

## PLANT AND PROCESS FOR FIREPROOFING WOOD.

(Continued from first page.)

work as possible, and what it carries will be rendered non-flammable by some system of fireproofing.

Of the many terrible conflagrations on land, we have quoted that which occurred last spring at the Windsor Hotel, because there is no question that the fearful rapidity with which the building was burned down was due to the large amount of wood which entered into its construction. It might also be mentioned that the destruction of the upper stories of the Home Life building, last winter, would scarcely have occurred, or at least would not have been nearly so complete, if the floors and general trimmings had consisted of non-flammable instead of untreated wood. It seems almost superfluous to emphasize the value of using for constructive purposes in any structure that is at all exposed to fire risk materials that are non-flammable and which in the presence of conflagration will add nothing to the fierceness of the heat.

The accompanying illustrations serve to give a clear conception of the methods adopted by a first-class fireproofing plant in the treating of wood. They represent the plant of the American Wood Fireproofing Company, of Newark, N. J.

As this is one of the latest to be put up, it may be taken as thoroughly representative of the present state of the art.

The plant consists essentially of three large digesters, which are built up of three-quarter inch flanged steel, and guaranteed to a pressure of 400 pounds to the square inch. Two of these are 6 feet 8 inches in internal diameter and 106 feet in length, and the third is of the same diameter and 32 feet in length. One end is permanently closed by a hemispherical head; the other end is provided with a massive cast steel hinged cover, 6 tons in weight, which is hung on a vertical hinge and may be swung to one side, as shown in our engravings, during the charging and emptying of the digester. It is provided with 36 heavy radial bolts, which engage the same number of sockets formed on the face of a cast steel flange on the digester. The locking bolts are of a rectangular cross-section and are cam-shaped at their outer ends, while at the center they abut against the inner side of a large plate washer. This washer is carried upon a massive screwbolt, which projects from the center of the cover, and is driven home against the cover by means of a massive threaded nut and hand-wheel, as shown in the general illustration of the plant. As the nut is screwed home, it presses the plate washer down upon the inner ends of the radial bolts, driving them into their several sockets and causing them to act with a cam-like effect to press the hinged cover to a snug bearing upon the face of the digester. A track formed of lengths of Z-iron runs the full length of the digester. A short piece of movable track is provided, by means of which these rails may be connected with the system of tracks which extends throughout the yard.

The wood which is to be treated is loaded upon small trucks until it conforms approximately to the curve and diameter of the cylinders, care being taken to observe a somewhat uniform spacing in order to allow a free circulation for the chemical solution with which the wood is to be treated. The timber is then secured to the tracks by iron bands and the trucks are wheeled into the cylinders and clamped down securely to the track. The end doors are then packed with a rubber gasket, swung to, and securely clamped. Steam is now admitted at a low pressure of about 10 pounds to the square inch, and the whole charge is submitted to a steam bath, which penetrates the wood, softening and loosening the dried juices which have remained in its fiber. The length of time during which the charge is subjected to the steam bath depends both upon the variety of the wood and its thickness, and it may be anywhere from one to fifty hours. After the steaming process is complete, a powerful vacuum pump is applied for a period of from three to fifteen hours, the vacuum as recorded by the gage being from 27½ to 28 inches. The immediate effect of the vacuum is to draw out of the cellular structure of the wood all of the saps, juices, etc., and leave it in a condition which might be described as that of an extremely finely divided honeycomb. When the vacuum treatment is complete, an alkaline solution is allowed to flow into the cylinders, great care being taken to prevent the entrance of any air. As the solution rises in the cylinders it is absorbed by the cavities of the wood until the latter is nearly saturated. To assist the absorption, the pressure pump is started and the pressure is raised to 200 pounds to the square inch, the pumping being maintained as long as there are any indications that the wood is absorbing the solution. The surplus is then pumped back from the cylinders to the storage tank, the doors are opened, and the wood is run out again to be stacked in the air for drying, or if so desired it is run directly into a drying kiln. In drying, the water evaporates and leaves all the inner walls of the cells covered with minute crystals of fireproofing salts.

