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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.

IS THE MOTOR BUS PROFITABLE?

The development of the motor bus in the United States has been slow and its use is at present decidedly limited. In England, on the contrary, and particularly in the city of London, this type of conveyance has experienced a really phenomenal growth, both in numbers and the amount of traffic handled. The traffic conditions in London are particularly favorable to the development of this form of travel. The horse-drawn bus has for many decades been one of the most popular means of travel in that city, particularly for short distances; and when the motor bus entered the field, it found the traffic already developed on an enormous scale. Furthermore, it is stated that the English laws regulating the grant and the usage of franchises have been as favorable to the bus companies as they have been stringent in their application to steam and other railroads. Moreover, the best of mechanical skill has been applied to the perfecting of the motor bus. So successful, in point of numbers carried, have been the motor bus companies, that the various other lines of transportation, both surface and underground, have suffered severely from the competition. Nevertheless, according to recent dispatches, it would seem that in spite of the favorable auspices under which the motor bus traffic has been operated, most of the companies find that they are steadily losing money, the chief cause of loss being the high rate of depreciation of the engines and running gear—a drawback which in the early years of the development of the automobile made itself painfully felt to all owners that were not favored with a generous bank account.

PROPOSED TEST OF FULL-SIZED BLACKWELL'S ISLAND BRIDGE CHORD.

Capt. Eads, whose great arched bridge at St. Louis and whose valuable work in the control of the Mississippi River have won for him a distinguished place in the field of engineering, possessed in an eminent degree that distinctive quality of the truly great engineer, of being ready at any time to break completely away from tradition, even to the extent of adopting methods, apparently crude, to secure his results. The merit of his great bridge across the Mississippi lies in the fact that he had but little precedent to go upon, and that, when he flung these huge 520-foot steel arches across the river, he struck out on bold, original, and largely untried lines. He realized at once that the most vital part of any framed structure, subjected to great stress, is its compression members—a fact which our later engineers seem somehow to have forgotten, or whose importance, at least, they have ceased to realize. These compression members in the Eads bridge were of circular cross section, and built up of steel plates. Although Capt. Eads had designed them after a thorough study of the comparatively meager literature on the subject, he did not trust either to theory or the analogy of such existing structures as included large compression members, but determined that the only way to turn a seeming certainty into an assured fact was to take one of these full-sized sections and crush it to destruction in a testing machine. Unfortunately there was at that early day no testing plant that was of sufficient capacity to do the work; and because of the difficulty of putting up a machine that would provide abutments of sufficient reactive strength, it would have been a matter of great expense to build one of the usual type. Capt. Eads decided, therefore, to extemporize a testing plant, and he did so in a very simple, cheap, and highly efficient manner. He selected a stone quarry, in which were two opposed vertical walls, the distance between which was a few feet greater than the over-all length of his compression member. The latter was placed horizontally between the walls, and at one end a hydraulic cylinder of short length, but large diameter, was interposed between the member and the wall of the quarry. All that was then necessary was to attach a small hydraulic pump to the cylinder, and a gage to record the pressure. This very cheap and simple device worked admirably, and the exact crushing strength of the column was determined. It was suggested to the writer several months ago by former Bridge Commissioner Lindenthal, that a similar test of the much larger and stronger bottom chord of the Blackwell's Island Bridge could be made at a comparatively small expenditure of money, and the question of its safety, or otherwise, be at once put beyond all doubt. We now note that the suggestion has recently appeared over Mr. Lindenthal's signature in our esteemed contemporary Engineering News, and that the editor of that journal has given it his strong indorsement. At the present writing the strength of the bridge is under investigation by Prof. Burr. of Columbia University, on behalf of the City Bridge Department, and by Messrs. Boller & Hodge, who are acting under instructions from City Comptroller Metz, who declared some months ago that he would sanction no further payments upon the bridge until the question of its security had been amply demonstrated. Mr. Boller has assured us that, if his investigation leaves the question of the strength of the bottom chord in any doubt, he will recommend a test, either of a model built to scale, or of a full-sized member. We think that if any test be made, it should be of the full-sized piece, not only because of the greater certainty thereby obtained, but because such a test would afford a most valuable reference in the design of future long-span bridges. If the tests were carried out by the simple methods adopted in the case of the Eads bridge, the expense would be insignificant in comparison with the important interests involved.

