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## THE FACTOR OF SAFETY IN YACHT CONSTRUCTION.

If we except the bicycle, there is probably no product of the mechanic in which the factor of safety is reduced so near to the vanishing point as in that highly developed machine known as the racing yacht. It has been estimated that the factor of safety in a light road bicycle when it is being ridden by a heavy rider over rough roads is not over  $1\frac{1}{2}$ . That is to say, when the machine experiences its heaviest jolts the metal is being strained to within 25 per cent of its ultimate strength. The frequency of broken forks and buckled frames is the price we pay for lightness in a machine which, while strong enough to withstand the ordinary stress of travel, has but little provision for accidents in the way of rocks, curbstones, or collisions. The public is willing to sacrifice a surplus of strength in favor of light weight, and in the case of careful and judicious riders the sacrifice is abundantly justified.

In competitive yacht construction the saving of weight is not a matter of choice but of necessity, particularly in these latter days of the art, when the principles of design are so well known that in model and sail plan there will be comparatively little to choose between two rival yachts when they meet on the trial course. As far as the designer and builder are concerned, the contest has come to be one of weight-saving in construction; and the engineer can now claim yacht construction as one of the many arts which, like that of practical architecture, have called in his services and availed themselves of his knowledge of strains and the strength of materials. Thornycroft in England and Herreshoff in America had both achieved reputations in the construction of fast torpedo craft when the inevitable drift of ideas and events in yacht construction drove Lipton to the one and Iselin to the other in their endeavor to secure the ideal racing craft.

How closely Herreshoff and Thornycroft have crept to the danger line in the yachts "Defender," "Columbia," and "Shamrock" is suggested by the mishaps which have overtaken these boats in the course of their respective preliminary trials. In one race "Defender" carried away her gaff, in another the enormous strains on the shrouds caused them to cut into the masthead, and in a third race the steering gear collapsed. "Shamrock" at her launch is merely touched by the stem of a friendly tug which leaves a deep imprint in the frail metal of her hull. Later she goes out for a trial sail, and the breeze has scarcely filled her sails before the halliards part and the mainsail comes down on the run. On her first race she carries away her club topsail yard, and immediately after her start for America, something goes wrong with her bowsprit and she must needs put back for repairs.

And now it is "Columbia's" turn, and just what has happened to her is best understood by a glance at the two illustrations on our front page, one of which shows this lovely craft—by far the most beautiful that Herreshoff has ever turned out—under her full press of canvas, while the other proves on what a "slender thread"—in this case a slender stick—the integrity of that towering weight of spars and sailcloth depends. It was the case of the strength of the chain being equal to the strength of the weakest link—the link in this case proving to be the "port spreader," a slight pine stick which extends some 15 feet laterally at a point near the heel of the topmast and serves to "spread" the topmast and masthead shrouds and enable them to exert a more lateral and less vertical pull on these spars. When the spreader split, these shrouds slackened, and the enormous lateral pressure upon that towering pile of canvas, nearly 140 feet in height, fell upon the steel mainmast. While the mast was strong enough to stand the compressive strains thrown upon it by the pull of the shrouds, forestays, and backstays, it was quite unequal to the cross-bending strain when the shrouds were slacked up, and it promptly bent over and shut up, "after the fashion of a boy's tin putty blower," as some one expressed it, the wooden topmast snapping in two, and the whole mass of sails, rigging, mast and spars falling over to leeward in the pic-

turesque confusion shown in our photograph of the wreck. No blame is to be attached to the steel mast, as a solid wooden spar would have proved equally helpless under like conditions.

There is a lesson in this circumstance which such a shrewd observer as Herreshoff will not fail to learn. While in the larger elements of a yacht, such as the hull and spars, weight may be judiciously saved to within a certain safe limit, there are smaller but very vital elements, such as the spreaders, the steering gear and certain details of the rigging, in which extreme economy of material may prove to be the very worst form of extravagance.

