SECTION 3

CHAPTER 5

DESYNN INSTRUMENTS

THE DESYNN TRANSMISSION SYSTEM

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CHAPTER 5

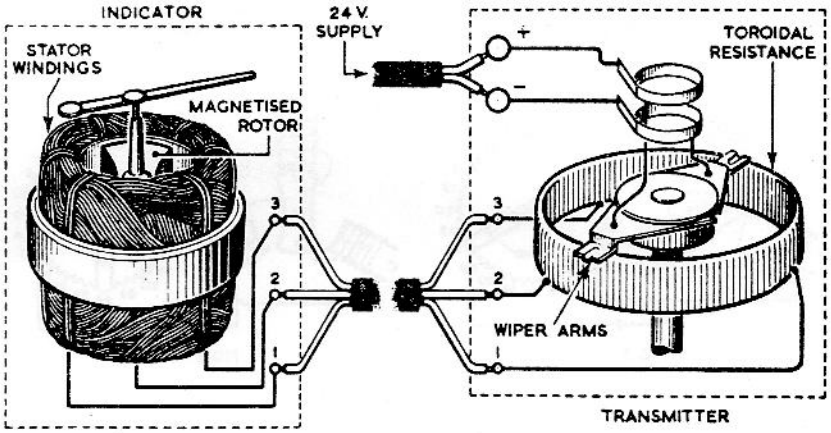
DESYNN INSTRUMENTS

THE DESYNN TRANSMISSION SYSTEM

Introduction

1. The Desynn System of transmission is an electrical method of conveying movement. It is a means by which the movements of remote devices, such as petrol float mechanisms, control flaps, etc., may be conveyed to indicators on the instrument panel.

2. The system comprises two units, a transmitter and an indicator. These components are electrically connected to each other and energized from a direct current electrical supply. When the transmitter mechanism is moved, the indicator pointer follows the movement.



DESYNN TRANSMISSION SYSTEM

Transmitter

3. In its simplest form a Desynn transmitter consists of an endless coil of resistance wire wound on a ring-shaped former, the assembly being known as a "toroidal resistance". The resistance is tapped at three equidistant points, and conductors from these points lead to the indicator.

4. A central spindle in the transmitter carries two wiper arms which bear on the toroidal resistance at points diametrically opposite. The arms are insulated from each other at the spindle, but are connected via sliding contacts, to the electrical supply.

Indicator

5. The indicator consists of a soft iron stator and a magnetized rotor. Disposed around the stator are three windings, which, for functional purposes, may be considered as three coils placed 120° apart. One end of each coil is connected to a transmitter tapping and the remaining three ends are connected together.

6. The rotor is a simple two-pole magnet mounted on a pivoted spindle at the centre of the stator. The indicating pointer is secured to the rotor spindle.

Operation

7. Since the wiper arms of the transmitter are connected to the power supply, current will enter the toroidal resistance at the positive arm and divide, half flowing to the negative arm in a clockwise direction and the other half flowing to it in an anticlockwise direction. With a supply voltage of 24 volts, the progressive drop in voltage around the resistance will be as indicated by the figures in the following illustrations. Note that as the arms rotate the relative voltage distribution rotates with them so that the voltages at the three tapping points changes.

