altered. Looked at attentively over the ship's side at night the water was seen to contain an enormous number of luminous particles pressed close together, and more brilliant close to the side (where disturbed). Some four hundred of these corpuscles, one to two centimeters long, could be counted in a bucket holding ten liters of the water. Drawn out, these were seen to be of gelatinous substance, which quickly dried and disappeared, leaving a dark globule one millimeter in diameter, which, in the microscope, presented a transparent ovoid animalcule, filled with eggs, and moving its fins and tentacles incessantly. A drop of water added to the dark globule brought back its luminosity; and when the creature was bruised in the hand, it gave a bright mark, which was quickly extinguished, and which had no smell. The milky water, kept till day and looked at in the dark, shows no luminosity, even though agitated; nor does the water procured by day and brought into darkness. It remains to be determined what causes the luminosity of those animalcula, and information is also desirable as to the position of the various milky seas on the globe, the times of their appearance, whether they persist in the same place or not, etc. Several of the officers on board the Armide had witnessed the phenomenon before, but never so brilliant or so continuous. The Armide, in going out, had passed thirty leagues further north in February, 1878, without encountering anything of the kind.

New Treatment for Cancer.

The *Lancet* calls attention to an important series of investigations conducted at the Queen's Hospital, Birmingham, as to a new method in the treatment of cancer, by Mr. John Clay, obstetric surgeon to the hospital, and professor of midwifery at Queen's College. Hitherto this terrible disease has proved incurable by medical treatment; but the inquiries and experiments conducted by Mr. Clay lead to the belief that by the use of Chian (or Cyprus) turpentine—which he has been the first to use—cancer can be not only arrested, but cured, without a surgical operation.

Mr. Clay's paper was published in the *Lancet* of March 27. He recommends his treatment especially in cases of cancer of the female generative organs. He says that he had made extended trial of various remedies, both general and local, but at last concluded that if cancer could be cured it must be by medicine administered internally, and must be of such a nature that it could be taken for a long time without affecting special functions or general nutrition. A study of the pathology of cancer led him to the opinion that a carbo-hydrate of some kind might prove beneficial, and for several reasons he decided that Chian turpentine might prove the most suitable. An opportunity was soon presented. A woman, aged 52, came to the hospital with cirrhous cancer of the cervix and body of the uterus. "Hemorrhage was excessive, pain of the back and abdomen agonizing, and cancerous cachexia well marked. The patient evidently had not a long time to live. In such a case it appeared to be justifiable to attempt to relieve the sufferings of the patient, even if the remedy should produce unfavorable symptoms, or should prove of no avail. I therefore prescribed Chian turpentine, six grains; flowers of sulphur, four grains; to be made into two pills, to be taken every four hours. No opiates were prescribed or lotion used. No change was to be made in her diet or occupation. On the fourth day after taking the medicine the patient reported herself greatly relieved from pain, and was in better spirits, but she complained of a large amount of discharge. It was feared that she referred to a discharge of a sanguineous nature. On examination, however, the vagina was found to be filled with a dirty-white secretion, so tenacious as to be capable of being pulled out rope-like, and this, although she had syringed herself three hours previously." The medicine was continued for twelve weeks with excellent results and every appearance of a cure being probable. At the end of that time she suddenly left the town and left no address.

The second case was a younger woman, aged 31. In this instance the cancer appeared to be melted away by the turpentine in four or five weeks.

Mr. Clay reports several other cases in which remarkable benefit evidently resulted, with every prospect of permanent cure. Some cases have been cancer of the breast, abdomen, etc. In a case where the turpentine could not be digested in pills, it was made into an emulsion by Mr. Whinfield, dispenser to the hospital, as follows: An ethereal solution of Chian turpentine was prepared by dissolving 1 oz. of the turpentine in 2 oz. of pure sulphuric ether (anæsthetic). The ether dissolved the turpentine instantly. Of this solution, ½ oz.; solution of tragacanth, 4 oz.; syrup, 1 oz.; flowers of sulphur, 40 grains; water to 16 oz.: 1 oz. three times daily.

Mr. Clay remarks that "ordinary oil of turpentine, if it produces any effect on cancer, is inadmissible on account of the speedy production of its specific effects, even when administered in small doses. The same remark applies with less force to the Venice and Strassburg turpentines; in my hands they have not produced the same beneficial effects on cancerous growths as the Chian turpentine has done. The maximum dose of the last named drug, which can be safely and continuously given, is twenty-five grains daily It is advisable to discontinue the remedy for a few days after ten or twelve weeks' constant administration, and then to resume it as before. The combination with sulphur was given at first, and has been continued. It is doubtful whether much benefit is derived from the combination, but the effects have been so uniformly good with it, that it was thought advisable to contiuue its use. There is every reason to believe, from the trials made with other substances in combination with the turpentine, such as carbonate of lime, iodide of calcium, ammoniated copper, quinine, bebeerine, hydrastin, etc., that the turpentine is best administered simply, as the most marked and rapid effects have always been manifested when it has been given alone.

"The turpentine appears to act upon the periphery of the growth with great vigor, causing the speedy disappearance of what is usually termed the cancerous infiltration, and thereby arresting the further development of the tumor. It produces equally efficient results on the whole mass, seemingly destroying its vitality, but more slowly. It appears to dissolve all the cancer cells, leaving the vessel to become subsequently atrophied, and the firmer structures to gradually gain a comparatively normal condition.

"It is a most efficient anodyne, causing an entire cessation of pain in a few days, and far more effectually than any sedative that I have ever given. In the cases I have described no sedative was employed in any instance, although in some cases where great pain had existed previously to commencing the treatment, large doses had been given. Whether this arrest of pain arises from the death of the tumor, or, as my son suggests, is due to there being no longer irritation of the sentient nerves (in consequence of tension being withdrawn by the removal of the cells), the fact is the same."

How Ramuau Poison is Made.

In a letter to the *World* from the interior of Peru, Ernest Morris gives a minute description of the ingredients of the ramuau poison and the process of making it, as practiced among the Yajua and Tucuna Indians. These two little-known tribes prepare and supply all the poison used by Indians west of the river Japura in Brazil to the headwaters of the Maranon in Peru. This poison is sometimes called woorara; but the true woorara is prepared by the Indians of Guiana, chiefly from a species of strychnos, while in the preparation of the ramuau poison Mr. Morris is positive no strychnos is used.

