CHAPTER 8

SWITCHES, solenoid, Rotax, Types D.0208 and D.0213

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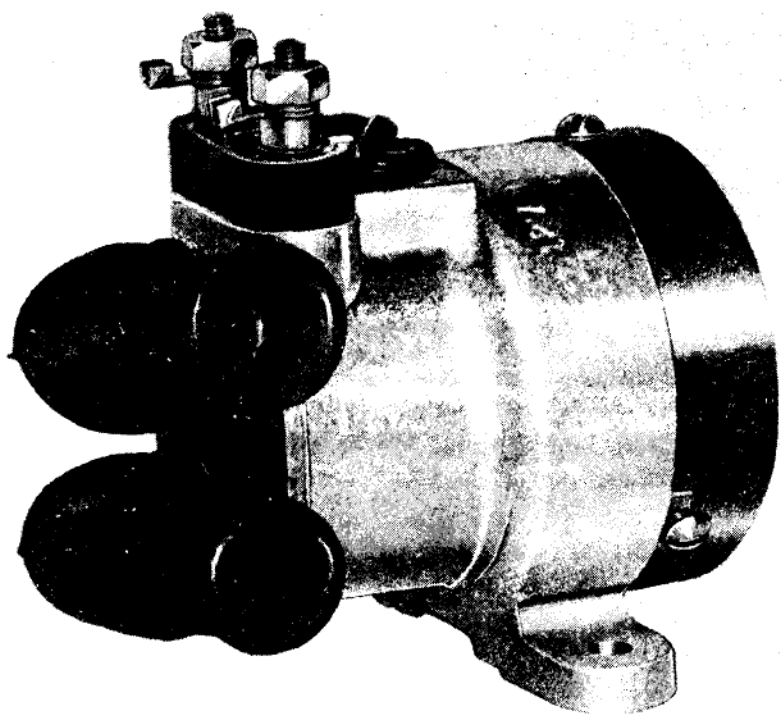

Fig. 1.—Rotax solenoid switch, Type D.0213

CHAPTER 8

SWITCHES, solenoid, Rotax, Types D.0208 and D.0213

Introduction

1. The Rotax Type D.0208 and D.0213 solenoid switches are of similar construction and are primarily used as relays for the remote control of electrical equipment installed in aircraft and marine craft, such as engine starting motors, undercarriage motors, etc., the operation of the switch being effected by means of a push-button located on the pilot's control panel. They are employed in heavy current circuits and may be installed adjacent to the controlled apparatus so that the amount of heavy cable required can be kept to a minimum. Only light gauge control wires are needed from the solenoid switch to the controlling push-button or circuit.

2. Many other applications are possible as the switches simply consist of two fixed contacts which are normally connected in series with the equipment to be controlled, and a moving contact which is attached to the armature of a solenoid. The moving contact bridges the two fixed contacts when the coil circuit is closed. When the solenoid is unexcited the main circuit is broken.

Leading particulars

3. Type	D.0208 (N5CP)	D.0213
Stores Ref.	5C/858	5C/1572
Voltage	12	24
Maximum current (main circuit)	300 amp.	300 amp.
Colour of coil leads	Yellow	1 Yellow, 1 red
Rating	30 secs.	30 secs.
Mounting	Flat	Flat

DESCRIPTION

4. General and exploded views of the Rotax switch, Type D.0213 are shown in fig. 1 and 2, together with a sectional drawing in fig. 3 to which reference should be made when reading the following descriptive paragraphs.

5. It will be seen from the exploded view shown in fig. 2 that the switch comprises two main assemblies, namely the switch body or housing assembly and the pole and coil cup assembly.

