ROYAL ENGINEER'S

DEMOLITIONS HANDBOOK

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1. The final policy on the types of explosives stores to be manufactured and issued in future has not yet been decided. To tide over the period when these will not be available and to use up existing stocks, an interim policy has been produced as follows :—

(*a*) The only explosives to be issued from UK for training and operations will be:—

PE 2
852
GC Slabs
TNT Slabs (for BAOR only)

(*b*) PE 2 will be the normal WET (War Equipment Tables) issue for plastic requirements.

(*c*) 852 will be the WET issue in tropical climates.

(*d*) Amatol, however, will be available for training expedients.

2. This publication contains a complete summary of the approved demolition technique, much of which is not available in ME, Vol IV, Part I, 1942. It has therefore been decided not to hold up printing and issue in order to make the necessary alterations to the explosive scales. As the publication is loose leaf, the amendments can be made later when the new scales are decided.

FOREWORD

1. This pocket book is based upon the Manual of Military Engineering, Volume IV, Part I—Demolitions, 1942, and is designed to be carried by Officers and NCOs actually engaged in demolition operations or in training.

2. Where the information given in this pocket book differs from that in the Manual, the information contained in the pocket book should be taken as correct.

3. This pocket book is intended to be bound in the green binder issued for Royal Engineers Pocket Book, 1936, together with others in this series which are :—

RESPB No. 1 —General (proposed)
,, No. 1A—Conversion Tables (published)
,, No. 3 —Bridging (published)
,, No. 4 —Demolitions (published)
,, No. 5A—Roads (published)
,, No. 5B—Airfields (proposed)
,, No. 5C—Earth moving and road and airfield constructional plant (proposed)
,, No. 6 —Water Supply (proposed)
,, No. 7 —Accommodation (proposed)

DEMOLITIONS

CHAPTER 1

DEMOLITION PROCEDURE

SECTION 1.—GENERAL

1. The technical aspect of demolition procedure is discussed in Military Engineering, Vol IV, Part I, Demolitions, and the tactical aspect in connection with withdrawal in Military Training Pamphlet No. 4.

Demolitions must be considered under two headings, Preliminary and Deferred, depending on whether they are blown as soon as prepared, or later, on the orders of the commander concerned.

(*a*) *Preliminary demolitions* are normally blown as soon as they are prepared. A very large proportion of demolitions in the field come under this heading. Because there is no need to cater for the prolonged effects of weather, enemy action, etc., on explosives and firing accessories, a more simple technique may be employed in preparing such demolitions than is required for deferred demolitions.

(*b*) *Deferred demolitions* are normally blown as the tactical situation develops, on the order of the formation commander concerned or an officer specifically delegated by him. When ordered for preparation the time at which they are to be blown may not be known and they should, therefore, be prepared as long-standing demolitions (*see* Sec 10). Of the deferred demolitions, some may be specified as *final* demolitions, special instructions being issued as to their protection and control.

2. The preparation of a demolition scheme, generally in connection with a withdrawal, or for the protection of a flank, requires very careful planning, so that :—

(*a*) A continuous belt of obstacles of maximum depth is presented to any enemy advance. The *primary* belts are those demolitions which form part of the main defence line of an army. Other belts of obstacles are called subsidiary belts.

(*b*) The roads on the axes of withdrawal are not blocked by demolitions before our own troops have moved across the demolitions belt.

(*c*) Deferred demolitions are protected from enemy interference until they are blown.

(*d*) The responsibilities and procedure for ensuring that firing takes place at the right moment are made as clear as possible and understood by all concerned.

These problems are the responsibility of the commander, but it is essential that RE officers should understand the factors affecting them. For this reason the problem of the protection of deferred demolitions and the orders for firing them, are discussed in Sec 2.

SECTION 2.—FIRING ORDERS (DEFERRED DEMOLITIONS)

1. **Protection.**—Deferred demolitions are normally sited at defiles or bottlenecks on routes which are vital to our own or enemy movements. Protection of such demolitions is therefore essential until the commander decides that they are to be blown. The object of such protection is to prevent the enemy from either blowing the demolition or capturing it intact for his own use.

For this purpose a close garrison for the all-round protection of the site, must be provided. At sites of special importance this close garrison may consist of all arms. In modern warfare the threat of airborne assault must always be borne in mind.

The RE firing party will be placed under the orders of the OC the garrison. *The officer or NCO in charge of the RE firing party will take executive orders from him and from no one else.*

2. **The RE firing party.**—The commander of the RE firing party must have a copy of AF W4012B signed by his superior officer. His responsibilities will be :—

(*a*) To have the firing circuits and charges in the state of readiness ordered by the garrison commander, *i.e.*, " Ready to blow at . . . hours notice."

(*b*) To do everything possible to protect the demolition charges against the effects of weather, traffic and hostile action.

(*c*) To maintain close liaison with the garrison commander and thereby keep himself and his men informed of the situation.

(*d*) To be prepared to assume command of the whole garrison in the event of casualties to all personnel senior to himself.

(*e*) To make a seniority roster of his party and ensure that each man knows his position on it and the action to be taken in the event of casualties.

(*f*) To ensure that each of his men is familiar with the firing arrangements and the source of the executive order to fire the demolition.

(*g*) To establish a firing point in consultation with the garrison commander in full view of the site and under cover from falling debris.

(*h*) To see that the exploder key is kept under guard at or near the firing point. (He will NOT carry it in his pocket.)

(*j*) To test the electrical firing circuit at regular intervals once it is installed, and at least every 15 minutes when the site comes under fire.

(*k*) To fire the charges immediately when ordered by the garrison commander and to ensure that the demolition is successfully completed.

(*l*) To report the result as ordered on AF W4012B.

SECTION 3.—RECONNAISSANCE AND DEPLOYMENT

1. The importance of sound reconnaissance in demolition work cannot be overstressed. Notes on reconnaissance generally will be found in RE RPB, Sec 1. AF W4012 (Demolition Recce Report) should be used for each demolition prepared as shown in RE RPB, Sec 38.

A summary of demolition recces should be prepared by formation RE HQ for handing over to any relieving formation or unit.

Conventional signs for use on demolition reports are shown in Fig 1.

2. **Sequence.**—If time is short :—

(*a*) Estimate the bulk requirement of explosives before detailed reconnaissance is carried out. Study maps, aerial photographs and other information obtained from the IORE. Quantities can be quickly assessed from the data in Table 14.

DEMOLITION SITE OR CRATER SITE _ _ _ _ _ _ _

DEMOLITION SITE OR CRATER SITE WITH CHARGE LAID _ _ _ _ _ _ _

CRATERED OR DEMOLISHED _ _ _ _ _ _ _

CRATERED ROAD _ _ _

BRIDGE DEMOLISHED

MINES _ _ _ _ _

MINEFIELD (ANTI-PERSONNEL MINES SHOWN BY ADDING A PER) _ _ _ _ _ _ _ _

GAP

A PER

TANK TRAPS _ _ _ _ _

ROAD BLOCK _ _ _ _

FLAME TRAPS _ _ _

FIG 1.—CONVENTIONAL SIGNS USED IN CONNECTION WITH DEMOLITIONS

(*b*) Arrange to have necessary explosives sent either to an RV where they can be collected as required, or direct to the site or sites. A 50 per cent reserve should be made available to cover unforeseen requirements.

(*c*) Detail platoon or section commanders to their particular sectors from a study of the map, and arrange for them to get on to the sites as quickly as possible.

(*d*) Deploy the platoons (or sections) concerned so that they are near the proposed demolition sites.

(*e*) The officers concerned can then carry out a rapid reconnaissance of their tasks and decide the method to be employed. Leave detailed measurement and planning to the NCOs concerned with sufficient men to assist them.

NOTE.—In the case of unforeseen tasks the supply problem may be overcome by the use of the G1098 holding of explosives. This practice should be avoided except in emergency, but units should NOT regard their G1098 holdings as sacrosanct. Explosives so used must be REPORTED AT ONCE so that deficiencies can be made up.

3. **Sequence.**—If plenty of time available :—

(*a*) Carry out detailed recce.

(*b*) Consolidate recce reports.

(*c*) Order explosives and deploy as in para 2 above.

SECTION 4.—SUPPLY IN THE FIELD

TABLE 1.—DEMOLITION STORES AND EQUIPMENT IN RE FIELD UNITS AND EXPLOSIVE LORRY

Serial	Item	Unit				
		HQ	Pl/Tp	Fd Coy/Sqn	Fd Pk Coy/Sqn	Explosive lorry
1	Primers, 1-oz	—	800*	2,400†	—	2,400†
2	Slabs GC Wet	—	224	672	—	672
3	808 (lb)	—	400	1,200	—	1,200
4	Ammonal (lb)	—	300	900	—	900
5	Dets No. 33	—	200	600	—	600
6	Dets No. 27	—	700	2,100	—	2,100
7	Detonating fuze (ft)	—	3,000	9,000	—	9,000
8	Safety fuze (ft)	—	384	1,152	—	1,152
9	Instantaneous fuze (ft)	300	—	300	—	300
10	Igniters percussion	—	20	60	—	60
11	Igniters striking	—	100	300	—	300
12	Igniters electric	—	25	75	—	75
13	Striking boards	—	10	30	—	—
14	Matches fuzee (boxes)	—	24	72	—	72
15	Tubes, fuze sealing	—	200	600	—	600
16	Compound sealing (tins)	—	4	12	—	12
17	Crimpers	—	8	24	—	6
18	Plasowax (lb)	—	20	60	—	60
19	Exploders	—	4	12	4	—
20	Test sets, demolition	—	4	12	—	—
21	Cable, electric (yds), single	—	1,760	5,280	2,640	1,320
22	Tape insulating (lb)	6	6	24	—	24
23	Beehives, 6-in	—	24	72	—	72
24	Earth augers, 9-in	1	4	13	4	—
25	Camouflet sets	—	1	3	9	—
26	Electric switches, pull/push	30	—	30	—	30
27	L delays	60	—	60	—	60

28	Pull switches	30	—	30	—	30
29	Pressure switches	30	—	30	—	30
30	Release switches	30	—	30	—	30
31	Trap wire (yds)	300	—	300	—	300
32	Trip wire (yds)	600	—	600	—	600
33	Camouflet tubes	—	4	12	36	8
34	Camouflet points	—	30	90	270	60

* When CE/TNT slabs issued in lieu of slabs GC (wet) 160 of these will be 1-cm primers.

