SMITHS F.R.U. EXCHANGE SCHEME

HOW THE F.R.U. SCHEME OPERATES

The Smiths F.R.U. Scheme operates throughout the United Kingdom and is intended to ensure speedy replacement of any Smiths Industries Limited and British Jaeger instruments and equipment.

Smiths Factory Replacement Units are supplied in exchange against the return of the complete original unit to Smiths Industries Limited Motor Accessory Division, Service Dept. Oxgate Lane, London NW2, or to any Smiths Depot or Approved F.R.U. Stockist. Where required, the replacement unit may be supplied in advance of the return of the original unit, thus enabling the removal and re-installation to be carried out at the same time. This latter facility applies to instruments and equipment from most vehicles manufactured in the last 5 years.

To ensure prompt attention and speedy service, it is important that the following information should be supplied in respect of each transaction.

SERVICE IN ADVANCE & ADVANCE REPLACEMENTS UNDER GUARANTEE

The order should be marked in bold letters—"Service in Advance" or "Service in Advance Under Guarantee".

1. **Description of unit (e.g. Speedometer-type, trip or non-trip, etc.).**
2. **Symptoms of failure.**
3. **Make, year, model and date of commission of vehicle.**
4. **Chassis or frame number of vehicle or motor cycle.**
5. **Where unit was not original equipment on the vehicle, the date of purchase should be stated, together with the name and address of the supplier.**

EXCHANGE SCHEME *The order should be marked in bold letters—"Supply F.R.U."*

1. **Description of unit (e.g. Speedometer-type, trip or non-trip, etc.).**
2. **Symptoms of failure.**
3. **Make, year and model of vehicle.**

CLAIM UNDER GUARANTEE

The order should be marked in bold letters—"Supply Under Guarantee".

1. **Description of unit (e.g. Speedometer-type, trip or non-trip, etc.).**
2. **Symptoms of failure.**
3. **Make, year and model of vehicle and date of commission.**
4. **Chassis or frame number of vehicle or motor cycle.**
5. **If not original equipment on the vehicle, the date unit was purchased and name and address of supplier.**

F.R.U. GUARANTEE

Factory Replacement Units are guaranteed for a period of twelve months from the date of receipt by the user, with the exception of Motor Cycle, Moped and Pedal Cycle Equipment, which carries a guarantee of six months. This means that if any such unit suffers from any failure or defect due to faulty workmanship or material and is returned to us during the guarantee period, we will replace or repair the unit free of charge. We do not undertake to dismantle or re-assemble, or bear the cost of dismantling, or re-assembling, any such unit on the chassis or vehicle.

The above guarantee takes the place of and excludes all conditions and warranties whether expressed or implied by law, statute or otherwise. In particular, it must be distinctly understood that we cannot accept any liability for direct or indirect damage to persons or property arising in any way from the sale of our goods or from any defect or alleged defect in the goods sold.

SMITHS INDUSTRIES LIMITED

MOTOR ACCESSORY DIVISION

SALES & SERVICE, OXGATE LANE, LONDON NW2

Telephone: GLAdstone 8030 Telegrams: Speedofac, London, Telex

Depots: **BRISTOL** . . . . . 7 Bath Road, 4. Phone: Bristol 70314
GLASGOW . . . . . 123-145 North Street, C.3. Phone: Glasgow Central 3972
MANCHESTER 780 Chester Road, Stretford. Phone: Manchester Longford 2414
BELFAST . . . . . 19 Ormeau Avenue. Phone: Belfast 32911

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IGNITION (BIRMINGHAM) LTD.
68, SHAKESPEARE STREET,
SPARKHILL, BIRMINGHAM, 11.
VICtoria 4911/2/3

SMITHS

THE CARE OF INSTRUMENTS

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 —Smiths Industries Limited Motor Accessory Division.

For this reason a guaranteed service exchange scheme is operated for all Smiths Instruments.

Details of this scheme are given on the 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 these pitfalls and to ensure that you get many trouble-free miles of motoring.

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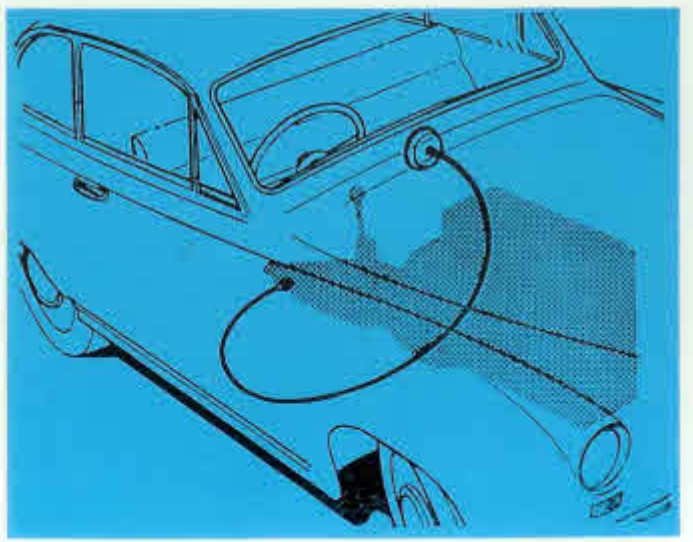
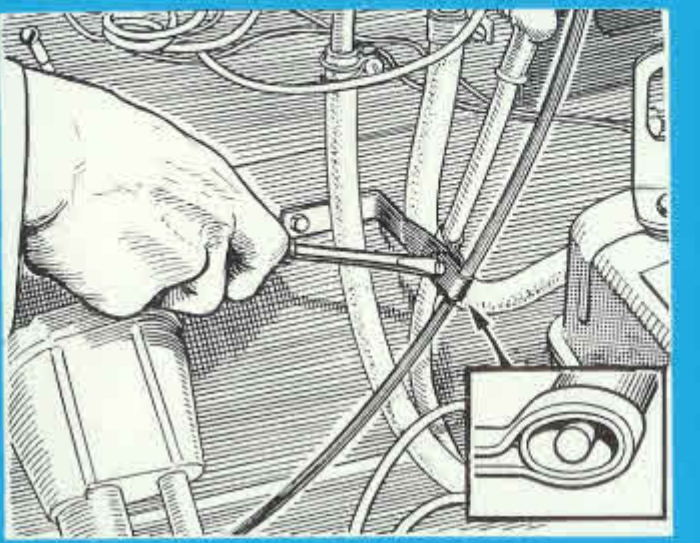
FLEXIBLE DRIVES
For Speedometers and Revolution Indicators

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.

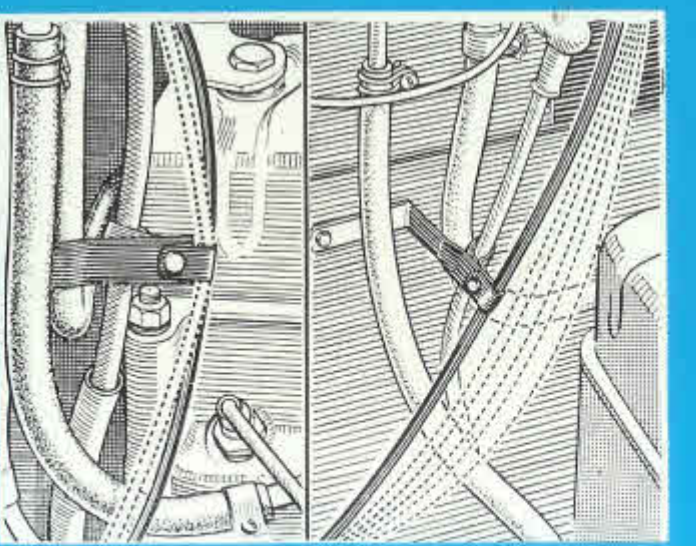
1 SMOOTH RUN. Run of flexible drive must be smooth. Minimum bend radius 6" (152·4 mm). No bend within 2" (50·8 mm) of connections.





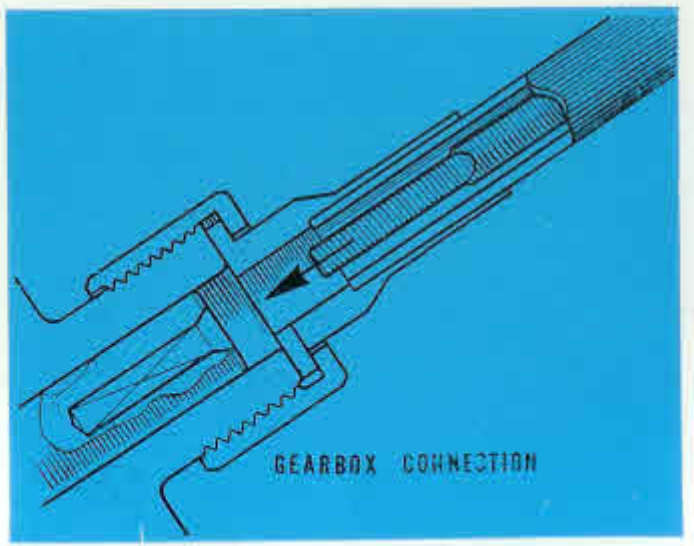
2 SECURING. Avoid crushing flexible drive by over-tightening clip. Flex can also be crushed between two moving components.

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.



