WHY MOTOR CARS COME HIGH

Biggest Part of Cost Goes Into the Making.

A LOOK INTO THE FACTORY

Besides Material and Labor, Considerable Brains Goes Into the Quality and Marketing of Machines.

It may be argued that the 500,000 motor-cars in use in this country to-day represent, say, $750,000,000 that has been received for them by the various manufacturers, and that this sum is being increased at the rate of from one-quarter to one-half billion dollars annually. These are figures that might make even our modern Aladdins pause to consider the "profits" that must lie in the production of motor-cars, but after a preliminary investigation they would be brought to realize that no more of this sum is "velvet" than is to be found in any well-conducted manufacturing business. The fortunes that may have been made in the automobile industry are due more to the immense volume of business done than to any "hundred per cent. profits," and competition nowadays is so keen that manufacturers are forced to sell their products at as close a margin as is possible.

In order to realize that the largest part of the cost of a motor-car is put into the machine itself, and not into the maker's profit, it is necessary to know some of the elements that go to make up the modern automobile. First and foremost, of course, is brains, for the motor-car is the product of a number of master minds that worked and slaved for years before the automobile, even in its crudest form, was ever seen on our city streets. While the manufacture of the motor-car in commercial quantities has been in progress but a little over a decade, its fathers and forefathers have been the subjects of experiment, trial, success, and failure for three times that many years and we are now reaping the benefits of the ideas and researches of the pioneers of those days.

Royalties on Patents.

But it is not the salaries of these pioneers or the royalties on their patents to which we contribute when we pay from one to six thousand dollars for a four-wheeled, self-propelled vehicle, for one of the best known and most vital patents on a motor-car yields its owners at the most but $15 for each automobile on which it is used. The purchaser of a modern motor-car gets what he pays for, for it is the tangible elements of material, workmanship, and design that form by far the greater part of the cost of an automobile, and there is less of a charge for the dealer's name-plate than the public seem to think. The maker's reputation helps to sell the automobile, but it does not furnish a sufficient excuse for raising the price of the machine above the amount for which another car of equal actual value is sold.

In order to know just what is "put into" a car, we must go to its birthplace, the factory, and there see what a multitude of wheels—speaking both literally and figuratively—are set in motion for the production of even the cheapest automobile. "A deal of fuss required for the manufacture of one car," you will say. Yes, but it requires no more "fuss" to produce a hundred or a thousand times that number, and it must be remembered that every motion or operation that we see there is repeated continuously throughout the day and year on the succeeding brothers of the car whose growth we are following.

Now, besides brains, what is it that is put into a motor-car? To be practical, we might say from two thousand five hundred pounds to two tons of iron and steel—besides the aluminum, copper, bronze, and other metals and alloys. That is true; but remember that each ounce of these two thousand five hundred odd pounds of metal receives individual attention from one or more machines and workmen, and that consequently we cannot say that we are paying one, three, or six thousand dollars for a "lump mass" weighing from one to two tons. It is not raw material that forms the major item of the cost of constructing an automobile—although that amounts to from six to sixty cents a pound—but rather is it the intricate workmanship required by each piece, large and small. The wonderful development during the last few years of automatic machines and tools that seem to do all but talk has greatly reduced the number of times that each piece must be handled, but the most up-to-date automobile factory is still far from being like the sausage-mill of the burlesque stage that popular opinion would have it—a mill into one end of which iron and steel can be placed, while from the opposite end, when a crank has been turned, the completed car is withdrawn. Such a similarity might be the impression received by any one watching only the raw stock-receiving room at one end and the shipping department at the other, but it is what goes on inside, between these extremities, that is the making of the car, and it is here that the greatest item of expense will be found.

Concealing Parts.

The tendency of modern design is to conceal as great a number of the working parts as is possible, and in looking at many a motor the layman might see only a one or two piece iron casting having but very few visible moving pieces; but if he drives a car or is at all familiar with its construction he will know that, hidden in the inner recesses of the machine, are pistons for harnessing the explosions, connecting-rods for transmitting the power to the crank-shaft, and valves for controlling the admission and ejection of the gases. Some of these parts, such as pistons, cylinder castings, and the crank-case, are comparatively large, and it is consequently difficult to realize that there are approximately fifteen hundred separate pieces in a modern automobile motor; but this number includes parts of the magneto and carbureter, as these are vital members of the power-plant. Of course some of these fifteen hundred distinct pieces are in duplicate, such as valve-stems, bolts, nuts, and connecting-rods, but the large majority must be fitted separately, and each part requires individual attention. And not only does each piece need to be handled separately, but some parts require several operations before they are made of the proper shape, size, and quality to fill their places in the completed whole.

