

NOT TO BE TAKEN INTO THE FRONT TRENCHES.

FOR OFFICIAL USE ONLY.

NOTE.

The information given in these Notes is not to be communicated, either directly or indirectly, to the Press, or to any person not holding an official position in His Majesty's Service.

49
W.O.
3667

NOTES
ON THE AMMUNITION FOR
Q.F. 13-PR., Q.F. 18-PR.
HORSE AND FIELD EQUIPMENT.

ORDNANCE COLLEGE.

3RD EDITION.

Head ¹⁹¹⁷Quarters.

LIBRARY.



LONDON:

BY THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE,
PRINTED AND SOLD BY H. K. MURRAY, BANK, W.C.

UF
860
.N67
1917

Y.

No.

[Crown Copyright reserved.]

40
W.O.
3667

NOTES
ON THE AMMUNITION FOR
Q.F. 13-PR., Q.F. 18-PR.
HORSE AND FIELD EQUIPMENT.

ORDNANCE COLLEGE.

3RD EDITION.

1917.



Defence Academy
LIBRARY
University College

LONDON :

PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE,
By HARRISON AND SONS, 45-47, ST. MARTIN'S LANE, W.C.
PRINTERS IN ORDINARY TO HIS MAJESTY.

DEFENCE FORCE ACADEMY LIBRARY



362603

CONTENTS.

	PAGE.
Table of Ammunition	4, 5
General Notes	6
Cartridge Cases	7
Primers, Percussion	9
Cartridge Clip	10
Charges	10
Q. F. 12- and 18-pr. cartridge with shrapnel shell	13
" " " with star shell... ..	16
High Explosive Shells	17
Q. F. 12- and 18-pr. cartridge with H.E. shell	23
" 18-pr. cartridge with incendiary shell	24
" " " smoke shell	25
Packing	27
Fuzes	29
Fuze, Grass, No. 100	31
Gaines	32
Fuze, Percussion, Nos. 101 and 101a	35
" " No. 102	37
" " No. 103	37
Time, and Time and Percussion Fuzes	39
Fuze, T. and P., No. 80	40
" " No. 85	43
" Time, No. 25	45
Plugging and fuzing filled shell... ..	46
Glossary	47

KEY TO SHADING OF FIGURES.

Yellow.



Red.



Green.



Blue.



These notes are intended for the information of officers as to the details of the ammunition issued for use with their equipments, and they supplement the regular Treatise and Handbooks.

It must be clearly understood that they are no authority in themselves, and that the official authority is contained in Lists of Changes published every month with Army Orders.

Descriptions are complete to April, 1917.

TABLE OF MAIN DETAILS

CARTRIDGE CASE	Solid-drawn brass case (p. 7) holding propellant gases.	
IGNITION ...	No. 1 Percussion Primer (p. 9) screwed	
PROPELLANT CHARGE	Full and reduced charges of Cordite	
PROJECTILE ...	SHRAPNEL (p. 13)	STAR (p. 15).
Filling ...	Bullets.	Stars of illuminating composition.
Opening charge, or detonation producer.	Gunpowder (fine grain).	Gunpowder (fine grain).
FUZE ...	T. and P. No. 80 (p. 40) or T. and P. No. 85 (p. 43).	Time No. 25 (p. 45).

OF CARTRIDGES.

the propellant charge, and acting as a sealing-device for the

into the base of the cartridge case.

M.D. or R.D.B. (p. 10), and full charges of N.C.T. (p. 10).

HIGH EXPLOSIVE (p. 23).	INCENDIARY (p. 24).	SMOKE (p. 25).
Amatol, Lyddite or Trotyl.	Thermit.	Phosphorus.
Gaine (p. 32) in conjunction with trotyl crystals or C.E.	Special.	Gaine (p. 32) in conjunction with trotyl crystals.
Grain No. 100, or Percussion Nos. 101, 101A, 102, or 103 (pp. 31-37).	T. and P. No. 80 (p. 40), or T. and P. No. 85 (p. 43).	Percussion No. 101 or 101A (p. 35).

GENERAL NOTES.

The ammunition used with the 18- and 18-pr. equipments is of the fixed type. The projectile, usually fuzeed, is fixed in the mouth of the brass case containing the propellant charge, and fitted with a primer as the means for igniting, so forming a complete round for loading into the gun.

The fuzes used with this ammunition are not fitted with safety pins, but have internal safety arrangements, so that no manipulation of the fuze, apart from the setting of the ring in the case of a time fuze, is necessary to put the round in a condition for loading. The fuze used with star shell is an exception, for a reason to be explained later, see p. 45.

Spring clips are fitted over the ends of the brass cases to protect the primers from accidental blows during transit, and to provide a support for webbing loops for withdrawing the ammunition from the limber or wagon.

In the limber or wagon, each round is packed in a tubular brass or cane carrier that fits into a pigeon hole. A wagon with limber holds 76 rounds, and a gun-limber 24 rounds.

For transport or storage, four complete rounds are packed in a wood box.

The bodies of the shells and the bases of the cartridge cases are painted in different colours to distinguish the different natures of cartridges.

Cartridges whose issued to both equipments, are identical, except as regards weights and dimensions.

When circumstances permit, lists should be kept up for each gun of the particulars of the ammunition provided for it, in the order in which it is to be expended. Particulars should include Designation and Mark, Initial of Manufacturer, Monogram of Station, Design Number of Filling, and Date of Filling and Lot Number. The information enables faulty rounds to be identified, and is of assistance in tracing causes of failure.

CARTRIDGE CASES.

The propellant charge is contained in a solid-drawn brass case (p. 12) with an integral and thick base, having a central screw-threaded opening for the primer, and an external rim that acts as a stop when loading, and as a projection against which the extractor acts. The case is slightly tapered to facilitate extraction from the gun, and is a close fit in the gun chamber for the whole of its length. The shell is fitted into a parallel portion at the mouth of the case.

The walls of the case are thin so as readily to expand against the walls of the gun chamber and form a seal for the propellant gases. The walls being thin, the cases should be protected from rough usage, as a dented case may jam if loaded; also the case may be crumpled, if undue force is used when inserting a separate case into the gun to discharge a separated projectile, if it is considered advisable to clear the gun in this manner.

Cases are repaired and refilled a number of times. The full "life" of a case, or the number of times it is considered safe to allow it to be used, is six full charges. The letter C, indicating Credite or its equivalent N.C.T., is stamped on the base of the case, as shown on p. 12, and a letter F (full) or R (reduced) added each time the case is filled.

All fired cases should be returned at the first opportunity.

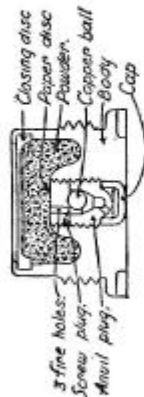
Cracks may develop in cartridge cases, particularly those that have fired a number of rounds. Cracked cases should not be used, as, if fired, they may cause serious damage to the gun.

As a general rule, the Mark II cases will give lighter extractions than the Mark I.

MARKING ON BASE OF CARTRIDGE CASES.

Cartridges which have been made up with cotton tape or cotton sewing instead of silk braid or silk sewing will have the letters "C.N." (sewn cotton) added to the mark of the complete round.

PRIMER, PERCUSSION, Q.P. CARTRIDGES, No. 1, MARK II.



Key No. 27 (Primer)



8

9

PRIMER, PERCUSSION, No. 1.

