Chapter 3

(Completely revised)

ABANDONING THE AIRCRAFT

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List of Illustrations

GENERAL

1. "Abandoning" is the term applied to controlled evacuation of an aircraft in flight, following an emergency. Evacuation of crashed aircraft is part of the forced landing procedure and is described in the Pilot's Notes for the particular type of aircraft.

2. As the blast effect of the airstream makes it difficult to abandon an aircraft travelling at more than approximately 200 knots I.A.S., all modern high-speed aircraft are equipped with ejection seats which, in an emergency, can eject the occupant (together with his parachute and survival equipment) from the aircraft. Most ejection seats are fitted with devices which automatically separate the occupant from the seat after ejection and deploy his parachute. Full details of ejection seats used in the Royal Air Force are contained in A.P.4288.

EJECTION

3. All connections between the seat and the aircraft are designed to separate on ejection; thus, the only actions needed to escape from a disabled aircraft in flight are to jettison the canopy and then to operate the ejection seat firing handle. On later aircraft, canopy jettisoning is initiated by the action of operating the firing handle; on other aircraft, the canopy is not jettisoned, ejection taking place through it.

4. During an ejection at high speed, the seat may spin and this, combined with the blast effect of the airstream, may cause serious injury to the occupant of the seat by causing his legs to flail. The early marks of ejection seat were fitted with thigh guards built into the seat pan, but later seats are fitted with leg restraint cords which,

during ejection, ensure that the legs are drawn back and restrained close to the seat pan (fig.1 and 2). An additional advantage of the leg restraint cords is that they prevent the legs striking parts of the cockpit during ejection. To provide further clearance for the legs during ejection, some aircraft are fitted with a control column snatch unit which severs the elevator controls and snatches the control column forward against the instrument panel. The snatch unit may be manually operated or automatic.

5. With the Mk.2 and 3 series seats, automatic separation and parachute withdrawal after ejection are achieved by a barostatically controlled time-release unit which, when the seat has descended to a pre-determined height (usually 10,000 ft.), releases the drogues and releases the safety harness hence, by transferring the pull of the drogues from the seat to the apron behind the occupant, pitches the occupant out of the seat; as separation occurs, the drogue link line withdraws the parachute from its pack (fig.3). Most seats are fitted with a 'G'-stop on the time-release unit; this prevents automatic separation occurring until the seat has slowed to a speed suitable for parachute withdrawal.

6. The Mk.4 series seats use a combined safety and parachute harness and have no apron. The harness is attached to the seat at three quick-release points, and automatic separation is achieved by the release of these attachments and the withdrawal of the parachute, the occupant being snatched from the seat as the parachute deploys (fig.4).

7. Although an ejection seat equipped with automatic separation and parachute withdrawal devices provides an almost infallible means of escape from a disabled aircraft, there is a possibility that the seat may not function or that the automatic devices may fail; it should be noted that failure of the ejection seat will almost certainly be due to the use of an incorrect technique rather than failure of the seat itself. Failure to eject will necessitate a manual bale-out from the aircraft (para.9); failure of the automatic devices will necessitate a manual separation from the seat after ejection (para.8). In either instance, there will be a free fall followed by manual operation of the parachute rip cord.

MANUAL SEPARATION FROM THE SEAT AFTER EJECTION

8. If, following ejection, it is suspected that the automatic separation and parachute withdrawal devices are not functioning, the first action must always be to pull the manual override handle on the parachute harness, thereby disconnecting the drogue link line from the parachute; failure to disconnect this line will result in the parachute becoming entangled with the seat, usually with fatal results. The complete sequence of actions to be taken when making a manual separation from the seat after ejection from a particular type of aircraft is given in the Pilot's Notes.

Note...
It is vital to concentrate all the faculties on the operations to be performed in these circumstances; the seat may be spinning and the occupant, therefore, confused.

MANUAL BALE-OUT

9. The detailed drill to be used when making a manual bale-out from a particular type of aircraft is given in the Pilot's Notes. There are, however, several general considerations and these are described in the following paragraphs.

10. The vizor or the protruding rims of the goggles may restrict the field of vision to a certain extent if left in position and it may be desired to raise them. If they are raised, the loss of protection to the eyes may be more serious than the restriction of view whilst still in the aircraft; the choice must therefore be left to the individual.

