AP 5275 S
BOOK No. 5
CHAP. No. 1

TITLE

TIME DELAY SWITCH

TYPE

ROTAX

PART No.

FITTED TO

VAMPIRE

Chapter 2

TIME DELAY SWITCHES, ROTAX, D8100 SERIES

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LEADING PARTICULARS

Operating current	16 *to* 29*V d.c.*
Winding current ...	0·5*A average at* 24*V* (*for* 3 *sec only*)
Contact voltage	28*V d.c.*
Maximum contact current	8*A*
Temperature range	−40 *to* +50°*C.*
Weight	1*lb.* 12 *oz.*
Overall dimensions:—	
Length	4·625 *in.*
Width (*over plug*)	4·531 *in.*
Height	3·322 *in.*

Introduction

1. The D8100 series of time delay switches are designed to open and close one or more separate circuits in a predetermined time sequence. The switches are primarily for use in starter control circuits for gas turbines, where the time sequence is initiated by depressing the starter push-switch in the pilots or engineers position. A typical switch is described in this chapter. Specific details of a particular switch will be found in the appropriate appendix to the chapter.

DESCRIPTION

2. The switch mechanism is housed in two light alloy castings which are bolted together to form a waterproof and flameproof housing (*fig.* 1).

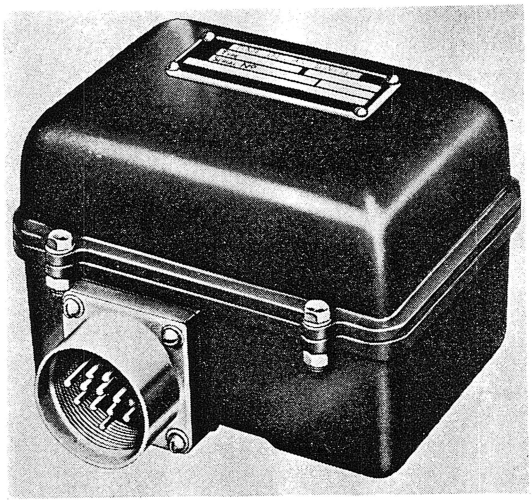

Fig. 1 General view of switch

Electrical connections to the unit are made via a 12-pole plug (*Ref. No.* 5*X*/6806) *and socket* (*Ref. No.* 5*X*/6089). For installation purposes there are four brass bushes, tapped 4 B.A., in the base casting. The switch mechanism itself is attached to the bottom of the case casting by three hex. head 4 B.A. screws.

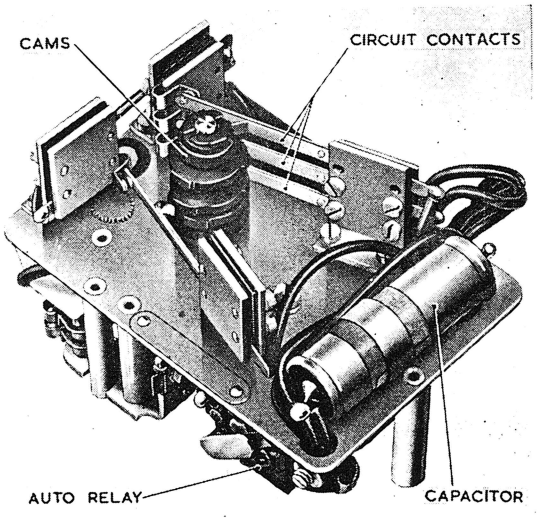

Fig. 2 Switch assembly

Switch mechanism (*fig.* 2 *and* 3)

3. Fixed to a mounting plate, an auto-relay is arranged to wind a pre-loaded clock type spring by means of a ratchet mechanism. The wound spring is free to drive a camshaft, the speed of rotation being regulated by an escapement mechanism.

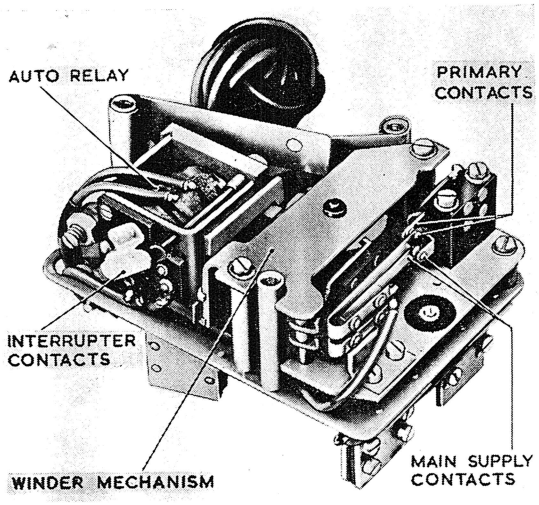

Fig. 3 Winding mechanism

4. Supported in two bearings, the camshaft projects through the mounting plate, the cams are keyed to the shaft by locking wire and secured with a circlip. The circuit contacts are assembled in holders adjacent to the camshaft, each moving contact leaf being fitted with a projecting cam follower which bears on a particular cam profile. Rotation of the camshaft causes each contact to open or close according to the profile of its particular cam.

OPERATION

5. The circuit diagram (*fig.* 4) is of a typical D8100 series switch and shows a unit with two pairs of circuit contacts (1 *and* 2) in their normally unoperated position. The interrupter contacts 3, the primary contacts 4, and supply contacts 5 control the winding of the spring, while contacts 1 and 2 control separate circuits via poles B(+), C, and D. The interrupter contacts are mounted on the relay and are operated directly by the relay armature.

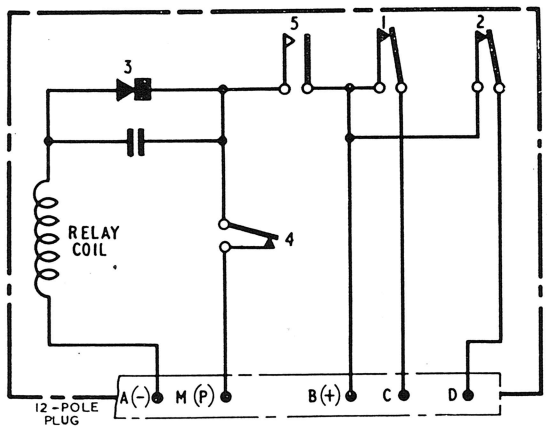

Fig. 4 Typical circuit diagram

All the other contacts are operated by cams mounted on the camshaft. The nominal 24V d.c. supply is connected across poles M(P) and A(−) via a starter push switch in the pilots or engineers position and then across poles B(+) and A(−) when the appropriate cam closes contact 5 and opens contact 4.

6. Upon depressing the starter push switch the relay coil (*fig.* 4) is energized via contacts 3 and 4. The energized coil then attracts the relay armature to its core. The movement of the armature breaks the coil circuit by opening the interrupter contacts 3. The coil now being de-energized, the armature returns to its previous position under the action of a spring and, in so doing, recloses contacts 3 ; the armature thus vibrates.

7. Attached to the armature is a steel driving spring which engages with a rachet wheel, so that each movement of the vibrating armature turns the wheel one tooth and so winds the spring. The total winding time is approximately three seconds. After the first six vibrations the cams which operate contacts 4 and 5 will have rotated so as to close the circuit at 5 and then break the circuit at 4. The coil is now energized directly from the supply and the continued depression of the starter push switch is unnecessary. At the end of the winding period the cam operating the supply contacts 5 will allow them to open again, and as contacts 4 are already open, the coil remains de-energized throughout the unwinding period.

8. Immediately contacts 5 open, unwinding commences. The total time taken for the motor to run down varies depending upon the switch Type number, but a typical run down period is 36 seconds. During the unwinding period the camshaft rotates and the circuit contacts 1 and 2 are opened or closed as governed by their respective cam profiles. At the end of the unwinding period the cam operating the primary contacts 4 will allow them to close, thus enabling a further winding operation to be made by depressing the starter push switch.

INSTALLATION

9. Before installing a switch in an aircraft refer to the appropriate aircraft air publication. When a switch has been installed it should be checked in its circuit for correct operation, i.e. run the engine etc.

SERVICING

10. Should the serviceability of a switch be in doubt apply the standard serviceability test detailed in the appropriate appendix to the chapter.

11. If a switch fails to meet the requirements of its standard serviceability test proceed as follows: —

(1) Remove the four 4 B.A. nuts and bolts holding the two castings together and separate the castings.

(2) Remove the three 4 B.A. bolts from underneath the bottom casting and withdraw the mechanism from the casting, taking care not to stress the connecting leads.

(3) Examine all moving parts for signs of wear with particular attention to the cam profiles, cam followers, and contacts for signs of burning. Examine soldered connections for dry-joints, etc.

(4) If the mechanism appears to be serviceable lightly lubricate all cam faces and the rachet teeth with grease, XG-275. Lightly lubricate pivots and moving parts with oil, OX-14. Clean electrical contacts with crocus paper if necessary.

(5) Refit switch mechanism into the bottom casting and secure. Refit top casting and secure. Apply a thin film of varnish to all nuts and bolts that have been disturbed.

12. Reapply the standard serviceability test to the switch. If the switch still fails the test or if in para. 11 (3) the mechanism was found to be worn, the switch should be disposed of in accordance with the current service instructions.

Appendix 1

STANDARD SERVICEABILITY TEST

for

TIME DELAY SWITCHES, ROTAX, D8100 SERIES

Introduction

1. The tests detailed in this appendix are to be applied to the switches before they are installed in an aircraft, at any time that serviceability is in doubt and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The following test equipment will be required: —

(1) Insulation tester, Type C, Ref. No. 5G/152

(2) Stop watch G.S. 1/5 second, Ref. No. 6B/9101001

(3) Multimeter, Type 1, Ref. No. 10S/16411

TESTS

Insulation test

3. Using the insulation tester, Type C, check between each pole of the 12-pole plug and the switch casing. Minimum permissible insulation resistance is 20 megohms.

Coil resistance test

4. Using the multimeter, Type 1, switched to its ohms range, check the resistance of the auto-relay coil (see, appropriate appendix circuit diagram for correct poles) this resistance should be between 6·2 and 7·2 ohms when the switch is at room temperature, i.e. 20°C.

