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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A WORD TO AEROPLANE BUILDERS.

If it were possible to take count of the number of people in the United States who are to-day engaged in building some form of heavier-than-air flying machine, whether aeroplane, helicopter, or ornithopter, the size of the total would probably be a matter of no small surprise. When an age-long problem of such difficulty as that of the human mastery of flight is solved in a sudden and sensational manner, as by the Wright brothers last year, a stimulus is given to the art, the effect of which is seen in the immediate effort of people of an inventive and more or less mechanical turn of mind, to emulate if not surpass the achievement. Much of this endeavor, probably most of it, is doomed to failure; chiefly because the experimentalist does not realize the extreme difficulty of the problem, both from the theoretical and mechanical standpoint, and labors under the mistaken impression that a machine which is a broad imitation of the original must of itself necessarily fly.

Light-weight motors may be bought in the open market; but for the construction of an aeroplane itself two things are absolutely necessary: first, a thorough knowledge of the unchangeable principles upon which the aeroplane is based, and second, an intimate knowledge of the strength of materials, of the stresses to which the aeroplane will be subjected, and of the best way to dispose this material so as to secure in the finished machine the maximum of strength with the minimum of weight. It was only last week that the Editor was invited to witness the trial flight of an aeroplane, on the construction of which a large amount of time and money had been spent. Asked for his opinion as to the probabilities of flight, he replied that it could never by any possibility get off the ground; and it never did. It was evident at first sight that, although the supporting area was large, the question of weight saving had been so completely neglected, that in spite of the large horse-power with which it was equipped and the generous amount of bearing surface, the weight of the machine, which must have been close to 2,000 pounds, was altogether prohibitive. And yet, from a distance, it had all the appearance of delicacy and lightness which is characteristic of the biplane type. Only on closer inspection was the neglect of weight saving everywhere evident. Instead of sawing off the projecting ends of the ribs on the two planes, they had been left in place, thereby adding considerably to the total weight. Projecting threaded ends of bolts, which should have been sawn close, had not been removed—an item of useless weight that represented not a few pounds in the total. The chassis, or frame for traveling upon the ground when rising or alighting, had been put together without any careful consideration of the stresses involved, and was heavy beyond all reason.

It may be said, once and for all, that the "rule of thumb" and the "cut and try again" method can never be applied to aeroplane building without involving a large amount of useless expenditure of time and money. Already, sufficient experimental work has been done, and the results published, to place within reach of the would-be builder of one of these machines sufficient data to enable him to go about his work intelligently. The lifting power per square foot of area, the best angle of flight, the thrust obtainable with a given type of propeller running at a given speed, and many other useful data have been made public, and we advise all would-be experimentalists in mechanical flight to make themselves familiar with as much of this literature as they can lay their hands upon, before determining upon the dimensions of their machines.

Unquestionably, the most important element as far as the mechanical construction is concerned, apart from the selection of the proper motor, is that of weight saving. We are all of us familiar with the success achieved by Herreshoff in the construction of yachts for the defense of "America's" Cup. The secret of his success lay, not so much in the form of the hull as in the all-round lightness of the construction Herreshoff was before everything else an engineer, and it was his ability to apply his material in exact proportion to the stresses, that was responsible for the extraordinary combination of lightness and power which characterized his yachts.

Now the weight problem is of even greater importance in the aeroplane than it is in the sailing yacht. The amateur builder, as far as his purse will allow, should select materials which combine lightness and strength. He should carefully study the nature and amount of the strains to which his machine will be subjected, and dispose his materials accordingly. Let him remember that the total saving in weight is due to the elimination of a pound here and a few ounces there. No economy in detail is so small that he can afford to neglect it.

NAVAL PROGRAMME FOR 1911.

According to the announcement recently made by Secretary Meyer of the Navy, it is the intention of the Administration to devote the greater part of the appropriations for new construction during the year 1911 to the building of two battleships of the "Wyoming" type, each to be of 26,000 tons displacement. Comparatively little of the appropriation will be used in the construction of smaller craft. It is likely that, outside of the battleships, the additions to the navy will consist of either five torpedo-boat destroyers or one modern repair ship for the fleet. We are gratified to learn that the decrease in the 1911 naval estimates of $10,000,000 is to be accomplished without making any reduction in the number of battleships which Congress recently decided should be added annually to our navy to maintain it at its proper standard of strength. In view of the large preponderance of battleships over vessels of other classes in our navy, and the fact that these ships are armed with the heaviest guns, Congress is probably right in its conviction that the annual addition of two battleships of such great size and power as our new 26,000 ton ships will be sufficient for our needs, at least for the present. Should the international situation at any time warrant a larger annual increase, our leading yards have shown that they are well able to meet the demand.

The two battleships planned for 1911 will be similar to the "Arkansas" and "Wyoming." On a displacement of 26,000 tons they will carry twelve 12-inch guns in six turrets placed on the center line of the ship. They will be driven by turbine engines at a speed of 20½ knots, and their bunkers will have a capacity of 3,000 tons of coal. The side armor extending from six feet below the waterline to the upper deck, will taper gradually from 11 inches in thickness at the water to 6½ inches at the level of the main deck. The defense against torpedo attack will be particularly powerful, consisting of no less than twenty-two 5-inch rapid fire guns, 50 calibers in length. In point of size, coal endurance, and power of attack and defense, these are the most powerful designs that have received official sanction in any navy. With the completion of the two ships, the navy will have a squadron of eight battleships of the same general type, possessing the same tactical qualities, and admirably suited for joint maneuvers.