During his stay with the Yajuas, Mr. Morris was permitted to accompany the Indians while collecting the plants and roots from which the poison is brewed; but his knowledge of botany is too limited to enable him to describe them scientifically. The following were used, the names being spelled as they are pronounced by the Yajuas.

No. 1. Ramuau.—This is the principal ingredient. It is a sepoy or climbing woody vine, varying from two to four inches in diameter, and is covered with a thin yellowish bark, which is exceedingly bitter to the taste. The leaves are very large, oblong, and deeply veined, and are of a light green color. The fruit and flower both unknown. Is a native of high land. The bark alone is used. No. 2. Wagana.—A large vine from four to six inches in diameter, with very small heart-shaped leaves, a native of low, flooded lands. It is very abundant. The roots alone are used. No. 3. Tuna.—A small tuberous plant with thick, glossy green leaves and beautifully variegated stalk, a native of low lands. The roots alone are used, and emit a very powerful and disagreeable odor, reminding one of asafœtida. No. 4. Rû-ûml.—A small bush with light green foliage, growing to a height of two feet, a native of low land. The bark and roots are both used, and are extremely bitter. No. 5. Cenu.—A very large bush with long, narrow-pointed leaves and very small white flowers, which are borne in clusters of three at the ends of branches. It is a native of high land, and is also bitter to the taste. The bark only is used. No. 6. Ne-wa-tu.—A small tree growing about twelve feet high. The trunk, which varies from two to five inches in diameter, is covered with a thin, light-green bark. The leaves are oblong and of a dark green. It is a native of high land. No. 7. No wu se; No. 8. Pupetu; No. 9. Ramre.—These are all small trees, the bark of which is used. No. 10, Mucutu, and No. 11, Newatu, are small shrubs. No. 12. Ramawe.—A bush attaining the height of three feet, with alternate fleshy, dark green leaves, which, upon being pressed, yield a whitish liquid, which, mixed with No. 9, gives to the poison that intensely bitter taste which it possesses when fresh. No. 13. Yellow peppers.

Many of the ingredients used in preparing this poison could, in Mr. Morris's opinion, be dispensed with. From four to six days are required to make one little pot, or two tablespoonfuls, of the ramuau. After the Indians have obtained a sufficient quantity of the plants and roots—and one would be astonished at the number they collect—they sit down on the floor, and both men and women carefully scrape the bark from the vine ramuau (No. 1), the principal ingredient. The bark is thrown into an earthen vessel, after which it is beaten and then pressed. It yields a whitish liquid, strong smelling and very bitter.

This liquid is put into a small earthen pot, conical in shape, and a great curiosity in itself, and suspended by a cord about eighteen inches above a slow fire. After a few hours Nos. 2 and 4 are added, after they have been treated in the same manner as No. 1. After the second day the mixture becomes almost black, and has the consistency of molasses. All this time it is very carefully watched by the Indians, who now and then taste it. Great attention is paid to the fire beneath the pot, for if the poison becomes the least scorched or burnt it is entirely worthless. After thirty-six hours No. 6 is added. During this time he had repeatedly tried the strength of the poison upon frogs. Grasping the animal by the hind leg he would, with a sharp-pointed stick, insert the fresh poison into the foot, but without any effect. But when tuna (No. 3) was added, the poison became very black, and, upon tasting it, he fouud that even if it was not strong enough to kill the frog, it was strong enough to take all the skin off his tongue.

This was now left to simmer for about ten hours, when the Indians tried its strength upon frogs, which are the hardest animal to kill with this poison. A few moments after being pierced with the poisoned arrow the animal died—too quickly, my interpreter said. So the Indians added one ingredient after another, the last being the small yellow peppers. Again and again they experimented, and when the frogs made one or two hops and then died, the poison was pronounced complete.

The poison made by the Tucuna and Yajua Indians is put in little earthen pots, made expressly for it, and never in gourds. These pots are hidden in the damp woods, where the poison does not become hardened. Often the poison is so strong as to be almost worthless, as birds and game shot with arrows tipped with it prove unfit to eat, and in a few hours putrefy.

ENGINEERING INVENTIONS.

It is well known that the cause of smoke is that the fresh air, entering the incandescent coal from below through the grate, has often all its oxygen consumed before it has passed half way through the layer of coal, so that the upper part of the layer cannot burn, but is simply heated by the underlying incandescent coal, while the products of the combustion of the lower layer of burning coal pass through the upper heated and not-burning layer, and carry with them the combustible gases evolved by the heat, but which cannot take fire for the want of free oxygen. In order to furnish these combustible gases ascending through the upper layer of coal with the necessary oxygen to burn, Mr. Benjamin F. Sherman, of Ballston, Spa, N. Y., has devised a means of introducing air in the furnace with a downward injection upon the fire by a vertically adjustable arrangement of pipes, which may be placed close to the coals or further from them, according to the requirement of the case.

Mr. John U. Sumpter, of Lynchburg, Va., has patented an improvement in the class of axle journal lubricators whose action depends upon capillary attraction, the vehicle for conveying the lubricant to the journals being fibrous material, such as felt, tow, cotton, or fabric of some kind. This invention relates to the means for holding the fibrous material and supporting it in contact with a journal.

An improved railroad gate has been patented by Mr. Samuel L. P. Garrett, of Lewisburg, Tenn. The object of this invention is to provide a railroad gate that an approaching train will open by the pressure of the flanges of the wheels upon a horizontal bar fixed parallel with the rails and rising a little above them.

Theories of Light and Color.

A good deal regarding light was known to the ancients. They knew the law of reflection and something of that of refraction, as shown by the reference of Seneca to the broken appearance of an oar when thrust into the water. Another phenomenon, that of the rainbow standing out in the sky as a sort of challenge to the human eye, could not escape detection. At one particular angle, as shown by Descartes, beams reflected by or emerging from a drop of rain were so welded together as to form a condensed sheath of rays, and it was in this condensed sheath that you saw the colors of the rainbow. Milton, in 1672, proved by the use of the prism, acted on by a beam of light thrown through an aperture in a window shutter into a dark room, that white light is not homogenal, but is composed of various constituents more or less refrangible, of which red is the least and violet the most refrangible. This premised, Professor Tyndall, by a series of beautiful and interesting experiments from apparatus managed by his assistant, threw upon a white screen disks of several colors in order to prove the true effect of intermixture. Thus the ordinarily received theory that combination of yellow and blue produces green was shown to be erroneous, the true effect of the combination of those two colors being, as proved to ocular demonstration, white. By the same means the true complementary colors were displayed. Fixing the eye on a white disk until the lecturer counted twenty and the special illumination of the disk was withdrawn, the spectator saw remaining the filmy semblance of the complementary color, black. Blue left orange, red left green.—*Professor Tyndall at the Royal Institution.*

What We Think with.