The primer is screwed into the base of the cartridge case, and is provided with a percussion cap and a small magazine of gunpowder. The cap is fired by the blow of the striker, and the flash from the cap fires the gunpowder, and this in turn ignites the propellant charge.

The magazine is closed by a metal or glazed-board disc, treated so as to open out when the primer is fired. Occasionally, these discs, particularly those of glazed-board, are blown out of the primers. If the blown-out disc rests in the base of the gun, it should be removed before loading the next round and so obviate the possibility of a jam.

Primers with glazed-board discs can be identified by the letter "B" added to the numeral, thus No. 1 Mark II B.

Marks II, V, VI of the No. 1 primer are fitted with a ball in the passage between the cap and magazine. The ball is blown back into its coned seating, and seals the passage against the back rush of the propellant gases.

Travelling the ammunition may cause the primer to uncrew and allow the entry of moisture, which is absorbed by N.C.T. charges and affects their shooting. A partly-projecting primer may prevent the breech from being closed when the round is loaded.

No. 27 key is used for inserting or removing the primer. It consists of a steel bar bent to fit the end of the case, and provided with two studs that engage the slots in the head of the primer. A lanyard is fitted to the key.

Before inserting the primer, the screw threads and underside of the flange should be coated with Mark III luting to prevent the entry of moisture into the cartridge case.

CARTRIDGE CLIP.

A four-armed brass clip (p. 12) is fitted over the base of the cartridge to protect the primer from accidental blows during transit. One arm is painted red, and is of a different shape to the others, so as to spring over the rim of the case. The clip is removed by springing back this arm.

A webbing loop is fitted to the clip to provide a handle for withdrawing the round from its basket. In future issues, these loops will be fire-proofed.

CHARGES.

The following charges are used with 18-pr. ammunition:—

Full charges of 1 lb. 4 oz. 11 dr. Cordite M.D. or R.D.B., size 8, or of 1 lb. 6½ oz. N.C.T., size 7, for all cartridges except those fitted with star shell.

A reduced charge of 6 oz. 10 dr. Cordite M.D., size 4½ for use with star shell.

The charges used with 18-pr. ammunition are:—

Full charges of 1 lb. 8 oz. 15 dr. Cordite M.D. or R.D.B., size 8, or of 1 lb. 10 oz. N.C.T. 7, for all cartridges except those fitted with star shell.

A reduced charge of 8 oz. Cordite M.D., size 4½, for use with star shell.

A special reduced charge of 9 oz. Cordite M.D., size 2½, for firing shrapnel and H.E. shell at high elevations to give howitzer effect.

As the ballistics of each lot of propellant vary, the weight of the charge at a temperature of 80° F. is adjusted to give in a new gun the standard muzzle velocity for each nature of projectile. The weights given above are, therefore, nominal, but the variation in any case is small.

That such an adjustment has been made is indicated by the letters A.C. stencilled on the base of the cartridge, and on the box in which the ammunition is packed.

Although the charges are adjusted, it sometimes happens that charge made up from different lots of propellants do not shoot together. To obtain regular shooting, the cartridges should therefore be grouped according to the lot number of the propellant.

The nature of the propellant and its lot number is stencilled on the base of the case, and on the box in which the ammunition is packed (p. 26).

The cordite charge is tied in a bundle, the sticks in the centre being slightly shorter to form a recess for the magazine of the primer (p. 12). The full charge is cut to a length to fit the case (p. 12), but the reduced charge is made up into a short bundle and packed by a paper cylinder (p. 14).

The N.C.T. charge is loaded loose into the case.

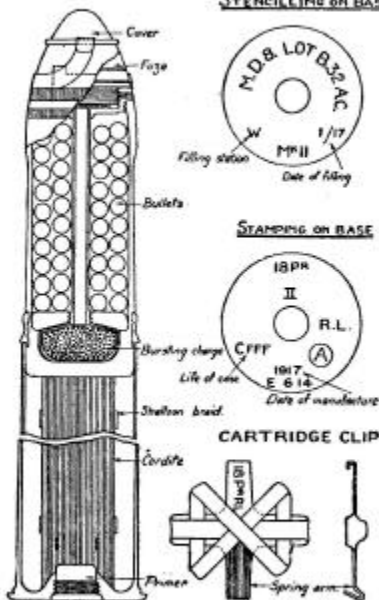
NOTE.—When extracting an unfired round from the gun, it occasionally happens that the cartridge case is detached, and the separated shell left in the bore. Under certain conditions—for example, a misfire or an incorrect fuze-setting of the original round—the separated shell may be expelled by firing the gun after it has been reloaded with a separate case containing its correct propellant charge. If this method is adopted, the gun should be fired under precautions.

When N.C.T. charges are used, care should be taken that none of the original charge is left in the chamber, as the N.C.T., being loose, is easily split. If part of the charge is left in the gun, this may lead to a jam when the next case is inserted, and, what is more important, might cause an excess charge at the next round.

AN EXCESS-CHARGE MAY, WHEN FIRED, CAUSE SERIOUS DAMAGE TO THE GUN. ON THE OTHER HAND, A REDUCED CHARGE WOULD CAUSE THE ROUND TO FALL SHORT, AND MIGHT ENDANGER FRIENDLY TROOPS. CARE SHOULD, THEREFORE, BE TAKEN THAT THE CHARGES ARE KEPT INTACT.

CARTRIDGE, Q.F. 18-PR., WITH SHRAPNEL SHELL.

STENCILLING ON BASE



CARTRIDGES, Q.F. 13- AND 18-PR. WITH SHRAPNEL SHELL.

The complete round comprises the cartridge case (p. 7), fitted with a percussion primer (p. 9), and containing the propellant charge (p. 10), a shrapnel shell fitted with fuze and fuze cover, and a cartridge clip fitted over the base of the case (p. 10).

The shell consists of a forged steel body, into which is screwed the fuze-socket of 2-inch gauge. A recess is formed in the base to take a tin cup containing the small gunpowder bursting-charge. On the ledge formed at the top of the recess rests the steel disc, which supports the bullets. The central pipe screws into the steel disc, and is soldered into the fuze-socket at the upper end. In some cases, it contains perforated gunpowder pellets, which increase the cone of dispersion of the bullets. The bullets weigh 41 to the pound.

A narrow copper driving band, pressed into an undercut groove near the base of the shell, is the means by which the shell is caused to rotate. Near the lower edge of the band, a lip is formed, which rests on the brass case. Below the lip, a groove is formed for the top of the case to be pressed into all the way round.

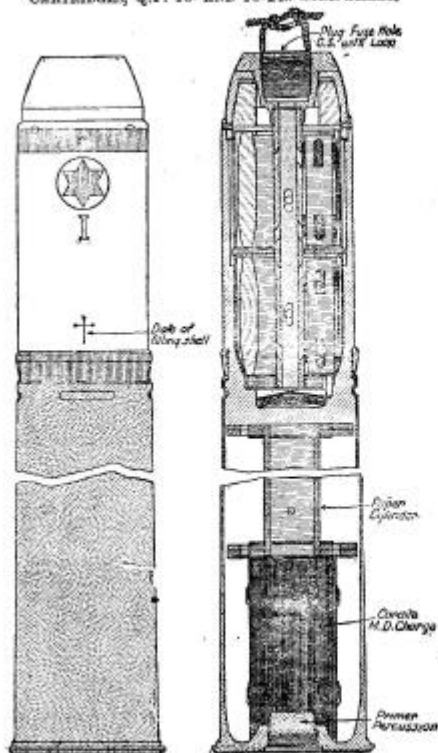
These shells are normally issued fitted with either Fuze, T. and P., No. 80 (p. 40), or No. 85 (p. 40). If not fuzed, the shells are fitted with the plug, fuze hole, 2-inch, No. 1.

