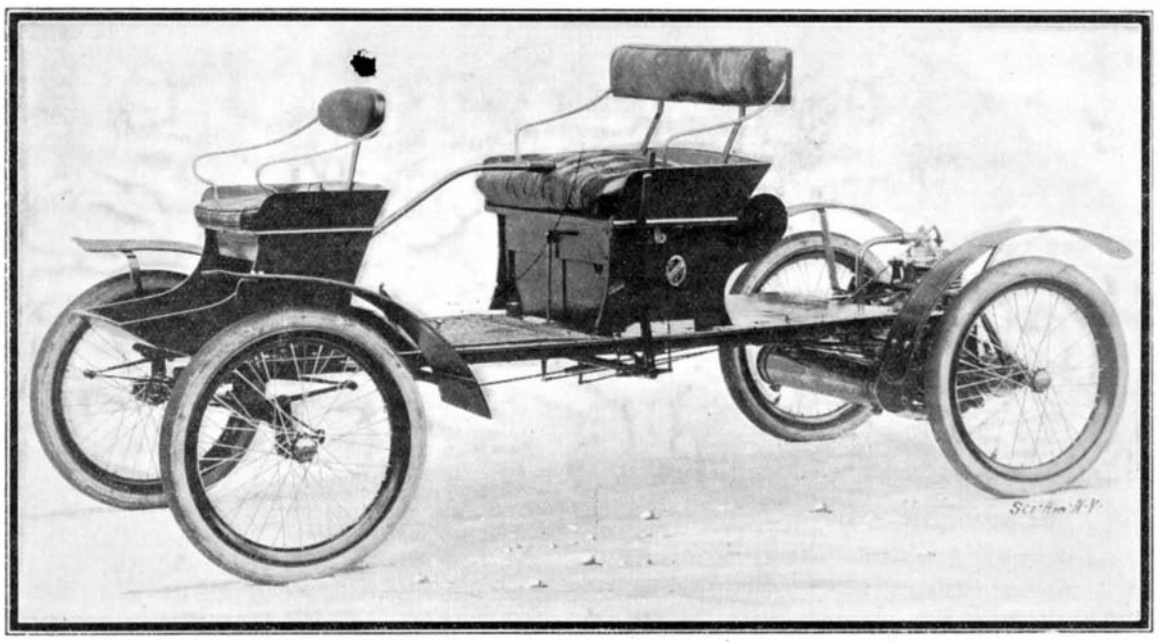
AN IMPROVED BUCKBOARD AUTOMOBILE.

The smallest, lightest, and cheapest automobile offered in the market is the Orient Buckboard, made by the Waltham Manufacturing Company, of Waltham, Mass. This is probably the simplest possible practical combination of a gasoline explosion motor and a four-wheeled road vehicle, and it has wholly superseded the motor tricycles and tandem-seated quadricycles that were so prominent during the introductory days of the automobile both in this country and in Europe. The Buckboard machine met with instantaneous success following its *début* at the Madison Square Garden automobile show a year ago, owing to its stability as compared with the bicycle and tricycle and to its closer resemblance to a "real" automobile. Moreover, in addition to being so simple that any person of ordinary intelligence and mechanical knowledge could operate it, it had a speed capacity of fully twenty miles an hour on good roads, was comfortable to ride in, and could carry two persons side by side, which overcame one of the strongest objections to the unsociable quadricycle with its tandem seats.



THE ORIENT BUCKBOARD.