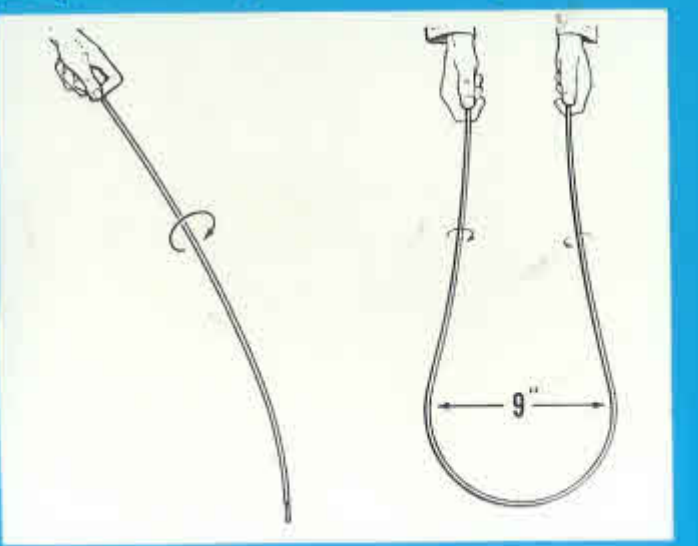
4 CONNECTION Ensure that threaded end connections are secure with no looseness of the outer casing end collars. Connecting nuts should be tightened by hand. Spanner or pliers should not be used. It is important that the drive to which the flexible drive connects is free from dirt and grit.

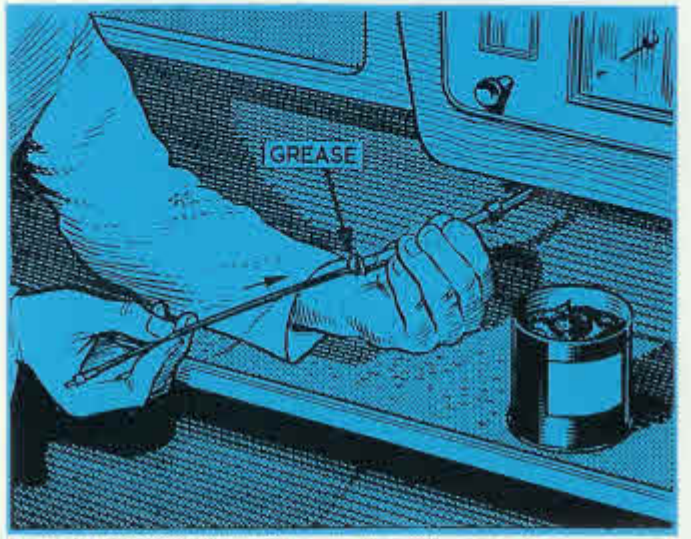
5 CONNECTION OF INNER FLEXIBLE SHAFT Where possible, slightly withdraw inner shaft and connect outer first to point of drive. Then slide inner shaft into engagement from the other end. It may be necessary to rotate shaft.



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.

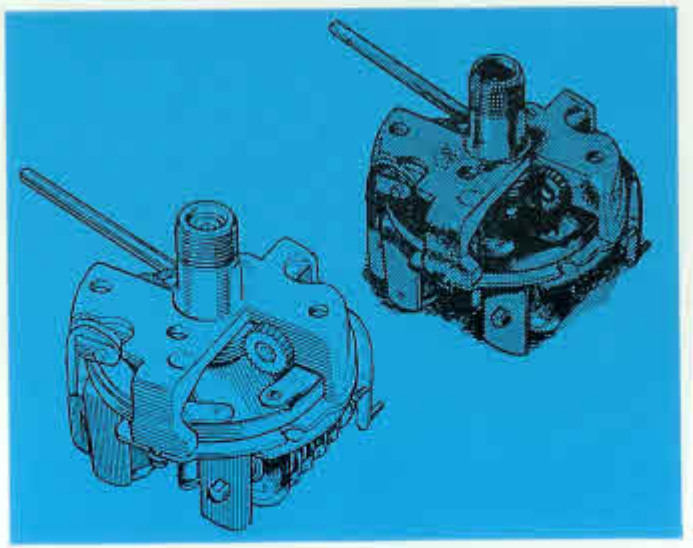
7 CHECK FOR INNER FLEXIBLE SHAFT Lay out shaft straight on flat clean table and roll. Any 'kinks' or obvious signs of damage will be seen. Then take an end in each hand allowing shaft to hang in a loop of approximately 9" (229 mm.) diameter. Rotate it slowly with the fingers. A satisfactory shaft will turn smoothly without 'snatch'.

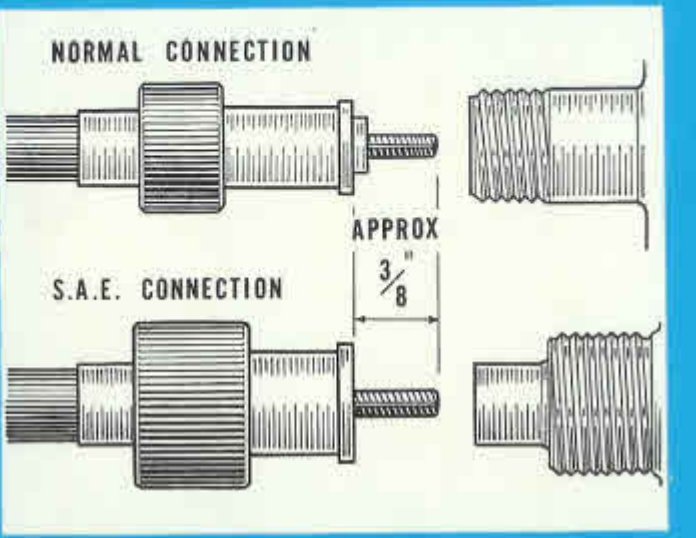




8 LUBRICATION Examine every 10,000 miles (16,000 Kms). Withdraw inner shaft and apply grease sparingly. Feed shaft back into its casing. Then withdraw approximately 8" (200 mm) and wipe off surplus grease. Use Castrol L.M. or Esso T.S.D. 119 grease or equipment. Do NOT use oil.

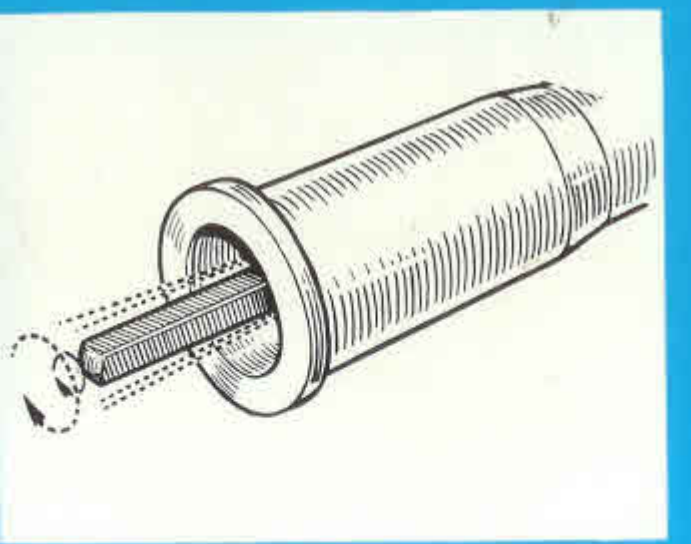
9 EXCESSIVE LUBRICATION Avoid excessive lubrication. If oil appears in flexible drive, suspect faulty oil-seal at point of drive. Illustration shows oiled-up speedometer movement.

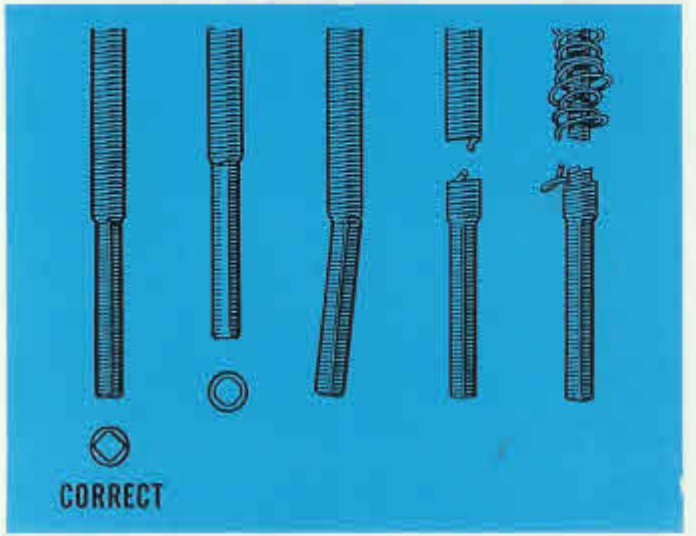




10 INNER SHAFT PROJECTION Check that there is approximately 3/8" (10 mm) projection of inner shaft beyond outer casing at instrument end. This ensures correct engagement in instrument and point of drive.

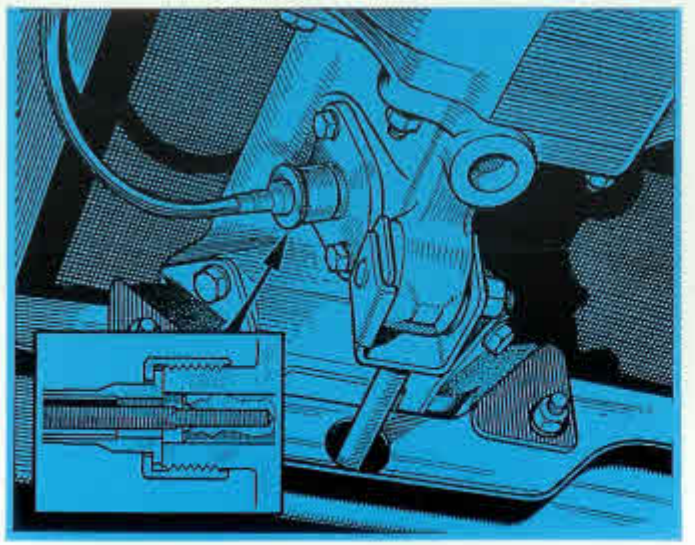
11 CONCENTRIC ROTATION Check that inner shaft rotates concentrically when fitted in outer casing, and not eccentrically, as shown by the dotted lines.





