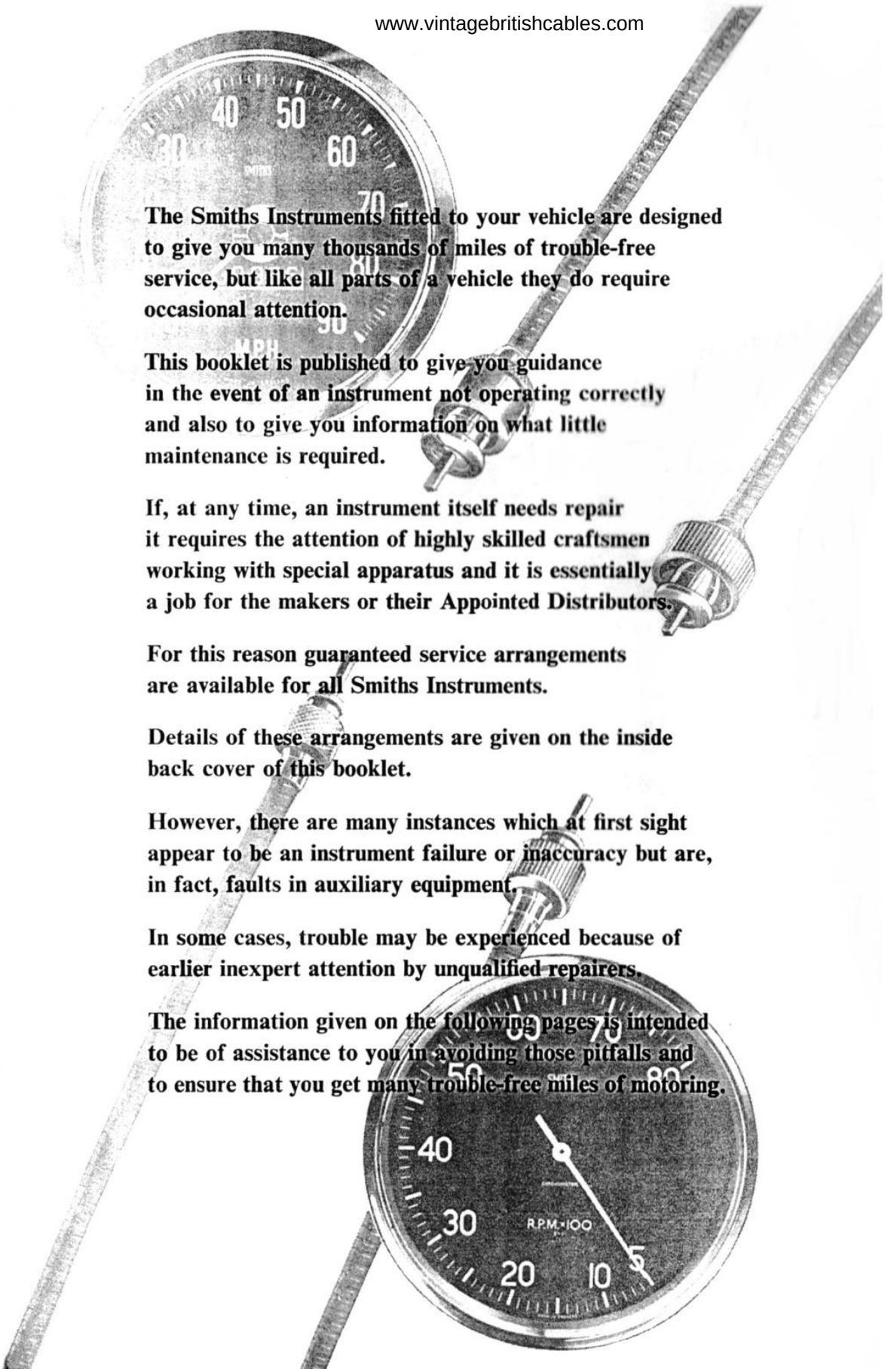
SMITHS

The Care of Instruments



The Smiths Instruments fitted to your vehicle are designed to give you many thousands of miles of trouble-free service, but like all parts of a vehicle they do require occasional attention.

This booklet is published to give you guidance in the event of an instrument not operating correctly and also to give you information on what little maintenance is required.

If, at any time, an instrument itself needs repair it requires the attention of highly skilled craftsmen working with special apparatus and it is essentially a job for the makers or their Appointed Distributors.

For this reason guaranteed service arrangements are available for all Smiths Instruments.

Details of these arrangements are given on the inside back cover of this booklet.

However, there are many instances which at first sight appear to be an instrument failure or inaccuracy but are, in fact, faults in auxiliary equipment.

In some cases, trouble may be experienced because of earlier inexpert attention by unqualified repairers.

The information given on the following pages is intended to be of assistance to you in avoiding those pitfalls and to ensure that you get many trouble-free miles of motoring.

CONTENTS PART I

FLEXIBLE DRIVES
for Speedometers and Revolution Indicators

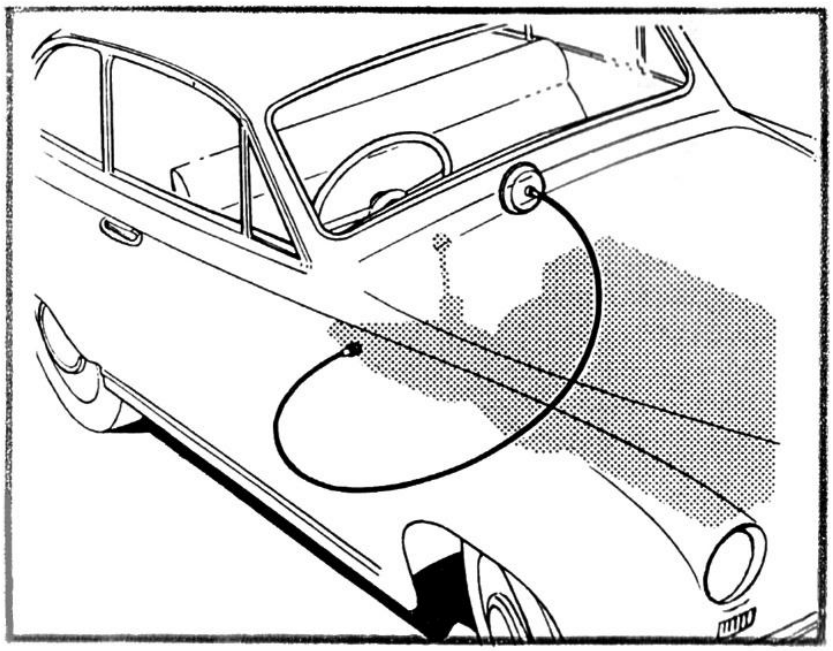
SPEEDOMETERS AND REVOLUTION INDICATORS

FLEXIBLE DRIVES

For Speedometers & Revolution Indicators

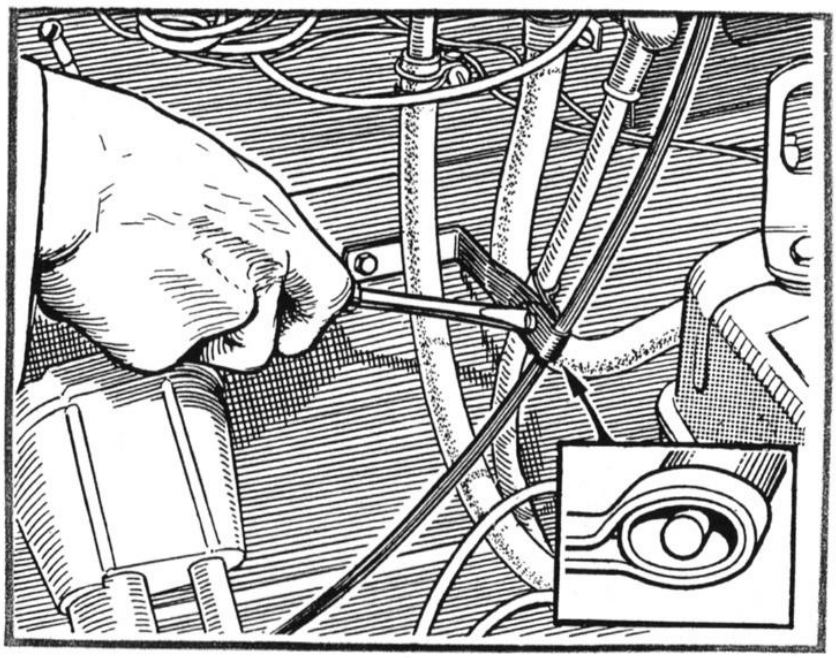
The condition of the flexible drive to a great extent controls the performance of the speedometer or revolution indicator, and poor installation or subsequent damage to the flexible drive will be shown up as an apparent instrument fault. It is, therefore, important that the flexible drive be correctly fitted and properly maintained.

The following illustrations give general information for fitting and maintaining your flexible drive. Some further points are brought out in the section dealing with speedometers and revolution indicators.



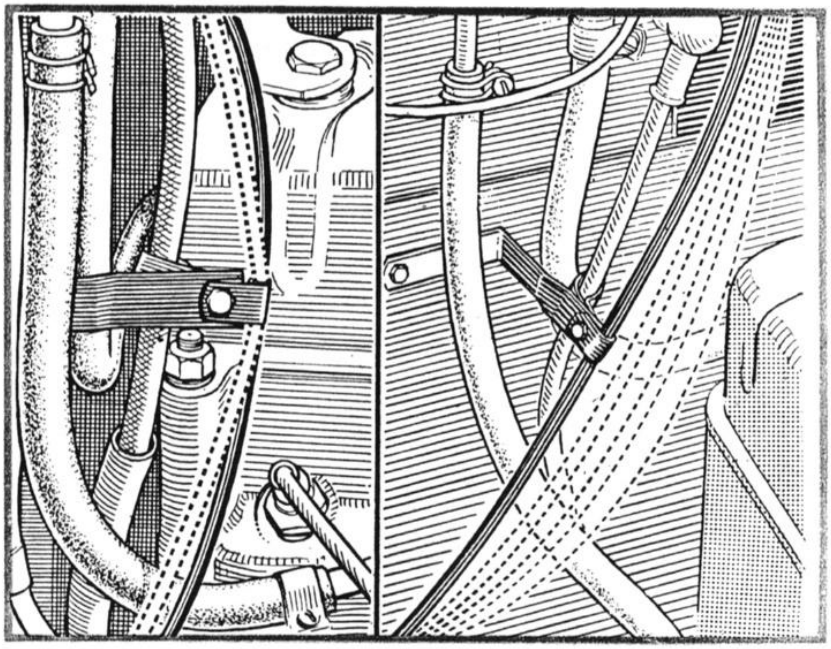
1. SMOOTH RUN

Run of flexible drive must be smooth. Minimum bend radius 6" (15 cm's.). No bend within 2" (5 cm's.) of connections.



