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MODERN SUSPENSION BRIDGES.

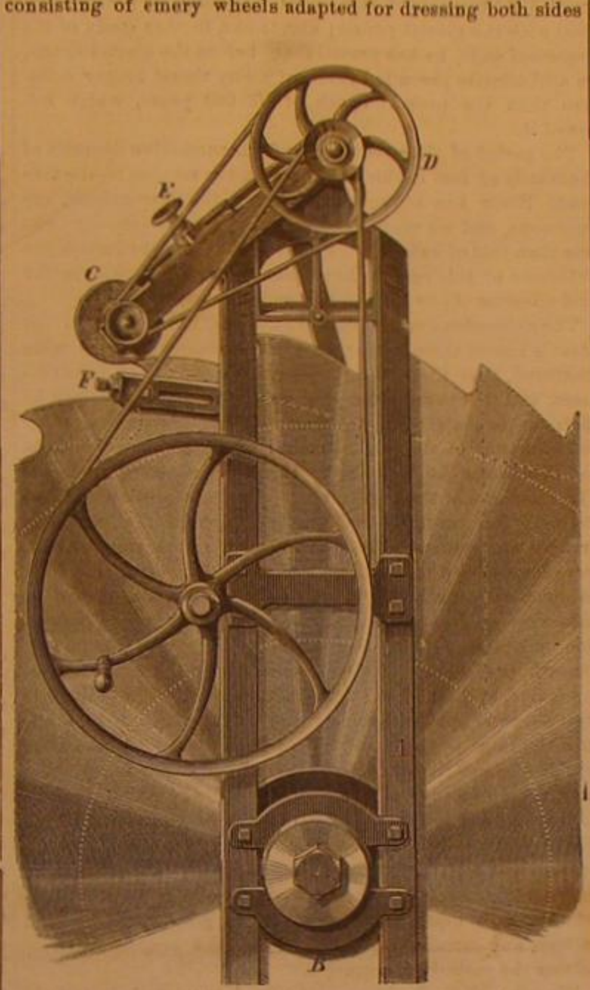
At Kiev, one of the most ancient towns in European Russia, and for centuries the recognized capital of the whole empire, is one of the most graceful and solid bridges ever erected. The roadway is perfectly level, being suspended from catenary chains of great strength which hang between the piers, of which latter there are five. Although the dimensions of these spans have been far exceeded in many bridges in the country, it will be admitted that the architect of the Kiev bridge has united, to a form of construction exceedingly difficult to treat with any artistic effect, a picturesque and imposing appearance.

Although we are accustomed to consider the suspension bridge as one of the triumphs of modern engineering skill, it is really one of the oldest forms of bridge construction in existence. In the year A.D. 65, Ming, the Emperor of China, built one in the province of Yun-nan; it was 330 feet long, and the road bed was laid directly on chains suspended across the river and drawn comparatively taut. In the time of the Incas of Peru, suspension bridges across the defiles of the Andes were made of ropes of the bark of trees; a roadway was in some places constructed, and in others a basket was drawn to and fro. The latter plan is in use in that country in this day. The iron suspension bridge was not brought into use till the year 1819, the first being the bridge at Berwick-on-Tweed, England. The roadway was hung to 12 cables, and the span was 449 feet, a considerable distance for a first attempt. Telford's bridge over the Menai Strait has a span of 580 feet. The Conway bridge by the same engineer, 327 feet, and Tierney Clark's bridge over the Thames at Hammersmith, London, 422 feet, were considered marvels of engineering in their day; but the wire bridge at Fribourg, Switzerland, with a span of 870 feet, eclipsed all previous achievements. But of late years, suspension bridges have been numerously constructed, and we have ceased to marvel at the dimensions they assume. The Cincinnati bridge has a clear span of 1,057 feet; and the most remarkable of all the suspension bridges yet designed, the New York and Brooklyn, is to have a span of 1,595 feet, the whole bridge being 3,475 feet long.

It must be considered that the bridges of the future, for long spans, will be constructed on the suspension plan. The great superiority of the iron and steel of the present day, and the improved facilities for turning out large masses of these metals, make it impossible to limit the capability of bridge constructors to defy the difficulties which Nature has placed in their way; and every year shows us fresh achievements in the art of engineering the way over crevasse, canons, and defiles.

J. AND J. A. CROOK'S SAW SHARPENER.

The annexed illustration represents a new saw sharpener consisting of emery wheels adapted for dressing both sides



of the teeth and gumming the saw. It is claimed that by the use of the device the saw is kept perfectly circular, and the teeth equidistant and of similar shape. The saw, it is further stated, will last longer, since no more metal is used than is necessary (see dotted lines in the engraving). The employment of files is obviated, the teeth are cut square across, and the work is done in one half the time usually required.

The radius bar, A, is provided with adjustable bearing pieces, B, which fit on the saw collar. At the outer end of the bar, a frame is pivoted which carries the grinding disk, C, and also, on the same mandrel, not shown, a smaller disk. These are turned by the belt from the pulley, D, which is actuated by the driving pulley on the radius bar. The pivoted frame swings toward and from the teeth, and has a spring which tends to keep it away from the latter. It has also a gage screw, E, which touches a stop when the teeth are dressed off sufficiently, and thus gages them to uniform sizes. Another gage, F, regulates the depth of the notches when gummed out by the small grinder. Both of these gages are adjustable to adapt the machine to different saws.

The large emery wheel, C, serves for dressing the teeth on the top, and the small one dresses the under or concave side of the teeth and gums the saw plate. Said wheels are adjustable lengthwise on their axis to adapt each for being located in the desired position relative to the saw. They are clamped in place by means of collars which are screwed along the mandrel. When the small wheel is used, the gage screw, E, is screwed back sufficiently to let the wheel drop into the notches, to the required extent. The stop for the gage screw is contrived so that the frame may be shifted over to the opposite side of the axis, as may be sometimes required for saws having the teeth arranged reversely to the direction of the same shown in the engraving. The driving wheel, gage, F, and a spring cam lever—which swings down on the opposite side of the saw and over a cam to hold the radius bar to the side and on the collar—are also arranged to shift in the above manner and for like purposes. The grinders are pressed on the teeth, and the radius bar is moved forward and backward along the teeth by one hand, while the crank is turned by the other hand.

Patented through the Scientific American Patent Agency, January 5, 1875. For further particulars regarding sale of State rights, etc., address the inventors, Messrs. J. and J. A. Crook, Augusta, Carroll county, Ohio.

PREVENTING SUFFOCATION IN THE EARTH.—M. A. G. suggests that, in cases of men being accidentally buried in the earth, who frequently survive some time before completely suffocated, iron pipes, of the sort used for drive wells, should be driven down just at the edge of the soft earth until the proper depth is reached: when, by the application of a pump at the top, an abundance of fresh air could be forced down to sustain life until the men could be rescued by digging.

SUSPENSION BRIDGE OVER THE DNIEPER AT KIEV RUSSIA

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VOLUME XXXIII., No. 17. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, OCTOBER 23, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE GEOLOGICAL IMPORTANCE OF OUR WESTERN EXPLORATIONS.

In no period of the world's history has there been a greater activity displayed in enterprises to increase the knowledge of our globe and its history than at the present day: as instances of which may be cited the explorations in Central Africa, those of the ruins of the cities of antiquity, such as Nineveh, the expeditions to the north pole, intended for settling the mystery of an open polar sea, the deep sea soundings in the Pacific Ocean, proving the existence of a sunken continent, and, last but not least, American explorations in the Great West, now in progress, which have already contributed to our knowledge of geology facts of greater importance than any obtained during the previous half century. It is especially in the region of the Yellowstone River, abounding as it does with hot springs and geysers, and in the valley of the Colorado, that the most instructive features have been discovered. While, in the last few decades, the importance and universality of slow upheavals have been demonstrated, the explorations have shown that a second agent, namely, erosion, is of the utmost importance, and results in a variety of features, varying with the nature of the soil, the climate (wet, dry, or rainless), presence or absence of winter frosts, etc.

In Colorado, the erosion by the rivers produces cañons in the comparatively easily worn-out rock of thousands of feet in depth; while the aridity of the climate prevents the rain from destroying the results of the erosion, as is the case in countries where rainfall is of ordinary occurrence. It is evident, therefore, that the arid regions around the Colorado river give specially favorable opportunities for studying the effects of erosion, and the recent researches in that country have resulted in classification of these effects, as 1, the erosion of water gaps, 2, the cliff erosion of cañons, 3, hogback erosion, and 4, hill and mountain erosion. The second and third classes are due to the undermining action of water in arid climates; while in the first and last, this action is modified by surface washings in rainy or moist climates.

When another topographical feature is added, namely, the eruption and outpouring of molten matter from below, its overflow covering the eroded lands, and its subsequent erosion in its turn, a new field of investigation is opened, especially instructive in arid climates, where surface washings do not destroy the prominent points of interest. This makes the region of the Colorado particularly rich in peculiar features, such as cañons and cañon valleys, volcanic cones and volcanic mountains, cliffs and hogbacks, buttes and plateaux, naked rocks and drifting sand, bluffs, valleys, etc. All the mountain forms of this region are due to erosion, being carved out by the running waters; but notwithstanding the aridity of the climate in many localities, beds hundreds of feet in thickness and hundreds of thousands of square miles in extent, beds of schist, granite, limestone, sandstone, scale, and lava, have slowly yielded to the unseen powers of the air, crumbled away into dust, and been washed away by the rivers. It is an illustration on a gigantic scale of the return of the lands to the ocean depths from which they once arose.

It appears, however, that the climate there has not always been so arid as it is now; so the basin of the Great Salt Lake, which is now so depressed that its waters have no outlet to the sea and are entirely disposed of by evaporation, leaving all dissolved matter behind, had once a moist climate and so much rain that the valley was filled with water to its brim, forming a large and deep fresh water lake, which had its outlet into the Columbia River. Mr. G. K. Gilbert, who studied the features of this outlet, considers its epoch identical with the glacial period; and from a further study of the deposited soils, he has proved that, before the glacial epoch, an arid climate prevailed there of many times longer duration than the present epoch of 100,000 years, which followed it.

The period of time required to form successive deposits of thousands of feet in thickness, which the erosion of the Colorado River has brought to light, in its deep cañons, are enormous, and we cannot suppose that here the erosion was less than that of other rivers, although in moist climates the evidences of this erosion have been destroyed; while in the arid climates of our West, they were preserved.

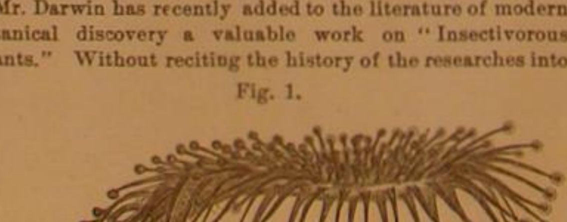
The evidences are that that region was lifted up from the ocean's bosom three times; that three times the rocks were fractured, that three times the lava poured out of the crevasses, and that three times the water carved out valleys in their course seawards. The first of these periods was after the formation of the granite rocks: the second succeeded the red sandstone formation; the third period is the present. The remnants of the first and second periods are buried; but we know that, unnumbered centuries ago in the past, the granites and schists, now on the bottom of the grand cañon, were formed as a sedimentary bed beneath the sea, that then an upheaval took place, after which thousands of feet of beds were washed away in the sea by rains; then a depression took place, sinking the whole region some 20,000 feet beneath the ocean's surface, and allowing the formation of sandstone, at least 10,000 feet in thickness, as a sediment; then a second upheaval came, changing it again into dry land; then the rains washed away channels in the sandstone 10,000 feet deep, requiring countless years of gentle but unrelenting energy. Again the sea rolled over the land, which became its bottom, and received a new deposit of more than 10,000 feet of rocky bed; and lastly, this ocean bed was again upheaved, and for 100,000 years the atmospheric influences and the running streams, gathered from the clouds in the highest mountain tops, have been making gorges, cañons, and valleys, and carrying the *débris* back to the sea, from whose bottom the material all came.

We ask: Will the sea, at some future period, invade that land, by the sinking down of the latter, and will coral reefs be formed, and serve perhaps for the burial of the bones of the beings which shall then exist? Will the surrounding continents or islands be washed into that sea and form new beds of rock, which, when again upheaved, will form a new land, and cañons again be formed, and reveal in their walls, to another race of intelligent beings, some of the features of the time in which we live at present?

CARNIVOROUS PLANTS.

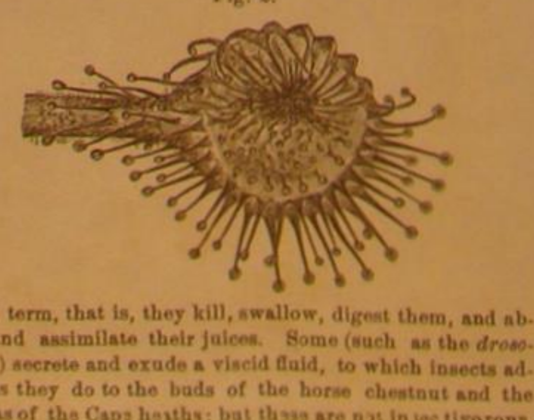
Mr. Darwin has recently added to the literature of modern botanical discovery a valuable work on "Insectivorous Plants." Without reciting the history of the researches into

Fig. 1.



this interesting subject, which has already been fully treated in our columns, we will simply state the author's broad proposition, which, coming from such an undoubted authority, must be considered as a final settlement of theories which were, till recently, still undergoing investigation. This proposition is that certain plants, chiefly the *droseraceæ* or sundews, devour insects in the ordinary acceptation

Fig. 2.



of the term, that is, they kill, swallow, digest them, and absorb and assimilate their juices. Some (such as the *drosophylla*) secrete and exude a viscid fluid, to which insects adhere as they do to the buds of the horse chestnut and the corollas of the Cape heaths; but these are not insectivorous. But the *drosera rotundifolia* shows a higher organization, being endowed with sensitive tentacles, of which we give a representation in Fig. 1. Each of these tentacles terminates in a knob, from which issues a glittering secretion, on account of which the plant has been called the sundew; and each tentacle can bend over towards its prey, either independently of or conjointly with the adjacent tentacles. Fig. 2 shows one half of the tentacles bent over and the other half erect. Almost any kind of interference with the tentacles, such as lightly touching them, placing inorganic substances upon them, or especially putting organic matters (particularly such as are nitrogenous) on them, will set the sundew in motion; and the more soluble the matter enfolded by the tentacles, the longer do they remain inflected over it.

In our third engraving are shown the magnified cells of the tentacles, exhibiting the various forms assumed by the

Fig. 3.

protoplasm. Mr. Darwin says: "If a tentacle is examined some hours after the gland has been excited by repeated touches or by inorganic or organic particles placed on it, or by the absorption of certain fluids, it presents a wholly changed appearance. The cells, instead of being filled with homogeneous purple fluid, now contain various shaped masses of purple matter, suspended in a colorless or almost colorless fluid; and shortly after the tentacles have re-expanded, the little masses of protoplasm are all re-dissolved, and the purple fluid within the cells becomes as homogeneous and transparent as it was at first."

Mr. Darwin's investigation also comprised an elaborate study of the digestive apparatus of the plants, and of the secreted fluids, which, beyond any doubt, perform the functions of the gastric juice and of a kind of pepsin, the latter being necessary to the complete direct assimilation of animal matter to a vegetable body.

THE FAIR OF THE AMERICAN INSTITUTE.

There is an ingenious device in a rather out-of-the-way corner of the fair, which will prove interesting to owners of horses, inasmuch as its object is to benefit the animals in a variety of ways, and principally by protecting them from negligence on the part of stable men. It is

AN AUTOMATIC HORSE FEEDER,

consisting of a simple clock, the works of which are connected by a cord with the hinged bottom of a grain hopper or water receptacle. At certain hours to which the clock mechanism is adjusted, the cord is slackened, and the bottom of the hopper or water vessel falls, allowing of the escape of the contents into the manger. This escape takes place for a certain time, regulated by suitable mechanism, so that a certain quantity of material is measured out, and then the bottom shuts, preventing a further supply. The horse is thus fed at exact hours and given a previously determined amount of food and water, without the intervention of the stable people, or requiring any other care than the timely winding of the clock.

BURGLAR ALARMS

in great variety are exhibited. The simplest is one which travelers can carry in their trunks or even pockets, and which will be found an excellent protection against the entry of thieves into an hotel room. It is a small wedge-shaped case of metal, containing a gong, the hammer of which is actuated by clockwork. The latter is wound, and the device is placed on the floor with the edge of the wedge just in front of the door. When the door is opened, however gently, from the outside, it strikes against the wedge, and suitable mechanism therein frees the spring of the clock train so that the gong is loudly and continuously sounded. The noise is sufficient to arouse the soundest sleeper. The invention might easily be adapted for windows as well as doors.

A NEW INDUSTRY

bids fair to be set on foot, through the utilization of the fir and pine tree leaves. Mr. Charles Fulton has devised a process by which the coherent parts, such as resin, wood, tannin, etc., from the fibers of the needles or acicular leaves, are dissolved and removed by boiling in suitable chemicals. The result is a substance resembling cotton, or perhaps more nearly wool, of a dark greenish brown color. It is prepared in four qualities, adapted for stuffing mattresses, pillows, etc., and for weaving. For the latter purpose, the fibers of the material are separated and treated in machines similar to fulling mills. Other processes follow, which result in the production of an excellent thread, which can be woven alone or mixed with wool, cotton, silk, or other fibers. Cloth of very close and fine texture is exhibited, made of the thread. It is soft and pliable, and resembles a fair quality of flannel. There is an enormous amount of raw material for this manufacture in the country, which now is of no value, and which can be obtained at simply the cost of transportation. By the process above described, it is rendered available both for textile and for paper industries, and hence may form a new and valuable supply.

The needs of dwellers in the narrow quarters of our city flats must be uppermost in the minds of inventors, if we may judge from the quantity of

COMBINATION FURNITURE

that is displayed. We spent an amused half hour in watching agile exhibitors put bedsteads and couches through astonishing transmutations, and departed as much entertained as if we had witnessed the wonderful performances of the mpossible furniture of the average pantomime. At one in stant, we observed an individual stretched upon a bed; we looked again, and the bed had vanished and its occupant was calmly sitting by a table. Another person launched himself at an inoffensive couch and dragged fiercely on handles and pulled on strings, and behold, a bookcase developed itself. Then there are pieces of furniture which are riddles in themselves; one never knows when he is through finding things in them. For instance, there is an affair which looks like an overgrown book case. On each side you discover a swinging rack of paper files; then you lift up a flap and pull out some legs, and there is a writing desk with a pivoted inkstand swung in it. You pull aside the flaps, and a series of closets and drawers appear. At the ends you discover more writing desks, with sunken inkstands and receptacles for pencils, more doors and pigeon holes, more cupboards underneath, until you depart, lost in admiration at ingenuity which leaves such simple affairs as Chinese puzzles far in the shade.

A PUFFING MACHINE

is something new for the ladies. There is a corrugated bed piece, and a kind of hand iron having a bottom similarly corrugated to fit into the indentations of the bed. The bottom of the iron is, however, V-shaped in section, the apex of the V being in line parallel with the direction of the handle, which resembles that of the common flat iron. Both bed piece and iron are heated, and the gathered material is dampened and pressed between the two until dry. The work is very neatly accomplished. The same machine may also be used, for fluting, in which case a corrugated comb not heated is substituted for the iron.

A NEW FIRE ESCAPE

is exhibited, which seems to us one of the best of the many similar inventions which have appeared. It consists of a swing ladder, with hickory rounds and wrought iron links. Between each pair of rounds is a light frame of iron which keeps the ladder out from the building. A hook on the upper end sustains the whole, when in use. It can be folded into a very small parcel, and weighs about one pound to the foot.

We defer reference to the

MACHINERY DEPARTMENT

for a time, until further novelties appear; as the present contents, though numerous, are almost entirely composed of machines already well known to our readers.

SCIENTIFIC AND PRACTICAL INFORMATION.

PROGRESS OF THE MILLION DOLLAR TELESCOPE.

Mr. Lick has fixed on Mount Hamilton, in Santa Clara county, Cal., as the most eligible site for the establishment of the observatory in which the great telescope is to be located, and he has notified the county supervisors that he will begin the erection at once, if they will construct a road to the summit of the mountain. As Mr. Lick offers to advance the necessary money to begin work on the road, and accept its bonds in payment, it is probable that his proposals will be adopted, and hence there is an excellent prospect of the much-talked-of telescope becoming ere long an accomplished fact.

Mount Hamilton is 4,448 feet high. The summit is higher than any land within 50 miles, and consequently below the level of the plane of the observatory, which, in an astronomical point of view, is the desideratum sought. The beautiful valley of San José, the snowy ridge of the Sierra Nevada, and a boundless area of mountain scenery are in the scope of vision, and the elevation is so high as to be above the fogs of summer, and is not so high as to be much disturbed by the storms of winter.

ABOUT BITTERS.

The Board of Health of the city of Boston, Mass., not long ago appointed Professor W. R. Nichols, a celebrated chemist of that city, to examine into the various concoctions enormously advertised and sold to an unsuspecting public under the mild name of "bitters." Mr. Nichols is continuing his investigations, and up the present time has elicited enough to warrant a wholesale condemnation, certainly, of the most popular of these disguised drinks. He says that, out of twenty samples, only one did not contain alcohol, and that had the least sale.

IMPROVED SUGAR MACHINERY.

Messrs. Morris, Tasker & Co., of Philadelphia, are now shipping a large amount of machinery to be used in Louisiana in a new process of manufacturing cane sugar. The method is what is known as the diffusion process, as distinguished from the maceration process, which is that of all previously constructed sugar machinery. The cane is passed between rollers by the old method and the juice squeezed out. In the new, the cane is sliced and the saccharine matter is dissolved out of it.

PARLOR MAGIC.

