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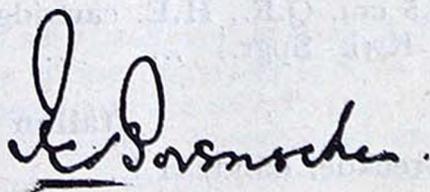
**HANDBOOK  
OF ENEMY AMMUNITION**

**PAMPHLET No. 4**

**GERMAN, ITALIAN AND JAPANESE  
SHELL, FUZES and SMALL ARMS  
AMMUNITION**

*By Command of the Army Council,*

THE WAR OFFICE,  
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1942

# HANDBOOK

## OF

# ENEMY AMMUNITION

## Pamphlet No. 4

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# HANDBOOK

OF

# ENEMY AMMUNITION

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## GERMAN FUZE DOPP Z. S/90. SAFETY

The following is a translation of an extract from German Artillery instructions:—

“ 15 cm. K. Gr. 18 and 21 cm. Gr. 18 shell with Dopp Z. S/90 fuzes from which the safety pins have been removed are no longer safe to be moved as the safety pin cannot be fully re-inserted. These shells must therefore be fired either for time or for percussion. Rammed or blind shell without safety pins must not be loaded again. They are no longer safe to move and should be destroyed in accordance with H. Dv.305. It is forbidden to remove the safety pin from a Dopp Z. S/90 fuze for training or instructional purposes.”

## GERMAN BASE FUZE (FIG. 1)

This is a graze fuze of the igniferous type.

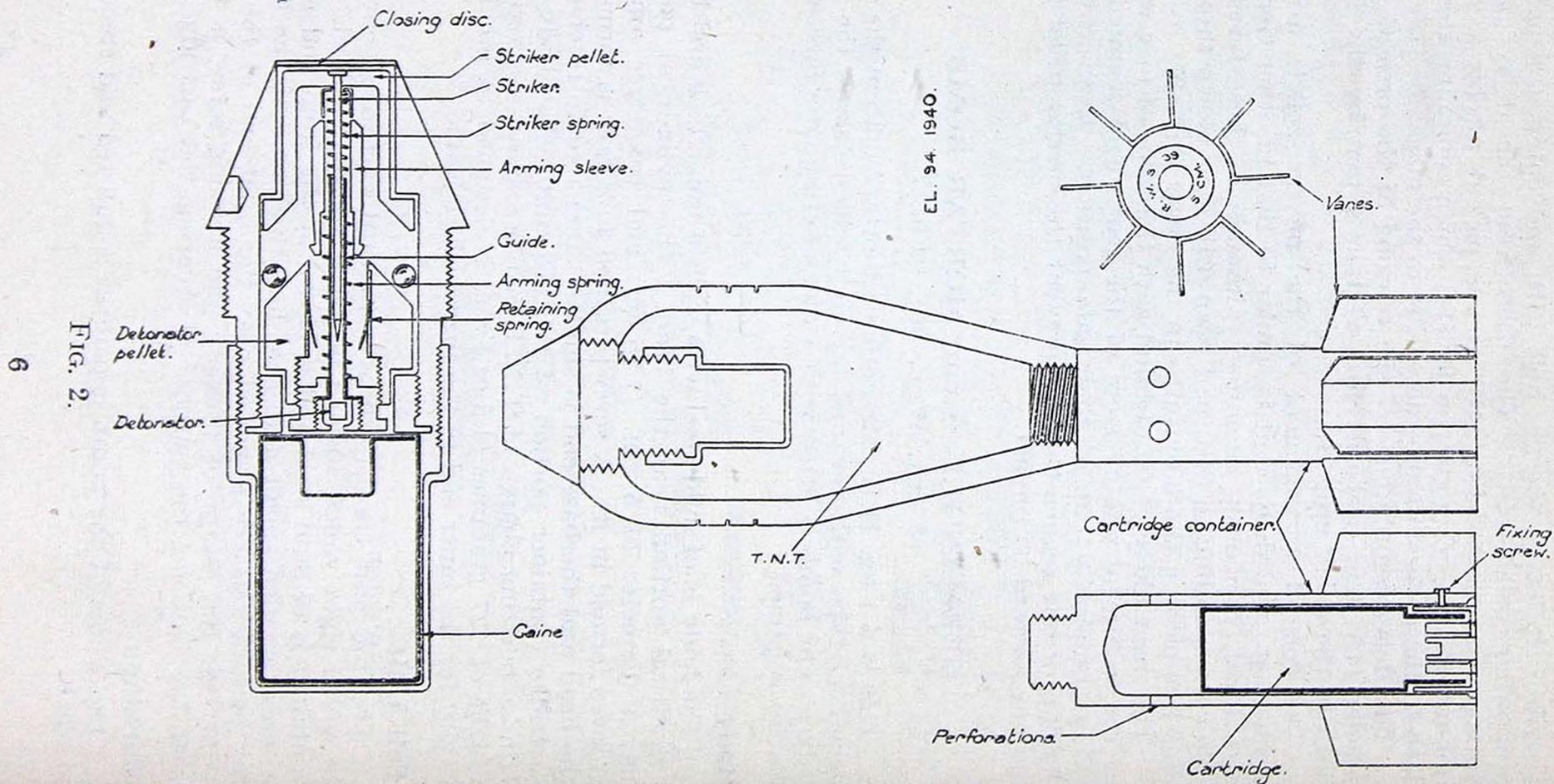
The brass inertia pellet (11) containing an igniferous detonator (9) is closed by the screwed plug (11A). In the unarmed position the inertia pellet is prevented from moving forward on to the steel needle (5) by the five centrifugal segments (6) which intervene between the base of the screwed plug (2) and the top of the inertia pellet. The segments are pivoted on the brass pin (6A) and are prevented from turning outwards by the brass sleeve (7). The sleeve is held in position by the two spring fingers (8A) on the collar (8).

### Action

On acceleration, the sleeve (7) sets back and is held in this position by the engagement of the spring fingers (8A) with the step (7A) in the sleeve (7). The segments are now free to open out under the action of centrifugal force. There is no creep spring. The inertia pellet, therefore, carries the detonator lightly against the needle during flight. The detonator is closed by a copper disc which is as thick (0.004-in.) as that used in the 3 grain “ A ” detonator, of the British base fuze.

On impact the flash from the igniferous detonator passes through the flash hole (3A) and enters the delay unit (3).

GERMAN H.E. 5-CM. MORTAR BOMB.



## Dimensions

The overall length of the round is 21.6 cm. (8.5 in.).

### FUZE Wgr. Z. 38

The body and main parts of the fuze are of aluminium with the exception of the detonator pellet which is of steel and the retaining spring and cover disc which are of brass. The mechanism consists of a striker secured to a cup-shaped movable pellet in the head of the fuze and located in a guide in the form of a tube which leads to the detonator. This guide is attached to the movable detonator pellet with a weak spring interposed between its forward end and the striker pellet which is the means of keeping the striker and detonator apart when the fuze is armed. For safety in transport and storage, nine steel balls are located between the striker pellet and the detonator pellet by means of an arming sleeve supported by an arming spring. This device prevents the detonator being prematurely fired by contact with the striker as the result of shocks and jars which might otherwise overcome the weak spring of the striker. The arming sleeve has a flange formed around the rear end to engage with the tongues of the retaining spring—fitted in the detonator pellet—when the fuze is armed.

### Action

On acceleration the arming sleeve sets back, compressing its spring and engaging with the tongues of the retaining spring which prevent it rising again. The striker is prevented from setting back and piercing the detonator by the steel balls. During flight the steel balls move forward into the striker pellet the available space in which has been increased by the setting back of the arming sleeve. The striker and detonator are then held apart only by the striker spring. The striker pellet is protected from air pressure by the brass closing disc in the head of the fuze. On graze or impact the striker spring is compressed and the striker fires the detonator. The flash from the detonator passes to the initiator filling in the head of the gaine which brings about the detonation of the gaine filling and thus detonates the bursting charge of the bomb.

### GERMAN 7.92/13 mm. A.P. TRACER, LACHRYMATORY CARTRIDGE (7.92 mm. Patr. 318 SmKH. Rs L'spur) (FIG. 3)

This round is fired by the German 7.92 mm. Anti-tank Rifles Pz.B.38 and Pz.B.39.

The round consists of a necked brass case fitted with a black tipped bullet. The cap annulus is varnished red. According to normal German identification, these marks indicate an A.P.T. round.

The case appears to be a 13 mm. one necked down to 7.92 mm. and has an unusually deep extractor groove. The head of the case is very thick and an interesting feature is the thickening of the wall of the "small cone" as the diameter

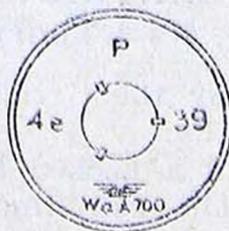
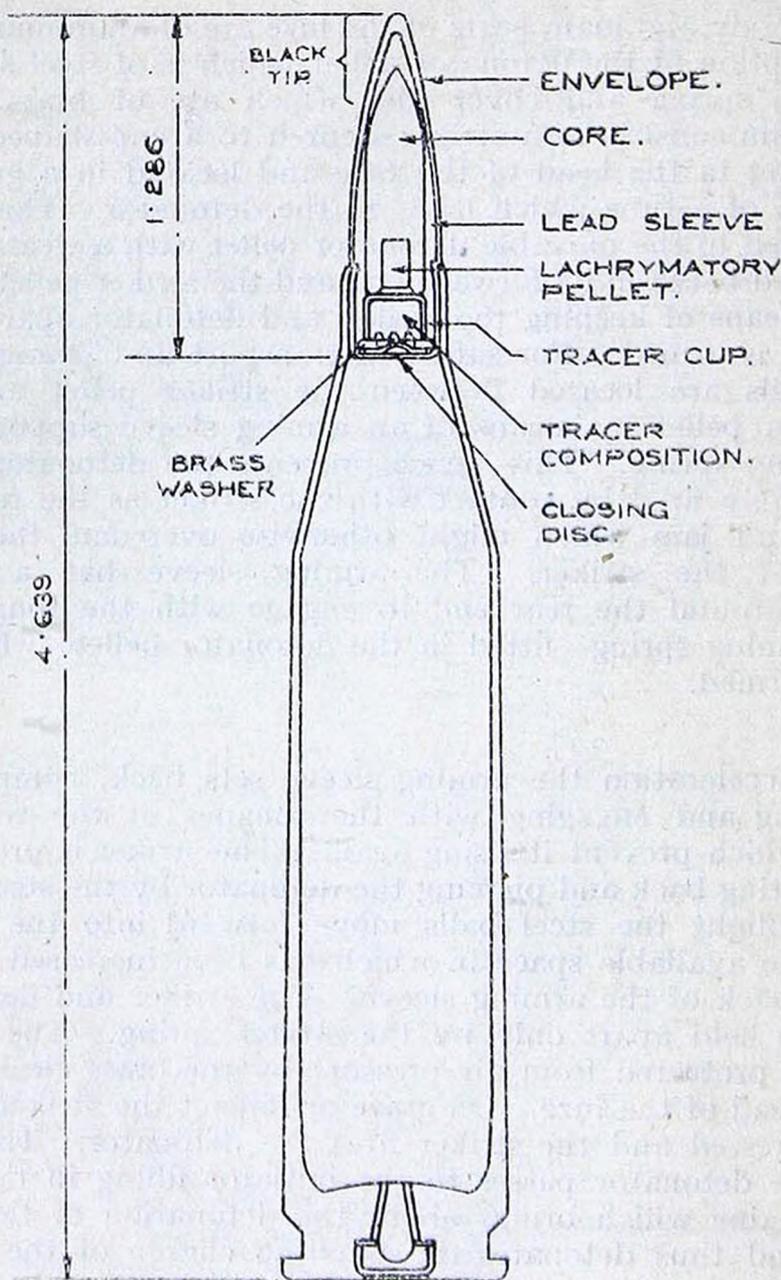


FIG 3.—7.92/13 mm. A.P.T. Lachrymatory Cartridge

is reduced towards the neck. This may be incidental to the coning but will help to withstand the action of the gases at this restriction. The cap is secured by three stabs.

The propellant charge consists of 200 grains of powder, apparently graphited N.C.T.

The bullet consists of a steel envelope coated on both sides with gilding metal and containing a tungsten carbide core in a lead sleeve and a tracer cup. A cylindrical cavity in the base of the core contains a .4 grain lachrymatory pellet. The tracer consists of a steel cap coated with gilding metal and containing a composition which produces a white trace which might be expected to last about 700 yards, allowing for the very high velocity this bullet will probably have. The base of the bullet is sealed by the turnover of the envelope on to a pink celluloid disc supported by a brass washer.

