stir all well together. You can always keep the gum-water prepared. The proportions are, two ounces of gum arabic to one pint of water; but you had better make only half the quantity if you use it but once a week, as it spoils especially in warm weather. But after making the best possible starch, you can not make the linen look "like new" without a "polishing-iron." These are sold at the furnishing stores, and are like a common flat-iron, but with rounded edges, and a highly polished steel face. It is hard rubbing with an iron of this kind that gives the new articles and those from the city laundries their peculiar gloss.

ENGLISH SHIP RAISING APPARATUS.—*Iron* describes the apparatus employed in raising the paddle-steamer *Edith*, sunk in Holyhead harbor on the 8th September, 1875, and to furnish an account of the operations. Various attempts were made to raise her up to the middle of 1876, but all failed; and it was not until eighteen months after the latter time (in December, 1857) that success was achieved. The depth of the water in which the *Edith* was sunk was 36 feet at low tide, and her weight was calculated at 800 tons. The lifting apparatus consisted of four large caissons, each about 59 feet long, by 15 feet wide and 15 feet deep, each divided into four compartments, and stayed inside with timber. The caissons were constructed of ⅜-inch plate, riveted to angle irons. Each pair of caissons was kept rigidly apart by wrought-iron girders. The five forward girders of the bow cradle were plate girders. The eleven girders of the cradle, and the remaining six of the bow were plate for a distance of 18 feet at either end. To the ship's side the attachments were made by means of 39 steel wire-ropes, which were securely wedged into holes, five inches in diameter, cut into the ship's sides. The pumping was effected by means of two 10-inch centrifugal pumping engines. On the morning of the 4th of December the cradles were got into position over the wreck, and sunk till they drew seven feet of water. The wire ropes, each of which had been lengthened by the addition of two steel wire strops, four feet in length, were then handed up by the divers, and the eyes passed over the screw hooks, and an equal strain on each attachment obtained. The water was then pumped out, and as the side rose the ship floated, the cradle having about four feet freeboard.

EUCALYPTUS TIMBER.—The value of the Eucalyptus tree for the timber it produces seems worthy of attention, as well as the other desirable qualities it possesses. When freshly cut, the wood is soft, but so full is it of a resinous gum that it soon hardens, and becomes well-nigh imperishable. For ships and docks and jetties it is invaluable. The *teredo navalis*, or ship worm, lets it alone. It is also proof against that awful scourge the termites or white ant. Hence, in India, eucalyptus wood is used for the sleepers of the railroads, where it defies the insects and the climate. So great is the variety of the eucalypti, that they are provident for nearly every purpose which wood can subserve. The ship-builder, wheelwright, carpenter, coach-maker and cabinet-maker are all supplied. Usually the eucalypti are evergreens, and hold tenaciously to their leaves. But they readily shed their bark, as a rule, and in such immense pieces can this be detached that the natives make a rude tent of a single piece. Of many species the bark is serviceable for paper-making. For size no trees can equal these Australian gums in the magnitude of the timber afforded. A plank sent from Victoria, and intended for the London Exhibition, but which arrived too late, sold for £100. It was clear plank, over 223 feet long, two feet six inches wide, and three inches thick. But, though excellent timber, some of the species are of little worth for fuel. In these the wood burns with such difficulty that it is regarded as specially suited for shingles. *N. W. Lumberman.*

How Sewer-Gas is Forced Out of the Pipes.—The sizes of our sewers are generally based upon the quantity of rain-water that is likely to get into them within a limited time, and the inclination or slope of the sewer itself. The volume of sewage is so small when compared with the possible flow of rain-water in this climate that it is hardly necessary to take it into consideration, even in our densely-peopled cities, as an element in determining the size of the sewers. It follows that the ordinary dry weather flow in our sewers is but a driblet if compared with their contents when gorged by the drainage of a powerful rain. Such rains often come suddenly, and the water enters the sewer at frequent intervals by trapped openings, preventing the exit of air. Sewers are at such times often quite filled with water through the least inclined parts of their course. The entrance of water in such quantities must summarily expel the air that was previously in the sewers, if it can find any way to get out. It may often happen, however, that a long sewer is at such times filled with water at two parts of its course, while some intermediate part, having a more rapid fall, may not fill so soon. If the influx of water continues to increase, the air in this portion may soon become subject to a pressure of several feet of water, and seek exit through every private drain in connection. Even if the connections of the private drains are under the water-line in the sewer, the pressure will be transferred through that water, which will back up into them, and force back their contents accordingly. The subsidence of the flow when the rain abates leaves voids which the outer air is sure to fill speedily. If direct access is not given, it will find its way through any private drains, emptying all their traps at once.

In cities which drain into tide-water the outfalls of the sewers are generally covered at high-water, either every day or at spring tides. If the ends have no gates, the tide enters and fills the sewer as far back as its level allows. If gates exist, they shut with the flow of the tide, and sewage accumulates behind them with a result often almost exactly similar to what would occur without gates. In either case a large volume of air is driven up from the outfall toward the ramification of the system by every flood tide which covers the mouth of the sewer, only to be drawn back again when the ebb tide allows the sewer to empty itself. If this air does not communicate freely with the outer air, a pressure of several feet of water must necessarily result, alternating with vacuum to the same amount every twelve hours.

Large variations of pressure inside the sewers may also arise from the variable quantity of sewage flowing in them. Nearly all the sewage is discharged from the houses during the hours of daylight, the flow during the night being very small in comparison. Hence a periodic increase and decrease of the amount of air space within the sewers, dependent upon and varying inversely with the amount of sewage flowing. This is particularly noticeable among manufacturing establishments where much water is used during working hours, and which do not run during the night. Of course, the air must leave the space to make room for the sewage in the morning, and, as the flow of sewage diminishes in the evening, the outer air crowds in to fill the vacuum by whatever openings or ducts are most available.—*Edward S. Philbrick, in the Plumber.*

CLEANING FURNITURE. — Nothing better than warm water and soap for taking off the old oil and dust. May be afterwards rubbed to a shine with wash-leather, or one drop of linseed oil to one teaspoonful of methylated spirit on some soft rag.

ROSIN IN OILS.—Rosin dissolves in boiling solution of potash, and hydrochloric acid re-precipitates it in soft solid flakes. It also dissolves in boiling alcohol, and deposits colourless rhombic plate prism crystals or sylvic acid on cooling.

FROSTING LEAVES.—The best preparation for this purpose is mica, powdered more or less finely. The articles are coated with glue or varnish, and powdered mica dusted on. It is sold at some colour-shops for the purpose. I think they call it frosting powder.

RIVETING CHINA, &C.—I have some alabaster ornaments to mend, and should be glad to know the most approved method of doing this kind of work; also plain directions for riveting china, delftware, &c., and cutting glass, such as broken decanters, making them into sugar basins, &c.

USEFUL CEMENT.

Dissolve five or six bits of gummastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In another vessel dissolve in brandy as much isinglass, previously softened in water, as will make a 2 oz. phial of strong glue, adding two small bits of gum ammoniac, which must be rubbed until dissolved. Then mix the whole with heat. Keep in a phial closely stopped. When it is to be used set the phial in boiling water. This cement perfectly resists moisture, and it is said to be able to unite effectively two surfaces of polished steel.

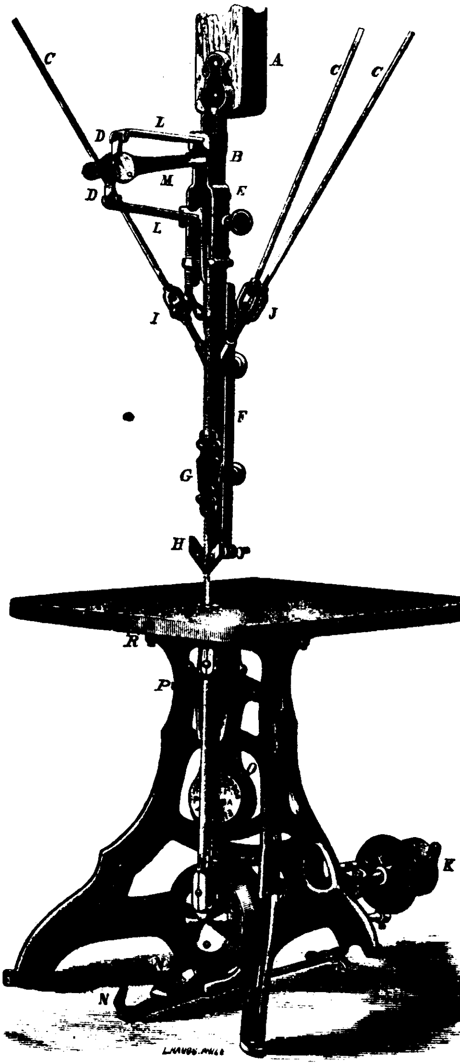
RED JAPAN VARNISH.—The simplest way to make this is to procure a stick of the best red sealing-wax, break it into small pieces, and drop it into a wide mouthed bottle; then cover the sealing-wax with strong alcohol; cork the bottle, and set in a warm place. When thoroughly dissolved, it will be fit for use. You can dip your little twigs in it "to make them look like coral." The varnish soon dries, so you can give several coats, if needed, without much trouble. Poor sealing-wax will make an unsatisfactory varnish. Buy of a stationer, who knows what a good article is.

A CARD-BASKET.—I know of no better pattern for "a card-basket of perforated card-board," than that with a hexagonal base and six five-sided pieces around the sides. Fig. 1 shows you half of the sides sewed upon the base. Let each side of your hexagon be exactly one inch and three-quarters wide. Cut your side-pieces of the shape of Fig. 2. (You will see the dimensions marked upon it.) Bind the pieces around, with narrow lute-string ribbon. You can either work some little design on each piece with silk or worsted, or you can stick a little picture upon each. Overhand the pieces together (as seen in Fig. 1.) Be careful to sew to the hexagonal base the side of the five-sided piece which measures 1¾ inches. A little bow of lute-string at the top (inside) of each side seam, will add to the effect.

INDIA RUBBER FROM LANDOLPHIA FLORIDA. — So much attention has of late been given to new sources of india rubber, or to the development of those already well-known, that the following note on the character and mode of collecting the milky juice of Landolphia florida in western tropical Africa may be of interest. Though the plant abounds in caoutchouc, which exudes from the slightest cut or wound, it does not run out with such freedom as to enable it to be collected in vessels, but forms a ridge or mass around the wound, which is regularly taken off. The blacks are said also to collect it "by making long cuts in the bark with a knife, and as the milky juice gushes out it is wiped off continually with their fingers and smeared on their arms, shoulders, and breast, until a thick covering is formed; this is peeled off their bodies and cut into small squares, which are then said to be boiled in water."

