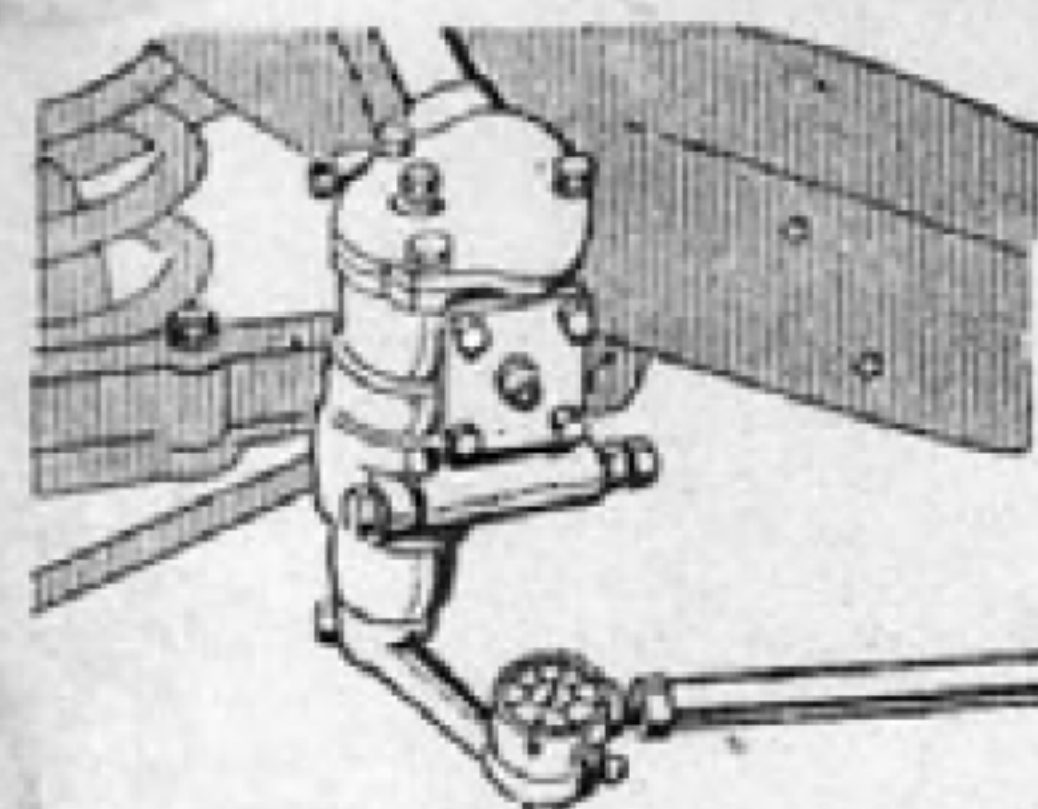


# Overhauling BISHOP CAM STEERING

● Removing drag link and drop arm, checking for rocker shaft wear, fitting new oil seals



**T**HE Bishop Cam steering-box (Fig. 1) is fitted to a wide range of popular cars, for example, most Austins, pre-war and early post-war Morris, M.G., etc. It is quite a simple box and, as spares are easily obtainable, it should present little difficulty to the owner-driver who wishes to do his own overhauls.

## THE MECHANISM

The mechanism consists of a spiral-shaped cam on the end of the inner column with a tapered peg engaging in the spiral. The peg is fixed in one end of a lever, on the other end of which is the rocker shaft carrying the drop arm. When the column is turned the peg travels up or down the spiral cam and moves the lever backwards or forwards. The rocker shaft, being carried in bushes in the body of the box, is thus turned and gives movement to the drop arm.

## DISASSEMBLY

The first step in overhauling is to remove the steering column and box assembly complete from the car. The method adopted will vary slightly from make to make, but can usually be visualised quite easily on inspection. If the horn push and trafficator switch are mounted in the centre of the steering wheel their wires pass down a stator tube in the centre of the column. This stator tube passes through the steering-box and is held at the bottom by a brass union nut and barrel-shaped olive. Disconnect the horn and trafficator wires at their snap connectors and remove the union nut. The tube can now be given a

tap up through the box and the olive will drop off the end. This will allow the oil in the box to run out, so a receptacle of some sort should be placed ready to receive it. The horn push and trafficator switch assembly can now be drawn out from the top of the steering column and placed to one side. If they are mounted on an arm at the side of the column the method of detaching them will be self-evident.

