PART 2: SECTION 5

CHAPTER 3

RADAR ALTIMETER—S.C.R. 718A

Purpose

1. The S.C.R. 718A gives a true measurement of height above terrain at heights from zero to 25,000 feet. It is particularly useful in bombing and in the pressure pattern technique of navigation.

Implementation

2. The height is obtained by measuring the time of travel of a radio pulse from the aircraft to the ground beneath it and back to the aircraft.

Construction

3. Constructional details are given in A.P. 2533.

Limitations

4. **Accuracy.** The maximum error at any given height is 50 feet plus $\frac{1}{4}$ per cent. of the height above the surface of the ground or water beneath the aircraft. Thus at zero feet the error is 50 feet or less, and at 25,000 feet the error is 112$\frac{1}{2}$ feet or less. The strongest reflected pulse, which is that from directly beneath the aircraft, reaches the receiver first and is the one selected by the navigator for reading. Thus there is no possibility of error through measuring slant height.

5. **Range.** Above 25,000 feet the insulation afforded by the atmosphere breaks down and the equipment is not fully effective, but indications received are still accurate to the degree stated in para. 4. Above 45,000 feet the insulation of the atmosphere breaks down to such an extent that operation of the set would probably result in serious damage. The practical minimum height of operation is 300 feet.

6. The instrument operates satisfactorily in all weather conditions.

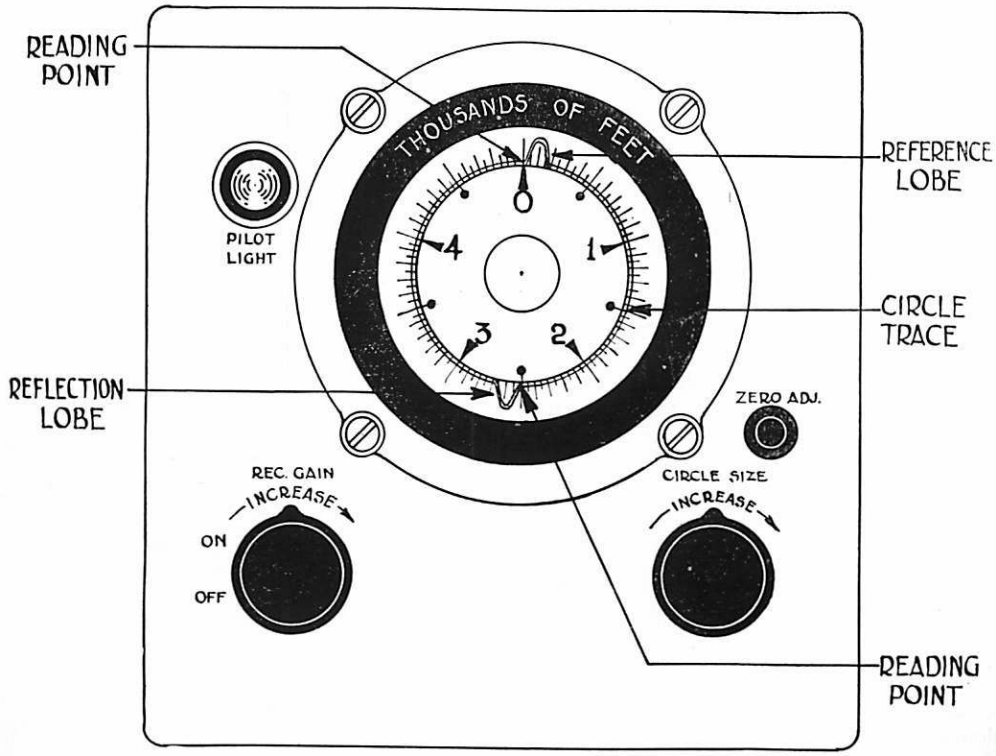

Fig. 1. Indicator for S.C.R. 718A Radar Altimeter.

OPERATION

Switching On

7. The S.C.R. 718A is switched on as follows :—

(*a*) Switch on the voltage control panel (V.C.P.).

(*b*) Turn the receiver gain control (REC. GAIN) clockwise until the pilot lamp lights up.

(*c*) Adjust the circle size control so that the green circle is just visible at the outer edge of the calibrated scale.

(*d*) Adjust the receiver gain control so that the lobe or lobes are about ¼ inch in size.

8. If the equipment is switched on before take-off, use the zero adjustment to position the reflection blip exactly at zero as the aircraft is on the point of becoming airborne. If the equipment is to be used as a low-altitude clearance indicator *do not touch this control again.*

9. If the adjustment detailed in para. 8 is not made at take-off, it may be made in flight. It is important to remember that in this instance the instrument may be inaccurate at low level. Do not use it as a low-level terrain clearance indicator under these conditions.

Reading the Indicator

10. As the aircraft leaves the ground, only the reflection lobe will be visible. This lobe will move clockwise around the time base as height is increased and will decrease in amplitude (size). It should be maintained at an amplitude of ¼ inch by operation of the receiver gain control.