† When CE/TNT slabs issued in lieu of slabs GC (wet), 480 of these will be 1-cm primers.

Explosive lorries are held by RASC formations on a scale of 1 per Fd Sqn/Coy RE.

1. Explosives are an Ordnance supply, obtained like ammunition through " Q " channels.

2. They are carried by RASC, apart from G1098 holdings of field units RE.

3. RASC have a standard 3-ton lorry-loading which practically duplicates the G1098 holding of the Fd Coy/Sqn RE. Div RASC hold one such lorry per Fd Coy/Sqn RE.

4. Large stocks of GC slabs and CE/TNT 1-lb slabs are held and will be issued until used up. Future policy is not yet decided.

CHAPTER 2

EXPLOSIVES AND ACCESSORIES

SECTION 5.—SERVICE BULK EXPLOSIVES

TABLE 2.—SERVICE BULK EXPLOSIVES

Serial	Name	Description	Packing (normal)	Uses	Effect of temperature		Effect of moisture	Sensitivity to shock	Effect of small arms fire	Remarks
					Heat	Cold				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
1	CE/TNT demolition slabs	1-lb slab $4\frac{1}{2} \times 2\frac{1}{4} \times 1\frac{3}{4}$ ins with 2 holes for 1-cm primer, or 2-lb slab $6 \times 3 \times 2$ ins. Both in millboard case	1-lb slabs : 14 slabs in tin box. Total wt : 26 lb 2-lb slabs : 10 slabs in a plywood box	All except borehole and Camouflet charges	Nil	Nil	Nil	Insensitive	Nil	May be issued in lieu of GC

2	" 808 "* Plastic	4-oz light blue cartridge in waxed paper wrapping 3 × 1¼ ins dia.	20 lb in wooden box containing 4 cartons each holding 5-lb. Total weight : 24 lb	All purposes	Very slowly affected by moist tropical heat	Becomes hard, loses plasticity	Effective under water for 12 months	Insensitive	Easily set on fire, particularly by tracer	Causes headache. Non-plastic form in brown, purple or green cartridges now obsolete. Not suitable for tunnelling
3	" 852 "* Plastic	Light yellow 8-oz cartridge in paper wrapping, 8 × 1¼ ins dia ; or 4 oz cartridges dimensions as for " 808 "	As for " 808 "	All purposes (nearly same power as " 808 ")	Softens slightly at high temperatures. Power not affected	Becomes hard, but at lower temperatures than " 808 "	Nil	Insensitive	Much less inflammable than "808"	At present issued ONLY for special operations. May eventually replace " 808 " in some theatres. Not suitable for tunnelling
4	P E 2* Plastic	8-oz dull yellow cartridges wrapped in waxed paper 8 × 1¼ ins dia.	As " 808 "	All purposes	In very hot climate becomes semi-fluid	Becomes hard and loses plasticity in very cold climate	Nil	Insensitive	Less easily set on fire than " 808 "	Obsolescent. Issued ONLY for special operations. Not suitable for tunnelling

Serial	Name	Description	Packing (normal)	Uses	Effect of temperature		Effect of moisture	Sensitivity to shock	Effect of small arms fire	Remarks
					Heat	Cold				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
5	P E 3*	8-oz black cartridge 8 × 1½ ins dia in paper wrapping		All purposes	Less affected by high temperature than "852"	Loses plasticity below freezing point	Nil	Insensitive	As for PE 2	For use in tropical theatres. Not suitable for tunnelling
6	"851"* Plastic	8-oz dirty white cartridge, 8 × 1½ ins dia in paper wrapping (may be case)	As "808"	All purposes. Only 80% as powerful as "808." *Therefore use 25% more in all cases*	Becomes soft at lower temperature than PE 2.	Hardens at higher temperature than PE 2	Nil	Insensitive	The least inflammable of all plastic explosives issued	Obsolescent. Not suitable for tunnelling
7	Guncotton (wet)	19-oz dirty white slab including 3-oz. water. 6 × 3 × 1½ ins	14 slabs in tin box in wooden crate. Total weight: 25 lb	All except borehole and camouflet charges	Liable to become dry and sensitive	Water in slabs may freeze and stick them together. *Dangerous* to attempt to remove from box in this condition	Slabs become inert if too wet.	Insensitive if water content is correct	NOT detonated or set on fire unless too dry	Obsolescent. Slabs may be sawn up if well moistened

8	Polar NS Gelignite	Buff coloured 4-oz cartridges in paper wrapping	Ten 5-lb cartons in 50-lb wooden case. Total weight: 56 lb	Borehole and mined charges. Particularly suitable for tunnelling. *See* Note 2 below	Deteriorates: liable to exude nitroglycerine	Non-polar type, freezes at 46° F. If frozen dangerous to handle	Deteriorates with same effect as heat	Very sensitive if in poor condition	Detonated by rifle bullet	If used in boreholes, ram carefully with wooden rammer. Causes headache if handled
9	Ammonal	Dark grey powder	25-lb in tin box, 9 × 9 × 9¼ ins. 3 boxes in crate. Total weight: 114 lb	All except cutting. DON'T USE in damp situations or on deferred demolitions	Nil	Slightly less sensitive	Very hygroscopic. Quickly becomes inert if water content is above 8%	Insensitive	NOT detonated or set on fire	ALWAYS use in sealed tins if possible to avoid damp. Likely to become obsolescent

* None of these cartridges need be unwrapped for initiation.

These Notes refer to Table 2.

Notes

1. (*a*) Standard issues are CE/TNT slabs or guncotton slabs, Plastic " 808 " and ammonal.

   (*b*) " 852 " PE2 and PE3 are alternative plastic explosives not at present generally issued. They may be issued for special operations.

2. Polar NS gelignite and other similar commercial types are not normally issued. They tend to deteriorate rapidly under service conditions, and when deterioration has set in they are dangerous to handle. Gelignite has been included in Table 2 because it is a common commercial explosive and also because, unlike all service explosives, it does not, when detonated, give off toxic fumes in strengths that may be lethal. It is therefore particularly suited to underground work (*eg*, tunnelling).

3. ALL SERVICE EXPLOSIVES SHOULD BE INITIATED WITH A PRIMER. Three knots in cordtex or a detonator alone may be used in emergency for " 852 ", PE 2, and " 851."

With " 808 " and PE 3 a primer must always be used.

4. Some facts about foreign explosives are given in Chap 4.

5. Details of shaped charges showing characteristics and uses are given in Sec 19.

SECTION 6.—INITIATION AND FIRING ACCESSORIES

TABLE 3.—FIRING ACCESSORIES (OTHER THAN ELECTRIC)

Serial	Name	Description	Packing (Normal)	Rate of burning or detonation	Method of initiation	Effect of temperature		Effect of moisture	Sensitivity to shock	Remarks
						Heat	Cold			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
1	Safety fuze No. 11 Mk 2	Black fuze with gunpowder core, 0·21-in dia	Circular tin containing 48 ft	Burns at approx 2 ft per min. ALWAYS TEST RATE OF BURNING	Matches fuzee; ordinary matches; igniter percussion Mk 3; igniter S F striking; igniter S F electric	Core deteriorates rapidly. Unreliable if tin has been open any length of time	Core burns more slowly. Cover becomes brittle and liable to crack	If core is allowed to get damp, fuze *is useless*. If core is kept dry, will burn under water up to 24 hours' immersion	Nil	When crimping on detonator, use crimpers. Scarf end to be lit by matches. Cut end to go into detonator or igniter square
2	Safety fuze "Blue Sump" (Commercial)	Blue fuze with gunpowder core, 0·21-in dia								
3	Igniter safety fuze percussion Mk 3	Brass case containing striker cap and spring held back by removable split pin. Sleeve to take fuze	10 igniters in sealed tin	—	Pull out split pin	Nil	Nil	Cap affected slowly by moisture. Can be sealed with compound.	Insensitive	Particularly useful in assault demolitions. Keep tin closed and sealed when not in use

