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B.R. 932 (1945) (RESTRICTED)

HANDBOOK

ON

AMMUNITION

1945

Admiralty, S.W.1
Naval Ordnance Department

LIST OF CHAPTERS

SPECIAL NOTE

Owing to the War ending, certain stores described in this Handbook have been withdrawn from service.

They have not, however, been deleted from this Edition because it is felt that their use during the War 1939-1945 should be on record. Also it would have meant reprinting, as the book was ready for the binders before the corrections could be made.

A list of stores under this category is appended, and it will be supplemented by "P" Series A.F.O. amendments as required.

Apparatus A.I.

Bombardment, Cartridges and Charges.

Cartridges, Aircraft, Catapault.

Cartridges for Holman Projector.

Charges, Bombardment.

Cordite A.S.N.

Fuze No. 125.

Fuze No. 402.

Fuze Time and Percussion, No. 93.

Holman Projector.

P.A.C.

Projectiles—Chemical Shell.

Projectiles—Pa[illegible] Shot.

Projectiles—Shra[illegible]el Shell.

Pyrotechnics—Projectiles Illuminating.

Pyrotechnics—Rocket Illuminating.

[illegible] Cartridges—Bombardment.

Rocket Flare Illuminating 9 lbs. (Snowflake) and Shrapnel shell.

Time and Percussion Fuzes.

(5141/1010) Wt. 18880/P7553 18m. 10/45 T. & B. Gp. 8.

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GLOSSARY

The definitions given are intended to apply to the terms in the sense in which they are used in this book.

Annulus : *In small arms ammunition, the varnished ring between the percussion cap and the base of the cartridge.*

Blast : *The outward pressure of the air caused by its displacement at the point of the explosion or detonation.*

Cannelure : *A groove, especially a circular groove formed round a bullet or projectile near its base.*

Capacity : *When used in relation to shells or bombs, the amount of explosive filling stated as a percentage of the total weight of the shell or bomb.*

Centrifugal force : *The radial force acting on a body travelling in a curve, owing to the tendency of the body to continue travelling in a straight line.*

Choking : *A method of closing the neck of a bag containing explosive in powder form by drawing it together with several pleats and then tying it round with silk thread.*

Closing : *A method of securing a projectile in its case consisting in pressing the mouth of the case into a cannelure on the projectile.*

Crimping : *A method of closing the mouth of a cartridge case with a series of small folds, e.g., as a means of retaining the charge in unbulleted blank cartridges.*

Danger Zone : *The space round the point where an explosion or detonation occurs within which damage may be caused. It may be divided into two distinct areas :—*

(i) *The Blast Zone—in which persons or material may be damaged by the expansion of gases of that explosion or detonation.*

(ii) *The Fragment Zone—in which persons or material may be damaged by fragments produced by an explosion or detonation. The fragments may consist of portions of the walls of the shell or other container or may be formed by material set in motion by the explosion.*

Drift : *The deviation of a projectile to the right from the plane of departure due to its clockwise rotation.*

Endothermic : *(of a chemical compound) Absorbing heat on its formation ; lead azide is an example of such a compound.*

Erosion : *The wear or mechanical damage produced on metals with which they come into contact by :—*

(i) *The mechanical friction of the solid products of an explosion.*

(ii) *The scrubbing action of the hot gases.*

The alternate heating and cooling, e.g., of the bore, by causing surface disintegration accelerates the erosive effect.

Fragmentation : *The breaking up of the container of an explosive ; the more violent the explosion, the smaller and more numerous are the fragments produced.*

Hygroscopic : *Tending to absorb moisture from the air ; ammonium nitrate is an example of such a substance.*

Indenting : *Process of pressing the metal of a cartridge case into a cannelure on a shell or bullet at several separate points on the circumference.*

Inertia : *The property by which matter continues in a state of rest or uniform motion in a straight line, except in so far as the state is changed by external force.*

Muzzle Velocity : *The velocity of a projectile relative to the mounting at the moment it leaves the muzzle ; sometimes called " Initial velocity ".*

Necking : *The operation of reducing the diameter of the mouth of a cartridge case from chamber diameter to projectile diameter, resulting in the formation of the conventional " bottle-shaped " cartridge. The operation may also be used to fix a bullet in its case, with or without an additional operation such as indenting.*

O.F.M. : *Obsolete for future manufacture.*

Penetration : *Holing of armour caused by shell burst on or near its surface.*

Perforation : *Passage of shell through armour in a fit condition to burst on the far side.*

the shell by the rifling of the gun. If heavy vibration is experienced the setting of pre-set fuzes may alter. If pre-setting is essential the setting of such fuzes is to be checked at frequent intervals, and in any case after heavy vibration has occurred.

404. The tensioning of the time rings of combustion time fuzes may alter owing to varying climatic conditions :—

(*i*) With normally tensioned fuzes, the tensioning may become either greater or less.

(*ii*) With clamped fuzes the tensioning may decrease so that the time ring can be turned by normal application of fuze setting key. If fuzes are fired with comparatively loose time rings there will probably be irregular results or premature bursts.

405. Where the tensioning is less than the standard laid down in the next paragraph, the fuzes may be retensioned on board as described below.

The standard of tensioning to be maintained is :—

(*i*) Fuzes as in para. 404 (*i*).—The time setting ring should require a firm pressure to set when using the hand fuze setting key. It should not be possible to turn the time setting ring with the finger and thumb.

(*ii*) Fuzes as in para. 404 (*ii*).—With clamped fuzes it should not be possible to turn the time setting ring with reasonable pressure using the hand fuze setting key.

Instructions for increasing tension of fuzes, para. 404 (i) :—

406. (*i*) Ease back the two small set screws near the top a full turn each.

(*ii*) Fit the key provided (key No. 133 for fuzes Nos. 198 and 400 or key No. 141 for fuzes No. 124).

(*iii*) Hold the shell or fuze firmly and screw down the top of the fuze.

(*iv*) Test the tension in accordance with the standard laid down and adjust if necessary.

(*v*) Screw up the set screws.

(*vi*) Set fuze to " safe " or setting ordered.

(*vii*) Replace the waterproofing composition R.D.11[illegible].

Instructions for clamping fuzes, para. 404 (ii) :—

407. Similar action is taken when clamping fuzes to that laid down for increasing the tension, except that the fuze must be set to the correct setting before clamping is hard down.

407A. Occasional checks on the tension of the combustion time fuze should be taken when carrying out inspections. It is not the policy to increase the tensioning of unclamped fuzes which are apparently stiff, as the stiffness may be due to dirt having penetrated or corrosion being present in the time rings. Easing of tension of stiff fuzes may lead to premature bursts.

Fuze Setting.

408. The amount of fuze powder to be burned is regulated by the angle through which the bottom ring is turned. Graduations are cut on the body of the fuze to enable this angle to be read off and an index line is cut on the exterior of the movable ring, or vice versa. The graduations on the body are arbitrary divisions chosen to obtain the requisite degree of fineness of setting ; they do not necessarily represent minutes, degrees of arc or seconds of time.

409. Fuze scales are published to indicate the times of flight corresponding to the various settings.

The movement of the bottom time ring may be (*i*) by hand, using the suitable setting key ; (*ii*) by a hand setter ; (*iii*) by a fuze setting machine. Slots are formed in, or studs project from, the ring to enable it to be turned.

For hand setting with a key the position of the slots or studs is of little importance as the ring is revolved until the graduation required appears opposite the arrow.

With some types of hand setter or fuze setting machine the position of the slots or studs must be accurate and care must be taken to avoid damaging or distorting them. On no account should they be used for any purpose other than setting the ring with the approved key, setter or machine.

Escape Holes.

410. In all Time fuzes (except No. 185) the time rings have radial exhaust channels or escape holes through which the gases generated escape into the atmosphere. These escape holes are closed by escape hole discs. An efficient seal is essential to prevent direct access of burning gas at high pressure from the gun (which would cause a premature by flash over) and also to prevent moisture reaching the composition during storage. Prematures are occasionally experienced in sub-calibre guns with No. 124 fuzes, when flash from cartridge gases enters the escape holes after the discs have blown off but before the projectile is clear of the parent gun.

Fuze, Time, No. 125. *Plate* 19.

411. This fuze is for use with 2-pdr. to 6-pdr. common nose fuzed shell and has superseded No. 124 ; it is smaller than but similar in design and action to No. 198.

The flash channel between the detonator and the top ring is filled with mealed powder. This gives a slight delay in the lighting up of the top ring and is intended as a guarantee against the shell bursting in the parent gun when used in sub-calibre guns.

The bottom ring has ratchet teeth around its periphery to engage the automatic fuze setter. No cover is fitted.

The design and components of the fuze are shown in the illustration.

Safety Arrangements.

412. The fuze embodies the following safety arrangements :—

(*i*) The detonator is carried in a pellet which is held clear of the striker needle by a stirrup spring housed inside the sleeve.

(*ii*) Accidental ignition of the detonator will not ignite the magazine while the fuze is set " SAFE," as the flash holes in the rings are blanked in this position.

Before Firing.

413. The fuze is set by turning the bottom ring until the setting mark is in line with the required graduation on the top ring.

Action—On Firing.

414. The inertia of the detonator pellet causes it to set back on to the needle which pierces the detonator. The resultant flash passes through the flash hole and ignites the composition in the top ring.

Action—During Flight.

415. The fuze powder in the top ring burns round until it ignites the powder pellet in the channel leading to the bottom ring. The fuze powder composition in the bottom ring is ignited and burns until it ignites the powder pellet at the head of the channel leading to the magazine. Escape holes are drilled in the time rings at the position where the train of powder is commenced. Each hole is filled with a perforated powder pellet and closed by a brass disc, which is blown out and allows the gases to escape as the powder burns.

Action—On Burst.

416. The flash passes along the channel and ignites the powder in the magazine. The flash from the magazine passes through the weakened portion in the centre of the closing plug and ignites the exploder.

Fuze, Time, No. 198. *Plate* 19.

417. This igniferous time fuze is of 2-inch gauge and is tensioned.

The fixed upper time ring is graduated 0 to 22. The movable lower time ring is engraved with the setting mark.

As an Auxiliary fuze No. 198 has been largely superseded by Nos. 206, 207 and 211 fuzes.

418. The fuze is for use with :—

(*i*) 12-pdr. to 8-inch H.E. shell.

(*ii*) 12-pdr. to 4-inch Star shell (except 4-inch Mark XVI).

(*iii*) 4-inch to 5.25-inch Smoke shell B.E.

(*iv*) 5.25-inch and 6-inch Chemical B.E. shell.

(*v*) 4-inch, 4.7-inch and 5.25-inch Target Smoke shell.

(*vi*) 12-pdr. to 8-inch H.A. Practice projectiles.

(*vii*) 12-pdr. Falling Target shell.

The design and components of the fuze are shown in the illustration.

The screwed watertight cover must be removed before fitting fuze to shell ; the cover may then be temporarily replaced.

Safety Arrangements.

419. The fuze embodies the following safety arrangements :—

(*i*) The detonator in its holder is kept clear of the needle by a spring.

(*ii*) Accidental ignition of the detonator will not ignite the magazine while the fuze is set " SAFE " as the flash holes in the rings are blanked.

Before Firing.

420. The cover is unscrewed and removed. The fuze is set by turning the bottom ring until its setting mark is in line with the required graduation on the top ring.

Action—On Firing.

421. The inertia of the detonator holder causes it to set back on to the needle which then pierces the detonator. The resulting flash passes through two flash holes and ignites the fuze powder in the top ring.

Action—During Flight.

422. The fuze powder in the top ring burns round until it ignites the powder pellet in the channel leading to the bottom ring. The fuze powder in the bottom ring is ignited and burns until it ignites the powder pellet at the head of the channel leading to the magazine. Escape holes are drilled in the time rings at the position where the train of powder is commenced. Each hole is filled with a perforated powder pellet and closed by a brass disc which is blown out and allows the gases to escape as the powder burns.

Action—On Burst.

423. Flash passes along the channel and ignites the powder in the magazine. The flash from the magazine passes through the weakened portion in the centre of the closing plug and ignites the exploder or detonates the gaine (where fitted).

The No. 198c is similar to the 198 except that part of the screw thread which holds the fuze in the nose of the shell has been removed. The cutaway of the thread allows the fuze to blow out easily. No. 198c fuzes are used in certain H.A. Practice projectiles and these are stencilled appropriately.

Fuze, Time, No. 400.

424. This is a short burning fuze for use with :—

(*i*) 6-pdr. to 16-inch H.E. shell (with a gaine).

(*ii*) 4-inch and below (except 3.7-inch) Shrapnel shell.

(*iii*) 12-pdr. to 8-inch H.A. Practice projectiles.

The body of the fuze and the safety arrangements are similar to those of No. 198, Mark II (*Plate* 19). Two additional flash channels are bored from the central space round the spring to the top time ring. The top time ring is empty, and flash from the detonator passes straight to the bottom ring which is filled with S.R.304 fuze powder.

The total time of burning of the fuze is 9 seconds. To distinguish the fuze from the No. 198, its lower ring is coloured with blue lacquer.

Fuze, Time, No. 402. *Plate* 19.

425. This fuze is for use with Shrapnel shell only in 12-pdr. H.A. and H.A./L.A., 3-inch 20-cwt. and 4-inch (Mark XIX) guns in R.F.M.S., Fast Liners and Oilers. The fuze must not be used with H.E. shell. The design and components of the fuze are shown in the illustration. The time of burning is fixed so that the shell is intended at 7,500 yards range and no fuze-setting is required.

Safety Arrangements.

426. The detonator holder is held away from the striker needle by the spring.

Action—On Firing.

427. The detonator holder sets back against the spring and the needle pierces the detonator.

Action—During Flight.

428. The flash from the detonator passes through the flash channel and ignites the delay composition which causes a certain delay before igniting the powder pellet and the gaine.

TIME, MECHANICAL

429. The mechanism of this type of fuze is designed to run at a predetermined rate after the fuze is armed. As the rate is little affected by the rotational velocity of the projectile in which it is fired, the time of running or time of burst is practically constant in any type of gun. The design is capable of being used in nearly all equipments, provided the time of flight is known, even though the range table does not include a scale for the actual fuze. The mechanical time fuzes in supply are Nos. 206, 207, 211 and 215; they differ only slightly in design.

Fuze Setting.

429a. Time Mechanical fuzes are intended to be set primarily by mechanical fuze setters, and the graduations provide a secondary means of setting by eye with a hand key.

The body or base piece is graduated externally from 00 to 21½. The lowest setting at which these fuzes will function is 007; with fuzes fitted with the muzzle safety bridge piece settings less than this will give blinds.

Fuzes are set by rotating the dome in a clockwise direction viewed from the point of the fuze.

430. The fuzes are issued set " safe " and must be in this condition before using the mechanical setter. If a fuze is disturbed from the " safe " setting, it must be carefully reset " safe " before it is set by a mechanical setter. Small reverse settings to adjust over-set fuzes may be made, but main setting must be in a clockwise direction only. Fuzes are not compromised by setting and may be reset a number of times if required. If heavy vibration is experienced, the setting of pre-set fuzes may alter. If pre-setting is essential the setting of such fuzes is to be checked at frequent intervals, and in any case after heavy vibration has occurred.

Although the most satisfactory setting is probably that d[one] by the mechanical fuze setter, good setting to the graduations by hand key is possible if care is exercised. These graduations also form a rough check for the mechanical setter. Particular care is required when setting with a hand key. The key is marked with an arrow to indicate in which direction to rotate.

It is important to ensure that the fuze is still set " safe " after the removal of the cover, especially when it has once been set.

431. The safety arrangements are similar to those in percussion D.A. fuzes, and differ fundamentally from Combustion Time fuzes as no detonator is struck on firing the gun.

432.

433. Consideration has been given to the use of time mechanical fuzes for bombardment, as this would simplify drill, and supply of fuzes to ships taking part in assaults. Trials have shown that under easy conditions a time mechanical fuze will function on impact, but at small angles of descent or on soft ground there will probably be a high proportion of blinds. The shell burst is caused by the crushing in of the head and nose, thus firing the detonator of the fuze or gaine, and this train of action must entail a longer delay than when a direct action fuze is employed, whereas rapid initiation is most desirable for bombardment shell.

434. Whenever possible, direct action fuzes should be used for bombarding, but when the guns that are being used for bombardment must also be at immediate readiness to repel aircraft, the use of time mechanical fuzes is acceptable unless a large proportion of the target is soft ground.

For fuzing and unfuzing shell, (*see paras.* 487 *and* 488).

Fuze, Time, No. 206.

435. This fuze is for use with :—

(*i*) 4-inch to 8-inch H.E. shell (with No. 9 or No. 10 gaine).

(*ii*) 4-5-inch to 5.25-inch Star shell.

(*iii*) 5.25-inch and below Target Smoke shell.

(*iv*) 4-inch to 8-inch D.A. Practice projectiles.

Some difficulty may be experienced on removing fuzes supplied in the cylinders No. 202. Should this occur and the fuze cover become screwed from the fuze, the fuze itself must be unscrewed from the cylinder by means of the fuze fixing key.

The mechanism is similar to that of the No. 211 fuze (*Plate 20*).

On impact with thin steel plating fuze No. 206 with a No. 9 gaine will also detonate the shell. At short ranges the gaine detonator will be actuated by the crushing in of the fuze body, even if the fuzes are set " SAFE " : at longer ranges or at oblique impact it is desirable that fuzes should be set to burst well beyond the target.

For instructions for fuzing and unfuzing shell, *see para. 487.*

Safety Arrangements.

436. The fuze embodies the following safety arrangements :—

(*i*) The striker is kept away from the detonator by a cam shaped foot which rests on a pillar. Should any fault in the mechanism allow the foot to come off the pillar before the fuze is rotated, further movement of the striker towards the detonator is arrested by the centrifugal safety catch which engages the set arm and becomes locked. Subsequent rotation of the fuze will not free this catch, and the fuze fired in this condition will be blind.

(*ii*) During flight, the centrifugal safety catch opens and does not interfere with the striker which is released after the passage of the " SET " time.

(*iii*) The clockwork mechanism cannot be started when the fuze is set " SAFE," as the trigger safety catch prevents the trigger from setting back and freeing the hand. As long as the fuze is set " SAFE " the trigger safety catch is retained under the trigger by a stud which projects from the inside of the dome.

(*iv*) *No. 206 Mark II* fuzes have been introduced into the service and have a device consisting of a bridge piece which prevents the hand of the clockwork mechanism from rising until the mechanism of the fuze has run approximately one second. This prevents premature bursts occurring just inside the muzzle of the gun.

Before Loading.

437. The watertight cap is unscrewed and removed. The dome is set to the required fuze length. This operation shears the dome shearing pin and also allows the trigger safety catch to come out from underneath the trigger.

Action—On Firing.

438. (*i*) The locking ring sets back, shearing the small rivets by which it is held, and its bottom edge is cut into the locking pins in the base piece. As the locking ring is keyed to the dome any further turning of the dome relative to the base piece is prevented.

(*ii*) The trigger swings back and releases the hand thus allowing the mechanism to start. The hand revolves anti-clockwise, and the hand spring continues to force it against the underside of the hand race.

(*iii*) The rotation of the projectile causes the centrifugal safety catch to swing out clear of the cam on the striker.

Action—During Flight and on Burst.

439. The hand revolves until it comes in line with the gate in the hand race. The hand spring forces the hand through the gate and the end of the striker lever is released. This allows the striker to turn so that its foot drops off the pillar. The striker spring forces the striker down so that its point pierces the detonator. Flash from the detonator ignites the powder in the magazine.

Fuze, Time, No. 207.

440. This fuze is for use with the same shell as No. 206 fuze and also with 4-inch, Mark XVI, and 4.5-inch to 5.25-inch Star shell, and 4.5-inch and 5.25-inch Chemical B.E.

The fuze was introduced as a strengthened form of No. 206, but is now being superseded by No. 211 for H.E. shell.

The Safety Arrangements and action are identical to those of No. 206. The Mark III design is fitted with a bridge piece, which prevents the hand of the clockwork mechanism from rising until the mechanism of the fuze has run approximately one second. This prevents premature bursts occurring just inside the muzzle of the gun.

Fuze, Time, No. 211. [illegible] 20.

441. The fuze can be used with

(*i*) 5-inch to 8-inch H.E. shell.

(*ii*) 3.5-inch and below Target Smoke shell.

This is a detonating fuze embodying a gaine; it is superseding No. 206 fuze in all H.A. equipments in which the combination of No. 206 fuze and No. 10 gaine is approved.

The design and components are shown in *Plate 20*. The mechanism is housed lower in the body than the No. 206 fuze to improve the strength of the fuze and its ability to resist stresses on firing.

For instructions for fuzing and unfuzing shell *see para.* 487 and 488.

Safety Arrangements.

442. The fuze embodies the following safety arrangements:—

(*i*) The striker is kept away from the detonator by a cam-shaped foot which rests on a pillar. Should any fault in the mechanism allow the foot to come off the pillar before the fuze is rotated, further movement of the striker towards the detonator is arrested by the centrifugal safety catch which engages the foot and becomes locked. Subsequent rotation of the fuze will not free the locked and a fuze fired in this condition would be blind.

(*ii*) During flight the centrifugal safety catch opens and does not interfere with the striker, which is released after the passage of the "set" time.

(*iii*) The centrifugally operated shutter blanks off the passage between the detonator and the magazine. A detent holds the shutter in the "*SAFE*" position.

(*iv*) The bridge piece prevents the hand of the clockwork mechanism from rising until the mechanism of the fuze has run for approximately one second. This prevents premature bursts occurring inside the muzzle of the gun.

Before Loading.

443. The watertight cap is unscrewed and removed. The fuze is set by turning the dome to the required fuze setting; this operation shears the dome shearing pin.

Action—On Firing.

444. There are two series of actions, namely, those caused by set-back (which occur simultaneously) and those caused by the rotation of the projectile.

In the first series :—

(*i*) The locking weights set back and force the locking pins into the space between the dome and the body, thus preventing any further relative movement between them.

(*ii*) The trigger sets back and frees the hand, thus allowing the mechanism to start. The hand revolves anti-clockwise and the hand spring continues to force it against the underside of the head.

(*iii*) The detent sets back against its spring and frees the shutter.

In the second series :—

(*i*) The centrifugal safety catch swings clear, allowing a free passage for the foot on the striker when it drops off the pillar.

(*ii*) The detent topples and locks itself back under the shoulder of the detent hole.

(*iii*) As the shutter is no longer held by the detent it slides over against the pressure of the shutter spring into the armed position.

Action—During Flight and on Burst.

445. The hand revolves until it comes into line with the gate in the hand race. The hand spring forces the hand through the gate and the end of the striker lever is released. This allows the striker to turn so that its foot drops off the pillar. The striker spring forces the striker down and its point pierces the detonator. Flash from the detonator ignites the C.E. in the stemmed channel in the shutter and the magazine is detonated.

Fuze, Time, No. 215.

446. This fuze is for use with 4.5-inch to 5.25-inch Star shell.

The safety arrangements and action are similar to those of No. 207 Mark III fuze, with a longer time of running. (Maximum of 80 seconds.)

CH. XII—SECTION 4.—TIME AND PERCUSSION FUZES

447. These are Time fuzes embodying a percussion mechanism which works on the inertia principle.

The fuze will function on impact before the time mechanism is due to function or if the time mechanism fails to function correctly. These fuzes are obsolescent.

The safety arrangements are detailed in the description of the No. 93 fuze.

Fuze, Time, Percussion, No. 93, Mark I. *Plate* 17.

448. This fuze is for use with 6-inch to 15-inch Shrapnel shell. It is a clamping fuze and its design and components are shown in the illustration.

Safety Arrangements.

449. The fuze embodies the following safety arrangements :—

Time Portion.—(*i*) The time pellet carrying the detonator is prevented from falling on the needle by a stirrup spring and a safety pin.

(*ii*) While the fuze is set to *SAFE*, accidental ignition of the detonator will not ignite the magazine as the flash holes are blanked.

Percussion Portion.—The percussion detonator is prevented from moving forward on to the percussion needle by a steel ball interposed between the top of the pellet and the top of the recess in the body of the fuze. It is also retained by the stirrup spring taking under the brass ferrule.

Before Loading.

450. The safety pin is removed. The cap is eased back (right-hand screw), the bottom ring is set to the fuze setting ordered and the cap screwed down again. No attempt should be made to replace the safety pin once it has been removed, and if not required for immediate use, the fuze must be removed from the shell and thrown overboard.

Action—On Firing.

451. *Time Portion.*—The inertia of the time pellet causes it to set back through the stirrup spring on to the time needle. Flash from the detonator ignites the fuze powder in the top ring and the powder burns as in the No. 198 fuze.

Percussion Portion.—The inertia of the ferrule causes it to set back, straightening out the arms of the stirrup spring and exposing the hole in the body in line with the steel ball. Centrifugal force causes the ball to fly out into the hole. The fuze is now armed, the percussion pellet being held back only by the spring.

Action—On Burst or Impact.

452. When the fuze powder has burnt the flash passes down into and ignites the fuze magazine. If the shell strikes an object before the time portion has functioned, the percussion detonator pellet will set forward on to the percussion needle; this will ignite the detonator, and the resulting flash will pass into and ignite the fuze magazine.

453.

CH. XII—SECTION 5.—DRILL FUZES

Drill, Percussion, Direct Action, Fuzes.

454. No. 45P and No. 230 are in service. They are converted service fuzes with all explosives and ignition arrangements removed, or solid plugs shaped to represent service fuzes.

Drill, Time Fuzes.

455. These consist of converted service fuzes with all explosives and ignition arrangements removed, or of specially manufactured plugs contoured to represent service fuzes. They can be used for fuze setting drill. Fuzes, drill, time, No. 206, Mark II, No. 207 and No. 211, Mark II, are provided with removable rings which can be replaced when worn.

Marking of Drill Fuzes :—

456. (*i*) All fuze bodies are black.

(*ii*) The caps of 45P drill fuzes are red.

(*iii*) The portions of time fuzes on which the graduations are engraved are left bright.

(*iv*) The word " DRILL " is stamped on the fuze.

ANY FUZE WHICH IS NOT BLACK OR WHICH DOES NOT HAVE THE WORD " DRILL " STAMPED UPON IT SHOULD BE TREATED AS LIVE.

CH. XII—SECTION 6.—GAINES

457. Gaines are used with igniferous fuzes (and occasionally with detonating fuzes) to produce detonation of the shell filling and are fitted in the shell directly below the fuze. They are actuated by pressure from the explosion of the fuze magazine and initiate the detonation wave which is conveyed through the exploder to the shell filling.

Gaines are fitted in all H.E. shell with 2-inch fuze holes, except shell for 3.7-inch howitzer and shell using fuze No. 211. Gaines are also used in some Target Smoke and special Bombardment shell. The letter Z after a Mark indicates that a Lead Azide Detonator is fitted.

Gaine, No. 10. *Plate* 19,

458. This gaine is for use with :—

(*i*) 3-inch to 8-inch, 14-inch, 15-inch (B.N.F.) and 16-inch H.E. shell.

(*ii*) 5.25-inch and below Target Smoke shell.

The design and components of the gaine are shown in the illustration.

Safety Arrangements.

459. This gaine embodies the following safety arrangements :—

(*i*) The detonator is not in line with the needle before firing. Should the needle be forced back by any cause its point will strike in a hole in the shutter. The shutter is held in its safety position by a spring and a detent.

(*ii*) Accidental ignition of the detonator will not fire the magazine as the detonator is not in line with the fire channel. Should the detonator fire accidentally, the gases generated will pass down into the vent hole.

(*iii*) During flight, the needle is kept clear of the detonator by the needle disc.

Action—On Firing.

460. The detent sets back against its spring and frees the shutter which moves, under the influence of centrifugal force, until the detonator is in the centre line of the gaine between the needle and the fire channel.

Action—On Burst.

461. The gases produced by the ignition of the magazine of the fuze force the needle of the gaine back on to the detonator. The detonator disrupts and starts the chain of detonation which passes through the C.E. in the fire channel into the magazine of the gaine.

Gaine, No. 9.

462. This gaine is similar to No. 10, except that it is manufactured in lead free material, and therefore can be used in shell filled with high explosive containing Picric Acid.

Gaine, No. 11. *Plate* 19.

463. This gaine is for use with :—

(*i*) 12-pr. 12 cwt. and 3-inch H.E. shell.

(*ii*) 4-inch, 5-inch, 6-inch, 6-inch (Mark XXIII guns) and 8-inch Chemical Bursting shell.

Its design and components are shown in the illustration.

Safety Arrangement.

464. The centrifugally operated shutter blanks off the channel between the detonator and the fire channel of the magazine.

Action—On Firing.

465. Centrifugal force causes the shutter to swing over against the pressure of its spring. The stemmed channel in the shutter is thus brought into line with the detonator and fire channel of the magazine.

Action—On Burst.

466. The gases produced by the ignition of the fuze magazine cause the detonator of the gaine to disrupt. The chain of detonation passes through the C.E. in the shutter and the fire channel into the magazine of the gaine.

CH. XII—SECTION 8.—DETONATORS FOR FUZES AND GAINES

467. A " true " detonator is one which on initiation will transmit a wave of detonation to the high explosive filling of a fuze or gaine.

The term detonator has been used rather loosely and it became customary to refer to caps filled with an igniferous composition as detonators.

Both true detonators and igniferous composition filled detonators are fitted in fuzes used in Naval Service, and to avoid confusion true detonators will be referred to as " Disruptive " detonators and igniferous composition filled detonators as " Igniferous " detonators.

The greatest care is taken to ensure that detonators are correctly made, that they are clean and that no loose fulminate or igniferous composition is on the exterior. In spite of precautions it is possible that over-sensitive detonators may sometimes be passed into the service and it is therefore of the utmost importance that detonators or fuzes containing detonators should be carefully handled.

468. Fulminate of mercury and igniferous compositions are liable to deteriorate and to become unserviceable with time ; the rate of deterioration of igniferous composition is very much less than that of pure fulminate.

No age limit is placed on the life of detonators filled with igniferous compositions or on composite detonators filled with igniferous composition and lead azide. A life of 5 years is placed on detonators of pure fulminate. The speed of deterioration is increased with the temperature of storage.

DISRUPTIVE DETONATORS

469. Disruptive detonators are fitted in Percussion D.A., and Time No. 211 fuzes and in all gaines.

The container is of copper and the filling consists of (i) a top layer of " A " mixture and a bottom layer of lead azide, or (ii) a charge of pure fulminate of mercury.

Detonators filled in the first manner have the letter " Z " suffixed to their nomenclature.

Disruptive detonators are initiated by a direct blow from a sharp hard needle which causes a molecular disruption and a wave of detonation is propagated to the fuze magazine.

470. The several types of disruptive detonator used are :—

4-grain detonator (filled fulminate of mercury) now superseded for current filling by the 5-grain " Z "	No. 18 fuze No. 18P fuze No. 19A fuze No. 45P fuze (Marks II, VII/II, VII****/II XI/II)
4-grain detonator (filled C.E. and lead azide)	No. [illegible] fuze No. [illegible] gaine (Mark IIZY)
5-grain detonator (filled fulminate of mercury) now superseded for current filling by the 5-grain " Z "	No. [illegible] fuze (all marks up to and including Mark X) No. 45P fuze (Marks VIII, VIII**, X) No. 8 gaine (all marks up to and including Mark IV)
5-grain " Z " detonator (filled composition " A " and lead azide)	No. 44 fuze (all marks above Mark X) No. 45P fuze (Marks VII****Z/II, VIII**Z, XZ, XIZ/II) No. 117 fuze No. 118 fuze No. 230 fuze No. 230P fuze No. 240 fuze No. 241 and 248 fuze No. 360 fuze No. 360 C fuze No. 211 fuze, No. 720 fuze No. 8 gaine (all marks above Mark IV) No. 9 and 10 gaine No. 11 gaine (Mark I)
5-grain detonator (filled A.S.A.)	No. 720 fuze (magazine detonator) as alternative to the 5-grain " Z "
6-grain detonator (filled C.E. and lead azide)	No. 25[illegible] fuze (Marks II and [illegible]) No. [illegible]5 fuze (Mark I)
10-grain detonator (filled fulminate of mercury)	No. [illegible] gaine (both detonator and gaine are obsolescent)
2.8-grain " Z " detonator (filled composition " A " and lead azide)	[illegible] Hydrostatic No. I

IGNIFEROUS DETONATORS

471. Igniferous detonators ignite gunpowder by flash and their usual function is to ignite the powder filling of a fuze magazine.

These detonators contain one of two types of filling according to their service :—

(A) Detonators for Percussion fuzes, the percussion part of Time and Percussion fuzes and Nos. 243 and 246 fuzes are filled entirely with A mixture. This type of filling is also used in Fuzes Nos. 206 and 207.

(B) Special detonators for Time and the time part of Time and Percussion fuzes, filled approximately half and half with B mixture and a powder pellet.

472. A and B compositions are mixtures of the following substances :—

	A MIXTURE	B MIXTURE
Fulminate of Mercury ...	... 6 parts by weight	11 per cent. by weight
Chlorate of potash ...	... 6 parts by weight.	52.5 per cent. by weight
Antimony sulphide ...	... 4 parts by weight.	36.5 per cent. by weight.

Igniferous Detonators, Filled " A " Mixture.

473. These detonators are made in three sizes—3, 2 and 1.7 grain. They are designed to be struck by a needle on the top and are fitted in the following fuzes :—

3-grain detonator	All medium and large [illegible] percussion fuzes.	
	No. [illegible] fuze No. 207 fuze	Time mechanical fuze.
2-grain detonator	Fuze, percussion, base, Hotchkiss.	
1.7-grain detonator	No. 81 fuze No. 93 fuze	Time and percussion fuzes—percussion arrangement.
	No. 243 fuze No. 246 fuze	With larger hole in the detonator.
	No. 720 fuze	With larger hole in the detonator for percussion arrangement.

Igniferous Detonators, Filled " B " Mixture and Powder.

474. This type of detonator is used in the time arrangement in Time, Time and Percussion and fuze No. 720, Marks I to III. These detonators are more squarely shaped than the plain igniferous detonators and are designed to be struck by a needle on the bottom.

The detonators fitted to the different types of Time fuze differ slightly in filling and construction, but are all made on the above lines.

As an example, the weights of explosive filling [illegible] detonator for fuze No. 198 are :—

1.1 grains detonating composition " B "

1.41 grains of gunpowder.

CH. XII—SECTION 8.—MISCELLANEOUS

Failures and Accidents with Fuzes.

47[illegible] " Blinds " " Prematures " may occur with any type of fuze. They may also occur through a fault in the shell or its filling quite apart from the misbehaviour of the fuze.

