

in the bottom ends of the levers, *H* and *K*. In the position shown it effectually locks these levers, and holds the gears in the neutral position. When it is desired to insert a gear in mesh, the operator first moves lever, *G*, to one side or the other of the H-shaped quadrant, and thereby releases at the bottom the lever that its latch, *J*, engages at the top. As soon as the clutch is thrown out the driver can then move *G* forward or backward in its slot until he has in mesh the gear desired. To bring into play the other gear set he must, after releasing the clutch, slip the lever, *G*, through the gate, or opening in the H-shaped quadrant, and thereby cause the latch, *J*, to lock into the other short lever, *H*, which

is at the same time automatically released by the pin, *M*, while its twin is locked. Thus, it will be seen that there is a double interlock on this car, a fact which should make it extremely difficult for the novice to get into trouble while shifting the gears. The rear axle and countershaft construction is shown in one of the photographs. As already stated, the countershaft revolves on Hess-Bright ball bearings, and these are placed in the drum, *Y*, directly beneath the driving-sprocket, which is attached on the six studs shown. The brakes are both of the contracting type, the foot brakes being applied upon drums which carry the driving sprockets, as can be plainly seen, while the emergency brakes, worked by the lever, *F*, are applied upon sprocket drums on the rear wheels. These drums are internally notched with ratchet teeth, and the pawl, *Z*, can be dropped into engagement with them to stop the car from running backward down hill. Last year this device was applied in a similar manner, except that the ratchet teeth were external instead of internal. The reverse is interlocked with the pawls, so that these cannot be engaged when the car is being backed. Perfectly straight, drop-forged radius rods, the rear ends of which completely encircle the rear axle, are employed on the new model Thomas cars. The construction is very substantial, and the car is one of the best-arranged machines used with a final chain drive.

THE LOZIER PROTECTED DRIVE CHAIN.

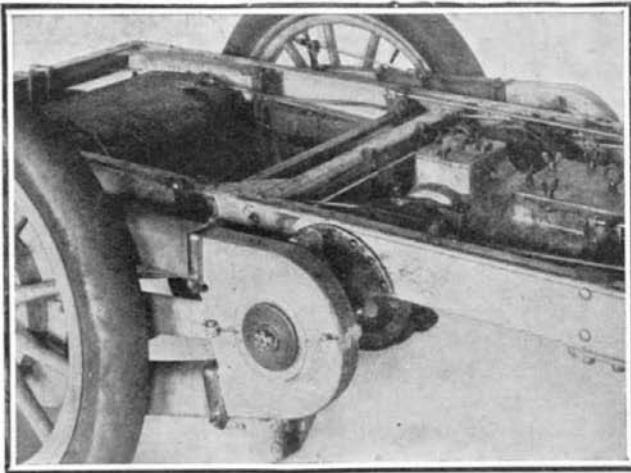
One of the great disadvantages of the double side-chain drive over the drive by propeller shaft and bevel gears, is that in the former case the chains are near the wheels, where mud and dirt can splash upon them, and where, as a rule, no protection is given them. An improvement on the 1907 40-horse-power Lozier touring car is shown herewith. This consists in the protective casing for each chain, which completely incloses it and keeps off both dust and mud. The casing is composed of two aluminium castings, which surround the sprocket on the countershaft and the sprocket on the wheel respectively. These two castings are connected by a straight central supporting member of rectangular cross section, while rubber tubing (also rectangular in cross section) surrounds the chain, and connects the aluminium castings at the top and bottom. These rubber connections are clamped to the castings in such a way as to make a tight joint. Being flexible, they allow for any movement of the countershaft relative to the rear axle. The protection is very complete, and adds greatly to the life of the chain as well as to its quiet running. Another feature of this car is the fitting of separate brakes near each end of the countershaft, just inside of the frame. These brakes are connected to the pedal through an equalizing device, and they are water-cooled, being fitted with water jackets supplied from a special tank.

THE POPE-TOLEDO COMBINED CLUTCH AND TRANSMISSION.