A DRESSING FOR PATENT LEATHER. — When patent leather boots or shoes lose their original lustre, they may be revived by a very simple dressing. Sugar one pound; Gum Arabic, in powder, one ounce; Ivory-Black, one pound. Add a pint of water, and boil together, stirring, until the Gum and Sugar are well dissolved. If too thick to apply smoothly, add more water. Let stand for a few hours for the coarser portions of the ivory-black to settle, then pour off and bottle. This is to be applied to the patent leather with a soft camel's-hair, or badger-hair brush. When a new application is to be made, the former coat, if too thick and stiff, may be removed by washing it off with a damp cloth. This renews the lustre of patent leather perfectly, and was given us by a gentleman from Europe, who paid his French valet a round price for the secret.

THE POTATO-BEETLE. — The experience of last season has shown how easily the potato-beetle may be vanquished. Notwithstanding this pest, potatoes are plentiful in New York markets, at $1.50 a barrel, and farmers seem to think that these prices are better than those for most of their products. The fight with the beetle, to be successful, must be swift, short, and sharp. No other remedy is so certain as Paris Green for the larvæ, and hand-picking for the first crop of the beetles. Hand-picking early in the season, prevents the deposition of thousands of eggs, and every egg destroyed diminishes the late crop by hundreds or thousands. If farmers would only work for one year, and destroy the beetles as long as one is to be seen, sparing none of the late crop, there would be an end of them, practically, for ever afterwards. To spare the latest brood is to save seed for the next season.



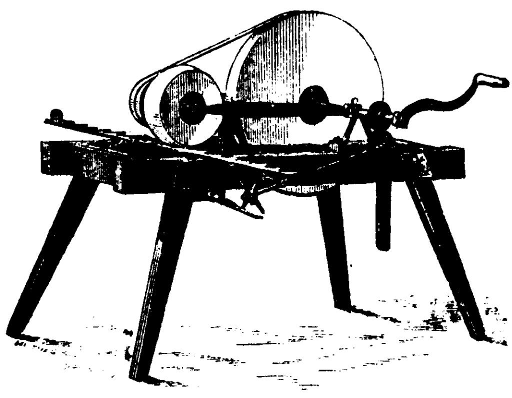
IMPROVED SCROLL SAWING MACHINE.

The scroll saw, as shown in this cut, has a rotary blower attached to the frame below the parallel adjustable slides, also a combined clamp and hook fastening for the blades, and is furnished with an iron and wood table as preferred. The frame is a rigid casting of suitable form and made in one piece, the upper works being secured to the post *A*, hung from above, and kept in place and adjusted by the rods *CCC*, and hand nuts J, at the sides and rear. The most important point to be considered in the construction of machines of this class is the manner of straining the blades, and the makers claim an especial *effective, simple and durable* arrangement for that purpose. It combines the head *E*, steel springs *LL*, steel anti-friction links *DD*, and lever *M*, arranged to produce an *even tension* on the blade *at all points of the stroke*, and the strain may be varied at pleasure, by turning the hand screw *I* directly in front of the operator. The spring head *E* also slides up or down the standard *B*, so that the same length of strap is always used for blades of different lengths. The hold-down *F* and the slides *G* may be adjusted independent of each other for thickness of stuff or length of blade, and the bank and side guide *H* removed, when not in use, for long and narrow blades. The wood or metal guides around the saw are adjusted by screws *R* in front of the table, and the hook fastenings for the blades are made to fit any thickness, the lower one combining both clamp and hook.

An improvement in the manner of adjusting the lower slides *P*, allows them to be set up for wear, &c., and kept parallel without trouble or loss of time. The sawdust blower *O* is attached to the frame and run by a pulley on the balance-wheel shaft, a rubber tube (not shown in the cut) conducting the air to the work above.

A constant blast of air from this blower is also forced against the dust as it leaves the saw below the table, keeping it from absorbing the oil on the lower slide and guides, and preventing the noise and heat so common in slides when running loose or dry.

The saw is started and stopped by the foot of the operator on the rod and brake *N*, and the belt shifter *K* may be set for the belt in any direction. The pulleys are six inches diameter by three inches face, and should make from 900 to 1,050 revolutions per minute.—*Scientific American.*



IMPROVED SELF-ACTING SHARPENING MACHINE FOR MOWER AND REAPER KNIVES.

The machine shown in the accompanying engraving possesses certain novel features of construction, which will appear from the following description :

On the supporting frame will be observed the knife-sharpening grindstone, which has a beveled or flat V-shaped periphery (to engage properly with the teeth to be sharpened). A large grindstone of ordinary form, connecting by means of a belt with a pulley on the shaft of the beveled grindstone, and set in rotation by the hand crank, acts as the driving-wheel to the combination.

The shaft of the smaller grindstone is hung into bearings of a swinging frame braced by a lateral piece, against the under side of which bears one end of a weighted lever fulcrumed to the supporting frame. This weight can be shifted so as to secure any desired pressure of the beveled grindstone against the knife, and, as it partly balances the weight of the stone and attachments, it facilitates the operation of swinging back the oscillating frame after a cut has been taken, to permit of the adjustment of the next knife section of the reaper or mower.

The reaper or mower knife, as seen in engraving, is supported on a lateral bed plate, having a V-shaped recess, where the beveled grindstone bears against it; the knife being fixed firmly in place by one or more clamp-screws. When the machine is set in motion, the bed plate carrying the knife is fed up toward the beveled grindstone by means of a rack and pinion on the under side of the plate, operated from a gear wheel at the end of a shaft, which gear wheel engages with a worm on the shaft of the main grindstone. This mechanism permits the whole length of the knife section to be fed up against the grindstone at a uniform rate, and when the cut has been taken, the radial arm at the extremity of the gear-wheel shaft, disengaging from the lever plate which communicates the forward motion to the bed plate, the latter is immediately thrown back to its first position by means of a spiral spring. In this position it remains until the lever arm of the pinion engages with the next radial arm of the gear-wheel shaft, when it again advances slowly, presenting the same or a fresh knife section to be sharpened. The amount of grinding with this device can be regulated at will by adjusting the weighted lever, and the cutting will be uniform. Where it is desired to grind at one place, as in taking out a nick, the bed plate carrying the knife can be held stationary by throwing the feeding mechanism out of gear. This, it should have been stated, can be engaged or disengaged instantly without stopping the machine. The inventors claim for the machine decided advantages over all others for a similar purpose, in the following points : In the before-described connection of two grindstones with each other, the one to grind mower and reaper knives, and the other to be used, by simply throwing off the belt, for ordinary grinding ; in the rapidity, uniformity and accuracy of the work done, both bevels being ground at the same time and true, commencing at the point, and finishing at the heel ; in the self-acting feeding mechanism involved in the automatic reciprocating motion of the bed plate ; and in its simplicity.

Coloring Woods.—The employment of alkaline manganates for imparting to light woods in furniture and floors an attractive, uniform, and durable walnut brown, is highly recommended by M. Viedt. The action depends upon the decomposition of salt in the pores of the wood, with the separation in them of very finely-divided brown hydrate peroxide of manganese, and an addition of magnesium sulphate to the solution is found to hasten the reaction. In practice, the following method is said to be successful. Equal parts of manganate of soda and crystallized Epsom salts are dissolved in twenty to thirty times the amount of water, at about 144 degrees, and the planed wood is then brushed with the solution ; the less the water employed, the darker the stain, and the hotter the solution, the deeper it will penetrate. When thoroughly dry, and after the operation has been repeated if necessary, the furniture is smoothed with oil, and finally polished, the appearance being then really beautiful. Before smoothing, however, a careful washing with hot water will have the effect to prevent the efflorescence of the sulphate of soda formed. In the treatment of floors, the solution, may be employed boiling hot, and, if the shade produced is not dark enough, a second application of a less concentrated solution is made ; after it is quite dry, it is varnished with a pefectly colorless oil-varnish. On account of the depth to which the coloring solution penetrates, a fresh application is not soon required.—*Lumb. Gazette.*

Muslin Glass.—A new method of rendering glass opaque and at the same time ornamenting it has been devised by M. Aubriot in his so-called "muslin glass." After carefully cleaning the surface a coating of vitrifiable color is laid over it. The vehicle is simply gum water, and care is exercised that the pigment is evenly applied. The glass is then submitted to a mild heat until the water has evaporated, when a stencil of the desired pattern is laid over the surface, and a stiff brush is used to remove the loose pigment from the parts which are to be transparent. The glass is next inclosed in a frame, and above it is extended a piece of tulle, or, if desired, embroidered lace,—the embroidery, in the latter case, being so disposed as to harmonize with the ground pattern previously made. The whole is then hermetically closed in a box which contains in a reservoir in its lower portion a certain quantity of dry color in the form of impalpable powder. This, by an air blast, is blown evenly upon the glass, and adheres to the latter wherever the surface is not protected by the threads of the lace. In this way the pattern of the latter is defined. In order to fix the powder, the sheets of glass are placed in a steam chamber, where the steam moistens the gum and causes the powder to adhere. The color is then burned in a special furnace. By using different colors, it is said that very beautiful designs can be produced in this way,—opaque or transparent according as the pigments themselves are the one or the other. Remarkable effects also are obtained by the superposition of the tints.—*Bost. Jour. Chem.* xii, 112.

PURIFICATION OF SEWAGE.