With percussion mechanisms a blind usually indicates that the main detonator of the fuze has failed to fire. With time mechanisms it may mean that (1) the detonator of the ignition arrangement has failed to function, or (2) the time rings have failed to ignite, or (3) the time rings having ignited, the fuze powder has failed to continue burning or to convey the flash to the magazine. The net result is the same in all cases—the fuze does not function.

Blinds in fuzes may be due to any one of a large number of causes or even to a combination of causes which it is impossible to determine without investigation. One of the non-technical reasons may be the failure to remove the safety pin or/and safety cap.

The term " premature " applied to a fuze indicates that some portion of the fuze has functioned sooner than was intended, with the result that the shell filling is exploded prematurely.

476. By reason of the Safety Arrangements in fuzes a premature action of the fuze detonator will not always result in the premature explosion of the shell. In fuzes, however, where there is nothing to prevent the flash from the detonator reaching the fuze magazine the premature action of the detonator will result in the immediate explosion of the fuze. A premature ignition of a fuze detonator may result in a shell bursting when the gun is fired and before the shell has had time to reach the muzzle. A similar accident may occur owing to a defective shell or filling.

It is important when reporting prematures to take great care to ensure that full particulars of the shell, the fuze and the charge used in the gun are reported to the Admiralty ; this will enable the matter to be fully investigated and unjust suspicion being thrown on the fuze or on the shell when the other is really responsible for the accident.

Premature fuzes may be due to a large number of causes, and it is impossible without thorough investigation to determine the cause of any one accidental explosion.

Firing through Muzzle Covers.

477. Base fuzed shell are not liable to premature if fired through a muzzle cover, even if the cover is coated with ice. Nose fuzed shell may premature if fired through a muzzle cover and if they do not they will probably be blind.

478. *For Guns, 2-pdr. to 12-pdr. inclusive.*—When muzzle covers of any nature are in place, whether or not they are likely to be coated with ice, the first round fired should be a practice projectile or a base fuzed shell.

479. *For Guns, 3-inch and above :—*

(*i*) When circumstances are such that throughout the whole period during which the guns are likely to remain loaded, formation of ice is not liable to occur, all shell, whether base fuzed or with direct action fuzes (including K device shell) or time fuzes, may be fired through muzzle covers when conditions make it desirable to keep covers in place. The exceptions to the above are fuzes [illegible]4 and 5P. Shell fuzed with these fuzes are not to be fired through covers, and when they are in use and it is necessary to keep covers in place, the first round must be a practice projectile or a base fuzed shell.

(*ii*) When ice is liable to form, base fuzed shell and K device shell may still be fired through the covers, but shell fuzed D.A. with those fitted with time fuzes should not be fired. A practice projectile (or a base fuzed shell, according to circumstances) should be the first round fired.

Note.—Cartridge, Q.F. 40 mm. Practice (weighted and plugged shell) must be used for 40 mm. Bofors guns and not Cartridges Q.F. 40 mm. Projectile Practice (fuzed and filled S.R.274).

CH. XII—SECTION 9.

Care of Fuzes.

480. Instructions for the care of fuzes supplied separately in tin cylinders are set out in the N.M. & E.R.s.

Should the watertightness of fuzes supplied in their component shell be compromised in any way (*e.g.*, by removing the pin or by setting of a time ring) that fuze, if not immediately fired, should be regarded as unfit for service, and the complete round returned to a Naval Armament Depot at the earliest opportunity.

Metal Fuze Covers.

481. Metal fuze covers have proved superior to rubber covers.

Metal covers are not to be removed until absolutely necessary, due regard being paid to operational and weather conditions.

In the event of fuze failures the routine report (Form No. S.1148(*j*)) is to state the period of time between the removal of the fuze cover and firing, together with any remarks as to weather conditions, etc., to which the shell may have been exposed before and during that period, and which may be helpful in determining the cause of the failure.

Kit Plasters.

482. Kit plasters form a method of waterproofing and a means of protection for fuzes of shell in ready use racks in exposed positions. Instructions for use are contained in N.M. & E.R.

The plasters consist essentially of a conical canvas cap soaked in kit composition and placed over the nose of the fuzed shell. They can be readily removed by the beckets without the use of a screwdriver or instrument. Kit plasters are supplied for No. 44 fuzes.

483. *The method to be used when fitting a plaster is :—*

(*i*) Remove any grease from the nose of the fuze.

(*ii*) Heat the composition in an ordinary gluepot. It should remain at full heat for about 15 minutes before it is used.

(*iii*) Men handling the plasters should rub a little mineral grease over their hands to prevent the composition adhering.

(*iv*) Place a paper cover (supplied with the plaster) over the nose of the fuze to prevent the composition adhering to the fuze.

(*v*) Dip the plaster into the composition and keep it there for one minute, so that it may be well saturated.

(*vi*) Lift the plaster from the composition and allow it to cool until the composition is no longer running.

(*vii*) Two men should each take hold of two loops and pull the plaster quickly over the nose of the shell, as shown. The seams should then be pressed down with a suitable piece of wood.

(*viii*) Finally, dip the nose of shell 4.7-inch and below into the hot composition till the composition just covers the junction between the bottom of the plaster and the shell. With shell above 4.7-inch, apply a coat of composition with a brush. Scrape off any composition which runs down on to the body of the shell when it is stood on its nose.

(*ix*) To facilitate removal of the plaster, a becket of spun yarn should be passed through all four loops of the plaster. A tug on this becket will pull all four loops at once.

CH. XII—SECTION 9.—FUZING AND UNFUZING SHELL.

GENERAL.

484. Regulations concerning the safety precautions to be observed while fuzing and unfuzing shell are set out in N.M.E.R.

Shell 6-pdr. and below and all shell for submarines are supplied fuzed.

As a wartime measure H.E. shell 5-inch and below fitted with Fuzes No. 206 or No. 207 are supplied fuzed.

In ships other than D.E.M.S., Fast Liners and Auxiliary Vessels, H.E. shell for use with Time Combustion fuzes are supplied plugged, with gaines in position (if fitted). Certain H.E. shell for use with Percussion, D.A., Fuzes, are also issued plugged.

For D.E.M.S., Fast Liners and Auxiliary Vessels, shell below 6-inch are supplied fuzed; 6-inch shell are issued plugged and are fuzed on board with assistance from Naval Armament Supply personnel.

All components that screw into the base of a shell (*i.e.*, base fuzes, tracers) have left-hand screw-threads. Nose fuzes have right-hand screw-threads.

INSTRUCTIONS TO FUZE—GENERAL.

485. (*i*) Ease the "grub" or fixing screw in the nose of the shell right back to ensure that it clears the threads of the plug. The screw recess will be found full of luting.

(*ii*) Unscrew the plug from the fuze hole and remove the plug and washer. Washers which are sometimes fitted round the head of a No. 8 gaine should not be removed. If the plug cannot be unscrewed with the service fuze key, the shell is to be landed at the first opportunity at a Naval Armament Depot.

(*iii*) Wipe the threads of the fuze hole to ensure that no explosive is left on them.

(*iv*) Coat the threads of the fuze with Mark V luting, taking care that no luting is applied to the bottom of the fuze. Place a fillet of Mark VI luting or R.D. 1205A under the washer. No lubricant other than Mark V luting is to be used; it is to be applied with a new brush. Mark VI luting is tacky and should be applied with a wooden spatula.

(*v*) See that the gaine is screwed home. With a No. 8 gaine this is done by feeling with the fingers that the head of the gaine is below the surrounding washer (care being taken that the pressure plate of the gaine is not touched); with other gaines it is done by feeling that the gaine itself is not loose. If the gaine is not screwed home the shell is to be returned to a Naval Armament Depot.

(*vi*) Fit washers to the fuzes as follows:—

No. 44 and 45P—no washers.

Percussion, D.A., Time, Time and Percussion—a copper asbestos washer unless a washer has already been fitted.

(*vii*) (*a*) Insert the fuze and screw home, using no more force than can be applied by hand with the service fuze key. The washer must be kept central so that no part of it protrudes beyond the side.

(*b*) Fuzes fitting G.S. fuze holes (*i.e.*, Nos. 44 and 45P fuzes) are screwed in by their caps, which are slotted across or provided with a square recess in the top. The cap turns the fuze by the body pins, on to which the cap locks with a bayonet joint. It is not always possible, because of the variation of the G.S. gauge, to screw the fuze far enough in for the underside of the head to rest on the bottom of the recess in the nose bush and a slight protrusion of the fuze is to be accepted; a fillet of Mark VI luting is applied in the recess in the shell under the head of the fuze. It is essential with fuzes having screwed down watertight safety cap and tightening plug (*e.g.*, No. 45P fuze) that the tightening plug should be in the screwed down position when the fuze is in the shell.

(*c*) Fuzes fitting 2-inch holes are screwed in by the body. The fitting key takes into a groove or hole in the body. Thus, in Time fuzes with watertight covers the cover must be removed before screwing in the fuze.

(*d*) Time and Time-and-Percussion fuzes must be set SAFE before they are inserted.

(*viii*) Screw the grub screw firmly home. Fill up its recess with luting, Mark VI.

(*ix*) Protect the head of the fuze from damp. This is applicable only to No. 44 and earlier marks of No. 45P, which have no watertight cap and have not already been waterproofed in depot.

The procedure is:—

(*a*) Untie the knot in the becket of the safety pin. The becket is now through the crown of the safety cap. No. 44 fuzes, Marks X and later, do not have a becket.

(*b*) Remove the securing pin or pins. In No. 44 fuzes, Mark X and later, this also removes the safety pin.

(*c*) Remove the safety cap carefully so as to avoid any strain on the becket of the safety pin.

(*d*) Examine the Pettman cement over the head of the fuze to see that it is sound and in good condition; if it is not in good condition the luting may work down into the fuze and saturate the detonator. Fuzes which are in good condition should be returned to a Naval Armament Depot.

(*e*) Coat the top portion of the fuze with Mark VI luting, placing a thick layer over the head of the fuze. In applying luting to the head of a No. 44 fuze care must be taken to avoid depressing the needle disc as this will fire the detonator.

(*f*) Reeve the becket of the safety pin through the crown of the safety cap.

(*g*) Replace the safety cap.

(*h*) Replace the securing pin or pins and open out the split ends. In fuzes No. 44, Mark X and later, replace the safety pin; if any difficulty is encountered in so doing the fuze should be removed and returned to a Naval Armament Depot unless it is likely to be fired in the near future.

(*j*) Re-knot the becket of the safety pin.

Note.—In future manufacture the luting may be applied to the head of the fuze at the fuze-filling factory. No further waterproofing on board will be necessary with these fuzes.

(*x*) With D.A. fuzes stencil the word " FUZED " on the shell with the special vermilion paint.

INSTRUCTIONS TO UNFUZE—GENERAL.

486. Unfuzing shell is carried out by reversing the operations just described :—

(*i*) Ease the grub screw right back.

(*ii*) Unscrew the fuze with the service fuze key (using no more force than can be applied by hand). If the fuze cannot be removed by this means, the fuzed shell must be returned to a Naval Armament Depot at the first opportunity.

(*iii*) Examine the fuze to see that no part of it remains in the shell. If a portion remains in the shell the shell is to be handled with care, kept in the horizontal position and lowered overboard in deep water. The remainder of the fuze should be handled with care and thrown overboard clear of the ship. In no circumstances should any attempt be made to remove a portion of a fuze remaining in a shell on board H.M. Ships.

(*iv*) Insert the plug, with leather washer under the flange, and follow a procedure similar to that in (*ii*), (*iv*) and (*vii*) of *para. 485*. The threads of the plug must be wiped clean before applying the luting. Screw up the grub screw and fill its recess with luting Mark VI. Care is to be taken that the correct type of plug is placed in the shell.

(*v*) Stencil through the word " FUZED " with vermilion paint.

(*vi*) Replace the fuze in a tin cylinder and seal it.

TIME MECHANICAL FUZES AND FUZE NO. 230.

487. Shell supplied fuzed with No. 206, 207 or 211 fuzes may also be used with Fuze No. 230 over Gaine No. 9 or 10 and *vice versa*. When a No. 211 fuze is fitted on board in place of any other fuze and gaine, the " G.9 " or " G.10 " marking on the shell should be erased or barred out and if a No. 211 fuze is being replaced by other fuze and gaine, the " G.9 " or " G.10 " as applicable, should be added by stencil to denote the presence of a gaine.

To Fuze with Fuze No. 211.

488. Ease the grub screw fully back and remove the plug (with leather washer) by means of Key No. 48, Mark I, or a suitable screwdriver, taking care that the components of the exploder system are not spilled from the shell. To ensure that all the components are in place a " gauge," depth of cavity, filled H.E. shell, No. 7 is supplied. The gauge should be applied to the shell cavity, using the longer end of the gauge which is marked " NOT GO." The bottom of the gauge will rest, without pressure, on the exploder in the cavity and the flange should be just clear of the nose of the shell. If the gauge, without undue pressure, touches the nose of the shell on both sides the shell should be re-plugged and returned to a Naval Armament Depot at the first opportunity.

If the gauging is correct screw in the fuze (which has a copper asbestos washer secured to it) using Key No. 89, Mark III (Schedule of keys, page 131). Screw the grub screw firmly home and fill the recess with luting, Mark VI.

To Fuze with Fuze No. 230 over Gaine No. 9 or 10.

489. Ease the grub screw fully back and remove the plug No. 20 (with leather washer) or fuze No. 211, taking care that the components of the exploder system are not spilled from the shell. Gauge the cavity with gauge No. 7 as described above for No. 211. Insert gaine No. 9 or 10 by means of Key No. 69, Mark II. The gaine, when screwed down, need not make metal-to-metal contact with the seating in the shell, but should give firm compression to the exploder system. Undue force is not to be used. Apply gauge No. 7 to the fuze hole using the end marked " GO " after insertion of gaine. The flange should make metal-to-metal contact with the nose of the shell. If gauging is correct, insert Fuze No. 230, using Key No. 121, Mark I (taking care that the copper asbestos washer, which is provided with the fuze, is in place). Screw the grub screw firmly home. Fill the recess with luting, Mark VI.

To Remove Fuze No. 230 and Gaine No. 9 or 10.

490. Ease the grub screw fully back and unscrew Fuze No. 230 (with the C. & A. washer) and unscrew the gaine, using the same implements as those for fuzing described above. No undue force should be used. The shell can then be fuzed with Fuze No. 211 or plugged with Plug No. 20 ; the precautions and gauging as set out in para. 488 being observed.

FUZES IN 14-INCH, 15-INCH AND 16-INCH, H.E. SHELL. *Fig.* 5.

491. These shell, when prepared for time fuzes, are marked with the word " TIME " in two places on the nose. If 15-inch H.E. shell have zinc alloy caps in place, the caps should be removed and left off after fuzing. The approved luting is Mark VII or VIIm.

To remove Time Combustion Fuzes in 14-inch and 16-inch H.E. Shell and Fuze with Fuze No. 118.

492. (*a*) Slack back the fixing screw.

(*b*) Remove the time fuze with key No. 89 and replace in its tape-banded cylinder.

(*c*) Remove the gaine No. 9 or 10 with key No 69 and place similarly in its cylinder.

(*d*) Insert exploder, 3 oz. C.E. pellet, with lifting band.

(*e*) Using gauge No. 9 test the depth of cavity and if correct, insert two tracing cloth discs on top of the exploder. Gauge No. 9 is a "Not Go" gauge, and when used, the bottom of the gauge will rest, without pressure, on the exploder, 3 oz. C.E. pellet, in the cavity and the flange should be just clear of the nose of the shell. Should the cavity be of incorrect depth, the shell must be returned to the nearest Naval Armament Depot.

(*f*) Insert fuze No. 118 with copper-asbestos washer under flange with Keys No. 113 or No. 121, using luting where and as described on the Diagram.

(*g*) Tighten the fixing screw and cover with luting as called for on the Diagram.

(*h*) At this stage the stencilling of the word "Time" in two places should be Carred through but not obliterated, in order that it may be known that this shell can be exploded to take a gaine and time fuze.

To remove Fuze No. 118 in 14-inch and 16-inch H.E. Shell and Fuze with a Time Combustion Fuze.

493. (*a*) Slack back the fixing screw.

(*b*) Remove the fuze No. 118 with Keys No. 113 or No. 121 and replace in its tape-banded cylinder.

(*c*) Remove the two tracing cloth discs and lift out the exploder, 3 oz. C.E. pellet, using a hook made of brass wire. In order to ensure that all components are in place and suitable for receiving a slight compression upon the insertion of No. 9 or 10 gaine, a gauge, depth of cavity filled H.E. shell No. 7, is supplied. Apply this gauge to the shell cavity using the longer end of the gauge marked "Not Go." The bottom of the gauge will rest, without pressure, on the exploding unit in the cavity and the flange should be just clear of the nose of the shell. If the gauge, without undue pressure touches the nose of the shell on both sides, the shell should be replugged and returned to an Armament Depot at the first opportunity.

(*d*) If the gauging is correct insert gaine No. 9 or 10 with Key No. 69.

(*e*) Apply gauge No. 7 to the fuze hole, using the end marked "... after insertion of gaine." The flange should make metal to metal contact with the nose of the shell. If incorrect, the shell should be returned plugged with plug fuze hole 2-inch No. 11 to the nearest Naval Armament Depot. On no account should fuze hole 2-inch No. 13 be inserted.

(*f*) If the depth is correct insert fuze No. 400, placing a copper-asbestos washer under the flange, or fuze No. 401, which has a copper-asbestos washer secured to it, with Key No. 89, using luting where and as described on the Diagram.

(*g*) Tighten the fixing screw and cover with luting as called for on the Diagram.

(*h*) The word "Time" should be stencilled on the shell.

To remove Time Combustion Fuze in 15-inch H.E., B.N.F. Shell and Fuze with Fuze No. 360.

494. (*a*) Slack back the fixing screw.

(*b*) Remove the time fuze with key No. 89 and replace in its tape-banded cylinder.

(*c*) Remove the gaine No. 9 or 10 with key No. 69 and place similarly in its cylinder.

(*d*) Remove the two tracing cloth discs, lift out the exploder, 26 dram C.E. pellet together with the three glazeboard discs placed at the underside between the pellet and the lifting band, using a hook made of brass wire.

(*e*) Insert exploder, 5-oz. T.N.T. pellet, with lifting band, followed by two tracing cloth discs.

(*f*) Using gauge No. 9 test the depth of cavity. Gauge No. 9 is a "NOT GO" gauge, and when used the bottom of the gauge will rest, without pressure, on the tracing cloth discs in the cavity and the flange should be just clear of nose of shell. Should the cavity be of incorrect depth, the shell should be returned to the nearest Naval Armament Depot.

(*g*) Insert fuze No. 360 with a copper washer under the flange with Keys No. 113 or No. 121, using luting sparingly on the thread and also on the copper-asbestos washer to make an effective seal. At this stage fuze No. 360 should have the safety cap removed and the watertight cover in place.

Note.—In the event of the shell striking required for use against targets which the common pointed shell were designed to attack, a special steel nose plug will be supplied to replace the No. 360 fuze.

(*h*) Tighten the fixing screw and cover with luting.

(*i*) Assemble the zinc alloy cap, using luting sparingly on the thread and also on the flange.

(*k*) At this stage the stencilling of the word "TIME" in two places on the head should be barred through but not obliterated, in order that it may be known that this shell can be exploded to take a gaine and time fuze.

To remove Fuze No. 360 in 15-inch H.E., B.N.F. Shell and Fuze with Time Combustion Fuze.

495. (*a*) Remove zinc alloy cap.

(*b*) Slack back fixing screw.

(*c*) Remove fuze No. 360 with keys, No. 113 or No. 121, and replace in its tape-banded cylinder.

(*d*) Remove the two tracing cloth discs and lift out the exploder, 5 oz. T.N.T. pellet, using a hook made of brass wire.

(*e*) Insert exploder, 26 dr. C.E. pellet, with the [illegible]zeboard discs between the lifting band and bottom of the exploder and follow by the insertion of two tracing cloth discs. To ensure that all components are in place and suitable for receiving a slight compression upon the insertion of No. 9 or 10 gaine, a gauge depth of cavity filled H.E. shell No. 7 is supplied.

Apply the gauge to the shell cavity, using the longer end of the gauge marked "NOT GO." The bottom of the gauge will rest, without pressure, on the exploder unit in the cavity, and the flange should be just clear of the end of the nose of the shell. If the gauge without undue pressure touches the nose of the shell on both sides, the shell should be returned plugged and returned to an Armament Depot at the first opportunity.

(*f*) If the gauging is correct, insert gaine No. 9 or 10 with key No. 69.

(*g*) Apply gauge No. 7 to the fuze hole, using the end marked "GO after insertion of the gaine." The flange should make metal-to-metal contact with the nose of the shell. If incorrect, the shell should be returned plugged with plug fuze hole, 2-inch No. 11, to the nearest Naval Armament Depot. On no account should plug fuze hole, 2-inch, No. 11, be inserted.

(*h*) If the depth is correct, insert fuze No. 400, placing a copper-asbestos washer under flange, or fuze No. 401 which has a copper asbestos washer secured to it, using luting sparingly on the threads and also on the copper-asbestos washer to make an effective seal.

Note.—On no account should an attempt be made to replace the zinc alloy cap on a shell that has time fuze in place.

(*j*) Tighten the fixing screw and cover with luting.

(*k*) The word "TIME" should be re-stencilled on the shell.

H.E. SHELL WITH A UNIVERSAL CAVITY 4-INCH TO 15-INCH.

495A. Shell fitted with a standard size of universal cavity have been recently introduced to permit an exchange of fuzing arrangements to be carried out afloat.

A list of shell so fitted with the appropriate fuzes and their exploder units are set out in the Addendum to this Handbook. These shell will have the letter "U" stencilled on opposite sides of the head as a means of identification.

Shell which have tracer fitted are not to be fitted with Fuzes Marks 56 and 60. When Fuzes Marks 56 or 60 are being fitted LUTING must not be used on the threads of fuze, fuze hole, screw, or screw hole; these must

(1) be wiped clean of [illegible]
and

(2) be dry before insertion of the fuze and grub screw.

Luting is to be used only on the underside of the copper-asbestos jointing washer under the fuze and for filling the recess over the grub screw when the screw is home.

Fuzes together with their appropriate exploder units are packed in metal cylinders and are [illegible] ready for insertion into the shell cavity. A lifting band is fitted to the exploder unit and enables it to be lifted as a whole. It must be used when the exploder unit is withdrawn from or inserted in the shell or cylinder.

To Exchange Fuzing Arrangements.

Ease the grub screw fully back, unscrew and remove the plug or fuze or fuze and gaine (as applicable) from the shell. Withdraw the exploder unit from the shell. These arrangements should then be placed in the appropriate metal cylinder, which should be marked suitably with a label for identification purposes and closed. When placing a gaine in its cylinder care must be taken to ensure that the plastic washer of the cylinder is positioned below the plastic adapter with the gaine intruding. The gaine must be screwed into the adapter and the shoulder below the thread on the gaine must be flush with the top face of the washer when the washer and the adapter are in contact. This ensures that the gaine will not exert any undue pressure on the [illegible] or permit play between the bottom of the gaine and the exploder unit.

Remove the fuze, or fuze and gaine required, and the exploder unit and the packing from the cylinder. Insert the exploder unit into the empty cavity of the shell, felt end first, followed by two tracing cloth discs. When a gaine is being fitted it must be screwed home on to its seating with Key No. 69, Mark II, to ensure the correct compression of the exploder unit. Check this by applying Gauge No. 7 to the fuze hole, using the end marked "GO" after insertion of gaine. The flange of the gauge should make metal-to-metal contact with the nose of the shell. Screw the fuze home with its appropriate key and screw the grub screw firmly home.

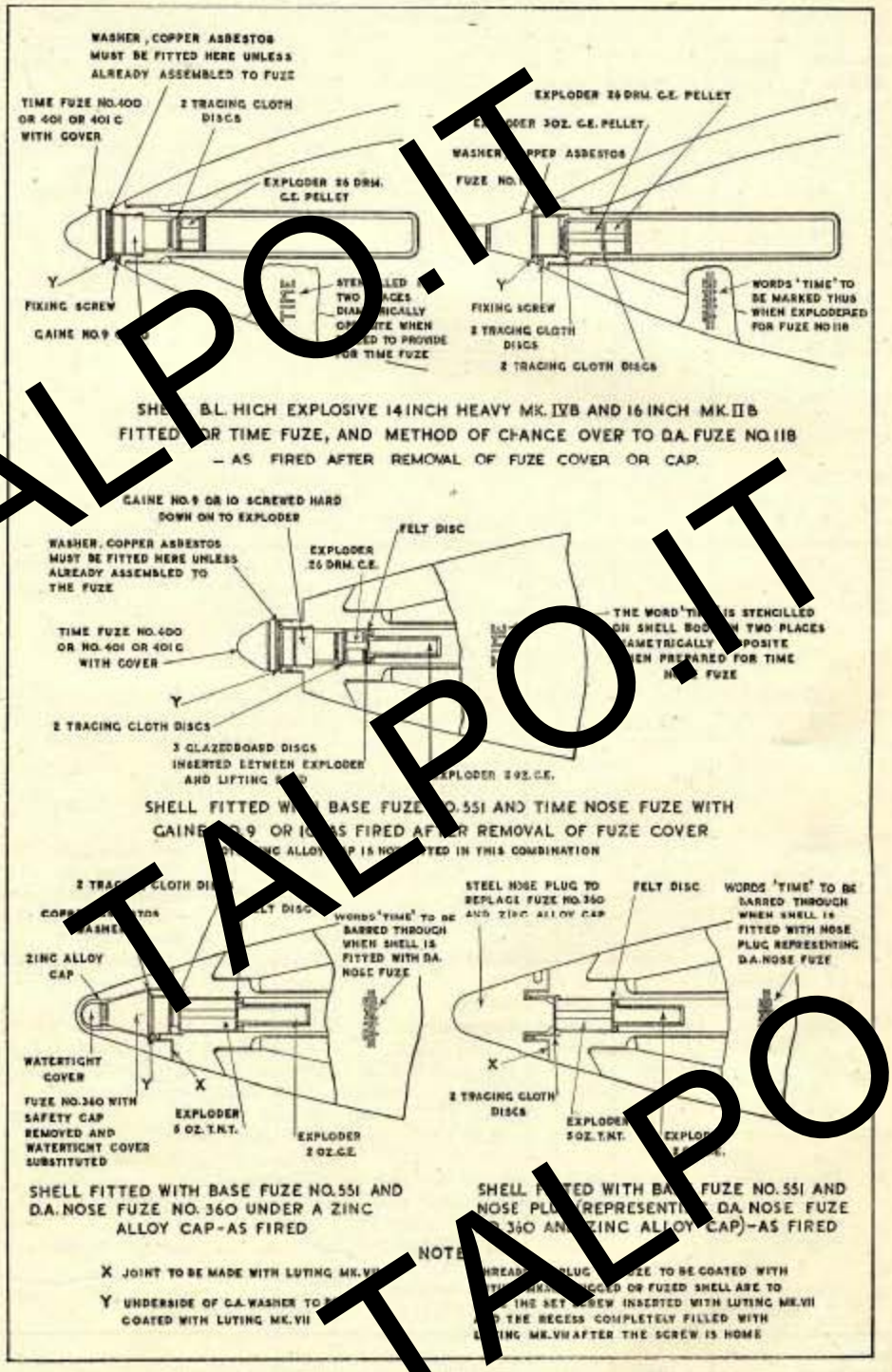


FIG. 5.—FUZES IN 14-IN., 15-IN., AND 16-IN. SHELL.

496. **FUZES AND GAINES IN USE IN THE NAVAL SERVICE**

TYPE AND SERVICE NO. OF FUZE	PARA.	PLATE NO.	PROJECTILES IN WHICH USED	GUN	REMARKS
Percussion, Direct Action.					
19A	—	—	H.E.	3-pdr. and 6-pdr.	O.F.M.
45P	*348*	*16*	H.E.	12-pdr. to 6-inch	For anti-ship use against thin plates
44	*353*	*16*	H.E.	3-pdr. to 15-inch	For bombardment
117	—	—	Smoke Shell	6-inch	Or Fuze No. 118
			Smoke Shell (A.Q.)	6-inch	
			Chemical Bursting without a Gaine	6-inch Mark XII	
118	—	—	H.E. Shell without Gaine	3.7-inch, 14-inch to 16-inch	
			Chemical Bursting without a Gaine	6-inch, Mark XII	
230	*359*	*16*	H.E. Shell with Gaine	8-inch and below	
	—	—	Target Smoke	4.7-inch	
	—	—	Chemical Bursting with Gaine No. 11	4.5-inch to 8-inch, except 6-inch Mark XII	
360C	*364*	—	H.E., B.N.F. (without Gaine)	15-inch	
240	—	—	H.E.	2-pdr. H.V.	O.F.M.
241	*365*	*17*	H.E.	2-pdr. L.V.	Supersedes Nos. 131 and 240
				3-pdr. and 6-pdr.	
			"K" device Projectile	6-inch and 8-inch	O.F.M.
243	—	—	H.E.	2-pdr. H.V.	—
246	*369*	*17*	H.E.	2-pdr. H.V.	Superseding No. 243
248	*370*	—	"K" device Projectiles	6-inch to 16-inch	Modified No. 241 to allow use with reduced charges as well as full charges
251	*374*	—	H.E.	40 mm. Bofors (British)	Superseded by No. 255
252	*375*	—	Incendiary	20 mm. Hispano	British and American manufacture O.F.M.
253	*577*	—	H.E. and H.E./I.	20 mm. Hispano	British and American manufacture
254	*561*	—	H.E., H.E./I. and H.E./I.T.	20 mm. Oerlikon	
				20 mm. Hispano	
255	*375*	*17*	H.E.	40 mm. Bofors	Supersedes No. 251
258	*561*	—	H.E./I. and H.E./I.T.	20 mm. Oerlikon	British manufacture only
259	*378*	—	H.E.	40 mm. Bofors	—
Percussion, Base, Hotchkiss	*383*	*18*	Steel Shell	3-pdr. and 6-pdr.	
			C.P. Shell	2-pdr.	
Percussion, Base, Small					
293	—	—	S.A.P.	2-pdr.	

TYPE AND SERVICE NO. OF FUZE	PARA.	PLATE NO.	PROJECTILES IN WHICH USED	GUN	REMARKS
Percussion, Base, Medium.					
12	—	—	C.P. Shell		
12F	—	—	C.P. Shell	12-pdr. to 4.7-inch	Lead-free metal. Weakened creep spring
12F.R.	—	—	C.P. Shell		
12W.F.	—	—	C.P. Shell		
12F Special	—	—	S.A.P.	4.7-inch and below	Lead-free metal. For use under base cover plates. Weakened creep spring
500	—	—	S.A.P.	12-pdr. to 5.25-inch	Supersedes No. 12F Special
501	*387 (i)*	*18*	S.A.P.	12-pdr. to 5.25-inch	Supersedes No. 500
502	*387 (ii)*	—	S.A.P.	4.5-inch, 4.7-inch (62 lb.) and 5.25-inch	Weakened creep spring
[illegible]	*387 (iii)*	—	C.P. H.E., B.N.F.	15-inch	Weakened creep spring
Percussion, Base, Large.					
15C	—	—	C.P.C. filled powder	6-inch and above	
15	—	—	C.P.C. filled powder	6-inch and above	
15 without delay	—	—	C.P.C. filled powder	6-inch	Obsolescent
16D	—	—	A.P.C., C.P.C., C.P.B.C. filled shellite	6-inch and above	
158	—	—	C.P.C. filled T.N.T.	15-inch	
			A.P.C. filled T.N.T.	14-inch, 15-inch and 16-inch	Supersedes No. 16D
158A	—	—	A.P.C. filled shellite		
159	*391 (ii)*	—	C.P.C. filled T.N.T.	15-inch	Supersedes Nos. 158 and 158A
			A.P.C. filled T.N.T. or shellite	8-inch and above	
345	—	—	S.A.P.C. filled T.N.T.	8-inch	Supersedes No. 16D
345A	—	—	S.A.P.C. filled shellite	8-inch	
346	*391 (iii)*	—	S.A.P.C. filled T.N.T. or shellite	8-inch	Supersedes Nos. 345 and 345A
479	—	—	C.P.B.C.; C.P.C. or S.A.P. filled T.N.T.	6-inch	Supersedes No. 16D
479A	—	—	C.P.B.C.; C.P.C. or S.A.P. filled shellite	6-inch	
480	*391 (i)*	*18*	C.P.B.C.; C.P.C. or S.A.P. filled T.N.T. or shellite	6-inch	Superseding Nos. 479 and 479A
Time, Combustion					
80/44	—	—	H.E. (16 lb.)	3-inch 20 cwt.	Obsolescent
124	—	—	C.N.F.	2-pdr.	O.F.M.