The mouth of the case is coned into a flat-fronted cannellure on the bullet.

### Weights

Round	...	...	1315.4 grains
Case and cap	...	...	889.7 ,,
Bullet	...	...	225.7 ,,
Propellant charge	...	...	200 ,,

## GERMAN 5 cm. Q.F., H.E. CARTRIDGE

### (5 cm. Pak. Spgr.)

This round is fired by the German 5 cm. anti-tank gun (5 cm. Pak. 38).

### Case

The case of this fixed Q.F. ammunition is of solid drawn steel, electro-plated with brass. A screwthreaded primer hole is formed in the base, the body taper increases sharply near the neck and the overall length is 41.8 cm.

### Propellant Charge

The propellant charge consists of a viscose rayon bag containing graphited flake propellant and a 30 cm. tube of propellant nearly half of which protrudes above the choked mouth of the bag. The external and internal diameters of the tube are .665—.5 cm. An annular bag, containing 5 grams of potassium sulphate, is attached round the choked mouth of the bag and the tube. This is presumably intended to reduce the flash. The flake propellant also is presumably intended to be flashless and contains diethylene diglycol-dinitrate, nitro-guanidine and nitrocellulose; no stabilizer is added. The dimensions of the flakes are 4 × 4 × .6 mm. and the mean weight per flake is .0154 gram. The tubular core is

a cordite type propellant containing nitrocellulose and diethylene diglycol dinitrate with akardite.

The igniter composition consisting of small graphited cylinders of nitrocellulose powder without surface moderant is contained in a viscose rayon bag stitched to the under side of the bag containing the charge. The bottom of the bag is of cotton dyed pink.

#### Primer (FIG. 4)

The percussion primer is of the normal German type and consists of a brass body with the enclosed cap and brass anvil

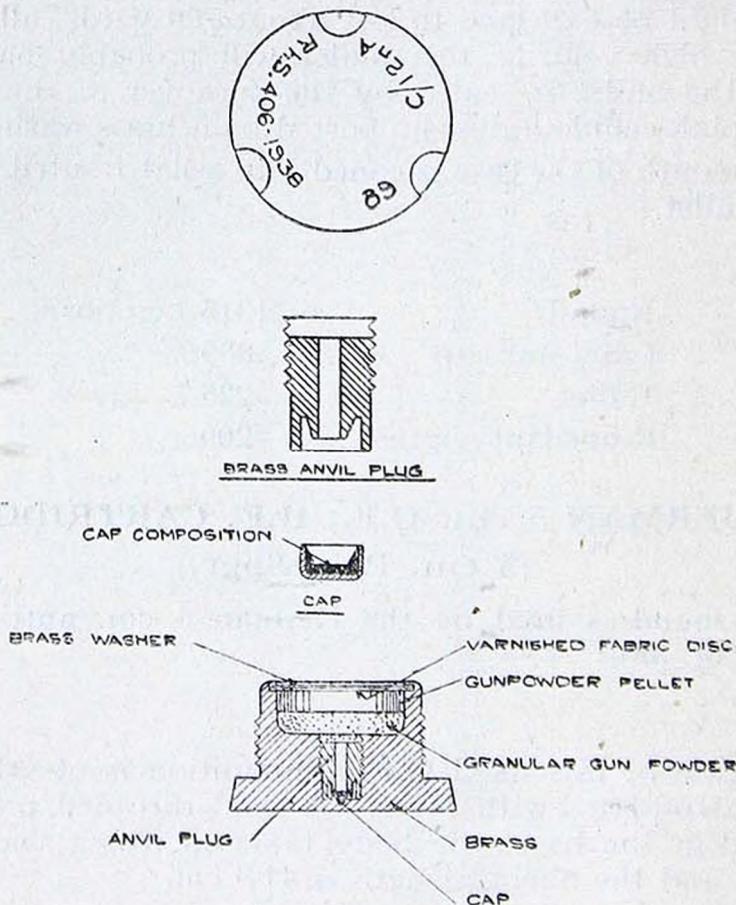


FIG. 4.—German Percussion Primer 5 cm. Q.F. Cartridge

plug. The cap filling is shaped to fit round the anvil and consists of mercury fulminate 28 per cent., potassium chlorate 34 per cent., antimony sulphide 32 per cent., and glass powder 6 per cent. The cap is a push fit in the underside of the anvil plug. The magazine contains a 1.44 gram pellet of gunpowder over .65 gram of granular gunpowder. The primer is closed by a brass washer and varnished fabric disc.

#### Shell (FIG. 5)

The shell is fitted with a driving band wholly of soft iron. The filling, in a paper container which is cemented to the

wall of the shell, consists mainly of pressed T.N.T. over which a smoke box is positioned in a surround of cast T.N.T. The exploder system consists of 7.6 gram pellet of P.E.T.N./wax (90/10) over a 9.2 gram pellet of P.E.T.N./wax (91/9). The

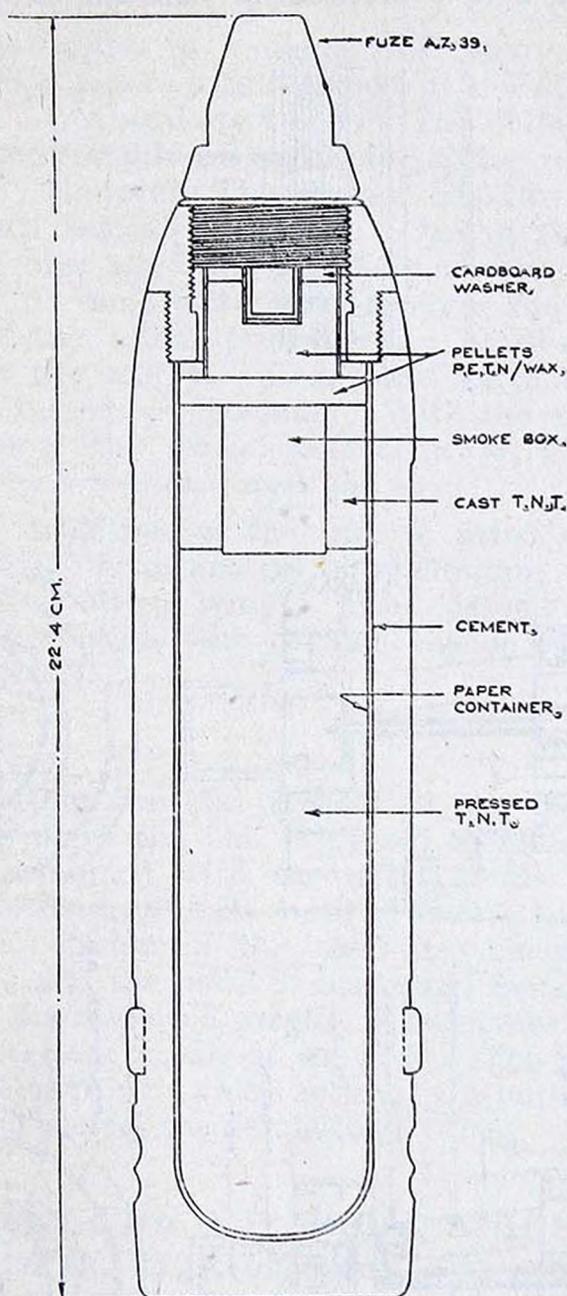


FIG. 5.—German 5 cm. H.E. Shell

total weight of the filling is 5 oz. 14 dr. and the complete weight of the shell 3 lb. 15 oz.

The smoke box, which weighs 10.6 grams, is similar to that in the 7.5 cm. H.E. shell but is smaller.

The shell is coloured green and stencilled in black.

fitted to the fuze. A cardboard washer takes up the space between the filling and the gaine adapter. The weight of the shell is approximately 4 lb. 9 oz., and its exterior, except for an unpainted band at the nose, is coloured black.

5 Cm. A.P.

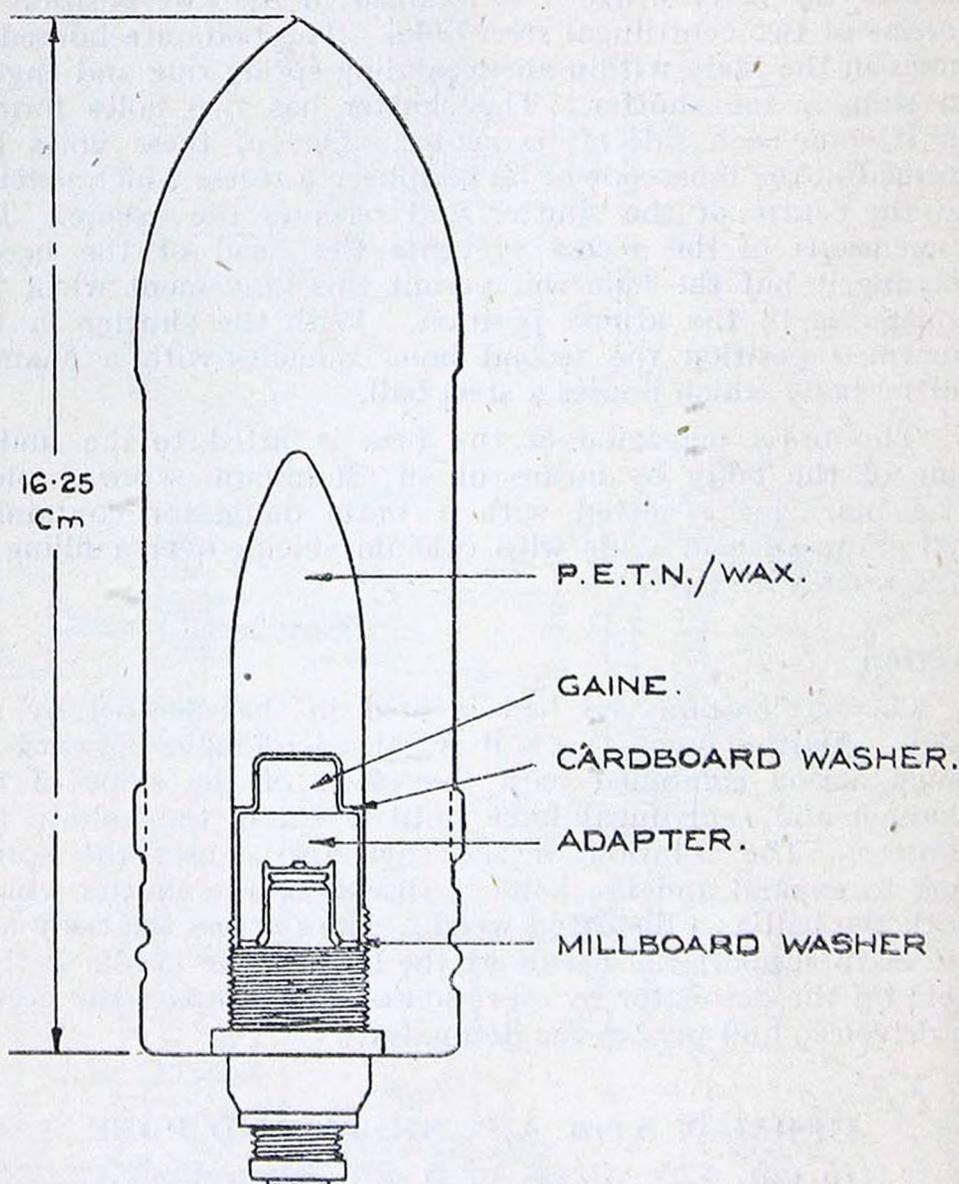


FIG. 7.

### Fuze (FIG. 8)

The base fuze and gaine are shown in Fig. 8. The aluminium inertia pellet, containing the igniferous detonator, is held away from the needle in the safe position by a hard brass shear wire. The brass needle is flat to provide flash channels and is retained in the steel body of the fuze by a screwed aluminium plug. The plug has a conical recess on

the underside and a small central flash hole which is closed by a paper disc at the front. A steel cap with a central hole is fitted over the disc at the front end of the fuze body to which it is cannellured.

