QUICK FIRING 18 PDR MK. I

This gun, introduced into service during 1904, replaced the Quick Firing 15 pdr. A mainstay of the Royal Field Artillery, some 8,000 were built in Great Britain. With a range of 6,525 yards and firing either shrapnel shells, high explosive or smoke producing ammunition, it was a very versatile piece of ordnance.

This gun was also built under licence and used by the Americans as a 75mm, to use the French ammunition of that calibre.

Trail

The trail was a steel tube of five inches outside diameter and one-quarter inch wall thickness.

A steel eye was secured to the rear end by countersunk rivets. Early eyes were fitted with a hardened steel insert, but later examples were case hardened. Angle steel brackets, riveted to the trail eye sleeve, carried a nickel steel spade. This was strengthened by a rear spade bracket. A lifting handle was riveted to the top of each spade bracket.

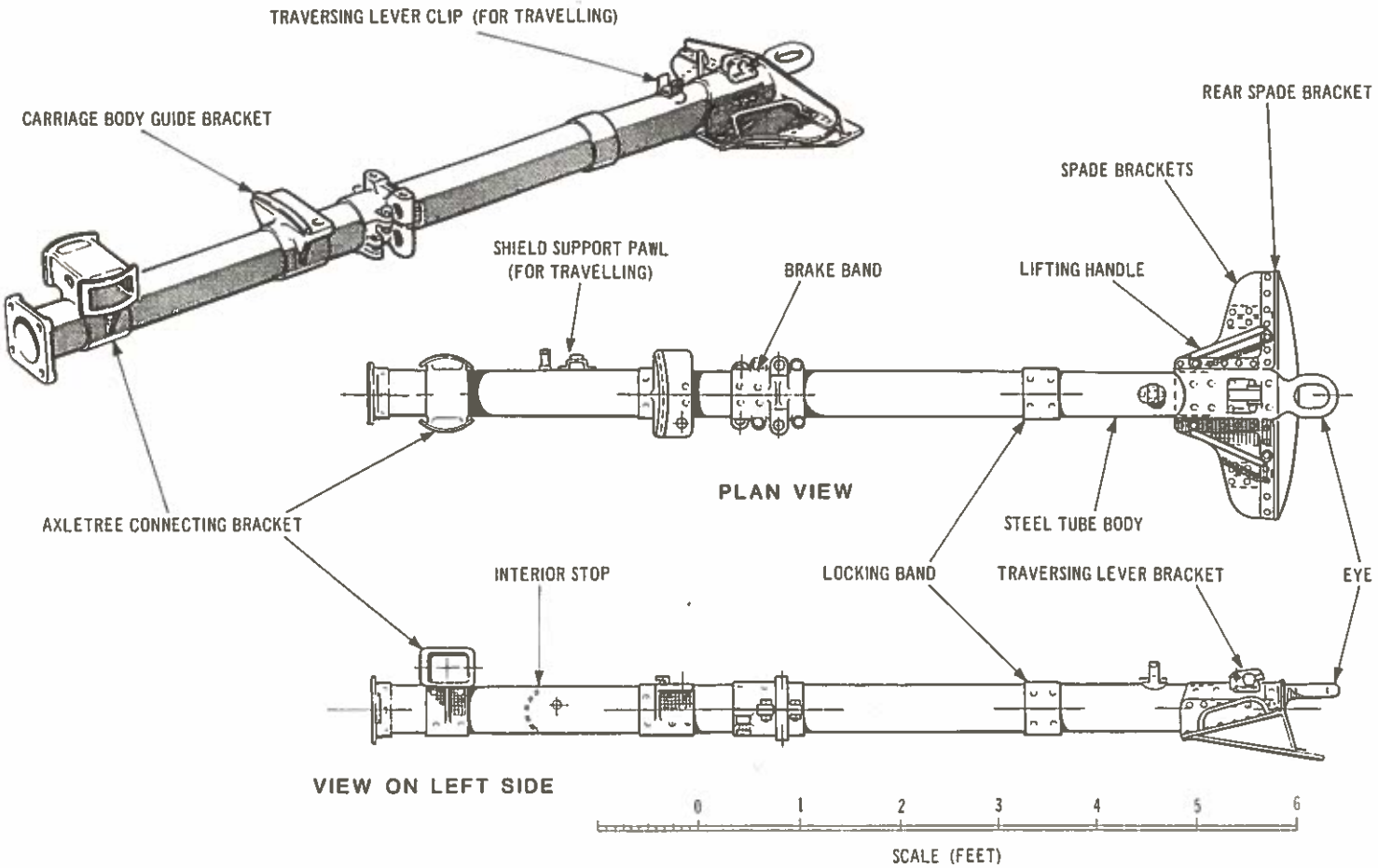
A traversing lever mounting bracket was riveted above the spade. For travelling, the traversing lever was folded over forward and retained by a spring clip. The steel locking band prevented damage being caused to the trail by the limber wheels when turning tightly.

Lugs, formed on the brake band, carried the brake arms and tensile stay rear ends.

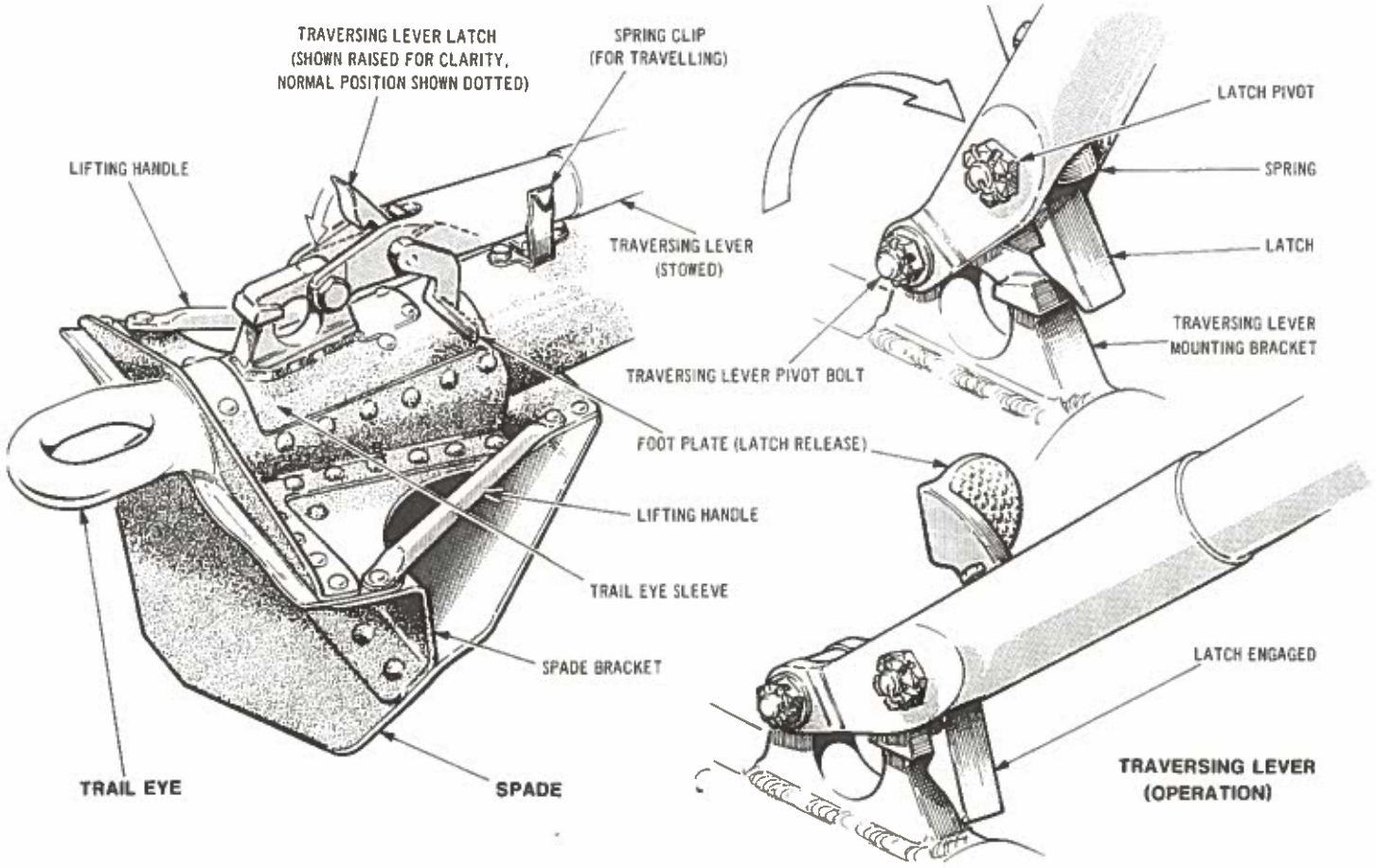
The carriage body guide bracket had, formed on the top surface, an undercut guide in which could slide the carriage body rear end. The left side of the bracket was drilled to house the traversing gear crosshead pivot. Forward of this, on the trail right side, was pivoted a spring pawl to support the shield lower, hinged half for travelling.

The axletree connecting bracket was a double loop. The upper loop was shaped to receive the axletree centre section, this being retained in the bracket by a tapered pin. At right-angles to the top loop was the lower loop, which encircled the trail and was secured to it by rivets.

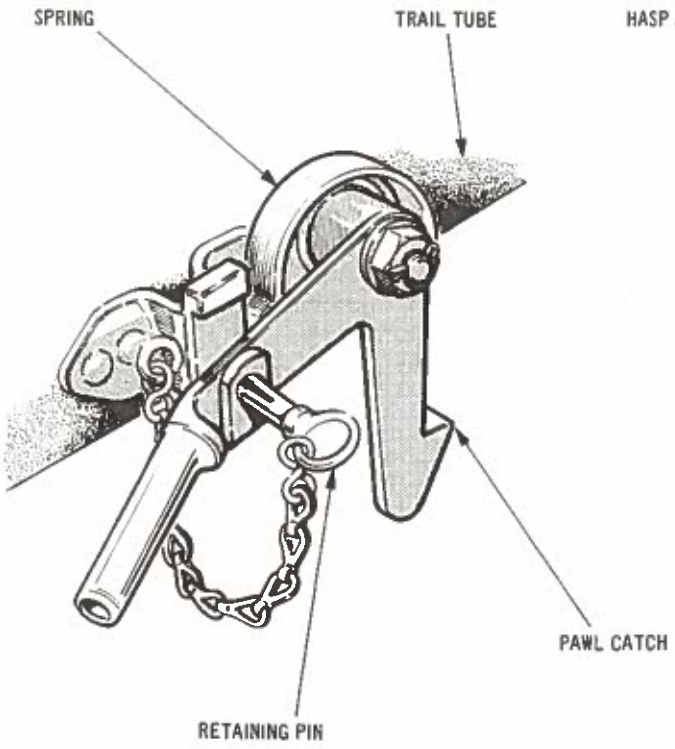
Inside the trail tube was secured a bulkhead, or stop. This formed a receptacle, some two feet in length, to house cleaners. It was closed by a hinged lid on a flanged frame riveted to the front end of the trail tube. The lid was secured by a hasp and turnbuckle. The shield was bolted to the frame flange.


TRAVERSING LEVER CLIP (FOR TRAVELLING)
CARRIAGE BODY GUIDE BRACKET
REAR SPADE BRACKET
SPADE BRACKETS
SHIELD SUPPORT PAWL (FOR TRAVELLING)
BRAKE BAND
LIFTING HANDLE
PLAN VIEW
AXLETREE CONNECTING BRACKET
STEEL TUBE BODY
INTERIOR STOP
LOCKING BAND
TRAVERSING LEVER BRACKET
EYE
VIEW ON LEFT SIDE
0 1 2 3 4 5 6
SCALE (FEET)

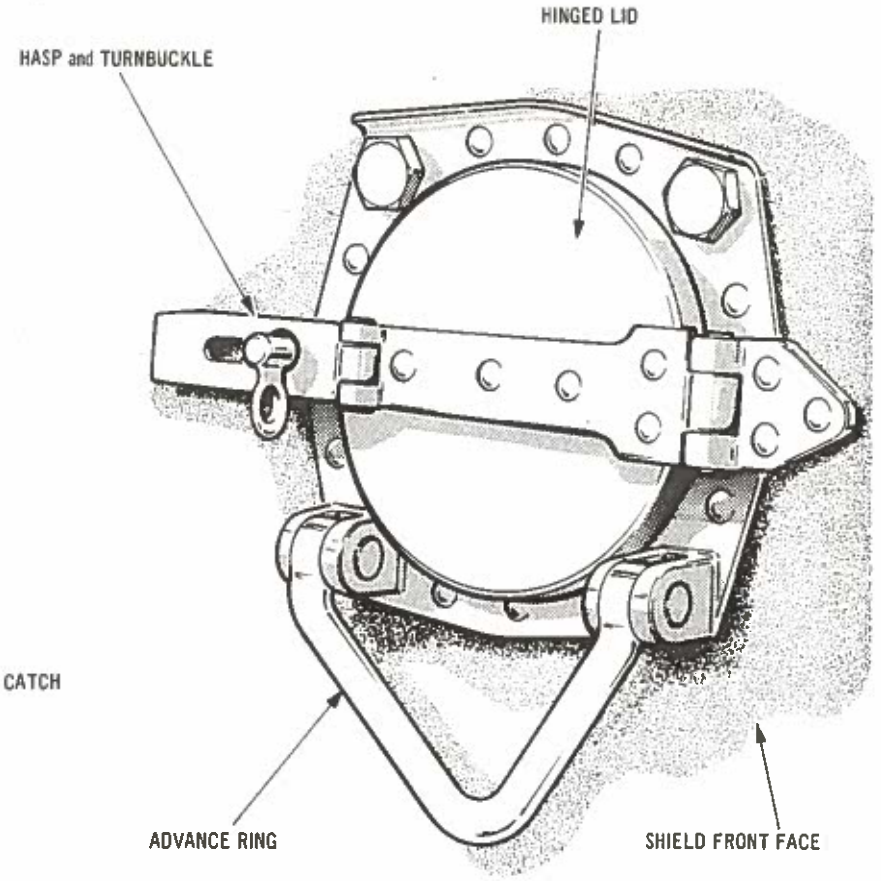
TRAIL



TRAIL EYE, SPADE AND TRAVERSING LEVER

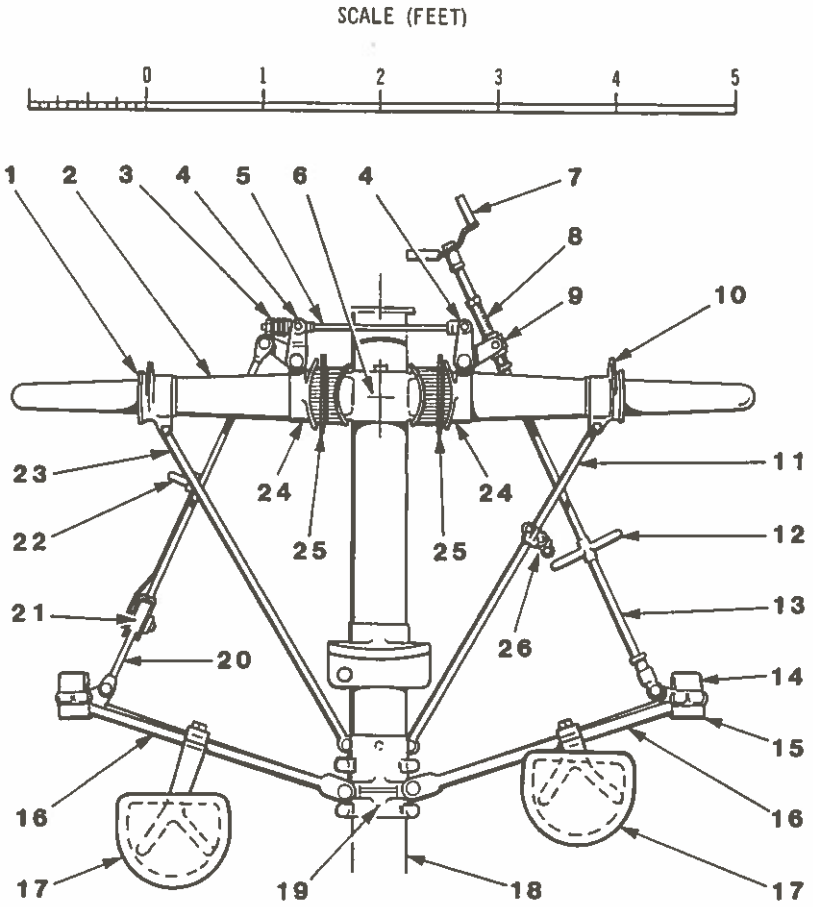


SHIELD SUPPORT PAWL



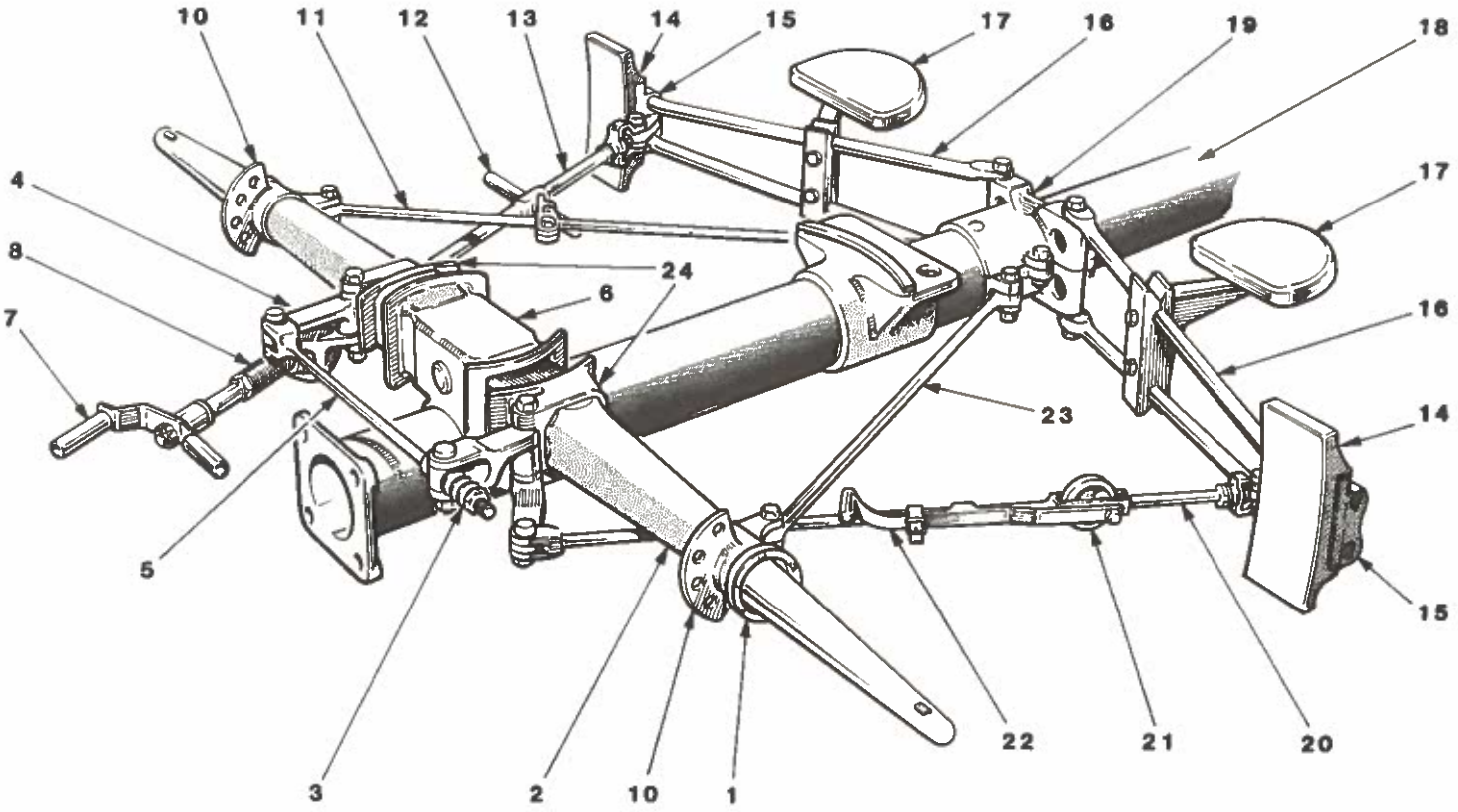
SHIELD SUPPORT PAWL AND TRAIL FRONT LID

PLAN VIEW



1 AXLETREE BRACKET
2 AXLETREE
3 DISC SPRINGS
4 BRAKE BELL-CRANK LEVER
5 BRAKE CONNECTING ROD
6 AXLETREE CONNECTING BRACKET
7 BRAKE HANDLE
8 THREAD (LEFT-HAND, SQUARE SECTION)
9 NUT
10 SHIELD STAY MOUNTING FLANGE
11 TENSILE STAY (RIGHT-HAND)
12 BRAKE CROSS-HANDLE
13 BRAKE RIGHT-HAND ACTUATING ROD
14 BRAKE BLOCK
15 BRAKE SHOE
16 BRAKE SWINGING ARMS
17 SEAT
18 TRAIL TUBE BODY
19 TRAIL BRAKE BAND
20 BRAKE LEFT-HAND ACTUATING ROD
21 BRAKE QUICK-RELEASE ECCENTRIC
22 QUICK-RELEASE OPERATING LEVER
23 TENSILE STAY (LEFT-HAND)
24 AXLETREE FLANGE
25 CARRIAGE BODY SUPPORT BEARINGS
26 FUZE INDICATOR MOUNTING BRACKET

AXLETREE AND SWINGING ARM BRAKE



AXLETREE AND SWINGING ARM BRAKE

Axletree and swinging arm brake

The axletree (2) was a hollow steel forging, with ends drawn down and tapered to 13.5 inches long forming 2nd class C pattern arms, these to carry 2nd class C pattern No. 45 wheels, 4 feet 8 inches in diameter. The shoulders were circular and had keyways cut to receive keys formed within the axletree bracket bores (1).

Each bracket (1) had a circular recess fitted with an L leather seal retained by a steel ring, to avoid contamination of the pipebox grease by grit and dust. The brackets (1) were formed externally with tensile stay (11 and 23) attachment lugs and mounting flanges (10) for the shield support stays.

The axletree centre portion (2) fitted into the trail connecting bracket (6) top loop and was retained by a tapered pin.

Spaced three inches outboard from the connecting bracket (6) on each side was an axletree flange (24), secured by a tapered pin. The spaces were to accommodate the carriage body support bearings (25). The connecting bracket outer flanges (6) and each axletree flange inner flange (24) were curved to allow the carriage body bearings (25) to slide between them when being traversed. Both axletree flanges (24) had lugs formed to carry the pivot pins of the brake bell-crank levers (4).

The axletree (2) was braced by tensile stays (11 and 23). At the rear these were secured to the trail brake band (19) front lugs and at the front to the axletree brackets (1). The bolt heads were grooved to form bearings for a lifting jack.

A bracket (26), to support a fuze indicator, was clipped by screws to the right-hand tensile stay (11) and incorporated a hinge to allow the fuze indicator to be secured in an upright position.

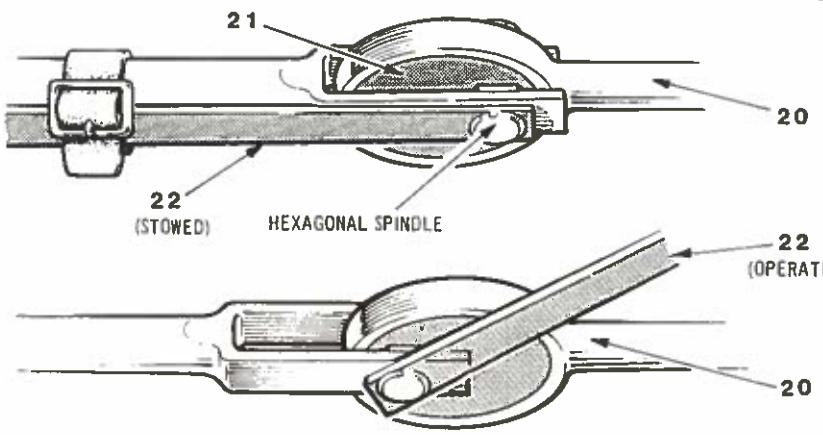
The swinging arm brake comprised four tubular steel brake arms (16), pivoted in pairs on each side of the brake band (19) at their inner ends. Each pair terminated in a steel brake shoe (15) at their outer ends, the brake shoe fitted with a cast iron brake block (14) which acted against the wheel tyre.

The brake right-hand actuating rod (13) carried a handle (7) at the forward end and a cross handle (12) behind the shield to enable brake operation from either end. Turning the handle (7) caused the threaded rod (8) to travel forward through a nut (9), formed with trunnions and mounted in the forked end of a rocking bell-crank lever (4), until the right brake block (14) contacted the wheel. Subsequent turning of the handle (7) caused the bell-crank lever (4) to draw the left-hand actuating rod (20) forward until the left brake block contacted the wheel. Four disc springs (3) were fitted at the left-hand bell-crank lever end of the steel connecting rod (5).

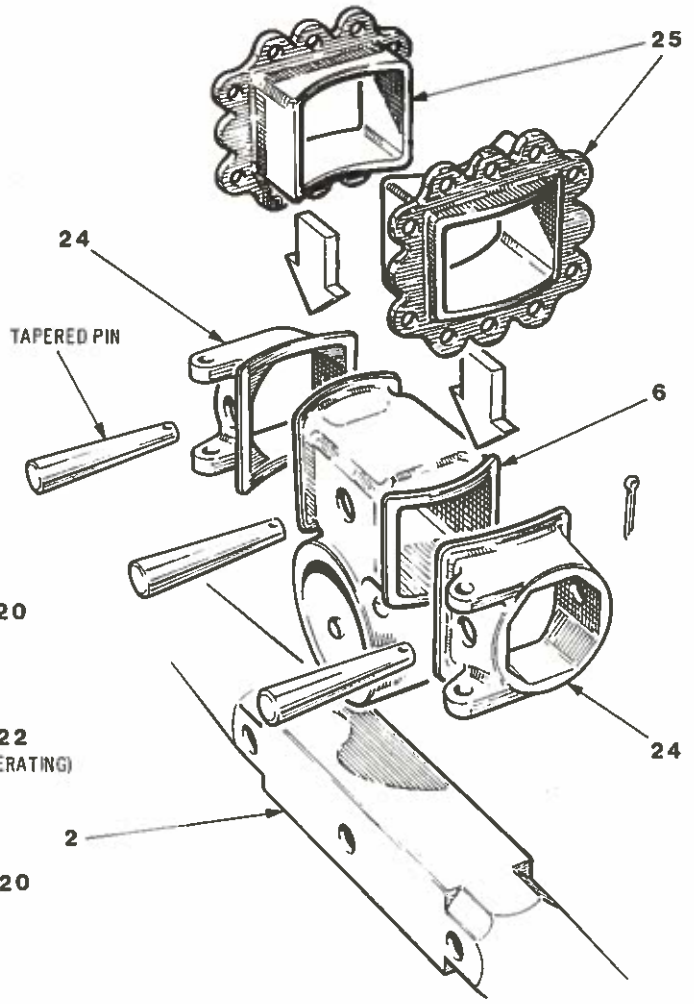
Forming part of the left-hand actuating rod (20) was a quick-release eccentric (21) and operating lever (22). For normal use the lever (22) was housed in the forward position and secured by a strap. In action, when small changes of position were required rapidly, without limbering up, the lever (22) would be swung to the rear, thus lengthening the left-hand actuating rod (20) by the amount of throw of the eccentric (21) and releasing the brake. Once the required movements were completed the lever (22) would be returned to the forward position, restoring the normal

brake action. A leather cover was provided to protect the eccentric from grit and dust.

Seats (**17**), for the use of the gun layers, were clamped to the brake arms (**16**).



BRAKE QUICK RELEASE OPERATION



Carriage body

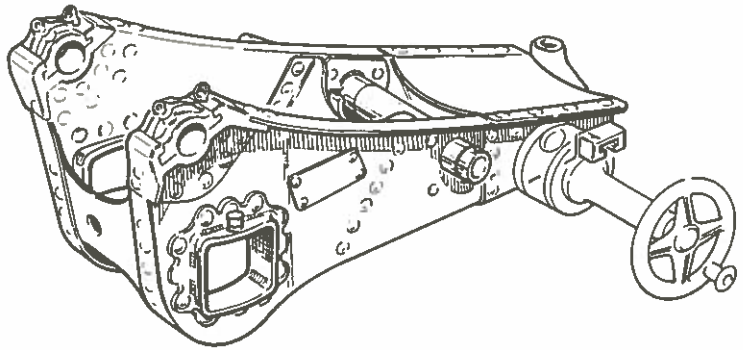
The carriage body consisted of two flanged, nickel steel side brackets or cheeks (**10**) connected by three transoms (**4, 6** and **7**). Riveted to each side bracket (**10**) was a cradle trunnion support bearing (**9**) of steel, fitted with sliding capsquares (**8**) and retaining pins.

Below each trunnion bearing (**9**) was a rectangular aperture, in which was secured a carriage body support bearing (**13**) of manganese bronze. The top of each bearing (**13**) was drilled and fitted with a lubricating cap (**11**).

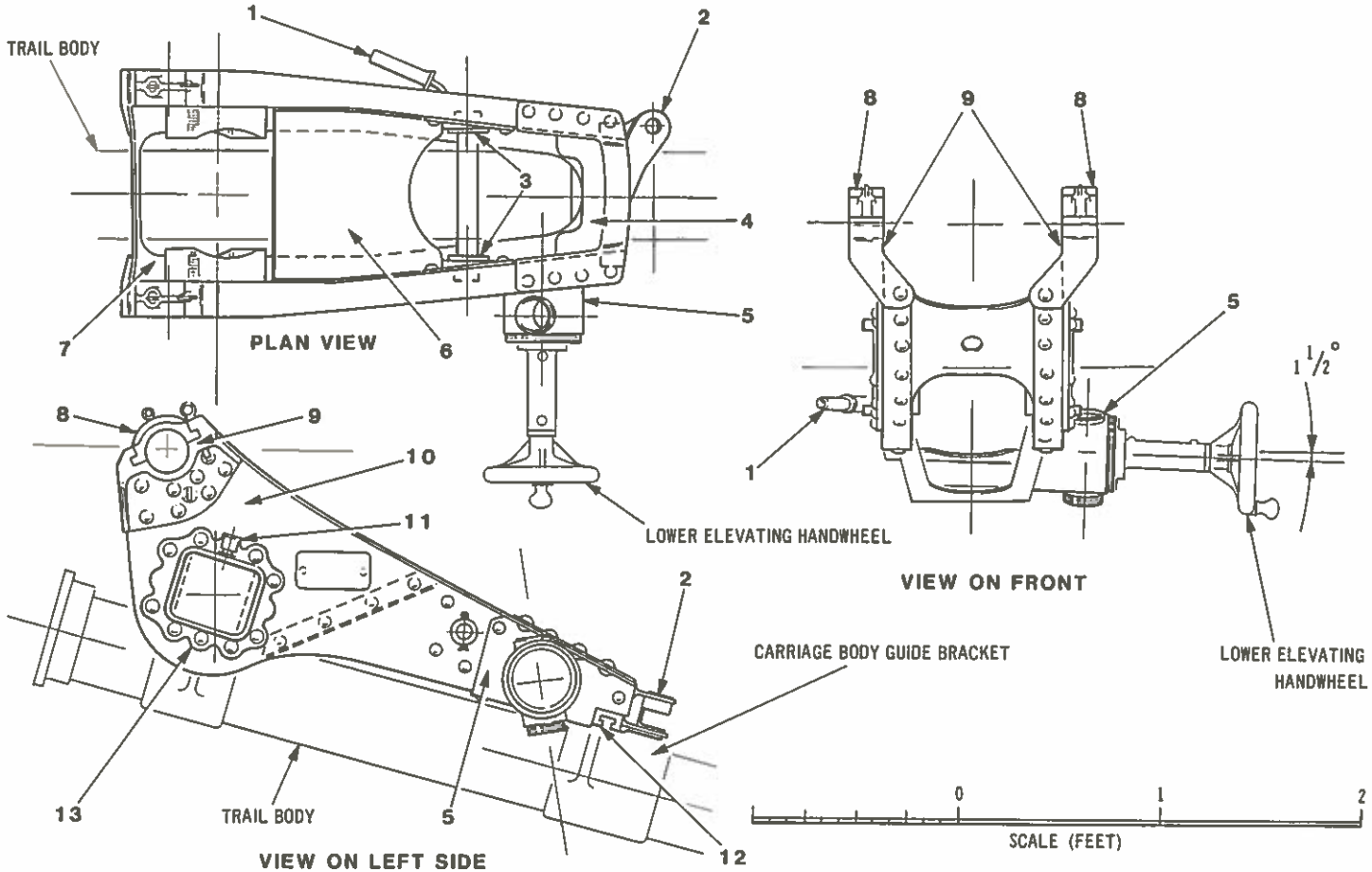
A manganese bronze traversing bracket (**12**) was riveted to the carriage body rear. The bracket (**12**) had, machined into the underside, an undercut groove which engaged the undercut guide on the trail carriage body support bracket. Excess wear at this point was remedied by sweating a brass strip onto the traversing bracket (**12**).

Riveted to the carriage body rear left side was a steel bracket (**5**), to house the elevating gear lower portion. Attached to the left side bracket (**10**) was a description plate, bearing details of the registered number and Mk. number of the carriage, manufacturer's initials and date.