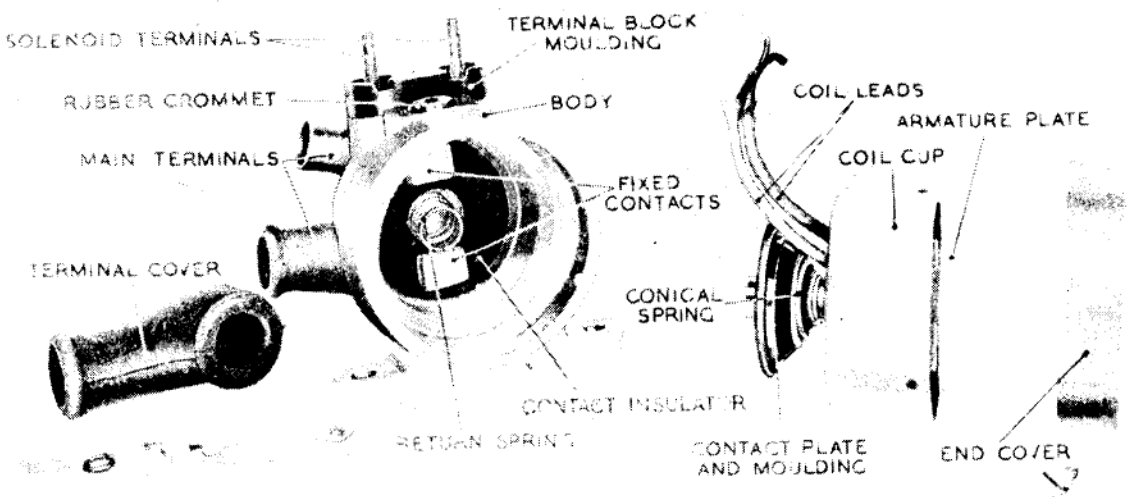

Fig. 2.—Rotax solenoid switch, Type D.0213, partly dismantled

6. The switch body is a cylindrical metal casting closed at one end and machined internally to house the pole and coil cup assembly. Two drilled feet are cast integral with the body to form a flat mounting base for installation purposes. An external boss, also part of the main body casting, provides the location for a coil terminal block which is attached to it by means of a cheese-head screw. This boss is extended over the body and is drilled so that two flexible connector leads from the solenoid coil may be brought out through a rubber grommet to two terminal studs on the terminal block moulding. Each terminal stud is fitted with the following components after the coil connection leads have been placed in position: a tab-washer, Grover washer, round terminal nut terminal tag (for the external connection lead), terminal washer and finally a standard 3 B.A. terminal nut.

7. Two fixed contacts forming the heads of the two main terminal studs are located internally at the rear of the switch body. The studs are extended through holes drilled in the body casting to form the main terminals on the outside. The contacts are diametrically opposed and are insulated from the switch body by means of a moulded plate known as the contact insulator and also insulating bushes where the contact studs pass through the body. The contact insulator is interposed between the contacts and the body casting and held in place by means of round terminal nuts with Grover and plain washers fitted externally, to the main terminals studs. An external cable socket, held in position by a nut and Grover washer is fitted to each main terminal stud. Terminal cover mouldings are placed over each terminal assembly on installation.