11. Before attempting to get clear, all connections between the seat and the occupant should be broken as close to the body as possible. It should be noted that if time is vital, all hoses, Mic/Tel lead etc., will separate as the occupant stands up to leave the seat but if time is not vital, it is preferable to separate these items by hand before attempting to leave. In the earlier marks of ejection seats, the emergency oxygen supply is carried in a cylinder secured to the parachute harness. The supply is turned on automatically as the occupant leaves the seat but if time permits, it is preferable (when at high altitude) to turn on the supply manually thereby ensuring that the oxygen is available before leaving. Later marks of seat have the emergency oxygen cylinder clamped to the

seat; no oxygen is available, therefore, during a manual bale-out and unless the aircraft must be abandoned immediately, it is advisable to remain in it until it has descended to at least 15,000 ft. thereby removing the danger of anoxia and exposure to extreme cold at high altitude. An additional advantage is that more detailed distress messages may be transmitted, thereby enhancing the chances of a speedy rescue.

12. When a chest type parachute is being fitted to the harness, it must be picked up by the lifting handles, NOT by the rip cord handle. Inadvertent operation of the parachute within the aircraft could be serious but if it occurs, should be gathered in the arms and shielded from the slipstream by the body during bale-out. When clear of the aircraft tail unit, release the canopy and throw it outwards away from the body; this will give the canopy a good chance of opening cleanly. Back and seat type parachutes are less prone to inadvertent operation but should it occur, the same principle of gathering the canopy in the arms before baling out applies.

13. The motion of the aircraft will approximate to one of the following:-

(1) Normal gliding attitude.

(2) Steep dive.

(3) Spin.

(4) Inverted spin.

In considering the best method of getting clear, recommendations will be made under each of these headings, but the emergency drill for the aircraft should be followed.

NORMAL GLIDING ATTITUDE

14. Any of the positions recommended in A.M.P.212 can be adopted, depending upon the type of exit.

STEEP DIVE

15. When the aircraft is descending in a steep dive, crew members must take action to avoid falling forward when the safety harness is released. Quick action is of the utmost importance when leaving the aircraft as the aircraft speed builds up rapidly, making escape more difficult.

SPIN

16. The safest way of abandoning a spinning aircraft is to leave on the side away from the axis of the spin, e.g., if the aircraft is in a left-hand spin, leave from the right-hand side of the aircraft.

17. The rate of descent of the aircraft depends upon its attitude; the flatter the spin, the lower the rate of descent. When an aircraft other than a single-seater is to be abandoned while in a spin, the possibility of moving the centre of gravity aft to flatten the spin should not be overlooked. This can be achieved by abandoning stations in the fore part of the aircraft first or by moving the crew aft and using the rear exits. The foregoing, of course, presupposes a reasonable amount of time available. If the aircraft can be induced to adopt a flatter spin, the crew will have a better chance of making a clean exit.

INVERTED SPIN

18. If a single-seat aircraft is to be abandoned when in a spin, it is usually possible to jettison the canopy, release the harness and fall clear of the aircraft. Few multi-seat aircraft are designed to allow this, however, and some unorthodox method of getting clear must be used. The probability is that the crew members will be deposited on the roof when they release their harness but it should still be possible to use the normal exits.

THE PARACHUTE DESCENT

19. A parachute is normally cleared for use at heights of up to 20,000 ft. and speeds of up to 175 knots but there have been several instances of correct functioning at much higher

speeds and heights. Normally, however, if the aircraft is abandoned above 10,000 ft., parachute opening should be delayed until that height is reached; this will reduce the length of exposure to extreme cold and, if no emergency oxygen supply is available, will reduce the risk of anoxia.

20. The rate of descent of an emergency escape parachute with an I.24 canopy is between 23 and 25 ft./sec. at sea level (A.S.L.). The speed of a free falling man varies according to his attitude and bulk but may be taken as 175 ft./sec. A.S.L., the rate increasing with height. When falling from great height, it is not always easy to judge the distance fallen and to avoid the danger of opening the parachute prematurely, or of making an over-delayed drop the parachute assemblies used in high-speed, high-flying aircraft are equipped with a barometrically controlled opening device which operates the rip cord at a predetermined height, usually approximately 10,000 ft. This device in no way prevents manual operation of the parachute, as an overriding manual release is provided for use if the wearer suspects that the automatic device is not functioning. Details of the barometrically-controlled devices used in the R.A.F. are contained in A.P.1182A and barostatic time-release units in A.P.4288. To enable survivors to have some idea of when they have descended to 10,000 ft., the following table lists the times taken to reach that height from various altitudes.

