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Contents.

(Illustrated articles are marked with an asterisk.)

Acetylene explosions, 90
Archeological news, 87
Arid regions, temperature of, 87
Bridge, a third East River, 83
Cableway car, Richardson's, 84
Cathod rays, action of, 85
Civil engineers' meeting, 83
Commerce on the great lakes, 83
Cosmetics, a variety of, 90
Croton dam, the new, 81
Cruiser, Japanese, launched, 83
Duell, Hon. Charles H., 89
Electricity on London underground roads, 82
Electric motor, the Sprague, 82
Electric third rail system, Germany, 82
Engine, rotary, Engberg's, 85
Exhibition, Dijon, France, 86
Export trade, the iron and steel, 82
Fear, causes of, 86
Fireproofing fabrics, 90
Greeley, Judge A. P., 89
Heavens in February, 83
Inventions recently patented, 82
Lacquer, negative, 90
Lenses, cleaning, 90
Measuring pole, Hegarty's, 84
New York City water supply, 81
Odor mixture, 91
Ozone, production and applications of, 86
Patent decision on Sprague motor, 82
Patents granted, weekly record of, 93
Patents, the new commissioner of, 89
Petroleum fuel, 83
Phosphorus, preparation of, 85
Pistol, Nygren's magazine, 84
Pole and chimney problem, the, 87
Science notes, 86
Smoke and its prevention, 82
Soap to quiet waves, 87
Spider and the fly, the, 81
Steam, cost of, 1870-1897, 82
Sun's eclipse in India, 86
Timber, government tests of, 83
Tin plate industry, our, 82
Tire, Hamp's punctureproof, 84
Torpedo boats, United States, turbine for, 82
Venus, observations of, 85
Wage earners, Pullman, nativity of, 84
Weatherproof coating, 84
Willow culture in Europe, 91

TABLE OF CONTENTS OF Scientific American Supplement

No. 1153.

For the Week Ending February 5, 1898.

Price 10 cents. For sale by all newsdealers.

I. AGRICULTURE.—The Smithfield Club Show, 18424
II. ARCHAEOLOGY.—Archaeological Discoveries in Northern Africa, 18430
III. ARCHITECTURE.—Effect of Electric Currents on Adjacent and Surrounding Buildings, 18425
IV. ASTRONOMY.—Astronomical Photography with Photo-Micrographic Apparatus.—By A. CLIFFORD MERCER, 18433
V. AUTOCARS.—Condition of the Horseless Carriage Industry.—By C. E. CORRIGAN, 18425
VI. CIVIL ENGINEERING.—Model of a Wooden Bridge of a Single Span that May Reach a Length of One Hundred and Forty Feet.—A description of a curious old bridge of the eighteenth century.—1 illustration, 18424
VII. ELECTRICITY.—Electricity in Cotton Mills.—By W. B. SMITH WHALEY.—This article gives valuable data regarding electricity as a motive power in textile factories. Effect of Electric Currents on Adjacent and Surrounding Buildings, 18425
VIII. MATHEMATICS.—Pyramid Geometry, 18434
IX. MECHANICAL ENGINEERING.—Transmission of Motion by Flexible Wire.—1 illustration, 18424
X. MEDICINE AND HYGIENE.—How to Prevent Typhoid Fever in Rural Districts.—By HARVEY B. BASHORE, 18435
Some Questions Often Asked About Drinking Water and Their Answers.—By B. C. LOVELAND, 18435
XI. METEOROLOGY.—Rain Drops.—Their size and rate of fall, 18432
XII. MISCELLANEOUS.—The Dreyfus Trouble in Paris.—8 illustrations, 18428
Engineering Notes, 18427
Electrical Notes, 18427
Industrial Notes, 18434
Selected Formulas, 18427
Opening of the Sarcophagi of Voltaire and Rousseau.—A full illustration of the curious researches which have just been carried on in the Pantheon, Paris.—2 illustrations, 18430
XIII. NAVAL ARCHITECTURE.—Shipbuilding in Japan, 18422
XIV. PHOTOGRAPHY.—Astronomical Photography with Photo-Micrographic Apparatus, 18433
XV. POULTRY.—The Standard Breeds of Geese.—9 illustrations, 18432
XVI. TECHNOLOGY.—Optical Glass.—Almost important address by JOHN A. BRASHEAR, treating of the manufacture of flint glass, annealing glass, etc., 18422
XVII. TRAVEL AND EXPLORATION.—Prince Henry of Prussia and His Fleet.—A full account of the expedition of Prince Henry of Prussia to China, with illustrations of the fleet.—3 illustrations, 18421
A Drowned Continent.—By R. LYDEKKER, 18431
China of To-Day, 18429

STRIKING SUCCESS OF THE TIN-PLATE INDUSTRY IN THE UNITED STATES.