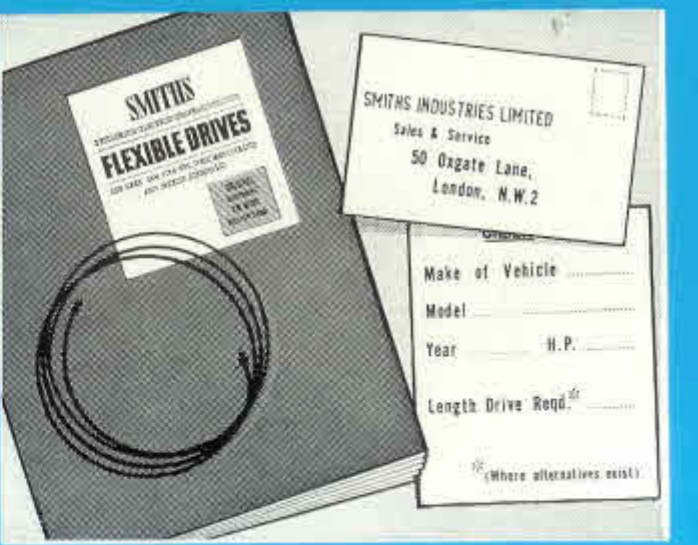
12 DAMAGED INNER SHAFT Examine inner shaft ends for wear or other damage. Before fitting new inner shaft, ensure instrument main spindle is free.

13 DAMAGED DRIVE END CONNECTIONS Examine point of drive for dirt or possible damage. Check to ensure tightness between the driving key and its gear in gearbox.



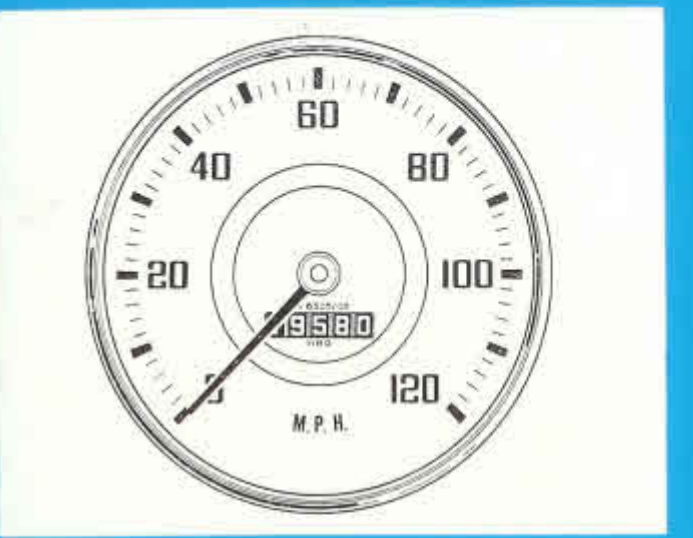
14 FLEXIBLE DRIVE STORAGE Flexible drives should remain packed as supplied until required for use. If very large stocks are involved, space can be saved by hanging up flexible drives by one end in suitable racking.

15 ENSURING CORRECT DRIVE FITTED Choose correct flexible drive from Smiths Recommendation Booklet. When ordering, state make, year and model of vehicle.
State also length of drive required when alternatives are shown in the booklet.



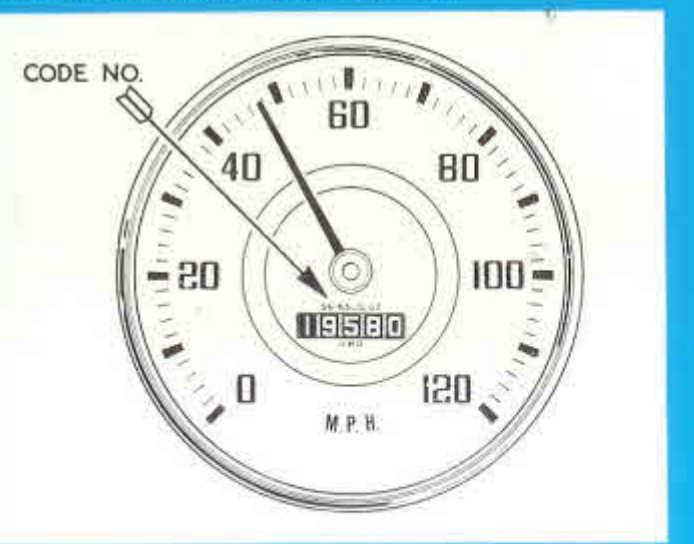
SPEEDOMETERS AND REVOLUTION INDICATORS

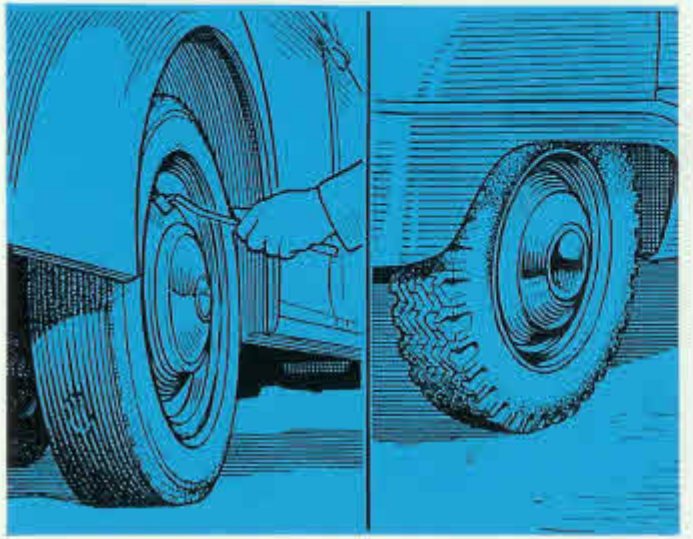
The correct performance of your speedometer or revolution indicator, is to a very large extent, dependent on your flexible drive being in the best possible condition. On many occasions what appears to be failure of an instrument is in fact due to a complete or partial failure of the flexible drive. Before 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 Industries Limited, 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 Industries Limited Motor Accessory Division dealer for specially calibrated instruments.

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 below, the figures found in the gearing test (see 20).

FORMULA

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

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

Cardboard pointer on inner shaft (see 20) rotates 9⅛ times as vehicle is pushed forward 6 turns of rear wheel. Rear wheel radius 12¼". Flex turns per mile.

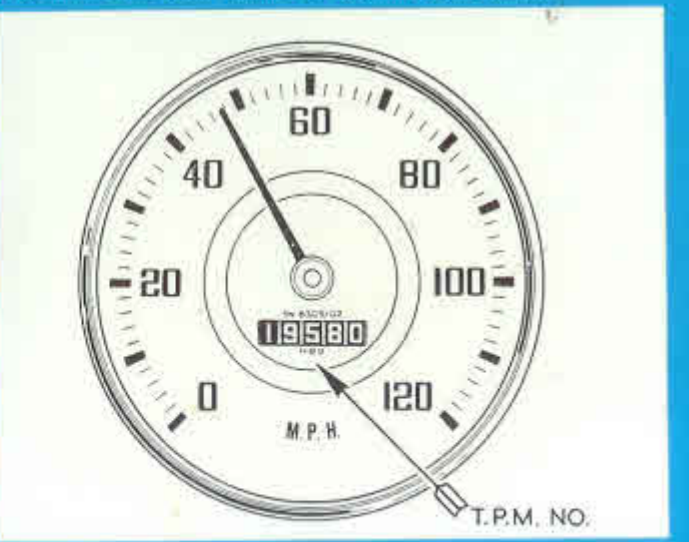
$$= \frac{1680 \times 9\frac{1}{8}}{12\frac{1}{4}}$$

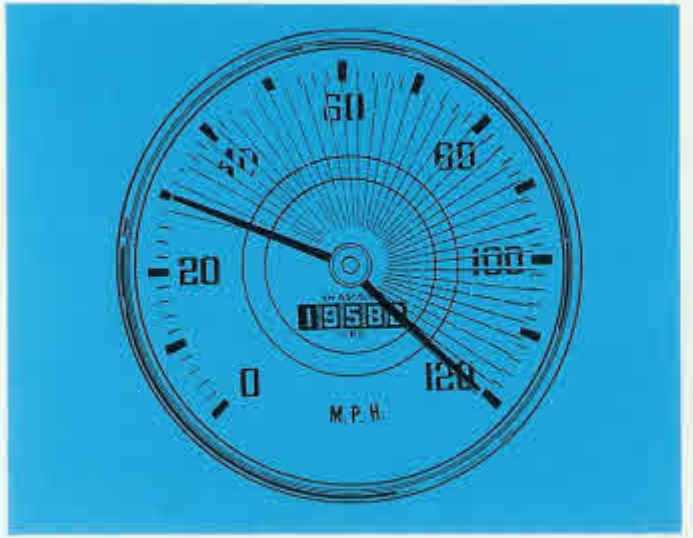
$$= \frac{15330}{12\frac{1}{4}} = \text{(appr.)}$$

1251 = T.P.M.

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).