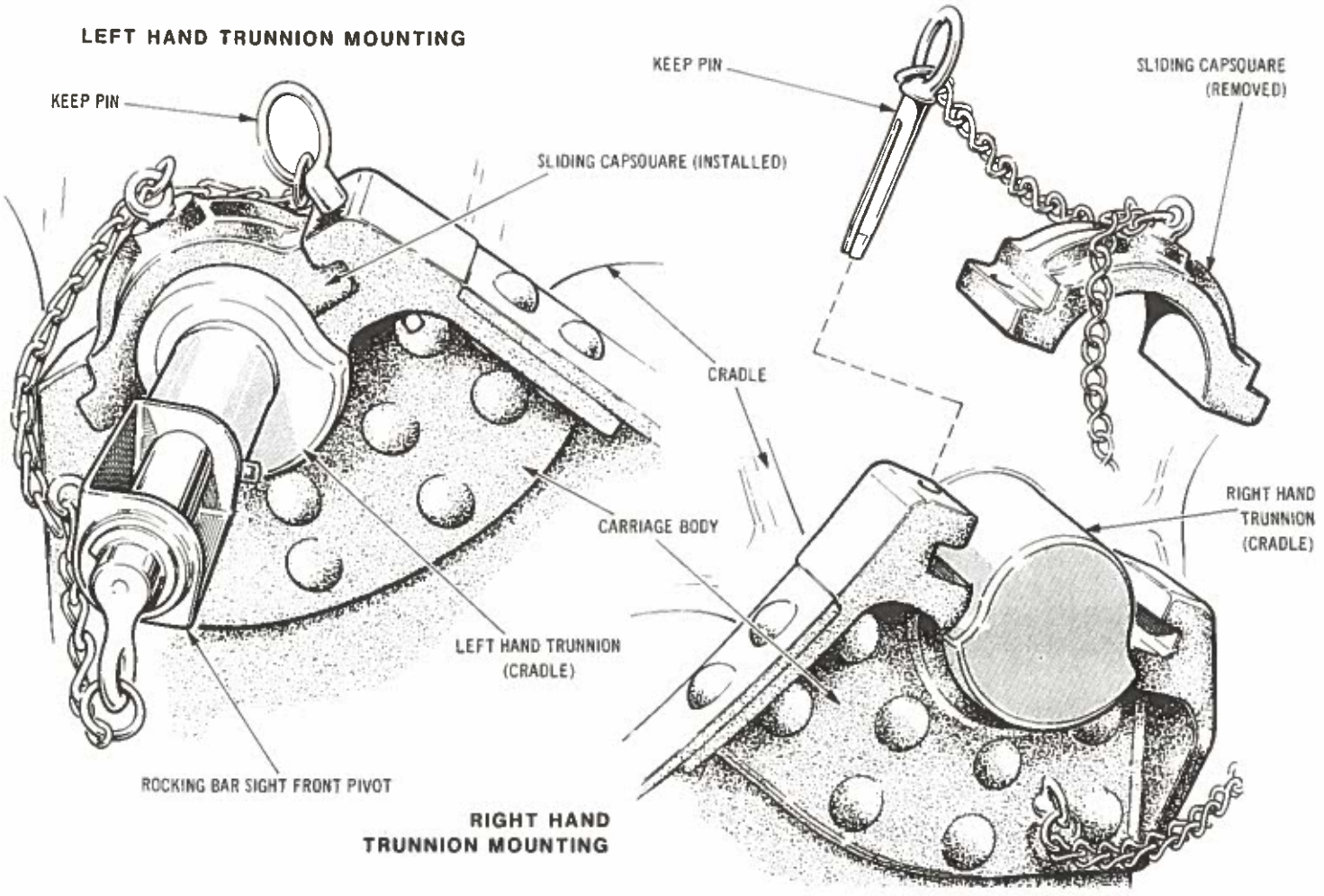
1 CRADLE CLAMPING GEAR HANDLE
2 TRAVERSING CROSSHEAD ATTACHMENT BRACKET
3 CRADLE CLAMPING CLUTCHES
4 REAR TRANSOM
5 ELEVATING GEAR LOWER SUPPORT BRACKET
6 CENTRE TRANSOM
7 FRONT TRANSOM
8 SLIDING CAPSQUARE
9 TRUNNION BEARING
10 SIDE BRACKET
11 LUBRICATING CAP
12 TRAVERSING BRACKET
13 SUPPORT BEARING



CARRIAGE BODY



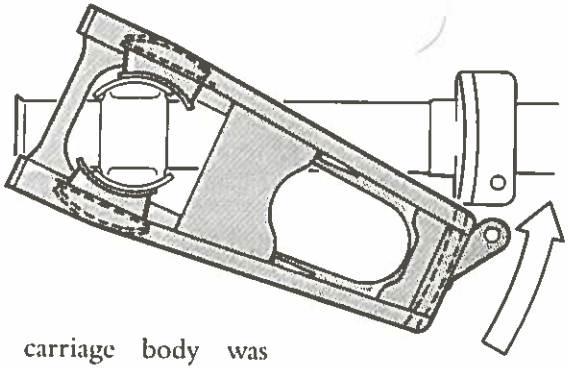
CARRIAGE BODY



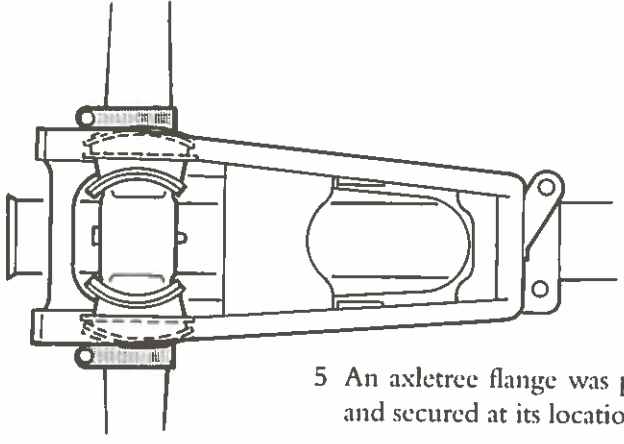
TRUNNION MOUNTINGS

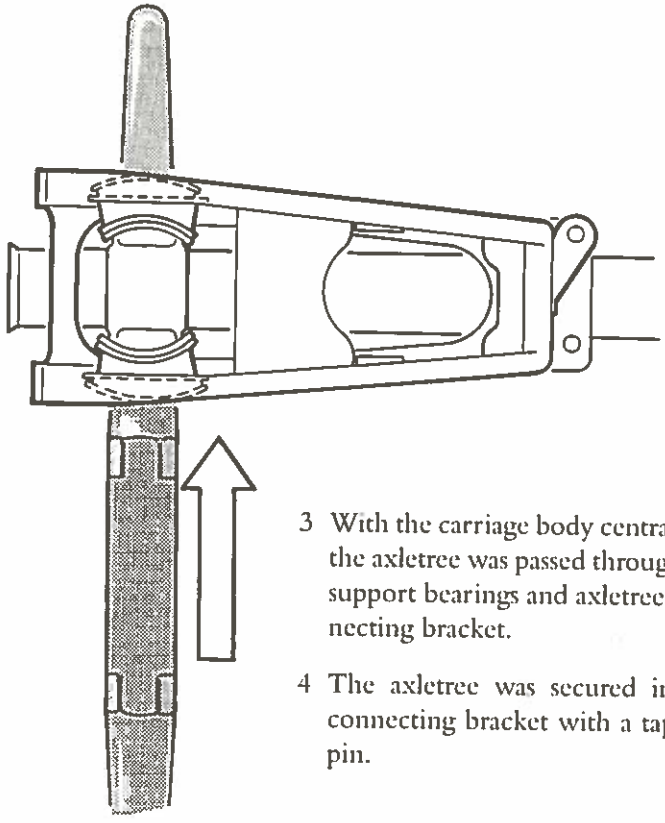
PLAN VIEWS

1 The carriage body was placed over the axletree connecting bracket (trail).



2 The carriage body was swung sideways to engage the traversing bracket with the trail carriage body guide bracket.





3 With the carriage body centralised, the axletree was passed through the support bearings and axletree connecting bracket.

4 The axletree was secured in the connecting bracket with a tapered pin.

5 An axletree flange was passed over each arm of the axletree and secured at its location with a tapered pin.

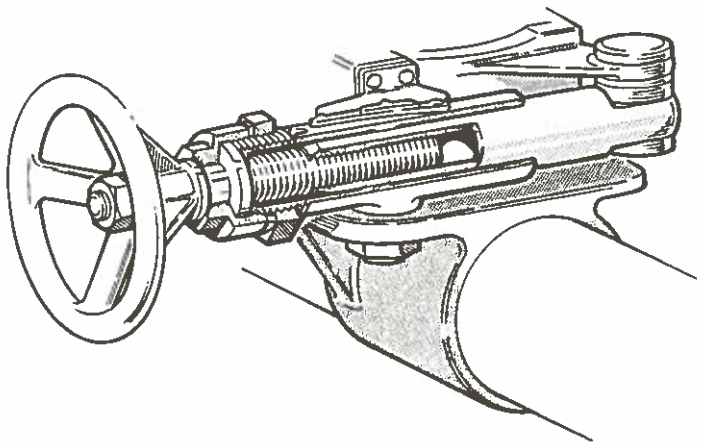
ASSEMBLY OF TRAIL, CARRIAGE BODY AND AXLETREE

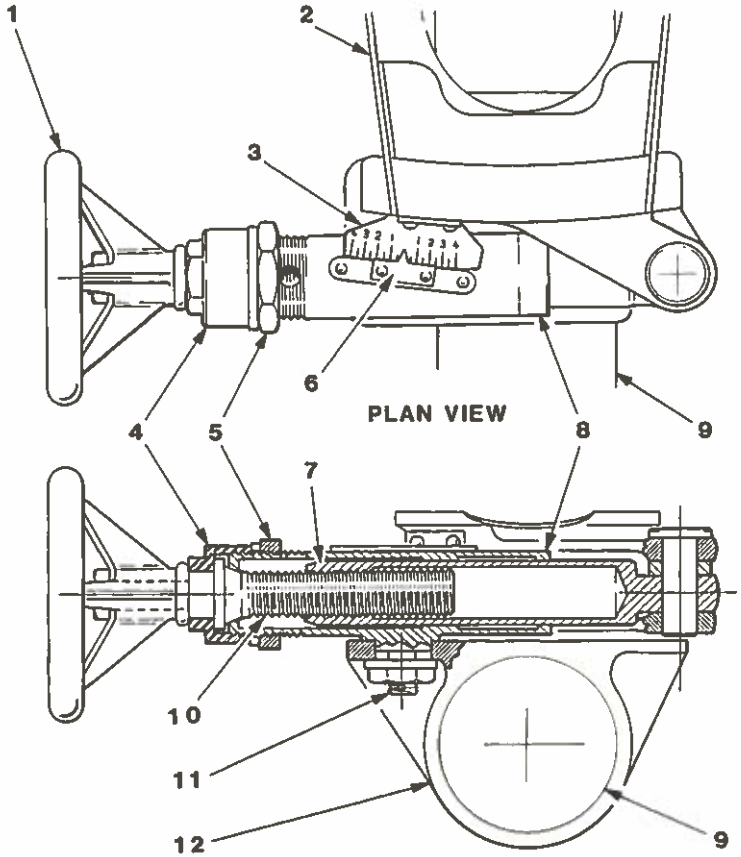
Traversing gear

The traversing gear enabled lateral movement of the carriage body over four degrees either side of the trail centre line. The crosshead (8) was a steel tube, pivoted to the traversing bracket (12) and secured by a washer, nut and split pin.

Sliding inside the body (8) was a manganese bronze nut (7) running on the traversing screw (10) and pinned at the right-hand end to the carriage body rear (2).

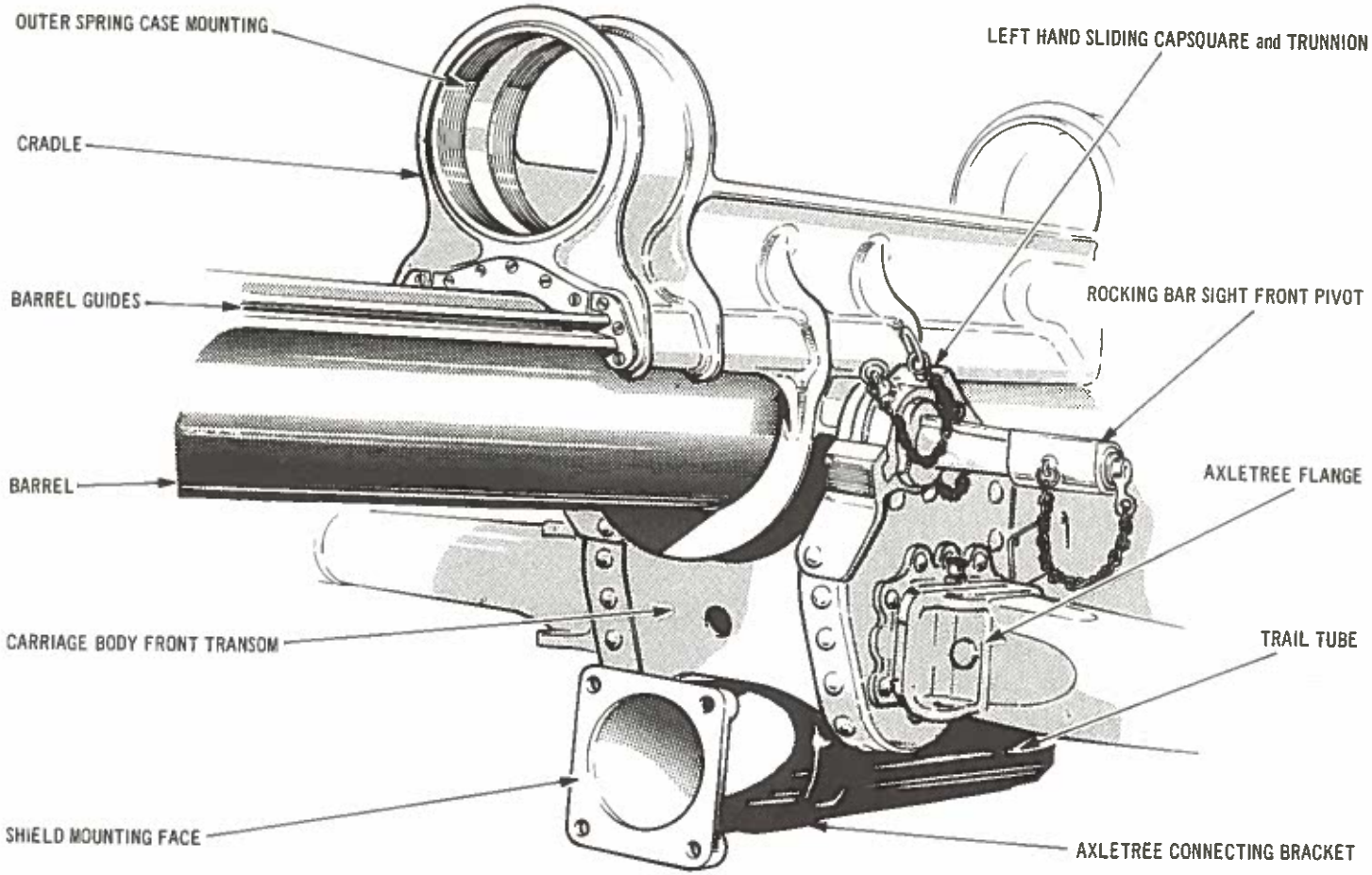
1 HANDWHEEL
2 CARRIAGE BODY
3 GRADUATED SCALE
4 SCREW CAP
5 STOP COLLAR (ADJUSTMENT)
6 POINTER
7 NUT
8 CROSSHEAD BODY
9 TRAIL BODY
10 TRAVERSING SCREW
11 CROSSHEAD PIVOT
12 TRAVERSING BRACKET





SECTION VIEW ON REAR

TRAVERSING GEAR



FRONT VIEW OF MAJOR ASSEMBLIES

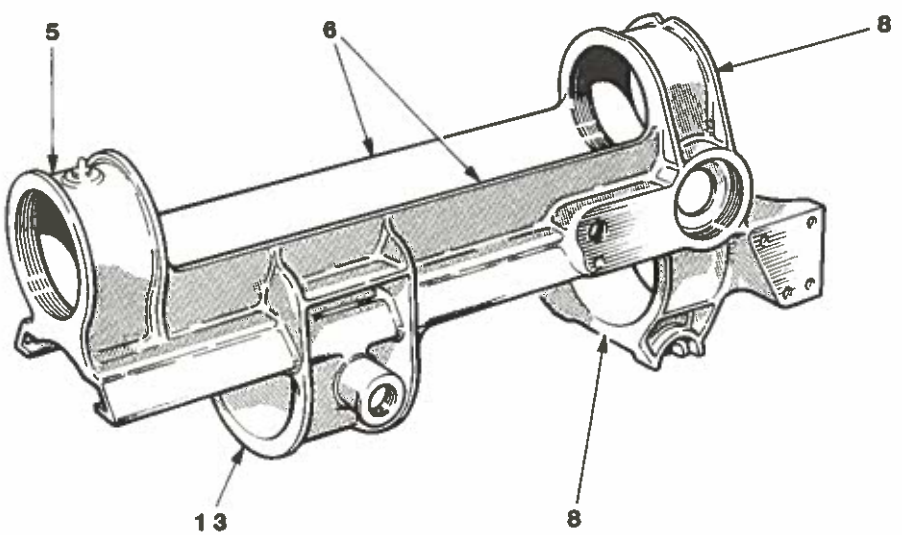
Cradle

The cradle was a one-piece, manganese bronze casting. It was formed by two single front collars (**5** and **13**) and a double rear collar (**8**), connected by two sides (**6**). The sides were formed with wedge-shaped grooves (**1**) to carry the barrel supporting wings. Both the front, upper, single collar (**5**) and the upper portion of the rear double collar (**8**) were screw-threaded, to receive the outer spring case.

Trunnions (**2** and **3**) formed on either side of the front, lower, single collar (**13**) had their axis inclined to an angle of one and a half degrees, left trunnion down (**3**), to compensate automatically for projectile drift at all elevations.

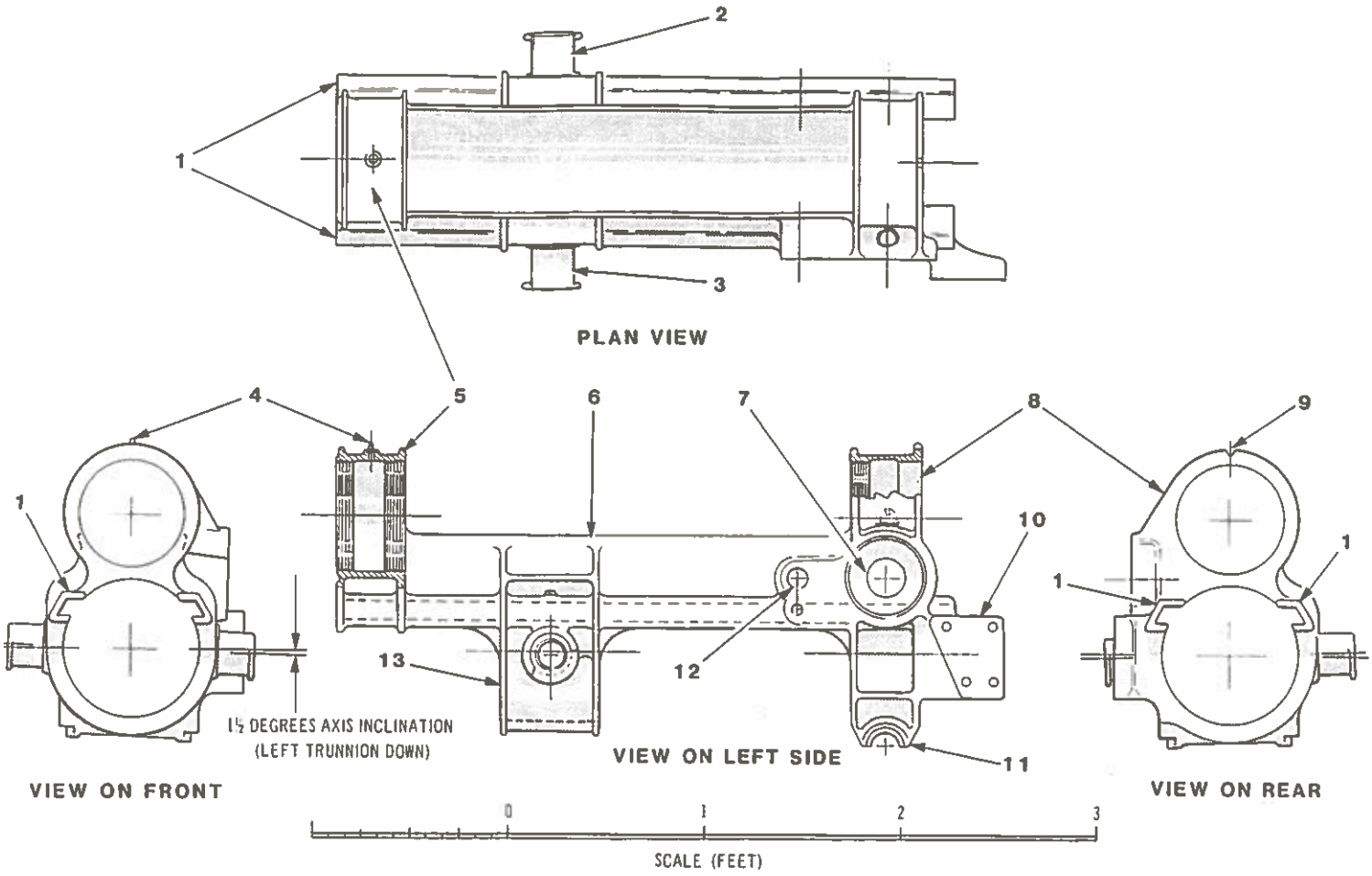
The left trunnion (**3**) was internally screw-threaded axially. On early patterns this thread received a steel arm pivoting the rocking bar sight, which was secured by a key and split pin. Later patterns had the steel arm replaced by a conical one which was secured to the cradle trunnion interior by a nut and split pin. To the outer end of the arm, a sight bar was secured by a nut and split pin.

Shaped brass protectors were fitted front and rear to the cradle and leather pads protected the guide grooves from the ingress of grit and dirt.

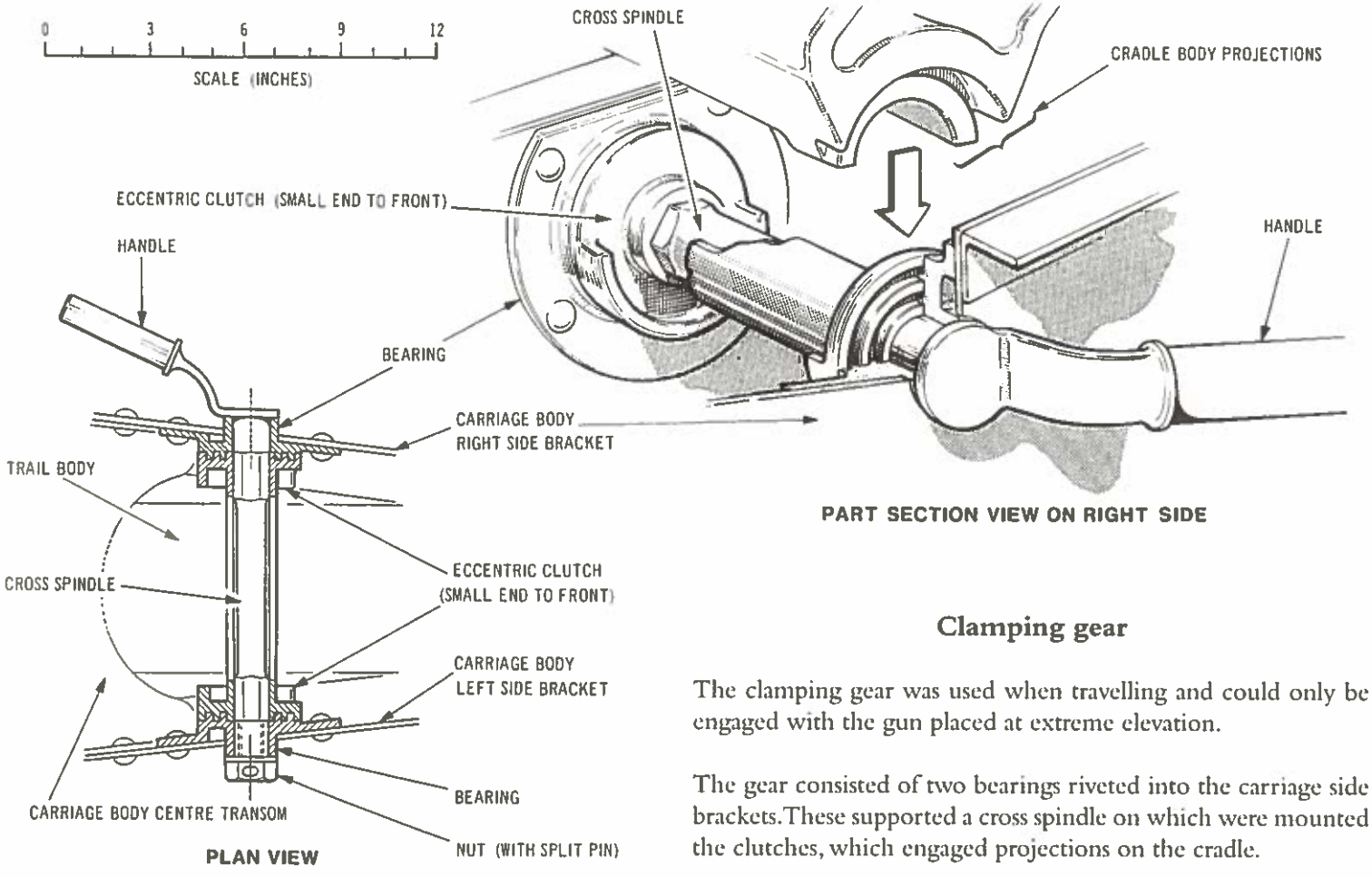


CRADLE

1 BARREL SUPPORTING WING GUIDE GROOVE
2 RIGHT SIDE TRUNNION
3 LEFT SIDE TRUNNION
4 ACORN FORESIGHT
5 UPPER SINGLE COLLAR (FRONT)
6 SIDES
7 ELEVATING GEAR CROSS SPINDLE LOCATION
8 DOUBLE COLLAR (REAR)
9 REARSIGHT NOTCH
10 LAYER'S GUARD MOUNTING FACE
11 CLAMPING PROJECTIONS
12 RANGE GEAR CROSS SPINDLE LOCATION
13 LOWER SINGLE COLLAR (FRONT)


1
2
3
PLAN VIEW
4
5
6
7
8
9
10
11
12
13
1½ DEGREES AXIS INCLINATION
(LEFT TRUNNION DOWN)
VIEW ON FRONT
VIEW ON LEFT SIDE
VIEW ON REAR
0
1
2
3
SCALE (FEET)

CRADLE

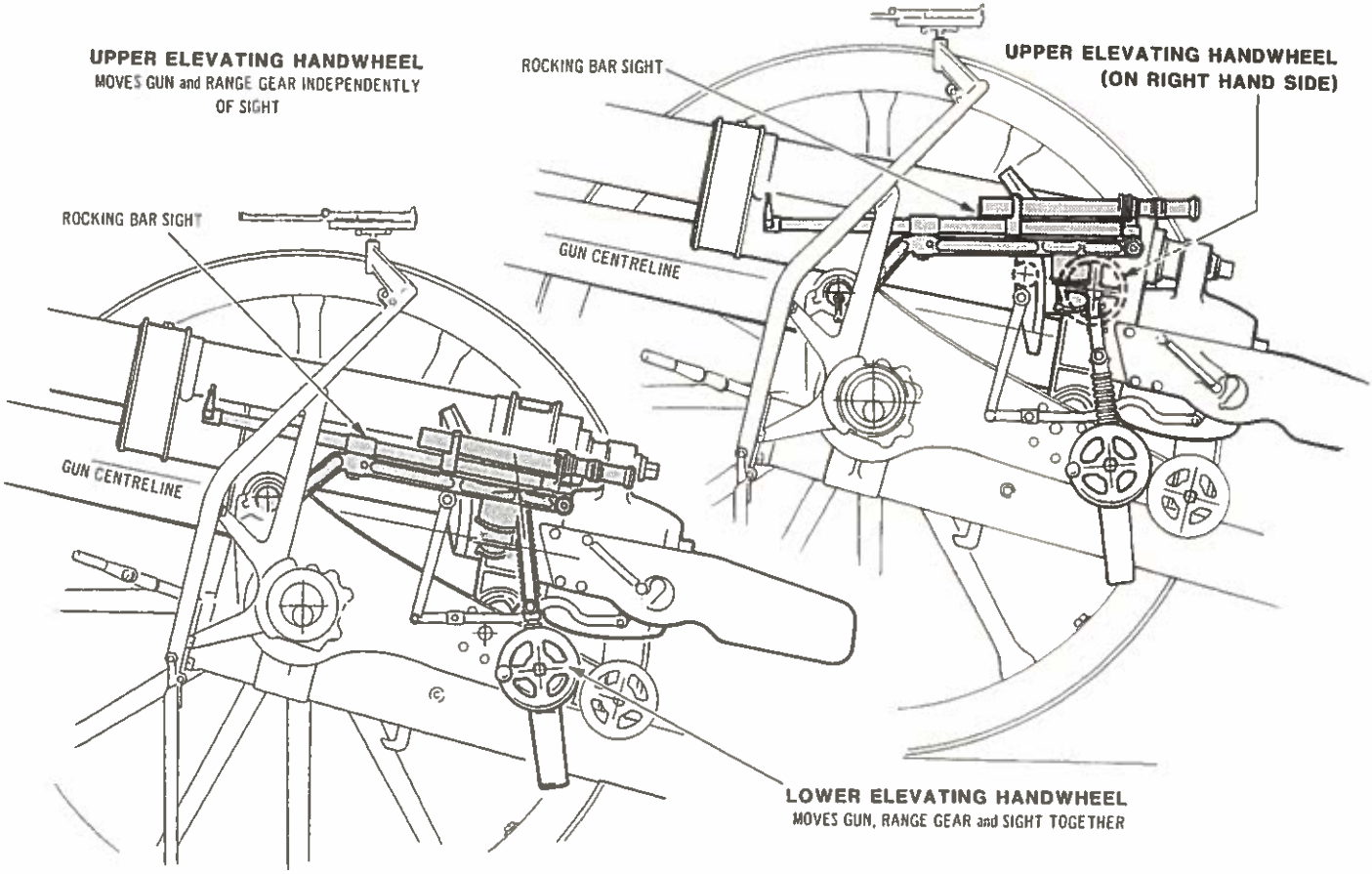


CRADLE CLAMPING GEAR

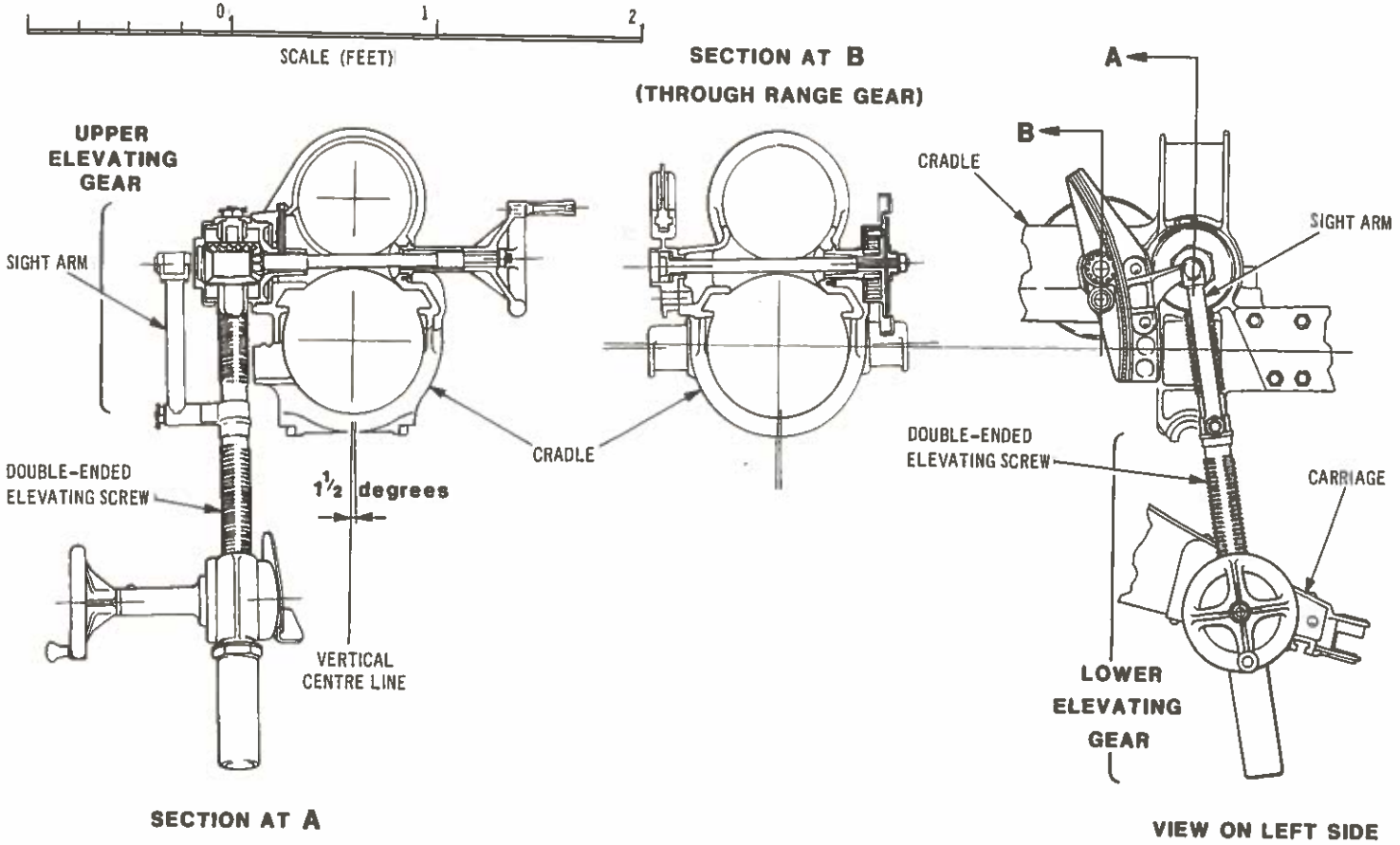
Clamping gear

The clamping gear was used when travelling and could only be engaged with the gun placed at extreme elevation.

