

CONFIDENTIAL

GERMAN DEMOLITION EQUIPMENT

MAY 1944

ENGINEER SECTION

A. F. H. Q.

GERMAN EXPLOSIVES AND DEMOLITION EQUIPMENT

CONTENTS

PART I - GENERAL

<u>Para.</u>		<u>Page.</u>
1	GERMAN EXPLOSIVES AND STANDARD CHARGES	1
2	DETONATORS AND INITIATING SETS	6
3	FUZES (SAFETY AND DETONATING)	10

PART II - ACCESSORIES

4	EXPLODERS	10
5	TESTERS	14
6	ELECTRIC CABLE	14
7	IGNITERS	16
8	PORTABLE DEMOLITION KIT 1940	20
9	ADHESIVE PASTE FOR DEMOLITION CHARGES	20

PART III - SPECIAL CHARGES

10	HOLLOW CHARGES - GENERAL	22
11	50 KG. HOLLOW DEMOLITION CHARGES	22
12	13.5 KG. HOLLOW DEMOLITION CHARGE	24
13	12.5 KG. HOLLOW DEMOLITION CHARGE	24
14	3.6 KG. MAGNETIC ANTI-TANK HOLLOW CHARGE	26
15	3 KG. MAGNETIC ANTI-TANK HOLLOW CHARGE	26
16	400 CM. HOLLOW DEMOLITION CHARGE	26
17	300 CM. HOLLOW DEMOLITION CHARGE	26
18	HOLLOW RING CHARGES	28
19	BANGALORE TORPEDOES	28
20	DEMOLITION CARTRIDGES - TYPE Z	30
21	3 KG. BALL CHARGE	32
22	POLE CHARGE	32
23	GRENADE CHARGE	32

PART IV - MISCELLANEOUS EQUIPMENT

24	RAILWAY TRACK DESTROYER	34
25	GERMAN BLAST DRIVE ROD D.K.	36
26	GERMAN LONG DELAY CLOCKWORK IGNITER	38
27	CAMOUFLET EQUIPMENT	38

PART V - FRENCH DEMOLITION CHARGES

28	135 CM. CHARGE - MODEL 28	40
29	1 KG. CHARGE - MODEL 31 A	40
30	LARGE CYLINDRICAL CHARGE	40
31	SMALL CYLINDRICAL CHARGE	42
32	1 KG. CHARGE - MODEL 29	42
33	10 KG. CHARGE - MODEL 29	42
34	20 KG. CHARGE	42

APPENDIX "A"

GLOSSARY OF GERMAN TERMS	43
--------------------------	----

P L A T E S

<u>No.</u>		<u>Page.</u>
I	Standard Charges	3
II	Detonators. Pyrotechnic Igniters	5
III	Safety Fuse Initiation Set - Sprengkapselzunder	5
IV	Electric Detonator - Stuck Glühzunder 28. Electric Flash	7
V	Field Exploder - Glühzündapparat 26	9
VI	Field Exploder - Glühzündapparat 39	11
VII	Small Field Exploder - Glühzündapparat 40	11
VIII	Continuity Tester - Leitungsprüfer 26	13
IX	Test Resistance - Vorschaltwiderstand	13
X	Neon Lamp - Prüfgerät	13
XI	Igniter - ZDSCHN.ANZ 29	15
XII	Igniter - BZE 39	15
XIII	Igniter - ZDSCHN.ANZ 39	15
XIV	Igniters - BZ.24 Nb.BZ.38 BZ.39	17
XV	Portable Demolition Kit 1940 - Zündgerät 40, Tragbar	19
XVI	Use of Adhesive Paste - Kaltklebekitt	19
XVII	Hollow Charges - Hohlladung	21
XVIII	50 kg. Charge	21
XIX	} 13.5 Kg. Hollow Demolition Charge	23
XX		
XXI		
XXII		
XXIII	3.6 Kg. Charge	25
XXIV	3 Kg. Charge	25
XXV	400 Gm. Charge	25
XXVI	Bangalore Torpedo	27
XXVII	} Demolition Cartridges, Type Z - Sprengpatrone Z	29
XXVIII		
XXIX		
XXX		
XXXI	Railway Track Destroyer - shewing hook in raised position	33
XXXII	" " " - shewing chutes	33
XXXIII	" " " - shewing charge attached to rail	33
XXXIV	Clockwork Long Delay Igniter, J-Feder 504	37
XXXV	Carrying Case for Clockwork Long Delay Igniter	37

FIGURES

<u>No.</u>		<u>Page</u>
1	Electric Detonator - Stuck Glühzünder 28	7
2	Field Exploder - Glühzündapparat 37	9
3	Firing Mechanism - Zünderwerke 42	11
4	Igniter - ZDSCHN.ANZ 29	15
5	Igniter - BZE 39	15
6	Igniter - ZDSCHN.ANZ 39	15
7	Igniters - BZ.24 Nb.BZ.38 BZ.39	17
8	50 Kg. Charge	21
9	13.5 Kg. Hollow Demolition Charge	23
10	12.5 Kg. Hollow Demolition Charge	23
11	3.6 Kg. Charge	25
12	3 Kg. Charge	25
13	400 Gm. Charge	25
14	Hollow Ring Charges - Höhlringladung	27
15	Bangalore Torpedo Type A - Rohrladung 3 Kg.	27
16	Bangalore Torpedo Type B	27
17	3 Kg. Ball Charge	31
18	Grenade Charge - Geballte Ladung	31
19	German Blast Drive Rod - Dornmerkeil	35
20	Clockwork Long Delay Igniter - J-Feder 504	38
21	135 Gm. Charge Model 28	39
22	1 Kg. Charge Model 31 A	39
23	Large Cylindrical Charge	39
24	Small Cylindrical Charge	41
25	10 Kg. Charge Model 29	41

GERMAN EXPLOSIVES AND DEMOLITION EQUIPMENT

PART I - GENERAL.

1. GERMAN EXPLOSIVES AND STANDARD CHARGES.

German explosives for demolitions are made up in Standard Charges in cartridge or slab form in special shaped containers frequently of the hollow charge type. These are all fitted with one or more detonator sockets threaded to take the standard igniter assemblies.

The type of explosive is indicated on the paper disc which seals the detonator socket. Markings used for the various types of explosive are shown below:-

	<u>Explosive.</u>	<u>Markings.</u>	<u>Remarks.</u>
i	T.N.T.	Fp.02	(Fullpulver 02).
ii	Picric Acid	Grf.88	(Granat Fullung 88). German designation gives proportion of T.N.T. first and ammonium nitrate second.
iii	T.N.T./wax	Fp (x)	
iv	P.E.T.N.(Penthrite)	Np.	(Nitro-penta).
v	P.E.T.N./wax	Np.(x)	
vi	R.D.X.	H.	(Hexogen).
vii	R.D.X./wax	H. (x)	
viii	Plastite		64% Hexogen; 32.5% Nitro-Hydrocarbon; 3.5% Collodion Cotton.

Notes.

(a) (x) denotes percentage of wax.

(b) i and ii are initiated by detonator alone. The rest require a detonator and primer.

In some prepared demolitions the Germans rely on blast effect (Zündübertragung) for detonating isolated charges which then require to have detonators inserted facing the source of detonation.

T.N.T. is the most usual filling for demolition charges though both T.N.T. and Picric Acid are being replaced by Penthrite which is at least as powerful.

Primers (Übertragungskörper) are not used as separate accessories but, where necessary, are incorporated in the charge containers. Where primers are used their composition is also shown on the seal over the detonator socket thus:-

"Fp.50/50 U.Kr.Np.10" together indicate a filling of 50/50 Amatol with a primer charge of P.E.T.N./wax in 90/10 ratio.

Standard German explosive charges are shown on Plate I and details are given in the table on page 4.

PROPERTIES OF GERMAN EXPLOSIVES.

Explosive	Group	Velocity of detonation (metres per second)	Relative expansion in lead block	Estimated strength weight for weight as a percentage of Blasting Gelatine	Colour (Indicative only)	Nature
Hexanitro-diphenylamine (HND)	C-T	7100	100	70	Intense Orange	Powder
HND/TNT	C-T	7000-7500	98	68	-do-	Cast
HND/TNT/Aluminium	-	6500-7000	110	77	Olive Green	Cast or block filling
Penta-erythritol tetranitrate (PETN or Penth-rite)	S	8300	166	115	White	Crystal-line powder
PETN/wax	S	7500-8000	120-130	80-90	White sometimes tinted pink	Pressed pellets
PETN/TNT	S	7000-7500	about 120	85	White to buff	Pressed or cast
RDX (Hexogen)	S	8300	167	117	White	Crystal-line powder
RDX/wax	S	7500-8000	about 130	99	White sometimes tinted blue	Pressed pellets
RDX/TNT/wax	S	7600	about 120	85	White to buff or pale yellow	Cast
RDX/TNT/Aluminium	S	7600	125	87	Pale yellow	Pressed blocks
RDX/TNT/Aluminium	S	about 6000 (estimated)	140-150	98-105	Grey	Cast
Ethylenediamine dinitrate	S	-	115	80	White	Pressed
RDX/Oil	S	Plastic demolition explosive generally similar to British R.H.E.				

NOTE : C-T = Coal Tar.

S = Synthetic.

All the above explosives except RDX/Oil are likely to be exploded by a rifle bullet.

The constituent proportions of the explosives vary in different types of equipment.

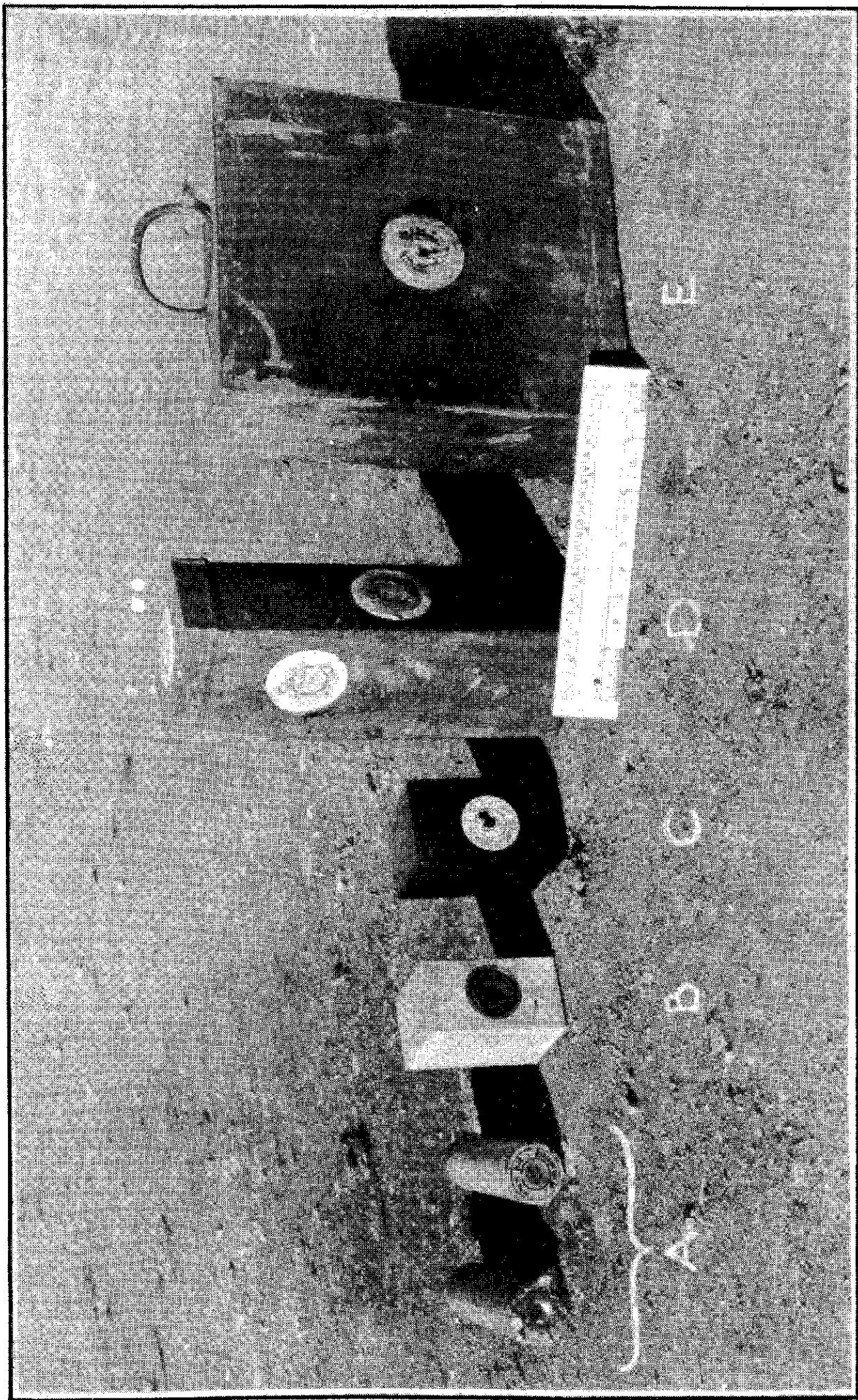


PLATE I
Standard Charges

STANDARD CHARGES

Figure on Plate I	German Name	Dimensions	Total Weight	Weight of Explosive	Type of Explosive	No. of Detonator Sockets	Remarks and Performance
A	Bohrpatrone 28.	3.9" x dia 1.2"	-	3.5 oz.	TNT, or Picric Acid	One	<u>100 gm Charge.</u> Covered in waxpaper waterproof to a depth of 16 1/2 ft - but should always have additional water proofing.
-	-do-	4.1" x dia 1.4"	4.5 oz	3.5 oz	Picric Acid	One	<u>100 gm Charge.</u> Covered in varnished compressed paper with bakelite ends. Similar to the above except for covering.
B	Sprengkörper 28.	2.75" x 1.5" x 2"	-	7.0 oz	TNT, or Picric Acid	One	<u>200 gm Charge.</u> Covered in waxed paper. (Waterproofed as for A). See Note (ii).
C	-do-	3.0" x 1.8" x 2.2"	8.75 oz	7.0 oz	Picric Acid	One	<u>200 gm Charge.</u> In moulded bakelite container (similar to B except for covering).
D	Sprengbüchse 24.	7.9" x 2.9" x 2.2"	-	2.2 lb	TNT, or Picric Acid	Three	<u>1 Kg Charge.</u> In pressure resisting zinc container. It is capable of (a) cutting one flange and most of the web of a 12" x 5" R.S.J. (b) cutting soft wood tree-trunks up to a maximum of 12" diameter.
E	Geballte Ladung	6.5" x 3.0" x 7.7"	-	6.5 lb		Three or five	<u>3 Kg Charge.</u> In pressure resisting zinc container.
-	Plastite		500 gm	500 gm	Hexogen; Nitro-Hydrocarbon; Collodion Cotton		

NOTES.

(i) One sample of the 1 Kg Charge (Sprengbüchse 24.) dated 1943 has recently been recovered in which the explosive was a mixture of TNT and PETN (+ 10% wax). The two varieties may be readily distinguished from the colour of the circular discs closing the detonator holes

TNT - Pink
TNT + PETN + 10% wax - Green

(ii) A similar slab, with the surface coated with wax and labelled "14 gue 43" and having no hole for an igniter, is used in the wooden box mine VB.

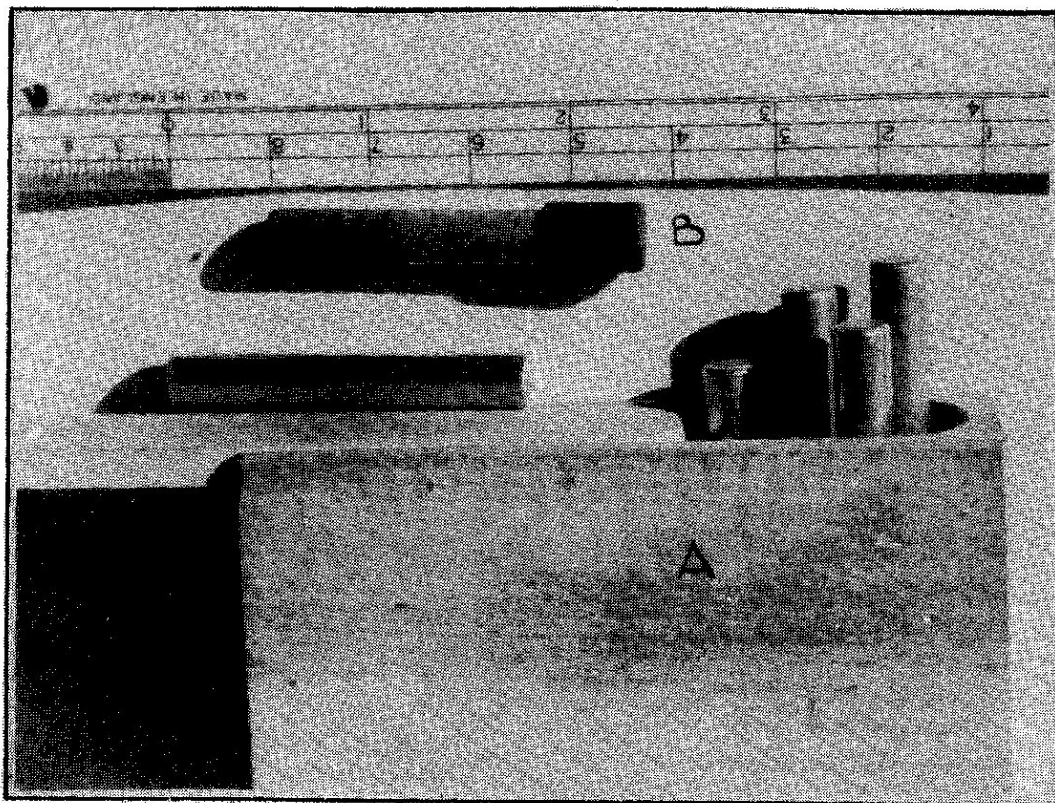


PLATE II

A. Detonators
B. Pyrotechnic Igniters

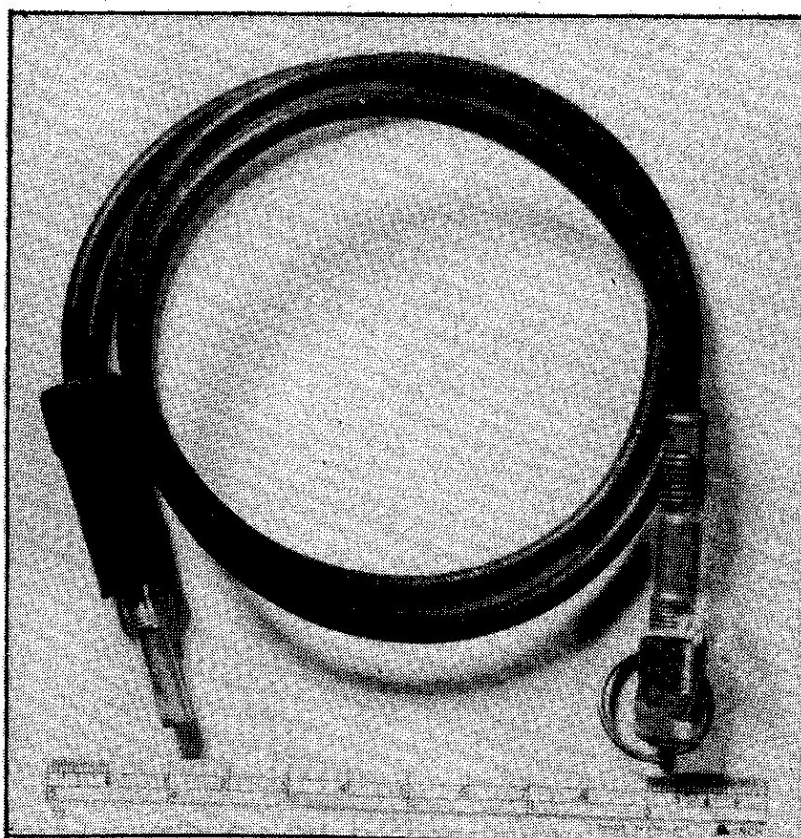


PLATE III

Safety Fuze Initiation Set
Sprengkapselz nder

2. DETONATORS AND INITIATING SETS.

German methods of initiation are by Safety Fuze and detonator, electric detonator, or delay igniter and detonator. German detonators are more powerful than British and American ones, and will fire most H.E. Charges provided that there is contact all round the detonator.

