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THE MODERN BICYCLE.

The enormous amount of capital represented by the bicycle industry has been noticed in these columns before. Originally the velocipede found no application except as a toy. In the early days adults as well as children took up the bicycle as recreation pure and simple, its propulsion over the ordinary roads being so laborious as to make it available only under very exceptional circumstances.

In the old velocipede the inelasticity of the frame made it hard to drive, and it was only rendered endurable from the point of comfort by having a saddle mounted on springs. Slumbering among the patent records meanwhile was an invention which was destined to transform the primitive bone shaker into a conveyance of ease and comfort and to minimize the inequalities of the road. The application of this invention, now known as the pneumatic tire, the adoption of a slight change in proportions, and the use of multiplying gearing for the increase of speed, were all that were wanting to make the modern bicycle.

The development of the cycle, notwithstanding, was slow. First came the old-fashioned high-wheel bicycle, the possible diameter of whose wheel was fixed by the size of the person riding. By special leverage arrangement the size of the wheel was increased in some cases up to 7 or 8 feet in diameter. After various efforts at front-driven low or safety wheels came the modern safety, driven by the rear wheel. Solid India rubber tires were still in use, and various attempts were made, and with more or less success, to introduce springs into the frame, so as to moderate the jar incident to the inequalities of the road, until the pneumatic tire was introduced. The modern bicycle is the result.

Two exhibitions of bicycles and accessories are to follow each other in rapid succession during the next two weeks—one in Chicago and one in New York. In February a third exhibition is to be held in Denver. The SCIENTIFIC AMERICAN, realizing that comparatively little is known by the general public of the methods of manufacture adopted in the modern bicycle factory, and that many points in modern bicycle construction are but little understood, has determined to present its readers with the methods of construction and machinery used in the production of a first-class wheel.

The exhibitions alluded to above will show the present development of the machine, which, in conjunction with the electric railroad and the automobile carriage, is doing its part to make the horse-drawn vehicle in great part a thing of the past. In them will be represented the latest modifications of this most interesting mechanical achievement, which enables a man to increase his speed from four miles an hour to twelve or fifteen—a machine in which the study of joints has received great attention and where the art of connecting steel members of a frame has been brought to the highest perfection—in which the subject of bearings has been worked up to consummate excellence so that a ball bearing wheel will travel thousands of miles without the balls or cones showing any appreciable wear.

Merely as an example of the truss, a bicycle represents a veritable achievement, for its frame may be considered as a truss spanning a distance between the front and rear wheel axles, and in the case of quadruplet and quintuplex wheels the truss may have to carry nearly a thousand pounds.

The most healthful sign of what cycling really means is its employment by business men, by the farmer and by government officials. The cycle is being used by the police of different cities, by the postmen and by street inspectors. It is being used with the greatest success by the signal service department of the army, and cycle drills in the regular army will soon be among the tactical evolutions in this country, as they have long been abroad.

As an example of the practical use of the wheel in the regular army, Lieut. Hugh D. Wise's ride from Sackett's Harbor, N. Y., to Governor's Island, in the harbor of New York City, may be cited. Mounted on an 18½ pound racing wheel, and loaded with a pack representing the heavy marching order equipment of the regular army, the distance of about 400 miles was made in 84 hours. The heat of the weather, the sandy roads, and the mountains traversed made the ride an unusually trying one, but six hours' sleep being obtained during the entire trip. Considering the extreme lightness of the wheel, it stood the trying ordeal of the trip extremely well, and the light racing tires stood with but a few punctures until one gave out near the end of the trip. The riding speed was 12¼ miles an hour. Lieut. Wise is in the regiment of the Ninth Infantry, U. S. A. Such service as that represented by this ride might be invaluable in time of war or riot. One of the bushings split and six hours were lost by the rider in making a new one at a common blacksmith shop on the road. The performance shows the efficiency of the wheel for all spatch purposes.

