Chapter 9

SMOKE DETECTOR, TYPE PSDA1—G4

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Smoke detector, Type PSDA1–G4	*Ref. No. 27N/132*
Operating voltage	21 *to* 29·5 *volts d.c.*
Overall dimensions	
(excluding plug and mountings) ...	11½ *in.* × 4 *in.* × 4½ *in.*
Fixing centres	9½ *in.* × 2 *in.*
Weight	2·95 *lb.*

Introduction

1. The smoke detector, Type PSDA1–G4 (*fig.* 1), is designed to give warning of incipient fire conditions occurring in aircraft in such areas as baggage compartments. Besides the ability to detect the presence of smoke emitted during the early stages of combustion, the detector is also highly sensitive to hydraulic oil mists formed by leakage from high pressure pipe lines.

2. The detector is fitted in the compartment to be monitored, and connected to a remote control panel on which is the appropriate indicator lamp or audible warning. Provision is also made at the supply plug and socket connection for the remote control panel to duplicate the test-reset switch on the detector whereby the detector can be operated and reset as desired.

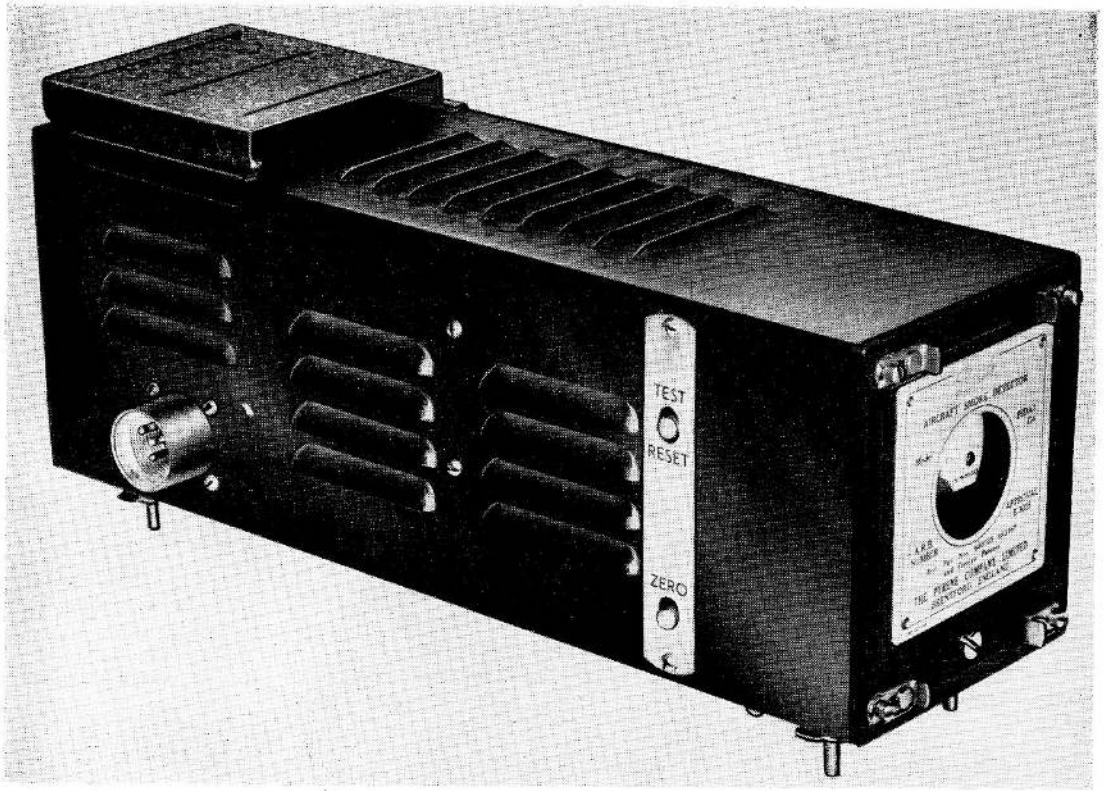

Fig. 1. Smoke detector, Type PSDA1–G4

DESCRIPTION

3. The case of the smoke detector is provided with anti-vibration mountings and is fitted with three covers, which have been shown removed in fig. 2. The detector is divided into three compartments, a detection chamber in the centre, a lamphouse at one end, and a sensitive relay chamber at the other.