TYPE AND SERVICE NO. OF FUZE	PARA.	PLATE NO.	PROJECTILES IN WHICH USED	GUN	REMARKS
Time, Combustion—*contd.*					
125	*411*	*19*	C.N.F.	2-pdr., 3-pdr. and 6-pdr.	Supersedes No. 124 Mean Time set full 16.9 seconds
185	—	—	Target Smoke (12½ lb.)	3-inch 20 cwt.	Obsolescent
198	*417*	*19*	H.E. with gaine	12-pdr. to 8-inch	Mean Time set full 45 seconds
			Star Shell	4-inch and below	
			Smoke Shell B.E.	4-inch to 5.25-inch	
			Chemical B.E.	5.25-inch and 6-inch	
			Target Smoke with gaine	4-inch, 4.7-inch and 5.25-inch	
			H.A. Practice Projectiles	12-pdr. to 8 inch	
			Falling Target Shell	12-pdr.	
400	*424*	—	H.E. Shell with gaine	12-pdr. to 16-inch	Mean Time set full 9.7 seconds
			Shrapnel Shell	4-inch and below (except 3.7-inch)	
			H.A. Practice Projectiles	12-pdr. to 8-inch	
401	—	—	H.E. Shell with gaine	12-pdr., 3-inch, 4-inch, 14-inch, 15-inch and 16-inch	Mean Time set full— Mark I, 16.7 seconds Mark II, 17.55 seconds
			Shrapnel Shell	4-inch and below. (except 3.7-inch)	Obsolescent. Being used as a temporary measure for projectiles mentioned
			Target Smoke Shell with gaine	5.25-inch and below	
			H.A. Practice Projectiles	12-pdr. 8-inch	
			Falling Target Shell	4-inch Marks V and XVI, 4.5-inch and 5.25 inch	
402	*425*	*19*	Shrapnel Shell	4-inch and below (except 3.7-inch)	Intended to function at 6,000 yards range
Time, Mechanical.					
206	*435*	—	H.E. with gaine	4-inch to 8-inch	Maximum time of running—43 seconds
			Star Shell	4.5-inch to 5.25-inch	
			Target Smoke Shell	5.25-inch and below	
			H.A. Practice Projectiles	4-inch to 8-inch	

TYPE AND SERVICE NO. OF FUZE	PARA.	PLATE NO.	PROJECTILES IN WHICH USED	GUN	REMARKS
Time, Mechanical— *contd.*					
207	*440*	—	H.E. with gaine	4-inch to 8-inch	Maximum time of running—43 seconds
			Star Shell	inch	
				ark XVI, inch to 5.25-inch	
			Chemical B.E.	4.5-inch and 4.7-inch	
			Target Smoke Shell	5.25-inch and below	
			H.E. Practice Projectiles	4-inch to 8-inch	
211		*20*	H.E. without a gaine	4-inch to 8-inch	Combined Fuze and Gaine
			Target Smoke Shell without a gaine	5.25-inch and below	Maximum time of running—43 seconds
	446	—	Star Shell	4.5-inch, 5.25-inch (in Cruisers and above)	Maximum time of running— seconds
Time and Percussion					
80	—	—	Shrapnel Shell	3.7-inch	
93	*448*	*17*	Shrapnel Shell	inch 15-inch	
Gaines					
No. 2	—	—	Target Smoke (12½)	uch	Obsolescent
No. 8	—	—	H.E.	3-inch to 8-inch	Used in conjunction with No. 230 or Time Fuzes
			Target Smoke	4-inch and 4.7-inch	
No. 9	*462*	—	H.E.	3-inch to 8-inch. 14-inch, 15-inch (B.N.F.) and 16-inch	Superseding No. 8. Can be used with shell fillings containing Picric Acid
			Target Smoke Shell	5.25-inch and below	
No. 10	*458*	*19*	H.E.	3-inch to 8-inch. 14-inch, 15-inch (B.N.F.) and 16-inch	Superseding No. 8. Can not be used with shell fillings containing Picric
			Target Smoke Shell	5.25-inch and below	
No. 11	*463*	*19*	H.E.	12-pr. and 3-inch	
			Chemical Bursting Shell	4.5-inch 8-inch (except 6-inch Mark XII)	

CHAPTER XIII

SMALL ARMS AMMUNITION

SECTION 1.—GENERAL REMARKS

505. Small Arms Ammunition is used with rifles, machine guns, machine carbines, sub-machine guns, revolvers and pistols.

The term "Small Arms Cartridges" includes the complete round—cartridge case, percussion cap, propellant charge and bullet.

All Small Arms cartridges, with the exception of the Cartridge, Aiming Rifle 1-inch Electric, are fired by percussion, and the resulting flash ignites the propellant charge.

Ammunition of British design for rifles, machine guns and machine carbines of the calibres 0.303-inch, 7.92-mm., 0.[illegible]-inch (Vickers and Browning), and 0.55-inch is dealt with in *Sections 1* and *2* of this Chapter. Ammunition of British design for revolvers and pistols of the calibres 0.455-inch and 0.380-inch is dealt with in *Section 3*, and American Small Arms ammunition in supply, other than Oerlikon, in *Section 4*.

Ammunition with special features is described for 20-mm. guns in *Chapter XIV*; for 1-inch Aiming Rifle and 0.22-inch Miniature Rifle in *Chapter XV*; and for rifles fitted with Grenade Discharger in *Chapter XVIII*.

CARTRIDGE CASE.

506. Cases (except Drill and Dummy) are of solid drawn brass. Their design is on similar lines to that of the Q.F. case for a gun, except that a Cap Chamber and Anvil are recessed in the base instead of a primer. Two fire holes are drilled through the bottom of this recess. The case is tapered from base to shoulder and has a bottle-neck near the mouth to secure the bullet.

507. There are two types of case :—

(*i*) *Rimmed.*—A rim or flange is formed round the base to position the cartridge and assist its extraction. All 0.303-inch cartridges are rimmed.

(*ii*) *Rimless.*—A groove is cut round near the base to assist extraction. The case is positioned by its shoulder seating on the lead or [illegible]tered end of the chamber. All rifle and machine gun cartridges except 0.303-inch are rimless.

The copper or brass percussion cap is partly filled with Cap Composition. It is pressed into the cap chamber, with the composition hard against the Anvil, and is secured by stabbing or ringing. It must fit tightly all round so that there can be no escape of gas between the cap and the case on firing. Varnish is applied between the cap and the case to make the joint water and gas tight.

A beeswax mixture may be filled into the cannelure of the bullet to render the ammunition watertight. An alternative and more modern method is to varnish the neck of the case internally or the bullet externally before inserting it in the case.

PROPELLANT CHARGE.

508. This is packed in the cartridge case.

The chief propellants are :—

(*i*) *Cordite M.D.T.*

(*ii*) *Neonite.*—The neonites are nitrocellulose powders, usually in the form of graphited flakes, composed of gelatinised nitrocellulose with diphenylamine as stabiliser and coated with a moderant.

With a cordite charge a glazed board or strawboard disc is inserted between the bullet and the charge. Its function is to control the gases at the moment of discharge, lessen barrel wear and thus increase the accuracy of the flight of the bullet.

THE BULLET.

509. This has a cylindrical body, an ogival head and a flat or boat-tailed base (except Tracer, which have open bases). It is composed of and has an envelope, a core and/or a filling. Bullets may be reinforced by the addition of one or two sleeves between the envelope and the core or filling.

Envelopes are of :—

(*i*) Cupro-nickel (silver colour) ;

(*ii*) Gilding metal (copper colour) ;

(*iii*) Soft steel, coated with one of these substarces externally and/or internally.

Ductile materials are used so that on engaging the rifling there is neither too much strain on the bullet nor undue wear on the rifling.

The features of the core and/or filling vary with the type of cartridge.

Normally, one or two cannelures are cut in the body of the bullet near the base, and the bullet is secured in the cartridge case by indenting and/or coning the case into the cannelure.

510. A bullet differs from a projectile or shell in that having no driving band it is made to engage the rifling of the rifle or gun by :—

(*i*) " Set up " (*i.e.*, expansion of the base of the bullet).

(*ii*) Being slightly larger in diameter than the bore of the rifle or gun.

The trajectory or line of flight of a bullet is influenced by gravity and air resistance, and the extent of the resistance depends on such factors as angle of elevation, muzzle velocity, rotation, weight, shape, etc.

The weight and muzzle velocity of bullets of the various types of cartridge of the same calibre vary, and when mixed types are fired from a belt or magazine the bullets will not follow the same line of flight. To ensure accurate shooting with mixed types of cartridges, modern cartridges are " matched " so that at a given range all bullets will reach the same point or target. Matching is effected by adjusting the weight or shape of the bullets or the quantity of the propellant charge.

MARKINGS AND MEANS OF IDENTIFICATION. *Plate* 21.

511. Types of cartridges may be identified by :—

(*i*) The colour of the varnished ring or annulus. Some types of cartridge have the tips of the bullets coloured in addition, and the colour of the tip thus provides the means of identification and *NOT* the colour of the annulus.

(*ii*) Each type of cartridge except Ball has a code letter stamped on the base of the case preceding the mark numeral.

(*iii*) The mark numeral is stamped on the base of the case.

512. Code.

SERIAL NO.	CARTRIDGES	CODE LETTER	COLOUR OF ANNULUS
1	Ball	[illegible]	Purple
2	Practice	[illegible]	Purple
3	Armour-Piercing (A.P.)	W	Grey
4	Semi-Armour-Piercing (S.A.P.)	F	Green
5	Tracer	G	Red
6	Incendiary	B	Blue
7	Proof	Q	Yellow
8	Blank or Restricted Blank	L	Nil
9	Drill	D	Nil
10	Dummy	U	Nil
11	Observing	O	Black
12	Explosive	R	Black
13	Grenade Discharger	H	Colourless
14	Smoke Generator or Discharger	E	Colourless
15	Self destroying	Y	According to rules set out below

513. Incendiary cartridges and special tracer for use by aircraft have the tips of the bullets coloured as a means of identification :—

Short range day tracer	White
Short range night tracer	Grey
Incendiary	Blue

A colour-varnished annulus of the appropriate code colour is also used.

Where a cartridge possesses more than one characteristic (e.g., S.A.P. tracer) and therefore comes under two or more serial numbers, all the relevant code letters will be used. The sequence of the code letters and the colour of the annulus is governed by the following order of precedence :—

Q, O, R, W, F, B, G, H, E.

Thus, S.A.P. tracer, serial Nos. 4 and 5, has code letters FG in this order, and the annulus colour is green, since F precedes G.

If the propellant is other than cordite, a letter is stamped on the cartridge case to denote the nature of the propellant :—

T	Black Powder.
Z	Nitro-cellulose or Ballistite.

514. The following particulars are stamped on the base of a cartridge case :—

(*i*) The manufacturer's initials or trade mark

(*ii*) Year of manufacture (usually only the last two figures).

(*iii*) The distinguishing letter or letters denoting the type of cartridge.

(*iv*) The mark numeral of the cartridge followed, where necessary, by the letter denoting the nature of the propellant.

CH. XIII—SECTION 2.—TYPES OF CARTRIDGE. *Plate* 21.

515. The cartridge case, percussion cap and propellant described in *Section 1* are typical for Small Arms ammunition of British design for rifles, machine guns, machine carbines and sub-machine guns.

The present types of cartridge are:—

Ball, Armour-Piercing (A.P.), Semi-Armour-Piercing (S.A.P.), Tracer, S.A.P. Tracer, Incendiary, Proof, Blank, Drill, Dummy and Observing.

The components for each type of cartridge are similar in its various calibres, differing only in size or amount.

Cartridge, S.A. Ball. *Plate* 21.

516. No Code Letter. Annulus Colour—Purple.

The cartridge is supplied for all calibres except 0.5-inch Browning for use against personnel.

The bullet envelope is of cupro-nickel, gilding metal, or steel coated with cupro-nickel or gilding metal. Its core is lead antimony with an aluminium, plastic or fibre tip, or mild steel with a lead antimony tip. The tip may be adjusted to the correct weight for the required ballistics and balances the bullet to ensure accuracy in flight. The 9-mm. bullet has no tip.

Note :—American 0.5-inch Browning is in supply. Cartridges for Vickers and Browning 0.50-inch machine guns are not interchangeable; they differ in length and other dimensions.

Cartridge, S.A. Armour-Piercing. *Plate* 21.

517. Code letter W. Annulus Colour—Green.

Cartridges are in supply in the following calibres:—

7.92-mm. 0.303-inch, 0.5-inch (Vickers), and 0.55-inch.

The bullet is specially reinforced to attain armour piercing. It has an envelope of cupro-nickel, gilding metal, or steel coated with cupro-nickel or gilding metal, a sleeve of lead antimony and a core of hard steel. The perforating power of the bullet is dependent on the striking energy of the core and the angle at which it strikes the plate. On impact with armour plate the core will perforate and the envelope and sleeve will flatten out and support the point of the core during the first instant of penetration, acting as a lubricant to assist its passage through the plate.

Cartridge, S.A. Semi-Armour-Piercing.

518. Code Letter F. Annulus Colour—Green.

The cartridge is in supply only for the 0.5-inch Vickers machine gun. It is similar to A.P., except that the core of its bullet is of mild steel.

Cartridge, S.A. Tracer. *Plate* 21.

519. Code Letter G. Annulus Colour—Red.

Cartridges are in supply in the following calibres:—

7.92-mm., 0.303-inch, 0.5-inch (Browning) and 0.55-inch.

Tracers are sometimes referred to as "Ball Tracer" to distinguish them from S.A.P. Tracer.

This type of cartridge enables the line of flight of the bullet to be observed to assist in correction of aim.

The bullet consists of an envelope, a core, a filling and a washer. The envelope is of cupro-nickel, gilding metal or steel coated with cupro-nickel or gilding metal. The core consists of a front section of lead antimony and a rear section is a solid drawn tube. Blinding and tracer compositions are filled into the rear section and its base is sealed by a brass washer with a central hole. On firing, the heat from the propellant gases ignites the blinding and tracer compositions which burn with a bright light and allows the flight of the bullet to be observed.

Dark ignition tracers with a trace which is not evident until the projectile is some distance from the muzzle of the gun are in supply for certain calibres.

The object of this type of tracer is to minimise blinding at night and to prevent the gunlayer being confused by the trace just outside the muzzle. To some extent they also avoid disclosing the position of the gun.

520. The tracer bullet is of lighter weight than Ball or A.P. and, by reason of the burning away of the tracer composition, its weight decreases during flight. In consequence and as a result of the

effect produced by the burning tracer composition being forced out of the rear of the bullet, the trajectories of tracer bullets differ from those of other bullets. Tracer cartridges are matched-up with other types of cartridge, but they are naturally less destructive than Ball or A.P., and are liable to foul the barrel. This latter disability is overcome by mixing the various types of cartridge in the belts and magazines. The length of trace (*i.e.*, time of burning) is regulated by adjusting the tracer composition.

Cartridge, S.A. Semi-Armour-Piercing Tracer.

521. Code Letter FG. Annulus Colour—Green.

This cartridge is in supply only for the 0.5-inch Vickers machine gun. It is similar to Tracer, except that the front section of the core of the bullet is of hard steel.

Cartridge, S.A. Incendiary. *Plate 21.*

522. Code Letter B. Annulus Colour—Blue.

Cartridges are in supply in the following calibres :—

7.92-mm., 0.303-inch, 0.5-inch (Vickers and Browning).

The cartridge is used primarily to attack aircraft. The sensitivity and incendiary effect of the bullet is such that it will perforate the skin of an aircraft without ignition and penetrate its self-sealing tank and ignite the petrol.

The bullet consists of an envelope, sleeves, base discs and a filling of Incendiary composition.

The early marks of 0.303-inch were filled with white phosphorus ; these are now obsolescent.

Cartridge, S.A. Proof.

523. Code Letter Q. Annulus Colour—Yellow.

Cartridges are in supply in the following calibres :—

7.92-mm., 0.303-inch, 9-mm., 0.5-inch (Vickers) and 0.55-inch.

This is a Ball cartridge with an increased propellant charge which gives a higher pressure. It is used for proving guns.

Cartridge, S.A. Blank.

524. Code Letter L. Annulus Colour—Nil.

The cartridge is special to 0.303-inch calibre. It has no bullet and its main purpose is to make a loud report.

The propellant charge consists of 10 grains reduced cordite Mark I Size 20, or 15 grains of nitrocellulose. A strawboard wad is fixed above the charge in the neck of the case which is closed by necking and crimping.

Cases manufactured for other types of cartridge may be used for Blank and markings other than the correct ones may be found for example a rejected Ball case may be used and the Ball mark numeral remain[illegible].

Cartridge, S.A. Drill. *Plate 21.*

525. Code Letter D. Annulus Colour—Nil.

Cartridges are in supply in the following calibres :—

7.92-mm., 0.303-inch, 9-mm., 0.5-inch (Vickers), and 0.55-inch.

These cartridges are used for training purposes ; they may also be included at the end of belts of cartridges for machine guns to remind the gun's crew to reload. The original type of case is chromium-plate with three vertical grooves which are painted red. There is no propellant charge or percussion cap. The recess forming the cap chamber is painted red and left empty.

Since the commencement of hostilities another type of case has been introduced. This case is an ordinary brass service case with four holes bored in the side and the recess forming the cap chamber is left empty.

Cartridge, S.A. Dummy.

526. Code Letter U. Annulus Colour—Nil.

Cartridges are in supply in the following calibres :—

7.92-mm., 0.303-inch, 9-mm., 0.5-inch (Vickers) and 0.55-inch.

The cartridge is used by inspecting officers and at depots and is not in supply to ships. It is similar to Drill, but has a plain case ; the bullet is of gilding metal. The weight and balance of the cartridge are the same as those of Ball.

Cartridge, S.A. Observing.

527. Code Letter O. Annulus Colour—Black.

The cartridge is in supply only for 0.303-inch calibre. The bullet makes a small puff of smoke on impact. The cartridge is used for training purposes to assist in observation of firing.

The cupro-nickel envelope has a hole bored in the nose which is closed with a plug of fusible metal. Phosphorus and powdered aluminium are filled into the envelope which has a lead core. The base is soldered. (The tips of the bullets are varnished black.) This cartridge is obsolescent.

Cartridge, S.A. Rifle Grenade, Ballistite, Mark IZ.

528. Code Letter H. Annulus—colourless. The front half of case is black.

These cartridges are used with (1) Rifles fitted with Dischargers, and (2) Bombs, B.L. H.E. 4-inch, Mortar 10 lb. Mark I. They are blank cartridges with a charge of approximately 30 grains of ballistite. Ballistite is a mixture of soluble nitrocellulose and nitroglycerine, and is rather more powerful than cordite; it is mostly used as a sporting powder. The mouth of the case is closed with a glazed board cup and is not crimped.

Note.—These cartridges must *NOT* be used with (1) a rifled grenade, *e.g.*, Rifle M.L.E., as the ignition of the ballistite is much too rapid and dangerous pressures would be produced; *NOR* with (2) Smoke Float, B.L. 4-inch Mortar, Marks II and III.

Cartridge, S.A. Rifle Grenade, 0.303-inch. Cordite.

529. Code Letter M. Annulus—colourless. The case is black all over.

These cartridges are used with (1) Rifles M.L.E. (line throwing), and (2) Smoke Floats, B.L. 4-inch Mortar, Marks II and III. They are blank cartridges with approximately 43 grains of Cordite M.D. The mouth of case is closed with a glazed board cup and is not crimped.

Note.—These cartridges must *NOT* be used with (1) Rifles fitted with a discharger as the propellant does not burn rapidly enough to ensure complete ignition; *NOR* with (2) Bomb, B.L. H.E. 4-inch Mortar, 10 lb., Mark I.

CH. XIII—SECTION 3.—REVOLVER AND PISTOL AMMUNITION.

Plate 22.

GENERAL.

530. Each of the many designs of Revolver and Pistol requires special ammunition but the variations are, in the main, minor ones. The cartridges are complete and have the same main parts as the rifle cartridge. The case may be rimmed, rimless or semi-rimmed and have one or more fire holes. The method of ignition is the same as for the rifle cartridge.

531. The types of cartridge are:—

Ball, Proof, Blank and Drill.

The markings and method of identification (except Proof) are the same as the corresponding type of rifle cartridge.

The ammunition described may be considered typical of the present supply.

PISTOL, REVOLVER, No. 1, 0.455-inch.

Cartridge, S.A., Ball.

532. No Code Letter. Annulus Colour—Purple.

The solid drawn brass case is rimmed and has a cap chamber and anvil recessed in the base. Two fire holes are drilled through the bottom of the recess. The brass or copper cap is filled with cap composition and secured by ringing. The charge is cordite or nitrocellulose.

The bullet has a cupro-nickel envelope and a lead antimony core. The cannelure is filled with beeswax mixture and the bullet is secured by rolling the mouth of the case; it may be further secured by indenting the case into the cannelure.

Cartridge, S.A., Proof.

533. Code Letter Q. Annulus Colour—Yellow. The case is a reddish copper.

The case and cap are the same as for Ball. The charge of cordite or nitrocellulose is loaded to give a pressure of 7 tons.

The bullet is of lead antimony and has three cannelures. It is secured by coning the mouth of the case and rolling the case into the top cannelure.

Cartridge, S.A., Blank.

534. Code Letter L. Annulus Colour—Nil.

The case and cap are the same as for Ball.

The charge consists of approximately 5 grains of gunpowder. Two felt wads are placed above the charge and the mouth of the case is crimped to retain the wads and the charge.

Cartridge, S.A., Drill.

535. Code Letter D. Annulus Colour—Nil.

The white metal or brass case is rimmed and has three vertical grooves painted red. The cap chamber recess is filled with a red fibre pad secured by three stabs.

The bullet is of lead antimony and has three cannelures. It is secured by coning the mouth of the case and rolling the case into the top cannelure.

PISTOL, REVOLVER, No. 2. 0.380-inch.

Cartridge, S.A., Ball.

536. No Code Letter. Annulus Colour—Purple.

The case is rimmed with the base of the rim bevelled off. The bullet has a cupro-nickel or gilding metal envelope and a lead antimony core. It has two cannelures, the lower being filled with beeswax mixture. The bullet is secured by coning the mouth of the case into the upper cannelure and rolling the case into the lower one.

Cartridges, S.A., Proof and Drill are similar to [illegible]esponding types in 0.455-inch calibre.

Cartridge, S.A., Blank has a charge of approximately 5.5-grains of gunpowder which is covered by a felt wad.

PISTOL, 0.455-inch.

Cartridge, S.A., Ball.

537. No Code Letter. [illegible]nnulus Colour—Purple.

Ammunition of this calibre is similar to that for the Pistol Revolver No. 1 with the following variations :—

The case is semi-rimless (that is, it has a groove cut round its base above the rim) and has three fire holes.

The bullet has a copper, nickel plated envelope with a lead antimony core. It has one cannelure and is secured by coning the mouth of the case into the cannelure.

538. **Cartridges, S.A., Proof, Blank and Drill,** differ from Pistol Revolver No. 1 ammunition in that the cases are semi-rimless and (except Drill) have three fire holes.

CH. XIII—SECTION 4.—AMERICAN SMALL ARMS AMMUNITION

539. Small Arms Ammunition of American design and manufacture is in supply for what may be considered essentially American calibres of Small Arms, namely, Rifle and Machine Gun 0.30-inch ; Thomson Sub-Machine gun, and Smith and Wesson revolver 0.[illegible]-inch ; and Browning Machine gun 0.5-inch. Ammunition is also in supply for the [illegible] carbine.

Cartridges are similar to British ammunition except :—

(*i*) Cases are of the rimless type. The anvil is a separate unit and is fitted in the percussion cap (termed " primer ") before the latter is inserted into the case. Rifle and Machine gun cartridges have one fire hole.

(*ii*) The propellant charge is nitrocellulose powder.

(*iii*) The bullet envelope (termed " jacket ") is of gilding metal and is copper coloured. The base of the bullet may be boat-tailed or flat (except Tracer which is open). The bullet is secured in the case by crimping the mouth of the case into the cannelure or where there is no cannelure (*e.g.* 0.45-inch) by coning.

(*iv*) Markings and means of identification :—The means of identification is by varnish colour marking the tips of the jackets. The American code of colours is the same as the British code with the exception of A.P., which may be either black or green. The colour-varnished annulus indicates that waterproof varnish has been applied. The code letter system is not used.

540. The base of the cartridge may be stamped with the initials of the manufacturer, year of manufacture and calibre, but there is no uniform standard. British manufactured ammunition for American calibres has the tips of the jackets coloured and base markings in addition.

Small Arms cartridges of American calibres will not lead into British weapons of approximately the same calibre. For example, the base of the 0.30-inch cartridge (rimless) is smaller than that of a 0.303-inch cartridge (rimmed) but the diameter of its case is larger at the top to [illegible]r a 0.303-inch rifle, gun or links belt. Similarly, 0.5-inch Vickers and Browning cartridges are not interchangeable as they differ in length and in other dimensions as stated above.

541. TABLE OF AMERICAN CARTRIDGES.

CARTRIDGES	CALIBRE	COLOUR OF TIP
Ball	0.30-inch [illegible]-mm. ; 0.[illegible]-inch and 0.5-inch	Nil
A.P.	0.30-inch and 0.5-inch	Black or green
Tracer	0.30-inch and 0.5-inch	Red
Tracer with dark ignition	0.5-inch	Orange
Tracer (short range day)	0.30-inch	White
Incendiary	0.30-inch and 0.5-inch	Blue
Dummy (Drill)	0.30-inch, 0.45-inch and 0.5-inch	Nil
A.P./Incendiary	0.5-inch	Silver

542-549.

CHAPTER XIV

S.A.A.(*cont.*)— 1-INCH AIMING RIFLE AND MINIATURE RIFLE CARTRIDGES

1-INCH AIMING RIFLE CARTRIDGES. *Plate* 22.

550. The 1-inch Aiming Rifle Cartridge comes within the definition of Small Arms Ammunition, but it differs from type by having a primer, electric or percussion, instead of the usual percussion cap. It is supplied in bulk, 96 rounds in a box, A.A., G.S., No. 4.

Cartridge, Aiming Rifle, 1-inch Electric, Mark II.

551. The cartridge comprises a cartridge case, primer, charge and bullet.

The solid drawn brass case is rimmed but is without the usual pronounced bottle-neck to receive and secure the bullet. It is annealed internally with the exception of the threads of the primer hole and that portion which supports the bullet. The base of the case is marked with the manufacturer's initials or trade mark, the letter N, and the mark numeral of the cartridge.

The brass primer comprises a body and magazine in a single unit. It is screwed into the primer hole and the joint is made tight with a fibre washer. A brass contact pin, insulated from the body by ebonite bushes, is fitted at the base. One end of the bridge wire is soldered to the point of the contact pin and the other to the body. The recess is filled with guncotton dust so as to surround the wire bridge. The charge in its magazine is gunpowder G.20 and the magazine is closed by a glazed board cup shellacked in position.

On firing, electric current is passed from the contact pin. The bridge wire gets hot and the guncotton dust and the magazines are in turn ignited. The resulting flash ignites the cordite charge.

The charge consists of about 160 grains of cordite, Mark I, size 3.

The lead-antimony alloy bullet weighs approximately 10-ozs. Its two cannelures are filled with beeswax mixture. The rear end of the bullet is reduced in diameter and a copper cup is pressed on firmly and turned in on the bullet.

Cartridge, Aiming Rifle, 1-inch Percussion, Mark III.

552. The cartridge is similar to Electric, Mark II, but is fitted with a percussion primer.

The percussion primer has an anvil and magazine formed integrally. The magazine is filled with a gunpowder pellet.

On firing, flash from the cap ignites the magazine and the resulting flash ignites the propellant charge. Gun pressure is prevented from blowing back by the soft copper cap sealing in the body.

MINIATURE RIFLE CARTRIDGES.

0.22-inch Ammunition.

553. The official nomenclature of ammunition of this calibre is " Cartridge, Rim Fire, 0.22-inch, Mark I," and the present Service type of cartridge is known as " Non-Rusting."

The term " Rim-Fire " denotes a cartridge without a percussion cap. The fold of the rim of the case is hollow and is charged with cap composition.

Cartridges are supplied in cardboard boxes of 100; 100 boxes are packed in a quarter B.L. case.

The cartridge comprises the case, charge and bullet.

The case is of copper zinc alloy, solid drawn.

The charge is usually black powder. Cordite, neonite or other nitrocellulose powders may, however, be used according to the particular manufacturer's practice.

The bullet is made of soft lead. It is rounded at the head and has three shallow cannelures, usually lubricated with beeswax mixture. It is secured in the case by coning, necking and crimping.

554-559.

CHAPTER XV

S.A.A. (*cont.*)—20 mm. CARTRIDGES

SECTION 1—GENERAL

560. 20 mm. ammunition is in supply for :—

(*i*) Oerlikon and Polsten guns.

(*ii*) The Hispano gun.

Oerlikon and Hispano ammunition is not interchangeable. The base of the Oerlikon case is of less diameter than its body, whereas the dimensions of the base and body of the Hispano case are almost identical.

The cartridges for both guns have similar components and comprise—case, percussion cap, propellant charge and shell or projectile.

The cases are rimless and their brass percussion caps are secured by ringing.

The steel shell are fitted with a copper driving band and, except Semi-Armour-Piercing which are closed with steel nose plugs, a percussion D.A. fuze is screwed in. A cannelure is cut below the driving band and the shell or projectile is secured in the case by indenting.

Practice projectiles are not fitted with a fuze.

SECTION 2—OERLIKON

BRITISH OERLIKON. *Plate* 23.

561. The designs and components of typical ammunition are shown in the illustration.

The fuze fitted is No. 254 or No. 258. Each is a Percussion Direct Action fuze having no moving parts ; the crushing of the fuze on impact actuates the detonator. The direct action nature of the fuze will perforate the skin of an aircraft without functioning, but will operate on impact with wing spars, petrol tanks or other heavy structures. At very short ranges the fuze will function on impact with the skin of an aircraft. The No. 258 is the more sensitive fuze and is in supply for H.E./I and H.E./I/T for Naval Service.

The propellant charge is nitro-cellulose, flashless or chopped tube.

The shell filling is C.E. or T.N.T. C.E. is obsolete for future manufacture.

The outside of the shell below the driving band is varnished to render the joint between shell and case watertight.

All future Oerlikon tracer of British manufacture will have Dark Ignition. (*See* para. 519.)

Markings and Means of Identification.

562. The types of ammunition are identified by the colour marking on the shell or projectile. The fuze can be identified :—No. 254 is painted the same colour as the shell. No. 258 is not painted except for a blue spot on the nose.

The Lot Number of the shell or projectile, the contractor's initials and, if applicable, the letters D.I. (indicating dark ignition tracer) are stamped on the side of the shell or projectile. Projectiles for Drill (except Drill, Marks I and II) have no stamped markings.

The base of the cartridge case is stamped as follows :—

(*i*) Initials or trade mark of the manufacturer of the case.

(*ii*) Oe. (*i.e.*, Oerlikon).

(*iii*) The letter " Z " (denoting neonite filling).

(*iv*) Year of manufacture of case, *e.g.*, '44.

Note.—Oerlikon ammunition of " new " British manufacture will be stamped with details of the lot number and type of ammunition on the cartridge case just in front of the base groove. It will be shown thus :—

S. [illegible]/H.E./I/T.

These details should be quoted in all reports dealing with defective ammunition.

Types of Ammunition. *Plate* 23.

562 (*a*) The present types of ammunition and the colour markings are :—

Practice	Lead Grey.
Practice Tracer	Light Green.
H.E. Incendiary	Signal Red.
H.E. Incendiary Tracer...	Bright Green.

S.A.P./H.E./I.	Red with white tip.
H.E.	Buff.
H.E. Tracer	Light Blue.
Proof	Lead Grey with red band round the body.
Drill, Mark I	Black with DRILL in White Letters.
Drill, Mark II	Wood, unpainted.

Projectile, Practice. Colour—Lead Grey.

563. The steel projectile is hollowed to make the weight correct and the nose is pointed to give the required ballistics; the base is closed with a steel disc.

Projectile, Practice Tracer. Colour—Light Green.

564. The projectile is similar to Practice, but for the purpose of ballistic matching the nose is less pointed. The body is partly filled with tracer composition. On firing, heat from the propellant gases ignites the tracer composition which burns for approximately 3½ seconds.

Shell, H.E., Incendiary. (H.E./I). Colour—Signal Red.

565. The filling comprises an increment of Incendiary composition with T.N.T. superimposed and pressed in; a waxed lasting cloth disc separates the T.N.T. filling from the incendiary composition.

On impact, the fuze detonates the T.N.T. filling and the detonation ignites the incendiary composition.

The inclusion of incendiary composition results in an extremely high temperature on detonation, and this is very effective for igniting petrol.

Shell, H.E., Incendiary, Tracer. (H.E./I./T.) Colour—Bright Green.

566. The shell is open at both ends and is divided into two compartments. The forward compartment is filled with an increment of Incendiary composition with T.N.T. superimposed and pressed in; a waxed lasting cloth separates the T.N.T. from the incendiary composition. The rear compartment is filled with tracer composition. A thin brass closing disc is placed over the tracer composition and is retained in position by a steel washer which is secured into the base of the shell.

On firing, heat from the propellant gases melts the centre of the closing disc and ignites the tracer composition which burns for approximately 3½ seconds. On impact, the fuze detonates the T.N.T. filling and the detonation ignites the incendiary composition.

Shell, Semi-Armour-Piercing H.E./I. (S.A.P./H.E./I.) Colour—Red with White tip.

567. This shell is similar to the H.E./I but a detonator is superimposed on the filling and the head of the shell is closed with a steel nose plug. The shell is detonated on impact with armour plate or heavy metal structure and the incendiary composition is ignited.

Shell, H.E. (H.E./T.) Colour—Buff.

568. The shell is similar to the H.E./I except for the filling, which is entirely high explosive. This type of ammunition is now obsolescent.

Shell, H.E. Tracer (H.E./T.) Colour—Light Blue.

569. The shell is similar to the H.E./I./T except for the filling, which is entirely high explosive. This type of ammunition is now obsolescent.

Cartridge, Drill, Mark I. Colour—Black with DRILL in White.

570. This cartridge and CARTRIDGE, DRILL, MARK II (described below) are supplied for magazine loading practice and must not be loaded into the gun. The projectile is of cast iron.

The base of the case is stamped :—

(*i*) Oc.

(*ii*) Letter " D " (denoting " Drill ") and I (denoting Mark I (Naval).

(*iii*) Date of filling barred out.

The cap is removed and a red annulus is painted.

Cartridge, Drill, Mark II. No colour marking.

571. The hardwood cartridge is stamped :—

(*i*) Oc.

(*ii*) Letter " D " and II N.

(*iii*) Contractor's initials or recognised trade mark

(*iv*) Year of manufacture, *e.g.*, '44

Clearing Charge.

572. The clearing charge comprises a shortened service cartridge case with a full charge. The propellant is retained by a glazed board cup.

A one-round magazine is supplied to facilitate the use of clearing charges.

The magazine is suitable for any mark of gun.

AMERICAN OERLIKON. *Plate* 23.

573. H.E., H.E./I and H.E./T ammunition of American design and manufacture are in supply. The case and shell are similar to those of British design.

The fuze, No. 26, is a Percussion, D.A. fuze which is an adaptation of the British No. 254 and functions in a similar manner. The propellant charge is graphite tubular neonite. The high explosive filling is either C.E. or Pentolite. Pentolite is now obsolete for future manufacture.

574. The types of ammunition and the filling are distinguished by the colour marking on the shell.

The base of the case is stamped :—

(*i*) Contractor's initials or trade mark.

(*ii*) Year of manufacture.

(*iii*) 20 mm.—Mark II.

575. The following particulars are marked on the side of the case in indelible blue ink :—

(*i*) Initials of filler.

(*ii*) Lot Number in ¼-inch letters.

576. The present types of ammunition in supply, their filling and colour markings are :—

H.E.	C.E.	White.
H.E.	Pentolite	Yellow.
H.E.T.	C.E.	Light Grey.
H.E.T.	Pentolite	Dark Blue.
H.E.I.	C.E.	Red.
H.E.I.	Pentolite	Pink.

SECTION 4—HISPANO

577. A typical round is shown, for comparison with Oerlikon, in the illustration. (*Plate* 23.)

The fuze fitted is No. 2[illegible]. A modified Oerlikon fuze, No. 254 Mark IV, is approved as an alternative.

The propellant charge is nitro-cellulose powder. The high explosive filling is C.E.

Markings and means of Identification.

578. The types of ammunition are identified by the colour markings on the shell or projectiles. The base of the case is stamped :—

(*i*) Manufacturer's initials or trade mark.

(*ii*) Year of manufacture.

(*iii*) 20 mm.