This completes the process, and the treated wood is to all appearances the same as before it went through

the operation. It contains all of its original properties except that by withdrawing all that remained of the juices the wood has been relieved of that portion of it that would tend to set up fermentation. Hence, incidentally, the treatment is a preservative one, for it substitutes an antiseptic in place of material which is the direct cause of dry rot. The treatment also has the advantage that the wood is so thoroughly filled that when it comes to be painted very much less oil is required than would be necessary in the case of untreated wood. Moreover, the fireproofed material is susceptible of a much higher polish even in the case of such soft woods as white pine and poplar.

Extensive tests of the treated timber have shown that the strength of the wood is slightly increased in some varieties, and slightly decreased in others, the average decrease of strength in all the varieties of timber that have been treated and tested being not over 5 per cent. Such a heavy impregnation with salts necessarily adds to the weight of timber, the increase being from 5 to 15 per cent, according to the variety that is under treatment.

One of our illustrations shows a little experiment which strongly illustrates the non-flammable quality of the wood. Not only is it impossible to ignite a shaving, but a strip of wood may be subjected to the heat of a blowpipe without any appearance of a flame, and nothing more than a temporary glow, which passes off immediately upon the removal of the blowpipe. This experiment proves that although the treated wood may be charred to a certain depth, beyond which the heat fails to penetrate, it is impossible for it to burst into flame and add to the heat of a conflagration.

The process as carried out at these works and above described has been approved by the recent United States Naval Board as being equal to any submitted to that board for test. The company has recently received a contract from the government to supply the interior wood construction for a building which is now being erected at the Brooklyn navy yard for use by the Ordnance Department of the United States navy for the storage of high explosives. The process has also been accepted by the Civil Engineering Bureau for use in the new executive building at the same navy yard, and the General Electric Company have now under treatment lumber to rebuild where fire recently damaged one of their buildings.

## Notes on the Columbus Meeting of the American Association for the Advancement of Science.

An interesting paper was read in the chemical section by Wilder D. Bancroft, of Cornell, on the Relation of Physical Chemistry to Technical Chemistry. It was held that practically every process now used in technical chemistry can be improved in output or in economy. This improvement must come by a study of the reactions, and hence physical chemistry, which is a study of chemical reactions, is of paramount importance to the student who intends to take up chemical work.

Dr. H. W. Wiley and W. H. Krug, of the Agricultural Department, presented a paper on some new products of corn stalks, which was illustrated by a large number of samples. Among the products of greater or less commercial value are cellulose pith and compressed pith, for coffer dams and for lining the armor plate of war vessels, nitrocellulose for explosives, smokeless powder, and collodion—these from the pith—and from the outer part of the stalk, cattle and chicken feed, either alone or saturated with molasses and mixed with other substances, paper pulp, and nitroglycerin absorbers for dynamite.

Dr. Charles Baskerville, of the University of North Carolina, read a paper on the wide distribution of titanium. The experiments of Dunnington have shown it to occur in practically all soils; of Wait, that it occurs in the ashes of most, if not all, plants; of Wait and of Howe, that it is a constant constituent of bones and is probably present in most flesh, and now Dr. Baskerville shows that it must be considered as one of the constant constituents of the human organism.

Prof. H. A. Weber, of the Ohio State University, gave an account of the practical methods of testing soils for the application of fertilizers in use at Columbus.

Five drain tiles are partly filled with sand and placed erect in a box of sand. The upper part of the tile is filled with the soil to be tested. No. 1 is mixed with superphosphate, potassium sulphate, and sodium nitrate, Nos. 2, 3 and 4 with two fertilizers only, while No. 5 contains the soil alone. Fifteen wheat or oat or barley grains are sowed in each plot, and by their relative growth can be told the fertilizers needed by the soil.

Fifty-five papers were presented in Section C, but quite a number of them were read by title. The attendance in the section was very large.

OUT of 2,489 miles of railways in Switzerland, only 56½ miles are rack railways. There are nearly 12 miles of cable lines and 89 miles of street tramways.