Next remove the steering-wheel. This may be held on by a central nut or by a pinch bolt and nut. Remove this and pull off the steer-

ing column, such as the horn or a bracket carrying a Bowden control for the accelerator, and then unclamp the column from the underside of the dash and remove the steering-box mounting bolts. The column is now free to be withdrawn from the car. On some makes it comes out over the top of the wing while on others the front of the car must be jacked up and the column pulled out from underneath. Some cars may require other components to be removed before the column will clear, such as the Series "E" Morris Eight, on which the

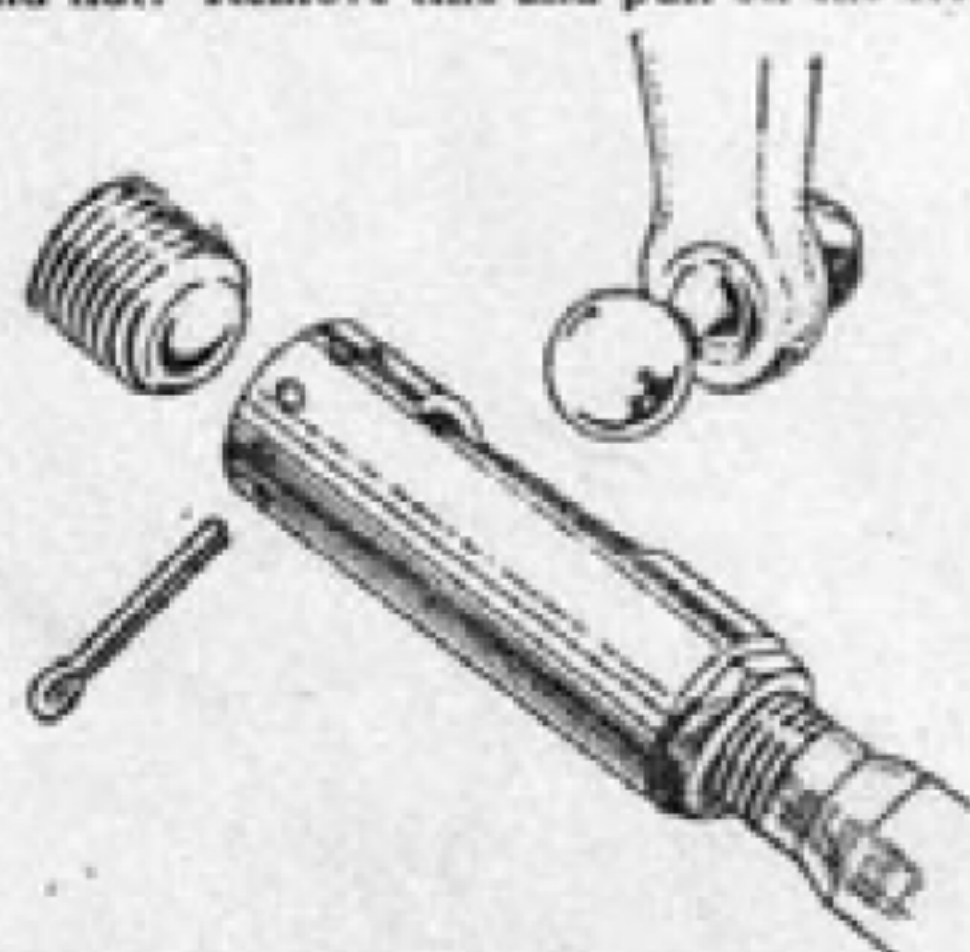


Fig. 3.—On cars fitted with adjustable drag link ends it is quicker to dismantle the joint and leave the ball pin in the drop arm.

ing-wheel, which will often yield to a few gentle blows upwards on the boss with a rawhide-faced hammer or a mallet. If this fails to move it a steering-wheel puller must be used.