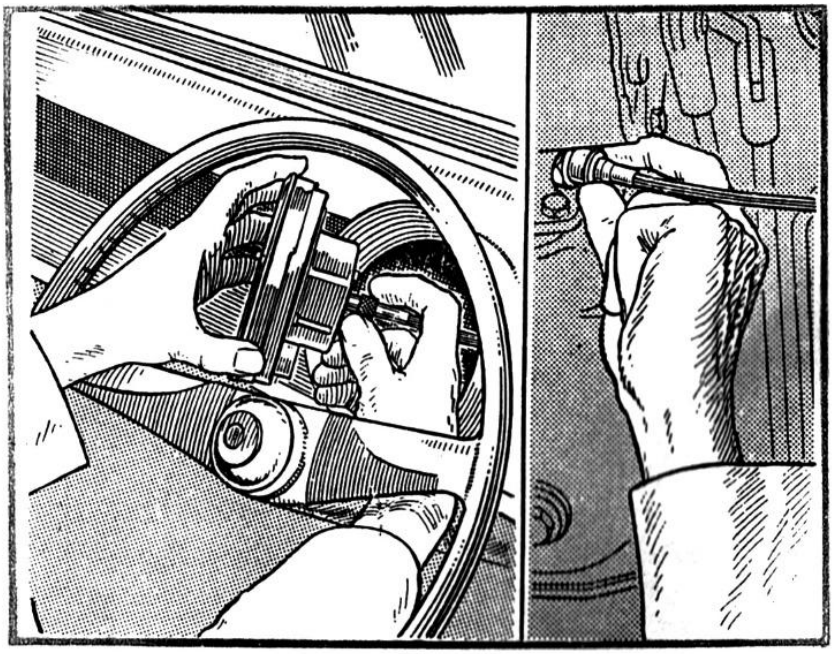
2 . SECURING

Avoid crushing flexible drive by over-tightening clip. Flex can be crushed between two moving components.



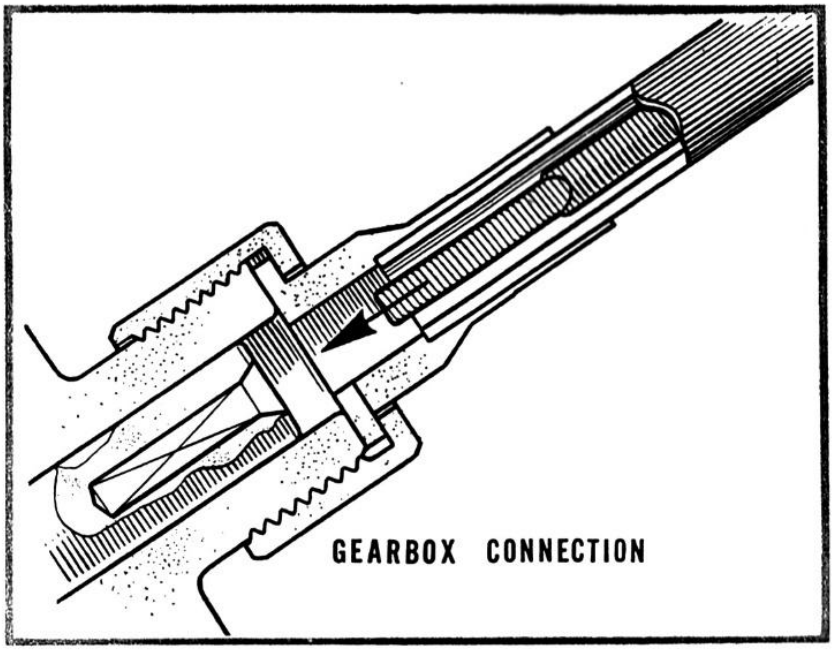
3 . SECURING

Avoid sharp bends at clips. If necessary alter position of clips. Excessive free movement of the flexible drive should be avoided. Fit extra clips if necessary.



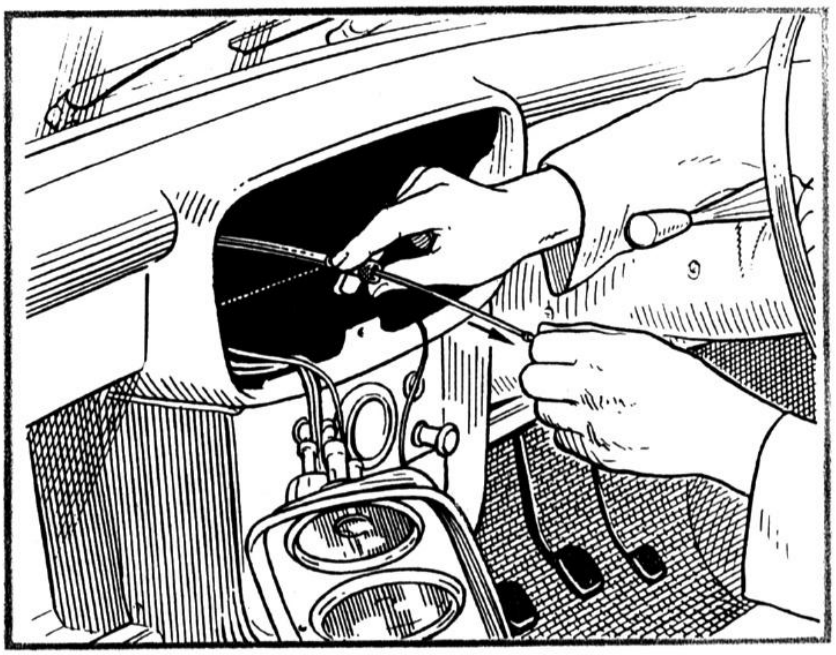
4. CONNECTION

Ensure that threaded end connections are secure with no looseness of the outer casing end collars. Connecting nuts should be tightened by hand. Spanner or pliers should not be used. It is important that the drive to which the flexible drive connects is free from dirt and grit.



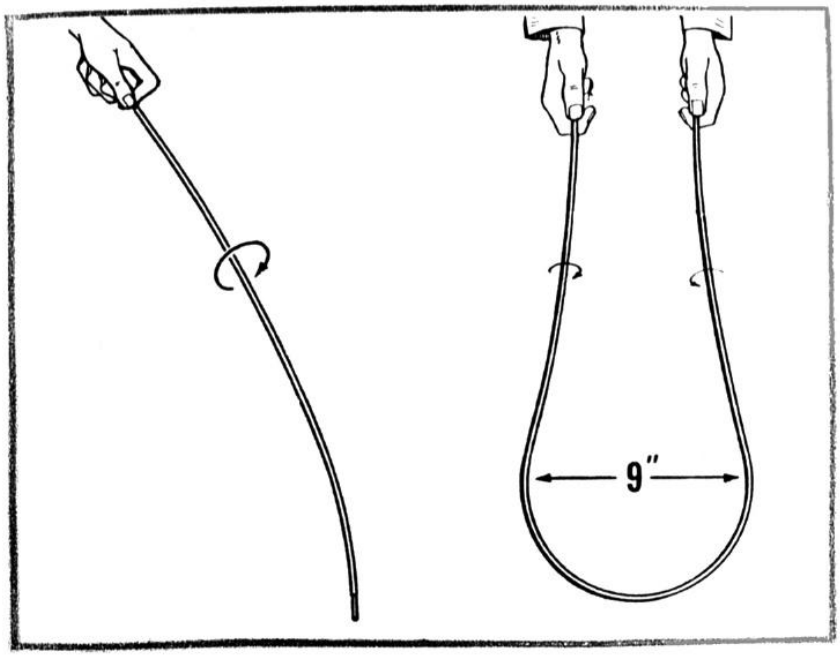
5. CONNECTION OF INNER FLEXIBLE SHAFT

Where possible, slightly withdraw inner shaft and connect outer first to point of drive. Then slide inner shaft into engagement from the other end. It may be necessary to rotate shaft.



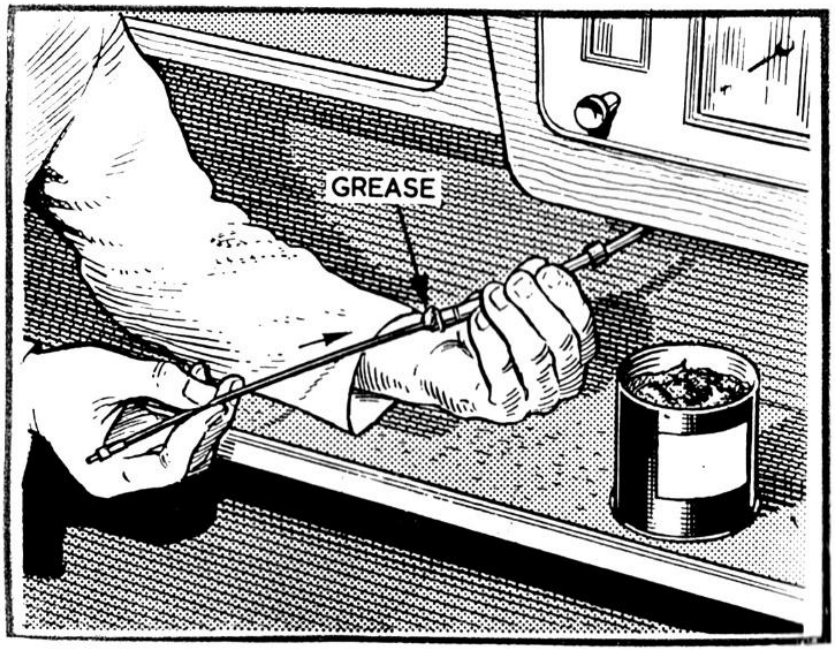
6. REMOVAL OF INNER SHAFT

Most inner shafts can be removed by disconnecting instrument end and pulling out shaft. Some must be removed from point of drive end after first taking off C washer at instrument end. Broken inner shaft will have to be withdrawn from both ends.



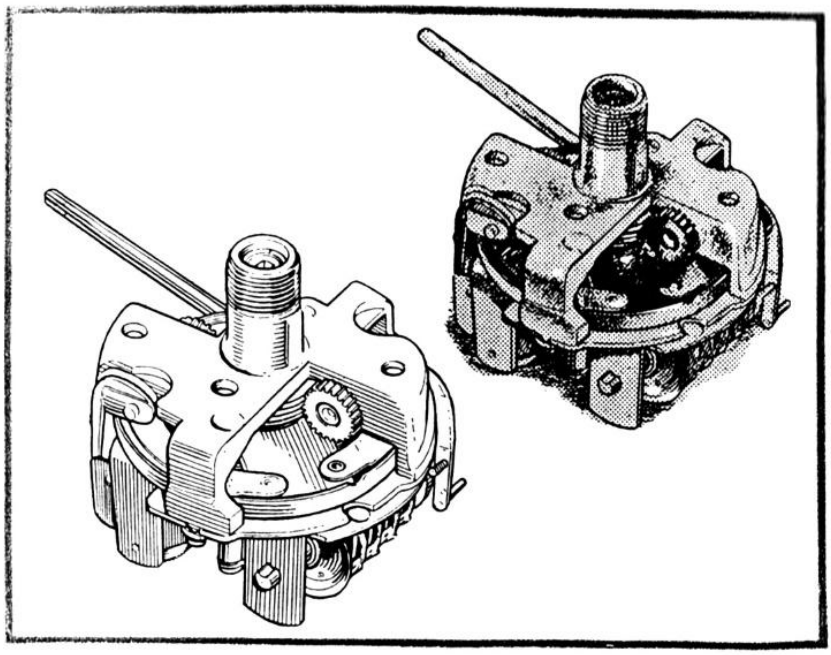
7. CHECK FOR INNER FLEXIBLE SHAFT

Lay out shaft straight on flat clean table and roll. Any 'kinks' or obvious signs of damage will be seen. Then take an end in each hand allowing shaft to hang in a loop of approximately 9" (23 cm's.) diameter. Rotate it slowly with the fingers. A satisfactory shaft will turn smoothly without 'snatch'.



