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(Illustrated articles are marked with an asterisk.)

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For the Week Ending March 3, 1894.

Price 10 cents. For sale by all newsdealers.

INFLUENCE OF SMALL PORTIONS OF ALLOY ON THE PROPERTIES OF METALS.

Exact alloys of metals are often difficult to make, and with many a very small quantity of alloy greatly affects their qualities and produces some peculiar and unaccountable phenomena in working the metal.

The presence of $\frac{1}{2000}$ of an ounce of antimony per pound of lead increases the rapidity with which it oxidizes and burns in the melted state. Lead containing more than $\frac{1}{1000}$ of an ounce of copper per pound is unfit for the manufacture of white lead, on account of its coloring properties. Gold, with an alloy of $\frac{1}{2000}$ of its weight of lead, is extremely brittle. Nickel was regarded as a metal which could be neither hammered, rolled nor welded, until it was discovered that the addition of $\frac{1}{1000}$ part of magnesium or of $\frac{3}{1000}$ of phosphorus makes it malleable and weldable to iron and steel. One-twentieth of an ounce of iron to one pound of copper renders the copper hard and brittle. Copper containing $\frac{1}{1000}$ of its weight of antimony or bismuth cannot be used for making rolled brass. Zinc mixed with copper to the amount of $\frac{1}{10}$ of an ounce per pound makes the copper red short. One-sixth of an ounce of arsenic makes copper hot short, while $\frac{1}{3}$ of an ounce makes it cold short. Some of the copper of commerce, made from ores containing other metals, sulphur, arsenic, and silicon, is sometimes the cause of serious trouble with manufacturers in the rolling and stamping of copper and brass goods.

The electric conductivity of copper is largely modified by small admixtures of other metals, as with one half of one per cent of iron its conductivity is reduced 60 per cent, as also with varying alloys of other metals of low conductivity.

The remarkable addition to the strength of metals by the fractional mixture or alloy of other metals or substances is a notable feature of modern metallurgy.

Copper having a tensile strength of 25,000 lb. by an addition of six per cent of tin may be equal to 28,000 lb., but with the addition of one to two per cent of phosphide of tin and copper its tensile strength is increased to 80,000 lb. or more per square inch.

The addition of aluminum to copper in the small proportion of one per cent largely increases its tenacity, and at 7½ per cent aluminum is equal to 60,000 lb., and a ten per cent alloy 90,000 lb. per square inch, the highest being a test at the Washington navy yard of 114,000 lb. tensile strength.

The minute fractional alloys of aluminum and nickel with steel, as well also its constituents, carbon, sulphur, phosphorus and silicon, are well known and need not be repeated.

Scientific Observers Needed.

The great advance made in recent years along every line of physical science has an important significance as suggesting the possibility of attaining still higher results in a near future.

Before these can be reached, however, an untold amount of work must be done in the fields of observation and investigation.

Wonderful as the increase in number of able and faithful workers has been, still, owing to the rapid extension of the lines of work and the increasing complexity of their inter-relations, it may be truly said, "The harvest is waiting, but the laborers are few."

The universe of space has been defined as having its "center everywhere, its circumference nowhere;" likewise the explorer of science may take his position at any point in any field and find the radiant lines of correlated action stretching out toward infinity.

By virtue of a subtle intellectual prescience accorded to only a few of our race, such master minds as Newton and Descartes saw clearly the possibility of the important revelations that would some day result from a proper conception of the laws of force, form and motion, as exhibited in the phenomena of nature.

Each of these individuals, working under such convictions, made marvelous progress in the conquests of science. The great primary ideas attained by such thinkers, and the results reached by the great experimenters, such as Faraday, are the priceless possessions of to-day. And through the extension of science and art in the accumulation of facts, and improved means for investigation, we of to-day may reap an abundant harvest, made possible by those immortal pioneers when they discovered the keys that can disclose a true interpretation of the phenomena of nature.

How strange that through all the past, and even now amid the splendid progress that has so far red emed and illumined the world, the word science has been and still is often flouted, while its pursuits, that can never be aught else but the pursuit of truth for its own sake, are still too often referred to in popular literature with contemptuous raillery. Better treatment and more enlightened teaching are still needed both from the school and the press. And this is written humbly to call attention to the latter point, and invoke consideration of its intrinsic importance. Can anything be more important to each one of our race than that he or she should as soon as possible learn as a habit to "think clearly and see straight"?

