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FUEL FLOWMETERS
Mk. 5 and 6 Series
(NEGRETTI and ZAMBRA)

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

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Chapter 1

FUEL FLOWMETERS, Mk. 5 SERIES
(NEGRETTI AND ZAMBRA)

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Introduction

1. The Negretti and Zambra fuel flowmeter, Mk. 5 series is used to measure the rate of fuel flow to aircraft engines, and also to indicate the amount of fuel that has been consumed. The flowmeter consists of a transmitting unit and a remote indicator which is calibrated in pounds per hour, and which also registers, in pounds, the amount of fuel that has been consumed, with a maximum of 99990 pounds.

2. The flowmeters and indicators will vary slightly for each particular aircraft installation, due to the positioning of the transmitter and also the type of inlet and outlet connections used. There may also be minor constructional differences. Table 2 lists all the flowmeters and indicators in the Mk, 5 series, and details of a particular flowmeter or indicator will be found in the relevant chapters.

3. The flowmeter and indicator weigh 6½ lb and 3¼ lb respectively, and they operate on a 115V, single-phase, 400 Hz a.c. supply.

DESCRIPTION

Flowmeter (fig. 1 and 2)

4. The flowmeter mechanism is housed in a body closed at its upper end by a pinion housing and at its lower end by an elbow connection. The connection is secured to the body by four bolts, and the inlet port in the connection is either threaded internally or is flanged to suit particular installations as shown in the relevant chapter Housed in the lower part of the body are an orifice plate and a tapered plug; this is located concentric with the plate. A piston rod passes through the plug which is free to move on the rod. A coil spring is positioned between the base and the plug, and a conical seating unit pinned to the piston rod. The top of the tapered plug is closed by an end cap, and a collar on the lower end of piston rod centralizes it in the lower end of the plug. A piston rod guide is secured to a web in the body above the tapered plug and consists of a plate secured to the body and having a phosphor-bronze bush in its centre.

5. The upper part of the body enclosed by the central web and the pinion housing acts as a chamber for a servo piston. The servo piston has a small bleed hole in it to provide an additional fuel transfer passage across the piston; fuel can also pass between the piston and the chamber wall. A rack secured between two rack mounts is secured to the upper end of the piston rod. The rack engages a pinion which transforms the vertical movement of the rack into a rotary movement to operate the flowmeter transmitter. The piston rod and rack are located in the pinion housing by a phosphor-bronze bush and a rack guide, and a top cap is secured to the pinion housing to enclose the upper end of the rack.

6. One side of the body is recessed and accommodates the control valve and capsule assemblies. These are enclosed by a capsule cover, and a valve seat is secured to the body. A valve housing is secured to one side of the capsule and locates a valve adjustment spring. A bearing piece at the other end of the spring is engaged by an extension of a range adjustment screw which passes through the capsule cover. Between the valve head and the valve housing are a number of bimetal compensating washers, and a small coil spring inside the valve adjustment spring holds the valve against the compensating washers to allow them free movement in expansion or contraction.

7. A recess in the capsule cover accommodates a circular metal filter which is retained in the capsule cover by a filter cover. To provide access to the

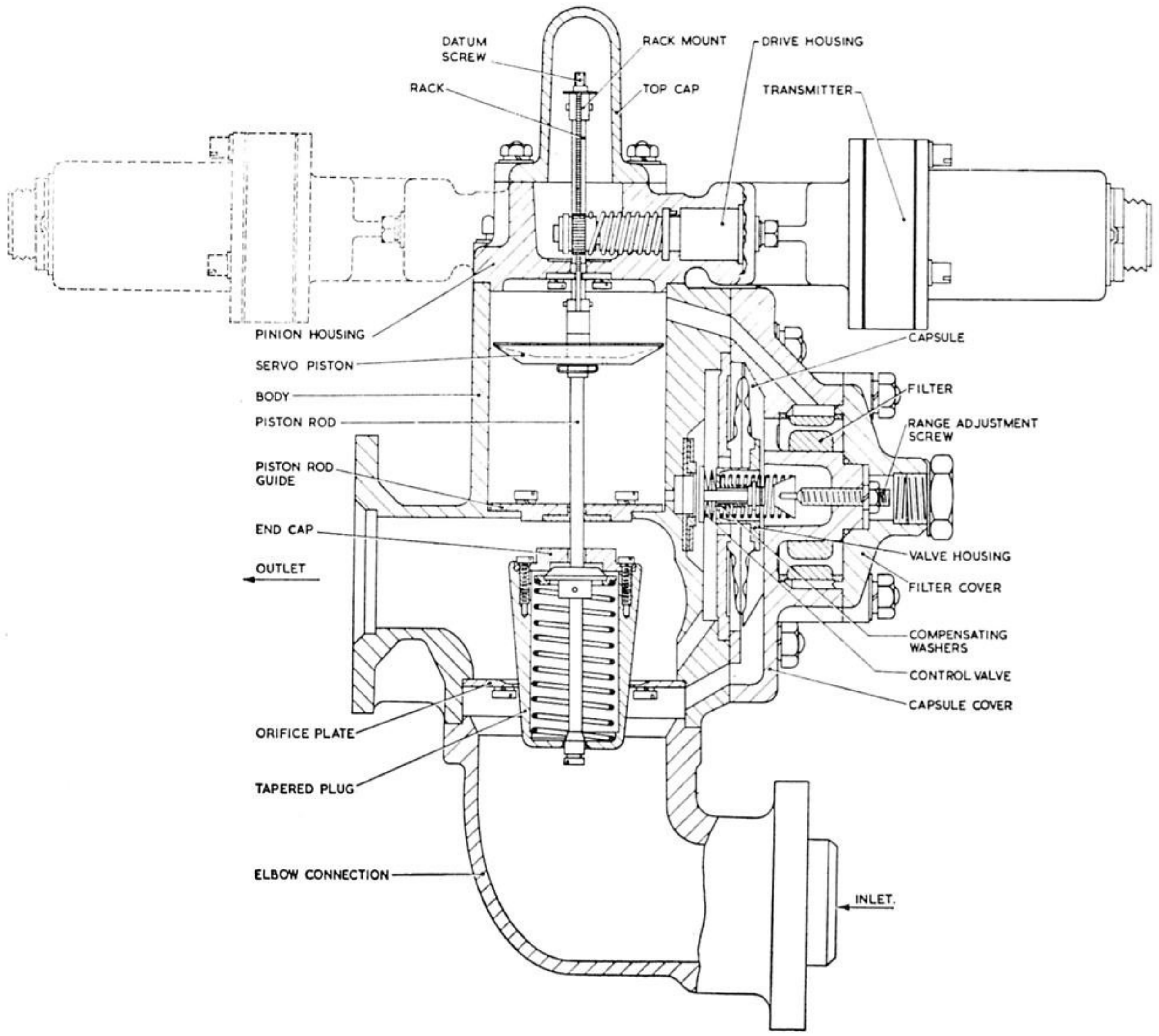

Fig. 1. Sectional view of flowmeter

range adjustment screw, a screwed cap is incorporated in the filter cover.

8. A drive housing (fig. 2) is secured to the side of the pinion housing. The housing carries a shaft which transmits the movement of the rack to a synchro torque transmitter. A plain bearing at each end of the drive housing supports the shaft which has a square-section drive dog on one end; the dog engages the fork end of a coupling assembly of the synchro torque transmitter. A pinion is secured to the other end of the shaft and a return spring is positioned over the drive housing with one end of the spring attached to the housing and the other end attached to the pinion. A seal is placed at the pinion end of the drive housing to prevent fuel from leaking into the transmitter, and also to prevent the silicone fluid in the drive housing from leaking into the flowmeter.

9. The interior of the drive housing and the synchro torque transmitter are filled with the silicone fluid. The fluid lubricates the bearings in the drive housing, and also passes into the synchro torque transmitter to lubricate the ball bearings in that component. The fluid surrounds the toroidal resistor and prevents any contamination of the coil.

Transmitter

10. The transmitter is secured to the end of the drive housing with a positioning block between them. The drive dog in the drive housing engages the fork end of the coupling assembly, and a wiper arm, positioned between two insulating rings, is also part of the coupling assembly. Rotation of the drive dog causes the arm to move over the track of a toroidal resistor carried in the positioning block. A synchro torque transmitter is secured to the rear of the positioning block, the transmitter shaft engaging the splined bore of the coupling assembly. The transmitter and its associated brush gear are enclosed by a cover which has a 6-pole Breeze plug secured at the rear end.

11. A slipring is in contact with the wiper arm, and is engaged by a brush. This consists of a V-shaped phosphor-bronze spring, the arms of the V resting on the slipring. The toroidal resistor and the series resistor, which is located in a groove around the toroidal resistor holder, are connected to the Breeze plug via three pins which pass through the positioning block. The brush is also connected to the Breeze plug by a similar pin. A shunt resistor is incorporated in the transmitter circuit to provide a constant output impedance of the unit.

Indicator (fig. 3)

12. A baseplate, with an upper and a lower body secured one on each side, forms the framework of the indicator. The bodies are enclosed by a steel cover which also serves as a magnetic shield for the electric motor magnet, and a sealing ring at each end prevents the entry of dust into the interior.