The following beautiful experiment in instantaneous crystallization is given by Péligot in *La Nature*: Dissolve 150 parts, by weight, of hyposulphite of soda in 15 parts boiling water, and gently pour it into a tall test glass so as to half fill it, keeping the solution warm by placing the glass in hot water. Dissolve 100 parts by weight sodic acetate in 15 parts hot water, and carefully pour it into the same glass; the latter will form an overlying layer on the surface of the former, and will not mix with it. When cool there will be two supersaturated solutions. If a crystal of sodic hyposulphite be attached to a thread and carefully passed into the glass, it will traverse the acetate solution without disturbing it, but, on reaching the hyposulphite solution, will cause the latter to crystallize instantaneously in large rhomboidal prisms with oblique terminal faces. When the lower solution is completely crystallized, a crystal of sodic acetate, similarly lowered into the upper solution, will cause it to crystallize in oblique rhombic prisms. The appearance of the two different kinds of crystals will not fail to astonish those not acquainted with this class of experiments.

FLAT SURFACES.

The following rules, for determining the thickness of boiler heads, cylinder covers, and other flat surfaces, are taken from *Des Ingenieur's Taschenbuch*, being adapted to English measures, and the constants being chosen so that the working pressure is one eighth as much as the breaking strain. These rules have never before been published in English, so far as we know, and we judge that they will be of interest to the engineering profession. They were deduced by Dr. R. Grashof, and the reasoning on which they are based will be found in *Die Festigkeitslehre, von Dr. F. Grashof*, Berlin, 1866. Being purely theoretical deductions, which have not, we believe, been verified by experiment, it is possible that they may be somewhat incomplete; but we are confident that, with the constants we have chosen, they will give proportions that are at least as safe as those determined by the empirical methods in common use. It is worthy of notice, in this connection, that so high an authority as Professor De Volson Wood remarks in a recent publication (as we understand him) that, in the present state of our knowledge of the strength of materials, it is impossible to solve the problems under consideration without additional experimental data. We believe, however, that the results of Dr. Grashof's investigations are generally accepted by German engineers—certainly they are by the distinguished editors of *Des Ingenieur's Taschenbuch*.

A. To find the necessary thickness for a flat plate exposed to a given pressure in lbs. per square inch (all dimensions in inches):

1. A circular plate, supported at the edges: Multiply the product of the square root of the pressure, and radius of the plate, by 0·018257, for a cast iron plate; by 0·11785, for a wrought iron plate; and by 0·0091287, for a steel plate.

2. A circular plate, secured at the edges, such as a boiler head, or cylinder cover: Multiply the product of the square root of the pressure, and radius of the plate, by 0·01633, for a cast iron plate; by 0·010541, for a wrought iron plate; and by 0·0081649, for a steel plate.

3. A flat plate, supported by stays, at a given distance from center to center: Multiply the product of the square root of the pressure, and distance between stays, by 0·0094281, for a cast iron plate; by 0·0060858, for a wrought iron plate; and by 0·0047141, for a steel plate.

4. A rectangular plate, secured at the edges:

(1) Divide the pressure by the sum of the fourth powers of the two adjacent sides of the rectangle.

(2) Take the square root of the quantity obtained by (1).

(3) Multiply the product of the square of the long side of the rectangle, the short side, and the quantity obtained by (2), by 0·014142, for a cast iron plate; by 0·0091287, for a wrought iron plate; and by 0·0070711, for a steel plate.

5. A square plate, secured at the edges: Multiply the product of the square root of the pressure, and the side of the square, by 0·01, for a cast iron plate; by 0·006455, for a wrought iron plate; and by 0·005, for a steel plate.

B. To find the working pressure, in lbs. per square inch, for a flat plate of given thickness (all dimensions in inches):

1. A circular plate, supported at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,000 for a cast iron plate; by 7,200, for a wrought iron plate; and by 12,000, for a steel plate.

2. A circular plate, secured at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,750, for a cast iron plate; by 9,000, for a wrought iron plate; and by 15,000, for a steel plate.

3. A flat plate, supported by stays: Divide the square of the thickness of the plate by the square of the distance between centers of stays, and multiply the quotient by 11,250, for a cast iron plate; by 27,000, for a wrought iron plate; and by 45,000, for a steel plate.

4. A rectangular plate, secured at the edges.

(1) Take the sum of the fourth powers of the adjacent sides of the rectangle.

(2) Multiply the quantity obtained by (1) by the square of the thickness of the plate.

(3) Multiply the fourth power of the long side of the rectangle by the square of the short side.

(4) Divide the quantity obtained by (2) by the quantity obtained by (3), and multiply the quotient by 5,000, for a cast iron plate; by 12,000, for a wrought iron plate; and by 20,000, for a steel plate.

5. A square plate, secured at the edges: Divide the square of the thickness of the plate by the square of the side of the plate, and multiply the quotient by 10,000, for a cast iron plate; by 24,000, for a wrought iron plate; and by 40,000, for a steel plate.

A few examples are added, to illustrate the foregoing rules.

1. What is the proper thickness for a steel boiler head, the pressure of the steam being 60 lbs. per square inch, and the diameter of the boiler 24 inches?

The product of 7·746 (the square root of 60), 12, and 0·0081649 is 0·78, or $\frac{25}{32}$ of an inch, nearly, the thickness required.

2. Required the thickness for the sides of a cast iron box 20 inches long, 15 inches high, exposed to a pressure of 20 lbs. per square inch.

Dividing 20 by 210,625 (the sum of the fourth power of 20 and 15), and extracting the square root of the quotient, we obtain 0·0097445. The product of 400, 15, and 0·0097445 is 0·83, or about $\frac{5}{6}$ of an inch.

3. What is the safe pressure for a flat plate, supported by stays, 10 inches from center to center, the plate being of wrought iron, $\frac{3}{8}$ of an inch in thickness?

Dividing 0·140625 (the square of $\frac{3}{8}$) by 100, and multiplying the quotient by 27,000, we obtain the pressure, about 38 lbs. per square inch.

4. The side of a rectangular box, 25 inches long, 20 inches high, is of steel, $\frac{1}{4}$ of an inch thick. What is the working pressure?

The sum of the fourth powers of 25 and 20 is 550,625. The product of 550,625 and 0·0625 (the square of $\frac{1}{4}$) is 6,882,812,700. The product of 390,625 (the fourth power of 25) and 400 is 156,250,000. Dividing 6,882,812,700 by 156,250,000, we obtain the working pressure, 44 lbs. per square inch. Below will be found the analytical expressions for the rules given in this article.

Thickness (T) in inches for a plate exposed to a uniform pressure (p) per square inch.

Form of the plate. (Dimensions in inches.)	Thickness (T) in inches.		
	Cast iron.	Wrought iron.	Steel.
Circular plate, of radius R, supported at the edges.	$0·018257R \times \sqrt{p}$	$0·011785R \times \sqrt{p}$	$0·0091287R \times \sqrt{p}$
Circular plate, of radius R, secured at the edges.	$0·01633R \times \sqrt{p}$	$0·010541R \times \sqrt{p}$	$0·0081649R \times \sqrt{p}$
Plate strengthened by stays, a inches from center to center.	$0·0094781a \times \sqrt{p}$	$0·0060858a \times \sqrt{p}$	$0·0047141a \times \sqrt{p}$
Rectangular plate, sides a and b, ($a \gt b$), secured at the edges.	$0·014142a^2 \times b \times \sqrt{\frac{p}{a^4+b^4}}$	$0·0091287a^2 \times b \times \sqrt{\frac{p}{a^4+b^4}}$	$0·0070711a^2 \times b \times \sqrt{\frac{p}{a^4+b^4}}$
Square plate, side a secured at the edges.	$0·01a \times \sqrt{p}$	$0·006455a \times \sqrt{p}$	$0·005a \times \sqrt{p}$

Safe pressure (p) in pounds per square inch for a plate of given thickness (T) in inches.

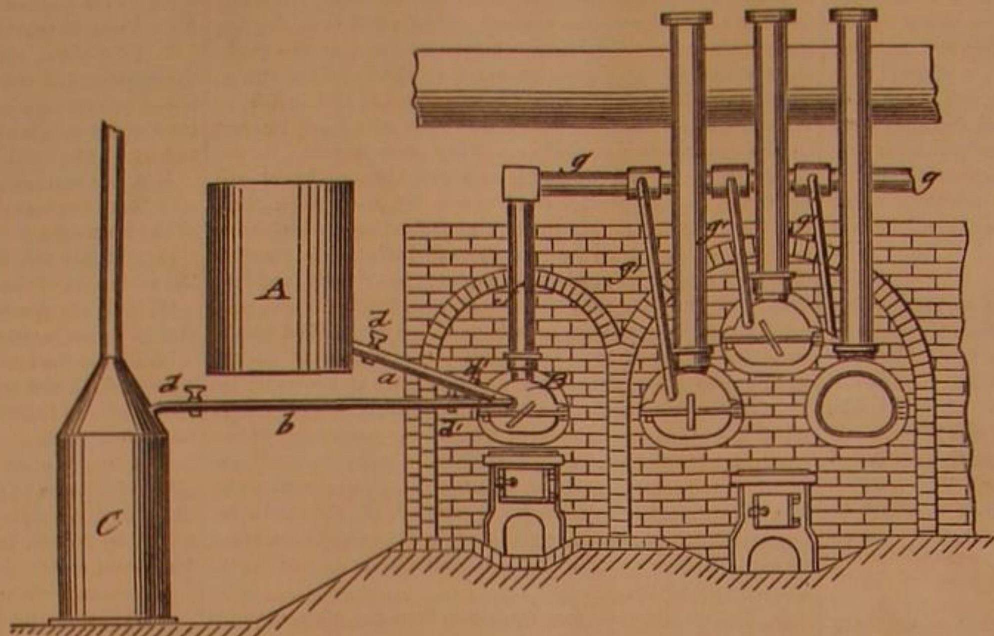
Form of the plate. (Dimensions in inches).	Safe pressure (p) in pounds per square inch.		
	Cast iron.	Wrought iron.	Steel.
Circular plate of radius R, supported at the edges.	$3,000 \times \frac{T^2}{R^2}$	$7,200 \times \frac{T^2}{R^2}$	$12,000 \times \frac{T^2}{R^2}$
Circular plate, of radius R, secured at the edges.	$3,750 \times \frac{T^2}{R^2}$	$9,000 \times \frac{T^2}{R^2}$	$15,000 \times \frac{T^2}{R^2}$
Plate strengthened by stays, a inches from center to center.	$11,250 \times \frac{T^2}{a^2}$	$27,000 \times \frac{T^2}{a^2}$	$45,000 \times \frac{T^2}{a^2}$
Rectangular plate, sides a and b ($a \gt b$), secured at the edges.	$5,000 \times \frac{T^2 \times (a^4+b^4)}{a^4 \times b^2}$	$12,000 \times \frac{T^2 \times (a^4+b^4)}{a^4 \times b^2}$	$20,000 \times \frac{T^2 \times (a^4+b^4)}{a^4 \times b^2}$
Square plate, side a, secured at the edges.	$10,000 \times \frac{T^2}{a^2}$	$24,000 \times \frac{T^2}{a^2}$	$40,000 \times \frac{T^2}{a^2}$

MAKING GAS FROM PETROLEUM.

Mr. John McClarty, of Racine, Wis., treats petroleum or naphtha under the admission of steam in a preparatory retort, and conveys the semi-fixed gas produced therein by connecting pipes to the common retorts of gas benches, from which the thoroughly fixed gas is conveyed for further treatment, in the usual manner.

In the engraving, A is a small tank, to which the petroleum or naphtha is fed by a hand pump. The oil is conveyed by a pipe, *a*, to the first retort, B, made of cast iron, of round shape, and suitable width and length, and heated to a bright red previous to the admission of the oil. The nozzle of a steam pipe, *b*, is inserted about one and a half inches into the oil pipe, as shown in Fig. 3, for the purpose of imparting force to the oil. The steam is obtained from a boiler, C, and the inlet of oil and steam, in pipes *a* and *b*, is governed by valves, *d*. The oil and steam pass together to the inside of the retort, B, through a pipe, *e*, passing to the back end of the retort, then to the front, and finally to the back end again, as shown in Fig. 2, being discharged in a highly heated spray, and forming, by the heat of the retort, a semi-fixed gas. This gas then passes through the outlet pipe, *f*, to a bench connecting pipe, *g*, and through drop pipes, *g'*, to the lids of the several retorts of the gas bench. The pipes, *g'*, enter the retorts, and extend to a point about twenty inches from the back end of the same, discharging there the gas, and converting it, by passing forward in the retorts to the stand pipes, into a thoroughly fixed gas. Each of the drop pipes, *g'*, on the benches is provided with a valve and union coupling, so that the flow of prepared gas into the retorts can be governed at pleasure.

Fig. 1



McCLARTY'S METHOD OF MAKING GAS FROM PETROLEUM.

Fig. 2

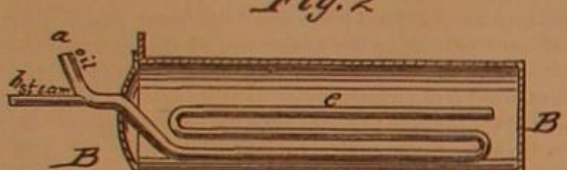


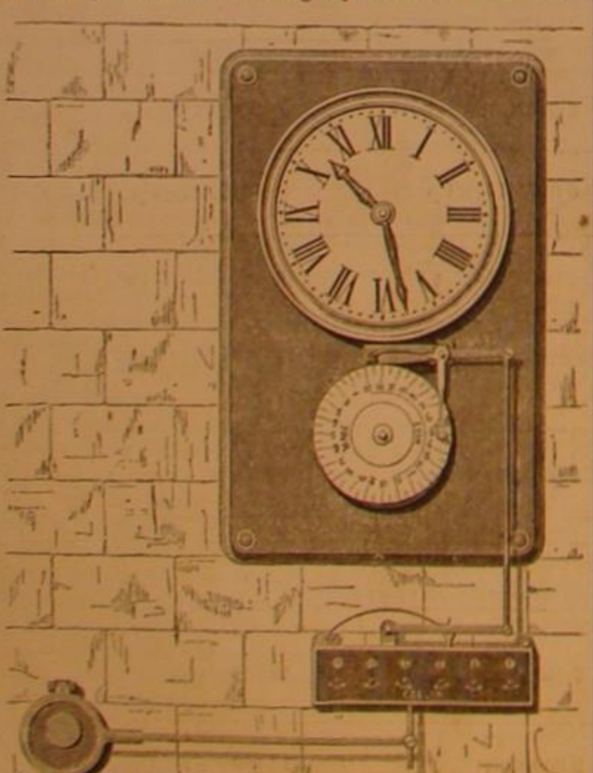
Fig. 3

The retorts are fed subject to a pressure gage placed on the stand pipe of retort, B.

The inventor claims that, should the supply of petroleum fail, by accident or otherwise, no interruption of the works is necessary, as they can be instantly employed for the common coal process.

NOVEL ENGINE COUNTER AND TELL-TALE.

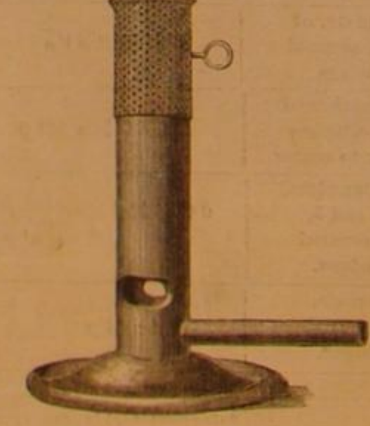
We extract from *La Nature* the annexed illustration of a new tell-tale for counting the strokes of an engine, indicating the speed, and also showing any variations in the working or stoppages of the machine. The mechanism, contained in the clock shown, causes the rotation of a disk placed below he clock face, on which disk a piece of paper, divided into divisions for 24 hours and fractions, is adjusted, the nigh t hours being denoted by a line, drawn from 12 to 12, and nearer the center of the circle than the other marks. Above the disk is a lever which moves a pencil holder in front of the disk, and which receives motion from an arm which is connected with a counter The latter is placed in communication with the engine by the eccentric and rod shown. The construction is such that, when the engine has made 100 turns, a rod, extending through the upper side of the counter and connected with the pencil-moving mechanism, rises one tenth of its entire course, causing the pencil to make a mark parallel to the scale divisions. During the time elapsing before the completion of the succeeding hundred turns, the disk continues its rotation, so that the pencil, pressing against the paper, leaves a circular line. This is again broken by a cross mark of the pencil when the hundred turns are finished, and so on, until ten indications are made, showing that 1,000 turns have been accomplished. The rod in the counter has then completed its upward motion, and falls instantly back to its lowest position, causing the pencil to make a cross or nearly radial line ten times as long as that made to indicate the hundred turns.



It will be seen from this that the circular line, or rather that portion of it included between any two hundred turn marks, passing as it does over the time divisions inscribed on the paper, shows exactly how long a period was occupied by the engine in making the above number of rotations. By comparing these sections of the line together, the fact of all being exactly the same length shows the regularity of the machine, while the stoppage or irregularity of the same will at once be indicated by the circular line continuing unbroken. The length of the line between the 100 turn divisions also shows the speed of the engine; and the same may, besides, be used to indicate whether or not the machine was started or stopped according to orders at any predetermined hours. The interior mechanism is securely inclosed in locked cases, so as not to be accessible to the engineer.

A SOLID FLAME BUNSEN BURNER.

The accompanying engraving represents a new form of Bunsen's burner, described in a paper recently read by Mr. John Wallace before the Newcastle-on Tyne Chemical Society. Its chief peculiarity is an adjustable cap of perforated metallic plate, which enables it to burn a much more inflammable mixture of air and gas than is possible with the ordinary burner. The tendency to light within is also completely prevented, whatever may be the pressure, quality, or quantity of gas passing. By raising the cap to the necessary hight a perfectly solid flame is obtained—a novel and valuable feature, since it allows any substance to be heated to be put much nearer than usual to the center of the flame without interfering with combustion. It can be made from one inch to two inches in diameter, and is capable of burning as much as 40 cubic feet of gas per hour.



Origin of Atmospheric Electricity.

According to M. Bécquerel, solar spots, which are sometimes 16,000 leagues in extent, appear to be cavities by which hydrogen and various substances escape from the sun's photosphere. But hydrogen, which appears here to be only the result of decomposition, takes with it positive electricity, which spreads into planetary space even to the earth's atmosphere and to the earth itself, always diminishing in intensity because of the bad conducting power of the successive denser layers of air and of the crust of the earth. That would then only be negative, as being less positive than the air. The diffusion of electricity through planetary space would be limited by the diffusion of matter, since it cannot spread in a vacuum.

That gaseous matter extends further through space than the distance which is generally assigned to the earth's atmosphere will be proved by the fact that auroras, which are due to electric discharges, are produced at hights of 100,000 and 200,000 yards, where some gaseous matter must exist.

M. De la Rive agrees with M. Bécquerel as to the electrical origin of the aurora, but considers that the earth is charged with negative electricity, and is the source of the positive atmospheric electricity, the atmosphere becoming charged by the aqueous vapor rising in tropical seas. The action of the sun, he considers, is an indirect action which varies with the state of the sun's surface, as shown by the coincidence in the periods of aurora and sun spots.

In the accounts of travelers in Norway, we often read of their being enveloped in the aurora, and perceiving a strong smell of sulphur, which must be attributed to the presence of ozone. M. Paul Rollier, the aeronaut, who descended on a mountain in Norway 4,328 feet high, saw brilliant rays of aurora across a thin mist which glowed with a remarkable light. To his astonishment an incomprehensible muttering caught his ear; when this ceased he perceived a very strong smell of sulphur, almost suffocating him.—*Manual of the Natural History, Geology, and Physics of Gr enland.*

LLOYD'S FLOATING APPARATUS.

Mr. Lloyd's apparatus has claims which are worthy of far more consideration than those of the Boyton dress. First perhaps in utility is an air mattress of the ordinary shape, which is inflated in three compartments, and by the aid of which Mr. Lloyd lately crossed the Solent. This mattress, says *The Field*, is available as an ordinary bed, either on board ship or under canvas. "With the middle compartment empty, Mr. Lloyd showed us that its buoyant powers are sufficient to enable him to jump into the water without sinking below his armpits, while it affords protection from mechanical injury by wreck or rock. After entering the water in this way, he inflates the middle compartment, and it then forms a raft, which he is a'b'e to propel with the paddle at the rate of between two and three miles an hour. Emigrants may therefore, without any extra outlay, provide themselves at the above rate with a floating apparatus which may be propelled to shore from a wreck. Another useful means of flotation is his swimming waistcoat, by the aid of which a bather can float without the possibility of its shifting. is unsightly, no doubt, but this ought not to weigh against its utility in avoiding the risk of sinking when learning to swim. Its price is only $3.75, gold."

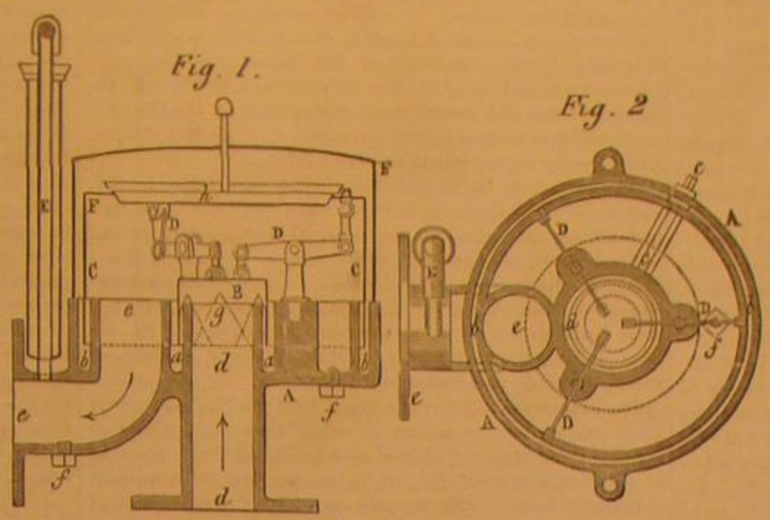
The most noteworthy, however, of Mr. Lloyd's inventions is his canoe, which can be folded into the compass of a small portmanteau or carpet bag when empty. It is made in two divisions, buckled firmly round the waist after inflation, and kept in position by a strap passing between the legs from the front to the back. A waterproof dress is first drawn on made of the ordinary twilled material used for coats, etc and buckled over the shoulders, with the arms quite free. Having first encased himself in this way, Mr. Lloyd jumped into the water, and, with his paddle in his hands, sinking only to the level of his armpits, easily paddled with the tide at the rate of 3 miles an hour.

