SCIENTIFIC AMERICAN

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TOXICOLOGICAL NOTES.

An Italian journal, according to the *Lancet*, records a case in which, to a child two years of age, the administration of a grain and a half of santonine was followed by convulsions, beginning in the face and extending over the whole body, with dilatation of the pupils, hinderance to respiration, and urine colored by the drug. The most efficacious therapeutic measure was found to be artificial respiration whenever paralytic asphyxia threatened. The convulsions continued for three days, gradually lessening. It is difficult to believe that the dose of santonine was not, by error, larger than was intended. The case, however, is instructive in respect to the therapeutics of santonine poisoning, since further experiments on animals, suggested by it, showed that the most potent means of combating the effects was by artificial respiration, that the convulsive attacks were best treated by inhalation of ether, and the elimination of the poison furthered by purgative and abundant drinks.

Instances of poisoning by chlorate of potash are very rare. In one case on record, seven drachms were taken at once by mistake, and caused the death of an adult. Another instance has just been recorded in Germany. Some of this substance was being given daily to some children of a physician as a prophylactic against diphtheria, then epidemic. One day the children, three in number, obtained the stock of chlorate and commenced playing "doctor," and took altogether between three and four drachms. The youngest, aged two and a half years, began quickly to vomit, and continued to do so till her death, seven hours later, with symptoms of acute gastritis and great somnolence. The others recovered. In a case recently recorded five grain doses of chlorate, continued for a considerable time, caused almost constant gastritis.

A curious case of tobacco poisoning is recorded in France. A woman, by the advice of a midwife, gave to a child aged eighteen months, suffering from oxyurides, an injection consisting of a decoction of two cigars. Some minutes afterward the child began to vomit, and became convulsed. Half an hour later it was in a state of coma, interrupted now and then by convulsive movements. The pulse was frequent and feeble, the extremities cold, respiration irregular, and the pupils contracted. The symptoms lessened after injections of warm water, warm baths, and ammonia, and next day the child was pretty well. The two cigars contained about two and a half drachms of tobacco.

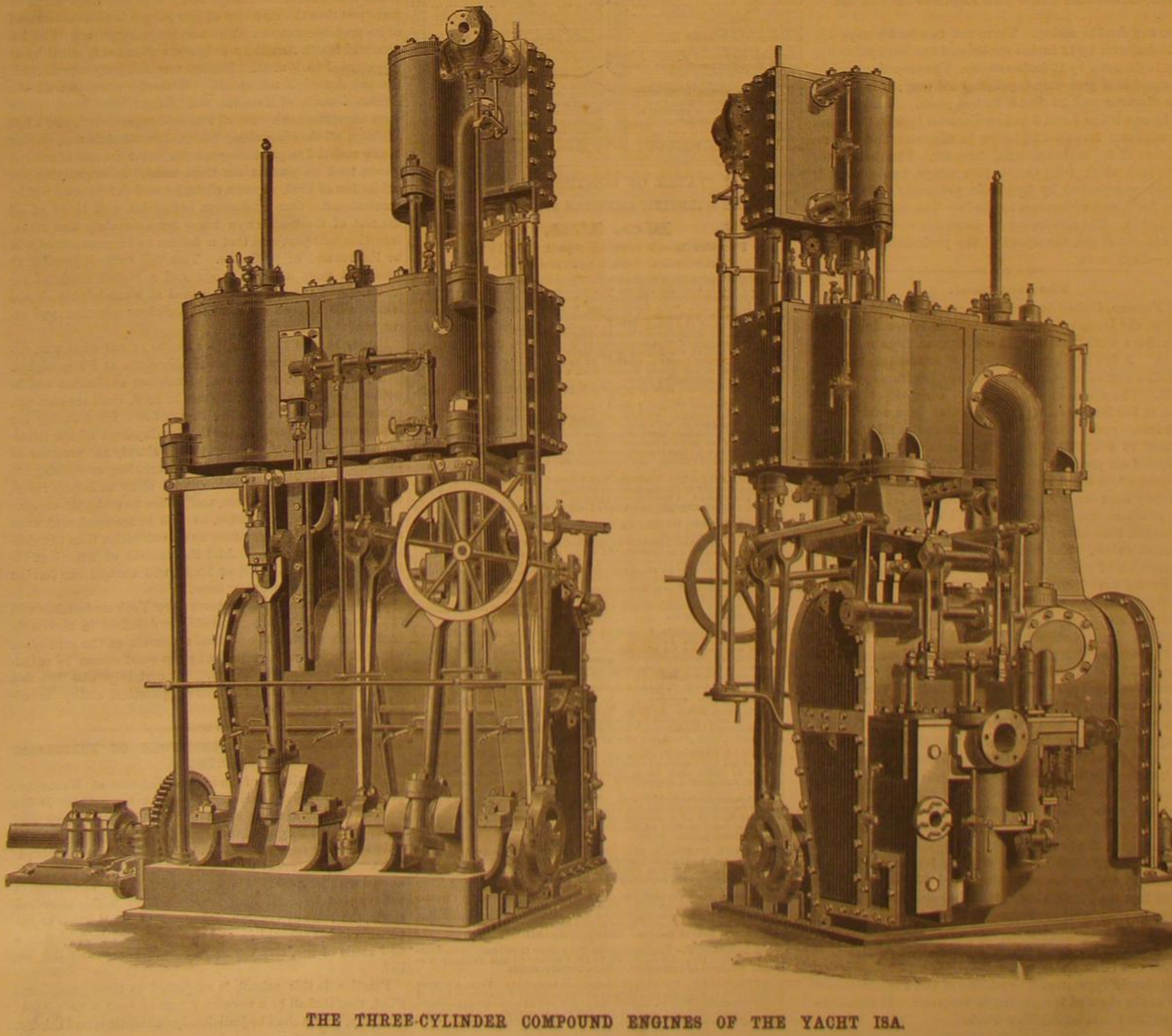
The *Pharmaceutical Journal* records a case in which a popular "soothing sirup" caused the death of an infant. The child, five months old, was supposed to be teething, and its mother purchased a bottle of "Mrs. Winslow's soothing sirup," administering ten drops of the nostrum about twice a day for about three days. On the night of the third day it died very suddenly from the effects of the medicine. The coroner said that the effects of "Mrs. Winslow's soothing sirup" were those of a narcotic, and that the *Pharmaceutical Journal* of 1872 stated that two doses had caused the death of a child fifteen months old, with the usual symptoms of narcotic poison. Analysis of this sirup showed that one ounce of it contained nearly one grain of morphine with other opium alkaloids. "It is not surprising," he adds, "that it should prove fatal to infants in small doses." However, it is safe to say that this case will prove no warning; and that mothers will go on just the same, stupefying their infants with Godfrey's cordial and "patent medicines," like the one above noted; and the practice will cease, perhaps, on the same day in the dim future in which the housekeeper and the average servant girl learn that benzine and kerosene are not proper substitutes for paper and wood in kindling the kitchen fire.

THE ENGINES OF THE YACHT ISA.

We illustrate herewith the engines of the yatch Isa, the property of Mr. H. Andrews, of Newcastle-on-Tyne, and belonging to the Royal Thames Yacht Club. The engines and boiler were built by Messrs. Douglas & Grant, engineers, Kirkcaldy, to the specification of Mr. Alex. Taylor, Newcastle.

The Isa is a well modeled twin screw yacht, with clipper bow and elliptic stern, 118 feet 8 inches length of keel, 18 feet 9 inches extreme breadth, 10 feet 5 inches depth moulded, and 10 feet depth of hold; flush decked, and rigged as a two-masted yacht, her yacht tonnage being 248 tons.

The engines are three cylinder compound, the cylinders



THE THREE-CYLINDER COMPOUND ENGINES OF THE YACHT ISA.

being 10 inches, 15 inches, and 28 inches in diameter respectively, all of 2 feet stroke. The high pressure cylinder is placed inverted over the intermediate one, the same piston rod serving for both, and there being space between for packing glands, etc. The cover of the intermediate cylinder is made in halves, so that its piston can be drawn without removing the high pressure cylinder. The crank shaft and screw shaft are forged from Lowmoor scrap, the diameter of journals being 5¼ inches. The surface condenser has 350 square feet of tube surface, the tubes are three quarter inch external diameter, packed with Marshall's patent rings. The air pump is 10½ inches in diameter by 12 inches stroke, and is single-acting; the circulating pump is 6 inches diameter by 12 inches

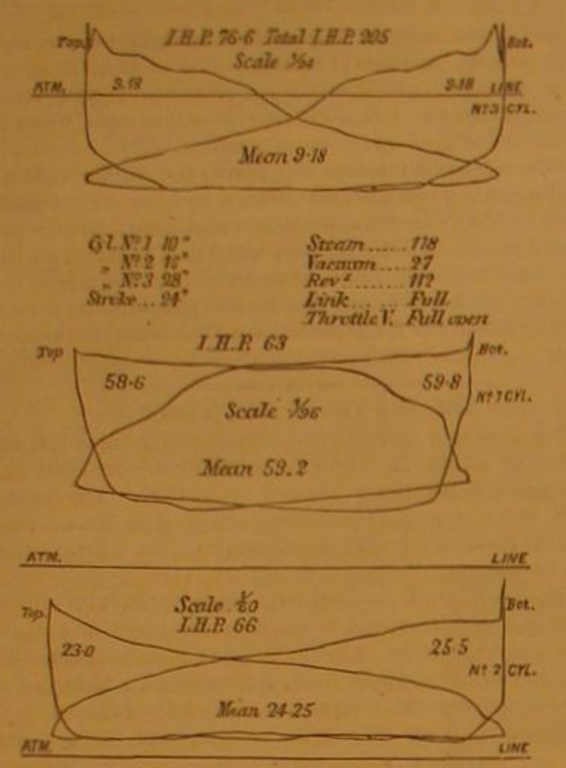


Fig. 2.—DIAGRAMS FROM THE ENGINES OF THE ISA.

stroke, and double acting. There are two feed pumps 1⅞ inch in diameter by 12 inches stroke, and one bilge pump 2⅜ inches in diameter by 12 inches stroke. The propeller has two blades and is of gun metal, polished all over; it is 8 feet 6 inches diameter and 12 feet 3 inches pitch. Steam is supplied by one boiler 8 feet 9 inches diameter by 8 feet 6 inches long, with two furnaces 33 inches in diameter, and 106 return tubes of 2¾ inches external diameter. The shell plates are one inch thick with double butt straps, treble riveted; the boiler was proved by hydraulic pressure to 250 lb. per square inch, and with steam to 150 lb. The working pressure is 120 lb. The accompanying diagrams were taken during a run out to sea, the speed of the yacht being about 12 knots.—*Engineering.*

The Suez Canal.

Mr. Farman, United States consul-general at Cairo, Egypt, furnishes the Department of State with an interesting article on the Suez Canal. His facts are derived from authentic sources. A few of them are selected of remarkable interest. The entire cost of the canal was 472,921,799 francs, or $92,273,907. The stock of the company consists of 400,000 shares, at 500 francs each. These shares have sold as low as 100 francs each. At the opening of the canal they had advanced to only 300 francs. They are now quoted at 717 francs, and are probably worth more. The British government paid about 568 francs. The number of shares bought, in 1875, by Lord Beaconsfield at this price was 176,602. This great purchase, aside from its political and commercial advantages, thus affords a clear profit of 25,000,000 francs at present prices. The balance of the stock is held by a large number of persons, mostly in France. The revenues of the canal have increased from 5,000,000 francs in 1870 to over 30,000,000 francs in 1877. The expenses, including interest, sinking fund, and lands, have been a little over 17,000,000 francs per year. While the revenues steadily increase, the expenses are decreasing or stationary. Deducting the amount paid for interest and the sinking fund, the actual expenses are about 5,000,000 francs annually. The cost of cleaning the canal and its accessories is only about 2,000,000 francs per annum. The small comparative cost of maintaining the canal arises from the fact that there are no locks or lateral embankments to be broken. Except the ordinary cleaning, there is little to be done. Vessels drawing twenty-five feet of water or less pass through the canal. The saving of distance to the British ships going to India is nearly 5,000 miles. Two thirds of all the vessels passing through the canal carry the English flag.

Monsieur Ferdinand Lesseps, who has been at the head of the enterprise since its beginning in 1854, expresses the opinion that the Panama canal must be constructed without locks to be successful or remunerative.

MATHEWS' BOILER ATTACHMENT.

In our last issue we gave an illustration and description of this simple apparatus. The address of Mr. F. C. Mathews, given at the close of the article, is incorrect. It should be 337 and 339 Canal street, New York.

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NEW YORK, SATURDAY, APRIL 19, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 172,

For the Week ending April 19, 1879.

Price 10 cents. For sale by all newsdealers.

THE WORLD'S FAIR OF 1883 AT NEW YORK.

That the hundredth anniversary of the acknowledgment of the Independence of the American colonies by the mother country in 1783, will be signalized by a grand world's fair in this city, may be accepted as morally certain.

The occasion will be one demanding especial recognition; and in this industrial age there is no way by which the great events of a nation's history may be celebrated so appropriately or so profitably as by a national or international exhibition of the arts and sciences. From idle pageantry and noise and mock engagements at arms, national celebrations have risen to the higher level of useful exhibitions of industrial achievements, progress in the higher walks of civilization, national resources, and the thousand inducements which commerce offers for the closer interweaving of nations in the arts of peace and mutual helpfulness.

Neither the educational nor the industrial nor the commercial benefits which flow from such exhibitions need be argued now. That lesson was sufficiently learned three years ago, and the coming census will show that Philadelphia alone has reaped a sufficient harvest from the Centennial Exhibition to more than repay the cost of it, had the burden fallen upon that city alone. And not only Philadelphia, but the whole country, even to the smallest hamlet or farmhouse or wayside workshop, however remote from the great centers of trade or manufacture, is to-day enjoying a real and growing prosperity, in which may be traced the influence of that exhibition, either in creating new industries and finding new markets, or in improving, stimulating, and widening the old. And whatever good was accomplished in 1876 will be easily confirmed and surpassed by the exhibition of 1883. The former demonstrated not merely the profitableness, but the possibility of a successful world's fair on this continent; and not only will our own people take a more lively interest in the next one, but millions of our American neighbors, who were but feebly represented, or not represented at all, at Philadelphia, will have the strongest possible incentive to come forward in 1883. The one took place during a period of profound industrial and commercial depression; the other will reap the advantage of the rising tide of what promises to be a period of national prosperity such as the world has never yet seen. The projectors of the Philadelphia Exhibition were met with almost universal doubt and incredulity; and it was not until the show was open that the majority of our people became convinced of its probable success. The vast majority of our West Indian and South American neighbors were not reached by or represented in it at all. Mexico was meagerly represented; Central America not at all. With the exception of the British Islands of Jamaica and Nassau, the West Indies were unrepresented. Brazil was well represented, and Chili slightly; all the other rising States of South America, so rich in raw material, so promising as markets for our manufactured goods, took no part at the Centennial. In organizing the exhibition of 1883, no such obstacles and deficiencies will be encountered. Our productive industries, and those of all the rest of the world, now know for a certainty that representation will pay, and that a failure to be represented will be the reverse of profitable. This will make it possible to secure at once a wider range and a higher grade of exhibits. And the experience gained at Philadelphia should secure also a more critical and judicious selection and arrangement of materials.

It may be said that it is too soon to repeat what was, despite its shortcomings, so admirably done at Philadelphia. True, but not too soon to hold another exhibition which, without repeating what was done in 1876, shall supplement, extend, and crown the work begun there for securing the supremacy of our country in the development of the peaceful arts and sciences. To represent simply the progress of the world between 1876 and 1883, excluding everything exhibited at Philadelphia which cannot show an improvement upon what was shown there, will suffice to make the coming exhibition as wide in scope, as rich in material, and even more valuable and instructive as an exhibition than the Centennial Exhibition was. And the success of American exhibitors, there and since, at Paris, will compel our foreign rivals to send the best they have.

We may be sure that whatever New York undertakes will not be second rate in magnitude nor deficient in thoroughness of execution. The assured character of the gentlemen engaged upon the new project gives good reason to anticipate a successful exhibition. It certainly will not fail through any lack of broad views, practical ability, or administrative capacity.

THE WORCESTER FREE INSTITUTE OF INDUSTRIAL SCIENCE.

The Free Institute of Industrial Science at Worcester, Mass., has now been in operation just ten years. It has graduated eight classes; and the list of the residences and occupations of its graduates shows them to be, almost without exception, engaged in honorable and lucrative occupations. Very naturally the great majority of them are connected with important productive industries. The directors believe that by combining practical work with theoretical study, the student's entrance upon professional life is an expansion of his school life, and not an abrupt transition to a new mode of life, and the results seem to justify the belief.

Practice, in this school, is subjected to three conditions: First, that it shall be a necessary part of each week's work; secondly, that it shall be judiciously distributed; and thirdly, that the students shall not expect or receive any immediate pecuniary return for it.

At the middle of the first year every student (except the mechanical section) chooses some department under the advice of the instructors, and, until his graduation, devotes ten hours a week and the month of July, to practice in that department—that is, for two and a half years. Students who select chemistry, work in the laboratory; the civil engineers, at field work or problems in construction; those who select drawing, in the drawing room; and physics, in the physical laboratory. The mechanical section practice in the workshop from the beginning of the apprentice half year, and their practice extends over the whole course of three and a half years.

We should be glad to see a similar institution in every American town.

THE BALTIMORE WATER WORKS.

We have given in previous numbers details of the Baltimore water works and the great seven mile tunnel now being bored through solid rock to increase the supply of water, but for the benefit of such of our readers who have not seen the articles referred to we will state that the city of Baltimore, having found its water supply insufficient, is now engaged in constructing an immense addition to their water works, consisting of a storage lake to be known as Loch Raven, about 5 miles long, and from 500 to 1,000 feet wide, with an average depth of 20 feet; an immense dam at the lower end of this reservoir, to raise the water to a proper level; a tunnel 7 miles long, to carry the water to a receiving reservoir, to be known as Lake Montebello; a drainage tunnel, 9 feet in diameter and 2,870 feet long, to divert from the reservoir the impure water of Tiffany's run and the surface drainage; and Clifton tunnel, 12 feet in diameter and 2,975 feet long, to connect Lake Montebello with a series of six lines of 40-inch cast iron pipes, which carry the water to the city limits to connect with the city mains.

To the politeness of Mr. R. K. Martin, the Chief Engineer of the Water Department in charge of the work, we are indebted for further particulars of the progress of the work up to March 1.

LOCH RAVEN.

The work done on this division since our last account consists principally in constructing bridges to span the ten streams emptying into the lake and crossing the road surrounding it, and in excavating the margins of the lake to give it the necessary depth. Of the bridges, four have been built during the past year of white marble in the most substantial manner, which are quite ornamental in appearance, and another one was commenced in November. The greater portion of the excavations of the margins are now completed, but little remaining to be done in order to have the lake ready to receive the water backed up by the dam when finished.