THE PNEUMATIC TIRE AND THE HEAVY COMMERCIAL AUTOMOBILE.

In a paper recently read before the French Society of Civil Engineers the well-known tire expert, M. A. Michelin, offered some valuable suggestions on the proper design of tires for heavy commercial vehicles.

The pneumatic tire has hitherto been found useless for heavy weights, for two reasons: The largest pneumatic tire cannot safely carry more than fifteen hundred pounds and the pneumatic is inferior in economy, owing to a fact which many experiments have permitted M. Michelin to express in the following empirical law:

"The total travel of which a tire is capable is inversely proportional to the cube of the weight which it carries." For example: If the load is doubled the average wear and tear will be multiplied by eight, and an increase in weight of 5 per cent will cause an increase in wear and tear of 15 per cent.

So, every attempt to increase the load has been followed by such rapid wear of the tires that their employment had to be abandoned.

Hence, it has been found necessary to retain the solid rubber tire in order to lessen noise and soften shock; but India rubber, although very elastic and easily deformable, is almost incompressible, at least far less compressible than most solid bodies. This curious fact is not generally known. The solid rubber tire may be compared to a hollow tire filled with water, instead of air. It diminishes noise, but for deadening shock it is little more satisfactory than an iron tire. It permits, furthermore, only a slight increase in speed, so that some of the best constructors of heavy vehicles are now recommending the employment of iron tires together with speeds not exceeding 11 miles per hour. This limitation of speed is absolutely opposed to the chief object of the employment of the explosive motor. If there is to be no increase in speed, traction by horse power is far more economical.

At present the situation of the heavy weight vehicles is precisely the position occupied by the touring car before the adoption of pneumatic tires. The vibrations and shocks transmitted to the chassis and to all the mechanism rapidly wear out the motor and gearing. Of 162 vehicles possessed by the Paris Autobus Company, not more than 97 are ever in service at once, although the repair and maintenance shops employ a force of 200 mechanics. Yet the oldest of the vehicles has been in service only eighteen months.

The problem of tires for heavy vehicles is therefore still unsolved. To prove how unsatisfactory is the solid rubber tire, M. Michelin cites the following experiment: A wheel was caused to rotate with the tire velocity of 15½ miles an hour while carrying a load of 1,100 pounds, and furnished alternately with a pneumatic and a solid rubber tire 2½ inches thick, which was in contact with the broad tire of another and larger wheel upon which different small obstacles could be fastened. The displacements of the hub of the small wheel were inscribed in their true dimensions by a style upon a rotating cylinder. Vibrations amounting to ¼ inch for the solid, but only 1/50 inch for the pneumatic were recorded, even when no obstacle was present. These vibrations are caused by a slight eccentricity of the large wheel. They give an idea of the inferiority of a solid tire, which is confirmed by the passage of the wheel over obstacles. The first obstacle was a semi-cylinder about 4/5 inch high. This produced an elevation of the wheel amounting to 0.16 inch with the pneumatic and 0.40 inch with the solid tire. In other words the pneumatic absorbs four-fifths and the solid tire only one-half of the obstacle. The difference increases with the size of the obstacle. On an elongated block 4/5 inch high, the rise was 0.36 inch with the pneumatic and 1.16 inches with the solid tire. A semi-cylinder 1.2 inches in height caused the wheel to rise 0.28 inch with the pneumatic, and 1.04 inches with the solid tire. Finally, with an elongated obstacle 1.2 inches high, the wheel rose 0.44 inch with the pneumatic and 2.36 inches with the solid tire. In every case the ascent of the wheel, carrying a pneumatic tire, is less than the height of the obstacle; while with the solid tire the ascent is always greater than the height of the obstacle, unless this is very small. In endeavoring to repeat the experiment with the solid tires, the steel axles of the two wheels, whose diameters were 1.8 and 2.4 inches, became sprung. In order to avoid breakage the manufacturers of heavy automobiles have been obliged to reinforce their axles. M. Michelin states that he has seen axles made of I bars of forged steel of a height of 9 inches. For heavy-weight vehicles Michelin recommends the multiple pneumatic. It may consist, according to the weight which it has to carry, of two or more pneumatics, placed side by side upon the same wheel. For heavy vehicles, we are not concerned with high speed, and the construction must be adapted to give great strength in supporting loads. The envelope of the multiple tire, therefore, would not be suited for a touring car. It might be feared that two or more tires exposed together to the inequalities of the road would wear out almost as soon as a single tire, but this is not the case. Twin tires are found to last from three to seven times longer than single tires.