13. The upper body has a synchro torque receiver secured to its end face. The receiver spindle passes through the body, the bezel, and the dial, and has a rate of flow pointer affixed to its end.

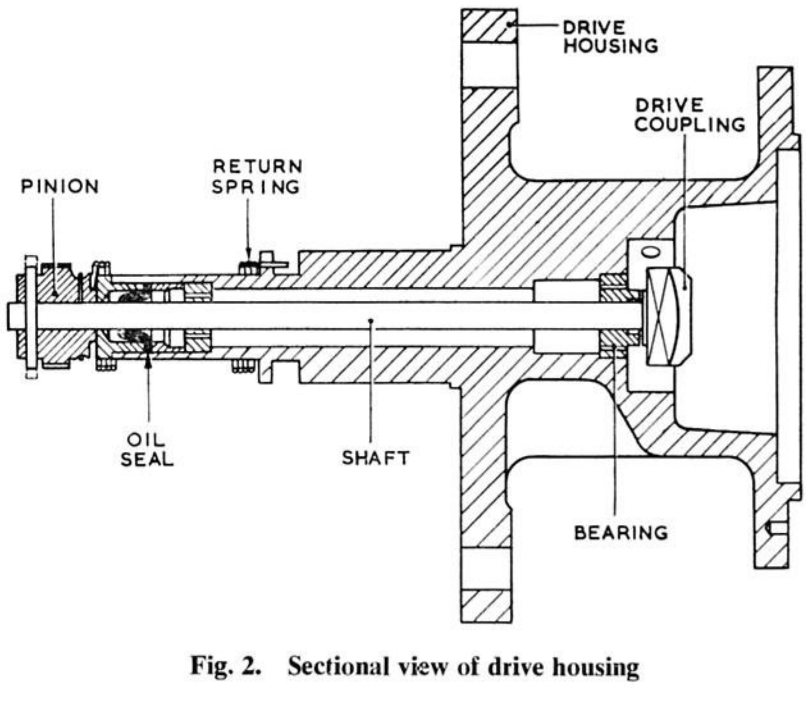

Fig. 2. Sectional view of drive housing

14. The items of elecrical equipment are supported in the upper body. The 115-volt, 400 cycle, single-phase a.c. supply is rectified to 140-volt d.c. and this is reduced, by a resistor/neon stabilizer circuit, to give a constant 75-volt supply to the motor circuit. A preset resistor further reduces the supply to 24 volts, this is fed to the toroidal resistor in the flowmeter transmitter, and the voltage from this resistor is taken to the electrical motor. Two capacitors, to suppress radio interference, are incorporated in the motor circuit and are mounted on a panel adjacent to the neon stabilizer. The capacitor is held in clips on a panel, and the stabilizer and its protective cover are mounted on the baseplate.

15. The lower body supports the electric motor and reduction gearbox. The motor is a low-inertia, permanent-magnet d.c. type; a pinion at the end of the motor shaft engages one of the gears in the gearbox. The drive from the gearbox to the drum counter is by a transfer shaft which passes through the upper body and rotates in bronze bearings in the base-plate and the body. A worm on the front end of the shaft engages a gear on the end of the counter shaft upon which is mounted four drum-type counters. The figures of the counters show in a slot on the dial face, and all figures, letters and scale markings on the dial are painted white, while the dial background is black. The dial presentation for a particular type of indicator is shown in the relevant chapter.

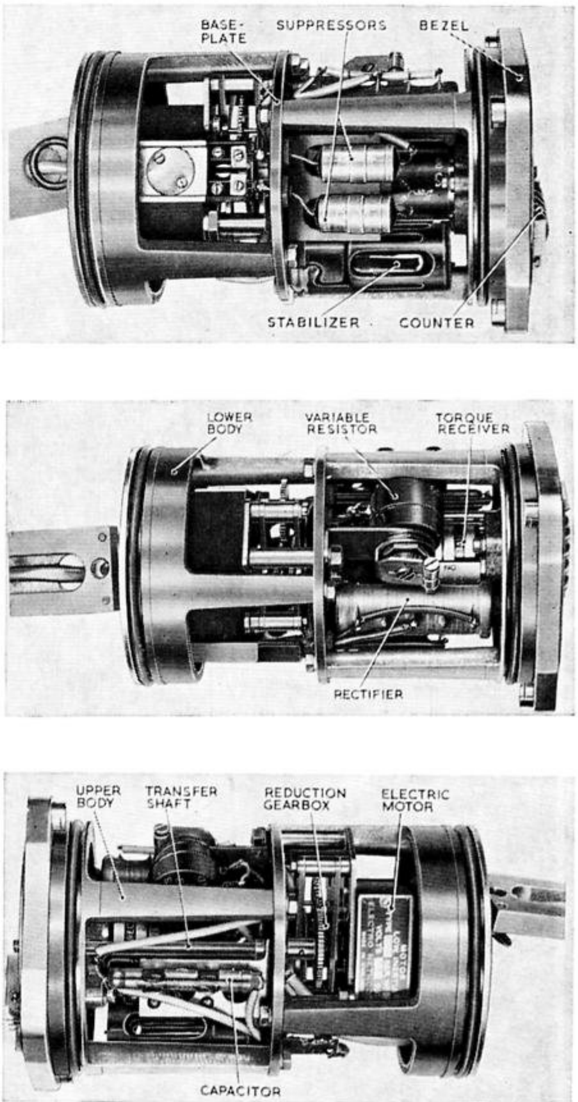

Fig. 3. Views of indicator

Operation (fig. 4)

16. As fuel commences to flow through the flowmeter, a pressure difference develops across. The control capsule will then be compressed until it has closed the by-pass valve and stopped the by-pass flow. Pressure will no longer be applied across the servo piston, and the pressure acting on the tapered plug will cause it to move upward. This upward movement will continue until the pressure difference is sufficient to re-open the by-pass valve and re-start the by-pass flow, which will increase until the pressure drop across the piston provides enough reaction to prevent further movement.

17. A reduction in flow rate causes a change in the pressure drop across the main orifice. This allows the capsule to open the by-pass valve further and more pressure will then act across the piston. As this has a larger area than the tapered plug, the piston will move downward until conditions are stabilized. Under a condition of a steady rate of flow, the pressure difference across the main orifice remains constant, and the position of the piston rod is a measure of the flow rate past the main orifice with the flow through the by-pass as a constant addition. The flowmeter thus gives a linear measurement of a liquid of constant density.

18. Variations in density of the fuel may be caused either by changes in temperature, or a fuel of a different density may be used. To compensate for changes in temperature, an appropriate change may be made in the control pressure, and this is done by the addition of the bimetal washers (para. 7). These change the relative setting of the capsule and the by-pass valve, and cause the valve to close at a lower pressure difference at lower temperatures and a higher one at higher temperatures, thereby compensating for density change.

19. The flowmeter is intended for use with kerosene of specific gravity 0·80, but variations of the specific gravity between 0·785 and 0·815 will not cause an additional error of more than one per cent of the reading. For specific gravities outside these limits, or for more accurate results, Table 1 is to be used.

TABLE 1

Specific gravity multiplication factor

Specific gravity	Multiply by :—	Specific gravity	Multiply by :—
0·85	1·031	0·790	0·994
0·84	1·025	0·785	0·991
0·83	1·019	0·780	0·987
0·82	1·012	0·77	0·981
0·815	1·009	0·76	0·975
0·810	1·006	0·75	0·968
0·805	1·003	0·74	0·962
0·800	1·000	0·73	0·955
0·795	0·997	0·72	0·949

TABLE 2

Details of flowmeters and indicators in the Mk. 5 series

Ref No.	Type No.	Nomenclature	Aircraft applicability
	Fuel flowmeter, Mk. 5 consisting of :—		
6A/6564	2-38149	Flowmeter transmitter	Britannia C, Mk. 1
6A/6565	2-38094	Indicator	Britannia C, Mk. 1
	Fuel flowmeter, Mk. 5A consisting of :—		
6A/6422	2-38150/AA	Flowmeter transmitter (Starboard outer)	Comet C, Mk. 2 (Post Mod. 2107)
6A/6423	2-38150/BB	Flowmeter transmitter (Starboard inner)	Comet C, Mk. 2 (Post Mod. 2107)
6A/6424	2-28150/AB	Flowmeter transmitter (Port inner)	Comet C, Mk. 2 (Post Mod. 2107)
6A/6425	2-38150/BD	Flowmeter transmitter (Port outer)	Comet C, Mk. 2 (Post Mod. 2107)
6A/5855	2-38095	Indicator	Comet C, Mk. 2 (Post Mod. 2107)
	Fuel flowmeter, Mk. 5B consisting of :—		
6A/7099	2-37517	Flowmeter transmitter	Comet C, Mk. 4
6A/7098	2-38148	Indicator	Comet C, Mk. 4

