OVERHAUL MANUAL

MODEL S.149 FORM 1 - INDICATOR RATIOMETER

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Signed. 

Date. July 1970

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MODEL S.149 FORM 1

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The introduction of any amendment or revision not certified in accordance with British Civil Airworthiness Requirements Chapter A6-2 will invalidate the statement of certification on MODEL S.149 FORM 1.
Amendments or revisions embodied in this manual, which have been certified under an approval authorisation other than that applicable to the initial certification must be recorded on separate record sheets.

OVERHAUL MANUAL

MODEL S.149 FORM 1 - INDICATOR

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ILLUSTRATIONS

MODEL S.149 FORM 1 - INDICATOR RATIOMETER

The overhaul procedure contained in this manual is applicable, in general, to all S.149 Form 1 indicators. The addenda at the rear of the manual contain details of particular versions of this indicator together with reference to the applicable information in the main part of the manual.

1. Description and operation

A. General

Model S.149 Form 1 is a ratiometer-type indicator fitted in a sealed flangeless case, connection to the aircraft wiring being via the end plate. As there are several variations of end plate, the details of each are contained in the appropriate addendum.

B. Detail (Refer to Fig.1.)

The movement (15) consists of two coils of fine copper wire wound on axially-connected, but separate, aluminium frames, one end of each coil being joined to a common connection; the two coils thus form a single unit, pivoted in adjustable jewelled bearings which are inset into the top and bottom bridges. The coil unit is free to rotate in the gap between two cores and a pole piece. Three fine ligaments, which connect the coils in circuit, are anchored to the pivot bases, two being at the bottom and the third at the top; the upper pivot also carries a pointer and balance arms. In indicators which do not incorporate a pointer return unit, the third ligament is replaced by a control spring. A T-shaped spacer is assembled in the gap of the pole piece, the stem of the 'T' fitting into a slot machined in the cores. A block permanent magnet of Alcomax rests on the flat top surface of the spacer, a yoke being assembled over, and enclosing, the magnet and pole piece. Two pointer stops, secured to the upper bridge of the movement, limit the arc of movement of the pointer. The lower scale (8) is secured to three pillars on the top mounting plate of the movement. A clip on the underside of the scale engages in a groove on one of the pillars whereas two screws (5) are used to secure the scale to the other two pillars; the screws (5) are also used to secure the upper scale (7) to the lower scale. Some indicators are fitted with a pointer return unit (14) which is secured to the movement (15) by two screws (12). The pointer return unit consists of an electromagnet having two coils, either in series or in parallel, wound over iron cores and connected in the positive supply lead of the indicator. A small, spring-tensioned ferrous vane is pivoted between the poles of the electromagnet; the vane carries an arm with a toothed segment which engages a pinion fitted with a curved wiper arm. The purpose of the arm is to return the pointer off-scale when the indicator is unenergized. Resistance spools (28) are fitted to a spool mounting plate (24) secured to pillars on the end plate (33). The complete assembly is retained in the case (3) by a sealing wire (1) which is soldered into position to provide a sealed indicator.

C. **Operation**

The indicator shows the ratio between the currents passing through two moving coils pivoted in permanent and unequal magnetic fields. When used as a temperature indicator, the current in one coil is relatively constant whilst that in the other is varied by changes in the resistance of the associated bulb, the changes resulting from temperature variations in the vicinity of the bulb. Alternatively, the current in both coils may be varied; the choice of circuit arrangement is governed by the temperature range to be covered. In either application, however, the indicator will show the ratio of currents passing through the coils, this ratio being shown as temperature on a suitably calibrated scale. For calibration purposes, the indicator cover is marked Pt. Law or Ni. Law to signify the resistive component (which may be platinum or nickel) of the bulb with which the indicator is used.

When used as either a pressure indicator or a position indicator, the current in both coils is varied in opposite senses, an increase in one coil being accompanied by a decrease in the other.

KEY TO FIG. 1.

1. Sealing Wire
2. Seating Ring
3. Case
5. 10 B.A. Screw
6. 10 B.A. Lockwasher
7. Upper Scale
8. Lower Scale
9. 6 B.A. Nut
10. 6 B.A. Lockwasher
11. 6 B.A. Tag, Terminal
12. 10 B.A. Screw
13. 10 B.A. Lockwasher
14. Pointer Return Unit
15. Movement Complete
16. L.H. Pointer Stop
17. R.H. Pointer Stop
18. Spacer
20. 6 B.A. Round Nut
21. 6 B.A. Lockwasher
22. Moulded Ring
23. Special 6.B.A. Nut
24. Spool Mounting Plate
25. 10 B.A. Screw
26. 10 B.A. Lockwasher
27. 10 B.A. Stud
28. Spools
29. Washer 6 B.A.
30. 6 B.A. Lockwasher
31. 6 B.A. Nut
32. Sleeve
33. End Plate
34. Screw and Washer Assembly
35. Label
36. 4 B.A. Nut
37. 4 B.A. Washer
38. 4 B.A. Tag, Terminal
39. 4 B.A. Washer