This is chiefly due to the law which we have already quoted, but there are other reasons. The twin tire suffers less from the brakes because their pressure is distributed over double the surface. Seventy-two experiments have proved that, at the same pressure, a pneumatic of small diameter absorbs obstacles better than one of large diameter.

ON COURTESY.

A large railway company, which every morning pours into New York thousands of suburban residents and in the evening carries them home again, has issued a set of five rules for the consideration of its agents and conductors—a semi-decalogue which constitutes an admirable code of manners and which may well be adopted not only by other railways, but by almost every public institution and business house. Conductors whose task it is to collect railway tickets usually assume an attitude which may best be described as restrained ferocity. Tickets are imperiously demanded, rarely asked for. When they are held out with rabbit-like submissiveness, they are snatched as if the passengers were reluctantly disgorging property stolen from the company. Starting with the principle that courtesy is a practical workaday application of the Biblical command to do unto others as you would they should do unto you, the little code of manners referred to points out that railroading is a highly complex and technical business, with every detail of which the employee of the road must be familiar, but of the intricacies of which the passenger has no conception. If in his bewilderment the patron of the road should seek enlightenment surely it is the duty of the employee to give politely and clearly whatever information may be asked. The manner of expression as well as the actual words used constitute an important element in the art of being polite. As the rules in question put it "a gracious manner . . . is to your words what oil is to machinery in making them more effective to their purpose."

The suggestions here very briefly summarized may profitably be applied by every business man in his daily commercial life. The man who solicits your advertisement, the salesman who has samples to exhibit, the life insurance agent whose hair-trigger tongue pleads eloquently for your family, even the seductive canvasser who tries to inveigle you into buying a history of the world in twenty-five volumes, can be listened to for a courteous minute or two and politely dismissed without seriously clogging the wheels of business. Perhaps they may really have something worth while of offer. Above all, the tellers and the cashier

of every bank need a course in the art of gracious expression. Why should the depositor of money be regarded with frowning suspicion, and why should his mistake in indorsing checks wrong side up or his failure to have his books balanced regularly, call forth shouts of correction instead of a few words of kindly instruction? After all, he is only ignorant, or only forgetful. No dark scheme for defrauding the bank lurks behind his failure to follow the bank's rules. Courtesy is its own reward. It pays in personal satisfaction, in minimizing friction, in making friends, and in raising you in the eyes of your business associates.

THE SHACKLETON ANTARCTIC EXPEDITION.

BY JOHN PLUMMER.

The readiness with which the Australian government voted the sum of $25,000, and that of New Zealand an additional amount of $5,000, toward the expenses of the Antarctic expedition under Capt. Shackleton, illustrates the deep interest manifested throughout Australasia in everything connected with the solution of the mystery of the continent surrounding the Southern Pole. Australasian scientists have long given attention to the meteorological questions associated with the great Antarctic continent; and when it was proposed that Prof. David, who holds the chair of geology at Sydney University, and a couple of students should accompany the expedition, a general feeling of satisfaction was expressed.