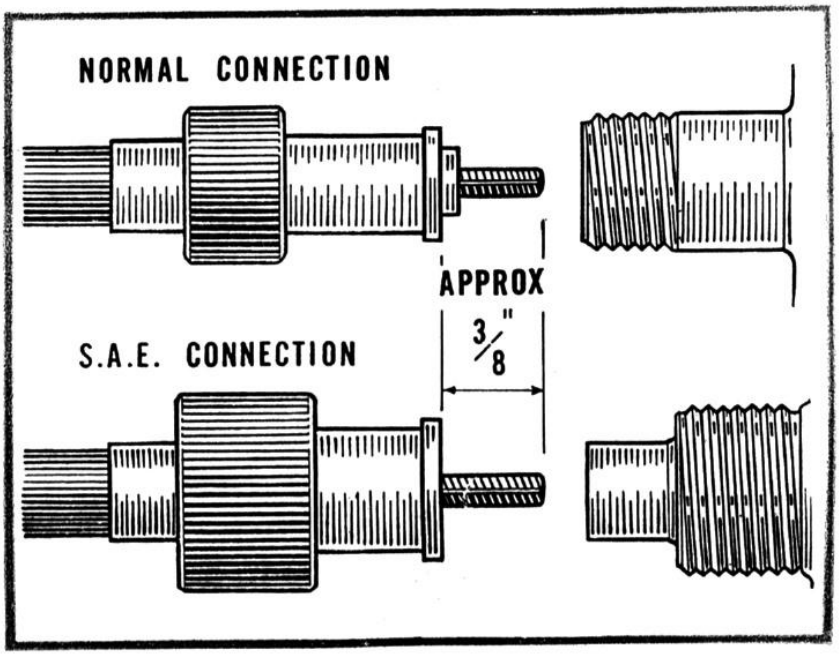
8. LUBRICATION

Examine every 10,000 miles (6,210 Km's.). Withdraw inner shaft and apply grease sparingly. Feed shaft back into its casing. Then withdraw approximately 8" (20 cm's.) and wipe off surplus grease. Use Castrol L.M. or Esso T.S.D. 119 grease or equivalent. Do NOT use oil.



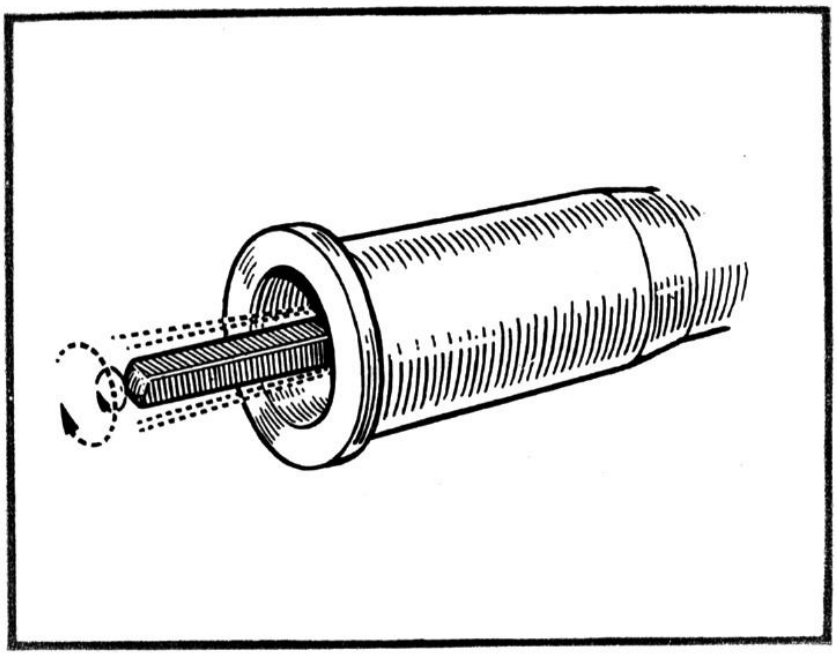
9. EXCESSIVE LUBRICATION

Avoid excessive lubrication. If oil appears in flexible drive, suspect faulty oil-seal at point of drive. Illustration shows oiled up speedometer movement.



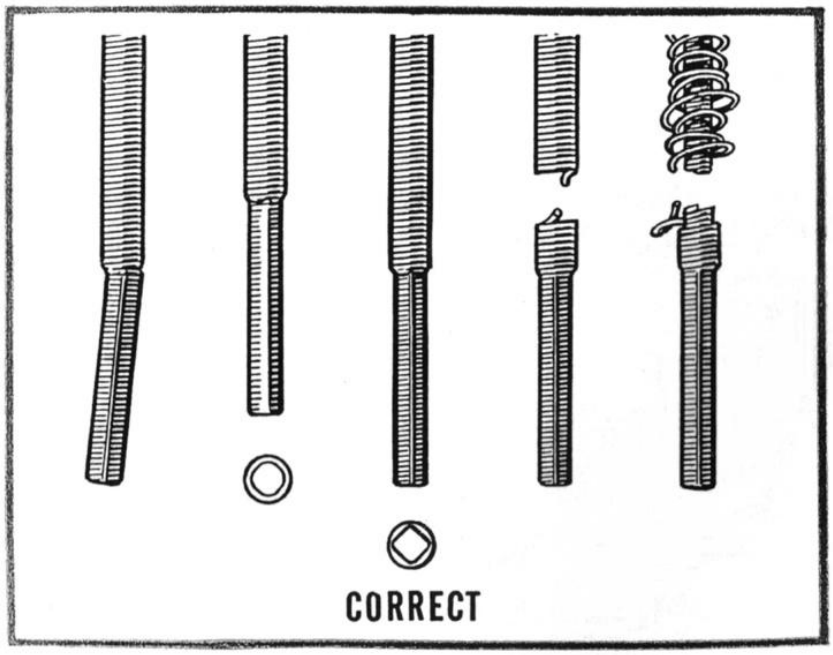
10. INNER SHAFT PROJECTION

Check that there is approximately $\frac{3}{8}$" (1 cm.) projection of inner shaft beyond outer casing at instrument end. This ensures correct engagement in instrument and point of drive.



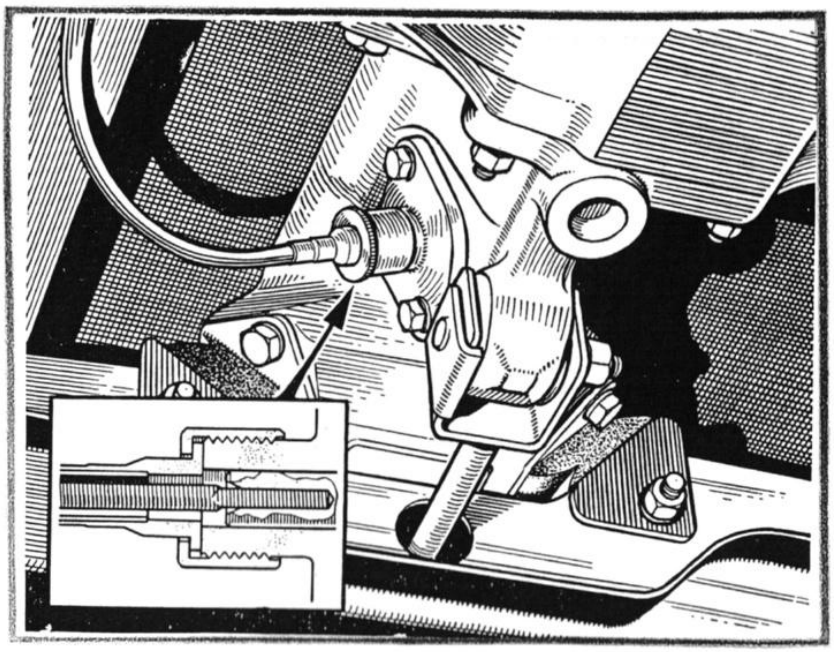
11. CONCENTRIC ROTATION

Check that inner shaft rotates concentrically when fitted in outer casing, and not eccentrically, as shown by the dotted lines.



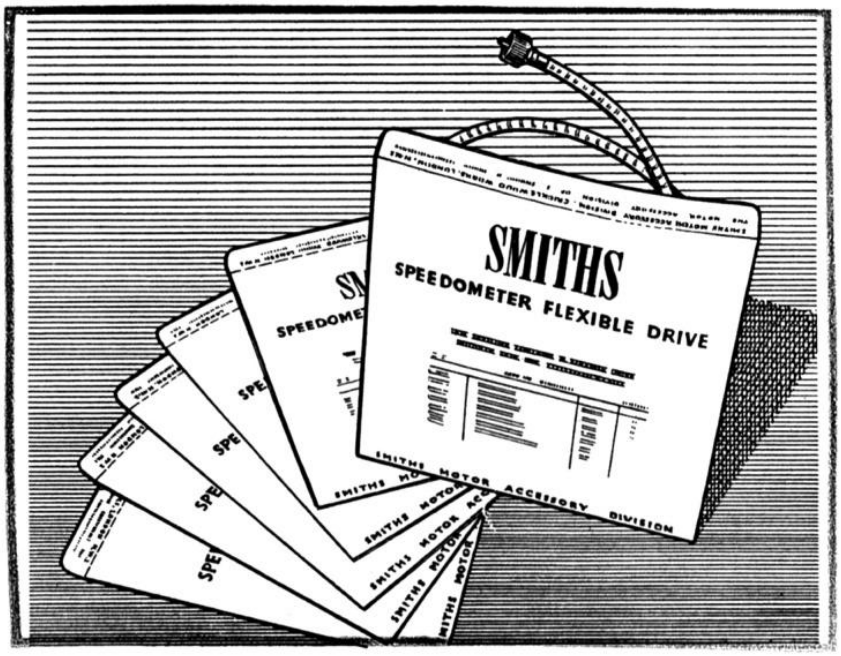
12. DAMAGED INNER SHAFT

Examine inner shaft ends for wear or other damage. Before fitting new inner shaft, ensure instrument main spindle is free.



