Chapter 53

TUMBLER SWITCH, ROTAX TYPE D4601

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LEADING PARTICULARS

Switch, tumbler, Rotax ... ... Stores Ref. 5CW/2735

Introduction

1. This switch has been designed to combine, within one switch, the control of the four operating conditions of the Rotol electrically-operated propeller. Its design also prevents two operations being selected simultaneously, there being only one switch lever for selection.

2. The top of the switch is indicated by a deep circular indentation on the cover plate, and a provision for its acceptance on the moulded body. When installed on the dashboard, this marking must be uppermost. All references in this chapter to switch lever positions and component positions assume that the switch is in this "upright" position (*fig.* 1).

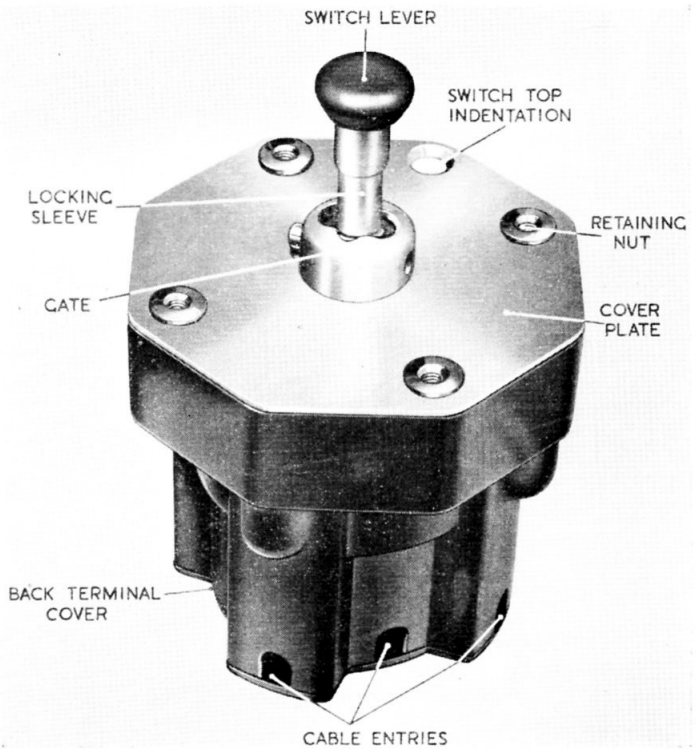


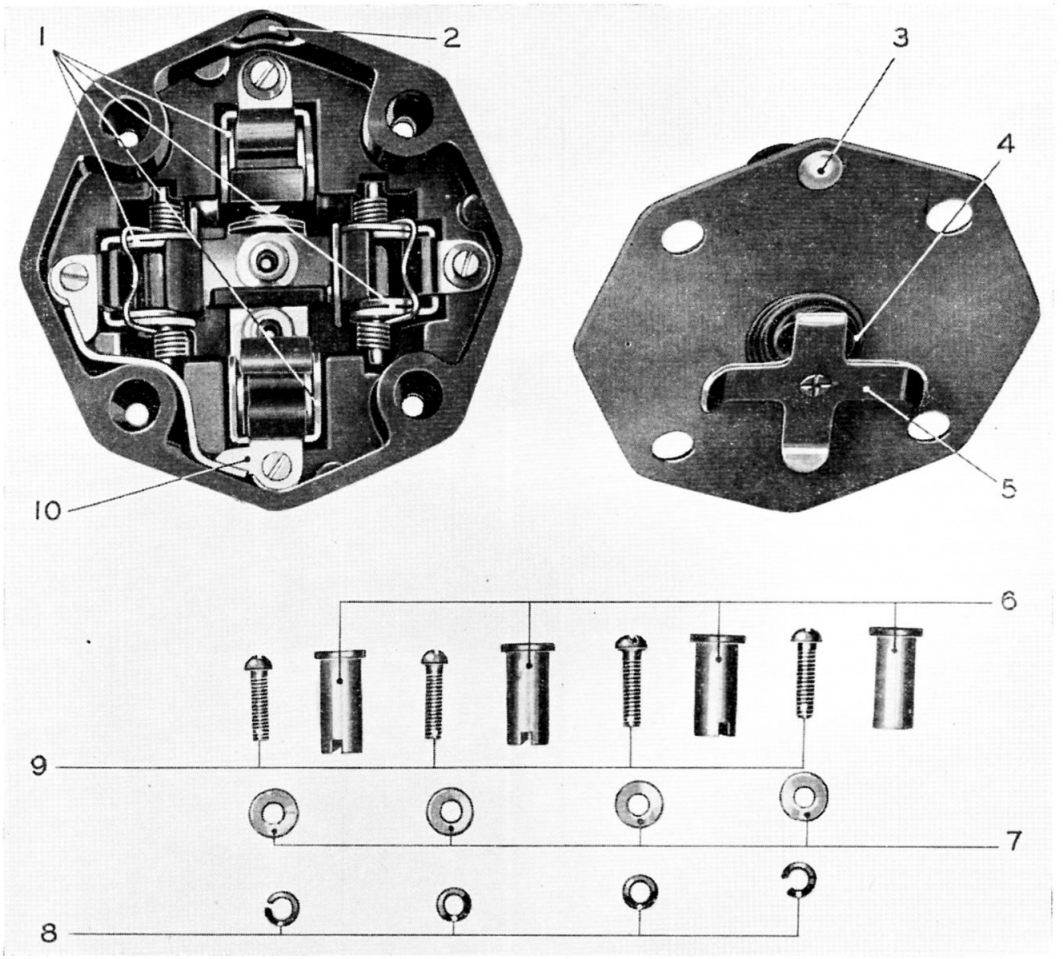
Fig. 1. Type D.4601 switch

DESCRIPTION

3. The switch consists of a moulded body incorporating four toggle type snap switches, each two diametrically opposite each other being at right-angles to the other two. There are two cover plates, one moulded and covering the terminals of the wiring connections at the rear of the main switch, and the other of metal integral with the switch lever arm assembly complete. (*Fig.* 1, 2 and 3.)

4. The four internal switches have specially shaped moulded toggles to accept the action plate of the main switch assembly. Incorporated in, and part of the switch lever, is a spring-loaded locking sleeve which can pass the "gate" on the top cover in the up, right and left positions and so operate the desired toggle switch. Owing to the design of the "gate", the down position cannot be selected until the switch lever is extended against its spring to enable the locking sleeve to pass over the "gate" entry. (*Fig.* 1.)

5. The positions of the switch lever as indicated on the dashboard are: Up—AUTOMATIC, Left—DECREASE R.P.M., Right—INCREASE R.P.M., and Down—QUICK FEATHERING. The circuits to which the rear terminals of the switch are connected are shown in fig. 5.



1 INTERNAL TOGGLE SWITCHES
2 TOP LOCATING RECESS
3 TOP LOCATING INDENTATION
