SCIENTIFIC AMERICAN

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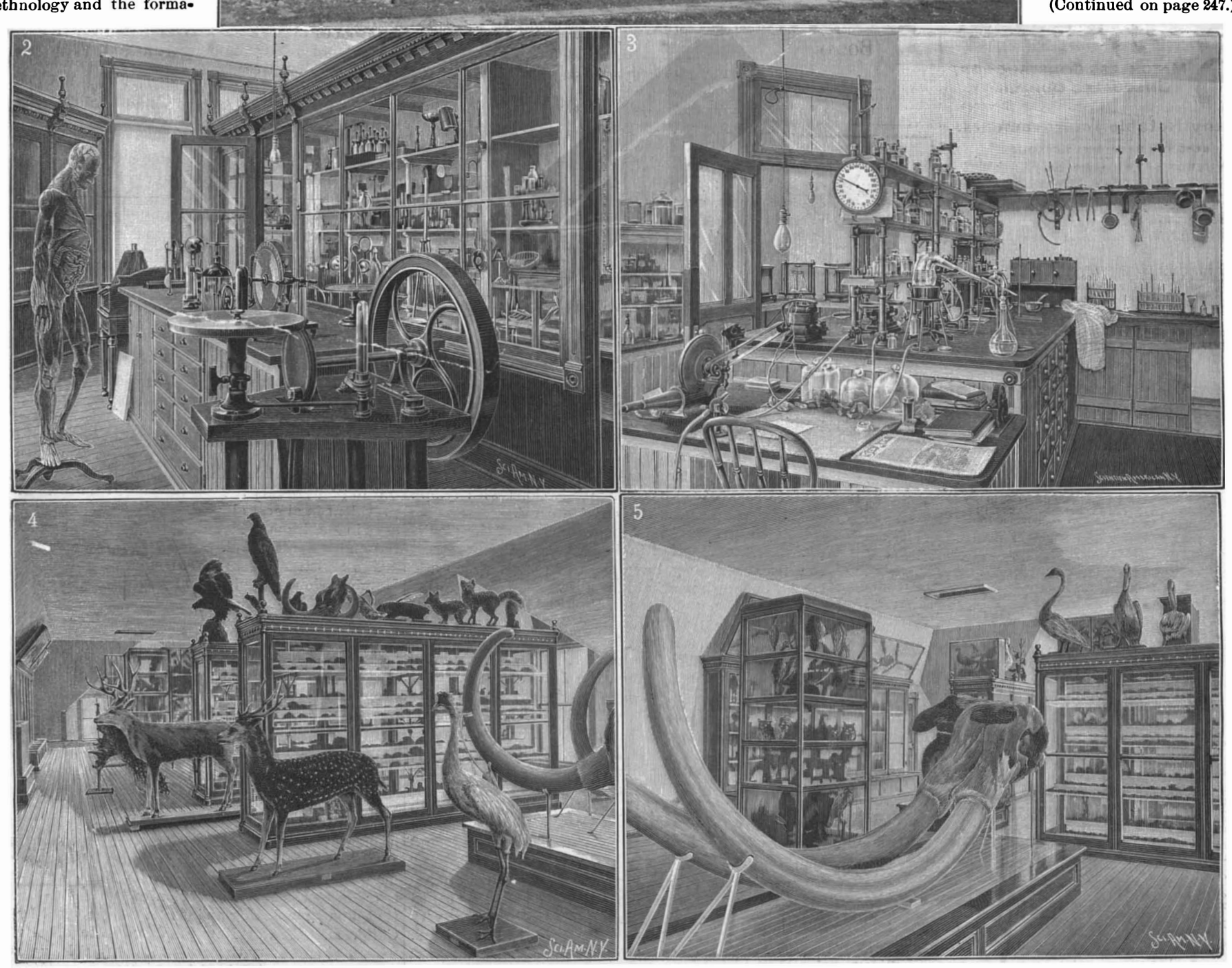
THE DESERET MUSEUM.

The Salt Lake Literary and Scientific Association is a body corporate, under the laws of the Territory of Utah, with headquarters at Salt Lake City. The association is the proprietor and promoter of the Deseret Museum, a depository of choice and extensive collections in the field of natural history and ethnology. Under the auspices of the Deseret Museum, the wonderful selenite formation in Wayne County, Utah, has been worked, and of the magnificent crystals thus obtained upward of fifteen tons have been gratuitously distributed to museums and other institutions of learning throughout the United States and in Europe. The specified purposes of the association are the promoting of study in literary and scientific subjects, especially the encouragement of the pursuit of natural history, including ethnology and the formation and preservation of museums and libraries.

For the better carrying out of the association's objects, a building has been recently erected and equipped in Salt Lake City, of which the accompanying pictures are illustrative. The structure is of pressed brick, with gray sandstone trimmings; is 90 feet in length and 67 feet wide, comprising three floors and a basement. A central tower rises on the west or front side. This is utilized on the top floor for meteorological work. Regular courses of evening lectures have been conducted during the past year and class work has been carried on during the day. A limited number of students has been admitted to the day classes, with the privileges of the laboratories; but the evening lectures are open to the public, with proper restrictions.

In the basement is situated an efficient heating

(Continued on page 247.)



1. Front view of the building. 2. Apparatus room. 3. Curator's private laboratory. 4 and 5. Main rooms of museum.

THE DESERET MUSEUM, SALT LAKE CITY, UTAH.

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, APRIL 20, 1895.

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(Illustrated articles are marked with an asterisk.)

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No. 1007.

For the Week Ending April 20, 1895.

Price 10 cents. For sale by all newsdealers.

ANIMAL VACCINATION.

It is questionable if any recent remedy has attracted more attention in the popular and medical worlds than has diphtheritic antitoxine. This as prepared by Dr. Roux, at the Paris Pasteur Institute, is the serum of the blood of an animal which has been inoculated with the diphtheritic virus. This serum injected into the human system possesses strong immunizing and curative properties for diphtheria. In our issue of November 17, 1894, we published a description of the remedy, with illustrations of its preparation and of its administration. The success of antitoxine has been so great that the new name of "serum-therapy" has been coined to express the type of treatment of which its administration is an example.

In the same laboratory, that of the Pasteur Institute of Paris, of which Dr. Roux is one of the chiefs, another class of preparations has been studied, of which one has been highly perfected and is now being introduced into this country. This is the vaccine preparation for the prevention of anthrax. This disease, much dreaded in cattle, sheep, horses and mules, has, in some infected districts in Germany, been known to kill as many as 60 per cent of a herd of cattle in one year, while in districts where anthrax has a constant existence the average annual mortality is put as high as 20 per cent. For Europe the annual loss is calculated as being $20,000,000 in amount. The disease in this country is known as blackleg, splenic fever, blow striking and by various other names. In Germany it is termed "milzbrand" and in France "charbon." It occurs more frequently in the United States than is generally supposed. It is dreadfully fatal. An animal stricken with it may die immediately or within twenty-four hours.

Pasteur began his researches on the disease fifteen or more years ago. He found that the only agent of the disease was the introduction of a microbe into the blood. One of the first problems to be solved was the method of its transmission from animal to animal and the cause of its inveterate persistence in infected districts, and its apparently unaccounted for appearance in others. The theory he formed and proved was that the bacillus remained alive in the soil. While this would seem to dispose of it for good and all, he recognized in earth worms, in the same annelid to which Darwin attributed such beneficial qualities, the cause of the dissemination of the disease. These worms, carrying up within their bodies earth from the strata of soil some inches below the top, discharge it on the surface. It is these little pellets of fresh earth from the lower strata that Darwin found to be so advantageous for plant life. While undoubtedly so, Pasteur found in the same pellets of earth the bacillus of anthrax, which, except for the worms, might have disappeared forever, being carried through the soil by the filtration of rain water.

Pasteur's studies of the anthrax bacillus extended over some six years, and in their prosecution some 40,000 animals, guinea pigs and rabbits for the most part, were sacrificed. In 1882 he produced the "vaccine." It is obtained by bouillon cultures. It is found that a culture of deadly strength on standing gradually grows weaker. By charging a set of second cultures by one weakened by standing, any number of cultures of that precise strength can be got. Thus, by repeated culture processes, vaccine of any desired strength can be obtained.

The Pasteur vaccine is found to be an absolute preventive of the disease; it is not curative, the disease is so sudden and fatal that once an animal is seized by it nothing can be done. The vaccine is now supplied in peculiarly shaped bottles adapted for the withdrawal of the contents to the last drop by a graduated hypodermic syringe. Cattle are vaccinated against anthrax by two successive hypodermic injections with lymph of two strengths at twelve days' interval.

Very elaborate tables have been made of the results of anthrax vaccination in France and other European countries, and they have shown in both sheep and cattle the most remarkable results.

Of the vaccinated sheep in France during the twelve years, 1882 to 1893, when over 3,000,000 were vaccinated, the loss has been reduced to 0·69 per cent, when formerly it had been 10 per cent. Among cattle, the average loss had been 5 per cent; it has been reduced among 438,824 animals vaccinated during the same period to 0·18 per cent. Over 10,000,000 animals have now been vaccinated in Europe. Our laboratories are preparing the vaccine in France, Germany, Austro-Hungary, Italy, and Russia. The anthrax vaccine has been introduced into Australia, where in New South Wales alone some 120,000 animals were vaccinated in 1893. For a long time the stockmen had complained there of a disease that originated in Cumberland County, and hence termed "Cumberland disease." Some of Pasteur's assistants, while working on another research in Australia, had their attention called to this malady, whose ravages were becoming very great, and identified the disease as being anthrax. This was in 1888. The losses in some cases amounted to 30 per cent. This brought about the introduction of the vaccine, and five years later the anthrax vaccine, as used in Australia, was reported on by the United States consul-general in Australia, by special direction of the State Department, and his report shows the most gratifying results.

The vaccine is now made in the Pasteur laboratory, in Paris, under the supervision of M. Chamberlain, one of Pasteur's eminent colleagues, but it is hoped soon to have a laboratory established in this country for the preparation of all the remedies and diagnostic preparations now made in Paris. Among the latter is the Koch tuberculine, of which so much was expected at one time in the cure of consumption. It is now used as a diagnostic reagent to determine the presence of tuberculosis in cattle. When such is discovered, it, of course, will lead to proper isolation to prevent the spread of the disease. Another reagent is mallein, used as a diagnostic for glanders. Both the latter are cultures of bacilli, and may arrest the disease in its early stages, although they are only supplied at present for purpose of diagnosis or recognition of disease.

Cheap Coal.

The great distances from our seaboard at which our chief bituminous coal fields are situated, says the Engineering and Mining Journal, have been held, by foreigners especially, to preclude the possibility of very cheap coal in our ports. The extremely low transportation rates on our railroads have, however, offset the long hauls, and we have recorded a price of $2 per ton f. o. b. Newport News and Norfolk, Va., for coals coming over the Chesapeake & Ohio and Norfolk & Western roads with a haul of fully 400 miles. As the prices paid for the coal at the mines were then about 80 to 90 cents per ton, this left only $1.10 to $1.20 for hauling and terminal charges, or about ¼ cent per ton-mile for hauling. These extraordinary figures created much comment abroad, and brought orders to this country that had formerly gone to England.

Equally low prices were taken for Alabama coal f. o. b. Pensacola and Mobile, but the haul is shorter and the railroad rate a little higher.

We confess we considered $2 a ton f. o. b. at our tide water ports as being a minimum, below which it would be almost impossible to go, nevertheless, this record has recently been lowered. Good steam coals have recently been sold f. o. b. Newport News at $1.80 per ton of 2,240 lb., and Clearfield coal has been delivered f. o. b. Philadelphia at $1.75 if not at $1.70 per ton, the haul being less than 300 miles.

With coal delivered in the railroad cars at the mines for from 60 to 70 cents a ton and railroad freights at 2½ to 3 mills per ton-mile it would seem as if the very bottom had been reached. These rates leave no fair return to capital invested in either mines or roads; it is not surprising, therefore, to find reductions being made in wages at some of the mines. On the other hand this remarkably cheap fuel benefits manufacturers, who are now quite active and are extending their markets in all directions both abroad and at home.

The Influenza Epidemic in Europe.

The present outbreak of influenza seems to be rapidly extending, and to be resembling in its far-reaching spread the visitation of five years ago. Thus it has become extremely prevalent in St. Petersburg, in Christiania, Copenhagen, and Berlin, and on the whole its line of spread has been rather from west to east than at the period referred to, when it may be remembered its rather uniform advance across Europe from the east led it to be generally termed "Russian influenza." On this occasion England would almost claim the unenviable position of being the starting point for the pandemic. Especial mention has been made during the past week in local newspapers of its great prevalence in Rochdale, in Cheshire, and in North Wales, but in point of fact there is no doubt that it is widely prevalent in almost all parts of the kingdom. Its ravages in Dublin and Newry are referred to by our correspondents in Ireland.

The registrar-general's returns for the week ending March 16 show a diminution in the number of deaths directly attributed to influenza—349, as compared with 473 in the preceding week; while there has also been a decline in the deaths from respiratory diseases, viz., from 1,366 to 1,031, the latter being, however, in excess of the corrected average by 507. The general mortality rates of the thirty-three great towns in England and Wales show mostly a diminution as compared with last week, there being only three towns in which the estimated annual death rate for the week was 40 or more per 1,000, viz., Preston, 40; London, 41·2; and Brighton, 48. The exceptionally high rate at the last named town, exceptional both comparatively and actually, may perhaps be ascribed in part to the immigration of influenza sufferers to this famed resort for convalescents. In the February summary issued by Dr. Seaton, the medical officer to the Surrey County Council, reference is made to the rapid extension of the disease during that month; including an interesting statement by Mr. Child, M.R.C.S., of New Malden, to the effect that, whereas in January there were 89 cases of influenza in a population of 3,437, in February there were 461 in the same population—i. e., nearly one-seventh.—Lancet.

Arrastra—"The Poor Man's Mill."

According to the Mining and Scientific Press, stamp mills and roller quartz mills have not wholly taken the place of a means of crushing quartz, crude but effective, still in use in some parts of California. Reference is made to the arrastra—"the poor man's mill," which, as well as the Chilean mill, a development from it, are not extinct, as arrastras are now in operation in Kern County. One is worked by horse power, one by water power and one by steam power, which in itself is considerable advance over the burro power of Old Mexico, and whilom of sections farther north.

There isn't much said about arrastras, and where there is a big mine, or a mine not so big, but some capital, there needn't be, for an arrastra seems as slow and stupid as the donkey that drives it in its native place, but, primitive as the arrastra may seem, and weakly productive in comparison to roller or stamp mill, it has an honorable though humble record, and has ground out many a dollar's worth of bullion in its simple old way.

With all its crudeness, it deserves a word of praise. Unlike some mills, it never beats the company; the battery assays and car assays agree; the ore owners know that what goes in comes out, and there is no addition, division or silence. And with free gold it will hold its own with many a costly mill.

It costs very little to set up; the running expenses are light; it rarely breaks down, and when it does can be cheaply and quickly fixed up; it needs little housing, watching or insurance; it can be built by the owner, who can be his own engineer, millman, foreman, amalgamator, feeder and boss, and the one man who combines all these positions can break the rock and keep the burro or the mule or the horse going all at once. Nothing blows up, and unless the mule gives out there isn't much prospect of loss; the amalgamation is usually satisfactory, and while there isn't much science or style about the outfit, there's considerable common sense and often lots of profit. It is not recommended as a superior article; it bears the same relation to better, faster, finer appliances for the same purposes that a country blacksmith shop does to the Union Iron Works, but "it beats nothing all to pieces," and in many an isolated mine would pay better to work ore than to have the owner sitting around "waiting for capital" to develop his claim, and thus work out his own salvation.

The arrastra is slow but sure. It is built in a primitive way, solidly and securely, its two greatest drawbacks being its limited capacity and liability to waste.

Judge Sumners' Kernville arrastras are in a granite country, much of it with feldspathic veins or dikes crossing, the arrastras occupying the site of a twenty-stamp mill built thirty years ago, but long since entirely removed, with the exception of the battery blocks.

The arrastras at Smartsville and Mooney Flat districts, Nevada County, are twelve feet across and three feet deep. The bottoms are paved with hard, rough-dressed rock, laid evenly in cement and sixteen inches in depth. The center post is fourteen inches square, eighteen inches high, the post having four arms, to each of which is attached a heavy drag. The drags are heavy diabase blocks clamped to the arms, so fixed as to cover all parts of the pit as they go round. Each block weighs from 700 to 1,200 pounds. About seven tons of gravel are run in from a car or a chute, water being added to keep it from caking, and the arrastra run very slowly till the mass is of a "thin mush" consistency, when a speed of about fourteen revolutions a minute is attained (this arrastra ran by steam power). After an hour of this the gate is opened and the charge run into the 200-foot sluice containing the riffles, the sluice being cleaned up weekly. The result for cement or soft top gravel gave satisfaction, the cost of milling being eight cents per ton.

