THE MODERN MOTOR CAR.

ITS PRINCIPAL FEATURES BRIEFLY DESCRIBED.

The Transmission.

Considerable variety is evident in the method of transmitting the engine power to the road wheels, or, as it is termed, the transmission gear. The majority of cars, however, employ either side chain transmission, generally called the "Panhard" type, or the cardan shaft transmission. In the first system power is conveyed by a longitudinal shaft and bevel gearing to a transverse or cross shaft. At each end of this shaft chain wheels are fitted, the drive then being by chain to another and larger chain wheel bolted to the driving wheel. Each driving wheel is so fitted, the wheels being independent of each other and free to revolve on the stationary axle. Amongst cars using transmission with side chains as in fig. 1, are the Albion, Beaufort, Brooke, De Dietrich, Durkopp, Fiat, German, Gladiator, James and Brown, Leon Bollee, Maudslay, Mercedes, M.M.C., Napier, Panhard, Peugeot, Pipe, Daimler, Star, Sunbeam, etc., In the other system what is termed a "live" axle is used, i.e., the axle and two driving wheels all revolve together, the engine motion, as before, being transmitted by a longitudinal shaft and a bevel gear. Cars using cardan shaft or "live" axle drive, as in fig. 2, are the

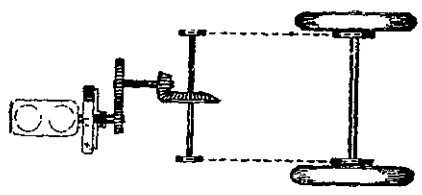


Fig. 1.—Side chain transmission.

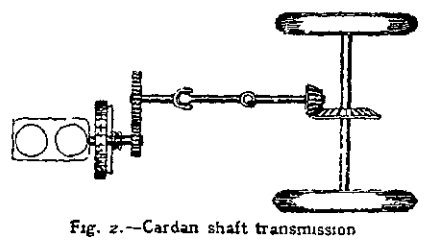


Fig. 2.—Cardan shaft transmission

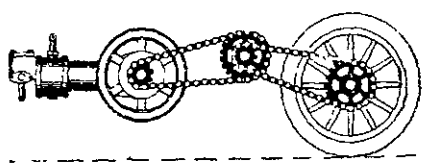


Fig. 3.—Chain drive with countershaft.

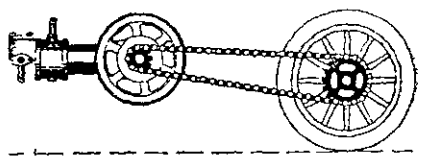


Fig. 4.—Direct central chain drive

Argyll, Ariel, Belsize, Clement, Decauville, De Dion, Dennis, Darracq, Elswick, George Richard Brasier, Humber, Renault, Rykneld, Simms-Welbeck, Speedwell, Spyker, Swift, Talbot, Thornycroft, Vulcan, etc. Another system is the chain drive with countershaft, as in fig. 3, which is found in the Siddeley, Wolseley, Belsize Junior, etc. Fig. 4 illustrates the direct drive with central chain from the engine to the back live axle. This system, which is used on the Cadillac, Duryea, Ford, Oldsmobile, Rational, Vauxhall, etc., gives a very high efficiency.

Carburetters.

The carburetter, or mixer, sometimes termed the vaporiser, is the arrangement for mixing the gas vapour with the required quantity of air, and delivering the proper quantity of correct explosive mixture to the engine according to the speed and power called for. What is known as a surface carburetter is simply a form of tank in which arrangement is made for drawing in-coming air either over or through the petrol. This type of carburetter is now practically obsolete, the spray carburetter, sometimes called the float feed, being generally employed. The chief advantage of the spray carburetters is that they can be adjusted to use petrol or alcohol of any density, or even paraffin, after preliminary warming by a few minutes on petrol. The worst fault with this carburetter, unless provided with an auxiliary air-inlet, is that it will not generate the mixture in constant proportions at varying speeds, giving too rich a mixture at high speed, which, if corrected, renders the mixture weak at low speeds.