The gear consisted of two bearings riveted into the carriage side brackets. These supported a cross spindle on which were mounted the clutches, which engaged projections on the cradle.



INDEPENDENT LINE OF SIGHT

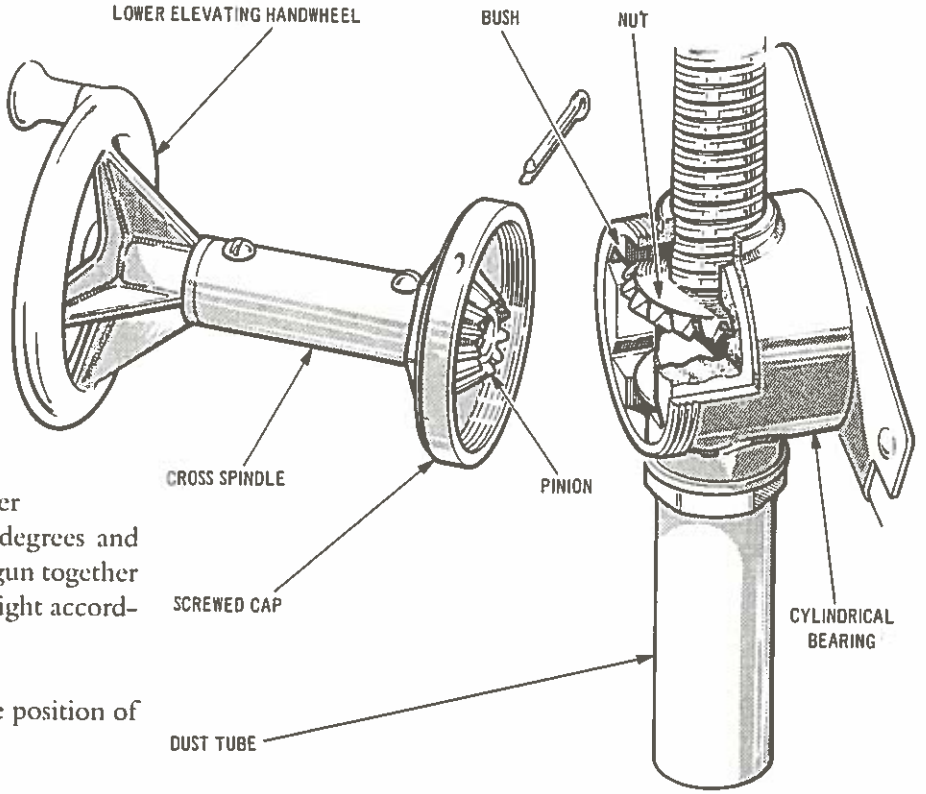


ELEVATING AND RANGE GEAR

Elevating and range gear

This equipment embodied the principle known as 'independent line of sight', in which the angle of sight adjustment (i.e. the angle between the line of sight and the horizontal) was separate from the angle of elevation adjustment (i.e. the angle between the axis of the gun and line of sight). The elevating gear was divided into upper and lower portions by means of a double-ended elevating screw, at the centre of which was attached an arm to carry the sight. The upper portion moved the gun relative to the line of sight and regulated the elevation angle to the range required. The angle of elevation applied by the upper elevating gear was measured by the range gear in degrees and yards. The lower portion moved the line of sight and gun together relative to the horizontal and regulated the angle of sight according to the line of fire being up or down hill.

By this method, alterations of range did not affect the position of the sight bar, only moving the gun relative to it.

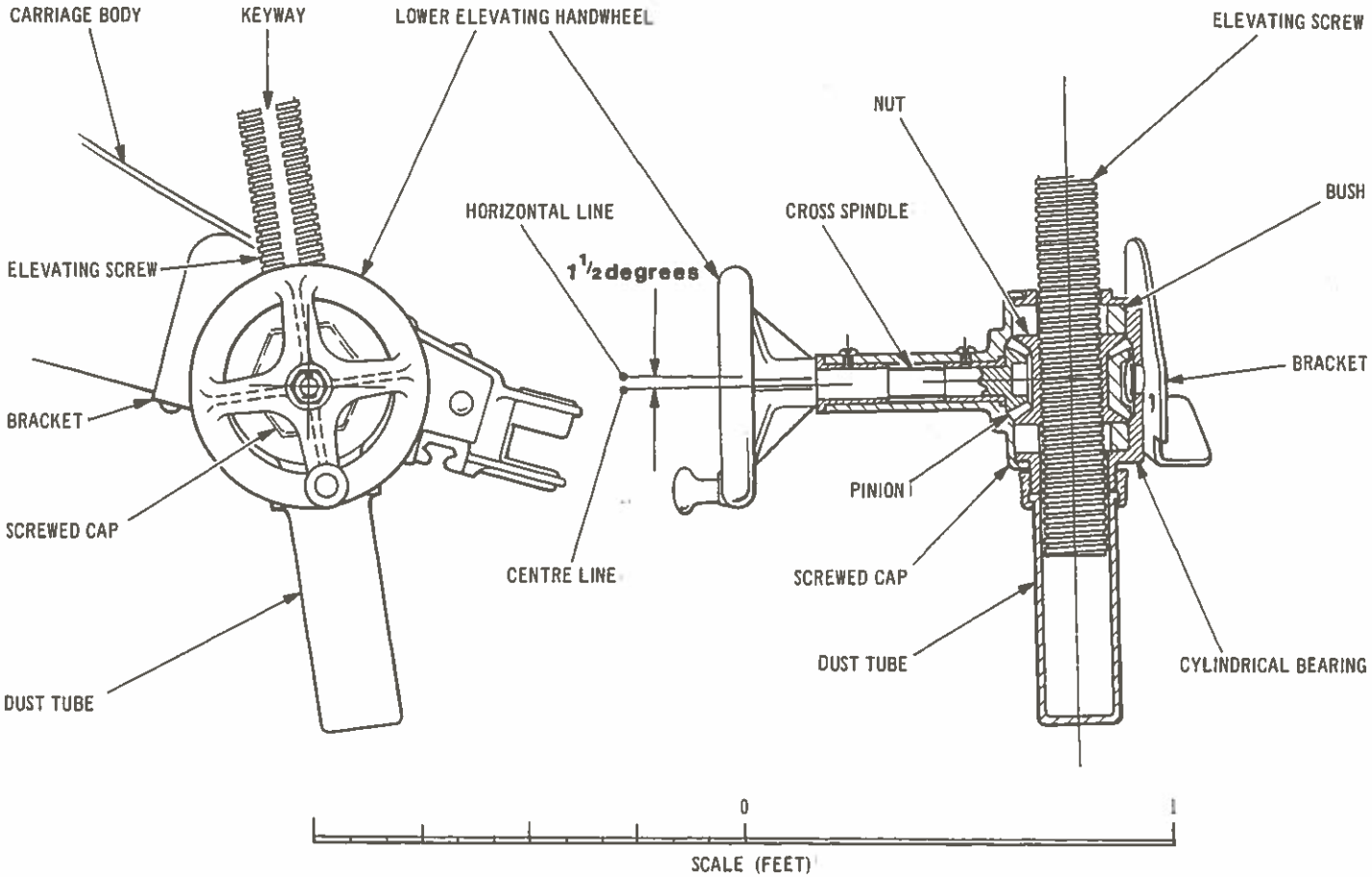


LOWER ELEVATING GEAR

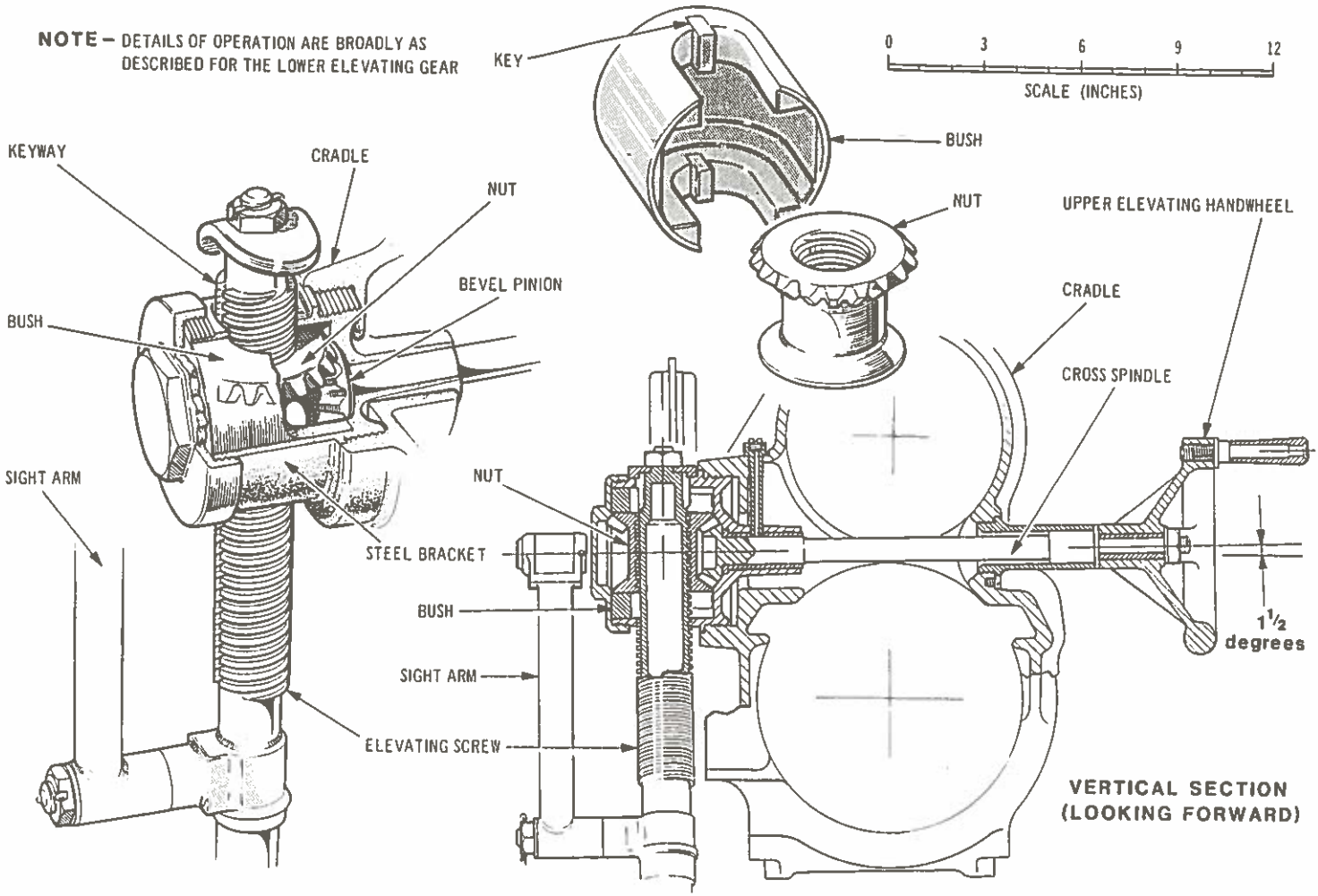
Lower elevating gear

The lower portion of the elevating gear consisted of a handwheel mounted on the outer end of a cross spindle, the inner end of which carried a pinion. The pinion engaged gear teeth formed on the exterior of a steel nut housed within a manganese bronze bush. The bush was carried in a cylindrical bearing riveted to the carriage body, the bearing being closed by a steel screwed cap locked with a split pin.

When the handwheel was turned, the nut turned and moved the elevating screw up or down, this moving the cradle and sight simultaneously.



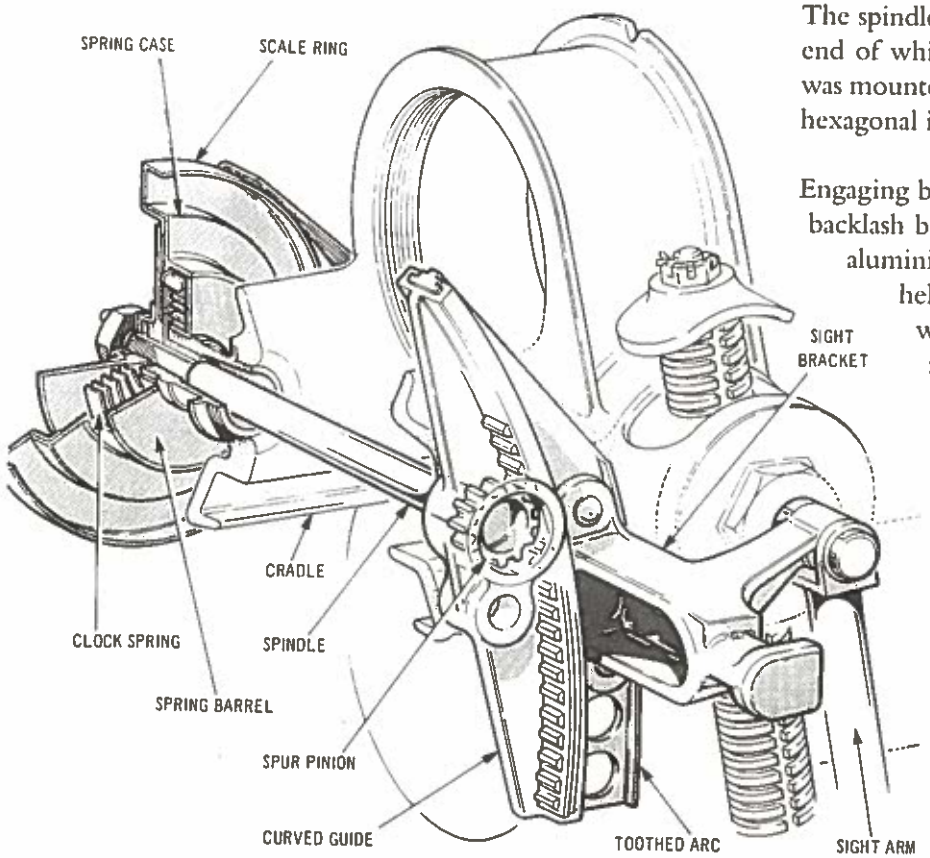
LOWER ELEVATING GEAR



UPPER ELEVATING GEAR

Range gear

The range gear consisted of a spindle, passing through the cradle from the left side, having a spur pinion on the left-hand end engaging a toothed arc attached to the sight bracket.



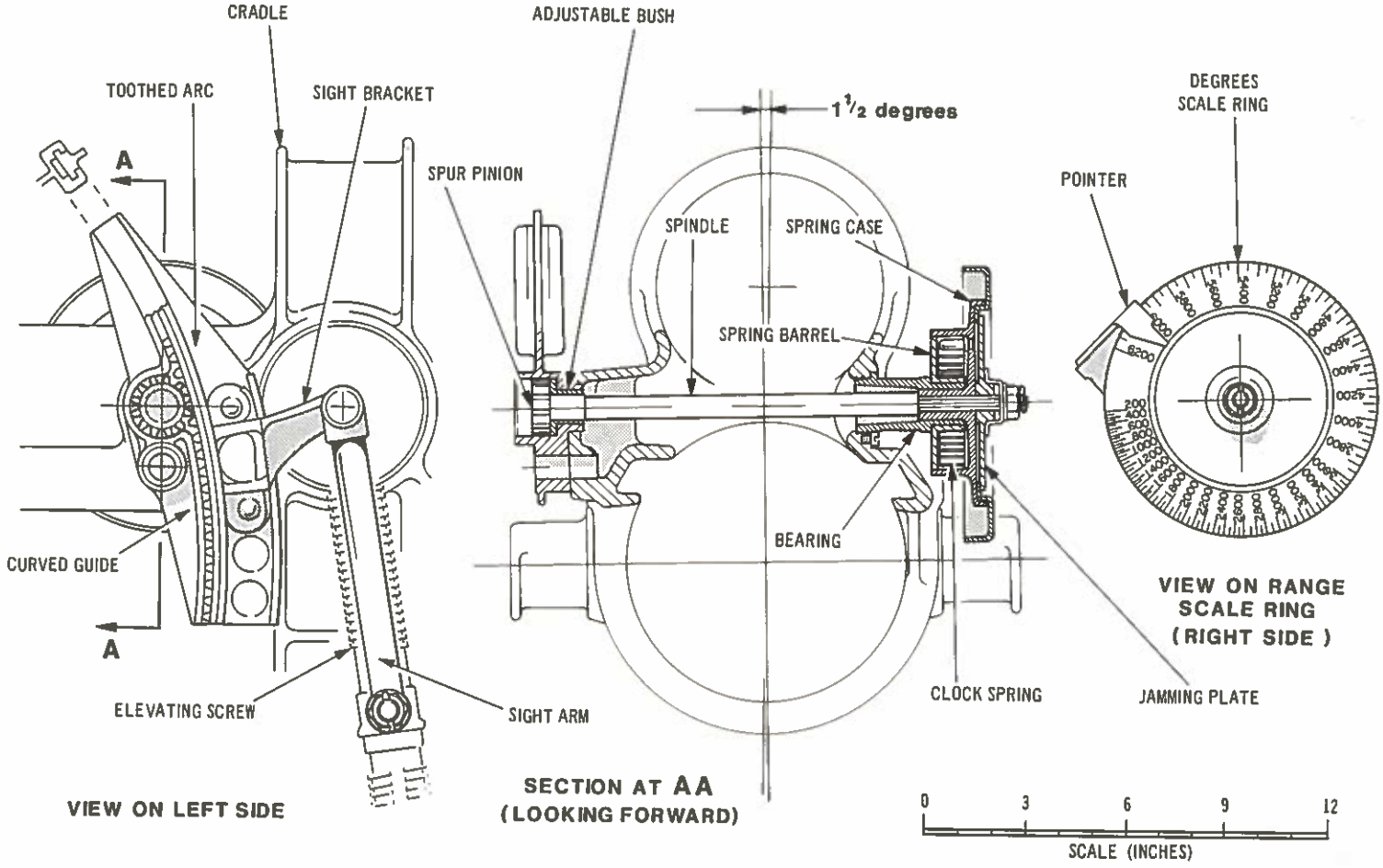
RANGE GEAR

Rotation of the upper elevating gear handwheel caused the cradle-mounted spur gear to roll along the toothed arc. The gear rotation was transmitted, via the spindle, to the range gear mounted on the cradle right-hand side.

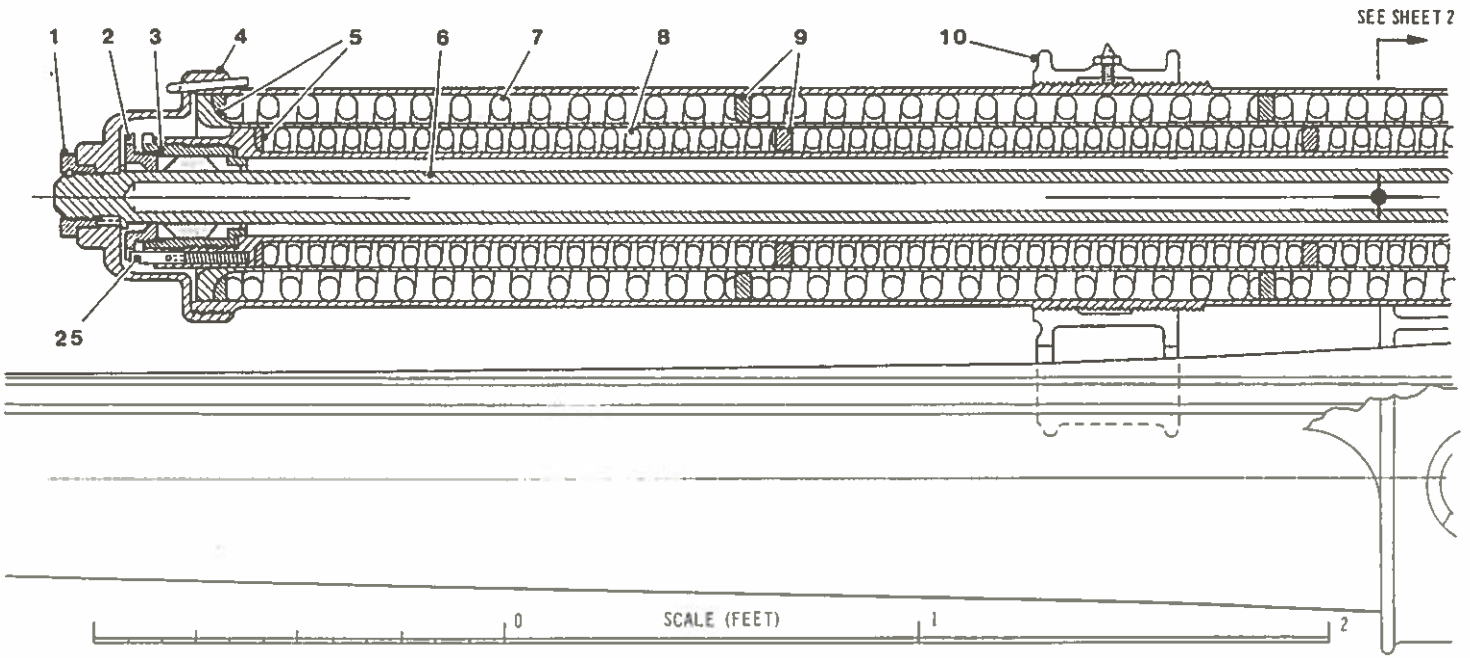
The spindle passed through a cradle-mounted bearing, the outer end of which was externally hexagonal in section, onto which was mounted a spring barrel. The spindle right-hand end was also hexagonal in section, onto which was mounted a spring case.

Engaging both barrel and case was a clock spring to prevent any backlash between the two. Mounted on the spring case was an aluminium scale ring, graduated in degrees and yards. It was held against the spring case by a jamming plate, woodite washer and nut. The elevation angle of the gun was read from the scale by a pointer, mounted on the cradle.

Any excess wear between the spindle spur gear and toothed arc could be corrected by turning the adjustable bush. The bush was eccentric, its rim notched and numbered, a stud in the cradle engaging whichever notch gave the correct operation. A few early bushes were made with five notches, most were produced with eight, the numbers one and eight representing the low and high setting limits.

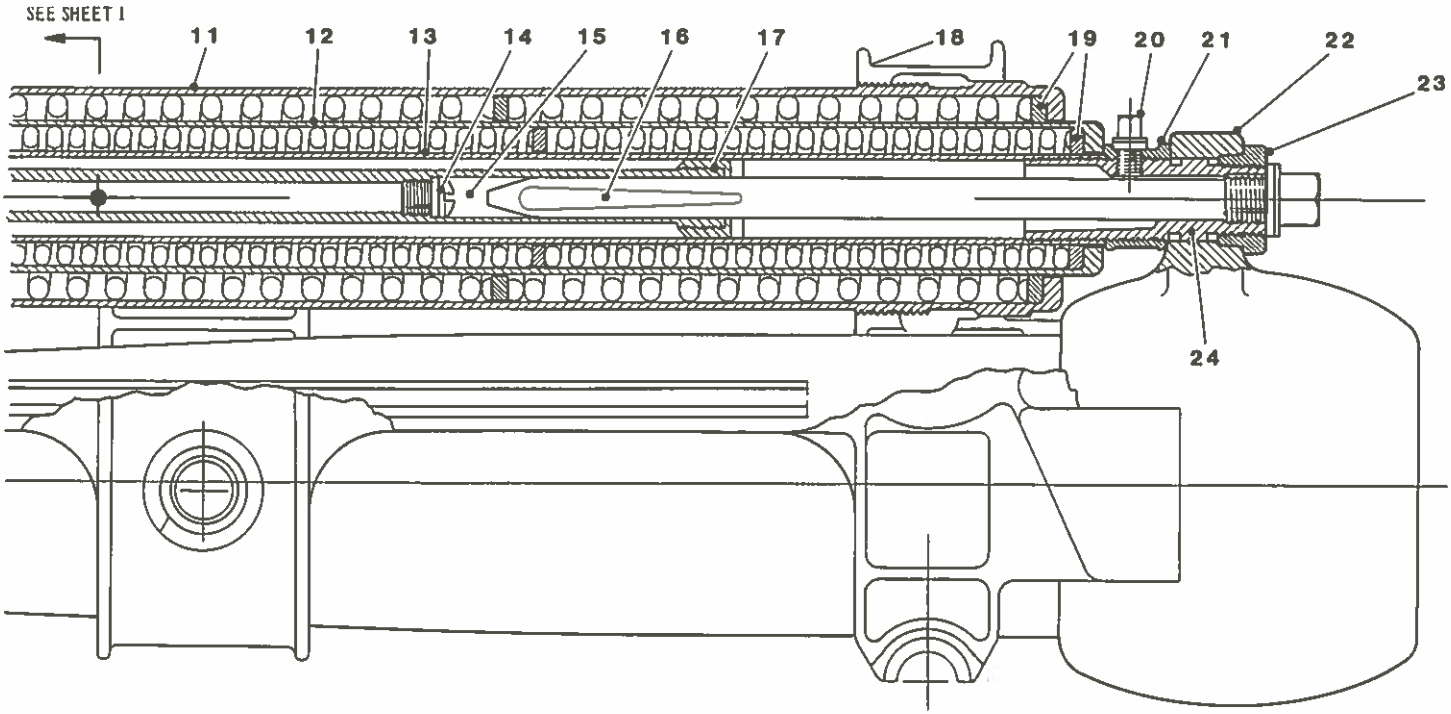

CRADLE
ADJUSTABLE BUSH
TOOTHED ARC
SIGHT BRACKET
A
SPUR PINION
1½ degrees
DEGREES SCALE RING
POINTER
SPINDLE
SPRING CASE
SPRING BARREL
CURVED GUIDE
A
BEARING
ELEVATING SCREW
SIGHT ARM
CLOCK SPRING
JAMMING PLATE
VIEW ON LEFT SIDE
SECTION AT AA (LOOKING FORWARD)
VIEW ON RANGE SCALE RING (RIGHT SIDE)
0 3 6 9 12
SCALE (INCHES)

RANGE GEAR



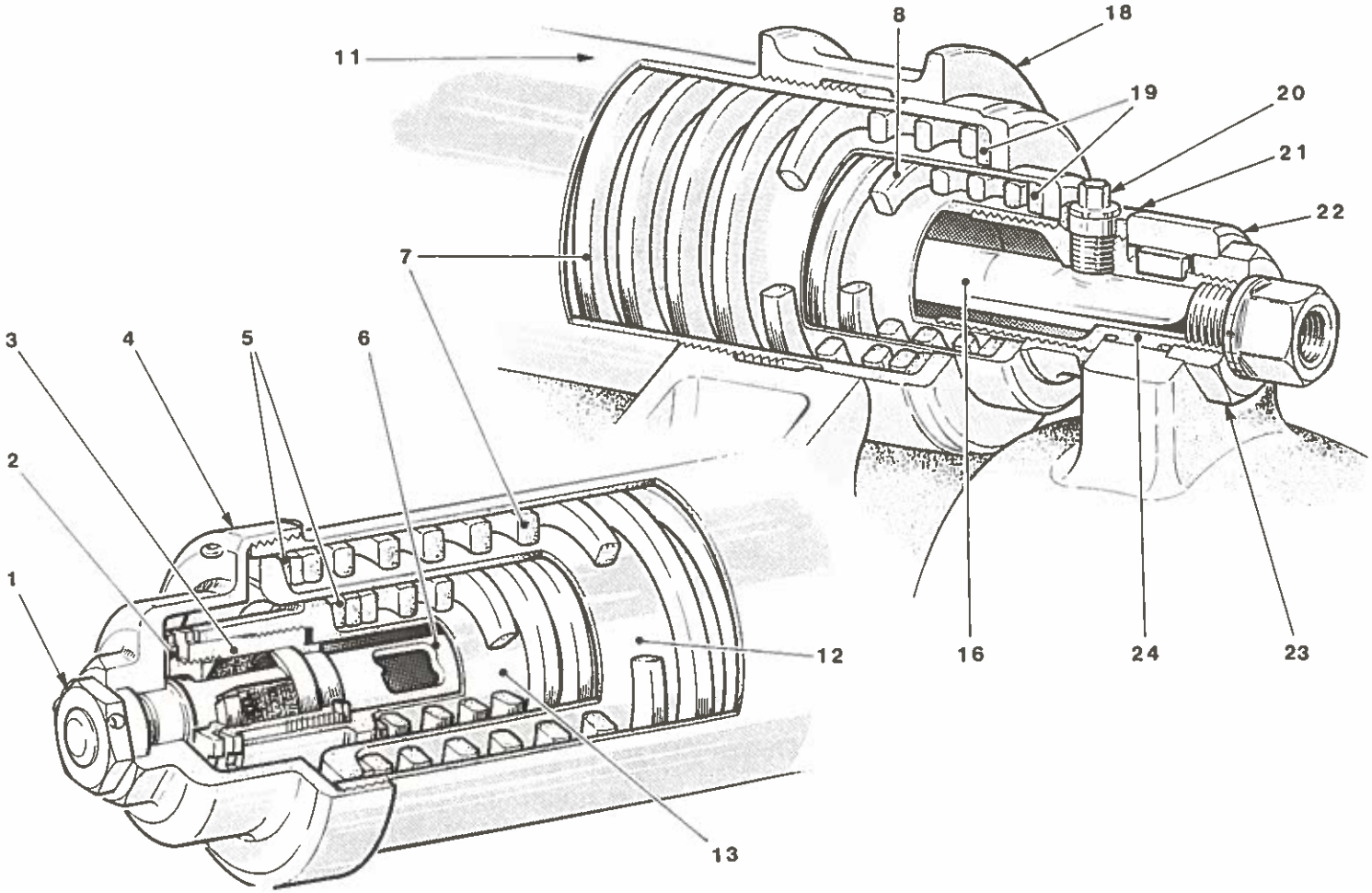
1 NUT (PISTON ROD)
2 GLAND
3 STUFFING BOX AND PACKING
4 FRONT CAP (OUTER SPRING CASE)
5 FRONT END PLATES
6 PISTON ROD
7 OUTER SPRINGS
8 INNER SPRINGS
9 PARTING PLATES
10 CRADLE UPPER SINGLE COLLAR (FRONT)
11 OUTER SPRING CASE
12 INNER SPRING CASE
13 BUFFER CYLINDER
14 SCREWED PLUG AND COPPER WASHER
15 RECESS (CONTROLLING PLUNGER)
16 CONTROLLING PLUNGER
17 PISTON
18 CRADLE DOUBLE COLLAR (REAR)
19 REAR END PLATES
20 FILLER HOLE PLUG
21 INNER SECURING NUT
22 BARREL LUG
23 OUTER SECURING NUT
24 CONNECTING PIECE
25 STUD WITH KEEP PIN AND SPRING

HYDRAULIC BUFFER AND SPRINGS



Hydraulic buffer and springs

The hydraulic buffer (**13**) was a forged steel tube, the rear end closed by a steel connecting piece (**24**) screwed and soldered into place. The connecting piece (**24**) was secured to the barrel lug (**22**) by flanged inner (**21**) and outer (**23**) securing nuts. The unthreaded portion of the connecting piece (**24**) which passed through the barrel lug (**22**) had two keys, fitted into keyways cut into the lug bore. The inner securing nut (**21**) had a vertical circular hole bored through to coincide with the filler hole in the connecting piece (**24**), this being threaded to admit a filler hole plug (**20**) and copper sealing washer. The plug was provided with a chain and keep pin. The connecting piece bore (**24**) was threaded at the rear to take a steel controlling plunger (**16**),



HYDRAULIC BUFFER AND SPRINGS

screwed up against a copper sealing washer, the bore thread being grooved longitudinally to enable air to vent, during filling of the buffer, with the plunger unscrewed through two turns.

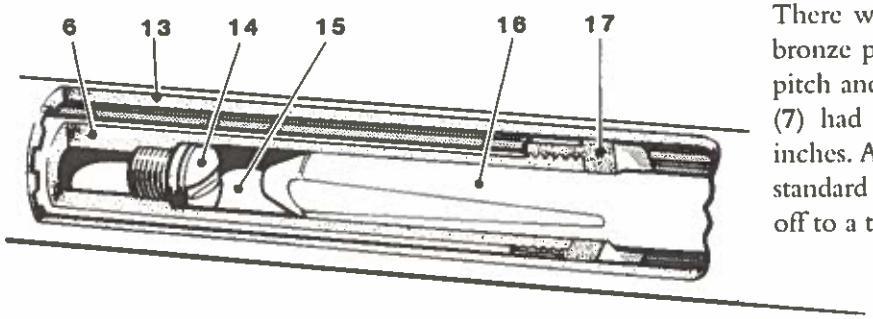
Screwed into the front of the buffer cylinder (**13**) was a manganese bronze stuffing box (**3**) butting against a sealing washer of anhydrous leather. The stuffing box (**3**) held two manganese bronze, coned supporting rings. These trapped a packing ring of asbestos and mutton suet enclosed in a canvas cover and pressed to shape. Rings and packing were pressed into the stuffing box by a manganese bronze gland (**2**), a spring stud with keep pin (**25**), housed in a recess in the front end of the buffer cylinder (**13**), prevented the stuffing box (**3**) and gland (**2**) from becoming unscrewed.

