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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