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TACHOMETER INDICATOR JAEGER TYPE 544-527

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

J. T. Dunnett

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LIST OF CHAPTERS

OCTOBER 1974

Technical data manual

JAEGER

TACHOMETER INDICATORS

Type 750

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CONTENTS

PREAMBLE

The present Technical Data Manual is designed to describe the JAEGER Electric Tachometer Indicators, Type 750, and to furnish users with all necessary information regarding operation, use, maintenance, repair as well as testing the equipment under review.

The general information and the description apply to tachometer indicator, Part No. 544504, the indicators, Part. Nos 544507 and 544527, being considered as variations.

Throughout the text of the Manual, the electric tachometer indicator will be referred to under the abbreviated term "INDICATOR".

This documentation comprises five sections :

SECTION I : DESCRIPTION AND OPERATION MANUAL

This section represents the basic documentation related to the instrument. It gives the fullest description of the instrument as well as the principles and modes of operation of each component.

SECTION II : UTILISATION MANUAL

This manual is designed to give information regarding operation of the instrument.

SECTION III : MAINTENANCE MANUAL

This manual concerns the maintenance and repairs which can be carried out on the equipment in the operating organisation or in an authorised repair depot.

SECTION IV : ILLUSTRATED PARTS BREAKDOWN

This section lists all components forming the general configuration of "TYPE 750 TACHOMETER INDICATORS".

SECTION V : VARIATIONS

This document is designed to complete the other four preceding sections in order that they might apply to the Type 750 tachometer indicators incorporating modification A.

TACHOMETER INDICATOR TYPE 750
(Fitted with removable mounting clamp)

SECTION I

DESCRIPTION AND OPERATION MANUAL

CONTENTS

LIST OF ILLUSTRATIONS

I - 1 GENERAL

I-1.1. PRINCIPLE

The JAEGER electric tachometer assures a continuous measurement of the instantaneous speed of rotation of the rotating element of an engine, expressed as a percentage.

To this end it uses a generator of the three-phase alternator type as well as an indicator incorporating a receiver motor and a speed measurement and indicating device expressed as a percentage (See Illustration I-2).

The indicator is fed by the tachometer generator at a frequency proportional to the speed to be measured ; it comprises two specific sections :

a) A cylindrical case of a nominal 50 mm diameter which contains :

- an automatic synchronisation three-phase motor ;
- a magnetic speed measurement device operated by induction of Eddy currents within a conducting metal drum, limited in its rotation by means of an opposing hairspring.
- a multiplying gear train, a central large hand moving in front of a scale with linear graduation of 0 to 100 %, an off-center small hand moving in front of the sub-dial graduated linearly from 0 to 10 %.

b) A removable mounting clamp.

I-1.2. MANUFACTURER'S PART NUMBER OF THE TYPE 750 INDICATOR

The two sections of the Type 750 indicator possess the following Part Nos :

a) 544504 : the cylindrical case containing the measuring device.

b) 544850 : the removable mounting clamp (57 mm dia.)

I-1.3. GENERAL CHARACTERISTICS

I-1.3.1. Overall dimensions (See Illustration I-1)

Without mounting clamp : in accordance with US Standard MS33639 (ASG)
With mounting clamp : in accordance with Pr L 70-110A (57 mm dia.)

I-1.3.2. Operating ranges

- Measurement of speeds between 0 and 110 % (the instrument is calibrated to give 100 per cent indication when the generator is running at 4200 rpm.
- Operating temperatures between – 20°C and + 55°C.

I-1.3.3. Weight

- Indicator	:	550 grams
- Mounting clamp	:	65 grams
Total		615 grams (without mounting screws)

I-1.3.4. Presentation

- The dial and sub-dial are graduated linearly (See Illustration I-1).
- The instrument has two hands : one small off-center hand which makes one revolution for a speed variation of 10 % (sub-dial) and one large central hand which makes 3/4 turn (270°) for a change in speed of 100 % ; the reading can be extended to 110 % by use of the small hand for the ultimate 10 %.
- The pointers, figures and graduations of the dial and sub-dial are treated with fluorescent compound.

I-1.3.5. Installation aids

- Mounting by means of a removable clamp in accordance with standard Pr L 70-110 (57 mm dia.).
- The indicator must be connected to a three-phase tachometer generator of the 4-pole type (JAEGER or U.S. standard), driven at the speed to be measured.
- The electrical connection with the tachometer generator is to be made by means of a standard connector to Pr L 54-115, type 13.

I – 2 DETAILED DESCRIPTION

The indicator is composed of two sections :

I-2.1. A cylindrical case with a nominal diameter of 50 mm

I-2.2. A mounting clamp

I-2.1. CYLINDRICAL CASE

I-2.1.1. Motor (See Illustration I-5)

The motor comprises the following components :

- A 12-pole piece wound stator (42) composed of a laminated magnetic circuit which carries three star-connected windings ; at their point of exit, the conductors are each identified by a specific colour : red, yellow and black (see winding diagram Illustration I-5).
- A rotor (46) composed of a hysteresis rotor and a starter magnet (46-1) mounted free on the rotor shaft. Rotation of the magnet is limited by a catch dog and flexible stop system.
- Two covers (41 and 50), clamped by three spring clips (43), contain the stator ; these two covers provide housings for the ball bearings which carry the rotor shaft and ensure that it is concentric to the stator.
- A permanent magnet (55) and a keeper ring assembly secured to the rotor shaft end by a cylindrical nut (56) housed in a recess of the magnet bushing ; a screwdriver device prevents the magnet sliding within the keeper ring.

The cylindrical 6-pole magnet, made of sintered Alnico, forms an integral part of a bushing.

