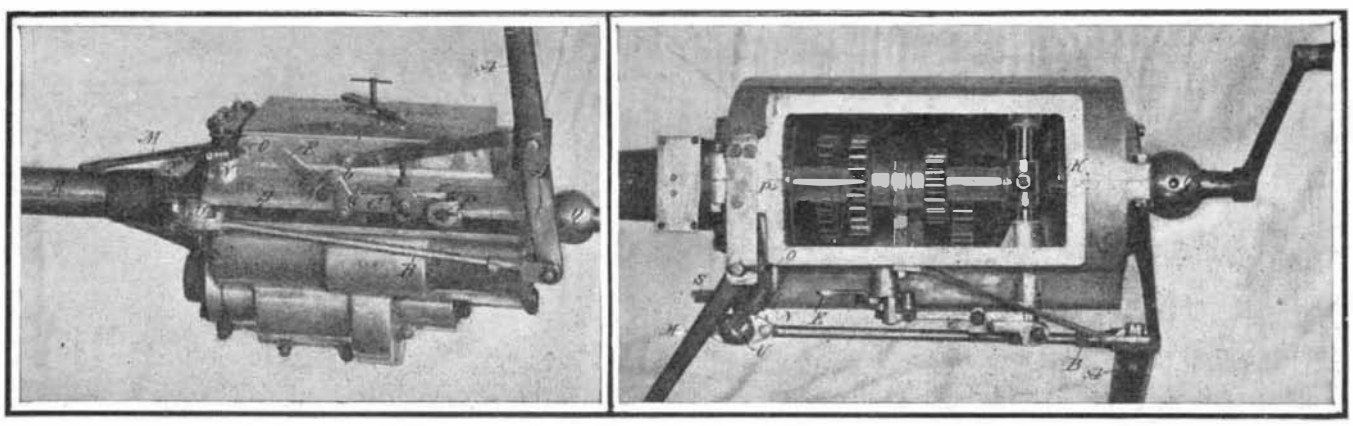
upon which the Packard and Northern cars have won success during the last two years. In our 1905 Automobile Number we showed the first application of the transmission to the rear axle as displayed on a Packard chassis. Last year the Northern company brought out a 4-cylinder car having this feature, and this year the Wayne and some others are exponents of it. The arrangement is a neat one, and gives, as a rule, little or no trouble.

The two photographs which we reproduce show the arrangement of the gear box on the rear axle and the method of operating the gears. The transmission is of the 3-speed-and-reverse selective type, in which there are two sliding sets of gears, either one of which is picked up when the lever, *G*, is slipped through the "gate," or transverse slot of the H-shaped quadrant, *Q*. When this is done, pin, *P*, on a short lever arm forming part of sleeve, *S* (which *G* turns), slips into one of the two forks, *V V'*, and, when *G* is moved forward or backward in one of the longitudinal slots of *Q*, causes this forked lever arm and its vertical part, *V* (both of which are in one piece forming a bell crank) to move forward or backward one of the sliding-gear members by means of the connecting rods, *R R'*. The other rods, *B* and *E*, apply the contracting running brakes and the expanding emergency brakes to the brake drums on the rear wheels. The brake bands are lined with camel's hair felt, and are operated by pedal, *A*, and lever, *D*, respectively. Pedal *C* throws out the clutch, *E*, when pushed forward, moving backward the lower ends of the levers, *I I*, which are attached to the ring, *J*, of the shifting collar, *K*. The clutch is of the expanding ring type, leather lined. It is placed within a drum in the flywheel, and is so powerful that only a 10-pound spring is required to operate it. Application of the emergency brake throws out the clutch by means of the lever, *M*, traveling along under the curved lever, *N*, and moving it. The propeller shaft is shown at *X*, and its two universal joints at *W* and *Z*. The torsion rod for taking the twisting strains of starting from the springs, is shown at *F*. The springs are placed outside of the frame, which gives them greater play. The rear axle is fitted with Hyatt roller bearings, and the front wheels have adjustable ball bearings. The motor used is a 30-35 horse-power, 4-cylinder, water-cooled engine of 4⅝-inch bore by 5¼-inch stroke. The valves and piping are all on one side, which gives the other side of the motor an especially neat clean-cut appearance. The cylinders are cast integral in pairs. A gear-driven water pump and belt-driven fan and lubricator are fitted. The timer is seen in the dash at *T*.



NOVEL INTERCONNECTED COMBINED CLUTCH AND TRANSMISSION USED ON THE SMITH CAR.

A. Clutch and gear-shift lever. *B*. Connection to slide, *S*. *C*. Clutch-operating lever. *E*. Lever for connecting *C* with brake. *K*. Multiple-disk clutch. *M*, *N*, *O*. Brake lever and plunger. *P*. Band brake. *Q*. Universal joint. *U*. Ball and socket joint. *R*. Propeller shaft.

A NOVEL COMBINED SLIDING-GEAR TRANSMISSION AND MULTIPLE-DISK CLUTCH.

One of the greatest improvements noted on any of the 1907 cars is that seen on the Smith machine, in which the usual three-speed sliding-gear transmission, arranged with a multiple-disk clutch in its forward end, is operated by a single lever, which not only slides the gears, but also throws out the clutch and lets it in again at the proper moment. A general idea of this improvement may be had from the side and plan view photographs which we reproduce. The gear-shift lever, *A*, which is suitably located beside the gear box, is connected through rod, *B*, and universal joint, *U*, with the sliding rod, *S*, which is connected to the shifting fork, *S'* (top view) inside of the gear box. The rod, *S*, has notches on its upper face. The lever, *C*, which rocks the shaft, *B*, and throws out the clutch, has a downward projection on which is mounted a small roller, *a*. When this roller is in one of the notches, as shown in the photograph, the clutch is engaged, but as soon as it is raised and slides along on top of the rod, *S*, the clutch is thrown and held out. When the lever, *A*, is moved so as to slide the rod, *S*, in one direction or the other, projection, *a*, rises and slips along over the top of rod, *S*, thus holding out the clutch until the next set of gears are in mesh. As these gears come into mesh the roller, *a*, falls into the succeeding notch, and the clutch is engaged again. With this arrangement the merest tyro can operate the gear-change mechanism without any danger of stripping or damaging the gears; in fact, the control of this car is as simple as that of an electric car, for all the operator has to do is to push the lever, *A*, forward or backward to pass through the various sets of gears. This transmission is a decided improvement over the usual form, in which the gear box is separate from the clutch and from the engine. It marks a distinct advance in automobile construction, and is a device which will doubtless be imitated by other automobile manufacturers.

