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REGULATIONS
FOR
ARMY ORDNANCE SERVICES
PART 7

1942

PAMPHLET No. 1

AN INTRODUCTORY SURVEY OF AMMUNITION

By Command of the Army Council,

THE WAR OFFICE,
17th June, 1944.

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46. Newer developments of grenades are variants of those mentioned. There are other grenades which are still in the service but are passing through the phase of obsolescence.

MINES

47. Service mines include the 75 grenade, the mine contact anti-tank, the mine, shrapnel and the mine, beach type C.

48. The mine contact A/Tk. is a flat cylindrical tin charged with H.E. Into a central cavity is fitted a fuze which is functioned by pressure on an exposed striker-head. Over the fuze a metal cover fits. Pressure on the cover is transmitted to the fuze and thus actuates the mine.

49. The mine, beach, is a much larger and heavier-cased mine containing more than 20 lb. H.E. A central fuze is seated in the top of the mine and a bow-shaped steel spring is arched over the fuze. A metal cover is seated above the bow-spring, whose curvature is reversed by pressure on the cover. Impact of the spring on the fuze sets off the mine.

50. The mine shrapnel is a cylindrical shaped mine that fits in an outer metal pot. The mine is equipped with a trip wire which on being disturbed releases the safety pin of a pistol; this in turn fires an internal cartridge to eject the mine from its pot. As the mine hops out of the pot a Mill's bomb type of handle is released and allows a striker to fall on a cap to fire a detonator and set off the explosive filling.

SMALL ARMS AMMUNITION

51. S.A.A. is exceedingly varied owing to a wide range of calibres, functions and packages which depend in detail upon the way the ammunition is to be loaded into the weapon.

52. Calibre include ·22, ·30, ·303, ·38, ·455, ·50, ·55 and 1 inch. 7·92, 9, 15 and 20 mm.

53. Functions include anti-personnel (for which ball ammunition is used),

armour piercing,
tracer,
incendiary,
H.E.,
observing,
blank, and
grenade discharging.

These types of round are distinguished by a coloured ring and/or an alphabetical symbol on the base. Some have coloured tips or stained cartridge cases. Some 20 mm. ammunition is fuzed.

54. Packing depends upon whether the rounds are to be loaded by a clip into a weapon or fitted into a belt for a machine gun. Some machine gun belts are packed complete with rounds, others are issued separately and filled from cartons by the user.

ROCKET AMMUNITION

55. Rocket ammunition is a comparatively new development.

The ammunition is bulky and is either of 2-in., 3-in. or 5-in. calibre.

The commonest types are used in an A.A. role and may be used to fire volleys on the shot-gun principle, effect depending upon concentration rather than the accuracy of single shots.

Rocket ammunition requires the best storage conditions.

PYROTECHNICS

56. Pyrotechnics comprise a very diverse range of signal, sound or smoke producers, including principally :—

signal cartridges (Verey lights),
signal rockets,
simulators, flash and sound to give the effect of gunfire,
ground flares,
smoke generators.

The majority are adaptations of fireworks. Smoke generators are tin canisters which may be as small as a two-ounce tobacco tin or as large as a two-gallon oil drum; they contain smoke compositions which function on ignition. The smoke may be for screening effect or coloured for ground-to-air signalling.

All pyrotechnics require dry cool storage.

DEMOLITION EXPLOSIVES

57. Demolition explosives are exceedingly varied in form and all have a high explosive risk and demand careful storage to ensure both safety and good condition.

The basic explosives are slabs of wet guncotton, slabs of C.E./T.N.T., gelignite or ammonal in fabric covered cartridges or in bulk.

These disruptives require in turn, intermediaries such as dry guncotton primers or C.E. primers; and also initiators, in the form of detonators, which are fired either electrically or by various forms of cord-like fuze, which may contain gunpowder or an H.E. core.

SECTION 4.—AMMUNITION IN THE FIELD

ORGANIZATION OF SUPPLY

1. Every unit takes into battle a certain quantity of ammunition as part of its war equipment. As this quantity is expended replenishments are obtained from the rear. A chain of supplies is organized to the unit from the base port.

This supply organization is necessarily elastic and will be altered from time to time if the location or intensity of the fighting changes considerably. The standard organization is briefly as follows :—

UNIT	The unit sends its own vehicles back to the ammunition point (A.P.), where they take on supplies from vehicles sent up by the R.A.S.C. This ammunition point is only a meeting place, and is changed frequently to avoid aerial observation.
R.A.S.C.	The R.A.S.C. lorries draw from small forward dumps operated by R.A.O.C. forward maintenance ammunition sections.
FORWARD DUMPS	The forward dumps draw from ammunition railheads (A.R.H.) operated by ordnance maintenance companies.
RAILHEAD	
B.A.D.	The ammunition railhead draws from the base ammunition depot (B.A.D.), which is normally established near a port. In some cases, where there is a considerable distance between the base ammunition depot and the railhead, an intermediate depot is established, known as an advanced ammunition depot (A.A.D.).

Forward Area ... Base Area

2. All concerned in the above chain of supply, from the unit rearwards, render a daily expenditure return or report of stock. In accordance with these reports, supplies are moved forward, to maintain at all times the reserves in the forward areas and in units' transport.

3. Ammunition with units either in transport or carried on the soldier is known as 1st Line Ammunition.

Ammunition carried in R.A.S.C. vehicles between units and railhead is known as 2nd and 3rd Line Ammunition.

CLASSIFICATION FOR STORAGE

4. Storage of ammunition in large static establishments is governed by its explosives group classification, and every package of ammunition carries an explosives group label for this purpose. *See* **Plate 6.**

For field storage, ammunition and explosives are classified into nine categories :—

Field Storage Categories.

*A.	Boxed ammunition (Q.F.) up to and including 3·45-in. calibre, that is, 25 pr. Q.F.
*AA.	Boxed Ammunition (Q.F.) above 3·45-in calibre: all Q.F. rounds with self destroying tracer: tails rocket U 2-in. and 3-in.
*B.	Component ammunition (B.L.). shell, fuzes, tubes, primers, gaines.
*C.	Bombs, grenades (except Nos. 73, 74, 75) and T.M. ammunition.
CC.	Grenades No. 73, 74, 75.
D.	Ammunition filled incendiary and smoke (white phosphorus) and pyrotechnics.
E.	Demolition explosives and components.
SAA.	All S.A. ammunition, that is, up to and including 15 mm. calibre.
CW.	Ammunition, charged chemical, and chemical and smok chargings in bulk.

SELECTION OF OPEN STORAGE SITES

5. The selection of a site for an ammunition dump is of extreme importance. An early reconnaissance must be made, and the following points borne in mind :—

(*a*) Sufficient area must be allotted for the correct storage of the target tonnage. There should also be sufficient room for expansion which is inevitable in time.

(*b*) The area must be free of floods. The state of the ground during the wettest season of the year should be ascertained.

(*c*) Good rail and road facilities are important. Transport must be able to get up to the stacks or close enough to employ only a few lengths of run-way.

(*d*) An area which provides natural cover and protection for the ammunition will lessen the work of providing this artificially.

(*e*) The area must be away from all other dumps and installations, to which it is a potential source of danger, such as petrol dumps, inhabited areas and any attractive targets for enemy bombing.

* Except incendiary, smoke (white phosphorus), signal and chemical.

Once the site is selected, the layout of the dump should be planned before the ammunition starts arriving. " Lines " should be surveyed, and areas allotted for captured and returned ammunition. Traffic arrangements are important, and the dump should be liberally sign-posted. A dispersal area away from the depot will be chosen, where lorries will be sent as soon as loaded. Only the number of vehicles that can be dealt with immediately should be allowed in the depot.

STACKING IN OPEN STORAGE

6. The best method of building stacks in the open will be determined by local conditions, for example, type of ground and materials available, but whatever method is used it must provide for adequate dispersal of stocks, preservation of the ammunition, and concealment from the air.

(*a*) **Disposal of stacks.**—The size of the individual stack should not exceed 9 feet x 9 feet x 5 feet high: this is the standard stack contained in a 21-piece I.G. shelter. There must be a clear ten yards between adjacent stacks in a group, and groups of stacks must be separated by the appropriate safety distances laid down in R.A.O.S., Part 7, 1942, Pamphlet No. 20.

(*b*) **Preservation.**—Ammunition should be kept clear of the ground by stacking on dunnage. Various forms of dunnage can be improvised, e.g. timber, timber off-cuts, bricks, cinders.

Added ventilation should be given by leaving air spaces in between the boxes in the stack, or by placing their cross-battens in between alternate layers of boxes.

The stack should be covered by a tarpaulin, with its edges pegged out away from the foot of the stack. The tarpaulin must not lie flat on the top of the stack, and for this purpose an improvised " ridge " should be made of branches or boxes.

(*c*) **Camouflage.**—Where possible, ammunition stacks should be sited so that artificial camouflage is unnecessary. This is possible in well-wooded country, or in road-side " dumps " where sections of banking can be cut out and replaced by ammunition stacks of the same height.

If artificial camouflage is unavoidable, it should be designed to blend as closely as possible with the local scenery. In stony, desert country, for example, stacks should be kept down to a maximum height of about three feet and covered with stones.

When camouflage netting is used, it must not conform to the shape of the stack it is intended to conceal, but should be stretched out and raised so that it prevents aerial observation of the shadow cast by the stack.

CONDITIONS OF STORAGE

7. Damp and excessive heat are the great enemies of ammunition in storage.

(*a*) **Damp** has three damaging effects: it may make ammunition unserviceable, dangerous or unrecognizable.

Unserviceability.—Damp is particularly damaging in its effects on powder-filled components, such as fuzes, primers and pyrotechncis. It also rots paper and fabrics and may make M.G. belts rotten, tending to jam in the gun. It spoils ammonal explosives with ammonium nitrate in them. Some propellants also take up moisture and become useless.

Danger aspect.—Gelignite contains metallic nitrates, and in a damp atmosphere these salts take up moisture: the texture of the gelignite then begins to break up and in time tends to exude nitroglycerine, which in the free state is exceptionally dangerous, besides being unpleasant to handle.

Damaged markings.—Damp rusts iron and steel articles and destroys identification markings.

It is not possible here to detail all the ill effects that moisture can give rise to, nor to emphasize too strongly the need for protection of all types from the ingress of moisture.

The first and best safeguard is not to open packages until the time comes to take the contents into use.

(*b*) **Heat.**—The effect of heat is to accelerate chemical decomposition, and as almost all explosives are inherently unstable compounds, protection from extreme heat is always an advantage. The explosives most seriously affected by heat are the propellants and other substances containing nitroglycerine, and special care should be given to ammunition containing these substances. When chemical decomposition of the contents is unduly fast, the ammunition becomes unserviceable before its time, and calls for replacements, which is both wasteful and expensive.

(*c*) **Extreme cold.**—The effects of extreme cold are purely physical and restoration to ordinary temperature normally brings the affected substance back to its original condition. The most important thing to watch in cold climates is the thawing period, when floods are likely.

HANDLING

8. (*a*) Good handling is most important as rough treatment may cause misfires, blinds, or prematures when the ammunition is fired. Packages, paint and markings also must be preserved.

Boxes must always be lifted, and not dragged, from place to place. **THEY SHOULD BE PLACED ON THE LORRY OR STACK AND NOT DROPPED OR THROWN.**

The following should be set aside and dealt with by an I.O.O.

Leakers.
Packages suspected of containing water.
Dropped packages. The height of drop should be noted.
Damaged packages.

(*b*) *Equipment for handling.*

The main item of equipment for handling ammunition is the gravity roller. They will be kept in good condition by :—

(i) storing under cover when not in use ;
(ii) keeping constantly oiled and renewing broken split pins.

Metal bars will not be used as buffers for boxes. This damages rollers.

For night issues, lamps suitably dimmed and illuminated traffic signs will be required.

(*c*) *In transit.*

Ammunition in transit needs the same protection as in normal depot storage. Covered vehicles should be used whenever possible, and always with time-fuzed ammunition. Open vehicles must be sheeted securely.

Ammunition must be securely loaded so that it will not be thrown about during shunting or travel over rough roads. B.L. shell should be secured by chocks nailed to the floor of truck or lorry to prevent rolling.

Lorries or wagons should be brushed out before use.

Lorries or wagons for shell should have floors at loading point protected by coir matting, unserviceable blankets, etc.

Ammunition must be loaded evenly, so that the weight is distributed between all wheels.

(*d*) *Points for attention.*

Packages containing the following should be treated with special care :—

(i) Q.F. cartridges with primer inserted.
(ii) Gelignite.
(iii) Bombs, grenades, etc., with detonator in place.
(iv) Star shell.
(v) Fuzes, tubes, primers, electric detonators.

The following call for careful handling in the case of B.L. shell :—

(vi) Driving bands.
(vii) Points of A.P. shell or shot.
(viii) Caps or capped shell.
(ix) Markings and paint.
(x) Base-fuzed shell ; avoid ramming base of one with point of another.

Steel boxes are easily damaged and liable to rust internally. Particular care must be taken to keep them dry and to avoid piercing or damaging the lid of one box with the corner of another.

Ammunition in " clover-leaf " packages is very liable to damage in the form of dented cartridge cases, and requires particular care.

(*e*) *Tonnage.*

It is difficult to give an accurate guide as to the tonnage of ammunition which can be handled by any number of men in a given time. Obviously, the nature of the ammunition and the circumstances and conditions under which it is being handled will affect the tonnage considerably.

For instance, B.L. shell, particularly the heavier natures, are in many ways more difficult to handle than the majority of boxed ammunition, while the comparatively easier handling of such light natures as Mines A/Tk., Mines Shrapnel and certain B.L. Cartridges is not sufficient to compensate for the loss of tonnage.

Furthermore, tonnage per man where double handling is necessary, for example, from truck to lorry and then from lorry to stack, are naturally very much lower than where only one handling is involved, for example, from truck or lorry direct to stack. In addition, weather conditions and hours of darkness also affect turnover.

An approximate turnover of 5 tons per man per eight hour day can be reckoned where double handling is involved. This rough calculation includes labour only, leaving out supervisory grades necessary for checking quantities, batch-lot numbers, etc.

Where direct handling only is involved, figures of upwards of 10 tons per man per eight hour day should be easily reached.

RETURN OF AMMUNITION TO ORDNANCE

9. (*a*) Ammunition is costly : for instance, a box of grenades 36M costs £2, a clip of S.A.A. 1*s.* and a 4·5-in. round of A.A. ammunition about £7 5*s.* Every round that has to be returned to Ordnance represents a loss of money to the nation, if it cannot be repaired, and an expense of time, labour and materials if repair is possible. Ammunition going back to Ordnance for repair is going " the wrong way " and is misusing transport.

(*b*) Units should keep as many packages as possible unopened. This keeps the ammunition serviceable for the longest possible time

and prevents the confusion of types in packages when it becomes essential for the unit to return all or some of its ammunition to Ordnance. When types are mixed in packages returned to Ordnance it hampers the work of making new issues. In any case the mixing of types is dangerous.