## OUR FOREIGN TRADE FOR THE LAST FISCAL YEAR.

The trade of the last fiscal year is most astonishing and is a remarkable indication of the prosperity of the country. Our total imports for the year amount to \$697,116,854. Of this sum, \$211,869,918 was for articles of food and live animals; \$221,998,377 was for articles in a crude condition which entered into the various processes of domestic industry; while only \$108,621,406 was for articles manufactured ready for consumption; and what the Treasury Bureau of Statistics terms "articles of voluntary use, luxuries, etc.," amounted to only \$93,914,635. Duty was collected on 43 per cent of everything imported and amounted to \$206,507,812.

Our total exports amount in value to nearly twice our imports, the sum reaching the enormous total of \$1,204,123,134. Of this sum, \$784,999,009 was for products of agriculture, so that in this class alone our exports amount to a larger sum than all our total imports. Our exports of products of manufactures amounted to \$338,667,794. Our products of mines exported amounted to \$28,832,547. Our products of the forests exported amounted to \$42,316,779. The fiscal year shows indeed a magnificent trade balance in our favor.

Manufactures are now becoming more than a third of our total domestic exports and the quantity and value are constantly increasing. Of this remarkable growth, the manufactures of iron and steel are the most striking. Out of a total increase in our exports of manufactures during the year which amount to about \$48,000,000 in round numbers, \$33,000,000 is in manufactures of iron and steel. The total exports of iron and steel manufactures for the fiscal year 1899 were \$93,715,000, or more than three times as much as those of 1894. On the other hand, the imports of manufactures of iron and steel continue to fall, having been during the year \$12,098,239 against \$25,338,103 in 1896 and \$53,544,372 in 1891; thus, while our exports in this line have been constantly growing, the imports have fallen, so that they are now less than one-half what they were in 1896 and about one-fifth what they were in 1891.

## A NATIONAL PARK IN THE EAST.

The creation of a great national forestry and game reserve in northern Minnesota, embracing 7,000,000 acres around the headwaters of the Mississippi River, with many lakes of rare beauty, well stocked with fish, will be advocated before Congress next winter by prominent citizens of Chicago and Minnesota. The promoters of the plan are not likely to experience much difficulty in interesting Congress. The game and the virgin forests of the United States are disappearing so rapidly that it is exceedingly important that measures be taken, before it is too late, to save some of the great wooded areas of the continent.

It is one of the marked features of the legislative and popular indifference to their best interests common to those regions that such enterprises as this never originate in our Southern States. Yet there, it would seem, we have the most promising, most adaptable, and most accessible regions for such purposes to be found anywhere within our national limits. Nearly all of the forestry reserves that have been established up to the present time are in the far Northwest; the chief of them, the Yellowstone National Park, is inaccessible to the great majority of the people. Nothing of national scope is to be found east of the Mississippi River.

Within about a day's travel of New York, Philadelphia, Baltimore, Washington, and most of the Atlantic seaboard, and quite as accessible to Pittsburg, Cincinnati, Louisville, Indianapolis, and St. Louis, there are vast stretches of virgin forests—along the line of the Great Smoky Mountains, on the border between Tennessee and North Carolina—that are thoroughly suited to the purposes of a great game and forest preserve. Going up from the lowlands at Walhalla, S. C., to the high plateau surrounding Highlands, N. C., a stage trip of about thirty miles, the late Prof. Gray, the eminent botanist of Harvard, tells us that he encountered a greater number of species of indigenous trees than could be observed in a trip from Turkey to England, through Europe, or from the Atlantic coast to the Rocky Mountain plateau. The region surrounding that described by Prof. Gray, especially to the west, with the headwaters of the Tennessee, the French Broad, and the Savannah Rivers, all within a few miles of each other, with fertile valleys and mountain elevations of 5,000 feet or more, and a density of ver-

ture unapproached elsewhere, is an ideal spot for a preserve, where every sort of North American animal or fish would thrive and where almost every tree or plant found within our borders from the Atlantic to the Pacific would grow uncared for. The land in this region is still purchasable "for a song," certainly at as little as or even less than that obtaining in the Northwest. The climate, while sufficiently severe in the winter to suit the more northern species of animal life, is never sufficiently so to kill great quantities of game, either by freezing or through lack of winter food, as is not uncommon in the Northwest woods.