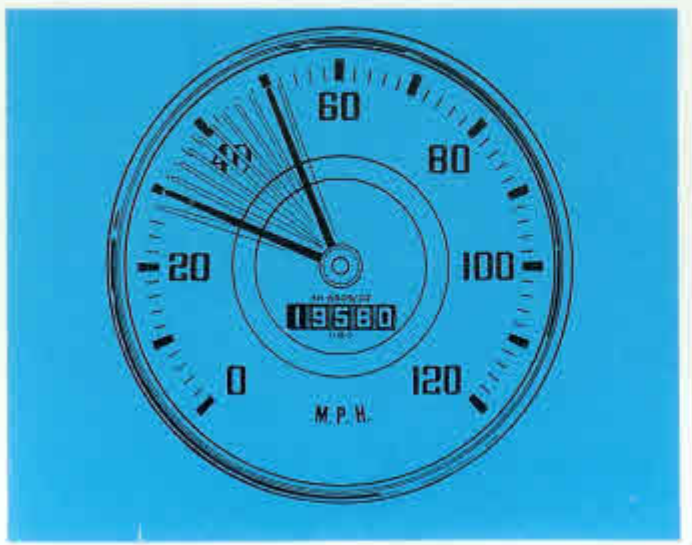
21 CORRECT SPEEDOMETER Number shown should correspond within 32 either way with the T.P.M. number obtained from 19 and 20. If it does not, apply to Smiths Industries Limited Motor Accessory Division dealer for specially calibrated instrument, giving details of test, vehicle and code number of existing speedometer.

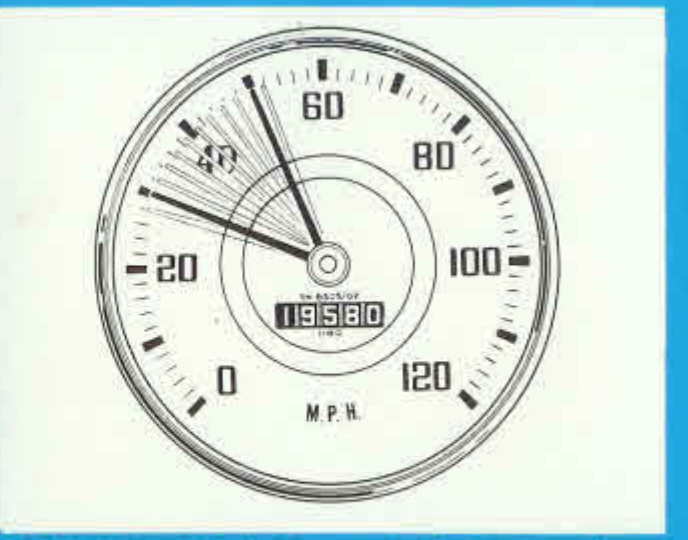




22 POINTER SWINGS OR SLUGGISH OPERATION Oiled-up instrument. Check diagram 9. Replace oil seal if necessary; clean and lubricate flexible drive (see 8). Return instrument for replacement.

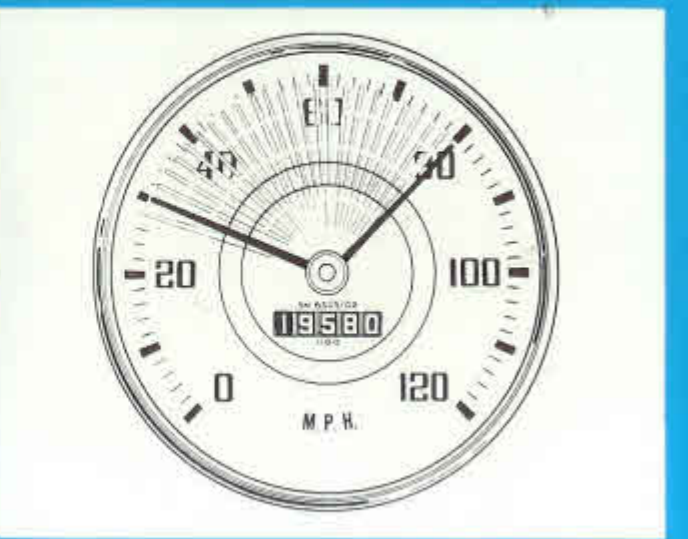
23 POINTER WAVER (INTERMITTENT) Inner flexible shaft not engaging fully. Check 10, then try 4. Also check 12.

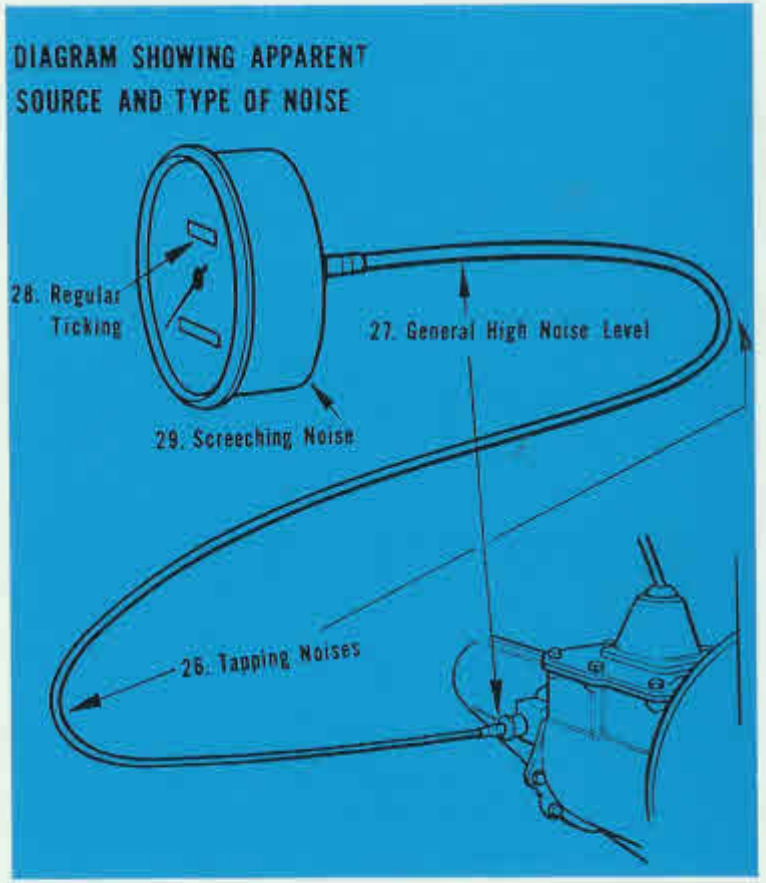




24 POINTER WAVER Kinked or crushed flexible drive. Check 7 and 3. For withdrawal of inner shaft see 6. Bends of too small radius in flexible drive, check 1.

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.

MOVING COIL REVOLUTION INDICATOR EQUIPMENT

This equipment is supplied to certain car manufacturers as original equipment only. The complete revolution indicating equipment consists of a generator unit and an indicator head.

The generator is mechanically coupled to, and driven from a take-off point on the vehicle engine and generates an A.C. voltage proportional to the speed of rotation of the generator shaft. This voltage is fed to the indicator head by two insulated electrical leads.

RECOGNITION

Indicator head always has prefix R.V. . . .

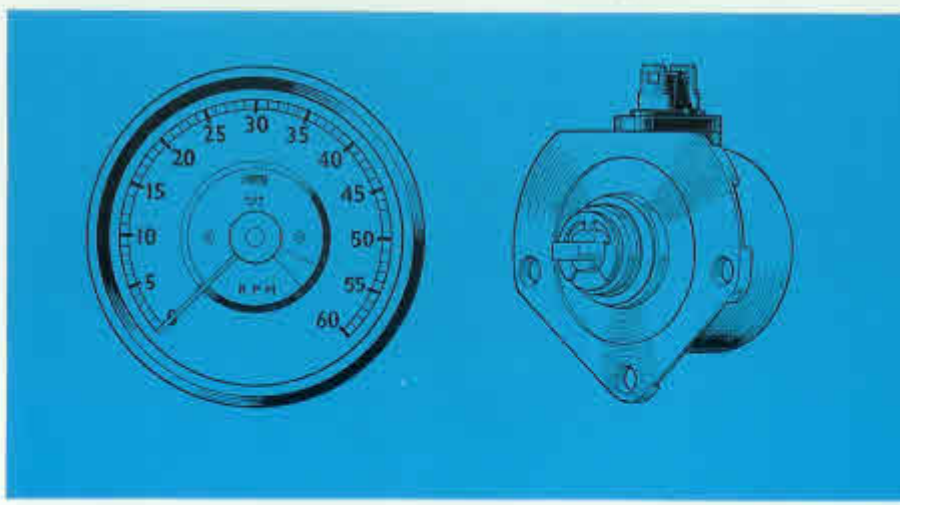
Transmitter has prefix T.V. . . . Units are connected by two wires which are completely independent of the vehicle electrical system.

TEST PROCEDURE

1. Check wiring between generator and indicator.
2. Test generator and indicator. Attach A.C. voltmeter in circuit from the two terminals on generator. Voltmeter should read approximately 1 volt per 100 r.p.m. of drive point. If no reading is obtained change generator. If generator satisfactory change indicator.

