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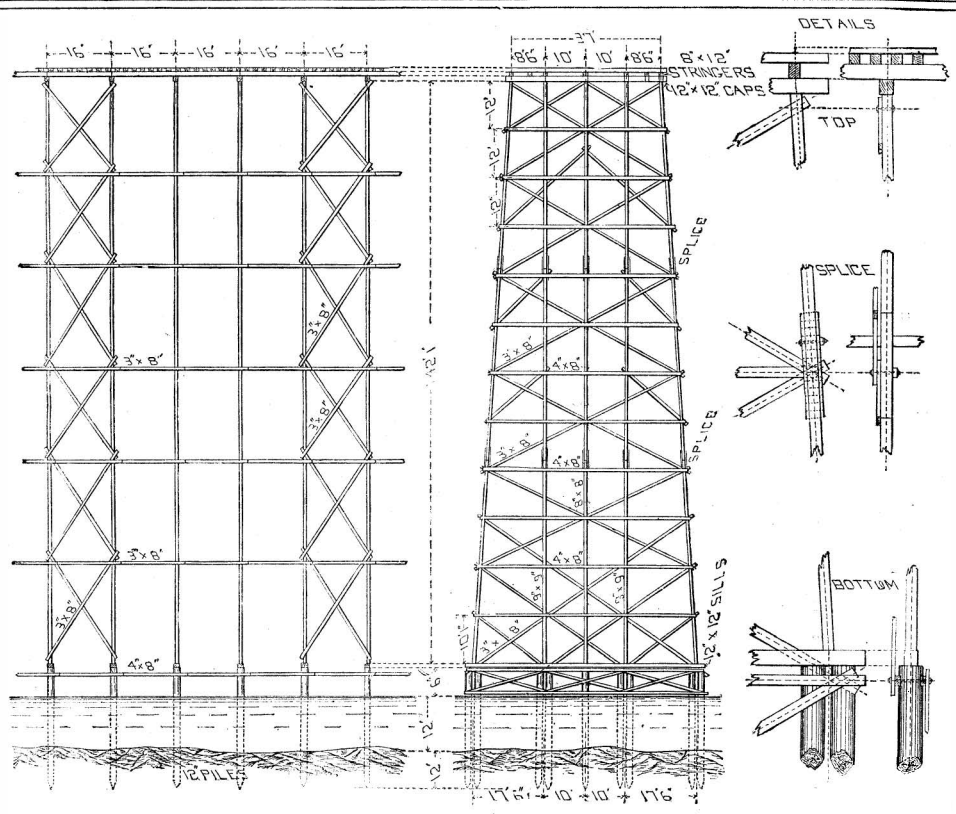
THE RONDOUT BRIDGE.

The New York, West Shore, and Buffalo Railway crosses Rondout Creek at an elevation of 150 feet above water, in order to permit the passage of large schooners and barges. There is a large amount of coal, cement, and flag stone that annually passes this point, and a drawbridge, which the height of the present structure makes unnecessary, would have seriously interfered with the operation of the road.

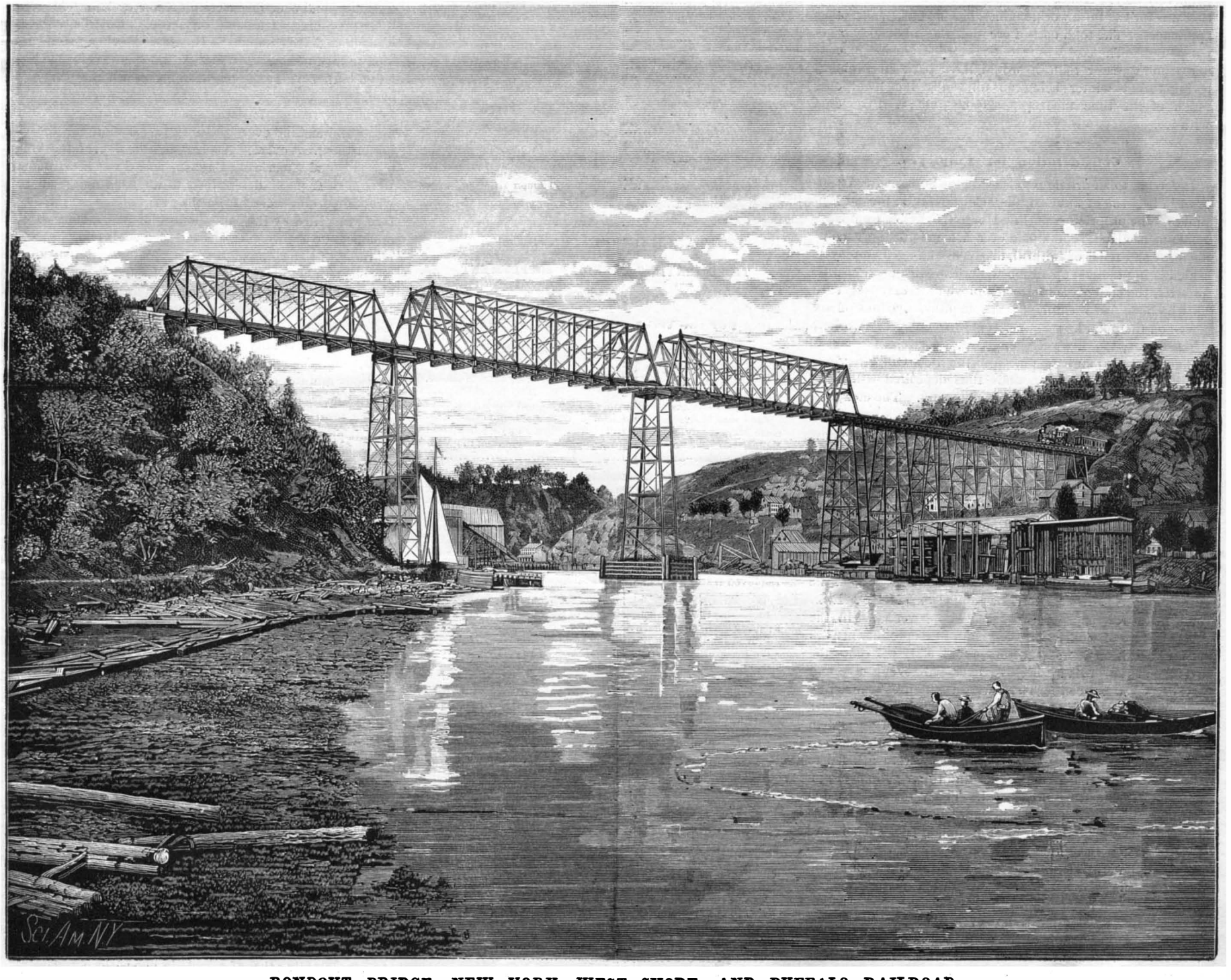
The line of the road leaves the top of a hill of the same elevation as the bridge, crosses the three spans, then a long viaduct, and thence through a tunnel in the opposite hill. The spans are of the following lengths, beginning at the south (left of the engraving): one of 163 feet, one of 241 feet, and one of 264 feet. They rest upon three iron piers of 15 by 30 feet section. The viaduct is 531 feet long, supported on piers—thus making a total length of 1,244 feet. The weight of the iron entering into the construction is 2,000 tons. The work of erection was begun November 8, 1882, and the first train crossed May 8, 1883. The total cost of the bridge was about $350,000.

The iron work was designed and constructed by Clarke, Reeves & Company, of Phœnixville, Pa., in accordance with specifications and detailed directions of Col. Walter Katte, chief engineer of the North River Construction Company, and E. L. Corthell, chief engineer, and A. Lucius, engineer in charge of bridges of the New York, West Shore, and Buffalo Railway.



FRAMEWORK FOR ERECTING THE SPANS.

The bridge is 29 feet wide from center to center of trusses, the viaduct being the same from center to center of column caps. The first span has a height of 32 feet, and the other two a height of 45 feet. It is a pin connected, wrought iron bridge, the iron having a minimum ultimate tensile strength of 50,000 pounds per square inch of original sectional area before fracture. The end and intermediate posts and top chords, as well as the columns in the piers, are of the pattern known as Phœnix columns. The wooden floor consists of transverse floor timbers, extending the full width of the bridge, supporting rails and guard beams. According to the specifications for bridges of this size, they must carry the dead load consisting of the iron in the structure and a floor weighing 400 pounds per lineal foot of track, consisting of rails, ties, and guard timbers only, and a moving load for each track—supposed to be moving in either direction—consisting of two consolidation engines, coupled,



RONDOUT BRIDGE, NEW YORK WEST SHORE, AND BUFFALO RAILROAD.

followed by a train weighing 2,240 pounds per running foot. In order to provide for vibrations and wind pressure, the bottom lateral bracing in through bridges is proportioned to resist a lateral strain of 450 pounds for each foot of span.

The viaduct is composed of lattice girders supported upon six iron piers, the distance between facing columns of the piers being 50 feet in all except that next the bridge, which is 60 feet. Much trouble was experienced in obtaining a suitable material upon which to build the piers, and in some instances excavations to the depth of 60 and 80 feet had to be made before finding a good foundation. The bridge piers rest on masonry, built on piles driven to refusal.

The placing in position of a structure of this magnitude at so great a height involves great care and much labor, and its rapid and successful completion makes it a subject well worth studying. No false work was used in erecting the viaduct. The piers consist, practically, of four iron columns resting on beds of masonry, and firmly held in position by struts and ties. After the foundations had been completed the columns were raised in place, when a gin pole (a wooden mast having a pulley at its upper end, through which a hoisting rope passes) is fastened to them by iron bands. A rope passes from a hoisting engine through a block at the base, thence through the pulley in the gin pole. By this means the several parts were raised into position and secured. The work was completed, section by section, to the full height and the track laid. As soon as the first section had been finished a traveler, operating on top, assisted in the work of raising the balance.

Very different and much more difficult was the task of erecting the spans. In this case it was necessary, in order to support the great weight of iron, to build a framework of heavy timber of strength sufficient to bear the load and resist the wind which sometimes sweeps through the gorge with great violence. Our drawings show a side and transverse elevation with details of the top, bottom, and splice. All bolts were three-quarter inch, all diagonal transverse braces were 3 inches by 8 inches, all horizontal transverse braces were 4 by 8 inches, all longitudinal braces 3 by 8 inches, with X bracing between outside and center legs. This framework was supported on piles; the distance from the top of the piles to the caps was 142 feet. Three hundred thousand feet of timber was used and 416 piles. Putting the span together after this had been finished was comparatively easy. About two-thirds of the total cost of erection was for the false work, engines, blocks, tackle, and other appliances. The total cost of erection was about 1½ cents per pound. The cost was from one-third to one-half a cent per pound greater than it would have been in summer, owing to last winter being an unusually inclement one. Much of the time the ropes, stagings, etc., were covered with ice.

Consideration for Employes.

Referring to an article published in the SCIENTIFIC AMERICAN in its issue of June 2d, on "Consideration for old Employes," the proprietors of the Morgan Crucible Company, London, England, send a plan of a scheme for the encouragement and relief of faithful, disabled, and aged employes, which is in practical operation with them with good results. In brief, the plan gives to each employe at weekly wages: to all who have been employed six months, a bonus of six pence on the pound, or 2½ per cent; to a one year's worker, 3¾ per cent; to a five years' employe, 5 per cent.

These bonuses must be placed in the Post Office Savings Bank, and every twenty pounds thus deposited will draw yearly 2½ per cent given by the company. The company give pensions also to incapacitated workmen at a rate of six shillings per week for a workman of ten years' continuous service, eight shillings per week for one of fifteen years' service, ten shillings per week for twenty years, and when a workman has performed twenty years of continuous service and has been retired, he receives 30 per cent of his salary thereafter.

Tar and Ammonia from Coke Ovens.

In the course of his inaugural address as President of the Iron and Steel Institute, Mr. B. Samuelson, M.P., F.R.S., said, with reference to the recent improvements in the manufacture of coke, that the yield of this product per ton of coal had been increased from about sixty per cent—the average of the ordinary beehive oven—to seventy-five and seventy-seven per cent. These were the figures realized by certain oblong ovens erected at the president's own collieries in Durham, and by the new ovens on the Corves system erected by Messrs. Pease. At the same time that the yield of coke had been increased, the by products were utilized to the extent of seven gallons of tar and thirty gallons of ammoniacal liquor per ton of coal. The value of these by-products at present is 4s. 3d. per ton; but against this must be set the charge of 1s. 4d. per ton for additional labor, and the interest on the capital cost of the plant, which is considerable. Viewed from the standpoint of the iron manufacturer, this advance in the utilization of by-products simply means a reduction in the cost of the production of iron. It does not appear, however, that Mr. Samuelson gave any further details of the profit and loss of the process referred to in his own case; and therefore his hearers were left unenlightened as to the extent to which the development of the system may be looked for.

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NEW YORK, SATURDAY, JULY 7, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 392,

For the Week ending July 7, 1883.

Price 10 cents. For sale by all newsdealers.

THE TOTAL SOLAR ECLIPSE OF THE 6TH OF MAY.

Not a word was heard from the astronomers who traveled many thousand miles to observe the solar eclipse, until the 12th of June. The glad news then flashed over the wires from San Francisco that the weather on the momentous day was excellent, and that the results attained were a great success. Somewhat fuller accounts of the expedition have since found their way eastward, but the full results of the observations can only be obtained from the official reports of the observers, which will be forthcoming as speedily as possible.

It will be remembered that the American expedition was sent out by the National Academy of Sciences to observe the total eclipse of the sun on the 6th of May at Caroline Island, in the South Pacific Ocean. It consisted of six members, and was in charge of Professor Holden, of the Washington Observatory, of Madison, Wis. The observers started for their destination on the 1st of March. From Callao, Peru, they were conveyed by the United States steamer Hartford to Caroline Island, which they reached on the 20th of April. Two observers joined them at Callao, sent out by the Royal Astronomical Society of Great Britain, and four officers from the Hartford increased the number of observers to twelve. On the 22d of April, a party of French astronomers arrived in the L'Eclaireur, and took up their quarters on the island. Among the members of the French expedition were several astronomers of world-wide fame, including M. Jannsen, to whom total eclipses and their awe-inspiring phenomena are as familiar as the letters of the alphabet to ordinary men; M. Tacchini, of the Roman Observatory, famous for his power of handling the spectroscope; M. Trouvelot, whose wondrous drawings of the sun and the planets gained for him great fame during his residence in Cambridge, Mass.; M. Palisa, distinguished for his skill in picking up asteroids; and M. Pasteur, of the Meudon Observatory, well known as an accomplished photographer.

Caroline Island was found to consist of a chain of small coral islands encircling a lagoon. The vegetation is good, and cocoanuts and a small quantity of guano form articles of export for a London firm which has leased the island from the British government. At the time of the astronomical invasion the seven inhabitants consisted of four men, one of whom was accompanied by a wife and two children. Caroline Island was not their permanent abode, but they had been brought from Tahiti to take care of the young cocoanut trees and the property left on the island.

The men of science landed on the coral rocks, not without difficulty, and encountered still greater difficulty in getting their precious instruments on shore. But the unloading was finished at last, and the Hartford, leaving ten men behind to give needed assistance, steamed away to Tahiti, to find a harbor where she might safely lie till the eclipse was over.

The intervening time was spent in mounting the instruments and making every possible preparation for the coming of the great event. At length, the day of the eclipse dawned, and American, English, and French astronomers were at their posts, determined to do what men can do to wrest important secrets from the grasp of the sun, while his face was veiled by the dark shadow of the moon. Serious doubts as to the weather disheartened the observers on the morning of the eclipse. But the clouds scattered, and the sky cleared before the grand event, and remained nearly clear till after the eclipse was over. A slight haze and a few passing clouds alone interfered with the perfection of the conditions under which the phenomenon was observed. The period of totality was five minutes and twenty-five seconds, and the practiced observers made the most of the precious minutes as they passed, each observer devoting himself to the part assigned to him.

The most glorious sight ever witnessed by human eyes was displayed in all its grandeur and sublimity to the band of observers on this lone island of the ocean. The four contacts were noted, and, as the moon covered the sun's face, the corona beamed brightly forth, with five well defined streamers. The rosy protuberances were, however, very few, and the chromosphere was in a state of unusual quiescence. Photographs were secured of the corona and its spectrum, and of the sky in the vicinity of the eclipsed sun. Some very interesting spectroscopic observations of the corona were made, whose result seems to upset prevailing theories; for Professor Hastings, of Baltimore, one of the observers, asserts that the corona is not an appendage of the sun, but an optical phenomenon. There was a time when this was the general view, but astronomers of late years have not only considered the corona as belonging to the sun, but photographs of the solar disk have been recently made showing the silvery streamers when there was no eclipse. Professor Hastings will have to support his observations by proofs strong as Holy Writ before his theory will be accepted, now that a different one has been long considered valid by the astronomical mind.