THE STODDARD-DAYTON CHASSIS.

The Stoddard-Dayton is one of the best built and most improved types of four-cylinder machines at present on the market. The photograph of the chassis, which we reproduce, shows very well the compact and neat appearance of the mechanism, as well as several of the special features, such as the aluminium protecting casing beneath the machinery. The engine is of the twin-cylinder type, the cylinders being cast in pairs, with the exhaust valves, *E*, on one side and the inlet valves, *I*, on the other side. The cylinders of the touring car engine have a 4⅝-inch bore by a 5-inch stroke. The commutator, *C*, is placed on a vertical post between the two pairs of cylinders, which makes it readily accessible. All the wires, both primary and secondary, are carried through insulating piping to the spark coil on the dashboard. This is of the individual type, there being four separate coils with vibrators. A mechanical force-feed oiler, worked by an eccentric, forces oil at 90 pounds pressure to the three crankshaft bearings and the commutator. Eccentric oil rings beside the bearings catch the oil as it oozes out therefrom and spray it up into the cylinders. Thus it is unnecessary for the cranks to dip in the oil that is kept in the bottom of the crankcase at a certain level by an overflow. The commutator has a special ring for the return or ground wire, an arrangement that makes sure the completion of the primary circuit and does away with an obscure cause of misfiring.

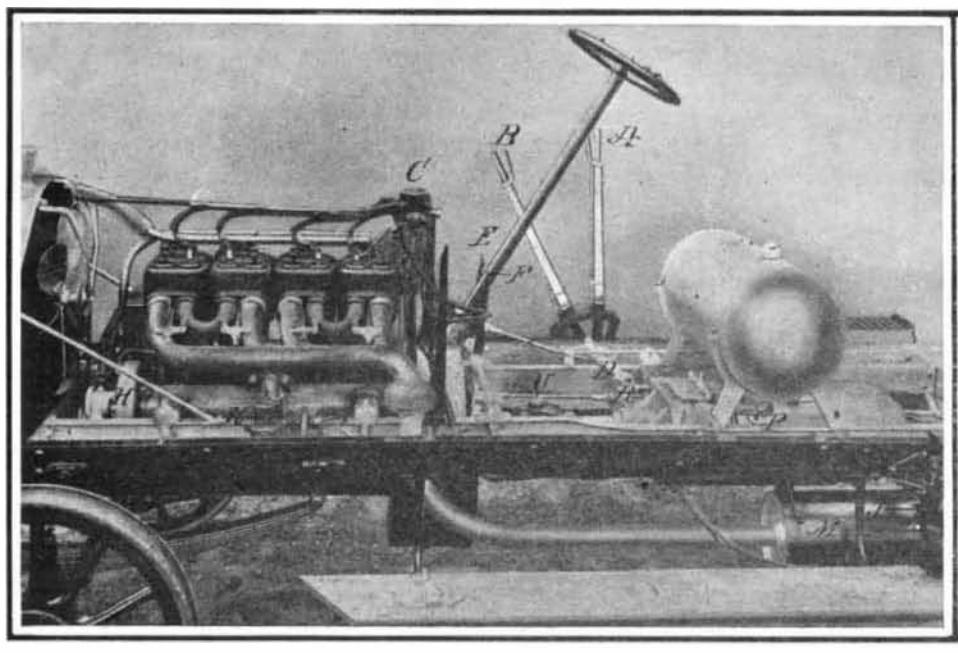
The transmission, as can be readily seen, is very compact. The lay shaft is placed at the bottom, and the ends of the bearings of this shaft are protected by oil-tight caps, so that there is no leakage of oil from the transmission. Although the gear box is quite small, the gears are exceptionally large, being 6-pitch and 1⅛-inch face. Timkin roller bearings are used in the transmission, wheels, and rear axle. The long levers which carry the clutch and brake pedals give so much leverage that a 400-pound compression spring can be used on the cone clutch, and yet the latter can be operated so gently that it is possible to start the car upon the high gear. Both the foot and hand brakes are interconnected with the clutch so that the latter is thrown out when the brakes are applied. Throwing out the clutch also throttles the motor, as the throttle of the automatic, water-jacketed carbureter is connected with the clutch pedal.

The torsion tube hanger, *H*, seen in the photograph, slides in a bronze ring which is attached to a bracket on a cross member of the frame, while the radius rods, *R*, are provided at their forward ends with a ball and socket. The foot brake is of the expanding type, working in a drum at the rear of the transmission. The levers, *A* and *B*, are for shifting the gears and for applying the emergency brakes on the rear wheels. These brakes are also of the expanding type. The transmission is of the three-speed selective type, and any gear can be picked up without going through the other gears, as is necessary with the progressive type of transmission.

THE GROUT 35-HORSE-POWER CHASSIS.

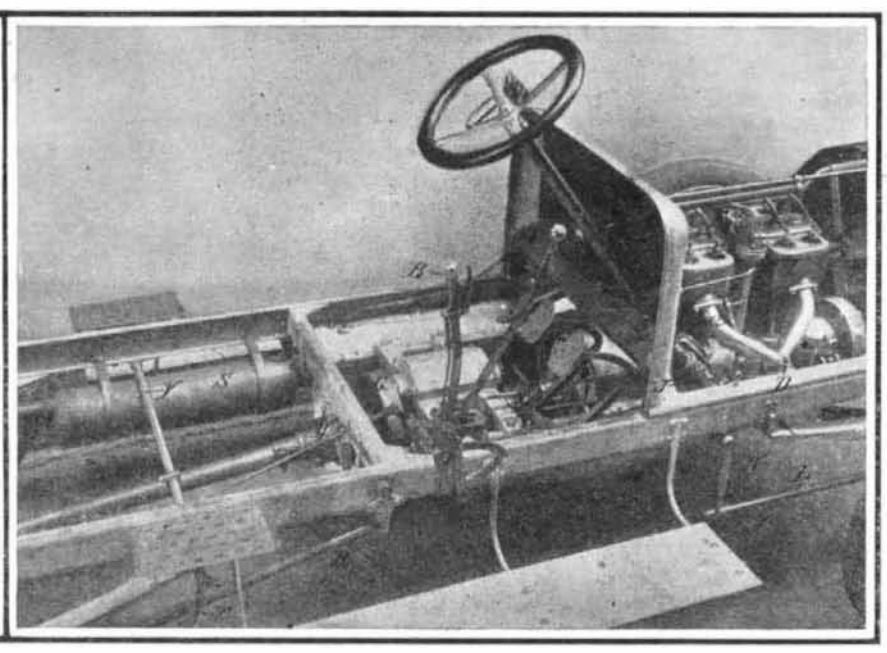
One of the most finished chassis exhibited at the show was that of the Grout car. Grout Brothers still retain the armored wood frame on account of its elasticity. The motor is a 4-cylinder Rutenber of 4½-inch bore by 5-inch stroke, rated at from 30 to 35 horse-power. As can be seen from the photo of the chassis, the valves of the engine are in chambers on one side, and the exhaust and inlet pipes are clamped in place by four brackets secured by four nuts. A Holley float-feed automatic carbureter is located at *K*, and the centrifugal water pump is shown at *H*. Igni-

(*Continued on page 53.*)



CHASSIS OF THE 35-HORSE-POWER GROUT TOURING CAR.

