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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 MONUMENTAL BLUNDER.

And so it seems that our worst fears regarding the $24,000,000 Blackwell's Island Bridge are verified; for we are now assured that this, the greatest engineering work of its kind in the world, would collapse, if it were subjected to the loads which it was designed to carry. A little over a year ago, that other great cantilever structure, the Quebec Bridge across the St. Lawrence, crumpled up under its own weight and fell into the river below. Naturally, public attention was at once directed to the Blackwell's Island Bridge; and since it was designed on the same general principles which had been found to be faulty, in some particulars, as developed in the Quebec Bridge, the public demanded that an investigation to determine the actual strength of the structure be made by independent engineers. To this the Bridge Department consented; and Prof. Burr, of Columbia University, and Messrs. Boller & Hodge, bridge engineers, of this city, were asked to make such an investigation. Their reports, which have recently been made public, show that if the bridge were opened and subjected to the loads which it was designed to carry, *the strains, in some of the members, would enormously exceed those for which the bridge was designed, the excess in the case of one member rising to 47 per cent above the safety point!*

Very wisely, when the construction of the bridge was determined upon, the Bridge Department decided to make it strong enough to carry the greatest possible congested loading that could be put upon it; and it was found that, when so loaded, it would be carrying 16,000 pounds of moving weight upon every lineal foot of its length. Subsequently to the completion of the plans, it was decided that to meet the demands of the future it would be desirable to increase the strength of the bridge to accommodate four elevated tracks upon its upper deck, two extra tracks being added to the two already provided for. This, of course, involved a very large increase in the live loads, to say nothing of an increase in the strength and weight of the bridge itself, to carry this extra load.

Prudence would have suggested that at this point a complete recalculation of the bridge be made, and a new strain sheet drawn up showing the exact stresses which would occur, under the heavier loading, throughout the whole bridge. As far as we can learn no such sheet was prepared, the first strain sheet being accepted as correct, and a *pro rata* increase being made in the section of the various members.

When Messrs. Boller & Hodge began their investigations, they wisely determined that the first thing to do was to ascertain what were the actual conditions of stress in the structure as built. Accordingly, they secured the shipping bills showing the weight of every piece of steel that had been built into the bridge, checking these weights by careful measurement of the various members, and from the weights as so received by them and checked, and upon the specification loading of 16,000 pounds to the lineal foot, they drew up a strain sheet, which the Editor recently had an opportunity to inspect, showing the actual conditions in the structure as it stands to-day.

The results are simply appalling. They mark this bridge as the most monumental case of faulty design in the whole history of the art of designing long-span bridges. Furthermore, our readers should understand that, when the maximum stress to which the metal in the bridge could be safely subjected was determined upon, no allowances were made for secondary stresses in the various members (due to tendency to distortion in the members themselves), or for snow load. The omission of snow load is simply amazing; for it means that in the event of a blizzard like that of 1888, in which the vast floors of the bridge and all the huge members might be loaded deep with a heavy burden of snow, the stresses resulting in the structure from this load would not be represented by any corresponding increase of material in the members to carry the additional burden thus imposed. Nor is it an answer to this criticism to say that the bridge might not be congested with traffic at such a time; for it is certain that a heavy blizzard might in itself be the cause of a stalling of trains and cars, and a blockade of vehicular traffic.

That our estimate of the magnitude of the blunder committed in this bridge is not overdrawn is shown by the following facts selected from the two reports: Prof. Burr says: "The result of these computations shows . . . that some of the bottom chord panels of the island span would carry about 25 per cent more than is permitted by the contract specification. . . . There would be also some similar overstresses in riveted tension members in the same parts of the bridge, rising above 33 per cent in a single instance." Prof. Burr exhibits here as elsewhere in his report a tender commiseration for the blunders committed; for he fails to mention that in this "single instance" the overstress rises, as shown by the strain sheet of Boller & Hodge, to no less than 47 per cent above what is allowed by considerations of safety.

When Messrs. Boller & Hodge had proved that the bridge, if subjected to the loading for which it had been calculated, or rather miscalculated, by the Bridge Department, must inevitably collapse into the East River, they set about the calculation of a strain sheet showing what loads the bridge actually could carry, without exceeding the safe limits of stress in the individual members as called for by the specification and by all good engineering practice. And what did they find? *That instead of being able to carry a congested load of 16,000 pounds per lineal foot, the bridge as it stands to-day can carry a load only of 6,000 pounds per lineal foot; and that even this live load can be safely allowed on the bridge, only if the traffic is carefully regulated by the police;* that is to say, if a certain distance be maintained between the trolley cars. This last restriction, being interpreted, means that, if, through carelessness or connivance, the spacing between cars be not maintained, and, as in the case of a sudden accident or panic, the cars become bunched together, the safety of the bridge, even under a live load nearly two-thirds less than that for which it was designed, will be imperiled!

But how is the loading to be reduced to this extent? Boller & Hodge in their report show that it can be done only by removing from the bridge the whole of the four elevated tracks which it was designed, or supposed to be designed, to carry. In other words, this $24,000,000 structure, whose greatest usefulness ultimately would have consisted in its serving as a link between the heavy electric train service, whether subway or surface, of Greater New York, is found to be totally unfit for such a purpose, and must be limited to the service of trolleys, trucks, and pedestrians. No elevated trains on a bridge, for whose approaches nearly half a mile of elevated structure has already been built!