Serial	Name	Description	Packing (Normal)	Rate of burning or detonation	Method of initiation	Effect of temperature		Effect of moisture	Sensitivity to shock	Remarks
						Heat	Cold			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
4	Igniter safety fuze striking	Small copper tube with match compound on the end. Will fit over SF	25 igniters in sealed tin		Rub match compound along safety match box or special striking board	Nil	Nil	Match compound very susceptible to moisture	Insensitive	Keep igniters dry at all times. Crimp at open end.
5	Detonator No. 27	Metal tube 1¾ × 0·26 ins dia. May be painted red. Tetryl-filled with initiating charge of A S A at open end	25 in special round tin. 8 tins in wooden boxes	—	Safety fuze, detonating fuze, instantaneous fuze. In case of instantaneous fuze, cover must be stripped back before inserting	Nil over normal climatic range. Store in cool, dry place		Filling slowly rendered inert if exposed to damp	May be detonated by shock, undue pressure or rifle bullet. Handle with care	With No. 8 commercial detonators ensure that sawdust is emptied from tube before inserting fuze
6	Detonator No. 8 (Commercial)	Metal tube 1¾ × 0·3 ins dia. Filled as No. 27	100 packed in sawdust in square tin							

7	Cordtex plastic-covered	White plastic cover, white core (PETN) 0·19-in dia	500 ft on wooden reel	Detonates at not less than 6000 metres per sec	2 Primers. Detonator only in hasty demolitions where fuze is dry and not kept made up with charges for long periods	Nil	Cover of cordtex brittle. Cannot be tied in knots or bent sharply. Cover of Primacord is pliable at lower temperatures and it is therefore more suitable in very cold conditions	Can be used under water if core is kept dry Seal all ends on long-standing demolitions	Insensitive. Joints backed by hard surfaces may be detonated by rifle bullet	Grey cordtex obsolete—not so flexible nor so reliable at high temperatures. A new 'low temperature' cordtex is being produced for use at temperatures below freezing. It may be identified by its green colour. 500-ft lengths on reels may be met.
8	Primacord, (American manufacture)	Yellow braided cover. White core (PETN)								
9	Fuze Instantaneous. Mk 4 or 5	Orange coloured fuze with thick gunpowder cord, 0·25-in dia. Will not fit easily into detonators	300 ft on metal reel	Burns at not less than 90 ft per sec	Percussion igniter, or pull, pressure and release switches. ALWAYS ignite by remote control	Nil	Nil	Like SF core is very susceptible to damp. Cover is waterproof, but ends and joints must be sealed	Nil	NOT DETONATING FUZE OR SAFETY FUZE. DO NOT confuse with American safety fuze which is also orange coloured

Serial	Name	Description	Packing (Normal)	Rate of burning or detonation	Method of initiation	Effect of temperature		Effect of moisture	Sensitivity to shock	Remarks
						Heat	Cold			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
10	Primers CE field 1-oz	Tapered cylinder 1·25 ins long, 1·35-ins dia at thick end tapered to 1·15-ins central hole for detonator. Tetryl filled with waxed paper cover. Detonator hole also water-proofed. MUST NOT BE RECTI-FIED	10 in tin or card-board cylinder. 6 cylinders in special wooden box. Total weight : 14 lb	—	Deto-nator or deto-nating fuze	Nil	Nil	Nil so long as cover is un-damaged	Fairly in-sensitive may be ignited or deto-nated by rifle bullet	ENSURE THAT WAXED PAPER COVER IS UN-DAMAGED

11	Primers GC (dry) field 1-oz	Dimensions as for CE primers. Waterproof coating of Acetone. Detonator hole NOT water-proofed in earlier marks	Packing as for CE primer	—	As for CE primer	N	Becomes insensitive in very cold climate	Acetone coating easily chipped. Primer may then become damp and insensitive	More sensitive than CE primer. May be ignited or detonated by rifle bullet	Obsolescent being replaced by CE primer
12	Primers 2-hole	Dimensions as for CE primers, but with 2 detonator holes. Composed of pressed pentolite plus 3½% PVA	Packing as for CE primer	—	Detonator or detonating fuze	Nil	Nil	Nil	Similar to CE	Structurally strong. Waterproof even if chipped
13	1-centimetre primer	Copper tube 1¼ ins long and 1-cm dia filled CE/TNT with PETN gaine. Sleeve at one end to take detonator. Sleeve is slit for easy insertion of detonator and has sliding ring for securing it	20 packed in tin box. 20 boxes in wooden case. Total weight: 25 lb	—	*Detonator only.* Detonating fuze must be capped with detonator	Nil	Nil	Nil	Comparatively insensitive	Fits into hole in 1-lb CE/TNT slabs. Now obsolescent

Serial	Name	Description	Packing (normal)	Rate of burning or detonation	Method of initiation	Effect of temperature		Effect of moisture	Sensitivity to shock	Remarks
						Heat	Cold			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
14	Detonating fuze branch junction	See Fig 2. Initiating charge of ASA is at closed end instead of near open end as in No. 27 detonator. Has sleeve and spring clip for attachment to detonating fuze	10 in a tin, 25 tins in a tin box, 19 ins × 8 ins × 8 ins	—	Initiated by detonating fuze run through holding clip across closed end	As for No. 27 detonator	As for No. 27 detonator	As for No. 27 detonator	As for No. 27 detonator	Used for rapid connection of detonating fuze branches to main in assault work. Issued only to Armoured Engineers, RE

These Notes refer to Table 3.

1. General notes

(*a*) FAILURES DUE IN NINE CASES OUT OF TEN TO MISUSE OR MISHANDLING OF SAFETY FUZE.

(*b*) Failures with other accessories very unlikely if they are used correctly, but NO initiating set can be guaranteed 100 per cent.

(*c*) REMEMBER IN ALL CASES :—

SAFETY FUZE IS THE WEAKEST LINK.
DAMP IS THE MAIN ENEMY.

2. Precautions in initiation

(*a*) *General.*

(i) Two initiating sets for all firing circuits.

(ii) Initiate all charges with primers.

(iii) Two points of initiation per charge.

(iv) Long charges initiated by a primer every 5 ft.

NOTE.—This only necessitates one primer in charge if new 2-hole primer is available.

(*b*) *Safety fuze.*—Likely causes of failure are :—

(i) Bad cutting of safety fuze. Use a sharp knife on a hard surface.

(ii) Damp attacking end of fuze. Seal adequately unless using at once. Always cut off 6 ins before use.

(iii) Poor contact between end of fuze and detonator filling or igniter cap. Crimp on all detonators and caps firmly, after pushing fuze right home.

(*c*) *Instantaneous fuze.—Neither a detonating fuze nor a safety fuze.*

(i) Avoid using in operations.

(ii) It may be used for booby traps in dry situations and for booby trap training.

(iii) *Never attempt to ignite the fuze by hand.*

NOTE.—Fuze is too thick to go into No. 27 detonator without stripping back outer cover. This distinguishes it from American safety fuze which is same colour.

(*d*) *Detonators, primers, detonating fuze and firing circuits.*

(i) For diagrams showing fuzes, joints, etc, *see* Figs 2, 3, 4, 5, 6, 7, 8 and 9. Fig 8 shows a new variety of "ring main" where no electrical method of firing is available.

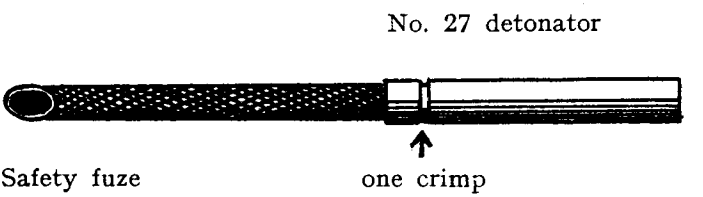
(ii) If two cordtex leads cross, one may be cut by the other when the circuit is fired; therefore avoid long unsupported lengths of detonating fuze, and keep lengths of detonating fuze 18 ins apart.

(iii) All spare ends of detonating fuze must be sealed with a sealing cap, crimped three times and coated with sealing compound.

(iv) Use CE primers in preference to guncotton, particularly on long-standing demolitions.

(v) Place initiating primers in centres of charge; in the case of cutting charges, on the face away from surface attacked, with detonating fuze coming in at right angles to the charge.