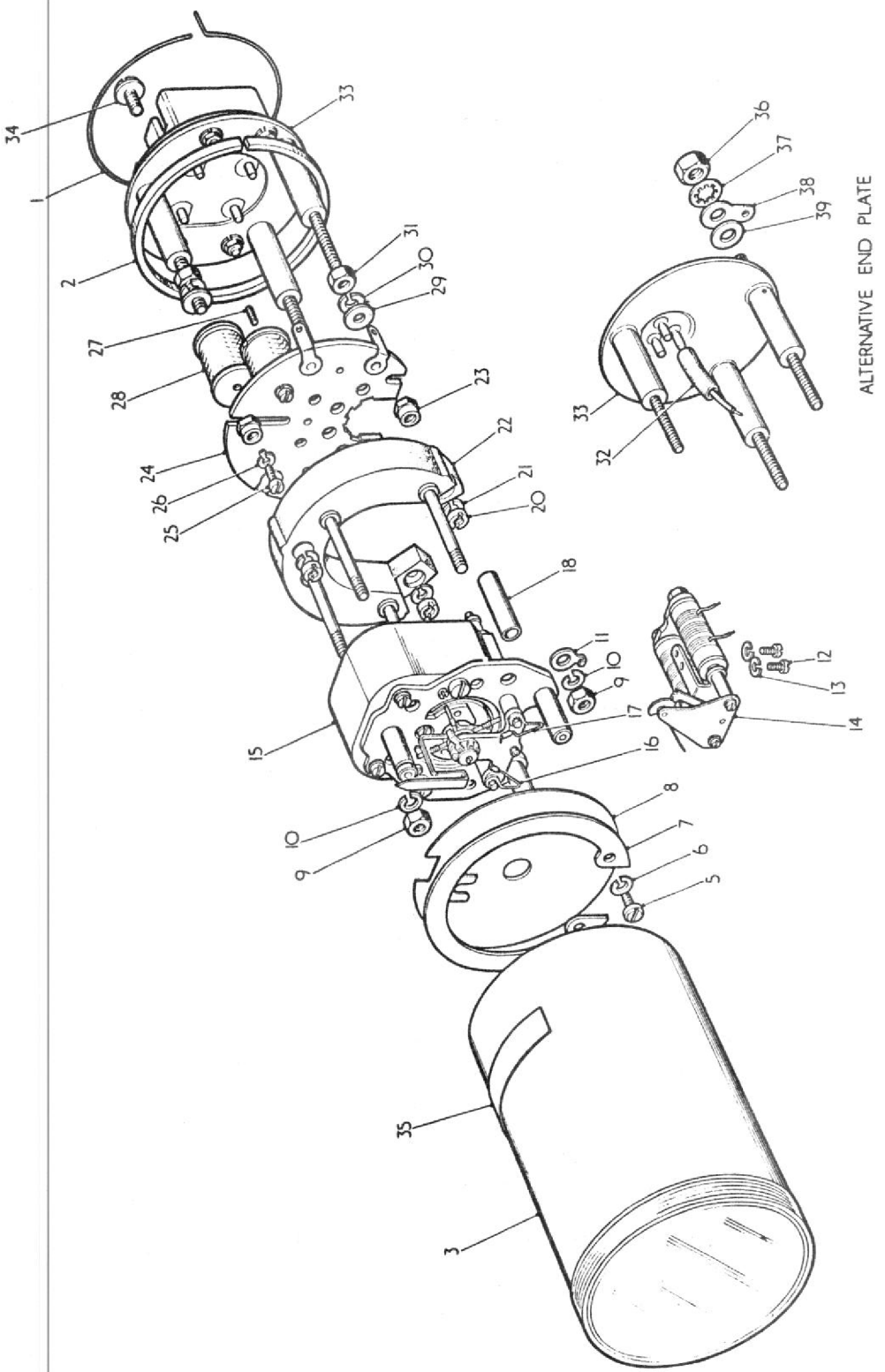

Fig.1. S.149 Form 1, Exploded view of indicator

2. Disassembly

A. Checks before Dismantling

Ascertain whether the indicator has been returned with a history sheet which may highlight any parts needing particular attention.

B. Preparation

Ensure that workbench and tools are free from dirt and dust.

C. Procedure

NOTE: All lockwashers disturbed during disassembly must be discarded.

(1) Hold the indicator, and, using pliers, remove the sealing wire (1).

(2) Withdraw the main assembly until it is possible to prise out the seating ring (2) from the case (3); withdraw the main assembly completely.

(3) Remove screws (5) and lockwashers 6 (2 off - each item), and remove the upper scale (7) and lower scale (8) taking care not to damage pointer.

NOTE: The upper scale has a locating clip which is in engagement with a groove in the top pillar of the front mounting plate.

(4) Remove nuts (9) lockwashers 10 (4 off - each item) and terminal tag (11). Remove screws (12) and lockwashers 13 (2 off - each item) and remove P.R.U. (14).

NOTE: The P.R.U. is still attached to the indicator by its leads and undue strain must not be exerted upon them.

(5) Lift the movement gently until it is possible to unsolder the leads connected to the ligaments. Record which lead is connected to which terminal.

CAUTION: THE SOLDERING IRON MUST NOT BE BROUGHT CLOSE TO THE MOVEMENT OR LIGAMENTS. THESE ITEMS CAN BE PERMANENTLY DAMAGED BY EXCESS HEAT.

NOTE: Further disassembly of the movement (15) is not permitted, special techniques being required for assembly. If defective, the movement must be replaced as a complete unit.

(6) Collect spacers 18 (4 off), and remove nuts (20) and washers 21 (3 off- each item); remove the moulded ring (22).

(7) Remove special nuts 23 (3 off) securing the spool mounting plate (24); remove screws (25) and lockwashers (26) and withdraw the spool mounting plate (24). The spools are still attached to the end plate terminals by their leads. To remove the spools, ease back the sleeves (32) and unsolder the connecting wires. Record the sequence of connections.

NOTE: To replace a spool (28) it is unnecessary to completely withdraw the spool mounting plate (24). Slacken nuts (31) on the underside of the plate and partially withdraw plate. Unscrew spool retaining screws (25), lockwashers (26) and remove spools.

(8) Remove the washers (29), lockwashers (30), and nuts 31 (3 off-each item) from the end plate pillars.

NOTE: If only the movement (15) or a spool (28) is to be replaced do not release nuts (20) or (23). These nuts have been set to give the correct position of the movement.

3. Cleaning

A. Schedule of Cleaning Materials

(1) Camel hair brush, No. 12 round.

(2) Acetone, B.P.C.

B. Procedure

(1) Use acetone to remove all Bostik adhering to threads of screws and nuts, and to all other components which have been disturbed. Ensure that the acetone does not come into contact with insulation or varnished surfaces.

(2) Remove the excess solder from the rim of the case.

(3) Use a soft brush to remove all dust etc. from the case.

4. Inspection

A. General Procedure

Examine all metal components for corrosion; check screws, nuts and threaded holes for good condition and serviceability of threads.

B. Detail Procedure

(1) Use a 10x magnifier to examine the gap, in which the moving coil swings, for obstructions; small particles adhering to the core or pole piece must be removed with a shaped piece of wood or celluloid.

CAUTION: UNDER NO CIRCUMSTANCES MAY A METALLIC NEEDLE BE USED FOR THIS PURPOSE. AVOID DAMAGE TO THE LIGAMENTS.

(2) Examine the case (3) and end plate (33) for distortion, scoring, cracks, bent pins on terminals, and for broken or loose glass.

(3) Ascertain that the resistance of the moving coils is within the limits quoted in the appropriate addendum (the connection on the top bridge of the movement (15) is common to both coils).