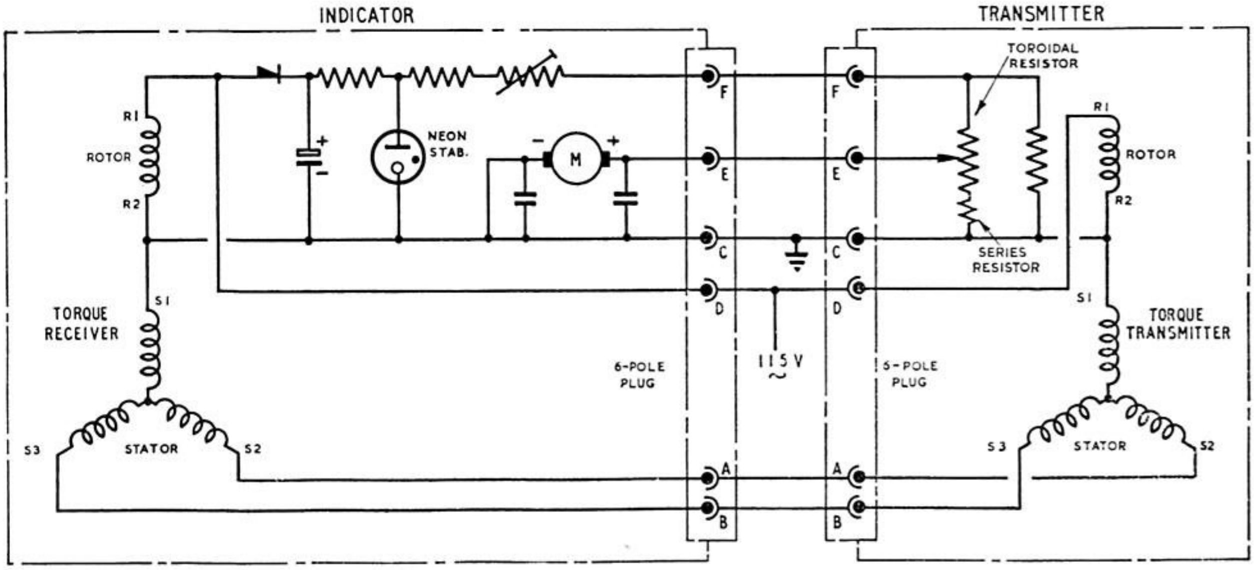

Fig. 4. Transmitter and indicator—circuit diagram

20. Overload pressure relief is provided to ensure a free path for the fuel flow should the flow meter seize. The powerful self-servo action of the piston will first try to clear the stoppage, but should the piston rod still stick, the plug will slide along the rod against the spring pressure.

21. The vertical movement of the piston rod is converted to a rotary movement by the drive housing which, being also connected to the flowmeter transmitter, causes a similar rotary movement of the torque synchro transmitter spindle and the coupling assembly. The signal from the torque synchro transmitter is passed to the receiver in the indicator causing movement of the rate of flow pointer. Movement of the coupling assembly causes the wiper arm to move across the toroidal resistor and so vary the voltage to the electric motor in the indicator. The shaft speed of the motor is directly proportional to the applied voltage, and rotation of the motor shaft causes operation of the counter.

22. The start of the scale of flow can be varied by adjusting the datum screw at the upper end of the piston rod. This adjusts the "at rest" position of the plug relative to the orifice.

23. The range of the scale can be varied by rotation of the adjustment screw in the centre of the filter housing. This screw loads the spring which holds the valve housing against the capsule.

INSTALLATION

24. The flowmeter is secured in position by attachment of the outlet flange to a mounting bracket. The method of attachment may vary for each particular aircraft installation, and will cause the flowmeter to have a different Part Number. The chapter which describes a particular flowmeter will illustrate the method of attachment.

25. The indicator is mounted on its respective panel by three screws which pass through the panel into three 4 B.A. captive nuts secured to the bezel of the indicator.

Servicing

26. The only minor servicing permitted is the examination of the flowmeter and indicator for damage, cleanliness, and security of attachment.

27. The filter may be removed for cleaning. To do this, remove the filter cover and withdraw the filter. Clean the filter in unleaded gasoline and examine for damage. When installing the filter, ensure that it seats correctly in the recesses in the housing and in the cover. If the sealing ring or gasket are damaged, they are to be renewed before the cover is fitted.

Chapter 1-1

FLOWMETERS, TYPE 2-38150/AA, 2-38150/BB, 2-38150/AB and 2-38150/BD

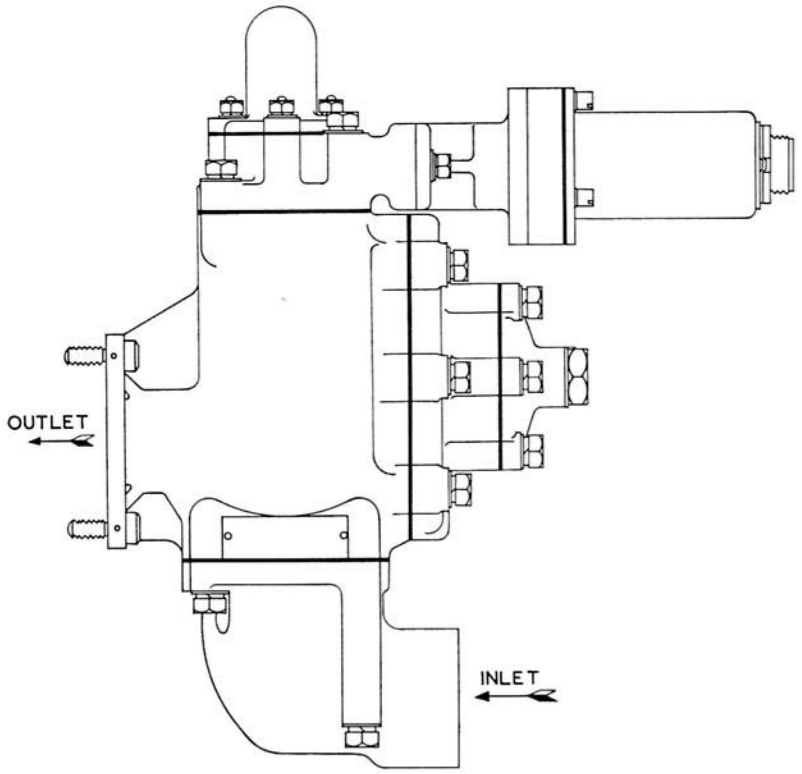

Fig. 1. Installation details of flowmeter, Type 2-38150

1. The flowmeters, Type 2-38150/AA (Ref. No. 6A/6422), Type 2-38150/BB (Ref. No. 6A/6423), Type 2-38150/AB (Ref. No. 6A/6424) and Type 2-38150/BD (Ref. No. 6A/6425) are all similar in construction to the basic flowmeter described in the chapter, but have different inlet and outlet connections. As shown in fig. 1, the inlet connection is an internally-threaded union, and four studs are provided on the outlet connection for attachment purposes. The two letters at the end of each type number denote the position of the synchro torque transmitter and the inlet connection relative to the outlet connection. Referring to fig. 2, it can be seen that the synchro torque transmitter and the inlet connection can each be in one of four positions. The first suffix letter denotes the position of the synchro torque transmitter, and the second letter denotes the position of the inlet connection. For example, 2-38150/BD means that the synchro torque transmitter is in position B of fig. 2, and the inlet connection is in position D of fig. 2.

2. The servicing instructions for this flowmeter are the same as the basic servicing instructions given in Chapter 1.

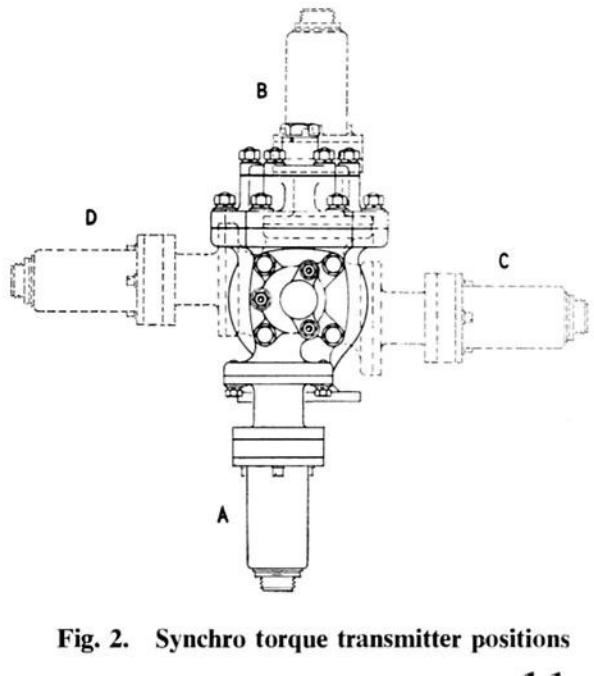

Fig. 2. Synchro torque transmitter positions

Chapter 1-2

INDICATOR, TYPE 2-38094

Description (fig. 1)

1. The indicator, Type 2-38094 (Ref. No. 6A/6565) is similar in construction to the basic type described in the chapter, but it has the dial presentation shown in fig. 1. The range of the indicator is from 450 to 3300 lb/hr, and it indicates a total of 99990 lb.

2. The figures and dial markings are in white and the dial background is black. The indicator is housed in a standard s.a.e. case, and the totalizing counter is reset by the operation of a reset knob at the lower right-hand corner of the instrument.