Added to the climatic and the varied physical characteristics of this region, which especially fit it for the purposes in view, there is no like region obtainable where the varied and picturesque scenery so admirably adds to the desirability of the location. While these headwaters are singularly devoid of lakes, there are ample streams running through deep valleys and gorges which render the production of artificial lakes and reservoirs a matter of detail and of slight expenditure. Cascades and even waterfalls of very considerable dimensions abound on every hand, vast stretches of virgin forests, with an evergreen undergrowth of laurel, kalmia, rhododendron, etc., afford ample shelter and browsing for the winter, while the steep mountain sides, largely covered with boulders and rocky ledges, from every cranny of which dense vegetation springs forth, furnish safe homes for all varieties of our smaller mammals.

A park that would take in the region along the Smoky Mountains around Clingman's Dome, or the southern slopes around where North and South Carolina and Georgia meet, in the middle of the headwaters of the Savannah River, or where Tennessee, North Carolina and Georgia meet, would not be misplaced. The timber and mineral wealth of the regions mentioned are such that it can only be a question of a few decades when these mountain slopes will be denuded and when the people of the vast valleys that depend on these watersheds for their water supply will suffer from the blindness of a generation that could not foresee the otherwise inevitable and combine its prevention with the benefits of an enduring national park in the populous East.

## POSTAGE AND THE EXPORT TRADE.

A correspondent of ours from Sydney, N. S. W., has made a complaint regarding insufficient postage on matter sent to him from the United States, and we have also received complaints from so many other sources that at last it has become necessary to sound a note of warning which American manufacturers and exporters should heed. Our correspondent states that American firms are extremely careless in the matter of postage paid by them. He and his partner are native Americans, and understand American methods of doing business, and the bulk of their business is in American goods. They keep a mail book and enter every letter posted, and when an answer is received a check mark is entered after it and an account is kept whether a reply is received or not, or whether the letter is returned to the Dead Letter Office. He found on going back over this book that 20 per cent of the letters were never answered, and that in the matter of underpaid postage from the United States it has cost them on an average of \$3 for each mail during the years the book has been kept. Often this amounts to from twenty-five cents to a dollar on circulars of absolutely no use to the firm of manufacturers' agents, importers, and commission merchants. They find that in twenty years only two failed to reply from English and Continental firms and in only three cases was their postage short. He strongly condemns American neglect and methods of business in this respect. Our export trade is now at the highest level which it has ever reached, and if we are to maintain our present satisfactory position it will be necessary for our manufacturers and importers to pay the strictest attention to all the minutiae connected with the business. Our consuls abroad are constantly sending complaints regarding the lax business methods in correspondence and in the matter of postage. There is no difficulty in prepaying all matter sent abroad, so that an onerous burden is not placed on the recipient. Often small matters of this kind defeat the very end which the sender has in view.

## THE PRODUCTION OF SLATE.

Various materials have been proposed to take the place of slate, but the ease with which this substance can be cleft assures for it a permanent use and it is interesting to note the actual importance of its production.

France holds an important place in this respect, and ranks second among the slate-producing countries. In Marne-et Loire the slate quarries produce annually about \$4,000,000 worth. Her principal competitor up to the present has been the United Kingdom, where, in Wales, Cumberland, Westmoreland, Ireland, and the Isle of Man, are situated quarries whose production last year amounted to nearly \$8,800,000. But it will soon be necessary to place the United States well up in

the list of competitors, for this special industry has assumed considerable proportions here, and slate to the value of \$3,600,000 is produced annually. Small quantities are also quarried in Canada, Belgium, Germany, and India. The estimated production of the entire world is valued at \$16,600,000.