In the regular old-fashioned Mexican arrastra, run by a burro, the bed is built of paving stones laid on a puddled clay five inches deep, set closely, the joints tamped with clay; in the center a large-sized stone as a step for the "peon" or pivot, made of two pieces of timber, 4 × 8, clamped together. A hole is bored in the bottom and a piece of round two inch iron worked off to a rounded point at the lower end, inserted. Through the peon at right angles are passed two pieces four-inch square, one extending horizontally seven feet six inches, to which the burro is hitched; to the other is attached the mullers or grinders. These are of rough stone, prismoidal in shape, thirty-six inches long and about fifteen inches wide, so dressed as to throw the center of gravity well toward the base. At the upper end of each stone's front face two six-inch plug holes are drilled, in which are fitted plugs of dry sugar pine, which, when wet, swell and are immovable. The outside edge of one stone works a little in advance of the inside edge, thus throwing the charge toward the center. Of course, in setting the other stone, this arrangement is reversed.

The upper end of the peon is fixed in a four-inch pinion, which works in a bearing collar made of wood 2 × 8 inches; the collar is mortised near each end 1 × 3 inches, corresponding holes being made in the other timber and the two secured by a wooden link and pins. With such an arrastra a six hundred pound charge is usual and the patient "manana" worker gets enough to satisfy his needs, his chief lookout being to see that no grease gets near his machine.

The Chilean mill is sometimes associated with the idea of the arrastra, from which it may be considered to have been developed. It is to all intents and purposes a millstone set on edge and so arranged that it will revolve in a circular track, the axle upon which it revolves being pivoted at one end, the mule hitched to the other. As an expedient in out-of-the-way places, the Chilean mill and the arrastra both serve a purpose, the Chilean mill reducing the assorted spalled ore to pea size, thence to the arrastra, where about one-half the charge is first placed and thoroughly moistened as the peon revolves, about two and one-half ounces of quicksilver being added as the grinding progresses, and the remainder of the charge is put in. From twelve to sixty hours is the limit for grinding, which depends on the nature of the ore and coarseness or fineness of the gold, amalgamation in the case of coarse gold being sometimes reached in twelve hours and in the case of fine gold requiring even more than sixty hours. The accompanying apparatus for settling, retorting, etc., is necessarily rude, but in most cases effective. In this brief notice of a primitive gold producer no attempt is made to give the detail of setting up or working, the subject being treated in outline in the most general way.

The Canadian Pacific.

The annual report of the Canadian Pacific Railway Company, for the year ending December 31, 1894, shows the results of a year which has proved quite as disastrous to the Canadian Pacific as it has been to the railroads on our side of the line. The earnings of the road had been increasing steadily till 1893, when this advance is ended, and for 1894 they show a large falling off.

The president in his report, assigns as the first cause of diminished earnings the low price of wheat and of all other agricultural products, from which followed a scarcity of money among farmers and the contraction of business throughout Canada. An additional heavy loss was sustained in an important period of the year just at the beginning of the summer passenger business, from the floods in British Columbia, which stopped through traffic to and from the Pacific coast for forty-one days, from May 26 to July 6. The damage from these floods is not all made good yet, and the year's results suffer by $550,000 in cost of repairs, extra expenses and loss of earnings.

The Pacific steamships show an increase in profits of $80,467, but all of the other allied businesses, that is, telegraph, express, sleeping cars, grain elevators, lake steamers, hotels, etc., show diminished profits. The sales of land suffered more than anything else from the bad conditions, and indeed they almost ceased.

But, in addition to these forms of loss, the company has been subjected to very heavy burdens on another side. Its two subsidiary lines, which were acquired with the intention of providing important feeders from the territory of the States, have met with heavy losses, and, under its guaranty of the obligation of these roads, the Canadian road has had to advance $456,187 for the Duluth, South Shore & Atlantic and $694,487 for the Minneapolis, St. Paul & Sault Ste. Marie. Again, besides all this, the interest on the land grant bonds due the government for the last year is now for the first time entered as part of the fixed charges, and to this item is added the accumulated interest of these bonds for the past. The sum of this amounts to $2,769,347.

Two years ago $4,000,000 was deposited as a special fund applicable to dividends, and it was partly the existence of this fund which made it seem so strange that the company should pass its January dividend. But it is now seen that a large part of this fund had been already taken during this year, not only for the August dividends, but for payment of the balances due the subsidiary roads, for interest on land grant bonds. The only other courses possible to meet these charges were to sell securities belonging to the company, which could only have been at a great loss under the present situation, or to incur a heavy floating debt. This latter course would be in direct contradiction to the policy of the road during its whole lifetime. Consequently, the special reserve fund has been diminished, and after charging off the above mentioned items and the deficit of $526,731 for the last year, there is left a surplus of $2,739,792, as against $7,261,213 on December 31, 1893.

The Winter Dock of the Petrel in China.

The U.S.S. Petrel wintered at Newchang, 13 miles up river from the mouth of the Liao, a stream that is so filled with moving ice that it is impossible for a vessel to lie in it. A dock was cut in the soft mud of the bank, and the vessel floated in at high tide. The entrance was closed with piles, and the vessel allowed to settle, shores being used to keep her on an even keel.

Artificial Silk.

Consul Germain, of Zurich, under date of December 17, sends the Department of State a description of the artificial silk produced by the process of Dr. Lehner, of Zurich. This description, obtained from the inventor, is substantially the same as that published in Consular Reports No. 171 (December, 1894), page 538, under the heading "Artificial Silk in England." The following additional matter is supplied by Consul Germain and is published in Consular Reports for February, 1895, No. 173.

The process is patented in the principal European countries. Patent has also been applied for in the United States, and in the English colonies of North America, where a company with a capital stock of $1,500,000 is in course of formation. A company for the acquisition of the patent rights in European countries and the British colonies (except British colonies in North America), owned by Dr. Lehner, was formed in England last July with a capital stock of $540,000. The patent rights were then purchased, Mr. Lehner receiving $160,000 in cash and $180,000 in full paid-up shares, thus leaving $200,000 of working capital to carry on the manufacture of this artificial silk.

The intention was first to manufacture the raw material in England, but as a large quantity of alcohol is consumed in its manufacture, and the tax on alcohol in England is almost prohibitory for manufacturing purposes, the company decided to establish the factory in a country where spirits used for the arts, science and manufacturing purposes are untaxed. The plant was therefore established at Glattbrugg, near Zurich, under the supervision and management of Dr. Lehner, who, in addition to being a heavy stockholder, receives a nominal annual salary of $2,919.60 for his services. Here alcohol consumed for such purposes is untaxed.

The artificial silk is thus forwarded in a raw state to England and there manufactured into textile fabrics.

Dr. Lehner says that it is the intention to manufacture this artificial silk in America, provided alcohol used for its manufacture is tax free; otherwise, it will have to be manufactured in Switzerland and then forwarded to America as raw silk, to be there manufactured into textile fabrics. He also says that so far his English company has not come into competition with the real cocoon silk, his articles being mostly used to mix with cotton and wool, but, of course, there is no telling how sharp a competition this artificial article will bring against real silk in the future.

I give below a copy of part of the prospectus issued by the English company during its formation period (July, 1894), which may throw additional light on the subject:

Lehner's artificial silk is a new material for use in textile manufacture, possessing distinct and valuable characteristics, which render it unique among all fibers hitherto existing. As the result of study and analysis of the natural methods of production of silk by the silkworm, the inventor has, by simple chemical and mechanical means, closely and successfully reproduced a natural process. Wood pulp, cotton, or jute waste, etc., are chemically digested and the liquid product is spun by a mechanical silkworm to a thread of even diameter throughout and of unbroken and unlimited length. The same machine which draws the threads from the liquid twists these threads in any desired number into the requisite "count," or thickness of yarn, in one uninterrupted and continuous process with perfect regularity. The machine is inexpensive and extremely simple. It can be run day and night without intermission, and requires but little power and attention.

The principal features of this process are (1) never failing supply of the raw material; (2) practically uniform price of same; (3) simplicity of machinery, so as to avoid risk of breakdown; and (4) no skilled, and only a small amount of low-priced, labor is necessary.

The production of Lehner's artificial silk is entirely independent of climate, temperature, special soil, or cultivation.

Lehner's artificial silk has been spun in Bradford, and has been worked up in a large variety of fabrics. In the dyeing, weaving, and finishing of these sample fabrics, no special treatment has been necessary. Unlike most vegetable fibers, Lehner's artificial silk can be dyed in all colors, and the shades obtained excel in brilliancy and delicacy those of the finest natural silk.

For softness and beauty of appearance the new material equals the best Chinese and Italian silks. By its use, therefore, in combination with cotton, wool, or natural silk, brocaded and other ornamental and decorative results can be obtained, which have hitherto been unattainable except by the employment of the finest trams, and the expensive character of these necessarily limits their sale for this purpose. The cost of Lehner's artificial silk being small, it follows that that fiber will open out a large and profitable new field to manufacturers, affording encouragement to them in the production of an unlimited variety of both choice and salable novelties in fabrics of almost every description.

The Meat Exports of the Argentine.

Last year England imported from abroad live stock and dead meat valued at something in excess of $116,000,000. To the items which made up this large total the Argentine Republic contributed 1,675,600 frozen sheep, 90,000 live sheep, 29,000 quarters of frozen beef, and 28,000 live bullocks. It is alleged by those who have practical experience of the matter that in no other country in the world can cattle and sheep be produced and fattened as cheaply as in the Argentine, on account of its exceptional climate and rich natural grasses, very little artificial food being required, and the winter being so mild that the animals can be fattened in the open air in wire-fenced paddocks. During the last 15 years the best English pedigree cattle have been introduced, thousands of Shorthorn and Hereford bulls have been used, and a great proportion of the criollo cattle have been transformed into magnificent crossbreds. The heaviest of the native criollo cattle are kept on alfalfa in the provinces of San Juan and Mendoza for some time, and are then driven across the Andes into Chile. A better class of animal, cross-bred, weighing on an average about 1,150 lb. live weight, is sent to Rio de Janeiro and some other Brazilian ports, while the best, heaviest and fattest animals are shipped to England. This export of live stock has suddenly become of great importance, the official value of live cattle and sheep exported from Argentine ports in 1894 being over $5,000,000. The English butchers find fault with the Argentine cattle as shipped at present. They are too wild, and are badly selected, cattle of all ages, sizes, and descriptions coming together. Moreover, they are purely grass-fed, and consequently the beef, though good, has not as bright a color as the North American corn-fed meat, and sells at from ½d. to 1d. per pound lower than its great rival. The sheep are better, and the butchers classify them the same as Canadians, and pay the same price for them—6d. per pound, sinking the offal.

Frozen Pneumatic Tubes.

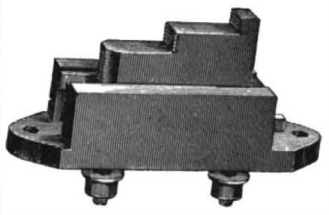
During the recent frost in London the proper working of the pneumatic tubes connecting the Central Telegraph Office with the various City and West End receiving and branch offices served by tube has caused great anxiety to the postal telegraph officials. A large number of carriers have from time to time been stopped in the tubes owing to the accumulation of ice, and these have in a few cases been freed only after considerable trouble. Many of the tubes were kept open night and day, and a current of air kept flowing through them. This air, heated by compression in the pumps, has been a very great help. In the event of a carrier stopping in the tube, another carrier partly filled with salt has been sent after it. The impact causes the salt to scatter against the imprisoned carrier, and the non-freezing mixture so formed quickly sets it free.

A CUSHIONED EAR PIECE FOR THE TELEPHONE RECEIVER.

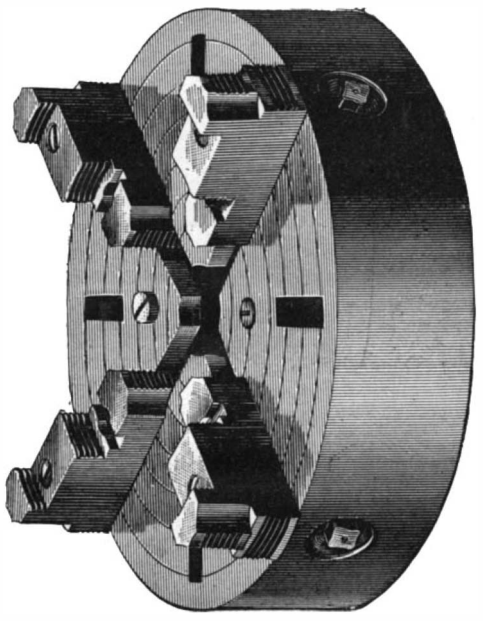
The illustration represents a simple pneumatic cushion adapted to fit all telephone receivers, and indicates the manner of placing it upon receiver. It is made of soft rubber, fitted into a metal rim which springs or clamps over the end of receiver, forming a complete air chamber designed to effectually prevent the buzzing or clucking sounds so annoying to users of the telephone. The improvement is being introduced by Mr. C. Maynard Evans, 107 to 109 World Building, New York City. Its touch to the ear is soft, and the distance to the ear drum is more conveniently regulated than with the ordinary hard rubber receiver. It has been adopted and is in use in many of our banks and public offices, scores of large new office buildings, etc.

A NEW CHUCK.

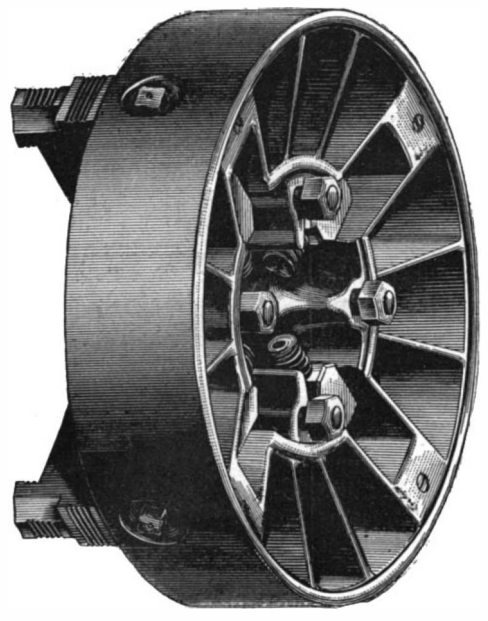
The illustration represents an improved chuck for heavy work, having a larger number of shell braces, a thicker face to the shell, and a greater depth to the chuck than the "National chuck," made by the same manufacturer, William Whitlock, of No. 39 Cortlandt Street, New York City. The dishing of the braces is such that the chuck may be mounted close to the bearings of the lathe, causing the least possible overhang, and the screw heads are recessed, so the workman can stop the chuck by the rim without injuring his hand. It has a reversible jaw. The small figure shows a new face plate jaw of the same manufacturer. It carries the regular "National" solid jaw, and is designed to take the place of the larger chucks where the character of the work permits of its use.



FACE PLATE JAW.



FACE VIEW.



BACK VIEW.

WHITLOCK'S NEW "WESTERN" INDEPENDENT CHUCK.

A SECTIONAL WATER TUBE BOILER.

In this boiler are embodied the following essential points: It is simple in construction; is easily repaired by any ordinary mechanic; affords perfect circulation; has a large amount of heating surface in proportion to its weight. All parts are readily accessible for repairs and cleaning, and it is non-explosive. It has been patented by Mr. Samuel P. Hedges, of Greenport, L. I., N. Y. The boiler has two mud drums, into which the vertical sections of the fire box tubes are tapped, horizontal sections forming the crown of the fire box, and being tapped into a fire box header or drum, which connects with a cross drum. On each end of the cross drum is a pipe connecting with the mud drums. This pipe is to supply the heating section farthest away from the center, where supply enters from fire box drum. The small figure represents the manner of connecting the heating sections to the cross drums. The flanged end on the tube enters the socket formed in the header and seats on an asbestos ring. The sleeve on pipe is screwed into the boss on the flanged end of tube, thus making a tight, strong joint. This connection at top and bottom of each section makes it easy to remove and replace any section that may require repairs and take it out into the fire room through the front connecting doors without disturbing any part of the casing, or a washer may be put in the opening and the collar screwed down while repairs are being made, without affecting the operation of the boiler. Feed water heaters are placed on the top of heating section (not shown in cut) of such size as to allow the feed water to enter the boiler at the boiling point. These boilers are designed for 200 lb. steam pressure.

A CURIOUS fact has been noted by Arctic travelers—snow when at a very low temperature absorbs moisture and dries garments.

