SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLVIII.—No. 18. [NEW SERIES.] NEW YORK, MAY 5, 1883. [$3.20 per Annum. [POSTAGE PREPAID.]

THE STEAMER CITY OF FALL RIVER.

The steamboat City of Fall River, shown in our engraving, presents some novel and interesting engineering features which are attracting the attention of engineers and others interested in steamboat traffic. The peculiar features of this boat are her compound beam engines and feathering paddle wheels. The engine is of 2,000 horse power, built by W. & A. Fletcher, North River Iron Works, this city. In general appearance it is similar to that of the ordinary beam engine, but instead of one cylinder the engine has two, one of which is 44 inches in diameter by 8 feet stroke, taking steam from the boilers at high pressure and exhausting it into a second cylinder 68 inches in diameter with 12 foot stroke. The wheels, though of a pattern common enough in England and elsewhere, are very unusual here. They are the Morgan feathering wheel, 25 feet 6 inches in diameter outside of the bucket, and are of extraordinary strength. Each wheel has 12 buckets 10 feet long, 5 inches thick, and 40 inches wide.

The boilers are two in number, of the "Redfield" tubular pattern, 17½ feet wide and 15 feet long, each having two shells 7½ feet diameter, made of Otis steel ½ inch thick and double riveted. Each shell contains 110 tubes 3½ inches diameter and 12 feet long. Each boiler has connected with it a superheater, with uptake 56 inches diameter, and outer shell 96 inches diameter. Boilers are placed one forward of the engine and one aft. They are very strongly built, and have been tested by a hydrostatic pressure of 150 pounds per square inch.

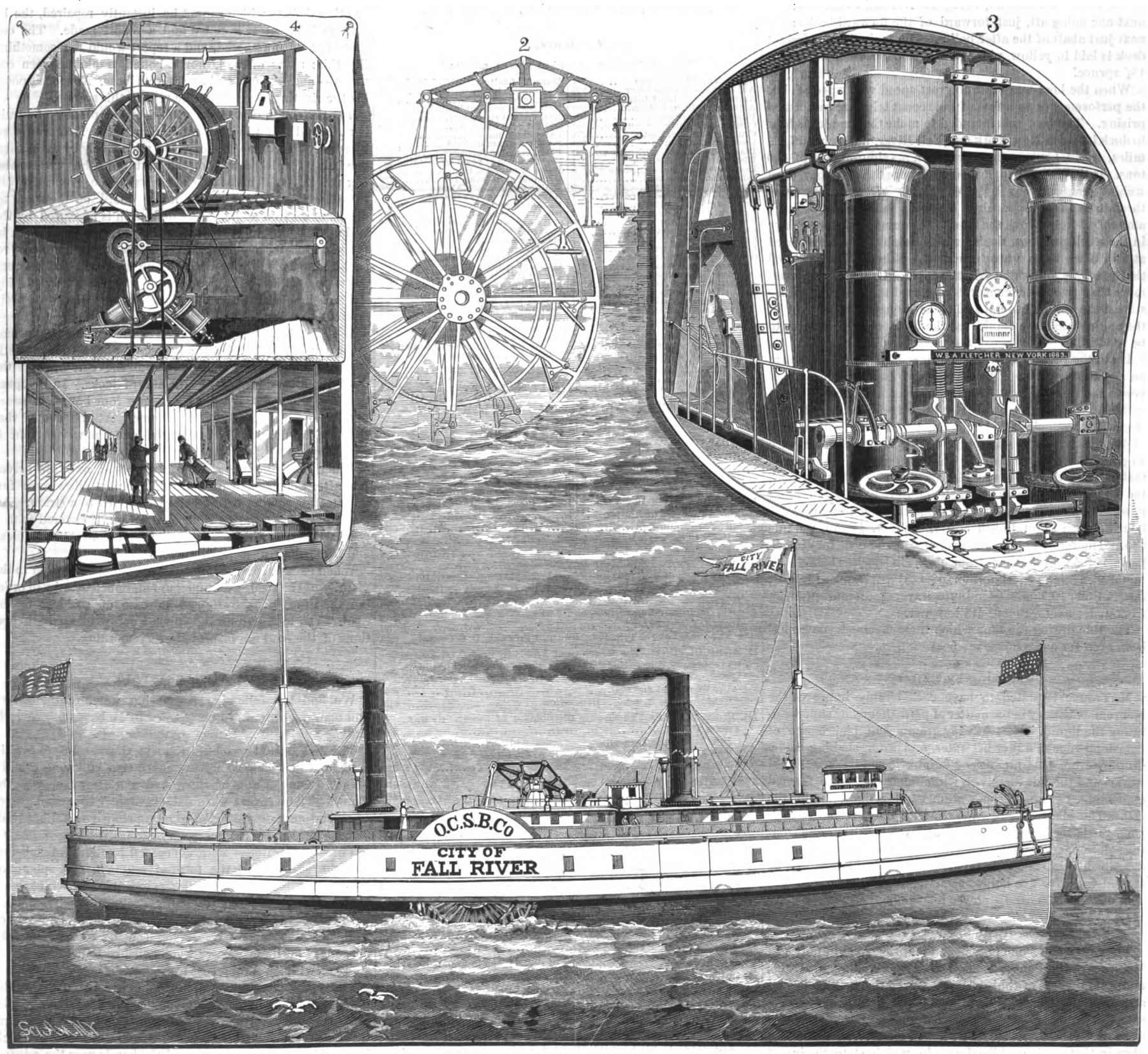
She has a donkey boiler, Worthington duplex steam pump, centrifugal pump with independent engine capable of pumping 5,000 gallons of water a minute, Sickle's steam steering gear, and a Providence steam windlass, made by the American Windlass Company, of Providence, R. I. She is a fine, able looking vessel, and has an estimated capacity of 100 car loads of freight.

The hull is rather a peculiar one, as the reader will see from the following particulars: It was built by Montgomery & Howard, of Chelsea, Mass., from specifications and model prepared by Mr. George Peirce, Superintendent of the Old Colony Steamboat Company, and is of the following dimensions:

Length on water line, 260 feet; length over all, 273 feet; breadth of beam moulded, 41 feet; breadth of beam outside, 42·4 feet; breadth of beam over guards, 73 feet; depth of hold amidship, 17 feet; depth at side moulded, 18 feet; depth amidship moulded, 18·4 feet; draught of water, light, 9 feet 8 inches; draught of water, loaded with 600 tons, 12 feet; depth between decks from top of plankshear to top of upper frame at outside, 11 feet. Keel, white oak, 14 x 8 inches; stem, white oak, 12 x 12 inches; apron, white oak, 12 inches; sternpost, deadwood Georgia pine, 12 inches; floors, white oak, double, 16 inches at keel, 8 inches at deck; sided, 8 inches; spanned, 26 inches, center to center. Every space between floors, from stem to stern, extending up bilge to a level of 2 feet above top of keel, is filled with white pine, making the whole bottom of boat solid.

Main keelsons are of Georgia pine, each 14 x 28 inches; sister and side keelsons are of Georgia pine, each 12 x 28 inches; bilge streaks and ceilings are Georgia pine, one streak 12 x 18 inches; 5 streaks 8 x 12 inches; and 5 streaks 5 x 12 inches, thoroughly edge bolted. Clamps and stringer streaks are yellow pine, 5 streaks of clamps 8 x 12 inches, and five stringer streaks 6 x 12 inches, thoroughly edge-bolted and keyed with oak and locust keys. Beams of Georgia pine, 6 x 10 inches, and spanned same as frames, 26 inches, center to center. Each beam has two hackmatack knees, siding 7 inches, with double knees at wheel, engine, and boiler beams. Each alternate beam has hanging knee outside of hull under guard.

Plankshear of white oak, 5 x 22 inches; main deck of white pine, 3½ x 5 inches, sheathed with spruce 1¼ inches



4. Steering Gear and Freight Deck. 2. Feathering Paddlewheel and Engine Connections. 3. Engine Room.

NEW FREIGHT STEAMER CITY OF FALL RIVER.

thick. Planking is white oak; first garboard streaks 6 inches, second garboards 5 inches, and the remainder 4 inches. All fastenings copper and yellow metal, and locust treenails up to 14 feet water line; above that, galvanized iron and locust treenails. Three water-tight bulkheads, one 20 feet aft of stem, and the others forward of forward boiler and aft of aft boiler. Engine frames and keelsons of Georgia pine. Rudder of white oak, 16 inches diameter of stock. Backing and filling securely bolted with 1⅛ inch yellow metal bolts, and hung with three sets of 4-inch braces and pintals of composition fastened with copper bolts. Sponsons extend from aft wheel beam to sternpost, and from forward wheel beam to where guard extends, only 20 inches outside of main hull.

Sponson timbers of yellow pine and hackmatack; planking, yellow pine, 2⅛ x 4 inches, well fastened, calked, and smoothed. Has two masts and complete set of kingposts and rods. Hull is strapped inside of frame with diagonal iron straps, 4 inches wide and ⅝ inch thick, with belt strap extending all around vessel, 6 inches wide and ¾ inch thick. Hull, throughout, built of the best material for the purpose, thoroughly fastened and without superior afloat.

A novelty in her construction is the absence of the hog-frame. In its place, however, and to obtain the requisite longitudinal vertical rigidity, a Howe truss—bridge frame—has been built in her hold. The upper chord of this truss, which is about 200 feet long, fore and aft, supports the deck beams, and the lower chord is bolted to each frame. Additional longitudinal strength is supplied, too, by a network of iron cross-strapping on the inside of her frame. These diagonal straps are of flat iron, 4 x ⅝, and are connected to an iron belt plate, 6 x ¾, which extends clear fore and aft parallel to and behind the clamp streak. This cross-bracing runs downward to and is fastened in the floor timber heads. The interstices between her frames are filled in with white pine, navy fashion, and the joints calked, thus making her floor solid from stem to stern. Her ceiling is calked also, that her compartments, of which she has four, may be truly water-tight. She has three water-tight bulkheads, the first, or the collision bulkhead, being 20 feet abaft the stem; the next one going aft, just forward of the forward boiler; the next just abaft of the after boiler. Her main deck or freight deck is laid in yellow pine, calked, and sheathed over with 1¾ spruce.

When the boat was built no great speed was expected, but the performances on a few of the recent trips are rather surprising. The boat was intended to make the time from dock to dock between New York and Fall River, a distance of 181 miles, in 12 hours, when carrying a maximum load of 600 tons. On the second trip, loaded with more than 700 tons, dead weight, and carrying only 75 pounds of steam, she came through in 13 hours against a strong ebb tide. The large amount of freight was the result of a number of foggy days in the week previous, during which freight had accumulated at Fall River to an unusual extent. When it is considered that previous to her first trip the engines had never been run more than two hours consecutively, and that since she has started the engine has not had to be stopped on account of the engine itself, we think that the builders have reason to be proud.

Up to the present time the bearings have not been warm on any trip yet made. The engine works very quietly, and keeps its rate of 23 to 26 revolutions a minute without trouble. On the night of February 21 she made the run from dock to dock in 10 hours and 28 minutes, with a load of 400 tons. This is an average of 17¼ miles per hour, with 75 pounds steam pressure. On the first trip, with wheels making 24½ revolutions and having a dip of 5 feet 9 inches, the engine, with 75 pounds of steam, developed 1,775 horse power. The boat was at that time making 15·2 miles per hour between Point Judith and Little Gull Island, the tide ebb. The following are the averages of the boat for sixteen passages: Average time from dock to dock, 11 hours 17 minutes; average consumption of coal per trip, 20$\frac{5}{16}$ tons; fastest time, 10 hours 24 minutes; average steam pressure 75 pounds; average load, 415 tons net.

The tide during the time which these averages cover has been even for and against the boat.

Lighting by Battery.

M. Trouve is stated to have considerably improved the bichromate battery in the matter of permanency by supersaturating the liquid. He takes 150 grammes of bichromate of potash powder to a liter of water, and after shaking adds, drop by drop, 450 grammes of sulphuric acid. The liquid warms and the salt dissolves, while no crystals are formed on cooling, nor are chrome alum crystals deposited in the cell. The elements are arranged with two carbons to each zinc, the latter being so placed that it can be withdrawn from the solution. With twelve elements and the solution above described, it is stated that ten incandescent lamps can be kept at work for five hours, each lamp giving ten candles. There is thus 100 candle power for five hours.

Ravages of the Spruce Tree Worm.

The ravages of some insects on the spruce trees in northern Maine, says the Bangor *Commercial*, is becoming a serious matter to owners of timber lands. A gentleman who is well acquainted with the wooded tracts in the vicinity of Rangely says that if the work of devastation goes on five years more as it has for five years past, it will destroy all the spruce trees in that section. The larva, in which state the insect does the mischief, is a green worm about an inch long.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, MAY 5, 1883.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 388,

For the Week ending May 5, 1883.

Price 10 cents. For sale by all newsdealers.

HOW THE ELEVATED ROADS ARE CARED FOR.

To properly care for such a vast structure as the elevated railroads of this city involves great labor and expense judiciously directed. The road may be considered as a continuous series of iron bridges, in which each span rests on iron columns, both the girders and columns varying in design in the several sections. The foundations, columns, the different parts of the girders, the track, and the buildings must be carefully examined, and the number of lives hourly depending upon the thoroughness of the work demands an immediate repair of any defects discovered. Up to March last there were, on the four roads, 8,751 columns, located as follows:

Main line, in the street	5,585
" on the curb	2,259
" on company's property	32
" in Battery Park	80
Shops and turnouts	58
North end of Eighth Avenue	25
Stations	696
Switch cabins	16
Total	8,751

When it is remembered that, on the average, there is a trifle more than one girder to each column, in addition to transverse girders, and that these girders will average more than 45 feet in length, a crude idea may be obtained of the magnitude of the work to be inspected.

The engineering department has control of all the force, and to it all reports are made. The roadmaster's department is made up of track supervisors, inspectors of girders and rivets, riveters, cleaners, etc. The remaining division is that of building and repairs. Each man has a certain work on a certain division of the road, which he is expected to attend to, and it is the duty of his superiors not only to receive his reports, but to ascertain for themselves if he capably performs his duties. The track is being constantly patroled, and the rails, spikes, fish plates, and frogs inspected. Distinct from this is the inspection of the girders, particular attention being paid to the panel points and pocket bearings and to the rivets. In case of the discovery of loose rivets, or other defects which cannot be instantly repaired, the location of the defect is noted and a report made. The columns are all numbered, and a report would be something like this: name of road, north bound track, between columns — and —, such and such rivets loose. As soon as possible the riveting gang would be sent to this section.

The deflection of a girder caused by the passage of a train is measured by an instrument similar to the level rod used by surveyors. Two rods of wood slide freely by each other, one being furnished with a scale and the other with an index point. One end of this rod rests on the ground, while the other is hooked over the lower chord of the span by means of an iron angle. Any deflection is measured by the scale. A deflection of $\frac{1}{1800}$ is allowed, but if a span be found which deflects more than this, its strength must be reenforced. This is done by inserting flat panel bars between the upper and lower chords, and in some cases by placing strips along either, or both, of the chords; all are securely riveted.

When, either from a depression of the track or from some other cause, it is found that a foundation has settled, a trestle work is immediately placed beside the column and the track lifted two inches by the aid of jacks. In this position it is allowed to remain for twenty-four hours, in order to test the strength of the false work. At the end of that time the foundation is uncovered and a new one laid if necessary.

When repairing, the rivets are prepared and are driven just after the passage of a train, thereby allowing a few minutes for cooling before being subjected to a strain. All new work, no matter of what description, is covered with a coat of paint, and care is taken to keep the structure as clean and free from rust as possible.

When excavations, or blasting, are being carried on in the vicinity of the road, watchmen are stationed near by in order that the trains may be stopped in case of accident to the road. The foundations and superstructure of the high portions of the road are inspected every morning.

WATCH CRYSTALS.

We find the following interesting sketch of the history and manufacture of watch glasses in *Ackermann's Gewerbe Zeitung:*

The first pocket watches in use in Germany were oval in form, and hence called "Nuremberg eggs" (like our "bull's eyes"). Only a few of them had a glass cover over the hands. These covers were flat or slightly convexed pieces of crystal cut out and polished on a primitive kind of grindstone. Of course they were very expensive.

These oval watches were succeeded by flattened spheres, and the glasses had the form of segments of a sphere, or spherical caps, made as follows: Small glass bulbs were blown on very small glass-blowers' pipes, and from each bulb two of these caps were cut with the aid of two red hot iron rings, the sudden expansion causing a circular crack. The edges of these glasses were polished either on a grindstone or with sand on a cast-iron plate.

This process was very tedious and expensive, owing to the necessity of blowing as many bulbs as they wanted crystals, for two could rarely be cut out of one sphere. Moreover, the glasses, owing to their spherical shape, were very high in the middle, while the ends of the hands near the edge of the dial had a very narrow space to move in.

As the thick watches of the last century gave place to thinner ones, and the high convexed glasses became inconvenient and unhandsome, flat glasses were made which were but slightly curved near the edges. They were made from thick, flat plates of glass hollowed out in the center and rounded off around the edges. Owing to their high price, they were only used on fine watches.

The concave watch glasses of the present day are not hollowed out on a grindstone, but made by a method invented in 1791 by a skillful watch-glass maker in Paris named Pierre Royer. The Geneva manufacturers imitated his method, and succeeded in developing it into an important branch of industry.

Before Royer's process had been perfected and come into general use, various interesting experiments were made in the glasshouse in Goetzenbrück, in 1830. Little phials were blown, each with a slightly curved bottom, and this bottom when cut off formed a concave glass; but as it required a new phial for every watch crystal, this made them too expensive too.

One improvement followed another until finally they are made in wonderful perfection and with surprising rapidity, which is due principally to the skill of the glass-blower, so that now very thin glasses of enormous size can be made.

The glass-blower takes up several pounds of glass on the wide end of his pipe in that plastic state in which it can be worked like wax, and rounds it off by rolling it on a damp block of wood and first blowing into it gently. He then blows a little harder and swings it to and fro, which lengthens it out, and with proper tools he gives it a long pear-shape. Having acquired the approximate form required, it is reheated in the furnace, and then blown out to a larger size, a steam blast being employed to finish the blowing. The finished ball, which resembles a balloon, is cut from the pipe and placed on a wooden work-bench upside down.

In some glasshouses they have succeeded in blowing balloons from 12 to 32 inches in diameter with ease. Sometimes they exceed 40 inches, and the walls of such colossal balls do not exceed $\frac{1}{32}$ or at most $\frac{1}{16}$ of an inch in thickness.

These enormous balls can be designated as truly industrial works of art. About 600 watch glasses can be cut from one such sphere, by a method which we will describe below. As these large balls, owing to their great size, are liable to break, and cannot be handled rapidly, it is customary to make smaller ones and cut them into two. First a metallic pattern of a watch glass is made, and either pressed on the sphere or on a strip cut out of it. While this is held in place with one hand, the other draws a little white hot tube around the edge of the pattern. This circle is immediately moistened with cold water, and the sudden contraction that follows the previous expansion causes the piece to crack off, forming a more or less hemispherical crystal.

This process has, however, been superseded by the so-called *tournette*, a tool that resembles a carpenter's compass (dividers), one leg being provided with a diamond. L. Veyret, of Lyons, deserves the credit of perfecting and introducing this instrument.

First, ten circles are cut on the large ball with the point of the diamond of this little instrument. As these little scratches do not go through the glass, the next and most tedious part of the operation is to break loose one of the separate crystals. This is accomplished by little strokes or taps all around the circle. After one has been taken out, the workman can put his thumb through this opening into the sphere; and then taking the next one between the thumb and fore-finger, he presses gently outward, and thus separates the second, after which the rest are taken out in the same way. (See SCIENTIFIC AMERICAN, Feb. 17.)

