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SECRECY IN YACHT CONSTRUCTION.

Now that the "Columbia" is launched and the "Shamrock" is practically completed, an accurate description, such as will be found on another page, of the method of construction adopted in the case of the American boat cannot fail to be of interest; moreover, it can be given without any fear of disclosing "wrinkles" whereby those responsible for the construction of "Shamrock" may benefit. And just here it may be well to say that so exact is the science of yacht designing, so much is it a matter of careful theoretical calculation of form, weights and material, that the idea of such men as Herreshoff and Fife "chopping and changing" their plans because of some glimmering of what the "other fellow" is doing, is—well, it is simply unthinkable. Much alike as the two yachts will be to the unpracticed eye, they will represent the latest development of two distinct schools of design as represented by the distinguished architects above named. If the two yachts resemble each other closely, it will be because, by an independent process of elimination and addition, each designer has been drawing closer and closer to the ideal racing machine, profiting each year alike by the failures and successes of his previous boats.

There is no nobler sport than that of yacht racing, none that is by common consent more free from the taint of professionalism. Hence there are many yachtsmen who will hail with delight the day when the present extreme methods of secrecy, such as are characterizing the construction of "Shamrock" and in a lesser degree "Columbia," will be abolished. In the first place, the secrecy is never successfully maintained, and even if it had been, the English challenger upon its arrival in this country has never exhibited any novelties of construction that would justify such elaborate precautions. The novelties (if we except, perhaps, the model of "Valkyrie" II.) have been more conspicuous in the American yacht, as witness the Tobin bronze underbody of "Vigilant," and the aluminum topsides and deck construction of "Defender." The broad and shallow American sloop and the deep and narrow English cutter have merged into the Anglo-American broad and deep cutter-sloop, with little to distinguish challenger from defender in materials and workmanship. Surely, then, we have reached a point in the history of international yacht racing when we can dispense with "petticoat" launchings, private detectives, and all similar incumbrances of a noble sport.

COMPARISON OF ELECTRIC AND STOVE HEATING ON STREET CARS.

A specialist from one of our leading technical institutes informs us that in an early day of electric street traction, and before electrical engineering had resolved itself into a separate profession, he was called in by a street railway company to report on the merits of an electrical heater for warming the cars of the company. Careful tests showed that each heater consumed two electrical horse power, and as it required four heaters, or eight electrical horse power, to warm properly each car, the company was advised that in the state of the art at that day, electrical heating would be uneconomical. The subsequent extensive growth of the railway system in question, the concentration of its power plant in large central stations, improved methods of steam generation and expansion, and more scientific construction of generators and heaters, have so far modified the situation since that first report was made that to-day the same company is not only heating its cars exclusively by electricity, but doing it for less cost than they could be heated by coal stoves. At the same time, notwithstanding the great advances which have been made in the generation and use of electricity, it is evident that the superior economy of electric heating in this particular case must be largely due to local and special causes; and an examination of the books of the company showed that while the cost per electrical horse power had greatly decreased, the economy resulted chiefly from conditions peculiar to street car warming. Thus the mere keeping of the stoves in repair, and cleaning and lighting them, necessitated the employment of a surprisingly large force of men. Then, again, during the period of moderate temperature at the commencement and close of the winter, the stoves would frequently be lighted for brief periods in the morning and evening, or at the request of particular passengers during the day, and this would necessitate the consumption of a whole stoveful of fuel, where, with electric heating, the current could be switched on and off at will, and maintained for the exact period of time during which there was a call for it.

The advantages of electric heating resulting from its cleanliness, absence of odor, and ease of control are familiar to all of us, but that it should have shown a positive economy over coal will come in the nature of a surprise to many of our readers. The result emphasizes the necessity of making all comparative estimates of cost of this kind on the broadest possible lines, a precaution which is too frequently neglected.

AN INVENTION SORELY NEEDED.

As an incidental result of our having become one of the colonizing powers, with four dependencies—Puerto Rico, Hawaii, Guam, and the Philippines—and Cuba likely to become the fifth, our inventors are already called on to cope with a considerable number of entirely new problems, some of them springing from conditions very foreign to anything known to the Father Republic, if we may coin that term—for surely "Uncle Sam" can scarcely be associated with a mother country.

One of the principal and most immediate needs of the hour, especially at this moment in Luzon, is some effective method whereby wood may be rendered absolutely impervious to the attacks of the various species or allies of the genus Termites—the white ants. Writing to our State Department, in 1893, the then United States consul at Amoy, China, Dr. Edward Bedloe, said:

"A fortune lies in store for the man who will discover some process for cheaply making wood proof against white ants. These pests are the curse of existence in Amoy and every other tropical or sub-tropical city. Their voracity is incredible. They ate the framework of a new door in this consulate in three weeks. In the same period they almost consumed a large and handsome cabinet in the court-room, and a heavy pine settee in the ante-room. Their work is invisible. They attack the wood from a mere point, through which they bore to the interior, and there eat everything until only a shell or film remains. Wood which will successfully resist these insect pests must be thoroughly charged with some powerful chemical, both poisonous and non-evaporable. A solution of corrosive sublimate, chloride of zinc, arsenic, or antimony would seem to meet the want. But how to force these into the fibers, until the latter are saturated, and to do so at a merely fractional cost of the wood itself, is the problem that confronts the inventor. The American genius is so prolific in invention and discovery, that I feel assured the problem will be satisfactorily solved."