#### SOME SODA WATER FOUNTAIN STATISTICS.

The chemist who discovers a process of making a new drink and is successful in putting it on the market soon finds himself on the high road to financial success; but of the scores who are laboring in season and out of season to concoct some new mixture that will appeal to the taste of thousands of thirsty mortals not one per cent reaches the goal for which he is striving. Notwithstanding the popular craze for something new in cooling drinks in summer, and hot and bracing in winter, the number of successful drinks each season is very small indeed. Occasionally the large department stores will take up a new drink and advertise it extensively, and there will be a temporary rush for it which will make the profits large both for the dispenser and the inventor. But there is nothing in which the public refuses to be fooled for any length of time more than in the drinks which are consumed summer and winter. If a really new article of virtue is introduced the public stands by it, and there is a steady and constant demand for it; but most of the new mixtures are merely variations upon the old drinks intended to deceive the consumers.

The summer trade in soft drinks is peculiarly handicapped in this respect. It is already so loaded down with different sirups and drinks that dealers will not take hold of a new thing unless it can be demonstrated to possess unusual virtues, or the inventor of it is willing to put a lot of money in advertising it. The largest fountains, where the trade in soda water on a hot day amounts to a thousand or more glasses, have to carry in stock from fifty to one hundred different flavors. The majority of the customers will only call for a few different flavors, but the dispenser of drinks must be prepared to satisfy the crank who is bound to call for some odd flavor if it happens to be out. It is to prevent the expansion of this already too formidable list of sirups that the trade is opposed to the indiscriminate introduction of anything new.

On the other hand new drinks are put on the market every season, but these are often the result of a little independent work on the part of the owner of the fountain. It is an easy matter for him to concoct a new drink. His knowledge of sirups, waters and chemicals enables him to mix different ingredients together which will produce a flavor peculiar to itself. It may have no other virtue. But if it is properly named and skillfully advertised, it may have a "run" or a season that will pay big profits. The soda water man does not expect a permanent trade in it; he is satisfied if it will take for a few weeks or months. Usually the drink is one that does not cost much to make. Enterprising druggists and department stores in the shopping districts get out these special drinks, which can be obtained nowhere else, and publish them in a little pamphlet to distribute among customers or on the street. It is remarkable what this little advertising will do on some hot days. The wording of the advertisement must, of course, be unique and attractive, and the name given to the drinks appropriate to the season and location. One druggist confessed that he caused a run on a simple and harmless drink in this way that averaged a sale of 500 glasses a day through July, and some of the big department stores must even exceed this.

The shopping district is the best all-round soda water district in the city. Down town in the business district the soda water season is short; comparatively few men will call for this typical American drink except in very hot weather. Then the stores do a rushing trade, especially in the phosphates. A phosphate soda is considered about as harmless a cold drink on a hot day as any concoction yet devised, and it quenches the thirst as well. Consequently, staid and sober business men will indulge in one or more glasses of this drink in preference to clear ice water. On the hot days, some of the large down town drug stores sell a thousand or two drinks, chiefly of plain soda and phosphates. Ice-cream soda is not a man's favorite drink, but up town in the shopping district it outclasses almost all other drinks. It has a long season, beginning early in the spring and lasting until cold weather comes. The department stores make a specialty of the ice cream soda because it is in such general demand; but on the whole it is not as profitable as the plainer drinks. The reason for this is not that the cream costs so much more, but because of the amount of time required to consume it. Time is everything to the soda water man on a hot day. With new customers crowding and jostling each other to reach the counter, it is money in his pocket to get rid of consumers as quickly as possible. It takes a woman considerable time to eat and drink her glass of ice cream soda. Usually she expects to make this an excuse to rest and gossip, and she may occupy her seat at the table or counter for ten or fifteen minutes. In that length of time a dozen

or more sodas could have been dispensed to new customers who would like to take their places. So as a matter of business the ice cream soda is not a favorite with the soda water man in the hot weather. Some absolutely refuse to serve it, except on ordinary days when there are no crowds. It is convenient to be out of ice cream when the mercury is climbing up among the nineties.