### Gaine (FIG. 8)

The gaine is screwed into an aluminium cylindrical adapter which is a sliding fit over the front end of the fuze. A pressed paper washer is used between the underside of the adapter and the fuze body. The gaine consists of an aluminium plug containing a mixture of lead azide and lead styphnate at its perforated base end and P.E.T.N./Wax at its front end. The

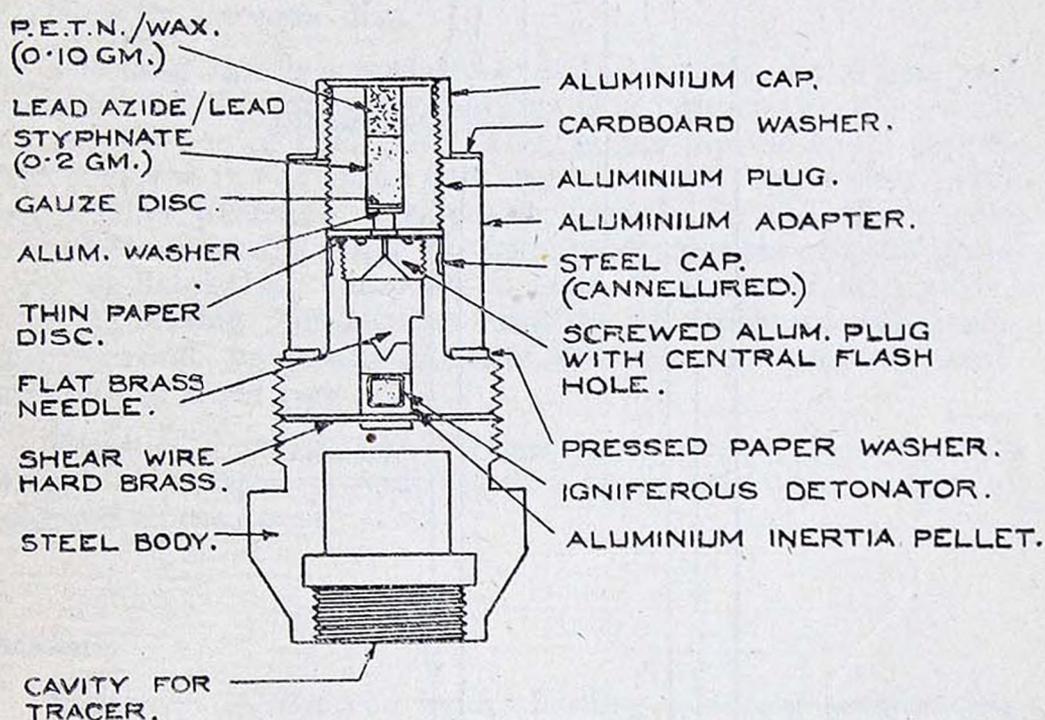


FIG. 8.—Fuze, 5 cm. A.P. Shell

perforation at the base end is closed by a gauze disc and an aluminium washer. The front end is closed by a screwed cap of aluminium.

Details of the tracer which screws into the base of the fuze are not available.

### Action

On impact the inertia pellet sets forward severing the shear wire and impinging the detonator on the needle. The flash passing over the flat needle and through the small hole in the aluminium plug enters the gaine. It is probable that the controlling effect of the small hole in the plug and also the presence of the paper disc on the front of the plug provides a short delay.

GERMAN FUZE FOR 4.7 CM. H.E. SHELL

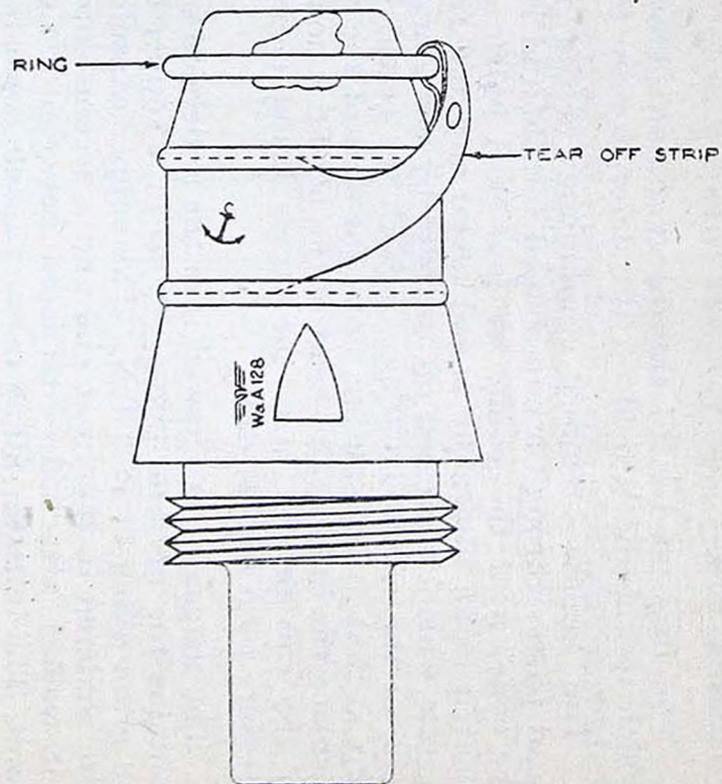
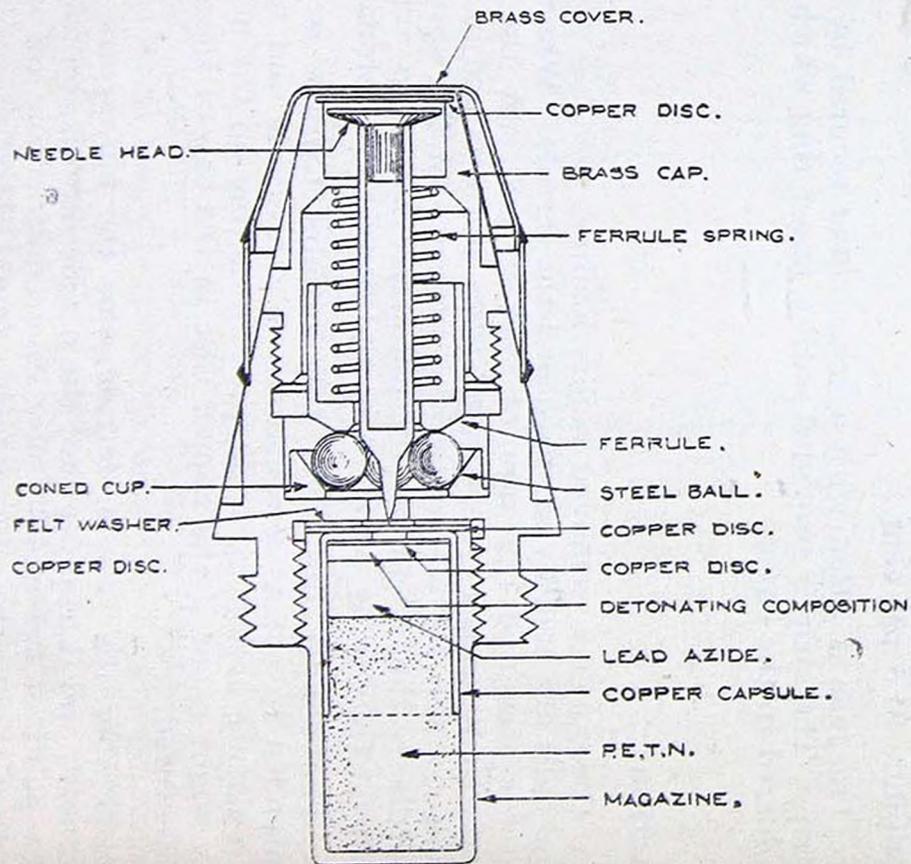


FIG. 10.

## GERMAN 4.7 cm. A.P. SHELL (4.7 cm. Pak. Pzgr.)

(FIG. 11)

This shell is fired by the 4.7 cm. anti-tank gun mounted on the S.P. armoured chassis Ib.

It is a normal armour piercing shell with an H.E. capacity of 1.6 per cent. The filling consists of a 6.6 dram bursting charge of cast T.N.T. with a 5.3 dram intermediary of pressed T.N.T. The intermediary pellet is wrapped in transparent

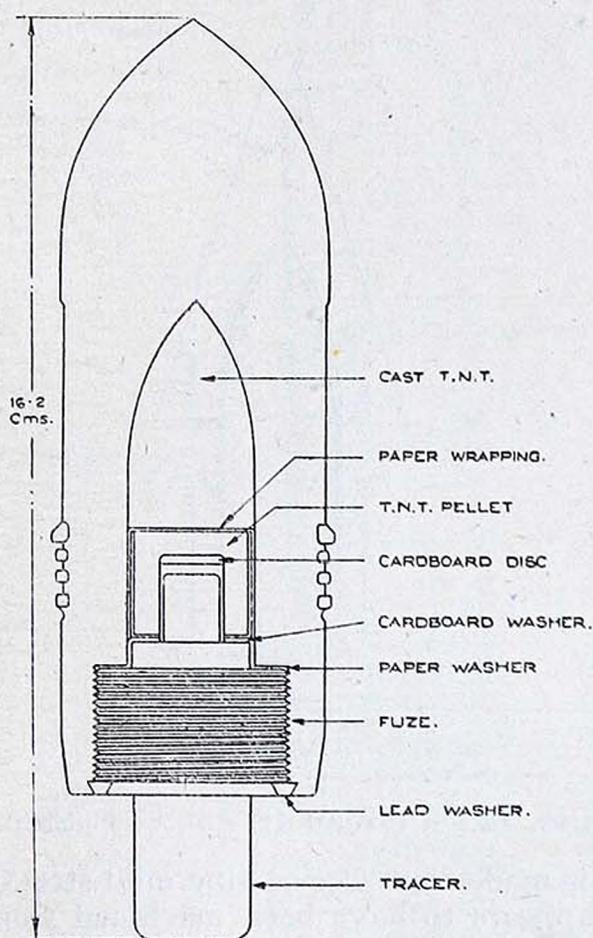


FIG. 11.—4.7 cm. A.P. Shell

paper and has a cavity to receive the gaine portion of the fuze. A cardboard disc in the cavity and a washer in rear of the pellet provide seatings for the fuze and presumably allows for tolerances in the length of the filling and the fuze.

Details of the fuze and tracer are not yet available.

### Weights

Empty shell, 1283.25 grams (2 lb. 13 oz. 5 dr.).

Cast T.N.T., 11.7 grams (6.6 dr.).

Pressed T.N.T., 9.35 grams (5.3 dr.).

**GERMAN 4.7 cm., Q.F., A.P. SHOT (ARROW-HEAD)**  
**(4.7 cm. Pak. Pzgr. 40) (FIG. 12)**

This shot is fired by the 4.7 cm. anti-tank gun mounted on the S.P. armoured chassis Ib.

The shot consists of an armour piercing core enclosed in a mild steel body. The body is fitted with a conical ballistic cap and prepared to receive a tracer. The weight of the shot (without tracer) is 1 lb. 13 oz.

The core is made from Tungsten carbide cemented by nickel. The portion enclosed in the steel body is painted white.

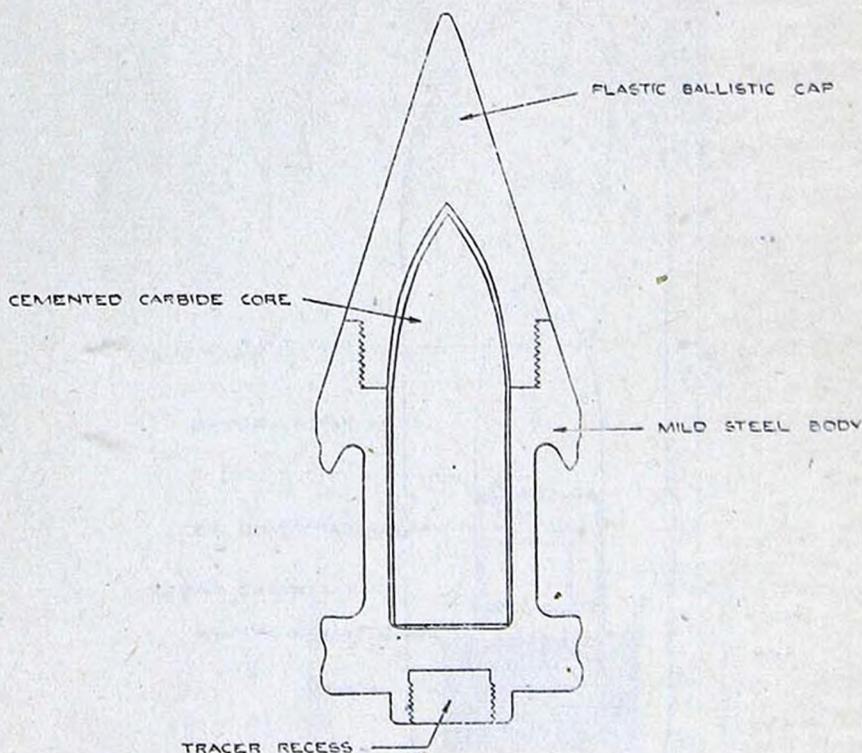


FIG. 12.—German 4.7 cm. A.P. Shot

The body is made from free cutting mild steel of low carbon content and appears to have been machined from rolled bar. In construction it is similar to the body of the 37 mm. shot.

