



Fig 1. Sectional view of drive gear, showing dimensions controlling pinion position



(SERIES Y)

The Rear Axle

by Eric Blower

THE three-quarter-floating type axle is driven from the gearbox by means of the propeller shaft in which the drive shafts are transmitting the driving torque only and not carrying the main load. The rear hub bearings are mounted on extensions of the rear axle casing and the integral driving shafts and rear hub flanges are easily withdrawn.

Countersunk retaining screws secure each brake-drum to the hub; the brake gear is of the normal two-shoe type, hydraulically operated from the brake pedal, also mechanically by a hand lever operating the same brake-shoes. The brake-operating cylinders, which act directly onto the brake-shoes, are mounted horizontally on the backplates.

A spiral bevel type drive gear is employed, and both the pinion and crown wheel are mounted on taper-roller bearings. The bearings are assembled into the housing with an initial pinch or pre-load, and when either the pinion or crown wheel is mounted separately in the housing a slight drag will be obtained when turned by hand. Preloading of the bearings prevents vibration and so helps to maintain a quiet-running axle. Pre-loading of crown wheel bearings (M) is set by means of the adjusting nuts (L) as detailed later (see Fig. 1).

Correct pre-load of bearings (H) and (J) is obtained by the distance piece (G), which is varied in length, and for service purposes the large and small bearings and distance piece are supplied only in pre-selected sets. These sets will give the correct pre-load in any axle as the dimension (K) is identical for all housings.

To obtain correct tooth engagement the crown wheel is adjustable from side to side by the use of the adjusting nuts (L), but there is no provision for in or out adjustment of the pinion; the correct drive position is held by accurately controlling in production the position of the shoulder (dimension [A]) and the width of the taper-roller bearing (B). The limits at (A) and (B) are such that the position of the pinion may not vary more than .004 in. So that this position may be checked when assembled, the pinion is ground on its end face to a nominal width (C). The dimension (D) may be checked with the aid of a special gauge while the dimension (F) may be checked as explained later. Periodically you should check the nuts securing the differential assembly, the nuts securing the propeller shaft to the gearbox and rear axle flanges, and the nuts securing the rear axle 'U' bolts.

Removal of the Differential Assembly

Remove the main plug in the bottom of the casing and drain the oil; jack up the rear of the car until the wheels are clear of the ground, remove the hub discs and the wheel securing nuts, and withdraw the road wheel. Remove the three set screws securing the brake-drum to the hub, turn the two adjustment nuts inwards to release the brake-shoe adjustment, and withdraw the brake-drum. Remove the rear axle drive shafts by screwing into the tapped holes two of the countersunk-headed screws and using them as extractors until the shafts can be parted from the rear hub bearing housing and readily withdrawn.

Mark the coupling flanges of the propeller shaft and rear axle, withdraw the securing bolts, and tie up the propeller shaft out of the way. Remove the eight nuts securing the differential assembly to the axle casing and withdraw the assembly in a forward direction.

Dismantling the Differential Assembly

Hold the differential assembly in a vice, using clamps made of lead or other suitable soft material to avoid damaging the flanged faces. Remove the lock plates for the differential adjusting nuts, each plate being secured by a bolt and spring washer.

Extract the two bolts in each differential bearing cap and withdraw the caps. As the caps are machined with the carrier it is most important that they should be fitted in their original positions when reassembling. As the caps are marked to show their correct assembly difficulty arising from loss or exchange of position can be avoided if the caps are replaced and bolted into position immediately the crown wheel assembly is removed. *The caps are definitely not interchangeable.*

Remove the crown wheel assembly and two differential assembly nuts. Extract the cotter pin for the pinion shaft nut, and unscrew the nut and remove the flat washer. The pinion shaft should be pressed out towards the crown wheel end of the shaft, using a drift, preferably brass, between the pinion and the ram of the press. The drift must be of a size to pass through the flange bore so that the flange may be pressed off at the same time. The inner race of the large bearing will come away with the pinion, the outer race remaining in the carrier, together with the smaller bearing and the oil seal. Press out, from the crown wheel end, the inner race of the small bearing together with the oil seal.