THE DAM

consists of a mass of masonry 34 feet high at its deepest part, nearly 500 feet long, and 65 feet thick at its base, backed by 165 feet of puddle clay, gravel, and riprapping. This work was divided in two parts; the bed of the stream having been diverted to one side, the eastern half of the dam was then begun and is now finished. The course of the stream has again been diverted, this time through a gap in the masonry of the dam, by means of a coffer dam, and the former bed is now being excavated for the foundations of the western portion of the dam and the gate house at the entrance to

THE TUNNEL.

This immense work, the longest tunnel on the continent, has made great progress during the past year, several of the headings having met, and there remained on the 1st of March only 3,321 feet (or about one eleventh of the entire length) to be driven, when the tunnel will be pierced from end to end, which it is believed will be done by next autumn. In six divisions out of the sixteen into which the tunnel is divided by the shafts, the headings have met, and there are several others where they soon will meet. The greatest difficulty appears to be between shafts 1 and 2, where the tunnel runs through limestone rock, through the fissures of which the water from a stream called Mine Run enters the tunnel in large quantities, and has driven the workmen out of the tunnel several times. There remained on March 1st, 1,290 feet of this portion of the tunnel to be driven, which is about three times as much as in the most backward of the remaining divisions. The total expenditure on the tunnel to March 1 has been $1,141,624.50. The next section of the work is

LAKE MONTEBELLO,

on which good progress has been made. The filling in of the bottom of the lake has been completed, and the embankments at the eastern and western ends of the lake are advancing toward completion. The gate house is finished to within a few feet of the top of the embankment or road surrounding the lake.

THE CLIFTON TUNNEL

was completed and arched up during the past year. This tunnel, being driven through soft material of the very worst kind for tunneling, gave the engineers and contractor considerable trouble, and much praise is due them for the successful manner in which the work was prosecuted to its final completion. This tunnel for its whole length had to be lined with brickwork, but the main tunnel was mostly through solid rock, requiring arching only in places.

From this it will be seen that the new water works are being pushed rapidly toward completion. When finished they will give Baltimore, it is believed, in addition to its present supply, 150,000,000 gallons of water per day, with a head of 170 feet above mean tide.

Those of our readers who would like to see fuller details of this great work may consult No. 19, vol. 36, of the SCIENTIFIC AMERICAN, and No. 135 of the SUPPLEMENT, where a sketch of the old Baltimore water works is given, together with a full description of the works now under way, together with a profile of the seven mile tunnel.

AN EXAMPLE FOR YOUNG INVENTORS.

The remark of the English builder, Mr. Frederick Smith (SCIENTIFIC AMERICAN, March 29, page 202), that everything about the American thumb latch "proves that brains were used when it was designed and made," calls out from an old friend of the inventor the following account of the circumstances under which the invention was made. Our correspondent gives the story in the words of the inventor, Mr. Blake. After telling how his previous business—the manufacture of tooth brushes—had proved unprofitable, Mr. Blake said:

"I found it was necessary to invent something. Going to the city of New Haven I went into a hardware store and asked the salesman to show me the worst made article of general use. He at once handed me a Norfolk latch. I bought it, took it home, and in a short time made the present latch. In the first year I sold 30,000 dozen."

The Blake latch was patented about 1830. Our correspondent says that the last Norfolk latches he saw were being worked up in a rolling mill at Philadelphia in 1845. Our correspondent adds:

"That in 1879, nearly 50 years after the American latch was patented, it should be considered a wonder by the intelligent Englishman, is perfectly marvelous. That the Blake latch has never been improved by the active American, proves that Mr. Smith is correct when he says brains were used in its design and construction. Having been 33 years in the retail hardware trade, I know whereof I speak, and that Mr. Smith has not overdrawn the picture, nor has he told one half the truth. If he would take up the padlock branch, the matter would be even more astonishing."

Our young readers will readily understand why we have called this an example for young inventors. To use a common phrase, Mr. Blake wanted to make some money. Yankee-like, he decided that the surest course open to him was to invent something. Even more Yankee-like, he went to work in the shrewdest possible way to find out where invention was needed. Given something of general utility badly made, his problem was comparatively simple. He used his brains, and produced something that everybody needed—for thumb latches were in every house in those days; and he did his work so well that he need have no fear of rivals.

But this is not the only lesson that may be drawn from this simple invention. Our article might as appropriately be headed "An Example for Statesmen." The Blake thumb latch is a type of countless Yankee notions, which in the aggregate have swelled enormously the conveniences of American households and the materials of American industry. Their inventors, like Mr. Blake, believed it would pay to invent something. However small in itself, any invention they might make could be patented and protected as property. The fee was small, and the protection fairly good. The humblest and poorest was encouraged to invent; and we see the results everywhere. Under a patent law like England's, we should still be using the Norfolk latch in its pristine clumsy ugliness.

With heavy patent fees and the systematic discouragement of small inventions—amendments(!) which short-sighted politicians would like to impose upon our patent system—not only the thumb latch order of invention, but much that ranks above it, would be wiped out. Not even the Senator from Minnesota or the attorney of the Western Railway Association would dare assert that such a result would prove advantageous to the country, however hard they may covertly work for its realization.

GOOD TIMES FOR AMERICAN FARMERS.

A citizen of Carrollton, Mo., sends to the *Evening Post* the following comparison of the prices of staple articles in that part of the country, as they are now, as they were before the war, and again at the height of "flush" times:

WHAT WESTERN FARMERS SELL.

	1860.	1873.	1879.
Corn, per bbl	$1.00	$1.50	$1.25
Wheat, per bush	75	1.15	85
Beef, per cwt	2.00	4.50	5.50
Pork, per cwt	2.50	3.25	3.00
Wool, per lb	30	45	22
Butter, per lb	10	20	10
Eggs, per doz	6	20	8
Beans, per bush	1.00	1.75	1.05
Dry hides, per lb	10	16	10
Green hides, per lb	4	7	5½
	$7.85	$13.23	$10.20½

WHAT FARMERS BUY.

Plows, each	$10.00	$13.00	$ 9.00
Wagons, each	90.00	90.00	60.00
Spades, each	1.25	1.50	1.00
Axes, each	1.25	1.40	1.00
Salt, per bbl	3.00	2.75	1.75
Coffee, per lb	20	30	20
Sugar, per lb	12	14	10
Boots, per pair	4.00	5.50	3.50
Calico, per yard	12	10	7½
Jeans, per yard	75	75	50
	$110.69	$115.44	$77.12½

From these figures it appears that the purchasing power of farm products is now nearly double what it was before the war, and considerably greater than it was in the flush times of 1873. For this the farmers are chiefly indebted to the development and perfection of the manufacturing industries of the country—especially the West; a development traceable mainly to the patent system, since the manufactures of the West are almost exclusively based on recently patented inventions. Yet in spite of evidence like this, demagogues in Congress and elsewhere have the effrontery to declare that the patent system should be emasculated (and the progress of manufacturing interests arrested) for the benefit of the farmers who are oppressed and devoured by "patent monopolies!"

A POSSIBLE IMPROVEMENT IN SUGAR MAKING.

A correspondent suggests the following method for securing a portion of the sugar lost in the usual treatment of sugar cane. Whether the process would prove economical on a large scale is by no means certain. It might pay, however, to give it a trial.

"Comminute the bagasse as it leaves the mill (by slicing, cutting, or tearing), and drop the mass immediately into milk of lime; leach out with steam of about two atmospheres. Decompose the solution of sucrate of lime with carbonic acid gas, let settle, and decant, evaporate, etc. My reason for bringing the (cane) juice in contact with milk of lime is based on the fact that even as little as one half per cent of lime prevents the conversion of cane sugar into invert sugar, etc."

ART AS AN AID TO INDUSTRY.

A mechanic working in the blacksmiths' shop of the Phœnix Iron Company, at Phœnixville, Pa., visited the Pennsylvania Museum and School of Industrial Arts in Memorial Hall, and took a fancy to the quaint and beautiful work in wrought iron there exhibited—vines, flowers, tendrils, and leaves, wrought by hand on the anvil by the skilled smiths of foreign lands. He not only admired them, but saw in that sort of work the opening of a profitable industry. So at night, in his own house, at a forge improvised for the occasion, he and his brother worked out designs in forged iron—oak leaves, acorns, and the like. Having finished his work, he took specimens to the trustees of the museum, told what he could do, and borrowed models for the continuance of his work. There is already a considerable demand for such ornamental iron work in the decoration of buildings, and it is safe to predict for the new industry and its originators a successful and profitable development.

A Valuable Mineral and Metallurgical Collection.

The American Institute of Mining Engineers lately presented to the Pennsylvania Museum and School of Industrial Art the large collection of metals and minerals obtained from foreign nations and from numerous States in this country at the Centennial Exhibition. Some idea of the worth of the collection may be gathered from the statement of William W. Justice, the managing director, who says that it "could not be duplicated to-day for $100,000, and is of inestimable value to the mining and manufacturing interests of Pennsylvania."

In this collection not only Pennsylvania and other States are represented, but also Germany, Sweden, Russia, Spain, Austria, Portugal, Italy, Belgium, England, Victoria, South Australia, Tasmania, Queensland, Canada, Nova Scotia, New Zealand, Brazil, and Mexico. Those who studied these admirable collections in 1876 will appreciate their importance to the students of the institution which has become their possessor

The Cincinnati Industrial Exposition.

Cincinnati is making great preparations for an exhibition of the industrial and fine arts next fall. Two large wings are to be added to the Springer Music Hall for the purpose of the exhibition, making the building four hundred feet square. The grounds for the extra buildings have been donated by the city, and already about $1,000,000 have been contributed to insure the success of the enterprise. The loans already secured for the fine art department promise to make the exhibition equal, if not superior, to anything of the sort thus far held in this country.

A Snail that Would not Starve.

An Egyptian desert snail was received at the British Museum on March 25, 1846. The animal was not known to be alive, as it had withdrawn into its shell, and the specimen was accordingly gummed, mouth downward, on to a tablet, duly labeled and dated, and left to its fate. Instead of starving, this contented gasteropod simply went to sleep in a quiet way, and never woke up again for four years. The tablet was then placed in tepid water and the shell loosened, when the dormant snail suddenly resuscitated himself, began walking about the basin, and finally sat for his portrait, which may be seen of life-size in Mr. Woodward's "Manual of the Mollusca." Now, during those four years the snail had never eaten a mouthful of any food, yet he was quite as well and flourishing at the end of the period as he had been at its beginning.

A Long Lived Brewery.

One of the oldest breweries in the world is that of Dobrau, near Pilsen, in Austria. It was founded in 1378, when it had granted to it a prescriptive right to brew "old" and "white" beers. The five hundredth anniversary of the establishment of this brewery was lately celebrated.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday, March 24th, at the Stevens Institute of Technology, Hoboken.

A NEW OZONE GENERATOR.

Prof. Albert R. Leeds exhibited his new form of ozone generator, by the aid of which he has been enabled to over come the difficulty hitherto experienced by investigators of preparing ozone in sufficiently large quantities for experimental purposes. Formerly sticks of phosphorus were placed in contact with moist air in large glass balloons or carboys; and so great was the uncertainty of the process that sometimes after the lapse of several hours the operator had scarcely enough ozone to show its properties.

In the new ozonator the phosphorus used is first melted under water in a watch glass, and when cool it is placed with its convex surface upward on a perforated lead tray provided with slots, so that it may be easily introduced in a bell jar and brought to rest upon short glass rods attached to the jar a little above the rim. A bell glass thus furnished with five or six phosphorus cakes is then plunged into a glass jar containing a solution of 25 grammes bichromate of potash in 1250 c.c. water acidulated with 150 c.c. sulphuric acid, so that the convex surface of the phosphorus, kept clean by the energetic action of the solution, remains exposed and ozonizes the air in the jar. It is advantageous to use the phosphorus in this form, because of the rapid consumption of sticks and the consequent danger of inflammation.

A series of careful experiments has revealed the fact that the temperature is a potent factor in the generation of ozone. Below 6° C. no ozone is given off; as the temperature rises the evolution of gas increases up to 24°, and from that point on it again rapidly diminishes. In consequence of this, Prof. Leeds finds it advantageous to place the jar in a copper water bath, and to provide it with a thermometer, so that the apparatus may be maintained at the maximum temperature. When two jars are used in conjunction, the amount of ozone obtained is 25 per cent greater than from one alone, and with three the increase is but slight.

A great point of difficulty in the construction of ozone apparatus is in connecting the parts. Where rigid connections are allowable they may be made by the use of paraffine, and all corks through which glass tubes pass must be coated with it. Rubber is almost instantly destroyed. Fortunately Mr. Day, of New York, has succeeded in making a species of kerite, suitable for flexible connections. Tubes made of this material have now been in use for several weeks without showing the slightest signs of deterioration.

Mr. Peter Cooper, who was present at the meeting, suggested that the substance might prove useful as a substitute for rubber gas tubing, which is soon attacked by coal gas and becomes offensive.

A NEW MEASURE OF ACTINISM.

It has been maintained by Schoenbein and others that perfectly pure sulphuric and nitric acids containing no trace of nitrous acid would not produce any change in iodide of starch. Prof. Leeds stated that he had been unable either to obtain acids so pure or to make them himself, but that his iodide of starch solutions were invariably affected by them. Upon reasoning on the circumstance, it struck him that iodides might be decomposed by light in the presence of acids, a supposition which afterward proved true; and he based upon it a method for measuring the relative actinic effects of different kinds of light. Upon exposing such solutions for the same length of time to the sun's rays, to the electric light, and to a magnesium light, and then comparing the results in a color comparator, described in a previous communication, he was surprised to find that the electric light had produced over three times as much chemical effect as sunlight, while the action of the magnesium light was but a very small fraction of it.

THE ELONGATION OF METALLIC RODS BY HEAT.

The Academy then adjourned to the physical laboratory of the Institute, where Prof. Alfred M. Mayer exhibited his apparatus for measuring the variations of length in metal bars at different temperatures. This apparatus has been so well described in the Scientific American (Dec. 8th, 1877) that only a brief reference to it will be necessary in this place. Finding that previous experiments in this direction were vitiated by the fact that the heat or cold applied to the metal bars to be measured at the same time affected the measuring apparatus, Prof. Mayer conceived the idea of separating the two parts, so that his bar could be brought to the required temperature and could then be measured with extreme rapidity. Great accuracy of measurement is rendered possible by the use of Saxton's reflecting comparator, described at length in the Scientific American Supplement, No. 96, Nov. 3, 1877.

MEASURING THE EFFICIENCY OF ELECTRIC LIGHT MACHINES.

Prof. Henry Morton then exhibited the apparatus in use at the Stevens Institute for measuring the efficiency of machines designed for generating powerful currents for the production of the electric light. The hour for adjournment having arrived, no detailed description was given.

C. F. K.

American Iron for China.—A shipment of 200 tons of American iron was lately made by the Thomas Iron Co. to fill an order from China. This is said to be the first American iron ever sent to that market.

Correspondence.

Gary's Nail Experiment.

To the Editor of the Scientific American:

In an article on page 208 of the Scientific American, of April 5th, the writer claims that the explanation of the nail experiment given in my letter, published March 22d, is essentially the same as that contained on page 144, issue of March 8th, namely, that the nail falls to the ground by reason of the superior force of gravitation while leaving the sheet iron for the magnet. I am, however, unable to discover in what respect these explanations are similar.

In the article on page 144, March 8th, no mention is made of change of polarity or demagnetization of the nail upon approaching the magnet; but, instead thereof, the explanation implies clearly that the nail is simply drawn away from the sheet iron, but before reaching the magnet the stronger force of gravitation brings it to the ground.

The actual fact is that the nail does not leave the sheet iron, "because, by reason of its approach to the attracting pole, it tends to fly to it," but because it becomes demagnetized, or so nearly so as to allow gravitation to control it. Furthermore, at the point of demagnetization at which the nail drops (if properly arranged to show the experiment), there is no tendency to fly to the magnet, and the magnet has no attraction for it.

Figs. 1, 2, and 3 will serve to show the three positions of the nail to illustrate this theory.

In Fig. 1 we assume that the nail derives its polarity principally from the armature; its north pole being at the greatest distance from the north pole of the magnet, and its south pole inclining slightly toward the north pole of the magnet. Fig. 2 represents the armature nearer the magnet, and the nail just ready to drop on account of demagnetization by having had its north pole brought nearer to the north pole of the stronger magnet, and its south pole carried further away, the tendency being to a reversed polarity from the proximity of its upper end to the magnet.

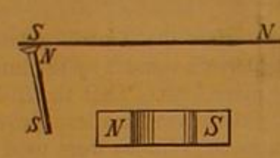


Fig. 1.

At this point the nail hangs free for an instant, with no inclination of its lower end either toward or from the magnet, and then drops directly to the ground.

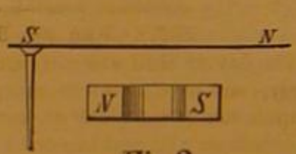


Fig. 2.

In Fig. 3 the armature is represented as still nearer the magnet. The upper end of the nail will now show a slight south polarity derived from the north pole of the magnet in excess of the north polarity influenced by the armature, which fact is proven by the inclination outward of its lower end, which has become the north pole.

This excess of magnetism derived from the magnet enables the nail to adhere (although very weakly) to the sheet iron armature, notwithstanding similarity of poles. Strictly speaking, the polarity of the armature is north to the nail at the point of contact, while it still remains south to the magnet, its relations with the magnet not having been changed, except as regards strength of magnetism acquired.

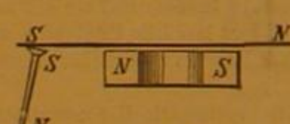


Fig. 3.

Mr. Gary, in his letter to the Scientific American, published April 5th, page 209, says in referring to my letter on page 177, of March 22d: "Does not the writer know that when a nail is in contact with an induced magnet, or any other magnet, it has the same polarity and is a part of the same?"

I will reply to this question by asking Mr. Gary if he does not know that a piece of soft iron cannot be attracted by a magnet without becoming itself a magnet, with a certain polarity, which polarity will remain the same whether in contact or not?

This fact also proves the non-existence of a "neutral line," for, if such did exist, there could be no attraction on that line, and the armature in approaching the magnet would lose its magnetism and drop back. This not being the case, there is no "neutral line." G. F. Milliken.

Boston, March 29th, 1879.

Gary's Neutral Line.

To the Editor of the Scientific American:

Referring to the latest "perpetual"—Gary's motor—I was much pleased with your editorials thereon. I noticed also in your last issue a correspondent's remarks regarding the nail which drops when approached to one of the magnets.

But there is one point in Gary's fallacy that you have not fully explained. I refer to his so-called "neutral line." I think the following explains this feature:

Referring to the sketch of the two permanent magnets—one stationary, the other rocking on centers—he claims that he arrests the attraction of the two magnets for each other by interposing the armature of soft iron between them on the "neutral line." He does cut off the attraction, and in this way:

His armature is of soft iron. He places it across the poles of the stationary magnet, and much nearer this than the rocking magnet. The armature is magnetized inductively by the stationary magnet, and, of course, its polarity is opposite that of the magnet that influences it. And as his two permanent magnets had their opposite poles exposed to each other, it now follows that the rocking magnet is exposed to the influence of the armature, whose polarity is like its own. Hence the action is repulsive instead of attractive.