It is beside the mark for apologists, in the endeavor to lighten the gravity of the situation, to suggest that 16,000 pounds per foot is a loading which may never occur. That loading was adopted as a measure of safety and as a means of covering the inevitable growth of traffic in the future. As a measure of precaution, it does not lose its importance in our eyes, because someone has committed a costly blunder in the Bridge Department.

A NEW ERA IN AEROPLANE TRANSPORT.

After his failure to make satisfactory flights in this country last summer, and after losing to Wilbur Wright the prize of the French Aero Club for the longest flight up to October 1, Henry Farman has at last shown himself to be, after all, one of the world's most daring aviators, while at the same time he has opened a new era in aeroplane flight, an era in which the flying machine will be put to practical use in the transport of individuals from place to place.

After a 25-mile flight above the camp at Chalons, France, on October 28, and a mile flight with a passenger the same day, Farman made some changes in his machine to improve its stability. Then, on the 30th, he again soared aloft above the camp; but this time, after describing one or two circles, he flew straightaway across country at a height of 100 feet, and did not alight until some 20 minutes later, when he reached the outskirts of Rheims, after traversing a distance of 17 miles. Our frontispiece shows him passing over one of the intervening villages, before the astonished gaze of several spectators. It was his intention to return in the same manner; but owing to the late hour and the making of some small repairs, he took the aeroplane apart and returned it to Chalons by road.

Not to be outdone by his compatriot, M. Louis Bleriot the next day made a 9-mile flight with his aeroplane across country from Toury to Artenay; and, after making a slight repair, returned to the starting point, making one stop *en route*. A photograph of the monoplane made during this flight appears on page 357.

These two remarkable performances have put France in the lead as far as practical cross-country flight is concerned. They have shown the possibility of winning the $50,000 prize of the London Daily Mail for a flight in stages from London to Manchester, and also the prizes totaling $10,000 for a flight across the English Channel. Furthermore, they have assured the holding of a cross-country aeroplane race next summer in France. A prize of $20,000 has been put up by the Aero Club of France, and it is proposed to run the race from Paris to Bordeaux in five stages.

Had it not been for his unfortunate accident, it is probable that Orville Wright would have made the first cross-country aeroplane flight at least a month before Farman, as the government requirements called for a ten-mile flight of this kind in making the speed test. As no such performance was required by the syndicate which has bought the Wright patents in France, Wilbur Wright has contented himself with making lengthy flights above a level field, in windy as well as in calm weather, and also with teaching several men the operation of his machine. He does not favor such spectacular performances as that of Farman, which, he claims, could not have been made save under ideal weather conditions and with the running of an extreme risk of accident.

WILBUR WRIGHT'S RECORD FOR HEIGHT.

After lengthening the rail from which his aeroplane starts some 35 feet, in order to enable him to attain the necessary speed by means of his propellers alone, Mr. Wilbur Wright competed successfully on the 13th instant for the prize for height offered by the Aero Club of France. The rules forbid the use of a dropping weight for starting the aeroplane, so Mr. Wright was obliged to dispense with his usual starting apparatus. His machine, however, started readily under its own power. At the end of a 5-minute flight, he cleared the line of small balloons placed at a height of 30 meters (98.4 feet) by 49 feet, making a total height of 147.4 feet. In a second flight of 11 minutes' duration, Mr. Wright is said to have risen to a height of 196 feet above ground. These are the first official records for height that the American aviator has made.

THE HANDY MAN'S WORKSHOP.

Among the features which have contributed to the success of the Scientific American have been articles written for the benefit of the amateur mechanic—articles which told in a simple way how motors, dynamos, batteries, barometers, and a hundred other machines and instruments can be constructed at home without elaborate tools. These articles have been the means of giving to thousands of young men of technical inclinations an electrical and mechanical training, which because of its eminently practical nature, admirably fitted them for the more serious work of the machine shop and the electrical laboratory.

In order to broaden this department of the journal, and to render it even more useful than it has been in the past, we have decided to publish about twice a month shorter accounts, which will tersely yet clearly describe simple devices which can be made by anyone who is reasonably skillful in the use of simple tools, and which will be devoted to the description not only of experimental apparatus, but of utensils and implements for everyday use. The department bears the general title, "The Handy Man's Workshop," and we intend to include under the heading all that it implies. The articles will explain the construction of simple physical apparatus, as in the past, but above all they will be devoted to the making of contrivances that a "handy man" can use about the house. In next week's issue we intend to publish brief articles on the making of simple Christmas devices at home, which will be far more intimate and personal in their appeal than factory-made products. That issue of the Scientific American will be a very practical Christmas number.

The reception thus far accorded to the innovation justifies us in assuming that "The Handy Man's Workshop" will prove one of the most popular departments in the Scientific American. Because it is still new, we shall be glad to receive suggestions from our readers for its improvement—if improvement it needs.

Judiciously used, the automobile may offer a remedy for nervous and mental affections. Dr. A. Mounteyrat, a French physician, ventures the opinion that motoring is a cure for anæmia and sleeplessness. He conducted some experiments during several tours of eight days each and states that he found a decided increase in the number of red corpuscles. The average increase figures out at 26 per cent. The effect of a week's touring is much the same as that of residence on high altitudes.