NEW GAS REGULATOR.

The annexed illustration, extracted from the *Bulletin du Musée*, represents a novel gas regulator recently devised by M. Liebda. A cast iron vessel, A, is provided with circular channels, *a* and *b*, which are filled with mercury. *c* is a conduit for emptying them. The gas enters by tube, *d*, and escapes by tube, *e*: and at *f* are screw plugs which close the apertures from which the water which accumulates in the apparatus is removed.

The entry of the gas is regulated by a valve or cover, B, the edges of which, as shown at *g*, are triangularly indented, and are plunged into the mercury in the channel, *a*. A large cover, C, is provided, the edges of which enter the mercury in channel, *b*, and at *h* access may be had to the interior. The covers, B and C, are connected together by the three double levers, D. E is a water manometer for indicating the gas pressure, and finally, F is the envelope which encloses all the working parts.

The gas, on entering *d*, passes under B, and through the triangular indentation in the edges of that valve. It then presses upon the larger cover, C, and, by raising or lowering the same, causes the reverse effect upon B, through the levers, as already noted. As the pressure increases, cover C rises and A falls, and *vice versa*, thus causing the apertures in B to widen and close just so as to admit a uniform flow of gas. To increase the pressure, weights may be disposed upon the cover, C. An economy of from 25 to 30 per cent is claimed to be gained, in the consumption of gas, through the use of this device.



LIEBDA'S GAS REGULATOR.

COTTRELL AND BABCOCK'S PERFECTING PRESS FOR WOODCUT PRINTING—FIRM'S ROTARY ATTACHMENT.

Two features are necessary to obtain a patent: First, the invention must be novel; second, it must be useful; and when these features are clearly demonstrated to the examiners, the exclusive right, for seventeen years, to manufacture, lease, sell, or otherwise dispose of it, is awarded under letters patent.

But there is another feature of importance to the patentee or his assigns, namely, the propriety of his keeping as near as may be within the beaten track of mechanical appliance in his inventions or improvements, in order that the workman, when he takes hold of the new machine, may feel a certain degree of familiarity with its mechanical principles, and thus be enabled to prosecute his labor with equal confidence as formerly, when engaged on the old and superseded machinery. During nearly half a century of careful and patient observation, we have noticed several really valuable inventions fall stillborn to the world because of a non-observance of this common sense theory. The inventor may feel satisfied that he sees clearly his means to an end, irrespective of the reasonable convenience of those for whose uses the invention is designed; but the workman cannot appreciate the value of an improvement which compels him to learn his trade over again. In such cases, it will necessarily be uphill work with the inventor to introduce his machine; and he displays a lamentable lack of knowledge of human nature if, in his disappointment, he attributes his want of success to the stupidity or stubborn prejudice of the workman. On the other hand, when improvements which are the results of new combinations of existing and well understood agencies are presented to the public—properly constructed and divested of every possible complication—they seldom fall short of usefulness and pecuniary profit to all parties concerned.

The new perfecting press which is illustrated in the above engraving seems to belong to the last mentioned class of inventions, a careful examination of which will present nothing unfamiliar to the modern pressman. It is simply a union of the rotary and drum cylinder presses, preserving the features of both with the greatest simplicity. Take off, in imagination, the type and impression cylinders and the second feed boards and piling apparatus, and we have the Cottrell improved four-roller printing machine remaining, without variation or modification. We shall proceed to describe the complete machine in a manner that will be understood by the craft for which it is designed, avoiding shop terms and speaking in the language of the pressroom.

Its foundation is the latest Cottrell and Babcock drum cylinder press, embracing the Cottrell improved air spring and governor, the whole so substantially built as to sustain the new rotary attachment without vibration, even when running at its highest rate of speed.

The patent rotary attachment consists of two cylinders—one for curved stereotype plates of the matter to be printed, the other to give the impression. These cylinders are supplied with a feed board, and revolve in harmony by the instrumentality of the usual gear wheel attachment, making two revolutions while the drum cylinder of the main press makes one, and yielding the sheet, when printed on one side from the curved stereotype plates, to a supplementary set of grippers on the drum cylinder, in perfect register, when it passes to the flat form on the bed of the main press, and is printed on the other side and piled in the usual manner.

The type cylinder is supplied with an ordinary distributing apparatus for three form rollers; and as it revolves twice before printing, the form is necessarily rolled twice also, with a fresh supply of distributed ink each time—an excellent feature in itself. There are four vibrating rollers, which thoroughly break up and distribute the ink before it is contributed to the form rollers. The space on the type cylinder not occupied by the curved plates serves for the ink table; and a simple device raises and drops the vibrators at the right times and places, thus avoiding all contact on their part with the stereotype plates.

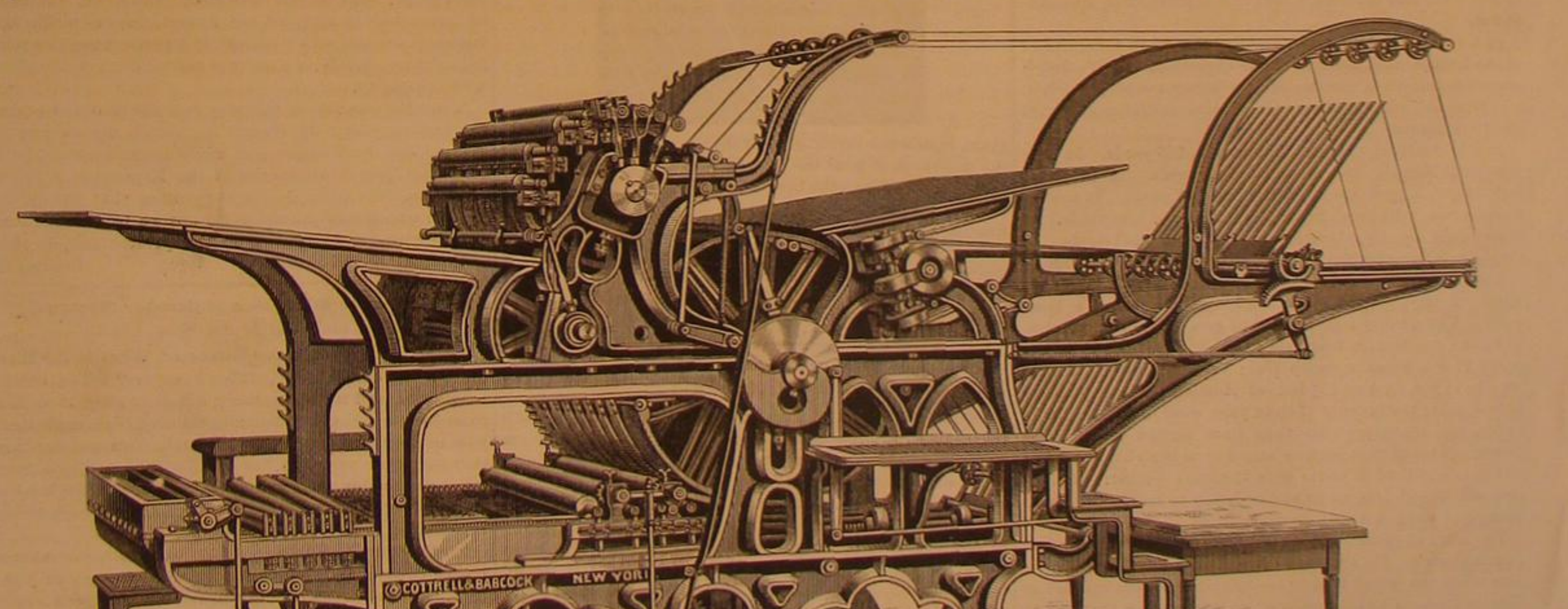
At each alternate revolution of the impression cylinder the impression is thrown off by a simple and reliable mechanical device, by which means the complete rotary attachment (as it gives the impression on its second revolution) works in harmony with the drum cylinder of the main press.

The great difficulty that most perfecting presses have to contend with is their tendency to set off. This difficulty is thoroughly overcome in the press under consideration by the introduction of slip sheets, which are fed to the drum cylinder, the grippers which carry the slip sheets being so manipulated as to hold each sheet for two impressions before yielding it to the piling apparatus, where it is smoothly and evenly piled for future use.

These presses being designed particularly for illustrated periodicals of large circulation, the plain forms are printed by the new rotary attachment, and the cut forms on the flat bed of the main press by the drum cylinder. The superiority of the Cottrell air spring and governor attachment over the old coiled wire springs enables a press of the printing magnitude of 42 x 60 inches to keep up a durable speed of over 1,200 impressions per hour. After allowing for the time consumed in making ready forms of long numbers, and the stoppages incident to removing printed paper and supplying fresh piles to the feed boards, the manufacturers assert that an average of over 10,000 sheets per day, printed on both sides, will pass through the machine. The new patent rotary attachment accomplishes its share of the work independently, and in proper season to pass the half printed sheet to the drum cylinder to be perfected without interfering in any way with the time of the main press; so that we thus have a clear issue of more than 20,000 single impressions per day of ten hours.

The usual method of making ready this class of illustrated work is by hard packing, the overlays of the cuts being made from certain cardboard, well known to the practical cylinder press printer, and the whole finally covered by a blanket of well worn billiard cloth. On the drum cylinder of the main press, of course, the *modus operandi* is the same as on the ordinary drum cylinder machine; while the rotary attachment is supplied with the necessary conveniences for the same class of make-ready.

We have thus, we believe, given an intelligible description of this new perfecting press, from which it will be under



COTTRELL AND BABCOCK'S PERFECTING PRESS FOR WOODCUT PRINTING stood that the invention, according to the manufacturers' statement, doubles the capacity of the drum cylinder machine, without detracting from the finished quality of the presswork.

The first of these machines is now in successful operation in one of Frank Leslie's pressrooms in this city. Messrs. Cottrell and Babcock's office is at No. 8 Spruce street, New York.

Correspondence.

Life-Saving Apparatus.

To the Editor of the Scientific American:

I am pleased to see the illustration of Mr. J. B. Rogers' life-saving apparatus in your issue of September 25. At this time, when so much is being attempted by the United States government and so much is done by foreign powers, in perfecting the means of communicating with stranded vessels, any new devices, so well illustrated, command respect. It is to be hoped that at our grand Centennial Exposition there will be ample space allotted and ample means provided for practical experiments with all known devices for rescuing shipwrecked persons.

Allow me to quote (from a pamphlet published by me in 1872) some of the results of experiments in casting lines by projectiles: "The Manby mortar was fully illustrated in a pamphlet published in 1826, and was for some time the popular means for getting communication with a wreck. Its weight, with its bed, was about 3 cwt., and it carried a line of 1½ inches 200 yards, by a 24 lbs. shot, and a deep sea line 270 yards against a strong wind. I give a quotation of value from Manby's pamphlet. "It is of the first importance for a lifeboat to resemble as much as possible those which the beach men are accustomed to and have confidence in, not only because it is necessary to humor the prejudices of such men, but whatever tends to increase their confidence must increase the chance of saving life." Whatever may be said of Manby's antiquated notions, the above advice is sound. The Boxer accelerating rocket has entirely superseded the Manby mortar in England. The effect is that, when the first charge is expended, when the rocket has attained a certain elevation or range, a second charge is fired. The line used is made of Italian hemp, 500 yards length and weighing 46 lbs. After getting the line on board a vessel, other, larger lines are hauled off, and finally a hawser is set up, and communication is established by means similar to those in your illustration. The principal objections to the general use of the Boxer rocket by the United States stations, and by humane societies, lies in the fact that it is costly, and that the inventor has given the right to use it into the hands of parties who naturally desire to profit by its sale. Could we have the privilege of manufacturing it in our laboratories, the cause of humanity would be greatly advanced.

I have been informed that the German government has in use a rocket which has a range of 800 yards, which is nearly double the range of the Boxer rocket. It has also another advantage over it by reason of the staff being attached in a direct line with the body of the rocket, which insures more accurate aim, the staff of the Boxer being attached to the side of the rocket. Measures should be taken to make rockets of our own, and if possible beat our transatlantic humanitarians.

In a report by Commander Jerningham, when Comptroller of the Coast Guard, he says: "The experiment at Woolwich gives the following results: Manby mortar, caliber 5½ inches, elevation 33°, charge 10 ounces. The mean distance carried in 20 rounds was:

In fine weather, 6 thread Russia line, 245 yards. In fine weather, Manilla line, same size 285, yards. In moderate weather, with fresh breeze, hemp line, 237 yards. In moderate weather, with fresh breeze, Manilla line, 279 yards. In strong gale, squally, elevation 28°, hemp line, 211 yards. In strong gale, squally, elevation 28°, Manilla line, 243 yards.

A strong wind requires less elevation than a moderate wind. A cross wind reduces the range more than a head wind. The quality and amount of powder is of much importance. A Manilla line, laid up slack, will stand 16 ounces when 12 will break a hemp line; 120 fathoms of Manilla weighs 11 lbs. against 15½ lbs. of Russian. Lines properly balled, after the manner of spun yarn, were found less liable to foul and more portable than lines carried on racks in boxes. Manilla rope beckets attached to the shot are best; one shot was fired 27 times with the same becket. Manilla line will absorb less water and be liable to less injury from being put away wet than hemp."

For want of space I cannot more fully quote this paper of Jerningham's. He alluded to firing off a block and double line when the wreck is near enough, in the same manner as Rogers does. He also speaks of an anchor shot that he had fired, in moderate weather 210 yards, in a gale 150.

In 1870 my attention was called to Rogers' apparatus. A report of trials made by the Admiralty states, in brief, as follows: "His anchor weighing 134 lbs., with a block and line making 200, was thrown 134 yards from an 8 inch mortar with 12 ounces powder. In another experiment the anchor was thrown from a common howitzer."

And again Captain Boys, of the Excellent training ship, fired an anchor weighing 128 lbs., with a block and line of 1 inch, 156 yards with 8 ounces powder, once 152 yards, once 163 yards, and in the fourth shot, with 12 ounces, 217 yards. Experiments were made with Rogers' anchor at Liverpool, throwing a 1 inch line 200 yards, and a smaller one 400; but in this last case, the line broke. In November, 1870, the Royal Naval Reserve Club resolved that "this meeting strongly recommended its adoption by the Royal National Lifeboat Institution." The Royal National Lifeboat Institution, through its executive agent Captain Ward, R. N., expressed the opinion in a letter to me that Rogers' apparatus would not take the place of the Boxer rocket, as he thought the anchor shot would be likely to attach itself to the wrong place; at the same time he said that Rogers had succeeded in throwing his anchor much farther than he expected. Notwithstanding the opinion of Captain Ward, I hope that the Rogers apparatus may be utilized in this country, where we have no Boxer rockets. If adopted, it may be made useful in throwing an anchor off shore to facilitate the launching of lifeboats. In cases like that of the Italian bark Giovanni, lost on Cape Cod, with all her crew save one, last March, the distance being 400 or 500 yards, the mortar of the government failed to carry a line far enough. In a case like this, the new German rocket would be very useful.

The cost of the Boxer rocket apparatus, as I learn from I. and A. W. Burt, London, is $625, which includes 24 rockets and sticks, 20 lights, 20 portfires, primers, lines, boxes, whip, hawser, tally boards, blocks, slings, triangle, 2 Ward belts, life lines, flags, tubes, fuzes, diagrams, and packing. Formerly Dennet's rockets were used by our society, but they were found to deteriorate by the necessary exposure on sea beaches; and they sometimes burst prematurely, so that our society has long ago discontinued their use.

The French use a different method from the English. Their lines are thrown by means of what they call *flèches* or arrows; more properly, they should be called clubs or sticks of wood, as well as of iron, which are thrown from various pieces of ordnance. The wooden ones have the advantage of floating sometimes within reach of the wreck.

A full detail of these means was given in a pamphlet published by me in 1872, to which I refer. Could we exercise as much ingenuity in devising means for saving life as we do for killing, many lives might be saved.

Boston, Mass. R. B. FORBES,

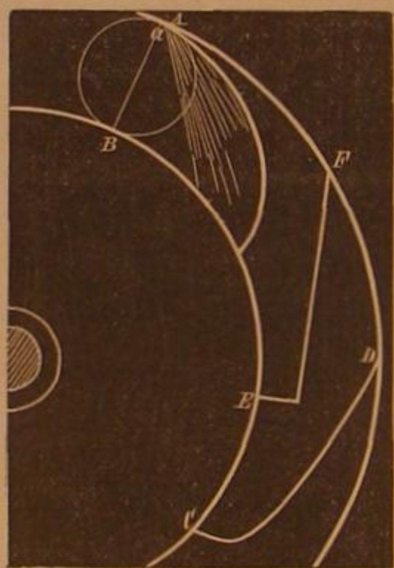
Chairman of Standing Committee of the Massachusetts Humane Society.

Water Wheel Buckets.

To the Editor of the Scientific American:

I give you a rule for the construction of the buckets of overshot water wheels, which I have never seen in print:

Make the inner face of the buckets in the form of an epicycloid, generated by a circle (whose diameter, *a* B, see dia



gram, equals the depth, A B, of the rim of the wheel, *minus* the thickness, *a* A, of the buckets) revolved upon the circle, B E C, which forms the back of the buckets. Then the outer corner, A, will be flush with the rim. As may be seen by rotating the diagram, this form of bucket retains its water better than either of the forms, C D and E F, in common use, but does not carry any too far, that is past, the lowest point of the wheel. TOWNSEND WOLCOTT.

New York city.

American Inventions in Europe.

To the Editor of the Scientific American:

One characteristic of American exhibits, in the world's fairs held in Europe, is that they do not consist of products so much as the agents for producing. Our tools, machines, and inventions are exposed before the world in a manner that conduces much to our credit as ingenious and persevering, but with a corresponding loss to our material interests, as any one who has examined the matter carefully must know. I am fully convinced that not one in a thousand among our implement makers knows to what extent and with what success our American products become models in Europe, and it is to call some attention to the matter that this is written.

Every circumstance in our country tends to promote this exposure of our tools and processes. Our isolated position from the rest of the manufacturing world, and the prohibition of imported tools by a high tariff, prevents a knowledge of what is done by others; and while we rely solely on our own resources in devising machines and processes, other countries not only employ their own skill, but draw on us for all that is of use to them. Our skill is the base of any success we have had or can hope for, in creating a foreign market for American manufactured products. This every one knows; and yet we throw open our workshops to the inspection of every one, with a recklessness which is astonishing to people in Europe; and we seem to have no secrets worth preserving. A German, Swede, Pole, Russian, or other foreigner has, as a rule, only to present a card at the doors of our workshops to be admitted and have every process pointed out and explained. This is not so in other countries, especially in those from which we can hope to draw useful suggestions as to commercial policy.

Without ignoring in any way the influence for good which may come from the reputation gained by exhibiting our handicraft, I would beg our engineers and manufacturers to consider that such influence is a weak one compared to price when it is desired to influence a buyer. The money cost of a product is the only sure base upon which a market for it can be made; and while foreign orders may be, as they now and then are, secured, such orders will not be repeated unless we produce the article at less cost than it can be copied for in Europe. I repeat that our only power and hope of a foreign market, now so much needed, lies in two things: skill in producing superior to, and labor more effective than, those of Europe. Our boundless natural resources may be balanced against three or four thousand miles of sea carriage, if we only keep our processes to ourselves, and show finished products instead. To go to America to learn to manipulate processes in working iron and wood is becoming part of the education of young mechanics and engineers from North Europe. I could at this time give names of many who are making, or have made, this kind of tour through our workshops. Hundreds, yes thousands, come to America to become skilled, and then return home to astonish their friends with what has been learned, and to reap the result in higher wages, which for a time will be paid for their services.

I may be asked: How is this to be prevented? The answer is simple enough. Shut up the shops, admit no one not supplied with proper reference, and not then, if the object is to acquire special information. This is done in England, thoroughly and completely, and nearly as well on the continent. Why cannot it be done in America? It may be said that our tools and machines must be shown in order to sell them, and that they must be exhibited next year at Philadelphia. This is true; but there is a wide difference between showing completed tools, implements, and machines, and in exhibiting the mode and processes of constructing them. Suppose the Waltham Watch Company, who have just occupied their magnificent new premises in London, were to send over some of the Clerkenwell manufacturers' skilled men to examine the operations at Waltham, and then furnish to these men a set of machines and tools like those in use at Waltham. How long would the business of exporting watches last? Yet this is what is continually done in many branches of our manufactures. Those operations of manufacture which do not find their way into our scientific journals—little things, not scientific and seemingly unimportant—very often determine the cost of products, in a way to secure or lose sales abroad. "It is the last cent that tells," and this last cent is generally taken off by some simple little expedient which, for a stranger to see, is for him to have and for us to lose.

These things would soon be understood and appreciated if our implement makers would visit certain parts of Europe which I could point out, and see the copies of our machines and tools exhibited as "improvements on the American," and hear (to explain the assumption) how "Americans are cunning and inventive, but without the power to apply their knowledge, because not educated," and so on. Something of this is done in England and France, but not much. These countries are not small enough and petty enough to tolerate such things; beside, we are too well known to be charged with incapacity.

A word of caution in this way will not be out of place for the coming year. Thousands in Europe are waiting for a raid on our workshops; and while nothing should be done to detract from the character of the Exposition in Philadelphia, you will excuse me for suggesting that the influence of your widespread journal could not be better used than in giving stronger expression to the present subject than is possible at the hands of OBSERVER.

Electric Force and Molecular Motion.

To the Editor of the Scientific American:

Mr. W. E. Sawyer, in his letter on "What is the Electric Force?" in your issue of October 9, says: "When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion, transmitting that signal as though he were transmitting it by applying a battery to a telegraph wire, and thus setting the atomic particles in motion?"

I propounded the above question to myself, endeavored to realize it, and failed signally; therefore I apply to you for help, and trust it will be given, for Mr. Sawyer's explanations of the electric force seem so clear and forcible as to enable almost any one to form a good idea of the subject.

