Warner Hi-Flex Four-Speed Transmission

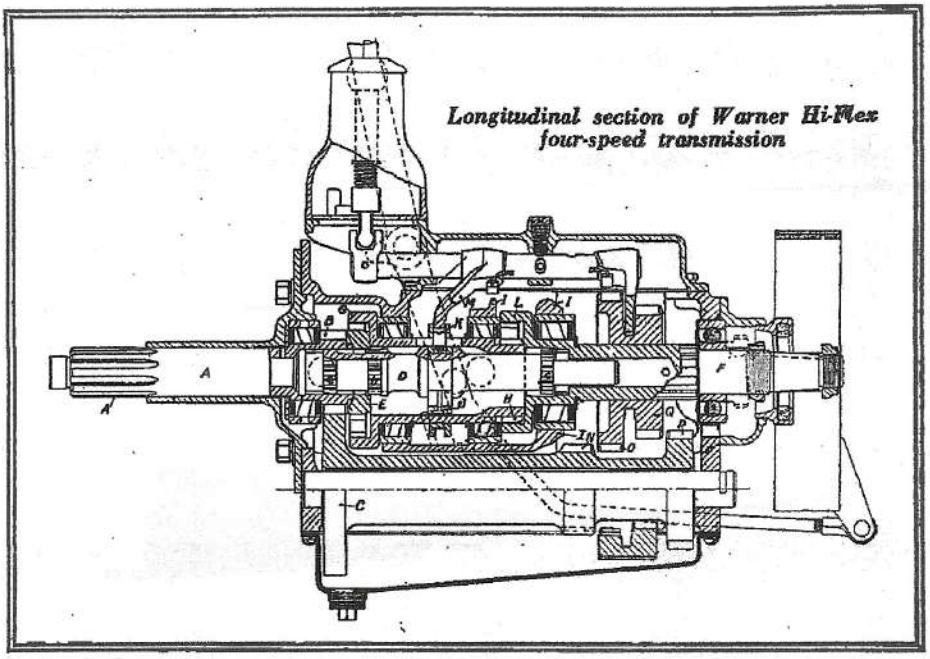
By P. M. HELDT

A FOUR-SPEED transmission for use on passenger cars and light trucks has been brought out by the Warner Gear Company of Muncie, Ind., and already is standard equipment on one eight-cylinder passenger car model. The transmission has a direct fourth speed and is designed for use with a comparatively small rear axle reduction. With this transmission the total reduction from engine to rear axle on high is less than with the conventional three-speed gear on high, with the result that when driving in high gear the engine will run at a lower speed for a given car speed. This means that the car is more comfortable at high speeds, because of the reduced engine noise and vibration; that engine wear and tear is reduced and that the fuel consumption is cut down. Furthermore, the maximum speed of the car on level road is generally increased somewhat. All of these advantages are obtained at the cost of a slightly heavier and slightly more expansive transmission and of somewhat more frequent shifting of gears.

As compared with the conventional four-speed transmission, largely used on heavier trucks and also on passenger cars in Europe, the new transmission has the advantage that the third, or next to the highest speed, is practically as silent and as efficient as the top gear or direct drive itself, hence there is not the same objection to operating on a geared drive as there is with most of the conventional transmissions.

This third speed is obtained by means of a train of two pinions and two internal gears. The internal gear is inherently somewhat more efficient than the spur gear, because of the reduced amount of sliding at the tooth surfaces, and it has been found also much quieter. This is probably due to a more effective oil cushion, tooth contact, in fact taking place in an oil bath.

