MAINTENANCE
77-10-66/01
April 1960

SMITHS AVIATION DIVISION

# Maintenance Manual

# THE ELECTRICAL ENGINE SPEED INDICATING SYSTEM



SALES AND SERVICE · WEMBLEY · MIDDLESEX

# RECORD OF REVISIONS

## THE ELECTRICAL ENGINE SPEED INDICATING SYSTEM

ASSIGNED TO

### SYSTEM DESCRIPTION

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# THE ELECTRICAL ENGINE SPEED INDICATING SYSTEM

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# THE ELECTRICAL ENGINE SPEED INDICATING SYSTEM

This manual deals with Engine speed indicating systems as a whole. For further and more detailed information regarding the integral parts of the system, see:

| | |
|---|---|
| Maintenance 77-10-66/02 | E.S. Generators |
| Maintenance 77-10-68/01 | E.S. Indicators |
| Maintenance 77-10-69/01 | Flexible Drives |

## DESCRIPTION AND OPERATION

### 1. DESCRIPTION

The Smith's Electrical Engine Speed Indicating System consists essentially of an engine-driven generator which supplies a three-phase, alternating current to a remote indicator.

Since the generator supplies current to operate the indicator a long mechanical drive between generator and indicator is obviated.

#### A. Generators

Two types of generator are in common use, the "direct drive" type which is flange-mounted on the engine casing, and the "flexible drive" type, which is base-mounted near to the engine and coupled to it by means of a flexible drive.

"Direct drive" generators sub-divide into three types. These are the "Two-pin drive", the "Spline drive" and the "Lightweight Tachometer" (also spline driven). Figs. 1, 2, 3 and 4 show the various types of generator in use.

NOTE: All types include a rotor designed to rotate at speeds up to a maximum of 5,000 r.p.m.



#### B. Indicators

Indicators are supplied in two sizes and the principle of operation of both is similar. Large S.A.E. case instruments cover both high and low engine speeds, while those in small S.A.E. cases are used for certain low speed applications. Figures 5 and 6 show the two types of indicator in use.

They are mounted in the aircraft instrument panel and, if required, two indicators may be operated by one generator.

NOTE: As with generators, the indicator rotor must not be rotated at speeds in excess of 5,000 r.p.m.