The keeper ring assembly is composed of :

- the keeper ring (51) itself ;
- a notched field ring (51-1), rotated by friction in the keeper ring ;
- a retaining ring (51-2) positioned in the annular groove of the field ring and ensuring that the field ring is securely located by means of three screws at 120° in the periphery of the keeper ring.

I-2.1.2. Movement (See Illustrations I-3 and I-4)

I-2.1.2.1. Description

The movement is composed of :

- A measuring drum (37) integral with the handstaff (31) carrying the large hand ; the open end of the drum rotates in the magnetic gap fitted to the motor shaft.
- A hairspring (33) which limits the rotation of the handstaff ; its outer end is anchored by means of a pin and post to an adjustable plate (34-1) clamped by a locking pin (36) and set screw (35). A shield and the disc of the adjusting plate limit the axial movement of the hairspring coils.
- A gear train which transmits the angular displacement of the drum to the small hand ; all the gear shafts run in jewelled bearings.

The gear train comprises :

- a wheel (31-1) fitted to the handstaff and equipped with a pin to limit its rotation ;
- an intermediate gear (26) carrying a wheel (26-1) and a pinion (26-2) ; the aforementioned pinion meshes with the wheel (31-1) ;
- a pinion shaft (25) carrying the small hand ; the pinion (25-1) meshes with the wheel (26-1) of the intermediate gear.

NOTE : The mechanism is compensated so that changes of temperature within specified limits do not affect its accuracy. This has been achieved by making the drum, magnetic system and hairspring from special materials.

I-2.1.2.2. Schematic gear train layout

Handstaff (large hand)	(31)	Wheel (84 teeth)	
Intermediate gear	(26)	Wheel (70 teeth)	Pinion (21T)
Pinion shaft (small hand)	(25)		Pinion (21T)

I-2.1.2.3. The movement is contained in a support which is formed by a frame (34) and two plates (23 and 30) ; each plate is secured to the frame by means of three screws.

The fixed stop (29) mounted on the lower plate (30) limits the rotation of the handstaff.

The movement is assembled to the motor cover (50) by three screws which pass through the base of the frame. It is centered on a boss of the cover in order to ensure correct alignment of the motor and movement shafts.

I-2.1.3. Case assembly (See Illustration I-6)

The case assembly comprises :

- A light alloy case (1), varnished in black, and sealed hermetically at the front by a glass bonded with Araldite.
- A large hand (3).
- A small hand (2).
- A graduated sub-dial (6) orientated by a pin.

- A main dial (5) secured to the upper plate of the movement by three screws (4). A window allow the sub-dial to be seen from the front of the instrument. The dial numerals and markings are in accordance with standard NF L 70-130 ; the graduations, markings, numerals and hands are finished in Fluorescent DTD 573.
- A snap ring (9) and three springs (8) ensure anchorage of the mechanism within the case. These three springs, positioned at 120° around the periphery of the movement frame, center the forward section of the mechanism. The snap ring is fitted in a internal groove of the case, between the lower motor cover and the back plate.
- A rubber sealing washer (10).
- A back plate (12) secured to the lower motor cover by four screws (13) ; the 3-pin receptacle (15) is secured to this back plate by two screws (16).
  A rubber gasket (14) is compressed between the receptacle and the back plate.
- An engraved cover (17) secured to the back plate by two screws (18) ; it carries the designation of the instrument, the type, the manufacturer's Part Number, the serial number and the date of manufacture and lapse of guarantee.

I-2.2. MOUNTING CLAMP

The mounting clamp, in two parts held together by four screws (see Illustration 1), complies with standard Pr L 70-110 (57 mm dia.). It fits over the serrated flange of the cylindrical case and allows the instrument to be fitted into the instrument panel.

I – 3 DETAILED OPERATION

I-3.1. MOTOR OPERATION (Illustration 5)

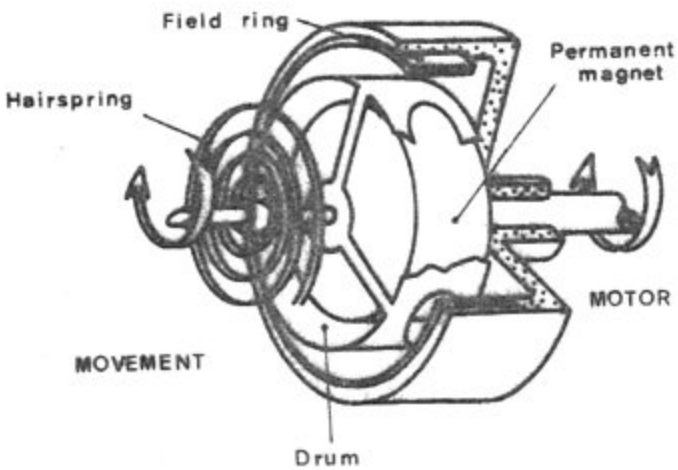
A three-phase alternating current supplied by the tachometer generator flows through the stator winding of the indicator, this current being proportional to the speed to be measured.

Under the effect of the rotating field produced by this current, the hysteresis rotor initiates its revolving movement as does the starter magnet ; both are additive in effect to ensure synchronous rotation of the assembly from start-up.

I-3.2. OPERATION OF THE MEASUREMENT AND SPEED INDICATING DEVICE

The permanent magnet (55), fitted to the end of the motor rotor shaft, furnishes a magnetic field which passes through the measuring drum skirt (37) to close within the field ring (51-1) (See Illustration 5).

The field by its rotating action induces Foucault currents into the measuring drum produced from a conducting metal ; these currents, by interaction with the field responsible for their production, develop a torque along the drum shaft which is proportional to the speed of flux variation and hence to the speed to be measured.