After they have been cut out, and before they are ground to the proper form, the glass must be subjected to another operation, the object of which is to improve and shape the rim so that it may fit accurately into the crease around the watch case.

The glasses are put into muffles of refractory clay heated with coke. In the muffles are many little moulds of the finest clay, having the exact shape that the crystals ought to have, the surface being nearly flat, with the edge slightly raised. [They look a little like a soup plate on a very small scale.—TRANS.] The workman lays one glass on each mould, after sprinkling over them finely pulverized lime and clay to prevent the glass from sticking to them, and introduces them quickly into the muffle. When the glass gets soft enough they are drawn out, one at a time, and the glass pressed down against the mould with a wad of paper, so that it takes the exact shape of the mould.

With a skilled workman who can watch several muffles, the process is quite a rapid one. But both the mould and the ball leave little marks on the glass which have to be polished off, thus increasing the cost.

Another method of shaping consists in using convex moulds a little smaller than the glasses. When sufficiently heated, they are placed on a cast-iron plate in front of the muffle and pressed down on the moulds with a wooden lid of conical form. The projecting edge of the glass getting heated first is softer, so that it alone is pressed down by the lid. This method is more rapid, and only the edges need polishing. This is done on grindstones of hard material, which produce the beveled, slightly projecting edge that holds it in the case. It is finely polished with cork.

The last method has been still further simplified by grinding the disks as soon as they are cut out with the diamond. The beveled edge is formed on sandstone wheels, and then the glass is put in a muffle without polishing to give it the arched or curved form. The ground edges are rounded by the heat, and rendered smooth and brilliant, and at the same time are harder and firmer, so that they can be set more easily.

[Here follows, in the original, a description of the watch crystal factory of Trois-Fontaines in Lothringen, where 520 gross (74,880) are manufactured daily, each glass passing through thirty-five distinct operations.]

After the watch glasses have acquired the requisite shape by pressing the warm and softened glass on to or into moulds, they are taken to a large room fitted with grinding and polishing lathes. The grinding is of three kinds, called *Flettage*, *Pontillage*, and *Biseautage*. The first consists in grinding away the convexed portion so that the outside is nearly all flat, and the glass is thin in the middle, but near the rim retains its original thickness. The second is similar to the first, but only the center is ground, forming a small circular spot that is slightly concave.

Biseautage is grinding the edge to a proper bevel, so that it will fit into the crease of the case accurately, which is absolutely necessary for holding it securely. This operation is performed on lathes driven by steam, and one man can tend eight or ten of them, as it is only necessary to put them on and take them off.

After a final polishing with pumice, measuring, sorting, and inspecting, they are ready for packing and shipping.

PAINTED DIAMONDS.

BY H. C. HOVEY.

The latest fraud in precious stones furnishes a curious confirmation of the law of chromatic contrasts, and an unexpected illustration of Shakespeare's saying:

"To gild refined gold, to paint the lily."

About six months ago the owner of a magnificent gem, which he had supposed to be a Brazilian diamond of the first water, suddenly found it reduced to about one-fifth its value by being accidentally washed with soap-suds. This simple process revealed its true character as a yellow African diamond of inferior grade. This trick, which was originally played in Paris, has since been reproduced in this country, and it is rumored that a single firm on Chatham Street was thus swindled out of many thousands of dollars without being able to detect the perpetrator of the fraud.

A case of the sort is now in the New Haven courts, being tried by Judge Deming, some of the particulars of which may be of interest, and serve to put persons on their guard against what is really an ingenious deception.

Jacob Nepel, a manufacturing jeweler in that city, had several diamonds, apparently of great value, which he disposed of by an agent to Mr. Edward Engel, a diamond broker of seventeen years' experience. The gems were faultless, but the low price set on them awoke suspicion that they were either stolen or spurious. Several local dealers examined them, using a microscope for the purpose, and pronounced them fine old mine diamonds and worth five or six times their price. Mr. Engel then took them to New York and exhibited them to Messrs. Heller & Bardell, importers and dealers in precious stones, who were also deceived by the appearance of the gems, until the owner mentioned his suspicions. Mr. Heller, remembering to have heard of a new process of painting diamonds, took one of the studs, estimated to be worth from $1,000 to $1,500, washed it in soap-suds, and found it to be a cheap African diamond worth perhaps $140. The rest of the set proved to have been tampered with in a similar manner. On returning to New Haven, Mr. Engel sought redress through the courts, and probably will get it.

The explanation is as follows: The common African diamonds are naturally a honey-yellow. On dipping one of them for a few minutes in an aqueous solution of aniline violet, and then letting it dry, it will be found that, while the luster remains unimpaired, the color is changed from yellow to the fine steel-blue usually observable only in the best stones. The two colors, yellow and violet, it will be noticed, are complementaries, and on blending produce the brilliant result described. The aniline is easily removed by the application of soap-suds, the water being tinged, not violet, but green, while the diamond regains its original yellow hue.

INFUSORIA AND RHIZOPODA.

JOHN R. COBYELL.

Darwin's revelations in regard to the earth-worm, besides showing the prodigious and useful work performed by that seemingly insignificant creature, were also added proof that some of the most unsuspected agencies are occupied in a labor of absolute necessity to the well-being or even preservation of the globe. Not that it is claimed for the earth-worm that its work is preservative, though that may be too; but it is certainly the fact that the stupendous labor performed by a creature almost universally thought of only in connection with the angler or the early bird is typical of the silent forces continually at work preserving or making habitable our world.

Not the whales, the elephants, the hippopotami, not the giants of creation, that do the effective work of the universe, but the atoms. But a trifling knowledge of geology is necessary to understand the importance of the limestone strata, and these are in large part the product of the tiny rhizopods, those almost microscopic shell-fish which in former ages swarmed in countless multitudes in the ocean depths, and, yielding up their own lives, combined in the ocean's bed to form a hard, thick crust, which should play a large part in the preservation of the world.

Another important factor was the infusoria, classed by Dana among animated creatures, but now known to belong to the vegetable world. Most of these microscopic vegetables were soft, but some had hard, scaly coverings which massing together formed a hard substance which played a fair part in the building of the world, and afterward as flint helped generations of man to make that immense stride in civilization from raw to cooked food. The softer infusoria did somewhat toward building, but did more perhaps in writing the book of nature, which scientific men have now learned to read. They found the skeletons of animals and filled in about them, keeping them, so that after the grand upheaval and displacement which sent the oceans to other beds, man might come and find this illustrated book and read it.

And this very same work the rhizopods and the infusoria are doing to day. Millions and thousands of millions are destroyed hourly by the whales, who almost subsist on them, and still millions and millions of times as many more are dropping, dropping through fathoms of ocean, seeking the bed to again build a wall against disintegration. They made the limestone and the chalk and now when the rivers carry the tiny particles of these formations out to sea to scatter and make them useless, these tiny creatures quietly gather them again and live only to die for the good of the world.

It is not a little curious to note the uses to which man has put his little benefactors. In Egypt they built pyramids with them; in Paris they build those monotonous rows of houses with them; everybody makes lime of them; the savages, when they did not turn them into deadly weapons, made fire by them; sometimes we call them silicon, and polish our silver with them; sometimes we say nothing, and add weight to paper and cotton goods with them; and in California they have put them to a new use, and wash their hands with them.

As soap they are not perhaps an unqualified success, but they do well to make the body of a soap made from fat. Still there is some reason in calling them, as is done, rock soap. During a recent upheaval, perhaps two hundred thousand years ago, a stratum of infusorial earth was broken, and now shows itself on edge along various parts of the California coast.

Somebody, who had probably first sat down upon it, both suddenly and unwillingly, for it is very slippery when wet, discovered that it would make a very fair lather in sea-water. Being an old Californian, he knew how to put one and one together. He tasted the substance, and found it was somewhat alkaline in flavor; he knew there was plenty of petroleum in the neighborhood, and it occurred to him at once that the oil and the alkali had been combined in nature's laboratory. Here was a natural soap!

It was not so, but never mind; in California it is enough to think a thing true to substantially make it so; and therefore it is that in California one may wash his hands with infusoria.

What is the Use of Snakes?

C. C. Hopey, in his very interesting work on "Snakes," writes of their usefulness as follows:

"Persons who dislike snakes continually ask, 'What is the use of them?' That they are not without a use will, I hope, appear in the course of this work, were it necessary to preach that all things have their use. But in one habit that offended Lord Bacon, namely, of 'going on their belly,' lies one of their greatest uses, because that, together with their internal formation and external covering, enables them to penetrate where no larger carnivorous animal could venture, into dark and noisome morasses, bog jungles, swamps, amid the tangled vegetation of the tropics, where swarms of the lesser reptiles, on which so many of them feed, would otherwise outbalance the harmony of nature, die, and produce pestilence.

"Wondrously and exquisitely constructed for their habitat, they are able to exist where the higher animals could not; and while they help to clear those inaccessible places of the lesser vermin, they themselves supply food for a number of the smaller mammalia, which, with many carnivorous birds, devour vast numbers of young snakes. The hedgehog, weasel, ichneumon, rat, peccary, badger, hog, goat, and an immense number of birds keep snakes within due limits, while the latter perform their part among the grain-devouring and herbivorous lesser creatures. Thus beautifully is the balance of nature maintained."

THE increase of the import duty from ten per cent to thirty per cent on works of art under the new tariff has elicited some humorous as well as serious comments from the press. Prof. Proctor in his "Knowledge" sarcastically suggests it is owing to the fact that American painters and sculptors are thirty per cent worse than those of Europe, that the duty is imposed.

Lubrication and Lubricators.

At one of the recent meetings of the members of the Association of Employes, Foremen, and Draughtsmen, at Manchester, England, Mr. J. Veitch Wilson read a paper on the lubrication of ordinary bearings, and of bearings and faces subject to the action of steam and heat. We make the following extracts from the *Colliery Guardian:*

Mr. Wilson having expressed his regret that the subject had not received the attention it deserved, dealt in an exhaustive manner with the question of lubrication under two aspects—as affecting (1) ordinary bearings under normal atmospheric conditions, and (2) bearings and faces subject to the action of steam and heat. With regard to oils for ordinary bearings, he laid down that their essential properties were that they must not give off inflammable vapor under 350° Fahrenheit; that they must not act upon the metals with which they came in contact, nor oxidize, which tended to spontaneous combustion and clogged the machinery; they must have body adapted for the work to be done; their boiling point must be sufficiently high to prevent evaporation and secure durability, and their freezing point must be low enough to insure regularity of feed from the oil cups and convenience in handling.

As the result of numerous experiments, he has become convinced that mineral oils were, if used alone, unsatisfactory lubricants, but bearing in mind the natural and almost ineradicable tendency of mineral oils to develop acid, and of vegetable oils by the absorption of oxygen to gum and clog the bearings and to induce spontaneous combustion, bearing also in mind the fact that mineral oils could now be obtained in every respect as safe as the finest animal oils, and that the admixture of mineral oil with animal or vegetable oil neutralized the acidity in the one case and the acidity and oxidizing tendency in the other, he was of opinion that the safest, most efficient, and most economical lubricants for all manner of bearings were to be produced from a judicious mixture of animal or vegetable with good mineral oils.

With regard to cylinder lubrication, the peculiar conditions were the liberation of natural acids from vegetable and animal fats and oils by the action of steam and heat, the action of these acids on cylinders, and the evidence that as these acids were constituents of all animal and vegetable fats and oils, they could not be removed by any process of refining. One of the lubricants largely in use was tallow, but there was conclusive evidence that it was the cause of considerable injury to the engine cylinders. From the mass of evidence he had been able to collect upon the subject he was convinced that, if care was exercised in the selection of the oil, and equal care in its preparation and application, hydrocarbon oil would be found thoroughly efficient as a cylinder lubricant, absolutely harmless, and much more economical than tallow.

The bulk of the cylinder oils now before the public were of American origin: they were usually sold pure, but sometimes a small percentage of animal or vegetable matter was added in order to increase their lubricating properties, and in his experience this had always been attended with most favorable results. The thickest oil that could be introduced to a cylinder was the best. Hot air engines might be lubricated on precisely the same principle as steam cylinders, but gas engines presented a new and special feature, as in their case the lubricant was not only subjected temporarily to the intense heat of the explosion, but also came in direct contact with the flame and was liable to be decomposed or carbonized thereby.

If, therefore, animal or vegetable fats and oils were objectionable in steam cylinders, they were much more so in the cylinders of gas engines, and in the case of gas engines he should most emphatically protest against the use of any but pure hydrocarbon oils without any admixture. Mr. Wilson gave tabulated results of numerous experiments he had made in support of his conclusions.

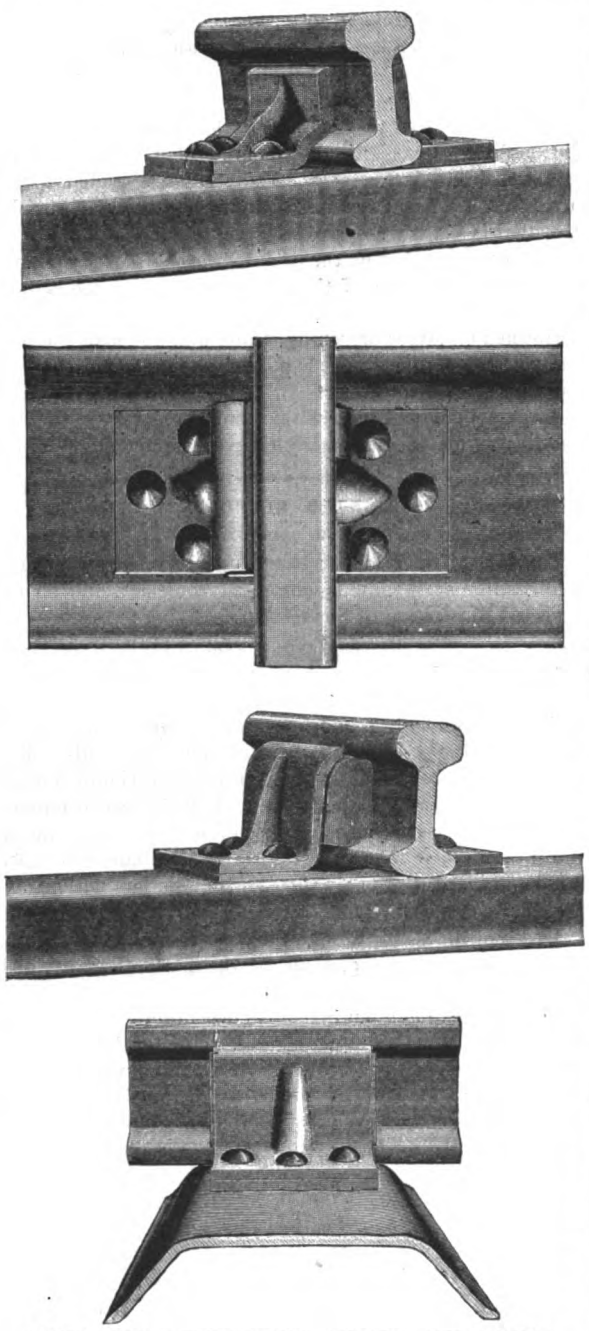
Hardening Concrete.

In a paper recently read before the Southend Mechanics' Institute, Mr. Henry Faija described his patented method of quickening the induration of concrete blocks. The concrete is made and rammed into the moulds in the usual manner, after which the moulds are placed in a chamber, which is maintained at a moist heat of about 100° Fahr. This greatly increases the crystallization or setting of the cement, and allows the objects to be moved from the moulds in the course of a few hours. The concrete is then placed in a bath of about 110° Fahr., composed of one part of silicate of soda and twelve parts of water. The solution penetrates to the center of the block, which is thus hardened throughout, instead of merely on the surface, as in the usual process. In three or four days the blocks will have attained the strength of ordinary cement three or four months old.

EACH nominal horse power of boilers requires one cubic foot of water per hour.

STEEL PERMANENT WAY ON THE LONDON AND NORTHWESTERN RAILWAY.

The amount of timber used yearly in the construction of railroads in the United States is so enormous as to render it certain that at no very distant day a substitute will be required. It is stated on good authority that fifteen millions of ties are yearly consumed in this country, and that 200,000 acres of forest are sacrificed to this purpose every year.

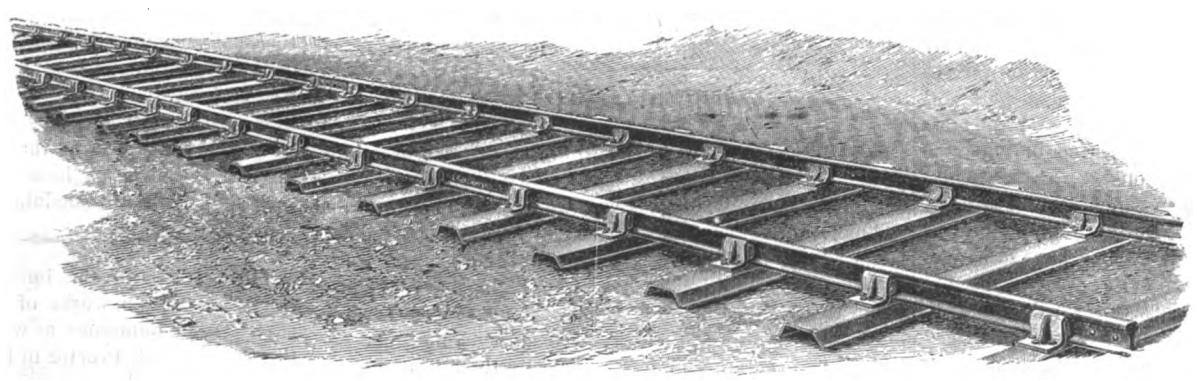


STEEL PERMANENT WAY, LONDON AND NORTHWESTERN RAILWAY.

Greater difficulty is experienced in the South than in the North in preserving ties, as the moist soils of the South are very destructive to wood. Various kinds of timber have been tried and several preservatives have been employed, which, however, have proved expensive. Ailantus and catalpa have been found the most durable of woods, and one road at least has established a plantation for raising these trees from the seed.

It is generally conceded that, notwithstanding durable woods and various preservatives, iron or steel will form the crosstie of the future. The principal requirements are that the tie be somewhat elastic, cheaply made, and readily laid.

The engravings, which we take from the *Railroad Gazette*, represent a system of permanent way designed by Mr. F. W. Webb, the Locomotive Engineer of the London and Northwestern Railway, and which has been thoroughly tested on that road, and seems to have the requisite qualities. The construction is shown so clearly by the engravings that no description is needed. The rails are of the "bull-head" form, so generally used on English roads, laid in chairs, and secured by wedges as shown. The rails are canted at an angle of 1 in 20, to conform to the cone of the wheels.



STEEL PERMANENT WAY LONDON AND NORTHWESTERN RAILWAY.

We learn from Mr. Webb, to whom we are indebted for the photographs from which the engravings were made, that ten miles of this permanent way are now being put down, and that its cost in England exceeds very little the price of creosoted wooden sleepers with the heavy cast iron chairs and screwed fastenings.

A Fortune Saved.

Twenty years ago, says one of our exchanges, a large manufacturing concern in New England, running several mills, and using about fifty steam boilers, began to burn anthracite screenings under their boilers in their mills When they first commenced, the fuel was purchased very low, as it was then a waste and a drug. With the improvements made in combustion, its use has become more general and the price has advanced, so that the difference is now only about two dollars a ton. Now, allowing that this difference is all that has been saved from the start, and estimating a daily consumption of one ton of fuel per boiler, doing a duty of three hundred days a year, we find an economy of between five and six hundred thousand dollars over what it would have been if lump coal had been used. This firm are now changing their boilers to use this fuel by utilizing the waste gases with hot air on top of the fire. As there is estimated to be millions of pounds of screenings wasted at the mines every year, it is astonishing none of the large cotton mills adopt this fuel. There are several mills in Lowell, Lawrence, and Manchester that burn from twelve to twenty-eight thousand tons of lump anthracite coal every year, while actual experience has demonstrated that the screenings, when properly fired, will make as much steam per ton as the best grades.