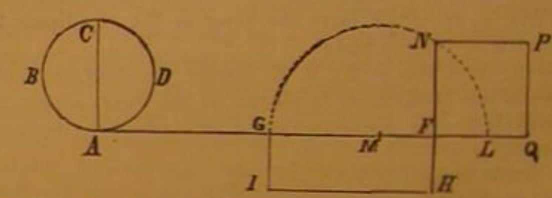
Therefore, if he could get power enough to move his armature up and down, his machine would be a perpetual motion undoubtedly. But to do this he must cut the magnetic lines of force of his stationary magnet, and the power required to do this is exactly proportional to the strength of those lines of that magnet, and therefore he never can produce any result, except to impoverish himself and those capitalists who believe in him.

Had Gary shown less contempt for scientific men, some one of them might have told him that with a pocket compass he could have demonstrated the fallacy of his "neutral line" in three minutes, and saved himself and others a world of expense and trouble. C. H. Haskins.

The Circle Squared.

To the Editor of the Scientific American:

Given any circle, A B C D, to find a square that shall be in area equal to it. Let the horizontal line, A F, be tangent to the circle at A. Revolve the circle on its circumference until the point, A, touches the line again at F. Then will A F be exactly equal to the circumference of the circle. Bisect A F in G. Draw the perpendicular F H = the radius, or ½ the diameter, A C, and complete the rectangle G F H I, which will be exactly equal to the area of the circle = ½ the circumference × ½ the diameter.



Now produce G F to L, making F L = F H; bisect G L in M; with M as a center and radius M G, describe a semicircle, and produce H F to N. F N will be a mean proportional between G F and F L or F H. On F N describe the square F N P Q, which will be exactly equal in area to the given circle, A B C D. Q. E. D.

Philadelphia, Pa., March 17, 1879.

A Warning to Western Farmers.

The *Colorado Farmer* counsels the agriculturists of his State to stick to their farms, and not be induced to leave their comfortable homes for the mining regions, where so much discomfort and uncertainty are in store for them.

We are told, says the editor, that farmers are quitting their farms or are letting their fields lie idle to rush to Leadville, or to haul freight from the railroad termini to the mining camps.

We have not a word of fault to find with them for striving to earn money, for all know how bravely they have struggled through two years of the locust plague, and two years of very low prices. But at this time to abandon their farms or fields to weeds and idleness, is suicidal.

There are pouring into Colorado 500 people every day, and this number will be increased twofold in less than a month, and will be kept up well into the summer. At least 50,000 will be added to the population of the State. These people must be fed, and the bread and meat to feed them should be supplied by our farmers. To do so will take much more breadstuffs and feed than all our farmers can, under the most favorable circumstances, supply. Raise as much as you may, it will all bring a fair price, even if Kansas and other Western States raise as large a crop as last year, which we do not expect them to do.

More money can be made this summer on Colorado farms than has been in any one year for the past six, and it is the height of folly to quit a certainty for the very, very uncertainty of mining.

Farmers of Colorado, stick to your farms; don't let the *ignis fatuus* of mining camps lead you from the solid ground of your farms to the bogs and quagmires that are in and through and all around the camps and cities that are created by the excited crowd in the rush and struggle for wealth that is got by accident or luck.

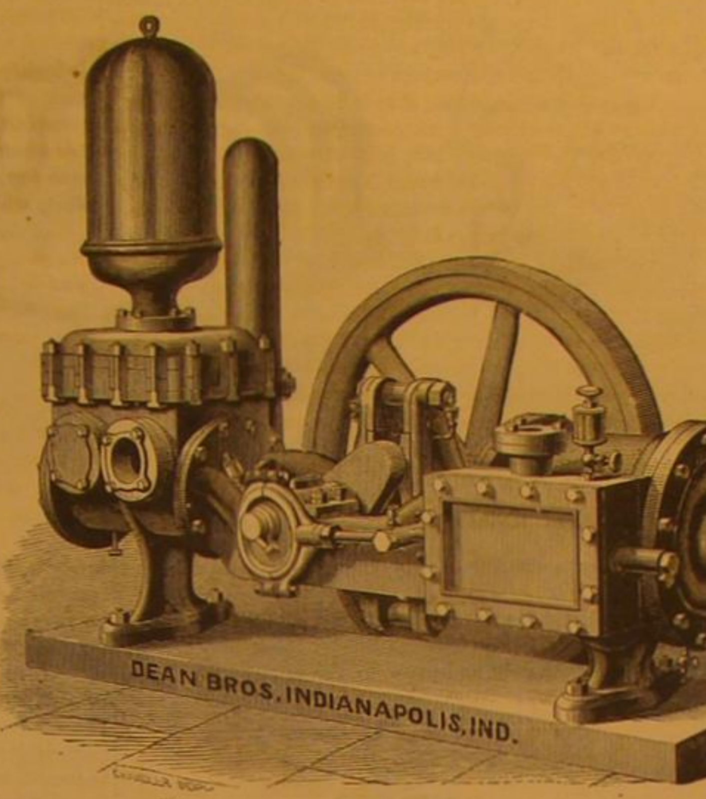
Coal at its Lowest.

The regular monthly coal sale of the Delaware, Lackawanna, and Western Company, in New York, for March, was largely attended, and the 100,000 tons offered were well distributed, in small lots, at an average reduction of 8 7-10 cents per ton from last month's prices, and an average reduction of 5 cents per ton from the prices obtained at the Delaware and Hudson Canal Company's sale on the 21st inst. The quantities sold and the prices realized were as follows: Five thousand tons of steamer at $2 17½, a decline from last month of 7½ cents per ton; 20,000 tons of grate at $2 20 to $2 17½, a decline of 7 cents per ton, 20,000 tons of egg at $2 20 to $2 17½, a decline of 9¾ cents per ton; 45,000 tons of stove at $2 55 to $2 50, a decline of 13¾ cents per ton; 10,000 tons of chestnut at $2 32½ to $2 35, a decline of 7½ cents per ton. This is the lowest price ever reached for stove coal.

DEAN BROTHERS' STEAM PUMP.

The accompanying engraving represents a large sized steam pump, such as is generally used in distilleries, blast furnaces, rolling mills, and extensive manufacturing concerns requiring a copious supply of water. They are made by Dean Brothers, of Indianapolis, Ind., in several sizes, with steam cylinders from three inches to thirty-four inches diameter, and pump cylinders from two inches to twenty inches diameter. The crank shaft is supported by a frame which joins the steam and pump cylinders, and the fly-wheel and rotating parts are balanced so as to run rapidly without shaking. The steam cylinder is provided with a simple, flat, three-port slide valve, which is worked directly by an eccentric on the crank shaft, as in the ordinary slide valve engine. The pump has ample water passages and large valve area, which prevents thumping when run at a high speed. The piston rods are made of steel, and the valve seats of gun metal, and both steam and water cylinders are fitted with adjustable packing. All of the parts are made interchangeable, so that any piece can be replaced without especial fitting.

We are informed that these pumps are made in the most careful manner, and no expense is spared to make them perfect in workmanship. The piston rod of the steam cylinder and pump are rigidly connected together by the link, which holds them as one piece, so that the power of the steam cylinder is imparted directly to the pump, while the crank, which plays on the slot of the link, governs the motion of the pistons, causing them and the other reciprocating parts of the pump to be stopped and reversed gradually, and not by sudden jerks, and also reversed with great exactness at the proper place, so as to obviate much clearance in the steam cylinder. It is evident that the pump cannot make the slightest variation in the length of the stroke. The crank motion approaches very near to the theoretically correct motion that should be imparted to a pump piston, namely, a uniformly accelerative motion from the beginning to the center of the stroke, and a uniformly retard motion from center to the end of stroke. The crank should be adopted in the construction of all pumps where regularity of flow is required.



DEAN BROTHERS' STEAM PUMP.

Steam pumps of this style are made for feeding boilers and for special purposes, such as brewery air pumps, ammonia pumps for ice machines, combined air pumps and condensers; they are also manufactured for water works, single and duplex condensing and non-condensing.

We name below a few places that are using Dean's duplex engines for water works purposes. The engines furnish the entire water supply for fire, domestic, and manufacturing purposes, having a capacity in millions of gallons per day of 24 hours, as follows:

Union City, Ind., 1; Brazil, Ind., 1; Attica, Ind., ½; Marion, Ind., 1½; Michigan City State Prison, Ind., ½; Indianapolis Stock Yards, 1; Charleston, Ill., 1; Peoria, Ill., 2½ and one of 4; Alton, Ill., 2; Nashville, Tenn., two of 5; Indiana Hospital for Insane, 1.

RECENT MECHANICAL INVENTIONS.

A machine for nailing the irons upon trunks and packing boxes, which punches the holes in the irons, drives the nails, and clinches them, has been patented by Mr. Robert M. Bidelman, of Adrian, Mich. The machine will work on boxes or trunks of any size or shape.

Mr. George S. Darling, of Chicago, Ill., has patented several important improvements in sewing machines which relate to the shuttle and shuttle carrier, the take-up, tension check, and shuttle motion. The patent is assigned to the Wilson Sewing Machine Company, and the improved machine was recently illustrated and described in this journal.

An improved garden roller, in which the handle-counterpoising weights are formed in circular plates, which also serve as ornamental heads for the roller and as dirt protectors, has been patented by Mr. Joseph W Hobson, of New York city.

Mr. Joseph B. Underwood, of Fayetteville, N. C., has devised an attachment for a sewing machine treadle, which is connected with the chair in which the operator is seated, so that the chair is partly sustained by the attachment, and the weight of the body, being slightly rocked or shifted from one point to another, assists in driving the machine.

An improved portable burglar alarm, patented by Mr. J. D. William, of Rising Sun, Ind., may be carried in the pocket or valise, and is readily applied to doors or windows. It consists of a small case containing alarm mechanism which is set off by cords connected with the doors or windows.

A novel rowing apparatus has been patented by Mr. G. H. Felt, of Brooklyn, Mich. The object of the invention is to enable the rower to sit facing the bow of the boat instead of the stern, while the motions are the same as in ordinary rowing.

Messrs. Benjamin A. Dobson and James Macqueen, of Bolton, England, have patented an improvement in spinning and doubling machinery. The invention consists in a combination of devices for controlling the rising of the copping-faller after the yarn is wound on the cop, to prevent snarling or cutting.

BRICK MAKING BY MACHINERY.

The day of old-fashioned hand-made brick is fast passing away, and in this, as in many other industries, machine work is taking the place of hand work. The introduction of machinery for making brick has been attended with the opposition that usually accompanies an innovation on hand work; but gradually, as the machines have become more and more perfect, and the product in both quality and quantity is found to surpass the hand-made article, the opposition dies out.

It is stated on good authority that the manufacture of bricks employs more capital than any other business in the United States.

In making bricks by machinery, and especially face or front bricks, as ordinarily practiced, it has been practically impossible to supply an equal amount of clay to each of the mould boxes. This results in inequality in size and density in the bricks. When but one pressure is imparted to the clay, as in previous methods of manufacture, the bricks are often defective in strength, especially at the corners and edges, and are therefore unsuitable for use as first quality front or face bricks. These serious objections have been overcome by Gregg's brick machine, which is shown in the accompanying engraving.

In these machines the heavy developing pressures take place while the mould table is at rest, thus requiring but a nominal amount of power to operate them, and avoiding undue strain, wear and tear, and breakage.

Brick machines may properly be classified under three heads—dry clay machines, slush machines, and crude or moist clay machines. From the peculiar construction of dry clay machines, where filler boxes or graduating measures are used to fill the mould boxes, the clay must be dried and granulated to fill with any degree of regularity into the filler boxes, and thence into the moulds. And when moulds are grouped together it becomes a physical impossibility by the dry clay system to fill them alike, hence those deficient in clay will but partially develop the bricks; this added to the fact that the cohesive quality of the clay is destroyed by extracting the moisture before moulding prevents complete vitrification in the process of burning, and the result is that bricks made from dry clay disintegrate by the action of the elements.

In the manufacture of slush brick the other extreme is met. To facilitate moulding in the hand way a large proportion of water is added, and the bricks being so soft must be spread upon floors to dry. The slow outdoor process of drying, or evaporation, is one of the most favorable processes for the hand brick maker, but it requires the continuous insurance of favorable atmospheric influences, and a continuity of fair weather, which practically can never be relied on.

Clay, to be made into bricks by hand moulding, must of necessity be so wet that at least 25 per cent of water must be evaporated before it is safe to burn, so that in fact, in works producing 30,000 bricks per day, upwards of twenty-three tons of water have to be evaporated therefrom every twenty-four hours. The labor of handling this enormous amount of water is an expensive item, and the bricks are rendered porous by the operation.

The Gregg brick machine occupies a medium position between dry clay and slush machines, and it effects a great saving, as the machine receives the crude clay and works it to advantage in so stiff a state that it does not contain more than one eighth as much of water as the hand made article, and yet all of its cohesive qualities are retained. In the burning process, the fusion being complete, the bond between the particles is perfect and the bricks are less porous, consequently stronger and absorb less moisture.

The following is a statement of hydraulic tests, showing the superiority in strength of the Gregg brick over hand-made brick:

1st. Hand-made brick, front, whole, crushed, 42,000 lbs.; half, 40,000 lbs.; quarter, 30,000 lbs.

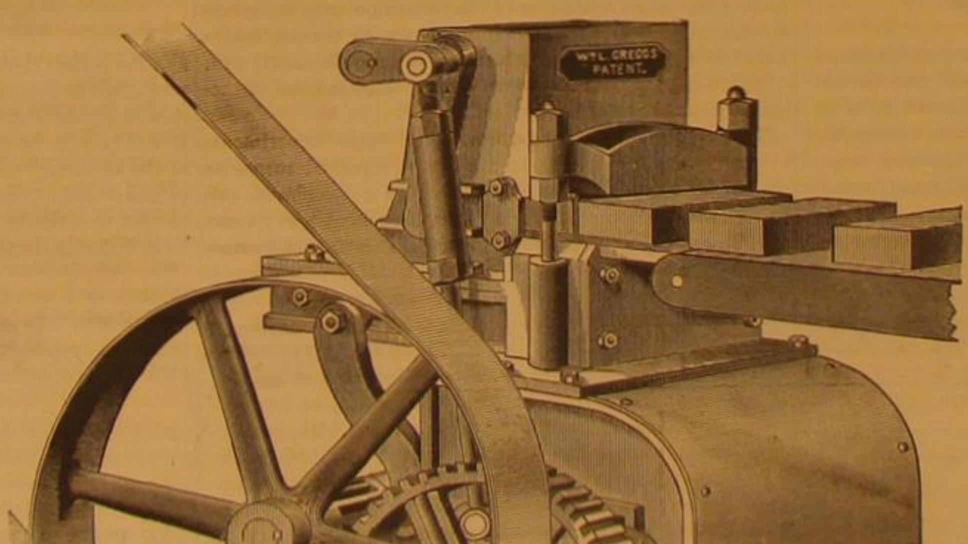
2d. Machine-made, front, whole, 60,000 lbs.; half, 57,000 lbs.; quarter, 55,000 lbs.

3d. Hand-made brick, hard, whole, crushed, 49,000 lbs.; half, 32,000 lbs.; quarter, 12,500 lbs.

4th. Machine-made, hard, whole, 55,000 lbs. half, 55,000 lbs.; quarter, 45,000 lbs.

The same tests were applied by direction of the Supervising Architect of the United States at the Treasury Department, with the same results—the Gregg brick were ordered to be used in the government work.

The general agents for the Gregg brick machines are the Gregg Brick Company, whose offices are located at 95 and 97 Liberty street, New York, and at 402 Walnut street, Philadelphia.



GREGG'S BRICK MAKING AND REPRESSING MACHINE.

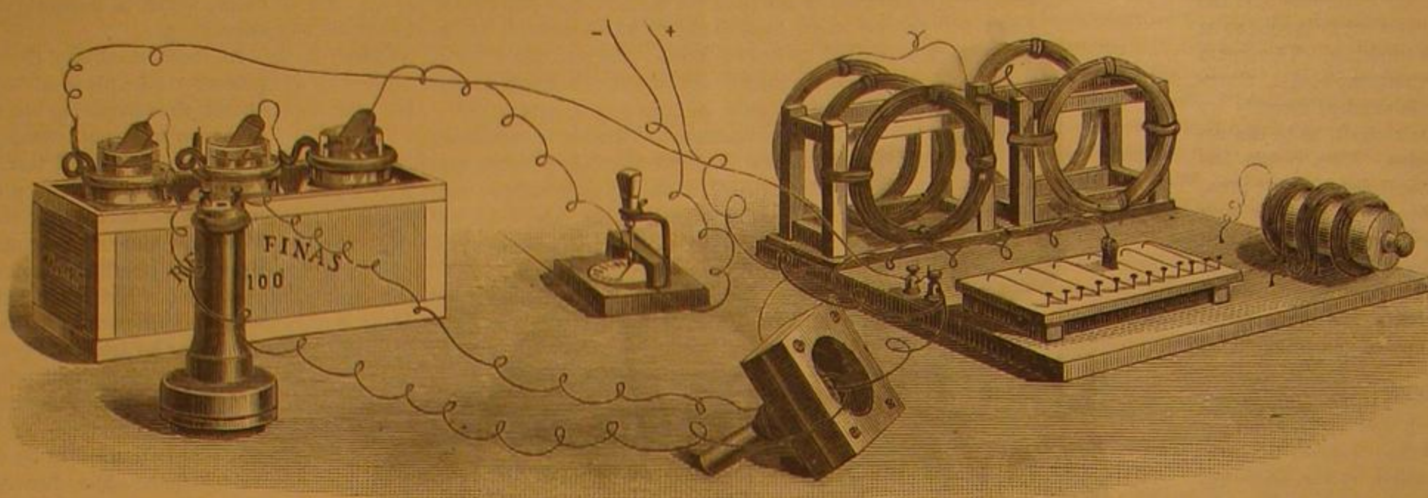
Cement for Uniting Metal to Glass.

The following recipe is from the *Monthly Magazine of Pharmacy*: Take 1 lb. shellac dissolved in a pint of strong methylated spirit, to which is to be added 0·05 part of solution of India rubber in carbon bisulphide; or take 2 ounces of a thick solution of glue, and mix with 1 ounce of linseed oil varnish, or 3-4ths of an ounce of Venice turpentine; boil together, and agitate. The pieces cemented should be fastened for 50 or 60 hours to get fixed.

PROFESSOR HUGHES' INDUCTION BALANCE.

We condense from *Engineering* of March 14, 1879, the following description of Professor Hughes' induction balance:

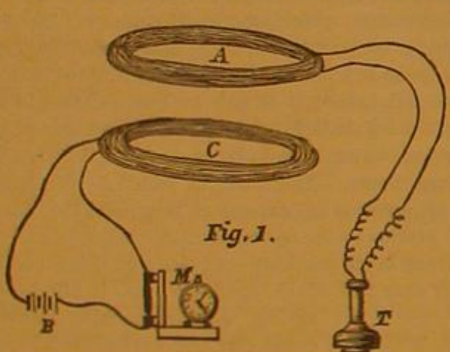
The invention of the telephone by Professor Bell has placed in the hands of the physicist a detecting instrument of greater delicacy and sensitiveness than the most delicate galvanometer, and one which is instant in its action and convenient in use; and the invention of the microphone by Prof Hughes has supplemented the telephone for electrical research, and has largely extended its field of usefulness. So sensitive is the telephone, or perhaps it would be more correct to say, so sensitive is the human ear, aided by the telephone, that variations of electric currents so small as to be far removed from the powers of the most sensitive galvanometer to detect, are instantly made apparent by its use, and it is found next to impossible to work the instrument for business purposes in many places during business hours by reason of the induced currents produced in its conductors by the influence of neighboring lines conveying telegraphic messages.