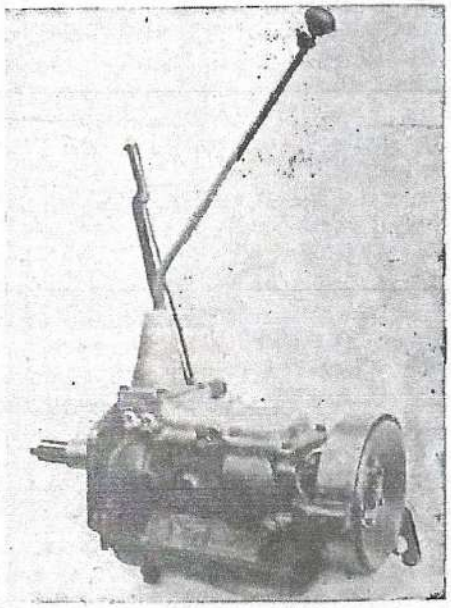
Referring to the accompanying sectional view of the transmission, the clutch shaft A extends through a long hub on the forward bearing plate, and at its rear end carries the constant mesh pinion B, which latter meshes with the constant mesh gear C of the secondary cluster gear which revolves on plain bearings on a spindle fixed in the gear housing. Clutch shaft A is drilled out from the rear end, and internally splined, and within the hole in it is located the forward end of a floating shaft D which is splined at both ends and also some distance back of the forward end. By means of the forward splines A it remains in driving connection with the clutch shaft at all times, although it can be shifted axially a certain distance by means of mechanism to be described. The second set of splines B serves to place the floating shaft D in driving connection with the third speed drive pinion E, while the set of splines C at the rear end of the shaft connect it with the tail shaft F when the floating shaft is moved toward the rear. In the drawing the floating shaft is shown in the central or neutral position, in which it is connected neither to the third speed drive pinion nor to the tail shaft.



Longitudinal section of Warner Hi-Flex four-speed transmission

The floating shaft is surrounded by a shell-like member comprising the internal gear G and the spur pinion H and referred to as a double internal gear. This member is supported in two Hyatt bearings mounted in a bearing support I forming a bridge across the main housing. At about the middle of its length the floating shaft is enlarged and has a groove for a shifter collar cut in it. Into the shifter collar groove in shaft D fits eccentrically the collar J which connects by pins extending radially through longitudinal slots in the wall of the hollow member G-H with a grooved collar K on the outside of this member. Into the groove of this collar engages a fork M mounted on one of the shifter bars of the transmission.

Warner four-speed transmission. Ball handle of shift lever has latch handle for reverse



When the floating D shaft is shifted forward the third speed drive pinion E is secured to it by means of splines B, thus giving the third speed, while if shaft D is shifted toward the rear, the splines C connect it with tail shaft F, since the floating shaft is at all times in driving relation with clutch shaft A through the splines A, the tail shaft is then connected to the clutch shaft through the floating shaft, and the drive is direct.

It will be noticed that the tail shaft F at its forward end carries the internal gear L, with which meshes the pinion H. Thus for the third forward speed the drive is from the clutch shaft through the internal combination EG to the double internal and thence through the internal gear combination HL to the tail shaft F. Except when driving on third gear the internal train runs idly.

First and second speed and reverse are obtained in the usual manner, except that the secondary pinion for the second speed is located close to the rear wall of the housing and the pinion for the first speed and reverse further forward, which is the reverse of the conventional arrangement. For the first speed the power is transmitted from B to C and from N to O, while for second speed it is transmitted from B to C and from P to Q.

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Motor Age
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The tail shaft is carried in a large ball bearing at its rear end and in a Hyatt roller bearing at its forward end and the exceptionally short span between these bearings gives it a very rigid support.