## DRAG LINK

The drag link should then be disconnected from the drop arm, either by dismantling the ball joint and leaving the ball in the arm if it is a type which permits this (Fig. 3), as are those fitted to the Morris range, or by undoing the nut at the end of the ball pin and removing the joint complete. The tapered ball pin can usually be shifted by holding a block of metal on one side of the drop arm and giving the other side a few sharp blows with a hammer. This will "spring" the taper and allow the pin to come out. Alternatively, a fork-shaped wedge may be driven between the ball joint and the drag link, thus forcing the ball pin out (Fig. 4). Always drive the wedge in line with the drop arm as this will prevent the drop arm being pushed round,

which places undue strain on the internal mechanism of the steering-box. Make sure that nothing else is mounted on

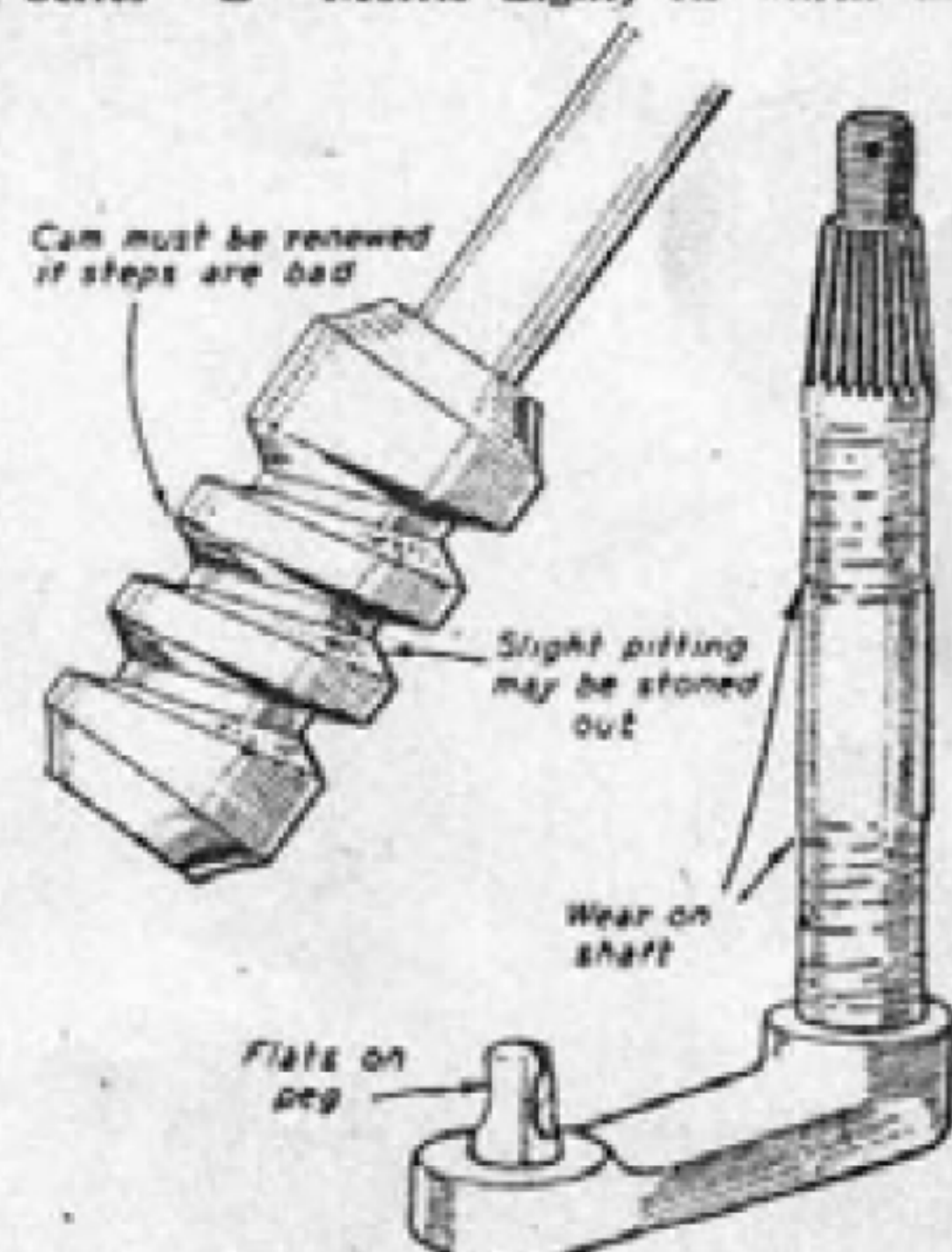


Fig. 2.—Points where wear is most likely on cam and rocker assembly.

radiator core must be drained and removed before the column will come out. This, however, is an exception and on most cars it will clear with a little twisting and easing. Having got the column out, wash it off and take it to the bench for dismantling.