Detecting mechanism

4. A 45-volt, 75-watt projector lamp, supplied through a resistance of 2·5 ohms, throws a parallel beam of light through the detection chamber by means of a lens mounted on the dividing wall between the two compartments. The beam falls on to a light-absorbing screen at the far end of the detection chamber which absorbs most of the light from the screen, thereby reducing stray light in the chamber to a minimum.

5. The detection chamber also houses two photo-electric cells, a detecting cell and a balancing cell. The detecting cell is mounted with its sensitive surface exposed parallel to the axis of the beam of light, and extends practically the whole length of the detection chamber; the balancing cell is mounted upside down and in such a position that it receives light directly from the projector lamp through a small window mounted below the projection lens. The terminals of the two cells are connected in series, and the coil of a highly sensitive relay is connected to form a network with the cells, such that excess output from the detecting cell closes the relay contacts.

6. When the lamp is energized and all extraneous light excluded from the detection chamber, the output of the detecting cell can be balanced by that of the balancing cell by adjusting, by means of a shutter, the amount of light which falls on the latter. When so adjusted, no current will flow in the sensitive relay, whose contacts will therefore remain open.

7. Extraneous light is excluded from the detection chamber by louvres in the casing which nevertheless allow air or smoke to circulate freely by convection currents through the chamber. When the detector is energized, any smoke entering the detection

