Chapter 5

FIRE PROTECTION SYSTEM

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LIST OF ILLUSTRATIONS

Introduction

1. Fire extinguishing systems are fitted in each engine bay, in the fuselage and in the outer planes. Each of the seven systems is independent of the other, but in the event of a crash all are operated by inertia type crash switches.

2. The extinguishing agent used is Methyl Bromide, stored under pressure in bottles. When the system is operated it flows under pressure to the spray rings where it is sprayed into the fire zone. In the event of a fire its low boiling point ensures that it vaporizes rapidly with an intense cooling effect, the resultant gas quickly smothering the fire. Under crash landing conditions where a fire has not already broken out, the effect of Methyl Bromide is to reduce the possibility of fire by cooling off hot metal parts to below the ignition point of fuel and oil and finally to create an enveloping blanket of vapour around the compartment.

3. If overheating occurs in an engine bay a warning lamp lights in the appropriate engine fire extinguisher button in the cockpit. The button must be depressed by the pilot to operate the system. On pre-Mod. 2457 aircraft, a fire detector is fitted to the 15th stage compressor breather on each engine to give warning of internal overheating. Each detector lights a special warning lamp mounted in the cockpit above the engine fire extinguisher lamps and buttons. ◀Post-Mod. 3094, flame detector switches fitted in the engine rear bearing cooling-air outlet ducts are connected to warning lamps mounted in the cockpit above the fire extinguisher controls.▶

4. In the event of overheating in a wing fuel bay one of the seven flame switches will be operated by its associated pyrotechnic ◀cord (pre-Mod. 2668) thus causing the▶ wing system fire bottles to be operated. There is no warning to the crew that a fire has broken out or that the bottles have been discharged. The port and starboard wing systems are independent of each other.

5. If overheating occurs in the fuselage tank bay the system operates in a manner similar to that for the wing systems. There are ◀three firewire▶ installations in the fuselage system.

Note . . .

Post-Mod. 2668, *all the pyrotechnic cords have been rendered inoperative by cutting, and the associated fire extinguisher bottles will be operated only by the inertia crash switches. The cords will later be removed from the aircraft.*

Engine system (*fig.* 1 *and* 2)

6. Each of the four engine bays is equipped with its own individual fire warning and extinguishing system; all four are however operated automatically and simultaneously by the inertia type crash switches in the event of a crash landing.

7. For fire protection purposes each engine bay is divided into three zones. Zone 1 covers the engine compressor section, Zone 2 the combustion stage of the engine, and Zone 3 the jet pipe.

8. Fire warning is given by automatic

KEY TO FIG. 1 (GENERAL LAYOUT OF SYSTEM)

1 FLAME DETECTOR SWITCHES ◀(if fitted)▶

2 SPRAY PIPES

3 DISTRIBUTORS

4 SPRAY PIPES

5 FEED PIPE TO TOP SURFACE

6 FEED PIPE TO LOWER SURFACE

7 METHYL-BROMIDE BOTTLES
PRE-MOD. 2523, TYPE 13A
POST-MOD. 2523, TYPE 40A
} 12 OFF

8 PILOTS' PLATFORM

9 INERTIA SWITCHES (PRE-SET TO 3g)

10 PYROTECHNIC CORDS

11 ENGINE BAY SPRAY PIPES

12 JET PIPE BAY SPRAY PIPES

13 FEED PIPES

14 FLAME DETECTOR SWITCHES ◀(if fitted)▶

15 SPRAY PIPES

16 ◀FIREWIRE DETECTOR ELEMENTS▶

17 FEED PIPES AND METHYL BROMIDE BOTTLES
(TWO OFF EACH, PORT AND STARBD.)
PRE-MOD. 2523, TYPE 13A AND 14A
POST-MOD. 2523, TYPE 40A AND 41A

18 FEED PIPE TO TOP SURFACE

19 FEED PIPE TO LOWER SURFACE

20 DISTRIBUTORS

21 FLAME DETECTOR SWITCHES ◀(if fitted)▶

22 SPRAY PIPES

23 METHYL-BROMIDE BOTTLE
PRE-MOD. 2523, TYPE 13A
POST-MOD. 2523, TYPE 40A

24 METHYL-BROMIDE BOTTLE
PRE-MOD. 2523, TYPE 12A
POST-MOD. 2523, TYPE 39A

25 SPRAY PIPES

26 PYROTECHNIC CORDS

27 PIPE CONNECTORS

28 FEED PIPE

29 FUEL TANK BAY PLATING

30 OUTER SKIN

31 DISTRIBUTOR

32 FEED PIPE CONNECTION

33 ELECTRICAL CONNECTION

34 DISCHARGE INDICATOR PIN

◀35 METHYL BROMIDE BOTTLES (POST-MOD. 1669 ◀or 3019▶ ARRANGEMENT)