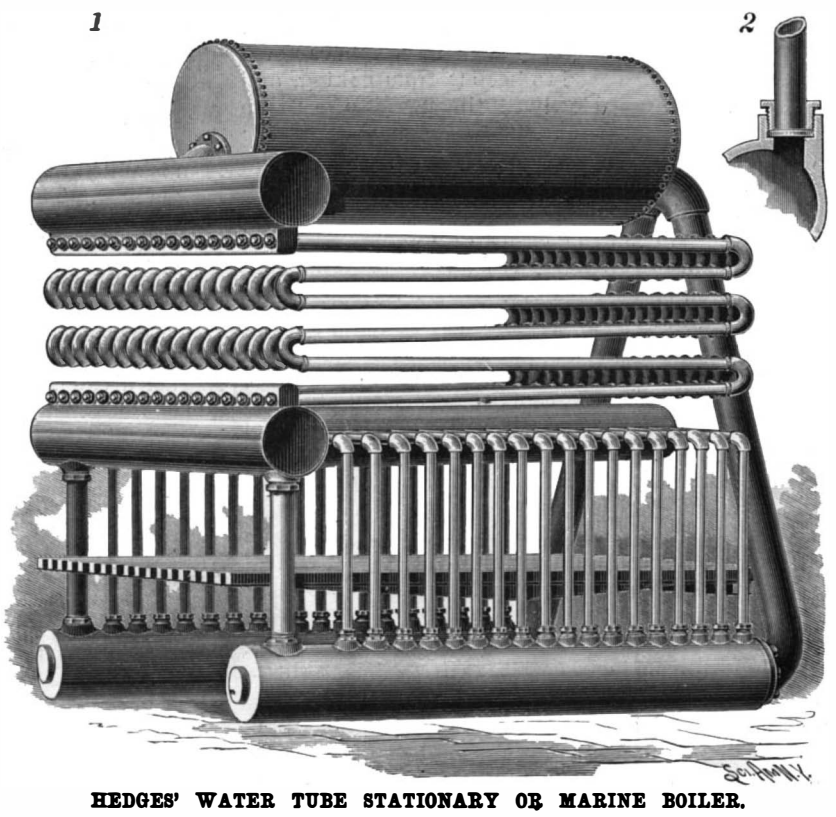
The Illinois Eight Hour Law.

The Supreme Court in Illinois has declared the eight hour law of that State unconstitutional, and a similar decision against the progressive inheritance tax of that State. As to the Ohio decision, we have not yet seen any report full enough to enable us to pass judgment upon its merits. The Ohio law, it will be remembered, levied a tax ranging from 1 per cent on estates above $20,000 to 5 per cent on estates above a million. But the fact that the law was good does not indicate that the decision against it was bad, for the Ohio constitution contains a general provision that citizens shall be taxed in proportion to their property, and this inheritance tax law may run counter to the phraseology of the constitution. The Illinois decision is of greater importance, because the principles laid down by the law provided that no woman should be employed in any factory or workshop more than eight hours in any one day or forty-eight hours in any one week. The court held that "This re-enactment is a purely arbitrary restriction on a fundamental right of the citizen to control his or her own time and faculty. It substitutes the judgment of the legislature for the judgment of the employer and employe in a matter about which they are competent to deal with each other. . . . The right to make contracts is an inherent and inalienable one, and any attempt to unreasonably abridge it is opposed to the constitution." The court also condemned the act because it applied only to women, and seemed to apply only to certain occupations.

Darwin G. Eaton.

Dr. Darwin G. Eaton died in Brooklyn, N. Y., March 17, at the age of seventy-three years. He was one of the best known teachers in the country, and for many years he was the leading professor in the Packer Institute, of Brooklyn. As a scientist Dr. Eaton will be chiefly remembered for his researches on volcanoes, as he made a life-long study of them, and visited Vesuvius several times, as well as Mauna Loa. He was born at Portland, N. Y., and graduated at the State Normal School in 1846. In 1851 he accepted a professorship in the Brooklyn Female Academy, which afterward became the Packer Institute. He held this place until 1883, when ill health compelled him to retire. He had been devoted to astronomical studies all his life, and had participated in many governmental scientific observations of solar and lunar eclipses. He was a member of many learned societies, and received the degrees of M.A., M.D. and Ph.D.

MR. GEORGE P. LOW, in the February issue of the Transactions of the American Institute of Electrical Engineers, concludes that the art of rail bonding now appears to have been perfected, and the damage that has been caused by corrosive electrolysis may be attributed to defective bonding, for without doubt proper main-to-track, rail-to-rail, and track-to dynamo bonding will cure the ill almost without exception. The problem of eliminating electrolytic corrosion is, in brief, simply one of judicious bonding.



HEDGES' WATER TUBE STATIONARY OR MARINE BOILER.

A Floating Cannery.

An American schooner has recently been fitted at New York with every facility for cooking and canning fish, game, fruits, etc., for the purpose of cruising in southern waters and collecting these delicacies and canning them at sea. This novel enterprise is expected to yield encouraging profits, since many of the goods canned in this way may be brought into the country free of duty. The ship is provided with an eight horse power boiler and three 25 gallon copper caldrons. The boiler was set up in the middle of the deck and connected by pipes with a large circular cast iron "process kettle." The schooner carries six canners and a chef in addition to the regular crew. Some 150,000 empty cans have been shipped, all of which it is expected will be filled during the voyage.

The materials to be canned will be turtle, pompano, guava jelly and fish game and fruit of many kinds. The turtles will be caught in the West Indies and off the Florida coast. Much of the material will be secured by exchanging for them various manufactured articles, with which the ship is well supplied. When the actual work begins, the meats will first be boiled down in the three copper caldrons. Next they will be canned and lowered into the process kettle in steel crates and boiled at a high temperature under steam pressure in order to make them keep. The preparation of the meats, fish, jellies, etc., will be superintended by the chef in charge and cooked after the most approved receipt. The floating cannery is expected to return to New York some time in the fall. Part of the canned goods will be brought back on the schooner and part will be landed at southern ports and sent by steamship or railroad to the North.

THE SUMATRA RHINOCEROS IN THE LEIPZIG ZOOLOGICAL GARDEN.

The accompanying engraving, for which we are indebted to the Illustrirte Zeitung, is from a drawing made directly from the specimen of the Rhinoceros sumatransis now in the zoological garden at Leipzig. This and another specimen—now in the zoological garden at Budapest—were carried to Trieste from Penang, a small island on the eastern coast of Malacca. This species was first found in Sumatra about one hundred years ago.

The engraving shows clearly the coat of stiff hair, so unusual in a rhinoceros, which covers its back, neck, ears and legs, giving it a most peculiar appearance. The folds of the skin, so marked in the Indian rhinoceros, are modified in this species, making it a connecting link between the former and the African rhinoceros. It differs from both of these species also in regard to the number and development of its horns, for although it has two horns they are not nearly as much developed as those of the two-horned African rhinoceros. The second horn between the eyes is scarcely perceptible in the creature in the Leipzig zoological garden, while the other is only about half as large as it is represented in the cut, the artist, who had formerly painted an older animal of this kind, having allowed for a year's growth. Its height at the shoulder is about 4 feet 4 inches and its color is dark brown. Specimens of this species are very rare, though more of them may be seen hereafter, for civilization, which is killing off animals of many kinds, is also bringing to light many others.

A LETTER COPYING BOOK WITH WHICH A PRESS IS NOT NEEDED.

The illustration represents a perfect letter-copying book in which copies may be made of letters written

BUSHNELL'S ROLLING COPYING BOOK.

with any kind of good copying ink, without the use of a press. The copies are made by simply rolling up the book around a roll which forms an integral part of its back, as shown in one of the views, the written letter having first been placed on a manila sheet beneath a blank leaf of the copy book, and the leaf covered by a damp cloth and a second manila sheet. After rolling up, the book is held firmly, close rolled, for about ten seconds, to insure an excellent copy, as good as can be obtained in a press. This book is manufactured by Alvah Bushnell, of No. 403 Chestnut Street, Philadelphia, in two sizes, letter size and note size. It affords a cheap, quick and always satisfactory way of making copies, and being so light and readily portable, may be conveniently carried in any traveling bag. When thus taken on a journey it is better folded as shown in the bottom view, than rolled, thus preventing the curling of the leaves.

IT is stated that the Canadian Customs Department has decided that electricity generated on the American side of the Niagara Falls and conducted by wires to the Canadian side must pay a duty of 20 per cent as "an unenumerated article."

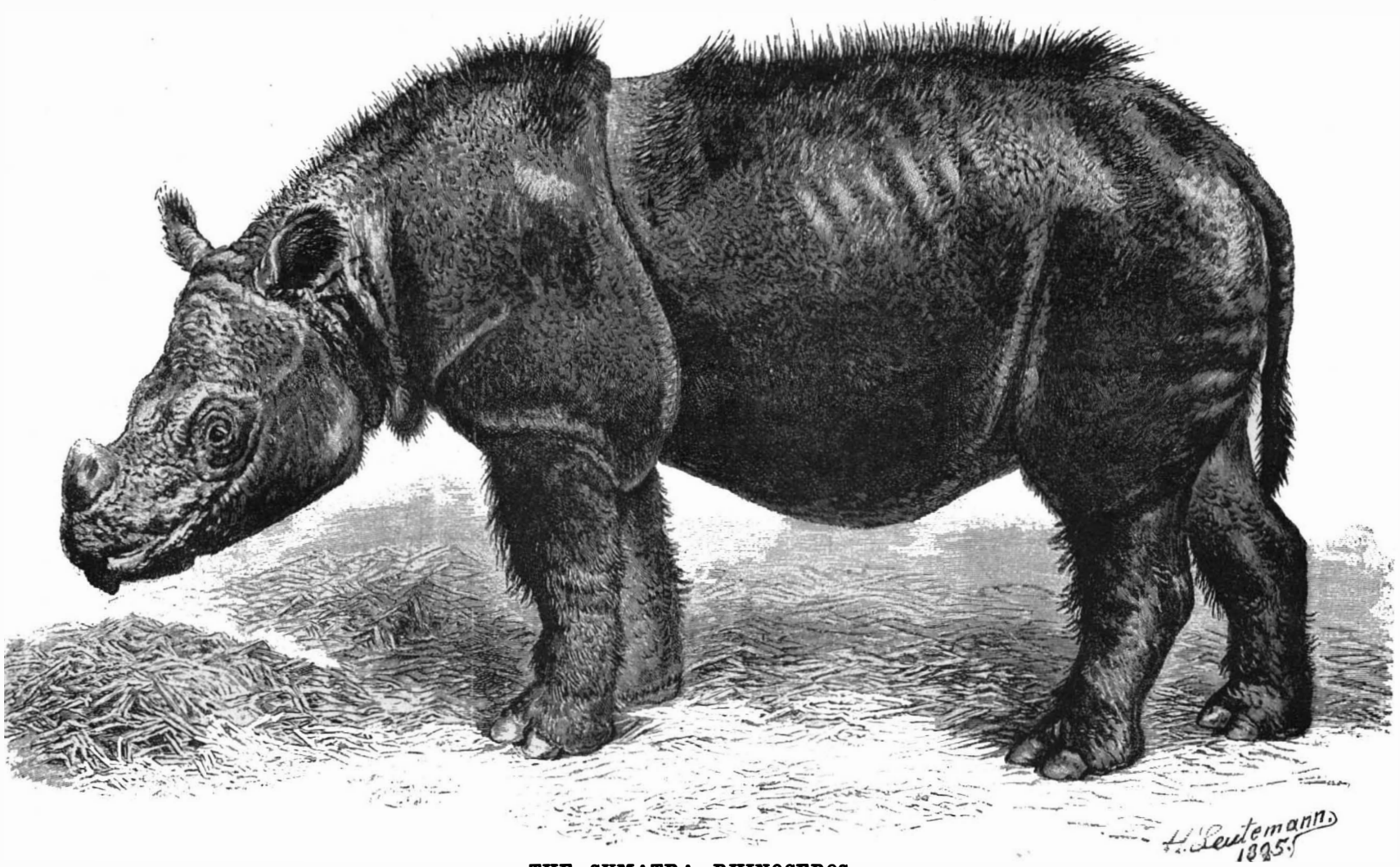
Electric Light Mains and Their Dangers.

An accident occurred at Bristol, England, on February 25 which resulted in the death of a workman and was probably due to a momentary inadvertence on his part. It appears that it was the duty of the man in question to remove the dust from a high tension fuse board, and while doing this with the right hand covered by an India rubber glove, the left hand (bare) seems to have touched a fuse terminal, and thus his body made contact to earth with the 2,000 volt main. It appears from the evidence of the corporation engineer that there were no printed regulations for the guidance of workmen employed on this particular duty, but it was the rule that when engaged on high tension work one hand only should be used, and that hand covered by an India rubber glove. The story of this accident, says the Lancet, is no doubt the old story of carelessness; but there may be room for doubt as to whether this carelessness was entirely on the part of the workman who suffered. Assuming that it was necessary to clean this apparatus while the electric current was passing over it, were the insulation precautions adequate? As a matter of fact, ought this man to have been at work on this "live" high tension apparatus without being duly insulated from the earth? Might he not have been provided with an India rubber mat and boots as well as with gloves for both hands, with at the same time an imperative caution staring him in the face never to relax the paramount rule of working only with one hand?

The Clearing Out of Insects in Florida.

Mr. H. G. Hubbard, the entomologist of the Department of Agriculture, writes that the cold weather which desolated the gardens and orange groves of Florida killed unnumbered millions of injurious insects. All cockroaches in sight, and even those in houses, unless they were exceptionally well protected, were killed. The young scale insects which had not passed their second moult were killed, although many eggs survive, and some adults of both sexes. The nitidulid beetles in decaying fruit were also killed, small gnats in flowers were frozen, and not a living colony of plant lice is to be seen on any orange or other tree.

No living specimen of the destructive white fly, Aleyrodes citri, was found, and as the eggs are laid on the leaves, every one of which will drop before the new growth appears, the cold wave would have almost exterminated this pest but for the fact that, besides the orange tree, it also infests the cape jessamine, and as the leaves of these plants have not all fallen, Mr. Hubbard is advising the orange growers to cut down their jessamines and burn them. Since the breeding of injurious insects has been suspended now for some weeks an excellent opportunity has been offered to clear the trees of scale with comparatively mild insecticides. On the other hand, the trees have been so enfeebled by the cold that they will be an easier prey to injurious insects than they were before.



THE SUMATRA RHINOCEROS.

Correspondence.

Growth of the Eucalyptus.

To the Editor of the SCIENTIFIC AMERICAN:

In connection with that portion of the article published in the SCIENTIFIC AMERICAN of March 2 relating to the growth of eucalyptus trees in California, I will add for the benefit of your readers that one of my neighbors recently chopped down a eucalyptus tree which he had planted nineteen years ago.

The tree yielded four cords of stove wood and the measurements were as follows:

Height, 63 feet; circumference at base, 12¼ feet; circumference just below the first limb, eight feet from the ground, 8¾ feet. ERNEST ROBERTSON.

New Jerusalem, Cal., April 8, 1895.

A Curiosity in Violin Playing.

To the Editor of the SCIENTIFIC AMERICAN:

I have a violin which has very loose strings when tuned to concert pitch. By a peculiar manipulation of the bow I am able to produce in a clear tone the second D below the treble staff, which is a full fifth lower than the natural open tone of the string, and by fingering play the scale from that point up. It is done by a heavy slow bow about three-fourths inch from the bridge, and can be done on any good slack-stringed instrument, but not on one on which the strings are very tight to procure the pitch. Can you give me an explanation of the character of vibrations brought into play in this case? I understand the philosophy of what is termed harmonics, but they are always of a higher pitch than the natural tones. The tone is not a squeak nor a grating noise, but a good tone nearly as pure as can be made on any other part of the instrument, and the instrument is a good one.

Buchanan, Mich. J. G. HOLMES.

Sun Spots and Aurora.

To the Editor of the SCIENTIFIC AMERICAN:

The reports of observations of the aurora that have been secured the past winter for the purpose of comparison with those of Lieut. Peary in North Greenland have shown a decrease in the number and brightness of displays, as compared with previous years since 1892, when there was a large increase following the years of minimum, which reached its height in 1889 and 1890. As is the rule, the present decrease is simultaneous with a diminution of the activities which produce spots on the sun. In some respects, a period of such declining activity is favorable for gaining an insight into the behavior of the phenomena in question, such outbreaks as occur, both of sun spots and auroras, being more isolated, so that any relations existing between them may be more readily distinguished. Thus, during the past winter, there have been but few auroras that have been widely seen, and the most prominent among these plainly conform to the periodicity at intervals closely approximating twenty-seven and one-quarter days, dates as follows: October 27, November 23, December 20, January 17, February 14, and March 14. All these displays were seen more or less widely, both in America and Europe; those in November, February and March being strongest, and the one in December being the weakest, thus conforming to what has been found to be a general rule in regard to relative brightness in the different months named. At each of the dates named traces of auroral action were noted, more or less, for two or three days, but the strongest manifestations were, as a rule, confined to a single day at the beginning of the outbreak. Preceding the return in March, notices were sent by the writer to a large number of observers suggesting the desirability of special observations from the 14th to the 16th of that month. The result was to secure much information that might otherwise have been lost. The aurora in this case had the peculiarity, as seen in many localities, of consisting of isolated streamers without an arch or diffuse luminosity of any sort. It was widely seen in Europe as well as this country, but in the reports thus far at hand is not described as specially brilliant, except in those from northern Canada. As is the rule, it was accompanied by disturbances of terrestrial magnetism, which were quite strong as compared with the conditions existing generally in the present year of declining activity. At the Toronto Magnetic Observatory much disturbance of the declination magnets was registered, the others remaining comparatively quiet. There was some disturbance of the longer circuits of the telegraph lines by earth currents in isolated localities on the North American continent. The chief disturbance from earth currents, however, seems to have been on the Atlantic cables on March 14 and on the evening of March 15.