(a) Detonator, Safety Fuze - Sprengkapsel Nr.8 (A1).

This is similar to the British No.27 Detonator, or U.S. No.8 Commercial Blasting Cap, except that it does not have a concave end, but it will take British Safety Fuze No.11 and U.S. Time Fuze.

It is 1.75" long and 0.28" external diameter. The container is of painted aluminium (copper in older models).

Letters stamped on the end of the detonator indicate the type of filling as follows :-

R 4 grms. Lead Azide/Lead Styphnate	75/25 and	6.9 grms. P.E.T.N.
T 3.9 " " " " "	42/58 and	10.8 " C.E.

The detonators are packed 15 in a small wooden block ($3\frac{1}{2}$ " x $2\frac{1}{8}$ " x 1") with sliding lid, as shewn at "A" in Plate II.

(b) Pyrotechnic Igniters - Zundladung N.4.

Used for igniting smoke or thermite charges and not to be confused with the No.8 Detonator, have the same containing tube but the end third of their length is coloured and supplied with a small cardboard cap to cover the exposed end. This is shewn at "B" in Plate II.

There are two types :-

- (i) Igniter for incendiary charges painted green, which burns with a bright white light.
- (ii) Igniter for smoke charges, painted white, which burns with a dull yellow light.

(c) Safety Fuze Initiation Set - Sprengkapselzunder.

This consists of a friction igniter (ZDSCHN.ANZ 29 or ZDSCHN.ANZ 39 - see Igniters), a brass igniter adaptor, a length of safety fuze and a detonator in a holder (Zunderhalter); see Plate III.

The igniter adaptor screws on to a short brass tube which is pressed on to the safety fuze. The open end of the adaptor is threaded to take a standard igniter. The open end of the detonator is push-fitted into a shaped metal collar to allow the joint of the safety fuze and detonator to be sealed. A cylindrical bakelite holder with bakelite cap fits over the joint and, having a standard screw-threaded shoulder fitting over the top of the detonator, can be screwed into the detonator socket of a standard charge. It is used to detonate Z cartridges (See Para 20).

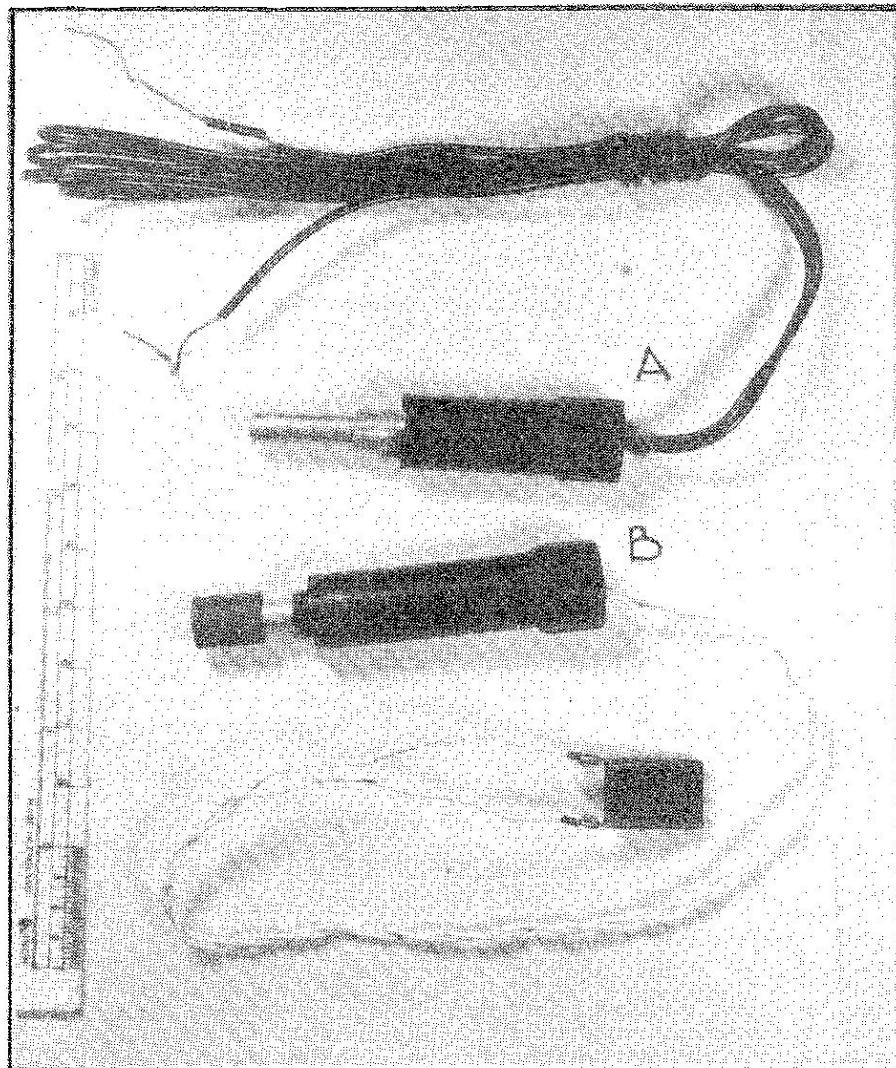


PLATE IV

- A. Electric Detonator - Stuck Glühzunder 28
- B. Electric Flash

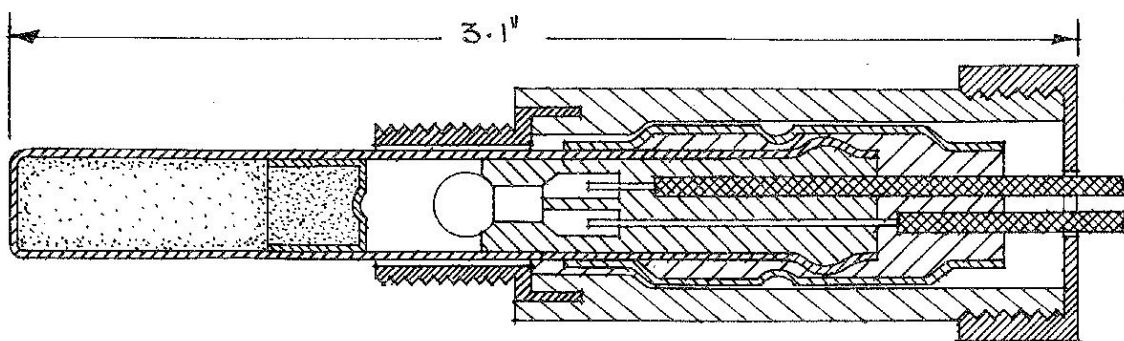


FIG. 1
Electric Detonator
Stuck Glühzunder 28

(d) Electric Detonator No.28 - Stuck Glühzunder 28.

This electric detonator, shewn at "A" in Plate IV and Fig.1, is encased in a bakelite holder, similar to that for the No.8 detonator.

There are two varieties of this :-

Type "A" (Earlier Type).

Actual resistance	1.8 ohms.
Resistance for purposes of calculation (according to German Manuals).	2.0 ohms.

The connecting leads are of copper with tinned finish to exposed ends.

Insulation consists of light brown rubber covered by black rubber with an outer covering of black fabric.

Type "B" (Later Type).

Resistance for purpose of calculation (according to German Manuals).	3.0 ohms.
---	-----------

The connecting leads are of steel with tinned finish to exposed ends.

The insulation is of a single moulded covering of black plastic which is hard and smooth.

These detonators are supplied 20 in a wooden box ($13\frac{1}{2}$ " x 3.15/16" x 3.1/16") with a sliding lid. The whole is encased in a sealed waterproof zinc case.

(e) Electric Detonator.

A sample captured in Dec. '41 would appear to be similar in every way to the above except in its electrical characteristics. The firing current was 0.75 amp. The voltage required for this was 3 volts giving a resistance of 4 ohms.

(f) Electric Flash.

This is used for initiating rocket equipment (e.g. the Nebelwerfer) and is shewn at "B" on Plate IV. It is not to be confused with the No.28 detonator. The leads have white insulation. The "detonator tube" is open at the bottom end and has a small cardboard cap to cover it. The resistance of this flash may be taken as 2.0 ohms.

(Note :- The leads may not have a sliding contact attached as shewn in the plate.)

(g) Delay Electric Detonator - Glühzunder mit Verzögerung.

Electric detonators which fire with a delay of 2, 4, 6, 8, or 10 seconds after electrical initiation are similar to ordinary electric detonators except that there is a pyrotechnic delay pellet between the wire bridge and the detonator proper. These electric detonators have the number of seconds delay marked on a disc attached to the leads.

(h) Spark Gap Electric Detonator - Spaltzunder.

Detonators have recently been introduced in which it is believed the wire bridge for initiation is replaced by a spark gap.

(i) Wire Bridge Detonators - Bruckenzunder .

Since the introduction of spark gap detonators it is believed some new detonators with a wire bridge are distinguished by the name "Bruckenzunder".

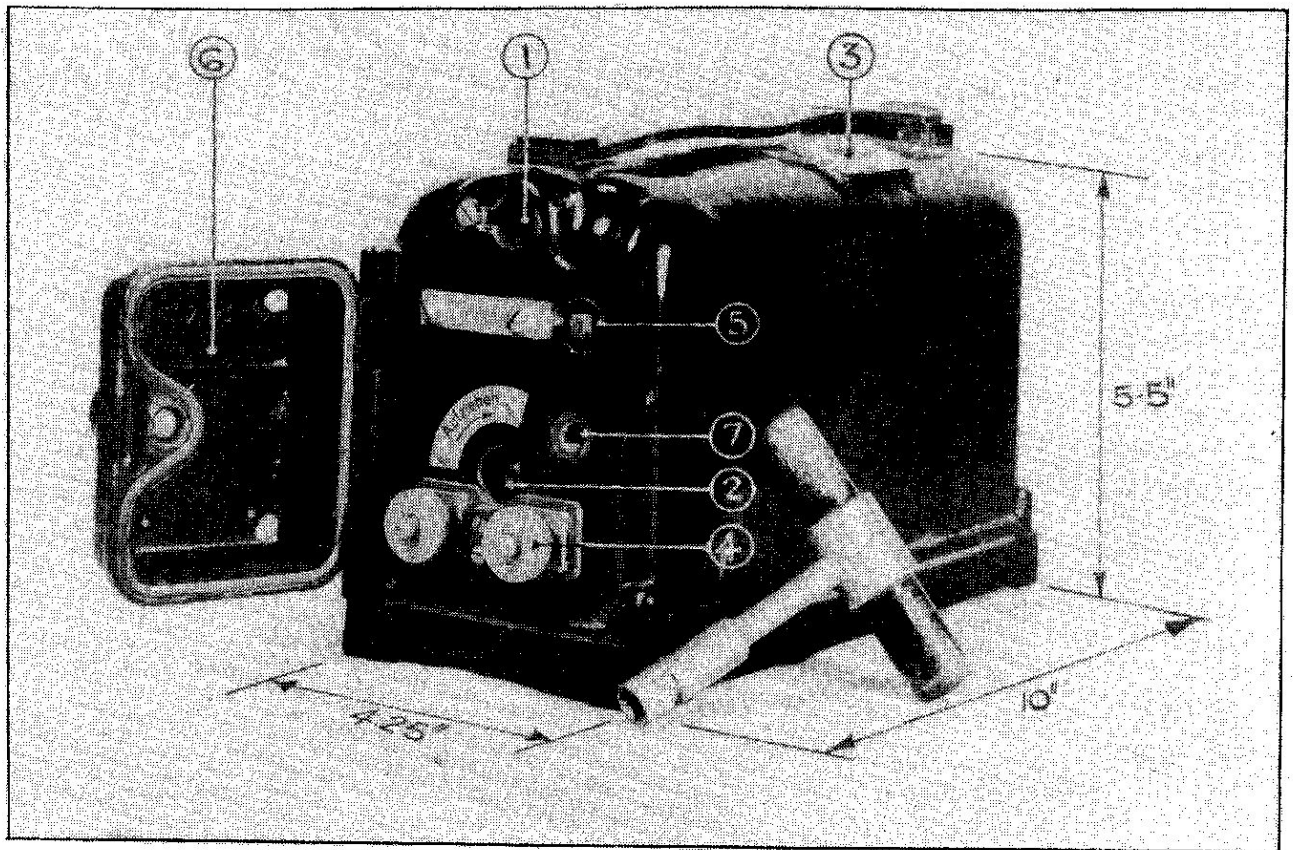


PLATE V
Field Exploder - Glühzündapparat 26

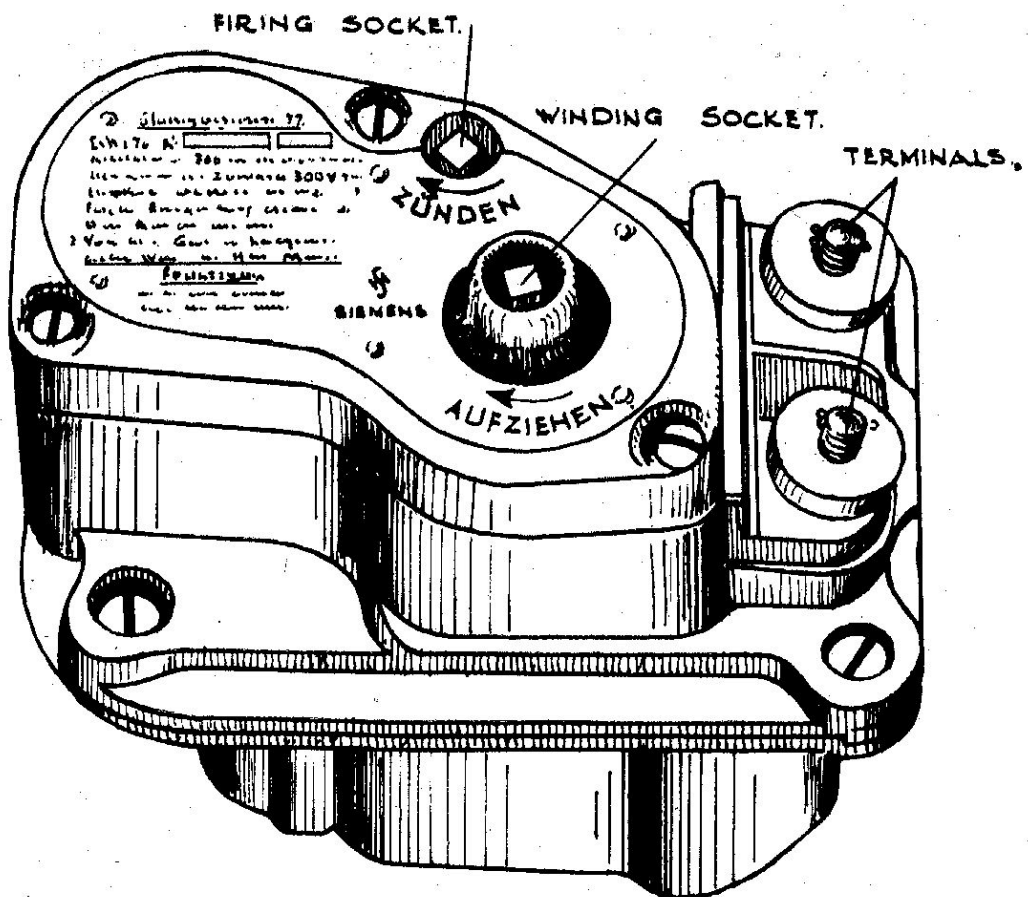


FIG. 2
Field Exploder - Glühzündapparat 37

3. FUZES.

(a) Detonating Fuze - Knallzündschnur.

This is a pale green, smooth and flexible fuze of external diameter 0.19". It will detonate under water provided that the ends are sealed. It is supplied in lengths of 50 metres on a wooden reel $7\frac{1}{2}$ " x $7\frac{1}{2}$ " and 5" wide.

Analysis :

P.E.T.N.	96.97
Red Lead (Pb_3O_4)	2.77
Grit	0.18
Wax	0.08

(b) Safety Fuze.

There are two types :-

(i) One type, (Zeitzündschnur 30), is a hard, black, smooth and rather stiff fuze, about 0.23" in diameter which burns at approximately 1 cm. per sec., (2 ft. per minute) with an error up to 10% (i.e. any length from 1'9 $\frac{1}{2}$ " to 2'2 $\frac{1}{2}$ " may be required for 1 minute of burning). This fuze will burn under water provided that the ends of it are not exposed.

Analysis :

Potassium Nitrate	69.6
Sulphur	17.3
Charcoal	12.7
Volatile matter	0.4

(ii) The second type is brown, has ridges but a smooth finish, and has a slightly slower rate of burning than the black type, (1 $\frac{1}{2}$ ft. per minute).

PART II - ACCESSORIES.

4. EXPLODERS.

(a) Glühzündapparat 26.

This low tension, spring-operated exploder is shown in Plate V, its main features being :-

- (1) Socket for key when not in use.
- (2) Winding hole - marked AUFZIEHEN and having an arrow to show direction to wind.
- (3) Indicator window - on top.
- (4) Terminals.
- (5) Firing hole and shaft (marked ZUNDEN).
- (6) Cover door.
- (7) Cover door lock hole.

Weight of Exploder = 14.5 lbs.

Weight of Case = 3.5 lbs.

Rated to fire through a resistance of 300 ohms total (including internal resistance of 45 ohms - 255 ohms external).

In the base is a metal plate, behind which is housed a spare spring, and which can be removed by unscrewing four screws.

Method of Operation.

- (i) Remove coach key from housing and open cover door.
- (ii) Wind up until white oblong appears in indicator window.
- (iii) Fire by turning ZUNDEN spindle as far as it will go in the direction of the arrow.

Do NOT fire unless the indicator is showing.

Do NOT turn winder in the wrong direction.

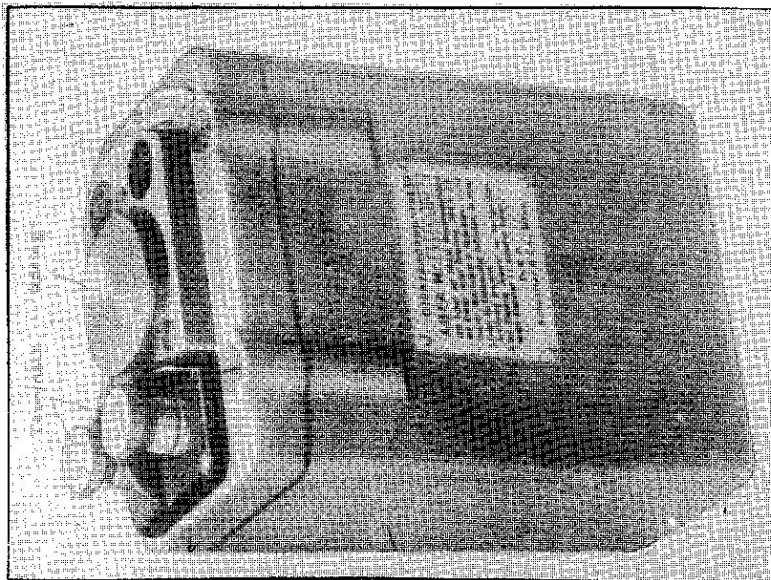


PLATE VI
Field Explorer
Glühzündapparat 39

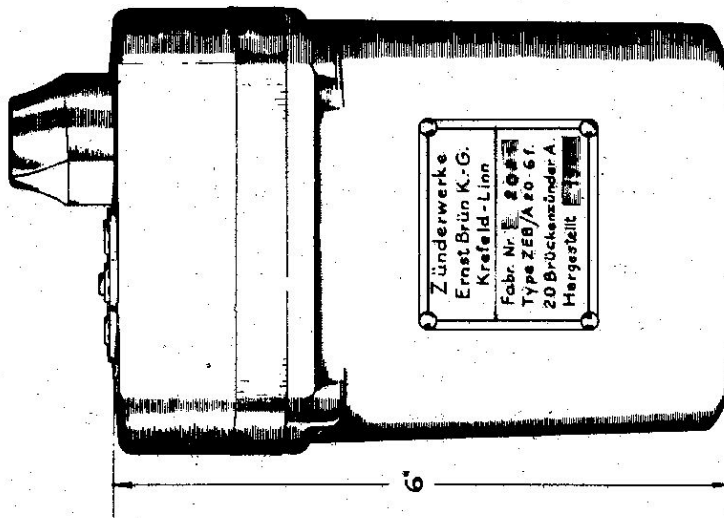


PLATE VII
Small Field Exploder
Glühzündapparat 40

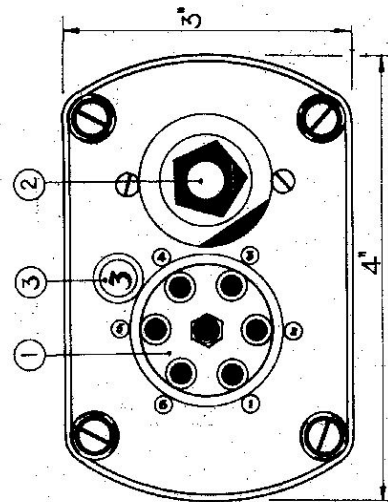


FIG. 3
Firing Mechanism - Zunderwerke 42

(b) Glühzündapparat 37.