The steam whaler "Endeavour" was to leave Lyttleton, New Zealand, on the first day of the present year, and after landing stores and all requirements for a year's stay on King Edward VII Land, return to New Zealand. Capt. Shackleton was a member of the expedition in 1901-4 under Capt. Scott, which reached the latitude of 82 deg. 17 min. south at longitude 163 deg. west. The explorers will remain about twelve months in the southland.

The distance from the proposed winter quarters of the expedition to the South Pole is about 730 miles, and of this about 270 miles as the crow flies has already been traversed. An automobile will draw a train of sledges the whole distance of 270 miles, when a number of Manchurian ponies will be employed. In the Scott expedition, ranges of high mountains were found in Victoria Land. They were situated about 82 deg. south, and reached from 10,000 feet to 12,000 feet in height. The coast line was traced due south as far as 83 deg. 20 min. Most of the traveling was accomplished on the great ice sheet floating on the sea front, and which was found to extend 100 miles from east to west, and 270 miles north and south, with a surface so flat and smooth that no change of level at the outer part could be detected by the aneroid. Further toward the shore the crumpling of icebergs and packs from the land created the customary array of hummocks and peaks, which make traveling both difficult and dangerous. Capt. Shackleton possesses the advantage of having his way clear up to within measurable distance of the South Pole, and of having the assistance of mechanical appliances unknown to previous explorers. Should no serious obstacles be encountered it is possible that the expedition will reach its destination within 35 days from the time of starting, traveling at the rate of 20 miles per day.

Prof. David will return in the "Endeavor" to New Zealand, and thence proceed to Sydney, but the limited time at his command will be well employed. Speaking to an interviewer, he said: "I will examine as far as possible, by landing here and there, the geological structure of the Antarctic regions, collect specimens, and obtain photographs; and I also hope to get some temperature and meteorological observations. Australia wants these latter particulars from the southern land urgently, for the Antarctic plays a most important part in the formation of her climate. It is indeed the great factor in controlling the weather conditions of Australia and New Zealand."

The Manchurian ponies which accompany the expedition possess considerable strength and powers of endurance. They number about twelve, and are provided with stalls on board the "Endeavour," but the space allowed for each is so limited that they will have to be on their feet during the whole of the voyage. As an additional precaution, it is proposed to drop a sledge load of provisions at each interval of a hundred miles during the overland journey, thus reducing the weight to be carried during the latter portion, and forming reserve supplies in case of accident during the work of return.

A subsidiary expedition is to leave New Zealand for the Auckland and Campbell Islands. The former are situated about 200 miles south of Stewart Island, the smallest and southernmost of the three islands forming the New Zealand dominion, and possessing an area of about 200,000 acres; the latter islands, embracing an area of 43,440 acres, being situated in latitude 52 deg. 33 min. south and longitude 169 deg. 8 min. west. Both groups, with a number of others, belong to New Zealand. This expedition will form a valuable adjunct to that under the command of Capt. Shackleton, the scientific data obtained being used in conjunction with that secured by the "Endeavour" party to assist in determining the actual relations of Australasia to Australia and New Zealand on the one hand, and to South America on the other. The party will be a somewhat large one, and include several of the leading Australasian magnetic observers, zoologists, botanists, geologists, and others. The whole of the observations will be conducted in a thoroughly systematic manner, and an effort will be made to obtain evidence bearing on the theory that in the past a vast continent existed in the south polar regions, uniting New Zealand to America in one direction, and to Australia, Kerguelen Land, Mauritius, Madagascar, Gerca, and the island of Tristan d' Acunha in the other.

THE WRIGHT AEROPLANE TESTS.

WILBUR WRIGHT'S LATEST FLIGHTS IN FRANCE.