Ignition Systems.

For firing or igniting the explosive mixture of gas and common air in the combustion chamber of a petrol engine, electric methods are now exclusively employed. Of these the most generally adopted is the high tension or battery method, in which a low-tension current generated by a chemical battery, or stored and drawn from an accumulator or storage battery, is transformed by means of an induction coil into a current of extremely high voltage, and consequently possessing the power to overcome high resistances such as that formed by the air-gap at the sparking plug points. The sparking plug is built up in many forms, but all consist of a small central rod or wire; to one end is fixed a terminal, to which the high tension wire from the coil is attached. This central core is passed through a tube of porcelain mica, asbestos, or other non-conducting material capable of resisting great heat. The core and its insulating tube are fastened into a socket which in turn is screwed into the combustion chamber. The current from the high tension coil flows down the centre conductor, finds itself compelled to jump the small gap between the points of the plug, causing the spark which ignites the gas. In ordinary high tension ignition there is, of course, considerable time-lag between the making of the contact in the primary circuit and the rise of the magnetic flux in the coil sufficient to draw the trembler and break the circuit, whereupon the ignition spark occurs, and it is principally this time-lag that makes it necessary to provide a means of varying the time at which the primary circuit is closed, or, in other words, providing a means of compensating for this time-lag. As everyone is aware a careless driver can set up enormous strains on the crank shafts and other parts of the engine by running an engine with the ignition set too early, as many broken crank shafts have testified.

The Timing Gear.

An important factor in controlling the efficiency of the petrol motor is the correct working of the timing gear. As only one explosion takes place for every two revolutions of the flywheel which is attached to the main crank shaft, a second shaft, called the half time shaft, is used for the purpose of opening the inlet and exhaust valves. This is connected by gear wheels to the main crank shaft, the gear being so proportioned that it revolves only once while the main shaft revolves twice. Both inlet and outlet valves consist of a disc with a bevel surface, fitting into a circular hole, which leads into the combustion chamber. Through this disc a stem projects downwards and rests on the tip of a rod placed in such a position that the lower end of it is thrust up by the projecting part of the cam passing under and allowing it to drop again, when it seats itself by means of a powerful spring. With every revolution of the half time shaft this operation is repeated, so that the inlet and exhaust valves are opened and closed once for every two revolutions of the flywheel. The two valves are similar in construction, but the cams which work them are set in opposite positions on the half time shaft, so that the inlet valve is open only during the induction stroke of the engine, and the exhaust valve is open only during the exhaust stroke, so that the back pressure that would otherwise be caused by a cylinder full of gas is averted.

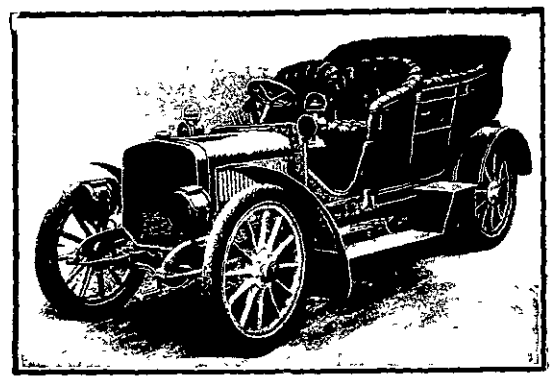
Governing.

With regard to system of governing, one method is to vary the amount of lift on the inlet valve itself. This method, however, reduces the compression, and therefore the economy of the motor. Another method is to vary the lift of the exhaust valve, thus retaining more or less of the exhaust gases in the cylinder, which prevents a fresh charge from entering until they are expanded below the atmospheric pressure. In either case the centrifugal governor is used to vary the lift of the valves. A device called the accelerator is fixed in some cars to cut out the governor and render it inactive. The speed of the engine is then increased above normal.

Change Speed Gear.