This is a light alloy, spring-operated exploder, shown in Fig.2, which generates 300 volts. There is an automatic device to prevent the spring from operating before it is fully wound. It will fire a service electric detonator through a resistance of 300 ohms.

It is packed in a leather carrying case.

Method of Operation.

- (i) Fit key to shaft labelled "AUFZIEHEN" on the top of the exploder and wind spring by turning key in direction shown by arrow until "STOP" is reached (about 9 turns).
- (ii) Attach leads to terminals.
- (iii) Transfer key to shaft labelled "ZÜNDEN" and turn in direction of arrow to full extent.

(c) Glühzündapparat 39.

This exploder, illustrated in Plate VI, measures 5" x 3" x 7 $\frac{1}{2}$ " and is packed in a leather carrying case. It fires through a maximum resistance of 300 ohms and has an internal resistance of 40 ohms. The winding key is kept in the carrying case, which also holds the test resistance, a spare spring and a screwdriver. On the top of the exploder are the winding socket (AUFZIEHEN), the spring socket (ZÜNDEN) and the spring terminals.

The spring driving the generator cannot be released until it has been fully wound. To use the exploder, wind the spring (about 6 times) until the "STOP" is reached. To fire, turn the socket marked "ZÜNDEN" with the key.

(d) Glühzündapparat 40.

This small exploder, illustrated in Plate VII, forms part of the portable demolition kit (Zündgerät 40), is of different design from the three previously described and has a lower performance. It is 5.3" high and has an oval shaped top mounting the firing terminals and the winding socket. It will fire through 80 ohms external resistance and the generator is turned directly by the handle in the winding socket. Only when the maximum current is generated is the circuit closed, therefore, for firing, the handle must be turned as fast as possible to the "STOP". The exploder has an internal resistance of 30 ohms and generates a current of 1 amp. at 80 volts.

Before using the exploder it must be tested with the special neon tube provided, which not only tests the exploder but also excites the magnetism in the generator. The neon tube fits across the terminals of the exploder.

(e) Glühzündapparat 41.

This "Siemens" exploder was reported in early 1943 and said to be similar to the 37 model, the main differences being :-

- (i) The 1941 model is smaller, lighter and more compact.
- (ii) The 1941 model has no indicator window to show when it is fully wound: the exploder cannot be fired unless the spring has first been fully wound.
- (iii) The carrying case of the 1941 model contains a neon tube for testing.

Further details are not known.

(f) Zünderwerke 42.

This exploder, shown in Fig.3, is designed for firing the 6 barrelled "Nebelwerfer", having a socket (1) to take a 7 point plug for six circuits with one common return. The socket for each circuit is numbered. Current is generated by giving the spindle (2) on top a sharp twist: as this is done a red number appears in a glass window (3) denoting which circuit has been fired. No tests have been carried out but as it is difficult to give the spindle a prolonged twist its capacity is limited.

Its weight is 6 lbs.

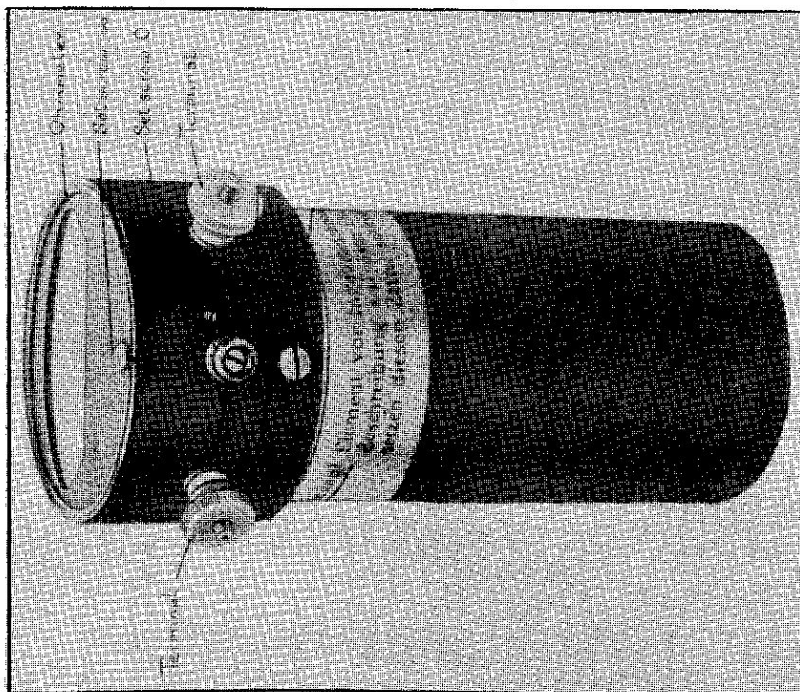


PLATE VIII
Continuity Tester
Leitungsprüfer

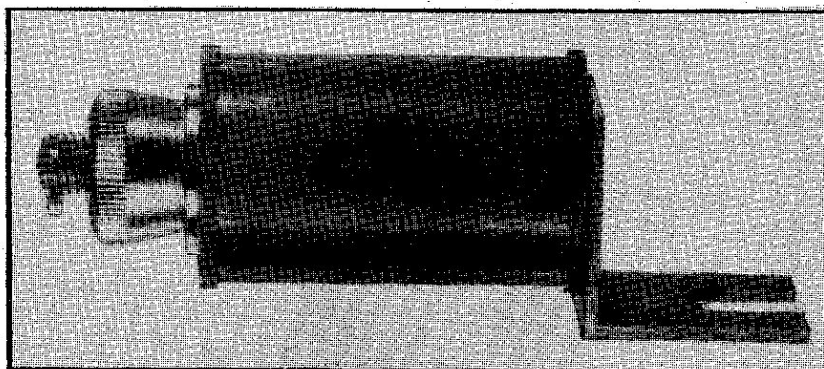


PLATE IX
Test Resistance
Vorschaltwiderstand

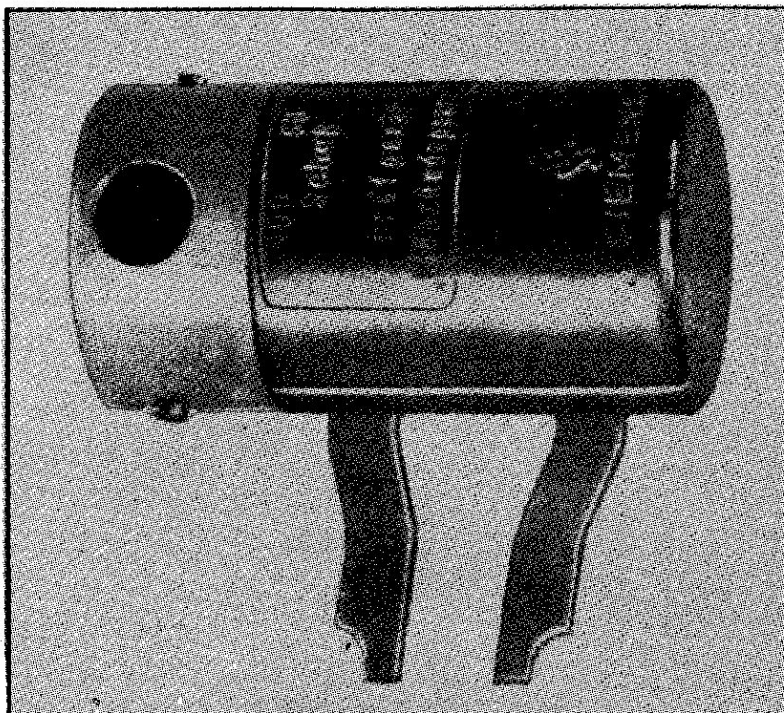


PLATE X
Neon Lamp
Prüfgerät

5. TESTERS.

(a) Continuity Tester - Leitungsprüfer 26.

The continuity tester, shown in Plate VIII, is made in one type, 1926, with two production models which are identical save for unimportant details. It serves to test for continuity and also to measure the resistance of circuits and detonators, for which purposes it contains an ohmmeter, resistance and battery (1.5 volts).

The battery is housed in a cylinder 4.7" high with the ohmmeter on top 2.2" in diameter. Adjusting screws for setting the ohmmeter needle to zero and infinity are midway between the testing terminals and are marked "0" and "∞" respectively. A built-in resistance protects detonators from being initiated while being tested for continuity.

(b) Test Resistance - Vorschaltwiderstand.

This is shown in Plate IX. The resistance is for testing the Field Exploder 1926 only and is to prove that the exploder will fire through 250 ohms resistance. The test resistance of 250 ohms consists of a coil with a terminal at one end and a terminal bar at the other end.

(c) Neon Lamps - Prüfgerät.

The Neon Lamp, shown in Plate X, is designed for testing the Field Exploders 1937 and 1939. It has a screw head which may be set for firing either 50 or 100 detonators. The lamp, with screw-head switch, is housed at the end of a metal cylinder 3" long and $1\frac{1}{2}$ " in diameter and has two terminal bars which fit on to the firing terminals of the exploders, which should on test cause the lamp to glow.

There is another neon lamp for testing the Small Exploder 1940. It consists of the neon lamp in the centre of a cylinder 3" long and fitted with two terminal bars which are further apart than in the model described above. It is part of the Portable Demolition Kit 1940, described in Para 8.

6. ELECTRIC CABLE - LEITUNG.

(a) Single demolition electric cable is made of 7 strands of copper wire in an insulated sheath. It is issued in 100 metre lengths (110 yds.) on light metal drums and having a resistance of 1.25 ohms per 100 metres. This single cable is used for connecting up the electric detonators and generally within the neighbourhood of the charges.

(b) Double cable consists of two lengths of single cable twisted together and is issued on light metal drums in 200 metre (220 yds.) lengths, which have a total resistance of 5 ohms. This double cable is used outside the area affected by the demolition.

(c) A light tubular frame and a winding handle are provided for the larger drum, enabling it to be handled quickly. The frame has four terminals at one side serving as a joint for the ends of the cable on the drum to the leads from the exploder.

(d) Demolition accessories are carried in a leather satchel. The accessories include detonator holders, etc., and tools for the electrical work, joints, crimping etc.

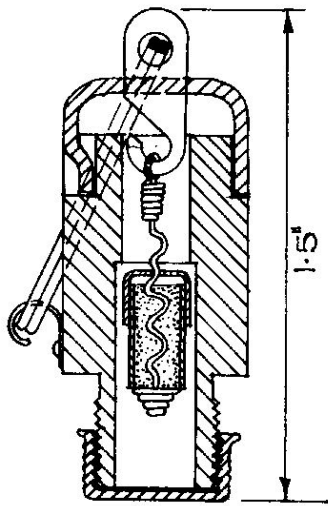
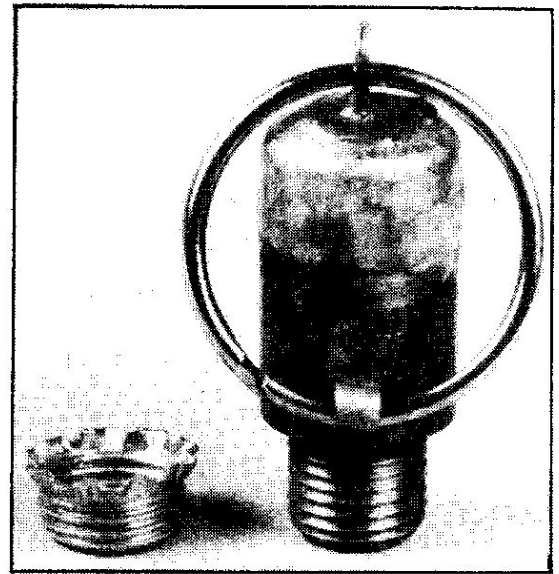


FIG. 4



Igniter - ZDSCHN.ANZ. 29

PLATE XI

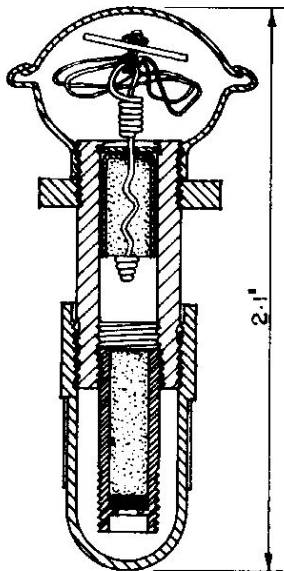


FIG. 5

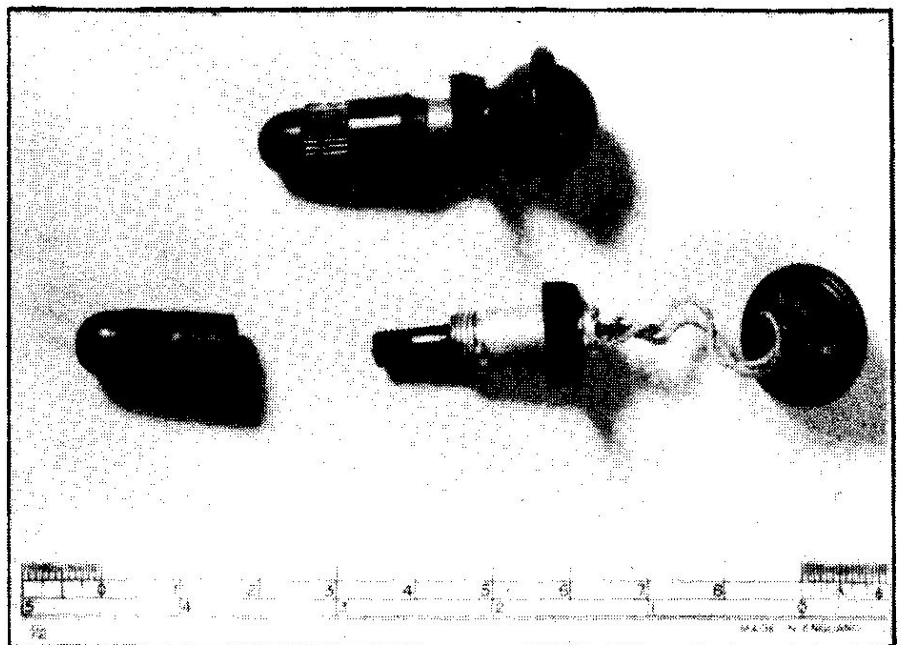


PLATE XII

Igniter - BZE. 39

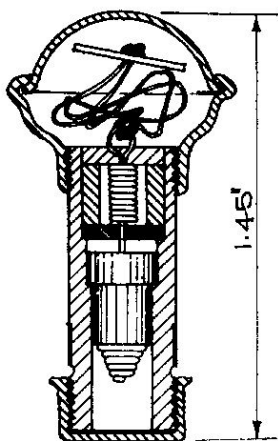
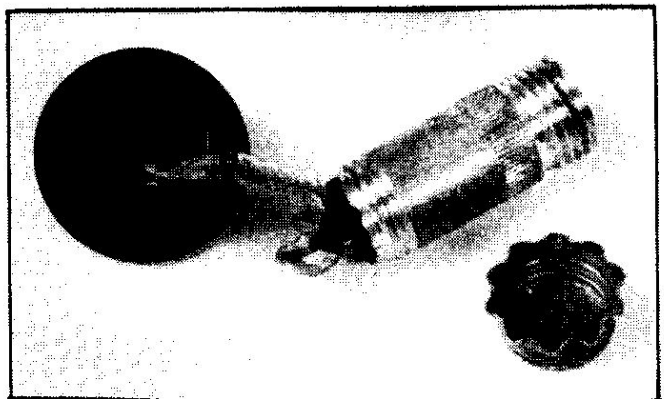


FIG. 6



Igniter - ZDSCHN.ANZ. 39

PLATE XIII

7. IGNITERS.

(a) ZDSCHN. ANZ 29. - Zündschuranzünder.

This is a small brass igniter for lighting safety fuze or initiating a detonator and is shewn in Plate XI and Fig. 4.

The ring at the top when not in use is held against the side by a small brass loop. When the ring is pulled, it draws out a hook to which is attached a friction wire. The latter is thus pulled through the match compound, held in a copper cap, igniting it and causing a flash.

At the bottom of the igniter is the standard screw thread. 15 of these igniters are supplied in a cardboard carton $4\frac{1}{4}" \times 3" \times 1\frac{3}{8}"$.

(b) B.Z.E. 39 (or B.Z. Eifer 39 or Brennzünder Eifer 39).

This is a small friction igniter and is shewn in Plate XII and Fig.5. It may be used for demolition work, though primarily intended for use in grenades and smoke candles.

It consists of a small cylindrical metal tube containing match composition with a friction wire passing through it and a delay pellet at the bottom. The top is capped by a small spherical hollow head containing a short length of string, one end of which is attached to the friction wire and the other to a disc which prevents it from leaving the head.

To initiate, unscrew head (normal right hand thread) and pull away sharply to drag the friction wire out.

This igniter is made with different lengths of delay, the length being indicated by the colour of the head as follows :-

- | | | | |
|-------|------------------|-------|-------------|
| (i) | Red head denotes | 1 | sec. delay. |
| (ii) | Blue head | " 4.5 | " " |
| (iii) | Yellow head | " 7.5 | " " |

15 igniters are supplied in a cardboard carton $5\frac{3}{8}" \times 3\frac{1}{8}" \times 1\frac{5}{8}"$.

(c) ZDSCHN. ANZ 39.

This igniter was originally intended for use with the German Smoke Candle (Nb.K.39) but is now replacing the ZDSCHN. ANZ 29 for lighting safety fuze. Illustrated in Plate XIII and Fig.6, this igniter is a somewhat similar one to the B.Z.E. 39 but has no delay pellet.