Complete rounds for the 13-pr. and 18-pr. weigh respectively 16 lb. 7 oz. and 22 lb. 14 oz., and the shrapnel shells 13 lb. and 18½ lb.

Markings.—The tip of the shell is painted red. With the full propellant charge, the body of the shell is painted lead colour; if a reduced charge is used, the body of the shell and the base of the case are painted white. A red ring is painted round the shoulder of the shell to indicate that it contains its bursting-charge, and the words "WITHOUT PELLETS" on the body, if powder pellets are not fitted in the central tube. A cartridge containing a N.C.T. charge will in future issues have a black band across the base of the case.

NOTE.—N.C.T. will be used in future issues of these cartridges containing full propellant charges, except those issued for hot climates in which cordite will be used.

CARTRIDGES, Q.F. 13- AND 18-PR. STAR SHELL.



CARTRIDGES, Q.F., 13- AND 18-PR., WITH STAR SHELL.

These cartridges are similar to the shrapnel, except that reduced charges (p. 10) are used, and the space in the case packed with a paper cylinder, which retains the charge in position. Normally, the shells are issued plugged.

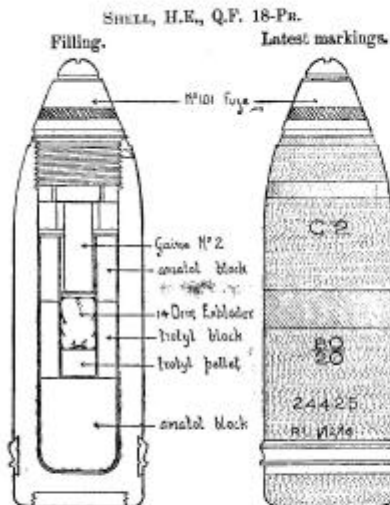
The shell is generally similar to shrapnel, but contains stars in two tiers in place of bullets, and is therefore much lighter. The fuze socket to the G.S. gauge (1-inch taper) is fitted in a separate head secured to the body by brass screws and steel pins. This attachment is weak, and the shell should not be subjected to rough usage, as a loose head would allow the entry of moisture, which would affect the ignition and efficiency of the stars.

The Mark I shell is secured to the case by indenting the latter into a groove near the base of the shell, as shown. Later marks are secured by cooling the case into a groove on the driving band as with shrapnel (p. 12).

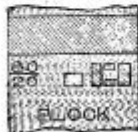
Fuze, time, No. 25 (p. 45), is issued for use with these cartridges.

The weight of a 13-pr. round is 11 lb. 6 oz., and of an 18-pr. 14 lb. 2½ oz.

Markings.—The bodies of star shell are painted black, and distinguished by a red star painted on white disc on the shoulder. A red ring indicates that the shell contains its bursting-charge.



EQUIVALENT-OLD TYPE MARKINGS.



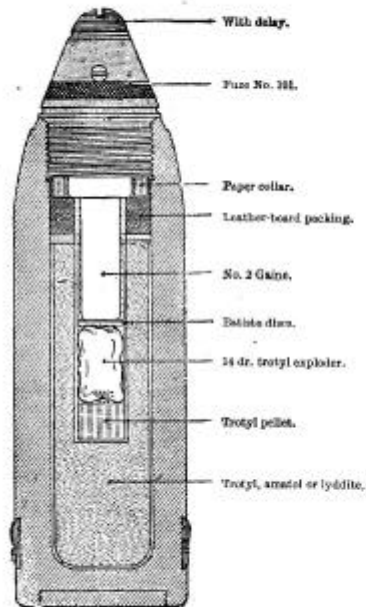
HIGH EXPLOSIVE SHELLS.

H.E. shells are arranged to detonate on impact, or in the air after graze. To obtain maximum effect in the second case, the shell should detonate nearly vertically over the target. With full and complete detonation of the bursting charge, the forged steel body is broken up into a large number of small fragments, which are projected mainly in a direction transverse to the axis of the shell; the moral effect also is considerable. When detonation is only partial, the fragments are unduly large, and there is more forward and backward effect; with mere explosion, the effect is much less as regards their number and spread, and the moral effect is negligible.

The bodies of H.E. shells are made of forged steel. A copper driving band, by means of which the rifling imparts rotation to the shell, is pressed into an undercut groove near the base. It also seals the escape of gas over the shell, and acts as a means for securing the shell and cartridge case together. The nose of the shell is screw-threaded to form a socket for the fuse or plug.

The high explosives used as the bursting charges are Lyddite (picric acid), Trotyl (tri-nitro-toluene) and Amatol. The latter is a mixture of ammonium nitrate and tri-nitro-toluene, which may be mixed in the proportion of either 40 or 80 of the former to 60 or 20 of the latter respectively. They are all comparatively inert and safe substances, as they have to sustain the shock of discharge from the gun, and they require a violent detonation actually in contact with them to ensure that they shall detonate and not merely explode. With Amatol this initial detonation needs to be more violent than with Lyddite and Trotyl. For convenience, the detonation of all these natures of filling is initiated by the detonation of one and the same exploder system designed to be effective with Amatol.

SHELL, H.E., 18-Pa.



Three types of fillings are used with these shells. (1) A block charge of Amatol (40/60), Lyddite or Trotyl in a paper container (see p. 15). (2) Upper and lower blocks of Amatol (80/20), with a trotyl block fitted between them and adjacent to the exploder (p. 16), to effect more certain detonation of the Amatol. (3) A charge of 80/20 Amatol introduced in powdered form into the shell and compacted by pressure.

With all fillings a cavity is formed in the centre to accommodate the gaine and exploder.

A H.E. shell when detonated has little incendiary effect, and the effect of the fumes is small. Detonation is indicated, with lyddite and trotyl, by black to nearly white smoke and the absence of yellow coloration in the crater. With amatol the smoke may be grey, or even nearly white.

Precautions have to be taken to guard against detonation of H.E. shell in any other manner than by the action of the fuze. A steel base-plate is screwed or riveted into a turned-out recess in the base, to guard against the flash of the propellant passing through possible flaws in the metal of the shell. The interior of the shell is coated with varnish to provide a smooth interior surface, and also in the case of lyddite to prevent the formation of dangerously-sensitive compounds by contact of the explosive with the metal of the shell. For the same reason, lead is excluded from the paint of the shell, and the metals of the fuze and plug; and precautions are taken to prevent the contact of the acid with metal particles, rusty filings, and also chalk, lime or plaster. The fuze or plug should only be removed where there is no danger of such contaminations.

The detonation of the bursting-charge in a H.E. shell is initiated by the detonation of a gaine (p. 32), fitted below the fuze, and inserted into the cavity in the filling. Detonation is not transmitted from this directly to the bursting charge, but through an exploder filling the cavity below the gaine, and consisting of trotyl crystals or C.E. (nominal weight 14 drams) in a fabric bag. The exploder is compressed after fitting into the shell;

extra compression is obtained by placing a trotyl pellet below the 14-gr. exploder; or alternatively by the use of a 16-gr. exploder, or by a corresponding reduction in depth of the cavity (p. 22).