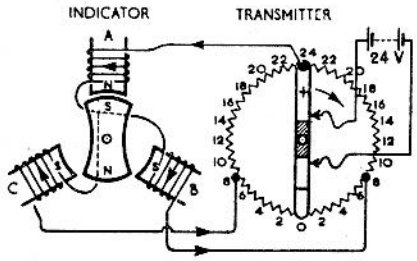


FIG. 1

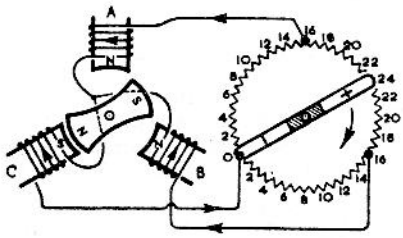


FIG. 2

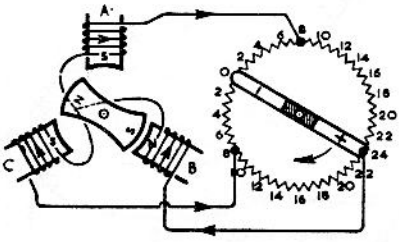


FIG. 3

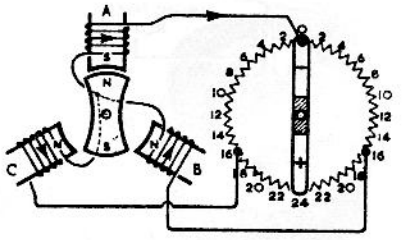


FIG. 4

DESYNN PRINCIPLE

8. Referring to fig. 1, the tapping to which coil " A " is connected is at 24 volts potential whilst coils B and C are at 8 volts respectively. Current will flow from the higher to the lower potential, i.e. in through A and out via B and C. By applying the grasp rule it can be seen that coil A will establish a " N " polarity at its inner end and coils B and C, " S " polarities. The resultant field at the centre of the stator will hold the rotor in the position shown.

9. In fig. 2 the wiper arms have rotated 60° clockwise. Potentials fed to the indicator coils are now, coil A—16 volts, coil B—16 volts, coil C—0. Current will flow in through A and B and out through C, creating " N " polarities at A and B and a " S " polarity at C. The rotor aligns itself with the field as shown ; note that the rotor has moved through the same angle as the wiper arms.

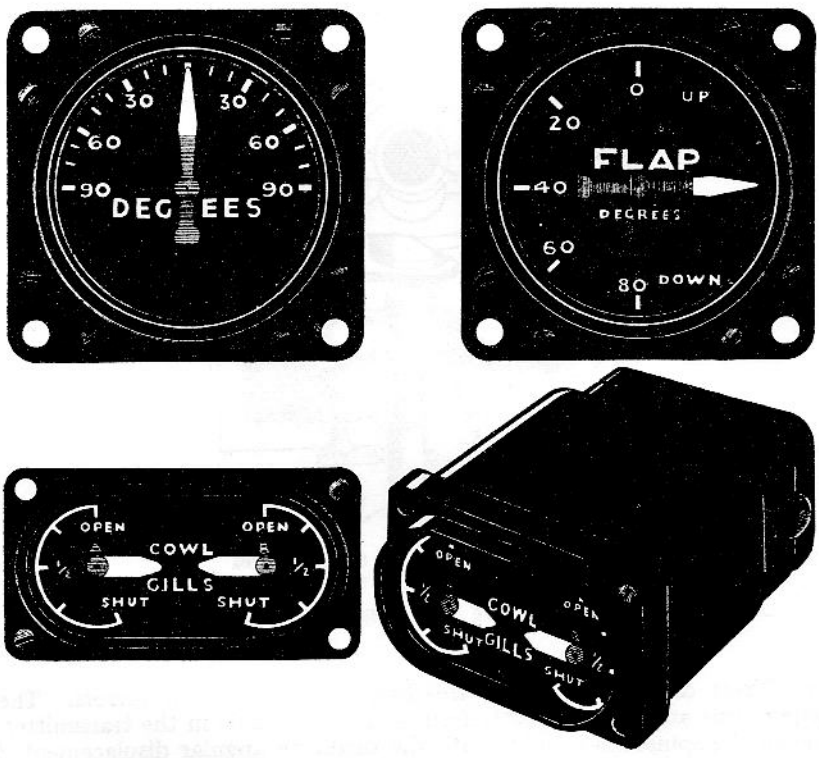
10. Similarly in figs. 3 and 4 it may be seen that as the wiper arms continue to rotate, the indicator rotor will follow them. 60° steps have been chosen for convenience of explanation but intermediate positions may similarly be proved by establishing the voltages at the transmitter tapping points and the resultant current ratios in the indicator coils.

POSITION INDICATORS

Purpose

11. Position indicators are used in aircraft to indicate to the pilot or engineer the attitude or setting of remote movable components such as retractable undercarriages, cooler shutters, control flaps, turrets and trimming tabs.

12. A Desynn transmitter is mounted near to the component, the setting of which is to be indicated, and is so coupled that as the component moves, the transmitter spindle is rotated. The transmitter is electrically connected to an indicator on the instrument panel and to the aircraft electrical supply, by multi-cored cable. As the component moves, the indicator follows the movement and provides a continuous indication of the position of the component.