To this end the primary definitions of science should be rigidly taught, for simple as are the laws that should govern the study of facts and relations, how few, apparently, entirely master or strictly regard them.

In this way it seems to the writer, practical science ought to be more popularized.

Important results might follow, both theoretical and practical, if the great army of industrial classes were better educated to be reliable scientific observers. In agriculture and the related sciences of biology, climatology, etc., there is great need of an increase of reliable observers. And should not the re-enforcement be most available from among those whose vocations bring them constantly near to the practical study of nature?

LUM WOODRUFF.

Prize for an Essay on Wind Power.

The Netherland Society for the Promotion of Industry, the secretary of which is Mr. F. W. Van Eeden, of Haarlem, Holland, offers its prize for 1894 for papers indicating the method of obtaining energy by means of windmills, to accumulate this energy electrically, and to transmit it or make it portable. An answer to the following questions is more particularly desired: (1.) What is the average energy a common windmill is able to produce, per day of 24 hours, in combination with an electric accumulator; what would be the installation most suitable to this effect, and what would be the cost of one horse power hour? (2.) Is it possible, from an economical point of view, to apply the new aerial motors on an extensive scale for the accumulation and the utilization of this energy? If so, what mechanical appliances would be required for this purpose? The project of a supposed application of the system by which a factory is provided with light and power is wanted as an illustration. The drawings belonging to the answers must be made on white paper on a scale of ¼ in. to the foot. The prize comprises the gold medal of the society and the sum of £30. The papers are to be sent before July 1, with the author's name in a closed envelope, to Mr. F. W. Van Eeden, of above mentioned address.

A pretty small prize for a subject requiring so much study and calculation.

What is Electricity?

Probably no better answer can be given to the above query than the one that follows: It is stated that on one occasion when Professor Galileo Ferraris, the Italian scientist, whose name is known to all electricians, was asked by a young lady what electricity was, he ventured to answer it. Opening her autograph book he wrote: "Maxwell has demonstrated that luminous vibrations can be nothing else than periodic vibrations of electro-magnetic forces. Hertz, in proving by experiments that electro-magnetic oscillations are propagated like light, has given an experimental basis to the theory of Maxwell. This gave birth to the idea that the luminiferous ether and the seat of electric and magnetic forces are one and the same thing. This being established, I can now, my dear young lady, reply to the question that you put to me: What is electricity? It is not only the formidable agent which now and then shatters and tears the atmosphere, terrifying you with the crash of its thunder, but it is also the life-giving agent which sends from heaven to earth, with the light and the heat, the magic of colors and the breath of life. It is that which makes your heart beat to the palpitation of the outside world, it is that which has the power to transmit to your soul the enchantment of a look and the grace of a smile."

Flow of Metals Under Pressure.

The ability of metals to flow under pressure is frequently much affected by the presence in them of other substances. Thus common cast iron, when cold, is very slightly malleable. But if a portion of its carbon be extracted, as in the manufacture of malleable cast iron articles, it assumes a good degree of malleability, and its particles flow readily under the action of blows or under steady pressure. One of the most interesting applications of the flow of metals for constructive purposes is a machine invented, says the *Tradesman*, somewhere between 1830 and 1840, by an artist for the manufacture of the collapsible tubes now universally used for holding artists' colors. As every one knows, these tubes are exceedingly thin—in fact, no thicker than foil; yet they are made from a small cylindrical block of tin, which by a single blow of a punch is made to flow into a mould by which not only the holding part of the tube is made, but also the nipple at the top upon which the cap is screwed. The bottoms of the tubes are closed by folding them over upon themselves, and thus what would appear quite a difficult thing to make, to those unacquainted with mechanical processes, is manufactured at so cheap a rate as to add scarcely more to the cost of a tube of color than the tin foil wrapping does to the cost of a paper of tobacco.

IT has been estimated that 25,000 horses are employed in the London carrying trade, that their value is a million and a quarter, and that the cost is for food alone £800,000 a year. A rule prevails of foraging the horses on threepence an inch per week—that is, a horse costs as many shillings a week as it stands hands high.