Height (ft.)	Minimum time (min. sec.)	Maximum time (min. sec.)
20,000	0:35	1:04
30,000	1:09	2:00
40,000	1:35	2:45
50,000	1:55	3:20
60,000	2:15	3:45

21. Experience has shown that a man leaving an aircraft by falling forwards or backwards will somersault and continue to do so while the body is bent. This somersaulting will not prevent the parachute canopy opening correctly provided that the legs are kept pressed firmly together to avoid interfering with the lift webs and rigging lines as they deploy. Somersaulting can be checked, before the rip cord is pulled, by straighting the legs and holding them together; the limbs can be controlled easily whilst falling through the air.

CONTROL DURING DESCENT

22. A parachute descent should be under control from the moment of leaving the aircraft until the moment of releasing the harness after landing; the phases of control are:-

(1) Correct attitude of the body before pulling the rip cord and during parachute deployment and development.

(2) Flight technique:-

(a) Damping oscillation.

(b) Turning.

(c) Side-slipping.

(3) Landing.

(4) Release from the harness.

Correct attitude of the body

23. After leaving the aircraft, the body should be held in a compact position with the feet and arms close to the body until the parachute has developed. When the canopy has opened, look upwards to check the development; any malformation should eventually right

itself. If the rigging lines are twisted, they should untwist of their own accord; some assistance may be afforded by kicking the legs in a circular movement against the twist. Ignore the twists when below 1,000 ft. and concentrate on the preparation for the landing.

Flight technique

24. A parachute descent is controllable in that it is possible to damp-out oscillation, to change direction by turning or sideslipping and to vary the rate of descent.

Damping oscillation

25. Oscillation, which at high altitudes is often violent and may cause air sickness, can be damped by distorting the periphery of the canopy. With the back or seat type parachutes, this is achieved by reaching high on the two front or back lift webs and pulling down hard until the hands are level with the shoulders. Hold this position until the swinging has ceased and then gradually raise the arms to return the lift webs to their normal position.

26. In addition to damping oscillation, pulling down on the lift webs also provides a means of varying the horizontal speed of the parachute. When strong winds are giving rise to high ground speeds, if the back lift webs are pulled down when drifting forward, or the front lift webs pulled down when drifting backward, the ground speed will be decreased. It should be noted, however, that the vertical speed will increase during this manoeuvre and this increase may result in a heavier landing than would otherwise occur had the drift been unchecked. The aim should be to reduce the ground speed sufficiently to counterbalance the effects of any increase in vertical speed.

27. Oscillation of a parachute with only two lift webs (such as the chest type) may be checked by pulling down strongly on both lift webs; when within 20 to 30 ft. of the ground, ease up gently on the lift webs.

Turning

28. Unless the user is facing in the direction of drift when the canopy opens, every effort to do so should be made in the early stages of the descent. By facing downwind, it is easier to assess the approximate landing position; in a strong wind, it is important to face the direction of drift to minimise the chance of injury during landing. To turn to the right, take the left hand round behind the left lift webs and grasp the right lift webs as high as possible with the left hand; pass the right hand across the face and grasp the left lift webs as high as possible with the right hand. Pull hard with both hands, to the right with the right hand and to the left with the left hand. To turn to the left, reverse the position of the hands in the above procedure.

Side-slipping

29. If there is a danger of landing on buildings, trees other obstructions, it is possible to take avoiding action by side-slipping. This is accomplished by pulling down the lift webs or rigging lines on the side of the canopy towards which it is desired to move, e.g. to sideslip to the right, pull down the right-hand lift webs. This causes air to be spilled from under the left-hand side of the canopy, producing a resultant air pressure to the right on the canopy.