Timing test

5. The timing test circuit, and the time in seconds for the operation of the motor and circuit contacts differ for each type of switch. The timing test is therefore included in the appropriate appendix for each type of switch but must be regarded as an integral part of this standard serviceability test.

Appendix 2

SWITCH, TYPE D8129 (Ref. No. 5CW/4719)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF: —

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 5·5 to 6·5 sec from zero

(c) Lamp 1 extinguishes 7 to 9 sec from zero

(d) Lamp 2 extinguishes 22 to 24 sec from zero

(e) Lamp 1 illuminates during last two sec of motor run

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

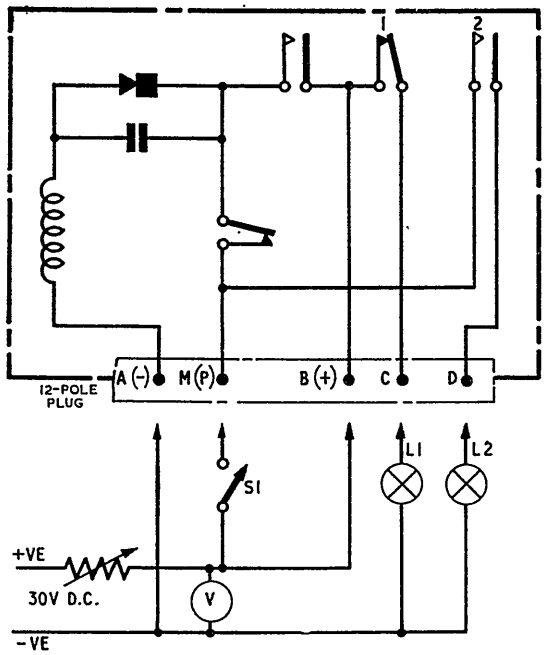

Fig. 1. Switch, Type D8129, circuit diagram and test circuit

Appendix 3

SWITCH, TYPE D8131 (Ref. No. 5CW/—)

Introduction

1. This time delay switch has only one pair of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF: —

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 1 extinguishes 30 sec from zero

(c) Lamp 1 illuminates during last two sec of motor run

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (*3*) (*a*) *to* (*c*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

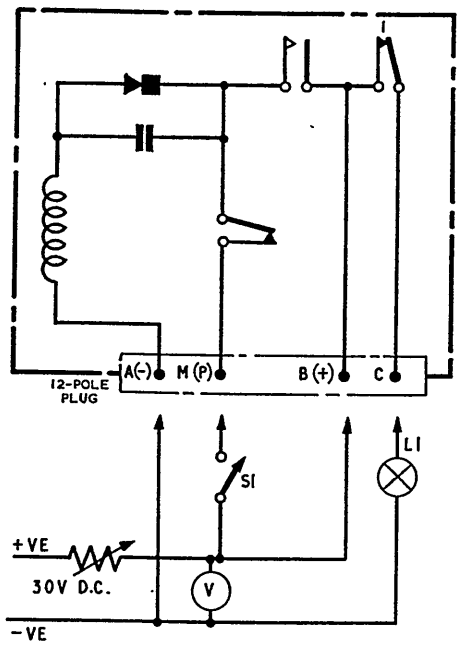

Fig. 1. Switch, Type D8131, circuit diagram and test circuit

Appendix 4

SWITCH, TYPE D8133 (Ref. No. 5CW/5306)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF: —

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 2·75 to 3·5 sec from zero

(c) Lamp 1 extinguishes 4·5 to 5·5 sec from zero

(d) Lamp 3 illuminates to 5·75 to 6·25 sec from zero

(e) Lamp 2 extinguishes 12 to 14 sec from zero

(f) Lamp 3 extinguishes 29 to 31 sec from zero

(g) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*g*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

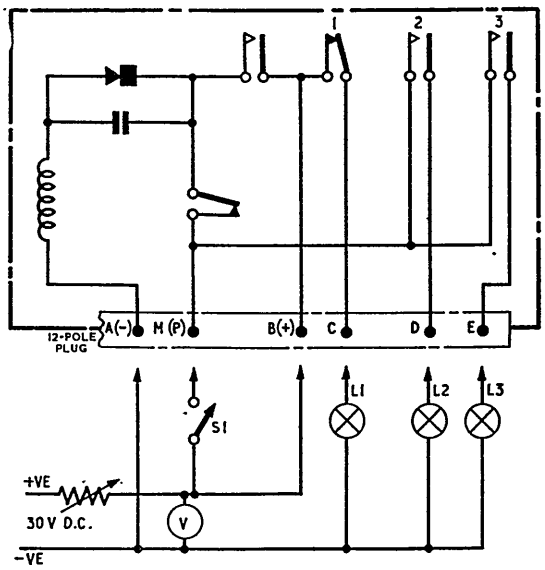

Fig. 1. Switch, Type D8133, circuit diagram and test circuit

Appendix 5

SWITCH, TYPE D8134 (Ref. No. 5CW/6545)

Introduction

1. This time delay switch has four pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF: —

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 2·75 to 3·25 sec from zero

(c) Lamp 1 extinguishes 4·5 to 5·5 sec from zero

(d) Lamp 3 illuminates 7·5 to 8·5 sec from zero

(e) Lamp 2 extinguishes 10 to 12 sec from zero

(f) Lamp 4 illuminates 12 to 13·5 sec from zero

(g) Lamp 3 extinguishes 15 to 17 sec from zero

(h) Lamp 4 extinguishes 28 to 30 sec from zero

(i) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*i*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

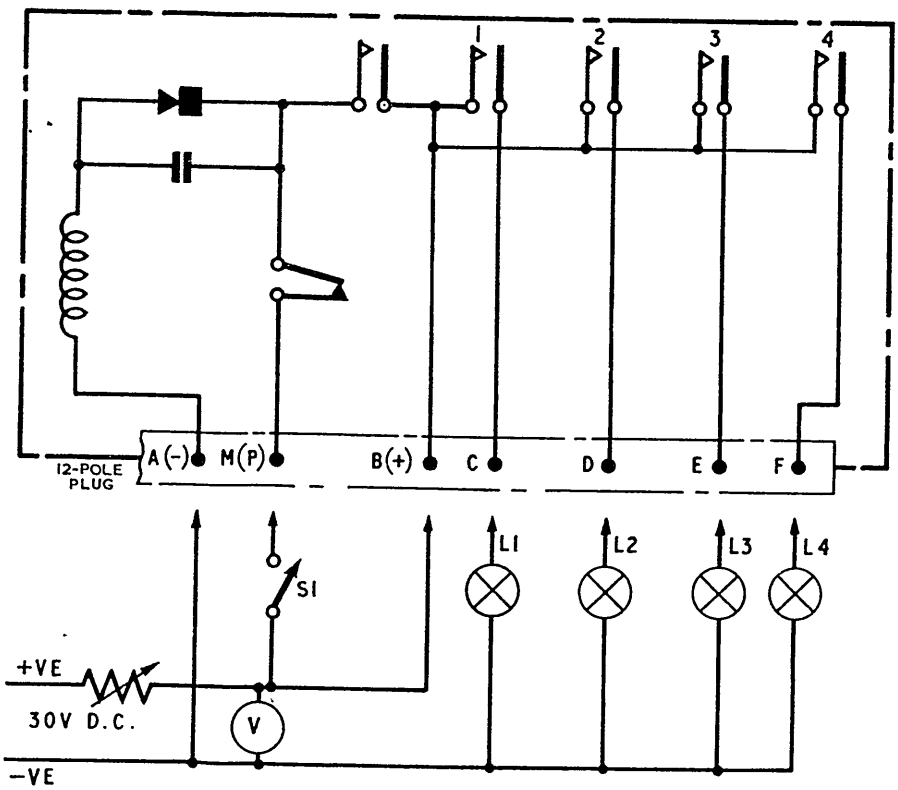

Fig. 1. Switch, Type D8134, circuit diagram and test circuit

Appendix 6

SWITCH, TYPE D8138/1 (Ref. No. 5CW/5983)

Introduction

1. This time delay switch has four pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 from zero

(b) Lamp 2 illuminates 2·5 to 3·5 sec from zero

(c) Lamp 1 extinguishes 4 to 6 sec from zero

(d) Lamp 4 illuminates 4·5 to 5·5 sec from zero

(e) Lamp 3 illuminates 10·5 to 11·5 sec from zero

(f) Lamp 2 extinguishes 12 to 14 sec from zero

(g) Lamp 4 extinguishes 14·5 to 16 sec from zero

(h) Lamp 3 extinguishes 29 to 31 sec from zero

(i) Lamp 1 illuminates during last two sec of motor run·

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*i*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

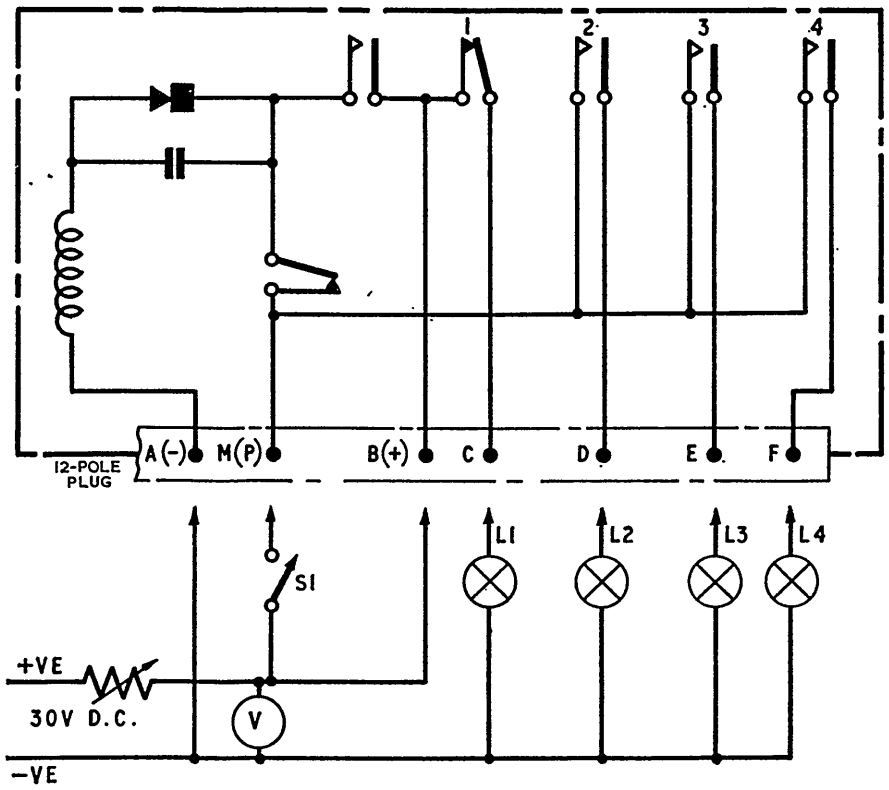

Fig. 1. Switch, Type D8138/1, circuit diagram and test circuit

Appendix 7

SWITCH, TYPE D8148 (Ref. No. 5CW/6404)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 0·75 to 1·25 sec from zero

(c) Lamp 1 illuminates 1·75 to 2·25 sec from zero

(d) Lamp 1 extinguishes 3·75 to 4·25 sec from zero

(e) Lamp 2 extinguishes 33 to 35 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch of the d.c. supply, and remove the switch under test.