Without phosphorus, no thought. So declared a famous German physiological chemist, some years ago. That particular brain substance, which he supposed to be essential to thought, has heretofore been known as protogen with phosphoric acid. Considering this name not sufficiently clear and definite, another German chemist has proposed for it the following precise and significant combination of seventy-two letters: Oxaethyltrimethylammoniumoxydhydrateleylopalmethyloglycerinphosphorsaüre. If mental derangement is in any way due to deficiency in the elements of this highly complicated compound, or to any snarling of its multitudinous constituents, the wonder is that anybody can ever think straight. And what a lot of it that German must have had in his head when he contrived such a name for it!

Manufacture of Antique Plate.

According to the London *Industrial Guardian* the manufacture of pseudo-antique articles in bronze, china, and plate is carried to a greater extent than most people are aware of. It is no exaggeration to say that this stuff is manufactured and sold in tons. The ways in which the public is imposed upon and the government, in many cases, defrauded by those who manufacture and vend it are various. First, there is what may be called the "hereditary plate trick." This plan is to get up articles after the antique, and to engrave upon them a fictitious inscription, as *e.g.*, "Presented by Lord A—— to his esteemed friend the Earl of B——, on his coming of age, A.D. 1750." The next step taken by some ingenious swindler is to write to some descendant of Lord A——, or of the Earl of B——, informing him that Mr. —— has obtained possession of an interesting *relique* of his distinguished ancestor, and to suggest the advantage of his lordship keeping it in the family. Then there is what may be styled the "ordinary trick" of the trade. The method here lacks the invention of the other, but it is sufficiently ingenious for the gulls for whom it is intended. The dealer purchases some ancient article, say a saltcellar, worth about £1 sterling. He then takes this to some needy and unscrupulous silversmith, and induces him to clip the Hallmark from this genuine article and to solder or affix it to the bottom of some spurious article of a much larger size. Sometimes the silver of the latter is of a much inferior quality to that of the former, but not always. The article is then displayed in the dealer's window, with a well-devised advertisement, and sold as a genuine antique at a fancy price.

The "spoon trick" is probably the most lucrative method of swindling the public known to the *pseudo*-antique artificer, and at the same time the most difficult to detect. It is managed as follows: The dealer purchases some old spoons, and, cutting off the shanks, beats the portion on either side of the Hallmark out thin, and then incorporates it with some vessel of inferior workmanship; or, cutting out the mark only, solders it into the "wire" running along the base of a cup or vase. This can be done by an ordinary workman so neatly as to defy detection by any but an expert. In all of these instances it will be observed that a genuine mark is used, the imposture consisting solely of fixing the antique stamp to a modern vessel, and thereby inducing the unwary customer to pay an exorbitant sum for the article. But there are members of the fraternity of knaves who descend to a deeper depth of rascality. Probably they do not see the advantage of being nice in iniquity. At all events they do not scruple to forge the Hallmark as well as the age of the article which they sell. This is easily accomplished with the aid of Chaffers' book of Hallmarks, which was originally intended as a shield to honest dealers, but which has become a two-edged sword in the hands of knaves. To give the article thus stamped with forgery an antique appearance, the dealer oxidizes it with sulphur fumes, and sells it for twice or twenty times its value. Lastly, there is the "foreign plate trick." This consists of manufacturing articles in imitation of German, Dutch, and other foreign productions, and marking them as if they were such. The dealer by this means robs the government of the duty of 1*s.* 6*d.* an ounce which he would otherwise have to pay, and in many instances obtains the price of genuine silver for a composition little better than nickel.

We suspect that a great majority of the antique *treasures* are of the above class which American travelers bring home from abroad, which were obtained through the special influence of some newly made acquaintance, or the self-sacrificing dealer who had always desired the special article should go to America; he assuring the purchaser that the round sum demanded was of minor consideration compared with the fact of the relic going to the States.

And it seems almost a pity to have the delusion expelled by an exposure of the tricks of the modern artificer, thus rendering the possessor of the supposed to be veritable antique suspicious of the genuineness of his treasure.

A Rising Industrial City.

Among the rapidly growing manufacturing towns of Connecticut few if any are making more substantial progress or enjoy brighter prospects of future development than Birmingham, at the junction of the Housatonic and Naugatuck rivers, ten miles west of New Haven.

The census of 1870 found in Birmingham a population of 2,103. To-day, in spite of the general industrial depression of recent years, the town boasts of 10,000 inhabitants within a radius of two miles. There are ten important manufacturing establishments on the power of the Ousatonic Water Power Company, and as many more, within the limits of the town, on the power of the Birmingham Water Power Company. There are churches of all denominations, excellent schools, a bank with $300,000 capital, a savings bank with over $1,000,000 deposit, gas and water works, telegraphic facilities, two lines of railway, abundant water communication by way of the Housatonic and the Sound, and all the other advantages for business and residence characteristic of a thriving New England town. Much of its rapid growth is primarily due to the enterprise of the Ousatonic Water Power Company, of which D. S. Brinsmade is secretary, in developing the natural advantages of the place in connection with its superior water power. By means of a dam of solid masonry, 22 feet high and 800 feet long across the Housatonic River, the largest and most reliable water power in the State was brought under control ten years ago, and the foundation laid for a large and prosperous industrial city. For after all that may be said of steam power—especially when coal is cheap, as it has been during the recent depression in the coal trade, or when steam power is taken in comparison with unreliable water power—the advantages of a reliable water power like that at Birmingham are incontestable. It is abundant, constant, and cheap, and costs per horse power only about one-third the average for steam power in New England. The Ousatonic Company own a large amount of real estate in the immediate vicinity of their works, providing ample room for mills and for the dwellings of operatives; also lots more remote, admirably adapted for first-class residences; all offered on such liberal terms to desirable parties that it is safe to predict for Birmingham a rate of growth in the immediate future as much more rapid than that of the past decade as the general prosperity of the manufactures of the country promises to be greater.