30. The canopy may appear to collapse during a violent side slip but this need not cause alarm as the canopy will open as soon as the lift webs are released. Side-slipping causes an increase in the rate of descent and should not be attempted near the ground except in an emergency (see para.26). When sideslipping is resorted to as a means of avoiding an unsuitable landing area, the aim should be to drift to one side of the area; attempts to increase the drift and overshoot will almost certainly fail due to the increased rate of descent.

LANDING

31. When possible, the landing should be made facing downwind; if there is time, the parachute should be turned to accomplish this (see para.28). Difficulty may be experienced in estimating height above the ground; the best method is to look alternately at the horizon and the ground immediately below, as considerable errors may occur if the eyes are focussed continuously on the ground.

Forward landing

32. When making a forward landing, pull down on the back lift webs to reduce drift (see para.26) and turn the body slightly off the line of approach to enable the fall to be made on the side of the leg and thigh. Feet and legs should be firmly together, knees bent slightly, head tucked well in, shoulders and back rounded, and arms (with the hands holding the lift webs) should be held at right-angles with the elbows held well forward; immediately before touchdown look at the ground slightly ahead of the feet.

33. The initial shock of landing is taken by the legs through comparatively flat feet, although the shock is made transitory by the relaxed attitude of the body. There should be no attempt to strike or beat the ground with the feet, the body falling or flowing across the ground with the side of the leg, thigh, buttock and diagonally across the rounded back to the opposite shoulder in that sequence. To assist the latter movement, turn the leading shoulder and the upper part of the body as the feet strike the ground.

Sideways landing

34. During a sideways landing, the sequence of movements is similar to that for the forward landing (para.32) except that, as the body is already across the line of drift, further turning is unnecessary; the final turning of the shoulder at touchdown need not be so pronounced.

Backward landing

35. When making a backward landing, pull down on the front lift webs and endeavour to land half-backward, half-sideways; this will avoid a direct blow on the base of the spine or on the back of the head. Shortly before touch-down, reach backwards with the legs to take the initial shock of the fall, keep the weight of the body well forward with the shoulders well rounded and the head tucked in and looking from under the arms at the ground behind.

Landing on high ground

36. Comparative tests at sea level and at 3,400 ft. using a standard 24 ft. canopy and harness have established that there is no appreciable increase in shock of landing at the higher altitude. However, if a descent has to be made on to high ground or in rarified atmosphere such as is common in some tropical countries, the rate of descent may be higher, but is still acceptable.

Landing in water

37. If a parachute descent is made into water, the following sequence should be used:-

(1) Before alighting on the water:-

(a) Check that the shoulder straps of the parachute harness pass under the folds of the life jacket stole. If they do not, the stole should be eased from under the straps until it is in the correct position.

(b) Inflate the life jacket by pulling hard on the operating knob under the left-hand lobe of the stole. If the stole inflates on one side only, unfasten the press-studs on the uninflated side. If the inflation cylinder fails to operate, unfasten the press-studs on the stole and inflate the life jacket orally.

Note...
For oral inflation, rotate the mouthpiece of the oral inflation valve, and depress it with the lips as inflation is commenced. After inflation, lock the mouthpiece by rotating in the opposite direction.

(2) After alighting on the water:-

(a) Operate the parachute harness quick-release fitting and discard the parachute and harness.

(b) Pull down on the life jacket lobe adjustment cords to bring the stole close to the body and thus provide the correct flotation angle.

(c) Inflate and board the dinghy.

Landing in trees

38. Landing in trees is not as dangerous as might be imagined. The standard landing posture should be adopted but the legs should be bent rather more to protect the abdomen, to fend off from large branches and to be prepared for the ground landing after crashing through light braches. The hands and arms should be brought across the face to form a protective screen through which the final stages of the descent may be observed. If the landing has been among tall trees and the parachute remains entangled, great care should be exercised in releasing the harness and climbing down the tree.

RELEASE FROM THE PARACHUTE HARNESS

39. Under normal conditions of light or moderate wind, immediately after landing the disc knob of the harness quick-release fitting should be rotated one quarter-turn in a clockwise direction; this will bring the red warning mark on the disc to the top indicating that the fitting is unlocked. A sharp blow or firm pressure on the disc is all that is necessary to release the harness straps; the canopy and harness may drift away with the wind or the canopy may collapse completely once the weight of the body has been removed. Alternatively, in a light wind the canopy may be collapsed deliberately after landing before the quick-release fitting is operated by pulling vigorously on the rigging lines attached to the lower part of the canopy periphery; this will spill air out of the upper part of the canopy, causing it to flatten out on the ground with the inner surface uppermost.