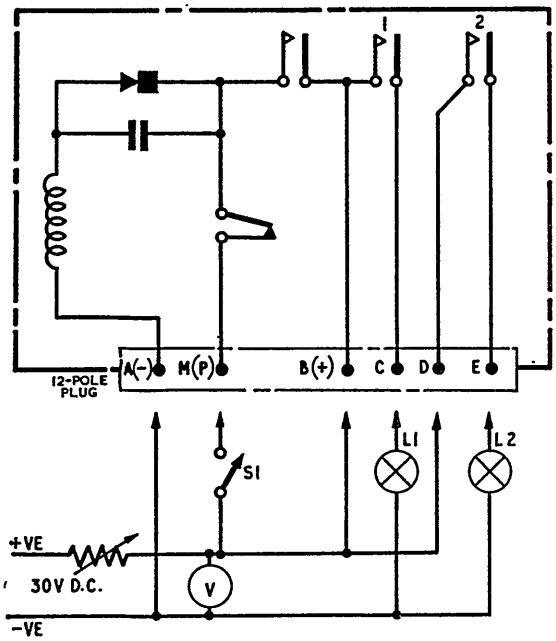

Fig. 1. Switch, Type D8148, circuit diagram and test circuit

Appendix 8

SWITCH, TYPE D8151 (Ref. No. 5CW/6011)

Introduction

1. This time delay switch has four pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 11·5 and 12·5 sec from zero

(b) Lamp 1 illuminates 0·25 to 0·75 sec from zero

(c) Lamp 2 illuminates 0·5 to 1·0 sec from zero

(d) Lamp 3 illuminates 1 to 1·5 sec from zero

(e) Lamp 4 illuminates 1·25 to 1·75 sec from zero

(f) Lamps, 2, 3 and 4 extinguish 4·5 to 5·5 sec from zero

(g) Lamp 1 extinguishes 10·5 to 11·25 from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*g*).

(5) Set S1 to OFF, switch of the d.c. supply, and remove the switch under test.

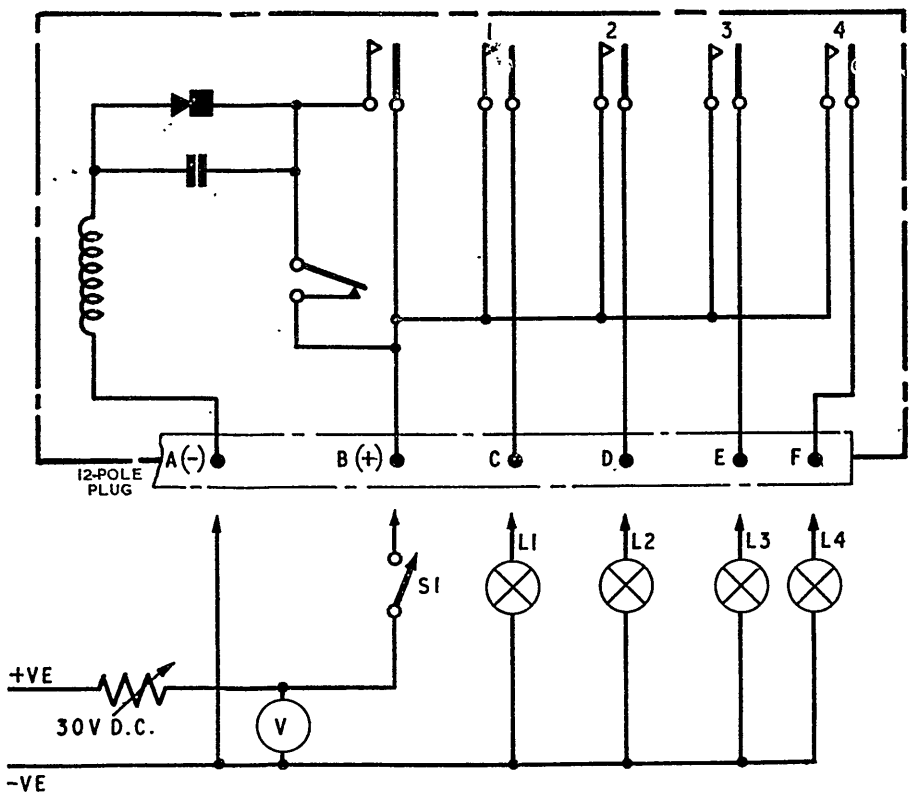

Fig. 1. Switch, Type D8151, circuit diagram and test circuit

Appendix 9

SWITCH, TYPE D8153 (Ref. No. 5CW/6010)

Introduction

1. This time delay switch has four pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 17·5 and 18·5 sec from zero

(b) Lamp 1 illuminates 0·75 to 1·25 sec from zero

(c) Lamp 1 extinguishes 3·5 to 4·5 sec from zero

(d) Lamp 2 illuminates 4·5 to 5·5 sec from zero

(e) Lamp 2 extinguishes 7·5 to 8·5 sec from zero

(f) Lamp 3 illuminates 8·5 to 9·5 sec from zero

(g) Lamp 3 extinguishes 11·5 to 12·5 sec from zero

(h) Lamp 4 illuminates 12·5 to 13·5 sec from zero

(i) Lamp 4 extinguishes 15·5 to 16·5 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*i*).

(5) Set S1 to OFF, switch of the d.c. supply, and remove the switch under test.

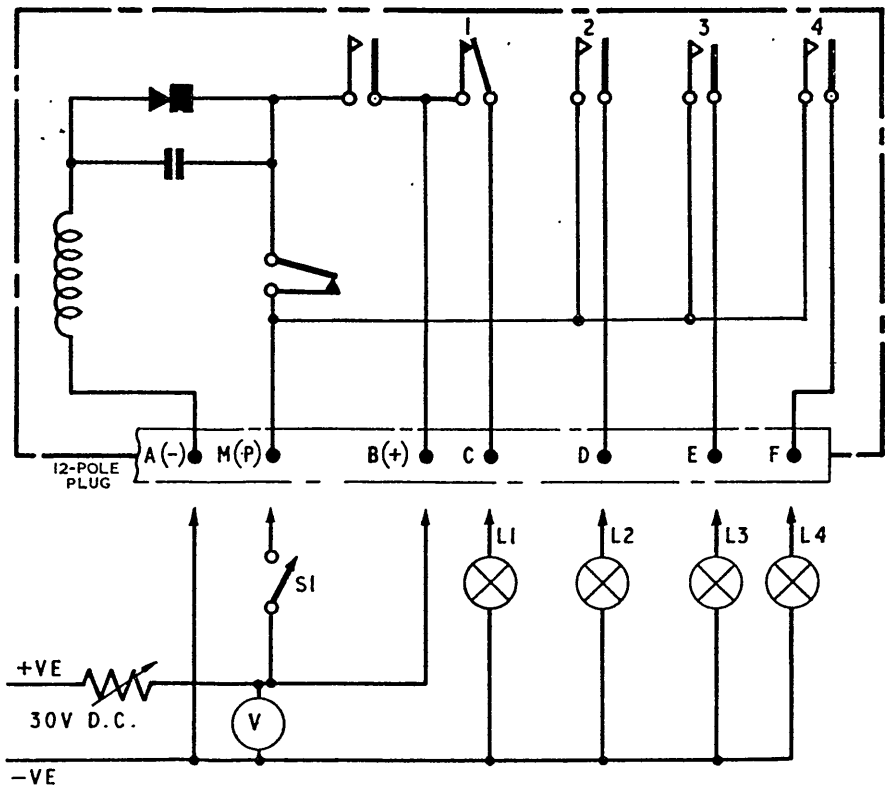

Fig. 1. Switch, Type D8153, circuit diagram and test circuit

Appendix 10

SWITCH, TYPE D8158 (Ref. No. 5CW/—)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF.

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 5·5 to 6·5 sec from zero

(c) Lamp 1 extinguishes 7 to 9 sec from zero

(d) Lamp 2 extinguishes 29 to 31 sec from zero

(e) Lamp 1 illuminates during last two sec of motor run

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch of the d.c. supply, and remove the switch under test.