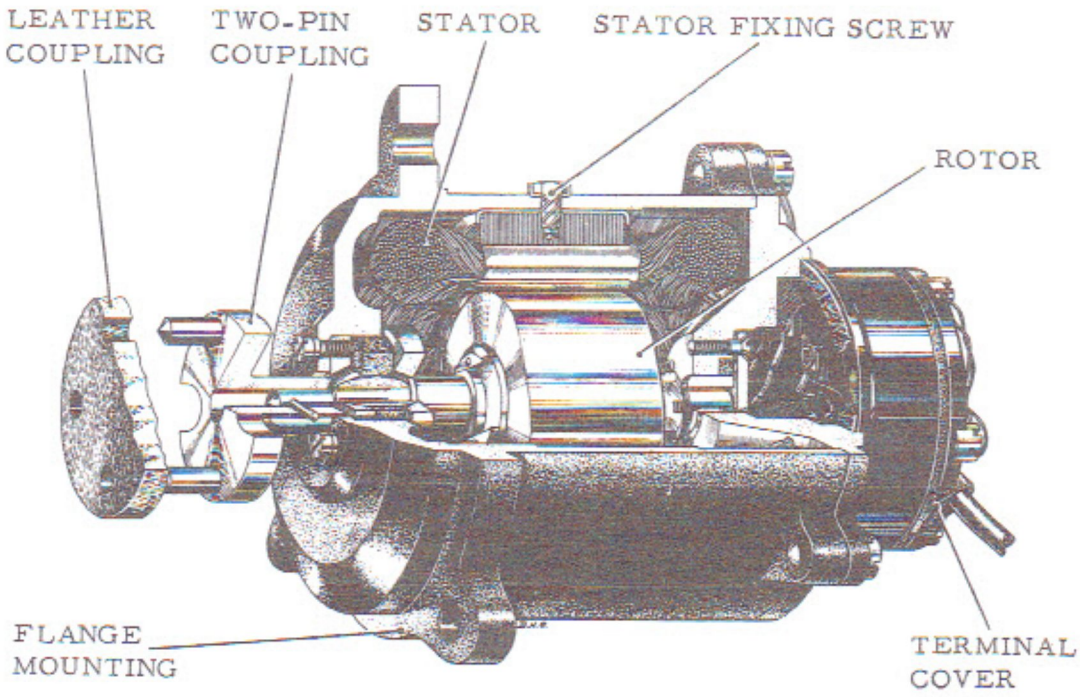


Fig. 1 Two pin leather coupling

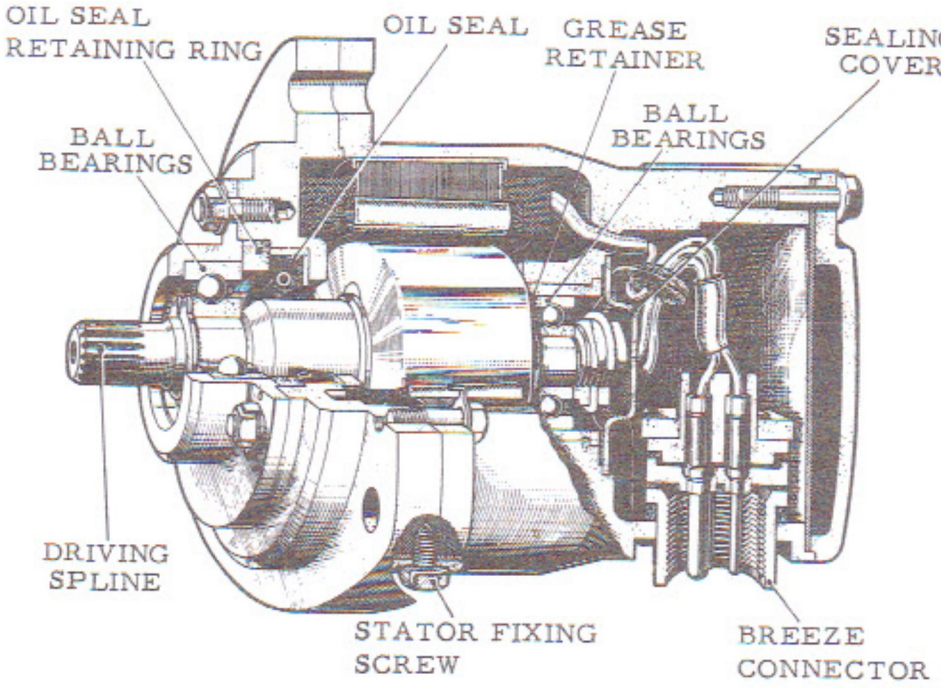




Fig. 2 Spline drive



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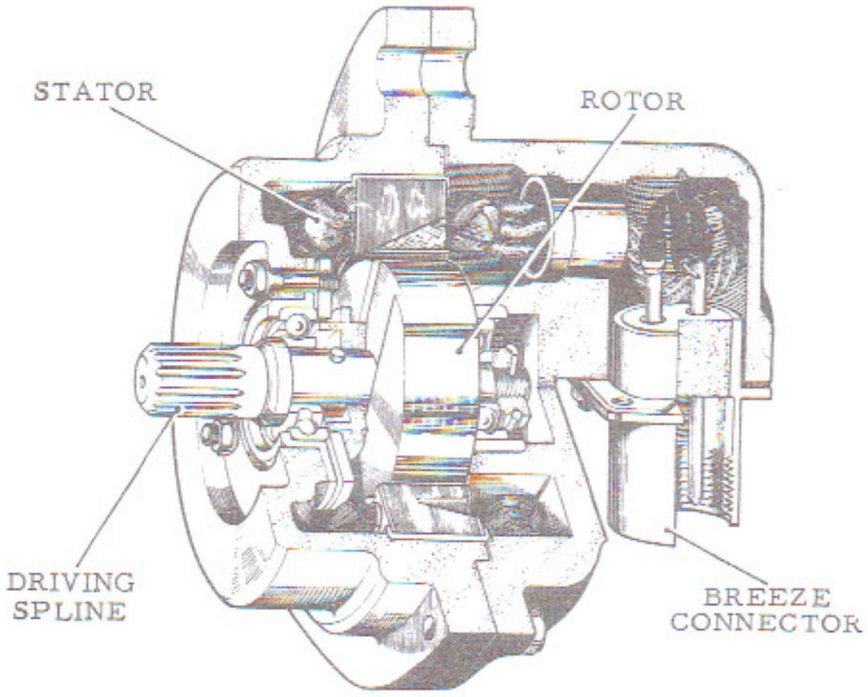


