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LIGHT-WEIGHT BICYCLES.

Our recent editorial on the increasing weight of the bicycle has provoked a widely extended discussion in which the suggestions we made have been generally indorsed; although in the case of one or two contemporaries devoted to the interests of the bicycle, the statement that the weight of the bicycle should be reduced has called forth a vigorous protest. The L. A.W. Bulletin, for instance, while it admits that in 1895 wheels were ridden that weighed 20 pounds, is quite satisfied that in 1898 the weight of wheels should have risen to 28 or 30 pounds—an increase of fifty per cent in three years. The Bulletin is of the opinion that this added weight is necessary, if the public is to be provided with a thoroughly reliable mount. "Nevertheless," says our contemporary, "light weight is desirable, and the lowest weight at which a machine can be produced which will embody all the essential features is what the public want, and they will demand it and get it, as soon as some one points out how the reductions can be correctly made."

The problem of the proper weights of the bicycle is, or rather should be, dependent primarily upon the weight of the rider. If an engineer is called in by a county board to design a bridge, his first inquiry will be as to the loads the bridge must carry. The amount of metal he will put into it will be absolutely determined by the maximum loads that are liable to come upon it. If the structure is intended to carry droves of cattle, marching regiments of soldiers, or heavy traction engines, the steel work of the bridge will weigh very much more than if it is intended to carry nothing heavier than a few foot passengers and an occasional one-horse wagon. In the case of the bicycle, however, this very elementary and obvious consideration is entirely ignored, and the same weight of wheel is provided for the 100 as for the 225-pound rider. Judged from the standpoint of scientific design, this is doing things in a very rough-and-ready, rule-of-thumb way. The light rider is taxed for the sake of the heavyweight; and it is a proposition which needs no demonstration, that if a 100 pound man is riding a wheel which will carry a 250 pound man with a proper margin of safety, he is penalized to the extent of from five to eight pounds of unnecessary weight, which he must drag over hill and dale with not the least resulting benefit to himself.

The weight of the wheel is determined, primarily, by the weight of the heaviest riders. There is not a first-class maker in the country who would hesitate to supply a 200 to 225-pound rider with a standard wheel taken from stock, for he knows that the wheel has been built to carry that load. Having built their machines to withstand the "maximum load," the makers feel perfectly secure as regards the riders of moderate weight.

In the first place, then, there should be at least two weights of machine, to secure the best results, and provide a rider with a wheel that contained no unnecessary material. If the public demanded that wheels be built to match the weight of the rider, they would be accommodated. It is more convenient and profitable to the manufacturer to turn out only one grade; but the demand for classification of wheels according to weight of rider—at least to the extent of providing two grades—would be so reasonable that it would meet with a ready response.

With wheels built according to weight, the problem of reducing weight would be greatly simplified. The manufacturer would be no longer handicapped by a "live load" of say 225 pounds, except in the case of the heavyweight wheels, the demand for which would probably not exceed twenty per cent of all the wheels sold. "Shock," to which is due most of the failures in forks and frames, results from suddenly arrested momentum, and momentum is the product of mass or weight by velocity. If the weight is reduced by from forty to fifty per cent, so is the shock to which the wheel is exposed in striking large rocks on the road, passing over badly laid crossings, or in collisions. A reduction of forty to fifty per cent in the stresses to which a machine is subjected allows a proportionate reduction in the weight and strength of that machine, whether it be a locomotive or a bicycle. Just how much reduction can be made in the case of the bicycle, in which the destructive forces at work are chiefly dynamic, could only be proved by experiment; but that it would be considerable is proved by the fact that in 1895 twenty-pound wheels, which had been put together with the conscientious care that marked the construction of the lighter and more costly wheels of that date, did carry heavy riders through a season of hard usage.

