
a Weekly journal 0f practical information, art, SCIENCE, mechanics, Chemistry, and manufactures.

PLANT AND PROCESS FOR FIREPROOFING WOOD During the past year there were two tragic events, resulting from sudden and unexpected conflagrations, which made a profound impression, not merely on the countries concerned, but throughout the world. at large. One of these was the swift destruction by fire, due to the shells of the American warships, of the Spanish cruisers engaged in the battle of Santiago, and the other was the awful conflagration by which the Windsor Hotel, in this city, was wiped out of existence with an attendant loss of nigh upon half a hundred lives. Although neither event taught the world anything that it did not know before, they both impressed deeply the lesson of the perils which are involved in the extensive use of wood as a material of construction where the risk of fire is aggravated and ever present. It has been commonly supposed that the Spanish ships contained a larger amount of wood work than is usually found in warships constructed at the same date as themselves. As a matter of fact, however, they car ried in the shape of decks, bulkheads, and partitions, no more wood work, and indeed, not so much, as is usually found in cruisers that were built about the year 1890. So far from the conditions being favorable


Blowpipe Tesc.
for such a rapid conflagration as took place, they were actually unfavorable. The decks were largely protected on their under side by the deck beams, stringer plates and diagonal strapping, so that not only was the amount of under surface exposed to fire greatly reduced, but the large amount of ironwork in close contact with the overlying decks would, by conducting the heat rapidly away, tend to retard combustion. Yet it is a fact that these vessels had not been many minutes under fire before our shells had set them so fiercely ablaze that before the Spanish batteries had been disabled, it was necessary to run the vessels ashore in the effort to save the lives of the crews.
Navalmen had been well aware, previous to the battle of Santiago, of the extreme peril involved in the presence of inflammable wood in the construction of warships, for at the battle of Yalu the Chinese gunners spent more time in putting out fires than in serving their batteries. The lesson suggested at Yalu received such a power of indorsement at Santiago and Manila that it is safe to say that every ship designed since the date of the Spanish war will be provided with as little wood (Continued on page 198.)


Uıgester Open, Showing Method of stacking Wood.


Interior of Digester, Showing Tracks, etc

plast of the american wood fireproofing company

# Srientifir simmiratt 

ESTABLISHED 1845
munn \& Co., - - - Edtors and Proprietors.
published weekly at
No. 361 BROADWAY, - - NEW YORK.

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## THE "OCEANIC.

The advent of the "Oceanic" to our port marks a new stage in the history of steamship construction. It introduces a true marine giant, as will be seen from the fact that the "Oceanic" is over fifty per cent larger than any of the huge vessels which have been launched in the past decade, and therefore constitutes in respect of size a class by herself. The largest vessel afloat, pre viously to the launch of the " Oceanic." was the "Kaise Wilhelm der Grosse" of the North German Lloyd Company, whose full load displacement is 20,000 tons The White Star liner, however, has been built to take divantage of the new 40 foot channels which are bein dredged in New York Harbor, and on her full load draught of 35 feet 7 inches she will displace, according to the builders' calculations, 31,590 tons. It was stated by the officers of the ship that a cargo and passengercarrying vessel of even larger dimensions, built on the lines of the "Cyiuric," is now under way at the Belfast yards. It is likely that the twentieth century will witness the construction of Atlantic liners whose mark will be set by this great ship of the year 1899 . In view of the many contradictory statements as to the horse power and speed of the "Oceanic," we have ascertained from the officials directly concerned in her construction that on her trial trip she made $21 \cdot 25$ knots with an indicated horse power of 28,000 and a boiler pressure of 192 pounds to the square inch. For those of our readers who may not have an opportunity to see the "Oceanic," an excellent scale of measurement is afforded by the fact that from the top of her 19 -foot mokestacks to the grate bars of the furnaces is. 139 feet.

## FINANCIAL PROBLEMS OF CUBA

Figures just compiled by the War Department give a most encouraging tone to the financial problems of Cuba. Already, under the liberal and intelligent management of the United States government, the total income of the island, for the first six months of this year, exceeds all expenditures by the very handsome balance of $\$ 1,480,021.92$. No doubt, this news will greatly surprise very many, who have hardly looked for such a result from a purely army management of affairs; as too many are apt to imagine that laxity, extravagance, and an absence of business methods are characteristic of military methods. As a matter of fact, this idea is based on a great misconception of the truth. During the period named the total receipts were $\$ 6,982,010.20$, and the disbursements $\$ 5.501,988.28$. Of the latter sum $\$ 1,712,014.20$ was expended in sanitation, an outlay such as Cuba never dreamt of in Spanish days; $\$ 505$,263.06 in the erection or improvement of barracks and army quarters; $\$ 443,563.19$ in establishing and maintaining the rural guard of the island; $\$ 250,674.12$ on public works; $\$ 293,881.27$ for charities and hospitals; $\$ 242,146.01$ for civil government ; $\$ 723,281.38$ in municipal management; $\$ 88,944.03$ in aid of quarantine affairs. When we consider that, notwithstanding the report for July shows an even greater proportionate saving, it has been possible thus far this year to expend nearly one-half the total in those things which make for greater physical and moral cleanliness, altruistic endeavors largely neglected hitherto in Cuba, this showing is especially gratifying to our national pride. It is easy, in view of these facts, to understand why British capital is pouring into Cuba for investment, assured as it is of a stable, honest, and far-seeing rule for that sadly abused island.

## MONEY SPENT BY TRAVELERS

Few have any conception of the enormous outgo of money earned in this country and spent by our leisure and traveling classes in Europe each year. It is now proposed, according to a chief of one of the I'reasury bureaus, in Washington, to compile an accurate set of statistics upon this subject. Several years ago such an effort was made, but it was not carried out as thoroughly as it should have heen. Even then, however, the total ran up to over $\$ 230,000,000$ before the work
was abandoned. It is promised now that the forth coming investigation will be very thorough, including as it will data from steamships, railroads, custon houses, consular estimates, reports of special foreign agents, etc. Such statistics cannot fail to have great interest and value to students of political economy and, especially, to all interested in the problems of the dis tribution of taxation.

## DANGER IN THE APPROACHES TO THE BROOKLYN

 NAVY YARD.The disastrous grounding of the "Massachusetts" and the "Brooklyn," both of which occurred during the past twelve months, have drawn attention to the fact that a visit on the part of any of the deep draught vessels of the navy to the Brooklyn navy yard is fraught with positive danger, particularly at certain stages of the tide. In the case of the "Massachusetts, the existence of the shoal off Governor's Island was well known to the authorities, but the accident to the "Brooklyn" was in the nature of a surprise, for it wa supposed that there was ample depth of water at the spot where she was supposed to have touched bottom. In the course of a survey made by the Coast and Geodetic Survey boat "Eagle," it has been found that the ob struction consisted of a sunken barge that lay about 200 yards out from the Hamilton Ferry slip in 30 feet of water.
It appears that this is not the spot on which the barge was sunk, the wreck having been carried ther by the powerful tidal currents that sweep through the channels in this vicinity; and it is this very liability of a sunken and semi-buoyant wreck to be shifted that renders it such a menace to the safety of vescels of the deep draught of our battleships and larger cruisers. The War Department cannot do agreater service to the sister arm of the service than by making a thorough survey of the approaches to the Brooklyn navy yard and presenting a comprehensive scheme for clearing the channels and deepening them to an extent that will allow our battleships to leave and enter the yard at any state of the tide. Our two latest battleships are about to pass through these channels to prepare for their trial trips, and it would be a humiliating mortification if they should open their careers with accidents which are of such a nature that they might easily become disasters.

## NEW WAYS OF USING THE BIG CORN CROP

The corn carnival is the feature of the great valley of the Central West " when the frost is on the pump kin and the corn is in the shock," but with a crop of some $300.000,000$ bushels to harvest there are tired souls and wearied bodies in the corn belt these fine autumn days. The promise of wealth and atundance of this world's goods brings consolation and joy ; it is the prolonged labor without the monetary compensation that disheartens and dispirits. Never was there a more propitious corn carnival season than the present and Kansas and the corn belt are jubilant. Crops are good, and prices are good. Corn is everywhere and everything. One cannot walk the streets of a Kansas town to-day without encountering witnesses of the State's wealth. There are corn neckties in the show windows, corn-husk parasols and hats in the possession of fair women pedestrians, cornstalk canes jauntily swung by prosperous swains, and corn shoes and dolls for children everywhere. The manifold value of corn for household and personal adornment has been the feature of each succeeding carnival, and this year's creations have totally eclipsed anything heretofore witnessed.
But while the carnival emphasizes the ornamenta ide, there is an undercurrent of seriousness abou this adaptation of corn and its by-products that more deeply concerns the people than an outside might iuagine. Corn was never used in so many different ways for commercial and manufacturin purposes as in the past year or two. If we cannot induce the Europeans to take our corn for house hold uses, we can manufacture it into different article of commercial value which they must take. This seems to be the trend of thought in the corn belt and new inventions and discoveries annually open up new consumptive markets for corn and its products. Corn is gradually entering into industries that seem far removed in every sense from this product of the fields. The queer corn shoes, corn hats, dolls, and neckties which were made and exhibited for celebrat ing the corn carnival stand in sharp contrast with the corn oil, corn cakes, and corn rubber.
The one hundred and twenty-odd recipes for using corn as an article of food, which government expert published ten years ago for the benefit of benighted Europeans who did not appreciate this article of food are not so important in increasing the consumptive demand as some of the recent discoveries. Corn oil for instance, which is extracted from the grain, has an extensive demand in various trades where vegetable ils are essential. Corn oil can be produced more cheaply than most of our vegetable oils because of the relative abundance of corn, and in the last year much of the
oil has been used for table purposes. No attempt has been made to substitute for good olive oil, but judiciously mixed it will pass muster as a low grade table oil. It is also a fair lubricating oil; but its largest use is in the trades and manufactures. Paint mixers employ it quite generally, and also manufacturers of fiber and shade cloth. It possesses qualities that recommend it particularly to these industries, and the demand for it is annually increasing.
Corn rubber is a new article which is substituted for pure rubber in certain lines of goods. This cheap substitute is mixed with equal parts of pure Para rubber. The corn part of the substitute is taken from the refuse of the glucose factory. About five per cent of the corn in making glucose could not formerly be utilized, and this waste seemed absolute. The new corn rubber is manufactured from this apparent waste, and when mixed with pure rubber it produces an especially valuable compound. Improvements in this rubber substitute are made each year, and it has to a certain extent supplanted Para rubber for many purposes. This imitation rubber is from 25 to 50 per cent cheaper than pure rubber, but it has not been sufficiently perfected entirely to displace the Para article. The oil which is found in corn gives a pliability to the rubber compound that prevents it from cracking and breaking as most cheap grades of rubber do. Moreover, the oil of corn tends to prevent the rubber from oxidizing, a fault common to most India rubber.

There are five refineries of corn oil in the United States which use between $10,000,000$ and $20,000,000$ bushels of corn and corn waste. Besides the output of oil, the refineries have'made nearly thirty other different products from the corn. But in spite of all these various products about 5 per cent was practically waste until the discovery of the rubber substitute was made. The spirits distilled from corn constitute another large industry, and recently the employment of the spirits in the nanufacture of new grades of smokeless powder has greatly increased the demand for corn. The British government has been a liberal buyer of the spirits for this purpose, and the Japanese government has quite recently placed an order for several thousand barrels for the same purpose. An extensive European war would consequently. send the price of corn "boom ing," because of its general need for food and be cause it would be in demand for the manufacture of large quantities of smokeless powder. The distilling companies are not only increasing in number, but the output of the largest is doubling. They absorb an enormous quantity of the farmer's corn and prevent a surplus that might otherwise reduce price below the point of profit for the growers.