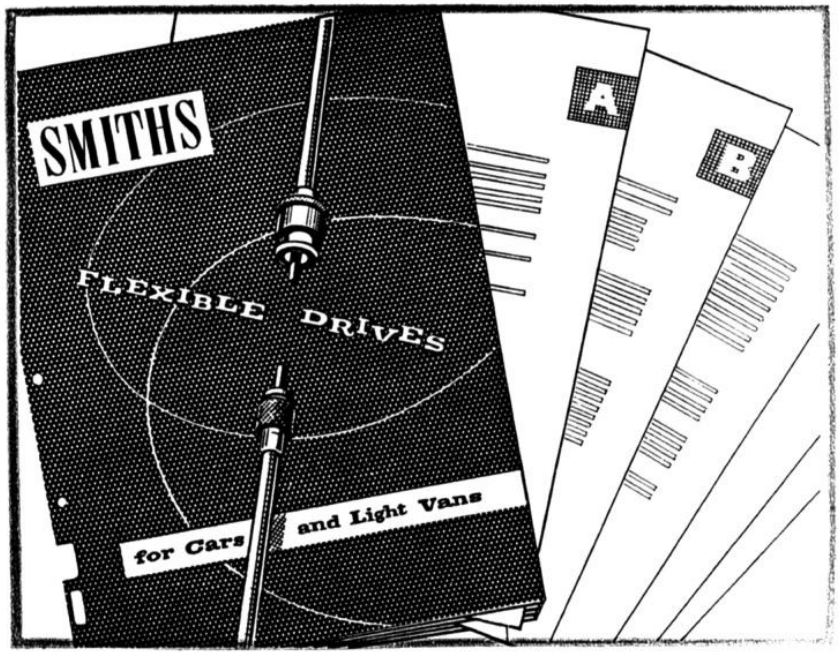
13. DAMAGED DRIVE END CONNECTIONS

Examine point of drive for dirt or possible damage. Check driving key to ensure tightness between it and its gear in gearbox.



14. FLEXIBLE DRIVE STORAGE

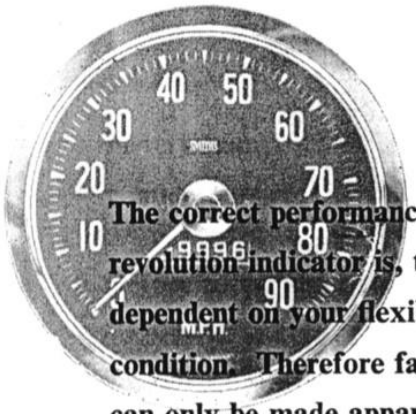
Flexible drives should remain packed as supplied until required for use. If very large stocks are involved, space can be saved by hanging up flexible drives by one end in suitable racking.



15. INSURING CORRECT DRIVE FITTED

Choose correct flexible drive from our Recommendation Booklet. When ordering, state Make, Year and Model of vehicle.
State also length of drive required when alternatives are shown in the booklet.

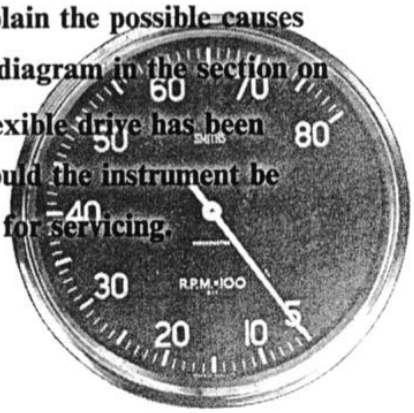
SPEEDOMETERS AND REVOLUTION INDICATORS

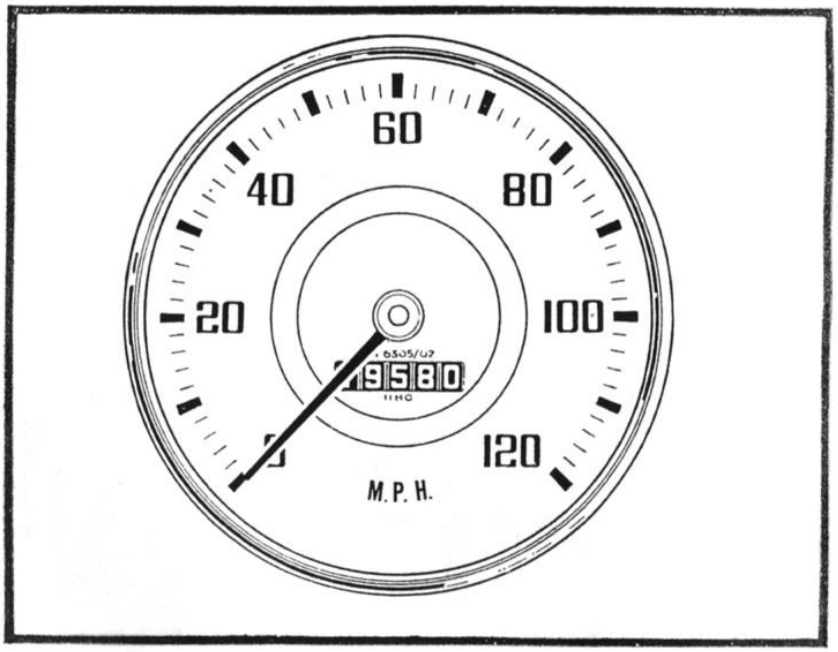


The correct performance of your speedometer or revolution indicator is, to a very large extent, dependent on your flexible drive being in the best possible condition. Therefore faults, which quite naturally can only be made apparent at the instrument, in very many instances are found to be caused by a complete or partial failure of the flexible drive.

Before returning a speedometer or revolution indicator for service under the guaranteed exchange scheme you should, therefore, make quite sure that there are no faults in the flexible drive by checking the points shown in the first section of this booklet.

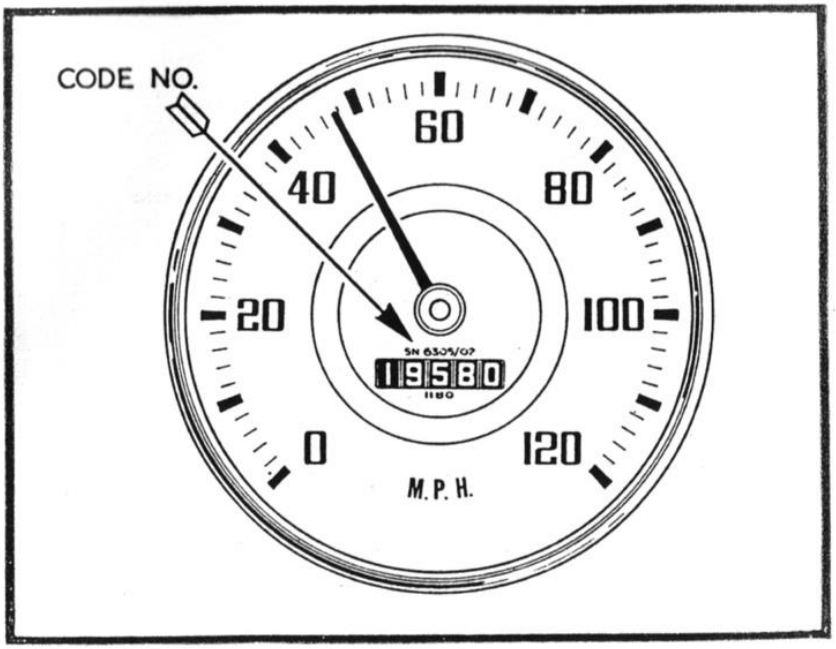
The following diagrams illustrate the failures you may experience and, in each case, explain the possible causes and refer you to the appropriate diagram in the section on flexible drives. Only after the flexible drive has been found to be in good condition should the instrument be treated as defective and returned for servicing.





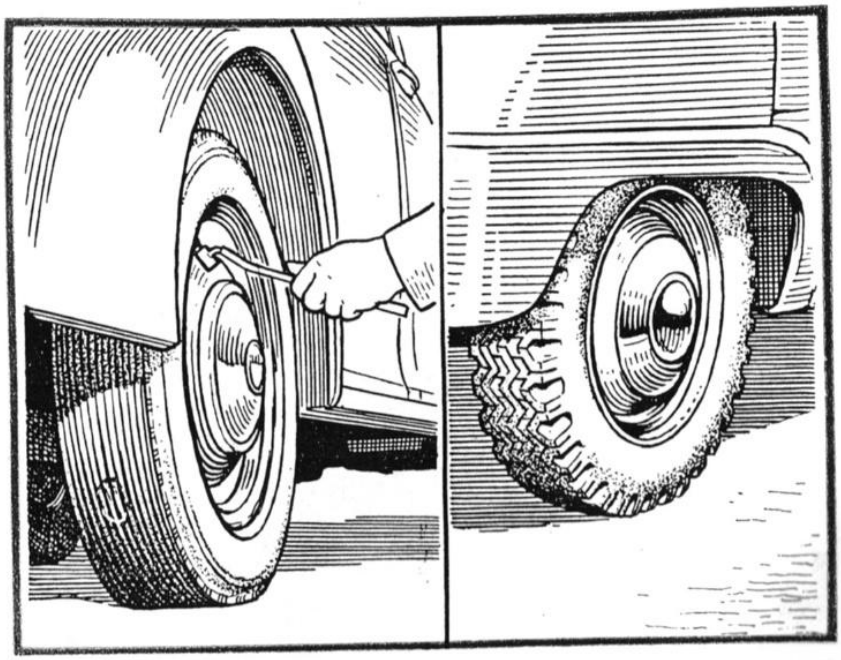
16. INSTRUMENT NOT OPERATING

Flexible drive not properly connected (see 5). Broken or damaged inner flexible shaft or fault at point of drive (see 12 and 13), in which case remove and replace inner shaft (see 6 and 8) or rectify point-of-drive fault. Insufficient engagement of inner shaft (see 10). Defective instrument—return for service.



17. INSTRUMENT INACCURATE

Incorrect speedometer or revolution indicator fitted. Check code number and refer to Smiths, or Smiths Distributor, stating make, year and model of vehicle.



18. SPEEDOMETER INACCURATE

Check tyre pressures. Inaccuracy can be caused by badly worn tyres. If non-standard tyres fitted, apply to Smiths for specially calibrated instruments.

FORMULA (MPH)

$$\frac{1680N}{R} = \text{T.P.M. No.}$$

Where N=Number of turns made by the inner shaft for 6 turns of rear wheel and R= Radius of rear wheel in inches measured from centre of hub to ground.

EXAMPLE (MPH)

Cardboard pointer on inner shaft (see 20) rotates 12½ times as vehicle is pushed forward 6 turns of rear wheel. Rear wheel radius 13". Flex turns per mile

$$= \frac{1680 \times 12.5}{13}$$

$$= 1616 \text{ T.P.M.}$$

FORMULA (KPH)

$$\frac{2653\ N}{R} = \text{T.P.K. No.}$$

Where N=Number of turns made by the inner shaft for 6 turns of rear wheel and R= Radius of rear wheel in centi-metres measured from centre of hub to ground.