A. Gear-shift lever. *B*. Brake lever. *C*. Combined timer and distributer. *D*. Lever connecting *A* with *R*. *E*. Brake pedal. *F*. Clutch pedal. *H*. Pump. *J*. Sprocket. *K*. Carbureter. *M*. Muffler. *P*. Gasoline pipe. *V*. Universal joint.



THE 35-HORSE-POWER STODDARD-DAYTON CHASSIS.

A. Gear-shift lever. *B*. Brake lever. *C*. Commutator. *D*. Carbureter. *E*. Exhaust valve chambers. *I*. Inlet valve chambers. *F*. Clutch. *G*. Expanding brake drum. *H*. Universal torsion tube joint. *J*. Worm steering gear. *K*, *L*. Steering gear lever and connection. *R*. Radius rod. *S*. Muffler. *V*. *T*. Transverse brake rod and lever arm.

charge. A slight comparison of the duties of this valve with the crankshaft of the same engine is interesting. The area of the 5-inch piston is approximately 20 square inches, while the area of the exposed surface of the valve is but a little over one-tenth this amount, being less than 2¼ inches. The bearing surface of the valve shaft extends the full width of the cylinder, whereas the bearing surface of the crankshaft does not total one-half of this amount, because of the crank-sides and crankpins which must be provided for. From this it will be seen that the work done by the valve is but 1/20 the work done by the crankshaft, and yet to provide ample packing surface, the valve diameter and consequent surface is 30 per cent greater than the crankshaft diameter. From this comparison, as well as from the results given in practice, it is readily seen that the life of the valve should be very long under normal usage.

Experiments have been made with tapered valves fitting their bushings as does an ordinary stopcock, but trial of both kinds has convinced Mr. Duryea that even the slight added cost and complexity of the tapered form is not necessary to secure the desired results.

In service, the rotary valve engine runs almost like a steam engine. The mechanical operation of the inlet permits perfect admission of the attenuated charge admitted at low throttle, and secures a wide range of speed because of this smooth running at low speeds, as well as because of the lack of reciprocating parts, which clatter and pound badly at high speeds. The crankshaft bearings are made quite large, and the connecting rods are forged and of so strong a design that high speeds cannot damage them.

The prediction is freely made that this invention is one of the most marked improvements in the four-cycle gasoline automobile motor that have been made in recent years. Mr. Duryea has several patents pending upon this device.

THE 50-HORSE-POWER NORTHERN ENGINE.

(*Continued from page 25.*)

arate steel pan. Nipples screwed into the cylinders just above the highest point of piston travel carry horizontal pipes with three vertical outlets, the center one of which carries a spark plug, the right-hand one a priming cock, and the other a patent relief valve for each cylinder. The relief valves are all connected together so that the chauffeur can, by pulling a handle, put them all in operation when turning over the engine. These valves only open when the compression occurs, and as soon as an explosion takes place, they instantly close.

The motor is started by a long lever having a pawl that engages the teeth of a ratchet wheel on the crankshaft. The movement of the lever in starting the engine automatically retards the spark. The two-to-one gears are shown incased at *T*, and are used as a water pump to force the cooled water received from the bottom of the radiator through the large pipe, *W*, leading to the bottom of the water jackets. The bracket for the fan belt pulley, seen at the front end of the engine, is mounted on a vertical spindle that can be raised or lowered by turning the star wheel on top. Thus the fan belt can be easily and quickly tightened. The cylinders of the Northern engine are slightly offset, which gives a more direct thrust on the working stroke.

A SUCCESSFUL FRICTION-DRIVE AUTOMOBILE.

(*Continued from page 26.*)

tenber engine rated at 40 H. P. at 1,000 R. P. M. The timer is shown at *T*. *P* is one of the connections between the timer and the base of the steering column, *V*, for advancing the spark by means of one of the levers that travel over the stationary segment in the steering wheel. The motor is provided with an 8-feed mechanical oiler, which efficiently lubricates it.

A NOVEL INDIVIDUAL CLUTCH TRANSMISSION.

(*Continued from page 29.*)

the end of the sliding shaft, *C*, the ends of which press the internal expanding wedge, *M*, forward, thus causing the four wedge pins, *K*, to protrude beyond the periphery of the shaft, *C*, opening the frictions, *AA*, against the internal wall of the bronze ring gear, *B*. This action makes the whole mechanism integral. To change the speed the sliding shaft is simply located under any gear desired and the operation repeated. *D* is the differential from which the jack shaft, *J*, protrudes from either side, to the sprockets. The reverse is accomplished by an intermediate gear which is located in a pocket at the bottom of the case under another gear (which is shown as not in mesh and on the shaft, *E*.)

THE GROUT 35-HORSE-POWER CHASSIS.

(*Continued from page 31.*)

tion is by accumulators and a single spark coil. The high-tension distributor is combined with the commutator, *C*, which is operated by a lever in the steering wheel. The muffler appears at *M*. The engine and transmission are mounted on an angle steel sub-frame, as shown.

Levers *A* and *B* operate the three-speed progressive sliding-gear transmission and the expanding emergency brakes on the rear wheels. The former lever is connected through the horizontal lever, *D*, with the sliding rod, *R*, that extends into the gear case, and shifts the gears, while the latter lever, *B*, when drawn toward the driver, applies expanding brakes in the rear wheels. The pedal, *E*, operates the contracting brakes on the rear wheel hubs, while the pedal, *F*, controls the clutch, which is of the ordinary leather-faced cone type. There is a large universal joint, *U*, between the clutch and the gear box, and the countershaft is provided with Oldham universal couplings between the gear box and the frame. One of the driving sprockets on the countershaft is seen at *J*. A cylindrical gasoline tank of 15 gallons capacity is placed under the front seat, and the pipe, *P*, extending from its lowest point to the carbureter, feeds the latter by gravity.