The comparatively new cattle foods owe their exist ence to the employment of corn in various manufacturing purposes. All of them have received scientific tests and the indorsement of experts in cattle feeding. The corn oil cake, which is really the refuse of factories contains nutriment of a high order, and when properly fed, in conjunction with other foods, it is of great value to the anitials and money in the pocket of the farmer Gluten meal, gluten feed, and chop feed are other cat tle foods that owe their origin to the different factories employed in convert

## cial and scientific use

The manufacture of glucose has opened up a whole field of new industries, and the glucose made from corn enters quite extensively into the refining of syrups jellies, and fruit preserves. It is also used by leathe tanners and brewers. The sugar and starch made from corn form other branches of important industries Different grades of grape sugar are made from the corn and they are used by ale brewers and tanners, while the better grades are employed by apothecaries and confectioners. Pearl and powdered starch come from the corn, and also dextrin and flourin. The former is employed in the manufacture of mucilage and glue and the latter is mixed with flour. The new uses to which these by-products of corn are put multiply rap idly, and every new employment of any of them makes a greater demand upon the corn crop. It is all along this line that improvements are being made which en courage the corn farmers and improve the future for them. If it were not for these several dozen different articles which are made from corn, the farmers of the corn belt would long since have been ruined. A crop of 300 , 000,000 bushels would simply swamp them, and make corn so cheap that it would not pay to harvest it. But with this enormous crop in view, the farmers are happy and jubilant, because there is sufficient demand for the product to keep the prices up.

## WIRELESS TELEGRAPHY TO REPORT THE YACHT

 RACES.The New York Herald has made arrangements for the exclusive use of the Marconi system of wireless telegraphy for reporting America's cup races off Sandv Hook. Signor Marconi and four assistants have sailed from Livernool with all the necessary instruments for use in reporting the races, and the work will be done under the personal supervision of Marconi and his assistants, who have been engaged in experiments on
the transmission of wireless dispatches across the Brit ish Channel during the last six months.
The instruments will be placed on the "Grande Duch esse," of the Plant line, upon the upper deck of which a tall pole, extending 60 feet in the air above the water lıne, wilì be placed, and a running account of the race will be telegraphed by Marconi and his assistants. On board the cable ship anchored near Scotland light a similar pole will be erected, and here two expert ope rators will be stationed to receive the message after it has been transmitted from the "Grande Duchesse." From the cable ship the suessage will be transmitted by means of submarine and land wires. The steamer "Ponce" will also be equipped with wireless telegraphy apparatus, the system of Mr. W. J. Clarke being used. Rear-Admiral Bridford, Chief of the Bureau of Equipment of the Navy Department, has been in formed that Signor Marconi will go to Washington to discuss with him the proposed experiments with wire less telegraphy. Admiral Bradford will recommend that one of the vessels of the navy be set aside for experimental work. It is proposed to place the receiver on shore, and the warship will communicate with it from varying distances. By this means it is believed the system will be developed and the value of it will be definitely determined.

## SOME CALENDARIAL FACTS ABOUT THE TWENTIETH CENTURY.

When will the twentieth century begin? Why there should be different answers to this question is a little puzzling to know. A few fundamental facts disposed of, ought easily to settle the controversy. Of course, the first century began with the year 1 , and closed with the year 100. The second century, then, began with the year 101, and closed with the year 200 . Now following this method to the present time, there can be but one answer to the above question. The nineteenth century closes with the year 1900, and the year 1900 closes December 31. Immediately after midnight therefore, of December 31, 1900, is when the twentieth century begins. In other words, it begins with the first second of the first hour of the first day of January 1901.

Just at the very nick of time when the twentieth century begins at the international date line, the nine teenth will still be enveloping, as it were, the entire globe ; but twelve hours afterward, it will be the twentieth century on half the earth and the nineteenth on the other half; twelve hours later the nineteenth will have entirely passed, and the twentieth will have made its first circuit round this ball on which we live. Thus it takes a century a full day's time to get complete pos session of affairs, and from the time of its very begin ning to the point where its last trace disappears occupies just 100 years and 1 day. This is evident from the fact that after a new century has begun on the earth, it still takes the preceding century full twenty-four hours to give way entirely to the new.
The twentieth century will open on Tuesday and close on Sunday. It will have the greatest number of leap years possible for a century--twenty-four. The year 1904 will be the first one, then every fourth year after that to and including the year 2000. February will three times have five Sundays; in 1920, 1948 and 1976. In 1901, Decoration Day, Fourth of July and Thanksgiving Day will occur the same day in the week. Then, after that, the same thing will happen at the following intervals : $6,11,11,6,11,11$, and so on years; or in 1907, 1918, 1929, 1935, and so on. In the years $1912,1940,1969$ and 1996, there are four holidays that will fall on the same day in the week: the three already mentioned and Washington's Birthday Anniversary, as also the 29th of February. Thanksgiving Day and Christmas will occur on the same day in the week in 1906, and then at successive intervals of 11,6 , 11, 11, 6, 11 years, and so on ; also in 1928, 1956 and 1984 March 4 will fall on Sunday in the inaugural years 1917, 1945, and 1973.
The same yearly calendar that was used in 1895 can be used again in 1901, after which, at successive inter vals of $6,11,11$ years throughout the century; that or 1890 again in 1902 and at intervals of $11,6,11$ years 1891, again in 1903 and at intervals of 11, 11, 6 years; 1892, in 1904 and at intervals of 28 years; 1899, in 1905 and at intervals of $6,11,11$ years; 1894, in 1906 and at intervals of $11,6,11$ years; 1896, in 1908 and every intervals of $11,6,11$ years; 1896, in 1908 and every
28th year thereafter ; 1897, in 1909, and at intervals of 28th year thereafter ; 1897, in 1909, and at intervals of
$6,11,11$ years ; 1898, in 1910, and at intervals of $11,6,11$ $6,11,11$ years ; 1898, in 1910, and at intervals of $11,6,11$
years: 1872 , in 1912 and every 28 th year thereafter; years: 1872 , in 1912 and every 28 th year thereafter ;
1876, in $1916 ; 1880$, in $1920 ; 1884$, in $1924 ; 1888$, in 1928 ; in the last four cases, also at intervals of 28 years.
The following are, in order, beginning with 1901, the dates of Easter for the first 25 years of the century; April 7, March 30, April 12, 3, 23, 15, March 31, April 19, 11, March 27, April 16, 7, March 23, Apri 12, 4 ,
The earliest possible date on which Easter can occur is March 22. The last time it occurred on this date was in 1818, but it will not occur again till after the twentieth century. The latest Easter can occur is April 25, and it will thus occur but once in the coming century; in 1943. Whenever Easter occurs on March 27, or April 3,

10, 17, or 24, Christmas also occurs on Sunday. Though one of the objects aimed at by the church authorities who fixed upon the method of determining the date of Easter was to prevent its occurrence on the same day as the Jewish Passover, nevertheless the two events will occur together four times in the twentieth century, A pri 12, 1903, April 1, 1923, April 17, 1927, and April 19, 1981.
The twentieth century will contain 36,525 days, which lacks but one day of being exactly 5,218 weeks. The middle day of the century will be January 1, 1951. The day of the week that will not occur as often as each of the others is Monday. Fifteen out of the hun dred years will begin on Wednesday and the same number on Friday. Fourteen will begin on each of the other days in the week.
The following is a special rule for finding the day in the week corresponding to any date of the twentieth century: Add together the number of the year of the century, one-fourth of one less than this number, neglecting fractions, and the number of the day in the year; increase this sum by 1 , and then divide by 7 . The remainder will indicate the number of the day in the week, Sunday being regarded as 1 and Saturday as 0 Thus in the case of July 4, 1980, we have as the num ber of the year of the century, 80; as one-fourth of one less than this number, 19 : and as the number of the day in the year, 186, the year being a lean year. Hence, $80+19+186+1=286$, which divided by 7 gives 6 as a remainder. The day in the week is, therefore, Fri day.
Several announcements are made of changes to be inagurated with the opening of the new century. The first of importance is that Russia will adopt the Gregorian calendar. This will be done by omitting thir teen days, the amount of error that will have accumulated after the close of February, 1900. The Russians will then write January 1, 1901, instead of December 19, 1900, or rather instead of December 19, 1900 the dual January 1, 1901
system now in vogue in that country and in Greece The other important announcement is that it is not at all unlikely that the astronomical day, which now begins at noon of the civil day, will begin with the civil day, at midnight. The present method of having the astronomical day to beyin twelve hours after the beginning of the civil day is apt to be confusing. On the other hand, to have the former begin at midnight, just when astronomers are often busiest, will be to them somewhat inconvenient.

As to eclipses in the coming century, there will be about 380 of them, the number of solar being to the number of lunar in about the ratio of 4 to 3 . What is of very rare occurrence in a calendar year will happen in 1935, the first time since 1823, viz., seven eclipses, the largest possible number that can happen in a year There are eight total solar eclipses predicted to occur visible in the United States, in $1918,1923,1925,1945,1954$ 1979, 1984, 1994. There will also occur twelve transits of Mercuryfon the following dates: November 12, 1907 November 6, 1914 ; May 7, 1924; November 8, 1927; May 10, 1937; November 12, 1940 ; November 13, 1953; November 6, 1960 ; May 9, 1970 ; November 9, 1973 ; No vember 12. 1986; November 14, 1999. The first, second, ninth and tenth will be wholly visible in the United States; the seventh and eighth only partially so. A transit of Venus, however, which is of much more con sequence, will not occur within the next century. The earliest date predicted is June 8, 2004.
While it is claimed at least a thousand comets come within visible range of the earth within a century, there is reasonable certainty of the recurrence of but one ex traordinarily conspicuous comet in the next century That one is known as Halley's. It was last seen in 1835. It will be due again in 1910 or 1911; the exact time is not known, owing to slight modifications in its orbit due to planetary influence. It will probably recur again sometime near 1985. Of course, it is not im possible for some hitherto unobserved comet to appear in all its blazing glory at any time. No astronomer knows. Of famous meteoric showers there will proba bly be the three recurrences of the Leonids, in 1932, 1965, and 1998, as in the present century, one being ye due, November 13 of this year.

Benjamin F. Yanney.

## NEWS OF LIEUT, PEARY

The Peary-Harmsworth steamer "Windward" has arrived at Brigus, Newfoundland, from Etah, North Greenland, and she will be followed by the "Diana of the Arctic Club, in about a week. The two steamers met at Etah August 12, and worked in company under the direction of Lieut. Peary in collecting supplies for the winter and the equipment for next spring's cam paign. Lieut. Peary and the sled parties were in the field almost continually from October, 1898, until August 6 of this year, and have effected an extraordinary amount of important work, adding much to the geo graphical knowledge of the coast line and to the interior of Ellesmere Land. The sledging journeys ag gregated more than 1,500 miles. Lieut. Peary made a careful reconnoissance of the coast line southwest of allman Bay, and carefully defined the lands between
that point and Cape Sabine. The "Windward" was icebound in Allman Bay on the west side of Kane Basin from August, 1898, to August 2, 1899. Lieut. Peary made several very successful hunting trips and in December he sledged 250 miles north to Fort Conger, the headquarters of the Greely expedition. He had the misfortune to have both his feet frostbitten, which caused six weeks' delay and confinement until he could make the return trip.
He was hauled all the way back to the "Windward" where several toes were amputated. This was followed by complete recovery, and he now walks as well as ever. Peary was the first to visit Fort Conger since Greely left it in 1883. He brought away and is sending home the original Greely records, the sextant of the Nares-Markham expedition of 1876-78, and many private letters and papers of members of the Greely party. The records can only be regarded as relics, as Gen. Greely had brought three copies of them to the United States. Lieut. Peary also conducted a reconnoissance beyond Fort Conger to Cape Beechey. Subsequently he made a second trip to Fort Conger, and four parties in all reached that point from the "Windward."
The winter is now settling down over his camp at Etah on the Greenland coast east of Smith Sound. It is a good place for a camp and is near the one where Dr. Hayes wintered in 1886. Peary has built a comfortable living and working room for himself and his companions, and during the winter he will collect more dogs for next season's campaign and prepare to resume his sledge work up the channels from Swith Sound as soon as the sun returns. The winter will be spent in rest and in working up the results of last year. The "Fram" wintered nearCocked Hat Island 10 miles west of Cape Sabine. She was released from the ice August 1, and reached Etah August 12, and left the same day for Cape Sabine. It is reported she will go to Jones Sound for the winter, unless she succeeds in getting beyond Kennedy Channel and landing Captain Sverdrup for a sledge trip across or around the northern end of Greenland, to be picked up on the east coast by the ship "Windward."