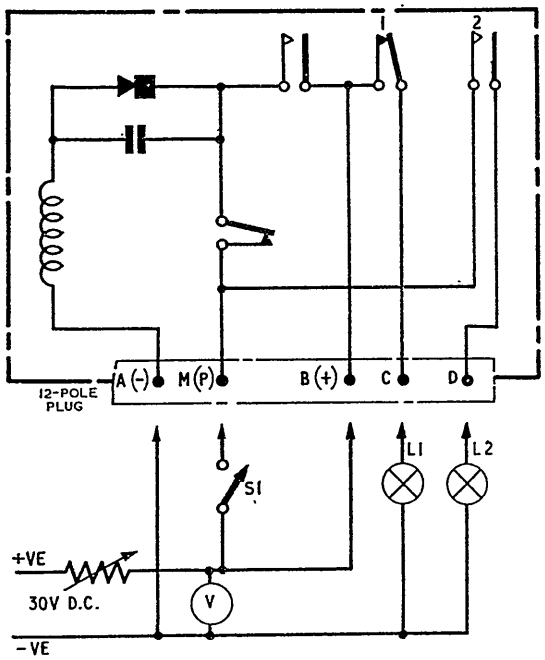

Fig. 1. Switch, Type D8158 circuit diagram and test circuit

Appendix 11

SWITCH, TYPE D8161 (Ref. No. 5CW/7266)

Introduction

1. This time delay switch has five pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run should be between 36 and 38 sec from zero

(b) Lamp 2 illuminates 2·75 to 3·35 sec from zero

(c) Lamp 1 extinguishes and lamp 4 illuminates 4·5 to 5·5 sec from zero

(d) Lamp 3 illuminates 10·5 to 11·5 sec from zero

(e) Lamp 2 extinguishes 12 to 14 sec from zero

(f) Lamp 5 illuminates 12·5 to 13·5 sec from zero

(g) Lamp 4 extinguishes 14 to 16 sec from zero

(h) Lamp 5 extinguishes 19 to 21 sec from zero

(i) Lamp 3 extinguishes 33 to 35 sec from zero

(j) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*j*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

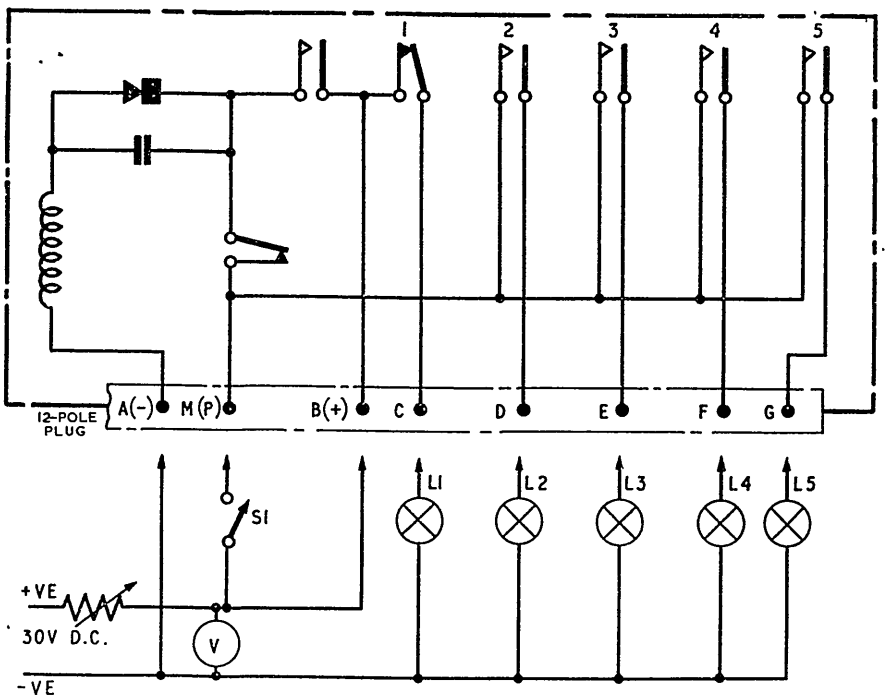

Fig. 1. Switch, Type D8161, circuit diagram and test circuit

Appendix 12

SWITCH, TYPE D8162 (Ref. No. 5CW/6753)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run should be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 2·75 to 3·25 sec from zero

(c) Lamp 1 extinguishes 4·5 to 5·5 sec from zero

(d) Lamp 3 illuminates 5·5 to 6·5 sec from zero

(e) Lamp 2 extinguishes 12 to 14 sec from zero

(f) Lamp 3 extinguishes 29 to 31 sec from zero

(g) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*g*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

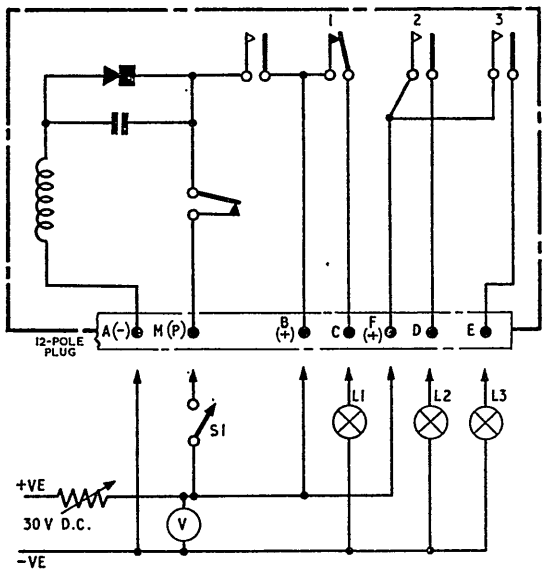

Fig. 1. Switch, Type D8162, circuit diagram and test circuit

Appendix 13

SWITCH, TYPE D8164 (Ref. No. 5CW/6656)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timings is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF.

(a) The total motor run should be between 12 and 13 sec from zero

(b) Lamps 1 and 2 illuminate and lamp 3 extinguishes 0·75 to 1·25 sec from zero

(c) Lamp 2 extinguishes 0·5 to 1·5 sec after it illuminates

(d) Lamp 3 illuminates 4·5 to 5·5 sec from zero

(e) Lamp 1 extinguishes 10·75 to 11·75 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

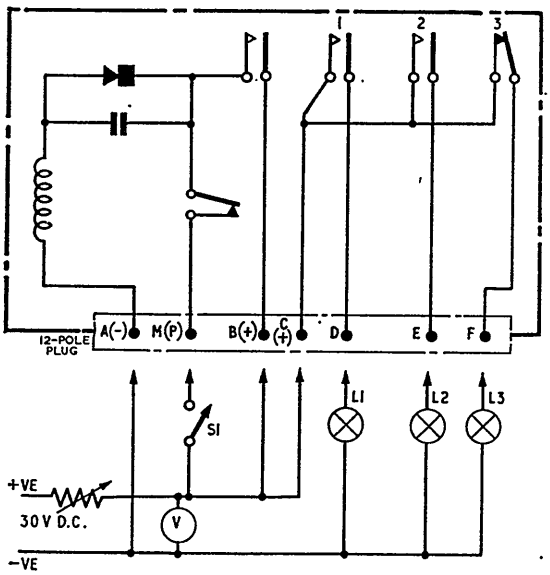

Fig. 1. Switch, Type D8164, circuit diagram and test circuit

Appendix 14

SWITCH, TYPE D8165 (Ref. No. 5CW/6692)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF :—

(a) The total motor run must be between 35 and 37 sec from zero

(b) Lamp 2 illuminates 0·75 to 1·5 sec from zero

(c) Lamp 1 extinguishes 29 to 31 sec from zero

(d) Lamp 2 extinguishes 30·5 to 31·5 sec from zero

(e) Lamp 1 illuminates during last two sec of motor run

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

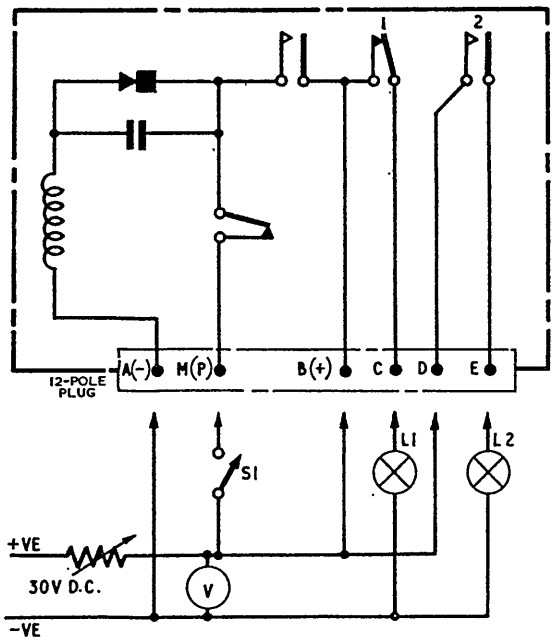

Fig. 1. Switch, Type D8165, circuit diagram and test circuit

Appendix 15

SWITCH, TYPE D8167 (Ref. No. 5CW/6685)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 12 and 13·5 sec from zero

(b) Lamp 2 illuminates 0·75 to 1·5 sec from zero

(c) Lamp 1 extinguishes 2·75 to 3·5 sec from zero

(d) Lamp 2 extinguishes 4 to 5 sec from zero

(e) Lamp 1 illuminates 10·5 to 11·5 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

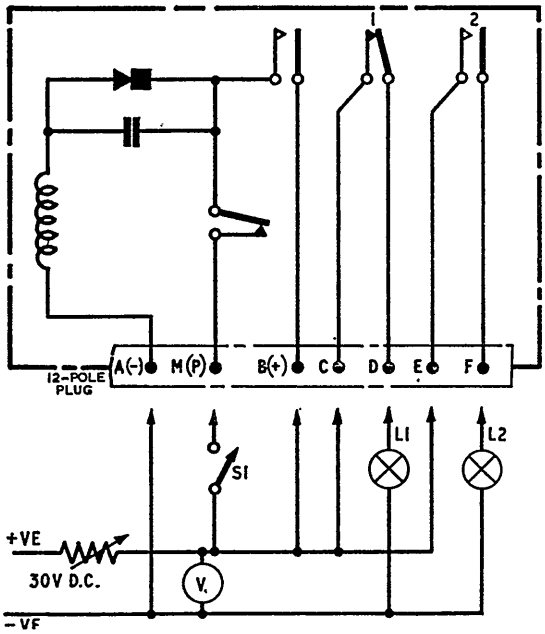

Fig. 1. Switch, Type D8167, circuit diagram and test circuit

Appendix 16

SWITCH, TYPE D8173 (Ref. No. 5CW/7817)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 12 and 13·5 sec from zero