C.E. exploders are specially provided in amatol-filled shells that are to be used in hot climates, and shells suitable for such climates have a distinctive marking (p. 21). Amatol-filled shells without this marking should be stored under such conditions that their temperature does not exceed 80° F.; for example, they should not be exposed to the direct rays of the sun, and when on ship-board should be stowed away from the boilers. If the above temperature is exceeded, oily products are liable to exude from the amatol, and by acting on the trotyl exploder reduce its efficiency or entirely prevent it from functioning.

Some amatol-filled shells with trotyl exploders may also have this marking. The amatol in these shells has been prepared with pure trotyl, and such shells may be employed in hot climates, even if the above precautions cannot be adhered to.*

Lyddite-filled shells are in all cases suitable for use in hot climates, and with these the special marking above referred to is unnecessary. C.E. Exploders must not be fitted to these shells.

H.E. shells can be burst in the air only by means of a ricochet combined with delay action in the fuze or its gaine. The ballistics of the 13- and 18-gr. guns only permit of this action up to ranges of 3,500 yards, and delay fuzes or gaines should, therefore, not be used when firing at longer ranges or over ground on which ricochets are not to be expected. The bursts of these shells are liable to be smothered and ineffective if they occur after penetration.

* Recently it has been decided that shells filled with pure trotyl may have the same extended use; these shells will also have the distinctive marking.

MARKINGS ON H.E. SHELLS.

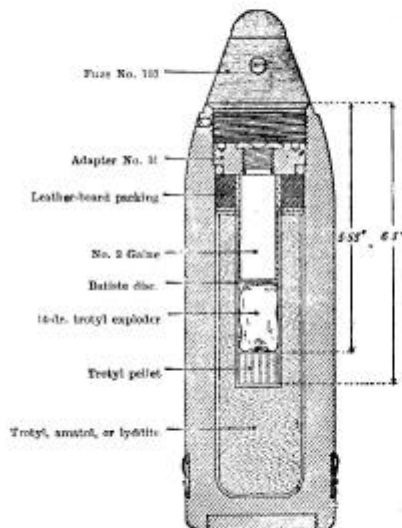
Various markings are used on these shells. To distinguish them from other natures of projectiles, their bodies are painted yellow. Fillings of amatol or trotyl are indicated by a green band painted round the body, and a fraction 80/20 or 40/60 stencilled below the band denotes in the case of amatol the proportions of its constituents. The words **AMATOL** and **FUSSES** are stencilled on the shell to show whether the charge is in block form or has been pressed directly into the shell; a green rectangle is added when the former filling has a central trotyl block (p. 16).

When filled, the usual red ring is painted round the shoulder of the shell, but in the case of amatol- or trotyl-filled shells suitable for use in hot climates, this ring is broken by yellow crosses.

The letter "G" denotes that a gaine is fitted, a numeral being added to indicate its pattern; thus, G. 2. A green square indicates that a trotyl pellet is fitted at the bottom of the exploder cavity.

The green square and rectangle, and the words **BLOCK** and **FUSSES** will be omitted in future, when the design number of the filling will be stencilled on the shell (p. 16).

SHELL, H.E., 18-Pr.



CARTRIDGES, Q.F. 13- AND 18-Pr., WITH H.E. SHELL.

These cartridges are identical with the shrapnel except as regards the nature of the shell and the fuze with which it is fitted. The same charges are used,* and the shell is secured in the case in a similar manner.

The shells are normally issued fuzed, but if plugged would most probably be fitted with plug, fuze hole, 2-inch, No. 3.

Perussion fuzes of a graze type are fitted. They are either Nos. 100, 101, 101a, 102 or 103 (pp. 31-37). The internal arrangements of the shell differ slightly when the No. 103 fuze is used, in that the gauge is fitted in an adaptor (p. 22) that screws directly into the fuze-socket. With other fuzes the gauge is fitted to the fuze. Covers are not fitted to any of these fuzes.

Complete rounds for the 13- and 18-pr. weigh respectively 16 lb. 7 oz. and 22 lb. 14 oz., and the shells 15 lb. and 18½ lb.

Markings.—These cartridges are distinguished by the bodies of the shells being painted yellow. The bases of the cases are painted with the same colour, so that these cartridges can be readily identified when in the limber or wagon.

Cartridges containing N.C.T. charges may have a black band painted across the base of the case.

* In future, these cartridges will be filled with cordite charges only.

CARTRIDGE, Q.F. 18-Pn., WITH INCENDIARY SHELL.

This cartridge is issued only with the 18-pr. equipment. The cartridge is identical with the shrapnel except as regards the filling of the shell. It is always issued with a full charge of propellant.

The incendiary shell consists of a shrapnel body with the bullet space filled with thermit, and with an igniting and bursting-charge of special composition in the tin cup and central tube. The shell is fitted with the same fuzes as shrapnel; that is, T. and P., Nos. 80 or 85 (pp. 40 and 48).

The fuse should be set to burst the shell just in the air, and low down over the objective. When burst under these conditions, the incendiary effect is good; for example, green grass is set on fire, forming an effective smoke screen.

Good smoke effect is given at the burst.

The complete round weighs 18 lb., and the shell approximately 13 lb. 10 oz. 11½ dr., but as this weight may vary the actual weight is stencilled on the body of the shell for grouping purposes. This shell requires its own range table.

The cartridges should be stored separately from other ammunition. An exception may be made in the case of smoke shells.

Markings.—To distinguish this ammunition the shells, the bases of the cartridge cases and the boxes in which the ammunition is packed are painted red.

Cartridges with N.C.T. charges will in future issues have a black band painted across the base of the case.

Note.—Incendiary shells marked A.Z. are of a different type, and are not suitable for use with these equipments.

CARTRIDGE, Q.F. 18-Pn., WITH SMOKE SHELL.

This cartridge is issued with the 18-pr. equipment only. The cartridge is similar to the H.E. (p. 23), and consists of the usual brass case (p. 7) with full charge (p. 10), and a H.E. shell body (p. 17) filled with phosphorus.

A cavity is formed in the centre of the shell-filling to take a tin container fixed in a collar screwed deep down in the fuze-socket. In the cavity is fitted the exploder system of a H.E. shell (p. 19), that is, a trotyl pellet, trotyl exploder (14 drams) and a No. 2 gaine.

Fuzes No. 101 or 101a, without delay, are fitted to these shells.

These shells are used to produce smoke screens. The fuzes and gaine are, therefore, without delay, so as to give bursts immediately on impact with the ground. The smoke lasts for 1-2 minutes.

The shell weighs about 19 lb. 1 oz. 4 dr., and the complete round 23 lb. 7 oz. 4 dr., but as the weight of the shell may vary the actual amount is stencilled on the shell body so as to allow of grouping. The shells are designed to shoot with the H.E. range table.

These cartridges should be stored separately from other ammunition. An exception may be made in the case of incendiary shell.

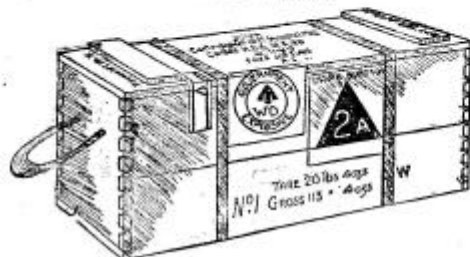
Markings.—The body of the shell, the base of the case, and the box in which the rounds are packed are painted olive-green to distinguish this ammunition from other natures. The head of the shell is painted yellow to indicate that a H.E. burster is fitted, which is further defined by the stencilling G. 2 for No. 2 gaine, and EXPR. TNT. 14 DRs. for the trotyl exploder. PHOS. is stencilled on the shell to indicate the nature of the smoke-producing material. The design number of the filling is also stencilled on the shell.