40. When landing in a strong wind, there is a danger of being dragged along the ground with the consequent risk of injury; the harness must be freed, therefore, as soon as possible after landing.

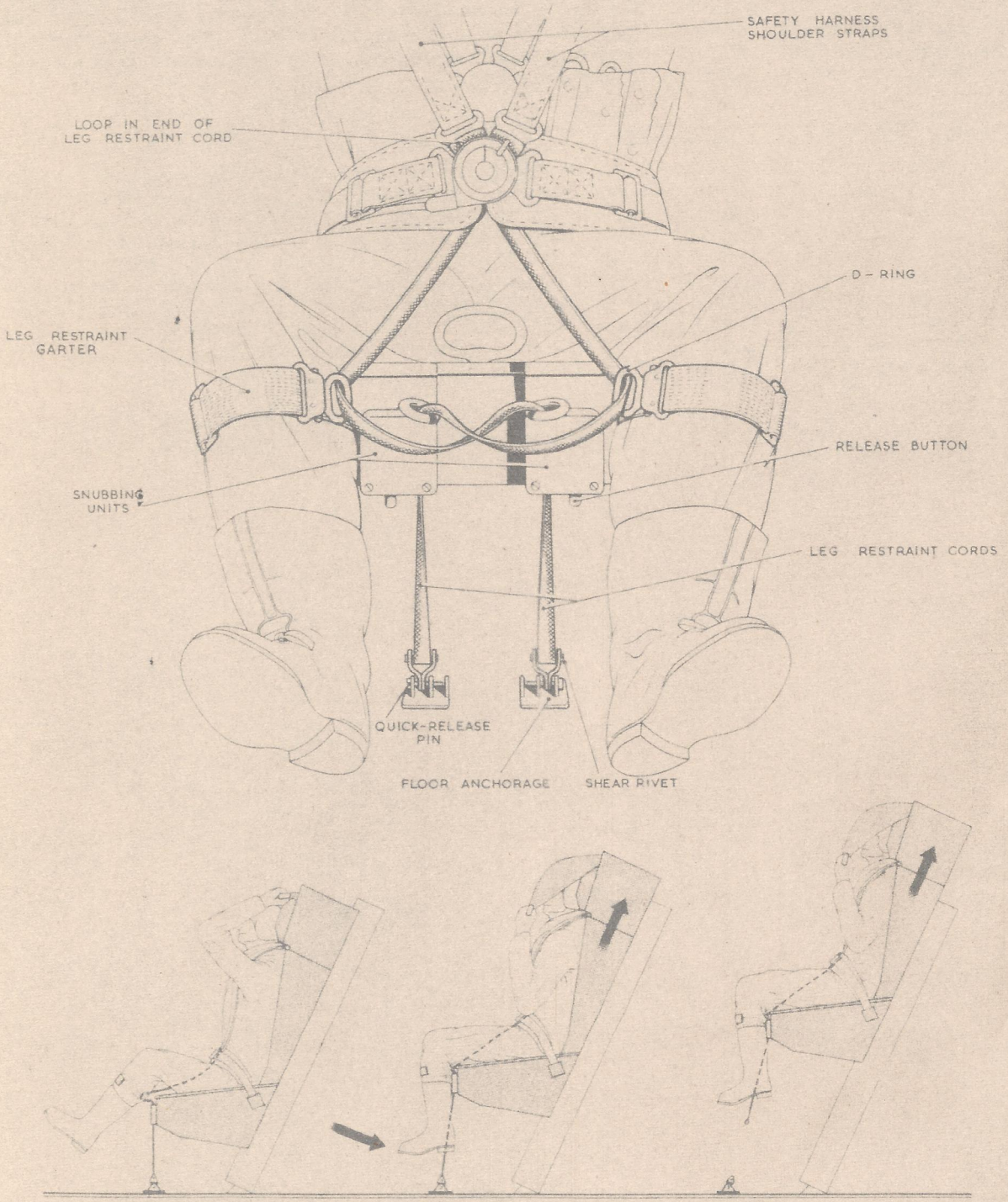