Ten longitudinal grooves, tapering in depth, were cut into the bore of the buffer cylinder (**13**) to graduate hydraulic pressure during recoil.

The tubular steel piston rod (**6**) was screwed to the front cap (**4**) at the forward end and keyed to prevent rotation. The piston rod (**6**) rear end carried a manganese bronze piston (**17**) which was screwed on.

A recess (**15**), formed by a plug and copper sealing washer (**14**) within the piston rod (**6**) had, operating within it, the controlling plunger (**16**). This was tapered at its front and had two filed flats to control the hydraulic oil during the final running out. A threaded recess in the rear end of the controlling plunger (**16**) was for use during operation of the running out springs adjusting apparatus.

Two banks of springs, an outer bank (**7**) and inner bank (**8**), surrounded the buffer cylinder (**13**), contained within steel cases (**11** and **12**). The outer spring case (**11**) was screwed into the cradle upper collars (**10** and **18**) and secured by a set screw. The outer spring case (**11**) had a rear inner flange bearing against the outer springs (**7**). The inner spring case (**12**) was a sliding fit between the buffer cylinder (**13**) and outer spring case (**11**). It had a front outer flange and rear inner flange bearing against the outer springs (**7**) and inner springs (**8**) respectively. The buffer cylinder (**13**) had a front external flange bearing against the inner springs (**8**).



There were four springs in each bank, separated by manganese bronze parting plates (**9**). Each inner spring (**8**) had a left-hand pitch and normal free length of 18.58 inches. Each outer spring (**7**) had a right-hand pitch and normal free length of 19.65 inches. Any spring with a permanent set of 1.25 inches below standard length would be replaced. The spring ends were finished off to a thickness of 0.125 inch.

On firing, the gun barrel recoiled towards the rear, drawing the buffer cylinder (13) over the piston (17) and forcing the hydraulic oil rearwards through the clearance between the two. The increasing depth of the cylinder wall grooves graduated the flow in such a manner as to give the required hydraulic resistance without allowing the carriage to lift about the point of the trail.

With recoil energy absorbed, the springs (7 and 8) returned the barrel to the firing position.

The controlling plunger (16) displaced the oil in the piston rod recess (15) and cushioned the final movement, bringing the barrel gradually to rest.

The full working recoil was forty-nine inches.

Shield

The shield was of Boynton steel, strengthened with ash slats, made in two portions. The upper portion was bolted to a flange secured to the trail tube front end. Additional support was given by stays attached to the axletree brackets. The lower portion was hinged to the upper portion. In action it hung vertically almost to the ground. For travelling it was swung back under the trail and secured by a pawl with releasing handle and keep pin.

Shields would be tested with a service rifle bullet at a range of four hundred yards and should not be pierced, cracked or distorted.

Fitted to the shield top edge were two sighting blades. These indicated, approximately, the field covered by the traversing gear to a man standing to the traversing handspike, equal to eight degrees.

At the shield top edge rear were fittings for a Fuze Indicator Mk. II. An advance ring was fitted centrally to the shield front face.

A lifting jack could be applied, from the front of the carriage, under the outer hinges of the shield. Leather cases and fittings were provided, on the shield and axletree, for carriage of the following stores: a dial sight, field clinometer, sight clinometer, spare parts, fuze keys, shovel, aiming posts, breech and muzzle covers, oil can, fuze indicator, tool case, telescope and drag ropes.

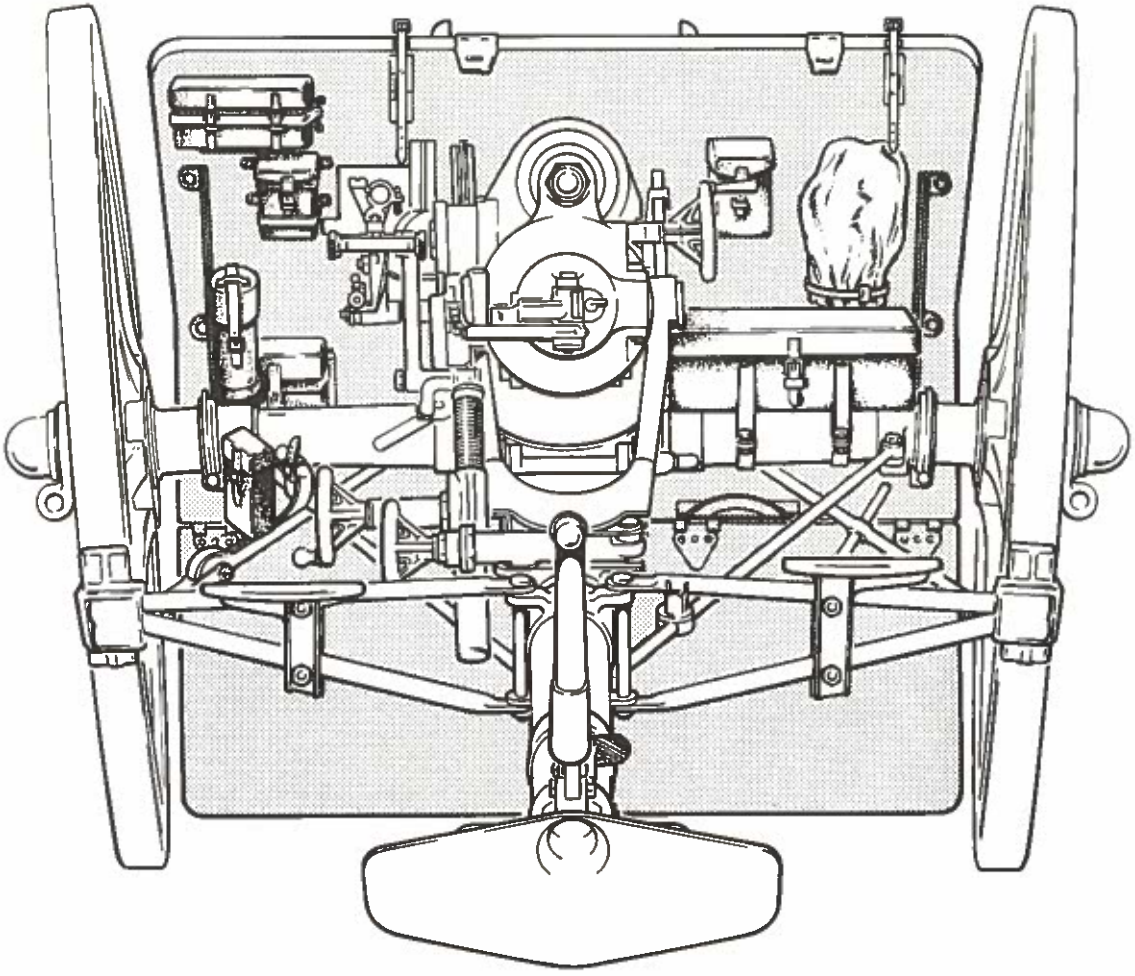
Sights

These sights operated on the **independent line of sight** principle.

Rocking bar sight

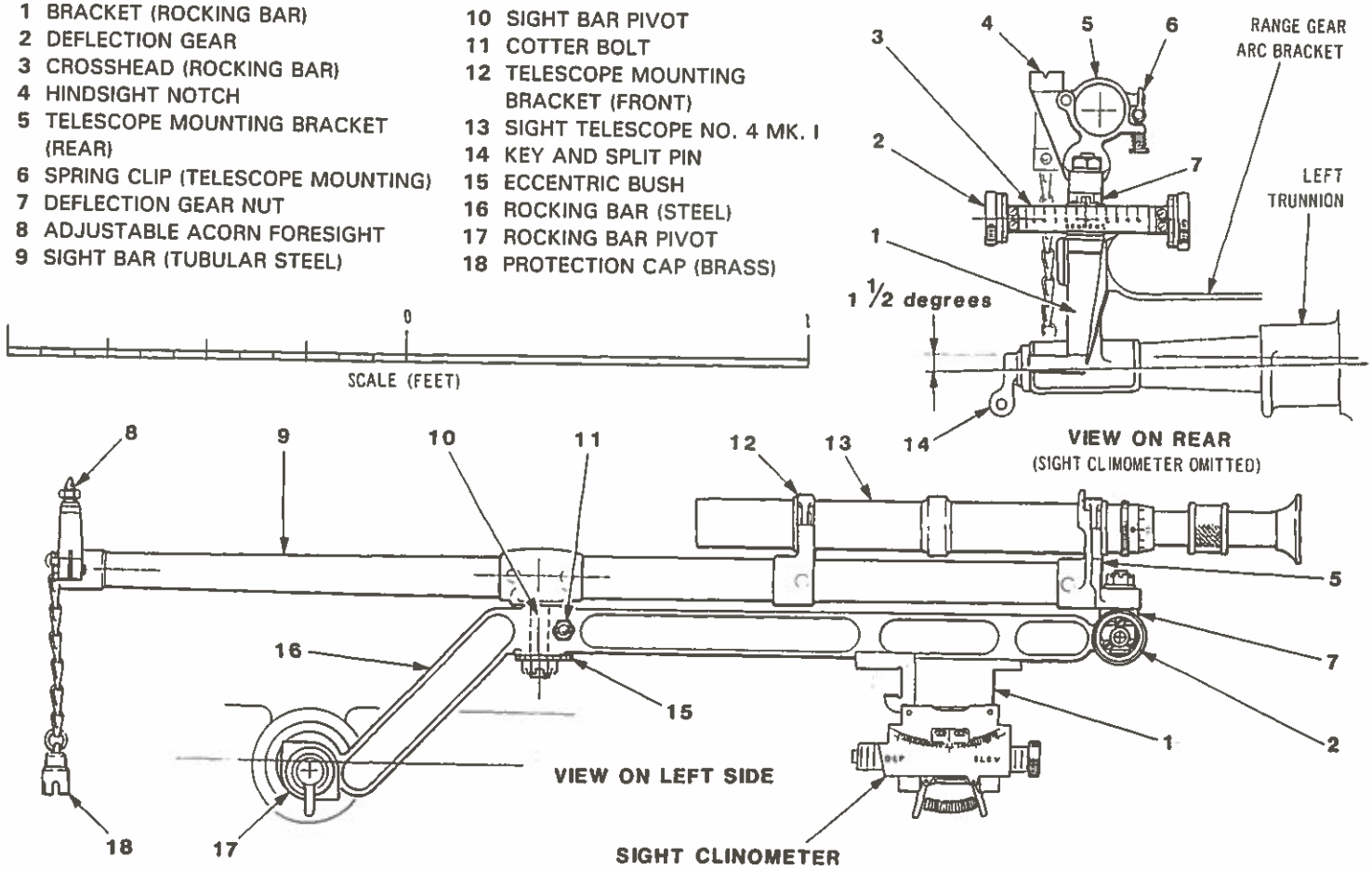
The steel **rocking bar** (16) was bent downwards at its front end and pivoted, by a manganese bronze key (14) secured by a split pin, to a steel arm screwed into the cradle left trunnion.

A crosshead (3), formed on the rocking bar rear end (16), carried the deflection gear (2). Riveted to the underside of the rocking bar (16) was a bracket (1) which engaged a projection on the range gear arc bracket. Lugs, formed on the lower portion of the bracket (1), were mountings for the sight clinometer.



SHIELD

1 BRACKET (ROCKING BAR)
2 DEFLECTION GEAR
3 CROSSHEAD (ROCKING BAR)
4 HINDSIGHT NOTCH
5 TELESCOPE MOUNTING BRACKET (REAR)
6 SPRING CLIP (TELESCOPE MOUNTING)
7 DEFLECTION GEAR NUT
8 ADJUSTABLE ACORN FORESIGHT
9 SIGHT BAR (TUBULAR STEEL)
10 SIGHT BAR PIVOT
11 COTTER BOLT
12 TELESCOPE MOUNTING BRACKET (FRONT)
13 SIGHT TELESCOPE NO. 4 MK. I
14 KEY AND SPLIT PIN
15 ECCENTRIC BUSH
16 ROCKING BAR (STEEL)
17 ROCKING BAR PIVOT
18 PROTECTION CAP (BRASS)



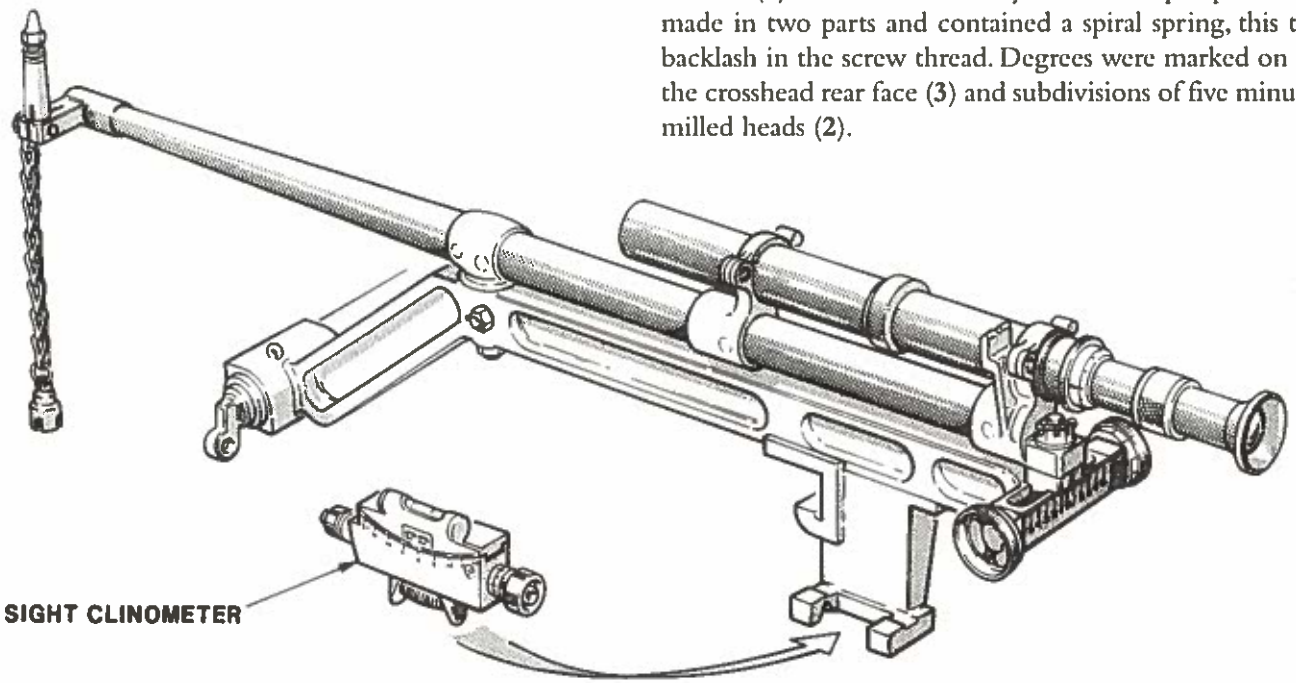
ROCKING BAR SIGHT

The rocking bar (**16**) was bored through vertically, near its front end, to house an eccentric bush (**15**). This bush received the sight bar pivot (**10**) and had its lower edge flanged and shaped to take a spanner. The bush provided horizontal adjustment.

The tubular steel **sight bar** (**9**) was pivoted to the rocking bar (**16**) and secured by a nut, with washer and split pin.

The rear telescope mounting bracket (**5**) had an elongated slot, for attachment to the deflection gear nut (**7**), and a hind sight with notch (**4**). The sight bar (**9**) carried an adjustable acorn foresight (**8**) at the front end.

The **deflection gear** (**2**) consisted of a screw, with milled heads attached at each end, supported in the rocking bar crosshead (**3**), operating a nut (**7**) with a projection on its upper side which passed through the elongated slot in the rear telescope mounting bracket (**5**) and was secured by a nut and split pin. The nut was made in two parts and contained a spiral spring, this to prevent backlash in the screw thread. Degrees were marked on a scale on the crosshead rear face (**3**) and subdivisions of five minutes on the milled heads (**2**).



ROCKING BAR SIGHT

Later cradles had the left trunnion modified to carry a different pattern sight supporting arm, this being held in the cradle by an internal nut and split pin, the sight being secured to the supporting arm outer end by a nut and split pin.

The **telescope** No. 4 Mk. I (**13**) had two gunmetal collars which fitted into the mounting brackets (**5** and **12**), the rear collar having a projecting pin which prevented the telescope turning in the mountings. The telescope had a magnification of five and a half diameters and a five and a half degree field of view. The object glass was positioned for infinite focus (all distances over four hundred yards). The pointer was fixed in a diaphragm at the object glass focal length and was adjustable through seven settings for individual requirements. The diaphragm was centrally adjusted by eccentric rings in the object glass cell.

The telescope length was 17.25 inches overall and it weighed 2 pounds 12 ounces.

Protective leather caps were provided for the telescope ends. They were joined by a sling which was attached to the telescope body by a small strap with buckles.

Sight clinometer

The sight clinometer was used to give the angle of sight. The cradle (**26**) was secured by spring clips (**27**) to lugs on the sight rocking bar bracket (**1**) and had, on its upper face, a curved, grooved track in which slid the spirit level (**22**). The spirit level had worm teeth (**31**) on its underside which engaged the actuating worm (**23**) in the centre of the worm spindle (**30**).

The spindle (**30**) was supported by movable bearings (**21** and **24**) in the cradle (**26**).

A flat spring (**29**) kept the worm (**23**) in mesh with the spirit level worm teeth (**22**), as the pivot bearing (**24**) was so arranged that the worm (**23**) could be pulled out of engagement and the spirit level (**22**) moved by hand for rapid setting. The flat spring (**21**) would be tested by suspending a six pound weight from the front milled collar (**20**). If this disengaged the worm (**23**) from the spirit level worm teeth (**31**), the flat spring (**29**) would be renewed.

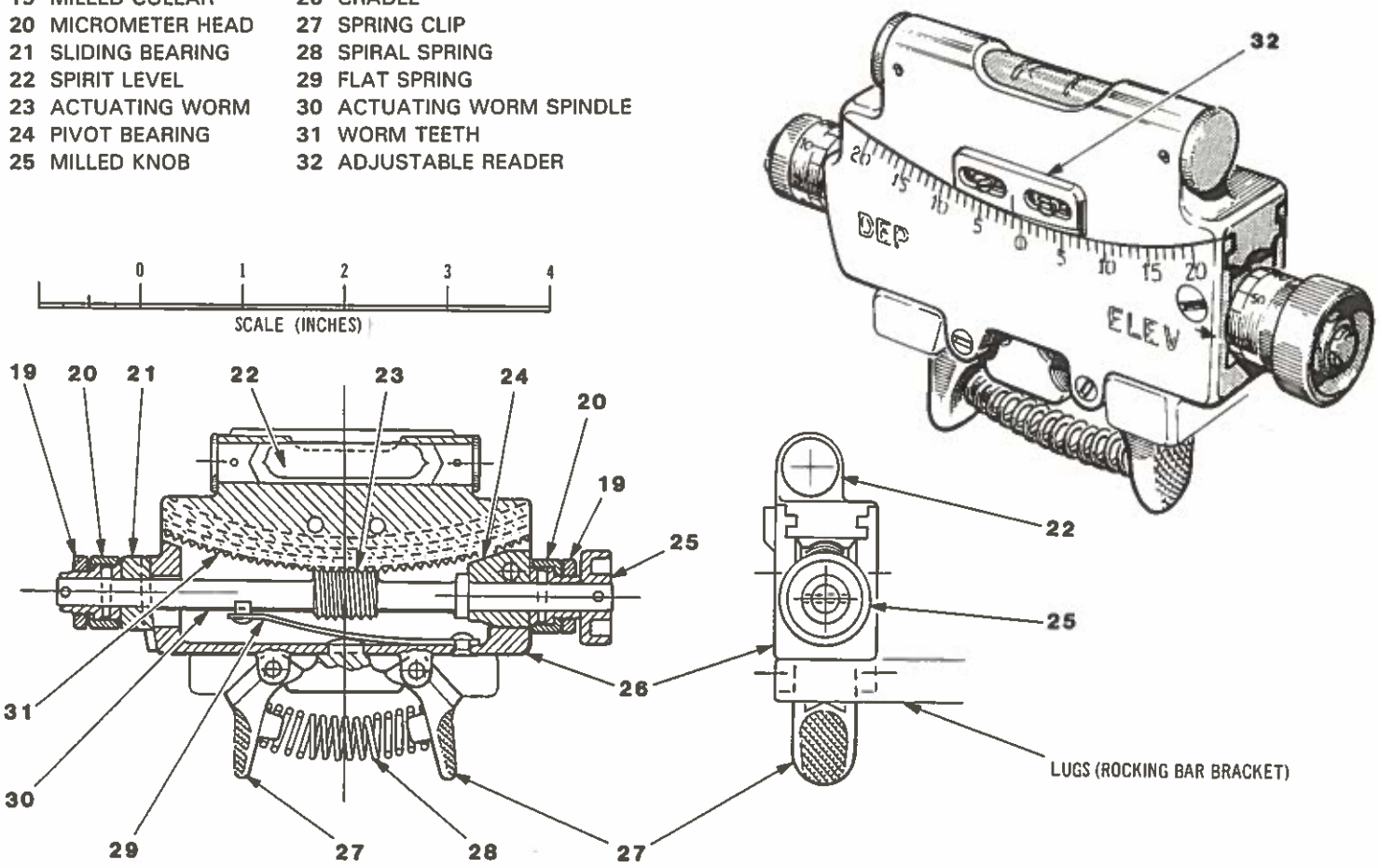
An adjustable reader (**32**) on the spirit level (**22**) read against a degree scale on the cradle (**26**) to twenty degrees either way. Micrometer heads (**20**) on either end of the worm spindle (**30**) were graduated to five minutes. The micrometer heads (**20**) were clamped by milled collars (**19**).

Dial Sight No. 7 Mk. I

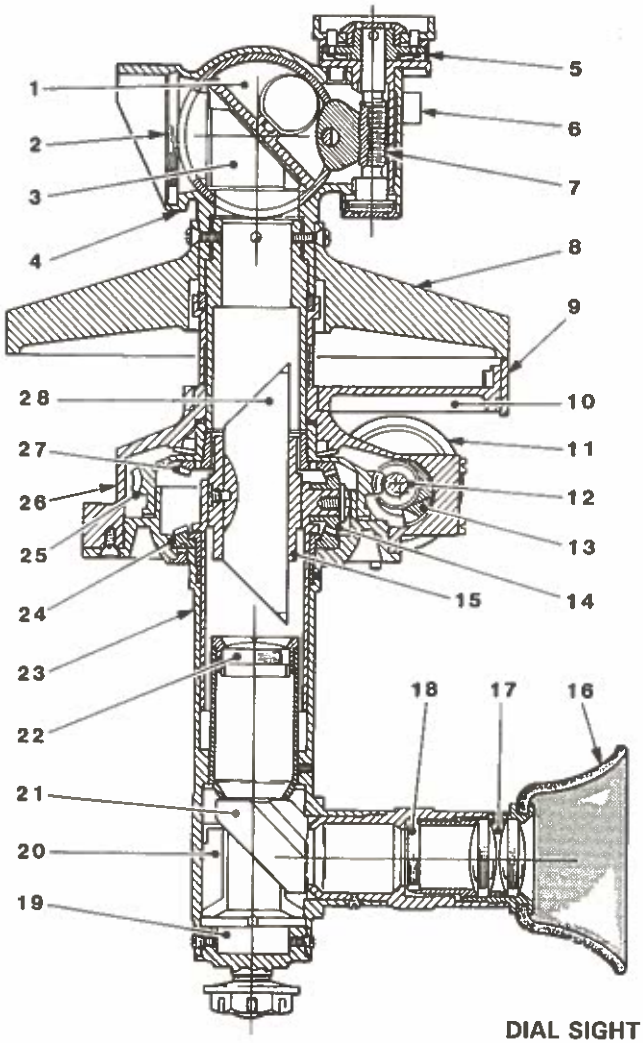
The No. 7 dial sight Mk. I replaced the No. 1 dial sight originally fitted to a mounting bracket on the shield front face. Details of the No. 1 dial sight can be found on page 152.

The No. 7 dial sight Mk. I was provided for indirect laying of the gun when the target could not be seen. The eyepiece was fixed, but the top portion could be turned through 360 degrees and set to any angle ordered, the angle being that between a line to the

19 MILLED COLLAR
20 MICROMETER HEAD
21 SLIDING BEARING
22 SPIRIT LEVEL
23 ACTUATING WORM
24 PIVOT BEARING
25 MILLED KNOB
26 CRADLE
27 SPRING CLIP
28 SPIRAL SPRING
29 FLAT SPRING
30 ACTUATING WORM SPINDLE
31 WORM TEETH
32 ADJUSTABLE READER

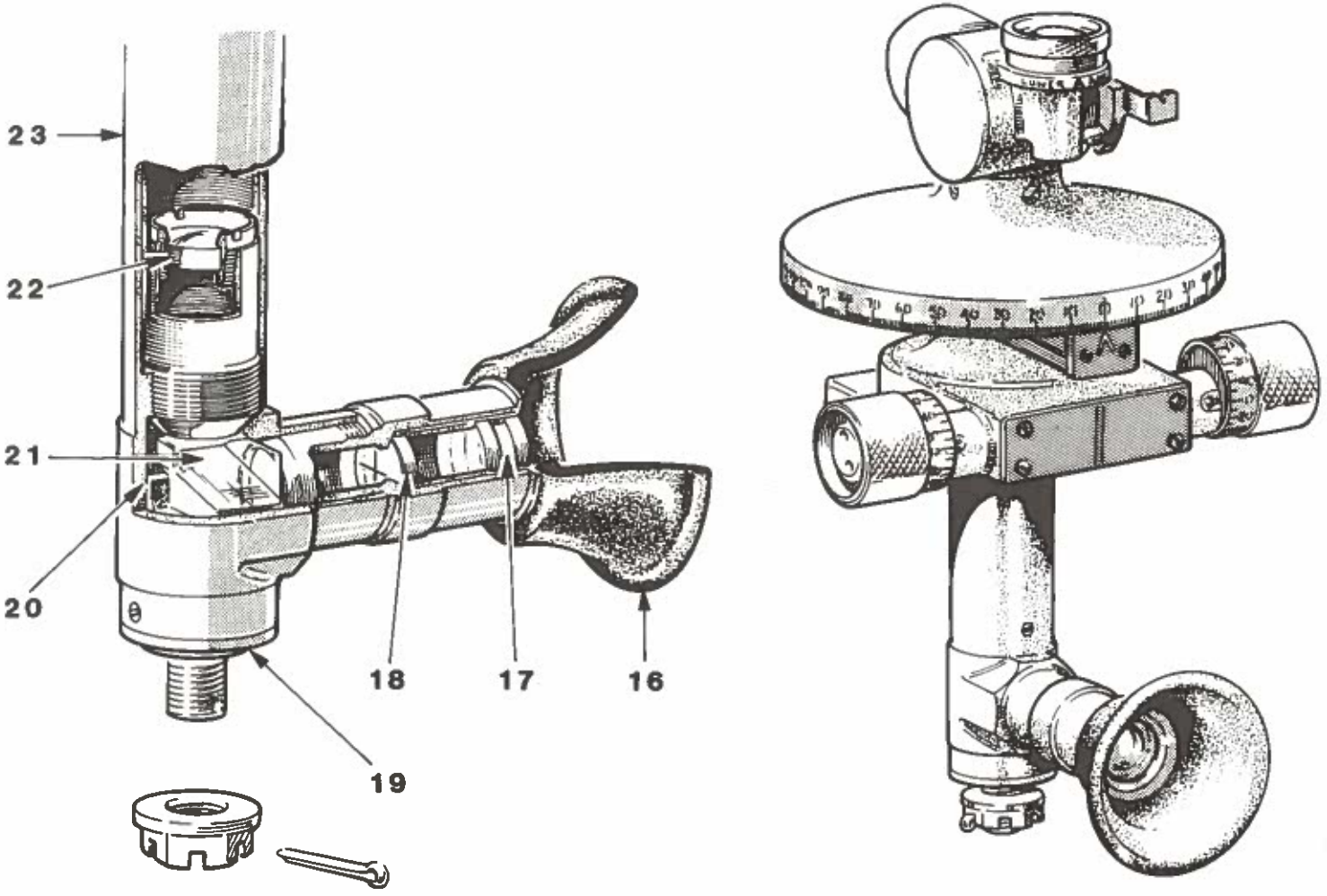


SIGHT CLINOMETER



1 UPPER PRISM MOUNT
2 WINDOW AND RAINSHADE
3 UPPER PRISM
4 UPPER PRISM HOLDER
5 MICROMETER HEAD (UPPER PRISM)
6 CROSSHEAD WITH NOTCH AND FORESIGHT
7 WORM SPINDLE (UPPER PRISM)
8 DIAL PLATE
9 SCALE READER
10 SCALE READER BRACKET
11 DRUM WITH MICROMETER HEAD (WORMWHEEL)
12 WORM SPINDLE (WORMWHEEL)
13 ECCENTRIC BEARING WITH COLLAR AND THUMBPIECE
14 IDLER BEVEL GEAR (CENTRE PRISM)
15 CENTRE PRISM MOUNT
16 EYE GUARD
17 EYEPIECE
18 DIAPHRAGM
19 PLUG (SUPPORTING PILLAR)
20 LOWER PRISM MOUNT
21 LOWER PRISM
22 OBJECT GLASS
23 SUPPORTING PILLAR
24 FIXED BEVEL GEAR (SUPPORTING PILLAR)
25 WORMWHEEL
26 WORMWHEEL BRACKET
27 ROTATING BEVEL GEAR (UPPER PRISM)
28 CENTRE PRISM

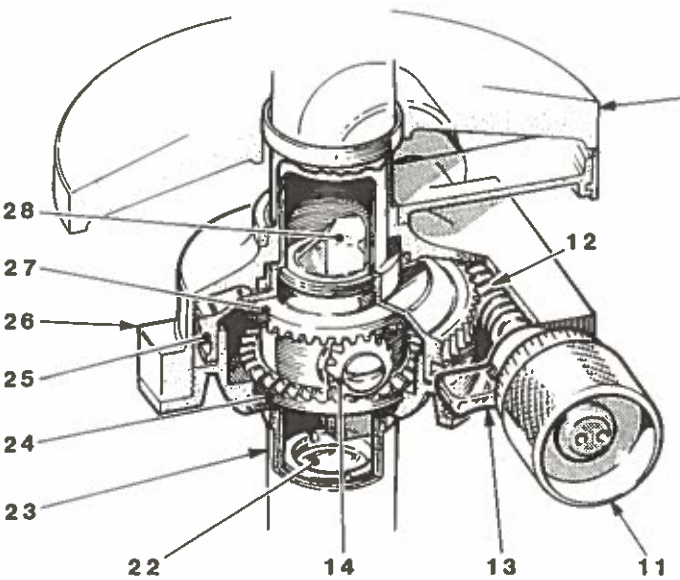
DIAL SIGHT NO. 7 MK. I

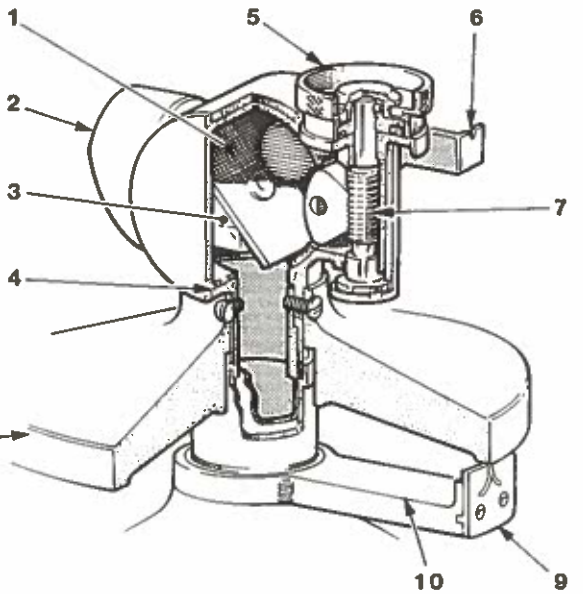


DIAL SIGHT NO. 7 MK. I

target and a line to an aiming point. The sight had a magnification of four diameters with a ten-degree field of view.

The optical combination was of an erecting type, comprising an object glass (**22**) and eyepiece (**17**) with erecting (**28**) and reflecting prisms (**3** and **21**). A diaphragm (**18**) in the horizontal section of the sight had cross lines marked on it. In order to keep the image constantly erect, the centre prism (**28**) revolved at half the rate of the upper prism (**3**), this being controlled by the internal bevel gearing (**14, 24** and **27**).





DIAL SIGHT NO. 7 MK. I

Rotation of the upper prism holder (**4**) was controlled by the worm spindle (**12**) and wormwheel (**25**). The worm spindle (**12**) was housed in an eccentric bearing (**13**) fitted with an actuating collar and thumbpiece. Moving the thumbpiece upwards disengaged the worm spindle (**12**) from the wormwheel (**25**) allowing the dial plate (**8**) to be moved rapidly to any required setting of whole degrees. At each end of the worm spindle (**12**) was a drum (**11**) graduated in divisions of ten minutes, each complete revolution of the drum representing a five-degree movement of the dial plate (**8**). The right-hand drum markings were in white on a black ground, the left-hand drum markings were in black on brass.

Attached to the wormwheel (**25**) were the dial plate (**8**) and upper prism holder (**4**). The dial plate was graduated to read from 0 to 180 degrees 'Right' (white markings on a black ground) and 'Left' (black markings on brass).

The upper prism holder (**4**) had a crosshead (**6**), with notch and foresight for rough laying, pivoted to it.