The photograph and line drawing reproduced herewith give a good idea of the new combined clutch and transmission, which is used as a separate unit on the

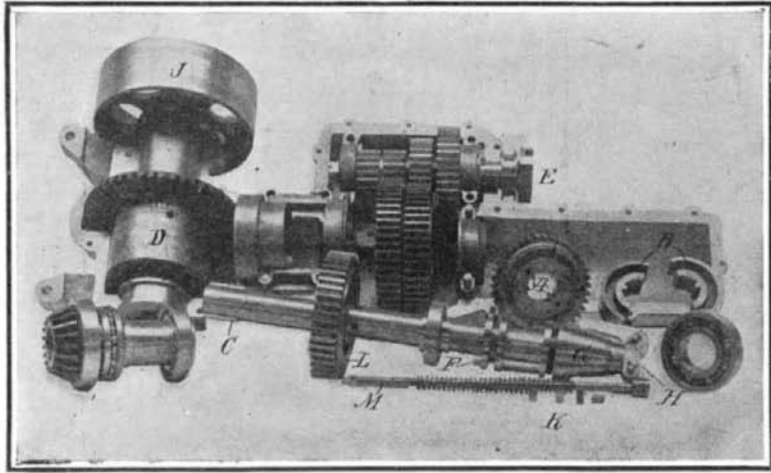
Pope-Toledo 40-horse-power touring car. All the gears and shafts are of chrome nickel steel, and every moving part is fitted with Hess-Bright ball bearings. Besides the carrying of the clutch in the forward part of the gear case, another feature of this transmission is that the direct drive is obtained upon the third speed by sliding gears *L I* to the right, so that *I*

other disks, which are 10 3/4 inches in diameter, are attached to their carrier, *G*, by four series of slots placed 90 degree apart around their peripheries, and through which pass bolts carrying spring washers between the disks, to assist in separating them when the clutch is disengaged. On the extreme outside of the disks are eight springs, *K*, placed radially at equal intervals. These act through the pressure plate, *H*, to press the disks together. By placing them on the outside of the disks, and causing them to work through this pressure plate, all the disks are compressed uniformly throughout their entire surface. Besides a universal joint, *B*, between the crankshaft, *A*, and the hollow stub shaft around *C*, there



PROTECTIVE CHAIN CASING ON THE LOZIER TOURING CAR.

This is one of the much-needed improvements on cars employing the double chain drive. The countershaft of this car is also fitted with a separate water-cooled band brake near each end.

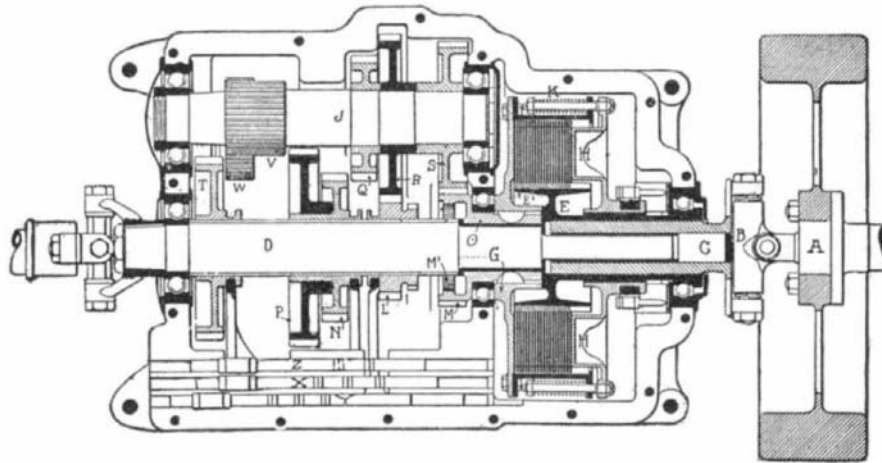


THE BERKSHIRE INDIVIDUAL CLUTCH TRANSMISSION.

A. One of the gears with clutch inside. *B.* Expanding clutch shoes. *C.* Keys on hollow shaft for bevel driving pinion. *D.* Differential and large bevel gear. *E.* Universal joint for drive shaft from engine. *F.* Shifting collar for sliding hollow shaft. *G.* Shifter for tapered pin. *H.* Pivoted end piece for working shifter. *I.* One of the four gears with clutches that slide on shaft. *K.* Four tapered blocks that are expanded by *M* through holes seen beside *L* and that thus serve to expand shoes *B*.

meshes with the internal gear *M*, while the fourth speed, which is used only under the best conditions, is had through *M S R L* as shown in the diagram. The drive on the first and second speeds is through *M S V P* and *M S Q N*, while the reverse is obtained by sliding *T* into mesh with the intermediate pinion *W*, the drive then being through *M S V W T*. The clutch is formed of nineteen soft-steel disks, *E'*, which are car-