11. Height above ground is read off from this lobe. Readings should be taken against the leading edge of the lobe (Fig. 1). Because the time base is formed by a clockwise rotation of the electron beam the leading edge of the lobe is the anti-clockwise edge. The reading will be correct at all heights only if the zero adjustment is made at take-off.

12. As height is increased further and the receiver gain control still further advanced to maintain the reflection lobe at the desired amplitude, a second lobe (reference lobe) will appear at or about zero. This is the transmitted lobe which has been invisible until now because of the screening between the aerials and the small amount of receiver gain employed. This lobe will remain in approximately the same position throughout flight.

13. When the two lobes are present, *i.e.* at levels higher than about 300 feet, the altitude is read off :—

(*a*) If the leading edge of the reference lobe is at zero, by reading the leading edge of the reflection lobe.

(*b*) If the transmitter or reference lobe is not at zero, and if the equipment is being used for low-level terrain clearance, by reading the leading edge of each lobe. To the reading of the reflection lobe add that of the reference lobe if its leading edge is to the left of zero and subtract if it is to the right.

(*c*) If the equipment is not being used as a low-level terrain clearance indicator, by setting the leading edge of the reference lobe to zero by the zero adjustment control and reading off the altitude against the leading edge of the reflection lobe.

14. A more accurate reading will be obtained by resetting the receiver gain so that both pulses are ¼ inch in amplitude at the time of their respective readings.

15. The instrument is calibrated in 50-feet steps, and, because of the small size of the indicator dial, interpolation can only be made to an accuracy of 25 feet.

Reading the Indicator at Altitudes Above 5,000 Feet

16. As height increases beyond 5,000 feet, the reflection lobe will begin a *second* circuit of the time base and will continue circling the time base as height is further increased, *e.g.* at 25,000 feet five circuits will have been completed.

17. Height may be read off by counting the number of complete circuits, multiplying by 5,000, and then adding the current reading of the reflected blip, but this method is inconvenient and subject to error. It is more practical to resolve the ambiguity by reference to the pressure altimeter and a contour chart of the underlying terrain. For example :—

Reflection lobe reads	2,825 feet
Pressure altimeter reads... ...	17,200 feet
Approximate contour	500 feet
Therefore approximate height above terrain is	16,700 feet
Therefore true height above terrain is	17,825 feet

Reading the Indicator at 5,000 Feet and Multiples Thereof

18. At heights of 5,000 feet and multiples thereof the two lobes become superimposed one upon the other and it is not possible to obtain an accurate reading owing to an inherent 250-feet wide blind spot.

19. A solution to this difficulty is to change height by 300 feet by the pressure altimeter, take a reading, and then return to the original height. By adding or subtracting the 300-feet change from the reading of the radar altimeter, a fairly accurate indication of height is obtained.

20. Operation of the zero adjustment control does not reduce the blind spot. Both pulses move when this control is operated, but still intermingle for 250 feet.

Use for Low-Level Terrain Clearance Indication

21. The S.C.R. 718A should only be used for low-level terrain clearance indication when the Mk. 5 or A.Y.F. low-level radio altimeters are unavailable.

22. The inherent accuracy of the S.C.R. 718A is 50 feet. Pulse width is 250 feet, and, although a certain amount of screening of the receiver aerial from the transmitter aerial is effected, the reference lobe often appears at heights of less than 250 feet.

23. This means that the lower safe limit of the equipment is 300 feet, and care should be taken not to approach closer to underlying terrain than this height.

Fault Finding

24. The serviceability of the S.C.R. 718A is high (95 per cent.) and few faults should be encountered in operation.

25. If the equipment ceases to operate in the air the following checks should be made :—

(*a*) Check the aircraft fuse.

(*b*) Check the fuse on the transmitter/receiver.

(*c*) Check the voltage control panel fuse.

(*d*) Check the security of the power leads and the interconnecting leads between the transmitter/receiver, indicator, and aerials.

26. If, on switching on, the pilot lamp fails to light, check :—

(*a*) The pilot lamp bulb.

(*b*) Items (*a*) to (*c*) in para. 25.

27. If the time base is oval in shape instead of circular, the instrument will not read accurately and the equipment should be reported as unserviceable.

SECURITY AND JAMMING

28. The radio frequency of the transmitted pulses is 440 mc/s ; therefore the range at which these transmissions may be detected by an enemy is limited to optical range. The presence of an aircraft could be detected from its S.C.R. 718A transmissions, but homing onto the transmissions is virtually impossible.

29. Two methods of jamming are available to an enemy.

(*a*) *C.W. Jamming.* This distorts the time base but, unless the jamming equipment is very powerful, height can still be assessed quite accurately.

(*b*) *Jamming with False Pulses.* There are two ways in which this can be done. The first is technically very difficult, but if successful, causes the true lobe to be replaced by a large false lobe which is immediately apparent as being false. The second method is comparatively easy to accomplish, and in this the true lobe is surrounded by a group of false lobes from which it cannot be identified.