At a recent meeting of the Newcastle Chemical Society, Mr. John Watson, F.R.A.S., of the Sheaham Chemical Works, read a paper on the utilisation of sewage and the purification of rivers, in which he alluded to a long series of experiments he has carried on in connection with the question. Some of the results were brought to the notice of the commission appointed to report on the pollution of rivers. At that time he was sent for, and he met four or five of the Government commissioners, told them what he was engaged with, and as his experiments and results were then in a crude form, he merely desired them, in the meantime, to suspend their judgment before reporting on the alleged injurious effects produced upon either the fishes or the inhabitants by the liquid or gaseous matters which escaped from alkali works; for he was prepared to prove that, instead of doing harm to the rivers or to the fish, or to the health of the people, that alkali makers, as a class, have yet to be recognized as the greatest benefactors of their communities. As time was short, he had left at home an outline of the claims of about one hundred patents for the utilisation and treament of sewage, and also for the purification of streams containing sewage; yet in a moment he could give them the conclusion and upshot of them all. The British Association having admitted the importance of this subject, some years ago appointed a special committee to watch the progress of discovery and invention in this direction, but at the last meeting the committee reported that so far nothing had been suggested which they considered worthy of the recommendation by so careful and cautious a society as the British Association for the Advancement of Science. Amongst modern farmers the cesspool was very often left to discharge itself into the nearest stream, and thus a supply of valuable manure was entirely lost both to the farmer and the community at large. Whilst the farmer was careful to look after collecting the milk, the honey (or valuable sewage) was allowed to escape. If the farmer or householder threw away his valuable sewage matter, where dit it go? It found its way into the nearest river. Whilst examining the various chemical reactions resulting from the addition of the usual expensive deodorising agents, he had occasion to try an experiment in a huge glass beaker containing over a gallon of thick stagnant sewage. Previous to adding the chloride of zinc and other expensive preparations, Mr. Watson thought he would first add a few drops of muriatic acid to correct the alkaline condition of the sewage. After a few hours all the animaculæ lay in a dead darkened mass at the bottom of the beakèr, and the supernatant water was changed from deep green to perfectly clear. But every grain of the dark precipitate was exactly suited for manufacturing vines, cauliflowers, or green peas, whilst the dirty sewage water was again fitted for the nourishment of ducks, swans, or fish; and it was quite suitable for the various secondary uses of every-day life, such as baths, washhouses, &c. If the method of purifying sewage so briefly described possessed the value which it seemed to him to possess, it was easy to see something of its value when applied to a river carrying away the sewage from a large town. Yet, since the day the first condenser was started no one ever heard of the Tyne stinking. Thirty years ago, when they were making only strong muriatic acid at Washington, he was told that Messrs. Burnett had set up on the Tyne what were then known as Burnett's condensers, so that they might prevent the least portion of muriatic acid vapour from escaping into the atmosphere, and the result was a very weak hydrochloric acid of little or no value, except to the fishes and to the folk. They could easily understand, from the experiment just described, the effect of such muriatic acid in sweetening the Tyne. Statistics carefully preserved showed that the Tyne fisheries had been increasing in value at an amazing rate. The corporation officials at Darlington had admitted the cheapness and simplicity of this method, but a grant of money had been voted for the purchase of land to be treated by irrigation, and that experiment of a sewage farm must first be fairly tried. If, then, complaints about the Skerne still continued they were ready at a day's warning to apply the specific described. Another place similarly situated was Windsor, where the complaints had led to legal proceedings, and the Thames Conservators had demanded steps to be taken to prevent a continuance of the pollution of the Thames. If the result of his experiments proved anything at all it was that the folk of Tyneside, and especially of a rather slow-going town like Newcastle, which cared so little for pure water, were deeply indebted to the chemical manufacturers for past favours, in the way of deodorising what might otherwise have been as dirty a river as the Thames was now. Although but a small stream as compared with the Mersey, the Clyde, or the Thames, the populations on its banks from its source, the Cumberland hills, to its month, including the two Shields, could not be much less than half a million inhabitants. The quantity of sewage from such a population must be considerable; yet he would ask if even the oldest inhabitant ever heard a complaint of the Tyne stinking? Already some of his friends were filling their note-books with quantitative results, showing the richness of various streams of sewage in organic matter, and also showing what an extremely small quantity of muriatic acid sufficed to purify the most putrid stream that could be met with. A single drop was magically potent in purifying liquid. The value of a simple and cheap antidote like this was only appreciated after others had failed. As for the chemical manufacturers as a class, he would say that as long as they were not prevented by law from benefitting the public by contributing their gentle streams of waste hydrochloric acid gratuitously to sweeten the stream of their noble river, the Tyne, famous alike for its factories as well as for its fisheries, it yet remained a vital question for them to consider whether it might not be as well carefully to collect every pint of the valuable acid, with a view to its more equal distribution amongst other populous midland towns, where, he was certain, at present it was much required to prevent malaria and other deadly and noxious influences, which were killing hundreds and thousands of our population every year.—*English Mechanic.*

PLANTS GROWING UNDER THE MICROSCOPE.

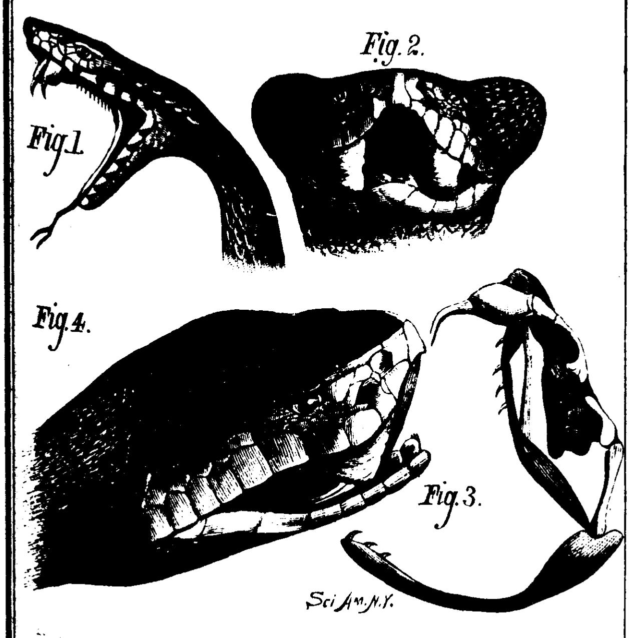
This is something that we read of in most books on the microscope, and although it is not by any means true plant growth, it is very curious and beautiful. Procure a little Collomia seed, which may be had from most seedsmen. Take one of the seeds, and with a razor, or very sharp knife, cut off a very thin slice. Lay this slice on a slip of glass (an ordinary slide), cover it with a thin glass cover, and, the microscope being in a vertical position, lay it on the stage. If you wish to incline the microscope, you must use a square glass cover, and not a round one, and hold the cover to its place by means of a very fine rubber ring. Now, bring the thin slice of seed into focus, and then apply a drop of water to the edge of the glass. The water will penetrate between the glasses and moisten the seed, which will at once throw out a very large number of spiral fibres—giving it the appearance of a veritable germination. Beginners will find it easier to perform this experiment if one will apply the water while the other looks through the instrument. A single drop is enough.—*Young Scientist.*

A SIMPLE AND GOOD VARNISH.

Take three-quarters of a pound of gum sandarach and two ounces of gum shellac (the brown I used), and place them in a bottle, and cover them with very strong alcohol. Stir up frequently, and keep in a warm place; in about two days pour off the liquor into a Winchester bottle, and put again some more strong alcohol; let it digest two or three days longer, stirring often, and keeping the bottle in a warm place. This will dissolve all the residue. Add the liquor to that already in the Winchester, pour in an ounce of castor oil, and shake it well up. Now dilute the whole with common methylated spirit till the Winchester is full, and, after fining, which will happen in a week by itself, you will have as good a sample of varnish as any one need want. The point in this preparation is, that the pure alcohol, being used as a solvent, only seems to take up all the good properties of the gums, and when the dilution comes, all the gum is still held in solution; whereas, in my hands at least any attempt to dissolve the gums direct in the methylated spirit is a failure, as far as the quality of the varnish is concerned. This varnish will dry half bright, and will take the pencil very readily, if it be wanted to add to the tooth. The surface will rub with perfect ease by the finger being just touched with powdered pumice, or resin, &c.

CASTOR OIL AS A HAIR DRESSING.—It is commonly used, mixed either with marrow or with other oils. It is considered stimulating, and makes the hair glossy; it also makes it stricky, and like all such messes, the less of it used the better. Hair oils, pomades, and such like, if used at all, should have only a very slight superficial employment. To rub them well in, according to directions, is an excellent preparation for headache.

THE German brewers are availing themselves of the lubricating qualities of glycerine to adulterate beer.



FANGS OF SERPENTS.

BY C. FEW SEISS.

The venomous serpents are divided into two groups, namely, *Solenoglypha*, including the rattlesnakes, vipers, &c., and *Proteroglypha*, embracing the cobras, coral or bead snakes (*Elaps*), and venomous water snakes of the East (*Hydrophidæ*). Fortunately, harmless serpents are, throughout the world, by far the most numerous. In the States north of Maryland, there are only two species of poison-fanged serpents (the rattlesnake and copperhead), while the non-venomous number eighteen species.

The fangs of serpents vary in number, shape and size. In the viper, *Pelias berus*, the only venomous one of the three species of serpents found in Great Britain, the fangs are two in number, and are situated in the superior maxillary bones. There are no other teeth in the maxillæ, but there is a row of small teeth in the palatine bone on each side. The bite of the viper is often extremely painful, but rarely if ever fatal. The viper is not found in the United States. I remember on one occasion in Maryland, a gentleman conducted me to a wood to show me a "viper" he had a short time before killed, and gravely informed me it was an "extremely poisonous species." It, however, proved to be a harmless hognose snake, *Heterodon platyrhinus*.

Fig. 1 shows the head of a viper, with fangs thrown forward in a position to strike.

The fangs of the rattlesnake (*Crotalus*) are also two in number, situated as in the viper. They are curved backward, and hollow save at the tips, where they are solid, and turned slightly forward. The minute opening through which the venom is ejected is in front, about one twelfth of an inch from the needle-like point. The glands in which the venom is secreted are oval or almond-shaped, two in number, situated one on either side of the upper jaw, behind the eye. Each gland has a duct connecting with the base of its fang. These poison ducts are kept closed by an arrangement of muscular fibers when the fangs are not in use, but at the moment when the snake strikes these ducts are forced open by certain muscles of the head, and the poison shoots through the ducts and out of the openings near the points of the fangs into the wound. When not in use the fangs lie upon the gums in the roof of the mouth, buried in the folds of mucous membrane.

Fig. 3 represents half of the skull of a rattlesnake, viewed from the side, with the fang thrown outward and forward, ready for action.

The deadly machuca, of Nicaragua (*Bothrops atrox*, Wagler), has four great fangs in the upper jaw, two on each side. Fig. 4 is the head of the machuca, two-thirds natural size, drawn from a large specimen in the Academy of Natural Sciences, Philadelphia. Fig. 2 is a front view of the head, showing the mucous folds covering the basal portions of the fangs. On the right side of the jaw of the specimen examined, one fang is drawn back against the roof of the mouth, while the other is thrown forward. This seems to show that the fangs are capable of independent motion, but we have no proof of this fact. It may be they were thus forced apart when the serpent was killed.

A Sure Cure for Poultry Lice.—Lice are the great pest of the poultry house. Hens left to range about the farm or garden will keep clean by swallowing in the dry dust. But for a good part of the year villagers have to keep their hens in confinement, and very soon, without constant watchfulness, lice appear, and if the poultry house is near the barn, or within it, the vermin spread to the cow and horse-stables, and make trouble there. White-washing, if it were attended to every month, would be effectual, if the wash penetrated all the cracks. But this involves a great deal of labour, and it is difficult to reach all the crevices. There is the same objection to sulphur and tobacco smoke. A few of the lice are generally left for seed after every smoking. The best remedy we have ever applied is crude petroleum, or, if more convenient, the common kerosene oil used for lamps. This is always at hand, and a few minutes' labour at the oil-can will rout the enemy. Generally one application is enough to destroy them. We apply it directly to the perches, pouring a continuous stream from the spout. The hens get this oil upon their feet and legs, and it is rubbed all over the feathers. It is penetrating, and the odor seems to be exceedingly offensive to all insects. We have no lousy hens since the application of this remedy.—*Scientific American.*

To Brighten Iron.—The following method of brightening iron, which appears suitable for some of the less important parts of large clocks, is recommended by Boden. The articles to be brightened are, when taken from the forge or rolls, in the case of such articles as planes, wire, etc., placed in diluted sulphuric acid (1 to 20), where they remain for about an hour. This has the effect of cleansing them and they are washed clean with water and dried with sawdust. They are then dipped for about a second in commercial nitrous acid, washed carefully, dried in sawdust, and rubbed clean. It is said that iron goods thus treated acquire, without undergoing any of the usual polishing operations, a bright surface having a white glance. Care should be taken by any one using the nitrous acid not to inhale its fumes.