The ballistic cap is made from a plastic consisting of a black moulding with fibrous filler. The cap is apparently moulded into position under pressure.

**GERMAN CARTRIDGE, Q.F., A.P. SHOT 28/20 mm.**  
**MODEL 41 (ARROW-HEAD) (2 cm. Pzgr. 41)**

(FIG. 13)

This fixed Q.F. round is fired from the high velocity 2 cm. anti-tank gun, Model 41 (Pz.B.41), which is of the coned bore type.

The brass cartridge case which is necked and fitted with a blued steel primer of the normal German design contains a

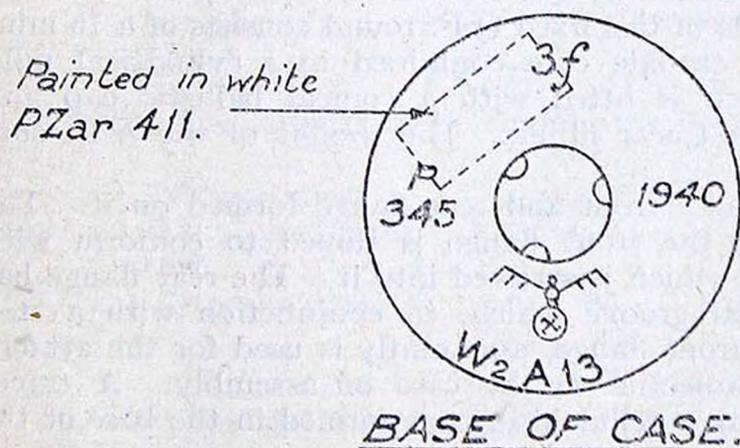
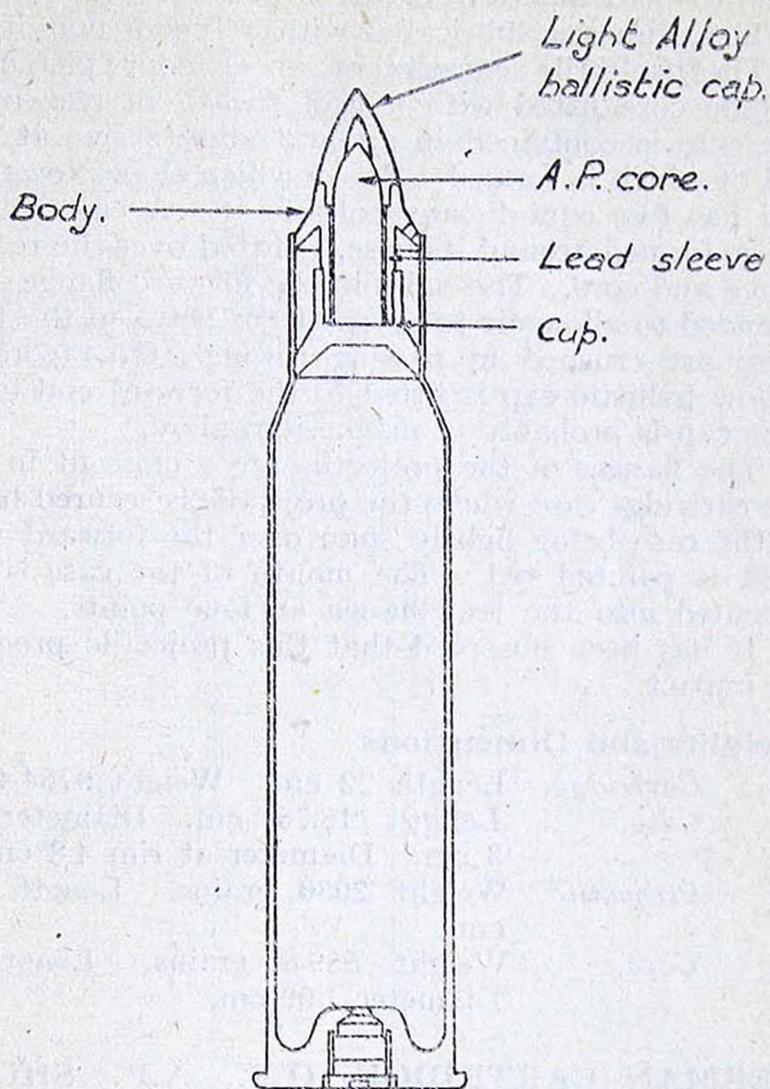


FIG. 13.—German Cartridge, Q.F., A.P., 28/20 mm., Model 41

2347.5 grain propellant charge of graphited N.C.T. The propellant is .051 inches in diameter and in lengths of .086 inches.

The primer is lubricated with a brown non-drying grease.

The projectile consists of an armour piercing tungsten carbide core fitted with a lead sheath in rear of the ogive. The core is contained in an iron alloy sleeve at the forward end of which is formed a flange which slopes towards the base and has five equi-distant holes in it. A cup, with a similar flange formed around its base, is fitted over the rear end of the sleeve and core. The holes in the forward flange are probably intended to allow air to escape from between the flanges when these are crushed in passing through the tapered bore. A hollow ballistic cap is fitted to the forward end of the sleeve. This cap is probably of magnesium alloy.

The flanges of the projectile are a close fit in the neck of the cartridge case where the projectile is secured by the mouth of the case being lightly spun over the forward flange. The joint is painted red. The mouth of the case is also lightly indented into the rear flange at four points.

It has been observed that this projectile produces a flash on impact.

### Weights and Dimensions

*Cartridge.* Length 22 cm. Weight 9754.4 grains.

*Case.* Length 18.75 cm. Diameter at mouth 3 cm. Diameter at rim 4.8 cm.

*Projectile.* Weight 2030 grains. Length overall 6.42 cm.

*Core.* Weight 559.6 grains. Length 4.07 cm. Diameter 1.09 cm.

### GERMAN CARTRIDGE, Q.F., A.P. SHOT 3.7 cm. (ARROW-HEAD) (3.7 cm. Pak. Pzgr. 40) (FIG. 14)

This round is fired by the 3.7 cm. anti-tank gun.

The projectile of this fixed Q.F. round consists of a 15 mm. A.P. cemented carbide core contained in a cylindrical mild steel body which is fitted with a conical ballistic cap and provided with a tracer filling. The weight of the A.P. core is 2297 grains.

The body has a front and rear flange formed on it. The forward side of the front flange is sloped to conform with the ballistic cap which is screwed into it. The rear flange has a circumferential groove which, in conjunction with a step formed on the front flange, apparently is used for the attachment of the projectile to the case on assembly. A tracer cavity, closed by a celluloid disc, is formed in the base of the body.

The ballistic cap is of aluminium alloy and contains a pressed paper tip.

The body is of free cutting mild steel with a higher sulphur

content and the weight of the complete projectile is 5500 grains.

The cartridge case is rimmed and made of steel, coated on both sides with brass, and contains a propellant in the form of dark green tubes of the following dimensions: Length 18.45 cm., external diameter 2.5 mm., internal diameter

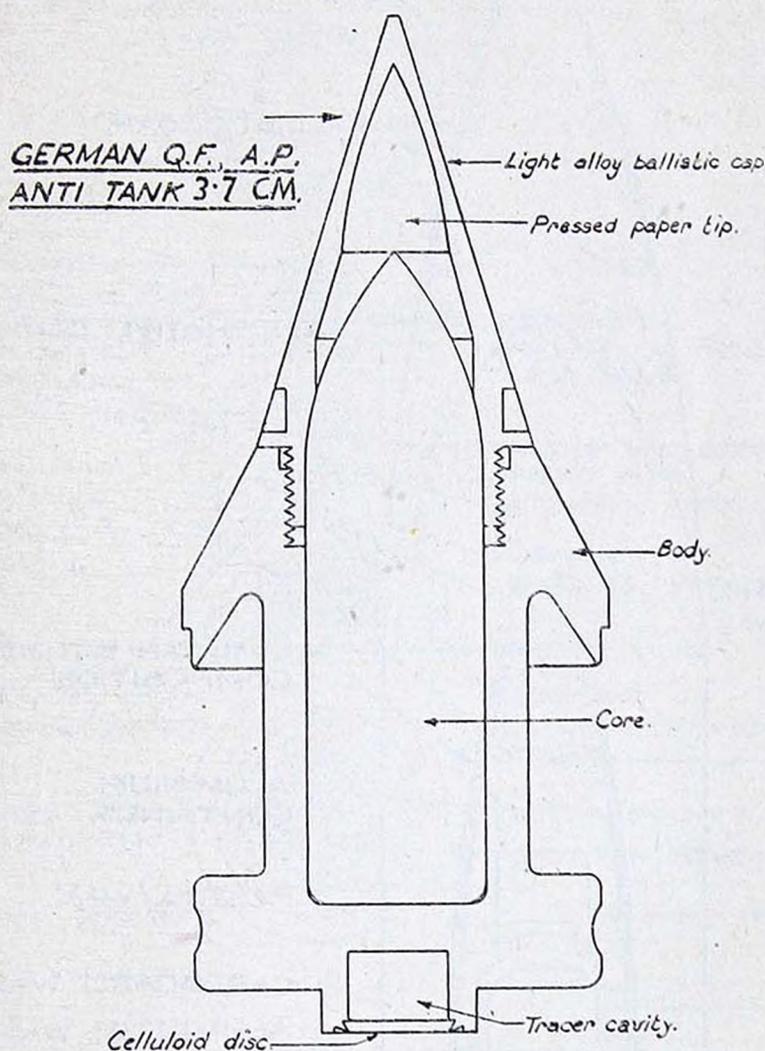


FIG. 14.

1.15 mm. The approximate composition of the propellant is:—

Nitrocellulose ...	...	58	per cent.
Ethyl centralite	...	2.5	„
Ash ...	...	.5	„
Nitroglycerine	...	39	„
		100	„

The case also contains an igniter in the form of a silk bag containing chopped cylinders of ungraphited nitrocellulose powder stabilized with diphenylamine. The chopped cylinders are approximately 1.15 cm. in length and .95 mm. in diameter. The weight of the igniter filling is 1.83 grams.

GERMAN 7.5 cm. A.P.C. SHELL AND FUZE (7.5 cm Kwk. Pzgr.) (FIG. 15)

7.5 Cm. A.P.C.

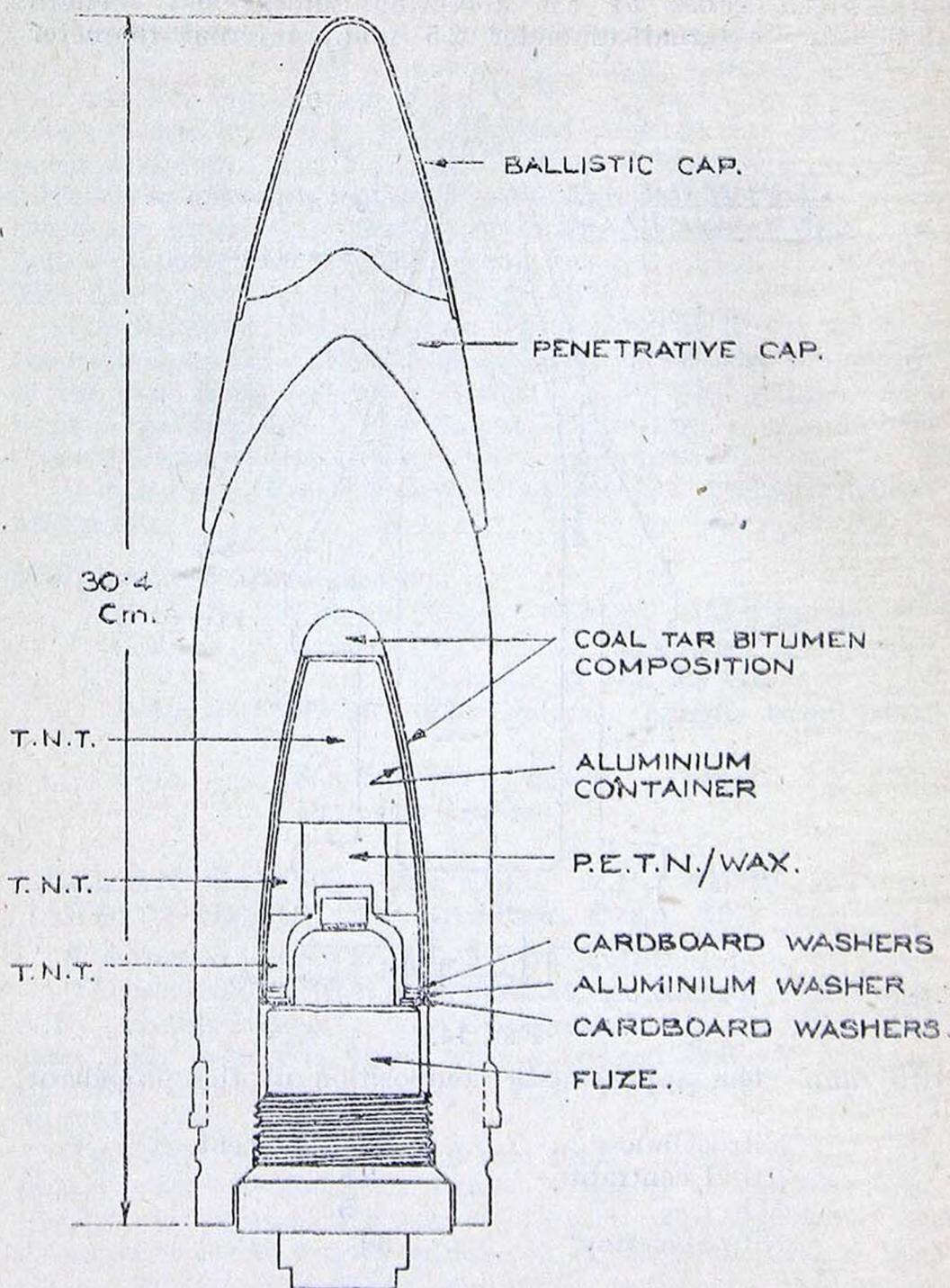


FIG. 15.