FIG.1. LEG RESTRAINT CORDS (MK.2 AND 3 SERIES SEATS) - FUNCTIONING

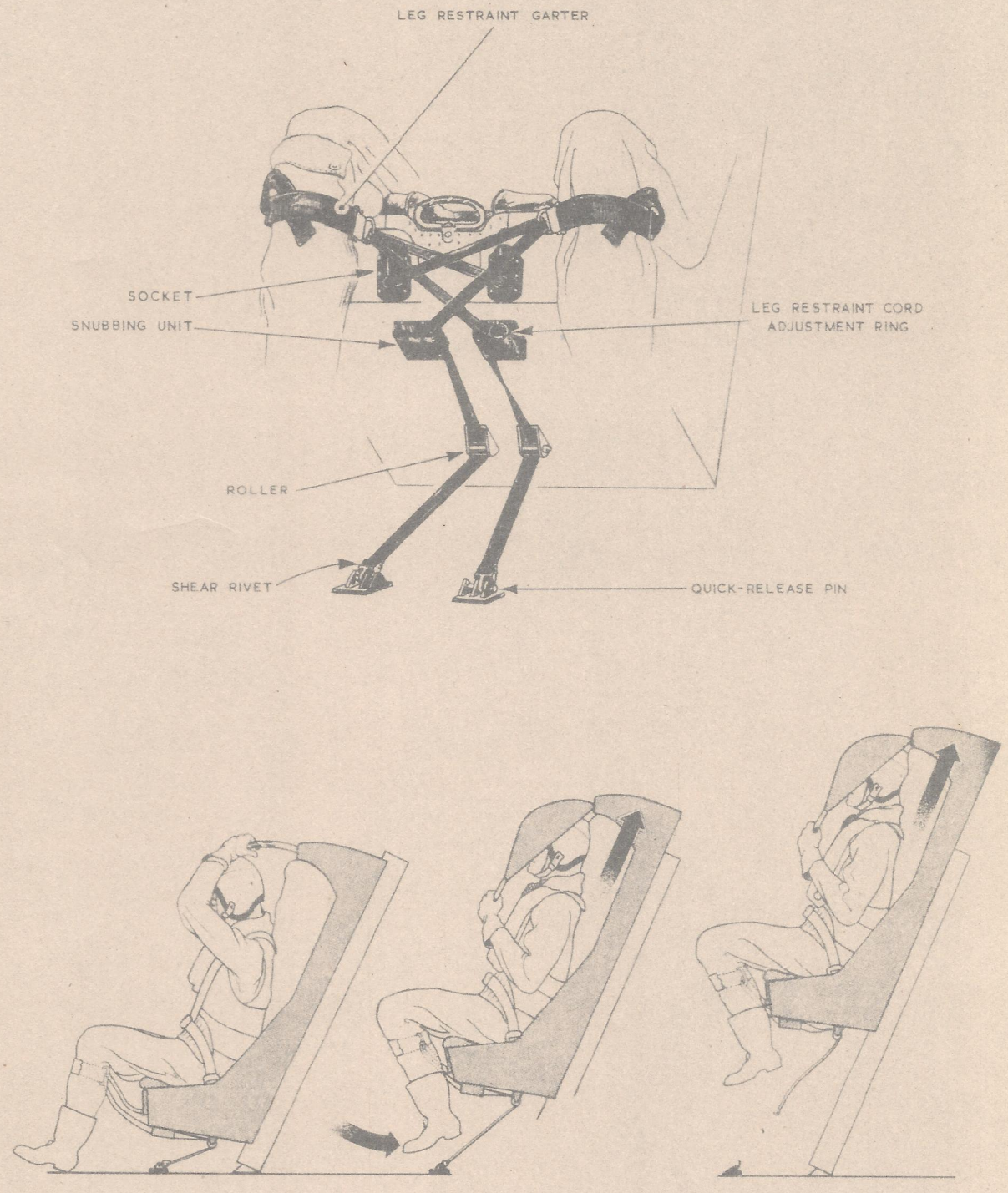

FIG.2. LEG RESTRAINT CORDS (MK.4 SERIES SEATS) - FUNCTIONING

FIG.3. AUTOMATIC SEPARATION FROM THE SEAT AFTER EJECTION (MK.2 AND 3 SERIES SEATS)