The great perfection of the bicycle depends on the ball bearings, which eliminate so much of the friction of the machine proper, and

reduces so largely the rolling friction between the wheels and the road by its principle of recuperation of energy. To some slight extent these improvements have been introduced among horse-driven vehicles, but a curious moral is to be drawn from the fact that it is only when man became his own vehicle propeller that the utmost refinements in the abolishing of resistance were introduced. It still seems as if the lesson of the modern bicycle had not been fully appreciated by the carriage builder. Within little more than three years the ordinary road wheel has been reduced in weight from forty or forty-five pounds to twenty pounds or even less.

Little further development in this line is to be, however, looked for immediately. Probably the lowest limit of weight for ordinary use has now been reached, and the minor points of width of tread, length of wheel base and similar features of proportion have been pretty well fixed.

America has made the most wonderful progress in the development of the wheel, and her manufacturers have been so alert and enterprising, competition so keen, and the public so critical, that the American wheel is to-day the most beautiful mechanism and the lightest and easiest running of any wheel manufactured in any country. The most defective feature of the wheel is the tire, which is very perishable and which is ill calculated to withstand the severe exactions of our bad country roads. It is believed, however, that great improvement will be made in this line during the coming season.

A RETROSPECT OF THE YEAR 1895.

The past year has been distinguished as much, unfortunately, by the loss of great leaders in the world of science and art as by the number and value of the discoveries and achievements that have marked its progress. A death roll which contains the names of our own Professor Riley, United States Entomologist, and of James Dwight Dana, and on the other side of the water the names of Pasteur and of Thomas Henry Huxley, is a sad one to contemplate.

Engineering.—In this department the greatest event of the year was the opening of the North Sea and Baltic Canal, which has a total length of 61½ miles and cost \$39,000,000. About the same time was opened the Harlem Canal to the north of New York City, which, though not remarkable for its size or cost, will have great commercial and strategic value, as uniting the East and North Rivers.

The Puget Sound and Lake Washington Canal, connecting the waters of the Pacific with a large fresh water lake in the North western State of Washington, is progressing favorably. Of canals projected we note in the United States the Atlantic Coastwise Canal, from Philadelphia to New York, the Cape Cod Canal, and the canal from the Atlantic to the Great Lakes. The projected Nicaragua Canal has been somewhat set back by the report of the commission of experts, who have stated that the preliminary estimates were too small. It will be a far more costly work than was at first supposed.

During the year the contract has been let for cutting the longest tunnel in the world—the Simplon Tunnel, through the Alps. It will be 12¼ miles long, and will consist of two tunnels, spaced 56 feet apart, one for each line of rails. The contract price is \$13,750,000.

Other great works that have been steadily advanced during the year are the Chicago Drainage Canal, in Illinois; the Peryar Dam, in India, which, when completed, will be 178 feet high, 1,300 feet long, and contain 5,000,000 cubic feet of masonry; and the great Siberian Railroad from Russia to the Pacific.

Transportation.—This year will ever be memorable for the great advance in railway speeds both in America and England. The remarkable long distance speed developed in the London-Scotland race, in England was followed by a similar acceleration in America, of both of which we give the results:

Table with 2 columns: Route and Average speed, including/excluding stops. Rows include West Coast Route, London to Aberdeen (539-75 miles), New York Central, New York to East Buffalo (436-32), and Lake Shore and M. Southern, Chicago to Buffalo (510-1).

There has been a steady increase in the weight and power of locomotives. The driving wheels are being made larger and steam pressures are increasing, 180 to 200 pounds to the square inch being common.

Electrical traction has received some very important applications, notably in the 96 ton electric locomotives of the Belt Line Tunnel, Baltimore. These are doing excellent work, having on one occasion hauled a 2,000 ton train with facility and without any tendency to slipping of the wheels. Another important application of the system to a standard gauge railway in this country has taken place on the N. Y., N. H. and H. Ry., where a trial speed of 60 miles per hour has been obtained with a passenger train. In France a 90 ton

electric locomotive, of the Heilmann type, has been tested in experimental work.

Electric street traction has continued to grow in favor. In 1887 there were only 13 electric roads in the United States; to-day there are 850 roads with a total mileage of 10,000, representing an investment of \$400,000,000. In this connection it is interesting to note that the possibilities of canal towage have been tested in both the old and new worlds; here in the form of a traveling motor, working separately from the boat, and in France by the use of a motor upon the boat itself, hauling upon a chain laid in the bed of the canal.