This shell is fired by the 7.5 cm. tank gun (7.5 cm. Kwk.). The shell body is hardened throughout, the hardness diminishing from nose to base. The penetrative cap is attached to the shell by a low temperature soldering process. Both the

shell (which is machined from rolled bar) and the penetrative cap are of 1 per cent. chromium steel. The ballistic cap is attached to the penetrative cap by spot welding and varies in thickness from .037-inch at the nose to .057-inch at the base.

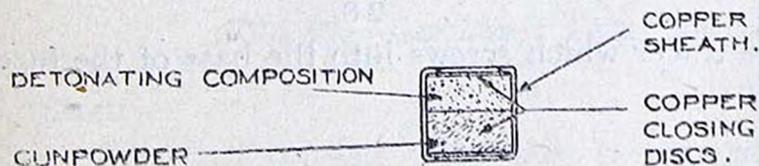
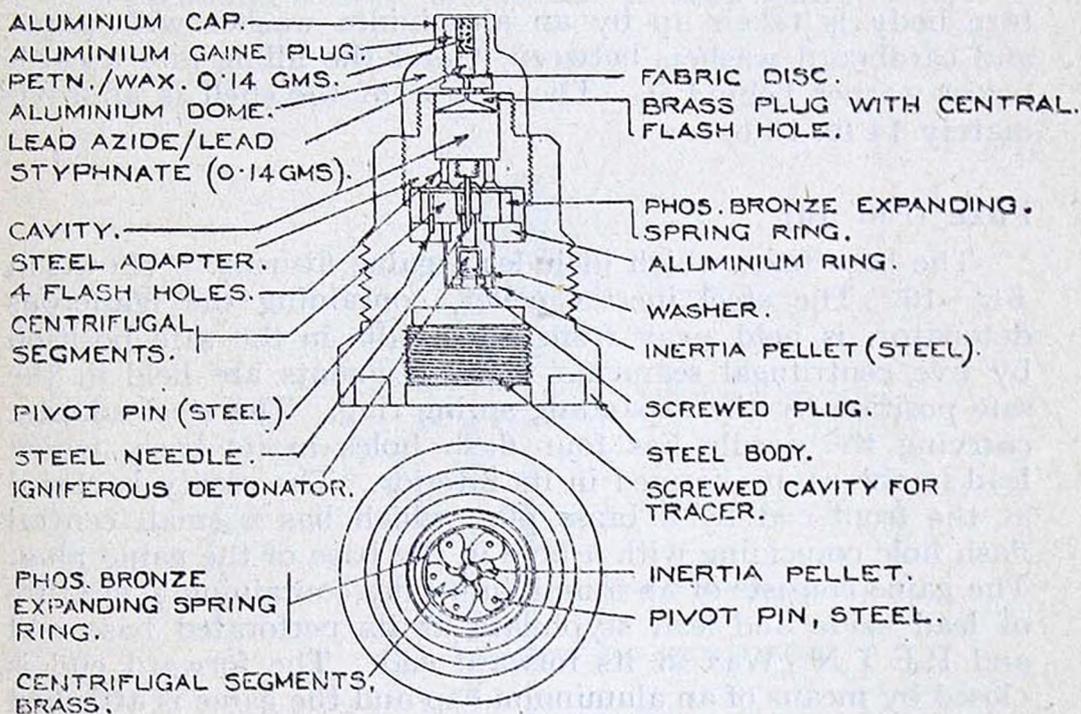
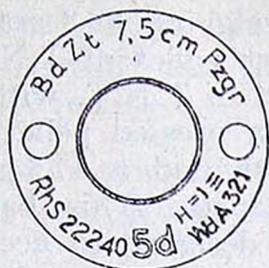


FIG. 16.—Fuze, 7.5 cm. A.P. Shell

The driving band is secured in the groove by longitudinal knurling and consists of soft iron under a copper exterior. An aluminium container for the bursting charge is set in the shell by means of a coal tar bitumen and a pad of the same material fills the reduced forward end of the cavity.

The bursting charge, weighing 83.3 grams (2 oz. 15 dr.), consists of a 33.9-gram cast pellet of T.N.T. at the forward end, a 21.5-gram cast pellet of T.N.T. with a central perforation containing a 10.4-gram pressed pellet of P.E.T.N./Wax in the intermediate position and a 17.5-gram cast pellet of T.N.T. adjacent to the fuze. This base pellet and the P.E.T.N./Wax pellet are designed to accommodate the forward end of the fuze. The space between the filling and the fuze body is taken up by an aluminium washer with paper and cardboard washers between it and the filling and a cardboard washer behind it. The weight of the shell is approximately 14 lb. 13 oz.

### Fuze (FIG. 16)

The base fuze, which includes a gaine fitment, is shown in Fig. 16. The steel inertia pellet, containing the igniferous detonator, is held away from the needle in the safe position by five centrifugal segments. The segments are held in the safe position by the expanding spring ring. The steel adapter carrying the needle has four flash holes in its base, which lead to the cavity formed in its interior. The cavity is closed at the front end by a brass plug which has a small central flash hole coinciding with a hole in the base of the gaine plug. The gaine consists of an aluminium plug containing a mixture of lead azide and lead styphnate at its perforated base end and P.E.T.N./Wax at its forward end. The forward end is closed by means of an aluminium cap and the gaine is attached to the steel adapter in the fuze body by means of the aluminium dome.

The composition of the initiator in the igniferous detonator is:—

Mercury fulminate	...	8.1	per cent.
Potassium chlorate	...	59.7	„
Antimony sulphide	...	29.4	„
Glass	... ..	2.8	„

Details of the tracer which screws into the base of the fuze are not available.

### Action

Centrifugal force set up by the rotation of the projectile in flight causes the segments to rotate on their axis against the expanding spring ring and, one after another, their inner ends move clear of the inertia pellet. There is no creep

spring. On impact the inertia pellet sets forward and impinges the detonator on the needle. The resultant flash passes through the small hole in the brass plug into the gaine. The combination of the adapter cavity and the small hole in the brass plug is apparently intended to act as a short delay by expansion of the flash within the cavity.

Details of the cartridge and primer are given in the section describing the H.E. round.

**GERMAN Q.F. 7.5 cm. SMOKE SHELL AND FUZE**  
**(7.5 cm. Kwk. Nb) (FIG. 17)**

This round is fired by the 7.5 cm. tank gun.

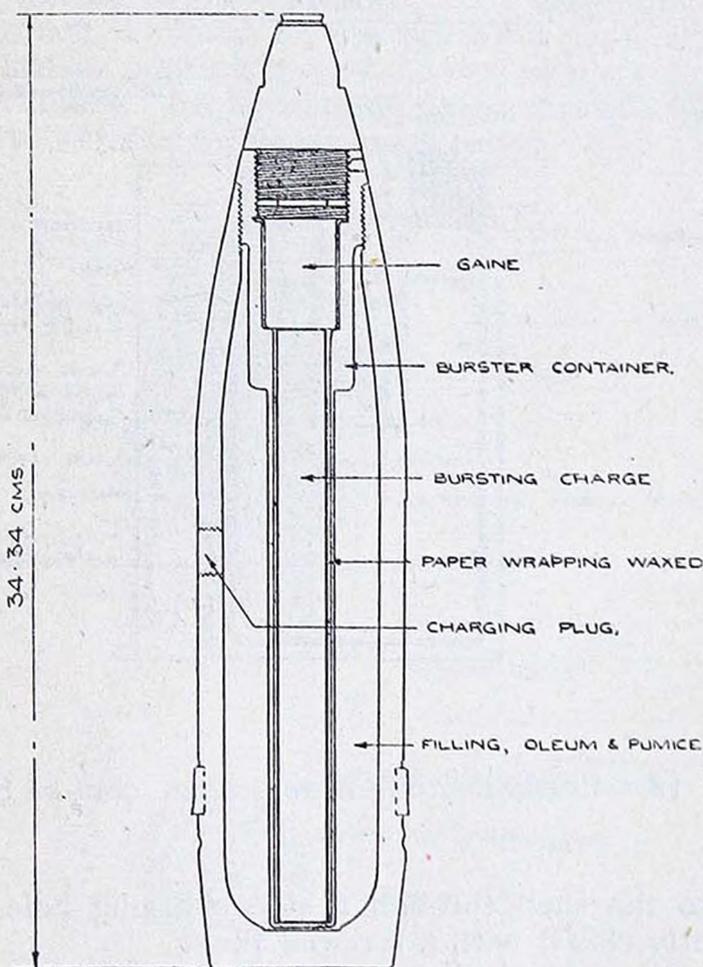


FIG. 17.—German 7.5 cm. Smoke Shell

**Shell**

The shell consists essentially of two parts—(i) the body, and (ii) the burster container screwed into the nose of the shell and extending almost to the base of the shell cavity. The driving band consists of soft iron clad with copper on the outside. The burster container accommodates a bursting charge of four pressed pellets of picric acid weighing 78.5 grams

(2 oz. 12.5 dr.). The four pellets are wrapped in a single wrapping of paper, about .005-inch thick, secured with an aqueous adhesive. The whole assembly is coated with paraffin wax. The wrapping is marked "KL. Ldg. Zd. K.Gr.Nb."

The smoke mixture contained in the body of the shell surrounding the burster container consists of 80 parts of oleum absorbed in 20 parts of pumice. The method of charging appears to be as follows: The pumice is pressed into the shell body and the burster container screwed in. Oleum is intro-

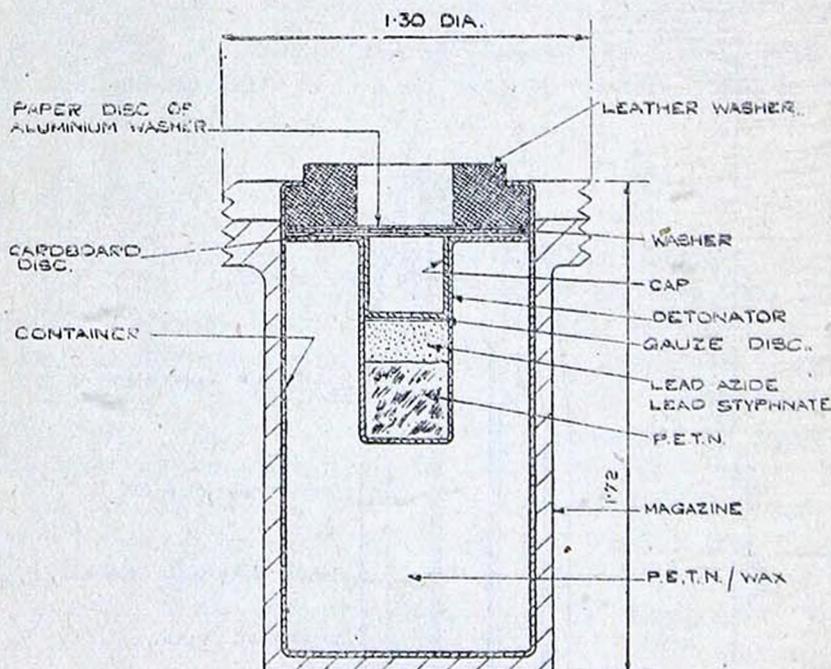


FIG. 18.—German Gaine from 7.5 cm. Smoke Shell

duced into the shell through a side charging hole, which is subsequently closed with a screwed plug.