## DROP ARM

The drop arm is serrated to the end of the rocker shaft and held either by a castellated nut and split pin, as on the Austin, or by a pinch bolt as on some of the Nuffield range. It may be possible to tap the drop arm off the serrations, but if not a puller must be used. On no account must the other side of the box be dismantled and the rocker shaft be driven through with the drop arm butting up against the side of the box. This will only

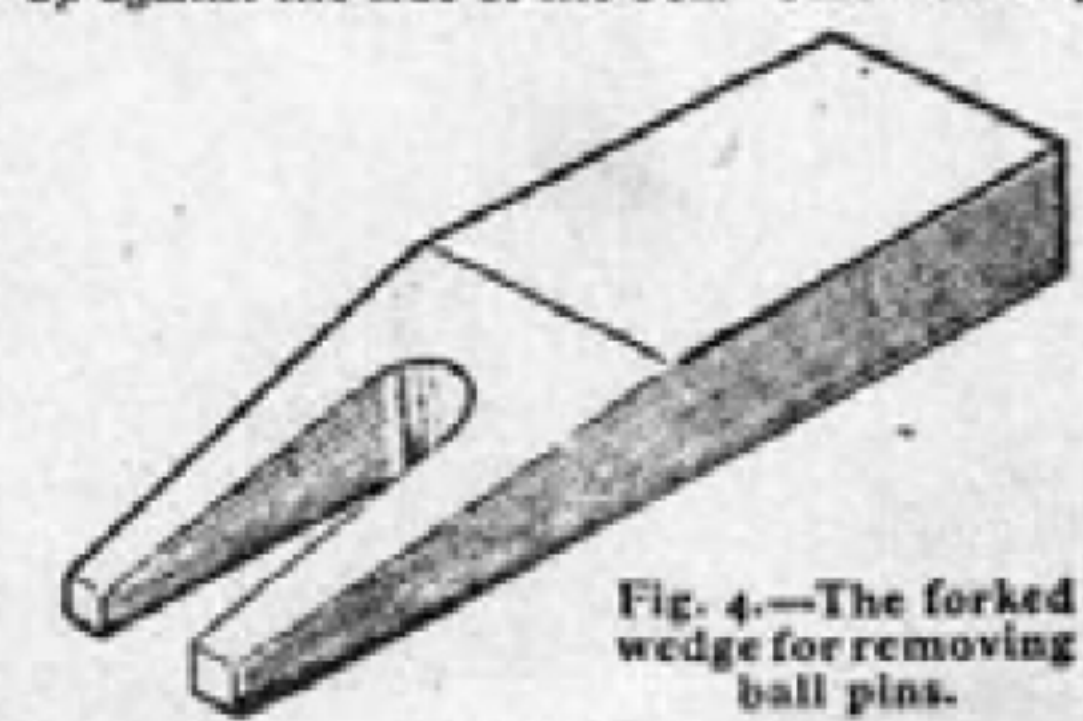


Fig. 4.—The forked wedge for removing ball pins.