The Destruction of Mice.—The Prague authorities invite earnest attention to the very serious proportions the plague of mice throughout Bohemia has assumed, and recommend the adoption of a number of measures whereby they hope to stay its progress. Among these are the protection of animals destructive to mice, such as fitchets, owls, hawks, jackdaws, and crows; suffocation by the introduction of smoke, or sulphur fumes, or water in the holes; deep plowing in autumn; the distribution of pills of iron filings and yeast made up with fat, or of wheat, barley, or other grain that has been soaked for 24 hours in a solution of oak ashes, or of little balls of meal and powdered glass, or, lastly, of small bits of sponge broiled in bacon-fat. They further gave warning that all this formidable arsenal will be of little service unless it be brought to bear before the mice have gained any considerable ascendency, for their natural fecundity is so uncomfortably great that under favorable circumstances, a single pair may reckon on some 25,000 direct lineal descendants in the course of a twelve month.

Aroma of Butter.—A Silesian farmer suspends in his empty churn a calico bag, filled with fragrant herbs, keeping the churn carefully closed. At churning time he substitutes four smaller bags, attaching one to each of the beaters of the churn. He thus communicates to the butter an aroma as delicate as if the cows had pastured in meadows most highly favored by nature.

Painting Venetian Blind.—Six pounds of white lead, two pounds of zinc white, one pound of mineral green, ground in turpentine. Add resin varnish till it is pretty stiff, and thin with turpentine till it works easy. These are the ingredients used in many of the best shops.

The Eames process at the steel works of Anderson & Passavant, Pittsburgh, is giving gratifying results. An 8-foot furnace is now in operation, and a 24-foot furnace is to be built. Strong iron has been puddled with 38 gallons of benzine, and "frozen" pots melted in a coke hole in 2 hours and 10 minutes with 17 gallons. The process is to be tried at some of the iron mills.

Tobacco smoking has doubled in Great Britain during the last 30 years.

BIG BAR.—The largest gold bar ever cast in Montana was made this month from 30 days' product of the Penobscot mine. It was valued at $53,258.30 in gold, and $977.32 in silver. The dimensions are as follows: Length, 20 inches; top breadth, 7 inches; bottom breadth, 6 inches; weight, 3,389 ounces.

A Cheap Poultry House.

Mr. "W. A. B.," Caroline Co., Md., sends the following description of his poultry house, suitable for those who need a cheap building, and can do the greater part of the work themselves. The plan is given in figure 1. The center building is 10 x 10 feet, and is 6 ft. to the eaves. The wings are each 8 x 6 x 4 feet. Either of the three parts may be built first, and the others may be added from time to time. No posts are used in building it. The sills, 3 x 4 in., and 10 ft. long, are mortised and put together in place; the plates, 3 x 3 in., and 10 feet long, are put on the sills; then eight boards are cut six feet long, four of them with the angle at the top to correspond with the pitch of the roof. These are nailed to the sills, and those in front and back nailed to the edges of those on the ends. Then four sticks are cut each five feet six inches long,

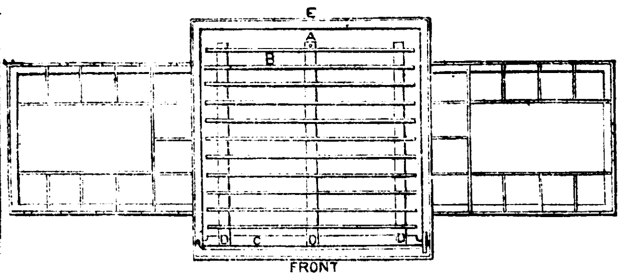


Fig. 1.—GROUND PLAN OF POULTRY HOUSE.

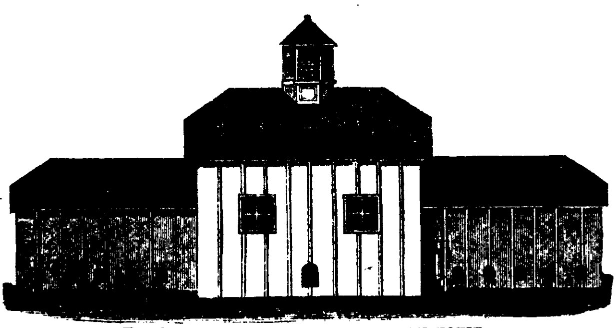


Fig. 2.—FRONT ELEVATION OF POULTRY HOUSE.

the plate is raised up, a stick put under it on the sill, in each corner; the boards are then nailed to it, and the frame is raised, boarded, and battened, and it is strong enough. The roosts are arranged as in figure 1; the piece, *C*, rests on the plates, and is held in place by cleats, and acts as a hinge. The pieces, *D*, are secured to it, and the roosts, *B*, to them. At *A* is a ring bolt, and over head a hook. When the house is to be cleaned out, the roosts are raised and hooked up, and are six feet high, so there is no trouble working under them. The door, *E*, is 6x3 ft. In each wing there are two rows of nests, each nest 18 x 18 x 12 inches, 12 in a row, 24 in each wing, and 48 in all; the bottom of the lower row is two feet from the ground, and under it are five

Fig. 3.—END ELEVATION.

coops on each side, in each wing, twenty in all, (18 x 18 x 20 inches). These are closed inside with slats, and each one is independent, and entered from the outside, as shown in figures 2 and 4. The entrances to the nests are in the doors, as in figure 2. Figure 4 is an inside view of one of the wings, showing the interior arrangement of one side. The two windows in front, one in each wing, three doors, and twenty-three entrances for the fowls, will give sufficient ventilation, but if more is needed, small doors or windows, 18x18 in., can be put above the plates, in the ends of the center building. The cupola is not necessary, but it allows the foul air to escape; it costs about a day's work for a handy man, and is built of scraps. The cost is for 875 ft. of lumber, $14; shingles, laths, and strips, $16 75; nails, hinges, glass, screws, and putty, $3.75. Total, $34.50, for materials. The roof need not, of necessity, be shingled, but it will be found the cheapest in the end, and at the same time it looks better.

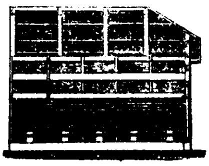


Fig. 4.—SECTION.

Goat Keeping for Profit.

The number of goats kept in the United States is rapidly increasing. Large flocks exist in parts of California and Texas, and many persons are turning their attention to the keeping of these animals as a profitable occupation. In some localities, goats are kept for their milk, and for this purpose they may be doubtless made still more widely useful. But goats can not be kept in large flocks for milking, nor is the flesh at present marketable. The profit from the goat can come only from the skin and the hair. A large quantity of goat skins is yearly imported for tanning, to produce morocco leather, and the hair of the common goat is valued for the plasterer's use. The Angora goat bears a fleece of "mohair" that is valuable for several different manufactures, and the Cashmere goat has an undergrowth of fine wool, from which the most costly shawls are made. By crossing with the Angora males, the common goat can soon be bred up to a point where the fleece is worth as much as that of the pure bred, and it is evident that if the largest profit is desired, the best animals should be kept. The goat will thrive where the poorest sheep would starve, and it better enjoys the rough fare of rough places than the sweetest pastures of grass.

There are many rocky and half-barren localities that might be put to good use by being turned into goat pastures, and there are many better pastures, ill-fitted for the less hardy sheep, upon which goats could be successfully kept. While much hardier than sheep, and less subject to destruction by dogs and wolves, goats have yet some diseases of their own to contend with. Of these, foot-rot is the worst, and diarrhœa and dysentery are sometimes troublesome. Of parasites, the louse is the only one that is seriously injurious, and this is not at all difficult to deal with. Foot-rot, and the other ailments of this animal, are to be prevented, or treated, precisely as those of the sheep; and precautions to avoid damp and close confinement during the kidding season, are necessary. In general, the management of a flock of goats differs in no material respect from that of a flock of sheep, the rules for feeding, breeding, etc., of the one, apply equally to the other.

Scoops for Sowing.

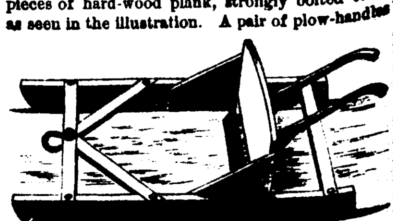
In sowing fertilizers or plaster, it is disagreeable to use the hands. A convenient implement for this purpose may be made of a piece of tin plate (a fruit can, which has served its first use, will furnish the material), cut in the shape shown at figure 1. This is then bent around a circular piece of board, and nailed with a few tacks or shingle nails. A handle is then inserted as shown at figure 2, and the scoop is complete. Various sizes may be made, one that will hold a quarter of a pound, will sow as near as need be, 100 lbs. per acre, each cast covering a space 16 feet long by 8 broad; 350 of these casts will cover an acre, and will use nearly 90 pounds of material. If double this quantity is to be sown, and great evenness is desired, it would be best to use the quarter-pound scoop and sow both ways. The same sized scoop would sow 6 pecks of wheat per acre. In using these scoops, it is necessary to give them a sudden slight twist, just as the contents are thrown out; this spreads the material in a broad sheet which covers the space mentioned, or may be made to do so by a little practice. Great skill in using these may be gained by practising with a pailful of sand, dry ashes, or lime, upon plowed ground. The sown material is then easily seen.

Fig. 1.—TIN.

Fig. 2.—SCOOP.

A Road Leveler.

We recently saw a machine in use to level some ground that had been graded down, which operated very effectively, and would serve a good purpose in smoothing roads. As this work will soon be necessary, we give an engraving and description of this implement. It consists of a frame of 3x6 inch hard-wood timber, made as shown in the engraving, with the ends rounded, so that it will slide over the ground easily. Near the center, the scraper is pivoted on two one-inch iron bolts. The scraper is made of a plank, a foot or more in width, with a slightly curved steel edge, bolted in the front. It is connected with the frame by two side-pieces of hard-wood plank, strongly bolted to it, as seen in the illustration. A pair of plow-handles



SCRAPER FOR LEVELING ROADS.