(4) Check the insulation on all wires and on the spools.

(5) Check that the moving coil swings freely in the bearings.

(6) Check the pointer return unit (14), if fitted, for mechanical action and for the resistance value of the field coils.

5. **Repair** (Refer to Fig. 1).

A. **Movement complete (15)**

As special techniques are required for the assembly of the movement, the complete assembly must be renewed if any parts are defective.

B. **Case (3) and End Plate (33)**

If either part is defective, it must be renewed.

C. **Glass**

The glass is an integral part of the case (3) and if damaged the case complete must be replaced.

D. **Pointer Stops (16 and 17)**

If the glass beads on the stops are damaged remove the associated nuts and lockwashers and fit new pointer stops.

E. **Terminal Tag (38)**

If this tag has been damaged remove nut (36), lockwashers (37) and fit new terminal tag (38).

6. **Assembly**

During assembly, apply a spot of B.S.104 to all threaded holes, nuts and screw threads to lock these items against vibration. Cement jewel screws and coat all soldered joints with Red Thermolene Lacquer. These finishes, to SANGAMO WESTON B.S. Specification, may be obtained from Messrs. SANGAMO WESTON LTD., ENFIELD, MIDDLESEX, ENGLAND, or may be obtained directly from the suppliers.

B.S. 104	BOSTIK No. 772 thinned with acetone to a brushable consistency.

A. **Procedure** (Refer to Fig.1)

(1) Fit nuts (31), lockwashers (30) and washers 29 (3 off - each item) to the pillars on the end plate (33).

(2) Place the spool mounting plate (24) in position on the pillars and solder the wires to their respective pins on the end plate.

(4)

(a) Fit the special nuts 23 (3 off), moulded ring (22), lockwashers 21 (3 off) and round nuts 20 (3 off) to the end plate mounting pillars.

(b) Adjust special nuts 23 (3 off) and round nuts 20 (3 off) to give a spacing between the outer surface of the end plate and the base of the yoke of 1.725 in.

(c) Adjust nuts 31 (3 off) to bring the spool mounting plate (24) hard against the special nuts (23).

(5) Fit the spacers 18 (4 off) to the pillars on the moulded ring (22).

(6) Check that the moving coil of the movement (15) is centred and turn the jewel screws clockwise in increments of approx. 1/10th of a turn until 'pointer flop' (the movement of the pointer due to the pivots being able to move laterally between the jewels) is just eliminated. Back-off the jewel screws by 1/10th to 1/8th of a turn until slight 'pointer flop' is just perceptible. Apply Red Thermolene Lacquer to the threads of the jewelled bearings.

(7) Place the movement complete (15) on the pillars of the moulded ring (22) and solder the wires to the appropriate ligament terminals.

CAUTION: DO NOT BRING THE SOLDERING IRON CLOSE TO THE LIGAMENTS OR MOVING COILS. PERMANENT DAMAGE TO THESE ITEMS MAY RESULT FROM EXPOSURE TO EXCESSIVE HEAT.

(8) Secure the pointer return unit (14) to the movement complete (15) by screws (12) and lockwashers 13 (2 off - each item).

NOTE: If the sector element of the pointer return unit is in the correct position, the sweep arm will return the pointer to its normal rest position.

(9) Fit the terminal tag (11) over the pillar of the moulded ring and secure the movement complete (15) by the lockwashers (10) and nuts 9 (4 off - each item).

(10) Slide the lower scale (8) under the pointer and position it on the three supporting pillars.

(11) Fit the upper scale (7) in position over lower scale (8) and ensure that the clip on the underside of the upper scale engages in the groove of the top pillar. Secure both scales in position by screws (5) and lockwashers 6 (2 off - each item).

CAUTION: AVIOD DAMAGE TO POINTER DURING THESE OPERATIONS.

(12) Carry out the checks listed in sub-para. B.

(13) Pass the seating ring (2) over the end plate (33). Insert the indicator into its case (3) and fit the seating ring against the rear face of the insulator. Place the sealing wire (1) in position.

(14) Make all the tests listed in Paragraph 8 (Testing).

(15) Seal the indicator, as described in sub-para. C.

(16) Carry out the Sealing Test listed in Paragraph 8.

B. Checks after Assembly

(1) Check that the adjustment of the jewelled bearings is correct, and then connect the indicator into a test circuit as shown at Fig. 9 .

CAUTION. IF NOMINAL VALUES OF RESISTANCES ARE BEING USED TAKE CARE NOT TO EXCEED THE NORMAL WORKING CURRENT OF THE INDICATOR.

(2) Apply 26 volts d.c. to the indicator circuit and adjust resistance boxes to deflect the pointer to mid-scale.

(3) Adjust the balance weights in the following manner to maintain the pointer within the permissible limits:-

NOTE: After balancing, pointer error must not exceed 0.5% of the full scale range value.

(a) With the indicator scale horizontal, turn the indicator until one of the balance arms is parallel to the table edge, pointer to the left of the operator.

(b) Raise the indicator slowly until the scale is vertical; the pointer deviation should be within the permissible limits. If it is not, adjust the balance weights on the horizontal arm.

(c) Lower the indicator until the scale is horizontal and turn it until the second balance arm is parallel to the table edge. Raise the indicator slowly until the scale is vertical with the pointer to the right of the operator and check that the pointer deviation is within limits. If it is not, adjust the weights on the second balance arm.

(d) Repeat operations (a), (b) and (c) and check pointer deviation; adjust the appropriate balance weights until the required balance is achieved.

(4) Check that the pointer stops are correctly positioned.

(5) Check that all the required finishes have been applied.

(6) Refer to paragraph 6A, sub-para. (13) to (16).

(7) The indicator is now ready to be adjusted as set down in Testing (8) and adjustments must be made before the indicator is sealed.

C. **Case-to-End Plate Sealing Procedure**

Prior to sealing the indicator, check that the rim of the case is free from excess solder. Insert the indicator into its case until approximately 0.5 inch remains exposed and place the complete indicator in an oven; 'dry-out' for eight hours at a temperature of 70 deg. C. The indicator must be sealed within one hour of removal from the drying oven; if this is not possible, the indicator must be placed in a dry atmosphere. Failure to comply with these requirements will necessitate a further drying period as specified above.

(1) Place the indicator in the case (3) with the end plate (33) resting on the seating ring (2).

