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HANDBOOK
OF ENEMY AMMUNITION

PAMPHLET No. 6

**GERMAN GRENADES, AND AMMUNITION
FOR GUNS, HOWITZERS AND MORTARS**

**JAPANESE GRENADES, MORTAR
AMMUNITION AND H.E. SHELL**

By Command of the Army Council,

L. D. D. D.

THE WAR OFFICE,
17th March, 1943.

HANDBOOK

OF

ENEMY AMMUNITION

Pamphlet No. 6

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HANDBOOK OF ENEMY AMMUNITION

GERMAN FRICTION IGNITER FOR EGG GRENADE (Brennzunder Ei) (FIG. 1)

The igniter which is used in the H.E. egg-shaped hand grenade and with booby trap devices has been described previously in Pamphlet No. 5 in connection with the grenade. The following is a more detailed description based upon later information.

The tubular aluminium body contains, near its upper end, an inverted copper cup with a central hole through which the pull-wire passes. The

TOP ELEVATION.

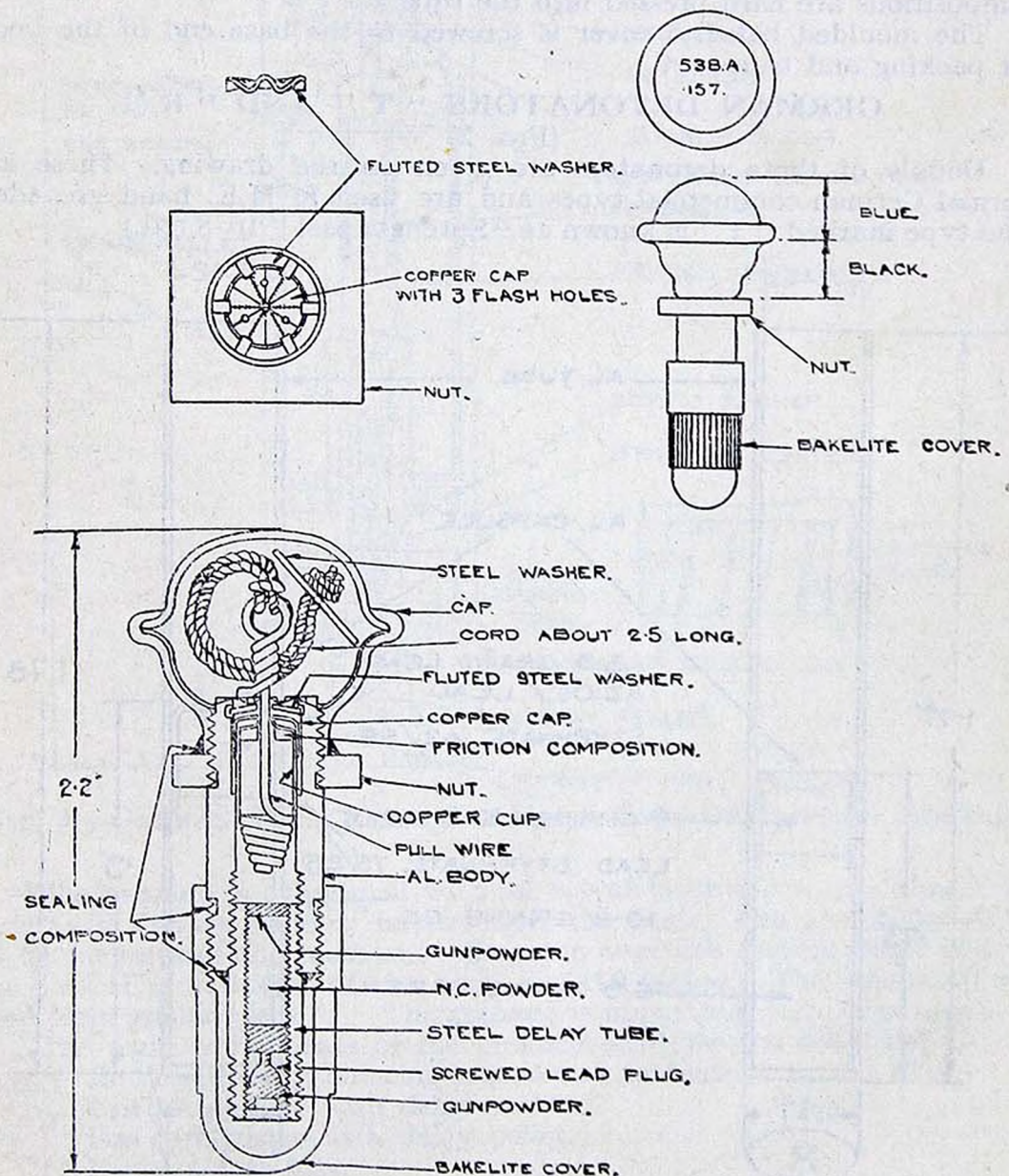


FIG. 1.—GERMAN FRICTION IGNITER FOR EGG GRENADE

cup contains a pressing of friction composition around the hole and is covered by a copper cap which has three equi-distant flash holes. Above the cap a steel fluted washer is secured in the top of the body by stabbing. The pull-wire is looped at the outer end for the attachment of the cord and washer. The inner end of the wire is coiled below the cup, the first coil being larger than the mouth of the cup. The wire is of soft iron and is coated with zinc.

The delay tube is of steel and screws into the base end of the body. The interior is screwthreaded and is divided into two compartments by a screwed perforated lead plug. The lower portion is screwthreaded externally for the assembly of a detonator of the screw-on type. The normal type of detonator is pushed on over this thread. The tube contains two compositions. The lower composition, which is pressed on both sides of the lead plug, consists of gunpowder. The upper composition, which is topped with a thin layer of gunpowder, consists of nitrocellulose powder stabilized with diphenylamine and is yellow-green in colour. Both compositions are hard pressed into the tube.

The moulded bakelite cover is screwed to the base end of the body for packing and transport.

GERMAN DETONATORS " T " AND " R "

(FIG. 2)

Details of these detonators are given on the drawing. These are normal German commercial types and are used in H.E. hand grenades. The type marked " T " is known as " Sprengkapsel " 10·8 (Al.)

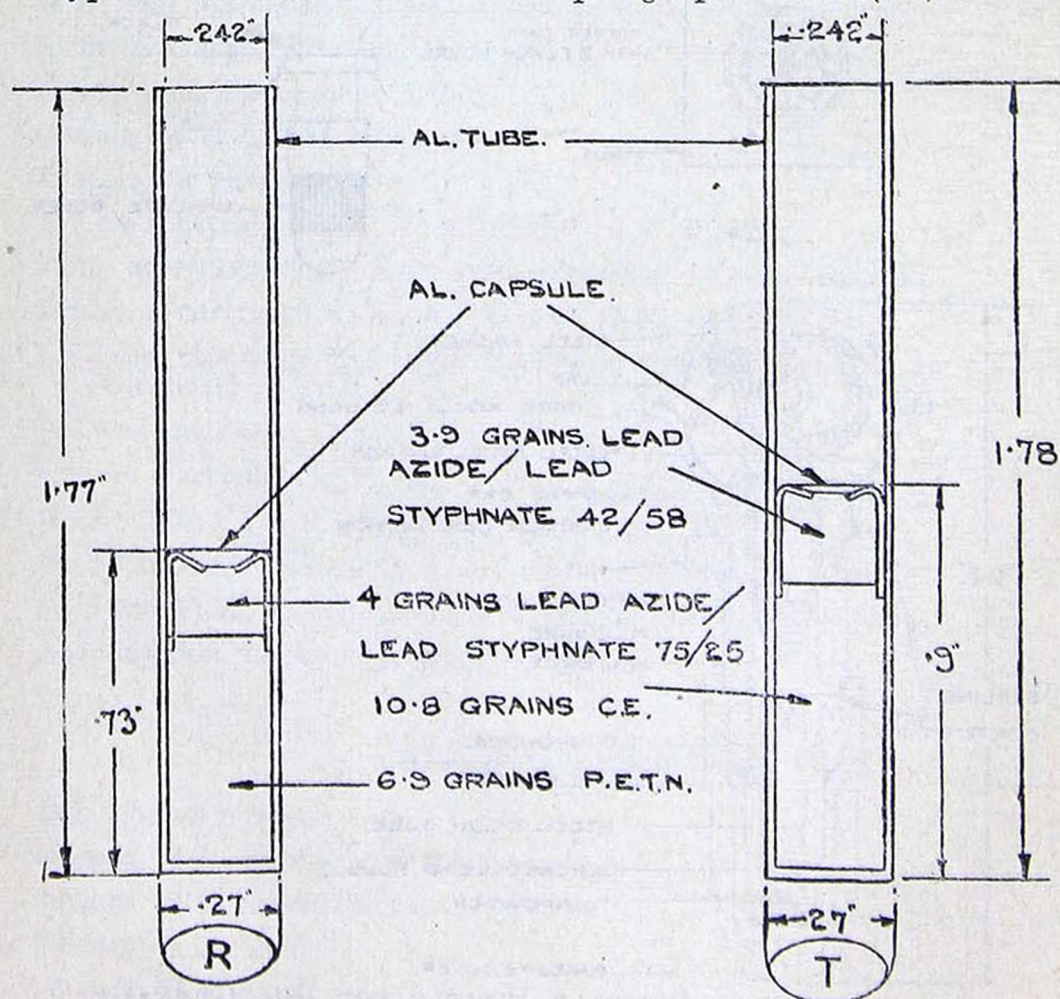


FIG. 2.—GERMAN DETONATORS

GERMAN, H.E., RIFLE AND HAND, SELF-DESTROYING, GRENADE

(Gewehrgränate Spreng) (FIG. 3)

The grenade is thrown by hand or fired from a rifled discharger device with a 7.92 mm. S.A. cartridge. When used as a hand grenade it is initiated by a friction pull igniter which is operated immediately before throwing and gives a delay of 4.5 seconds. As a rifle grenade it is initiated by a percussion fuze or by a self-destroying device which functions after a lapse of 11 seconds from the time of firing.

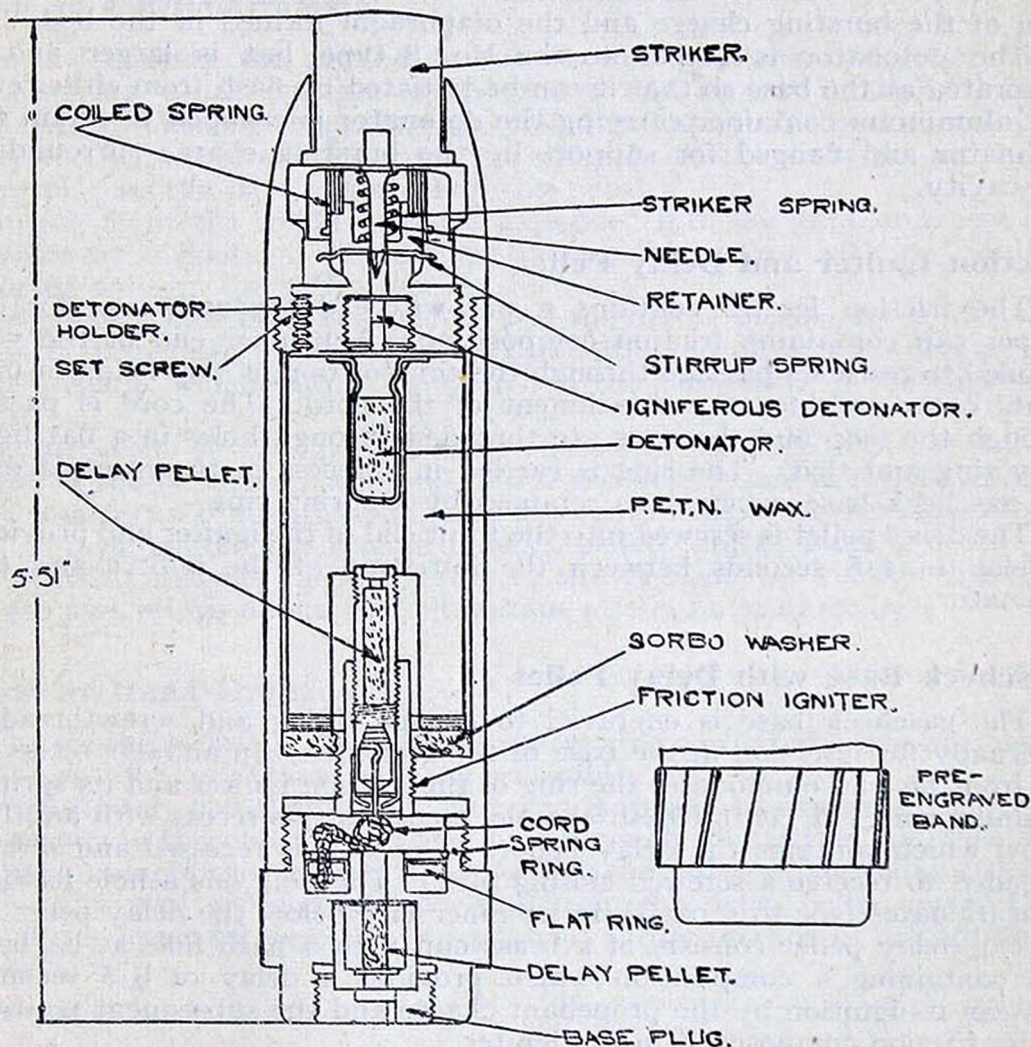


FIG. 3.—GERMAN, H.E., RIFLE AND HAND, SELF-DESTROYING GRENADE.

The grenade is cylindrical with an ogival head and a nose fuze. An engraved driving band is formed near the base. The overall length is 5.51 inches and the maximum diameter over the driving band is 1.22 inches. The diameter of the body is 1.18 inches. The weight of the complete grenade is 9 oz. The grenade is unpainted, but rustproofed.

The main components of the grenade comprise the following:—

- Body with H.E. bursting charge and detonator.
- Friction igniter with delay pellet.
- Gas check base with delay pellet.
- Direct-action fuze.

Body and Filling

The body is in the form of a steel tube 3.15 inches long and 1.18 inches in diameter, the wall being .08 inch thick. A diaphragm formed near the base end is bored centrally and screwthreaded to receive the friction igniter which is inserted from the base. The body is screwthreaded internally at the front end to receive the fuze and at the rear to receive the gascheck base.

The bursting charge consists of 1.1 oz. of P.E.T.N./wax in a waxed cardboard carton with a central cavity to receive the detonator with its container at the front end and the igniter delay pellet at the base end. A sorbo washer, under another washer, is positioned between the base of the bursting charge and the diaphragm formed in the body.

The detonator is similar to the No. 8 type but is larger and is perforated at the base so that it can be initiated by flash from either end. The aluminium container carrying the detonator is crimped to retain the detonator and flanged for support by the bursting charge surrounding the cavity.

Friction Igniter and Delay Pellet

The friction igniter contains a pull-wire led through a perforated copper cap containing friction composition. The inner end of the wire is coiled to resist its passage through the composition, a loop being formed at its outer end, for the attachment of the cord. The cord is passed through the loop and the ends are threaded through holes in a flat light alloy ring and tied. The ring is carried in a recess in the front face of the gascheck base, where it is retained by a spring ring.

The delay pellet is screwed into the front end of the igniter and provides a delay of 4.5 seconds between the initiation of the igniter and the detonator.

Gascheck Base with Delay Pellet

The gascheck base is engraved to engage rifling and screwthreaded externally for insertion in the base of the grenade. An annular recess in the front face accommodates the ring of the friction igniter and its spring-retaining ring. A central flash channel connects this recess with another below which contains the delay pellet. The base is recessed and screwthreaded to receive a screwed closing plug. The plug has a hole leading from its outer face to a cavity in its inner face below the delay pellet.

The delay pellet consists of a brass cup with a flash hole at its base and containing a composition which provides a delay of 6.5 seconds between its ignition by the propellant charge and the subsequent ignition of the friction composition in the igniter.

Fuze

The fuze is of aluminium and has an ogival body with a hole at the nose through which the cylindrical striker protrudes. The body is screwthreaded for insertion in the grenade and has an internal circumferential recess below the striker to permit the expansion of the coiled spring in flight. The striker carries a needle surrounded by a spiral spring which is held between the underside of the striker and a cup-shaped retainer. The retainer has a central hole for the needle and has a step formed near the front end around which a length of flat spring is coiled. The coiled spring is retained by a cylindrical arming ferrule with an internal groove

near its base end. A stirrup spring is held between the retainer and the detonator holder. The detonator holder is screwed into the base of the fuze and carries an igniferous detonator in a perforated screwed plug. The holder is secured in the fuze body by a set screw.

Cartridge

The steel cartridge is of the 7.92 mm. S.A.A. type, crimped at the neck, and containing a 139-grain propellant charge of nitrocellulose flake.

Action as a Rifle Grenade

On acceleration the arming ferrule in the fuze sets back over the stirrup spring which engages in its groove and retains it clear of the coiled spring. During this period the coiled spring is held by the set back of the striker, and propellant gases, entering the flash hole in the screwed closing plug at the base, ignite the delay pellet.

During flight the coiled spring is expanded into the annular recess in the body by centrifugal force, thus leaving the striker with its needle supported only by the striker spring.

On impact the striker is driven in and the needle pierces the igniferous detonator of the fuze. The flash from this detonator initiates the detonator in the grenade, which in turn brings about the detonation of the bursting charge.

In the event of the fuze failing to function, the flash from the delay fitment in the base, after a period of 6.5 seconds, enters the perforations in the copper cap of the friction igniter and ignites the friction composition. This in turn ignites the attached delay pellet, which, after a delay of 4.5 seconds, initiates the detonator in the grenade by a flash through its base and brings about the detonation of the bursting charge.

Action as Hand Grenade

The gascheck base is removed by unscrewing so that the ring attached to the cord of the friction igniter is accessible.

Immediately before throwing, the cord is tugged by means of the ring. This results in the pull wire being drawn through the friction composition and the production of a flash which ignites the filling of the delay pellet. After a delay of 4.5 seconds the flash from the delay pellet enters the base of the detonator and thus brings about the detonation of the bursting charge.

GERMAN, H.E., ANTI-TANK, HOLLOW CHARGE, RIFLE GRENADE (FIG. 4)

The grenade is fitted to a rifle, by means of a spigot device, and fired with a 7.92 mm. blank cartridge with wooden bullet.

The grenade consists of a streamlined bell-shaped body, with a slightly convex closing disc of aluminium, a graze fuze which screws into a projection on the base of the body, and a vaned tail unit which screws on the base of the fuze and is closed by a rubber plug. The whole of the grenade is painted olive green and a 5 mm. blue band is painted round the projection at the base of the body. The overall length is approximately 9.3 inches and the maximum diameter 2.4 inches

Body and Bursting Charge

The body is made of thin steel and is streamlined with a cylindrical projection about $\cdot 4$ inch long welded at the base. The projection is screwthreaded internally for the insertion of the fuze. A hole in the base of the body is fitted with an aluminium cup to accommodate the protruding magazine of the fuze. The head of the body is closed by a concave disc of aluminium which is secured by the overturned rim of the body.

The bursting charge consists of cast cyclonite/wax, bluish white in colour, with a hemispherical cavity of $\cdot 79$ inch radius in the head. The cavity is fitted with an aluminium liner of corresponding shape with a flange which fits inside the body at the head. The length of the body is 3.15 inches.