Not a trace of that mythical member of the solar brotherhood, the planet Vulcan, was obtained, though careful search was made. Perhaps there is no such planet, and perhaps he was safely hidden behind the sun's vast mass, and may beam forth at some future total eclipse to prove conclusively that Mercury's unexplained perturbations have a tangible cause. Much more valuable work was done. Trouvelot made a sketch of the corona; Dr. Dixon sketched its five well defined streamers; Tachini observed a spectrum resembling that of comets in one of the coronal streamers; Jannsen noted dark lines in the spectrum of the corona.

The English and French astronomers obtained a series of coronal negatives. Some of these extended to its outer limits, and some of those of the coronal spectrum contained several bright lines. The meteorological observations showed a rise in barometric pressure of 0·02 inch, the rise in humidity was five per cent., the temperature fell to that of night, the direction and velocity of the wind were uniform, and the observations on radiation showed that the reception of heat by the earth was almost entirely checked.

Even these barren items of information are of exceeding interest, and will furnish admirable material for thoughtful study until the official accounts are made public, and a wonderful story of personal experience, observation, and devotion to science will be related that will find admiring listeners all over the civilized world.

The astronomers enjoyed excellent health during their long trip. After the eclipse, the Hartford returned to Caroline Island and carried the American party to Honolulu, from whence they took passage to San Francisco and home.

HOW SCREWS ARE THREADED.

Screw threads are "originated" in the lathe usually. All lathe turning, with regular—constant—feed of the turning tool, is screw cutting, or threading; the tool cuts a spiral around a revolving cylinder.

It is evident, therefore, that by increasing the speed of the feed relative to that of the revolving cylinder, and having the point of the cutter properly shaped, a screw thread would result, instead of a paring off of the entire surface of the cylinder. All important actuating or working screws, as those for feeding on machine tools, are formed in this way, and large numbers, also, of ordinary machine screws, which when once seated are expected to remain *in situ* until the machine or implement of which they form a part is worn out.

Wood screws, as screws for fastening wood to wood, metal to wood, etc., are threaded in a similar manner, the thread being cut from the solid by a single cutter removing the material between the threads.

Large numbers of screws are threaded by dies, which may be called hollow screws, or nuts with cutting edges. These, by rotating, form the feed as well as the cutting device for threading the smooth cylindrical rod or bar. Some of these dies are worked by hand, others by power, but in either case the cut, by the modern and improved dies, is clean, and the thread is formed from the solid. The old fashioned dies were adjustable so as to be "set up," and could be made to cut several sizes of diameters. Much of their work was done by pressure, or squeezing, and a part of the thread was "raised" instead of being cut from the solid material. There are adjustable dies made now, but they are so formed as to do solid cutting.

There is another method of cutting threads direct from the solid, and that is by milling. It is the invention of the late Eli Horton, the chuck man of Windsor Locks, Conn. The machine is entirely automatic, the blank to be cut being rotated as in a lathe, and a rotary milling tool rotating against it at an angle adapted to the pitch of the thread desired. As the blank revolves slowly toward the cutter, the cutter revolving more rapidly forms the thread by being fed along over the blank as is the cutting tool in a lathe. The milling tool is so formed in cross section as to produce any shape of thread desired. This method is still in use by the successors of Mr. Horton to thread the steel screws of their chucks.

Threads on large cast iron screws are sometimes formed simply by being cast, and formerly there was much cheap small work of that sort in the market.

Threads may be raised by forging in dies, and some good work by this is produced. In both these cases, however, an after finish in the lathe is desirable.

For some peculiar purposes threads are formed by twisting a square or a flat bar; a common form of hand drill that has superseded the bow drill being a case in point. The stock of this drill is a bar, square in cross section, twisted, and which is rotated by sliding a loosely fitting nut rapidly back and forth over its length. A familiar instance of a screw thread of this description is the ordinary auger or bit, the cross section of which is a flattened parallelogram like a flat bar.

One peculiar method of forming screw threads remains to be mentioned. It is that of raising a thread by rolling between dies under pressure. There is a great deal of what is known as "bright wire goods" in the market, which are threaded. In many cases these threads are formed by simply rolling—one revolution, or a little more—the wire between two hardened steel plates that are corrugated spirally to form, when combined, a continuous thread. Sufficient pressure is applied during the rolling—which, however, is very rapid—to raise the metal from the annealed wire enough to make a thread. In this case the threaded portion is considerably larger than the stock or wire, at least half the depth of the thread on each side.

The threads in nuts are produced either by the "originating" method, cutting them in a lathe, by being tapped, or sometimes by being cast of soft metal, as brass, on a threaded core of hard metal, as iron or steel. But nuts are mostly threaded by tapping, running one, two, or three successive taps through them either by hand or in a power machine. Nuts of very thin material, as sheet brass for lamp tops, jar covers, etc., are formed simply by rolling between spirally corrugated rolls, a work analogous to "beading" on tin ware.

D'ARREST'S COMET.

[Translated for the SCIENTIFIC AMERICAN from *Ciel et Terre* of the 15th of April.]

On the 27th of June, 1851, D'Arrest discovered at Leipzig a very faint comet. After following its course for a fortnight, D'Arrest and Yvon Villarceau announced, almost simultaneously, that the orbit of the new comet was elliptical, and that it must be ranked among periodical comets that return at regular intervals to perihelion, the only time when they are visible. The comet was observed for three months. Yvon Villarceau, from the computation of its positions, assigned to it a period of about six years and a half, and an orbit that at aphelion approached very near the orbit of the giant planet of our system, the mighty Jupiter, whose mass is nearly 340 times greater than that of the earth, and whose attraction must consequently exert a powerful influence upon the path traversed by the comet, and complicate the determination of the successive epochs of its return.

It is difficult to form an idea of the length and tediousness of the process required by these mathematical calculations. The task was, however, undertaken, and, on the 1st of June, 1857, Yvon Villarceau announced the return of the comet during the winter of 1857–58.

According to the ephemeris issued at the same time with the article in question, he also announced that the comet would not be visible in the northern hemisphere, and notified observers in the southern hemisphere of the results of his work, that they might be on the watch for the erratic visitor. On the 4th of December, 1857, Sir Thomas Maclear, of the Cape of Good Hope Observatory, detected a faint comet in the neighborhood of the position assigned to it.

In July, 1861, Yvon Villarceau published a new paper concerning the comet's orbit. He predicted its return to perihelion on the 26th of February, 1864, but declared that its faint luster and small angular distance from the sun would probably render it invisible. This prediction was fulfilled, and the return of 1864 was not observed.

The next appearance of the comet was announced for 1870. M. Leveau calculated the probable orbit for this epoch; following the plan of M. Yvon Villarceau, he introduced into his calculations an indeterminate quantity from which he selected three probable values that gave him three different ephemerides. In spite of the great perturbations caused by the attraction of Jupiter between the returns of 1858 and 1864, and the absence of observations in 1864, D'Arrest's comet was detected by Winnecke at Carlsruhe on the 31st of August, 1870.

Its position was in right ascension 16 h. 38 m. 3 s.; its declination was 10° 39·8′ south. One of the ephemerides of M. Leveau had assigned to it for this epoch a probable position in right ascension of 16 h. 38 m. 18 s., and in declination of 10° 41·1′ south. The agreement between calculation and observation is remarkable.

Finally, the return of 1877 was observed at Marseilles on the 8th and 9th of July. The return of the visitor is expected during the present year. It has even been already announced, but the news proved to be without foundation, and the celestial object mistaken for D'Arrest's comet is a faint new nebula.

The reader will, perhaps, ask what scientific interest there can be in announcing the return of periodic comets. After the brilliant confirmations of the law of universal attraction that have been furnished by phenomena of various kinds, of what use is it to build monuments of figures in order to predict the return of a comet? At first sight it would seem that such labor is unwarrantable, and without direct utility.

We must, however, discard such conclusions, for they are in contradiction to the essentially perfectible character of science. Certainly it is no longer necessary to seek in the movements of the planets of our solar system confirmation of the law of universal gravitation; but the utility of the labor in question is not bounded by this law!

A multitude of secondary causes play a part in the economy of the material universe, and the effect of these multiple causes can only be revealed by the constant observation of all the phenomena offered for examination. Each observation constitutes, in some measure, a function of the constant quantities that enter into the great law of universal attraction, combined with the effects of these causes in detail. The accumulation of a great number of these functions will alone allow us in the future to suspect the existence of these causes and to discern the part that belongs to each one of them in the production of phenomena as we observe them. The constant study of facts constitutes the experience of science; this is not lost, like personal experience, but it can be transmitted to our successors to throw light upon their researches in ages to come.

Each comet therefore presents, as it were, a special interest in our studies of the universe. Encke's comet seems to feel the effect of the resisting medium through which it passes. The great comet of 1882 grazed the sun's atmosphere and furnished appreciable elements of the small resistant power of this atmosphere. D'Arrest's comet offers in the same way at every reappearance the possibility of measuring the extent of the perturbations to which it has been subjected, and as it passes exceptionally near to Jupiter it is eminently adapted for furnishing the data of observation relative to the mass—not yet absolutely determined—of this immense planet, which exerts so powerful an influence upon the solar system.

Snakes in Australia.

"Although the bushman has nothing to fear out here from the attacks of any wild animals," says a writer whose knowledge of Australian country life is not to be excelled, "he has still his secret enemies, which in many cases are as dangerous as the open foe; and what he has most to dread in the Australian bush are the snakes." Such is certainly the case. "I do not believe," he continues, "any part of the world can be more infested with these reptiles in the summer season. Let him walk where he will—in the depths of the forest, in the thick heather, on the open swamps and plains, by the creek or water holes—the shooter is sure to meet with his enemy, the black snake. It enters his very tent or hut, and coils itself in his blankets. In fact, nowhere is he safe; and if he did not banish the thought of them altogether from his mind, he would not have a moment's peace.

"It does, indeed, appear as if the eye of a watchful Providence peculiarly guarded the traveler in these wilds; for at any moment he is liable to tread upon a deadly snake, coiled up in his very path, which does not always get out of the way, but lies watching him with his basilisk eye, ready in a moment to make the fatal spring if touched, and very often the snake is not seen until the danger is past." Bushmen soon become accustomed, like the black fellows, to the indications of the presence of a snake, and can see it before reaching it, unless coiled up very snugly. The bush fires destroy thousands of snakes, but seem to make no impression on their numbers. Curiously enough, snakes are not found in New Zealand, although there is no record of St. Patrick having ever visited that part of the world.

A Bolivian Saurian.

"The Brazilian Minister at La Paz, Bolivia, has remitted to the Minister of Foreign Affairs in Rio photographs of drawings of an extraordinary saurian killed on the Beni after receiving thirty-six balls. By order of the President of Bolivia the dried body, which had been preserved in Asuncion, was sent to La Paz. It is twelve meters long from snout to point of the tail, which latter is flattened. Besides the anterior head, it has, four meters behind, two small but completely formed heads (?) rising from the back. All three have much resemblance to the head of a dog. The legs are short, and end in formidable claws. The legs, belly, and lower part of the throat appear defended by a kind of scale armor, and all the back is protected by a still thicker and double cuirass, starting from behind the ears of the anterior head, and continuing to the tail. The neck is long, and the belly large and almost dragging on the ground. Professor Gilveti, who examined the beast, thinks it is not a monster, but a member of a rare or almost lost species, as the Indians in some parts of Bolivia use small earthen vases of identical shape, and probably copied from nature."

Mr. William E. A. AXON, in a note giving the above to the *Journal of Science*, says: "If this account should prove to be accurate, it would form a counterpart to the etching of the mammoth, which forms so interesting a memorial of prehistoric art."

New Explosive.

Herr Koppel has devised a new explosive substance, which he expects to be less costly than any other, to give out no injurious fumes, and not to be liable to explosion by shock or friction. The following is the composition of two kinds, No. 1 being suitable for hard rocks, such as basalt, and No. 2 for softer, such as sandstone:

	No. 1.	No. 2.
Saltpeter	35	42
Soda	19	22
Sulphur	11	12·50
Sawdust	9·50	10
Chlorate of potash	9·50	—
Charcoal	6	7
Sulphate of soda	4·25	5
Prussiate of potash	2·25	—
Refined sugar	2·25	—
Picric acid	1·25	1·50
	100	100

The New Nickels not a Standard Weight for Measure.

The new V nickels are now coming into general use, the word "cents" having been added to prevent their being mistaken, when gilded, for half-eagles. The following, which was true of the old nickel, although it does not apply to the new, is now going the rounds of our exchanges:

"*Five Cent Nickels as Measures.*—A fact probably but little known is that the United States nickel five cent pieces furnish a key to metric measures and weights. This coin is two centimeters in diameter, and its weight is five grammes. Five of them placed in a row will give the length of a decimeter, and two of them will weigh a decagramme. As a kiloliter is a cubic meter, the key of the measure is also a key to a measure of capacity."

Although the new nickel pieces are larger in diameter than the old, they weigh less.

The average weight of those which we have tested is 4·9 grammes, or 75½ grains, while the diameter is 21 millimeters. Both old and new are so nearly two millimeters in thickness that the eye cannot distinguish the difference, hence a very correct idea of a millimeter can be had by taking half the thickness of a five cent nickel.

To give an idea of larger metric measures we may add that the column rules of the SCIENTIFIC AMERICAN are 0·36 meter, or 36 cm., in length, while the editorial columns are 8 cm. wide. The columns of the New York *Sun* and *Times* are nearly 54 cm. long and 6 cm. wide.

Ergotinine (Tanret's).

Upon request of the Pharmacological Institute of Strassburg, Gehe & Company have made many attemps to prepare this alkaloid, to which the oxytoxic effects of ergot are ascribed, and have at last succeeded. It is a substance which is very readily decomposed, being quickly altered by alkaline reagents, or even by a moderately elevated temperature. It soon assumes a red-brown color. Dr. Kober, of Strassburg, writes to Gehe & Company in respect to it as follows:

"You can scarcely realize how you have delighted my pharmacological heart by your ergotinine, for its action is most extraordinarily strong, and such as I never have attained in my own experiments. Frogs are placed by one-twentieth milligramme into a deep toxic condition, which is remarkable by its close resemblance to that produced by veratrine, inasmuch as the muscles—although promptly contracting—require from four to six hours for again relaxing. This peculiar condition lasts many days. A few milligrammes administered to Guinea pigs produce a condition resembling strychnine poisoning, inasmuch as they exhibit convulsive twitchings of the legs and dyspnœa, and finally die from paralysis. The intoxication may be very nicely studied in rabbits, which are affected already by injections of one-tenth milligramme into the circulation. At first the cardiac plexus is excited, then follows a stage in which the blood pressure is increased. This discovery is of the *greatest importance*, since it has been suspected, for the last twenty years, that ergot increases the blood pressure and thereby acts upon the uterus. Larger doses diminish the blood pressure in rabbits permanently, produce cramps lasting for hours, and cause death by asphyxia. It is remarkable that the alkaloid has no effect upon chickens, although the latter are very easily affected by ergot, and may be killed by feeding three times with ten grammes of the crude drug."

The hypodermic dose of the substance is ten to twenty drops of a solution containing one milligramme in one cubic centimeter.

This preparation, says *New Remedies*, is the *most expensive* drug so far quoted, since at lowest rate it must be put at 200 marks (50 dollars) per gramme (or 3⅓ dollars per grain, over $1,300 per ounce). Yet even this price is seven and one-half times *lower* than that charged by the French manufacturer, namely, 1·50 marks (36 cents) for one milligramme in solution.

CHEMICAL VAPORIZER AND DEODORIZER.

Our engraving shows a compact and portable apparatus for the radical destruction of sewer gas, foul air, and fungous germs in the atmosphere. This device practically applies the latest scientific discoveries of Prof. Robert Koch, and others, on treating by inhalation diseases caused by germs of sewer fungoid, for continuously charging the air with chemicals which produce artificially any desired atmosphere considered essential by physicians, for the prevention or treatment of diseases.

This apparatus enables practitioners to administer by inhalation active volatile drugs during the night, bringing within the range of curable complaints several fatal diseases which have heretofore resisted scientific treatment.

The apparatus consists of a small case containing the vaporizing cylinders and a spring acted fan which draws in air and forces it through the cylinders containing the remedial or disinfecting agent.

The air thus charged is poured into the apartment in a continuous stream.