THE NORTHERN FOUR-CYLINDER 50-HORSE-POWER CAR.

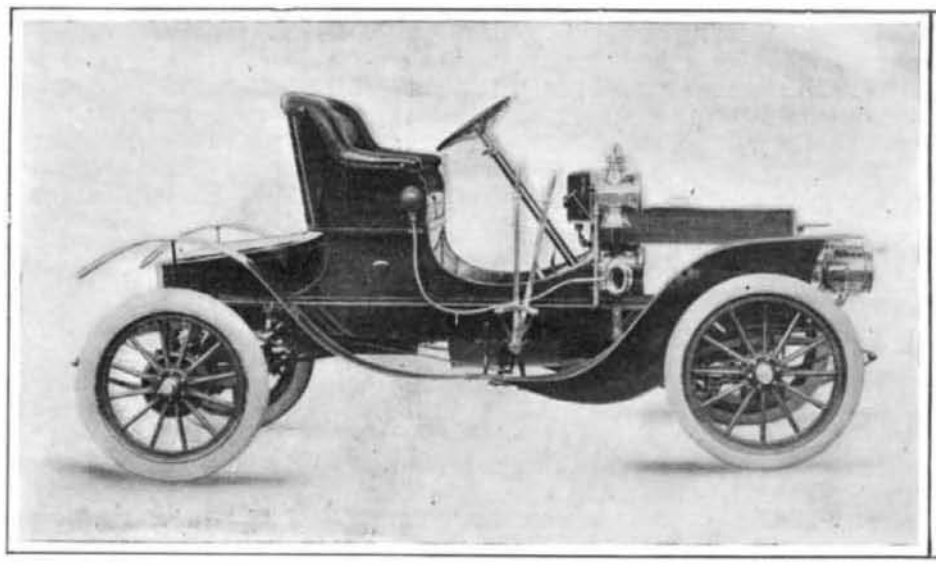
(*Continued from page 34.*)

son, the Northern Motor Car Company has placed on the market a 50-horse-power car embodying all the essential features of the air control. Clutch and air control features remain practically the same as last year, with the exception that the parts are increased in proportion to the larger car, which is rated at 50 horse-power.

It will be noticed that the entire control is placed on the steering column, and that all side levers are omitted. The gear-shift lever is placed horizontally just below the steering wheel, and the small lever which operates the shift gears controls the clutch. A slight turning motion of the hand grip on this lever throws in or releases the clutch. It will be seen that practically the same motion that shifts the gears operates the clutch at the same time. The reverse operation is taken care of with the right foot by pressing on a pedal projecting from the steering column. This reverse position is interlocked in such a way that the reverse can only be operated in a certain position of the gears. The transmission is placed on the rear axle. It is very compact, and runs on roller bearings of the Timken type. Easy adjustment and accessibility are marked features of this arrangement. Ball bearings are provided for the steering spindles as well as the worm and segment mechanism, which renders steering very easy.

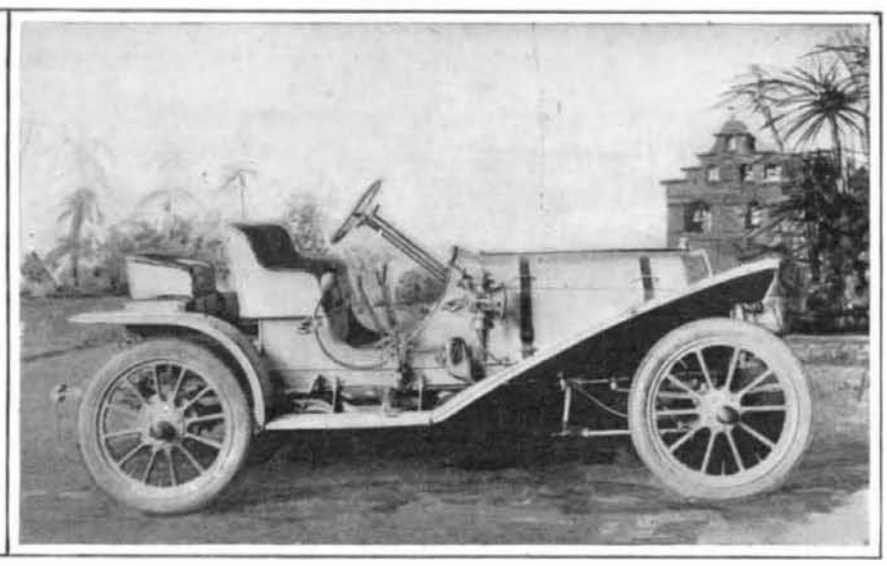
Special attention is directed to the pivotal rear platform spring, which permits of either of the rear wheels passing over an obstruction without imparting any shock to the car frame. It will be

(*Continued on page 56.*)



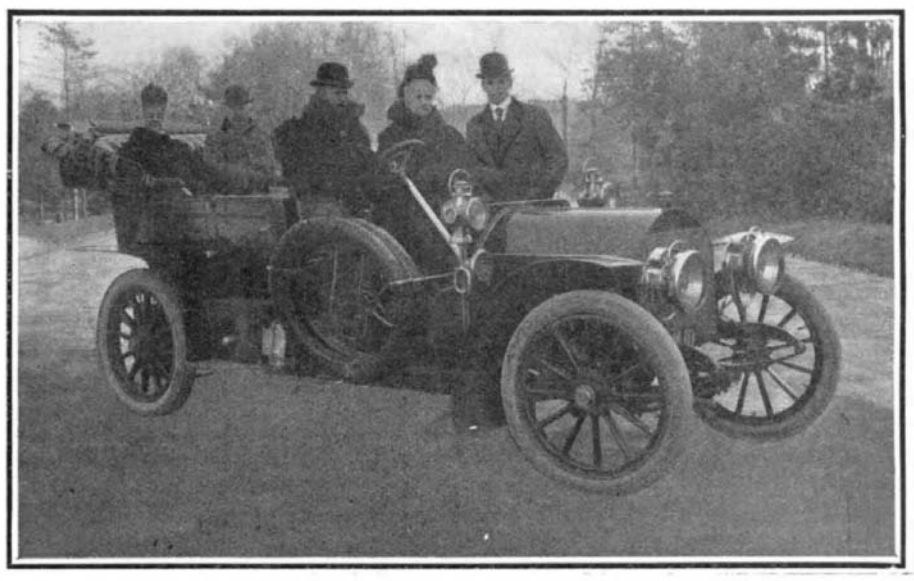
The New 12-Horse-Power Franklin Light Runabout.