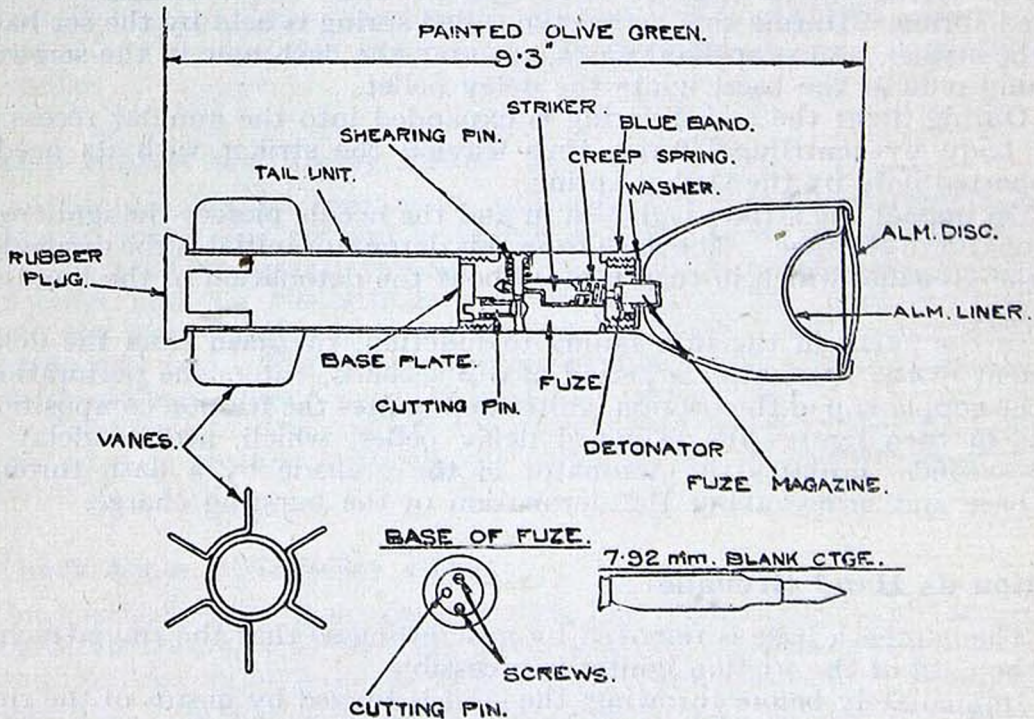


FIG. 4.—GERMAN, H.E., ANTI-TANK, HOLLOW CHARGE, RIFLE GRENADE.

Fuze

The fuze body is cylindrical with an external screw-thread at each end for assembly as the connecting piece between the tail unit and the body. A central recess contains the striker and creep spring and is closed at its enlarged front end by an aluminium magazine which is screwed in and contains a detonator and an intermediary explosive. A transverse channel near the base contains a spring-loaded screwed shearing pin which engages in a recess in the stem of the striker. Another channel, containing a cutting pin with spring, is bored from the base of the body and communicates with the shearing-pin channel at a point where the shearing pin is reduced in diameter. A circular plate, secured in a recess in the base of the body by two screws, retains the cutting pin in its channel. The base end of the cutting pin passes through a hole in the circular plate and is thus exposed to the pressure of the propellant gases.

Details of the magazine filling and the composition in the detonator are not available.

Tail Unit

The tail unit screws on to the base of the fuze with a right-hand thread and consists of a drawn-steel tube with six vanes formed in pairs. The cartridge is placed inside the tube for transport and the tube is closed at the base by a rubber plug.

Cartridge

The cartridge is of the 7.92 mm. small arm type with an undyed hollow wooden bullet. The granular propellant consists of cylindrical grains, .06 inch long and .02 inch in diameter with a basic composition of 54 per cent. of P.E.T.N. and 31.4 per cent. of nitrocellulose. Mineral jelly and graphite are also included.

Action

The rubber plug is removed from the tail unit and with the cartridge loaded into the rifle in the normal way the tube of the tail unit is placed over the spigot device at the muzzle.

On firing the hollow wooden bullet is shattered by the propellant gases which project the grenade and, overcoming the spring of the cutting pin, drive the pin forward, causing it to cut the shearing pin away from its screwed end. The shearing pin is then ejected by the spring held in compression under its head, and thus leaves the striker held off the detonator only by the creep spring. On graze the momentum of the striker overcomes the creep spring and the detonator is pierced.

GERMAN 8 CM., H.E., MORTAR BOMB

(8 cm. Wurfgrate 34) (FIG. 5)

This bomb can also be fired from the Italian 81 mm. mortar.

The bomb is painted a dull red and stencilled in black. The overall length is 12.95 inches, the maximum diameter 3.18 inches, and the weight, filled and fuzed, is approximately 7.75 lb.

Bomb and Bursting Charge

The construction of the bomb is similar to that of the 5 cm. type shown in Pamphlet No. 4, Fig. 5, but the cartridge container is fitted with twelve vanes instead of eight and has four rows of perforations for the escape of pressure. Also, the guide band or parallel portion of the body has four grooves. The body is made of cast iron.

The bursting charge consists of approximately 1.1 lb. of T.N.T. and has a cavity below the fuze hole for reception of the steel container which holds the gaine.

Gaine

The gaine has a cylindrical body of aluminium containing a 535-grain filling of P.E.T.N./Wax (87.8/12.2 per cent.) and a detonator assembly. This assembly, fitted in the head of the gaine, consists of a flanged detonator shell which fits into a cavity in the gaine filling and closes the head of the gaine. The detonator contains 7.6 grains of lead azide and lead styphnate (63.2/36.8 per cent.) over 7.7 grains of P.E.T.N. The flanged mouth of the detonator is closed by an aluminium flanged cup with five holes in its base. An aluminium washer between two paper

GERMAN 8cm. H.E. MORTAR BOMB AND CARTRIDGES.

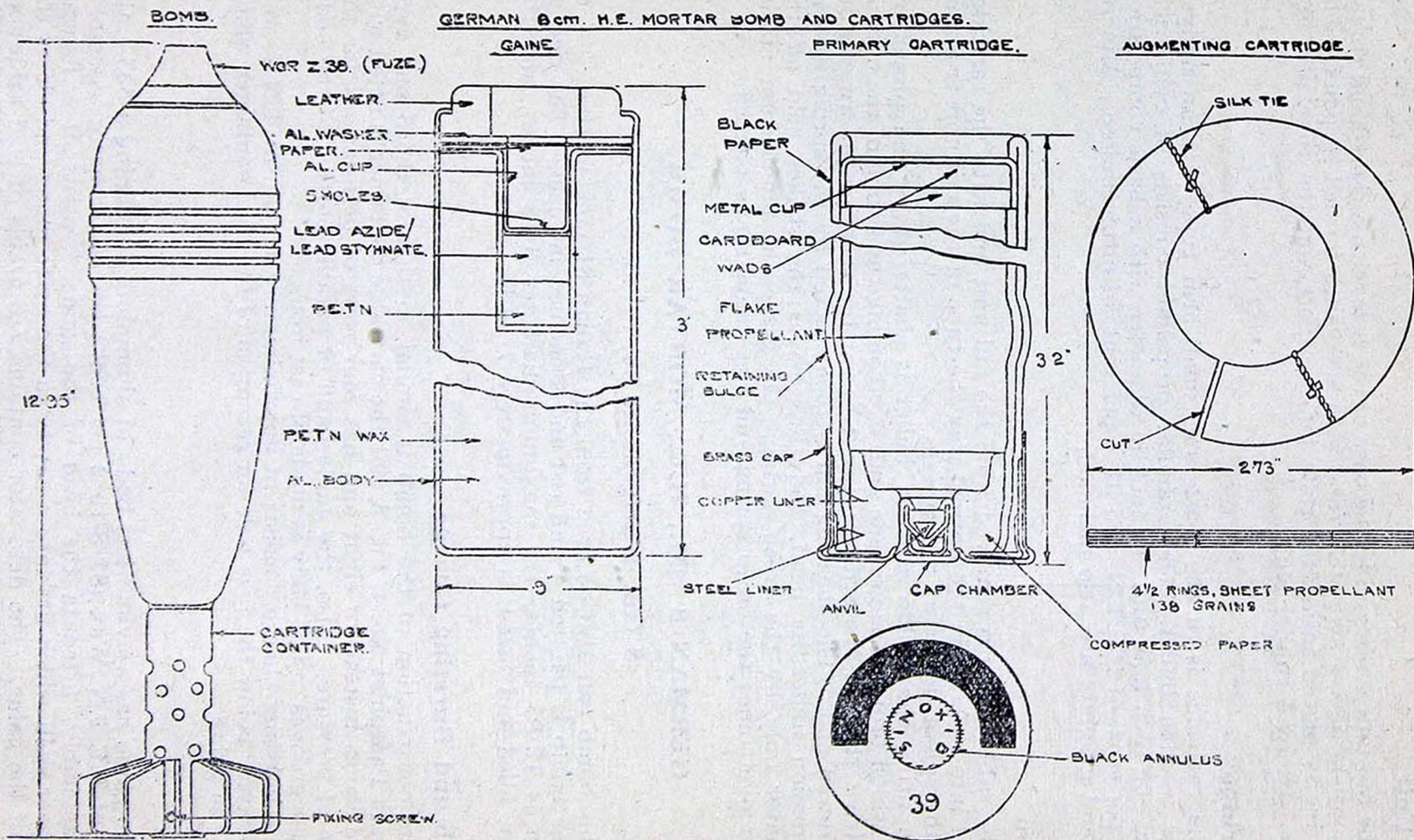


Fig. 5

discs and surmounted by a leather washer is fitted in the head of the gaine and secured by the turned-in rim of the body. The approximate dimensions of the gaine are : length 3 inches, diameter .9 inch.

Fuze (Wurfgrate Zünder 38).

The fuze bears the same number as that used in the 5 cm. bomb, *i.e.*, Wgr.Z. 38.

Cartridges, Primary and Augmenting

The propellant charge consists of a primary cartridge, carrying its own means of ignition, and three secondary charges. The primary cartridge is placed in the cartridge container of the bomb, where it is secured by a screw in the container and a bulge formed in the rolled paper body of the cartridge. The augmenting charges are fitted round the cartridge container in front of the vanes.

The primary cartridge (Fig. 5) is of the 12-bore sporting type and consists of a rolled paper body and liner containing 152 grains of graphited flake propellant and fitted with the usual type of cartridge head which is considerably reinforced. The dimensions of the flake are $.04 \times .04 \times .009$ inch. The copper cup and wads at the front end are presumably intended to hold the pressure momentarily and ensure better ignition of the augmenting charges.

The augmenting charges each consist of four-and-a-half rings of annular sheet propellant covered with cambric and are provided with a radial slit for assembly round the cartridge container. The sheet propellant is .017 inch thick and the weight of each charge is 138 grains.

GERMAN, FUZE, TIME, MECHANICAL, S/30

(Zeit Zünder S/30 or Zt.Z.S/30) (FIG. 6)

The fuze approximates to the principle of design of the British No. 207 fuze and includes the bridge device for muzzle safety which prevents the possibility of the hand rising until it has been rotated clear of the bridge. This movement takes approximately one second of time. The maximum time of running is approximately 30 seconds. The weight of the complete fuze is $13\frac{1}{2}$ oz., and its overall length 4.4 inches.

The main points of difference in construction from the No. 207 fuze are :—

- (a) Apart from the steel screwed collar the fuze is made of aluminium or aluminium alloy.
- (b) The base piece is not graduated for setting.
- (c) The tensioning (approx. 400 inch/oz.) is adjusted by jamming of the waved wire spring between the screwed ring and a flange round the base of the cap.
- (d) The dome with its hand race is inserted in the cap and locked by four lugs so that it turns with cap when turned for setting.
- (e) Instead of a locking ring to prevent independent rotation of the dome relative to the base piece and mechanism in flight, there are two taper plungers with knife-edge projections which lock the dome by set back on acceleration.

- (f) There is no trigger safety catch.
 (g) The centrifugal safety catch does not include the locking step.
 (h) The striker has a pyramid-shaped point. The cam collar rests on the safety step of the centrifugal safety catch.

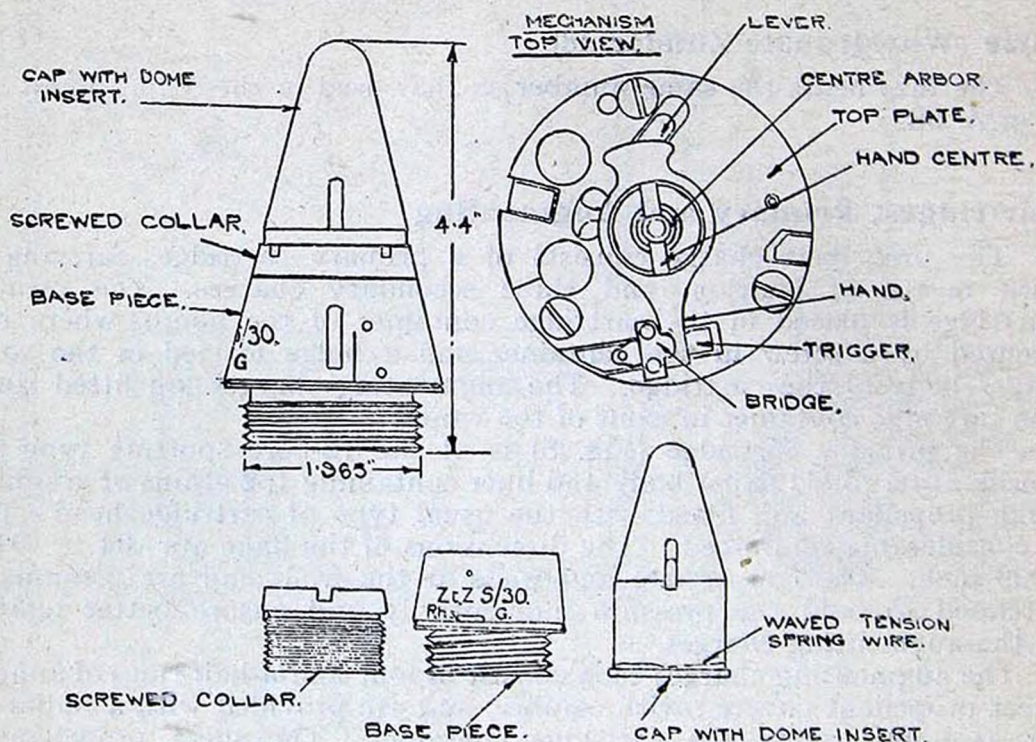


FIG. 6.—GERMAN MECHANICAL TIME FUZE S/30, ZEIT ZÜNDER S/30.

GERMAN GAINES FOR H.E. AND SMOKE SHELL

(Zündladung "A," "B" and "C/98") (FIG. 7)

The gaines used beneath nose fuzes of the igniferous type in H.E. shell and smoke shell are in the form of aluminium or brass cylinders which contain an H.E. filling and are fitted with a detonator inside the forward end. This end is fitted with an external leather washer. The filling may be picric acid, P.E.T.N./Wax or Cyclonite/Wax. The detonator filling may be P.E.T.N. or cyclonite with a priming layer of lead azide/lead styphnate or, in the case of gaines filled with picric acid, the detonator filling is mercury fulminate. The picric acid filling is in the form of powder, the P.E.T.N./Wax filling is tinted pale pink and the Cyclonite/Wax filling is tinted pale blue or a blue-green. Gaines containing P.E.T.N./Wax fillings have been found with the marking "Np" after the designation marking, e.g., "Zdlg. C/98 Np." These are the letters normally used by the Germans to indicate P.E.T.N.

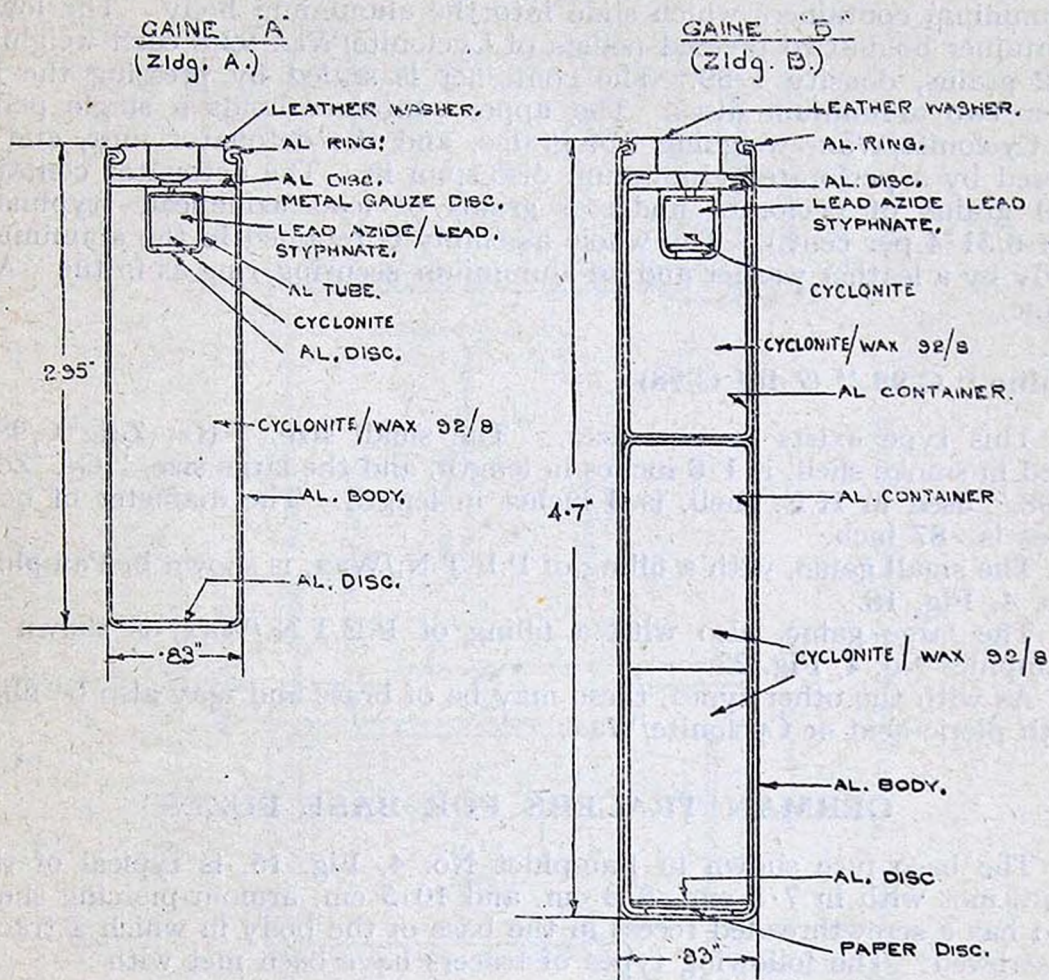
Brass gaines filled picric acid are shown in Pamphlet No. 1, Figs. 13, 14 and 16. Aluminium gaines filled P.E.T.N./Wax are shown in Pamphlet No. 4, Figs. 18 and 22.