36 SPRAY NOZZLES

37 BOMB BAY FEED PIPES

38 BOMB BAY SPRAY PIPES

39. ◀FIREWIRE DETECTOR ELEMENTS▶

Note . . .

The following type detonator heads are fitted to the fire bottles : —

Pre-Mod. 2945	*Post-Mod.* 2945
Type A/216 (2-*pin*)	*Type A*/716 (2-*pin*)
◀*Type A*/217 (3-*pin*)	*Type A*/717 (3-*pin*)▶

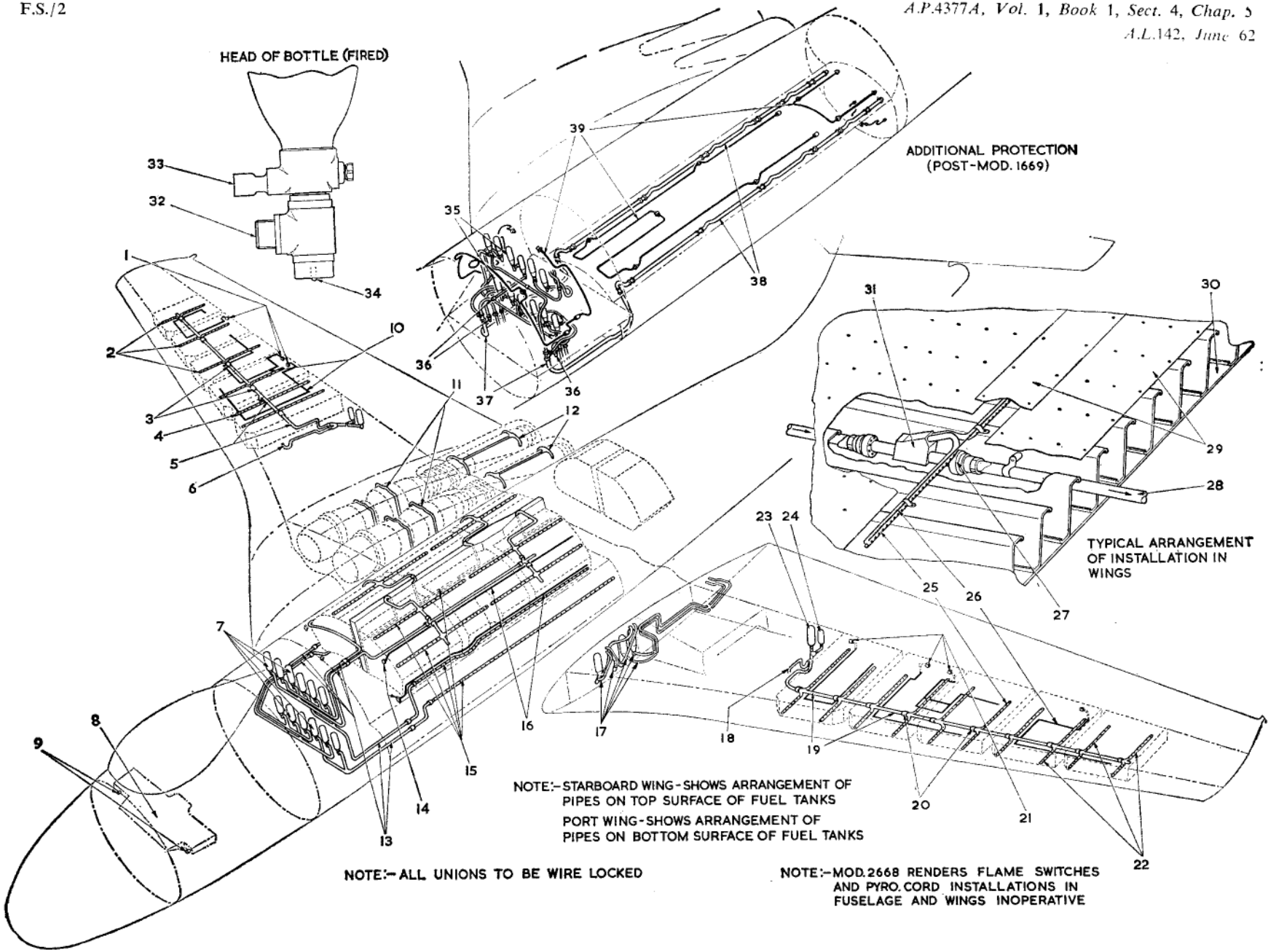

Fig. 1. General layout of system ◀*Additional protection, Mod.* 1669 *or* 3019▶

resetting fire detector switches located as follows :—

(1) Five in Zone 1, arranged radially close to the intermediate bulkhead, with their barrels protruding towards the engine through the engine bay plating.

(2) Six in Zone 2, four on the rear bulkhead protruding through the steel shrouding and two between the rear bulkhead and the rear spar at the bottom of the forward face of the spar.

(3) Five in Zone 3, three on the rear face of the rear spar (two at the top and one at the bottom) and two at the rear end of Zone 3 above the jet pipe.

(4) A detector switch (pre-Mod. 2457 aircraft only) is fitted in the fifteenth stage compressor breather of each engine to detect an internal engine fire or overheating.

9. When an undue rise in temperature occurs in the vicinity of a fire detector switch, the switch operates to light the appropriate warning lamp in the cockpit.

10. The fire extinguisher bottles are mounted four in each wing at rib Stn. 93, an access hole being provided in the main undercarriage bay. (See key to fig. 1 for fire bottle types, and note that post-Mod 2523 all fire bottles are wire wound). There are two bottles to each engine bay, one a dual head double-rate discharge bottle for the engine bay Zones 1 and 2, and the other a single head bottle for the jet pipe Zone 3. The dual head bottles are connected by flexible hoses to a union at wing rib 93. On the engine side of the rib the piping is of stainless steel and it is routed to supply spray rings fitted fore and aft of the intermediate bulkhead in Zones 1 and 2. The spray rings are perforated throughout their length and the ends are flattened to direct a flat jet of methyl-bromide under the engine. The single headed bottles are connected by flexible hoses to tungum pipes which lead along the inboard wall of