4 CONICAL SPRING
5 SWITCH ACTION PLATE
6 COVER PLATE RETAINING NUTS
7 PLAIN WASHERS
8 SPRING WASHERS
9 COVER PLATE FIXING SCREWS
10 CONNECTING STRIP

Fig. 2. Top cover removed showing internal toggle switches

OPERATION

6. When the selector switch lever is in the central or "off" position, the propeller is flown as a fixed pitch unit. In this position, the pitch changing motor circuit is open and the brake engaged, locking the blades in the pitch obtaining. When the switch lever is moved right or left, fine or coarse pitch circuits are closed respectively and whilst held in either of the two positions, the motor is turning the blades to fine or coarse pitch. Upon releasing the switch lever, it automatically returns to the central or "off" position, thus breaking the circuit of the motor, engaging the brake and locking the blades in the obtaining pitch setting. Feathering pitch can be attained in this manner, which takes an appreciable amount of time but a minimum of current consumption.

7. To attain feathering pitch quickly in an emergency, the switch lever is extended against its spring and depressed downwards. This method of feathering brings into operation a booster, the latter providing approximately 60 volts additive to the 24 volt battery supply, thus providing a supply to the quick feathering line of approximately 80 volts. The switch lever remains in the downward position when released and the blades are turned to the full feathering pitch in a few seconds, but the current consumption is high.

8. The remaining movement of the switch lever in the upward direction brings into operation the constant speed unit. Again, the switch lever remains in this position when released, connecting the pitch control motor circuit directly to the constant speed unit.

SERVICING

9. Check action of switch as follows:—

(1) Operate the switch 5-6 times in each position to ensure that the operation is correct.

(2) In the "Inc. R.P.M." and "Dec. R.P.M." directions, i.e. right and left respectively, the switch handle after being pressed fully home, must on release spring back without hesitation and with no sign of sticking, to the centre "off" position.