We have been asked to state in detail just where the reduction in weight could be made; we reply that the total reduction in pounds can only be gained by taking off ounces or fractions of ounces at every possible point in the wheel. We have already suggested that by increasing the height of the frame to reasonable proportions and introducing a diagonal strut, all bending strains in the plane of the frame would be eliminated, and the reinforcements of the joints could be considerably lightened without in the least impairing its strength. By returning to sprockets of reasonable diameter and cutting out of the sprockets all unnecessary metal, many ounces of weight may be saved, both in the sprockets and in the reduced length of the chain. The lighter pedal pressures, due to the use of moderate gears, would allow some slight reduction in the weight of pedals and cranks—not a great reduction, perhaps, in itself, but something that would go to make up the five or six pounds that could be taken off the present wheel. By abolishing the divided crank axle, with its heavy sleeve, and returning to crank hangers of moderate dimensions, more weight could be saved. There is a certain combined 32-tooth sprocket, cranks and axle in considerable demand just now which must weigh double what the same parts did in the machine of 1895. We have lately seen barrel hubs that were cast in the same generous mould—massive chunks of metal which, in comparison with the small and thoroughly efficient hubs of the earlier wheels, are hideous and clumsy to the last degree.

The largest saving of weight, of course, is possible in the tires. Here we tread on debatable ground, for we are well aware that there are thousands of riders who believe that anything less than a 1⅝-inch tire is a "snare and a delusion." A few years ago, it is true, the 1¼ and 1⅜-inch tires were unable to stand the test of road work; but so rapid has been the improvement in the art, that there are certain makes of light, small-diameter tires that will hold up a rider indefinitely upon the average roads which a tourist encounters.

In conclusion, we draw attention to the fact that the light but strong wheel ought to have just as much attraction for the staid tourist as for the most pronounced and wild-eyed "scorcher." To the latter the reduced weight means that, riding up to and beyond the limit of his strength, he is able to get more speed out of his wheel for the same power. To the tourist the reduced weight means that he can maintain his old gait with considerably less expenditure of power. That this gain in efficiency is desirable, no wheelman can deny, and it is equally true that the manufacturers will provide it just as soon as the riding public makes the demand.

OUR LATEST BATTLESHIP.

With the successful launching on October 4 of the "Illinois," the total number of first class battleships afloat in our navy was raised to eight. The others are the "Iowa," "Oregon," "Indiana," and "Massachusetts," which are in active service, and the "Kearsarge," "Kentucky," and "Alabama," which are nearing completion, the two former at the yards of the Newport News Shipbuilding Company, where also the launch of the "Illinois" took place, and the last named at the Cramp's shipyard, Philadelphia. The "Illinois" is one of three vessels whose construction was authorized by Congress in 1896. The other two are the "Alabama" and the "Wisconsin," the latter of which will be launched within a few weeks by her builders, the Union Iron Works, of San Francisco.

In estimating the power and all-round efficiency of the new battleship, we cannot do better than compare her with another ship of the same class with which the public has become thoroughly familiar—the "Oregon." Measured on the basis of the displacement, the "Illinois" is about 1,237 tons larger, the normal displacement of the "Oregon" being 10,288 tons, and that of the "Illinois" 11,525 tons. A comparison by displacement of two ships built at an interval of six years (the "Oregon" was authorized in 1890 and the "Illinois" in 1896) does not, however, give an adequate idea of the superiority of the later over the earlier vessel, as the improvements in the methods and materials of warship construction in the interim render the later ship, weight for weight, a greatly superior fighting machine.

In a general way it may be said that mere increase in size means increase of efficiency, for the larger ship will be more stable as a gun platform, will be less affected by a head sea, and in case of an artillery duel to the death will possess a larger reserve of buoyancy, that is to say, it would take a larger number of shot holes to sink her.