PROFESSOR HUGHES' INDUCTION BALANCE.

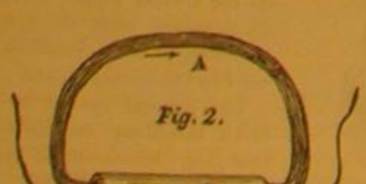
The elimination of the effects of induction for telegraphic working has hitherto been one of the great unsolved problems of the telegraph engineer, and several plans have been adopted whereby the evils resulting from it have been lessened, but all are far from satisfactory.

It has remained for Professor D. E. Hughes, the eminent inventor of the type printer, as well as of that still more



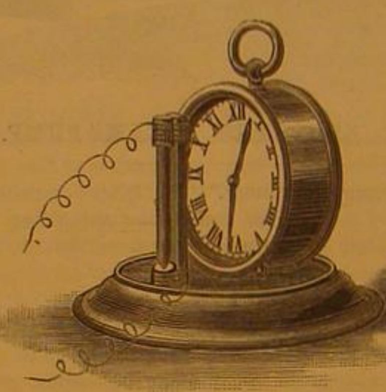
wonderful instrument the microphone, to solve the problem by which induction currents in telegraph lines may be absolutely eradicated, and his solution of this problem is as simple as it is scientifically accurate. His whole apparatus, part of which we illustrate, consists of a few coils of wire, a telephone, a microphone, a small three cell Daniell's battery, and a galvanometer.

The diagram, Fig. 1, represents an experiment arranged by Professor Hughes, which demonstrates a simple case of ordinary electrical induction. A and C are two circular coils of insulated wire, of which one, C, is placed in circuit with a battery, B, and microphone, M, upon which a small clock is placed, and the other coil, A, is joined up in circuit with a telephone. Upon placing the ear to the telephone the ticking of the clock is loudly heard by the induction currents produced in A, by the influence of the neighboring microphonic currents passing through C. When the two coils are placed one against the other the sound is nearly as loud as when the telephone was included in the primary circuit, and as the distance between the two rings is gradually increased, the ticking becomes fainter and fainter, but at several inches distance the ticking was louder than the origi-



nal sound emitted by the clock, and with several feet between them it remained distinctly audible. The demonstration of induction currents by means of two such rings does not, of course, possess any novelty, but the employment of a clock and microphone in conjunction with a battery as a simple automatic source of sound, or rather of electrical impulses, and of a telephone as the detecting instrument, forms together an exceedingly convenient arrangement, and we mention it here because it forms the groundwork of the system upon which Professor Hughes' recent experiments have been carried on. We may mention here, in passing, that this arrangement forms a beautiful way of illustrating the diminution of induction influence by destroying the parallelism between the planes of the two rings, for if either of them be slowly turned about one of its diameters, the sound heard in the telephone gradually diminishes as the angle between the planes of the rings is increased, disappearing altogether at the moment that they become perpendicular to one another.

Professor Hughes placed between the coils a sheet of copper 12 inches square and one millimeter thick between the coils (joining both coils and plate to the same earth plate),

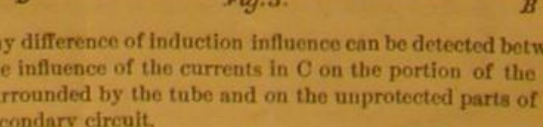


CLOCK AND MICROPHONE.

without disturbing the induction effects, he next tried the effect of introducing between the coils laminæ of sheet iron; but no perceptible reduction of the induction currents could be detected. Covering each of the coils with several layers of tin foil and immersing both in a vessel of salt water, with a plate of copper between them, did not diminish the induction as far as the ear could detect.

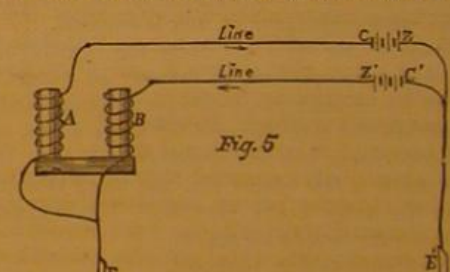
Fig. 2 represents a modification of the same experiment. A is a D-shaped coil of wire having a hundred turns, its two ends being joined to the terminals of a telephone, and the straight portion of the coil is inclosed in a heavy brass tube, B, one eighth of an inch thick. C C is a primary wire

in connection with a clock microphone and battery. Upon placing the side, B, of this coil near and parallel to the wire, C, the sounds of the clock are distinctly audible, and hardly



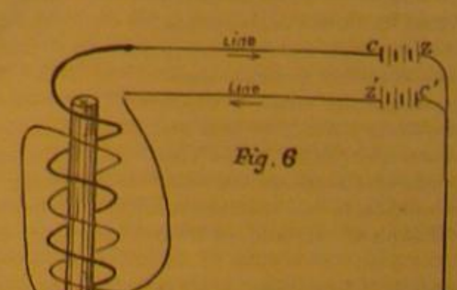
any difference of induction influence can be detected between the influence of the currents in C on the portion of the coil surrounded by the tube and on the unprotected parts of the secondary circuit.

Having demonstrated that a metallic sheathing or screen is altogether ineffectual for the protection of telegraph lines from the effects of lateral induction, Professor Hughes turned his attention to the question whether, although induction cannot be destroyed, it may not be neutralized or compensated. With this object in view he constructed a coil of four separate insulated wires, which could be joined up at their free ends in several combinations. Joining one wire to the microphone, and one of the others to the telephone, powerful induction, as might be expected, took place, the ticking of the clock being heard loud and clear, but no apparent increase or diminution of the sound was produced when three of the wires were in circuit with the microphone, in the same direction, and the fourth was connected with the telephone. By joining two of the wires to the microphone in such a manner that the current through one returns by the other, the inductive influence is completely neutralized, and absolute silence is the result. From this it follows that it is perfectly possible to protect a telephone line absolutely from the inductive effects of a neighboring parallel telegraph line by employing a return wire instead of an earth connection, and fixing that wire upon the poles, so that the telegraph or primary wire is equally distant from the line wire and return wire of the telephone circuit. The disadvantage of such a system is that it introduces a double resistance and twice the cost of wire, and is a protection only as regards one particular telegraph line, but for that line the protection from induction is absolute and complete. As it would be practically impossible to insure the absolute equi-distance of the two telephone wires from the telegraph line, and in order to make the system equally protective against the influence of other wires running along the same line of poles, Professor Hughes tried the experiment of twisting the two wires (that is to say, the line and its return) together, so as to form a sort of cable, so that at each turn of the twist a portion of the line circuit

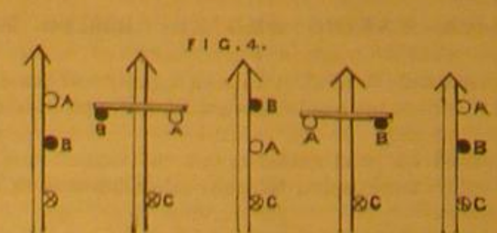


and the return circuit respectively would be alternately presented to the inducing wire. The diagram, Fig. 3, will make this clear, the arrows indicating the direction of the current. It will be seen by reference to this diagram that the portions of the secondary circuit, A, which are presented toward the primary line, B, are alternately positive and negative in direction, and therefore all effects of induction are neutralized. This is demonstrated by bringing the side of the rectangular coil against a twisted cable, such as shown in Fig. 3, no sounds whatever being heard in the telephone. It is not necessary to twist the wires into the form of a cable, for if they be attached to the poles in such a way as to cause one to rotate round the other, making one turn in a mile, or say at every four poles, it is equally effective. See Fig. 4.

In Fig. 5, A and B represent the two cores respectively of the horseshoe electro-magnet of a telegraph instrument at the receiving station, but it differs from the ordinary electro-magnets in the fact that the coil surrounding each core is connected with its own separate battery at



the transmitting station and with the earth; and the batteries are so arranged with regard to the transmitting key that each depression of the latter sends a positive current through one wire and a negative through the other, and as the coils of the magnet are so wound as to give opposite polarity to the two cores under the influence of this double current, its magnetic effect is exactly the same as that of an electro-magnet wound



in the usual way. An improved application of the same principle is shown in Fig. 6. The bobbin of the electro-magnet is wound with two coils of equal length and thickness. Each of these coils is connected with its own separate line and battery, and the connections at the transmitting station are so made that a depression of the key sends a positive current through one line and a negative current through the other, but the coils of the magnet are so connected to the lines at the receiving station, that the positive current traverses its coil in one direction as regards the magnet core, and the negative current passes in the opposite direction, so that, by the process of double reversal, the effect is the same as that of a single current of double the strength traversing the magnet in the usual way.

We now come to that portion of Professor Hughes' researches which constitute the important contribution to electrical science and to telegraph engineering. We have but little doubt that Hughes' induction balance—by which term we would include all instruments based upon its essential principle—will ultimately take its place side by side with Wheatstone's bridge in the history of the electric telegraph, for by its means the telegraph engineer will be enabled to eradicate from his lines the retarding and cost-entailing effects of electrical induction. In Fig. 7, let D, E, and F represent three lines of telegraph, supported on poles and running parallel to one another; if a current of electricity be transmitted by the line D, it will induce in each of the lines E and F a current in the opposite direction, whose relative strength will be determined by the distance of its corresponding wire from the inducing or primary wire, D. Now, if at the moment of sending a current through the latter, it were possible to transmit through each of the lines, E and F, a current in the same direction as itself of exactly the same strength as the currents produced in the opposite direction by induction, the two, being equal and opposite, would completely neutralize one another, and although, as a matter of fact, the induction would be exactly the same, its effects would be completely eliminated and destroyed.

At the transmitting end each of the lines is connected to a small induction coil or ring, X, Y, or Z, similar to those figured in Fig. 1, and placed one in front of the other, so as to exercise an inductive effect, the one upon the other. Now, from what has been said, it is clear that if the coils were all similarly connected to their respective wires the effects of induction between one circuit and the other would be increased by the addition of the inductive effects of the coils being superposed upon and added to the inductive effect of the lines; but if at the moment of transmitting a current through the primary wire the two ends of its corresponding coil were reversed, then the inductive effects of the line and of its coil would be acting on the lines and coils of the other circuits and in opposite directions, and the aggregate induction would be diminished by the difference between the two influences. By making the length of wire contained in each coil, however, proportional to the length of its corresponding line, and the relative distances between the coils proportional to the mean distances of the lines from one another, the inductive effects of the coils are exactly equal to the inductive effects of the lines, and if their directions be in opposite directions as is accomplished by the reversal of the coils, then the problem is solved and all effects of induction are eradicated.

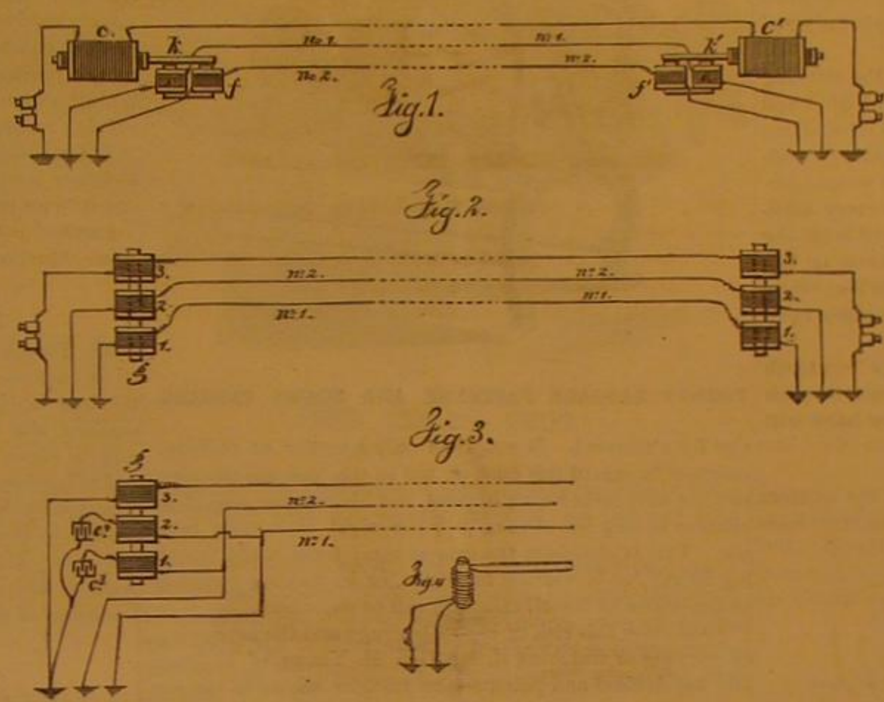
For the purposes of practically demonstrating the system of compensation, Professor Hughes constructed the apparatus shown to the right of the general perspective view. The five rings of insulated iron wire attached to the board represent three lines of telegraph running parallel. The two coils of each of the outside pair are joined so as to form one circuit, consisting of one black ring and one white one, each pair representing one line of a certain length, and between them is a single coil representing an intermediate telegraph line of a shorter length; this difference of length was adopted by Professor Hughes in his experimental model in order to represent a somewhat complicated case, and to show that no matter what the relative lengths and distances apart of telegraph lines, their mutual induction may be compensated by suitably constructed and adjusted compensating coils. The compensation portion of the apparatus consists of three rings whose distances apart can be adjusted by sliding in or out the cylinder to which each of the outer coils is attached. On the left front corner of the board is the commutator, consisting of six stiff elastic wires, which can be sprung against twelve brass nails, and the connections are so arranged that the battery circuit may be sent through any one of the lines, with or without the balance in the circuit, and each line can be made either a primary microphone circuit, or a secondary line in connection with a telephone, by simply placing the commutator wires against their proper contact pins. The microphone and clock, which is the source of sound, and which is shown below, was placed in a distant room, and the direction of the currents throughout the whole apparatus was under perfect control by means of the commutator to which we have referred.

PROF. EDISON'S INDUCTION BALANCE FOR TELEPHONE LINES.

On the opposite page we give a full description of Professor Hughes' induction balance—an invention for which he claims originality, and for which he is receiving great credit in England. It is, however, identical in principle, and almost exactly the same in construction and arrangement as Professor Edison's apparatus, patented in England July 30, 1877, and in the United States April 30, 1878. The fact that Prof. Edison perfected his invention, patented it, and brought it into use so long before Prof. Hughes brought out his alleged invention, is *prima facie* evidence that he—Edison—is the first inventor of the induction balance.

From Edison's U. S. Patent Specification.

In telegraph lines there are very often numerous wires running in the same direction upon the poles, and it has long been known that currents passing through one or more of said wires set up induced currents in the other wires. These, ordinarily, are harmless in the Morse and other systems of telegraphy; but where a wire for a telephone, acoustic, or speaking telegraph, runs parallel to or within the field of the electric influence of another wire, there are false and confusing sounds at the receiving instrument that greatly interfere with hearing the message sent upon such acoustic lines.



EDISON'S INDUCTION BALANCE.

The object of the invention is to compensate, neutralize, and destroy the extraneous or induced currents from contiguous circuits, so that the messages will not be in any manner interfered with by false currents. The invention consists, in the combination with the telephonic circuit, of an induction coil, connected with the contiguous circuits in such a manner that a reactionary induction is established in the telephonic line of a power corresponding and similar to the primary inductive action, but opposed to the same, so as to neutralize the action of the same.

In the engraving, Fig. 1 is a diagram representing one of the forms in which the compensation is effected. The large coils, *c c'*, are included in the telephonic circuit at each end of the line. In the coils are iron cores, surrounded by a primary coil, the ends of which may or may not be connected together, according to the compensation desired.

The iron core extends outside of the coils some distance. The circuits, No. 1 and No. 2, running in close proximity to the telephone wires, induce a momentary current in it every time the circuits are opened or closed, the strength of which is proportionate to the proximity of the wires to each other and the number of miles that they run side by side. These induced currents are in one direction in closing the circuit, and the opposite direction on opening the circuit. To neutralize the induced current from, say, No. 1 circuit, electro-magnets, *e e'*, are placed at each terminal in the circuit of circuit No. 1.

These magnets are then adjusted to approach the iron cores, *k k'*, until the induced current thrown into the coils, *c* and *c'*, and telephone line by the action of the magnets, *e* and *e'*, is equal, but opposite to, the induced current from the circuit No. 1 thrown into the telephonic wire by running parallel to it. Thus a perfect compensation is attained.

If the two lines run parallel for long distances the two ends of the primary coil on *c* and *c'* are connected together, and thus retard the magnetism and demagnetization of the cores, *k k'*, and consequently lengthen the induced currents thrown into *c* and *c'* by the action of *e'* and *e*.

Having thus compensated for circuit No. 1, the compensation for circuit No. 2 is exactly similar. If the latter circuit does not affect the telephone circuit as strongly as No. 1, the electro-magnets, *f* and *f'*, are placed a greater distance from *k* and *k'*; the latter may be elongated, and compensation attained from many circuits by employing separate magnets in each circuit which affects the telephonic circuit.

Owing to the great diversity in the character of the induced currents thrown into telephonic wires from wires in close proximity—due to different lengths and the employment of different battery powers and systems of transmission—many methods to meet special conditions are necessary. Thus in Fig. 2, where the circuits 1 and 2 employ powerful batteries and reversals, and many magnets are in circuit, the induced currents thrown into the telephonic wire are exceedingly powerful; hence a more powerful means of compensation is necessary.

In Fig. 2, *g* is an iron core, over which there are three or more coils—one for each line circuit. The coils 1 and 2 are in the ordinary or Morse circuits Nos. 1 and 2, while coil 3 is in the telephonic circuit. The coils are so wound and arranged, in relation to the induced currents thrown into the telephone wire by the proximity of the other wires, that they will act in the iron core, *g*, to set up a magnetism therein that will cause a powerful induced current to pass into coil 3 and telephonic line opposite in direction to the induced currents in the telephonic line due to the proximity of the other wires.

In cables containing a number of wires there is not only dynamic induction, but static induction. The latter appears sooner than the former, and is of exceedingly short duration, so that magnetic compensation alone is too sluggish. In Fig. 3 is shown a modification of Fig. 1 to meet this condition, which it does to a considerable extent, but not entirely. The induction coils, 1 and 2, are included in derived circuits from the line circuits, 1 and 2, that pass to the condensers, c^3 and c^4, and to the earth. To obtain perfect compensation, both the static and dynamical induced currents must be set up in the compensations so they will circulate in the telephonic wire in a direction opposite to those induced by proximity of the wires; and to obtain these conditions both magnets and condensers are necessary—the former to set up dynamical induction currents, and the latter statical currents. If current No. 1 is opened there first appears a short wave of current due to static induction, then an interval, and then the dynamical inducted current appears, which gradually dies away to nothing, hence a compensation which will eradicate the dynamical current will leave that due to static induction free to circulate, and this cannot be eradicated by an induced current from a magnet, because time is required to charge and discharge the cores and the consequent production of the induced current.

