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## THE INCREASING WEIGHT OF THE BICYCLE.

In spite of the steady advance that marks the development of the bicycle, there is one particular in which, during the past two or three years, there has been a decided retrogression. We refer to the all-important question of weight.

We use the term "all-important" advisedly; for it is a fact that, in the advance which has taken place during the past half century in engineering construction, the remarkable reduction of dead weight, whether it be in a steel bridge or a buggy, is quoted as one of the most striking evidences of our "end of the century" development. Mediocre construction of the rule-of-thumb order is satisfied if the structure accomplishes the end in view; but thoroughly scientific engineering, whether civil or mechanical, seeks to secure the same end with the least possible expenditure of material or increase of bulk or weight. It is this combination of lightness and strength that gives strong national individuality and much of its superior merit to the engineering work which is turned out in this country.

This good feature was formerly one of the best characteristics of the American bicycle, and, up to the years 1895 and 1896, there was a steady decrease in the weight of each season's wheels, the standard makes in these years being many pounds lighter than those of foreign manufacturers. It was largely the light weight of the domestic wheel that brought the heavier and clumsier foreign wheels into disfavor and practically drove them out of the market.

It is to be regretted, we think, that the wheels of the last two or three seasons have shown a steady increase in weight, and this, in spite of the fact that the constant improvements in the manufacture of steel make it possible to use less material to secure the same margin of strength. In 1895 and 1896 the public demand for light wheels had resulted in the production of racing wheels that weighed from 17 to 18 pounds, light roadsters of from 20 to 22 pounds, and heavy roadsters, equipped with brakes, of from 23 to 25 pounds; but in 1898 we find that racing wheels weigh 20 to 22 pounds, light roadsters 23 pounds, and the ordinary roadsters from 25 up to 28 and even 29 pounds.

Now this is a decided step in the wrong direction. From a structural point of view, there is no excuse for it; for the improvement in the materials of construction gives the public a full right to expect that, instead of growing heavier, the bicycle will grow steadily lighter.

The manufacturers attribute the increase in weight to various causes. Some makers state that the light wheels of 1895 were due to special care in manufacture, and that work and materials that were put into a $125 machine cannot be expected in one that is sold for $50. Others do not hesitate to attribute the change to a demand on the part of the public for a heavier wheel; while there are other makers who hold that the increased weight is due to the introduction of altogether new features into the wheel itself.

We are inclined to think that most of the added weight is due to changes in the construction of the wheel, some of which have been introduced for strength and others being due to the caprice of the public. Among the former sources of weight we might mention the extra length of the reinforcements at the joints; the larger diameter of the hubs, crank hangers, and bearings; the increased amount of metal involved in the use of the divided and bushed crank axles; the very considerable increase in weight due to the rage for larger and, therefore, heavier sprockets, involving a very considerable increase in the length and weight of the chain; the complete reinforcement of the head for its whole length, and the great lengthening of the fork reinforcement; and the tendency, while maintaining the large diameter tubing, to increase its gage, in order to prevent bruising or indentation.

Now it may be taken for granted that as long as the public is satisfied with the heavier bicycles, there will be no disposition upon the part of the manufacturers to make them lighter. The question of weight being eliminated, the builder will make it his first care to put up a wheel that will carry its rider through a maximum amount of rough usage. The makers understand well that a positive breakdown in the way of broken forks, twisted wheels, or a buckled frame works more damage to their reputation than any other form of failure, and it is certain that a reduction in the amount and weight of material put into the bicycle will never be made by the manufacturers on their own initiative. It will only be done in response to the demand of the bicycling public.

There is not the slightest doubt that the weight of the bicycle of to-day could be brought down to and below that of 1895-96 without impairing the *needful* strength of the machine. This could be accomplished partly by throwing out certain useless fashions or fads in the present machine and partly by using the very highest quality of steel in all parts of the wheel. As an instance of unnecessary weight involved in catering to a popular fad, we might mention the large sprockets of thirty teeth and over which are being used on many machines. In the era of light wheels there were from sixteen to twenty teeth in the front sprockets; to-day an up-to-date wheel will carry a front sprocket with from twenty-six to thirty-two teeth and a rear sprocket large in proportion. This means an increase in weight due to from 10 to 12 inches of increased periphery in the sprocket and an increase in the length and weight of the sprocket disk or spokes in addition to the weight due to lengthening the chain by 6 to 8 inches.

