CHECKING GEAR RATIOS

WORKSHOP HINTS and TIPS

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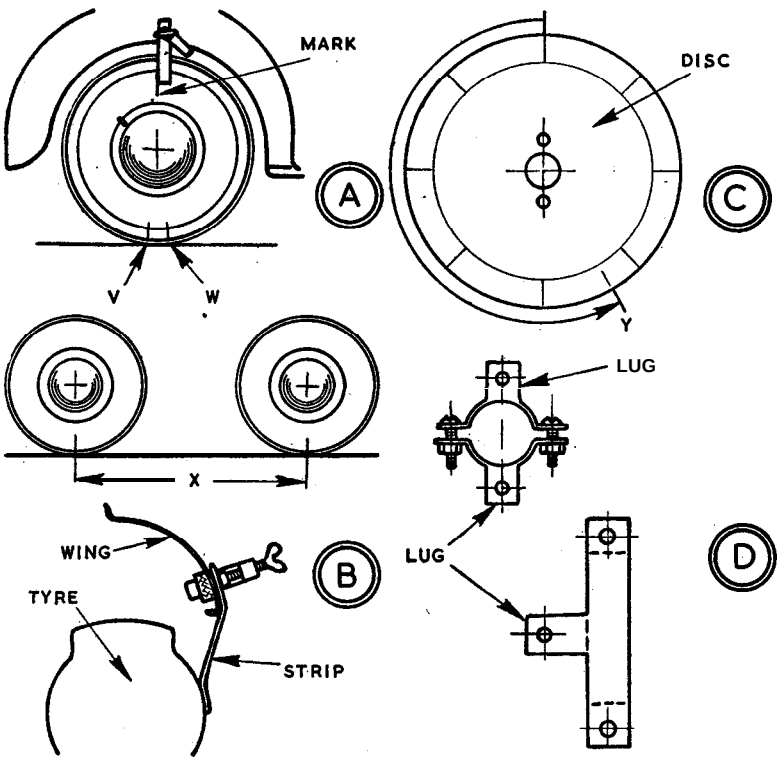
WHERE numbers of teeth in gears are known, or can be obtained by counting, ratios may be easily obtained by calculation. But where nothing is **known** and gears are enclosed in casings, as for example with gearboxes and rear axles,. some method other than dismantlmg assemblies is required. Information from makers or other sources would not necessarily be correct in a particular case, for there may have been alternative ratios available, giving rise to doubt and permitting alteration.

Given basic data of gear ratios of a car or any road vehicle, other useful information may be obtained or adapted from it-such as r.p.m. at 30 m.p.h. in top gear; m.p.h. per 1,000 r.p.m., corresponding speeds in other gears; theoretical top speed; piston speed; ratio of speedometer drive and so forth.

Checking begins by obtaining the rear axle ratio, moving the car over level ground in a straight line for the rear wheels to make one revolution. Both rear tyres should be the same size and well inflated. One revolution can then be verified, as at ***A,*** by a chalk mark on the tyre coming to a strip clamped, as at ***B,*** to a wing, to avoid the error which could occur as between V and ***W*** when a mark is made to come to the ground. Moving the car should be done by rotating the engine-sparking plugs out for easy turning-with a graduated disc of cardboard, as at C, slipped over the starting handle, and fixed by a simple clamp, as at D-a starting reference on the disc then coming to a line on the bumper bar, or anywhere convenient.



With top gear engaged, and turning the engine to take up transmission slackness, the starting point on the disc can be verified and a mark made on the tyre against the strip (by an assistant).

When the rear wheels have made one revolution, the disc will have made several turns, and part of one; and this part, converted to a decimal fraction and added to the whole turns, completes the figure for rear axle ratio. For convenience, the disc can be marked with 45 deg. angles, and the distance between estimated. Thus, as at C, from the top (reference) to Y there are 180 deg., plus about 30 deg. This 210 divided by 360 (degrees in whole circle) gives the decimal fraction 0.5833. If the whole turns were 4, the rear axle ratio would be 4.58 to 1.

All the other gear ratios may be obtained in the same way. A whole series might be: top 4.55 to 1; third 6.415 to 1; second 10.80 to 1; first 16.47 to 1. These are ratios through gearbox and axle. If the rear axle ratio is divided into each of these ratios, the gearbox ratios alone are obtained. Thus, top 1 to 1; third 1.409 to 1; second 2.373 to 1; first 3.62 to 1.

If the distance in feet covered by a wheel in one revolution, as at ***A-X,*** is divided into 2,640 (feet in 1/2 mile), the r.p.m. of the wheel at 30 m.p.h. is obtained. In distance X, there will be whole feet and inches. The latter should be divided by 12 to obtain the fraction as a decimal. Thus, if the distance is 6 ft 4-1/2 in., as a decimal it is 6.375 ft. This divided into 2,640 gives 415 r.p.m. for the wheel. Multiply 415 by the axle ratio (4.55) and the engine is turning at 1,888 r.p.m. at 30 m.p.h. in top gear.

If the engine r.p.m. at 30 m.p.h. are divided into 30,000 (a constant) the m.p.h. per 1,000 r.p.m. is obtained; thus, 30,000/1,888 gives 15.88 m.p.h. per 1,000 r.p.m. in top gear.

If the m.p.h. per 1,000 r.p.m. in top are divided by the gearbox ratios, there are then obtained corresponding road speeds per 1,000 r.p.m. in other gears. For the gearbox ratios given, practical approximate speeds would be: third 11.3 m.p.h.; second 6.6 m.p.h.; first 4.4 m.p.h.