3. The servicing instructions given in Chapter 1 are applicable to this indicator.

Fig. 1. Dial presentation of indicator, Type 2-38094

Chapter 1-3

INDICATOR, TYPE 2-38095, MOD. 2

Description (fig. 1)

1. The indicator, Type 2-38095, Mod. 2 (Ref. No. 6A/5855) is similar in construction to the basic type described in the chapter, but it has the dial presentation shown in fig. 1. The range of the instrument is from 400 to 7500 lb/hr, and it indicates a total of 99990 lb.

2. The figures and dial markings are in white and the dial background is in black. The indicator is housed in a standard s.a.e. case, and the totalizing counter is reset by the operation of the reset knob at the lower right-hand corner of the instrument.

3. The servicing instructions given in Chapter 1 are applicable to this instrument.

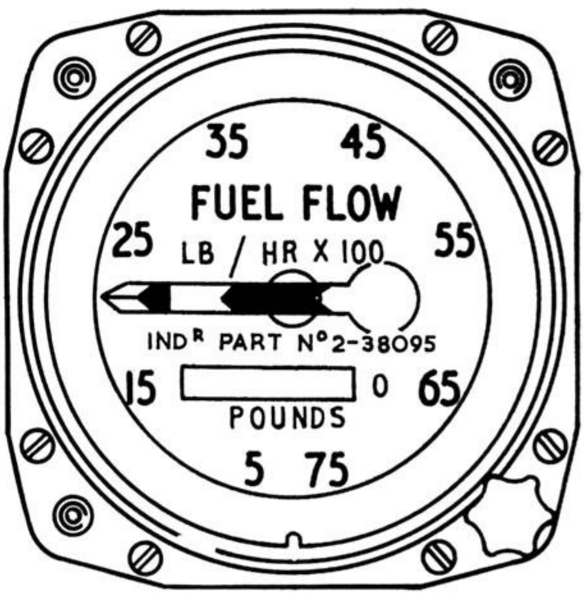

Fig. 1. Dial presentation of indicator, Type 2-38095, Mod. 2

Chapter 1-4

FLOWMETER, TYPE 2-37517

Description (fig. 1)

1. The flowmeter, Type 2-37517 (Ref. No. 6A/7099) is simlar in construction and operation to the basic type described in the chapter. There are, however, certain differences as shown in fig. 1, and these are described in the following paragraphs.

2. The synchro torque transmitter is positioned on the body as shown in fig. 1, and the inlet and outlet connections are of the type shown in fig. 1.

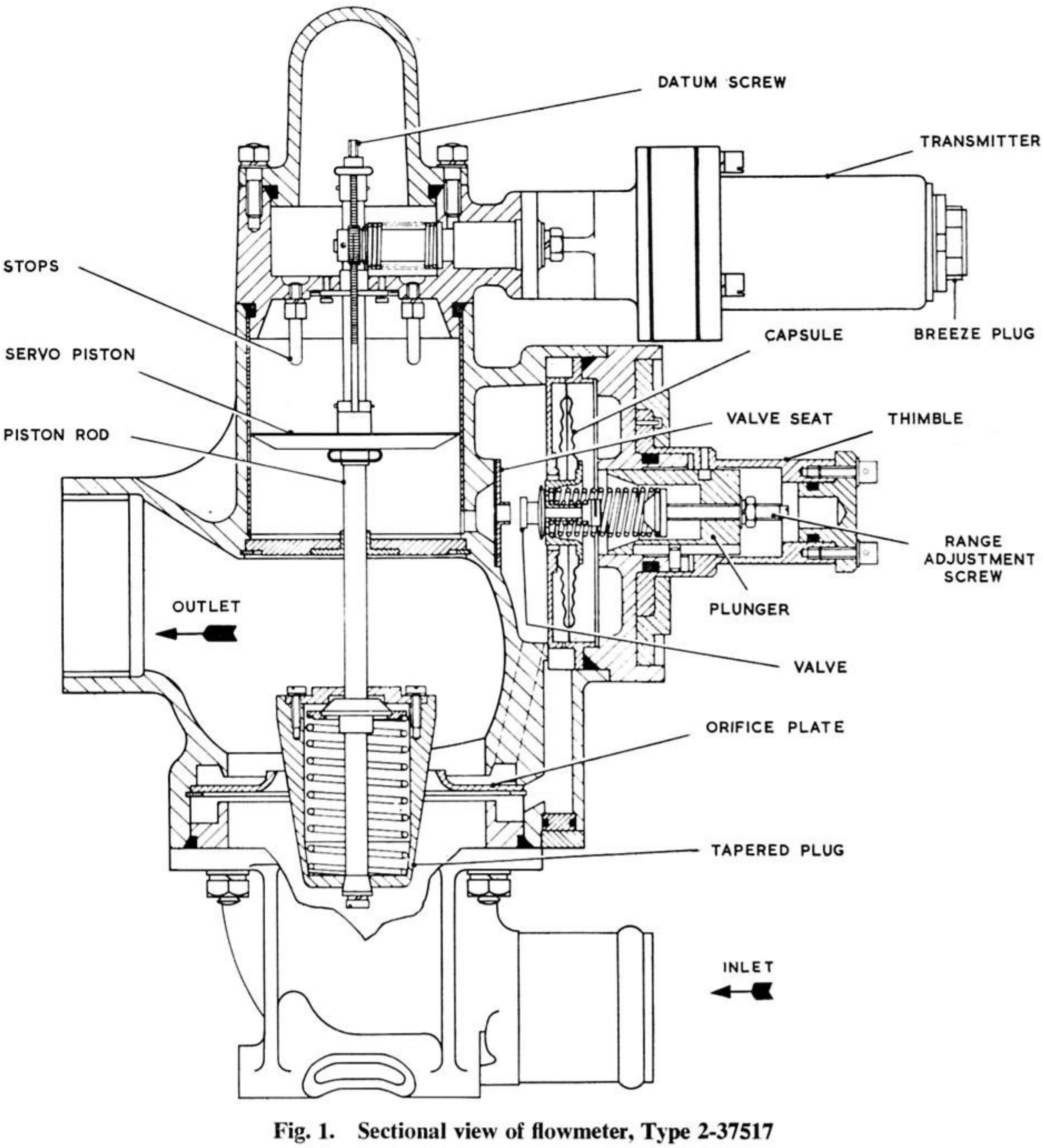

Fig. 1. Sectional view of flowmeter, Type 2-37517

3. The control valve and capsule assemblies are housed in the side of the body together with a specific gravity adjustment. This consists of a thimble which can be rotated to any one of a series of fuel density settings indicated on a plate, and is locked at the required setting by a spring-loaded ball which engages one of a series of indentations on the periphery of the thimble flange. Inside the thimble is the plunger carrying the range adjustment screw. The plunger has a spiral groove in its outer face which is engaged by a peg in the thimble. As the thimble is rotated, the plunger is moved axially causing the range adjustment screw to vary the pressure on the valve spring. This variation in spring tension varies the degree of response of the valve to capsule variations.

4. The filter is housed in the body on the inlet side of the piston. Two stops are screwed into the underside of the pinion housing and project into the piston chamber. The stops limit the upward movement of the piston and prevent it from rising above the inlet port.

Operation

5. The operation of the flowmeter, Type 2-37517 is the same as the basic type described in para. 18 to 25 of the chapter.

Servicing

6. For servicing details, refer to para. 26 of Chapter 1.

Chapter 1-5

INDICATOR, TYPE 2-38148

Description (fig. 1)

1. The indicator, Type 2-38148 (Ref. No. 6A/7098) is similar in construction to the basic type described in the chapter. The range of the indicator is 500 to 10500 lb/hr. and it indicates a total of 99990 lb.

2. The figures and dial markings are in white and the dial background is black. The indicator is housed in a standard S.A.E. case, and the totalizing counters are reset by the operation of the reset knob at the lower right-hand corner of the instrument.

Servicing

3. The servicing instructions given in Chapter 1 are applicable to this indicator.

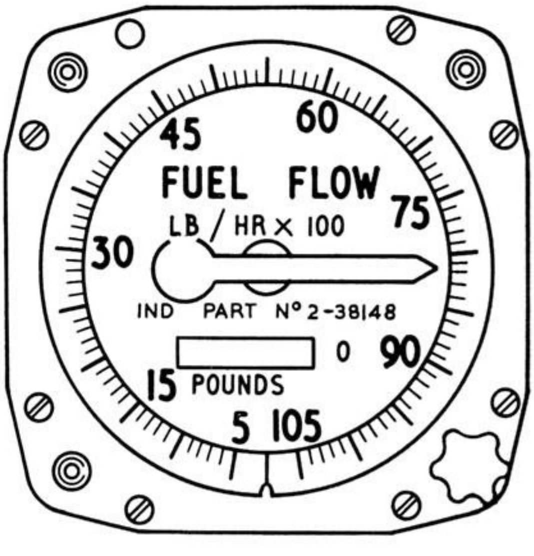

Fig. 1. Dial presentation of indicator, Type 2-38148

Chapter 1-6

FLOWMETER, TYPE 2-38149

Description (fig. 1)

1. The flowmeter, Type 2-38149/A (Ref. No. 6A/6564) is similar in construction to the basic flowmeter described in the chapter, but has a different type of inlet connection at the lower end of the body. This is to suit particular installation requirements. The synchro torque transmitter is positioned on the body as shown in fig. 1.