The colour of the annulus is purple for all types of ammunition except Dummy, which is uncoloured.

The markings stamped on the side of the shell are :—

(*i*) Lot Number and last two figures of the year of filling.

(*ii*) Filling contractor's initials or trade mark.

(*iii*) Mark of complete round and type of propellant.

Types of Ammunition.

579. The present types of ammunition in supply and the colour markings on the shell or projectiles are :—

Ball	Black or blued.
Tracer	Black with T in Red, or red band.
A.P./T. (Day)	Black body, white tip and white band.

A.P./T. (Night)	Black body, white tip and green band.
H.E.I.—Top half of body	Buff.
Lower half of body	Red.
Nose of fuze	Green or Red.
A.P.	Black with white tip.
S.A.P. Incendiary	Red with white tip.
Dummy	Black or blued.

Note.—No red band is painted on shell to denote that they are filled.

H.E. and Incendiary are obsolescent.

The above ammunition is similar to the corresponding British types of Oerlikon ammunition described earlier in this Chapter, except as following :—

Cartridge, S.A., Ball. Colour—Black or blued.

580. The projectile is hollow and a metal closing disc in the base prevents the entry of gases into the projectile.

Cartridge, S.A., Armour-Piercing (A.P.). Colour—Black with White tip.

581. This ammunition is for use against armoured fighting vehicles and armour protection in aircraft.

The projectile, which has no filling, is of armour-piercing steel and its pointed tip is fitted with a coloured plastic cap. The length of the cartridge is the same as Ball, and the ammunition can be used in all types of magazine and in belts. Later marks are without a cap and have either an inert filling or a spigoted base plug.

Cartridge, S.A., Armour-Piercing Tracer (A.P./T.). Colour—Black body, white tip and white or green band above the driving band.

581A. The projectile is of armour-piercing steel and is uncapped. There are alternative fillings for Day and Night tracers.

Cartridge, S.A., Semi-Armour-Piercing Incendiary (S.A.P./I). Colour—Red with White tip.

582. This ammunition has been developed for the ignition of aircraft petrol tanks protected by armour plate.

The shell is an H.E. shell body filled with incendiary composition, or alternatively, filled with incendiary composition and containing a detonator superimposed. The head is closed with a steel nose plug.

On impact with armour plate the heavy metal structure the shell breaks up and the incendiary composition is ignited. The penetrating power is less than that of A.P.

Cartridge, S.A., Dummy. Colour—Black or blued.

583. The cartridge comprises a standard case with three holes drilled in the side about three inches from the base, a wooden distance piece, and a "ball" projectile secured by soldering and rolling.

584-589.

CHAPTER XVI

ROCKET-PROJECTED DEVICES

SECTION I—PROJECTILES

ROCKETS " U " (UNROTATING).

590. These projectiles consist of a cordite rocket or Tail, Propelling, with a shell screwed into the head. They are launched from the rails of a projector instead of being fired from the conventional gun, and are not rotated. Unlike the ammunition of a gun, the charge forms an integral part of the projectile and travels with it in flight until consumed.

591. The original nomenclature was Rocket, Unrotating, Projectile (U.P.), but with the extension of the use of rocket projection this was changed to Rocket " U " (U denoting Unrotating).

Some of the advantages and disadvantages of rocket projection of shell are :—

Advantages.

(*i*) The velocity of the shell of a Rocket " U " is greater than that of a shell of similar calibre fired from a rifled gun.

(*ii*) Lower acceleration obviates the necessity for strength against pressure and set-back.

(*iii*) Projectors are light and simple.

(*iv*) Absence of " deck thrust " on launching.

(*v*) Absence of gun wear.

(*vi*) Ease and rapidity of manufacture as a complete unit, *i.e.*, projector and projectile or other device.

Disadvantages.

(*i*) Less accuracy.

(*ii*) Lower average and striking velocity.

(*iii*) Slower loading.

Lack of accuracy is partly compensated by using multiple projectors which fire salvoes varying up to 20 rounds, and thus it need not be a disadvantage as a heavy gun effect is obtained.

Rockets, " U," 2-inch. *Plate* 24.

592. The 2-inch rocket " U " is an anti-aircraft device.

Only one type of shell is fitted to these rockets, namely, the H.E. shell.

The main components of a round are Shell, Propelling, Tail Fins, and Fuze. These parts are supplied separately for assembly on board and are assembled in the following order :—

(*i*) Tail Fins to Tail, Propelling.

(*ii*) Shell to Tail, Propelling.

(*iii*) Fuze to Shell.

Dismantling is done in the reverse order.

593. *The Tail, Propelling*, is a welded steel tube with a shell ring secured into the head by studs. Below the shell ring the Head Obturator, a cupped disc of thin shell steel, seals the head end of the Tail, Propelling, against leakage of gases. The venturi (nozzle) is welded to the other end of the Tail, Propelling. The bag of silica gel in the venturi is for desiccating purposes. The bottom obturator prevents any leakage of gas past the venturi. The charge of cordite M.D. is castellated at the head ; it rests in the tube and is supported at the tail by a grid. A magnesium composition igniter incorporating an electric puffer is fitted in the castellation of the charge.

Electric leads from the igniter pass through the annulus of the cordite to four brass contacts near the tail orifice. The contacts (two positive and two negative) are wired so that proper contact is made with the knife-edges of the mounting irrespective of the angle at which the round is loaded.

The tail orifice is sealed by a tinned disc closing cap secured in position by R.D. Cement No. 1. The Tail, Propelling, will not self-propel. If there should be accidental ignition of the cordite with a round in an unassembled state, the Head Obturator (which is without the support of the base of a shell) will blow out and the products of combustion will escape from both ends of the tube.

594. *Tail Fins* (4), of steel plate, are inserted into slots in the tube ; they are driven back by means of a wooden hammer and latched in position.

595. *The Shell* is of the High Explosive type filled with 9-ozs. of T.N.T. It is screw-threaded near the base to screw into the shell ring of the Tail, Propelling. On firing, the shell gives support to the Head Obturator.

596. *The Fuze, No. 720,* is a wind vane arming, direct action type which arms at a distance of approximately 75 feet from the projector. The self-destruction device operates at a short range of 4,500 feet (4½ seconds); no shutter is incorporated. An internal and an external detent prevent the wind vane rotating until the round is fired. The external detent is visible and houses into a slot cut into the skirt of the wind vane cap. On firing, acceleration causes both detents to set back.

The wind vanes of the fuze are then free to rotate; approximately five complete turns of the wind vane in an anti-clockwise direction (looked at from the nose) will put the fuze into a direct action functioning condition at the same time releasing the time [illegible], and the fuze will detonate 4½ seconds later. Additional safety is provided by a safety split pin which is passed through the skirt of the wind vane cap and fuze body. The safety pin prevents rotation of the wind vane cap in either direction and must be removed before loading. The pin is secured in position by means of wire which takes round the body of the fuze and is sealed with a lead seal.

The fuze is not watertight and must be protected from the weather by applications of Grease No. 0, in accordance with the instructions.

Action.

597. The rocket is launched by electric current initiating the electric puffer. The magnesium composition igniter and cordite charge are ignited. The pressure of gas set up by the burning cordite disperses through the vents and provides the impetus to the rocket. The cordite burns for approximately .8 second, during which period the rocket is accelerating.

SECTION 2—ILLUMINANTS

2-inch Rocket Flare. *Note* 24.

598. The Rocket Flare is launched from a special Projector which is attached to a gunshield, at an elevation of 30°. It is set to burst at 5,000 yards at an approximate height of [illegible] feet; the flare burns for [illegible] seconds.

The handbook, *B.R.924 Handbook for the 2-inch Rocket Flare,* should be consulted for general instructions, maintenance and detail.

599. The round is supplied for assembly on board and comprises the following main parts—Tail, Propelling, Flare Head and Fins (4).

The order of assembly is:—

(*i*) Fins to Tail, Propelling.

(*ii*) Flare Head to Tail, Propelling.

600. *The Tail, Propelling,* is similar to that of Propelling, of a 2-inch Rocket "U," except that the Head Obturator is not perforated. The fins are identical to those of the Rocket "U."

601. *The Flare Head Container* is a tinned plate cylinder with two cannelures near the base. The canister, containing the illuminating flare candle with a parachute assembly attached, is inserted in the Container. The Ballistic Cap fits on the forward end of the Container, to which it is secured with adhesive tape. The Base Socket is secured into the other end of the Container by indenting the cannelures; it contains the Thermal Ejector which screws into the shell ring of the Tail, Propelling. The Thermal Ejector consists of a steel base plate with a septum of accurately machined thickness in the centre.

The lower end of a piece of Bickford's Fuze (primary delay) cut to burn approximately 22 seconds makes intimate contact with [illegible] grains of L.D.N.R. (lead-dinitro-resorcinate) which is stemmed into the septum recess. The upper end of the Bickford's Fuze projects into the magazine which contains approximately 40 grains of G.12 gunpowder (primary ejection charge). A short piece of Bickford's Fuze (secondary delay) cut to burn for 3 seconds projects from the base end of the canister; the lower end is in close proximity to the primary ejection charge, and the upper end projects into a magazine containing 40 grains of G.12 gunpowder (secondary ejection charge).

Action.

602. On launching the rocket, heat from the cordite propellant is transmitted through the Head Obturator and thin septum of the Thermal Ejector and ignites the L.D.N.R., which in turn ignites the lower end of the Bickford's Fuze (primary delay). After 9, 18 or 22 seconds (depending on the mark used) the primary ejection charge is ignited, and the canister is ejected from the container in a forward direction.

The Bickford's Fuze (secondary delay) is initiated by the flash from the primary ejection charge. Three seconds later the secondary ejection charge is ignited and the action ignites the candle and ejects the parachute, cable and candle in a forward direction from the canister. The parachute opens when ejected from the canister and the light candle [illegible] in mid-air. The purpose of the secondary delay is to allow the velocity of the canister to fall to a speed at which it is safe to eject the flare and the parachute assembly without [illegible] break-up.

Rocket, Illuminating, 9-lbs. (Snowflake).

603. This store is an illuminant and is used in locating enemy submarines.

The cylindrical *2-inch Powder-filled steel rocket* is similar to Apparatus A.D. Type D; in addition, it is fitted with tail fins (4). The *Parachute Head* contains a parachute with a star and igniting arrangements. The rocket is launched from a Projector Type A or B of Apparatus A.D. Type D, using the appropriate 60 grain cartridge.

Action.

604. When the rocket reaches the vertex of its flight, about 1,500 feet or more, the burster is ignited by the burning rocket composition. Its action ignites the star and expels the parachute and lighted star from the rocket head. The parachute opens out and the burning star is suspended from it ; the star burns for about 60 seconds.

SECTION 3—APPARATUS, AIR DEFENCE (A.A.D.)

Apparatus A.D., Type D. *Plate* 25.

(Parachute and Cable—P.A.C.)

605. This device suspends a cable from a parachute above the firing ship. The cable is rendered lethal on the impact of an attacking aircraft, and aircraft must either keep at a height which precludes accurate bombing or change course.

The Handbook should be consulted for general instructions, maintenance and detail.

The Mark III/N consists of the following main component parts—Rocket with Parachute Head, Main Container, Main Cable and Lower Parachute Assembly. The assembled ammunition is termed " Apparatus A.D. Type D " and is fired from a " Projector A.A.D. Type D." (Abbreviation P.A.C.).

606. *The Rocket* is a gunpowder filled 2-inch steel rocket with a tin parachute head attached. A 38-inch diameter parachute and a small gunpowder burster are packed in the parachute head. The painted canvas cover attached to the parachute head fits over the outside of the muzzle of the projector and prevents access of water into the barrel. Two stirrups and a bridle are attached to the rocket ; the bridle has about five feet of cable which is covered with asbestos at the rocket end and fitted with a spliced eye for shackling to the Main Cable. Before securing the rocket tail to the Main Container the lid of the Container is removed and the top loop of the K.B. Cable is secured by its swivel to the rocket wire tail, a short portion of the wire tail is coiled down into the Main Container. The lid is then fitted so as to nip the rocket tail, and it is retained in place until it is discharged by the pull of the rocket.

607. *The Main Container* is a cylindrical iron box which has two concentric compartments. The outer compartment contains the Main Cable and the inner contains the Lower Parachute Assembly. The lid is detachable. The Main Container is lashed to the deck.

608. *The Main Cable* consists of 400 feet of K.B. 1D cable with a loop at each end and a swivel on each loop. One swivel is attached to the wire tail of the rocket burster and the other to the Lower Parachute Assembly.

609. *The Lower Parachute Assembly* comprises a 28-inch diameter parachute and a small trail parachute. The larger parachute is packed in canvas and the small trail parachute is attached.

Action.

610. The 60-grain gunpowder cartridge ejects the rocket from the Projector and also ignites the rocket composition. When the rocket reaches a height of approximately 550 feet, the burning rocket composition ignites and explodes the gunpowder charge in the parachute head and the upper parachute is ejected. At this stage the lower parachute assembly will be approximately 150 feet above the sea, the lower parachute will still be inverted, but the trail parachute will be open. The lower parachute remains in the bridle until the impact of an aircraft with the cable. On impact the trail parachute pulls the ripcord and releases the lower parachute which opens and renders the cable " lethal."

Apparatus, A.D. Type J. *Plate* 25.

611. The objects and means of operation of this device are similar to those of the A.A.D. Type D. Type J Mark I ejects a 600 ft. 2¼ ton cable.

The Handbook *B.R.293/44, Handbook for the Apparatus Type J*, should be consulted for general instructions, maintenance and detail.

The Apparatus is supplied in three main component parts, (*i*) the Tail, Propelling, (*ii*) the Head Canister and Thermal Fuze, and (*iii*) the Main Container.

The round is assembled on issue to ships. The fully assembled round (including the Tail, Propelling) is " Apparatus A.D. Type J." The Apparatus is launched from a " Projector A.A.D. Type J."

612. *The Tail, Propelling*, is similar to the Tail, Propelling of a 2-inch Rocket " U," except that :—

(*i*) The head obturator is not perforated.

(*ii*) There are no fins or fin slots.

(*iii*) A short stirrup is welded to the exterior of the base of the tube.

(*iv*) The venturi is closed with a tinned plate closing disc. The flexible rubber pigtail containing the firing leads is passed through the closing disc ; contact studs are omitted.

613. *The Head Canister and Thermal Fuze.*—The Head Canister is of tinned plate and contains a 62-inch parachute ; it is made integral with the cast iron ejector cup by soldering. The lower circumference of the Head Canister rests inside the ejector cup on a piston or diaphragm. The base of the ejector cup is screwed into the shell ring of the Tail, Propelling. Provision is made in its base for the Thermal Fuze which is a separate unit.

capacity of approximately 25 per cent. The blast effect is greater than with S.A.P., but the main damage is caused by fragmentation. A pistol and detonator is inserted in either the nose or the tail of the bomb. A nose pistol must function before it is broken or crushed by impact, and for this reason an instantaneous detonator is fitted with it. This arrangement reduces the crater effect. When a delay is required the suitable detonator should be used along with a tail pistol.

Medium Capacity Bombs. Example, 500-lbs. M.C. *Plate* 32.

734. These bombs have a greater capacity than G.P. bombs, and consequently have an increased blast effect and produce smaller fragments. Their fuzing and detonator arrangements are similar to those of G.P. bombs.

Anti-Submarine Bombs. Example, 100-lbs. A.S.

735. These are special-purpose bombs as their name implies, but they may be suitable for other targets if a greater blast effect than that given by G.P. bombs is required. Depending on type, either a nose fuze or a tail pistol and detonator may be employed.

Anti-Personnel Bombs.

736. These are small bombs of 20-lbs. to 40-lbs. designed to give a large number of small fragments on detonation. The 40-lb. G.P. bomb is suitable for this purpose; it is fitted with a nose pistol and detonator only, but in other respects is similar to the larger G.P. bombs. A parachute attachment may be fitted.

Incendiary Bombs.

737. The main filling of these bombs is incendiary. In the 25-lb. Incendiary bomb the pistol is built into the bomb at the tail end. Other types have a nose fuze.

PRACTICE BOMBS. *Plate* 32.

738. These are small bombs (about 10-lbs.). They have a cast-iron or plastic moulded nose screwed to a container filled with either a smoke composition for day practice or a flash or flare composition for night practice. Night practice bombs are supplied filled. Day practice bombs may be supplied without the smoke filling, which is issued separately. The bomb is filled locally before use. The pistol is built into the bomb, and on impact the striker shears a wire and fires a detonator-burster.

Drill Bombs.

739. Any of the above types of bomb are supplied for instructional and drill purposes and differ only from service bombs in that their filling is inert.

Markings on Aircraft Bombs.

740. Stencil markings on the bomb give the following information :—

(*i*) Nomenclature and mark.
(*ii*) Gross weight.
(*iii*) Where filled and date of filling.
(*iv*) Lot Number.
(*v*) Date and place of last examination.
(*vi*) Design number of method of filling of Bomb (where applicable).

741. Colour markings are used as follows :—

(*i*) H.E. bombs are coloured green (earlier bombs were yellow).
(*ii*) A red band near the nose indicates that the bomb is filled.
(*iii*) A white ring adjacent to the red identifies an S.A.P. bomb.
(*iv*) Two white rings, one either side of the red, denotes A.P.
(*v*) A plain green band denotes a T.N.T. filling—"T.N.T." is stenciled on or near the band.
(*vi*) A criss-crossed green band, with a fraction below, denotes an amatol filling of high grade.
(*vii*) A plain green band, with a numeral above and a fraction below, denotes an amatol filling of low grade.
(*viii*) Incendiary bombs are painted a dull red.
(*ix*) Practice bombs are painted white; two green bands denote a smoke composition filling and two black bands a flash composition.
(*x*) Drill bombs are painted black with a yellow band.

Note.—The new system of colour marking, common to all Services, to denote the explosive filling will be found in B.R. 1202.

742-744.

CHAPTER XXII

AMMUNITION PACKAGES

SECTION 1.—GENERAL REMARKS

745. For the purpose of this chapter Ammunition Packages are grouped as follows :—

(1) Packages stowed on board with their ammunition (*e.g.*, Cases for cartridges, B.L.; Q.F. Cartridge and Ammunition boxes).

(2) Packages for the transport of ammunition (which are not stowed in the ship).

The weight, dimensions and contents of the various packages are included in "*Notes on Naval Guns and Armament Stores.*"

746. Packages containing ammunition must be handled with great care, and the instructions in the N.M. & E.R. carefully observed. Rough usage of packages may result in :—

(*i*) Damage to the contents. This may cause missfires, hang-fires or prematures.

(*ii*) Loss of air-tightness. This will cause a loss of efficiency.

(*iii*) Jamming of lids of cases. This will cause loss of time and possibly a reduction in the rate of fire in action.

747. Ammunition packages must not be raised or lowered quickly. Ample time should be allowed. Embarking and disembarking ammunition should never be treated as an evolution or as a matter of competition between ships. If a package catches or jams in such a way that damage may be caused to it or its handles the package should be set aside and carefully examined; if there is damage or suspicion of damage, the package must be returned to an Armament Depot for test.

Care must be taken to prevent water getting into packages, particularly packages of aluminium-silicon or galvanised iron; filled packages should not be exposed to heavy rain.

Packages are rendered weather-tight and air-tight by the use of luting, dermatine rings or rubber rings.

Luting is a thick paste which does not dry easily; it is placed between metal surfaces or in channels to form an air-tight joint. It is also used to render metal or tin lined cases and cartridge and ammunition boxes water-tight. If possible, luting should be examined at intervals of six months to test its efficiency; lids of packages are not to be removed specially for this purpose.

Dermatine is a rubber composition; when a ring of dermatine is pressed into the groove around the lid or opening of certain cases it forms an air-tight seating for a flange.

748. The sealing devices of packages must be examined on embarkation and packages with broken tapes or seals are to be returned to the Naval Armament Depot with a report of the circumstances. When receiving filled ammunition packages those with broken seals are to be kept separate and the Armament Depot informed.

CH. XXII—SECTION 2.—PACKAGES STOWED ON BOARD WITH THE AMMUNITION

CASES.

749. Cartridges, B.L., are packed in cylindrical or rectangular flash-tight cases of aluminium alloy, steel or brass. The cases are stowed to permit easy access, *i.e.* so that the contents can be withdrawn without moving the case in its stowage. The abbreviated nomenclature denotes the shape, *e.g.*, "C.E."—Cylindrical "E," "R.N."—Rectangular "N." Cases are usually sealed by affixing two station monogram labels over the joint of lid and body; some cases have sealing labels fixed over the ends of tapes. "C.E.," first supplies of "C.F." and "R.N." cases have their own individual sealing arrangements.

Cases and certain cartridge and ammunition boxes require metal keys to open and close them. The keys vary in shape according to the type of lid; they are usually hung in a convenient position in the magazine. A list of keys is set out in *paragraph* 751 with illustrations in the Schedule of Keys on *page* 131.

CASES, POWDER, CYLINDRICAL. *Plate* 34

750. Fractional charges for B.L. 14-inch, 15-inch and 16-inch guns are packed in cylindrical cases with the ignitered end of the Cartridge, B.L. towards the lid. The cases are of sheet brass or steel, jointed with rivets or welded and strengthened by circular bands. The lid is secured by feathers or lugs taking under recesses in the rim of the case; it is rendered air-tight by a rubber or dermatine ring. The bottom of the case is strengthened. Cylindrical cases should never be rolled along the deck.

" C.E." Case. *Plate* 34.

751. This case holds three 1/6 charges for a B.L. 16-inch gun. The case is of brass and strong end rings improve the flashtightness. It has three handles. Cardboard liners provide further anti-flash protection and facilitate the withdrawal of cartridges. (To assist withdrawal the lifting band of the second cartridge is attached to that of the third.) The lid is secured by a locking ring whose six lugs drop into grooves in the end ring. A screwed ring revolves inside the locking ring.

Sealing is effected by two lead alloy seals each passing through a hole in the end ring of the case. The head of the seal bears the monogram of the closing station; the other end is riveted into a countersunk recess in the end ring and impressed with the monogram of the station. The air testing plug is covered with a small brass disc bearing the monogram of the closing station and is soldered in position.

752. *To open.*—Ship the " Key, Case, Magazine, No. " over the bar running diametrically across the screwed ring and turn in an anti-clockwise direction until the lugs in the locking ring are in line with the slots in the end ring of the case. Remove the lid. If the locking ring is not moved when the spring catch is in contact with its stop, the catch should be withdrawn and rotation continued until it is again in contact with its stop, when a further attempt to move the locking ring should be made. If the lid is stuck it can be withdrawn when the lugs on the locking ring are in line with the slots in the end ring by means of the lever opening, C.E. case " should be used to prise the lid and free the dermatine ring from the joint face.

753. *To close.*—Place the spring catch anti-clockwise to its stop. Insert the lid into the end ring of the case, ship the key and turn in a clockwise direction until the locking ring reaches the limit of its travel. Withdraw the spring catch and continue the rotation until the lid is hard down. The spring catch should be depressed again if more than one revolution is needed to close the case.

" M " Case. *Plate* 34.

754. This case holds two ½ charges for a B.L. 15-inch gun. The case is of brass or steel and has a handle of copper wire covered with leather; later Marks have a metal handle. Strengthened end rings improve the flashtightness; cardboard liners provide further anti-flash protection and facilitate the withdrawal of cartridges. Cases were originally designed with a lid at each end, but were converted by having one end permanently closed; this end is painted blue. The set screw in the end ring at the lid end can be screwed home to prevent the lid rolling off during transport. This screw is removed before opening the case and must be readily accessible; during hostilities, all the screws should be removed. There are two small holes in the case and one in the lid and the sealing label is secured by tapes.

755. *To open.*—Remove the set screw if fitted. Ship the " Key, Case, Powder, Cylindrical 'L' and 'M' No. 4 or 5 or 'M' No. 6 " (as supplied) and turn in an anti-clockwise direction until the lugs on the locking ring are visible in the slots in the end ring of the case. Remove the lid. If Key No. 6 is supplied the lid can be lifted clear with it. A lever is provided to assist opening.

756. *To close.*—Place the lid in the mouth of the case so that the lugs on the locking ring enter the inclined grooves in the case. Turn the lid in a clockwise direction using the Key provided. Undue force should not be used but an air-tight joint is essential. The lid is prevented from turning by screwing home the set screw.

" C.F." Case. *Plate* 34.

757. This case holds two ½ charges for a B.L. 14-inch gun. The case is of brass or steel with a solid bottom. It has only one handle. First supplies have a brass body with strengthening bands, modern cases have circumferential corrugations. All " C.F." cases have two locating bands to engage the wriggle bars of the magazine stowage. The case is sealed by affixing two linen ration monogram sealing labels on opposite sides over the junction of lid and end ring.

758. *To open.*—Remove the locking pin by pulling the toggle. Ship the " Key, Case, Magazine, No. 4 " and turn the locking ring in an anti-clockwise direction. When the lugs on the locking ring are visible in the slots in the end ring of the case, the lid with the locking ring attached will be held on the key by the two spring catches and can be withdrawn from the case.

759. *To close.*—The lines on the locking ring and the lid should be opposite before the lid is shipped on the case. Ship the key on the lid and insert the lugs of the locking ring into the slots in the end ring of the case. Make sure that the slot for the locking pin is opposite the holes in the end ring when the lid is fitted. Turn the locking ring in a clockwise direction until the lid is secured. Before unshipping the key make sure that the locking pin can be pushed in one or other of the holes in the end ring and, if necessary, adjust the position of the locking ring. Unship the key and insert the locking pin, open out the ends of the split pin (locking pin) so that the pin is held in position. Stick a piece of adhesive tape over the wire to keep the toggle in position.

RECTANGULAR CASES. *Plate* 34.

760. Charges for B.L. guns 8-inch and below and Charges, Aircraft, Catapult, are supplied in rectangular cases of aluminium alloy or sheet brass, corrugated or indented to give strength. The ends are solid and are secured to the body by various means. Wood linings are fitted in some old type cases to prevent irregular fittings in the ends of the cases injuring the cartridges. Wood or cardboard packing pieces in the shape of stools, cylinders, etc., may be supplied for convenience of

packing and unstowing or for ensuring firm stowage. Packing pieces of cardboard are covered with a preservative, usually bakelite varnish. Wooden packing pieces are mildrew proofed.

The opening for the lid may be in the centre of or in a corner of one end. Cases are stowed to permit easy access, *i.e.*, so that the contents can be withdrawn without moving the case in its stowage.

" R.M." Case. *Plate* 34.

761. This case holds five ½ or ten ¼ charges for the B.L. 8-inch gun. It is of aluminium alloy and brass with riveted joints. The lid, which lifts in one piece, comprises two parts, namely, the lid proper and the locking handle (a star shaped piece of metal whose ends take in inclined recesses round the lid opening). The two bronze handles are on the top of the case.

762. *To open.*—Ship the Key, Case, Magazine, No. 3, and turn the locking ring in an anti-clockwise direction until the lugs on the locking ring are free of the grooves in the body. Remove the lid.

763. *To close.*—Insert the lid. Revolve the locking handle in a clockwise direction, using the key, until the lid is felt to be hard down.

" R.N." Case. *Plate* 34.

764. This case holds five cartridges packed in cardboard containers for B.L. 6-inch, Mark XXIII guns. It is of aluminium alloy and the ends are welded to the body. The two metal handles are recessed in the top. The locking device is a brass cover plate or locking ring with four lugs.

765. *To open.*—Ship the Key, Case, Magazine, No. 2, and turn the locking ring in an anti-clockwise direction until the lugs on the locking ring are free of the grooves in the body. Remove the lid.

766. *To close.*—Insert the lid. Revolve the locking ring until the lugs are home in the grooves at the top of the case. Insert the key and turn clockwise until the lid is hard down.

" R.J." Case (Cartridges for 8-inch guns).

" C.E." Case (Cartridges for 6-inch, Marks XXII and XXII* guns.) *Plate* 34.

767. The locking arrangements of these cases are similar.

To open.—Ship the Key, Case, Magazine, No. 1, and turn the locking ring in an anti-clockwise direction until the lugs on the locking ring are free of the grooves in the body. Remove the lid.

768. *To close.*—Insert the lid. Ship the key and turn in a clockwise direction; the lugs on the locking ring must be carried home to the ends of the grooves in the top of the case. When home, the label recesses on top of the case and on the locking ring will be approximately in line. The turning movement must be continued until the lid is felt to be hard down.

" T," " W " (*Plate* 34) **" S," " R " and " C " Cases.**

769. These cases hold cartridges for B.L. 4-inch, 4.7-inch or 6-inch guns. The cases are similar and are typical of the old cases still in the service. The corrugated brass sides are riveted to flanges on the top and bottom. The lid is secured by a locking ring and is operated by a key. (*See* paragraph 772). The cases are sealed with Admiralty monogram sealing labels.

770. *To open.*—Ship the key and turn the locking ring in an anti-clockwise direction until the lugs on the locking ring are free of the grooves in the body. Remove the lid.

771. *To close.*—Ship the lid and locking ring so that the arrows on the locking ring and on the body of the case are opposite. Insert the lugs of the locking ring into the grooves in the body. Ship the key and turn the locking ring in a clockwise direction until the lid is home in the c

772. LIST OF KEYS

Key, Case, Powder, Rectangular,	No. 5	" W " Case.
" " " "	No. 4	" R " [illegible]
		" [illegible] II-III
		" C " Mark [illegible] III-IV, [illegible] VII.
" " " "	No. 3	" S " [illegible] IV-V.
		" T " [illegible] V-VI.
		" W " [illegible] III-IV.
" " " "	No. 2	" T " Mark IV.
		" [illegible] Mark V.
Key, Case, Powder, Cylindrical, M.	No. 6	" L " Marks III, III*, IV & VI.
" " " "	L. & M. No. 5	" M " Case.
" " " "	L. & M. No. 4	do.
" " " "	L. No. 2	" L " Mark I.
" " " "	L. No. 1	" L " Mark I.
Key, Case, Magazine,	No. 4	" C.F." Cases.
" " "	No. 3	" R.M." Cases.
" " "	No. 2	" R.N." and Catapult Cases.
" " "	No. 1	" C.E." " R.H," and " R.J."
" " "	No. 1 Special	do.

BOXES FOR Q.F. AMMUNITION.

773. Boxes for Q.F. separate loading cartridge cases are called "Cartridge Boxes," and boxes for Q.F. fixed ammunition are called "Ammunition Boxes." The boxes are rectangular and are of wood, aluminium alloy or steel. They have various methods of locking. These and other boxes are marked with a code letter to identify the contents; the number after the code letter denotes the series in the class. The code of letters is as follows :—

P.	Projectiles.
F.	Fuzes.
C.	Q.F. cartridge cases and Q.F. fixed ammunition.
B	Bombs and accessories.
G.	Grenades and accessories.
H	Small Arms Ammunition (A.S.A.).
M.	Miscellaneous.
T.	Tubes, vent.

The letter and a number are branded or engraved on each end of the box.

CARTRIDGE BOXES.

774. All cartridge boxes (except C.185) are of teak or other hardwood and are lined with tinned copper or tinned plate. Strengthening bands are fitted as necessary. The handles are of galvanised iron, steel wire rope or grummets with leather or canvas grips. The lid of the older type of box is secured by a locking plate which engages four metal bolts; the plate has an eccentric action and is operated by a rectangular key. The modern box lid is fastened by catch levers which are held down by split pins or by a hasp secured with a turn buckle. Lids are rendered watertight by filling luting into grooves around the top of the lining.

Box, Cartridge, C.23 Mark II. *Plate* 35.

775. This box holds six cartridges for Q.F. 4-inch, Marks V-V** guns. It is of hardwood and has a metal lining. It is fitted with two wire handles. The lid is secured by four catch levers which are held down by split pins.

Box, Cartridge, C.185. *Plate* 35.

776. This box holds four cartridges for Q.F. 4-inch guns. It is of galvanised steel and its lid screws down on to a rubber or dermatine joint. The two wire handles are at the sides. Three steel diaphragms retain the cartridges in place and a strap (which lies over the bases of the cartridges) prevents lengthwise movement. Tape is threaded through the handle and round the centre pin of the lifting plate and knotted. A linen sealing label is affixed over the knot and the ends of the tape.

777. *To open.*—Turn the handle in the centre of the lid anti-clockwise and remove the lid. Remove the cartridge stop by unscrewing the wing nut in the centre; use Key, Box, Cartridge, No. 2, if necessary. Withdraw the cartridges from the box.

778. *To close.*—Insert the cartridges in the box and assemble the cartridge stop on the centre spindle. Tighten up the wing nut, using Key No. 2. Assemble the lid and tighten up on the handle in a clockwise direction.

AMMUNITION BOXES.

779. All Ammunition boxes (except C.190) are of teak or hardwood and are lined with tinned copper or tinned plate. The handles are of steel or wire rope with leather grips. The lids are secured by catch levers held in place by split pins.

Ammunition Box C.163. (*Plate* 35). C.163C, C.273.

780. Each of these boxes holds two rounds of Q.F. 4.7-inch ammunition. They are of hardwood. The lid is secured by two hinges and is fastened by catch levers held down by split pins. A frame with diaphragms and suitable packing pieces is fitted inside to prevent movement of the rounds. Instructions for replacing fired cartridge cases are on the inside of the lid of the box. C.163C and C.273 boxes differ from C.163 only in that they are wider in order to accommodate rounds fitted with No. 211 fuze. The C.163C box is a converted C.163.

Ammunition Box C.190. *Plate* 35.

781. This box holds 30 rounds for Q.F. 4-pdr., Mark VIII and XIV guns if packed in bulk (the rounds stowing heads and tails) or 28 rounds belted in two articulated belts. The belted rounds will only stow properly in one way, *i.e.*, the way in which they are packed on issue. If unloaded and not used they must be stowed in the same way or the box will be strained on closing. The box is of galvanised steel. The lid is the complete top of the box, and it hinges on and is fastened by two hasps. The loaded box should be kept upright as otherwise the weight of the ammunition may break the internal watertight seal.

Linen monogram sealing labels are affixed over the hasps.

Ammunition Boxes C.216 and C.219.

782. Ammunition Q.F. 40 mm. (Bofors) is packed in boxes C.216 and C.219. Each is a rectangular steel box with a hinged lid which is fastened by two spring clips. A piece of tarred string is passed through the loop of each clip, knotted on each side, passed through a hole in the stud and secured.

The C.216 box holds 24 rounds in 6 chargers. The C.219 box holds 24 rounds, each in a cardboard container.

CASES, POWDER, METAL OR TIN-LINED.