Vegetable Silks.

Under the name of "silk grass," "silk cotton," "pillow cotton," "soie vegetale," "ouate de fromager," etc., there are grouped in commerce the silky hairs and down that cover the seeds of several plants of the orders Bombacineæ and Sterculiaceæ, such as *Bombax pentandrum*, or "kapok," of India; *B. Malabaricum*, or Malabar "silk cotton tree;" *B. munguba*, or "huimba," of Brazil; *B. heptaphyllum*, *B. Ceiba*, or "god tree," of India and Guiana; *B. Carolinum*, or "paina de imbirucu;" *B. phisianthus*, or "paina de cijio;" *Eriodendron anfractuosum*, or "kapok," of the Dutch Indies; *E. Caribæum*, or "beuten," of Senegal; *Chorisia speciosa*, or "paina de paneira femea," of Brazil; *C. Pecholtiana*, or "paina de paneira macho," of Brazil; *Stipecoma peltigera*, or "paina soeira," of Brazil; and *Ochroma lagopus*, or "hare's foot," of the Antilles and India.

In the order Asclepiadaceæ we have the *Asclepias volubilis*, of Guadaloupe; *A. gigantea*, or "madar," of Martinique; *A. curassarica*, of the Antilles and Senegal; *A. Cornuti*, of North America; *A. fructicosa*, of Southern Italy; and *Gomphocarpus fructicosa*, of Cape Tunis and Senegal.

The *Vincetoxicum officinale*, or "contrayerva," the *Cochlospermum gossypium*, of Senegal, and *C. tinctorium*, also furnish vegetable silk.

The allied order of Apocynaceæ furnishes a large number of vegetable silks, *e. g.*, the *Apocynum venetum*, found in the Crimea and Turkistan, and the *A. cannabinum*, or "Indian hemp," of North America.

The *Wrightia tinctoria*, of the Indies, also produces a silk cotton, as do also the *Echites grandiflora*, *E. conduta*, and *Beaumontia grandiflora*. From the seeds of a species of *Batatas* is obtained a textile material called "Natal cotton."

The beautiful silky fiber yielded by the above named plants, and very appropriately named silk cotton, is used wherever the plants grow, whether in India, Africa, or America, for precisely similar purposes, viz., for stuffing pillows and cushions, although it is hoped that some day a better use will be found for it. The Malabar silk cotton is used in Assam for the manufacture of a kind of quilt or thick cloth, probably by felting, as it is not adapted for spinning.

Finally, several common trees, such as the poplars and willows, yield a soft down, and some of the acacias, such as the *Acacia julibrissin*, bear flowers imitating silk, whence the name "silk tree" sometimes given it. The bark of a Chinese *Euonymus*, shown at the Exposition of 1889, contains a fibrous material that seems to be a vegetable silk, and from the stems of the *Ricinus* a sort of silk may be obtained.

At the Exposition of 1889 there was exhibited the vegetable silk called "kapok" sent by the French colonies of Indo-China, the Dutch colonies of Java and the English colonies of India and the Antilles. Kapok is the name given in Indo-China and the Indian Archipelago to the setaceous fiber surrounding the seeds of *Bombax pentandrum* and *B. Ceiba*. The trees begin to bear fruit and yield their textile material when three years of age. The countries that produce the best kapok are the islands of the Indian Archipelago, Java, Bombay, Sumatra, and the peninsula of Malacca. That of the English East Indies is less esteemed, since it is not so elastic. The fibers of the kapok are crisped and twisted like those of cotton. It has been supposed that the material was not known in Europe until 1851, at the epoch of the London Exhibition, but this is disproved by the fact that Magalotti, in 1600, in his scientific letters, describes it and says that it is called by the Dutch "sidervate," *i. e.*, silk cotton, and by the Arabs "beidelsaar," which means silk wool. He states that it is combed and spun like flax.

In 1851 it was newly presented in London by the Dutch, but little attention was paid to the product, and it was in Australia, only, that it began to find great favor. It is employed throughout this whole country in the decorative industries. In 1884, 1,000 bales were imported, and, in 1886, 8,600, 7,991 of which came from the island of Java, where is produced the most esteemed, cleanest, and the least compressed, and consequently the most elastic kapok.