EXAMPLE (KPH)

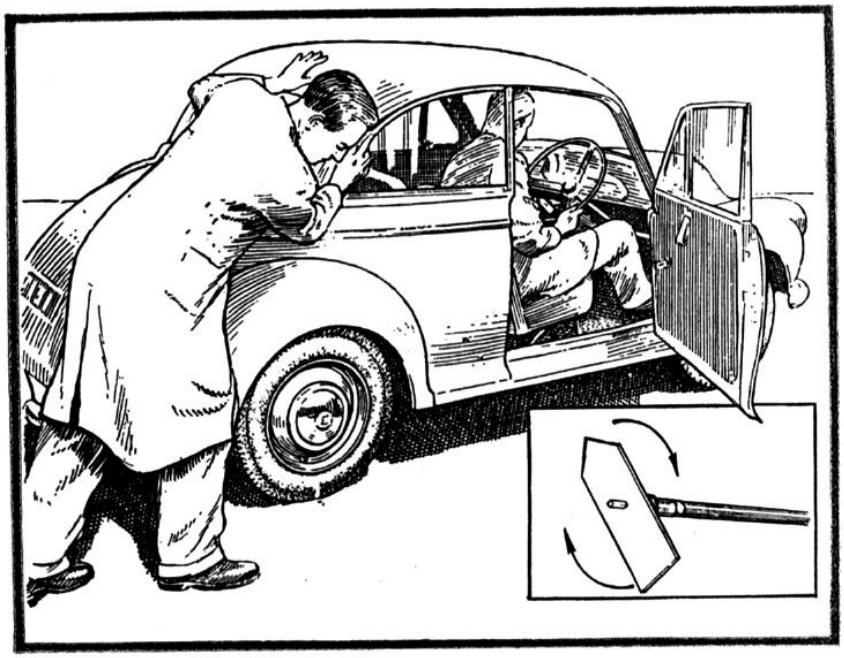
Cardboard pointer on inner shaft (see 20) rotates 12½ times as vehicle is pushed forward 6 turns of rear wheel. Rear wheel radius 33cms. Flex turns per kilometre

$$= \frac{2653 \times 12.5}{33}$$

$$= 1005 \text{ T.P.K}$$

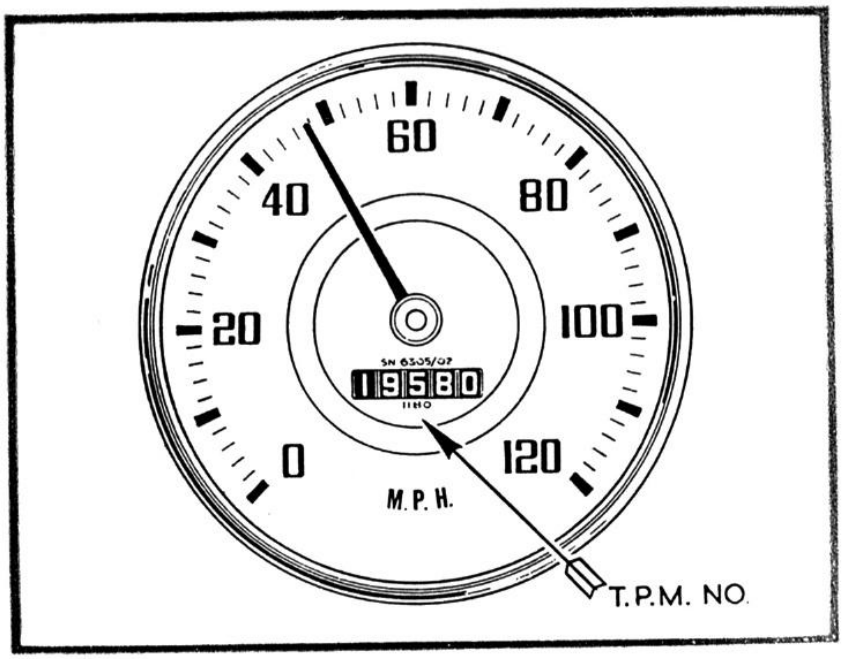
19. SPEEDOMETER INACCURATE

Rear axle ratio non-standard. Drive ratio in vehicle gearbox non-standard. A rapid, simple but approximate check is obtained by entering in the formula shown above, the figures found in the gearing test (diagram 20).



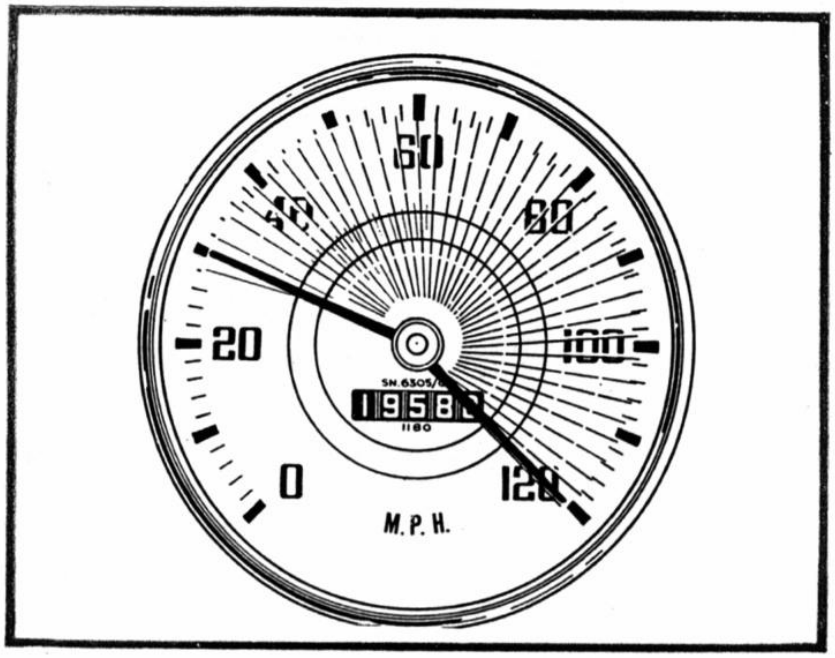
20. GEARING TEST

Disconnect flexible drive from speedometer. With gears in neutral, count number of turns of inner shaft for six turns of the rear wheels when vehicle is moved forward in a straight line. Measure rolling radius of the rear wheels with tyres at correct pressure—centre of hub to ground. Apply figures in formula (see 19).



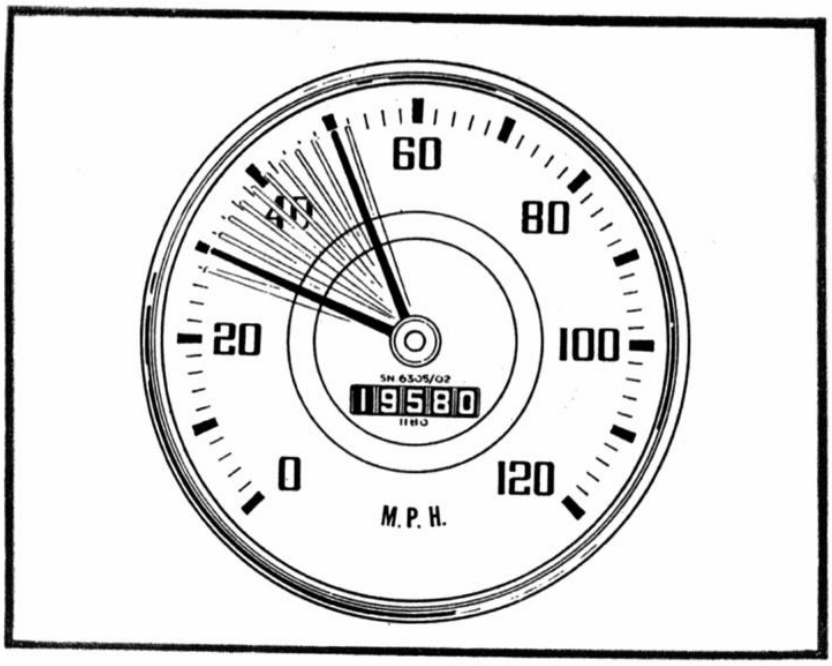
21. CORRECT SPEEDOMETER

Number shown should correspond within 32 either way with the number obtained from figs. 19 and 20. If it does not, apply to Smiths for specially calibrated instrument, giving details of test, vehicle and code number of existing speedometer.



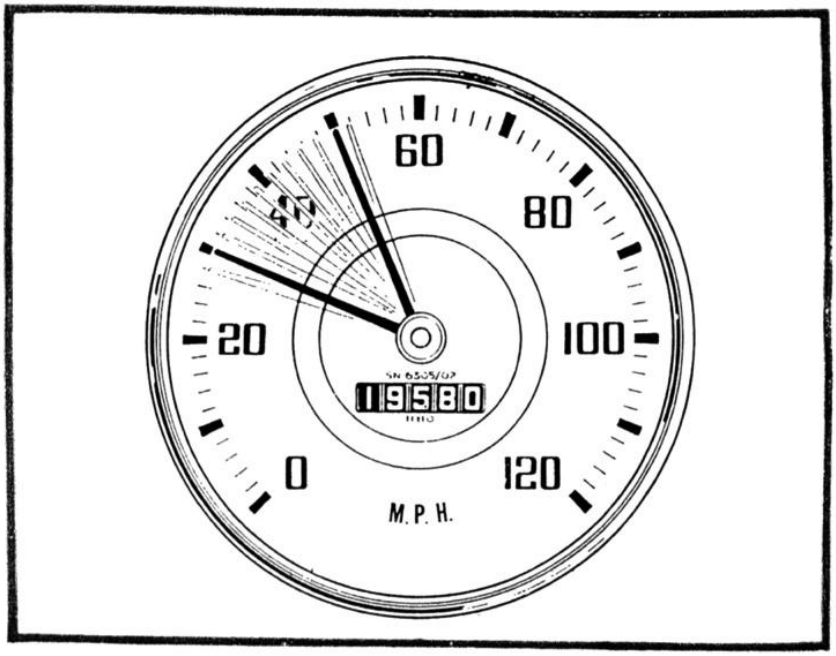
22. POINTER SWINGS OR SLUGGISH OPERATION

Oiled-up instrument. Check diagram 9. Replace oil seal if necessary; clean and lubricate flexible drive (see 8). Return instrument for replacement.



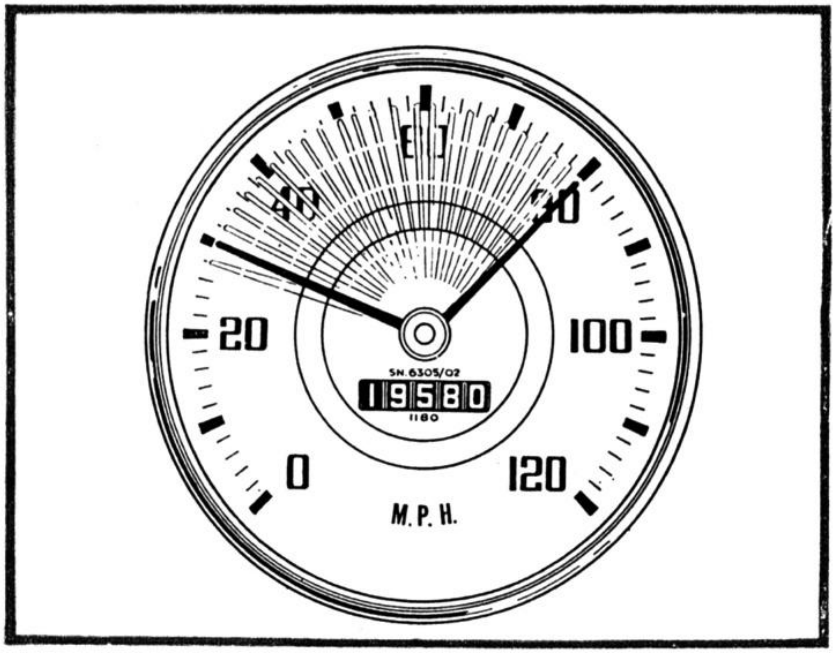
23. POINTER WAVER (INTERMITTENT)

Inner flexible shaft not engaging fully. Check 10, then try 4. Also check 12.