The following types have been identified as being marked in a lettered series:—

Gainé "A" (Zdlg "A")

The gainé consists of an aluminium body 2.95 inches long and .83 inch in diameter, filled with a pressed pellet of Cyclonite/Wax 92/8, weighing

577 grains, density 1.61. The Cyclonite/Wax mixture is tinted pale blue by the addition of a small quantity of dyestuff. A cavity is formed at the head end to receive the detonator, which is enclosed in an aluminium tube. The detonator contains 6.5 grains of cyclonite under 6.3 grains



DETONATOR OF GAINE 'A'.

DETONATOR OF GAINE 'B'.

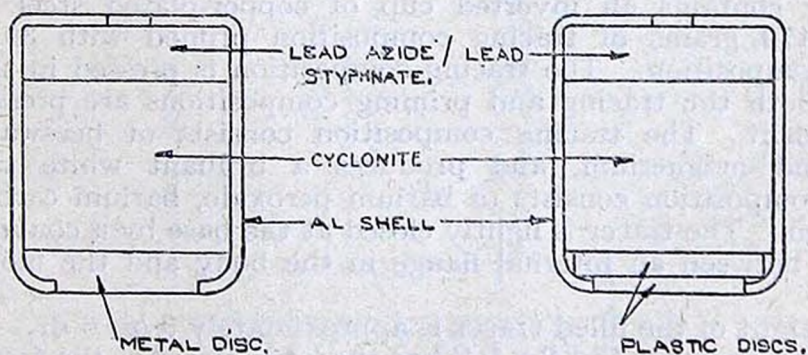


FIG. 7.—GERMAN GAINES

of lead azide/lead styphnate (58.8 per cent./41.2 per cent.). A disc of aluminium, with a central hole, holds the detonator tube firmly in its cavity and is itself held by a leather washer. An aluminium ring completes the closure by being folded over the lip of the body. The body is marked "Zündladung 'A'" or "Zdlg. 'A.'"

Gaine " B " (Zdlg " B ")

This gaine is 4.7 inches in length and has the same diameter as the " A " gaine. The Cyclonite/Wax pellets are enclosed in two separate aluminium containers which slide into the aluminium body. The lower container holds two pressed pellets of Cyclonite/Wax 92/8 each weighing 232 grains, density 1.59. The container is sealed by pressing the lip over two aluminium discs. The upper container holds a single pellet of Cyclonite/Wax, weighing 324 grains, and the detonator unit, and is closed by a perforated aluminium disc spun in. The detonator contains 6.9 grains of cyclonite under 5 grains of lead azide/lead styphnate (68.6/31.4 per cent.). The whole assembly is retained in the aluminium body by a leather washer and an aluminium securing ring as in the " A " gaine.

Gaine " C/98 " (Zdlg C/98)

This type exists in two sizes. The small size, " Kz. Zdlg C/98," used in smoke shell, is 1.6 inches in length, and the large size, " Gr. Zdlg C/98," used in H.E. shell, is 3 inches in length. The diameter of both sizes is .87 inch.

The small gaine, with a filling of P.E.T.N./Wax, is shown in Pamphlet No. 4, Fig. 18.

The large gaine, also with a filling of P.E.T.N./Wax, is shown in Pamphlet No. 4, Fig. 22.

As with the other types, these may be of brass and may also be filled with picric acid or Cyclonite/Wax.

GERMAN TRACERS FOR BASE FUZES

The base fuze shown in Pamphlet No. 4, Fig. 15, is typical of the fuzes met with in 7.5 cm., 8.8 cm. and 10.5 cm. armour-piercing shell, and has a screwthreaded recess in the base of the body in which a tracer is screwed. The following types of tracers have been met with :—

The type shown in Fig. 8 " A " consists of a steel body in the form of a hollow cylinder with an external screwthread for insertion in the fuze. The body contains an inverted cup of copper-plated steel. The cup contains 179 grains of tracing composition primed with 30 grains of priming composition. The tracing composition is pressed in three increments. Both the tracing and priming compositions are pressed with a serrated drift. The tracing composition consists of beeswax, barium nitrate and magnesium, and produces a brilliant white trace. The priming composition consists of barium peroxide, barium carbonate and magnesium. The tracer is lightly closed at the base by a convex celluloid disc held between an internal flange in the body and the mouth of the cup.

The weight of the filled tracer is approximately 3 oz. 6 dr.

The type shown in Fig. 8 " B " has the body closed at the front end by a steel disc and is fitted with a steel liner instead of a cup. The tracing composition, with a weight of 185 grains, is pressed in two increments and contains shellac instead of beeswax. The 62-grain priming composition is pressed in two increments and has the same composition as that in the first type. The tracer is closed by a flat celluloid disc let into an undercut recess,

The weight of the filled tracer is approximately 3 oz. 7 dr.

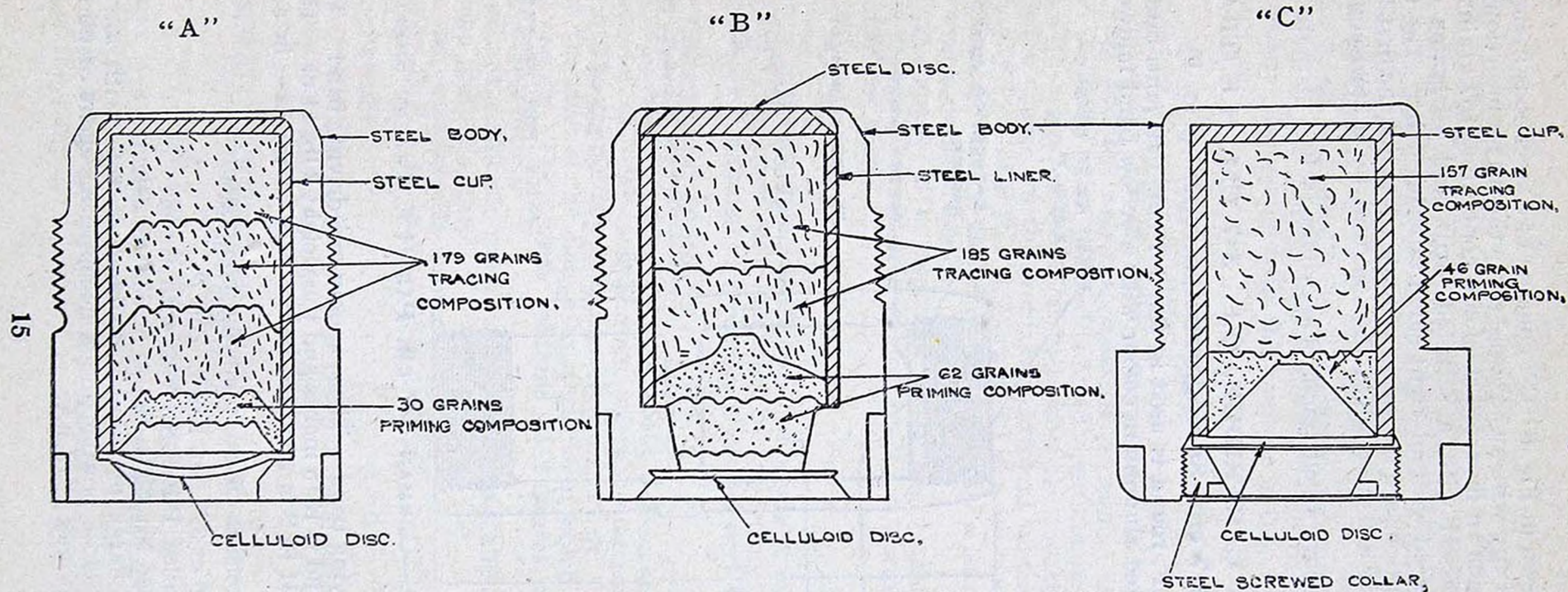


FIG. 8.—GERMAN TRACERS FOR BASE FUZES

The type shown in Fig. 8 "C" consists of a steel body in the form of an inverted flanged cup with an external screwthread for insertion in the fuze. The body contains an inverted steel cup containing 157 grains of tracing composition pressed with a serrated drift and 46 grains of priming composition pressed with an eight-sided tapering drift. The tracing and priming compositions are the same as those given for the first type. The body is closed by a flat celluloid disc secured by a steel collar screwed into the body.

The weight of the filled tracer is approximately 4 oz. 5 dr.

GERMAN CARTRIDGE, Q.F., 3.7 CM. H.E./TRACER
(3.7 cm. Sprenggranatpatrone) (FIG. 9)

The fixed Q.F. round is used in the 3.7 cm. Pak (anti-tank gun) and has a shell painted aluminium colour with a yellow band midway between

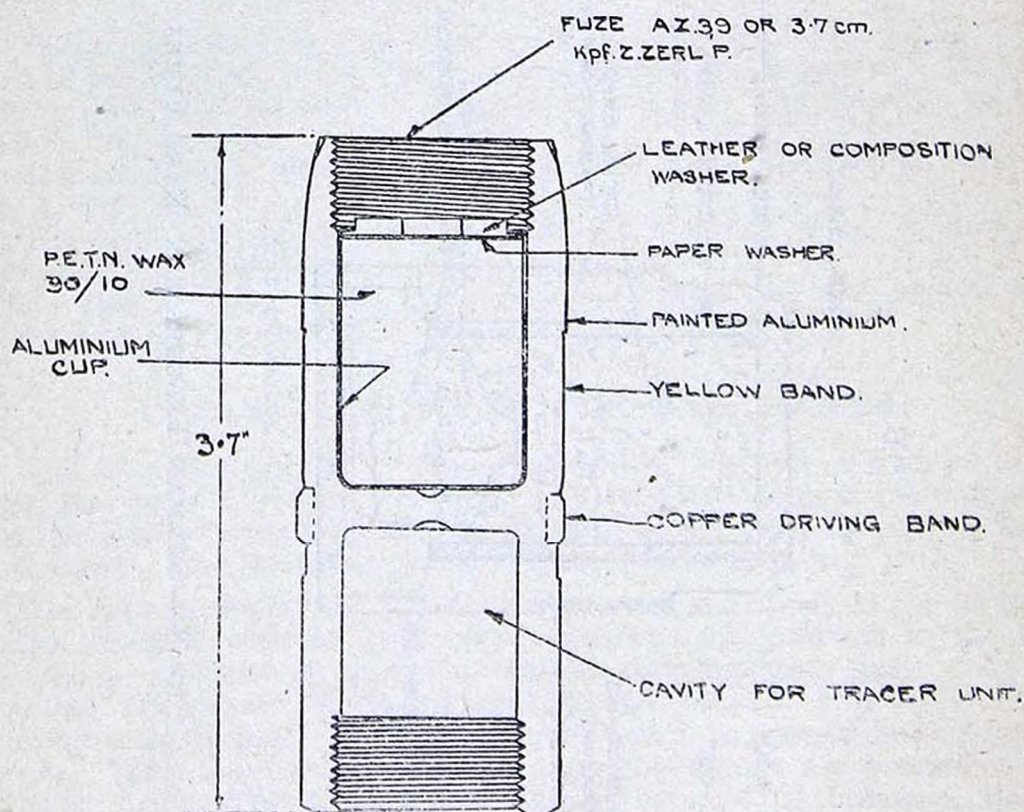


FIG. 9.—GERMAN 3.7 CM. PAK H.E./TRACER SHELL

the fuze and driving band. There is only one driving band. The overall length of the round is 13.5 inches and the weight 2 lb. 11 oz. The number "6331" or "6331 St" is stamped in the base of the case in addition to "3.7 cm. Pak."

The round consists of the following components:—

Fuze A.Z. 39 or 3.7 cm. Kpf Z Zerl P.

H.E. shell filled P.E.T.N./Wax with tracer.

Cartridge case No. 6331 (brass) or 6331 St (steel).

Propellant charge of tubular double-base type with an igniter of nitrocellulose powder and a decoppering agent of pure lead.

Percussion primer C/13 nA.

Fuzes

Fuze A.Z. 39 is described in Pamphlet No. 4. The fuze "3.7 cm. Kpf Z. Zerl P" is somewhat similar in appearance but has a red tip and is stamped with the designation of the fuze, the stamping being coloured red. The fuze is fitted with a centrifugal safety bolt which is retained in the safe position, obstructing the movement of the needle, by a powder pellet. A flash channel connects the powder pellet with a detonator which sets back on to a needle on acceleration and ignites the powder. The combustion of the powder leaves the bolt free to be displaced by centrifugal force. The needle with the hammer is then only held off the detonator by creep.

Shell

The interior of the shell is divided into two parts by a diaphragm formed in the shell. The forward compartment is screwthreaded to receive the fuze and the rear compartment to receive the tracer. The driving band is wholly of copper and is fitted approximately at the centre of the shell with a groove behind it to receive the mouth of the case.

The bursting charge, in the front compartment of the shell, consists of approximately 1 oz. of P.E.T.N./Wax 90/10 in a cup-shaped aluminium container. The container is closed at the mouth by a leather or composition washer over a paper washer.

The tracer consists of a steel cup containing tracing and priming compositions and has an external screwthread for assembly in the rear compartment of the shell.

Case

The case is 9.8 inches in length and has a slight increase in taper near the mouth. The steel case, identified by the letters "St" following the number "6331" stamped in the base, is coated with brass.

Propellant Charge and Igniter

The charge consists of tubular cords about 6.8 inches long with an external diameter of .098 inch and an internal diameter of .01 inch. The weight of the charge is approximately 5 oz. 11 dr. A small igniter is secured to the base of the charge by a silk strip which extends up the side of the charge. The igniter contains 34.2 grains of nitrocellulose powder in granular form.

The propellant is black in colour and consists basically of nitrocellulose and diethylene glycoldinitrate.

The silk strip securing the igniter is marked:—

"162 g. Digl R.P.—8.2—(175-2 2/085)."

Percussion Primer

The primer, C/13, is of the normal German type with a diameter of .63 inch at the base and a length of .55 inch.

GERMAN CARTRIDGE, Q.F., 5 CM. A.P. SHOT (ARROWHEAD)

(5 cm. Panzergranate 40)

The round is used with the 5 cm. Pak 38 (anti-tank gun) and has an overall length of 19.5 inches. The conical head of the projectile, protruding from the neck of the brass-coated case, is painted black. The weight of the complete round is approximately 6 lb. The same shot

is used in the 5 cm. Kw.K. (tank gun) with the 11·3-inch case (6317 St), length of round 14·3 inches, and the electric primer, C/22, also with the 5 cm. Kw.K. 39 (tank gun) with the 16·5-inch case (6360 St), length of round 19·5 inches, and the electric primer C/22.

The anti-tank gun round consists of the following components:—

- (a) Armour-piercing shot with tungsten carbide core and tracer.
- (b) Case stamped with the number "6360 St" on the base.
- (c) Propellant charge of double base composition with igniter.
- (d) Percussion primer C/12.

Shot

The shot is of the same construction as 4·7 cm. type described in Pamphlet No. 4, page 20 and Fig. 12, but has a reinforcing cap of thin sheet steel over the head of the plastic ballistic cap. The reinforcing cap is made up in two layers and extends about half-way down the plastic cap. A hole is drilled in the base of the body, presumably for the escape of air when the core is inserted.

The weight of the shot, without the tracer, is 1 lb. 14 oz. The core weighs 11 oz. 12 dr. and has a hardness figure varying between 1430 and 1690.

Case

The steel case, coated with brass, is 16·5 inches in length, has a shoulder at 13·5 inches from the base and is necked. The shot is fixed in the neck of the case, where it is secured by indenting of the case into the lower flange of the shot body. Only the conical head of the shot is exposed.

Propellant Charge

The propellant charge, indicated by marking to weigh approximately 1 lb. 8 oz. 14 dr., is made up of tubular cords which are green in colour. The propellant consists basically of nitrocellulose and diethylene glycol dinitrate.

The igniter consists of a flat circular silk bag containing propellant consisting of 88·1 per cent. nitrocellulose with camphor.

Primer

The C/12 percussion primer is described in Pamphlet No. 4.

GERMAN CARTRIDGE, Q.F., 7·62 CM. A.P.C.B.C.

(7·62 cm. Panzergranatpatrone 39)

The cartridge is used with the 7·62 cm. Pak. 36 (r) (field gun of Russian origin) and includes a case and primer also of Russian origin. The projectile is German.

The overall length of the round is approximately 26 inches, the capped projectile being painted black. The weight of the complete round is 21½ lb.

SHELL AND BURSTING CHARGE

The shell with its penetrative and ballistic caps is approximately 11·8 inches in length and is of the same general construction as the 7·5 cm. shell described in Pamphlet No. 4, which includes a drawing

(Fig. 15). The ballistic cap is attached to the penetrative cap by a circumferential weld. The forward end of the cavity for the bursting charge is occupied by a pad of inert composition.

The bursting charge is held in an aluminium container, shaped to fit closely in the shell cavity, and consists of a 530-grain block of T.N.T. followed by a 162-grain cylindrical block, also of T.N.T.

The cylindrical block contains a 593-grain exploder pellet of P.E.T.N./Wax which includes a pink dye and has a cavity in its base shaped to receive the head of the fuze. The weight of the explosive filling is

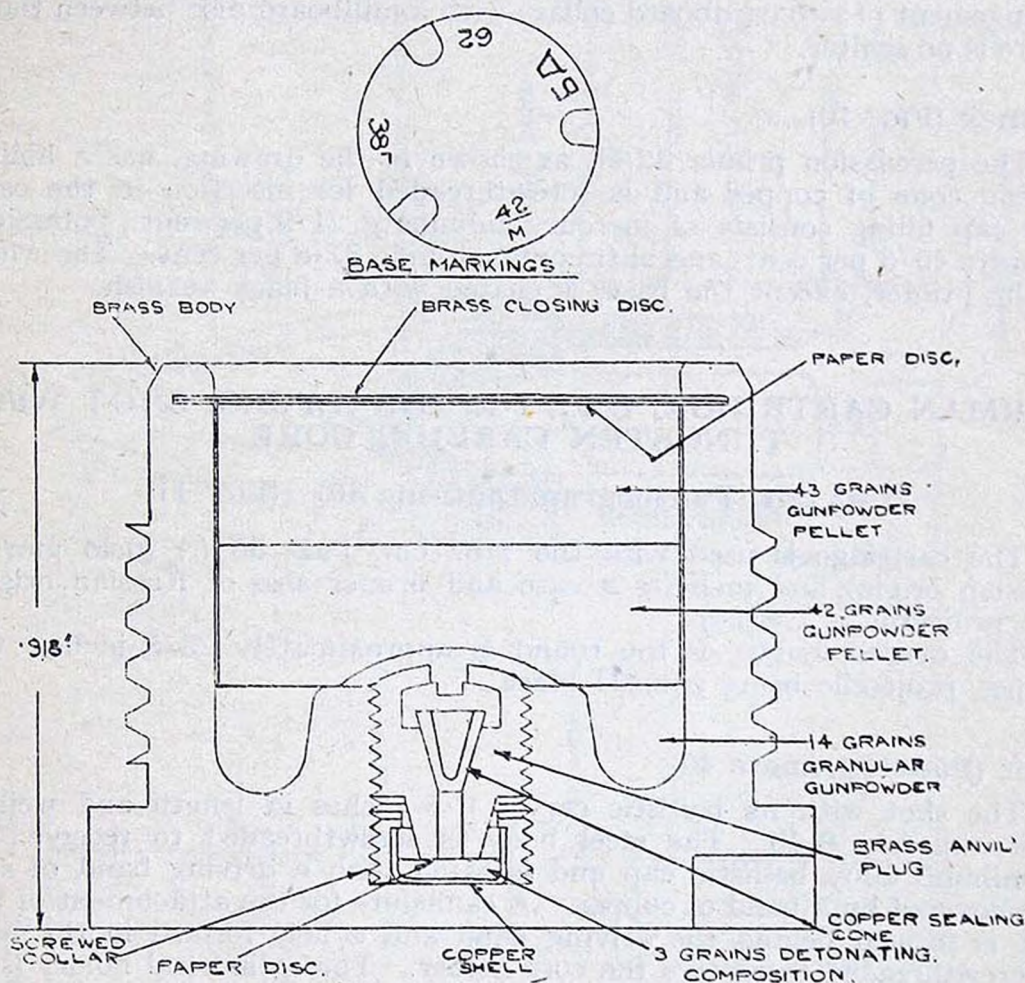


FIG. 10.—RUSSIAN PRIMER FROM GERMAN 7.62 CM. ROUND

approximately 3 lb. The aluminium container is turned in at the base on to a cardboard and an aluminium washer.

