Chapter 63

TIME DELAY SWITCH, ROTAX, TYPE D 8420

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Operating voltage	16 to 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 8420 time delay switch is designed so that, when operated, it automatically controls the making and breaking of two pairs 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.

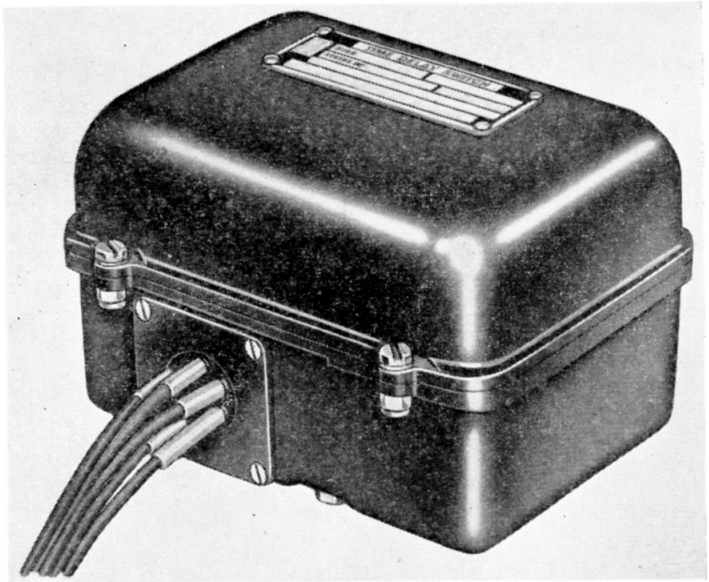

Fig. 1. D.8420 time delay switch

(A.L.81, Sep. 56)

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 bolts 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 wheel, by means of a driving spring, to wind a preloaded clock type main-spring. The main-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 mainspring, ratchet wheel and escapement drive wheel, to the contact side where it carries three moulded cams. The cams operate the three moving contacts via. contact followers.

5. The primary and main supply contacts of the auto-relay circuit (*fig.* 4) are mounted on the winder side of the mounting plate (*fig.* 3). They are operated by metal cams, the primary contacts cam rotating with the cam shaft 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, 2 and 3 are the circuit contacts, making contact between leads 3B(+) and 4C, 2M(P) and 5D and 2M(P) and Aux.E respectively for predetermined periods during the 36 second cycle (*para.* 10). Contacts 4 are the interrupter contacts of the auto-relay, being operated by a pin attached to 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 16–29-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