When one pulls a bell rope, causing a bell to ring at a distant point, one can readily realize the disturbance of the atomic particles from ocular demonstration. He sees the movement of the cord where the force is applied, and also where the bell lever receives it, and the only rational explanation is that of molecular transmission.

In the case of the telegraph, he sees no motion, either where the force is applied, or where it is taken off, even when the force so applied is very powerful. However, this may be deduced by reasoning, as Mr. Sawyer so ably shows, but the real difficulty is at the end, where it is utilized. The wire terminates in a coil, and inside of this coil, entirely separated from it, is a bar of metal, and entirely separated from this is the bell lever. Now it is difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell lever or armature. If the motion were transmitted directly to the bell lever by a material connection, as in the first case, then there would be no difficulty in understanding this application of the theory.

Philadelphia, Pa. THOMAS C. MARCKLEY.

An Amateur Chemist's Narrow Escape.

To the Editor of the Scientific American:

I am, by accident, the discoverer of a most wonderful explosive; I say that I am the discoverer of it, for the simple reason that, so far as I can ascertain, it has not heretofore known. If I am wrong, I desire to be corrected. Of the nature of the explosive and the cause of its explosion, I am unable to speak; but from its composition, I should say that it was related to nitroglycerin; and its effective power confirms the idea, as, although its force was not nearly so powerful as that of nitroglycerin, it exercised it in much the same manner. I shall, most likely, and perhaps not without cause, be denounced as fool hardy, and be advised to let alone that of which I know nothing. But be this as it may, the following are the facts in regard to the composition of the compound, and the *modus operandi* of its discovery:

I had been experimenting on the absorptive powers of turpentine, and among the other substances employed was nitric acid; I found, after the acid had been in contact with the turpentine some twenty-four hours, that they had both undergone a material change in their nature; they had assumed an entirely different color, the acid being reddish, the turpentine yellow, and a third substance (between them) of an exceedingly red color, and their properties seemed to be changed in other respects. I thought this change might have been caused by some impurities in the acid, which was commercial; so I determined to repeat the experiment and use chemically pure acid. To carry out my plans, I procured a common eight ounce, glass-stoppered bottle, and poured into it two ounces of acid and the same quantity of turpentine. They both remained perfectly clear and colorless, and showed, on account of the great difference in their specific gravities, a decided division line. I then placed the stopper in the bottle and shook it, then let the liquid subside, and noted that the turpentine retained its colorless condition, but the acid was of a reddish tint; I once more shook it, and, when the contents had returned to rest, the turpentine was of a yellow color, the nitric acid a fiery red; the division line between them was almost lost. I then shook it a third time, and noted that the whole quantity was blood red; I had but just placed it on a table to allow the contents to settle when it commenced to effervesce; I picked it up, tried to pull the stopper, found I could not, and turned to a window distant some two feet; the window was up, but the shutters were closed. I made a motion to open the shutters, when there was a terrific report; the hand in which I held the bottle was empty, my face covered with acid, and the room completely filled with gas and vapor.

I left the room immediately, and applied water and milk to my face to stop the biting of the acid, and then returned to the scene of disaster. The floor was covered with glass almost in a state of powder. In a piece of walnut furniture, distant from the point of explosion fifteen feet, I found glass in pieces the size of shot, completely imbedded in the wood; the carpet, directly under where I had held the bottle, was torn in sundry places, and the glass buried in the floor. The bottle was demolished in the strictest sense of the word, being reduced to pieces from the size of corn grains down to wheat, and even finer. The stopper of the bottle I have not been able to find, and I suppose it was demolished also. The way in which I escaped was miraculous; the hand in which I held the bottle was not so much as scratched. I think the bottle must have passed from my hand before it exploded; but if it did, its passage and explosion were so instantaneous, that it seemed to burst in my hand.

I enclose for your inspection a sample of the remains of the bottle.

Monticello, Pa. E. G. ACHESON.

[We are sorry to be compelled to dash the hopes of our correspondent by saying that his discovery is not new in many of our college laboratories.

The experiment above described is one usually performed before a class beginning the study of chemistry, in order to demonstrate the power with which nitric acid oxidizes bodies capable of undergoing oxidation, like phosphorus, sulphur, carbon, and the hydrocarbons. Turpentine also is generally the hydrocarbon selected, as being nearest at hand. It is also frequently repeated by tyros with effects presenting a striking similarity to those graphically depicted in this thrilling narrative, but young students seldom venture upon more than a few drops of the mixture. There is certainly a great novelty in beginning to experiment upon four ounces of so unstable a body as nitric acid, and so volatile and inflammable an oil as turpentine. We make a publication of the results in this case, in the hope that it may be of service in preventing accident, if not loss of life, to other amateur experimenters. Our correspondent certainly had a narrow escape —EDS.]

Steam Boiler Phenomena.

To the Editor of the Scientific American:

In the account of steam boiler phenomena on page 193 of your current volume, the temperature of the feed water is not given in either case. This is an important item in considering cases of this kind.

If in the first case, the feed water were very hot, it would require but little more heat to convert it into steam. This heat being supplied from the overheated boiler, the pressure would go up until the temperature of the iron was reduced to that of the feed water.

In the second case, if the feed water were cold, it would sooner absorb the heat of the boiler. It would then condense the steam and produce a partial vacuum, as stated.

The action would be similar in the two cases, the pressure going up to a point corresponding to the amount and temperature of the feed water and the heat contained in the iron of the boiler, and then falling, as I have no doubt it would have done in the first case if the pumping had been continued.

Perry, Ill. L. D. KENNEDY.

American Grape Vines in France.

To the Editor of the Scientific American:

In regard to an article in your valuable paper of September 11, headed "American Grape Vines in France," I would respectfully call your attention to a letter which appeared some time ago in the *Gironde*, of the Canton of Bourg, contributed by M. Marchal (a justice of peace). He attributes the plagues of the grape vines, known as oidium and phylloxera, not the introduction of parasites from America, but to a diseased condition of the vines, caused by old age and general exhaustion, of which the parasites, which attack the roots, take advantage. As the vines are multiplied from the old plants by cuttings, he considers that there is no renewal, but only a propagation or continuance of its former life and age. If, therefore, the cuttings from old vines are planted, it is not a recreation of a new plant, but simply a continuance of the life of the older plant from which the cutting was transferred. The age, therefore, of a vine in general reaches to the time when it was first planted from the seed, consequently he advises growers, under these circumstances, to plant new vines raised only from the seeds.

May not the success of the American vines, being younger and more vigorous, and transplanted to different soil and to a different climate, be attributed to this law of Nature? To many, undoubtedly, this view will appear rational; and it certainly deserves a fair trial, not only in France but also in other countries, wherever the plant, that produces the golden or ruby fluid which makes the heart glad, flourishes.

Kissingen, Bavaria. JOHN EITEL.

Black Oxide of Manganese for Destroying Noxious Gases.

Don Julius de Valmagini, of Vienna, claims to have discovered a new and valuable disinfectant in the ordinary black oxide of manganese. In the *Bayerisches Industrie and Gewerbeblatt*, he writes as follows:

"It is well known that ozone is the only substance which will rapidly decompose badly smelling gases; but up to this time we possess no method of preparing ozone cheaply and in large quantities. I have found by a series of experiments that ozone is present in black oxide of manganese (*Braunstein*) in large quantities, and that it is continually regenerated. It was not hitherto known that many kinds of oxide of manganese (manganite, pyrolusite, etc.) were ozone carriers; but I can prove that they not only possess all the properties of the known ozone bearers, but are excellently adapted to use in all cases where ozone has proved useful.

(*a*) Ozone test paper, prepared with starch and iodide of potassium, is immediately blued by the liberation of iodine without any acid being added.

(*b*) A solution of chemically pure iodide of potassium is at once decomposed by dropping into it a fragment or some of the pulverized mineral, the liberated iodine turning the solution brown. The liberated iodine is recognized by all its reactions, such as turning blue with starch paste, dissolving in chloroform or bisulphide of carbon, subliming at the boiling temperature, and the characteristic odor.

(*c*) Chemically pure binoxide of manganese, prepared artificially, shows the same reaction in chemically pure iodide of potassium as given above at *b*, reacting just like the natural product.

(*d*) When the pulverized mineral is strewn upon chemically pure silver and moistened, the silver is browned at once by the formation of oxide of silver; on heating, the brown spot entirely disappears, proving that it was not sulphide of silver which was formed.

(*e*) The air is also ozonized by contact with the surface of the mineral or of the powder.

(*f*) The reaction about to be mentioned now was indeed known, but was never considered as an ozone reaction, namely: Tincture of guaiacum is colored deep blue by the oxide of manganese.

(*g*) Black oxide of manganese is also well adapted, by its ozonizing power, to destroy putrid gases, such as sulphuretted hydrogen, and putrefactive gases, and that too in a very short time.

From this it may be concluded that many kinds of manganese ores could meet with extensive use for sanitary and building purposes."

The Soda Lakes of Wyoming Territory.

Professor Pontez, Geologist to the Union Pacific Railroad, reports as follows on an interesting deposit of carbonate of soda in Wyoming Territory:

"The carbonate of soda deposit is, by nearest road for wagon, sixty-five miles from Rawlins Station, nearly due north. There are two lakes. The upper and larger one covers about 200 acres; the water has an average depth of three feet and a specific gravity of 1·007; it therefore contains nearly one pound of soda to ten of water. The soda is nearly all carbonate. The second lake is situated about two miles east of the large lake, on a somewhat lower level. It is bowl-shaped, and covers rather more than three and one half acres. During the greater portion of the year, it is a concrete mass of crystals of carbonate of soda, mixed with a small quantity of dust blown from the adjacent plain. I excavated to the depth of six feet, but did not reach the bottom of the deposit. Its entire depth can only be ascertained by boring. It is a reservoir or pocket which receives its increase from the periodic influx from the larger lake. The water, having no outlet, evaporates during the summer, and by autumn becomes a compact mass.

The quality of the carbonate is fully equal to the imported article used throughout the country. Its minimum or bottom price has been $45 per tun, up to $67, its present price. Estimating the quantity by the specific gravity of the water, its depth and area, the large lake covering 200 acres will yield on evaporation 78,000 tuns, which, at the market value, would realize, at $45 per tun, $4,510,000. Besides the cost of freight, the expense of preparing the article for market would be $4 per tun, for evaporating.

The small lake already crystallized, and estimated only to the depth of six feet and an area of 155,000 feet, contains 30,660 tons, which, at $45 per tun, would realize $1,379,700, with no drawback except freight and commission.

The reason why this valuable deposit of a staple article has not already been drawn on largely is the difficulty and expense of hauling it 55 miles. A range of mountains called the Seminole intervenes between the deposits and the Union Pacific Railroad."

The Practical Determination of Coal Tar Colors.

The colors fabricated from coal tar are commercially known by such a variety of names that it has become quite difficult for consumers to recognize the nature of the bodies employed by them. The following information, communicated to the *Muster Zeitung* by H. Goldschmidt, will serve as a practical guide in determining the principal dyes, etc. now produced.

The red coal tar colors most frequently met with in commerce are fuchsin, saffranin, and red corallin. These three are easily distinguished by their action in the presence of an acid, which will color an aqueous solution of fuchsin, yellow; of saffranin, violet blue; and with corallin, will give an orange yellow precipitate. The violet coloring matters are the violets of phenyl, of iodine, and of methyl. The first two are but partially soluble in alcohol and in water. To distinguish them, a certain quantity of the specimen is dissolved in alcohol, and ammonia is added. If the solution becomes red, phenyl violet is recognized; if colorless, then one of the other two. To determine which one, dissolve another portion of the specimen in water and add ammonia; violet of iodine gives a clear liquid; violet of methyl gives a colorless but troubled liquid.

Coal tar blues are aniline and alkali blues. The last is always soluble in water. Aniline blue present two modifications, of which one is soluble in water and the other in alcohol. The two blues are easily distinguishable from the fact that aniline blue always gives a blue solution; while that of alkali blue is colorless until an acid is added.

The green aniline colors most commonly found are aldehyde green and green of iodine, simple or with picric acid. Determine first whether the body is soluble in water; if so, then it is iodine green. If not easily soluble, dissolve it in alcohol, and add cyanide of potassium. If the liquid then becomes colorless, the body is aldehyde green; if it turns brown, picric acid iodine green is present.

The commonest yellow colors are picric acid and its salts and naphthaline, all soluble in water. Dissolve, add cyanide of potassium, and heat; if the liquor becomes reddish brown, picric acid or a picrate is present; but if the color simply darkens, a little napthaline is denoted. In the first case, to determine between picric acid and a picrate, treat with benzine and heat; picric acid, alone, dissolves.

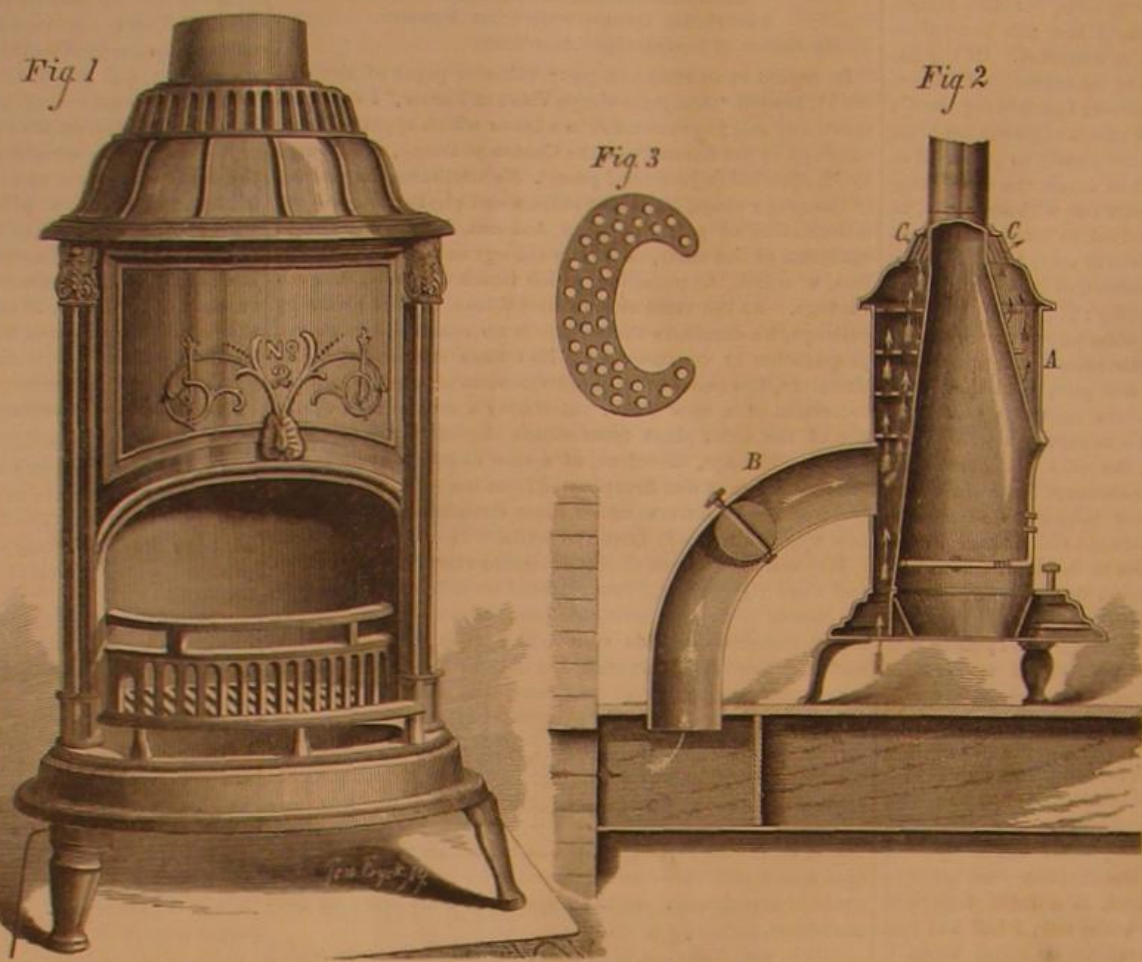
The orange hues are yellow corallin, the salts of chrisanilin and of chrysotoluidin, Victoria orange and a mixture of naphthalin and fuchsin known as aniline orange. Add ammonia; if it dissolves, giving a red liquor, corallin or a chrisanilin combination is present. To distinguish which, dissolve a little of the sample in alcohol, add zinc and diluted sulphuric acid: if the liquor becomes colorless, corallin is denoted. If ammonia, as above, does not color the solution, dissolve in water and treat with acid: if there be any change, chrysotoluidin is recognized; but if a precipitate is formed, it is a sign that the substance is either Victoria or aniline orange. To distinguish which of the two, add to the aqueous solution cyanide of potassium; if the liquor turns brown on heating, Victoria orange is present; if the color changes but very slightly, aniline orange.

The browns are those of aniline, maroon, grenat, and two species of phenyl brown, one made with carbonic acid, the other with phenylendiamine. Determine, first, whether the substance is soluble in water. If not, add hydrochloric acid; and if a yellow color is produced, maroon is present. If the acid occasions no change, add to a portion of the solution some ammonia; if there be a precipitate, the substance is anilin brown or phenylendiamine brown; if the ammonia is without action, it is grenat (isopurpurate of potassium). Phenyl brown and anilin brown are distinguishable from the fact that the last yields a precipitate when cyanide of potassium is added to it, while phenyl brown similarly treated undergoes no change.

IN preparing lard for the market, it should first be cut into pieces about the size of a walnut, and these should be allowed to stand in water for half an hour. Then work the material with the hands in 5 or 6 successive portions of water. Next pour off the water, melt the lard in a water bath, and strain through fine linen. In the first straining, it will be impossible to get rid of all the water; so that after cooling and draining, it will be necessary to remelt the lard and finally to filter it through paper in a warm closet.

IMPROVED VENTILATING HEATER.

A new heater is illustrated in the annexed engraving, which, besides supplying a uniform current of hot air, thus warming the apartment, is so constructed as to draw in fresh air, thus at the same time ventilating the room. There is no contact of the incoming air with red hot metal or with the hot coals, and hence the warm current is delivered pure and uncharged with carbonic acid. For churches, school rooms, halls, and other apartments where ventilation is much more frequently bad than good, the ventilating heater appears to be especially suited, and may advantageously replace the usual forms of stove. A perspective view of the invention is given in Fig. 1; the construction is exhibited in the sectional view, Fig. 2. From the latter it will be seen that there is a direct connection between fire box and flue, so that there can be no impediment to the draft. Surrounding the flue is a chamber, A, into which fresh air is led by the pipe, B, the latter connecting with the space between the flooring and with the atmosphere outside the building. In passing up through the chamber, as shown by the arrows, the air traverses several perforated metallic plates, one of which is shown in Fig. 3. These, in addition to impeding the flow of the current, heat the same, since the plates themselves become quickly warmed by the flue walls. The heated air then makes its escape into the room through the openings at C.



CHURCH'S VENTILATING HEATER.

We are informed that the consumption of fuel in the stove is small, one hod of coal being sufficient for a ten hours' supply, provided the fire be properly cared for. Either hard or soft coal may be burnt. The construction is simple, and there are no parts to get out of order, nor is there any opportunity for fouling or clogging in the flues. Dampers being absent from the stove, all casualties from careless regulation are avoided. Patented through the Scientific American Patent Agency, September 7, 1875. For further information, address the inventor, Mr. M. C. C. Church, Parkersburg, W. Va.

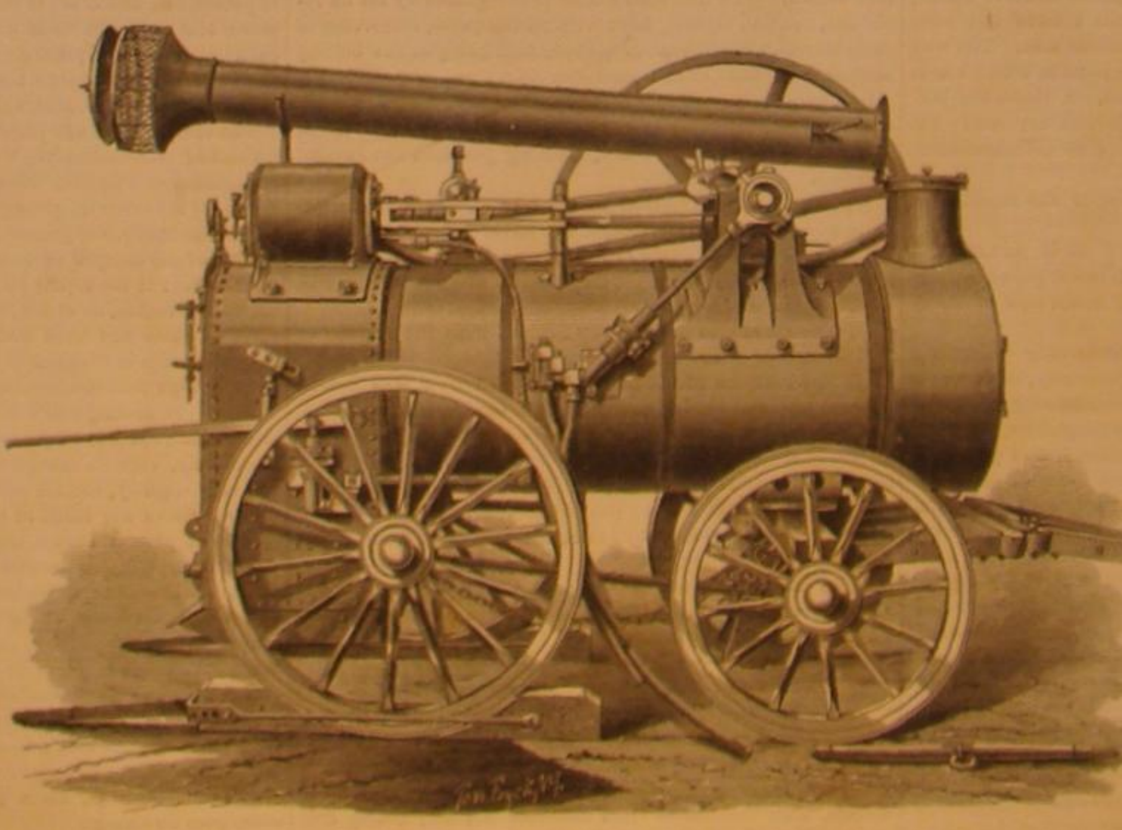
PORTABLE STEAM ENGINES.