The weight of the shell filled and fuzed is approximately 14.3 lb.

Fuze

The base fuze with tracer is the same as that used in the 7.5 cm. shell. The tracer filling is held in a mild steel container inside the tracer body, which screws into the base of the fuze and is closed by a cellophane disc held between two screwed steel collars. The filling weighs 238 grains and burns statically with a vivid light for about 10 seconds.

Case and Propellant Charge

The case is of brass, 15.1 inches in length, and is not necked. The primer hole, which is .99 inch in diameter, is screwthreaded with 14 threads to the inch, and the flash hole at its inner end is closed by a cloth disc secured with shellac.

The granular propellant charge consists of 2 lb. 4 oz. of yellow-brown tubes of nitrocellulose powder containing a small proportion of potassium chloride. The stabilizer is diphenylamine. The powder is filled directly into the case with a millboard cup above it. The cup is secured by an arrangement of two cardboard collars with a millboard disc between them. There is no igniter.

Primer (FIG. 10)

The percussion primer 42/M, as shown in the drawing, has a hollow sealing cone of copper and is screwthreaded for insertion in the case. The cap filling consists of mercury fulminate 21.9 per cent., potassium chlorate 40.3 per cent. and antimony sulphide 37.8 per cent. The whole of the primer, except the base, is coated with a black varnish.

GERMAN CARTRIDGE, Q.F., 7.62 CM. A.P.B.C. SHOT WITH TUNGSTEN CARBIDE CORE

(7.62 cm. Panzergranatpatrone 40) (FIG. 11)

The cartridge is used with the 7.62 cm. Pak. 36 (r) (field gun of Russian origin) and includes a case and primer also of Russian origin. The projectile is German.

The overall length of the round is approximately 23.5 inches, the capped projectile being painted black.

Shot (Panzergranate 40)

The shot with its ballistic cap is 9.5 inches in length and weighs approximately 9 lb. The steel body is screwthreaded to receive the aluminium alloy ballistic cap and is fitted with a driving band of soft iron covered by a band of copper. A cannellure for the attachment of the case is formed behind the driving band and a hole formed in the base is screwthreaded to receive the core holder. The cylindrical holder is of steel and is screwed into the base of the body from the front. Two recesses are formed in the holder, one at the front end to receive the armour-piercing core and the other at the base, which is screwthreaded to receive the tracer. The diaphragm between the two recesses is bored centrally to permit the escape of air when the core is inserted. Details of the tracer are not available.

The armour-piercing core is 1 lb. 15 oz. 3 dr. in weight and consists of tungsten carbide plated with nickel. The base end of the core is chamfered to facilitate pressing into the holder. The marking "249E" has been found on the core in black.

The core and its holder are surrounded by a sleeve of moulded plastic which fills the space between the body and these components and has an ogival head within the ballistic cap. The plastic has a fairly high shock resistance and the design and construction of the projectile provides a rigid assembly of the components during flight without impeding free egress of the core on impact.

Case, Primer and Propellant Charge

The brass case and the percussion primer are the same as those described for the A.P.C.B.C. round. Details of the propellant charge are not available.

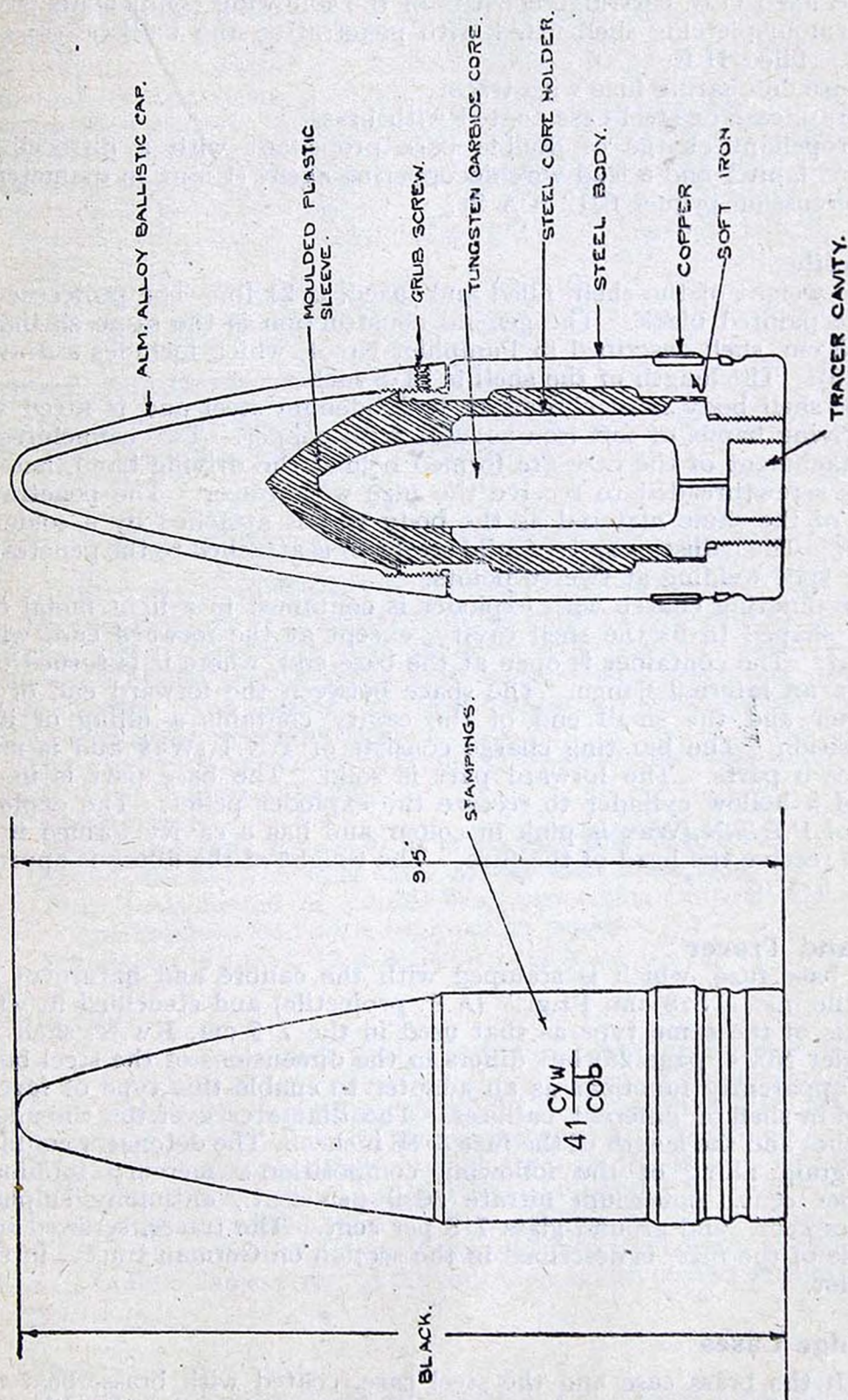


FIG. 11.—GERMAN 7.62 CM. Q.F. SHOT A.P. 40. (TUNGSTEN CARBIDE CORE)

GERMAN CARTRIDGE, Q.F., 8.8 CM. A.P.C.B.C. (8.8 cm. Panzergranatpatrone)

The cartridge is used in the 8.8 cm. Flak 18 and 36 (8.8 cm. multi-purpose gun) in the anti-tank role. The length of the complete round is approximately 34.3 inches and the weight 34 lb.

The fixed Q.F. cartridge consists of the following components:—

Armour-piercing shell fitted with penetrative and ballistic caps and filled H.E.

Base detonating fuze with tracer.

Brass case or steel case coated with brass.

Propellant charge of double base propellant with a nitrocellulose igniter and a lead wire decoppering agent (1 mm. in diameter).

Percussion primer C/12 n A St.

Projectile

The weight of the shell, filled and fuzed, is 21 lb. The projectile and cap are painted black. The general construction is the same as that of the 7.5 cm. shell described in Pamphlet No. 4, which includes a drawing (Fig. 15). The length of the shell is 14.5 inches.

The shell body is of chromium molybdenum steel and is fitted with two driving bands of soft iron covered with copper. Two cannelures for the attachment of the case are formed behind the driving band, and the base is screwthreaded to receive the fuze with tracer. The penetrative cap is of the same material as the body and is attached by a soldering process. The ballistic cap is of mild steel and is attached to the penetrative cap by spot welding at twelve points.

The bursting charge with exploder is contained in a light metal container, shaped to fit the shell cavity, except at the forward end, where it is flat. The container is open at the base end, where it is turned over to form an internal flange. The space between the forward end of the container and the small end of the cavity contains a filling of inert composition. The bursting charge consists of T.N.T./Wax and is made up in two parts. The forward part is solid. The base part is in the form of a hollow cylinder to receive the exploder pellet. The exploder pellet of P.E.T.N./Wax is pink in colour and has a cavity formed in its base to receive the head of the fuze. The weight of the filling is approximately 5.5 oz.

Fuze and Tracer

The base fuze, which is stamped with the calibre and nature of the projectile, *i.e.*, "8.8 cm. Pz.gr." (A.P. projectile) and stencilled in white "40," is of the same type as that used in the 7.5 cm. Kw.K. shell (*see* Pamphlet No. 4, page 25) but differs in the dimensions of the steel body, which apparently functions as an adapter to enable this type of fuze to be used in shell of different calibres. The diameter over the threads is 2.1 inches and the length of the fuze 3.56 inches. The detonator contains a .32-grain filling of the following composition: mercury fulminate 25.8 per cent., potassium nitrate 36.9 per cent., antimony sulphide 29.5 per cent., and ground glass 7.8 per cent. The tracer, screwed into the base of the fuze, is described in the section on German tracers in this pamphlet.

Cartridge Cases

Both the brass case and the steel case, coated with brass, bear the number "6347" stamped in the base. The steel case is readily dis-

tinguished from the brass by the letters "St" following the number. Both types are 22.4 inches long, increase sharply in taper near the mouth, and are necked. The primer boss is screwthreaded.

Propellant Charge and Igniter

The propellant charge, in the form of tubular cords, is partially enclosed in a bag which fits over its base end and contains the igniter composition. The weight of the charge is 5.34 lb. The propellant is of the double base type and consists basically of nitrocellulose and diethylene glycoldinitrate and includes sodium bicarbonate. The tubes are graphited and have a glossy black appearance. The igniter composition consists of greenish cylindrical grains of graphited nitrocellulose powder containing a small proportion of potassium nitrate.

The following markings are typical of markings stencilled on the bag in black:—

"2.425 kg. Digl R.P. 8—(460-5 5/2 75) dbg 40/4 LV 24-3-41 P."

The bag is also stencilled "Abgebr Ldg" in red.

Primer (Zündschraube C/12 n A St)

The percussion primer C/12 n A St is similar to the brass primer of the same number described in Pamphlet No. 4, page 10, but is of steel.

GERMAN CARTRIDGE, Q.F., 8.8 CM., H.E.

(8.8 cm. Sprenggranatpatrone L/4.5 (KZ)) (FIG. 12)

The cartridge is used in the 8.8 cm. Flak 18 and 36 (8.8 cm. multi-purpose gun). Cartridges may be fitted with the mechanical time fuze S/30 (Zt.Z.S./30) or the graze and direct-action percussion fuze 23/28 (A.Z. 23/28). The length of the complete round is approximately 36.7 inches and the weight 33 lb.

The fixed Q.F. cartridge consists of the following components:—

H.E. shell filled amatol.

Gain C/98.

Mechanical time fuze S/30 or graze and D.A. fuze 23/28.

Brass case 6347 or steel case, coated with brass, 6347 St.

Propellant charge of double base propellant with a nitrocellulose igniter and a lead wire decoppering agent.

Percussion primer C/12 n A St. or C/12 n A.

Projectile

The weight of the shell, filled and fuzed, is approximately 20 lb. The body of the shell is painted yellow. A drawing of the empty shell and details of the method of filling with T.N.T. are given in Pamphlet No. 1, pages 18 and 19. The amatol bursting charge is of the 40/60 variety and is filled by the direct casting method through the base. The weight of the filling is 1.9 lb. The walls of the cavity and the inner surface of the base plug are coated thinly with a bituminous composition. A steel exploder container for the gain is screwed into the nose of the shell below the fuze-hole. The exterior of the container is also coated with bituminous composition.

GAIN

Details of the gain C/98 are given in the section on German gains in this pamphlet.

Fuzes

Details of the mechanical time fuze Zt.Z. S/30 are included in this pamphlet.

The graze and direct-action fuze A.Z. 23/28 with optional delay is similar in construction and action to the A.Z. 23 Rh.S. (0.25) described in Pamphlet No. 1, page 7. The aluminium delay holder is stamped

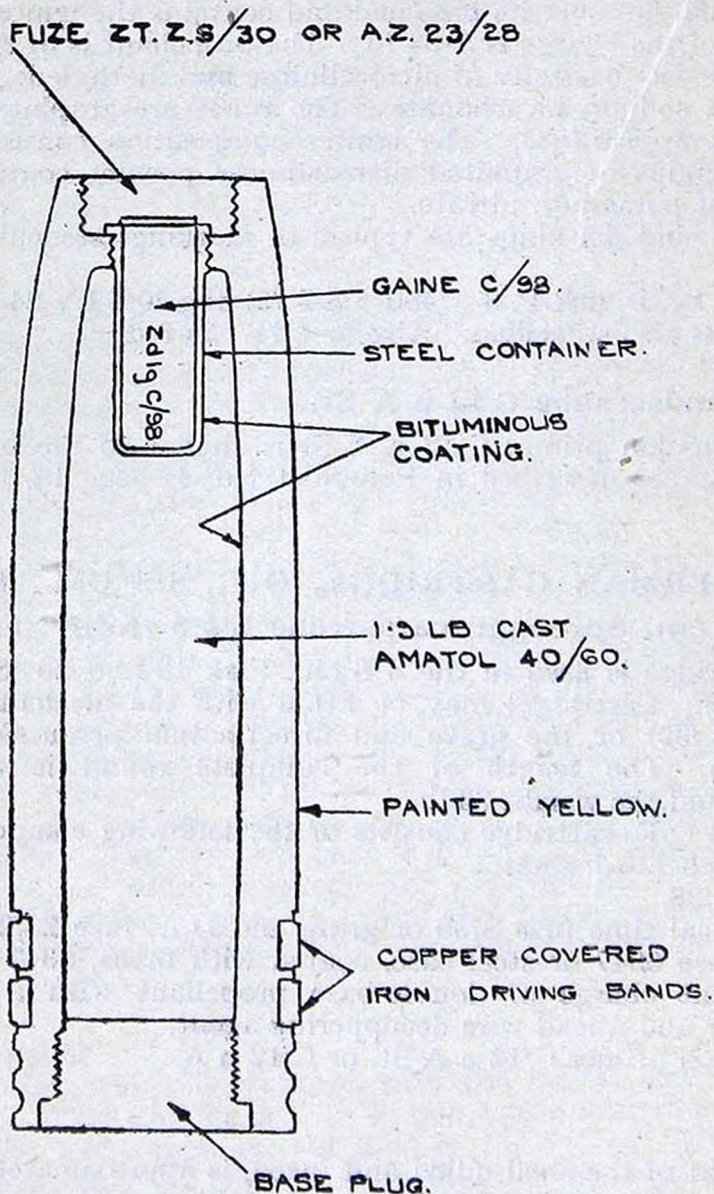


FIG. 12.—GERMAN SHELL, Q.F., 8.8 CM. H.E.

0.2 on its upper surface, and it is possible that this indicates a delay of 0.2 second. The overall length of the fuze is 4.4 inches and the length from the flange to the nose is 3.7 inches.

Case, Propellant Charge, Decoppering Agent and Primer

These are the same as those described for the A.P.C.B.C. round. The charge weight markings of 2.75 kg. (5.65 lb.) and 2.29 kg. (5.03 lb.) have been met with.

GERMAN Q.F., 10.5 CM. A.P.C.B.C. SHELL

(10 cm. Panzergranate rot)

The shell has a diameter of 10.5 cm. and is used in :—

10.5 cm. 1 F.H. 18 (gun howitzer).

s, 10 cm. K. 18 (10.5 cm. medium gun). The shell is fired with the highest propellant charge in this gun.

The shell is painted black and marked with a red band above the single driving band, which is of the copper and iron type. The weight of the shell, filled and fuzed, is 34 lb. 10 oz.

The construction of the shell with its ballistic and penetrative caps is the same as that of the 7.5 cm. described and illustrated (Fig. 15) in Pamphlet No. 4. The pad of inert composition in the front end of the cavity for the bursting charge is also included.

Bursting Charge

The bursting charge is contained in an aluminium container shaped to fit the wall of the shell cavity. The exterior of the container is marked "Sprgldg 10 cm. Pzgr. rot 86." The charge of ethylene-diamine-dinitrate is made up in three pressed pellets. These take the form of a solid pellet in the forward part of the container, followed by an annular pellet containing the exploder, and, lastly, a ring pellet inserted in the annular pellet behind the exploder. The blue exploder pellet of Cyclonite/Wax weighs 633 grains and is cylindrical with a cavity at the base to receive the head of the fuze. The total weight of the filling is approximately 8 oz. 3 dr.

Fuze

The base fuze with tracer is the same as that used in the 7.5 cm. shell (see Pamphlet No. 4, Fig. 16) except that the body is of bigger dimensions to suit the larger shell, and is accordingly stamped Bd.Z.f. 10 cm. Pzgr. (i.e., base fuze for 10 cm. A.P.). The maximum diameter of the fuze body is 3.5 inches and its length 2.56 inches.

The tracer fitment which screws into the base of the fuze is described in the section on German tracers in this pamphlet.

GERMAN Q.F., 10.5 CM. A.P. SHELL

(10 cm. Panzergranate)

The shell is fired from the 10.5 cm. 1 F.H. 18 (gun howitzer) with a separate loading Q.F. cartridge.

The shell is painted black, has a filled weight of approximately 31.25 lb. and, including the tracer, which protrudes half an inch from the base, has an overall length of 11.5 inches. There is no marking to indicate the presence of the tracer.

Shell

The shell, weighing 22.25 lb. empty, is machined from rolled bar chromium molybdenum steel and has a hardened head. The hardness figure varies from 675 at the point to 308 at the shoulder.

The driving band is of the iron copper-clad type. Two cannelures are formed behind the band.