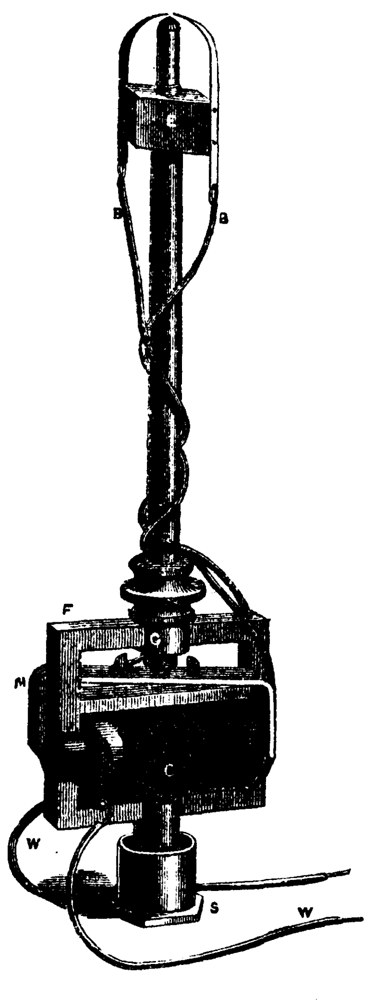
is fixed to the back of the scraper. The machine is drawn by an ordinary clevis, fixed to the front bar, and a short chain. It should be about 10 feet long, and 6 feet wide, to be used with a pair of stout horses or a yoke of oxen.

ON DETERMINATION OF CHLORINE.—H. Pellet, in "Bulletin de la Societe Chimique de Paris," 1877+28 p. 68, shows that in the titration of chlorine by means of nitrate of silver, with potassium chromate as indicator, that (the presence of) arsenic, arsenious and phosphoric acids, as also fluorides, does not interfere with the reaction. Hence, in determining chlorine in ashes and the like, it is not necessary to previously remove phosphoric acid.

Subscribers to this MAGAZINE in arrears are respectfully requested to remit the amounts due at their earliest convenience.

GAS LIGHTING BY ELECTRICITY.

FOR some months a method of lighting gas-lamps by electricity has been practically tested at the Fulham branch of the Chartered Gas Co.'s works, and with so satisfactory a measure of success that it will probably soon be brought into daily use in some of the metropolitan districts. It is the invention of Mr. St. George Lane Fox, and has been secured by letters patent in nearly all parts of the world. At the Fulham gas-works, the automatic lighter was tested on a series of 23 lamps, the connecting wire being taken in a zigzag course of about half a mile. The wire is uncovered as a rule, being insulated only at those places where the support is a conductor; in practice, however, the wire would be not merely insulated but buried, as there are many objections to the use of aërial lines for the purposes of gas-lighting. Nearly the whole of the apparatus attached to the lamps is carried in a small circular box, which will be scarcely noticed unless looked for by those who are aware of its presence. The annexed engraving shows the construction and the arrangement of the mechanism, which consists of a coil, C, carried in a frame, F; M is a horse-shoe magnet, working on a pivot resting on a cross-piece in the frame, F, and carrying on its upper surface two studs which actuate the tap for turning the gas on and off. The permanent horse-shoe magnet has a reciprocating horizontal motion, and its movement is effected by a change in polarity of an electro-magnet consisting of a soft iron core in a coil. Around the primary coil is a secondary coil of smaller wire of much greater length, so that we have for each lamp a small induction coil and a permanent magnet. The wire (B B) from the secondary coil is carried up to the top of the gas-burner and attached to platinum points, which are themselves secured to an ebonite collar, E; and the wires, W W, are connected throughout the whole series of lamps in the circuit with the magneto-electric machine at the office. When it is desired to light the lamps, a current is sent along the wire, W, to turn the gas on by causing the magnet, M, to move round in the direction that will bring one of its studs against the pin or lever in the gas-tap, and the motion being continued, the gas is turned "on." At the office is a condenser and a Ruhmkorff coil, by means of which a current is produced, which, when sent through the wires, W, sets up a secondary current in the coil, C, and produces a small spark at the platinum points just over the burner, which ignites the gas. When it is desired to extinguish the lamps, a reverse current is sent through the wire, W, which acting on the primary coil, causes the permanent magnet to turn on its pivot and bring its other stud against the pin of the gas-tap, thus turning out the light. The whole arrangement is attached to the gas-pipe by a socket, S, fitted with some insulating material; this socket opens into the frame, F, which is hollow, to afford a passage for the gas to the stop-cock, G. The plug of the latter is supported at its external end on the same pivot as that on which the magnet turns, and the annular space between the plug and its socket is filled with almond oil, which is not liable to be affected by ordinary frosts, and a film of which is sufficient to lubricate the tap, and seal the passage of gas. We have no details as to the cost of the apparatus, but as there is no longer any reason to doubt that it is a practical success, it will probably sooner or later supplant the lamp-lighter. It is well known that unless a great number of lighters can be employed, gas must be burned to waste in some parts of a district in order that the others may be lit at the proper time, so that where a man has a round that occupies an hour, some lamps must be lit half an hour before they are wanted, while those that come at the end of the journey often remain in darkness long after they ought to be alight. If the new system is applied to the whole of the lamps in the metropolis, the economy will be considerable, and will soon repay the first cost of the apparatus. It is said that it will be applied experimentally to



the lamps in Pall-mall, but the authorities of several of the large provincial towns are taking the question up in earnest, and some of them will probably lead the way to the general introduction of the new method of lighting gas-lamps.

NEW SYSTEM OF PILE-DRIVING.—The *Journal of the Franklin Institute* says that the Messrs. Stoecklin & Vetillart, in their works for enlarging the harbor of Calais, found great difficulty in sinking the piles and plankings through the fine, moist beach sand. The use of water to facilitate the penetration of broken iron piles suggested its use on the outside, and in advance of the wooden logs that they were using. By the use of two hand-pumps the sand was so loosened and held in suspension that the labor was greatly abridged. On the old plan an average of 185 blows was required to drive a pile, 900 blows for a panel, requiring, on an average, 8 hours and 36 minutes. With the help of water injection the number of blows per panel varied from 0 to 50, the mean time being only 1 hour and 9 minutes; many of the panels required only from 14 to 16 minutes, and the longest time was only 1 hour and 45 minutes. The extraction of displaced or broken piles or planking, which has hitherto been attended with great difficulty, is accomplished with the greatest ease by the new system.

Vienna Bent Woodware.

The growing popularity of this style of furniture, first brought to the notice of the American public at the Centennial, will doubtless give interest to a brief discription of the methods of making it. The industry, says the *Iron Age*, is conducted chiefly in Moravia and Hungary, but promises to become very general. Articles of this description are remarkable for their neatness, clean finish, light lines, great strength, and the fewness of their joints; this latter point being usually accomplished by bening the wood used so as to necessitate as few pieces as possible; thus, an ordinary chair contains, according to this method, only six pieces besides the cane seat, and is said to be an article which has no superior in its way. For this kind of furniture, beech is the only sort of wood used, it being found excellently adapted for the purpose. The trees being felled, the tops are removed and made into charcoal, for use in the glass works; the trunks are sawed into planks of suitable thickness by gang saws, and the planks are in turn ripped up with curcular saws into square pieces for turning. If intended for the back and hind legs of a common chair, which are composed of one piece, the square piece of proper length is put into a kind of gauge-lathe, which does its work very rapidly, and varies the size where needed. The ordinary dowel lathe is used for pieces of uniform size, such as the hoops, which are placed inside of the leg to stay them, instead of straight pieces of rungs, and the hoops are so placed that the feet cannot rest upon them. After being rounded as required, the wood is steamed in the green state for 24 hours, in boilers adapted to the purpose, when it is taken out and bent to the shape desired, on a cast-iron frame, by hand. If intended for the seat, the piece is first strapped with iron on its outside, so that the bending may be a process of compression, lengthwise, rather than an expansion. It is then attached by one end to a pattern fastened to a turn-table, the other end being held by a chain wound upon a drum, to which is applied a brake, so as to regulate the te on with which the piece is delivered to the pattern; the turn-table is then set in motion, and winds the wood on its own form. If designed for a scroll, the pattern may be complicated and in several pieces, which are put in place at the proper time in the progress of the rotation; for a double scroll, two of the tension bands are employed.

VELOCITY FOR CIRCULAR SAWS.—The *Manufacturer and Builder* says: That 9,000 feet per minute for the rim, on an average, may be laid down as a rule. For example, a saw 12 inches in diameter, 3 feet around the rim, 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, 750 revolutions; 5 feet in diameter, or 15 feet around the rim, 600 revolutions. The rim of the saw will run a little faster than this, because the circumference is a little longer than three times the diameter. Shingle and other saws, either riveted to a cast-iron collar, or very thick at the center and thin at the rim, may be run with safety at a greater speed.

AN IRON BUGGY.—An attempt has been made by an inventor, resident at Berlin, in the Maryborough district, Victoria, to introduce iron buggies into use. Mr. Alexander Jamieson has constructed a vehicle which consists exclusively of iron and steel. For instance, in place of hickory spokes and oak felloes, he has employed wrought-iron tubes and T iron. The tubes fit into the axle box at one end, and are riveted to the T iron at the other. The first noticeable effect of the employment of iron for all parts has been to add to the weight of the vehicle. This has accrued in spite of the thinness of the parts. The cost also has been enhanced. Strength and durability are regarded as a full equivalent for the increase of cost, and to belong to that form of expensiveness which proves cheapness in the long run.

BORING HARDENED STEEL.—In the "Journal suisse d'Horlogerie," 1877, p. 76, the following method is given: The drill is made oval pointed instead of having the usual form. It is hardened as much as possible without being burned. The surface of the steel to be drilled is next moistened with a little nitric acid, so as to make it a little rough. The drill is then applied and is from time to time moistened with oil of turpentine. Many workmen use instead kerosene or good rectified petroleum, in which previously a little camphor has been dissolved. When the drill acts no longer, clean the hole of chips with a little turpentine or kerosene and add nitric acid to roughen the smooth bottom of the whole, and proceed as before. This operation is, it is true, a little tedious, but it comes finally to the desired end and is the only safe way of boring hardened steel.

SIMPLE FORM OF BUNSEN BURNER.—*Dingler's Journal* says that this can be easily made of glass. A tube of glass, four or five inches long by one-third or one-half of an inch wide, is taken, and by blowing out the glass, heated at two points by the pointed flame, the air holes at the bottom are produced. The gas is introduced at the center of the bottom of the tube by an upward-bent glass quill tube, with the delivery end shaped like this cross ×, a form well adapted to mix the rising current of gas with the air. This tube is fastened to the lamp by a foot, made of plaster of Paris, in which it is embedded. A short piece of glass tubing may be fastened by a rubber coupling to replace fractures. This lamp is much better for the flame reactions than the ordinary metal lamps.

MACHINERY RUNNING AT NIGHT.—The *Manufacturer and Builder* has timed the revolutions of wheels and found them actually the same night and day, notwithstanding all present in the shop imagined that they run faster at night. The simple reason is that by the stillness of the night, the motion of ponderous machinery appears more rapid and heavier, while in the day time it is partially drowned by other noises:

ON ABSORPTION OF WATER BY THE ROOTS OF PLANTS.