The largest recorded day's business in soda was made on one of the hot days in June, when one down town drug store, which keeps open all night, sold over its counter 8,000 glasses of soda and soft drinks. There were many other stores which sold from 3,000 to 5,000 glasses. Such records are not made often, but there are always from a dozen to twenty days in each summer when the average thus runs high. During the rest of the season the demand is what is called moderate, but in reality the profits are enormous.

In former days the few manufacturers of soda water controlled nearly the whole trade in sirups and all carbonated waters. To make more of a monopoly of it, and to hold on to customers, the manufacturers supplied their customers with elaborate fountains and signs. The only stipulation was that the customer bought his soda from the manufacturer. The outfits did not go out of the possession of the manufacturers, and could be taken to another customer if the soda water man failed to live up to his agreement. The cost of these plants, with their handsome marble fronts and plate glass sides, ran all the way from \$500 to \$10,000 and \$15,000. To-day most of the department stores and druggists order their own fountains and owe allegiance to no company. More than that, they do not even patronize the companies to the extent of purchasing sirups or carbonated water from them. They have their own carbonating plant and make their own sirups. A complete carbonating plant can be put in for a few hundred dollars, and after once installed the cost of making the soda water is very small. The firms who supply the carbonated waters in portable tanks charge from eight to ten cents a gallon, but the druggist can make his own beverage at less than three cents per gallon. Where large quantities are used, the difference in the original cost is so great that the saving will almost pay for the equipping of a carbonating plant in one summer.

With the carbonated water thus reduced to three cents a gallon, the profit on a glass of soda water is great. The sirups and cream represent a greater cost than the water itself; but where the flavoring extracts are made right in the store a glass of plain soda with any of the ordinary sirups does not cost the dealer more than a cent and a half. A good glass of ice cream soda cannot be made for less than three to five cents. The latter is usually the average cost in high class stores where the best of cream is used. The price of ten cents a glass, considering the slowness with which consumers drink it, does not make the profit so large as an ordinary plain soda.

The soda water fountain is an American product, but there is reason to suppose that other countries are gradually contracting our national taste for this summer beverage. One large firm makes a business of manufacturing a certain type of soda water fountain and carbonating plant for export. The South American countries in particular show a growing penchant for soda water. A good many of the old-fashioned, discarded soda water fountains find their way to South America and even to South Africa. The demands of the trade are such that every druggist in the city aspires to have constructed for his store a fountain of superior size and taste, and this causes many old fountains to be thrown upon the market. Formerly these were sold to the small country dealers, but now a considerable number of them are bought up by the second hand dealers for the export trade. G. E. W.

#### IMPROVEMENTS IN OUR TOBACCO.

The Department of Agriculture has now a number of experts at work on the question of improving our tobacco and making it as desirable for consumption as that imported. We do not know of any subject to which the department could devote its attention which would bring back such a large financial return as the improvement in our domestic tobacco, which will dispense with the importation of such vast quantities of wrappers and filling tobacco. The Sumatra leaf, while not relished by all smokers, is a most economical wrapper-leaf. It is good in color, and a pound will cover many more cigars than the domestic product. The Havana wrapper is a great favorite, owing to its color and incomparable flavor. To compete with these imported wrappers the American producer must furnish a leaf which will resemble the others in appearance and which will be fully equal in flavor. It is not so difficult for them to accomplish the former as the latter, and whatever is deficient in soil and climate must be supplied artificially, and the government experts are working on this line, and by change of soil, fertilization, hybridization and breeding it is possible that the effect can be produced. Of course, it will take many years to grow a nearly perfect leaf by artificial means.