It is very similar but can be recognised by the following :-

- | | |
|-------|------------------------------------|
| (i) | It has a slightly flatter head. |
| (ii) | The head is painted grey. |
| (iii) | The head has a left-handed thread. |
| (iv) | It is knurled round the base. |

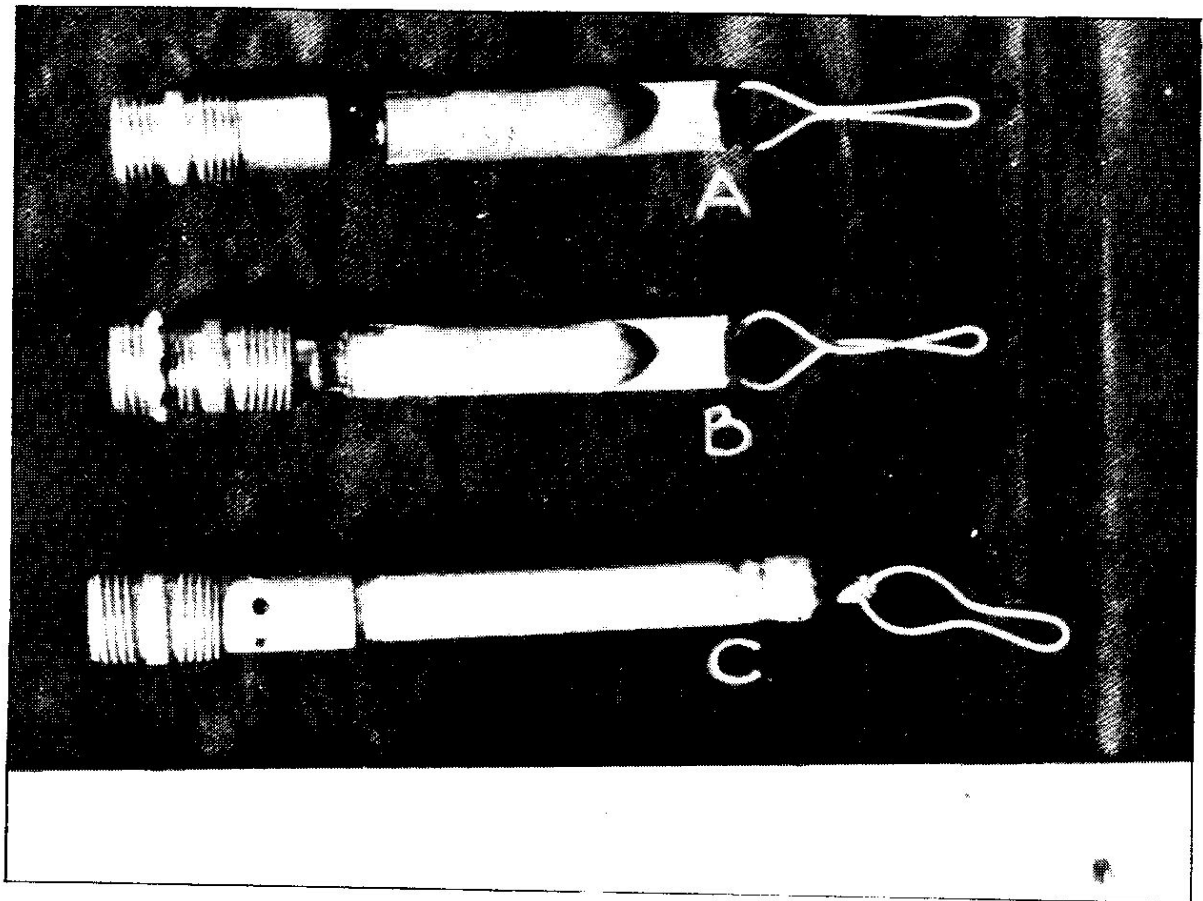


PLATE XIV
Igniters

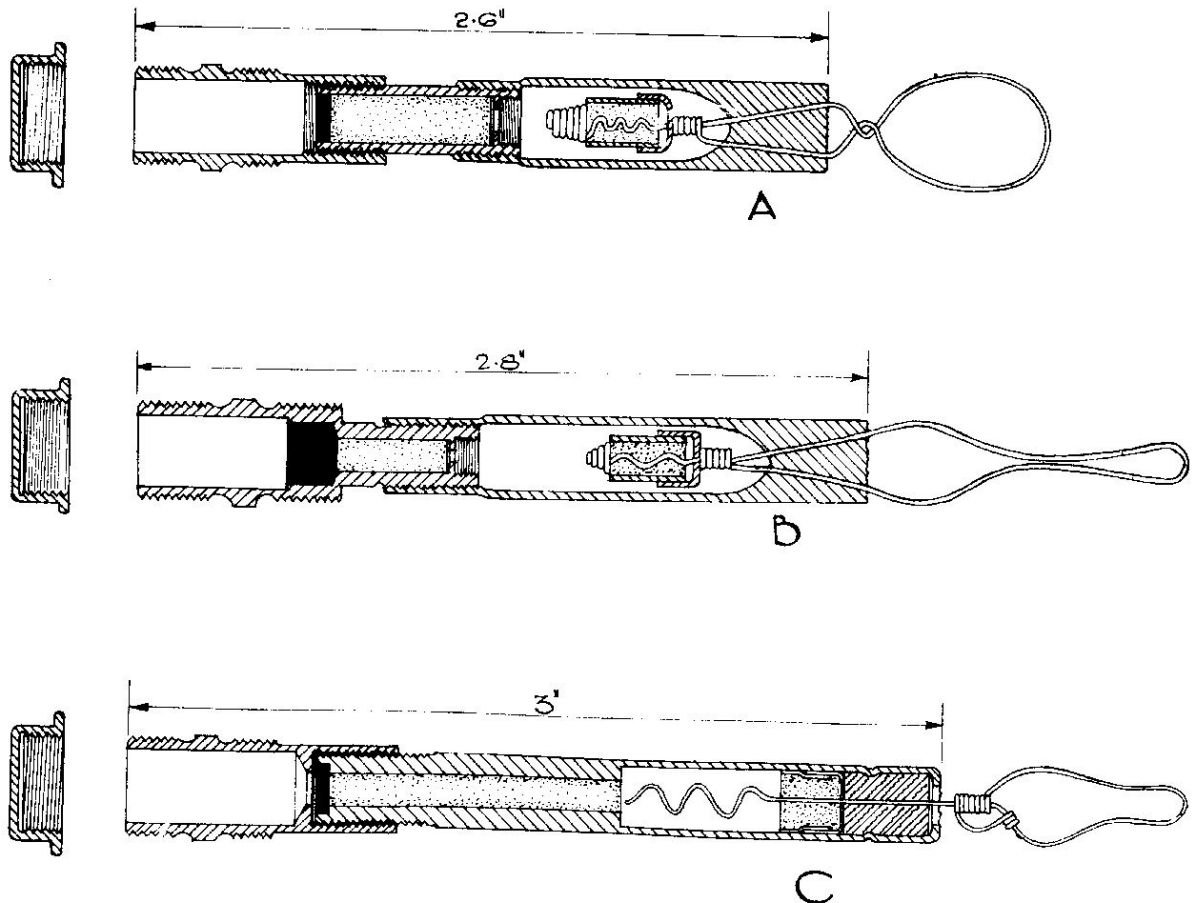


FIG. 7
Igniters. A - BZ. 24. B - Nb.BZ. 38. C - BZ. 39

(d) BZ 24 Igniter - Brennzunder 24.

This igniter, shown at "A" on Plate XIV and Fig.7, works on the same principle as the BZE igniter. It is larger (2.6" long) and has a brass adaptor threaded with the standard igniter threads. The main difference is that the knob and string has been replaced by a lead sheath and wire loop.

The brass adaptor is coupled to the lead sheath by a steel union containing the pyrotechnic delay and the cap. The joints of the union are waterproofed with black bitumastic.

The time delay is stamped on the lead sheath (e.g. $4\frac{1}{2}$ S = $4\frac{1}{2}$ second delay).

15 of these igniters are supplied in a cardboard carton $4\frac{3}{4}$ " x 3" x $1\frac{3}{8}$ ".

(e) 1lb.BZ 38 Igniter - Nebel Brennzunder 38.

This is shown at "B" in Plate XIV and Fig.7. It is designed for firing smoke charges. This is similar to the BZ 24 but can be recognised by the fact that the adaptor which may be of aluminium or brass and which carries the pyrotechnic delay and cap, screws direct into the lead sheath. The joint is sealed with black bitumastic: a white band is painted round the lower end of the sheath.

15 igniters are supplied in a metal box $4\frac{1}{2}$ " x 3" x $1\frac{3}{8}$ ".

(f) BZ 39 Igniter.

Shown at "C" in Plate XIV and Fig.7, this is a new edition of the BZ 24 differing slightly in its construction and the metal used, which is all aluminium.

The friction wire is pulled through a rubber collar crimped in the top of the tube. A delay of $4\frac{1}{2}$ seconds is incorporated.

15 igniters are supplied in a cardboard box 4" x $2\frac{3}{4}$ " x $1\frac{1}{8}$ ".

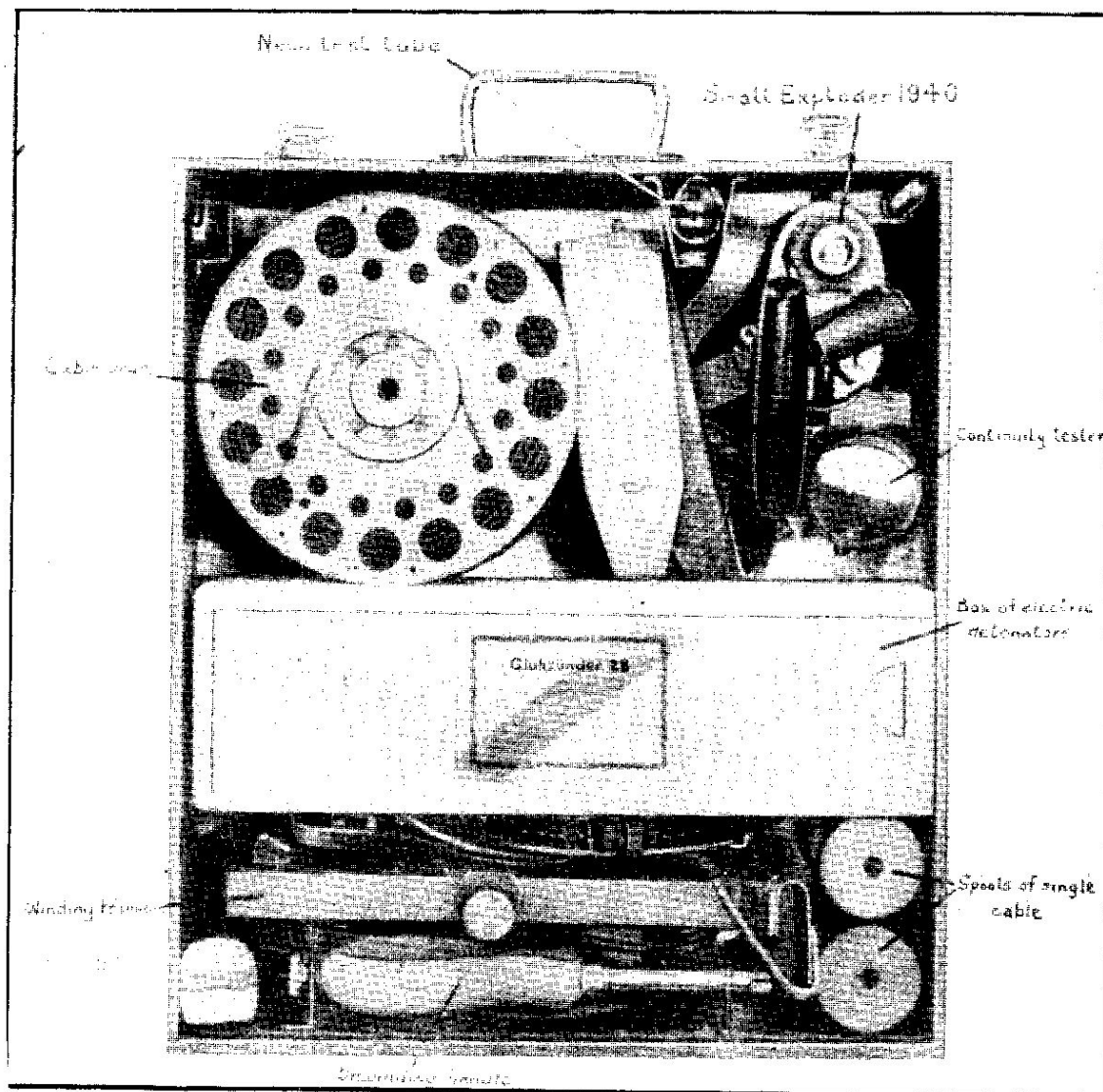


PLATE XV
 Portable Demolition Kit 1940 - Zündgerät 40, Tragbar

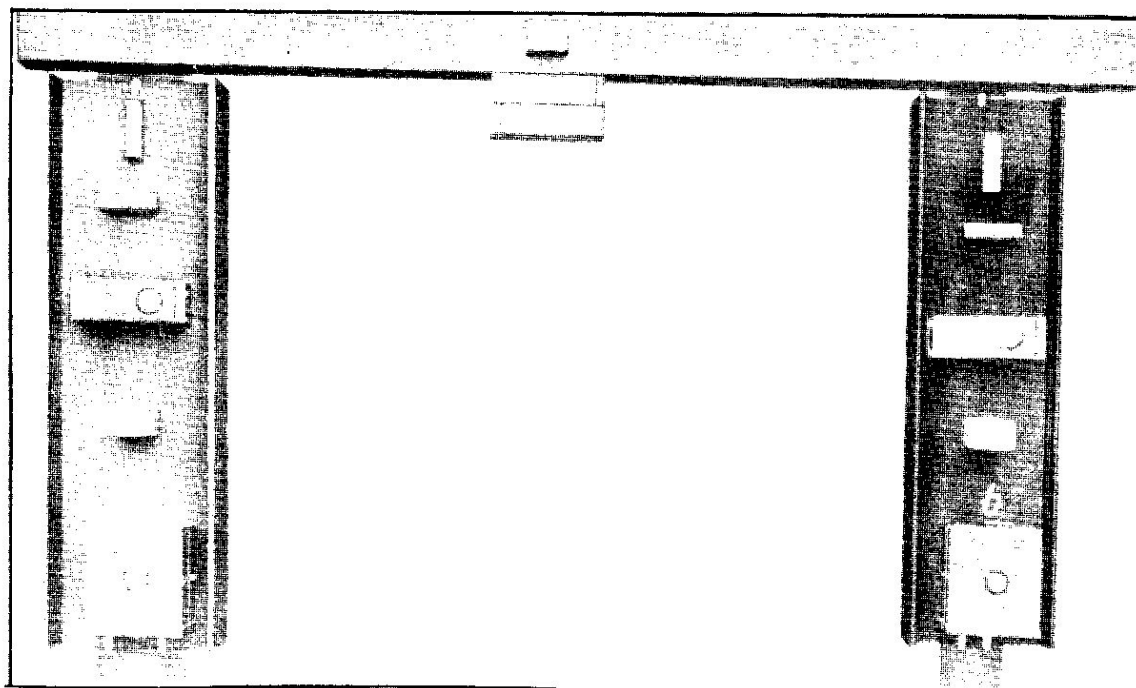


PLATE XVI
 Use of Adhesive Paste - Kaltklebekitt
 - 19 -

8. PORTABLE DEMOLITION KIT 1940 - ZÜNDGERÄT 40, TRAGBAR.

This is a pack, shown in Plate XV, which contains everything needed to fire charges electrically. It weighs 51 lbs. and can be carried by a handle or by shoulder straps on the back. It contains the following :-

- (a) A small exploder 1940, capacity 80 ohms, described in para 40, and the Neon Test Tube.
- (b) A Continuity Tester 1926, described in para 5 (a).
- (c) 40 Electric Detonators, in a box.
- (d) Two wooden spools of single cable and two drums of double cable, together with handles for holding the drum while it is unwound and for winding-in on a winding frame.
- (e) A winding frame, consisting of a frame with an axle to take the drum, and a handle geared to the axle.
- (f) Metal sleeves, which are crimped over electrical joints.
- (g) A notched pocket knife for removing insulation, crimpers, and insulating tape.

9. ADHESIVE PASTE FOR DEMOLITION CHARGES.

Plate XVI illustrates the use of a substance known as "Kaltklebekitt" (Kat 39) which is used for speedy attachment of demolition charges to all types of surface (except those thoroughly wet), e.g. wood, stone, metal, painted or unpainted, dry or damp.

Description.

Kat 39 is a dark brown tenacious substance made up in $\frac{1}{2}$ Kg. tins with a spatula and instruction sheet. It weathers well, can be stored for a long time but cannot be used in a frozen state. It retains its adhesive property at body temperatures.

Application.

Smear side of charge for attachment with a layer $\frac{1}{16}$ " to $\frac{1}{8}$ " thick of paste and apply the charge with a slight back and forward motion. If the surface is excessively damp, dry first with a cloth. A wire should also be used to hold the charge on: only in extreme cases of emergency should this be omitted since it is not possible to ascertain that the whole surface is in contact.

Kat 39 can also be used for joining standard charges together, e.g. 100 gm. and 200 gm. to form one larger one.

Heavy charges can be prevented from slipping down by sticking $\frac{3}{4}$ " planks to the surface below the charge.

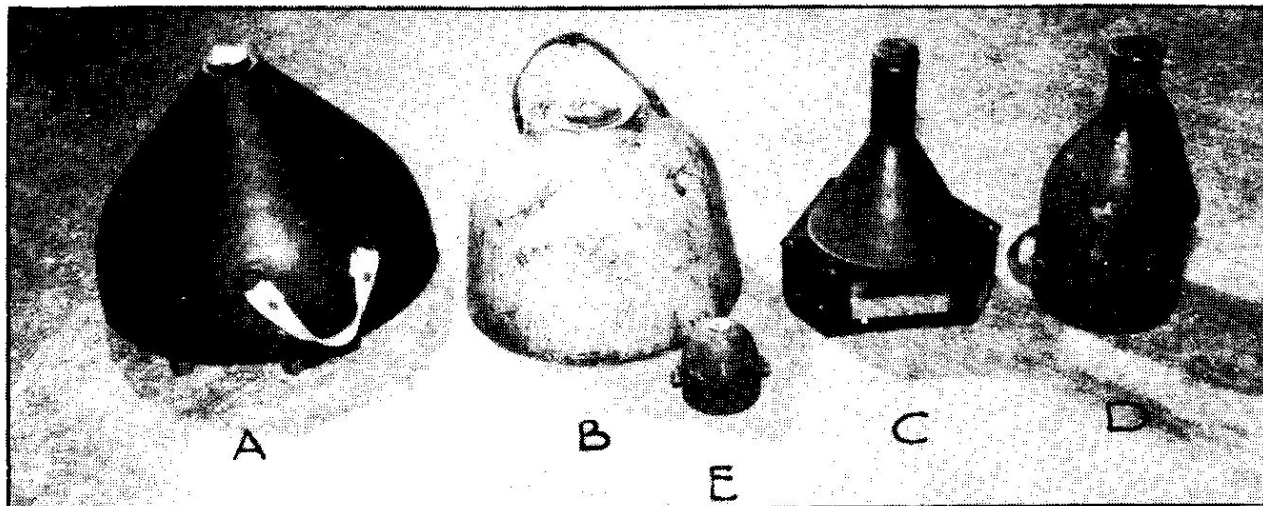


PLATE XVII
Hollow Charges - Hohlladung



PLATE XVIII
50 Kg. Charge

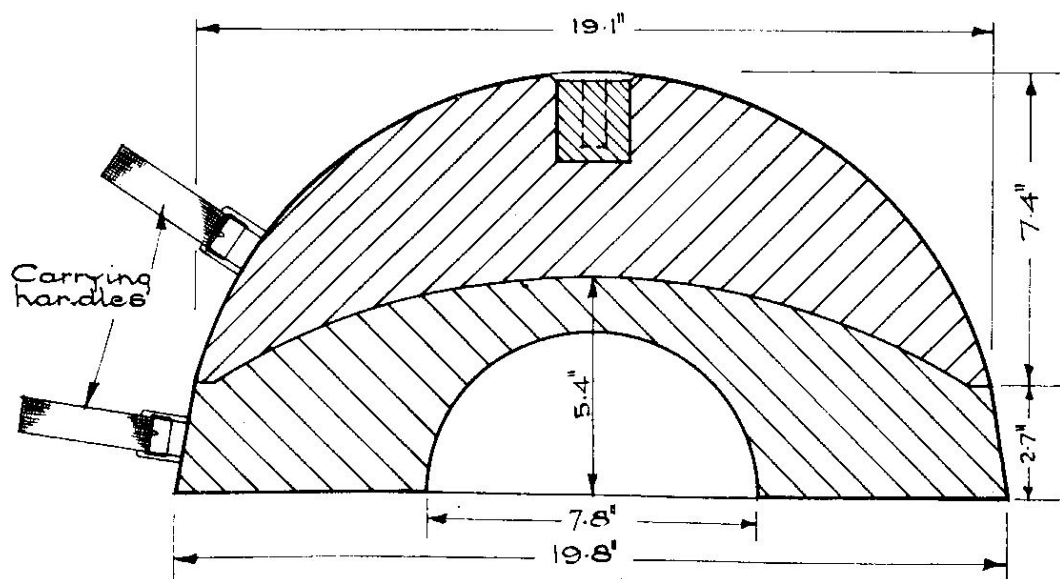


FIG. 8
50 Kg. Charge

PART III - SPECIAL CHARGES

10. HOLLOW CHARGES - GENERAL.

Plate XVII shews the following charges :-

- A - 13.5 Kg. Charge
- B - 12.5 Kg. Charge
- C - 3 Kg. Charge
- D - 3.6 Kg. Charge
- E - 400 Gm. Charge

Details of the performance of hollow charges may be summarised as follows :-

Wt. of Explosive Charges.