Bursting Charge and Exploder

The weight and method of filling are the same as, described for the 10.5 cm. A.P.C.B.C. shell in this pamphlet.

Fuze and Tracer

The fuze is the same as that described for the 7.5 cm. shell in Pamphlet No. 4, page 26 and Fig. 16, but has a larger body.

Details of tracers used with this type of fuze are given in the section on tracers in this pamphlet.

GERMAN Q.F., 10.5 CM., STREAMLINED SMOKE SHELL (10.5 cm. Nebelgranate)

The shell is of the bursting type and is used with a separate loading cartridge in the 10.5 cm. 1 F.H. 18 (gun howitzer).

The length of the shell with fuze (Kl.A.Z. 23Nb.) is 19.25 inches and the weight 30.8 lb. The body is painted olive green and marked prominently in white above the driving band with the letters "Nb" in two places.

The general construction and method of filling and charging of the shell is the same as with the 7.5 cm. shell of this type described in Pamphlet No. 4, which includes a drawing (Fig. 17).

This 10.5 cm. shell has a burster consisting of 1,925 grains of pressed picric acid crystals in a paper tube which rests on three fibre washers in the base of the long central burster container. The gaine, in an exploder container at the head of the burster container, is the C/98 (Zdlg C/98), a description of which is included in this pamphlet. The charging of oleum/pumice weighs 4.1 lb. The inclusion of pumice gives a slight increase in the persistence of the smoke. According to German documents the smoke cloud formed on burst has a diameter of 80 to 100 feet.

Nebelgranate 38

The 10.5 cm. 1 F.H. 18 also fires a more recent design streamlined smoke shell known as "F.H.Gr. 38 Nb." The fuze is the same, *i.e.*, Kl.A.Z. 23 Nb, but the filled weight of the shell is 32.4 lb. and the diameter of the smoke cloud formed is given as 100 to 130 feet. The body and base of the shell are marked "38 Nb" in white.

GERMAN AMMUNITION MARKINGS AND NOMENCLATURE

The following markings and designations have been reported or met with in the course of examining captured German ammunition. Variations in the abbreviations and in the positions and dimensions of marking are not uncommon, but the following appears to be the normal:—

General

The following letters, commonly used in German nomenclature, have the following meanings:—

n A	new pattern.
umg	modified.
St.	steel.

In some instances the calibre given in the designation is not the actual calibre of the gun; for instance, the 10·5 cm. medium gun is always known as the "s. 10 cm. K.18."

Fuzes

The designation is stamped above the flange on nose fuzes and on the underside of base fuzes.

Nose fuzes, with the exception of one of the models used in 3·7 cm. Pak (anti-tank gun) ammunition, are designated in a numbered series. In some instances—as, for example, the 23 fuze—there is more than one type of the model, but these are all designated under the same model number.

The letter "S" with an oblique stroke immediately in front of the fuze number indicates a mechanical fuze.

The letter "C" with an oblique stroke immediately in front of the fuze number is found on fuzes from naval ammunition and older types of base fuzes of the igniferous type (these are probably also of naval origin).

The following letters are included in the designation of nose fuzes and precede the model number (or letter and number) :—

Stamping	Indication
A.Z.	Percussion fuze.
E.K. Zdr.	Sensitive type of percussion fuze.
K.Z.	Percussion fuze used under a ballistic cap.
Kl. A.Z.	Smaller size of a percussion fuze model.
l.I. gr. Z.	Fuze for infantry gun or howitzer shell.
Wgr. Z.	Fuze for mortar bomb.
Zt. Z.	Time fuze.
Dopp. Z.	Time and percussion fuze.

Fuzes for smoke shell have the letters "Nb" following the fuze number.

The excepted 3·7 cm. fuze referred to is designated "3·7 cm. Kpf.Z. Zerl P." The letters "Kpf.Z." indicate a nose fuze, while "Zerl P" indicates the presence of a gunpowder pellet which is destroyed on firing to release a centrifugal safety device.

Base fuzes, except the older igniferous types, are designated to include the calibre of the equipment and the nature of projectile in which used. The following are typical examples :—

Bd.Z. f 7·5 cm. Pzgr—indicating base fuze for 7·5 cm. armour-piercing projectile.

Bd.Z. f 15 cm. Gr. 19 Be—indicating base fuze for 15 cm. anti-concrete shell model 19.

The following is an example of the older type of igniferous base fuze designated in a numbered series :—

Bd.Z. C/38—indicating base fuze C/38.

Nose fuzes or base fuzes with a setting device for optional delay are stamped with the letters "M," "V" and "O" to indicate the positions to which the slot in the setting plug must be set to obtain either delay or non-delay action. With nose fuzes the "M" and the "V" are normally diametrically opposite and the plug is turned so that the slot in its head is aligned with them to obtain the "with delay" action. With base fuzes the "M" and "V" are stamped together as "MV" and the slot in the setting plug is aligned with this stamping to obtain delay action. The "O" stamping indicates the setting position for "without delay."

The stamped setting letters are coloured red. With these types of fuzes the letter "V," followed by numerals enclosed in brackets, is printed after the fuze number on package labels. The letter indicates delay, and the figures the period of delay.

The presence of a delay unit in the igniferous older type of base fuzes is not indicated by marking, but some of the oldest which are neither numbered nor designated by calibre, are stamped with the letters "m.V." on the underside. This marking indicates "with delay," *i.e.*, a delay fitment not of the optional setting type.

Gaines

Gaines are designated in a numbered series, sometimes with a letter and an oblique stroke immediately in front of the number, *e.g.* :—

Black marking	Indication
Zldg A	Gainé A.
Zldg B	Gainé B.
Zldg C/98	Gainé C/98.
Gr. Zldg C/98	Large gainé C/98.
Zldg C/98 Np	Gainé C/98 filled P.E.T.N./Wax.

Exploders

Where paper wrappers are used, the marking "Zldg" is also used as the designation for exploders and for the bursting charge similar to a long exploder which is used in smoke shell.

The Cyclonite/Wax used in exploders is coloured blue or bluish-green. The P.E.T.N./Wax used in exploders is coloured pink.

Smoke Boxes

The designation "Rauchenwickler" is marked on the side of smoke boxes for H.E. shell.

Projectile Nomenclature

The name "granate," abbreviated to "Gr" or "gr," is used for all types of projectiles (shot or shell), mortar bombs and rifle or hand grenades. The letter "W" precedes the abbreviation ("Wgr.") in the designation of mortar bombs, and "I" ("Igr.") for infantry gun shells.

With gun or howitzer projectiles the nature of the projectile is indicated by a prefix to the word "granate" or to the abbreviation "gr.," and with all types of projectiles, etc., the model number is normally included in the designation as a suffix. The model number is an important part of the designation in the case of piercing projectiles, as without this it is impossible, without examination, to differentiate between shot and shell or between capped and uncapped piercing shell. The model numbers are not common to the various calibres for other natures.

The following are typical designations from package labels, bursting charge containers, etc. :—

Designation	Indication
Gr, (Mod. No.), Be	Anti-concrete shell.
Gr, (Mod. No.), (Hl)	Hollow charge shell.
Nbgr	Smoke shell.
Pzgr	Armour-piercing shell.
Pzgr 39	A.P.C.B.C. shell.
Pzgr 40	A.P. shot with tungsten carbide core.
Pzgr 41	A.P. shot with T.C. core for tapered bore guns.
Sprgr.	H.E. shell.

The word "rot" included in the designation indicates the presence of a tracer in the shell.

Projectile Markings

(a) The basic colours—

- (i) Piercing shot and shell are painted black. In some instances only the head or cap is painted.
- (ii) H.E. shell (excepting naval and anti-aircraft types), smoke shell, anti-concrete shell and hollow charge shell are painted a deep olive green. This is a darker shade than the British service green.
- (iii) Naval and anti-aircraft H.E. shell are painted yellow.
- (iv) 3.7 cm. shell with a two-compartment cavity, one filled H.E. and the other filled tracing composition, are painted aluminium colour with a yellow band midway between the driving band and fuze-hole.
- (v) Projectiles of the later types are sometimes painted white. This colour appears to be used for projectiles in the experimental stage supplied for trial by the Army in the field.
- (vi) H.E. and smoke mortar bombs are painted dull red.

(b) Bands

Band markings are not in common use except for a red band above the driving band which is found on some shell fitted with tracers, and the yellow band on the 3.7 cm. aluminium coloured, H.E./tracer shell.

(c) Stencilling (FIG. 13)

The following details of stencilling on projectiles are arranged in the sequence in which the markings are normally found, commencing at the head or ballistic cap of the projectile :—

- (i) The stencilling "Z.f. Hbgr" in black on the ballistic cap of an H.E. B.C. shell indicates the use of a nose fuze under the ballistic cap.
- (ii) The stencilling "R" followed by a number or, alternatively, the stencilling "MR" in black near the tip of the shell, indicates the presence of a smoke box.
- (iii) The nature of filling of H.E. and hollow charge shell, other than naval types, is indicated by Arabic numerals stencilled in black on the head of the shell just below the fuze hole. The following markings are used :—

Stencilling	Indication
1	T.N.T. in cardboard carton packed with magnesium putty.
1A	T.N.T. in cardboard carton packed with paper.
2	Picric acid in cardboard carton packed with magnesium putty or wax.
5	T.N.T./Wax 95/5 in paper or cardboard carton.
10	T.N.T./Wax 90/10 in paper or cardboard carton.
13	Amatol 40/60, cast.
14	T.N.T., cast.
32	P.E.T.N./Wax 90/10.
36/38	P.E.T.N./Wax 60/40 or 65/35.
91	Cyclonite/Wax 95/5.
95	Cyclonite /T.N.T./

- (iv) The place and date of the filling of the projectile, followed by a work-mark, are indicated by stencilling in black at the shoulder of the projectile. The place is given in the form of an abbreviation somewhat similar to the British "Station monogram," e.g., "Lu 2.12.30 Kl."
- (v) Roman numerals stencilled in black near the shoulder of the projectile indicate the classification of the projectile for weight.

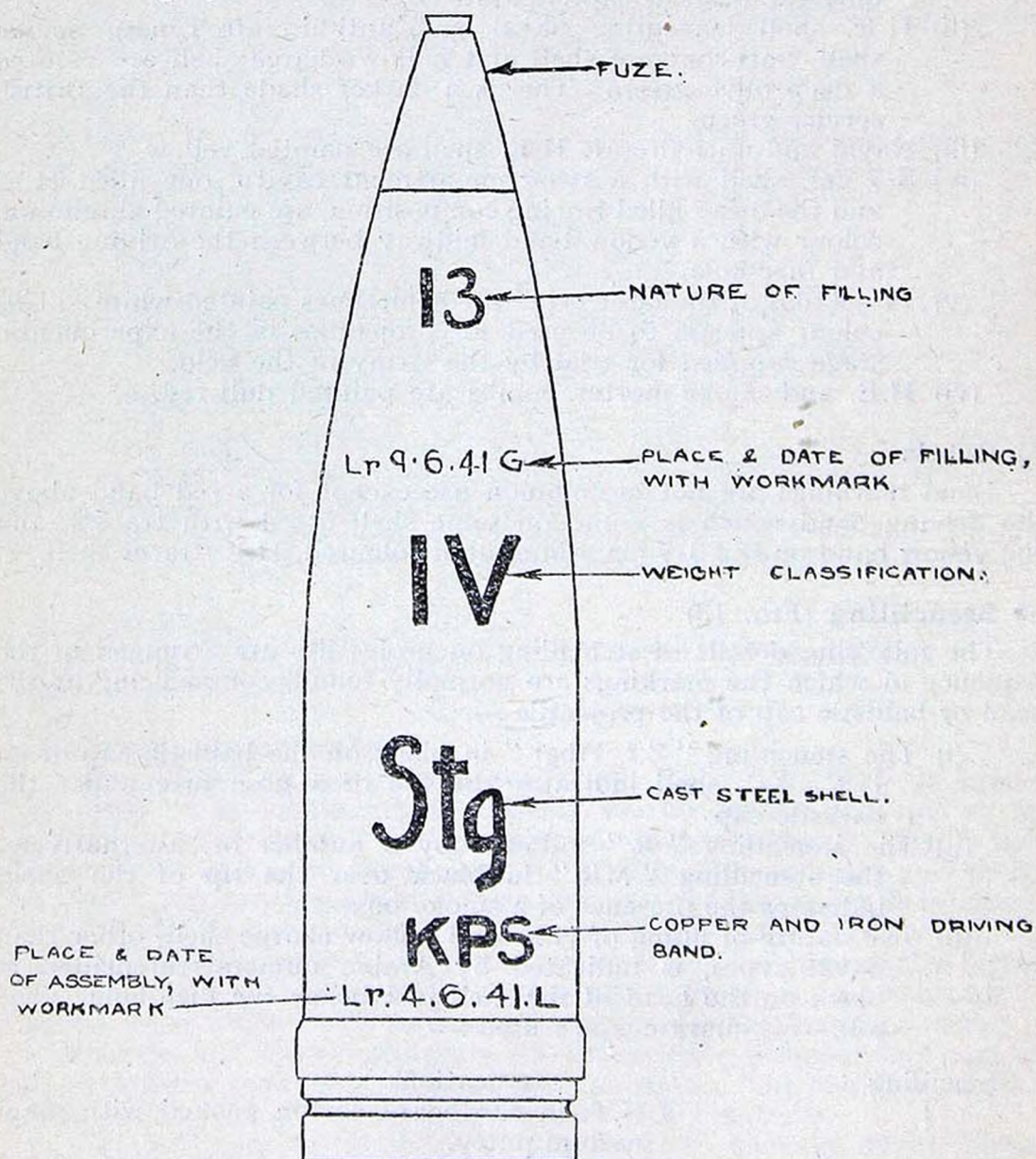


FIG. 13.—GERMAN SHELL MARKINGS
TYPICAL STENCILINGS

The system appears to be similar to the "unit system" used for separate loading shell for field equipments in the British service. Projectiles marked "III" are apparently within the "dead weight limits," "II" and "I" indicate lighter and "IV" and "V" heavier projectiles. The stencilling is in 1.2-inch numerals for calibres up to 21 cm. and in 2-inch numerals for larger calibres.

- (vi) In the following instances the type of shell, and to some extent the nature of filling, is indicated by 2.4-inch letters stencilled at two positions round the shell midway between the driving band and shoulder :—

Stencilling	Indication
A or LS (white)	Base ejection shell with flash-producing charge.
Al (black) ..	Filling includes aluminium powder to produce flash.
Bl (white) ..	Inert filling.
Ex (red) ..	Drill projectile.
Nb (white) ..	Smoke shell.
Üb (white) ..	Practice projectile, filled gunpowder.
Üb.B (white) ..	Practice projectile, filled T.N.T.
Vp (black) ..	Dummy projectile.

Light case shell of pressed steel with a corresponding large bursting charge capacity are stencilled "Bo" in 1-inch lettering midway between the driving band and shoulder.

Cast steel shell are stencilled "Stg" in black 2.4-inch lettering at a short distance above the driving band.

- (vii) The letters "KPS" stencilled in white or red above the driving band indicate a driving band of the bi-metal type, iron covered with copper. The place and date of assembly, followed by a work-mark, are stencilled in .4-inch black or red lettering above the driving band, *e.g.*, "Lr 4.6 40 L."

(d) Stampings.

Fig. 14 gives the normal positions and significance of stampings on projectiles.

MARKINGS OF FIXED, Q.F., CARTRIDGE CASES AND CHARGES

The abbreviation "Patr" for "Patrone" is included in the designation of the complete round stencilled on packages or printed on package labels to indicate fixed Q.F. ammunition. The following are typical examples :—

"7.5 cm. Pzgr. Patr. Kwk. Bd. Z. f. 7.5 cm. Pzgr."
i.e., 7.5 cm., anti-tank gun, A.P.C. cartridge with the appropriate base fuze.

"7.5 cm. Nbgr. Patr. Kwk. m. Kl. A.Z. 23 Nb"
i.e., 7.5 cm., anti-tank gun, smoke cartridge with the small size of percussion fuze No. 23 for smoke shell.

In the designation of H.E. rounds the letters "Gr" without the prefix "Spr" are often used.

The markings on cases forming part of fixed rounds comprise stencillings round the side and base of the case and stampings in the base.

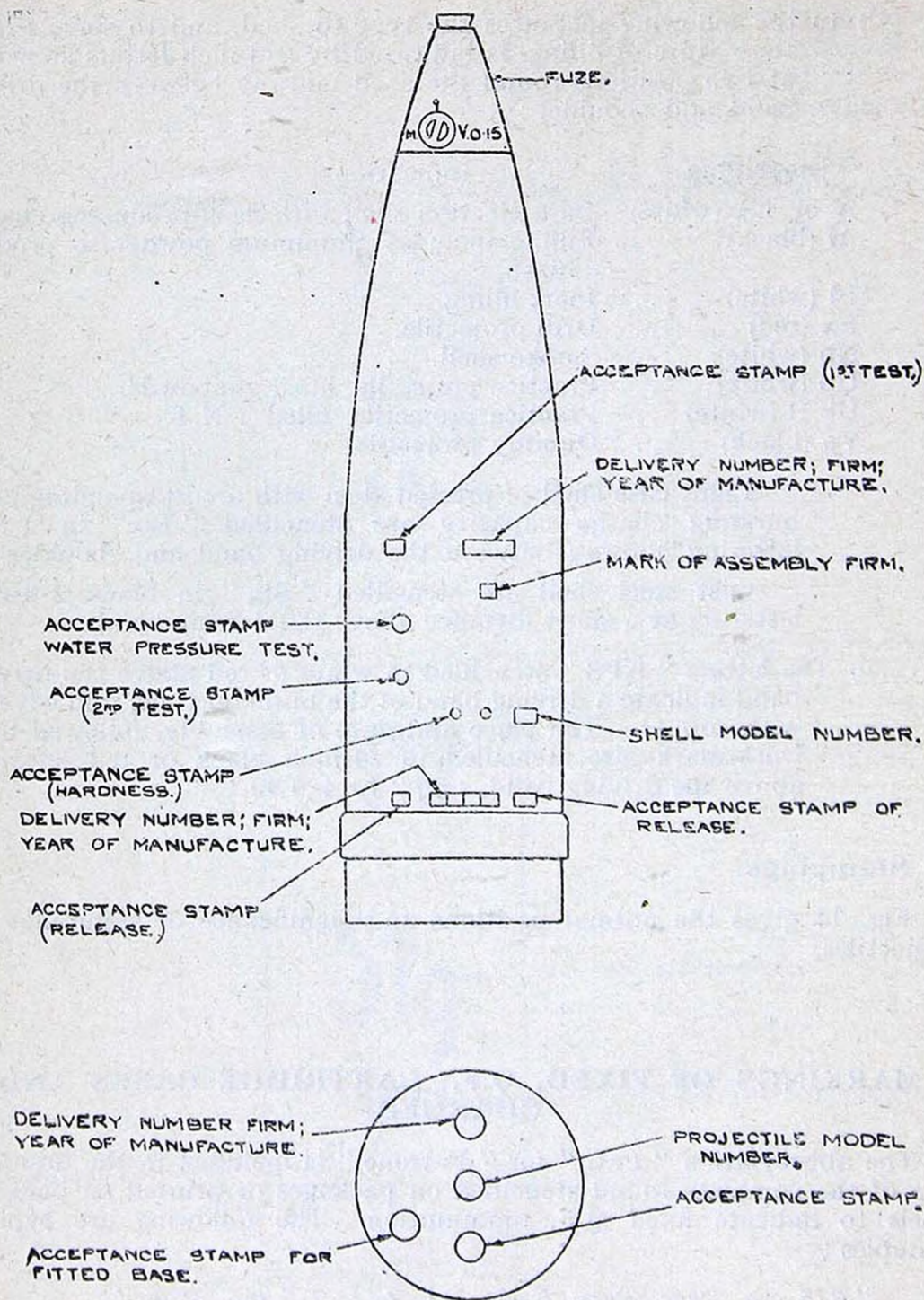


FIG. 14.—GERMAN SHELL STAMPINGS

(a) Stencilling on Side of Case (FIG. 15)

Stencilling on the side of cases is in black except the stencilling relating to propellant charges for use in hot climates, which is in red.