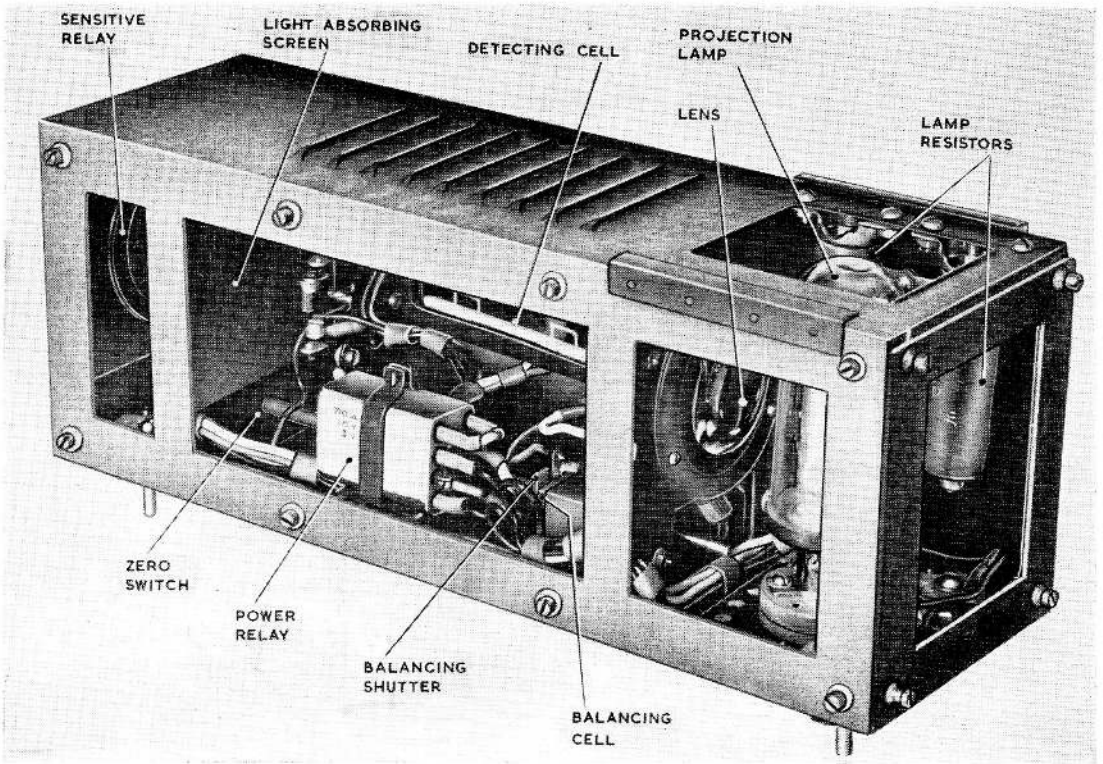

Fig. 2. Smoke detector with covers removed

chamber crosses the beam of light, and by reflection increases the output of the detecting cell, though not affecting that of the balancing cell.

8. The sensitive relay is mounted in the end chamber remote from the projector lamp, and is operated by a current of 2 micro-amp., which represents increased illumination of less than $\frac{1}{3}$ foot candle. When the needle has moved on to the fully deflected position, the contacts are automatically held closed by a small permanent magnet until released mechanically when the detector is reset. Operation of the sensitive relay passes a supply to the coil of a power relay, Type 4184 G.D., and the closing of the power relay contacts transmits a signal to the remote indicator.

Test-reset switch

9. A test-reset control is mounted on the side of the detector. When the top switch is raised to the TEST position, it operates a switchette, Type V3, to light a test lamp in the roof of the detector chamber. This lamp, which receives its supply from the volt drop across the 2·5 ohm series resistance (two 5 ohm resistors in parallel) in the projector lamp circuit, increases the stray light in the detection chamber, simulating the presence of smoke, and operates the sensitive relay.

10. If the switch is depressed to the RESET position, this operates another V3 switchette to energize the reset coil in the sensitive relay, which mechanically breaks the magnetic hold-on contact of the sensitive relay. If no smoke is present, the needle of the sensitive relay will return to the zero position.

Zero switch

11. When the zero switch is raised, it operates a third V3 switchette to cut out the 2·5 ohm series resistance in the projector lamp circuit. This is used to obtain accurate balancing of the cell and relay bridge and to avoid running up the engines during adjustment to obtain full running voltage.