(b) Lamp 1 extinguishes 2·5 to 3·5 sec from zero

(c) Lamp 2 extinguishes 7·5 to 8·5 sec from zero

(d) Lamps 1 and 2 illuminate 10 to 11·5 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*d*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

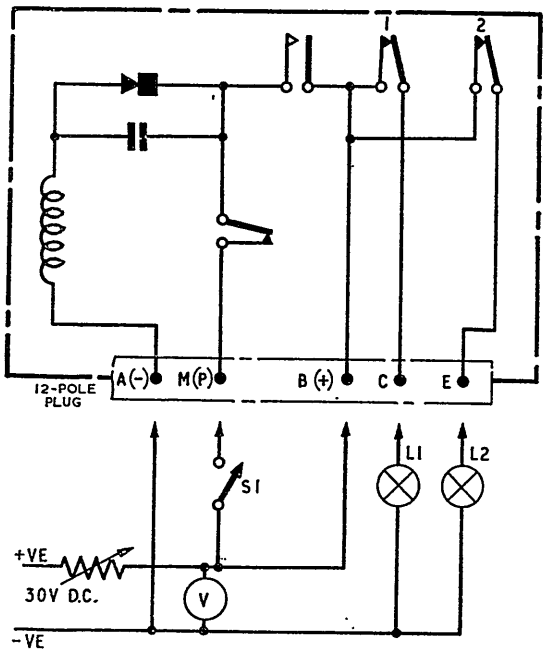

Fig. 1. Switch, Type D8173, circuit diagram and test circuit

Appendix 17

SWITCH, TYPE D8178 (Ref. No. 5CW/7410)

Introduction

1. This time delay switch has only one pair of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run should be between 36 and 38 sec from zero

(b) Lamp 1 illuminates 1 to 2 sec from zero

(c) Lamp 1 extinguishes 30 to 31 sec from zero

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3) (*a*) to (*c*).

(5) Set S1 to OFF, switch off the d.c. supply, and remove the switch under test.

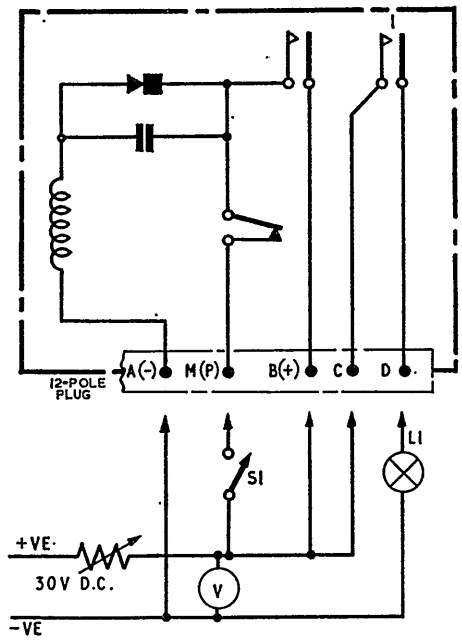

Fig. 1. Switch, Type D8178, circuit diagram and test circuit

Chapter 3

TIME DELAY SWITCHES, ROTAX, D8400 SERIES

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LIST OF ILLUSTRATIONS

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LEADING PARTICULARS

Operating voltage	16 *to* 29*V d.c.*
Winding current	0·5*A average at* 24*V* (*for* 3 *sec only*)
Contact voltage	28*V d.c.*
Maximum contact current	8*A*
Temperature range	−40 *to* +50°*C*
Weight	1 *lb to* 12 *oz*
Overall dimensions	
Length	4·625 *in*
Width	3·750 *in*
Height	3·322 *in*

Introduction

1. The D8400 series of time delay switches are designed to open and close two or more separate circuits in a pre-determined time sequence, which varies for individual switches within the series. The switches are primarily for use in starter control circuits for gas turbine engines, where the time sequence is initiated by depressing the starter push button in the pilots or engineers position. A typical switch is described in the chapter ; specific details of a particular switch will be found in the appropriate appendix to the chapter.

DESCRIPTION

2. The switch mechanism is housed in two light alloy castings which are bolted together to form a waterproof and flameproof housing (*fig.* 1).

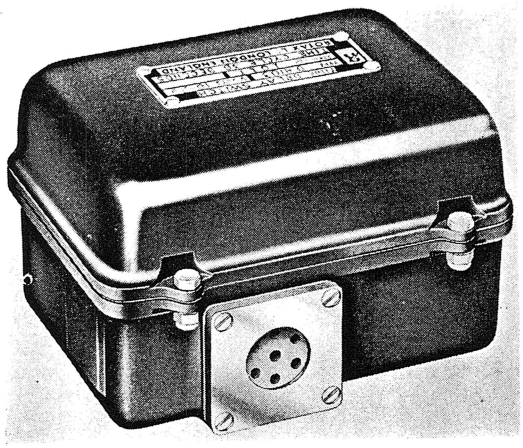

Fig. 1. General view of switch

Electrical connections to the unit are via 12 inch trailing leads, which are fed through a waterproof grommet in the side of the base casting; each lead is identified by a sleeve bearing its full designation. For installation purposes there are four brass bushes, tapped 4 B.A., in the base casting. The switch mechanism itself is attached to the bottom of the base casting by three hex.hd. 4 B.A. screws.

Switch mechanism

3. Fixed to a mounting, an auto-relay is arranged to wind a pre-loaded clock type spring by means of a ratchet mechanism (*fig.* 2). The wound spring is free to drive a camshaft, the speed of rotation being regulated by an escapement mechanism.

4. Supported in two bearings, the camshaft projects through the mounting plate, the cams are keyed to the shaft by locking wire and secured with a circlip. The circuit contacts are assembled in holders adjacent to the camshaft, each moving contact leaf being fitted with a projecting cam follower which bears on a particular cam profile. Rotation of the camshaft causes each contact to open or close according to the profile of its particular cam.

OPERATION

5. The circuit diagram (*fig.* 3) is of a typical D8400 series switch, and shows a unit with two pairs of circuit contacts (1 *and* 2) in their normally unoperated position. The interrupter contacts 3, the primary contacts 4, and supply contacts 5, control the winding of the spring, while contacts 1 and 2 control separate circuits via the terminal leads B(+), C and D. The interrupter contacts are mounted on the relay and are operated directly by the relay armature. All other contacts are operated by cams mounted on the camshaft. The nominal 24V d.c. supply is connected across M(P) and A(−) via a starter push switch in the pilots or engineers position, and then across B(+) and A(−) when the appropriate cam closes contact 5 and opens contact 4.

6. Upon depressing the starter push switch the relay coil (*fig.* 3) is energized via contacts 3 and 4. The energized coil then attracts the relay armature to its core. The movement of the armature breaks the coil circuit by opening the interrupter contacts 3. The coil now being de-energized, the armature returns to its previous position under the action of a spring and recloses contacts 3 ; the armature thus vibrates.

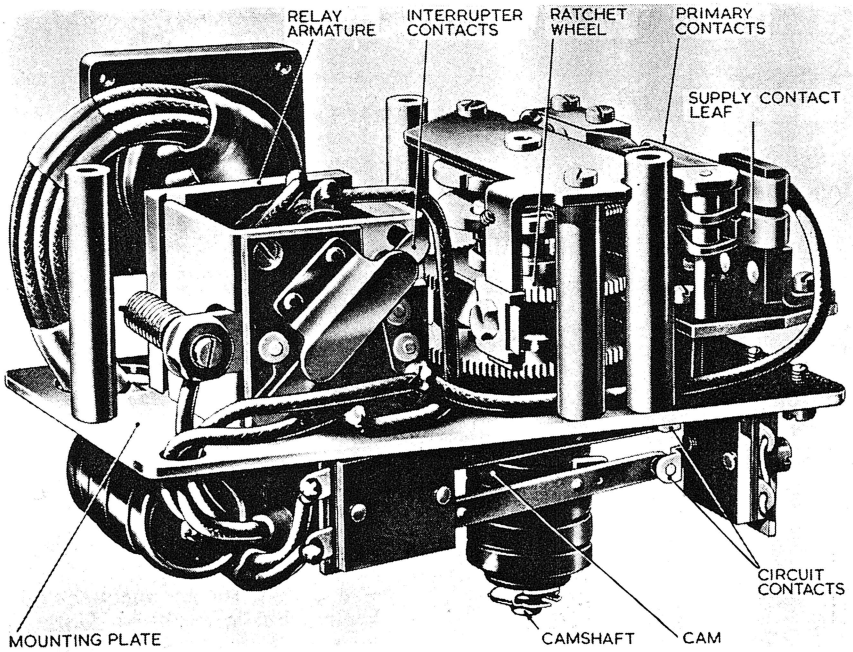

Fig. 2. Switch mechanism

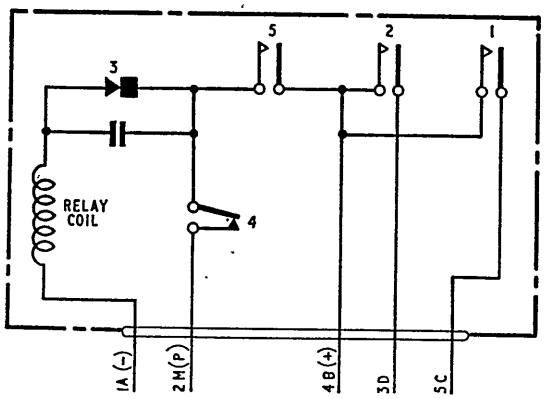

Fig. 3. Typical circuit diagram of switch

7. Attached to the armature is a steel driving spring which engages with a ratchet wheel, so that each movement of the vibrating armature turns the wheel one tooth and so winds the spring. The total winding time is approximately three seconds. After the first six vibrations the cams which operate contacts 4 and 5 will have rotated so as to close the circuit at 5 and then break the circuit at 4. The coil is now energized directly from the supply and the continued depression of the starter push switch is unnecessary. At the end of the winding period the cam operating the supply contacts 5 will allow them to open again and as contacts 4 are already open, the coil remains de-energized throughout the unwinding period.