The following details are arranged in the sequence in which the markings are normally found between the approximate centre of the case and the flange at the base :—

- (i) The calibre, types and model numbers of the equipments for which the round is suitable are stencilled in the form "7.5 cm. Kwk 40" (*i.e.*, 7.5 cm. tank gun, model 40). Where a round is suitable for more than one equipment the designations of the equipments are stencilled in sequence with the letter "u", signifying "and", as a conjunction.

The following abbreviations, used to indicate types of fixed, Q.F., equipment, have been met with:—

Stencilling	Indication
F.K.	Field gun.
Flak	Anti-aircraft gun (may be dual-purpose gun).
Kwk	Tank gun.
Pak	Anti-tank gun.
S.K.	Naval gun.
Stu.K. or	Assault gun.
Stu.G.(calibre)K	Do.

The following markings are examples of those added to the designation, normally after the model number, to indicate equipments of foreign origin:—

- (t) Czech. (p) Polish. (r) Russian. (f) French. (ö) Austrian.
- (ii) The weight of the propellant charge in grammes is stencilled in the form of numerals, followed by the letter "g" below the details of the equipment, *e.g.*, "164g."
- (iii) The nature, shape and size of the propellant are stencilled below the marking indicating the charge weight.

The following markings are used to indicate the nature of propellant:—

Stencilling	Indication
Digl.	Double base propellant of diethylene glycol-dinitrate and nitrocellulose.
Gu.	Double base propellant with the addition of nitroguanidine.
Ngl.	Double base propellant of nitroglycerine and nitrocellulose.
Nz.	Nitrocellulose powder.

These letters, in the case of double base propellants, are followed by figures or letters which also appear to relate to the composition. The shape of propellant is indicated by the following letters added to those used to indicate the nature:—

Bl.P.	Flake.
Rg.P.	Perforated disc (<i>i.e.</i> , resembling a washer).
R.P.	Tubular.
Str.P.	Strip.

The size of the propellant is given by a statement of the dimensions in millimetres following the letters used to indicate the shape. The dimension figures are enclosed in a bracket and are arranged as follows with commas serving as decimal points:—

Flake	(length · breadth · thickness), <i>e.g.</i> (3.3.0,8).
Perforated disc. . .	(thickness, external diameter/internal diameter), <i>e.g.</i> (1,9 × 15/4).
Tubular.	(length with minus tolerance, external diameter/internal diameter), <i>e.g.</i> (175-2, 2/0,85). An "X" is sometimes used instead of the "—" between the length and the tolerance.
Strip	(Length-breadth-thickness), <i>e.g.</i> (125 × 5 × 0,5)

The following are typical examples of the complete markings used to indicate the nature, shape and size :—

“ Digl. R.P. 8,2 (175-2, 2/0,85).”

“ Gu.B.I.P. A.O. (4, 4, 0,6).”

“ Ngl. Bl.P. 12,5 (40 × 40 × 0,2).”

“ Nz R.P. (135-5, 5/2).”

“ Digl. Str.P.-9·2-(125×5×0,5).”

MARKINGS ON SIDE OF CASE

MARKINGS ON BASE OF CASE AND PRIMER

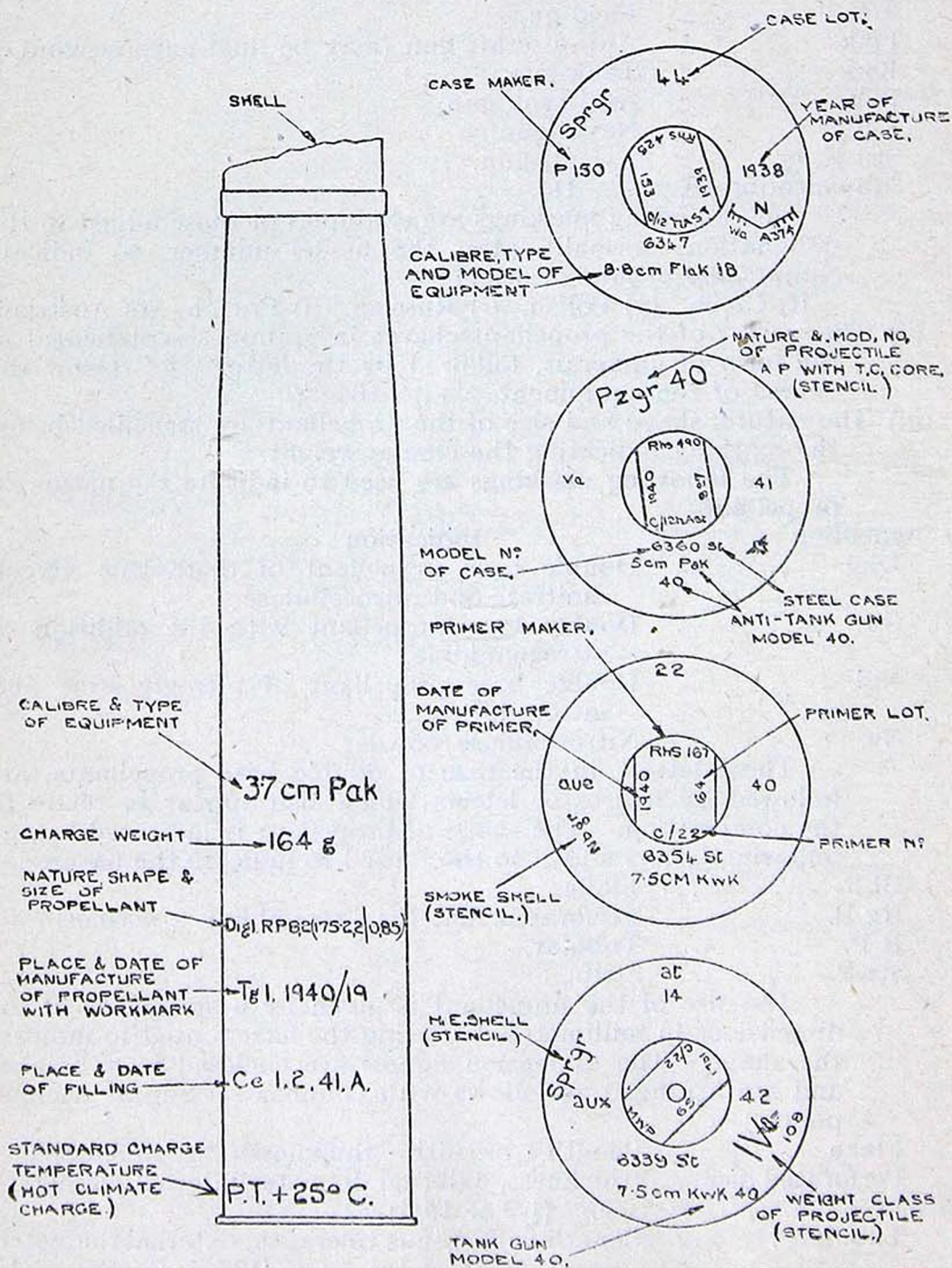


FIG. 15.—GERMAN FIXED Q.F. CARTRIDGES
TYPICAL MARKINGS

- (iv) The place and year of manufacture of the propellant, followed by a work-mark, are stencilled below the marking relating to nature, shape and size. The following is a typical example :—
 “ dbg 1942/3.”
- (v) The place and date of the filling of the propellant charge, followed by a work-mark, are stencilled below the marking relating to the manufacture of the propellant, *e.g.*, “ On 17.6.42 x v.”
- (vi) The red stencilling used to indicate propellant charges of a reduced weight for hot climates may be found near the base of the case, just above the flange, or higher up the side of the case, above the other stencilling. The marking used, “ P.T. + 25° C.,” indicates that the normal or standard charge temperature on which the weight of the charge is based is 25° C. (*i.e.*, 77° F.). The German standard charge temperature for normal European temperatures is 10° C. (*i.e.*, 50° F.).
- (vii) In some instances cases are stencilled “ Abgebr Ldg ” in red. This marking is found near the base (corresponding to the position of the “ P.T. + 25° C.” marking) and refers to the propellant charge. The marking probably indicates propellant charges of low stability which are to be given priority in expenditure.

(b) Stencilling on the Base of Fixed Q.F. Cases (FIG 15)

The positions of the following markings are as viewed with the case turned so that the stamped letters and numbers on the base are upright.

Distinctive markings in script lettering which indicate the nature, and in some instances the model number, of the projectile are stencilled in white or black-paint to the left above the primer hole. The markings used indicate the type of shell, and are the same as those given above under “ Projectile Nomenclature.”

In some instances the Roman numerals indicating the weight classification of the projectile are stencilled in white to the right below the primer hole.

(c) Stampings on the Base of Fixed Q.F. Cases

Fig. 15 gives the normal positions and significance of base stampings. The model number, below the primer hole, is followed by the letters “ St ” when the case is of steel.

The abbreviations following the calibre of the equipment, stamped below the model number of the case, are the same as those given in the details of stencilling on the side of the case.

(d) Markings on Cartridge Bags in Fixed Q.F. Rounds

The markings on the bags are the same as those stencilled on the side of the case except that the calibre, type and model number of the equipment are not included.

A typical example is given in Fig. 16.

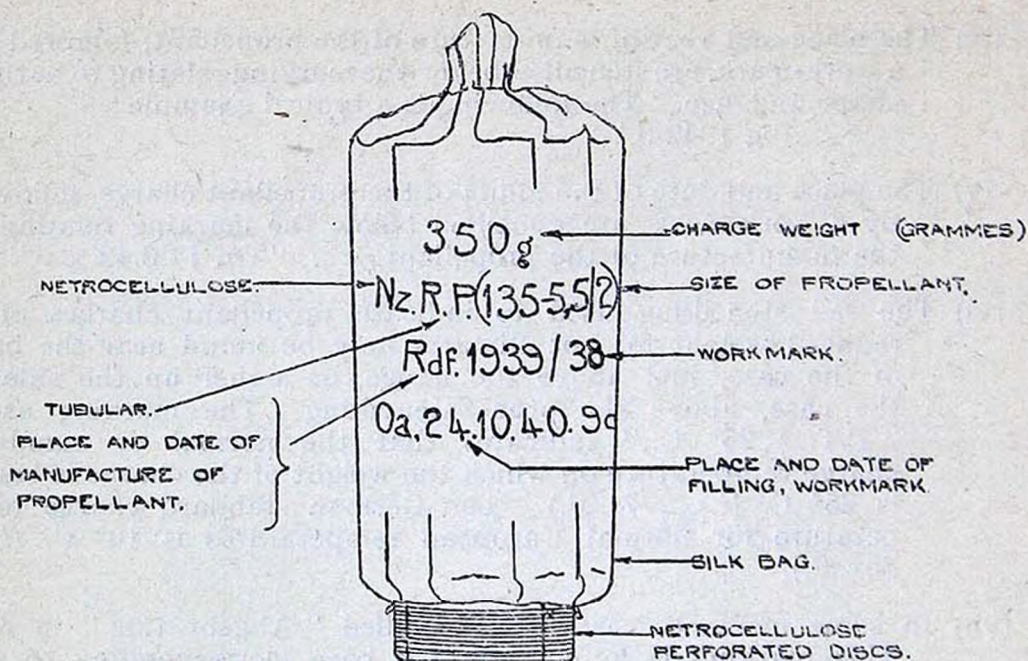


FIG. 16.—GERMAN Q.F. CHARGE FOR FIXED CARTRIDGE
TYPICAL MARKINGS

Markings of Separate Loading Q.F. Cartridges (FIGS. 17 AND 18)

Where a cardboard or leatherboard cup is used to close the mouth of the case, labels on the cup give details corresponding to those stencilled on the side of cases forming part of a fixed Q.F. round. The label giving details of the equipment, charge weight, nature, shape and size of propellant, place and date of manufacture of propellant and place and date of filling is printed in black. The label indicating propellant charges for hot climates with a charge weight based on a normal charge temperature of 25° C. is printed in red.

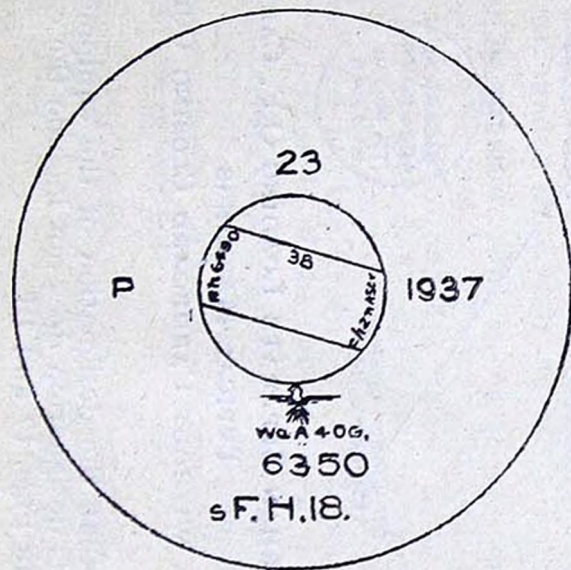
Cases with steel covers for packing and transport, which are removed before loading, have neither labels nor stencilling relating to the propellant charge excepting the stencilling "P.T. + 25° C." in red on the base where applicable. Details of the propellant are available, however, from the stencilling on the charge bags.

The stampings on the base of the case are the same as those on the base of a fixed Q.F. round except that the calibre of the equipment is sometimes omitted.

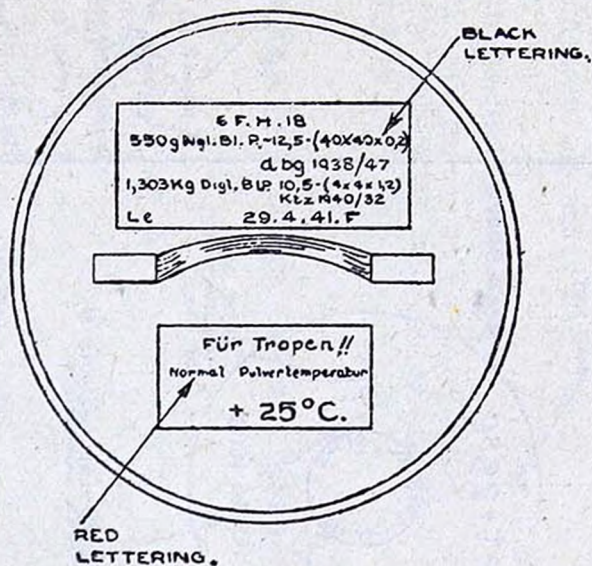
The following additional abbreviations used in the stamped designation of the equipments have been met with :—

Stamping	Indication
Geb. H (Model No.)..	Mountain howitzer.
Geb. K (Model No.)..	Mountain gun.
l.F.H.	Light field howitzer (British equivalent, gun howitzer).
s.F.H.	Heavy field howitzer (British equivalent, medium howitzer).
l.I.G.	Light infantry howitzer.
s.I.G.	Heavy infantry howitzer.
s. (Calibre) K ..	Heavy gun (British equivalent, medium gun).
L.G.	Light gun, recoilless.
K (model No.) (E) ..	Railway gun.

BASE OF CASE,



CARDBOARD CLOSING CUP.



CHARGE SECTION.

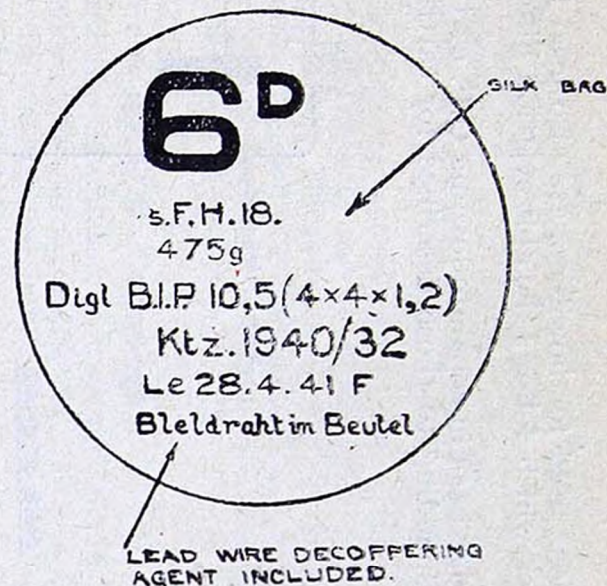


FIG. 17.—GERMAN SEPARATE LOADING Q.F. CARTRIDGE
TYPICAL MARKINGS ON CTGE WITH CARDBOARD CLOSING CUP

The abbreviations used for howitzers are also used for gun-howitzers. The model number which follows the abbreviation differentiates between these types.