the main undercarriage bay, through the rear spar and into the jet pipe bay. Here they connect to stainless steel pipes supplying the three spray pipes, one located under the heat shield between the engine bay rear bulkhead and the rear spar in Zone 2; the two other spray rings are fitted one immediately aft of the rear spar and one at the rear end of the jet pipe. The rear spray ring in Zone 2 has its ends closed completely, all fluid spraying from the holes drilled around its length.

Wing tanks system (*fig.* 1)

11. Each wing fuel system is protected by a network of spray pipes fitted between the fuel tank plating and the aircraft structure above and below the fuel tanks. Two bottles provide the extinguishing agent and are discharged automatically by the operation of the inertia crash switches. (See key to fig. 1 for type of bottles).

12. The two bottles are mounted on the front face of the rear spar inboard of rib Stn. 240. Each bottle has a single head and is coupled by a flexible hose to a common feed pipe, which in turn is divided by a 'Y' fitting to provide a supply to the upper and lower spray networks.

13. The upper feed pipe runs outboard between wing Stn. 240 and 521, lying between stringers an equal distance between the front and rear spars. Five distributors are fitted along the feed pipe, from each of which two spray pipes run across the wing as shown in fig. 1. Where the spray pipes cross stringers, a contoured strip maintains a smooth contour in the tank bays over the bulge caused by the spray piping. A sixth spray pipe is fitted between the under-wing tank support ribs at Stn. 290 and 296. A special 'T' fitting lowers the spray pipe into the chamber formed between the two ribs.

14. The lower surface feed pipe is positioned nearer the front spar to clear the tank access panels and is fitted with ten distributors. The spray pipes run on either side of each fuel tank access panel.

15. The seven fire detector switches are mounted at intervals along the rear face of the rear spar. The pyrotechnic cords from three of the switches are routed around the upper spray pipe network and the remaining four cords follow the lower pipe network, but are all rendered inoperative by Mod. 2668.