## OBSERVATIONS OF POLARIS.

Prof. W. W. Campbell, on September 12, made the following statement in regard to his recent observations, by means of which he discovered that Polaris, familiarly known as the North Star, embraces three distinct bodies :
"The observations of Polaris," says The New York Times, "were made with the Mills spectroscope attached to the 36 -inch telescope. From the well-known principle of the shifting of the line in the spectrum of a star, we can determine whether the star is approaching or receding from the observer and how rapidly. For most stars the velocity is constant. For some stars the velocity is variable, due to the attractions of companion stars.

- The recent observations of Polaris, at Lick Observatory, show that its velocity is variable. It is approaching the solar system now with a velocity of 8 kilometers per second. This will increase in two days to 14 kilometers, and in the next two days will decrease again to 8 kilometers. This cycle of change is repeated every four days. The bright Polaris, therefore, revolves about the center of gravity of itself and its invisible companion once in four days. The orbit is nearly circular and is comparable in size with the moon's orbit around the earth.
"This center of gravity, and therefore the binary system, is approaching the solar system at present with a velocity of $111 / 2$ kilometers per second. A few measures of the velocity of Polaris made here in 1896 gave its approach at the rate of 20 kilometers per second. Part of this change since 1896 could be due to a change in position of the orbit of the binary system, but most of it must have been produced by the attraction of a third body on the two bodies comprising the four-day system. The period of revolution of the binary system around the center of gravity of itself and the third body is not known, but is probably many years.
"Both companions of Polaris are invisible, but their presence is proved by disturbances which their attractions produce in the motion of the bright Polaris."


## GOVERNMENT AID IN FORESTRY.

The Division of Forestry, of the United States Department of Agriculture, has issued a circular stating that the division is prepared, as far as a limited appropriation will permit, to render practical and personal assistance to farmers and others by co-operating with them to establish forest plantations, wood lots, shelter belts, and wind breaks. An expert tree planter will have charge of the work, and he will be assisted by collaborators from the different States who are familiar with local conditions. It is proposed that visits be made by the superintendent or one of his assistants to the lands of the farmers desiring aid in forestry, and that working plans be given, including help in the selection of trees, information about planting, and instruction in handling forest trees after they are planted.

## A SAN FRANCISCO FIRE FIGHTER.

 by herbert i. bennetThe San Francisco Fire Department has in its service a machine bearing somewhat the appearance of a small cannon mounted on two wheels. Instead of pouring out shot and shell like the latter, the machine in question, however does pour a great volume of wate on a fire with telling effect. This piece of apparatus is known as the Monitor Battery, and was invented by Mr. H. H. Gorter, constructor for the San Francisco Fire Department. It is designed to take the place of Fire Department. It is designed to take the place o a water tower in small confines where the latter cannot be taken and can be used in a basement blaze and up to a fourth story inclusive. Several lines of hose are connected, thus concentrating a great force of water that is easily handled by one man.
The nozzle is provided with tips so that either a 2 , $21 / 4,21 / 2.23 / 4$ or a 3 -inch stream can be thrown. When not in action, the table upon which rests the huge nozzle is suspended so as to throw the weight on the wheels and relieve the horse of the strain. When required for action, the table is released by a lever which throws it forward to a level, at the same time moving the center of gravity forward. The weight is thus thrown between the toes at the end of the shaft and the axle, giving the machine stability to withstand a back pressure of fifteen hundred pounds to the square inch. The toes referred to are spikes under the end of the shaft for the purpose of obtaining a purchase in the ground to prevent moving.
The vertical movement of the nozzle is on an improved ball and socket joint, allowing a free flow of water at any angle. A roller bearing is provided tor traveling the nozzle through a horizontal arc the nozzle through a horizontal arc
which reduces the friction caused which reduces the friction caused
by back pressure to a minimum. by back pressure to a minimum.
On the rear end are six short flexiOn the rear end are six short flexi-
ble connections or pieces of hose for bleconnections or pieces of hose for
connecting the battery with the various lines of hose leading from the engines. When not in action the connections are suspended beneath the rear end of the appa:atus. They are automaticallv released by the tilting of the table when rethe tilting of the table when re-
quired for service. The tilting of quired for service. The tilting of
the table also releases a strut or the table also releases a strut or
brace which assists in relieving the brace which assists in relieving the
strain on the shaft and frame due to strain on the shaft and frame due
back pressure from the nozzle.
The total weight of the battery complete is 1,650 pounds, and owing to its construction and free waterway, a solid stream is thrown rang. ing from 200 to 300 feet, according to the pressure. The nozzle with its tremendous pressure can, as before stated, be easily handled by one man, who guides it with a small lever. At the Bald win Hotel fire two batteries kept the blaze under control on the Market Street side. showing their value in cases of large conflagrations. They are splendid for handling hig lumber fires also. From a point of econo my, the machine deserves mention too, because it requires but one man and one horse, whereas a water tower takes three men and three horses to operate it. The inventor intends to make them automobiles in the near future.

Moving Millions of Gold.
Bigger heaps of gold than ever were buried by Capt. Kidd, or carried by rakish craft in the palmy days of the Spanish Main, are week in and week out hauled around New York city, to and from banks and steamship wharves, in a commonplace truck.
The business of moving the gold used in the settlement of commercial balances is always active in New York. for the credits and debits between the local banks, and, in a wider sense, between the United States and foreign countries, are daily shifting and must constantly be met, says The Saturday Evening Post. Of course a growing share of the exchanges between banks is made by the check system and the clearing house, so that after the associated banks, by their representatives, have met together in the morning of each business day and exchanged the checks on each other taken in the previous day's transactions, only the differences have to be paid in actual money.
Thus it happens that the actual exchange of cash is
generally less than 10 per cent of the total clearings, or exchanges of checks. For example: One day recently when the New York banks had the largest clearings ever recorded-more than $\$ 352,000,000$-all that immense sum was paid and received by the use of only $\$ 15,000,000$ of actual money. Ordinarily, this money would have been in the form of greenbacks, but for some months bills have been very scarce, and clearinghouse balances have uniformly been paid in gold, as are foreign balances.
When the balance of trade demands actual shipments, New York bankers or foreign exchange houses call in the services of Mr. Barkley, a rotund truckman well known to everybody in Wall Street. He has a monopoly of the trucking of gold there; all the bankers know and trust him, as they did his father for more than forty years. Barkley has a slate hanging in a doorway near the Stock Exchange, and his truck stand near by when not busy. The bankers send a

the gorter "battery" onlimbered for action.


A SAN FRANCISCO FIRE FIGHTER-THE "BATTERY" IN ACTION to get away in safety. recorded.
some agile thief get a way with one of the little kegs. But the little kegs are their own protection ; the $\$ 60,000$ they contain makes troublesome lifting for two men, and only a Sandow of a thief would have any chance

When Barkley or his European confreres bring a consignment aboard, it is carefully stored in the ship's vault, and the purser takes sole charge of the keys. The first officer of the vessel sees that the vault is covered fathoms deep with the solidest kind of freight. If any robberies have occurred, they have never been

The Ebony of the Ancients.
Ebony was known and highly esteemed by the ancients as an article of luxury, and was used by them for a variety of purposes, says The Jeweler's Weekly. In India, it is said that it was employed by kings for scepters and also for images. On account of its supposed antagonism to poisons, it was used largely for drinking cups. Its use has extended continuously down to the present time, and in England, as well as on the Continent, it has always been held in high esteem by the wealthy for toilet articles and boxes. In France particularly, the manufacture of ebony goods has attained a high degree of perfection. Within a few years its use in the United States has increased remarkably, in a large measure, no doubt, on account of its combination with silver, which is believed to have originated in this country. The striking contrast of the dead black of the wood and the brilliant white of the silver has roul the outset commended it to the American public. This combination, it is said, has now been introduced into England and other European countries. The silver mounting of the ebony gives scope for the taste and originality of the silversmith. The style of decoration most frequently used on the larger pieces consists of a border of scrolls, of flowers, or of a combination of scrolls and floral designs. The variety and degree of elaboration of the borders shown are almost endless. Sometimes the border extends only half way around the edge of the article. A silver shield, on which the initials of the owner may be engraved, is generally placed in the center of the piece: This shield is occasionally replaced by a monogram, more or less elaborate, which may be the only mountings used. Large initials are also used instead of a monogram. Another style of decoration consists of a beaded edge of silver. While the border is occasionally used on smaller pieces, the decoration for these is generally confined to a shield or monogram. The shield may be combined with floral designs or scrolls. The name ebony is given to the wood of several varieties of trees. All kinds of ebony are distinguished for their great density and dark color. The wood in all varieties is heavier than water; the heaviest varieties are the darkest. The other grades re quire a considerable amount of staining to make them black. Ebony is of a uniform color throughout and will not show any deterioration even from long-continued use.
elerk or messenger for Barkley when they want any carting done. The last time I passed that door the slate said, "Cali at $\mathcal{C}^{\top}$. P. Morgan \& Company's and see Mr. King." Another day 4 may contain one or half a dozen orders from the big houses, and thither Barkley or one or two of his men go to do their bidding.
Gold in transit is packed into small rouleaux. wrapped carefully in little canvas bags. The small bags are incased in bigger and heavier ones. The whole thing is then put into a small keg and the interstices are filled with sawdust. This is to prevent abrasion, for gold that is much worn by rolling around loses considerably in value.
Some gold stays in its wrappings for months and years together. It may in that time have traveled a dozen or twenty times across the ocean, or it may have lain untouched in bank vault or clearing-house. When moved about on the trucks, it might be supposed that a big guard of men would be necessary to watch lest

There are three varieties of ebony
well known in commerce. The ebony from the Gaboon coast of Africa is the darkest. The Madagascar ebony is the densest. The Macassar ebony furnishes the largest pieces. Almost all ebony is sent in the form of logs to London, and from there shipped to the various countries in which it is used for manufacturing purposes. It is sold by weight. Imitations of ebony can always be distinguished by their lighter weight, and the cheaper imitations can be detected by merely scratching the surface.

## Wyoming Fossil Discoveries.

The party of scientists who have been investigating the Wyoming fossil beds are having remarkable success, and a large number of boxes containing fossil remains have been sent to the State University, and the work of restoration will soon be begun under the direction of Prof. Wilbur C. Knight.

September 23, 1899.

## THE GRANT ROLLER-BEARING.

In the accompanying illustration we present a novel roller-bearing made by the Grant Axle and Wheel Company, of Springfield, Ohio, which has been used with noteworthy success upon wagons, carriages, autowobiles, and vehicles in general.
The tapered rollers of the bearing turn between a cone held upon the axle spindle and an exterior coned ring. The inner cones are not keyed to the spindle, but are loose; so that they turn independently of the rollers. Should the rollers bind, the wheels would not be locked; for the cones could still rotate on the spindle. The method of assembling the various parts of the bearing is so apparent from the illustration that no extended description is necessary. Perhaps the wost striking feature of the construction is the simple method provided for taking up the wear.
The adjusting nut is held on the outer end of the axle spindle by a pin or cotter passing through the


THE GRANT ROLLER-BEARING.
nut and through the reduced end of the axle. The nut is made in two concentric members having threaded connection, whereby the outer portion or shell of the nut may be adjusted inwardly to take up the wear of the cones. Once set, the nut cannot be jarred or loosened from its position. It is evident that the spindle may be removed from the hub or wheel without in any way disturbing the adjustment of the parts.

## AN IMPROVED VEHICLE-TIRE.

An ingenious form of tire is being placed upon the market by the Consolidated Rubber Tire Company, of 40 Wall Street, New York city, which is particularly adapted to the requirements of wagon, buggy and carriage wheels.