As regards the solar conditions attendant upon this aurora and its predecessors at the regular interval named, it will be noted that the period of recurrence corresponds closely to the time of a synodic rotation of the sun, as determined from the average rate of motion of the spots, which do not remain fixed upon the sun's surface, but have motions of their own.

This correspondence of the times of recurrence of the aurora to the rotation period of the sun as viewed from the earth, which is advancing in its orbit in the same direction in which the sun is turning on its axis, shows that the solar impulse which originates the aurora must proceed from some particular meridian relative to the position of the earth; otherwise there could be no periodicity at the twenty-seven and one-quarter day or any other uniform interval. It will be observed that we are able to affirm positively that the effect proceeds from some particular solar meridian, whether we are able to identify that meridian or not. As a matter of fact, at each return of the aurora which has been mentioned, the portion of the sun exactly at the eastern limit appearing by rotation was the seat of very persistent spot groups. Observation in numerous other cases, as well as that under consideration, has shown that. no matter what there may be or may not be elsewhere upon the sun, there is always a portion specially frequented by spots and faculæ at the eastern limb appearing by rotation whenever there is an aurora and magnetic storm. This is the one thing that stands out prominently in the arrangement of these two sets of phenomena in their natural order, based upon the twenty-seven and one-quarter day period. If there is any error in the length of this period, it must be so small as not to obscure, within several years, the relation which has been described by producing discrepancy between tables of auroras showing their recurrence at the twenty-seven and one-quarter day interval, and the similar table of sun spots, showing their returns to the meridian at the eastern limb at the same interval.

The identification of the particular part of the sun concerned in any individual outbreak, or series of outbreaks, of the aurora is the proper starting point for the study of the mode of operation of the forces concerned. Indeed, there can be no assured progress whatever without such identification. It is the one clew that is required for the elucidation of details that could not otherwise be understood at all.

It is not proposed at the present writing to enter into these details, although some of them are beginning to be understood.

Lyons, N. Y. M. A. VEEDER.

Wood World Waifiets.

Native woods used in building in Sierra Leone, Africa, are oak, whismore, brimstone, teak, mahogany (two varieties), rosewood (fine quality) and black walnut. These are durable woods that will withstand insects and weather.

"Knock-me-back" is a Honduras tree 25 feet high. Each leaf ends in a sharp thorn, which suggests the name to the natives who brush against them.

Among Honduras trees is the "Santa Maria," or Calophyllum calaba, suitable for shingles and buildings. It grows 80 feet high and 24 inches through. It is hard. The seeds yield oil for lamps.

The principal native woods of South Africa are: Yellow-wood (two kinds), black and white ironwood, stinkwood, olyreuhout (olive), assagai, white pear, kerschout (candlewood), white alder and others. None of these woods grow in sufficient quantities to cut any figure in lumber problems, except the following: Yellow-wood, which somewhat resembles poplar, though it is harder and has a cross grain, and stinkwood, which is more like American walnut and has many colors and shades when polished.

Wild cinnamon grows 30 feet high and 16 to 18 inches in diameter.

Argentine Republic woods are distinguished for their pronounced colors. The algarrobo is white, red, gray, black and violet. The quebracho is deep red and pure white. The cedar is bright red. The cibil is white, red and black. The gayaibi is white, gray and black. The laurel is white, black and yellow. The tipa is white, red and yellow. The palo amarilla is bright yellow, and so is the palo moro. The viraro is dark brown. The calden is bright red. The tatanè is golden yellow. The pacara is dark red. The molle is black brown. The lapacho is green, gray and black. The guayabo is deep red, veined with black and yellow. The palo ribera is dark cinnamon, with red veins. The guayacan is jet black and almost indestructible. Some of these woods are hard enough to resist the keenest tools and to withstand fire in a remarkable degree.

European nations recognize the value of forests. The Austro-Hungarian government does not sell any part of its forests, but buys more each year. In some parts of the country, as in the eastern region of the Carpathians, woods are found of several thousand acres in extent, consisting for the most part of red beech. This is used for firewood, carriages, staves, agricultural implements and in the manufacture of bent wood. There are few fires, and they seldom permanently damage the woods. There are large, resinous forests in Transylvania, but they are not very accessible; and there are some in the district of Marmaros, in the northeast part of the country. In France there is little primeval forest. Woodlands of heavy growth sell at $60 to $100 per acre. Labor is very cheap. The percentage of forest land to the whole area is very small. The demand for wood products is very large and such as to secure a heavy price for forest products of any variety. Even faggots sell by the bunch, kindling wood sells by the pound, and lumber is scarce and high. In Germany, Austria-Hungary and England similar conditions prevail, to a greater or less degree of intensity. Government regulations for forestry management have been adopted in most of these countries. They have but small areas of primeval forests. The forests of central Europe look like the public parks of America, with very few trees to the acre, mostly full-grown specimens, with very little underbrush, and with a degree of uniformity which bespeaks careful artificial management.—American Wood Worker.

Quince Culture.

Prof. L. H. Bailey, of the Cornell University, has recently issued, in Bulletin 80, one of the most complete accounts of quince culture that we have met with for some time. T. C. Maxwell & Brother, of Geneva, N. Y., have a tract of about thirty acres, which is used expressly for growing this fruit for commercial purposes. Professor Bailey states that though the quince will grow on light soil, it will do best on heavy land, provided it be well drained. On account of the shallow roots, which are always near the surface, it is found best to keep the soil continually stirred about the trees. A heavy manuring is judicious.

The Maxwell orchard is fertilized chiefly with stable manure. Two-thirds of the annual growth of the trees are cut away each winter; the branches left for fruit bearing are shortened in. About three hundred trees occupy an acre, which gives them an area of 10 by 15 feet each. A bushel of fruit to a tree is considered a fair crop. The Maxwells sort their quinces, before marketing, into three grades—the best grades are shipped in grape baskets of about a peck each, or in kegs holding a bushel, while the second grade is shipped in barrels or half barrels. They bring about two to two and a half dollars a barrel. The third grade, or "culls," are not very profitable. The Orange, the Champion, the Meech, and the Rea are the principal varieties cultivated in the State of New York.

The leaf blight and the fruit spot are the chief enemies of quince culture. The brown spot on the leaf is caused by one of the species of microscopic fungus named Entomosporium maculatum. When attacked by this fungus, the leaves fall early, in which case, as with the pear and other fruits, the product is inferior in size and quality. In a perfectly healthy tree of any variety of fruit the leaves should remain on until their natural period of falling, in the autumn.

Spraying with the various copper solutions recommended is found to be a complete remedy against the attack of this or any other fungus. The quince borer would be very troublesome if not kept away from the plant; but no good cultivator now is annoyed by this insect, as care and watchfulness prevent them from operating.

Formaldehyde in Photo Gelatine.

The discovery that formaldehyde (H.COH) renders gelatine insoluble in water is likely to be of much value in photography. Gelatine, both in solution and in the dry condition, is rendered insoluble by formic aldehyde, and the jelly after treatment becomes non-fusible. When a very small proportion of formaldehyde is mixed with a warm solution of gelatine the whole sets on cooling, but can be remelted. If, however, the jelly is spread out and allowed to dry, the gelatine becomes perfectly insoluble in water, forming a flexible film, which can be used for photographic negative purposes. In both the wet and dry collodion processes, chrome gelatine is used to insure the adhesion of the collodion to the glass plate, the sensitized collodion emulsion being poured on to the thin layer of chrome gelatine previously applied. Instead of chrome gelatine, formaldehyde gelatine can be used, although whether there is any advantage in it remains to be seen. The applications of formaldehyde gelatine are patented (A. Zimmerman, London. From the Chemische Fabrik auf Actien, vorm. E. Schering, Berlin, Germany. Eng. Pat. 2,036, January 30, 1894), and a process for making sensitive films is described in the specification.

A Noble Gift to Lick Observatory.

Edward Crossley, the English philanthropist and member of Parliament, has given his great three-foot reflecting telescope to Lick Observatory, on condition that it be named the Crossley reflector, and that the cost of transporting it from Halifax, England, be borne by Americans. As Mr. Crossley gives the dome and all the apparatus, it will cost $5,000 to move it.

There is a place at Lick Observatory for the big glass, as James Lick's will provided for both a refractor and a reflector, but the money provided could buy only one. With the Crossley reflector superb photographs have been taken even in the humid English atmosphere, so that much better work ought to be done in the dry air of Mount Hamilton.

THE DESERET MUSEUM.

(Continued from first page.)

and ventilating plant, toilet rooms, storage rooms for chemicals, chemical apparatus, and mineralogical material, and a commodious assay room. The main lecture hall, 16 by 32 feet, has its principal entrance on the first floor, the seats being terraced, to give from all parts a view of the demonstration table. This table is provided with commodious pneumatic trough, gas, electric wires from primary and storage battery, and numerous other facilities, and for lectures without demonstrations a movable platform is placed behind and on a level with the table. The wall in front of the audience is used in place of a screen for stereopticon projections. On the first floor are also three smaller lecture rooms and an office.

The second floor is entirely devoted to physical science. A small lecture room is provided with a demonstration table, similar to that in the main room, and an extensive series of charts occupies a frame behind the table. A laboratory for general chemistry, 33 by 32 feet, and another for analytical work, 32 by 25 feet, are on this floor.

The laboratory rooms are excellently lighted, and the tables are set diagonally, so that no worker intercepts his neighbor's light. A combustion table covered with asbestos mill board and provided with blowpipe and blast, an anvil, and other appliances, are conveniently located in each room.

The apparatus room (Fig. 2) contains a main case, 25 feet by 9 feet high by 5 feet deep; two corner cases, each 9 feet long and of height and depth corresponding to the other. The apparatus constitutes a particularly full equipment for demonstrations in natural philosophy and in general and analytical chemistry. The physical lecture and chemical apparatus for demonstration alone has cost about $15,000. The curator's private laboratory (Fig. 3) is very completely fitted up for analytical and general work. It contains a well equipped working table, a table for blowpipe analysis, and a corner table for occasional work with the microscope, hoods with automatic burners, cupboards, etc. A balance room adjoining the private laboratory gives protection to two pulp and pharmaceutical balances, a Becker long arm analytical, a Sartorius short arm analytical, a Troemner assay balance, and a Mohr specific gravity balance. These are mounted on marble slabs, carried by iron supports independent of the floor. The curator's private office, an assistant's laboratory, and a dark room complete the apartments of this floor.

The third floor is occupied wholly by the museum. The stair landing carries two upright cases, in which is an excellent display of the finest of the selenite crystals taken from the Wayne County geode. The main room extends the entire length of the building and is 32 feet wide. It holds thirteen upright floor cases, and wall cases along one entire side. This room is devoted mainly to mineralogy and geology, though some cases are occupied by shells and corals. Two other rooms are given up to zoology and ethnology respectively. At the time Figs. 4 and 5 were taken some of the prominent zoological specimens were still in the main room. At present the catalogue shows upward of 3,000 mineralogical and lithological specimens; a thousand paleontological specimens; 500 vertebrate preparations, whole or parts; 2,000 invertebrate preparations; and nearly 1,000 ethnological specimens. The Deseret Museum enjoys the distinction of having been admitted to membership in the Museums Association. It sent an officer to the London meeting of this association in 1893 and expects to be similarly represented at the approaching Dublin meeting set for June, 1895.

For the interesting particulars here presented we are indebted to Dr. James E. Talmage, who has been called to the newly endowed chair of "Deseret Professorship of Geology" in the University of Utah, of which the Museum now forms a part.

The Early History of Telephony.

We reproduce below the text of the reply of Professor D. E. Hughes, F.R.S., to the toast of "Our Guests," at the banquet given by the staff of the National Telephone Company, London, March 15th last.

I am exceedingly grateful to you for having so kindly mentioned my name in connection with the toast of your guests, and I am sure that I am only expressing the sentiments of all your guests in thanking you for having so kindly invited us to participate in this magnificent banquet on such an important occasion.

To me this is indeed an important event in the history of telephony, for I see around me some 200 members of the staff of the National Telephone Company, which now represents one of the most useful and powerful commercial organizations of the present age. When I look back only some 40 years to the first printed idea in France, and some 30 years to the birth in Germany of its first telephone, and that it is only 18 years since the idea became really practicable, I am indeed astonished at its widespread success, so that what was a few years since a scientific toy now has become a necessity of our present age.

The earliest record of a perfect theoretical electric telephone was contained in Du Moncel's "Exposée des Applications," Paris, 1854; when M. Charles Bourseul, a French telegraphist, conceived a plan of conveying sounds and speech by electricity. Suppose, he explained, "that a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice, that this disk alternately makes and breaks the current from a battery; you may have at a distance another disk which will simultaneously execute the same vibrations." Unfortunately M. Bourseul did not work out his idea to a practical end, but in these few words we have the shortest possible explanation of the theory of our present telephones.

It is now exactly 30 years since my first experiments with a working telephone, for in 1865, being at St. Petersburg in order to fulfill my contract with the Russian government for the establishment of my printing telegraph instrument upon all their important lines, I was invited by his Majesty the Emperor Alexander II to give a lecture before his Majesty, the Empress, and Court at Czarskoi Zelo, which I did, but as I wished to present to his Majesty not only my own telegraph instrument, but all the latest novelties, Professor Philip Reis, of Friedericksdorf, Frankfort-on-Main, sent to Russia his new telephone, with which I was enabled to transmit and receive perfectly all musical sounds, and also a few spoken words, though these were rather uncertain, for at moments a word could be clearly heard, and then from some unexplained cause no words were possible. This wonderful instrument was based upon the true theory of telephony, and it contained all the necessary organs to make it a practicable success. Its unfortunate inventor died in 1874, almost unknown, poor, and neglected, but the German government have since tried to make reparation by acknowledging his claims as the first inventor and erecting a monument to his memory in the cemetery at Friedericksdorf.*

The duties connected with my printing telegraph instrument prevented me from continuing my experiments with the telephone of Professor Reis; but in 1876 we heard in Europe of the invention by Professor Alexander Graham Bell of his wonderful telephone, by means of which the practical transmission and reception of human speech had become an accomplished fact, and early in 1877 the instrument was brought to England. I at once resumed my experiments of 1865 with it, and found that Professor Bell's telephone, considered as a receiver, was absolute perfection, but that his mode of transmission of magneto-electric currents generated solely by the movement of an iron diaphragm near its electro-magnet was defective, as the currents produced were too feeble for any practical use. I then tried to adopt Professor Reis' system of using a separate battery, brought into play by the movement of a diaphragm.

I will not cite the numerous experiments and difficulties that I met with in this research; but at last I succeeded in finding the effect I wished, by the use of a very slight electric contact of the surface of solid carbon, or any other metals, such as ordinary iron nails. This slight or microphonic contact has the remarkable power of varying the resistance and consequently the force of an electric current, exactly in accordance with the sonorous vibrations of the human voice; and, in fact, the contacts could easily be rendered so sensitive that the instrument became a true microphone, rendering audible sounds far too feeble for the human ear. All of these results I gave freely to the public, and brought before the notice of the scientific world in a paper I read to the Royal Society in May, 1878.

Another discovery which I made in the continuance of my researches, which is now of the highest utility to far distant telephony, was the use of twisted wires, or wires so arranged upon their insulators that the whole line should gradually revolve on its axis, so as to prevent induction from other independent wires. This was given freely to the world in my paper read before the Society of Telegraph Engineers, March 12, 1879, and fully illustrated by engravings in Engineering of the same week. In order to understand this, I will quote a single paragraph from this paper.

"If two ordinary aerial lines are thus used, they should have the twist given to these wires by changing their position relatively to other wires from vertical to horizontal at each pole or mile. Thus, if we had two lines, A and B, they should have their four relative positions repeated as often as possible, viz., A B, then $\frac{B}{A}$; then B A and $\frac{A}{B}$."

This is the system employed by the telephone line between London and Paris, and, in fact, upon all successful long distance telephone lines throughout the world, so I think it is only fair that it should be known that I discovered and published this long before long distance telephony was ever brought into use.