8. Immediately contacts 5 open, unwinding commences. The total time taken for the motor to run down varies depending upon the switch type number, but a typical run down period is 36 seconds. During the unwinding period the camshaft rotates and the circuit contacts 1 and 2 are opened or closed as governed by their respective cam profiles. At the end of the unwinding period the cam operating the primary contacts 4 will allow them to close, thus enabling a further winding operation to be made by depressing the starter push switch.

INSTALLATION

9. Before installing a switch in an aircraft refer to the appropriate aircraft air publication. When a switch has been installed it should be checked in its circuit for correct operation, i.e. run the engine etc.

SERVICING

10. Should the serviceability of a switch be in doubt, apply the standard serviceability test detailed in the appropriate appendix to the chapter.

11. If a switch fails to meet the requirements of its standard serviceability test proceed as follows :—

(1) Remove the four 4 B.A. nuts and bolts holding the two castings together and separate the castings.

(2) Remove the three 4 B.A. bolts from underneath the bottom casting and withdraw the mechanism from the casting, taking care not to stress the connecting leads.

(3) Examine all moving parts for signs of wear with particular attention to the cam profiles, cam followers, and contacts for signs of burning. Examine the rubber grommet and trailing leads for deterioration and examine all soldered connections for dry-joint etc.

(4) If the mechanism appears to be serviceable lightly lubricate all cam faces and the ratchet teeth with grease, XG-275. Lightly lubricate pivots and moving parts with oil, OX-14. Clean the electrical contacts with crocus paper if necessary.

(5) Refit the switch mechanism into the bottom casting and secure. Refit the top casting and secure. Apply a thin film of varnish to all nuts and bolts that have been disturbed.

12. Re-apply the standard serviceability test to the switch. If the switch still fails the test or if in para. 11(3) the mechanism was found to be worn, the switch should be disposed of in accordance with the current service instructions.

Appendix 1

STANDARD SERVICEABILITY TEST

for

TIME DELAY SWITCHES, ROTAX D8400 SERIES

Introduction

1. The tests detailed in this appendix are to be applied to the switches before they are installed in an aircraft, at any time that their serviceability is in doubt and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The following test equipment will be required :—

(1) Insulation tester, Type C, Ref. No. 5G/152.

(2) Stop watch G5 1/5 second, Ref. No. 6B/9101001.

(3) Multimeter, Type 1, Ref. No. 10S/16411.

TESTS

Insulation test

3. Using the insulation tester, Type C, check between each of the trailing leads and the switch casing. Minimum permissible insulation resistance is 20 megohms.

Coil resistance test

4. Using the multimeter, Type 1, switched to its ohms range, check the resistance of the auto-relay coil (see appropriate appendix circuit diagram for correct leads), this resistance should be between 6.2 and 7.2 ohms when the switch is at room temperature, i.e. 20° C.

Timing Test

5. The timing test circuit and the time in seconds for the operation of the motor and circuit contacts differ for each type of switch. The timing test is therefore included in the appropriate appendix for each type of switch but must be regarded as an integral part of this standard serviceability test.

Appendix 2

SWITCH, TYPE D8402 (Ref. No. 5CW/4734)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following squence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 1 illuminates 2·5 to 3·5 sec from zero.

(c) Lamp 2 illuminates 2·5 to 3·5 sec after lamp 1 illuminates.

(d) Lamp 1 extinguishes 28 to 31 sec after it illuminates.

(e) Lamp 2 extinguishes during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

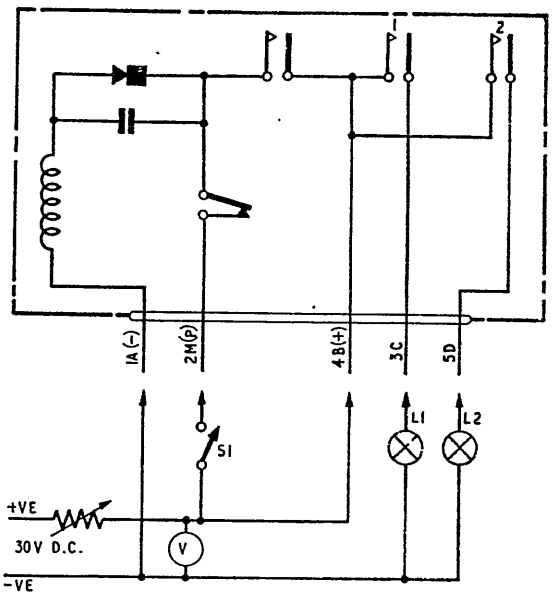

Fig. 1. Switch, Type D8402, circuit diagram and test circuit

Appendix 3

SWITCH, TYPE D8403 (Ref. No. 5CW/4434)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF: —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 1 illuminates 2·5 to 3·5 sec from zero.

(c) Lamp 2 illuminates 6 to 7 sec after lamp 1 illuminates.

(d) Lamp 1 extinguishes 28 to 31 sec after it illuminates.

(e) Lamp 2 extinguishes after lamp 1 extinguishes but before end of the motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

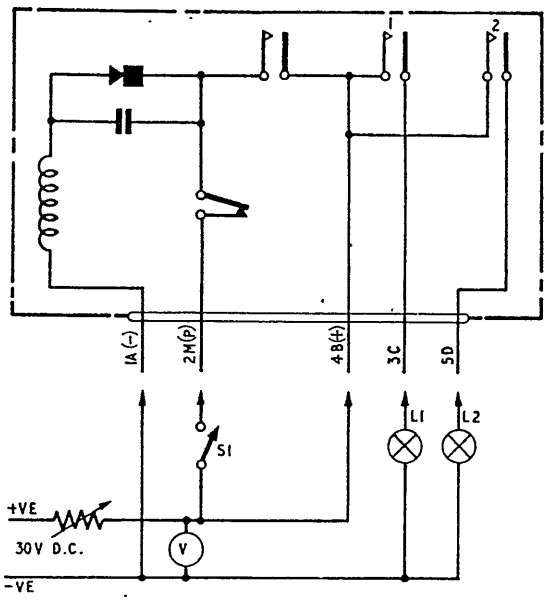

Fig. 1. Switch, Type D8403, circuit diagram and test circuit

Appendix 4

SWITCH, TYPE D8404 (Ref. No. 5CW/4698)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 1 illuminates 2·5 to 3·5 sec from zero.

(c) Lamp 2 illuminates 2·5 to 3·5 sec after lamp 1 illuminates.

(d) Lamp 1 extinguishes 8 to 10 sec from zero.

(e) Lamp 2 extinguishes during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

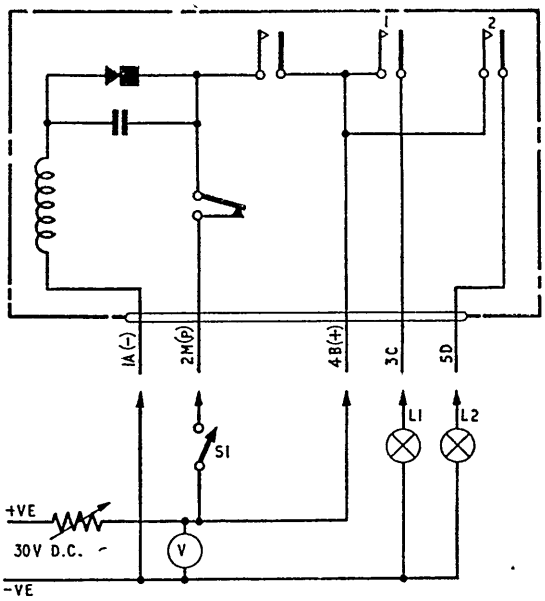

Fig. 1. Switch, Type D8404, circuit diagram and test circuit

Appendix 5

SWITCH, TYPE D8413 (Ref. No. 5CW/5879)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 2 illuminates 2·5 to 3·5 sec from zero.

(c) Lamp 1 extinguishes 4·5 to 5·5 sec from zero.

(d) Lamp 2 extinguishes 19 to 21 sec from zero.

(e) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

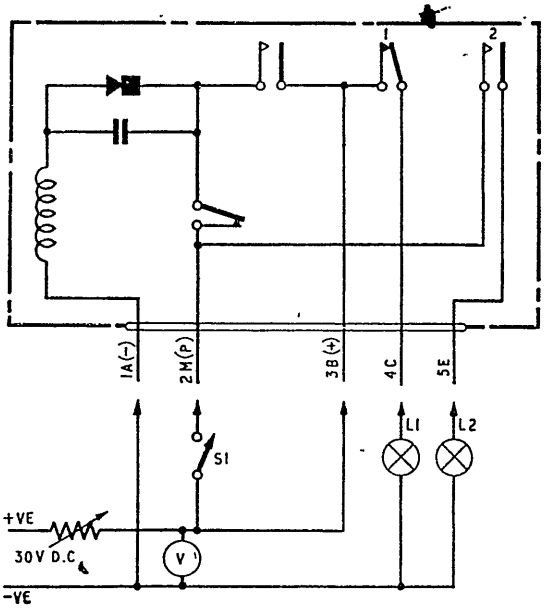

Fig. 1. Switch, Type D8413, circuit diagram and test circuit

Appendix 6

SWITCH, TYPE D8414 (Ref. No. 5CW/5851)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequences of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 2 illuminates 2·5 to 3·5 sec from zero.

(c) Lamp 1 extinguishes 4·5 to 5·5 sec from zero.

(d) Lamp 3 illuminates 10 to 12 sec from zero.

(e) Lamp 2 extinguishes 12·5 to 14 sec from zero.

(f) Lamp 3 extinguishes 29 to 31 sec from zero.

