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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.

WEIGHT AND VELOCITY IN HEAVY GUNS.

Elsewhere in this issue we give illustrations of the successful tests recently carried out with the new army 16-inch gun, tests which prove it to be the most powerful weapon in existence, exceeding greatly in energy the 16¼-inch Armstrong gun built several years before. Whether, in comparison with modern ordnance, it is the most efficient piece relatively to its weight and cost is another question, to which even the gentlemen who designed and built it would probably return a negative answer. In defining the question of relative efficiency, however, it should be mentioned that the 16-inch gun was designed several years ago, and therefore cannot be said to represent the very latest developments in ordnance. The tendency to-day is toward reduced weight of gun and projectile and increased muzzle velocity. As we have shown very clearly in the data of the Krupp gun of the 1901 pattern (included in the table shown on another page), although the weight of the Krupp piece is only about half that of the 16¼-inch Armstrong gun, and its projectile is about 40 per cent as heavy, its high muzzle velocity of 3,330 foot-seconds gives the shell a muzzle energy of 59,280 tons or between 3,000 and 4,000 foot-tons greater than that of the Armstrong piece and 75 per cent of that of our own gun. The muzzle energy per ton-weight of gun, moreover, reaches the high figure of 1,029 foot-tons. It is interesting to notice that the increase which is made in the length of the bore as compared with the older guns, with a view to obtaining the full ballistic value of the relatively small powder charge, is so great that the smaller gun is actually the longest of the three, longer even by a few inches than the great 16-inch gun now at Sandy Hook. This comparison is given, simply to illustrate the advance which has been made in heavy ordnance since the plans of the English gun and, later, of our army 16-inch gun were drawn up; for, as the tests on Saturday clearly demonstrated, the great gun is a most excellent piece of work, which reflects the greatest credit on Major Rogers Birnie, Major Charles Smith, and Col. J. P. Farley, who were responsible for its design and construction. At the time when it was planned, this piece was not only the most powerful, but the most advanced type of heavy gun in the world. As it was necessary, however, before work on the gun could be even commenced, to build a special and costly plant for its construction, the delay has been such that the 16-inch gun to-day would be considered, even by those who were responsible for its construction, as in some respects out of date; and while the weapon in these tests has answered every demand made upon it, it is probable that it will be at once the first and last of its size to be built. Apart from the convincing proofs offered by the tabular comparison, above referred to, we may mention that our Ordnance Board has made such rapid advance in the development of nitro-cellulose powders, and the design of guns suited to these powders, that a muzzle velocity of 3,600 feet per second is contemplated in future guns. To understand what influence velocity has in reducing the weight both of gun and projectile, we have but to remember that while the energy varies directly as the weight of the projectile, it varies as the *square* of its velocity; and, therefore, by reducing the diameter and weight of the projectile and increasing its velocity, it is possible to build a gun that will have the same muzzle energy as the 16-inch piece and yet weigh not more than half as much. We do not know just how far the plans of the Ordnance Board for high-velocity guns have progressed; but if they were called upon to produce a 12-inch gun of half the weight of the 16-inch gun but of equal muzzle energy, they could doubtless do so; that is, if the 3,600 foot-second velocity, which they claim to have secured, is applicable to a gun of this caliber. At the same time we must remember that comparisons of muzzle velocity and energies are misleading—at least to the layman; for a heavy shell with a low velocity will hold its energy longer than a light shell with a high velocity, the velocity falling off less rapidly as the range increases than in the case of the lighter shell.

THE AMERICAN AUTOMOBILE.

The Automobile Exhibition which was held last week in Madison Square Garden, New York, proved, beyond everything else, that both the American public and the American manufacturers have learned a certain fundamental lesson, without which any real progress toward the evolution of a satisfactory automobile and the development of a flourishing trade in the same, would have been absolutely impossible. The lesson is this: that in the very nature of things, because of the inherently complicated nature of the machine itself, and the particularly trying conditions under which it is called upon to do its work, the designing and building of a satisfactory automobile is an extremely serious and difficult matter. Now it is for want of realizing this fundamental truth that the development of the automobile, mechanically, industrially, as a commercial proposition, and as a great public utility and means of pastime, has been very materially delayed in this country. "American inventiveness and ingenuity" and "American labor-saving machinery" have grown so accustomed to taking hold of any new device of European origin, and quickly improving and cheapening it, that when the first serious automobile exhibit of four years ago was held, the press and the public alike (we plead guilty to the indictment ourselves) were prolific in promises and prophecies as to the speedy "revolution," or whatever it may have been called, that we were going to make in the automobile industry now that we had set our hand to the task.

The self-confidence that prompted this splendid optimism was not without justification, for we could point to unnumbered devices of European origin which, in the hands of our inventors, machinists, and manufacturers, to say nothing of our business promoters, had grown from somewhat crude objects of doubtful utility into perfect appliances of a world-wide reputation and world-wide demand. In the automobile industry, however, we were, for once, mistaken. Overlooking the fact that the automobile of some four or five years ago represented the combined efforts of some of the brightest engineers among that nation of brilliant engineers, the French; and that the successful machines of that day had been brought to their then stage of perfection by a long and costly process of experiment, invention, and design, our makers, with a few rare exceptions, to which full credit must be given, rushed hastily into the business of automobile manufacture and met in the majority of instances, at the very outset, with most discouraging results. Many of them seemed determined to take up the problem *de novo*; and instead of profiting, as they should have done, by the trials and failures of French and German makers, they began to go over the same old experimental ground, and put themselves to the expense, loss of time, and inevitable disappointment, incident to the development of a satisfactory automobile. Hence it was that our first two exhibitions simply proved that, except in the steam-driven vehicles, we were following leisurely in the trail of the European manufacturer; many of the forms and types shown being from eighteen months to two years behind the best current practice of the day.

