Chapter I

DUPLE BURNER

(Derwent and Nene aero-engines) AL 32.

TYPE BL 6601, BK 9262, BK 7765/

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

1. To ensure suitable combustion characteristics at all fuel flows the Duple burner is designed with two independent metering orifices, a main and a primary, each of which emits a separate spray of atomized fuel. The small primary orifice maintains an atomized fuel spray at very low fuel flows thus facilitating combustion at low r.p.m., with consequent improvement in starting, and in relighting at altitude. The main fuel circuit is inoperative until the pressure in the fuel system has risen sufficiently to ensure efficient atomization at the higher flows through the main orifice. With this arrangement the main orifice can be made large enough to satisfy the maximum fuel demand at a lower maximum pressure, thus reducing stresses in the high-pressure system.

2. The operation of the burner in relation to the complete fuel system is described in the relevant engine Air Publication.

DESCRIPTION (Derwent type)

General

3. The complete burner assembly, illustrated in fig. 1, consists of a mounting block carrying the fuel inlet connections and joined by two rigid pipes to the burner head, with provision made for mounting the unit to the engine by two flange plates. The mounting block assembly, burner pipes and burner head are cadmium coated externally to resist corrosion.

Burner mounting

4. The mounting block, which is recessed on the underside for lightness and carries the two fuel inlet unions, is clamped between two flange plates to form a ball mounting. The two flange plates are spigotted together to ensure that they are concentric, and a sealing ring prevents gas leakage between the flanges and ball mounting.

5. This mounting arrangement allows easy alignment of the burner head during assembly, and so prevents distortion of the rigid burner pipes. Excessive tilting of the burner head in its locating sleeve, when the burner is fitted to the engine, is prevented by the locating peg which is permanently retained to the ball mounting by a pin, and engages in a slot between the flange plates. The slot is formed by the mating of a cutaway in each flange plate when the unit is mounted on the engine.

Unions and pipes

6. The fuel inlet unions screwed into the burner mounting have different sized external connections to prevent the primary and main branch feed pipes being crossed on assembly.

On Derwent type burners the primary feed connection is larger than the main, on Nene type burners the primary connection is smaller than the main; these arrangements facilitate the run of the flexible branch pipes connecting the burners to the fuel manifolds.

7. The inlet unions connect through drillings in the mounting block with two rigid burner pipes which carry the fuel to the burner head. These pipes are copper brazed into the mounting block and burner body, and increase in thickness at both ends to prevent fracture at the points where greatest stress concentration occurs. To give extra rigidity the pipes are also brazed together where they converge at the bend.

Burner head

8. The burner head contains the primary and main fuel atomizers which perform the main function of the burner by emitting two co-axial sprays of atomized fuel to facilitate rapid and efficient combustion at all operating conditions.

9. The burner body is brazed to the main and primary burner pipes and contains drillings which direct the primary and main fuel flows to their respective discharge nozzles. Primary fuel flows along the centre drilling, and main fuel flows to an annular space concentric with the centre drilling. Two further drillings and slots are provided to direct air to an annular passage formed between the burner body and casing.

10. The primary and main atomizers are a close fit inside the bore of the burner casing, which screws over the burner body and holds the atomizers together; the discharge orifices are concentric, and the primary nozzle is positioned to emit a separate spray through the centre of the main orifice. This primary spray assists atomization of the main spray at low main burner pressures when flow is commencing through the burner main orifice. Accurate mating of all contact faces prevents fuel leakage between the primary and main flows, and both discharge orifices are produced to very close limits to finally meter the fuel sprays.

11. Tangential drillings in the primary atomizer, and tangential passages formed between the two atomizers, control the inlet flow to the nozzles and also impart swirl to the fuel as it enters the conical swirl chambers. This swirl causes the fuel to atomize into very minute droplets on leaving the discharge orifices, and the rate of swirl, together with

