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Contents.

(Illustrated articles are marked with an asterisk.)

Arson and bellum in meteoric iron 186
Bicycle notes 183
Bicycle, popularity of the 186
Boats, aluminum 186
Boiler leveling device 181
Books and publications, new 189
Canal, Seattle and Lake Washington 182
Canal, the Cape Cod 182
Carbonic snow, properties of 187
Coal, mixed, for economical firing 178
Colors, sensation of 187
Drops, formation of 187
Earthquake, vicinity of New York 187
Electric propeller for boats 181
Electrification by rain drops 187
Elevators, Bell & Williams' stop for 181
Fabrics, non-shrinkable 187
Firing boilers with mixed coal 187
Gas, Pictet's 187
Gateway of hammered iron, large 183
Gold saving apparatus, Frisbie's 181
Horn combs, the manufacture of 180
Horseless vehicle contest, the 183
Horseless vehicles, the Paris-Bordeaux race 186
Hydrogen sulphide experiment 182
Indigo, artificial 187
Insect friends and foes 183
Invalid chair, Jamme's 181
Inventions recently patented 189
Iron work, fine hammered 177
Jewelers, women 182
Locomotive speeding truck 182
Meteorite, El Capitan 186
Paper pulp for leaks 187
Patents, decisions 188
Patents granted, weekly list of 189
Phosphorescence 179
Photography, gold in 179
Pumping, philosophy of 188
Rose, forging a 177
Sleep, a new theory of 186
Steamers, the stopping of 188
Steel, arsenic in 187
War vessel frame and armor test 188
Whales, twenty-seven ashore 188
Wood pulp pinions 179
Yacht America, 1851 185
Yacht racing, international 184

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 1029.

For the Week Ending September 21, 1895.

Price 10 cents. For sale by all newsdealers.

I. ARCHÆOLOGY.—The Greater Antiquity of Man.—By Prof. JOSEPH PRESTWICH.—A valuable paper, giving the facts upon which our belief in the greater antiquity of man is based. 16441
II. BIOLOGY.—Is Life Universal? 16443
III. CHEMISTRY.—Concerning Fuming Sulphuric Acid.—By R. W. HILL.—A chemical study of the so-called Nordhausen acid. 16454
IV. CIVIL ENGINEERING.—Irrigation in India.—An account of Mr. Herbert M. Wilson's personal observations during a visit and inspection of some of the principal irrigation works in India, in 1890.—2 illustrations. 16449
The Great Dam of the Peryar, India.—2 illustrations. 16450
Hydraulic Swing Bridges—North Sea Canal.—This swing bridge is illustrated by perspective plan and elevation views.—7 illustrations. 16446
V. ENGINEERING.—The Relation of Engineering to Economics.—By WILLIAM KENT.—A continuation of Mr. Kent's interesting paper, deferred before the American Association for the Advancement of Science. 16451
VI. FORESTRY.—The Hazels.—12 illustrations. 16443
VII. MECHANICAL ENGINEERING.—A Remarkable Water Power.—Improved Centrifugal Apparatus.—1 illustration. 16452
The Singer Sewing Machine Company's Manufacturing, Kilbowie, Scotland.—Full details of this great factory, where 6,000 people are employed and where 9,000 machines are produced a week. 16452
VIII. MISCELLANEOUS.—Is the Inventive Faculty a Myth?—By W. H. SMYTH.—A curious essay on the mystery known as the inventive faculty.—A full article containing considerable out-of-the-way information. 16444
IX. PHOTOGRAPHY.—On the Preparation of Collodio-Chloride Paper.—By G. H. MOSS.—Full details for preparing the paper, how to print and tone it. 16454
X. TECHNOLOGY.—Petroleum from Blabber.—C. A. LOBBY DE BRUYN.—1 illustration. 16453
Trickery in Textiles. 16453
XI. TRAVEL AND EXPLORATION.—The Voyage of the Antarctic to Victoria Land, in the Southern Polar Region.—An article of the greatest interest, giving details of exploration by C. E. Borchgrevink of this little known region.—1 illustration. 16439
The Exploration of the Surface of the Globe.—By Professor J. LOGAN LOBLEY.—A valuable article, giving figures regarding the explored and unexplored portions of the earth. 16440
Notes on Ruk and the Mortlock Islands.—By Rev. F. M. PRICE, of Ruk.—This article gives information on the location and population, products, manufactures, houses, dress, and customs on these islands. 16440
Petroleum in Peru.—By H. POLAKOWSKY. II. 16442
XII. YACHTING.—The British Yacht Valkyrie III.—Various views of the British yacht Valkyrie III, which was defeated in her recent attempt to obtain the America's cup.—1 illustration. 16448

THE AMERICA CUP RACES OF 1895.