## Correspondence.

## Class Experiment Showing How the Resistance of Carbon Falls with Rise of Temperature.

To the Editor of the SCIENTIFIC AMERICAN:

I am in the habit of giving an illustration of the decrease of resistance in carbon with increase of temperature, which commends itself by reason of its effectiveness and simplicity.

In a 110-volt circuit, I introduce a piece of charcoal some four or five inches long. The spark produced upon short-circuiting this stick at one of the contacts ignites the charcoal there. Then I slowly draw the short-circuiting wire from the ignited point zigzag along the surface to the end. The glow follows the wire and is maintained. Thus the current keeps to the path it has "blazed" for itself throughout all the fifteen or sixteen inches of meandering, preferring the road that is hot, though long, to the short but uninviting chilliness of the straight line.

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## Automobile News.

A new automobile journal entitled *Die Automobile* is to be issued fortnightly in Berlin.

The Automobile Association in Germany, according to *The Cycle Age*, are continually arranging tests to help to popularize the motor vehicle.

It is said that a test of a gas engine automobile will be made by carrying a message from Brig.-Gen. Anderson, at Chicago, to Maj.-Gen. Merritt, at New York.

The police department of Hartford, Conn., will soon be equipped with automobile patrol wagons, ambulance, and prisoners' van. There are great possibilities in the way of the use of automobiles for municipal work.

An electric brougham in Boston was recently upset through the collapse of the front wheel tire, and its two occupants were badly scared, although they were not injured. The front tires of broughams and the rear tires of electric hansoms are those most liable to punctures and other injuries.

It is reported that the New York Central Railway intends to establish an electric cab service in New York and other large cities along the line, and the Pennsylvania Railroad has been experimenting with a sample vehicle, and it is possible that these carriages may be substituted for the horse-driven cabs at the stations of the company's system.

An automobile ambulance is being made for St. Vincent's Hospital, New York city. It will be propelled by electricity, and will be a model of its kind. Electric power is more advantageous for propelling a vehicle where it is essential to have a very steady motion. The large pneumatic tires, it is expected, will also contribute in no small degree to the comfort of the patient.

It is probable that the maximum speed allowed to automobiles in Paris will be greatly decreased, and also that persons must possess certificates as to their knowledge of and ability to run automobiles. In a single week *The Electrical World* says that eight persons were killed and as many as fifty injured through automobile accidents in and near Paris. In nearly every case these accidents were owing to rapid traveling or to the ignorance of the drivers.

## A Bridge Destroyed by Electricity.

The bridge over the Wabash River at Clinton, Indiana, was recently destroyed with the aid of electricity. It was a wooden bridge resting on stone piers and it was very essential to have the bridge removed by a certain time. Of course, dynamite could have been used, but the explosion would have injured or destroyed the piers, and if the bridge was set on fire it would have cracked or injured the masonry. An electrician agreed to wreck the wooden structure without injuring the piers. Each span of the bridge was composed of nine chords, each consisting of three timbers. If the twenty-seven sills were cut simultaneously, the spans would drop into the river at the same instant. This was actually done, the cutting being accomplished by burning through the wood by loops of iron wire made hot by the passage of the electric current. No. 12 wire was used for the loops, and at the bottom of each loop a five-pound sash weight was fastened to an insulator. This weight pulled the loop down as it burnt its way through the timber. According to *The Western Electrician*, an alternating current of fifty volts pressure was employed. One span was wrecked at a time, and the total time which elapsed from the turning of the current until the fall of the span was one hour and forty minutes in each case. After the fall of the bridge an examination showed that all of the sills were burned by the wire loop in exactly the same manner, five inches deep on the top and three inches deep on the sides. When this depth was reached the weight of the span fractured the remaining wood. The cut was sharp and clean and the wood was not charred more than an inch from the place of the fracture. Two thousand spectators witnessed the feat.

Science Notes.

A novelty is the cold storage of hops. This is done in several places in England. Several systems are employed, notably the Linde, Pontifex and De la Vergne.

The second annual report of the Council of the Roentgen Society shows that steady progress is being made, and the Society now numbers, according to Nature, 148 ordinary members and five honorary members.