The silk cartridge bags in separate loading Q.F. cartridges are marked with details corresponding to those described for cartridge bags in fixed

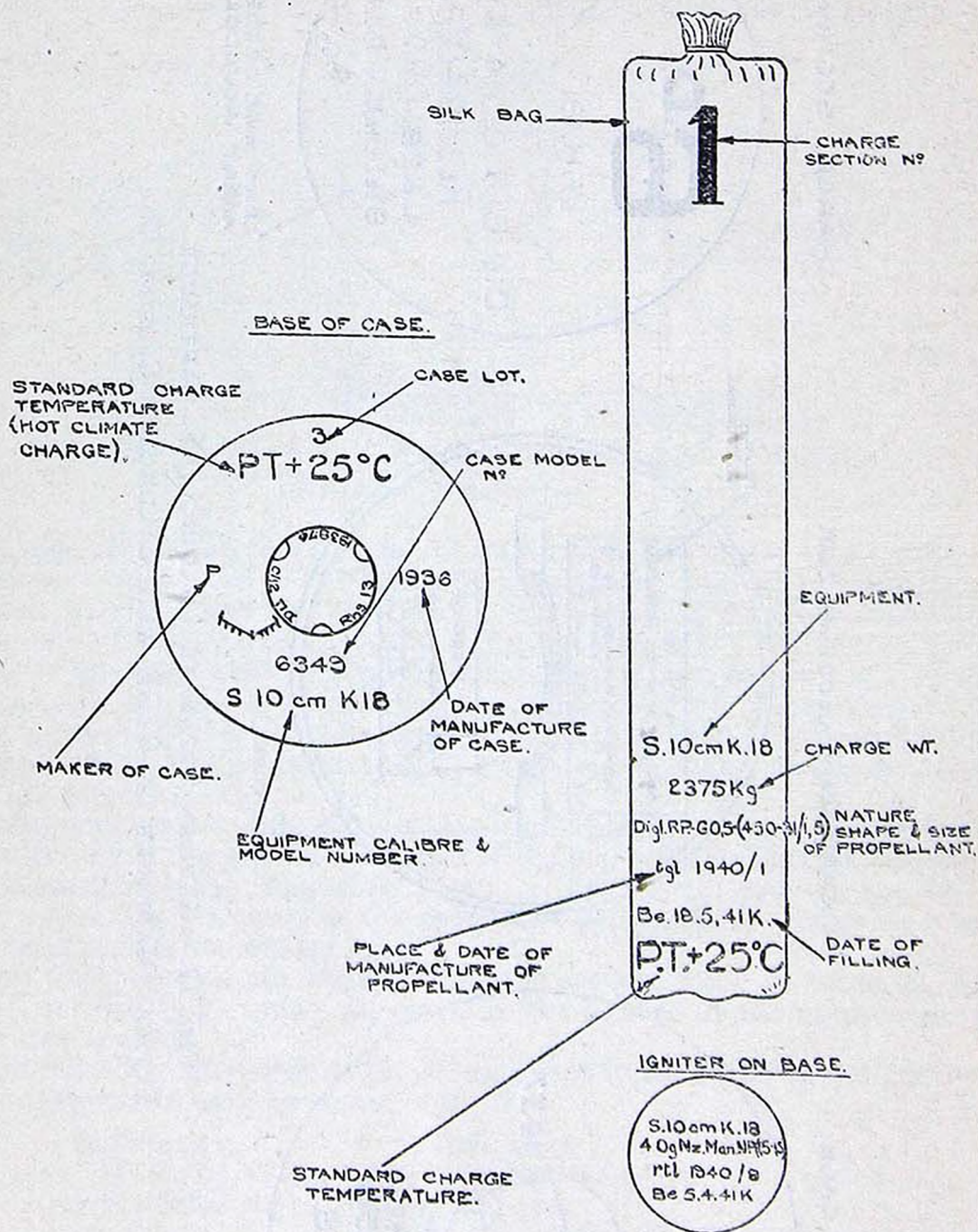


FIG. 18.—GERMAN SEPARATE LOADING Q.F. CARTRIDGE
TYPICAL MARKINGS
(CTGE. WITHOUT CARDBOARD CLOSING CUP)

Q.F. rounds except that the designation of the equipment is included. In most instances this designation does not include the calibre. Typical markings are shown in Figs. 17 and 18.

When lead wire is included in the bag as a decoppering agent, the bag is marked "Bleidraht im Beutel".

The number indicating the charge is marked prominently in black on the sections of howitzer and gun-howitzer cartridges. The letter "D" often follows this number and in some instances the marking is encircled by a red ring.

With certain equipments additional charge sections, to be used for long ranges in place of those in the cartridge case, are supplied in cylindrical cardboard packages. These sections are numbered in continuation of those supplied for use at normal ranges in the case. Cardboard packages containing these additional charge sections are marked "Sonderkart" followed by the numeral of the section.

Marking of Primers for Q.F. Cartridges

Primers are normally designated in a numbered series with the letter "C" and an oblique stroke immediately in front of the number. The "nA" and "St" (indicating new pattern and steel) are included in the designation of those in common use.

Typical stampings are shown in Fig. 15.

Marking of Flash Reducing Charges.

The flat circular silk bag is stencilled in black "Kart. Vorl." followed by the abbreviation indicating the equipment with which used and the weight of the charge in grammes.

JAPANESE, H.E., HAND GRENADE

(FIG. 19)

The cylindrical body of the grenade tapers near the base and head, is grooved for fragmentation and contains a 2-oz. bursting charge of T.N.T. The striker, forming part of the igniter set, protrudes from the head of the body and is covered by a brass cap secured by a safety pin. The igniter set is of the time type with a delay of approximately 4.5 seconds and is initiated by a blow immediately before throwing. The grenade is 3.78 inches in length, has a maximum diameter of 1.97 inches and has a filled weight of approximately 1 lb. The grenade is marked at the head with a red disc surrounded by a black circle.

The body is of cast iron with a cup-shaped interior and is screw-threaded internally at the mouth to receive the closing plug. The bursting charge has a central cavity throughout its length to receive the detonator and igniter set and is topped by a washer before the insertion of the closing plug. The central cavity is provided with a liner which contains a wad at its base end for the detonator, while its front end fits into a central hole in the underside of the closing plug.

The detonator consists of a cylindrical shell which is solid at the base, lightly closed at the head, and contains an initiating composition of which details are not yet available. A perforated steel disc is positioned between the detonator and the igniter set.

From the incomplete information and the sketches at present available, the igniter set consists of a brass body fitted with the striker, a percussion cap and a delay filling, and a container with a perforated filling which is fitted below the body.

The brass body is screwthreaded for insertion in the closing plug and is cannellured near the top to receive a similar cannellure formed in the safety cap. Above the cannellure two holes are formed for the insertion of the safety pin. A recess is formed in the head of the body to receive the striker assembly, which consists of a protruding pellet fitted with a screwed needle and supported by a helical spring and the safety pin. At the base of the recess a percussion cap is fitted over a channel filled with a delay composition which extends through the body and is provided with radial channel just below the cap for the escape of pressure.

The brass safety cap is split and cannellured for assembly and functioning and is perforated to coincide with the body for the insertion of the safety pin.

JAPANESE H. E. HAND GRENADE.
THESE CHARACTERS INSCRIBED ON TUBE:-
 CH © 東京 3 大 + 1915
 (CH © TOKYO 大 MARCH 1915)

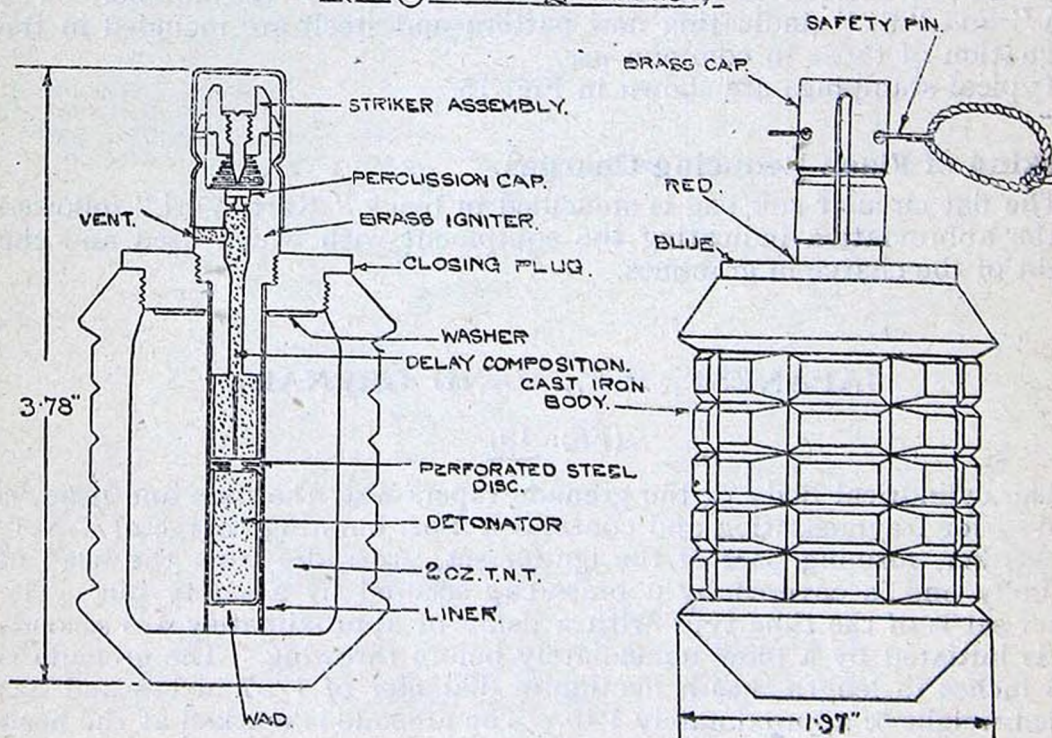


FIG. 19

The container below the body serves as a priming to amplify the ignition from the delay filling to bring about the initiation of the detonator. Details of the filling are not available.

Action

After removing the safety pin the safety cap is given a sharp blow on the head before throwing the grenade. The blow forces the cap down over the igniter body and drives the needle into the percussion cap. The flash produced by the cap filling ignites the delay filling, which ignites the composition in the radial vent, and with the pressure set up by the combustion escaping through the vent, the delay composition burns steadily through to the priming composition. The ignition of the priming composition brings about the initiation of the detonator, which in turn detonates the bursting charge.

JAPANESE 50 MM., H.E., MORTAR AND HAND GRENADE

(FIG. 20)

The grenade may be used with the 50 mm. grenade thrower, and differs from the hand grenade shown in Fig. 19 in having a slightly heavier body—1 lb. 2½ oz. compared with 1 lb.—and in being fitted with a propellant container which also carries the means of ignition.

The container consists of a mild steel cylinder 1.22 inches long and 1.02 inches in diameter which is screwed into a recess in the base of the

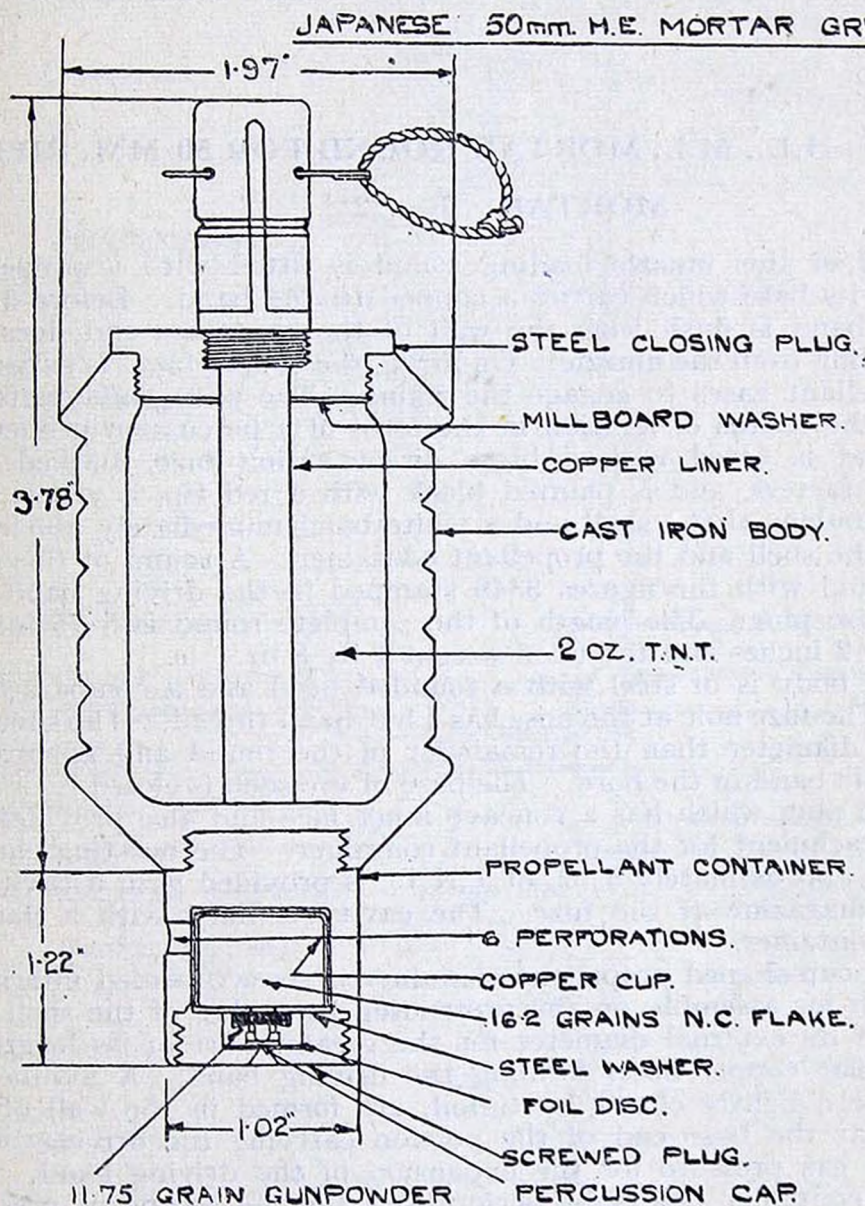


FIG. 20

grenade and has six radial perforations for the escape of pressure. The container is closed at the base by a steel plug fitted with a percussion cap.

The filling of the container consists of an 11.75 grain igniter of gunpowder and a propellant charge of nitrocellulose flake. The rectangular flakes are a light yellow-green in colour with graphite distributed

irregularly over the surface. The propellant contains over 95 per cent. of nitrocellulose (nitrogen content 13 per cent.) and is stabilized with diphenylamine.

The cap composition consists of mercury fulminate 32 per cent., potassium chlorate 36 per cent. and antimony sulphide 32 per cent.

Action

With the safety pin removed before firing, the needle pellet is supported only by the helical spring. On acceleration the pellet sets back and the needle pierces the detonator. The subsequent action is the same as that of the hand grenade.

JAPANESE, H.E., M.L. MORTAR ROUND FOR 50 MM. RIFLED

MORTAR (FIG. 21)

The shell of this muzzle loading round is fitted with a propellant container at its base which carries a copper driving band. Before firing, the driving band is flush with the wall of the container and does not obstruct loading from the muzzle. On firing, the copper band is expanded by the propellant gases to engage the rifling. The propellant container also carries the means of ignition in the form of a percussion primer.

The round is fitted with a brass direct action fuze, marked with Japanese characters, and is painted black with a red tip, a yellow ring below the shoulder of the shell and a white band immediately above the junction of the shell and the propellant container. A round of this type has been found with the figures 3349 stamped in the driving band and inside the base plug. The length of the complete round is 5.75 inches, the diameter 2 inches and the filled weight 1 lb. 8 oz.

The shell body is of steel with a rounded head and a comparatively thin wall. The fuze hole at the nose has a left-hand thread. The shoulder is of higher diameter than the remainder of the round and apparently acts as a guide band in the bore. The base of the shell is closed by a steel screwed base plug which has a concave inner face and also provides the means of attachment for the propellant container. The bursting charge, consisting of approximately 5 oz. of T.N.T., is provided with a cavity to receive the magazine of the fuze. The cavity is lined with a flanged aluminium container.

The steel cup-shaped propellant container is screwthreaded internally at the mouth for assembly on the protruding base plug of the shell and is reduced in its external diameter for the greater part of its length to receive the flat copper hoop forming the driving band. A number of radial channels, lightly closed by tinfoil, are formed in the wall of the container near the base end of the portion carrying the driving band. These admit gas pressure for the expansion of the driving band. The base of the container has eight perforations for the escape of pressure arranged in ring and central perforation for the striker leading to a recess in the inner face which contains the primer. The perforations are lightly closed by a paper disc adhering to the base of the container. A copper container with a cover is carried inside the container to receive the ring-shaped shellacked paper bag holding the propellant.

The propellant charge consists of approximately 46 grains of finely graphited nitrocellulose flake. The approximate dimensions of the rectangular flakes are $.028 \times 0.024$ inch. The thickness varies from

003 inch downwards. The nitrocellulose, which forms 95.7 per cent. of the propellant, has a nitrogen content of 13 per cent.

The cylindrical brass body of the primer has a cap chamber with anvil

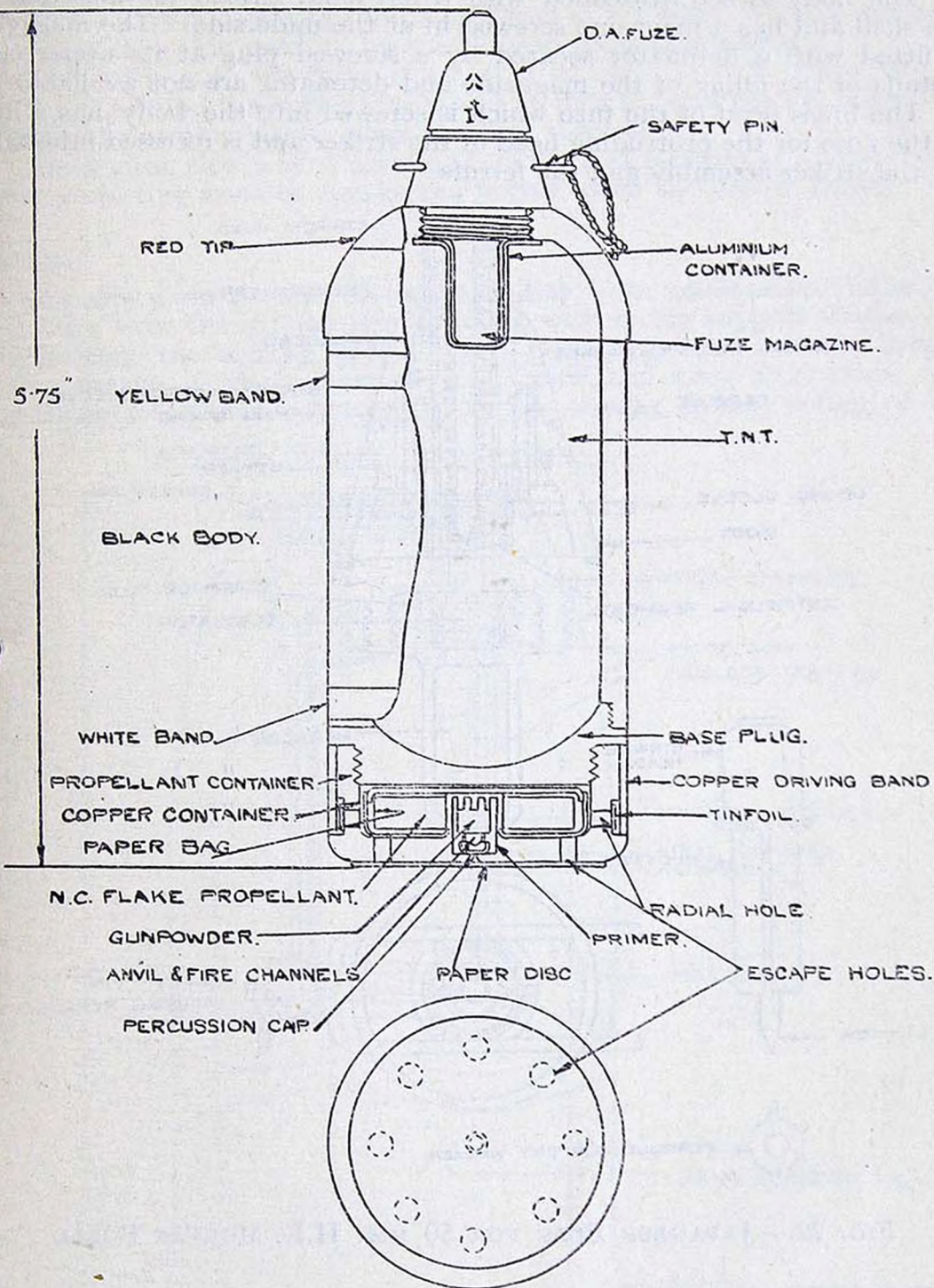


FIG. 21.—JAPANESE 50 MM. M.L. RIFLED MORTAR H.E. ROUND

and two fire channels formed in its base and a magazine containing gunpowder. The forward end of the body is castellated. Details of the filling of the percussion cap are not available.