The portable engine illustrated on this page is one manufactured by Messrs. Clayton and Shuttleworth, of Lincoln, England, and was awarded the first prize given for portables at the last trials of the Royal Agricultural Society of England. The competitive trials by the Royal Society are of the most severe and searching nature; and in the case of all descriptions of engines, paid engineers of responsibility and eminence are intrusted with the duty of minutely examining and reporting as to the merits of each competing engine, embracing the distinctive points of strength, proportional and general construction, economy of fuel, quality of material, workmanship, and general efficiency. A combination of these advantages, it is claimed, have given to Messrs. Clayton and Shuttleworth the leading position in England, as portable engine makers, and to this date they have manufactured 13,000 of such engines, and their present production is 25 engines per week.

The following are some of the distinguishing features of the engine herewith illustrated:

The boiler is butt-jointed and riveted by hydraulic machinery, which process of manufacture makes incomparably stronger work than the old plan of hammering. The fire box is invariably of Low Moor iron. The boiler is lagged and covered with iron plate and banded, and the cylinder is steam-jacketed and lagged. All wearing parts, such as slide bars, nuts, pins, etc., are case-hardened. The engines are fitted with improved adjustable side blocks, carriages, and bearings, all of the best quality of gun metal. The crank shaft is bent, in preference to using the cheaper overneck kind. A second lock-up safety valve and Salter's spring balance are affixed to each engine. Reversing gear is added, allowing the engine to run either way. The feed pump is supplied with an arrangement for heating the water; it is continuous in its action, and cannot get out of order.

The workmanship and material used in the construction of these engines are of the best kind obtainable, and the boilers are tested to 200 lbs. per square inch. Mr. W. C. Oastler, 43 Exchange Place, New York, the agent for Messrs. Aveling & Porter's road engines, steam plows, etc., is also the representative of Messrs. Clayton and Shuttleworth in the United States.



CLAYTON AND SHUTTLEWORTH'S ENGLISH PORTABLE ENGINE.

Laborious Rest.

Speaking of the habits of English statesmen, a Liverpool paper states that two hours before the recent meeting at Hawarden "Mr. Gladstone was engaged in his favorite exercise of felling trees. For a portion of two days he has been welding the ax upon a large tree in a lane at the outskirts of Hawarden village, and he succeeded in bringing it to the ground late yesterday afternoon. Those who saw him say that he went to work in true woodman fashion, with his braces thrown off behind him and his shirt collar unfastened. After completing his task, he walked home with his axe slung over his shoulder, and two hours afterward was at the meeting, looking not tired and weary, but quite refreshed with his bodily labor."

The Origin of Coal.

The discovery of diatoms in coal, by Count Castracane, recently announced, is of much interest, as throwing additional light on the mode of formation of carboniferous coal These minute forms of plant life have not been recognized in any but very modern formations; but Count Castracane has succeeded in showing that they date from the palæozoic epoch, and as far back, at least, as the carboniferous period. He says: "All the forms I have been able to observe among the ashes of the coal present such an appearance that the most practised and sharpest eye could not detect the slightest difference between them and actually living diatoms: outline, structure, shape, and number of the flutings—in short, all the peculiarities which characterize the species that we meet with in the state of actual vegetation —agree exactly with those of the carboniferous period." It can scarcely be denied that the existence of these minute forms of aquatic vegetation in the substance of carboniferous coal goes to confirm the view of those who (like Professor Bischof) hold that this mineral has been formed in presence of water, and the great preponderance of fresh water forms of the diatomaceæ proves that this was fresh water; still the occasional occurrence of marine forms leads to the inference that the waters of the ocean occasionally had access to the lagoons or inland lakes.

In fine, the presence of diatoms, taken in connection with the strategraphical phenomena of carboniferous coal beds, appears to bear out the views of those who hold that the mineral has been formed from the decay of successive generations of plants and forest trees, growing with their stems partially immersed in the stagnant waters of vast lagoons these lagoons being nearly on a level with the waters of the sea, which sometimes gained access to them, and carried with them marine forms.

Epizootic in Horses.

This disease, that swept over this entire country and proved so serious in the fall of 1872, is appearing again this fall, though probably in a milder form. Nearly all the horses of this and other cities are affected with it already, and it is certain to spread to the country very soon. Horses that are in good condition will suffer the least from its attack. Its first symptom is a slight cough, which gradually becomes more frequent and severe, accompanied with running at the nose and swelling of the throat between the jaw bones. Horses that are in good heart and are properly taken care of will probably only be slightly affected.

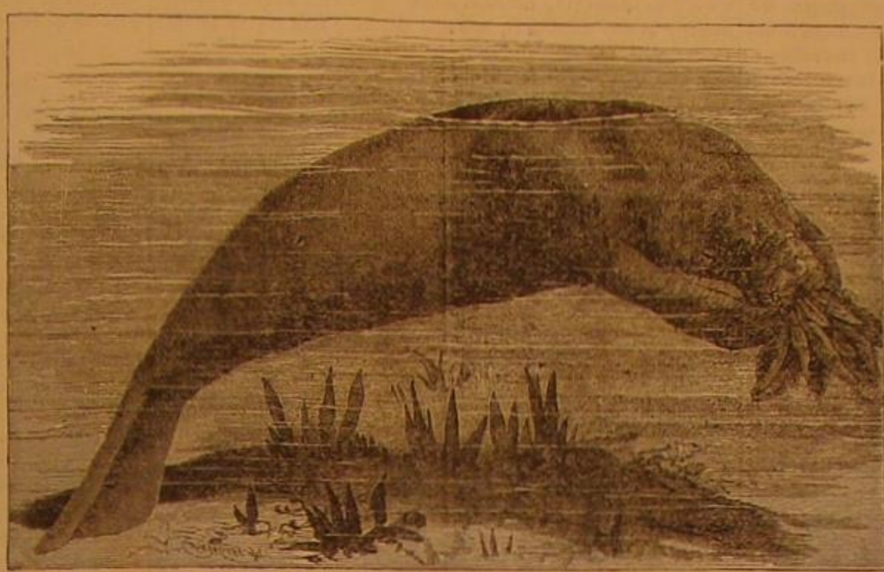
A writer in the *Ohio Farmer* advises the simplest treatment possible. Keep the horses in a warm, comfortable, clean, and well ventilated stable, blanketed in wet, cold weather; feed well with oats and sweet hay (corn is too heating), with a good bran mash once a day; the only medicine needed is to thoroughly rub the throat with some good liniment if it should become much swollen, and be very careful not to let them take cold. A little exercise every day at light work or careful driving, we deem beneficial; but any violent exercise, or anything approaching over exertion, will be almost certain to produce serious results.

The aim should be to keep the horse in as strong heart as possible, and Nature will soon work out the disease. The usual term of this distressing and destructive malady is from twelve to twenty days.

THE MANATEE OR COW FISH.

The manatee, says Mr. Frank Buckland, is one of the rarest and most interesting beasts that has been brought to England for many years past. His external appearance is very puzzling. At one moment he looks like a pig, the next moment he reminds us of a porpoise or herring hog. The home of the manatee is the shallow bays and quiet rivers of Central and South America. He is purely herbivorous, and lives upon the water plants which abound in those tropical regions. Mr. Bartlett, of the Zoölogical Gardens, London, has discovered that he is exceedingly fond of lettuces and vegetable marrows, cut into slices. His hind legs are flattened out into a fan, somewhat resembling a porpoise's tail. When he wishes to move forward he gets way on by moving his tail up and down; and—as those who unpacked him from his traveling box know—he is able to use this beaver-like tail with very great force. The manatee is purely mammalian, and suckles its young at the breast.

"The manatee is allied to the dugong found in Australia. The dugong has a face ornamented with a big, hooked nose, and when I see the figure of Punch performing in the street, it puts me in mind of the dugong. The dugong and the manatee are without doubt the origin of the fable of the mermaid; either of them, especially the dugong, when coming to the surface of the water to breathe or look round, is very human. The manatee now in the gardens is 7 feet 2 inches long; a full grown beast is from 14 feet to 16 feet long. Unfortunately for this animal, the flesh is very good eating. It has the flavor of pork with the taste of veal, reminding one of that curious relish 'beef cut with a hammy knife.' The skin of the manatee is like the rind of a prickly pear; he has stiff bristles inside his mouth; this is really a form of whalebone, as found in the whale's mouth. The animal seems to be a compromise between a pig and a porpoise.



THE MANATEE OR COW FISH.

LAND TORTOISES.

The two large tortoises, living at present in the Zoölogical Gardens, belong to a species indigenous and peculiar to Aldabra, a small island, or rather group of small islands, situated in the Indian Ocean, about 180 miles northwest of Madagascar.

The animals, of which a faithful representation has been given by our artist, have left their island home a long time ago. They were kept in a semi-domesticated state in a paddock, partly for the sake of their young, partly as a kind of curiosity, the male being the largest individual of its kind existing at present, of which the proprietor was very proud, and in which the islanders generally took an interest.

The female lays twice a year, between July and September, some forty eggs, which are hatched in about ten weeks. The young of such domesticated tortoises are allowed to grow till they are four years old, and from 12 inches to 15 inches long, when they are considered fit for the table. Some of the young individuals which are now on the continent of Europe are the offspring of the animals now in the Zoölogical Gardens. The tortoises were transported in separate cages, and that for the male had to be made as strong as wood and iron could do it, his strength being so great that, if he gets a good purchase with his feet and brings his shell against a square bar two inches thick, he is able to break it like a reed. In spite of every precaution, he nearly succeeded in getting out of the cage on board of the steamer conveying him to Aden. The sailors had placed the cage of the female opposite to his, and as soon as he obtained a sight of her he commenced to raise himself on his hind legs, and to break through the roof of the cage. There is no doubt that he soon would have succeeded in his efforts if Dr. Brooks had not resorted to the expedient of greasing from time to time the inside of the cage, so that he could no longer support himself against the slippery sides.

The two individuals differ from each other considerably, not only in size, but also in the form of the shell; and in the Seychelles they were thought to belong to different races, possibly they come from different islands of the Aldabra group.

The shell of the male is 5 feet 5 inches long, and 5 feet 9 inches wide, measured over the curvature; the length of the head and neck is 1 feet 9 inches, and the circumference 1 foot 6 inches. The circumference of the foreleg is 1 foot 11 inches, of the hind leg 1 foot 5 inches. The weight of the animal when it left the Seychelles was 870 lbs; it is still growing! The center of each of the scutes along the middle of the back is raised into a hummock, and also the other scutes are divided by deep grooves or sutures. The color is a dirty brown, gradually changing into black towards the center of each scute. The shell of the female is 3 feet 4 inches long, and 3 feet 10 inches broad (measured over the curvature); the circumference of its foreleg is 13 inches. The shell is perfectly smooth, nearly polished, without any unevenness.

They feed on vegetables of all kinds, of which they consume daily a large quantity; in the Zoölogical Gardens they seem to prefer cabbage and vegetable marrow, but eat grass freely. A constant supply of water to drink is essential; without it they would perish in a short time. They are fond of basking in the sun, but dislike a long exposure to the direct rays of a powerful midday sun, which they avoid by seeking the shade. As the temperature in the Seychelles does not sink at any time of the year below 70°, the utmost care is to be taken to shield them from the cold of the nights of early autumn; and we believe that neglect in this respect has been the cause why the specimens imported into England some thirty years ago never survived their transmission to Europe for more than a few months. Twenty-four hours' exposure to a temperature below 50° is fatal to them.

Their walk is slow and clumsy, but is not impeded by the weight of as many people as can possibly find room on the back of their shell. The male is believed to be able to carry as much as a tun, but we should not care to recommend this experiment, as the shells of these large tortoises are comparatively much thinner than those of the smaller kinds.

These tortoises never bite, and the male is so tame as to take the food out of the hand. He was thus sketched while being fed with a vegetable marrow. He is fond of being stroked and rubbed about the head and neck, which he stretches out of the shell to their full length. He shows great affection for the female, and this was especially apparent when he was released from the two months' confinement in his cage; he seemed stiff, without any inclination to move, until the female was placed before him, when he at once stretched out his head, and followed her about in their inclosure. Some time before sunset they go to rest, one with the fore part of the shell resting against that of the other. The male has a loud voice, compared by the keeper to the roaring of a bull.

LAND TORTOISES IN THE ZOOLOGICAL GARDENS, LONDON

Remarkable Electrical Phenomena

The night of July 7-8, 1875, will be long remembered in Switzerland for thunderstorms, several of them of almost unexampled severity. Of these, one that broke over Geneva was unprecedently severe and disastrous. It appears to have originated to westward, in the department of Ain, and took an easterly course up the valle, of the Rhone to Geneva, on reaching which it spread over a wider area, and thence directed its course over Savoy. As midnight came on, though the heat was suffocating and not a breath of wind stirred below on the streets, light objects on the roofs of the houses began to be whirled about and carried off as by a tempest of wind. At the same time a dull rumbling sound, resembling neither that of wind nor that of thunder, announced the approach of the thunderstorm, and at 12 midnight exactly it burst over Geneva in all its fury. An avalanche of enormous hail-stones, with no trace of rain, was precipitated from the sky, and shot against opposing objects by a tempest of wind from the southwest. In a moment the street lamps were extinguished, and in a brief interval incredible damage was inflicted, the glass and tiles of houses smashed to powder, trees stripped of their bark on the side facing the west, and crops of every sort were, in many places, all but totally destroyed. The smallest of the hailstones were the size of hazel nuts, many were as large as walnuts and chesnuts, and some even as large as a hen's egg. Some of the hailstones measured four inches in diameter, and six hours after they fell weighed upwards of 10 ozs. For the most part the hail stones were of a flattish or lenticular form, with a central nucleus of 0·16 to 0·40 inch diameter, developed in several concentric layers of ice, generally from 6 to 8 alternately transparent and opaque. A map has been printed in the *Journal de Genève*, showing the districts where the storm was felt as well as the degree of its intensity in each locality. The electrical phenomena were very remarkable; the flashes of lightning succeeded each other with such rapidity, from midnight till a few minutes after 1 o'clock in the morning, that a mean of from 2 to 3 were counted each second, or from 8,000 to 10,000 per hour. Electrical phosphorescence was remarkably intense before and during the hail. The ground, animals, prominent objects, as well as the hail stones, were strongly phosphorescent. Immediately after the hail, ozone was greatly developed, the smell being so pronounced as to be compared, by nearly all observers, to garlic. The incessant electrical discharges passed from cloud to cloud over a central point from which the hail fell, but thunder was very rarely heard.—*Nature.*

A good cheap paint for barns and outhouses is made as follows: Put ¼ bushel of good lime in a clean barrel, and add sufficient water to make a thin whitewash; stir it well with a flattened stick until every lump of lime is dissolved. Then add 50 lbs. mineral paint, 50 lbs. whiting, 50 lbs. road dust, finely sifted. Mix to a thick paste with linseed oil and thin gradually to the proper consistence with sweet buttermilk, fresh from the churn. The covering quality is improved by the addition of 1 gallon soft soap.

THE SHOEMAKER'S OPPORTUNITY.

Not liking the crippled motion of the feet of a certain young American, whose unsteady gait when shod was very unlike his graceful carriage when barefoot, we protested that broader shoes should be furnished him "They are not to be had" was the mother's reply. The child was wearing shoes half an inch longer than his feet, but they were too narrow, by half an inch, across the toes. To make matters worse, the heel was much too wide, allowing a slipping of the ankle from side to side, which even the stiff counters could not keep from causing a marked overrunning of the sole.

Remembering the reform which was made a few years ago in the matter of men's foot wear. we thought it altogether likely that the makers of children's shoes, or some of them at least, might have been led to pay some regard to the shape of children's feet; so we volunteered to find a suitable shoe for our friend's child. Our search was long and faithful: but we had to give it up defeated. There may be dealers in New York who sell children's shoes bearing some reasonable resemblance to children's feet; we sincerely hope there are; but we failed to find any.

The accompanying outline shows the relation between the sole of the child's foot—a perfect foot, such as a sculptor might copy—and the sole of the broadest shoes that could be found of corresponding length. Though they were button gaiters, and so far rights and lefts, not the slightest recognition of the right and left character of a child's feet is discernible in their shape, or the shape of any other children's shoes that we found in the market. "We almost always have trouble in fitting children, their feet are usually so chubby," said one honest salesman. "Why then don't you have the shoes made properly?" we enquired. "Because we could not sell them," was the reply." A mother invariably judges a shoe by its looks. Show her one with a sole broad enough for a baby, and she will scarcely look at it. She wants something pretty and stylish."

Short sighted shoemaker! To allow her to get off with the notion that anything could be prettier than her darling's tootsy-wootsies!

The society for the prevention of cruelty to children may go far before they find a more suitable occasion for the exercise of their authority. The aggregate amount of pain inflicted upon small children by misshapen shoes must be something enormous.

But surely all mothers are not vain and pitiless—though most of them are sadly uncritical of customary abuses. We are confident that any shoemaker who will adopt for a trademark the foregoing design—first come, first served, gratis—and advertise to furnish suitable foot wear for small children, will receive the thanks of thousands and be rewarded with a profitable business.

There is room for improvement in the material as well as in the shape of babies' shoes. A young creeper will ruin in a fortnight a pair of shoes costing a dollar or more at retail. A buckskin moccasin neatly made would be far more durable, vastly more comfortable, and much cheaper. Hard soles can well be dispensed with until after the child begins to run about outdoors; even then the uppers should be soft and easy.

Who, at this season of revivals, will lead off with the Centennial moccasin?

Mrs. Maxwell's Museum of Natural History in Colorado.

"On the corner of one of the streets in the town of Bowlder, Colorado, is a building with a narrow and somewhat rickety staircase leading up on the outside. At the top of the staircase is the sign 'Museum.' Somebody had said in my hearing that all the animals in the museum were shot and stuffed by Mrs. Maxwell herself, and the collection was nearly a complete one of the native animals of Colorado. I went to the museum, expecting to be much amused by a grotesque exhibition of stiff and ungainly corpses of beasts, only interesting as tokens of the prowess of a woman in a wilderness life.

"I stopped short on the threshold in utter amazement. The door opened into a little vestibule room, with a center table piled with books on natural history, shelves containing minerals ranged on the walls, and a great deer standing by the table, in as easy and natural a position as if he had just walked in. This was Mrs. Maxwell's reading room and study. On the right hand a door stood open into the museum. The first thing upon which my eyes fell was a black-and-tan terrier, lying on a mat. Not until a second or two did the strange stillness of the creature suggest to me that it was not alive. Even after I had stood close by its side I could hardly believe it. As I moved about the room I found myself looking back at it from point after point, and wherever we went its eyes followed us, as the motionless eyes of a good portrait will always seem to follow one about. There was not a single view in which he did not look as alive as a live dog can when he does not stir. The dog alone is enough to prove Mrs. Maxwell's claim to be called an artist.

"In the opposite corner was a huge bison, head down, forefeet planted wide apart and at a slant, eyes viciously glaring at the door—as distinct a charge as ever bison made. Next to him, on a high perch, was a huge eagle, flying with outstretched wings, carrying in his claws the limp body of a lamb. High above them was a row of unblinking owls, labeled 'The Night Watch.' In a cage on the floor were two tiny young owls, so gray and fluffy they looked like little more than owls' heads fastened on feather pincushions. Mrs. Maxwell opened the cage and let them out. One of them flew instantly up to its companions on the shelf, perched itself solemnly in the row, and sat there motionless, except for now and then lolling its head to right or left. The effect of this on the expression of the whole row of stuffed owls was something indescribable. It would have surprised nobody at any minute if, one and all, they had begun to loll their heads.

"The distinctive feature of the museum, however, is a dramatic group of animals placed at the further end of the room. Here are arranged mounds of earth, rocks, and pine trees, in a by no means bad imitation of a wild, rocky landscape. And among these rocks and trees are grouped the stuffed animals, in their families, in pairs, or singly, and every one in a most life-like and significant attitude. A doe is licking two exquisite little fawns, while the stag looks on with a proud expression. A bear is crawling out of the mouth of a cave. A fox is slyly prowling along, ready to spring on a rabbit. A mountain lion is springing literally through the branches of a tree on a deer, who is running for life, with eyes bloodshot, tongue out, and every muscle tense and strained. Three mountain sheep—father, mother, and little one—are climbing a rocky precipice. A group of ptarmigans shows the three colors—winter, spring, and summer. A mother grouse is clucking about with a brood of chickens in the most inimitably natural way. And last, not least, in an out-of-way corner is a touch of drollery for the children—a little wooden house, like a dog-kennel, and coming out of the door a very tiny squirrel, on his hind legs, with a very tiny yellow duckling hanging on his arm. The conscious strut, the grotesque love-making of the pair is as positive and as ludicrous as anything ever seen in a German picture book. Only the most artistic arrangement of every fiber, every feather, every hair could have produced such a result. We laughed till we were glad to sit down on the railing, close to the grizzly bear, and rest.

"But a funnier thing still was on the left hand—a group of monkeys sitting round a small table, playing poker. One scratching his head and scowling in perplexity and dismay at his bad cards, and another leaning back smirking with satisfaction over his certain triumph with his aces; one smoking with a nonchalant air; and all so absorbed in the game that they do not see the monkey on the floor, who is reaching a cautious paw and drawing the stakes—a ten dollar bill—off the edge of the table. Beard himself never painted a droller group of monkeys, nor one half so life-like. It will always be a mystery to me how, to these dead, stiff faces, Mrs. Maxwell succeeds in giving so live and keen and individual a look.