(*c*) Above all, it is essential that types which are assembled immediately before going into action, or before use in demolition, should, if they are not expended, be dissembled again before going back to store. The practice of returning to store such items as grenades 36M and G.C. slabs with the detonators in place is extremely dangerous and has given rise to a number of accidents.

(*d*) It is also prohibited to return Q.F. rounds to store with misfired primers in place : several accidents have arisen from this source.

SALVAGE

10. (*a*) Live ammunition that for any reason has become surplus to requirements is a valuable source of metal salvage. So are also the non-explosive components, including packages left over after firing, and the care of these items in good condition with a view to their ultimate end as salvage is important.

(*b*) Ammunition empties must be stored and transported separately from filled ammunition. Units should be particularly careful not to leave unfired ammunition and explosive components, e.g. unfired portions of cartridges, in packages returned as non-explosive salvage.

FIRE PRECAUTIONS

11. (*a*) The possible results of a fire in an ammunition dump are well known. To deal with fires successfully demands speed of action, knowledge of the equipment available and of the ammunition that is on fire. Fire appliances must be sufficient and so placed as to enable them to be got into action quickly. Training in fire fighting should be given high priority, and fire orders so framed that both equipment and men are kept highly efficient.

The following points are of particular importance :—

(i) Phosphorus ignites spontaneously in contact with air. A phosphorus fire may appear to have been put out by water but re-ignites if allowed to dry.

(ii) Propellant in bulk may burn to a very violent explosion.

(iii) Fires may be caused by pieces of glass or tin concentrating the heat of the sun.

(*b*) **The System of "Fire-Risk Classes."**

When outside assistance is secured to help fight an ammunition fire, it is essential that the newcomers should know the contents of each stack, and how the ammunition will behave should the flames get a hold on it.

To enable them to obtain this information immediately and on the scene of the fire, all ammunition and explosives have been divided into five " Fire-Risk Classes." These can be briefly summarized as follows :—

		Corresponding Explosive Groups
Fire Risk Class 1	Explosives, in bulk or in ammunition, which will almost certainly explode or detonate *en masse* immediately fire reaches them.	I and II.
Fire Risk Class 2	Explosives, in bulk or in ammunition, which are readily ignited and burn with great violence without necessarily exploding.	III and IX
Fire Risk Class 3	Explosives, in bulk or in ammunition, which ignite comparatively slowly or with difficulty and which may, or may not, detonate after ignition.	IV, V, VI, VII, VIII and X.
Fire Risk Class 4	Substances, in bulk or in ammunition, liable to spontaneous ignition and which burn fiercely, or substances which give off dense smoke, with, in some cases, toxic effects.	XI and XII.
Fire Risk Class 5	C.W. preparations, in bulk or in ammunition, offering no risk of mass explosion, but from which toxic effects are likely to be serious.	XIII.

The fire-risk class of each group of stacks of ammunition will be marked by the appropriate symbol, *see* **Plate 7.** Each symbol is to be made approximately 12-in. overall dimension, painted yellow, and mounted on a post.

TECHNICAL MATTERS

INSPECTION OF AMMUNITION

12. Inspecting ordnance officers and ammunition examiners are responsible for inspection of ammunition, and to provide advice on storage. Mobile ammunition repair units are equipped to carry out minor repairs and repacks in forward areas. Application for the services of an I.O.O. or an A.E. should be made to local formation headquarters.

DEFECTS IN AMMUNITION

13. (*a*) Ammunition is frequently blamed for failures where the matter is actually the fault of the unit who have not exerted proper maintenance, especially in the way of the waterproofing of fuzes in ready-for-use ammunition. The " Notes on Care and Maintenance of Ammunition " should be studied. Faulty drill and preparation of ammunition sometimes also proves to be the cause of a failure that may at first sight be due to defective ammunition.

(*b*) Ammunition that is definitely faulty should be reported at once to local formation headquarters where the inspecting ordnance officer will investigate the matter in every detail. Early reporting of defects is of importance, as ammunition of the same lot or date of manufacture all over the world may be affected and may need to be withdrawn or at least used under special instructions.

ACCIDENTS WITH AMMUNITION

14. (*a*) Accidents are in very rare cases due to faulty ammunition. The great majority are due to carelessness of one kind or another. Whatever the apparent cause they must be reported *at once* for investigation.

(*b*) It must be remembered at all times that ammunition is designed to kill, and that it cannot discriminate between friend and foe. There is only one correct way of using ammunition and that is to store it and to handle it with the greatest care in every sense, and eventually to use it in the proper manner, either at practice or against the enemy. **ANY OTHER TREATMENT IS A BREACH OF DISCIPLINE.**

(*c*) Apart from the very infrequent trouble with faulty or defective ammunition, the causes of accidents fall roughly into three classes :—

(i) irregular storage or bad maintenance ;
(ii) illegal possession of " souvenirs " by troops or civilians ;
(iii) ignorance of technical details ;
(iv) neglect to clear ranges ;
(v) illegal breaking down or tampering with ammunition, serviceable or otherwise.

(*d*) **Custody and maintenance.**

At any one time, a unit should have in its possession only the smallest number of opened packages compatible with operational or practice requirements. The observance of this rule will ensure the highest possible proportion of fully serviceable rounds being in the unit's possession at any time, and will prevent pilfering.

(*e*) **Illegal possession or retention by troops.**

Attention must be paid to the recovery after practice of unexpended small natures of ammunition such as hand grenades. These are frequently kept for private experiments or for souvenirs, either as they stand, or after breaking down. Illegal experiments and souvenir collecting among all ranks is strictly forbidden.

(*f*) **Ignorance of details of drill and of safety measures.**

This is a very large field, and gives rise to many accidents. As typical cases may be quoted :—

(i) Firing mortar ammunition through foliage.
(ii) Wrong preparation of grenades, etc.
(iii) Repacking of rounds with misfired primers among serviceable ammunition.
(iv) Neglect to remove primers and detonators from demolition charges when these have been made up but not expended.
(v) Use of practice ammunition for drill purposes.

Accidents of this type can only be eliminated by constant training.

(*g*) **Neglect to clear ranges.**

The victims of this neglect are usually civilians, and not infrequently children.

(*h*) **Illegal breaking down.**

Breaking down, or sectioning of, or tampering with ammunition by any person not in possession of a special War Office certificate authorizing breaking down or sectioning, is forbidden, as is also the carrying out of experiments involving the use either of unauthorized types of propellants and explosive fillings, or of increased charges of service propellants.

SECTION 5.—MARKING OF AMMUNITION

GENERAL

1. (*a*) All Service ammunition bears means of identification, generally in the form of stampings, colourings and stencillings. A guide to some of the commoner Land Service markings is given in the following lists, and in **Plates 8 and 9.**

(*b*) Departures from these markings may be found due to the existence of old stocks marked in accordance with pre-war codes,

or the introduction of new types of ammunition for which markings have not yet been standardized. In case of doubt, reference should be made to an I.O.O.

(*c*) Markings concerning the *empty* ammunition and its inspection before filling are stamped into the metal.

(*d*) The subsequent painting and stencilling of ammunition is designed to enable :—

(i) easy identification in the field ;

(ii) sorting by unskilled labour ;

(iii) identification of lots or batches in which failures have occurred, necessitating withdrawal ;

(iv.) protection against rust.

MARKINGS ON PROJECTILES

2. (*a*) **Stampings.**—Details regarding the metal body of a projectile will be found stamped on the base if it is a " separate " projectile, and on the side if the projectile forms part of a Q.F. " fixed " round. These stampings are of interest almost entirely to technical personnel.

(*b*) **Painting.**—After manufacture of the metal body of a projectile, it is painted all over in a distinctive colour, to indicate its general type. Further markings may then be super-imposed. *See* table on page 29.

(*c*) **Miscellaneous colourings.**

Black band round shell above driving band	Gun shell. Used where both gun and howitzer shell of the same calibre exist.
Two vertical black strips OR Two vertical white strips	Economy driving bands.
Circular green disc	Smoke box.
Red " X–X–X " around nose	Filled explosive suitable for limited storage only overseas

(*d*) **Stencilling** (*see* **Plate 10.**)

Calibre of projectile.
Mark of projectile, followed by letter indicating the C.R.H.
" Gun " or " How " or " Gun and How," as applicable.
Monogram of filling station.
Date of filling.
Series number in a ring to distinguish the filled lot.
T if fitted with tracer.

MARKINGS ON PROJECTILES

(*Referred to in* **Sec. 5, para. 2**)

Type of Projectile	Body Colour	Bands round Body	Rings on Ogive (near tip)	Coloured Tips
H.E. Shell ..	Yellow	No band .. Lyddite Plain green band .. Amatol 80/20 Plain green band with " 60/40 " .. Amatol 60/40 Plain green band with " T.N.T." .. T.N.T. Two black bands .. Practice	Red .. .. Contains explosive Red " XXX " Contains explosive suitable for overseas storage. Brown .. Cast iron or semi-steel White .. S.A.P. Two white .. A.P.C. Black .. Combustion fuze necessary	Black .. Amatol filled shell, not containing a smoke box
Smoke Shell ..	Green	Yellow band Practice	Red .. Contains explosive Brown .. Cast iron or semi-steel (Not to be confused with Detector Paint No. 2)	
Shot	Black	Yellow .. Practice (the normal round has no band)	Red .. Contains explosive Brown .. Cast iron or semi-steel White .. S.A.P. White ring below white tip .. A.P.	White tip above white ring .. A.P.
Gunpowder filled shell	Black	Yellow .. Practice (the normal round has no band)	Red .. Contains explosive	Red .. Shrapnel
Chemical Shell	Grey	Yellow .. " Y " type filling Green .. " G " type filling Black .. " B " type filling	Red .. Contains explosive Brown .. Cast iron or semi-steel	

MARKINGS ON B.L. CARTRIDGES

3. These are, in the main, a repetition of those on the outside package, which is described in detail further on. The markings are stencilled in black on the cartridge bag and include :—

Calibre of gun.
Mark of cartridge.
Weight of charge.
Nature, size and lot number of propellant.
Propellant code letter.
Date of filling.

MARKINGS ON Q.F. (SEPARATE) CARTRIDGES

4. Similar markings to those on B.L. cartridges, but differently applied. The calibre and mark are stamped into the base of the cartridge case, and the remaining markings stencilled with silver nitrate on the side of the case.

The lot number, filler and date of filling of the primer will also be found stamped into its face.

MARKINGS ON Q.F. (FIXED)

5. The fact that Q.F. cartridges are made up into batches reduces the number of markings that need be put on the cartridge case. Since all the rounds in each batch are made up from the same components, the batch number of a round is all that need be known.

This batch number, and the propellant code letter, are stencilled in silver nitrate on the side of the cartridge case. The batch number consists of several numerals prefixed by a letter indicating the type of projectile. The various letters used for this purpose are as follows :—

A—Shrapnel	F—Target
B—H.E.	G—Case shot
C—Smoke	H—H.E., Streamline
D—A.P. and Steel	J—Smoke, Streamline.

The above types are " Service " rounds, that is, containing the full charge of both propellant and explosive. Other types exist for

practise purposes and these will have one of the following batch prefix letters according to the type :—

Reduced charge	L. Shrapnel. M. H.E.
Practice, full charge	N. H.E. P. A.P. Q. Common, base fuzed. R. Common, nose fuzed (C.N.F.). S. Practice projectile (filled). T. Practice (weighted) and practice shot, and sub-calibre shot.
Practice, reduced charge.	U. Practice projectile. X. Practice shot, flathead and pointed.
Practice, burst short charge.	V. Shrapnel. W. Practice projectile.

MARKINGS ON S.A. CARTRIDGES

6. The date of manufacture of a small arms cartridge is shown by stamping the last two numerals of the year of manufacture into the base of the round.

If it is other than a ball cartridge, a code letter will also be found stamped into the base of the round. The series of code letters is given below, together with the various " annulus colours." (" Annulus " is the name given to the ring surrounding the cap in the base of the cartridge.)

Type of Round	Code Letter	Colour of Annulus
Ball	Nil	Purple
A.P.	W	Green
S.A.P.	F	Green
Tracer	G	Red
Incendiary	B	Blue
Blank	L	Colourless
Observing	O	Black
Grenade discharger	H	Colourless
Smoke generator discharger	E	Colourless

PROPELLANT CODE LETTERS

7. Each type of propellant is known by a code letter, for example, " B " for ballistite. The appropriate propellant code letter is marked on all B.L. or Q.F. cartridges and on their packages. To avoid confusion with other markings, the propellant code letter is framed inside a square, as shown in **Plate 11.**

Cartridges marked " A," " K," " L " or " X " contain flashless propellant ; all other types are non-flashless.

A=Cordite N and N.Q.
B=Ballistite.
C=Cordite R.D.B. in cord or tube.
D=Cordites M.D., M.C. or M.D.C. in cord or tube.
E=Cordites W. or W.M.
F=Cordites M.D. or R.D.B. in flake.
H=Cordite H.S.C.
J=Cordite Bofors.
K=F.N.H./D.B.
L=F.N.H. or F.N.H./P.
M=M.4.X.
N=N.C.T. of 1914 to 1918 manufacture.
O=N.H. Powder.
S=Cordite S.C. and S.U.
X=Cordite A.N.

The letter D in a circle indicates drilled cordite.
The letter G in a circle indicates grooved cordite.
} Applicable to Rocket U ammunition only.

SECTION 6.—MARKING OF PACKAGES

A.—MARKING OF PACKAGES OTHER THAN S.A.A. PACKAGES

GENERAL

1. With the very large number of packages containing ammunition' some of them very similar in appearance, it is necessary to be able to identify the contents readily and with certainty. A system of marking to be applied to packages has been evolved and is standardized to a large extent.

It is necessary to paint steel packages with a rust preventative and to colour wood boxes as a camouflage measure. Both these requirements afford a means of indicating their contents by the ground colour of their coating.

GROUND COLOURS OF PACKAGES

2. The number of colours which retain their distinctive appearance when exposed to sun and weather is small, so that only a few distinctions can be made by the ground colours. The following are used :—

Steel or wood boxes to contain smoke producers	LIGHT GREEN
Steel or wood boxes to contain chemical stores	GREY

Steel or wood boxes to contain incendiary stores	DULL RED
Packages containing gunpowder and blank cartridges	BRIGHT RED
All steel packages except those mentioned above	SERVICE COLOUR

Note.—Service colour was formerly dark bronze green but has recently been changed to No. 2 Camouflage Brown, so that both colours will be met in service.

Wood ammunition packages except those mentioned above ..	VANDYKE BROWN STAIN
Metal containers for bulk ammonal, wet or dry guncotton and other miscellaneous explosives, also metal liners in certain wood packages..	BRUNSWICK BLACK VARNISH

Rolled paper containers are, in general, painted Service colour, except where it is necessary to impregnate them with wax for waterproofing.