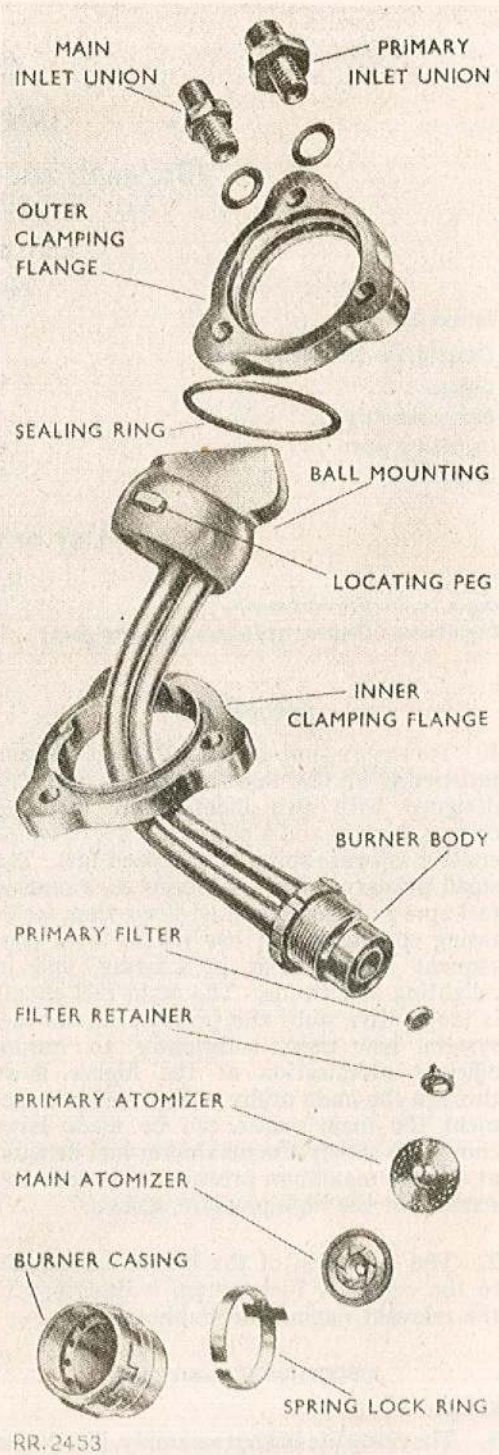

Fig. 1. Duple burner (Derwent type)

