

CHAPTER 2

R.A.T.O. EQUIPMENT

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Chapter 2 R.A.T.O. EQUIPMENT

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ELECTRO-MECHANICAL RELEASE UNIT No. 2 Mk. 1

Introduction

1. The electro-mechanical release unit, Ref. No. 26SR/13780, together with a housing, Ref. No. 26SR/13781, and an attached actuator for mechanical release emergency operation, are the only items of aircraft ancillary equipment in the R.A.T.O. installation. The release unit, held in a housing in an inner plane rib (*Vol. 1, Book 1, Sect. 4, Chap. 7*), is normally electrically operated, but can be operated in emergency by a mechanical device incorporating an actuator which, in displacing a lever and moving a rod, causes the release to be tripped.

2. Both normal and emergency release of R.A.T.O. units is controlled by switches in the pilots' cockpit (*Vol. 1, Book 1, Sect. 1, Chap. 1, fig. 5*), normal operation being possible only after a master control switch has been operated, but not when the unit is firing. Emergency release can be effected

at any time by lifting the switch guard and selecting the desired unit. Assembly to the aircraft is described in Sect. 4, Chap. 7.

Description (*fig. 1 and 2*)

3. The unit has a heavy case in two bolted halves, machined internally to provide housing for the electro-magnetic cocking and release equipment and the two hooks that retain the R.A.T.O. unit. At the centre, a boss provides housing for the suspension pin internally, and a hook mounting journal externally. The hooks, shaped to ensure clean release with minimum drag, are spring loaded to assist in release and to hold the jaws apart after release or prior to assembly of a R.A.T.O. unit.

4. The electro-magnetic cocking and release equipment is a four-pole rotor loaded by two coil springs, attached to a toggle linkage. The linkage lower portion houses a roller which locks the hooks in the closed position when lowered, and permits them to fly apart under the R.A.T.O. unit weight

and spring loading when withdrawn. To offset harsh roller ejection with possible linkwork damage, when the hooks are opening a spring-loaded buffer acts against the linkwork to smooth its movement.

Note . . .

The unit can also be mechanically released through a spring-loaded slide impinging upon the rotor and turning it to operate the linkwork.

5. Although not required when this release is used with R.A.T.O. units on Valiant aircraft, an interlock tumbler operated by one of the hooks, is fitted into one side of the release casing (*para. 7*).

OPERATION (*fig. 3*)

Cocking the release unit

6. When the hooks are open, the roller has been withdrawn from the hook top projections and the gap is closed. The roller will be resting on and held above the hook projections by the rotor spring action,