Using a mild steel drift, $\frac{3}{8}$ in. diameter, drive out the outer races of the large and small bearings, slots being machined in the carrier for this purpose.

This operation will not be necessary if examination shows that they are serviceable.

Dismantling the Crown Wheel Assembly

The differential case is in two pieces, the crown wheel and differential assembly being held together by eight bolts. The two portions of the case are marked to ensure correct assembly, and these markings and their location should be noted before dismantling to ensure that they correspond when reassembling.

Extract the cotters for the eight securing nuts, remove the nuts, and drive out the bolts with a soft drift. The crown wheel can then be removed from its register on the case and the case parted. Then withdraw the two differential gears, the four differential pinions, and the differential spider.

Every part should be carefully examined before reassembly for each must be in a serviceable condition. To examine correctly thoroughly clean all parts and keep perfectly clean during the examination. If there is any doubt as to a component's condition it should be renewed.

The differential case should be renewed if the wear in the bores in which the shafts of the differential gears revolve is excessive or if, when the whole is assembled, excessive end-play or wear between the bore and shaft of the pinion is noticeable. In the case of the pinion, end-play exceeding .010 in. is excessive and a replacement differential case will be necessary.

Assembly of Crown Wheel and Pinion

The bearings of both crown wheel and pinion are pre-loaded. This means that when they are assembled and not in use they are under a definite predetermined load. It is part of the assembly process to subject the bearings to the predetermined load, and it is therefore very important that each operation of the assembly is carried out carefully as detailed.

Assembly of Pinion to Carrier

The pinion bearings are supplied in pre-selected sets consisting of the large and small bearings (H) and (J) and distance piece (G) (see Fig. 1). As they are manufactured to special limits they must be used in complete sets only, which should assemble into any axle and give the correct amount of pre-loading.

Remove, with a smooth file, any buffs and any abrasions in the carrier against which the replacement bearings will bear.

Any condition which will prevent the bearings fitting flush against the shoulders will make it impossible to obtain the correct preloading of the bearings and also give incorrect engagement of the crown wheel and pinion.

Press the outer races of the pinion shaft bearings into the carrier, the larger one from the crown wheel side of the carrier and the smaller one from the driving flange end. The inner race of the large taper bearing complete with rollers is then pressed onto the pinion shaft, making sure that it goes tight home against the shoulder on the pinion. Place the distance piece on the pinion and insert the pinion into place in the carrier. Place the inner race complete with the rollers of the smaller bearing on the pinion shaft and press the assembly together. Fit the driving flange, washer, and nut and tighten securely. The oil seal is not fitted at this stage.

To check the pre-load rotate the pinion by applying the special torque recording spanner T110 to the rear axle universal joint flange. If the pre-load is correct the pointer of the spanner should show a reading of 5 to 6 lb. in. on the scale. If it does not, re-check the fitting. If still incorrect exchange the bearings and distance piece, or in difficult circumstances refer to the manufacturers' setting of the pre-loaded bearings, details of which appear later.

If the correct pre-load is recorded remove the nut, washer, and driving flange and press the oil seal into the bore machined in the forward end of the carrier, with the knife edge of the central leather portion towards the bearing, and then replace the driving flange, washer, and nut, tighten the nut securely, and lock with the cotter pin. Check the distance between the end face of the pinion, now in the carrier, and the centre line of the differential bearings. In place of the differential assembly use a mandrel 2.884 in. in diameter, when the distance from the mandrel, measured with slip gauges, should be within the limits .8895 and .8935 in., as at (F) (Fig. 1). If this is not so, the end faces of the races are not home against the shoulders on the pinion and carrier and the shaft should be removed and the operations above repeated.

Manufacturers' Setting of the Pre-loaded Bearings

Each pair of pinion roller bearings (H) and (j) are fitted into a master carrier, and by the selection of suitable distance piece (G) the correct pre-loading of 5 to 6 lb. in. is obtained. The distance pieces are made in lengths which vary in increments of .001 in. between the dimensions 1.770 to 1.790 in., and the bearings and distance pieces are then boxed in sets for replacement use.

