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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.

LESSONS OF THE WRIGHT AEROPLANE DISASTER.

Seldom has there occurred a more pitifully tragic disaster than the sudden fall of the Wright aeroplane, involving the death of that promising young officer Lieut. Thomas E. Selfridge, and inflicting shocking injuries on the talented inventor, Orville Wright. That the disaster should have occurred at the culmination of a series of brilliant flights, and on the eve of winning that prize of government recognition for which the Wright brothers had striven, unaided, through long years of patient toil, renders the disaster extremely pathetic, and accentuates that worldwide sympathy in which the Scientific American so sincerely shares.

But although the accident is deplorable, it should not be allowed to discredit the art of aeroplane navigation. If it emphasizes the risks, there is nothing in the mishap to shake our faith in the principles upon which the Wright brothers built their machine, and achieved such brilliant success. The defect was purely one of structural detail. The breaking off of the blades of the propeller of an airship is comparable to the bursting of a tire on an automobile. In each case there is the danger of an upset; but in neither should the accident be taken to indicate that the principles and design of the whole machine are at fault.

Nevertheless, it must be admitted that if the demand for absolutely first-class design and materials is strong in the automobile, it is doubly so in the aeroplane. Judged by the nature of the work it has to do, and in view of the tragic penalties which may attach to the breakage of any one of its delicate and nicely calculated parts, it would seem that a broader margin of safety should be allowed in cutting down the size and weight to secure the necessary lightness. The supporting planes, with their fragile wooden struts and hair-like wires, constitute a trussed bridge, whose strength, like that of a chain, is no greater than the strength of its weakest link. Should a single strut or wire snap, the whole fabric must collapse. Similarly, the equilibrium of the whole structure is so sensitive to disturbance, that any sudden change in the opposed forces, such as was occasioned by the snapping of one of the two propellers, must instantly upset the delicate poise, and change the aeroplane, suddenly, from a self-sustaining machine to an inert mass, subject only to the destructive force of gravity.

The lessons of this particular case are, first, that wood is too uncertain a material to safely endure the complicated stresses due to thrust, high centrifugal force, excessive vibration, or the possibility of contact with the machine to which a propeller is subjected; and, secondly, that the distribution of the thrust between two propellers, placed on either side of the center of gravity, constitutes, as this terrible accident has too clearly shown, a constant invitation to disaster. Should one propeller break, become loose, or be disconnected from its chain drive, the whole power of the engine becomes concentrated at a point several feet to one side of the center of resistance of the machine, with the result that it becomes immediately unmanageable, and is driven violently from its path; whereas the breaking of a single, centrally-placed propeller would have no greater effect upon the control than would the simple stopping of the motor.

Undoubtedly, it was the inevitable confusion created by the breaking of the propeller on the vertical rudder wire that caused the disaster; for although Wright made a gallant effort to bring the machine back to control, stopping his motor, etc., the horizontal rudders appear either to have failed or to have been pulled in the wrong direction; the aeroplane, after partially righting, taking a sudden and steep plunge to the ground.

Perhaps the most important lesson of all, however, is, that, to render the aeroplane thoroughly reliable, some method of automatic control of both lateral and horizontal stability must be devised. This control should automatically hold the rudders and plane tips in the requisite position for equilibrium, any deviation therefrom being made by separate manual control.

SOME SUBMARINE SUCCESSES.

The increase in size, power, and endurance of the submarine, and the accumulated knowledge and confidence which are being acquired by officers and men in the handling of this sensitive and capricious type of boat, are rapidly winning for the submarine a position as a well-tried and efficient type of fighting craft. On the return of the submarine flotilla to Newport after its last series of maneuvers carried out in Buzzards Bay, it was made known that the five submarines, "Octopus," "Viper," "Cuttlefish," "Tarantula," and "Plunger," representing the latest additions to our fleet, had made a most successful attack upon the United States cruiser "Yankee." The significance of the result, all five of the boats making a hit, is emphasized by the fact that the attack was made in broad daylight, and that it was expected by the "Yankee," whose officers and crew were keenly on the watch for the submerged enemy. In carrying out the maneuver, the submarines first steamed away from the "Yankee" on the surface of the water, closely observed by the glasses of the officers on board, until they disappeared from view. At twenty miles distance they submerged and proceeded to the attack under water, making observations at intervals by means of the periscope, until they came within hitting distance, when each boat discharged its torpedo and found the mark. Although the "Yankee" searched closely for surface indications of the boats, there was no notification of their presence until the five torpedoes got home against the hull. A second attack, made from a less distant point, met with equal success. This exploit is certainly a strong demonstration of the efficiency of the submarine under the conditions existing; and it may fairly well be claimed that the fact that the "Yankee" was stationary was offset by the other fact that the time and direction of the attack was known to those on board the ship.

Another notable success was that achieved by a flotilla of Italian submarines, or to speak more strictly, submersibles, consisting of four boats, which recently made the trip of 1300 miles from Venice to Spezia under their own power and without any assistance from auxiliary boats. These craft can steam 7 knots submerged, and 14 knots in the light condition. They carry two torpedo tubes below the bow, and embody the principle which is adopted in the Lake boats in this country of carrying a heavy false keel, which may be detached should the submarine, through accident, sink to the bottom. Comparable with this 1300-mile trip, in a semi-submerged condition, of the submersibles is the recent cruise, under war conditions, of the British submarine flotilla for a distance of 300 miles, during which they stayed for forty consecutive hours under water.