The large sprocket fad is not altogether based on sound mechanical theories; for, while the tension in the chain is less, its speed is greater, and the friction due to its more rapid passage around the sprockets is proportionately increased. That the mechanical gain is more imaginary than real is borne out by the fact that the racing men, even those who are using gears of from 100 to 112, are all returning to sprockets of moderate size.

The increasing size and thickness of the barrel hubs is also answerable for some of the added weight, and a glance at many of the crank hangers shows that here also several ounces have been added in the last two or three years. The increase in the length of the cranks from 6½ to 7 and 8 inches, due to the craze for higher gears, has added its quota of weight, and something must be put down to the abnormally wide handle bars which are just now the vogue.

It is strange that no maker has succeeded in introducing a feature into the bicycle frame which is not only thoroughly scientific, but would undoubtedly strengthen it, and at the same time allow a certain reduction in its weight. We refer to the introduction of a cross tie or strut within the frame, running either from the joint at the seat-post to the joint at the bottom of the head or from the top of the head to the crank-hanger. The introduction of such a member would make the frame what it certainly is not at present—a truss. It would cause all the strains, whether of tension or compression, to act along the axis of each tube, and it would have the important result of relieving the tubes at the joints of all bending strains acting in the plane of the frame. This would remove the necessity for much of the reinforcement at the joints and would necessarily lighten the structure. A pair of wires joining opposite angles of the frame, each provided with a neat little turnbuckle, would have at once a remarkable stiffening and lightening effect on the whole wheel. Popular taste, however, would probably object to the innovation.

Light weight is to-day, and ever will be, one of the most valuable considerations in the bicycle. The seven or eight pounds which could be taken off the present wheel would make a world of difference in an all day ride, especially in the latter part of the journey. Weight, as we have suggested, is not necessary to rigidity, and its present rapid increase in the bicycle is a distinctly retrograde step on the part of both the manufacturer and the public.

## PROBABLE INCREASE OF THE NAVY.

According to the best information at hand, it is likely that the naval board will make recommendations calling for an exceedingly powerful addition to our present navy. The provisions, which are in every way commendable, bear evidence of being directly inspired by the lessons of the war, and we are gratified to observe that the recommendations are directly in line with suggestions which have been made from time to time by this journal.

The report of the board will probably recommend the construction of three battleships of 13,000 tons displacement and a minimum speed of 18½ knots when the ships are at their deepest draught, with a full load of stores and coal on board. They are to have a cruising radius of 8,000 knots, or sufficient to carry them to Manila without recoaling. The main battery is to consist of four 12-inch rifles of great length, to suit the new smokeless powder, and fourteen or sixteen 6-inch rapid-fire guns. There will also be a heavy battery of 6-pounders and automatic guns.

It is likely that provision will be made for six armored cruisers. Three are to be first-class ships of 12,000 tons displacement, 22 knots speed, and a cruising radius of 10,000 knots. They will be protected by a complete waterline belt of armor reaching entirely from stem to stern, and we presume protecting the broadside battery as far up as the main deck. They will each carry four 8-inch guns mounted in turrets, and a broadside battery of ten or twelve 6-inch rapid-fire weapons.

The other armored cruisers are to be of the second class, with a displacement of 6,000 tons and an armament of two 8-inch guns and ten or twelve 5-inch rapid-fire guns. The speed is to be 20 knots and the cruising radius about 12,000 knots.

The board will probably recommend the building of six protected cruisers of 2,500 tons displacement and 16 knots speed. The details of these vessels have not as yet been worked out, but they are to have the large steaming radius of 13,000 knots and a powerful battery.