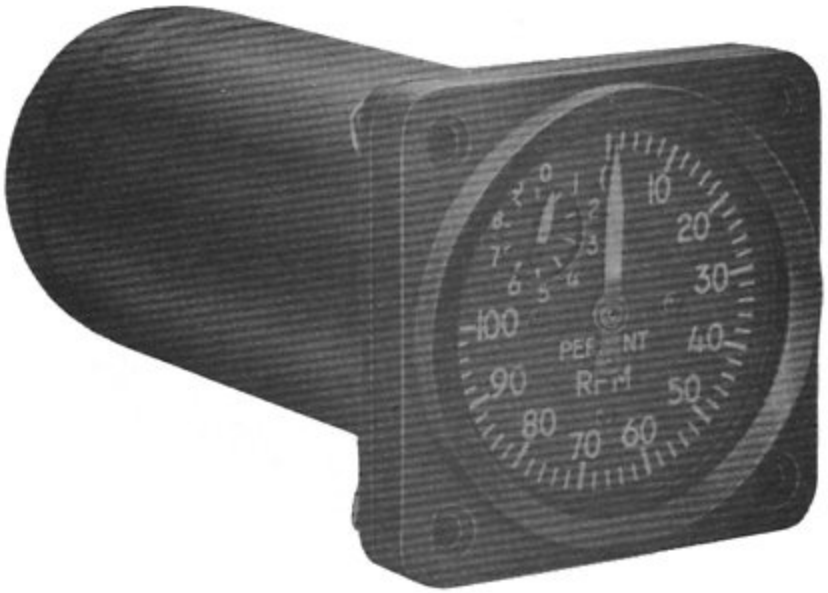
The hairspring (33) fitted to the drumshaft by a collet, opposes rotation of the latter, so that its angle of deflection corresponding to the equilibrium position, is equally proportional to the speed of rotation of the magnet and hence to the speed to be measured.

The offset small pointer is made to rotate in front of the sub-dial by the multiplying gear. The center large pointer is rotated in front of the main dial by direct action of the drum-shaft ; its rotation, limited by the moving stop of wheel (31-1) and the fixed stop (29) mounted on the lower plate, is slightly in excess of 270°.

The ten graduations of the sub-dial are equidistant and spread over 360°, whilst the graduations of the main dial, equally equidistant, are spread over 270°.

I – 4 DESCRIPTION OF VARIATIONS

I-4.1. The JAEGER Tachometer Indicator Part No. 544507 is electrically and mechanically similar to indicator Part No. 544504 described in the earlier chapters. It differs only by the dial which has english markings.



TACHOMETER INDICATOR Part No. 544507
(with removable mounting clamp)

I-4.2. The JAEGER Tachometer Indicator Part No. 544527 is similar to indicator Part No. 544504, but in this instrument electrical connection is made by a CANNON receptacle (MS 3102R-14S-7P), and the dial is fitted with coloured markings as follows :

Yellow sectors	from 96.2	to	98.7 %
	from 99.7	to	103.2 %
Green sector	from 98.7	to	99.7 %