Penetration into Reinforced Concrete.

$\frac{1}{2}$ lb.	12 - 15 inches
1 "	15 - 20 "
5 "	24 - 30 "
10 "	30 - 40 "
20 "	40 - 50 "
40 "	55 - 65 "
60 "	60 - 70 "
80 "	70 - 80 "
100 "	75 - 85 "

When used against armour steel the following rough formula applies :-

$$\text{Weight of explosive in ounces} = 1/9 (\text{thickness of steel in inches})^3.$$

11. 50 KG. HOLLOW DEMOLITION CHARGE.

This is a circular hollow charge made up in two parts for convenience of carrying, and is shewn in Plate XVIII and Fig.8.

The top half is fitted with a screwed socket to take a standard igniter set and has a priming charge. It is dome-shaped with a concave underside which fits on to the bottom half.

Each half has a canvas carrying handle and is encased in aluminium, painted olive green.

It is intended for use against armoured structures in fortifications, and is placed flat on the surface to be attacked.

Effect :- It is reputed to pierce $9\frac{3}{4}$ " of armour plate: if followed up by a 12.5 Kg. Hollow Charge a total of 12", or by another 50 Kg. Hollow Charge a total of 20", may be penetrated.

This charge is part of the equipment used by airborne troops. A dropping container (Abwurfkiste) may be used to drop two 50 Kg. charges. This can be fitted with two wheels on stub axles for easier transport on the ground.

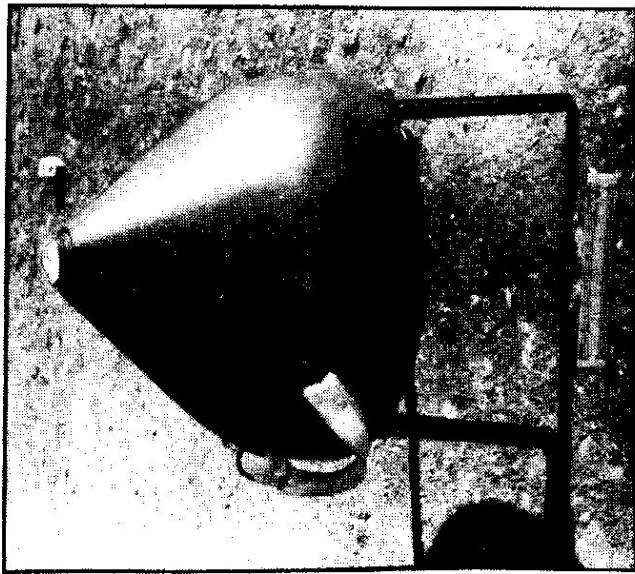


PLATE XIX



PLATE XX

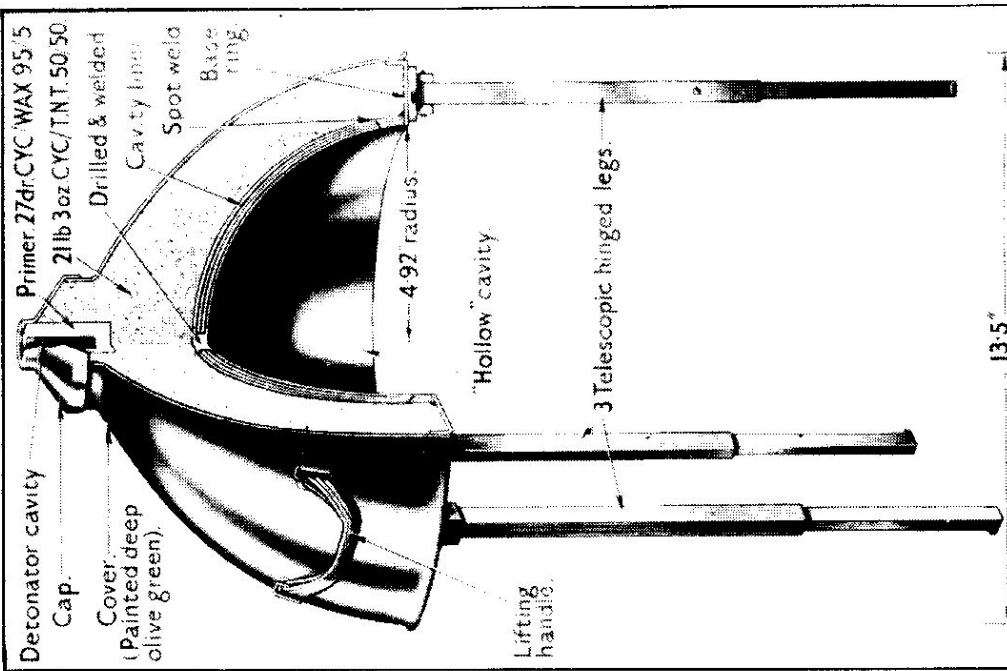


FIG. 9
13.5 Kg. Hollow Demolition Charge

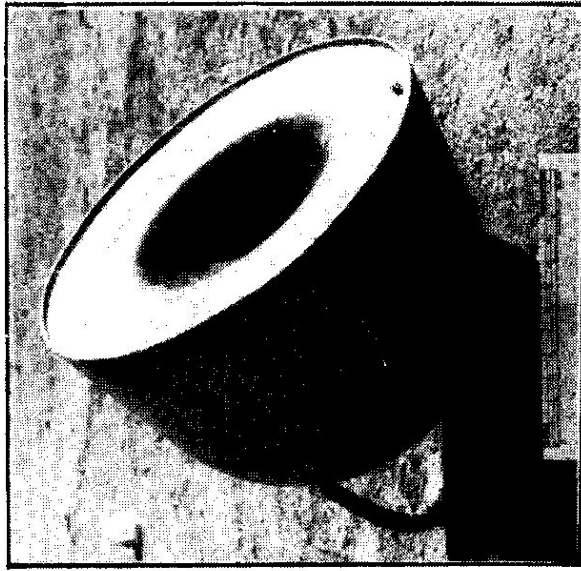


PLATE XXI

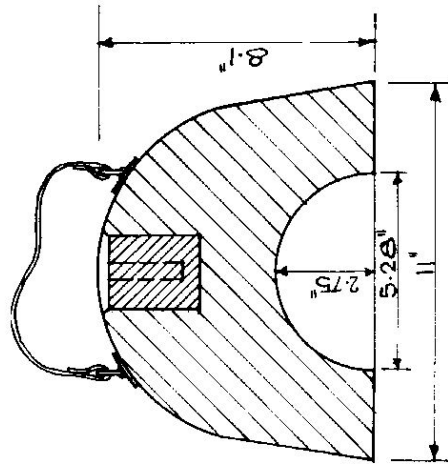


FIG. 10
12.5 Kg. Hollow Demolition Charge

12. 13.5 KG. HOLLOW DEMOLITION CHARGE.

This is a dome-shaped hollow charge, the body of which is 13.5" in diameter and 10.1" high and is shewn in Plates XIX and XX, and Fig.9.

It is provided with three telescopic folding legs (shewn in their three positions in the Plates). At the top is a protrusion containing the primer and standard detonator socket. There is a carrying strap on the side. The case is of thin low carbon mild steel, each sheet being $\frac{3}{64}$ " thick. The legs will extend from 8.5" to 13.5". The whole is painted olive green.

The explosive filling is 21 lbs. 3 ozs. of RDX/TNT (50/50): the primer is of RDX/wax and weighs $1\frac{7}{8}$ ozs.

Effect :- On armour plate with legs extended it will perforate a 9" thickness with a hole 1.5" by 3.15" and cause spalling over an area of $1\frac{1}{2}$ sq. ft.

It will perforate 3 to $3\frac{1}{2}$ ft. of heavily reinforced concrete with a hole 4 to 6 inches in diameter and cause damage over an area of 6 sq. ft.

13. 12.5 KG. HOLLOW DEMOLITION CHARGE.

This is shewn in Plate XXI and Fig.10. It is a dome-shaped hollow charge intended for use on armoured structures. It has a standard igniter socket with priming charge in the top and a carrying strap. It is part of the equipment used by airborne troops.

The case is of sheet iron painted olive green, and the explosive filling is T.N.T.

Effect:- According to the Germans, it is capable of piercing $2\frac{7}{8}$ " of armour plate and has perforated a $4\frac{3}{4}$ " thick steel dome with a hole 3.9" in diameter causing spalling on the inner face over an area of 24" diameter.

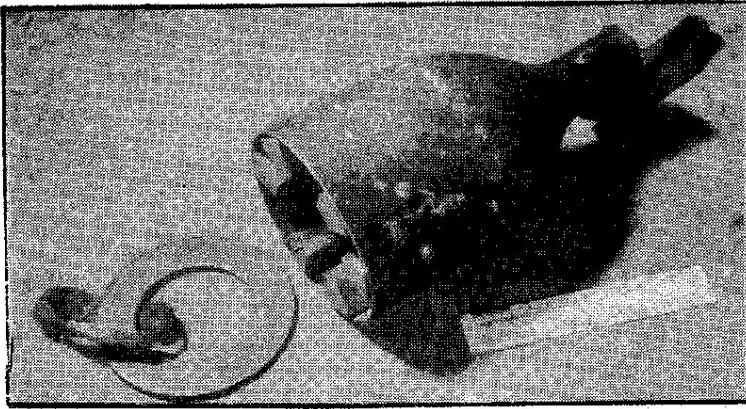


PLATE XXII
3.6 Kg. Charge

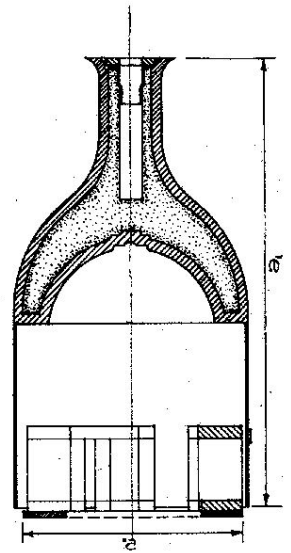


FIG. 11

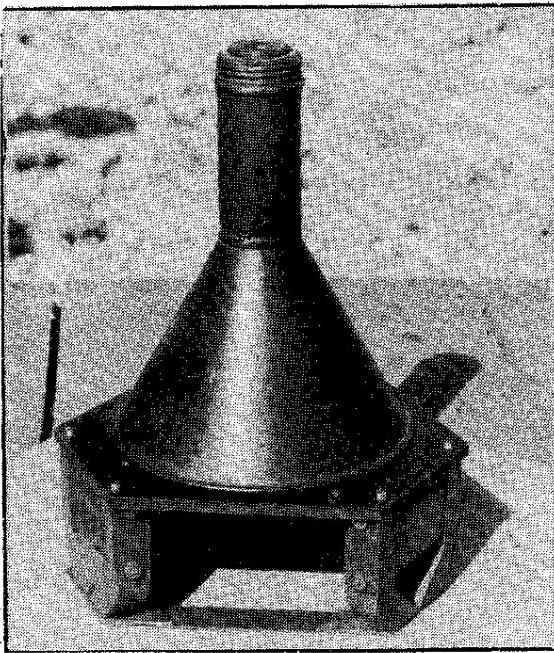


PLATE XXIII

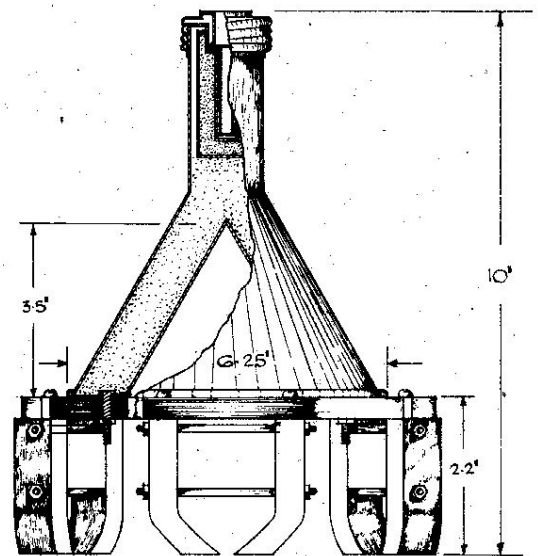


FIG. 12

3 Kg. Charge

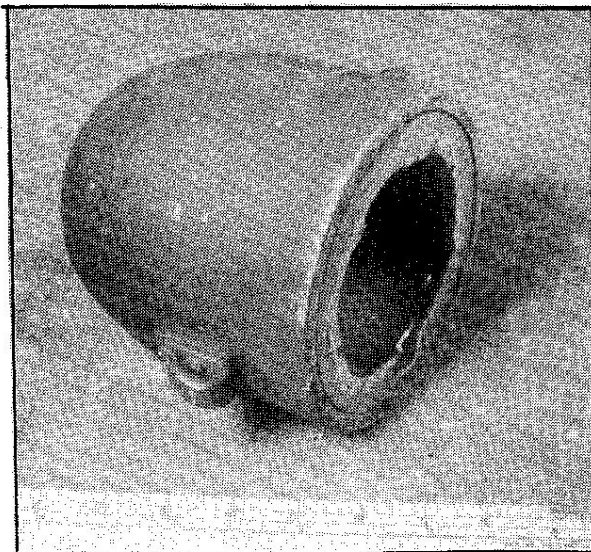


PLATE XXIV

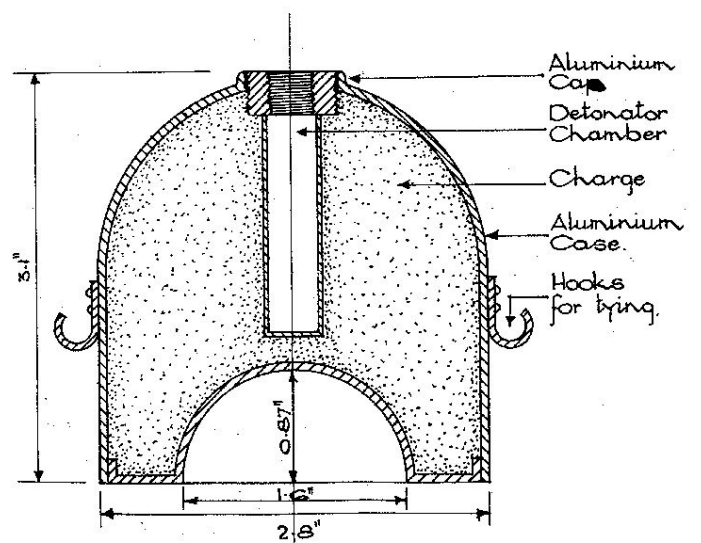


FIG. 13

400 Gm. Charge

14. 3.6 KG. MAGNETIC ANTI-TANK HOLLOW CHARGE.

Illustrated in Plate XXII and Fig.11, this charge has a $2\frac{1}{2}$ lb. T.N.T. charge and a total weight of 8 lbs. The magnets at the base will attach it to a steel surface so that the hollow charge is at a distance of $3\frac{3}{4}$ ". There is a standard detonator socket at the top with a priming charge.

The aluminium case is painted olive green.

Effect :- It will produce a $\frac{3}{4}$ " hole through 5/16" armour plate and cause 6" cracks. (Note. It should be capable of more than this).

15. 3 KG. MAGNETIC ANTI-TANK HOLLOW CHARGE - HAFT-HOHLADUNG 3 KG.

Plate XXIII and Fig.12 illustrate this charge which has a $1\frac{1}{2}$ lb. RDX/T.N.T. 50/50 filling in the cone and in the stem at the top. It is initiated by a $3\frac{1}{4}$ oz. P.E.T.N./wax primer. There is a standard igniter hole in the top.

Three magnets at the base, for which there is a thin steel keeper, act as legs and hold the charge on to a steel surface. If the surface is vertical the charge should be placed so that two legs are uppermost. The pull on the magnets can be over 30 lbs on a suitable surface.

The hollow is a 60 degree cone of base $4\frac{1}{4}$ " diameter.

Penetration of steel by this charge is not known: it will bore a hole of 20 to 27 inches depth in concrete or limestone.

16. 400 GM. HOLLOW CHARGE.

This hollow charge, shown in Plate XXIV and Fig.13, weighs 14 ozs., has an aluminium case with two attaching lugs. There is a standard detonator socket at the top. The charge consists of 12 ozs. of Penthrate.

Effect, placed direct on surface :-

Armoured plate	5/16" thick	produced	2" diameter perforation.
"	" 13/16"	"	" 1 $\frac{1}{2}$ " " "
(" " 3"	"	"	cavity $\frac{1}{4}$ " deep)
Volcanic rock,	-	no effect.	

17. 300 GM. HOLLOW CHARGE.

This is similar to the 400 Gm. charge except that it is smaller, being 3.5" high, 1.75" in diameter and weighing a total of 10 ozs.

This type was reported some time ago and has not appeared recently. Full details are not known.