Fuselage system (*fig.* 1)

16. The fuselage tank bays are protected by twelve extinguisher bottles connected in pairs to six main feed pipes. Two of the feed pipes branch at intervals to form a network of spray pipes. The remaining four feed pipes are drilled and form spray pipes in themselves. The system is extended by Mod. 1669 ◀(B Mk. 1) and Mod. 3019 (all other marks)▶ to give protection to the bomb bay and servicing bays, the bottles being interconnected in groups (*para.* 18 *and* 19) to obtain maximum effectiveness. The operation of the system is entirely automatic in the event of a crash, by the operation of the inertia crash switches.

17. The twelve bottles (fig 3 and key to fig. 1) are mounted on a rack in the centre of the upper servicing bay, forward of the entrance hatch. They are arranged in two rows of six bottles one above the other and numbered from port to starboard 1 - 6 top row and 7 - 12 bottom row. On post-Mod. 1669 ◀or 3019▶ aircraft, bottles No. 6, 7, 8 and 10 are fitted with dual heads to permit interlinking and so enable groups of bottles to serve selected areas.

18. Four of the feed pipes (pre-Mod. 1669 ◀or 3019)▶ pass through the floor and bulkhead to the servicing bays where they connect with the upper and lower spray lines running the length of the port and starboard servicing bays aft to Stn. 613-634. The other two feed pipes are routed upwards to supply the spray pipe network above the fuel tanks on each side of the centre beam. These two feed pipes run the full length of the tank bay with two cross feed pipes branching off on both sides. The cross feed pipes supply spray lines running parallel to the feed pipes above and between the fuel tanks. The paired fire bottles are connected to their feed lines in the following order: —

No. 1 and 3 supply the upper section of the port servicing bay.

No. 7 and 9 supply the lower section of the port servicing bay.