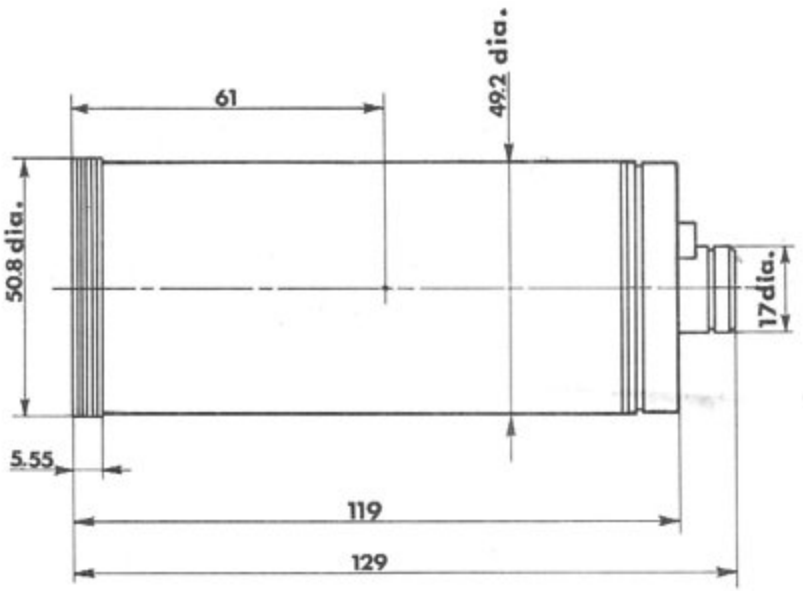
Red lines at 96.2 and 103.2 %

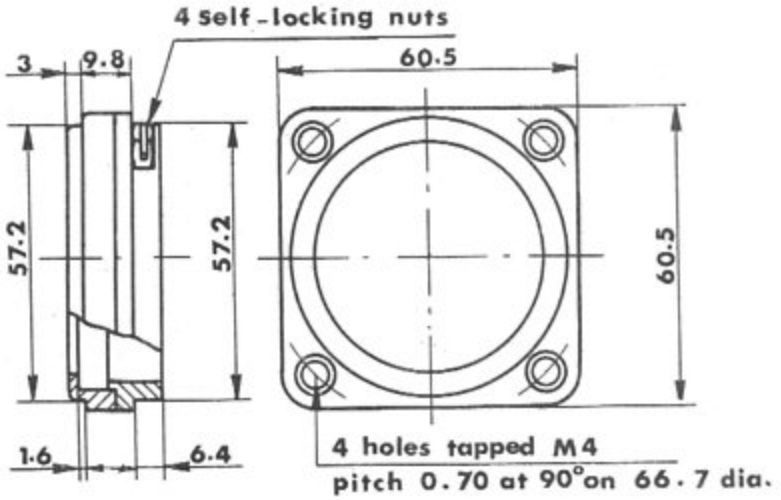
TACHOMETER INDICATOR Part No. 544527

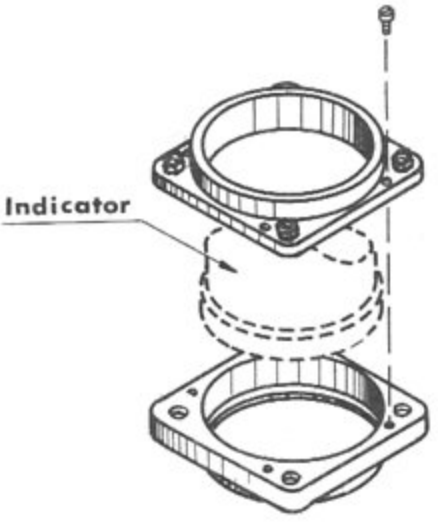
LIST OF MODIFICATION MADE TO THE EQUIPMENT