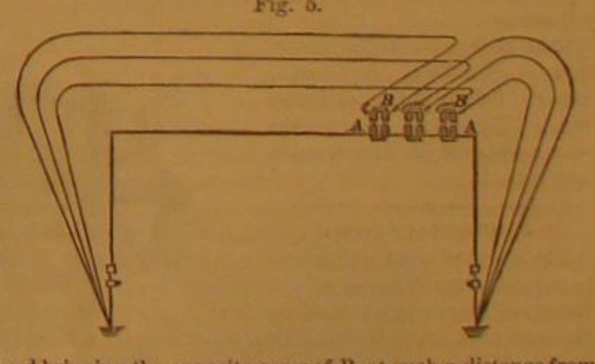
Upon short circuits a coil with two or more wires, wound side by side upon a wooden bobbin is used, as shown in Fig. 4. One wire is placed in the telephonic circuit, while the others are placed in the circuits to be compensated for, and so connected therewith that the currents thrown into the telephonic coil are equal but opposite to those due to induction resulting from the wires running parallel.

By employing large wire, and a large quantity of it, I am enabled to obtain nearly perfect compensation, as the coils set up both dynamical and statical currents, no iron cores being used to retard the appearance of the currents.

From Edison's English Specification.

When several line wires run near each other, the wire used for the acoustic or speaking telegraph is influenced by induction, and false sounds will be produced. I counteract this tendency by placing one or more electro-magnets, A (Fig. 5), in the circuit of the speaking telegraph, and one or more electro-magnets, B, in the circuit of the adjacent wires,

Fig. 5.



and bringing the opposite cores of B, at such a distance from the cores of A, that a certain magnetic action will be set up in A by induction in the opposite direction to the induction currents from the adjacent line or lines.

By adjusting the distance between these magnets when the speaking telegraph is not in use, until there is no sound at the diaphragm from the induction currents, then these currents will be neutralized, whether strong or weak.

Les Mondes calls attention to the success with which M Ravel, a merchant of Montagnac, near Riez, is cultivating the truffle. He is in a position at present to furnish thousands of these fungi, of excellent quality, at about 75c. each. He suggests that vines destroyed by phylloxera be replaced by truffle yielding oaks where the soil is calcareous or argillo-calcareous; this would be a means of recovering from the loss sustained. The products would be quickly realized, for M. Ravel has oaks six, seven, and eight years planted, which already yield truffles.

A NEW PEDOMETER.

Walking, especially in the open air, is acknowledged to be the most economical, the most enjoyable, and in many respects, the most healthful form of physical exercise. It is an exercise, too, which is growing more and more in popular favor, and as the season for summer rambling approaches, when many will be seeking health and amusement in rural excursions, the advantage of a simple means for recording distances walked need not be insisted on.

To a great extent the value of walking as an exercise depends upon the proper adjustment of the amount of walking to the walker's physical capacity, that there may be no overdoing nor any deficiency through fear of overdoing. On the other hand the satisfaction attending the knowledge of just how far one has walked in a day's excursion, always adds a relish to the performance. Accordingly not a few of those who, for pleasure, or in the pursuit of health, have cultivated this most delightful of recreative exercises, have so felt the need of a simple pedometer that quite a demand has arisen for such an instrument.

The pedometer made abroad for surveyors' use has failed to meet the wants of walkers generally. It was expensive, and, besides, could not be adjusted to suit the varying step of men, women, and children. The instrument illustrated in the accompanying engravings meets these wants fully and cheaply.

The American pedometer is shown in Fig. 1; the working parts, which are few and simple, may be seen in Figs. 2 and 3. The recording apparatus is impelled by the oscillations of the weight, A, which is nearly counterbalanced by an adjustable bow spring. The arm that supports the weight carries pallets that engage the ratchet wheel, B, at every oscillation of the weight. The small pinion connected with the ratchet wheel engages a pair of differential wheels on the back of the dial, C, one of which is secured to the dial, while the other is placed on a hollow stud, carrying an index hand in front of the dial, as shown in Fig. 1.

The wheel that carries the index hand has one less tooth than the other, so that, when the dial has been turned through one revolution, the wheel that carries the index hand will have gained a distance equivalent to one tooth, recording one revolution of the dial.

THE AMERICAN PEDOMETER.

The instrument may be readily adjusted to any length of step, from 17 to 35 inches, the varying scale on the dial being constructed to admit of this adjustment.

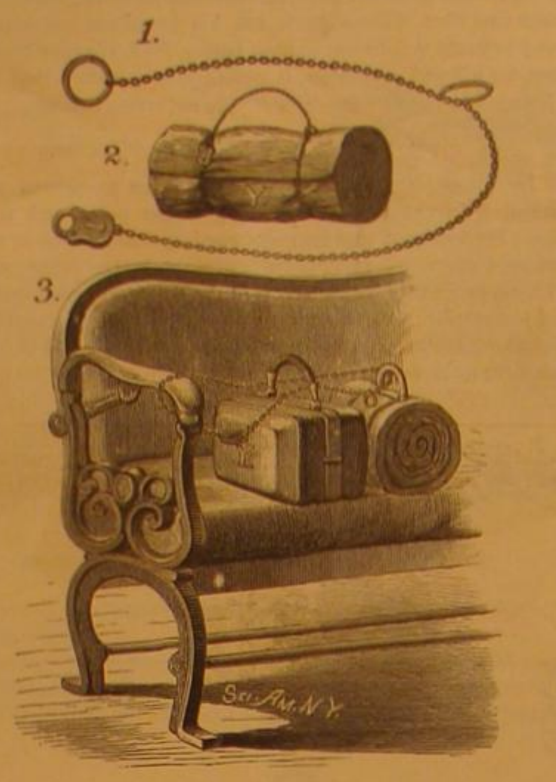
This pedometer is the invention of Mr. Benj S. Church. Messrs. Tiffany & Co., of Union Square, New York city, are the sole agents for its introduction and sale.

A Singular Storm.

The storm of sleet which lately caused so much havoc in the forests of France by overloading the trees with ice, was more than paralleled by a recent storm in Oregon. The Ashland *Tidings* reports that one morning, on looking towards the mountains south of Ashland, the people were surprised to see the pine trees all bending in one direction, as though bowed by a terrific wind storm, while the morning was clear and calm—not a breath of air in motion. Upon a closer inspection the phenomenon was easily accounted for. During the night before a heavy windstorm had swept over the mountains, accompanied by rain and snow, and the steady force of the wind held the branches of the trees in the bending, crouching position, while the snow weighed them down, and the rain freezing upon them as it fell fastened them in that shape with unyielding bonds of ice; and so they remained until old Sol mercifully set them free.

NOVEL BAGGAGE FASTENER AND SHAWL CARRIER.

In the old times a valise, shawl, package, or parcel deposited in a car seat sufficed to secure it if left by the traveler for a moment. It was then only a matter of ordinary courtesy to regard this custom, but in this fast age the traveler not only risks losing his seat, but his baggage also, if he chances to step out of the car or lose sight of it for a minute. This is especially the case at meal times while traveling by rail, or in waiting for trains, or in making transfers in the course of travel, either by rail or steamboat.



YOUNG'S BAGGAGE FASTENER AND SHAWL CARRIER.

To obviate this risk of loss of baggage and the annoyance of carrying or watching it, Mr. Geo. M. Young, of El Paso, Ill., has devised and patented the fastener shown in the accompanying engraving. This invention, although very simple and inexpensive, must prove of great value to travelers. It consists of a chain carrying a loose link, and having upon one end a large ring, and upon the other a padlock. The lock and the ring at the ends of the chain are of such size as to retain the loose link, as will be seen by reference to Fig. 1.

In employing this device as a shawl carrier a loop is made in one end of the chain to receive the shawl or other article, by passing the portion of the chain near the end through the end ring: the loose ring and lock form another loop, and the portion intervening between these loops serves as a convenient handle. The device as thus arranged is shown in Fig. 2.

When used as a baggage fastener either end of the chain may be passed through the handles of the valises, baskets, or whatever it is desired to secure, and then passing them around a car seat arm, chair round, or other object, when the lock is engaged with either or both of the rings, as shown in Fig. 3.

Mr. Young, the originator of this device, is an old railroad man and an experienced traveler, and having seen the necessity of a thing of this kind he invented it. Its advantages need not be further stated, as it recommends itself.

A NEW DOUGH KNEADER.

The improved dough kneading machine shown in the accompanying illustration is capable of rapidly and thoroughly mixing and kneading large quantities of dough. Probably few of our readers realize the great advantage in mixing dough so thoroughly that every particle of the flour is utilized. We are informed that actual experiment has proved that where this machine is used there is a considerable saving in flour, besides producing a finer quality of bread, which readily commands a better price than the hand-made article.

The construction of the machine is quite simple, and seems well adapted to the purpose. The large annular trough, which contains the dough, is supported upon rollers, and rotated by a bevel pinion on the horizontal driving shaft, the latter being driven by a small steam engine, secured to the same base that supports the trough. There are in the trough two peculiarly shaped kneaders secured to horizontal shafts, and a breaker which is supported by an arm and carried by a vertical shaft. The shafts of the kneaders and mixers receive their motion from the driving shaft by an ingenious combination of gearing, which is concealed by the middle portion of the trough. In this machine the dough is rapidly and uniformly mixed by the joint action of the revolving trough and the kneaders and breakers.

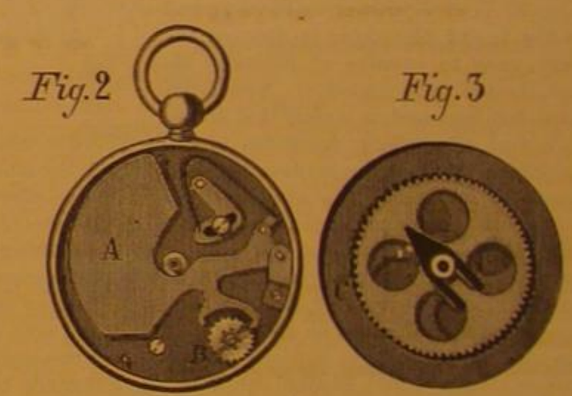
The manufacturer says that the machine does not require a skilled mechanic to run it; an ordinary baker can learn to run it in an hour.

Further information may be obtained from Mr. H. C. Bosse, Quebec, Ontario, Canada.

RECENT AMERICAN PATENTS.

Mr. Thomas B. Taylor, of Mount Meigs, Ala., has invented an improvement in cotton presses, by which slackness of the bale band is obviated, and the bale is retained at the smallest size to which it was compressed, and the old ties may be removed without cutting.

An improved looping attachment for sewing machines, patented by Mr. Alfred W. Cochran, of Harris, Ala., forms a loop in the upper thread above the presser foot, so that when the needle descends in making the last stitch in a seam, a knot is formed, which prevents the unraveling or loosening of the end stitches.



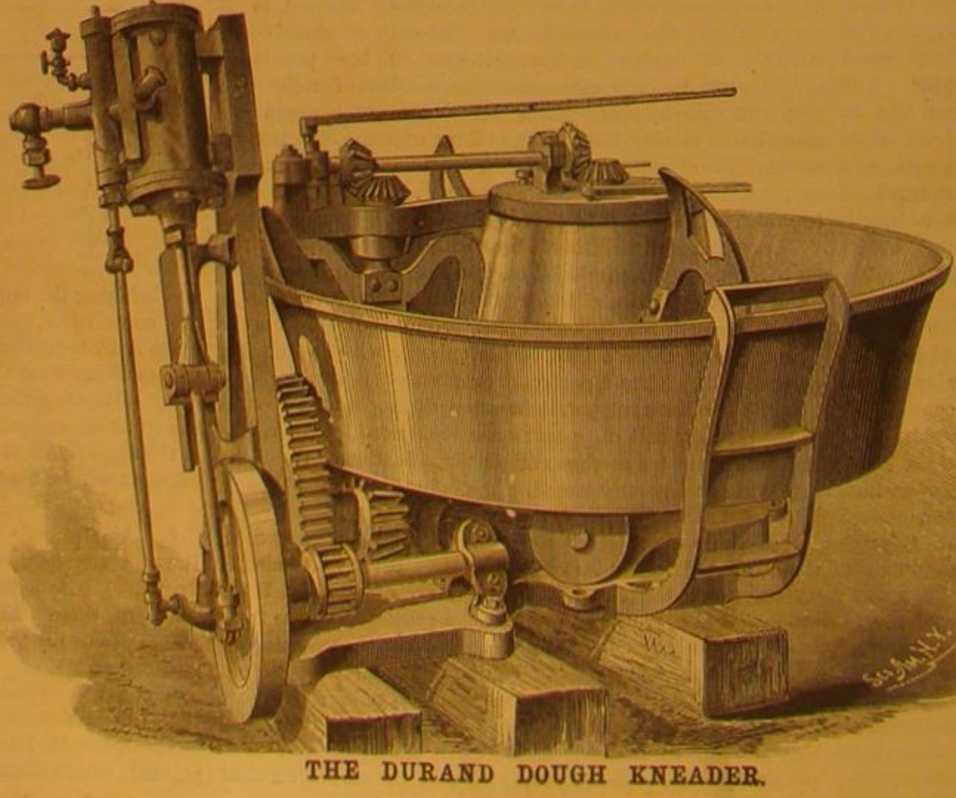
THE AMERICAN PEDOMETER.

Mr. Francis W. Long, of Philadelphia, Pa., has patented a novel bird cage support, which consists of a spring-acted drum, on which is wound the cord which supports the cage. The spring in the drum is sufficiently powerful to sustain the cage, and the cord is clamped in any desired position by a peculiar fastener.

An improved thill coupling, patented by Mr. R. Houghtaling, of Great Valley, N. Y., has a rubber pressure block fitted into the hinged cover for preventing rattling and taking up wear. The coupling permits of readily attaching and detaching the thills or pole from carriage.

An improvement in vehicle axle lubricators has been patented by Mr. James M. Smith, of Sycamore, Ill. It consists of a box having grooves and recesses filled with packing material for retaining the oil, and in an oil box of peculiar construction, which communicates with the packed grooves.

Messrs. P. J. Clark and Joseph Kintz, of West Meriden, Conn., have patented an improvement in hanging lamps, which consists in connecting rubber tips to the underside of the weights upon the edge that rests upon the shade or ring holder, the object being to prevent the jar resulting from the contact of the weight with the shade ring.



THE DURAND DOUGH KNEADER.

THE FLYING FROG.

The flying frog is a native of East India and the islands of the Sunda Archipelago. Several species of these frogs have long been known, but it was not until a few years ago that Wallace discovered that the skin connecting the toes of this frog serves not only for swimming, but for flying also. Wallace thought he had discovered an entirely new species, but subsequent researches have proved the identity of this frog with the so-called paddle frog previously known

As will be seen from the accompanying engraving, the toes of the flying frog are very long, and are connected by a skin, which is laid in numerous folds when the animal is at rest, but which, when spread, covers a larger area than is taken up by the body and limbs of the animal. The individual captured by Wallace was altogether about four inches long. The skin between the toes of the hind feet measured four and a half square inches, while the area taken up by the extended skins of all four feet exceeded twelve square inches. The ends of the toes are provided with concave disks, the peculiar construction of which permits the frog to take a firm hold of the branches. Another peculiarity of this frog is the power to inhale and store in the body a large volume of air. By this means the body is considerably distended, and its weight, compared with its bulk, reduced. This faculty and the large surface offered by the membrane between the toes, enable the frog to fly short distances from branch to branch. In appearance the flying frog is extremely beautiful. The back and legs are of a lustrous green color; the belly and toes are yellow; the skin between the toes black and decorated by yellow stripes. With the exception of the folds in the web of the feet, the surface of the entire body is smooth.

THE FLYING FROG.

THE FENNEC, OR SAHARA FOX.

The fennec is an inhabitant of Africa, being found in Nubia and Egypt. It is a very pretty and lively little creature, running about with much activity, and anon sitting upright and regarding the prospect with marvelous gravity. The color of the fennec is a very pale fawn, sometimes almost of a creamy whiteness. The tail is bushy, and partakes of the general color of the fur, except at the upper part of the base and the extreme tip, which are boldly marked with black.

The full grown animal is quite small, measuring scarcely more than a foot, exclusive of the bushy tail, which is about 8 inches long.

It is said that the fennec, although a carnivorous animal, delights to feed upon various fruits, especially preferring the date. It is also said that it can climb the trunk of the date palm and procure for itself the coveted luxury.

This creature presents a strange medle of characteristics that have been a stumbling block to systematic zoologists, and it has been frequently transferred by them from one portion of the animal kingdom to another. Now, however, it is admitted that the fennec belongs to the genus *Vulpus*, being a congener with the various foxes of the Old and New Worlds.

Like veritable foxes, the fennec is accustomed to dwell in subterranean abodes, which it scoops in the light sandy soil of its native land. Its fur is of considerable value among the natives of the locality wherein it is found; it is said to be the warmest found in Africa, and is highly prized for that quality.

The fennec is a quaint little creature, wearing an air of precocious self-reliance that has quite a ludicrous effect in so small an animal. The color of its eyes is a beautiful blue; and the whisker hairs which decorate its face are long and thick in their texture and white in color. The fennec is identical with the fox-like animal named "zerda" by Rüppell and "cerdo" by Illiger.

KNOWLEDGE cannot be acquired without pain and application. It is troublesome, and like deep digging for pure waters; but, when once you come to the spring, it rises up to meet you.

Utility of Toads.

In our last issue we published an appeal, all the way from India, for the crow, which our farmers a little later will strive to annihilate, and, failing in that, will contrive all sorts of devices for scaring them from their fields. Now comes an appeal from our own land in behalf of the toad.

A writer in the New York *Tribune* notices the fact that many gardeners already appreciate the valuable services of common toads for their insect-destroying propensities, and afford them protection, while as many more, perhaps, are ignorant of their usefulness. To the latter class it should be known that toads live almost wholly upon slugs, caterpillars, beetles, and other insects, making their rounds at night when the farmer is asleep—and the birds too—and the insects are supposed to be having it all their own way. English gardeners understand these facts so well that toads are purchased at so much a dozen and turned loose, and the best of it is the toads generally stay at home, so the gardener is not troubled with buying his own toads over again every few days.

The toad can be tamed, and will even learn to know its master, and come when called; the writer has not only had such pets himself, but could give other instances of toad-taming that have come under his observation. Toads can be made very useful about the house, and will do not a little good in destroying cockroaches, flies, and other household pests. They are sometimes known to eat worms, which they grasp by the middle with their jaws, cramming in the writhing ends of the unfortunate articulates by means of their front feet. Insects are seized and conveyed to the mouth by means of the rapidly darting tongue, which always secures the victim as it is about to fly or run away.

NATURAL HISTORY NOTES.