The shell is coloured green, stencilled in black and white, and has a red ring above the driving band. The weight complete is 13 lb. 9 oz.

### Gaine (FIG. 18)

The cylindrical steel body has a screw thread at the front end for insertion in the burster container. The magazine filling of 16.8 grams P.E.T.N./Wax is in an aluminium container. The container is closed at the front end by the flange formed on the aluminium body of the detonator. The detonator fits

into a cavity formed in the magazine filling and contains .6 grams of P.E.T.N. topped with .3 grams of lead azide/lead styphnate. The mouth of the detonator is closed by an aluminium cap which has four perforations lightly closed by a gauze disc. An aluminium washer between cardboard and paper discs is fitted over the detonator and retained by a leather washer. The leather washer is secured by turning over the mouth of the aluminium container.

### Fuze (FIG. 19)

The fuze used is the A.Kl. AZ 23 Nb. This has a combined direct and graze action and, excepting the igniferous detonator, has no explosive filling. The aluminium body of the fuze, which is closed at the top by a brass cap, carries a wooden striker positioned over a steel needle secured in an aluminium holder. An aluminium plug screwed into the base of the body contains the brass graze pellet with its 3.16 grain

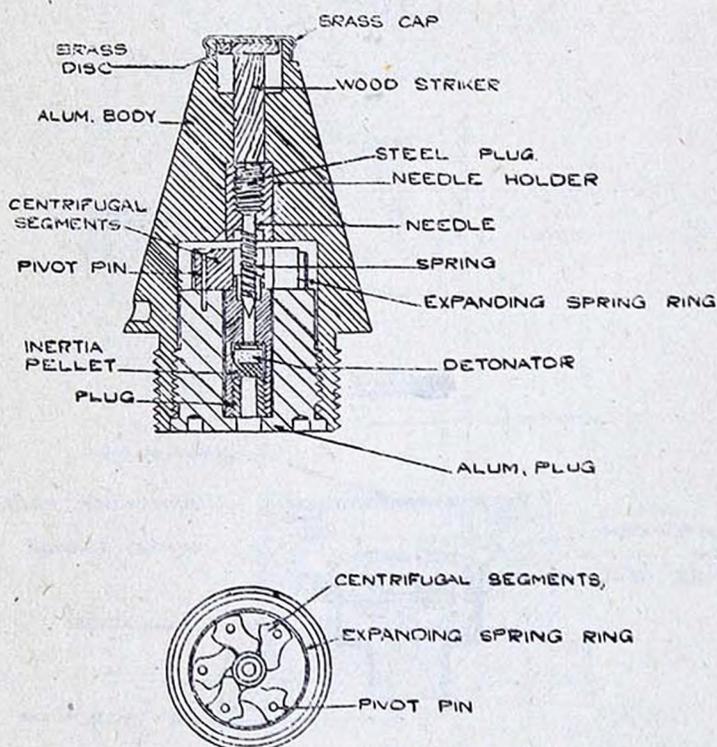


FIG. 19.—German Fuze for 7.5 cm. Smoke Shell

igniferous detonator and receives the pointed end of the needle. A steel spiral spring, fitted between the needle holder and graze pellet, keeps these two members apart during flight when the centrifugal safety segments have been swung clear. The five segments which prevent the needle approaching the detonator in transport and in the bore are of aluminium and are pivoted on steel pins at the front end of the plug, where they are retained in the safe position by an expanding spring

ring of phosphor bronze. A flash hole is formed in the base of the plug.

### Action

Centrifugal force set up by the spin of the projectile in flight causes the spring ring to expand and permit the segments to rotate clear of the graze pellet, thus leaving the needle and graze pellet held apart by the spiral spring. On graze or impact the spring is compressed by the striker being

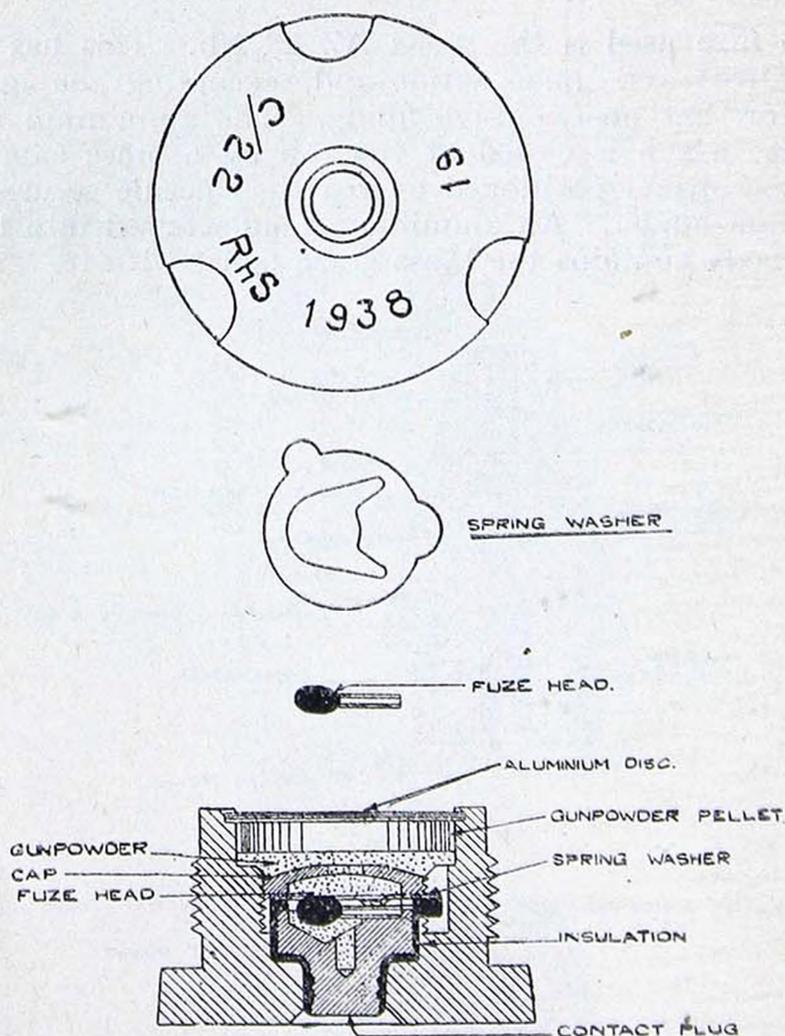


FIG. 20.—German Electric Primer for 7.5 cm. Q.F. Cartridge

driven in and the graze pellet setting forward. The flash produced by the needle piercing the detonator passes through the flash hole in the base of the plug to the detonator in the gaine. The recess in the underside of the needle holder fitting over the projection on the front of the graze pellet prevents the flash escaping in the wrong direction.

Details of the cartridge and primer are given in the section describing the H.E. cartridge.

## GERMAN 7.5 cm. Q.F. H.E. CARTRIDGE (7.5 cm. Kwk. Spgr.)

This shell is fired by the 7.5 cm. tank gun.

The propellant charge of this fixed Q.F. round is contained in a viscose rayon bag with an igniter sewn to the bottom. The propellant is a nitrocellulose powder and consists of a bundle of green, yellow, brown and grey-black tubes. The colours are due to the inclusion of dyestuffs and appear to bear no relation to composition but may be used for blending purposes. The nitrocellulose used has a nitrogen content of

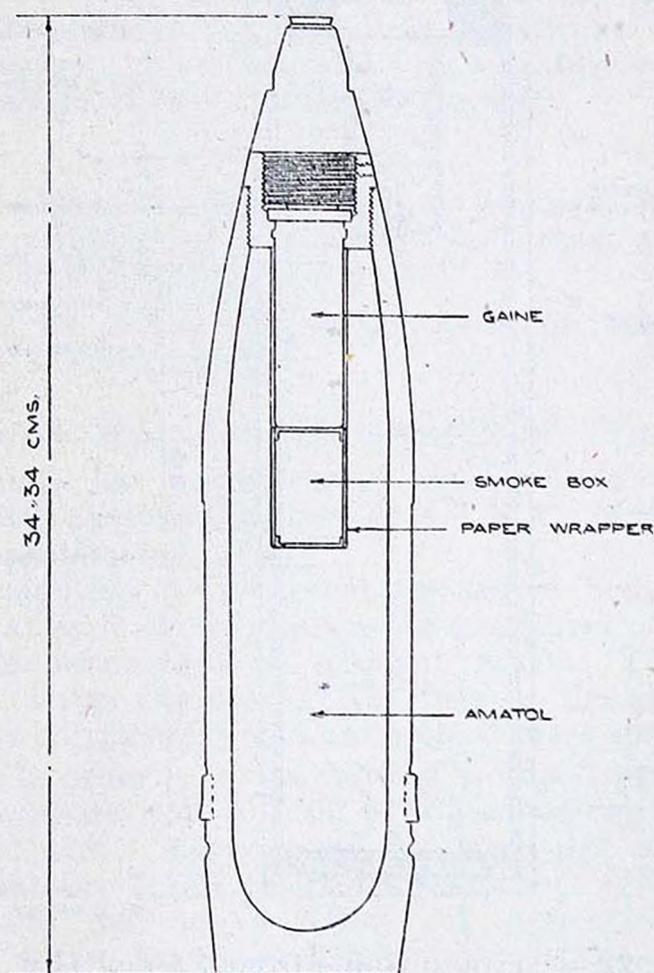


FIG. 21.—German 7.5 cm. H.E. Shell

13.3 per cent. and the stabilizer is diphenylamine. A small proportion of sodium sulphate is also included. The igniter composition contains nitrocellulose and nitroglycerine with possibly a small proportion of polynitroglycerine and akardite.

### Primer (FIG. 20).

The primer is initiated electrically and is of unusual design. The fuze head with a composition consisting mainly of lead styphnate in a nitrocellulose sheath has a resistance of approximately 2.2 ohms and is in circuit with the insulated contact

plug and, through the spring washer, the body of the primer. The gunpowder filling, consisting of a pellet and granular, has a total weight of 31 grains. The magazine is closed by an aluminium disc with discs of paper or varnished fabric.

### Shell (FIG. 21)

The amatol 40/60 bursting charge is directly pressed into the shell; the weight of the filling is 653 grams (1 lb. 7 oz.). The exploder cavity contains a smoke box and gaine.

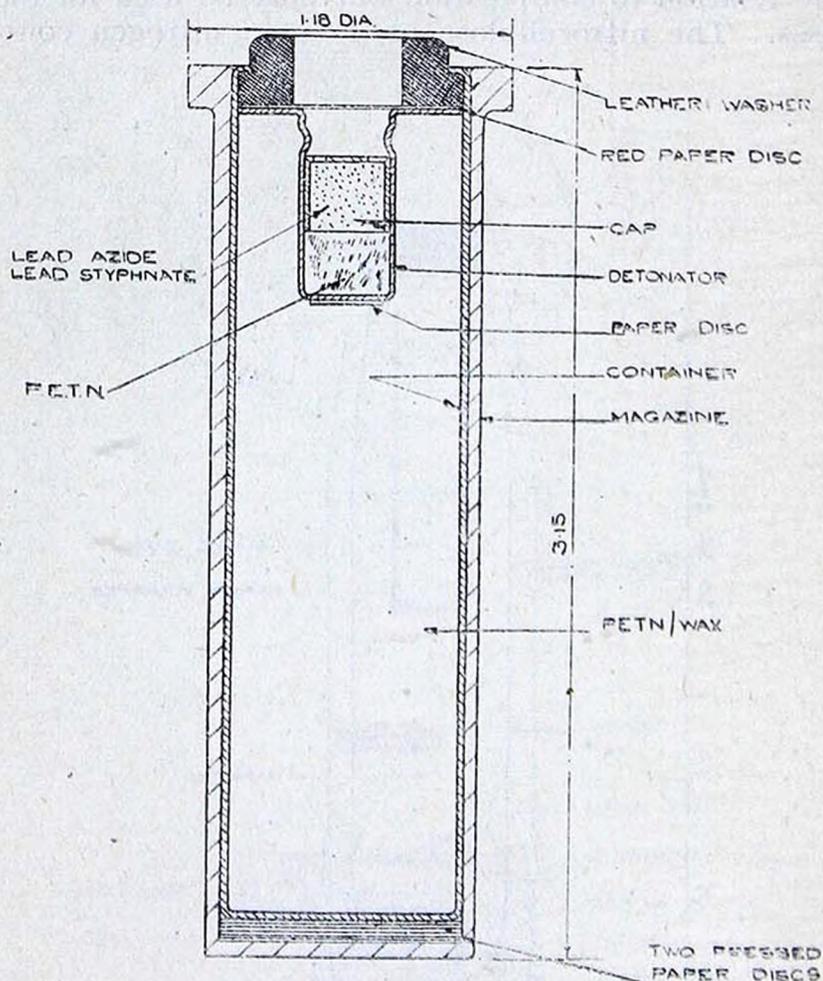


FIG. 22.—German Gaine from 7.5 cm. H.E. Shell

The smoke box, weighing 32 grams (1 oz. 2 dr.), consists of a waxed paper carton containing a smoke pellet of the following composition:—

Red phosphorus	...	...	85 parts
Paraffin wax	...	...	13 "
Alumina	...	...	2 "

The carton is marked "Ravchenwickler No. 8."