Fuze (FIG. 22)

The brass fuze is of the direct-action type and is marked in Japanese characters.

The body is screwthreaded with a left-hand thread for insertion in the shell and has a magazine screwed in at the underside. The magazine is fitted with a detonator secured by a screwed plug at its upper end. Details of the filling of the magazine and detonator are not available.

The brass head of the fuze which is screwed into the body has a hole at the nose for the protruding head of the striker and is recessed internally for the striker assembly and the ferrule.

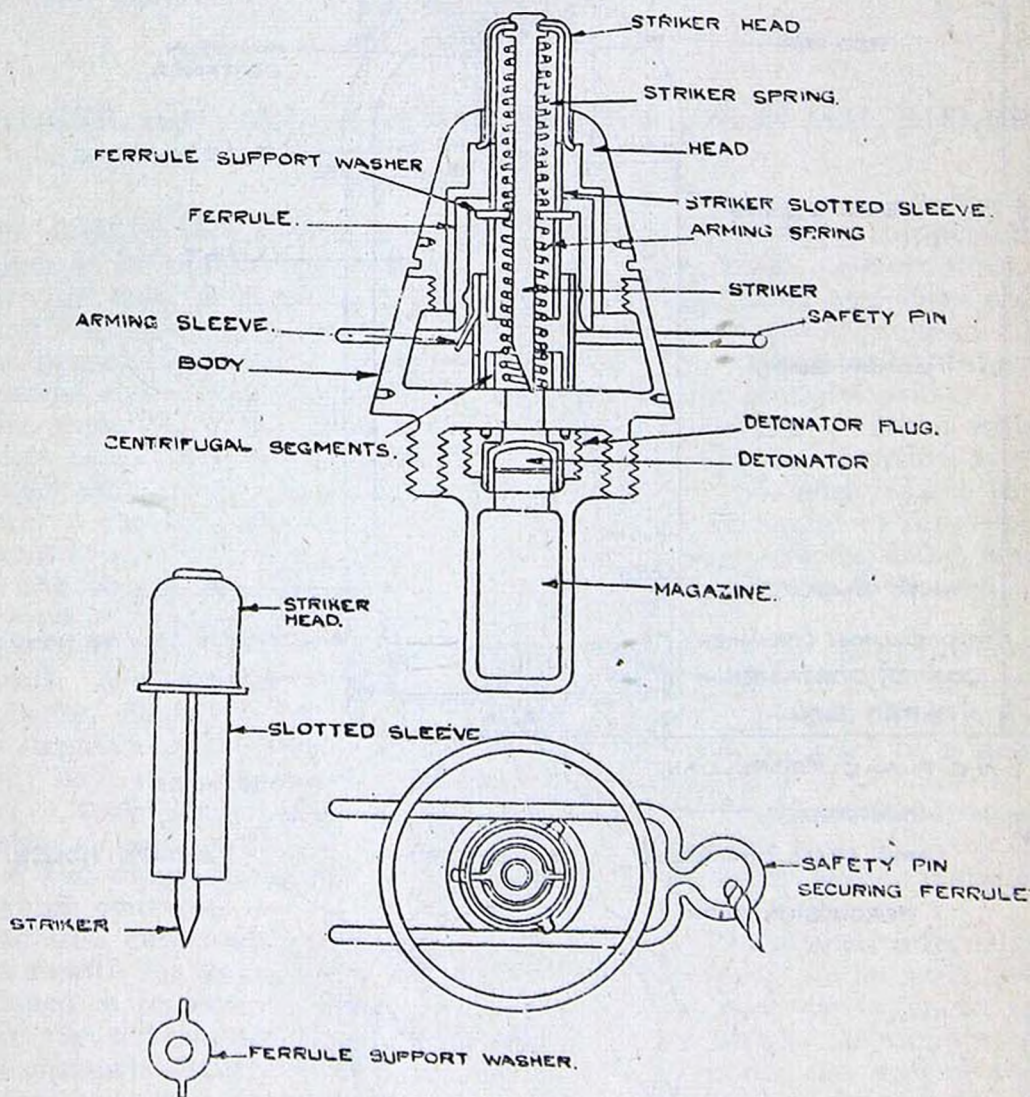


FIG. 22.—JAPANESE FUZE FOR 50 MM. H.E. MORTAR SHELL

The striker assembly consists of a steel striker with a brass cup-shaped head and sleeve attached at its outer end. The head is flanged to engage the step formed in the head of the fuze. The sleeve which extends over the greater part of the striker has two slots extending from the open end to the striker head and contains the striker spring and arming spring. The brass support washer for the ferrule separates the two springs and the two arms formed on the washer protruding through the slots in the

sleeve form a support for the ferrule. Before the loading of the round the ferrule is further supported by a two-pronged safety pin inserted through the body. Four brass segments are positioned between the inner end of the striker sleeve and the diaphragm of the body. These segments are retained in this position by the cylindrical arming sleeve.

The ferrule is in the form of an inverted cup. A hole in the base of the cup fits round the striker sleeve and an internal groove near the mouth engages the arming sleeve when the fuze is armed.

The arming sleeve is of aluminium alloy and consists of a sleeve with three projecting arms to engage the ferrule when the fuze is armed.

Action

The safety pin is removed before loading. On acceleration the ferrule sets back over the arming sleeve taking with it the support washer and compressing the arming spring. The projecting arms on the arming sleeve engage in the groove in the ferrule and thus lock these two components together. During flight the arming spring, acting on the

JAPANESE 70 mm. H.E. SHELL.

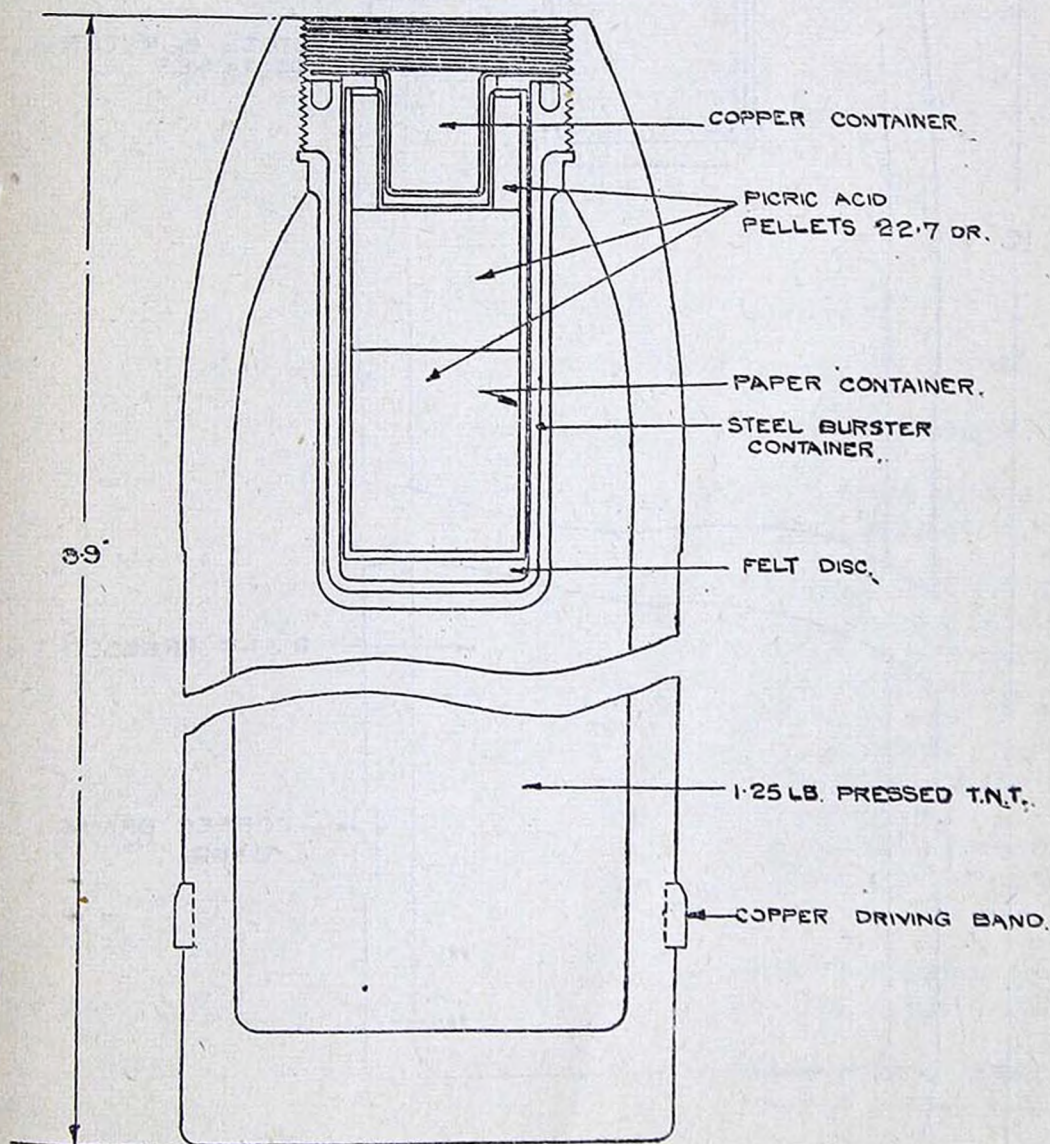


FIG. 23

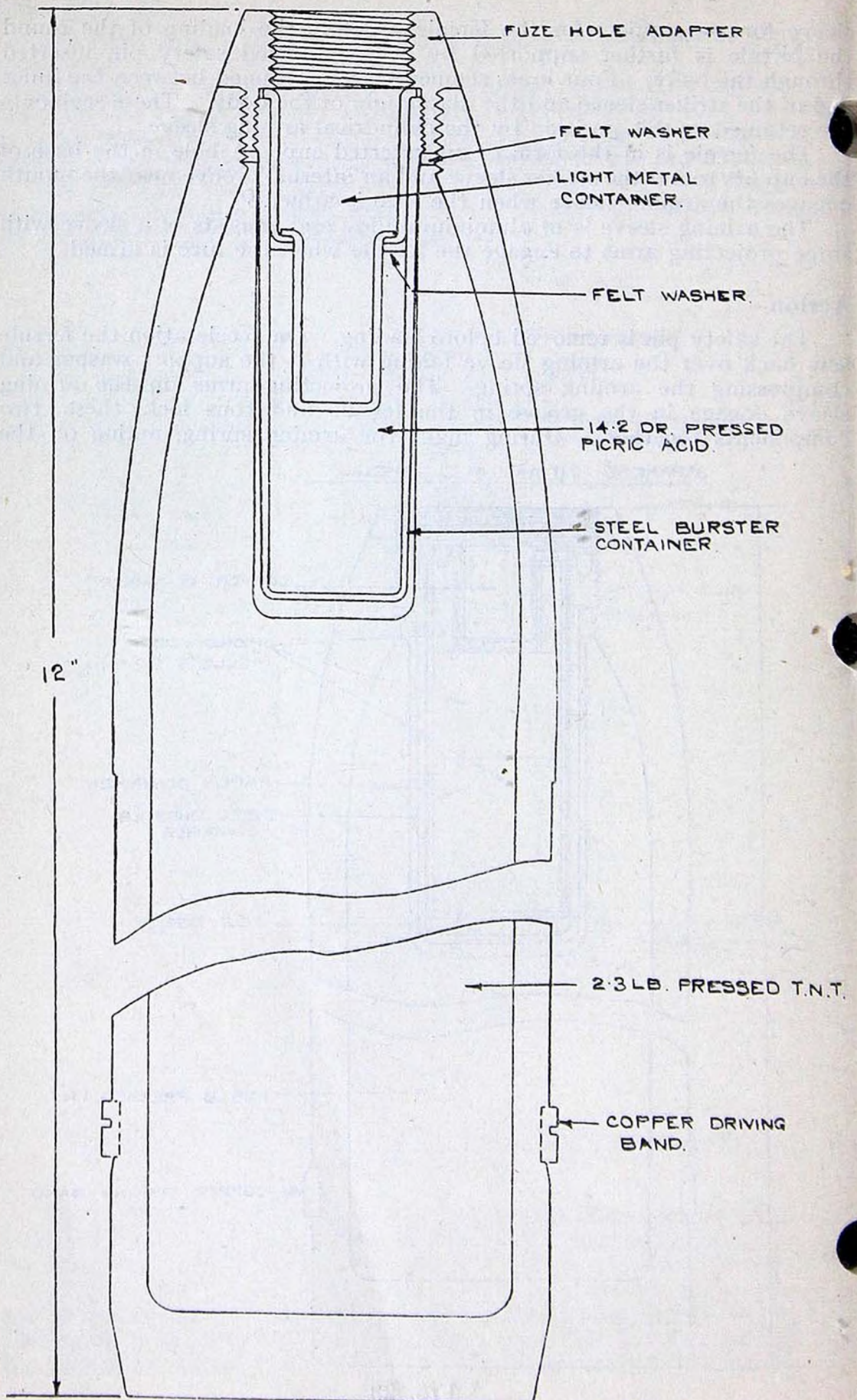


FIG. 24.—JAPANESE 75 MM. H.E. SHELL

support washer, moves the ferrule forward and, taking with it the arming sleeve, leaves the segments free to be thrown clear by centrifugal force. The striker is then held off the detonator by the springs only. On impact the striker is driven in and pierces the detonator.

JAPANESE 70 MM. H.E. SHELL

(FIG. 23)

The filled shell, without the fuze, weighs 7 lb. 15 oz. 8 drams and is 8.9 inches in length.

The shell has a comparatively thin wall and is fitted with a copper driving band. There is no base plate.

The bursting charge consists of 1.25 lb. of pressed T.N.T. which in quality corresponds approximately to "Grade 2." A cavity is formed in the charge to receive the steel burster container which is screwed into the fuze-hole.

The burster container has a felt disc at the bottom and contains an exploder consisting of a perforated picric acid pellet over two solid pellets of the same nature. These are enclosed in a paper container. The weight of the exploder is 22.7 drams.

A copper container, to receive the magazine of the fuze, is inserted above the burster container and fits into the perforated pellet at the top of the exploder.

The weight of the empty shell is 6.1 lb.

Details of markings are not available.

JAPANESE 75 MM. H.E. SHELL

Two types are shown in Fig. 24 and Fig. 25. Details of markings are not available.

The type shown in Fig. 24 without fuze is 12 inches in length and has a filled weight of 9 lb. 12 oz. 8 dr.

The shell has a comparatively thin wall and is fitted with a copper driving band. There is no base plate. A fuze-hole adapter is inserted at the nose.

The bursting charge consists of 2.3 lb. of pressed T.N.T. which in quality corresponds approximately to "Grade 2." A cavity is formed in the charge to receive the steel burster container which is screwed into the fuze-hole adapter. A felt washer is inserted on top of the filling.

The burster container has a filling of pressed picric acid in which a cavity is formed to receive the lower portion of a lightly constructed container which closes the burster container. The filling of the burster container weighs 14.2 drams and is topped by a felt washer.

The light container closing the burster container is of the two-diameter type and is apparently intended to receive the lower portion of the fuze and a gaine.

The weight of the empty shell is 7 lb.

The second type of shell shown in Fig. 25 is 11.5 inches in length without fuze, and has a head of smaller C.R.H. The weight of the filled shell without fuze is 12 lb. 14 oz. 8 dr.

The details of the method of filling are the same as those given for the 70 mm. H.E. shell except that the bursting charge is cast T.N.T. and weighs 1.9 lb.

The weight of the empty shell is 10.5 lb.

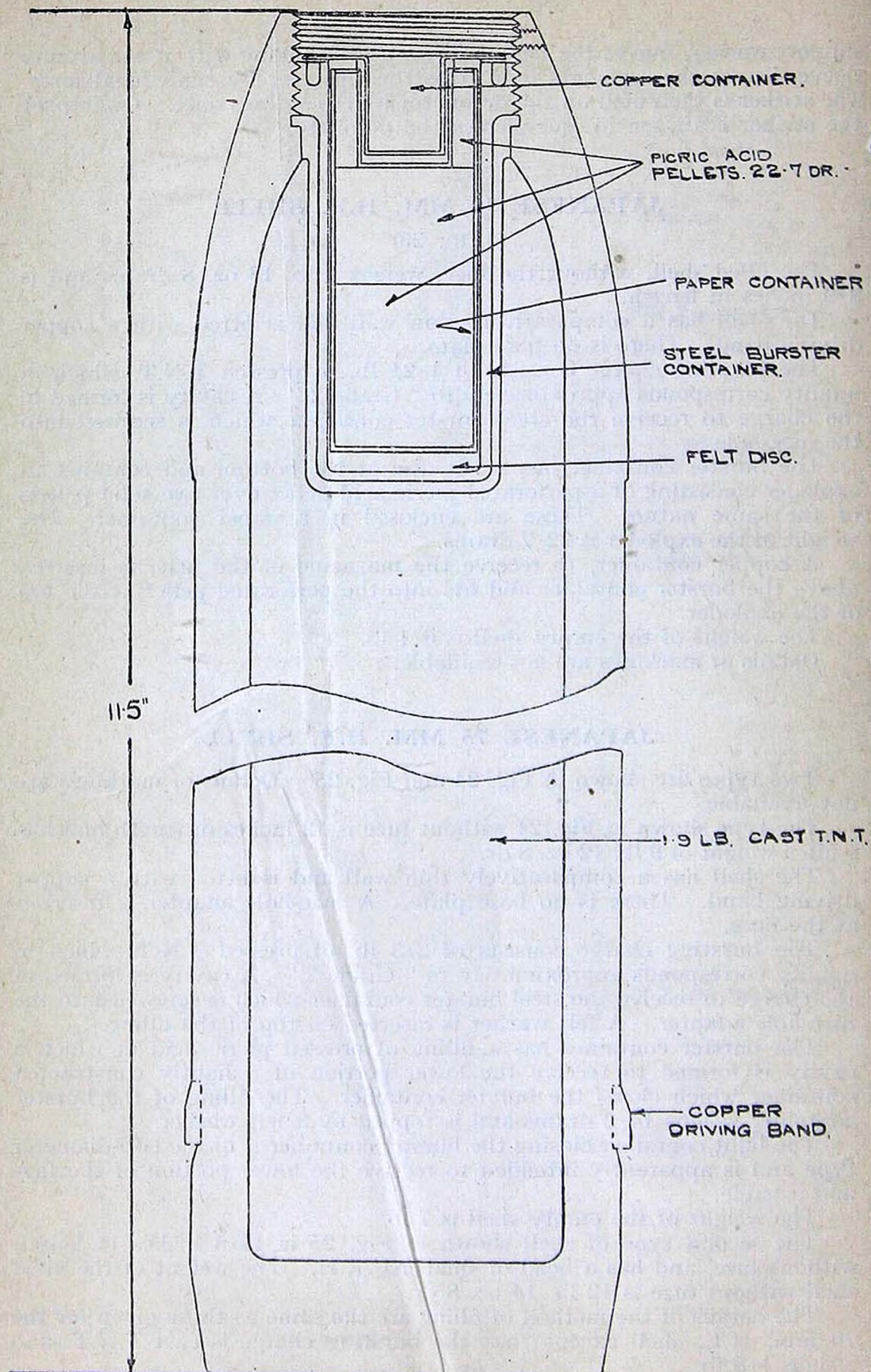


FIG. 25.—JAPANESE 75 MM. H.E. SHELL