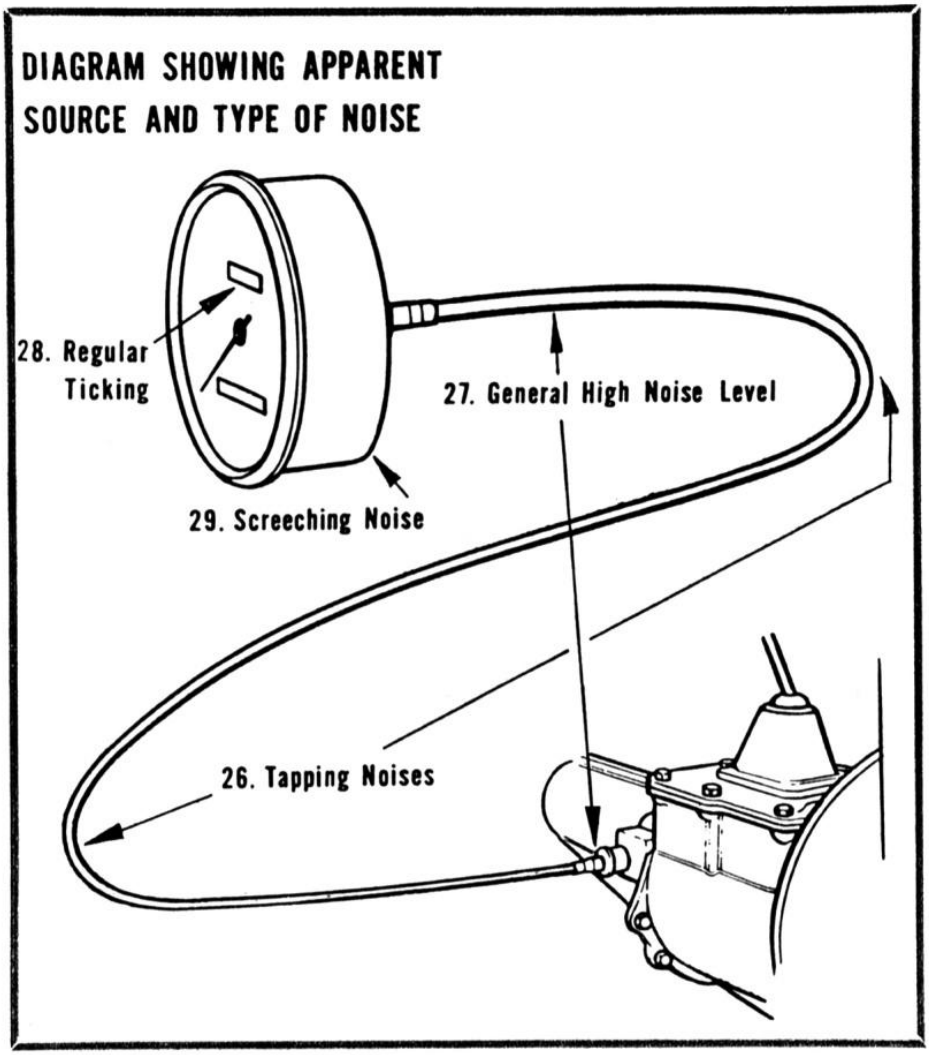
24. POINTER WAVER

Kinked or crushed flexible drive. Check 7 and 3. For withdrawal of inner shaft see 6. Bends of too small radius in flexible drive, check 1.



25. POINTER WAVER

If 22, 23 and 24 show no sign of trouble, instrument is possibly defective. Return for replacement.



26. TAPPING

Check 2, 3 and 4. Flexible drive damaged, check 7 and 12 (also see 6). Check that lubrication is adequate (8). Check 10, 11 and 13.

27. GENERAL HIGH LEVEL OF NOISE

Withdraw inner shaft (see 6) and reconnect outer casing only. If noise continues at lower level then source of noise is in vehicle point of drive. Fitting P.V.C. covered flexible drive with nylon bush on inner shaft may assist in overcoming this trouble. If it does not, refer to vehicle manufacturer.

28. PERIODIC TICK INCREASING WITH SPEED

Excessive regular ticking in time with speedometer decimal distance counter Return instrument for replacement.

29. 'SCREECH' (MORE PREVALENT IN COLD WEATHER)

Return instrument for replacement.

CONTENTS PART 2

GAUGES

FUEL GAUGES

OIL GAUGES AND PRESSURE SWITCH

TEMPERATURE GAUGE (MECHANICAL)

ELECTRIC TEMPERATURE INDICATOR (SEMI-CONDUCTOR)

ELECTRIC TEMPERATURE INDICATOR (THERMAL)

CLOCKS

ELECTRIC CAR CLOCKS

GAUGES AND CLOCKS

FUEL GAUGES

The automobile fuel gauge consists of two parts—the fuel gauge itself mounted in the dashboard, and a tank unit in the fuel tank. These items are connected by a lead which is often vulnerable to corrosive or abrasive action (see fig. 31.).

The fuel gauge indicates the level of fuel in the tank in accordance with the position of the tank unit float. There is a limited reserve of fuel left when the gauge shows "Empty".

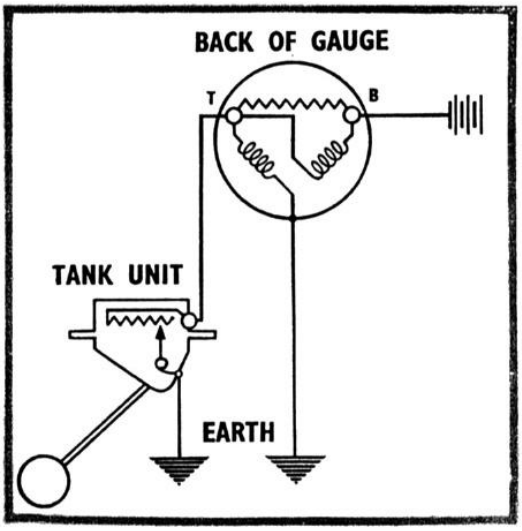
Before investigating this equipment:

Always disconnect battery.

Never connect battery direct to 'T' terminals, as this will burn out the gauge.

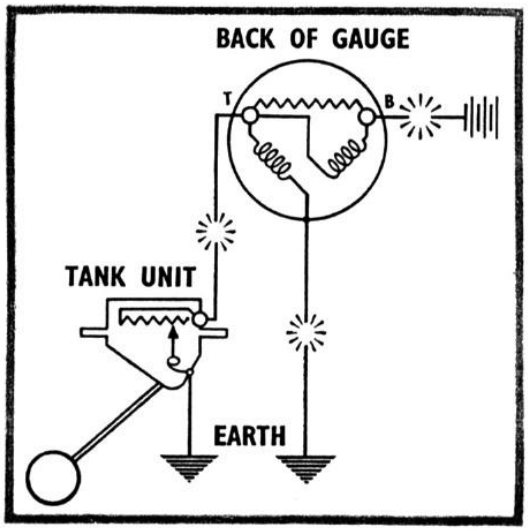
30. CIRCUIT DIAGRAM

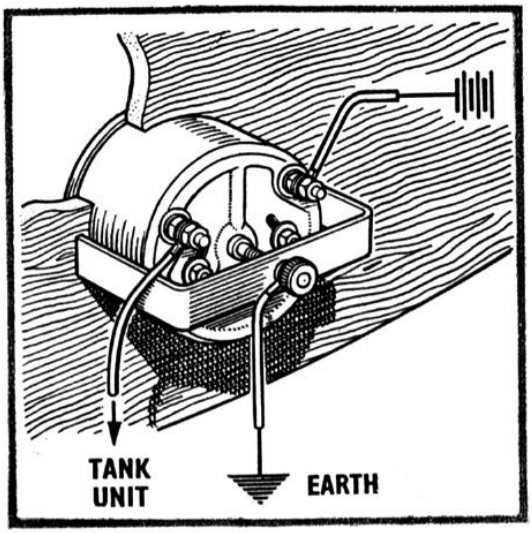
The fuel gauge and tank unit are connected as in the circuit diagram. 'Earth' is the vehicle frame.



31. NO READING OR 'EMPTY' WITH FULL TANK

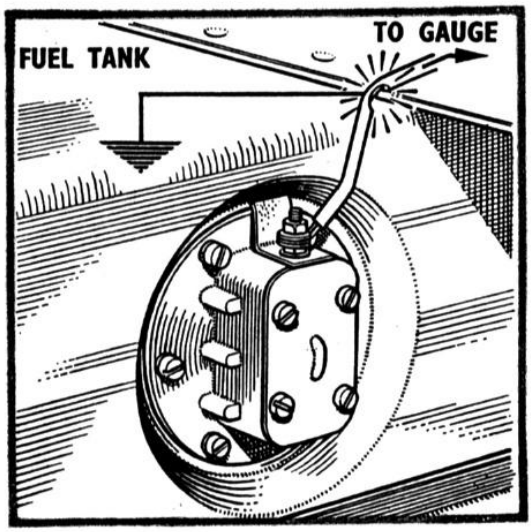
Check for broken or disconnected leads. Ensure that gasket is in place between tank unit flange and tank. Reconnect as circuit diagram, fig. 30.





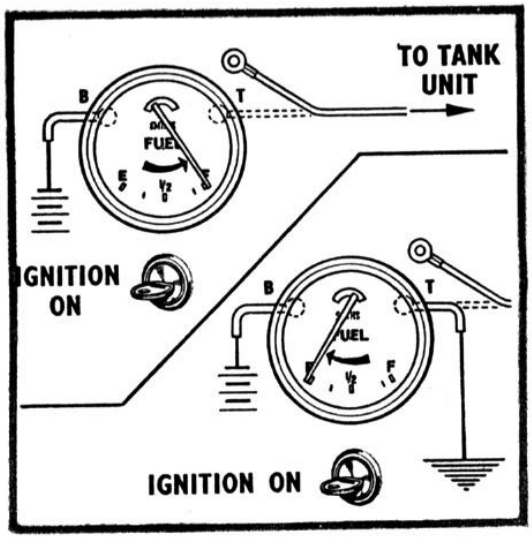
32. NO READING OR 'EMPTY'

Check Fuel Gauge 'Earth'. (Particularly important where panel is wooden.)



33. NO READING OR 'EMPTY'

Check lead to tank unit short-circuited to 'Earth'. To re-connect see fig. 30.



34. FUEL GAUGE TEST

(i) Disconnect 'T' terminal. Reconnect battery. Switch on ignition. Gauge should read 'Full'.

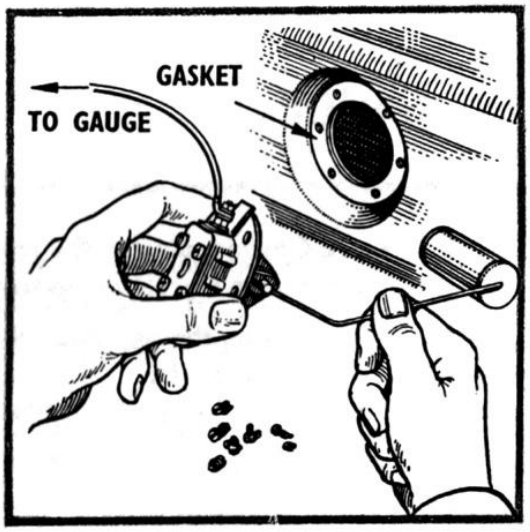
(ii) With 'T' terminal still disconnected, earth 'T' terminal Gauge should read 'Empty'.