30 INDICATOR HEAD

31 GENERATOR UNIT



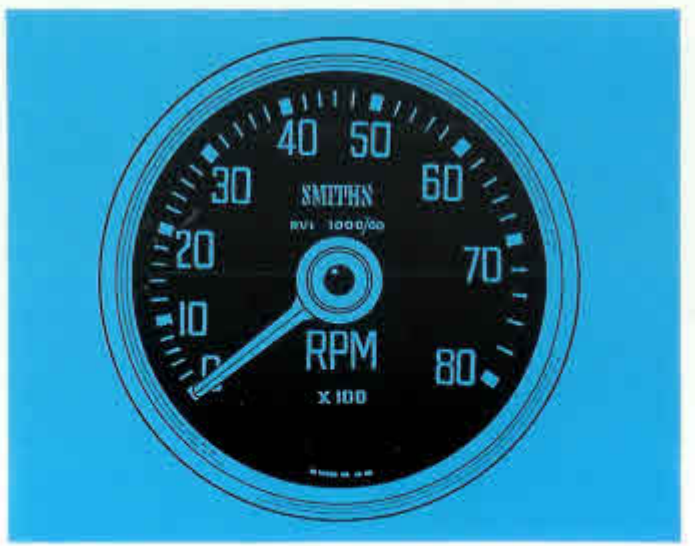
IMPULSE TACHOMETERS
(Universal and Original Equipment)

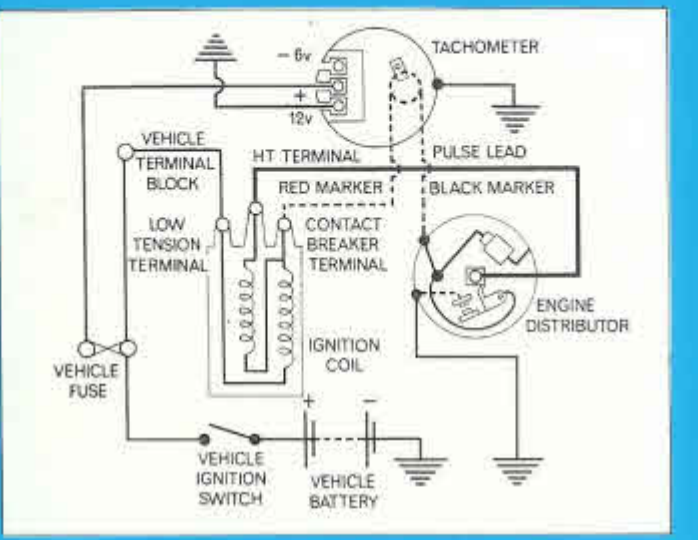
The equipment consists of an indicator head and a pulse lead. The pulse lead when connected in series between the contact breaker terminal on the engine ignition coil and the contact breaker terminal on the distributor, will transmit voltage pulses to the indicator head. There are Impulse Tachometers to suit various types of engines i.e. 4 cylinder, 6 cylinder, 8 cylinder etc.

RECOGNITION

The identification code numbers printed on the dials of all Impulse Tachometers are prefixed RVI. Universal Impulse Tachometers can be identified by the 3 terminal block on the rear of the case and Impulse Tachometers fitted by the vehicle manufacturer as original equipment, by the single terminal on the rear of the case.

32 IMPULSE TACHOMETER HEAD

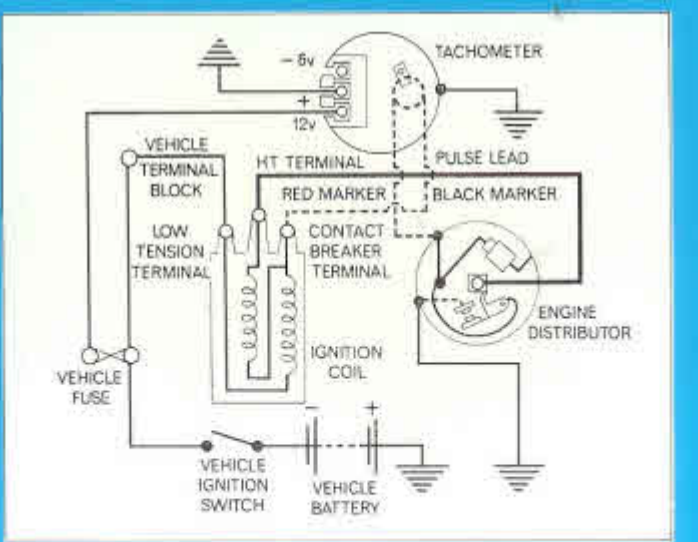


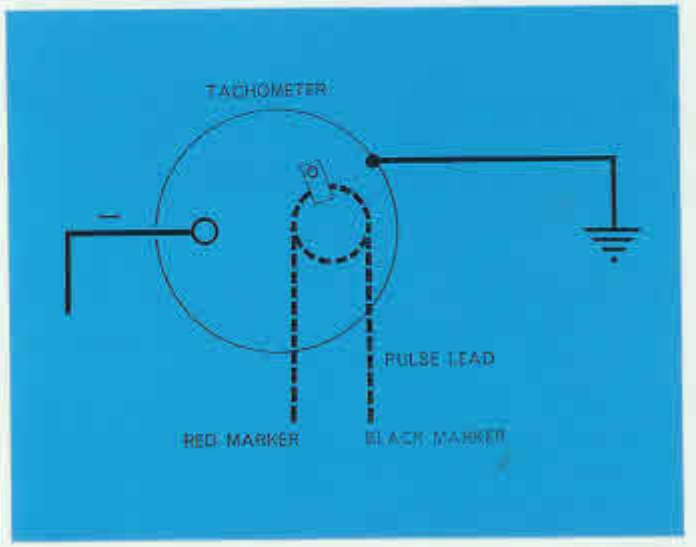


33 CHECKING FOR FAULTS Impulse Tachometer (Universal) Negative Earth System.

Using the appropriate diagram fig. 33 or 34 check that the wiring of the Tachometer to the vehicle is correct.

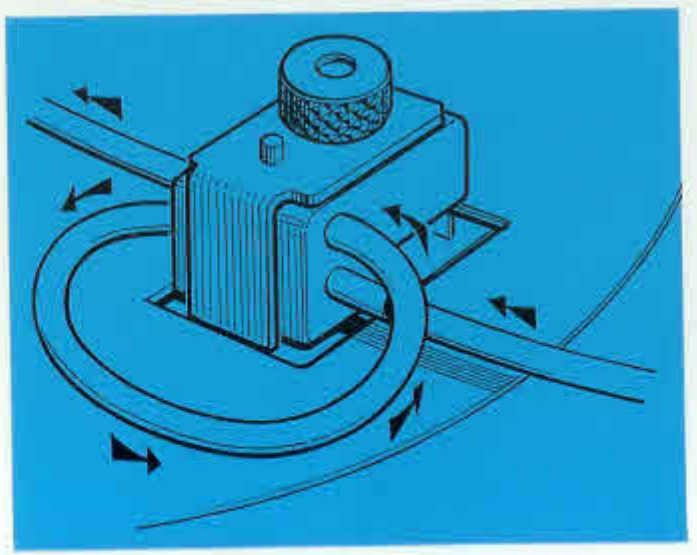
34 CHECKING FOR FAULTS Impulse Tachometer (Universal) Positive Earth System.





35 CHECKING FOR FAULTS Impulse Tachometer (Original Equipment). Check the connections to the tachometer (35). Also check vehicle wiring.

36 CHECKING FOR FAULTS Impulse Tachometer (All Types). Check that the iron core and pulse lead assembly is as shown in 36. The pulse lead should form a symmetrical loop and should not be tight enough to pull the plastic former out of line, as this may well cause a poor electrical connection at the iron core. Poor connection may well result in intermittent operation of the tachometer.



GAUGES and CLOCKS

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AUTOMOTIVE ELECTRICAL INSTRUMENT TESTER

12 volt — Code SR/D.366

Measuring $7\frac{1}{4}$" x $4\frac{3}{4}$" x $4\frac{1}{4}$" and housed in a strong wooden box, the new Smiths Automotive Electrical Instrument Tester will be of considerable help to all automotive electricians. It enables electric fuel gauges, temperature indicators, thermal pressure indicators and voltage stabilisers to be checked 'in situ' on any vehicle.

To enable identity of the different types of electrical car instruments there is a visual identification chart on the opposite page.

37

VISUAL IDENTIFICATION OF ELECTRICAL CAR INSTRUMENTS

Prefix	Indicator	Identification
(1) X or FG	Moving iron Fuel gauge	Pointer moves immediately ignition is switched ON.
(2) X or TE	Thermal Temp. Indicator and Thermal Pressure Indicator	Pointer moves slowly when ignition is switched ON. Pointer goes to HOT when ignition is switched OFF.
(3) TC	Semi-conductor Temp. Indicator	Pointer moves immediately ignition is switched ON.
(4) BT or BF	Bi-metal Temp. and Fuel Indicators	Pointer moves slowly when ignition is switched ON.

HOW TO USE THE ELECTRICAL INSTRUMENT TESTER

TO TEST BATTERY VOLTAGE Connect Terminal 'I' on test set to battery supply and Terminal 'Earth' to vehicle chassis. Battery voltage is satisfactory if tester gauge indicates in right-hand sector (13 V) after two minutes.

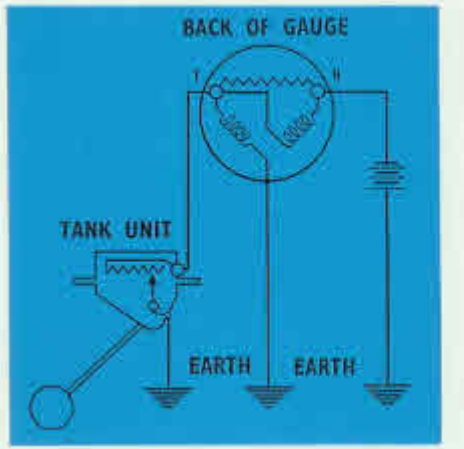
PROCEDURE FOR TESTING INDICATORS Test battery voltage. With ignition switched 'OFF' disconnect lead from transmitter (Fuel or Temp.) and re-connect to Terminal 'T' on tester. Connect 'Earth' terminal on tester to vehicle chassis. Switch on ignition and after two minutes vehicle instrument should indicate position at which tester switch is set, i.e. Empty, ½ or Full, Cold, Normal or Hot. If correct, transmitter is faulty. If incorrect to the switch position selected, the instrument, wiring, or in the case of codes BF or BT, the voltage stabiliser is faulty. When wiring is suspected, connect 'T' terminal of tester direct to 'T' terminal on back of indicator and repeat. If instrument is now correct wiring between indicator and transmitter is faulty.