Judged as a seagoing vessel, the most marked advantage of the "Illinois" over the older ship is in her increased freeboard. The main deck in the "Oregon" is about 12 feet above the waterline, but the "Illinois" is provided with a spar deck which extends above the main deck for over two-thirds of the ship's length. This raises the freeboard to 20 feet forward and amidships and 13¼ feet aft, an increase which would enable her to steam full speed and with fairly dry decks into a sea which would roll green water over the bows and forward turrets of the "Oregon." The advantage of freeboard was noticed during the Santiago blockade, when the "Oregon," or one of her type, was steaming to Guantanamo in company with the "Texas" (a high freeboard ship) against a nasty head sea. The "Texas" was dry and buoyant, while the low freeboard vessel was plunging heavily. A further advantage resulting from lofty decks is the high command of the guns. The bore of the forward 13-inch guns of the "Illinois" will be 26½ feet above the water, as against 18 feet for the "Oregon." The other guns will be carried at the following heights: The 6-inch guns from 15 to 22½ feet, the 6-pounders from 30 to 40 feet, and the 1-pounders in the tops will be from 60 to 80 feet above the waterline. Command in a gun at sea has been likened in its advantages to "reach" in a boxer. Not only are the guns and their mounts out of the reach of the waves, but their projectiles are less likely to be deflected by striking the tops of the waves.

The protective arrangements of the "Illinois" are greatly superior. Not only does she carry armor of a greater resisting quality, but it is better disposed. The side armor of the "Oregon" only extends in the wake of the engines, boilers, and magazines, that of the "Illinois" is carried right up to the bow. The bow of the "Oregon" might be broken in by rapid-fire shells, letting water into the forward compartments and throwing the ship out of trim. This could scarcely happen to the "Illinois," whose bow at the waterline will be protected with 4 inches of Harveyized steel—sufficient to burst the shells of medium caliber on the outside of the vessel. The protective deck, moreover, will be heavier, being 2¾ inches on the flat and 3 to 4 inches on the slopes, as against a uniform thickness of 2¾ inches in the "Oregon." The heavy armor of the sides, turrets, and barbettes will be of about the same thickness as that of the "Oregon;" but as it will embody the improvements in the art of armor manufacture which have taken place in the past six years, its resisting qualities will be considerably greater.

The same degree of improvement is noticed in the armament, for although the main battery is the same, consisting of four 13-inch guns, the improvements in turrets and turret gear, in mounts and breech mechanism, are such as to greatly increase the efficiency of these weapons in the "Illinois." When we come to the secondary or intermediate armament, we are on debated ground. In the "Oregon" this consists of eight 8-inch and four 6-inch slow-fire weapons, while in the "Illinois" it is represented by fourteen 6-inch rapid-fire guns. The twelve guns of the "Oregon" are capable of about nine shots per minute, under favorable circumstances, whereas, under similar conditions, the fourteen guns of the "Illinois" could deliver between eighty and ninety shots in the same time. The destructive and crippling effect of an 8-inch shell would be enormously greater than that of a 6-inch shell, but the chances of making a hit would be 9 to 1 in favor of the rapid-fire weapons. The results at Santiago show that rapidity of fire is of prime importance, and seem to confirm the wisdom of our naval authorities in replacing the 8-inch slow-fire by the 6-inch rapid-fire guns.

But what a pity that we do not possess an 8-inch rapid-fire gun in our navy.

The 6-inch battery is disposed on two decks and is protected by a complete wall of armor 5½ and 6 inches in thickness; moreover, the effect of a bursting shell is localized by walls of 1½-inch steel which extend out from the sides of the ship between each pair of guns. Other improvements will be found in the method of supplying ammunition to the guns and in the mounting and general handiness of the guns themselves.

Taken altogether, the "Illinois" is a great advance upon the earlier ships, the only point in which the "Oregon" approaches her being that of speed. The "Oregon," on her trial trip, made 16·8 knots; the contract speed of the "Illinois" is 16 knots. As there is no speed premium attached to the later vessel, it is not probable that it will exceed, even if it equals, that of the Pacific coast vessel.

IMPORTING SONG BIRDS FOR OUR WOODS.

Humiliating as it is, the fact must be recognized that our native song birds have been so flagrantly destroyed that many varieties have become rare visitors in our woods and parks, and a few are even threatened with total extinction. The attempts to protect the birds adequately have only succeeded partly in stemming the crusade of destruction, and in no instance have these protective measures resulted in any material increase in the number of songsters. It is believed by experts that the work of killing off the birds has gone

so far that it is quite essential that their numbers should be multiplied by some artificial means. The ordinary processes of nature are too slow, considering the great mortality that must, of necessity, obtain among birds beset by so many enemies as our native songsters are from the moment of their birth until they reach maturity.