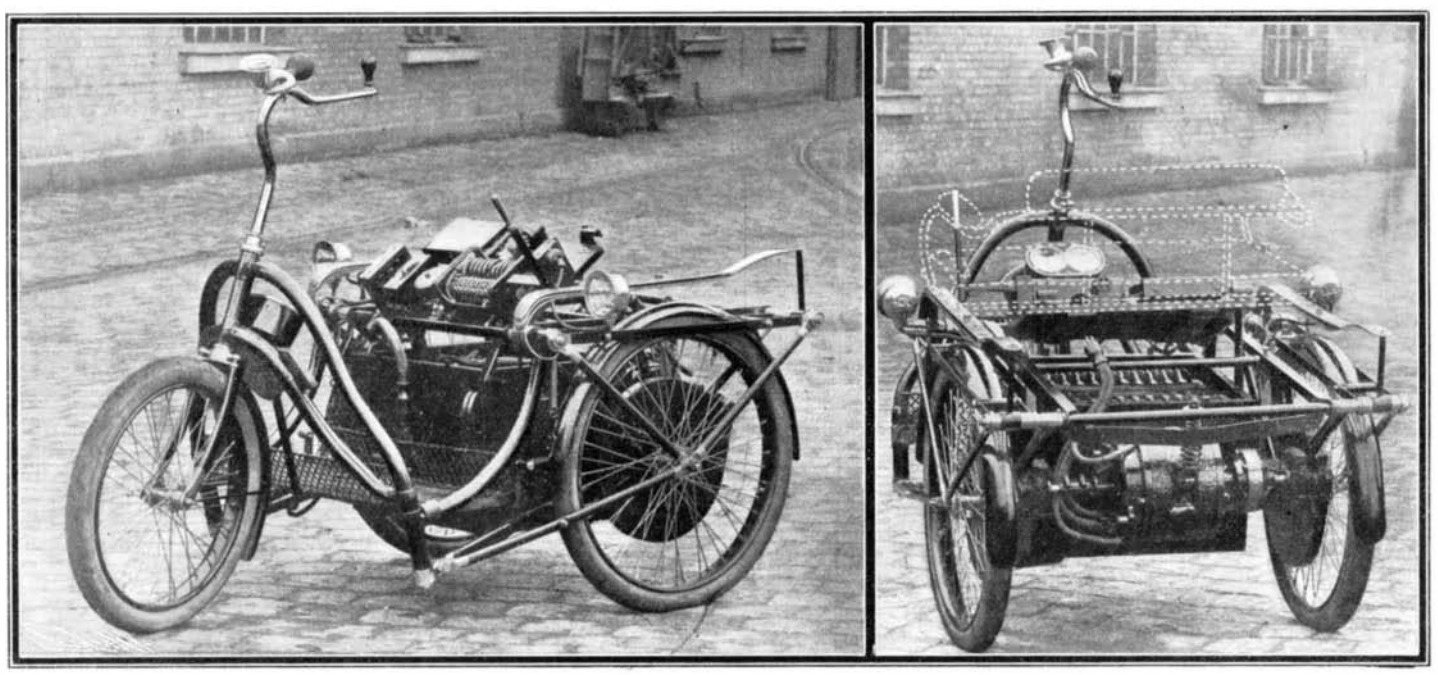
Briefly, the vehicle consists of two sets of 26-inch wire suspension wheels, the rear pair carrying at the middle of the axle a single-cylinder, air-cooled, upright gasoline motor of 4 horse power; a narrow platform, whose side members are of 1¼ by 3-inch seasoned hickory, and a cushioned buggy seat placed in the middle of this platform. The entire power and transmission mechanism is carried on the rear axle as a unit, the motor being supported in a tubular truss, the ends of which are as close as possible to the wheel bearings. The motor has flywheels inclosed in the aluminium crank-case, like a bicycle motor, and drives by a pinion a large spur gear on the differential. The gears are this year laminated with fiber to reduce the sound when running. Band brakes on the rear axle are operated by a pedal. A cylindrical gasoline tank is attached to the rear of the seat out of harm's way. The muffler is suspended below the platform just in front of the rear axle, and has been made larger this year than last to make the exhaust noiseless. Full elliptical springs have also been interposed in the new models between the rear axle and the rear end of the platform as well as under the front end of the platform, and the seat and its back have been provided with spring cushions.

Principal among the improvements for 1904, however, is the addition of a two-speed gear mechanism between the motor and the differential. This is operated by a left-hand side lever. It increases the hill-climbing ability of the machine, so that it can mount any grade met on public streets and roads, and it also enables the operator to drive slowly and carefully through streets congested with traffic and through mud and rough places. Another change is the substitution of a crank starting device for the strap and ratchet used on last year's machines. A more compact and reliable carbureter has been fitted, and mud fenders have been attached over all the wheels with bolts and nuts that are secured against working loose. Other improvements are the use of heavier hickory reaches in the platform, the raising of the platform two inches higher from the ground, and the use of a wider seat.