TYPICAL POSITION INDICATORS

Description

13. The operating units of all indicators are similar to the Desynn indicator previously described, but dial designs vary according to the purpose for which each indicator is intended. Three representative types are illustrated. The dual indicator comprises two distinctly separate indicating units mounted side by side in a common case. They are designed thus for ease of reading and comparison, also to save panel space.

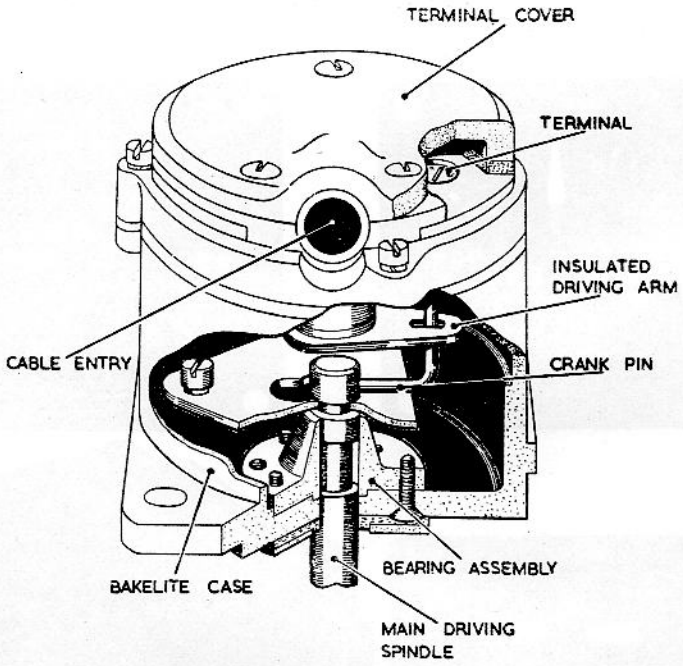
14. All indicators incorporate an " off-scale " device. This is a small weak magnet which is located near to the rotor. The device does not affect the normal functioning of the instrument but, should the power fail, the magnet will attract the rotor and move it to a position where the pointer is held off the scale. The pilot will then be aware that the instrument is not working.

15. Electrically all transmitters are similar to that previously described, but mechanically they differ to suit the components to which they are to be coupled. Three types are in use, they are :—

(*a*) Direct drive type.

(*b*) Radial arm type.

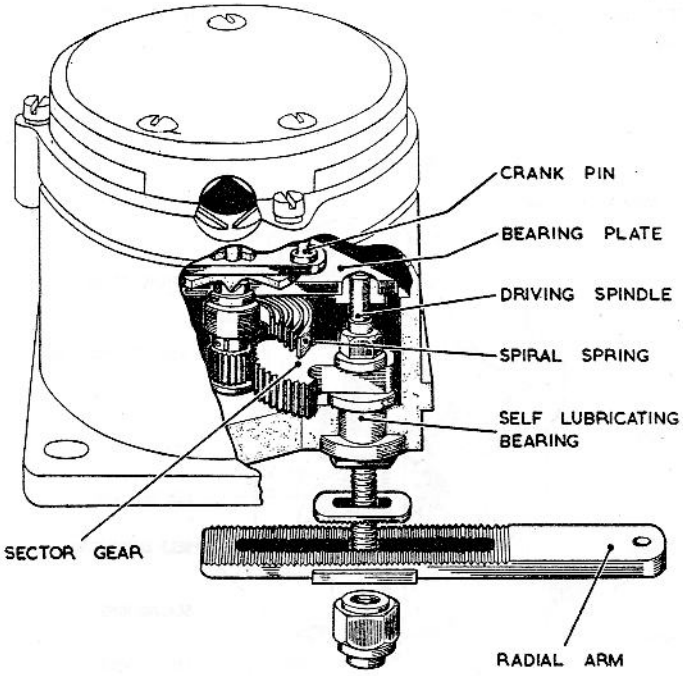
(*c*) Push rod type.



DIRECT DRIVE TRANSMITTER (DESYNN)

16. Direct drive transmitters are designed for use with turrets: The wiper arms are driven directly from a central spindle in the transmitter. When the spindle is coupled with the turret an angular displacement of the turret will cause a similar displacement of the wiper arms. The indicator dial is calibrated in degrees of rotation.