Cartridges containing N.C.T. charges will in future issues have a black band painted across the base of the case.

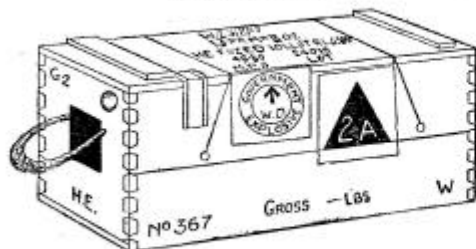
Note.—As phosphorus melts at about 111° F., it is desirable that these cartridges should be kept as cool as possible, and protected from the sun's rays.

BOX, AMMUNITION, Q.F. 18-PR.

OLD TYPE MARKINGS.



LATEST MARKINGS.



PACKING.

For transport and storage four complete rounds are packed in a wood box fitted with removable packing pieces. The standard box is bound with steel hoops, to which the lid is secured by nuts, but in a temporary box wire bands are passed across the lid and secured to the sides.

The box is labelled as shown opposite*, and stencilled thus:—

LID.

OLD TYPE.

Numerical of Fuzes.	" Fuzed " date of fuzeing. Number of Cartridges in box. Designation and numeral of filled Cartridge and Shell. Size and Lot number of the Cordite. Monogram of Station and date of filling. " Filled and Fuzed." " A.C." if the charge is adjusted. † " No Fuze Covers. Use at once."	Numerical of Fuze.
---------------------	--	--------------------

† Omitted if fuze covers are fitted.

LATEST TYPE.

Filling Station and Date of Filling, " 18-pr." or " 18-pr.," Mark of Cartridge, " G. 2," if fitted with Galva No. 2. Nature of Shell. " Fuzed." Pattern and Lot No. of Fuze. Nature of H.E. Filling. Design No. of Filling. Nature and Size of Propellant. Lot No. of Propellant.
--

* In future boxes, the government explosive and classification labels will be combined into one.

FRONT.

*Tare and gross weight,
Monogram of Packing Station,
Number of box.

SPECIAL MARKINGS.

18-PR. SHRAPNEL.—The box has black cleats or painted black rectangles on the ends.†

18-PR. H.E.—On the lid, "High Explosive" replaces "Shrapnel"; on the ends 18-pr. in black on the left of the cleats, and "H.E." below them. A blue disc is painted on the right-hand top corner of each end of the box when the ammunition is fitted with delay. If the ammunition is fuzed with No. 101x fuze with delay, a blue diamond is painted round the disc; if with this fuze but without delay, a black diamond is painted on each end of the box.

Amatol or Trotyl-filled shells suitable for use in hot climates have two red crosses painted on each end of the box.

18-PR. SHRAPNEL.—As shown on p. 27.‡

18-PR. H.E.—On the lid, "High Explosive" or H.E. in place of "Shrapnel"; on the ends, "High Explosive" or H.E. stencilled in black below the cleats. A blue disc is painted on the right-hand top corner of each end of the box when the ammunition is fitted with DELAY. If the ammunition is fuzed with No. 101x fuze with delay, a blue diamond is painted round the disc; if with this fuze but without delay, a black diamond is painted on each end of the box.

Amatol or Trotyl-filled shells suitable for use in hot climates have two red crosses painted on each end of the box.

18-PR. OR 18-PR. STAR SHELL.—In addition to the other markings, the ends are painted with a black star.

* Tare weight omitted in latest issues, also gross weight transferred to lid of box.

† In future, the letter "L" will be stencilled on the ends of boxes containing cartridges fitted with aluminium fuzes.

FUZES.

The bursting-charge of a shell is ignited or detonated by means of a fuze designed to act at any particular instant during flight, or upon or after impact or graze. These functions correspond to the time and to the percussion fuzes respectively, or they may be combined as in a time and percussion fuze. All three types of fuzes are issued with these equipments.

Fuzes, when not fixed in the shells, are issued packed in tin cylinders. The lid of the cylinder is sealed by a soldered strip or by a shellaced tape band; and it is important, in order to prevent deterioration and consequent blunts or prematures, that the strip should not be removed until the fuze is to be fitted in the shell.

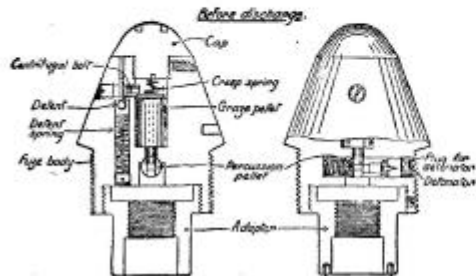
Fuzes are secured in the shells by set screws or by punching a lip on the fuze into shallow slots cut in the fuze socket. Fixing is necessary, as the vibration when travelling, and also the act of setting T. and P. fuzes, tends to cause the fuze to unscrew in its socket.

All fuzes are stamped with their distinguishing number and mark, the maker's initial, date and lot number, and the same information is given on a label on the lid of the box.

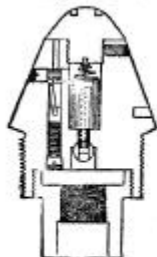
PERCUSSION FUZES AND GAINES.

The percussion fuzes used with these equipments, whether combined with time fuzes or not, are of the graze type. They rely for their functioning on the shock to the forward velocity of the shell that takes place on graze or impact, and not on an actual blow delivered to any part of the fuze. Certain of the fuzes may function on direct impact, even if graze action fails to take place.

FUZE, GRAZE, No. 100, MARK I.



During flight



FUZZS—continued.

A Graze Action Percussion Fuze is very sensitive. Its action depends upon a movable pellet inside the fuze, which moves forward on graze, causing a needle to come in contact with a detonator. Special arrangements are provided to guard against premature action in transport, in handling, and in loading; on discharge, while the shell is in the bore; and during flight, before it strikes or grazes.

The percussion fuzes are designed to be used in H.E. shell in conjunction with gains. In many cases the fuze or gain is fitted with a delay. This, in addition to giving a retarded burst on impact or graze, acts as a safety device to retard the burst and prevent damage to the gun and to personnel, should the fuze function prematurely.

FUZE, GRAZE, No. 100.

To be used with H.E. shell of these equipments in conjunction with a gain (p. 82) until later patterns are available.

The fuze, with a gain screwed into a threaded recess in the underside of the body, is packed in a tin cylinder.

The fuze comprises a body, an adapter and a cap. The lower part of the fuze body is screw-threaded to 2-inch gauge, and the contour of its upper part continues the general lines of the shell. The mushroom-shaped cap is secured in the upper part of the central recess.

The percussion pellet, fitted with a needle, is held clear of the detonator with the pellet spring compressed, by the graze pellet. This, in turn, is prevented from moving forward out of place by the centrifugal bolt, which is locked by a detent pressed upwards by a spring.