The upper prism (**3**) and crosshead (**6**) had vertical adjustment of fifteen degrees elevation and depression controlled by a worm spindle (**7**) with micrometer head (**5**). The micrometer head had a graduated drum engraved in divisions of ten minutes. Each revolution of the worm spindle (**7**) indicated a five-degree elevation or depression on the crosshead (**6**). Below the crosshead (**6**) was a scale with five-degree graduations read by an arrow on the prism holder (**4**). Indicating arrows and the words 'higher' and 'lower' on the worm spindle bearing showed the direction of turn for the micrometer head to effect the vertical line of sight, up or down.

For carriage purposes, a holder and waterproof cover were provided for the No. 7 dial sight and the No. 2 carrier on the inside of the shield.

Dial Sight No. 7 Mk. II

The Mk. II sight had only a zero and index marks on the crosshead (**6**) and micrometer head (**5**). The wormwheel (**25**) and worm spindle bearings (**12**) were of manganese bronze instead of steel. Springs and spring washers were nickel plated.

Barrel and breech

Barrel construction

The steel A tube had successive layers of steel wire wound around it surrounding the chamber and a portion of the bore.

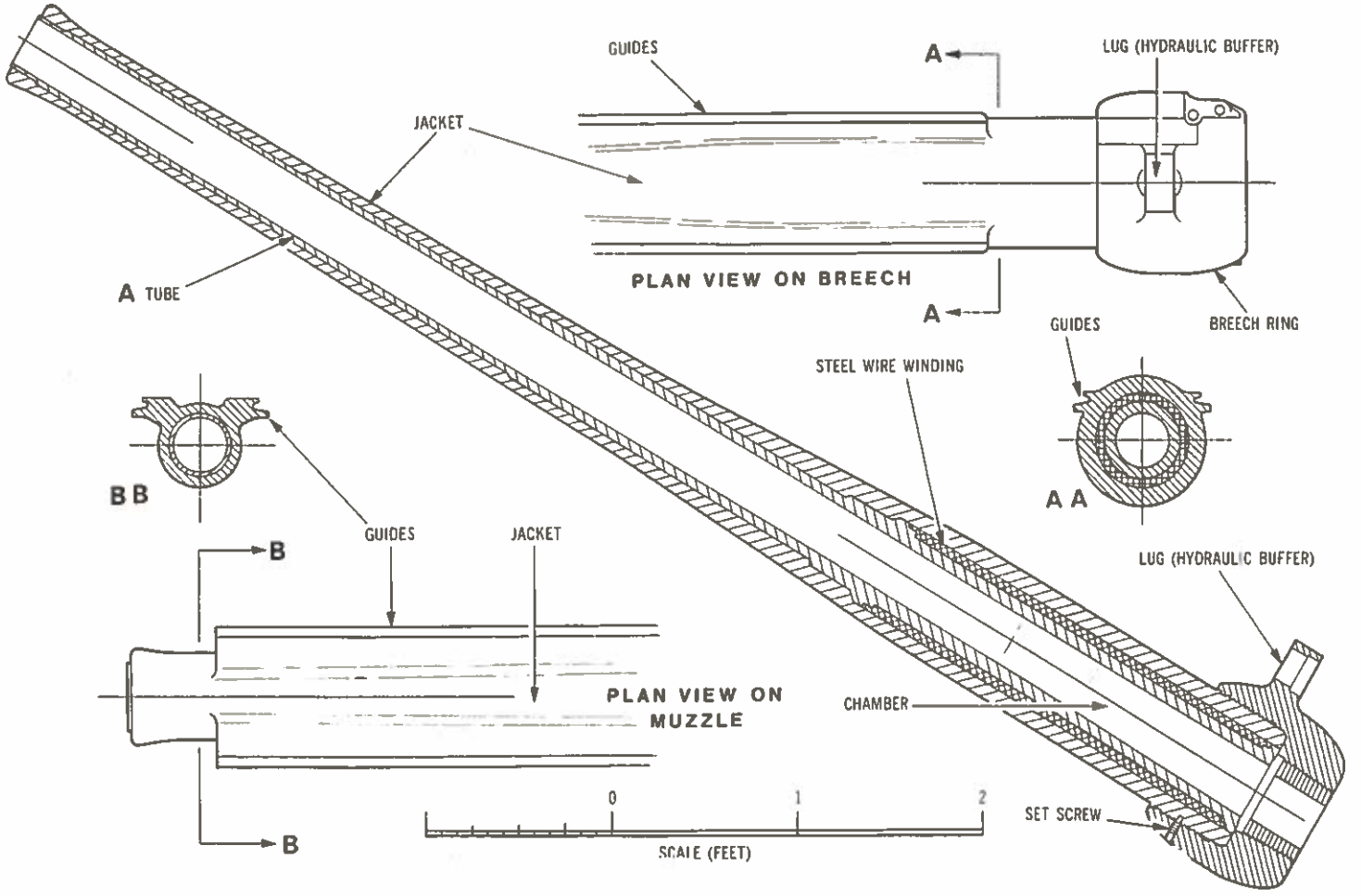
An outer steel jacket was shrunk on over the wire and A tube, being secured longitudinally by internal shoulders and a breech ring screwed over the jacket rear end. The breech ring was machined for the reception of the breech mechanism and secured by a set screw.

Longitudinal projections, or wings, along both sides of the jacket, formed the sliding mountings which were engaged by the guide grooves of the cradle. The chamber was slightly coned throughout its length to facilitate cartridge case extraction.

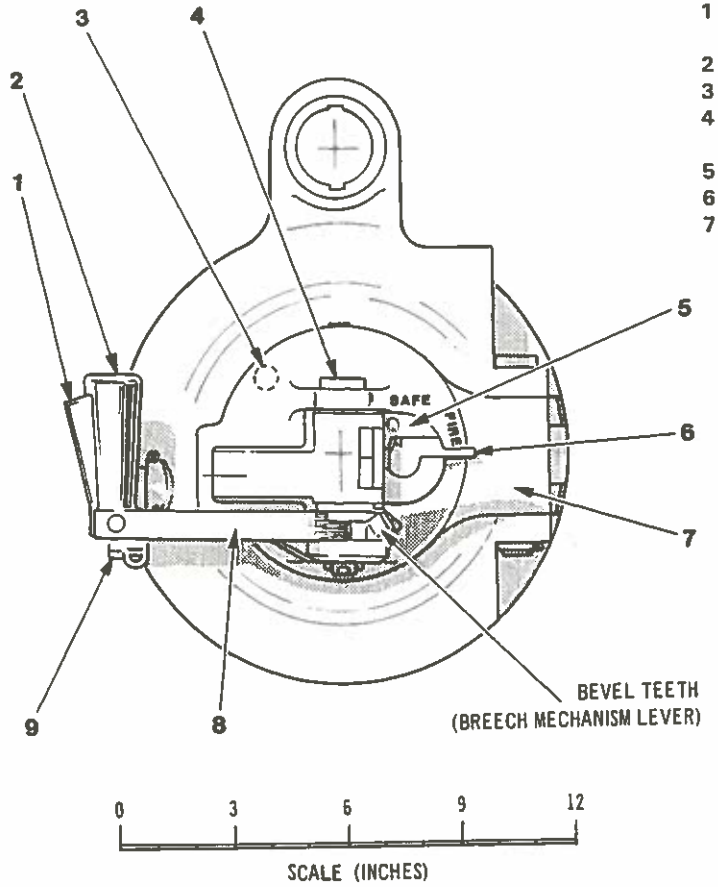
The total barrel length was 96.96 inches, of which the bore, of 3.3 inches diameter, took up 92.62 inches from the breech screw face.

The bore was rifled, for a length of 80.232 inches, with eighteen grooves of polygroove, modified plain section, 0.04 inch deep x 0.384 inch wide. The rifling was a right-hand uniform twist, one turn in thirty calibres (99 inches).

The breech ring had a lug, on the top surface, to which attached the hydraulic buffer cylinder rear end. A surface for a clinometer was machined on the breech ring upper surface. An axis line was cut at the breech right-hand side. Horizontal lines were cut on



BARREL CONSTRUCTION



BREECH

1 BREECH MECHANISM LEVER RELEASE CATCH
2 HANDLE
3 BREECH SCREW RETAINING CATCH
4 BREECH MECHANISM LEVER HINGE BOLT
5 STRIKER GUIDE BLOCK
6 SAFETY CATCH
7 CARRIER
8 BREECH MECHANISM LEVER
9 TRIGGER
10 BREECH SCREW
11 STRIKER (FIRING MECHANISM)
12 EXTRACTOR
13 FIRING HOLE BUSH
14 FIRING LEVER
15 EXTRACTOR HINGE BOLT
16 CARRIER HINGE BOLT

the breech face and vertical and horizontal lines were cut on the muzzle face.

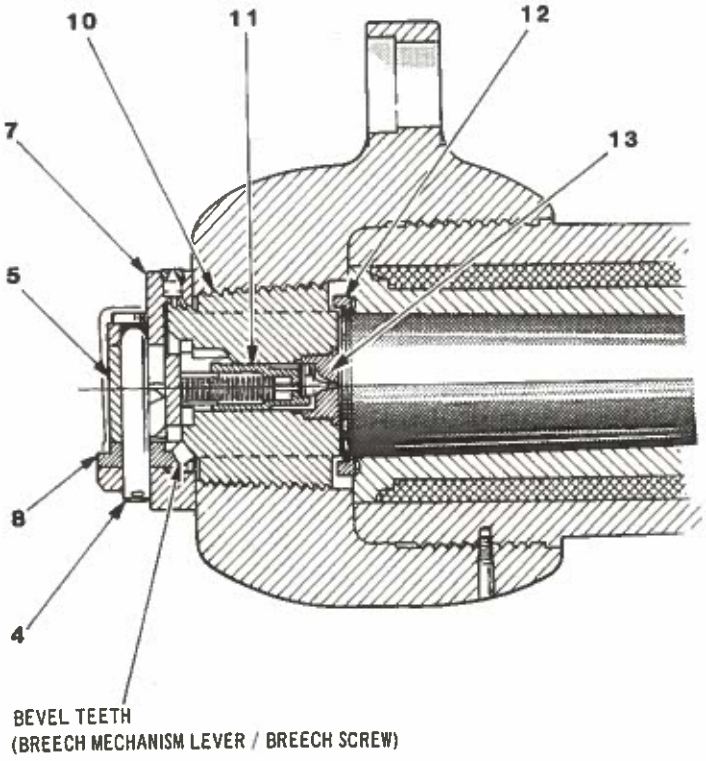
Barrel weight, with breech fittings, was 9cwt (1,008 pounds).

The Mk. I gun barrel described above, when repaired by renewal of the A tube, became a Mk. I* barrel. The repair consisted of fitting a new A tube and wire winding into an existing jacket, the A tube exterior and wire winding being slightly tapered, the jacket bore being coned to suit. The operation was performed using hydraulic pressure.

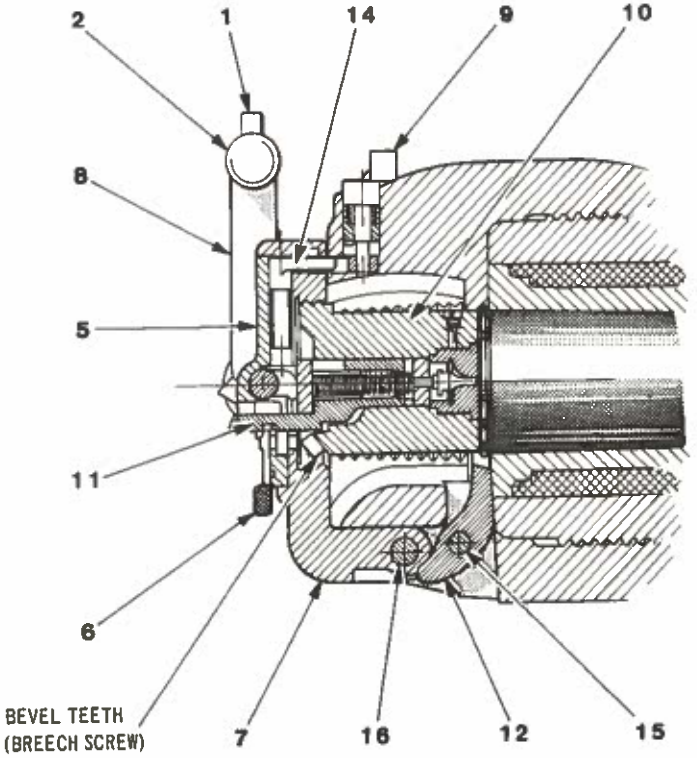
Mk. II barrels were manufactured as above, but with the use of a new jacket.

Breech

The breech mechanism was of the **single motion** type, so arranged that one pull on the handle (**2**) unlocked the breech and swung the breech screw (**10**) and carrier (**7**) into the loading position. After loading, one thrust on the handle (**2**) inserted the

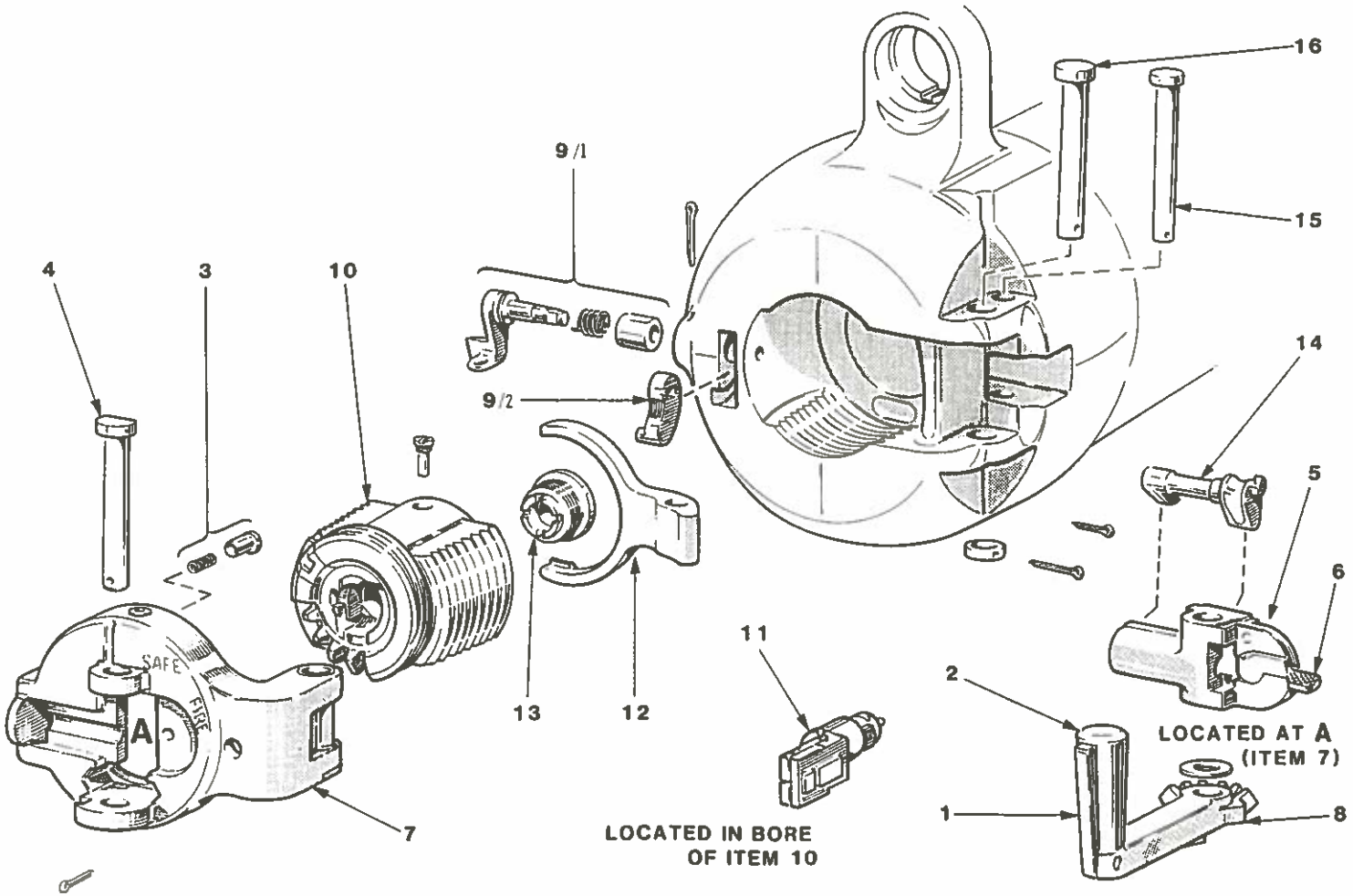


VERTICAL SECTION



HORIZONTAL SECTION

BREECH



BREECH COMPONENTS

breech screw (**10**) into the breech opening and turned it into the locked position.

The breech screw (**10**) tapered towards the rear and had opposite sides machined away, allowing the screw to lock or unlock with one quarter of a turn. Bevel teeth on the rear of the breech screw (**10**) were engaged by bevel teeth on the breech mechanism lever (**8**), the lever being hinged to the carrier rear face (**7**).

The breech screw (**10**) was secured in the carrier (**7**) by a left-hand screw thread. Housed in the carrier rear face (**7**) was the striker guide block (**5**) containing the firing mechanism (**11**).

Firing mechanism operation (see page 263)

VIEW A This shows the firing mechanism at rest with the breech screw closed and locked. Note that the firing pin was withdrawn and not projecting from the breech screw front face.

VIEW B Pulling on the firing handle rotated the trigger (**9/1**) on its spindle, causing the lever (**9/2**), housed within the barrel breech rear face, to rotate the firing lever spindle and cam (**14**) mounted within the striker guide block (**5**). Clockwise rotation of the firing lever spindle and cam (**14**) caused the cam lower portion to push the main-spring guide forward, while the projection on the cam upper portion engaged the tripping piece, this drawing the tripping piece with the striker to the rear, compressing the main-spring.

VIEW C Clockwise rotation of the firing lever spindle and cam (**14**) continued until the cam upper projection slipped past the tripping piece, this releasing the striker to be thrown forward under the pressure of the main-spring. Near the end of the striker travel, the rebound block stopped against a face machined within the breech screw bore, the striker body continuing to travel forward, the firing pin emerging from the breech screw front face to strike and detonate the cartridge percussion cap.

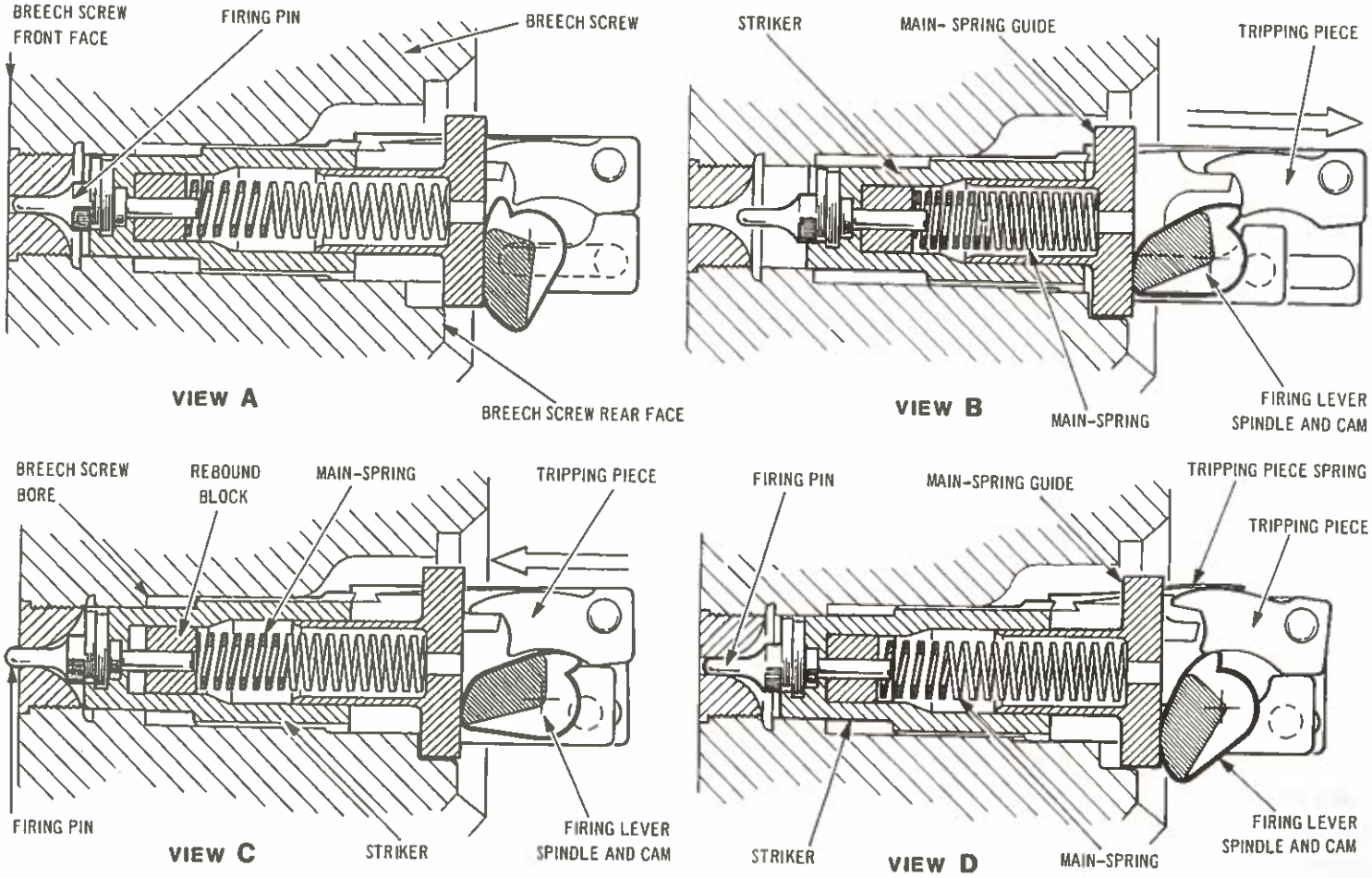
VIEW D Forward return movement of the firing handle allowed the firing lever spindle and cam to rotate counter-clockwise, allowing main-spring pressure to push the main-spring guide rearwards, the final movement pushing the striker body rearwards, this withdrawing the firing pin within the breech block front face.The cam upper projection rotated past the tripping piece, the tripping piece spring returning the tripping piece to the position shown in VIEW A.

The configuration of the breech screw rear face ensured that the main-spring guide could not move forward until the breech screw was fully turned into the closed position.

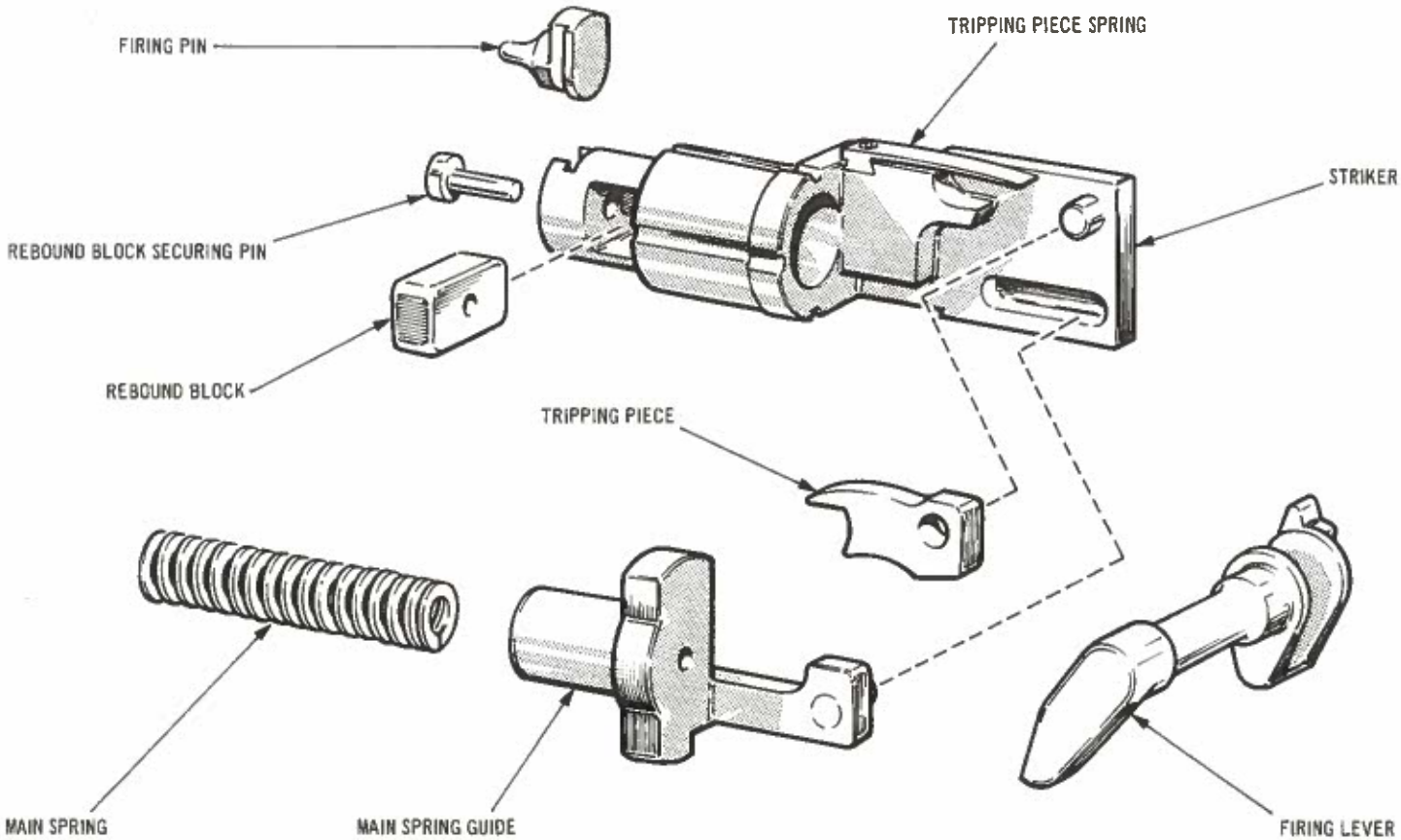
Fuze indicators

Fuze Indicator Mk. I (see page 267)

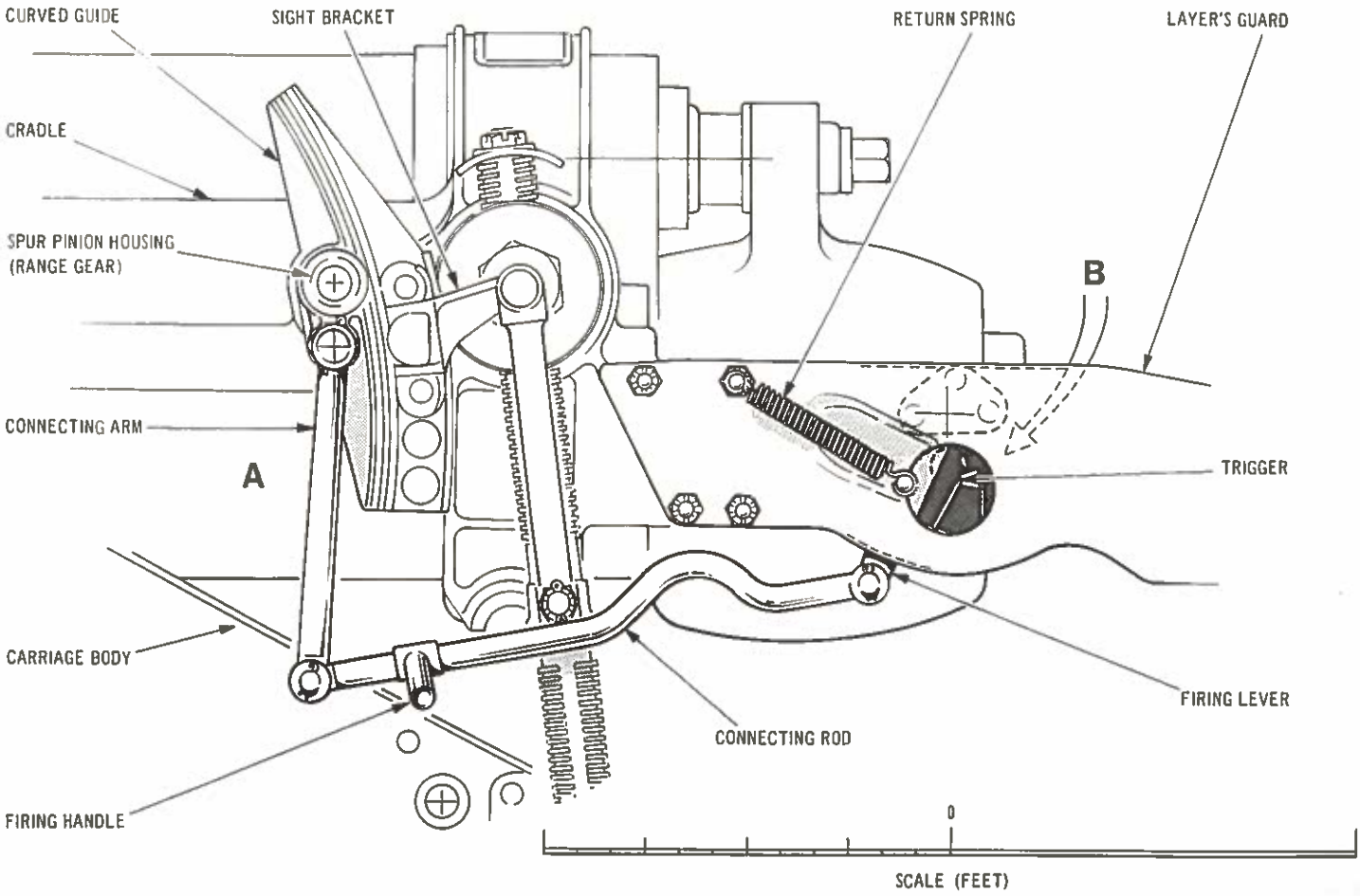
The range ring (**6**) was graduated on its outer edge in hundreds of yards, subdivided to read 50s. A portion of the inner edge was graduated from 0 to 300 to form a corrector scale. The fuze setting disc (**7**) was graduated on its outer edge from 2 to 22, these numbers representing the fuze divisions, each division being



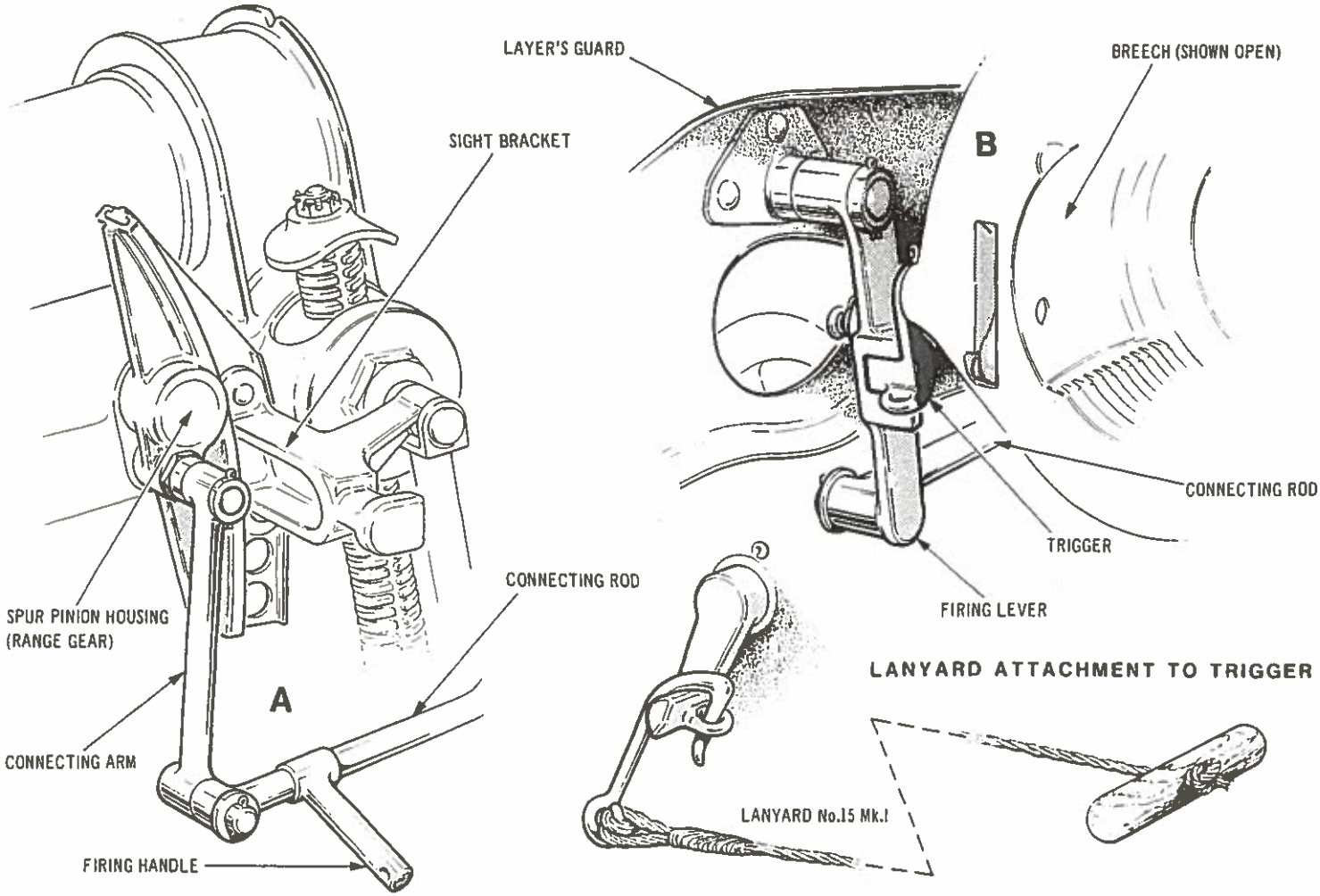
FIRING MECHANISM OPERATION



FIRING MECHANISM COMPONENTS


CURVED GUIDE
SIGHT BRACKET
RETURN SPRING
LAYER'S GUARD
CRADLE
SPUR PINION HOUSING
(RANGE GEAR)
B
CONNECTING ARM
A
TRIGGER
CARRIAGE BODY
FIRING LEVER
CONNECTING ROD
FIRING HANDLE
0
SCALE (FEET)

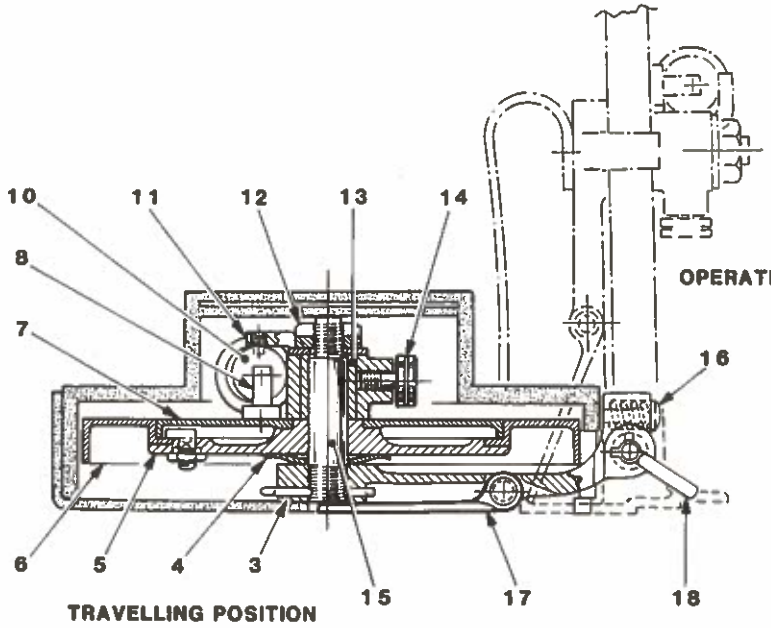
FIRING GEAR


LAYER'S GUARD
BREECH (SHOWN OPEN)
SIGHT BRACKET
B
CONNECTING ROD
TRIGGER
FIRING LEVER
SPUR PINION HOUSING
(RANGE GEAR)
CONNECTING ROD
A
CONNECTING ARM
FIRING HANDLE
LANYARD ATTACHMENT TO TRIGGER
LANYARD No.15 Mk.I

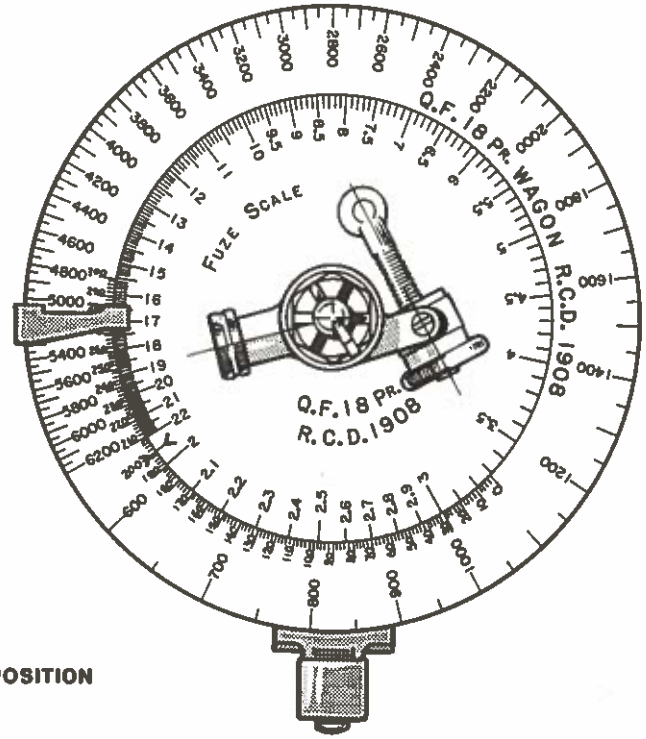
FIRING GEAR

subdivided to give settings of 0.1. An arrow head on the setting disc (7) coinciding with an arrow head on the range ring (6) indicated the normal setting position. The arrow heads were filled with red wax. A hinged pointer (2), when set to the required range, indicated the fuze setting to 'point of burst'. A disc spring minimised involuntary movement of the range ring (6).