Not the least important recommendation will be that all these vessels, including the battleships, should be sheathed and coppered—a provision which, in connection with their great steaming radius, will render them specially suited for service in the Southern Pacific and in the tropical waters of the West Indies.

If these recommendations are formally presented and accepted, they will exactly meet the needs of the hour in providing for a fleet of vessels that are big, fast, and powerful and able to steam unaided to the utmost limits of our newly acquired possessions.

If the new ships are made as thoroughly up-to-date in armament as they are in size, speed, steaming radius, and defensive qualities, we shall possess in them vessels that are the equals, if not the superiors, of anything afloat. We shall await with some anxiety, however, the announcement of the character of the guns that it is proposed to mount on the new ships; for it is a fact that they must be supplied with weapons of vastly greater power than those at present mounted in the navy, if they are to be a match for the best warships of foreign navies. We have no doubt that the Ordnance Board has already draughted the plans for guns of greater power than the present weapons; but we hope that it will not be satisfied with a table of ballistic powers that is one whit behind that of Vickers-Maxim in England, Krupp in Germany, or Schneider-Canet in France.

In this connection we refer our readers to the discussion of the subject which will be found on page 46 of the SCIENTIFIC AMERICAN ARMY AND COAST DEFENCE number, where the tables of our own army and navy guns are compared with those of the parties just named. That our Ordnance Board is moving in this matter is shown by the fact that the patent rights for this country of the Welin breech-mechanism have been purchased from the Vickers-Maxim Company. This will reduce the weight of these parts and, directly and indirectly, increase the rapidity of fire. Drawings of this mechanism were given in the SUPPLEMENT for June 18, 1898. We do not know whether the new Maxim-Schupphaus powder will give the high ballistic results achieved by the Vickers-Maxim guns, but there is every indication from published results that it will.

How great is the room for advancement is shown by a comparison of the present navy 12-inch gun with the 12-inch Vickers-Maxim weapon, the energy of the former being 25,985 foot tons and of the latter 44,573 foot tons, the one being capable of penetrating 30·8 inches of iron at the muzzle and the Vickers wire gun being good for 45·9 inches. The respective weights of the two guns are 45·2 tons for the hooped and 50·3 tons for the wire-wound weapon.

We have not the slightest doubt of the ability of our navy to turn out a 12-inch gun equal in power to any that exists. If the ordnance experts doubt the possibility of producing a hooped gun to stand the high pressures accompanying these velocities, they have the wire-wound system with which they have fully experimented to fall back upon.

Whatever type of gun we employ, the glorious traditions of our navy demand that the weapons mounted upon the splendid ships called for in the new programme shall be equal or superior in power to the best of those carried by the ships of foreign powers.

## ENGINES AND ENGINEERS OF THE "OREGON."

In our admiration of the men and material above the protective deck of our warships we are in danger of forgetting the materials and men below it; yet the unrivaled successes of the navy are as much due to stokers, wipers, and engineers as they are to gunners, quartermasters, and the officers of the line. The engine room and stokehold should share with the gun deck and conning tower the credit of such victories as that off the south coast of Cuba; for it was the unusual speed of our battleships, due to the high state of efficiency of the motive power and engine and boiler room staff, that rendered the complete destruction of Cervera's flying squadron possible.

The 14,700 mile voyage of the "Oregon" from the Pacific stands out as the most notable engineering performance of the era of steam navies, and in its way it ranks with any of the brilliant exploits of the war. Among the mass of literature that has already been published on the subject, we have seen nothing of greater interest than a letter written by First Assistant Engineer C. N. Offley, of the "Oregon," to friends, and published, by permission, in The New York Sun. The letter, which is of considerable length and detail, will be found in the current issue of the SUPPLEMENT, and we must be content to give in these columns one or two of the leading facts from this most interesting "log."