In addition to the attractions already enumerated Birmingham is favored by close and speedy connection with New York by rail and by water. Two lines of competing railways and a good water route insure reasonable freight rates; and the nearness of the town to the other manufacturing centers in the Naugatuck Valley removes any fears as to the supply of skilled labor. The town is also happily situated on the score of general healthfulness, and the surrounding scenery is fine.

To Distinguish Dyes in Colored Goods.

It is often necessary to know with what coloring matters a pattern has been dyed. In some cases an experienced dyer can soon ascertain, almost at a glance, or by simple methods, which dyestuff has been employed; but with many colors this is sometimes impossible. Especially is this the case with blue dyed fabrics, in which it is not easy to say whether a pattern has been dyed with vat indigo alone, or has been topped with cheaper stuff.

This detection can be made by a chemical analysis, the method consisting in destroying one of the coloring matters by some reagent, and thus prove its existence by the use of the destroying medium. To ascertain which mordant has been used, it is only necessary to burn a certain quantity of the fabric, and to find out by chemical analysis which oxide was present on the fabric. These methods are, however, only of use to chemists; but the following is a simple method that may be employed by anybody to determine the coloring matter. To begin with blue dyed fabrics. *Vat blue*, in the first place, is neither affected by alkalies nor acids (with the exception of nitric acid). Only chlorine and chlorine compounds react on vat blue.

A blue dyed with *sulphate*, or *extract*, or *carmine of indigo*, is readily abstracted by boiling water, and even more so by caustic alkalies.

Prussian blue is easily recognized by using alkalies which destroy it, while chlorine and acids have no effect upon it. However, the alkaline chlorine compounds of commerce (bleaching powder, etc.) react upon it.

Goods dyed with *logwood* give, with acids, a coloration more or less yellowish. In case there is another color associated with logwood, the latter may be extracted with a large quantity of acid. The fabric is then well washed, and the remaining color examined.

The red colors are more difficult to determine; but these colors have not the same importance as the blues.

Colors dyed with *cochineal* and *Brazil wood* (which, however, every dyer can easily distinguish) become gooseberry red when treated with muriatic acid. If it is washed, and then passed through milk of lime, a pretty loose violet is obtained. *Madder red*, treated exactly in the same way, and after the milk of lime bath boiled with soap, acquires a more intense color.

Cochineal red and *Brazil wood red* can be easily distinguished by means of oxalic acid, cochineal red becoming brighter, while the other is more or less destroyed.

Black, which is generally dyed by two methods, either with iron or chrome, when treated with chlorine, is destroyed if dyed with iron; but, if a chrome black, resists to a certain extent, only becoming chestnut brown, even with strong treatment.

To distinguish other colors there are many methods, which are, however, too complicated to be mentioned here. Aniline colors require greater chemical knowledge to distinguish them from each other.

Quenching a Fire in a Coal Mine.

"Anthracite," writing to the *Tribune* from Wilkesbarre, Pa., gives an interesting account of the means lately employed in quenching the fire in the Stanton shaft at that place. The fire began with the burning of the breaker on the night of May 3, 1879. The shaft, 840 feet deep, was filled with water, and when it was pumped out it was found that there was still fire in a part of the mine (a slope up from the bottom of the shaft, about 500 feet in length and 200 feet vertical height), from which the water had been kept by the inclosed air, which had no means of escape.

The fire was burning so briskly that they were compelled to let the shaft fill with water again to prevent the entire mine from getting on fire. To get the water to rise into the A shaped apex of the coal measures where the fire was, they employed Mr. John Muirhead, of Wilkesbarre, to drill a hole six inches in diameter to strike the burning gangway at the highest point to let the air out, so that the water would rise and fill the cavity.

At the depth of 662 feet he found indications of the internal fire, and the borings came up very hot. At 667 feet his drills got fast in the heated rock and coal, for, instead of coming out in the gangway, he was in the solid coal at one side of it. His method of getting his drill loose was rather novel. After all the known methods had failed he had 670 feet of inch pipe, weighing 1,008 pounds, attached to the beam of his drilling machine, and connecting the pipe with a powerful pump he forced a stream of water through the pipe at a pressure of 200 pounds to the square inch. The end of the pipe was fitted with a circular steel bit, and by working the drilling apparatus he succeeded in removing the obstruction and getting his drill out, after drilling to the bottom of the vein—685 feet. The air could not escape; so to remove the partition of coal between the gangway and the hole, they put down a cartridge of giant powder 10 feet long, charged with 100 pounds of giant powder, and fired it with a battery. The powder had only about 30 per cent glycerine, and did not prove strong enough to burst the barrier. Then they put in a larger charge of 80 per cent glycerine and burst the coal out at the bottom. The water filled the hole within 50 feet of the top.

The main interest in this experiment will be reached after the water is pumped out and they have seen what the effect of a large charge of nitro-glycerine has been at that great depth and under the great pressure of over 600 feet of water. Torpedoes are used in oil wells, but the exact effect is not known.

Care Needed in Canning Fruit.

Recently four members of a Brooklyn family were taken violently sick after eating canned cherries. The poisoning was found to be due to a salt of zinc formed by the action of the free acid of the fruit on the zinc screw cover of the jar. In his report the chemist said:

"The presence of a zinc compound in the sirup was unmistakable, and it appeared in such abundance that some lack of precaution is preparing the fruit seemed probable. I learned, however, upon inquiry that the preserving had been done with scrupulous care by a friend of the family. Moreover, the contents of other jars of the collection prepared at the same time had been eaten without unpleasant results. As the jars yet unopened were placed at my disposal through the politeness of Mr. Gilbert [whose family had been poisoned], I selected one having a zinc top with a porcelain lining. There was no indication of zinc in the contents of this jar. I then poured about a fluid ounce of the sirup of this jar into the cover of the first jar and warmed it over a water bath for three quarters of an hour. The solution then yielded promptly to the test for zinc. . . . The case is not without parallel, but it is not sufficiently well known to the public that zinc yields so readily to the action of fruit acids, and consequently that the use of zinc or galvanized iron in the preparation or preservation of canned fruits is not free from danger."

Where the Colors Came From.

A Detroit man received from Japan a couple of Japanese hand-made illustrated books. The illustrations were finely colored. The Detroiter was particularly struck with the brilliancy of two of the colors. He saw that the Japanese had evidently some secrets in the color line that were worth having, so he wrote to his friend in Japan to see the bookmakers, and if possible find out where they got their colors and purchase some to send to Detroit. Yesterday, says the *Free Press*, an answer came from Japan. The gentleman there found where the colors were sold, and on making inquiry at the paint shop, he found that one of the colors came from Basle, Switzerland, while the other came from America.

