Chapter 46

TIME SWITCH, TEDDINGTON, TYPE FHM/A/39

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LEADING PARTICULARS

Time switch, Type FHM/A/39	Stores Ref. 5CW/5268
Voltage	18 to 29 d.c.
Governed speed of motor	9,000 or 3,000 r.p.m.
Reduction gearing	18,000:1
Rating of switch contacts ...	22 amp. at 208 volts, 3-phase, 400 c/s a.c.
Weight	4 lb. 6 oz.
Overall dimensions	8·0 in. × 6·4 in. × 2·9 in.

Introduction

1. The time switch, Type FHM/A/39, is a three-phase, two-way time switch used in aircraft with propeller turbines. It is designed to supply current alternately to the intake, and propeller and spinner de-icing heater mats.

2. This is a cycling switch, and differs considerably from other switches of the FHM series as described in A.P.4343, Vol. 1, Sect. 11, Chap. 19, and the following paragraphs will therefore give a full description of the switch.

DESCRIPTION

3. The switch unit (*fig.* 1) is enclosed within a cast aluminium alloy housing, the cover

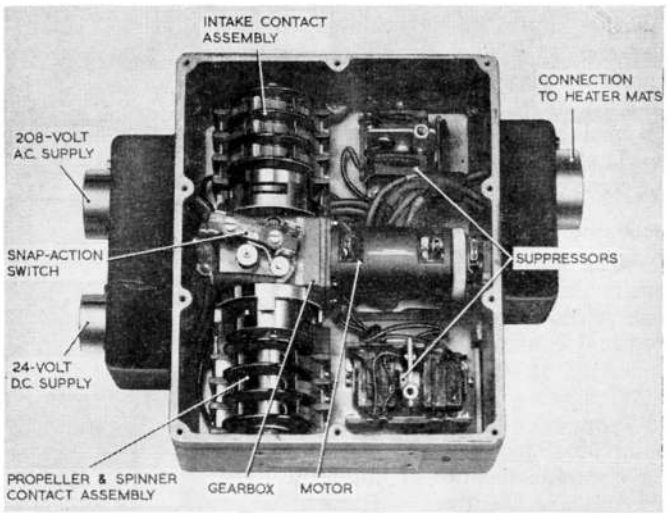

Fig. 1. Time switch, Type FHM/A/39

(A.L.79, Sep. 56)

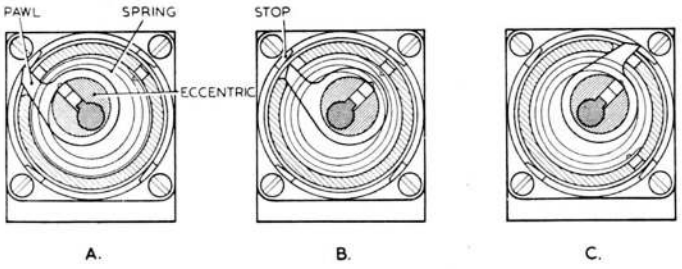

Fig. 2. Latch plate and pawl mechanism

plate of which provides a base for the mechanism. The cover is secured by ten 6 B.A. bolts, and synthetic rubber gaskets provide sealing between all joints.

4. Electrical connection to the unit is made by means of three Breeze plugs mounted at each end of the housing. At one side are the 4-pole plug (Stores Ref. 5X/6031) for the 24-volt d.c. supply to the motor, and the 4-pole plug (Stores Ref. 5X/6056) for the 208-volt a.c. supply. At the other side is the 6-pole plug for the 208-volt a.c. connection to the heater mats.

5. The mechanism of the switch consists of a two-speed, governed electric motor, suppressed to eliminate radio interference, coupled to reduction gearing and driving two contact bridge assemblies through latch plate and pawl mechanisms.

6. The final drive shaft protrudes from both sides of the gearbox, one side driving the contact bridge assembly which operates the switching for the intake de-icing mats, and the other side the switching for the propeller and spinner de-icing mats. Each side has its own latch plate and pawl mechanism, to produce the different on/off ratios required.

Motor and gearbox

7. The motor in this switch can run at one of two speeds, fast or slow, as selected by an external control switch. It is governed at either 9,000 or 3,000 r.p.m.; each centrifugal governor has a resistor, of either 80 or 50 ohms, shunted across the contacts to prevent undue arcing and heating. These resistors are carried on a bracket mounted on the motor housing.

8. The gearbox gives a reduction of 18,000:1, and the final drive shaft protrudes on both sides of the gearbox, to operate the two switching mechanisms. On the upper face of the gearbox is a cam-operated snap-action switch, which can be connected to an indicator light. A 100-ohm, 0·2 amp. resistor is connected across the switch contacts, so that remote indication of alternate bright and dim flashes of the lamp is given for as long as the cycling switch is operating.

Latch plate and pawl mechanism

9. The timing sequence for each contact assembly is obtained by a latch plate and pawl mechanism, which periodically releases the energy of a wound coil-spring connected to the contact bridge mounting shaft, and allows it to be rotated to a new position with a rapid snap-action and locked. On the intake side the latch plate has six stops, and on the propeller and spinner side it has four stops.