The Japanese government has decided to make vaccination compulsory in Japan, and that all children are to be vaccinated before they reach the age of ten months. They must be revaccinated when they are six and again when they are twelve years of age.

It is said that Dr. Nansen will not undertake another northern polar expedition, but that he is much interested in Antarctic explorations, and it is possible that his next trip will be toward the south. He is now engaged on his large scientific work on polar explorations.

The German toy trade has fallen off greatly, and the government has established a professional school of toy making at Grünhainiden. This is an excellent example of the careful attention which Germany is giving to other phases of the manufacturing industry and export trade.

In the working of fluorine the great objection has been that the apparatus that comes in contact with the fluorine must be either of platinum or fluorspar. M. Moissan is now, however, using vessels of copper, which is less attacked than other metals. This is probably caused by the thin layer of copper fluoride which forms on the copper and which is insoluble in hydrofluoric acid.

Germany has prohibited the use of saccharine for the production of beer, wine, etc. Other artificial sweetening substances are also interdicted. Belgium has prohibited the importation, manufacture or sale of saccharine except for medical purposes, and France also prohibits the use of these substances in food. In Great Britain saccharine must not be used in beer manufacture. In Spain, Portugal and Austro-Hungary similar laws are in force.

According to The Nation, a Danish northern light expedition has just left Copenhagen for Iceland. The expedition has been several months under preparation, and its members have been carefully practiced in the use of the instruments. Two stations will be built, and will be connected by telephone and by an optical telegraph. The Director of the Danish Meteorological Office, Dr. Adam Paulsen, is at the head of the expedition, and he will test his own published theories on the aurora, as well as all of the other late ones of the various scientists. The expedition will return in May, 1900.

A year ago Cornell University secured 30,000 acres of woodland in the Adirondack Mountains for the exclusive use of her forestry department. The land has been divided into a number of sections and several seed beds have been laid out in which there has been planted over a million small trees of different varieties. The students of forestry will study the theory of the subject from October to April, and from then until commencement they will study the practical side of forestry. Cornell University is the only college in the United States which has a forestry department. Prof. John Gifford was recently elected to the Chair of Forestry in the University.

Dr. E. W. Allen, Assistant Director of Experimental Stations in the Agricultural Department, has just returned from the West, after inspecting various stations. One of the most interesting matters to which he devoted his attention was the collection of facts relating to cheese making. The station at Wisconsin is taking the lead in this matter, and the discoveries which have been made there are at variance with those made in Europe—that the ripening of cheese is due to bacteria. American experiments demonstrate beyond doubt that the principal change in the albuminoids which takes place in the ripening process is dependent upon the fermentation in the milk itself and not upon the bacteria.

Siberia is no longer a penal colony. The present Emperor, Nicholas II., has issued an order for a commission to work out schemes to replace the transportation of criminals by punishments by the courts; to reorganize penal servitude and the deportation which follows, and to better the condition of convicts now in Siberia. It will also devise means for establishing compulsory public labor and workhouses as penal measures. The transportation of criminals to Siberia was established in the seventeenth century, and it assisted in populating this vast and wealthy region, which was in need of workmen for constructing roads, fortresses, and in cultivating government lands; but in the development of easy means of communication and the beginning of the industries, Siberia has lost something of its penal character, and now, under the new edicts of the Emperor, almost as satisfactory results may be looked for as in the case of Australia, which was once practically nothing but a dumping ground for criminals.

Engineering Notes.

The Russian ice-breaking steamer "Ermak" has just finished a two weeks' trip to the northwest of Spitzbergen. She passed through about 200 miles of ice, and its thickness is estimated at about 14 feet. The ship performed the task without injury.

The Baltimore and Ohio has changed the names of its dining cars from those of Roman generals to the names of the popular hotels in the great cities touched by their line. Thus, we have the "Waldorf," "Savoy," etc., for New York, "Carrollton" for Baltimore, the "Raleigh" for Washington, etc.