Under the head of transportation the year will be celebrated as seeing the practical development of the horseless carriage, or motorcycle. In the Paris-Bordeaux race over 60 vehicles started; and the first two prize winners covered the 360 miles at the respective rates of 15 and 14.9 miles per hour, many of the other contestants making excellent time. In the Chicago race the winner made a speed of over 5 miles per hour through a course that was blocked with snowdrifts and mud—the results of a blizzard of the day previous.

The bicycle continues to enjoy an enormous and ever-increasing popularity. It has won its way this year into the highest circles, and when indulged in with moderation it has received increasing medical endorsement. This year has seen an extended use of wooden and aluminum rims, narrow treads, and larger bearings.

In naval and marine engineering, the year has shown that there is a continued tendency to increased size and speed in ships. In regard of speed a noteworthy performance was the U. S. steamer Columbia's transatlantic trip, at an average speed of 18.1 miles per hour. This is far beyond anything on record for a warship on a run of that distance. In the merchant marine, the run of the Cunard steamship Lucania, from Queenstown to Liverpool, 240 knots in 10 hours, is the record performance of the year; and it is even more creditable than her transatlantic record of over 22 knots per hour for the whole trip. The Buenos Ayres, a cruiser built at Newcastle for the Argentine Republic, steamed 23.2 knots on a six-hour trial. There is noticeable a growing tendency to increase the power of the quick-fire secondary battery of warships, and to decrease the weight of the heavier guns. The enormous energy of quick-fire is shown in a comparison of the energy of fire per minute of the Buenos Ayres, a 4,500 ton cruiser, with that of the Royal Oak, a 14,000 ton battleship. In the former case it is 304,844 foot tons, as against 292,830 foot tons in the larger boat.

In the United States Navy we have seen the launch of the Brooklyn, an improved New York. The Iowa, which, in power of heavy gun attack, will be the most formidable warship in the world, is nearing completion; and this year sees the practical completion of that famous trio, the Oregon, Massachusetts and Indiana.

A noteworthy event of the year was the speed attained by the torpedo destroyer Sokol. In making 30 1/4 knots, she was the first boat of any kind to pass the 30-knot limit.

The status of the United States merchant marine has been greatly raised by the addition of those two splendid vessels, the St. Louis and St. Paul, of the American line. They are of American material "from truck to keelson," and are the equal, and, in accommodation, the superior, of anything afloat.

The naval battles of the Japanese war have verified existing theories as to guns and armor. The development this year has been in the direction of higher velocity of projectiles and lessened weight and caliber of guns. At Elswick, we are told, "a muzzle velocity of 4,800 foot seconds has been obtained with a charge of cordite." This is nearly double the highest velocity of recent years. In armor the United States has continued to lead the world; and in other countries the developments have been along those lines of improvement first laid down by our manufacturers. The American system, which, briefly stated, presents intense hardness of face rather than thickness of metal to the shot, has up to this year succeeded in smashing the hardest shot that struck it. Reports now come from Russia of a successful perforation by a shot which is made on some secret system, which is supposed to consist in attaching a separate point, which is made of softer metal, to the head of the shot. Perhaps the most important event in the electrical world was the opening of the great Niagara Falls electric plant. Other successful plants for long distance electrical transmission of water power, that have been opened or enlarged this year, are those of Sacramento and Oregon City, respectively in California and Oregon.

The Glasgow Hydraulic Power Supply, opened this year, is remarkable for the high pressure, 1,120 pounds to the square inch, at which it is operated.

The most important event in the field of chemistry was the discovery of a new constituent of the atmosphere—argon—by Professor Ramsay and Lord Rayleigh. The discovery of this element explains the discrepancy which chemists have always found between

the density of nitrogen obtained from the atmosphere and that obtained from chemical compounds. Atmospheric nitrogen was always heavier by the amount of argon that was present with it.

This year has seen the development, in useful commercial form, of acetylene, a brilliant illuminant, which is obtained by the action of water upon calcium carbide. As compared with the other hydrocarbons, methane and ethylene, the ratios of illuminating power are: methane 5%, ethylene 70, acetylene 240.