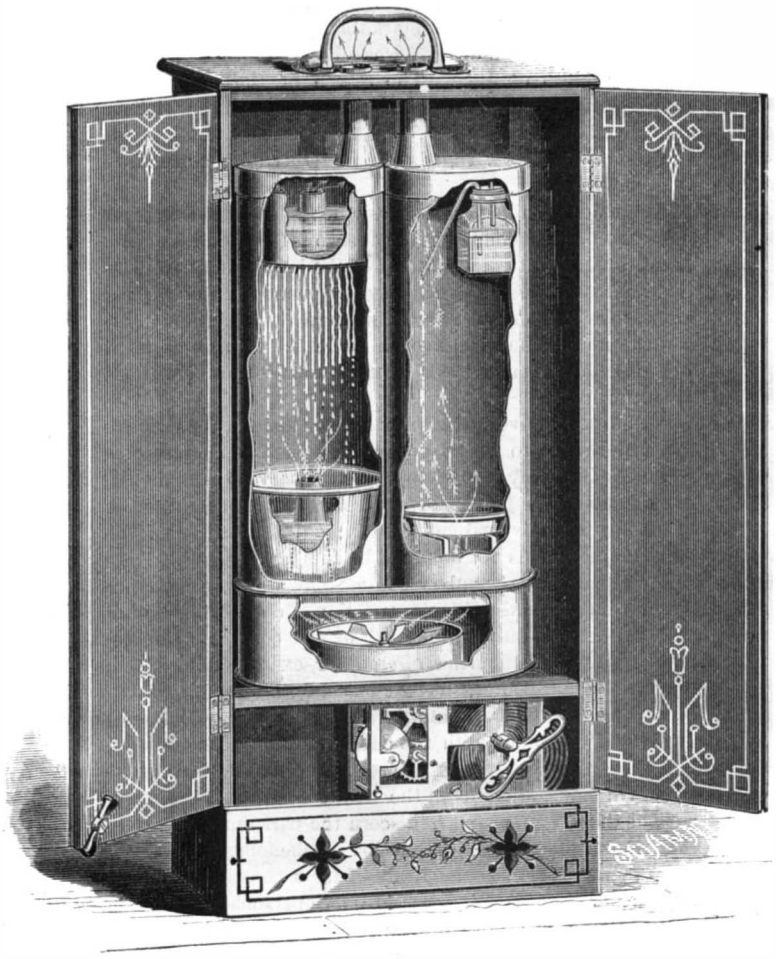
The vaporizer demands but little attention, and the chemicals used are inexpensive. All of the formulas or drugs recommended for use with the apparatus are furnished prepared for immediate use.

As the vaporizer makes no noise it can be put in the sleeping room, or it may be placed on a bracket in the hall on the floor occupied as sleeping apartments.

For the use of hotels and office buildings, a large chemical vaporizer, capable of supplying the entire building, is placed in the basement. Connecting pipes leading from the generator carry the vapor to the ice boxes, supply rooms, water closets, halls, sleeping rooms, and other locations.

This apparatus may be employed in diffusing grateful and invigorating perfumes, as well as the remedial and disinfecting agents. If desired, a double effect may be secured by charging the cylinders with different agents. The apparatus seems well adapted for the rational treatment and prevention of zymotic diseases.

Further information may be obtained by addressing the Chemical Vaporizing and Deodorizer Co., 94 Greene Street, New York city.



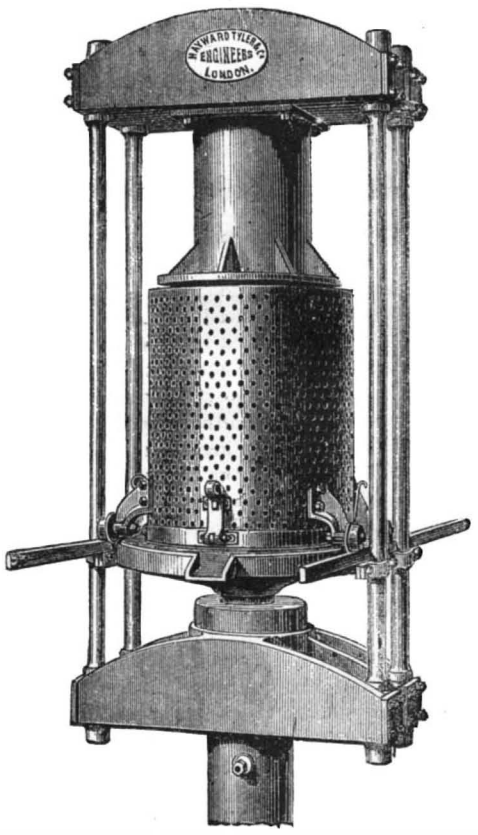
DR. HUBBARD'S CHEMICAL VAPORIZER AND DEODORIZER.

MORITZ GROSSMAN, in his Year Book for 1883, gives the following recipe for cementing rubber or gutta-percha to metal: Pulverized shellac, dissolved in ten times its weight of pure ammonia. In three days the mixture will be of the required consistency. The ammonia penetrates the rubber, and enables the shellac to take a firm hold, but as it all evaporates in time, the rubber is immovably fastened to the metal, and neither gas nor water will remove it.

IMPROVED HOP PRESS.

Various presses have been contrived at different times for extracting the wort from spent hops, but as a rule the objections to them have been their very complicated character and consequent expense.

The press here illustrated is fitted with two circular wrought-iron boxes, holding about six bushels each, which are filled and pressed alternately, and are arranged to run in and out of the presses on wheels and rails. The pressed hops are discharged from the bottom of the press, which opens



IMPROVED HOP PRESS.

downward like a door, and can be run into any suitable receptacle, or through a chute into the yard. One of these new hop presses has just been constructed for and fitted at Messrs. H. & G. Simonds' Brewery at Reading, and has proved highly successful. The pump which works the hydraulic press is driven by a strap from the main shafting, so that the attendant has nothing to do but open and close the valve; but the pump can also be made to work by hand.

Destruction of Steam Boilers.

The Dusseldorf Society for the Supervision of Steam Boilers consider the following to be the chief causes of the destruction of steam boilers:

The corrosion of steam boilers on the outside is principally due to the action of the heating gases and of the moist masonry. The products of combustion very frequently contain sulphurous acid, which in contact with moisture is gradually converted into sulphuric acid, and as such corrodes the iron. The moisture of the brick work causes direct rusting. With regard to interior corrosion, the following points are to be noted:

When an upper and a lower boiler are used, the feed water is let into the latter, which the fire gases reach last, and therefore is not so hot as the other. It is often noticed that the separate plates of this boiler are pock-marked with little grooves. When fresh water containing air is warmed, little bubbles of air containing much oxygen form, and as there is very little motion in this part of the boiler, they adhere to any rough spots on the iron and are destructive to it. It is easy to see that rough iron is attacked more readily than smooth; and of course, the action is most powerful in the grooves themselves. If steam bubbles attach themselves to any spot whatever in a steam boiler, where the temperature is not very high from its being heated with hot gases only, rusting will take place. Here too the atmospheric air in the feed water would be the destructive agent.

Hence, if care is taken to keep the water in motion circulating around in the boiler, the chief cause of internal corrosion will be for the greater part neutralized.—*Polyt. Notiz.*

Detection and Estimation of Lactic Acid.

R. Palm says that when lactic acid is added to a clear or slightly opalescent solution of basic acetate of lead, *i. e.*, acetate of lead mixed with five or six parts of alcoholic ammonia, a white amorphous precipitate of plumbic lactate will be immediately formed.

The same precipitate is produced when acetate of lead is added to a mixture of lactic acid and alcoholic ammonia. The precipitate is soluble in a large quantity of water, in acetic acid, lactic acid, and caustic alkali, but insoluble in alcohol, and must therefore be washed with alcohol. It dries to translucent scales like dextrine. After heating with fuming sulphuric acid and igniting, it left behind 79½ to 77½ per cent of oxide of lead, so that its composition corresponds to a basic salt having the composition

$$3PbO,2C_3H_6O_3,$$

which requires 78·8 per cent of oxide of lead.

Lead for the Examination of Drying Oils.

The lead is obtained by precipitating with slips of zinc a 10 per cent solution of lead nitrate acidulated with a few drops of nitric acid. The precipitate obtained is agitated for a few moments with distilled water, washed by decantation two or three times; thrown into a funnel plugged with glass wool, washed quickly, first with alcohol and then with ether, and dried in a vacuum over sulphuric acid. To expel traces of ether, it is lastly exposed to the air in thin layers for about two hours.

For the examination of an oil, one gramme of the lead is spread out in a rather large watch-glass, and the oil in question is allowed to fall drop by drop from a pipette drawn out to a point, placing the drops in such a manner that a space may remain between them. The lead gradually sucks up the oil, so that every fragment is coated with an excessively thin film of oil. If the oil has been added in too great quantity it forms a thick coating, which dries at the surface, and forms a solid pellicle, which protects the lower part.

About 2 parts of oil at most should be used for 3 parts of lead. The watch glass should have been first tared; the lead is then weighed, and afterward the oil added. The watch glass is then exposed to a mean temperature and to full light, which materially aids oxidation. With drying oils the increase of weight sets in after about eighteen hours, and is generally at an end after three days, when it remains constant.

With non-drying oils the weight generally does not begin to vary until after four or five days. Numerous series of experiments have shown the following numbers as the limits of the increase of weight of oils in presence of finely divided lead: Linseed, 14 to 15·5 per cent; nut, 7·5 to 8·5; cotton, 5 to 6; beech nut, 4 to 5 per cent. The non-drying oils give an increase of weight from 1 to 3 per cent, and it is only after the lapse of some months that we find an increase of 4 to 5 per cent.—*A. Livache.*

The Petroleum Fields of the World.

The relative importance of the oil fields of the world are succinctly stated as follows, in the July *Century*, by E. V. Smalley, in his graphic and fully illustrated article on "Striking Oil:" "Nearly all the petroleum that goes into the world's commerce is produced in a district of country about a hundred and fifty miles long, with a varying breadth of from one to twenty miles, lying mainly in the State of Pennsylvania, but lapping over a little on its northern edge into the State of New York. This region yielded, in 1881, 26,950,813 barrels, and in 1882, 31,398,750 barrels. A little petroleum is obtained in West Virginia, a little at various isolated points in Ohio, and a little in the Canadian province of Ontario. There is also a small field in Germany, a larger one, scantily developed, in Southern Russia, and one still larger, perhaps, in India. The total production of all the fields, outside of the region here described, is but a small fraction in the general account, however. Furthermore, the oil of these minor fields, whether in America or the Old World, is of an inferior quality, and so long as, the great Pennsylvania reservoir holds out, can only supply a local demand in the vicinity of the wells."

Boring an Oil Well.

A letter from Bradford, Pa., to the *Drug Reporter* gives a very clear description of the above operation as follows:

The machinery used in boring one of these deep oil wells, while simple enough in itself, requires nice adjustment and skill in operating. First comes the derrick, sixty feet high, crowned by a massive pulley.

The derrick is a most essential part of the mechanism, and its shape and height are needed in handling the long rods, piping, casting, and other fittings which have to be inserted perpendicularly. The bore or drill used is not much different from the ordinary hand arm of the stone cutters, and the blade is exactly the same, but is of massive size, three or four inches across, about four feet long, and weighing 100 or 200 pounds. A long solid rod, some thirty feet long, three inches in diameter, and called the "stem," is screwed on the drill. This stem weighs almost a ton, and its weight is the hammer relied on for driving the drill through dirt and rock. Next come the "jars," two long loose links of hardened iron playing along each other about a foot.

The object of the jars is to raise the drill with a shock, so as to detach it when so tightly fixed that a steady pull would break the machinery. The upper part of the two jars is solidly welded to another long iron rod called the sinker bar, to the upper end of which, in turn, is attached the rope leading up to the derrick pulley, and thence to a stationary steam engine. In boring the stem and drill are raised a foot or two, dropped, then raised with a shock by the jars, and the operation repeated.

If I may hazard a further illustration of the internal boring machinery of the well, let the reader link loosely together the thumbs and forefingers of his two hands, then bring his forearms into a straight line. Conceiving this line to be a perpendicular one, the point of one elbow would represent the drill blade, the adjacent forearm and hand the stem, the linked fingers the jars, and the other hand and form the sinker bar, with the derrick cord attached at a point represented by the second elbow. By remembering the immense and concentrated weight of the upright drill and stem, the tremendous force of even a short fall may be conceived. The drill will bore many feet in a single day through solid rock, and a few hours sometimes suffices to force it fifty feet through dirt or gravel. When the debris accumulates too thickly around the drill, the latter is drawn up rapidly. The debris has previously been reduced to mud by keeping the drill surrounded by water. A sand pump, not unlike an ordinary syringe, is then let down, the mud sucked up, lifted, and then the drill sent down to begin its pounding anew. Great deftness and experience are needed to work the drill without breaking the jars or connected machinery, and in case of accident there are grapples, hooks, knives, and other devices without number, to be used in recovering lost drills, cutting the rope, and other emergencies, the briefest explanation of which would exceed the limits of this letter.

The exciting moment in boring a well is when a drill is penetrating the upper covering of sand rock which overlies the oil. The force with which the compressed gas and petroleum rushes upward almost surpasses belief. Drills, jars, and sinker bars are sometimes shot out along with debris, oil, and hissing gas. Sometimes this gas and oil take fire, and last summer one of the wells thus ignited burned so fiercely that a number of days elapsed before the flames could be extinguished. More often the tankage provided is insufficient, and thousands of barrels escape. Two or three years ago, at the height of the oil production of the Bradford region, 8,000 barrels a day were thus running to waste. But those halcyon days of Bradford have gone forever. Although nineteen-twentieths of the wells sunk in this region "struck" oil and flowed freely, most of them now flow sluggishly or have to be "pumped" two or three times a week.

"Piping" and "casing," terms substantially identical, and meaning the lining of the well with iron pipe several inches in the interior diameter, complete the labor of boring. The well, if a good flowing one, does all the rest of the work itself, forcing the fluid into the local tanks, whence it is distributed into the tanks of the pipe-line companies, and is carried from them to the refineries. The pipe lines now reach from the oil regions to the seaboard, carrying the petroleum over hill and valley hundreds of miles to tide-water.

A Historical Expedition.

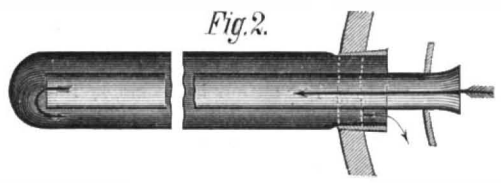
Professor Nordenskiöld's present expedition to the northern regions is not connected with ordinary polar researches, as his efforts will be mainly devoted to attempts to reach the interior of Greenland, the coast of which presents a forbidding wall of "icy mountains," as designated in Bishop Heber's hymn, "From Greenland's Icy Mountains." The professor believes that the interior of Greenland is not only habitable, but measurably fertile. As a supplement to his interior explorations, Nordenskiöld will seek on the southeast coast for relics of the old Norse colonies which were founded in the eleventh century, and which gradually passed into oblivion after a historical existence of several hundred years, their principal records being found in the Icelandic sagas, and a memory of them in occasional historical references. The poet Montgomery, in one of his longer poems, gives a semi-historical account of the Greenland settlements and their destruction based on the theory of a cataclysm of intense cold.

[Translated from the REVUE INDUSTRIELLE.]

RADIAL TUBULAR BOILER, BY L. HERVIER.

The engravings represent a unique steam boiler, in which the tubes are exterior to the boiler proper, and are double, providing an annular space around the central tube for the action of the heat, and also an annular space between the double walls of the boiler, the actual generation of steam taking place in the tubes and the annular chamber, the upright cylinder, corresponding to the upright boiler in general use, being mainly a water receptacle.

Fig. 1 shows the boiler, with a portion of its enveloping masonry removed to exhibit the tubes. The upper portion



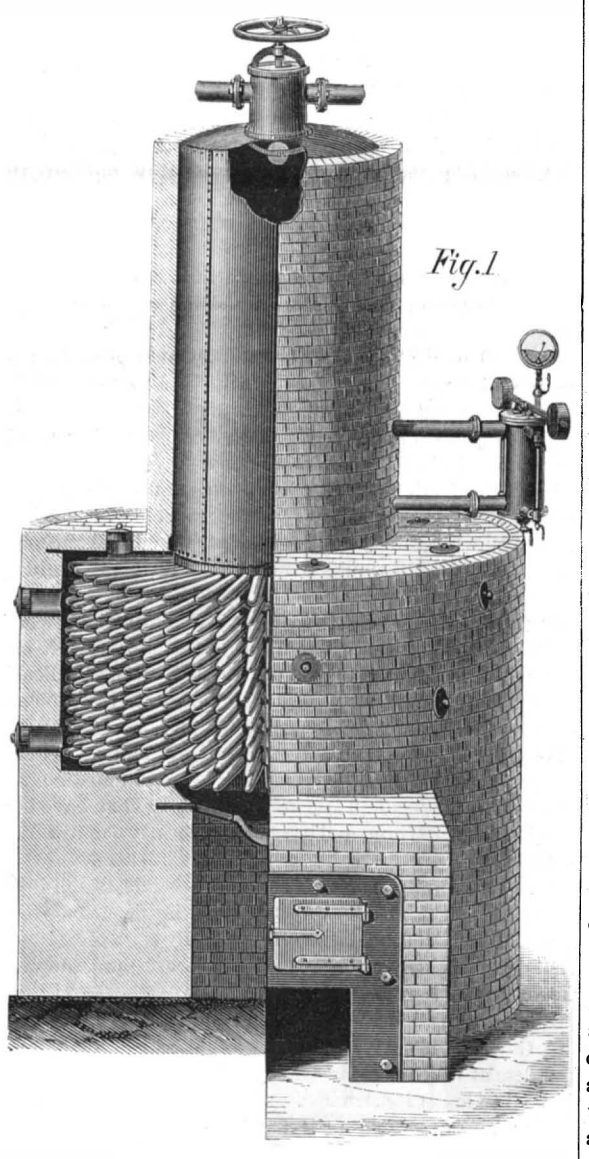
DOUBLE BOILER TUBE.

of the figure is a steam dome, from which steam is taken for use, and to which the safety valve and steam gauges are attached.