In the first place, the "Oregon," it seems, though rated as a vessel of a little over 10,000 tons, actually displaces about 12,000 tons with full stores and 1,500 tons of coal on board. The run of 4,076·5 knots from San Francisco to Callao was made on 900 tons of coal at a speed of 11·49 knots, or at the rate of 4·24 knots per ton. The highest speed was 14·55 knots for the 132 miles from Port Tamar to Sandy Point, when the ship burned 1 ton of coal for every 2 knots. This was done under "semi-forced draught," and the speed rose to within 0·45 knot of her contract speed. Although the ship carries four double-ended boilers, only three were in use at one time—the fourth being used whenever leaky tubes demanded repairs in any of the other boilers.

Mr. Offley attributes the success of the motive power to the excellent work put into the engines and boilers by the builders and to the great care which was taken to always "keep everything as nearly up to perfection as possible," every wear or failure, however small, being at once detected and set right.

### FREDERIC WARD PUTNAM.

BY MARCUS BENJAMIN, PH.D.

This week the American Association for the Advancement of Science celebrates the fiftieth anniversary of its existence. In 1847 the American Association of Geologists and Naturalists, which had been formed in 1840 as the Association of American Geologists, met for its annual meeting in Boston. It was then determined to enlarge its scope and broaden its work. This it accomplished chiefly by the adoption of a new constitution which provided for the admission of all lovers of science to membership and the acceptance of the larger name. Accordingly, the first meeting of the American Association for the Advancement of Science was held in Boston, although it was not until 1848, a year later, that the first regular meeting of the newly formed organization was held in Philadelphia under the presidency of William C. Redfield, an early leader in American meteorology.

Regular annual gatherings of this, the fifth oldest scientific society in the United States, have since been held, except in the years 1861 to 1866, the period of the civil war. In 1866 the Association met in Buffalo under the presidency of the learned Frederick A. P. Barnard, who, for a quarter of a century, presided with conspicuous ability over Columbia University in New York city.

This year the Association turns to the place of its birth and meets in the hospitable precincts of Boston. The selection of a suitable candidate to preside over the deliberations of this semi-centennial meeting was not a difficult one. An officer—indeed, the executive officer—of the Association, after a faithful service of a quarter of a century, resigned his place at the Detroit meeting last year.

Of New England ancestry, an alumnus and a member of the faculty of Harvard University, Prof. Putnam was at once recognized as the only candidate possible, and he was, without dissenting voice, promoted from the most active office to the most honorable one in the gift of the Association. Equally was American science honored by this selection, for whether as a naturalist or as an anthropologist, Prof. Putnam is recognized as easily one of the foremost of American scientists.

Frederic Ward Putnam was born in Salem, Massachusetts, on April 19, 1839, and is a direct descendant of John Putnam, who was one of the first settlers in Salem. If we cross the ocean, the Putnam line may be traced to Puttenham of Puttenham, who died in 1642. His ancestry likewise includes the Appleton, the Ward, and the Fiske families, all well known New England names.

As a boy, young Putnam showed unusual fondness for the study of natural history, and his parents afforded him every facility in the pursuit of this favorite subject. One of the results of his fondness for the study of nature was the preparation by him of an accurate "Catalogue of the Birds of Essex County, Massachusetts," which was published by the Essex Institute in 1856, when he was only sixteen years of age, and which resulted in his being made Curator in Ornithology in that institution.

It was about this time that the attention of Louis Agassiz was attracted by the young man's devotion to natural history, and he was thus drawn to Cambridge, where, in 1856, he entered the Lawrence Scientific School of Harvard University and became one of that brilliant band of young men among whom were the younger Agassiz, Morse, Packard, Scudder, Shaler, and Verrill, all of whom now hold high rank among living naturalists in this country.