Complicated Castings.

Consider, for example, the cylinders. These are not moving parts, their exteriors require no attention except at a few points, and yet their shape, valve-pockets, water-jackets, and the openings make them the most complicated castings in the entire car. In fact, the majority of automobile manufacturers obtain the cylinder castings for their motors from other concerns provided with special foundry equipment and corps of skilled molders. But the production of these complicated castings is only the beginning of the grooming that the cylinders must receive. They must be bored and ground out so that the interior will be as smooth as glass, the valve-pockets and openings must be finished, the surfaces smoothed off where adjoining cylinders or pipes are to be connected, holes must be drilled and threads cut in a dozen places; and all of this work must be done without injuring the casting or raising its temperature above a given point, for with every explosion the thin walls of each cylinder must withstand a pressure of from four to five hundred pounds per square inch.

Paradoxical as it may seem, the more cheaply a good car is to be produced the greater must be the investment in tools and other equipment—and yet it is the cost of such machines that really determines the selling price of an automobile. The car of the olden days, built piece by piece in the small machine-shop, cost three times as much as the better automobiles of to-day manufactured in establishments having millions of dollars' worth of tools and equipment. But this investment in tools saves labor and increases the quality and quantity of the output—and thereby reduces the cost of production.

Uniform Parts.

One of the demands growing out of the increased use of automobiles is that all parts of cars of like model shall be interchangeable, so that broken or worn portions may be replaced without the necessity for extra fitting. In former days this accuracy would have increased the cost of production greatly, but under modern methods it fits in perfectly with the conditions of machine manufacture. To render like parts interchangeable, all must be of exactly the same size and shape. This means that all holes must occupy the same relative position to one another in every duplicate piece, and that far greater accuracy must prevail than could be obtained merely by means of measurements. To facilitate matters, the multiple, or "gang" drill has been introduced, by means of which a dozen holes may be drilled in a piece in the time that would ordinarily be required to bore one. This is one machine, but it consists of twelve or fifteen drills, each of which is set in a movable spindle. This allows each drill to be set independently of the others, and thus any combination of location or size of holes may be obtained. But even with such a machine, properly set, sufficient accuracy cannot be obtained to meet the rigid requirements of modern automobile construction without the additional use of "jigs." These are steel plates in which holes have been bored corresponding to the proper location of the holes to be drilled in a certain piece. The holes in the jig are provided with guides of the proper size, and these direct each drill to its place.

Five Thousand Pieces.

And so each part of a modern car may be taken as an illustration, the machine operations and processes described, and the amount of time and labor necessary for the completion of each computed, with astonishing results. The statistician would find, probably, that there are approximately five thousand different parts to a car; that there is an average of five handlings and as many distinct operations required by every piece; and that no surface is left rough or unfinished, for all are milled, bored, ground, polished, or plated. He would tell you that to make any of these pieces—except the simplest screw, bolt, or nut—in even the best equipped shop outside of an automobile factory, would cost from one to one hundred dollars, and even then there would not be the certainty of obtaining the perfect fit that is assured by the interchangeability-of-parts feature of modern motor car production. Five thousand parts at an average cost of five dollars each represents a total outlay of $25,000 that would be needed for the manufacture of a single high-grade car by this piece-meal method—and no allowance has been made for testing or assembling.

Then in addition to the men who are in direct contact with the actual construction of the car there are those who experiment with and develop the new parts and machines, and who are intimately concerned with the birth of each year's models. These include a small army of engineers, designers, draftsmen, chemists, metallurgists, and testers, who have at their disposal laboratories and experimental equipment that are not surpassed by the finest technical colleges of the land.

And then, of course, there are the executive, sales, bookkeeping, and clerical forces which must be maintained by any large manufacturing concern. But the cost of manufacturing a car must include these expenses, as well as those concerned more with the direct production. It is no wonder, then, that in order to sell a small but high-class automobile for twelve or fifteen hundred dollars the annual output must be counted by the thousand.—Harper's Weekly.

CORRECT HORSEPOWER FOR PRACTICAL MOTORS

"With their ever increasing knowledge of automobiles, the motor-wise public are beginning to wonder, 'Just how much power should a car have in order to comply with all conditions of road, weather and grade we may care to negotiate'," said an officer of the Marion Sales company in a recent discussion of this most important subject of horsepower.

"There have been such a deal of statements regarding horsepower ratings," he went on, "such numerous bickerings as to French, German, American, etc., ratings, that the mind of the man who wants to buy is, as a rule, hopelessly muddled. After years of motor designing our engineer has finally realized that a touring car equipped with a thirty-horsepower motor had the proper amount of power, if used in conjunction with the proper gear ratio. In our model '35' we have found the gear ratio that gives the best results in actual road work. This ratio is three and three-fourths to one, an unusual one, but the resulting efficiency on hills, through hub-deep mud and sands, verifies our belief in it.