TO TEST VOLTAGE STABILISER Remove lead from Terminal 'I' on voltage stabiliser. Connect lead from terminal 'I' on tester to terminal 'I' on voltage stabiliser. Connect 'Earth' terminal on tester to vehicle chassis, switch ignition on and pointer on test gauge should read in first white segment after two minutes. If satisfactory proceed as for other types of indicators.

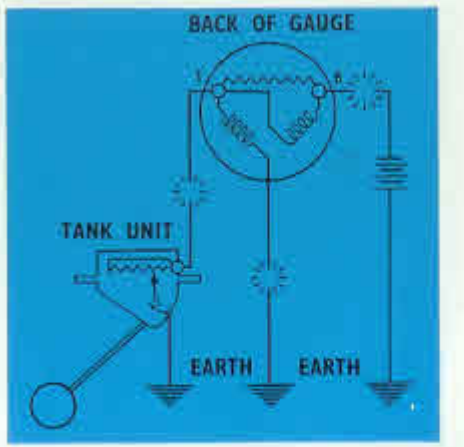
FUEL GAUGES (Prefix X. or FG.) and TANK UNITS (Prefix X. or FT.)

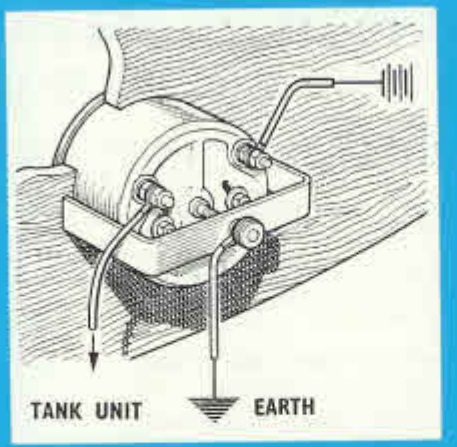
The automobile fuel gauge consists of two parts—the fuel gauge itself mounted in the dashboard, and a tank unit in the fuel tank.
These items are connected by a lead which is often vulnerable to corrosive or abrasive action (see fig. 41).
The fuel gauge indicates the level of fuel in the tank in accordance 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.
For fault finding see page 25.

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

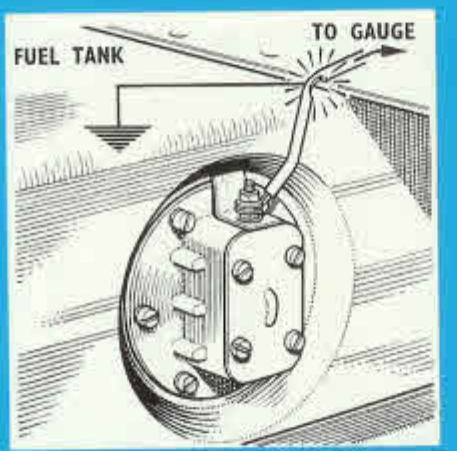


39 NO READING OR 'EMPTY' WITH FULL TANK Check for broken or disconnected leads. Ensure that gasket is in place between tank unit flange and tank. Reconnect as circuit diagram, 38.

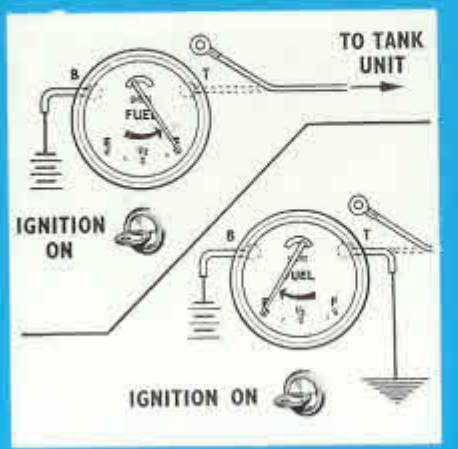




40 NO READING OR 'EMPTY'
Check Fuel Gauge 'Earth' (Particularly important where panel is non-metallic.)

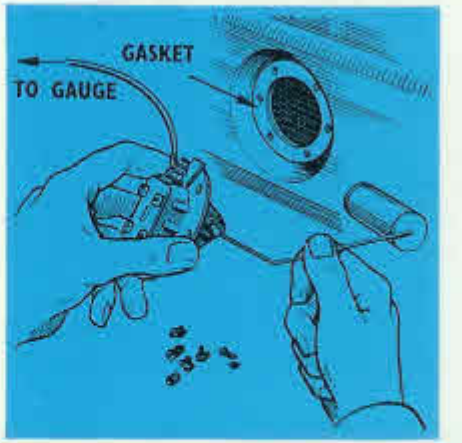


41 NO READING OR 'EMPTY'
Check lead to tank unit short-circuited to 'Earth'. To reconnect see 38.

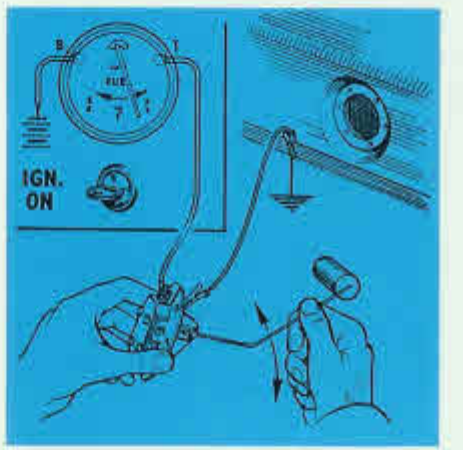


42 FUEL GAUGE TEST
(i) Disconnect 'T' terminal. Reconnect battery. Switch on ignition. Gauge should read 'Full'.
(ii) With 'T' terminal still disconnected, earth 'T' terminal. Gauge should read 'Empty'.

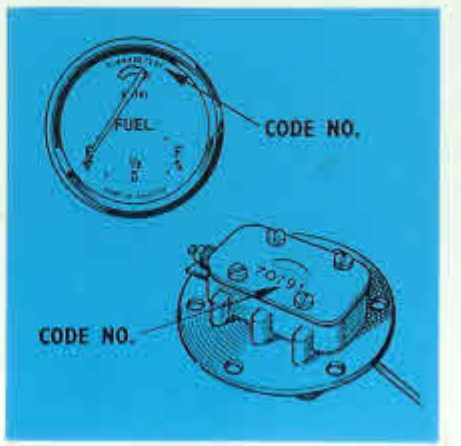
43 TANK UNIT TEST (*a*)
(i) Ensure petrol is below level of Tank Unit.
(ii) Remove Tank Unit from tank by undoing six screws and carefully lifting out. Arm should not be bent other than as supplied.
(iii) Check that arm works freely.



44 TANK UNIT TEST (*b*)
(i) Connect Tank Unit terminal to 'T' terminal of Fuel Gauge already tested (see 40 and 42).
(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.

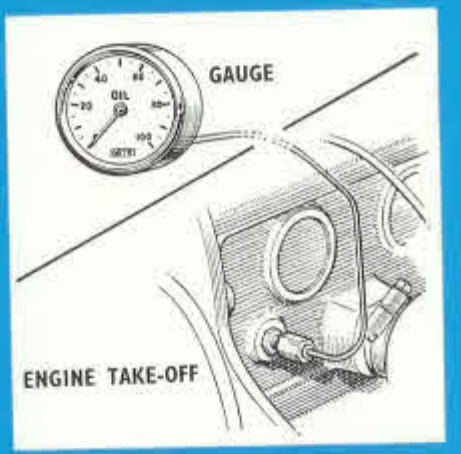


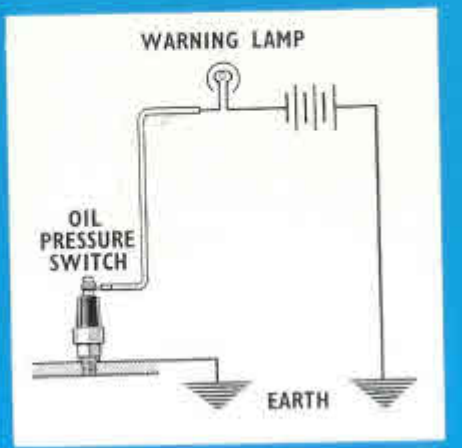
45 RECOGNITION GUIDE
Where inaccurate readings are suspected, it may be that an incorrect fuel gauge or tank unit has been fitted. This can be checked by noting the code number which appears on the dial of the gauge and the top plate of the tank unit, and referring to Smiths Industries Limited.



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.





46 NO READING

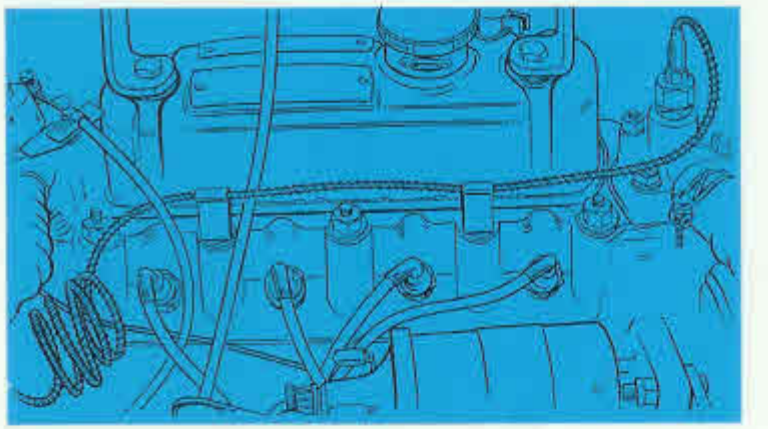
(i) Check sump level.
(ii) Turn engine by hand and check that oil appears at gauge end of the pipe. (This applies also when a new gauge is fitted.)
(iii) Check that oil pipe from engine to gauge is clear by blowing air through.
(iv) Ensure that gauge hole connection is clear.
(v) Check that engine oil pressure release valve works correctly.