Fig. 3 Lightweight tachometer



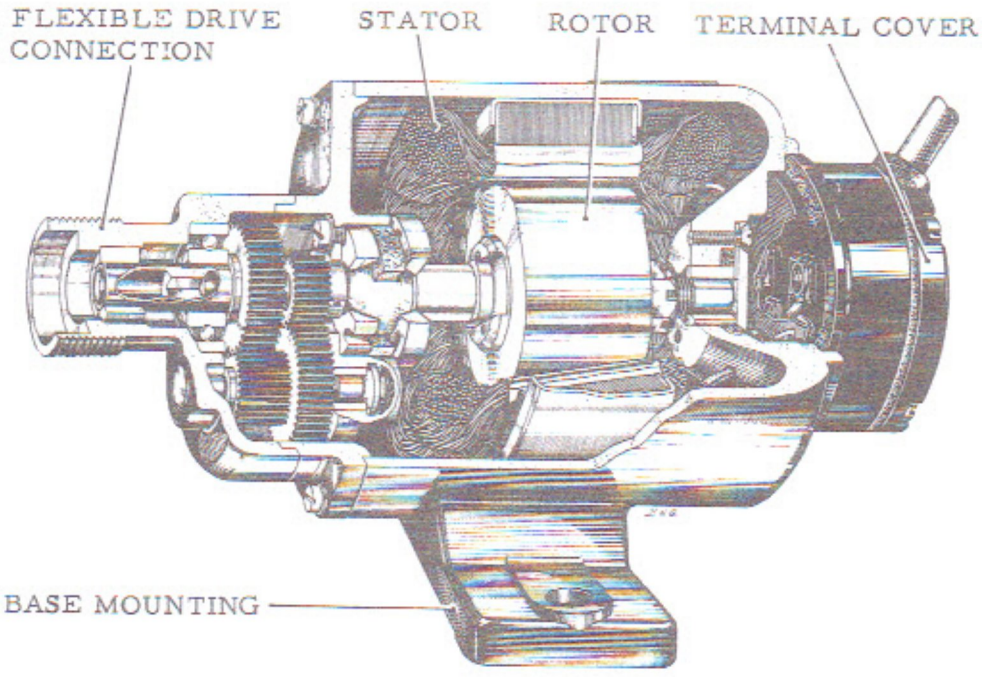


Fig. 4 Flexible drive

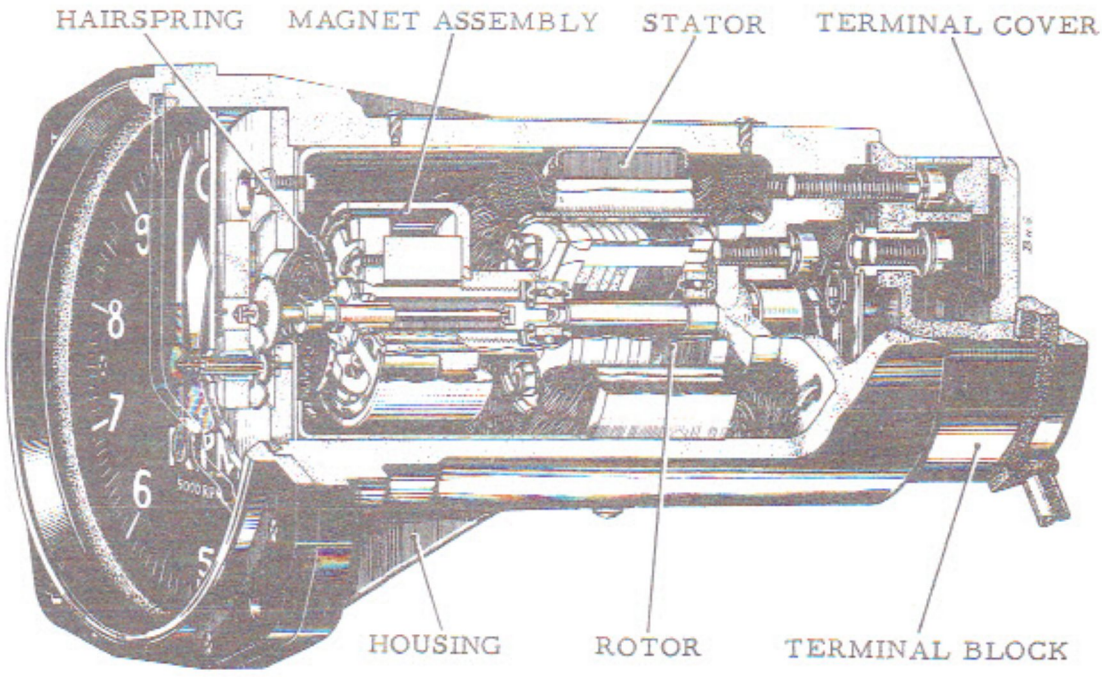


Fig. 5 Large case indicator



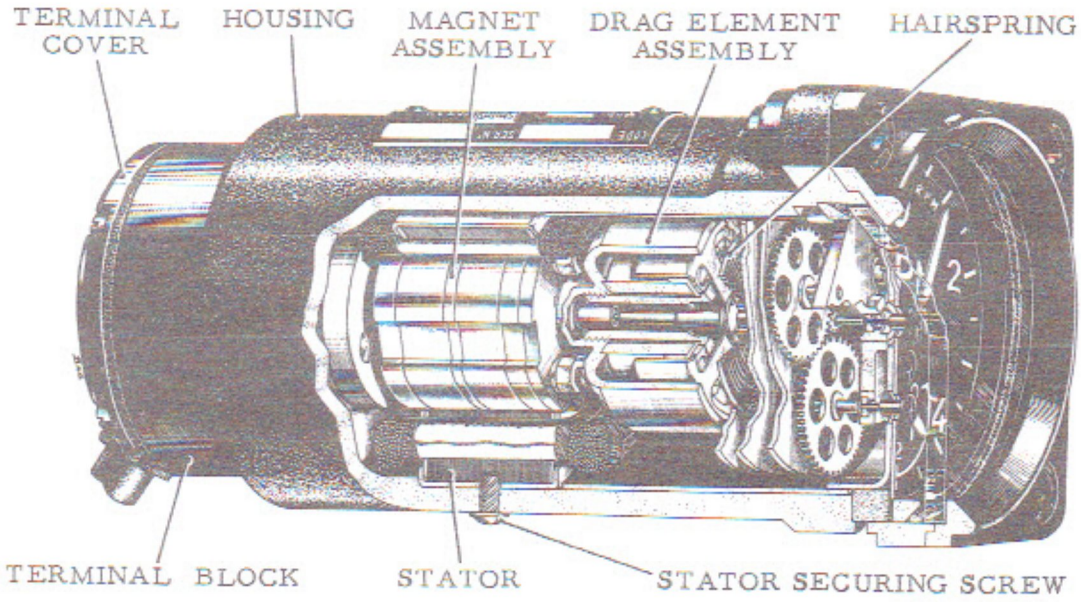


Fig. 6 Small case indicator



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C. Flexible drives

The flexible drive used with certain types of generator provides the connecting drive between the engine and the generator. Figure 7 shows a sectioned view of a flexible drive.