#### SCIENCE NOTES.

Lord Kelvin is to resign the chair of Natural Philosophy in Glasgow University, which he has held for so many years with such honor to the University.

The Chilean government is fitting up a state vessel for the exhibition of national products and manufactures for the purpose of making them known abroad. The principal ports on the Pacific will be called at first.

Mr. Benjamin Hoppin has forwarded his pleasure yacht "Senta" to Greenland as a gift to the Peary relief expedition. Mr. Hoppin gives this yacht without any restrictions as to its use, except that he desires to have it used in scientific research.

It is expected that the wheat harvest in Europe will be about as good as that of last year. The Statist estimates that importing countries will require 210,000,000 bushels from America, out of 250,000,000 bushels which the United States is expected to have for export in reserve.

A curious story comes from Turkey. A German firm sent some textile goods wrapped in old newspapers. The Custom House officers noticed this fact and informed the censor, who promptly decreed that the articles had to be unpacked and repacked without the newspapers, and this was done.

International expositions are not always a financial success, but the one at Turin seems to have been an exception. The shareholders were all paid in full and there was 140,000 left over. Naturally the city was a great gainer by the exposition, as it is estimated that more than 1,000,000 strangers visited it.

The late Robert Bonner was a famous compositor. One day, for a wager, he set and corrected 25,500 ems of solid minion in twenty hours and twenty-eight minutes. The greatest record which he ever made was setting and correcting 33,000 ems in twenty-four hours, an average of about 1,376 ems per hour.

The third International Astronomical Conference will be held at the Yerkes Observatory, Williams Bay, Wis., September 6, 7 and 8. Prominent astronomers from this country and Europe will be present. A permanent organization will be effected at the coming meeting, and arrangements to hold the annual meetings at the larger observatories will be made.

Surgeon Beck, of the Thirteenth Minnesota, states that the small caliber Mauser bullets rarely fracture a limb and that he knows of fully a hundred men shot through the chest cavity in every portion except the heart who recovered. Abdominal wounds are, however, nearly always fatal. Interesting details on "Bullet Wounds in Modern Warfare" will be found in the current number of the SUPPLEMENT.

Preparations are now being made for the Passion Play, which will be held at Oberammergau in 1900. The last Passion Play was given in 1890, and was a success financially and artistically. Singers have been selected and some of the actors who are to take important parts. Anton Lang will probably take the part of Christ. The committee has decided to erect new buildings, and the auditorium is to be covered with an iron roof. This was very essential, as many of those who visited the play nine years ago found their pleasure in it greatly marred by the fierce rays of the sun beating down upon them.

The Seventh International Geographers' Congress will meet in Berlin, September 28, and will hold sessions until October 4. These will be held in the new building of the House of Deputies. General meetings will be held in the mornings, special meetings in the afternoons, and the evenings will be devoted to social gatherings. Only twenty minutes will be allowed for the reading of any paper, though exceptions can be made to this in cases of subjects of universal interest. German, English, French, and Italian will be the only languages permitted. The "Protector" of the Congress is Prince Albrecht of Prussia, and among the vice-presidents are the King of Belgium, the Prince of Wales, Crown Prince of Denmark, etc. Among the honorary vice-presidents is General Greeley.

The Chief of Police of Jersey City has hit upon a novel plan for entertaining the poor of the city and giving them enjoyment during the hot summer months. He proposes to give a series of open air dances for the public in different parts of the city. The plan does not entail the expense of hiring hot, stuffy halls, but he intends to utilize the asphalt pavement for dancing purposes. He proposes to take a block of asphalt pavement and have it perfectly cleaned, then traffic will be suspended on it until the dance is over. The block will be roped in to keep out traffic and the rough element that might interfere with the dancers. Music will be furnished by a band which is hired to give free concerts. In nearly all large cities the municipalities are doing a great deal for the pleasure of the poor, and schemes like the present cannot be too warmly commended. The recreation piers which have been opened in New York city have been a great boon to the poor and have undoubtedly saved the lives of many children.