"Probably the greatest mistake in modern auto building is the use of a motor of enormous power whose working value is hampered immeasurably by an impractical gear ratio. They cannot make hills on rough roads on high speed and consequently have to overwork their motors on second speed. These cars are wasting thousands of gallons of gasoline annually through power which is not properly transmitted. All this power is simply thrown away.

"In our Model 35s, geared at three and three fourths to one, we find that we have a car of ample power for all ordinary circumstances and, best of all, a car that will not hesitate at any hill grade or road condition we ever care to tackle. Our thirty-horsepower motor has demonstrated its road ability the world over by the cleverest drivers that ever sat behind a steering column and by the veriest tyro in the art of running a motor car."

MORE SPEED IN MICHELIN TIRES

World's Road Record Lowered Twice at Santa Monica.

Felice Nazzaro's long standing automobile road record of 74.5 miles per hour, made by him three years ago in the Florio cup race in Italy, was broken twice last Saturday over the Santa Monica, Cal., course, first by Herrick's National in the 202-mile free for all, and again, by Merz, in the National, with which he won the 151-mile Shettler trophy contest. Herrick averaged 74.93 miles per hour, while Merz' average was 74.4 miles per hour. Like Nazzaro's Fiat, which previously held the record, both the National cars in Saturday's victorious contest, were equipped with Michelin tires.

Motorcycle Notes.

The F. A. M. recently received additional honors when its former president, Earle L. Ovington, the aviator, distinguished himself in "birdland" by being the first aviator to carry United States mail in a cross-country flight. Ovington did this at the Long Island aviation field recently.

Approximately 45,000 motorcycles will be built in the United States in 1912, it is estimated. Thirty-two companies will contribute to this output and all but 1,000 machines will be made by twelve firms.

Richmond, Va., will probably be the next city to adopt the motorcycle for collecting mail. Postmaster Edgar Allen, jr., has already tried out the plan, and may ask the department to furnish the machines.

Winfield Graham of Buffalo has been appointed chairman of the transportation and facilities committee of the F. A. M., to succeed E. L. Buffingham. Arthur Davidson of Milwaukee has been named a member to succeed Graham.

Charles D. Sigsbee, jr., son of the captain of the battleship Maine, now being raised in Havana harbor, rode 12,000 miles on his motorcycle last season. Sigsbee is captain of the Lebanon (Pa.) Motorcycle club.

Two thousand two hundred and twenty-five miles, from Philadelphia to Milwaukee and back, on a motorcycle for $7.43! This is the experience of John Benders of the Quaker City. Benders went by way of Harrisburg and Cleveland and returned through Chicago, Albany and New York and used 29¼ gallons of gasoline and four gallons of oil.

ELECTRIC TRUST COMES DOWN

Parent Concern and Its Subsidiaries Get Into Sherman Law Reservation.

That 97 per cent of the business in electric lamps has been in the hands of a single trust or combination may have been suspected by the purchasers of such lamps long before the United States Department of Justice began its investigation. There was an electric trust. That trust has pleaded a desire to obey the Sherman law as construed by the supreme court of the United States, and has consented to a decree by the circuit court for the northern district of Ohio, forbidding all trade practices held to be in contravention of the law.

The General Electric owned the National Lamp company. The National Lamp company owned or controlled a large number of subsidiary manufacturers. And nearly all the factories not in its control were dominated by the Westinghouse Electric and Manufacturing company. Thus, when the General Electric and the Westinghouse interests combined to fix prices for selling and reselling lamps, competition was killed. For a term of years the future seemed secure, because, though anybody might manufacture the old carbon filament lamps, sixteen-candlepower, the trust owned patents on the tungsten, tantalum and other metallated film lamps, and would not sell these to any dealer who did not take his supply of unpatented lamps from the same source. No dealer could afford to be without the tungsten lamps. Therefore, no dealer could afford to patronize an independent factory making the carbon filament lamps.

Now, by court order, price fixing, discrimination in the sale of patented lamps, refusal to sell needed parts to independent manufacturers and all unfair trade competition are forbidden; and the National Lamp company, with all its subsidiaries, is ordered dissolved. The General Electric, which owns them, may go on with their business under its own name, and not otherwise. Attorney General Wickersham declares that the last named principle has been accepted voluntarily by the General Electric in the dissolving of eleven other subsidiaries in electric supplies, which had been pretending to compete with their real owner. —Brooklyn Eagle.