783. These packages are used for small combustible stores and for boat work. They are of wood and are lined with tinned copper or tinned plate. The lids of the older cases are secured by two screw bolts which are withdrawn by a special key. Lids of the later marks are secured by a brass catch which engages into a slot in the side of case. There are three sizes of metal and tin lined cases—Whole, Half and Quarter. The following types of ammunition may be contained in these cases :—

Whole Case :—C.118 (*Plate* 35) **and C.122.**

7,680 rounds 0.303-inch rifle, blank.
rounds 3.7-inch B.L. Q.F. blank.
rounds 4-inch Q.F. blank charges.
rounds 3.7-inch Q.F. blank charges.

Half Case C.119 (*Plate* 35) **and C.123.**

3,400 rounds 0.303-inch rifle, blank.
rounds 3-pdr. Q.F., blank, charges 11-oz.
37 rounds 6-pdr. Q.F., blank, charges 15-oz.
30 rounds 12-pdr., 12-cwt. blank charges.
20 rounds 6-pdr. Q.F., blank cartridges.
25 rounds 3-pdr. Q.F., blank cartridges.
30 rounds 3-inch H.A., blank charges or 4-inch blank reduced charges.
5 belts Maxim, filled.
168 rounds cartridges, signal, 1¼-inch.
306 rounds cartridges, signal, 1-inch.

Quarter Case :—C.121 (*Plate* 35) **and C.124.**

1,200 rounds 0.303-inch rifle, ball, for belts.
840 rounds 0.303-inch rifle, ball, in chargers.
1,450 rounds 0.303-inch rifle, blank.
10,000 rounds 0.22-inch R.F.
66 rounds cartridges, signal, 1¼-inch.
120 rounds cartridges, signal, inch.
rounds cartridges, safety fuze.

SMALL ARMS AMMUNITION BOXES (A.S.A.).

784. Small Arms Ammunition is provided in various types of wooden boxes which have a tinned plate lining or tinned plate containers. The lining is liable to deteriorate, and the oldest ammunition in the ship must be used first. Linings of all boxes passed up for firing practice should be lifted out and examined. If a lining is defective boxes of the same date are to be examined and if necessary, the ammunition is to be exchanged at the first opportunity. Exposure to damp may cause discoloration or corrosion of Small Arms cartridge cases in chargers; discoloration does not affect the serviceability of the ammunition, but where there is marked corrosion, the ammunition should be returned at an early opportunity.

The following may be considered typical of A.S.A. boxes generally.

Box A.S.A. G.S., H.4. *Plate* 35.

785. This is a " Whole " A.S.A. box. The sliding lid is attached to the box with whipcord and is fastened with a split pin. The short length of twisted copper wire attached to the split pin lies in a groove and the seal label is superimposed. A loop of leather is attached to the wire behind the seal; the end of the wire is secured to the lid and the label must be broken before the box can be opened. Galvanised iron wire handles with leather grips are fitted to each end. The lining is of tinned plate with a rip off soldered lid; if the box is opened it cannot be made watertight again except by soldering the lid.

786. The following ammunition may be contained in this type of box :—

270 rounds 0.5-inch M.G. ammunition in cartons.
96 rounds 1-inch A.R.
840 rounds cartridges, S.A., ball, 0.303-inch in chargers.
850 rounds cartridges, S.A., ball, 0.303-inch in bandoliers.
1,000 rounds cartridges, S.A., ball, 0.303-inch, in cartons.

A.S.A. Box, Half, Naval, H.3. *Plate* 35.

787. This is a "Half" A.S.A. box. It is smaller but of similar construction to the "Whole" A.S.A. box. It has a galvanised iron wire handle at one end. The lid is secured with a brass split pin which has a T-shaped handle attached. To open—withdraw the split pin, slide back the lid and tear off the cover of the lining.

788. The following ammunition may be contained in this type of box :—

828 rounds 0.455-inch revolver.
360 rounds 0.303-inch, ball, in ch[illegible]s.
500 rounds 0.303-inch, ball, fo[illegible]gun, in cartons.
480 rounds 0.303-inch, ball, [illegible] Lewis g[illegible], in cartons.
500 rounds 0.303-inch, rifle, [illegible]k.
350 rounds 0.303-inch, ball, in [illegible]ndoliers.
500 rounds [illegible] tracer.

Box Ammunition, S.A., H.2 *Plate* 3[illegible]

789. This box co[illegible]ins t[illegible]ee tin-plat[illegible]oxes, each of which holds 100 rounds of 0.5-inch cartridges in an articulated l[illegible] T[illegible] bo[illegible]has two g[illegible]vanised iron wire handles ; it is closed with two hasps.

Box A.S.A. H.[illegible] *Pl*[illegible]35.

790. This is a [illegible]ial box for 20 mm. British Oerlikon ammunition and it holds 306 rounds in bulk [illegible]th suitable p[illegible]king pieces. It has a screw-on lid. The lining is of zinc or tinned plate with a rip o[illegible]oldered lid.

[illegible]xes, U[illegible] Oerlik[illegible].

791. T[illegible]re two types of American manufactured box for American man[illegible]ctured Oerlikon A[illegible]ion. One type, a wooden box similar to Box A.S.A. H.33, holds 300 r[illegible]. The other type, steel box somewhat similar to C.216, holds 180 rounds.

[illegible]ainting of Packages.

792. All packages for gun ammunition, fireworks, torpedo, mining and depth ch[illegible]e explosive components, except those specified in *paragraphs* 793 and 79[illegible]low, are pai[illegible]d a STONE colour.

793. Packages painted the following colours contain[illegible]tores as [illegible]own :—

GREEN	... ...	Target smoke a[illegible]munition.
GREEN (stain)	... ...	A.S.A., l[illegible]led, belted, or in [illegible]artons or Signal cartridges.
BROWN	... ...	R.A[illegible]stores [illegible]or A.A.
BROWN (stain)	... ...	A.[illegible], in cl[illegible]gers.
RED	... ...	Blan[illegible]mmunition.
RED	... ...	Cases, [illegible]nsport, detonator and explosive.
BLACK	... ...	Drill and [illegible]ummy ammunition.
YELLOW	... ...	Bombs.
GREY	... ...	El[illegible], lachrymatory, and generators.

794. The [illegible]owing [illegible]ack[illegible]re not painted externally or internally apart from special markings :—

Cases, [illegible]agazine, [illegible]ade of aluminium-silicon alloy.
Cases, [illegible]od, pac[illegible]g.
Boxes, p[illegible]ectile.
Packages of galvanised steel.

The following packages are not painted internally :—

Cases, magazine.
Cases, powder, cylindrical, and rectangular.
Cases, cordite.
Cases made of galvanised steel.

Special Markings on Packages.

795. The following markings will be found :—

TWO RED BANDS	[illegible] package[illegible] containing [illegible]xplosives except those [illegible]ted R[illegible].
DARK BLUE BANDS	P[illegible]kag[illegible] for [illegible]explosive Naval armament [illegible], i[illegible]ding drill and dummy ammunition [illegible]xes.
PRACTICE (BRIGHT) YELLOW BAN[illegible] ...	Q.[illegible] target smoke ammunition boxes.
TWO LIGHT BLUE BANDS ...	Bo[illegible]s, cartridge, aircraft, catapult.
H.V.	Packages for Q.F. 2-pdr. High Velocity Ammunition.
WHITE CROSS	Packages containing a full charge of Flashless cordite (not Star shell charges).
GREEN BAR	Packages containing American Propellant.
BLACK OR WHITE "ZIG ZAG"	Packages containing H.E. (Radar) Shell.

796. To assist rapid identification of the TYPE of projectile contained, all packages for FIXED AMMUNITION are marked with a coloured bar; the bar is painted on the centre cross batten of the lid or on the side bearing the label and on packages for 4-inch and under, where practicable, at an angle to an edge. The colours are as follows :—

Light Blue	H.A. Practice	
Dull Yellow	Common, H.E.	Not applicable to Wartime packages.
Practice (Bright) Yellow	Practice	
Red	Shrapnel	
White	S.A.	
Black (broken bar)	C.P.	
Black	N.F.	

Other Markings.

797. Containers, filled with explosives, which are removed from packages during use and handling in H.M. ships will have the words "Explosive" overprinted in red on the label and will not have red bands (vide paragraph 795). Cardboard containers for cartridges, B.L., and Charges, Aircraft, Catapult are painted with two red bands and will bear an N.13 label.

Wooden packages of new manufacture for fireworks will be fireproofed and the letters "F.P." cut or branded on each end.

One end of "M" boxes is painted blue to indicate that this end is permanently closed, as stated above.

Markings on S.A.A. Boxes.

798. Small arms ammunition in chargers is packed in brown-stained boxes; ammunition in bulk, bandoliers or belts is packed in green-stained boxes.

A definite indication of the type of ammunition packed and its Mark can only be obtained from the labels; for classification labels are printed in the following distinctive colours :—

Group VI (except blank)	Green on white ground.
Blank	Red on blue ground.
Group IX...	Blue on white ground.
Group XII	Brown on white ground.
Drill or dummy	Black on rose ground.
Incendiary ammunition... ...	...ked on white ground.

799. Each type of small arms cartridge up to and including .5-inch is identified by a symbol. The symbol is printed on the label in the proper group colour and is overprinted in black with the code letter and, where necessary, the colour indicating the nature of the propellant. The symbols are displayed on large distinguishing labels, one on each side of the box. The labels also contain the following information :—

The number of rou...
Nomenclatu...
Method ... packing.
Dat... and ...spection ...rk (for new type boxes).

A small distinguishing label is also affixed at each end of the box. On these are printed the symbol and (except ball and special) the characteristic name, *i.e.*, tracer, armour-piercing, etc.

800. To facilitate identification in the dark of 0.303-inch charger packed ammunition and of 0.303-in. ammunition packed in other than the normal method (*e.g.*, ball and tracer belted together) raised metal letters are affixed to the end of A.S.A. boxes so packed.

The identification letters will be :—

CC ... charger packed.
X ... any other unusual packing.

This will be additional to the method at present in force for identifying ammunition in the dark *i.e.* :—

Belt packed—A "V" shaped wood piece at each end.
Carton packed—One batten at each end.
Bandolier packed—No battens at end.

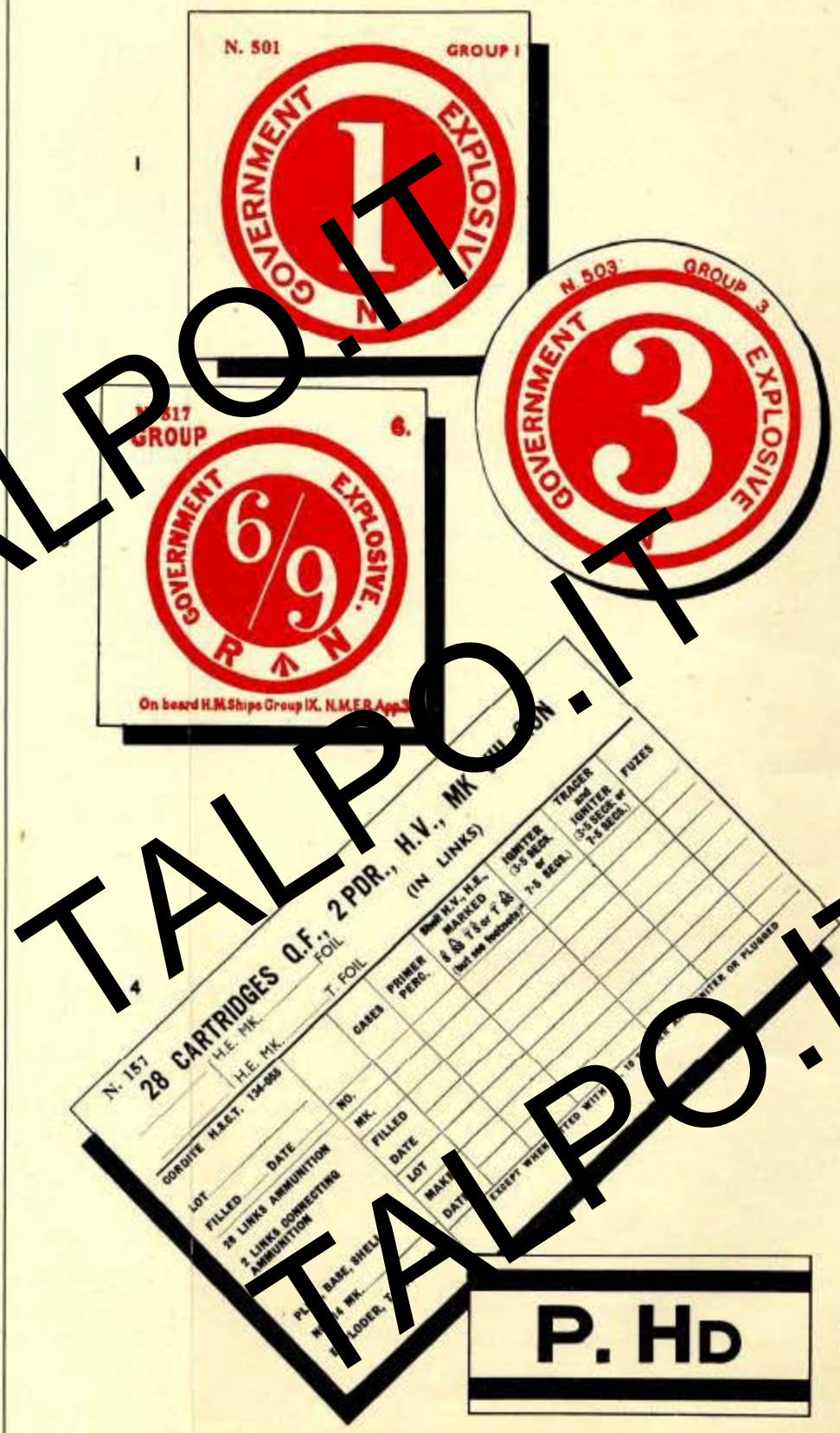
CH. XXII—SECTION 3.—PACKAGES FOR THE TRANSPORT OF AMMUNITION (WHICH ARE NOT ALLOWED IN THE SHIP)

BOX, AMMUNITION, Q.F., 4-INCH, MARK XVI* GUNS.

Ammunition Box C.222. *Plate* 35.

801. This box holds two rounds of 4-inch, Mark XVI* fixed ammunition. It is of steel and consists of two halves in which cradles to support the rounds are secured. It is jointed longitudinally and the joint is made by a rubber gasket. The package is secured by three wing nuts, the centre nut being drilled and sealed by a wire seal. The wire is threaded through the hole in the small bracket

LABELS



and the wing nut and the ends of the wire are sealed with a lead disc which is impressed with the Station Monogram of the Naval Armament Depot which sealed the package. Two wooden packing pieces are fitted, one at each end of the box. The packing pieces ensure that the tapes of cartridge clips are not caught in the joint of the box and the clips pulled off. Packing pieces must always be kept in place during handling and transport and the tape tucked down before closing the package.

To Open.

802. To prevent damage to the packing pieces the package should be opened as follows :—

Slack back and remove the three wing nuts. Key, Box, Ammunition, No. 3, should be used if necessary. Remove the lid by lifting both handles simultaneously; lifting one handle only will split the packing pieces. Remove the packing pieces and the rounds and then replace the packing pieces in the box.

To Close.

802a. Place the rounds in the cradle. Fit the packing pieces in place, making sure that the tapes on the clips are well tucked down. Fit the lid of the box and screw down evenly on each wing nut. Key, Box, Ammunition, No. 3, should be used if necessary.

Ammunition Box, C.290.

803. This box holds two rounds of Q.F. 4-inch, Mark XVI*, fixed ammunition. It is of steel, and is of similar shape to the C.222, which it supersedes.

The lid is [illegible] the lid and is secured by four bolts; these are tightened or released by a "high speed," or [illegible] spanner.

Container, Ammunition, Q.F., 4.5-inch Gun. C.217. *Plate* 35.

804. This container holds one round of 4.5-inch fixed ammunition. It is of rolled paper and its lid is secured by a webbing harness and quick release buckle; [illegible] eyelets are provided in the buckle and securing straps. The container is sealed by a wire threaded through the eyelets and secured by a lead disc.

Containers, Cartridge, Q.F., 5.25-inch Gun, C.227. *Plate* 35.
4.7-inch Mark XI Gun, C.228.
4.5-inch Gun, C.279.

805. These containers each hold one cartridge of Q.F. separate ammunition. They are of rolled paper and are similar in design to the container C.217.

CH. XXII—SECTION 4.—LABELS.

806. All packages containing Government explosives have a Station label or lead seal and a combined Group and Government Explosive label. Usually they have also a Contents label affixed to them.

Station Label. *Diagram* 5.

807. This white linen label has two parallel black stripes with the Station monogram between them. Two of these labels are placed on each package by the packing or repacking station to indicate where the package was sealed. The labels are affixed to cover the joint between the lid and the body, over a hasp or the knot of the sealing tapes; so long as both labels are intact the contents may be accepted as correct.

Group and Government Explosive Label. *Diagrams* 1, 2 and [illegible]

808. The size of packages used for the public conveyance of explosives is limited by the Board of Trade, but the limitations do not apply to packages containing Government Ammunition Stores. These packages have Group and Government explosive labels to indicate that they contain Government explosives of the Group number specified in N. & E.R. The Group number is in the centre of the label.

Sometimes Group Stowage ashore and afloat are not identical, and in this event a Composite label is affixed. (*Diagram*). The explosive is classified for general purposes under the Group number which forms the numerator and for the special purpose of stowage in H.M. Ships under the Group number which forms the denominator.

Contents Label. *Diagram* 4.

809. A Contents Label is affixed to Q.F. Cartridge and Ammunition boxes and to most packages containing stores filled with explosive giving full particulars of the contents. It is put in the most convenient place for reading, stowage ashore and afloat being taken into consideration.

CHAPTER XXIII

AMMUNITION EMBARKATION AND SUPPLY

EMBARKATION OF AMMUNITION.

815. Ammunition is as a rule embarked from lighters but in certain conditions embarkation may be carried out with the ship alongside a jetty.

Embarkation involves :—

(1) Lifting the ammunition on board and

(2) Striking it down to magazines and shell rooms.

Hoisting inboard is usually by the ammunition derrick or a general service derrick. Aircraft cranes are also used for hoisting in the smaller packages. In small ships, shell may be embarked through side scuttles and packages embarked through wooden chutes.

Hoisting Inboard.

816. Arrangements for hoisting inboard include :—

(*i*) Screw grabs for shell above 6-inch calibre.

(*ii*) Scale-boards for shell of 6-inch calibre and under and for Q.F. ammunition in containers. Scale boards are wooden trays slung from the four corners by wire ropes led to a central ring. Various sizes are used according to the maximum load which can be lifted by the derrick or crane.

(*iii*) Special slings of various kinds for cordite cases and for the larger packages.

(*iv*) Steel cargo nets for the smaller packages.

(*v*) Webbing straps or two-legged slings for pom-pom and similar boxes.

After the ammunition has been placed on deck it is struck down a line of hatches to the magazines or shell rooms. An additional operation may be necessary, for example, boxed Q.F. ammunition to be stowed in bottle racks must first be unboxed.

Main armament ammunition for capital ships requires special arrangements for striking down. Shell or cordite cases are lowered inboard and placed on a transporting trolley or on a " perambulator " which is wheeled along the deck to the embarking hatch. The perambulator is placed over the open hatch and the shell or the cordite case lifted by a hoist ; the perambulator is removed and the shell or the cordite case is struck down.

817. Arrangements for striking down include :—

(*i*) Screw grabs for horizontal handling of 15-inch shell in older battleships.

(*ii*) Six-legged slings for 15-inch cordite cases in older battleships.

(*iii*) Combined slings and screw grabs for main armament shell and cordite in *Nelson*, *Rodney* and later battleships.

(*iv*) Mechanical endless chain or wire hoists in reverse and operated by hand.

(*v*) Various types of slings, bags or strops for other ammunition rounds or boxes.

(*vi*) Carriers, hand, for 4.7-inch shell.

(*vii*) " Cruets " or carriers, ammunition, quadruple, and quadruple shell bars (*see para.* 828).

(*viii*) Carriers, ammunition, single or double. (*See para.* 826.)

818. Typical ammunitioning arrangements, *e.g.*, for a modern cruiser of the *Fiji* Class, are as follows :—

Six-inch shell are hoisted inboard by ammunition derricks and struck down in slings by whip and power bollard through a run of hatches direct to shell room. Cordite cases are hoisted inboard and struck down in slings in a similar manner.

Fixed ammunition for the 4-inch guns is hoisted in by the aircraft crane and struck down by means of the endless chain hoists (made reversible for this purpose) in cruets through hatches by whip and power bollard.

Boxes of pom-pom and small arms ammunition are hoisted in by the ammunition derrick and struck down by power or hand-operated hoists through hatches and scuttles to the magazines.

AMMUNITION SUPPLY.

819. The supply route from magazine or shell room to the gun is usually broken and transport is in one or more stages in a horizontal or vertical direction.

Means of horizontal transport include :—

Trolleys or barrows.

Overhead rails fitted with travelling grabs which may be moved by hand or by power.

Conveyors, hand or power operated.

Hand-through scuttles.

Means of vertical transport include :—

Hand-ups and Vaughan chutes, *i.e.*, steeply inclined chutes passing through the decks up which the ammunition is pushed by hand. For 4.5 inch fixed ammunition power operated hand-ups are used.

Whips. Ammunition may be hoisted through one or more decks either by hand or by means of an electric bollard.

Hoists forming part of the gun mounting.

Endless wire hoists.

Endless chain hoists.

Endless whips.

820. In capital ships overhead rails are fitted in the shell rooms for conveying main armament shell from the bins to the hoist in hydraulically operated grabs. Special facilities are also provided for conveying cordite charges to the scuttle. In *King George V* and *Nelson* classes inclined chutes with shaped wooden rollers are fitted, and in *Queen Elizabeth* and *Royal Sovereign* classes special trolleys carry four charges.

821. Ammunition for Q.F. guns 4-inch, and 4.5-inch, and for 4.7-inch guns other than those in turrets is supplied direct from the magazine to the deck below the gun or to a compartment on the gun deck. The rounds are transported from the top of the hoist by way of " hand-ups " and " shell chutes " to the gun deck and into the ready-use lockers.

822. In small ships where ammunition has only a short journey to the gun deck, an endless whip is fitted which extends from the deck of the magazine to the deck head at the top of the hoist. The whip has two hooks arranged so that one travels up when the other is on its way down ; two rounds at a time can be hoisted using either bags or single carriers.

823. Difficulty in arranging a rapid supply of ammunition to close-range armament may arise through :—

(*i*) Inconvenient location of the magazines in relation to the guns. In allocating space such items as main machinery and main and secondary armament ammunition take precedence.

(*ii*) The necessity for stowing more than one type of ammunition in the same magazine.

(*iii*) Ammunition being packed in boxes. Boxes must be hoisted singly by whip (usually worked by an electric bollard).

To overcome this delay a proportion of ammunition is stowed unboxed in Ready-Use Lockers and in boxes in Ready-Use Magazines and/or Magazine Lockers. [*See paras.* 867 *and* 868.]

824. Alternative supply arrangements will, according to the ship and to the restrictions imposed by considerations of weight and means of operation. In large ships, where the primary method of supply is by power, the secondary supply arrangements are through a line of hatches using a single whip with bags or carriers hoisted by a bollard hoist (where possible) or by hand. In small ships the secondary supply arrangements are often the main route of supply for pom-pom and other ammunition for close range weapons.

AMMUNITION SUPPLY APPLIANCES.

825. Various appliances and devices are used for the supply and safe transport of ammunition from magazines and shell rooms to gun positions. A list of the principal devices is set out below with brief remarks on the purpose for which they are used. The appliances used to supply guns mounted in turrets are not included as detailed descriptions of these are given in the various gun mounting handbooks.

Appliance	Description	Purpose for which used
Power operated :—		
Dredger hoist ...	Horizontally placed buckets attached to motor-driven endless chains	Hoisting B.L. 6-inch shell and cordite (in Clarkson's cases)
Chain hoists (E.C. hoists) and Endless wire hoists	Ammunition hoisted vertically by "heads" attached to motor-driven endless chains	Hoisting Q.F. fixed ammunition, Q.F. cartridges (separate), Q.F. 4.7-inch shell
Motor bollard hoist (double or single drum)	Single whip with— (*i*) Shell or cartridge bags (*ii*) Carriers, ammunition, single, double and quadruple (*iii*) Carriers, shell, fixed, and cartridge, shell, quadruple (*iv*) Slings for boxed ammunition)	Various, including the following :— B.L. and Q.F. shell and cartridges Q.F. fixed ammunition Q.F. 2-pdr. and S.A. ammunition in boxes
Mechanical hand-up	Chute with motor-driven sprocket wheel and belt. Angle of chute 45° approx.	Supplying Q.F. 4.5-inch fixed ammunition
Mechanical conveyor	Horizontal chute with motor-driven belt	For transporting Q.F. 4-inch or 4.5-inch ammunition
Hand operated :—		
Hand-up chutes	Chute with cam and handworked wire haul up, fitted between decks. Angle of chute 45° approx.	Supplying Q.F. 4.7-inch shell to gun positions. Not considered practicable for a weight heavier than 62 lbs.
Hand conveyor ...	Chute, generally portable, fitted at a convenient inclination determined by the maximum supply height and minimum delivery height permissible	For supplying 4-inch ammunition to gun casemates, positions where a fixed mechanical conveyor would be unsuitable
Ammunition hand-up	Chute fitted between decks. Rounds are pushed up by hand. Angle of chute 45° (approx.)	Supplying Q.F. 4-inch fixed ammunition suitable for deck heights of ft.
Vaughan chute ...	Chute and hand worked pulley. Angle of chute 45° approx.	Supplying Q.F. fixed ammunition. In some cases the chute has been adapted for use in hoisting Q.F. 2-pdr. ammunition in boxes
Carrier hand-up ...	Whip with a carrier at one end and a balance weight at the other	Hoisting Q.F. 4-inch or 4.5-inch fixed ammunition from a lower to an upper magazine
Endless whip ...	Endless whip with hooks attached, and sheaves at top and bottom of hoist (diameter of sheave, 7 inches)	Suitable for hoisting shell and cartridges in bags or a round of Q.F. fixed ammunition in a carrier, ammunition, single
Hand-up platforms	Built-up or hanging platforms, usually fitted with back rest and body belt for the safety of the operator in a seaway	For positions where owing to restricted space it would not be possible to fit a chute hand-up
Hand-down ...	Sloping chute with spring buffer at the lower end	For supplying ammunition from an upper to a lower magazine or shell-room
Miller's flaps ...	Hinged half plates or gratings (flaps) fitted with return springs. Usually a toggle or lead ball on the whip opens the flaps; when the ammunition which is being hoisted has passed through, the springs close the flaps. Arrangements are made for pinning the flaps in the open position	Fitted in ammunition trunks where there is a possibility of rounds falling down the trunk when hooking. They are not fitted where Q.F. cartridges or fuzed shell are hoisted unless provision is made to prevent the flaps coming into contact with, and damaging, the ammunition
Hand-through supply scuttles	Shuttered openings in bulkheads through which ammunition is passed and placed on a tray (where fitted) on the receiving side	Fitted where necessary through bulkheads of shelters and deck houses to gun positions in destroyers and sloops. Used also in some magazines where a bulkhead divides the magazines into two separate compartments

Note—(*i*) Where exposed to the weather, coamings and watertight covers are fitted to the openings in the deck through which chutes are worked. The covers should be so fitted that they can be placed in position, if required, while the chute is rigged.

(*ii*) In general, the chutes are portable and suitable stowage is to be provided for them when unrigged.

CARRIERS, AMMUNITION AND SHELL.

Carriers, Ammunition.

826. The designs in general service hold the following quantities of ammunition :—

Single type—One round of fixed ammunition.

Double types—Two rounds of fixed ammunition.

Quadruple types—(*i*) Four rounds of fixed ammunition.

(*ii*) Four Q.F. cartridges.

(*iii*) Two Q.F. cartridges and two projectiles.

The quadruple type is commonly known as the ammunition "cruet." The double and quadruple types have fittings for guide and hoisting wires and arrangements for retaining the ammunition. The cartridges rest on rubber pads.

827. There are three designs of quadruple carriers for fixed ammunition and cartridges :—

(*i*) *The "all-round" type* : Rounds are loaded into and removed from either side. This design cannot conveniently be used where space is restricted on one or two sides and is therefore being superseded.

(*ii*) *The "one-way" type* : Rounds are loaded into and unloaded from one side only.

(*iii*) *The "end-through" type* : Rounds are loaded into and unloaded from either one or two sides.

The guide wires of (*ii*) and (*iii*) may be so arranged that the carrier in transit revolves through an angle up to a maximum of 90° in order that the rounds may be unloaded where required if restriction of space will not permit the orthodox arrangement. The double and quadruple carriers are hoisted by a whip and bollard and the hoist is usually trunked up.

Carriers, Shell.

828. Two designs of carriers have been introduced into the service :—

(1) *Carriers, Shell, Hand, Steel*, for Q.F., 4.7-inch and Q.F., 4.5-inch (separate loading) guns. The carrier consists of a tapered steel ring with a handle ; the handle is secured to the ring by a handle clip. The carrier is used in pairs of a bag and strop for hooking to the hoist whip or to a Carrier, Shell, Quadruple. With the exception of ships fitted with endless chain hoists the carriers are on the shell in stowage, thus avoiding the use of rope grommets.

(2) *Carriers, Shell, Quadruple*, Q.F., 4.7-inch, Marks IX, IX*, X, X*, XII and XII* guns.

The carrier consists of a cross with an eyebolt for lifting, fitted with guide tubes at each end ; on the under side are four hooks for hoisting projectiles in Carriers, Shell, Hand. The carrier is hoisted on guide wires by a whip and bollard and the hoist is usually trunked up.

Bands, Lifting, B.L., 6-inch Projectiles.

829. These are similar to Carriers, Shell, Hand. They are supplied to ships mounting B.L., 6-inch, Mark XXIII guns (except those fitted with sliding shell stowage) for removing projectiles from the upper tiers of the shell bay.

830-834.

883. The functioning of the fuze magazine ignites the powder burster and cordite ejection charge, and in turn the rocket tail, cordite and target flare are ignited.

The target flare is ejected under action of the pressure plate; the split supports, driven to the rear, shear the threads securing the fabricated tail which falls away, as do the split supports.

The burning target flare speeds towards the firing ship, the radar aerial being extended under action of the springs.

ROCKET GLIDER TARGET

884. The target is a model glider with a wing span of 5 inches, and is used on a shore range. It was originally designed for firing practice with Thompson sub-machine guns.

885. The equipment consists of (1) A Model glider with a rocket motor, and (2) a special launching catapult.

The fuselage, wings, tailplane and fins of the glider are covered by a strong outer skin of special material; its tailplane incidence is hinged so that it can be adjusted for trim. The rocket motor, fitted in the underside of the fuselage, consists of a rocket tube, adapter and striker sub-assembly venturi, percussion cap and a cordite charge.

The catapult performs the following action:—

(1) The rocket motor is initiated by its firing mechanism.

(2) Impetus from the elastic cords launches the glider. Once launched, the means of sustained propulsion is provided by the rocket motor.

[illegible]-INCH ROCKET, TARGET

886. This rocket provides a moving target whose speed is from 250 to 400 knots. The range is approximately 5,000 yards. The means of launching the rocket are:—

(1) On board ship.—From a Modified projector, which has a heavy wooden cross as a base.

(2) On shore.—From an Unmodified projector, which is secured by passing the feet and spade into the ground.

The Target Handbook should be referred to for general instructions, maintenance and detail.

887. A round consists of the following main parts:—Propelling Unit, Target Head and Fins (4). The order of assembly is:—

(1) Fins to Propelling Unit.

(2) Target Head to Propelling Unit.

Dismantling is done in the reverse order.

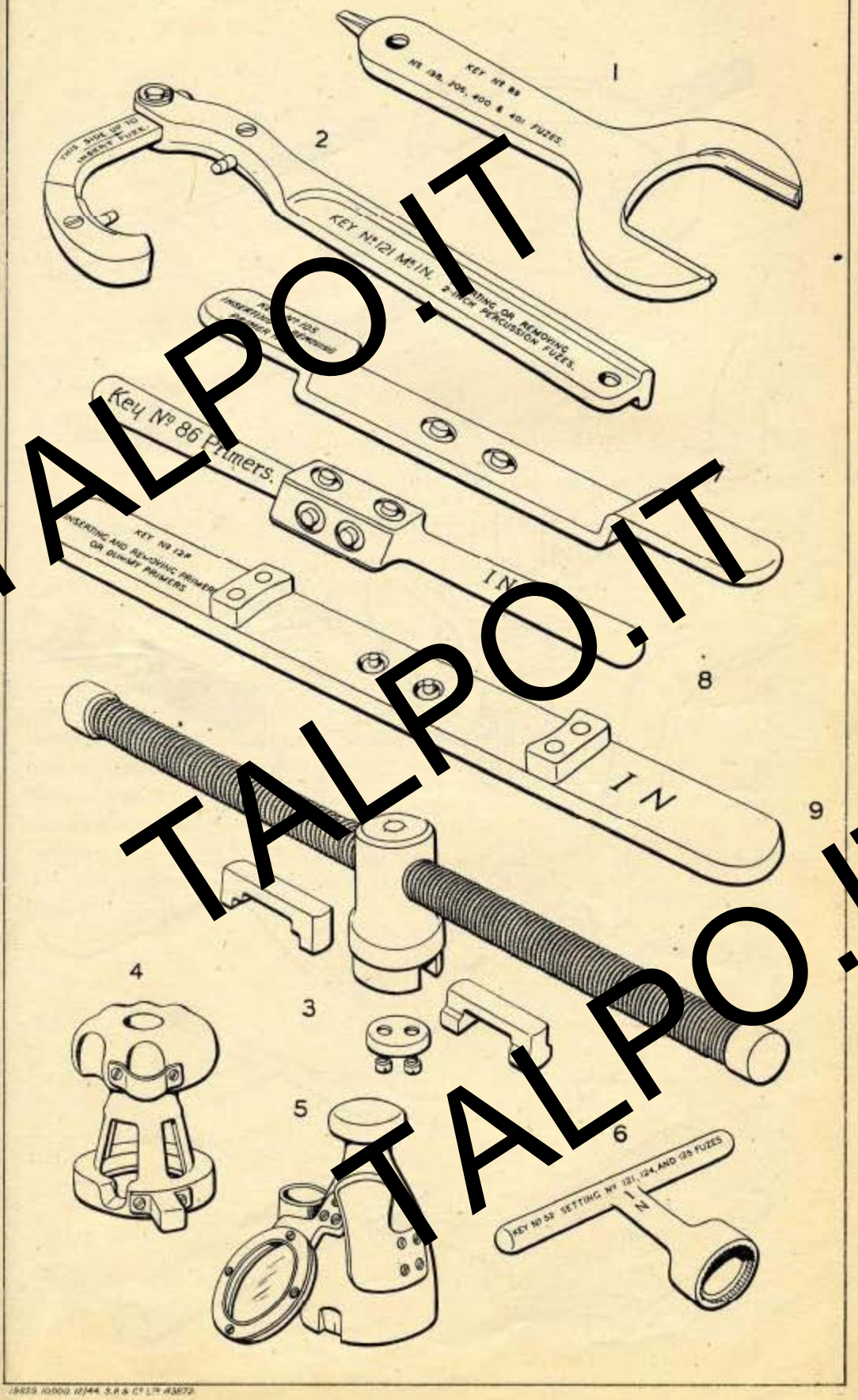
THE PROPELLING UNIT is a shortened 2-inch Rocket U. The tube is 2¼-inches in diameter and 20¼-inches in length.