2. The servicing instructions for the flowmeter are the same as the basic servicing instructions given in Chapter 1.

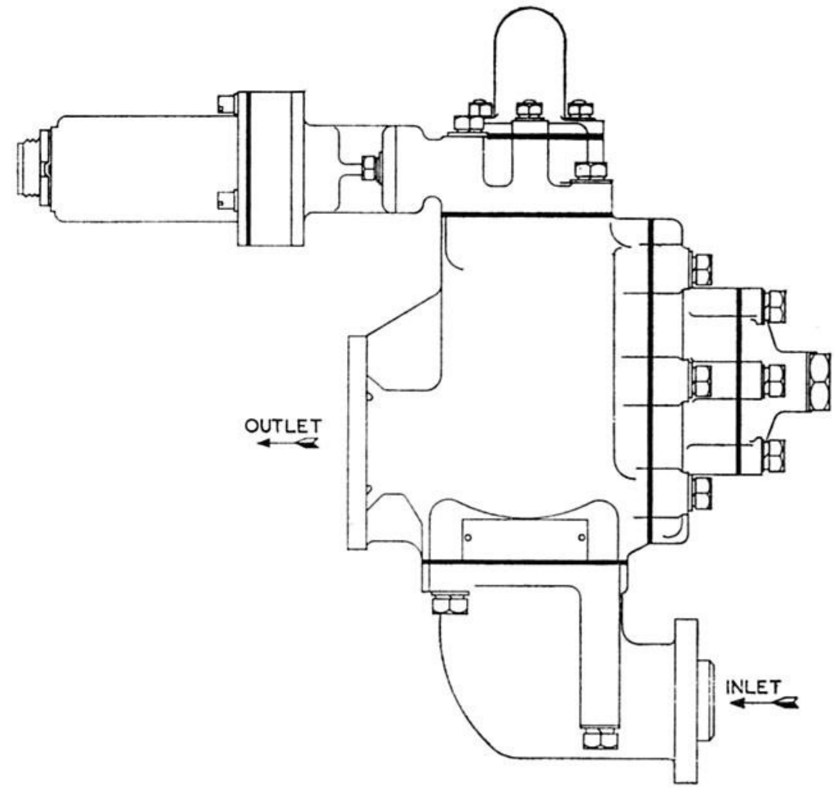

Fig. 1. Installation details of flowmeter, Type 2-38149

Chapter 1-7

FUEL FLOWMETER SYSTEM (NEGRETTI AND ZAMBRA)

Introduction

1. The flowmeter system consists of a transmitter flowmeter series 6, Ref. No. 6A/12497, electrically connected to a fuel flow indicator series 4, Ref. No. 6A/11816. The system provides an indication of fuel flow to Spey jet engines.

DESCRIPTION AND OPERATION

2. The fuel flowmeter system for each engine consists of a meter transmitter, engine-mounted in the fuel supply line, and an indicator, panel-mounted in the aircraft cabin. The two units are interconnected by a 6-wire cable into which is fed the electrical supply.

Meter

3. The meter provides an orifice measurement of flow, the orifice effective area, being varied with changing flow to maintain a constant pressure drop across it. This is effected by servo-controlled axial movement of a conical plug within the orifice, the control being such that the plug position is a measure of the rate of flow through the orifice.

Transmitter

4. The primary, differential and reference windings of the differential transformer are installed on the outside of a non-magnetic cube inside of which moves an iron core connected coaxially to the conical plug of the meter. The primary winding is

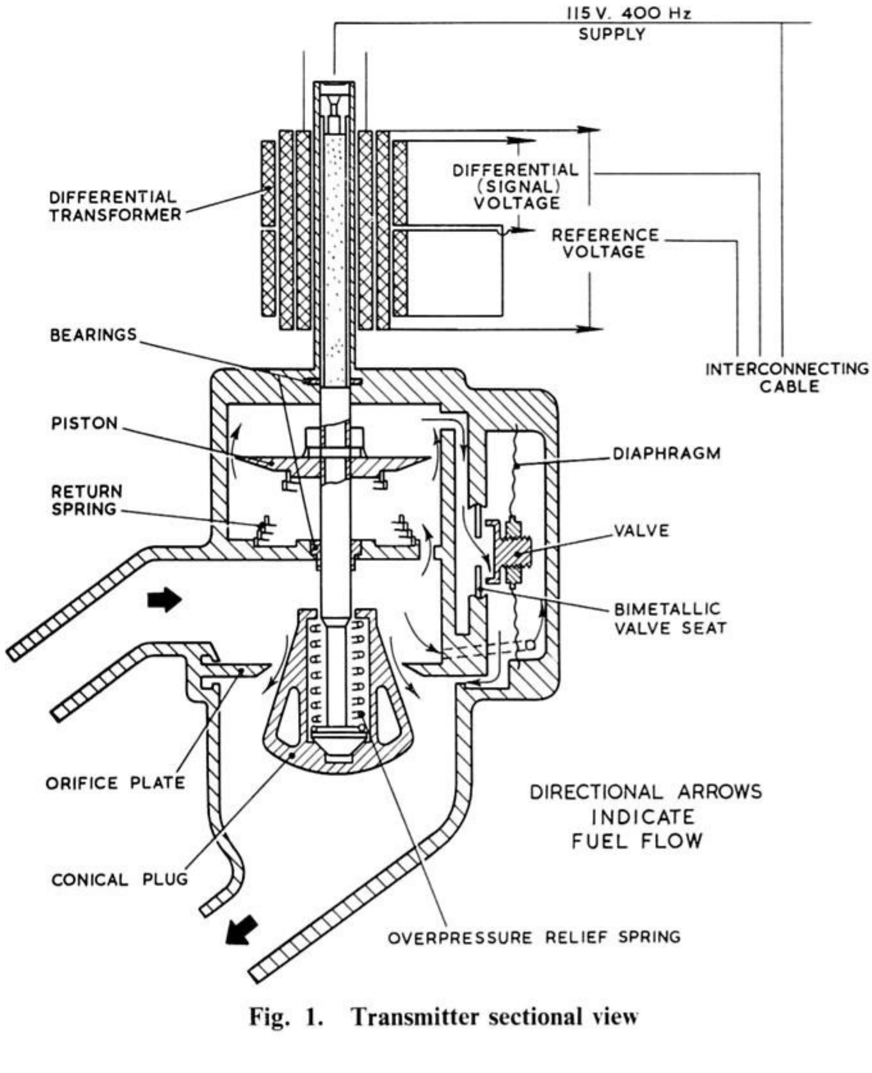

Fig. 1. Transmitter sectional view

excited from the system supply. Change in displacement of the core from its null position with change of flow through the meter induces a proportional change in the output of the differential winding, the ratio of which to that of reference winding bears a direct relationship to the rate of flow through the meter. These two signals, in the form of two alternating voltages, are transmitted via the interconnecting cable to the indicator.

Indicator

5. The signal and reference voltages on the meter transmitter are fed, together with the system supply, into a null balance circuit utilizing a servo-operated potentiometer. The angular position of the potentiometer wiper arm is a direct indication of the relative magnitudes of the signal and reference voltages, and consequently, of the rate of flow through the meter.

6. A pointer carried by the wiper arm spindle, transverses a dial calibrated in pounds per hour. A stabilized voltage is fed across a second potentiometer, the wiper arm of which is ganged with that of the servo potentiometer.

7. The voltage picked from the second potentiometer consequently bears a direct relationship to the rate of flow through the meter, and is fed to an integrating circuit. The integrator, in conjunction with a voltage comparator, is triggered to discharge at a voltage level such that the frequency of discharge is coincident with the reference of passage of one pound of fuel through the meter. Each discharge is registered by an electro-mechanical counter which displays, through an aperture in the indicator dial. The total number of pounds fuel passed by the meter.