During the same months of 1877 that I was experimenting with Professor Bell's telephone, Mr. Edison in the United States was also engaged upon a similar research, viz., endeavoring to adopt Professor Reis' method of transmission by a diaphragm and separate battery, and he succeeded in inventing and patenting his form of transmitter, which he called the carbon telephone. This transmitter was brought to England in 1878, and it worked remarkably well, although I felt convinced then, as I am still, that the theory upon which it was supposed to work was wrong. Mr. Edison's views were that its mode of action was based upon the varying resistance obtained through a varying pressure of the diaphragm upon an elastic button of carbon. (He believed that the varying resistance of carbon by pressure was an original discovery, but it was well known for many years previous in Europe through its publication by Du Moncel and its application by Clerac in his carbon resistance tube, whose resistance was varied according to the pressure given to its adjusting screw.) The error of this theory is shown by the fact that we cannot obtain more than a difference of resistance through pressure upon any conducting substance but of a few ohms, say one to ten, but with a microphonic joint we can easily obtain the widest possible range, from almost zero to an infinity of resistance, and this with the smallest possible expenditure of mechanical energy from the diaphragm, or even without a diaphragm. I believed then, as I do still, that its excellent functions were due to a microphonic joint, of which, and of the value of which, he was unaware, and I also believe that the often successful transmission of words by Professor Reis' transmitter was due to an accidental adjustment of his contacts to a true microphonic condition. He was, of course, unaware of the power and importance of microphonic joints, else his telephone would have been a practical success at once.

Unfortunately, Mr. Edison and myself had a painful discussion as to priority of invention, in which we have both sustained our individual views up to the present time. Mr. Edison's views have been sustained by all the companies owning his patent; mine have been sustained by nearly the whole scientific world. The companies, however, whose interest it was to sustain and possess for themselves an entire monopoly, have spared neither wealth nor power to obtain this coveted monopoly, and by the means of the ablest legal counsel and expert witnesses they obtained a legal decision giving them the sole right to the use of a diaphragm pressing upon a variable resistance, notwithstanding that the diaphragm was the discovery of Professor Reis and microphonic contact by myself.

This is all now past history, but I am now more than consoled by the fact that at the present time there is not a single transmitter in practical use throughout the world whose function is not based entirely upon its microphonic joints, whether in the form of solid conductors pressing upon each other or when these contacts are multiplied, as in the form of granules or powder.

In conclusion, it gives me great pleasure to call attention to the vast progress and improvement in the telephonic system, due to the energy and enterprise of the different telephone companies. The telephone and microphone would have never reached their present vast stage of usefulness if it had not been for the establishment of the exchange system, with its complex and costly system of switchboards. This has enabled a single subscriber upon any separate line to be brought into almost instantaneous connection with any chosen subscriber out of thousands on the list. They have built the best possible of lines, and whenever possible have given a complete metallic circuit in order to avoid induction from other lines.

I beg to thank you for having so kindly listened to my few remarks, and to thank you most sincerely, in the name of your guests and myself, for the warm hospitality with which you have welcomed us here this evening.

* "Philip Reis, Inventor of the Telephone." A biographical sketch by Professor Silvanus P. Thompson, F.R.S., etc. London: E. & F. Spon, 1883.

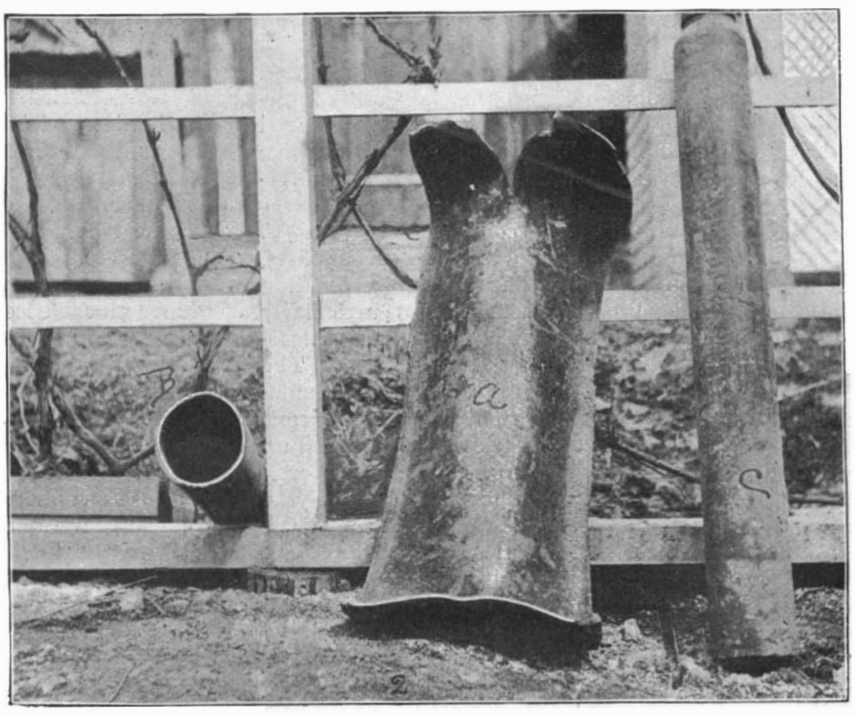
Aztec Ruins in Arizona.

The Journal, of Los Angeles, Cal., reports that D. J. Court, a mining prospector, has returned to Prescott, Ariz., from a three months' sojourn in "one of the most remote and little known parts of the Territory, and says that that section contains more Aztec ruins than any other portion of America, evidences of human habitation being found from the highest peaks to the lowest valleys. In one place he found a road or street three miles in length, perfectly smooth and straight, and sixty feet in width. On either side of the street, the entire distance, are ruins. The road was evidently built prior to some mighty earthquake, as it ends abruptly at the brink of a mighty chasm. He dug up and found lying about a great number of skeletons, which were in a fair state of preservation, the heads of all being alike—very large over the eyes and receding, and almost flat toward the back of the head; jaws well developed, but front upper and lower teeth small and sharp. The ruins show the people to have been workers in stone, some fragments of work in turquoise being found. Every available foot of land had once been cultivated."

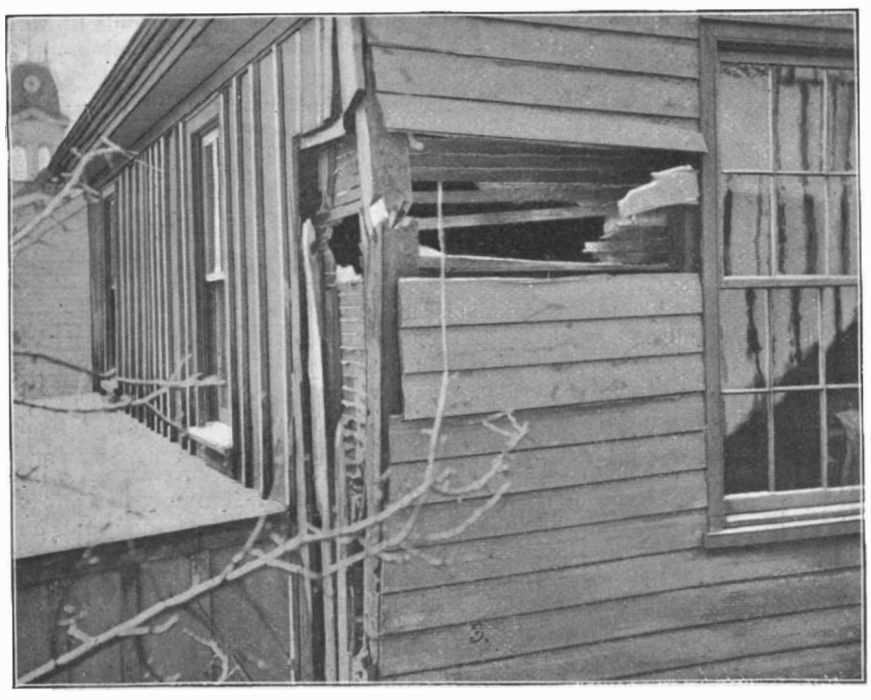
A REMARKABLE EXPLOSION.

The accompanying views are from photographs sent us by Mr. L. G. Harpel, pharmacist, of Lebanon, Pa., together with the explanatory details of a fire and explosion which recently occurred at Haine's bottling works, in that city. A fire from some cause occurred in the little annex of the larger building seen in Fig. 1, separated by a board partition from which were three carbonating cylinders which had been received from Philadelphia that morning. The heat of the fire caused the explosion of two of these cylinders, and the third was found with its valve broken or blown off after the fire. The first cylinder to explode blew out its bottom, passed through the side of the building and diagonally across the street, through the second story window of a double frame dwelling, through a partition separating the dwellings, through the top of a bedstead (as shown in Fig. 4), through other partitions, and then out through the corner of the building (as shown in Fig. 3), breaking a corner post 4 × 4 in., knocking out the weather boarding, and depositing itself in the yard. The other cylinder exploded immediately after, and was turned completely inside out, blowing out its bottom and top and tearing open a space on its side. It dropped a short distance outside of the building, as shown at a, Fig. 2. In the same view, B shows the cylinder which had passed through the building across the street, and C the cylinder which was recovered uninjured. The shells of these cylinders are of scant ¼ in. material, and one of them blew out its bottom clean, while in the other a small piece, about an inch long, of the side, still adheres to it. One of the cylinders is said to have been marked on the top, "Tested, 3,700 lb."

BOTTLING WORKS WHERE THE EXPLOSION TOOK PLACE.



THE RUPTURED CYLINDERS.



THE CYLINDER WENT THROUGH ANOTHER BUILDING.

WRECKAGE IN FLIGHT OF CYLINDER.

AN EXPLOSION OF LIQUEFIED CARBONIC ACID CYLINDERS, LEBANON, PA.

According to the London Times, the amount spent for in-maintenance of paupers in England and Wales during the half year ended Michaelmas, 1894, was $5,338,405, and on outdoor relief $6,167,835, making a total of $11,506,240. This is equivalent to a cost per head of the population of 1 s. 6¼ d. The cost varies from 2 s. 3¾ d. in the metropolis to 1 s. 0¼ d. in the northwestern division. The cost of maintenance of lunatic paupers in county and borough asylums, registered hospitals, and licensed houses is not included.

The number of paupers relieved in the metropolis on the last day of the fourth week of February was 140,088, or 36,355 more than were relieved on the corresponding day last year.

The Sandy Hook Mortar Battery.

For some time past the army engineers have been engaged in the construction of a very important defense for the harbor of New York, a great mortar battery containing sixteen 12 inch breech-loading rifled mortars. Considerable secresy has been maintained regarding this battery which is situated at the extreme end of the Sandy Hook spit and is known as No. 1 A. It is now completed and the fortification is ready for any emergency. The battery controls the entire ranges of the channels leading into the lower bay, and the lower bay as well, so that a landing could only be made, if the vessels succeeded in passing inside the hook, under a terrible fire from the mortars. The chances of the mortars being injured by a hostile fleet are very remote, as they are hidden away behind and below great earthworks, so that a vertical fire only could injure them, and this is difficult to get on shipboard. The battery is surrounded by a counterscarp wall twenty feet high, which is intended only as a shield against the storming party. On this wall in casemates are rapid fire guns which sweep a deep ditch which separates the wall from the earthwork. The mortar pits are four in number and are square like the earthwork. In each pit are four mortars. The mortar pits are connected with passages which are in turn connected with a bomb-proof gallery which is intersected by the magazine. The ammunition is transported from the magazine to the mortars on cars which travel on steel tracks.

Each of the mortars may be fired independently or the whole sixteen may be discharged at once, in which case the fire can be concentrated so that the projectiles will all strike within a space equivalent to the area of a ship. As the shells weigh 600 pounds and are loaded with high explosive, it will be readily seen that no vessel could stand this fire. The men at the mortars, of course, see nothing of the fight and have only to obey the signals which they receive. The officers who direct the fire may be a mile away. With their range finders they plot the course of a hostile vessel, the harbor being divided off into squares on a chart. When the time has arrived to fire they telegraph the position of the vessel on their chart to other officers, who have duplicate charts, at the end of the bomb-proof gallery. The range and elevation of the mortars is rapidly determined by means of tables. The extreme range is about five miles. Orders are given to the men in the pits, the mortars are trained according to the instructions given them and they are then fired by the officers. The projectiles descend in a graceful curve and strike with great accuracy.

In addition to the mortar battery, the harbor is now protected with a gun lift battery provided with two all-steel breech-loading 12 inch rifles, which have a maximum range of ten miles. The battery is placed in a great earthwork. The harbor is to be protected on the southern and eastern extrances by a series of works similar to those already constructed. The projects for defense as contemplated by the Engineer Corps is, according to the report of the Chief of Engineers for 1893, as follows: Twenty-one 12 inch guns on lifts, fifteen 10 inch, nine 8 inch guns on disappearing carriages, one hundred and seventy-six 12 inch mortars and various submarine mines operated from five mining casements. The mining casements are already finished. When all these defenses shall have been completed the metropolis will be amply protected from the attack of any fleet now afloat.

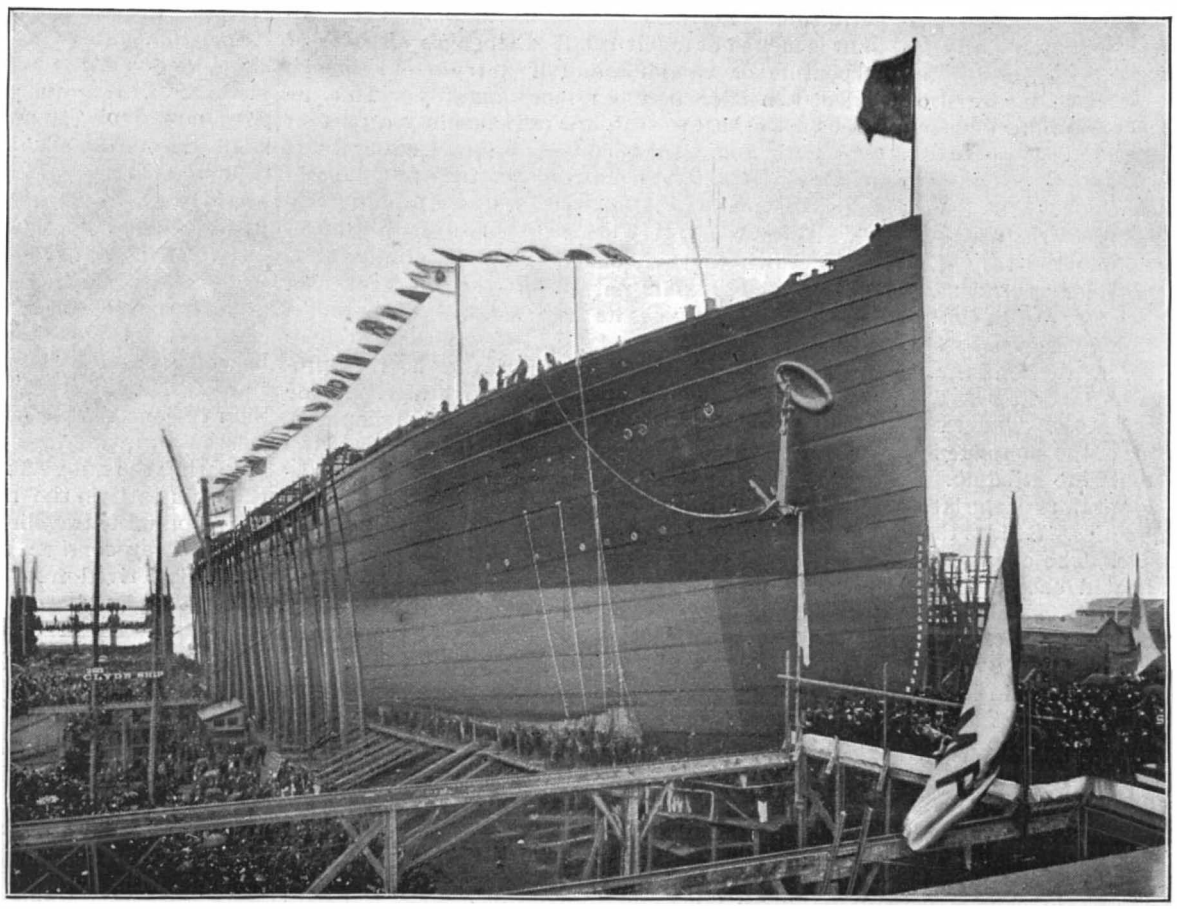
The scales used in weighing diamonds are so delicately poised that the weight of a single eyelash will turn the balance.

THE NEW AMERICAN STEAMER ST. PAUL.

No more successful launching of a large vessel was ever effected than was that of the new American liner St. Paul, from the Cramps' shipyard, at Philadelphia, April 10. This was especially gratifying because of the failure to effect the launch some two weeks ago, as was first intended, causing great disappointment to a great crowd which had then assembled to do honor to the occasion. The first failure was attributed to the poor tallow, but there was no fault of this kind the second time, and the tallow was mixed with lard oil and steamed just before the launch. It has been asserted that the vessel was heavier the first time than she should have been, but this was effectually answered by the fact that the builders continued to put in weight instead of taking it out.