47 OIL PRESSURE SWITCH

The Oil Pressure Switch is connected to a warning lamp on the dashboard. If lamp fails to go out check 45 (i) and (v). Check wiring. Ensure that Pressure Switch orifice is not blocked.

TEMPERATURE GAUGE (Mechanical) Prefix TD. TG. or TL.

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.



48 INSTALLATION DIAGRAM

The bulb should be fitted into such a position that it is fully immersed in coolant or oil. The tubing should then be securely cleated to some part of the engine, approximately 3"–4" from the bulb. There should be no intervening coils, and tubing should not be curved in a radius of less than 1". The tubing should then be run down the engine towards the bulkhead, and be securely cleated every 4"–6". From the last cleated point on the engine to where the tubing passes through the bulkhead, there should be arranged 3 or 4 coils of not less than 2" diameter.
From the bulkhead to the gauge it is not necessary to insert any more coils unless there is an excess of tubing.

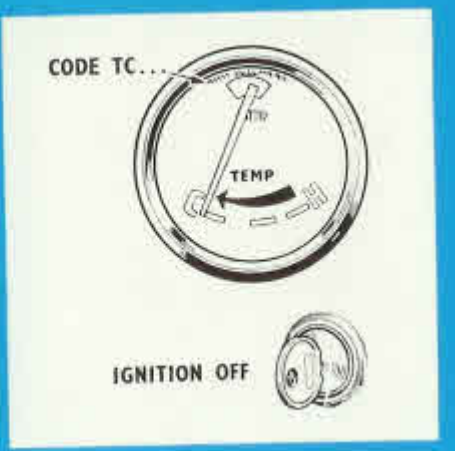
49 HOT WATER TEST

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.

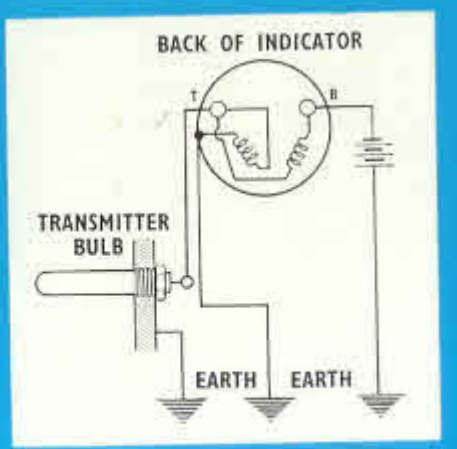
TEMPERATURE INDICATOR (Semi-Conductor) Prefix TC.

This type of temperature indicator 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 lead which is often vulnerable to corrosive or abrasive attack.
The performance of the Semi-Conductor Temperature Indicator depends on the correct functioning of the transmitter, and often an apparent fault in the indicator can be traced to the transmitter.

For fault finding see page 25.

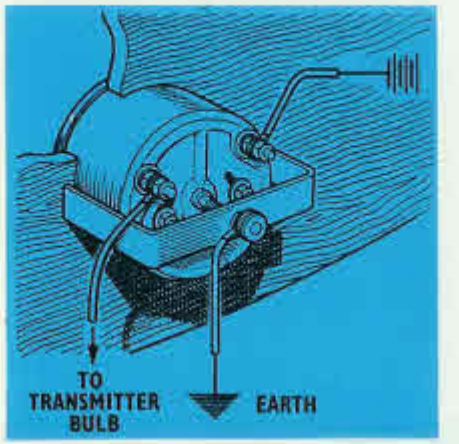


50 RECOGNITION
This type of instrument is identified by the fact that when the ignition is switched off, the pointer drops instantly to 'Cold'. The code number always has the prefix "TC".

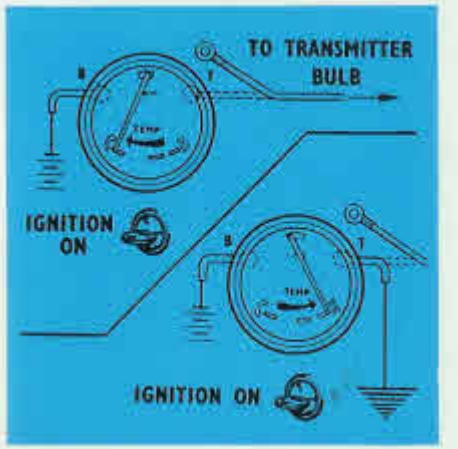


51 CORRECT CIRCUIT CONNECTION
Indicator and Transmitter are connected as shown in the circuit diagram. **Never** connect battery direct to 'T' terminals, as this will burn out the indicator.
'Earth' is vehicle frame.

52 NO READING
Check for broken or disconnected leads. To reconnect see 51. Check Indicator 'Earth'. (Particularly important where panel is non-metallic.)



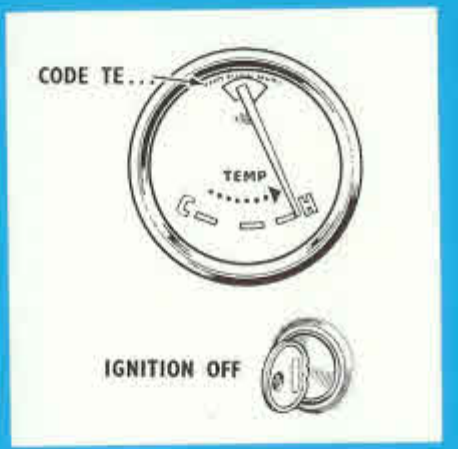
53 TEMPERATURE INDICATOR TEST
(i) Disconnect 'T' terminal. Reconnect battery. Switch on ignition. Indicator should read 'Cold'.
(ii) With 'T' terminal still disconnected, earth 'T' terminal. Indicator should now read 'Hot'.



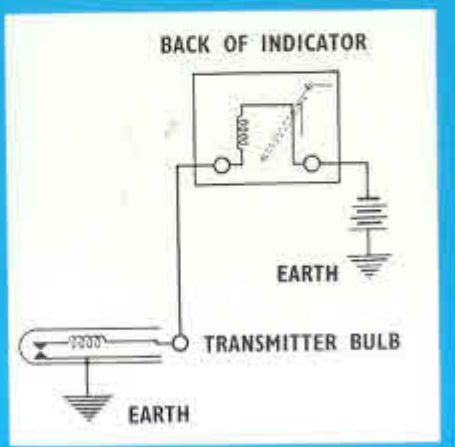
54 TRANSMITTER TEST
Ensure coolant or oil is below level of Transmitter. Remove Transmitter from cooling or oil system. Connect transmitter terminal to 'T' terminal of checked indicator (see 53). Connect body of Transmitter to 'Earth'. Reconnect battery Switch on ignition. Place transmitter in boiling water. Indicator should read 'Hot'.

TEMPERATURE INDICATOR (Thermal Type) Prefix TE.

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 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 Industries Limited.
For fault finding see page 25.



55 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 the prefix "TE".



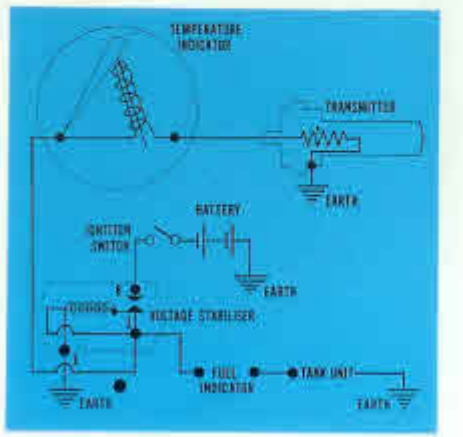
56 CIRCUIT DIAGRAM
Indicator and Transmitter should be connected as shown. If any error occurs in readings, check for broken or disconnected leads. Before returning either component for service, check performance of transmitter with checked Indicator and vice-versa, so that only faulty part is returned. Transmitter may be identified from other types by its assembly. Locking nut is separate from main body.

BIMETAL RESISTANCE INSTRUMENTATION

The bimetal resistance equipment is for fuel contents indication and engine temperature indication. The equipment consists in each case of an indicator head and transmitter unit. Both units are connected to a common voltage stabiliser.
For fault finding see page 25.

In both engine temperature and fuel contents applications, the indicator head operates on a thermal principle, using a bimetal strip surrounded by a heater winding, the transmitter unit is of a resistance type.
The system by which the equipment functions is voltage sensitive and the voltage stabiliser which serves one or more indicators is necessary to ensure a constant supply of a predetermined voltage to the equipment.

57 CIRCUIT DIAGRAM
Instruments should be connected as shown.

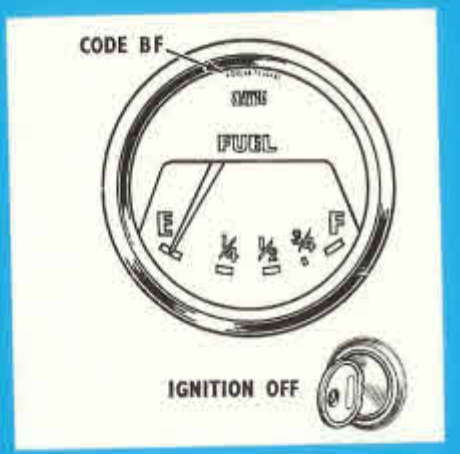


FUEL INDICATOR (Prefix BF.)