(g) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*g*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

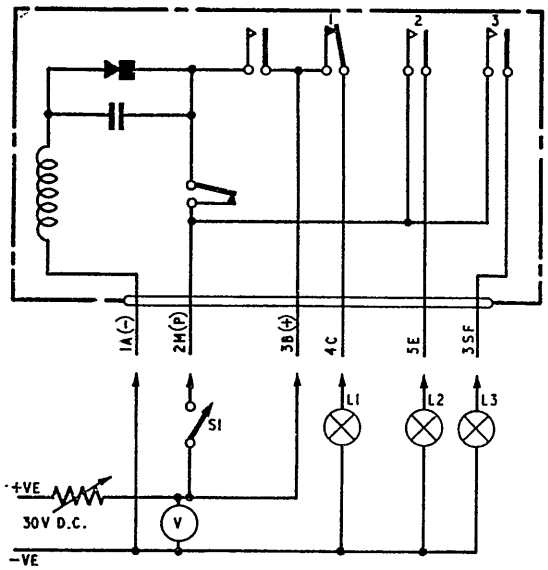

Fig. 1. Switch, Type D8414, circuit diagram and test circuit

Appendix 7

SWITCH, TYPE D8420 (Ref. No. 5CW/—)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamps 2 and 3 illuminate 2·5 to 3·5 sec from zero.

(c) Lamp 1 extinguishes 4 to 6 sec from zero.

(d) Lamp 3 extinguishes 9·5 to 10·5 sec after it illuminates.

(e) Lamp 2 extinguishes 19 to 21 sec from zero.

(f) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*f*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

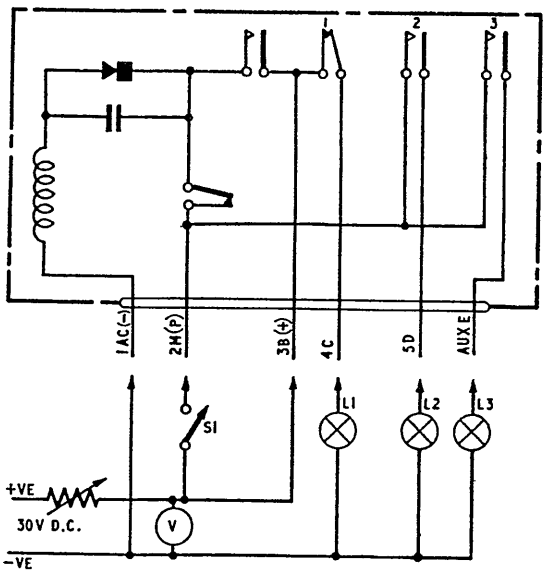

Fig. 1. Switch, Type D8420, circuit diagram and test circuit

Appendix 8

SWITCH, TYPE D8427 (Ref. No. 5CW/6174)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 24 and 26 sec from zero.

(b) Lamps 1 and 2 illuminate 0·5 to 2 sec from zero.

(c) Lamp 1 extinguishes 16 to 17 sec from zero.

(d) Lamp 2 extinguishes 22 to 23 sec from zero.

Note . . .

Lamps 1 *and* 2 *are to illuminate within* 0·5 *sec of each other.*

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*d*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

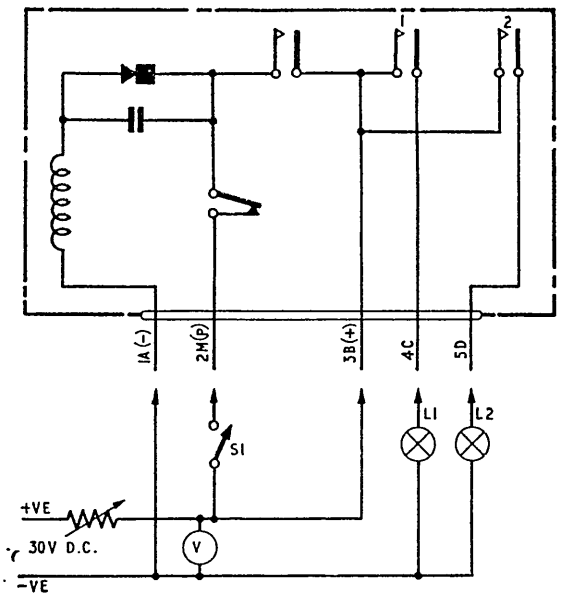

Fig. 1. Switch, Type D8427, circuit diagram and test circuit

Appendix 9

SWITCH, TYPE D8437 (Ref. No. 5CW/6175)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamps 1 and 2 illuminate during first sec of motor run and within 0·5 sec of each other.

(c) Lamp 2 extinguishes 5 to 6 sec from zero.

(d) Lamp 1 extinguishes 21 to 22 sec from zero.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*d*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

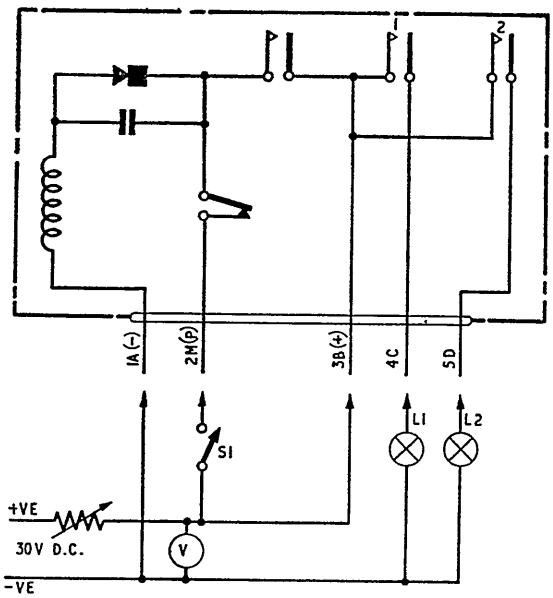

Fig. 1. Switch, Type D8437, circuit diagram and test circuit

Appendix 10

SWITCH, TYPE D8443 (Ref. No. 5CW/6281)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 2 illuminates 9·5 to 10·5 sec from zero.

(c) Lamp 1 extinguishes 12 to 14 sec from zero.

(d) Lamp 2 extinguishes 29 to 31 sec from zero.

(e) Lamp 1 illuminates 33 to 35 sec from zero.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

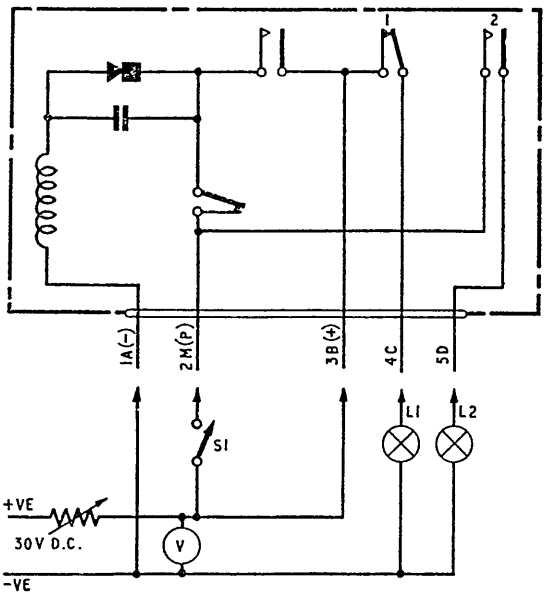

Fig. 1. Switch, Type D8443, circuit diagram and test circuit

Appendix 11

SWITCH, TYPE D8471 (Ref. No. 5CW/8050)

Introduction

1. This time delay switch has two pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, operation, installation and servicing detailed in the chapter apply to this switch. The description detailed in the chapter applies to this switch with the exception that the trailing leads of the D8471 are 24 in Uninyvin 20.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the test circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamp 2 illuminates 5·5 to 6·5 sec from zero.

(c) Lamp 1 extinguishes 7 to 9 sec from zero.

(d) Lamp 2 extinguishes 29 to 31 sec from zero.

(e) Lamp 1 illuminates during last two sec of motor run.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

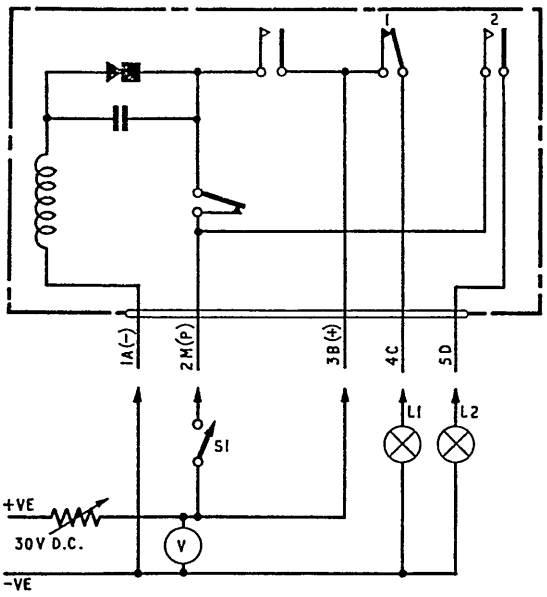

Fig. 1. Switch, Type D8471, circuit diagram and test circuit

Appendix 12

SWITCH, TYPE D8476 (Ref. No. 5CW/7211)

Introduction

1. This time delay switch has three pairs of circuit contacts, the circuit diagram (*fig.* 1) shows the switch internal wiring and the associated test circuit. The total motor run and circuit contact timing is detailed in para. 3.

2. The leading particulars, description, operation, installation and servicing detailed in the chapter apply to this switch.

STANDARD SERVICEABILITY TEST

Timing test (*App.* 1, *para.* 5)

3. (1) Wire up the test circuit as shown in fig. 1 and connect to the switch under test.

(2) Switch on the d.c. supply, set S1 to ON and adjust the variable resistor until the voltmeter wired across the circuit reads 28V.

(3) Check with a stop-watch that the following sequence of operations takes place, within the limits detailed, and continues until S1 is set to OFF : —

(a) The total motor run must be between 35 and 37 sec from zero.

(b) Lamps 1, 2 and 3 illuminate 0·5 to 1·5 sec from zero.

(c) Lamp 2 extinguishes 5·5 to 6·5 sec from zero.

(d) Lamp 3 extinguishes 15 to 17 sec from zero.

(e) Lamp 1 extinguishes 20 to 22 sec from zero.

(4) Set S1 to ON and alter the variable resistor to reduce the voltage to 16V, repeat sub-para. (3)(*a*) to (*e*).