A New Natural Order of Plants.—If not an entirely new order, at least a very anomalous member of the vegetable kingdom, has been discovered by Dr. Beccari, in New Guinea. It is described and figured in the third part of Dr. Beccari's *Malesia*. At first sight one would take it for an orchid, and on a little closer inspection one would be inclined to regard it as an orchid with six free stamens. The plant, which has been called *Corsia ornata* (the genus name in honor of the Marchese Corsi Salviati), is a brittle, straw-colored, root parasite, from 6 to 8 inches high, with a stoloniferous root emitting long fibers, and bearing scales and buds. The stems are somewhat clustered or tufted, and clothed with variable scales increasing in size upward, the upper ones sheathing at the base, and about an inch long. Each stem is unbranched,

FENNEC.—(*Vulpes Zaarensis.*)

and terminates in a solitary flower about 1½ inch in diameter when fully expanded. The perianth is superior, and consists of six divisions, a large upper cordate one, which is erect and flat, like the standard of some *Papilionaceæ*, and five narrow strap-shaped ones directed downward. Stamens six, in two series; filaments distinct, but very short and thick; anthers two-celled, relatively large; pollen pulverulent; ovary inferior, one-celled, with three intruding parietal placentas; style short, clavate, terminating in a three-lobed stigma. With regard to the position of this singular plant in the natural system, Dr. Beccari says it is undoubtedly near the orchids, and further adds that it might constitute the type of a new family between the *Burmanniaceæ* and *Hypoxidæ*, to be called the *Corsiaceæ*. The habitat of the plant is in Mount Morait, on the north coast of New Guinea, at an elevation of 1,200 to 1,300 feet.

Respiration of "Amia."—The *Amia calva* is a fresh water fish, abundant in the Mississippi river and the great lakes. It attains a length of about two feet. Prof. Burt G. Wilder, of Cornell University, has published in the Proceedings of the American Association for the Advancement of Science, an account of a series of experiments which seem to show conclusively that *Amia* not only exhales, but also inhales air, and that this respiration is carried on by means of its swim-bladder. This is so much subdivided that Cuvier and others compared it to the lung of some reptiles. Experiments seemed to show that the aerial respiration was more active when the water in which the fish lay was imperfectly aerated. The average of 23 measurements of the amount exhaled was 13 c. centimeters. The exhaled air contained 3 per cent of carbonic acid; and, when the fish was fasting, it contained at least 1 per cent. The fish displays great powers of endurance of privation of water. On one occasion a specimen was kept out of water for 65 minutes without any apparent discomfort or injury. During most of the time the gill covers tightly closed, but there were regular movements of the jaw, hyoid apparatus, and sides of the mouth.

Does the Opossum "Play 'Possum?"—We often hear of this mammal "playing 'possum," as it is called; in other words, feigning death when captured. Does this really occur? Does the opossum deliberately make an effort to deceive its captors by assuming such a position, and suppressing its breathing to such an extent as to appear dead? In an article on this subject in the *Science News*, Dr. C. C. Abbott answers these questions in the negative. After a number of experiments made on this animal he draws the conclusion that the curled up position usually assumed by the opossum when it is supposed to be feigning death is that which the animal always assumes when sleeping, and that it is the one best calculated to prevent injury from blows, as the head and breast are thus protected. He says that the opossum is superlatively lazy and positively timid, and not intelligent when compared with the raccoon, otter, muskrat, or marmot, and he believes that the supposed habit of feigning death when captured by man is to be attributed to fear, and by no means to cunning.

Coorongite.—Great interest was excited in South Australia about ten years ago by the discovery of a curious carboniferous substance resembling caoutchouc found on the surface of the soil, and serious attempts were made to utilize it. The origin of the substance (which was known by the name of "coorongite") was very uncertain, although it was supposed to be derived from subterraneous deposits which oozed through fissures in the ground; but the sinking of deep wells in the ground led to the discovery that this theory was wrong. Large quantities were sent to England for experiment, but the supply proved very uncertain, and it was found that though useful chemicals might be derived from it, it would not properly amalgamate with the India rubber, so that it was useless to the manufacturers of India rubber goods. From an examination of specimens sent to the well known cryptogamic botanist, the Rev. M. J. Berkeley, the latter was inclined to believe that the substance was a vegetable production; and this view was held also by Mr. G. Francis, of the Adelaide Institute, who considered it a lichen from the fact that it was granular in structure and covered over with cups containing spores. During the fall of 1878 a fresh deposit was found, and a liberal supply having again been sent to Dr. Berkeley he now pronounces it to be not a vegetable, but a substance of as yet problematical nature, and states that nothing is likely to solve the difficulty but examination of it in the moment of deposit. The commercial value of the article being doubtful, the question now becomes one of purely scientific interest.

A Gigantic Earth Worm.—The government of Victoria has recently issued the first decade (containing ten colored plates) of a "Prodromus" of the zoology of the colony. One of the most interesting of the invertebrate animals figured in the work is the gigantic earth worm, named *Megascolides Australis* by Prof. McCoy, which inhabits the rich soil of the Brandy Creek district of Victoria, and attains the surprising length of from 5 to 6 feet.

The "Whistling Tree."—In Nubia there are groves of acacias extending over 100 miles square. The most conspicuous species, says Dr. Schweinfurth, is the *Acacia fistula*. Its Arabic name is "soffar," meaning flute or pipe. From the larvæ of insects which have worked their way to the inside, their ivory white shoots are often distorted in form and swollen out at their base into a globular bladder-like gall, about one inch in diameter. After the insect has emerged from a circular hole, this thorn-like shoot becomes a sort of musical instrument, upon which the wind as it plays produces the regular sound of a flute. On this account the natives of the Soudan name it the "whistling tree."

The Puff-balls of the United States.—In a monograph of these fungi read before the Albany Institute in February, by Mr. Charles H. Peck, the author states that these well known vegetable productions are useful because they are edible. None of the species are considered dangerous or even hurtful, yet some are so small and so scarce that they are not of much value for food. The larger ones are generally better flavored than the smaller and more common ones. They should be used as food in the immature condition only, while the flesh is as yet of a pure white color. Puff-balls as an article of food have the advantage over mushrooms that they are not often infested by insects or their larvæ, and there is scarcely any possibility of mistaking any deleterious species for them. There are several genera of puff-balls, the most extensive one being that of *Lycoperdon*. It is this genus that is the subject of Mr. Peck's paper. The whole number of species of this genus thus far known to grow in the United States, according to the article, is 23; and of these the edible qualities of six of the larger species were personally tested. He recommends as good eating the "giant" puff-ball (*L. giganteum*), the "cup-shaped" (*L. cyathiforme*), the "long stemmed" (*L. saccatum*), and "Wright's" (*L. Wrightii*); but finds the two common ones—the "studded" (*L. gemmatum*) and the "pear-shaped" (*L. pyriforme*)—of an unpleasant flavor. The largest specimen of New York puff-ball that Mr. Peck has seen was one contributed to the State cabinet by Mr. Warne, and which was 15 inches in diameter in its dried state, and which was of course considerably larger when fresh.

Operation of Trimming a Tiger's Toes.

The Philadelphia *Evening Bulletin* gives the following graphic account of the operation of securing a tiger and trimming his toe nails, as performed at the Zoological Garden a few days ago. It seems the Royal Bengal Tiger had been suffering for a long time from in-growing claws, which had become so painful that it was with difficulty he was able to walk about his cage. It seems also that "Jim," for that is the animal's name, had become somewhat celebrated for his intractability, and from his distinguishing himself a short time after his advent at the Garden—1876—by inflicting injuries on his mate, from which she shortly afterward died. The female was confined in a cage next to "Jim," and one day stuck her tail through the bars into the compartment of her lord and master. That individual, being in a particularly ugly mood, seized her tail and held on. She, in order to free herself, put her hind legs against the bars and pulled. Her leg slipped between the bars, and "Jim" relinquished his hold upon her tail and caught her leg, which he literally crunched between his teeth. The injured animal died soon after the occurrence.

Not long ago, while Mr. Forepaugh, who performed the operation, was visiting the garden, he noticed the tiger's condition, and said at once that the claws should be cut. Speaking from a life-long experience, he said that if the claws were allowed to remain much longer, death from lockjaw would be the result. Superintendent Brown accordingly made arrangements for the lion tamer to undertake the job.

The undertaking was no trifling one, for a tiger is so powerful and active an animal that there was serious danger of his breaking his neck in his struggles. The operator was also in danger from the teeth and paws of the tiger. Upon the rail in front of the cage were arranged five stout manila ropes, each provided with a slip knot and a safety string. A safety string is a stout cord attached to the knotted loop in the rope, and when pulled it acts so as to release or open the knot. It is used so that the rope can be thrown at once from an animal in case "anything goes wrong," to use Mr. Forepaugh's words. One of the ropes was a ¾ inch rope, which was used to secure the animal's head. The others were ½ inch ropes, and were used to fasten the paws.

TYING THE TIGER.

The spectators were decidedly nervous when Mr. Forepaugh drew off his coat and the keepers arranged themselves in front of the cage. But not so with the man upon whom all the danger and responsibility rested. He was calm, cool, and deliberate, and his steel-gray piercing eyes took in every movement of his animal.

The tiger, meanwhile, was lying with its head close to the bars at the front of the cage, and when Mr. Forepaugh gently touched him with a pole he got up and hobbled around, looking in mild surprise at the array of keepers. The lion tamer coaxed him over near the bars, and placing the loop of the large rope on a pole, tried to pass it over his neck. The tiger did not at first understand this maneuver and avoided it. He was soon cornered, however, and the loop thrown over his neck and pulled tight. To his intense surprise and rage, he was drawn close to the bars. He then lay down and quietly awaited developments. The loop of one of the smaller lines was next laid in front of his front right paw. Mr. Forepaugh then, with a small iron scraper, pushed one rope under the paw, when the assistants drew the loop tight, and pulled the paw also close to the bar. "Jim," by this time, was fully awake to the situation, and he showed his rage by deep roaring and frantic struggles to free himself. The cool and collected Mr. Forepaugh paid no attention to these demonstrations of the tiger's disapprobation of the proceedings, but secured the other paw in the same way. The animal was now fronting the spectators, and, in order to secure the hind legs, Mr. Forepaugh had to enter the cage, and tie the unsecured paws of the tiger. When both of the rear legs were caught in the noose, "Jim" sprang up in order to attempt to get loose, when the assistants, by drawing on the ropes, threw him on his "broadside" and drew his four paws close to the cage bars in front.

THE CUTTING.

When the paws were secured close to the bars, the rope around the neck was removed, and a man was stationed near the head with a stout stick of oak, with instructions to put it in the tiger's mouth every time he raised himself and attempted to bite his fastenings.

The rear right foot, the worst of the four, was next drawn through between the bars, and the cutting part of the operation commenced. Mr. Forepaugh used a pair of wire nippers, sharpened to a fine edge, and seizing the paw, he pressed out each claw and cut the end off. In this paw each claw had grown into the ball of the foot. After cutting off one of the claws, Mr. Forepaugh called for a penknife, and dexterously drew from the wound another claw which had grown in and which had been shed. When the claws on this foot had been cut, burnt alum was rubbed into the wound and balsam of fir was then poured in. The former was to remove the corruption and the latter to heal the wound. This same operation was repeated with the other hind paw, and Mr. Forepaugh then proceeded to attend to the front feet. This operation was rather more dangerous, as the lion tamer was forced to place his hands within reach of the tiger's formidable teeth. Each time, however, that he started up, the stick was presented to him to chew upon, and when all was over, the end of the oaken stick was found to have been splintered by the animal's teeth. When all the claws had been clipped, and the alum and balsam rubbed into the wounds, the attendants, at a word from Mr. Forepaugh, pulled on the safety ropes, and the tiger sprang to his feet and was free.

The relief was immediate, judging from the manner in which the great beast walked about his cage. Mr. Forepaugh said that the paws would probably heal in a few days, if proud flesh did not appear. In that case "Jim" would have to be again secured, and more alum, or perhaps caustic, rubbed into the wounds. The whole operation was performed inside of twenty minutes, and had the cage been smaller and the bars further apart it would have taken even less time.

The cut claws will grow again in time, and will, in all probability, grow in again, and will have to be clipped; but after they are clipped once more, it is believed they will not grow in again. Mr. Forepaugh said that they should be cut as soon as they grow out and exhibit a tendency to turn inward. He also said that all graminivorous animals should have their hoofs pared once a year, as it makes them stand better. Neglecting this injures all such animals.

Capture of a Devil Fish.

One of the fishermen employed by Larco in drawing his nets this morning found, entangled in its meshes, a veritable devil fish of large size. The ugly thing was so entangled, and held on with such tenacity, that it was with great difficulty, and only after tearing the net badly, that it was released and got into the boat. It was brought to the wharf, where a number of persons visited and inspected the monster. The body is an elongated oval about 15 inches wide and 4 feet long from the head to the end of the spear-shaped tail. The mouth, or rather beak, is exactly like the mandibles of a hawk, and is placed underneath the body. The long arms or feelers, of which there are eight, radiate from around this beak, and the largest of them are upward of 7 feet in length, making 11 feet from the end of the two longest tentacles to the tip of the tail. The other arms are from 4 to 5 feet long. The underside of these feelers, for about two feet from the tip, are armed with rows of sharp-pointed hooks, increasing in size as they approach the end, where they terminate in veritable talons. The body is of a reddish-gray color on top and a pale salmon pink underneath. The underside is covered with small suckers possessing considerable power. Even after the creature had been on the dock for some time, and was nearly dead, a finger placed to the mouth of one of these suckers was seized upon and only released by a strong pull. While lying on the dock the fish exuded about two gallons of the dark fluid with which it is supplied, and which it uses to discolor the water, either to conceal itself, or to render helpless its prey. This fluid is of a most offensive odor and is of a dark yellow color. The monster, which was captured just inside of the line of kelp, would be an unpleasant thing to come across in the water, and after seeing him one can thoroughly appreciate the scene in the cavern, so graphically described by Victor Hugo in "The Toilers of the Sea." The fish was cut up and taken out by the fishermen to their crab nets as bait, but the beak and some of the larger talons were secured by Mr. Reece. Small fish of this description have been found in the channel at different times, measuring from 6 to 8 inches, but nothing approaching this one in size has ever been captured in this vicinity.—*Santa Barbara (Cal.) Press, March 22.*

Pinto's Journey Across Africa.

Pinto, the Portuguese explorer, reports that, notwithstanding the grievous hardships and difficulties, he succeeded in saving all his papers, embracing twenty geographical charts, many topographical maps, three volumes of notes, meteorological studies, drawings, and a diary of the complete exploration of the Upper Zambesi with its seventy-two cataracts

Architects' Trials and Tribulations.

A writer in the *American Architect* relates the common experience and trials of architects with their customers as follows:

What architect has not had clients who came to him with a painfully elaborated impossible sketch, saying, "Now, this is about my idea of a house. I wish you would make me a design that would embody it in a practical form." The architect takes such a sketch and remodels it, endeavoring to satisfy all the requirements, and making of it, in the end, a creation entirely his own, which he presents to his client, who exclaims almost invariably, "Why, how simple! any one could have done that!" and makes up his mind that architecture is a very easy business. Or, again, an architect inquires about some work that excites his interest or admiration, as having architectural merit, and is answered, "Well, Mr. So-and-so was our architect, but we really did not need him; my wife was the real designer, and the good points of the house are all her ideas." Of course it is not pleasant to have one's thunder stolen in such a manner, and the unfortunate architect who has twisted and turned his plans and put one tracing over another, in trying to reconcile the ideas of his client's wife with themselves, with each other, and with his design, is tempted to vow that in future he will reject, on principle, all ideas brought forward by his client's wife or any of his female relatives; or—a more dreadful vengeance still—that he will let madam design the house herself. It is the only redress he can hope for, as, when such a version of his services is given, it is more generally believed than would seem possible, in view of its improbability, and he has few opportunities to justify himself.

But there are other instances where architects are subjected to more serious wrongs and annoyances, and which are seemingly as difficult of redress. An architect is invited, for instance, together with a number of other architects, to submit designs for some large building; the architect whose design proves the most acceptable to the owner or client is to be appointed architect of the building, and to carry out his design; the other competitors are to be paid a fixed sum, avowedly based, under the most liberal arrangements usually made, upon the amount of time and labor required to produce the drawings. In due time the designs are submitted to the owner, or his representatives, one of them is selected, and its author appointed architect, the other designs being returned to their authors, with the stipulated compensation. So far our architect, whom we will suppose to be one of the unsuccessful competitors, has nothing to complain of, unless, indeed, he has reason to believe that other considerations than the competence of the competitors and the merits of their design were allowed to influence the choice of the owner, a contingency which we will not consider here. The building goes on, and our architect returns to his own affairs, but discovers, during or after the erection of the building, that certain essential features, which at the time of the competition only appeared in his drawings, have been embodied in the new building. Now, what position can he take in the matter? Has he a right to feel that he has been defrauded, and if so, who has defrauded him, and what redress can he obtain?

Beer Drinking in the United States.

For some years past a decided inclination has been apparent all over the country to give up the use of whisky and other strong alcohols, using as a substitute, beer and bitters and other compounds. This is evidently founded on the idea that beer is not harmful and contains a large amount of nutriment; also that bitters may have some medicinal quality, which will neutralize the alcohol it conceals, etc. These theories are without confirmation in the observations of physicians and chemists where either has been used for any length of time. The constant use of beer is found to produce a species of degeneration of all the organism, profound and deceptive. Fatty deposits, diminished circulation, conditions of congestion, and perversion of functional activities, local inflammations of both the liver and kidneys, are constantly present. Intellectually, a stupor amounting almost to paralysis arrests the reason, precipitating all the higher faculties into a mere animalism; sensual, selfish, sluggish, varied only with paroxysms of anger, that are senseless and brutal; in appearance the beer-drinker may be the picture of health, but in reality he is most incapable of resisting disease. A slight injury, severe cold, or shock to the body or mind, will commonly provoke acute disease, ending fatally. Compared with inebriates, who use different forms of alcohol, he is more incurable, and more generally diseased. The constant use of beer every day gives the system no time for recuperation, but steadily lowers the vital forces, it is our observation that beer-drinking in this country produces the very lowest forms of inebriety, closely allied to criminal insanity. The most dangerous class of tramps and ruffians in our large cities are beer drinkers. It is asserted by competent authority that the evils of heredity are more positive in this class than from alcoholics. If these facts are well founded, the recourse to beer as a substitute for alcohol, merely increases the danger and fatality following.

In bitters we have a drink which can never become general; but its chief danger will be in strengthening the disordered cravings, which later will develop a positive disease. Public sentiment and legislation should comprehend that all forms of alcohol are more or less dangerous when used steadily; and all persons who use them in this way should come under sanitary and legislative control.—*Quarterly Journal of Inebriety.*

SILVER WATER BOTTLE.

The engraving on this page represents a solid silver water bottle of rare beauty, engraved by native Indian designers, who follow with great strictness the canon of art which has obtained for centuries; only too often misapplied by our own workmen in their endeavors to improve upon foreign styles of art, without understanding their principles.

ENGRAVED SILVER WATER BOTTLE.

The Coliseum Drained.