"I found, upon talking with her, that she has had for a great many years this passion for collecting birds and beasts. She began the collection for her own pleasure, and took several courses of instruction from taxidermists, that she might be familiar with all the processes. Her own methods, however, are peculiar. She molds the animal first of plaster, just as she wishes it to stand. Then she covers it with the skin, fitting the skin to it, instead of stuffing the skin out till it is in the shape of an animal. It seems that there is twice as much skin on an animal as it needs to cover it, and that one reason stuffed animals ordinarily look so frightfully unnatural is that the skin is stuffed till it is stretched out of all proper proportions.

"Mrs. Maxwell is, then, in reality a sculptor of animals. None of the animals in her museum are, properly speaking, 'stuffed animals.' They are sculptured animals, covered with skins appropriate to their kind. Her first collection she had sold, five years ago, to obtain money to make a larger one. Her great desire is to make a Colorado museum which shall be truly a complete one of all the animals and birds of the territory, and its minerals, and fossils, and Indian relics. Coloradoans ought to join hands with her in the enterprise, and all strangers who visit Colorado ought to see her museum—not only as a collection interesting in itself, but as evidence how independent a genuine passion for anything is of outside stimulus and help."—*Mrs. Hunt, in the Independent.*

Boilers.

At a recent session of the British Iron and Steel Institute, Mr. T. R. Crampton said: In the case of boiler performance, the question was how much water would a boiler evaporate with a given weight of coal, and the boiler which gave the highest performance in this way with the smallest area of heating surface was the best boiler. The question of what horse power the steam thus generated would develop was one which depended upon the class of engine to which the steam was supplied, and hence it had nothing whatever to do with the boiler. The class of boiler Mr. Crampton considered unimportant so long as good circulation and sufficient surface were provided for the work to be done. As a general rule, it was desirable to use the most simple construction of boiler possible under the given conditions; but under special circumstances greater complexity was justifiable to obtain the necessary area of heating surface within the required space. Mr. Crampton added that in 1842 he introduced the type of locomotive boiler with the firebox crown made flush with the barrel—the latter being made larger than in the older type—and he found that the additional water space thus provided at the sides of the tubes in the barrel had a decidedly beneficial effect on the circulation. For use in iron works in connection with a puddling or heating furnace, Mr. Crampton recommended a vertical boiler, say, about 8 feet diameter by 30 feet high, resting on the ground and free at the top, this boiler being surrounded by a brickwork casing, to the space between which and the boiler the heated gases from the furnace are admitted by a lateral flue, while they are led off at the top. Inside the boiler should be placed a tube some inches less in diameter than the boiler, thus dividing the ascending and descending currents, and thus promoting the circulation. A boiler thus arranged, Mr. Crampton stated, would never burn. and the gases would be discharged to the chimney with their temperatures reduced to 500°.

Lime in the Blast Furnace.

Mr. I. Lowthian Bell, says: "When limestone, in its natural state, is used as a flux, it quickly reaches a zone where the heat is sufficient to separate the carbonic acid from its calcareous base. The temperature of this region, indeed, is so intense that not only the carbonic acid associated with the lime, but a portion of that due to the deoxidation and carbon impregnation of the ore, is reduced to the form of carbonic oxide.

I have shown, on a former occasion, that the smelting of a tun of iron is probably accompanied by the conversion of 6·58 cwt. of carbon from the state of carbonic oxide to that of carbonic acid. The carbon in its acidified form, in the quantity of limestone consumed, upon one occasion, in a 48 feet furnace, was 1·92 cwt. Hence, we may infer that, were there no reduction of carbonic acid to a lower condition of oxidation, we ought to find, for each tun of iron produced, 8·50 cwt. of carbon, combined with its maximum dose of oxygen.

Instead of this quantity, only 5·47 cwt. of carbon so oxidized was found, in the escaping gases of one of the smaller furnaces referred to, per tun of iron of its make.

This change in the composition of the escaping gases of a blast furnace involves more serious consequences than what, perhaps, at first sight might appear.

	cwt. units.
There is the heat absorbed by splitting up carbonic acid containing (8·50 — 5·47) 3·03 cwt. of carbon	9,696
The decomposition of this carbonic acid carries off the same weight of carbon which it contains, and which escapes combustion at the tweers, involving a further loss of	7,272
	16,'68

The coke consumed upon the occasion which furnished these data amounted to 28 92 cwt. per tun of iron, and the heat estimated to be afforded by its combustion was 104,012 units. The proportion of the total heat generated, which was absorbed by the expulsion of carbonic acid from the limestone, and the decomposition of this compound of oxygen and carbon, amounted to 22 per cent. Of this, 16 per cent is due to the use of limestone, and 6 to the dissociation of the carbonic acid, produced by the reduction and carbon impregnation of the ore.

An expenditure of 16 per cent of the heating power of the fuel, which is rendered necessary by the presence of one of the constituent parts of our flux, affords *primâ facie* a strong reason why we should seek to relieve the furnace of a duty represented by about 4½ cwt. of coke, particularly as half this weight of inexpensive small coal sufficed for the purposes of the limekiln.

I am not aware that the experience of any iron smelter justifies the belief that any approach to this economy was ever realized by the substitution of lime for limestone. With the same quality of coke in each case, one of the smaller furnaces (48 feet) gave the following results:

14 days' make per furnace.	Average No.	Coke per tun.	Mine yielded.		
tuns.		cwt.	per cent.		cwt.
419	3·34	29·06	41·9	Limestone per tun	14 53
444	2·20	30·64	42·6	Burnt lime "	11·14

Other examples from furnaces of similar dimensions gave the following averages:

14 days' make per furnace.	Average No.	Coke per tun.	Yield per mine.		
tuns.		cwt.	per cent.		cwt.
404	2·65	29·31	42·0	Limestone per tun	15·89
451	2·10	27·99	42·6	Burnt lime "	11·46

In the first two cases given, the consumption of fuel is practically the same, but the produce of Cleveland iron, when smelted with calcined limestone, is somewhat better. Discarding this cause of difference, the sole advantage from the use of lime is the increased make and superior quality of the iron. In the next two examples, an improvement in production and grade of metal is also observable, along with an economy of 1·32 cwts. of coke, part of which is probably due to the better yield from the ironstone (Cleveland), as well as to a somewhat superior quality of coke received at the works, when calcined limestone was being used. In none of these instances, judging by the relative qualities of burnt and raw limestone employed, has one half of its carbonic acid been expelled.

The apparent want of reconciliation between the theory and practice in the consumption of fuel, when using the flux raw or calcined, is, in my judgment, in a great measure independent of the imperfect expulsion of carbonic acid from the latter; and further, I am of opinion that a complete separation of this element would fail to effect, in a larger furnace, any appreciable good in respect to the coke required for this process."

SALE OF SEWING MACHINES.—From the *Sewing Machine Journal*, we learn that there were sold, during the year 1874, 602,074 sewing machines of the different American makes, and that, since 1853, when the first sewing machines were made, up to the end of 1874, there have been in the aggregate 3,785,968 made and sold. Quite a business.

The Fraunhofer Lines of Diffraction and Prismatic Spectra.

BY PROFESSOR JOHN C. DRAPER.

Having been engaged during the past year in making photographs of absorption spectra of organic bodies, in which a solar spectrum with Fraunhofer lines was formed by a diffraction grating, I have resorted to the following method of forming such solar spectra, a description of which may prove of interest to those who are experimenting in the same field.

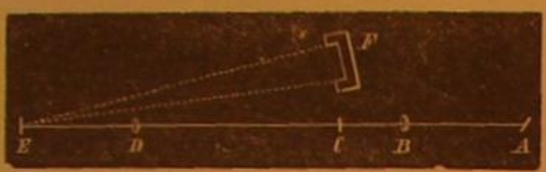
The grating generally used was made by Mr. L. M. Rutherford; it is ruled on speculum metal, 6,481 lines to the inch; it gives spectra by reflection. Other gratings on glass, now in my possession, give spectra by reflection and by transmission. The method answers equally well for both. It may be briefly stated as follows:

A beam of light is directed by the silvered plane mirror of a heliostat, A, into a darkened room.

It is received on an achromatic lens, B, 3·93 inches in diameter; focal distance from posterior surface, 23·50 inches.

A slit, C, is then placed within the focus of this lens, the distance being 18·86 inches from the lens, B.

After passing through the narrow slit, which is about 0·04 inch wide, the light is received upon a second achromatic lens, D, of the same diameter as the first, but with a focal



distance of 45·2 inches. The distance of this lens from the slit is 64·4 inches, and the focussing of the lines of the spectrum on a paper screen or on the ground glass of the camera is accomplished by moving the lens, D, nearer to or farther from the slit, C, or by moving the camera or screen, F, itself.

The grating, E, mounted on a suitable stand, is placed at a distance of 31·4 inches from the second lens. All parts of the apparatus being carefully adjusted, so that A, B, C, D, E are on the same horizontal axis, the grating is then arranged on its vertical axis, to throw the center of its reflected image on the opening of the slit, C.

The lines of the grating being accurately parallel to the sides of the slit, a series of beautiful spectra are produced on each side of the slit, any or all of which may be received on suitably adjusted screens, one of which is represented at F. In all of these spectra, if the slit has been very narrow, the prominent Fraunhofer, with numerous other lines, appear sharply defined.

Of the spectra described above, only the first, second, and third orders on each side of the image of the slit are available for general use on account of the overlapping of those that follow. Of those that are available, I have preferred to use the second order, since in this the dispersion is much greater than in the first, and by the apparatus described above a spectrum of a length of more than 11·8 inches is obtained.

For the projection of the prismatic spectrum a prism is substituted in place of the grating, when a very fine spectrum is produced, the focus of the violet end of which is very much closer to the prism than that of the red end.

In the diffraction spectra, also, it is necessary to vary the angle at which the screen is placed, to define sharply the lines at the extremities of each spectrum. In the spectra of the first order on each side, the screen is placed very nearly at right angles to a line drawn from the grating to *b*, in the spectrum. As each order in succession is examined, the divergence from this angle is greater and greater, and at the same time the focal distance of the lines moves nearer to the grating.

The lenses I have employed were those of a very fine photographic combination; they give with the rest of the arrangement a spectrum in which the definition of the lines is perfect, and they are present by hundreds. Though the lenses are 3·93 inches in diameter, only the central portion of each is used, a diaphragm with a circular aperture of 1·97 inches or less being placed in front of B.

To form the absorbent spectra of any organic substance, a suitable solution of the same is poured into a cell with parallel sides. This is placed at any convenient point between A and B, care being taken that the faces of the cell are at right angles to the course of the ray, A B. The slit may in this case be opened wider, when each spectrum will show the characteristic absorbent bands of the substance employed, the position being indicated (and if required, recorded) by their relation to the lines of the solar spectrum in which they are produced.

When the calcium or electric light is to be used for lecture room demonstration of diffraction spectra, the lens, B, should have as short a focus and as large a diameter as possible. The grating may also be so arranged on its vertical axis as to throw its image at a right angle to the line, B E, to be there received on a screen. Though by this device the spectra on one side of the image of the grating are greatly elongated and those on the other compressed, it presents the advantage of enabling the audience to see all the spectra at once, and also the optical contrivances by which they are produced.

AT Pribram, in Bohemia, the Adalbert shaft of the silver and lead mines has reached the extraordinary depth of nearly 3,300 feet.

Useful Recipes for the Shop, the Household, and the Farm.

Varnish brushes should never be allowed to touch water, as it not only injures the elasticity of the hair, but a resinous substance is formed in the hilt of the brush, which can never be thoroughly removed, and which will work out little by little when the brush is used, destroying the glassy surface which otherwise might be obtained.

Paint intended for outside work, which will not be protected by varnish, is mixed as follows: Crush the color if in lumps, and mix to a stiff paste with linseed oil, boiled or raw—the latter is preferable; then, if a dark color, add brown Japan or gold size, in the proportion of ½ pint to a gallon of oil; in a light color, use patent dryer in similar quantities.

A large stick of cypress timber will rot off cypress tenons, or tenons of any other kind of timber (if put together when the cypress is green), if kept under shelter. Cypress will dry rot itself, if over 15 or 18 inches square: and green oak of any kind, 12 inches square, will rot a dry 1½ inch pin of the same wood, or a pin of any other wood, if dry, and driven tight to exclude all air.

Horses will work much more easily, and lose less of their effective force, by working abreast, than when they are placed in single file. If four horses are to draw a load in one wagon, it is better to have a long double whiffletree, with a span of horses on each side of the tongue, than to have one span placed before the other.

A skillful sawyer, in sawing a log into scantling, which he knows will spring, will first mark off the ends into cuts; and then, after sawing once through on one side of the log, will saw a slab off the other side, and finish in the middle. By this means the lumber will be about as true as if the timber were not inclined to spring at all.

Chimneys are excellent lightning conductors. In view of which, it is recommended: First, that they be kept clean; then, that all the grates in a house be connected by means of a strong wire, such as is used for telegraph purposes, with a piece of metal in the earth, or with the iron gas or water pipes.

Veneered Diamonds.

The enterprising capitalists who are pecuniarily interested in the Keely motor will doubtless be glad to learn of another great discovery, which promises results certainly as astounding as those due to the "watery vapor." Abundant opportunities for investment are offered. The discoverer has worked twenty-eight years at the process, a little more than double Keely's time; and unlike the latter colossal genius, he does'nt keep the secret to himself, or lock it in the bosoms of a chosen few, but spreads it before an astonished world in this wise. Any body can try it for himself, and have a small Golconda in an incredibly short period of time. We extract from gigantic advertisements in the daily journals, the "Process of Producing the Parisian Diamonds."

"The body is of crystal, which is the hardest and best substance that could possibly be used for the purpose. Then, after the crystals are cut in proper shape, they are put into a galvanic battery, which coats them over with a liquid, that is made of diamonds which are too small to be cut and the chippings and cuttings that are taken off of diamonds during the process of shaping them. Thus all of the small particles of diamonds that have heretofore been comparatively worthless, can now, since this great discovery, be used to produce diamond liquid."

The Law of the Rail.

Some one, who has taken the trouble to post himself on the law governing railroad passenger travel, says that extra charges for failure to buy tickets are universally sustained by the courts, but there must be a full opportunity to buy afforded by the ticket seller. Passengers must show tickets when asked for. As to stopping off, there is only one decision, which is that a passenger cannot stop off, and resume his journey, without the previous assent of the company. As to the obligation of the road to furnish a seat to a passenger, a decision says: "A passenger who exhibits his ticket need not surrender it until he has been furnished with a seat." A railroad is not liable for things stolen out of a passenger's seat, there being no previous delivery to the company's servants; for the same reason the company is not liable for baggage in the passenger's own care. Passengers who neglect to look after their own baggage on arrival at their destination cannot recover it if it is lost without fault of the carrier. Baggage left in station houses for the passenger's convenience, after it has reached its destination, comes under a new class of rights and duties, the baggage master assuming the position of a gratuitous bailee, who only becomes liable in cases of gross negligence. The obligation of the railroad as carrier ceases when it has delivered it to its owner at the place of destination, or when he has had reasonable opportunity of receiving and removing it. It will interest sportsmen to know that they may recover for the value of dogs when they entrust them to baggage masters for hire because of their exclusion from the passenger cars.

Outdoor Amusements.

During the recent festival of the German turners in this city, a variety of curious gymnastic amusements were undertaken.

The competitive exercises on the horizontal bar attracted much attention, some of the contestants exhibiting great strength, ability, and endurance. There was also a swimming race in the East river. Twelve swimmers were taken in a tugboat nearly to Blackwell's Island (about 350 yards), and at a given signal all jumped into the water and struck out for the New York shore. After a few dozen strokes three swimmers became exhausted, and were picked up by the boats in attendance. Of the entire number only four swam to the shore. Another amusing feature, and one which caused a great deal of merriment, was boat tilting. Ten boats were each manned by one rower and another man, who stood at the stem armed with a long pole topped with rubber. As the two boats were rowed past each other, each man tried to push off his opponent into the water with his pole.

Common Sense Ventilation.

"The best practical statement I have met about ventilation," says Colonel Waring in the last *Atlantic*, "was contained in the remark of a mining engineer in Pennsylvania: 'Air is like a rope; you can pull it better than you can push it.' All mechanical appliances for pushing air into a room or a house are disappointing. What we need to do is to pull out the vitiated air already in the room; the fresh supply will take care of itself if means for its admission are provided. It has been usual to withdraw the air through openings near the ceiling, that is, to carry off the warmer and therefore lighter portions, leaving the colder strata at the bottom of the room, with their gradual accumulation of cooled carbonic acid undisturbed. Much the better plan would be to draw this lower air out from a point near the floor, allowing the upper and warmer portions to descend and take its place. An open fire, with a large chimney throat, is the best ventilator for any room; the one half or two thirds of the heat carried up the chimney is the price paid for immunity from disease; and large though this seems, from its daily draft on the wood pile or coal bin, it is trifling when compared with doctors' bills and the loss of strength and efficiency that invariably result from living in unventilated apartments.

A Hen Crocodile.

A female crocodile, recently shot in Florida, measured ten feet eight inches in length, and presented many points of contrast with the other. Her teeth were regular and white and sharp. The mottled black and yellow of her back and sides were distributed evenly, the yellow rather predominating than otherwise; while in the case of the male, no part was yellow except the belly—the sides shading off into the lusterless black which covered almost all of the back and tail. The ovary of the female contained four hundred and twenty eggs, varying in size from a No. 8 shot to a hen's egg, and all perfectly spherical. It may be added, in passing, that the female crocodile lays twenty or thirty eggs at a time, which she puts in layers in a hole in the mud or sand on the shore, covering each layer with a coat of earth and reeds and grass. She then leaves the process of hatching to the fermentation of this mass, which reaches the right degree of heat in about a month's time.

Just So.

We have waited long and patiently, says the *Philadelphia Evening Bulletin*, for Keely, because he said he wanted time to make his engine and to secure himself by patent in Europe. Since the announcement was first made, he has had time enough to have built one of the pyramids of Egypt, and to have obtained patents from every government on the civilized earth. Therefore, if Keely does not soon place that engine on a railroad track, and run it over to New York with a spoonful or two of water, it will be only natural that the public should finally determine that the enterprise is a humbug. Perhaps we may save time and ease popular expectation by expressing that opinion now.

For the preservation of wood by means of copper salts, says M. Rottier, cupric acetate and indigo, though good, are too expensive. Heating wood after impregnation with copper sulphates does not give reliable results. Cachou can only be used under certain circumstances. Ammoniacal copper salts are, however, susceptible of very general application, and when applied have more permanent effects than those of other copper salts.

THE clay smoking pipes marked T. D., which have been in use longer than the oldest inhabitant, are made by Messrs. W. White & Sons, of Glasgow, Scotland, an honest old Quaker house which has conducted the manufacture for a century and a half. Over one million of these pipes are imported and consumed in this country annually.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 17 to September 8, 1875, inclusive.

ATTACHING HEELS TO BOOTS.—J. W. Brooks, Boston, Mass.
BEARINGS.—Lathrop Antifrictionate Company, New York city.
BUSTLES, ETC.—A. W. Thomas, Philadelphia, Pa.
CLEARING PIPES.—J. H. Hawley, Stapleton, N. Y.
COMBINED BEVEL, RULE, ETC.—W. Ascough, Buffalo, N. Y
CRANE.—I. Hahn, Pittsburgh, Pa.
DREDGING SOIL, ETC.—P. Cramer, Providence, R. I.
ENGINE AND METER.—J. S. Foster, Salem, Mass.
EXTENSION LADDER.—R. Gilchreest, Louisville, Ky.
IRON SHIP, ETC.—R. Powell, Washington, D. C.
KNITTING MACHINERY.—N. B. Westcott *et al.*
LIQUID METER.—J. H. Shedd, Providence, R. I., *et al.*
MATCH SPLINT MACHINE.—F. de Bowens (of Elkton, Md.), London En
PREPARING FIBERS.—C. C. Coleman, San Francisco, Cal.
ROLLING MILL.—I. Hahn, Pittsburgh, Pa.
SEWING MACHINE APPLIANCES.—G. H. Bishop, Newport, Me.
SHEET METAL BOX, ETC.—H. Martyn, Boston, Mass.
SINK TRAP, ETC.—F. Adee, Brooklyn, N. Y.
STEAM GENERATOR.—D. Renshaw, Cohasset, Mass.
STREET CAR.—A. S. Gear, Boston, Mass.
TOY.—L. Schmetzer (of Chicago, Ill.), Rothenburg, Bavaria.
TREATING BONE BLACK.—J. Gandolfo *et al.*, Brooklyn, N. Y.
TREATING PAPER, ETC.—H. Kellogg, Milford, Conn.
TYPE MAKING AND SETTING.—C. S. Westcott, Elizabeth, N. J.
UMBRELLA, ETC.—J. C. Hutcombe (of New York city), London, Eng and

NEW BOOKS AND PUBLICATIONS.

Life Boats, Projectiles, and other Means for Saving Life By R. B. Forbes. Boston, Mass.: W. P. Lunt, 102 Washington street.

Mr. Forbes is Chairman of the Standing Committee of the Massachusetts Humane Society, and he details some of his views on another page of this issue His work now before us is a well written *resume* of what has been done in this country and in Europe in inventing and perfecting means of saving life in case of shipwreck; and it should be read by all shipowners and seafaring men, as well as by philanthropists and others who are trying so mitigate the dangers of the sea.

Recent American and Foreign Patents.

Improved Wooden Frame for Hinged Awnings.

Henry Sykes, New York city, assignor to himself and William Campbell, Brooklyn, N. Y.—This awning frame consists of metallic crew-threaded elbow couplings and wooden bars, provided with tenons, which are screwed into the said couplings, so as to make a perfectly rigid and smooth frame. It is stiffer than iron frames, and is not liable to rust, or to cause injury to the cloth.

Improved Farriers' Tool.

Michel Baltes, Franksville, Wis.—This is an instrument for cutting grooves in horses' hoofs to receive the clinch of the shoe nails. A straight jaw has a notch formed in the inner edge of its forward end. A curved jaw has an edge formed upon its forward end, and a spring is arranged in connection with the two jaws. In using the instrument, the straight jaw is placed against the hoof upon the upper side of the projecting part of the nail, and with the nail in the notch of the said jaw. The edge of the curved jaw is pressed against the hoof, and with an outward and downward pressure enough of the hoof will be scraped out to form a groove for the clinch. The use of this instrument avoids the use of a rasp to form a groove for the clinch, and avoids the injurious rasping of the hoof to take out the said grooves

Improved Toy Whistle.