(5) Set S1 to OFF, switch off the d.c. supply and remove the switch under test.

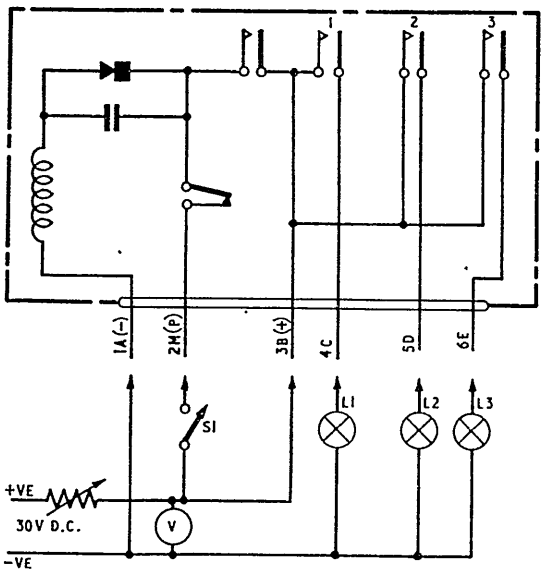

Fig. 1. Switch, Type D8476, circuit diagram and test circuit

Chapter 4

IGNITION TIMING SWITCHES, VENNER, PTC/DH/20 and PTC/DH/30

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1. Time switches, Type PTC/DH/20 and 30, Ref. No. 5CW/4505 and 5275 respectively are clockwork-driven ignition switches. The switches are employed to complete an electrical circuit during a fixed period of time to enable gas turbine engine relighting to take place.

DESCRIPTION

2. The only difference between the switches is the timing period i.e. 20 sec for the Type/20 and 30 sec for the Type/30, therefore, the two types will be treated as one unit for the purpose of description and operation.

3. The switch (*fig.* 1 *and* 2) consists of a clockwork mechanism, with a specially shaped escape wheel, an operating cam, a resetting cam, a cam follower and an operating centre spindle. There are three electrical contacts in the switch, one

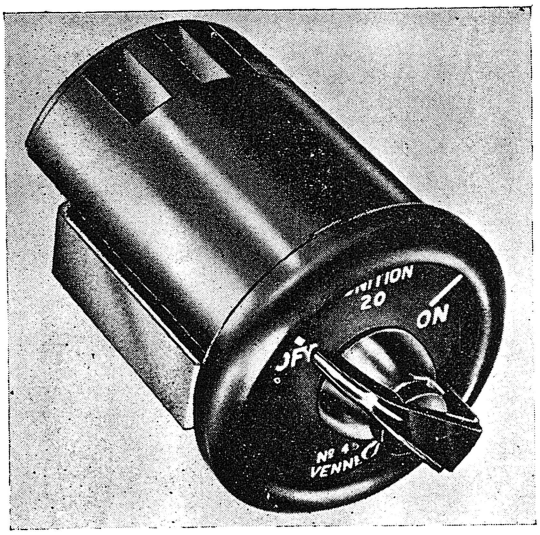

Fig. 1. Time switch, Type PTC/DH/20

contact is attached to the cam follower and the other two are fixed, one on either side of the cam follower. All of the components are housed in a bakelite case which measures $3\frac{5}{32}$ in. by $2\frac{5}{32}$ in. and the complete switch weighs 8 oz. The operating knob is attached to the operating spindle by a split pin; between the operating knob and the mechanism top plate is the dial with a transparent shield. The dial is located in position by three small dowels located on the top plate. Electrical connections to the switch are via three hexagonal pillars and ch. hd screws located at the rear of the unit.

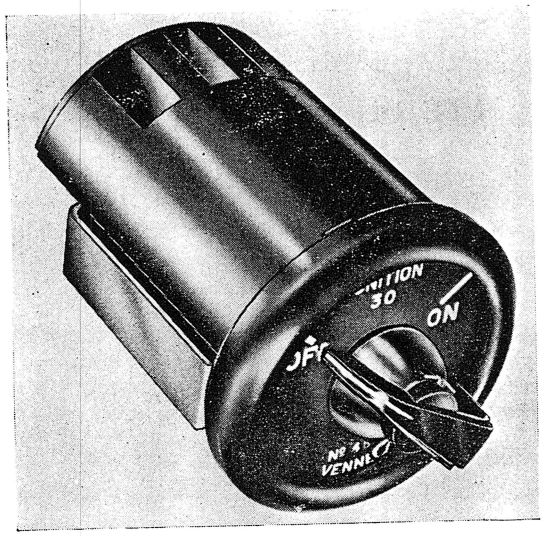

Fig. 2. Time switch, Type PTC/DH/30

OPERATION

4. When the operating knob is turned to ON the centre spindle winds the mainspring and at the same time moves the reset and operating cams so that the cam follower is pushed outwards by the high section of the operating cam thus the outside pair of contacts make and complete the electrical circuit. With the control knob in the ON position the clockwork mechanism commences to operate and the control knob centre spindle and the cams gradually move to the OFF position. On completion of the timed period i.e. 20 sec or 30 sec the cam follower drops off the high section of the operating cam and the contacts open to break the electrical circuit. The mechanism is

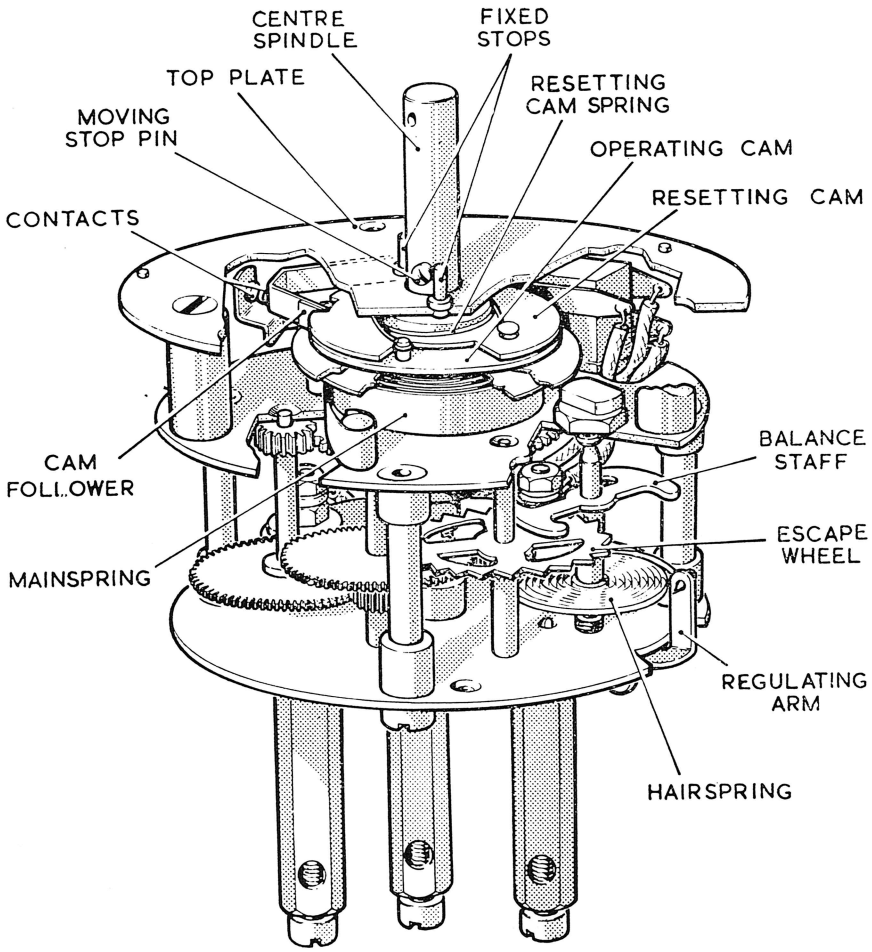

Fig. 3. Cutaway view of switch mechanism

brought to a halt by a protrusion on the centre spindle coming against a stop on the top plate.

Note . . .

In normal operation the inside electrical contact is not used.

INSTALLATION

5. Before installing a switch refer to the appropriate aircraft air publication.

SERVICING

6. If the serviceability of a switch is in doubt the unit should be serviced as follows : —

(1) To gain access to the mechanism turn the bezel anti-clockwise until the three bezel projections are in line with the small slots in the case; the bezel can now be removed. Withdraw the mechanism from the case. The following points should be lightly oiled using oil OX-14, Ref. No. 34B/9100589 : —

(a) All pivots including the balance staff.

(b) Apply a spot of oil to the impulse pin and the staff where the escape wheel engages.

(2) Examine the electrical contacts and if necessary clean with a cloth moistened with lead-free gasoline. Check with a feeler gauge that the gap between the contacts in the open position is at least 0·012 in.

Timing test

7. Connect a multimeter, switched to its ohms range, between terminals C and 2 (*fig.* 4). Set the operating knob to ON and note that the multimeter reads zero ohms. Release the operating knob and with a stop watch time the period until the contacts open (multimeter reads infinity). The operating times in seconds for the switches are detailed in Table 1. If the times are outside the tolerances shown in Table 1 alter the hairspring regulating arm and repeat the test until the timing is satisfactory. Replace the mechanism in the case, ensuring that the dial is correctly seated on the three small dowels, and replace the bezel. With the switch reassembled repeat the timing test.

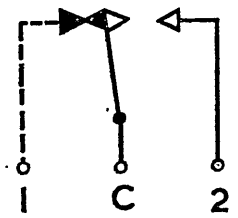

Fig. 4. Wiring diagram

Insulation test

8. With an insulation tester, Type C connected between terminals C and 2 (*fig.* 4) and with the operating knob in the OFF position the minimum insulation resistance permissible is 20 megohms. Repeat the test with the operating knob in the ON position and the insulation tester connected between terminals C and 1.

TABLE 1

Switch timing tolerances

Switch Type No.	*Tolerance (sec)*
PTC/DH/20	20 ± 1
PTC/DH/30	30 ± 1

575320/Wt.39939/D.5635 3,000 7/61 E.S.Ltd. Gp.375/7