The shock of discharge causes the detent to set back, compressing its spring; and the detent pin, thrown outwards by

FUZZES—continued.

the spin of the shell, catches under the shoulder of its recess (as in the lower figure), and prevents the return of the detent to its original position. The rotation of the shell then causes the centrifugal bolt to move outward, clearing the graze pellet. The latter is restrained from working forward during flight by a creep-spring. On graze or impact, the graze pellet flies forward, compressing the creep-spring, and clearing the percussion pellet, which, by the action of its spring, carries its needle on to the detonator. The flash passes down into the gaine, which detonates the filling of the shell.

SPECIAL MARKS.—A red patch is painted on the body of the fuze. When the fuze is fixed, this mark must not lie directly above the set-screw hole in the shell, or there will be a chance of piercing the detonator and exploding the shell when the set-screw is put in.

When the gaine used with the fuze contains DELAY composition, the fuze cap is painted BLUE.

No. 16 fuze key is used for fixing and removing all fuzes of this type, but will be superseded by a double-ended key, No. 53, in the future.

GAINES.

Used with H.E. shells, filled Amatel, Lyddite or Trotyl, and with Smoke shells, in conjunction with a graze or percussion fuze.

The violence necessary to detonate the bursting charge can be produced by successive detonations, and the gaine is a means to this end.

No. 2 GAINES is a steel sleeve or tube. The upper end is threaded and screw into the adapter of the fuze, or the adapter and gaine may be formed in one piece. When the fuze is fixed in the shell the gaine lies below it in the cavity formed in the material of the bursting-charge.

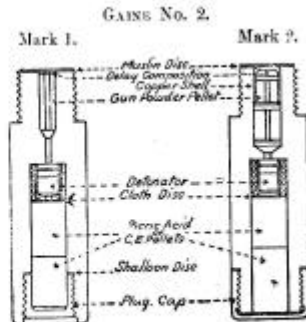
FUZZES—continued.

The flash from the magazine of the fuze explodes the perforated powder pellets. The flame from these passes through a flash hole and ignites a detonator. This detonates two pressed pellets of exploding composition (C.E.), or of picric acid, which in turn detonate the 14-dram exploder of trotyl crystals contained in a small bag, placed choke down below the gaine, in the lower part of the recess in the material of the bursting-charge. This detonates the filling of the shell.

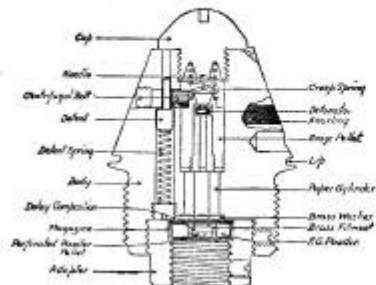
A red band round the body of the gaine denotes that it contains C.E., and a yellow band denotes picric acid. There is no difference in use.

The gaine may be fitted for DELAY action. When this is the case, a blue band is painted round the body of the gaine, above the red or yellow band.

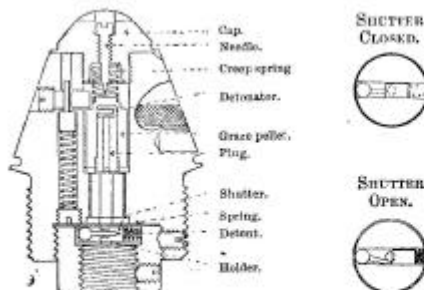
Packing.—Gaines are usually issued ready fitted to a graze or percussion fuze, as described on p. 31.



FUZE, PERCUSSION, No. 101.



FUZE, PERCUSSION, No. 101E.



FUZZE—continued.

FUZE, PERCUSSION, No. 10L.

This fuze is to supersede the other graze and percussion fuzes in H.E. or Smoke shell in conjunction with a gauge.

It is generally similar in outline to the No. 100, but it has no percussion pellet, and the detonator is contained in the graze pellet. With this arrangement it is possible for the needle to fire the detonator when the cap is crushed in on impact, although the graze pellet may not have functioned.

This fuze also differs from the No. 100 in that a set-screw is not required to secure it in the shell, but a lip turned on the fuze is punched into shallow slots cut in the fuze socket; the cap of the fuze is secured in a similar manner; a magazine is fitted in the adapter, and may contain a delay pellet in addition to the gunpowder.

The needle may be spun in as shown, but to obtain a fixing more capable of withstanding set-back, the needle in later issues is screwed in from the exterior of the cap.

All spun-in needles are tested to determine if properly held; if found satisfactory, the caps of the fuzes are painted green.

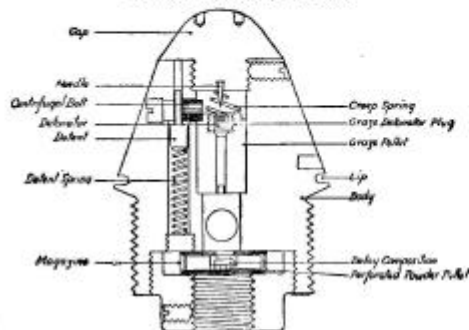
When delay is provided in the magazine, the cap of the fuze is painted blue. Delay in the gauge is useless, as it is negated by the powerful flash from the magazine. In fuzes with tested needles, delay is indicated by a blue tip to the green cap, or by the cap being painted half green and half blue.

This fuze is distinguished by a black or knurled band.

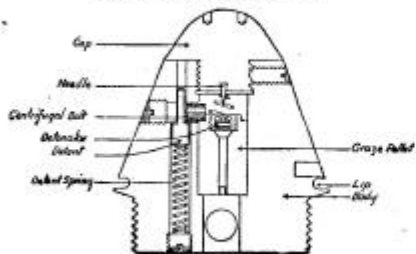
FUZE, PERCUSSION, No. 101E.

This fuze is identical with the No. 101 with screwed in needle, except that a shutter is fitted in the place of the magazine. The shutter negatives premature functioning of the fuze while the shell is in the gun.

FUZE, PERCUSSION, No. 102.



FUZE, PERCUSSION, No. 103.



FUZES—continued.

The shutter consists of a block fitted into a slot in its holder, and held in a closed position masking the flash-hole by an oppositely-disposed creep-spring and detent with weighted head. The parts are held together by a tin cap. As the shell spins the shutter moves outwards, unmasking the flash-hole. At the same time the tail of the detent is released from its recess in the shutter, and moving to one side, prevents the shutter returning and masking the flash-hole.

FUZE, PERCUSSION, No. 102.

To be used in H.E. shells in conjunction with a gaine until later types become available.

This is No. 100 fuze, converted to No. 101 pattern by the removal of the percussion pellet, the insertion of the detonator in the graze pellet, and the provision of a groove to take the punch-dabs for securing the fuze. A knurled band engraved around it indicates that the cocked percussion pellet has been removed. A magazine, which may contain some delay composition, is generally provided in the adaptor. The fuze may bear signs of the red patch, but it has no significance.

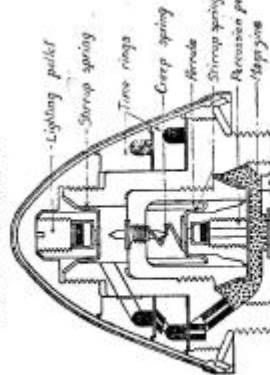
This fuze may be fitted with either a spun-in or a screwed needle. All the former have been tested, and the fuzes marked accordingly, see fuze No. 101 (p. 35).

FUZE, PERCUSSION, No. 103.

To be used in 18-pr. H.E. shells in conjunction with a gaine fitted into a No. 10 adaptor (p. 22), or into a No. 12 adaptor. The latter is provided with a shutter similar to that used in the No. 101x fuze (p. 35).