35. TANK UNIT TEST *(a)*

(i) Ensure petrol is below level of Tank Unit.

(ii) Remove Tank Unit from tank by undoing six screws and carefully lifting out. Arm should not be bent other than as supplied.

(iii) Check that arm works freely.



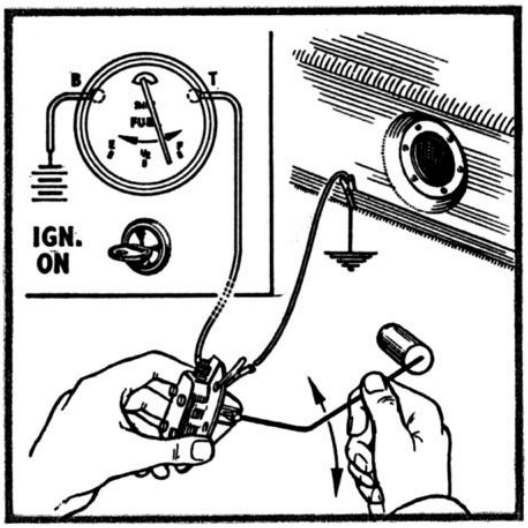
36. TANK UNIT TEST *(b)*

(i) Connect Tank Unit terminal to 'T' terminal of Fuel Gauge already tested (see 32).

(ii) Connect Tank Unit body to 'Earth'.

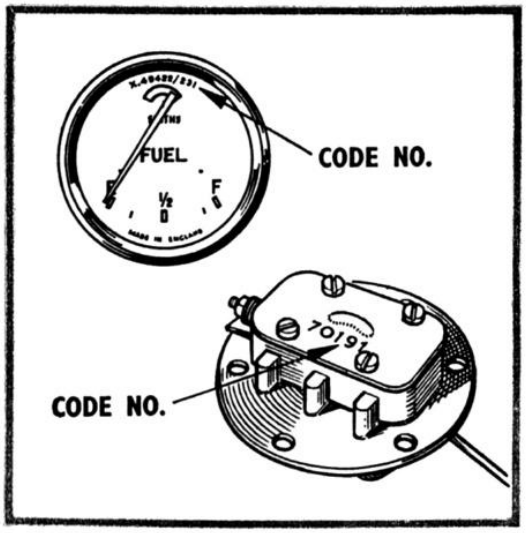
(iii) Reconnect battery.

(iv) Switch on ignition. Fuel Gauge should show relative position of float arm. If Fuel Gauge shows 'Full' only, Tank Unit is defective. Return for replacement.



37. RECOGNITION GUIDE

Where inaccurate readings are suspected, it may be that an incorrect fuel gauge or tank unit has been fitted. This can be checked by noting the code number which appears on the dial of the gauge and the top plate of the tank unit, and referring to Smiths.



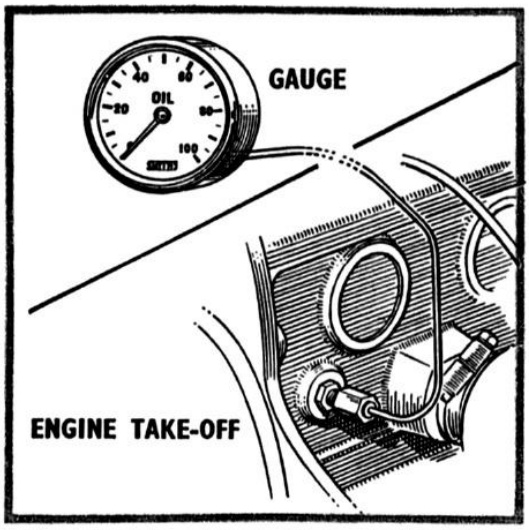
OIL GAUGE OR WARNING LAMP

The Oil Pressure Gauge indicates the pressure of the oil circulating in the engine lubrication system.

The instrument works on the bourdon tube or diaphragm principle and is accurate to close limits.

The Oil Pressure Switch is fitted in the lubrication system and is connected electrically to a warning lamp on the dashboard.

The lamp lights when the oil pressure drops to the minimum safe working level.



38. NO READING

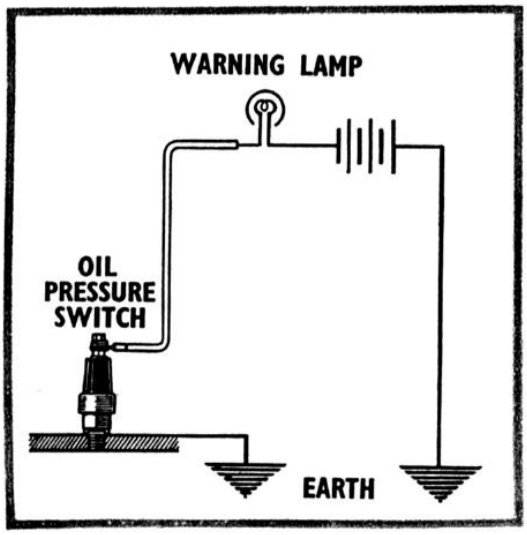
(i) Check sump level.

(ii) Turn engine by hand and check that oil appears at gauge end of the pipe. (This applies also when a new gauge is fitted.)

(iii) Check oil pipe from engine to gauge is clear by blowing air through.

(iv) Ensure gauge hole connection is clear.

(v) Check engine oil pressure release valve works correctly.



39. OIL PRESSURE SWITCH

The Oil Pressure Switch is connected to a Warning Lamp on the dashboard. If lamp fails to go out check 38 (i) and (v). Check wiring. Ensure that Pressure Switch orifice is not blocked.

TEMPERATURE GAUGE (MECHANICAL)

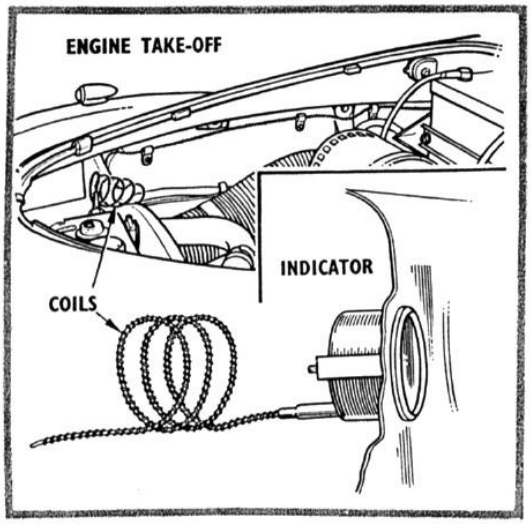
The instrument consists of a Gauge in the panel and a Temperature Sensitive Bulb in the cooling or oil system, the two parts being connected by a capillary tube.

The whole system contains a volatile liquid and is sealed throughout.

NO attempt should be made to remove the bulb or gauge from the capillary.

40. INSTALLATION DIAGRAM

The tubing should have no sharp bends, should be kept clear of the exhaust system and be arranged to include three 2″ (5 cm's) coils adjacent to both the bulb and the gauge. Check that the bulb is fully immersed in coolant or oil. Check for broken capillary.



41. HOT WATER TEST

To test Temperature Gauge, drain coolant or oil to below level of bulb. Remove bulb and place in boiling water. Gauge should read 100°C or 212°F. If not, return complete instrument for replacement.

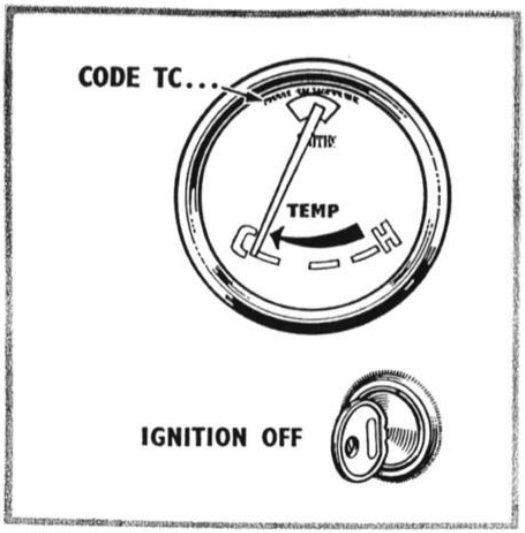
TEMPERATURE INDICATOR (SEMI-CONDUCTOR)

This type of temperature gauge consists of two parts—the Indicator mounted in the dashboard, and a Temperature Sensitive Transmitter in the cooling system.

The two parts are connected by a wire lead which is often vulnerable to corrosive or abrasive attack.

The performance of the Semi-conductor Temperature Gauge depends on the correct functioning of the transmitter, and often an apparent fault in the indicator can be traced to the transmitter.

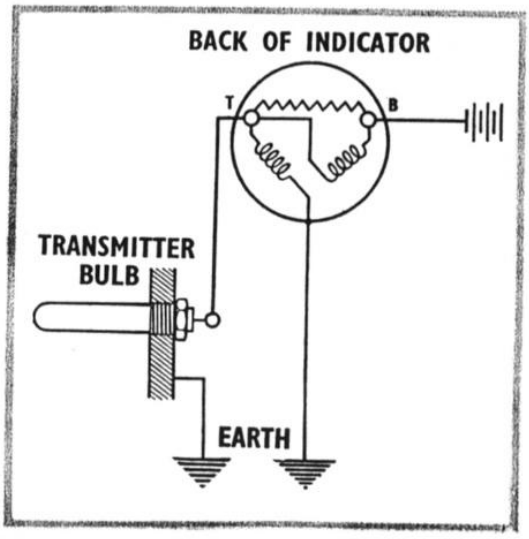
CAUTION.
Always disconnect the battery before examining indicator or transmitter bulb.



42. RECOGNITION

This type of instrument is identified by the fact that when the ignition is switched off, the pointer drops instantly to 'Cold'.

The code number always has the prefix 'TC'.



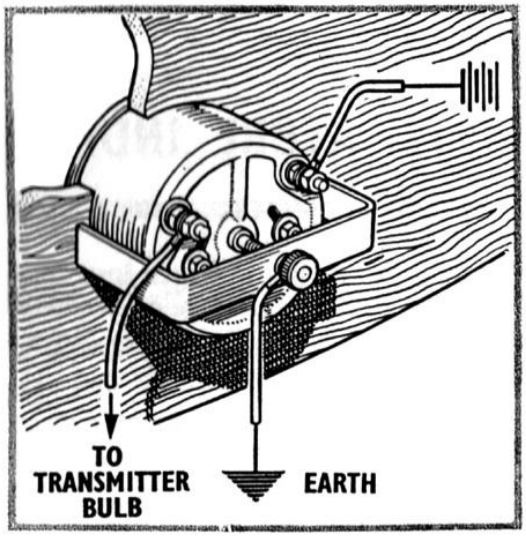
43. CORRECT CIRCUIT CONNECTION

Indicator and Transmitter are connected as shown in the circuit diagram. *Never* connect battery direct to 'T' terminals, as this will burn out the indicator.

'Earth' is vehicle frame.