To use the corrector scale, the adjusting nut (10) would be turned to move the setting disc (7) position relative to the range ring (6), the setting being maintained by tightening the jamming screw (14).



TRAVELLING POSITION

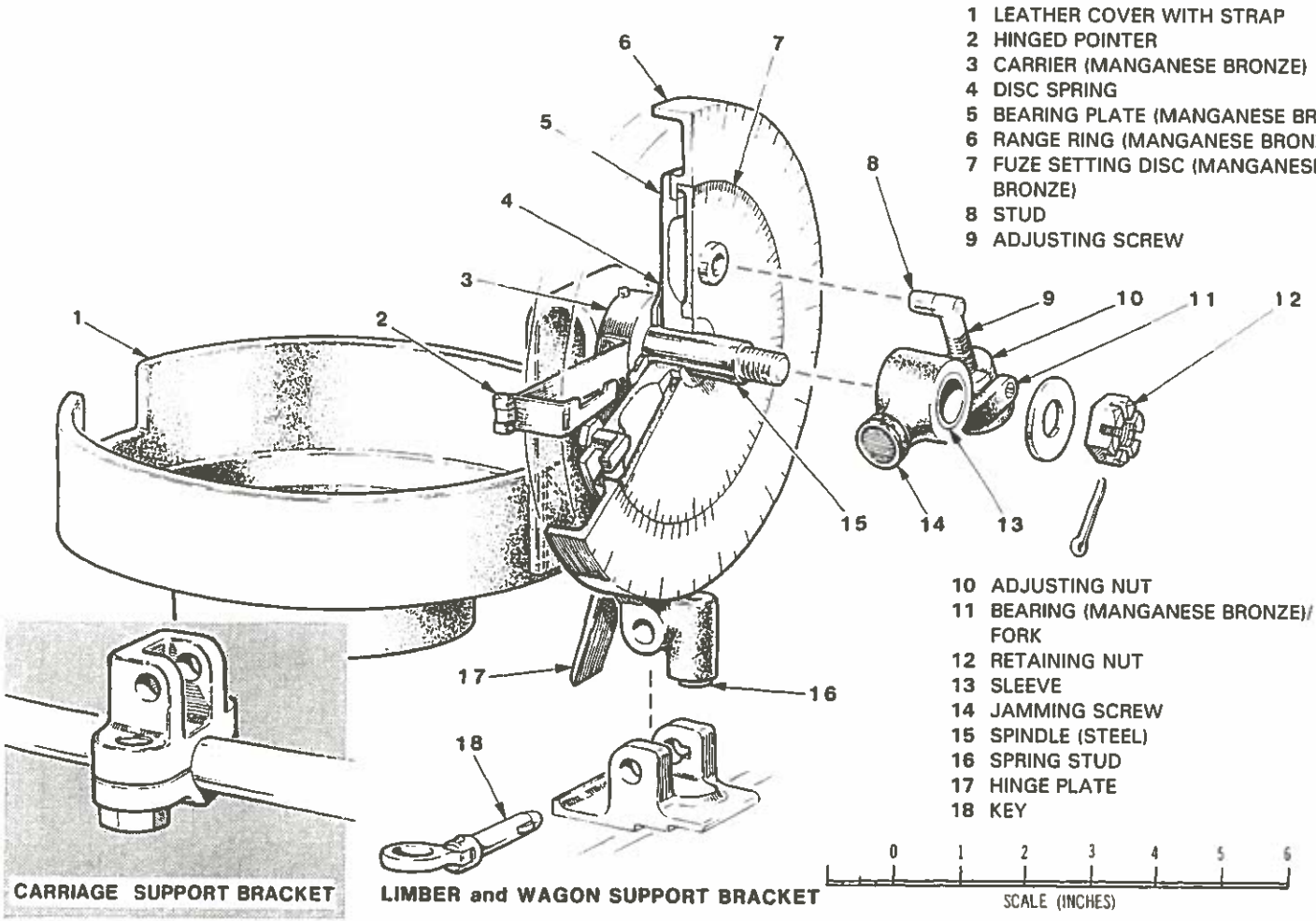


OPERATIONAL POSITION

FUZE INDICATOR MK. I

In use, the indicator was supported upright by the hinge plate (17) working in opposition to the spring stud (16). When not in use the indicator was laid horizontal and protected by a leather cover secured by a strap (1).

The fuze indicator was a separate store and not a component of the carriage, limber or ammunition wagon. It was not carried on the carriage during travelling.



FUZE INDICATOR MK. I

Fuze Indicator Mk. II (see page 270)

Handbooks of 1911 quote Fuze Indicators either Mk. I or Mk. II as being fitted. By 1913 the Mk. II had completely replaced the Mk. I.

The grooved base plate was graduated on the upper portion with a range scale reading from 1600 to 6200 yards and on the lower portion with a corrector scale graduated from 0 to 200.

The slide, which fitted into the base plate central groove, was graduated with a fuze scale numbering from 4.5 to 22, these numbers corresponding with the graduations on a Time and Percussion Fuze No. 80. An arrow, engraved on the slide lower edge, coinciding with No. 150 on the corrector scale, indicated the normal setting position. The slide could be clamped in any required position by use of the clamping handle. The range and fuze scales were read by the sliding reader. The reader movement could be dampened by adjustment of the top screw tensioning the friction spring.

The fuze indicator was suspended by two hooks, attached to the rear face of the base plate, being steadied by the two base plate studs. Two indicators were carried per sub-section, one on the gun carriage shield and one on the rear of an ammunition wagon.

Percussion and Time Fuze No. 80 Mk. IV

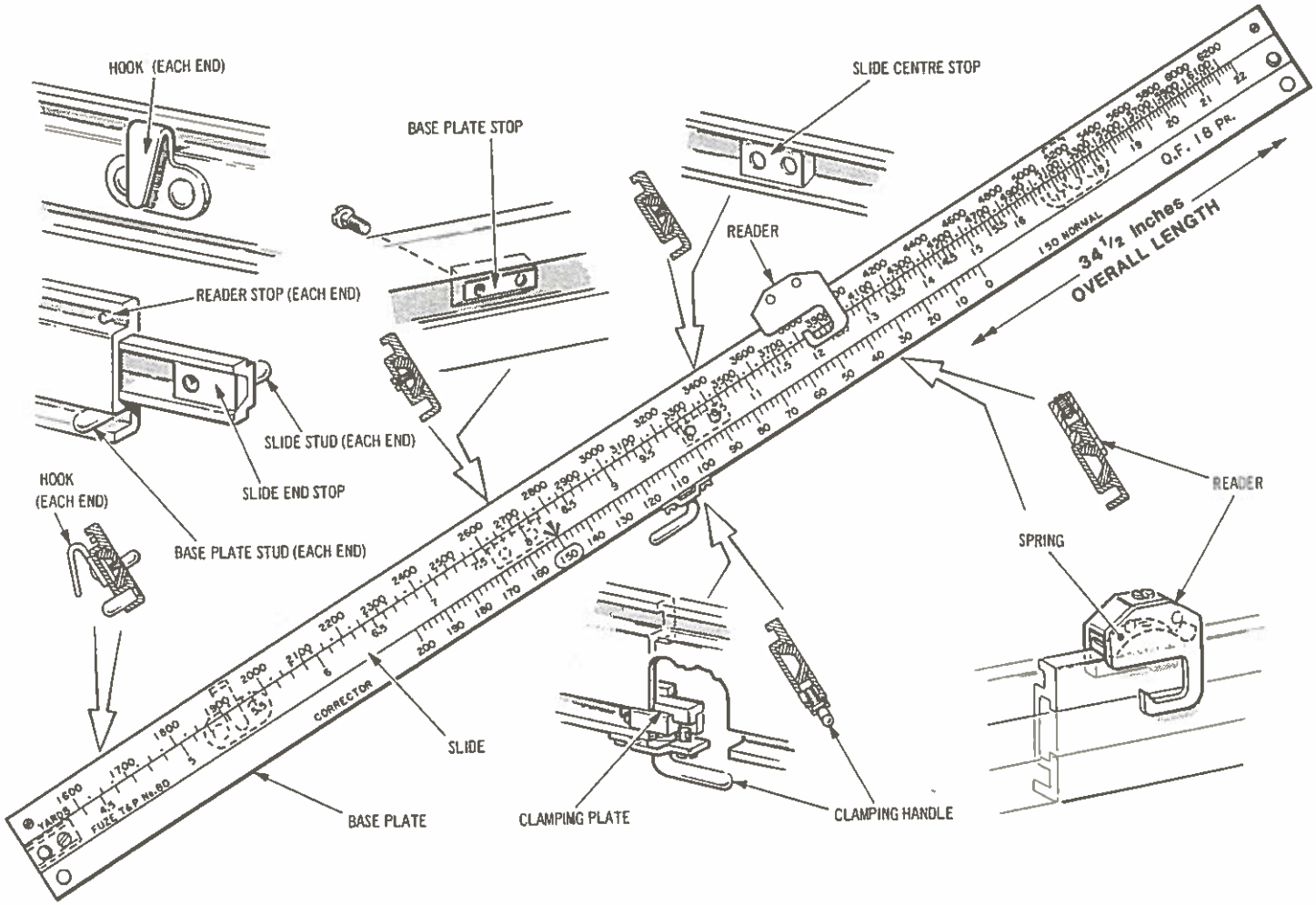
The fuze major components were of aluminium unless otherwise stated in the key on page 271.

The body (**11**) lower portion was threaded to house the percussion fuze holder (**18**); the body upper portion forming a stem containing the time fuze pellet (**9**) and stirrup spring (**10**). The body base was fitted with a brass ring (**15**), the upper part of which was graduated from 0 to 22, the graduations being subdivided into 10 divisions. A square notch was cut into the ring for the Fixing Key No. 17 Mk. II. An engraved cross indicated the safety point.

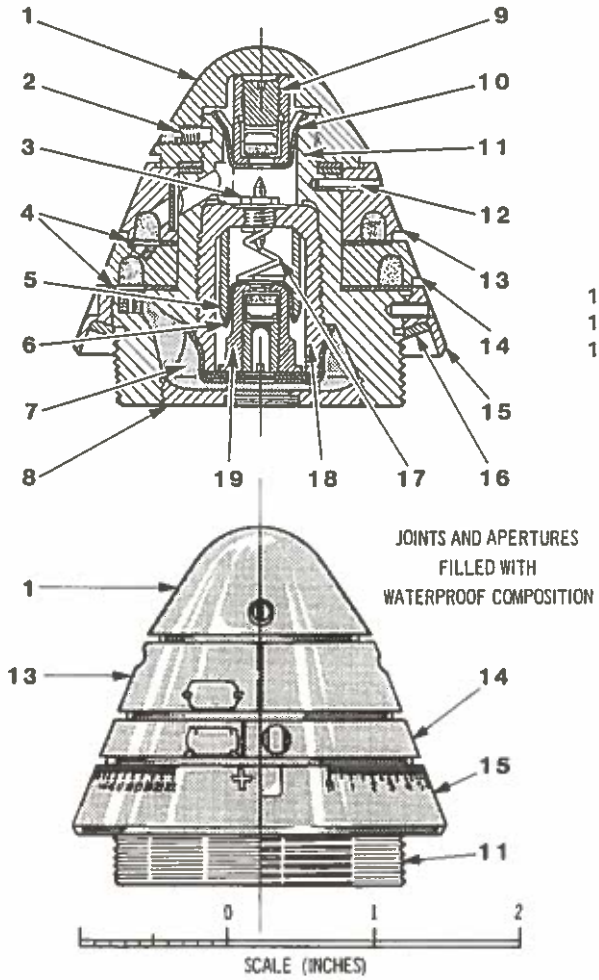
The leather washer (**16**) to fit between fuze and shell was soaked in mineral jelly.

The bottom time ring (**14**) had a projecting pin to engage the Setting Key No. 18. A setting mark was cut on the ring. The percussion fuze holder (**18**) held the needles (**3**) for both time and percussion detonators.

The brass fuze cover (**22**) was held in place by a tearing off strip (**20**) soldered to both the cover (**22**) and lower edge of the graduated ring (**15**). To remove the fuze cover (**22**), the ring was released from the securing strip (**21**) and pulled to tear off the strip (**20**), when the cover (**22**) would fall off and expose the fuze.



FUZE INDICATOR MK. II



PERCUSSION AND TIME FUZE NO. 80 MK. IV

1 CAP
2 SET SCREW (CAP)
3 NEEDLES
4 WASHERS (WATERPROOF CLOTH)
5 FERRULE
6 STIRRUP SPRING (PERCUSSION FUZE)
7 POWDER MAGAZINE
8 BASE PLUG
9 TIME FUZE PELLET
10 STIRRUP SPRING (TIME FUZE)
11 BODY
12 PIN (2)
13 TOP COMPOSITION (TIME) RING
14 BOTTOM COMPOSITION (TIME) RING
15 GRADUATED RING (BRASS)
16 WASHER (LEATHER)
17 SPIRAL SPRING
18 PERCUSSION FUZE HOLDER
19 PERCUSSION DETONATOR PELLET
20 TEARING OFF STRIP
21 RING SECURING STRIP
22 CAP (BRASS)
23 RING

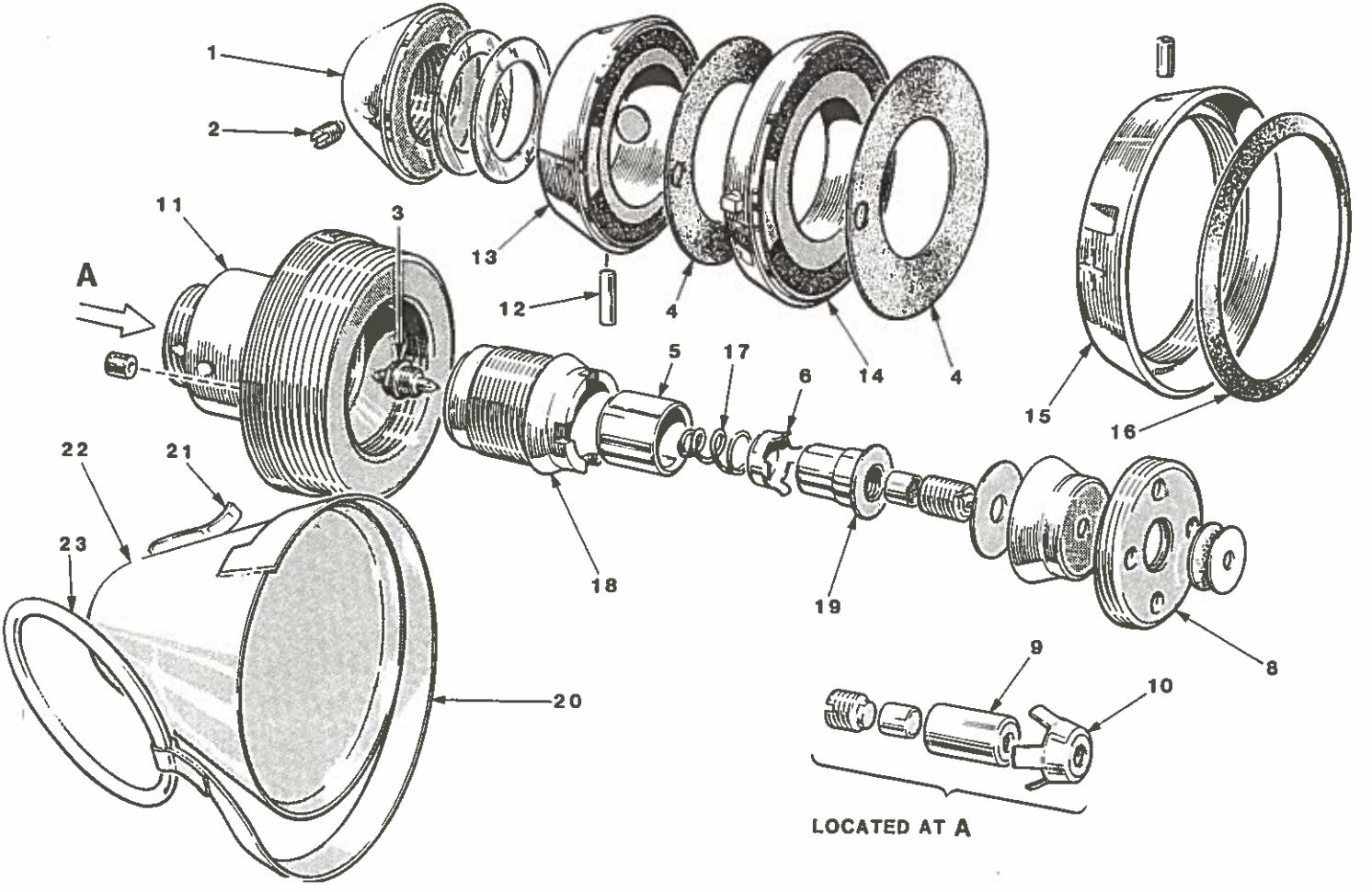
To set the fuze, the bottom time ring (**14**) would be turned to position the setting line opposite the required mark on the graduated ring (**15**).

The weight of the fuze was 10.25 ounces.

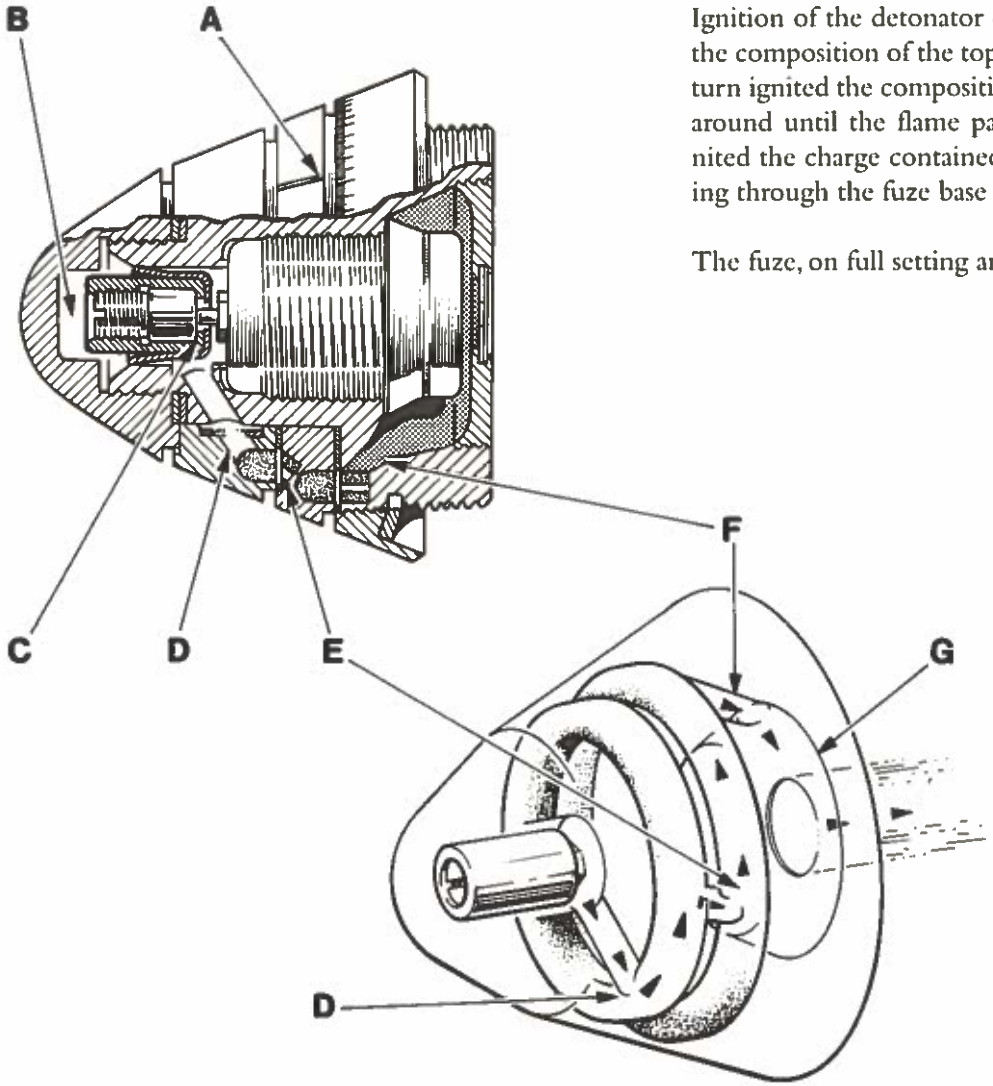
Time fuze operation (see page 273)

The time fuze was set by turning the bottom time ring until the setting line coincided with the required mark on the graduated ring (**A**).

On discharge, inertia caused the time fuze pellet to move rearwards (**B**), straightening the clips of the stirrup spring, allowing the detonator housed within the pellet to strike the forward facing needle (**C**).



PERCUSSION AND TIME FUZE NO. 80 MK. IV



Ignition of the detonator composition fired through and ignited the composition of the top ring (**D**) which burned around and in turn ignited the composition of the bottom ring (**E**). This burned around until the flame passed through the channel (**F**) and ignited the charge contained in the powder magazine (**G**), this firing through the fuze base plug into the shell bursting charge.

The fuze, on full setting and at rest, would burn for 22 seconds.

TIME FUZE OPERATION

Percussion fuze operation

On discharge, inertia caused the ferrule to move rearwards over the detonator pellet (**A**) straightening the clips of the stirrup spring.

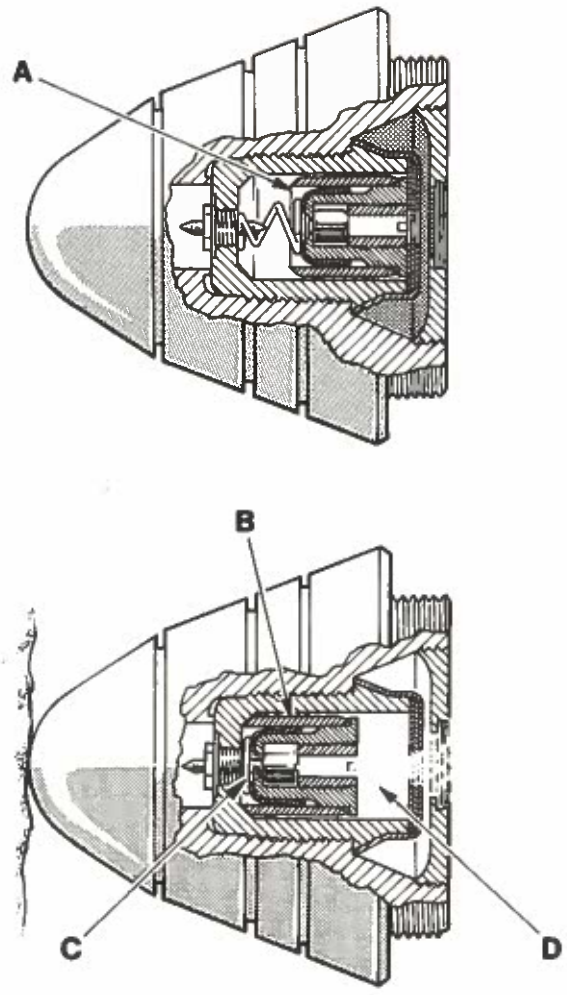
On impact, the ferrule and detonator pellet moved forwards (**B**), compressing the light spiral spring and allowing the detonator housed within the pellet to strike the rearward facing needle (**C**).

Ignition of the detonator composition fired through into the charge contained in the powder magazine (**D**), this firing through the fuze base plug into the shell bursting charge.

A number of fuzes were issued which bore no numeral, lot number or date of manufacture. They were marked only on the cover with the design number 16603A. These fuzes differed from the MK. IV fuze in the shape of the brass ring and other minor details.

The **Mk. III** fuze had no brass ring around the body flange for fitting a cap. The **Mk. II** fuze was identical to the Mk. III except that the external joints were not waterproofed. Existing Mk. II fuzes which were subsequently waterproofed were known as Mk. II*. Fuzes Mks. II and III were fitted with a cover, No. 80 Mk. II. This was a brass cap, shaped to fit over the fuze and attached with a screwed ring and tin band. Tearing off the tin band caused the cap to fall off, exposing the fuze. The weight of the cover was 2.5 ounces.

Fuzes were issued in tin cylinders, one fuze per cylinder. The cylinders were known as Cylinder No. 80F and were painted green with yellow labels.



PERCUSSION FUZE OPERATION

Drill Fuze No. 80

Burnt-out service fuzes were converted to drill fuzes by being blacked all over, except for the body flange. A bright area was left on each composition ring. The setting pin was of steel and the cap was stamped with the word DRILL.

Fuze Safety Clip No. 80 Mk. I

This was a steel clip, horseshoe shaped, to fit around the No. 80 fuze and hold it in the safety condition. It had a slot to fit over the setting pin and a tongue to fit into the fixing slot. It was retained by projections which gripped the edge of the fuze body.

Fixing Key No. 17 Mk. II (Fuze Nos 80 and 83)

This was of steel, one end being ring shaped to fit over the fuze.

One edge of the ring bore was bevelled to suit the body profile of all No. 80 fuzes without covers and had a projection to fit the square notch in the fuze graduated ring. The opposite edge of the ring bore had a slot cut into it to engage with the projection on a fuze cover, when screwing the fuze into a shell.

The **Mk. I** key was without a slot and could not be used with a Mk. IV fuze with cover.

Setting Key No. 18 Mk. II (Fuze Nos 80 and 83)

This was of steel and used when the bottom time ring was too stiff to set by hand. It had a slot to engage with the projecting setting pin on the bottom time ring. The length of the key was 6.17 inches and it had a loop of white line 30 inches in length.

The **Mk. I** key was shallower in depth than the Mk. II.

Time Fuze No. 25 Mk. III (15 seconds)

This was partially similar in construction and operation to the time arrangement of the No. 80 Mk. IV fuze.

It had only one composition time ring, this being externally graduated from 0 to 44. An arrow on the time ring would coincide with a black mark on the body shoulder when set at safety. A copper safety pin passed through the top cap and detonator pellet. It was provided with a loop of red cord. This safety pin suspended the detonator pellet which was held also by a stirrup spring.

The powder magazine contained 45 grains of RFG 2 powder. External openings were waterproofed.

The weight of the fuze was 5.75 ounces.

The **Mk. II** fuze differed only in not being waterproofed.

Cartridge, primers and shells

Cartridge case

The solid drawn brass cartridge case contained a propellant charge consisting of a one pound, six and fifteen-sixteenths ounces bundle of cordite MD size 8, recessed at one end to sit over the primer and primer housing boss, the other end being in contact with the shell base.

The weight of the case, with primer, was 2 pounds 15 ounces.

Shrapnel shell

Although part of a fixed round, the shrapnel shell retained most of the features to be found on the earlier shrapnel shell projectiles used in conjunction with separate cartridges.

The **Mk. III** shell had a forged steel body with an internally recessed base to hold a tin cup containing the bursting charge. This was 2 ounces 8 drams of either RFG 2, blank FG new, SFG 2, or QFFG powder.

The shell head was formed with an external radius of two diameters. Screwed into the shell head was a two-inch brass fuze socket to receive a Time and Percussion Fuze No. 80 Mk. IV.

Fitting into the fuze socket was one end of a brass tube, the other end of which was screwed into a steel disc positioned over the bursting charge tin cup. The tube contained perforated powder pellets, which conveyed the fuze detonation flash to the bursting charge. The pellets weighed three-quarters of an ounce, this weight being included in the bursting charge total weight. The shell contained 375 mixed metal balls at 41 to the pound.

The copper driving band was secured from rotating in its groove by two waved bands. To secure the shell in its case, the case lip was pressed into the driving band groove. Shell weight, filled and fuzed, was 18 pounds 8 ounces.

