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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

ANALYSIS OF THE RECENT AUTOMOBILE ENDURANCE TEST AND SPEED TRIALS.

The second endurance test of automobiles in America this year was held under the management of the Automobile Club of America on Decoration Day, and was in every way a success. The weather was fair, and the competitors were aided in their outward journey by a stiff breeze that blew all day from the southwest.

The first machine was sent over the starting line promptly at 9 A. M., and was followed at one-minute intervals by 54 other vehicles. Seventy-four machines had entered, but 19 failed to start. An examination of the Automobile Club's report of the run, which was compiled from the memoranda of the official observers, one of whom was placed on each vehicle, shows the following interesting facts: Of the 55 vehicles that actually started, 44, or 80 per cent, finished within the maximum time limit, which required them to make an average speed of at least 8 miles per hour. The minimum limit of 6 hours and 40 minutes for the course, which was equivalent to an average speed of 15 miles an hour, was not exceeded by any competitor, and there were consequently no disqualifications for racing, as in the previous Long Island test.

Only a little over one-quarter of the machines that started were of the steam type; all the others being gasoline, with the exception of one electric. Eighty-six and two-thirds per cent of the fifteen steam carriages that started finished, and 72 2-3 per cent finished without a penalized stop, while 3 steam Stanhopes, of a well-known make, equipped with condensers, repeated their performance on Long Island, covering the 100 miles without a single stop. The manufacturers of this vehicle seem to have thoroughly demonstrated that the use of a condenser on a steam carriage is entirely practicable, which results in making it possible for vehicles of the steam type to compete hereafter in the long-distance class.

The percentage of gasoline automobiles that finished was but 79½ per cent, while only 43 per cent of those starting in this class finished without a stop. This low average of non-stop gasoline machines was caused, in some degree, by the presence among the contestants of several old or partly experimental vehicles that either did not get very far, or else succeeded in covering the entire course after many breakdowns and tedious waits for repairs. A German Benz machine built five or six years ago was started on a wager that it could not be made to run the 100 miles in 24 hours. The story of its trip is a most interesting recitation of the overcoming of difficulties and repairing of many breakdowns on the road. The vehicle finally arrived at its destination at 2 A. M. the following morning, thus winning the wager, to the great gratification of its plucky chauffeurs. One of the small American motorettes covered the last 80 miles of the journey on the low gear. The operator was forced to do this or else stop and adjust the high-speed clutch. He chose the former, and succeeded in finishing within the time limit, without making a stop. When it is understood that the small De Dion motor used was obliged to run steadily at a speed of 2,000 revolutions per minute for 8 consecutive hours, some idea can be formed of the strength and fine workmanship contained in this light weight bit of mechanism.

Another cause of the low percentage of gasoline vehicles that finished without stops is that several of the best American machines experienced no little trouble with their water-circulating pumps and oiling apparatus. One carriage with fan-cooled motor was a noteworthy exception, and the perfect performance of three machines of this type over a far more difficult course than that on Long Island would appear to indicate that the problem of the medium-sized, air-cooled gasoline motor has at last been solved in a practical manner.

The endurance test, though a comparatively short one, was yet long enough to develop troubles with many of the cars. The steam carriages made the best showing as to perfect runs under the rules, though it should be remembered that the two stops they were allowed for water, fuel, and lubrication were a relief to the operators and the machines which the gasoline cars did not have. Two of the three steam vehicles, that had condensers and made no stops, lost but 6 gallons of water apiece, and the gasoline consumption was but slightly greater. One of the machines consumed only 5¾ gallons, or about half as much as most of the other makes, and less by over a gallon than some of the similar two-passenger gasoline machines. The lowest water consumption of a steam carriage without condensers was 71.35 gallons; the average water consumption was 81.33 gallons. The lowest fuel consumption for gasoline vehicles was three gallons.

The one electric vehicle entered in the test succeeded in turning the halfway point (50 miles) with one change of batteries at the first control, or one-third of the entire distance. Shortly afterward it dropped out, since it was not able to run any further. The performance of this carriage is considerably exceeded by the recent run over muddy roads of two English electric touring cars, which traveled successfully from London to Bexhill, a small town on the south coast some 80 miles away. The American manufacturers evidently have much to learn regarding the production of long-distance electric touring vehicles capable of covering 50 miles of cross-country roads on a single battery charge.

The speed trials held on Staten Island May 31 by the Automobile Club of America were brought to an abrupt close by the fatal accident that occurred to the Baker electric racer. The appearance of this machine before and after the accident was depicted in our last issue. Had it succeeded in finishing without accident, it would undoubtedly have made a world's record. As it was, it made a record for electric machines of 36 1-5 seconds for the kilometer (0.621 mile). Other records made were a mile in 1 minute 12 seconds by a Locomobile racer; one in 1 minute 17 3-5 seconds by a Winton medium-weight gasoline machine; and a third in 1 minute 10 2-5 seconds by an Orient motor bicycle.

The endurance test and speed trials have demonstrated that while contests of the former kind can, when properly organized, be held on the public highway without danger to life and limb, all speed trials should take place on a private course, where the spectators, for their own safety, can view the racers from an elevated point, such as a bank or reviewing stand, where their lives will not be endangered by accidents occurring to the contesting vehicles.

PRACTICAL APPLICATION OF SCIENTIFIC EDUCATION IN GERMANY.