To the wooden wheel upon which the tire is to be secured a metallic rim is fastened having angularly projecting flanges forming a groove with tapered sides, within which the inner portion of the tire is held. The outer portion of the tire is formed at an angle to the inner portion, the angle or corner between the portions being placed within the outer periphery of the flanges. Openings extend through the entire unexposed portions of the tire, and through these openings independent retaining wires pass, the ends of which are united after the rubber has been endwise compressed. The bottom portion of the tire is reinforced with a canvas strip.

By having the sides of the unexposed portion of the tire inclined and formed at an angle to each other, the compression of the tire in use is such that all portions

Sicientific Americum.

New Coast and Geodetic Survey Vessel.
The new steamer of the United States Coast and Geodetic Survey, the "Pathfinder," after receiving her scientific outfit at Washington, recently started on a voyage to San Francisco via Cape Horn, her destina ton being Alaska and subsequently the Hawaiia on Islands, says The National Geographic Magazine. An examination made by Superintendent Pritchett las year developed the necessity of continuing the geode tic and hydrographic surveys of those islands by the United States government. The land operations, however, have been successfully organized and carried on for the last 25 years by the Hawaiian Government Survey. The steamer carries the necessary instruments for observations of terrestrial magnetism, densities of sea water, current velocities, and sea bottoms, as well as for the regular hydrographic and topographic survey of the coast. A record will also be kept of the phenomena observed while en route along the coast of South America. During the summer seasons the "Pathfinder" will reinforce the ships and parties of the Survey operating in Alaskan waters, retreating during the winter months to the milder Hawaiian shores. The "Pathfinder" is under the command of Frank Walley Perkins, of the Survey staff, with J. C. Dow, a well-known Transatlantic master, as executive officer. She is the largest of the Survey's vessels, and is peculiarly well fitted for the long distance work of the character she undertakes, her coal endurance being about 6,000 miles. She carries a complement of about 75 officers and men. Including the "Fathfinder," the Survey will now have four steam vessels on the Pacific station and three along the Atlantic and Gulf coasts, besides a number of schooners and smaller craft at various points.

## Wireless Telegraphy During the Naval

 Maneuvers.We have already referred briefly to the trials of Mr. Marconi's wireless telegraph apparatus at the naval maneuvers, says The Electrician, and we have now received a letter from Mr. Marconi himself giving us some interesting additional information and directing our attention to the significance of the experiments from a theoretical point of view. The maximum distance to which service messages were sent was 60 sea miles, and this was obtained with apparatus similar to that which has been in use for some time past at South Foreland, the vertical wires being 150 feet and 128 feet long. Mr. Marconi points out that it would geometrically be necessary to have poles 700 feet high at each end in order that a line between their summits should clear the curved surface of the earth. The greatest height employed above the level of the sea, however, did not exceed 170 feet, so that the Hertz waves, if it was really Hertz waves that passed, had either to go over a dome of water 530 feet higher than the top of the mast or to pass through it. This thickness of water, Mr. Marconi considers, would probably be much more opaque than Dover cliff. Non-official messages were obtained up to 74 sea miles in one stretch, which Mr. Marconi considers to be an un doubted record for electric waves.
The following detailed particulars of the trials are given in an article by Commander E. P. Statham, R.N., in The Navy and Army Illustrated: When the reserve fleet first assembled at Torbay, the "Juno" was sent out day by day to communicate at various distances with the flagship, and the range was speedily increased to over 30 miles, ultimately reaching something like 50 wiles. At Milford Haven the "Europa" was fitted out, the first step being the securing to the main topnuast head of a hastily prepared spar, carrying a small gaff or sprit, to which was attached the receiver, the wire from it being brought down to the starboard side of the quarter deck through an insulator and into a roomy deckhouse on the lower afterbridge which contained the various instru ments.

When hostilities commenced, the "Europa" was the leading ship of a squadron of seven cruisers dispatched to look for the convoy at the rendezvous. The "Juno" was detached to act as a link when necessary and to scout for the enemy, and the flagship, of course, re mained with the slower battle squadron. The "Europa" was in direct communication with the flagship long after leaving Milford Haven, the gap between reaching 30 or 40 miles before she lost touch, steaming ahead at a fast speed.

Reaching the convoy at four o'clock one afternoon, and leaving it and the other cruisers in charge of the senior captain, the " Europa" hastened back toward another rendezvous, where the admiral had intended remaining until he should hear whether the enemy had
found and captured the convoy. But scarcely had she got well ahead of the slow ships when the "Juno" called her up and announced the admiral coming on to meet the convoy. The "Juno" was at this time fully 60 wiles distant frou the "Europa."
"Now imagine," says Commander Statham, "a chain of vessels 60 miles apart ; only five would be necessary to communicate some vital piece of intelligence from distance of 300 miles, receive in return their instruc tions, and act immediately, all in the course of half an hour or less. This is possible already. Doubtless a vast deal more will be done in a year or two or less; and meanwhile the authorities should be making all neces sary arrangements for the universal application of wireless telegraphy in the navy. The outfit is not expensive ; £120 would probably fit up any ship, and it is sure to become cheaper in time."

## A RECENTLY INVENTED ROTARY ENGINE.

A small, compact rotary engine which is arranged to utilize steam expansively has been patented by Richard Toennes, of Boonville, Mo., and is noteworthy chiefly for the construction of the piston and for the method employed in adiuitting and controlling the steam. Fig. 1 is a perspective view of the engine with parts broken away to show the cut-off mechanism Fig. 2 is a partial sectional front elevation; and Fig. 3 is a view of the reversing valve. The piston of the engine is eccentrically mounted and is provided with a spring-pressed piston-head which consists of a shank made in parts breaking joints and which is formed at its outer end with a pivot on which an auxiliary head is mounted to rock, this auxiliary head being likewise made in sections breaking joints. The engine has two main ports, one of which can be used as a supply port and the other as an exhaust port: These ports are reversed in function when the engine is reversed.
To change the direction of the piston motion, a re

perspective and detail views of rotary engine.
versing-valve (Fig. 3) is used having two through ports and an exhaust recess or port on one side designed, as the valve is shifted by the long lever shown in the engraving, to connect either main port with the exhaust port. The cut-off mechanism comprises a valve superposed on the reversing-valve and having a swinging arm extending across the engine-shaft. The arm is provided with a yoke which is acted upon by an eccentric on the shaft to cut off the steam and allow it to work expansively. The steam can be cut off at $1 / 4,1 / 2$, or $3 / 4$ of the piston-stroke. In lubricating the cylinder, piston, and bearings, oil is fed at only three places. With the exception of the shaft, no moving parts are to be seen on the outside of the engine-casing.

Educational Assistance for Young Men.
A very large number of young men are handicapped in business and social life by deficient education. For these there are excellent opportunities presented in the evening classes of the Young Men's Christian Association. Here they may get an education at the same time they are earning a living.
At the West Side Branch, 318 West Fifty-seventh Street, New York, there are elementary and advanced commercial courses, and language and scientific sub jects so arranged that a young man can take one or more studies at a time and devote to study as many or as $f \in w$ evenings as he desires.

The courses of study begin on October 2 next. Those participating have the advantage besides of the Read ing and Current Topic Clubs, Literary Society, and a library of over 42000 volumes, which is a decided gain for any young man inclined to better his condition.

A Correspondent from New Orleans writes us con cerning the water hyacinth, about which we recently published an article. He states that the country around New Orleans has also been very much troubled with the water hyacinth, and attempts to mitigate the evil have been made. Experiments have been made on the Melpomene Canal with a chemical spray, and the result has been highly satisfactory.

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 nonflammable 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 np, it may be taken as thoroughly representative of the present state of the art.
The plant consists essentially of three large digest ers, 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 inter nal 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 othe 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 en gage the same number of sockets formed on the face o 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 abu against the inner side of a large plate washer. Thi washer is carried upon a massive screwbolt, which pro jects 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 presse the plate washer down upon the inner ends of the ra dial 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 smal 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 in to 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 ap plied for a period of from three to fifteen hours, the vacuum as recorded hy the gage being from $271 / 2$ 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 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 cylin ders it is absorbed by the cavities of the wood unti the latter is nearly saturated. To assist the absorp tion, 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 storaye 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 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 vard 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 chensical work.

Dr. H. W. Wiley and W. H. Krug, of the Agricultural Department, presented a paper oin 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 absorbents 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 or ganism.

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 Co umbus.
Five drain tiles are partly filled with sand and placed erect in a box of sand. The upper part of the tile is 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 at tendance in the section was very large.

OUT of 2,489 miles of railways in Switzerland, only $561 / 2$ miles are rack railways. There are nearly 12 miles of cable lines and 89 miles of street tramways.

## lass Experiment Showing How the Resistan 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 de crease of resistance in carbon with increase of tem perature, which commends itself by reason of its ffectiveness and simplicity.
In a 110 -volt circuit, I introduce a piece of charcoa some four or five inches long. The spark produced upon short-circuiting this stick at one of the contact 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 unin viting chilliness of the straight line.
I. J. Kavanagh, S.J.

St. Mary's College, Montreal.

## utomobile

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.-Gien. Anderson, at Chicago, to Maj.-Gen. Merritt, at New York.
The police department of Hartford, Conn., will soon be equipped with automobile patrol wagons, ambu lance, 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 vehisle, and it is possible that these carriages nay 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 con tribute 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 certair 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.

A novelty is the cold storage of hops. This is done in several places in England. Several systems are ennployed, 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 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.
lt is said that Dr. Nansen will not undertake another northern polar expedition, but that he is much interested in Antaretic 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 toy making at Grunhainiden. 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 flourine 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 prowhich is less attacked than other metals. This is pro-
bably caused by the thin laver of copper fluoride which bably caused by the thin layer of copper fluoride which
forms on the copper and which is insoluble in hydroforms on the
fluoric 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 also prohibits the use of these substances in food. In
Great Britain saccharine must not be used in beer 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. Adain 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 deperident 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 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 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.

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 wate 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 immates.
Mr. Henry Hess, in a recent issue of The Aınerican 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 $\mathrm{P}=9.9 \mathrm{D}--14$ up to $\mathrm{D}=10 \mathrm{in}$. For crank fits $\mathrm{P}=5 \mathrm{D}$ +40 from $D=12 \mathrm{in}$. to 24 in . Straight crank pins +40 from $D=12$ in. to $24 \mathrm{in} . \quad$ Straight crank pins
$\mathrm{P}=13 \mathrm{D}$. Taper crank pins $\mathrm{P}=14 \mathrm{D}-7$. Where $\mathrm{P}=$ $\mathrm{P}=13 \mathrm{D}$. Taper crank pins $\mathrm{P}=14 \mathrm{D}-7$. Where $\mathrm{P}=$
total pressure on ram in tons to force on and $\mathrm{D}=$ diatotal pressure on ram in tons to force on and $D=$ dia-
meter 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 $1 / 8$ inch of shoulder and then forced home. Taper $\frac{1}{16}$ 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 iarge 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 downbound 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 $71 / 2$ 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 com puting the surface of fire-tube boilers. The boiler horse power is made $341 / 2$ units of evaporation per hour, i. e.. $341 / \frac{1}{2}$ 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 . 33,305.

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 Hananer 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 $301 / 2$ 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 comgaging acids or halogens. Among the chemical com-
pounds named are salts of iron, such as chloride pounds 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 Sincei, 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 isoclinal lines, and the isodynamical lines for the horizontal component. The rewarkable 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 Pare 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.

## ダrinutific Amrricau.

ed. The river San Piedras is in ordinary seasons an inconsiderable stream, but within four hours after the storm had burst in this locality it had swelled into a raging torrent. As viewed in the illustration it flows in the direction of the bridge as seen from the point of view at which the photograph was made. The rush of water appears to have washed away the embankment which
shown was wrought entirely by the wind and consisted chiefly of the unroofing of houses and, in some cases, the complete demolition of the upper stories.
One of the greatest scenes of desolation after the storm was presented in the public square of Caguas, which was formerly one of the attractive sights of the town and the common place of recreation for the

damage in the mann street of caguas.