MODIFICATION NO.	OFFICIAL NOMENCLATURE OF MODIFICATION	TYPES OF EQUIPMENT CONCERNED	INTENDED APPLICATIONS

ILLUSTRATIONS







OUTLINE DRAWING

ILLUSTRATION 1

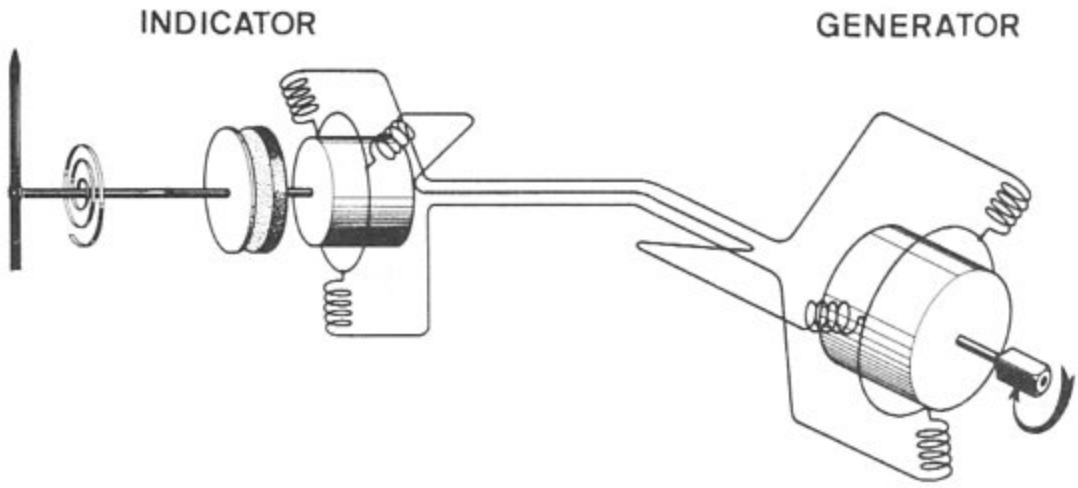
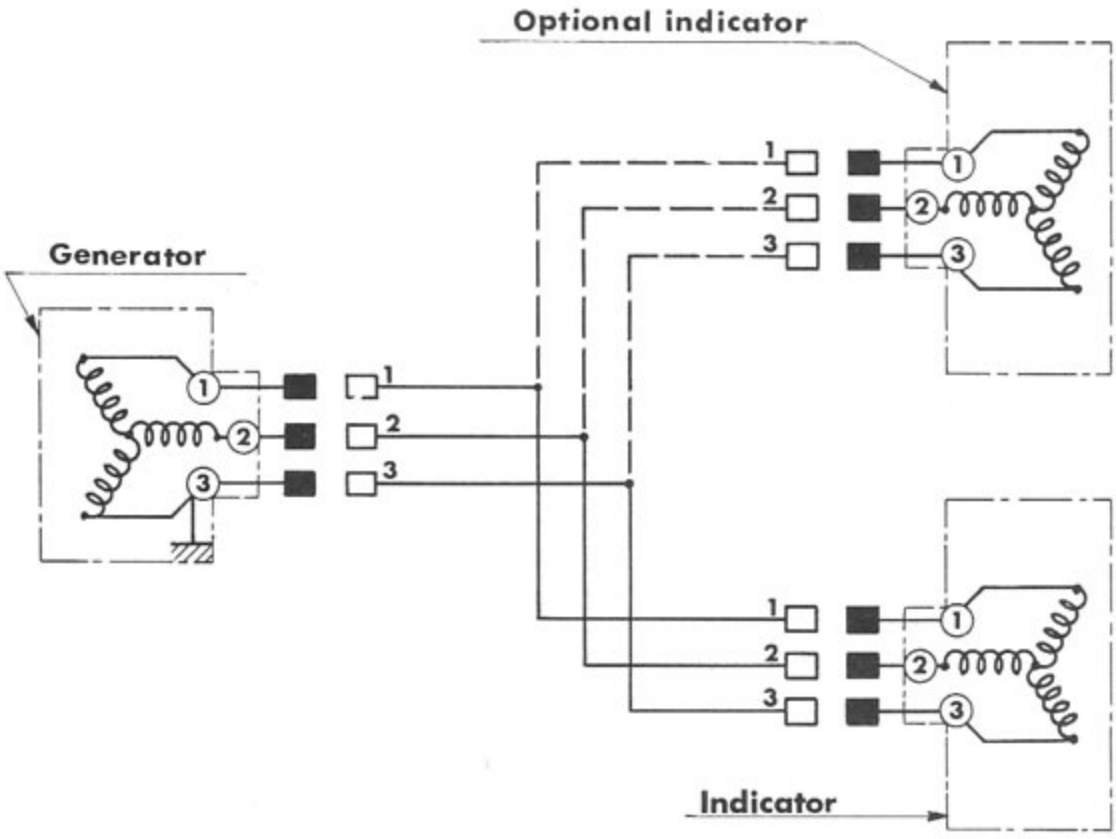
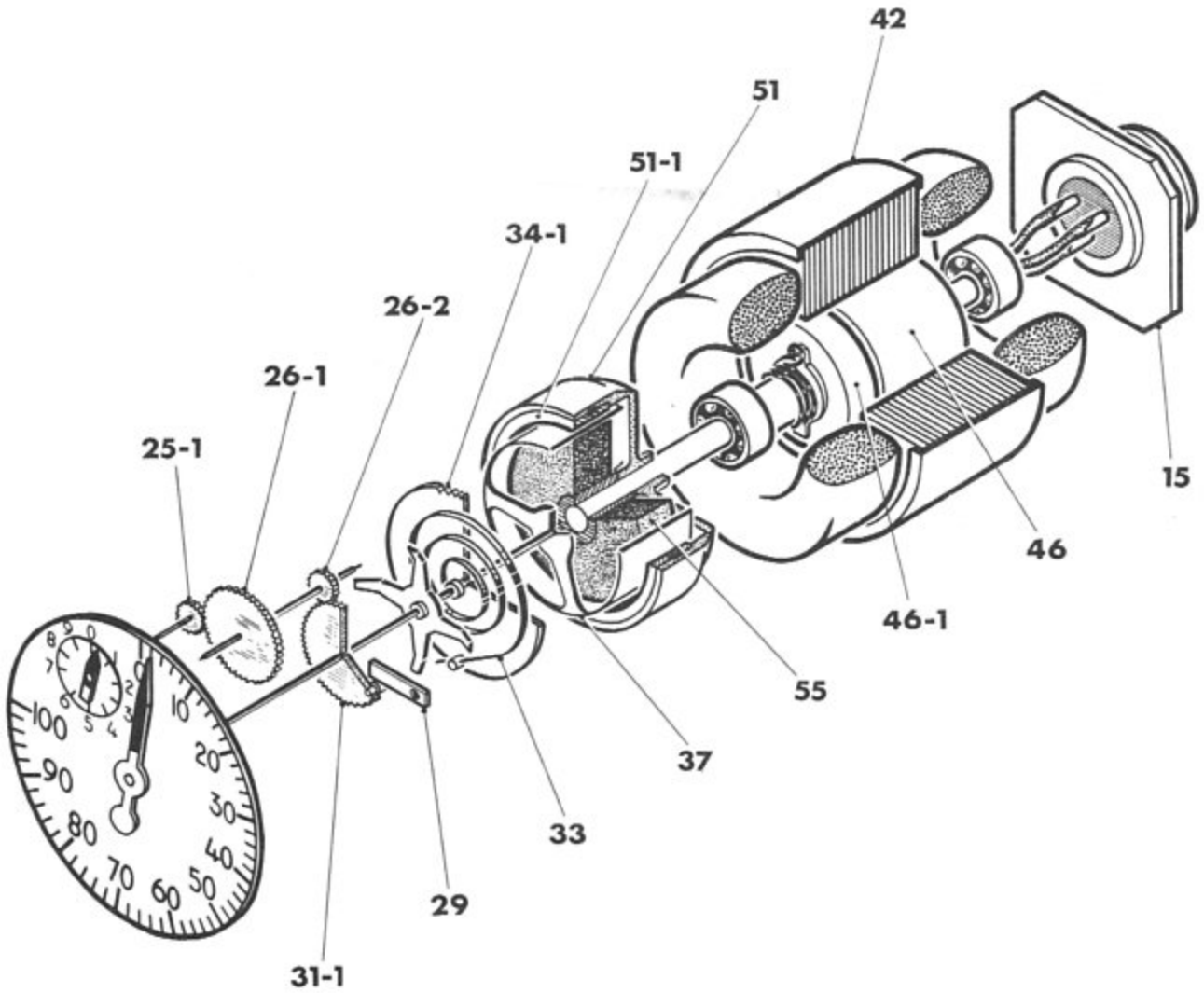