It is a modification of No. 102 fuze, effected by cutting off the screw-threaded portion at the base which takes the ordinary adaptor. There is no magazine.

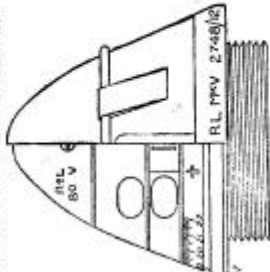
POSITION WHEN SET 0.



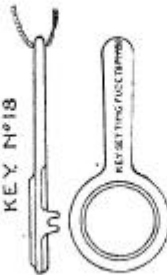
KEY No 17



POSITION WHEN SET AT SAFETY.



KEY No 18



FUZZES—continued.

TIME AND TIME AND PERCUSSION FUZZES.

A Time Fuze provides for bursting a shell at any instant during its flight, at the expiration of an interval of time which is regulated by the setting of the fuze previous to loading. According to the setting, a longer or shorter portion of a length of composition, ignited on discharge, is allowed to burn before exploding a small magazine of gunpowder, which communicates a flash to the bursting charge of the shell. A Time and Percussion Fuze also includes a percussion arrangement of the graze type, intended to ensure action on graze or impact should the time portion fail, or should it be incorrectly set for the actual range.

The composition is pressed into grooves in one or more rings, and setting is effected by adjusting the position of the rings with respect to each other or to the fuze body. The rings are held together and to the body by means of the cap of the fuze, and when issued are fixed at a standard tension, that cannot be easily re-adjusted once the fuze is assembled. This tension is almost or quite sufficient to prevent the rings being turned with the fingers.

Occasionally, the tension is lost, and the rings become loose. Such a fuze should be locked on with suspicion, as the tensioning is the method by which the flash from the composition is confined, and also the safeguard against the entry of the flash of any propellant gases that might pass over the shell. If these safeguards are non-existent, a premature may result. From this it follows that the cap of the fuze should not be released to facilitate setting.

Time fuzes must be grouped for firing by lots. When a fresh lot is taken into use it may be necessary to verify the corrector setting.

The preservation of the composition from DAMP is most important with all time fuzes. Damp might lengthen the time of burning or even prevent ignition. Deterioration

Fuzes—continued.

of the composition might result in the flash from the detonator pellet passing right round to the powder pellet and causing a premature.

For directions as to the preservation of fuzes, see page 41.

FUZE, TIME AND PERCUSSION (22 SECONDS), No. 80.

This fuze is used with the shrapnel and incendiary shells of these equipments. It consists of a body screwed to the 2-inch gauge, and provided with the two time rings, the upper of which is fixed. Each time ring has a groove in its underside, forming a circle broken by a short bridge of metal. The fuze composition is pressed into the rings, which are furnished with gas-escape holes, closed by brass discs.

The lighting-pellet, fitted with a detonator, is supported on a stirrup-spring. On discharge, this pellet sets back, straightening out the arms of the stirrup-spring, and carrying the detonator on to the upper point of a double-ended needle. The flash from the detonator passes through a hole in the stem and lights the time composition in the upper time ring. The flame burns round in the same direction as the spin of the shell until it ignites a powder pellet in the passage communicating with the lower ring. The composition of this ring is then ignited, and the flame travels in a reverse direction until it reaches the powder pellets in the channel to the magazine, which is then fired. When the setting mark of the ring is opposite the red star on the body—that is, when the fuze is set at safety—the flash hole to the lower ring is masked by the bridge of the upper ring, so that the lower cannot be ignited, if the fuze should function during transit. A second safety is provided by the bridge of the lower ring masking the flash hole to the magazine.

The protection given to the lighting-pellet by the cap of this fuze, particularly if this is of aluminium, is not great, and a fused round, if dropped on to its nose, may

Fuzes—continued.

cause the fuze to function. It is important, therefore, that the fuzes of complete rounds should not be subjected to rough usage, and that the fuzes should be set at safety during transport. If such a fuze has functioned, the disc in the escape hole of the upper time ring is blown out; this serves as a means of detection.

The percussion-mechanism is fitted in the body above the magazine. The percussion-pellet is kept clear of the lower point of the needle by a ferrule supported on a stirrup-spring. On discharge, the ferrule sets back, straightening the arms of the stirrup-spring, and a creep spring prevents any further action during flight. On graze or impact the percussion-pellet and detonator fly forward on to the lower needle. The flash passes through the pellet and into the magazine.

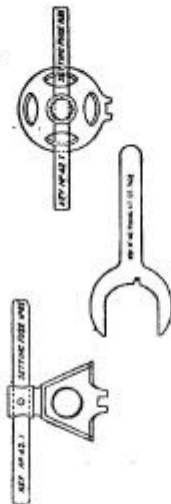
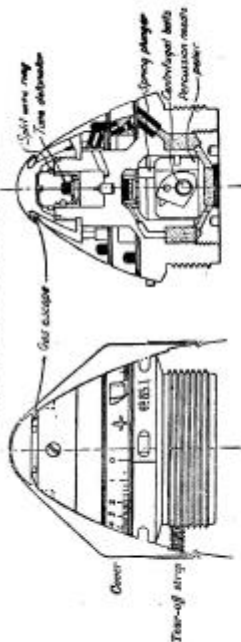
A brass, tinplate or rubber cover, to be removed at the time of setting, is fitted to protect the fuze from damp.

No. 17 key is used for fixing and removing the fuze. No. 18 key is used for setting. It is provided with a prong which engages a stud on the lower time ring. When the setting mark on the ring is opposite the red cross on the body, the fuze is set at SAFETY.

NOTE.—No. 80, and other T. and P. and Time fuzes are waterproofed before issue, by waterproofing-composition rubbed into the joints of the rings and into the gas-escape holes. When a fuze is set, this seal is broken. If a fuze, which has been set, is not used, it should be re-set to safety, and waterproofed as described above, or if waterproofing-composition is not available, by sustained Mark III luting.

Fuzes without covers should be protected from damp by fitting rubber covers, which are secured by applying a band of Peitman's cement to the shoulder of the shell after removing surplus luting or grease from the fuze and shell.

FUZE, TIME AND PERCUSSION, No. 85.



FUZZE—continued.

FUZE, TIME AND PERCUSSION (22.9 SECONDS), No. 85.
Used with shrapnel and incendiary shell for Q.F. 13- and 18-pr. equipments.

The fuze body is screw-threaded to a 2-inch gauge. The arrangement of the time rings is similar to No. 80 T. and P. fuze, but the setting mark is on the body, below the ring, and the scale and red safety cross are marked round the lower time ring. The gas escape from the time rings is through openings leading into a groove round the cap. The lighting-pellet, carrying the detonator, is supported over the needle by a split wire ring. On discharge, the pellet escapes from the ring, which is left on the shoulder of the pellet recess, and sets back on to the needle; the detonator is fired, igniting the composition.

The percussion detonator is fitted in the upper part of the needle-pellet recess. The needle is carried on a pivoted block, which is kept housed in the pellet by centrifugal bolts. On discharge, the bolts spin outwards, compressing their springs, disengaging the pellet, and allowing the needle block to revolve about its pivot by centrifugal action, so as to bring the needle underneath the detonator. Spring plungers prevent the pellet creeping forward during flight. On graze or impact the pellet flies forward, depressing the spring plungers, and carries the needle on to the detonator, the flash from which passes down the passage in the body and fires the magazine.