The substance is used by preference to cotton for wadding for clothing, for stuffing cushions, for the manufacture of fabrics imitating beaver, and of ornaments that compete with silk. Hats are made from it in mixing it with the hair of the rabbit, and it is used for some high-priced fabrics, such as those employed for turbans, mantles, etc.

The fibers take certain dyes very well, and, with various silks differently colored, there may be obtained elegant fabrics, and velvets or imitations of feathers of a very handsome effect. Upon weaving with cotton, mixed tissues are produced that are capable of competing with genuine silk.

Kapok may be employed, too, in lieu of cotton for preparing a detonating powder by treating it with nitric acid. This nitrated kapok, mixed with pyroligneous ether, and with protochloride of iron having an organic base, yields a reduced fiber, which, differently colored, furnishes a solution of vegetable silk which solidifies in water and may be spun and afterward mixed with animal silk.—*Moniteur Scientifique.*

Influence of Decortication upon the Mechanical Properties of Wood.

Buffon and Duhamel du Monceau have taught that oaks decorticated while standing form wood that is denser and that offers greater resistance to breakage than those that are not so treated. This opinion, assailed in France by Varenne de Feuille at the end of the last century, was still more vigorously attacked in Germany at the beginning of the same century, without such attacks being based upon direct experiment. So the question has remained undecided. Mr. Mer, thinking it was of some interest to take it up, has, as a result of researches based upon a histological examination and upon the chemical composition and a determination of densities, found that, contrary to the opinion of Buffon, the sapwood of decorticated specimens preserves all the characters that distinguish it from the perfect wood, save one—the absence of starch. From this it became probable that its resistance to breakage was not increased. This, in fact, is what results from the experiments pursued by means of a special apparatus installed at the School of Forestry by Mr. Mer, and that permitted him to compare the tissues, on the one hand, of the specimens operated upon, and on the other, of those of a tree for comparison, after assuring himself that both were perfectly dry. The realization of this condition is essential, since the mechanical properties of a wood vary greatly according to its degree of humidity. It is probable that, for want of having taken such precaution, Buffon and Duhamel du Monceau obtained results that were always favorable to the trees operated upon. This is doubtless the case, because the sapwood of their subjects for comparison was slightly altered by fungi, as generally happens with trees abandoned for a certain time without bark, even in a protected place. At the epoch at which these investigators lived there were no means of recognizing such slight alterations. Decortication therefore does not present the advantages that were claimed for it, but, as an offset, it possesses others that were not suspected. It preserves wood from getting worm eaten and permits of drying it without much cracking or an incipient rotting resulting therefrom, an alternative which always besets the owner when he cannot cut up his trees almost immediately after they have been felled.—*La Nature.*

Xylolith, or Wood Stone.

Xylolith, or wood stone, is coming into extensive use in Germany. A recent number of the *Bautechniker* gives the following particulars. Xylolith, or steinholz, or wood stone, is made of magnesia cement, or calcined magnesite, mixed with sawdust, and saturated with a solution of chloride of calcium. The pasty mass, before the cement sets, is spread out into sheets of uniform thickness, and subjected to an enormous pressure, amounting to more than 1,000 lb. to the square inch. The compressed sheets are then simply dried in the air. The original invention of this material dates back to 1883, but it is only within the last five years that a single firm, that of Otto Sening & Co., at Pottschappel, near Dresden, has undertaken the manufacture of it on a large scale, and has met with such success that it is already engaged in the erection of extensive additional works in the Austrian territory, to supply the South German market. In 1888 a series of tests of xylolith was made at the royal testing station for building materials in Berlin, covering its chemical as well as mechanical qualities. In resistance to tension it was found, naturally, that dry material was much superior to the same soaked with water, dry specimens resisting a tension of about 100 lb. per square inch, while pieces saturated with water resisted only two thirds as much. Soaking the dry material in linseed oil increased the tensile strength about 16 per cent, and freezing diminished it slightly. The resistance to compression proved to be about 300 lb. to the square inch. This was diminished about 10 per cent by freezing and increased to about the same extent by careful drying and saturation with linseed oil.