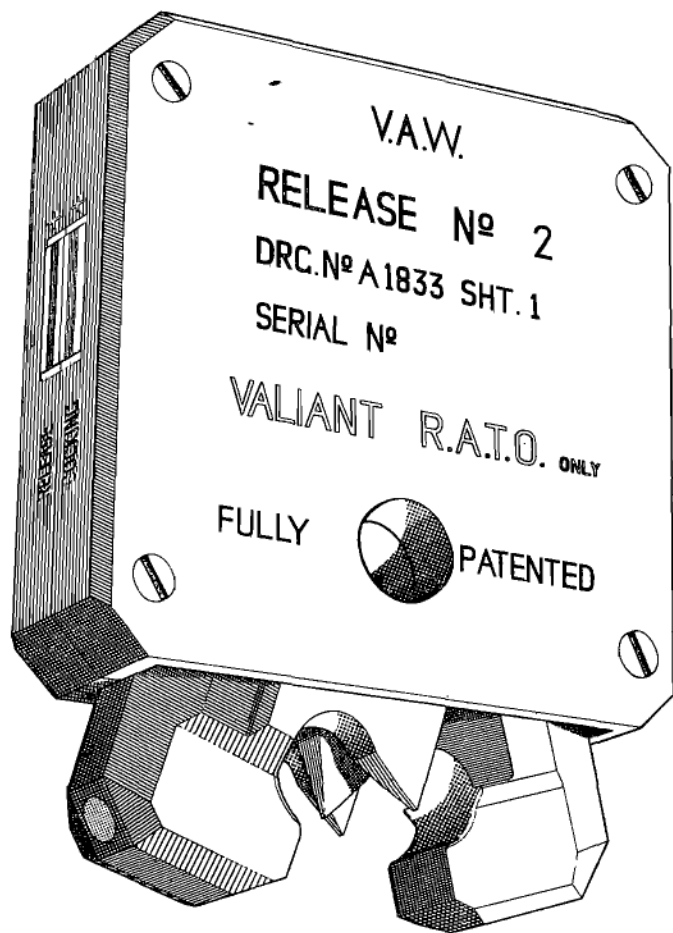


Fig. 1. Electro-mechanical release unit No. 2 Mk. 1

the toggle linkwork will be out of line, and contact between the rotor and both the release and cocking feed springs will be broken. The feed springs are supplied from a release and cocking contact switch unit in the release unit housing, the supply passing to the circuits through a clearly-marked insulated feed plug in the release casing forward side. The cocking feed contact spring connecting with the rotor is shortened to ensure that it is only in contact when the rotor is turned fully to the cocked position. To obviate arcing and burning, the release contact spring is shaped to

ensure complete and rapid disconnection at the moment of release.

7. The release is normally cocked by the R.A.T.O. unit swinging link, but can be cocked manually for test purposes. The hook bosses have lips which contact the swinging link as the unit is raised, moving them apart and bringing the hook jaws closer together until they meet in the locked position, with the jaw springs fully loaded. During this movement, the passage for the cocking roller has been opening and, at the cocked position, will permit the roller to enter under pressure exerted by the coiled rotor springs through the linkwork. The links move into a position where the linkwork axis pin passes slightly over centre to form a geometric lock and hold the roller firmly in the gap; in moving, the links will turn the rotor which makes contact first with the release circuit feed spring, and then with the cocking circuit feed spring on reaching the fully-cocked position. This latter contact is used only when testing for satisfactory cocking action. The interlock tumbler protruding from the release unit rear face when the hooks are open, will progressively withdraw into the casing as the hooks close, and will be completely withdrawn at the locked position.

Actuating the release unit

8. When the firing switch is pressed, the supply is connected to the rotor coil via the release contact switch unit and release circuit feed spring, returning via the suspension pin. The coil energises the rotor, causing the poles to be attracted towards four soft-iron pole pieces housed in the casing adjacent to the rotor. This causes the rotor to turn, disconnecting the rotor and cocking circuit feed spring and moving the linkwork to withdraw the roller from its

lock position, the hook jaws opening under pressure from the hook springs. When the rotor reaches the end of its travel, contact with the release circuit feed spring is rapidly broken. When the rear hook moves to its open position, the interlock tumbler pivots and protrudes from the rear of the release casing and would complete an interlock circuit. An interlock switch unit is not however used in this installation, its position being taken by an unwired dummy contact switch which prevents ingress of moisture and foreign matter.

Mechanical release

9. Provision is made to release the R.A.T.O. unit mechanically if necessary by means of a spring-loaded plunger housed in the release unit casing, operated by a lever in the release unit housing. When operated, the lever depresses the plunger which impinges on and turns the rotor. The remaining release action will function exactly as for electrical release. The release plunger spring is compressed during release action, and will return the plunger and lever to their normal positions when the lever pressure is removed.

SERVICING

10. No adjustment can be made to the release unit, its efficient working being dependent upon internal cleanliness and freedom from corrosion. If the unit is not in use, the transit dust cover supplied should be fitted in conjunction with the dust cover attached to the lower part of the release unit housing, forming a complete seal against ingress of moisture, etc. The unit operates on the earth return system; cleanliness of contacts, the suspension pin and its housing, and of the unit boss bore are extremely important. Being an earthing contact the boss bore is not anodised, and should therefore be kept lightly coated with D.T.D.121 (lanolin in white spirit) as an anti-corrosive measure.

Note . . .

D.T.D.121 is an emulsion consisting of Ref.