(3) On the "Auto" or upward direction, the action must be such that the switch lever snaps into the fully closed (or open if switching off) position as soon

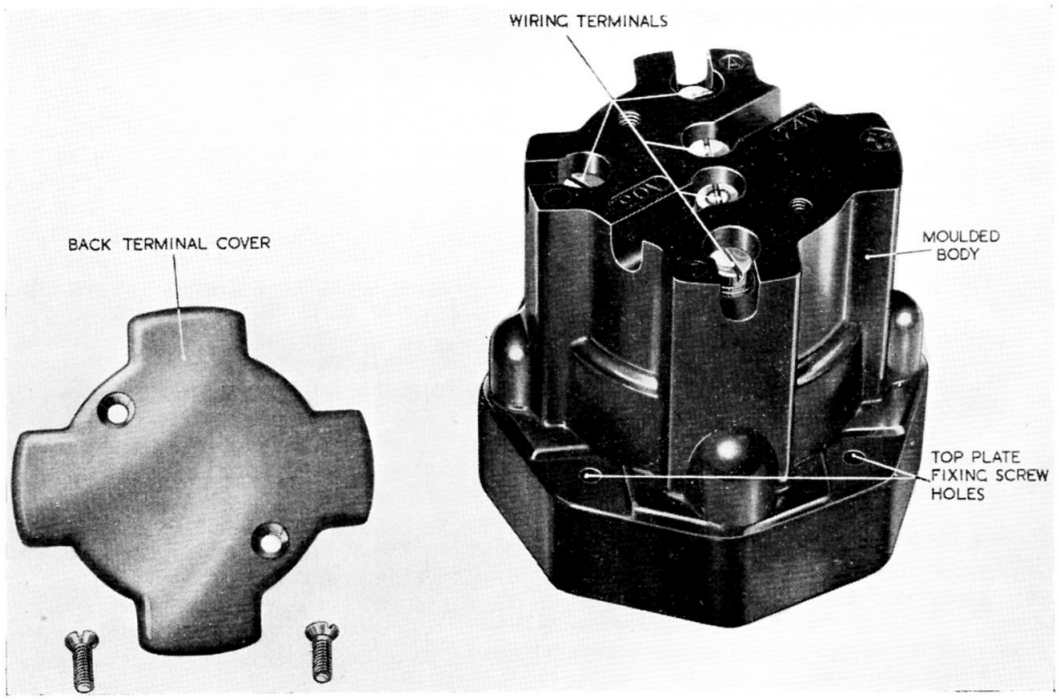


Fig. 3. Back cover removed showing external connections

as the toggle mechanism is moved over its dead centre. This action must be quite positive with no tendency whatever for the lever to jump back in the reverse direction.

(4) In the "feather" or downward direction, the action should be as in the "Auto" direction with additional provision that it must be impossible to operate the toggle mechanism over dead centre and so complete the circuit in the feather direction without first extending the lever against its spring and moving the locking sleeve over the "gate" entry. Further, when moving back to the centre "off" position, it must be impossible for the locking sleeve to drop back to its normal position before the internal toggle mechanism has operated in the reverse direction and broken the circuit.

(5) The internal toggle snap action must be positive in all directions.

(6) It must be impossible to connect any pair of terminals by the internal switches by moving the switch lever within the limit of its free movement in the centre "off" position.

General electrical tests

10. *Millivolt drop test.*— Pass a current of 15 amperes through the appropriate pair of terminals in each of the four "on" positions in turn. In no case should the millivolt drop between terminals exceed 75 millivolts at 15 amperes.

11. *Insulation resistance test.*—The insulation resistance measured with a 250 V. insulation resistance tester should not be less than 50,000 ohms.

(1) Between each terminal and each other terminal with the switch lever in the centre "off" position.

(2) Between each pair of terminals and the switch cover plate in each of the closed positions of the switch lever.

12. *Flash test.*—The insulations mentioned in para. 11(2) above, must withstand a pressure of 500 V. 50 cycles 1-phase a.c. for one minute. (Maintenance Units only.)

Dismantling for inspection

13. Unscrew and remove the four fixing screws complete with plain and spring washers, and withdraw the four retaining nuts from the top cover side. The top cover, complete with switch lever assembly is then free to be removed. It is desirable in this and the following instructions, reference should be made to fig. 1, 2, 3 and 4. Inspection should then be carried out in the following sequence.

14. Check the top cover switch lever assembly for correct functioning:—

(1) Move the switch lever fully home in all directions and release. The lever should return to the centre "off" position by means of the conical spring. This also applies if the switch lever is extended and the locking sleeve passed over the "gate" entry in the feathering or downward position.
Examine the conical spring for fracture.