Engine: 3¼ x 3¼, 4-cylinder, air-cooled. Transmission: 3-speed progressive type. Clutch: Multiple disk in flywheel. Drive: Shaft. Weight: 1,250 pounds. Wheel base: 90 inches. Tires: Front, 30 x 3; rear, 30 x 3½.



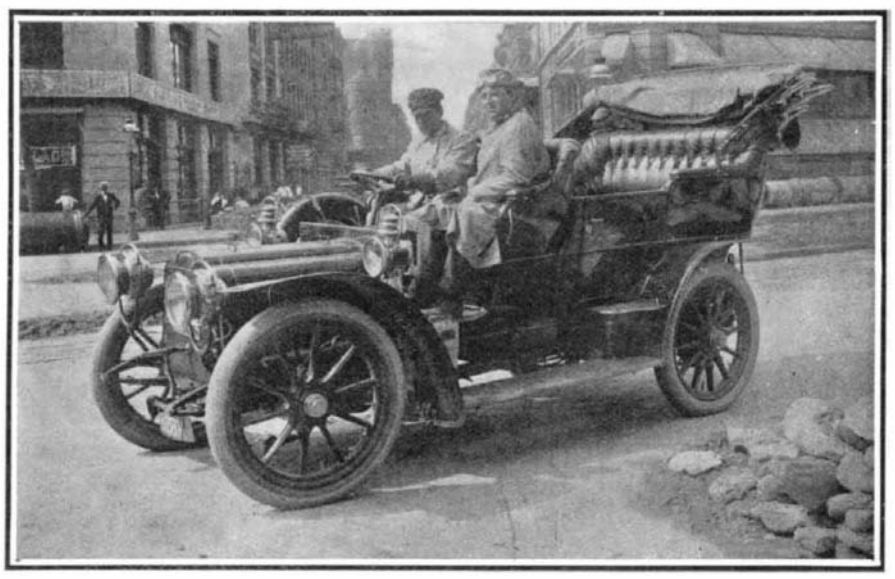
The Oldsmobile 35-Horse-Power Runabout With Rumble Seat.

Engine: 4⅛ x 4¼, 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Reverse cone. Drive: Shaft. Weight: 2,600 pounds. Wheel base: 106 inches. Tires: Front, 34 x 3½; rear, 34 x 4.



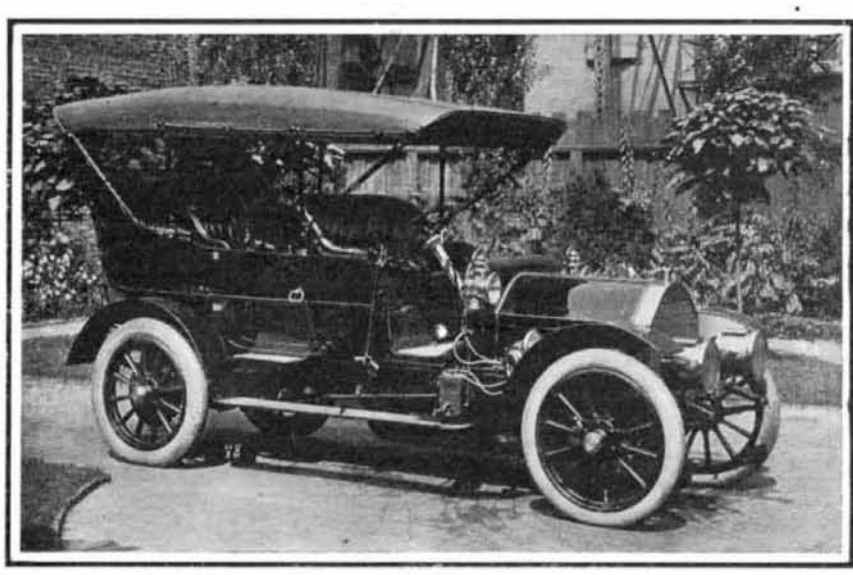
Mrs. F. D. Cottle—98 Years of Age—in a 40-Horse-Power American Mercedes.

Mrs. Cottle made trip from New York to Boston pleasantly and without fatigue in two days. Engine: 120 x 150 mm. (4.724 x 5.905 in.), 4-cylinder, water-cooled. Transmission: 4-speed selective type. Clutch: Metallic expanding ring. Drive: Double side chain. Weight: 3,440 pounds. Wheel base: 127 inches. Tires: 36 x 4.



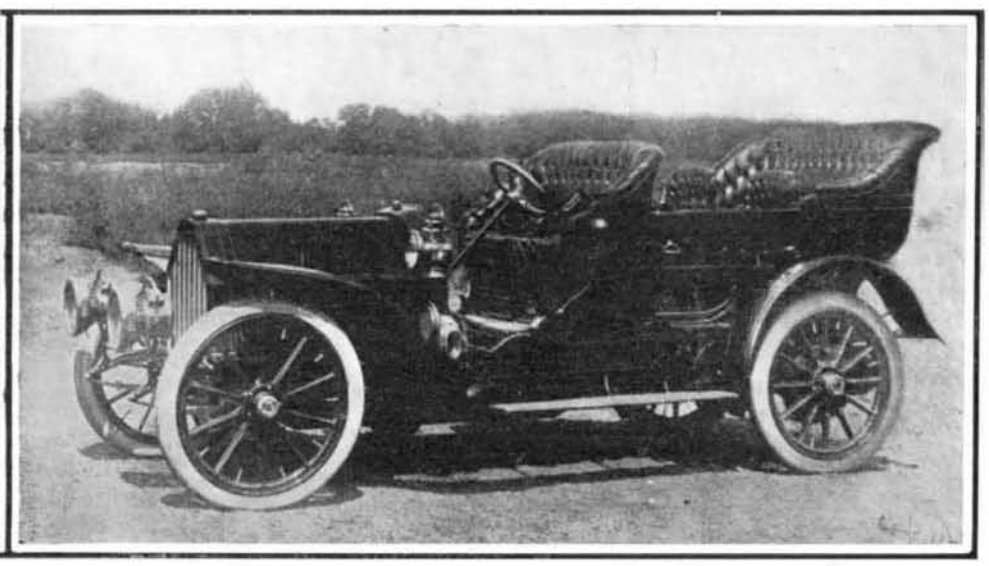
The New 24-32-Horse-Power Model of the American Mors Touring Car.

Engine: 4.9 x 5.9, 4-cylinder, water-cooled. Transmission: 4-speed progressive type. Clutch: Cone. Drive: Double side chain. Weight: 2,500 pounds. Wheel base: 106 inches. Tires: 36 x 4½.