(2) Fit the sealing wire (1) into the gap between the end plate (33) and case (3); the sealing wire must fit snugly into this gap without leaving spaces.

(3) Solder the sealing wire (1) into position and ensure that the end plate (33) is completely sealed to the case (3). The wire must overlap at the split and the soldered join must be flat and level with the end plate; the projecting end of the wire must be free from solder.

8. Testing

For ease of reference, the test procedures are sub-divided into the following:-

Test Procedures for a Pressure Indicator
Test Procedures for a Temperature Indicator
Test Procedures for a Position Indicator

A. Spool Adjustment Procedure for a Pressure Indicator

The Pressure Indicator is for use with a SANGAMO WESTON S.122 pressure transmitter; for spool adjustment purposes, two decade resistance boxes, R1 and R2, are substituted for the transmitter. Adjustments are made with 26 volts d.c. applied to the circuit.

(1) Preparation

(a) For circuits and values refer to the appropriate addendum for the variant. To determine the correct scale length for a required pressure range, spools listed as unadjusted must be adjusted; all other spools (if any) are pre-determined.

(b) Connect the spools of pre-determined value in circuit, substitute decade resistance boxes R3 and R4 for unadjusted spools, and resistance boxes R1 and R2 for the pressure transmitter (see Fig.2).

(2) Procedure

(a) Set resistance boxes R3 and R4 to the nominal values of these spools.

(b) Set the resistance boxes R1 and R2, which simulate the pressure transmitter, to the values corresponding to the full scale pressure of the indicator.

(c) Apply 26 volts d.c. to the appropriate connecting pins and note the position of the pointer.

(d) Re-set resistance boxes R1 and R2 to the values corresponding to the zero pressure reading and note the position of the pointer.

(e) If the indicated scale length is too short, decrease equally the values of resistance boxes R3 and R4; if the indicated scale length is too long, increase the values.

(f) Repeat this sequence until the correct scale length is obtained. On completion, adjust the unadjusted spools to the values of the appropriate boxes. Fit the spools to the spool mounting plate, and connect into circuit.

NOTE: As the centre-to-end scale ratios may not be identical, it may not be possible to change equally the resistance of the boxes which simulate the unadjusted spools when making the final adjustment.

(g) The indicator is now ready for calibration; full details of the procedure are contained in the appropriate addendum to this manual.

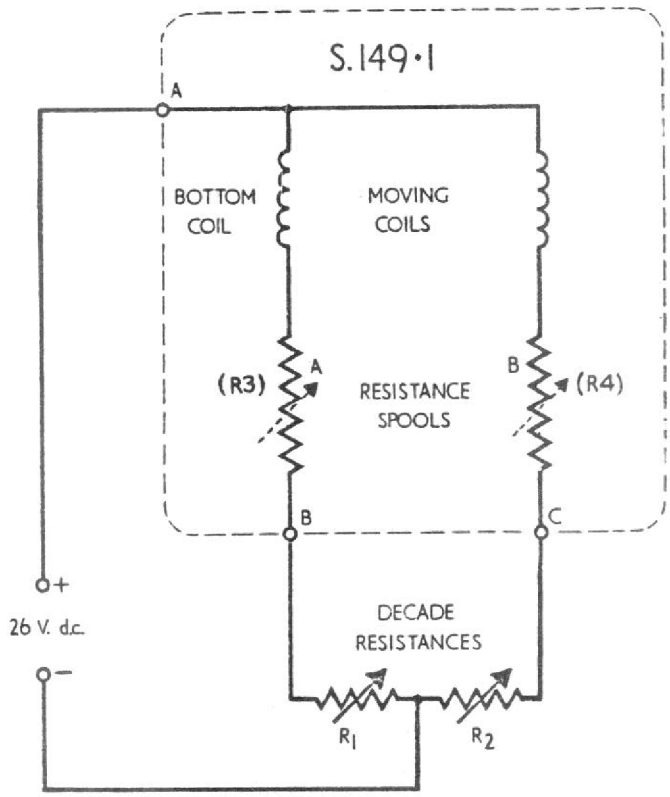

Fig. 2. Test circuit diagram. Pressure Indicator

B. Spool Adjustment Procedure for a Temperature Indicator

The temperature indicator is for use with a resistance bulb, the resistive component of which may be either platinum or nickel; the case of the indicator is marked Pt. law or Ni. law to signify with which bulb the indicator is to be used. For spool adjustment purposes, the bulb is replaced by a resistance box R1. Adjustments are made with 26 volts d.c. applied to the circuit.

(1) Preparation

(a) For circuits and values, refer to the appropriate addendum for the variant. To determine the correct scale length for a required temperature range, spools listed as unadjusted will require adjustment; the values of all other spools are pre-determined.

(b) Connect the pre-determined spools in circuit and insert the two decade resistance boxes, R2 and R3, in place of the unadjusted spools, with a further decade resistance box, R1, in place of the resistance bulb (see Fig. 3).

(2) Procedure

(a) Set resistance box R2 to the nominal value of the spool, and R1 to the equivalent resistance of the resistance bulb mid-scale value. Apply 26 volts d.c. between the +ve and -ve terminals and adjust resistance box R3 to give a pointer indication of approx. mid-scale.