With the withdrawal of Valkyrie III from the contest of September 12, the third race of the series was placed to the credit of the American cutter, and the safe keeping of the cup was intrusted for another indefinite period to its guardians, the New York Yacht Club.

Never in the history of these contests for the blue ribbon of the seas has the racing flag been hoisted under more auspicious and promising circumstances; and never has a contest realized a more unsatisfactory and altogether disappointing close.

The terms of agreement called for five races; three of them to be dead to windward and leeward and two on a triangular course.

The first race was sailed on September 7. The course was laid 15 miles out to sea, against the wind, and return. The wind was light and shifting. There was an enormous fleet of yachts and excursion steamers in attendance, and the maneuvering for the start, and the start itself, were made amid a confused crowd of attendant sightseers; the spectators vaguely speculating as to where the starting boats were anchored, and the yachts themselves having difficulty in finding the same. In the first 11 miles of windward work, the performance of the two yachts was very even. Four miles from the mark the breeze hauled to the southward and freshened considerably; and, when the yachts laid for the mark, Defender was seen to be over three minutes in the lead. What was intended to be a run home before the wind, with spinnakers, was changed by the shift of wind into a reach, and Defender gained rapidly, coming home in handsome style, a winner by eight minutes and forty-nine seconds.

The second race was sailed on Tuesday, September 10, over a triangular course of 10 miles to the leg, of which the first leg was laid to windward. In the maneuvering for the start, and just as Valkyrie, who was half a length ahead of Defender and to windward, was straightening for the line, her main boom fouled the Defender, carrying away the latter's starboard spreader. The Defender put about, so as to relieve the strain on the topmast, speedily repaired the damage, and then set off on a stern chase for the English boat. Valkyrie gained in the windward work, but her lead was cut down on the two remaining legs of the course, so that she eventually came in a winner by the small margin of 47s. That Defender should have done so well in her disabled condition makes this second race a moral victory for the home boat. The protest by Defender was taken under advisement by the Cup Committee, and after hearing all the evidence, they gave judgment against the visitor.

The third race was sailed on Thursday, September 12. Both boats were at the starting point and crossed the line with the wind dead aft. Immediately after the start Valkyrie drew out of the race, alleging, as excuse for her withdrawal, that the Cup Committee would not guarantee a free course, clear of obstruction from excursion steamers.

The Defender stuck to her contract and sailed the course in gallant style.

The two marine pictures herewith given present a timely and interesting comparison. The historical schooner yacht America is shown on page 185 as she appeared at the time she was winning the cup in a race round the Isle of Wight in August of 1851. It was an easy victory for the schooner, and the many novel features embodied in her design and construction were quickly recognized and favorably commented on by the English yachting world.

The Defender of forty-four years later—page 187—shows the enormous increase in power that has taken place in the interval. Of much the same displacement, she carries nigh upon double the amount of canvas that was spread by her predecessor.

HIGH SPEED RAILWAY RECORDS.

During the closing days of last month the two great competing railways that run from London to the north of Scotland, known respectively as the East Coast and West Coast routes, commenced an acceleration of service on their through trains. In the active competition that followed, the West Coast companies covered the total distance of 540 miles in the unprecedented time of 512 minutes, or at the rate of 63.25 miles per hour.

The sustained speed was remarkable in any case, and especially so when it is considered that it was made by a regular daily train starting on schedule time, and that the latter half of the journey was made through a mountainous country, in which, for a distance of 60 miles, the grades are very severe, varying from 1 per cent to 133 per cent. The engines, moreover, that hauled the train were not the largest on the road, but in some cases were of a type known as the President class, that is now some 25 years old, but which, on account of its excellent performance, is still in active service.