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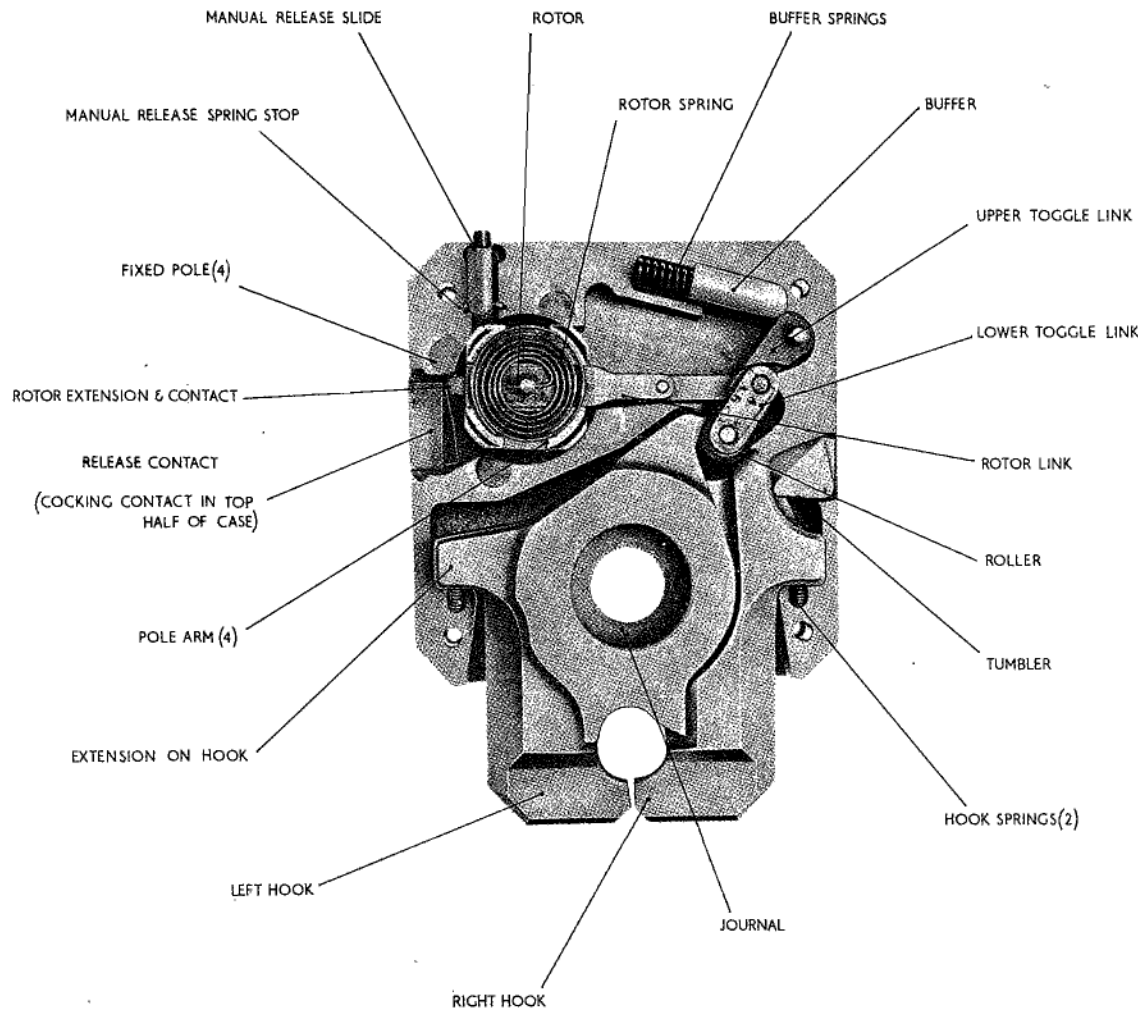
No. 33C/511, lanolin, 30-35 per cent by weight, and Ref. No. 34D/246, white spirit 70-65 per cent by weight.

11. It will occasionally be necessary to dismantle the release unit to ensure internal cleanliness. The four soft-iron pole pieces have no protective finish and may therefore corrode. Any corrosion should be removed by lightly rubbing with very fine (grade 00) emery cloth, after which the poles should be lightly smeared with D.T.D.121 and then lightly wiped with clean rag to leave only a trace of protective on the surface. If oily or dirty, all components, including the rotor, may be immersed and thoroughly rinsed in acetone or similar fluid, followed by wiping with clean rag. On reassembly, the mating faces of the case halves should be given light protective treatment with D.T.D.121, but it is important that when wiping the faces and pole pieces, fillets of protective are not formed in the case, particularly in the rotor recess where freezing at low temperature could cause operational failure.

Dismantling

12. It is important that the mating faces are not damaged when opening the case; burrs caused from prising the casing apart could affect the magnetic efficiency, impair the sealing, or be detrimental to the rotors smooth working. It is also important to avoid damaging the rotor spindle when removing it from the casing, or when winding the springs. For winding, the special assembly tool Sht.A. 1832, Pt. 121 must be used. To dismantle, proceed as follows:—

- (1) With the unit lying flat, remove the screw at each corner, and lift the upper half clear. *Do not damage the rotor spindle.*
- (2) Ease the linkwork to withdraw the roller from its seating, and move the hooks to the fully-open position.
- (3) Free the hook springs and remove the hooks complete with springs.