The Buckboard weighs about 500 pounds, is 106 inches over-all length, and 48 inches over-all width. It is finished in the natural wood. Single-tube Goodrich tires are fitted. The Waltham Company has recently brought out a carrier attachment for the buckboard to be used for delivery purposes by small merchants, such as grocers, butchers, laundrymen, druggists, dry goods, and notion stores, etc., and has also designed an extra seat for one person to be placed over the front axle as shown.

AN ELECTRIC TRICYCLE FOR POSTAL WORK.

The accompanying photographs show an electric tricycle specially constructed for the Royal Bavarian Postal Service, of Munich, by the Siemens-Schuckert Works.



THE SIEMENS-SCHUCKERT ELECTRIC AUTOMOBILE TRICYCLE.

The chassis consists of two truss frames, each of which holds a driving wheel. The hind wheels, as shown in the illustrations, are set one in each frame, and consequently there is no regular rear axle. By this arrangement, a greater space is obtained under the double seat for the storage batteries, motors, differential gear, etc.

The rear view shows very well the compact and practical arrangement of the various parts, which are so placed that there is room for a box for carrying small articles.

Both rear wheels are connected, through two strong pieces of tubing, with the double, inverted V-tubing that supports the front fork, while the cross-connection between the two side frames is made with light tubing, which conduces at the same time to simplicity of construction and ease of taking apart. The battery, the seat, and also the motor, are double spring suspended, and the differential gear renders it possible to steer the machine easily. It can be turned around in a street whose width is equal to double the length of the machine. There is both a foot and an electric brake ready at hand. The latter operates so energetically that when going at full speed and carrying two people, the machine can be brought to a full stop in from 7 to 10 feet. The machine is equipped with a motor capable of giving 1 horse power at 800 revolutions per minute. There are 24 cells of Tudor storage battery, arranged in two crates, and weighing complete 286½ pounds. They have a capacity of 18 ampere hours at a one-hour rate of discharge.

The controller has ten notches—one for the stop or off position, five forward speeds, two reverse, and two for braking. The total weight of the machine is 842 pounds, and the weight which it is capable of carrying is 352.73 pounds. Its maximum speed is 9.31 miles an hour.

THE 24 HORSEPOWER POPE-TOLEDO TOURING CAR.

The 1904 Pope-Toledo gasoline touring car differs radically from all previous models, and embodies many of the latest ideas in automobile construction.

The motor has four vertical cylinders of 4¼-inch bore and 5¼-inch stroke, and develops 24 horse power at a speed of 900 revolutions. The cylinders are cast separately without water jackets, and are merely flanged tubes, bored with great care within and machined on the outside to an even thickness. The water jackets, which are of copper, are corrugated to allow for expansion. The lower ends of the jackets are slipped into grooves turned in the cylinder flanges and "sweated" in place, after which the grooves are filled with solder. The upper ends of the copper jackets are turned in, and form gaskets between the cylinders and the cast-iron combustion chambers. This arrangement of cylinders and water jackets obviates the necessity for difficult cored work in casting the cylinders, while the fact that the cylinder walls are of even thickness assures equal expansion when they become heated. Further than this, the construction described affords ample opportunity to reduce weight to a minimum, although no strength is sacrificed.

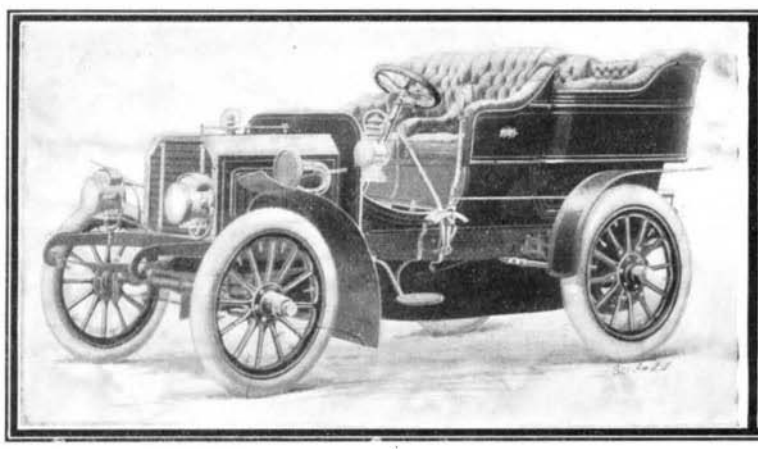
The Toledo Company still maintains its claim that automatic inlet valves are preferable to the mechanically-operated variety, and its latest motors are so fitted. The inlet valves are held in place by strut pieces, which engage the heads of suitably-placed screws, and may be removed quickly and without difficulty. The inlet valves are forged of nickel steel, and the exhaust valves are of a special nickel alloy, which is practically the pure metal. It is generally conceded that nickel is particularly suitable for exhaust valves, as it does not warp under the ordinary heat developed by the engine, while constant "pitting" is eliminated by its use.