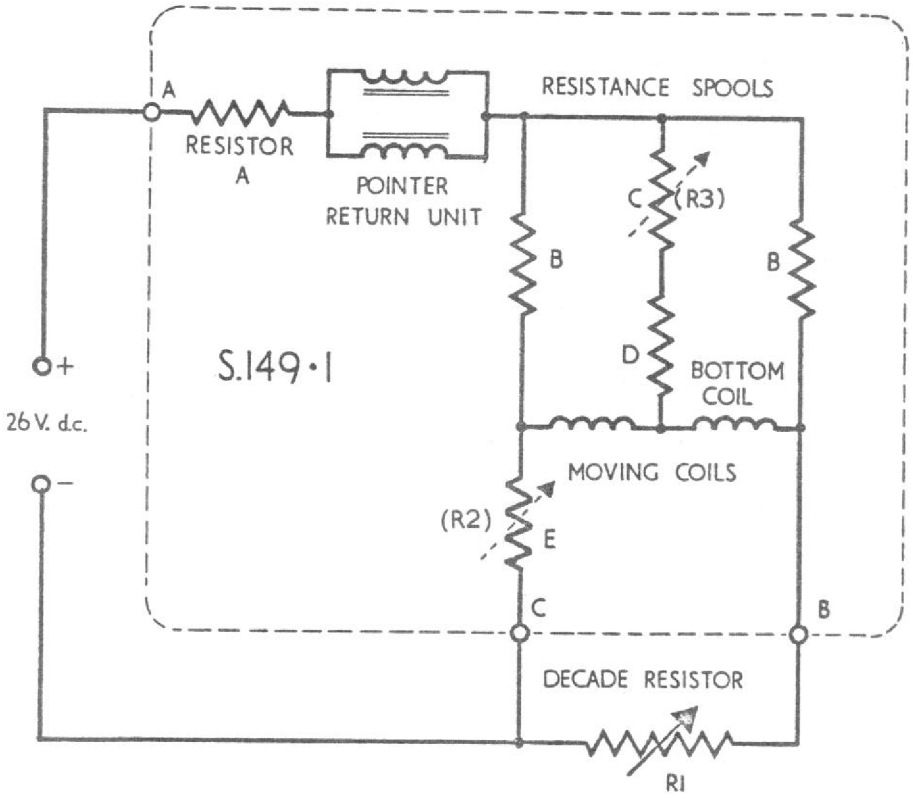

Fig. 3. Test circuit diagram. Temperature Indicator.

(b) Adjust the bulb resistance box to the lowest range value and then to the highest range value; record the indications.

(c) If the scale length is too great, reduce box R3 in value; if the scale length is too small, increase box R3 in value. Alteration of the value of this box will tend to move the arc covered by the pointer to the left or right, but this effect may be rectified by re-adjusting the value of box R2. An increase in the value of R2 shifts the scale length to the left.

(d) All further adjustments may now be made from the lowest temperature indication scale mark. Set the bulb box, R1, for the lowest temperature reading and adjust box R2 to obtain the correct pointer indication.

(e) Re-check the full scale mark with the resistance box, R1, set to the correct value; if the indication is incorrect, reset R1 for the lowest temperature reading before making any further adjustment. Correct the scale length as described in (c).

(f) Repeat (d) and (e) to obtain the correct scale length. When the adjustments are complete, remove the decade resistance boxes which simulate the spools and adjust the spools to the values of the boxes.

(g) Connect the spools in circuit and make a final check for lowest and highest temperature values.

(h) The indicator is now ready for calibration; full details of the procedure are contained in the appropriate addendum to this manual.

NOTE: The resistance values for temperature indicators, given in the calibration table in the addendum include an additional 0.4 ohm which allows for the working conditions of the indicator and its associated transducer. This additional value includes 0.2 ohm for lead resistance. When calibrating the indicator use connecting leads of negligible resistance.

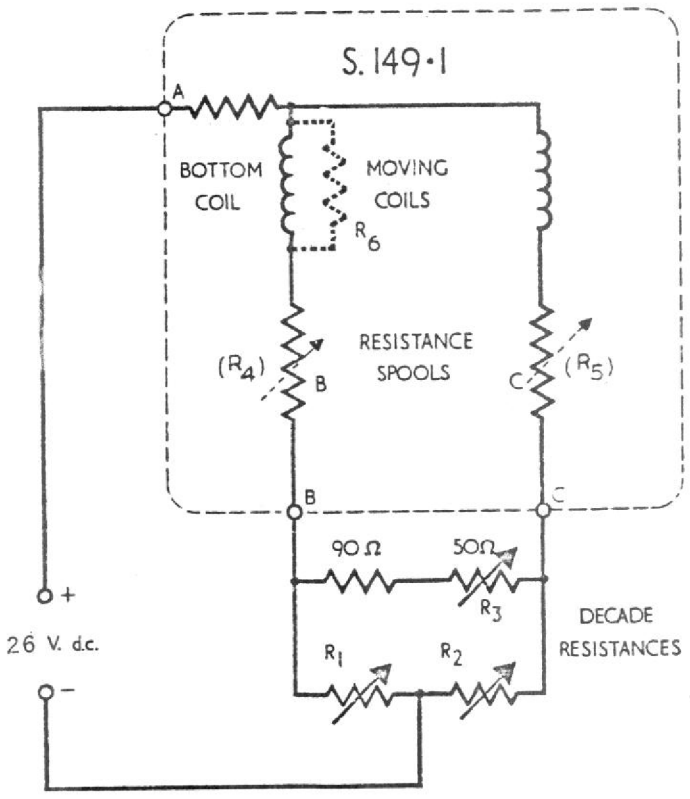

Fig. 4. Test circuit diagram. Position indicator.

C. Spool Adjustment Procedure for a Position Indicator

The position indicator is for use with a SANGAMO WESTON S.132 position transmitter; for spool adjustment purposes the transmitter is replaced by three decade resistance boxes R1, R2 and R3. The adjustments are made with 26 volts d.c. applied to the circuit.

(1) Preparation

(a) For circuits and values, refer to the appropriate addendum for the variant. To determine the correct scale length for a required movement range, spools listed as unadjusted will require adjustment, the values of all spools are pre-determined.

(b) Connect the pre-determined spools in circuit, insert two decade resistance boxes, R4 and R5, in place of the unadjusted spools, and decade resistance boxes R1, R2 and R3 in place of the position transmitter (see Fig. 4).

(2) Procedure

(a) Set resistance boxes R4 and R5 to the nominal values of spools B and C as given in the relevant addendum, these boxes when adjusted, must always be of equal value, if this is not possible a shunt spool R6 will have to be used as described in (c).

(b) Set R3 to 25 ohms, R1 and R2 each to 500 ohms, apply 40 volts d.c. to the circuit input.

(c) If the pointer deflects to the right of mid-scale (towards full scale position when indicator is viewed from the front) connect a decade resistance R6 across the top moving coil, between the top ligament and the lower of the two bottom ligaments. If deflection is to the left of mid-scale, connect box R6 across the bottom moving coil, between top ligament and the upper of the two bottom ligaments.

(d) Set R1 to 1000 ohms and R2 to zero, adjust R3 to bring the pointer over the cardinal indicating full scale position.

NOTE: The value of R3 must be kept within zero and 50 ohms for all adjustments required in (b), (c) and (d), otherwise the associated position transmitter S.132 will not be adjustable to the indicator.