17. The radial arm transmitter is used for control flaps, cowl gills, etc., where smaller angular movements are to be measured. It is connected to the moving component by a link which is attached to the end of the radial arm. A sector and pinion gear is built into the transmitter so that a small displacement of the radial arm will cause a relatively larger displacement of the wiper arms. A tensioned spring is mounted on the central spindle to take up play between the gears and in the connecting linkage so that no lost motion will occur when the direction of movement is reversed.



RADIAL ARM TRANSMITTER (DESYNN)

18. To suit differing installations, the effective length of the radial arm is adjustable. Separate transmitters are supplied for clockwise and anti-clockwise rotation and with alternative gear ratios as follows :—

Type.	*Rotation.*	*Gear Ratio.*
A ..	Clockwise	6 : 1.
B ..	Anticlockwise	6 : 1.
C ..	Clockwise	3 : 1.
D ..	Anticlockwise	3 : 1.

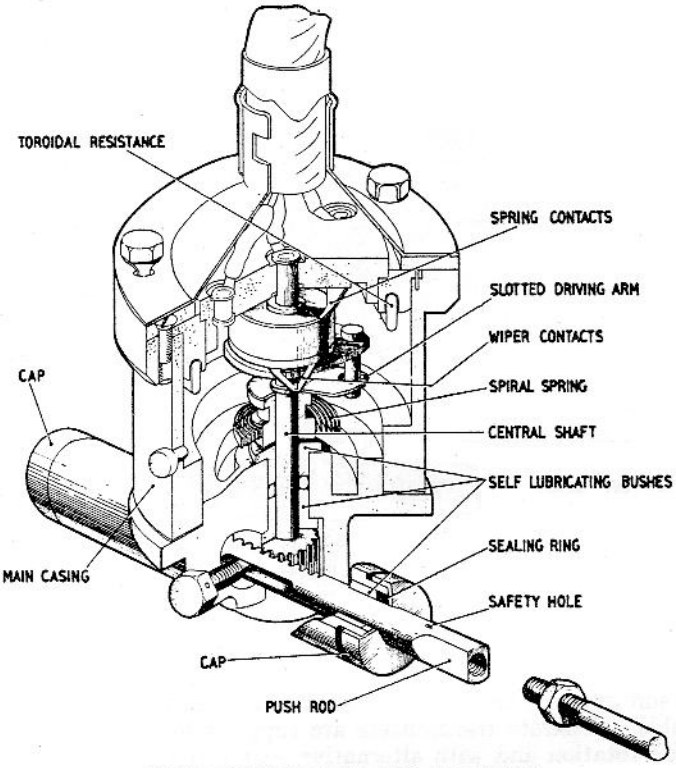
19. The push rod transmitter is designed for use in conjunction with linear actuating gear. It is coupled to the moving member by a connecting rod which screws into the end of the push rod and is locked by a lock-nut.

20. The push rod has a rack cut into its surface which engages with a pinion on the central spindle of the transmitter. When the push rod is operated, the rack rotates the spindle which moves the wiper arms over the toroidal resistance. A tensioned spring is fitted to the spindle to prevent lost motion between the rack and pinion.

Installation and Servicing

21. When it becomes necessary to replace an indicator or a transmitter, the replacement unit must be of the same type as the one removed.

Indicators should be handled carefully before and during fitting. Transmitter mechanisms must not be allowed to spring back violently against their limiting stops or the correct settings of the wiper arms may be disturbed.



PUSH ROD TRANSMITTER (DESYNN)

22. To install a direct drive transmitter, bolt the unit in position and connect the electrical cable. Terminals numbered 1, 2 and 3 are connected to the similarly numbered terminals of the indicator and terminals marked " + " and " — " to the positive and negative of the electrical supply. Switch on the power supply and proceed as follows :—

(*a*) Centralize the turret.

(*b*) Turn the transmitter spindle until the indicator reads zero.

(*c*) Connect the spindle to the turret.

(*d*) Operate the turret in both directions and see that the indicator responds smoothly and in the correct sense.

(*e*) Centralize the turret and re-check that the indicator registers zero. Switch off the power.

23. To install a radial arm transmitter, bolt it in position and connect the electrical leads (connections as for direct drive transmitters). With the power supply on, adjust as follows :—

(*a*) Set the component, which is to operate the transmitter, to one extreme of its movement.