There is, perhaps, no industry in the history of the United States which has enjoyed such a rapid and uninterrupted growth as the manufacture of tin-plate. Each year has shown an increase over its predecessor in the number of mills in operation and in the total output, and the most gratifying feature of all is that the price of the tin-plate to the retail dealer has steadily declined since the year when its manufacture in this country was first fairly started.

Of these fifty firms, only one used foreign-made plates during a portion of one quarter, the amount being 57,208 pounds out of a total production by the firm for that quarter of 213,687 pounds. Compare this with the report of the previous year, when, of fifty-three firms reported as producing tin and terne plates, three used both American and foreign rolled sheets, with an aggregate output of 15,503,523 pounds, of which 4,226,523 pounds, or 27 per cent, was made from foreign rolled sheets.

ELECTRICITY TO REPLACE STEAM ON THE LONDON UNDERGROUND RAILWAYS.

At last, after nearly half a century of discomfort due to steam and gases from the locomotives, the two famous underground railways of London, known familiarly as the "Metropolitan" and the "District," are about to banish the steam locomotive altogether. It has been decided to use electric traction; and it is likely that the third rail system will be employed. Only those who have had the misfortune to travel on these lines can appreciate what a relief the proposed change will afford to the general London public and to the City business man in particular.

THE THIRD RAIL SYSTEM IN GERMANY.

Travelers by the Brooklyn Bridge cars will recognize familiar features in the description of a third rail electric system which is about to be installed in Germany. The line, which is about 7 1/2 miles in length, runs between Berlin and Zehlendorf. The conductor will consist of a third rail carried at the side of the track on wooden saddles which will themselves be bolted to the ends of the ties.

SMOKE AND ITS PREVENTION.

Experiments recently carried out at Sibley College to determine the physical features of smoke show that dense smoke from a furnace produces on an average from 10 to 12 pounds of soot to the ton of fuel used. About one-half of the former was carbon, and the remainder was chiefly made up of unburnt hydrocarbons, from 10 to 15 per cent of ash and 2 per cent of moisture. The figures just stated were obtained with a restricted air supply. Low temperature combustion and a restricted supply of oxygen are the most fruitful causes of smoke production.

near by means of the lever opened the doors for each shovelful and instead of shutting them abruptly drew them slowly together. He explained that he was "burning the smoke," and illustrated the fact by shutting the door quickly after a shovelful was thrown in, when dense volumes of smoke appeared at the smoke stack. This was an extreme case; but it serves to indicate the careful firing to which, no doubt, is due in large measure the economy of the British express locomotives, which burn only from 22 to 35 pounds of coal per mile according to the load hauled.

SPRAGUE MOTOR PATENT DECISION.

An important decision affecting the Sprague patent for a suspended railway motor has been given by Judge Wheeler, in the United States Circuit Court. It is well known that in the earlier attempts at electric traction the motors were either carried upon the car platforms or rigidly attached to the wheel trucks, connection with the driving axle being made by chain and sprocket or by friction wheels.

Frank J. Sprague patented a method of suspending the motors so that both they and the track would be relieved from shock and yet the motor would be always maintained in its proper relation to the axle. This was done by suspending one end of the field magnet of the motor on the axle and supporting the other end on springs, thereby causing the latter to move with a radial play around the driving wheel axle and permitting the use of gear wheels.

The Sprague Company was absorbed by the Edison Electric Company, and the latter was eventually absorbed by the General Electric Company. The present suit was brought by the General Electric against the Union Railway Company and the Walker Company, of Cleveland, on the ground that the latter were infringing upon the Sprague patent, and the present decision of Judge Wheeler sustains the plaintiff.

Commenting upon the decision, the Walker Company, who intend to carry the case to the Circuit Court of Appeals, state that they expect the patent to be overthrown, and believe that the use of the invention will be thrown open to the world.

The decision states that "the defendants' structures differed in some respect from those of the patent, but have all these parts" specified in the decision "working together in the same relation to each other for the same purpose and producing the same result."

COST OF STEAM IN 1870 AND 1897.

One of the best papers recently read before the American Society of Mechanical Engineers was presented by Mr. F. W. Dean, on the decrease in the cost of steam power between the years 1870 and 1897. This was shown to amount to nearly 40 per cent. Seventeen per cent of this is attributed to the use of multiple cylinder engines, steam jacketing, higher steam pressure and superheating the steam. Five per cent is due to the use of vertical engines, 7 per cent to improved boilers, 7 per cent to economy realized in heating the feed water, and 2 per cent is put down to the credit of improved construction of grates.