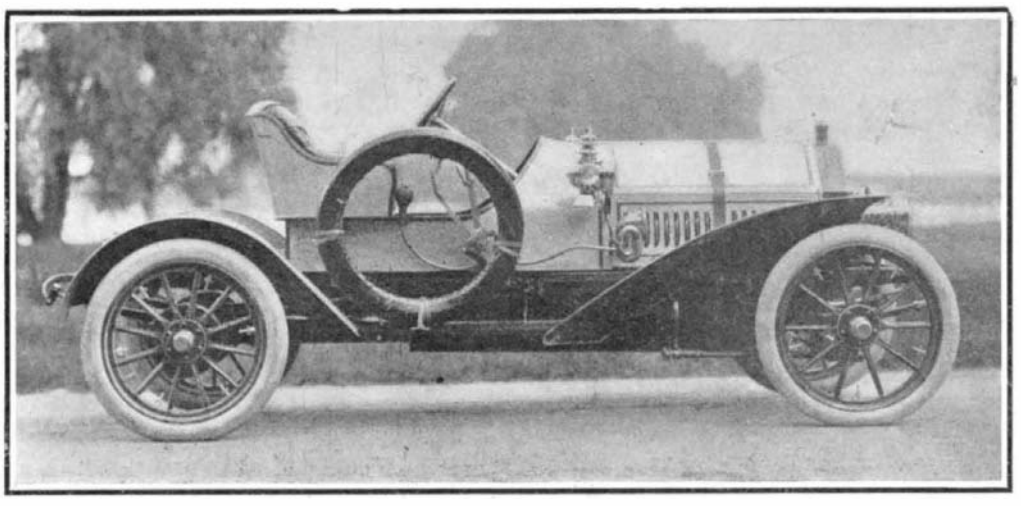
The 45-Horse-Power, 7-Passenger Pierce Touring Car.

Engine: 5 x 5½, 4-cylinder, water-cooled, with two separate high-tension ignition systems by batteries and high-tension magneto. Transmission: 3-speed progressive type operated by lever on steering column. Clutch: Cone. Drive: Shaft. Weight: 3,700 pounds. Wheel base: 124 inches. Tires: Front, 34 x 4; rear, 34 x 5.



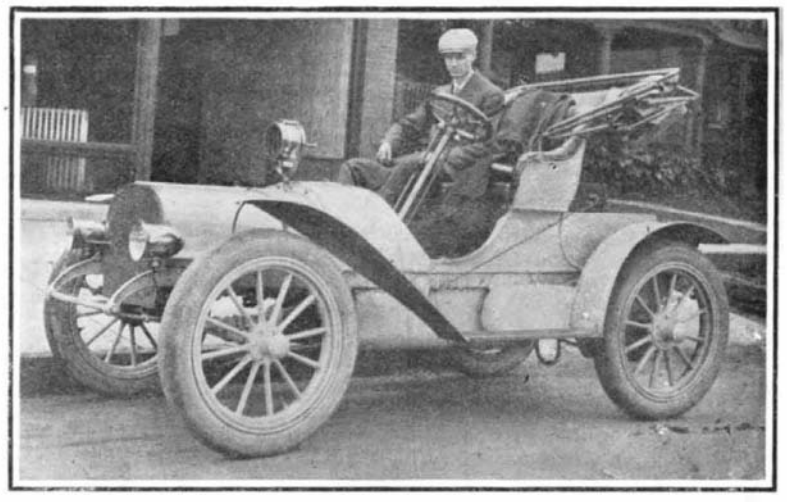
The Pope-Toledo 40-Horse-Power, 7-Passenger Pullman Touring Car.

Engine: 4⅞ x 5¼, 4-cylinder, water-cooled, with valves in heads. Transmission: 4-speed selective type, direct drive on third speed. Clutch: Multiple-disk in gear box. Drive: Double side chain from separate countershaft. Weight: 3,200 pounds. Wheel base: 115 inches. Tires: Front, 36 x 3½; rear, 36 x 4½.



The Thomas 40-Horse-Power Two- or Three-Passenger Runabout.

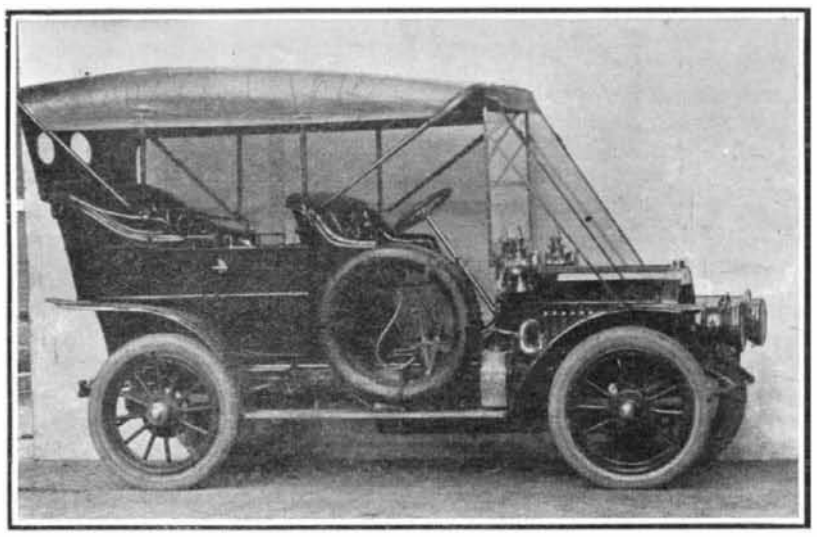
Engine: 4¾ x 5, 4-cylinder, water-cooled. Transmission: 3-speed selective type fitted with roller bearings. Clutch: Cone; interlocked with brake. Drive: Shaft. Weight: 2,500 pounds. Wheel base: 112 inches. Tires: Front, 34 x 3½; rear, 34 x 4.



Electric Touring Runabout Capable of Making 75 Miles on a Charge.