The Visibility of Ruled Lines.

At a recent meeting of the Boston Scientific Society, Professor W. A. Rogers read a paper on fine ruling, a considerable portion of which has already been given in this journal. A few interesting points, however, deserve the attention of microscopists. Professor Rogers stated that he had ruled bands of lines in which the lines were so fine and delicate that they could not be seen with a microscope, although their spacing was much within the power of the microscope to resolve. Yet he was assured of the existence of the lines. The evidence in support of this assertion was of three kinds: The pressure of the diamond upon the glass was sufficient to produce a cut; the diamond produced a peculiar singing sound while moving over the surface, which is always indicative that it is working well; and, finally, the lines become visible when filled with fine graphite.

There is a limit beyond which lines cannot be satisfactorily filled with graphite. It is difficult to fill lines finer than about $\frac{1}{80000}$ or $\frac{1}{90000}$ of an inch.

A most surprising result of some of the experiments of Professor Rogers is that the unaided eye can discern not only single lines that cannot be seen with a microscope, but that it can detect errors which the microscope will not show. Thus, he has a bar upon which lines are distinctly visible to the unaided eye, and, although an objective of low power will show them, one of high power will not. But even error or imperfections in ruling which cannot be seen or measured with the microscope may reveal themselves to the eye by a peculiar waviness of the image. He attributes the failure of the objective to show the lines, as mentioned above, to the inability to illuminate the lines with light of the exact angle of incidence required, and the proper angle of illumination he thinks deserves more careful attention.

Distillation in a Vacuum.

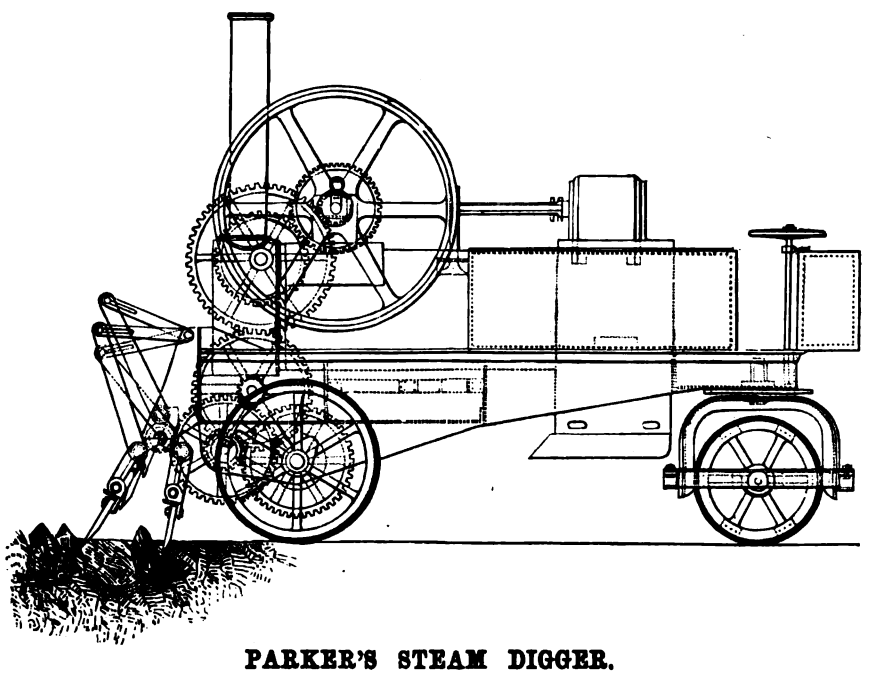
H. Schüller has observed the behavior of thirteen inorganic and twelve organic bodies when heated in a vacuum, their sublimations and distillations, and the nature of the residues. Many of the elements examined, especially selenium, tellurium, cadmium, zinc, magnesium, arsenic, and antimony, were capable of sublimation, while the very fusible metals, bismuth, lead, and tin, distilled with difficulty, the last mentioned scarcely at a red heat. On the other hand, Demarcay found bismuth volatile at 292°, lead and tin at 360°, which Schüller explains by the presence of volatile impurities. During the whole time of the distillation of a metal an escape of gas was observed. But on repeated evaporation this phenomenon was imperceptible, or very slight. Sodium, selenium, tellurium, cadmium, zinc, arsenic, and antimony evaporate so readily in a vacuum that this method may be used for their purification. Among organic bodies many unstable mixtures, such as tallow, wax, and resin, distill so easily in a vacuum that they may thus be separated from impurities.—*Annalen der Physik.*

BASIC slags, incidental products of the Bessemer process, are to be introduced as agents for purifying the sewage of cities by Mr. Neujeuen, of Liege.

IMPROVED STEAM DIGGER.

The engraving shows Parker's patent steam digger, in which the digging is performed by a revolving crank shaft carrying an arm, terminating at its lower extremity in a fork, while the portion of the arm above the crank, corresponding to the handle of a spade, is held and guided by the free end of a link attached to it by a pin, the other end of which is fixed to the framework of the machine. This link, or lever, acts like a man's arm in guiding the spade or fork, while the crank in its descent takes the place of the foot in forcing it into the ground. The digger must move forward during the revolution of the crank shaft through a space equal to the width of the spit proposed to be dug; the speed of the traveling wheels being regulated to suit. This machine is much lighter and less complicated than the majority of digging machines.

Two or three of these machines have been put to work recently which, we are informed, only weighed 6½ tons each, including the light traction engine of 6 to 8 horse power nominal. The working cost of steam digging is less than steam plowing, and the first cost of the digging machinery is, of course, much lower than any steam plowing set. It is suggested that this digger can be used for all the purposes for which ordinary traction engines are now used, such as hauling, etc., by simply taking off the digging apparatus. This is a great point in its favor.—*Mechanical World.*



PARKER'S STEAM DIGGER.

The Microphone.

Mr. Stroh, during a discussion at the last meeting of the Society of Telegraph Engineers, described a highly ingenious experiment with the microphone, from which he deduced that "during the time when the carbons are really in what is called microphonic contact, they are not in contact at all, or, at all events, that there is a repellent action at the point of contact." In the experimental apparatus one small rod of carbon was attached at one end to an almost frictionless oscillating rod, having on its opposite side an extremely light concave reflector. The other end of this carbon rod fell across another carbon rod, which was fixed. The displacement of a spot of light reflected by the mirror showed that the upper carbon was repelled through $\frac{1}{1000}$ part of a millimeter.

Length of a Nautical Mile.

In common parlance, the length of a nautical mile is considered as a "minute of latitude," without any consideration of the range of value included within this definition. A paper upon this subject by Prof. J. E. Hilgard, Superintendent of the Coast and Geodetic Survey, has just been published. It gives the values of one minute under nine different definitions. The values are based upon the elements of the Clarke spheroid. One minute of latitude at the poles = 1,861·653 meters = 6,107·85 feet; one minute of latitude at the equator = 1,842·787 meters = 6,045·95 feet; one minute on the equator (considering it as a circle) = 1,855·345 meters = 6,087·15 feet.

As adopted by the Coast and Geodetic Survey and by the Hydrographic Office, a nautical mile is *one-sixtieth part of the length of a degree on the great circle of a sphere whose surface is equal to the surface of the earth.* Using the Clarke spheroid, this definition gives a nautical mile = 1,853·248 meters = 6,080·27 feet. This value closely corresponds with the English admiralty knot of 6,080 feet.—*Rep. U. S. Coast Survey*, 1881, *app.* 12.—*Science.*

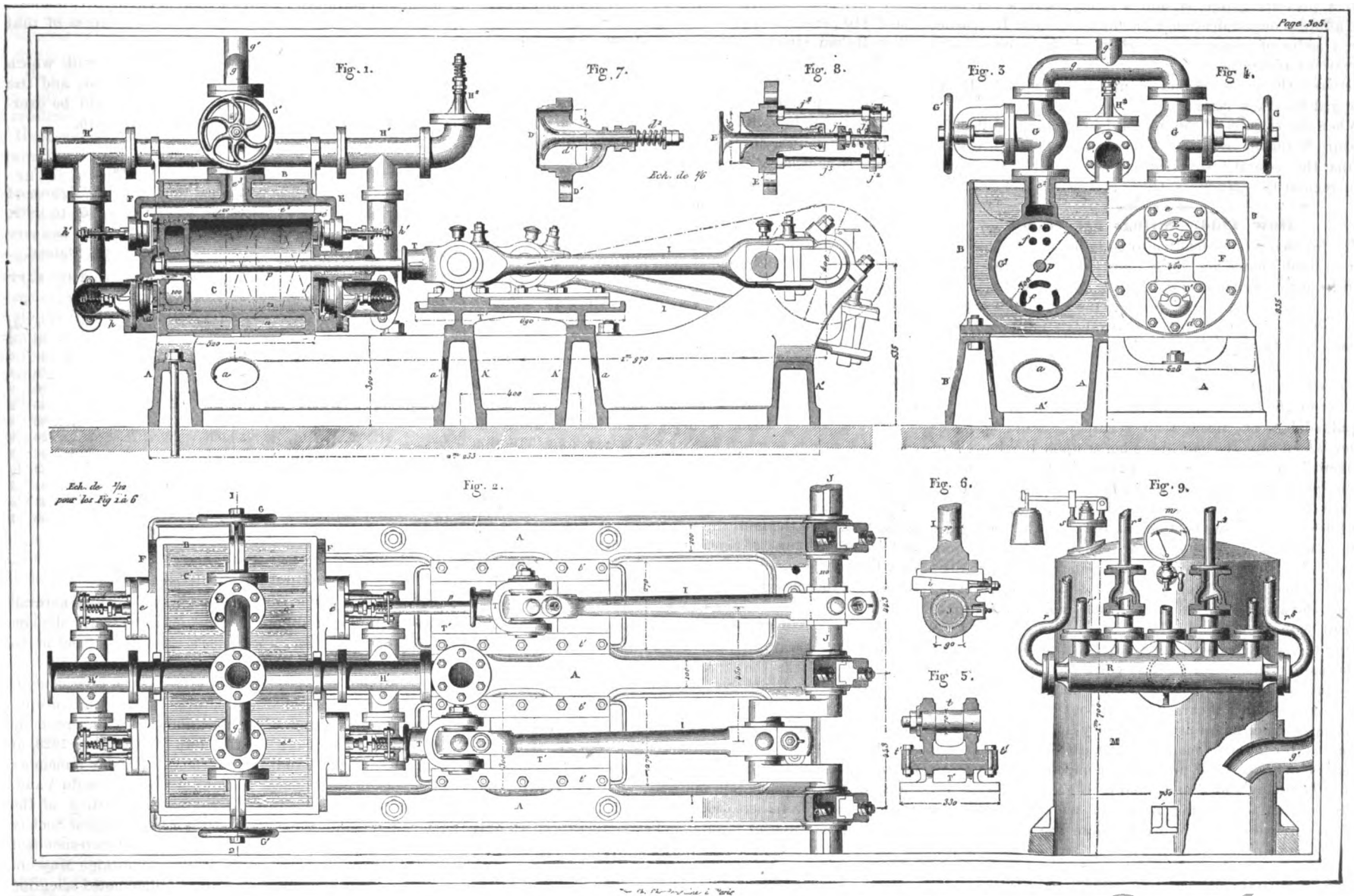
SAUTTER, LEMONNIER & CO.'S DOUBLE CYLINDER AIR COMPRESSOR.

The applications of compressed air, which formerly were not very numerous, have been extended to proportions that can only increase with the accomplishment of certain public works that have been projected or are in course of execution in various countries. Everybody knows at present of the use of compressed air in the laying of the foundations of bridges and in other submarine works, and in the ventilation of long tunnels in the course of execution. Metallurgy makes constant use of it for hastening the reactions that occur in blast furnaces, and the exploitation of mines of great depths could not take place without calling in its aid for furnishing air to the galleries. For a few years past Mr. Mekarski has succeeded in rendering it practical as a motive power on tramways; and finally, at Paris, New York, Vienna, and Berlin, it is employed in a system of sending dispatches based on the simultaneous use of pressure and a vacuum in tubes laid under ground or in sewers. We represent in the accompanying plate a type of air compressing machine invented by Messrs. Sautter, Lemonnier & Co., of Paris, and which has received an application in various public works and in numerous industries. Fig. 1 represents a longitudinal section through the axis of one of the two cylinders. Fig. 2 gives a general view of the apparatus in horizontal projection. Fig. 3 is a transverse half section on the line 1—2 of the plan. Fig. 4 shows an extended half view of the end. Fig. 5 gives a transverse section of the slides and piston head. The head of one of the connecting rods, slightly modified, is seen in Fig. 6, and the details of the suction and delivery valves are shown in Figs. 7 and 8.

The two cylinders, C C′, of the compressor are cast in a piece with a water reservoir, B, and are bolted firmly to a frame, A. The latter, as may be seen from Figs. 1 and 2, consists of three longitudinal pieces connected by four transverse ones, A′. In these uprights there are openings, *a*, to permit of the mounting of the cylinders and slides. The bottoms, F F′, bolted on the two cylinders, are each cast in a piece with one of the plane sides of the reservoir, B, and contain apertures, *f′*, that establish a communication between the cylinder and the valve boxes of the suction valve, *d*, and delivery valve, *e*. The air sucked in, instead of being taken from the outside, comes from a reservoir to which the compressed air goes that has been utilized. This reservoir communicates with the suction valve boxes, *d*, through the pipe, H, and the coupling pipes, H′, *h*, and *h′*.

To the extremity of the pipe, H′, there is bolted a blow valve, H². The two delivery valve boxes, *e*, of the same cylinder communicate with each other through the pipe, *e²*, which is cast on the cylinder, as is the pipe, *e²*. Upon this latter there is bolted a clock box, G, which communicates, through the coupling, *g*, and the pipe, *g′*, with a reservoir that distributes the compressed air to the different apparatus in which it is utilized.

The boxes, G, offer nothing peculiar. The valves which they contain are opened or closed by means of screws terminating in the hand wheels, G′. In each of the cylinders, C,



IMPROVED DOUBLE CYLINDER AIR COMPRESSOR.

there works a piston, P, cast in a single piece, and in the circumference of which there are five grooves. The two extreme grooves are 9·6 mm. in width, receive two rubber rings, and communicate by small conduits with the faces of the piston. The compressed air enters through these conduits, and acts upon the internal circumference of the rings so as to fit them exactly against the internal surface of the cylinder, thus preventing all direct passage of the air from one side of the piston to the other. These rings are formed of two bands of rubber of different quality, united with each other without any break by a method kept secret by the inventor, Mr. Giffard. The external band is of hard rubber, which resists friction well, while the inner one is of more elastic rubber, that better distributes the pressure exerted upon it by the compressed air. The diameter of the piston is 300 mm., and its travel 400 mm. The piston is coupled with the rod, *p*, by means of a conical bearing and a strong bolt, which, when the piston reaches the end of its travel, enters a hollow in the head of the cylinder.

To the other extremity of the piston rod there is keyed the forked head, T, which is traversed by the steel pin on which the end of the connecting rod works. The head, T, is cast in a piece with a well planed slide which runs on a cast iron guide, T', bolted to the frame, A. The connecting rods, I, present no peculiarity. They are very carefully constructed, the heads are well rounded, and the wear of the bronze bearings is capable of being taken up by tightening the two keys, *i* (Fig. 6). These rods, I, are actuated by the crank shaft, J, on whose two extremities are mounted pulleys not shown in the engravings.

DETAILS OF THE VALVES.

Fig. 7 shows a vertical section of the suction valve, and Fig. 8 a horizontal section of the delivery valve. The bronze supports of the suction valves consist of a short cylinder carrying a tube, *d'*, which guides the valve, and provided with a triangular flange, D', which is fixed by three bolts upon the corresponding valve box, whose external form is rectangular. The valve rod is pulled back by a spiral spring, d^3, which bears against the threaded extremity of the tube, *d*. The valve thus tends to be kept constantly open. The flange, E', of the delivery valve support is elongated and fixed by two bolts on the corresponding valve box. This valve having to be closed when there is no delivery, its rod carries a nut, *j'*, against which acts a spiral spring, *j*, whose fixed bearing point consists of a small crosspiece, j^2, which connects the two rods, j^3.

RESERVOIR FOR THE DELIVERY OF AIR.

We have already said that the air forced by the compressor was sent into a special reservoir, that afterward distributed it to the various apparatus for which it was needed. This part is the invention of Mr. Lambert, who devised it especially for use in the sugar refining industry. It is shown in Fig. 9. The apparatus consists of a large boiler plate cylinder, M, 1·7 meters high by 750 millimeters in diameter, in which terminates a pipe, *p*, which leads the air forced toward it by the compressor. The reservoir is provided with a pressure gauge, *m*, and a safety valve, *s*. A large pipe affords communication with the receptacle, R, whence start a series of pipes, r, r^1, r^2, r^3, r^4, r^5, that connect with the various apparatus.

Between the pipes, r^2 and r^3, and the receptacle, R, are arranged the clack boxes.

When the velocity of the motor is regulated so that the pressure in the air reservoir is nearly constant, it is easy to see that the apparatus supplied will be enabled to work with great regularity.—*Machines, Outils et Appareils.*

How Fiddle Strings are Made.

The following facts relative to an industry of which the general public have but little knowledge have been compiled from the *Manufacturers' Gazette* and New York *Sun*.

The name "catgut," as applied to the animal fiber strings used on musical instruments, is altogether a misnomer. The cat is in no wise reponsible for the string, and, much as the fact is to be deplored, the manufacturers of such strings refuse to utilize cats for the supply of their material. That disposes of the last excuse for the existence of the cat.

Aminadab Sleek, amended to accuracy, should speak of "they who scrape the hair of the horse upon the bowels of the lamb"—not the "bowels of the cat." Catgut is of no use to anybody but the cat; hence no consideration of damage to valuable raw material need hereafter stay the hand that hurls the avenging bootjack at the nocturnal serenader on the back fence. Violin, guitar, and banjo strings, and, in fact, all sorts that come under the general head of "gut," are made from the entrails of lambs and cattle, from the delicate threads used for sewing racket ball covers up to the half inch thick round belts.

After the lamb is seven months old its entrails are no longer fit for making strings for violins; consequently this branch of the manufacture can only be carried on a few months in each year. Whether it can or not is about to become a matter of indifference as far as the industry in this country is concerned, for the only man who now carries it on says that he cannot, without tariff protection, compete with the cheap labor of Germany and France, and he is going to give it up. Mr. Blumenthal, a leading importer, who has sought to build up this industry here, went before the roving Tariff Commission to plead for a duty on gut strings for musical instruments, but did not succeed in having it recommended. Some fourteen years ago there was a duty of thirty-five per cent, but for a dozen years there has not been any.

In that time a number of Germans have come over and tried to start the manufacture. They could get their raw material cheaper here than in Europe, but the work admits of no mechanical aid, must be done wholly by skilled hand labor, and the men they could have hired for $3 per week in Germany or France they here had to pay $15 or $16 a week. That broke them. The importation of this class of strings into the United States amounts to more than $500,000 per annum. During the past year the home manufacture amounted only to $15,000, and in the year before to $12,000.

"Few people," said a New York manufacturer to a *Sun* reporter, "have any idea of the many uses to which gut strings are now put. They are used to hold up clock weights, for belting, for the lacing on lawn tennis and racket bats, for lacrosse scoops, for weaving fine whip covers, for sewing covers on balls, for jewelers' drills, and for a thousand things, I suppose, that even I do not know of. One down town manufacturer uses from $7,000 to $8,000 per annum just for making lawn tennis, racket, and battledoor bats. 'Anglers' leaders, or snells?' No, not at all, although most people have an idea that those are made of gut. That material would never do for such a purpose. It would get soft in the water in a few minutes, and the fish would eat it off. In fact, I don't know but what it would be good bait. Most so-called 'gut' leaders are made from silk, and the best from a marine plant.