Up near the bow one side of the cradle had sunk two inches, two weeks ago, under the pressure of the jack screws, and the ways were shaped to allow for this settling. It was intended the launch should take place at 2:30 p. m., but a freshet in the Delaware brought high water earlier, and at 12:15 p. m. was heard the "rally" of the four hundred men who had been told off as wedgers, as they lifted the vessel from the keel blocks by pushing up the launching ways against her. In five minutes more the men were heard cutting away the keel blocks, and soon the vessel commenced to glide down the ways, keeping the same pace nearly all the way. As she started the usual christening bottle was broken on her bow by Miss Frances C. Griscom, a sixteen year old daughter of President Griscom, of the International Navigation Company. The vessel was towed back to the yard within twenty minutes.

The St. Paul is a sister ship of the St. Louis, launched in November last, and both are, in the words of Mr. Charles H. Cramp, "American from truck to keelson. No foreign materials enter into their construction. They are of American model and design, American material, and built by American skill and muscle."

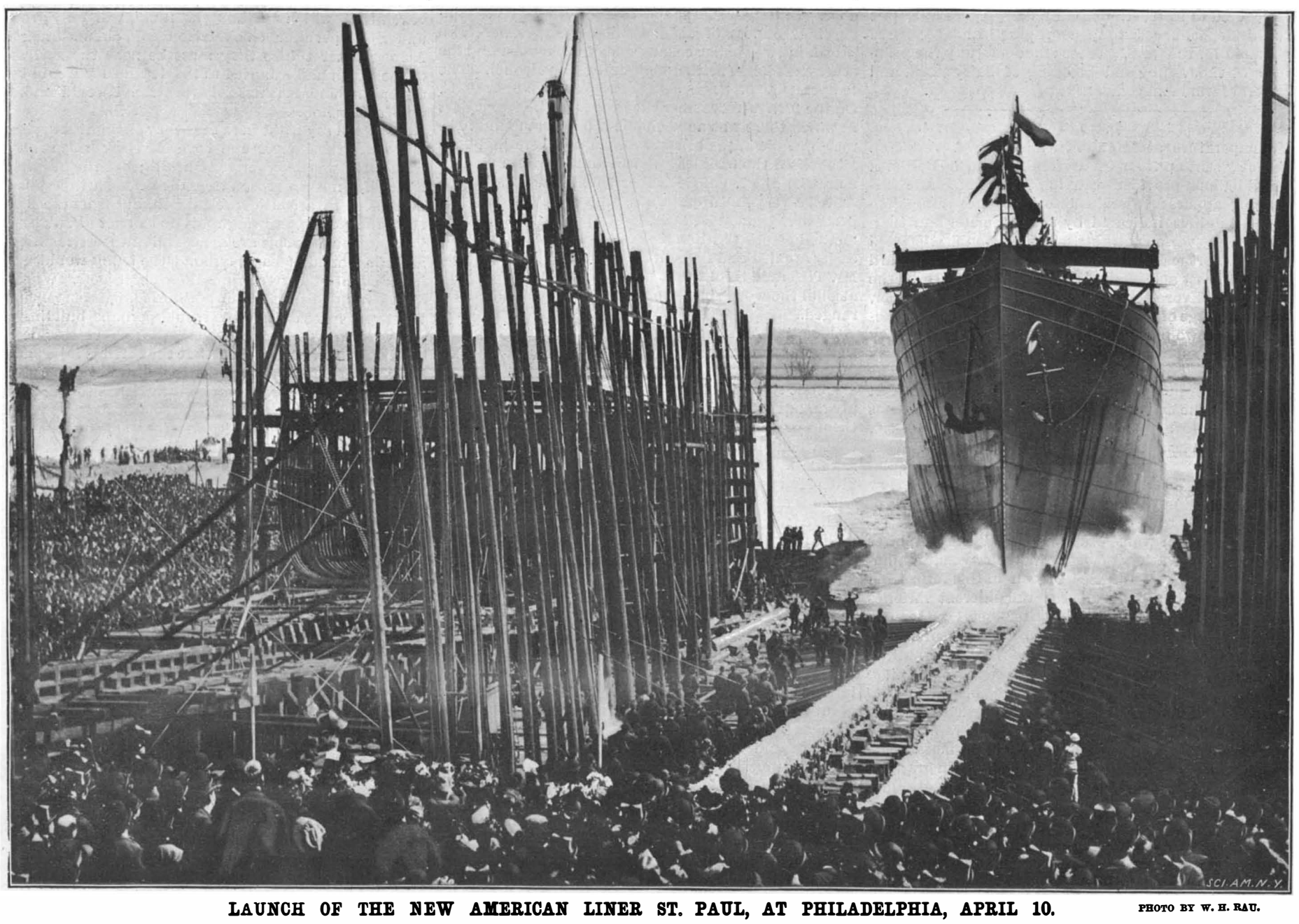


THE ST. PAUL READY FOR LAUNCHING.

They are the largest vessels ever constructed in America, their principal dimensions being: Length over all, 554 feet; length on load water line, 536 feet; extreme breadth, 63 feet; moulded depth, 42 feet; tonnage, gross register, 11,000 tons. The hull has a double bottom constructed on the cellular principle, subdivided by athwarthship bulkheads and a longitudinal division arranged for heeling purposes, the whole available for water ballast. It is so subdivided by transverse bulkheads that even in the event of a collision and injury to a bulkhead, whereby two compartments might fill with water, the ship would still float in perfect safety. It has a straight stem and elliptical stern, topgallant forecastle and poop, with close bulwarks fore and aft, and promenade, saloon, upper, main and orlop decks, the three first named to be plated from end to end. The main deck will be plated for the length of the machinery spaces, and will have stringers and tie plates beyond. Wood planking will be laid on all decks. The promenade deck will remain unbroken the whole length of the vessel. The vessel will carry about 320 first-class and 200 second-class passengers and 900 emigrants.

The engines are quadruple expansion, designed to develop 10,000 I.H.P. each. The cylinders are 36, 50, 71, and 100 inches respectively in diameter, with a piston stroke of 60 inches, two sets of engines turning twin screws, which will be sectional, with three blades. Steam for the working of the main engines will be furnished at about 200 pounds pressure by six steel double-ended boilers, each 20 feet long and 15 feet 7½ inches diameter. To comply with the terms of the contract, the builders will have to show, by an extended sea trial, that when working under ordinary sea-going conditions the vessel is easily capable of maintaining a speed of 20 knots per hour at sea.

The St. Paul, as well as the St. Louis (described in the SCIENTIFIC AMERICAN, August 11 and November 24, 1894), has been especially arranged to be readily and quickly convertible into an armed cruiser of the United States government, in which capacity she will carry a number of six-inch rapid fire guns.



LAUNCH OF THE NEW AMERICAN LINER ST. PAUL, AT PHILADELPHIA, APRIL 10. PHOTO BY W. H. RAU.

The Wisconsin Dairy School.

The Wisconsin Dairy School is one of the most successful institutions of its kind in America. The novelty of its purpose and its unusual methods and equipment make it very curious and interesting. The institution offers courses of study in the theory of dairying, besides being equipped to give practical instruction in all kinds of dairy work. The school is sustained at great expense, but it is believed that the outlay is justified by the advantages resulting to the dairy interests of the State.

The school is planned to accommodate one hundred students, besides those taking courses in farm dairying. The course of study covers a term of twelve weeks, and during this time the student is required to pass some ten written examinations and several oral ones. The main school building is a structure three stories in height, with a frontage of ninety-five feet and a depth of fifty-four feet. It is provided with an office, a room with lockers where each student's work clothes are kept, bath rooms, a large creamery room, a cheese-making room and a large room for instruction in farm dairying, a lecture room and a large laboratory. The building cost with its equipments $40,000. The creamery room will give a good example of the completeness with which the various departments are fitted up. It contains, for example, six large separators of the latest pattern used for study and for practice. Besides these are the churns, butter workers, etc. The cheese room is provided with eight steam-heated cheese vats of three hundred pounds capacity, each of which has its own complete set of cheese-making apparatus.

The school day begins at eight o'clock. The students first attend a lecture of fifty minutes in length, and afterward report in snow white working suits and white caps for practical work. One section is instructed in milk testing in the laboratory and another in the mysteries of the creamery. In all there are eight lecturers and nine teachers. Some idea of the work accomplished may be suggested by the fact that two tons and a quarter of milk are required daily for the use of the school.

The student who has passed all the examinations of the dairy school can become a candidate for a dairy certificate. But to secure this he must work in a creamery or cheese factory for not less than two full sessions of seven months each, and during one of these he must have entire charge and be responsible for the cleanliness and success of the factory. He must, besides, report the operation of the factory monthly, and his factory is regularly visited by an authorized inspector. After all these requirements have been fulfilled the certificate is granted.

The school contains still another department which is devoted to instruction in farm dairying. The object of this department is to turn out practical dairymen as required for the farm. These students study the problems of the feeding and breeding of dairy stock, and general farm management.

Science Notes.

Temperature at High Altitudes.—Prof. Assmann recently sent up from Charlottenburg, near Berlin, a small balloon provided with improved automatic registering apparatus designed to reproduce automatically the figures indicated by the barometer and thermometer at various heights. The balloon first started off in a northeast direction, veered suddenly toward the southeast and finally landed in good order in the district of Zvornik, on the Servo-Bosnian frontier, after a voyage of eleven hours. Since the distance between the two points is about 600 miles, the velocity of the balloon was, without counting curves, nearly 60 miles an hour. At the moment of starting, the thermometer marked 17° and the barometer stood at 764 mm. The extreme figures noted by the apparatus during the voyage were: For the temperature, —52°, and for the barometric pressure, 85 mm. This latter reading denotes an altitude of 16,325 meters (10 miles and 546 feet) above the surface of the earth. Such low pressures had not hitherto been suspected at the altitude above stated.

Graphite from Iron.—Having studied the graphites obtained in a variety of ways, and shown that a number of metals can displace carbon in this form from iron, Mr. Moissan has compared the different varieties of graphite liberated from the latter metal under different conditions of temperature and pressure. He finds that, at the ordinary pressure, the graphite formed is purer as the temperature becomes more elevated, besides being more stable in the presence of nitric acid and potassium chlorate. The effect of the pressure on the crystals and masses of graphite is to give the latter the appearance of a fused mass. The small quantity of hydrogen always present in graphite diminishes in proportion as the purity of the graphite increases.

Is Sulphur a Simple Substance?—Mr. Auguste Strindberg, says the Annales Industrielles, asserts, as the result of numerous experiments made by him, that sulphur is a compound of carbon, oxygen and hydrogen, in proportions as yet undetermined. He goes still further than this, and claims that it is not only not a simple body, but not even an original one, being merely a common fossil resin or bitumen. Between it and these substances he finds certain resemblances, such as crystalline or amorphous aspect, brittleness, fusibility, combustibility, insolubility in water, solubility in sulphide of carbon, electrification by friction, etc. Besides, sulphur in a native state is found in the vicinity of bitumen, lignites, anthracite and petroleum. Farther, says Mr. Strindberg, when sulphur is melted at about 120° it disengages an odor of turpentine or camphor, and if a trace of iodine be added, the odor becomes more marked. This, he claims, is because the sulphur resin has lost a part of its oxygen and become converted into camphor. If it be heated anew to between 160° and 230°, it loses more oxygen and drops to the level of a caoutchouc, of which it assumes the color and consistency. Then, if the brown and viscous liquid thus obtained be cooled, it preserves its nature for a certain length of time, and then resumes its state of resin.

Curious Echoes.—One of the most remarkable echoes in the world, says a writer in La Nature, is that produced by the Menai Strait suspension bridge. If one of the abutment piers be struck, say with a hammer, not only will the sound be re-echoed by the pier at the other extremity, which is over six hundred feet distant, but also by all the metallic cross pieces that support the flooring and by the water itself, which repeats the succession of shocks under the bridge. Every blow of the hammer is re-echoed at the rate of five perfectly distinct echoes per second. The effect produced is that of a sort of sonorous and strident metallic trill.

The castle of Simonetta, at about two miles from Milan, produces a curious echo which repeats the detonation of a firearm as many as sixty times, even when the atmosphere is very foggy, and, consequently, unfavorable for experiments.

Not far from the church of Shipley, Sussex, England, an echo is produced of quite a peculiar kind, and which distinctly repeats sentences of eighteen and even twenty syllables.

Finally, we must not forget the echo of the Pantheon, at Paris, where the noise of a cane falling to the floor produces the effect of the firing of a gun.

Preservation of Fruit.—At a recent meeting of the Societe Nationale d'Agriculture, Mr. Tisserand, director of agriculture at the ministry, read a note from Mr. Petit upon the preservation of fruit. Mr. Petit has found that upon keeping fruit, grapes, for example, in a closed place permeated with the vapor of alcohol, it may be preserved for some time. On the 31st of October, 1894, that is to say, very late in the season, some grapes were collected and placed upon wood shavings in a cellar closed as tightly as possible by a wooden door. In the same cellar was placed a vessel containing four ounces of alcohol. Some grapes were also placed in two similar cellars, one of them open and the other closed, but neither containing any alcohol. The temperature of these cellars ranged from 8° to 10° C. On the 20th of November the grapes in the two cellars in which there was no alcoholic vapor were found to be rotten, while in the cellar whose atmosphere had been alcoholized the fruit was perfect and free from mouldiness. On the 7th of December these grapes still presented a very fine appearance, and when tasted by experts were pronounced to be of exquisite flavor. This method of preservation is extremely simple, may be easily applied and necessitates no special installation. Mr. Tisserand thinks that it would suffice to treat with alcohol the wood shavings upon which the fruit is arranged.

Chemical Fern Fronds.—A neat experiment to please the young may be performed in the following way: Saturate some strips of thin cartridge paper with an alcoholic solution of gum benzoin, and, when dry, apply an aqueous solution of bichromate of ammonia. Crimp or fold these slips backward and forward so that when opened out they will stand upright in a zigzag form. Place one of these slips upon a plate and ignite it in two or three places along the upper edge, but without allowing it to blaze. It will burn slowly down with a red glow, diffusing an agreeable perfume, while the ash of the paper will assume the most fantastic arborescent shapes, together with a green color, which, to a lively imagination, may be suggestive of the growth of ferns or lichens.

Cellulose Paint.—A writer in La Nature proposes as a paint for the protection of steel ships and metallic surfaces generally a ten per cent solution of ordinary wood pulp, to which may be added any coloring matter that may be desired. At the moment of using the paint there is to be added to it some sort of siccative, such as an acid salt of lead or of manganese. This paint is said to become finally insoluble and absolutely inalterable.

It is very adhesive, and does not scale off like oil paints, varnishes and lacquers. The paint may be rendered immediately insoluble and resistant by passing over its surface a solution of one of the siccatives above mentioned.

Monkey Skins.—Among the curious products that constitute the wealth of the Gold Coast, the Revue des Sciences Naturelles Appliquées mentions monkey skins. These skins, which are in great demand among tailors, usually fetch from 3 to 9 shillings apiece. The quadruman that furnishes these skins is known to naturalists by the name of Colobus vellerosus. It is of the size of a large dog. Its hair is black, long and silky, and the animal has a white muzzle and a long white tail. The statistics of the colony of the Gold Coast mention the fact that large quantities of these skins are annually exported from Cape Coast, Salpond and Accra. The exportation in 1891 amounted to 187,000 skins, valued at the coast at more than 30,000 pounds sterling. During the last eight years it has reached the figure of 1,075,000 skins.

The Kola Nut.—The State Department has been calling upon the United States consuls in Africa for specific information in regard to the kola nut, which, by its peculiar action upon the muscular system, enables the African negroes to make long journeys, bearing enormous loads under tropical suns and across difficult country without food. Authentically reported cases prove that an old negro may carry a 176 pound bag of coffee four leagues by chewing a single nut slowly. Mr. Robert P. Porley, United States consul at Sierra Leone, Africa, has sent in the first report upon this subject, treating of the methods of growing and preparing the nuts. According to him, the natives eat the nuts early in the morning as a stay against ordinary food while traveling, and in the evening to induce sleep. They consider that a general benefit to the system is derived from the consumption of the kola, say a single nut morning and evening.

Diseases of Peach Trees.

Some years ago a gentleman residing near Cincinnati created a sensation by what he regarded a new method of keeping peach trees healthy. All that he did was to pile up earth about the trees, the mound reaching up to the branches. It took several cart loads of earth to make these mounds, and the little orchard had the appearance of bushes growing out of the top of the cone of earth. Every one used to look on and laugh at the thought of burying up the trunk of a tree in order to make it healthy; but there were the trees, and undoubtedly models of health. Those who saw, simply stated their belief that it was only a coincidence, and that the trees would probably have been as healthy without the mound of earth as with it. Since it has come to be well recognized that many of the diseases of plants, not merely of the peach tree, but of other trees, are caused by the mycelium of a minute fungus attacking the roots, it is not at all unlikely that this mound of earth operated beneficially by preventing the growth of the fungus which preys on the roots of trees. It is now well understood that all plants of a low order of vegetation, which we know as fungi, will only grow under a peculiar combination of circumstances. Among other things they must be near the surface of the earth, and if buried to the depth they would be under a mound, it is unlikely that fungi would find a satisfactory home.