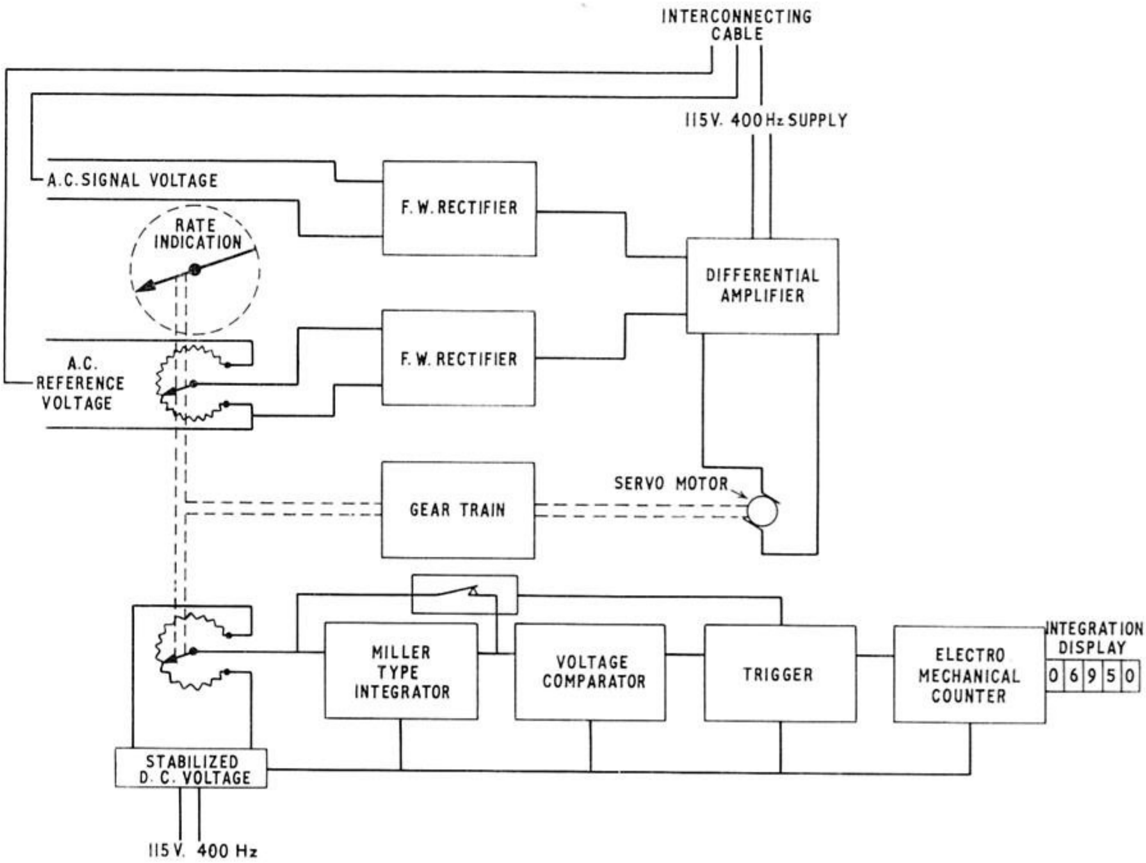

Fig. 2. Transmitter and indicator interconnecting circuit

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Chapter 1-8

FLOWMETER INDICATOR TEST SET 6C/1094992

1. Test set 6C/1094992 is used to check fuel flow indicator 6A/11816. It consists of a front panel on which are mounted a mains indicator lamp, fuse F1, ON/OFF switch SW2, rate selector switch SW1 and a multi-pin plug.

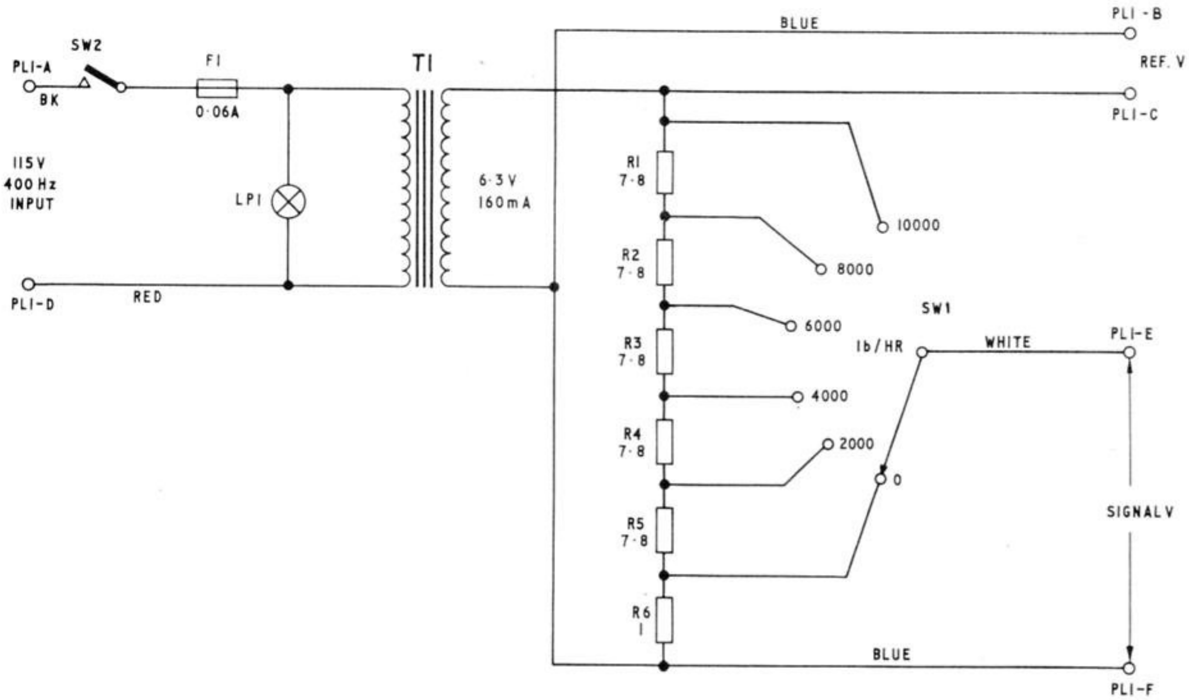


Fig.1 Flowmeter indicator test set 6C/1094992: circuit

DESCRIPTION (fig. 1)

2. A mains supply of 115V 400Hz is applied via SW2, F1, to the primary of transformer T1. Two parallel outputs are taken from the 6·3V secondary winding; one is used as a reference voltage for the indicator, and the other is applied to resistors R1-R6. The junctions of these resistors are connected to a multi-contact switch SW1, each switch position corresponding to a rate of flow, the higher the rate of flow the larger the voltage, i.e.

zero flow $= \frac{\text{Vsig.}}{\text{Vref.}} = \frac{1}{40}$ full flow $= \frac{\text{Vsig.}}{\text{Vref.}} = \frac{1}{1}$.

The output from the switch is applied to the indicator as a signal voltage.

3. Supply variations do not effect rates of flow because reference and signal voltages are derived from the same source.

SERVICEABILITY TEST

4. To check the serviceability of the connectors and test set proceed as follows:-

(1) Using a test set, multirange No. 1 (5QP/1057049), set to the ohms ÷ 100 range, check for continuity between correspondingly lettered inserts/pins of each plug/socket of the connectors.

(2) Connect the main socket of the double interconnecting cable to the test set plug.

(3) Connect a 115V 400Hz supply to pins A and D of the plug on the thinner cable.

(4) Switch the test set ON, and, using the test set, multirange No. 1, measure the reference voltage across inserts B and C of the free socket. It should be approximately 6V a.c.

(5) Measure the a.c. signal voltage across inserts E and F of the free socket for each position of the rate selector switch, the signal voltage should be in the following ratios to the reference voltage.

Switch position	Ratio		
	Vsig.		Vref.
0	1	:	40
2	8·8	:	40
4	16·6	:	40
6	24·4	:	40
8	32·2	:	40
10	1	:	1

Chapter 1-9

FUEL FLOW INDICATOR TYPE 05760

LEADING PARTICULARS

Fuel flow indicator Type 05760	...Ref. No. 6A/1172770
Range of flowrate	0 - 10000 lb/hr (scale divisions of 200 lb/hr)
Indicated fuel consumption	99990 lb maximum (in 10 lb increments)
Input power supply	115V 400Hz single phase
Dimensions:	
width	82.80mm (3.260in)
length	118.11mm (4.650in)
overall length (includes connector and reset knob protrusions)	131.57mm (5.180in)
height	82.80mm (3.260in)
Weight	1.133kg (2.5 lb)

Introduction

1. The fuel flow indicator Type 05760 is a series 4 instrument used in conjunction with fuel flow transmitter Type 05703 (Ref. No. 6A/12497), to provide a flowmeter system which indicates flow to Spey 250 jet engines. Fuel flow transmitters are described in Chapter 1-7.

DESCRIPTION

2. The instrument (fig. 1) indicates flowrate and fuel consumption within the ranges specified in the Leading Particulars. The flowrate scale has an aperture of 70.10mm (2.760in) of anti-parallax design with a pointer/scale diameter of 58.92mm (2.320in). Fuel consumption is indicated on a digital counter whose 'units' position displays a permanent zero. The counter may be reset to zero by means of the reset knob located in the bottom right-hand corner of the indicator face.

3. Ventilation is provided by a sintered glass filter, located at the rear of the instrument, to restrict entry of foreign particles larger than 30 x 10^{-6} in diameter into the interior.