The special gravity of the new substance was found to be 1·553. The fractured surfaces showed a yellow color, with a perfectly uniform, close grain. When immersed in water, unbroken sheets of perfectly dry material took up 2·1 per cent of their weight of water in 12 hours, and 3·8 per cent in 216 hours. Broken pieces absorbed in the same time about 20 per cent more water than the unbroken sheets. To try the resistance to the influences of the weather, a large number of samples were taken, and subjected to boiling in water, brine, soda lye, hydrochloric acid, and solutions of sulphate of iron, sulphate of copper, and sulphate of ammonium, alternating the boiling with sudden cooling. After several days' treatment with hydrochloric acid a loss of 2·3 per cent in weight was observed, but the properties of the pieces under test were not perceptibly affected. In the other cases no loss of weight could be detected, nor was there any other apparent alteration, and the liquids used for treating the samples remained perfectly clear. Exposure to superheated steam, in a Papin's digester, also produced no visible effect. In hardness, the material was found to occupy a position between feldspar and quartz, being scratched by the latter, but not distinctly so by the former. As a conductor of heat, the xylolith was found to rank between asbestos and cork, being, therefore, one of the best non-conductors known. To test its fire-resisting qualities, sheets were exposed for three hours to the flame of a Bunsen gas burner, by which the actual surface touched by the flame was charred, although there was no crumbling, or extension of the charring beyond the marks of the flame. Similar pieces laid on the burning coal in the fire-box of a drying oven, and kept for some time at a red heat, were rendered brittle, and crumbled at the edges, but kept their shape and cohesion, and showed no sign of breaking into a flame.

For use, xylolith is delivered in sheets, from a quarter of an inch to an inch and a half thick, and of all sizes up to a meter square. The dimensions are almost unchangeable by dryness or moisture. A sheet measuring one meter square when perfectly dry will expand from one to two-tenths of one per cent when soaked in water, and a moist sheet will contract in drying to about the same extent. Being so little subject to contraction and expansion, it is extensively used for floors in railroad stations, hospitals, and similar buildings. It is readily planed, sawed, bored, and fashioned with ordinary wood-working tools, and may be painted or decorated in the same manner as wood. It is itself nearly waterproof, and with suitable putty in the joints and a good coat of paint, it may be made entirely so. It is not surprising that a material possessing so many advantages should have come into extensive use, and we trust that its use will extend.

Test for Wintergreen Oil.

The following is an excellent test for oil of wintergreen, or birch, that is suspected of being mixed with the synthetic oil.

The theory is that while synthetic oil wintergreen is almost the same chemically as true oil, yet it being an alcoholic product it is impossible to entirely remove traces of alcohol; hence, if a small particle of red aniline soluble in alcohol be dropped into a vial of the synthetic oil it will immediately show a disposition to dissolve, which is not the case with true wintergreen. Practically this is found to be the case. In three to five minutes time, by agitating vials of both oils with aniline in them, it will be noticed that the artificial product readily dissolves the aniline, whereas the other will hardly have any perceptible effect on it. After the lapse of fifteen minutes to half an hour both will be discolored, but the artificial will have a purplish tint, while the natural oil will be more of a cherry color; and in proportion as the two are mixed, so will be the time and extent of coloration.

This is a delicate test, fit only for use by experts, for which reason we have not hithertofore published it, as by it a careless user would probably reject all the oil he purchased, whether pure or otherwise. Before adopting it for use it will be well to make several experiments in order to get a correct idea of the length of time required for the action of pure oil wintergreen on the aniline, in comparison with the artificial or known mixtures of the two.

Soap Suds for Calming Waves.