(e) Set R1 to zero and R2 to 1000 ohms, adjust shunt resistance box R6 to bring the pointer in alignment with the left hand end-scale cardinal (nominal zero).

(f) Repeat operations (d) and (e) until pointer aligns accurately with both end scale cardinals. Adjust value of shunt spool (if used) to the final value given by resistance box R6.

(g) Adjust spools B and C to final values for resistance boxes R4 and R5; the value of these two spools should always be equal.

D. Sealing test (Refer to Fig.5)

The sealing test follows the completion and checking of the calibration of the indicator.

(1) Connect the exhaust stud on the indicator's end plate of the pumping equipment in order to remove air from the case.

(2) Ensure that a tight seal is made between the exhaust stud and the manifold.

CAUTION: PLACE THE INDICATOR IN A SAFETY TANK TO AVOID POSSIBLE INJURY TO PERSONNEL IN THE EVENT OF THE CASE GLASS DISINTEGRATING.

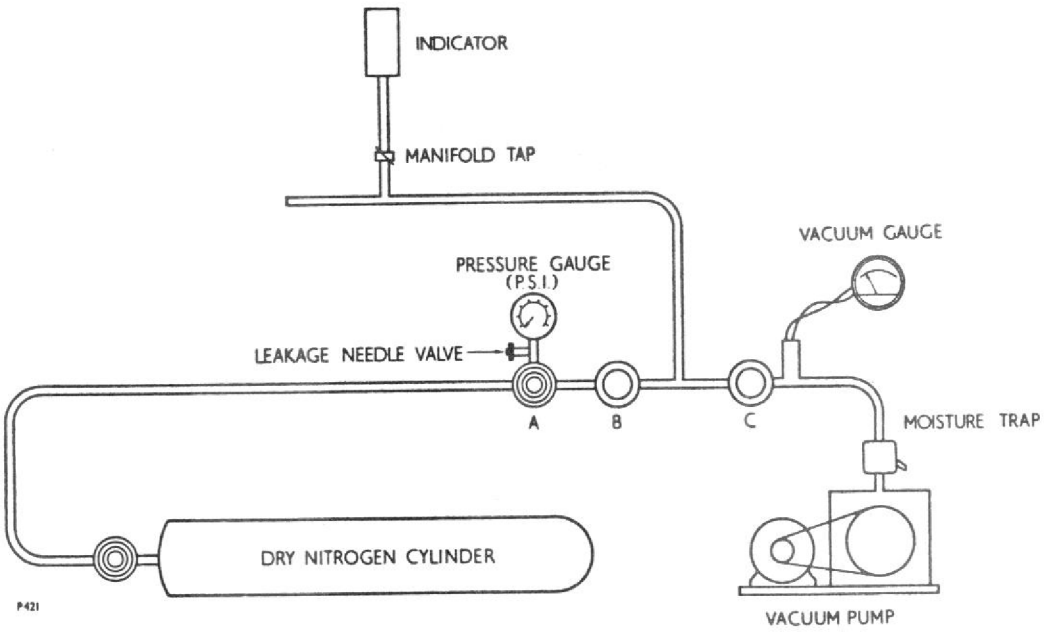

Fig.9 Sealing Test

(3) Check that the manifold tap connected to the indicator is closed; and also that the dry nitrogen and admittance valve taps A and B are closed.

(4) Start the vacuum pump motor and obtain the required degree of vacuum which is 0.1mm of mercury.

(5) When the correct vacuum is indicated open valve C and the manifold tap and allow the system to regain the required vacuum.

NOTE: If it is not possible to maintain the vacuum, close the manifold tap, remove the indicator and check for leakage as detailed in sub-paragraphs (8) and (9). Inspect and if necessary reseal the indicator. Reconnect the indicator to the system, open the manifold tap and regain the required vacuum.

(6) Close the valve C and open valve B to admit dry nitrogen into the indicator. Adjust control valve A to obtain a pressure of 15 lb per square inch gauge.

(7) After a lapse of 30 seconds, manipulate control valve A and the leakage needle valve to reduce the indicator pressure to 10 lb per square inch gauge.

(8) The indicator, still under pressure, must now be completely immersed in a tank containing 99.5% distilled water and 0.5% wetting agent.

NOTE: A suitable wetting agent is Shell Teepol 514.

(9) Shake the indicator to remove any trapped air that may be present and then check for any sign of leakage over a period of 5 minutes.

Leakage will be shown by the presence of bubbles leaving the case.

In the event of leakage, mark the case at the defective part for action on removal of the indicator from the system.

Particular care must be taken to check for leakage at the sealing join of the end plate and the case glass.

(10) At the completion of the test for leakage, reduce the dry nitrogen pressure to zero by operating control valve A and the needle valve.

(11) Close the manifold tap and remove the indicator from the tank and dry with a piece of clean muslin.

(12) Disconnect the indicator from the manifold, and seal as instructed below:

(a) Indicator case fitted with a sealing tube:

Crimp the tube in a suitable fixture and seal the end of the tube with solder.

(b) Indicator case fitted with a sealing stud:

Place a sealing pin in the stud aperture and complete the sealing process by carefully soldering the pin to the stud.

NOTE: The final sealing of the indicator must be made immediately after its removal.

(13) Carry out the High Voltage and Insulation Test described in sub-paragraph E.

E. High Voltage and Insulation Tests

(1) High Voltage Test

Apply a voltage of 1 000 volts (r.m.s.) for one minute between all the plug pins (or terminals) connected together and the case; there must be no breakdown.

(2) Insulation Test

The insulation test, which must follow the High Voltage test immediately, involves measuring the insulation resistance between the connections and the case; after 15 seconds electrification at 500 volts d.c., the resistance must be 20 megohms or more.

9. **Trouble Shooting** (Refer to Fig. 7.)

A. **Faults**

(1) The main symptons of faults after overhaul are:

(a) Erratic movement of the pointer

(b) Incorrect indication of the pointer

B. **Correction**

(1) Check fault against trouble shooting chart and complete the suggested procedure.

(2) Re-test indicator after correction of fault and any subsequent reassembly.