THE TARGET HEAD is a body tube with a weight and a ballistic cap attached to the forward end and a socket containing the detonator and the igniter at the rear end. Two candles, each with a priming composition, are contained in the body. There are four vent holes in the casing for each candle and for protection the holes are covered by lassolastic strips.

888. After launching, the pressure of gas developed by the cordite in the rocket operates a reversible diaphragm and striker, and the detonator is exploded. This ignites priming compositions and in turn the candles are ignited. (A burster ensures the satisfactory ignition of the forward priming composition.) The candles burn simultaneously, the lassolastic strips are burnt off and the gases and flames escape through the vent holes. The flaming rocket travels at a high velocity to the end of its run.

ROCKET TARGET, PRACTICE, 1 lb. *See Para.* 689.

KEYS FOR FUZES AND PRIMERS



(9633) 10000 11/44 S.P.& C° Ltd A3872

IMPLEMENTS, AMMUNITION AND KEYS, CASES

SCHEDULE OF IMPLEMENTS AND KEYS

Index No.

SHEET 1

Key No. 89	1
Key No. 121, Mark IN	2
Key No. 69, Mark II	3
Key No. 115, Mark III	4
Key No. 1[illegible] Mark I	5
Key No. 92	6
Key No. 105	7
Key No. 68	8
Key No. 128	9

SHEET 2

Ring, inserting and removing lid, 5.25-in., Mark I	10
Tool, rectifying mouths of Cartridge Cases, Q.F. 5.25-inch, Mark I	11
Tool, opening tangs of cartridge cases, Q.F. 5.25-inch, No. 3, Mark I	12
Key, cases, powder, rectangular, No. 3, Mark II	13
Key, cases, powder, cylindrical, No. 3, Mark IIN	14
Key, case, magazine, No. 1	15
Key, case, magazine, No. 2, Mark III	16
Key, case, magazine, No. 3	17
Drift, 5.25-inch, Mark I	18

INDEX

A

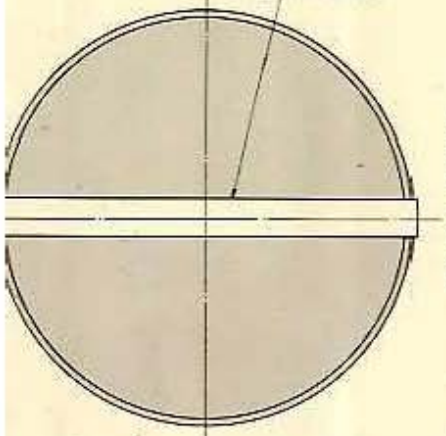
B

C

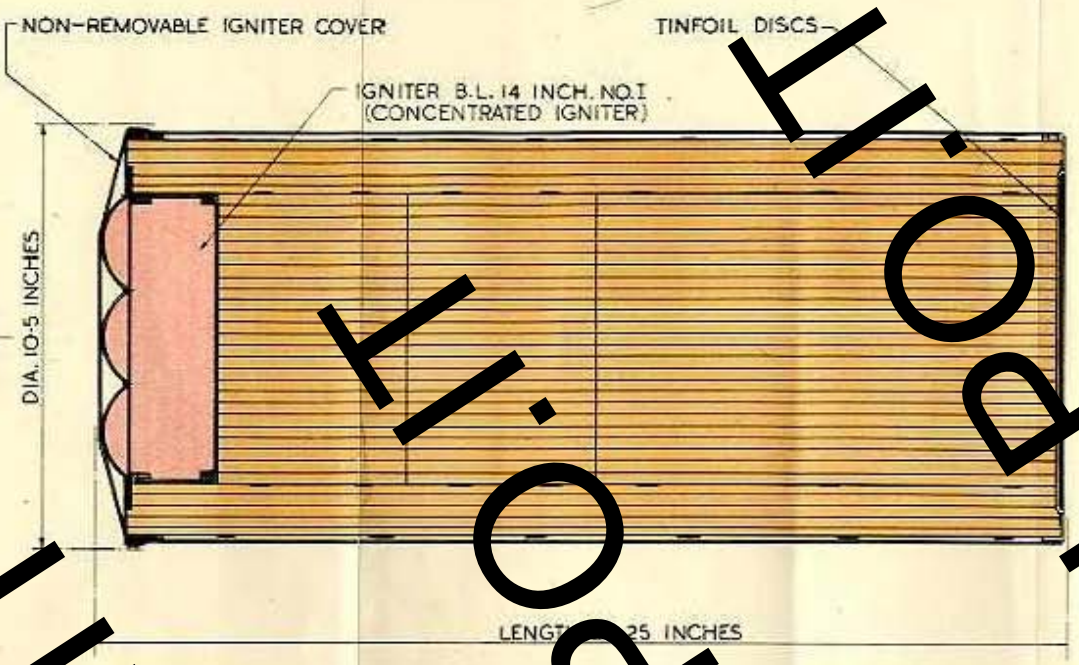
(3143/528) Wt. 16690/D7553 18m. 7/45 T. & B. Gp. 8.

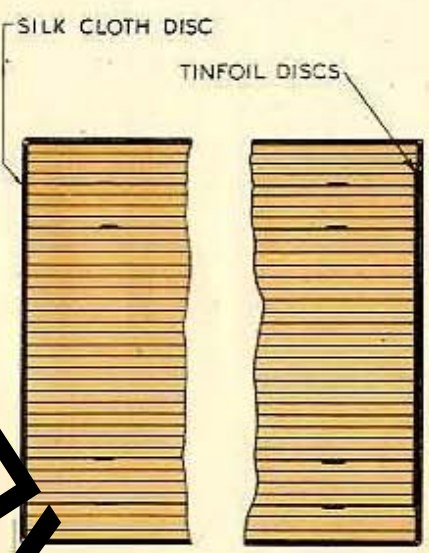
PLATE

CARTRIDGE, B.L. 14 INCH, 84 LB. 9 OZ.
SILK CLOTH, 1/4 CHARGE, FILLED, TYPICAL



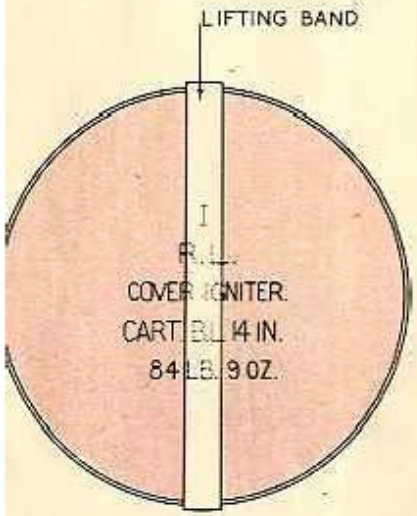
PLAN OF BASE



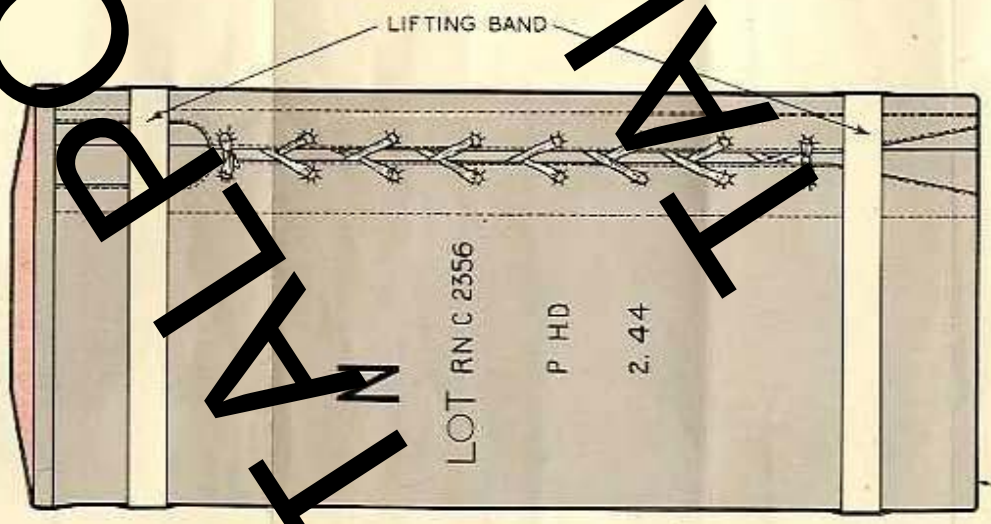


LENGTH 24·75 INCHES

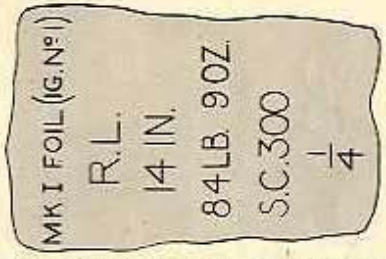
FOR CARTRIDGES WITHOUT IGNITERS



PLAN OF COVER



ELEVATION SHOWING MARKING ON BACK OF CARTRIDGE

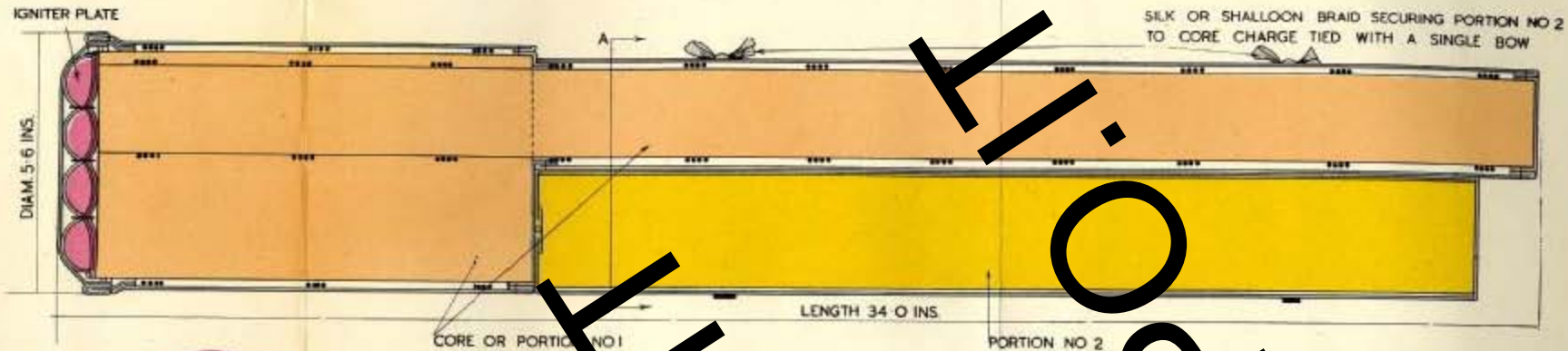


MARKING ON FRONT OF CARTRIDGE

RN C. 2356

MARKING ON BASE

BOMBARDMENT CHARGES



END MARKING

✢ INITIALS OR TRADE MARK OF MAKER OF EMPTY BAG

I
✢
6 IN
5 LB. 10 OZ.
3 LB. 6 OZ.
S.S.C. 008.

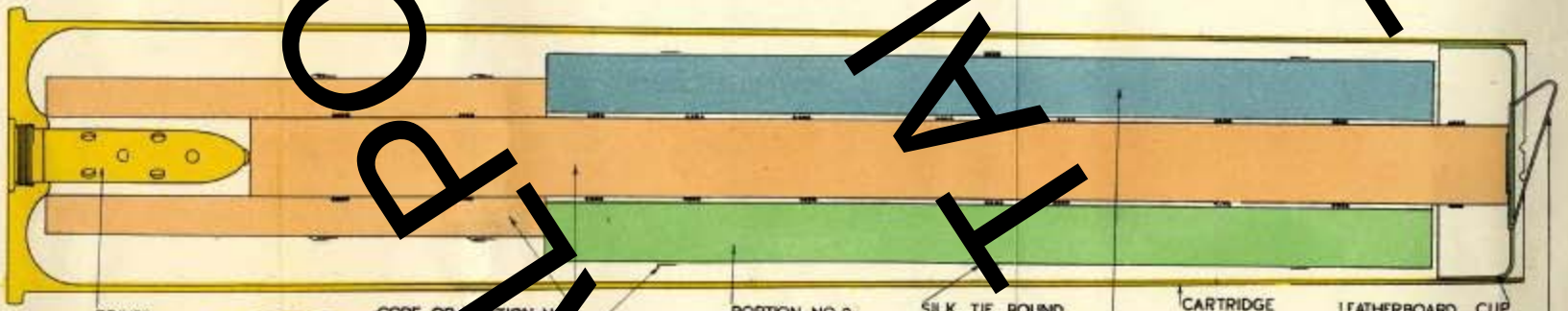
MARKING ON SIDE OF PORTION NO 1

I
✢
6 IN
5 LB. 10 OZ.
2 LB. 4 OZ.
S.S.C. 008.

MARKING ON SIDE OF PORTION NO 2

CROSS SECTION A-A

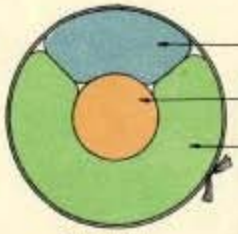
CARTRIDGE B.L. FOR 6 INCH MARK XII GUN
5 LB. 10 OZ. CORDITE S.S.C. 008 (PLATED) MARK I



BASE MARKINGS

SHALLOON BRAID SECURING PORTIONS 2 AND 3 TO CORE

* DISTINGUISHING LETTER OF CORDITE MANUFACTURER
✢ LOT No. OF CORDITE
⊕ MONOGRAM OF FIRM OR STATION FILLING
#/# DATE OF FILLING

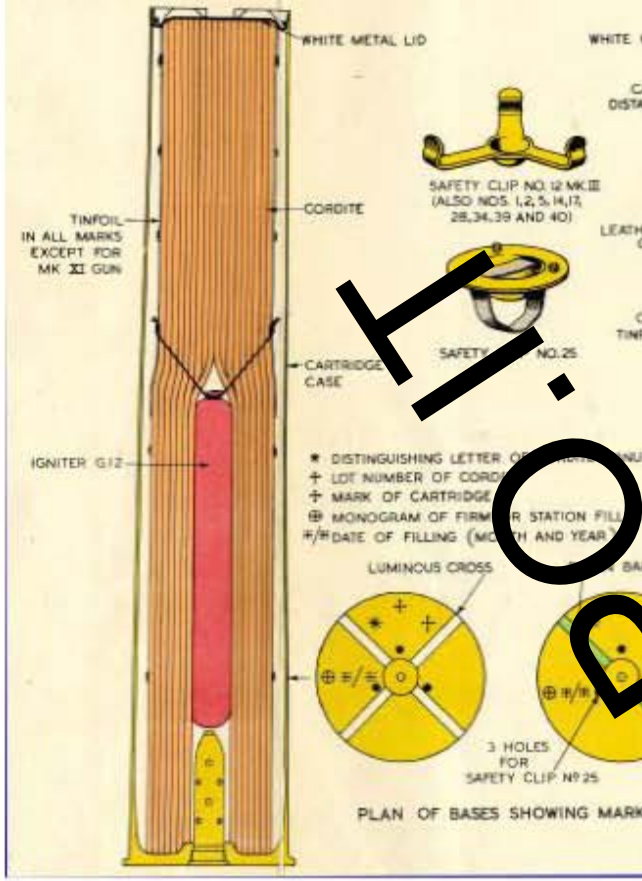


END VIEW

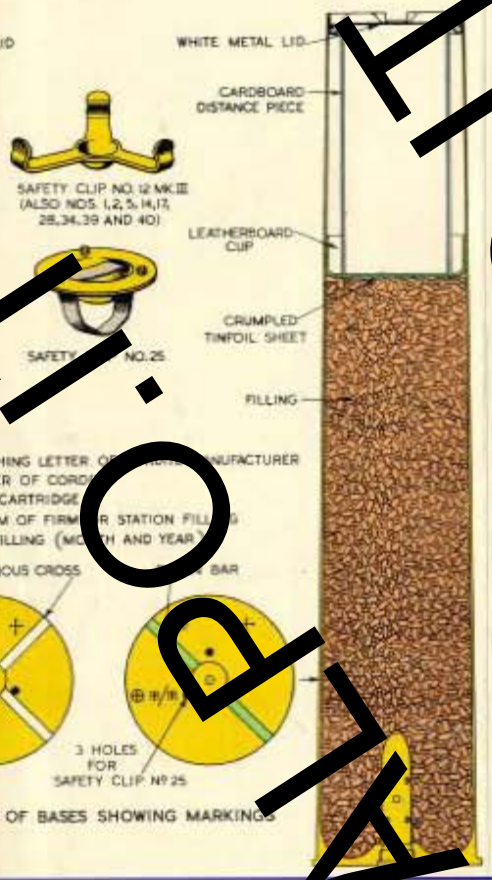
CARTRIDGE FOR Q.F. 4·7 INCH MARKS IX TO IX** D.E.F. AND XII GUNS

PLATE 3

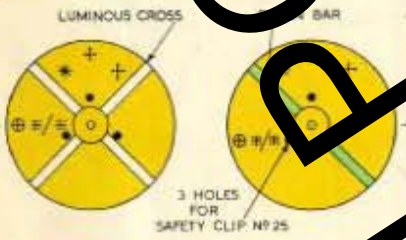
Q.F. 4·7 IN. SEPARATE AMMUNITION FILLED N.F.Q/S



Q.F. 4·7 IN. SEPARATE AMMUNITION FILLED N. H.

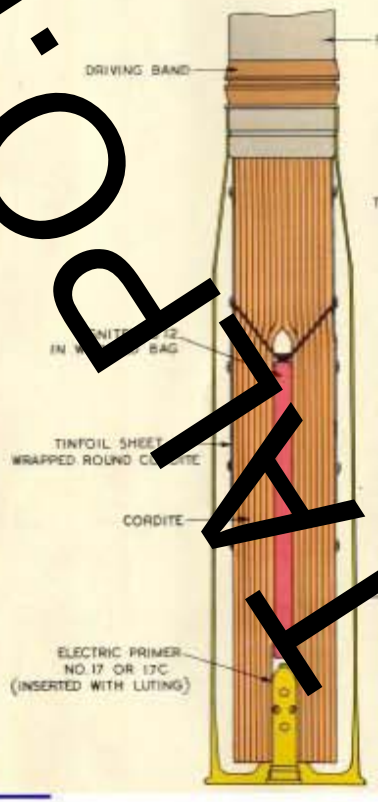


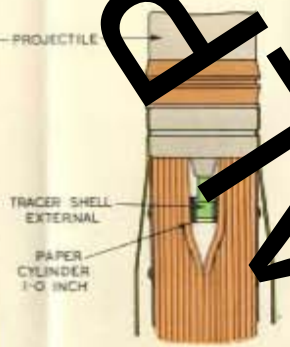
* DISTINGUISHING LETTER OF MANUFACTURER
† LOT NUMBER OF CORDITE
‡ MARK OF CARTRIDGE
⊕ MONOGRAM OF FIRM OR STATION FILLING
#/# DATE OF FILLING (MONTH AND YEAR)



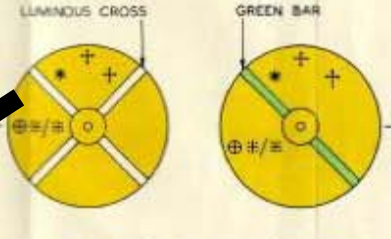
PLAN OF BASES SHOWING MARKINGS

Q.F. 4·5 IN. FIXED AMMUNITION FILLED CORDITE N.F.Q.



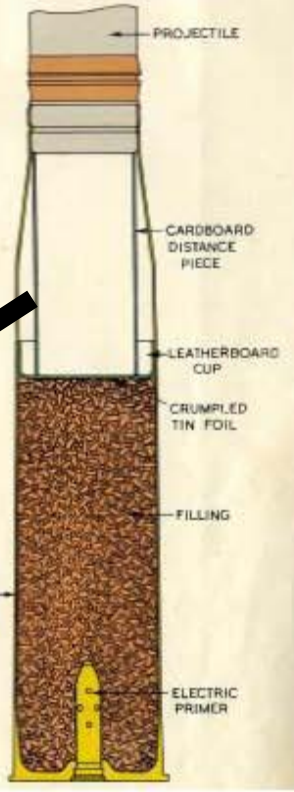


ARRANGEMENT FOR EXTERNAL TRACER



PLAN OF BASES SHOWING MARKINGS

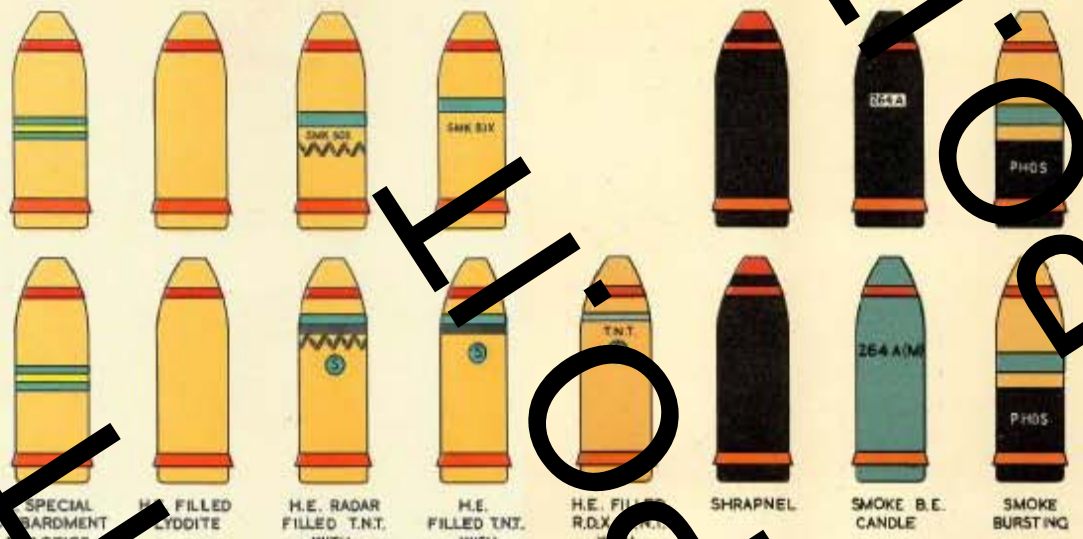
Q.F. 4·5 IN. FIXED AMMUNITION FILLED N.H.



COLOURING OF PROJECTILES

OLD METHOD

PRESENT METHOD



SPECIAL BOMBARDMENT PRACTICE | H.E. FILLED LYDDITE | H.E. RADAR FILLED T.N.T. WITH SMOKE BOX | H.E. FILLED T.N.T. WITH SMOKE BOX | H.E. FILLED R.D.X. WITH SMOKE BOX | SHRAPNEL | SMOKE B.E. CANDLE | SMOKE BURSTING

OLD METHOD

PRESENT METHOD

* SOME C.P.B.C. OR C.P.C. SHELL HAVE A GREEN & BLACK BAND ON BODY OR CAP

† S.A.P.C. SHELL HAVE A WHITE BAND ABOVE THE RED BAND

‡ GREEN STAR FOR SHELL WITH 27 INCH MK III PARACHUTE

S.A.P. FILLED T.N.T. | A.P.C. OR C.P.B.C. OR C.P.C. FILLED T.N.T. | A.P.C. OR C.P.B.C. OR C.P.C. (OR S.A.P.) FILLED SHELLITE | C.P. FILLED T.N.T./B.W.X. | TARGET SMOKE | H.A. PRACTICE | STAR | PRACTICE PROJECTILE

FUZE MARKINGS ON BASE *PLATE 13*

SCREWED RING AND GASCHECK COVER PLATE FOR FUZE Nº 158A OR Nº 159

SCREWED RING AND GASCHECK COVER PLATE FOR FUZE Nº 58 GREEN BAR ALSO APPLIES WHEN FUZES Nº 345 OR Nº 479 ARE FITTED

SCREWED RING AND TRACER SHELL FOR FUZE Nº 346 OR 345

SCREWED RING AND GASCHECK COVER PLATE FOR FUZE Nº 159 OR 158A

COLOUR OF SCREWED RING	Nº OF FUZE FITTED
WHITE	158 158A OR 159
YELLOW	345 345A OR 346
BLUE	479 479A OR 480

SCREWED RING AND GASCHECK COVER PLATE FOR FUZE Nº 502

COLOUR OF BAR	Nº OF FUZE FITTED
WHITE	551
GREEN	500 OR 501
YELLOW	502

STENCILLING ON SHELL
OLD METHOD

CALIBRE OF GUN
MARK OF SHELL
FILLING CONTRACTOR'S INITIALS
DATE OF FILLING SHELL
PICRIC ACID EXPLODER 3¼ OZ.
LOT NUMBER OF EXPLODER
MAKER'S INITIALS & MARK OF FUZE
LOT NUMBER & DATE OF FILLING
SERIAL NUMBER OF FUZE
RED BAND FOR FILLED SHELL
S.A.P.C. SHELL HAS WHITE BAND ABOVE RED
COMPOSITION OF SHELLITE
CENTRE OF GRAVITY MARK
ALL SHELLS MARKED 'N' FOR NAVAL SERVICE

TYPICAL BASE FUZED SHELL
A.P.C. C.P.C. OR C.P.B.C. FILLED SHELLITE

RED BAND FOR FILLED SH
PROJECTILES FITTED FOR TRACERS ARE STENCILLED AS FOLLOWS
WHEN PREPARED FOR TRACER
WHEN FITTED WITH NIGHT TRACER
WHEN FITTED WITH No2 MKIE TRACER
CALIBRE OF GUN
MARK OF SHELL
GREEN BAND FOR SHELL FILLED T.N.T
CENTRE OF GRAVITY MARK
FILLING CONTRACTOR'S INITIALS
DATE OF FILLING SHELL
PELLET EXPLODER
COMPOSITION EXPLODING 26 DRS

TYPICAL NOSE FUZED SHELL
H.E. FILLED T.N.T.

STENCILLING ON SHELL
PRESENT METHOD

CALIBRE OF GUN
MARK OF SHELL
FILLING CONTRACTOR'S INITIALS
DATE OF FILLING SHELL
PICRIC ACID EXPLODER 3¼ OZ
T NUMBER OF EXPLODER
MAK'S INITIALS & MARK OF FUZE
LOT NUMBER & DATE OF FILLING FUZE
SE NUMBER OF FUZE
TRACER MARKING SHOWING SERIAL NUMBER
AND MARK OF TRACER
ED BAND FOR FILLED SHELL
A.P. AN SHELL HAVE A WHITE BAND
OVE ED BAND
COMPOSITION OF SHELLITE
CENTRE OF GRAV MARK
ALL SHELLS RKED 'N' FOR NAVAL SERVICE
RED BAND FOR SH FITTED WITH LIVE TRACER

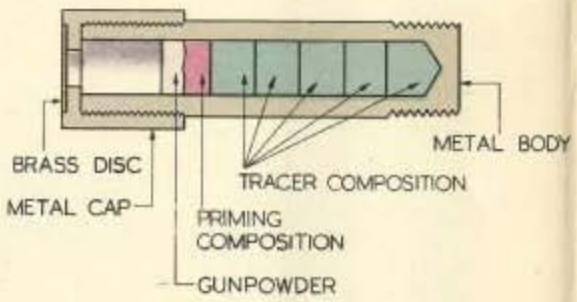
TYPICAL BASE FUZED SHELL
A.P.C. C.P.C. C.P.B.C. FILLED SHELLITE

RED BAND FOR FILLED SHELL
PROJECTILES FITTED FOR TRACERS ARE STENCILLED AS FOLLOWS:-
WHEN PREPARED FOR TRACER
WHEN FITTED WITH TRACER
MARK OF TRACER
NUMBER OF TRACER
WHEN FITTED WITH DIM IGNITION TRACER
MARK OF TRACER
NUMBER OF TRACER
CALIBRE OF GUN
MARK OF SHELL
GREEN & BLACK BANDS FOR SHELL FILLED T.N.T.
CENTRE OF GRAVITY MARK
FILLING CONTRACTOR'S INITIALS
DATE OF FILLING SHELL
PELLET EXPLODER
COMPOSITION EXPLODING 26 DRS
RED BAND FOR SHELL FITTED WITH LIVE TRACER

TYPICAL NOSE FUZED SHELL
H.E. FILLED T.N.T.

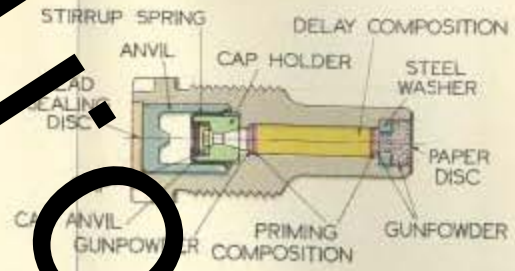
TRACER SHELL Nº1 MARK VI A EXTERNAL

(SCALE APPROXIMATELY 4/3)



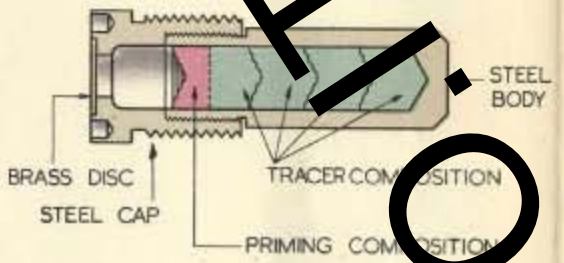
IGNITER SHELL Nº1 MARK I

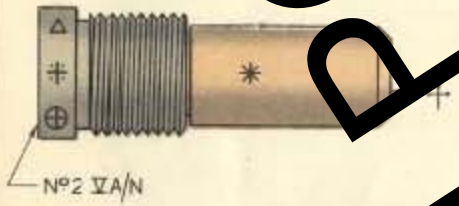
(SCALE APPROXIMATELY 4/3)



TRACER SHELL Nº 2 MARK V A INTERNAL

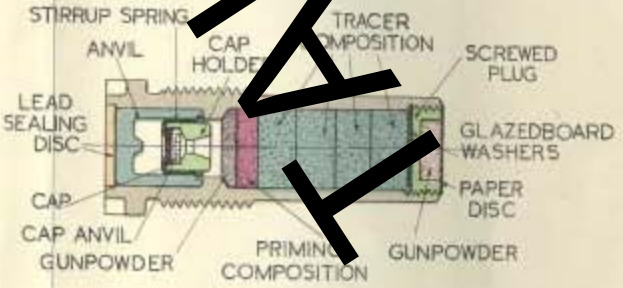
(SCALE APPROXIMATELY 4/3)





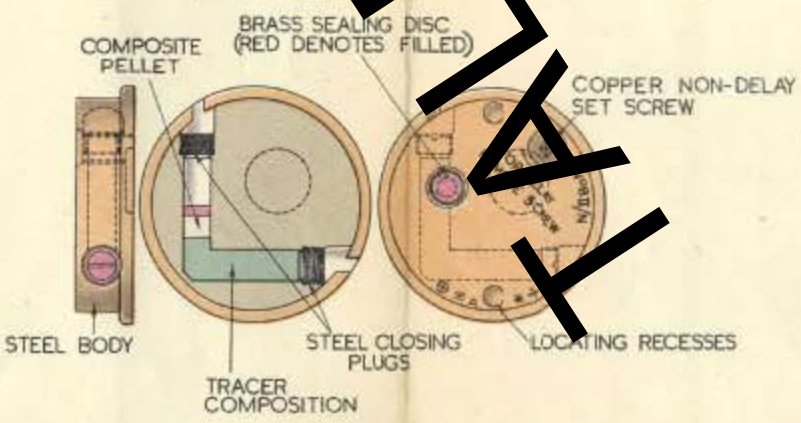
TRACER AND IGNITER SHELL Nº7 MARK IV INTERNAL

(SCALE APPROXIMATELY 4/3)



TRACER SHELL Nº8 MARK II

(SCALE APPROXIMATELY)



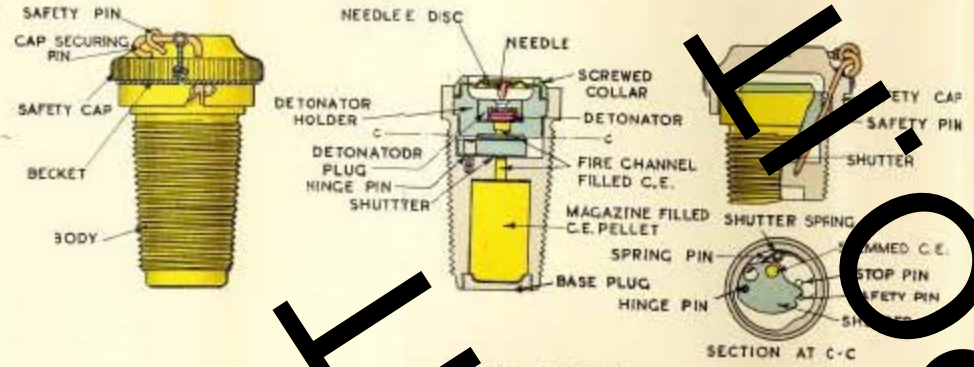
✱ CONTRACTOR'S INITIALS OR RECOGNISED TRADE MARK
‡ DATE OF MANUFACTURE MONTH AND YEAR
‡ DATE OF FILLING MONTH AND YEAR
⊕ MONOGRAM OF FILLING STATION
△ FILLED LOT NUMBER