COLOURED BANDS

3. Distinctive coloured bands, as shown below are superimposed on the ground colour to indicate special features :—

BROAD YELLOW	Packages containing ammunition made, or converted, for practice purposes.
BROAD WHITE ..	Packages containing ammunition made up with charges giving lower velocities than Services charges, e.g. Burst short cartridges, the letters " B.S. " being stencilled on the band : Reduced charges, with " RED " stencilled on the band.
NARROW WHITE	Packages containing drill or instructional grenades and drill detonators.
NARROW YELLOW	As applicable on packages containing chemical stores (on grey ground). The letter and figure denoting nature and number of chemical charge will be stencilled on the band, in BLACK on the yellow or green band, and in WHITE on the black band.
NARROW GREEN	
NARROW BLACK	
NARROW BLUE ..	Horizontally on Box C. 207 (Mk. I only) containing Q.F. 2-pr. H.V. rounds, with the letters " HV " stencilled on the band in yellow.

3-in. and 2-in. Mortar carriers bear coloured bands to denote filling as under, and the top cylinder is stencilled as indicated :—

Colour of Band	*Nature*	*Stencilling*
Yellow	H.E.	Batch particulars
Green	Smoke	Batch particulars
Green	Smoke Em.	" SMK " and " EM " (either side of band)
Black	Practice	Batch particulars
None	Star	" STAR "
None	Drill	" DRILL "

In addition to the green bands, coloured bands are painted round the carrier to agree with bands on smoke bombs.

COLOURED PATCHES AND STRIPES

PATCHES

4. BLUE .. .. Boxes containing HIGH velocity rounds for Q.F. 2-pr. Mks. IX and X guns and Q.F. 6-pr. 7 cwt. with the letters " H.V." stencilled on the patches. Certain mortar bomb boxes also have panels painted blue.

KHAKI-BROWN (DARK STONE) Boxes containing SUPER velocity rounds for Q.F. 2-pr. Mk. XB gun with the letters " S.V." stencilled on the patches.

STRIPES

BLUE .. .. Painted at the vertical edges of Box C.167A containing Q.F. 2-pr. A.P.C.B.C. rounds.

SYMBOLS

5. GREEN DISC .. To indicate presence of smoke box in certain H.E. shell when packed. The letter " A " or " B " indicating material of smoke box—when of aluminium or bakelite respectively, stencilled in black on the disc.

ALUMINIUM PAINT DISC To indicate presence of flash producing composition in shell filling.

TRACER SYMBOL To indicate that shell is fitted with tracer or tracer fuze, as applicable.

RED CROSSES or RED " X–X– " On ends of boxes containing shell which bear a similar marking round the nose, indicating suitability for hot climates or limited life in hot climates, respectively.

YELLOW DIAMOND On the side of boxes and containers for ammonal.

STENCILLING

6. In addition to the ground colours, coloured bands, patches and symbols on packages, details are given in lettering which is usually stencilled. This marking is done in yellow, except on grey packages where it is black. On certain wood packages that have been oil dressed, the letters " O.D." will be stencilled.

The letter " Q " was formerly marked on Q.F. ammunition boxes, and on the cartridge themselves, to show that the primers were filled with " Q.F." composition. At this time there was another type of primer in the service filled with " A " composition. This second type is no longer used, and " Q " primers are standard. The distinctive " Q " marking is therefore unnecessary, and has been omitted from recent manufacture. It may still be found on old stocks.

The following list gives particulars of typical stencilled markings to be found on various types of ammunition packages with a reference to the Fig. numbers showing the arrangement of the markings :—

(*a*) **Boxes, steel, containing Q.F. Fixed Ammunition.** (*See* **Plate 12.**)

Number of cartridges packed, calibre and nature.
Batch letter and number, also sub-batch letter, if any.
Particulars of fuze (or " PLGD " if plugged rounds are packed).
Fuze factor correction (as applicable).
Propellant code letter, enclosed in a rectangle.
Packing serial number of box, stencilled in WHITE.

(*b*) **Boxes, steel, containing Q.F. separate loading cartridges.** (*See* **Plate 13.**)

Number of cartridges packed. Calibre and Mark.
Weight of charge, as applicable.
Lot No., nature and size of propellant, as applicable.
Propellant code letters, enclosed in a rectangle.
" FOIL," when applicable.
Initials or monogram of filling station and date of filling.
Primer Lot No. and date of filling.
Packing serial number of box, stencilled in WHITE.

(*c*) **Boxes, steel, containing projectiles.** (*See* **Plate 14.**)

Number of shell packed, calibre and nature.
Particulars of fuze (or " PLUGGED " if plugged rounds are packed). Filler and Lot No.
" T.N.T." if shell are so filled, or fraction denoting composition if shell are filled Amatol.
Green disc when H.E. shell contain smoke box. (" A " or " B " stencilled on disc, as applicable, denoting type of smoke box.)
Design No. of M. of F. shell.

FOREWORD

Supply of ammunition in war is vital. Shortage may seriously hamper operations; failure in supply may mean disaster. It is of the utmost importance that every soldier should be able to recognize all the different types of ammunition with which he comes into contact and to have a general idea of their use. A close study of this pamphlet will supply the essential knowledge he needs to handle safely and use effectively the ammunition with which he is equipped.

CONTENTS

Mark of shell.
Place and date of filling.
Red " XXX " or " X–X–" when shell bear a similar marking round the nose.

(*d*) **Boxes, ammunition, containing Q.F. Howitzer complete rounds.** (*See* **Plate 15.**)

Number of shell, cartridges and fuzes packed.
Calibre. Nature of shell filling.
Design No. of M. of F. shell and date and place of filling.
Propellant code letter, enclosed in a rectangle.
Lot No. of propellant.
No. and Mark of fuze and filled Lot No.
Monogram of station and date of packing.
Packing serial number of box, stencilled in WHITE.

(*e*) **Boxes, wood and steel, containing B.L. Cartridges.** (*See* **Plates 16 and 17.**)

Number of cartridges packed.
Charge, as applicable.
Calibre, weight and mark of cartridge. (" FOIL " added, when applicable.)
Nature of propellant, size and Lot No.
Propellant code letter enclosed in a rectangle.
Monogram or initials of filling station and date of filling.

(*f*) **Cylinders containing B.L. Cartridges.** (*See* **Plate 18.**)

Number and nature of charges packed.
(" SUPER CHARGE " or " H.V." charge, when applicable.)
Calibre, weight and mark of cartridge. (" FOIL " added, when applicable.)
Nature of propellant, size and Lot No.
Propellant code letter enclosed in a rectangle.
Monogram or initials of filling station and date of filling.

On both ends of skeleton case :—

Calibre
Lot No. of propellant.

(*g*) **Boxes, steel, containing Mortar Ammunition.** (*See* **Plate 19.**)

Number of bombs packed, Calibre and Mark.
" FM ", " CSAM " or " PHOS " as applicable, when smoke bombs are packed.
(" PHOS " stencilled on lid in RED) or " H.E." when H.E. bombs are packed.
Number of augmenting cartridges packed and weight.
No. and mark of fuze (or " PLGD " if plugged rounds are packed).
Batch letter and number, also sub-batch letter, if any.

LABELS

7. All packages containing explosives bear a Government Explosive label and, in the case of batched ammunition, a Batch label. Affixed inside the lid is a Packer's label. In addition, one or two sealing labels (according to type of package) are so placed that the seal must be torn before the package can be opened.

B.—S.A.A. PACKAGES

GENERAL

8. Small-arm cartridges are normally made into cardboard cartons, chargers and bandoliers, small tin boxes or belts. These are packed and sealed into tinned plate linings, which fit into outer wooden boxes. The contents of the wooden box are indicated by the ground colour of the box, by the stencilling and labels superimposed, and in some cases by raised metal letters for night identification.

BOX COLOURS

9.

Containing cartridges packed in bundles, cartons or tin boxes	Yellowish green
Containing belt-packed cartridges ..	Bluish green.
Containing charger, case charger and bandolier packed	Brown

Boxes containing belt-packed cartridges are further distinguished by a V-shaped batten on each end, carton or bundle-packed having a plain batten.

STENCILLING AND LABELLING (*see* **Plate 20**)

10. All boxes S.A.A. have a large distinguishing label affixed to each side, which states the number of rounds, type of ammunition and method of packing. This information is repeated on a small descriptive label affixed to the top of the box.

Printed on each distinguishing label will be found a coloured symbol. There is a different symbol for every type of round, for example, a cockerel for ·30-inch Ball and a grid for ·303-inch Ball. These symbols are useful when giving directions to persons unable to read English.

Stencilled on each box are the box number, gross weight, make and date of the ammunition in some cases, and the letters " O.D." (oil-dressed) where necessary.

RAISED METAL LETTERS OR FIGURES

11. Raised metal letters and/or figures are screwed to the ends of boxes containing certain types of S.A.A. to assist identification

in the dark. The following are either already in use or are being adopted :—

B	·303-in. Incendiary	15	15 mm. Ball
O	·303-in. Observing	15W	15 mm. Armour-piercing
H	·303 in. Rifle grenade	15G	15 mm. tracer
		15WG	15 mm. A.P. tracer
5	·5-in Ball		
5W	·5-in. armour-piercing	9	9 mm. Ball
5P	·5-in. S.A.P.	9G	9 mm. Tracer
5B	·5-in. Incendiary	4	·45-in. Ball
55	·55-in. Ball	M	Mixed packing of any type
55W	·55-in. Armour-piercing		
55G	·55-in. Tracer		
7	7·92 mm. Ball	X	Unusual method of packing
7G	7·92 mm. Tracer		
7B	7·92 mm. Incendiary		
7W	7·92 mm. Armour-piercing		

SECTION 7.—SOME AMERICAN AMMUNITION TERMS

1. Each type of round is given a " Model number " which consists of the letter " M " followed by an Arabic numeral. If a modified version is brought out, the letter " A " is added followed by a numeral. Thus " M86A3 " is equivalent to " No. 86 Mark IV " in the British nomenclature system.

2. The following are common American terms used in connection with ammunition :—

American Term	British Equivalent
Adapter plug	Plug fuze hole
Black powder	Gunpowder
Blasting cap	Detonator
Boat-tailed shell	Streamlined shell
Booster	Gaine
D.P. (deck-piercing) bomb	Armour-piercing bomb
Fixed ammunition	Q.F. fixed ammunition
Loaded	Filled
Limited standard	Obsolescent
P.D.F. (point-detonating fuze)	Percussion fuze
Rotating band	Driving band
S.D.T. (shell-destroying tracer)	Tracer-igniter shell
Semi-fixed ammunition	Q.F. separate ammunition
Separate loading ammunition.	B.L. ammunition
S.Q. (super-quick fuze)	Direct action fuze
T.S.Q.	Time and percussion fuze with direct action

SECTION 8.—GLOSSARY

A.P.	Armour piercing : applied to any projectile specially designed to penetrate armour.
A/Tk	Anti-tank. (Note that the abbreviation A/T is incorrect.)
Ballistite ..	A type of propellant used in rifle grenade cartridges.
B.L.	Breech loading. Originally used as in opposition to " M.L." (which see) but now applied particularly to a gun or howitzer of which the propellant charge is contained in a fabric bag and not in a brass cartridge case.
Blank charge ..	Mainly for ceremonial use. Normally gunpowder.
Blind	Ammunition which has failed to explode. Applied to projectiles, grenades, demolition charges.
Bore	The interior of a gun or other weapon into which the projectile is loaded for firing.
Bullet	The projectile in a small arms cartridge.
Burst-short charge.	For A.A. practise firing at target aircraft.
Cartridge ..	A term applied to the propellant charge of any gun or howitzer, complete with the fabric (B.L.) or brass (Q.F.) container. When the cartridge is fixed to the projectile as in S.A. or A.A. ammunition the whole round is known in official nomenclature as a " cartridge."
Case shot ..	Filled with shot which scatter as they leave the muzzle. This type is practically obsolete.
Chamber ..	The space in the bore behind the projectile when it is in place ready to fire. It contains the propellant charge.
Charge	The quantity of propellant in a cartridge. The terms first, second, third charge, etc., refer to combinations of the sections of certain cartridges which can be varied to give different ranges, striking velocities and angles of impact of the projectile. The term is also used to indicate a quantity of explosive used in a demolition, or more loosely still, to indicate any quantity of explosive used for a particular purpose.

Component .. Any individual part of a complete round, for example, the igniter set of a grenade 36M or the fuze of the Bomb 3-in. S.B.

Composite charge Incorporates different types or sizes of propellant in the same cartridge, in order to avoid the " all burnt " position being outside, or too close to, the muzzle when firing the smaller charges.

Crimping .. The method of fastening one object to another by squeezing with fluted pliers, with particular reference to detonators and safety fuze.

C.E. .. .. " Composition Exploding." A sensitive high explosive used chiefly as an intermediary between the fuze and the main filling of a shell or other projectile.

C.R.H. .. .. The determining factor for the ratio of the radius of curvature of the tapered part of a shell in front of the shoulder to the main diameter of the shell. The shape of the shell is described as n C.R.H. where n is the ratio in question.

Crown Cork .. (*a*) A metal disc with an inner cork washer, used to seal a bottle or tin by crimping over the neck.
(*b*) A cork with a metal top or crown.

Decoppering .. Charges for the purpose of preventing coppering contain a certain amount of tin foil. The tin foil is either placed inside the cartridge or in some cases it is loaded separately. On firing the tin foil melts and is sprayed on the bore of the gun. The tin combines with the copper deposited in the bore to form a brittle alloy, which is swept away by the next projectile.

Detonation .. A very violent form of disruption. More violent and rapid than an explosion and producing smaller fragments of the shell or projectile concerned. Travels through materials as a wave motion. Not a form of burning. *See* Explosion.

Detonator .. A small metal container (usually of copper or aluminium) containing mercury fulminate or other initiatory substance, for setting off explosive trains, in fuzes, etc.

Driving band .. A soft metal band usually of copper, fixed to a projectile, which bites into the rifling when the projectile is fired and causes it to rotate in flight.

Exploder .. (*a*) A small bag of sensitive H.E. used as an intermediary between the fuze and the main filling in some projectiles.
(*b*) (Exploder, dynamo) an electro mechanical device for generating a small electric current for a short time for use in demolition.

Explosion .. A very rapid rate of burning, *see* Detonation.

Explosive .. A substance or mixture of substances which, when suitably initiated, is rapidly converted into gas with liberation of heat. *See* " H.E.," " Propellant."

Exudation .. In certain conditions some explosive fillings will seep out between the junctions of fuze and body, etc., of shell grenades and so on: both the process and the messy product that appears on the outside of the round are known as exudation.

Fractional charge. A general term used to describe charges which are supplied in sections.

Full charge .. The standard Service charge for which the equipment is designed.

Fuze .. .. A term applied to two different types of appliance :—
(*a*) The component in any round of ammunition that initiates the explosive train, by a combination of mechanical and explosive devices.
(*b*) A ready-made continuous train of explosive contained in a fabric tube and capable of being cut into appropriate lengths. *See* Fuze, safety, and F.I.D.