"All the work of making gut strings is about the same, but greater care has to be exercised in preparing those intended for musical instruments than others. The process of manufacturing those is comparatively simple, but far from easy. When the entrails, for which a good price has to be paid, are thoroughly cleaned, they are split with a razor. Only one-half is fit for use in violin strings. That is the upper or smooth half. The lower half is fatty, rough, and of unequal thickness. The strips are put through rollers turned by hand for eight or nine days, to take all the stretch out of them. Then they are spun or twisted.

"Five or six strands go to make an E-string, eight or nine an A-string, and twenty are put into a D-string. Then they go through a bleaching bath of sulphur fumes. After that they are twisted again. Then they are softened in pearlash water, again subjected to the action of the sulphur fumes, twisted again, dried, and finally rubbed down smooth with pumice stone. Altogether, it takes ten or eleven days to make a string. When done they are each seventy-two inches long—four lengths for a violin—and thirty of them coiled separately and tied together make up the 'bundle' of the trade.

"We can make just as good violin strings here as the best that come from Saxony or any other part of Germany, and very much better than any that are made in France, but we cannot compete with the best Italian strings in point of quality. Except in the latter, not more than one in three will be absolutely correct and equal in tone throughout; but there is one maker in Italy who, by some secret process of his own, secures and guarantees perfect accuracy throughout for every string he makes. He does not make more than sixty or a hundred bundles a year, but his strings command $10 per bundle here—cost that to the importer—while other Italian strings are worth only $3 or $4, and others only $1.50. The Italian makers have one great advantage—that the raw material is thin, fine, free from fat, and evenly smooth all around, so that they can use the whole instead of having to split it, as we must. That gives to their completed strings a durability and evenness that we cannot attain. No gut harp strings are made in this country.

"A good many E-strings now used on violins in this country are made of steel wire. That is the finest string and most liable to break. The wire is, of course, the most durable by far, but it lacks the tone of a gut string. Perhaps the strongest recommendation in favor of wire strings is that they can be furnished for about fifteen cents a dozen. The frequency with which gut strings are softened by perspiration on the fingers and broken during play in the summer time has caused the very general adoption of silk strings for use during the months of July and August. They have not so good a tone as the gut, but are better for use in that season.

"Heavy belting string is made from beef entrails, and some of it brings as much as fifty cents per foot. In that we are not required to be so particular about getting a fine light color as we are when making musical instrument strings. Musicians cannot be made to understand that the dark strings are the most durable and best, but such is the fact. Perhaps most of them may know it, but, all the same, they have the common American preference for the prettiest thing, whether it is really the best or not."

Aid of Machinery to Labor.

Labor is a natural burden upon humanity; yet it is the key which unlocks the storehouse of wealth, convenience, and luxury. By the use of invented and applied machinery muscular work is greatly relieved, and results cheaply and extensively obtained. In all this, however, intelligent skill is not supplanted; but rather there is a wider field created for the same, and more and more does it come in demand as the facilities for production multiply. Man, of course, may exist as our forefathers did, living in a rude and limited way on the necessaries of life, and even these secured only at the expense of oppressive toil; but as improvements are made, and varied and enlarged benefits flow therefrom, he rises in the scale of being, and the sphere of life is extended. The easy supply of want in any direction only begets efforts in others; and as matters thus progress, instead of the demand for useful industry being diminished, there is more and more inducement to laborers to employ themselves with the exercise of every faculty.

It is a mistaken view, therefore, to imagine that there is the least tendency in the use of machinery to supersede the necessity of workmen, and take from them all opportunity to labor. Their skillful hands, discerning eyes, and intelligent brains are surely destined to find an ever widening field. Of course, the worker must not remain stationary, content to live and die an antiquated fossil, while all the world about him is changing and progressing. What he once did painfully and slowly with the hands alone he must now more abundantly accomplish through the agency of labor-saving devices and tools. Society has need of more production, and will only be satisfied with even more and more. With its prosperity and progress the laborer shares; and today he has more of the comforts and luxuries of life than were enjoyed by kings a hundred years ago. The prejudice against improvement, and the jealousy against capital and associations in their efforts to manage and direct production into more efficient and beneficial channels should disappear. As changes occur, old ruts should be promptly abandoned. By adapting himself to circumstances as they are thrust upon him, there is not a man who cannot succeed and find a market for his labor far beyond his ability to supply.—*Dubuque Trade Journal.*

Instrument for Removing Foreign Bodies from the Ear.

Dr. Louis B. Couch, of Nyack, N. Y., sends to the *Medical Record* the description of a little instrument which any jeweler can make, and which, he says, is very useful and efficient in removing foreign bodies from the ear. The description is as follows:

I have been interested in the late discussion going on in your journal with reference to the best methods for the removal of foreign bodies, such as corn, beans, etc., from the auditory canal or nares, and herewith transmit my mite to the general fund of information.

Take a piece of eight-sided brass wire, or round wire with roughened surface, and drill into either end a small hole a quarter of an inch deep. Into one end bronze or solder a small twist drill one thirty-second of an inch in diameter, and into the other a nice sharply cut screw (such screws may be obtained of any jeweler) of about one twenty-fifth of an inch in diameter. When this is done, you are ready for your smart boy with more beans in his head than brains.

Suppose the bean is at the bottom of the auditory canal, enlarged and surrounded by inflamed swollen tissues, a small portion only being visible.

Introduce the speculum, and carefully with light pressure drill into the presenting portion of the corn or bean to the depth of about one-quarter of an inch, and clear off all dust; then reverse the instrument and insert the screw, and the bean must come.

I have by actual test inserted my sample instrument into a bean, and sustained with it a weight of twenty-five pounds, as shown by scales; a holding power far in excess of that required for the removal of any such bodies.

Physicians will be surprised at the rapidity with which the drill will perforate the hardest of dry beans, and the slight pressure required. Care, however, should be exercised in first entering the drill, that it does not slip.

Wheat for Twenty-five Years.

The London *Times* has published the following figures of the imperial averages of prices of wheat from 1858 to 1882, which are worth preservation, because in a great measure they have governed prices of wheat in the United States:

YEARLY AVERAGE PRICE OF WHEAT DURING THE LAST TWENTY-FIVE YEARS.

Year.	s.	d.	Year.	s.	d.
1858	44	2	1871	56	8
1859	43	9	1872	57	0
1860	53	3	1873	58	8
1861	55	4	1874	55	9
1862	55	5	1875	45	2
1863	44	9	1876	46	2
1864	40	3	1877	56	9
1865	41	10	1878	46	5
1866	49	11	1879	43	10
1867	64	5	1880	44	4
1868	63	9	1881	45	4
1869	48	2	1882	45	1
1870	46	11			

Francisco Sumichrast.

Adrian Luis Jean Francisco Sumichrast, an able naturalist and collector, well known to the scientific world, died on the 26th of September, 1882, after a short illness, and in the 54th year of his age, at Tonala (Chiapas), Mexico.

Prof. Sumichrast, although for thirty years a resident of Mexico, to the study of whose natural history and antiquities he devoted much of his attention, was a European by birth, having been born on the 15th of October, 1828, at Ivorne (Canton du Vaud), Switzerland. He was a member of the Societe des Sciences Naturelles du Canton du Vaud, of La Sociedad Mexicana de Geografia y Estadistica, of the Societe Zoologique de France, of the Entomological Society of Philadelphia, etc., and a valued and active correspondent of the Smithsonian Institution, of the Cambridge Museum of Comparative Zoology, and of several other noted scientific institutions.

Correspondence.

Preservation of Yeast by Freezing.

To the Editor of the Scientific American:

Noticing an article in your issue of April 14 on Dr. Lintner's experiments with frozen yeast, I would say that for several years I have caused the winter's supply of yeast for my family to be prepared at the commencement of the cold season, put into a jar, and frozen solidly. When required, the yeast would be thawed, as large a quantity taken out as could be used with good results, and the remainder quickly frozen again. This process of thawing and freezing is continued until all is consumed, save a sufficient quantity as a nucleus for a fresh supply.

It has always been found to retain its vitality, and the bread made from it as light and wholesome as from fresh yeast.

I can lay no claims to being a scientist, though a weekly reader of your paper; but, interested in everything pertaining to and for the advancement of science, wish to give another practical confirmation of the theory, "that yeast may be preserved, and yet retain its full vitality, by being frozen." SARAH G. MILLARD.

Flint, Mich., April, 1883.

Wall Papers and Decorations.

This is the time of year usual for house cleaning, painting, papering, and for making such other alterations about the house as to render the house more attractive and convenient. In the matter of wall papers the *Building and Engineering Times*, London, contains some hints which will likely prove useful to a large number of our readers.

First, the writer says the sizes of rooms should be considered, for papers with large patterns and wide dadoes are not generally adapted for small rooms, and *vice versa*, insignificant designs do not suit spacious rooms. In the first instance, a cramped effect is obtained where there should be freedom and expanse, and in the second a feeling of vacuity is produced, and the intention of the design is lost, owing to the vast extent of wall exposed to view. A good deal also depends on the design. Mr. Edis in his recent lecture said:

"No strongly marked patterns should be accepted—such as birds seemingly in flight, or cherubs, holding festoons, frozen into rest, or bunches of flowers fossilized into unnatural forms, so as to present longways and crossways, or any way they are looked at, clearly marked lines or spots on the general surface, at all times fatiguing to the eye, and tending to discomfort and mental annoyance." In the main, broad, free designs suit nearly all classes of rooms, and plant life offers most opportunities for producing pleasing and elegant figures embodying these qualifications, which possess the advantages of a simplicity and purity of form that never wearies or grows tame and conventional. Moreover, with careful treatment, and an observance of natural conformation, floral designs may be rendered far more consonant to nature and adapted to harmonize more thoroughly with surroundings than birds or figure subjects.

Squares or circles at regular distances, or conglomeration of mathematical or architectural figures, are to be avoided, for they invest a room with a solidity and formality that can only be wearisome, and the sameness of pattern, which is rendered doubly apparent by the methodical arrangement of lines, angles, and circles, tends to tire both the eye and brain.

And as to color, drawing rooms are usually furnished with lighter tinted paper than morning rooms. It is not advisable, however, to select a monochromatic paper, for although when first put up it may present a very clean and light appearance, yet the absence of variety, more especially in dull weather, invests it, after a time, with a cold and commonplace appearance. A paper should be selected, therefore, that appears to contain to the most advantage pleasing diversity of color without gorgeousness, and easy and natural outlines without formality. Papers with considerable gold in them are suitable for drawing rooms, because gold is in itself warm and at the same time light. Cheap gold papers unfortunately soon lose their gloss and look dull, but generally speaking, gold, if used sparingly and discreetly, forms a rich addition, and combines agreeably with ordinary tints.

The dado is an indispensable addition to a modern room, and should be of a slightly darker color than the wall paper; this arrangement serves to show the paper to greater advantage than if the whole were of the same tint. The top of the dado is usually finished off with a narrow strip of printed paper, and though this is apparently of minor importance, it will if properly treated form a pleasing bond or connecting link between the dado and paper. The frieze is also an important item, and this Mr. Edis suggests should be "treated in good decorative subjects of figures, birds, or natural flowers," but papers modeled on the latter are, as we have already pointed out, the simplest if not the best suited for ordinary decorative purposes where agreeable effects are sought without any great expenditure of money or artistic skill. A frieze may also be formed of thick flock paper, stamped leather, or raised plaster work slightly tinted or gilded. This destroys the deadness of the wall and conceals the junction of the paper with the ceiling.

As regards the dining rooms, and other rooms of a similar nature, it is advisable that the paper selected be of a dark, warm hue, not necessarily elaborate but simple and appropriate. Here the dado may be finished at top with a small oak or deal moulding in lieu of the narrow paper band before mentioned; this prevents the walls being broken by chairs or other furniture pushed against them.

In choosing colors it should be remembered that gaslight completely changes the effects of some tints, such as blue, green, and yellow, and the two former also, in a measure, absorb light, and thus, unless employed with discretion, render a room somewhat darker than other colors.

The so-called æsthetic, and what Mr. Edis designates "washed out colors," are no doubt at home in a snug little Queen Anne Bedford Park house, but rarely suit the surroundings of ordinary life. Respecting bedroom papers, much might be written in condemnation of the hideous and artificial productions that pass by this name, and it is really surprising, considering how essential to health and comfort a light and cheerful sleeping apartment is, bedroom wall papers have not suffered greater improvements in accordance with the requirements of the age. It is fervently to be hoped that the day is not far distant when manufacturers will turn their attention to this question, and banish the spotty, dauby, ridiculous representations of impossible flowers that now adorn (?) our walls, and give us instead papers that will metaphorically, and in the words of Byron, "fill the air around with beauty."

The papering of halls, staircases, and passages are points that require very careful deliberation if we wish to render them something more than what Mr. Edis aptly terms "long vaults walled in with blocks of imitation marble." As a rule we *do* find this varnished marble paper selected for these places, and the plea for its adoption usually hinges on the supposition that it renders passages "light," and possesses the pleasing property of being "so clean." Now it does not require much deep thought to arrive at the fact that there are fifty papers at least in existence that will bear varnishing, prove equally "light," and yet be more appropriate to everyday life and everyday surroundings.

The entrance hall should present a comfortable appearance, and a dark, rich paper with Indian matting dado is very suitable for covering the walls. Light colored papers are not adapted for this purpose, as they show the smallest particle of dirt or the faintest trace of a fingermark with alarming distinctness. And *apropos* of this point, it may not be out of place to suggest that hanging a few etchings, drawings, or paintings on the walls of landings, stairways, and halls will prove a simple and effective way of introducing a little "portable" decoration in places where the eye usually finds merely "an infinite deal of nothingness."

Respecting wall coverings for kitchens and similar apartments, plain, washed walls are undoubtedly cleaner than *any* papers, but if the latter are to be employed, a plain, white tile paper is perhaps most in keeping with the fittings and furniture. If varnished, such papers may be easily washed, and thus rendered always clean and fresh.

Manufacture of Salt at Turk's Island.

BY N. K. SAWYER, UNITED STATES CONSUL.

This island, Grand Turk, and the Caicos are particularly well adapted by nature for this business. This island is about five miles long and two broad. The southeast side is fringed with a high bank, having the appearance of having been formed by the ceaseless action of the waves in the indefinite past. This wall affords protection from a sudden inundation by a tidal wave from that quarter, the point from which come the prevailing winds.

Running through the island the longest way is a sag or valley, in which are located the salinas and salt ponds. The northwest side is skirted with a beach, but not so high as that on the northeast side. The land on which are located the ponds is on a level with the sea. A canal, neatly walled with stone, conducts the water from the sea to a reservoir, which feeds the "pans" when needed, or when the elements have converted the sea water into brine strong enough to be used in the pans.

There are two kinds of saline resources for the conversion of salt water into salt. One kind may be called a "saline" proper, and the other a "salt pond." The latter has a never-failing supply of water, being fed by springs of salt water.

A saline proper is a flat, and it may contain a few acres or a great many, and is supplied with water from the ocean by the canal already named, which can be opened or closed at will. The first water let in from the ocean goes into a large reservoir, which holds about half as much as the entire area of the salina. The water remains in this receptacle some weeks, evaporation continually going on by the action of the wind and the sun. When it reaches 60° or more, as measured by a salometer—salt water being between 10° and 12°—it is fit to be turned into the division called pans, which is done either by hand water-wheels or wind-mills. At 60° all foreign matter held in solution is precipitated.

The "pans" vary in size, but generally are from one-eighth to three-fourths of an acre in area; are laid out so as to allow watercourses between each for the purpose of obtaining a supply of "brine" from the main reservoir. The divisions are separated by walls made with stone and mud. These are about 2 feet high, with a width from 3 to 4 feet. These "pans" are generally "raked down," and the *debris* thrown out once a year. This is called "cleaning pans."

The brine seldom crystallizes into pure salt unless there has been a month's absence of rain. It becomes a saturated solution at 96° and commences to crystallize at 110°, as measured by the salometer. To be gathered, the salt has to be broken up by hand by an instrument called a "break-up." It is then raked into rows to be carted into piles or heaps, some of which contain as many as 10,000 bushels. The pans yield from 5,000 to 8,000 bushels per acre during the season. The canal has to be opened sometimes at low water to prevent an overflow of the pans from the reservoir after a rain.

A salt pond is distinguished from a salina by having a basin or a spring of salt water in the center, and has its pans on a little higher ground. The basin is also a reservoir whose water is evaporated and becomes brine sooner or later, according to the state of the weather. The methods of manufacture are about the same in the two classes. Care must be taken to have the water as pure as possible.

The crop gathered each year does not vary much from about 2,000,000 bushels, with perhaps a quarter of the crop left over; so the annual sales amount to about 1,500,000 bushels, one-half made on this island, and the balance equally divided between Salt Caye and Cockburn Harbor.

About two-thirds of this go to the United States in coarse salt, and in American bottoms, and the balance to various ports in Nova Scotia in fine salt, or "fish salt," to supply the fishermen. Of late years the salt merchants here have put up mills for grinding the coarse salt made here to a fineness suitable to cure fish with. This fact has enlarged their trade with Nova Scotia.

It is very evident that the business as now conducted leaves no margin for profit for the manufacturer. For, first, the manufacturer has to pay the local government a royalty of 10 per cent *ad valorem*, the price being fixed annually by the local government.

Secondly, the season may be unpropitious, thereby increasing the cost of manufacture.

Thirdly, the waste while waiting a sale and shipment, and the cost of cartage to be shipped, and the cost of putting the same on board the vessel that takes it to market, which latter charge amounts to 1¼ cents per bushel and comes out of the seller.

The average price per bushel is 6 cents for coarse and 8 cents for fish salt; if anything, a little off of these prices.

I may add, *en passant*, that the business men complain of the high tax that the American Government has placed on salt, almost or quite one hundred per cent. And since the trade relations of this colony are so close, this high duty on foreign salt does seem excessive, and a real impediment to a more general trade.

The population of Grand Turk Island is put down at about 2,000, one-fourth white, and that of the whole colony at 4,732, and about the same proportion as to color.

Electric Light Battery.

M. Trouve has recently modified the bichromate battery to render it fitter for electric lighting purposes. This cell gives off no fumes, is a single fluid cell of high power, and therefore especially valuable for electric lighting; but it has the great drawback of being inconstant in its action. M. Trouve has obviated this drawback by supersaturating the liquid. He takes 150 grammes of bichromate of potash powder and puts it into a liter of water; then, after shaking it, he adds drop by drop 450 grammes of sulphuric acid. The liquid warms up a little, and the salt dissolves. The liquid thus prepared keeps clear, and does not form crystals in cooling. Moreover, it does not form chrome alum crystals when the cell is in action.

The supersaturation of the exciting liquid is, in M. Trouve's view, the cause of the remarkable constancy, which is perhaps explained by the absence of chrome crystals on the carbons. Each element consists of a zinc plate and two carbons coppered by electroplating at their upper part. This coppering consolidates the carbons and diminishes their resistance at the upper part. The zinc is arranged so as to be easily taken from the cell to be amalgamated. The batteries are arranged in sets of six elements placed in cases of oak wood. The carbons and zincs can be raised or lowered at will by a device like that employed in the Wollaston battery. In this way the power of the cell is regulated. With twelve elements ten incandescence lamps can be kept lit for five hours; but M. Trouve has kept twenty lamps lit for two hours, each giving a light of ten candles. The electromotive force of the cell is two volts with fresh solution, and the intensity of current at the beginning on a short circuit is 118 amperes. The resistance is 0·07 ohm. Four batteries working a Gramme machine have produced fourteen kilogrammeters of work during two hours without weakening in power.