DIAGRAM
OF A SIMPLE ELECTRIC TACHOMETER



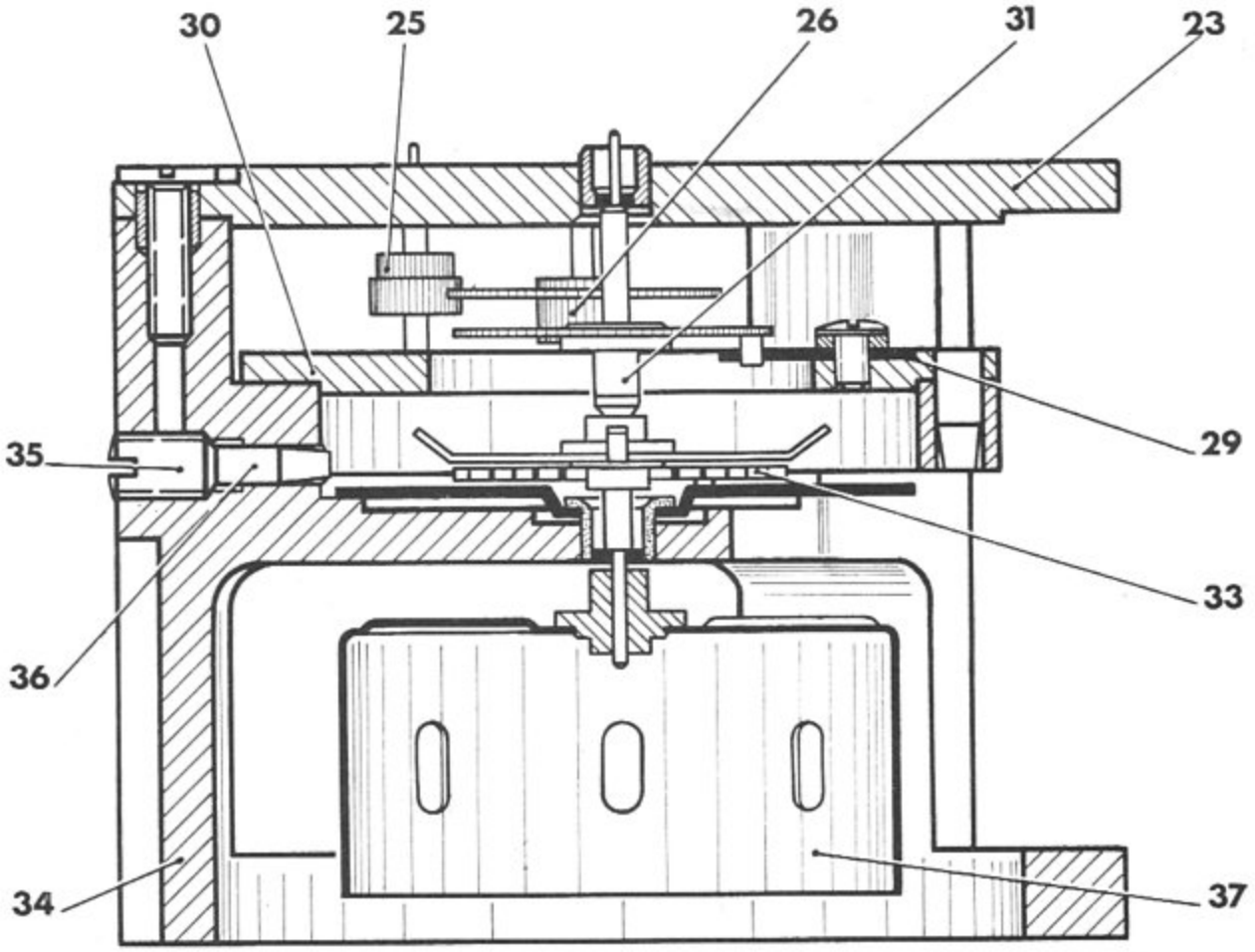
WIRING DIAGRAM

ILLUSTRATION 2



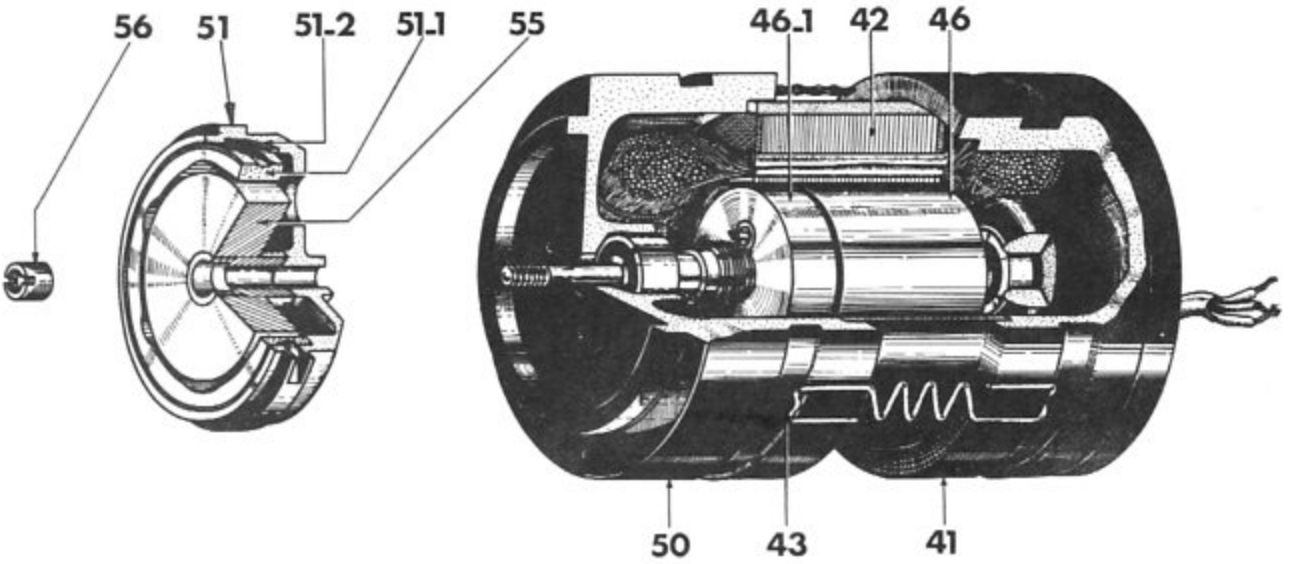
SCHEMATIC DIAGRAM OF MECHANISM

ILLUSTRATION 3