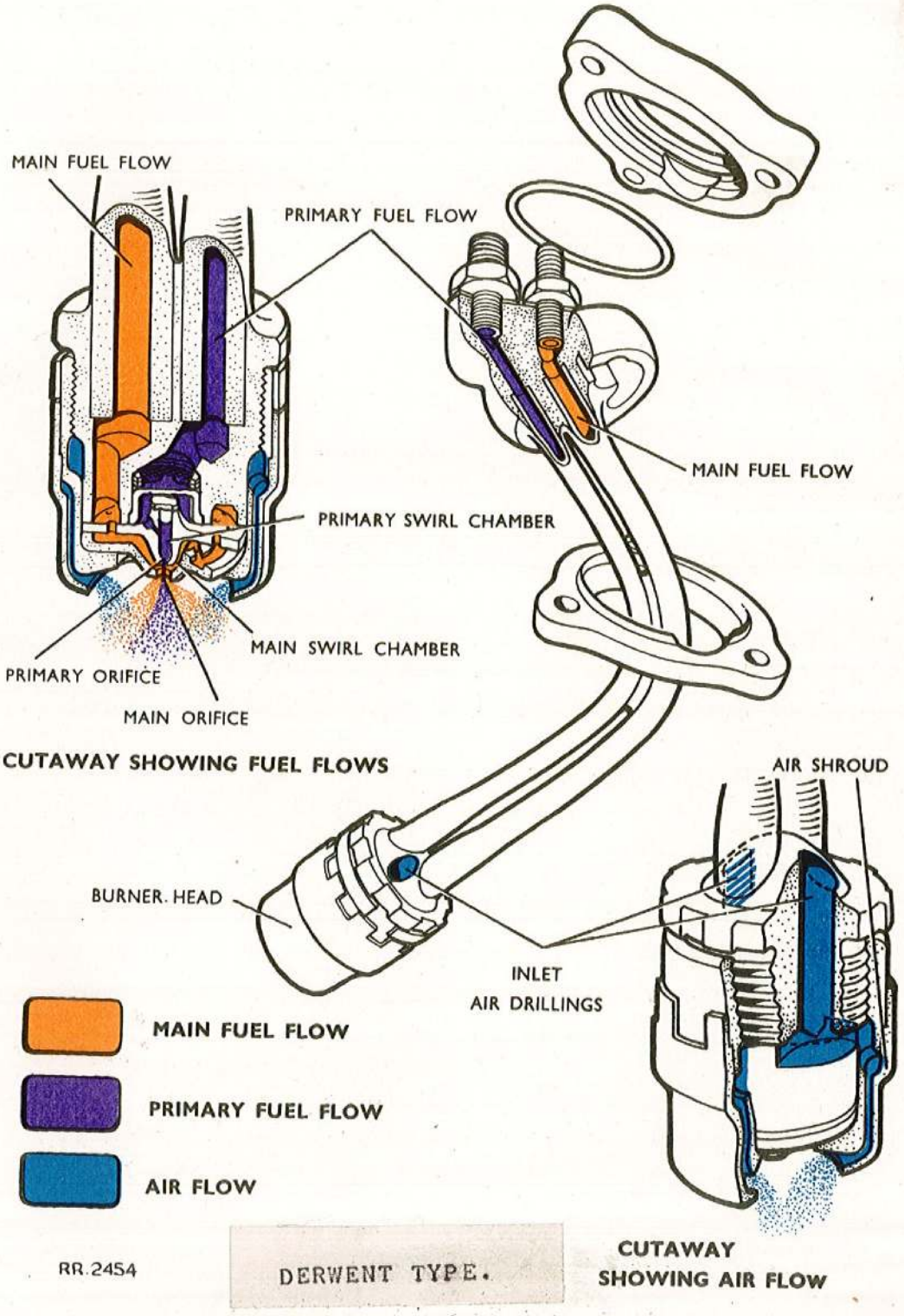

Fig. 2. Duple burner (cutaway showing flows)

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the size of the orifices, determines the cone angles of the fuel sprays. This produces controlled sprays of atomized fuel which will mix rapidly with air in the correct proportion for efficient combustion.

12. Two filters are incorporated in the burner head to prevent obstruction of the flow through the tangential swirl drillings and passages, by small particles which may be present in the fuel. The drillings to the primary swirl chamber are protected by a fine mesh gauze filter situated in the centre bore of the burner body, and the slots to the main swirl chamber are likewise protected by the coarse mesh filter formed by a double row of drillings in the primary atomizer flange.

13. A thin, lipped shell is copper brazed around the outside of the burner casing to provide an air shroud, the air being supplied from the annular passage formed between the burner body and casing, through a ring of holes in the casing. This air flow through the shroud is provided to minimize carbon formation on the burner head caused by rich burning in the stagnant area around the apices of the fuel sprays, and since the rate of this flow is critical it is controlled within close limits by precision drilling of the holes in the burner casing.

14. The burner casing is locked in position by a spring lock-ring, the tabs of which engage in the spanner slots in the casing and the burner body. The slots are arranged on a vernier principle so that when the casing has been tightened sufficiently, further tightening to line up the slots is kept to a minimum.

INSTALLATION

15. Installation of the burners is as described in A.P.4038B and C, Vol. 2, Part 3, Sect. 4.

SERVICING

16. No routine servicing of the burners is necessary.

STORAGE

17. Before storing, the burners must be flushed through with oil OM-13 (Stores Ref. 34B/43), a protective cover fitted over the end of the shroud to protect the atomizers, and blanking caps fitted to the unions.

18. Particular care must be taken to avoid damage to the atomizers, and the protective cover must be fitted to the shroud at all times whenever the burner head becomes exposed.

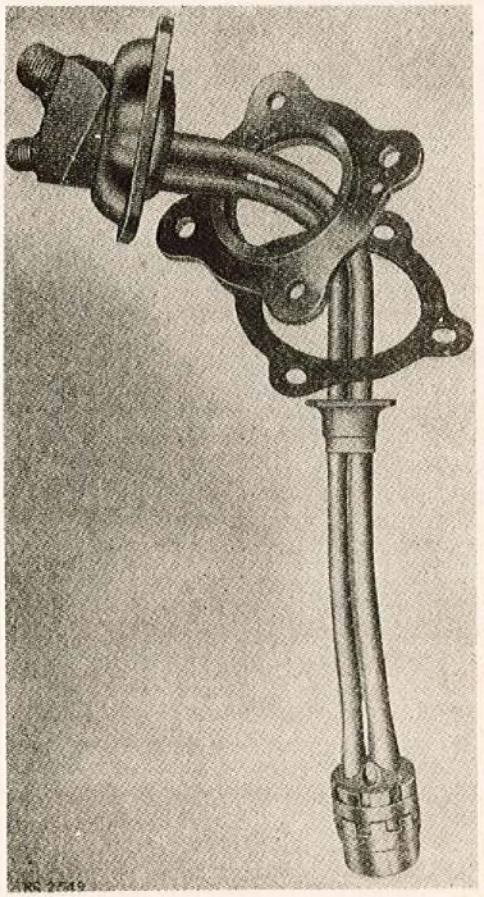

Fig. 3. Duple burner (Nene type)

DESCRIPTION (Nene type)

General

19. The Nene type Duple burner, illustrated in fig. 3, is functionally the same as the Derwent type Duple burner excepting that it incorporates an air baffle secured to the burner pipes; this baffle assists in controlling the air flow through the burner head.

20. Servicing and storage particulars for this type of burner are the same as for the Derwent type burner.

INSTALLATION

21. Installation of the burners is as described in A.P.4167B, Vol. 2, Part 3, Sect. 4.