Fuze, safety .. A ready-made continuous train of gunpowder in a fabric tube, burning at 90±15 seconds per yard.

F.F.C. .. .. Fuze Factor Correction.—Each lot of combustion fuzes used with anti-aircraft ammunition (complete rounds) is allotted a correction factor from the results found at proof.
It is necessary when ranging, etc., with A.A., that reliable results be obtained, and this being so it follows that if the fuzes are grouped together to give, as far as possible, the same time of burning, great assistance is given to the gunners. As in a full " Batch " of Q.F. ammunition all the fuzes are of one lot number it follows that all the rounds of the batch will have the same fuze factor correction.

	When issuing to units, batches giving the same F.F.C. should be selected. The F.F.C. is plainly stencilled on all the boxes and is also marked on the fuze cap.
F.I.D.	Fuze instantaneous detonating. A metal-covered continuous type of fuze, used for demolition work. The detonation wave travels through F.I.D. at 4,000 metres per second.
Grummet ..	A device usually of rope, for the protection of driving bands on unboxed B.L. shell. A shell with a damaged driving band cannot usually be fired and has to be returned to Ordnance.
H.E.	High explosive. In general, any substance capable of being detonated. The particular application of this term is to the main explosive fillings of shell, grenades, etc.
Igniter	A small bag of gunpowder between the primer and the main propellant charge in a gun or howitzer cartridge.
I.G. shelter	Iron galvanized shelter.
I.O.O.	Inspecting Ordnance Officer.
In situ	In position, that is, " where it lies." The special application of this term is to blinds which have to be destroyed " *in situ*." Where this instruction exists it means that the blind must not even be touched, and that when the demolition charge is laid against the blind it must be done with the utmost care to avoid disturbing the blind and possibly setting it off.
Long-range and short-range portions	Fulfil same purpose as the composite charge.
Luting	A greasy plastic substance used as a waterproof seal in certain ammunition and packages.
Misfire	A round which has failed to leave the weapon through non-ignition of propellant. A type of failure which is generally traceable to the effect of moisture.
M.L.	Muzzle loading (as opposed to " B.L." which see).
M. of F.	Method of Filling.
Obsolescent ..	No longer being manufactured, but existing stocks will be used by the Service until exhausted.
Obsolete ..	Out of date and withdrawn from the Service.

Paper shot ..	Used to test mountings which cannot, owing to their position, fire service projectiles in peace. They are designed to give the same recoil as a service shell but to break up in the bore. Made of wood pulp or rolled brown paper filled with shot and sawdust.
Piece of Ordnance	The traditional term applied to weapons designed for propulsion of missiles by explosive force. It includes guns, howitzers and mortars.
P.A.G.D. ..	Polar Ammon Gelatine Dynamite. A type of gelignite—originally a trade explosive, but now used in some circumstances as a substitute for guncotton in demolition work.
Practice	A practice round may be either a Service round degraded for practice or a round especially designed for use at firing practice. It is a live round and should not be confused with a DRILL round. Drill rounds are inert and are for practice in loading, etc. BLANK rounds are for the simulation of ordinary gunfire and contain explosive.
Practice charge	Smaller than reduced charge. For use when the range permissible for practice firing is very limited.
Practice shot ..	Used for practice—solid cast iron.
Premature ..	When any round of ammunition fires, or explodes in any part at any time after the commencement of loading or throwing, but before it should fire or explode, the occurrence is referred to as a " premature."
Primer	(*a*) A device in the base of a Q.F. cartridge containing a cap which, when struck by the firing pin of the gun mechanism, ignites a small gunpowder charge in the primer magazine: the flash in turn fires the igniter (where present) and finally the main propellant charge. (*b*) A small pellet of dry guncotton or other sensitive H.E. used in demolition work to transmit the explosive impulse from the detonator to the main charge.
Projectile ..	Usually used when speaking of shell, but any nature of ammunition whether fired or thrown is a projectile.
Propellant ..	The explosive substance which, burning very rapidly indeed within the gun, pushes the shell or bullet out of its way to the target.

Proof shot ..	For proof of guns and hows.; made with a flat head so that they will not penetrate too far into the proof butts.
Pyrotechnic ..	A firework, but applied equally to any type of signal, whether light or sound.
Q.F.	Quick firing. Applied to any gun or howitzer using a brass cartridge case. Q.F. cartridges may be either "Fixed," where the shell and cartridge case are issued permanently joined together, or "separate," when the shell and case are packed and issued separately.
Reduced charge	Smaller than full charge. For use at practice, giving reduced range and less erosion of the bore.
Rifling	The series of grooves inside the bore of a gun or other weapon, intended to cause the projectile to revolve about its long axis in its flight, which makes it fly straight and nose foremost.
Round	A round of ammunition is one complete set of components ready for firing, or alternatively the term applied to firing one such assembly.
S.A.A.	Small arms ammunition—for rifles, carbines, machine guns, pistols, etc.
Safety device ..	A device or piece of mechanism in any explosive component intended to make the component safe for handling and transportation, or to prevent the component from functioning prematurely on firing or throwing.
Shell	A hollow steel projectile filled with H.E. or smoke, etc., and fired from a gun or howitzer.
S.I.P.	Self-igniting phosphorus; an alternative name for the No. 76 grenade.
S.T.	"Sticky Type": the early name of the 74 grenade.
Shot	(*a*) A solid projectile for firing from a gun or howitzer. (*b*) Finely divided pellets for use in S.A.A.
Shrapnel ..	A relatively thin-cased shell, filled with bullets set in resin, and designed for anti-personnel use. It is fitted with a time fuze, which sets off a G.P. bursting charge in mid-air, thus scattering the bullets.
Smoke box	A small metal or bakelite cylinder containing smoke-producing composition, generally red phosphorus. Inserted into exploder cavity of shell from which it is desired to obtain a good smoke effect on bursting, for observation purposes.

Spigot	The steel root from which the spigot mortar bomb is fired.
Star	An illuminating or signalling pellet ejected from rockets, T.M. ammunition or shell. Illuminating stars are sometimes suspended from a small parachute to prevent their too rapid return to earth.
Streamline charge	Made slightly shorter than the full charge to allow for the greater length of the streamline projectile behind the driving band.
Super charge ..	Issued for certain equipments to give greater range. Greater than full charge.
Tamp	A term used in connection with demolitions or "blasting"—meaning that the H.E. is sealed by sandbags, earth or clay, etc., to prevent the "blast" blowing backwards, thus ensuring the maximum force being directed against the object to be demolished.
Time Fuze ..	A fuze designed to function at a pre-determined interval after leaving the gun. They are of two types, one in which the timing depends on the burning of a fuze composition, and the other on the action of clockwork mechanism.

CROSS SECTION OF A SHELL SHOWING POSITION OF COMPONENTS USED TO BRING ABOUT EXPLOSION OF THE MAIN FILLING

This diagram is much simplified to bring out the essential points.