There has, consequently, been started a movement among the bird societies of the country which promises to make a complete change in the character of our woods, fields, and parks in a comparatively short time. There has always been a large importing trade in birds in New York, and thousands of Europe's best singers have been brought to this country annually; but these canaries, bullfinches, nightingales, and linnets have all been reared for cage life. They have found their way into innumerable pleasant homes, where their singing is understood and appreciated. New York's bird importing trade has amounted to many thousands of dollars annually, and, with the steady decrease in the numbers of our native songsters, it has expanded and broadened. To-day there are some half dozen large importing houses which make a specialty of handling the song birds of Europe, while retail traders are scattered all over the country.

But now the bird importers have a new demand for their stock. From all parts of the country bird societies and private individuals are purchasing the European song birds for the purpose of restocking the woods, fields, and parks of the country with little warblers. It has been found easier to import certain foreign song birds here than to attempt to increase the numbers of native singers by artificial means. In Europe the song birds are raised on a large scale for commercial purposes, and they can be purchased in quantities cheaper than our own native birds.

Some ten years ago the question was seriously discussed, "Can the European song birds be successfully introduced and reared in this country?" The only answer to this was a practical experiment. A number of nightingales and English skylarks were imported and turned loose in Connecticut and Massachusetts. Great expectations were entertained, but the experiment was doomed to failure. The birds were seen a number of times after they were given their liberty. Then they disappeared entirely. Another lot was imported and turned loose in the northern part of New York city, but, like the first importation, the birds soon died. This was so discouraging that for a time the matter rested. It was supposed that our climate was not suited to the health of these little foreign singers.

But it was hinted by some bird fanciers that the English nightingale was about the hardest of the European songsters to acclimate, and that there were many good song birds in the Harz Mountains which might find this country a congenial home. Following this, a bird society in far-off Oregon decided to make an experiment. Mr. Frank Dekum, a public spirited resident of Portland, was president of the society, and Mr. C. F. Pfluger secretary, and together they raised enough subscriptions to purchase a large consignment of European birds. The Web Foot State has some of the finest game birds in the world, but its woods have always been barren of song birds, and it was considered quite an achievement to stock the fields and parks with song birds from Europe that the Eastern bird societies had failed to introduce.

The first consignment was a large and representative one. There were three hundred pairs of song thrushes, skylarks, goldfinches, siskins, woodlarks, black thrushes, chaffinches, crossbills, black starlings, green finches, bullfinches, robin redbreasts, linnets, singing quails, goldanners, forest finches, and both the plain and blackheaded nightingales. This large company of singers left Europe in perfect condition, but they had a rough ocean voyage, and a number of them died before they reached New York, and many others were sick and worn out. They reached their destination twenty-two days after starting from Germany. They were turned loose in the fields, woods, and parks near Portland. Beforehand, however, they were placed on exhibition in cages, and thousands of people went to visit them. Some of them, after they had rested a day or two, began to pipe and warble, and by the time they were given their liberty they were in a very tuneful condition.

Without waiting to see if this first consignment proved a failure or success, the same enterprising society had a second lot imported in the autumn of 1892. As it was considered dangerous to turn them loose just before a hard winter, this consignment of birds was wintered in a large aviary erected for them by the president of the society. The following spring they were given their liberty in the city park and the adjoining woods and grounds. The birds, upon being released, hopped about among the trees, singing and twittering joyfully. Then many of them gradually disappeared in the woods, while the finches and linnets took up their abode in the park.

The results of these two experiments were watched anxiously by bird-lovers all over the United States. If they should prove adaptable to their new home, it would be the beginning of a great movement for importing European songsters. The following summer, the birds were not only found in the woods and fields, but many of them were building nests, and before another winter came around they had more than doubled their numbers. Since then they have increased rapidly, with but few exceptions. The woods are full of singing skylarks, woodlarks, linnets, and finches. The nightingales, however, did not do well, pretty conclusively proving that the Eastern bird societies happened to select the most difficult singer to acclimate. At first the range of the imported singers was limited to the woods within a few miles around Portland, but now they have extended to neighboring counties, and the skylarks in particular are found in plentiful numbers all over the State. These birds rear from two to four broods every season, and flocks of hundreds of them can be seen any day in the fields of the Web Foot State.