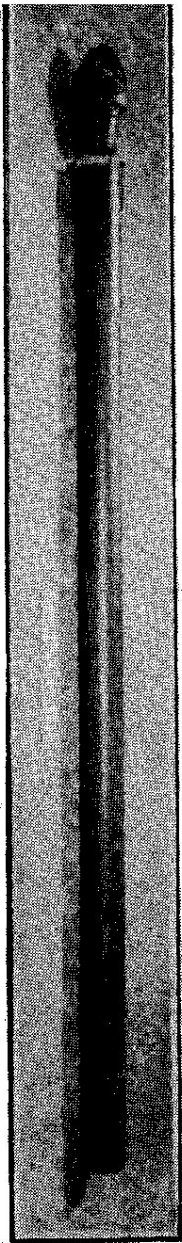


PLATE XXV
Bangalore Torpedo

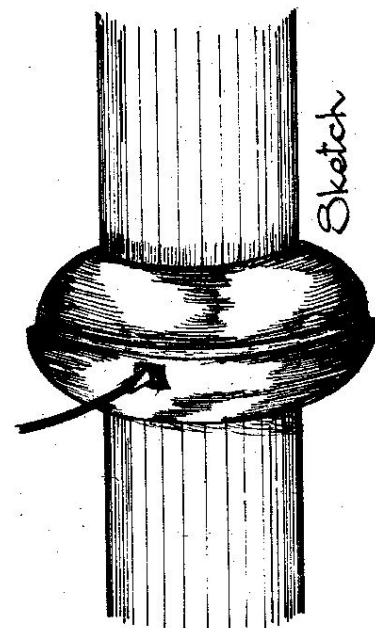
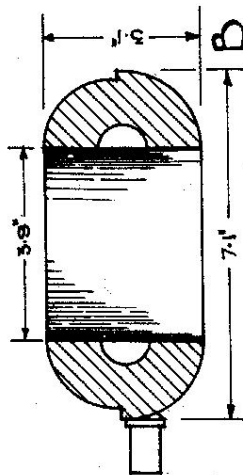
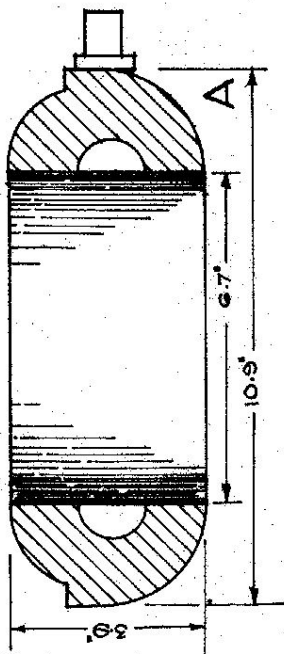


FIG. 14
Hollow Ring Charges
Hohlringladung

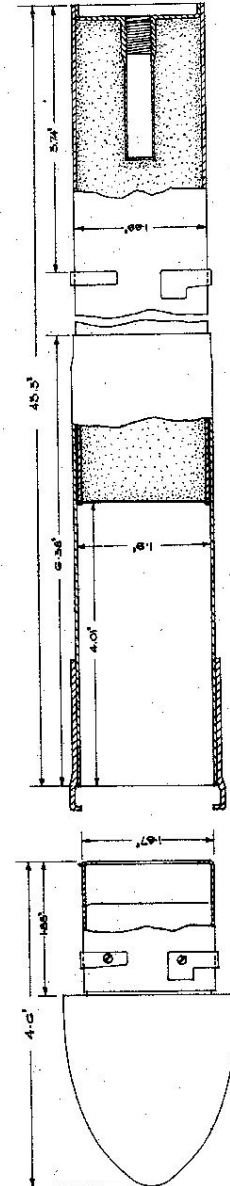


FIG. 15
Bangalore Torpedo. Type A
Rohrladung 3 Kg.

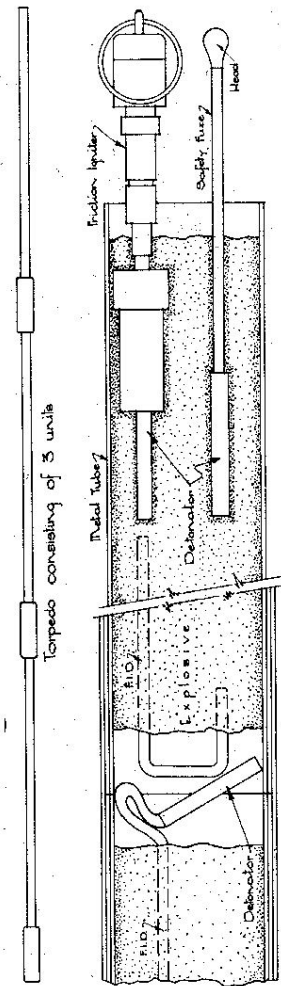


FIG. 16
Bangalore Torpedo. Type B

18. HOLLOW RING CHARGES - HOHLRINGLADUNG .

These charges are ring shaped with a convex outer face and concave (hollow) inner face of semi-circular cross-section. A standard detonator socket is provided on the outside.

Both charges are designed for offensive demolition of gun barrels, the smaller charge being for M.G's and A Tk guns and the larger one for field artillery. The sketch shows the method of use.

The effect is to cut off a barrel or to dent it so heavily as to make it useless. It is believed however that the use of this type of charge is discontinued in favour of the "Z" type, described on page 30, para 20.

- (a) The 3.2 Kg. Ring Charge, is illustrated at "A" in Fig.14. Its weight is 6 lbs. 7 ozs., internal diameter 6.7" and external diameter 11".
- (b) The 1.2 Kg. Ring Charge, is illustrated at "B" in Fig.14. Its weight is 2 lb. 7 ozs., its internal diameter 3.9" and external diameter 7.1".

19. BANGALORE TORPEDOES. - GESTRECKTE LADUNG

There are three types of these as follows :-

- (a) Standard Metal Tube, Type A - Rohrladung 3 KG.

This is shown in Plate XXV and Fig.15.

Length of Section	-	43.3 inches (less nose cap).
External Diameter	-	1.9 "
Total weight of Section	-	9 lbs. (including nose cap).
Weight of filling	-	6 lbs. 12 ozs. (3 Kg. T.N.T.)

It is made up of steel tubing 0.06" thick with a sleeve shrunk on to one end to form a socket for the adjoining unit. Junction is effected with a twisting motion by two metal clips fitting over two vertical lugs on the next section. Initiation takes place at the other end where there is a standard detonator socket. Sympathetic detonation is relied on for the detonation of adjoining sections of the torpedo other than the tail one.

Each section is supplied with a nose cap during transit but, except for the one on the front end of a torpedo, these are discarded.

- (b) Standard Metal Tube, Type B.

This type is made up in units of length 7 ft. to 7 ft. 6 ins., of 16 gauge steel pipe, diameter 2 ins., with a sleeve 1 ft. in length welded on to one end to form a socket for joining the next unit. It is shown in Fig.16.

Units are packed with explosive and a length of instantaneous fuze which runs the whole length of the tube.

Initiation takes place at one end by two methods, :-

- (i) Standard Safety Fuze Initiation Set.
- (ii) A 30 sec. delay length of safety fuze with a detonator at one end and a quick match head at the other.

Other sections have a detonator fitted to the end of the instantaneous fuze and the socket end of one section is probably tied to the detonator at the spigot end of the next section.

This type of Bangalore Torpedo has been reported as having been dropped with paratroops in the campaigns in Greece and Crete. Having a special end firing unit would appear to be the disadvantage of this type.

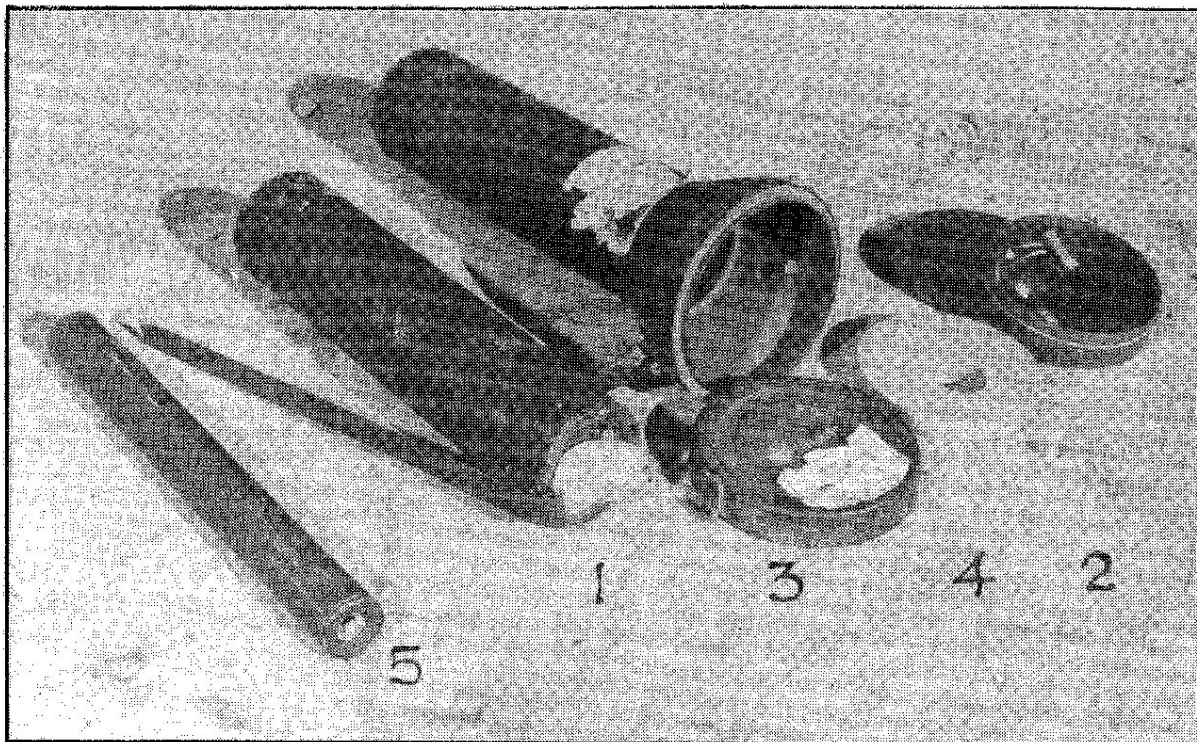


PLATE XXVI
 Demolition Cartridges Type Z
 Sprengpatrone Z

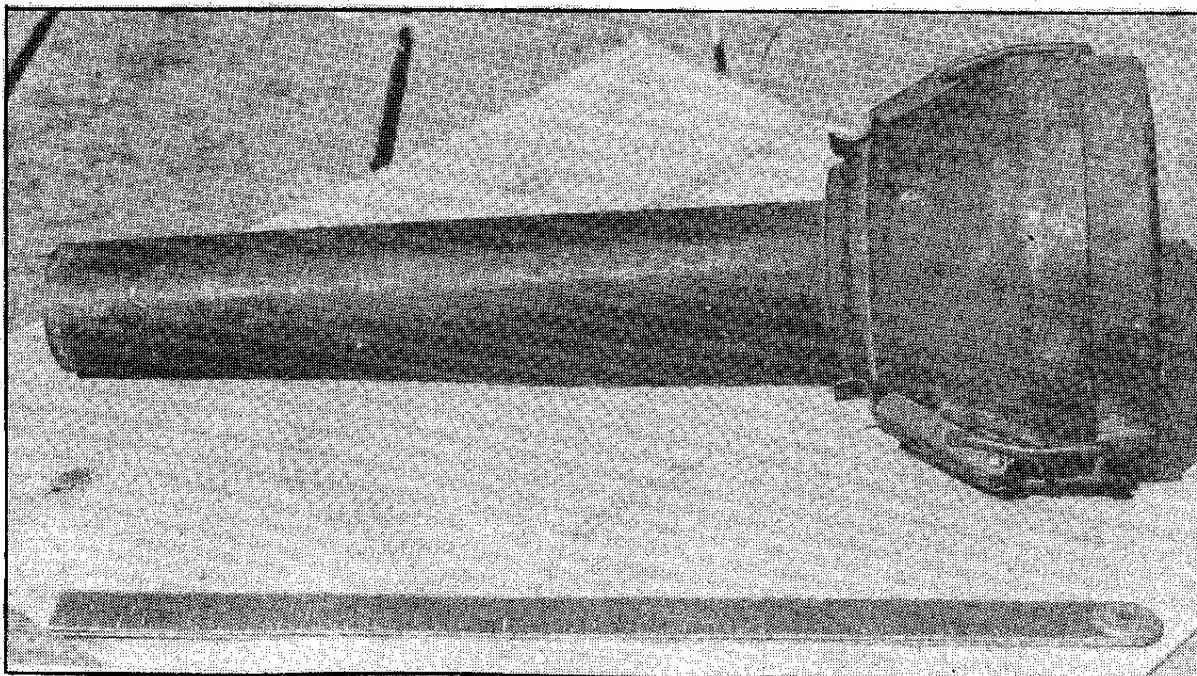


PLATE XXVII
 Z. 72

(c) Mobile Type - Ladungsschieber.

This is improvised from two wheels with an axle between. Several such trolleys are made or collected and spaced 5 yds. apart. The pipe of the bangalore torpedo is laid over the axles and made fast. To supplement this, 3 Kg. charges (geballte Ladung 3 Kg.) are placed on the pipe, two spaced between each axle. The normal length of the bangalore torpedo on wheels is 25 yds. and it clears a gap 4 to 6 yds. wide. It is towed for as far as possible before being pushed out into the minefield. In overgrown country the front trolley is replaced by skids.

(d) Improvised Types.

One such type consists of 15 to 20, 20 gm. slabs (Sprengkörper 28) placed end to end and wired to a wooden plank, the end slab being fitted with a standard safety fuze igniter set. Other improvisations include the use of piping.

20. DEMOLITION CARTRIDGES, TYPE Z - SPRENGPATRONE Z

A series of special charges have been introduced by the Germans for the hasty destruction of guns. The present range is Z 34, 48, 72, 85, 102 and 120 - the number denoting the diameter of the charge in millimetres. Plates XXVI and XXVII shew a standard Z 72 set which consists of the cylindrical H.E. charge (1) and a round flat tin (2) containing an igniter set with spare igniter, and a light metal airtight container (3). The charge fits into the further (smaller) end of the case and is separated from the igniter set by the wooden block (4).

By contrast a Z 34 Charge (5) is also shewn.

The following table lists the various types of Z cartridges in use, with the weapons for which they have been designed and their distinctive markings.

German designation (abbreviation below)	Application	Gross Weight lbs.	Container Markings.
(a) Sprengpatrone Z.34 (b) Spr. Patr. Z.34	3.7 cm. Pak and Flak.Guns up to 4.7 cm., Mobile guns under 10 cm., 5 cm. and 8cm mortars.	0.77	I VI d C 985
(a) Sprengpatrone Z.48 (b) Spr. Patr. Z.48	5 cm. Pak, Flak and Kw.K. Guns up to 7.2 cm.	1.01	I VI d C 986
(a) Sprengpatrone Z.72 (b) Spr. Patr. Z.72	All 7.5 cm. and 7.62 cm. guns 10 cm. and 10.5 cm. howitzers. 10,15,21,28/32 and 30 cm. smoke mortars, light and heavy spigot mortars.	4.10	I VI d C 987
(a) Sprengpatrone Z.85 (b) Spr. Patr. Z.85	8.8 cm. Pak, Flak and Kw.K. Guns up to 10 cm.	7.76	I VI d 988
(a) Sprengpatrone Z.102 (b) Spr. Patr. Z.102	10.5 cm. fd. guns and Flak Guns up to 12 cm.	13.85	I VI d 989
(a) Sprengpatrone Z.120 (b) Spr. Patr. Z.120	All equipment from 12 cm. to 15.5 cm.	-	I VI d 990
(a) Sprengpatrone Z.150 (b) Spr. Patr. Z.150 (a) Sprengpatrone Z.370 (b) Spr. Patr. Z.370	Equipment over 15.5 cm.	-	-

Additional Z charge cartridges are being produced and include sizes 10, 15, 21, 28/32 and 30 cm. for smoke mortars, light and heavy spigot mortars and weapons over 15.5 cm.

The Z type charge has a 100 gm. demolition charge (Bohrpatrone 28) embedded at one end of the H.E. filling, in such a way that the detonator socket is exposed. Hinged to the top end of the charge is a long metal strip which lies along its length but can be unfolded to push the charge into place.

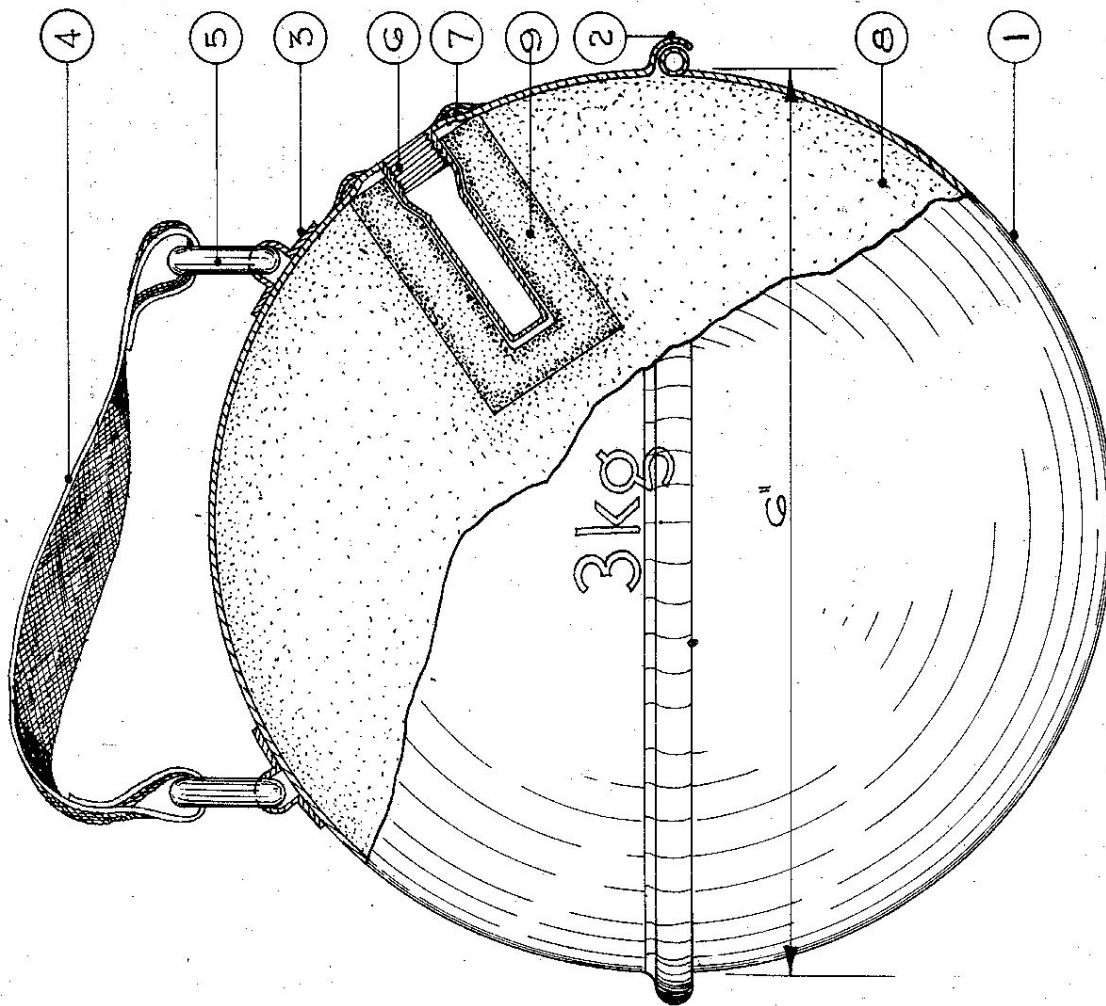


FIG. 17
3 Kg. Ball Charge

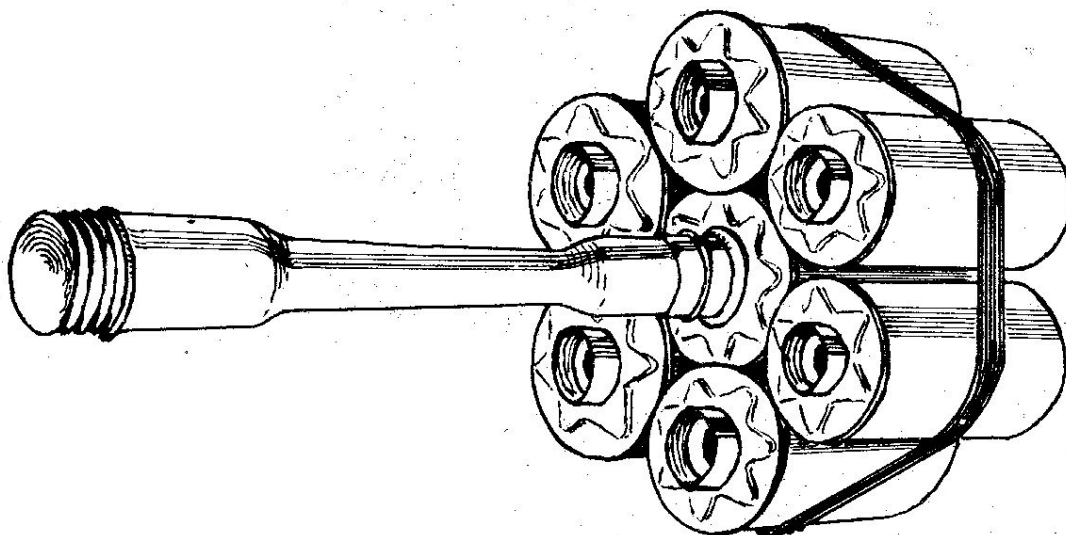


FIG. 18
Grenade Charge
Geballte Ladung

The igniter set has a No.8 detonator (in a bakelite holder) with a safety cap which is fired through 1 metre of safety fuze (burning time 100 secs.). To the other end of the safety fuze is attached a brass adaptor into which a ZDSCHN. ANZ 29 (or 39) friction igniter is screwed. To demolish a gun, the breech is opened and the Z cartridge inserted as far as possible into the chamber by means of the hinged bar. The Z cartridge can also be introduced from the muzzle, e.g., with mortars. In demolishing vehicles, the Z cartridge should be attached to the crank case; in ammunition dumps it should be fixed to a shell, adjacent to the fuze or gaine, and inserted into the middle of the dump.