(*b*) Connect the coupling link to the radial arm of the transmitter and adjust the length of the link until the indicator reads correctly.

(*c*) Move the component slowly to the other extreme, ensuring that the pointer operates smoothly and in the correct direction. If the pointer overshoots the correct reading, increase the effective length of the radial arm, if it undershoots, decrease the length of the arm.

(*d*) If the radial arm is altered, re-check the pointer at the original position. If necessary, readjust the link and repeat the process until the pointer movement fits the scale at both ends.

(*e*) Lock all adjustments.

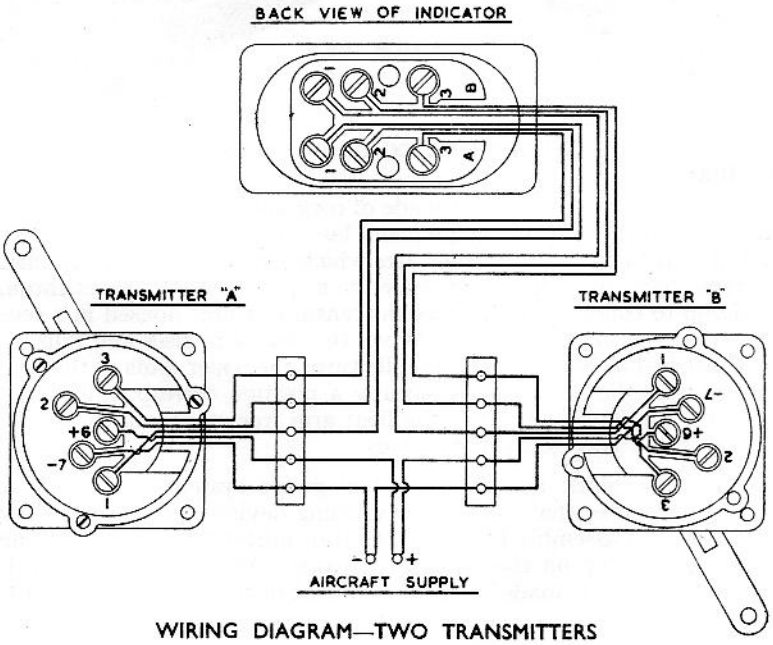
24. Where a centre reading instrument is used, such as for trimming tabs which move either side of a normal mid-position, the transmitter should be adjusted to the central position first and then to the two extremes.

25. The installation of a push rod transmitter is similar to that of the radial arm type, except that no adjustment can be made at the transmitter. Means of adjustment is embodied in the actuating device and this will vary with different installations.

26. A push rod transmitter must be carefully aligned with its coupling so that no side thrust is imposed on the push rod during operation. The coupling screw must enter the push rod beyond the safety hole and be securely locked by the lock-nut.

27. Servicing consists of examining the condition of connecting cables for deterioration, checking components for security and periodically testing each installation by operating the appropriate control to see that the indicator responds smoothly and correctly.

28. Transmitter spindles and push rods operate in self-lubricating bushes so that no lubrication is necessary. Bearings should, however, be examined from time to time to ensure that wear has not produced excessive side play.