NOTE: SHOWN WITH TOP HALF OF CASE REMOVED

Fig. 2. Release unit—component assembly

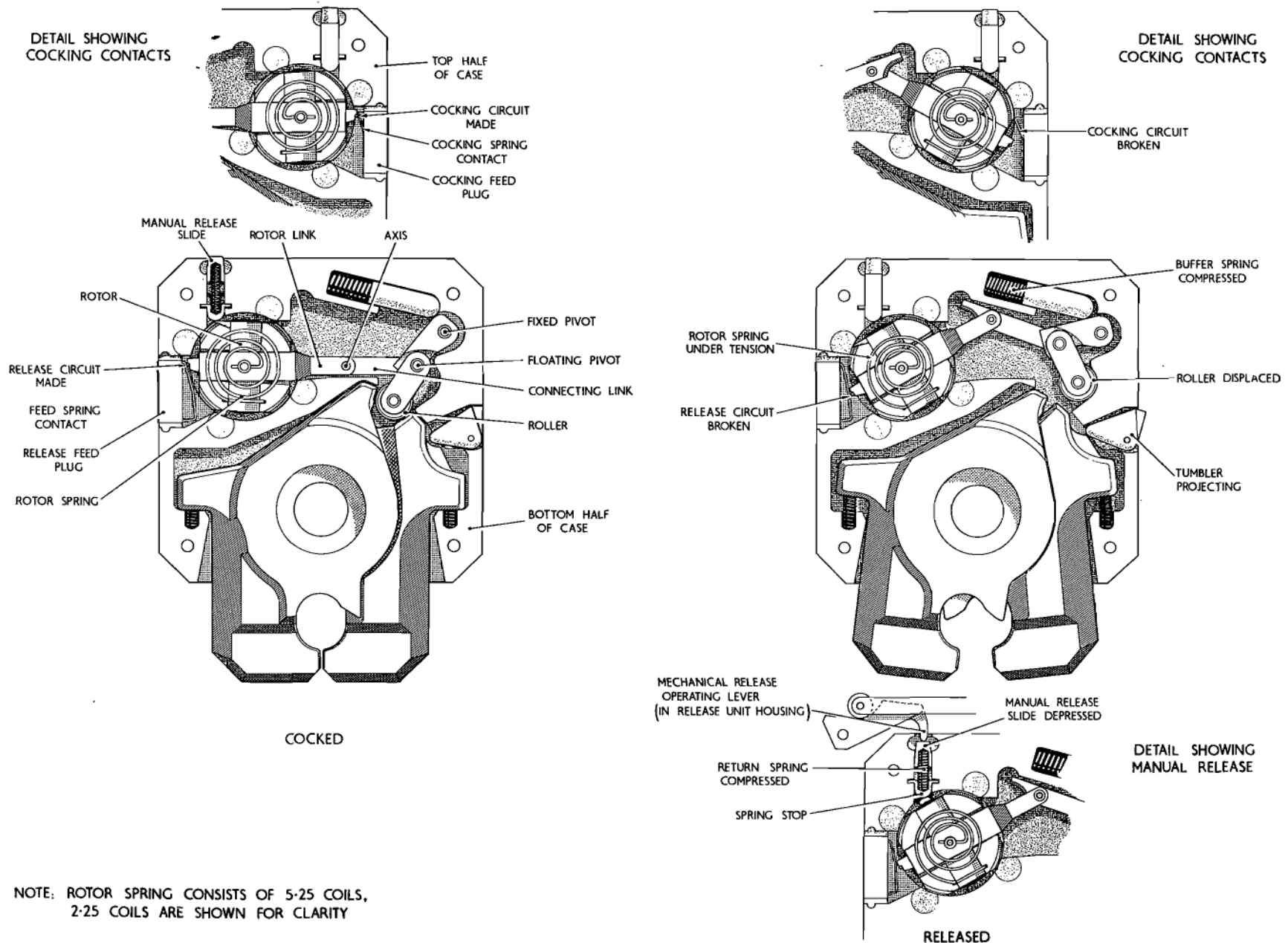


Fig. 3. Release unit functional diagram

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- (4) Remove the springs from the hooks by turning them counter-clockwise and exerting a slight pull.
- (5) Remove the upper spring from the rotor and lift the rotor from its housing complete with linkwork and lower spring.
- (6) Remove the lower spring, withdraw the rotor fulcrum pin and release the linkwork.