Assembly of Differential Case and Crown Wheel

With a smooth file remove any burrs or abrasions on the joint faces of the differential case and on the register for the crown wheel. Smear a small quantity of oil on the shafts of the differential gears and insert a gear into each half of the case.

Lightly lubricate the pinion spider and then thread on the four differential pinions with their teeth facing inwards. Insert the spider assembly into the half of the case to which is attached the



Fig. 2 Showing rear axle teeth markings

crown wheel and with the pinions engaging the gears correctly.

With the identification marks corresponding, place the two halves of the case together and engage the crown wheel with the register machined on the case to take it. Before doing so make sure that there is no dirt, burrs, or foreign matter between the faces of the wheel and case as dirt or foreign matter will throw the wheel out of truth. Bolt the crown wheel and both halves of the case together and make sure that the differential assembly rotates freely, and then lock the slotted hub with the cotter pins.

The Timken roller races should now be mounted on the spigots of the case, making sure that the smaller diameter of the inner ring faces outwards from the case.

The crown wheel and case assembly should now temporarily be mounted in the carrier. With the aid of a dial gauge check the crown wheel for true running, the permissible error being $\pm .003$ in. If the crown does not run true within this margin of error dismantle the case, repeat the assembly instructions, and then try again.

Assembly of Crown Wheel and Case Assembly to Carrier

The crown wheel assembly should be placed in the carrier with a considerable amount of backlash between the teeth. Fit the differential bearing cap bolts in position, the caps according to marks, and tighten down fully with the bolts and spring washers.

The distance between the flats machined on the bearing caps should be measured with a 5 to 6 in. micrometer, and with the spanner T115 the differential nuts should be tightened until the caps are loaded so that the distance is increased by .006 in. This increase ensures a pit-load of 5 lb. in. on the differential bearings.

The relative position of each adjusting nut and cap should be marked and the crown wheel then drawn closer in mesh with the pinion by releasing and tightening the adjusting nuts by equal amounts. The correct backlash is from .006 to .008 in. The placing of the dial gauge pointer on the teeth and oscillating the crown wheel will check the extent of the backlash present.

Confirm that the measurement between the machined flats on the bearing caps has not varied from that taken when the adjusting nuts were tight.

Replace the differential adjusting nut lock plates, secure with the bolts and spring washers, making sure that the bolts are tight and cotter-pinned.

The prongs of the lock plates must be in correct engagement with the differential adjusting nuts, and can be tapped home with a hammer if necessary.

Gear Meshing

To check for correct gear meshing a marking of the teeth should be taken, using red lead mixed with engine oil, and lightly applied to the crown wheel teeth, and the whole assembly turned in both directions by the use of the cranking handle T121.

Fig. 2 will show the correct marking required when the assembly is tested without load on a bench.

When mounted in the car the markings will travel up towards the full length of the teeth without creeping over the heel, which would, of course, produce a noisy axle.

To Complete the Assembly

Clean both the faces of the axle housing and differential assembly. Check the bolts in the housing which secure the carrier to make sure that they are firmly screwed down on their spring washers and that the nuts will screw on the bolts readily. These two points are important as attention at this stage will avoid difficulty later.

Use a new gasket between the axle casing and carrier; when replacing the carrier avoid damaging the securing bolt threads and use a spring washer under each securing nut.

Clean the joint faces of the half-shaft flanges and rear hub, replace the half-shafts, using new gaskets, refit the brake-drum and secure by means of the three countersunk screws in each, and reset the brake adjustment. Couple up the propeller shaft to the rear axle universal joint flange, making sure that the marks made when dismantling correspond.

Check all nuts for tightness and ensure that they are correctly cotter-pinned. Fill the axle with oil to the correct level.

One final word of warning.

Adjustment of the differential assembly or the fitting of new parts can easily be carried out if the facilities and special tools are available. If, however, through lack of equipment, any difficulty is anticipated, it is strongly recommended that a factory-reconditioned differential unit be fitted, which can be supplied through the M.G. Distributor Organization.

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