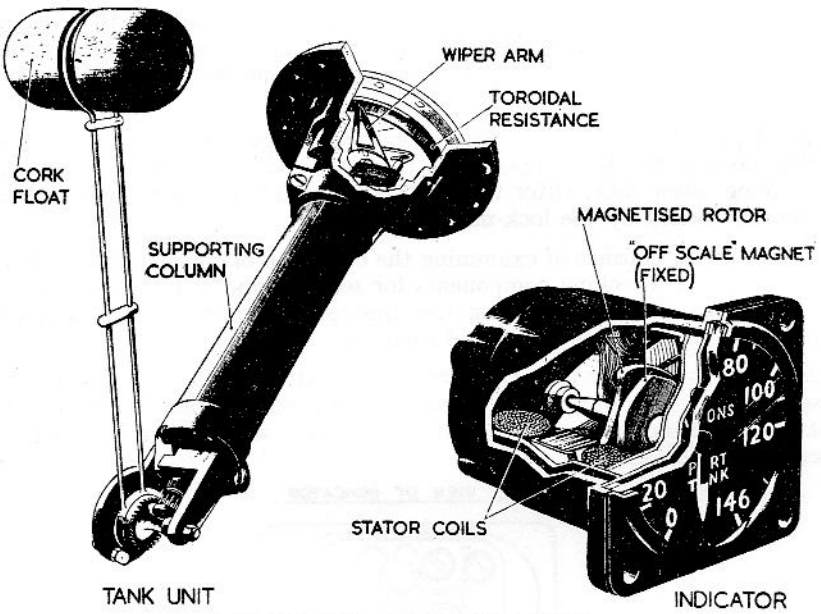
WIRING DIAGRAM—TWO TRANSMITTERS

DESYNN FUEL CONTENTS GAUGES

Introduction

29. The Desynn fuel contents gauge provides a continuous indication in gallons of the quantity of fuel in the tank of an aircraft. Where, as is usual, several tanks are fitted, a separate gauge system is used for each tank. Each system comprises a tank unit and an indicator. A float on the tank unit operates a Desynn transmitter ; the float responds to the level of fuel in the tank and positions the wiper arm of the transmitter accordingly. The transmitter is electrically connected to a Desynn indicator on the instrument panel and the circuit is connected to the aircraft's electrical supply.

30. Since the fuel level is taken as a measure of the contents of the tank, the size and shape of the tank must be considered. Each tank unit and indicator is therefore designed and calibrated to suit a specific type of tank and the appropriate tank part number is marked on both the tank unit and the indicator.



DESYNN FUEL CONTENTS GAUGE

Tank Unit

31. The float of the tank unit is made of cork and is treated with bakelite to prevent saturation and consequent loss of buoyancy. The float is attached to the end of a light steel arm which is pivoted from a cylindrical supporting column. The arm is geared to a spindle which passes through the column to connect with a Desynn transmitter unit housed in a recess at the other end of the column. When the float arm rises and falls with the level of fuel in the tank, the spindle turns the wiper arms of the transmitter so that the arms always occupy a position corresponding to the fuel level. Limit stops prevent the float arm from touching the sides of the tank at the two extreme positions.

32. Where the mark number of a fuel gauge system is starred (e.g. Mk. 4B*) it denotes that a low level warning device is fitted. This consists of a contact assembly housed in the transmitter head of the tank unit and a warning lamp on the instrument panel. When the fuel level becomes low, contact is made by the movement of the wiper arms, and the warning lamp lights.

Indicator

33. The indicating instrument contains a normal Desynn movement. An " off-scale " device is incorporated to prevent false readings being given in the event of power failure (see para. 14). Engraved on the instrument dial is a number preceded by the letter F.G. (e.g. F.G.922) This is the part number of the tank for which the instrument is calibrated. The appropriate tank unit is similarly marked with this number.

34. Most fuel gauge systems are designed for a supply voltage of 24 volts, but systems are available which can be operated from a 12-volt supply or adapted to 24 volts by the inclusion of limiting resistors in the main supply leads. These resistors are usually installed as separate units but some earlier indicators have them built into the back of the instrument cases; the latter can be identified by the seven terminals they possess in place of the normal three.

Installation

35. Before a tank unit is removed from a tank, corresponding marks should be made on the tank unit flange and the tank. These marks are to assist in positioning the replacement unit so that the float arm lies in the correct direction. Ensure that the replacement unit has the same F.G. number as the unit removed. (If in doubt consult the aircraft handbook.) Fit the replacement unit as follows :—

(*a*) Give the mating surfaces of the tank unit, sealing washer, and tank a coating of jointing compound. New sealing washers are supplied with the tank units.

(*b*) Fit the tank unit with the sealing washer interposed between the tank unit securing flange and the tank.

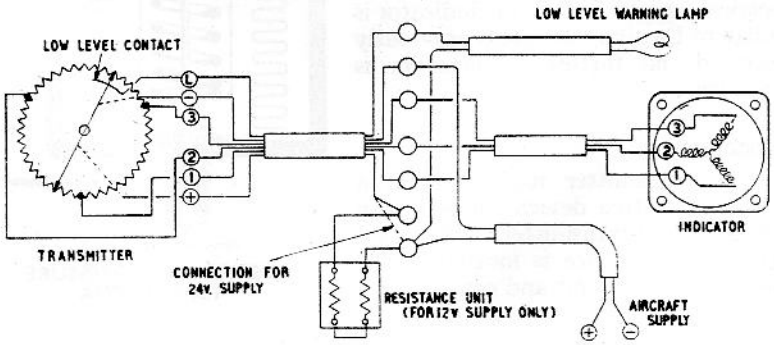
(*c*) Align the float arm correctly by reference to the relative markings previously made on the old unit and bolt the tank unit in position.

