Chapter 62

TIME DELAY SWITCH, ROTAX, TYPE D 8413

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Operating voltage	16–29-V d.c.
Winding current (average)	0·5 ampere at 24-V
Contact voltage	28-V d.c.
Contact rating...	8 amperes
Operational temperature range ...	—40 deg. C. to +70 deg. C.
Operational ceiling	60,000 ft.
Length	4·625 in.
Width	3·750 in.
Height	3·322 in.
Weight	1 lb. 12 oz.

Introduction

1. The Rotax D 8413 time-delay switch is designed so that, when operated, it automatically controls the making and breaking of one pair of normally open contacts and one pair of normally closed contacts in a predetermined sequence, resetting itself at the end of a 36 second cycle for further operation when required. It is primarily for use in starter control circuits for gas turbine engines, where the sequence is initiated by depressing the starter push switch in the pilot's or engineer's position.

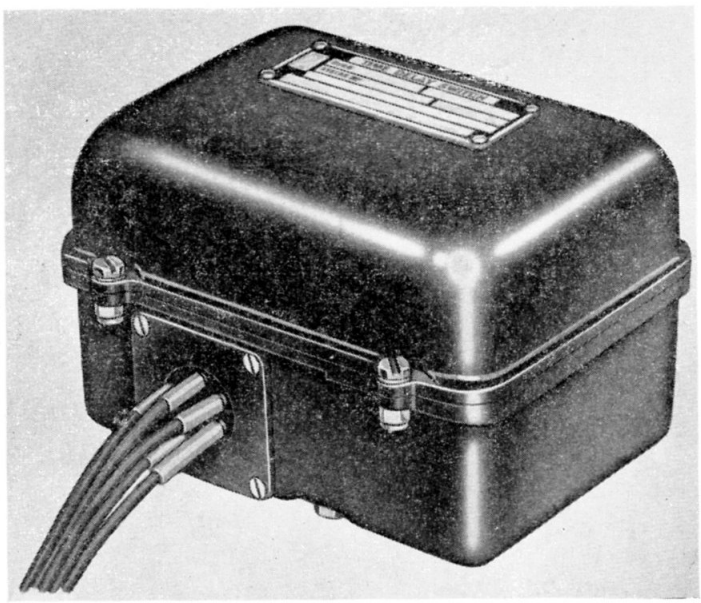

Fig. 1. D 8413 time delay switch

DESCRIPTION

2. The switch mechanism is housed within two light

alloy castings which are bolted together to form a waterproof and flameproof housing (*fig.* 1). The leads are brought out through a waterproof multiple grommet in the base casting. The switch mechanism is secured to the base casting by three hexagon head screws which locate in three mounting pillars (*fig.* 2).

Switch mechanism

3. An auto-relay and winding mechanism are fixed to the underside of a mounting plate situated just below the rim of the base casting and the circuit contacts are mounted above the plate. The auto-relay operates a ratchet which winds a preloaded clock type main spring. The spring drives a camshaft (concentric with the ratchet wheel), an escapement mechanism accurately controlling its speed of rotation.

4. The camshaft is carried by two friction bearings and projects through the mounting plate from the winder side, where it carries the main spring, ratchet wheel and escapement drive wheel, to the contact side, where it carries two moulded cams. The cams operate the two moving contacts via contact followers.

5. The primary contacts and main supply contacts of the auto-relay circuit are mounted on the winder side of the mounting plate. They are operated by metal cams, the primary contacts cam rotating with the camshaft and the main supply contacts cam rotating with the ratchet wheel. The two moving contacts are interlocked so that when the main supply contacts have closed the primary contacts open, but when the main supply contacts open, the primary contacts remain open until allowed to close by their cam.

Operation

6. The diagram of internal connections (*fig.* 4) shows the contacts in their normal positions, i.e., with the switch set before commencing a cycle. Contacts 1 and 2 are those for controlling the external circuit, making contact between leads 3B(+) (28-V. d.c.) and 4C and between leads 2M(P) (28-V. d.c.) and 5E respectively for predetermined periods during the 36 second cycle (*para.* 10). Contacts 3 are the interrupter contacts of the auto-relay, being operated by a pin on the armature, and contacts 4 and 5 are the primary contacts and main supply contacts. Lead (1A(—) is the negative of the auto-relay.