The remarkable action of oil upon waves is well known. This phenomena led the officers of the steamship Scandia, of Hamburg, to make an experiment upon the same principle that was very successful and that appears to us worthy of mention. During its last trip to the United States, the vessel, while in midocean, was attacked by a very heavy storm. It then occurred to the officers to dissolve a large quantity of soap in tubs of water. Having thus obtained several hundred gallons of soap suds in a very short time, they threw it overboard in front of the ship. The effect was almost instantaneous, and the vessel soon began to navigate without difficulty. Her officers at once addressed a long report to the Hydrographic Bureau of the United States, giving an account of their voyage, the storm, and the means that they employed to still the waves. They conclude by saying that although soap suds does not produce absolutely all the effects upon water that oil does, it at least suffices to break the force of waves in most cases. Besides, this method recommends itself to transportation companies careful of their interests. Soap suds is much cheaper than oil, and a relatively large quantity of soap can be carried without encroaching too much upon the space set apart for passengers and merchandise.—*La Nature.*

ALUMINUM WITH TEXTILE FABRICS, CORD, ROPE.—The invention consists in weaving or intertwining threads of aluminum, either by itself or along with the material usually employed in the manufacture of cloth of various descriptions, lace, rope, cord, and the like.—*W. Darlow, Plaistow, London.*

Electrical Notes.

Referring to the low-frequency alternate current—25 per second—adopted at Niagara Falls, Mr. William Stanly, Jr., in a recent article in the *Electrical World*, shows that for the transmission of power the use of very low frequencies is not justified, and he intends to show why such a procedure is bad engineering from the transformer standpoint.

To sum up the virtues of high-frequency motors, we have, according to the author's calculations:

First.—A greater torque at all times for the material employed, and, consequently, a greater output.

Second.—A lower impedance armature and a lower inductance in the armature circuit, consequently for a given load a smaller armature current.

Third.—A smaller armature reaction and "blowing out" effect produced by armature reaction.

The experience at Pittsfield, where for fifteen months two-phased motors whose magnetizing currents are supplied from condensers have been in operation, is a sufficient proof of the practical operation of condensers. These motors are operating at 130 periods per second. They are connected to all classes of work, operating, as they do, a sawmill, a woolen factory, machine shops, a printing office, etc., and it has been found by actual observations of the voltmeter, in circuit on the consumers' premises, that the variation of potential due to changes of load and lag on the motors does not average 2 per cent of the voltage applied. The regulation of these circuits is as perfect as if they were simply operating lamps alone.

In order to carry off the heat generated in transformers working under a heavy load, Prof. Henry A. Rowland, of Johns Hopkins University, has invented a method employing a current of liquid led through the iron in tubes so placed as not to be cut by the lines of magnetic induction, the tubes and iron laminæ alternating with one another. Water or any other conducting liquid may thus be employed without interfering with the proper working of the transformer.

Another method employed by Prof. Rowland is to surround the transformer with a vessel containing a volatile liquid which, by boiling, carries away the heat. The vapor may be recondensed in the upper part of the vessel or carried off through a condensing coil and returned to the vessel in a liquid state. He also provides means for reducing the pressure in the vessel, in order that the liquid may boil at a low temperature.

To cool conductors carrying heavy currents, Prof. Rowland suggests making them hollow and passing a current of cooling liquid, such as water, through them from end to end, the liquid issuing in the form of spray to break the continuity of the stream, and thus insulate it from the vessel into which it flows.

Work has been begun on the Baltimore and Washington Electric Railway. The electric line will be only 32 miles long, while the Baltimore and Ohio's steam road is 40 and that of the Pennsylvania 42 miles in length between the two cites. Entrance has been secured both in Baltimore and Washington, and connection will probably be had in the former city with the Edmondson Avenue line of the Traction Company, which is to be converted into an electric railroad.