The shell is coloured green, stencilled in black, and has a complete weight of 12 lb. 9 oz.

The driving band consists of soft iron clad with copper on the outside.

## **Gaine (FIG. 22)**

The gaine has a cylindrical body of steel with a flange formed at its front end to engage the fuze hole bush. The magazine filling, 33.8 grams of P.E.T.N./Wax is in an aluminium container which rests on pressed paper discs in the bottom of the body. The container is closed at the front end by the flange formed on the aluminium body of the detonator. The detonator fits into a cavity formed in the magazine filling and contains .38 grams of P.E.T.N. over which is positioned an aluminium cap containing .41 grams of lead azide/lead styphnate. Four perforations are formed in the front end of the cap. The detonator is closed by means of a disc of red paper and secured in the container by a leather washer over which the mouth of the container is turned.

## **Fuze**

The fuze K1 AZ23 is designed to function on graze or impact and is similar in construction and action to the AZ23 described in Pamphlet No. 1, Sec. 4.

Details of the A.P.C. and smoke shells for this equipment are included in this pamphlet.

## **ITALIAN H.E. HAND GRENADE (FIG. 23)**

The grenade has a percussion action of the "Always" type, is lightly constructed and has a T.N.T. bursting charge weighing approximately 2½ oz.

The grenade has a cylindrical corrugated body of tinned plate coned at each end to produce the movement of the needle and detonator necessary for "Always" action. The base cap of the body forms the cone at the base of the grenade and is secured by corrugations and an internal brass spring.

The needle pellet is in the form of a tinned plate cylinder carrying the needle and is fitted with a coned cap of brass at its outer end which bears against the coned end of the body. This cap contains T.N.T. and fine lead shot, apparently for weighting and destructive effect. A perforated tube of aluminium, fitted to the pellet, surrounds the needle and extends from the inner face of the pellet. This tube fits over the detonator and, bearing against a brass spiral spring in the centre tube of the magazine, is the means of keeping the needle off the cap of the detonator when the grenade is armed in flight.

The magazine consists of a tinned plate cylinder with central tube. The cylinder contains T.N.T. and is closed at the base, where it rests on the coned base cap of the body, by a perforated cap.

The detonator with its percussion cap is housed in the perforated tube of the needle pellet within the centre tube of the magazine. Details of the initiator compositions used are

not available, but that in the detonator is probably lead styphnate and P.E.T.N. and that in the cap is probably

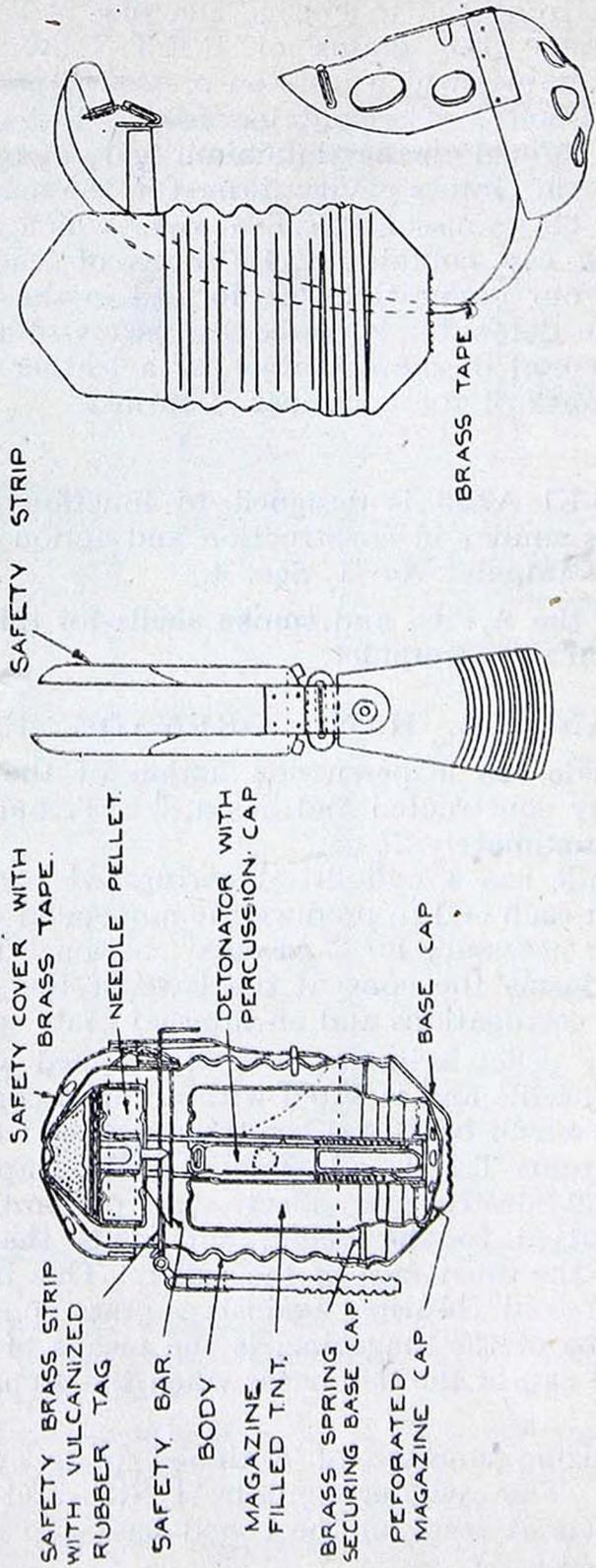


FIG. 23.—Italian Hand Grenade

mercury fulminate, antimony sulphide and potassium chlorate. A safety bar of tinned plate is inserted in the body of the

grenade between the needle and the percussion cap of the detonator. The outer end of this bar is attached to the safety cover by a brass tape, which is wound round the grenade when the cover is fitted.

The safety cover is a perforated tinned plate cup which acts as a drogue for the removal of the safety bar when the grenade is in flight. The cover is fitted with a curved portion which fits to the body when the cover is fitted over the head of the grenade. The cover is secured by the safety strip passing through the body of the grenade and the curved portion of the cover. The safety strip is of brass and is fitted with a vulcanized rubber tab by means of which it is pulled out of the grenade by hand.

The grenade is painted red and the safety cover black. The base is stamped "BREDA."

### Action

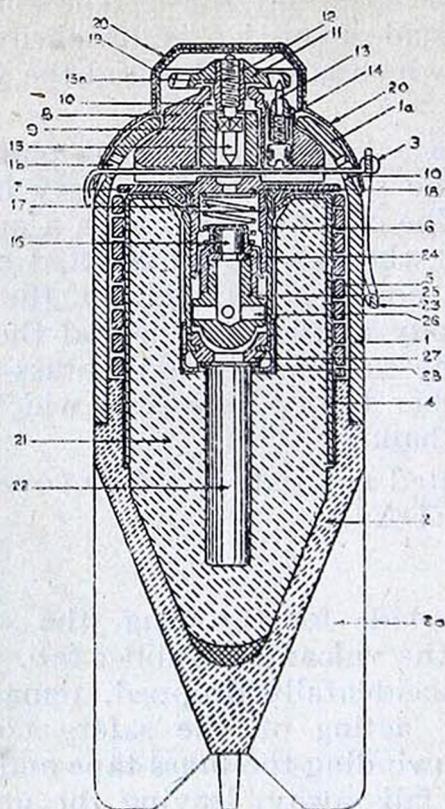
To prepare the grenade for throwing, the safety strip is withdrawn by pulling the vulcanized rubber tab. The grenade is now ready but, if accidentally dropped, remains unarmed. During flight, the air acting on the safety cover removes it from the grenade, unwinding the brass tape and withdrawing the safety bar, which falls away, leaving the needle and cap of the detonator held apart by the spiral spring. The action on impact depends upon the position of the grenade. If it strikes head or base downwards the spiral spring is compressed by the momentum of magazine or needle pellet respectively and the needle pierces the cap. With side impact, the outer ends of the needle pellet and magazine move down the inclines of the coned ends of the body causing both members to move towards each other and the needle pierces the cap.

It is known that the Italians have had accidents with their grenades even though the safety bar was in position. The grenades should therefore be treated with caution.

### ITALIAN H.E. MORTAR BOMBS, BRIXIA MORTAR MODEL 35 (FIG. 24)

The projectile for the 45 mm. Brixia mortar, Model 35, is a 0.465 Kg. (1 lb.) streamlined bomb, having a cylindrical steel body (1) with a rounded head (1a). A conical aluminium tail (2) with four vanes (2a) is screwed into the rear end of the body. The tail and vanes are painted red.

The bursting charge (21), consisting of 70 grams (1080 grains) of a T.N.T.-dinitronaphthalene mixture in a compressed block, is housed partly in an aluminium container (4) and partly in the tail (2). The container (4) is surrounded by a flat-section coiled spring (5), which is probably intended to increase fragmentation, and its front end rests against a steel disc (7).



KEY TO DIAGRAM.

- |   |                                    |
|---|------------------------------------|
| 1. CYLINDRICAL BODY.                        | 16. DÉTONATOR                      |
| 1a. ROUNDED HEAD.                           | 17. CREEP SPRING.                  |
| 1b. APERTURES FOR SAFETY PIN.               | 18. DIAPHRAGM OF SLEEVE 9.         |
| 2. TAIL.                                    | 19. ROTOR CAP.                     |
| 2a. VANES                                   | 20. FUZE CAP.                      |
| 3 SAFETY PIN.                               | 21. BURSTING CHARGE.               |
| 4 ALUMINUM CONTAINER.                       | 22. GAINE.                         |
| 5 FLAT-SECTION COILED SPRING.               | 23. RING.                          |
| 6 GUIDE TUBE FOR GRAZE PELLET.              | 24. WASHER.                        |
| 7 STEEL DISC.                               | 25. GRAZE PELLET WITH CLOSURE CAP. |
| 8 FUZE BODY.                                | 26. FIRE HOLES.                    |
| 9 STRIKER -- PIN SLEEVE.                    | 27. HEAD WASHER.                   |
| 10. WASHER.                                 | 28. ADAPTER FOR GAINE.             |
| 11. ROTOR.                                  |                                    |
| 12. ROTOR HUB.                              |                                    |
| 13. PIN FOR PREVENTING ROTATION OF ROTOR.   |                                    |
| 14. STIRRUP SPRING.                         |                                    |
| 15. STRIKER - PIN.                          |                                    |
| 15a. SCREW-THREADED STEM OF STRIKER SPRING. |                                    |

FIG. 24.—Bomb, H.E., 45 mm. Brixia Mortar, Model 35

The fuze comprises a fuze body (8), striker-pin (15), graze pellet (25), detonator (16) and a creep spring (17).

The fuze is provided with two safety devices, one for ensuring safety during storage and the other for ensuring safety in flight.

The device for ensuring safety in storage consists of a brass safety pin (3) which extends transversely through apertures (1b) in the head (1a) of the body and through similar apertures in the fuze cap (20). This brass pin separates the striker-pin (15) from the graze pellet (25) and prevents arming of the fuze until it is withdrawn by means of a ring (23).

The device for ensuring safety in flight comprises a rotor (11) and a pin (13), which is mounted in the fuze body (8) by means of a stirrup spring (14), so that its point engages in the rotor. When the projectile is discharged, the pin (13), owing to inertia, overcomes the resistance of the stirrup spring (14) and moves back, freeing the rotor (11), which is immediately caused to rotate by the air flowing past the nose of the fuze, thereby unscrewing itself from the screw-threaded stem (15a) of the striker-pin and causing the point of the striker-pin to project through the hole in the diaphragm (18) of the striker-pin sleeve (9). The arming of the fuze in this way is not, however, completed until the projectile has travelled about 10 yards from the muzzle of the mortar.