A Useful Kind of Solder.

A soft alloy which attaches itself so firmly to the surface of metals, glass, and porcelain that it can be employed to solder articles that will not bear a very high temperature can be made as follows:

Copper dust obtained by precipitation from a solution of the sulphate by means of zinc is put in a cast iron or porcelain lined mortar and mixed with strong sulphuric acid, specific gravity 1·85. From 20 to 30 or 36 parts of the copper are taken, according to the hardness desired. To the cake formed of acid and copper there is added, under constant stirring, 70 parts of mercury. When well mixed the amalgam is carefully rinsed with warm water to remove all the acid, and then set aside to cool. In ten or twelve hours it is hard enough to scratch tin. If it is to be used now, it must be heated so hot that when worked over and brayed in an iron mortar it becomes as soft as wax. In this ductile form it can be spread out on any surface, to which it adheres with great tenacity when it gets cold and hard.—*Polyt. Notizblatt.*

NEW GRINDING MACHINE.

The accompanying engraving shows a small universal grinding machine, designed and invented by C. C. Hill, C.E. Its primary use is to enable users of machine tools to secure absolute uniformity of angle and truth in lathe centers, and to true up chucks of all kinds and sizes. It is also adapted to the accurate grinding of cylindrical or conical surfaces (internal or external), reamers, gauges, milling cutters, taps, etc.

The construction of the machine is fairly shown by the cut, and the operation will be readily understood from the following brief description. For use, the machine is set upon a lathe in place of the tool post, and securely fastened by tightening the bolt, B.

To insure accurate alignment of the center of graduated arc, A, with the lathe centers, a central piece is placed between the base plate of the machine and the face plate of the lathe at the time of tightening the bolt, B.

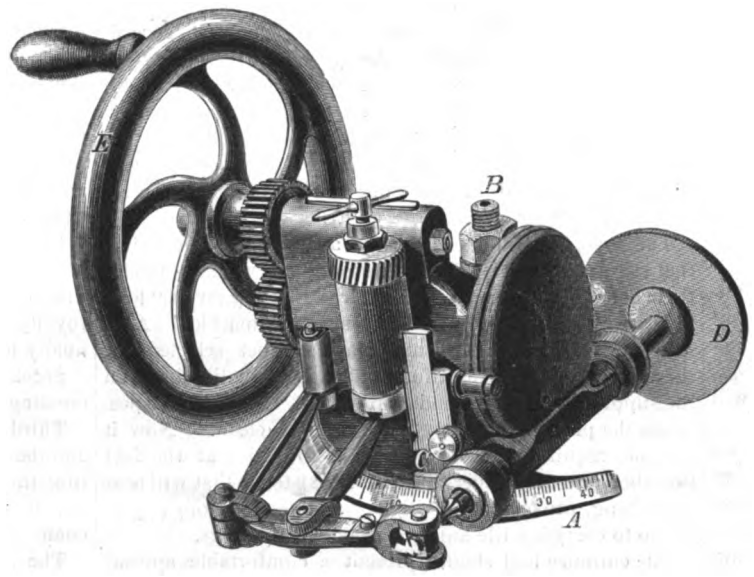
When the base plate has been properly adjusted and secured, the grinder may be rotated upon its center of arc until its reading (at C) indicates the desired angle, then firmly fixed to the base plate by means of a clamping screw, not seen.

By turning the crank the emery wheel, D, acquires a high rotative speed (5,000 to 6,000 per minute, with moderate crank motion) and a slow traversing motion across the work. This traversing movement may, in a moment, be changed from 0 to 2 inches, or intermediate distances.

The machine is built to rank with the best tool work, and is guaranteed accurate. The main shaft is made of tool steel hardened and ground, and the bearings are furnished with compression bushings of same material, also hardened and ground. All parts liable to injury from dust or grit are protected by casings.

The machine may be run by hand or power. The former is preferable in short jobs, as we may often finish a set of centers or a mill in less time than would be consumed in setting *any* machine run by power, if it be a portable one.

For sale by dealers in tools and machinery, and by the Union Bag Machine Company, 84, 86, and 88 Franklin St., Chicago, Ill., sole manufacturers.



HILL'S UNIVERSAL GRINDING MACHINE.

Dynamite.

The base of this extremely powerful explosive is nitroglycerine, sometimes known as nitroleum, which is an amber-like fluid, discovered by Sobrero, in 1847. Nitroglycerine itself is made by adding glycerine, in a manner not necessary here to particularize, to a compound formed of one part of nitric acid and two parts of sulphuric acid. This terrible agent is known as *glonoin* oil, and is a light yellow, oily liquid, of specific gravity ranging from 1·525 to 1·6. It has a pungent taste, and but one drop placed on the tongue induces intense pain of the spine. Sobrero, when he discovered this fluid, was a student at the famous Pelouze Laboratory, Paris. He did nothing to develop his discovery; but Alfred Nobel, a Swede, being in want of a new blasting agent, experimented with the new liquid, known to be highly explosive, and, by adding other ingredients, obtained the now well known dynamite. This, as usually manufactured, is composed of infusorial earth, porcelain earth, coal dust, silicious ashes, etc., and all this base has to be saturated in a certain proportion with the nitro-glycerine. The process of manufacture is dangerous, and the cost about four times that of gunpowder, while its power is, perhaps, ten times greater. Besides dynamite, other explosive compounds have been made from nitro-glycerine, such as *dualline*, a combination of wood gunpowder soaked with this terrible oil, while *lithofracteur* consists of fifty-two parts of nitro-glycerine, thirty of silex, twelve of coal dust, and two of sulphur. Then there are varieties known respectively as colonia powder, lignose, sebastine, heracline, and fulminatine.

Sixty Hours in the Water.

A remarkable instance of sustained muscular effort is given in the *Medical Press* as having occurred in an Australian mine. The drift from one shaft having unexpectedly broken into another, a rapid inundation took place, so that in a few minutes the lower levels were flooded and the water stood thirty feet in the shaft. Twenty-seven men in one part of the workings were unable to ascend the shaft, being caught in a drift where the water soon rose so high that only by clinging to the timbers could they keep their chins above it. One by one during the terrible sixty hours that elapsed before help came did the men drop off exhausted; but five of them succeeded in holding on during the whole of that time, and were brought out alive. The bodies of the other twenty-two were found scattered about on the floor of the drift. Great indeed are the strength and tenacity inspired by desperation, when they could enable five men to hang on by their hands with their bodies immersed in water for sixty hours.

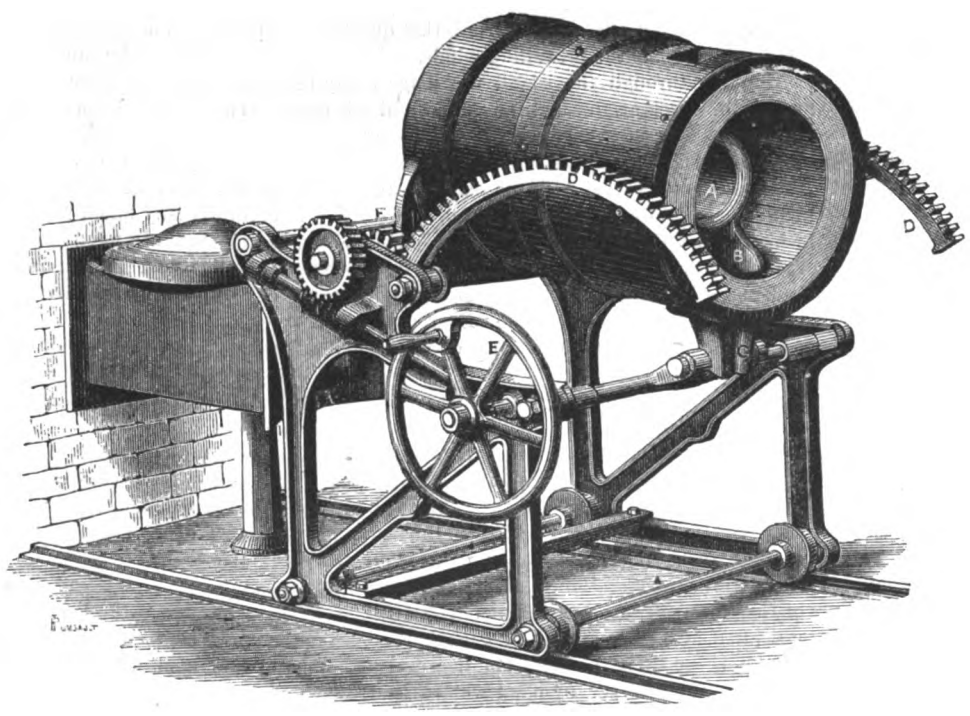
Old Tin Cans Utilized.

That heretofore useless article, old tin cans, has become a factor in trunk making. Newark, N. J., is famous for its trunk making industry, and recently some of the manufacturers discovered that old tin cans may be advantageously used, and they are now gathered and sold to trunk makers to bind the edges and bottoms of trunks, and sometimes to cover up defects of woodwork. The process of heating the cans also has its profitable results, for the solder, running into a receptacle, is sold for 12 cents a pound, it alone paying, it is claimed, all that is originally paid for the cans.

PIAT'S CRUCIBLE FURNACE.

The parts are shown in the positions in which they stand when the last portion of the metal is being run from the crucible. This rests upon a fire clay block, and is wedged in its place between the spout piece, B, and a block that is not visible in the view. The furnace itself is formed of wrought iron plates lined with fire bricks, and is arranged to rotate about a point at the back of the spout, G. The tilting is effected by two segmental racks, D D, one at each side of the furnace, gearing into pinions on a cross shaft operated by a worm and worm wheel through the hand wheel, E.

In commencing operations the furnace stands vertically, with the flue mouth, G, opposite to the opening in the fixed flue, F. Coke is packed in between the crucible and the furnace sides, the metal placed in the pot, A, and the whole covered with the lid shown on the fixed flue. When the charge is melted the cover is slid off, and the furnace run forward on the rails to the moulds. It is then gradually tilted until the molten metal runs from the crucible, A, down the spout piece, B, and escapes at C. Should a long interval occur between the filling of one mould and the next the metal is kept quite fluid, and there is no danger of making bad castings on account of the delay. In these furnaces meltings up to 1,000 pounds weight may be made continuously with rapidity, ease, and safety. The average of a large number of tests shows that with a medium sized furnace 71 pounds of metal may be run down with 12¼ pounds of coke in twenty-five minutes, when the draught is urged by a fan. When it is produced by a chimney it is usually somewhat longer. The Morgan Crucible Company of the Battersea Works, S. W., are the sole agents for the sale of the Piat furnaces.—*Engineering.*



PIAT'S CRUCIBLE FURNACE.

Education for Workers.

One of the best evidences of the changes that are going on in the methods of educating young people as mechanics and artisans is afforded by the work now carried on by the City and Guilds of London Institute, which has been formed for the advancement of technical education. The Council is composed of representatives of the Corporation of London and of the various guilds of the City, which a century or more ago were the chief supporters of the old apprenticeship system. The guilds represented in the Council of the Institute are the Mercers', the Grocers', the Drapers', the Fishmongers', the Goldsmiths', the Skinners', the Salters', the Ironmongers', the Vinters', the Clothworkers', the Dyers', the Leathersellers', the Pewterers', the Bakers', the Armorers' and Braziers', the Carpenters', the Cordwainers', the Coopers', the Plasterers', the Needlemakers', the Plumbers', the Tallow Chandlers', the Wheelwrights', and the Cutlers' Companies. These have all united, not to teach their separate trades in schools, but to give young people technical education that will fit them to take up any industrial occupation. Instruction is also given to advanced pupils in particular trades, and evening lessons are provided for apprentices and learners who get practice in the shops by daily work, but need scientific education that they cannot obtain from their fellow workmen.

The most important work of the Institute is carried on in the Technical College, Finsbury, which, although a new institution, is established on a most liberal basis and has already outgrown the accommodations originally provided for the students. The departments of the College are those of Mechanical Engineering and Practical Mechanics, of Electrical Engineering and Applied Physics, of Chemistry, and of Applied Art, the latter embracing for the present technical design, painting, and cabinet making, to which are to be added various other trades. There are day classes and evening classes, organized like those of the Spring Garden Institute, the day classes being for young people of leisure, the night classes for students who are already at work. In all departments of the Technical College instruction is given by lectures, class lessons, and laboratory, studio, or workshop *practice*. The course of day instruction extends over two years, nine months of each year and about thirty-five hours per week. The evening course extends over three years. In addition to the studies already mentioned, special classes are formed in many of the principal trades.

Another important work of the Institute is the encouragement of technical education outside of its own schools by the offer of prizes to those who pass examinations in various subjects related to the trades and industries of the country. Thirty-three such trades are represented in the subjects for examination this year, and the prizes amount to from one to five pounds each in money, besides bronze and silver medals. There is no limit of age and no fee for examination. Such a system cannot fail to stimulate young men to study, for a prize won in competition becomes at once a passport to remunerative employment.

In Nottingham, Manchester, Leicester, Sheffield, Middlesbrough, Belfast, and Bradford there are great technical schools in addition to the industrial art schools established in every business center by or through the influence of the South Kensington Museum. And this activity in industrial education, this full recognition of the fact that the days of the apprentice have passed away, means to this country that it must take similar measures for educating skilled mechanics and artisans, or rest content when beaten by England in the markets of the world and even here at home. There is scarcely a trade to-day that does not hold intimate relations with the physical sciences, that does not employ the principles of art in some of its stages. It is not necessary that all the workmen in it should be scientists and artists, but the more they know of the subjects bearing upon their trades the better fitted they will be to work intelligently and skillfully. England is giving her young men such education, through the enterprise of her manufacturers and merchants, to enable them to compete with Continental workmen, for whom similar schools have been established by the Government. The United States is doing scarcely anything in this direction, either by Government aid or by private subscription. Boston, St. Louis, Philadelphia, though each has a school of the kind, have not together expended as much money on these enterprises as the little city of Bradford, England, of scarcely more than one hundred and fifty thousand inhabitants.—*Philadelphia Ledger.*

DR. BIGELOW, of Boston, has won the highest of the Argenteuil prizes ($1,200) for a medical treatise sent to the Paris Academy of Medicine.

FLESH EATING INSECTS.

The family of horse beetles (*Silphidæ* or *Silphales*) feed upon the flesh of dead animals. They differ so widely in the structure of their bodies that it can only be said in general that the eleven jointed feelers gradually become thicker toward the point or have a knob at the end, and the wings reach almost to the point of the body.

They are very lively in their movements, and their sense of smell seems to be very acute, for guided by this they will fly from a great distance and make their appearance in a body about the carcass of a bird, fish, dog, or other animal. They often eat decayed vegetable matter if they cannot find a dead body, or seize upon living insects, not sparing their own species.

There are forty-one species of the common burying beetle (*Necrophorus vespillo*), the most of them living in Europe and North America. When these beetles perceive the body of some dead animal, they fly toward it with a humming noise like a hornet, and begin to inspect the body to be buried and the ground about it, which is not always adapted for a burial place. If the ground is not suitable, they have been observed tugging and pulling the body along until they had moved it to a place which would answer their purpose. If they find everything in order, they move away at a suitable distance from each other, so as not to interfere with each other's movements, and burrow underneath the body, scratching away the earth so as to form a hollow, into which the body sinks.

In a very short time, owing to the rapidity with which they work, the body entirely disappears, and only a little ridge of earth indicates the place where it lay, and this is soon leveled. In loose soil they sometimes bury the carcass thirty centimeters deep. Gleditsch says that four of these beetles buried in fifty days two moles, four frogs, three birds, two grasshoppers, the entrails of a fish, and two pieces of liver.

As an experiment a mole was suspended above the ground by cords, as seen in the engraving; these burying beetles used their utmost endeavors to cut it down and cause it to fall when they were convinced that they could not proceed to bury it in their ordinary manner. Their object in burying these carcasses is to gain a proper body wherein to deposit their eggs, as the larvæ when hatched feed entirely upon decaying animal substances.

After the carcass has been buried, the female disappears in the ground, where she generally remains invisible five or six days. The larvæ creep out of the eggs in about fourteen days, and soon attain their full growth, when it burrows deeper in the ground, and at the chrysalis state becomes first white, afterward yellow, then darker and darker as it develops into the beetle.

The engraving shows a number of the best known forms of horse beetles.—*From Brehm's Animal Life.*

FLESH EATING INSECTS.

Water Gas from Coal Gas Retorts.

It has been suggested by a German patentee to render ordinary gas retorts available for producing alternately illuminating and non-illuminating or water gas by the following method:

When the carbonization of the usual charge of coal is completed, and nothing but coke remains in the retort, a jet of steam is introduced, and a mixture of carbonic oxide and hydrogen gas is thereby obtained. This action is continued until about 80 per cent of the coke has disappeared, when the retort is again charged with coal without drawing the remainder of the coke, and the production of illuminating gas is resumed. Thus in retorts fitted for the double or alternative process there is no intermission of work, as either lighting or heating gas is continually being evolved.

If the retorts are worked above a dull red heat, which is most convenient for the production of carbonic oxide and hydrogen, a proportion of carbonic acid gas is also formed, which will necessitate the water gas generated in one retort being passed over the coke in another, in order that the carbonic acid may be reduced to carbonic oxide. Water gas being inodorous, it is proposed, with a view to the detection of leakage and the prevention of explosions, to charge it with the vapor of isocyanure of phenyl. With this object the gas is to be washed in a scrubber with a solution of 10 grammes of this odoriferous compound to 1,000 cubic meters of gas.

THE French Admiralty are now having thirty-one vessels constructed in the Government dockyards and fifteen in private yards. Fourteen of them are ironclads, and are estimated to cost $25,000,000. The two principal ships, the Admiral Baudin and the Formidable, are to cost $2,200,000 each.

Ammonia from Blast Furnaces.

It has been stated that at the Gartsherrie Iron Works the waste gases from two of the blast furnaces, each of which consumes fifty tons of coal per day, are treated for the recovery of ammonia, and that about a ton of sulphate is obtained daily from this source. At other Scotch iron works the furnace gases are simply scrubbed with sulphuric acid, the product being very dark sulphate, except when especial care has been exercised to keep it clean. A firm of iron-masters in the neighborhood of Glasgow have improved upon this process, and have secured a patent for a method of fixing the ammonia immediately by means of sulphurous or other acid in the vaporous or gaseous form, which unites directly with the gaseous ammonia and forms a compound easily arrested and washed down with water, yielding liquor of about 60° Twaddel. The resulting product is a mixture of hyposulphite, sulphite, and sulphate of ammonia. This mixture is not considered objectionable for some purposes for which it is not necessary that the ammonia should be combined solely in the form of sulphate. Thus, in the Bronner and Mond ammonia-soda process, the less sulphate present the better; for when distilled with lime to free the ammonia, the residue in the stills would consist of a solution of soluble hyposulphite and sulphite of calcium, instead of nearly insoluble sulphate. The amount of sulphate of ammonia annually consumed in this country for the ammonia-soda process alone, according to Mr. Robert R. Tatlock, is now nearly 3,000 tons, and the quantity is certain to increase, the present value being about £56,000 a year. If all the blast furnaces now working in Scotland were to economize their ammonia, the product would, at the present rate of working, amount to more than 25,000 tons per annum.

The Volatilization of Solids.