21. 3 KG. BALL CHARGE.

The body of the charge, shewn in Fig.17, is spherical in shape, and is painted drab green, with single marking "3 Kg" stencilled on its side in white paint. Its particular use is not known.

It is constructed in two hemi-spherical sections of 3/64" pressed mild steel seamed together by the rolled joint (2) and is 16 cm. in diameter.

Welded to the top half of the body are two securing lugs (3) to which are attached the two ends of the 1" wide canvas carrying strap (4) by means of the two swivelling bands (5).

The detonator pocket (6), which is tapped internally to take any of the standard German igniters, is secured by the light soldering (7) of the flanged head to the outer surface of the charge body.

The main filling (8) is Amatol, with a small Penthrite pellet (9) which surrounds the detonator pocket.

The weight of the main filling, including the Penthrite pellet, is 5.6 lbs. (The dimensions and weight of the Penthrite pellet are not at present available, owing to the steaming out of the charge).

22. POLE CHARGE - STANGENLADUNG

The Pole Charge is used by Assault Engineers for attacking pillboxes, fortified positions and A.F.V's. It consists of a number of standard explosive slabs fastened to a small board at the end of a long pole and provided with an initiating device using a detonator igniter set. One source mentioned the use of electrical initiation. This may, however, be an exception to the general rule.

The total weight of the explosive used is probably 1 - 4 kg. made up of standard picric or T.N.T. slabs.

23. GRENADE CHARGE - GEBALLTE LADUNG

This charge is used primarily against A.F.V's. but may also be used for attacking pillboxes in the same way as the Pole Charge. It consists of the heads of six standard stick grenades bound firmly round a central grenade. Initiation probably takes place in the normal way by a friction igniter in the handle of the central grenade. It is illustrated in Fig.18.

RAILWAY TRACK DESTROYER

PLATE XXVIII
Shewing Hook in
raised position

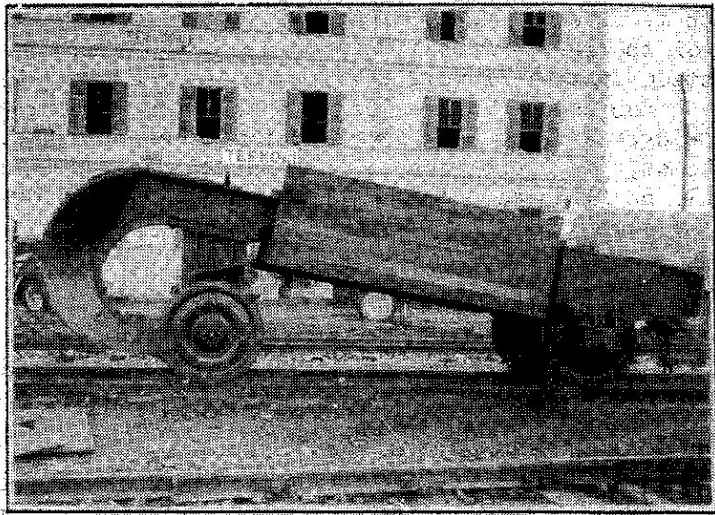


PLATE XXIX
Shewing Chutes

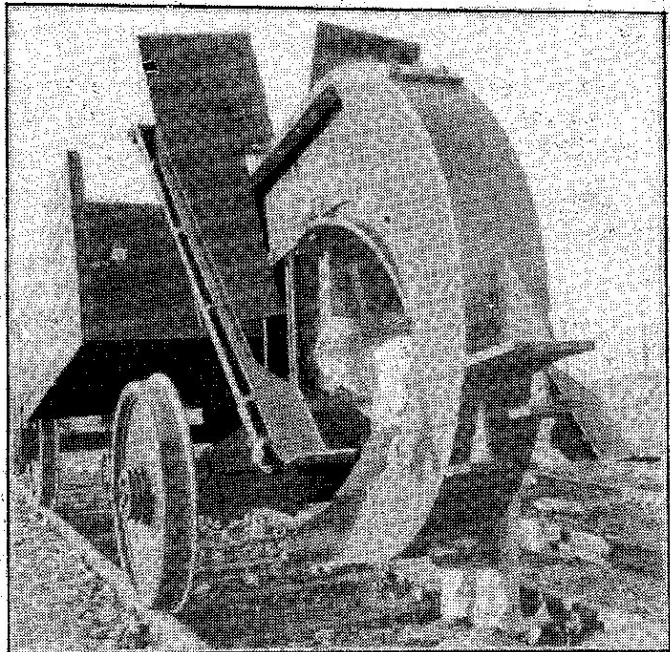
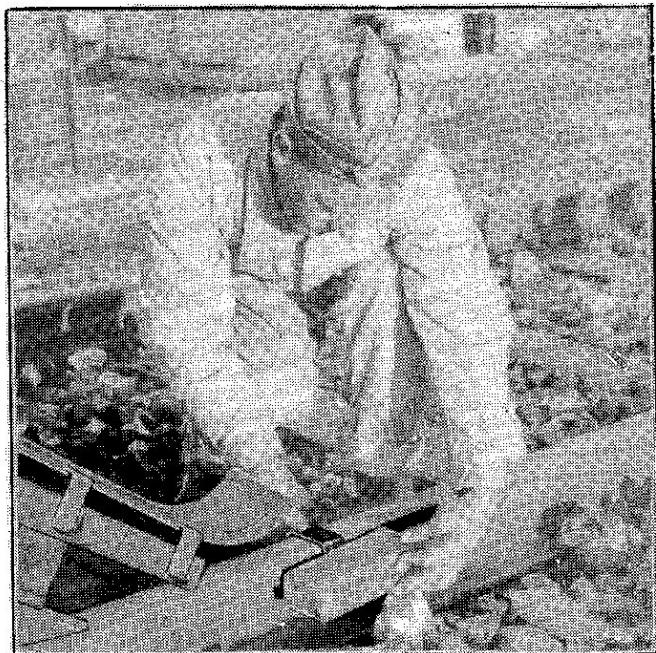


PLATE XXX
Shewing Charge attached
to Rail



PART IV - MISCELLANEOUS EQUIPMENT

24. RAILWAY TRACK DESTROYER.

This equipment consists principally of a specially shaped hook mounted on the rear two wheeled axle of a special four-wheeled chassis with a timber body, two chutes and protection shields.

It destroys sleepers, severs rails into various lengths and scarifies the ballast, with the minimum of salvageable material remaining, thus necessitating the complete reconstruction of the track.

Points and cross-overs are probably an effective obstacle to the hook.

Description.

(a) The Hook.

The truck and hook weigh approximately 10 tons. In Plate XXVIII the hook is shown in the raised position mounted above the rear axle. The blade appears to be a continuation of a R.S.J. approximately 16 ins. deep which has been bent through 180 degrees with the lower flange removed and the web cut to a shape to form the knife. Gusset plates have been welded between the upper flange and the bottom of the web and on each side of it. The edge of the knife is the thickness of the web.

(b) Chute.

On each side of the hook is a charge feeder, which rests on the rail as shown in Plate XXIX. This chute has a quick release stud permitting it to be jettisoned should a charge become stuck on it with the fuze ignited.

(c) Charge.

Each is a 1 Kg. (2.2 lb.) charge which is initiated by safety fuze 20 cm. in length having a 20 second delay after ignition of the fuze. The charge box has a spring clip on one side, which holds it on to the side of the rail, as shown in Plate XXX. The charge slides down the chute, the shield at the bottom preventing it jumping off the rail, and clips on to the rail.

Operation.

When not in use the hook travels on a flat. When in use a train is made up of the following: locomotive, flat, closed goods truck for explosives, closed goods truck for personnel, and the hook truck. For hasty demolitions the charges only are used. If the hook is to be used, two or three sleepers must be removed and a hole dug deep enough to accommodate the hook when it is lowered. Jacks are then placed beneath the three projecting brackets on the back of the hook, and the intermediate support resting on the rear axle is removed. The axle is then brought back sufficiently for the hook to be lowered on to the axle seating and bolted; the hook is now in the hole. The locomotive is then started with sand under the wheels and the hook moves forward. The angle of the under surface of the hook to the ground forces the sleepers and rails upwards until the back wheels of the equipment overcome the upward force of the hook; at this stage the hook shears the sleepers. The truck moves at a speed of 9.4 m.p.h. At this speed the charges with 20 second delay will detonate 55 yds. behind the truck.

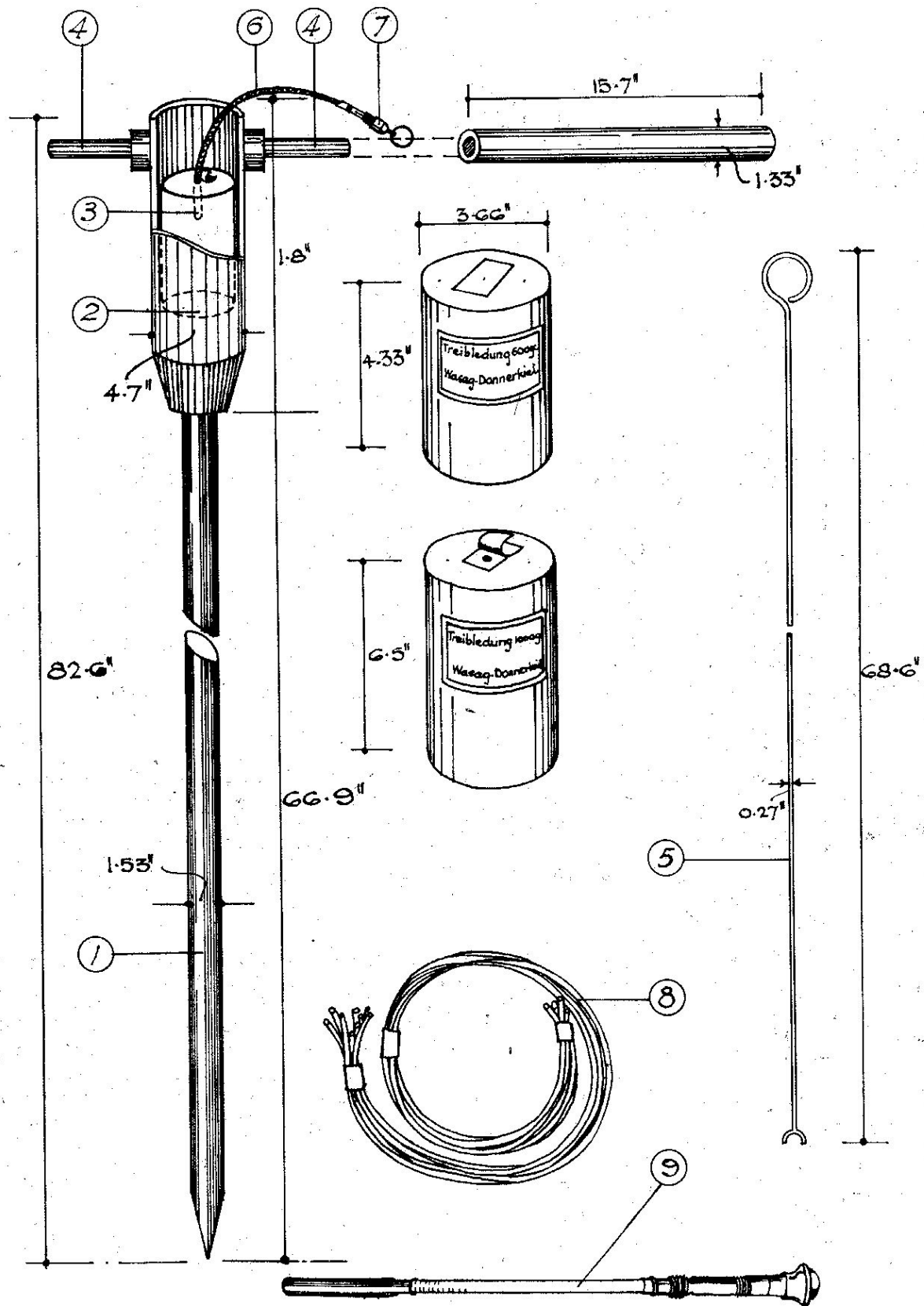


FIG. 19
German Blast Drive Rod
Donnerkeil

Description.

This equipment, shown in Fig.19, is intended to be used to produce rapidly small diameter vertical holes in the ground suitable for use in erecting telegraph poles or similar supports. The complete equipment, weighing 32 Kg., consists of :-

- (a) The drive rod.
- (b) Two tubular hand levers.
- (c) A long thin steel rod.
- (d) The propellant charge, safety fuze and igniter.
- (e) Detonating fuze with prepared igniter.

The drive rod (1) is made of steel and has attached to its upper end the cylindrical pot or firing chamber (2) which accommodates the propelling charge (3). Two hand levers made of tubular steel and each weighing approximately 1 Kg., fit on to the two projections (4) situated near the top of the pot.

One end of the thin steel rod (5) is forked and the other is provided with a loop.

The propelling charge, cylindrical in shape, consists of 1.1 Kg. of black powder. A smaller charge of the same diameter but shorter and weighing only .66 Kg. is also included in the outfit.

The safety fuze provided for the ignition of the propelling charge consists of a length of 12" of fuze (6), fitted to a friction igniter (7) ZDSCHN. ANZ 29 (or 39). The time of burning of the fuze is approximately 30 seconds.

Seven 5 ft. lengths of detonating fuze (8) are bound together in three places to form the explosive charge, the total weight of which is 0.3 Kg. For firing this charge a prepared detonator (9) is provided, consisting of a No.8 detonator fitting to 6" of safety fuze (burning time 15 secs.) and provided with a friction igniter ZDSCHN. ANZ 39.

Operation.

The drive rod is set vertically over the spot where the hole is desired and pushed in by hand till securely held. The propelling charge is inserted in the pot - the large one for hard ground and the smaller one for softer ground,- and the end of the 12" length of safety fuze inserted in the hole in the charge. On pulling the friction igniter the charge is ignited after about 30 secs. and the drive rod is driven into the ground.

The lever rods are now pushed over the projections on the spot and the rod manoeuvred till the drive rod is free and can be withdrawn. Using the steel rod with the fork end placed in the binding near one of the bundle of detonating fuze the latter is pushed into the hole made by the driving rod. Sufficient fuze is left at the surface of the ground to enable the prepared detonator to be attached to it. The detonating fuze is then fired through the 15 sec. delay safety fuze with the result that the hole is widened to sufficient diameter to take a telegraph pole.

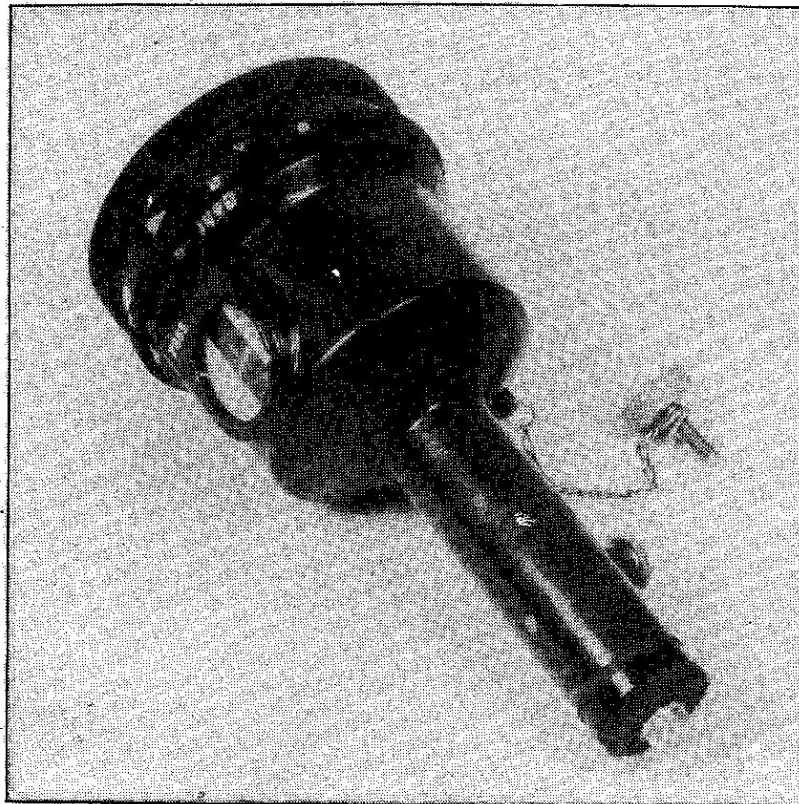


PLATE XXXI
Clockwork Long Delay Igniter
J-Feder

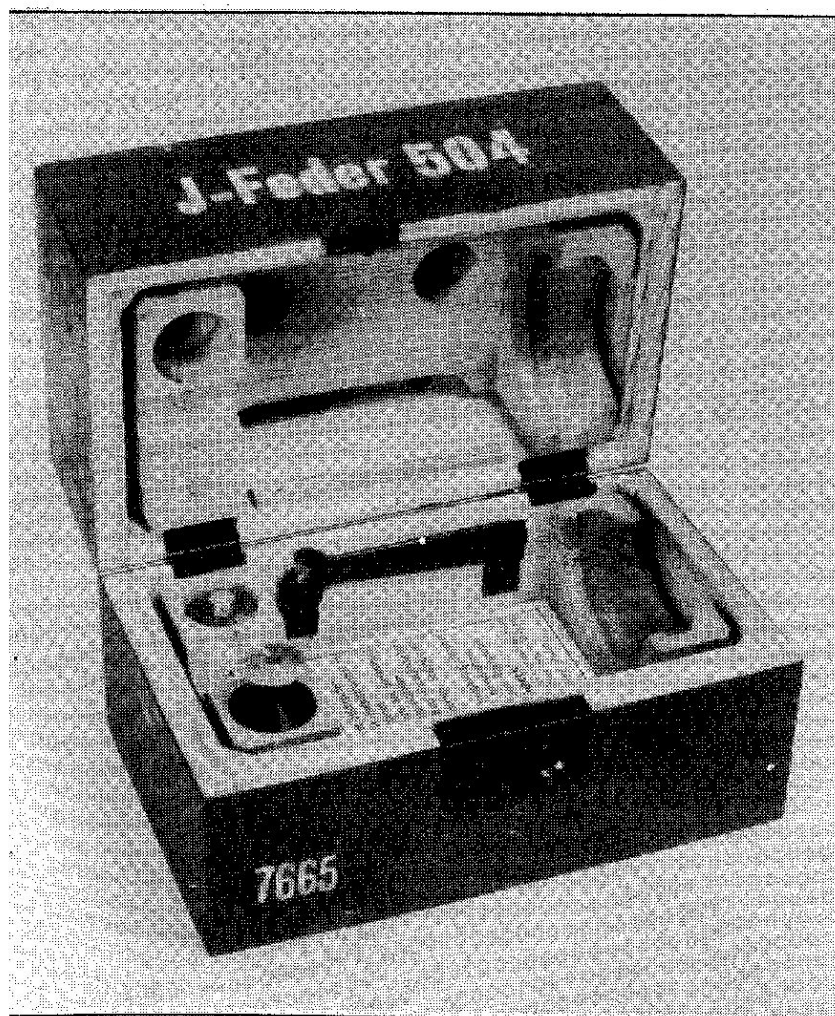


PLATE XXXII
Carrying Case for Clockwork Long Delay Igniter

26. CLOCKWORK LONG DELAY IGNITER - J-FEDER 504.

Description.