Henry B. King, Paterson, N. J.—This is a whistle or reed with funnel-shaped mouth and guide wing, the whole attached to a cord and whirled through the air to produce a sound. A vane keeps the mouth steadily against the wind, and produces thereby the sound, which, if more than one whistle or reed be used. may be varied so as to be harmonious and pleasant to the ear.

Improved Composition for Preserving Eggs.

Joseph K. Boone, Booneville, Mo.—This is a compound of alum and lime, in equal proportions, dissolved in hot water, for the preservation of eggs, which are dipped in, and allowed to remain for ten seconds. A cement is formed on the eggshell, producing an airtight polished surface.

Improved Feed Water Regulator.

Christopher M. Bridges, Leon, Iowa, assignor to himself and Creed Bobbitt, of same place—A float in a chamber connected to the boiler at the water level rises when the water fills the chamber, and opens a passage from the chamber containing the float to the pump, thus allowing the boiler pressure to close the check valve in the supply pipe from the tank. A circulation of the hot water of the boiler by this means will be maintained through the pump as long as the water in the boiler is high enough to keep the chamber full and the float up; but when the water falls in the boiler below the connection with the chamber, the pump will exhaust the chamber, and the float will fall and close the passage from the float chamber. The check valve then, being relieved of the boiler pressure, will open, thus making an automatic regulator, and at the same time facilitating the circulation of the water, so that steam is made faster and more economically.

Improved Life-Preserving Stool.

Henry H. Nash, Baltimore, Md.—The object of this invention is to provide a simple, cheap, and effective life-preserving stool, applicable for use upon steamers and other sea-going vessels. It consists simply in arranging one or more disks of cork between two rounded boards, which constitute the seat of the stool.

Machine for Grinding and Fitting Pearl Veneers.

Jacob Hoffman and Georg Hoffman, Philadelphia, Pa.—The invention consists in a recessed gage and holder for the veneers, combined with the carriage, and an end-beveled gage connected with a beveled block and hinged dog. These improvements have been found in practice greatly to facilitate the grinding of the veneer.

Improved Meat Chopper.

H. P. Rankin, Allegheny, Pa.—The invention consists of a meat-block made in sections, held together by a metallic band that extends there above, so as to prevent the meat from escaping over the edges; and so that when one or more sections become uneven, the same may be replaced without destroying the whole block.

Improved Crimping Machine.

Thomas J. Greenwood, Warren, Ill.—This is a base plate, whereon is a crimping block or former, on which the boot is to be stretched. There is a clamp, which is the counterpart of some portions of the block, and a base plate for pressing the leather into shape upon it. A shaft, cam, and lever actuate the clamp, the shaft being detachably supported in its bearings, so that it can be taken out of the way readily for removing and applying the clamp, and the clamp being notched or serrated in the seat on which the cam works, to hold it whenever it comes to rest.

Improved Endless Chain Pump Bucket.

Jared S. Manley, Canton, Pa.—A circular disk is placed between two semi-globular pieces of rubber, and the whole is secured together by a bolt having washers, and swivels at the ends.

Improved Blind Slat Adjuster.

George A. Myers, Brooklyn, E. D., N. Y.—This is a device for adjusting and fastening the slats of a window blind at any desired angle, and for securing the blinds at an angle with each other. A wire attached to one cleat of the blind is secured at the other end to a block which slides in ways. After the slats are adjusted, the wire holds all in place, by a screw securing the block at any desired point on the ways.

Improved Apparatus for Holding Meat in Cutting.

William Tetley, Pana, Ill.—This is a curved bar hinged at one side of the butcher's block so as to be detachable. It is brought over the meat to be cut, so as to hold the same by pins projecting downward from the bar and into the meat, and is suitably secured on the opposite side of the block.

Improved Hose and Pipe Coupling.

Henry G. Koehler, Cleveland, Ohio.—One portion of the coupling enters the opposite portion. About the inner piece is a ring groove. On the outer piece are beveled spring catches, which, when the parts are pressed together, are forced into the grooves. Suitable spring tongs are used to pull the catches outward in uncoupling.

Apparatus for Gathering and Elevating Hay.

Alfred J. Park, Virginia, Mo.—This consists of a vertical frame supported on a pivot, and also on wheels resting on a bed, so that it has free rotation about a perpendicular axis. In the frame are posts having curved grooves in their sides to receive the shaft which forms the fulcrum of a hoisting lever. Said lever has a grappling device at one end, and a rope for raising or lowering it the other.

Improved Eaves Trough.

Chas. A. Codding, Dowagiac, Mich.—This invention relates to certain improvements in the half-round eaves troughs attached to the lower edges of the roofs of houses for the purpose of conducting away the water. It consists of a band of metal, soldered upon the transverse lap seam and fastened at one end beneath the stiffening tube, and bent over the edge of the trough and soldered at the other. It also consists in a brace bar, one end of which is bent around and soldered to the tube, and the other soldered to the opposite side of the trough, to brace and hold the sides of the trough the proper distance apart.

Improved Drag.

David Miller, Carrollton, Md.—This invention relates to certain improvements in that class of drags in which a single log of wood is provided with draft attachments, and is drawn laterally across the field for the purpose of crushing and pulverizing the clods and leveling the surface of the ground. It consists in the combination, with such a drag, of a pair of handles rigidly attached thereto and projecting to the rear, provided with a pair of wheels, upon which as a fulcrum the drag may be raised from the ground by bearing upon the handles, so as to avoid stumps and stones, and facilitate the turning of the corners at the end of the row, the said wheels and handles serving also to prevent the drag from rolling under the horses' heels when going down hill.

Improved Method of Making Pills.

Jacob Dunton, Philadelphia, Pa.—This invention relates to certain improvements in the manufacture of pills, made by compression in dies or molds. In manufacturing pills according to this method, it is found that the pill compressed of materials containing the natural moisture of the air possesses but little cohesion of particles and stability of form; and in removing them from the die, the attraction of adhesion is often greater than that of cohesion, and they crumble and break in such a manner as to render this method of compressing certain materials into pills wholly impracticable. This invention is intended to obviate this difficulty, and it consists in the method of drying the material to be compressed, so as to expel the moisture and insure the more thorough cohesion of particles, and the lubrication of the die or mold.

Improved Three-Horse Equalizer.

Ezra Graham, Manchester, Iowa.—The invention relates to an equalizer by which three horses may be hitched abreast and be enabled to draw their respective proportions of weight. It consists in two unequal levers jointed on the same pole pin. and connected by a chain passing over a rear pulley.

Improved Wash Board.

Edwin S. Heath, North Hope, Pa.—The invention relates to the construction and arrangement of parts whereby the corrugated zinc plates which form the rubbing surfaces of the wash board are secured together and to the flexible grooved and bent frame piece.

Improved Car Coupling.

George Wernimont, Dubuque, Iowa.—The invention consists of a serrated link guide that is adjustably attached to supports of a lateral shaft. The crank shaft is also connected, by crank arm and chain, with a swinging crank frame that raises the pin chain and pin in the drawhead for uncoupling.

Improved Dinner Box.

James S. Davis, Monroe, Mich., assignor to himself and George R. Hurd, of same place.—This is a case having a series of drawers for the solid food entering at one side between suitable partitions, and a coffee or tea holder, connected to the front by slides, in such manner as to fasten the drawers in the case. This makes a simple and efficient arrangement, by which as many separate drawers or boxes as desired may be had for the solid food.

Process for Forming the Ends of Carriage Slat Bows.

Charles Benton, Meriden, Conn.—This is an improved die for forming the ends of slat bows for carriage tops, or similar forgings. The invention consists in passing the ends of the slat bows through a series of gradually narrowing and deepening dies with inclined edges, which raise the stock by the impressions given to the ends without the edging used at present.

Improved Carbonic Acid Motive Power.

John Westcott, Tocoi, Fla.—This invention has in view the utilization of carbonic acid and other gases as motive powers, and it consists in storing up the carbonic acid gas in a separate receiver from that in which it is generated through the agency of the surface attraction of animal or vegetable charcoal, the latter material absorbing five times its volume of the gas, so that large quantities of the gas may be stored up without increased risk to the tensile strength of the receiver. and yet be easily developed and eliminated by heat so as to furnish an available motive power. The invention also consists in the method of developing and eliminating and expanding the gas from its condensation upon the absorbent material by means of a vehicle of boiling oil passing through pipes in the reservoir.

Improved Harvester Rake.

Moses Ray, Valley Grove, W. Va.—This invention relates to certain improvements in harvester rakes, and it consists in a shaft driven by the harvester mechanism, and terminating in a pulley which engages with a frictional contact two other similar pulleys, one on each side. Around these pulleys passes a band to which is attached an arm or extension, one end of which is provided with a friction roller and moves in a groove in the adjustable supporting frame, and the other end carrying at right angles to the arm a barrel. In said barrel is contained a loose standard which carries the rake. The standard falls out of the barrel of its own gravity when on the descending part of its revolution, and the rake takes the gavel at the cutter head and delivers it at the side of the harvester in the rear, a projecting arm attached to the rake standard striking a pin upon the table and giving the rake the necessary sweep. On the ascent of the rake, the standard is telescoped into the barrel and out of the way until ready for the next gavel. The entire frame work carrying the above described mechanism is pivoted upon the main shaft, and is provided with adjustable locking devices which engage with vertical supports and give necessary adjustment to the rake for high or low grain.

Improved Die Stock.

Virginius J. Reece, Greenfield, Mass.—In place of the bushing at present in use, adjustable guides are used, that are made in the shape of curved elbow levers, pivoted at one end to the die stock and acted upon by a sliding plate having eccentrically curved slots, which engage lugs of the guides at the corners of the same. The free ends of the guides are thrown, by the turning of the plate, in one direction toward the center of the die stock, being in any position at equal distance therefrom, so that they may be set to any size of bolt, and be firmly secured in position by a clamp screw.

Improved Gate Fastening.

William Leach, Omaha, Neb.—This invention relates to fastenings that enable a gate to be latched automatically as it swings to the head post, and consists in combining a rod having reversely beveled wings and weighted arm with a slotted angle plate.

Improved Fireplace Heater.

John B. Oldershaw, Baltimore, Md.—This invention consists in making a fireplace heater in sections, with a magazine open both at top and side as well as the cylinder, the two being connected by a chute.

Improved Hot Air Registers.

Edward A. Tuttle, New York city.—This is a combination of wal frame and register frame, fitting closely together in front, having lugs for fastening screws in a divergent angle between said frames.

In another register, patented to the same inventor, there is a segmental roller for carrying a slide and a slot and pin for working the fan, arranged on opposite sides of the slide. The pin for working the fan is arranged half the length of the throw of the slide from the pivot of the fan, in combination of a groove or slot of forty-five degrees of inclination to the slide. A notch in the end of the fans and a projection of the frame are so arranged that, by turning the fans a little beyond the vertical position to which they are brought to open the register, the notches pass beyond the projections, and thus free the fans to slide endwise far enough toward the frame to withdraw the opposite pivot from its bearing for taking out the fan or entering it to put the fan in its place.

Improved Strainer for Pumps.

Leonard Blass, Germantown, N.Y.—This invention consists in the combination of a cylinder having a cap screwed upon its lower end and a cap plate bolted to its upper end, and provided with an inle pipe and an outlet pipe. The tube has a flange formed upon its upper end, a wire gauze plate attached to its beveled lower end, and a hole formed in its side, combined with each other to adapt the device to be attached to a pump pipe.

Improved Refrigerator.

Henry G. Gleyre, Glasgow, Mo.—In this refrigerator, the interior is supplied with cold and pure air, while it is also used as a water cooler. The ice receptacle has an inclined perforated rear flange, and forms, with the rear walls, an intermediate ventilating flue. A perforated cover, having a pendent flange, cuts off direct air communication between the ice receptacle and ventilating outlet for the passage of air outside of the refrigerator.

Improved Wagon Springs.

Michael Feigel, New Utrecht, N. Y.—This is a novel combination of the V rod and tie rods with the body and other portions of the wagon, the object being to strengthen the forward part of the running gearing, to prevent the platform from sagging in the middle, and thus throwing the weight upon the fifth wheel, instead of keeping it around the king bolt, thus enabling the vehicle to be much more easily guided by the team.

Improved Earth Auger.

William Low, Webster, Mich.—The cutting bits have a point formed by a curve from the inner end to the wall of the throat and curved downward from the junction with the bottom to the point. They are arranged at opposite sides of the center with space between for the passage of stones, in combination with the bottoms, spirally molded for clearance.

Improved Pocket Book Lock.

Julius Hanau and Sigmund Bendit, New York city.—This invention consists of a series of short pieces of wire placed side by side in a little box, in combination with a spring at one or both ends of the series, so contrived that the hasp may engage between any two of the rods whenever it may come along the rods, by reason of the pocket book being more or less full, the row of rods being ranged in the line of the hasp. Thus the fastening is self-adjusting to the fullness of the book.

Improved Road Scraper.

Edward Huber, Marion, Ohio.—This invention is an improvement in the class of scrapers, the handles of which are unlocked from the body thereof by the action of the bail or draft rod when the handles are raised to a vertical, or nearly vertical, position. The elevation of the handles causes their spring catches to slide off the horizontal lugs affixed to the sides of the body of the scraper, thus allowing the latter to revolve and discharge its contents.

Improved Invalid Lounge.

Andrew Shiels, Portland, Oregon.—This invention relates to certain improvements in lounges, and consists in the combination, with the hinged bottom boards, of devices which enable the patient to adjust himself either from a recumbent to a sitting posture, or *vice versa*, without assistance.

Improved Horse-Detaching Apparatus.

Johusa W. Glover, Mount Savage, Ky., assignor to himself and William R. Kitchen, same place.—This consists of spring catches for detaching the traces by a cord passing over guide pullleys, and up into the carriage box, where a weight is attached for automatically detaching in case the carriage is suddenly overturned and the driver prevented from pulling the cord.

Improved Clothes Dryer.

John Sutton, Deep River, Iowa.—This consists of two racks suspended from a long plate supported at the middle on the top of a standard having a long narrow base, having swing feet to throw out and brace it laterally. The racks have braces which throw them out obliquely for use when the braces are adjusted on arms projecting from the standard below the top plate; and above these are two racks similarly supported on standards rising up from the top plate, and having braces to hold them out obliquely for use. Other clothes-supporting arms are used, some being permanently and others detachably connected, the whole making a rack that can be readily opened and extended for use and folded up out of the way.

Improved Hollow Staff for Watches.

William A. Belcher and David J. Plume, Ophir City, Utah Ter.—This is an improved staff, which may be quickly replaced when one of the pivots is broken off, without in the least interfering with the balance wheel or other parts. The staff is made hollow, with detachable center plug, that is readily removed and replaced without interfering with the other parts.

Improved Chimney Cowl.

Theodore C. Nativel, San Jose, Cal.—The ventilating cowl is formed of two parts or cylinder flues, one enclosed by the other. The inner part, or flue, has vertical exterior ribs, which form a bearing or support for the section of the outer flue, leaving air passages between. The flue sections are beveled at their ends to form a close and strong joint, and the ribs act as buttresses for each flue.

Improved Turbine Water Wheel.

Y. W. Larmon, Russellville, Ky.—This invention contemplates the improvement of turbine wheels so that they may run more easily against back water, under a less head of water, and be susceptible of adjustment of the power. The several features of improvement seem well adapted to the object in view, and will doubtless economize water and enable the power to be graduated with facility.

Improved Steaming Table.

Asabel J. Randell, Belvidere Seminary, N. J.—This invention relates to a culinary apparatus combined with a falling-leafed table, designed for cooking by steam. Beneath the table top is a case, which contains a steam chest having an upper bottom, beneath which is a drawer which extends entirely through the case and forms a fire chamber. A lamp and a gas burner are placed in this chamber, either of which may be used in the absence of the other. There is a removable bread tray in which is a dough mixer, and a case contains drawers for keeping dishes, table linen, and similar articles. With this apparatus, a family in close quarters or small apartments may be accomodated with the essentials of housekeeping in a small space.

Business and Personal

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Hoadley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co, New Haven, Ct.

Soap Stone Packing, in large or small quantities. Greene, Tweed & Co., 18 Park Place, New York.

Screw Cutting Index and Rule for Compound Gearing, Price 10c. Address E. Lyman, C E., N. Hav., Ct.

Scale in Boilers Removed—No pay till the work is done. Send for pamphlet. Geo. W. Lord, Phila., Pa.

Suction & Blast Fans, Wood-working Machinery, &c. D. J. Lattimore, 31st & Chestnut st., Phila., Pa.

Wanted—Copy of Patent Office Gazette of April 29, 1873. Also, all issues of said Gazette from January, 1872, to June, 1872, inclusive. F. G. Jillson, Woonsocket, R. I.

Save your fuel 25 per cent worth, or get same amount of extra power, by applying the R. S. Condenser. T. Sault, Consult'g Engineer, Gen'l Ag't, N. Haven, Ct.

Fine and Elaborate 1st class Working Models made for exhibition. Address B. 1228, Chestnut St., Philadelphia, Pa.

Rubber and Oak Tanned Leather Belting.—Greene, Tweed & Co., 18 Park Place, New York.

Patent Scroll and Band Saws, best and cheapest use. Cordesman, Egan & Co., Cincinnati, Ohio.

Geo. P. Rowell & Co., the N. Y. Advertising Agents, have the monopoly of space and location in many hundred newspapers, and know, by their experience, just where to invest money to the best advantage.—*Berkshire Courier.*

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), $7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue o Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Wanted—To Invent, Improve, and Simplify Machinery for some manufacturing firm; will take part interest in the inventions or at a salary. Satisfaction guaranteed. Address Inventor, Clark House, Minneapolis, Minn.

Carriage "Spring Equalizer" Patent for Sale.—New thing, ornamental, principle the best, and takes with all who see it. Sold only on account of pressure of other business. Terms easy. Address S. Elliott, Box 118, New Haven, Conn.

For Sale—Pontiac Planing and Saw Mills, containing 52 in. Circular Saw and 18 modern Machines for the Manufacture of Sash, Doors, &c. Apply to H. Heitsch, Pontiac, Mich.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

Perfection of Hay Rakes, Self Dump, without Ratchets, Gears or Springs, just patented. Address C. La Dow, Ballston, N. Y.

For Sale—Back-geared, Screw Cutting, Engine Lathes, as follows, viz: 28 in. x10 ft. power cross feed, $375; 22 in. x8 ft., $225; 20 in. x7 ft., $175; 12 in. x7 ft Hand Lathe, $60; 48 in. Chucking Lathe, $175; 70 in. x52 in. x27 ft. Planer, $2,800; 48 in. x48 in. x20 ft. Planer, $1,800; 32 in. x32 in. x16 ft. Planer, $750; 26 in. x26 in. x6 ft. Planer, $475; 36 in. B. G. Drill, $175; 32 in. Horizontal Boring Machine, $225; 72 in. Gear Cutter, $450; 3 Milling Machines, $175 each; Profiling Machine, $150; Screw Machine, $150; 8 Fowler style Presses, 1½ size, $200 each; 5 Fowler Presses, 00 size, $90 each; 4 Fowler Presses, 0 size, $125 each; 5 Farrell Presses, 0 size, $125 each; 2 very large Fallinsber Presses, new; 100 Wrought Iron Vises at 40 per cent off list. All above tools good as new. Shearman & Hilles, 45 Cortlandt Street, New York.

Wanted—A Situation by a Machinist & Draughtsman. Address R. P., Machinist and Draughtsman, P.O. Boston, Mass.

To Purchasers of Engines, Boilers, and Machinery—Special and important information may be obtained, and special inducements will be offered, by addressing Todd & Rafferty Machine Company, Paterson, N. J., or No. 10 Barclay St., New York.

Hyatt & Co., New York, Manufacturers of Varnishes, make the best that is now in use. Wherever it is used, it takes the place of all others, and becomes at once the standard. This product is better than the best imported, and nothing in the country can compare with it.

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$5,000 invested in a valuable Invention will give arge returns.—A. D., 353 Morris Avenue, Newark, N. J.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List ree. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use Address Milo Peck, New Haven, Conn.

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The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

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Notes & Queries

A. K. can cast iron free from air holes by following the directions on p. 409, vol. 31.—F. K. will find a recipe for hair wash on pp. 267, 363, vol. 31.—R. J. will find that casehardening iron is described on p. 69, vol. 31.—R. N. will find directions for frosting glass on p. 264, vol. 30.

(1) B. B. N. asks: How and why does the magnet attract the compass needle, and extract its magnetism? A. By its superior power. When the two are placed with opposite poles in contact or near together, they tend to neutralize each other; but the magnet, being more powerful, demagnetizes and even reverses the polarity of the needle.

(2) W. S. R. says: I have a telegraph sounder, of which only one spool is wrapped, and I would like to wrap the other spool myself. I have enough wire to do it, but the good one is wrapped to the right, and I would like to know if the other is wrapped to the left, or as the first one is done. A. Wrap the same way and connect the inside ends together.

(3) J. T. S. asks: If I dissolve or liquefy wood or paper in sulphuric acid, is there any way of separating the liquid wood or paper from the acid? A. The action of sulphuric acid on woody fiber is to extract the elements of water, leaving it black and charred. If the clean fibers of the wood be digested in strong sulphuric acid for several days, a change will take place, and the cellulose will be converted into starch. If the acid is then largely diluted with water, boiled for several hours, and then carefully neutralized with chalk, a mass of glucose (grape sugar) will be obtained, which, if the process has been well condducted, may exceed in weight the woody fiber employed.

(4) P. D. B. says: I am in want of some material that will hold water, and in which ice, in congealing, will not adhere to the sides. A. Try vessels lined with smooth non-conductors, like porcelain, glass, etc.