EXCELLENT CONDITION OF THE IRON AND STEEL EXPORT TRADE.

The present condition of the iron and steel export trade is very satisfying and full of promise. If the figures for the first ten months of the year are a criterion, the total exports for the year 1897 will amount to some 600,000 tons, valued at about \$13,000,000. The largest item was pig iron, of which we shipped in the first ten months 194,734 tons; the next was steel rails, 108,816 tons. The other most important exports in their order were steel ingots, billets, bars, etc., 59,633 tons; wire, 44,016 tons; scrap and old iron for remanufacture, 34,929 tons; and cut nails and spikes, 13,165 tons. Our steel rails and locomotives are being sold in Europe in successful competition with the local manufacturers, and in view of this fact it is needless to add that we are gathering in an increasing share of the foreign trade of the world, which was formerly exclusively controlled by Europe.

THE TURBINE FOR UNITED STATES TORPEDO BOATS.

We are pleased to note that the United States is not to be behindhand in the development of the steam turbine for naval purposes. The truly astonishing results obtained with the Turbinia have a significance which cannot be gainsaid. We do not predict that the turbine will revolutionize marine propulsion in general, but we are satisfied that for vessels up to a size yet to be determined, it is the coming motor. Commodore Melville, Engineer-in-Chief of the Navy, is about to make tests of an American design of turbine in the

propulsion of torpedo boats which is said to be free from the somewhat serious defect of the Parsons turbine. The latter can only run in the forward direction, and it has been necessary to install a separate motor to drive the ship astern, an obviously uneconomical arrangement. The new motor has a further advantage in its moderate speed—about 600 revolutions against 2,000 in the Parsons machine.

PETROLEUM FUEL.

It is also gratifying to learn that the experiments which the Bureau of Steam Engineering is carrying out in the Stiletto in the use of liquid fuel are meeting with complete success. The great advantages of liquid fuel are that it may be run into the bunkers or tanks by gravity, thus doing away with the tedious and costly loading by hand. It can be brought into the furnaces without handling, thus reducing the number of stokers, and it produces no ashes. A ton of oil, moreover, contains about twice as much heating power as a ton of coal, and hence the amount of fuel supply may be doubled without adding to the weight of the vessel. With a combination of liquid fuel and the turbine in the same vessel we may look for some great developments in the present government experiments.

A THIRD EAST RIVER SUSPENSION BRIDGE.

The new commissioner of bridges of New York strongly advocates the erection of another bridge across the East River. It is proposed to build a great suspension bridge which shall be used exclusively by the various railroad systems, both street and elevated. The site would be chosen with strict regard to the location of the various lines of railroad, so as to serve as a connecting line which would intersect them at the most convenient points.

The proposal is largely the outcome of the recent agitation for running elevated and surface roads across the existing New York and Brooklyn Bridge, and it is urged that the building of such a bridge is the only satisfactory solution of the railway traffic problem. More than one site has been suggested; but the two most favored lie between the present bridge and the new bridge now building about a mile further up the river, and just below the present bridge on a line between the New York and Brooklyn post offices.

GOVERNMENT TESTS OF TIMBER.

It is surprising that in these days, when the strength of all structural material is carefully determined, we should possess such imperfect knowledge of the strength of the various woods which are used in construction and manufacture. There is lacking to-day a thoroughly reliable table of the strength of woods. We say this with the full knowledge that all the text books and engineers' and mechanics' pocket books give such tables; but unfortunately the data upon which they are founded is not of that comprehensive or scientific kind which alone can give such tables their proper value. Most of the investigations of the strength of timber already made have been carried out by individuals who had neither the time nor the means to do the work as thoroughly as it should be done. The first investigation of the subject on an adequate scale is now being carried out by Dr. B. E. Fernow, of the Forestry Division of the Department of Agriculture. To examine and test a sufficient number of specimens of any given species is a costly undertaking; but the department has shown good judgment in preferring to expend its appropriations in doing thorough work on a limited number of species rather than in doing more or less superficial work upon a larger variety.

During the past year, owing to the failure of government to provide funds for carrying on this work, Dr. Fernow rented a testing machine with which to carry on his investigations. In the course of his work he made the important discovery that a constant mathematical relation exists between the compressive and the tensile tests of any species of timber, and that henceforth it will be sufficient to make a laboratory compressive test, the tensile strength being calculable from the data so obtained. Dr. Fernow gives the credit for this important discovery to Mr. S. F. Neely, one of his assistants. It is needless to say that the cost of completing the investigation of American woods will be greatly reduced, and it is to be hoped that Congress, encouraged by this fact, will grant the appropriations asked for the coming year's work.