The cam shaft runs within a chamber cast integral with the upper half of the aluminium crank case, and the cams and shaft journals are splash-lubricated. The two-to-one gears are unusually large. The circulating pump, which is of the gear type, is mounted on the exhaust-valve side of the motor at the extreme front end of the crank case, and is driven from the large cam-shaft gear. The pump-driving gear carries a boss on which the fan pulley is mounted, the fan being belt-driven. The engine bearings are of bronze. They are cast in halves, accurately surfaced on a milling machine, soldered together and machined up as a single casting, and then separated, the bearing surfaces being scraped by hand to remove all tool marks and assure a perfect fit.

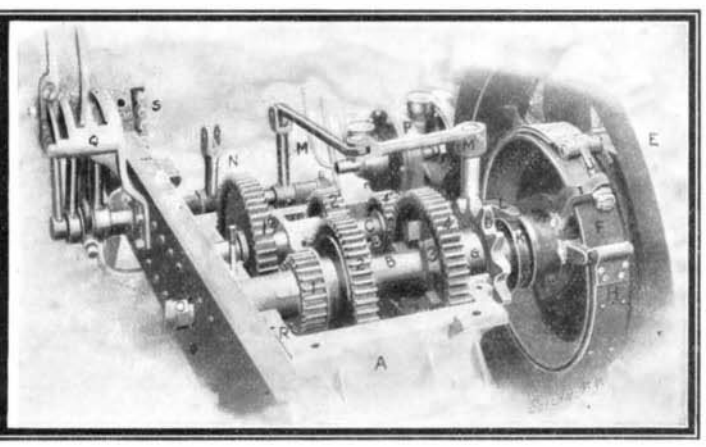
An efficient circulating system makes the use of a large supply of cooling water unnecessary, only 3½ gallons approximately being required. The construction of the radiator is such that the water is obliged to circulate back and forth from the top to the bottom in a very thin film; thus every drop is subject to the cooling influence, whether the system is filled or not, a feature not common to all types of radiators. The water is forced from the bottom of the radiator

to the lower ends of the cylinder jackets, passing around the cylinders and back to the radiator, which it enters at the top. No separate water tank is carried. A small overflow tube conveys excess water to the ground when filling the circulating system. Compression relief cocks, which are tapped into the cylinders, are connected by a linked rod which extends through the radiator and terminates in a small brass knob, a single movement of which relieves the compression in the four cylinders.

The 1904 Toledo transmission is clearly shown in the accompanying line engraving. It is designed for three forward speeds and a reverse, and the drive is direct on the high gear, the secondary shaft and gears being idle, a result not always attained in "direct drive" transmission mechanisms.



THE STEARNS 24 HORSEPOWER TOURING CAR.



TRANSMISSION OF STEARNS CAR.

Referring to the drawing, the mechanical details and method of operation may be easily understood. Shaft *A* is driven by the motor, and communicates the power to the sliding gear sleeve, *U*, through the medium of the two bevel gears, *C*. Sleeve *U* carries sliding gears, *D* and *D'*, and the male portion, *O*, of a miter gear clutch. These parts are free to move endwise, but are prevented from turning independently of the sleeve by long feathers set in opposite sides of the sleeve. The sleeve, *U*, is free to turn on the transverse transmission shaft, *B*. Directly below this shaft is a countershaft, which carries gears *F*, *F'*, and *P*. The operation of this mechanism is as follows:

It will be noted that driving gear, *E*, is not fixed to the differential case, but may be held in driving relation thereto by the spring, *Q*, which normally presses the spur driving gear, *E*, against hub, *H*, and causes miter teeth on the right-hand face of its hub to mesh with similar teeth on *H*, which is integral with the differential gear case and has miter teeth on its other side also. When teeth on *E* mesh with those on *H*, *E* is locked to the differential case. This relation exists only when the car is being driven on the slow or intermediate speed or the reverse. It will be seen that when driving on the slow speed, sliding gear, *D*, meshes with gear, *F*, on the countershaft, and power is transmitted through the shaft and pinion, *P*, which is in mesh with gear, *E*. The ratio of this gear system is 8 to 1. On the intermediate speed, sliding gear, *D'*, meshes with pinion, *F'*, on the countershaft, and the power is conveyed to the driving shaft through pinion, *P*, and gear, *E*, as before. The ratio of this combination is 5 to 1. In reversing, sliding gear, *D*, is meshed with pinion, *G*, and power is transmitted through the reverse shaft and pinion, *G'*, and gear, *F*.

The most interesting feature of the new Toledo transmission is the method of driving on the high speed, at which time the only gears in mesh between the motor and the driving wheels are the bevel gears, *C*. This is accomplished by sliding the gear set, *DD'*, to the left until its miter teeth, *O*, are in mesh with those on hub, *H*. This movement also pushes gear, *E*, to the left sufficiently to disengage miter gears on its hub from those on *H*, thus releasing the countershaft and establishing a positive connection between sleeve, *U*, and the differential. On returning to the lower speeds, spring, *Q*, again establishes a positive driving relation between gears *E* and hub *H*.

Further reference to the drawing of the transmission will show that ball bearings are used extensively, the bearings being unusually long, while every opportunity for close adjustment is afforded by the construction.

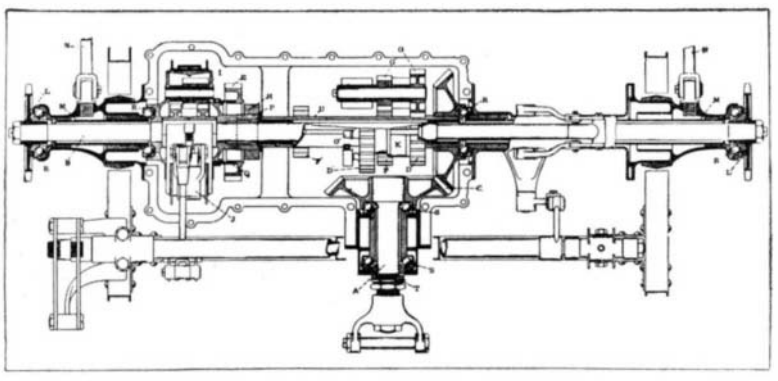


DIAGRAM OF TRANSMISSION OF THE POPE-TOLEDO CAR.

An internal cone clutch with multiple springs takes the place of the ordinary push clutch found in previously designed Toledo cars. The mechanism is entirely inclosed, while at the same time the interior is readily accessible by removing the friction ring, which is bolted to the rim of the flywheel. The end thrust of the clutch spring is relieved from the motor shaft by means of a large ball bearing thrust collar, and the springs are easily adjustable from outside the clutch by means of screw plugs with lock nuts. When the clutch is engaged there is virtually no end thrust.

The three forward speeds and the reverse are controlled by a single lever. The brake lever applies two hub brakes and releases the clutch. The hub brakes are of the expanding-ring type, while a pedal-actuated band brake operates on a drum carried by the differential.

The wheel base of the car is 93 inches, and the tread is standard. The front wheels are 32 inches in diameter, and the rear wheels are 34 inches. The tires are 4 inches in diameter.

The frame of the car is of pressed steel, and the side bars are extended to form "pump-handle" spring hangers. Sheet steel is used extensively in the construction of the car, notably in the curved seat panels and the hollow dash. These parts are pressed into shape in special dies and, being perfectly smooth, present a suitable surface for the finishing enamel, which is baked on, and is a durable and attractive substitute for paint.