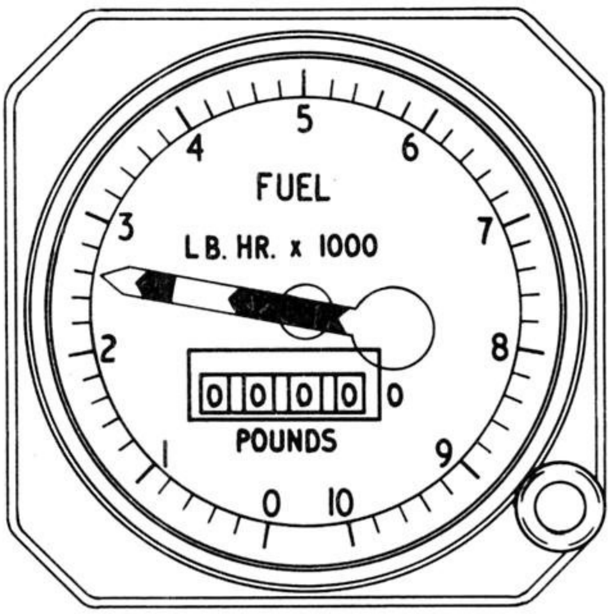


Fig.1 Indicator Type 05760 dial presentation

4. The indicator (fig.2) is housed in a stainless steel case and incorporates power, servo amplifier, voltage controlled oscillator printed circuit boards, also potentiometer and electro-magnetic counter solenoid sub-assemblies.

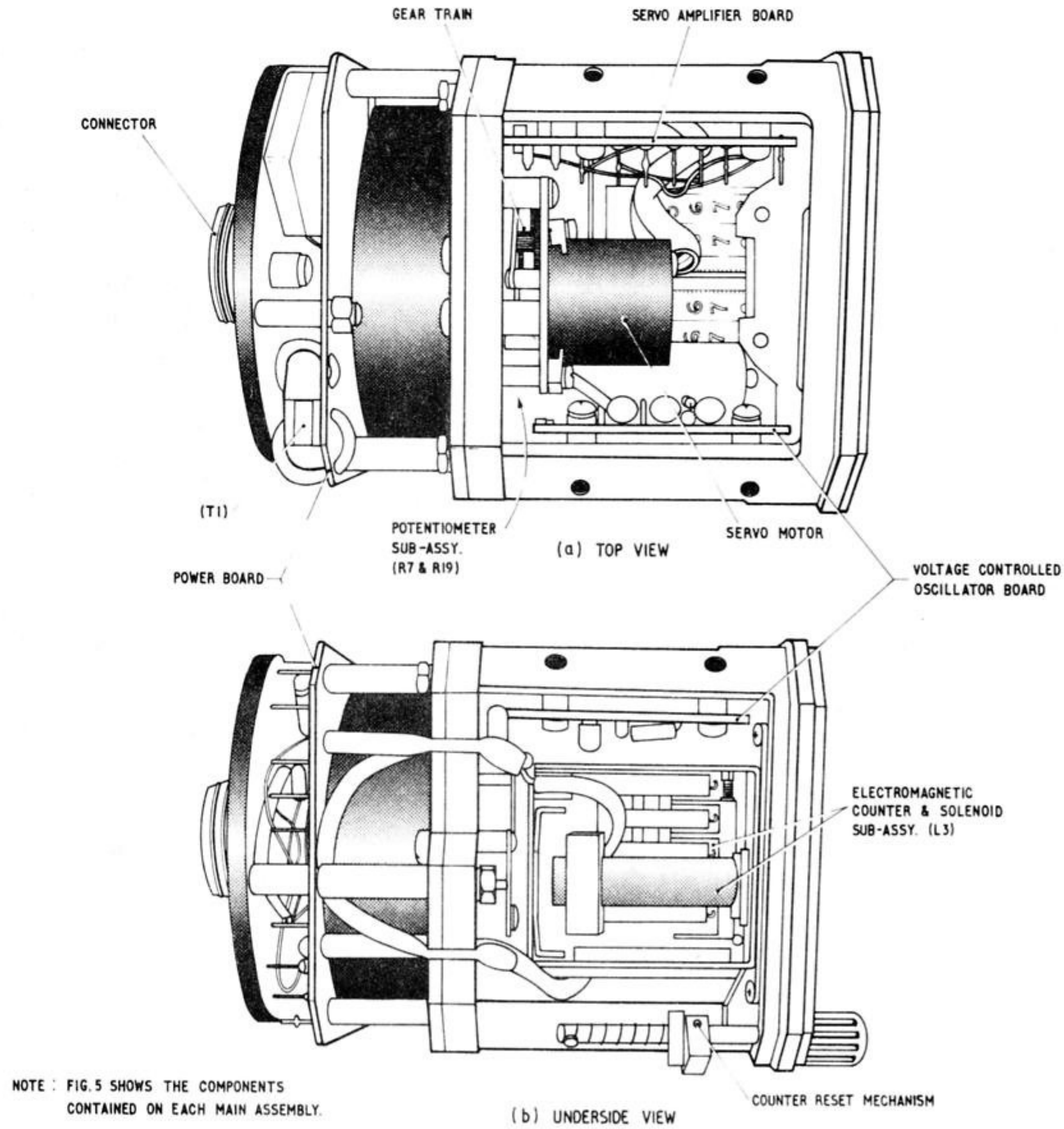


Fig.2 Disposition of indicator main assemblies

OPERATION

5. A block diagram of the indicator is shown in fig.3 and a circuit diagram in fig.4. The 115V 400Hz power supply is fed via the inter-connecting cable to a power supply circuit which produces a 15V d.c. supply for the control circuits.

6. The a.c. reference and a.c. differential signals from the transmitter are also fed in via the connecting cable (pins B,C and E,F respectively), both signals being fed to a balance circuit. The differential signal is developed across a preset resistive load (R4, R6) and is summed with the reference signal developed across the servo-controlled potentiometer 'X'. Provided that a change of fuel flowrate is currently occuring (i.e. the balance

circuit is unbalanced) the result of the summation is an error signal, and this is fed to the error amplifier (IC1). The amplified error signal is fed via a motor drive amplifier (TR1, TR2) to drive the a.c. servo motor, which via a reduction gear train, drives the fuel flowrate pointer to indicate the new flowrate, and also drives the potentiometer wiper until balance is acheived at the new flowrate.

7. Mechanically connected with potentiometer 'X' is a further potentiometer 'Y' across which is connected a stabilised reference voltage. The voltage picked off by potentiometer 'Y' wiper consequently bears a direct relationship to the currently indicated flowrate, and is fed to an integrator circuit. The integrator output is fed to a voltage level detector in the form of a Schmitt trigger which switches to its inverse state as soon as its preset input threshold level is reached. The inverse state of the Schmitt trigger is amplified and used to energise relay RLA whose contact RLA/1 closes to discharge the integrator, and so cause the Schmitt trigger to revert to its former state. The time constant of the integrator and the threshold level of the Schmitt trigger are chosen such that the integrator is charged and then discharged coincident with one pound of fuel being passed by the flowmeter. Thus the integrator is charged and discharged at a rate determined by the flowrate.

8. The amplified pulses produced by the Schmitt trigger are passed to a thyristor drive circuit to provide gating pulses for the thyristor, which in turn is connected to 'pulse' the solenoid of the electro-magnetic counter which displays total number of fuel pounds consumed.