JAPANESE CRUISER LAUNCHED AT CRAMPS' YARD.

Special importance attaches to the launch of the Japanese cruiser "Kasagi," at the Cramps' yard, Philadelphia, which took place on January 20. This is the first warship of the modern type to be built in this country for a foreign power, and if this should prove to be the forerunner of other foreign orders to follow, an important industry will be opened up which will go far to remove the stagnation which has settled upon many of our shipbuilding yards. At the time when the "Kasagi" was ordered a contract was made for a sister ship to be built at the Union Iron Works, San Francisco. This vessel was illustrated in the SCIENTIFIC

AMERICAN for July 3, 1897, and its launch will take place at an early date. The high character of the work which is being put into these vessels will speak for itself and establish our reputation with the various governments which purchase their warships abroad. The "Kasagi" is modeled on the lines of the fast and powerfully armed protected cruisers which have been built by Armstrong, of England, for the Japanese and other foreign navies. She is 396 feet long, with 49 feet of beam and a draught of 17 feet 9 inches, her displacement at this draught being 4,900 tons. She is to show a speed of 22½ knots. Her horse power is 17,000, and she will carry enough coal to cruise for 4,000 miles at 10 knots an hour. Her armament will be supplied from England, and will consist of two Armstrong 8-inch and ten Armstrong 4.7-inch rapid-fire guns. She will rely upon a protective deck and her coal bunkers for protection, the former being 1¼ inches thick on the flat portion and 4½ inches thick on the slope. The 8-inch rapid-fire guns have a speed of fire three times that of the old slow-firing type, so that these two guns alone would equal the six 8-inch guns carried on our own "New York," a ship of 8,000 tons displacement. As the energy of each shell from the "New York's" 8-inch guns is 7,498 foot-tons and that of the shells from the "Kasagi's" 8-inch guns is 10,662 foot-tons, we see what an enormous advantage is gained by the adoption of the rapid-fire system. In the present instance it brings the offensive power of a 4,900-ton ship up to and beyond that of an 8,000-ton ship. This comparison is an important commentary upon the urgent plea of Assistant Secretary of the Navy Roosevelt for the arming of our cruisers with guns of the rapid-fire type.

ANNUAL SESSION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The forty-fifth annual meeting of the American Society of Civil Engineers was begun in the new house of the society under the presidency of Benjamin H. Harrod. The membership of the society was announced as 2,079, the number of non-residents being 1,604. It was announced that the Norman medal had been awarded to Julius Baier for his paper on "Wind Pressures in the St. Louis Tornado, with Special Reference to the Necessity of Wind Bracing for High Buildings," and that the Thomas Fitch Rowland prize had been awarded to Arthur L. Adams for a paper on "The Astoria City Waterworks." No award was made of the Collingwood prize for juniors.

It was moved that a special committee be appointed to examine into the question of paints used on structural work, and that another committee be appointed to consider the subject of rail joints for standard steam railroads. W. W. Crehore offered a resolution that the society "hereby record its disapprobation of the Department of Public Parks" of New York in employing a firm of architects to design the new bridge across the Harlem River at Lenox Avenue, "and protest against the selection by public officials of a person or persons outside the engineering profession to design and prepare plans for a distinctly engineering work of such importance and magnitude."

The result of the annual election of officers was as follows: President, Alphonse Fteley, New York; vice presidents, E. P. North, New York, and Frederick P. Stearns, Boston; treasurer, John Thompson, New York. The members of the society, after the installation of the new president, formed into three parties, one of which visited the Jerome Park reservoir, another the Bowling Green building, and a third went to Columbia University and inspected the new buildings.

COMMERCE ON THE GREAT LAKES.

The lake navigation season just closed was one of the most active on record, and the statistics now published, says The Pittsburg Dispatch, give their own evidence of the restoration of prosperity. The first part of the season business was lighter than usual, but the deficiency was more than compensated for in the later months. A total of 18,218,400 tons passed through the canals at Sault Ste. Marie during the year, an increase of over 2,000,000 over the shipments of 1896.

A notable feature of this business is that it was carried by fewer vessels than were in service the year before, the modern carriers being of much greater capacity than those of a few years ago. The deepening of the channel and the completion of the new American lock permitted the new vessels to load all they could carry. This year the navigators believe the lake trade will be larger than ever, and they are preparing to carry it with fewer ships than they had in service in 1897.