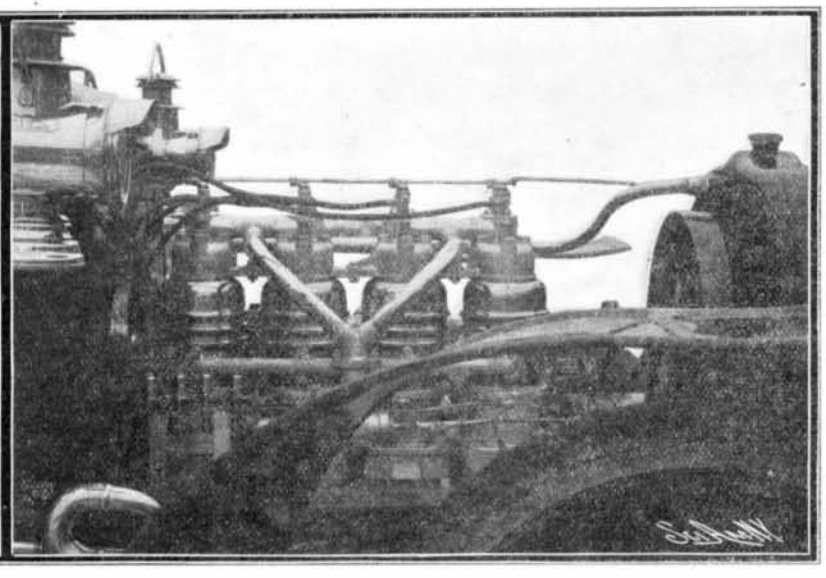
The Pope-Toledo car is built by the Pope Motor Car Company, of Toledo, Ohio.

THE STEARNS GASOLINE TOURING CAR.

The Stearns car and its transmission are shown in the accompanying cuts. This machine is a powerful touring car with a motor of the double, opposed-cylinder type, running at a normal speed of 900 revolutions per minute, and capable of driving the car as fast as 50 miles an hour. The motor is fitted with a brass water jacket square in cross-section. It is fed with gas from two float-feed, atomizing carbureters in which the suction is against the spraying nozzle instead of in the direction in which it points. This novel construction is said to offer advantages in the way of supplying a good mixture at widely varying speeds. The cooling water is circulated by a centrifugal pump, *P*, friction-driven from the flywheel, through a flanged radiator consisting of about a dozen small copper pipes laid side by side horizontally in front of the bonnet and coiled back and forth in an S-shaped formation. The warm water of the cooling system enters the bottom of the oil tank and heats the oil, at the same time putting a pressure on it and causing it to flow to the six sight feeds that supply oil to the motor through small copper pipes. The pipes that oil the cranks are curved so that the drops of oil forming in the ends of them are caught in small cups on the crank-pin boxes, as the cranks pass under the oil-pipe ends.

The transmission gears run in an oil-tight case, *A*. The flywheel is shown at *E*, and the band brake clutch, *J H*, by clamping the drum, *F*, of the flywheel when the shipper, *K*, spreads levers, *I I*, drives the shaft, *B*, through levers, *I I*, which are mounted on studs on a flange at end of *B*. The gears are slid in mesh by a lever working in the H-shaped slot, *Q*. They are of the usual pattern, giving a direct drive on the high speed by the meshing of miter gears, 3, 3. The first and second speeds are obtained through 1, 1', 4', 4, and 2, 2', 4' 4 respectively, gear 4, sleeve *G*, and sprocket *D* being one solid piece of steel. In the position shown, the reverse is accomplished by raising a wide intermediate pinion beneath 1 and 1' so that it meshes with each gear. The motor is started by a crank applied at *O*. The frame of the Stearns machine is of armored wood. The car has a long wheel base and large 34 and 36-inch artillery wheels shod with 4 and 4½-inch tires. The throttle control of the motor is very flexible, thus making it possible to obtain speeds of from 5 to 50 miles an hour on the high gear. The throttles on both carbureters are operated by a pedal, or they can be set by a handle on the steering wheel. One of these machines made an extremely good showing in the New York-Pittsburg run last October, and, despite some mishaps due to hard driving, reached Pittsburg among the first at the end of the contest.

THE POPE-TOLEDO 24-HORSEPOWER TOURING CAR.



SEPARATE CYLINDERS OF MOTOR, SHOWING CORRUGATED COPPER JACKETS.