FIXING No. 27 DETONATOR TO SAFETY FUZE



SEALING CAP ON FUZE

IGNITER SAFETY FUZE, STRIKING

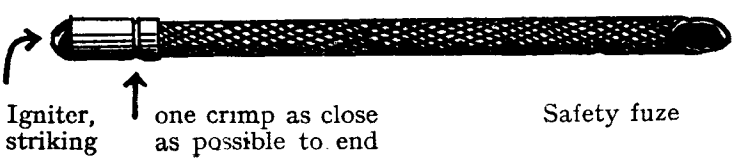


FIG 2.—**CRIMPING**

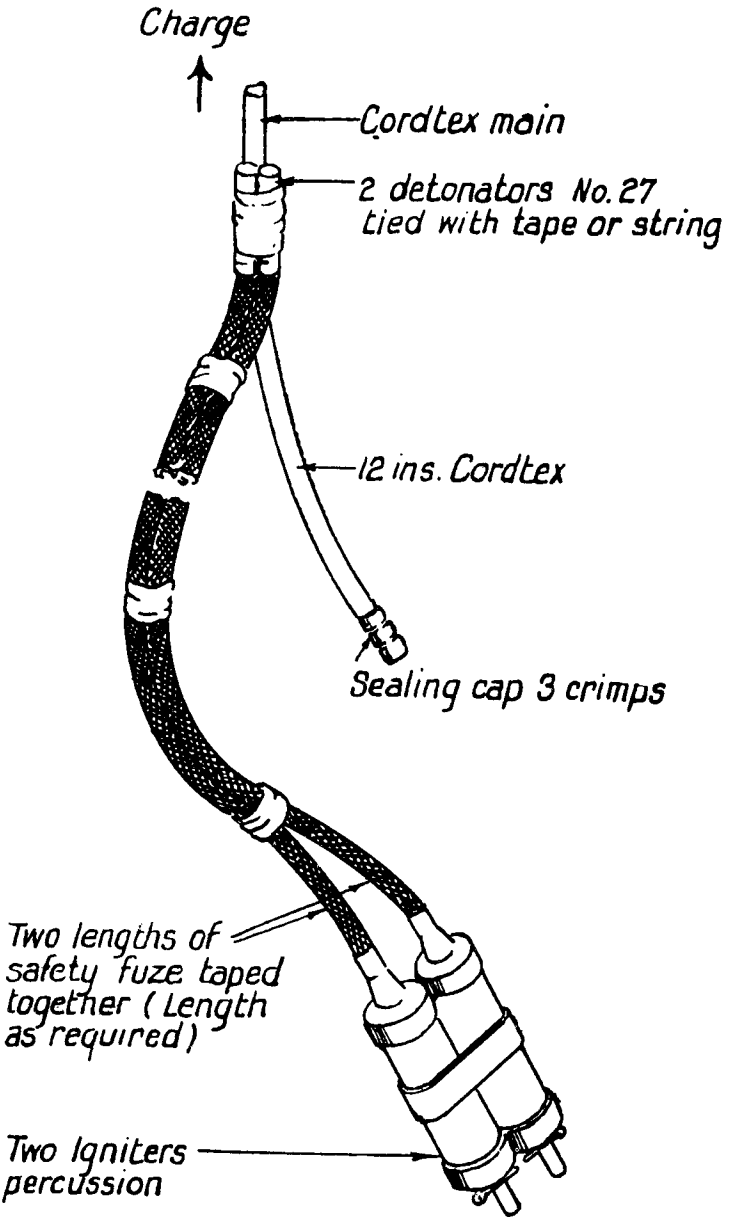


FIG 3.—DOUBLE INITIATING SET

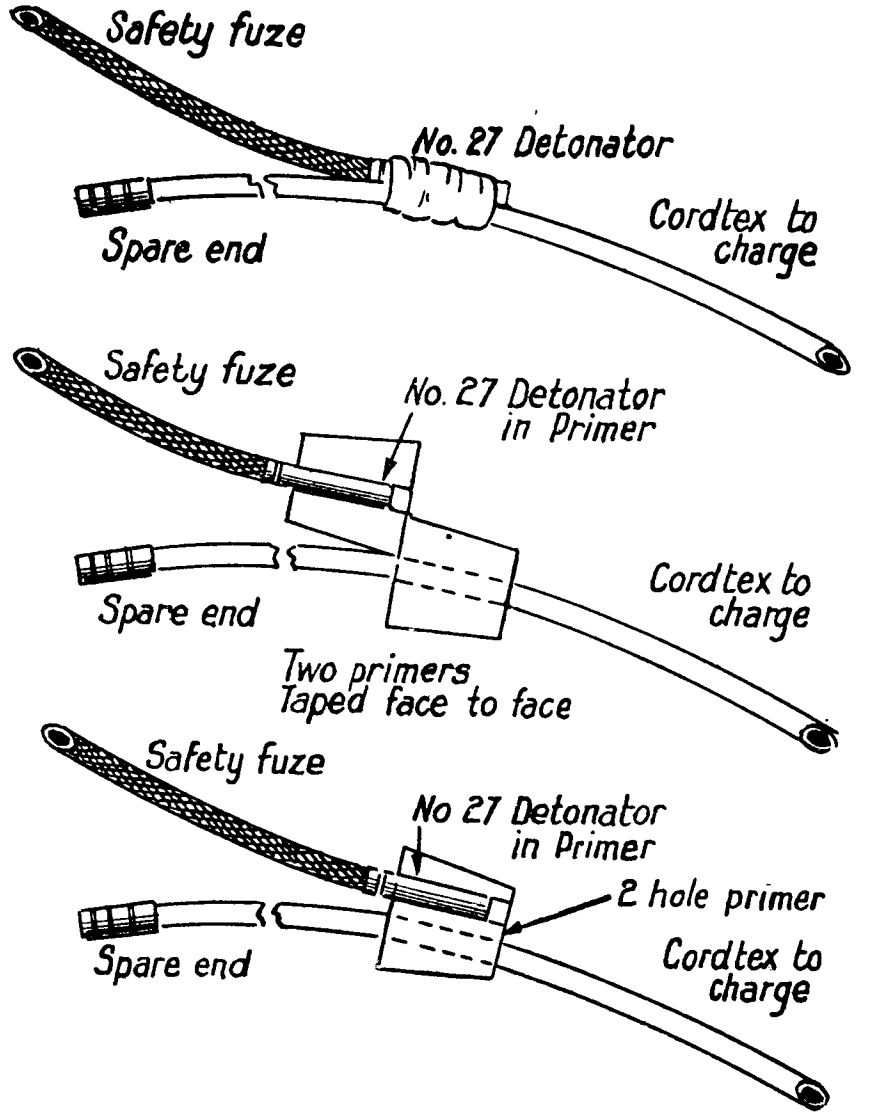


Fig 4.—INITIATION OF CORDTEX

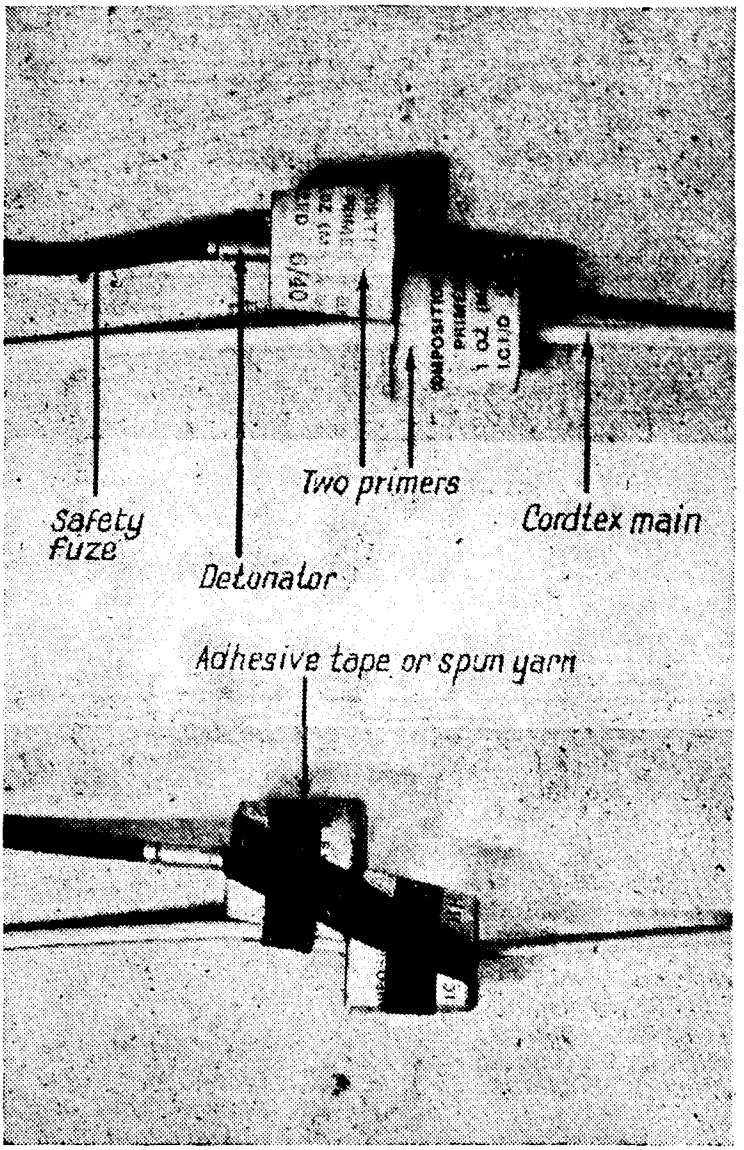


FIG 5.—**Normal method of initiating cordtex using two primers taped together. (Before and after taping.)**