10. The latch plate and pawl mechanism is illustrated in fig. 2. At A, the pawl is shown in engagement with one of the stops on the latch plate. As the shaft slowly rotates,

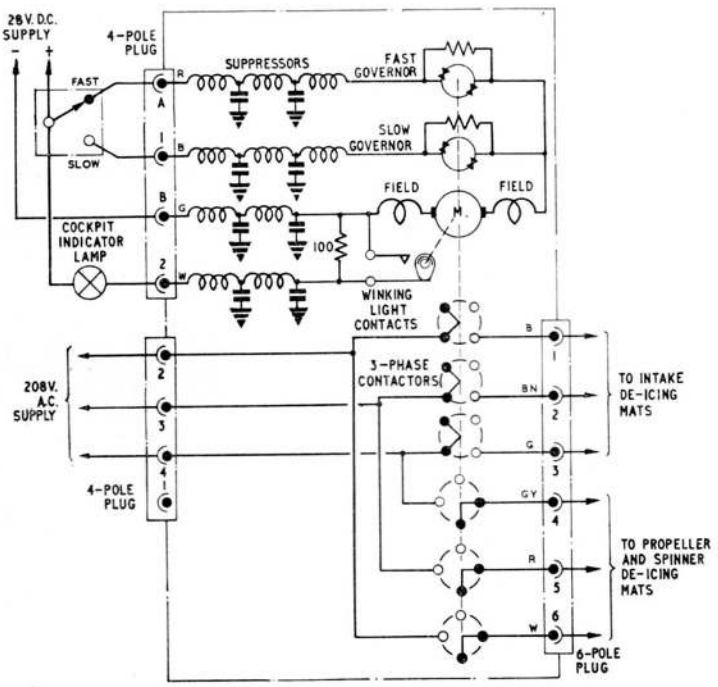

Fig. 3. Circuit diagram

carrying the eccentric with it, the spring is gradually wound and the pawl slowly withdrawn from the stop by its follower on the eccentric. When the pawl is completely clear of the stop (B), the spring-retaining drum snaps quickly round in the direction of the eccentric, carrying with it the pawl and folllower. The pawl is now engaged with the next stop (C), its follower having reached the point of maximum lift on the eccentric; this movement has the effect of making, breaking, or maintaining a break of the switch contacts.

Switch mechanism

11. Each side of the gearbox final drive shaft carries a set of insulated copper bridges. Each bridge is positioned between a pair of spring contact blades, so that during its interrupted rotation, it is brought to rest across the pair of blades once every revolution on the intake side, and twice every revolution on the propeller and spinner side. On the intake side, the contact bridges have two contact lugs diametrically disposed, and the wiper blades are arranged three on each side of the contact block, both banks being normal to the block; on the propeller and spinner side, the contact bridges have two contact lugs at 90 deg. to each other, and the wiper blades are arranged with one bank normal to the contact block and the other in the same plane as the block.

OPERATION

12. The switch will continue to operate, switching on alternately the intake de-icing mats and the propeller and spinner de-icing mats, for as long as the external control switch is closed. The switch can be set to run at one of two speeds, either fast (9,000 r.p.m.), or slow (3,000 r.p.m.), according to temperature conditions.

13. A circuit diagram of the installation is given in fig. 3, and a diagram showing the relative on/off periods for each side in fig. 4. Table 1 indicates the length of time that the heater mats are switched on and off for each side; it should be noted, however, that the cycles as shown there do not begin concurrently, but take place alternately, as represented in diagrammatic form in fig. 4.

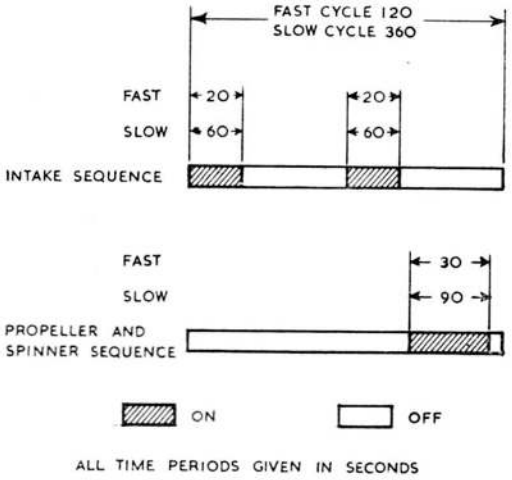

Fig. 4. Timing diagram

TABLE 1

Operating data

	Intake	Propeller and spinner
Heating cycle per rev.	On–off–off–on–off–off	On–off–off–off
Fast operation		
Period ON	20 sec.	30 sec.
Period OFF	40 sec.	90 sec.
Time taken for 1 rev.	2 min.	2 min.
Slow operation		
Period ON	60 sec.	90 sec.
Period OFF	120 sec.	270 sec.
Time taken for 1 rev.	6 min.	6 min.