In an earlier model of this projectile, the container (4) is made of brass instead of aluminium, and the graze pellet is in one piece, i.e., without any closure cap.

### ITALIAN FUZE, MODEL 16 (FIG. 25)

The fuze model 16, which is used with 120 mm. and 380 mm. ammunition is in the shape of a truncated cone with screw-threaded adapter at base to screw into the nose of the shell. The entire fuze—apart from the brass wind-shield at the nose, and base plug—is painted black. The overall length of the fuze is 7.9 cm., and the diameter at its widest part is 6.2 cm.

The steel outer casing is closed at the top by a brass cover plate or wind shield, fixed at the top end of a cylindrical mouthpiece by a brass ring positioned over the cover plate and fixed by indentations of the rim of the mouthpiece.

A brass base plug with central channel screwed (L.H.) into a brass bush is itself screwed (R.H.) into the base of a steel adapter screw threaded internally and externally.

The steel adapter screws internally into the base of the outer case for about 1 cm., and holds in position, by a flange at the top end, the aluminium housing to the brass cylinder block in which is found the mechanical shutter arrangement.

The brass bush is screwed at the bottom end of the adapter

against the aluminium housing and has a central cylindrical cavity containing creep spring and detonator adapter.

The detonator adapter is cylindrical, of reduced diameter at the top half, to carry the creep spring, the lower half being

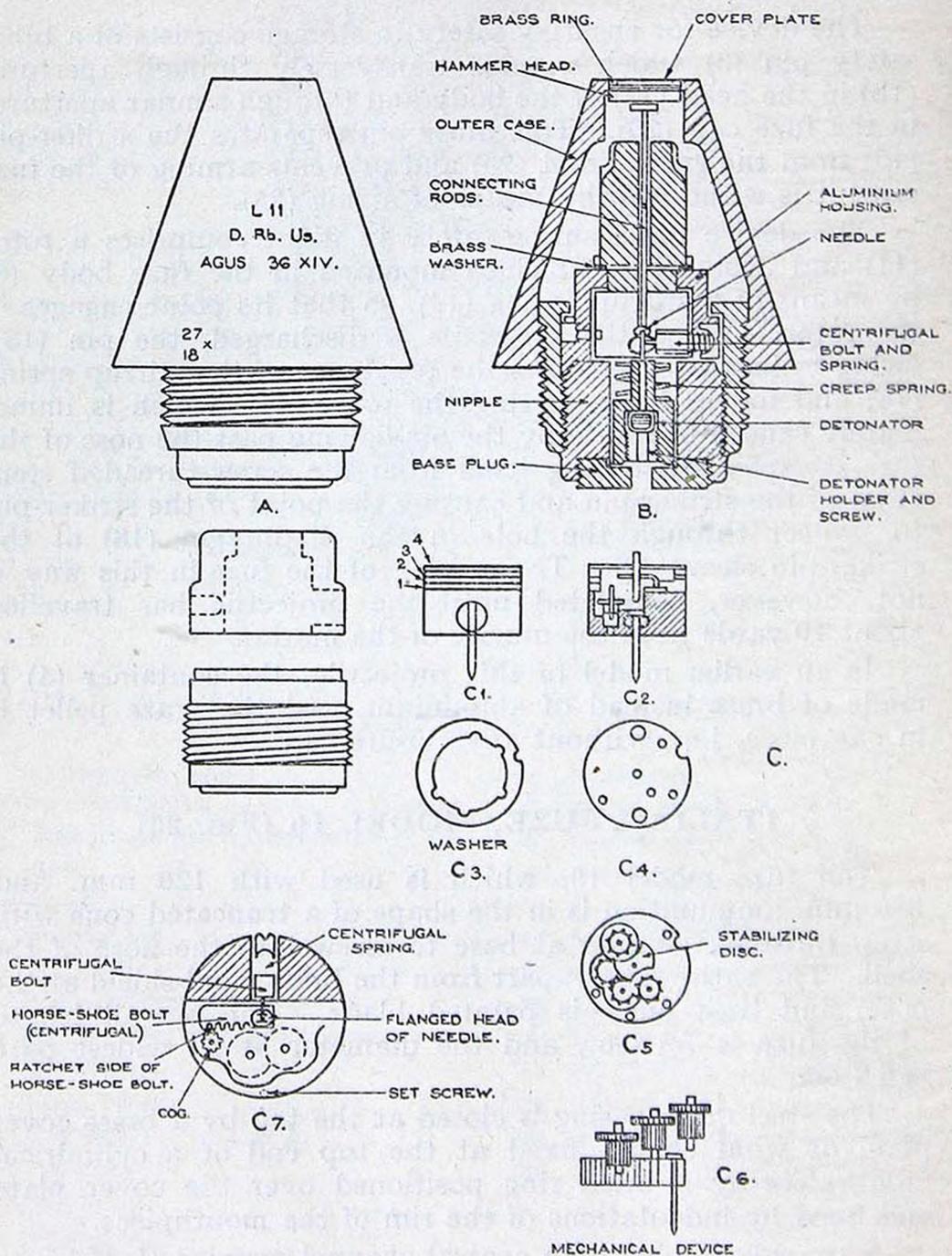


FIG. 25.—Italian Fuze, Model 16

hollow and screw threaded to take the detonator holder, which is also cylindrical with a cylindrical cavity in the inner half to hold the detonator. This, too, is cylindrical and loose, being positioned when the detonator holder is screwed into the adapter. The upper half of the detonator adapter has a central

longitudinal channel, down which a needle passes to pierce the detonator on impact or graze.

The aluminium housing is positioned on top of the brass bush, thus holding the creep spring in tension. It is fixed by a flange at the top of the steel adapter. The brass cylinder block fits into the lower end of the housing and is positioned by a closing flange at the top end and fixed by a set screw.

The brass cylinder block contains the shutter mechanism and the components are shown in diagram "C." "C" shows the external appearance—a bottom brass cylinder surmounted by a brass positioning disc with a small central guide tube for the second connecting rod, two steel washers (C3) and a closing disc (C4) all attached to the main body by two screws. The central guide tube is positioned directly above the flanged head of the needle supported by the flange on the U end of the horseshoe centrifugal bolt—see C2, C6 (longitudinal sections) and C7 (transverse section).

The shutter arrangement can be seen from C7 to consist of a centrifugal bolt with a small protruding lug on the inner end, working against a centrifugal spring, held in place by a screw plug. The lug fits into a hole in the side of one of the arms of the horseshoe centrifugal bolt so that until the centrifugal bolt is thrown out, the horseshoe centrifugal bolt and the needle are immovable.

The horseshoe centrifugal bolt is a cylindrical bolt, forked at the end and flattened at the top and bottom so that it cannot move in the channel. The whole of one side is grooved transversely to fit the teeth of the first cog wheel so that as the bolt moves the first cog wheel rotates. This drives a second cog wheel by an axial cog as shown in C6, and the second cog wheel drives a third, and the third a fourth in the same way, so that each cog wheel overlaps the previous one over quite a large area. The fourth cog contacts a stabilizing disc, which vibrates as the cogs rotate, i.e., as the centrifugal bolt moves outwards. When the bolt moves inwards the cogs rotate but the disc remains still.

Above the brass cylinder block and fitting to the cavity formed by the flange of the aluminium housing, but separate from the latter by a brass washer, is a long aluminium guide shaped at the top end to fit the cylindrical mouthpiece of the outer casing and having a central channel throughout the length. Into the top end of the channel fits the rod with hammer head attached. Inside the channel is the first connecting rod of the same diameter, and below that, protruding from the guide, is a second connecting rod of much smaller diameter so that it passes through the small central guide of the brass positioning disc in the shutter block and emerges in contact with the top end of the needle supported on the arms of the horseshoe centrifugal bolt.

The channel inside the guide has a reduced diameter at

the top half so that the hammer head can move forward, but not the first connecting rod, whereas they can both move backwards as on impact.

### **Action**

On firing, the centrifugal bolt immediately flies out leaving the horseshoe centrifugal bolt free to move out under the action of centrifugal force. If this were also to take place immediately, the needle would be released during acceleration and would set back on the detonator, thus causing a premature in the bore. To prevent this, the horseshoe centrifugal bolt is controlled by the system of cogs. During acceleration, the cogs set back on one another and the friction set up between the comparatively large faces of contact is sufficient to prevent the bolt moving outwards. On deceleration, however, the cogs set forward and separate, friction forces are small and the horseshoe centrifugal bolt can move out, releasing the needle, which, however, owing to set forward, remains in its original position against the second connecting rod.

The detonator holder at this stage tends to set forward but is held away from the needle by the creep spring.

On graze the detonator holder sets forward on the needle.

On impact the impacting force is transmitted through both connecting rods to the needle which pierces the detonator.

In both cases, the flash is transmitted through the flash channel in the base plug to the exploder system.

### **JAPANESE FUZE (FIG. 26)**

This is a direct action fuze of the detonating type in which the striker is held off the detonator by a spiral spring. For safety in transport and in the bore a safety device is included which consists of segments positioned under the striker holder to prevent its movement towards the detonator.

The steel striker, attached to the aluminium striker head by means of the steel holder, is supported in the brass body by means of a steel spiral spring. The spring is held in compression between the brass guide ring and a collar formed on the striker head.

The brass base of the fuze screws into the body and carries a brass cylindrical ferrule supported on a cupro nickel stirrup spring. The ferrule locates four brass segments between the striker holder and the base and has an internal groove to engage the arms of the stirrup spring when in the armed position.

Details of the initiator fillings and the filling of the brass magazine are not available.

### **Action**

On acceleration the ferrule sets back and is retained in this position by the arms of the stirrup spring engaging the groove

in the ferrule. The striker head also sets back, causing the segments to be held by the striker holder. When acceleration ceases, centrifugal force set up by the rotation of the projectile causes the segments to move outward and leave the striker

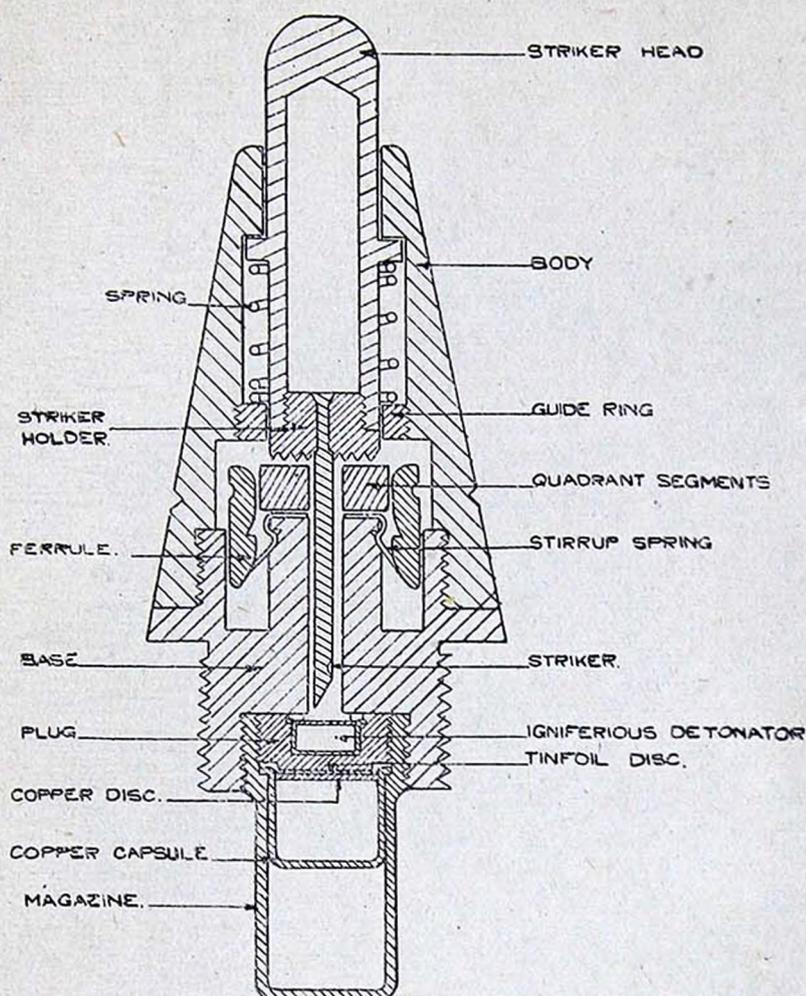


FIG. 26.—Japanese Fuze

held off the detonator by the spiral spring. On impact the striker head is driven in, compressing the spring and the striker pierces the detonator.