WRECK OF STEEL BRIDGE ON THE MILITARY ROAD.

desolation in public square, caguas.


STREET OF NATIVE HUTS, SUBURBS OF CAGUAS.
were taken in the town of Caguas, a place of 14,000 inhabitants which is situated in one of the richest tobac co districts of the island and is like Cayey and Camerio one of the most productive centers of the tobacco industry. The other view is taken on the celebrated military road which runs from San Juan through the island to the city of Ponce. This bridge is a modern steel structure which was built to carry the road across the river Piedras. It is situated about 21 miles from San Juan, and in the solidity of its construction it was a fair sample of the excellent work which is characteristic of the whole of the military road above mention-
formed the approach to the bridge on the left, and get ting in behind the abutment it brought down the masonry with one end of the bridge, as shown in the illustration, letting the whole superstructure fall into the river.
The street which is shown in another photograph is Furabo Street, one of the principal thoroughfares of Caguas. It coincides with and forms part of the military road, and along it are to be found the principal stores and places of business. Generally speaking, the lower stories were built of brick and the upper stories were of wooden frame construction. The damage here
people. It contained a handsome grove of Framboyan trees, and how complete was the havoc wrought by the wind will best be understood from an inspection of the accompanying photograph. Not merely was the foliage entirely stripped from the trees, but the the foliage entirely stripped from the trees, but the
greater part of the branches were torn off and scattered in a confused mass throughout the plaza.
The American people have heard a great deal lately about the flimsy huts which serve as dwelling places for the poorer inhabitants of Cuba and Porto Rico, and the accompanying view taken in the poorer quarters in the suburbs of Caguas proves how extremely

"OGEANIC" PASSING SANDY HOOK ON HER MAIDEN TRANSATLANTIC TRIP.
primitive these dwellings really are. The walls con sist of rather slight posts set in the ground, closed in with the bark of the native trees, while the roof consist of light pole rafters with a thick covering of palm leaves. The inhabitants of these huts are employed chiefly on the farms and in the tobacco factories, where they do the common laboring, receiving for their services a wage which varies from 38 to 60 cents a day. These poorer classes live on dried codfish, sweet potatoes, rice, beans, bananas and coffee. It can easily be understood that the ravages of the hurricane were not so severely felt by these people as by the owners of the better class of houses; for the matter of repairing one of these huts is merely a question of a day or two.

## THE "GREAT EASTERN" AND THE "OCEANIC"-

 a COMPARISON.With the arrival of the magnificent liner " Oceanic" of the White Star Line Company at this port after a successful maiden trip, the people of New York city are carried back to the time when, some forty years ago, that other mammoth steamship, the "Great Eastern," made her first trip across the Atlantic. Although the "Oceanic" is a first-class passenge steamship in every particular of the hull, engines, safety and accommodation, and represents in all these respects the highest development of the steamship builders' art, there is no question that it is in respect of her unprecedented size that she will command most attention. For this reason we have thought best to make this article a comparison of the "Oceanic" with the "Great Eastern," with a view to bringing out, in cidentally, the great strides which have been made during the past forty years in the building of transatlantic liners.
To begin with the question of size, the "Oceanic" is longer over all by 12 feet and her displacement at a working draught of $321 / 2$ feet is greater by 1,500 tons. In beam and depth, however, the ship of the fifties was enormously larger, having a beam of 83 feet as against 68 feet for the "Occanic," while her depth was $571 / 2$ feet as against 49 feet. These differences are shown very clearly in the sectional view of the two ships. At first sight it would naturally puzzle the reader to understand how the "Oceanic" with a cross section so much smaller could have a larger displacement than the "Great Eastern," when both ships are of approximately the same length; but it must be remembered that while the average draught of the "Great Eastern" was only $251 / 2$ feet, that of the "Oceanic" is $321 / 2$ feet. The fact that a larger proportion of the hull is above the water-line will also explain
the more bulky appearance of the "Great Eastern" in our broadside view of the two vessels. Moreover, the model of the "Great Eastern" was considerably finer than that of the "Oceanic"; she did not maintain her


CROSS SECTION OF "GREAT EASTERN" AT THE PADDLE ENGINES
full beam for any considerable distance amidships, her under-water body fining away toward the ends like that of a yacht. Further, her bilges were very much easier, being rounded up with a broad easy sweep, while those of the "Oceanic," as is the fashion in modern steamships of this class, are nearly square with a flat floor, a small dead rise, and a short radius at the turn


MIDSHIP SECTIONS OF "GREAT EASTERN" AND
"OCEANIC."
Another feature which serves to make the "Great Eastern" look more bulky than the modern vessel is the fact that her plating was carried up to the top deck, which was entirely flush from stem to stern and carried only a few deck houses. In the " Oceanic," on the other hand, the two upper decks amidships are carried upon stanchions and extensions of the side frames and have no side plating.

The "Great Eastern."-The construction of the "Great Eastern" was commenced in the spring of 1854 on the banks of the Thames. She was built broadside on to the water, and the enormous difficulties attending her launch delayed her taking the water until the last day of January, 1858. Her total cost was probably about $\$ 4,400,000$. She was propelled by two sets of engines. Amidships was a four-cylinder paddle wheel engine of huge dimensions, while astern of this was a horizontal four-cylinder single screw engine. The paddle wheels were enormous affairs, 56 feet in diameter, and each of them weighed over 90 tons, while the breadth of the ship over the paddle wheel boxes was 118 feet. Each of the paddle wheel engine cylinders was 6 feet in diameter by 14 feet stroke, and the indicated horse power was 3,500 . The four cylinders of the single screw engine were 7 feet in diameter with a 4 foot stroke, the indicated horse power being 4,500. Steam was supplied by ten double-ended multi-tubular box boilers, which carried a working pressure of 20 pounds to the square inch. The total daily consumption of coal when the vessel was running at full speed was 400 tons. The bunkers had the enormous capacity of 12,000 tons, this large supply being provided with a view to enabling the vessel to steam out to Australia and back without recoaling. The hull was constructed of iron, and, considering the early date at which it was built, it was a masterpiece of construction, and was of a strength which has probably never been exceeded in modern vessels. In the first place, the double bottom was carried, as shown in our cut, well above the waterline, and the upper deck, like the bottom, was of cellular construction, and consisted of a series of longituainal girders extending throughout the entire length of the ship and closed in at top and bottom by plating. Fully 30,000 plates were used in the vessel, and when she was launched her estimated weight was about 8,500 tons. Provision for safety was made by building the ship with twelve watertight compartments below the lower deck and nine compartments above it. The ship carried four decks in all, and her passenger accommodation, in respect of the total number carried, was far ahead of anything that has ever since been attempted, provision being made for 800 saloon passen gers, 2,000 intermediate, and 1,200 steerage passengers The staterooms and saloons were built on what were for those days very generous proportions. The main saloon measured 36 feet in width by 100 feet in length and 13 feet from floor to ceiling.

On her first trip to this country she made the pas sage in eleven days two hours. Her maximum speed was $141 / 2$ knots, and her average speed during the time

 " GREAT EASTERN" and "OCEANIC" COMPARED.
he was under full steam was about 13 knots. Al though, financially, she was a failure, her vast siz proved most opportune for the task of laying the trans atlantic cable. The latter days of the great ship were somewhat ignominious. After being sold to an enter prising speculator, who used her for show purposes, she was sold for old iron and broken up on the banks of the Mersey. If we bear in mind that the art of iron shipbuilding was in its infancy at the time she wa built, we must admit that the construction of the "Great Eastern" was, and is to day, the greatest engineering feat of the nineteenth century, and reflects the highest credit upon her designers, J. Scott Russell and I. K. Brunel.

The "Oceanic"-We have recently described the "Oceanic" at such great length that it will not be neessary at this time to do more than recapitulate her eading features. In her lines and general arrange ment the new ship is an "nlargement of the White Sta boats "Majestic" and "Teutonic" and unless one near enough to realize her gigantic proportions, she might easily be mistaken for either of these vessels.
dimensions of the largest ocean sthamers

| Name of $\begin{gathered}\text { Natip. } \\ \text { shio }\end{gathered}$ | Date. | $\left\lvert\, \begin{gathered} \text { Length } \\ \text { onger } \\ \text { oll. } \end{gathered}\right.$ | Beam. | Depth. | Draugt. | ${ }_{\text {Displace- }}^{\substack{\text { Dipent. }}}$ | Speed. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Feet | Feet | Feet | Feet | Tons | Knot |
| Great East. | 1888 |  | ${ }_{63}^{83}$ | 571/2 | ${ }_{261 / 9}^{251 / 9}$ | 27.000 15.0000 1 | 141/2 |
| Teatonic.... | 1889 | 585 | 577/2 | ${ }_{4}^{4}$ | ${ }^{26}$ |  | ${ }^{20}$ |
|  | ${ }_{1893}^{189}$ | ${ }_{625}^{564}$ | ${ }_{65}^{63}$ | ${ }_{41}{ }^{42} /$ | $\stackrel{\text { 2\% }}{27}$ | ${ }^{19,0000}$ | 22 |
|  | ${ }_{1897}^{1897}$ | ${ }_{7}^{649}$ | ${ }_{6}^{66}$ 68 | ${ }_{4}^{43}$ | ${ }_{32 / 6}^{29}$ | 20.000 28.500 | ${ }_{\text {21/4 }}^{21 / 62}$ |

The accompanying table shows what an advance in size has been made in the "Oceanic" over existing ships. She is 42 per ent larger than the next largest transatlantic liner, "Kaiser Wilelu der Grosse" whose displace ment on a draught of 29 feet is 00000 tons. Following the "Kaiser Wilhelm" is the "Campania," of 9,000 tons and then in order of size come the "St. Paul," of 16,000 tons, the "Paris," of 15,000 tons, and the "Teutonic," of 13,800 tons. But though the vessel is so much larger, she does not compare in speed with the fastest of the trans tlantic liners. Her indicated horse power is only 28 r00 or the saue as that of the "Kaiser Wilhelm der Grosse" and the estimated ses speed is only 20 knots an hour, as against a sea speed of over $221 / 2$ knots, which has been achieved by the North German Lloyd vessel It is the belief of the White Star Company that the average transatlantic traveler cares less about extremely high speed than is genrally supposed, and it is believed that by giving the "Oceanic" suffiient power to enable her to make the trip with great regularity, the company will not only effect a great saving of fuel, but will meet al
the wishes of the traveling public. Thus, it is claimed that the saving of twelve hours by pushing a vessel across the Atlantic at the highest speed frequently serves merely to bring the ship into New York Harbor just too late to pass Quarantine. This necessitates the passengers being detained on board until the fol. owing morning
In the construction of the vessel great attention has been paid to the elements of strength and stiffness. The rames are heavy channel irons of steel 9 inches in depth, spaced $311 / 2$ inches from center to center. The plating varies in thickness from 1 inch to $11 / 2$ inches. The double bottom extends throughout the full length of the ship, and in general is a little over 5 feet in depth, except beneath the engines, where, in order to comply with naval requirements, the depth is increased to 7 feet. Great strength is also derived from the five steel decks. which are completely plated from stem to stern. Including the inside floor of the ship's bottom, there are seven distinct decks, and above these a boat deck which extends for several hundred feet amidships. The captain's bridge is about 96 feet above the keel, and will be 68 feet above the water when the ship is down to her present load line of 29 feet.
The engines are of the twin-screw triple-compound inverted type, working upon four cranks, are set according to the Schlick system, which is designed to reduce vibration and has shown excellent results in practice. The cylinders are high pressure $471 / 2$ inches, intermediate 79 inches, and two low pressure 93 inches in diameter, the common stroke being 72 inches.
There are accommodations for 410 first-class pas sengers, 300 second-class, and 1,000 third-class pas-
sengers, and as the crew numbers 390 , the total numbe of people on board when the ship carries her full com plement will be 2,100 . The decorations are carried ou with the good taste which is a marked feature in all the vessels of this line, and while it is rich there is nothing gaudy or over-elaborate. The saloon has the generous proportions of 64 feet in width by 84 feet in length. It has a seating accommodation of 350 . The opening in the ceiling under the glass dome is 21 fee square, and the four sides between the pendentive contain allegorical figures that represent respectively Great Britain, America, New York, and Liverpool The library is an exceedingly picturesque room, mea suring 53 feet in length by 40 feet wide, with a height of 9 feet 6 inches from floor to ceiling. An excellent effect has been secured in this room in breaking away from the long, straight sides and forming nooks and recesses. We cannot attempt to enter any further into a detailed description of the passenger accommodation on this fine vessel. It is sufficient to say that her vast size and weight insure a degree of spacious comfor and steadiness of movement which have never before been realized in ocean travel. The total cost of the vessel was five million dollars.
In conclusion we must confess that, contrary to our expectations, the "Oceanic," on a near inspection, looks every inch of her great size. There is a sense of roominess and steadiness both above and below decks far in excess of anything experienced on other large ships, and her behavior in a seaway on the passage over was up to and beyond expectations.