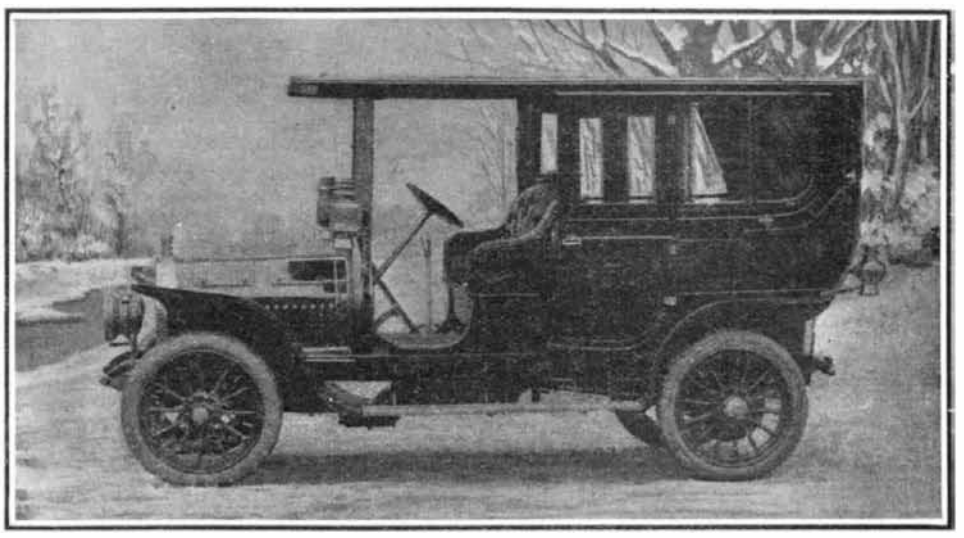
Battery: 24 150 A. H. cells weighing 975 pounds. Motor: 2 H. P. Drive: Double chain. Speeds 10, 12, 14, 24, and 30. Weight: 2,450 lb. Tires: 34 x 4½. For further particulars see current SUPPLEMENT.

SOME LEADING TYPES OF 1907 AUTOMOBILES.



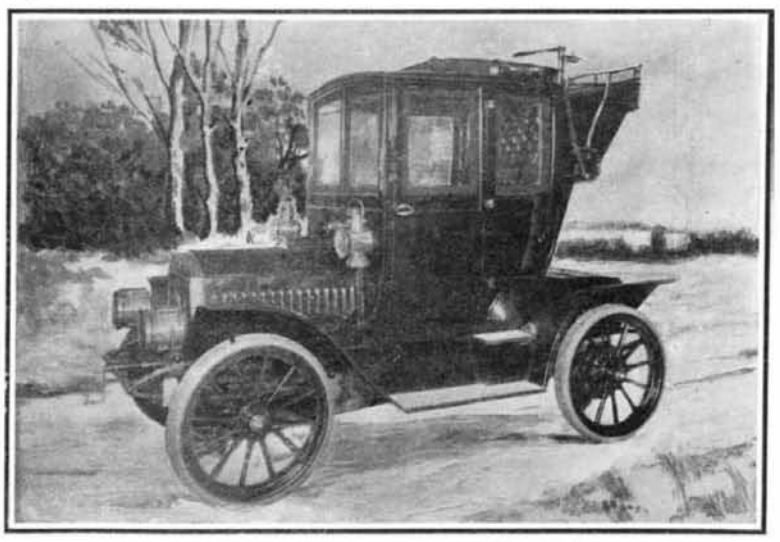
The 30-Horse-Power Studebaker Touring Car.

Engine: 4⅛ x 5¼, 4-cylinder, water-cooled; make-and-break igniters with magneto. Transmission: 3-speed progressive type. Clutch: Cone. Drive: Shaft. Weight: 2,400 pounds. Wheel base: 104 inches. Tires: 34 x 4.



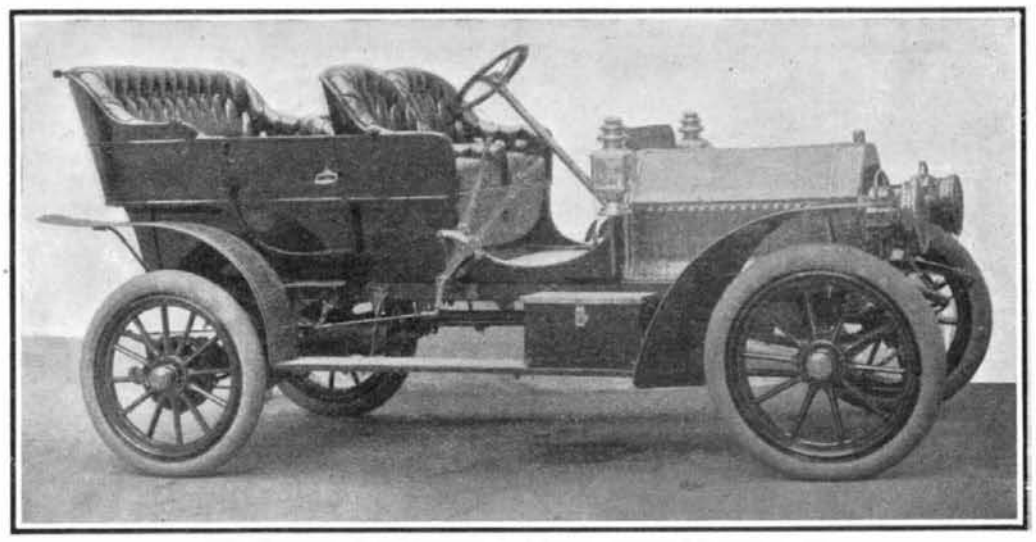
The 45-Horse-Power Royal Tourist Limousine for Winter Use.

Engine: 5⅛ x 5½. 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 3,700 pounds. Wheel base: 114 inches. Tires: 34 x 4½.



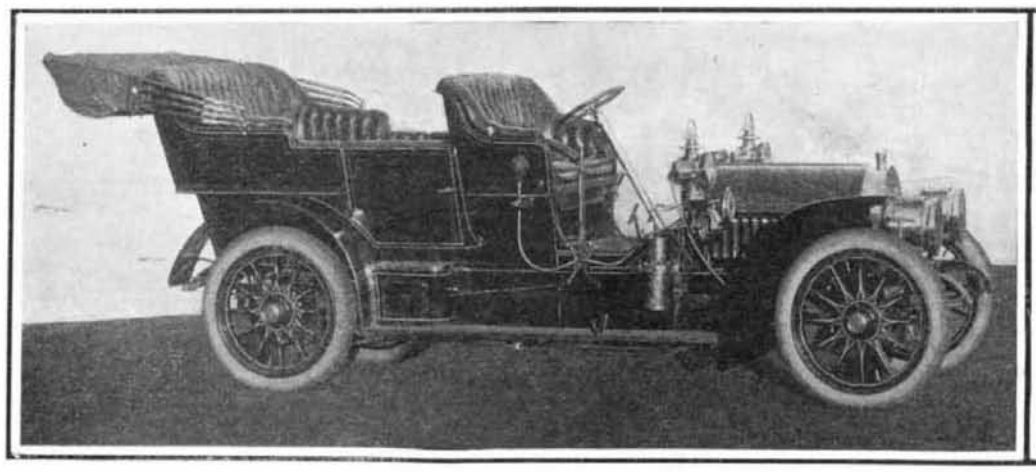
The Frayer-Miller 24-Horse-Power Coupé With Driver's Seat Behind.