Polar Shoes.

A Philadelphia firm are making fifty pairs of shoes for the members of Captain Howgate's Polar Expedition. Each pair weighs about five pounds, and are large enough to allow the wearer to protect his feet with three or four pairs of thick stockings. The soles are three-fourths of an inch thick, and between the inner and outer soles are layers of cork. The uppers are thick black Arctic beaver cloth, lined with lamb's wool, with a layer of bladder between.

The Birth Rate in France.

The *Continental Gazette* notes that the birth rate in France is steadily diminishing; so is that of marriage, but in a lesser degree, the number of children resulting from these marriages having greatly declined. In the class composed of petty tradesmen or the well to-do peasants there is seldom more than one child per marriage, and it is stated that in one of the royal communes in Picardy the number of children among the best-off of the peasants is thirty-seven for thirty-five families. What, asks the *Gazette*, is to be the ultimate destiny of France if this decline of the population continues?

Pita—A New Fiber Plant.

The American Consul at Vera Cruz has been calling attention to a new fiber plant, a species of cactus commonly called "pita," which promises to add materially to the resources of Mexico. Some of the fibers are sixteen feet long. The fiber is strong and silky, and capable of minute subdivision. Some months ago a native of Vera Cruz sent some of the fiber to England, where it was woven into handkerchiefs, which were strong and extremely beautiful, appearing more like silver tissue than like linen. The plant grows wild, and there are millions of acres of it.

Molecular Changes in Iron.

At a recent meeting of the Society of Telegraph Engineers, Prof. Hughes communicated the results of his further experiments in this direction. He finds that the brittleness is not due to any flaw in the steel or iron wires which he immersed in the acid, but invariably happens with all kinds of steel or iron. Nor does it arise to any specific proportions of sulphuric or other acid to water. But as far as he has gone he has not found any other metals, such as copper and brass, to behave in like manner, and therefore he is inclined to consider the property as peculiar to the metal iron.

The suggestion made by Mr. W. Chandler Roberts that the brittleness is due to absorption of hydrogen by the iron wire is fully borne out by the tests of Prof. Hughes. The brittle wire shows no change of metallic conductivity when tested by the induction balance, such as would be the result of heating, straining, tempering, or corroding the wire. Again, if the wire is immersed in very weak acid (one-twentieth part of sulphuric acid, say), it takes about thirty minutes for the wire to become fully brittle, whereas on immersing an amalgamated zinc plate in the same liquid also, and connecting it to the iron by means of a wire so as to form a voltaic element giving off abundant hydrogen at the surface of the iron, the full effect is produced in a minute or two, owing apparently to the absorption of the hydrogen by the iron. In the latter case, too, the presence of the zinc protects the iron from the action of the acid, and therefore demonstrates that the brittleness is not due to a mere surface corrosion.

It is not absolutely necessary that the zinc should be in the same cell with the iron, for if a current from a few cells of an external battery is passed through two iron wires acting as electrodes in sulphuric acid and water, both wires become brittle, though in a very different degree, the wire connected with the zinc or negative pole becoming bright and excessively brittle, while that connected with the positive pole is much corroded, and but feebly brittle. Prof. Hughes also finds that with this arrangement, all acids and neutral salts he has tried, as well as ordinary water, produce the brittleness in a space of time proportional to the conductivity of the liquid employed. When water and most neutral salts are used the negative pole is quite bright, but brittle, while the positive is much corroded but not at all changed in pliability.

Prof. Hughes believes the brittleness due to absorption of hydrogen in its "nascent" state, for he has obtained no such effect by continued immersion of the wires in carbureted hydrogen (or ordinary lightning) gas; whereas, as above described, when plunged in a medium containing hydrogen just freed from combination with some other elements, the brittleness is very marked. The hydrogen seems to permeate through the entire mass, for rods one-quarter inch thick require more time to be affected than the smaller needles experimented upon. Mr. Stroh has confirmed this observation by filing and polishing saturated wires down to a mere fraction of their original diameter, and still finding them to retain their brittleness. Once a wire is completely "hydrogenated" it appears also to retain its brittleness indefinitely. If, however, it be heated to a cherry red in the flame of a spirit lamp its flexibility is completely restored, and the hydrogen appears to be driven out of it. Prof. Hughes also remarked, curiously enough, that tension of the wire brought back its original flexibility. In connection with these results Prof. Hughes discovered that a wire immersed in sulphuric acid and water of any proportion, say one-sixteenth of acid, becomes afterward more electro-negative than at the first moment of plunging. In a voltaic cell with plates of amalgamated zinc and iron it is evidently the electromotive force of zinc and *hydrogenated iron* which is obtained. Moreover, Prof. Hughes finds that when the iron has absorbed its full complement of hydrogen the cell becomes constant, and shows but little signs of polarization, though "short circuited" for hours. After a few days' hard work through small resistance there is a slight diminution of electromotive force, owing perhaps to the acidulated water becoming more neutral by the formation of sulphate of zinc and iron. And, singularly enough, to restore the cell to its original electromotive force it is only necessary to *short circuit* it for a few seconds.

Now in most batteries, as is well known, short circuiting is the very thing to reduce the electromotive force, but with the iron-zinc cell, on the contrary, it restores it. The explanation of this anomalous result is doubtless due to the fact pointed out by Prof. Hughes, that it is not iron but hydrogenated iron which forms the electro-negative plate of such a cell, and that this iron is most electro-negative to the zinc when saturated with hydrogen. The highest electromotive of the cell is then obtained. Continued working of the cell probably weakens the electromotive force by robbing the iron of its hydrogen in some way, but on short circuiting the cell again clouds of hydrogen envelop the iron and enable it to absorb its full charge of the gas. It is not at the first instant after breaking the short circuit that the electromotive force is fully restored, but about ten seconds after, apparently when the iron has had time to absorb the hydrogen. Experiments made by Mr. H. R. Kempe, at the instigation of Mr. W. H. Preece, the president, tended on the whole to confirm these results.

An ingenious practical application of iron as a negative was also suggested to Prof. Hughes, namely, the chemical purification of mercury from zinc alloy by immersing the mercury in dilute acid and touching it with an iron wire. So long as any zinc remains in the mercury, hydrogen gas is given off by this conjunction. In proof of this, if after a certain time no hydrogen is given off, the mercury is simply touched with zinc for an instant the hydrogen at once reappears, and is evolved until this trace of zinc is thrown off by the mercury. In concluding his paper Prof. Hughes remarked that though the presence of hydrogen in iron rendered it more brittle, on the other hand it made it more electro-negative, and hence better able to keep free from rust.