7. The cycle is commenced by connecting 28-V. d.c. to the lead 2M(P) (i.e., by depressing the starter button) thereby making a circuit through the auto-relay coil via the interrupter contacts. The interrupter contacts open immediately the armature is

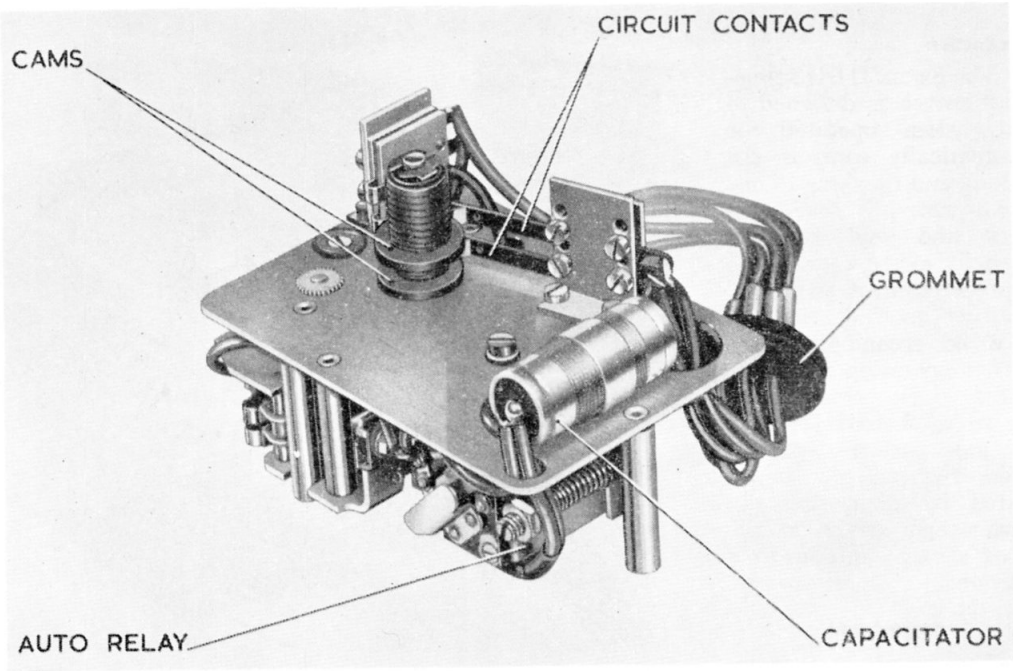

Fig. 2. Switch assembly

attracted to the relay core, so that the coil is again de-energized, the armature returns to normal under the action of its return spring and the interrupter contacts again close. In this way, the armature is made to vibrate.

8. The auto-relay armature has a drive spring which engages the teeth of the ratchet wheel and moves the wheel round one tooth per vibration. The main spring commences unwinding and rotating the camshaft immediately the ratchet wheel begins to wind but, owing to the restriction of the escapement mechanism, the winding is much quicker than the unwinding and a winding period of 3 seconds is sufficient for the 36 second cycle.

9. After about five vibrations, the ratchet wheel has rotated sufficiently for its cam to have closed the main supply contacts and open the primary contacts. The reason for this arrangement is that the primary contacts can be connected to supply via the overspeed relay (if the unit is connected in a starter circuit) so that the cycle can commence only after the starter has begun to rotate. When the cycle has commenced, the main supply contacts connect the auto-relay directly to supply so that the switch will complete its cycle and reset in the event of the overspeed relay dropping out before the end of the winding period. After approximately 3 seconds winding, the main supply contacts open. The primary contacts close in preparation for a fresh cycle just before the camshaft comes to rest.

Sequence of operation

10. The sequence of operation of contacts 1 and 2 is as follows:—

Contacts 2 close	$3 \pm 0{\cdot}5$ seconds after commencement of cycle
Contacts 1 open	$5 \pm 0{\cdot}5$ seconds after commencement of cycle
Contacts 2 open	20 ± 1 seconds after commencement of cycle
Contacts 1 close	During last 2 seconds of cycle

The time of cycle is 36 ± 1 seconds.

INSTALLATION

11. There are four stub mounting feet on the underside of the base casting, each tapped 4 B.A. for attachment to a mounting plate. The fixed centres form a rectangle 2·000 in. by 3·500 in.

12. When supplied from Stores, the switch has five free leads, 12 in. in length, for connection to its associated equipment. Each