A cyanide leaching vat made of wood which had been in use for four years was recently tested as to the percentage of values absorbed. A hole was bored one half inch deep in the bottom, and the shavings therefrom assayed \$13 per ton. Thus, says The Mining and Scientific Press, the absorption by wooden tanks is shown not to be as great as has been claimed.

The Central Railroad of New Jersey has instituted examinations for its baggagemen. All of the men employed in the baggage department will be compelled to undergo an examination, in order to retain their positions. The examination will be in the nature of questions concerning the route of a piece of baggage from one station to another and methods of tracing lost pieces of baggage, etc.

There is now under construction at a Baltimore shipyard a large floating dry dock for the United States navy, which is to be stationed at Algiers, La., the plans for which were prepared by Messrs. Clark & Standfield, London. This dock will not be launched in the regular manner, but is being constructed in a basin dredged for the purpose, into which the water will be admitted when she is ready to be floated.

The American coal exhibit at the Paris Exposition will be very complete. It will consist largely of small cubes of about four pounds weight. Views of various collieries, shipping arrangements, etc., will also be shown. A model of the New York State prison at Sing Sing will be one of the exhibits of the State of New York. The model itself will be made of alabaster and is the work of the inmates.

Mr. Henry Hess, in a recent issue of The American Machinist, gives some information regarding force fits which he obtained from a prominent engine-building concern in Ohio, and from which he has deduced the following approximate formulæ: For crank fits  $P = 9.9D - 14$  up to  $D = 10$  in. For crank fits  $P = 5D + 40$  from  $D = 12$  in. to 24 in. Straight crank pins  $P = 13D$ . Taper crank pins  $P = 14D - 7$ . Where  $P =$  total pressure on ram in tons to force on and  $D =$  diameter in inches. For cranks and straight pins allow 0.0025 in. per inch of diameter. Taper crank pins are fitted on the lathe to within  $\frac{1}{8}$  inch of shoulder and then forced home. Taper  $\frac{1}{8}$  per inch.

The last train to leave the old Park Square station, Boston, was the New York express, which left at 12:03 A. M. on September 10. It went out of the station with the burning of red fire and the cracking of railroad torpedoes. Then the work of demolishing began, some of the interior fittings being taken out for use at the new Back Bay station, which is not entirely completed. This removal completes the scheme of passenger train consolidation of all the roads entering the city from the south. The Park Square station was finished in 1875 and cost about \$800,000. It is not known as yet what will be done with the property, but it is possible that it will be turned into a market.

The embargo on Lake Superior navigation caused by the sinking of a steamer in the Soo Passage was raised on September 10, and more than 200 large craft began to move. One vast procession headed down the lakes, while another started on its way to Lake Superior. The vessel was sunk by collision with a schooner. Divers succeeded in putting a patch of wood over the break in the "Houghton," and the ore with which the boat was loaded was shoveled into lighters. The rocks which held the vessel were blasted, and the vessel was pulled out into the channel. The down-bound fleet was carrying 300,000 tons of iron ore, 11,900,000 feet of lumber and 900,000 bushels of wheat.

The committee appointed by the American Society of Mechanical Engineers to revise its code for conducting boiler tests has decided that heating surfaces must be measured on the fire side. This means that the inside surface of the tube must be taken when used in a horizontal tubular boiler and the outside when used in a water-tube boiler. This, says Power, gives the water-tube boiler about  $7\frac{1}{2}$  or 8 per cent more heating surface per foot of tube with 4 inch and 3 inch tubes respectively, and necessitates the use of tables or a knowledge of the thickness of tubes when computing the surface of fire-tube boilers. The boiler horse power is made  $34\frac{1}{2}$  units of evaporation per hour, i. e.,  $34\frac{1}{2}$  pounds of water evaporated from and at  $212^\circ$ ; this is equivalent to the transfer of 33,317 British thermal units per hour. The old unit, the evaporation of 30 pounds per hour from  $100^\circ$  Fah. into steam of 70 pounds, was equivalent to the transfer of 33,305.

Electrical Notes.

Pekin is now to have an electric railroad running from the south gate of the city to the steam railroad station, and it is even hoped that permission to enter the city may soon be obtained. The road is built by a German firm.