It is the common belief that the commercial rise of Germany has been largely due to the results of the Franco-Prussian war, which put money into its coffers and stimulated the energies of the people. Doubtless much of Germany's phenomenal success of the last quarter of the past century was due to this event; but in order to gage accurately the nation's capacities and aims, it is necessary to look farther back than 1870-71.

It is perhaps unnecessary to say that the whole standard of education in Germany is higher than in either the United States or England, and technical education had its beginning in Germany long before the Franco-Prussian war.

Sixty years ago, Liebig had fifty students working in his factory, and all of the German universities have had their own chemical laboratories since 1827. To-day, there are in German factories 4,500 thoroughly trained chemists, besides more than 5,000 assistants, whose brains are constantly at work upon the problems of improving processes, and lessening the cost of production.

The sugar industry illustrates the practical application which the Germans make of their educational system. In 1840 154,000 tons of beet root were crushed, from which 8,000 tons of raw sugar were produced, showing about 5½ per cent of raw sugar extracted from the root. Twenty years later 1,500,000 tons were treated which produced 128,000 tons of sugar, or about 8 per cent. Last year about 12,000,000 tons were crushed, which produced 1,500,000 tons of raw sugar, raising the percentage to 13. This advance is due entirely to scientific treatment.

The production of dry colors, chemicals and dyes in Germany shows a corresponding increase in product and in dividend-paying capacity. Comparing the statistics of the dyeing industry of the year 1874 with those of 1898, it is found that notwithstanding prices in 1898 were considerably lower than in 1874, the net income in 1874 was 24,000,000 marks (about $6,000,000) and in 1898 was 120,000,000 marks (about $30,000,000). The great increase of earning capacity is due largely to the constant labor of trained men, who by application of their technical knowledge have so cheapened production that they have succeeded in getting this trade away from the English, who formerly controlled it. Another illustration is found in the manufacture of artificial indigo, a chemical process for making which was discovered in Germany about thirty-five years ago. It was started with less than forty workmen, all told. It now employs over six thousand men, and has a staff of one hundred and forty-eight scientific chemists. By placing this substitute upon the market at a very low price the Germans have nearly ruined the natural-indigo industry of India.

The Germans have also discovered a method for obtaining ground slag from steel processes, which is used as a fertilizer; and England, although she produces as much steel as Germany, has become a good customer for this article.

A century ago, the English and French makers of scientific instruments were far in advance of the Germans. During the last twenty years all this has changed. The value of the exports from Germany of scientific instruments for the year 1898 was about $1,250,000—three times what it was in 1888—and the work gave employment to 14,000 people.

The conclusions to be arrived at from the foregoing are not so much academic as economic and practical. In Germany, a young man is called upon to decide, early in his career, whether he will take a classical or a scientific course. If he decides to take the latter he goes into the "Real Schule," or lower scientific school, to be elevated thence to the "Real Gymnasium," or scientific high school, and thence to the "Polytechnicum," or institute of technology, which is separate from the universities. In this course he learns no Greek and only a moderate amount of Latin; but he has the sciences, engineering, mathematics, modern languages, history and a mixture of practical and theoretical training in various technical branches, with frequent excursions for the purpose of inspection of work in factories and public enterprises.

The faculties of these institutions keep in touch with the manufactories, and when capable young men graduate they easily find situations. This is also true of the technical high schools, of which there are twenty-four, which likewise have courses in engineering, architecture, drainage, irrigation, modeling, drawing, chemistry, modern languages, history, etc.

The questions for the people of the United States are: Is our system of education as perfected as it should be? Have we sufficient scientific education of the best grade, and are our educational institutions in close enough touch with the manufactories to supply their needs? If not, are we not hampered in competition with our great commercial rival, which enjoys this complete co-operation?

The Imperial Department of Commerce and Industries has been of great assistance to the German manufacturer. It has been an intermediary between the educational and practical work, guiding the one, sustaining the other, and furnishing information to the manufacturer, first in beginning his industry, later in expanding it, and finally in marketing his surplus.

We should not rely too much on our unrivaled natural resources in the struggle for foreign trade. No country can rest in fancied security. What is the cheapest and best to-day may be made cheaper and better by our rival to-morrow, with its human plant of half a hundred thousand trained scientific brains working daily and steadfastly.

RICHARD L. MADDOX, M.D.

It is probable that very few photographers are familiar with the name of Dr. Maddox, who died on May 11 last in Southampton, England, at the age of 85. He was, however, regarded as the inventor of the gelatino-bromide process now so universally used. The process was improved after him by Kennett, Burgess and Bennett. Dr. Maddox prior to the seventies was particularly interested in photo-micrography, and found the work of drawing the enlarged images so vexatious that he looked about to see what could be done in the line of photography. He learned the practice of the collodion wet-plate process, and worked with that for a while. But the small darkroom he used soon became so saturated with ether evaporating from the collodion that it seriously affected his head and health. He then determined to try and ascertain a substitute for the collodion, and made an emulsion of isinglass, gelatine and other materials.

His experiments resulted successfully, for in 1871 he prepared a gelatino-bromide of silver emulsion and coated it upon glass plates, exposed them in a camera, securing very good negatives. These original negatives were placed on exhibition at the Inventions Exhibition in London in 1885, and he was awarded a gold medal therefor.

In 1889 he was awarded the Scott medal of the Franklin Institute at Philadelphia, and in 1901 he was awarded the Progress medal of the Royal Photographic Society of London, in each case in honor of his early work in the production of a practical gelatino-bromide process.

In 1892 a special fund was raised for his benefit of about $2,000 through the efforts of Sir William

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