Note . . .

All pins other than the fulcrum pin must be considered as fixed parts.

- (7) Compress the buffer spring and remove the linkwork buffer.
- (8) Remove the mechanical release and tumbler.

Assembly

13. To assemble the unit, proceed as follows:—

- (1) Assemble the linkwork to the rotor by inserting the fulcrum pin.
- (2) Ensure that the spring-locating slot in the rotor is on the horizontal link lower side, and assemble the rotor springs. They are set to wind UP when turned clockwise.
- (3) Place the rotor assembly in its housing and turn it to the fully-locked position.
- (4) Assemble the hook springs by inserting them and turning counter-clockwise whilst gently pushing on them.
- (5) Place the hooks in position on the boss and carefully ease the springs into position.
- (6) Lift the rotor in its housing just sufficient to ensure that the lower spring is clear of the slot in the case boss and, using the special tool, Sht.A.1832, Pt.121, wind the spring 180 deg. clockwise until the lower spring engages the slot. Set the upper spring inner coil end in a central position, move the links to the unlocked position and hooks to 'fully open', and

press the spring end into the case recess. Re-lock the mechanism.

- (7) Assemble the manual release slide, spring stop and spring.
- (8) Assemble the buffer slide and springs.
- (9) Place the tumbler in position.
- (10) With the rotor in the locked position, assemble the switches with the engraving and feed spring stiff end adjacent to the rotor contact bar, and the multiple contacts towards the case inner face. The switch faces in contact with the case should be lightly coated with rubber adhesive before assembly, to form a seal.
- (11) Turn the rotor to the unlocked position and assemble the casing top half, ensuring that the delicate cocking feed spring is not fouled and its setting undisturbed. Press the two halves gently together, and examine to ensure that the faces mate evenly before inserting the fixing screws.
- (12) Insert the four corner screws and screw down finger-tight only.
- (13) Press the mechanical release to prevent nipping, and tighten the adjacent screw.
- (14) Tighten the remaining screws diagonally.

NO LOAD TESTS

14. After assembly, the action is tested for freedom as follows:—

- (1) Operate the mechanical release slowly, and ensure that the hooks fly fully open before full plunger travel is reached.
- (2) Slowly re-cock the female hook onto the case shoulder stop, then slowly close the male hook. The lock should fly in before the hook toes meet, the action being audible.

Repeat these tests with the release unit inverted, and also with each side of the unit uppermost.

ELECTRICAL TESTS

15. The following electrical tests are necessary to ensure operational efficiency:—

- (1) Operate the mechanical release slowly and, with a suitable meter, check the resistance between the release contact switch and the suspension boss inner face. The meter reading should be steady and not exceed 3.6 ohms until the hooks fly open, at which point infinity should be recorded. Unsteady readings would indicate a dirty or intermittent contact.
- (2) With a 250-volt megger, check that the release and cocking circuits are dead when the hooks are open.
- (3) Using a standard cocking test box, Ref. No. 5G/560, check that the lamp is 'on' only when the unit is fully cocked. After the clearance between the mechanical release plunger and the rotor has been taken up, further plunger depression of 0.01 in. should extinguish the lamp.
- (4) With the 250-volt megger, check all OFF positions to ensure adequate air gap to allow for vibration.

Housing and release bench test

16. After assembly and test (*para. 12 and 13*), fit the unit to a housing for bench testing to ensure electrical continuity and correct mechanical release operation:—

- (1) Assemble the release unit in the housing (*Book 1, Sect. 4, Chap. 7*) and fully cock. Using test box, Ref. No. 5G/560, ensure that the lamp is 'on'.
- (2) Check that the resistance of the feed circuits between the release contact switch and the suspension pin does not exceed 3.6 ohms.
- (3) Pull the mechanical release link out slowly, and check that the hooks fly open before the link is on its stop. Release the link and ensure that it returns to its original position smoothly and quickly.
- (4) Re-cock the unit, apply a 22-volt supply to the release circuit and check that the hooks fly fully open.