A supplementary paper by Mr. Chandler Roberts, F.R.S., chemist to the Mint, established the fact that iron wires immersed in sulphuric acid behaved like the metal palladium and "occluded" or absorbed hydrogen. The late Prof. Graham found that palladium absorbed nine hundred times its own volume of hydrogen, expanding linearly at the same time about two per cent. This expansion was exhibited to the meeting by Mr. Roberts in a very conspicuous way, by means of a long index or lever actuated by the expansion of a palladium rod fed with hydrogen by means of electrolysis in a zinc-palladium cell. Mr. Roberts, by heating the brittle wires of Prof. Hughes *in vacuo*, has found that they occlude or absorb about twenty times their volume, irrespective of the "natural gas" in the metal, which amounts to from three to ten volumes of hydrogen and carbonic oxide.

It is, therefore, beyond a doubt that the brittleness is due to absorption of hydrogen by the wires, but as the president pointed out, this does not solve the problem *how* the gas produces the loss of pliability. That this brittleness is not attended by any loss of tensile strength in the wires would appear from some experiments of Mr. Stroh. Prof. Abel could not offer any explanation of the molecular process.

THE TEMPER OF IRON AND STEEL DUE TO GASES.

Mr. Anderson, chairman of the committee for investigating the true nature of tempering, said that Mr. Edison's experiments on tempering metal *in vacuo* had led him to the theory that what is called the temper of iron and steel is due to the gases, chiefly hydrogen, in the interior of the metal. Hardening the metal or tempering by heating, then suddenly cooling it, had the effect of keeping the gases out of it, and shrinking the particles of metal more closely together so as to increase their cohesion. He, therefore, asked if any hardening of the wires on immersion in the acid had been noticeable; and Mr. Stroh replied that he had found none. The wires were apparently as soft as before. Moreover, it seemed to have been forgotten by the meeting that Prof. Hughes in his paper stated that the wires when tested in the induction balance showed no change of strain or *tempering.*

Prof. Adams then explained that the molecules of hydrogen absorbed by the metal would probably, by separating the molecules of the metal further apart, reduce the force of cohesion, just as the atoms of one metal when alloyed with another lose their original cohesion. Prof. Perry pointed out that there were alloys, such as those of tin and copper, which were really stronger than either of the component metals, and that the cohesion of the iron wires did not seem to be affected longitudinally, for they were as strong as before when subjected to tensile stress. Mr. J. Munro suggested that the brittleness might be due to a mechanical effect in the wires. When a wire is bent one side is in tension while the other is in compression, and perhaps the intruding molecules of the gas would block up the intermolecular spaces on the latter side, and by preventing this compression cause the wire to snap across. At the same time the tensile strength of the wire need not be altered. He also endeavored to account for the fact cited by Prof. Hughes, that subjecting the wires to tension restored their pliability, by supposing that the stretching of the wires allowed the molecules of the gas to escape, or in other words that it "squeezed" them out.

The discussion, which was highly interesting, was terminated by Mr. Treuenfeldt, alluding to the practical importance of the subject in practical telegraphy; and Mr. Willoughby Smith observed that it had long been customary in soldering telegraph wires with a flux of sulphuric acid to see that the acid is properly "killed" with zinc, and to wash the joint carefully thereafter, in order to prevent any free acid from rendering the wire brittle. He might have added that resin is often used instead of a sulphuric acid flux for this reason. The deleterious effects of the acid, however, were, we think, commonly set down to corrosion, and in fine apparatus to a deliquescence causing loss of insulation.—*Engineering.*

How Postal Cards are Made.

In a long article on the history and manufacture of postal cards, the New York *Sunday News* says that the American Phototype Company—to whom the contract for making the postal cards of the United States was awarded in 1877—carried on the business in this city for two years; but to save the expense and risk attending the transportation of paper from the mill at Holyoke, Mass., the business was removed thither in the spring of 1879, a new building being erected for its accommodation. The main portion of the building is divided by a partition through the middle. One side is used by the contractors for manufacturing cards, and the other side by the Special Agent of the Post Office and his subordinates, in the transaction of the government business pertaining to making up of orders, and forwarding cards to the various post offices ordering them. No business, of whatever nature, is transacted with more systematic precision than is maintained in both departments of the postal card agency.

On entering the contractor's side, the first thing noticed is the large piles of paper, which are delivered to the contractors by the Parsons Paper Company in loads of 3,000 sheets each. The works consume on the average about three tons daily at present. The process of manufacturing cards is neither lengthy nor complicated, but is at once so novel and interesting that a brief description is well worth a recital. The sheets are about thirty by twenty-two inches in size, and are just fitted by the plates from which the cards are printed, each plate covering forty cards, four in width and ten in length. The printing is done on two Hoe super-royal presses by skillful pressmen, and as each sheet passes into the press the number of cards is unerringly recorded by registers attached to the presses, and which are carefully locked every night to prevent any tampering. The sheets are then piled up and allowed to dry in order that they may not be damaged by future handling. Incident to the rapidity with which the work is performed, now and then a sheet is misprinted, but this occurs only rarely, the number of cards spoiled in this way being not over one-tenth of one per cent, or one in a thousand on the average.

After drying thoroughly, the sheets are then passed through the rotary slitter, a machine fitted with circular knives, which cuts them into strips of ten cards each, and trims the edge of the outside strip. The strips are then passed transversely through the rotary cross cutters, the mechanism of which is similar to the "slitters." The cross cutters divide the strips into the single cards, which drop into a rotary hopper containing ten compartments. As soon as each compartment has received twenty-five cards, the hopper revolves and throws the cards out upon a table. A number of girls then take them, and after throwing aside all damaged cards, bind the perfect ones into packs of twenty-five each. Other girls then take the packs, and after recounting them, put them in pasteboard boxes containing twenty packs or five hundred cards each. The boxes are made entirely of one piece of pasteboard, without seam or paste, and after being filled are all weighed. Each box is supposed to weigh three pounds and two ounces. In the rear of the building is a large fire-proof vault with a capacity for storing 25,000,000 cards. By the stipulation of the contract the American Phototype Company is required to keep at least 10,000,000 in store all the time.

