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PART 2 : SECTION 3

CHAPTER 1

INTRODUCTION TO COMPASSES AND SELSYN TRANSMISSION

Introduction

1. All existing aircraft compasses, except the navigator's astro-compass, work on the magnetic north-seeking principle. The three main types are :—

(a) *Self-Contained Magnetic Compasses.* The P.10, P.11, P.12, and the E-type emergency compasses, in which the direction-indicating card or pointer are directly attached to the magnets, are included under this heading. These compasses are now generally relegated to stand-by roles except in the smaller non-operational aircraft.

(b) *Remote Indicating Unstabilized Magnetic Compasses.* The Magnesyn and the Admiralty Transmitting Compass Type 3 are of this type, in which the magnetic element is remote from the pilot's indicator. Compasses in this category are subject to error during turns, changes of airspeed, and for a brief period after the resumption of steady flight. Remote indicating, unstabilized magnetic compasses are in limited use in the Royal Air Force, but are not described in this manual. A

description of them is given in A.P.1234D, Manual of Navigation Instruments.

(c) *The Gyro-Magnetic Compasses.* The Distant Reading Compass, Mk. 1, and the G.4 Series Gyro-Magnetic Compasses come within this category. In these, the wander of a gyroscope is restrained electrically by signals from a north-sensing detector unit fitted in the aircraft in a position where local magnetic interference is at a minimum, e.g. in the wing tip or tail. The gyroscope may be combined with the magnetic element, as in the D.R. compass master unit ; or it may take the form of a directional gyro mounted on the pilot's instrument panel, or elsewhere, and remotely controlled by the north-sensing device.

SELSYN TRANSMISSION

2. The G.4 (Gyrosyn) Compass, which is described in the next chapter, uses the Sperry Selsyn electrical transmission system, the salient features of which are described below.

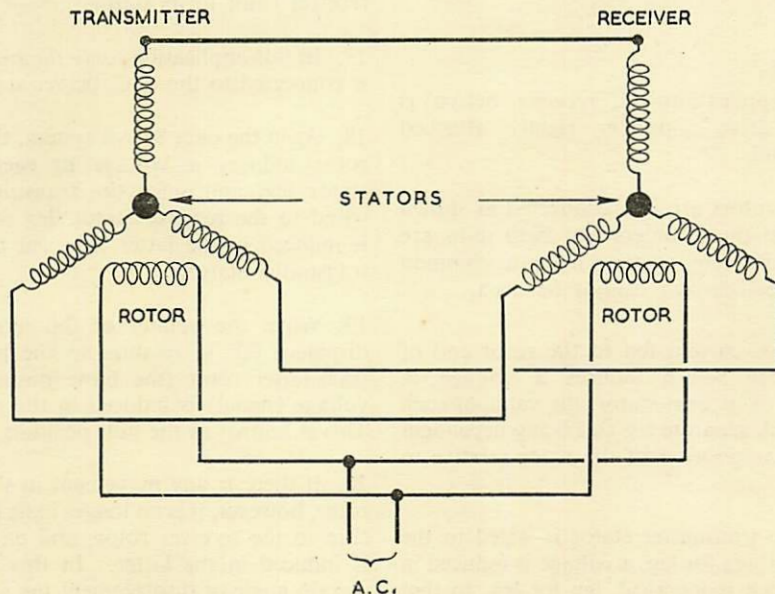


Fig. 1. Simple Selsyn Transmission System.

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3. The name "Gyrosyn" is derived from the words "gyro synchronized" and is applied to this instrument because the G.4 comprises an electrically-driven directional *gyro* which is *synchronized* to the earth's magnetic field.

4. A Selsyn system is an electro-magnetic transmission system, and its operation is continuous while electrical power is available. Selsyns have many and varied applications; as a rule each is a development of one or both of the following principles:—

(a) Transmission of angular movement, in which case the unit is known as a Data Selsyn.

(b) Generation or transmission of electrical signals, in which instance the unit is termed a Signal Selsyn.

5. Each of the above two basic systems requires a transmitter Selsyn unit and a receiver Selsyn unit (Fig. 1), and it should be noted that the rotors are single-phase wound, whereas the stators are three-phase wound.

6. It should also be clearly understood that the rotors are not of the type that spin continuously. The basic theory of Selsyns can be more readily understood if the transmitter rotor is considered to be rigidly fixed to a shaft the position of which, stationary or otherwise, is governed by some external means, while the receiver rotor is also mounted on a shaft which, in data Selsyns, is free to turn.

Data Selsyns

7. In this application the *receiver* Selsyn is required to drive a pointer rigidly attached to its rotor coil.

8. The two stators are interconnected as shown in Fig. 1, and the rotor coils of both units are fed with alternating current from a common source. Direct current cannot be used.

9. The electric current fed to the rotor coil of the transmitter Selsyn induces a voltage in each leg coil of its own stator, the value of such voltage in each separate leg coil being dependent on the angular position of the rotor relative to each leg coil.

10. Since the transmitter stator is wired to the receiver stator, leg for leg, a voltage is induced in the latter which is identical, leg for leg, to that of the transmitter stator.

11. As current flow in a coil results in the coil becoming an electro-magnet, a resultant electro-magnetic field is set up in relation to the three coils of the receiver stator, this field being identical to that of the transmitter stator.

12. The receiver rotor is also an electro-magnet and will automatically align with the resultant field of its own stator, this in turn being determined by the position of the transmitter rotor.

13. By aligning itself with the receiver stator field the receiver rotor thus takes up the same angular position relative to its own stator as that between the transmitter rotor and stator.

14. Any subsequent change in this angle between the transmitter rotor and stator changes the pattern of the transmitter stator field. This change is reproduced in the receiver stator field and causes the receiver rotor to revolve until it is again at an angular relationship to the receiver stator corresponding to that of the transmitter rotor to the transmitter stator.

15. Thus the rotors of both transmitter and receiver are always "in step", *i.e.* the system is self-synchronous; hence the name "Selsyn".

Signal Selsyns

16. The Selsyn system can also be used, as stated in sub-para. 4(b) for generating electrical signals related to the angular position of the receiver rotor to its stator.

17. In this application, *only the transmitter rotor* is connected to the A.C. power supply.

18. As in the data Selsyn system, the transmitter rotor induces a voltage in each transmitter stator leg, and since the transmitter stator is wired to the receiver stator, leg for leg, a field is induced in the latter identical to that of the transmitter stator.

19. When the pointer of the receiver rotor is displaced 90° in relation to the pointer of the transmitter rotor (the basic position) no A.C. voltage (signal) is induced in the receiver rotor. This is known as the null position.

20. If there is any movement in the transmitter rotor, however, it is no longer in its basic relationship to the receiver rotor, and an A.C. voltage is induced in the latter. In this event, over a certain angle of displacement the strength of the induced signal is a measure of the displacement.

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21. The signal voltage is fed to an amplifier where it is boosted to give enough power for the operation of supplementary mechanism which turns the shaft on which *the receiver rotor* is rigidly fixed. The shaft continues to rotate until the rotor is returned to its basic (null) position. That is to say, the induced signal persists and the turning mechanism continues to operate, reducing the relative displacement of the receiver rotor in the receiver stator field, until the relative displacement no longer exists; this condition is reached when the transmitter and receiver rotors are again in their basic relationship, at which instant the induced signal ceases.
22. No further signal current is induced in the receiver rotor unless the rotors again become de-synchronized.

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