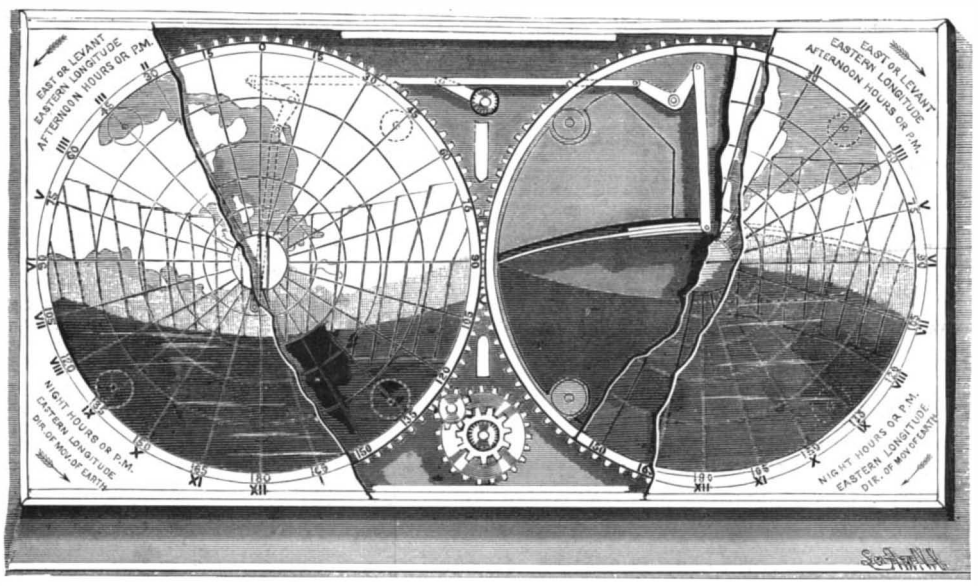
Some will say right here that they thought burying up the trunks of trees and covering the surface roots with earth was destructive to health; but the burying by itself is not the reason trees die when earth is piled over them to a considerable depth, but from the fact that the young, growing roots do not get air. These young, growing roots are almost all at the extremities, and the mound of earth around the trunk would not in the slightest degree injure these outer roots. Whenever a valued tree is somewhat buried, it is customary to leave a space around the trunk, perhaps building a dry wall, in order to keep the earth from getting near the trunk; but this is not that the earth is injurious, but to give a chance for water to flow freely down into the soil, and the flow of water always leads to a flow of air following the water. These remarks are suggested by an article in an agricultural paper, stating that the apple borer and the peach borer have been kept out of the trunks of trees by making a mound of earth around the trunks.—Meehans' Monthly.

The African Transcontinental Telegraph.

Early in 1893 it was announced that the telegraphic system from Fort Salisbury, in Mashonaland, would be continued through the African continent to connect with the Egyptian system at Cairo. A company was formed with a capital of $2,000,000, and on September 27, 1894, the line was open from Cape Town to Blantyre. Commencing at Salisbury, the line is to cross the Zambesi, in the neighborhood of Tete, and continue to Zomba. From Zomba the line will skirt the shores of Lake Nyassa up to Karonga. From Karonga the line will be continued along the Stevenson road, which runs over the uplands on the Tanganyika plateau, and it will touch the lake at a point on Abercorn Bay. From the north of Lake Tanganyika the line will proceed to Victoria Nyanza, and thence to Uganda. The wire will be strung on light iron poles. When connection is made with the Egyptian lines at Wady Halfa, it is expected that messages will be transmitted from London to Cape Town at one-third the present cable rates.

AN IMPROVED MAP.

The illustration is of a map consisting of two revoluble disks or hemispheres, and fixed universal meridians for them, by which one can fix the time in any place in the world without an error of more than four minutes, the map also indicating the rising and setting of the sun, according to the season of the year and the latitude, all countries in the world where the sun is rising or setting being seen at once. This map has been patented by Mr. Miguel Arriaga, of the city of Mexico, Mexico, and is being introduced by Mr. Alberto Ituarte, Calle de Alfaro, No. 15, Mexico. In a suitable frame are mounted wheels which mesh with each other, and on whose top edges are disks of transparent material displaying a map of the world in two hemispheres, the northern and the southern. Set in the casing, directly above the disks, are glass covers on whose under sides are etched meridian lines terminating at the edges of the disks on graduations on fixed boards secured in the frame under the covers. The graduations on the boards for the meridians on the glass covers commence with zero at the top, until the lowest point directly opposite indicates 180°. Next to this meridian graduation is arranged a time graduation to indicate the hours of the day. The gear wheels carrying the hemisphere disks are revolved by a small gear, with a button or head to be taken hold of, the hemispheres being thus simultaneously rotated to bring them into the desired position. The sun appears to be shining on the upper half of each hemisphere, while the lower half indicates night, to represent which shaded boards are fastened under the transparent map-carrying disks, so that the lower part of the hemispheres, looked upon from above, appears to be in partial darkness. Between these spaces of light and shadow a band is arranged under each disk and above the shaded boards, the band being in folds and having an upper light portion, an intermediate dotted red space representing twilight, and a lower shaded portion corresponding to the shaded tops of the boards. This band is held on curved springs, extending centrally across under the disks, and the springs are moved to shift the band, the springs being connected by links and bell crank levers with a button in convenient reach, whereby the twilight portion of the bands may be shaded up or down to indicate twilight at the proper place. Where the light and dark backgrounds under the disks terminate sunrise and sunset are indicated, the intervening red spaces denoting the duration of dawn or twilight. The map is adjusted to any particular meridian by turning the button at the bottom, revolving the hemispheres until the name of the place appears below the hour chosen, when the corresponding time in any part of the world will be shown, as well as where the sun is rising and setting, and the locations where dawn and twilight prevail.



ARRIAGA'S MAP.

Cost of Torpedo Boat Destroyers.

The contract prices of a large number of the torpedo boat destroyers now being constructed for the British navy are given in a blue book recently issued in England. The general dimensions of the vessels are about 200 feet in length and from 230 to 240 tons displacement. Their engines are about 4,000 to 4,500 I. H. P. and a speed of 27 knots has been attained by them. Of this type three built by Messrs. Yarrow, of London, cost $187,000 each. Messrs. Thornycroft, of London, have built three at $182,150 each. The average price is about $185,000, though in some cases considerably higher than this. By way of comparison, it is interesting to note that the French government recently paid $152,600 for a 27 knot torpedo boat only 140 feet long and of only 123 tons displacement. Similar boats in the English fleet cost only $72,400 each. Of larger vessels the price of the 14,000 ton cruiser Terrible was $2,711,735, and that of her sister ship the Powerful was $2,676,260.

Great Ship Canal.

The ship canal between the Baltic and Black Seas will be about 1,000 miles long. There are no very formidable engineering difficulties. The estimated cost is £20,000,000, and the construction will occupy five years. The canal will be 27 feet deep, 213 feet wide at top, and 114 feet at the bottom. It is to run from Riga, follow the course of the Dwina, Beresina and Dnieper, and end at Cherson. The canal will be lighted by electricity along its whole length, enabling the transit to be performed in six days, reckoning six knots as a maximum speed. Other towns and districts besides those touched by the canal will be benefited, owing to the improvement of navigation in the various rivers.

Marketing Apples.

Some essential points to be considered in the marketing of fruit were given by Mr. George A. Cochrane in a paper read a few weeks ago before a meeting of the Massachusetts Fruit Growers in Worcester. We quote in a condensed form a few paragraphs, which will be found interesting to buyers as well as growers:

For several reasons the barrel is too large a package for apples, which should be marketed in boxes no larger than those used for oranges and lemons. Last fall I advised the trial of such a package, and suggested that each apple be wrapped in paper as oranges and lemons are. Three thousand cases were sent to me for shipment to Europe. Out of fifty growers of apples only three understood what a close selection of fruit meant, and the apples sent by these three growers sold in London at $2.40 a case, when fruit in a barrel, which held three times as much as one of the cases, brought only $4. Some growers sent windfalls, in the hope that wrapping them in paper would insure their safe arrival in England. Some sent Snow apples and Russets mixed in the same case. Of course, when barrels are used, new ones, and not second-hand flour barrels, should be used, for, no matter what care is taken to dust and wash them, sufficient flour will remain in the seams or staves of old barrels to rattle out in transportation and dust the fruit.

In packing a barrel, select a fair sample of the contents for the bottom layer. Place the apples, stems down, in the form of a ring, beginning at the outside, and having secured this layer firmly, place the second layer in so as to fit closely in the interstices, then fill the barrel quickly and gently, and when one-third full rock it slightly to settle the apples. Repeat this rocking when the barrel is about three-fourths full, and when it is filled place a padded board on top and rock it while the board is held down firmly. Then place in enough more apples to form a cone at least two inches above the chime. Now force the head down with a barrel screw presser, nail the chime hoops, both top and bottom, securely and have the head lining sufficiently large to lap the presser that forms the head.

Never pack red apples until they are of a good color. It is an expensive blunder to wait until the last moment and then strip the tree of all its fruit. It is also a mistake to pick the apples faster than they can be packed. It is a good plan to go over the trees a week or a fortnight before the general picking and remove the well developed and well colored fruit and market it at once. Aside from the advantage of early marketing, such pickings help the fruit which remains, increase its size, and improve its color. Apples should be headed up at once, and if they are to be held they should be hurried into cold storage as near a temperature of thirty-two degrees as possible. They should never be allowed to lie on the ground, and under no circumstances should they be exposed to sun or rain after being picked or packed. Fall varieties decay quickly, because they are exposed to a higher temperature after leaving the tree than the winter varieties are, and more fruit is lost after being picked in the heat than from the frost. Growers who keep apples in bins to market during the winter should select and sort at the time of picking. Only perfect and healthy fruit should go into such bins. Cellars should be ventilated so that advantage of any change in the temperature can be taken and the fruit kept as nearly as possible at the required coolness. When the average temperature has been above forty-five degrees from the time of sorting up to December 15, apples should be marketed as soon after the turn of the year as possible. When they are kept in the bin after this time they will not stand rough usage and will not answer to ship to Europe in barrels. One reason why fall fruit does not pay arises from the fact that a large quantity of delicate fruit is placed in one compartment, which, because it is airtight, becomes overheated. Such delicate fruit ought never to be placed in barrels, except for near-by markets, and then only under the most favorable conditions of weather. Were American apples marketed in as sound condition as oranges are, if they were graded as oranges are as to quality and size, if they were wrapped and packed as oranges are, they would be worth three times as much as they now command in Liverpool.

Argon.

The Paris correspondent of the Standard, writing recently, says that Professor Berthelot made an interesting communication to the Academy of Sciences respecting argon. A small specimen, of thirty-seven cubic centimeters, had been forwarded to him by Lord Rayleigh and Professor Ramsay. M. Berthelot set to work to discover whether argon would combine with any other body, and by inclosing the new gas and vapor of benzine in a glass tube, and sending through it what the Temps describes as un effluve electrique, which I presume to be an inductive current, an absorption took place in ten hours, amounting to 11 per cent. On increasing the intensity of the effluve, the absorption increased to 83 per cent; the gaseous residue consisted of argon, hydrogen, and vapor of benzine. The product of the combination was too small to be analyzed; it formed a yellow compound not unlike what is obtained with nitrogen. M. Berthelot remarked that the name of the new gas, which is the Greek for "inactive," seemed after his experiment to be no longer appropriate. He thinks that in a short time further compounds of the new gas will be obtainable.

The Invention of Matches.

At the Borough Hall, Stockton, on Thursday, March 14, Mr. Joseph Parrott lectured on "The light of former days, and how it was obtained." Primitive methods of obtaining light were described, also the quaint processes in vogue in medieval times. The old sulphur-tipped splints of most inflammable wood were then shown, and also the method of obtaining light by chlorate of potash and sulphuric acid. A case containing ten of the original matches made by the Stockton inventor, Mr. John Walker, was exhibited, and also Chinese matches. From these exhibits Mr. Parrott passed on to refer to the inventors of the friction matches. The dates are as follows: The first American patent for them was taken out in 1836. Janos Irmzi, the Hungarian, made the discovery in 1835. He sold it for £700. He was still living in the south of Hungary. Kammerer, the German, discovered it in 1833, and Sauria, the Frenchman, in 1831. He still enjoyed a pension for his discovery. Sir Isaac Holden's discovery was in 1829, but the late Mr. John Walker, of Stockton, took priority of all, he having invented it in 1827, as his day book proved by the sales entered in it; and thanks to the courtesy of Mr. Hardcastle, Finkle Street, chemist, the lecturer had again had lent to him the original book.—Northern Echo.

Brains versus Luck.

Every mechanic, says the Sanitary Plumber, can call to mind certain men in his particular line of business who seem to succeed with little effort in undertakings where others fail. This class of men are usually spoken of by their friends as being lucky; as having natural talent; as being to the manner born, etc. None know the fallacy of these popular suppositions so well, however, as do the successful men themselves. The cases are rare where successful men would not have been equally successful in lines other than those they follow, because energy is the power that bridges difficulties. Brains are certainly an important factor, and while brains cannot be purchased, they can be developed by study and practice, but with the largest equipment of brains success does not follow, unless there be application, industry, and energy. On the other hand, industry and energy often go far to supply deficiencies in talent and brain power. Probably the highest compliment that can be paid to a mechanic is to tell him that he performs difficult work with ease, but no words appeal so little as these to the ears of men who have spent hours in accomplishing what the uninitiated think requires but a few moments' application of "natural (?) talent."

THE Fairfield Shipping and Engineering Company launched on March 27th on the Clyde the torpedo destroyer Heart, built to the order of the British Admiralty. The vessel is of 300 tons displacement, and the speed 32 miles per hour.

On the Law of Evidence.*

Parties often enter upon their legal combats with a mistaken idea of their strength, on the supposition that they have ample evidence to prove their claims, only to find that much of the testimony they offer is objected to as "improper, incompetent, irrelevant and immaterial," and is ruled out by the court. All who engage in mercantile transactions involving those elements of uncertainty—misunderstanding of the contract, mistake as to financial responsibility, or changes in condition which may occur between an order and payment—that may lead to contests before the courts, either to establish the contract or collect the debt, should have a general knowledge of the rules of law applicable to the admissibility of testimony.

Testimony, broadly defined, is merely the declarations of the witness under oath, while evidence includes all the means by which any alleged matter of fact, the truth of which is submitted to investigation, is established or disproved; and proof is such an amount of it as shall lead to conviction and produce belief. Testimony may either be given in person or submitted by deposition, and evidence may be either oral testimony or written documents.

Whatever facts are necessarily involved in any transaction submitted to the court are said to be "in issue," and evidence as to their existence or non-existence is always relevant. Such facts may be proved by direct evidence or circumstantially. Direct is the testimony of persons who either saw or heard, or the production of the thing itself. Indirect evidence is proof by some other fact or facts, from which the one in issue may be inferred, as a probable consequence. All facts so intimately connected with the facts in issue as to form part of the same transaction or subject matter are relevant to it. So, also, proof of any facts which would be the natural and probable effect or result of the existence or non-existence of any fact in issue is admissible as relevant thereto. It follows that facts not directly in issue, or relevant, are not admissible.

Evidence as to character, hearsay statements, and opinions, are generally irrelevant, except in certain cases. The opinions of experts on matters requiring special study or experience are admissible, for the purpose of assisting the jury to arrive at a correct understanding of the matters submitted. Other derivative evidence, such as admissions, are admitted; for a party is bound by declarations which he has made against his own interest; by the declarations of those whose interests he represents; those jointly interested with him; those whom he has authorized to make admissions or those to whom he has referred for information.

Facts must be proved by the best kind of evidence obtainable. One cannot prove the contents of a letter by copy or oral testimony, unless it is first shown that the original is not in existence or unattainable; nor then if it has been destroyed by the party offering its contents intentionally. If lost, it must be shown that diligent search has been made for it, where it should be if in existence.

Ordinarily the most natural and satisfactory method of proving the existence or non-existence of a fact is by the direct oral testimony of witnesses who have perceived its existence or non-existence by the operation of their own senses; and therefore this is most generally resorted to for that purpose; except where it is a presumption of law; a matter of public record; embraced in a written contract, or by formal deed or document.

Oral testimony cannot be given to vary the terms of a written contract, where it appears that it was intended as a formal and binding statement between the parties, and which has been accepted by both sides. But oral evidence of the terms of a verbal contract is not excluded by the fact that there was a written memoranda, unless the latter was understood by both to embrace their agreement. This rule does not prevent a party from showing that a contract was obtained by fraud, duress, etc. And oral testimony may be introduced to explain what is uncertain, but never to contradict. Any distinct subsequent oral agreement to rescind or modify a written contract, provided the agreement is not invalid under the Statute of Frauds, or otherwise, may be admitted; it being a well recognized principle of common law that any obligation in writing, not under seal, may, in the absence of statutory interference, be either totally or partially dissolved or modified, before breach, by a subsequent oral agreement.