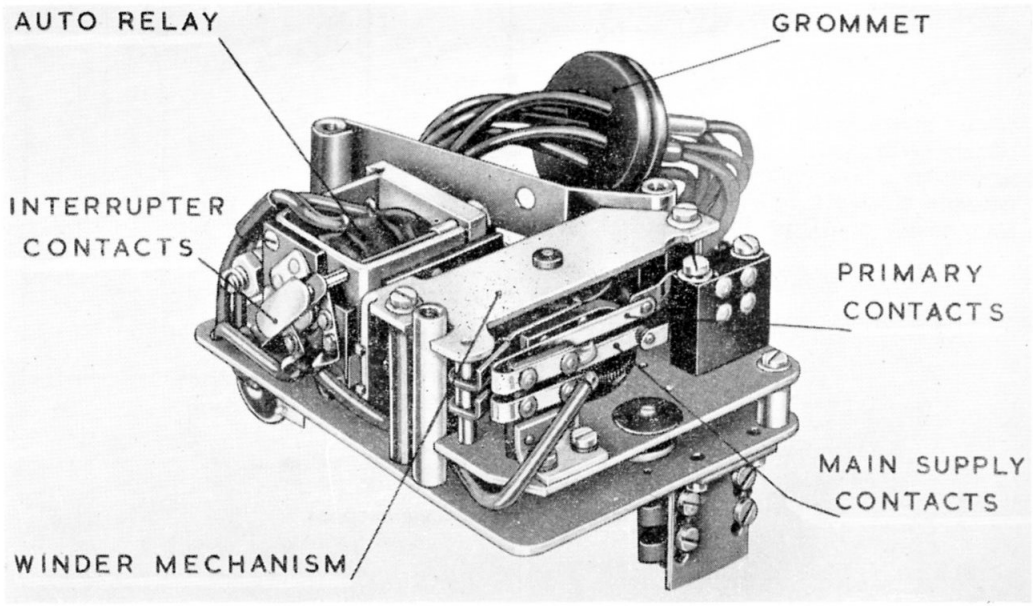

Fig. 3. Winding mechanism

lead is identified by a sleeve bearing its full designation (*fig.* 4).

SERVICING

13. Make an external visual inspection to ensure that the switch has not sustained damage and is in good condition. Ensure that the castings are firmly clamped together, that the grommet has not perished and that the insulation material of the leads is sound.

14. Ensure that the switch functions satisfactorily in its circuit and then apply the following tests, for which all the leads should be disconnected from the associated equipment.

Coil resistance tests

15. The resistance of the auto-relay coil, measured between leads 1A(—) and 2M(P) and corrected to 20 deg. C. ambient temperature, should be 6·7 ohm. ± 0·5 ohm.

Voltage drop tests

16. Measure the potential drop across leads 3B(+) and 4C (contacts 1) and 2M(P) and 5E (contacts 2) with 8 amperes flowing. The potential drop in each test should not exceed 0·2 volt.

Note . . .

Since contacts 2 are normally open it will be necessary to test them while a cycle is in progress. They are closed for approximately 17 seconds per cycle.

Insulation resistance tests

17. Measure the insulation resistance between the following points using a 250-V. insulation resistance tester. A reading of at least 50,000 ohm should be obtained in each test.

(1) Lead 1A(—) and lead 3B(+)
(2) Lead 1A(—) and lead 5E
(3) Lead 4C and lead 5E
(4) Frame and each lead

Note . . .

The value of insulation resistance given above applies to units being tested under normal workshop conditions. Due allowance should be made for climatic conditions of the locality and those of the aircraft servicing area or dispersal point where the tests are being applied. In particularly damp climates the readings may be sufficiently low to give apparently sufficient reason for rejection, and, in these instances, discretion should be exercised.

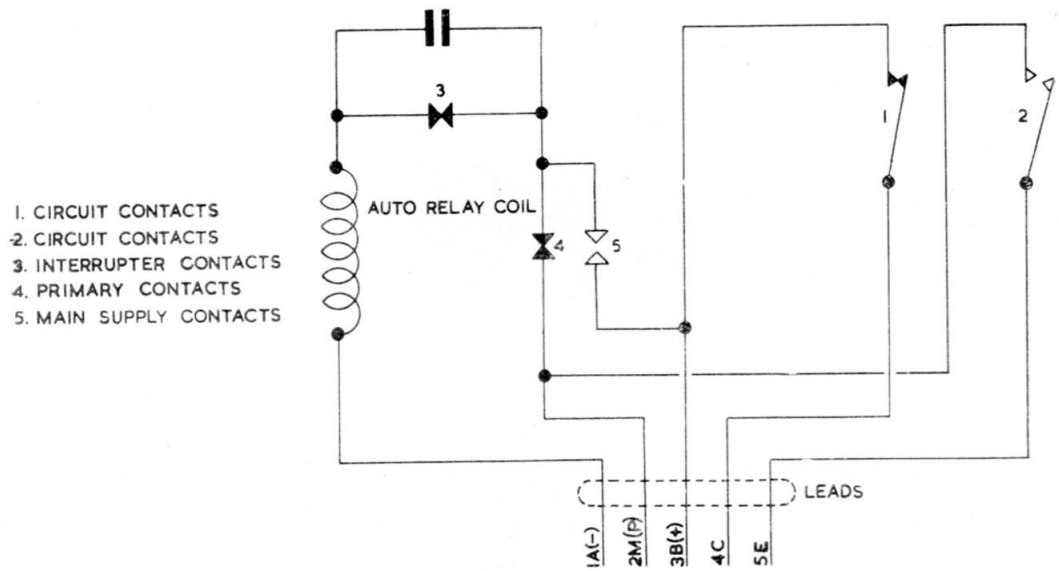

Fig. 4. Diagram of internal connections