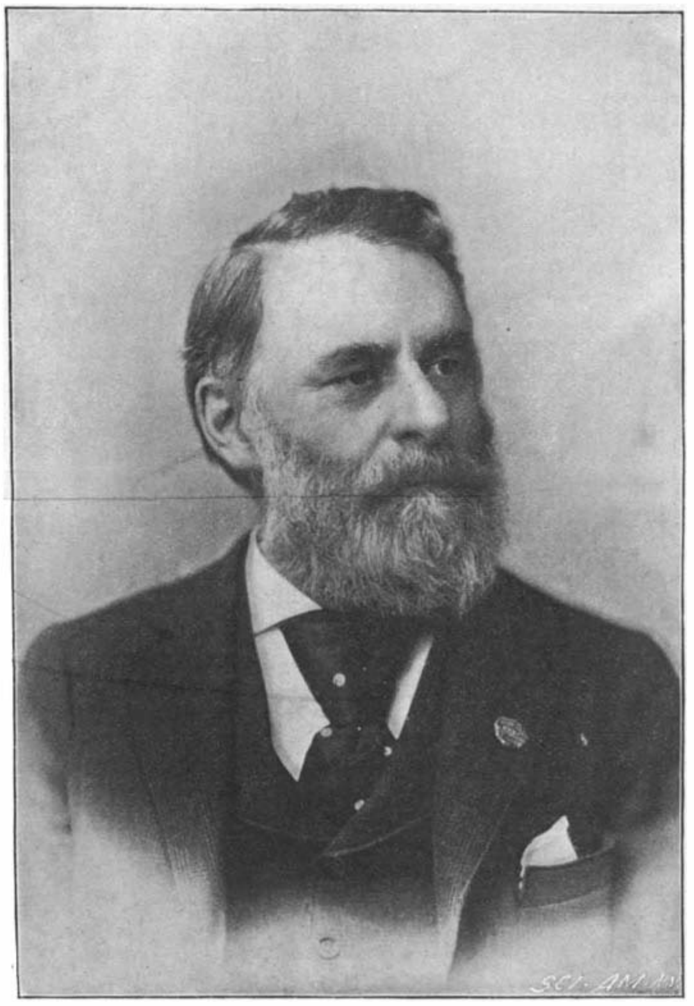
It was Putnam's intention to take a course in the Medical School, but the influence of Agassiz proved irresistible, and he soon became assistant in charge of the collection of fishes in the Museum of Comparative Zoology, which office he retained until 1864.

He then returned to Salem, where he accepted the place of director of the museum of the Essex Institute, and in 1867 he was made superintendent of the East Indian Marine Society's Museum. A few years later, largely as a result of his influence, the Peabody Academy of Science was organized by the combining of these two collections, and he was made director of the new institution.

When a student, his attention had been directed to American archæology, and in 1857, while in Montreal, Putnam discovered a shell heap, which, on investigation, he determined to be refuse material from an ancient habitation-site, and thus he became one of the first to attribute such shell-heaps to ancient man.

Although the first years of his scientific career were occupied with zoological investigations, still, on the death of Jeffries Wyman, in 1874, he was called to the charge of the collections in the Peabody Museum of American Archæology and Ethnology, in Cambridge, of which institution, in 1875, he was made curator.

His life work has since been devoted to the newer field of anthropology, but the change was not an abrupt one, and in 1876 he resumed his charge of the department of fishes in the Museum of Comparative Zoology. Thereafter, until 1878, he divided his time between the two museums, and then he decided to devote his chief attention to the growing demands of anthropology. The wisdom of this course has since been abundantly proved by his rich contributions to American archæology, and received its most conspicuous recognition in 1886, when he was called by Harvard University to fill the new chair of American archæology and ethnology, which he still holds.



PROF. F. W. PUTNAM.

In February, 1891, he was made chief of the Department of Ethnology in the World's Columbian Exposition, and in that capacity he directed the researches of seventy-five assistants in archæological, ethnological, and somatological investigations in all parts of America. The results were exhibited in the Anthropological building and afterward formed the nucleus of the anthropological department of the Field Columbian Museum in Chicago. Indeed, Prof. Putnam was the first to call attention to the importance of establishing a scientific museum in Chicago as a result of the World's Fair, and his article in The Chicago Tribune, in May, 1890, was the first public appeal to the wealthy citizens of Chicago, to secure such a museum for that city.