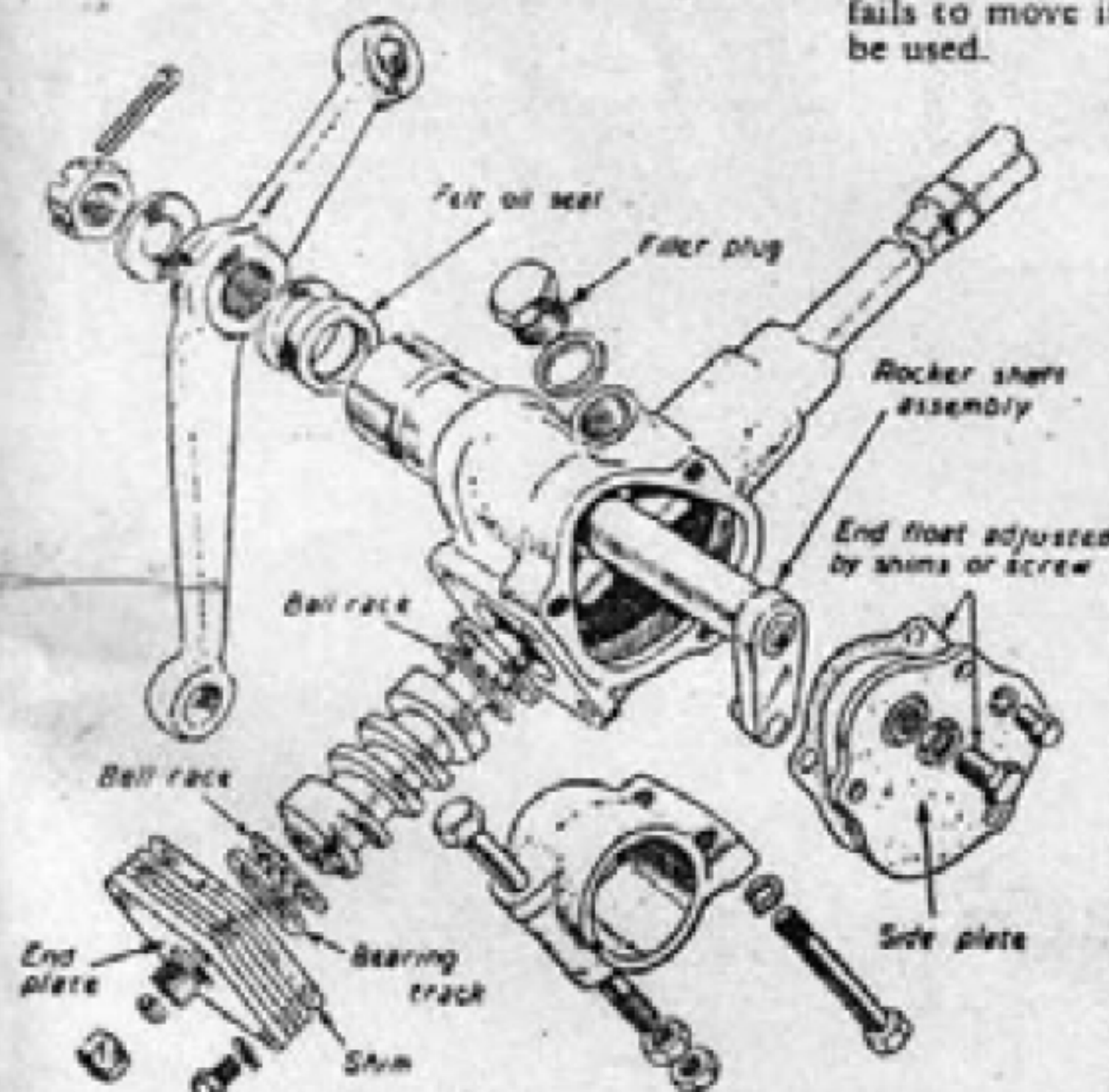


Fig. 1.—Exploded view of a Bishop Cam steering-box.



result in damage to the oil seal seating and may even split or chip the box itself. Remove the screws holding the side plate in place and remove this together with its paper gasket and shims. The lever and rocker shaft may now be withdrawn. Remove the end plate together with its gasket and shims and pull the inner column out of the bottom together with the ball thrust races. If the steering-wheel is keyed on, the key must be removed before the inner column will come out. Wash all the parts off in paraffin before inspecting for wear.

### WEAR ON ROCKER SHAFT

The most usual place for wear on the rocker shaft and lever is the small tapered peg which