THE relation between taking up water by the roots and evaporation by the leaves of plants has lately been made a subject of experiment by M. Jullien Vesque. He sought to determine by experiment the quantities of water absorbed with varying intensity of transpiration, and thereby obtain an answer to the question—whether the absorption increases in the same degree with the transpiration, whether the curves of these two functions are similar, or, if different, what is the nature of the difference? Also, what is the influence of changes of temperature. (His researches have been recently described in the *Annales Agronomiques.*)

The experiments were all made in darkness. The plants were placed with their roots in a glass cylinder 10 ctm. long and 15 mm. internal diameter. This had at its lower end a stopper with two openings—one for a thermometer, the other for a tube (furnished with a cock), through which water could be admitted from a higher cylinder. The upper end of the root cylinder was likewise closed with a stopper which surrounded the stem of the plant in a water-tight way, and also held a tube bent twice at right angles. The meniscus of liquid in this tube indicated, by its displacement, the quantity of water absorbed from the cylinder. The whole apparatus stood mostly in a water-bath, so that the temperature might be maintained constant. The air parts of the plant were contained in a glass vessel, which, above, had two openings—one for a thermometer, the other for a glass tube, which—closed at both ends with wadding—served to maintain atmospheric pressure in the interior. This vessel was also inclosed in a water-bath, which could be heated with steam. In the intervals of experiment the vessel containing the air-parts was opened. The water admitted to the roots was distilled water, with a small addition of chloride of potassium and sulphate of ammonia, or of nitrate of potash and nitrate of lime. All air-bubbles were, before experiment, carefully removed.

To test his apparatus M. Vesque first experimented with reference to the known fact that young leaves transpire more vigorously than old ones. He determined the water absorption by the roots of one and the same plant, when leaves of different age maintained the transpiration. The numerical results show that the relations between the surface of the leaves and the evaporation is quite masked by influences of another order, among which the age of the leaf takes the first place. More particularly, the author found, however, that it was not the very youngest leaves which transpired most vigorously, but that there is a maximum, which, in the case of *Helianthus tuberosus*, occurs with the eleventh leaf. The graphic representation of the numerical results shows clearly that, commencing with the youngest leaves, the transpiration quickly increases with the surface, but from the eleventh leaf onwards it becomes less, though the surface still increases. At the seventeenth leaf it becomes pretty stationary, though the surface goes on increasing to twenty-three fold.

The influence of changes of temperature was studied in both directions (rise and fall); and experiments were also made with dry air, and with air saturated with moisture, in which transpiration is impossible. In the case of dry air, the air round the upper parts of the plant was previously dried, and it was kept dry by means of two dishes of chloride of calcium placed in the inclosing vessel. A saturated atmosphere was obtained by means of saturated wicks and blotting-paper. The experiments led to the following conclusions:—

"In the action of heat two things must be distinguished. Independently of the action of each temperature supposed stationary the variations of temperature have a peculiar influence. The rapid *increase of temperature* produces *decrease of the absorption* by the roots; this decrease, of course, relates to the normal absorption corresponding to each temperature. Very often, however, the rise of temperature causes also an absolute retardation. On the other hand, a *lowering of temperature* causes *acceleration of the absorption* by the roots—an acceleration to which the same applies as in the case of retardation. These two modifications are independent of the state of density of the air. They are probably caused by the expansion and contraction of the gases in the plants."

These facts show that, in investigating the relation between the temperature of the atmosphere and the absorption of water by the roots, it is a very important condition that the temperature of the atmosphere be kept constant during the experiment. M. Vesque, therefore, in his further experiments, always made his measurements at constant temperatures. First, the absorption by the roots was determined in the case of the leaves being in an atmosphere as dry and dark as possible, protected from all action of radiant heat. In a second series the atmosphere surrounding the leaves was saturated with moisture, all other conditions remaining the same. Lastly, M. Vesque made a special series of experiments, with a view to ascertain the influence of radiant heat on the absorption by the roots. The upper portion of the plant was inclosed in a large balloon, which, besides the two openings which it had like the glass used before, had two opposite openings, through which passed a thick glass tube covered with moist blotting-paper. Through this tube was passed a constant current of steam, which acted as a dark heat source.

The general results of experiment are given in *résumé* thus:—

"The absorption of water by the roots is not proportional to the temperature of the leaves, if these are placed in an unsaturated atmosphere. At a low temperature it increases but slowly in proportion as the temperature rises, but at a certain temperature, fixed for each plant, the absorption increases rapidly; it becomes stationary at a temperature maximum, which is different in different species. The absorption of water by the roots is independent of the temperature of the leaves, when these are in an atmosphere which is saturated, dark, and protected against heat radiations.

How Bowlders Travel.

At a late meeting of the Edinburg Geological Society, Mr. Milne-Home stated that, in the course of a recent visit to Islay, he discovered at Port Askaig a large mass of claystone rocks forming part of the coast of the Sound of Jura, which, on examination, was found to be filled with pebbles and large bowlders of granite, of a kind not found in bulk nearer than the Ross of Mull, some 40 or 50 miles to the northward. An interesting question arose as to how these pebbles and bowlders had been brought to Islay, across a stretch of sea attaining the depth of 150 fathoms. The epoch when this took place must go far back beyond the bowlder clay, seeing that the claystone rock seemed to have been the bowlder clay of some period, which had become hardened. In Loch Creran, an arm of Loch Linnhe, he found, on a bed of detritus, about 200 feet above the sea, some bowlders of enormous size, consisting of a black granite, quite different from the gray granite of the neighborhood. The sharp points of the bowlders were all turned toward the mouth of the loch; and this suggested the probability that they had been floated in. Looking at the bearings, he found that they pointed to the island of Mull, and he had since learned from Prof. Judd that they were identical with rocks found in that island. It thus appeared that Mull had very likely been a centre of distribution. Mr. Judd had discovered that it had been an immense volcanic island, and he estimated that the top of the crater must have been at one time 10,000 feet above the level of the sea, though now, owing to denudation, the mountains were not more than 2,000 feet high. The bowlders found in Loch Creran, on sand and gravel, must have been floated thither at a comparatively recent date. Those in the claystone of Islay must have been transported at a much earlier period; and it is thus appeared that, during the epoch in question, there must have been in this part of the world a great current flowing from northwest to southeast, and conveying bowlders on floating ice.

THE USE OF ORNAMENT IN CONSTRUCTION.—At a meeting of an English engineering society Mr. R. Blunt read a paper on "The Use of Ornament in Manufacture," under which title he spoke of two correlative subjects, viz., the place and use of ornamental beauty in structure and design, and the manufacture of ornamental work for such purpose. Taking the first question, he contended for the encouragement, wherever possible, of ornamental beauty in engineering structural work, contesting and criticising Mr. Ruskin's law (as laid down in several passages quoted from his works) that all ornament or decoration whatever is unadmissable in places of business and active life, and is to be confined to the beautifying of home. Passing to the second question as to the use of machine-made ornament, Mr. Blunt defended the employment of such work in default of hand-made sculpture against the charges of badness and dishonesty which Mr. Ruskin alleged against it. He then defined the proper place and purpose of good ornamental work as completing and aiding to harmonize the effect of the whole structure, and, while strongly condemning all badly designed, made and placed ornament, of which he gave illustrations, pleaded that it was largely in the power of engineers and architects to decide whether they would aid by their work in the encouragement of what was beautiful in shape and proportion or the contrary.

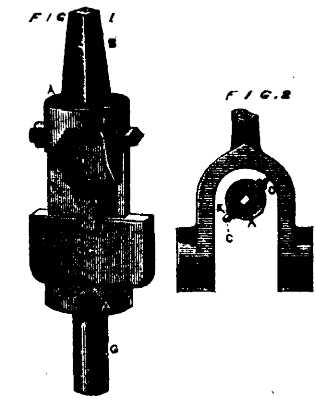
REMARKABLE SURGERY.—Robert F. Hurlbut, private secretary of Governor Bishop, of Ohio, has just had his tongue amputated near the root. The chin was sawed in twain and the jaws spread apart in order to take out the diseased tongue. The work was done in a comparatively short space of time, and the patient was comfortable and conscious in less than an hour. Next day Mr. Hurlbut walked across the room, and wrote his wants upon paper.

CAPTURING WILD HORSES. *Engraved for the American Agriculturist.*

It is generally admitted that the wild horses of our far Western plains descended from European stock. The term *Mustang*, applied to the wild horse in both South and North America, is a corruption of the Spanish *mesteño* (from *mesta*, pasture). In Mexico, and the portions of our territory bordering upon that country, the Mustang is still largely employed, though it is being rapidly replaced by better breeds. Large herds of Mustangs are found on the broad plains of the South-west, and their capture is still followed by both Mexicans and Americans. The usual method of capture is by the lasso, though sometimes, in favorable localities, they are taken by driving into an enclosure. The skill with which the Mexican throws the lasso, is often a subject of comment, but many Americans are quite as expert in this very useful accomplishment of the herdsman. In lassoing a wild horse, or other animal, the horse ridden by the hunter plays a most important part. The saddle is of great strength, and secured by girths correspondingly strong. One end of the lasso (usually 30 or 40 feet long), is made fast to the horn of the saddle, and when the rider makes his cast, which is done at a full gallop, and the noose falls upon the neck of the wild animal, the horse seems to take as much interest in the capture as the rider himself. When it is necessary to check the captive, the well-trained horse braces himself for the tussle, and renders essential aid. The writer traveled for some months in the region of wild horses, and though "sign" of various kinds was frequent, and our interest was greatly hightened by the wonderful stories told of them, not a drove, not even a single *caballo*, could we see, until at last the party concluded the wild horse to be a myth, and it was the subject of many a joke. Early one morning, a few days out from Corpus Christi, Texas, as we reached a crest of one of the great swells of the prairie, there were wild horses at last, and enough to make up for any former deficiency! As far as the eye could reach, were horses in every direction, in groups and droves—hundreds—no doubt thousands were in view at one time—a sight never to be forgotten! When we first saw them they were quietly grazing, but they soon saw us, and we then found that the wild horse was far from a "myth," and the meeting with them was very unlike a "joke." Perhaps the white covers of our train of a dozen or more 4 and 6-mule wagons attracted their curiosity, at all events they seemed to wish a nearer inspection, and down they came, in squadrons, regiments, and divisions, circling at full speed, nearer and nearer, their ample manes and tails giving an air of surpassing grace. We did not have long to admire the wonderful beauty of this scene. The mules, from their well-known sympathy with horses, became fairly excited, and soon were unmanagable. It was impossible to keep them in line, and though by firing at the wild horses with rifles and pistols, they took alarm and began to make off, the trouble then was that the mules would make off too! Then followed a "circus," compared to which the "Greatest Show on Earth" is a tame affair. Over 50 frantic mules, and a dozen or more equally frantic Texan teamsters, the mules with braying, trying to go in one direction, and the teamsters, with quite the reverse of praying, urging them to go in another, all emphasized by the *staccato* of the drivers' whips, might not be called a "Great Moral Entertainment," but was a very lively one. In the midst of it all, one team—to our mess wagon at that—got beyond all control, and went on a full jump for several miles after the horses, before fatigue brought it to terms. The droves of wild horses disappeared as strangely as they came, and when the line of march was resumed, all hands were willing to admit that there were wild horses, but that it was not a good plan to hunt them with a train of mule-teams.