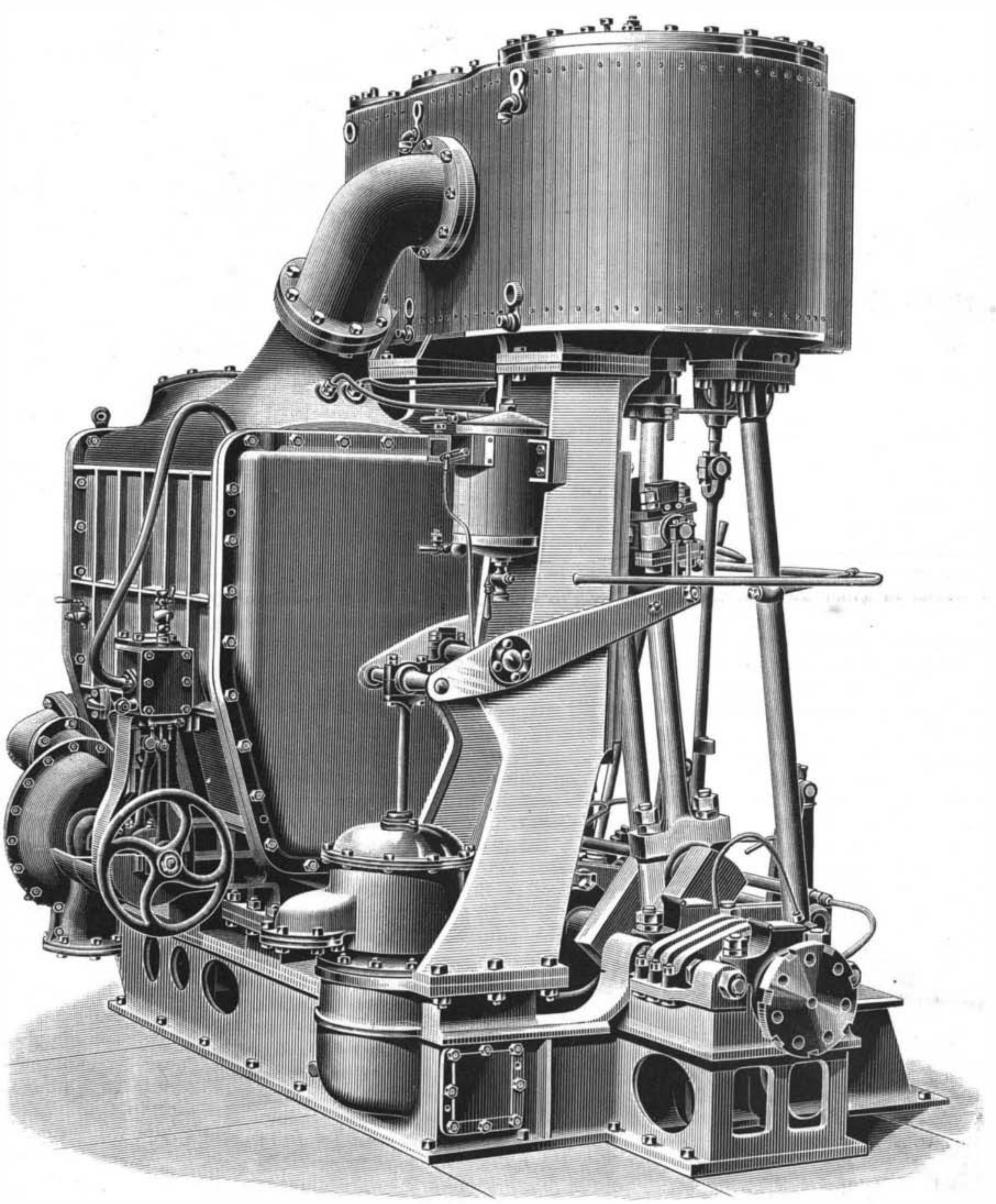
A trolley line connecting New York and Philadelphia will be built in the near future. Within the last few weeks arrangements have been made to extend the New Jersey Traction Company's lines from Newark to Elizabeth and thence to Plainfield by way of Westfield Avenue, the "county road," running parallel with and but a stone's throw from the New Jersey Central Railroad, and hence passing through all the smaller towns whose travel has been exclusively controlled by the latter road. From Plainfield the road will probably be extended through Bound Brook and from there to New Brunswick, and thence through Princeton and Lawrenceville to Trenton.

IMPROVED TRIPLE EXPANSION ENGINES.

The Condor, the engines of which we illustrate from *Engineering*, is a small composite schooner, built some time since at Havre, by the Forges et Chantiers de la Mediterranee, for the Chilean government. The following are her principal dimensions:

Length between perpendiculars	88 ft. 7 in.
Breadth	18 " 8 "
Depth	9 " 10 "
Mean draught of water	8 " 1 "
Displacement	145 tons.
Engines	250 horse power.
Speed on trials	10½ knots.
Approximate tonnage	115 tons.