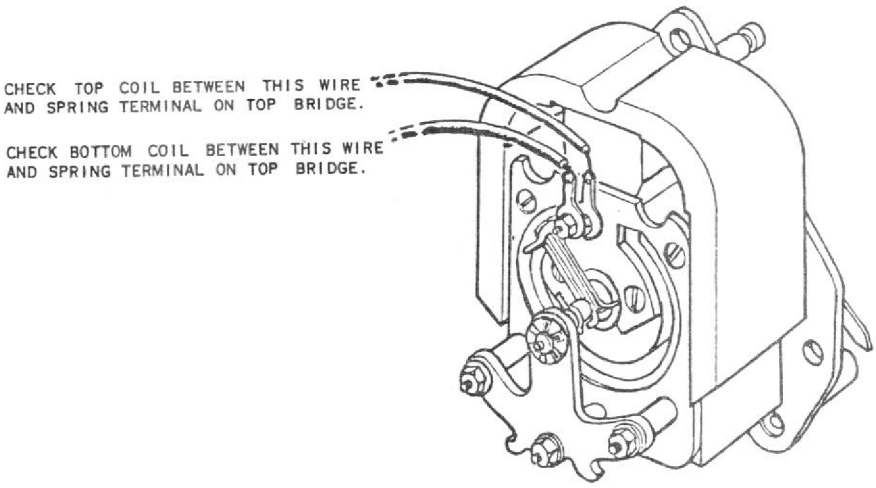

Fig. 6. Moving Coil connections.

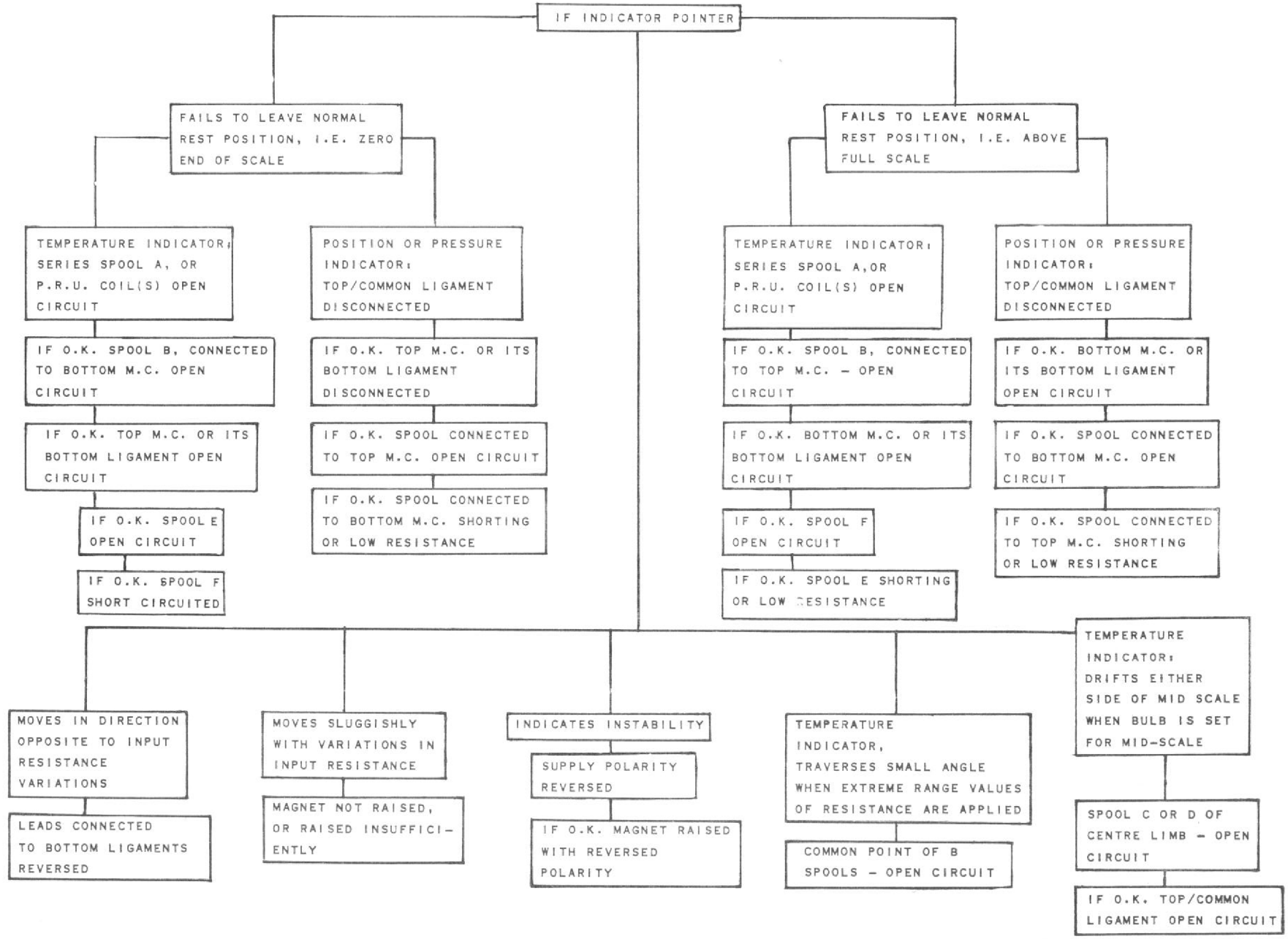

Fig. 7. Trouble shooting chart.

10. Storage instructions

A. Conditions

(1) If the original packing is not available, prepare the following:

(a) Packing for temperate areas:

(i) Oven dried silica gel.

(ii) A polythene bag; to contain the indicator together with the silica gel. The opening of the bag must be heat sealed.

(iii) A rubberised hair mould to enclose the indicator in its polythene bag.

(iv) A cardboard box to contain the hair mould.

(v) Gummed paper strip to seal the cardboard box.

(vi) A label to be affixed to the box and giving the following information:

a - Identification, e.g. S.149.1.000

b - Modification standard

c - Date of removal from aircraft

d - Date of last overhaul

e - Details and date of any component change

f - Reason for return of indicator

(b) Packing for tropical areas:

(i) Water resistant paper to completely enwrap the indicator; then proceed as described in (a) (i) to (iii).

(ii) A polythene bag large enough to hold the rubberised hair mould. Heat seal the bag and proceed as described in (a) (iv) and (v).

(iii) A wooden box of suitable dimensions to enclose the cardboard box; secure it and affix a label as in (a) (vi).

(2) If the original packing is available, repack the indicator and affix a label as in (1) (a) (vi).

B. Storage limiting period

(1) The storage limiting period of the indicator is five years.