Prof. Putnam was called in April, 1894, to the curatorship of the department of anthropology in the American Museum of Natural History, in New York city, and since then he has had the direction of the various expeditions that have been sent out under the auspices of that institution for the purpose of forming an anthropological collection worthy of that great museum.

Brief mention must be made of other duties with which he has been active. In 1874 he was a member of the Kentucky Geological Survey, and made a special investigation of the caves of that State, and during the summer of the same year he was an instructor in the Penikese School of Natural History. He was appointed in 1876 to take charge of and report upon the anthropological material collected by the Geological Survey west of the one hundredth meridian, and three years later his results were published as Volume vii. (Archæology) in the quarto series of the reports of that survey. From 1882 till 1889 he was State commissioner, in Massachusetts, of inland fisheries.

In connection with his zoological and anthropological work, he has published over three hundred papers. He was the originator and editor of the Naturalist's Directory, as published by the Essex Institute in 1865. He was one of the founders of The American Naturalist in 1867 and an editor until 1874. He edited the Proceedings of the Essex Institute and the Reports of the Peabody Academy from 1864 till 1874, as well as the annual volume of the Proceedings of the American Association for the Advancement of Science since 1872; he has also prepared the annual reports of the Peabody Museum, in Cambridge, and edited all its publications since 1873. In 1890 he contributed to The Century Magazine several articles on his explorations of the famous Serpent Mound in Adams County, O., together with a summary of the archæology of the Ohio Valley, and the preservation of this prehistoric monument by the State of Ohio is due to his influence in creating a public sentiment in favor of such an action.

The degree of A.M. was conferred on him by Williams College, in 1868, and that of D.Sc. by the University of Pennsylvania, in 1874. The French government gave him the Cross of the Legion of Honor, in 1896. He has been elected to membership in fifty-six learned societies in this country and eleven abroad. In 1859 he was elected Curator of Ichthyology in the Museum of the Boston Society of Natural History, of which society he was made vice president in 1880, holding that office till 1887, when he was chosen president. Since 1890 he has been president of the Boston branch of the American Folk Lore Society, and in 1891 he was elected president of the American Folk Lore Society, the parent body. The American Philosophical Society of Philadelphia, the American Academy of Arts and Sciences, and the National Academy of Sciences, the three scientific societies in the United States to which election is only by invitation, include his name on their rolls of membership.

Prof. Putnam joined the American Association for the Advancement of Science at its tenth meeting, held in Montreal, in 1857, and in 1873 he was chosen permanent secretary, which office, by successive re-elections, he has since held. The membership, when he became secretary, was barely 500, and it is now upward of 2,000. The growth and development of the American Association are chiefly due to his tact, untiring energy, and remarkable executive ability.

His elevation to the presidency is an expression of the appreciation and gratitude of the thousands of scientific men both in this country and abroad, with whom he has formed pleasant acquaintance during his faithful service to the American Association, all of whom sincerely hope that, as a permanent member of the council, he may for many years continue to honor its deliberations with the wisdom that has come from his long service and experience.

### THE NEW SMOKELESS POWDER FOR ARMY AND NAVY.

The general public has learned in a practical way during the war the great superiority of smokeless powder over the now obsolete brown powder. The interference of our own smoke with our guns at San Juan and Santiago, and the way in which the Springfields, with which the volunteers were armed, drew the Spanish fire were object lessons easily understood and laid to heart by a practical people.

The decision of both the Army and Navy Departments to make the new powder the standard type in both branches of the service will be received with unfeigned satisfaction, as will the announcement that large orders are being placed for its manufacture. One of the chief causes of our backwardness in this matter has been the fact that, for lack of encouragement, manufacturers have hesitated to enter extensively into the manufacture and do the necessary but costly experimental work. Now, however, they not only start with large orders for an excellent powder, but the experience they will gain must necessarily result in a steady improvement in the art as carried out in this country.

In the current number of the SCIENTIFIC AMERICAN SUPPLEMENT will be found a lengthy account of the