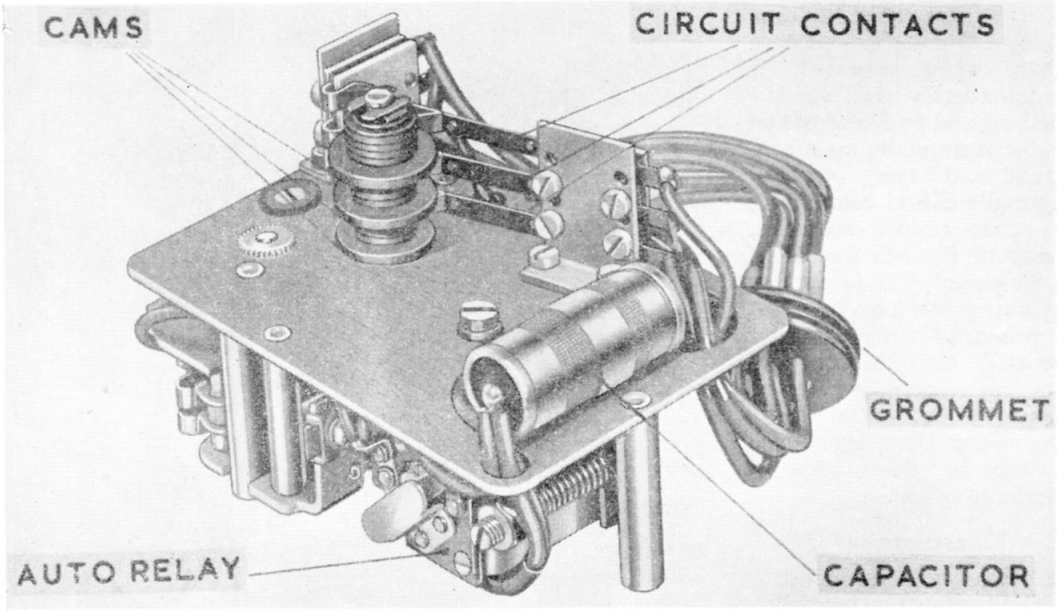

Fig. 2. Switch assembly

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

8. The auto-relay armature has a driving spring which engages the teeth of the ratchet wheel and moves the wheel round one tooth per vibration. The mainspring begins to unwind and rotate 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 a total cycle of 36 seconds.

9. After about five vibrations of the armature the ratchet wheel has rotated sufficiently for its cam to close the main supply contacts and open the primary contacts. The reason for this arrangement is that the primary contacts can be connected (when the unit is in a starter panel circuit) to supply via the overspeed relay so that the cycle cannot commence until the starter has begun to rotate. When the cycle has begun, however, the main supply contacts connect the auto-relay directly to supply so that the full cycle is completed and the switch reset in the event of the overspeed relay dropping out before the end of the winding period. After the winding period of approximately 3 seconds the main supply contacts open. The primary contacts remain open until just before the camshaft comes to rest, when they close in preparation for a new cycle.

Sequence of operation

10. The sequence of operation of contacts 1, 2 and 3 is as follows:—

Contacts 2 and 3 close	$3 \pm 0{\cdot}5$ seconds after commencement of cycle
Contacts 1 open	5 ± 1 seconds after commencement of cycle
Contacts 3 open	$10 \pm 0{\cdot}5$ seconds after closing
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 having a 4 B.A. tapped hole for attachment to a mounting plate. The fixing centres form a rectangle 2·000 in. by 3·500 in.

12. When supplied from Stores, the switch has six free leads, 12 in. in length, for connection to its associated equipment. Each lead is identified by a sleeve bearing its full designation (*fig.* 4).

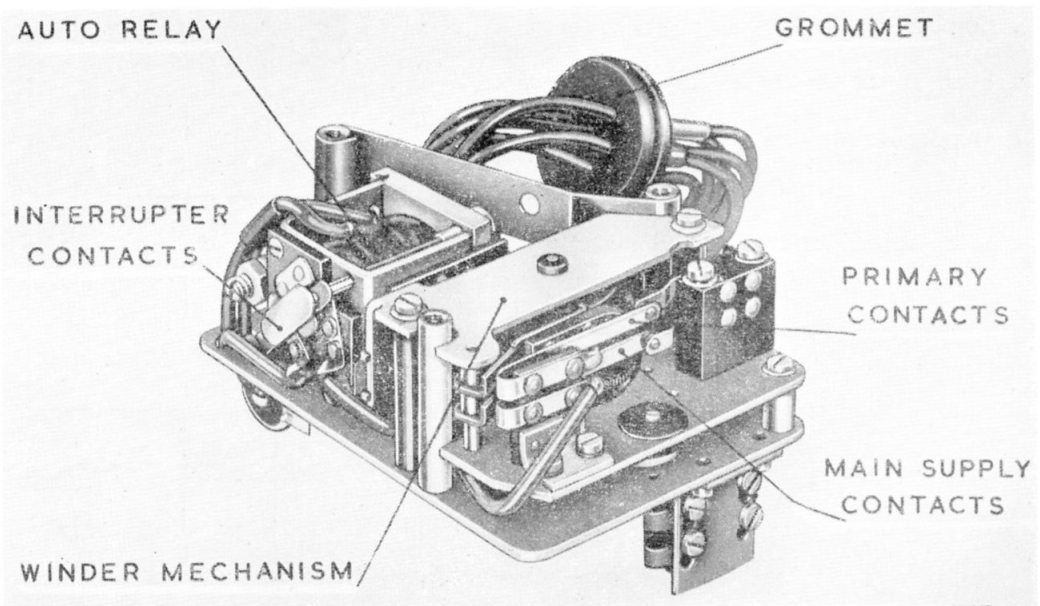

Fig. 3. Winding mechanism

SERVICING

13. Make an external visual inspection to ensure that the switch has not sustained damage and that it is in good condition. Ensure that the castings are firmly clamped together, that the grommet has not perished and that the insulation 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 external leads should be disconnected from the associated equipment.