In a communication to the Manchester Literary and Philosophical Society, Mr. Henry Wilde deals briefly with the behavior of solids at high temperatures, in relation to the property possessed by these solids of giving off vapor of their own substance. In connection with incandescent electric lamps this phenomenon is made susceptible of easy study. Platinum threads were at first used for these lamps; but it was soon found that an atmosphere of platinum vapor was formed in the interior of the bulb, which, after the lamp had been in action a considerable number of hours, condensed on the surface of the glass, and formed a bright reflecting surface like a mirror. The substitution of a filament of carbon for the platinum in lamps of this order overcame the objection to a great extent; for the vaporization and condensation of the incandescent material, however interesting from a philosophical standpoint, was fraught with much practical inconvenience. Still, when a high degree of incandescence is imparted to the carbon in the modern lamp, an atmosphere of its vapor is formed in the interior of the bulb, which condenses on the glass, forming a dark lustrous surface, and thereby obstructing the light in the same manner as when a filament of platinum was employed. Thus the behavior of the carbon and platinum in such cases clearly shows that the most dense and refractory substances in nature vaporize at high temperatures while still retaining their solid form. Electric lamps were shown by Mr. Wilde, exhibiting the condensed platinum and carbon on the interior surfaces of the glass bulbs.

Uniform Railway Time.

A uniform system of standard time was proposed by Mr. W. F. Allen, the Secretary of the General Railroad Time Convention, in a report recently made at the St. Louis meeting, which met with such general approval that it was recommended for adoption by a unanimous vote. With the unanimous approval of those present at the time of the convention, the proposal acquires such a standing, says the *Railroad Gazette*, that no one is likely to ignore it, and the examination of it now will be made as of a practical matter, likely to result in positive action. Mr. Allen proposes to establish a railroad time for every fifteen degrees of longitude, beginning with the 75th east of Greenwich. In this way the different railroad times will be just one hour apart, and in few places will the local time vary more than thirty minutes from the railroad time, which is not so great a variation that it will not be possible to use the railroad time instead of local time. The time of the 75th meridian is but four minutes slower than New York time, and is one minute faster than Philadelphia time.

Without varying more than thirty minutes from local time, all the local railroads to the eastern boundary of Maine could be run by this time, and all as far west as Detroit, Columbus, O., and Bristol, Tenn. It is not proposed that the time should change precisely at the halfway point betweeen the 75th and the 90th meridians, but in all cases at the nearest railroad or division terminus.

Thus Buffalo might be made the point—would be the point—between "eastern time" and "central" or "Mississippi Valley time," for the roads terminating there, though it is some distance to the east of the central district, as this would make it possible to have but one time on the Lake Shore, the Nickel Plate, and the New York, Pennsylvania, and Ohio. This "central time" would be that of the 90th meridian, which is one minute faster than St. Louis time, nine minutes slower than Chicago time, and three minutes faster than Vicksburg time; and of course just one hour slower than "eastern time." By it would be run all railroads and divisions of railroads, roughly speaking, from Detroit to Omaha, Kansas City, and the Red River of the North, and in Texas as far west, say, as Fort Worth and San Antonio. "Mountain time," that of the 105th meridian, which is exactly Denver time, would rule thence west to the Colorado River and Ogden, west of which to the Pacific coast the standard would be "Pacific time," that of the 120th meridian, which is ten minutes faster than San Francisco time.

Mr. Allen has studied the adaptation of these several times to the railroad system as it exists, and has made a map showing exactly the lines which would be run by each time. His plan would substitute four time standards for about fifty now used, and no place would have more than two, and these would be exactly an hour apart, and a large part of the confusion—substantially all of it—now existing would be avoided even at these places.

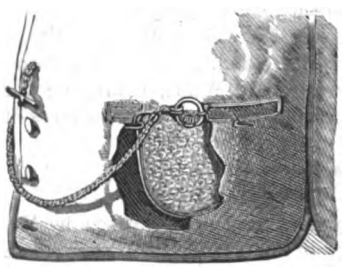
The Pulse of Animals.

In horses the pulse at rest beats forty times, in an ox from fifty to fifty-five, and in sheep and pigs about seventy to eighty beats per minute. It may be felt wherever a large artery crosses a bone, for instance. It is generally examined in the horse on the cord which crosses over the bone of the lower jaw in front of its curved position, or in the bony ridge above the eye; and in cattle over the middle of the first rib, and in sheep by placing the hand on the left side, where the beating of the heart may be felt. Any material variation of the pulse from the figures given above may be considered a sign of disease. If rapid, hard, and full, it is an indication of high fever or inflammation; if rapid, small, and weak, low fever, loss of blood, or weakness. If slow, the probabilities point to brain disease, and if irregular, to heart troubles. This is one of the principal and sure tests of the health of an animal.

RECENT INVENTIONS.

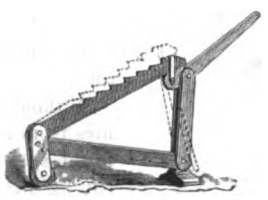
Improved Watch Pocket.

The engraving represents an improved pocket intended to be applied to the ordinary watch pocket to keep the watch clean and protect the case from unnecessary wear, at the same time holding the watch firmly in the pocket, saving money on repairs. The pocket is made of chamois skin or other suitable material, and is furnished with a wire spring of semicircular or semi-elliptical shape, having its ends pointed so as to fasten the pocket in the pocket of the garment. The spring stretches the pocket flatwise, closing the mouth so as to make the sides pinch and hold the watch. The same device is applied to eye-glass pockets, also to scissors pockets. Further particulars may be obtained by referring to our advertising columns, or addressing the Automatic Pocket Company, No. 517 Market Street, Philadelphia, Pa.



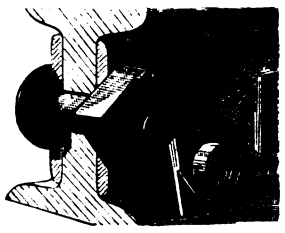
Improved Wagon Jack.

We give an engraving of an improved wagon jack recently patented by Mr. Thomas Milles, Jr., of Springborough, O. The inclined bar is provided in its upper edge with a series of offsets or notches arranged like steps, and is pivoted at its lower end between two short standards, which also carry a small wheel. The upper end of the inclined bar rests upon the rounded end of a hand lever. This lever is pivoted to one or two bars having their lower ends pivoted to one end of a base bar secured to the base block. The jack is passed under the axle of the vehicle until the axle rests upon one of the offsets or steps of the bar. Then the free end of the hand lever is depressed, raising the upper end of the notched bar, which will raise the axle so as to permit removing the wheel from the axle supported by it. By means of this improved jack a heavy wagon can be raised easily. The jack can be moved about on the wheel by raising the end carrying the lever.



Improved Nut Lock.

This invention consists of a nut of two parts, one having a cavity in the face or top eccentric to the bolt hole and a stud projecting from one corner of the face, together with another part, forming a check nut by having a boss eccentric to the bolt hole, and also having a projection or raised part on its face, which shall engage with the stud on the nut first named when the parts are in the non-interlocking position, and can be both together screwed on to the bolt. Then, by turning one part of the nut while the other part is not turned, the eccentric boss of the one binds in the eccentric cavity of the other nut, thereby locking the nuts on the bolt securely. This invention has been patented by Mr. John Ford, of Portneuf, Quebec, Canada.



Railroad Gardening.

Last year a majority of the stations along the main line and branches of the Philadelphia and Reading Railroad were put in thorough repair, and were further improved by handsomely laid out glass plats brightened with beds of flowers. This year the company, it is said, intend to further beautify the surroundings of their stations by increasing the acreage of flower beds and planting them with choice specimens. The plan will be heartily approved by travelers and by residents in places along the line. Too often the railroad station is the most bare, dreary, and unattractive place in the town.

The New York, Lake Erie, and Western Company is also making arrangements to beautify a number of its wayside stations by surrounding them with small grass plats, in which flowering shrubs and plants will be set out.

The Pennsylvania Railroad, on which this plan of improving the appearance of stations was first adopted, is extending the work each year.

Artesian Wells in Colorado.

Three artesian wells have been sunk in the corporate limits of Pueblo, the last one more than a year ago. All are over 1,000 feet deep, and one over 1,300. Each discharges a regular and considerable flow of mineral water, the water from two of them being highly charged with valuable hygienic properties. They are respectively the Clark well, the Worrall well, and the well of the Colorado Coal and Iron Company.

M. GREEN.

Ivory, Historical, and Useful in the Arts.

We who are accustomed to see ivory in common use about us are apt to forget how important a part it has played in the early history of mankind. Our cave dwelling and mound building ancestors soon discovered the great advantage of making use of the tusk of the elephant, the walrus, or the boar in the place of bone in the manufacture of their war and hunting implements, and strange as it may seem, the little acquaintance we have with these early people is from making a study of the rude weapons which they have left buried in their humble homes and graves. One of the most conspicuous tests that we have in determining man's antiquity is an ivory horn which was found in a cave in France a few years since, and which has carefully engraved upon it an accurate representation of the mammoth, that fierce adversary of the mastodon, and the hairy rhinoceros, all so long since extinct. This picture stands forth conspicuous, not only for its value as proving man's long habitation on the earth, but as a witness to the first dawning of art.

Coming to the historic age, ample evidences exist of the remarkable skill to which artists in carving had attained. Two daggers (now in the British Museum) handsomely inlaid, and ornamented with gold, are attributed to the age of "Moses." In the same collection are several chairs of the 16th century B.C., inlaid with ivory, also two boxes (representing water fowl) of the 11th century B.C.

We read that the throne of Solomon (1,000 B.C.) was of ivory, overlaid with the purest gold, and King Ahab's house was made of ivory. The prophetical books give accounts of horns, benches, and beds of ivory, while scepters, thrones, and other insignia of royalty among the Hebrews are spoken of as being made of the same material. Mr. Layard, in his archæological researches at Nineveh, found in that ancient city fragments of articles fashioned in ivory, the most interesting of which was an ivory tablet, representing seated figures of Egyptians, with a cartouche bearing hieroglyphics; parts of this tablet were inlaid with a blue vitreous substance, and the whole ground of the tablet was originally gilded, remnants of the gold leaf still adhering to it.

The Greeks also learned the art in ancient times. Phidias and his successors mention composite statues of ivory and gold, which practice was continued down to the Christian era. Pausanias describes a number of these statues, particularly the colossal ones of Athene, at Athens; and Jupiter, at Olympia—the former nearly forty and the latter fifty-eight feet high, and conspicuous as being one of the seven wonders of the world. These statues were the largest and most precious ever executed in those costly materials. Ancient writers, including Pliny, declare that the workers in ivory of still more ancient times had the secret by which they could flatten and join ivory, so as to make it cover large surfaces, though modern experimenters have never been able to do it.

In more modern times the "Elephant's Tower," Futtehpoor Sikra, is a most celebrated structure. This was a favorite residence of Akbar, the most illustrious Asiatic ruler of modern times (1556–1605), and was ninety feet high, and studded with elephants' tusks from top to bottom. It is conjectured to have been erected over the remains of a favorite elephant.

The consumption of ivory at the present day is something enormous. In Sheffield, England, alone 45,000 elephants' tusks are said to be employed in manufacture annually, and allowing for the occasional finding of shed tusks and those of elephants found dead, it is estimated that 20,000 are slaughtered yearly to supply this demand.

A veneer of ivory was exhibited at the World's Fair in London, 1851, 41 feet long and 14 inches wide. It was sawed from a block in a continuous ribbon, the block rotating and its axis gradually approaching the plane of motion of the saw.

Artificial ivory is made from a combination of caoutchouc, sulphur, and some white ingredients, such as gypsum, sulphate of baryta, oxide of zinc, or pipe clay. Numerous patents have been granted in the United States for its manufacture, but it is inferior in every respect to the genuine article.

Whale's Skeleton for the Smithsonian.

Gen. Babcock, Lighthouse Engineer of the Baltimore, Md., district, says the Baltimore *Sun*, has returned to Baltimore on his steamer, the Jessamine, bringing with him the skeleton of a sperm whale, found on the coast of Florida, near Jupiter Inlet. It was secured for Professor Baird, of the Smithsonian Institution. The place where the whale went ashore is the same place where, two years ago, the coast was covered with dead fish for miles. Recently sixteen dead whales were found along the same coast. One of them was said to be at least seventy feet long. The cause of so many dead fish going ashore at that point has puzzled the scientists. Professor Baird, hearing of the whales, authorized Gen. Babcock to expend $100 to get a skeleton for the Institution. The whales were of a new species of sperm, and the skeleton secured is said to be perfect.

A Monster Codfish.

A codfish, weighing 100 pounds, was captured near Portland, Me., a few days since, by a boat fisherman with a hand line or trawl. The fish was 5 feet 5 inches long, and the length of its head, from tip of nose to extremity of gill flap, measured 17½ inches. The girth of head was 32 inches. This is said to be the largest cod captured for a long time.

A Destructive Tornado.

On Sunday, April 22d, a terrific cyclone passed over the States of Mississippi, Alabama, Georgia, and extending into South Carolina, killing eighty-three persons, wounding about three hundred, and destroying an immense amount of property. The village of French Camp, a town of three hundred inhabitants, was totally destroyed. Houses, public buildings, and churches were demolished, fences were leveled, and trees uprooted.

In Barnwell County, South Carolina, a path three-fourths of a mile wide was cut through Salkehatchie Swamp as clean as if the timber had been felled for a railroad.

The first place reached by the cyclone was Georgetown, Miss., a small village on the Pearl River. Many of the residents of that place and vicinity were assembled in the Methodist church, the quarterly circuit being in session. The cyclone struck the church, pushing in one of the side walls, which fell upon the congregation. One person was killed; another, the minister, was seriously and probably fatally injured. Two or three others were injured, but the main portion of the large congregation marvelously escaped without injury. Many of the persons killed were blown long distances, and some have not yet been found. The scenes following the disaster were pitiful in the extreme.

The course af the cyclone was from the southwest to the northeast. It is said to have divided at Morton, one arm continuing on the original course, the other taking a more easterly direction, passing through Alabama and Georgia, extending into South Carolina. The length of the path of the storm and its exact course have not been reported, but it seems to have swept the greater portion of the length of the State of Mississippi, and to have crossed two other States, reaching into the third, touching here and there.

Chills, their Causes and Consequences.

Catarrhs should receive careful consideration, instead of the neglect which they generally meet with until they have fastened on the part affected so much as to excite the attention, and perhaps alarm, of the sufferer. Here, however, we propose to say a few words about the causes of chills. A person in good health, with fair play, easily resists cold. But when the health flags a little, and liberties are taken with the stomach or the nervous system, a chill is easily taken, and according to the weak spot of the individual, assumes the form of a cold, or pneumonia, or, it may be, jaundice. Of all causes of "cold," probably fatigue is one of the most efficient. A jaded man coming home at night from a long day's work, a growing youth losing two hours' sleep over evening parties two or three times a week, or a young lady heavily "doing the season," young children at this festive season overfed and with a short allowance of sleep, are common instances of the victims of "cold." Luxury is favorable to chill taking; very hot rooms, soft chairs, feather beds, create a sensitiveness that leads to catarrhs. It is not, after all, the "cold," that is so much to be feared as the antecedent conditions that give the attack a chance of doing harm. Some of the worst "colds" happen to those who do not leave their house or even their bed, and those who are most invulnerable are often those who are most exposed to changes of temperature, and who by good sleep, cold bathing, and regular habits preserve the tone of their nervous system and circulation. Probably many chills are contracted at night or at the fag end of the day, when tired people get the equilibrium of their circulation disturbed by either overheated sitting rooms or underheated bedrooms and beds. This is especially the case with elderly people. In such cases the mischief is not always done instantaneously, or in a single night. It often takes place insidiously, extending over days or even weeks. It thus appears that "taking cold" is not by any means a simple result of a lower temperature, but depends largely on personal conditions and habits, affecting especially the nervous and muscular energy of the body.—*Lancet.*

Utilization of Diseased Potatoes.

A correspondent of the *Journal of the Society of Arts* says:

I know from practical experience that M. Bourlier and M. Herve are quite correct as to the value of diseased potatoes as an article of food for cattle, pigs, etc., but the most important item to be observed they omit in their directions, which I revise as follows:

Boil the diseased tubers fast till done; drain, and let them become perfectly dry by spreading them out on sieves—a gravel screen is the best. The tuber, when cooked, is free from poison; the water in which it is boiled is a very strong poison, and will scour, if not kill, any animal that partakes of it. When dry, ram tight into any kind of dry cask (with salt), and keep in a cool place till wanted. One copperful can be dried and packed while the next is cooking, so that a large quantity can be cooked in one day. Every farmer should know this, as it would save him suffering any loss, however bad his crop might be. GEO. WM. PASCALL.

Exhibits for the Chicago Railway Exposition.

Seventeen cases of exhibits, including the locomotive Rocket (the first railway engine built by George Stephenson), have been shipped from London, for display at the Railway Exposition which will open in Chicago on May 24. In addition to the main exposition building, the management has constructed temporary buildings on the lake front, which, taken together, make a structure five blocks in length.

ENGINEERING INVENTIONS.

An automatic car brake operated by the movement of sliding weights which are actuated by the momentum of the train, has been patented by Mr. Benj. F. Smith, of Alabaster, Mich. The automatic brake is applied as auxiliary to the usual brake, and may be used with the latter, or independently of it.

An improved car coupling consisting of clevis shaped links for connecting the cars is the subject of a patent granted to Mr. Edward S. Carter, of Keokuk, Iowa. The drawbars are provided with the usual link socket, and taken altogether the coupling possesses many desirable qualities, among which is its simplicity and durability.

Mr William H. Diehl, of Hyde Park, Pa., is the patentee of a novel car coupling which is composed of a bar pivoted to the under side of the car truck in such a manner as to permit its being swung vertically or laterally. The coupling bar is provided at its outer end with a device for holding and guiding the link into the drawhead, and a rod operated by a crank lifts the link. This coupling can be applied to any drawhead in use without any change of the link or pin.

Messrs. Abraham O. Frick and William H. Snyder, of Waynesborough, Pa., have added an important improvement to the list of inventions relating to road engines. This invention has reference to the manner of mounting the boiler upon the running gears, and is designed mainly to relieve the boiler plates of the strain at the rivets which connect the boiler to the spring boxes. The invention further consists in passing beneath the rear end of the boiler one or more stirrup rods, which support the weight of the rear end of the boiler.

A balanced slide valve of improved construction has been patented by Mr. E. T. Conrad, of Cadillac, Mich. The invention consists in connecting with the valve plate, by means of bolts, a plate which will move with the valve plate. These plates are so arranged that they will accurately fit both the top and bottom of the steam chest. The plate being of the same area as the valve receives equal pressure with it, and thus prevents rapid wear of the valve seat and enables the valves to be operated with less consumption of power.

A very convenient attachment for stock cars has been patented by Mr. M. H. Gilbert, of Smithville, O. This consists in pivoting the feeding troughs to the uprights of the car and attaching bars to them in such a way that by operating the lever at their extremities the troughs may be turned into or out of position for use. The trough on the doorway of the car is pivoted to a frame, and may be removed altogether from the door if the door is to be opened. Tanks are mounted at the ends of the car, from which water may be drawn from one to the other, and may be discharged by nozzles into all the troughs. The parts of the water pipes on the opposite sides of the doorway are connected by telescopic coupling pipes.

MECHANICAL INVENTIONS.

Messrs. Jacob and Henry Friedlander, of Memphis, Tenn., are the patentees of a convenient implement for grocers' use consisting of a scoop, to the handle of which is attached a weighing appliance, so that the article answers the double purpose of scoop and scales.

A combined table and carriage for potters and others is the subject of a patent granted to Mr. Michael W. Jordan, of Bellaire, O. This carriage consists of two trucks connected together by crossbars, and provided with one or more oscillatory tables supported in bearings, and so arranged as to enable the material to be shipped from the upper to the lower platform.

An implement for dentists' use, denominated a dental engine hand piece, has recently been patented by Mr. J. H. Lincoln, of Chattanooga, Tenn. It is intended to enable the working process to be carried on to greater advantage by the adjustment of the elbows of the implement, so that force may be transmitted and applied to any portion of the mouth of the person being operated upon.