THE COMING TRANSIT OF MERCURY.—A good deal of interest, says the *Independent*, is felt by astronomers in the transit of Mercury, which is to occur on the 6th of May and will be visible all through the United States. The observations of this phenomenon will have a considerable value, by themselves considered, as giving a very precise determination of the planet's place; thus furnishing a severe test of the accuracy of Leverrier's tables, and consequently of the reliability of his conclusions respecting an intra-mercural planet or groups of planets. But the chief importance of the observations lies probably in their bearing upon the observations of the transit of Venus. The optical appearances must be nearly identical in the two cases; and, hence, a transit of Mercury affords excellent practice in the way of preparation for the more important event. By the liberality of a French banker, who appropriated 30,000 francs for the purpose, Messrs. Andre and Angot, French astronomers of distinction, have been sent to this country, to make the necessary observations, and will take their station at Ogden, on the Pacific railroad.

PULSES BY TELEGRAPH.—*Appropos* to a lecture in England on the telegraphing of pulse beats the editor of the *Manufacturer and Builder* remarks: This reminds us of the pleasure we enjoyed when at the meeting of the American Association for the Advancement of Science, at Salem, Mass., in 1874, the different beats of the pulses of various patients in the Boston City Hospital were made audible by telegraph in Salem to a large audience. The difference of the pulses in patients laboring under attacks of pneumonia, phthisis, fever and ague, etc., was quite marked, and perfectly satisfactory to give data by which to recognize the disease. Making the vibrations also visible is a step in advance.



A NEW TOOL.

A new and very useful tool has of late been introduced into the marine engine manufactories of Glasgow, Scotland, and it is likely to find an extended field of usefulness, because it is capable of performing a class of work which is somewhat troublesome to manipulate and usually requires a great deal of hard finishing. With this new tool, however, most, if not all the hand manipulation can be dispensed with.

In our engravings, Fig. 1 shows the construction of the tool, which consist of the stock, A A, with the shank, B, made tapering to fit the socket of a boring or drilling machine. Through the body of the stock is a keyway or slot, in which is placed the cutter, C, provided in the centre of the upper edge with a notch or recess. Into this slot fits the end of the piece, D, which is pivoted upon the pin, E. The radial edge of D has female worn teeth upon it. F is a worm screw in gear with the radial edge of D. Upon the outer end of F is a square projection to receive a handle, and it is obvious that by revolving the screw, F, the cutter, C, will be moved through the slot in the stock, and hence the size of the circle which the cutter will describe in a revolution of the stock, A, may be determined by operating the screw, F. Thus the tool is adjustable for different sizes of work, while it is rigidly held to any size without any tendency whatever either to slip or alter its form. The pin, G, is not an absolutely necessary part of the tool, but it is a valuable addition as it steadies the tool. This is necessary when the spindle of the machine in which it is used has play in the bearings, which is very often the case with boring and drilling machines. The use of G is to act as a guide fixed in the table upon which the work is held, to prevent the tool from springing away from the cur and hence enabling it to do much smoother work. It is usually to make the width of the cutter, C, to suit some piece of work of which there is a large quantity to do, because when the cutter is in the centre of the stock both edges may perform cutting duty; in which case the tool can be fed to the cut twice as fast as when the cutter is used for an increased diameter, and one cutting edge only is operating. The tool may be put between the lathe centres and revolved, the worked being fastened to the lathe saddle. In this way it is exceedingly useful in cutting out plain cores in half-core boxes.

In addition to its value as an adjustable boring tool this device may be used to cut out sweeps and curves, and is especially adapted to cutting those of double eyes. This operation is shown in Fig. 2, in which D is the double eye, A is the tool's stock, F is the adjusting screw, and C is the cutter. The circular ends of connecting rod strips and other similar work also fall within the province of this tool, and in the case of such work upon rods too long to be revolved, this is an important item, as such work has now to be relegated to that lowest and most unhandy of all machine tools, the slotting machine. The tool was invented by one of the engineers of the Transatlantic steamships, who unfortunately neglected to patent it.—*Scientific American.*

The value of Peter's pence and other offerings made to Pius IX. amounted to no less than $95,000,000 in all.

Treating flannel goods with high pressure steam is recommended as a means of preventing the subsequent shrinkage by washing.

CURE FOR HYDROPHOBIA.

Two Russian doctors lately treated the case of a girl twelve years of age, who had been bitten in the hand by a mad dog. The wound was cauterised immediately with nitrate of silver. In eight days the cicatrisation was complete. Seventeen days after the bite the first symptoms of hydrophobia appeared. The doctors prescribed inhalation of 3 cubic feet of oxygen. The effect was immediate, and in two hours and a half the patient was quite calm. Two days after fresh symptoms of the malady occurred (difficulty of swallowing and breathing, convulsions, etc.) A fresh inhalation of oxygen for forty-eight minutes again counteracted these. There remained only a slight difficulty of breathing, and this was overcome by means of monobromide of camphor, the use of which was continued for three weeks. The girl recovered perfect health with the exception of having aphonia—a morbid consequence of diphtheria.

BELL METAL ALLOYS.

Edward Kirk in his articles on the founding of alloys in the *Iron Age*, gives the following notes on bell-metal: One hundred and forty-four pounds copper, 53 pounds tin and 3 pounds iron, is said to make a superior bell. Iron, copper and tin do not unite well, if each is added separately to the other, but if tin-plate scraps are melted in a crucible together with tin, and then this tin and iron alloy added to the molten copper, it will unite readily.

Another alloy that is highly recommended is composed of 53.5 parts copper, 6.11 parts tin 2.13 parts lead and 3.9 parts tin. This alloy has a good, sonorous sound, even if the mould is not thoroughly dry.

House bells are made of 4 pounds tin to 15 pounds copper.

Soft musical bells are made of 3 pounds tin to 16 pounds copper.

Common bell metal consists of 50 pounds copper to 15 or 20 pounds tin.

The silver bells of Rouen, France, consist of 40 pounds copper, 5 pounds tin, 3 pound zinc and 2 pounds lead.

Too much tin causes bell metal to be brittle.

The gongs or cymbals and tam-tams of the Chinese are composed of 40 pounds copper to 10 pounds tin. To give these musical instruments their proper tone, they are plunged in cold water while hot after being cast; cooling in water deprives the metal of almost all its sound. It is tempered and very slowly cooled, which imparts to it that peculiarly powerful sound.

If bell metal is suddenly cooled, it becomes less dense and hard, and is increased in maleability, but the tone of the metal is decidedly impaired, and bells ought never to be cast in damp moulds. When bells are cooled suddenly they should be reheated and tempered by cooling slowly.

Singular Property of Tomato Leaves. — "I planted a peach orchard," writes M. Siroy, of the Society of Horticulture, Valparaiso, "and the trees grew well and strongly. They had but just commenced to bud when they were invaded by the curculio (*pulgon*), which insects were followed, as frequently happens, by ants. Having cut some tomatoes, the idea occurred to me that, by placing some of the leaves around the trunks and branches of the peach trees, I might preserve them from the rays of the sun, which were very powerful.

"My surprise was great, upon the following day, to find the trees entirely free from their enemies, not one remaining, except here and there where a curled leaf prevented the tomato from exercising its influence. These leaves I carefully unrolled, placing upon them fresh ones from the tomato vine, with the result of banishing the last insect and enabling the trees to grow with luxuriance. Wishing to carry still further my experiment, I steeped in water some fresh leaves of the tomato, and sprinkled with this infusion other plants, roses and oranges. In two days these were also free from the innumerable insects which covered them, and I felt sure that, had I used the same means with my melon patch, I should have met with the same result. I therefore deem it a duty I owe to the Society of Horticulture to make known this singular and useful property of the tomato leaves, which I discovered by the merest accident."

The oyster fisheries of the United States yielded in 1876, $50,000,000; the cod, $4,825,540; whale, $2,241,000; mackerel, $2,375,262.

Nitro-glycerine has been used in breaking up ice in the St. Lawrence with success.

CLEANING CLOCKS.—Common brass clocks may be cleaned by immersing in boiling water. Rough as this treatment appears, it works well whenever they stop from dust or thickening of oil upon the pivots. Boil in rain water, and dry in a warm stove.

THE Alaska waters contain more salmon than all the other waters in the known world. Within a few years salmon canneries will be established along the Alaska coast. Already the Pioneer cannery of Alaska has been located at Klawank, on Prince of Wales Island.

TO REMOVE FRECKLES. — Grate horseradish in a cup of cold sour milk; let it stand twelve hours; strain and apply two or three times a day. Or mix lemon juice, one ounce; pulverized borax, one-quarter drachm; sugar, one-half drachm; keep a few days in a glass bottle, then apply occasionally.

LIME IN THE EYE.—The evil effects of lime in the eye are well known, plasterers and whitewashers not unfrequently having their eyes seriously injured, if not destroyed, by the caustic power of the lime. Wells says: "If the patient is seen soon after the accident, an effort should be made at once to neutralize and wash out the lime by a weak solution of vinegar, with a free use of the syringe. Afterwards, cooling and anodyne lotions and general antiphlogistic treatment should be adopted."

DEATH FROM AN ORANGE SEED.— A short time ago, says the *Journal of Chemistry*, an only daughter of a physician in Cambridge died, with symptoms of the perforation of the bowels. It was found than an orange seed was lodged in the appendage called "appendix cæci vermiformis," which is about the size of a goose-quill. This produced a perforating ulcer that allowed the escape of the intestinal contents. Inflammation ensued that could not be controlled. No doubt thousands of orange seeds are daily swallowed, but this case shows the need of caution, and the tremendous power that resides in our food for evil as well as good.

COAL TAR FOR FLESH WOUNDS. — Mr. F. D. Curtis informs the New York *Tribune* of what he considers the best application for any and all flesh-cuts and raw sores. It is gas coal-tar, which may be had at any gas-works where gas is made from coal. A barrel of it, costing $2, has been in use at the Kirby Homestead for ten years and is not half gone yet. Coal tar, when applied to a flesh-cut, shuts out the air and thus stops the smarting; it will also keep off the flies; it is very healing, and it is antiseptic, that is, cleansing, and will prevent the growth of proud-flesh. It is the cheapest, most healing and best application we have ever used. I have tested this remedy for several years on all sorts of cuts and sores with the most gratifying and successful results. It was an experiment at first, but now it is a necessity.