(5) L. H. R. asks: How can I obtain a vacuum in a glass tube without the use of an air pump I wish to seal the ends of the tube in such a manner as to admit the two wires from a battery, for an electrical experiment. A. Close one end of the tube by means of a blowpipe, and displace the air contained in the tube by means of carbonic acid gas. Then hermetically seal the open end of the tube into the mouth of a strong glass bottle or flask containing a quantity of caustic potassa. After a long time the potassa will have absorbed the carbonic acid contained in the tube, thereby forming a nearly perfect vacuum. That part of the tube just above its connection with the bottle may then be softened by means of a blowpipe (or Bunsen lamp), drawn, out and sealed. The wires, previously placed in position in the tube, should be of platinum.

(6) J. M. G. asks: 1. Do bones that have been exposed for some years on the prairies lose any of their valuable properties as fertilizers? A. Very probably. 2. Is the demand for crushed bones sufficient in the Northern States to justify one in shipping the same from Texas? A. We do not think it would be advisable.

(7) F. C. & Co. ask: What alloy of metals turns nitrate of silver black, and what are the proportions? A. Nearly all the common metals and their alloys, when brought into contact with an aqueous solution of nitrate of silver, precipitates the silver in the form of a fine black powder.

What will take the rust off the steel points of drawing instruments? A. Try a little emery paper and oil.

(8) J. C. L. asks: How can I make a small cord (about $\frac{1}{16}$ of an inch thick) impervious to dampness without diminishing its pliability? A. Saturate it with a concentrated solution of copper in ammonia, and dry.

(9) F. A. W. says: 1. In melting silver I have used a flux of pumicestone and borax: and when I cast, part of the flux runs in with the silver. How can I avoid this? A. The pumicestone should be added in sufficiently large quantities to absorb the superfluous borax. Do not crush your pumicestone too fine. 2. How can I get the silver out of the pickle into which the bars are put after being cast, the pickle being made of sulphuric acid and water? A. Precipitate the silver in the form of chloride by the addition of muriatic acid. Then heat the precipitate together with a quantity of borax and a little rosin, in a small crucible, until the metal is reduced. The flux may then be removed by means of pumicestone as before.

(10) B. asks: Is glucine to be had in New York? A. We do not recognize any substance by this name.

(11) W. O. C. asks: Can you give me a recipe with which I can dissolve pieces of imitation tortoiseshell, so as to run it into molds? A. You do not state of what your imitation shell is composed. We of course must know its composition before we can tell what will make a good solvent.

Is there anything not injurious, which will completely remove dandruff? A. Dandruff or pityriasis is a chronic inflammation of the skin, attended with redness and itching, and characterized by the production of minute white scales or scurf in great quantity. It may attack any region, but the scalp is the most common seat. Great cleanliness is the first consideration in its treatment. The use of tonic infusions and of sedative or alkaline lotions to the affected part are measures to be employed. A wash frequently used is the following: Boil 1 lb. rosemary in 2 quarts water, and add to the filtered liquid 1 oz. spirit of lavender and ¼ oz. salt of tartar.

(12) G. F L. asks: Is there any substance which will absorb coal gas when mixed in small quantities with the air in an ordinary living room? A. It can be absorbed by a solution of cuprous chloride in hydrochloric acid, presenting a large absorbing surface.

(13) L. S. C. asks: In the manufacture of brown sugar from cane juice, I have large quantities of muddy sediment in the bottom of juice vats, also a great quantity of skimmings: both are somewhat gummy in character, but as valuable as clear juice, if purified. Can this material be filtered through bone black, charcoal or any other material, and made reasonably pure, and how? A. You will require charcoal filtration, and Dumont's filter will probably work to your satisfaction. It consists of a wooden box of the form of a four sided truncated pyramid with a double bottom. The inner bottom is a metallic plate pierced with numerous holes; upon it a cotton cloth is laid, and coarse-grained animal charcoal moistened with water is then spread layer by layer, each layer being rendered of uniform thickness, and packed or pressed closely together by means of a trowel. When the bone black has been thus formed into a compact bed or stratum of about 15 inches in thickness, and within 5 to 10 inches from the top of the box, it is covered with another cotton cloth, and with another metallic plate pierced with holes. The object of the second cloth and metallic cover is to collect any substances which would otherwise obstruct the interstices of the superior stratum of the bone black, an inconvenient accident which is easily prevented by the use of such a cover, and this cover is readily exchanged for another, should it become itself obstructed. It is important, in order to avoid false passages, that the juice should be constantly at the same level of about three inches above the cover of the bone black. This is accomplished by means of a self-regulating cock. Animal charcoal is expected to purify, on an average, an equal weight of fine, or twice its weight of seconds, sugar. The same bone black may be employed any number of times, provided the substances which it has withdrawn from the sirup be removed. This is often done by simple reburning. Consult Muspratt's "Chemistry," vol. 2, pp. 950 to 1,000.

(14) C. Z. P. asks: In one of your late numbers you said that silver (metallic) is to be re-obtained from nitrate of silver by melting it with borax or rosin. Will this be applicable for oxides or other metals, such as lead or zinc? A. Gold may be reduced by this method, but not lead, zinc, or any of the more common metals.

(15) S. B. P. asks: If the lower metals are alkaline, are the higher metals acids? Is there any distinct division between the alkaline and other metals? A. We do not understand your classification of the metals. The term alkali is restricted to those bodies, such as potash and soda, which have an acrid nauseous taste, and are unctuous to the touch. If the metals be arranged into a table with reference to their affinity for oxygen, the noble metals—gold, silver, platinum, etc.—will be found at one end, and the metals of the alkalies at the other. Those elements having the greatest affinity for oxygen are called electro-positive; while those at the other end of the list are known as electro-negative bodies. There is no definite dividing line between these, each element being negative to the one preceding, and positive to the one following it.

(16) C. L. W. asks: What oil is best for oiling silk for insulation? A. Paraffin oil.

(17) O. B. asks: What is the formula for producing oxide of gold? A. The protoxide of gold is obtained as a dark green powder by precipitating the protochloride of gold by a dilute solution of potash.

(18) I. B. M. asks: What is the name of a microscopic organism, occurring in an infusion of walnut leaves last spring, and consisting of a cup-shaped head anchored by a thread to a twig? The thread slowly contracts to a spiral spring, and then suddenly and projects the head forward, as if to secure food. A. The microscopic organisms described by you are infusorial animalcules, of the family *vorticellidæ* or bell animalcules. The genus *vorticella* consists of little creatures placed at the top of a long flexible stalk, the other extremity of which is attached to some object, such as the stem or leaves of an aquatic plant. This stem, slender as it is, is nevertheless a hollow tube, through the entire length of which runs a muscular thread of still more minute diameter. When in activity and secure from danger, the little vorticella stretches its stalk to the utmost, while its fringe of cilia is constantly drawing to its mouth any luckless animalcule that may come within the influence of the vortex it creates: but at the least alarm the cilia vanish, and the stalk, with the rapidity of lightning, draws itself up into a little spiral coil. But the vorticella is not wholly condemned to pass a sort of vegetable existence, rooted, as it were, to a single spot by its slender stalk; its Creator has foreseen the arrival of a period in its existence when the power of locomotion would become necessary, and this necessity is provided for in a manner calculated to excite our highest admiration. At the lower extremity of the body of the animal, at the point of its junction with the stalk, a new fringe of cilia is developed; and when this is fully formed, the vorticella quits its stalk, and casts itself freely upon its world of waters.

(19) W. W. B. asks: 1. What is the form of galvanometer used in testing the connection of a lightning rod with the ground? A. An ordinary tangent galvanometer of the form designed by Dr. Bradley is most convenient. 2. What is the method of operation? A. Two earth connections in addition to that of the rod are necessary. Call these B and C, and the rod A. Measure the resistance of A and B together, then A and C, and finally B and C. Add the resistance of A and B to that of A and C, subtract the resistance of B and C from their sum, and divide the remainder by 2. This will give the resistance of the rod alone. 3. Would a sink vault be a good place to insert a lightning rod? A. Yes, provided it exposes sufficient surface.

(20) J. W. F. says: In a rainstorm, four barrels of water were caught on one half of a roof of a house 16x24 feet. I claim that the same amount of water would have fallen on a piece of ground 8x24 (leaving out projection of eaves). A friend claimed that the roof, being ¼ pitch, contained more square feet, consequently would catch more rain. Which is right? A. You are right. It is the same problem as that of perpendicular pickets in a fence running up hill; it takes the same number of pickets over a hill as upon level ground When the rain is driven obliquely against the roof, there will, of course, be more to fall upon one incline, but just to the same extent will there be less falling upon the other.

(21) A. B. C. asks: 1. What is the proper pronunciation of Léclanché? A. Lehclanchai. 2. Please explain why the zinc of a battery is the positive pole or element (as stated on p. 107, vol. 33) when the flow of electricity is from the other pole to the zinc? A. There seems, at first sight, to be some inconsistency in using the terms positive and negative in connection with the zinc plate of a battery; but as any part of a circuit considered by itself must present both a positive and a negative pole, and as the outside poles alone are of practical importance, these are the ones alluded to when any are mentioned: the negative pole being that one towards which the current is directed. When the metal itself is referred to, we call that one positive which is consumed, because, in this case, attention is more particularly called to the direction of the current in the battery, and here it is from the metal on which the action takes place. 3. Which of the following four methods is best applied to lightning arresters for telegraph offices: Points, connected with the line wire presented to points connected with the ground, line points presented between ground points, line points presented to a plain ground surface, or ground points presented to plain surface connected with the line? A. Experiments, made for the purpose, showing that those lightning arresters are most efficacious which combine, in one system, opposed points and opposed plates separated by very thin pieces of mica. 4. Why do you think that the best one? A. By their diffusive property, points tend to prevent an accumulation or charge; sometimes, however, the sudden presence of a great quantity of electricity exceeds this power of points; in such cases, the plates act like condensers, in which the potential becomes so high that a discharge takes place between them rather than through the instruments; this is what constitutes their principal advantage. 5. Is the efficiency of the arrester increased by increasing the number of points? A. Yes.

(22) E. M. C. says: Our orchards have been greatly infested with caterpillars, which seem to have few enemies, as no bird round here will eat them. But I have several times noticed small gatherings of red ants, and upon examination found them to be eating a large caterpillar; and since then I have often seen two or three ants attack, kill, and eat large caterpillars. Is this common? A. Yes. It is by no means a new discovery.

(23) A. K. asks: 1. How can a writing ink be made that will stand the test of acids, so that no acid can erase it? A. Aniline black, asphalt in turpentine, and coal tar in the same solvent have been used for this purpose. 2. What color is most permanent? A. Writing fluids are, as a rule, more permanent than ordinary black ink. After a short exposure to the air they become black, or nearly so.

(24) B. B S. says: I have never succeeded in making a perfect ink or fluid from any recipe, either with extract of logwood, nutgalls, or a combination of both. How can I make a bright, limpid, and bluish green at first, turning black on drying? A. Try the following: 12 ozs. nutgalls, 8 ozs. each sulphate of indigo and copperas, a few cloves, 4 or 5 ozs. gum arabic, for a gallon of ink. The addition of the sulphate of indigo renders the ink more permanent and less liable to mould. It is blue when first written with, but soon becomes an intense black. It is a true solution, and in composition nearly resembles that of P. & J. Arnold.

(25) C. O. O. says: I am using tin for plating; it works well for a time, but becomes hard by being heated so often. What can I do to make it flow more freely? A. This is probably due to impurity in the bath. You should state what are the character and the composition of the articles plated.

(26) R. S. W. asks: How can brass be melted on a small scale, by amateurs? A. The operation is rarely at first accomplished by amateurs without considerable difficulty. It requires a good furnace, capable of fusing copper, and a crucible capable of withstanding the high temperature. For this latter reason black lead crucibles are generally employed. The crucible is placed in the newly made fire, so as to heat up gradually. When well heated, place in your copper in small pieces and force your fire until the copper is just fluid: then place in your zinc, stirring the fused alloy meanwhile. Do not allow the temperature to rise too high, as in this case a great part of the zinc will be volatilized, and, coming into contact with the air, will become ignited and converted into a copious white vapor of oxide of zinc. It is advisable to keep the surface of the fused metal covered with a quantity of chloride of ammonium (sal ammoniac), in order to preserve the surface free from oxide and clean.

(27) H T. C. asks: Is there any scientific method by which to ascertain the depth to water underground, without digging or boring? A. No.

(28) W. A. D. asks: 1. Is there an article of the nature of oilcloth, or thin rubber cloth, that can be put over a frame about 3 feet square, and heated, from underneath, to a temperature of from 100° to 140° or 150° Fah., and will admit of a shower of water being thrown on immediately after the discharge of heated air, without injury to the covering or any disagreeable odor from the material? It must needs be airtight and watertight. A. Try a suitable modification of asbestos cloth. 3. What material could I get for heating the space in the manner described? A. Try gas manufactured from a suitable light coal oil.

(29) J. A. says: I have seen an argument that, the centrifugal and centripetal forces at work in the earth's rotation not being equal, the earth is consequently hollow. What are the centrifugal and centripetal forces in this connection? A. Consult "Sketches of Creation," by Professor Winchell, pp. 36—60.

(30) A. E. says: I have been troubled for a long time with my well water. The well is over 40 feet deep; the water is delicious, clear, and cool; and yet, on holding a glass of it between you and the sunlight or lamplight, you can see minute living creatures. I have discovered two species. There are also earth worms occasionally drawn up in the bucket. Will you tell me the cause of these appearances? A. It is very unusual for animal life to be developed in water of such a character as you describe. The earth worms have probably gotten in accidentally, and the living creatures may not have come from germs present in the water itself. 2. Is wholesome water ever found in this condition? A. If you fill a quart bottle half full of the water, close it with a good cork, put it in a warm room, and then after a week's time find on opening the bottle there is no smell, the water is probably wholesome.

(31) J. J. G. asks: 1. Why will not aniline yellow (lemon) and aniline blue mix? A. They are used separately—first the blue, and finally the yellow—in order to obtain the desired shade of green. 2. What colors can I take that will make any shade of green ink I may want? A. Verdigris dissolved in acetic acid gives an elegant green.

(32) W. H. B. asks: Is there any way to remove printed matter from postal cards, sufficiently to allow the surface to be legibly written over? A. Remove the printing by means of a sharp steel eraser, and polish with a good bone or ivory paper knife.

1. How can I make a liquid preparation to apply to cuts and bruises, such as will quickly dry and form an artificial cuticle? A. Use collodion. 2. Is collodion dissolved in ether a good preparation for this purpose? A. Yes. 3. Can collodion be dissolved in alcohol? A. Collodion is a solution of negative cotton in ether, or a mixture of ether and alcohol. Gun cotton is insoluble in alcohol alone.

(33) F. A. H. asks: Can a good durable white ink be made? If so, what are the ingredients? A. Shake up a little finely ground oxide of zinc with a small quantity of gum water. This, we think, will answer your purpose.

(34) G. M. S. says: How do you compound nitric acid with water so as to give galvanized iron the snowflake finish? A. Use muriatic acid 3 parts, nitric acid 1 part, and water 3 parts; wash immediately afterward with pure water.

Why does metal blister after it comes out of the water, immediately after galvanizing? A. This may be due to the fact of the metallic surface not having been perfectly clean, or on account of the too rapid cooling of the surface.

(35) C. W. B. asks: How can I crystallize alum, so that it will adhere readily, in quantity and in regular forms? A. Make a concentrated solution of the salt in boiling water, and set it aside to cool slowly.

(36) C. L. C. says: A grain of corn consists of the heart or soft part (the germ) and a hard portion; which of these would produce the most spirits, starch, and sugar, respectively? What difference is there in the chemical composition between the hard and soft parts? A. We do not find any published statement that furnishes the desired information, and an experimental investigation would require considerable time.

(37) J. S. asks: Is there anything that can be mixed with glue to make it harder? A. Try the following: Melt together equal parts of common pitch and gutta percha. Apply hot.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. C. B. F.—It is sulphide of iron.—C. B. K.—It is a rock composed of felspar and hornblende. The brilliant yellow metallic particles are sulphide of iron.—D. H.—It is decomposed potash mica. For a possible advantageous use of such mica, see an article by Professor Leeds in the *Gardener's Monthly* for August, 1875.—E. A. H.—You are right. A further examination, however, shows that these specimens contain a small percentage of lime and silicic acid. It is largely used in the manufacture of paints, for which the mineral sent would answer.—M. M. C.—It is difficult to account for the presence of such a mass of the mineral which you send, at the bottom of a well. It is sulphide of iron. Such concretions sometimes occur, but the fact of one being in a well may be due to accidental circumstances.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Large and Small Wygon Wheels. By S. L. M.
On Tens and Hundreds. By W. S. H.
On Weather Predictions. By M. O'R.
On the Keely Motor. By F. K.
On Railroad Cars. By S.
On Natural Phenomena and Temperatures. By J. K.
On Mouse Traps. By C. R.
On Repairing Bells. By T. K. A.
On the Relation of Time and Movement. By A. W.

Also inquiries and answers from the following:
G. V. B.—J. G.—R. S. W.—J. T. F.—B. S.—H. D.—W. B. W.—J. G. A.—J. C. W.—J. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes an air or steam engine suitable for driving a sewing machine? Who sells podometers? Who sells machines for making matches? Who sells steel drills, used in riveting crockery and glass? Who sells mica in sheets?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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DESIGNS PATENTED.

8,655.—TOY BANK.—C. W. Crôteau, Philadelphia, Pa.
8,656.—PIPE.—C. D. Grimm, Glenwood, N. J.
8,657.—CIGAR BOX.—M. Hilson, New York city.
8,658.—WOOLEN FABRICS.—A. Jewell, Lawrence, Mass
8,659.—GAUNTLET BOXES.—B. G. Shults, Johnstown, N. Y
8,660.—STOVE.—W. Tweeddale, Brooklyn, N. Y.
8,661.—BRUSH HOLDER JAWS.—C. B. Clark, Buffalo, N. Y.
8,662.—CANE HANDLE.—T. R. Lovett, Philadelphia, Pa.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

September 20 to 28, 1875.

5,187.—J. G. Martin, Cobourg, Ont. Washing machine. Sept. 20, 1875.
5,188.—C. J. Riply, Cumberland, Ont. Tug pins for vehicle shafts. Sept. 20, 1875.
5,189.—I. Stebins, Boston, Mass., U. S. Hydraulic elevator. Sept. 20, 1875.
5,190.—R. S. Galbraith *et al.*, Montreal, P. Q. Umbrella and parasol case. Sept. 20, 1875.
5,191.—J. Brakenshine, Kingston, Ont. Ship pump. Sept. 22, 1875.
5,192.—H. J. Yeargin *et al.*, Liberty, Tenn., U. S. Combined hand roller and harrow. Sept. 23, 1875.
5,193.—D. W. Rawson, Croyden, N. H., U. S. Cloth washer. Sept. 24, 1875.
5,194.—J. McBean, Chicago, Ill., U. S. Stone and compound pavement. Sept. 25, 1875.
5,195.—S. Webster, St. Catherine's, Ont. Oil tank. Sept. 25, 1875.
5,196.—W. J. Parmlee, Herkimer N. Y., U. S. Carriage axle box. Sept. 25, 1875.

5,197.—G. Kallmeyer *et al.*, Hamburg, Germany. Button hole machine. Sept. 25, 1875.
5,198.—J. Howe, Milford, Mass., U. S. Sand-papering machine. Sept. 25, 1875.
5,199.—J. D. Imboden, Richmond, Va., U. S. Car axle lubricator. Sept. 25, 1875.
5,200.—H. F. Eberts, Detroit, Mich., U. S. Wheel tende. for vehicles. Sept. 25, 1875.
5,201.—A. H. B. Blanchard, Montreal, P. Q. Yard and cravat holder. Sept. 25, 1875.
5,202.—M. Durand, Montreal, P. Q. Fire escape apparatus. Sept. 25, 1875.
5,203.—G. W. Cook *et al.*, Chicago, Ill., U. S. Safety attachment to car trucks. Sept. 25, 1875.
5,204.—W. W. Lambie *et al.*, St. Mary's, Ont. Fanning mill. Sept. 25, 1875.
5,205.—S. S. Ryckman, Hamilton City, Ont. Lamp cleaner. Sept. 25, 1875.
5,206.—N. D. Martin *et al.*, North Troy, Vt., U. S. Milk cooler. Sept. 25, 1875.
5,207.—A. H. Watkins, Wellesley, Mass., U. S. Vapor burner. Sept. 25, 1875.
5,208.—H. C. Moody, Oswego, N. Y., U. S. Carriage curtain. Sept. 28, 1875.
5,209.—D. Gurnsey, Watertown, N. Y., U. S. Milk cooler. Sept. 28, 1875.
5,210.—V. Colvin, Albany, N. Y., U. S. Portable boat. Sept. 28, 1875.
5,211.—A. G. Rykert, Attica, N. Y., U. S. Carriage painter's jack. Sept. 28, 1875.
5,212.—G. H. Jones, Rose, N. Y., U. S. Turbine water wheels. Sept. 28, 1875.
5,213.—J. W. Reed *et al.*, Kalamazoo, Mich., U. S. Lubricator. Sept. 28, 1875.
5,214.—S. Williams *et al.*, Boston, Mass., U. S. Mitering machine. Sept. 28, 1875.
5,215.—C. L. Holland, Ipswich, Mass., U. S. Lock nut. Sept. 28, 1875.

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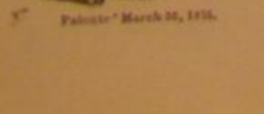

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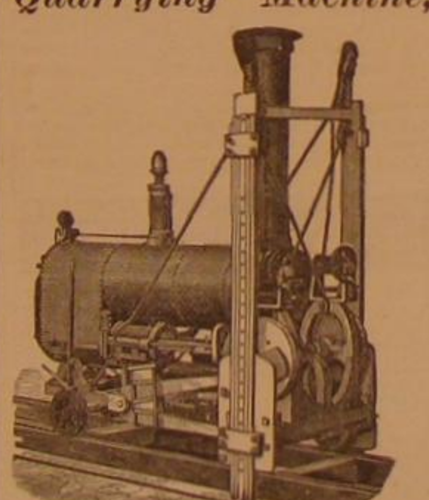

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