The three performances above recorded are very encouraging, since they foreshadow the ultimate mastery of two difficult problems in the submarine: radius of action and certainty of attack. The submarine of the future will grow in size, and as it does so its speed and radius of action will steadily increase—possibly even to the point at which the largest type will be capable of accompanying a fleet in its operation on the high seas.

OUR PONDEROUS PASSENGER CARS.

Does it ever occur to the passenger, when he is sweeping through the country in the luxurious comfort of his heavily upholstered seat in a Pullman car, that, in order to give him that accommodation, the railroad company must haul over the tracks, not merely his individual 150 pounds of weight, but an additional two tons of weight of the car? The largest modern Pullmans will weigh over 60 tons; and, since they provide only sixteen sections, it follows that for every passenger carried, even when the car is full, two tons of dead weight must also be moved. In respect of the weight hauled per passenger, therefore, a Pullman train is the most extravagant and costly method of transportation in the world, as the following comparative facts will show. A touring car capable, when running on a good road, and if, like the railroad train, unhindered by speed restrictions, will carry seven people at the same speed as a Pullman train. The machine will weigh about 3500 pounds, or 500 pounds to the passenger. A 7-horse-power motorcycle, weighing 150 pounds and running on a good road without speed restrictions, will transport two people on the level at a speed of 40 miles per hour; while a bicycle, weighing only 25 pounds, can be driven by an ordinary rider on a good road at from 12 to 15 miles per hour, and by a racing man at from 20 to 25 miles an hour. Even that good old standby, the two-seated buggy, weighing, let us say, 320 pounds, will convey its two passengers in comfort and safety at a speed of from 15 to 20 miles an hour. Summing up our comparative results, then, we find that the dead weight necessary to carry a passenger in a touring car is 500 pounds, on a motorcycle 75 pounds, on a bicycle 25 pounds, and in a horse-drawn buggy 160 pounds, as against the enormous load of two tons of dead weight necessary for the transportation of a Pullman passenger. It may be objected that the Pullman car represents an extreme case, and that much of the weight is due to the provision of sleeping accommodations; but we find that, even in the first-class day coach, the dead weight per passenger is very high, being, in the case of coaches accommodating, according to size, from seventy to eighty-four people, about 1 1/3 tons of dead weight per passenger.

It does not require any elaborate mathematics to show that the hauling of this enormous dead weight over the track is very costly, involving heavy maintenance expenses on the part of the railroads and proportionately higher rates for the traveling public. Apart from the large expenditure of fuel, the excess weight causes a rapid deterioration not only of the tracks and roadbed, but also of the rolling stock itself. Rails are broken, or battered down at the rail joints; rails and tie-plates are crushed down into the ties; the heads of the rails and the flanges of the wheels are rapidly ground away on the curves; and, because of the heavy impacts due to the great deadweight, there is not only a more rapid deterioration of the rolling stock, but of every part of the system that comes into physical contact with it.

The great weight of passenger cars is due in no small measure to the great length to which these cars have grown in recent years. The body of a modern Pullman, over 70 feet in length, supported on a truck at each end, may be regarded structurally as a bridge carried upon two end piers; and, in the case of the car, as of the bridge, the bending stresses tending to break it in two, and, therefore, the weight of material necessary to resist those stresses, increases in a much more rapid ratio than the length. Moreover, the concentration of weight on the two trucks calls for heavy construction in the trucks themselves; and it is a question worthy of the consideration of the car builder whether a great saving in weight would not be effected by reducing the length of the cars and substituting lighter four-wheeled trucks for the ponderous six-wheeled trucks now in use. Furthermore, the roof construction could be considerably lightened by abolishing the present ventilator and substituting a plain curved roof. Considerable weight might also be saved by abolishing the end platforms, vestibuling the car bodies directly against one another, and substituting entrances at the center of the cars.

The greatest reduction of weight, however, would come from the introduction of steel in place of wood and the application to the design of the cars of those principles of bridge construction which have rendered the modern steel bridge such a marvel of lightness in proportion to its strength and the load it can carry. We believe that the weight of our present railroad cars is due not a little to the fact that too much of the coach builder's and too little of the bridge engineer's art has been employed in their design and construction. It is one of the curious anomalies of railroading, that at this late day, when so many steels and alloys offering great strength in proportion to their weight are available, we should still be building our cars of wood and building them on such massive lines. We note that in a recent discussion of this question, as applied to street railway and interurban cars, Mr. M. V. Ayers, of the Boston and Worcester Street Railway, estimates that the weight of a 60-passenger, 31-ton car could be so greatly reduced by careful design and the use of steel, that there would be a saving of $1100 per year in power cost alone, in favor of the lighter car—an economy which would more than offset the increased cost due to special design and the use of a high-grade steel. The Scientific American has more than once drawn attention to this important question during the past few years, and we heartily indorse Mr. Ayers's statement that more actual saving of money can be effected by reducing the weight of cars than by any other change that can take place in the art of railroading.