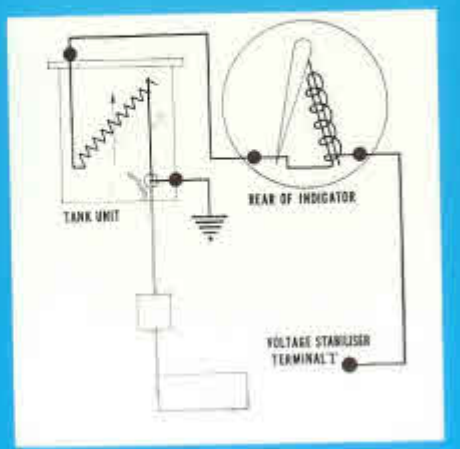
The indicator head and transmitter unit are connected to a common voltage stabiliser. The units are connected by a lead which is often vulnerable to corrosive or abrasive attack.

CAUTION
These instruments must not be checked by short circuiting transmitters to earth.

For fault finding see page 25.



58 RECOGNITION
This type of instrument is identified by the fact that when the ignition is switched off the pointer drops SLOWLY to 'Empty.' Code number always has the prefix "BF".



59 CIRCUIT DIAGRAM
Indicator and tank unit should be connected as shown. **Never** connect battery direct to terminals—lead to indicator should always be taken from 'I' terminal on voltage stabiliser.

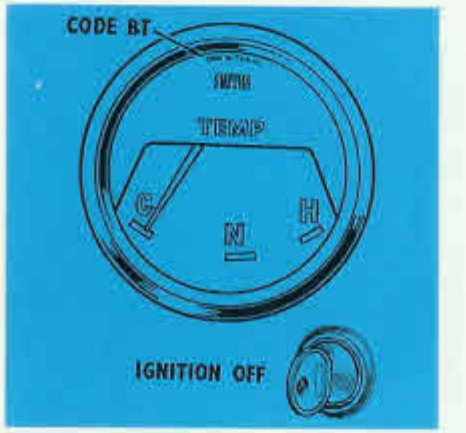
TEMPERATURE INDICATOR (Prefix BT.)

The indicator head and transmitter unit are connected to a common voltage stabiliser. The units are connected by a lead which is often vulnerable to corrosive or abrasive attack.

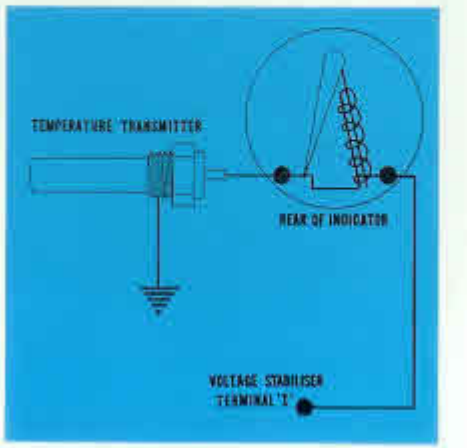
CAUTION. These instruments must not be checked by short circuiting transmitters to earth.

For fault finding see page 25.

60 RECOGNITION
This type of instrument is identified by the fact that when the ignition is switched off the pointer drops SLOWLY to 'Cold.' Code number always has the prefix "BT".



61 CIRCUIT DIAGRAM
Indicator and transmitter should be connected as shown. **Never** connect battery direct to terminals. Lead to indicator should always be taken from 'I' terminal on voltage stabiliser.



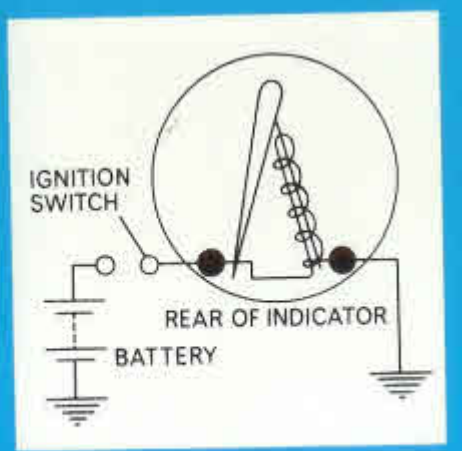
BATTERY CONDITION INDICATOR (Prefix BV)

This is a voltmeter with a specially calibrated dial which indicates the condition of the vehicle battery. The movement is very similar to that found in the Bi-metal type of instruments.

CAUTION: This instrument is suitable only for 12 volt ignition systems.

62 RECOGNITION

This instrument can be identified by its specially calibrated dial and by the fact that the pointer drops SLOWLY to "zero" when the ignition is switched off. Code number always has the prefix B.V.



63 CIRCUIT DIAGRAM

The indicator should be connected as shown. Should any error or failure occur check for broken or disconnected leads.

BIMETAL RESISTANCE FAULT ANALYSIS

For fault finding see page 25

NO READING ON INDICATOR/S

1. Voltage stabiliser. Mean voltage between output terminal 'I' and earth should be 10 volts.

2. Relating Indicator. Check for continuity between terminals with leads disconnected.

3. Relating Transmitter. Check for continuity between terminal and case with lead disconnected.

4. Wiring. Check for continuity between each unit and also that the voltage stabiliser and relating transmitters are earthed.

HIGH/LOW READING ON INDICATOR/S

1. Voltage Stabiliser. As (1) above.
2. Relating Indicator. Substitute similar indicator.
3. Relating Transmitter. Substitute similar transmitter.
4. Wiring. Check for leak to chassis.

HIGH READING ON INDICATOR AND OVERHEATING

1. Voltage Stabiliser. As (1) above.
2. Wiring. Check for short circuits to chassis on wiring to each transmitter.

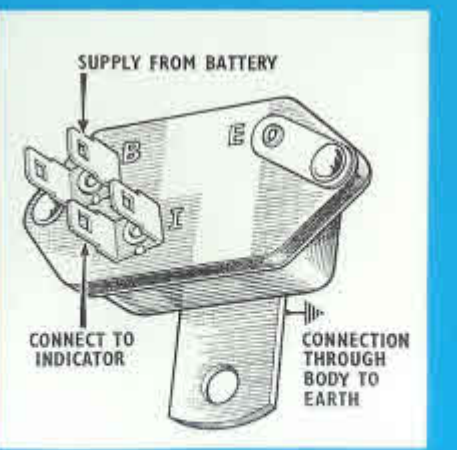
INTERMITTENT READINGS

1. Voltage stabiliser. Test stabiliser with Automotive Electrical Instrument Tester.

2. Indicator and Transmitter. Test units with Automotive Electrical Instrument Tester.

3. Wiring. Check terminal wiring for security, chassis connections and wiring continuity.

If voltage stabiliser is removed, it is essential to ensure that when replacing, B and E are uppermost and NOT exceeding 20° from vertical.



64 VOLTAGE STABILISER

ELECTRIC CLOCKS

Electric car clocks operate from the battery and require very little current.

Time keeping is independent of normal voltage variations, but if the voltage is abnormally high or low some effect will be noticed.

There are two types of clock, one with and one without rectifier. Identification and correct connection are as follows.

A normal clock is identified by green moulding on live connection at rear of clock. A rectified clock has black moulding on live connection at rear of clock.

Correct polarity of rectified clocks is essential. Case is stamped either:—

—VE for positive earth application:—Note negative live lead to clock terminal.

+VE for negative earth application:—Note positive live lead to clock terminal.

Lead to clock should run fom 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.

IMPORTANT

Always disconnect battrey before investigating electric clock or wiring.

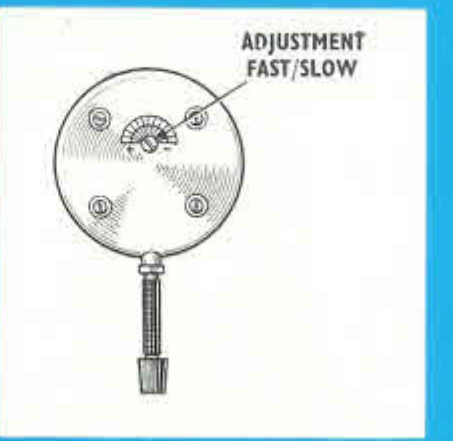
The clock must never be inoperative when still connected.

65 STARTING AND HAND SETTING

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

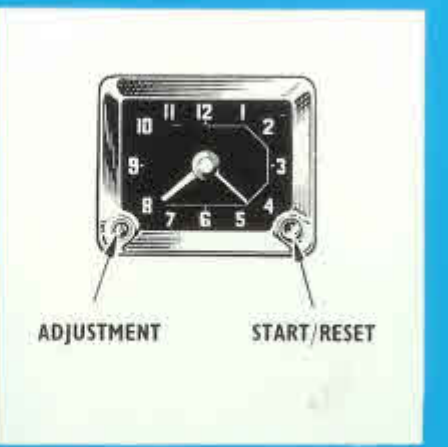
66 REGULATION

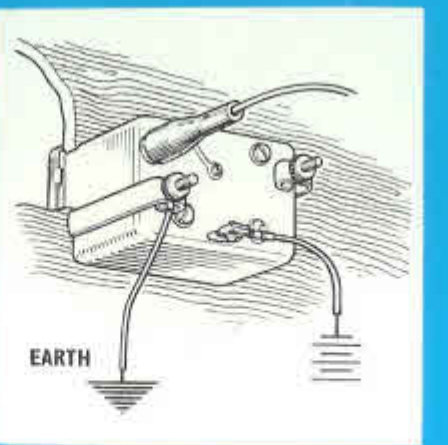
Regulation of timing is effected by turning the adjustment towards minus if the clock is gaining, or towards plus if losing.



67 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.



68 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.