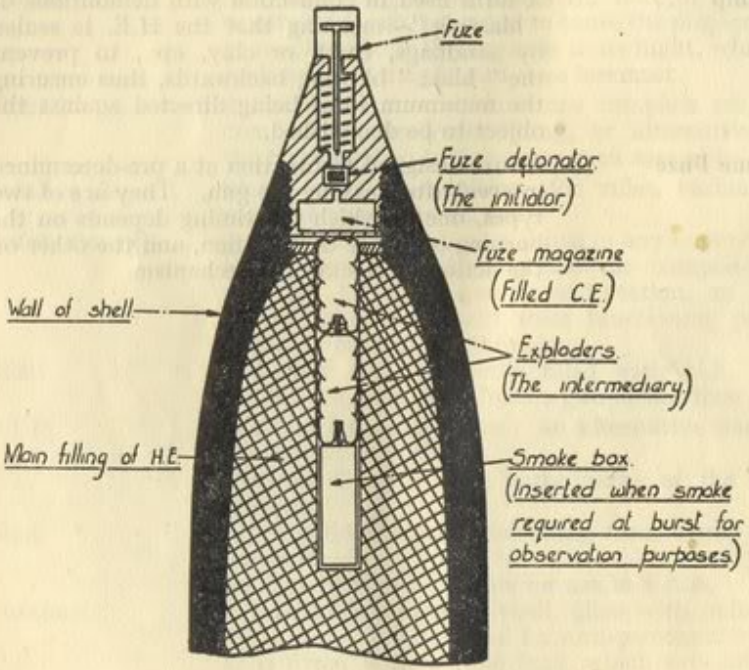


PLATE 1

BOMB. M.L. H.E. 2-INCH MORTAR MK I

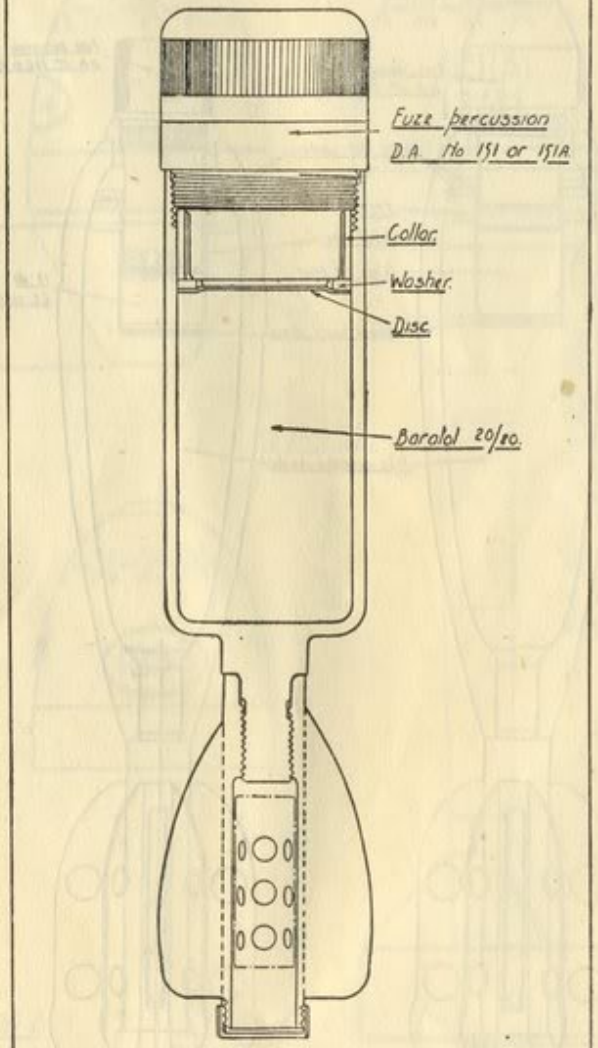


PLATE 2

BOMBS M.L. Hf 3-INCH MORTAR

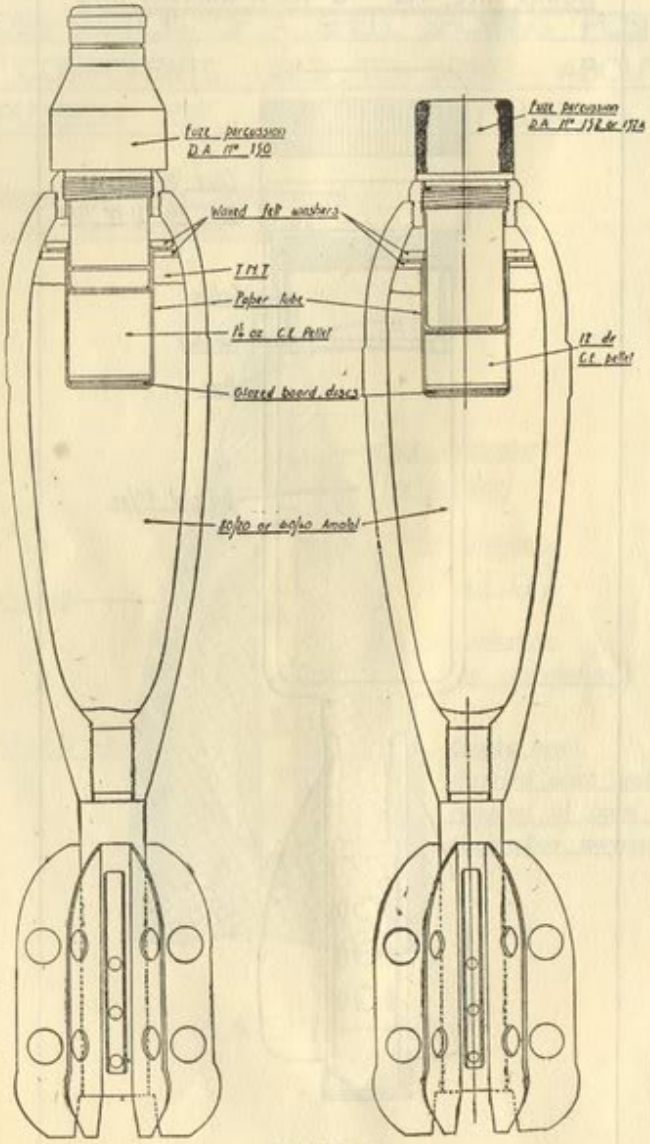


PLATE 3

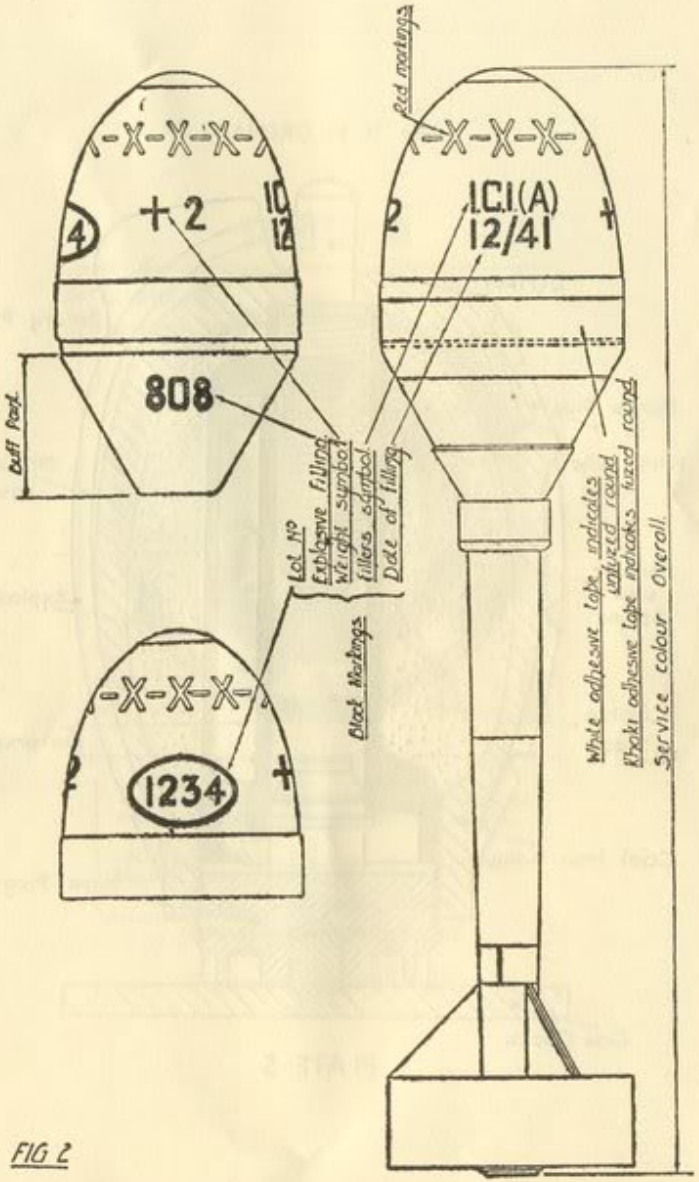


FIG 2

BOMB SPIGOT H.E. ANTI-TANK 29mm MORTAR 20lb MARK 1

PLATE 4

No: 36 M GRENADE

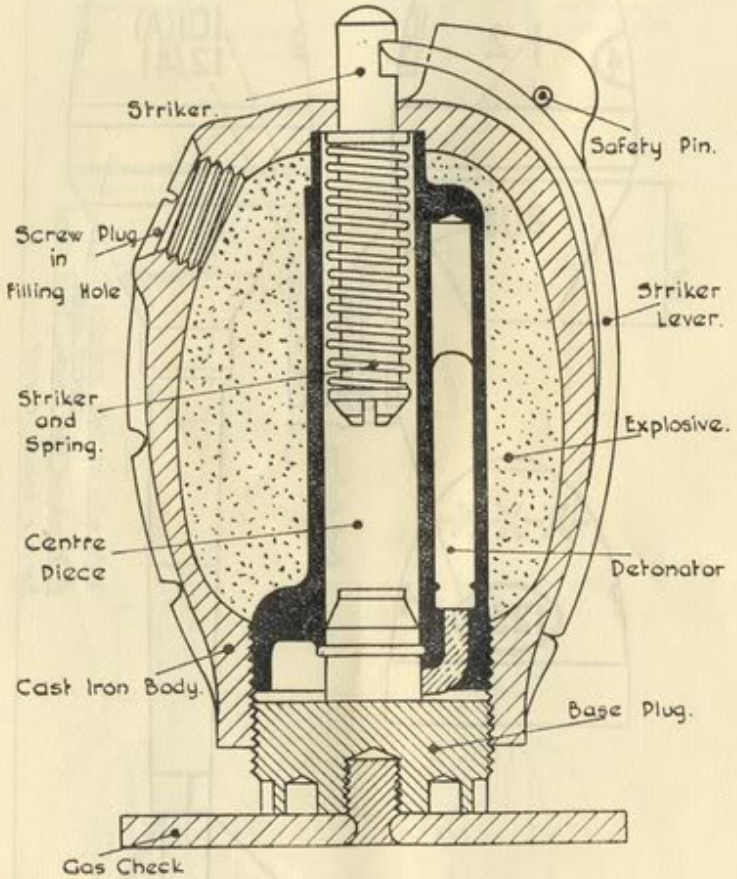


PLATE 5

PLATE 6

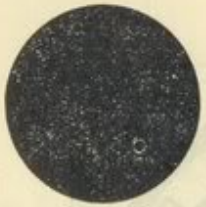
R.A.F. FOR AIR SERVICE, THE BROAD ARROW BEING PLACED AT THE TOP OF THE LABEL.

PRINTED IN RED AS SHOWN ON COLOURED PAPER AS FOLLOWS:-

BLUE - FOR LAND SERVICE.
BROWN - FOR AIR SERVICE

SIZE OF LABEL $3\frac{3}{4} \times 3\frac{3}{4}$.

PLATE 7



FIRE RISK CLASS 1

FIRE RISK CLASS 2

FIRE RISK CLASS 3

FIRE RISK CLASS 4

FIRE RISK CLASS 5

THE SYSTEM OF MARKING PROJECTILES

H.E. SHELL

① The empty body is painted all over with a colour to indicate the purpose for which it is intended. e.g. H.E. Shell - buff

② When filled H.E. red filling ring round nose.

③ Type of H.E. filled is shown according to following code of bands round body :-

No band Lyddite

Plain band Amatol 80/20

Green band & Fraction Amatol 40/60

Green band & "T.N.T." - T.N.T.

④ Green disc indicates smoke box.

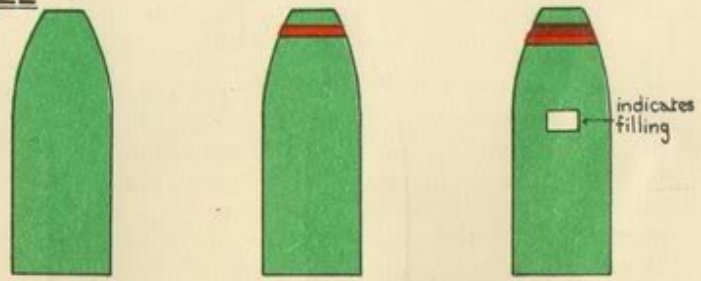
⑤ White ring if S.A.P.

⑥ Two white rings if A.P.C.

(16308D) Wt. 24518/9092 26-961-8 36000 7,44 L. & S.

PLATE 8

SMOKE SHELL

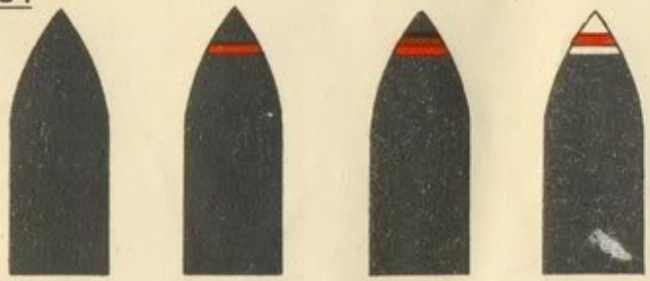


The body of a smoke shell is painted green

Red filling ring shows explosive contents.

Brown ring if cast-iron or semi-steel

SHOT



Body of shot is painted black

Red ring if with tracer

Brown ring if cast-iron or semi-steel

White tip and ring if A.P.

OTHER TYPES

Gunpowder filled Shell

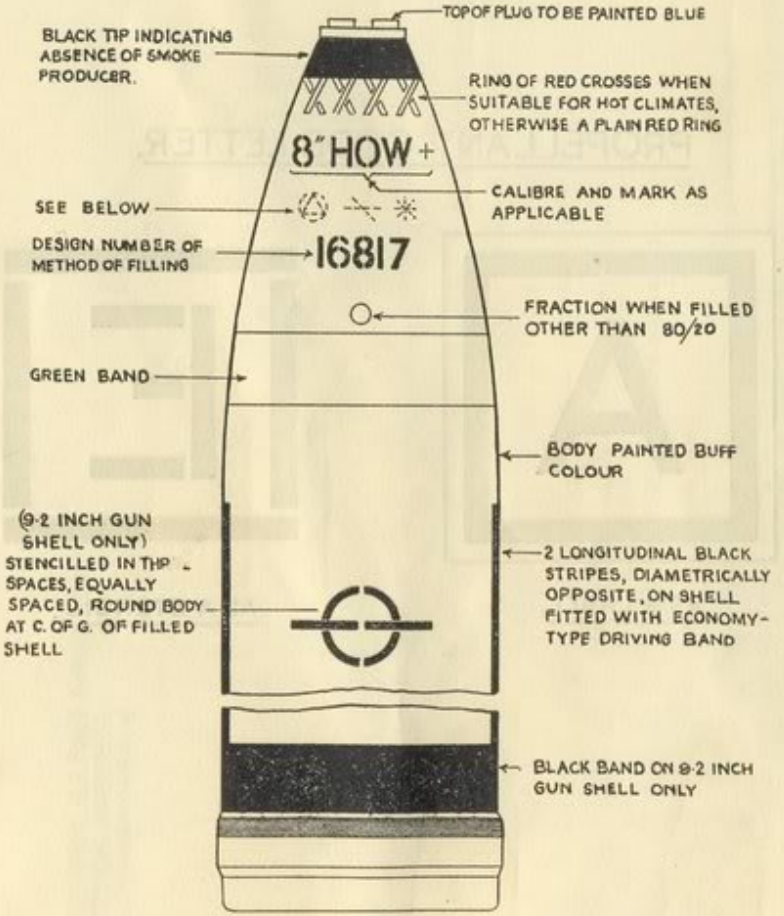
Shrapnel Shell

Chemical Shell

PLATE 9

SHELL, B.L., H.E., 7·2 INCH TO 12 INCH FILLED AMATOL.

Typical painting and marking details



△ SERIES NUMBER IN RING DISTINGUISHING FILLED LOT
DATE OF FILLING (MONTH & YEAR)
✳ MONOGRAM OF FIRM OR STATION FILLING

} STENCILLED ON REVERSE

PLATE 10

CONTENTS—*continued*

PLATES

REGULATIONS FOR ARMY ORDNANCE SERVICES, PART 7, 1942

PAMPHLET No. 1

AN INTRODUCTORY SURVEY OF AMMUNITION

SECTION 1.—AN ELEMENTARY INTRODUCTION FOR THE AMMUNITION BEGINNER

1. The make-up of a modern round of ammunition is easily understood if one compares it with the simpler form of ammunition used in Tudor times. The Elizabethan gunner had :—

Fig. 1.—A cannon ball.

Fig. 2.—Some gunpowder.

Fig. 3.—A simple form of gun.

Fig. 4.—A match.

The powder was poured down to the bottom of the barrel, the cannon ball rammed in on top, a " priming " of gunpowder put into the flash hole, and finally a flame applied to the priming. The flame from the priming passed down the flash hole and exploded the bulk of the gunpowder which threw out the cannon ball.

The cannon ball was known as the projectile. Modern types of projectile are of a long, pointed shape which decreases their resistance to the air and therefore increases the distance they travel (known as the range). Some projectiles are filled with H.E. (high explosive) and can be made to burst on impact or up in the air by using special types of fuzes.

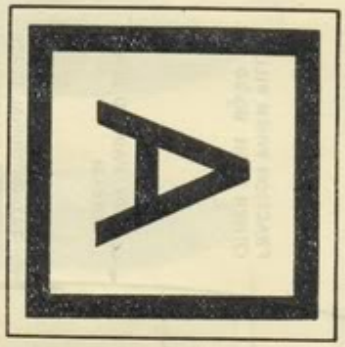
2. The gunpowder poured down the barrel was known as the charge. A loose charge of that type had three drawbacks :—

(*a*) the powder was liable to get wet, in which case it would not explode ;

(*b*) the powder was liable to be accidentally exploded by a spark or flash from another gun ;

(*c*) general difficulty of handling.

PROPELLANT CODE LETTER.



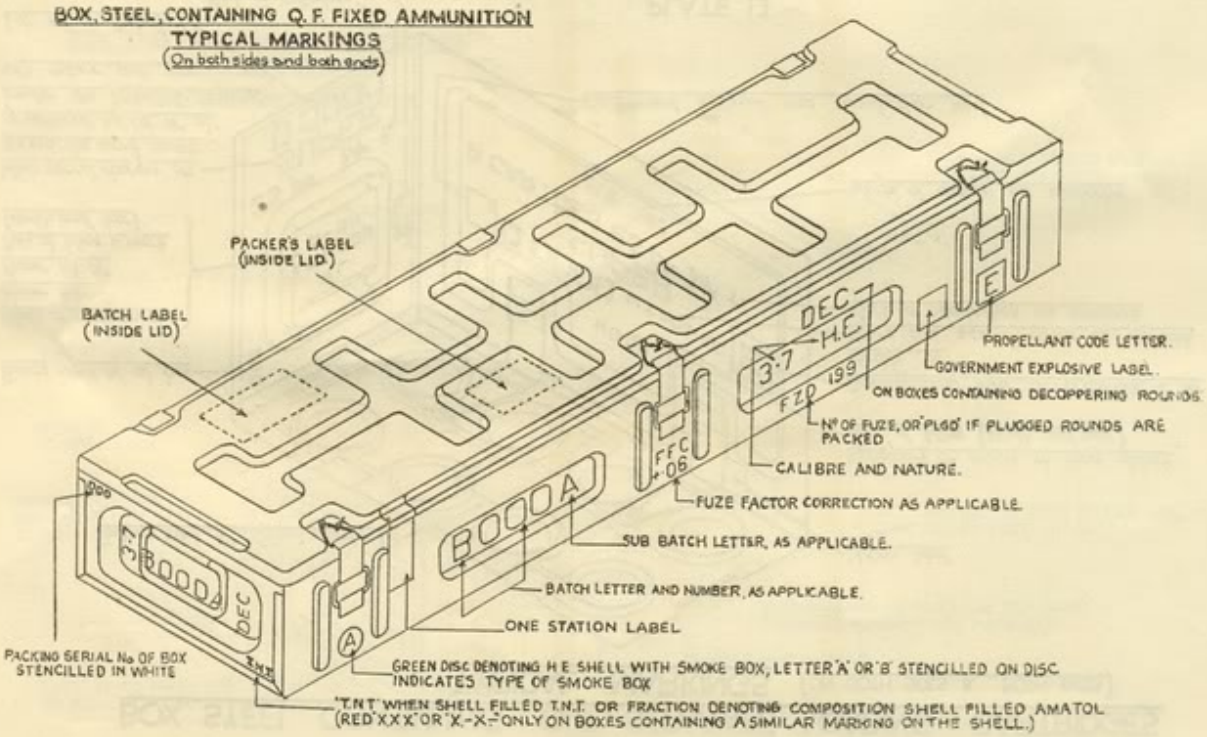
AS A LABEL.

AS A STENCIL.