Coil resistance test

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), 2M(P) and 5D (contacts 2) and 2M(P) and Aux. E (contacts 3) with 8 amperes flowing. The potential drop in each test should not exceed 0·2 volt.

Note . . .

Since contacts 2 and 3 are normally open, it will be necessary to test them while a cycle is in progress. Contacts 2 are open for approximately 17 seconds per cycle and contacts 3 for approximately 10 seconds.

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 Aux. E
(3) Lead 4C and lead 5D
(4) Lead 5D and lead Aux. E
(5) Frame and each lead

Note . . .

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

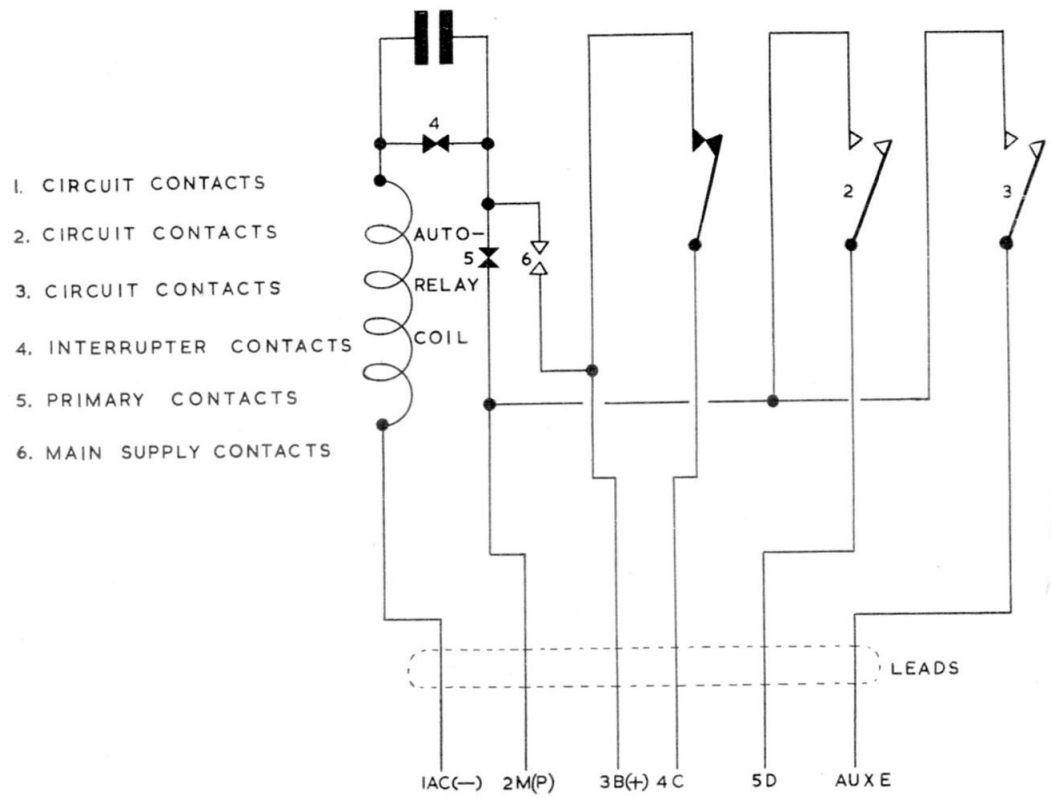

Fig. 4. Diagram of internal connections