On account of the small race track near Le Mans (670 x 2,600 feet), and also because the great crowd of spectators somewhat confused him, Wilbur Wright made arrangements to fly above the military field at Auvours, which is several miles in length by nearly a mile wide. After the broken plane had been repaired, his machine was towed by an automobile to this new practice ground. The transport of the aeroplane was effected expeditiously, the 7 miles being covered in three-quarters of an hour. After waiting several days before he was able to use the field, Mr. Wright at last, about 6 P. M. on August 21, was able to resume practice and to make two excellent flights of 1 minute 46 seconds and 2 minutes 18 seconds respectively. During these flights, which were made in a 7-mile wind, the aeroplane described a figure 8 and made other complicated curves at a height of from 10 to 50 feet above ground. These flights were witnessed by a great crowd despite the fact that the ground was much more inaccessible than the race track at Le Mans. Some German military men who witnessed them expressed great admiration of the machine and its aviator. When going with the wind in the second flight, Mr. Wright estimated that he attained a speed of practically 50 miles an hour, which was a greater speed than he had ever reached before. The machine worked satisfactorily, and it is probable that Mr. Wright will make the 31-mile flight called for within a very few days.

ORVILLE WRIGHT'S TESTS OF THE GOVERNMENT AEROPLANE.

The younger of the two Wright brothers, Mr. Orville Wright, arrived in Washington on the 21st instant, and, after inspecting the various parts of his aeroplane at Fort Myer, stated that it would require about ten days time in which to assemble the aeroplane and get it ready for the test flights. He has until September 28 in which to make the official speed and endurance trials, and, as the new machine has never been tried, he will doubtless proceed slowly and carefully, as his brother has done in France. The endurance test of 40 miles in an hour he expects to make above the parade ground at Fort Myer, but the speed test will probably be made over a straightaway 5-mile course across country.

RECENT MILITARY DIRIGIBLE BALLOONS.

THE BALDWIN AIRSHIP ACCEPTED.

After its preliminary trials to determine the speed, as detailed in our last issue, the committee which had charge of the testing of the Baldwin airship superintended the test for endurance on August 15. In the flight the previous day an average speed of 19.61 miles an hour was maintained. The requirements were that in the endurance flight the airship should maintain an average speed equal to 70 per cent of this and that it should fly continuously for two hours. The test was not started until 6:42 P. M. The same 4⅛-mile course from Fort Myer to Cherrydale, Va., and return was used as was followed the day before. The speed obtained was somewhat higher in one direction owing to a strong cross wind. The airship rounded the course seven times, and then flew about a mile out and back in order to complete the two-hour flight. It was in the air 2 hours, 1 minute, and 50 seconds, with the motor running continuously, and in this time it traversed a distance of nearly 28 miles. As it fulfilled all the conditions, it has been acquired by the War Department, and Captain Baldwin is at present engaged in instructing the officers of the Signal Corps in its management. A considerable number of short practice flights have already been made.

The dimensions of the new airship are 94 feet long, by 20 feet greatest diameter, its capacity being 19,500 cubic feet of gas. While it is by no means as large as the dirigibles of France, Germany, and England, it is nevertheless of sufficient size to carry two men with ease, and it is expected that it will serve a useful purpose in initiating the officers into the use of this type of air craft. In the endurance test, this new dirigible maintained an average speed of 13¾ miles an hour.

PRACTICE FLIGHTS OF THE NEW GERMAN MILITARY DIRIGIBLES.