44. NO READING

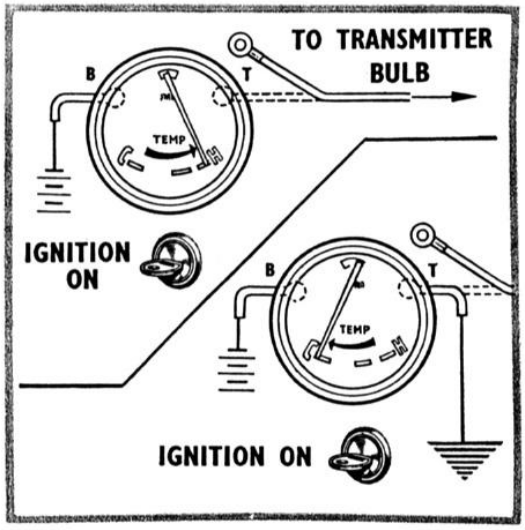
Check for broken or disconnected leads. To reconnect see fig. 43. Check Indicator 'Earth'. Particularly important where panel is wooden.



45. TEMPERATURE INDICATOR TEST

(i) Disconnect 'T' terminal. Reconnect battery. Switch on ignition. Indicator should read 'Hot'.

(ii) With 'T' terminal still disconnected, earth 'T' terminal. Indicator should now read 'Cold'.



46. TRANSMITTER TEST

Ensure coolant or oil is below level of Transmitter. Remove Transmitter from cooling or oil system. Connect transmitter terminal to 'T' terminal of checked indicator (see 45). Connect body of Transmitter to 'Earth'. Reconnect battery. Switch on ignition. Place transmitter in boiling water. Indicator should show 'Hot'.

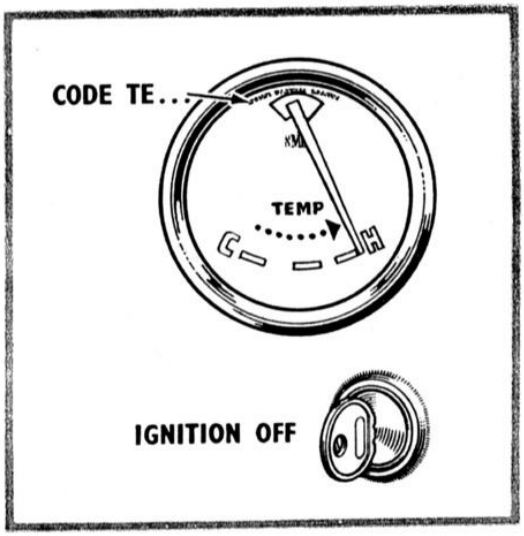
TEMPERATURE INDICATOR (THERMAL TYPE)

This is an electrically operated instrument consisting of an Indicator in the dashboard and a Transmitter bulb in the cooling system.

The two parts are connected by a wire lead which is often vulnerable to corrosive or abrasive attack.

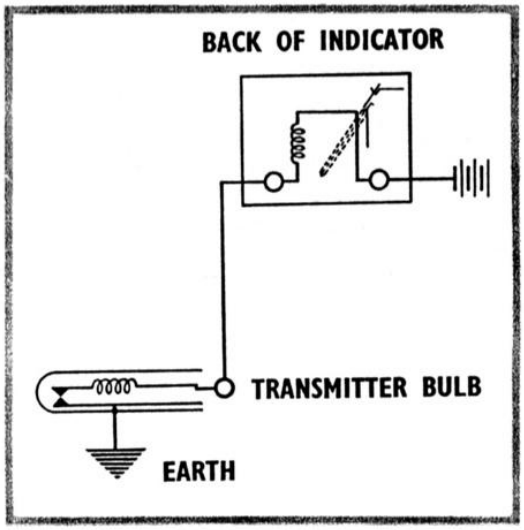
If errors are suspected, it may be that an incorrect Indicator or Transmitter has been fitted.

This can be checked by referring the code numbers of the parts to Smiths.



47. RECOGNITION

This type of instrument is identified by the fact that when the ignition is switched off, the pointer rises slowly to 'Hot'. Code number always has prefix 'TE'.



48. CIRCUIT DIAGRAM

Indicator and Transmitter should be connected as shown. If any error occurs in readings, check for broken or disconnected leads. Before returning either component for service, check performance of transmitter with checked Indicator and vice-versa, so that only faulty part is returned.

ELECTRIC CAR CLOCKS

Electric Car Clocks operate from the battery and use very little current. Timekeeping is independent of normal voltage variations, but if the voltage is abnormally high or low, some effect will be noticed.

Lead to clock should run from A1 or A2 terminal on common terminal block.

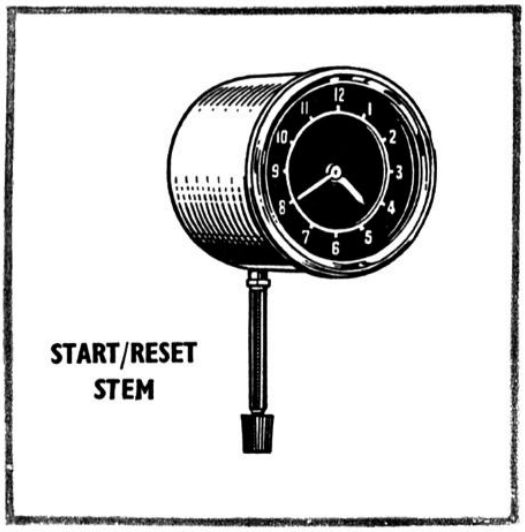
It should be remembered that over long periods even small gains or losses will add up to a substantial error.

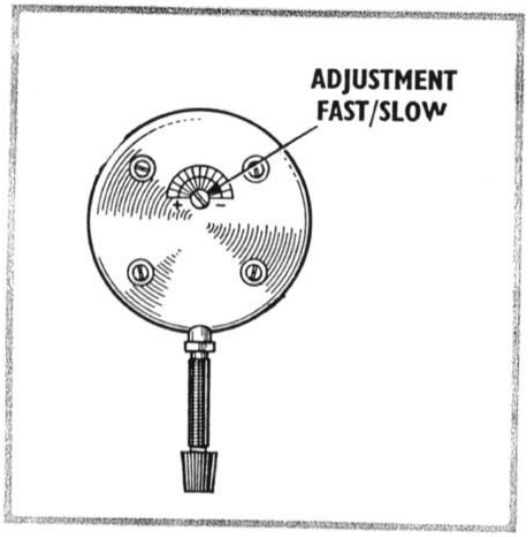
The clocks are not self-starting, but will restart when the reset stem is pushed in and released.

CAUTION.
Always disconnect battery before investigating electric clock or wiring.

49. STARTING AND HAND SETTING

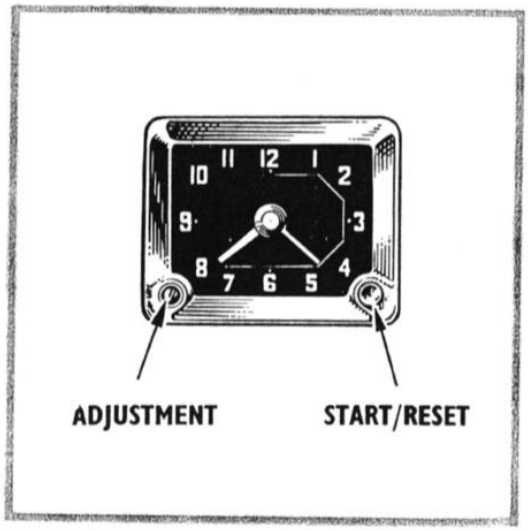
The electric clock is started by pushing in the stem and releasing it again. The hands are set by pushing in the stem and turning.





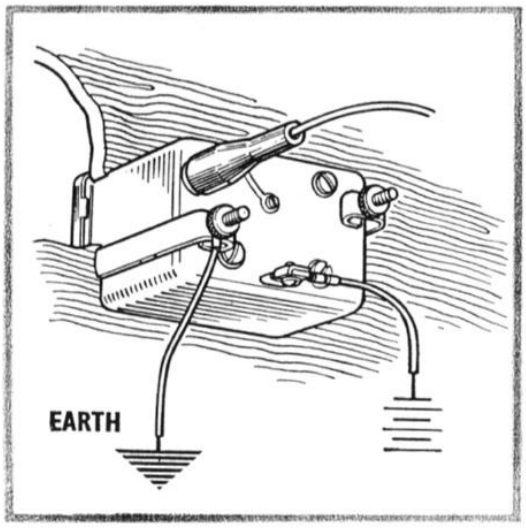
50. REGULATION

Regulation of timing is effected by turning the adjustment towards minus if the clock is gaining, or towards plus if losing.



51. FRONT SETTING CLOCKS

These clocks are conveniently arranged so that all adjustments can be effected from the front. To start clock, push in right hand button and release. To set hands, push in right hand button and turn. To regulate, turn screw head on left hand side, see also fig. 50.



52. WIRING

For satisfactory operation a good 'Earth' is essential, and where the clock is mounted in a non-metallic panel an earth connection will be necessary from the clock case to the vehicle chassis. If the clock stops and fails to restart when the reset is operated, the wiring should be checked for breaks before the clock is returned for replacement.

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The products manufactured by the above Companies are guaranteed against defects arising from faulty material or workmanship, subject to the instrument not having suffered from maltreatment, interference or neglect.

SERVICE ARRANGEMENTS

In the event of repairs or replacements being required, the instrument should be forwarded to the Smiths Service Dealer, and if sent by post a separate covering letter will be required giving full particulars of the instrument returned.

In the case of Guarantee Claims it will also be necessary to give the following particulars:—

1 Make of car/cycle.
2 Model and year.
3 Chassis/frame number.
4 Date of purchase new.
5 Through whom purchased.
6 Full details of trouble.

SMITHS MOTOR ACCESSORY DIVISION
CRICKLEWOOD WORKS, LONDON, N.W.2
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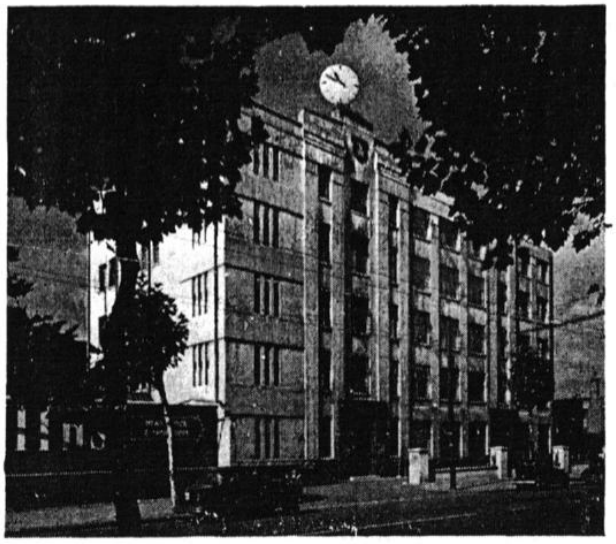

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The motor industry's demand for Smiths accessories is immense and this demand is adequately met by the vast production resources of Motor Accessory Division. Renowned for their excellent design and workmanship, Smiths instruments and accessories are giving distinguished service and playing an essential and a stylish part on countless thousands of cars throughout the world.

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