So much has been said of the magnitude of this internal commerce, compared with the seagoing trade of this and other countries, that every one is familiar with it. But for Pittsburg the fact has a peculiar interest. To no other point does as large a proportion of the total tonnage go as goes there, and at no point does a larger proportion start than in the Pittsburg region.

THE HEAVENS IN FEBRUARY.

BY GARRETT P. SERVIS.

The Milky Way has become an object of increased interest since Barnard made his exquisite photographs of its star clouds and star gaps, and every observer of the heavens should note its position and appearance from month to month. At 9 P. M. in the middle of February it forms an arch completely spanning the heavens and passing not far from the zenith. Rising from the horizon in the north-northwest it passes just east of Sirius, which is then near the meridian, and between the head of Orion and Gemini, the latter being nearly overhead in our latitudes. Then it traverses Auriga, to the north of Taurus, and descends through Perseus and Cassiopeia, leaving Andromeda on the west, until it disappears behind the hills in the south-southwest. At the same hour the Great Dipper is seen rising in the northeast with its handle pointing downward.

THE PLANETS.

Mercury is a morning star, and can be seen before sunrise in the first part of the month. It is in the constellation Sagittarius at the beginning of the month, but at the end it will have passed across Capricornus into Aquarius. A close conjunction of Mercury and Mars will occur on the 11th. The two planets will be only one minute of arc, or less than one-thirtieth of the moon's diameter, apart. Unfortunately, their closest approach will occur at 1 o'clock P. M., eastern standard time, but they will be near enough together just before sunrise of the same day to present an interesting sight if the eastern horizon is clear.

Venus is also a morning star during the first half of the month, but too near the sun to be well seen. She is in Capricornus at the beginning of the month and in Aquarius at the end. She passes behind the sun (superior conjunction) on the afternoon of the 15th and then becomes an evening star, but still too near the solar orb to be seen.

Mars is likewise in the morning sky, very near the sun. He passes from Sagittarius into Capricornus about the 12th.

Jupiter is gradually coming into a better position for observation. He is in Virgo, not far from the double star Gamma, and rises about 10 P. M. at the beginning of the month and about 8 P. M. at the close.

Several interesting phenomena arising from the motions of Jupiter's satellites occur on the night of the 12th at fairly convenient hours for observation. At about 10:19 P. M. the shadow of Satellite II will be seen passing upon the planet's disk. The transit of the satellite itself across the disk will begin at 12:10 A. M. In the meantime, at 11:08 P. M., Satellite III will come out from behind Jupiter, or reappear from occultation. At 12:55 A. M. the shadow of Satellite II will pass off the face of the planet, and at 1 o'clock 2 minutes and 46 seconds A. M. Satellite I will be eclipsed by passing into Jupiter's shadow.

On the night of the 13th Satellite I, preceded by its shadow, may be watched passing across Jupiter between the hours of 10:12 P. M. and 1:18 A. M.

The observation of Jupiter's satellites requires the use of a telescope, but a good 3½ or 4 inch glass will amply suffice. The time given is Eastern standard.

Saturn is in the constellation Scorpio, very close to the border of Ophiuchus, and will pass into the latter in the course of the month. It is a few degrees northeast of the red first magnitude star Antares. It rises on the 1st shortly before 3 A. M., and at the close of the month about 1 A. M.

Uranus is also in Scorpio, about a degree east of the pair of little stars called the Omegas, just below the well known double Beta Scorpium.

February both opens and closes with a waxing moon. The first moon fulls on the 6th and reaches last quarter on the 13th. The new moon of the month occurs on the 20th, reaching first quarter on the 28th.

The moon will be in perigee, or nearest to the earth, early on the morning of the 17th, and in apogee at midnight on the 28th. The greatest libration east occurs about midnight on the 8th and the greatest libration west about 11 P. M. on the 22d. It is owing to the libration of the moon that we are able to see a portion of that lunar hemisphere which is perpetually turned from the earth. We look first a little around one side and then a little around the other side.

A STUDY of ozone from a technical standpoint, by E. Andreoli, appears in The Journal of the Society of Chemical Industry. Theoretically, one should be able to produce a kilo of ozone per electric horse power, but in practice only 10 or 12 grammes are obtained. By improvements in the apparatus for producing ozone, the author increases the production to thirty and even fifty grammes per horse power, making the cost about 75 cents a kilo. The author proposes practical applications of ozone, such as purification of drinking water, cleansing of beer casks, preparation of wood for instruments and furniture, bleaching of starch and dextrin, oxidation of drying oils, purification of wine and brandy, etc. It does not appear, however, that any of these proposed uses have been tested practically and on a large scale.