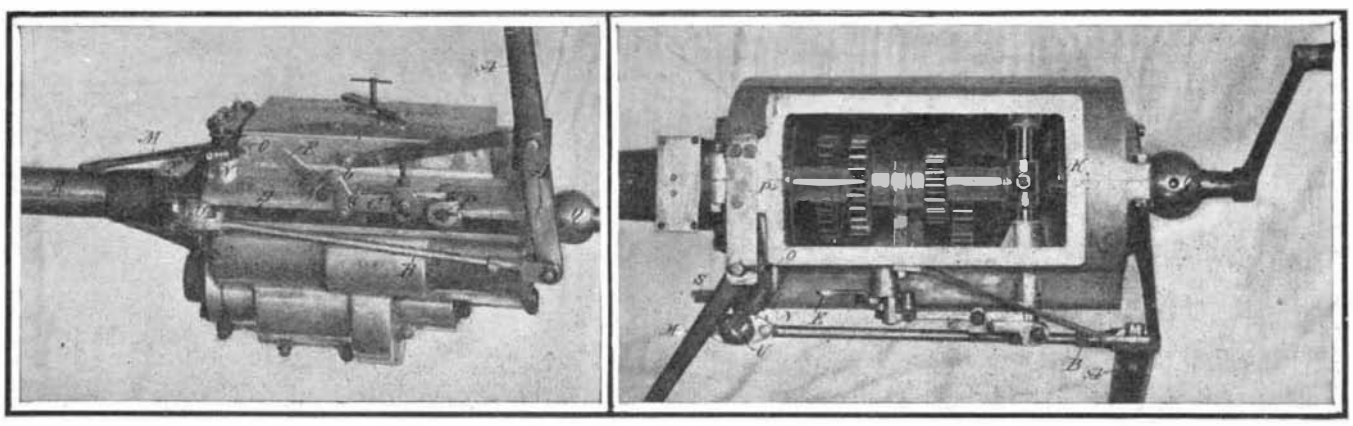
upon which the Packard and Northern cars have won success during the last two years. In our 1905 Automobile Number we showed the first application of the transmission to the rear axle as displayed on a Packard chassis. Last year the Northern company brought out a 4-cylinder car having this feature, and 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.

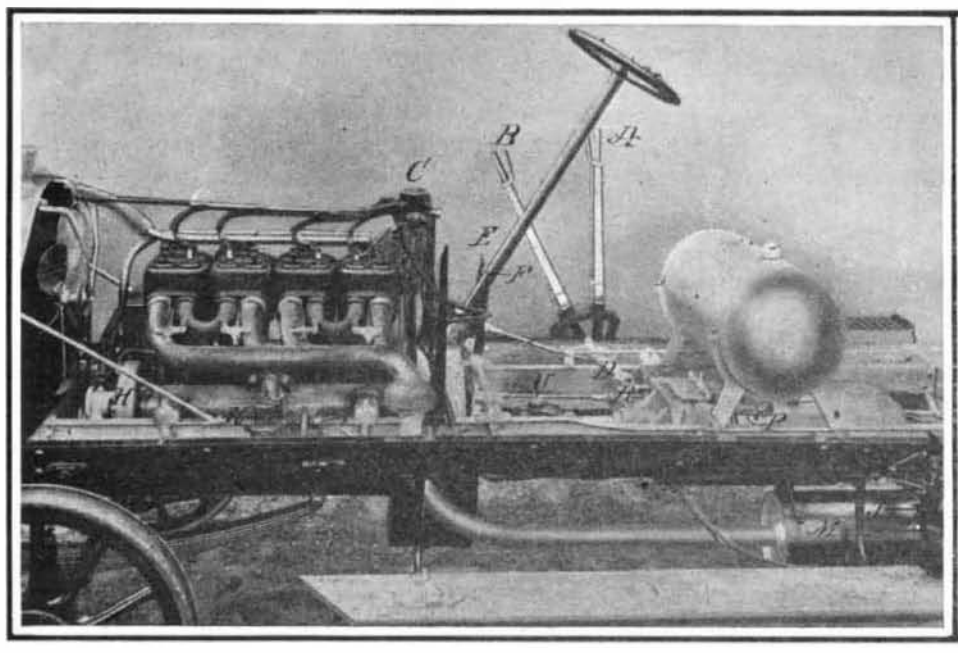
The transmission, as can be readily seen, is very compact. The lay shaft is placed at the bottom, and the ends of the bearings of this shaft are protected by oil-tight caps, so that there is no leakage of oil from the transmission. Although the gear box is quite small, the gears are exceptionally large, 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.

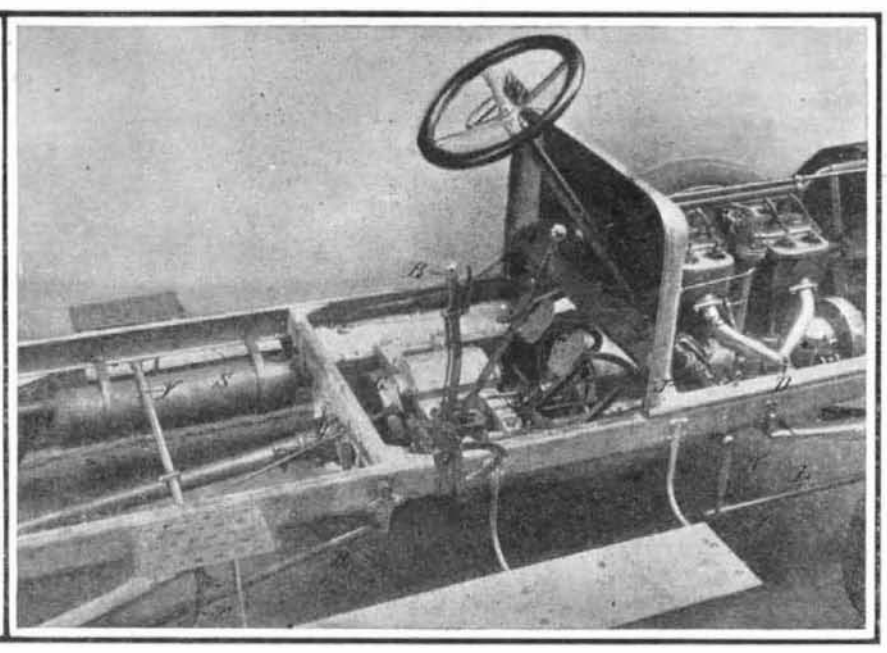
One of the most finished chassis exhibited at the show was that of the Grout car. Grout Brothers still retain the armored wood frame on account of its elasticity. The motor is a 4-cylinder Rutenber of 4½-inch bore by 5-inch stroke, rated at from 30 to 35 horse-power. As can be seen from the photo of 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.