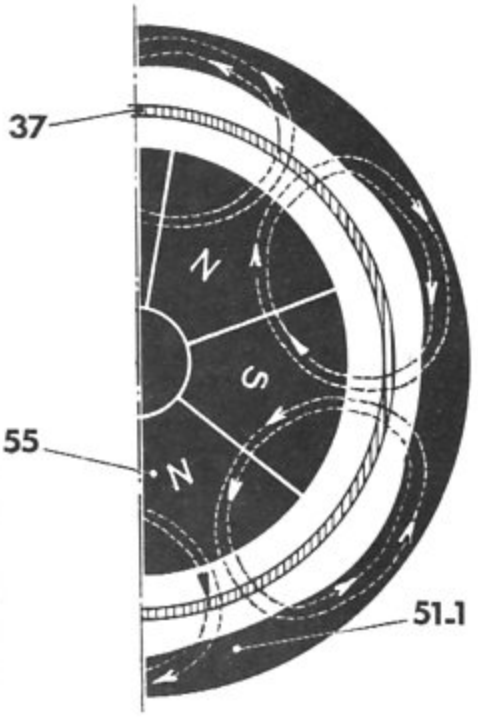


SECTIONED VIEW OF MOVEMENT

ILLUSTRATION 4



MOTOR



MEASURING DEVICE

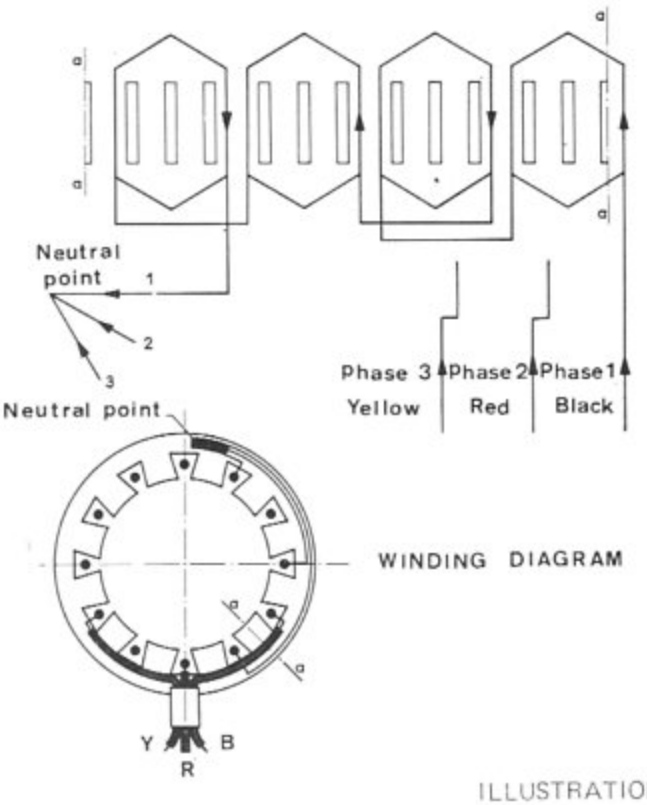
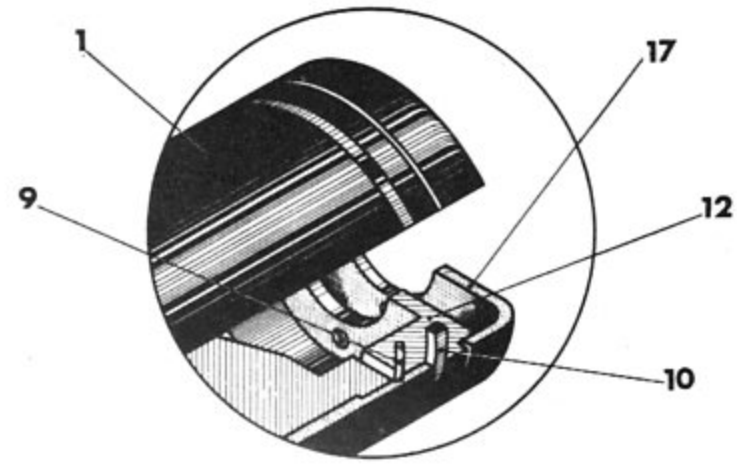