So rapidly has the popular demand for postal cards increased that the works have lately been run night and day, employing in all nearly fifty hands, and producing nearly a million cards a day on the average. The government portion of the works is no less interesting than the other. Here the business is carried on in a manner similar to that in the general post offices in large cities. Every post office in the country requiring postal cards sends its order, together with a requisition for other supplies, to the office of the Third Assistant Postmaster General at Washington. There the orders are separated, and all the orders for postal cards are made up in one general order to the agency at Holyoke, the names of ordering post offices being put down alphabetically. An order is sent every day, and often includes the orders of several hundred post offices, and requiring all the way from a few hundred thousand to two, three, and even four million cards to fill it. During the first month in each quarter the orders average much larger than at other times, for, as a rule, a large number of offices order supplies in those months to last for the quarter. As an example of this, there were ordered during the month of January last 36,488,500 domestic cards, while 16,582,000 filled the orders for February.

A large portion of all the cards made are used in the Eastern and Middle States. New York city alone uses about ten per cent of the entire production. Chicago stands next to New York, using more cards than Boston. The Southern States take but few cards.

The total number of cards issued during the fiscal year ending June 30, 1879, was 221,807,000. The department estimate for the year to close June 30 next is 259,514,190, an increase of seventeen per cent over the previous year's issue; but if the number issued for the first eight months of the year should be continued proportionately till the close, the year's consumption would amount to 275,839,750. If a like increase were to be presumed from year to year, before 1890 the yearly issue of postal cards would exceed a thousand millions.

Congress passed an act, March 3, 1879, providing for the issue of international cards at a postage charge of two cents each. It was not, however, until December 1 that the first were issued. The demand for them has not been as large as was anticipated. Up to March 1, this year, three months from the first issue, only 2,500,000 have been ordered, and of this number 1,000,000 went to New York city.

A Remarkable Case of Skin Grafting.

Probably the most extensive case of skin grafting ever attempted has been going on with gratifying success during the past year in Danielsonville, Conn. The patient, Jesse Morgan, eleven years old, fell into a vat of caustic potash on the last day of the year 1878. Both legs were immersed nearly to the hips, and the skin was so completely destroyed that a new growth was impossible. After some months of hopeless and excruciating agony, the older physicians of the place giving up the case as hopeless, a young man, Dr. George J. Ross, undertook to save the boy's life by skin grafting. Over two thousand grafts were used, the boy's mother, the family coachman, and many neighbors and friends contributing thereto. The process was begun in April, 1879, and though the work is not yet complete, the legs are nearly restored to their natural functions. The boy is still weak, but can walk a short distance without a crutch. The grafts are said to grow fastest in the spring months.

Business and Personal.

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

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Best American Shot Gun made is the "Colts." Far superior to any English guns for the same price. For description, see SCI. AMERICAN of May 29. Send for circular to Hodgkins & Haigh, Dealers in General Sporting Goods, 300 Broadway, New York.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Wilson's Business Directory, second edition, and Wilson's Co-partnership Directory for 1880-81, are now ready. Price, $3 each. All orders addressed to the Trow City Directory Company, No.11 University Place, New York, promptly attended to.

The Oriental Hotel, the largest of all the immense hotels at Manhattan Beach, the Pequot House, New London, Conn., the Old Orchard Beach Hotel, Maine, are now being painted with H. W. Johns' Asbestos Liquid Paints. H. W. Johns M'f'g Co., 87 Maiden Lane, New York, are the sole manufacturers of these paints, which are rapidly superseding all others for large and elegant structures, and for the better classes of dwellings everywhere.

$400 Vertical & Horizontal Engines, 30 H.P. See p. 349.

$5 to $20. A County Right. A Clothes Line Fastener. Sample by mail, 20 cents. J. A. Worley, Cleveland, O.

Free-stone Quarrying Machinery wanted. Circulars, etc., to Box 2606, P. O., Toronto, Ontario.

Oil Cups, $1.50 per dozen. Liberal discount per gross. Send ten 3c. stamps for two samples. James D. Foot, 78 Chambers St., New York.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

Silhouette.—I want a Silhouette Instrument. Address Geo. C. Henning, Washington. D. C.

Suction Fans or Blowers, $10 to $30. Send for circular. R. K. Teller, Unadilla, N. Y.

When you can't get the particular pen of Esterbrook's that you want, write to The Esterbrook Steel Pen Company, 26 John St., New York, for it.

Asbestos Board, Packing, Gaskets, Fibers, Asbestos Materials for Steam & Building Purposes. Boiler & Pipe Covering. Asbestos Pat. Fiber Co., limited, 194 B'way, N.Y.

Information and Recipes on Industrial Processes.—Fruit Drying and Preserving. Inks and Dyes. Ice Making. Cements. Blacking. Waterproofing. Fireproofing. Paints and Lacquers. Preparing Textile Materials. Cleansing and Bleaching. Vinegar and Wine Making. Sugar Making. Tempering and Hardening etc., etc. Park Benjamin's Expert Office, 49 and 50 Astor House, N. Y.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Geared Power Press, cost $450, for $200. York & S. Clev. O.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

For Middlings, Mill and Mill Furnishing, see adv. p. 348.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros. 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

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Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

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Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

For Patent Shapers and Planers, see ills. adv. p. 316.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 334.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 300.

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For Separators, Farm & Vertical Engines, see adv. p. 316.

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Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor. Stiles & Co., Riegelsville, N. J.

For Alcott's Improved Turbine, see adv. p. 234.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

For Standard Turbine, see last or next number.

For Power Paper, Lard, Cider Presses, see adv. p. 348.

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Milling, Profiling, Cam Cutting, Revolving Head Screw Machines. Pratt & Whitney Co., Hartford, Conn.

C. J. Pitt & Co., Show Case Manufacturers, 226 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

4 to 40 H. P. Steam Engines. See adv. p. 348.

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Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher. Schumm & Co., Philadelphia, Pa. Send for circular.

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Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 365. Totten & Co., Pittsburg.

Penfield (Pulley) Block Works. See illus. adv. p. 348

NEW BOOKS AND PUBLICATIONS

THE SUGAR BEET. An illustrated quarterly paper, devoted to the cultivation and utilization of the Sugar eet. Philadelphia: Henry Carey Baird & Co. Price 50 cents per annum.

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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.