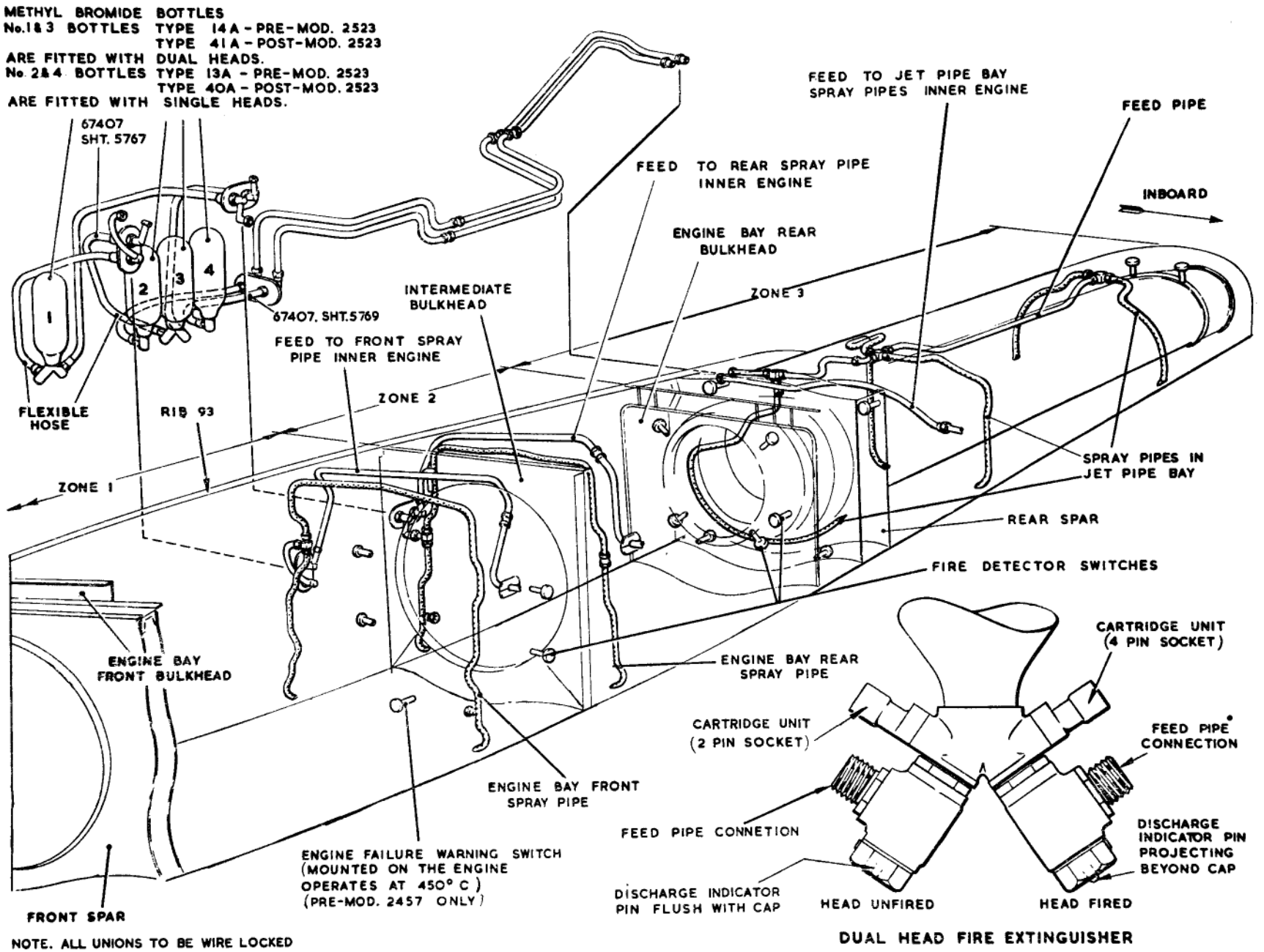

Fig. 2. Engine and jet pipe system

◀Bottle hoses amended▶

RESTRICTED

No. 4 to 6 supply the port tank bays.

No. 2 and 5 supply the starboard tank bays.

No. 8 and 11 supply the upper section of the starboard servicing bay.

No. 10 and 12 supply the lower section of the starboard servicing bay.

19. Post-Mod. 1669 or 3019 distribution is as follows:—

(1) From bottles No. 1 and 2, two pipes supply the spray pipe network in the fuel tank bays.

(2) From bottles No. 5, 6, 7 and 8, four pipes pass through the floor and bulkhead to feed upper and lower spray pipes in the port and starboard servicing bays.

(3) From bottles No. 6, 9, 10 and 11, two common pipes pass through the floor and bulkhead to feed port and starboard spray pipes in the bomb bay.

(4) Bottle No. 3 connects with a spray nozzle facing forward in the upper forward servicing bay.

(5) Bottle No. 4 is connected to a spray nozzle facing aft in the upper forward servicing bay.

(6) Bottles No. 7, 8 and 12 are interlinked to supply port and starboard spray nozzles in the lower forward servicing bay.

20. Post-mod. 1669 or 3019, firewire systems (connected to warning lamps mounted below the fuel panels) are fitted in the servicing bays, the forward bomb bay and the rear bomb bay to give warning of fire and actuate appropriate extinguishers through the spray network. Should fire occur and be extinguished by fire extinguisher discharge without damage to the firewire system, warning of subsequent fire in the same area will be given, but protection will not be available in that area until the necessary servicing has taken place.