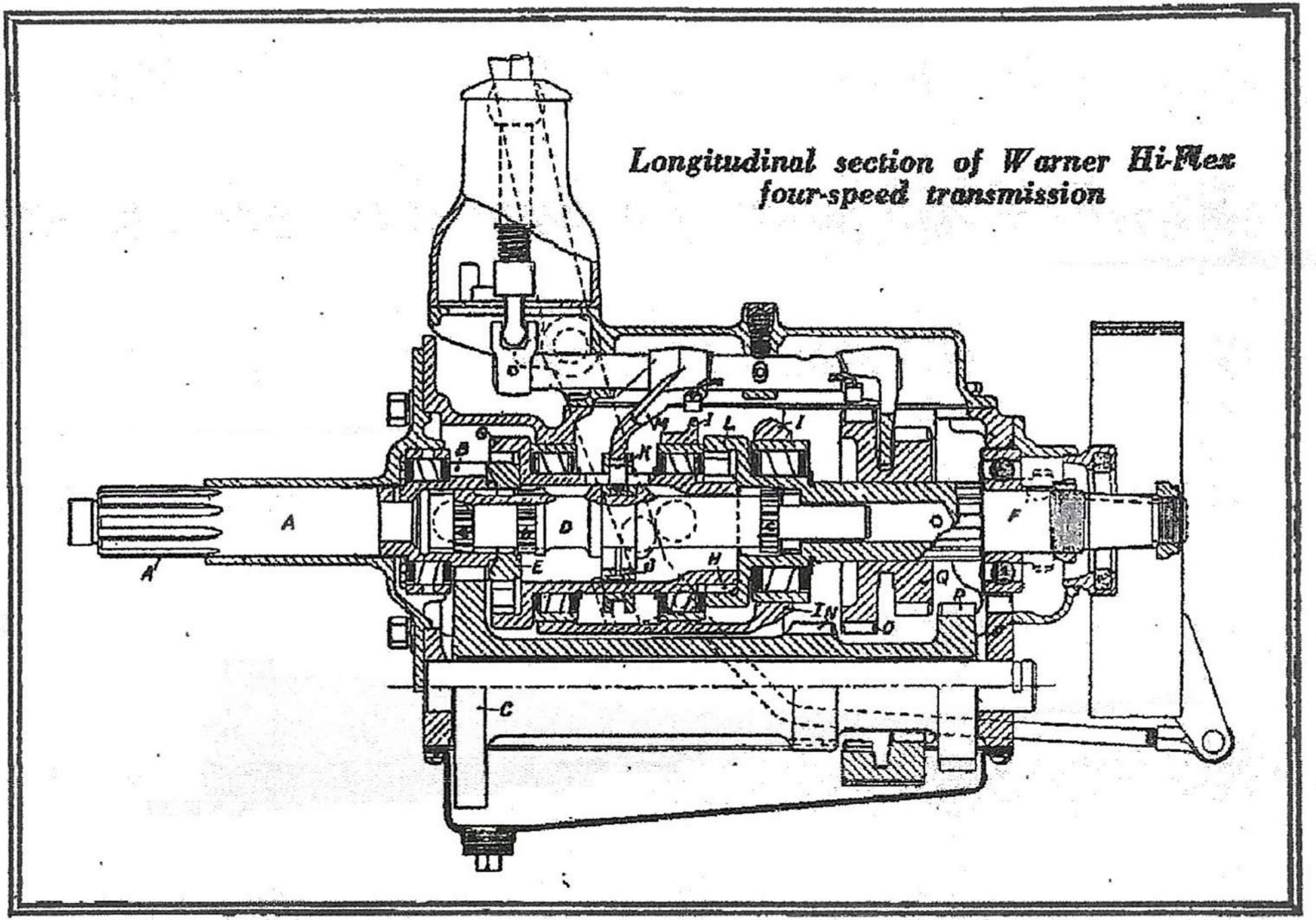
Control of the transmission is by the usual cane-type of shift lever. The first speed is obtained by pulling the lever over to the left and pulling it backward; shifting to second consists in pushing it directly forward from the first speed position. Shifting to third involves returning the lever to the central neutral position, pushing it to the right and then backward and, finally, shifting to high is accomplished by merely pushing the lever forward from the third speed position.

In all ordinary driving the car is started on second gear, the first being considered merely as an emergency rear axle reduction, starting in second can be readily accomplished without much slipping of the clutch.

In order to engage the reverse it is necessary to pull up on a latch mounted on the shift lever. This permits of moving the ball handle further to the left than for the first and second speed positions and thus picking up a third shifter bar which controls the reverse gear combination. The reverse position being locked by the latch, it is impossible to engage it by mistake.

The reductions within the transmission are as follows: Low, 4:1; second, 2.46:1; third, 1.42:1 and fourth, 1:1. With a gear reduction in the rear axle of 3.69:1 as used in the Paige eight, this gives the following total reductions: Low speed, 14.75:1; second, 9.1:1; third, 5.25:1 and high, or direct drive, 3.69:1.

A special system of lubrication is employed, which ensures a constant supply to the internal gears and their bearings, which are housed in. The low-speed driven gear, which is of con- formed a gutter which catches this oil and delivers it into the housing of the internal gear mechanism.



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