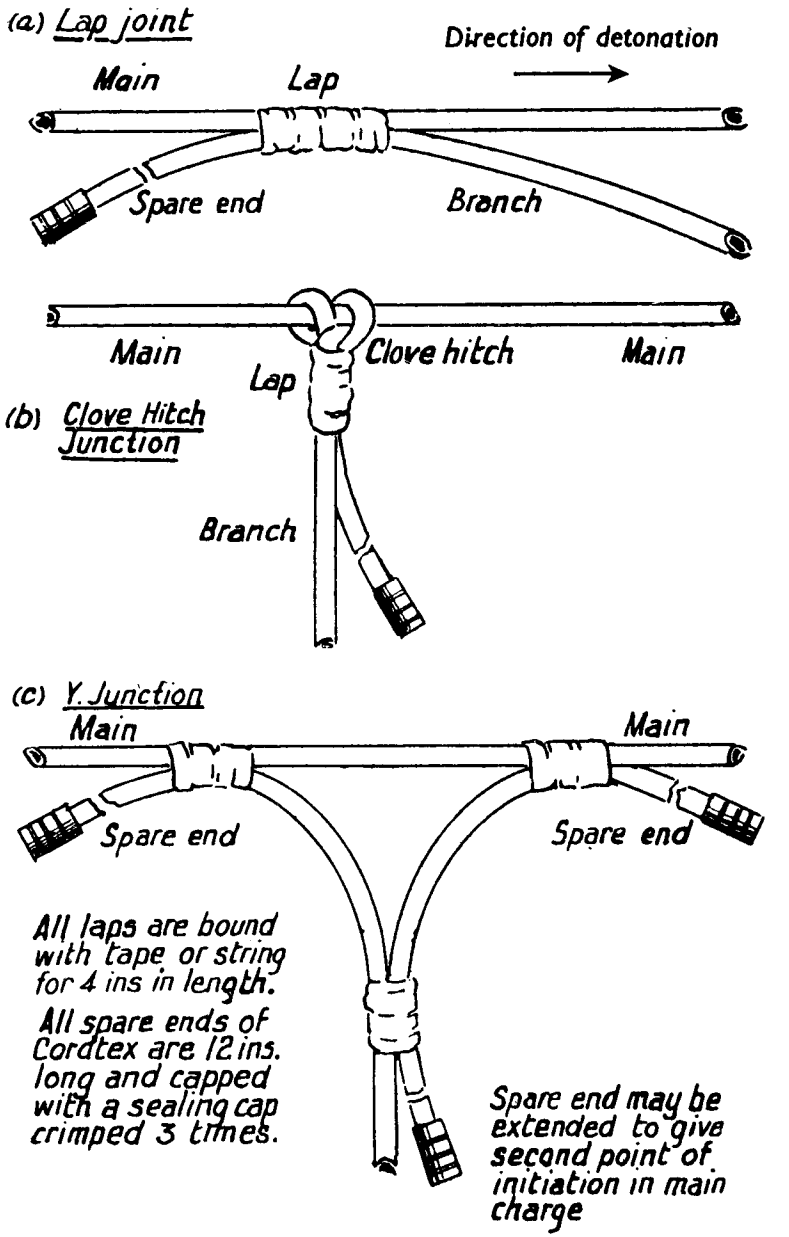
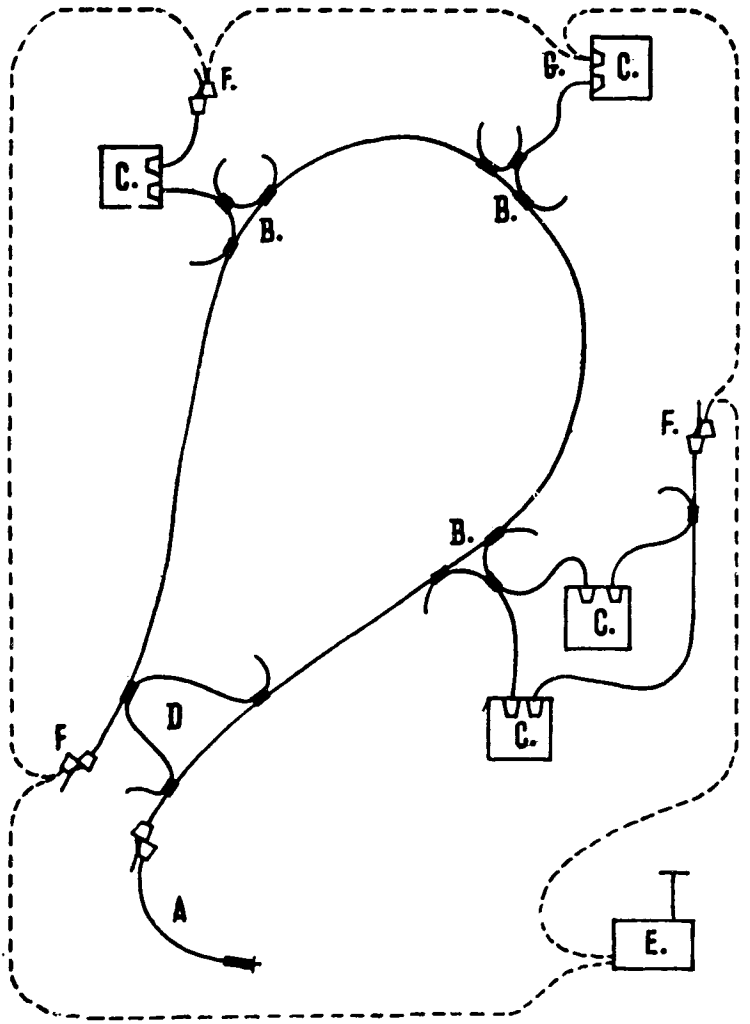


FIG 6.—CORDTEX JUNCTIONS

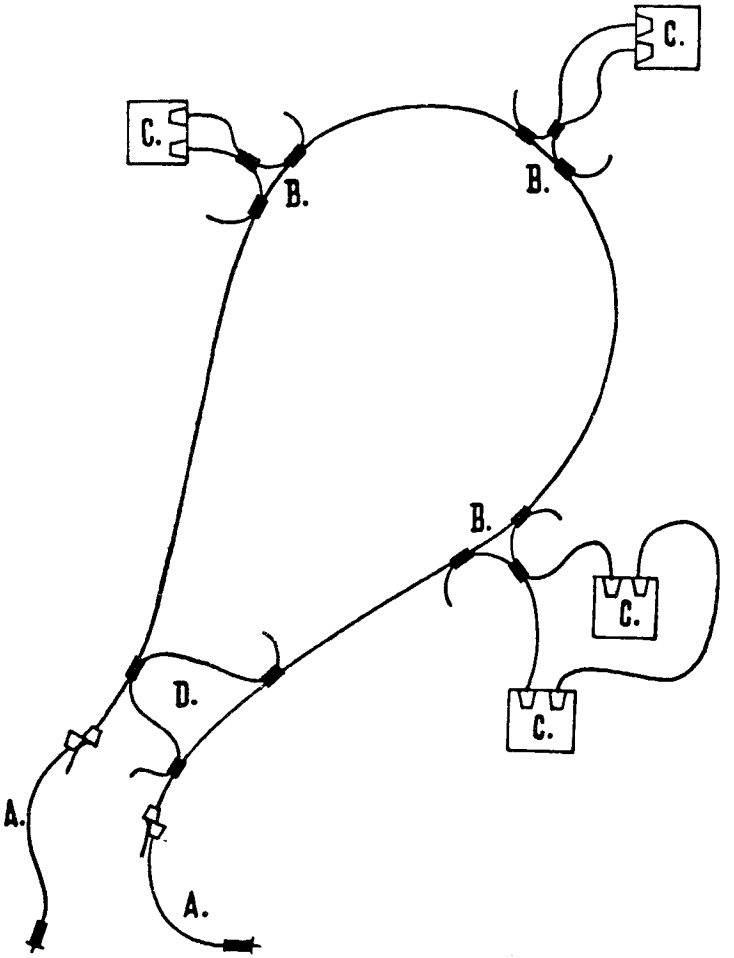
Note.—Method (*b*) used for hasty demolitions only.



A = Single safety fuze initiating set with primers
B = Cordtex Y-joint with double branch
C = Charges, each initiated in two places by primers
D = Cordtex switch
E = Electric exploder
F = Electric detonator igniting cordtex with primers
G = Electric detonator initiating primer direct in charge.

FIG 7.—TYPICAL CIRCUIT FOR LONG-STANDING DEMOLITIONS

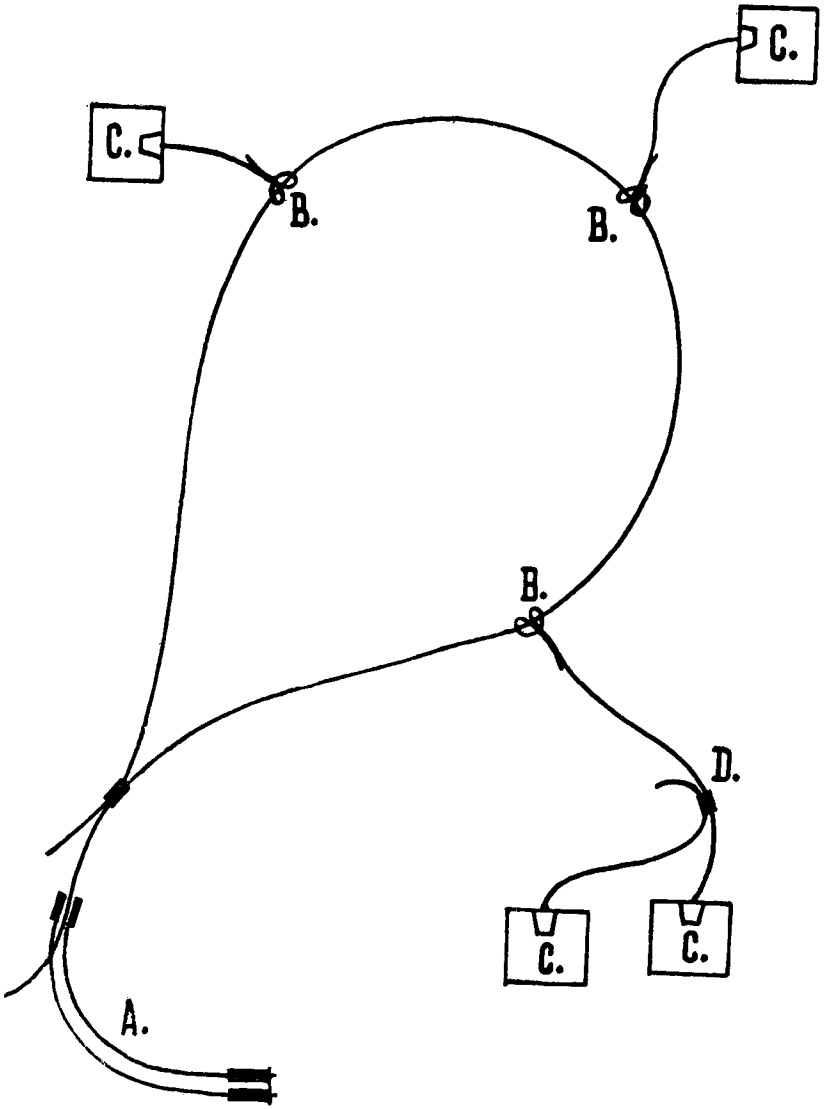
Firing both by electrical and safety fuze methods