An electric road for the Catskill Mountains is now being surveyed. It will connect with the Otis Elevating Railway, and from there will run from Saugerties to Catskill, connecting there with the railway. The right of way has been secured, and construction will soon be begun.

Street sweeping by electricity has been introduced in St. Louis. The appliance is said to be of ordinary construction, save that the broom wheel in the rear is operated by electricity, which is found to be more effective than if the brushes derived their rotation from the road wheels.

It is reported that the wireless telegraph apparatus of a young Swedish engineer named Orling will be tested by Lord Armstrong. He will get some of the Atlantic liners to use the transmitters and receivers while crossing the ocean, and thus try to communicate with them at a land station.

A new Swiss railway from Thun to Burgdorf was opened recently, says The Engineer. The line is electrically driven by three-phase current at 750 volts. Its length is 25 miles, and the power is derived from the river Kander. The current is generated at Spiez at a pressure of 4,000 volts, and then transformed up to 16,000 volts, at which pressure it is transmitted by overhead wires to 14 transformers along the line.

The experiments in wireless telegraphy which have been carried on at Dover have been most successful. Messages have been sent from the Town Hall at Dover to the South Foreland, the waves passing through the Castle Rock, which is 400 feet higher than the Town Hall flagstaff. The results were most satisfactory. It is hoped that messages can be transmitted between the British and French associations at their meetings.

Vice-Consul-General Hanauer writes from Frankfort, July 22, 1899, that the total length of the street-railway system in Frankfort at the end of the year 1897 was  $30\frac{1}{2}$  kilometers (18.9 miles). The gross receipts during that year were 2,655,685 marks (\$632,000), of which 288,722 marks (68,000) were paid to the city treasury, according to the contract. There were 781 horses and 197 cars in use, and 26,507,403 passengers were carried during the year. The net proceeds amounted to 430,491 marks (\$102,457).

The Glasgow Town Council has confirmed the recommendations of the tramways committee giving the contract for two electric traction engines to the Allis Company. It is said that the decision of the council has occasioned much disappointment to home firms, but they could not compete with the speedy delivery of the Milwaukee firm. There are two or three new schemes for electric subways in London, and it is probable some of the projects will materialize in the autumn, and this will afford an opportunity for further supplies of American equipment.

According to The Electrical World, a patent was granted August 1 to Gustav Platner, of Witzenhausen, Germany, for a new primary battery depolarization solution composed of chlorates combined with metallic salts capable of readily forming basic salts and disengaging acids or halogens. Among the chemical compounds named are salts of iron, such as chloride sulphate of iron and iron and chromium salts. For example, in the case of a carbon cylinder battery, the cylinder containing a dry mixture of sulphate of iron, chlorate of potash or sodium and peroxide of manganese tightly packed together, with zinc in a solution of chloride of ammonium, an E. M. F. of 1.8 to 1.9 volts is obtained. The chemical action gives rise to a basic iron or chromium salt, while the sulphuric acid decomposes the chloric acid, which at once separates into chlorine and oxygen. This action, however, takes place so slowly that the cell would remain constant for a very long period.

The general results of the magnetic survey of Sicily and the adjoining islands, commenced in 1890 by Prof. Chistoni and Signor L. Palazzo, were recapitulated in a communication by the latter observer to the Atti dei Lincei, vi., (2) 11. In Terrestrial Magnetism for June, 1899, Signor Palazzo now gives a magnetic chart of Sicily, showing the course of the isogonal and isoclinical lines, and the isodynamical lines for the horizontal component. The remarkable deviations produced in these curves by volcanic areas are well shown. Signor Palazzo, having been appointed as a delegate at the International Magnetic Conference held in connection with the Bristol meeting of the British Association last year, availed himself of the opportunity for instituting a comparison between the magnetic instruments of the Italian Central Meteorological Office and those of Parc Saint-Maur and Kew. The results of this comparison have been published in the Atti dei Lincei, viii., (1) 8 and 9, and the author considers that these comparisons fully establish the trustworthiness of the Italian instruments and methods.—Nature.