This little vessel presents no special features of construction; the hull is composite, with copper sheathing over the wood and steel frames, it is divided into watertight compartments by four transverse bulkheads. The forward compartment contains the sail and cordage stores, in the next are the sleeping quarters of the men; the center compartment contains the engines, boilers, and coal bunkers; the fourth and fifth are devoted to the ammunition and general stores and officers' quarters.



IMPROVED TRIPLE EXPANSION ENGINES.

The engine, of which we publish an illustration above, is triple expansion, with the three jacketed cylinders placed side by side, and an independent condenser with brass tubes, tinned inside and out; the circulating pump is driven by a separate motor. The boiler is cylindrical, with two corrugated furnaces and return flues; the shell is of Siemens-Martin steel, and the furnace plates are of iron. The following figures give some particulars of the engines and boiler:

Diameter of high pressure cylinder	12·20 in.
" intermediate "	17·72 "
" low pressure "	26·77 "
Length of stroke	17·72 "
Number of revolutions	130
Diameter of boiler	9 ft. 6 in.
Length	8 " 7 "
Internal diameter of furnace	2 " 7½ "
Area of grate	30·14 sq. ft.
Total heating surface	807 sq. ft.
Authorized working pressure	142 lb. per sq. in.

CORNELIUS VERMUYDEN, the Dutch engineer, was invited to England in 1621 to embank the Fens district.

The Cause of Trees being Struck by Lightning.

The frequent striking of trees by lightning is a traditional phenomenon that is well known, but the causes of it are not so precisely known, although it is, in a manner, a primordial electric manifestation. Mr. D. Jonesco has recently made a series of interesting experiments on this subject, the results of which have been communicated by him to the Agricultural Society of Brabant.

Mr. Jonesco has ascertained that certain trees attract lightning better than others. Starting from this, he has endeavored to find out how the various forest trees behave with respect to electric discharges, and has ascertained that the greater or less conductivity of trees should be taken so much the less into consideration in proportion as the electric tension is stronger. When the latter is sufficiently elevated, any tree may be struck by lightning; but differences exist from the moment that the tension is feeble. The richness of the wood in water, contrary to what is generally believed, has no influence upon the conductivity of the living wood for the electric spark. On the contrary, such conductivity depends much upon the richness of the wood in starch and oil. Mr. Jonesco, in accordance with Mr. A. Fischer on this subject, consequently distinguishes trees as oil trees and starch trees, and reaches the following conclusions:

The green wood of trees is in all cases a bad conductor of electricity, and so much the worse in proportion as the tree is richer in oil. On the contrary, the green wood of amylaceous trees, poor in oil, conducts electricity relatively well. Living wood is a much better conductor than dead. This existence of dead branches in trees of both categories, therefore, increases the danger of lightning. This is an observation of no small importance from the standpoint of the safety of houses situated in the vicinity of large trees. The cambium and bark are better conductors than the wood, but these parts are relatively to the bulk of the tree, too slightly developed to modify its electric conductivity. The latter, therefore, depends upon the wood only, since, according to Mr. Jonesco, the foliage is equally without influence upon the relative conductive power of trees for the electric spark.

The results of these researches are confirmed in the statistics given by Mr. Jonesco, and which consist in the observations made upon lightning strokes and trees since 1847 by the superintendency of forests of the principality of Lippe. It has been found, for example, that the oak is much oftener struck than the beech. Now, the first is a type of starch tree and the second a type of oil tree. On another hand, the observations made establish the fact that the frequency of lightning strokes is greater in the dry than in the other branches. Besides, the same statistics go to prove that the danger of lightning has no relation with the character of the soil. Although the highest figures are shown in hard and sandy ground, this is due to the fact that starch trees grow in such soil, but the nature of the latter is without influence.—*Le Genie Civil.*

Explosion of a War Ship's Boiler.

On the 16th of February an explosion of one of the new boilers of the German war ship Brandenburg took place in the harbor of Kiel. Forty men were killed and many wounded. The disaster took place during a test of the boiler. The Brandenburg is a steel belted cruiser, of 9,840 tons. Her dimensions are: Length, 354 feet 3 inches; beam, 64 feet. She draws 24 feet 7 inches of water. Her engines are of 9,500 indicated horse power, and she has a speed of 16 knots per hour. She was built at Wilhelmshaven in 1891.