A = Single initiating set with primers
B = Cordtex Y-joint with double branch
C = Charges each initiated in two places with primers
D = Cordtex switch

FIG 8.—ALTERNATIVE CIRCUIT FOR LONG-STANDING DEMOLITIONS

Firing is by safety fuze method in duplicate



A = Double initiating set (*see* Fig 3)
B = Clove hitch joints to cordtex branches (*see* Fig 6(*b*))
C = Charges, each initiated with one primer
D = Cordtex lap-joint (*see* Fig 6(*a*))

FIG 9.—**SIMPLIFIED CIRCUIT FOR HASTY DEMOLITIONS ONLY**
Firing is by safety fuze method

TABLE 4.—ELECTRIC FIRING ACCESSORIES

Serial	Name	Description	Packing (Normal)	Use	Resistance (ohms)	Remarks
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
1	Detonator No. 33 (Electric)	No. 27 detonator with electric firing head	Packets of 20 packed in tin canister. 10 or 20 packets per canister.	As No. 27 detonator	At firing temperature: 1·6 ohms.	Maximum safe current for testing 0·025 amps. *Minimum current for firing:* 1·5 *amps.* For precautions to be taken in practice, *see* Note 1 opposite.
2	Igniters safety fuze electric	Electric firing head crimped into one end of a copper tube. Safety fuze is inserted in the other.	Packets of 20 5 packets in a wooden box.	Firing charges successively by remote control using electrical means.	As for No. 33 detonator.	Current for testing and firing as for No. 33 detonator.
3	Cable electric E 1 Mk 2.	Well insulated cable 6 copper and 1 steel strand. Weight: 14·4 lb per 100 yds double.	220 yards cable (single) on metal reel	Connecting up electrical firing circuits.	2·6 ohms per 100 yds. double.	*See* Note 2 opposite.
4	Exploders Mk 7* and dynamo condenser Mks 1 and 2	*See* Table 5				
5	Batteries (all types)	*See* Table 6				

These Notes refer to Table 4.

Notes

1. Electric detonators

(*a*) Test for continuity before use. Same applies to igniter, safety fuze, electric.

(*b*) Keep number in any circuit to a minimum. Normally unnecessary to use more than 20.

(*c*) Avoid inserting electric detonators directly into charges themselves and NEVER put them into boreholes or buried charges. Connect them to charges with detonating fuze leads. (*See* Fig 7.)

(*d*) If commercial or foreign electric detonators have to be used, avoid detonators of different types in same circuit.

(*e*) Avoid parallel circuits. They should never be necessary.

2. Firing cables

(*a*) For standard method of jointing and connecting up detonators, *see* Fig 10.

(*b*) Any strong well-insulated cable may be used in emergency. Find resistance of measured length before use with Demolition Test Set.

(*c*) The following are resistances of cables normally carried in the field by R Sigs :—

Cable, assault No. 1—71·6 ohms per 100 yds double.

Cable, assault No. 2—34·8 ohms per 100 yds double

Cable, electric, D3—15·5 ohms per 100 yds double.

Cable, electric, D8—12·0 ohms per 100 yds double.

Cable, electric, 0·002—2·5 6ohms per 100 yds double.

(J, single 10w)

3. Exploders

TABLE 5

Serial	Name	Description	Firing capacity	Remarks
			No. of dets No. 33 through 400 yds double cable el. E1, Mk 2	
(a)	(b)	(c)	(d)	(e)
1	Exploder dynamo, Mk 7*	Rack and pinion operated dynamo in steel box with handle acting as carrier when not in use. Weight : 13 lb.	40	Test on demolition test set using "Fusion" setting of switch. Should fire through 210 ohms resistance. Mk 7 will only fire through 150 ohms.
2	Exploder dynamo condenser, Mk 1	Rectangular metal case with terminals at one end. Packed in leather case with box fusion test and 3 spare handles. Weight : 15 lb in leather case.	190 Equivalent resistance 300 ohms.	Test with box fusion test, NOT demolition test set. Full operating instructions on box.
3	Ditto, Mk 2	Similar but with waterproof bakelite case. Weight : 18 lb in leather case.		

These Notes refer to Table 5.

Notes

(*a*) When using Mk 7* exploder remember to exert maximum force at end of stroke.

(*b*) When using DC exploder give at least 15 *additional* turns after red light has begun to flash continuously. *See* instructions inside lid of case.

(*c*) In the Mk 1 DC exploder there is a possibility of a residual charge *after* use and *after* removal of the handle. To counteract this possibility connect up the Box Fusion Test, insert the iridio platinum wire across the bridge and press the operating button.

(*d*) Testing exploders—*see* Table 7.

(*e*) REMEMBER THAT FULL DISCHARGE FROM THE DC EXPLODER IS VERY POWERFUL AND MAY BE LETHAL.

4. Batteries and cells

TABLE 6

One 6-volt battery		One 12-volt battery	
Length of *double* cable, electric E1. Mk 2	No. of dets No. 33 or igniters SF electric	Length of *double* cable, electric E1. Mk 2	No. of dets No. 33 or igniters SF electric
50 yds	2	50 yds	4
100 ,,	1	100 ,,	3
		150 ,,	2
		200 ,,	1

These Notes refer to Table 6.

Notes

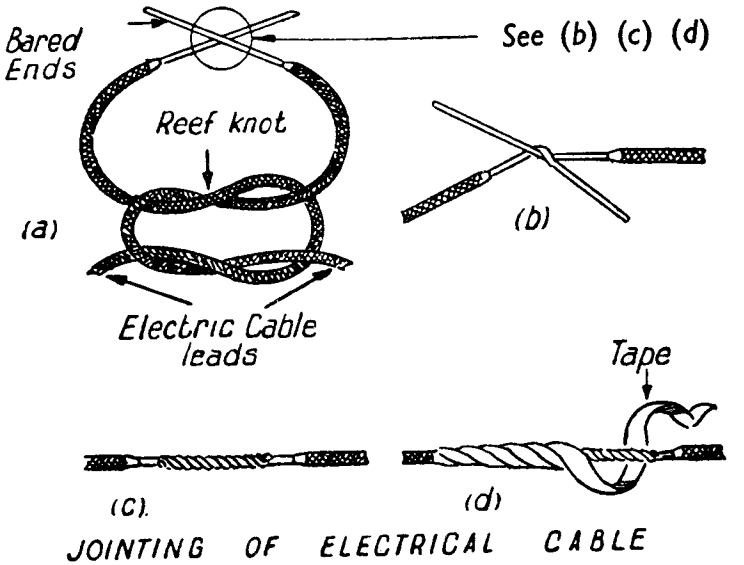
(*a*) Batteries must be *fully charged* to give results shown above.

(*b*) (i) *Service torch batteries* consisting of 3 small dry cells have total EMF 4·5 volts, and internal resistance of 1·2 ohms.

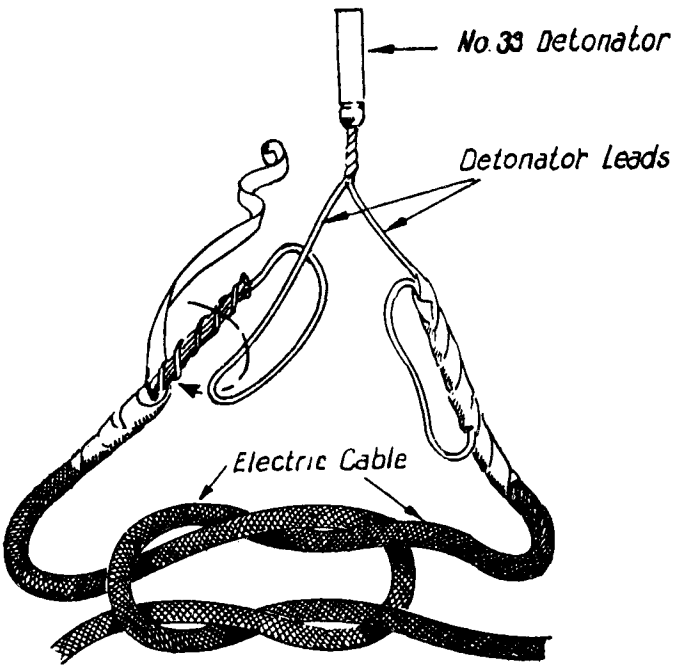
(ii) *Cells inert A, O, Q, and S* (Signals issue).

To render active, fill with water in accordance with instructions printed on them, at least 10 hours before use.

Allow 2 cells per detonator and one per ohm of resistance in firing cable.