Next to the skylarks, the song thrushes and woodlarks multiplied the quickest, and then followed the starlings and the goldfinches and chaffinches. The most remarkable thing about these little strangers was their migration. When the cold winters swooped down upon the State, the birds took their departure to warmer climes. In October many of them were found in California, journeying southward in flocks. Later they appeared in Southern California; then some of them were reported in Mexico, and a few of them went as far south as Central America. But as soon as spring returned they retraced their steps, and never stopped on their way to breed until they reached Oregon and Northern California. Here they built their nests near the place where they had first been given their freedom, and every summer since they have returned to their first home as regularly as our native migrants. Some of them were hardy enough to withstand the rigors of our climate, and they wintered in the dense forests of the Cascade and Coast mountain ranges.

These birds are not so high priced as the cage birds which are trained to sing certain tunes and to live comfortably in confinement. They are wild and semi-wild singers, trapped in the woods for this purpose, and shipped to this country immediately. They would not live long in confinement, nor would the cage birds live long in the woods. By ordering them in numbers, the singers can be obtained as low as $1 a pair for skylarks and woodlarks, while nightingales cost from $5 to $10 per pair. The chaffinches and goldfinches are 50 cents to $1 apiece and the bullfinches a little more.

G. E. W.

THE UNIFORM OF THE SAILOR.

In the issue of the SCIENTIFIC AMERICAN for last week the reader will find an article on the "Uniform of the Soldier" which deals with the origin of the army uniform. We will now take up briefly the consideration of the navy uniform, and for our facts we are indebted to an interesting article in The New York Sun.

In the days of the Continental Army navy blue, red, and buff prevailed, but in the navy to-day the only colors to be seen are blue, white, silver, and gold. For many years the American naval officers had their uniforms lined with either red or white, but this was abandoned before the war of 1812. The records of the Navy Department show that the first American naval uniform was authorized by the Massachusetts Council in 1776, the resolution being adopted that the uniform of the officers be green and white, and that the colors be a white flag with a green pine tree and an inscription "An Appeal to Heaven." On the 5th of September, 1776, the Marine Committee met at Philadelphia and issued an official regulation. The captain's uniform should be blue cloth with red lapels, slashed cuffs, standup collar, yellow buttons, blue breeches, and red waistcoat. A midshipman had a blue lapeled coat, cuffs faced with red, and with red at the button and buttonholes. In full dress gold lace was introduced and red was eliminated. The coats were of dark blue, with white linings and white cuffs.

In the spring of the next year there was a further change, which is noted in some manuscript papers of Paul Jones, preserved in the Library of Congress, blue coats with white linings and white cuffs, narrow white lapels, red down the whole length of the waist, and, instead of the red waistcoat and breeches, white ones were prescribed. The regulations said that gold epaulets were to be worn on the right shoulder, the figure of a rattlesnake being embroidered on the straps of the epaulets, with the motto, "Don't Tread on Me." The yellow flat buttons on the waistcoat also had the impression of the rattlesnake and the motto, "Don't Tread on Me." Various portraits of Paul Jones, Capt. Nicholas Biddle, Commodore Edward Preble, Commodore Alexander Murray, and Commodore John Barry are instructive links in the history of the evolution of the uniform, and show that the commanding officers introduced certain changes. Beginning with the order in 1830 of John Branch, Secretary of the Navy, the uniform was materially changed and further changes were introduced perhaps a dozen times before the present styles were adopted. Secretary Branch made the full dress coat of dark blue cloth lined with white. It was double breasted, with long lapels and cut with a swell; nine buttons on each lapel, which was to be buttoned back, and an equal number of buttonholes worked in twist as long in width as the lapels would allow. It had a standing collar lined with white and embroidered with gold. Two gold epaulets, faced with white, and white breeches with small naval buttons and gilt knee buttons, white silk stockings and shoes with gilt buckles completed the costume. Under these regulations epaulets were only to be used with cocked hats or caps. Lieutenants wore only one epaulet. Until the year 1839, the marines wore green coats with white or buff facings, but in that year it was changed to blue with red facings. The color has not since been altered and the members of the marine corps still wear coats of blue with red linings. The uniform of the sailors has changed as frequently as that of the officers. Up to 1835 they wore red waistcoats when in their mustering suit, but between that time and 1839 they wore blue cloth jackets and trousers and white shirts, with large blue nankeen collars and fronts trimmed with rows of white tape.