On Thursday, September 12, the New York Central Railroad made up a special train that was a counterpart of the Empire State Express, drawn by their latest and most powerful engines, and set out with the express

purpose of "breaking the record" of their transatlantic brethren. Over a course that is 100 miles shorter and over a line that is remarkably level and free from gradients, this special train, which was considerably heavier than the English train, made an average speed that was one mile per hour faster than that of the West Coast train, being 64.348 miles per hour, as against 63.25 miles per hour for the English train. These are both very remarkable performances. For purposes of comparison, however, they are useless, until we are in possession of all the conditions that prevailed. The bare question of speed is in itself no test of locomotive performance. This is a fact little understood by the public at large; but well understood by engineers themselves. To judge of two performances it is necessary to know:

- 1. The ratio of the weight of engine to the weight of the train hauled.
2. The ratio of the amount of coal burned, water evaporated, and oil used per mile to the weight of train hauled.
3. The state of the weather, whether wet or dry, and the force and direction of the wind.
4. Most important of all, the amount and extent of the grades and curvature on the two roads on which the record is made.

With all these data to hand a very close estimate could be made in each case of the actual units of work performed in a given unit of time. Only after such a comparison, based on accurate data, as above, could it be even approximately stated which performance was the most satisfactory.

FIRING OF BOILERS WITH MIXED COAL.

A very interesting experiment, and one that ought to revolutionize the firing of steam boilers, has been in progress at the flour mill of Urban & Company in this city for several months and has now proceeded so far that positive advantages can be claimed with confidence.

The mill has made 1,200 barrels of flour in 24 hours, though the ordinary output is much less. The engine is a Corliss pattern of about 400 horse power, driven by steam generated in two upright tubular boilers with twin furnaces and covered with a composition to retain the heat.

The fuel formerly used was run-of-mine soft coal, but last March Mr. Urban, having long been dissatisfied with the fuel, began to use in connection with it various proportions of screenings of hard coal. The improvement was marked from the first. The amount used was much less, the cost was reduced, and the smoke and soot practically disappeared.

When the experiment began, the furnaces required fully 1,200 pounds of soft coal per hour to develop on the average 380 horse power. The amount now required for the same service is 890 pounds on the average. The coal used is one part soft coal culm, or any of the cheapest product of the mines, and four parts hard coal screenings, such as is not considered valuable in the general trade and is sold to whoever will buy it at a mere nominal price.

All possible proportions were tried and hard coal was used entire, but the present proportion of four to one is found to be the best. This affords soft coal enough to cement the fuel into small masses, but is not enough to harden it into large masses, as was the case if a greater proportion of soft coal was used. As the soft coal ignites first, it in a measure cokes the whole, and the slow-burning anthracite assists in producing a very lasting fire, not needing replenishing for a much longer time than is the case with clear soft coal. Anthracite used alone fills the grates with ashes, but the accepted mixture burns very free.

The cost of hard coal screenings is \$1.45 per ton and of soft coal slack \$1.50. The difference is so small that either price may be taken, and reckoning the consumption at 900 pounds an hour, which is slightly more than the reported amount, a 24 hour run would consume 21,360 pounds at a cost of \$16.02, reckoning \$1.50 to the ton. The cost of run-of-mine soft coal is \$2.20 per ton. At an expenditure of 1,200 pounds an hour, which is considered below the average requirement, a 24 hour run on soft coal would cost \$31.68.

The saving appears to be largely in the entire combustion of the coal. If the test has proved anything, it is that a much greater amount of carbon is blown out of the chimney than any one has supposed. With soft coal there was not only a constant waste in the dense smoke that ruined so many things about the city, but a blower was needed to keep up the draught, and that carried the particles of carbon up the flue in a constant stream.

With soft coal the chimney had to be blown out every twelve hours, but with the present mixture no blower is used. The flue is scraped once a week, just as it was with soft coal. It is not difficult to see by this that the forcing of draught costs money.

The mixed coal is kept very wet; in fact, fairly saturated. In this condition it does not escape from the chimney at all, either in smoke or in fine particles independent of the smoke. For the most part there is no perceptible smoke and it is never more than a