(2) Indicators which have been in store for five years must be subjected to the calibration check and the insulation resistance test detailed in paragraph 8 (Testing) and, if found satisfactory, returned to storage.

(3) Indicators must be stored under conditions where humidity does not exceed 50% and where the temperature is within the range $-20^{o}C$ to $+50^{o}C$.

11. Special tools, fixtures and equipment

Item	Description	Supplier
1	Set of Balance weight wrenches:- 271157-11 off	Sangamo Weston Ltd.

13 Overhaul period 'ON CONDITION'

NOTE: The term 'On Condition' is applicable to systems/components on which airworthiness is determined by inspections, measurements and tests, or by other means specified, without extensive disassembly or renewal.

Inspections or checks of the aircraft indicator are scheduled at intervals shown in the aircraft maintenance schedule which will determine the repairs, replacements and refinishing needed to maintain the required airworthiness standard.

12. Illustrated Parts List.

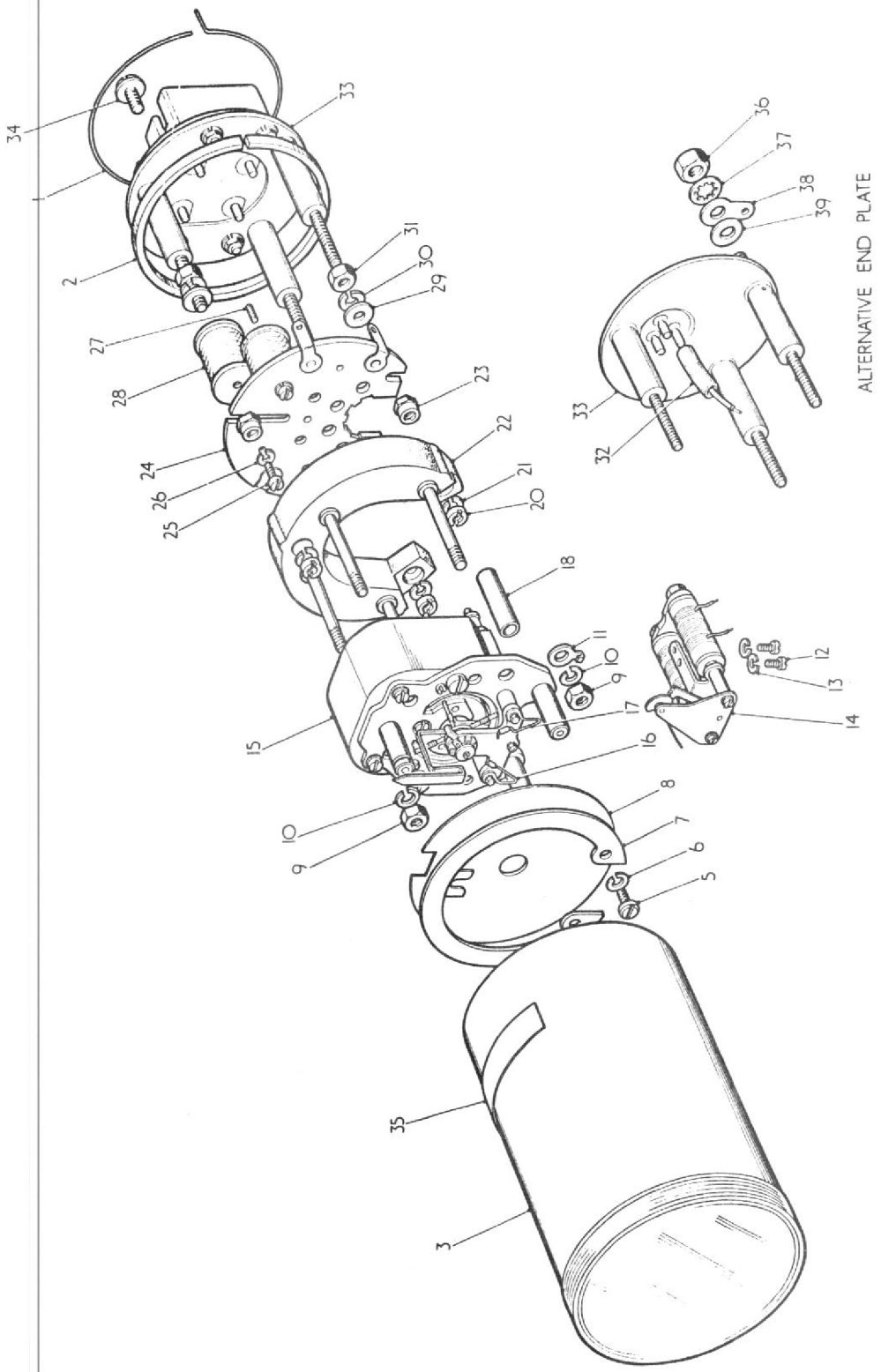

Fig.8. Model S.149 Form 1

This list to be used with Variant Parts List for Model S.149 Form 1

COMMON PARTS LIST

MODEL S.149 FORM 1

	Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
	Fig.8	Model S.149 Form 1		
	1	Wire, Sealing	168416	1
	2	Ring, Seating	169908	1
	3		See Variant Parts	
R				
	5–8		See Variant Parts	
	9	Nut, 6 B.A.	112243	4
	10	Lockwasher, 6 B.A.	156976	4
	11	Tag, Terminal, 6 B.A.	156456	1
	12–15		See Variant Parts	
	16	Pointer Stop L.H.	162557	1
	17		See Variant Parts	
R				
R	18	Spacer	176247	4
R				
	20	Nut, Round, 6 B.A.	92356	3
	21	Lockwasher, 6 B.A.	See Index No.10	3
	22	Ring, Moulded	170060	1
	23	Nut, Special, 6 B.A.	170056	3
	24	Plate, Spool Mounting	171590	1
	25–26		See Variant Parts	
	27		See Variant Parts	
	28		See Variant Parts	
	29	Washer, 6 B.A.	90296	3
	30	Lockwasher, 6 B.A.	See Index No.10	3
	31	Nut, 6 B.A.	See Index No.9	3
	32		See Variant Parts	
	33–39		See Variant Parts	

NOTE: Sangamo Weston Code appears on front of Scale

The term 'variant' defines a particular application of the Model. The last figure group of the Sangamo Weston Code number identifies the variant and enables the user to select the correct variant parts list.