Engine: 4 1/16 x 5⅛, 4-cylinder, air-cooled with blower. Transmission: 4-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 2,950 pounds. Wheel base: 96 inches. Tires: Solid, 32 x 3½.



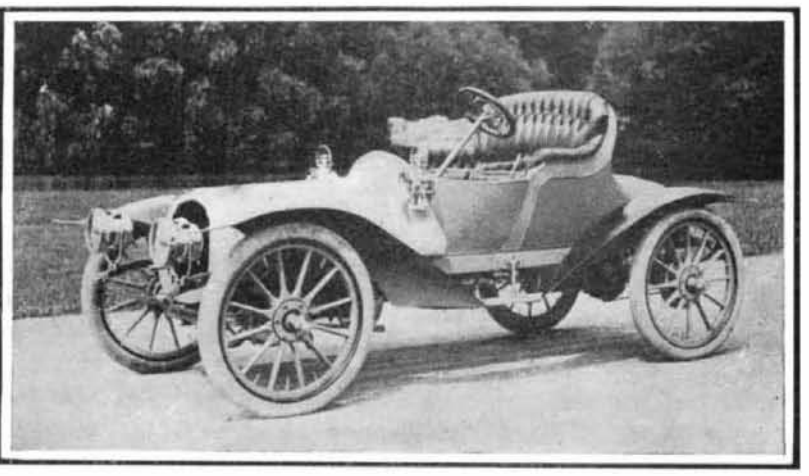
The New 20-Horse-Power Cadillac Light Touring Car.

Engine: 4 x 4½, 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 2,000 pounds. Wheel base: 100 inches. Tires: 32 x 3½.



The Locomobile 35-Horse-Power, 7-Passenger Touring Car.

Engine: 4½ x 5½, 4-cylinder, water-cooled; low-tension magneto ignition. Transmission: 4-speed selective type. Clutch: Cone. Drive: Double side chain. Weight: 2,800 pounds. Wheel base: 120 inches. Tires: Front, 34 x 4; rear, 34 x 4½.

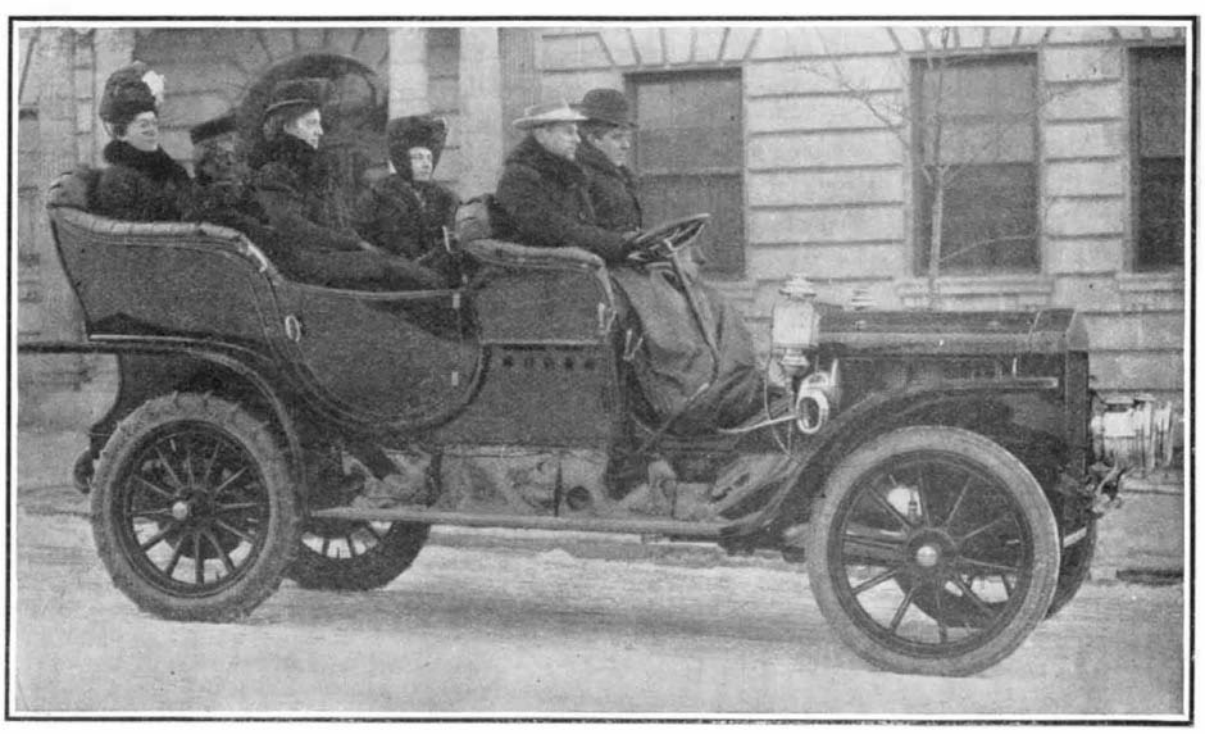


The 20-Horse-Power Aerocar Runabout.

Engine: 4 x 4, 4-cylinder, air-cooled. Transmission: 3-speed progressive type. Clutch: Multiple-disk. Drive: Shaft. Weight: 2,100 pounds. Wheel base: 104 inches. Tires: 36 x 3½.

The 16-Horse-Power Maxwell Touring Car Which Ran 3,000 Miles Without Stopping the Engine.

Engine: 2-cylinder, 5 x 5, double-opposed type, water-cooled. Transmission: 3-speed progressive type. Clutch: Multiple disk in gear box. Drive: Shaft. Weight: 1,700 pounds. Wheel base: 86 inches. Tires: 30 x 3½.



The New White 30-Horse-Power Steam Touring Car With Pullman Body.

Engine: Compound with cylinders of 3 and 6-inch bore by 4½ inches stroke. Boiler: Flash type maintaining steam pressure constant at 600 pounds. Weight: 3,000 pounds. Wheel base: 115 inches. Tires: Front, 36 x 4; rear, 36 x 4½. The new method of closing the space between the fenders and running board and the body by means of patent leather strips secured by lacing or buttons, is shown in the photograph. The new type of square oil lamps are also to be noted.

SOME LEADING TYPES OF 1907 AUTOMOBILES.