The lower portion, or the boiler proper, is double, the exterior walls receiving a large number of tubes, shown in section in Fig. 2, which project radially into the flame space of the furnace. These tubes are open at the boiler end, and closed at the outer end, and are secured firmly in the shell of the boiler by means of conical rings, as seen in Fig. 2.

The inner concentric shell is also pierced for tubes of a smaller diameter, which project into the closed outer tubes, and are open at their ends. These are fastened by being expanded at their inner ends in the usual way. The arrows in Fig. 2 show the course the water takes in its expansion by heat. It passes from the interior cylinder through the small tubes into the annular spaces surrounding them, and back through the larger tubes to the annular space between the outer and inner shells of the upright boiler or cylinder.

The inventor says that the projecting tubes, being exposed to the direct heat of the furnace, soon bring the boiler under pressure, even when it is filled with a large amount of



HERVIER'S TUBULAR BOILER.

water, because the steam does not pass through the body of the water in the interior of the boiler; but the mixture of water and steam which fills the annular envelope is less dense than that of the central portion, and as a result the steam rises in the annular space very rapidly, the water being displaced and drawn through the smaller internal tubes, as seen in Fig. 2.

This circulation is quite regular, and it favors the production of steam, and it hinders the deposition of scale, compelling it to settle through the body of cooler water to the bottom of the cylinder, whence it may be removed by a convenient hand hole.

The Refuse of Furnaces for Building Purposes.

On the utilization of the refuse material from blast furnaces for mortar for building purposes, Mr. W. Mattieu Williams, F.S.A., relates some interesting experiences. It is far from a new idea to make a conglomerate from the slag of a furnace for building purposes, and Mr. Williams thinks he has heard of its use in finer work, and he concludes from the chemical nature of the cinder heaps found around furnaces that their composition renders them well suited for many purposes where lime mortar is now used.

The slag refuse is composed of silicates of lime and alumina, intermingled with silicates of iron, manganese, and magnesia in variable proportions. When the silica is in excess they are glassy; when the proportion of lime is greater they are earthy. These earthy cinders pulverize spontaneously, and are those which, I believe, have been used directly for cement; but I should expect the best result from the glassy cinders (or "slags," as they are improperly called), as these contain sufficient silica to combine actively with the lime of mortar and thereby harden efficiently.

While on the subject I may mention a little device which I adopted in building the brickwork setting for the retorts, premising, however, that I began at this work quite as a novice, a purely amateur builder. At first I contracted in the usual manner with the bricklayer, at so much per cubic foot measured all over, I finding all materials, he only doing the work. The work was badly done in spite of all my vigilance, and the discharging of three or four bricklayers in succession, the fault being that the bricks were not laid closely enough, and the thick joints of mortar crumbled when the whole structure was heated. At last I found a remedy for this which was very simple. Instead of finding *all* the materials I only found the bricks, leaving the contracting workman to supply his own mortar, and of course paying him accordingly. The difficulty of making each brick to rest in firm contact with its neighbor with no more mortar between each than was necessary for filling up inequalities of surface, immediately disappeared.

Ready-made Houses.

The *Northwestern Lumberman* (Chicago) predicts, from the large number of inquiries regarding the ready-made house business, that it will eventually become a large industry and consume a large amount of lumber.

A gentleman visited the *Lumberman* office recently who wanted from twenty-five to fifty houses for a colony that is about starting to Dakota. Such houses for the people settling in that territory, and often in other sections, are just what is needed. In many parts of Dakota it is impossible to buy lumber, and often when lumber can be obtained the services of a carpenter are hard to secure. A ready-made house can be shipped to its destination and erected by any man of ordinary ingenuity. It saves all bother of running around the country after building material and men to put it together. A gentleman called at the office of the same paper a few days ago who wanted a house to set up on a lot in the city limits. He could rent the lot during the summer for a small sum, and thus avoid paying big rent, and at the same time have a house of his own to live in that could be handily moved whenever it was desired to do so. A late inquiry from Philadelphia was made regarding ready-made houses for export, and the same day came letters of inquiry relating to the same subject from West Virginia and New York. These letters, and hundreds of others, show that the ready-made house business is not carried on extensively enough to meet the demand. There is no good reason why a manufacturer of knock-down houses should not use 100,000,000 feet of lumber yearly in this city alone.

The Chicago Cable Roads.

By the courtesy of Superintendent Holmes your correspondent was allowed to examine the cable system of street railroads in operation at Chicago. There are four lines operated from the station on State Street, and one branch line on which the cars are moved by horses after leaving the cable. The cables enter the station at right angles from the street and pass around the driving drums, of which there are two of fourteen feet diameter for each cable. The drums are geared directly to a shaft operated by two engines of 1,000 horse power each, moving the cables at a speed of seven and eight miles an hour. The cables run over rollers in the tube laid between the rails, and are raised about eight or ten inches by the clutch when griped. This causes a slackening and tightening of the cables, and requires an automatic take up of the slack. For that purpose, at the station the cables pass around a tension drum carried by a sliding carriage that is connected to a weighted chain, which draws the carriage back more or less according to the slack on the cables. There is a constant back and forth movement of the carriage varying from six inches to three feet, the longer movement being when the most trains are running. The longest cable is operated a distance of two and a half miles, that being the length of the line.

These roads are no doubt a success on the point of economy, and there is no reason why the system should not entirely supersede horse roads. For some reason, injuries by running over persons have been frequent, though why it should be so more than with horse cars is not apparent, as the speed is not greater and the stoppages can be made as quick. It may be from the fact that there is no driver at the front of the grip car to watch passers by, the gripping lever being at the middle of the car. W.

Metallic Nickel and its Uses.

Nickel belongs, says the *Metallarbeiter*, to the metallic elements that cannot be chemically decomposed into its constituents, such as gold, silver, platinum, iron, copper, tin, mercury, lead, zinc, aluminum, etc., as distinguished from composition metals like brass, bronze, red metal, German silver, argentan, Britannia metal, etc., which are composed of different substances of unlike chemical and physical properties. Unfortunately the names of these compounds, or alloys, are entirely arbitrary, and owing to this uncertainty it would be very desirable to introduce a nomenclature founded on their composition.

A comparison of the properties of nickel with the other metals will furnish an indication of the uses to which this metal may be applied. The specific properties of nickel are the following:

Conductivity for electricity: nickel, 13·11; iron, 16·18; copper, 99·9; silver, 100.

Specific gravity of nickel, 8·90; that of iron, 7·84; copper, 8·95; platinum, 21·50; lead, 11·40; silver, 10·55; gold, 19·50. These numbers show how many pounds a pint of each metal would weigh.

Nickel melts at 1,400° C. (2,552° Fahr.); iron at 1,500° to 1,600°; steel at 1,300° to 1,400°; copper, 900°; gold, 1,250°; silver, 1,000°; platinum, at 2,500° C.

Its strength is equal to that of hard iron.

The chemical symbol of nickel is Ni; atomic weight, 58·7, which means that in chemical compounds of nickel 58·7 parts of nickel are combined with the atomic number of the other substance. For example, the oxide of nickel contains one equivalent each of nickel and oxygen.

The atomic weight of Ni is	58·7
Equivalent of oxygen	16·0
Hence the equivalent of the oxide of nickel is	47·7

Nickel ranks between silver and gold in oxidizable qualities, but nearer the latter.

Nickel ore is found in Germany, Sweden, America, New Caledonia (a French island in Australasia), and in Austria.

The ore generally contains iron, copper, and cobalt. Cobalt and its preparations, as well as copper, are by-products in the nickel preparation; the cheaper iron occurring as an impurity is thrown away.

Metallic nickel has been known quite a long time, but did not find much technical use until Dr. Fleitmann, a pupil of Liebig, succeeded in preparing it in a very pure state economically. The valuable properties of nickel were then first recognized, and to-day castings are made of it, and it is rolled and drawn, while it was not long ago considered to be infusible and incapable of being drawn. This was due in part to foreign substances contained in it, and in part to a lack of suitable apparatus for melting it, which have since been brought to a high degree of perfection, owing to the advance made in the iron industries.

Owing to its relatively poor conductivity for electricity, nickel will find a limited use in electro technics, especially as a substitute for lead in Faure's secondary batteries (accumulators). Nickel is a better conductor (13·11) than lead (8·32), is lighter than lead, and does not oxidize so much.

Since nickel has the strength of iron, the strongest metal, while it is as unoxidizable as the noble metals, even excelling silver, it will evidently find extensive use in the future, since it possesses the properties of a noble metal at comparatively low price, and even excels silver in its reaction toward oxygen, and far exceeds all the other noble metals in strength. Of course, when these properties are recognized the increased use of the metal will raise its price, if the production of nickel does not keep pace with its increased uses, which is very doubtful.

For years the use of nickel was limited almost entirely to the manufacture of pinchbeck, and afterward to other nickel alloys, new silver, China silver, alpacca, alfenide, argentan, now euphemistically baptized "nickelin," the quantity of nickel varying in them from 6 to 31 per cent.

The price and fineness of the composition depend on the quantity of nickel in it, so that first quality of argentan (nickelin) with 31 per cent of nickel would follow the Chinese new silver with 36·8 per cent. It would be desirable if the manufacturers would state the percentage of nickel for the guidance of buyers, whereby they might to a certain extent combat the competition of those who prefer to make these nickel alloys without any nickel in them.

The next advance in point of time, that recognized the inoxidizable quality of nickel, was for nickel plating the more oxidizable metals, like brass, pinchbeck, zinc, iron copper, etc. In nickel plating, nickel anodes and nickel salts are employed. Articles suspended in the bath, to be plated, are called cathodes. The object of the anode is to replace the nickel taken out of the bath by the cathodes under the action of the galvanic current.

Aside from the electromotive power employed, whether battery or dynamo-electrical machine, the discussion of which would be foreign to our present paper, the purity of the anodes and of the nickel salts that the bath is made of are of first importance in determining the quality of the plating. To obtain good results red and blue litmus paper should always be at hand to test the acid or basic nature of the nickel bath. It may be observed that the white nickeling generally preferred is obtained by acid baths, while a basic bath gives a darker colored coating; hence, in the latter case ammonia or the liver of sulphur is added to the nickel bath if the so-called "black" nickel is wanted. Acid baths redden blue litmus, basic baths turn the red litmus blue.

Complaint is often heard against white nickeling not succeeding. This may be due to the current, that is too weak or too strong, or to the composition of the bath, but frequently the cause is to be sought in the nickel film being too thin, so that the metal beneath, which is generally brass, shows through. In the case of iron this is not so striking, owing to the similarity in the color of iron and nickel. But here there is another disadvantage of thin nickeling, that the iron rusts. There is always danger of rusting, even when well plated, if the iron has been cleansed in acid. This evil may be entirely overcome by using the sand blast instead of acid pickle. Another advantage gained is that the surface is roughened and the nickel adheres to it better, while subsequent polishing is unnecessary.

Experience has shown that scythes cannot be put in pickle before nickeling, as they soon become checked or cracked in the bath. The author had some scythes polished with sand blast and then nickel plated with entire success. This would seem to solve the problem of how to best protect scythes from rust, for the innumerable experiments and attempts to protect them with varnishes have always given negative results.

The nickel plating of sheet zinc has already become quite extended, so that it has become a commercial article. (Where?)

The use of nickel for protecting other metals is far more extensive in America than in Germany. The nickel steel factory at St. Veit, near Vienna, deserves mention as a model establishment. The articles made there are very handsome and at a reasonable price. This large establishment has a fifty horse power steam engine, three electro dynamos, and one hundred and five nickel baths.

One difficulty often met with in nickel plating brass and zinc should not go unmentioned. These and other metals which are flexible, yet only slightly elastic, do not quite return to their original shape after the bending force has been removed, while nickel is so elastic that it endeavors to return to its former position.

This is frequently the cause of nickel plate getting loose when deposited on these metals. A thin layer of nickel sticks better, but, as already mentioned, does not prevent the other metal from showing through, while it offers little or no protection against oxidation.

In concluding the subject of nickel plating we may refer to a quite extensive fraud. We frequently see on price lists, business cards, labels, and in show windows the expressions, watches with nickel works, nickel attachments, watch chains, genuine nickel, warranted nickel, etc., yet they have no nickel about them except a thin plating. The public can protect themselves to a certain extent by testing it with a magnet, which attracts iron and pure nickel. Nickeled iron and steel might deceive any one, but the fraud is usually with brass, pinchbeck, etc., hence the magnet test suffices to show whether it is pure nickel or some cheaper metal.

In recent times the valuable properties of metallic nickel —its strength and permanence—are utilized in many other ways.

We shall now attempt to lay before our readers the new and more important uses of solid nickel, following the order of their introduction.

Oxide of nickel now finds a modest but increasing use in the enameled glass and ceramic industry.

The introduction of the regenerative furnace in iron making afforded the means of casting nickel, that had long been considered infusible. It was also found that the addition of a little tin would render nickel fusible in ordinary furnaces.

At present cast nickel is used for different articles which combine in them the strength and malleability of soft cast iron with the permanence of the noble metals. Malleable nickel castings are used also for surgical instruments, harness ornaments, art castings, spurs, etc.

Nickel coins contain 25 per cent nickel and 75 per cent copper; they have recently been introduced in Mexico, and it is proposed to adopt them in Servia. (They have long been in use in Belgium, and have more recently come into use in Germany.)

Dr. Fleitmann's discovery makes it possible to roll it out into extremely thin foil, and draw it out into very fine wire. Rolled nickel anodes consist of chemically pure nickel; still Fleitmann makes cast anodes that are very pure, although they cost less than the rolled ones.

The price of nickel foil is intermediate between real silver and German silver. From a hygienic aspect nickel is as harmless as iron, whereas German silver requires to be well silvered to make it harmless.

Fine nickel wire is used for lace and dress ornaments, while nickel filigree is used for ladies' ornaments.

The use of nickel for technical articles is also quite extensive, and wire nails of nickel are in the market. Pure nickel is also used for ornaments and enamels. It is particularly adapted to *Emaille cloisonne* with difficultly fusible fluxes.

By far the most important use, because the most extensive, is for covering sheets of other metals. In the method devised by Fleitmann, and named after him, sheets of iron, or copper and nickel alloy, receive a thin skin of nickel applied by welding and rolling.

In all the metallic branches of industry, there is a tendency to use iron and steel, the cheapest and strongest of all metals, for various utensils, and to prevent their oxidation by covering them with more permanent metals, among which nickel holds the first rank. For this purpose the nickel may be deposited by the galvanic current, or by Fleitmann's method.

The nickel copper alloy, with 10 per cent. of the former and 90 of the latter, plays a very modest part in this as compared with iron.

Copper in the United States.

At an extraordinary general meeting of the Arizona Copper Company (Limited), which was lately held in Edinburgh under the chairmanship of Sheriff Guthrie Smith, some very interesting statistics in reference to the production and price of copper in the United States were mentioned by Mr. James Duncan Smith, S.S.C., one of the directors of the company, who had just returned from a visit to the company's mines and smelting works. Commencing with the year 1872, when the production of copper in the United States was 28,000,000 pounds, he said it had risen to 88,000,000 pounds in the year 1882. Over the eleven years the quantities produced were as follows:

Year.	Quantity, pounds.
1872	28,000,000
1873	31,000,000
1874	34,000,000
1875	37,000,000
1876	40,000,000
1877	42,000,000
1878	43,000,000
1879	46,000,000
1880	57,000,000
1881	70,000,000
1882	88,000,000

The consumption of copper in the United States in 1872 was 34,000,000 pounds, and the quantity went on increasing until last year, when the consumption was 77,000,000 pounds. At first it was necessary to import copper, but almost nothing has been done in that direction for several years. The great increase in consumption commenced in 1880, when it reached 62,000,000 pounds, as against 34,000,000 pounds in 1872. This was due to the development of electric lighting business—62,000,000 pounds in 1880; 63,000,000 pounds in 1881; and 77,000,000 pounds in 1882. The average price in 1872 was 35 cents per pound, and taking the following years, the averages ranged as follows: 27, 22½, 22, 20, 18, 16, 18½, 20, 17½, and last year, 18½ cents. The highest price last year was 20⅛ cents, and the lowest 17¾ cents per pound.

Discoloration of Brick Walls.

Within late years the great popularity of brick as a building material and the great increase in the number of brick edifices which have been erected have brought into prominence a matter which could not have escaped the notice of the most casual observer, namely, the disfigurement of brick walls from a coating of white powder resembling in appearance hoar frost or mildew.