## A NOVEL MENU CARD

One of the most curious menu cards on record was nsed by the Patent Law Class of 1899 of Columbian University, Washington; D. C. By the courtesy of on of those who were fortunate enough to partake of


## MENU CARD SIMULATING A PATENT

the repast, we are enabled to present our readers with a reproduction of this interasting menu card, whic simulates a United States patent issued for one day. We are pleased to note that the "ingredients are to be taken separately, in reasonable proportions," and that they are to be "seasoned with wit and good humor and accompanied by speech and song." Of course din ners are very much alike and we do not doubt that the ners are very much alike and we do not doubt that the
statement of the "invention" that "it will be found that when used as described, our invention will surpass in efficiency all previous attempts to produce a similar unction" will at once be challenged. This question will never be decided without recourse to the Court of Apleals of bon vivants.
The patent was supposed to be issued for the term of one day, and it will probably not be reissued unless some satisfactory grounds can be given, such as failur to produce the desired effect as specified in the pre amble.

The Reduction of Prints as Contrasted with he Reduction of Negatives.
The August issue of the Photographische Rund schau contains a long article by Herr Janko on the re duction of prints, the essential feature of this article being a useful contrasting of the conditions unde which negatives and prints may be treated with advantage. In the first place, there must be a clear understanding as to the difference between true reduc tion and the mere removal of a general veil or fog, the latter operation being of special importance in rela tion to prints, as an amount of veil which may be o no practical importance in the case of a negative will
sometimes ruin a print, as by reflected light a slight veil may completely mask a vigorous or fully gradated print. Further, a consideration of this subject will show that reducers which are excellent in the case of negatives may be useless for slightly veiled prints. The persulphate of ammonium is a case in point, as it does not sufficiently attack the faint deposit. Farmer's ferricyanide reducer, as also cupric chloride ferric ferloride, and cupric brouide, are escellent for or vil chloride, and cupric bromide, are excellent fog or veil removers in the case of negatives, but when used ior prints are subject to the disadvantage that the faintest deposits of silver which remain take a yellowish tone, and sometimes the whole surface of the paper takes a yellowish tint. The general yellow tint which often arises when Farmer's reducer is used for prints may be removed by a sodium sulphite bath or by Belitski's alum and hydrochloric acid bath, but neither of these will remove the yellowish tint of the faint gradations of the true silver image. A fog eliminating reducer not subject to this disadvantage is prepared as follows: Stock solution-Water, 100 parts ; iodide of potassium, 10 parts ; iodine, 1 part. From 2 to 5 c. c. of this liquid are added to $100 \mathrm{c} . \mathrm{c}$. of water, and the positive print is immersed, when the fainter deposits become rapidly converted into silver iodide, and this salt must be removed by a hyposulphite bath, a 10 per cent strength being convenient. Ordinary papers are frequently sized with starch, and this will cause a general blue coloration, but this blue coloration disappears in the hyposulphite bath. Still, the blue coloration is an inconvenience, as it renders it difficult to judge of the progress of the reduction; hence, a more convenient all-round fog-removing reducer for prints is the following: Saturated solution of alum, 50 parts; 4 per cent thiocarbawide solution, 50 parts; glacial acetic acid, 1 part. The print being immersed in this bath, the dish is rocked until the reduction has sufficiently progressed, after which the print is washed.-Amateur Photorrapher.

## The Camphor Barometer

A recent number of the weekly bulletin of questions and answers, published by the secretary of the French Association for the Advancement of Science, submits the following problem says The Monthly Weather Review
How can we explain the formation of clouds, threads, and crystals that are produced in the so-called chemical or camphor barometer, which consists of a solution in alcohol of equal parts of three substances, the nitrate of potash, camphor, the hydrochlorate of ammonia, if the glass tube that contains this solution is hermetically sealed, and the variations of tem perature to which it is subjected have no influence on the phenomenon?
This form of barometer is found everywhere in English-speaking countries under the names of "the farmers' weather glass," "the domestic barometer," or some other equally misleading title. In some forms that the editor has tested, there is scarcely any apparent change in the clearness of the liquid, year after year. In other instruments, the crystals of camphor assume different forms, from day to day, which are certainly very interesting to observe and study but have nothing to do with the weather and storms, and haven loss than one with the surre, and perature. To ihe mat perature. To the meteorologist and farmer. these
instruments have no value, but to the student of molecular physics, they are well worth an investigation.

The gas in the space above the liquid being a mixture of air and vapor of alcohol exerts a very variable pressure upon the liquid below ; the latter is saturated with the three chemicals above mentioned, but as its temperature and pressure vary, it alternately rejects and absorbs a slight surplus of camphor. The rapidity with which this change takes place appears to decide the question as to the crystalline or fibrous structure of the visible cloud. Nearly all the changes in the appearance of the camphor cloud seem to depend upon the rate at which the changes of temperature take place, and the time that is given to the solid to collect into larger crystals and settle to the bottom or rise to the top, according to the relative density of different parts of the liquid. The ascending and descending currents going on within the liquid are slow and barely appreciable, but must have an effect upon its cloudy appearance.

THE projected ship canal from Georgian Bay to Montreal would mean the saving of 725 miles in the transportation of grain from Chicago to Liverpool all but 29 miles is open river and lake waters.

## September 23, 1899.

ฐrivntific Ancricam.
THE "SHAMROCK" DISABLED
A few weeks ago we presented an iliustration show ing the "Columbia" disabled off Newport during one of her tuning-up trials; and now it is the "Shamrock" that serves to "point a moral and adorn a tale." We suggested at the time of the "Columbia" mishap tha in his desire to save weight aloft Herreshoff had prob ably ventured nearer to the limit of safety than was justified by the few seconds of time or fractional in crease of speed secured thereby. "Columbia's" broken mast, however was taken out and repaired in the Bristol shops, additional diaphragus and longitudinal stiffeners no doubt having been inserted at the poin where it buckled. Let us at least hope so, for it would be a pitiful ending to all these months of preparation f the races should be won through the carrying away of spars or any other fortuitous causes.
The breakdown of the "Shamrock" happened on the very first trial of her new and large mainsail. At the time of the "Britannia" races, Sir Thomas Lipton stated that "Shamrock" was not carrying her full can vas, and promised a "surprise" when her racing can vas was spread in American waters. The "surprise" came when the 103 -foot boom was unshipped and an immense spar of nickel steel, whose length is supposed to be 111 feet, was shipped in its place, the gaff being replaced by a hollow nickel-steel gaff of duly increased proportions. The new mainsail, unlike the first, had the cloths running from luff to each, a type of sail which Ratsey the sailmaker said his firm had experimented with half a century ago and found wanting. Evidently he has discovered some positiv advantages in the system, fo here the sail was, with it loths running square, instead of parallel with the leach or atter edge of the sail. Th object aimed at is to reduce the friction of the wind as it slides past the sail when the boat is close-hauled or on a close reach.
The "Shamrock" had just tarted in a light eight-knot breeze for a ten-mile ru down the wind, with main boom swung to starboard and spinnaker set to port, when suddenly the hollow gaf buckled and bent into sharp angle at the point where it was bearing agains the shrouds. The peak at once dropped and allowed th mainsail to fall into the posi tion shown in our engraving the clubtopsail remaining aloft and assisting to give the yacht her curious and truly original appearance
The accident illustrates a fact which is well known to bridge builders and all who have to do with framed struc tures involving the use of hollow built up members namely, that a hollow meta post or strut which is subjec o great compressive strain
as in the case of a hollow gaff) will give way very quicky if a comparatively small bending strain be brought upon it. The enormous strain put upon a gaff by the pull of the peak halliards is largely resolved into a compression strain along the axis of the gaff, which accumulates in that portion of the gaff between the jaws and innermost point of attachment of the halliards. In running before the wind a bending strain was brought upon the gaff by its bringing up against the shrouds and spreader, with the result that it bent over ike a boy's tin horn. That the accident should have happened in a light, eight-knot breeze suggests that in the matter of lightness of construction Fife has outheroded Herod, and makes one ask what will become of these spars in a blow. Solid wooden spars will give and bend before they break and afford some evidence that they are being strained to the breaking point, but there is no such ample warning in these hollow and largely unstiffened shells which do duty for spars in the modern racing machine. The experience of this season's cup races suggests that for topmast, gaff, and clubtopsail yards there is nothing to surpass a sound wooden spar.

A FEw years ago a western railroad planted 600 acres of land with trees, with the idea of growing timber for railway ties and telegraph poles. The trees have made gool growth. hut are not quite ready for use as poles, and some of the trees are now being cut out and made into fence posts in order to thin the forest.


## "SHAMROCE" DISABLED.

to be. The next point for consideration, and it is a very important one, is the exposure, which is the one unknown quantity. Unfortunately, no hard and fast rule can be laid down to indicate what the correct exposure is, because it depends on so many factors, viz. the density of the negative, the degree of enlargement, the focal length of the lens, the intensity of the light the sensitiveness of the bromide paper, and the size of the stop used. With reference to the second and ourth of these factors, must be borne in mind the ule that the intensity of the light varies inversely a he square of the distance from the source of light. But in practice this is comparatively simple and easy A little experience with negatives of his own mak ing will soon indicate to the worker the approxim ate exposure, and then by means of trial slips, pinned diagonally across the picture, so as to embrace, as far as possible, all the gradations, and exposing these slip or different times, say ten, twenty, forty, and eight seconds, and developing the slips, it will soon be seen which of these times is the correct one. Indication will also be given as to whether any part of the nega tive requires shading, masking, etc., so as to stop ex posure of certain parts, allowing a longer exposure to ther parts. Of course this ean only be done when he imare is prit cann onto be don cannot be done
the enlar pext developer
uite quite so amenable to development, as a compensatio to errors of exposure, as are dry plates. Another thing

It was quite a shock to me a few days ago-the be ginning of August-to see the fall styles displayed in the windows of the dry goods stores. But so it is, sum mer is melting into autumn, and long evenings ar coming. This means for many of us artificial light to work by, and a few remarks on bromide enlarging may be useful. For some of the hints which 1 give am indebted to Mr. J. H. Baldock. The choice of the lens to be used is a matter usually decided by taking the lens which made the negative. This is a rour and ready rule, and one easily remembered. But if a wide-angle lens has taken the negative, it may be neces sary to use a longer focus lens for the enlargement ; it might be a good rule to have the focal length of the lens at least the diagonal of the enlargement. For light daylight is, of course, cheapest ; and on a clear day with no clouds it is perhaps the best.