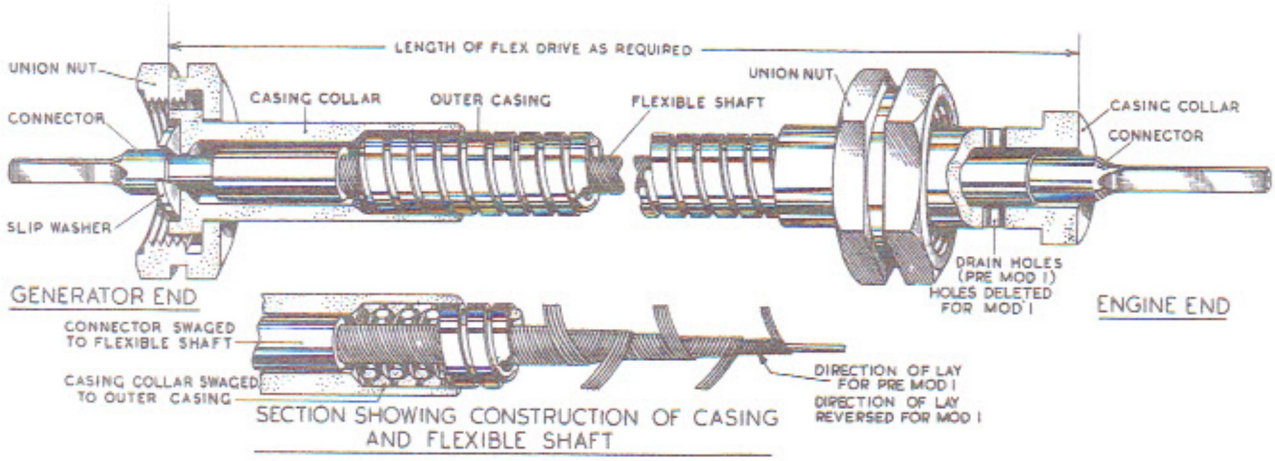


Fig. 7 Flexible drive

2. OPERATION



A. Generators (all types)

A two-pole permanent magnet rotor rotates within a slotted stator which carries a star-connected three-phase winding. The ends of the windings terminate at three terminals or at the pins of a Breeze connector.

The frequency of the alternating current, and, to some extent, the output voltage, are dependent upon the rotor speed, which, in the case of piston engine installations, is equal to the crank-shaft speed.

In the case of gas turbine installations, however, the rotor speed may be a quarter or a half turbine speed.

When used with piston engines having a tachometer drive running at a quarter engine speed, the generator operates via a 4 : 1 step-up gear box, and with a tachometer at half-speed, a 2 : 1 step-up gear box.

When used with gas turbines, direct drive generators are usually used and the necessary reduction in speed between the turbine shaft and the generator is effected by taking the drive from a half or quarter-speed shaft, depending upon the operational speed of the turbine.

B. Indicators

An eddy current speed indicating mechanism includes a cup-shaped copper alloy drag element, which is free to revolve within the annular space between the poles

of a permanent magnet. The drag element is coupled to the rotor of the alternating current motor and moves in accordance with Lenz's law. The element carries the pointers connected either directly or through gearing.

NOTE: Information concerning Data, Unpacking, Acceptance Checks, Storage Conditions, Shelf Life, Checks/Tests before Installation, and Installation is contained in the Maintenance manual appropriate to the instrument.

## CHECKS/TESTS AFTER INSTALLATION

After installation, the whole system should be tested for correct operation in conjunction with the aircraft electrical installation (Engine speed indicating system point-to-point wiring).

When the engine is run up for the first time after the system has been installed, the indicator pointer may tend to fluctuate and read low idling speeds.

Should this be so, it merely points to non-synchronisation of the indicator motor and, as engine revolutions increase, the pointer will jump forward and thereafter show correct engine speeds without appreciable lag.

NOTE: Indicator motor synchronisation should occur at the speeds shown for the respective indicator ranges.

| Indicator range (r.p.m.) | Synchronisation at (r.p.m.) |
|---|---|
| 0 - 5,000 | 800 |
| 0 - 10,000 | 1,200 |
| 0 - 20,000 | 2,400 |

As engine revolutions are reduced, check that the indicator pointer returns to its zero position smoothly and without hesitation.



## OPERATING INSTRUCTIONS

Not applicable.

## MAINTENANCE SCHEDULES AND PROCEDURES

Maintenance schedule.

| | |
|---|---|
| Daily. | Check for correct operation. |

## FAULTS, CAUSES AND RECTIFICATION (TROUBLE SHOOTING)

Systematic trouble shooting, in the event of failure of the indicating system, should begin with an attempt to isolate the faulty component.



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Once it is known which component is causing the failure, further checks, following the lines suggested in the appropriate maintenance manual, should very quickly reveal where the fault lies.

Thereafter, depending upon the nature of the fault, rectification can either be achieved with the instrument in situ, or it must be removed and bench tested. In either instance, full instructions are contained in the appropriate instrument Maintenance manual.

NOTE: Information concerning Removal, Bench Checks, Overhaul Period and Return to Manufacturer or Base is contained in the appropriate instrument Maintenance manual.