JOINTING OF ELECTRICAL CABLE



(e) *Method of joining No 33 detonator to electric cable*

FIG 10.—**ELECTRIC JOINTING**

Exploder Mk 7*. (Mk 7 is similar to Mk 7* but without the additional base section.)

Exploder Dynamo Condenser Mk 2. (Mk 1 is similar but with a metal case.)

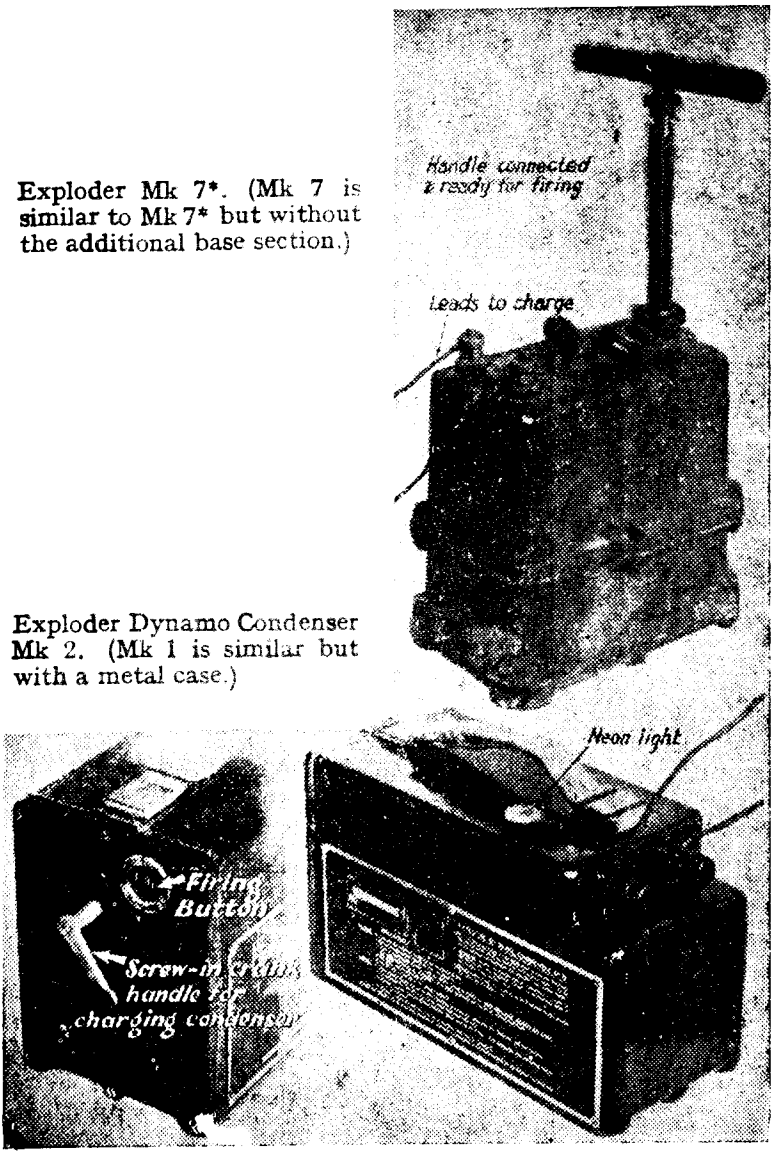


FIG 11.—SERVICE EXPLODERS

TABLE 7
SEQUENCE OF OPERATIONS FOR TESTING ELECTRICAL FIRING CIRCUITS USING DEMOLITION TEST SET MK 1

Serial	Test	Switch setting	Operation	Result	Remarks
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
1	Condition of cell in set	Continuity	Short circuit terminals on set. Press contact key.	Deflection on galvanometer shows cell is in good order	Must ALWAYS be carried out before using the set
2	Exploder test: (*a*) Mk 7*	Fusion	Connect exploder with two short leads to terminals on set. Insert iridio-platinum wire across bridge. Set resistance coils at 210 ohms. Operate exploder.	Fusion of iridio-platinum wire bridge shows exploder will fire through 210 ohms.	
	(*b*) Dynamo condenser Mks 1 and 2	TEST SET MUST NOT BE USED	Connect Tip Box Fusion Test and charge up the exploder, as for normal operation. Press operating button.	Fusion of iridio-platinum wire bridge on Box Fusion Test shows exploder will fire through 300 ohms	After test remove handle from exploder, replace iridio-platinum wire across bridge and press button to ensure exploder is discharged (Mk 1 only).
3	Continuity	Continuity	Connect ends of main leads to terminals A and B. Press contact key.	Deflection indicates complete circuit	Pricker test required if there is no deflection, unless break can be found by visual inspection

Serial	Test	Switch setting	Operation	Result	Remarks
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
4	Discontinuity	Continuity	Disconnect circuit at a detonator. Proceed as for continuity test	Deflection indicates short circuit	If short circuit is revealed carry out visual inspection of the insulation of the complete circuit *including any cable still left on the drum*
5	Continuity	Continuity	Connect up again and repeat Test 2	As for Test 2	
6	Pricker test	Continuity	Connect pricker leads* to test set. Work round cables making connection by piercing insulation of cables and testing for continuity.	No deflection indicates break in circuit between the points where the prickers are inserted.	Only necessary if visual inspection does *NOT* reveal a break after failure of continuity test. Remember in this case also *the cable still on the drum*
7	Resistance of circuit	Wheatstone bridge	Connect main leads to terminals and adjust the resistance coils on the set until a nil deflection is obtained on the galvanometer when the contact key is pressed.	When the nil deflection is obtained the sum of the readings on the three resistance coils will be the resistance of the circuit.	Only necessary on very important demolitions or when the Mk 7* or Dynamo Condenser exploder are not available. Particularly useful when batteries are employed for firing

* A pricker lead is a length of cable (about 4 ft) with one end attached to a small nail or other sharp metal point which will penetrate the cable insulation.

These Notes refer to Table 7.

Notes

1. **Demolition test set.**—Following stores are carried in box containing set :—

Cable electric, J single low 0·002	9 ft
Linen, old	½ lb
Pliers, side-cutting, 5-inch, pairs	1
Crimpers	1
Tape, insulating, ¾-inch	1 lb
Rectifiers	1

2. **Testing** (*see* Fig 12)

(*a*) Test all detonators separately for continuity before incorporating in circuit.

(*b*) DISCONNECT ELECTRIC DETONATORS FROM ALL CHARGES when testing completed circuit for first time.

(*c*) Test circuits on long-standing demolitions frequently and when due for firing at least every 15 mins.

(*d*) Use " Wheatstone Bridge " switch for checking *short circuits* and *leaks to earth*. Increase on previously measured or estimated resistance indicates leak to earth or faulty joint. Decrease indicates short circuit.

Section 9.—USE OF MINES, BOMBS AND SHELLS AS DEMOLITION CHARGES

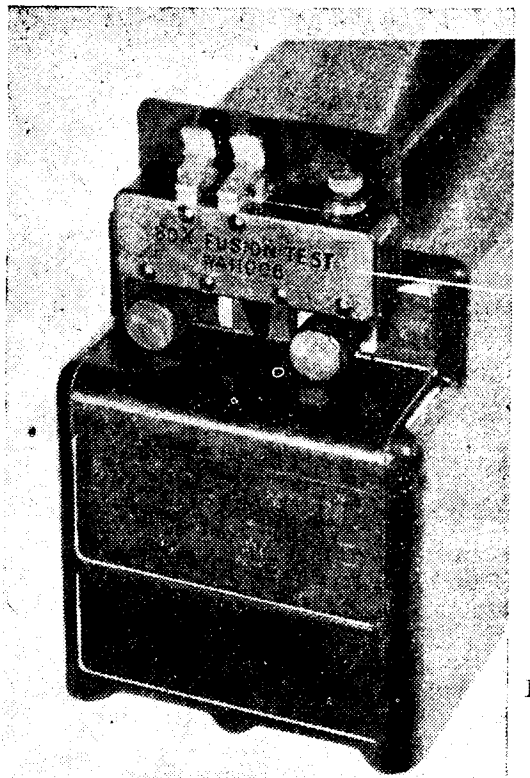
1. Mines, bombs and shells may be used as demolition charges, particularly where close contact is not essential.

2. Suitable for use as concussion charges, mined charges and pressure charges ; also in booby traps, etc.

3. Use two pounds of CE/TNT or equivalent as a priming charge, and place to detonate filling rather than to actuate fuze or firing mechanism.

4. Explosive content

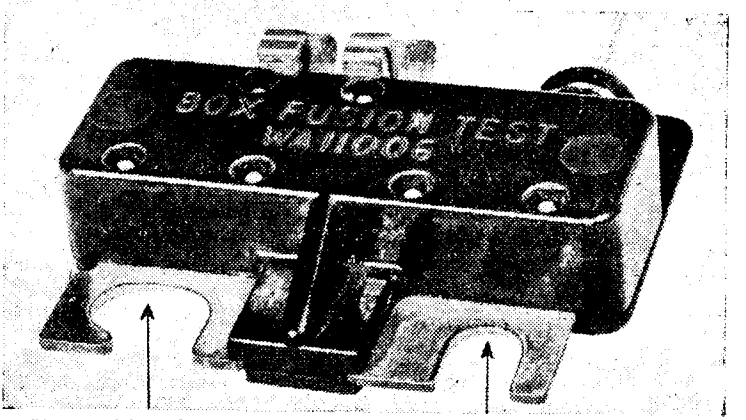
(*a*) Aerial GP bombs (500- and 1,000-lb) : about 50 per cent of total weight.