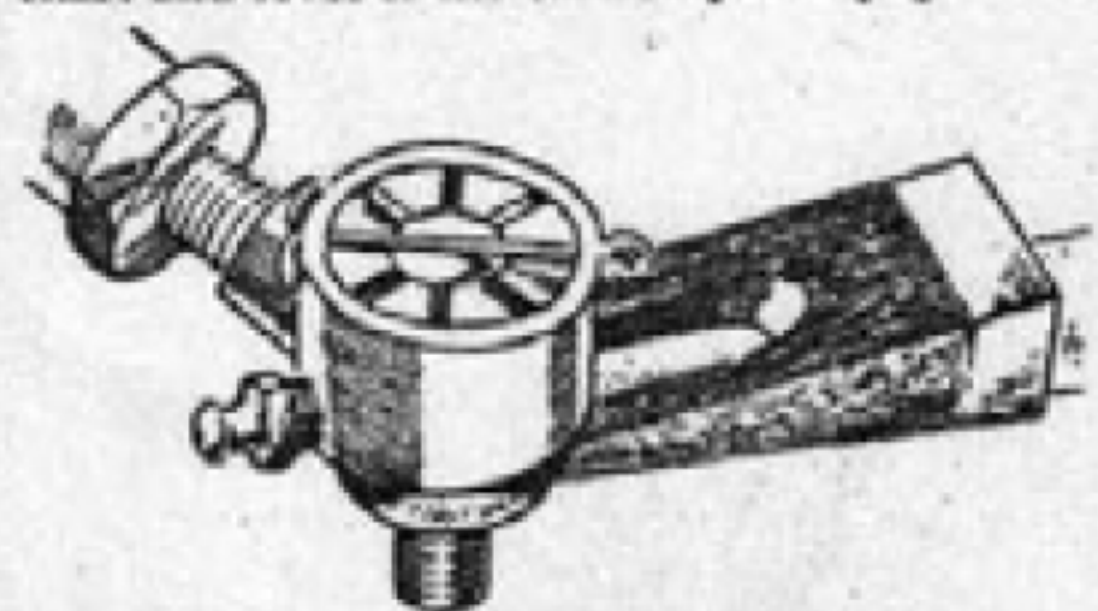


Fig. 5.—If a forked wedge is used to break the taper it should be driven in line with the drop arm to avoid forcing the rocker shaft round.

engages with the cam. This may either be carried in a bush at the end of the lever or in a small ball race, but more usually it is a tight drive fit in the end of the lever. In any case it must be removed if it shows any sign of having flats worn on it. If the shaft itself shows bad signs of wear where it passes through the box, it too must be renewed or turned down and undersize bushes fitted.

The box sometimes has bronze bushes to carry the rocker shaft and if worn these can be renewed and reamed out to fit the shaft. If the shaft bears directly in the box itself and this is badly worn it may be possible to bore out oversize and make up special bushes to fit. If the shaft is turned down at all be very careful not to turn so much that the taper holding the drop arm is affected, or the arm will butt up against the box before it is tight. However, serious wear on the shaft is comparatively rare and in the majority of cases a new peg will be all that is needed.

### INSPECTING SPIRAL GROOVE

If the spiral groove shows signs of a step or pitting it must receive attention. Slight pitting will respond to stoning with a carborundum slip but if the wear is serious the cam must be renewed. The wear is most likely to be in the centre of the cam as this is the position of the peg with the wheels in the straight-ahead position.