RESTRICTED

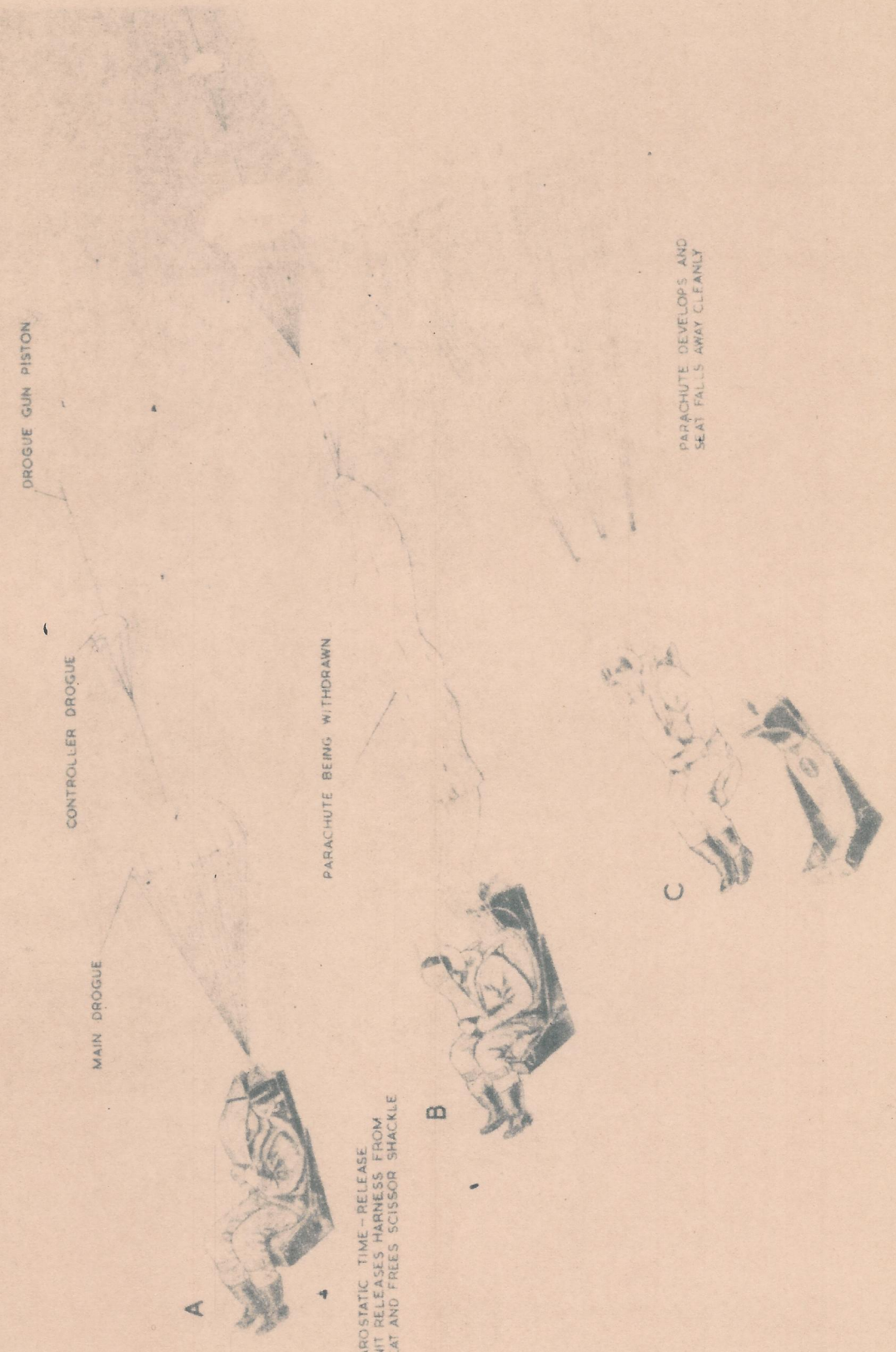

FIG.4. AUTOMATIC SEPARATION FROM THE SEAT AFTER EJECTION (MK.4 SERIES SEATS)