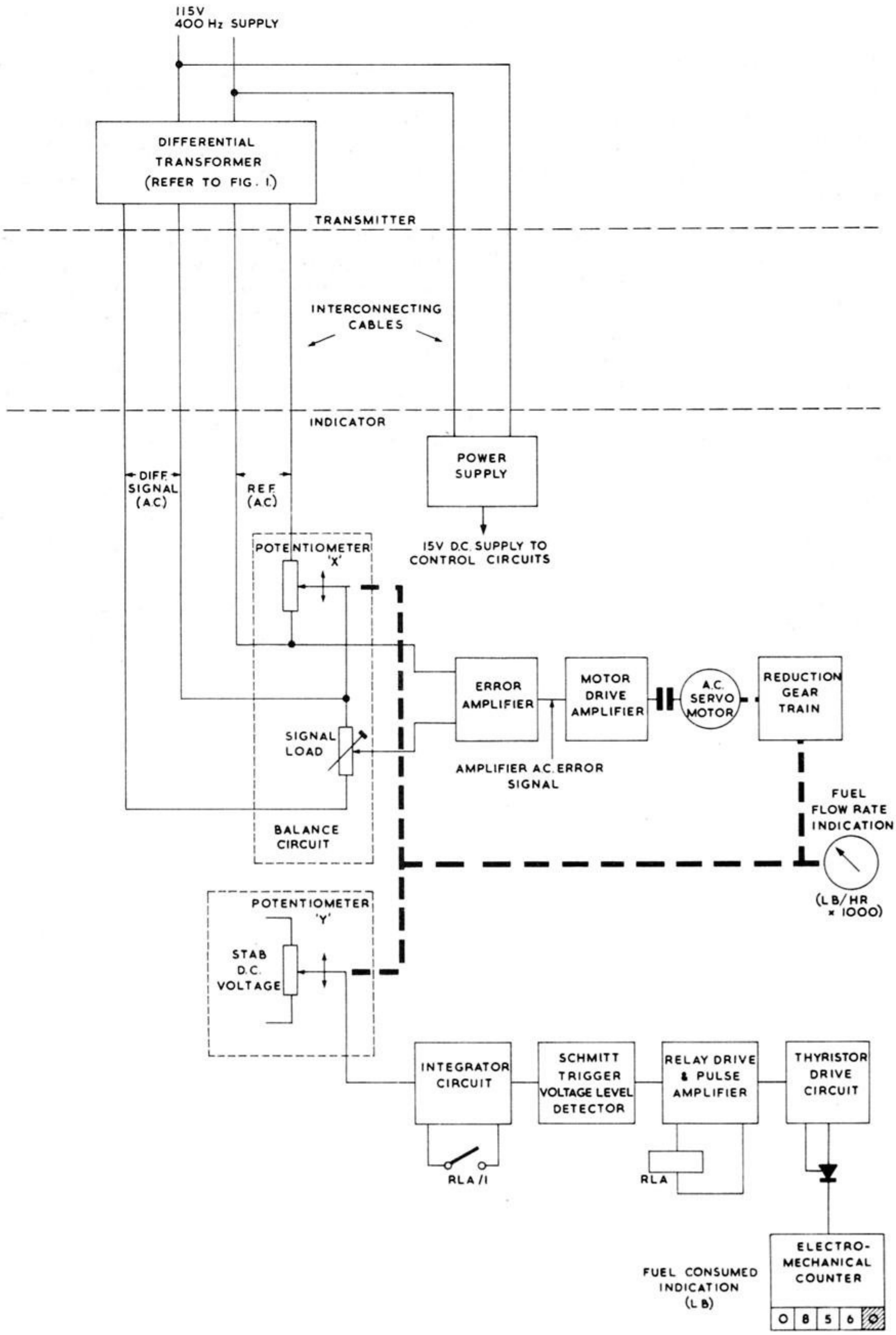


Fig.3 Indicator, block diagram

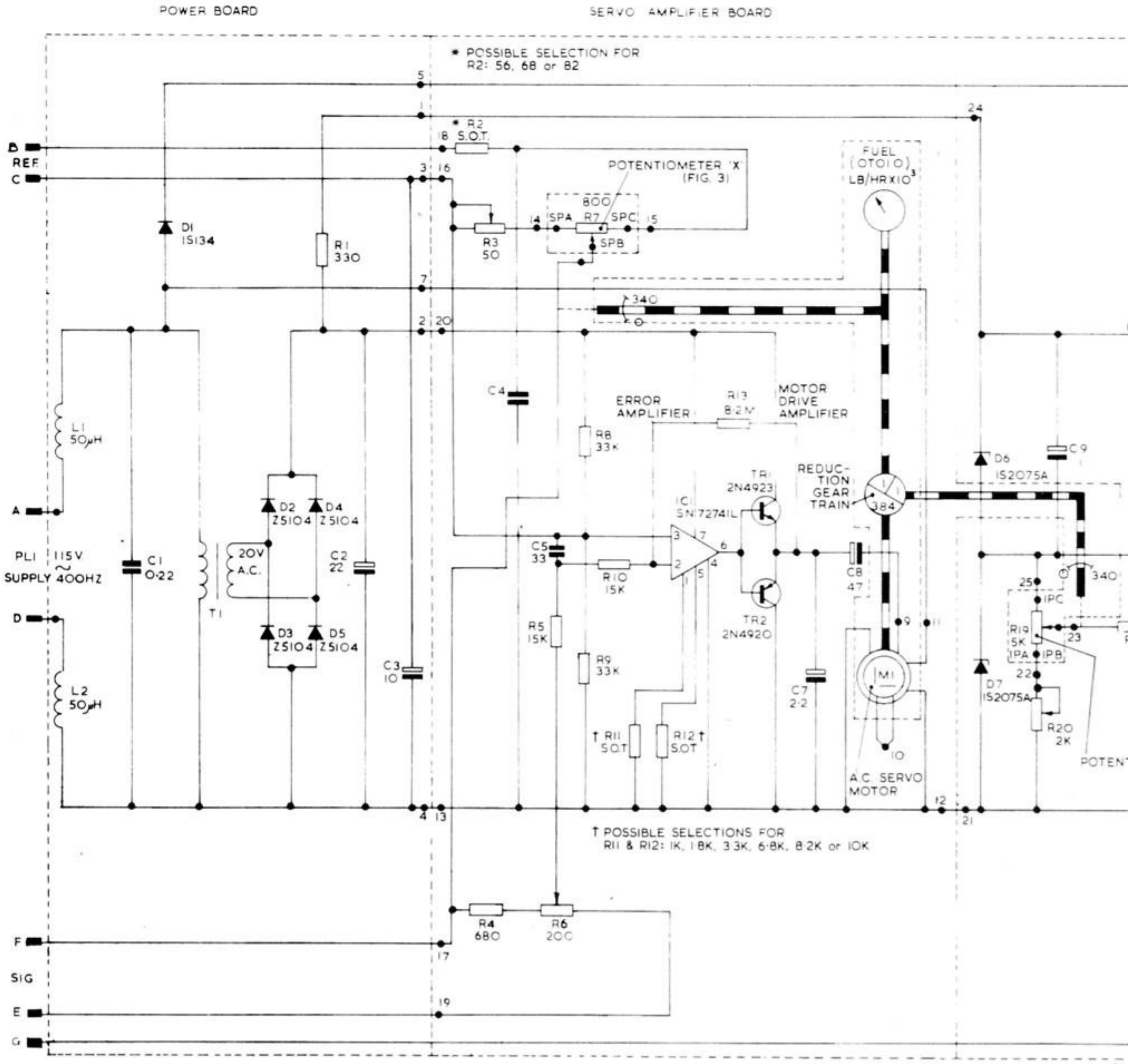
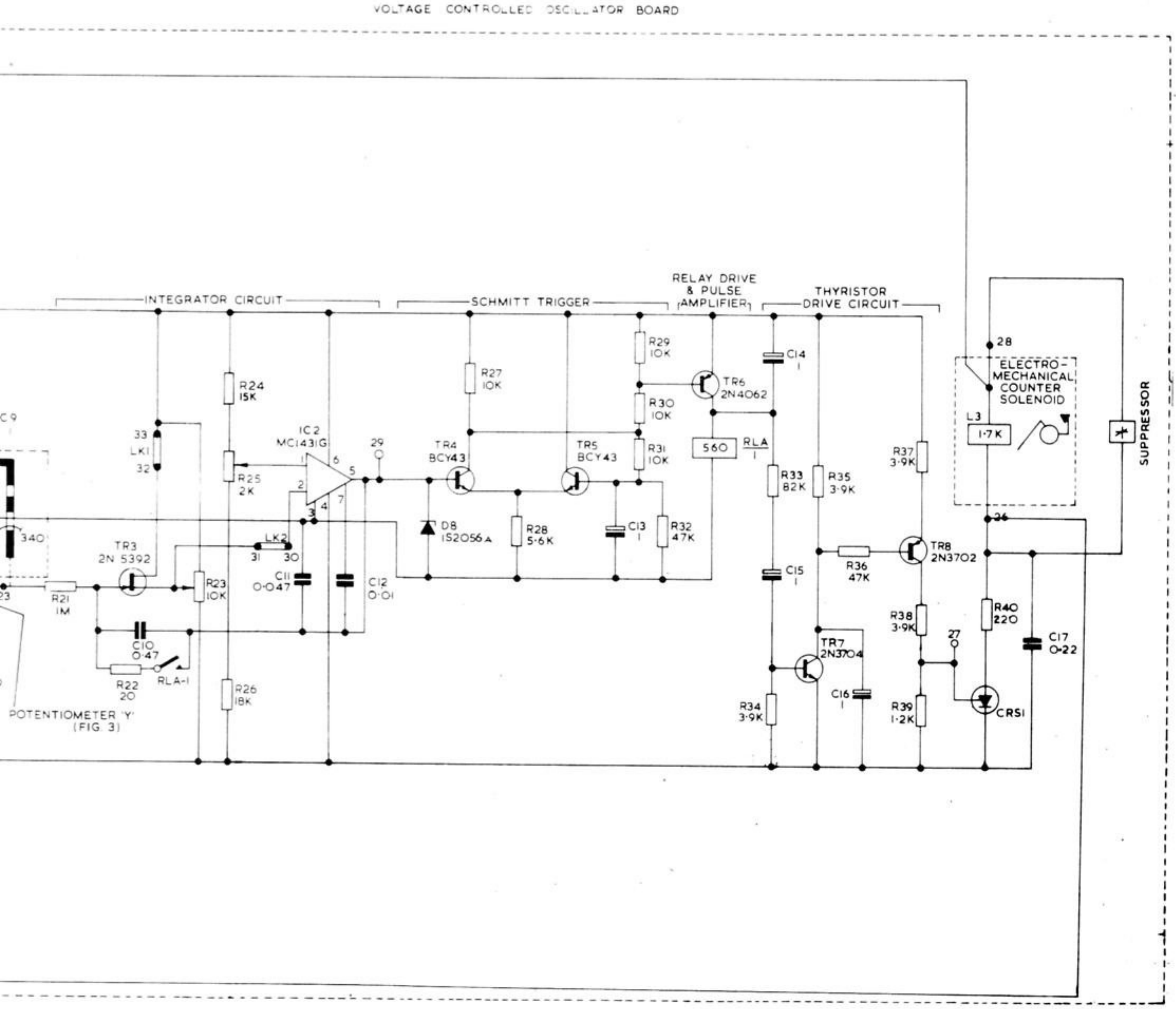


Fig. 4

Fuel flowmeter indicator (TYP



(TYPE 05760)circuit diagram