These deposits are usually formed in rainy weather, and for a long time it has been a mooted question how this substance comes to be collected, what it is, and what can be done to remove it or prevent its formation. The rains of this spring seem to have been especially favorable to the forming of these deposits, and old buildings even, which hitherto have never been defaced by this substance, have this year given up their ruddy appearance for a paler and less attractive complexion. Dr. Joseph Leidy, President of the Academy of Natural Sciences, in speaking of this subject recently said:

"The efflorescence is simply ordinary Epsom salts or sulphate of magnesia. The sulphurous acid, which results from the burning of coal, combines in the presence of moisture with the magnesia in the mortar or from the clay in the bricks. It was decided that it emanated from the former source. The sulphate of magnesia dissolves in the water, which runs over the bricks, and, evaporating, leaves the deposit. Some walls are covered with a black substance which seems at a distance to be smoke. This is a fungus, which flourishes in damp places, and is materially different from the white sulphate." Dr. Charles M. Cresson explains in a similar way the method by which the substance is deposited on the walls, but expresses the belief that it is sulphate of potash. Edwin F. Durang, the architect, said that sulphurous acid acting on the mortar decomposes it to such an extent that chimneys had often to be rebuilt on account of it. He thought the efflorescence was sulphate of lime.

Liquefied Carbonic Acid.

The use of liquefied carbonic acid in the preparation of carbonated beverages is recommended by Mr. Apotheker Volk, of Ratzeburg, who states that experiments have proved it to be the purest, most suitable, and best method of impregnating mineral waters. It is also claimed that by using the carbonic acid in this form the more expensive part of the apparatus now used in the manufacture could be dispensed with. It is evident, however, that even should a sufficiently cheap supply of pure liquefied carbonic acid be forthcoming, special precautions will have to be adopted as to the containing vessels and the manner in which they are stored, as the gas requires at 0° C. for its liquefaction a pressure of 36 atmospheres, which increases rapidly with a rise of temperature. It would be worth while to carry the experiment a little further and try the soldified acid, the relatively slow evaporation of which, even when exposed to the air, might facilitate manipulation.

A BEAVER COLONY.

The beaver is one of the animals which constantly advancing civilization is gradually exterminating. In earlier times the beaver was found almost everywhere, even in the southern regions of Europe, but at present they are only found in large numbers in the northern part of America, also in southern Siberia, and on the shores of rivers flowing into the Caspian Sea.

The beaver (Castor) belongs to the race of mammals of the order of rodents. These animals furnish the beaver fat, an animal substance which is secreted by them in glands or pouches, and the pelt also is valuable. In earlier times the fur of the beaver was used for the finest hats.

The products of the American beaver are not so valuable as the Russian, yet the American beaver trade, especially of the great Hudson's Bay Company, is a remarkably profitable industry.

Beavers are especially interesting, for of all the mammals they show the most mechanical instinct in building their habitations, and the American beavers have the reputation of being by far the most ingenious builders in the whole family.

Our illustration represents a beaver colony of northern Minnesota, and the industrious animals are employed in constructing their water castles. They are remarkably shy, and labor only in the night, so that it is very difficult to surprise these architects at their labor and find out the secrets of their method of construction. The individual dwellings consist of rounded hills, which are composed of pieces of wood, stone, and mud, and are divided in the inside into two apartments, an upper dry room and a lower one filled with water. The single habitations are united by a solid dam, for which whole trees are used as the building material.

The beavers gnaw with their powerful teeth the trees standing close by the shore, near to the ground, and when they have gnawed the trunk nearly through they so direct it by a peculiar trick that, as the tree falls into the water, the stream carries the trunk downward, and it is brought into the right position.

In early times travelers who were not punctilious in regard to the truth, and who gave free rein to their fancy, told wonderful stories in regard to the skill of these architects, and though many of these stories have been shown to be false by observation and research, yet it still remains a fact that the beavers are really the most ingenious builders to be found in the whole animal kingdom.—*From Um die Welt.*

THE RUBBER PLANT IN MEXICO.—Mexico is making a study of the culture of the rubber plant. The hardiness of the plant is said to be such that its culture is exceedingly simple and inexpensive, where the climate and soil are suitable. In much of the Mexican coast region the only expense is the weeding required when the plants are young, to give them a chance to grow and strengthen.

The Rabbit Pest in New South Wales.

The keeping of rabbits of any kind is now prohibited by law, there being a penalty of £100 for every offence proved. This may seem severe, but it is stated that the rabbit pest can be traced, in a large measure, to a few rodents which were thoughtlessly let loose. It is marvelous how rapidly their numbers become multiplied in the pastoral districts, in several of which they have completely eaten out the sheep. In reference to the ravages of these unwelcome animals, Mr. Maxwell, of Cobar, says: "Once rabbits get on a run, it is a constant outlay. In a small paddock of 40 acres I have seen three men constantly killing four and five dozen per day for months together, and still they kept coming. That was twelve years ago. They tried killing for several years. Before rabbits came we used to have 70 to 80 per cent of lambs, and ran three sheep to four acres. In less than three years we could not rear a lamb, and it took four acres to keep one sheep alive, and all our cattle died.

"Then we fenced with paling and kept them out of the run, and kept killing—that is, trapping, shooting, hunting with dogs and ferrets, and poisoning. The brutes kept coming most of the time into the little paddock, as it was the sweetest feed. There are still rabbits on the place, and men have to be kept to keep them down." At first Victoria was the principal sufferer, but, somehow or other, the rabbits have crossed the Murray, spreading devastation and panic throughout the southwestern portions of the colony, and ruining the prospects of numbers of hardy settlers. How far the Rabbit Nuisance Act will aid in abating the evil remains to be seen, but if it fails the situation will be one of the gravest character.—*Ill. Sydney News.*

Bird-Eating Frog.

The following curious narrative is taken from the Cape *Times*, March 27, 1883: "A lady living in the George district supplies the G. R. *Herald* with the following particulars of the remarkable habits of this creature:

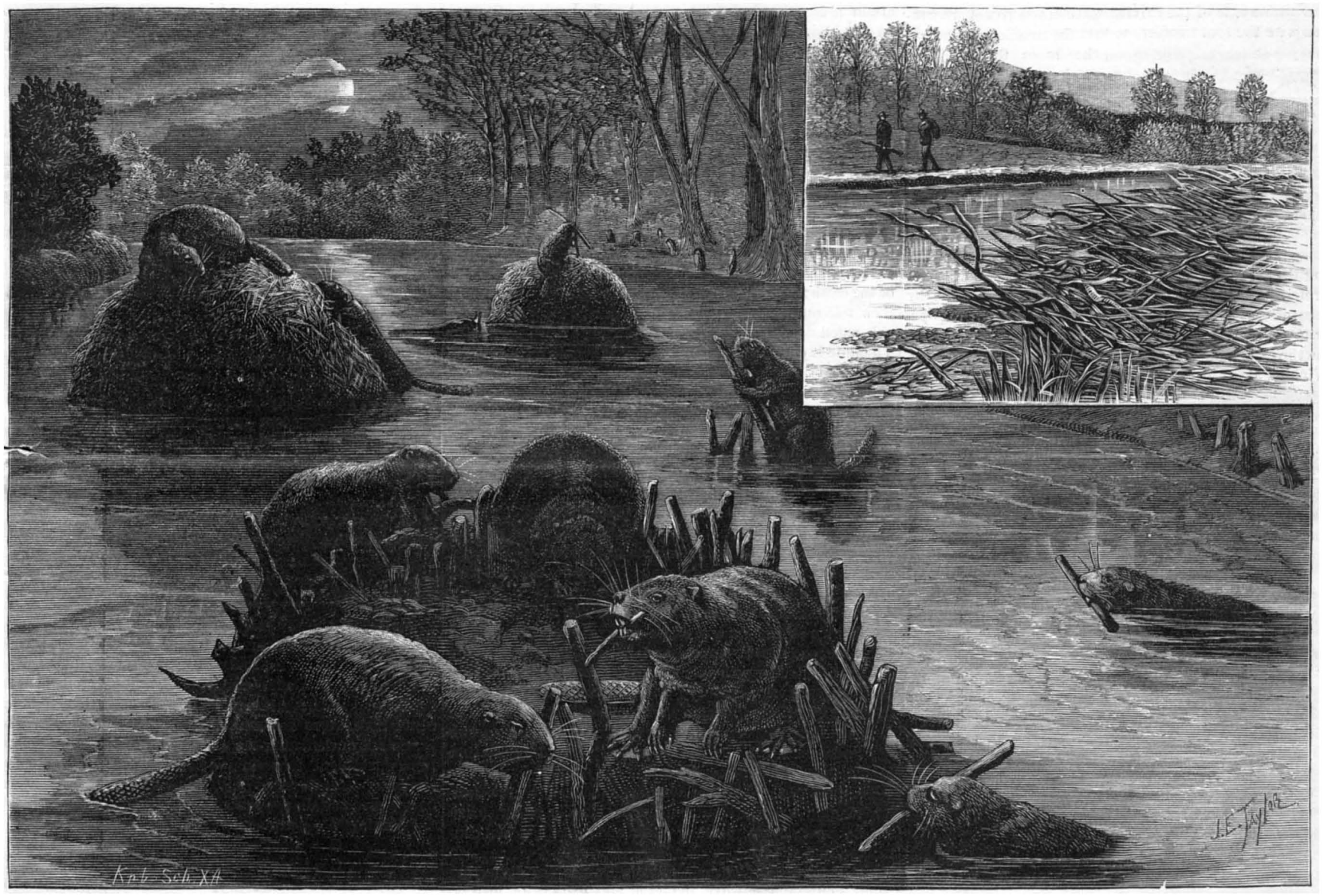
"'I have much pleasure in furnishing all the information we have regarding the large frogs which have proved so destructive to our young chickens. A water sluit runs round our terrace, and passes through the ground over which the poultry range, and in this the frogs harbor. The first time our attention was drawn to their bird eating propensity was by the cries of a small bird in a fuchsia near the stream. Thinking it had been seized by a snake, several hastened to the spot, and saw a beautiful red and green sugar bird in the mouth of a large greenish frog; only the bird's head was visible; and its cries becoming fainter, the frog was killed and the bird released. Its feathers were all wet and slimy, and for some days after we could distinguish it in the garden by its ruffled plumage.

"'Since then the same species of frog has on several occasions been killed with young chickens half swallowed, and once a duckling was rescued from the same fate. Whether the noise is natural to these frogs, or assumed to decoy the chickens within their reach, we know not; but they constantly make a chuckling sound so exactly like a hen calling her chickens for food that we have seen whole broods deceived, and rushing toward the sluit where they supposed the hen to be. The frogs are very wary, and it is difficult to find them unless by the screams of their victims. We have lost large numbers of small chickens in an unaccountable manner, and feel sure now that these frogs must be answerable for very many of them, as there are no rats here, and the chickens are carefully housed at night.'"

Gluttony in a Frog.

A rather interesting incident occurred while I was a student in the Sheffield Scientific School of Yale College. In the Peabody Museum we had a large wire cage containing numerous reptiles, and among these was a frog of unusual size.

On one of our excursions I brought in a number of frogs and other animals, and going to the cage dropped the contents of the jar, frogs and all, down among the animals at the bottom. The large frog, which had been confined there for some time, caught one of the small ones before it reached the bottom of the cage, and swallowed it with as great ease as he would have captured a fly. This quickly done, he sat and looked about with an air of satisfaction for a moment, then sprang upon another of medium size, caught and swallowed it as quickly as the first. This done, there was another pause of a couple of minutes, and then, with another quick bound, he seized and swallowed a third frog, equal in size to the second; this accomplished there was another pause of about five minutes, and then another quick, savage bound for a fourth victim, this time for a frog two-thirds the size of himself. Each of the three was seized and swallowed head first, but the fourth effort was not so successful as the others, for this he only managed to get into his mouth as far as its hind legs, when there was a pause and a struggle. The unfortunate frog in the mouth of the large one persisted in holding its hind legs out sidewise, at right angles to its body, as if conscious that these tactics would prevent the other from swallowing it; and at the same time the large one used its front feet, at times one, and again both, to straighten out the hind legs of his victim so that he might be able to swallow it; and while this struggle was going on, he made frequent efforts to use the sides and bottom of the cage as an object against which to press the other frog, so as to aid his efforts to swallow it. The struggle, however, after lasting a number of minutes, terminated in favor of the smaller frog, for by desperate efforts it managed to elude the grasp of its assailant; but while the battle did last it used both its muscular and vocal powers to their utmost to thwart the murderous designs of its enemy.—*B. F. Koons, in American Naturalist.*

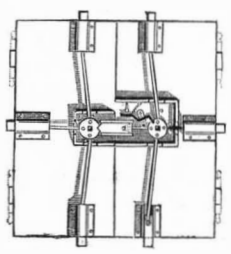


BEAVERS AT WORK.

RECENT INVENTIONS.

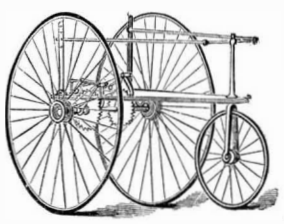
Door Bolt.

This is an arrangement of bolts, wheels, or disks and rods, in which the wheel of one part of a double door has an angular recess formed in its side to receive the angular end of a bolt of the wheel of the other part of the door, so that the bolts of one part of the door will be locked by the bolts of the other part of the door. In the bolt operating wheel is formed a recess to receive the end of a locking lever, held against the wheel by a spring to adapt the bolts to serve as outside fastenings. This device is applicable to safe, vault, and other strong doors, as well as to ordinary doors. It is also equally well adapted to single and double doors. This useful invention has been patented by Mr. Charles Clark, of Smyrna, Tenn.



Improved Velocipede.

This is an improved arrangement of foot treadle mechanism for applying the power for propelling velocipedes and other vehicles. An improved arrangement of steering apparatus is also included in this invention. Ratchet wheels are placed on the axle of the driving wheels, and pawls are connected with the foot treadles, so that the treadles will act on the axles through the ratchets and pawls, instead of cranks, as commonly arranged. By this means dead centers are avoided, and the wheels may continue to run when the treadles have ceased to act, allowing the operator to stand on them without working the machine, thus saving the trouble of stepping off in any case when it may be preferred to allow the machine to continue its motion by momentum or otherwise. This arrangement enables the operator to govern his action to suit his preference with respect to the throw or range of his tread. Mr. William B. Denton, of Wichita, Kan., is the patentee of this invention.



Baby Jumper.

This consists of a wire suspending device forming a neat, simple, and efficient seat frame, back rest, and arm supports, together with an arrangement of seat body adapted to the frame, the whole making a very convenient, neat, and inexpensive jumper. It will be seen that by the bow shape of the wire loop, the seat falls directly under the point of suspension and thus balances properly, and also that by such form of the wires the seat is more accessible than when suspended by hangers of cords and other devices falling in straight lines. The device is made by simply shaping a single wire. When the child is seated securely in the jumper, and when the spring is not forcibly expanded to raise and lower or "jump" the child, the elasticity of the spring will give the jumper all the advantages of an easy chair for the comfort of its occupant. The device is neatly made and japanned or nickled. The inventor furnishes a simple attachment for young babies to sleep in, which can readily be applied to the jumper. This invention has been patented by Mr. M. M. Raymond, Corry, Pa.

Eosine Photo Plates.

At a recent meeting of the Photographic Society of France, M. Vidal exhibited his experiments with gelatino-bromide plates containing eosine. These plates were prepared by MM. Clayton and Tailfer. The sensitiveness to certain rays has been greatly modified by employing the eosine, especially for the yellow.

The isochromatism, without being perfect, is progressing by the means proposed. We can now obtain the respective value of violet, blue, green, and yellow rays. As to the red rays, they are still refractory, but it is to be hoped that ere long they will be subdued, so as to give every satisfaction to artists, who will then be enabled to see their pictures reproduced by photography with all the real effects of light and shade.

M. Vidal gave a warning to the Bank of France that it is now very easy to imitate their bank notes by means of eosine plates. He (M. Vidal) had reproduced a bank note in a very satisfactory manner by covering the note with a very thin film of yellow gelatine. The blue lines of the bank note are of a bluish-yellow tint and are very non-actinic, whereas the yellow comes out admirably, and the negative leaves nothing to be desired.

M. Gobert, an official of the bank, followed M. Vidal through all his explanations, and said that this subject merited all the attention of the governors of the Bank of France.

M. Lugardon, of Geneva, was present at the meeting, and exhibited some very remarkable instantaneous proofs of birds, dogs, horses, and other animals. The developer which gave him the most satisfaction for these instantaneous pictures is that of Herr Wild, which permits the development to be continued for more than half an hour without inconvenience.

Dr. Eder says that the formula of Herr Wild is very good, and that he obtained by its agency more softness and detail in the shadows than by the use of potassium bromide. Herr Wild takes 1 gramme of iodine and dissolves it in 200 c. c. of alcohol; he then adds 200 c. c. of water to the whole. Five to ten drops of this solution are added to the 50 c. c. of the ordinary oxalate of iron developer.

Dates.