A novel mode of converting reciprocating into rotary motion has been patented by Mr. George J. Altham, of Swansea, Mass. The inventor provides a shaft having opposite cranks, connected by a diagonal arm with a connecting rod, which terminates in a fork journaled on the ends of a diagonal shaft, whereby reciprocating motion applied on the connecting rod will be converted into rotary motion.

A machine for shaving barrel hoops has been patented by Mr. John Prince, of West Randolph, Vt. A reciprocating carriage is provided with a clutch for grasping the hoop, and is operated automatically. The knives for shaving the hoop are also opened and closed automatically. The machine, in fact, is automatic in all its operation, and it is claimed that it will produce hoops of even thickness throughout, and that no short bends will be left in the hoops.

An improved land roller, claimed to possess some advantages over the ordinary roller, is the subject of a patent granted to Mr. Abraham J. Stevens, of Owaneco, Ill. Three rollers are used, the middle one being placed in advance of the other two. These cylinders are connected with one another in such a way, and are secured in such a manner upon hangers, that the rear rollers adapt themselves to the uneven surface of the land being rolled. Provision is likewise made for drawing the machine in either direction.

A wood boring machine, the object of which is to provide a machine for boring by a single operation a number of holes at different angles to each other, such as are required in chair legs, etc., has been patented by Mr. John M. Nash, of Hudson, Wis. Two sets of boring bits are supported normally at right angles to each other, and are provided with means for adjusting each set at the desired angle, for adjusting the bits of each set to or from each other, as the case may require.

A furnace for heating tubes to facilitate the brazing or welding of them has been patented by Mr. R. H. Brown, of Omaha, Neb. The furnace is so constructed that the pipe is passed through openings in the side, but does not come in contact with the fuel, insuring a better connection than when the welding is done in the fire. When this has been accomplished and the required heat is obtained, the pipe is drawn upon a mandrel, and between two swages, one permanent and the other movable, when the work is completed by blows from a hammer on the movable swage.

An improved machine for coating pills with gelatine or similar material has been patented by Mr. Charles C. Wells, of Saratoga Springs, N. Y. A rotating cylinder is provided with a series of needles designed to hold the pills, the coatings of which are dried by rotating the cylinder. The improvement further consists in providing an inclined platform with a series of grooves, and furnished at one edge with a notched strip for directing the needles into the pills, and with a similar notched strip at the opposite edge for stripping the pills from the needles.

A steam ice cutting machine has been patented by Mr. J. Jamieson, of Rockaway Beach, N. Y. Two anchor sleighs are placed some distance apart on the field of ice, and between these are arranged frames for carrying the cutters. Adjustable legs are also provided for lifting the cutters from the ice when not in use. The cutter frames are moved by ropes passing around windlasses fastened on one of the sleighs, and from thence pass around horizontal pulleys which are fastened to the other anchored sleigh, and so on to the second cutter frame back to the windlass again.

An improved elevator and carrier for unloading hay or grain, and depositing it at a remote point from where the grain is lifted from the wagon in which it was brought from the field, is the subject of a patent granted to Mr. George W. Brower, of Crawfordsville, Ind. The invention provides a beam or track on which is mounted, on rollers, the pulley rigging, to which the fork for unloading the hay or grain from the wagon is suspended. When the fork has been thrust into the hay, the latter is raised by the hoisting rope to clear the wagon, and then conducted to the desired place of deposit, by the apparatus running on the carrying beam, where it is discharged.

An improvement in machines for wiring corks on bottles is the subject of an invention by Mr. G. C. Coon, of Jersey City, N. J., for which he has obtained a patent. The machine possesses an adjustable clamp for holding the bottle by the neck during the process of wiring, and of suitable jaws adapted to be closed upon the wires and revolved for twisting the wire by means of a revolving shaft. Means for opening and shutting these jaws automatically are provided. Taken in all its parts, the machine is capable of accomplishing a great deal in the cork wiring line, and this is a business which has increased till it has attained enormous proportions in this country.

A novel centrifugal machine for drying clothes or for extracting juice from different matters has been patented by Mr. Michael Wanner, of St. Louis, Mo. The invention consists of a centrifugal machine formed of a tub containing a perforated rotary vessel provided at its bottom with a pinion engaging with a cog wheel, connected with an arm of a rocking shaft which is operated by a rocking handle lever, whereby by rocking the handle lever the vessel in the tub will be rotated very rapidly. The invention also consists in a brake for stopping the motion of the vessel, and also in a slotted cover for permitting a quantity of air to be drawn into the vessel.

AGRICULTURAL INVENTIONS.

A patent has been granted to Mr. Henry A. Hyle, of Redwood, N. Y., for a device which is designed to facilitate the controlling of mowers and reapers, and promote their efficiency. The invention consists principally in improved appliances for giving motion to the sickle bar and adjusting the shoes and cutter bar.

A corn planter for planting on a large scale is the subject of a patent by Mr. James Ressegieu, of Cleopatra, Mo. This machine is of a rectangular form, provided with a driver's seat, and with seed hoppers on each side of the frame, in each of which is a rotary dropper connected by lever bars with the axle. The vehicle is provided likewise with check row markers and also with drill openers for making the furrows in which the corn is to be dropped.

A novel attachment for plows called a stirrer is an invention for which Mr. W. C. Hawkins, of Lima, S. C., has obtained a patent. It consists in attaching a stirrer or rake to the plowbeam for the purpose of more completely exposing the weeds turned up by the plow, and thus more rapidly killing them. By changing the position of the stirrer, it may be used to rake up the grass and weeds on a row when the operation of plowing is progressing.

An improved harrow has been patented by Mr. Charles P. Lewis, of Del Rio, Texas. Two rectangular frames are mounted upon a main frame and provided with drag hook teeth to tear up roots, clods, etc., and clear away obstructions before the rotating teeth, which are mounted immediately behind the drag hook teeth, but so located as to work between them, are brought into use. Levers are connected with the frame of the hook teeth with the object of vibrating them, and thus clear the teeth of any clogging matter that may have collected upon them.

An improvement in seeders has been patented by Mr. Frank Koht, of Gladbrook, Iowa. This invention, which is an improvement upon the Gorham seeder, and designed to facilitate the sowing of seeds of different sizes and different quantities, consists in a seed discharging wheel provided with arms upon which are mounted cups so constructed that their capacity may be altered by means of a binding screw which secures a section of the cup that operates telescopically. The cup is provided with an index and scale, by which the quantity of seed is designated.

Mr. A. L. Reese, of Chase, Kan., has recently patented some improvements upon a wheat drill, for which he obtained a patent April 4, 1882. This drill consists of two corresponding frames connected together by an arch composed of two angle bars adapted to be bolted together. This arch is provided with a number of holes, so that the main parts of the drill may be held nearer together or further apart, as circumstances may require. When the drill is to be used on ordinary ground, the arch connection will be unbolted and the axles of the two frames brought close together. When the drill is to be used for drilling between rows of corn, the arch connection will be replaced and the main parts of the drill will straddle the row, the corn passing uninjured under the arch.

MISCELLANEOUS INVENTIONS.

A device designed to regulate the outflow from an oil can has been patented by Mr. John C. Thickens, of Hinsdale, Mass. Valves are so arranged in the tube of the vessel that the oil will escape by drops or in a continuous stream, as is required.

An improvement in gig harness saddles, so constructed as to render the pad readily removable from the saddle, and replaced by another pad without defacing the leather of the saddle, is the subject of a patent granted to Mr. Joseph Bevard, of Wooster, O.

A device for facilitating the attachment of the perches of bird cages to their supports has been patented by Mr. Joseph Bagot, of Brooklyn, N. Y. The invention also consists in a parasite trap consisting in a cup-shaped recess at the end of the perch, into which the parasites will collect, when they may be readily destroyed.

An improved brush, adapted especially for velvet, silks, etc., has been patented by Mr. Lucinius Havasy, of New York city. This brush is provided on one side with short bristles like fur, and on the other side with short fine fur, the former being employed for removing the dust, the soft fur side serving to smooth the fabric.

A convenient wall match safe has been patented by Mr. Augustus T. Gillender, of New York city, which can be suspended against the wall of a room with two receptacles, one for holding a box of matches, and the other for the unconsumed portion. A hole is provided in the match holder, in which is exposed the igniting portion of the box.

A finger ring, so constructed that it may be adjusted to any size of finger, has been patented by Mr. Heinrich Henrich, of New York city. The ring has the side pieces of its head grooved on the inner side, and a separable shank is provided with slots in the ends, and secured in the grooves of the side pieces.

A thill carrier, which is so constructed that the usual trouble of running the ends of the thills into the loop and then backing the vehicle to release the thills is obviated, is the subject of a patent granted to Mr. Francis A. Hake, of Cuero, Texas. The new thill carrier is ornamental, and secures the shafts of the vehicle in the most perfect manner.

Mr. Theodor Kihneman, of New Orleans, La., has patented a new method of making brushes for cotton gins. Instead of securing the bristles to their stripe of rubber, and then winding the rubber stripe around the handle, the bristles are cemented directly to the handle. In this way the bristles are attached quite as securely as in the former method, and thus a brush of equal quality is produced at much less cost.

An improvement in awnings, designed to prevent the accumulation of water upon it after a rain or thaw, has been patented by Mr. William Freeland, of Brooklyn, N. Y. Troughs are arranged on the under side of the awning at certain distances to carry away the water, the water passing into these troughs through holes in the awning proper, which holes are located at suitable distances apart and directly over troughs.

A reflecting mirror to be applied to the sight of fire arms used in shooting galleries which are lighted by gas or other artificial means has been patented by Mr. Richard Cannon, of Washington, Pa. The improvement consists in attaching a concave reflector by a wire clamp upon the gun barrel to reflect the light upon the rear sight of the gun to enable accurate firing.

A novel device for stopping runaway horses has been patented by Mr. Carl E. Von Schwarz, of Vienna, Austria. The invention consists in so arranging a curtain or blinder to the bridle that it may be dropped over the horse's eyes should he become unmanageable, thus cutting off the light and reducing him to submission. When the animal is once more under control, the curtain may be raised again without subjecting the driver to alight from his vehicle.

Letters patent have been granted to Mr. John Wade, of Oregon, Ill., for an improved barrel head. The invention consists in a device for holding the slats of a barrel head together by a strip which passes transversely across the slats and through which screws are passed into the barrel head, whereby the parts are firmly held together. This tranverse strip is provided with a suitable handle for lifting the head from the barrel when desired.

An improvement in wagon axles has been patented by Mr. Andrew Kimble, of Moundsville, W. Va. This consists of securing the bolster, hound, axle, and truss bar together by a bolt. The ends of the truss bar are turned over the axle in such a way that the axle skeins will secure the truss bar firmly in place thus keeping the axle from springing or breaking, and preventing the end of the truss bar from becoming loose.

An improvement in secondary batteries, the object of which is to store up a greater amount of energy in less time than is possible with solid lead plates of equal dimension, has been patented by Mr James Pitkin, of Clerkenwell, Middlesex, England. These batteries consist in electrodes formed of thin spiral shavings or turnings of lead, crumpled and packed in an open frame of wood or ebonite, and covered with a porous fabric.

A novel improvement in spring shade rollers has been patented by Mr. Daniel Willis, of Harrison, N. J. The roller of the shade is mounted upon brackets by a fixed spindle at one end and by a loose spindle at the other in such a manner that when the roller is revolved by raising or lowering the shade, the connecting spring will be put under tension, so as to roll up the shade when the shade is released. The invention relates to improvements in the construction of the loose spindle.

An improved method of fastening the pockets of pool and billiard tables to the pocket blocks has been patented by Mr. George J. Bock, of Zanesville, O. Instead of attaching the pocket by tacking it to the block, according to the former method, which is apt to cut the meshes of the net, a metal strip is provided which is curved in shape like the form of the block and is provided with notches over which the meshes of the net are passed. This strip is thereupon screwed to the pocket block, furnishing a simple and secure fastening.

An improvement in the holding ring and frame for embroidering machines that employ a plurality of needles has been patented by Mr. Benj. F. Robinson, of New York city. A series of rings or other shaped clamps for holding the canvas to be embroidered is fastened into a frame, thus avoiding the old practice of sewing the pieces of canvas to be embroidered together, which rendered accessibility to all parts of the fabric very difficult. With the newly patented arrangement the work is always accessible to the embroiderer.

A siphon faucet for use especially in dispensing kerosene and other like commodities has been patented by Mr. N. A. Ellis, of Boonesborough, Iowa. A pipe passes over the top of the barrel, from which the air is removed by a pump prepared for the purpose, and when the air has been exhausted the liquid begins to flow through the pump, the stop cock which connects the pump with the faucet pipe being turned off. Then by turning on the stop cock of the main faucet, the liquid will flow out in a continuous stream.

A new method of coloring photographs has been patented by Mr. Jesse W. Hyman, of Englewood, N. J. The process consists in immersing the photographs in a solution of naphtha, paraffine, mastic drops, ether, and vinegar, and applying to the back, in oil paint, the desired shade and tone, and also applying a mixture of glue and glycerine to the back, and pressing the back to canvas until cohesion takes place, whereby the whole picture will be flexible and have the appearance of having been painted on the canvas.

A satchel, so contrived that it may be used either as such or as a muff, has been patented by Mr. Lucinius Havasy, of New York city. The satchel is provided with a longitudinal pocket with openings at the ends into which a muff may be inserted. The muff is of fur or any suitable material, and is made of such a size as to be readily inserted or withdrawn from the pocket. The special advantage of Mr. Havasy's invention is that in summer the muff may be withdrawn from the pocket, and the satchel, which is provided with a handle and lock, may be used as an ordinary satchel.

A novel departure in the construction of fireproof structures has been made by Mr. Samuel Liddle, of Hamilton, Nev., for which he has obtained a patent. The invention consists in a building with a hollow shell, and perforated iron posts and beams, which shell is to be filled with water from a reservoir above in case of fire. By an ingenious arrangement the water is conducted through their hinges into the hollow blinds. After the fire the water may be drawn off into a tank, and pumped back into the reservoir again. This invention is also applicable to the hulls of vessels.

A kitchen safe has been patented by Mr. F. X. Oberle, of St. Joseph, Mo. This is constructed with a sliding top, upon which is mounted a box provided with a drawer. A sliding kneading trough is arranged underneath the cover, and when both of these are slid out, compartments for holding flour, sugar, etc. are uncovered and are rendered accessible to the housewife or cook. Beneath these compartments are arranged small drawers for holding salt, spices, and like articles. This safe occupies but very little space, and is an ornamental as well as a useful piece of kitchen furniture.

An implement for rendering meat tender and more digestible has been patented by Mr. John G. Perry, Jr., of Nyack, N. Y. The meat tenderer, as the inventor calls his invention, has a toothed roller and a smooth roller confined in the same frame. The rough or toothed roller is pressed into the meat, and as it is rolled over it the fibers are punctured, making it quite tender. The smooth roller follows behind the other roller, smoothing the surface made rough by the rough roller, and restoring the meat to its original appearance.

An improved gate has been patented by Mr. Dennis M. Bridges, of Woodstock, Ill. The gate is arranged to operate vertically on guide rods held on standards connected by a top beam. To this beam is attached a pulley over which passes a rope, which likewise passes over pulleys fastened to both ends of a diagonal beam, and which carries weights at its two ends. By pulling the weight the gate is elevated, and when it has been passed the gate may be closed by raising the weight on the other side. The gate may be made very light, as it is guided on each side instead of being hung like a swinging gate.

An improvement in a telephone transmitter has been patented by Mr. Robert D. Woodworth, of Orange, N. J., which consists in attaching a spring to the fixed part of the jointed conductor, for conducting the current to the pendulous electrode. By this arrangement the oscillations of the pendulous electrode will be accelerated, and the current transmitted without passing the hinge. Mr. Woodworth observes that other transmitters become defective after some use, and he attributes this imperfection to the oxidation of the hinge of the pendulous electrode, a difficulty his device is intended to obviate.

Mr. Charles L. Work, of Mount Vernon, O., is the patentee of an improvement in book holders which belongs to the class used for supporting large books like Webster's Unabridged Dictionary, or any other work required for frequent reference. An ornamental standard has fastened to its top a hinged platform similar to table leaves, with the leaves opening downward, set at sufficient distance apart to receive as large a book as required. These leaves are hinged to the centerpiece, which acts as a rest for the book. The book is placed edgewise between these leaves, which, when raised, are held up and in place by a spring. For libraries, editorial rooms, and offices, such a holder will not only be found convenient, but a great preserver of the book.

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NEW BOOKS AND PUBLICATIONS.

THE ST. LOUIS PHOTOGRAPHER. Published monthly at St. Louis, Mo., by Mrs. J. H. Fitzgibbon.

It aims to set forth in an interesting manner, with Western freshness and vigor, the photographic news of the day. Each number is adorned with a fine specimen of the photographic art. Taken altogether it is one of the best journals devoted to photography published.

MODERN DWELLINGS.

Among the more recent contributions to architectural literature which have come to our notice we find an attractive little work by Mr. H. Hudson Holly, of 111 Broadway, New York city, entitled "Modern Dwellings in Town and Country." The author has attempted to show how it is necessary, in bringing over styles of architecture from across the Atlantic, to naturalize them and adapt them to our American wants and climate. He speaks of the inconsistency of our following step by step the rules relating to the various styles of architecture which existed generations ago, and which were evolved by slow degrees at a period and under circumstances so different from our own that what then might have been regarded as a trait of perfection or a matter of necessity becomes in our day an incongruity and almost an absurdity. The work, however, is by no means a critical one, and after the author pleads for independence on the part of the American architect, he enters into the practical part of the work, which comprises a series of papers giving most useful hints regarding how to set about building a house. He first mentions the beauty and economy of country life, and then he dwells upon the most desirable locations for sites, and when this has been settled, how the plans should be drawn up. So he proceeds, discussing clearly and concisely the utilitarian in architecture. The book is illustrated with about a hundred designs, giving the elevations and the ground plans of country houses, with the estimated cost of each. The last half of the work is devoted to the extensive and all important subject of internal decoration, and numerous cuts are given of the different features of household furnishing. To persons contemplating building a new villa or cottage, or remodeling an old house, Mr. Holly's book will be found very useful.

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 this 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. R. D. asks: 1. How short will it do to have the pitman in a vertical saw mill? It has a two foot stroke, and the saw sash runs on two inch iron rods. A. Three to four times the stroke. If shorter, it creates a cutting action upon the slides. 2. What should be the velocity of the circumference of an emery wheel, for grinding small tools? A. 1,000 to 1,500 feet per minute. 3. What should be the speed of the surface of the article to be turned (wood) in a lathe? A. It depends upon the size; large articles like bed posts, or pieces 4 inches diameter, 400 to 500 revolutions per minute. Small work 1 or 2 inches in diameter may run up to one or two thousand per minute, according to the nature of the work.

(2) F. B. S.—For liquid bluing either of the following is recommended: 1. Dissolve indigo sulphate in cold water and filter. 2. Dissolve good cotton blue (aniline blue 6 ounces) in cold water. 3. Dissolve Prussian blue with one-eighth part of oxalic acid in water. 4. Dissolve Tiemann's soluble blue in water, with 2 per cent of oxalic acid.