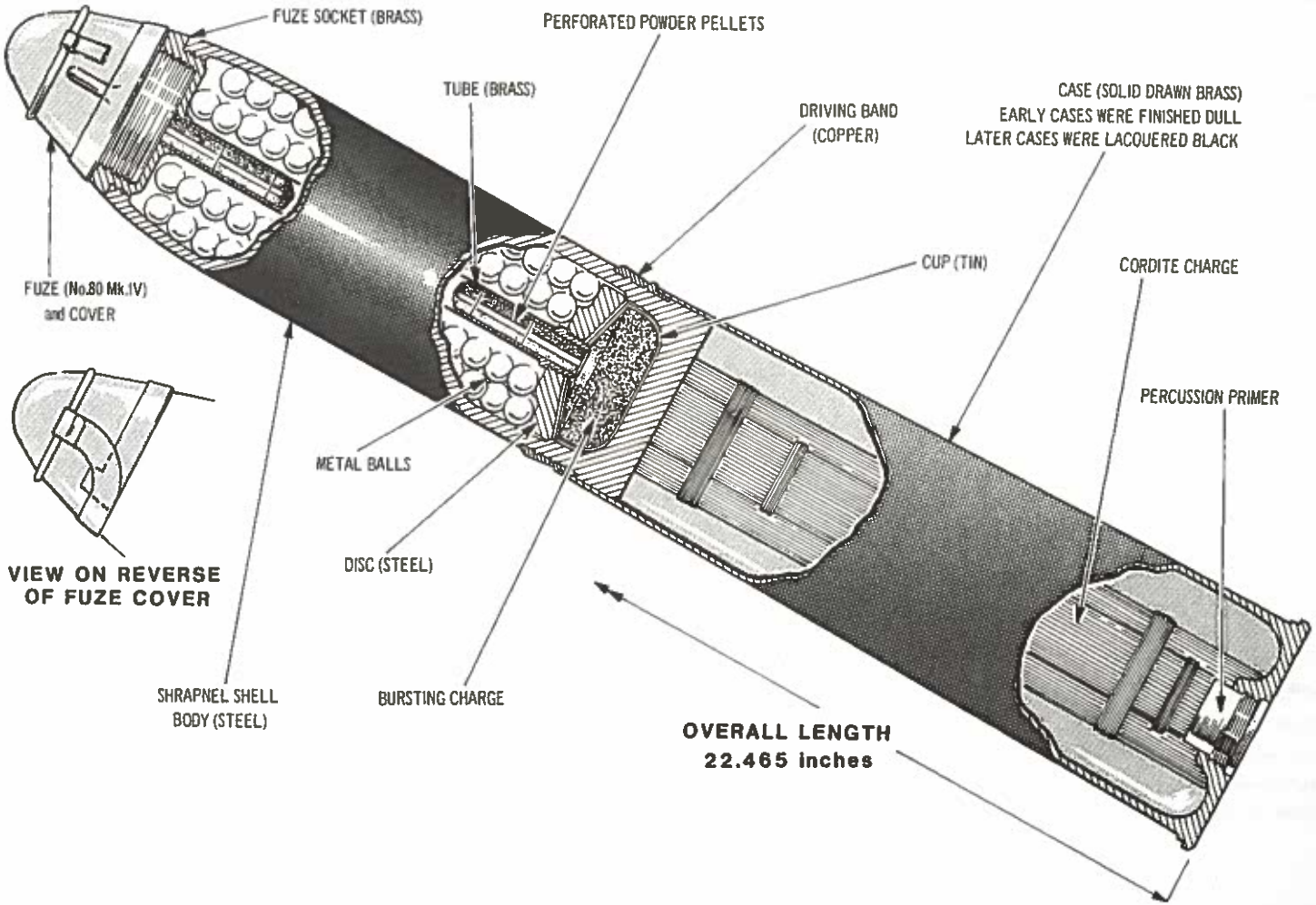
The shell was painted lead grey for the purpose of identification. The weight of the complete round was twenty-two pounds, thirteen and fifteen-sixteenths ounces.

The **Mk. II** shell had a driving band slightly narrower in width to that of the Mk. III shell. It had a turned cannelure at the rear, filled with Pettman's cement, into which the cartridge case was secured with four indentations.

The **Mk. I** shell head was formed with an external radius of one and a half diameters. Early shells would take the Mk. I fuze cover only, later shells were slightly modified to take fuze covers of later Mk. numbers.

The lower portion of the shell body wall was thinner in section than that of the Mk. II or Mk. III. It contained 365 balls. The lid of the bursting charge tin cup was also of different shape.

The shell exterior was painted black.



SHRAPNEL CARTRIDGE MK. I

Blank cartridge

The **Mk. II** blank cartridge consisted of a service case and percussion primer, with a 1 pound charge of LG powder in a silk cloth bag (No. 1 class), having three silk braid hoops, enclosed in a felt jacket with a lifting loop.

The cartridge mouth was closed with a split paper ring and leather-board cup, this being fitted by the use of a wood drift, supplied for the purpose.

The **Mk. I** blank cartridge had two silk braid hoops and a smaller lifting loop.

Smokeless Blank Cartridge Mk. I

This was a service case and percussion primer containing a 7 ounce charge of smokeless blank and 4 ounces 5 drams of matchwood shot.

The cartridge mouth was closed with a split paper ring and leather-board cup, this being fitted by the use of a wood drift, supplied for the purpose. Empty cartridge cases for blank use were issued in a wood box, 20 to a box. Charges were issued specifically for use in blank cartridges.

Dummy cartridge

This was used for fuze setting practice. It consisted of a service cartridge case and shell body, the latter fitted with a 2 inch fuze hole socket closed at the bottom, the body filled with a mixture of dust and lead ash. This was fitted in the normal way into the service cartridge case, which contained a wood block, recessed at one end to fit over the boss in the base, the other end butting against the shell base. A through bolt, the head of which fitted into the primer hole, passed through the wood block and screwed into the base of the shell.

For identification, four holes were bored in the case side and three in the base.

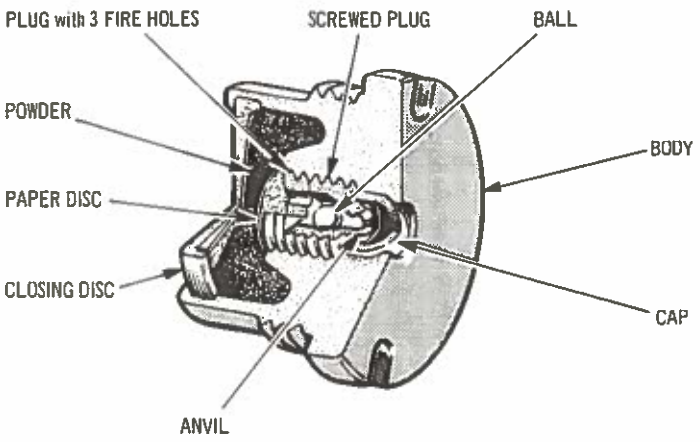
Drill cartridge case

This was an empty service case with the mouth plugged by a tightly fitting, 1 inch thick hardwood disc.

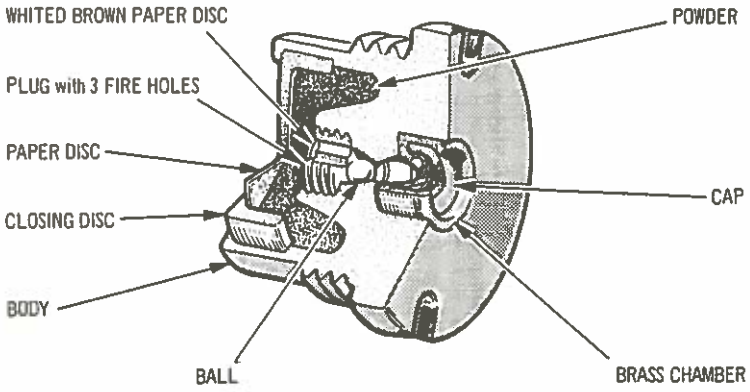
The drill primer was of the same external shape as a service primer, but bored out to house a hard rubber plug, this being held in position by a screwed plug. It was stamped, on the head, with the word DRILL.

Percussion primer No. 1

The **Mk. II** percussion primer consisted of a brass body, externally threaded to fit into the cartridge case base. It was internally bored and recessed to take the percussion cap which was secured by a screwed plug. The plug was formed with an anvil at one end, the plug body being bored to form a coned seating chamber. This



Mk.II



Mk.I

PERCUSSION PRIMER NO. I

contained a soft copper ball and was closed by a perforated plug. A chamber in the primer body contained RFG 2 gunpowder and was closed by a paper disc and a brass closing disc with six slits.

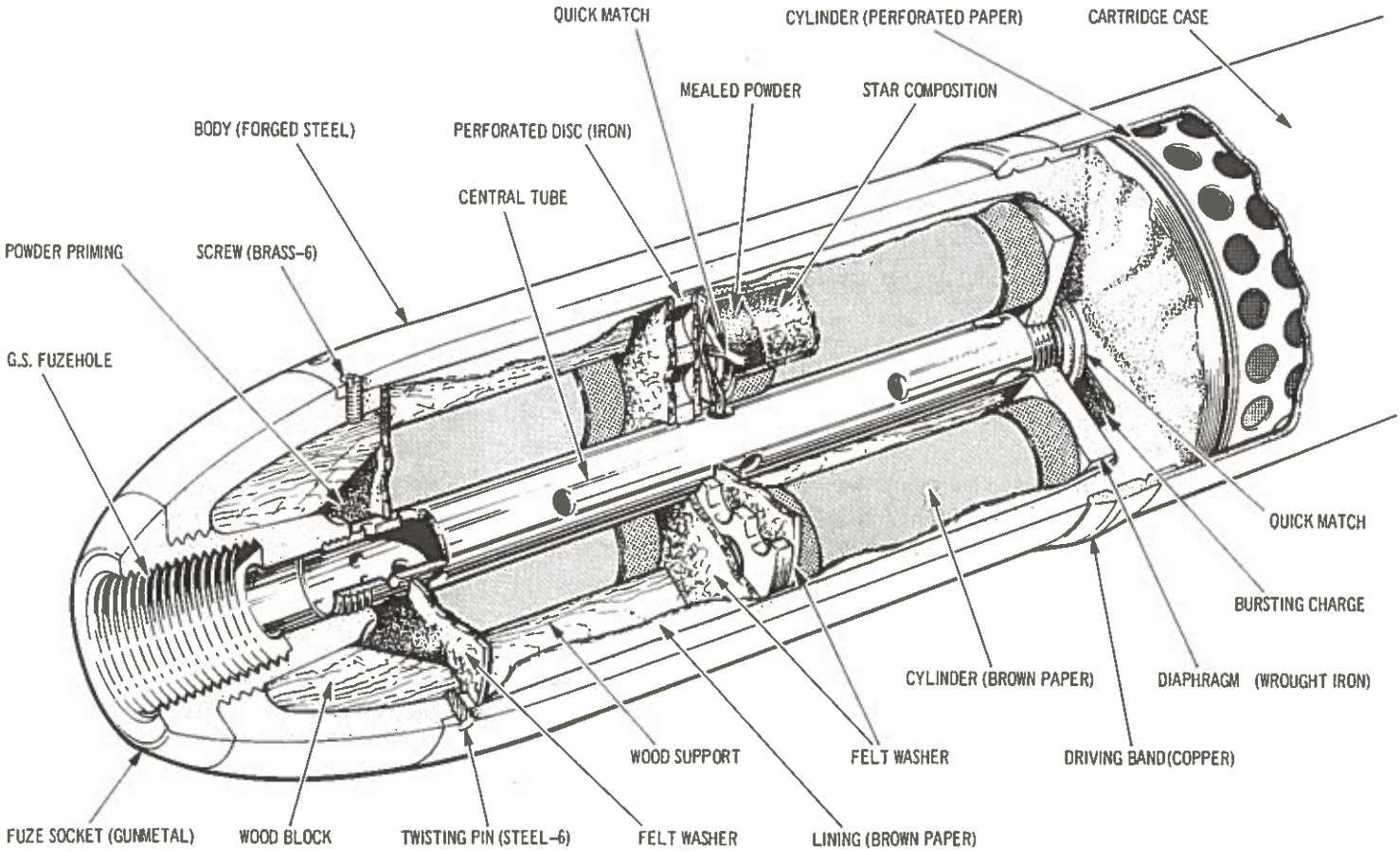
Upon firing, the gun firing pin crushed the percussion cap against the anvil and detonated the percussion compound. The detonation fired past the ball, through the three fire holes in the plug and ignited the RFG 2 gunpowder charge, which burst through the six slits in the brass closing disc. Gas pressure drove the soft copper ball into the coned seat of the screwed plug bore and relieved gas pressure on the cap.

The **Mk. I** primer differed from the Mk. II in the head being recessed to house a brass chamber containing the cap. The brass chamber formed the anvil and had three fire holes to enable the primer detonation to pass through the coned sealing chamber past the ball and through the fire holes in the plug to the RFG 2 gunpowder contained in the body chamber.

Primer Key No. 27

The key was used to insert or remove the percussion primer in the cartridge case. It was of steel, and had two projections to engage with the two recesses in the primer head.

The length of the key was 13.1 inches and it was fitted with a white lanyard 43 inches in length.



STAR SHELL CARTRIDGE MK. I

Star Shell Cartridge Mk. I

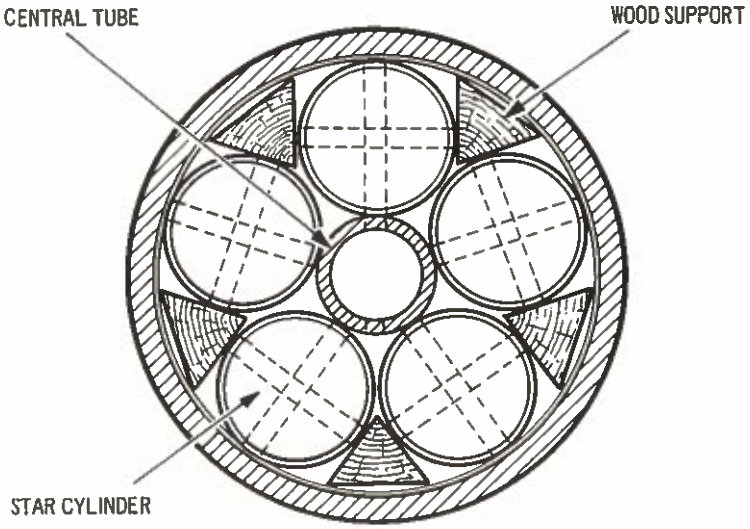
The charge, contained in a service cartridge case, consisted of 8 ounces of cordite MD, size 4¼, in a circular bundle, recessed at one end to sit over the primer boss. It was held in position in the case by a perforated paper cylinder. This had two perforated paper discs at each end, an additional unperforated disc being secured to the cylinder end which contacted the cordite charge.

The star shell had a forged steel body, recessed in the base for a bursting charge of three and one-quarter drams of RFG 2 gunpowder contained in a shalloon bag threaded with quick match.

The shell head, fitted with a gunmetal fuze socket and wood block, was secured to the body with 6 brass screws and 6 steel twisting pins. A metal tube, perforated with 12 fire holes, was screwed at one end into a wrought iron diaphragm over the bursting charge and at the other end into the fuze socket.

The shell body, lined with brown paper, contained 10 'stars', in 2 tiers of 5. A perforated iron disc, with a felt washer on either side, separated the tiers. The disc was held by wood supports placed between the stars. The ribs in the driving band groove were waved.

A Time Fuze No. 25 (15 seconds) would be used with this round, which was issued on special order only.



SECTION THROUGH SHELL BODY

Limber (Carriage)

The limber frame consisted of four flanged, nickel steel plate futchells, deepened where the axletree located and tapering to each end. The futchells were strengthened by corrugations on either side of the axletree location. The inner and outer futchells were connected by a nickel steel plate, semi-circular in section, riveted across their front ends. The frame was strengthened near the centre by two flanged nickel steel plate stays, riveted to the inner and outer futchells. Towards the front, the outer futchells were bent inwards and a swingletree hook was riveted to each front end. A draught pole socket was riveted between the inner futchells below the platform board and a socket to receive the draught pole end was riveted, between the inner futchells, behind the axletree. Nickel steel plate brackets were riveted to the futchell rear ends to give support to the ammunition box.

The front ends of the futchells were bent upwards to give sloping support to an elm footboard bolted across them. Between the footboard and ammunition box front was a two-piece, ash platform board, bolted across the futchells. One platform board end was recessed to give clearance for the shovel handle carried on the ammunition box side.

Half the number of limbers constructed had loops for kicking straps bolted to the footboard. Jack plates were riveted to the outer futchells beneath the axletree.

Early limber hooks were of forged steel, the bearing area being deeply hardened. Two arms of the forging overlapped the inner futchells and were riveted to them. The hook was provided with a lugged steel key, attached by a chain.

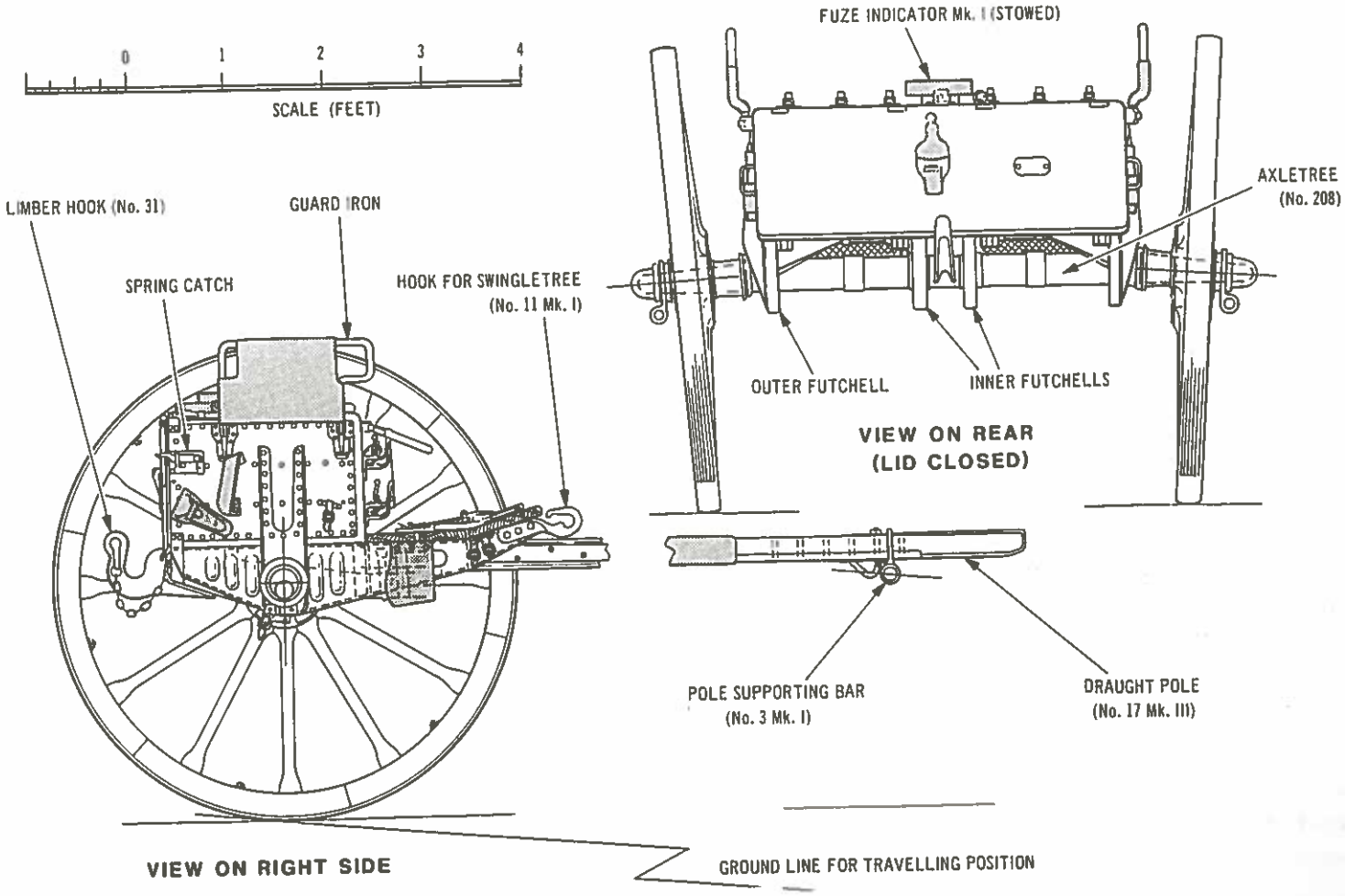
Later limbers were equipped with spring hooks, which automatically locked on engagement with the carriage trail eye. To unlimber, the catch handle would be depressed, allowing the trail eye to be lifted clear. On early pattern hooks, the steel key acted as a stop, preventing too much vertical angular movement between limber and carriage. The later spring hooks did not have this facility, and precautions had to be taken, when limbering up with the horses not hooked in, to prevent the limber from turning over backwards.

The wheels (2nd class, C pattern, No. 45), ran on a tubular steel axletree, circular in cross section. The axletree bearings were riveted to the inner futchells and bolted to the outer ones. The outer bearings had keys formed in them which engaged keyways in the axletree shoulders, these securing the axletree in position.

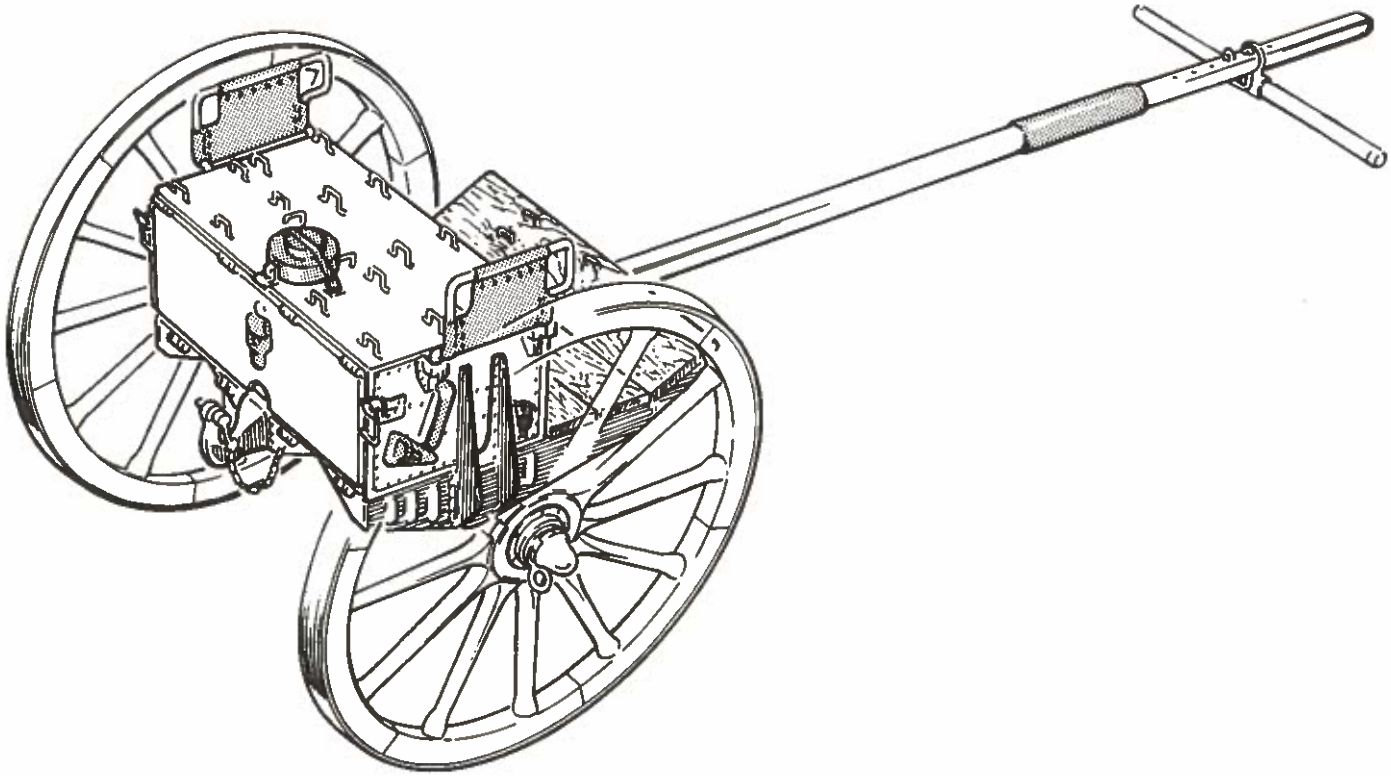
The wheel pipebox inner ends ran in L leather dust excluders fitted to the outer bearings.

The ammunition box was of steel plate. The front, lid, hinged steel plate and the sides were of bulletproof steel. The box top and bottom were of nickel steel plate, the bottom plate being provided with drain holes. The assembly was riveted together, the complete box being riveted to the futchells, to the futchell rear brackets and to the stay plates riveted to the outer futchells and box ends.

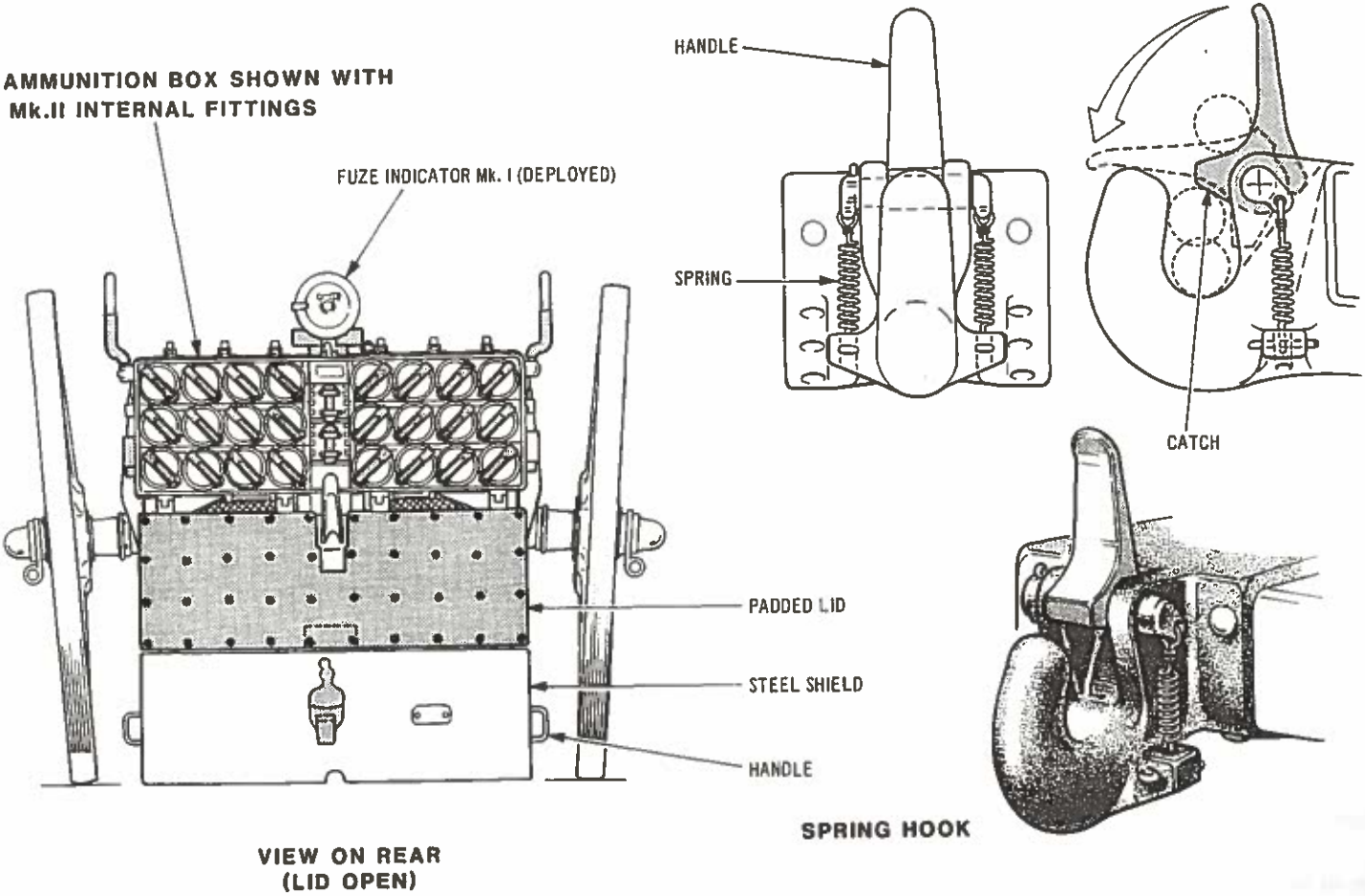
The box lid was hinged to the frame rear brackets and opened downwards. It was padded on the inside with felt and a leather



LIMBER (CARRIAGE)



LIMBER (CARRIAGE)



LIMBER (CARRIAGE)

cover, secured by rivets. With the lid closed, the pad acted as a steady to the cartridge ends.

A bulletproof shield plate was hinged to the lid upper edge, secured, when closed, by spring catches on the box ends engaging handles on the shield plate. The box lid was also secured by a lock and key. When opened, the shield plate, lid and box together afforded protection from small arms fire to gun crew members in the rear of the limber.

The **Mk. II** box interior (illustrated) was divided into horizontal partitions by steel shelves braced by angle steel strips, into which were wedged tubes of plaited Indian cane, each shaped to hold one round of ammunition and fitted with a quick-release strap.

The box held twenty four rounds of ammunition. Two central compartments each housed a wood tray containing small stores, secured by a spring catch.

The **Mk. I** box interior had a nickel steel vertical plate riveted inside at the rear. This had twenty-four flanged holes, each to hold the rear end of a brass tube which was shaped to conform to the contour of a cartridge. The front end of each tube had a steel stud plate riveted to it, the stud projecting through the box front plate and secured by a manganese bronze nut with split pin. The rear end of each tube was lipped and formed with a projection which engaged the cartridge clip (see page 383).

Boxes of both Mk. numbers were originally fitted with a hinge plate on the box top, at rear, for the attachment of a Fuze Indicator Mk. I.

Riveted to the top of the box sides were steel sockets, into which fitted guard irons secured by a steel screw, with leather guards. Spring clips were attached to the front of the box to carry two service rifles, in canvas covers, secured in position by quick release straps. The body underside was fitted with two wire netting receptacles, secured by spring catches and leather ties, for the carriage of various stores.

Limber (Ammunition Wagon)

This limber was similar in construction to the carriage limber, but the frame was wider to take a larger ammunition box. The box carried thirty-eight rounds of ammunition in three compartments, sixteen rounds in each outer compartment and six in the centre one. Below the centre compartment ammunition was space for a wood tray containing small stores.

Each outer compartment was fitted with a padded lid, hinged at the bottom to the rear frame brackets, with a shield hinged to it at the top.

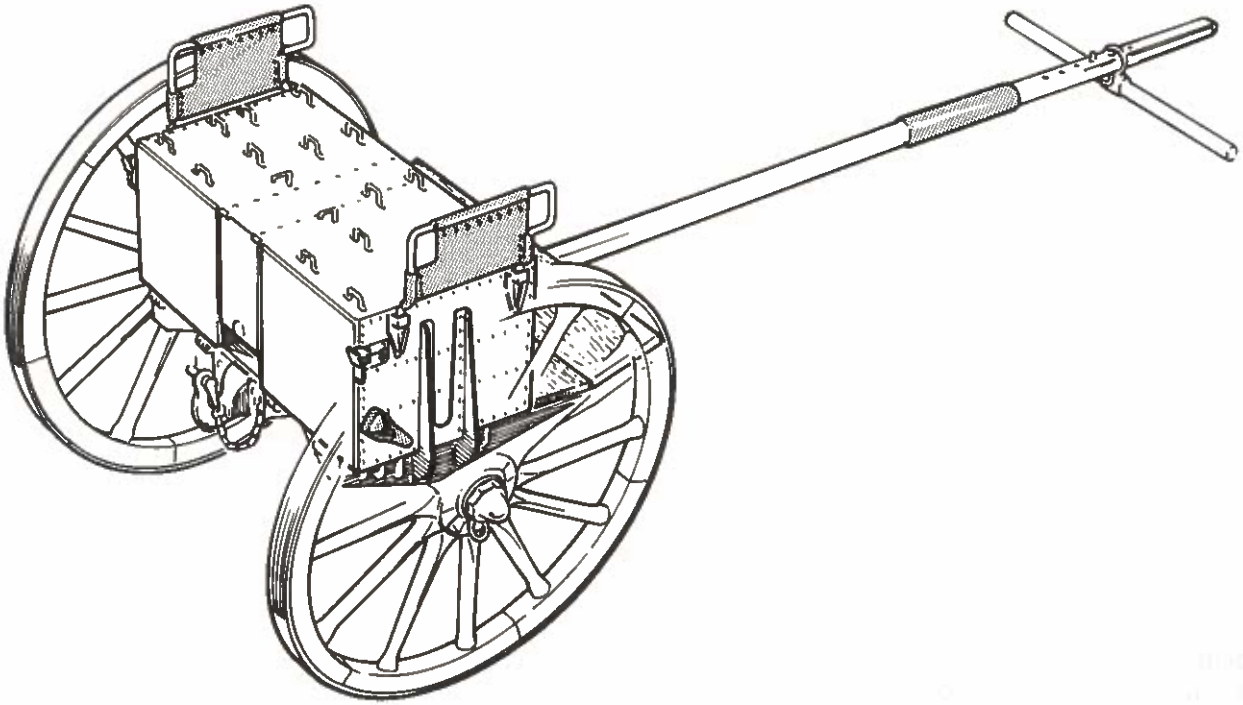
The centre compartment lid was hinged at the top to the box and was secured by two spring catches and a lock with key. The centre lid would be closed last, as it secured the outer lids by bearing against flanges formed on them. The outer lids were also secured by spring catches, as on the carriage limber.

The outer axletree bearings were shorter than those of the carriage limber, on account of the wider frame.