This fuze is shown in Plate XXXI and Fig. 20 and is designed to fire after any delay, between $\frac{1}{4}$ hr. and 21 days. It consists of a clockwork mechanism in the top and a spring loaded striker in the stem. By removing the cap (1), the clock is wound up by turning the milled wheel inside. The time of delay is set by turning the small milled knob (3) which turns two drums (4&5) visible through the window (6), relative to the pointer (7) which rests against them. The top drum (4) has graduations and figures marked in red giving the number of days (Tage) of delay, while the lower drum (5) has marked in black figures and graduations (of ten minute intervals) the number of hours and portions of hours delay (in excess of the exact number of days). To set the delay, turn the knob till the appropriate number of days and of hours are against the pointer. The knob should only be turned clockwise.

A safety device consists of a sprung detent (8) which remains the spring cotter of the striker unless the long screw plug (9) marked "SCHARF" is screwed into a hole (10) in the stem of the fuze. When the fuze is not in use, this hole is sealed by a short screw plug marked "Blind" (11).

The device should be tested before use by putting into operation a short delay, having first removed the cap holder. After the clock is reset the striker is recocked by use of the accessory (12) which is screwed into the base in place of the cap holder.

Operation.

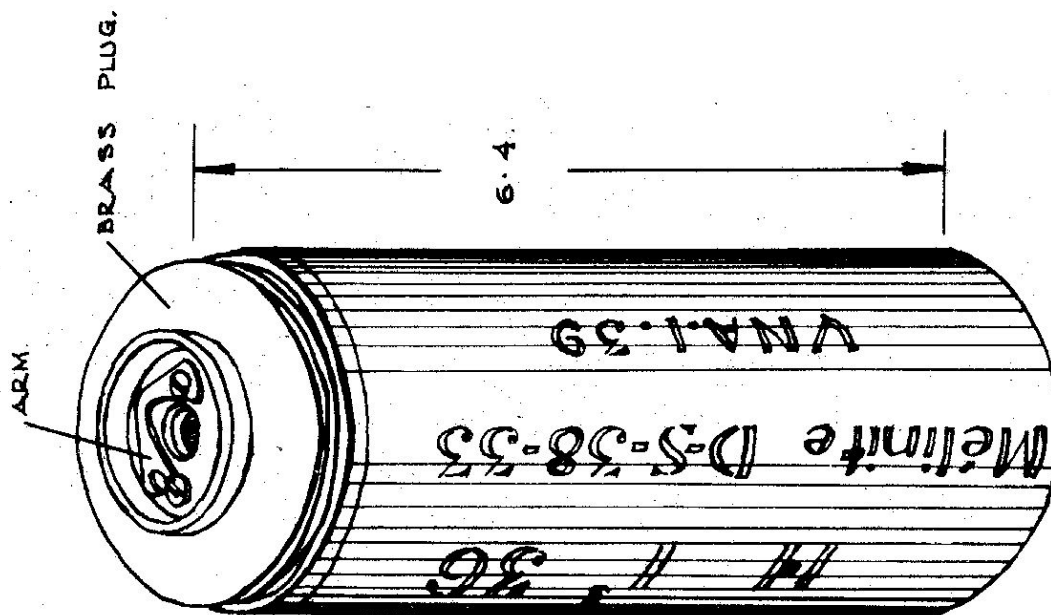
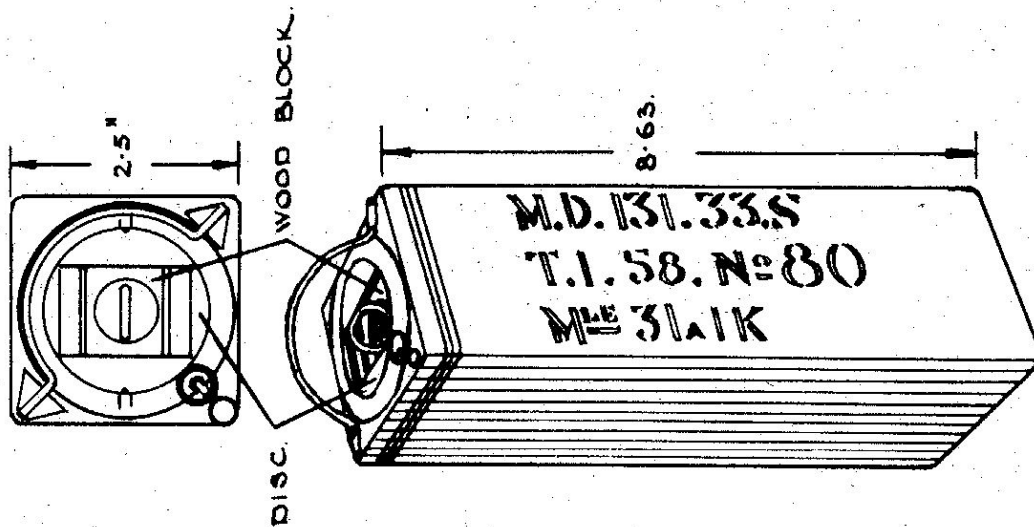
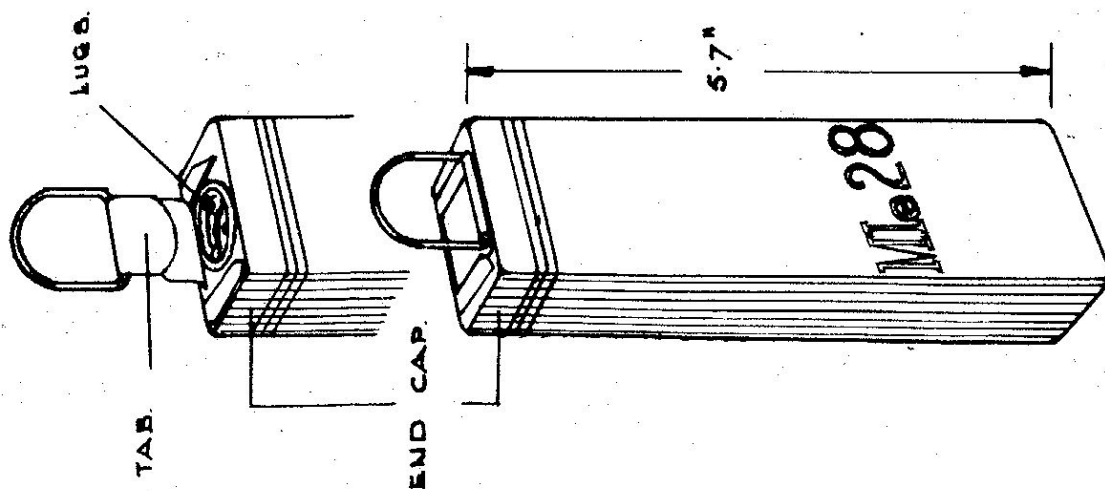
The clock is started by turning the milled ring (13) so that the red mark on it moves from in between the two white marks (labelled "Steht"- stop) to a position in between the red marks (labelled "Geht"- go).

At the end of the delay period both drums will have rotated back to Zero where there are slots into which the pointer falls, thus releasing the trip (14) on the striker (15). The latter fires a cap (16) in the holder which may be removed by the special spanner (17). The bottom of the cap holder is fitted with a standard screw thread.

The spring fitted case is shown in Plate XXXII.

27. CAMOUFLET EQUIPMENT.

A captured document states that camouflet equipment (Minenkammer-Sprenggerät) is being issued for road cratering and other purposes on a scale of two sets per light Engineer Column. Apart from the weight, which is 40 Kg. -(88 lbs.) no more is at present known of this.



PART V - FRENCH DEMOLITION CHARGES.

Since the Germans may be expected to use French charges, the following brief details are given.

28. 135 GM. CHARGE - MODEL 28.

Illustrated in Fig.21, this consists of a brass case heavily tinned and filled with melinite. The lower portion of the filling is cast while the upper part is powder. The end cap is soldered on after filling and has a soldered tab with loop. When the tab is torn off it reveals, below, the recess for the detonator. Three metal projections are provided for securing the detonator in place after it has been inserted. This demolition charge was formerly known as the "cavalry petard".

29. 1 KG. CHARGE - MODEL 31A.

The body of the container, shewn in Fig.22, is made of sheet brass which is shaped on a former and brazed longitudinally down the middle of one side. A carrying handle is provided. A recess in the centre of the charge $7\frac{1}{2}$ " deep and 1" by 1.38" cross-section is fitted with a rectangular wooden block 5.7" long below which is a second perforated block 1.5" long. In use the upper block is removed and a charge Model 28 is inserted, which acts as a primer for the larger charge.

In the head of this charge is a circular disc with a rectangular aperture having the same dimensions as the section of Model 28. When this disc is rotated so that the aperture coincides with the recess in the charge, the smaller prepared charge can be inserted and by turning the disc, the smaller charge is locked in position. The filling consists of cast picric powder primer round the detonator tube. The total weight is 3 lb.

30. LARGE CYLINDRICAL CHARGE.

This charge, shewn in Fig.23, consists of a brass case approximately 1 mm. thick filled with melinite. The total weight is 24 lbs. The top is closed by means of a threaded brass plug and has a recess for the detonator. This latter is held in place by means of the arm which pivots about the round-headed screw and is locked by the clamping screw.

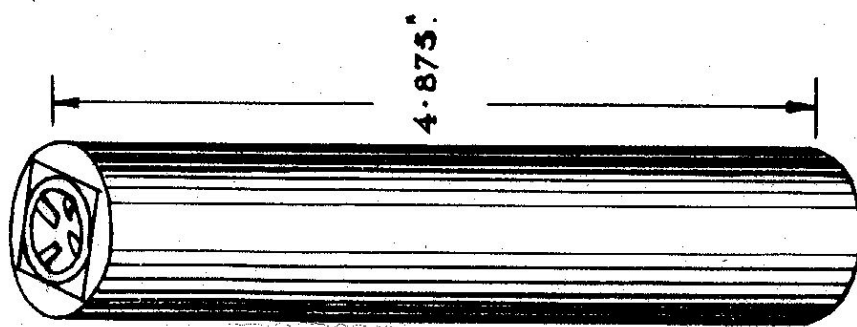


FIG. 24
Small Cylindrical Charge

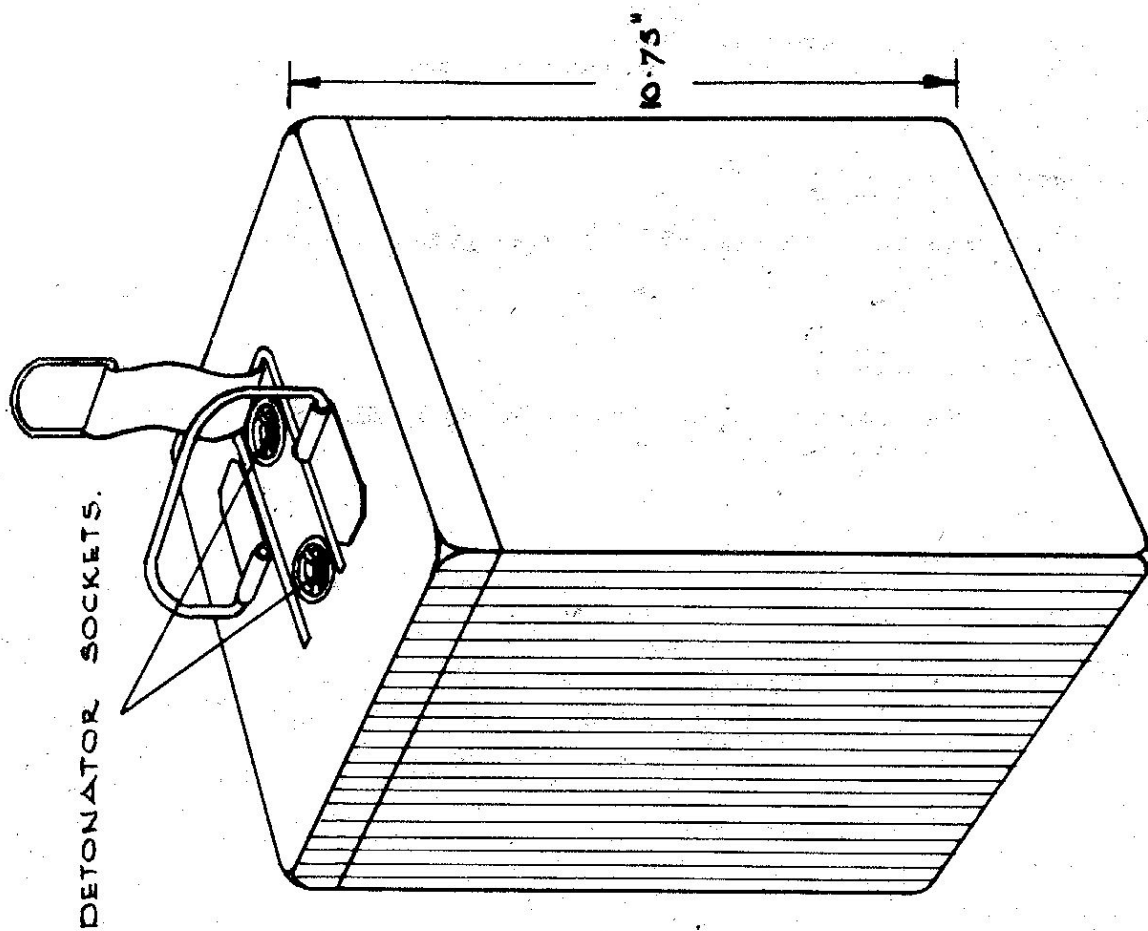


FIG. 25
10 Kg. Charge. Model 29

31. SMALL CYLINDRICAL CHARGE - MODEL 29.

This charge, shown in Fig. 24, consists of a brass case filled with melinite with a total weight of 100 gms. (3.25 ozs.). The end cap, which is soldered on after filling, has a soldered tab with loop. When the tab is torn off it reveals the recess for the detonator. Three metal projections are provided for securing the detonator in place after it has been inserted.

32. 1 KG. CHARGE - MODEL 29.

This charge is of the same type of construction as the 135 gm. Model 28.

33. 10 KG CHARGE - MODEL 29.

This charge, shown in Fig. 25, has a carrying handle and recesses for two detonators. The total weight is 33 lbs.

34. 20 KG. CHARGE.

Dimensions

Length	-	1 ft. 6.5 in.
Breadth	-	6.625 in.
Thickness	-	6.625 in.
Total Weight	-	56 lbs.

Further details are not known.

NOTE : The size of the detonator hole is not standard, but it may be said that British and American Detonators cannot be used, except perhaps, with some of the larger holes.

APPENDIX "A"

GLOSSARY OF GERMAN TERMS

<u>German Terms.</u>	<u>Abbreviations.</u>	<u>Definition.</u>
Ablage	ABL.	Depot; dump (on map)
Abwurfkiste		Hollow demolition charge dropping container.
Abzugsvorrichtung	ABZ. YORR.	Firing Mechanism; trigger mechanism
Alarm	A.	Alarm
Ampulle	AMP.	Ampoule
Amsol	AN	Trinitro-Anisole
Anschlussleitung	A.L.	Connecting circuit
Antungsladung	A.L.	Initial charge (blasting)
Apparat	App.	Apparatus; device; equipment
Attrappe	ATTR.	Dummy
Aufschlag	A.	Impact
Aufschlagzunder		Percussion fuze
Aufschlagzunder mit Verzögerung	Az.M.V.	Percussion fuze with delayed action
Ausbildung	A.	Training
Behelfsmässig	BEH.	Emergency; hasty; makeshift
Belastung	BEL.	Load; charge
Blindgänger	BL.	Dud
Bodenzunder	Bd.Z.	Base percussion fuze; base detonator
Bohrpatrone	BHR. PTR.	Blasting cartridge; explosive cartridge
Brennlange	BRLG.	Time of burning; fuze setting
Brennzunder	BZ.	Time fuze
Brisanz	BRIS.	High explosive
Brücke	B.	Bridge (on map)
Brückenzünder	B.	Wire bridge detonator
Buchse	B.	Rifle
Donarit	D.	Donarite (explosive)
Donnerkeil	D.K.	Blast driving rod
Dynamit		Dynamite
Eierhandgranate	EIHGR.	Egg-shaped hand grenade
Empfindlich	E.	Sensitive; instantaneous (fuze)
Empfindlich Zunder	E.Z.	Instantaneous fuze
Ersatzrohrenpulver	ERP.	Substitute tubular powder
Frei Angelegt	FR.	Blasting charge attached to outside
Fullpulver	Fp.	Powder charge
Geballte Ladung		Grenade charge; 3 Kg. charge
Geht		Go
Gestreckte Ladung		Bangalore Torpedo
Glühzündapparat		Field Exploder
Glühzunder mit Verzögerung		Delay electric detonator
Haft Hohlladung		Magnetic Anti-Tank hollow charge
Hohlladung		Hollow charge
Hohlringladung		Hollow Ring charge
J-Feder		Clockwork Long Delay Igniter
Kaltklebekitt	KAT.39	Adhesive Paste
Knallzündschnur		Detonating fuze
Körper		Blasting
Ladung	L.	Charge; propelling charge; load
Ladung Schieber		Mobile type Bangalore Torpedo
Lange Brennlange	l.b.	Long burning action (fuze)
Leitung		Electric cable
Leitungsprüfer		Continuity Tester

<u>German Terms.</u>	<u>Abbreviations.</u>	<u>Definition.</u>
Melinit	MEL.	Melinite (explosive)
Minenkammer-Sprenggerät		Camouflet Equipment
Mit Verzögerung	M. V.	With delay action (fuze)
Nebel Brennzunder		Nb.BZ 38 Igniter
Nebelwerfer		Rocket Equipment
Nitrozellulose	Nz.	Nitro-cellulose
Patrone	P.	Cartridge
Pionier Sprengmittel	PiSpr.M.	Explosives used by combat engineers
Prüfgerät		Neon Lamp
Prüfzunder		Test Igniters
Pulver	P.	Powder
Rohrladung		Bangalore Torpedo metal tube
Scheissbaumwolle	S.	Gun cotton
Spaltzunder		Spark gap detonator
Spreng	Sp.	Explosive
Sprengbüchse	Spr.B.	Blasting charge
Sprengkabel	Spr.KAB.*	Blasting ignition cable
Sprengkapsel	Spr.Kps.	Detonating cap
Sprengkapselzunder	Spr.Kps.ZD.	Detonator Igniter Set
Sprengkörper	Spr.K.	Blasting charge
Sprengpatrone		Demolition Cartridges
Sprengzunder		Safety fuze initiation set
Stangenladung		Fole Charge
Steht		Stop
Stiel handgranate	STIELHGR	Stick hand grenade (potato masher)
Stuck Glühzunder		Electric Detonator
Treibladung	TR.LDG.	Propelling charge
Übertragungskörper		Primers
Verdammt	VERDT.	Tamping (explosive charge)
Verzögerungszunder	VERZ.Z.	Delayed action fuze
Vorschaltwiderstand		Test Resistance
Wurfelpulver	W.P.	Flaked powder (explosive)
Zeitzunder	ZtZ.	Time fuze
Zeitzündschmur		Safety fuze
Zertrümmerung	ZERTR.	Demolition; destruction
Zunder	Z.	Fuze; detonator
Zunder mit Verzögerung	Z.mv.	Delayed action fuze
Zunderhalter		Detonator holder
Zunderwerke		Firing mechanism
Zündgerät Tragbar		Portable Demolition Kit
Zündhütchen	ZDHT.	Primer; percussion cap
Zündladung M.		Pyrotechnic Igniters
Zündschmur	ZDSCHN.	Fuze
Zündschnuranzunder	ZDSCHN.ANZ.	Igniter
Zündübertragung		Blast effect
Zwischenladung	Z.L.	Intermediate blasting charge