The introduction of new grades into all branches of the navy, in 1866, necessitated a reorganization of the navy uniform, which was done by Secretary Welles. At the present time the special full dress coats of all commissioned officers, except chaplains, is of dark navy blue cloth, double breasted, lined with white silk serge, the waist of the coat to descend to the top of the hip, the skirts to begin about one-quarter of the way from the front edge and descend four-fifths of the distance from the hip bone to the knee. Two buttons are on the waist behind and one near the bottom of each fold. Two rows of large naval buttons are on the breast, nine in each row, the rows being from four to five inches apart, from eye to eye at the top, and two and one-half inches at the bottom. The collar has one strap of heavy gold wire or thread lace around the top and down the front, the width varying according to rank. The frock coat is lined with black silk serge, and has shoulder attachments for epaulets.

The service coat is made to descend to the inseam of the trousers and is single breasted. The collar edges of the coat, side seams, and edges of the hip slits are trimmed with lusterless black mohair braid, one and one-quarter of an inch wide. On each side of the collar is embroidered in high relief, one inch in width, the corps badge and grade devices. The trousers are of dark navy blue cloth and have a strip of gold lace down their outer seams. Instead of the red or white waistcoat of former years, the one now worn is a dark navy blue. Gold lace ornaments are worn on the sleeves to designate the rank of the officers. They vary in width according to rank. The staff officers, except chaplains, wear the lace of their rank, but, in addition, have bands of colored cloth around the sleeve, medical officers using dark maroon velvet; pay officers, white cloth; engineer officers, red cloth; naval constructors, dark violet cloth; professors of mathematics, olive green cloth; civil engineers, light blue velvet.

On epaulets, rear admirals have two stars, with a silver foul anchor in the center; commodores have one star, with a silver foul anchor at each end: captains have a silver spread eagle in the center, with a silver foul anchor at each end; and commanders have a silver oak leaf at each end, with a silver foul anchor in the center. A gold oak leaf is used in a similar way by lieutenant-commanders, and lieutenants substitute two silver bars at each end for the leaves, while ensigns have to be content with a single foul anchor.

All commissioned officers, except chaplains, are also provided with a rigid cocked hat, made of silk beaver. The rank is distinguished by various decorations and trimmings. Of course, these hats are only used for state occasions, and the ordinary navy cap is used on shipboard.

SPANISH WOODEN BULLETS.

It is well known that Spanish soldiers in Cuba were poor marksmen, but great surprise has been expressed at the remarkable lack of execution which characterized their fire at Guantanamo and Santiago, and an officer of the United States gunboat "Montgomery" has been able to throw some light on the matter. He visited the "Maria Teresa" after the destruction of Cervera's fleet in search of souvenirs. He found a large number of Mauser cartridges in groups of five ready to go into the magazines of the guns, and, if the entire Spanish army and navy were equipped with that kind of ammunition, both Cervera and Toral were amply justified in surrendering when they did. The cartridges consisted of a metal shell loaded with hair and a sprinkling of powder. The bullet was of neither brass nor lead, but of wood. Some army contractor had imposed on the ordnance bureau of the Spanish navy, but to what extent the wooden Mauser bullets were used will probably never be known.

PENSIONS IN NEW ZEALAND.—In New Zealand a law allows a yearly pension of almost $200 to every needy and respectable person who has passed the age of 65 years and has lived for 20 years in the colony.