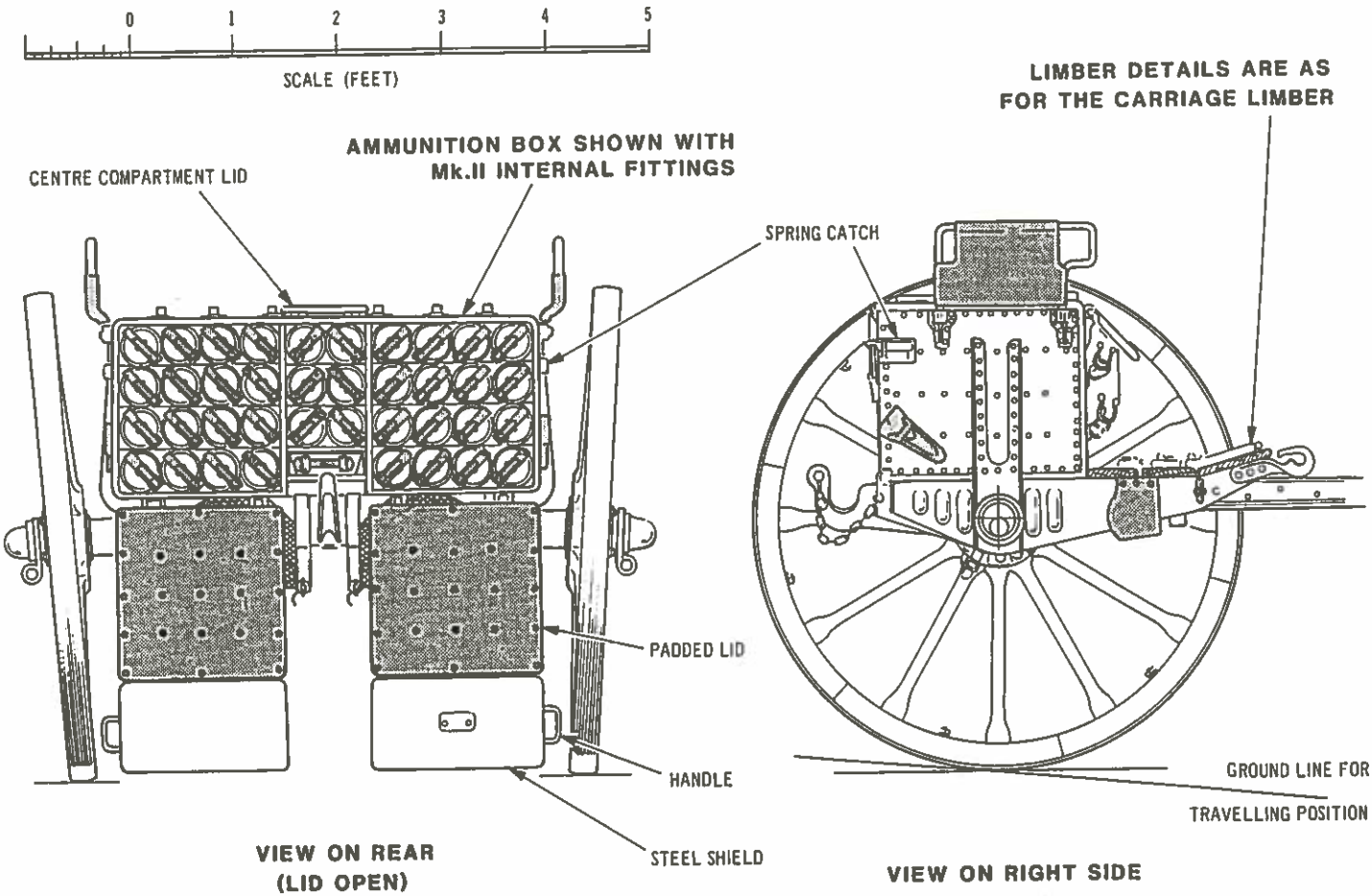
The differences between the Mk. I and Mk. II carriage limbers applied also to the wagon limbers. Small fittings carried on the carriage limber applied also to the wagon limber.

Ammunition wagon

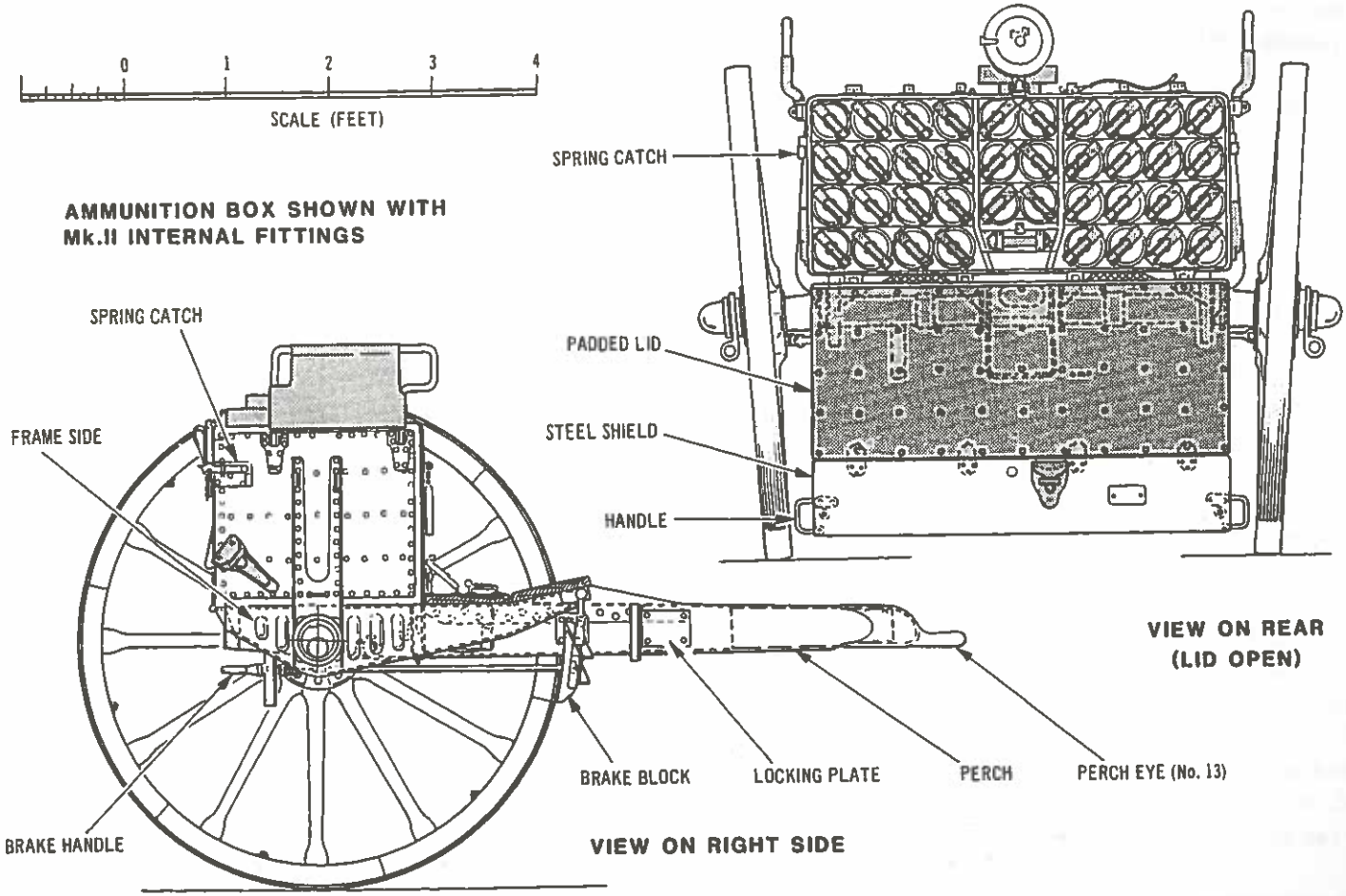
The nickel steel perch was bent in the form of a box, tapering from rear to front, overlapping and riveted on the underside. A steel plate was riveted underneath the perch at the axletree position. The centre of the perch was strengthened by steel plates riveted to each side. These plates sloped upwards to support the footboard. A hardwood block, eighteen inches long, was inserted inside the perch, near the eye, to strengthen it. The perch eye was a steel forging, the rubbing portion being hardened, secured to the perch by rivets.



LIMBER (AMMUNITION WAGON)



LIMBER (AMMUNITION WAGON)



AMMUNITION WAGON

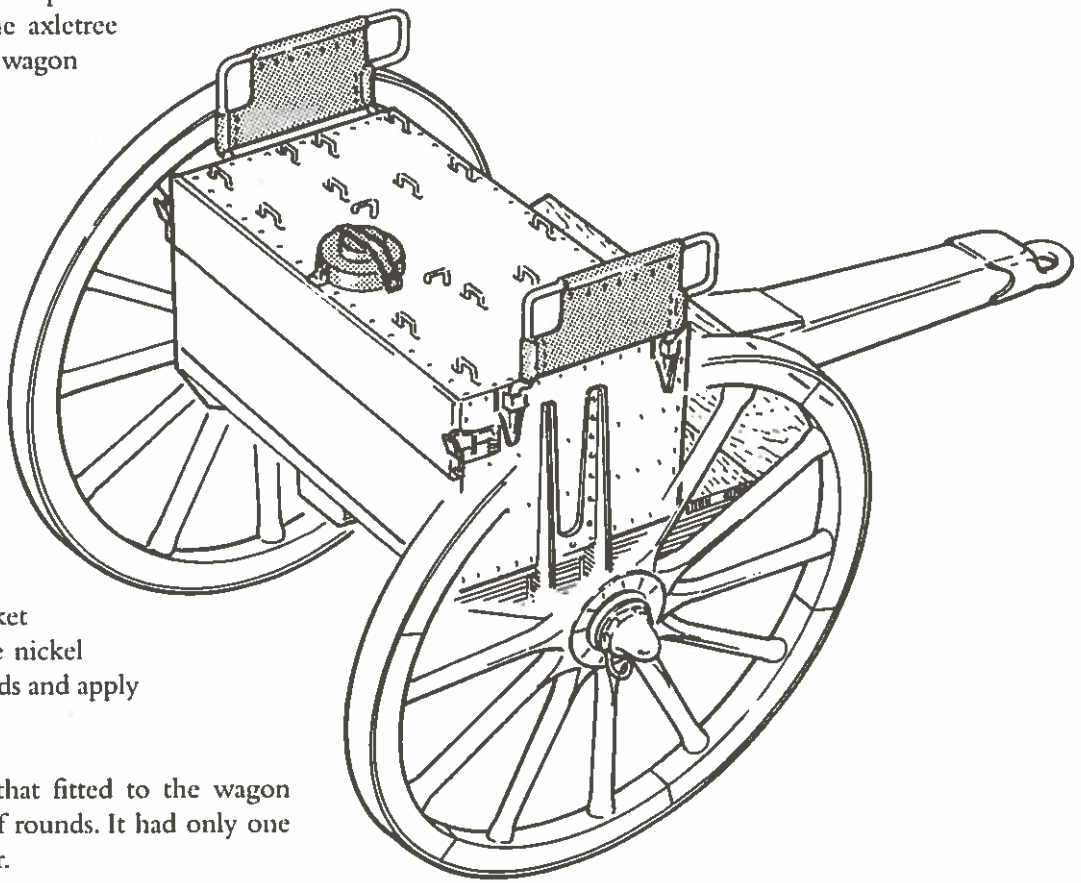
The frame sides were of flanged, nickel steel plate similar in form to the limber outer futchells. They were connected to the perch by two flanged, nickel steel stays in front of the axletree, a third stay being fitted inside the perch at this position. Brackets were attached to the rear end of the sides and perch to support the ammunition box. The frame sides sloped upwards at the front to support the footboard. The axletree and wheels were similar to that of the wagon limber, secured in the same manner.

An ash platform board, made in one piece, and an elm footboard were secured across the perch and frame sides, forward of the ammunition box. A slot was cut in each footboard supporting plate to allow handspikes to pass through when these were carried instead of a spare jointed draught pole.

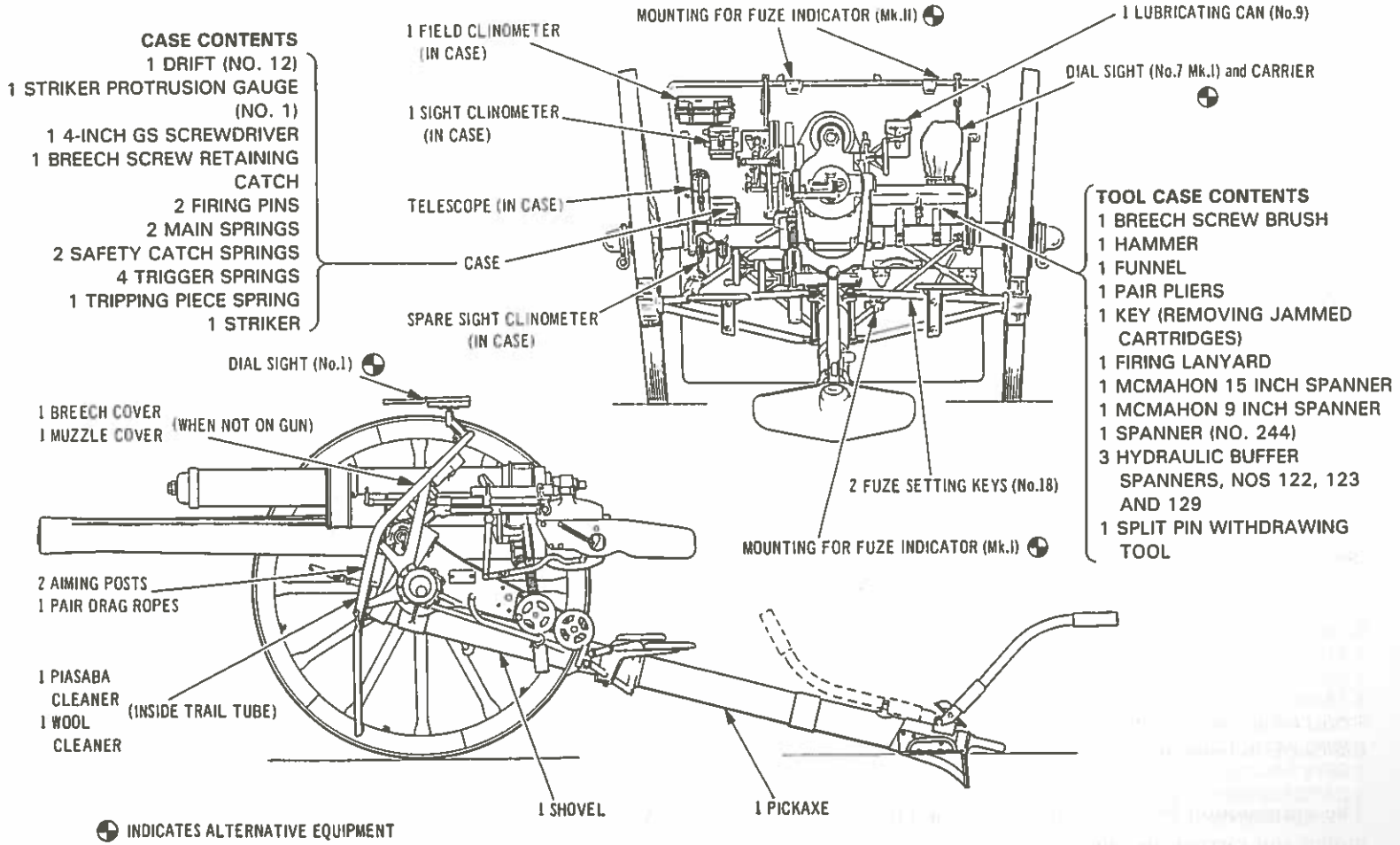
The brake was actuated by a handle at the frame rear. Turning the handle caused two operating rods, linked by a bell-crank lever pivoted in a bracket bolted around the axletree, to draw the nickel steel, channel section brake bars rearwards and apply the cast iron brake blocks to the tyre.

The ammunition box was similar to that fitted to the wagon limber and carried the same number of rounds. It had only one lid, similar to that of the carriage limber.

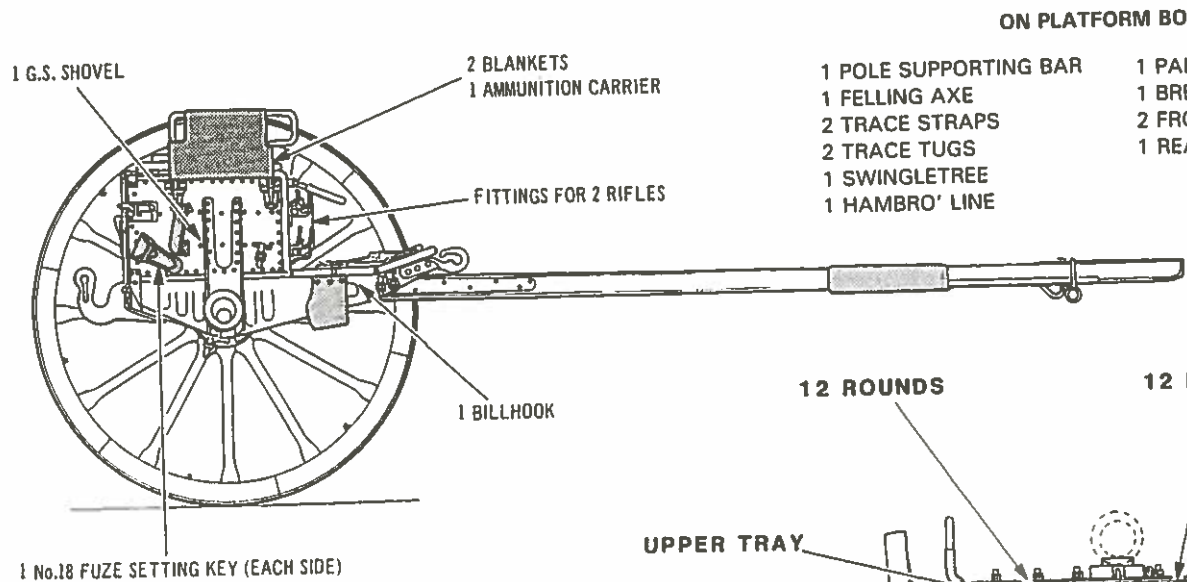
A shelf was fitted under the platform board, on each side of the perch, each to carry a fourteen-pound grease box. There were fittings underneath the perch to carry a spare jointed draught pole or handspike, and a fitting under the footboard centre for a siege lamp box.



Stores and equipment



CARRIAGE – STORES AND EQUIPMENT



ON PLATFORM BOARD

1 POLE SUPPORTING BAR
1 FELLING AXE
2 TRACE STRAPS
2 TRACE TUGS
1 SWINGLETREE
1 HAMBRO' LINE

1 PAIR SADDLERY TRACES
1 BREAST PIECE
2 FRONT SUPPORTING STRAPS
1 REAR SUPPORTING STRAP

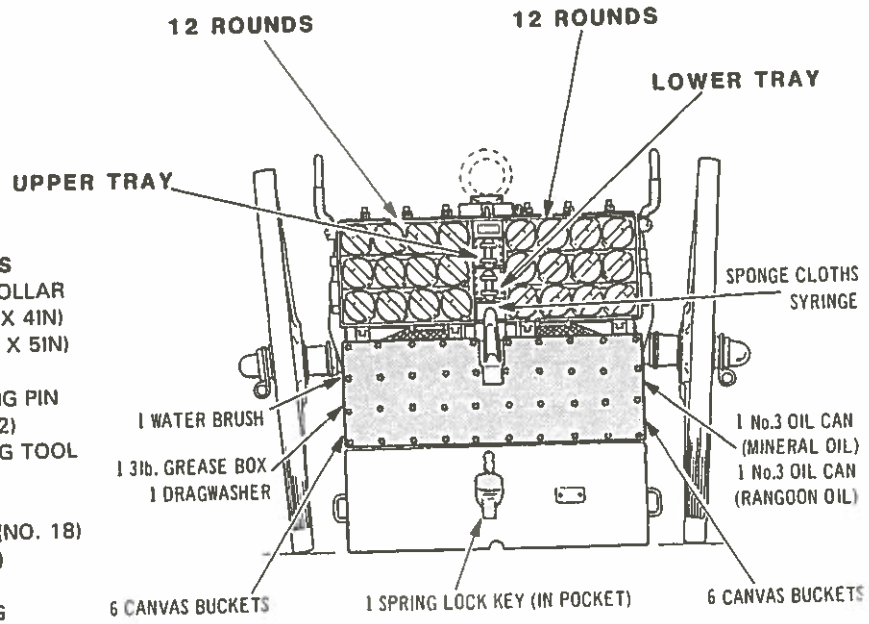
WHEN THE GUNS WERE PARKED, FUZE KEYS WOULD BE PLACED IN THE LOWER TRAY

UPPER TRAY CONTENTS

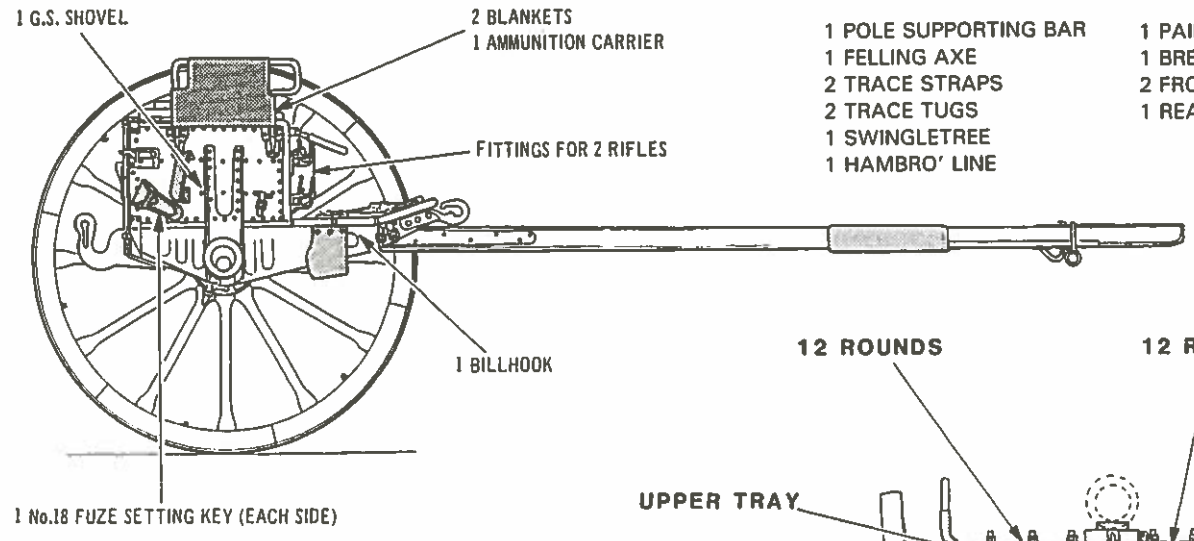
VARIOUS SPLIT KEEP PINS
2 PACKING RINGS
6 LUBRICATING SCREWS
1 STUFFING BOX RETAINING STUD
1 SIGHT CLINOMETER SPRING
2 TRAVERSING LEVER SPRINGS
1 COLLAR GLAND PACKING TOOL
2 RING WITHDRAWING TOOLS
2 SETS PACKING WASHERS
1 CATCH SPRING (LIMBER AND PERCH HOOKS)

LOWER TRAY CONTENTS

1 WHEEL ADJUSTING COLLAR
1 FLAT, SPLIT KEY (1IN X 4IN)
1 SPLIT KEEP PIN (.25IN X 5IN)
1 CAPSQUARE PIN
1 SHIELD PAWL LOCKING PIN
2 DISC SPRINGS (NO. 62)
1 GLAND PLUG PACKING TOOL
1 SMALL FILE HANDLE
1 LINCH PIN
2 FUZE SETTING KEYS (NO. 18)
1 DRAUGHT PIN (NO. 3)
2 FILLING HOLE PLUGS
1 SHIELD PAWL SPRING
2 FIRING GEAR SPRINGS



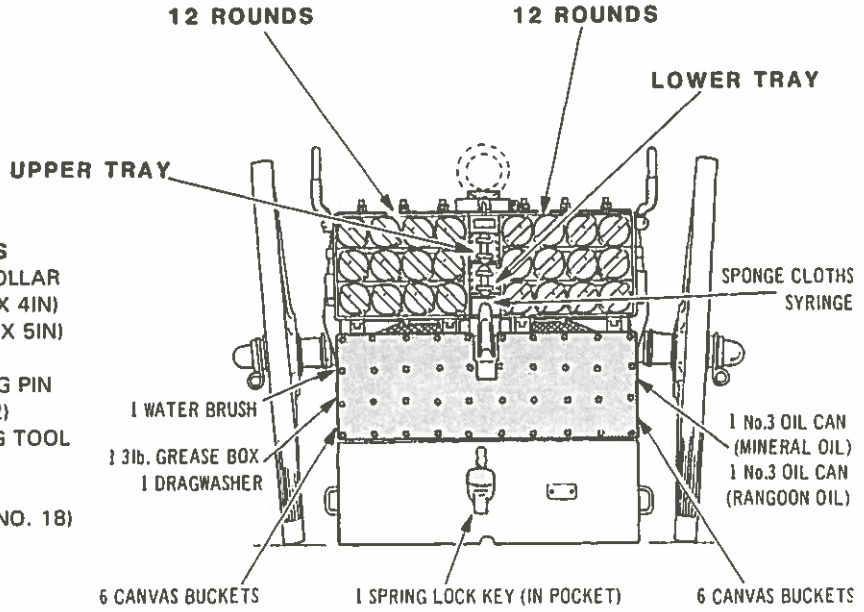
LIMBER (CARRIAGE) STORES AND EQUIPMENT



WHEN THE GUNS WERE PARKED, FUZE KEYS WOULD BE PLACED IN THE LOWER TRAY

ON PLATFORM BOARD

1 POLE SUPPORTING BAR
1 FELLING AXE
2 TRACE STRAPS
2 TRACE TUGS
1 SWINGLETREE
1 HAMBRO' LINE
1 PAIR SADDLERY TRACES
1 BREAST PIECE
2 FRONT SUPPORTING STRAPS
1 REAR SUPPORTING STRAP



UPPER TRAY CONTENTS

VARIOUS SPLIT KEEP PINS
2 PACKING RINGS
6 LUBRICATING SCREWS
1 STUFFING BOX RETAINING STUD
1 SIGHT CLINOMETER SPRING
2 TRAVERSING LEVER SPRINGS
1 COLLAR GLAND PACKING TOOL
2 RING WITHDRAWING TOOLS
2 SETS PACKING WASHERS
1 CATCH SPRING (LIMBER AND PERCH HOOKS)

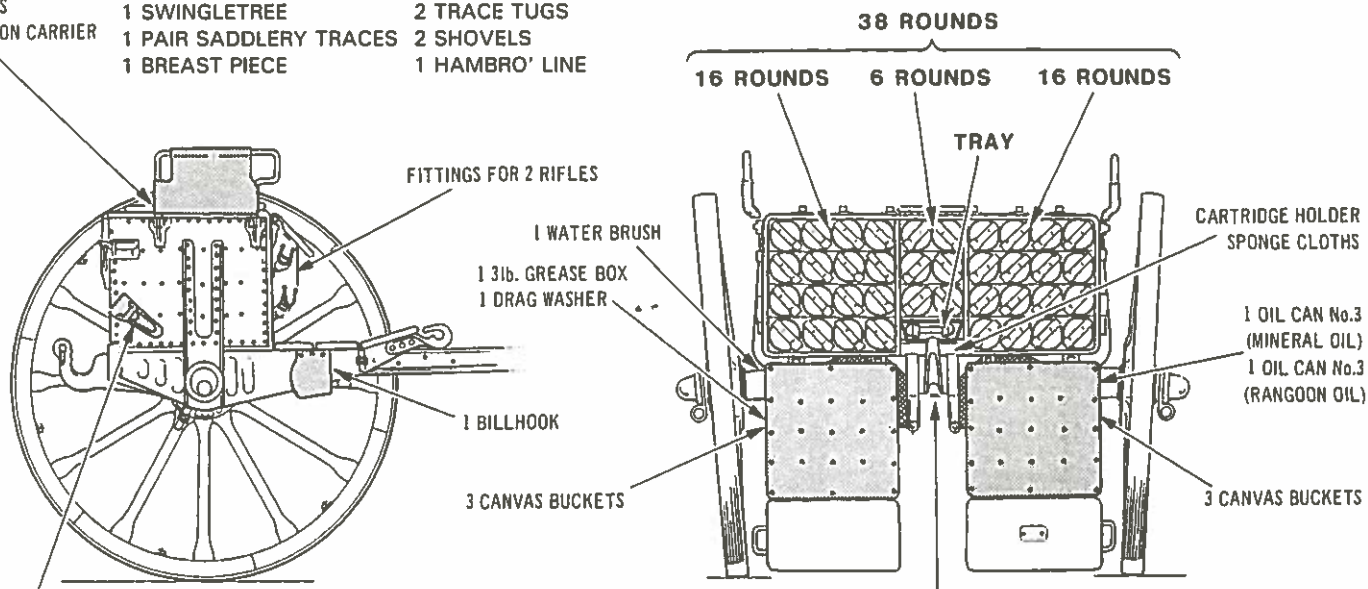
LOWER TRAY CONTENTS

1 WHEEL ADJUSTING COLLAR
1 FLAT, SPLIT KEY (1IN X 4IN)
1 SPLIT KEEP PIN (.25IN X 5IN)
1 CAPSQUARE PIN
1 SHIELD PAWL LOCKING PIN
2 DISC SPRINGS (NO. 62)
1 GLAND PLUG PACKING TOOL
1 SMALL FILE HANDLE
1 LINCH PIN
2 FUZE SETTING KEYS (NO. 18)
1 DRAUGHT PIN (NO. 3)
2 FILLING HOLE PLUGS
1 SHIELD PAWL SPRING
2 FIRING GEAR SPRINGS

LIMBER (CARRIAGE) STORES AND EQUIPMENT

ON PLATFORM BOARD

1 PAIR DRAG ROPES
1 POLE SUPPORTING BAR
2 TRACE STRAPS
1 SWINGLETREE
1 PAIR SADDLERY TRACES
1 BREAST PIECE
2 FRONT SUPPORTING STRAPS
1 REAR SUPPORTING STRAP
2 TRACE TUGS
2 SHOVELS
1 HAMBRO' LINE

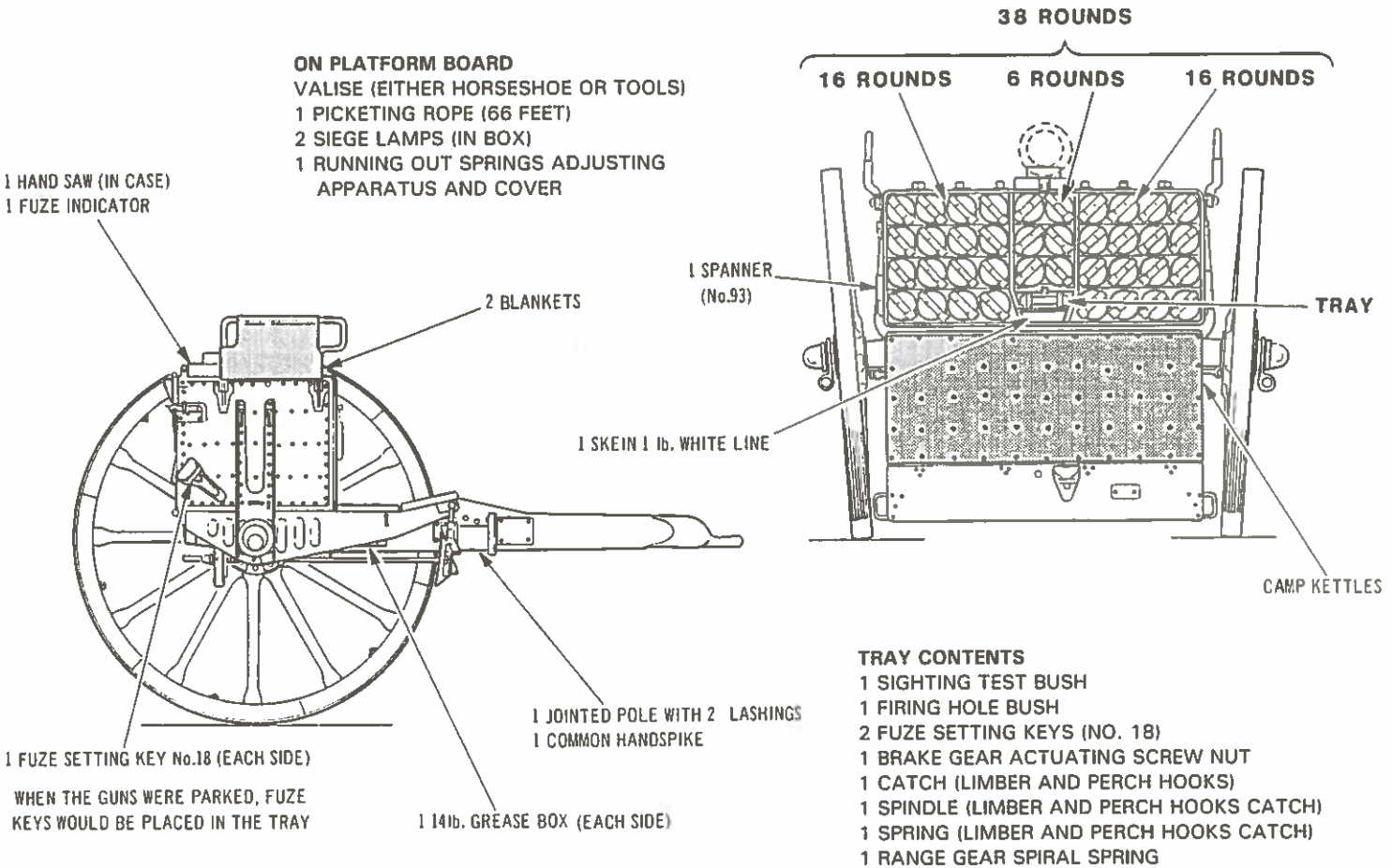


WHEN THE GUNS WERE PARKED, FUZE KEYS WOULD BE PLACED IN THE TRAY

TRAY CONTENTS

1 WHEEL ADJUSTING COLLAR
1 SCREWDRIVER
1 FUZE FIXING KEY (NO. 17)
1 PRIMER KEY (NO. 27)
1 FLAT, SPLIT KEY (1IN X 4IN)
2 FUZE SETTING KEYS (NO. 18)
4 PERCUSSION PRIMERS (IN TIN BOX)
1 LINCH PIN
1 DRAUGHT PIN (NO. 3)

LIMBER (AMMUNITION WAGON) STORES AND EQUIPMENT



AMMUNITION WAGON STORES AND EQUIPMENT