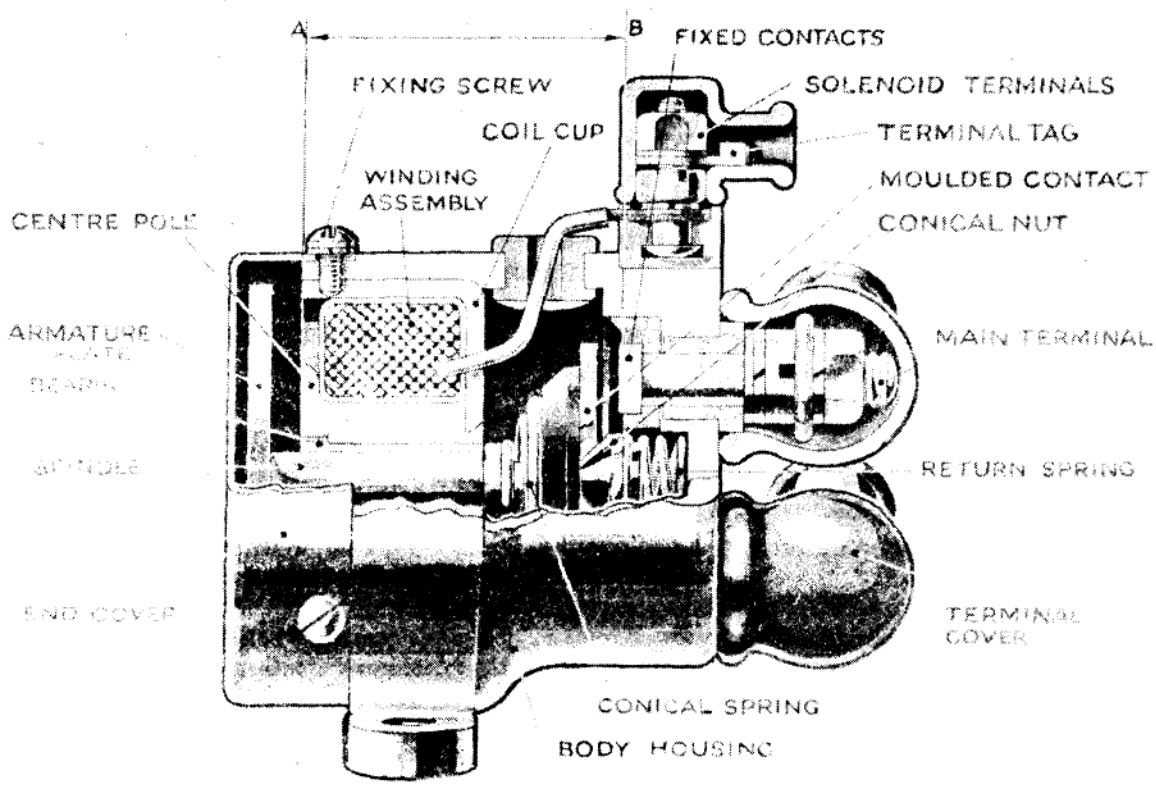

Fig. 3.—Sectional perspective of Rotax solenoid switch, Type D.0213

8. The coil and cup assembly is housed in the switch body and secured by three filister head screws with lock-washers, which also hold the end cover in place. Slotted holes are provided in the cover, so that it may be detached from the switch without removing the fixing screws. The wound coil is inserted in the cup and suitably insulated from it. Two flexible connections leads from the coil

are brought out through holes drilled in the back of the coil cup. They are threaded through the rubber grommet in the switch body and connected to the coil terminal studs. The centre pole is spun over after the coil has been fitted and therefore this unit cannot be dismantled for coil replacement. A brass bush passes through the centre pole and forms a bearing for the armature spindle which is attached to an armature plate at one end and carries the moving contact assembly at the other end.

9. The moving contact is in the shape of a ring and is incorporated as an insert in an insulating moulding. A conical spring is fitted behind this moulding, locating up against a shoulder on the armature spindle. This spring ensures that the moving contact seats on the fixed contacts correctly when the switch is in the closed position. A spacing collar, followed by a conical nut secures the moving contact assembly to the armature spindle. The conical nut is locked by peening.

10. A return spring, housed in a recess at the centre of the switch body and between the two fixed contacts fits over the end of the armature spindle and returns the moving contact to the normal position when the solenoid circuit is broken.

INSTALLATION AND OPERATION

11. Reference should be made to the appropriate aircraft or marine craft handbook for information concerning the installation of these switches.

12. When used to control a single piece of equipment such as an engine starting motor, the switch should be wired up as shown in fig. 4.

13. The main switch terminals should be connected in series with the equipment and the supply and the coil terminals should be connected, by means of light cables, in series with the supply and a push-button switch mounted on the control panel. The coil connections should be connected to a point as near to the supply as possible in order to prevent voltage drop in the heavy current cables affecting the relay coil voltage.

14. The operation of the switch in this type of circuit is as follows. When the push-button switch is depressed the solenoid coil is energised and the outside edge of the coil cup and the centre pole become magnetised and of opposite polarities. The armature plate is then attracted to the coil cup, at the same time pushing forward the armature spindle so that the moving contact bridges the two fixed contacts and thus completes the external circuit to the equipment. The return spring is also compressed and as soon as the push-button is released the coil becomes de-energised, the coil cup and centre pole demagnetised, and the return spring forces the moving contact assembly back into the normal or open position, breaking the external circuit.

SERVICING

15. The only servicing required on these switches, apart from checking that all electrical connections are clean and the terminal nuts secure, consists of the regular inspection of the fixed contacts. If the fixed contacts are pitted, the solenoid assembly together with the moving contact should be detached from the switch body in accordance with the information given below. The whole switch body assembly should be changed, complete with contacts. If there are facilities for skimming, however, the pitted contacts may be replaced by new ones and when fitted, the body of the switch should be placed in a lathe and the contacts machined in position to the dimension A—B shown in fig. 3, which should be 1·625 in. $^{+\ 0{\cdot}000}_{-\ 0{\cdot}005}$ in

16. The sequence of operations given below should be followed when dismantling the switch:—

(i) Take off the two coil terminal assemblies, and remove the coil connection leads from the terminal studs.

(ii) Ease the rubber grommet out of its location hole in the body and slip it off the coil connection leads.