No such charge, however, could be made against the excellent exhibit of machines that was gathered together last week in Madison Square Garden. It is evident that our manufacturers have decided to accept that which has proved to be best in the practice of foreign makers, incorporate it in their own designs, improve upon it where possible, and make only such changes as had stood the test of trial under actual service conditions. Consequently, one noted an almost entire absence of the freak machine; and the exhibits conformed pretty closely to one or other of the accepted types, both in details of mechanism and in general structural appearance and finish. It is too much to claim that we have left as yet any very distinctive national mark upon the automobile, unless it be in the production of moderate-priced runabouts of light weight and comparatively small power.

Evidently the automobile industry, as such, has now settled down to a working basis. We have learned that something more than a blacksmith's forge, a lathe, and more or less native ingenuity are necessary to the building of an automobile. The thousand-and-one individuals who rushed into the business with but few of the qualifications necessary for such difficult and arduous work, have learned their bitter lesson and gone back to their former or to other pursuits, leaving in the field only such makers as are duly qualified and equipped. Furthermore, if a visitor to the show had taken the trouble to select the American machines which have survived the period of trial to which we have just referred, and had asked the makers to what they particularly attributed their success, he would have found it to be due to the fact that no machine or part of a machine that was new was allowed to go upon the market, until its utility had been proved by a long period of very searching and exhaustive trial. It is impossible to overestimate the harm that has been done to the automobile industry by the many mushroom companies that have rushed into the public market, with nothing more to show than a set of blueprints, a machine shop, an office, and a soliciting agent. During the past year there was a notable case of a firm that had entered upon its books thousands of dollars worth of orders for automobiles, equipped with a new type of transmission that, at the time the orders were booked, had never had a shop test, to say nothing of a trial on the road. The damaging effect of such practice in delaying the growth of the automobile in public favor, it would be difficult to estimate. There is one respect in which the American automobile has already won for itself golden opinions, and that is in regard to its general lines and finish. Alike in the light runabouts, in the medium-powered touring cars, and in the high-powered machines, there is evidence of a careful effort to produce the most harmonious and graceful outlines, and we believe that in this respect, among others, the American automobile will win for itself universal and unqualified favor.

With regard to the future improvement of the automobile, we suggest that it may be looked for along the following lines:

1. Transmission Gear: It will be generally agreed among automobile users that the most important point demanding further experiment and improvement is the transmission gear. While there are some excellent gears in use, the best of them are exceedingly costly. The endeavor of the American manufacturer has been to produce a transmission gear that will have the certainty of action and the durability of the best foreign makes, and that can also be produced at considerably less cost. Upon the solution of this problem depends very largely the future of the moderate-price automobile, for which the great mass of the American people are asking. The endeavor to produce a cheaper gear is commendable; but unfortunately some of the new types have been rushed into service without adequate trial. This is a problem that will richly reward the inventor who can produce a gear that is cheap, reliable, and durable.

2. Sparking Devices: The experience gained on the endurance runs of last year, proved that there is yet much to be done before the problem of an absolutely reliable sparking device has been solved. The dry battery and the independent dynamos have each troubles of their own; and while some of the systems shown at the exhibition are excellent, there are many makes that will require considerable improvement, if they are to become popular with the public. The problem of adjusting the sparking device to the variable speed of the engine is one which will repay still further investigation, particularly in the matter of automatic governing.

3. The Wiring: As in the case of transmission gears and the sparking devices there is notable improvement in the wiring of automobiles as compared with those exhibited two years ago. In the past our machines have suffered from the use of too small cables and more or less imperfect insulation. This is a detail which has been responsible for many a half-hour of puzzled and fruitless search by the inexperienced automobilist for the cause of a breakdown. The cables are now of generous dimensions, and the insulation has been carefully carried out.

4. Engines: In general the engines, particularly in the higher-priced machines, are admirably made, both as regards the castings and the machine work. Cast-steel has taken the place of cast-iron, and both in respect of mechanical operation of the valves and the greater care that is being taken in the seating of the valves and their general mechanism, there has been a very marked advance. The makers of the cheaper gasoline machines have been driven to the use of cheaper materials and less costly machine work in the endeavor to keep the price within reasonable limits; and in view of the limitations thus imposed, the greatest credit is due to two or three of the best-known makes. In some cases the contact-making devices are still very crude, and this detail also will repay future careful attention.

Taking a general view of present conditions, it may be said that the automobile industry is now established upon a thorough working basis. There is a considerable number of reliable firms that are prepared to take orders for machines that have stood the test of hard usage, and shown that they can be relied upon for continuous service without a visit to the repair shop. We are unquestionably feeling the first flood of a prosperity in the automobile industry whose extent it is hard to predict.