Illumination should be from the north or northeast and a reflector placed at an angle of $45^{\circ}$ should be used. Of course, care must be taken that the reflector is turned against clear sky-there must be no branche or buildings to interfere with even illumination. The distance between the negative and the lens, and the lens and sensitive bromide paper, will depend upon two things. i. e., the focal length of the lens to be employed, and the number of times the enlargement has
too, is that more light may be used with bromide paper than with dry plates; consequently, its develop. ment can be carried on with greater safety and comfort in working. There is a good choice of developers, bat pyro cannot be used, on account of its liability to stain. I do not altogether recommend hydroquinone alone, though in conjunction with metol it forms a capital developer. Ferrous oxalate has always been a favorite, and is still largely used ; but it is no good for under-exposed prints, and it requires the use of an acid fixing bath. With proper exposures it gives a brilliant, plucky, clear black image. Two good developerss are amidol and metol, either of which gives good black tones; they are easy to use, clean, nonstaining, and can be used more than once. Amidol is used with pure and good sodium sulphite alone, while metol requires sodium carbonate in addition; either requires about two grains of potassium bromide to each ounce of developer. Should it be found that some parts of the print do not develop up by the time the rest of the picture is well out, pour off the developer, wash the print (with acid water if iron is being used), and then by means of a brush, or the tip of the finger, locally develop those parts which lag behind. In the case of clouds, tilt the dish, pour in a little developer, and try, by means of local work, to get detail in the sky. Finally, give the print or prints a good rinse, and fix them for about twenty minutes in the acid fixing bath, and then wash thoroughly for about two hours.

Next comes the question of clouds. If in a small picture the lack of clouds may sometimes prove fatal - and the introduction of clouds is es sential-how much more ne cessary is it in the case of an enlargement, in which nothing looks worse than a vast expanse of white paper, sup posed to represent the sky Proceed as follows: Throw the image on an easel, and roughly cut out a cardboard mask, following the horizon line fairly correctly, but if trees or a church spire pro ject into the sky, these may, as a rule, be disregarded, as they will print overthe clouds. Having done this, select a cloud negative, soft and with not too pronounced effect, lighted from the same direc tion as the landscape, place it in the lantern, cap the lens, and make a trial exposure having done this, pin up the enlargement paper, and make the necessary exposure on it, shielding the landscape portion with the already prepared mask. which must be kept moving, and as near the lens as possible. To soften the effect, and prevent the formation of a hard line, recap the lens, remove the cloud negative, and replace it by the landscape negative, the exposure necessary for which has been previously ascertained; uncap the lens and give this exposure, recap, remove bromide paper and develop. You will probably find that a certain amount of local development has to be resorted to here.

There is sometimes a difficulty in mounting large bromide prints. When the print is pasted over it begins to curl, and when it is dry on the mount.the whole thing cockles. I lay the mount on a table face downward and well dampen its back with a sponge. Then I lay the back of the print on the back of the mount and put them under slight pressure for a minute or two. This moistens the print just enough to let it lie limp when pasted, and the dampness of the back of the mount will counteract the strain of the paper in drying, and so the whole will dry flat.-Thomas Wood in Wilson's Photographic Magazine.

Some of our Western railroads have been using weed burners to protect their tracks. One worked over 90 miles of track last year at a cost of $\$ 2.35$ per mile. The speed is very slow, being orily $11 / 2$ miles an hour, and a barrel of oil is used for each mile. Compressed air is forced through the oil, forming a vapor which is ignited. This vapor is kept close to the track bv a shield over it. The intense heat burns the weeds be tween the rails. Once at work, the shield is lowered within four inches of the rail, and when not in use it is raised to eighteen inches above the rail.

A complete treatment of this subject is to be found in a work by Rebierre, "Les Femmes dans la Science," a second edition of which has just been published in Paris. In this edition Mr. Rebière has arranged in alphabetical order the names of all women who hav publicly engaged in scientific work. From a brie resume of this work by Senator Paolo Mantegazza, in Nuova Antologia (Rome), which The Literary (Digest translates, we take the following data:
Maria Agnesi, at least for the Italians, is the most illustrious among women scientists. It was she who was called the oracle of seven languages. She was born in 1718 of noble parents. Among the letters of De Brosses we find the following description of a visit made by him to Agnesi : I entered into a grand and beautiful apartment, where I found thirty persons of all European nationalities in a circle about Signora Agnesi, who was seated under a canopy with her sister She is a girl of eighteen or twenty years of age, neithe plain nor beautiful, with a very sweet and simple air The Count Bellini addressed a discourse in Latin t her, to which she responded with great vigor, continu ing the discussion with him in the same language She wrote a work on the theme that algebra and geometry are the only provinces of thought in which peace reigns. This was in two voiumes, dedicated to Maria Theresa, and cost her ten years of work. It was for this that Pope Benedictus rewarded her by the gift of a rosary made of gems and a gold medal Later he also called her as professor of mathematic to the University of Bologna. She afterward becam a nun and died on the field of battle-that is, in her dear hospital-at the age of 81
In 375, to Theon, professor of science in the cele brated school of Alexandria, a daughter was born This was the distinguished Hypatia. It seems that in her early youth she went to Athens, where she at tended the lessons of Plutarch the younger and his daughter, Asclepigena, who together directed the philosophical school. Leaving her country as a pupil, she returned as master, and the magistrates of Alex andria invited her to lecture in public. Later sh taught mathematics and philosophy. She also taugh geometry, algebra, astronomy, and several invention are attributed to her, as the aerometer, planisphere astrolabe, and the alembic. Her works were lost, bu the historians attribute to her a commentary on the "Treatise on Conic Sections," by Apollonius; a com mentary on the Arithmetic of Diophantus--the firs algebraic works known; and an astronomical rule. No other woman has had greater glory. Beautiful eloquent, with a voice which was called divine; honor ed, admired by all, Hypatia had many celebrated dis ciples, among them Synesius, who called her "my benefactress, my sister, my wother." After the mos uminous glory came the inost ferocious torture. At that time Alexandria was torn by religious strife, and three rival religions contested the ground-Judaism Paganism and Christianity. In 415 she was dragged from her cart into the church of Cæsar, where she was stoned to death; then the poor limbs, lacerated and bleeding, were taken to Cinaron, the place of torture, where they were burned. We have no portrait of Hypatia hut all of us can imagine her with the luminous halo of wartyr to science.
Besides these two great stars, Hypatia and Agnesi we can introduce a number of minor planets, all of whom revolved in the great heaven of mathematical and astronomical science. To Margaret Bryan, an English astronomer of the beginning of our century, we owe several works on astronomy, hydrostatics, etc.
Miss Clark is our contemporary. She was born in the south of Ireland, and is author of a "Popular History of Astronomy in the Nineteenth Century," which has already passed through several editions, and other astronomical works.
Maria Cunitz (1610-64), of Silesia, through her astronomical works published in 1650 , merits her title of "the second Hypatia."
Sofia Germain, born at Paris in 1776 , was said by Biot to be "probably the person of her sex who has nost deeply penetrated into mathematics."
Caroline Herschel, sister of the great astronomer, passed entire nights with him observing the stars, aiding him most efficiently, and herself discovering comets. She died at the age of 98 , in 1848.
Maria Margaret Kirch, born Winkelman (1660-1720), the wife of the astronomer, continued his work after his death, studying the skies. She published an important work on the conjunction of Jupiter and Satarn which took place in 1713.
Another illustrious woman astronomer is Dorothea Klumpke, born at San Francisco, who, after a splendid examination at the Sorbonne, became chief of the bureau for the photographic catalogue of the stars. She is a worthy rival of the celebrated Sofia Kowalevski, born at Moscow in 1853, who was the author of several famous mathematical works, made important discoveries in the science of the calculus, and was professor in the University of Stockholm, where she died in 1891.
Madame Lepante, the Greek astronomer, calculated
the annular eclipse of the sun which took place in 1764, for entire Europe. It was a woman, a Miss Maury, to whom we are indebted for the discovery of the periodic revolution of some of the fixed stars, observed by her for the first time in the observatory of Harvard College. Maria Whitney was the pupil of the great astronomer, Maria Mitchell. The latter was born in the island of Nantucket, and at the age of 29 had already discovered a new comet. In honor of this discovery the King of Denmark sent her a gold medal and her admirers gave her a magnificent telescope. At the age of 47 she was called to the chair of astronomy at Vassar College, where she afterward became director of the observatory. She died in 1889
Among the professors at Bryn Mawr College we find Carlotta Angas Scot, born at Lincoln, England, in 1858, who is one of the best living mathematicians.
Everybody has heard of Maria Somerville, who died at Naples in 1872 at the age of 92 . Lord Brougham, wishing to render popular that great work by Laplace, "Mécanique Céleste," which was in five volumes, requested Miss Somerville to place this in accessible form. "The Mechanism of the Heavens" appeared in 1831, and was such a perfect work that Herschel is said to have read it with admiration, and only regretted that Laplace no longer lived to admire it. Miss Somer ville not only occupied herself with astronomy, but with physical science. Among other works she published a physical geography, which was translated into many languages and ran through many editions. Serene, tranquil, happy, it is said that she never stu died more than two hours a day, and to this fact is as cribed her long life of almost a century
In addition to those already mentioned, Senator Mantegazza calls attention to Laura Bassi, of Bologna (1711-73) ; Saint Hildegond (1100-86) ; Sofia Pereyaslaw zewa, celebrated for her original observations in com parative anatomy; the French anthropologist, Clém ence Royer, and others.

Some Drawbacks to the Use of Acetylene.
While coal gas has had to struggle for a whole century before becoming the almost universal lighting agent, its rival, acetylene, has already-after only a short time-achieved a certain success. Of course acetylene is not a newly discovered body, but it is only since the economic production of carbide of calcium that it has become practicable as a lighting agent

Theoretically the production of acetylene is a very simple matter, but such is not the case practically.
Carbide of calcium, as is well known, is a black, crys talline, very hard material, not decomposed by heat, but easily decomposed by water into acetylene and lime. It has a density of $2 \cdot 2$, and it is not soluble either in petroleum or in benzine.
Concentrated acids have no action on it.
Acetylene consists of a colorless gas, with a penetrat ing odor of garlic. Its density is $0 \cdot 1: 1$ liter of acety lene weighs $1 \cdot 16$ grammes. It is easily soluble in water, and can be liquefied at $0^{\circ}$ under a pressure of 48 atmo spheres. In this state it is very explosive. It burns with a white flame, without a dark cone; the tempera ture of this flame is lower than that of coal gas.
Unfortunately, lighting by acetylene still presents numerous difficulties, to which I am desirous of calling the attention of specialists and others, now that I have had the opportunity of examining the installation which supplies the town of Veszprim in Hungary.
Let us first consider the carbide, the source of all the trouble. This body is never pure, but always contain at least 20 per cent of impurities. Theoretically, 64 parts by weight of carbide should give 26 parts of acetylene, that is to say, that 1,000 grammes of carbide ought to produce $406 \cdot 25$ grammes of acetylene; and, as 1 liter of this gas weighs $1 \cdot 16$ grammes, we ought to get 350 liters. But the Continental factories will not guarantee a return of moro than 300 liters, and practi cal experience shows that wo can hardly depend on more than 280 to 290 liters. It is true that the estima ion of the return is not free frow causes of error, in asmuch as during the weighing the carbide absorbs a certain amount of moisturc from the atmosphere; this causes a loss of acetylene, but the small errors which result, when calculated on 1,000 grammes of material are multiplied in proportion. We are obliged to wor with small quantities, seeing that only 100 grammes of naterial give off 30 liters of gas, and it is difficult to arrange graduated gas-holders to store such large quantities. Further, the carbide is so little homo geneous that several samples must be tested and ex amined in order to obtain a mean value. If, on the other hand, we only take 10 grammes, the error result ing from the disengagement of acetylene in the air will be multiplied one hundred times if the results ar calculated, as they should be, on 1,000 grammes. I have examined the manner in which the carbide be haves in the presence of acids, and I found that con centrated sulphuric acid has no action on this body but, no matter how little water the acid may contain bubbles of gas are formed until the whole of the water is consumed. This property of the carbide of not being attacked by concentrated sulphuric acid enables
us to estimate its producing power of acetylene. I have made several experiments in this direction, and the results obtained were fairly correct and concordant.
I must here again mention that the carbide contains sulphur, phosphorus and nitrogen, from which it re sults that the acetylene will be contaminated with sulphureted hydrogen, phosphureted hydrogen and ammonia. The acetylene must, therefore, be purified to the same extent as is coal gas, for fear that its us in closed places might cause serious accidents.
But the greatest drawback of all is that acetylene burns with a smoky flame. Certainly the flame does not smoke at first, but after 200 or 300 hours smoke begins to be formed. This is caused by the burners attaining a temperature higher than that of the decomposition of the acetylene, and thus the gas is decomposed into carbon and hydrogen.
I have also noticed a very curious phenomenon in the gas pipes. I there found a deposit of finely divided carbon, like soot. I also found a very remarkable liquid condensation, consisting of carbides of hydrogen. These bodies are also formed in the generators, whence the necessity of using siphons. We thus see that it is quite erroneous to imagine that acetylene does not require purifying
There is still another inconvenience resulting from impurities contained in acetylene. It is by no means uncommon to see, in a closed place, a sort of fog fill the room after a longer or shorter interval. What is the cause of this phenomenon? The acetylene is decomposed in the burner, the carbon is deposited while the hydrogen burns, giving rise to the formation of watery vapor: and it is this, in conjunction with the ammonia, the sulphureted hydrogen and the phosphureted hydrogen, which produces the fog, causing headache and nausea.-Chem. Zeitung, 1898, p. 174.