PLATE 11

PLATE 12

BOX, STEEL, CONTAINING Q. F. FIXED AMMUNITION
TYPICAL MARKINGS
(On both sides and both ends)



BOX, STEEL. CONTAINING Q.F. SEPARATE LOADING CARTRIDGES
TYPICAL MARKINGS (ON BOTH SIDES & BOTH ENDS)

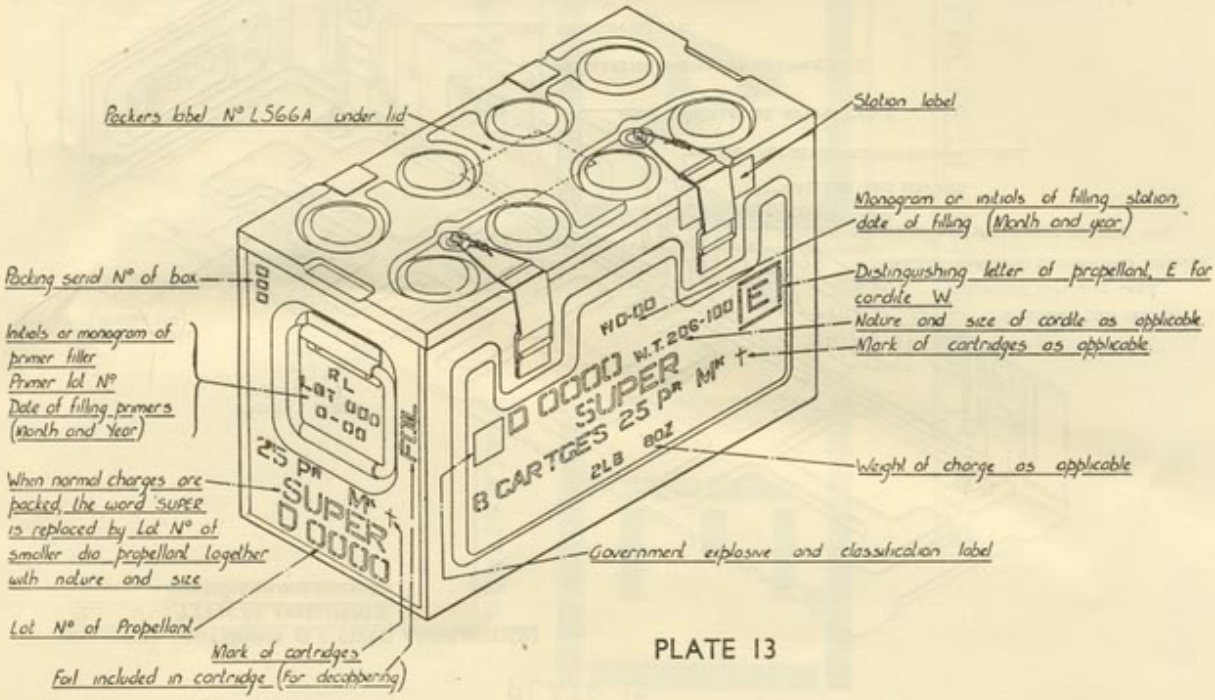
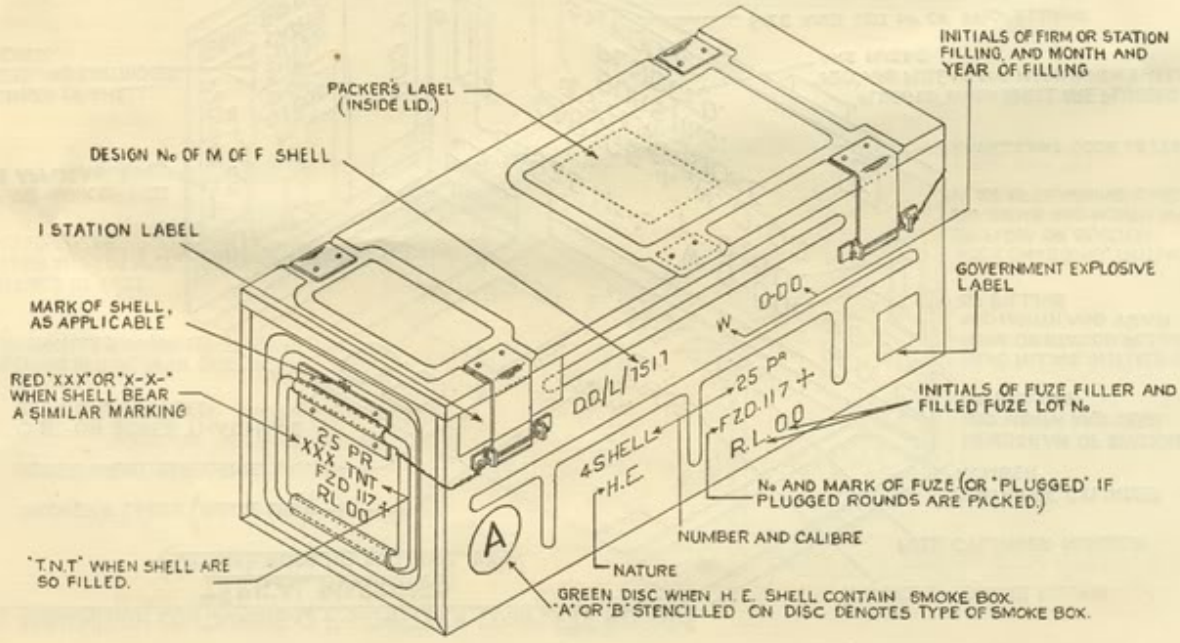


PLATE 13

PLATE 14

BOX, STEEL, CONTAINING PROJECTILES
TYPICAL MARKINGS.
On both sides and both ends.



BOX AMMUNITION CONTAINING Q.F. HOWITZER COMPLETE ROUNDS.

TYPICAL MARKINGS.

(On both sides, lid and both ends)

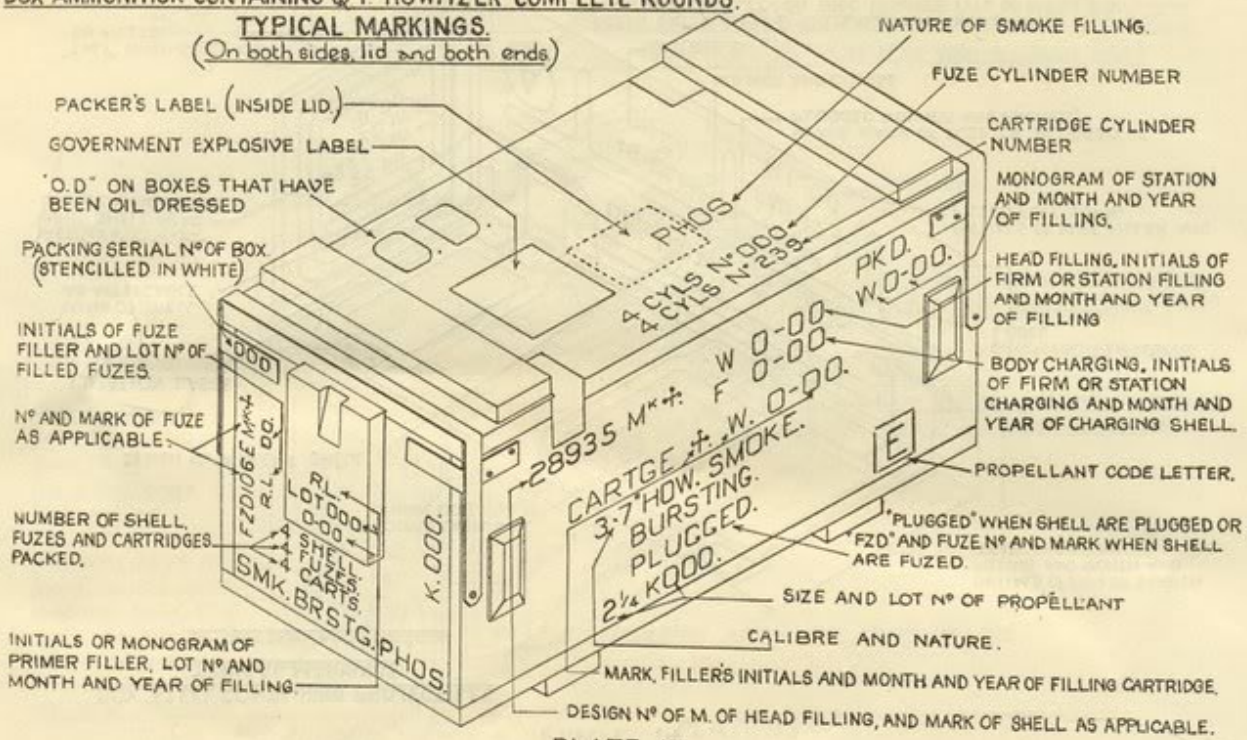


PLATE 15

BOX. WOOD. CONTAINING B. L. CARTRIDGES

TYPICAL MARKINGS

HINGED LID TYPE, ON ONE SIDE & BOTH ENDS

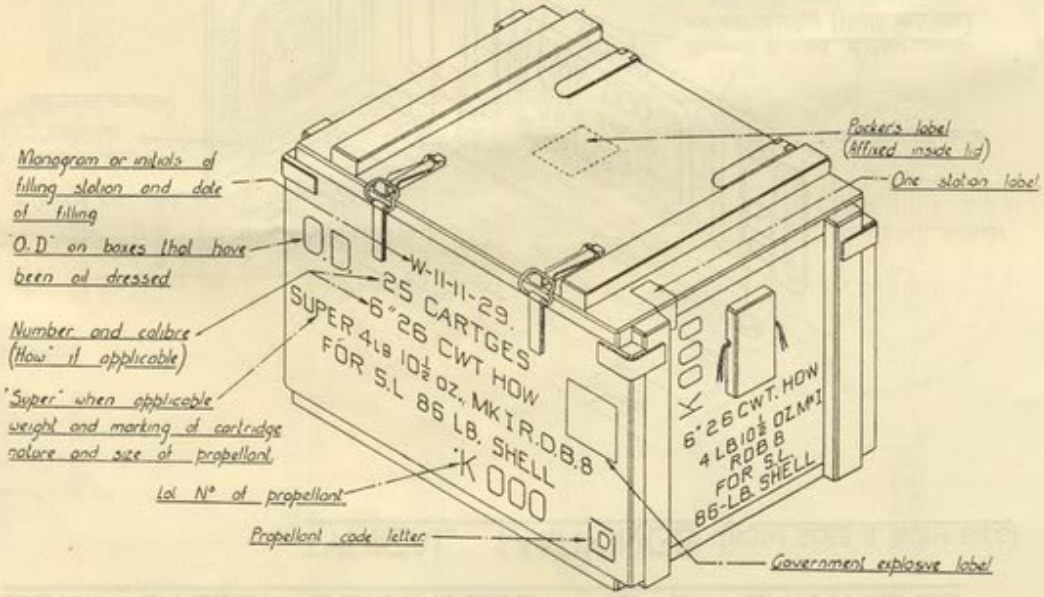


PLATE 16

BOX, STEEL, CONTAINING B. L. CARTRIDGE

TYPICAL MARKINGS (BOTH SIDES & BOTH ENDS)

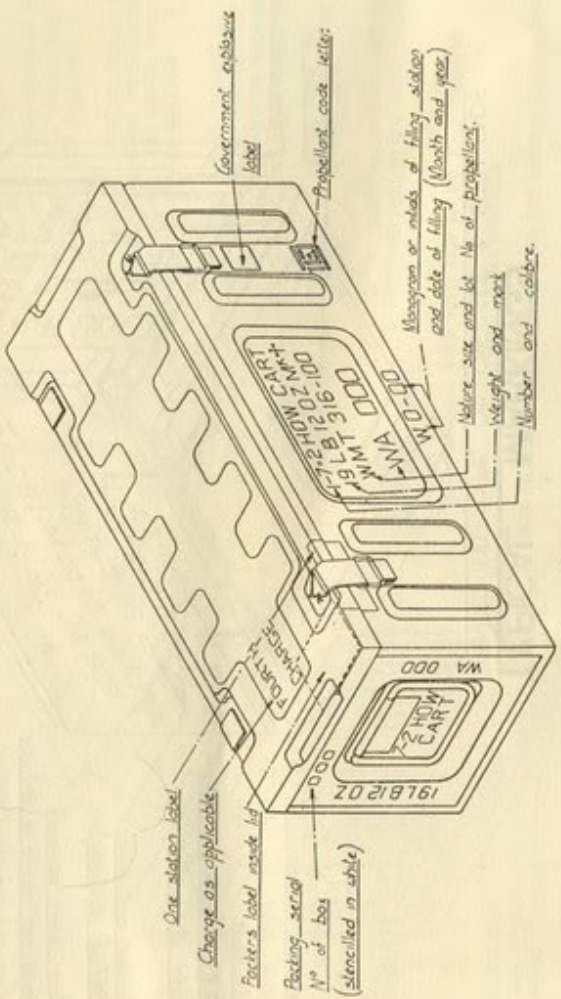


PLATE 17

CYLINDER CONTAINING B. L. CARTRIDGE. TYPICAL MARKINGS

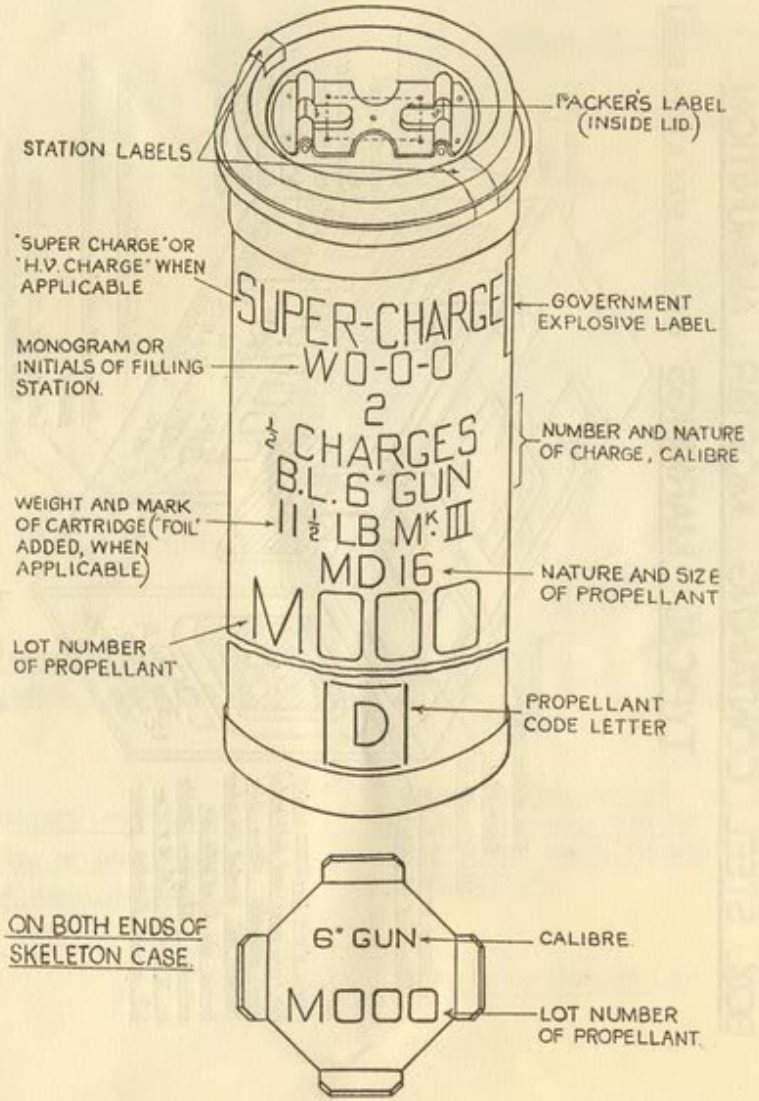


PLATE 18

BOX. STEEL. CONTAINING MORTAR AMMUNITION.