(1) W. O. D. asks: 1. Will a pump working water from a heater into a boiler work in air if the supply is not sufficient to keep the pipes full? A. Yes. 2. Will the air do any harm? A. No, it would rather be an advantage.

(2) A. P. W. asks: 1. Would a cylinder, 3 inches diameter, 4½ inches stroke, run a side wheel boat, 12 feet long, 3 feet wide, working direct from the shaft (oscillating cylinder)? A. Yes, probably at a speed of about four miles per hour. 2. Can you tell me where to obtain the mercury flasks used in making the boiler described in SUPPLEMENT, No. 182? A. Any druggist can obtain mercury flasks for you. You may also get them from manufacturers of vermilion.

(3) J. W. C. writes: I have a battery of 32 cells (about one pint each) composed of carbon and zinc, but I cannot find the proper solution to make it work properly. I have just amalgamated the zinc very carefully, and used a solution made of the following: 1 gallon sulphuric acid, 3 gallons water, then dissolved 6 lb. of bichromate of potash in 2 gallons of boiling water, mixing the whole, and using when cold. I find that I get a very powerful spark, but not the burning heat that is required when one takes hold of handles attached to the two poles of the battery. And also, I find that the amalgamating substance has entirely disappeared. The battery, I understand, is a modification of Storms' element. Please tell me whether you think I have used the proper solution or not. The zinc and carbon are suspended in the cell about three-eighths of an inch apart. A. Your solution contains too much sulphuric acid. The following will be better: Dissolve 2 lb. bichromate of potash in 10 quarts of hot water. When cold add slowly and carefully 1½ lb. of sulphuric acid. By using an interrupter you will be likely to feel the effects of the current from your 32 cells. By employing a small induction coil having an interrupter, in connection with a single cell of your battery, you will get a secondary current that can be felt without any difficulty.

(4) H. C. B. writes: 1. I have constructed a pantograph as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, page 2506. I have no trouble in copying any drawing, either enlarged or reduced in size, but I have not been able to make a drawing the same size as the original. Will you have the kindness to tell me how to arrange the tracing point and pencil, so as that I can make a copy of the same dimensions as the original? A. Change places with the pivot and tracing point; that is, put the tracing point in the center of the middle bar. The tracing will be inverted. 2. Can you give me a good receipt for ebonizing wood? I would like the one which is now used by furniture makers. A See p. 19 (18), Vol. 40, SCIENTIFIC AMERICAN. 3. What is the best wood to use for small articles, such as hanging cabinets, which are to be ebonized? A. Mahogany, holly, maple, black walnut, in fact almost any wood may be ebonized.

(5) T. M. asks: 1. What is the velocity of steam under some certain pressure? A. Velocity flowing into the atmosphere at 30 lb. pressure above atmosphere, 1,400 feet per second; 50 lb. pressure above atmosphere, 1,429 feet per second; 70 lb. pressure above atmosphere, 1,444 feet per second. 2. Is there any difference in the velocity of steam through different sized pipes? A. No difference except that due to difference of friction in pipes.

(6) H. D. writes: I have a side wheel steamboat here that is geared up; the wheels are 10 feet diameter, buckets 11x30 inches, dip 14 inches; the engine is geared up to make 4½ revolutions to the wheel's one; the large gear wheel has wood teeth. There seems to be a good deal of back lash and noise. I want to stop it, or help it, if raising up the buckets would make any difference. A. Raising the buckets would relieve but not remedy the difficulty. Put a fly wheel on the crank shaft of the engines, or fit the gearing closer.

(7) E. G. S. asks how to test his steam boiler by hydraulic pressure. A. Fill the boiler entirely full of water by any convenient means, then with a force pump increase the pressure to the desired degree. Use a pressure gauge on the boiler to indicate the pressure produced within the boiler. Place an air cock or valve in the highest part of the boiler, and be sure all the air has been expelled before you close it.

(8) A. K. E. writes: 1. I desire to make an induction coil 8 inches long with ¾ inch iron wire; core in center wound round with about 7 layers of No. 18 cotton covered wire; and have a large spool to slide over this wound up with about 18 layers of No. 36 silk covered wire, and use a single Grenet battery such as is used in all electrical medical machines, and would like to know how many persons could be charged with this size of coil and receive a reasonable charge. A. Two or three layers of No. 16 wire would be better for the primary than seven layers of No. 18. Such a coil would be altogether too large for giving shocks. It would, if well made, give shocks that might prove dangerous. You will find full instructions for making induction coils in SUPPLEMENT 160. 2. How could I make a shocking attachment for same? A. The arrangement of the interrupter is shown in the article referred to. 3. What acids are used for making brass black and how used? A. See p. 371, Vol. 40, SCIENTIFIC AMERICAN. 4. I have often heard that 9 or 10 bells (electric) can be made to ring on the same circuit. Is it true, and if so, how are the connections made? A. Use single stroke bells.

(9) A. S. P. asks for M. Pellet's method, of producing blue lines on white by photo process. A. Chemically pure ferricyanide of potassium, 1 oz.; citric acid, 20 grains; dissolve in 5 ounces soft water. Immerse the paper in this, dry in the dark, expose under a negative, develop in a dilute aqueous solution of ferric chloride, wash in plenty of water.

(10) J. T. W. writes: 1. I have just read your article in the SCIENTIFIC AMERICAN SUPPLEMENT descriptive of the steam yacht Flirt. As you kindly consent to supply further information upon application, I make bold to submit a few queries. The text says: "The furnace is cylindrical, 11 inches diameter, and 16 inches long. The upper end of grate is about 11 inches from top of furnace." There must be an error, since that would bring the grate to the top of furnace. A. This is evidently an error or misprint, as the drawings show. 2. Does the stuffing box of the pump serve for guides, or are there guides besides that? A. The stuffing box is the guide. 3. About how much fuel and what kind does she consume? A. With sharp draught it might burn 25 to 35 lb. per hour less with the ordinary draught. 4. The grate surface, 1 square foot, and heating surface 34 feet, seem small for the quantity of steam consumed. Are these the correct figures? A. We would advise you to increase the boiler 25 per cent. 5. What would the complete machinery (boiler, engine, shaft, propeller, and connections) such as that of the Flirt cost (leaving out the nickel plating)? For how much could the machinery of the Flirt be purchased, if at all? How much would an engine not plated, the size of the Flirt's, cost, not including the shaft, propeller, and boiler? A. Complete about $280, without shaft and propeller about $240.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

May 4, 1880,

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 one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, 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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