are two other universal joints between the transmission and the countershaft, which is located some distance farther back on the frame as an entirely separate unit. This makes it possible to use short driving chains, and is a distinctive feature of the new Pope-Toledo car. The entire power transmission of this machine is, therefore, quite different from that ordinarily used. The idea of incasing the clutch with the gears is a good one, as is also the plan of placing the countershaft as near the rear wheels as possible. The Pope-Toledo engine of 4 1/2 bore by 5 1/4-inch stroke is rated at 40 horse-power. It is very similar to the De Luxe engine illustrated on page 24, as it has the same walking-beam valve mechanism, and the cylinders are cast in pairs and provided with copper water jackets. A peculiar arrangement is noted in the oiling of this engine, which is accomplished by pressure feed, from a small oil tank placed beneath the floor, and having a pressure of 5 pounds per square inch, supplied by a hand-operated air pump between the individual front seats. There is also a plunger for forcing oil directly into the crankcase. A convenience with regard to the carbureter is that it can be primed by pressing a button arranged beneath the radiator at the front of the car. The fuel is forced by air pressure from a double 25-gallon tank at the back of the car to a 5-gallon running tank on the dash, in which the gasoline is kept at a certain level automatically. Should it fall below this level, an alarm is sounded.



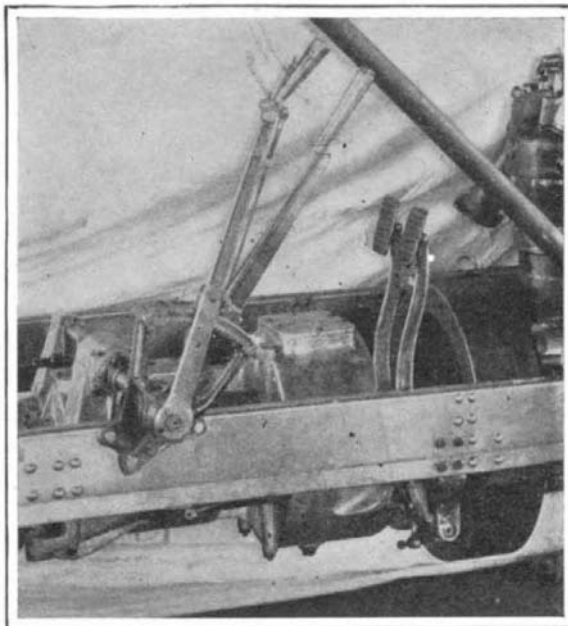
CROSS-SECTION OF POPE-TOLEDO COMBINED TRANSMISSION AND CLUTCH.

A. End of crankshaft carrying flywheel. *B.* Universal joint. *C.* Bearing of main transmission shaft, *D*, in hollow stub shaft that carries clutch disk drum. *E.* *E'* Driving disks of clutch. *F.* Rear shaft extending to countershaft. *G.* Driven drum of clutch. *H.* Pressure plate of clutch. *I.* High-speed gear that fits in internal gear. *M.* *J.* Lay shaft. *K.* Clutch springs. *●* Sleeve carrying master pinion. *M.* *X.* *Y.* *Z.* Notched shifting-gear rods.

ried on the special carrier, *E*. This carrier is keyed to the hollow shaft that connects with the universal joint, *B*. Twenty hard-steel disks supported at their peripheries on another carrier, *G* (which terminates in the gear *M*), form the other part of the clutch. The first-mentioned disks are attached to their carrier, *E*, by means of six keys, arranged radially around the carrier. These disks are 10 3/4 inches in diameter. The

A NOVEL INDIVIDUAL CLUTCH TRANSMISSION.

The accompanying photograph shows the transmission of the Berkshire car taken apart to show the interior construction. The top half of the case is simply removed to show the interior. At one end of the top half of the case is a raised housing. Dependent from the inside of this housing are the shifting forks, which in turn are connected by a shaft to the operating lever on the side of the car. The shaft, *E*, is connected direct to the engine. Upon this shaft are keyed the steel gears which mesh into the phosphor bronze ring gears, *B*. Each of these ring gears are supplied with internal expanding frictions, the two halves of which are shown at *B*. These two halves are again shown placed in position at *A*. The sliding shaft, *C*, upon which this ring gear is placed moves longitudinally, when placed in position in the case, through all of these gears. At a point in this movable shaft, four square holes are made, which open into a hole drilled longitudinally through the entire length of the shaft. These holes are shown beside *L*. The steel wedge pins, *K*, are inserted in these square holes, *L*, and when located under any of these ring gears, are forced outward by the internal expanding wedge *M*, which is operated by a side lever on the car, in connection with the depending shifting forks, which are connected with *F* and *G*. The forward motion of the lever operates *F*, which is fast to the shaft and moves the shaft longitudinally under the desired gear. The backward movement of the lever operates forks connected with the tapered cone, *G*, and forces it under the fingers, *H*, which are fulcrumed on



TRANSMISSION AND OPERATING LEVERS OF POPE-TOLEDO TOURING CAR.

The multiple-disk clutch is in a compartment at the front end of the gear box. The countershaft for the double chain drive is placed by itself some distance back of the gear box, thus allowing short chains to be used.

(Continued on page 53.)