ILLUSTRATION 5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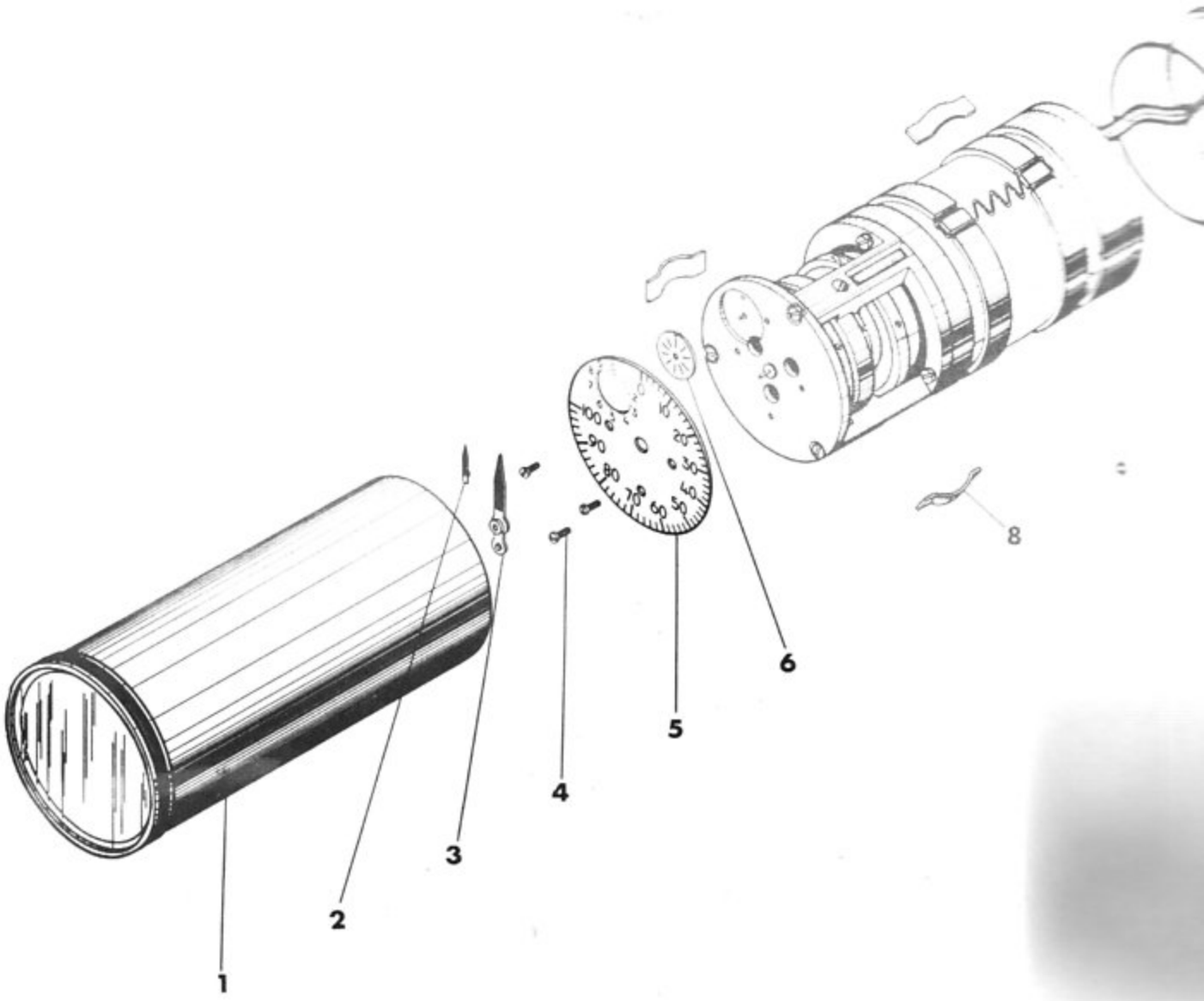
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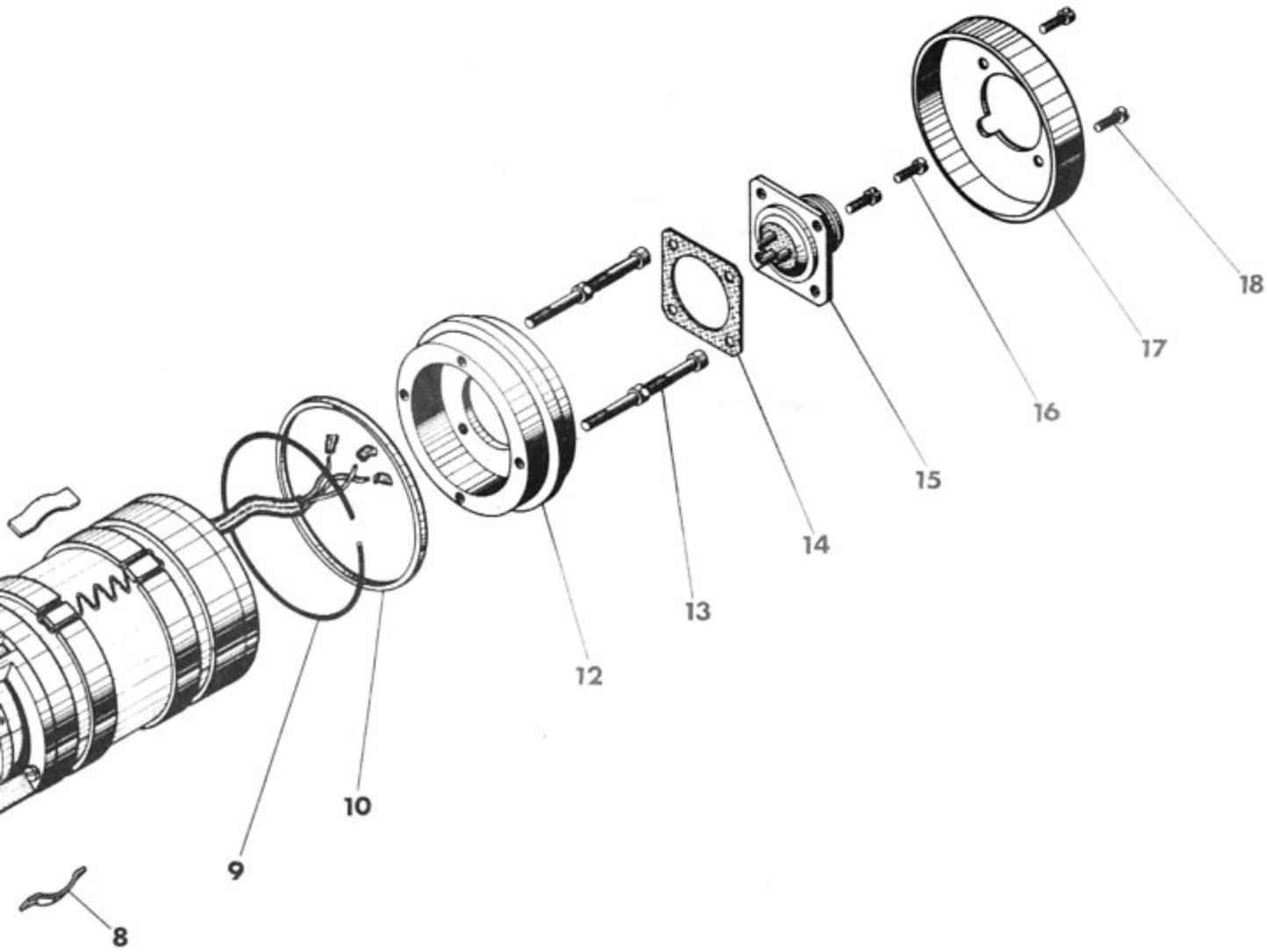

PARTLY EXPLODED VIEW OF INDICATOR