The gear box, after the engine, is a very important part of the car, but has been a weak link in a good many. When correctly designed and constructed of the right material it should give no trouble whatever. All kinds of devices have been made to obtain a variable speed ratio between the engine and road wheels, but the Panhard system is one of the most popular. The disadvantage of the Panhard system is the liability, not only of novices but also of skilled drivers, to miss their gear, —i.e., they do not make the desired change when they endeavour to do so, and have to come down to lower gear than that required. This usually happens on an uphill grade. With most forms of sliding gears it is necessary in changing to pick up any intermediate gear that may come before the desired one. For instance, if when running on the fourth speed it is necessary to stop for any reason, such as the traffic or a restive horse, and it is necessary to get into the first gear to start again, the driver has to get into his second gear, then out of that into his third, then out of that into the fourth, in some cases a most troublesome proceeding. To get over this difficulty good designers are arranging their change gear so that the driver can pass from one speed to any other without passing through intermediate gears.

Motor-car owners are quick to see the value of a simple and reliable transmission gear, and, consequently, the Argyll system has a large share of the public favour on that account. No gear wheels

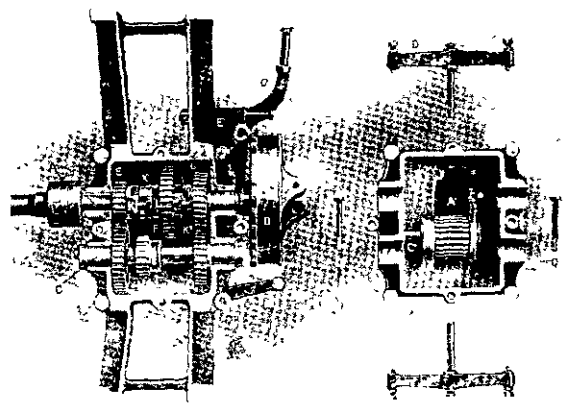


Ford 35-H.P. touring car.

have to be thrown into mesh, and the necessity of crossing through gear wheels in passing from a low to a high set is quite done away with, besides which a neutral point is given between each of the three forward speeds, and, most important of all, the Argyll has an arrangement of levers by which the novice operator will not spoil any of the wheels by the inevitable mistakes made when learning to operate, or in putting into operation the wrong set of speed wheels Further advantages in these gears are .—no notches to find in quadrant, gears cannot bind, if car stops while changing, it is impossible to put in the reverse by mistake, direct drive on the speed, exceptional accessibility, changes are made without clatter or noise.

Differential Gear.

The differential gear appears to mystify most people, and is one of the least generally understood parts of the power-transmitting mechanism of a motor car In a car having side chain drive this gear is situated on the countershaft carrying the sprockets. In a gear driven car it is usually located at the centre of the live back axle. Its object is to vary automatically each driving wheel's relation to the other, according to the requirements of the moment. The car never proceeds far in a straight line, but is either owing to turns in the road or the necessity for avoiding traffic, constantly describing a series of curves. Now, it can be easily seen that the



The Argyll Gear Box.

A *Universal Sliding Coupling*
B *Main Shaft*
C *Counter Shaft*
D *Brake Drum and Sprag Ratchet*
E *3rd Speed Pinion and Shaft*
F *1st Speed Wheel*
G *2nd Speed Wheel*
H *Counter Shaft Speed Wheel*
I *1st Speed Pinion*
J *2nd Speed Pinion*
K *3rd Speed Clutches*
K1 *3rd Speed Engaging Clutches*
K2 *2nd Speed Engaging Clutches*
K3 *2nd Speed Clutches*
L *Actuating Fork (Main Shaft)*
L1 *Actuating Fork (Counter Shaft)*
M *1st Speed Bell Crank*
N *Sprag Ratchet*
O *2nd and 3rd Speed Bell Crank*
P *Clutch Shaft*
Q *Bearing Joint Bolts*
A1 *Reversing Pinion*
B1 *Gear Box Cover*
C1 *Reversing Spindle*
D1 *Gear Box Cover Clamps*
E1 *Gear Box*