WHAT TO DO FOR CROUP. — *Hall's Journal of Health* says: Croup is so common a disease among children that it requires no description; it affects the windpipe. As it attacks suddenly most often in the night, and as an hour's time may be all the difference between life and death, it is proper to state the most reliable course to be pursued *until a physician be obtained.* 1st. Keep the feet warm by having a jug of hot water kept against them; let them also be well wrapped up in woolen flannel. 2nd. Have a bucket of water almost as hot as the hand can bear. Have two pieces of woolen flannel of several thicknesses, one being on the throat while the other is in the hot water, renew every two or three minutes, until relief is given or the physician arrives. The water in the bucket must be kept hot by the constant addition of boiling water.

SUBSTITUTE FOR SLATE.—The new composition proposed by Mr. J. A. Ditch, of Hastings, England, consists in mixing the various materials, or their chemical equivalents, in the proportions or thereto, as hereinafter mentioned, for the purpose of providing, when applied as a coating to any convenient and suitable substance, a substitute for slate for building, writing, and other purposes. The mixtures and proportions for coating substances for exterior work are—One quart of methylated spirit or its equivalent, ½lb. gum shellac, ½lb. flour of emery. For coating substance to serve as writing slates, add powdered glass, rotten stone, or pumice stone, together with lamp black or Paris green sufficient to give the desired shade of color. Other powdered substances, such as chalk, brick, slate or stone, may be used for the purpose of giving a body or a braiding surface to the composition. A convenient way of making writing slates is to coat millboard with the new composition, frame the board, and mount it on an easel so arranged that it can be closed and shut up when not in use.

SMALL tubular boilers, set in the carved wooden cases and heated by parlor lamps, are now sold for sewing machine motors. The apparatus connecting the boiler with the machines has but three pieces, and is very simple.

THE experiments made with the new glass type has turned out well. The type wears a long time, is easy to keep clean, and gives a clearer impression than metals. Little change is required in the type founders' mould or machinery.

THE heat produced during the burning of fuel is given out when the carbon of the fuel unites with the oxygen of the air, and carbonic gas is produced, as it is by the breathing of men and animals. This poisonous gas usually passes up the chimney.

THE *Lancet* thinks that the most interesting physiological discovery of the year is that made by Boll, of the red color which the retina has in health, and which is constantly destroyed by light and renewed by the ordinary processes of nutrition.

PROFESSOR Newcomb says: "So small is the earth, compared with the celestial spaces, that if one should shut his eyes and fire at random in the air, the chance of bringing down a bird would be better than that of a comet of any kind striking the earth."

PROFESSOR Balfour Stewart, who is one of the highest living authorities on the subject of sunspot, frankly says that it is nearly if not absolutely impossible, from the observations already made, to tell whether the sun is hotter or colder as a whole when there are more spots on his surface.

INCORRODIBLE Ink.—A black ink, claimed not to corrode steel pens, and neutral, is prepared by digesting in an open vessel 42 ounces of coarsely powdered nutgalls, 15 ounces of gum senegal, 18 ounces of sulphate of iron (free from copper), 3 drachms of aqua ammonia, 24 oz. of alcohol, and 18 quarts of distilled or rain water. Continue the digestion until the fluid has assumed a deep black color.

THE under-drainage is strongly recommended for orchards, vineyards and gardens. The cost of tiles for under-drains varies according to the size of the diameters. Two-inch tiles are worth about $12.50 per thousand feet; three-inch tiles about $15. The experiments made in many parts of Ohio and Illinois prove that the value of almost every grade of soil can be increased from fifty to seventy-five per cent. by under-drainage alone.

THE inference that the telephone would probably work best when the membrane is slanted toward the source of sound, has been drawn from the fact that the drum of the human ear is inclined at a considerable angle to the axis of the outer ear passage. *Nature* mentions an instance in which this notion was justified by actual experiment on the part of a gentleman who found "that his telephone worked best when he spoke to it in a slanting direction."

THE opinion that the land which surrounds the North Pole is undergoing a general movement of upheaval is confirmed by the published observations of Mr. H. W. Feilden, naturalist to the recent British Arctic expedition; or, rather, as he says, we find evidence that there has been an upward movement since any subsidence took place. Mr. Henry H. Howorth is mentioned as having originally advanced the view that the surface of the North Polar region is gradually rising.

AN invention that promises to considerably cheapen railroad construction, is of iron bent at right angles and riveted upon wooden stringers; and the advantages claimed from it over the old T rail are less weight, greater elasticity, and the consequent saving of wear and tear of rolling stock. The chief economy of this rail lies, of course, in the greatly reduced weight of iron required for the building of a road, and it would seem to be especially calculated for narrow guage railroads, and indeed all railroads upon which the traffic is not extraordinarily large.

NO IMPROVEMENT has been effected in the quality of coal gas supplied to the city of London within the past quarter of a century. According to Dr. E. Frankland, the well-known chemist, it appears better because it is tested with improved burners, but, in fact, when burned in those generally used, it gives no more light now than it did in 1851. From the recent published researches of the same chemist, it appears that the celebrated Davy safety lamp cannot be introduced into mixtures of air and coal gas without liability to explosion.

A New Brick Kiln.

A new brick kiln was recently tried at Normanton, the advantages claimed for which are economy in fuel and labor. The kiln is 108 ft. long and 8 ft. broad. The raw bricks are set direct from the making machine upon iron wagons, which carry them through the entire length of the new kiln and bring them out at the exit end baked, which saves much of the usual handling. The fires are placed in the middle of the kiln, at each side, and the draught of hot air travels toward a flue or chimney at the entrance end. By this means the bricks are gradually baked before reaching the fires, and after passing the intense heat of the central section they have time to cool before being drawn out at the receiving end, where the burnt bricks can at once be thrown into carts and railway wagons or stacked. The barrows, of which nine are in the kiln at one time, are coupled together, and the action of drawing one out advances each of the succeeding eight a stage, while at the same time pulling in a newly loaded one at the other end. Each wagon holds about 5000 bricks, making 45,000 in the kiln at once, or a total weight of about 300 tons. The wagons are made so as exactly to fit the breadth of the kiln, and, excepting the usual spaces left for the equal penetration of the heat through the entire mass, the bricks are piled upon each wagon to a height of 7 ft., thus filling up the whole space of the arch through which they pass. The iron of which the lower parts of the wagons are composed is preserved from injury through the heat, not only by the fires being on a higher level, but by a superposed layer of fire-bricks and by a current of cool fresh air being secured under the wagons. By means of Mr. Foster's present appliances, which may be still further improved, a load of 5000 finished bricks can be drawn out in five minutes; but a period of four or six hours in the kiln is required before the bricks are sufficiently burned and then cooled enough to be taken out. It is said that the cost for fuel for burning 1000 bricks by this new process is under 3d., and certainly the utilization of heat seems to be in every way complete. No work, says the Leeds *Mercury*, is required inside the kiln; and there are no wickets to build or plaster, the doors being closed at each end after the passage of a wagon until it is time to send in and discharge a fresh load.

Every Day Uses of the Telegraph.—Telegraphy is the great time-saver in all business transactions. It may be used not only for these purposes, but also in those pertaining to domestic economy. For instance, the Duc de Montpensier has, it is said, attained great proficiency in this direction. Telegraphic communication connects every door in his mansion, and the duke can, whether he be in the boudoir, the library, or —Guy Fawkes like—in the cellar, tell when a door opens, and which one it is. Indeed, the system does not end here, for when more than one person of average physique crosses the vestibule the door-mats are so sensitive that the signals are proportionately doubled everywhere, and the duke is made aware that a pair has entered. If the gentleman lately occupying the luxurious chambers in Ludlow street ever visited the veteran statesman during his Spanish peregrinations, we suppose the signals were increased indefinitely, for Spaniards have not the privilege of entertaining men of his status every day. However this may be, it only shows us how much can be done with telegraphy. Every well-ordered hotel has a telegraphic call in each chamber, and our merchants are using it extensively. Bradstreets, with commendable enterprise, have no less than twenty-five branch offices in the city, each with direct wires to the head office. Those who can afford to do so should introduce telegraphy as a means of communication between every part of their household. This is coming, and it will not be long before an electric system of communication will be as necessary in warehouses and well-appointed dwellings as speaking-tubes and bell-wires.—*Iron Age.*

How British Commerce helps British Manufactures.

In an able review of the condition and prospects of the British Empire in the *Nineteenth Century*, Sir Julius Vogel incidentally points out one secret of England's command of the carrying trade of the world, and the importance of that trade to the prosperity of her mechanical industries. The groove into which the conduct of England's shipping has fallen supplies one of the largest systems of trade protection and bounty that has ever been in operation. The whole principle on which the English shipping trade with other countries is conducted is to make the homeward freight supply the profits. On the outward route a bare return to cover expenses, and sometimes not even that, is submitted to, the homeward voyage to make the whole trip a profitable one. For instance, a ship carrying out a $100,000 cargo, makes for her outward freight $12,500. She will under ordinary circumstances make at least $25,000 on the way home, or $37,500 on the entire trip.

If this were equally divided there would be a return of $18,750 each way; the difference between that amount and the sum actually received on the outward route is $6,250, and that is so much bounty to the cargo carried out, or 6¼ per cent. And the same amount may be added as an impost on the homeward freight. This system has arisen accidentally; nevertheless it greatly helps England's exterior trade, the prosperity of which has been largely due to her control of the merchant marine. It will be readily seen how critical would be England's position in case a foreign war should seriously interfere with her commercial supremacy. England is now one vast industrial concern. Deprive her of the means of making that industry profitable, and the loss of wealth would be as rapid as the previous gain.

THE Kansas City *Price Current* says that the drive of Texas cattle this season will reach fully three hundred thousand head in good condition, and they will reach their destination much earlier than last year. Eighty-five thousand head of cattle in Southern Kansas will be ready to go to market by the middle of June.

Glass Type.—*La Patrie* reports favorably on some French experiments to substitute hardened glass for type metal. It is stated that the type-founders' molds and machinery can in general be used without further change. The new types, made of glass, preserve their cleanliness almost indefinitely; they are said to wear better than metal, and they can be cast with a sharpness of line that will print more distinctly than is possible with the old type. There will be also the advantage of an absence of half-defaced letters, since it is a peculiarity of the hardened glass that as soon as it is broken at all, it crumbles altogether. But as transparency will not be required in glass used for this purposes, it is believed that a toughness extraordinary, even for the hardened glass, can be secured. —*Tribune.*

THE narrowest railroad in the world is between North Billerica and Bedford, Mass., a distance of 8½ miles. The track is 10 inches wide. The engine and cars are proportionate with the width of the track. The passenger cars have an aisle in them and a seat on each side, instead of two seats, as a full-grown car. There are 30 seats in each car. The train runs 12 miles an hour; one grade on the road is 155 per mile. The trains consist of two passenger and two freight cars and an engine. The cars and engines have air brakes and all the modern improvements. Ordinary cars weigh four time as much as these little coaches. The cost of the road is $4,500 per mile, and the running expenses are stated to be about one-fourth those of ordinary trains.