In no case must the tip of the peg bottom

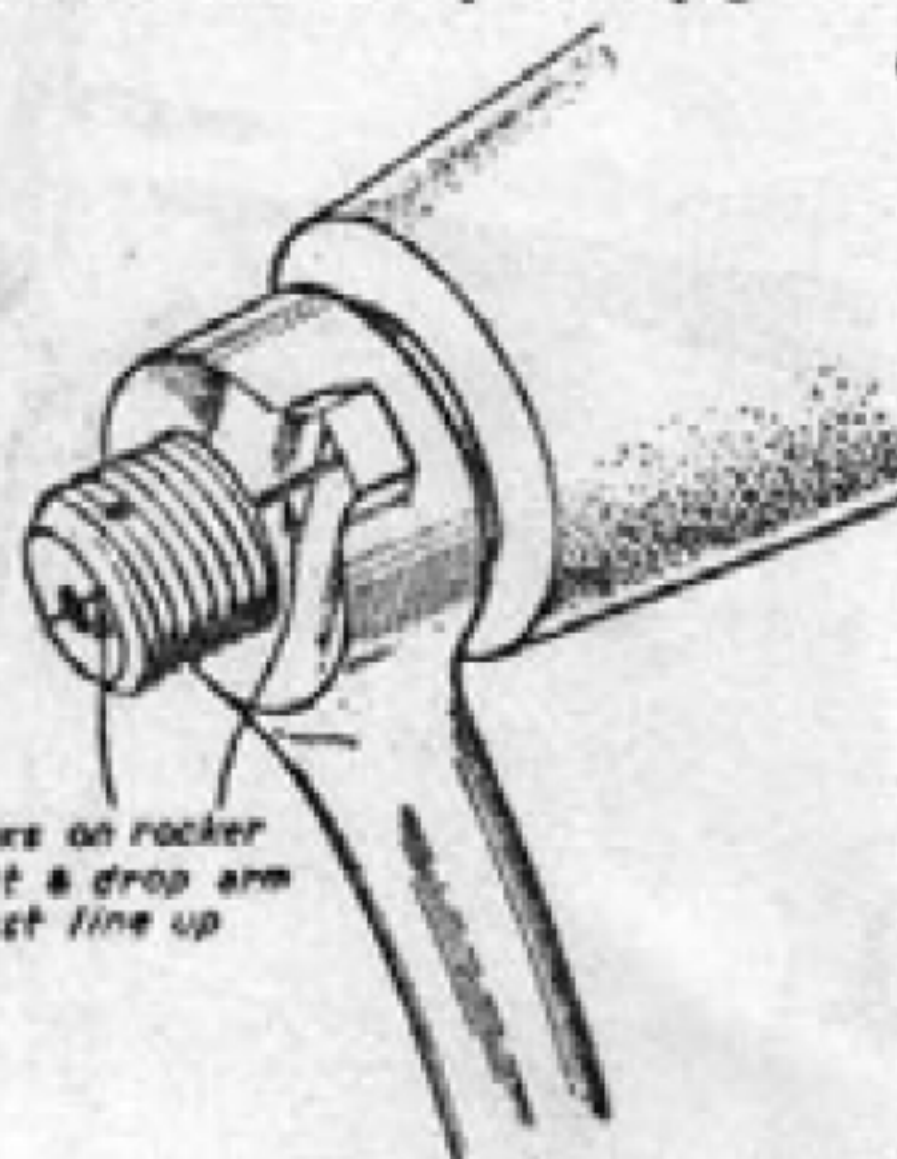


Fig. 7.—Refitting the drop arm.

on the base of the spiral or adjustment for backlash will be impossible. A new inner column and cam can usually be obtained on an exchange basis or the cam itself may be renewed. This is serrated on to the column, the end of which is swaged out to hold on the cam. To remove it bring the end of the column to a bright red heat and drive off the cam (Fig. 6). The new cam may then be driven on and the end of the shaft reheated and swaged out with a ball peen hammer. The cam must be absolutely tight on the end of the shaft. Before removing the old cam make a note of the top and bottom and ensure that the new cam goes on the same way round.