The date is the fruit of the *Pœnia dactyfera*, the Byled-el-Djerid of the Arabs. The palm date has a naked and cylindrical stem; it grows in Asia and in certain provinces in Africa, and is abundantly used by the natives, and is as indispensable to them as the cocoanut to the savages of Oceanica.

The flowers of the date are inclosed in a long spathe and change into an oblong fleshy fruit, yellow in color, of which the thick skin is readily preserved by drying. It incloses a cylindrical, deeply furrowed nut, hard and corneous, which contains an oily and sugary substance. Each date tree carries a variable number of clusters, and these in maturity attain a length of about a meter, and a weight of ten or twelve kilogrammes. When the fruit is to be preserved, it is gathered before reaching maturity and dried in the sun. Their cultivation requires fresh water and a hot sun. There are more than thirty varieties of dates, among which the male date, *dakkar*, or *menakker*, is pre-eminent. All these varieties have the same botanical characters, their trunks resemble the underground stems of ferns, their leaves are pinnate and luxuriant. Dates are planted in two different ways: the first consists in sowing the seed and transplanting the tender shoots at proper intervals, the second in planting the young buds which appear at the foot of the adult tree or grow from the axils of the leaves.

The palms and their congeners belong to the warm regions of the earth; they are found in India, Persia, etc. In Europe their sole representatives are the *Chamærops humilis*, and the cultivated date palm, whose fruit does not ripen naturally. The date is common in Spain, where it is cultivated upon a great scale for its fruit. The tree grows extensively in Provence; there are numbers at San Remo, at Bordighiera, and in their vicinity; they are cultivated principally for their palms, which are bleached and which are also sent to Rome and throughout Italy, to be used in processions through Holy Week. The Jews also use them at the festival of the Passover.

The gathering of the dates takes place in autumn, two or three times, and is over in three months. They are divided into three sorts according to their state of maturity. Exposed to the sun upon mats they become at first soft, then fill with a juicy pulp, then thicken and are no longer liable to change. The best dates come from Africa by the way of Tunis; they are as large as a finger and of an orange hue; their flesh is solid, vinous in taste, sweet, and somewhat viscous; they contain a nutritive principle helpful to horses, used on long journeys, and also useful in fattening cattle. The fruit is softened by boiling in water, and goat's milk is added. The Arabs in their pilgrimages across the desert make a species of bread from them, and use the pulp, extracted by pressure in earthenware colanders, for butter and sugar.

The fruit of the date tree contains mucilage, a gum similar to gum arabic, albumen, crystallizable sugar (cane sugar), parenchyma, pectose, citric and tartaric acids, coumarine, and water.

The dates of the Pharmacopœia in France are disgusting to eat, containing always the eggs and excreta of insects. They are not those which formerly enjoyed a great reputation as a remedy for phthisis, and as a nourishment to prolong life. Plutarch tells us that the master of Hippocrates lived a long time though touched with pulmonary phthisis, through the use of these dates and persistent exercise.

All parts of the date tree are used; the young branches recently cut furnish a milk which is both healthful and agreeable; this milk or sap when fermented affords an alcoholic drink named *lakhby*, or palm wine. Crushed dates with water also afford after fermentation the same decoction. Frequently the bark and fibrous portions of the young sprouts are removed to obtain the white substance within, which is eaten; the young leaves and the male flowers are also eaten when seasoned with citron juice, or arranged as a palm salad it forms a palatable dish. The Chinese use the date nuts in their writing and printing inks, and also as a dentifrice. The dried leaves are also used to make carpets and various other objects even in construction.

As the use of spirituous drinks is strongly prohibited by the Mohammedan religion, the date wine passes among the devout under the name of a remedy to rectify the crudities of the stomach. Formerly, to assist in curing certain maladies, the rich added to this liquor certain aromatic principles, and the poorer classes Persian absinthe. The nectar of dates that the sovereigns of the Congo drank a century ago, was the alcoholic product of fermented dates.—*Journal d'Hygiene.*

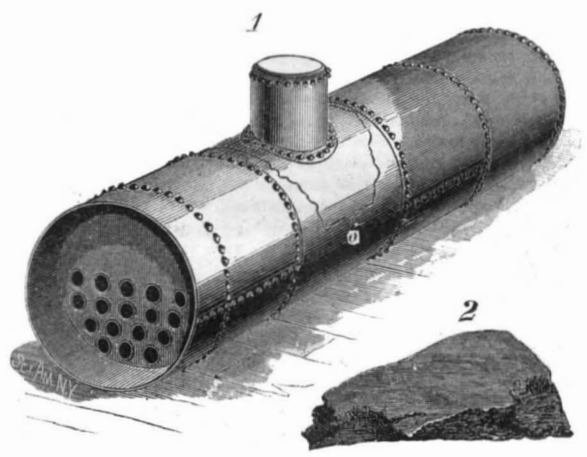
PROF. PALMIERI announces the existence in the lava of Vesuvius of a substance giving the spectrum line of "helium," an element hitherto recognized only in the sun.

Correspondence.

Boiler Explosion at Minneapolis.

To the Editor of the Scientific American:

The boiler in the machine shop of H. E. Penney, No. 315 Third Avenue, So. Minneapolis, Minnesota, exploded at fifteen minutes before 12 M., June 20. No one was hurt except one boy about seventeen years of age, who was at work at the pump near the rear end of the boiler. He was buried in the debris, but was got out within a few minutes somewhat bruised and burned. The rear end of the building, which was of brick, was demolished and most of the debris fell in on to boiler and engine. The boiler lay parallel with engine, and when the explosion occurred it left its bed and went sideways, apparently turning over once, and stopped directly on top of engine, breaking the fly wheel and other parts of engine. The boiler was a common tubular boiler about 30 inches diameter and 10 feet long, and contained 17 3-inch tubes. The second sheet from front tore across about the center of one side of boiler and then tore nearly around the boiler, as shown by sketch, which is intended to represent the boiler as it would appear if the ruptured sheet was bent back into place. The initial point of rupture was evidently at *a*, and the sheet containing dome went



around the boiler until it was nearly torn from the boiler, leaving about one foot of the sheet not broken. The owner, Mr. H. E. Penney, says he had gone into the engine room and looked at the steam gauge, which indicated 60 pounds steam pressure, and had turned to go out when the explosion occurred, blowing him out of engine room into machine shop. The boiler is four years old, and made by Messrs. Glenn & Lusk of this city from one-quarter inch boiler plate, purported to be of 60,000 pounds tensile strength. I send herewith a piece from the side of the ruptured sheet, that you may examine for yourselves.

E. O. MCGLAUFLIN.

To the Editor of the Scientific American:

I notice in the SCIENTIFIC AMERICAN, June 2, 1883, an inquiry by C. D. & Co. as to the safe velocity at which a grindstone may be run, without danger of rupture from centrifugal force. Thinking it may be interesting to divers readers of the SCIENTIFIC AMERICAN, I send the following simple formula for calculating the strain per square inch resulting from centrifugal force in a cylinder, or cylindrical wheel, revolving upon its axis. Also, the velocity required to produce a given strain per square inch.

Making V = peripheral velocity in feet per second,
G = specific gravity of material,
C = the constant number $222\frac{336}{1000}$,
and S = strain per square inch, tending to part the cylinder through any section made by a plane coinciding with the axis,

Then $S = \frac{V^2 G}{C}$, whence $V = \sqrt{\frac{C\,S}{G}}$ = peripheral velocity producing a given strain equal to S upon each square inch of section, as above. Or, to state the same verbally:

The strain per square inch equals the specific gravity of material multiplied by the square of the peripheral velocity, and divided by $222\frac{336}{1000}$. And the peripheral velocity required to produce a given strain to the square inch of section equals the square root of the quotient of $222\frac{336}{1000}$ times the given strain divided by the specific gravity of material.

Hence, knowing the cohesive strength of the material, and the specific gravity, the speed may be limited to any required margin of safety.

S. WHIPPLE.

Albany, June 6, 1883.

A New Market in New York.

The new Washington Market building, New York city, will cost $250,000 and cover an area of 54,000 square feet. It will be built of iron and glass, one story in height, having frontages of 186 feet on West Street, 235 on Fulton Street, 255 on Vesey Street, and 175 on Washington Street. The roof will be of glass with a large dome in the center. The general height from floor to roof, except under the dome, will be 24 feet, but the standholders will not be allowed to run up their partitions more than 18 feet, thus insuring light from the roof over the entire building and a good circulation of air.

ENGINEERING INVENTIONS.

A flue plugging device for mending the flues of locomotive and other engine boilers when they become ruptured, and which may be accomplished by this implement while the boiler is in use, has been patented by Mr. Frank Sharp, of Los Angeles, Cal.

Mr. Charles Weik, Jr., of Bristol, Pa., is the patentee of an improved car coupling. The drawhead is provided with a sliding block upon which the coupling pin rests before the coupling is effected. When the cars are brought together the sliding block is depressed by the action of the connecting link, and the pin drops into the link, when thecars become automatically coupled.

An improved steam brake for locomotives has been patented by Mr. W. B. Wallace, of Belleville, Ill. The mechanism by means of which power is applied to the brakes consists of a steam cylinder open at one end and closed at the other, and provided with a piston to which is attached one end of the chain which actuates the brake. Wherefore when steam is admitted to the cylinder through the steam ports at its closed end, the piston will be projected and the brake set.

Mr. W. P. Senour, of Pimento, Ind., is the patentee of an improved car door and fastening to be used on common freight cars in which grain is to be carried in bulk. In this improvement an inner car door is provided which effectually prevents the loss of the grain in case the outer one becomes loose or gets jarred open. A fastening is applied to it which is quite ingenious, and is so constructed that it cannot be worked loose by the jarring during transportation.

Mr. Wm. J. Carey, of Millvale, Pa., has recently patented a supplementary fastening for car doors to render them more secure against the jarring open of the door while the car is in transit. The inventor provides a hinged brace which is made to prop the door fast and relieve the lock and hasp ordinarily used, while it does not take the place of the ordinary lock and hasp fastening, but acts as auxiliary thereto, rendering increased security to freight car doors.

One of the most simple car coupling devices that has recently been patented is that of Mr. A. Wells Case, of South Manchester, Conn. The invention consists in coupling heads having their sides beveled to adapt to overlap each other, and in unequal armed U-shaped coupling rods having curved bars attached to the ends of their long arms. The said rods couple the cars by the coupling head of an adjacent car when the cars are run together.

An improved governor for steam engines has been patented by Mr. William Knowles, of Bolton, County of Lancaster, England. Instead of employing the ordinary ball governor for controlling the action of the throttle valves and cut-offs of the engine, Mr. Knowles has interposed between the main governor and the valve a regulating governor which operates automatically, and serves to accelerate the action of the governor on the cut-off, and reduce to a minimum the variation in the speed of the engine.

A novel car truck has been patented by Mr. Austin A. Brooks, of Eau Claire, Wis. The object of the invention is to prevent serious accidents when car or locomotive trucks run off the track, by providing bevel guard wheels which are secured to the same axle with the tread wheels for retaining the latter in line with the rails in case the tread wheels jump the track. An axle bearing is also provided for preventing the axle from dropping in case of breakage. The liability of cars being overturned by derailment, or smashed up in case of the breakage of an axle, is prevented.

In sinking driven wells where the water-bearing stratum is more than twenty feet below the surface, it is customary to excavate the earth down to that distance, and then to drive the pipe from the bottom of this excavation. Mr. Jehyleman Shaw, of Bridgeport, Conn., has obtained a patent for an improvement upon this method which avoids the necessity of excavating. In some cases a large pipe is driven the whole distance to the water bearing stratum, while in others both a large and small pipe suitably coupled together are employed, as well as a pump valve or plunger that is adapted to work both upon the suction and lift principles.

Mr. Jacob Ruhle, of Pittsburg, Pa., has recently patented some new improvements in draught and drawhead attachments for railway cars, by which much timber is saved in the construction of the draught, a stronger draught attachment is obtained, labor is economized in making the attachment, and the whole draught connection is cheaper and more durable. The inventor also claims that much advantage is obtained and expense saved by dispensing with the follower plates for the springs, and likewise a large number of bolts. Cars may be coupled while standing without risk of injury to life or limb, and the same coupling pin, if broken, may be utilized by reversing it.

A balanced rotary valve is the subject of a patent granted to Mr. Abiel E. Wilson, of Worcester, Mass. The invention consists in a double valve carried by a single stem and formed with ports combined with a body or case for use with regulators for either steam, water, or air, and is applicable for any situation where a frictionless valve is necessary. The two valves are balanced by the pressure of water or other fluid, and consequently there is little or no friction even under heavy pressure. The valves may be rocked by slight variations in pressure in the regulator. The valve case is to be connected in a water supply pipe for regulating the discharge and pressure, and having the stem connected to a pressure diaphragm in any suitable manner.

A simple and seemingly practicable automatic car coupling for either passenger or freight cars has been patented by Mr. Charles H. Schaaff of Alexandria, Va. The drawhead is provided with a sliding hook over which the connecting link passes in coupling the cars, dispensing thereby with the ordinary coupling pin. A pivoted lever is placed at the top and end of the car, and connects with the sliding hook in the drawhead, whereby when the lever is elevated the hook will be projected from the drawhead, and will thereupon assume a pendent position and the cars will be uncoupled. Although the uncoupling cannot be effected by any jar the car can receive, nevertheless the mechanism is so complete that it may be readily accomplished by one hand, by simply raising the lever.

MECHANICAL INVENTIONS.

A stop motion mechanism for knitting machines is the subject of a patent granted to Mr. William Diebel, of Philadelphia, Pa., the object of which is to stop knitting machines automatically should a hole occur in the fabric while the machine is in operation.

Mr. Lewis E. Williams, of Peekskill, N. Y., is the patentee of an improved burglar alarm and door bell, in which a gong is attached to the lock spindle inside of the house, so that the turning of the knob to open the doors at the same time operates the hammer and sounds the alarm.

An ingenious device for maintaining power for clock springs has been patented by Mr. Francis T. Marchand, of Annapolis, Md. This invention consists in an improved gearing for the springs of clockwork and all spring actuated mechanism, and is designed to prevent the retardation of the mechanism while being wound, and insure uniformity in the action of the spring, whether fully or partially wound.

Mr. John Strachan, of New York city, has obtained a patent for an improved method of bushing the flue openings of steam boiler heads, which consists in an unflared ring of soft metal, and driving this ring into the flue opening of the boiler head, and finally expanding the ring in the opening, whereby the inner walls of the ring will always be in the form of a true circle, insuring always a perfect fit with the ends of the boiler flues.

Mr. Joseph Marion, of Brooklyn, N. Y., has patented an improvement in oil stoves for family use consisting of an open bottom or tray upon which is placed asbestos fiber or similar material, to which the oil is supplied for burning. The supply of oil to the asbestos is regulated by the weight of the oil on the tray. A valve and counter balanced weight regulate and effectually seal the pipe and prevent any flow of gas to the tray.

A machine for starting and sizing hats has been patented by Mr. William Simmonds, of Yonkers, N. Y., consisting of a machine provided with three rollers, which are driven by gear wheels. The movable roller is held back by springs and drawn forward by cords and a treadle connected with the bearings. To the vat beneath the frame is attached a table provided with an edge flange to receive the hat rolls from the rollers, and prevent them from falling into the vat.

A superior automatic safety brake for elevators has been patented by Mr. Wright J. Seaton, of Wyandotte, Kas. This brake is arranged to act automatically should any accident cause the carriage to fall, and provision is likewise made whereby in case the brake should fail to act automatically, it may be set by a person in the carriage. The brake may also be used for regulating the descent of the carriage independently of the machinery for operating the carriage.

A machine for trimming lumber has been patented by Mr. W. B. Swartwout, of Three Rivers, Mich. This invention is an improvement upon a machine patented November 29, 1881, by same inventor, which was designed for cutting lumber or boards into standard lengths, certain of the saws being thrown automatically out of action according to the length of the lumber. The object, however, of the present improvement is to provide for throwing the automatic mechanism into or out of action by hand or foot.

An improved rotary filing machine, the object of which is to make a uniformly smooth surface on metal articles especially applicable for making rules has been patented by Mr. De Loss H. Stephens, of Riverton, Conn. The slide upon which the rule is placed, and the frame which carries the slide, are located at the outer edge of the wheel, and the joint to be filed is carried against the wheel, where the cut will be made in lines nearly parallel with the sides of the rule. The slide is actuated by a foot treadle.

An improved apparatus for the disintegration of bagasse or other vegetable substances has recently been patented by Mr. Theophile Harang, of New Orleans, La. The object of the invention is to so treat the fibers of cane leaves, sorghum, or other plants as to render them useful for any of the purposes to which other non-saccharine fibrous materials are used. After the crushing and compressing operations to which the fibrous materials are subjected, lime water, caustic soda in solution, and steam are brought into use to complete the operation.