The stagnant water which has been suffered for years to accumulate and breed fevers and frogs in the Coliseum at Rome, has been drained off at last. An ancient sewer, extending from the *meta sudans* to the Tiber, was discovered, and was connected with a drain from the Coliseum. The water was admitted into this ancient sewer on the 3d of March, and the flood which filled the basement story of the famous amphitheater of Flavius was gradually drawn off. In cleansing the sewer there were found a quantity of ancient lamps with gladiatorial ornamentation, human skulls, and bones of animals. Much of the old Roman road in the Foro Romano is now exposed to view, and the ruins of the shops of the goldsmiths and silversmiths are visible.

Waterproofing of Cotton and Linen Fabrics.

The recipe for "waterproofing" stout calico, used by the Chinese, and which is perfectly efficient, alike in the hottest and coldest climates, is believed to be composed of boiled oil, one quart, soft soap, one ounce, and beeswax, one ounce; the whole boiled until reduced to three quarters of its previous quantity; but experiments are required to satisfactorily test the above proportions; paint soon cracks, and ceases to be impervious to water. The addition to the boiled oil preparation of some ingredient which would prevent all risk of spontaneous combustion, when bales of oiled goods are sent abroad, would be advantageous; but no objection on this account applies to the supply of waterproof sheets (prepared with boiled oil, etc.) for use in ships, as only those that are in the hammocks would be coated, and with them there would be no more risk than is incurred with the seamen's waterproof jackets; the small spare supply would be harmless calico sheets, not to be waterproofed until required.

The recipe used by Mr. Berthon to render the canvas of his collapsing boats airproof and waterproof, and believed to be similar to that used in the British dockyards for hammock cloths, is as follows: To 6 oz. of hard yellow soap add 1½ pint of water, and when boiling, add 5 lb. of ground spruce ocher, ½ lb. patent driers, and 5 lb. of boiled linseed oil.

For waterproofing sheets, the ocher should be omitted, as it adds to the weight, lessens the flexibility, and is unnecessary.

Japanese Bronzes.

Mr. Consul Flowers, in a report on the commerce of Hiogo and Osaka, Japan, lately issued by the Foreign Office, thus speaks of the manufacture of Japanese bronzes: "The moulds, which of course vary according to the shape of the vase or bowl it is desired to make, are made of wood, sometimes covered with straw. On this a coating of clay is placed; over this comes a layer of wax, which is moulded into the design required. Another thick coating of clay is then added, and the inner wooden mould being taken out the orifice at each end is closed. Two holes are then made at one end connecting with the layer of wax, so as to enable the wax, when melted, to run out, and through these the molten bronze enters, filling the interstices occupied by the wax. The subsequent process of casting is of the rudest kind. The earthen mould is placed in a small clay oven hollowed out in the floor of the workshop, the size of which depends upon that of the casting. The oven is then filled with charcoal and closed, with the exception of a circular opening at the top, on which a chimney, a foot or so high, is built of wet clay. The oven is connected underground with a wooden bellows, protected from the sparks and heat from the furnace by a small earthen or stone wall a foot high, and which is worked by hands and feet. The first operation is to melt the wax, which runs out, leaving the impression of the design stamped firmly in the surrounding layer of clay. This done, the mould is taken out and allowed to cool. It is then put a second time into the furnace as before, and the molten bronze is then poured into the mould through the holes by which the wax escaped. After the bronze has filled the mould the chimney is knocked off, the oven supplied with fresh charcoal laid evenly around the mould, and a lid being put on the oven, furnished with small perforated holes, the bellows are set to work again for an hour or more, according to the size of the casting taken. This operation generally occupies a day. When the casting is taken out of the oven, the earth outside and inside is scraped off, and reveals the vase or bowl in a rough state. It is then put into the hands of rude workmen, boys being mostly employed in this part of the work, by whom it is polished and scraped with a knife until it presents a smooth surface. It then passes on to the carver, who fills in the details of the designs. When his work is done the vase or bowl is dipped into a boiling solution of vinegar, sedge, and sulphate of copper, in order to give it the proper color. A few finishing touches in the way of polish are added, and the article is finished and ready for sale."

Simultaneous Inventions.

We have repeatedly alluded to the singular fact, from our own observation, of persons residing in remote places from each other making the same invention about the same time. The *New England Journal of Education* mentions a new case of the simultaneous appearance of the same invention as follows:

"The application of the methods of ordinary writing to telegraphic communications has been a matter of long study and experiment, but hitherto without success. We were shown on Saturday, March 22, at our office, a simple contrivance, invented by Professor Dolbear, of Tufts College, Somerville, Mass., by means of which the handwriting of the operator may be transmitted with the record of the message to the office to which it is sent. Singularly enough, on February 26, 1879, Mr E. A. Cowper, of London, exhibited in operation, before the Society of Telegraph Engineers, in that city, a writing telegraph, constructed on the same principle as that of Professor Dolbear; and from the drawings in the SCIENTIFIC AMERICAN of March 29, one would suppose the instruments identical. The achievement is a valuable one, and both parties are worthy of highest credit as inventors."

DR. JAMES FREEMAN CLARKE recently delivered a discourse on the Chinese question, in which he very quaintly and truly said that in America, if a man is black we enslave him; if he is red we steal his lands and massacre his wife and children, and if he is yellow we won't let him come here at all.

Isinglass from Seaweeds.

A very interesting product, called "kanten," or vegetable isinglass—a species of gelose derived from either of the seaweeds *Gelidium corneum* or *Plocaria lichenoides*—is made in China and Japan, and exported to Europe in flat and moulded tablets and in bundles of strips. It is known in Cochin China as "hai thao," and is used in France in several industries, especially in the preparation of gold beater's skin, and for rendering tissues impermeable. It is soluble in boiling water only, of which it takes up about 500 times its weight. It is manufactured as follows:

The seaweed, called by the native name of "tengusa," is carefully washed and afterward boiled, so as to form a gluish decoction, which is strained off and put into square boxes. When cool it forms a stiff jelly, which can easily be divided into squares a foot in length. The manner in which the surplus water is removed is very ingenious. The jelly prisms are exposed in the open air during a cold night and allowed to freeze. During the day the sun melts the water, which runs off, leaving behind what one might term the skeleton of white horny substance, which is extremely light and easily dissolved in hot water; when cooled, it again forms a stiff jelly. This article can be applied to many purposes—for culinary uses, for making bonbons and jellies, for clarifying liquids, as a substitute for animal isinglass, for making moulds used by the plaster of Paris workers, for hardening the same materials—in short, as a substitute for all kinds of gelatines, over which it has the advantage of producing a firmer jelly. Another seaweed much used for industrial purposes is the "fu," resembling carrageen or Irish moss, and applied to similar uses, such, for instance, as the sizing of the warp of silk goods. Recently the manufacture of an isinglass of this kind has sprung up in France, being made from the seaweeds found on the coast of that country. In its crude state it is a yellowish gelatine, but after repeated experiments under the auspices of the Industrial Society of Rouen it has been successfully converted into what bids fair to prove the best sizing for cotton cloth known, and will probably entirely supersede the Asiatic product. Macerated in water for twelve hours, boiled for fifteen minutes, and stirred till it becomes cold, the article gives a clear solution, which, as it does not again become a jelly, can be laid in its cold state upon any textile fabric and be left to dry. One invaluable property it possesses is that of defying at common temperatures damp and mildew; and is, therefore, being applied to give a luster not only to French prints and muslins, but also to woolens and silks.

In China the first quality of the seaweed isinglass is used in a number of industries, especially in stiffening light and transparent gauzes, and the fine silk which is used for making fans, screens, hangings, etc. It is on these stuffs, so well stiffened, that the artists produce such beautiful designs in colors, incomparable for their freshness and brilliancy. A second quality of the article, of darker tint, is used by the makers of paper umbrellas and parasols and paper lanterns, to smear the fine stretchers of bamboo on which they are formed. When thoroughly dried these articles of such extensive use acquire an impermeability of long duration.

The Utilization of Sulphides as Fuel in Metallurgy.

A new application of a process of rapid oxidation, by means of which sulphides are used as fuel, and which promises apparently to become of considerable importance in metallurgical operations on a large scale, has recently been brought to the attention of the Society of Arts by Mr. John Holloway.

The new process is based on the following data: The combinations which go to make up the solid crust of the earth consist, as is well known, of compounds of the elementary bodies with oxygen, and compounds of the elementary bodies with sulphur. Thus, for instance, iron combined with oxygen, forming oxide of iron, occurs in almost all rocks and forms vast deposits in many parts of the world. The same metal, mineralized by sulphur in sulphide of iron, known as iron pyrites, is one of the most widely distributed and abundant of natural minerals. Copper, lead, and zinc are likewise found as oxides and sulphides, and it is from these natural combinations that is extracted the whole of these metals, artificially produced. It is in one or the other of these two forms that the more common metals occur in nature.

In the present processes for extracting metals from their ores the requisite heat is always obtained by the burning of coal, coke, or other form of carbon. Mr. Holloway reminds us, however, that the sulphides can be made to burn in the air, and thus are truly combustible substances, while the oxides, on the contrary, are bodies that have already been "burnt." The metallic sulphides are consequently natural combustible minerals; in fact the largest deposits of coal existing in various parts of the world are, perhaps, more than rivaled as sources of latent heat by these natural sulphides, abundant in every country and occurring in almost every vein in the earth's crust. It was the author's object to prove that these minerals can be utilized as sources of heat in certain metallurgical operations. On account of the frequency of its occurrence, and the extent of its deposits, pyrites rank as the most important of the metallic sulphides. The principal constituent in this mineral in bisulphide of iron, with which are frequently associated sulphides of copper and arsenic; silver and gold, too, being often present in larger or smaller quantities.

When iron pyrites are roasted in the open air, an increase of temperature takes place in its mass, so that the oxidation proceeds without the continuation of external heat. The other principal sulphides are those of copper, lead, zinc, and antimony. Sulphureted ores of copper, lead, and zinc are usually roasted to render them reducible in the furnace, the necessary heat being always obtained by the combustion of coal or similar organic material. This roasting process extends over a considerable space of time, and the sulphur and metals frequently burn to waste, because the utilization of the heat resulting from the burning of such fuel has not hitherto been considered of much importance. From data obtained by calculating the comparative temperatures produced by the oxidation of the principal sulphides, Mr. Holloway was led to believe that during this oxidation sufficient heat was produced to render the smelting of the sulphides a self-supporting operation. Instead, therefore, of allowing the roasting of the pyrites to proceed in the usual slow manner, in which all the heat developed is lost, he proposes, after starting the oxidizing process by means of extraneous heat, to force a rapid current of air through the molten sulphide. By this means, he claims that the whole of the oxygen of the air is abstracted while passing through, and that the elevated temperature obtained by the quickened oxidation accomplishes in a few minutes what, in the case of copper pyrites, takes many months to do.

In several preliminary experiments, in which large quantities of pyrites were treated in a Bessemer converter, it was found that the pyrites could be melted by the heat evolved by its oxidation, and that the heat developed was sufficient to render the operation continuous. Full details of each experiment are submitted in Mr. Holloway's lengthy paper read before the Society of Arts; and the results of the experiments themselves, which were witnessed by many of the most prominent chemists of England and France, seem to promise an approaching revolution in the methods heretofore employed in certain smelting operations.

Silver Reduction in Colorado.

Mr. J. K. Hallowell gives in the Kansas City *Review* the following interesting account of the silver reduction works at Pueblo, Colorado:

The town (5,500 population) is garnished with a well-built court house and school houses, and is furnished with waterworks—the Holly system—while the fine brick residences on the surrounding mesa add materially to its substantial appearance. The place of most interest to me was the silver reduction works of Messrs. Mather & Geist, situated quite near the railroad cut. The chimney of the works is built on top of a hill, and the building containing the furnaces near the bottom; a long flue running up the hillside connects the two, and the distance is such that most of the vaporized precious metal is deposited and saved within it, while otherwise it would be lost. There are three furnaces, capable of reducing seventy-five tons of ore per twenty-four hours, each furnace running from eight to ten weeks before choking up; this is owing to the suitable character of the flues used and the care taken in keeping up an even temperature. Each furnace is square in shape, with two openings for running off the slag, and two more smaller through which the metal is continually emerging into a small pot built into the brickwork, and from there ladled into iron moulds containing about 150 lbs. each, and shaped very much like bars of pig iron. In this condition it is called base bullion, and is ready for shipment East, where it can be still further reduced more economically. The slag is drawn off into large iron pots mounted on wheels, and when cool enough is wheeled into the yard, dumped, and broken up, quite a large button of metal settling at the bottom, which is saved to go again through the furnaces. The coke comes from Trinidad, Col., the iron ore flux from Garland, while the limestone used is obtained about four miles up the river, where it is loaded direct on the cars from the quarry, the Narrow Gauge road having a switch track to the works, as does also the Atchison, Topeka, and Santa Fé Railroad, standard gauge, making railroad communication with the whole country. I was somewhat surprised to learn that Cañon City coals would not coke, while those from the north contain too much sulphur to be as good for smelting purposes as the coke obtained from Trinidad. The ores used are shipped from Rosita, Col., and Leadville, consisting of argentiferous galena from the "Ben Franklin" mines, some carbonates from the "Bassick" of the first place, and all carbonates from the latter. The Rosita ores are hauled to the works in wagons; the Leadville ores are hauled to Alamosa, Cañon City, and Colorado Springs, and from there shipped by rail. Of the Leadville carbonate—well, I have seen many clay banks that looked as rich, although there is a perceptible difference in the specific gravity; in color they resemble the clay banks of Kansas City, while the "Bassick" ore was a light yellow and much richer in "pay." The ores are shipped in sacks weighing from 70 to 150 lbs. Some is received in bulk from Leadville at present, the quantity taken out being greater than can be properly packed; to this there must be some waste in the long haul by wagons, and where, of course, a saving will be effected in time.

It is a real pleasure to visit works conducted as these are. Although many men are employed, there is no confusion or noise Each man appears to understand his duty and does it. The proprietors give personal supervision to everything, and as I watched the men carrying sacks of ore into the building, previous to weighing, I heard the manager cautioning the men to be careful in handling some sacks in which small holes were worn, that no ore might be wasted. It is such close and careful attention to the interests of their customers as this that is giving these works an enviable reputation among mine owners; for, as near as I could understand it, the smelting furnace stands in the same relation to the miner that the grist mill does to the farmer, and is conducted on much the same basis. As the ore is received after weighing, an average assay is made; a deduction of ten per cent made for loss, or difference between assay returns and actual working product. A charge of $30 per ton is made for reducing, and the balance paid the shipper at once, the price being based on the price of silver per ounce on that day.

A New Great Gun.

The British War Office has been invited by Herr Krupp to send representatives to be present at the trials of a new steel gun of extraordinary size, to take place at Meppen, in Westphalia. The invitation has been accepted by the War Office, which will be represented by two officers deputed for that purpose. The gun to be experimented with on this occasion is the largest specimen of steel ordnance yet made. It weighs 72 tons, with a caliber of 40 centimeters, or 15¾ inches. The length of the gun is 32 feet 8 inches, and that of the bore 28 feet 6 inches. The English 80 ton gun has a caliber of 16 inches, a total length of 27 feet, and a bore 24 feet long. The superior length of bore in the Krupp gun is thus apparent, being 21¾ calibers, as against 18 calibers in the English gun. The material of which the Krupp gun is composed is steel throughout. The core of the gun consists of a tube running its entire length, as in the Woolwich gun, but open at the rear, the loading being at the breech instead of the muzzle. The tube of this large weapon being of such great length it has been made in two portions, the joint being secured in a peculiar manner.

We may observe that a sectional drawing of a Krupp gun is not to be obtained; that the exact mode of building up is not discoverable, except by cutting the gun to pieces. Over the tube are four "jackets," or cylinders, of various lengths, supplemented by a ring over the breech portion. The cylinders are much less massive than in the Fraser gun, and approximate more to the pattern of the Armstrong ordnance. The gun is chambered—that is to say, the powder chamber has a greater diameter than the bore. The form given to the powder prisms, and the adjustment of the cartridge in the bore, allow altogether an amount of space which gives 40 per cent of air to the powder actually composing the charge. The gun is rifled on the polygroove system, with a uniform twist, and the shot is rotated by means of a copper ring let into its circumference near the base. This ring, by filling the grooves of the rifling, also acts as a gas check, and seals the bore from the moment it is rammed into its place, without waiting for any "setting up" by the pressure of the powder gas on igniting the charge. The closing of the breech is effected by means of a sliding wedge, which passes across the bore, and is there fixed. The construction of this wedge is highly ingenious and simple, one feature being that of rendering it impossible to fire the gun until the breech is effectually closed. The wedge is rounded at the back into the form of the letter D, so as to prevent the splitting of the gun by sharp angles. This modification of the wedge has made the Krupp guns much more secure than they were some years ago, when the wedge was made square at the rear.

The charge for this monster gun is to be 385 pounds of prismatic powder, the projectile being a chilled iron shell of 1,660 pounds, with a bursting charge of 22 pounds of powder. It is estimated that the velocity of the projectile as it leaves the muzzle of the gun will be 500 meters, or 1,640 feet per second, corresponding to an energy of very nearly 31,000 foot tons. Calculations have been made for certain distances—namely, at 547 yards a velocity of 1,565 feet, at 1,094 yards a velocity of 1,502 feet, at 1,641 yards a velocity of 1,443 feet, at 2,187 yards a velocity of 1,391 feet, and at 2,734 yards a velocity of 1,345 feet per second. This last range, it will be seen, is equal to 2,500 meters, the other distances given being respectively 500 meters, 1,000, 1,500, and 2,000.

The Meppen shooting ground is admirably adapted for the trial of this great gun, there being an available range of 17,000 meters, or nearly 11 miles, with a breadth of 4,000 meters. It is not likely that the gun will be fired at any great angle of elevation, or even this noble range would be insufficient. It is estimated, rather as a matter of curiosity than otherwise, that if the gun were fired with its axis raised to an angle 43° with the horizon, it would send its projectile to a distance of 15 miles. Great accuracy is also claimed for this weapon, as for all the Krupp breech loading guns. At the forthcoming trials targets will be placed at such a distance that the gun will have to be directed by other means than the visibility of the object to be hit. As may be supposed, the cost of this great steel gun will considerably exceed that of the Fraser gun of 80 tons. The largest steel guns previously made are Krupp's two 56 ton breech loaders, one of which is at Constantinople and the other at Cronstadt.

Dr. Draper thinks that stupid people may as well stop eating quantities of fish for the purpose of repairing the deficiencies of nature, for it won't make them intellectual. In brief, fish doesn't contain an excess of phosphorus, and when dead fish

Shine as bright
As the stars at night,

it positively isn't owing to the presence of phosphorus, but to the oxidation of carbon.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

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.

Going Abroad.—Any family intending to visit Europe this summer, and desiring the services of a competent and experienced courier, can hear of an honest and obliging man, who speaks most of the Continental languages, to accompany them, by addressing the editor of this paper, P. O. Box 773, New York.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N. Y.

The reason why Downer's Anti-Incrustation Steam Boiler Liquid is so successful, lies in the fact that it is a scientific preparation. It meets all cases. When properly used it cannot fail. Is not injurious to iron. Office 17 Peck Slip, New York.