FLAT BASE TRACER

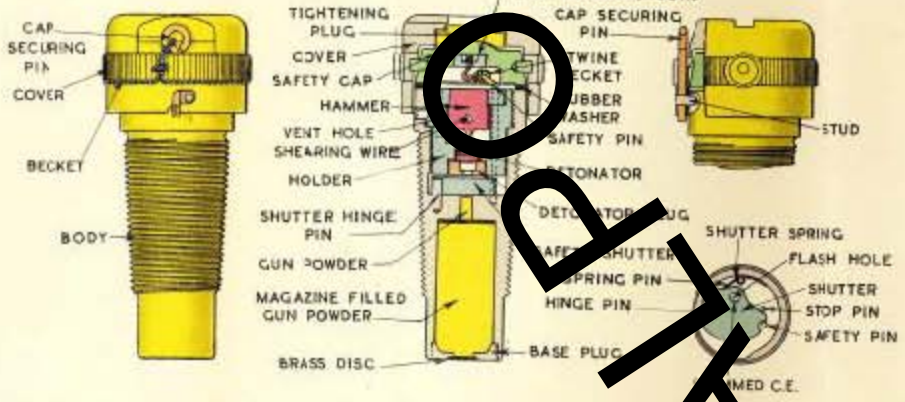
FACES OF PLUGS AND SEALING DISC PAINTED RED AFTER FILLING

PLATE 16

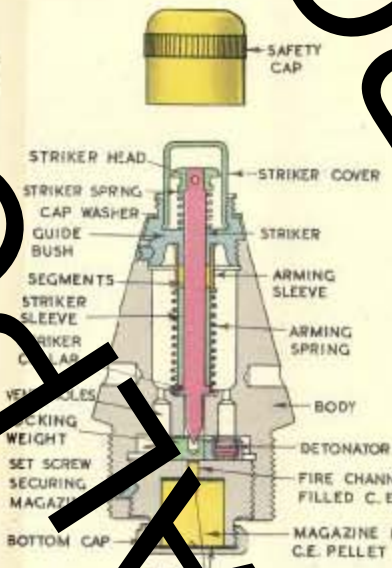
FUZE PERCUSSION D.A. NO. 44 MARK X WITH CAP



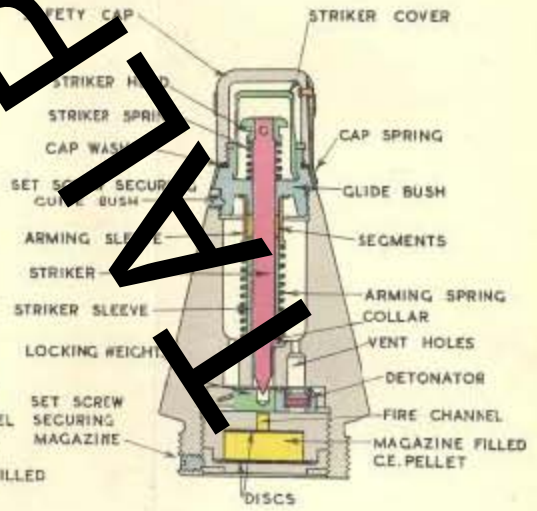
FUZE PERCUSSION D.A. NO. 45 MARK X WITH CAP

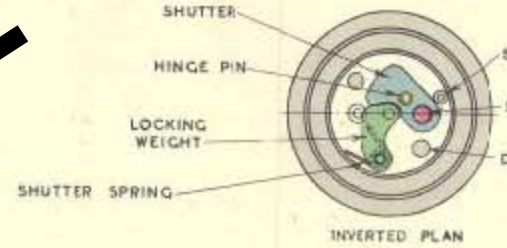


FUZE PERCUSSION D.A. NO. 118 MARK II



FUZE PERCUSSION D.A. NO. 230 MARK V



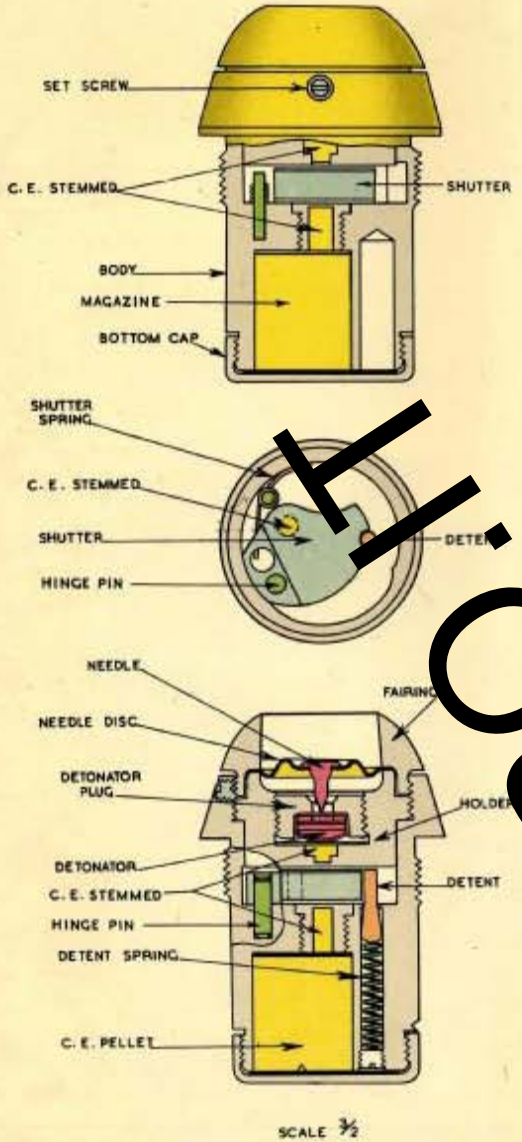


INVERTED PLAN

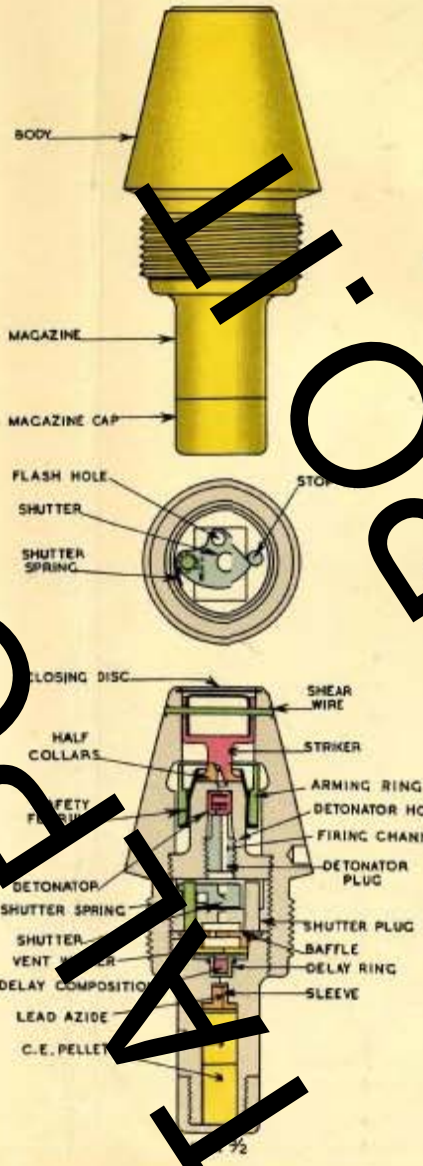
SCALE: FULL SIZE

PLATE 17

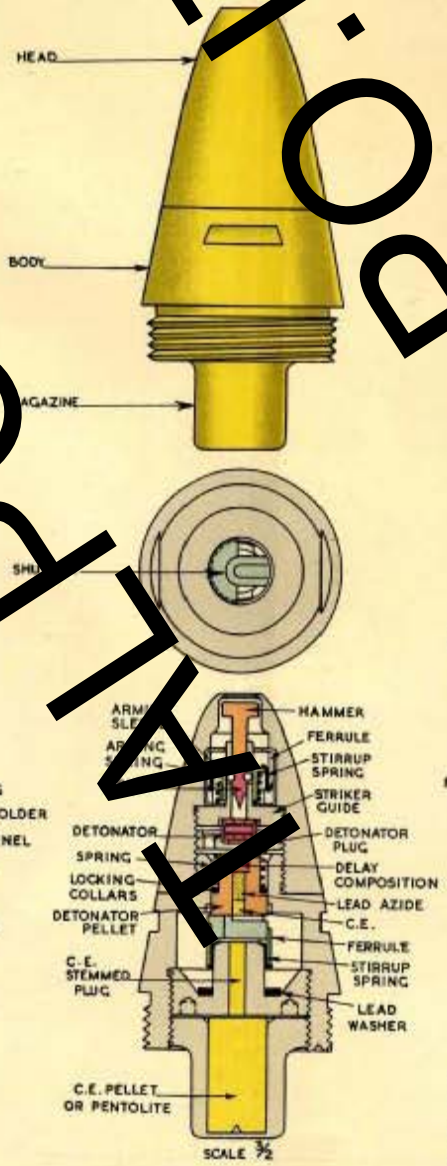
FUZE, PERCUSSION D.A. NO. 241 MARK I



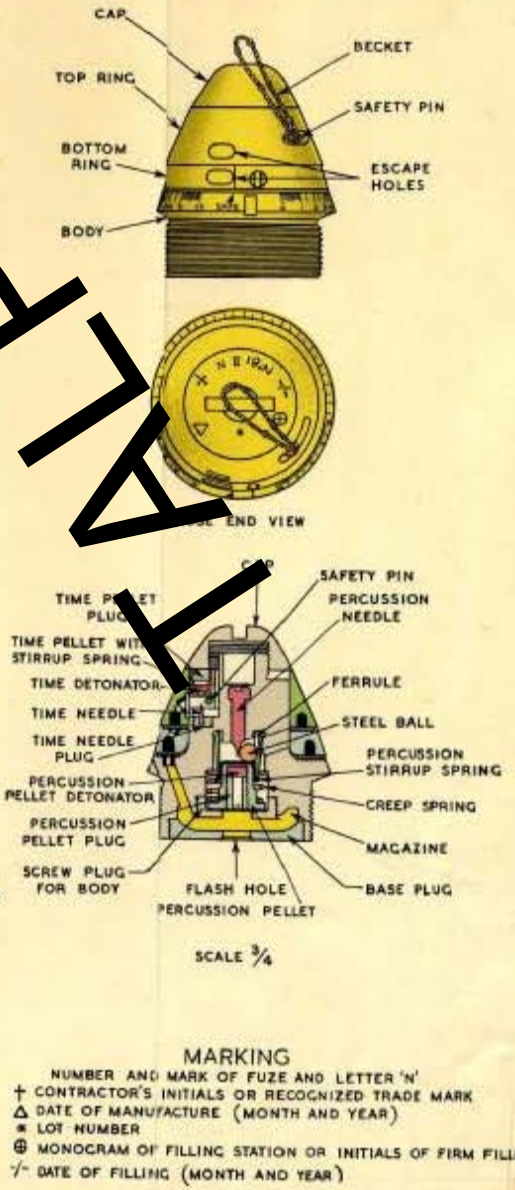
FUZE, PERCUSSION D.A. NO. 246 MARK I



FUZE, PERCUSSION NO. 255 MARK I



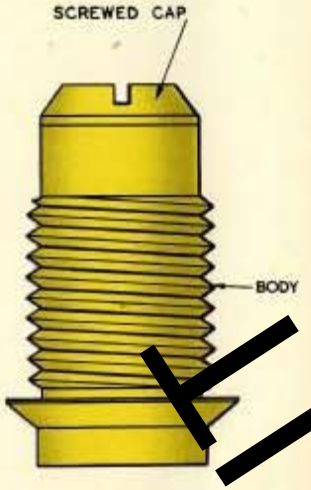
FUZE, TIME AND PERCUSSION NO. 93 MARK I



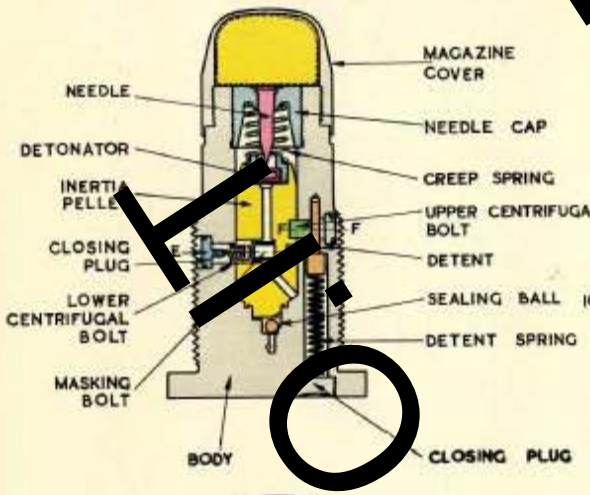
MARKING

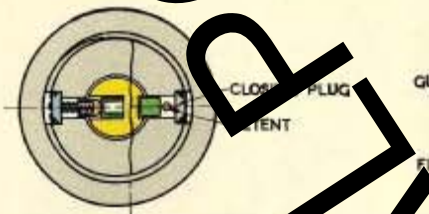
NUMBER AND MARK OF FUZE AND LETTER 'N'
+ CONTRACTOR'S INITIALS OR RECOGNIZED TRADE MARK
△ DATE OF MANUFACTURE (MONTH AND YEAR)
* LOT NUMBER
⊕ MONOGRAM OF FILLING STATION OR INITIALS OF FIRM FILLING
√ DATE OF FILLING (MONTH AND YEAR)

FUZE, PERCUSSION BASE, HOTCHKISS MARK IX

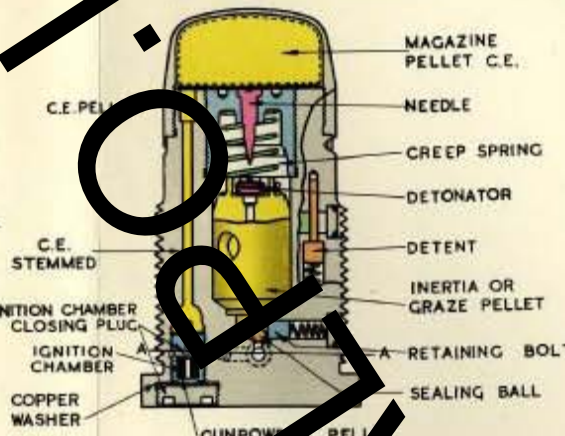


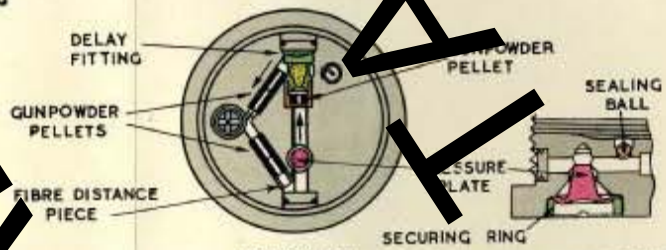
FUZE, PERCUSSION, BASE, MEDIUM Nº 501 MARK I





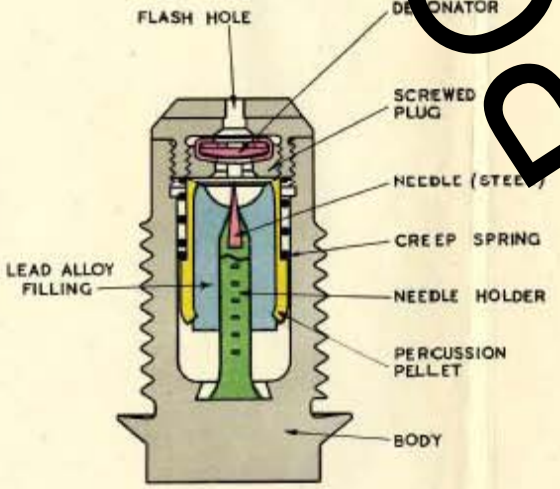
FUZE, PERCUSSION, BASE, LARGE Nº 480 MARK II



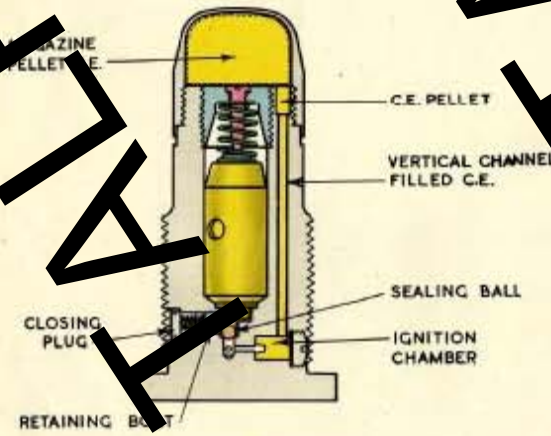


SECTION A-A

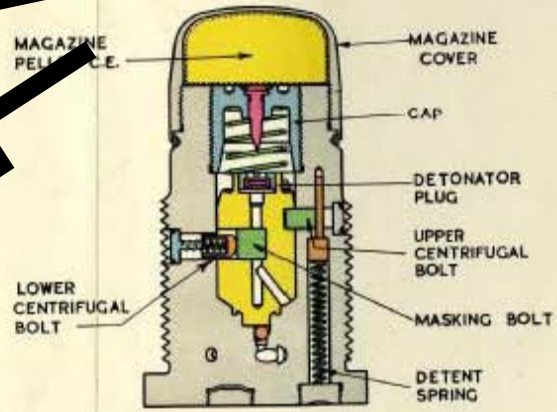
SECTION OF PRESSURE PLATE



SCALE 2/1



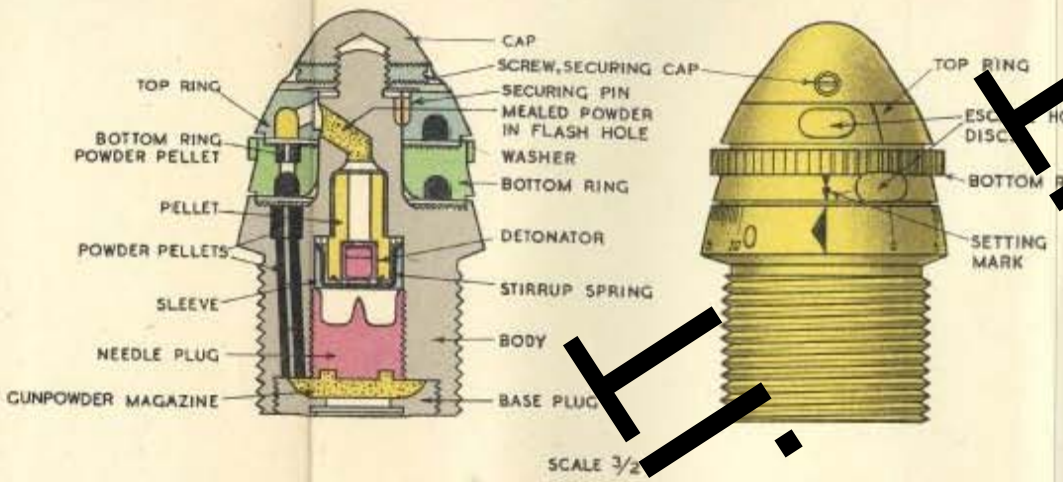
SCALE 3/4



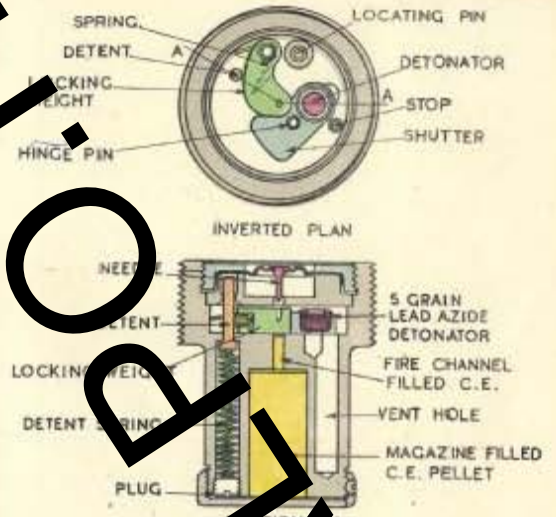
SCALE 3/4

SEE ADDENDUM TO HANDBOOK P. 18

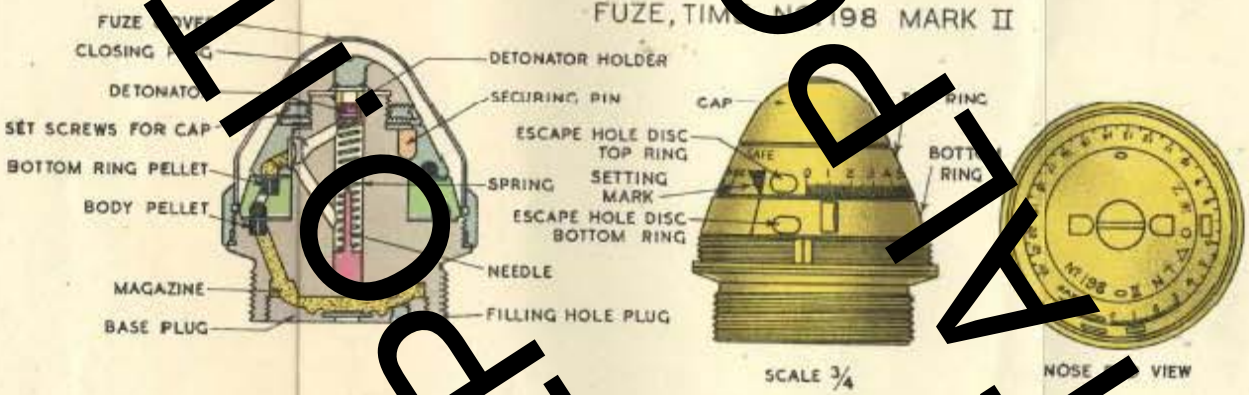
FUZE, TIME, NO. 125 MARK I



GAINE NO. 10. MARK I

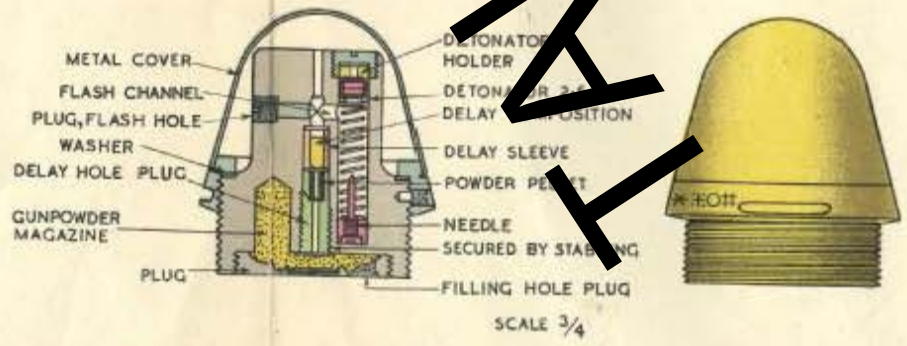


FUZE, TIME, NO. 198 MARK II

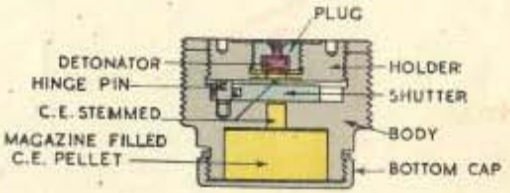


† CONTRACTOR'S INITIALS OR REGISTERED TRADE MARK
△ DATE OF MANUFACTURE
✱ LOT NUMBER
○ MONOGRAM OF FILLING STATION
-/- DATE OF FILLING (MONTH AND YEAR)

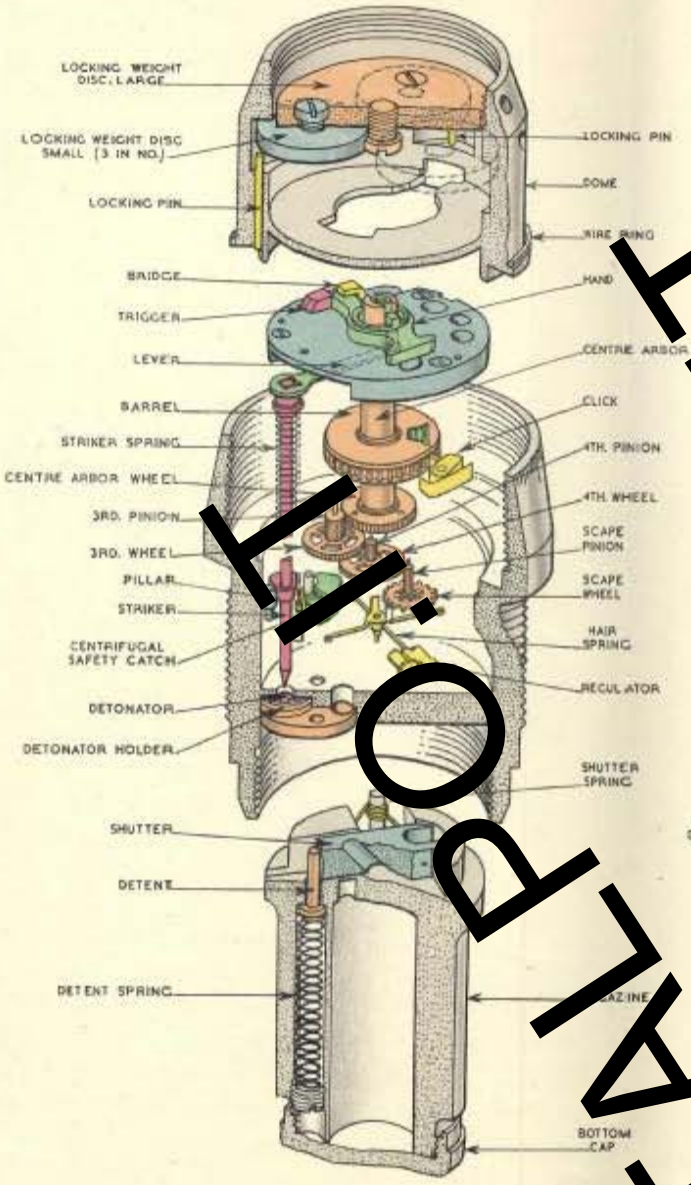
FUZE, TIME, NO. 402 MARK I

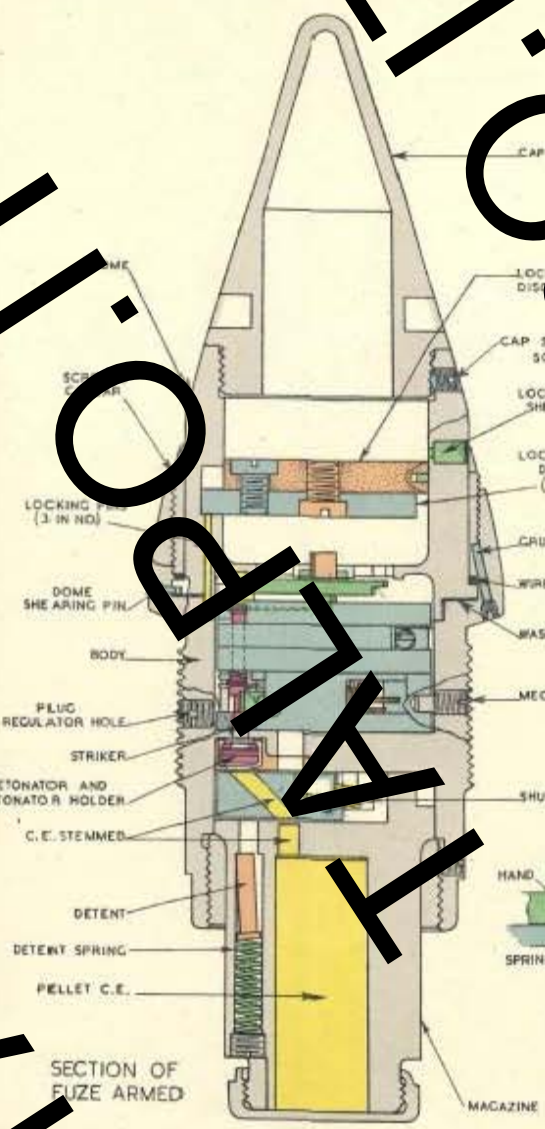


GAINE NO. 11. MARK II Z.Y.