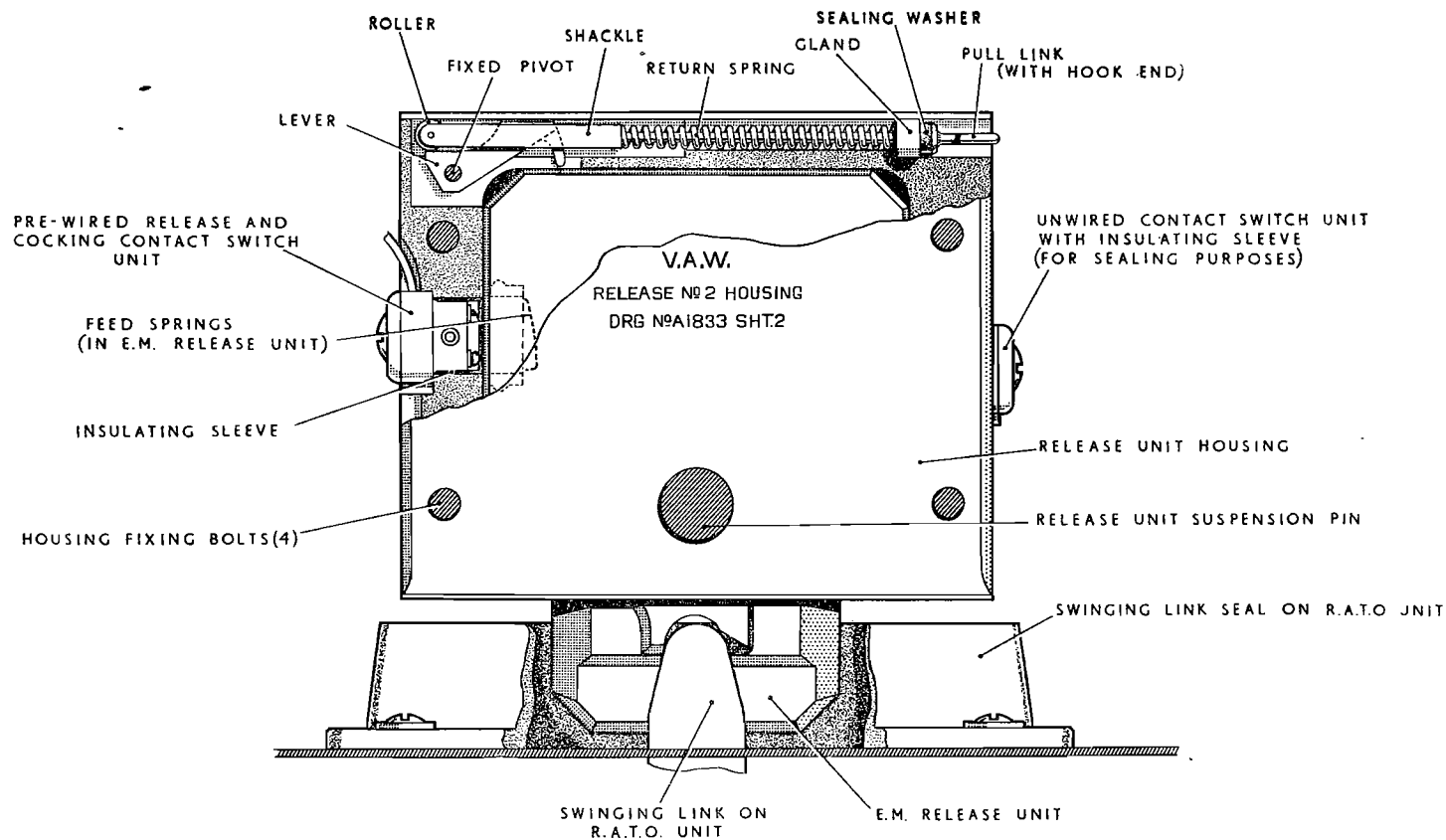


Fig. 4. Release unit housing

Release unit housing (fig. 4)

17. The release unit housing is fitted to inner plane rib 45.28 and is removed only for servicing. It is a rectangular metal box structure with side plates drilled to receive the unit suspension pin, and the front and rear faces recessed to receive contact switch units. Only the front recess is fitted with a contact switch, the rear being sealed by

an unwired switch, each being retained in position by pins passing through both the housing and the switches. This operation must be completed before the housing is installed. Mechanical release equipment consisting of a spring-loaded operating rod and lever is fitted at the top of the housing, the rod being formed with a hook at its

outer end and a shackle link to retain a roller at the inner. The hook is connected to the actuator via an adjustable rod and lever, actuator movement causing the rod to be withdrawn and the roller to move over the cam-faced back of the release operating lever, depressing it and causing the release mechanism to operate.

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