(*d*) Where possible, check visibly that the float arm does not touch the tank at its two extreme positions, the limit stops should prevent this.

(*e*) Apply a coating of petrol-resisting varnish around the tank unit joint.

Note. The method of fitting tank units to special types of tank may differ from the above, e.g. some flexible tanks require a protective cage to be fitted around the float arm assembly; all such information will be given in the aircraft handbook.

36. Replacing a defective indicator presents no difficulty, but the replacement must bear the same F.G. number as the indicator removed (e.g. the same number as tank and tank unit). Care must be taken to ensure that



WIRING DIAGRAM GAUGE AND TANK UNIT

cables are correctly connected; numbered terminals of the tank unit should connect with similarly numbered terminals of the indicator. Terminals marked " + " and " — " connect with the power supply and, if the tank unit has a low level contact, an additional terminal marked " L " is connected to the warning lamp.

Servicing

37. The accuracy of a contents gauge installation is checked by emptying the tank and then pouring in measured quantities of fuel. If it is not possible to drain the tank, check the contents by means of the dip stick provided for that particular tank and then pour in additional measured quantities.

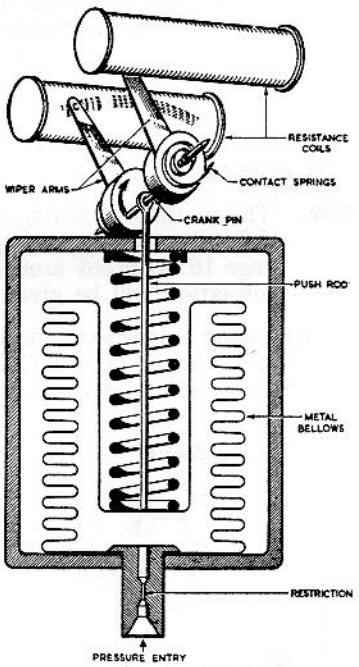
38. While the tank is being filled, see that the indicator responds smoothly. If the pointer tends to fluctuate, it is an indication that the toroidal resistance of the transmitter unit has become dirty. To rectify this fault, unscrew the six screws around the bakelite flange of the transmitter and carefully lift out the unit; the toroidal resistance and wiper arms will come away with it. Clean the contacting surfaces of the resistance and wiper arms with a non-fluffy rag, moistened with petrol. During this operation, and at all times that the unit is disengaged, take care not to move the wiper arms, or difficulty will be experienced in locating the slotted driving arm when refitting.

39. Periodically check all terminals for tightness, and test the insulation resistance to earth, the latter should not be less than that stated in the Servicing Schedule.

DESYNN PRESSURE GAUGES

Introduction

40. Desynn type pressure gauges are used for similar purposes to the transmitting gauges described in Chapter 1 of Section 2, but have none of the disadvantages associated with capillary tubing and pipe lines. The system comprises a transmitter unit and an indicator. The transmitter is installed near the engine and connected to the pressure system by a short flexible pipe. The indicator is mounted on the instrument panel and connected to the transmitter by three-cored cable; energizing power is obtained from the aircraft's electrical supply. Since the indicator is similar to Desynn indicators previously described, no further explanation is necessary.