THE PROPOSED NEW WATERWAY IN CANADA.

In view of the fact that New York State is spending over one hundred millions for the construction of a State barge canal with a depth of twelve feet, to improve water communication between the Great Lakes and the Atlantic, great interest attaches to the Georgian Bay Canal, which is designed to shorten the distance between Montreal and Lake Huron by the construction of a ship canal twenty-two feet in depth. The route is *via* Georgian Bay, the French and Pickerel Rivers, Lake Nipissing, and the Ottawa River, the total distance being 440 miles. Although there will be a total of twenty-seven locks, it is estimated that there will be a saving of a day or more in time over the present route for steamships through the Lakes. The saving in distance on the route *via* the canal from Lake Superior to London, as compared with the route *via* the New York barge canal, will be 806 miles. The topographical features along the canal are such that 332 miles of the distance will consist of natural waterways, upon which no work of excavation need be done. Of the remaining 108 miles, 80 miles will consist of submerged channels, on which there will be only a limited amount of excavation in the removal of rocks and shoals. This leaves about 28 miles of canal in which the full prism must be excavated in cuts that vary from 200 to 300 feet in width. The summit level will be 99 feet above Georgian Bay and 659 feet above Montreal. The estimated total cost of the canal is about the same as that of our State barge canal, or about $100,000,000, and the estimated time to complete the work is about ten years.

It would be fatuous to close our eyes to the important bearing which this scheme has upon our smaller waterway from Lake Erie to the Hudson. The one, with its limited draft, can take nothing larger than a 1,000-ton barge; the other, with its minimum draft of twenty-two feet, will be able to pass ocean-going freight steamships from ports on the Lakes to the Atlantic. The advantages of carrying freight in large bulk and without rehandling are well understood. There is a saving both of time and cost. On the other hand, the opening of a ship canal from the Lakes to the ocean would not render the whole fleet of lake steamers available for coastwise traffic between the Lakes and the ports on our own seaboard, or service in the transatlantic trade. It is urged by the commercial interests which would be affected that the average lake steamer is not suitable for deep-sea service; the type of ship that is adapted for service on the Lakes being in some respects unsuited for oversea voyages. This may be true of some of the smaller craft; but we doubt if it would apply to the ships of larger displacement, which constitute the bulk of the more modern lake fleets. After all is said and done, it is certain that, with the near approach of the completion of the Georgian Bay Canal, vessels suitable for combined lake and ocean voyages will be constructed.

STORAGE OF COAL UNDER WATER.

The storage of coal under water has been proposed as a remedy for two great inconveniences of the common method of storage—danger of spontaneous combustion and deterioration of the quality of the fuel. Coal, when freshly mined, is very easily affected by chemical, mechanical, and physical agencies. The effect of exposure to the atmosphere is a gradual diminution of the value of the coal in consequence of a loss of calorific power and substance, and a deterioration in the quality of the gas and coke obtained from it.

The first action is a rapid absorption of oxygen which is partly retained by the pores of the coal and partly combined chemically, with the formation of water and carbon dioxide and a disengagement of heat. This effect is particularly noticeable in fine coal, which exposes a large surface to the air. During the storage the gas-producing power of the coal also diminishes. If oxidation is increased artificially it may be observed that the coke produced from the coal does not cohere, and that the gas consists largely of hydrogen and gives little light. The value of the by-products is also diminished. The gases evolved by piles of coal consist chiefly of methane, mixed with very variable quantities of carbon dioxide, and in certain cases of carbon monoxide, higher hydro-carbon and even nitrogen. The absorption of water is very variable, from 4 to 10 per cent. Grundmann's researches show that, in regard to calorific power, a medium coal containing 5 to 10 per cent of ash and as much of hygroscopic water and producing 6,500 or 7,000 calories lost at least 4 per cent of its value in four weeks, 9 per cent in six months, and 12 per cent in one year. In certain climates the loss in a year amounts to 20 or 30 per cent.

Spontaneous combustion is always to be feared in large masses of coal. It has been proved that the temperature of English coal freshly stored rises in two or three days to from 70 to 85 deg. F. and thereafter continues between 85 and 100 deg. F. Water may accelerate this rise of temperature by bringing oxygen in solution. Special care should be taken not to deposit dry coal upon any large quantity of damp coal. Wet coal should be spread in layers 8 inches thick and allowed to dry 24 hours before being covered with a new layer. Sulphur compounds do not play an important part in spontaneous ignition. Pyrites resists atmospheric influences well, with the exception of the variety called marcassite which tends to decompose in the presence of water. The practice of ventilating piles of coal by means of little shafts and canals, although recommended by insurance companies, is rather injurious than otherwise, as it facilitates the absorption of oxygen. If ventilation is attempted, it should be mechanical and very energetic in order to produce a refrigeration which will counterbalance the oxidizing effect of the air.

An interesting article in The Automobile disposes of some fallacies in connection with the gyroscopic action of automobile flywheels. It has been suggested that advantages comparable with the action of the Schlick gyroscope on ships or mono-railways are obtainable by the placing of flywheels in unusual positions in four-wheeled cars, and the writer clearly points out that conditions essential to the steadying effect of a gyroscope are non-existent in an ordinary automobile.