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Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

I beg to state that owing to lack of manufacturing facilities I am unable to fill the numerous orders from all sections for my Economy Hydraulic Motors, and would ask manufacturers and others desirous of purchasing the right to manufacture in any State or the United States and Canada, to address me for good cash bargains. James Talley, Jr., Kansas City, Mo.

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Best Turkey Emery in kegs, half kegs, and cans; liberal rates by the ton. Greene, Tweed & Co., 18 Park Place, New York.

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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.

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. asks: 1. How large or what sized spool, silk insulated copper wire No. 35, must one have to obtain the best results in making a pair of bell telephones? A. The spool should be about ¾ inch long and 1¼ inch diameter. 2. Is it absolutely necessary for the spool to fit close up to the magnet, or must the wire be wound directly on the bar? A. The spool should fit the bar, and it should be very thin, so that the wire may be as near as possible to the magnet. 3. Will common annealed iron, such as is used for self-binding harvesters, do for a line for working telephones from one half to three miles? A. It is not large enough. Use No. 12. No. 10 is still better.

(2) F. P. H. asks (1) how to make nitroglycerine in quantities of, say, 50 lbs. A. To 33 parts of an ice cold mixture, 1 part fuming nitric acid (sp. gr. 1·49), and 2 parts strongest sulphuric acid, add slowly by drops 5 parts of pure and concentrated glycerine (sp. gr. 1·25). The liquid should be constantly agitated by blowing a uniform current of cold air through it. After standing for 10 minutes or so the whole contents of the vessel is cautiously transferred to a large tub of very cold water to which a rotary motion has been imparted. The nitroglycerine sinks to the bottom as a heavy oily liquid, which may be washed by decantation with fresh water. Consult Mowbray's "Trinitroglycerine." 2. How is the oil of glycerine manufactured and from what? A. Glycerine in a more or less impure state is a by product from the manufacture of candles and soap. It is most readily obtained in a pure state by the action of superheated steam or neutral fats. See Wagner's "Chemical Technology," p. 634.

(3) F. K. writes: I have a large plate of glass that has a scratch on it. Is there any way to fix it so the scratch cannot be seen, that is, to replace the quicksilver? A. Clean the bare portion of the glass by rubbing it gently with fine cotton, taking care to remove any trace of dust and grease. If this cleaning is not done very carefully, defects will appear around the place repaired. With the point of a knife cut upon the back of another looking glass around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury; a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgam to where it was cut off by the knife, and the required piece may now be lifted and removed to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton; it hardens almost immediately, and the glass presents the same appearance as a new one.

(4) J. S. asks: 1. How can I stain white holly wood to a suitable dark brown color for scroll sawing? A. Paint over the wood with a solution made by boiling 1 part of catechu, cutch, or gambier, with 30 parts of water and a little soda. This is allowed to dry in the air, and then the wood is painted over with another solution made of 1 part of bichromate of potash and 30 parts of water. By a little difference in the mode of treatment, and by varying the strength of the solutions, various shades of color may be given with these materials, which will be permanent, and tend to preserve the wood. After drying, slightly oil and finish with shellac varnish if desired. 2. Will the same materials do for staining butternut gunstock? Is it best to use varnish or shellac after? A. Yes, if the wood is free from oil. 3. Also please tell how to make a hand mirror, that is, what will I put on the back for reflecting? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 105.

(5) D. T. J. asks for the number of pounds pressure per square inch from twenty to forty feet head of water. A. A column of water one foot in height produces a pressure of about 0·433 lb. per square inch.

(6) J. E. S. asks: Is there a receipt for softening cast iron so that it can be drilled? I have used quicklime and it had no effect on sleigh shoe. A. To get a good effect from the lime, you must have a large quantity, that is, sufficient to prevent the radiation of heat from the iron after it is immersed in it. Try heating the shoe and leaving it in the fire until the fire dies out.

(7) L. H. D. writes: In the preface to "The Pioneers," Appletons' edition, page xiii., occurs the following: "It is worthy of remark that one of the most ingenious machines known in European art is derived from the keen ingenuity which is exercised in this remote region." What machine did Mr. Cooper allude to?—[Perhaps some of our readers may be able to answer Mr. D.'s question.]

(8) J. D. H. asks: What are the proportions of the ingredients of a bichromate battery? A. For information concerning batteries see SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 157, 158 and 159.

(9) C. W. H. asks: What is best to use for whitening belts worn by the militia? Something that will not rub off. A. If not enameled, rub them thoroughly with chalk reduced to impalpable powder and a trace of sperm oil.

(10) N. A. C. asks how to clean nickel-plated brass or iron which has become coated with burned grease and dirt, without injuring the nickel surface. A. Boil in strong solution of potash or soda, rinse in water, and rub first with moistened and then with dry rouge or chalk.

(11) J. W. W. asks: 1. What degree of centigrade is water at its greatest density? A. 4°. 2. How is the degree of centigrade converted into Fahr.? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 141. 3. What would the degree of 4° centigrade be if converted into Fahr.? A. 39·2°.

(12) A. B. C. asks: What is the best method of cleaning and polishing old copper coins which have become badly coated with dirt and oxide? A. Boil them in a strong aqueous solution of caustic soda, rinse in soft water, and dip bright in nitric acid, and quickly rinse again. Polish with a little putty powder, rouge or tripoli.

(13) C. L. writes: 1. I have made two electro-magnets which, when connected with the battery, are very strong, but retain the magnetism for several days after being disconnected. Please let me know cause and remedy. A. If the armature of a magnet is left in contact with its poles during and after the rupture of the electric current, the magnetism will be retained. If the cores of the magnets are not of the softest iron, they will retain more or less magnetism. 2. Is "bichromate battery," described in SUPPLEMENT No. 159, suitable for telegraphing purposes? A. If you refer to the Grenet, it is not sufficiently constant.

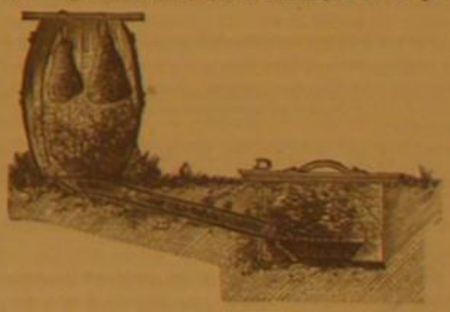
(14) F. S. asks (1) how to construct an electro-magnet of about 4 lb. sustaining power, and how many cells of gravity batteries it will take to run it? A. Take a ½ inch bar of soft iron, 8 inches long, bend it into U form, with the arms about 2 inches apart. Wind on each limb of the U 8 or 10 layers of No. 18 wire. These coils must be wound in opposite directions. Use three or four cells of gravity battery. 2. How many of the same cells will it take to run an electric engine powerful enough to run a large sewing machine? A. 40 or 50. 3. How can I clean a straw hat that became dark? A. Hang it in a barrel or box filled with the acid fumes of burning sulphur.

(15) E. N. S. asks how to put on the watered or mottled appearance to brass articles. A. The brass is first polished to the required degree, and if it is a fine surface, the mottled appearance is imparted by rubbing over it with a gyratory motion a Scotch gray stone moistened with water. If the work is not very fine, a piece of fine emery paper may be used in the same way. If it is coarse, a dead smooth file may be used. Another method is to secure emery cloth or paper to the end of a small round stick, placing the stick in the universal chuck of a lathe, holding the work against it with a light pressure, and moving it along while the lathe revolves.

(16) F. A. S. asks: 1. Does the strength of a bar magnet increase in proportion to its size? A. No. 2. Does the strength of a telephone depend more upon the strength of the magnet or size of the induction coil? A. It has been determined that the strength of a telephone magnet may be varied between very wide limits without materially affecting the loudness of the tones. If an induction coil is used, it should have about the same resistance as the telephone bobbin. 3. What sized magnet and induction coil are used upon the latest improved telephones? A. A triple bar magnet with a round wrought iron pole extension seems to answer well. The induction coil may have in its secondary wire 200 or more ohms resistance. 4. Is there an advantage in rounding the end of a bar magnet? A. Yes.

(17) H. H. J. asks: 1. Would a steel flue, ¼ inch thick, or an iron one, 5/16 inch thick, 20 inches in diameter, and 7 feet long, be safe without stays of any kind? A. Five sixteenths inch thick would do for ordinary purposes, if but 7 feet long. 2. Would you prefer a boiler like that in the steamship Columbus, for portable use, to locomotive type? A. No. 3. In SCIENTIFIC AMERICAN, February, 1, 1879, in an article headed "A Hint for an Invention," you say the construction of the fire box of the locomotive boiler "is an arrangement necessitated by the requirements of science, and not indicated by rules of utility or good construction." Will you please give the scientific reasons for this construction? I have long supposed there must be some cause not apparent for this style of boiler. A. From the design of the machine as a whole, the parts attached to and depending upon each other.

(18) N. M.—Professor W. R. Brooks, in *Rural New Yorker*, gives the following simple but very effective smoking arrangement for all kinds of meats, especially hams, shoulders, and bacon. The smoking is effected in a very thorough manner and in a short time. The writer had for this morning's breakfast some ham which was smoked in a contrivance precisely similar to this, in six hours. The arrangement can be made by any one without the least trouble, and it is sure to "work" every time. The sketch almost explains itself. The device consists of the barrel, A, of any suitable size. An ordinary flour or apple barrel will smoke four or five moderate sized hams or shoulders. Both heads are removed and a movable cover provided for the top. This may be of boards, or an old oil cloth or tight blanket will answer. A short trench is dug, in which is laid a length of old stove pipe, B. A larger excavation, C, is then made, in which a pan



of burning cobs or chips can be placed. This is covered by a tightly fitting plank, D. One end of the stove pipe communicates with this excavation; over the other end the barrel is placed, the earth banked up around the bottom of the barrel and over the stovepipe, to keep all tight, as plainly shown in the cut. The meat may be suspended from a stick laid across the top of the barrel, and then all covered tight with an oil cloth or blanket. On placing a pan of smoking cobs or chips in the place provided, the smoke passes through the stovepipe into the barrel, filling it with a dense, cool smoke. Should the support of the hams, etc., break, the latter cannot be hurt by coming in contact with the fire or ashes, as sometimes happens in the regular smoke house.

(19) W. H. asks: Will you please tell me the composition of the mixture with which manifold paper is prepared, and what keeps the black from rubbing off on the hands? A. Melt together one part of beeswax and 6 or 7 parts of good lard, and add to the fused mixture sufficient lampblack. Rub this mixture into the paper placed on a heated iron plate. Then pass between heavily weighted rollers to remove excess.

(20) R. F. B. asks for the method of preparing what is known as "bottled light." It is used by the watchmen in Paris to give light in places where explosives are stored. A. Agitate a few fragments, about the size of peas, of clean phosphorus, with about 3 fluid drachms of pure olive oil, hot enough to melt it. Then close the flask, which should not be more than one-fifth full, with a glass stopper. When required for use agitate and remove the stopper for a minute.

(21) "Subscriber" asks: Is there an electric light that would be suitable for lighting a mine; if so what would be the cost? The mine is about 200 feet deep and 600 feet long. Want to light the bottom when the men are at work. A. There are several electric lights that would answer your purpose. Consult our advertising columns, or insert in the SCIENTIFIC AMERICAN an advertisement for proposals to light your mine.

(22) Chemist asks if there is known any chemical or combination of chemicals which, if applied to the hair of the head, will turn it gray, without producing any injurious consequences. A. We know of nothing that we can recommend for this purpose.

(23) S. W. C. writes: In your paper for February 1, 1879, page 75, No. 14 of "Notes and Queries," you state that a strong aqueous solution of tannic acid will restore faded writing on parchment. Would that work on paper? A. Yes.

(24) W. M. asks what is the best varnish or paint for iron tanks, to protect them from rust. Would like to get something that will not scale off. Would paraffine applied to the iron hot, stick well and stand for a long period? A. Coat the dry tank with genuine asphaltum varnish, and when this has nearly dried, with melted paraffine. Let the varnish harden thoroughly before filling the tank.

(25) L. M. C. asks how to make a gold bath for plating, so that he will get a dark gold deposit, and how many Bunsen's elements are required. A. See "Electro gilding," p. 2540, SCIENTIFIC AMERICAN SUPPLEMENT, No. 160.

(26) J. B. asks what chemicals are used in fire extinguishers. A. Usually a strong aqueous solution of carbonate or bicarbonate of soda and strong sulphuric acid.

(27) W. H. G. S. writes: I have a large quantity of small malleable iron castings: I wish to copper them. How shall I do it? A. See SCIENTIFIC AMERICAN, vol. 39, p. 75 (23).

(28) J. P. asks: 1. Is there any way of making artificial stone without kiln drying; is there any treatise on the manufacture? A. Yes; consult patents 82,202, 82,731, 105,132, 100,944, 100,945, 101,253, 118,477, 119,394, 150,179, 157,511, and 155,176. See Maj. Gen. Q. A. Gillmore's "Practical Treatise on Coignet Beton and other Artificial Stones." 2. Have the postal department found a satisfactory canceler? A. We believe not.

(29) C. H. asks: What was the first steamship to cross the Atlantic? Was it the Savannah of New York in 1819 or a vessel from Liverpool in 1817? A. Savannah, 1819.

(30) F. H. B. asks how to make a glossy blue japan for tin. I tried white varnish added to blue dissolved in linseed oil and spirits turpentine, but the color was dingy and the mixture muddy. A. Grind bright Prussian blue or smalt with pale shellac or mastic varnish.

(31) H. L. asks: What wire gauge is referred to in giving the size of wire used on the dynamo-electric machine described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161? A. American.

(32) J. A. S. writes: 1. Give size and material (metals, etc.) of the Righi telephone (dimensions of each part). A. The construction of the Righi telephone is described on p. 186 of current volume of the SCIENTIFIC AMERICAN. The dimensions given in the engraving are correct. The diaphragm may be of wood or metal, or a membrane may be used. The spring may be of brass or steel. 2. Where are the connections made? A. One wire is connected with the spring, the other with the metal attached to the diaphragm.

(33) J. W. W. asks (1) how lead pipe is made. A. By forcing semi-melted lead by hydraulic pressure, through a die, in which, concentric with its walls, is supported a core. The process is analogous to that of tile making. 2. How is iron gas pipe made? A. By passing strips of iron heated to a welding heat between rolls having semicircular grooves. The pipe is formed and welded over a mandrel as it passes between the rolls.

(34) R. E. H. asks: Does the Gatling gun send all its shots to the same point, or do they scatter? A. It may operate either way. The gunner, by giving it a lateral motion, may scatter the bullets to almost any extent.

(35) J. H. F. asks by what process he can extract nicotine from tobacco. A. Tobacco leaves are digested for 24 hours, and repeatedly, with water containing sulphuric acid, pressed, and the liquid evaporated half down. It is then distilled with caustic potassa, and the nicotine exhausted from the distillate by ether. The ether is removed from the ethereal solution by evaporating, finally elevating the temperature to 140° C (=284° Fah.). The nicotine, which is still impure, of a brown color, is distilled slowly at 180° C (=356° Fah.) in a current of dry hydrogen over quicklime. Some varieties of tobacco yield as much as 7 per cent of nicotine, Havana only 2 per cent. Nicotine turns brown and is partially decomposed in contact with air.

(36) F. H. N. writes: You told in a late paper how to cut off water gauge glasses for steam boilers. I suggest a better plan. Take a small round file, insert it in the glass, and hold your thumb for a gauge as to the length you want to cut off, then scratch around and the thing is done.

(37) M. McL. asks (1) how gas is made, and of what material, at the Municipal Works, foot of 44th street. Is it made from water? My friend contends that it is made from water; I say that it is not possible even in this age of science. A. Yes; when superheated steam is passed slowly through a large body of ignited carbon (coal) it parts with its oxygen to the latter. The resulting gas—composed chiefly of hydrogen—and carbon monoxide—has very little illuminating power, but this is remedied by introducing a small quantity of the vapor of some rich hydrocarbon—as naphtha—into the retort with the gases. 2. Also what is meant by the governor room in a gas works. A. The governor is an appliance by which a uniform pressure is automatically maintained as the gas passes from the reservoirs or gas holders to the street mains. The room where the governor stands is called the governor room.

(38) D. C. asks: 1. What is the temperature of a vacuum? A. The temperature of bodies within a vacuum under ordinary circumstances varies with the temperature of surrounding bodies, the inclosing walls, etc. 2. What is the recipe for making a brilliant black ink used in fine pen work? A. See answer No 15, p. 218, current volume SCIENTIFIC AMERICAN. 3. Which is the best steam engine governor in use? A. There are several governors that seem equally good. We are unwilling to decide between rival manufacturers.

(39) G. L. L. asks: 1. What can I use to coat the inside of a wooden box for holding silver plating solution? A. Line the vat with sheet lead, and give the latter several good coats of a melted mixture of equal parts of genuine asphaltum and gutta percha. 2. What kind of wood is the best to make the box of? A. Cypress is among the best. 3. Is the inclosed sample of rubber the kind that is used for making rubber hand stamps, and will I have to vulcanize it after taking it from the mould? If so what is the most simple process? A. Yes; see pp. 48 and 105 SCIENTIFIC AMERICAN, vol. 39.

(40) W. G. W. asks: 1. What will make hair grow, such as beard and moustache? A. Keep the system in a vigorous condition and the skin clean. Bathe the parts frequently with cold water containing a small quantity of tincture of cantharides. See "Hygiene of the Hair," by Professor Erasmus Wilson, SCIENTIFIC AMERICAN SUPPLEMENT, No. 110. 2. What will turn it black or dark, not instantly, but slowly? A. The diluted juice of the hulls of green walnuts (Paulus Ægineta) is commonly employed.

(41) C. H. H. writes: 1. Take two round balls of precisely the same size, one being, say, four times heavier than the other, and let them both drop at the same time. Will the heavy ball strike the earth any quicker than the light ball? A. In air the heavier body would reach the earth first. 2. In the SCIENTIFIC AMERICAN of February 15, in the article headed "Galileo's Museum" by H. D. Garrison, it is stated that all bodies large or small, dropped from an elevation at the same time, will reach the earth at the same time. Is this so? Please explain, as I think the atmospheric resistance would be greater in the large body than in the small. A. In a vacuum all bodies would fall with the same velocity; in air, the action is modified. 3. In query February 1, in answer to E. W. in directions for making a Leyden jar, he is told to coat an ordinary candy jar with shellac and then coat with tin foil inside and out. This I have tried by putting three or four layers of shellac on first, and then coated both inside and out smoothly with tin foil, and yet the jar will not work. Please give me the reason. A. Jars for this purpose should be of green glass. Flint glass is not a good insulator. You should also reject a jar which has the slightest crack or flaw.

(42) B. W. asks if an electrical plate machine and a battery of Leyden jars will work an electrical pen, as well as a Bunsen battery? Or tolerably well? A. No; the discharge of sparks is not sufficiently rapid.

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

W. M. S.—It is the pollen of the pine (Pinus strobus).

COMMUNICATIONS RECEIVED.

On Electric Light. By G. F. S.
On Vibratory Motions. By J. C. W.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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March 11, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, 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.

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