(3) D. D. L. writes: 1. I bought for sewing machines a sperm oil; it gums. What shall I add to obviate this, and in what proportion? A. Expose the sperm oil in open air with lead clippings. 2. What is the best remedy known for corns? A. The following is suggested: Take a quarter of a cup of strong vinegar; crumb finely into it some bread. Let stand half an hour, or until it softens into a good poultice. Then apply on retiring at night. In the morning the soreness will be gone, and the corn can be picked out. 3. What work will best inform me how to manufacture all kinds of flavoring extracts, simple and good? That you may better understand what I want, I am manufacturing and selling flavoring extracts, perfumes, and other useful remedies, etc., and I want to get a work from which I can obtain formulas for these articles through which I may be enabled to manufacture a good article at as small a cost as possible. A. Consult SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 77, 196, 256, and 293. See also R. S. Cristiani, "A Comprehensive Treatise on Perfumery, with Thorough Practical Instructions and Careful Formulas" $5.00. Also Dr. S. Piesse on the "Art of Perfumery," $5.50.

(4) J. M.—Your brass tubes no doubt have brazed seams. In this kind of tube the spelter used for brazing is not always of the best quality. The composition of the tube may be low brass, which requires low brazing, which insures brittleness and worthlessness.

(5) E. C. H.—You cannot use an efficient steam jet for ventilating the kitchen in connection with the range flue. The jet will destroy the draught of the flue. A tight iron flue would make an efficient ventilator with a steam jet which must be a multiple one for quantity draught. If you turn the jet into any other brick flue, you will create pressure along the flue, which is porous and will allow the odors to permeate the brick work and enter the adjacent rooms. If you can bring an adjoining flue in the same stack with the range flue into use for ventilating the hood, with its full opening, it will be the most feasible plan.

(6) R. L. M.—A glazier can cut the end from your glass dome. It will not make the electric machine better to remove the end, although it might look better to have both ends alike. Make a light frame for fastening to the inside of the glass cylinders and stick it with shoemaker's wax, which is the safest cement. All other parts can be put together with shellac in the form of a varnish or by melting, as convenient. Make the collecting points of brass wire sharpened or of common pieces, make the receiver of pine, cylindrical with rounded ends and covered with tin foil fastened with shellac varnish. The points can be pushed into the wood. The glass insulating standard can also be let into the wooden receiver with shellac and also into a wooden foot. All other parts may be of wood.

(7) W. H. R. writes: My church has brick walls eighteen inches thick, floor about two feet from the ground. It is not painted on the outside, but plastered and frescoed on inside, both walls and ceiling. The dampness has disfigured the fresco, ceiling, and sides very much. Could this be stopped by painting exterior of building? If so, what kind of paint should be used? The ceiling is flat; would the acoustic properties be changed, either for better or worse, if the ceiling were arched? Would the walls, which are well settled, bear changing the roof and making it very steep, thus doing away with a ceiling, having the interior timbers dressed and varnished like the interior of modern churches? A. The outside of the brick walls of your church do not need painting. The moisture does not come through the walls, but is due to condensation upon the plaster resulting from changes in the weather, excessive rain, and want of heat and continued ventilation. We suggest as a remedy that the space under the church floor be thoroughly ventilated by cutting large holes through the walls so that the prevailing or dry winds will sweep through. Then open the windows every dry day, and in wet foggy weather build a fire in the stove. The acoustic properties would not be injured by changing the roof, they might be improved. The walls are strong enough to bear the load, but must not be depended upon to support a spread in a framed arch. The roof must be trussed so as to be self-sustaining. It would be well to consult an architect or a builder that understands high roof trussing.

(8) W. A. S. writes: I have an Eclipse steam rock drill, running about 175 strokes per minute, at a distance of 200 feet from a 7 horse boiler. The size of steam cylinder of drill is 5 inches by 2¾ inches. Size of steam pipe, 1 inch. The boiler is an upright one situated on a hill, and although I have eighteen feet of stack the boiler does not generate steam fast enough. Can you tell me what the trouble is? Can you tell me the best way to temper steels for the above drill; also the proper color, the rock being very hard? In the first question, the 1 inch pipe is uncovered. Could I run the steam through three hundred feet of 1 inch pipe without the steam condensing to any great extent, and at the same time run the above drill? A. It is possible that your 7 horse upright boiler is overrated, as the drill at 60 pounds pressure indicates about 1½ horse power; but considering that it has considerable friction from large piston rod, and possibly two stuffing boxes, you ought to rate the drill at least as requiring 5 horse power to drive it and make up for leakages. What is commonly called a 7 horse boiler will not be equivalent to 7 horse power. All of the tubes are not generating surfaces. The naked shell radiates a great deal of heat. the steam pipes, especially if long, condense steam very rapidly. An upright boiler for such a drill should have 100 square feet of fire surface besides the portion of the tubes above water line. The steam pipe should be felted. Then 1 inch pipe will do for a distance of 100 feet. If 200 feet distant, 1¼ inch should be used. For hard rock the drills should be as hard as they can be made without breaking. Harden the drills at as low a heat as possible in clear water at shop temperature. Try them without drawing the temper; if they do not stand without breaking, draw the temper very slightly, say to a straw color. If you manage the hardening and sharpening rightly, you need not draw temper. Select the best quality drill steel.

(9) J. W. B.—Steel bars bent into a triangular shape are in common use in Europe, and have also been used in this country as gongs. Select a bar of square or round steel and suspend it in the center with a cord and strike it with a wooden mallet about half way between the center and end to get the tone. If it suits you, have it bent into a triangle having the three sides equal. Suspend it with a cord at one of the angles, and it is ready for use. A wooden mallet produces the best tone.

(10) J. G. R. writes: I have some chloride of gold and also some nitrate of silver, both in liquid and crystallized form, and would like to get them into a perfectly neutral state without changing them from a chloride or a nitrate. Can you direct me how to do it? Also, can you direct me so that I can make some hydrocarbonate of copper in a small way? I have plenty of carbonate of copper. Can it be made of that? A. The salts must be brought into solution, then test with litmus paper; they should be acid or neutral; if acid, add ammonium hydrate until neutral, then evaporate to dryness and dissolve the residue in distilled water. See Fresenius' "Qualitative Analysis." When sodium carbonate is added in excess to a solution of cupric sulphate, the precipitate is at first pale blue and flocculent, but by warming it becomes sandy, and assumes a green tint; in this state it contains $CuCO_3,CuH_2O_2+Aq$, which is probably the salt you speak of.

(11) W. S. H. asks how such concave articles of thin metal as ladle bowls can be polished up bright, presuming that all scale, etc., has been previously removed. Is there any kind of polishing tools made to hold against such articles to polish them while they would be revolved in a lathe? A. Sole leather wheels are used for polishing or smoothing concave bowls or other articles, using tripoli or rotten stone, or pumice stone if the articles are rough. Walrus hide is now much used because it is very thick (about one inch); these wheels may be had of tool dealers in this city. You can turn them into shape; first glue them to a wooden mandrel or chuck. Revolve the polisher and hold the bowl in the hand so that it will cross the grain in polishing; finish with a rouge or chalk buff of felt or cotton.

(12) F. W. J.—Case harden wrought iron work by heating the piece in an iron case or trough cover with charcoal made from leather scrap, hoofs, horns, or bones, pulverized finely and mixed with about 10 per cent by weight of prussiate of potash. Cover the article with the mixture and fill up the trough with sand to keep out the air. Heat to full red and keep it up for half an hour, then dip as with steel.

(13) J. M. M. writes: Please give me through Notes and Queries, size, focal length, and distance apart of lenses for astronomical eyepiece (high power) for telescope with 5 inch object glass (plano-convex), 72 inch focus. Also, will such an eyepiece do for an object glass of 4 or 6 inches, convex or plano-convex, of 48 inch focus? A. A field glass plano-convex 2 inches focus and an eye lens plano-convex ¾ inch focus, placed 1¾ inches apart, face to face, plane sides toward the eye, will give you a power of about 75 with your objective; a 1¼ inch field glass, ½ inch eye glass 1 inch apart, placed as above, will give you a power of about 100, which will be as much or more than your object glass will stand, unless it is achromatic. It makes no difference in the application of eyepieces whether the focal length of the object glass is long or short, except in magnifying power.

(14) S. A. R. asks: Will a cast iron idle wheel run successfully on a cast iron shaft? A. Cast iron upon cast iron and wrought iron upon cast iron run well at low speeds where the pressure upon the journal is not great. Speeds above 100 or with pressure require anti-friction bearings. Much depends upon special conditions, of which speed and pressure are essential elements, and of which you make no mention.

(15) F. M. C.—All nets should be dried as soon after using as possible. A cross belt should run perfectly, if your pulleys are properly crowned upon the face. A slight change in the line of the counter shaft which you should be able to make in a few minutes, will set you right.

(16) D. G. writes: I run a saw mill here having six boilers, tubular, 48 inch shell, fired with green sawdust and occasionally with some dry slabs; we carry 85 pounds steam. At 6 P.M. the furnaces are filled up with sawdust, draught doors banked with the same, so as to stop draughts; steam will stand from 80 pounds to 50 pounds through the night. Boilers are pumped full about 7 P.M. At half past 4 A.M., draughts are opened to get up steam to start engines at 6 A.M. When steam rises to 30 to 40 pounds, the surface pipes are opened, blowing off from boilers that may have too much water. Boilers are fed from front separate feed from each. It occasionally happens that the sawdust below one of the boilers has not burned to any extent, so that there is no evaporation of water in that boiler. When the surface pipe is opened from that boiler, for the purpose of letting off the surplus water, there sometimes takes place in that boiler a tremendous rolling and thumping, as if the water was compressed and thrown from one end of the boiler to the other, causing the whole fronts and boilers to shake. I cannot understand the cause of it. A. You do not state whether there is any pressure upon the boiler that makes the hammering. Should judge from your general statement that the hammering boiler was not making steam, and had the pressure of the other boilers upon it through the steam connections, in which case the water would be solid, *i. e.*, free from elastic vesicles of steam. When the surface discharge or blow off is opened wide under such conditions, the water in the immediate vicinity of the interior opening will become depressed and allow steam to enter the blow off pipe by fits and create a hammering. If your blow pipe is at one end of the boiler, the noises and jarring may be caused by currents set up in the boiler. If you put another blow pipe at the other end of the boiler, and open both partially at the same time, it is possible the noise will be cured.

(17) A. H. McC.—When acetic acid is made by the destructive distillation of wood, the crude acid is converted into acetate of lime by being saturated with calcium carbonate; this in its turn is converted into acetate of sodium, etc. See "Acetate of Lime, its Manufacture and Analysis," by Stillwell & Gladding; *Journal American Chemical Society*, iv., 94; also page 49, "Encyclopedia of Chemistry," published by Lippincott

2. The Deutochloride of copper is the cupric chloride or copper perchloride of to-day. 3. Information pertaining to Daguerre's process can be obtained from the cyclopedias and works on photography.

(18) E. B. D.—You will find rules for calculating the power of springs in Rankine's "Rules and Tables," page 304. The following formulas are also used: For maximum load,

$$M=\frac{d^3\times 12{,}000}{r};$$

d=diameter of round wire; r=mean radius of coil. For the weight to deflect the spring one inch,

$$\frac{d^4\times 180.000}{r^3\times n};$$

n=number of coils. There is still another rule given in Clark's "Manual for Mechanical Engineers." We doubt if any is reliable, as the result must vary greatly with the quality of the steel.

(19) H. J. T.—The advantage of the pop safety valve is that it opens quickly and freely, and remains until the pressure falls to the limit of pressure, and closes quickly. The range of pressure between opening and closing is much less than with the common safety valve.

(20) M. J. G.—Matches are first dipped in sulphur, then in a composition which varies. The following is a type:

Phosphorus	4 parts.
Niter	10 "
Fine glue	6 "
Red ocher	5 "
Smalt	2 "

(21) E. M.—For size of belts calculate by the following formula:

$$\text{H. P.}=\frac{W\,S}{600};$$

W=width of belt in inches; S=speed of belt in feet per minute. With narrow or short belts use 800 for divisor. This is a common, practical rule, but is not strictly correct, as the condition of the belt, its material, and size of the pulleys all affect the result.

(22) J. B.—Ganot's "Physics," says: "If water contains salts or other foreign bodies, its freezing point is lowered. Sea water freezes at —2·5° C. (27·5° Fah.) to —3° C. (26·6° Fah.); the ice which forms is quite pure, and a saturated solution remains."

(23) J. C. H.—Nearly all range boilers in use in the United States have no vent for the steam that may be generated by overheating. The general practice is to have the water-back so small that ordinary firing will not produce steam in the boiler at the pressure usually carried, which is from 15 to 50 pounds water supply pressure. Any overheating sends the water back into the supply pipe, and the violent circulation through the water-back and heating pipes sets up a hammering. The remedy is to open the hot water faucet and blow out the steam. In some places where the supply is taken from a tank in the house a vent pipe is inserted into the top of the boiler and carried up and bent over the top of the tank. Drawing off the water from the boiler when the supply is shut off, with a strong fire in the range, is dangerous to the safety of the water-back. It might not burst, but would be liable to crack or be burnt in the joints. There is no weldless wrought iron pipe made in the United States. Weldless steel tubes are made in England. Seamless or homogeneous copper and brass tubes of iron pipe sizes, and also for boiler flues, are made in this country.

(24) W. N. H.—For ink for marking bales use:

Shellac	2 ounces.
Borax	2 "
Water	25 "
Gum arabic	2 "
Venetian red, sufficient to color.	

Boil the borax and shellac in the water until they are dissolved, add the gum arabic, and withdraw from the fire. When the solution has become cold, complete 25 ounces with water and add Venetian red enough to bring it to a suitable consistency and color. This ink must be preserved in a glass or earthenware vessel.

(25) J. R. R. writes: Seeing some time ago a question asking how to mend a cracked bell, which though I am afraid it will be too late for the inquirer, may be useful to other persons, I send the following, which was given at a meeting of the Institution of Civil Engineers: The crack is first soldered with tin, and the bell is heated to a dull red or nearly so for a little time. The tin has the property, when heated above its melting point to nearly a red heat, of rapidly dissolving copper, and being thereby formed in the crack of nearly the same kind of composition as the bell itself, and which, being in absolute metallic union with it, is quite as brittle and as sonorous as the other portions of the bell.

(26) J. W. C. asks: 1. Does it injure bicarbonate of soda (used in a fire extinguisher) to be exposed to the atmosphere? A. If crystals of sodium bicarbonate are exposed to the air, they absorb moisture, but a solution of the salt will not be affected by the air. 2. Would like a simple test to know whether the soda is pure or not. A. It can be tested for sodium chloride by dissolving it and treating with it a drop of silver nitrate; a white precipitate will indicate the presence of this ingredient.

(27) A. W. E.—For nickel plating process without a battery try the following: To a solution of from 5 to 10 per cent of chloride of zinc, as pure as possible, add enough sulphate of nickel to produce a strong green color, and bring to boiling in a porcelain vessel. The piece to be plated, which must be perfectly bright and free from grease, is introduced so that it touches the vessel as little as possible. Ebullition is continued from 30 to 60 minutes, water being added from time to time to replace that evaporated. During ebullition nickel is precipitated in the form of a white and brilliant coating. The boiling can be continued for hours without sensibly increasing the thickness of this coating. As soon as the object appears to be plated it is washed in water containing a little chalk in suspension, and then carefully dried. This coating may be scoured with chalk, and is very adherent. The chloride of zinc and also the sulphate of nickel used must be free from metals precipitable by iron. If during the precipitation the liquor becomes colorless, sulphate of nickel should be added. The liquor spent may be used again by exposing it to the air until the contained iron is precipitated, filtering, and adding the zinc and nickel salts as above. Cobalt also may be deposited in the same manner.

(28) E. C. M. asks: What is meant by a feathering paddle wheel? A. Wheels in which the buckets or floats are revolved through a certain angle, so as to enter and leave the water vertically or nearly so.

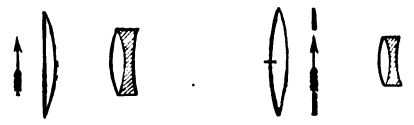
(29) J. J. R.—For coloring brass dissolve 20 cents' worth of silver and about 1 ounce of copper in 2 pounds nitric acid. Heat the objects slightly, then dip into the solution, and again heat until the article is black. Let the objects cool on an iron platter or anvil, then remove surplus coating with a brush dipped in oil. A black color is produced in this manner that will last and will improve with age. For a clear varnish for bronzes try the following: Digest 1 part of bruised gum copal with 1 part oil of rosemary in 3 parts of absolute alcohol. This gives a clear varnish, and should be applied hot.

(30) J. W. asks: 1. Can you give me a good recipe for making cocoanut hair oil?

A. Cocoanut oil	½ pint.
Castor oil	½ "
Alcohol	6 "
Slippery elm bark	1 oz.
Water	4 "
Oil of bergamot	1 "
" lemon	½ "
" pimento	¼ "
" almonds	1 drachm.

The cocoanut oil is mixed with the castor oil, and the alcohol mixed slowly with them at a slight heat. The elm bark in coarse powder is dissolved in the water and strained, and mixed by agitation with the rest. Lastly it is filtered, perfumed, and colored with a little tincture of gamboge. 2. Also, what can be used in the place of stove blacking, that will so color the iron that it will not burn off and become rusty, and that will not rub off as ordinary stove blacking does? A. We know of nothing more satisfactory than graphite stove polish. Kerosene is used to prevent stoves from rusting.

(31) R. B. G.—The Kellner eye piece is of the Huyghens form, with an achromatic eye glass, the field glass being double convex. The Steinhill is of the Ramsden form, with an achromatic eye glass. The general arrangement for diameters and focal distances are nearly the same as in the Huyghens and Ramsden eyepieces. The composition for polishing object glasses



is made of clear, clean resin, with enough turpentine to make it tough, or so that you can indent it with your finger nail without chipping. The turpentine and resin are melted together in a clean vessel; then stir in one tenth the quantity of fine wheat flour; stir well until the flour is thoroughly mixed. Then try it by dipping a clean stick into the mass and cooling a small lump that sticks to the stick in water of the same temperature as the room you propose to work in. If the test is right as above, it is ready to use. If too soft, boil until it is right. If too hard, put in a little more turpentine. When right, warm your lap and spread.

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

E. M.—The sample is sandstone containing a large quantity of iron peroxide, or limonite. It is of no special value.—A. C. H.—The sample sent is rather small for satisfactory identification. It is a silver ore, however, and looks like a telluride. An assay would cost $5.00.

COMMUNICATIONS RECEIVED.

On the Storage of Electricity. By H. G.
On Electric Heat Regulators. By C. P.
On the Occultation of Saturn. By L. W. L.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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Jewelry, trimming for articles of, H. G. Mackinney 13,861
Shawl, J. G. Savage 13,864
Show stand, G. E. Cuming 13,856
Spoon handle, A. F. Jackson 13,860
Type, font of printing, H. Ihlenburg 13,859

TRADE MARKS.

Ale, ginger, Sachs, Pruden & Co 10,190
Baking powders, Ridenour, Baker & Co 10,197
Carpets, ingrain, R. Carson 10,192
Cigars, cigarettes, and all manufactured tobacco, L. Miller 10,194
Cigarette paper, May Brothers 10,198
Corsets, I. W. Birdseye & Co 10,186, 10,187
Cotton piece-goods, Amoskeag Manufacturing Company 10,185
Fish hooks and fishing tackle, R. Harrison, Bartleet & Co 10,189
Hermetically sealed vegetables, fruits, oysters, fish, meats, etc., F. H. Sieverd & Bro 10,195
Hop substitute, P. Müller 10,199
Medical compounds, certain, World's Dispensary Medical Association 10,191
Medicines, proprietary, Craig Kidney Cure Co 10,188
Medicines, proprietary, H. A. Ingham 10,196
Preservatives, food, Humiston Food Preserving Company 10,203, 10,204
Tobacco, cigars, and cigarettes, chewing and smoking, Goodwin & Co 10,200
Tobacco, cigars, and cigarettes, smoking, Goodwin & Co 10,201
Tobacco, composition of, J. J. Lawrence 10,198
Tobacco, manufactured and unmanufactured, E. Hoffman & Son 10,202