(2) Ensure that the locking sleeve is kept in its normal position by the internal spring, and does not pass over the "gate" entry in the downward position.

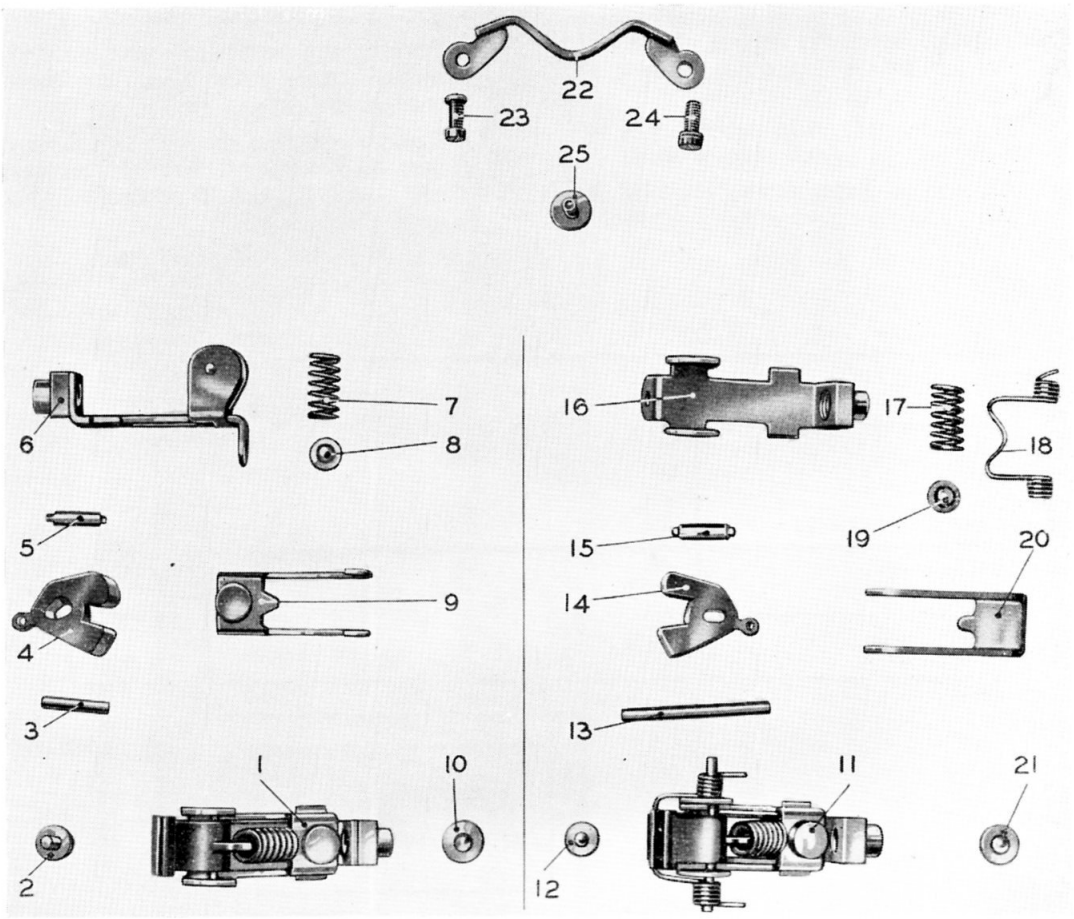
(3) Check the tensions of the extending switch lever spring. This should return to normal positively and without any sticking when released after extending.

(4) Examine the action plate for distortion and damage.

(5) Should any of the functional tests of the switch lever assembly show a fault, replace the complete cover and switch assembly; no attempt to renew parts must be made.

15. Inspect the internal moulded switch toggles and ensure they are not broken, chipped or cracked.

16. Check the action of each of the four switches by hand operation and ensure that all springs are sound and the spring cups are in place. Faulty switches can be removed complete by removing the terminal screw at the base and the fixing screw inside the body. The left-hand and bottom of the latter screws also hold the connecting strip in position. The left-hand switch is retained only by the internal screw, there being no corresponding terminal screw in the base. It is obvious that the moulded rear cover plate must be removed to obtain access to the terminal screws. The internal switches, when removed, can be completely dismantled and any faulty or broken parts be renewed (*fig.* 4). It will be noted that opposite pairs of switches are alike though differing from the pair at right-angles to them. As there are two switches alike, it will be found advantageous when completely dismantling a switch, to keep one fully assembled to be used as a pattern when dismantling and assembling.