The burden of proof lies on the party substantially asserting the affirmative of the issue; as it is but reasonable that one who relies on the existence of a fact should prove it. In civil actions, of which we write, the party commencing the suit must make out his case by a preponderance of the evidence. This, however, does not require that he have more witnesses than the other, though if he alone asserts a thing to be true, and the other denies it, the former will not recover unless he be supported by documentary proof.

Let merchants be forewarned, preserve their papers, and keep in mind and memory the facts that go to make evidence in courts—for

Thrice arm'd is he who knows what proofs to trust,
As well as he who has his quarrel just.

*Clothier and Furnisher.

Ferrous Steel.

Thomas Doherty, of Sarnia, Ont., has discovered a new process for improving castings. The sample punching sent appears soft, like wrought iron, but not as strong. He writes:

"I inclose you sample of what I name ferrous steel. It is punched out cold from a top of an ordinary coal range. You can see the grain and sharp edges. It is so ductile that a strip 1½ inch wide, ⅛ inch thick, 12 inches long, can be wound around a 2 inch gas pipe without breaking; at the same time is of great tensile strength, a ½ inch square bar 12 inches long bearing on the points will carry a load of 500 lb. without fracture. It is made from a mixture of 60 per cent common scrap and 40 per cent No. 2 pig iron. My process is to inject a steam jet into the tuyeres at cupola, which forms another element in combustion (hydrogen gas), giving out great heat; forming black oxide of iron on the iron at the point of charge, as it becomes red, magnetic oxide, and is so closely coherent and adherent that the absorption of sulphur from the coke is entirely prohibited on its course down through the furnace. The color of the gases is entirely changed. The molten metal is much more fluid and almost free from slag or dross and gives a casting of much smoother surface with a steely appearance. This process saves fully 10 per cent in fuel and has several other advantages of greater or lesser importance not stated here. It is being patented in all countries. The days of common cast iron are nearly ended."

Improved Grinders for Dressing Metal Rolls.

William E. Harris, of Niles, O., obtained two patents on March 26, 1895, for improvements in grinders for dressing metal rolls without removing them from their housings. Mr. Harris' idea is to form the grinder with a chamber and to connect pipes therewith, so that while the rolls are being dressed a stream of water may be caused to pass through the grinder to keep it cool. Mr. Harris sets forth different ways of doing this in his two patents.

RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE. — Walter W. Wainright, Palestine, Texas. According to this invention a suction fan is located between the chimney or stack and the fire box, to draw the gases from the stack and force them into the fire box above the grate bars, thus insuring complete combustion and preventing the escape of smoke and obnoxious gases. When applied to locomotives the exhaust passes with the smoke and gases to the fire box, while in stationary boilers and engines the exhaust is passed directly into the throat of the suction pipe for the fan. The device also completely arrests all sparks.

Electrical.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.—John M. Byron, New York City. This improvement relates to systems where a sectional trolley wire or rail is employed, the sections being insulated from each other and each supplied by a feeder with current from the main line. The improvement provides automatic means for switching the current successively through the sections of the trolley wire or rail, the parts being perfectly insulated and there being but few mechanical parts to get out of order, the mechanism being also arranged to facilitate repair, while the several switches are so devised that if a number of them are damaged the rest of the line will not be interfered with. The improved system is designed to supply the power economically and without danger.

Railway Appliances.

TRAIN ORDER BOX.—William A. Tucker, Dayton, Tenn. This is an improvement in boxes combined with the levers used for working semaphores or switches, the device automatically locking the semaphore-working lever when the operator takes his order blanks from the box, and automatically unlocking the lever when the order blanks are placed in the box, preventing accidents and mistakes, or the pulling of the signal until the train crew has received its orders. When the semaphores are in or clear for trains the box is closed and the blanks cannot be reached, and when the blanks are out of the box the signal must be at danger, and cannot be changed until the blanks are put back in the box.

SWITCH WORKING MECHANISM.—Edward J. Ill, Jersey City, N. J. For use in connection with an ordinary switch point, this inventor has devised a simple apparatus adapted to be operated by mechanism on a passing car to open or close the switch. It is a screw mechanism which positively moves the switch point, the screw shaft being turned in either direction by a sprocket wheel and chain, there being oppositely moving striking plates beneath the slots in the track bed.

Mining, Etc.

AMALGAMATOR. — Nathan L. Raber, Corvallis, Oregon. This patent is for an improvement on formerly patented inventions of the same inventor, designed to avoid danger of breakage, as the mercury cup contains agents by the electrolysis of which the mercury is purified or cleaned. Step brackets formed with step risers extend between and are supported by the sides of the frame, the mercury receptacles being arranged above the steps. The step plates may be removed each independently of the other.

CLEANING RETORTS OF ZINC SMELTING FURNACES.—Herman Kaemmerling, Girard, Kansas. After the last draw of metal, and before charging the retort with fresh ore, it is cleaned of residuum, ashes, etc., according to this invention, by discharging jets of water under high pressure into the hot retort throughout its length, thus generating steam to loosen and force out the residuum, the discharge being continued until the residuum is cooled and washed out.

Mechanical.

WRENCH.—James G. Lowe, New York City. This wrench is especially adapted for use around a bicycle, being a quick-adjusting tool adapted for a wide range of work, and being easily and quickly manipulated with one hand. It has claws at the end of its handle designed to be useful in straightening a wheel and a pivoted hook arm for use, in connection with a projecting pin, in manipulating the ball casings.

DRILL CLAMP.—John F. Forsyth, Bloomington, Ind. Simple and effective devices for clamping the drill of stone channeling machines form the subject of this invention. The parts can be readily detached and assembled, and are manufactured at small cost. The head block has a slot straight at one end and tapering inward, a recess having similarly arranged end walls opening into the slot way, while a clamp member fitting in the recess has one end straight and the other tapering, there being also an intermediate clamp member and wedge plate.

MICROMETER.—Otto J. Ebert, Cleveland, Ohio. To cover and protect one of the bearings or screw points of the instrument is the special object of this improvement, which comprises a measuring gage well adapted for calipering screw bolts or other articles. A removable cap is provided for the lower bearing or screw point, the cap having a lengthwise slit and opposite lateral perforated lugs, and there being a screw for drawing the edges of the slit together and clamping the cap upon the screw.

Agricultural.

TRANSPLANTER.—Frederick Richards, Freeport, N. Y. This improvement comprises a receiving vessel, open at the top and bottom, and adapted to be forced into the bottom around a small plant in such way that on its removal the plant will also be taken up with the earth around its roots, there being used in connection with it a similar vessel to be forced into the ground at the place where the plant is to be again put down, to remove the earth for the replanting. The invention also provides for retaining plant runners in contact with the ground by a suitably bent wire rod.

Miscellaneous.

FILTER. — Joseph G. Sutton, West Newton, Pa. This invention relates to filters employing a porous block, and the patent is for a cheap and durable filter which may be readily cleaned by reversing the flow of water through it to carry a sponge back and forth through a serpentine supply passage, and also cause the water to permeate reversely through the pores of the filtering block, and thus release the foreign matter deposited by the inflow to the filtered water chamber.

OVERHEAD CONVEYOR. — Walter G. Berg, New York City. To facilitate the moving of packages, bales, etc., to and from warehouses, factories, and other buildings, this inventor has devised an apparatus in which an overhead rail is supported on hangers and extends through the building, the carrying chain being secured to a lever fulcrumed on the carriage traveling on the rail, so that by turning the lever a grappling device and the article held by it may be raised to the carriage. Locking means are provided to hold the grappling device in elevated position. Any number of carriages may be run on the rail, each one provided with a picking up and dropping device.

VENDING MACHINE.— Owensby H. Woodfill, Nevada, Mo. This is a machine especially adapted for dispensing weighty articles, and it is so constructed as to relieve the dispensing mechanism from the greater portion of the weight of the articles. The motor mechanism has a notched disk in engagement with which is held a coin-released brake when the motor is at rest, a number of pivoted arms having head portions forming seats for the support of the goods, and these arms being moved by a pitman connecting them with the disk of the motor.

SPROCKET CHAIN.—Charles E. Fanning, Keokuk, Iowa. A bicycle chain designed to reduce friction and wear and not liable to lengthen, has been devised by this inventor. Pintles unite the links and balls surround the pintles between the links, flanged sleeves fitting reduced ends of the pintles and entering the balls, spacing them from the pintles, while the flanges of the sleeves abut against the inner surface of the links. The links are braced against sidewise strain and lateral play is prevented, while the balls are moved on their axes by the sprocket teeth, freeing the chain of mud and dirt.

IRRIGATING DAM. — Hugh C. Magarrell, Trinidad, Col. According to this invention a main plate is adapted to form a central rigid cut-off, the plate having an opening and a slide gate, while wing members pivotally connected with the main plate are adapted to swing outwardly as they are moved vertically. It is a simple device for use in irrigating ditches, made of sheet metal in different sizes and adapted for readily shutting off the water partly or wholly, as desired.

PROCESS OF TREATING LEATHER.—Rossiter Owens, Olean, N. Y. To improve the appearance of hemlock leather, making it look equal to oak leather, and also to give increased weight, this inventor has patented a process for treating the leather after it has been tanned and dried in the usual manner with a solution of sal soda, then bleaching it in oxalic acid and finally washing it with water, using first a strong gambier or other liquor in a wheel handler to give the increased weight.

COMPOUND FOR MAKING CIDER. — Philip Nickols, Albany, N. Y. This is a compound which includes burned apple peels, blackberries, sugar, tartaric acid, oil of apples in certain proportions and prepared after a stated manner, to make a cider which does not get sour or hard, and affords a delightful drink for summer and winter.

FLOWER PACKAGE. — Hubert Bailey, Brewster, N. Y. For conveniently packing and shipping flowers and blossoms without liability to injury, this inventor has devised an improvement consisting principally of a casing and an apertured piate removably connected therewith to carry the flowers. Means are also provided for attaching a moisture-carrying material in which the flower stems are embedded, so that they are kept in a healthy condition during transportation.

TABLE FORK.—Joseph Eros, Anniston, Ala. This is a patent for a new article of manufacture, comprising a table fork having a ridge upon the upper surface and along one edge of each of its tines, while one outer tine has its ridge on the outside and the other outer tine is widened and has a ridge on the inside, thus forming a scoop. With this fork children and others can more readily take up food from the plate and convey it to the mouth.

DISH CLEANER.—John H. Nolen, Jr., Columbus, Ohio. This invention relates to that class of dish washers in which the dishes are rotated in a wire cage in a water holder or pan. The dish holder proper consists of a cylinder having a perforated bottom and internal inclined wings oppositely arranged, adapted to support the dishes and take up water when the holder is rotated. The dishes may thus be thoroughly cleansed, and when afterward rinsed with boiling water are dried by the heat in a few seconds, so that they present a bright polished appearance.

WEATHER STRIP.—Philip W. Cassil, Garner, Iowa. This is a weather strip which, when used under doors, is arranged to pass over the sill to the outside when the door is closed, and stand clear of the carpet or floor when the door is opened. It has in one edge openings for screws with pivoted heads to be passed into the door, while a shedding strip secured to the door has its lower inwardly curved edge extending over the hinged edge of the strip. A guide rail on the floor and a pin at one side of the door frame act to hold the strip over the carpet when the door is opened and press it down to form a tight joint when the door is closed.

SASH HOLDER.—William Linden, Helena, Montana. This is a holder in which the clamping member is made entirely of rubber or other yielding material, and as the clamping surfaces become worn they may be readily and conveniently adjusted to renew positive contact with the surfaces engaged, the whole device being very simple and inexpensive and capable of attachment on any description of sliding window to hold it in the position desired.

CAROUSEL AND PANORAMIC APPARATUS.—Joseph Darling, Baldwin, Pa. This is a merry-go-round which has a wave motion in addition to the usual rotary motion, and designed to give to the rider the sensation of sailing or flying. It also has an inclosing tent with an observation opening, in front of which movable scenery is held to pass, all co-operating to convey the feeling of moving as the scenery passes along, the sailing sensation being augmented, if desired, by "swashing" means automatically operated under the platform.

ROOFING COMPOSITION.—John A. Freeze, Mason, Texas. A new compound designed to be used with especial advantage as a roofing paint has been devised by this inventor. Among its ingredients are coal tar, pitch, alum, rock salt, oxide of iron, chloride of iron, etc., and applied hot with a brush on wood, paper or metal roofs, it forms an excellent protective cement, rendering the material to which it is applied waterproof and almost fireproof.

PUZZLE.—Helen E. L. Fisher, Germantown, N. Y. This device has central concentric inclosures having gates for the passage of balls, while extending from the outer wall of the inclosures are channels, each having a dividing longitudinal partition and a receiving chamber at the outer end. The receiving chamber contains a box in which is held a spring-pressed figure, confined in shielded position by a locking device, but released when the chamber is unlocked by a rolling ball, the player tilting the puzzle board to cause the balls to roll in the channels.

DESIGN FOR PENCIL TIP.—George A. Wieland, Duluth, Minn. This design consists of a hollow cylindrical body with radial imperforate points, as of a five pointed star, in the same plane.

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References to former articles or answers should give date of paper and page or number of question.

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(6490) W. J. R. asks: 1. I have your SUPPLEMENT, No. 600, with instructions for building an eight light dynamo, and wish to build one equal to four lights; if I reduce everything from full to half size, will that be all right? A. No. Reduce to nine-tenths the size by lineal measurements. 2. What numbers of wire would be best for armature and field magnets? A. It depends on the voltage desired. Use one or two numbers finer wire than those specified.

(6491) S. B. asks: What will be the pressure due to an explosion of gasoline gas mixed with 10 parts of air? How many times will it expand with nominal loss of heat due to working an engine piston? What will the pressure be after it has expanded to 3 volumes and to 6 volumes? What part of the loss of pressure is due to loss of heat? Will the increase in pressure be greater or less if the mixture is compressed? A. Allow for an expansion to about 10 volumes, giving an initial pressure of 150 pounds per square inch. At 3 volumes allow 105 pounds, and at 6 volumes 60 pounds. The loss of pressure is accompanied by loss of heat, and as necessarily accompanied by it, may be said to be due to it. Compression gives a higher initial pressure, and consequently a higher average pressure.

(6492) F. C. W. asks: What is the temperature of the flame of an arc electric light one thousand volts, two thousand candle power? Is there any known material that will not crumble or melt under such a heat, and where can such a material be procured? A. It is questionable if any reliable record of this can be obtained. In the ordinary arc the temperature of the negative carbon is put at 3,000°—3,500° C. and that of the positive carbon at 4,000° C. Carbon neither crumbles nor melts in it.

(6493) G. E. M. says: Please inform me through your columns how I can brighten copper coins, so they will stay bright for a coin collection. A. Coins can be quickly cleansed by immersion in strong nitric acid, and immediate washing in water. If very dirty, or corroded with verdigris, it is better to give them a rubbing with the following: ½ ounce pure bichromate of potash; 1 ounce sulphuric acid; 1 ounce nitric acid. Rub over, wash with water, wipe dry, and polish with rottenstone or chalk. To keep them bright permanently thay should be lacquered.

(6494) S. S. asks: 1. May an article upon which the patent has expired be made by any person, and by him sold under a name different from the one by which the invention is generally known? A. Yes. 2. May any one freely make and sell perforated maps, etc., which are made by the cheap electric pen, described in SCIENTIFIC AMERICAN of June 4, 1887? A. Yes. 3. What is the lowest temperature yet attained? A. See our SUPPLEMENT, Nos. 990, 896, 948, 973, 967.

(6495) W. M. asks: 1. Will a rifle shoot the same at an object on water as it shoots on land (without changing elevation)? A. It is probable that gravity may be slightly less on the sea than on the land and may cause a very small difference in the range. The amount is too small to appreciate in ordinary practice. 2. Will the accuracy of a rifle be changed by having a ring that is heavier on one side fitted tightly around the barrel near the muzzle. A. A gun barrel unbalanced as described will not recoil in the line of the bore, and will throw a bullet away from the center line of fire toward the light side.

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Tobacco pipe, A. Bortzluzzi 537,381
Toilet powder bag, M. Duncan 537,107
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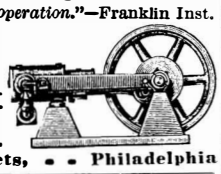

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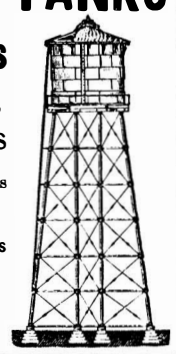

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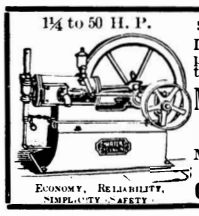

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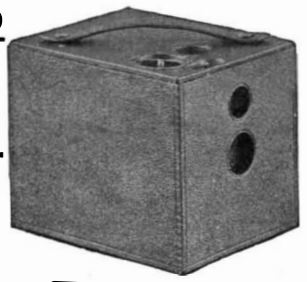

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