A magnetic separator, intended for separating iron sand from common sand, the object being to obtain as large a percentage as possible of the ore free from other sands, has been patented by Mr. Joseph La B. Viger, of Montreal, Canada. The invention consists in an endless traveling apron combined with a series of magnets placed at an inclination, so that as the sand is fed to the side of the apron the magnetic particles will be retained thereon and carried forward to the discharge end, while the common sand will fall through into a waste receiver below.

An improvement in an attachment termed a "beamer," used in connection with weaving, has been patented by Mr. Edward Cadigon, of Adams, Mass. A comb of metal or wood, with an equal number of teeth to the vertical rows of threads in the beamer, and operating in connection therewith, is the nature of this improvement. By this arrangement the strips are located close to the side of the copper, so that the copper and the strips can be threaded at once, and thus save the second operation of threading the harness, as in the common arrangement.

Messrs. Anton Prier, Charles Doherty, and Pierce E. Everett, of Kansas City, Mo., are the patentees of a self-closing faucet which consists of a stem passing through the apertured seat of an elastic cushion, and supporting the upper end of the valve stem, with a lever resting upon the end of the valve stem, so that when the lever is moved so as to force the valve downward, the water will be allowed to pass from the pipe and be discharged, and when the lever is released, the expansive action of the spring will cause the lifting of the valve and its stem, and thus automatically stop the flow of water.

An improved surgeon's operating chair, which is so constructed that the patient may be brought into any desired position, has been patented by Mr. F. Adon Krill, of Burton, O. This chair is of simple construction, and the position of the various parts may be readily changed to suit the requirements of the case. In fact it is capable of about as many adjustments as a chair one of our contemporaries mentioned the other day, in which it said: "A man has invented a chair that can be adjusted to 800 different positions. It is designed," the wag adds, "for a boy to sit in when he goes to church".

An improved mode of protecting superheating pipes has been patented by Mr. Magnus Gross, of New York city. The invention consists in coating the pipes inside and outside with dry plumbago, covering the pipes singly with strips of hair felt coated upon the inner side with plumbago paste, covering the felt with strips of asbestos paper coated upon the inner side with plumbago paste and washed upon the outer side with a mixture of plumbago, pulverized fire clay, and water. The hair felt and asbestos paper is secured in place with wire. It is claimed that a pipe so prepared is practically indestructible, as it cannot be injured by fire, gases, or steam vapor.

An improved apparatus for regulating the feed water supply of steam boilers, whereby the level of the water may be constantly maintained at the same point, has been patented by Mr. George C. Pyle, of Dayton, O. This contrivance is so constructed that when the water in the regulator reaches the level required, the float will automatically open the valve of the escape pipe, and the water instead of flowing from the pump into the regulator, will pass off by the escape valve, but if the water falls below the proper level the escape valve will be closed, and the water will flow into the regulator again until the water has acquired the desired level.

A machine for dampening or wetting grain, to prevent pulverization during the grinding process has been patented by Mr. John Miller, of Milton, Oregon. This invention provides for the accurate regulating of the degree of wetting, and also of regulating the supply to the grinding mill, according to its capacity, so that there shall be no accumulation of the wetted grain, beyond what is necessary to moisten the hulls. To insure the even moistening of the grain, so that the hulls will come off so clean as not to require a regrinding, after the grain has passed direct from the dampening machine through the grinding mill a revolving table with raking attachment is provided for stirring the grain after the water has been applied.

The fact of a new ice creamer having been invented is in itself a refreshing announcement these hot days. But more than that, Messrs. William Rogers and Thomas A. Maher, of New Orleans, La., have patented what seems to be an excellent improvement in this useful article, by which the old and tiresome method of rotating the can is avoided. The ice freezing vessel in the new invention is provided with a central ice chamber open throughout its full diameter at both ends. Experience has satisfied the inventors that, from the large amount of freezing surface to which the cream is exposed, by simply charging the freezer with ice and salt and placing the cream therein, the latter will become frozen without any manipulation of the machine, thus avoiding much labor.

AGRICULTURAL INVENTIONS.

Mr. John T. McIntire, of Purdy, Tenn., is the patentee of an improved cultivator in which the plows are so set in the beam that they may be adjusted to the elevation and inclination desired, the handles being likewise so arranged as to be shifted, so as to enable the plowman to walk either in or out of the furrow.

Letters patent have been granted to Mr. Laurens S. Wheeler, of Independence, Kan., for an improved harrow which is made in two sections connected together side by side by chains, so that it may better accommodate itself to the uneven surface of the ground.

A binding attachment for harvesters has been patented by Mr. Edward Ebi, of Cedar Rapids, Iowa, which consists of an apparatus to be used in connection with self-raking harvesters to receive the gavels as they are discharged from the platform of the harvester and deliver them to the binder arm of binding machines.

A simple cultivator, adjustable according to the work to be done, has been patented by Mr. G. W. Hammond, of Earl Park, Ind. It is so constructed that the machine is drawn over every other row and cultivates the entire space between that row and the adjacent one upon each side, so that the machine will cultivate four rows at each round. The machine may also be adjusted to cultivate wide or narrow rows, and to hill the plants more or less as may be desired.

The patent of Mr. William S. Prosser, of Auburn, Cal., relates to an improved method of feeding straw as fuel to the furnaces of traction engines. The invention consists in a device to be applied to combined "headers" and "thrashers" that are moved over the field and which cut and thrash the grain at one operation. A straw feed box is provided with reciprocating flexible bars, which connect the straw direct from the thrasher into the furnace, where its consumption creates the power for driving the machines.

An improvement in steam plowing machines has recently been patented by Messrs. J. D. Malone and J. F. Hamel, of Pittsburg, Pa., which is intended to simplify the process of plowing on a large scale. The engine and boiler, which are mounted in the usual way on a truck frame, are provided with a crank shaft and pulley, so that when the machine is not in use for plowing, it may be used for a variety of other purposes. A very ingenious arrangement of what the patentees term "pushers" is employed for lifting or buoying up the machine and preventing the wheels from becoming embedded in the soft ground.

MISCELLANEOUS INVENTIONS.

Mr. W. H. Stuckey, of Covington, Ky., has patented a fire escape adapted to be secured to the wall of a building, and provided with an electric appliance by which a latch is raised and the fire escape released, and put in position for use.

Mr. T. H. Chubb, of Post Mills, Vt., is the patentee of an improved fishing rod tip, the end of which is funnel shaped and provided with an opening at the side for the line to run through. Provision is made for tightening the tip in case it should become loose.

Mr. Edward P. Waters, of Roseville, Ill., is the patentee of an improved hame tug which consists of two plates having their ends bent around the cross bar of the buckle, and riveted together for holding the hame clip or eye and the trace keepers, whereby the tug is made very strong, without increasing the cost over ordinary hame tugs.

A very simple and inexpensive bulletin board has been patented by Mr. Charles H. Tessy, of Leadville, Colo. This invention consists of frames covered with cloth which is coated over with shellac or varnish, for making the fabric translucent. These frames are hinged together at the top, making a box of the shape of an ordinary hen coop.

Mr. S. S. Ward, of Greenfield, Mass., is the patentee of an improved carving fork guard consisting in a bar or tongue which lies alongside the prongs when not in use, but is extended and held by a spring at right angles to the prongs when in use, thus protecting the hand of the carver in case the knife held in the other hand should slip.

Mr. Thomas Sturgin, of Fairview Township, Mercer County, Pa., has obtained a patent for an improved balance gate which is so constructed that it may be raised vertically or may be swung open in the ordinary way. This gate is adapted especially for use in cold regions where the ground is liable to be covered with snow during a good portion of the year.

Mr. George Maris, of New York city, has obtained a patent for an improved pestle handle. The pestle, which is made of Wedgwood or porcelain, etc., is provided with a hard rubber handle which is screwed and cemented on the pestle. The advantages of this handle are that it is light, is not affected by acids, and presents a hard and smooth surface which will endure as long as the pestle or mortar.

Mr. Peter E. Crist, of Brighton, Ill., has patented a new surgical apparatus for fractures, consisting of a device for supporting the shoulder in proper position in cases of fracture of the clavicle or collar bone, so as to hasten the reuniting of the broken bone. It consists in a forked crutch-like support for supporting the shoulder and a belt connection for the waist, so constructed as to permit an adjustment of the crutch.

Mr. John Curtin, of Marion, Vt., has secured a patent for an improved hub attaching device which relates to that class of skeins for vehicles which are made of iron to cover the wooden axle. The skein has a cylindrical stud and a half circular flange attached to it with a spiral ended conical nut, and two or more conical edges for holding the parts together in a substantial manner.

A practical time signal for signaling standard time simultaneously over a series of telephone circuits has been patented by Mr. John M. Oram, of Dallas, Texas. This time signaling instrument is provided with several sets of contacts and with two or more conductors of electricity upon the same actuating arbor, each of which is insulated from the other and connected with an independent generator.

Mr. Horace E. Henwood, of New York city, is the patentee of an improved thill coupling. A ball is formed upon the neck iron of the thill, and connects with the axle of the vehicle by concave shaped clamp irons. By this ball and socket arrangement the coupling allows the thills to be readily detached, but while in use they securely hold the thills to the axle, and do not rattle.

To prevent injury to the interior fittings of horse stables by the common practice among hostlers of rapping the curry comb upon the wood work while cleaning horses, Messrs. G. C. Bunce and Lewis W. Sammis, of Brooklyn, N. Y., have patented the attachment of elastic cushions to the sides of curry combs, which not only prevents injury to the stable, but facilitates the removal of the dust from the comb.

Mr. Henry Roth, of New York city, is the patentee of an improved reflector and signal frame for car lamps, the object of which is to provide reflectors and signal frames for car lamps constructed in such a manner as to be more effective in lighting the ends and platforms of railroad cars than heretofore. A series of reflecting glasses are so arranged within the frame that when the lamp is placed in position inside of the car, it illuminates both the interior and platform.

Mr. Daniel F. Beatty, the enterprising organ and pianoforte manufacturer of Washington, N. J., has, by assignment from Charles H. Davis, the inventor, obtained a new patent for swells for reed organs. The intention of the inventor by his improvement is to produce a full volume of sound and regulate the swell at the will of the operator. The swell is so combined with the action of the instrument and under such control of the organist that he may obtain the most perfect graduations and effects.

Mr. Theodore P. Case, of Powell, O., has obtained a patent for an improved vehicle tongue for sleds which is so constructed that it may be secured in a rigid position, or adapted to oscillate to either side, the object being to facilitate the loosening of the runners in case they have become frozen in the ground. This may be accomplished by securing the tongue rigidly to the sled, when a lateral pressure may be applied to the runners for their dislodgment. When this has been accomplished the tongue is rendered flexible, so that the sled may be controlled in going down hill.

Mr. Tobias Hamilton, of Centerfield, O., is the patentee of an improved life boat which consists in an approximately spherical shell segmentally cut away at its two sides, walled in at the chord of each segment by a vertical plane, and each of the segmental spaces floored over, forming a tight hull. The boat is provided with propelling wheels journaled in the vertical walls. The inventor claims that a boat of this style twenty feet in diameter is capable of holding one hundred and twenty-five persons with enough water and provisions for several days, and may be propelled by four men at the rate of six miles an hour.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

MAGAZINE OF AMERICAN HISTORY. For June. Historical Publication Company, 30 Lafayette Place, New York.

The second historical paper on Wall Street appears in this number, reaching down to the time of the occupation of New York by the general government. Some of the illustrations are quaint reproductions of century old scenes. An account of recently found manuscripts of Benjamin Franklin and a finely engraved portrait of the philosopher add to the interest of the number.

THE STRENGTH OF MATERIALS. By Thomas Box. E. and F. N. Spon, London, and 35 Murray Street, New York.

The author says, in his preface, that two special objects have been kept in view throughout the work—that the rules and data shall be correct and trustworthy, and that their application to practice shall be clearly understood; for which purpose every rule has been illustrated by example worked out in detail. Where theory did not bear the test of experiment, the theory was cast aside and rules from the empirical tests substituted. It appears to be a very thorough and practical book and has a copious reference index.

A CENTURY OF ROUNDELS, AND OTHER POEMS. By Algernon Charles Swinburne. R. Worthington, 770 Broadway, New York.

This is a volume of something more than 100 pages containing one roundel on each leaf—a blank page between—the paper being "hand wove," given with ample margin. Admirers of Mr. Swinburne as a lyrical writer will be gratified with this collection, as he has been very exact in modeling each page poem on a certain lyrical rule, and shows all his peculiar faculty in the use of words to produce a rhythmical effect.

A TREATISE ON ELECTRICITY AND MAGNETISM. By E. Mascart and J. Joubert. Translated by E. Atkinson. Thomas De La Rue & Co., 110 Bunhill Row, London.

This volume is the first of two, and is based on a course of lectures delivered by Professors Mascart and Joubert in the College of France on the theory of electricity and magnetism. The authors, in a preface, consider this volume as an "Essay on the Mechanical Theory of Electricity." It is divided into four parts: statical electricity; electrical currents: magnetism, and electro magnetism. The problems are fully elucidated by text, and are so arranged progressively as to lead the student gradually from the rudiments on to a thorough understanding of the theory, so far as it is treated in this volume.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. M. asks for a receipt for making common gold solder. I make plain rings with gold:

	Dwt.	Grs.
Coin gold	10	12
Fine silver	8	18
" copper	10	18

and would like a solder that would not turn black. I use silver solder, but it is not satisfactory. A. For common gold solder take of the composition used for the rings 10 dwt., pure tin 1 dwt. This will make a solder that will flow easier than the stock composition. If it does not flow easy enough, add a little more tin. If you wish the solder of exactly the same color as the stock, you make the composition the same as the stock and substitute 2 dwt. tin in place of 2 dwt. silver. Some use zinc in place of tin, but zinc is an oxidizable metal and only suitable for very low compositions.

(2) G. W. F. asks for a receipt for making a black copying ink to be used on a hektograph. I am not allowed to use colored inks, but can use black.

A. Nigrosine black	1 part.
Water	14 parts.
Glycerine	4 parts.

This will make a black ink suitable for use with the hektograph. In order to make it copy add more glycerin, gum arabic, or sugar.

(3) C. P. writes: I would like to know if it is better to paint a tin roof. If so, what kind of paint do you use? A. Use a metallic paint, such as an iron oxide paint.

(4) I. B. T. asks if there is any solvent for celluloid from which it will deposit unchanged on evaporation or by precipitation. Can celluloid be softened in hot water so as to be worked under the rolls or by press? A. There is nothing in which celluloid can be dissolved and reprecipitated without its being altered. Celluloid can be softened somewhat by treatment with hot oil or water.

(5) W. A. C. asks: What is the specific gravity of ivory, and what does an exact cubic inch weigh? A. Ivory, specific gravity, 1·822; 1·654 ounces is the weight of 1 cubic inch.

(6) W. W. S. H. asks: What is the horse power of an engine, cylinder 12 inches diameter by 20 inches stroke, making 120 revolutions, steam pressure 120 pounds? A. About 120 horse power.

(7) J. A. asks: 1. How can I prepare some fine chromo pictures I have for framing without glass? A. Use ordinary picture copal varnish. 2. Give me a good varnish for fine engravings, so that they too may be framed without glass. A. Engravings are not generally framed without glass. 3. Can these pictures be attached to cotton or linen cloth? A. They can be pasted on mounts if desired.

(8) H. S. W. asks how hollow rubber balls are made. A. Two flat (round, or pear shaped) pieces of rubber of suitable size are cut, and after being cemented together the crude ball is filled with water. The balls thus formed are placed in a mould and heated in a vulcanizer. The water expands and presses the sheet rubber against the sides of the mould.

(9) J. W. H. writes: I frequently have small castings of iron which I would like to make malleable, or by some simple process toughen them. Can you help me? A. If the castings are hard or chilled upon the edges, they can be annealed by packing in a cast iron or sheet iron box or old crucible, with fine sand mixed with about one-quarter pulverized charcoal, so that the air does not get to the castings, heat the whole to a low red heat and keep at that temperature for one, two, or three hours, according to the size of the pieces of castings to be annealed. Then withdraw from the fire and let the whole cool gradually; unpack when nearly cold. The manufacture of regular malleable castings cannot readily be conducted on a very small scale.

(10) C. S. F. writes: 1. It has been stated to me that an engine would not exert the same tractive force to start a load as it would after it started, that a locomotive would not exert as many pounds of force in the coupling link when standing with the steam turned on as after it had got in motion. A. It will do so unless the drivers slip. 2. That a one horse power engine would not start a street car that one horse would start. How is it? How many pounds of tractive force do street car companies require of their horses; they require them to draw the car through the trip whether they are weak or strong, so the labor required of each must be precisely the same. A. The tractive force of the engine is not exerted in the same way as with a horse. The horse power of an engine is based on what a horse can do for eight hours continuously and not what he can do for a jerk; for an instantaneous pull a horse could probably do three times as much as on continuous work.

(11) J. B. asks: What is the name of the stone used in the first cut in concaving razors? A. The razor grinder's first cut stone is called the "Wickersly stone." It comes from Wickersly, Eng.