TYPICAL MARKINGS (ON BOTH SIDES & BOTH ENDS)

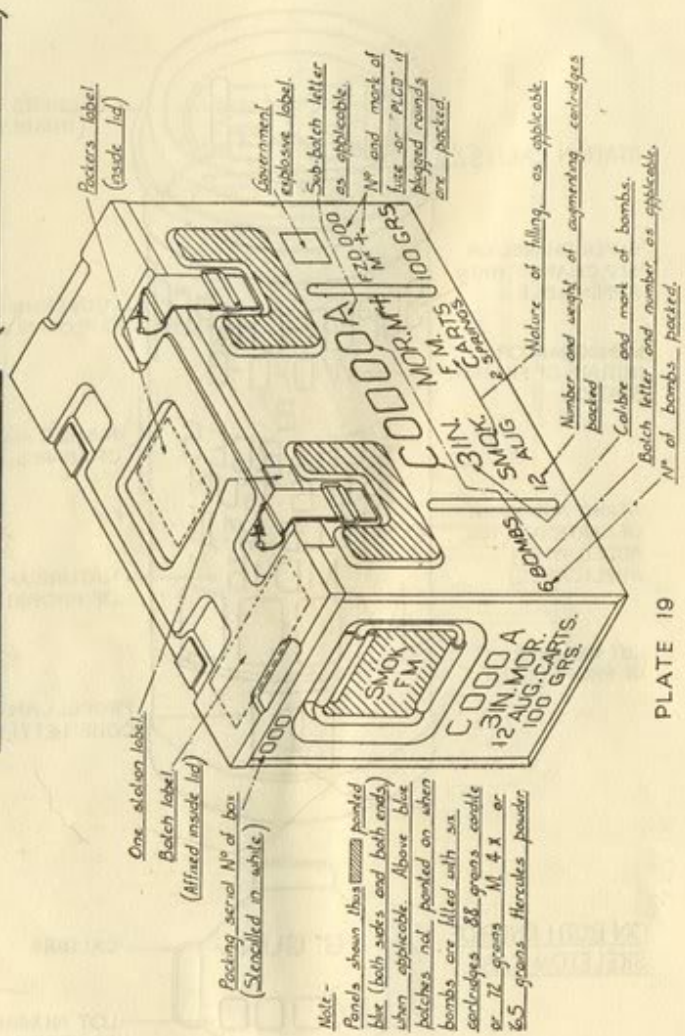


PLATE 19

TYPICAL S.A.A. BOX

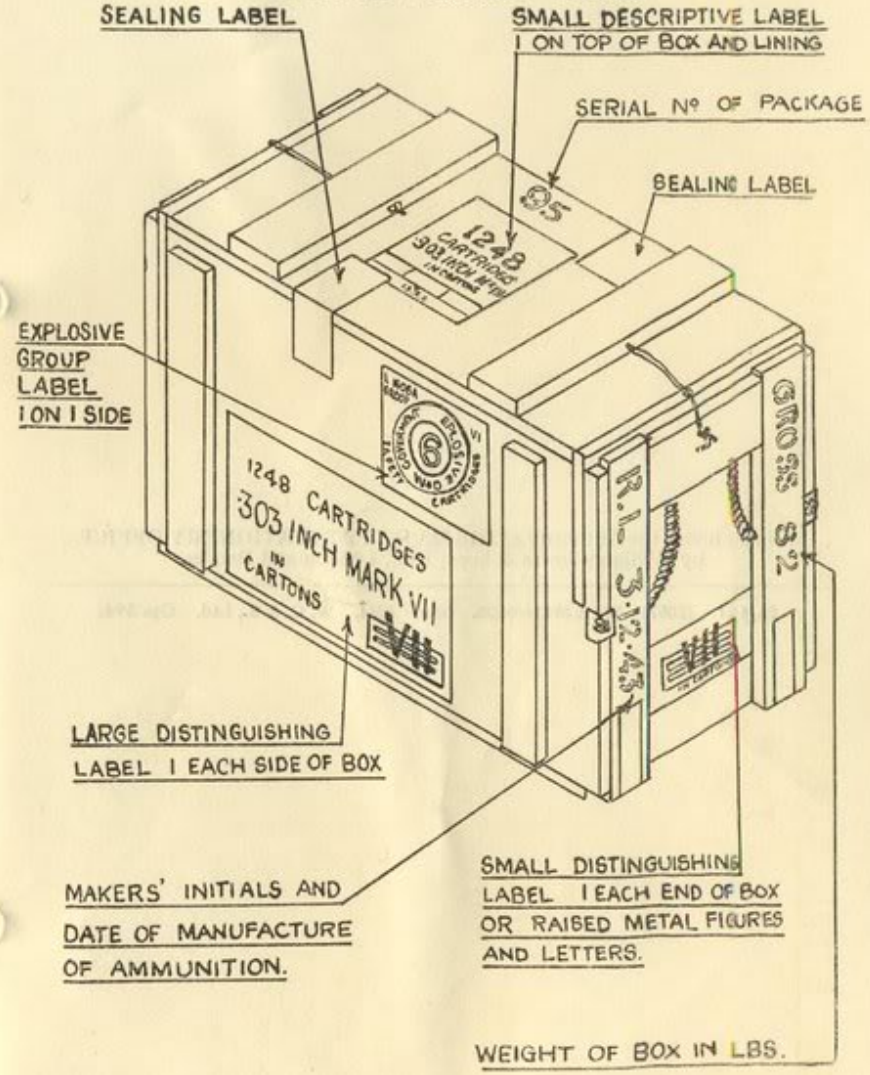


PLATE 20

3. The obvious remedy was to put the loose charge inside a container, namely a cloth bag. The charge in a container was called a cartridge. Cartridges of this type are used nowadays and known as B.L. (breechloading) cartridges.

Why " B.L." ? To understand this term, we must study the development of the gun itself. The original guns were loaded at the muzzle end ; that is to say, they were of the muzzle loading or M.L. variety. The inside of their barrels was smooth ; that is smooth-bore or S.B.

The round projectile did not fit inside the smooth barrel very exactly, particularly after the gun had become worn. Consequently some of the forces exerted by the exploding charge was wasted, because part of the gases escaped round the projectile before it was out of the barrel. Also, the projectile had a rather unsteady flight through the air.

These two problems were solved during the 19th century by the introduction of (*a*) a driving band of soft copper fitted to a lengthened and pointed projectile ; and (*b*) slightly twisting grooves or rifling cut inside the barrel. This is the system used to-day.

4. The diameter of the shell across the driving band is approximately equal to the internal diameter of the barrel measured across the grooves or " rifling." (The raised ribs left in between the grooves are known as " lands ")

When a projectile with driving band is propelled up a rifled gun barrel, the soft copper band is squeezed to fit tightly into the rifling. The gases from the explosion cannot escape past the projectile before it is out of the barrel, and are said to be " sealed." At the same time the slight twist of the rifling makes the shell spin rapidly and keeps it steady throughout its flight.

5. The introduction of a banded projectile made it no longer possible to ram the projectile down the barrel from the muzzle end. A heavily-built, screw-fastening " door " was therefore built into the other end of the barrel, and this is known as the breech screw. Its construction has to be very strong indeed to withstand the force of explosion. Guns of this type, and the ammunition for them, are referred to as breech loading or B.L.

6. The position of the flash hole was changed, and it now runs through the centre of the breech screw. In this position the flash is directed right into the centre of the charge, giving a more effective explosion than the old method. To " boost up " the flash and make sure the charge is ignited, an igniter is sewn on to the back of the cloth bag containing the charge. This igniter, which is flat, disc-shaped and made of red cloth, contains gunpowder.

The initial flash is provided by a tube, inserted in the rear of the breech screw and ignited by a spring-operated striker or electrically.

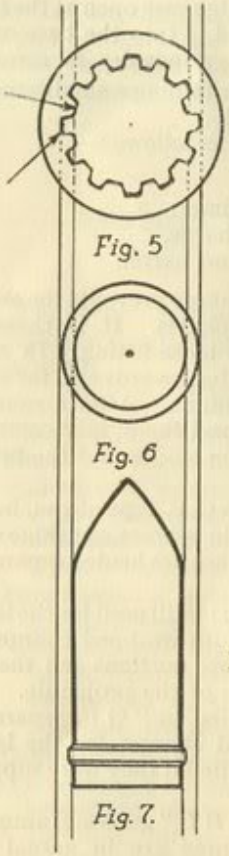


Fig. 5—End-on view of barrel (simplified).

Fig. 6.—End-on view of shell and driving band

Fig. 7.—Side view of shell and driving band.

7. To fire a round from a B.L. type gun, the gunner has to :—

(*a*) ram a projectile into the barrel ;
(*b*) place a cartridge in behind the projectile,
(*c*) insert a tube into the rear of breech screw ;
(*d*) close breech screw.

8. To simplify these operations and make possible a quicker rate of firing, an entirely different type of gun was introduced, known as the Q.F. (quick firing), at the beginning of this century. This has a sliding breech block or a breech screw, and all the ammunition components (projectile, charge, priming, and means of giving the initial flash) are fastened together into one complete round or cartridge. (Note that this is a second meaning of the word " cartridge ").

9. The charge is placed inside a brass cartridge case open at the front end, into which the projectile is securely fixed. Into the base of the cartridge case a small primer containing gunpowder is screwed.

10. The primer incorporates a tiny cap containing a small amount of very sensitive explosive (the " initiator ").

11. On firing, the sequence of explosion is as follows :—

Striker hits cap.
Flash from cap ignites gunpowder in primer.
Flash from gunpowder explodes main charge.
Explosion of charge expels projectile from barrel.

12. The brass cartridge case enclosing the charge prevents the escape of gases to the rear when the charge explodes. It is therefore possible for the breech block to be slightly loose-fitting. In some equipments the breech block is made to slide backwards and forwards across the rear end of the barrel between rounds. After a round is fired, the breech automatically slides open and the empty cartridge case is ejected : a new round is slid in by the loader and the breech slides back into the closed position.

13. There have been many variations on the Q.F. type of gun, but all retain the basic idea of enclosing the charge in a brass cartridge case. In some equipments the projectile and brass case are loaded separately (" Q.F. separate ").

14. It should be noted that the B.L. system is still used for the larger calibres of guns and howitzers, because a cloth-wrapped charge can be made up in several portions. One or more portions can then be omitted if it is desired to shorten the range of the projectile. The same plan of using variable charges is applied to " Q.F. separate " ammunition. Moreover, the projectiles and charges for the larger guns are so heavy that they could not be handled if they were supplied as a fixed Q.F. round.

15. The differences between " Q.F." and " B.L." guns and ammunition should now be appreciated. Q.F. guns are in actual fact " breech loading," i.e. loaded at the breech end. The best way of remembering this is to think of the three terms " S.B.," " B.L." and Q.F." as representing *three stages in the historical development of the gun* :—

S.B. Muzzle-loaded (" M.L.").

B.L. Breech-loaded.
Charge contained in cloth bag.
Gun closed at breech end by breech screw.

Q.F. Breech-loaded.
Charge contained in brass cartridge case.
Gun closed at breech end by sliding breech block or breech screw.
Capable of a high rate of fire.

16. The essential difference in the functioning of the B.L. and the Q.F. equipments is that in the first class the breech mechanism provides the obturation i.e. prevents escape of gases to the rear and in the second the cartridge case does it.

SECTION 2.—SERVICE EQUIPMENTS

GENERAL

1. The term " Ordnance " is applied to weapons designed for the propulsion of missiles by explosive force, and includes guns, howitzers and mortars.

TYPE OF ORDNANCE

2. The several types of ordnance are as follows :—

Gun.—A long-barrelled piece of ordnance firing a specific charge of propellant, which imparts a high velocity with a flat trajectory to the projectile. Variation in range is obtained by varying the elevation of the gun, for example, 2-pr., 6-pr. guns.

Howitzer.—A short-barrelled, rifled piece of ordnance firing a comparatively small charge at high elevation, producing a low velocity and a short, high trajectory. The range is varied partly by varying the elevation and partly by varying the weight of the propellant charge; for example, 3·7-in. howitzer, 155 mm. howitzer.

Gun-Howitzer.—A piece of ordnance which combines the advantages of the gun and the howitzer. Using a heavy propellant charge the long, low trajectory of the gun is obtained, while by reducing the charge the high, short trajectory of the howitzer is produced; for example, 25-pr., 4·5-in., 5·5-in. Gun Howitzers.

Mortar.—A piece of unrifled, muzzle-loading ordnance firing a bomb. It is a very low-velocity weapon, has a high trajectory and a comparatively short range. An exception is the 3·7-in. Q.F. Mortar. This is really a tank howitzer but is called a mortar to distinguish it from the 3·7-in. howitzer used in the field and which requires different ammunition.

Grenade Discharger Cup.—A cup fitted to the muzzle of a service rifle, enabling the rifle to be used in the role of a mortar. The grenade is placed in the cup and projected by means of a ballistite cartridge.

Discharger Smoke Generator.—A short mortar fitted to some A.F.Vs. for projecting smoke generators by means of a ballistite cartridge.

Light Machine Gun.—An automatic fire weapon, normally fired from the shoulder with the aid of a rest. It can also be fired from a mounting, for example, Bren, Lewis.

Medium Machine Gun.—An automatic fire weapon, firing a rifle-calibre bullet, but of heavier construction than the light machine gun. Belt fed, fired from a mounting, for example, ·303-in. Vickers, 7·92 mm. Besa.

Heavy Machine Gun.—An automatic fire weapon specially designed to fire ammunition for the penetration of armour or for use against aircraft, for example, ·5-in. Vickers, 15 mm. Besa.

Northover.—A smooth-bore gun of simple design, for firing anti-tank and anti-personnel grenades at short range.

Rocket Projector.—In essence, a " stand " to point the Rocket U 3-in. in the required direction. This is not, strictly speaking, a " piece of ordnance " as the rocket is not ejected from a barrel, but develops its own velocity from the initial position of rest on the guide-rails.

3-in. S.B. Gun (Smith Gun).—A small gun of simple design on a mobile mounting.

SECTION 3.—GENERAL SURVEY OF LAND-SERVICE AMMUNITION

1. There are at present about 700 different varieties of live ammunition. A proportion of these are in the process of being superseded by newer natures chiefly because they were originally intended for specialized work and have now become unsuited to the present phase of the war.

2. In size the ammunition may vary from the Small Arms round weighing a fraction of an ounce and of ·22 in. calibre, to an 18 in. projectile weighing a ton.

3. In form, ammunition may vary considerably from the familiar appearance of the complete round of artillery ammunition. Mines resemble cake tins, Bangalore torpedoes are like drain pipes and R.A.O.C. holds a smoke producer resembling a water cart.

4. In effect ammunition is also varied. Shell are designed for bursting effects, whereas a solid shot depends upon velocity and not explosion for penetration. Other forms of ammunition are designed to produce an incendiary effect or to produce a screen of smoke or of toxic gas.