1 TOGGLE SWITCH COMPLETE (MANUAL)
2 FIXING SCREW AND WASHER
3 TOGGLE ARM PIVOT PIN (MANUAL)
4 TOGGLE ARM MOULDING (MANUAL)
5 CONTACT ARM PIVOT PIN
6 BEARING BRACKET ASSEMBLY
7 TOGGLE SPRING
8 TOGGLE SPRING CUP
9 CONTACT ARM ASSEMBLY
10 TERMINAL SCREW AND WASHER
11 TOGGLE SWITCH COMPLETE (AUTO)
12 FIXING SCREW AND WASHER
13 TOGGLE ARM PIVOT PIN (AUTO)
14 TOGGLE ARM MOULDING (AUTO)
15 CONTACT ARM PIVOT PIN
16 BEARING BRACKET ASSEMBLY
17 TOGGLE SPRING
18 TOGGLE ARM RETURN SPRING
19 TOGGLE SPRING CUP
20 CONTACT ARM ASSEMBLY
21 TERMINAL SCREW AND WASHER
22 CONNECTING STRIP
23 FIXING SCREW AND WASHER
24 FIXING SCREW AND WASHER
25 TERMINAL SCREW AND WASHER

Fig. 4. Exploded view of internal toggle switches

Assembling

17. When replacing individual internal switches ensure that:—

(1) Toggle springs and cups are in correct position.

(2) Toggle arm return springs of the right and left-hand switches are in place and function correctly.

(3) The connecting strip between the left-hand bottom switch is in position.

(4) All internal fixing screws are tight and plain and spring washers in position.

(5) Check the action of each switch by hand.

(6) Grease all rubbing surfaces and pivot pins with pure clean vaseline.

(7) Replace top cover, retaining nuts and fixing screws with plain and spring washer and tighten up.

(8) Make a complete check as laid down in para. 9. The general electrical test (*para.* 10, 11 and 12) should be applied where applicable.

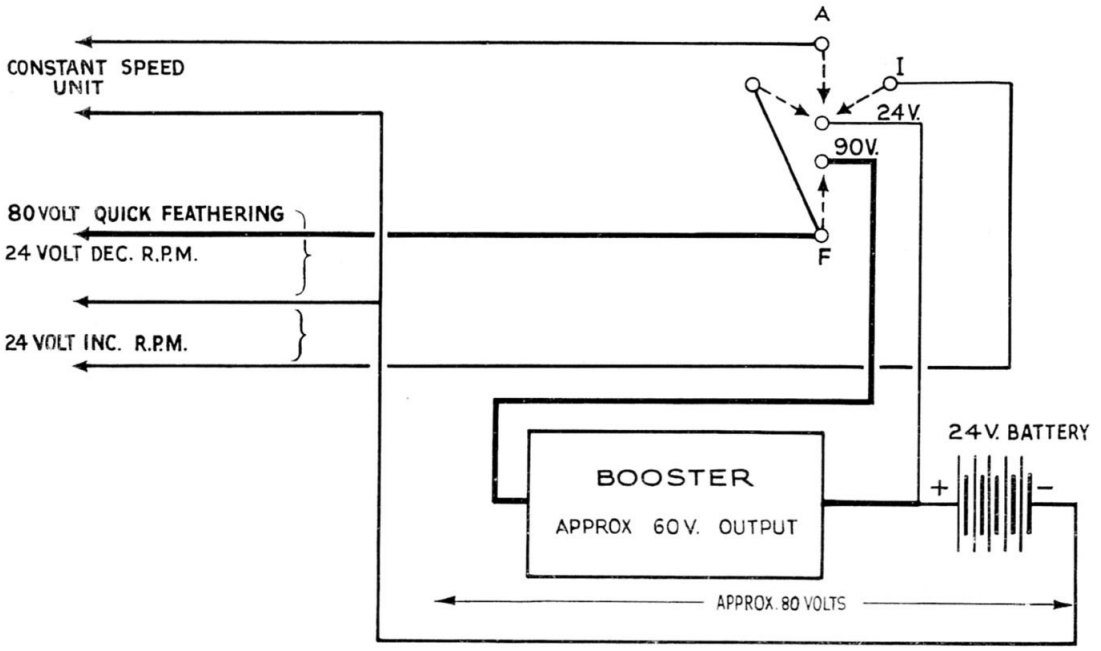


Fig. 5. Installation circuit diagram