(12) S. S. B. asks whether Babbitt metal is now more generally used in the main journals of engines than brass. A. Yes, taking all classes of engines. 2. I run an engine 16x28 with a 7 inch shaft, 80 revolutions, and 70 pounds pressure; the main pillow block has a cast iron cap (no Babbitt) with cast iron side pieces filled with Babbitt places in small rectangles, bottom of journal all Babbitt. Is this a better journal than one containing brasses side and bottom? A. No; good brass boxes with sufficient bearing surface are best.

(13) J. G. writes: We are constructing a yacht as follows: Two cigar shaped barrels, placed side by side, will constitute the hull. Each will be 20 feet long, 2 feet diameter at center, 1 foot at ends; each end supplemented with a pointed piece of solid wood. The beam is 10 feet. What will it carry, and how much will be the displacement? A. If one-half immersed, the two will displace, as an elliptical spindle, 0·91 ton, and as a parabolic spindle 0·96 ton.

(14) J. L. G. asks: Could an arrangement be made on the principle of the injector that would fill an air chamber with air and furnish air enough to run a compressed air engine? Do you think it would be possible to make such an arrangement? A. It is possible to make a water injector that would compress air to a moderate pressure, but would probably cost more than to use the water directly for power. Compressed air is now furnished by hot air engines for use at a distance. Water blowers are used in Europe for furnaces where great pressure is not required. They are constructed upon the same principle as the injector, using gravity or the natural descent of water for the initial power.

(15) J. B. H. writes: I had a silver headed cane; in order to reduce the size of it I put it in nitric acid until it was about one-half the size. Now, will you please tell me what to do, so as to get the silver which was taken off. There are about three-quarters of an ounce of the silver dissolved in 4 ounces of acid? A. Precipitate the silver with dilute hydrochloric acid or sodium chloride, and fuse the resulting precipitate with alkaline carbonate in a sand crucible.

(16) L. F. M. M. asks whether milk, fresh or boiled, has any constipating effect. A. The effect of milk upon the human system depends largely upon the individual peculiarities of the person. Its general effect is a constipating one, brought about by the casein contained in it, which is not easily digested, and also by the production of a large amount of mucus, which has a similar effect.

(17) C. E. H. writes: I am building a new brick house, and should paint one side to protect it from rain and wind. I am told I can economize oil and paint by putting on one coat of crude petroleum and another coat of oil paint. Will this do as well as the ordinary way of two coats of paint? A. The use of petroleum is not to be recommended. It is difficult of drying, and a coat of paint cannot be satisfactorily put over it. It is best to use two coats of paint.

(18) D. W. writes: I find in No. 22, June 2d, on inquiry for method of drilling glass. "Glass can be drilled as easily as soft iron and with a common drill by using a saturated solution of gum camphor in alcohol and equal part spirits turpentine; keep this about the cutting edge of drill, and in filing glass keep the file wet with it" Can you give me a formula for white or nearly white varnish for maps on common drawing paper? A. Dissolve shellac by heat in 8 parts of water and 1 of pearlash. Precipitate by chlorine, and dissolve in rectified spirit. The following is recommended for drawings: Dextrine 2 parts, alcohol one-half part, water 2 parts. The drawings should be prepared by applying two or three coats of thin starch or rice boiled and strained through a cloth.

(19) W. D. G. writes: I read of a "gauge cock and low water alarm" which depends for its action on the temperature of the water remaining constant at 212° while that of the steam is higher. The statement seems to be well substantiated, but I have always supposed, and do still, that the water and steam in a boiler both attained the same degree of heat; will you please inform me through your Notes and Queries which is correct? A. The water and steam inside the boiler are nearly of the same temperature. The water in the alarm part of the gauge cock has little or no circulation from the boiler, and remains cool until low water allows steam to enter.

(20) C. H. F.—1. We would not recommend you to risk strengthening your boiler by patching up with braces. Get a new one of copper made by a coppersmith, No. 16 copper, brazed. 2. A good strong metal for a small engine may be made with an alloy of 1 pound copper to 2 ounces tin and 1 ounce zinc.

(21) A. H.—The method of making rubber stamps is described as follows: Have a vulcanizing apparatus with a thermometer and a lamp under it, such as dentists use; have an iron printing frame, in which you lock up the type for all the names which you wish to reproduce in rubber, and of such a size that the plaster mould made from it can be placed inside the vulcanizer. This mould is made like an ordinary stereotype mould, by first oiling the type and then pouring the plaster over it; when set, take it off carefully, and do not let it dry, but proceed at once by placing on top of the mould a piece of sheet rubber (vulcanized rubber). Then have two iron plates, one for placing on top of the sheet rubber and one below the plaster mould, and which by proper screws can be pressed together and squeeze the rubber on the mould. Back up the rubber with a few sheets of paper, so as to prevent it from sticking at the back of the iron plate. After screwing down sufficiently immerse the mould and rubber in the water in the vulcanizer, screw the cap on, and heat to 300° Fah., then let it cool, open the vulcanizer, take out the mould and rubber, and remove the rubber carefully from the mould. This will be easily done if you have put the mould while still wet in the vulcanizer. Cut up the rubber so as to separate the various names, glue them to handles, and your rubber hand stamps are finished.

(22) A. W. B. writes: I have found it very difficult to make a perfect matrix for rubber stamps. What is the best material to use? Have used plaster, pure, but it is apt to break the fine lines. Is anything used to toughen it? What can be used to make the type leave the plaster freely? Is pure rubber used, and if so, how? I have dissolved it in bisulphide of carbon, but have had trouble in getting it to form a complete shape, as I think the rubber is lighter than the bisulphide, so that it does not seem to enter into the lower parts of the letters. I mean that when it hardens it has formed a sort of thick skin over the mould, but seems to rise away from the lower parts of the letters. I did not know but some composition was used that could be melted and poured in hot. A. The plaster mould is best made by taking the very finest of plaster of Paris and sprinkling it into water, and stirring until the mixture is of the consistency of thick cream. If the mould or type is oiled with a little sweet oil or boiled linseed oil, the type can be readily removed. Vulcanized rubber is used. See the process as given in detail elsewhere in this number. It must be understood that experience or proper manipulation is essential to good results. See page 3794, SCIENTIFIC AMERICAN SUPPLEMENT, No. 251.

(23) E. C. asks: What is the mixture of metal for the manufacture of chilled cast iron rollers used in roller mills; also the method of chilling them? A. Chilled rolls are generally made from "charcoal pig" No. 3, but some roll makers claim to have some

special combinations known to themselves only. The chilling is done by casting the metal in contact with an iron mould.

(24) C. H. S. asks: What is "rectified" whisky? Wherein does it differ from "distilled" whisky? Which is the purer and more costly and which is the more wholesome? A. Rectified whisky is generally passed over animal charcoal, while distilled whisky does not pass through this process. It is simply distilled directly from the mash. The distilled whisky is apt to be the cheapest, and as regards wholesomeness it is entirely dependent upon the quality.

(25) A. J. B. writes: How can I melt rubber? A. Heat the rubber by steam or over a water bath till the rubber melts,and let it run into hot water, where it will collect at the bottom of the vessel, while the vapor will prevent it from burning.

(26) I. N. G. writes: I have a private telephone line half a mile in length, using three of Bell's hand telephones without microphone or battery. I notice that in time of lightning it passes in on the wire sufficient to ring the bells at each station. I supposed it was owing to the heavy magnets in the signal bells, and I arranged a simple "cut out," by which the bells and telephone might be disconnected entirely in a moment, and thought that would leave the wire free from any attraction for lightning, but when all instruments are off, the lightning during rain storms will snap and crack from the ends of the wire inside as though it was a telegraph line heavily charged. Why is this, and is there any special danger or way to avoid it? A. You should provide a lightning arrester of approved form for each end of your telephone line. The magnets have little or nothing to do with the effects you mention. It is advisable to keep away from the telephone during a near thunderstorm.

(27) F. M. S. asks: I have a graphoscope lens 7 inches diameter, 40 inches focus; what sized lens would I require for eyepiece to make an achromatic telescope, and what should be the length of tube? A. Supposing that your graphoscopic lens is a single crown of good quality and accurate finish, you will need a concave flint lens about 3 inches diameter and 30 inches focus, placed about 25 inches from the object glass; this distance must be ascertained by trial, as the effect of the flint lens depends upon its dispersive power. The focus should be at from 50 to 60 inches. For the eyepiece use the Huyghens form, field glass 3 inches focus, plano convex; eye lens, 1 inch focus, plano convex.

(28) O. C. L. asks (1) how I can cheaply prepare the porous cells used in batteries? A. No porous cell is of much account unless made of clay and properly baked. You can purchase porous cells for a small sum, and it will not pay to try to make them. 2. Which would give the best current for the electric light—a chromic acid battery of M. Trouve's solution and same construction, or one using porous cells, same size carbons and a like solution in porous cells? A. The battery without the porous cells is preferable for this purpose. 3. Taking the better one of the above batteries, how many would it require for one and two lights respectively, carbons 9x6x¼? Would the effect for lighting purposes be increased by dividing the same amount of material and making a greater number of cells? A. All this depends on the kind of light you propose to make. A small incandescent light can be run with 4 or 5 such cells.

(29) J. A. C. asks: What size of reservoir at an elevation of 75 feet will produce a 6 horse power at a distance of 600 feet for twenty-four hours, and what size pipe to convey the water? A. You would require a reservoir 85 feet square, 16 feet deep, capable of holding 2,250 cubic feet of water, which will furnish you with 6 horse power for twenty-four hours without addition. Your pipe 600 feet long will require to be 4 inches inches in diameter with 75 feet fall.

(30) A. M. I. asks: Can you give me instructions how to make the simplest galvanic battery adapted for medical use? A. See article on galvanic batteries, SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 157, 158, and 159, for complete description of all sorts of batteries.

(31) E. M. B. asks what is the best non-conducting covering for steam pipes. A. The following table gives the results of a series of experiments by Mr. C. E. Emery, for the New York Steam Company:

Material.	Non-conductivity. Per cent.
Hair felt	100
Mineral wool No. 2	83·2
Mineral wool No. 2 and tar	71·5
Saw dust	68
Mineral wool No. 1	67·6
Charcoal	63·2
Pine wood, across grain	55 3
Loam	55
Gas works lime, slaked	48
Asbestos	36·3
Coal ashes	34.5
Fuel coke	27·7
Air space, 2″ deep	13·6

(32) L. M. K. asks for a receipt for a cheap coating to put on cast iron that has to be submerged in water, that it may not rust or make the water taste. My pump is all cast iron, and if it is put in wells containing sulphur water it rusts very badly and spoils the water. A. There is probably nothing better than red oxide of iron or Prince's metallic paint and good boiled linseed oil, for iron work in water. Dry in an oven so as to make it hard, or a coat of good japan varnish stands well if baked hard. It is used on what is called enameled pipes for water. If the water has much sulphur, it will be difficult to thoroughly protect the iron.

(33) W. asks: Will you kindly inform me through your paper how I can clean the willow work on the baby carriages now so commonly used. After they have been used a short time they get sun burnt or soiled by the exposure to weather. A. If you are certain the soiling is not due to dirt from the atmosphere, etc., settling on the wood, then we recommend you to try some bleaching process. Either by using a chlorine bleach or burning sulphur in a closed chamber, or perhaps by using hydrogen peroxide (SCIENTIFIC AMERICAN SUPPLEMENT No. 339). The size of the carriages is an objection, but we think that the only satisfactory process will be a bleaching one.

(34) E. T. S. writes: Please inform me through your paper where I can find a full description of the manufacture of turpentine and resin, from saw dust. A. The spirits of turpentine are made from the saw dust and refuse by a sweating process yielding 14 gallons of spirit, 3 to 4 gallons of resin and a quantity of tar per cord. The spirits obtained in this manner possess a different odor from those produced by distillation. The article on turpentine in Spons' Encyclopedia of the Industrial Arts, page 1686 et seq, will give some useful hints and descriptions of processes in use abroad.

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

C. P. C.—The samples sent are not at all characteristic and their identification is somewhat difficult. They appear to be as follows: No. 1 is a quartz mineral containing some flecks of black mica. No. 2 is a hornblendic mineral with some pyroxine. No. 3. Hornblende with traces of pyrite. No. 4 is a siliclous conglomerate. No. 5. Felspathic rock. No. 6 is a hornblendic schist or slate. No. 7 is a mixture of different silicates, probably felspar and hornblende. No. 8 is a piece of hornblendic rock.—J. S.—The sample is pyrite (iron sulphide), a mineral which usually carries gold, the amount of which can only be determined by a fire assay.—W. M.—This sample is a little below what is sold as second quality. Its value is dependent upon the supply. When the first quality is hard to procure, this variety will bring within 25 per cent of the value of the better varieties. It sells at from 10 cents to $2, according to the size of the sheets.—J. R. W.—The specimen is magnetite (iron oxide) and is a valuable ore of iron. The crystals resemble the ore which is mined at Port Henry, N. Y.—H. S.—No. 1 is a variety of hornblende called pearl stone. No. 2 is a silicious clay, a sort of conglomerate. It may carry metal, and therefore recommend you to have it assayed. No. 3. Yellow clay, too hard to grind cheap enough to compete with other varieties.—L. J.—The mineral is galena (lead sulphide). It may carry silver. This must be determined by assay.—W. C.—From a superficial examination of the sample, we are forced to conclude that it is of inferior value.—F. C. Y.—The sample is a sulphide of iron, probably marcasite; it may carry gold. An assay would determine this.—J. D. M.—It is one of the uncrystallized varieties of quartz, probably jasper.—C. H. D.—The sample is pyrite (iron sulphide).

COMMUNICATIONS RECEIVED.

On Steam Boiler Furnaces. By J. M.
On Microscopes. By S. R. G.

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June 19, 1883,

AND EACH BEARING THAT DATE.

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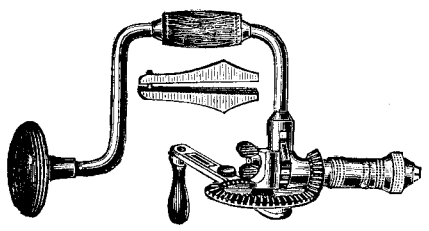

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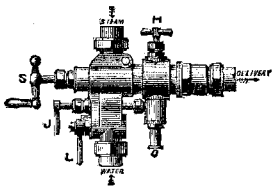

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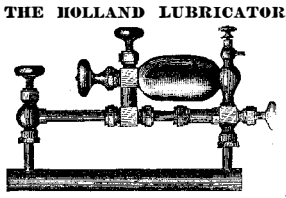

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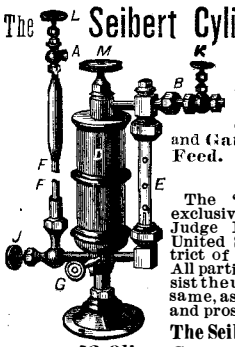

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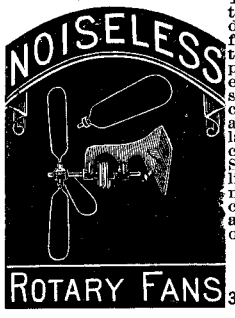

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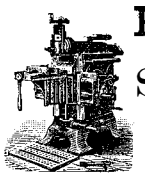

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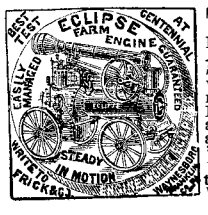

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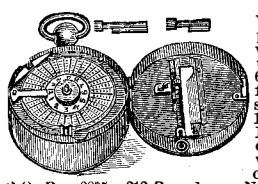

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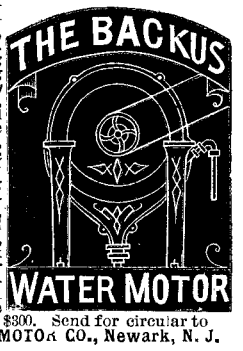

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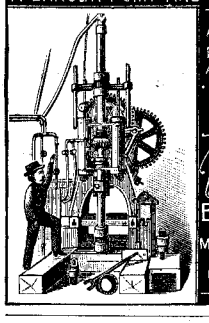

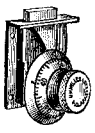

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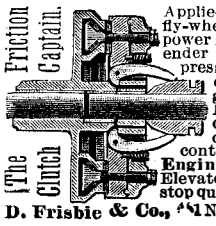

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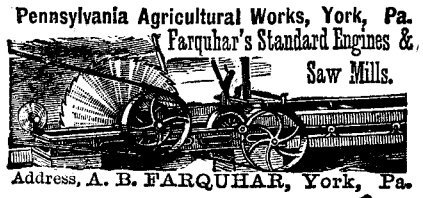

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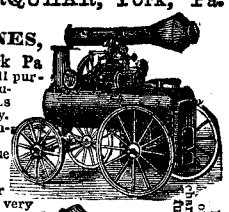

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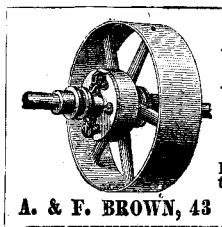

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