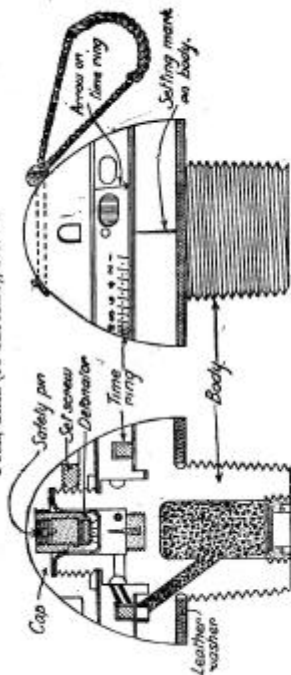
If the percussion-mechanism has been tested before issue, the cap of the fuze is painted green.

The fuze is very strongly tensioned. Each graduation represents about .08 seconds longer time of burning than with No. 80 fuze.

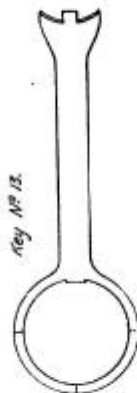
No. 42 key is used for setting, and No. 43 key for fixing and removing the fuze.

Note.—These fuzes are usually issued with a rubber band round the gas-escape groove. The band prevents the entry of damp, and must be removed before loading.

An alternative arrangement is a brass cover fitted over the fuze, and provided with a tear-off strip, the lower edge of which is crimped into a groove on the shoulder of the shell.



44



Key No. 13.

45

FUZES—continued.

FUZE, TIME (15 SECONDS), No. 25.

Used with star shell, Q.F. 13- and 18-pr.

The fuze consists of body, time ring and cap. It does not contain any percussion or graze arrangements.

The lower portion of the body is screw-threaded to G.S. gauge.

The cap, retained by a set-screw, screws on to the upper stem of the body, and clamps the time ring with a standard tension. In the upper stem of the body is a recess containing a detonator pellet supported by a stirrup spring and a safety-pin, and below the detonator pellet is a needle plug. The time ring has a groove machined in its underside, into which is pressed a slow burning composition. The groove does not extend all the way round, and the bridge of solid metal, when set at safety (i.e., with the arrow on the time ring pointing to the setting mark on the body) covers a powder pellet in a recess in the body. From this recess an oblique channel leads to the magazine.

As star shell are fired with reduced charges, giving low starting pressures, the initial set-back on the lighting-pellet is correspondingly reduced. The stirrup-spring has, therefore, to be of a weak type, if the fuze is to function correctly. This weak spring would not alone give adequate safety during transport, and the safety-pin is, therefore, fitted to prevent premature functioning.

Key No. 13 is used for setting the time ring, the graduations being on the ring and the setting mark on the body, or vice-versa. The circular end of this key is used for fixing the fuze in the shell. The safety-pin is pulled out before loading.

The shock of discharge sets back the detonator pellet, straightening out the arms of the stirrup-spring, and so starts the action of the fuze.

PLUGGING AND FUZING FILLED SHELL.

Particular instructions are noted where necessary under the head of the several shells and fuzes.

Luting, Mark III, consists of 80 parts of whiting, 20 parts of mineral jelly, and 1 of castor oil. It is best applied with the fingers.

Thin luting consists of Mark III luting and mineral jelly in equal parts. It should be applied with a small brush.

Waterproofing-composition consists of 2 parts, by weight, of beeswax, $2\frac{1}{2}$ of French chalk, and 1 part of mineral jelly.

It is important that neither fuze, adapter, nor gaine, should work loose. Set screws are provided to ensure this, and punch-dabs are made at the junction of screw threads for adapter and gaine, and for adapter and fuze.

When inserting set screws for adapters, plugs, &c., the hole should be filled with Mark III luting, and the surplus wiped off after the screw is in place.

No set screw is required with grooved fuzes, such as No. 101. The lip of metal below the groove is punch-dabbed into the nose of the shell.

When fuzing shells with fuzes of the 100 type, a paper collar must be first inserted, as in the diagram, p. 18.

The design of filling of H.E. shells provides for the cushioning of the exploder, and force has to be used in screwing fuzes home into them.

Fuzes not provided with washers should be smeared with Mark III luting under the platform, before insertion, and the screw threads—omitting the lowest three—treated with thin luting.

GLOSSARY.

ADJUSTED CHARGE.—A propellant charge adjusted in weight at a temperature of 80° F. to give standard ballistics in a new gun. Denoted by letters A.C.

B.L. AMMUNITION.—Ammunition in which shell and cartridge are separate, and the cartridge consists of a propellant charge in a fabric bag carrying an igniter.

COMPOSITION EXPLODING OR C.E.—A high explosive that is readily detonated; used in gainees and certain fuzes and exploders.

CORDITE.—A propellant in cord, stick or tube form, and consisting of a mixture of gun-cotton, nitro-glycerine and mineral jelly, gelatinised by acetone. Gives high temperature in the chamber. Sometimes termed Cordite Mark I.

CORDITE M.D.—Cordite (Mark I) modified by a reduction in the proportion of nitro-glycerine so as to give lower temperatures in the chamber and less erosion.

CORDITE M.C.—Similar to Cordite M.D., but made with a special form of mineral jelly.

CORDITE R.D.B.—A cordite propellant giving similar ballistics to Cordite M.D., but prepared with a different form of gun-cotton. R.D.B. is an abbreviation for Research Department "B" mixture.

DETONATION.—The normal explosive action with high explosives. Results from a detonating-wave moving with extreme rapidity through the explosive; the action being so extremely rapid the resulting blow is correspondingly more violent and brusque. Compare EXPLOSION.

DIRECT ACTION OR D.A. FUZE.—A percussion fuze which functions only when a blow is actually delivered to the operative part.

EXPLORER, EXPLOR., OR EXPL.—A small charge of high

explosive fitted into a cavity in H.E. fillings, and the detonation of which effects the send-off of the main charge.

EXPLOSION.—The normal explosive action with propellants. The action consists of progressive burning; each layer is raised to its ignition temperature by heat directly transmitted from the layer preceding it. Compare **DETONATION**.

GRAZE-ACTION FUZE.—A percussion fuze that functions when the forward velocity of the shell is checked.

G.S.—General Service.

G.S. GAUGE.—A gauge used for fuze holes; 1-inch across and tapered.

HIGH EXPLOSIVE or **H.E.**—An explosive in which the normal explosive action is detonation; used for filling H.E. shells, exploders, and detonators.

N.C.T. or **NITRO-CELLULOSE TUBULAR.**—A propellant powder consisting of gelatinized nitro-cellulose; contains no nitro-glycerine; made up as short cylinders pierced longitudinally with one or more holes.

QUICK-FIRING or **Q.F. AMMUNITION.**—Ammunition in which the propellant charge is contained in a brass case, which is fitted with the means of ignition.

R A L.—The abbreviation or monogram marked on ammunition to denote that it has been manufactured or filled at the Royal Laboratory, Woolwich.

TIME AND PERCUSSION, or **T. AND P. FUZES.**—Fuzes that can alternatively be made to function after a predetermined time or on impact.

T.N.T., TRITYL, or **TRI-NITRO-TOLUENE.**—A high explosive used in the filling of shells and exploders.

2-INCH GAUGE.—The standard gauge for fuze-holes in the Land Service; 2-inches across, and parallel.