In photography we note that at the soirée of the Royal Society at Dublin this year, Dr. Joly, of Dublin, presented some photographs in color, which showed "the same fidelity of reproduction that characterizes the camera."

The notable event in the medical world has been the successful treatment of diphtheria with antitoxine. This is one of those great triumphs of medicine whose benefit to mankind is beyond possible estimate. Professor Roux announces 74 per cent of cures on 300 cases, and Professor Erlich 85 per cent on 163 cases.

The geographical world has welcomed home this year from Polar expeditions Lieutenant Peary, the Jackson-Harmsworth expedition and Professor Borchgrevink. The efforts of the latter gentleman will probably result in the organization of an Antarctic expedition.

The present disturbances in the Turkish empire and the gathering of the European fleets suggest a possible rearrangement of geographical maps in Eastern Europe at an early date.

The industrial world has to record in America the holding of the Atlanta Exposition, at Atlanta, Ga.; and in Europe, the acceptance of the designs and the execution of other preliminary arrangements for the World's Fair to be held at Paris in the year 1900. The Atlanta Exposition will always possess special historical significance. It marks the coming of age, the ripening into the strength of full manhood, of what has very aptly been termed "the New South."

The ominous war cloud which darkened the relationship of the United States and England in the closing days of the year will be chiefly remarkable in history for the widespread expressions of mutual regard and goodwill which it immediately drew forth in profusion on both sides of the water, and for the equal abhorrence with which the possibility of what was aptly termed a fratricidal war was regarded by all classes of society in both countries.

Henry J. Newton.

The accidental death of this old veteran, yet modern photographer, 72 years old, on December 23, 1895, we are sure will be regretted by his many friends and others interested in photography. While crossing Broadway from the east to the west side between Twenty-third and Twenty-second Streets in this city, on Monday evening, December 23, he accidentally fell in front of a Lexington Avenue cable car which had just started, and before the car could be stopped he was crushed, and lived but five minutes.

Mr. Newton was born in Connecticut in 1823. He married and settled in New York in 1850. For the past thirty-five years he had lived in the Forty-third Street house. He was a member of the firm of Light, Bradbury & Newton, manufacturers of pianos, and in this business and through judicious investment in real estate in the northern part of the city, he amassed a comfortable fortune. A number of years ago he retired from active business and devoted himself to amateur photography. He was president of the Newton-Merritt Bronze Company, of Nyack, the business being conducted by his son.

He began the practice of photography soon after the introduction of the daguerreotype, and by research and experiments was able to suggest and introduce several useful improvements in photographic manipulation.

Having acquired the art of drawing and painting, and noticing the usefulness and adaptability of photography for obtaining details which it would be difficult to remember, he became infatuated with the new discovery and devoted himself earnestly to its improvement and perfection. He had his laboratory and skylight arranged on the top floor of his residence where he pursued his experiments. He recommended the use of nitrate of ammonia in the silver bath for the sensitizing of albumen paper, by which the need of preliminary fuming with ammonia is avoided.

About 1876-77 he improved the collodion-bromide emulsion process and prepared an emulsion by which dry plates as sensitive as those by the wet plate process could be made and used at any convenient time. He further suggested the use of the fixed alkalies such as carbonate of soda in developers in place of ammonia, and later, with the introduction of the gelatine dry plate process, advised the use of yellow prussiate of potash in the pyro developer, which gave the latter greater vigor and produced more brilliant negatives. He also recommended the single solution iodide of mercury intensification method for gelatine plates. Since the introduction of the coal tar developers he suggested certain modifications in their use for the

development of prints on bromide paper, advising particularly the addition of, to a metal and hydroquinone developer, barium hydrate as yielding velvety black prints.

He made many beautiful photographs in Central Park, of the landscapes, sheep and other animals, and was also an expert in the development of instantaneously exposed plates.

He was identified with several photographic societies, and had been president of the photographic section of the American Institute for many years; also at one time he was vice-president of the Society of Amateur Photographers, of New York. Seldom has any amateur continued such a lively interest in photography as Mr. Newton did, and the photographic world has been much benefited by his investigations.