TYPES OF EXPLOSIVES USED

5. Explosives are divided into two main categories according to the violence with which they explode :—

" Low " Explosives.—Examples are gunpowder and cordite. Gunpowder was in world-wide use as a propellant until it was superseded by cordite, but it is still used for vital purposes, for example, fuzes, primers, bursting charges for shrapnel shell, etc. *Gunpowder becomes completely useless if it gets damp.* In a loose form it is very dangerous to handle, as it can be exploded by a spark, a light blow, or slight friction.

Cordite is mainly a mixture of nitro-glycerine and nitro-cellulose, generally used in the form of long sticks, which are bundled together to form the charge.

Various forms of cordite have been developed, which are known by the propellant code letters marked on the ammunition (*see* p. 32). Several propellants similar to cordite are also used, such as ballistite and nitro-cellulose (N.C.) powders. N.C. powders are supplied in small grains which in a Q.F. cartridge produces a rattling noise when the cartridge is handled.

" High " Explosives.—These are substances that produce a violent shattering effect, known as detonation, when they explode. The best known example is T.N.T.

6. An important consideration in using high explosives in ammunition is that they must not be too sensitive, or they may explode at the wrong moment. In particular, H.E. fillings for shell have to stand up to the very considerable shock of discharge from the gun.

7. High explosives are therefore designed to be comparatively insensitive. The problem then arises of making them explode when required. To do this, shells are designed with an explosive system which is, in effect, a " chain " of explosions, starting comparatively mildly and building up to the shattering detonation of the main charge. This is a typical explosive system. *See* **Plate 1.**

8. A minute quantity of very sensitive H.E. known as an initiator is enclosed, in the form of a detonator, in the fuze. The detonator is usually placed so that, were it accidently set off by dropping the round, its explosion would not reach the main filling. Fulminate of mercury is a well-known initiator.

9. The " small " explosion of the initiator sets off a larger quantity of slightly less insensitive explosive, known as the " intermediary." The intermediary explosive is generally enclosed in a small fabric bag, in which case it is known as an " exploder." The most common intermediary is known as C.E. (Composition, Exploding).

10. The more powerful explosion of the intermediary causes the explosion of the main filling or bursting charge of H.E. Examples T.N.T., amatol, lyddite.

11. This chain of explosions can be compared with the lighting of a fire, for which one has to use, for example :—

(*a*) a match to light the paper ;
(*b*) paper to light the wood ;
(*c*) wood to light the coal.

It must, of course, be remembered that, although the chain of explosions has been described at length in sequence, they are actually almost simultaneous.

ARTILLERY AMMUNITION

Q.F. FIXED. (Q.F.=QUICK FIRING)

12. The simplest artillery ammunition is known as " Q.F. Fixed " and resembles a round of small arms ammunition, though it may be more than a yard in length. Each round is completely assembled so that it can be loaded with rapidity.

13. A round consists of a brass cartridge case, charged with a propellant which is usually cordite or nitrocellulose. Into the base of the cartridge case is screwed a primer. The primer has a central cap to receive the impact of the firing pin of the gun : the flash from the cap ignites some gunpowder in the primer magazine, which in turn ignites the propellant charge in the cartridge case.

14. The cartridge case is attached at its neck either to a shell, which is usually filled with H.E., or to a solid shot, carrying a tracer. With shell, the fuze is fitted to the nose of the projectile. On impact with the target or, in some cases, after the lapse of a pre-set interval of time, the fuze initiates the bursting of the shell.

Q.F. SEPARATE

15. Modern guns incorporate the functions of a howitzer, can fire projectiles at considerable elevations and obtain a variety of ranges and trajectories by using variable charges in the cartridge. The 25-pr. is of this type and in order that the cartridge charge can be adjusted just before firing, the fuzed shell is issued separately from the cartridge. The brass cartridge case contains three bags of propellant : the performance of the gun depends upon the number of bags left in position by the gunner. Ammunition of this type. consisting of a brass cartridge and a separate projectile (shot or shell) is known as " Q.F. Separate."

B.L. (BREECH LOADING)

16. Q.F. ammunition has a brass cartridge case (fixed or separate) which prevents the high-pressure gases, produced in the gun, from escaping to the rear. The full propelling force is thus exerted forwards. This sealing of the propellant gases is known as " obturation." In the bigger equipments (guns or howitzers) a brass case has disadvantages which include the weight of the case. The equipments are therefore designed with a breech mechanism which effects the obturation and obviates the necessity of a heavy metallic cartridge case. Equipments with their own obturating device are called " Breech Loading " or " B.L." B.L. cartridges consist of cloth bags of propellant which may be cylindrical in shape or alternatively composed of sections, of varying shape and form, capable of being assembled to suit the desired range and trajectory.

17. The ignition of a B.L. cartridge is effected by a separate component called a " tube," very similar in appearance to a small arms cartridge, which fits into the breech mechanism. " Tubes " may be fired electrically or by percussion.

18. B.L. ammunition is usually stored and issued as four separate components : cartridges, shell, tubes and fuzes. Only when the fuze fits into the base of the shell are the shell issued ready fuzed.

19. The term " Breech Loading " has lost its distinctive significance as all modern guns and howitzers are loaded at the breech.

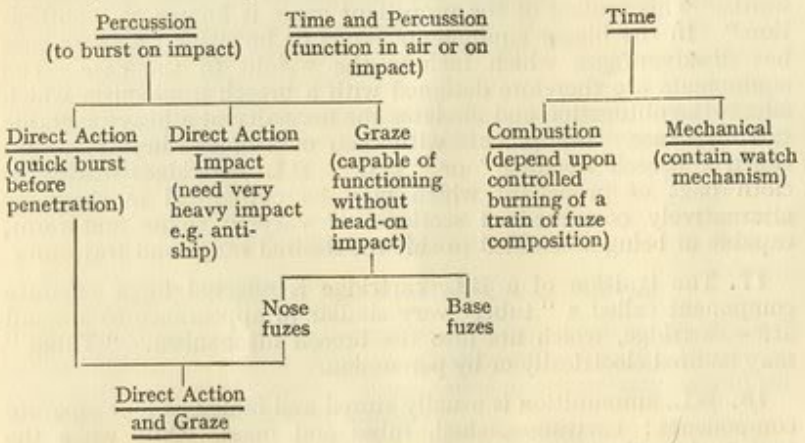
FUZES

20. Fuzes are the means of exploding a projectile at will, either on impact on the target, or in the air in a position which depends upon the time that elapses in flight. The majority of fuzes fit into the nose of shell and are shaped to conform with the outline of the projectile. When the nose of a shell must have penetrative power the fuze is fitted in its base.

21. Fuzes in general contain :—

(*a*) a body mechanism which functions in the desired circumstances ;
(*b*) a detonator, which is fired by a striker in the body mechanism ;
(*c*) a magazine, of suitable explosive to build up the effect of the detonator ;
(*d*) safety devices which protect the detonator from the striker and separate the magazine from the detonator until the shell is fired. The forces due to rotation of the shell and set-back in the bore overcome the safety devices and " arm " the fuze.

22. The design of a fuze depends upon the nature of the target and the result required at the target : thus a shell required to burst with anti-personnel effect on impact will require a different fuze from a shell which is intended to penetrate armour or concrete before bursting. Fuzes may be classified by their action :—



23. Direct action fuzes are instantaneous and depend upon the crushing of a striker into a detonator. Graze fuzes contain a movable pellet which continues to move forward inside the fuze when the flight of the shell is checked. The pellet hits the striker and actuates the fuze. The inherent delay in operation of this type of fuze allows the projectile to effect penetration. Against heavy armour more complicated delay devices are used. Since base fuzes cannot be crushed on impact their mechanisms are of necessity of the graze variety.

PROJECTILES

24. Shells are hollow projectiles which may be filled with H.E., smoke, incendiary or chemical filling. Modern shell have a streamlined shoulder and tapered base. The following three types of shell-body design will be met :—

Common Pointed.—Designed for attack against light armour, concrete emplacements or dug-outs. Walls are somewhat thicker than H.E. Shell as the projectile must withstand shock of impact and penetrate before bursting. Base fuzed.

Armour-Piercing.—The object is to perforate armour and then burst effectively. Every other consideration is subordinated to this end. Its head is specially hardened and the walls are thick to withstand the shock of impact. Explosive capacity is small in comparison as this is sacrificed in order to provide strength. This type also is base fuzed.

H.E.—Designed to cause damage to material by force of burst, or to personnel and aircraft by fragments. This type is nose-fuzed. The main consideration in design is that the bursting charge should be as large as possible.

Against personnel and aircraft the maximum effect is obtained when the shell breaks into a large number of pieces, each of which should retain sufficient velocity, and be large enough to disable a man at a reasonable distance from the point of burst.

25. Shot are solid projectiles intended for penetration and are usually fitted with a tracer in their base to leave a visible wake. The curvature of the head of shot is blunter than that of shell. The steel from which shot have been forged is hardened to give penetrative property. Shot may be fully armour piercing (A.P.) or semi-armour piercing (S.A.P.). Hardening tends to produce brittleness so that some shot have a protective cap of tougher metal superimposed over the head of the projectile. These are called A.P.C. (armour piercing capped). The cap makes the head of the projectile still blunter and so, to assist the flight of the projectile, a light tapered cap is fitted, called a ballistic cap and the projectile is now termed A.P.C.B.C.

26. The hardening of the metal for penetration is not limited to shot but may be employed with armour piercing shell. Here the strength of the head and walls of the shell limits the H.E. content and prevents the use of a nose fuze. Piercing shell may be A.P.C. or A.P.C.B.C.

27. Projectiles are fitted with a copper driving band which enables the projectile to accept the rotation imparted by the pitch of the rifling of the gun barrel. The volume of available copper is sufficient to fill the grooves of the rifling and prevent the escape of propellant gas forward past the projectile.

28. Shrapnel shell are little used nowadays. They are charged with lead alloy balls, set in resin, which are ejected by a burst of gunpowder to produce a cone of " shrapnel."

29. Smoke shell were originally filled with white phosphorus, which gave storage problems and produced an indifferent smoke screen on bursting. Modern smoke shell contain canisters of slow burning smoke mixture. These canisters are discharged from the base of the shell by the action of a time and percussion fuze during the flight of the shell. The shell does not burst : it is " opened " by the ejection of a comparatively loosely screwed base plate. The flight of the shell ensures the spread of the canisters and the smoke materials used give rise to a low bank of smoke which builds up into a continuous screen as the separate canisters reinforce each other.

30. Chemical shell are somewhat similar in structure to smoke shell, the older variety spreading their contents by bursting and the newer variety expelling its content from the base, in flight.

31. Anti-aircraft shell are usually functioned by a time fuze, the setting of which demands the precision of mechanical target predictors and fuze setters. Smaller A.A. shell such as the Bofors (40 mm.) have direct action fuzes but are also fitted with self-destroying devices so that if they miss the target they still burst in the air.

32. Star shell are intended to burst in the air and to eject an illuminating star suspended on a parachute.

MORTAR BOMBS

33. Mortar bombs, in the British Land Service, are of three calibres: 2-inch, 3-inch and 4·2 inch. These are all cylindrical or steamlined cylindrical bombs fitted with a vaned tail to give stability in flight and propelled by cartridges in the tail unit. The bombs are loaded into the muzzle of smooth-bore mortars of sufficiently light construction to demand a comparatively low propellant pressure on firing. Since the bombs do not rotate, the structure of the fuzes must be different in design from fuzes for shell fired from rifled guns.

34. 2-inch mortar H.E. bombs are thin cased and issued fuzed. *See* **Plate 2.** The 2-in. mortar smoke bomb functions by burning and not by bursting, and is initiated by the flash from the cartridge. The cartridge is in all cases somewhat similar in appearance to a sporting cartridge and fits into the central tube of the tail.

There are also 2-in. mortar bombs designed to produce signal flares of various colours and combinations. One contains a parachute which when the bomb bursts is ejected into the air and supports an illuminating flare.

The 2-in. bomb thrower, mounted on tanks for laying smoke screens in their immediate vicinity, fires either :—

(*a*) the same design of smoke bomb as is used with the 2-in. mortar ; or

(*b*) a bursting smoke bomb filled white phosphorus and fitted with a D.A. fuze.

Bombs for the 2-in. bomb thrower are fitted with a cartridge less powerful than that used for the 2-in. mortar bombs.

35. 3-in. mortar bombs, *see* **Plate 3,** are heavy-cased projectiles of streamline shape. There are H.E. and also phosphorus-filled smoke bombs, both of which are fuzed. There is also an ignition type of smoke bomb. All 3-in. bombs are fitted both with a primary cartridge in the central tail container and also with augmenting charges held between the tail fins. The augmenting charges are either 100 grains each or 210 grains with corresponding differences of range.

36. 4·2-in. mortar bombs are twice as heavy (20 lb.) as 3-in. mortar bombs. In principle they resemble 3-in. mortar bombs except that a smoke bomb is used which contains a fuming liquid instead of phosphorus.

37. The 29 mm. spigot mortar bomb, *see* **Plate 4,** and the bomb, projector infantry anti-tank (P.I.A.T.) are both fired from a spigot, i.e. the long tail tube of the bomb fits over a spigot, through the core of which a striking pin operates. The cartridge is contained in the hollow tail tube. These bombs are light-cased and contain relatively high charges of H.E. They incorporate certain very modern details of design.

GRENADES

38. A variety of grenades have been produced during the war, designed to be thrown by hand, propelled from a rifle discharger cup or from a specially designed projector or else laid as a mine. The effect of the grenades may be anti-personnel or anti-tank.

39. The 36M grenade is the familiar Mill's bomb, a segmented iron body filled with a T.N.T. mixture. The striker device is operated by the release of a handle which flies off when the grenade is thrown. The striker fires a cap, which in turn ignites a length of slow burning fuze : this allows a few seconds to elapse before a detonator sets off the main filling. *See* **Plate 5.**

40. The 68 grenade contains high explosive and is intended mainly for use against tanks and pillboxes. It has fins and is fired from a discharger cup on a rifle.

41. The 69 grenade differs from the 36 in having a bakelite body, a heavier explosive content and a fuze that operates on impact and is armed by the unwinding of a lead-loaded tape while the grenade is in flight.

42. The 74 or sticky type, S.T., grenade is a demolition charge of a nitroglycerine compound enclosed in a flask. The mechanical functioning is similar to that of the 36M grenade.

43. The 75 grenade is shaped like a water bottle and is normally used as a mine. It can, however, be thrown by hand in certain circumstances. It is actuated by the crushing of a glass phial containing a chemical mixture which fires a detonator.

44. The 76 grenade or S.I.P. (self-igniting phosphorus) bomb is a glass bottle of phosphorus in a benzene-rubber solution. It can be thrown by hand or projected from the Northover Projector.

45. The 77 grenade is filled with white phosphorus or other smoke-producer and functions on impact by the action of an " Allways " fuze, similar to that of the 69 grenade. The " Allways " fuze operates irrespective of the direction of impact.