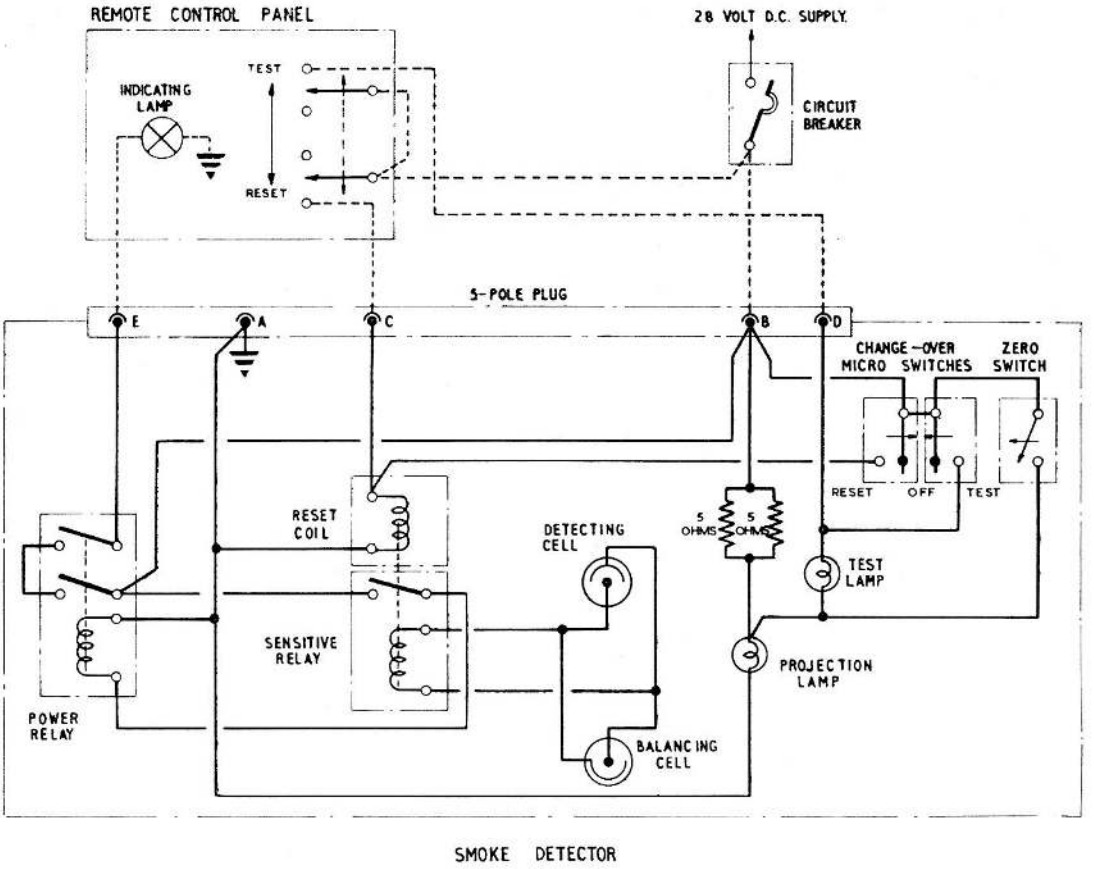

Fig. 3. Circuit diagram

With the zero switch raised, the lamp receives full battery voltage, and gives a lumen output comparable with that obtained when working on 29·5 volts with the series resistance in circuit.

Remote control panel

12. The remote control panel is not supplied with the detector, and may vary according to requirements for a particular aircraft. It normally incorporates an indicator lamp or audible warning, and may duplicate the test-reset switch on the detector, so that the detecting mechanism may be checked and reset as required even though the detector itself may be installed in an inaccessible position.

INSTALLATION

13. The detector should be mounted with the anti-vibration mountings underneath the detector, and with its longitudinal axis in line with that of the aircraft. If there is an airflow through the compartment to be monitored, the detector should be placed near the outlet of air from the compartment, and as high as reasonably practicable, though with at least 2 inches between the detector and the roof of the compartment. It is preferable for it to be mounted in a cradle suspended from the roof, somewhere near the centre of the compartment, and in such a position that there is no possibility of water dripping on to the case.

14. Although it is possible for the detector to be tested and reset from the remote control panel, it must be sufficiently accessible for the three covers to be removed to permit renewal of the projector lamp and test lamp in situ. It must be possible to operate the test-reset switch and zero switch on the detector, and also the balancing cell adjusting screw, which is situated on the end face below the sensitive relay.

SERVICING

Functioning checks

15. The detector should be tested and reset before flight and at regular intervals during flight to ensure that it in working order. For this test the switch should be held in the TEST position for approximately 5 seconds for each operation, and a check should be made that the warning lamp is lit each time, and that it goes out as soon as the switch is moved to the RESET position. Failure to obtain a warning denotes a fault in the equipment, which should be investigated ; if the warning light does not go out when the reset switch is operated, the compartment should be inspected for fire.

16. To check the detector for balance, raise the zero switch and check that the needle of the sensitive relay does not move from the zero position. If there is any movement of the needle, this is due to out-of-balance current, which must be neutralized by turning the balancing cell adjusting screw. The dial is graduated to indicate the amount of current flowing in the relay, and the screw must be turned in the same direction as that in which the needle must move to return to zero.

General inspection

17. The covers should be removed and the interior of the detector inspected. Brush the light absorbing screen to remove any dust. Clean all glass windows of the cells and the projection lens, and ensure that no dust is left inside the detection chamber.

18. Clean the projector lamp shroud. Inspect it for freedom from damage, and also to ensure that there are no signs of blackening of the lamp envelope nor condensation between the envelope and the shroud. If this is present, the lamp must be renewed.

Note . . .

It should be noted that even with the electrical supply cut off, the detector will operate upon removal of the side cover, except under conditions of darkness. The detector cannot then be reset unless the electrical supply is reconnected.