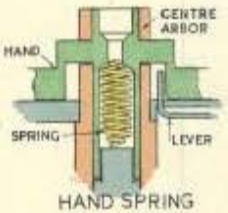


FUZE, TIME Nº 211

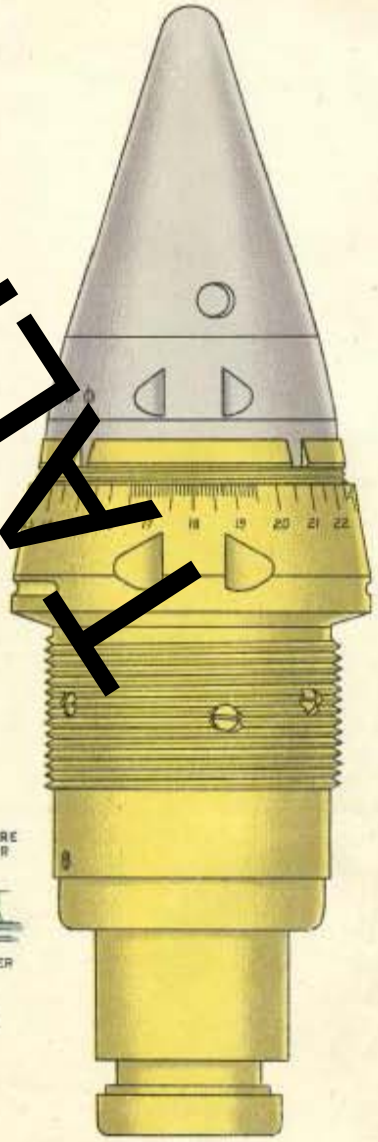




SECTION OF FUZE ARMED



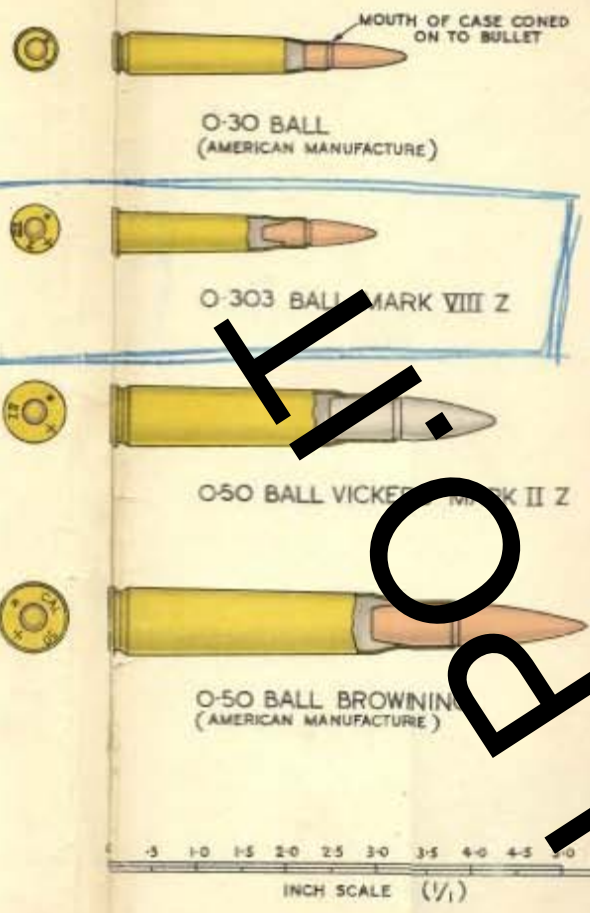
HAND SPRING

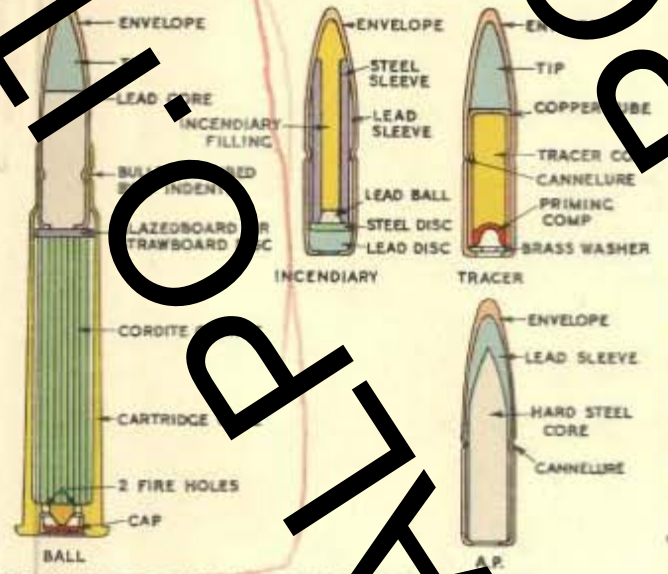


SCALE APPROXIMATELY 3/2

RIFLE AND MACHINE-GUN CARTRIDGES

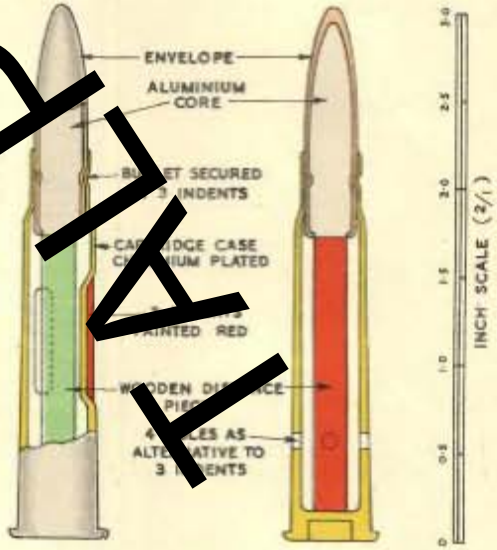
PLATE 21





SECTION OF TYPICAL ROUNDS AND BULLETS

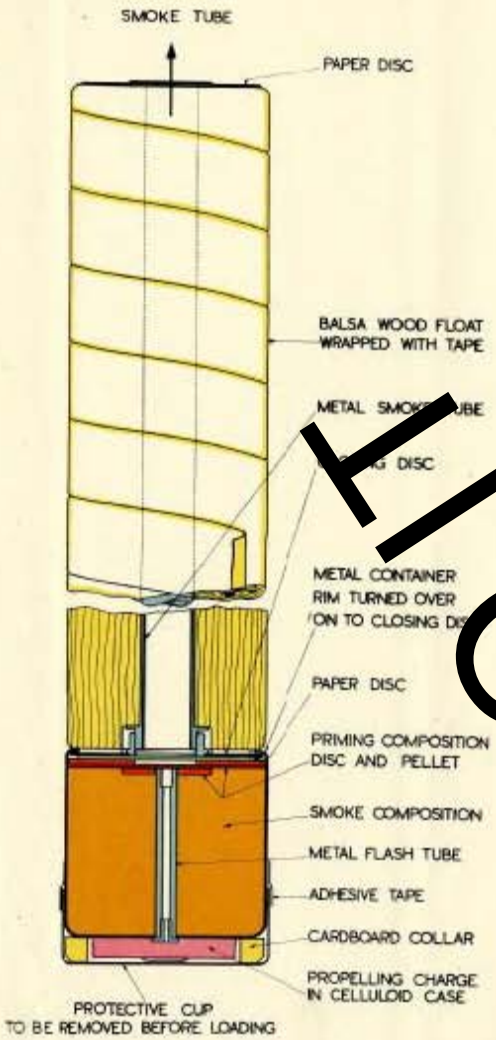
* CONTRACTOR'S INITIALS OR TRADE MARK
† YEAR OF MANUFACTURE



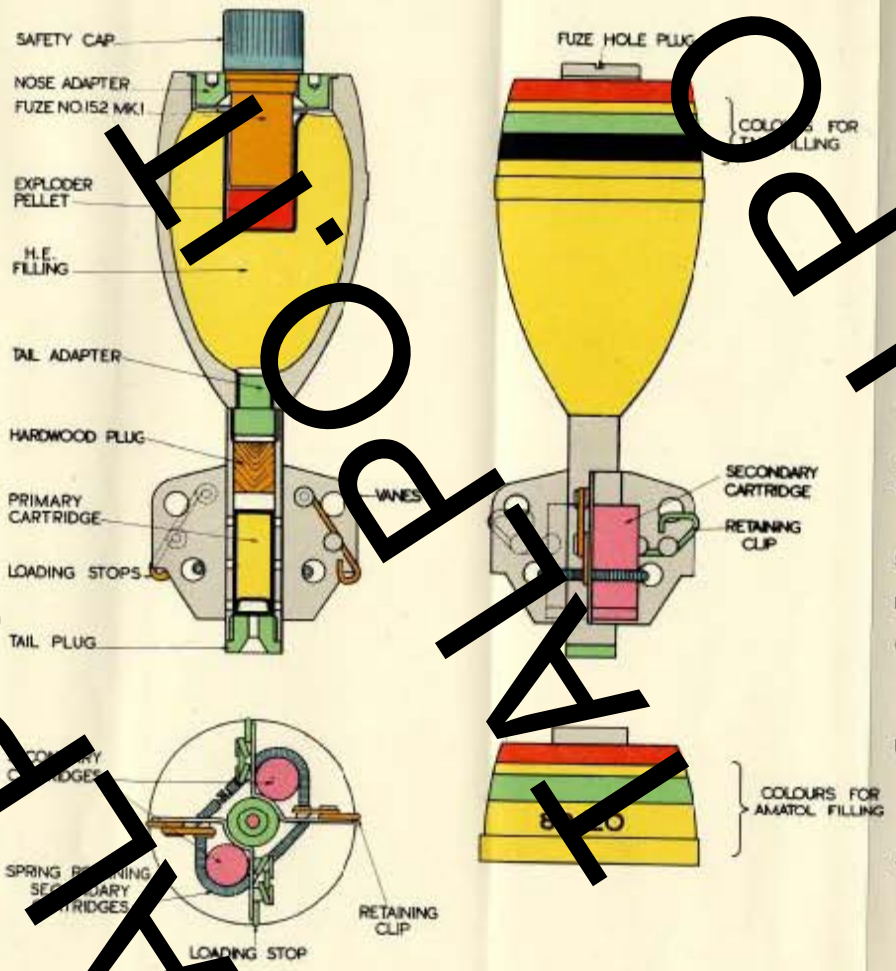
SECTION OF DRILL ROUNDS

BASES

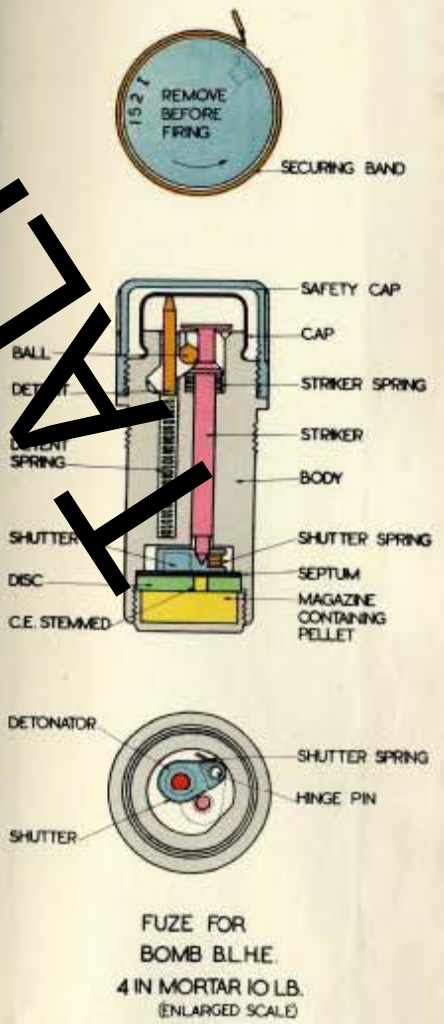
B.L. 4 INCH MORTAR AMMUNITION



SMOKE FLOAT B.L. 4 IN. MORTAR MARK III



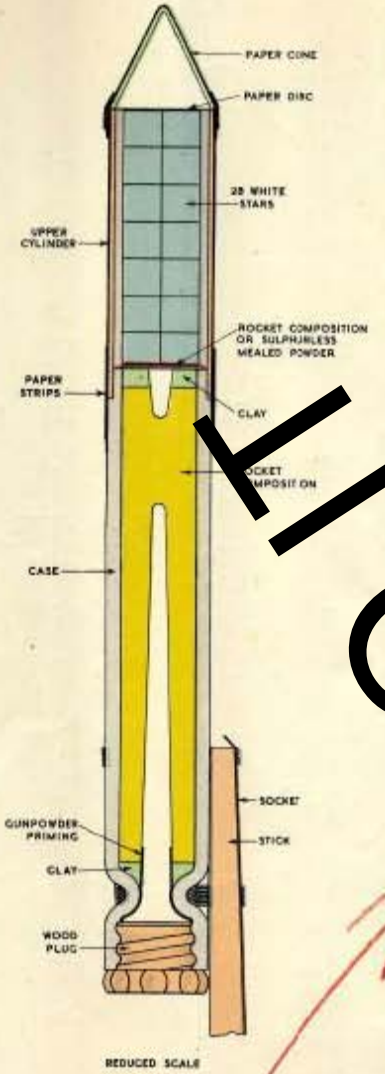
BOMB B.L. H.E. 4 IN. MORTAR 10 LB. MARK I



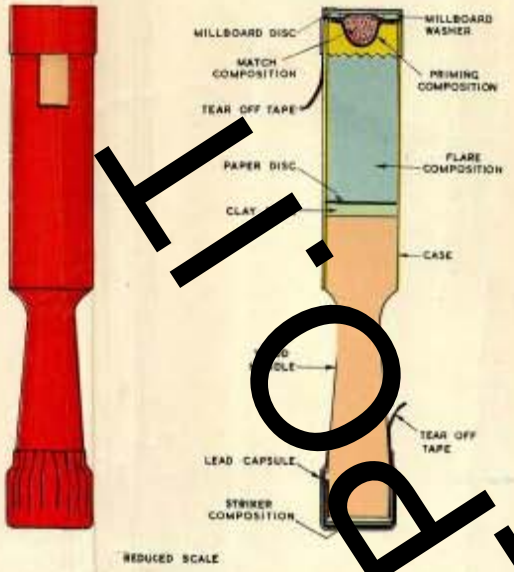
FUZE FOR BOMB B.L.H.E. 4 IN MORTAR 10 LB.
(ENLARGED SCALE)

PLATE 30

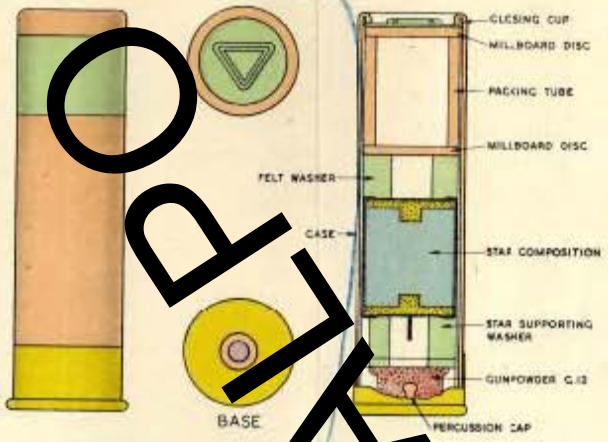
ROCKET, SIGNAL, 1 LB. SERVICE



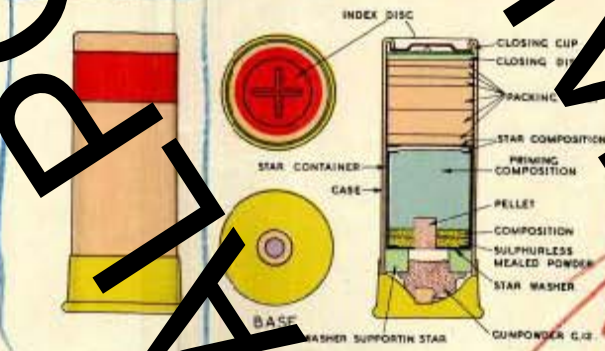
FLARE, SIGNAL, MARK II



CARTRIDGE, SIGNAL, GREEN, 1-INCH, MARK XI T



CARTRIDGE, SIGNAL, RED, 1-INCH, MARK XIV T



CARTRIDGE, SIGNAL, RED, 1½ INCH, MARK VT

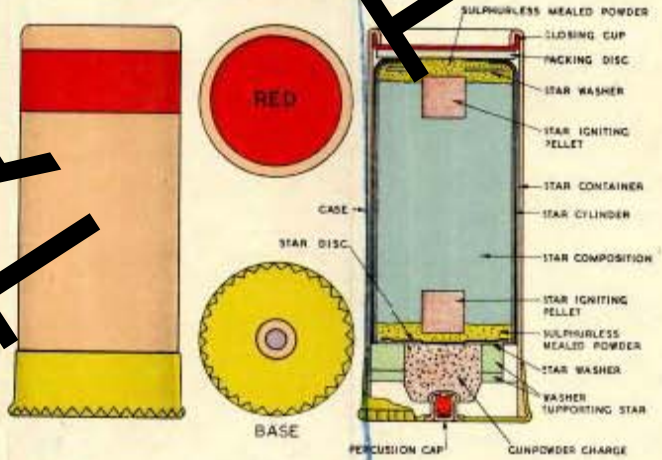
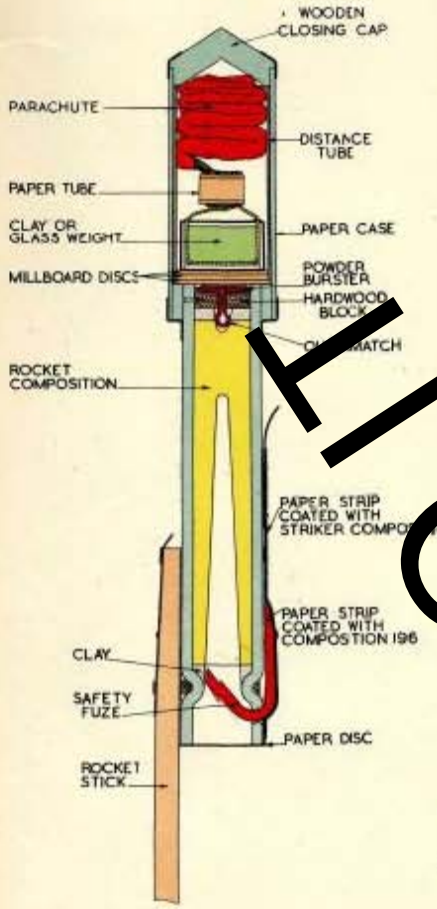
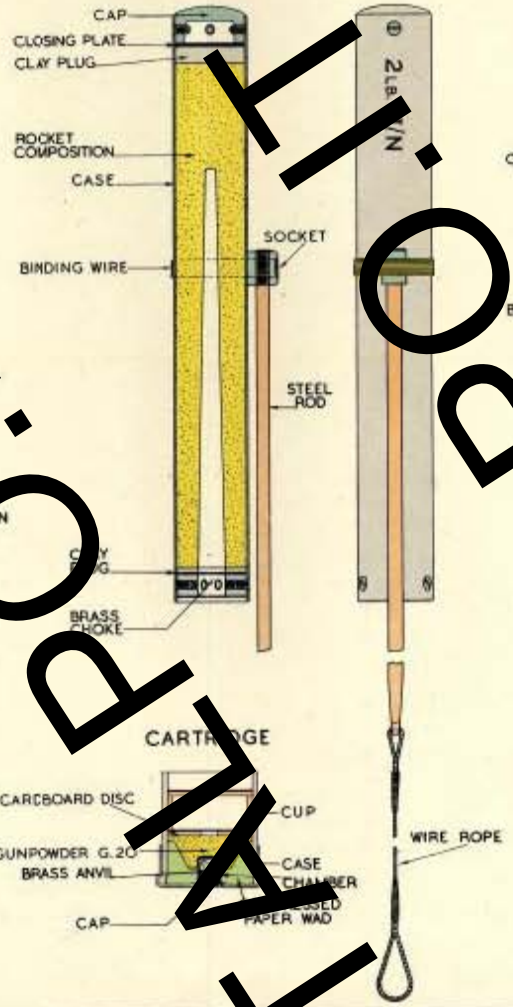


PLATE 31

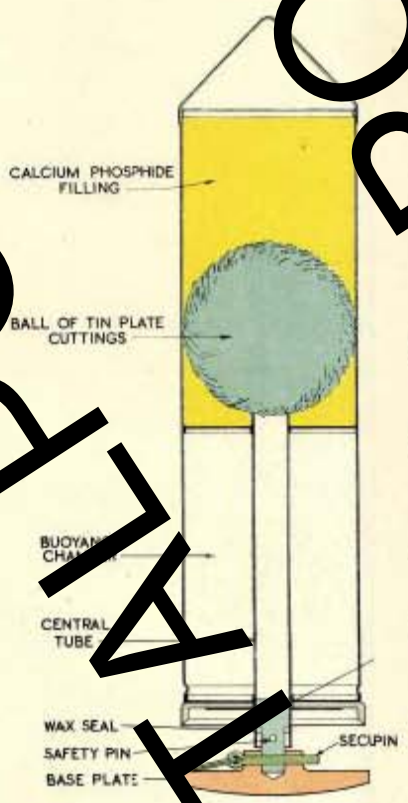
ROCKET, TARGET, PRACTICE 1 LB. MK II



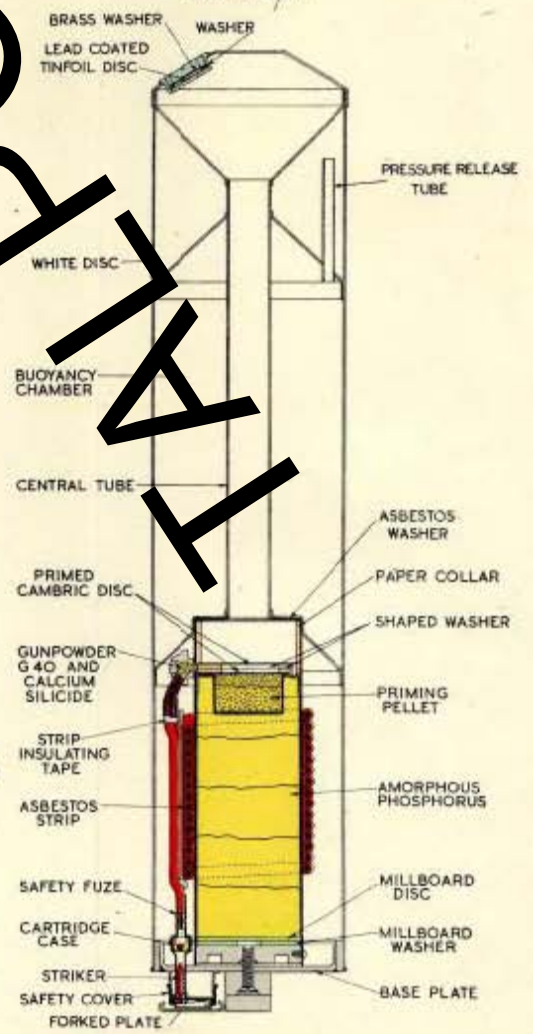
ROCKET, LINE CARRYING, SCHERMULY 2 LB., MARK I



CANDLE, SMOKE WHITE MARK I

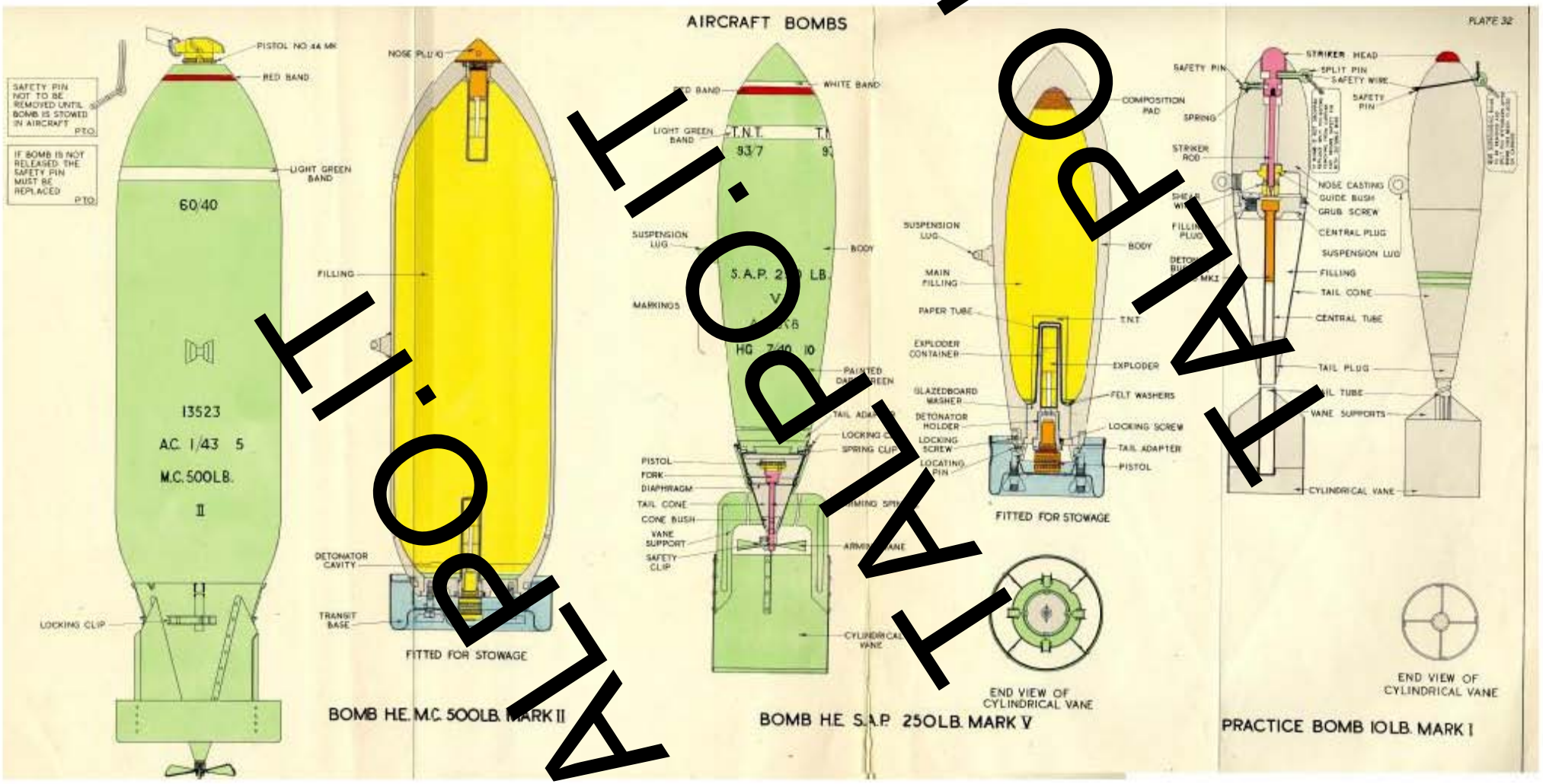


FLAME FLOAT DELAY MARK I/N

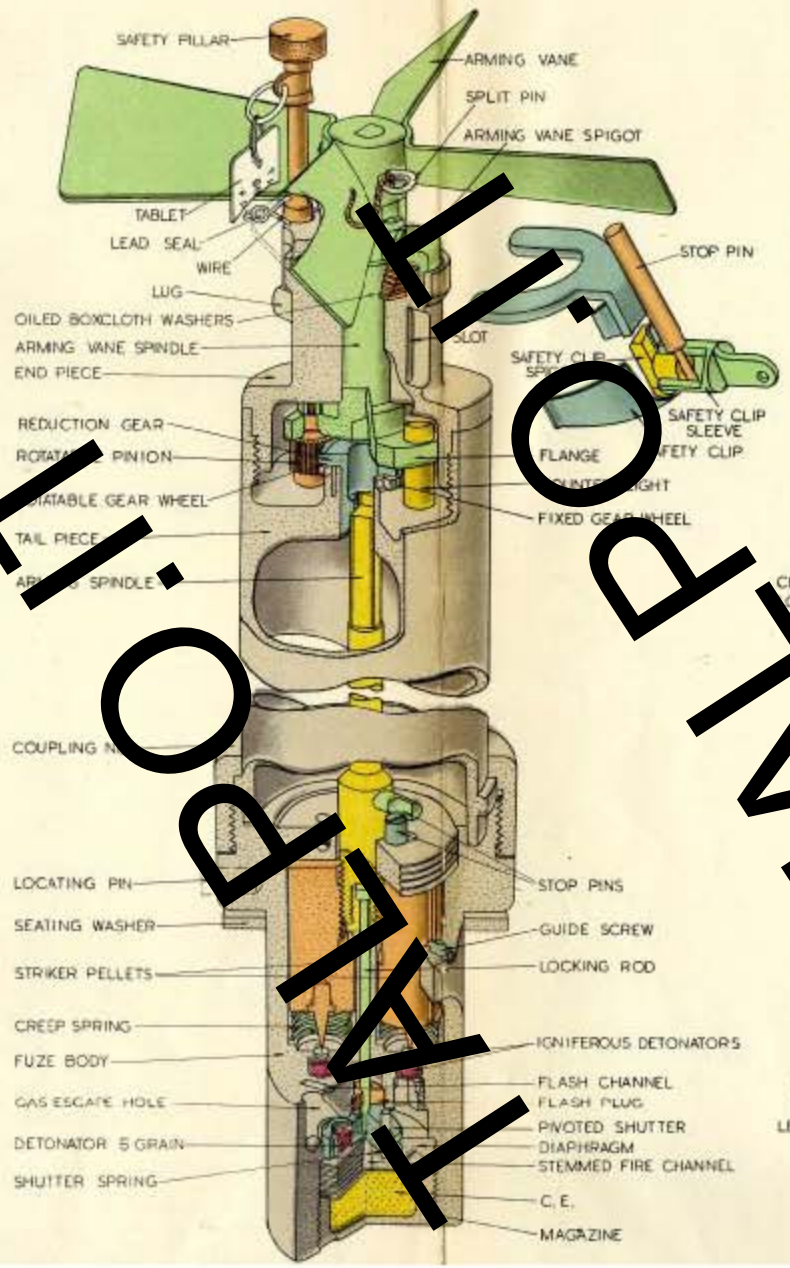


AIRCRAFT BOMBS

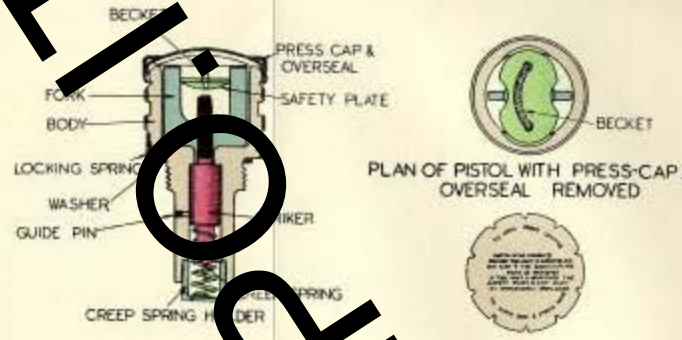
PLATE 32



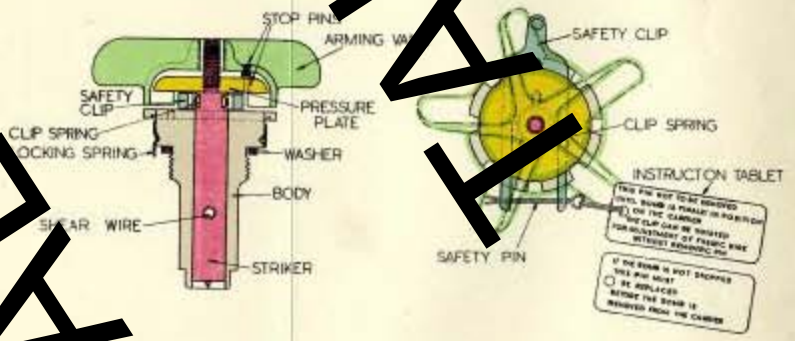
FUZE, PERCUSSION, AIRCRAFT BOMB, TAIL, NO. 30 MARK III



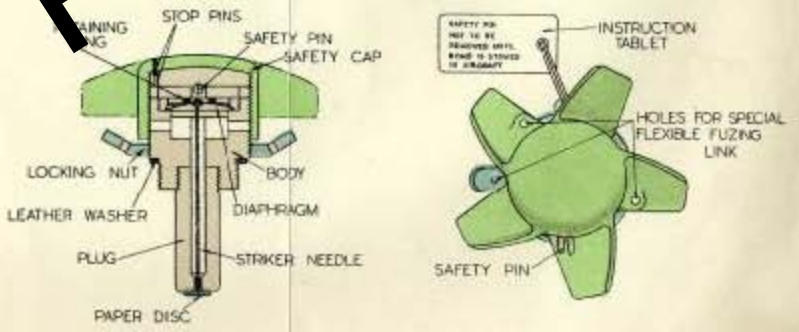
PISTOL, BOMB, TAIL, NO. 30 MARK III



PISTOL, BOMB, D.A. NO. 27 MARK I, I* AND II



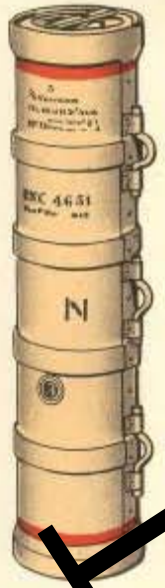
PISTOL, BOMB, D.A. NO. 44 MARK I



CASES FOR B.L. CHARGES

CLARKSON'S CASES AND CONTAINERS FOR B.L. CHARGES

PLATE 34



CASE, MAGAZINE, C.E.

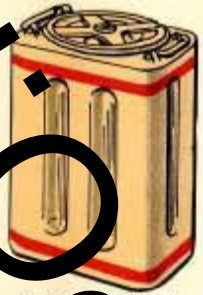
CASE, MAG. C.F. MK. II

CASE, POWDER - CYLINDRICAL 'M'

CASE, CARTRIDGE NO. 65 MARK III

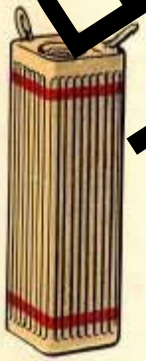
CASE, CARTRIDGE NO. 75 MARK I

CASE, CARTRIDGE NO. 72 MARK I



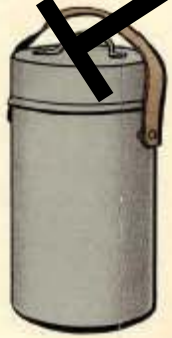
CASE, MAG. R.M.

CASE, MAG. R.H. MK. II



CASE, POWDER, RECTANGULAR W. MKS. III AND IV.

CASE, MAG. R.N. MK. I N.

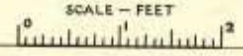


CASE, CARTRIDGE NO. 74 MARK I

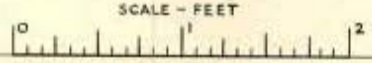
8 INCH BOXCLOTH WRAPPER

CONTAINER, CARTRIDGE B.L. 6 INCH MARK III

SCALE – FEET

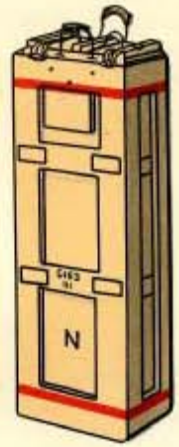


SCALE – FEET



CARTRIDGE AND AMMUNITION BOXES

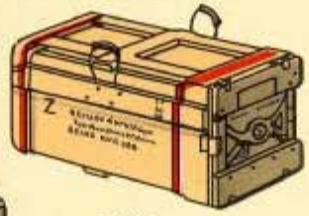
BOXES A.S.A. AND CASES M.L.



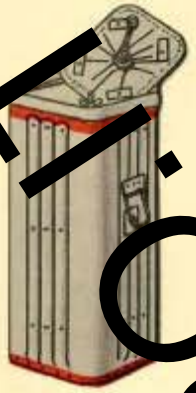
C.163

C.17

C190



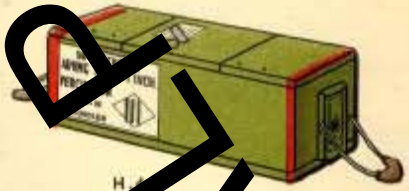
C.23



C.185

H.33

H.3 MK.I



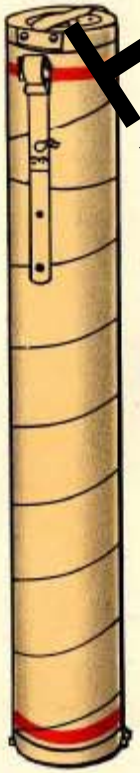
H.

C.119

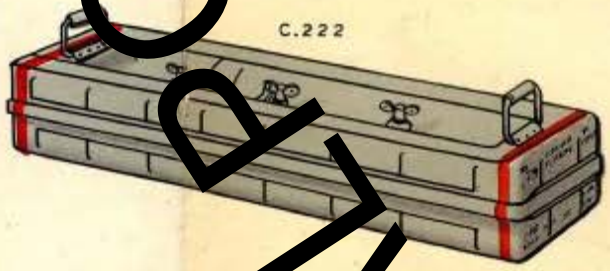
SCALE – FEET

0 1 2

CONTAINERS FOR Q.F. AMMUNITION



CONTAINER Q.F. 45
MARK III C.217



C.222

C.227

SCALE – FEET

0 1 2

C.118

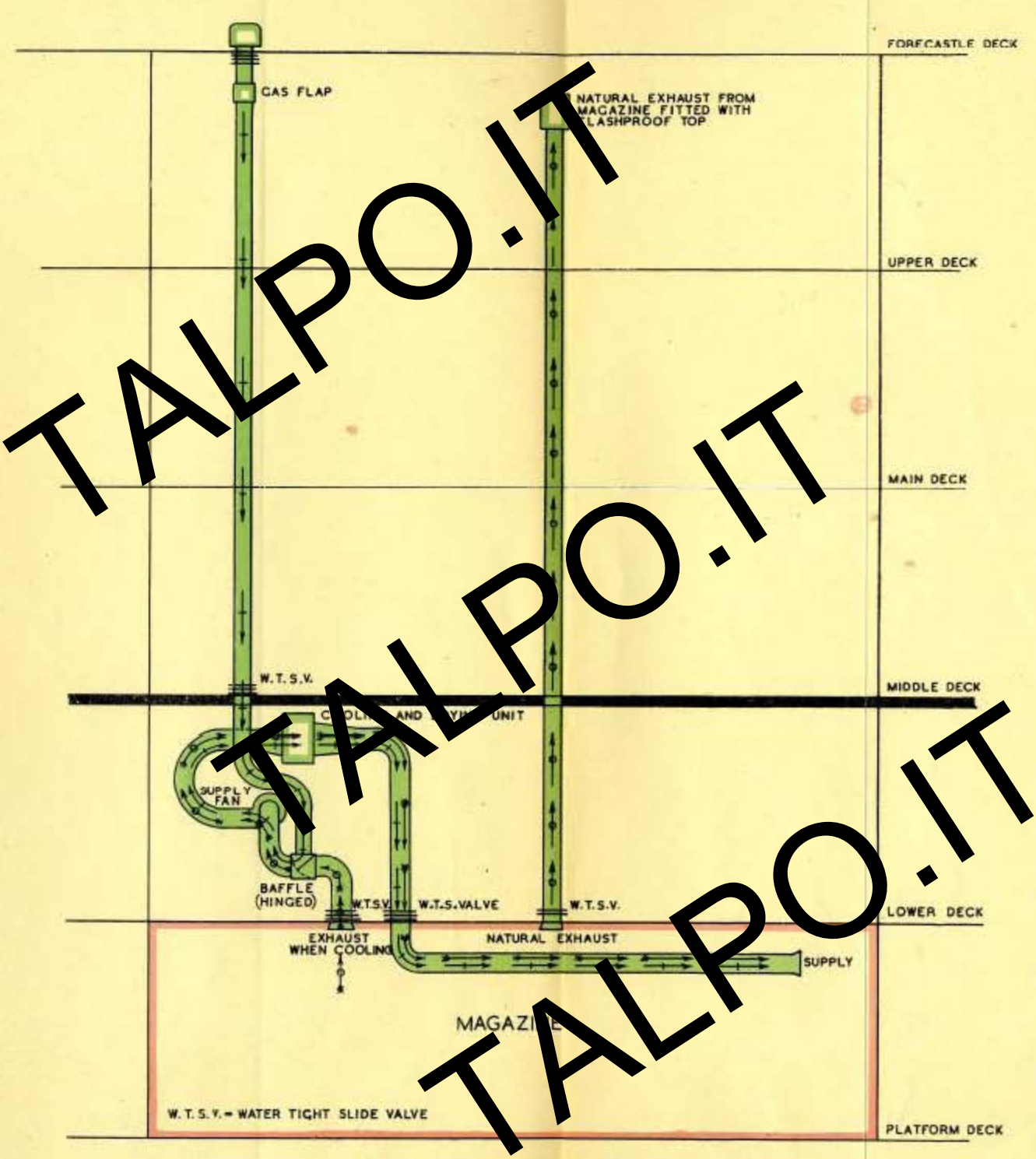
SCALE – FEET

0 1 2

C.121 MK. V

MAGAZINE VENTILATION, AIR COOLING AND DRYING, -DIAGRAMMATIC ARRANGEMENT

PLATE 40



NORMAL VENTILATION { OPEN AIR SUPPLY WITH ORDINARY VENTILATION SHOWN THUS
NATURAL EXHAUST " " " " "

AIR COOLING AND DRYING { SUPPLY TO MAGAZINE WHEN OPERATING ON CLOSED CIRCUIT
EXHAUST " " " " " " "