DESYNN OIL PRESSURE TRANSMITTER

Transmitter

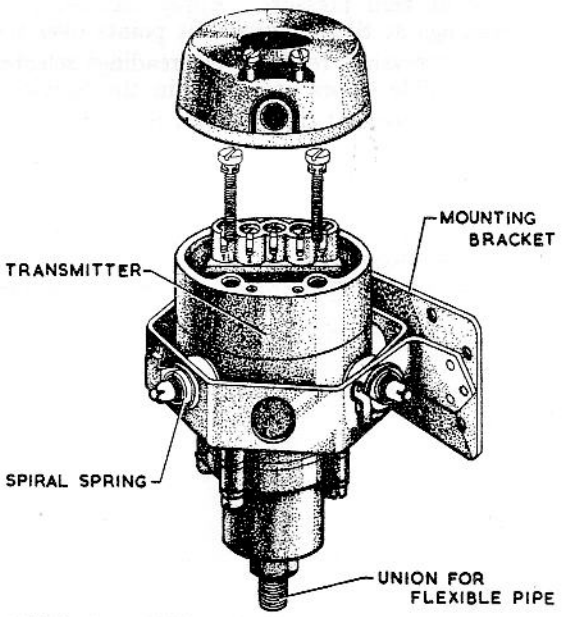
41. The transmitter unit contains a pressure sensitive device coupled to a Desynn micro-transmitter. The pressure sensitive device is located in the lower part of the unit and consists of a

corrugated metal bellows and a control spring. Pressure is fed into the bellows from a union at the bottom of the transmitter and the bellows expand against the thrust of the spring. Movement of the bellows is conveyed to the micro-transmitter by a push rod. To prevent pump pulsations affecting the bellows, the bore of the inlet union is restricted.

42. The Desynn micro-transmitter is a development of the toroidal type, it consists of two cylindrical resistance coils, mounted side by side, and two wiper arms which make sliding contact with them. Tappings from the coils are arranged and connected so that the device responds in a similar manner to the toroidal transmitter but is more sensitive to small movements of the wiper arms. The arms are operated by a crank pin, to which the bellows movement is applied and current is conveyed to the arms by two spiral springs.

43. For each pressure, the bellows locate the wiper arms in a definite position relative to the resistance coils. The output from the transmitter, which depends upon the position of the wiper arms, is conveyed to the indicator which registers the pressure in lb/sq. in.

44. To prevent mechanical vibration affecting the transmitter mechanism, the unit is supported in a special anti-vibration mounting. The mounting consists of a metal strap suspended on three springs in an outer cradle. The cradle is rigidly secured to the aircraft and the transmitter is held by the floating strap which grips the transmitter body when a clamping screw, on the strap, is tightened.



DESYNN PRESSURE TRANSMITTER IN MOUNTING

Installation

45. The transmitter may be mounted either vertically or horizontally, but not in an intermediate position ; it should be clear of obstructions by at least $\frac{1}{4}$ in. The flexible connecting pipe must avoid sharp bends and

be securely cleated along its length with the exception of 10 in. at the transmitter end, this must be free to allow movement of the transmitter on its flexible mounting.

46. Numbered terminals on the transmitter are connected to similarly numbered terminals on the indicator and those marked " + " and " — " are connected to the 24-volt D.C. supply. All connecting cables must be securely cleated except for 10 in. at the transmitter end to allow movement of the transmitter.

Servicing

47. Little primary servicing is required apart from examining the components for security, checking that there is no leakage from the transmitter or the connecting pipe couplings, and ensuring that anti-vibrational movement of the transmitter is not obstructed. The functioning of the instrument is checked by switching on the supply and seeing that the indicator registers zero (with engine stationary), also that the pointer moves to a position " off " the scale when the current is switched off.

48. Periodically, as defined in the Servicing Schedule for the aircraft in which the system is installed, the accuracy of the transmitter and indicator must be checked. This is usually done with the components removed from the aircraft. The method is as follows :—

(*a*) By means of a suitable adaptor, connect the transmitter to a pressure gauge calibrator (see Sect. 2, Chap. 1).

(*b*) Connect terminals 1, 2, and 3 of the transmitter to terminals 1, 2, and 3 respectively of the indicator, and terminals marked " + " and " — " to a 12- or 24-volt supply as appropriate.

(*c*) Check reading at zero pressure. Apply increasing pressure and check the readings at three equidistant points over the scale.

(*d*) With pressure decreasing, re-check the readings selected at (*c*) and at zero. Permissible errors are given in the Servicing Schedule.

(*e*) During the test ensure that the indicator pointer responds smoothly and without flicker.

(*f*) Check the insulation resistance of the transmitter and indicator with an insulation tester. For this check, one lead of the tester is connected to any of the terminals of the component, and the other lead to a clean surface on the metal body. Minimum permissible resistance is given in the Servicing Schedule.