## The Climate Adapted to Tobacco.

In the report of the Virginia section for May, Mr. E. A. Evans, section director, gives a summary of our knowledge of the soil and climate adapted to raising tobacco. So far as climate is concerned, tobacco rais ing is profitable over a very wide extent of territory throughout the world. The range of climate that is found in the United States by no means exhausts the adaptability of the plant; in fact, with tobacco it is as much a question of soil as of climate. The climatic peculiarities of the regions in which the best tobacen is grown are not especially dwelt upon by Mr. Evans, but would make an interesting subject for study. The cultivated plant is evidently more susceptibleto weaiher than the native tobacco of Virginia, and is, probably, the descendant of some variety imported by the early settlers, so that both soil and climate must be adapted to it. In general, the agriculturist labors to overcome the natural climate of any spot, and his resulting crop represents not the plant, or the soil, or the climate, but the intelligence of the skilled labor.

We hardly know how one should proceed in order to obtain botanical or agricultural material for a fair comparison between different climates as to their effect upon any given plant. The question of the relation between climate and crop belongs to the division of soils even more than to the Weather Bureau, since the meteorological climate must be considered in connection with the underground conditions. The roots have one climate, the leaves and the fruit have an other; the crop results from a combination of both with a very large admixture of agricultural skill.Monthly Weather Review.

The Current supplement
The current Supplement, No. 1238, contains many articles of great interest. "The East India Village in the Vienna Zoological Gardens " is described end illus trated. "The Nature of Valence" is an important chemical article by F. P. Venable. "The Use of Acetylene Gas for Street Cars, Street Lamps and for Automobiles" is described and illustrated. "Pulque, Mexico's National Drink," is an illuatrated article. "Zoological Discoveries in Carthage" is the continuation of an article begun last week and describes the Punic necropolis. "Outlinc History of Brick Making" contains many curious facts. The "Blake," the first large cruiser of the British navy, is fuliy illustrated by sectional views. "Russia's Great Naval Enterprise" is an elaborate article. "The Catalogue of Science" gives particulars of the new schemes which are being made for an international catalogue of all scientific literature.


RECENTLY PATENTED INVENTIONS

## Agricultural Implements.

Straw-stacker.-Herman Stein, Georgetown, Miun. This straw-stacker can be applied to any thrash-ing-machine, and is so constructed that a current of ai drawn from the outside of the stacker will be directed
beneath the falling chaff and straw, thus facilltating th passage of the chaff and straw through the flue connected with the receiving-chamber and out through a chute connected with the flue. The chute is adjustable directs the straw and chaff.
machine for cleaning grain. - norton Rooker, Agency, Mo. The machine is of the robulky refuse from the tail end and to deliver the smalle seed and dust to a chute at the exterior of the reel int which the grain is fed, the good grain being retained in the reel and delivered automatically to outlets from whence it may be conducter to any desired poinc struction of the apparatue so that its operation will b accompanied by no exceesive friction.

Electrical Apparatus
AUTOMATIC CODE TELEGRAPH FIRE-ALAKM ars invertion is esentially concerned with the teating of the circuits upon which automatic fire-alarm instruments are installed, the purpose being to enable the whole of the alarm mechaniens upon the same circuit - circuit at the fre bengomentariy closing a test spection of the seve-engine station, so that personal inspection of the several installations is unnecessary
The test may be repeated at such frequent intervals a insure immediate detection of any injury to the ci cuits or instruments.

## Mechanical Devices.

Log-Sawing machine.-Samuel W. Butterield, Three Rivers, Canada. The machine is provided with a feeding device for the log and with a lever
mounted to swing up and down under the control of the operator. In the free end of the lever a circular saw is journaled and adapted to pass transversel
of the feeding devices. The end of the log abuts againe movable stop and is actuated from the lever a mov ble block-kicker is normally held in a locked positio nd out of engagement with the front end of the log he kicker being automatically unlocked by the lever bout the time the saw has passed through the log and the stop has been withdrawn to allow the kicker to mo the cut-off block from the feeding device.
CYCLOMETER-JAMEs E. BEAN, Fond du Lac vo. The cyclomber of miles traveled during the seaso nd the number of miles of the individual trips mad the time. The mechanism comprises independent set of numeral-wheels and a star-wheel adapted to be drive from the bicycle-wheel. The cyclometer is provided with a shaft carrying two pinions, each geared with a et of numeral-wheels. A worm engages one of the gear-wheels of
the star-wheel.
automatic dead-latch lock.-W.G. Raines 48 West 12 th Street, Manhattan, New York city. In which drops hehind is customary to provide a dete its withdrawal atter the door is closed, except by a key. This invention provides a peculiar construction and arrangement of the parts of a lock of this kind, which may be set into operative engagement by the departing person, thus rendering the locking-detent yet permitting the door to be opened with a latch-key.

## Railway-Appliances.

Rail-Joint.-German L. Baxter. Lexington, Ky ject of this invention to provide means for supporting the joint at the ends of the rails and to bind displaced, thus preventing the shock due to dropping of he joints. Thus preventing the shock due to dropping on and is provided with a cross-bar which engages the nnder sides of the rails.

## Miscellaneous Inventions.

 Thill-coupling. - George W. Davis, Gilsum, N. H. The inventor has so constructed his thill-coup-ling that when the draft-animal is removed, the thills ing that when the draft-animal is removed, the thills
will be automatically carried up to a position of rest. The coupling permits the thills or shafts to be readily The coupling permits the thills or shafts to be readily
removed and replaced whenever necessary, and possesses the merit of being noiseless under all conditions of travel. ACETYLENE-GAS GRNERATOR.-Arthur Rief FEL, Boulvard Exelmane 42. Paris, France. In this ap-
paratus for the automatic production of acetvlene gas, paratus for the automatic production of acetylene gas,
the column of feed-water for the gas-generating part of the apparatus is kept very much at the same height generator, and the water is fed i the consumption, by means of $-a$ deviee which relieves the bell-shaped top of the gasometer when it descends and weights it when ascending, so that the top exercises on the gas a pressure which is inferior or superior to the load in the feed-water column
bottle-closure. - William d. Kllbourn, Pueblo, Colo. The closure is designed particularly for bottles containing liquid under pressure, and comprises a hollow expansible stopper in which a plunger moves, which arms extend having teeth and engaged by a clamp ing-ring. The closure is tightly held in place and hermetically seals the neck
blind-Fastener.-Edward Hughes, New Bedfor, Mass. This fastener is designed to be attached to a building so that the latch carried by the ehutter will automatically effect a locking engagement therewith. The fastener will automatically exert tension between itself and
the blind, when the blind is to be locked to a wall, thus preventing accidetal closure The fastener is provided with more than one keeper for the blind latch, thus en abling it to be used even should one keeper break.

LOCKING DEVICE.- Hoses M. Godrrey, Lovell,
Wyo. The present invention provides a locking device
or Tor use on singletrees, doubletrees, cockeyes, cranks and
the like. The locking device has two parts, one of whe like. The locking device has two parts, one on outer lug, and the other of which is provided with ore grooved to permit the passage of the shank. On to rest against in order to limit the turning of the shank in the bore.
HAND-SHIELD.-Melville F. Barth, Indianapois. Ind. This hand-shield is designed to protect the earer's hands while engaged in outaoor work or amuse enis, particularly in riding the bicycle. The shiel aay be manufactured of thin leather, silk fabric, canmands of the trade graded sizes are to be furnished to fit upon the hands of men, youths, or women.
garment-supporter.-William W. Carder, diown, Md. The supporter is especially adapted fo results to thick and to thin garments. The device ight and strong, is so constructed that the weight of the carment when the supporter is hung up will tend to in The hauger will remain in a fully open position until inhe hanger closed.
umbrella.-Elisa a. and Edward de biagei anhattan, New York city. The invention pro ides a means for preventing umbrellas from turning contact with other objects while in use. The um brella has a handle or stem on which a crown is r atable provided with longitudinal slots in its upper porfon. A cover is fastened to the crown; and upon ans engaging the slots of the crown. A bell surround he slotted upper portion of the crown, engages the
washer, and is prevented from moving longitudinally.
amusement device.-George C. Tilyou and Jean M. A. Lacomme, Coney Island, Brooklyn, Nen
York city. The object of the invention is to attract an muse people by the novelty of the sensations produce y the use of the device. The apparatus consists essen-
tially of two concentric cylinders, the inner one being provided with seats and pivotally supported upon haft, so that it will remain in approximately the same position at all times, the center of gravity being belo he shaft and the outer cylinder being mounted to turn
bout the inner cylinder. The device is provided wit nechanism by which the seats within the inner cylinde given vertic
MANUFACTURE OF MANTLES OR INCANDES ING ELEMENTS FOR GAS-BURNERS.- ОTTO HeInze, Baerimore, Ma. The inventor has devised rendered indestructible without impairing their illum ating quality, are rendered flexible and firm after igniion, and are prevented from shrinking when in use he inventor thinly coats the surface of the refractor with a vitrew he mantle or element is compose use the coating with the refractory porous mass of the mantle or elemen
retouching-Frame. - John n. Choate, Carsle, Pa. A novel effect can be produced in retouching tive itself instead of to the retouching-pencil or the hand of the retoucher. The present invention provide an apparatus for this purpose, comprising a frame and clamp adapted to support the negative out of conta with the adjacent portions of the frame. A hammer is hereto and to the negative independently of the
hunting-Knife.-William J. Shelton, Colum , Tex. It is the object of this invention to provide nnife with which a wire-cutter is connected, so as render the knife nseful in cutting through wire fences. The blade is formed with a recess in which a lever is ever and blade, cutting-disks are secured having cutting recesses. In cutting wire, the knife is placed with the
cutting-edges of the disks embracing the wire; and the wire. When one set of cutring edges becomes dull another set may be brought into register with the proper recesses.

## Designe

drainer.- Courtland haynes, Hawesville, K The leading feature of the design is found in the espe ial shape of the drainer, in which the bottom is in the same horizoncal plane troughout and the back is nd straight from the back to a point near the front from which point the sides gradually converge and meet a straight line defining the front of the drainer
plate.-August A. Grametbaur, Manhattan, New York city. The plate has a central panel containing picture of Admiral Dewey. Surrounding the central panel are portraits of the commanders of the Manila squadron. The outer border of the piate contains pic , Lap-robe.- Magaie B. Showen, Macon, Mo. The ed portions flaring outwardly.
spoon. - William a. Rayment, Taunton, Masb Two designs for a spoon have been issued to this inback and under and has its extremity lapped against the inner side of the handle, near the juncture of the latter with the bowl. In the other design the hande is curve to return upon itself. with its free end lying below the apper portion of the handle and detachuil therefrom and

SPOON. - William Mcausland. Taunton, Maes. down, the portion below by a handle returned or ben down, the
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