The funeral occurred on December 26, at the Church of the Divine Paternity, corner of Forty-fifth Street and Fifth Avenue, and was largely attended. Dr. Eaton and Dr. Collyer each paid eloquent tribute to Mr. Newton's memory.

Manufactured Iron and Steel.

The event of the week, as reported in the Iron Age for December 26, was the opening of the new set of bids for the construction of the Appraisers' Stores in this city. The figures submitted are the following:

	Bessemer.	Open hearth.
Post & McCord, New York.....	\$339,550.00	\$339,550.00
Benj. Hyde, Chicago.....	339,800.00	339,800.00
Pennsylvania Steel Company.....	341,313.00	345,591.00
F. J. Hyers, Hamilton, Ohio.....	344,400.00	366,400.00
M. Giblin, New York.....	352,220.00	356,220.00
Edge Moor Bridge Company.....	371,500.00	374,500.00
C. A. Schneider's Sons, Washington, D. C.....	377,583.00	377,583.00
Passaic Rolling Mill Company.....	385,953.00	385,953.00
Youngtown Bridge Company.....	406,987.00	408,734.00
New Jersey Steel and Iron Company...	406,600.00	406,600.00
Berlin Iron Bridge Company.....	419,844.00	425,947.00
Leach & Son, Chicago.....	429,398.00	398,703.00

The lowest bid made some time since was \$419,000, but since then the plans have been modified, and where they formerly called for about 7,000 gross tons of material, the new plans, on which the above figures were made, required only about 6,000 net tons of material. It will be noted that quite a number of bidders quote exactly the same prices for Bessemer and for open hearth steel, while with a number of others the difference is only slight. We believe that this is the first conspicuous instance in which this has been brought out in the structural trade, the usual custom being to ask somewhat higher prices for open hearth. It is a somewhat striking commentary on the ability of the basic open hearth to come close to Bessemer in cost, on rigid specifications. We understand a Pittsburg mill has taken the material. We quote for large lots on dock: Beams, 1.68c. to 1.75c.; angles, 1.55c. to 1.60c.; universal mill plates, 1.60c. to 1.65c.; tees, 1.75c. to 1.80c.; channels, 1.70c. to 1.80c.; steel plates are 1.50c. to 1.60c. for tank, 1.65c. to 1.75c. for shell, 1.75c. to 1.90c. for flange, 2.10c. to 2.25c. for fire box, and 2.25c. to 2.50c. for locomotive fire box, on dock. Charcoal plates are 2.25c. for shell, 2.75c. for flange, and 1/2c. advance for fire box quality. Refined bars are 1.35c. to 1.50c., and common are 1.25c. to 1.35c., on dock. Soft steel bars, 1.30c. to 1.35c.; steel hoop, 1.60c. to 1.75c. base. Steel axles, 1.65c. to 1.80c.; scrap axles, 1.70c. to 1.80c.; links and pins, 1.65c. to 1.80c. Best iron boiler rivets, 3c. to 3.25c. delivered. Steel rivets, 2.15c. to 2.25c.

Cycle Notes.

There are no very marked improvements in the bicycles for 1896, with the exception of larger tubing and barrel hubs. To those accustomed to a small hub, the barrel hub looks clumsy, but it allows the use of large balls in the bearing, and thereby decreases friction.

A tire stuck full of knives, tacks, etc., has been on exhibition in a Broadway store window, New York, for some time. This tire contains a layer of cork between the tubes. A cross section of the tire shows the cork to be crescent shape and one-third of an inch thick in the widest part. It is inclosed between two tubes of rubber, each of which is a seamless tube. The cork lining lies within the running surface of the tires, and if the outer tube is cut or torn, the inner air tube, being protected by the cork, remains good. It is said the practically puncture-proof quality does not seem to interfere with the resiliency of the tire.

The parcel carrier, which is a tricycle with a capacious carrier in the rear, is now a familiar sight in New York City. They are much more economical than delivery wagons.

French wheelmen have adopted a code of signals whistle. The whistle is much used in France in reference to the bell.

A bicyclist in England who killed a man by ing him down on the road was indicted slaughter, and is now serving a four months' of imprisonment at hard labor.

A New York expressman who ran down woman was sentenced to nine months' im for reckless driving.