(iii) Remove the three end cover fixing screws, detach the end cover and withdraw the coil and cup assembly from the switch body.

17. No further dismantling of the coil and cup is necessary. Cleanliness is essential when servicing these switches and any surplus oil, dust, swarf or moisture must be wiped off the switch

mechanism and housing, and the moving contact cleaned if required with Grade 00 sandpaper to give a smooth finish.

18. After cleaning or skimming the contacts should be lightly smeared with white petroleum jelly (Stores Ref. 13B/806) as soon as possible. If the coil is found to be defective, the coil and cup assembly should be renewed.

19. The operations given in para. 16 should be reversed to re-assemble the switch.

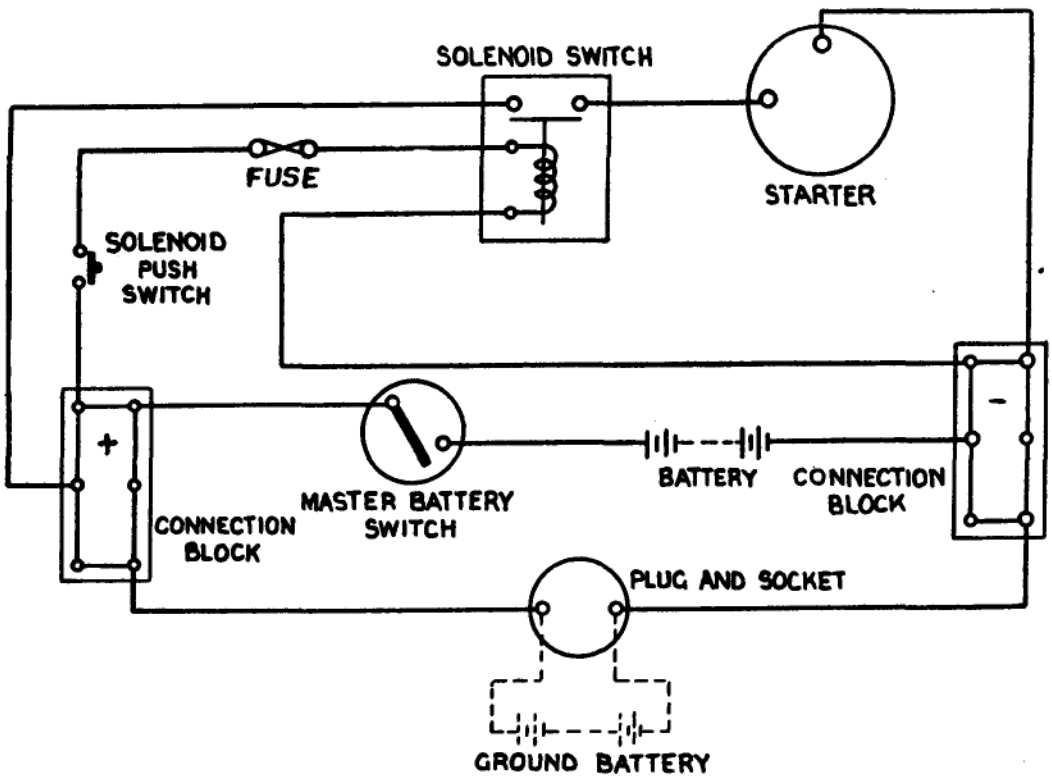

Fig. 4.—Typical circuit diagram

Testing

20. The following series of tests should be applied to switches that have been dismantled for servicing:—

(i) Check that the switch contacts close when a voltage not greater than 8·0 volts for the type D.0208 and 18 volts for the Type D.0213 is applied to the solenoid coil, by connecting the main current terminals in series with a low tension source of supply, and an indicating light or a suitable testmeter.

(ii) Measure the voltage drop across the main contacts with a current of 100 amp. passing, and a voltage of 8·0 for the Type D.0208 and 18 volts for the Type D.0213 applied to the solenoid coil. This figure should not exceed 40 millivolts for either type.

(iii) The insulation resistance between the coil windings and the frame should not be less than 2 megohms, and not less than 20 megohms between the main contacts and the frame with the switch closed, when using a 250-volt insulation resistance tester.

(iv) Finally check the resistance of the solenoid coil at 20° C. This should be between 1·0 ohms and 1·2 ohms for the Type D.0208, and between 5·0 ohms and 5·7 ohms for the Type D.0213.