During the past week the officers of the German army have been experimenting with the two new military dirigibles which Germany has recently had constructed—the "Parseval," and the "Gross II.," the latter of which is considerably smaller than the former. On August 14 the "Parseval" made a 2¾-hour flight, during which it circled completely around the city of Berlin. On August 17 it made two more ascents in the morning. The first was quite successful, but during the second the airship entered a cloud and the resulting contraction of the gas caused it to lose its shape and descend rapidly. It struck the ground so hard that one of the officers had his arm broken. The same evening at 10 P. M. the "Gross II." was taken from its shed and driven to Neustadt and return, a total air line distance of about 95 miles. It reached its starting point at Tegel at 3 A. M., so that, including the various maneuvers that were executed, it averaged about 20 miles an hour. On August 20 the two airships, with the Duke of Saxe-Altenbourg at the helm of the larger, maneuvered for two hours above Berlin. They traversed the Avenue of "Unter den Linden" at a slight elevation above the housetops, and so successfully did they perform different evolutions that the military authorities were greatly pleased. Since the excellent performances of these two new dirigibles, coupled to that of the ill-fated Zeppelin, Germany is now pressing France hard as regards the supremacy of the air from a military point of view.

SCIENCE NOTES.

"Neossin," the Chinese edible bird's nest, has been studied by E. V. McCollum, who finds that it is a glucoproteid. It gives Millon's, Adamkiewicz's, the biuret and xanthoproteic reactions. It contains 2 per cent of sulphur, 9.69 per cent of nitrogen and no phosphorus. Hausmann's method showed the nitrogen to be distributed as follows: NH_3, 1.3 per cent; humus, 1.27 per cent; phosphotungstic acid precipitate, 1.59 per cent; amino acids, 5.53 per cent. The substance is remarkable in that about one-fourth of its sulphur is liberated as SO_2 when the proteid is hydrolyzed with 3 per cent HCl. No sulphites are present in the nest. The gas was washed with $CuSO_4$ solution and gave no evidence of hydrogen sulphide. The mercaptan sulphur test is very faint. When boiled with 3 per cent HCl, the carbohydrate group is readily split off. The hydrolysis solution was precipitated with phosphotungstic acid and the filtrate used for the estimation of the sugar by Fehling's solution. It showed the presence of 15 per cent of sugar calculated as glucose in the sample. This solution gave an osazone which melts at 183 to 185 deg. C. and has the composition of a hexosazone. Arginine and histadine were identified in the phosphotungstic precipitate. Lysin appears to be absent.

The total oil output of the world may be taken as being about 20,000,000 tons per annum as against 800,000,000 of coal, and of this oil at best only one-third is available for fuel purposes. The crude oil as it comes from the well would be absolutely unfitted for use, as in most cases it gives off inflammable vapors at air temperatures, and these mingling with the air form highly explosive mixtures. The temperature at which such inflammable vapor is evolved is called the "flash point" of the oil, and for use in the British navy no oil with a flash point below 200 deg. F. is allowed on board, although in the German navy and the mercantile marine the limit is fixed at 150 deg. This necessary limitation means that the crude oil as it comes from the well has first to undergo a process of distillation, the more volatile portions yielding petroleum spirit or petrol, employed in motor cars, etc., while higher fractions flashing above 73 deg. F. form the lamp oil, used for illuminating purposes, and with most crude oils it is only the residue, which from American oil is called "residuum" and from Russian oil "ostatki," that fuel oil supplies can be drawn.

The annual report of the Astronomer Royal dealing with the work of the observatory during the past year contains an interesting paragraph on the method of illuminating the field of the transit circle. Sir W. H. M. Christie records the fact that it was discovered last year that the method of illuminating this field by means of an elliptical annular reflector, lit by an axis lamp, was open to objection, as the tilting of the reflector to different points to produce various degrees of illumination caused a shift in the center of light, and an apparent shift in the wires. A uniform central illumination has now been substituted, a small elliptical reflector with a matt white surface being cemented to the center of the object glass, reflecting the light of a small electric lamp: change in the degree of light is produced by altering the current through the lamp by a rheostat. This plan, says the report, has been in use in the altazimuth for a year with very satisfactory results. Arrangements have been made on each instrument to take a few transits by the old method for the purpose of comparison. A new arrangement of wires has also been inserted in the collimators of the transit circle, thin parallel wires replacing the thick oblique wires in former use.