Six years have passed, and the consul's faith in the genius of American inventors has not yet been vindicated, while the great need of some such process as he suggests has yearly grown greater as clothes-wearing Europeans have attempted to penetrate deeper and deeper into tropic wildernesses. A soldier-correspondent of one of our Western dailies graphically writes from Manila, after having returned from one of the recent Aguinaldo-chasing raids:

"These Tagals are as elusive and annoying as wasps, and not much more dangerous, if you can only catch them. For my part, I consider the white ants much more invincible. A fellow feels pretty bad after a three days' tramp in this fern-house climate to get back to camp and clean clothes, only to find that a colony of white ants have burrowed into his chest and that all his belongings, not made of metal or glass, have been reduced to a rather fine powder."

Now that this white ant scourge is about to make itself felt upon the American colonist, we may look for something more than the stolid acquiescence with which its ravages have been so long received. We have here a field for invention which is decidedly promising. The income to be derived from a successful system of ant-proofing could not fail to be very considerable, and the successful inventor would have the satisfaction of conferring a lasting boon upon this and many another pest-ridden corner of the earth.

PETROLEUM FUEL BETTER THAN COALING STATIONS.

We are in receipt of a letter from a naval attaché in Europe who has been for many years identified with this branch of the service, from which we quote the following: "I note in the United States papers that the Bureau of Equipment of the Navy Department is making large deposits of coal in various quarters of the world, and that experiments are being continued with someone's method of coaling ships at sea. I wish your paper would protest against this and call attention to the fact that the same amount of money devoted to perfecting furnaces for consuming liquid fuel would lead to much more practical results. Ships can never be coaled at sea, except in a dead calm, whereas, with liquid fuel, you can take the tank ship in tow and steam in the teeth of a gale while you pump your fuel on board through a hose. In time of war the tank ships can meet the fleet at any given latitude and longitude in the middle of the ocean. Coaling stations are expensive to keep up, the coal deteriorates, and England has all the good places anyhow."

We are heartily in favor of generous appropriations for liquid fuel experiments, especially as many of the latest battleships building for foreign navies are designed to carry oil in their double bottoms and use it in conjunction with coal in their boilers. At the same time the Navy Department has to deal with the situation as it stands, and for many a long year to come we are certainly committed to coal as the fuel of our warships. The superior advantages of petroleum over coal are so many and obvious that it will unquestionably form a large part of the fuel supply of armored vessels in the near future; but until our own ships are fitted for its use, we think that coal supply stations are a positive necessity, particularly in view of the recent territorial enlargement of our republic.

THE LIQUID AIR FALLACY.

BY HENRY MORTON, PH.D., LL.D., SC.D., PRESIDENT STEVENS INSTITUTE OF TECHNOLOGY.

Having examined a pamphlet entitled, "Liquid Air. Perpetual Motion at Last. Tripler's Surplusage Explained." By H. Gaylord Wilshire, Los Angeles, Cal., 1899, I will try in a brief and popular manner to point out what I conceive to be the essential fallacy of the position taken by the author of this pamphlet.

To the ordinary reader it is not easy either to perceive this fallacy or, in fact, to get any very clear notion of the actual conditions of the problem which the author proposes to solve and explain, there being a remarkable mixture of true and incorrect statements and assumptions which are directly contrary to fact. But, fortunately, at the very end of the article, there is given a note which contains in itself a fairly clear and concise expression of the fundamental position of the author, which thus can be without much difficulty appreciated, and can therefore be answered without too many words and too much elaborate explanation. The note to which I refer reads as follows:

"NOTE.—Theoretically the energy developed by expansion of a given weight of liquid air in *A* will liquefy an equal weight of air in *B* during a definite time. The process toward liquefaction involves overcoming resistance to compression of air in *B*. If this resistance is reduced by cooling with water, then more air in *B* would be liquefied in a given time than is at the same time expanded in *A*. The difference between these weights of air is the surplusage effected by the cooling of the water. (See diagram.)"

To start with, I should explain that, as far as this note is concerned, the only important parts of the diagram are two cylinders, *A* and *B*, having pistons in each, so connected that an upward motion of the piston in *A* involves a downward motion of the piston in *B*, developing equal displacements, so that, for example, if the contents of the cylinder, *A*, doubled in volume, the contents in the cylinder, *B*, would be correspondingly reduced.

This being premised to render unnecessary the reproduction of this diagram, I think there is no difficulty whatever in understanding the position taken by the author of this note. He evidently intends to say that, theoretically, the energy developed by the expansion of a given weight of liquid air in *A* will liquefy an equal weight of air in *B* during a definite time, without the aid of cooling water, which he describes as being subsequently applied and as being a source of an increased effect.

Now, this statement is absolutely incorrect. The expansion of a given weight of liquid air in *A*, so far from developing a power capable of liquefying an equal weight of air in *B*, would be absolutely incapable of liquefying a single drop of air in *B*. What would really happen is this: The energy developed by the expansion of a given weight of liquid air in *A* would develop an equivalent amount of energy in *B*, theoretically, in two forms; in the first place, as heat, or, in other words, the air in *B* would be very highly heated by the act of compression; in the second place, another portion of energy would be developed in *B*, by reason of the increased pressure or tension brought about in the air filling *B* by the afore-mentioned compression. Even if no heat at all were developed in *B*, and it remained at the atmospheric temperature during this compression, this would not convert it into liquid air, for it is, of course, a well-known fact that no amount of pressure will liquefy air until its temperature has been reduced to what is known as the critical temperature, which is 220° Fah. below zero. Still less, therefore, would it be possible to liquefy this air while leaving in it the heat of compression, by reason of which its temperature would be greatly