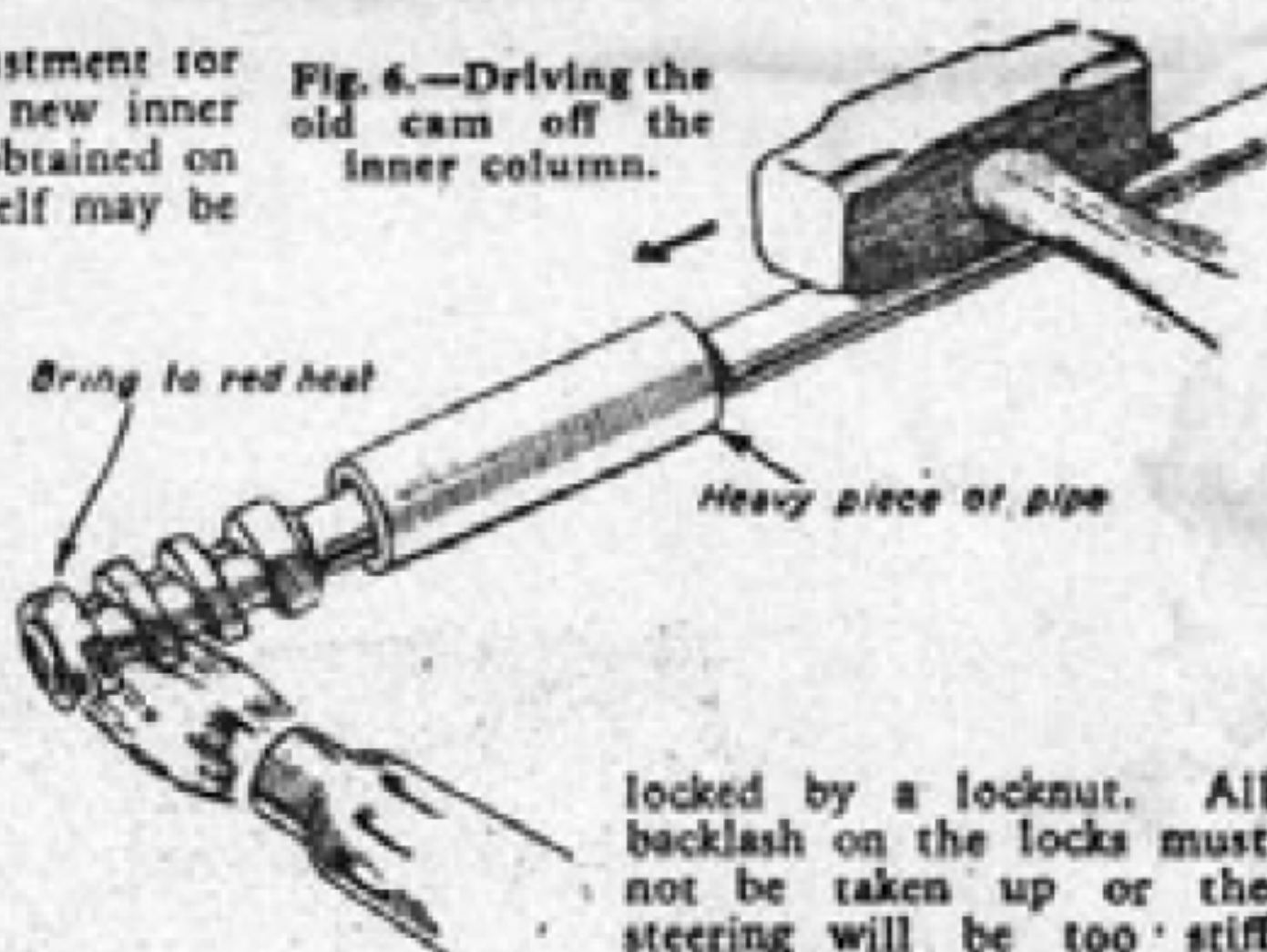
The bearings should be inspected for wear and the tracks for pitting. If these show any sign of wear they must be renewed. The upper thrust race track is a press fit in the box and may be a little awkward to remove. Immersing the box in hot water for a time will expand the housing and allow the track to be drifted out. A similar procedure can be adopted when pressing in the new one.

### REASSEMBLING THE BOX

To reassemble the box place the inner column and cam together with the bearings back in position and fit the end plate together with its shims and a new gasket. These shims control the end float of the inner column and this should be reduced to a minimum while still allowing the column to turn easily and freely.

Next put the rocker shaft back in position and engage the peg in the cam. Replace the side cover and shims and adjust these until there is no backlash in the central position. On some post-war boxes, for example those fitted to the Austin Twelve and Sixteen, shims to control the mesh were not fitted but backlash was adjusted by means of a screw bearing on the end of the rocker shaft and

Fig. 6.—Driving the old cam off the inner column.



locked by a locknut. All backlash on the locks must not be taken up or the steering will be too stiff in the straight-ahead position.

### SEALS AND WASHERS

Fit a new felt oil seal to the end of the rocker shaft and refit the drop arm, making sure that the lines scribed on it and the shaft are aligned (Fig. 7). If the wear on the rocker shaft was insufficient to warrant renewal but still enough to make it a little loose in the oil seal it is a good plan to sandwich an additional felt washer between the drop arm and the box to prevent persistent oil seepage.

Fit a new felt washer at the top of the steering column and also the steering wheel key (if fitted) and the unit is ready to replace in the car.

### REPLACEMENT

Replacing is the reverse procedure of removing and should present no difficulty. Refit the steering wheel, and horn and trafficator wires. These can best be threaded through the steering column by tying a weight on a piece of string, dropping it through the column and then pulling the wires down. Fit a new olive at the bottom of the tube, tighten the union nut, and fill the box with the recommended oil. Refit the drag link and the job is finished and ready for road test.

My Rocker with the old worn peg and the new peg fitted