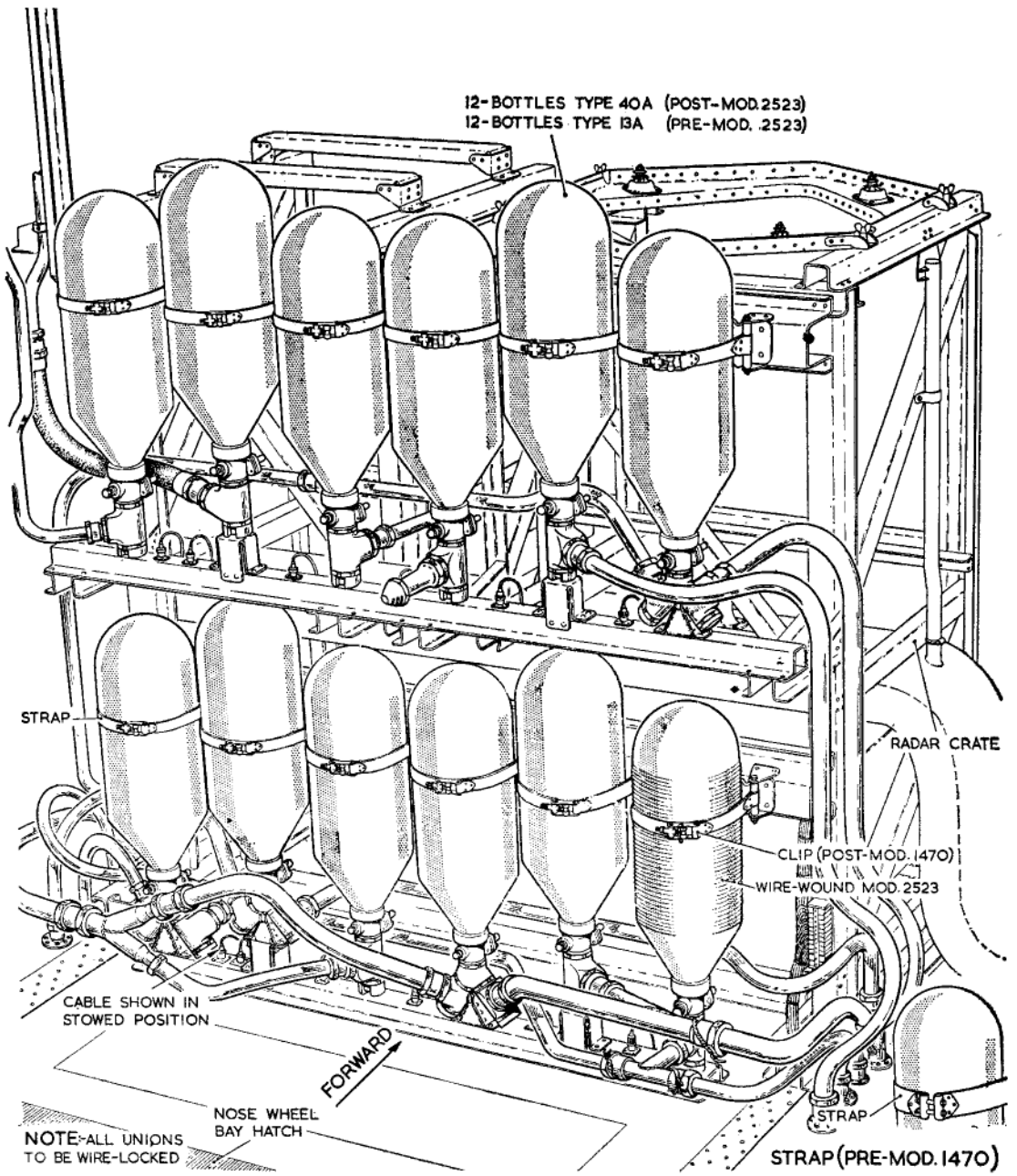

Fig. 3. Fuselage bottle installation

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SERVICING

21. The extinguishing agent used in the fire protection system is methyl bromide, and it should be noted that its vapour is highly toxic and heavier than air. Precautions must therefore be taken to protect ground personnel working on an aircraft after the system has been operated. The maximum possible ventilation should be provided and if there is a possibility of contact with liquid methyl bromide, protective clothing should be worn. For further information on the servicing of the fire extinguisher bottles refer to A.P. 957C, Vol. 1.

◀**22.** The method of checking the system is as follows:—

(1) *Engine feed pipes.*—Disconnect at extinguisher containers, blank off ends at engine bays (or as required) and leak test with clean dry air at 100 lb/in²; there should be no detectable pressure drop over a period of 5 min. Blow through all assembled pipelines at 100 lb/in² (approx.) for at least 1 min. with clean dry air. Check that all pipelines are clean internally and that the holes in the distribution pipes are unobstructed.

(2) *Fuselage feed pipes.* — Disconnect extinguisher containers, blank off ends of feed pipes at joints nearest to spray pipes and leak test with clean dry air at 100 lb/in²; there should be no detectable pressure drop over a period of 5 min. Blow through assembly pipelines at 100 lb/in² (approx.) for at least 1 min. with clean dry air. Check that all pipelines are clean internally and that the holes in distribution pipes are unobstructed.

(3) *Outer wing feed pipes.*—(Leak test of these pipes is impracticable). Blow through assembled pipelines at 100 lb/in² (approx.) for at least 1 min., with extinguisher containers disconnected and pipe ends blanked off. Check that assembled pipelines are clean internally and the spray holes are unobstructed. ▶

23. To check for air flow through the spray pipe networks the feed lines to each network should be disconnected and dry air at a pressure of 150 - 250 lb/in² should be blown through each network.

24. The servicing of the electrical circuits and associated components is covered in A.P.4377A, Vol. 1, Book 2, Sect. 5, Chap. 4.

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