Box fusion test fitted in position on exploder DC Mark 2

Bridge

Reel of platinum wire



Slots which fit over the terminals of exploder DC Mark 2

2a—22740 FIG 12.—**BOX FUSION TEST**

(*b*) HE shells: normally about 10 per cent of total weight. Content of SAP and AP even lower, and these types therefore should not be used.

(*c*) Common A tk mines—*see* Table 8 below.

5. Markings of shells (British)

All shells filled HE ...	Yellow Cap
All shells filled smoke	Green Cap
All shells filled gas ...	Grey Cap
Solid shot	Black Cap
Shells suitable for tropical storage	Red " XXXX " round body or nose

TABLE 8.—HE CONTENT OF ANTI-TANK MINES

British anti-tank mine, Mk 5	8 lb TNT or baratol
British No. 75 grenade, Mk I	1½ lb ammonal
American anti-tank mine M1A1 or Mk 5	6 lb TNT
German Tellermine (all types)	12 lb TNT
German Holzmine ...	12 lb TNT
German Riegel mine...	9 lb TNT
German Topfmine ...	13 lb amatol

SECTION 10.—PROTECTION OF CHARGES ON LONG-STANDING DEMOLITIONS

1. Following have to be borne in mind when preparing long-standing demolitions.

(*a*) DAMP.

(*b*) HEAT (in tropical theatres).

(*c*) COLD (in theatres where prolonged frost may be expected).

(*d*) ENEMY ACTION (bombing, shell fire, SA fire).

(*e*) TRAFFIC VIBRATION.

2. General precautions

(*a*) Inspect regularly. Firing party normally responsible, but in some cases maintenance party detailed to inspect at regular intervals. Lashing, strutting, tamping and packing all require careful maintenance.

(*b*) *Guncotton.*

(i) Avoid using where possible on long-standing demolitions.

(ii) Slabs are too wet if water can be squeezed out with thumb-nail. If so replace with slabs having correct water content. Slabs can be dried out quickly in dry well-ventilated room.

(iii) Slabs become flaky if too dry. Replace if in this condition. Moistening slabs with water when in position is not recommended.

(iv) Protect slabs in exposed positions by wrapping in oilskin, canvas or similar material.

(v) See that surface water does not drain on to GC charges.

(*c*) *Ammonal.*

(i) Avoid using on long-standing demolitions where possible.

(ii) If use is unavoidable, keep ammonal in tins and keep sealing of tins intact.

(iii) If tins have to be opened, ammonal must be kept in rubber bags and carefully sealed. Sealing must be inspected at frequent intervals.

(*d*) *Polar NS gelignite, Polar blasting gelatine, etc.*

(i) Keep all cartridges wrapped.

(ii) Inspect frequently for signs of deterioration. Remove and destroy by burning any gelignite that begins to exude. Gelignite in this condition is extremely sensitive and must be handled with care.

(*e*) '808', *PE* 2, *PE* 3, '852' *and* '851.'—'808' should have a "life" of at least 12 months in hot moist conditions. Other plastics have better keeping qualities. In very hot climates PE 3 or 852 should be used if available. Others lose plasticity and tend to become fluid. Their power is unaffected.

(*f*) *Primers.*—Always, if possible, use CE or two-hole primers and see that waxed paper covering is not damaged. GC primers if slightly chipped become moist and insensitive. If they have to be used, replace at least once a month, or keep them in oiled silk or rubber bags with neck sealed.

(*g*) *Detonating fuze.*—Have all spare ends 12 ins long and sealed.

(*h*) *Safety fuze.*—If possible *do not remove from tins* until firing is imminent. If fuze has to be fixed some time before firing have fuze 6 ins longer than required and sealed.

(*j*) *Leads* (*detonating fuze or electric*).

(i) Protect from traffic, blast, splinters, etc., by running them under cover of beams, girders, parapets, drains, etc., or enclosing with boards or sandbags, or burying.

(ii) Separate cordtex ring main from electric circuit to avoid simultaneous damage to both.

(iii) Prevent water running down detonating fuze leads on to charges, by giving leads a small " U " bend before they enter charges.

(iv) Avoid running them over sharp edges or corners and protect where necessary from abrasion by binding with insulating tape.

(v) Avoid long unsupported lengths, and hold leads in position with lashings or soft materials such as sandbags or sods.

(*k*) *Junctions and junction boxes.*

(i) Position these so that they are protected from small arms fire, splinters, etc., and avoid having them backed with concrete or steel. Protect where necessary with sandbags.

(ii) More than one branch can be taken off at a joint, forming a junction box ; this should be avoided, as the cordtex leads may cross, and when fired may cut each other. Several single junctions are safer.

(*m*) *Underwater charges.*

(i) Use CE/TNT or " 808 " or other service plastic explosives and CE primers.

(ii) Have charges connected to initiating points above water level.

(iii) Fix charges so that they can be lifted out of water for periodical inspection.

SECTION 11.—STORAGE OF EXPLOSIVES

1. Store in a dry, cool place with good cover and ventilation.

2. See that explosive store is at least 200 yards away from any other buildings.

3. Keep explosives above floor level on shelves or duckboards.

4. Keep detonators well away from other explosives, if possible in another building or with a blast-proof sandbag wall between them and main explosive store.

5. On transport keep detonators in a separate truck from other explosives if possible—if not, separate them on truck.

6. When in harbour, see that explosives trucks are protected as far as possible from blast and splinters and park them away from other vehicles and from signal cables.

7. Do not remove explosives from their boxes or packages until they are about to be used. Avoid having several half-empty boxes.

NOTE.—These precautions are the practical minimum for active service conditions. They should be read in conjunction with Standing Orders on the subject.

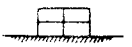
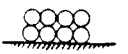
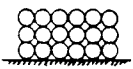
CHAPTER 3

CHARGE CALCULATION AND PREPARATION

SECTION 12.—CUTTING CHARGES

1. "Hasty" formulæ for cutting charges.

TABLE 9

Serial	EFFECTIVE THICKNESS			END CROSS-SECTION		
	Mild steel	Wood	Masonry	Charge in 1-lb slabs	SLABS	CARTRIDGES
1	1 in	9 ins	18 ins	1		
2	2 ins	18 ins	36 ins	2×2=4		
3	3 ins	—	54 ins	3×3=9		

These Notes refer to Table 9.

Notes

(*a*) To get number of slabs or cartridges per cut, divide length of cut by the length of slab or cartridge and multiply this by the number in the cross-section shown above.

(*b*) For intermediate thicknesses, estimate from above table. Charges should be laid in the width-height ratio of about 2 to 1.

(*c*) The table shows correct end cross-sections for 1-lb slabs. If 2-lb slabs are used, charge should be equivalent weight of explosive with end cross-section conforming as nearly as possible to those given in the table.

2. Formulæ to be used where economy in explosives is desirable

B = width of object attacked in feet.
b = width of object attacked in inches.
c = circumference of object attacked in inches.
D = diameter of object attacked in feet.
d = diameter of object attacked in inches.
T = thickness of object attacked in feet.
t = thickness of object attacked in inches.

A charge must ALWAYS be continuous over the surface attacked, even if this involves increasing the calculated charge.

TABLE 10

Serial	Object attacked	CE/TNT	" 808 ", " 852", PE3
(*a*)	(*b*)	(*c*)	(*d*)
1.	**Iron or steel**		
	Round section	$\frac{2}{3}d^2$ or $c\frac{2}{16}$ lb	$4d^2$ or $\frac{1}{2}c^2$ oz
	Rectangular section	$\frac{1}{8}bt^2$ lb	$\frac{3}{2}$ bt^2 oz
2.	**Timber***		
	Round section	$3D^3$ lb	$2D^3$ lb
	Rectangular section	$3BT^2$ lb	$\frac{3}{2}BT^2$ lb
3.	**Masonry**		
	Walls	$\frac{1}{2}BT^2$ lb	$\frac{1}{2}BT^2$ lb
	Piers	$\frac{2}{3}BT^2$ lb	$\frac{2}{3}BT^2$ lb
	Arch ringsø	$\frac{3}{4}BT^2$ lb	$\frac{3}{4}BT^2$ lb

* Hard wood. For soft woods charges may be halved. Maximum thickness of timber that can be cut is 30 ins.

ø *See* para 3 (*h*) on page 44.

In all cases minimum cross-section is one slab or one cartridge.

3. Notes on placing of cutting charges

(*a*) Cover full breadth of surface to be cut with explosive.

(*b*) Ensure all voids between charges and surface attacked are packed, if possible with plastic " 808 " or other plastic explosive.

If no plastic explosive is available, use clay or mud *no thicker than is necessary to get a flat surface.*

(*c*) At each point of initiation see that direction of the detonating wave is normal to surface attacked.

(*d*) Charges should not normally be thicker than 6 ins. The width of charge should be from 2 to 4 times the height of charge.

(*e*) For placing charges on steel girders, etc., the most satisfactory method of fixing is to place charges in wooden boxes windlassed to the girders with wire. Where possible on steel trusses, etc., use staggered charges so that a shearing effect is obtained. Remember that charges fixed directly opposite each other, *e.g.*, on either side of web of an RSJ, will nullify each other. (*See* RE RPB Sec 34.)

(*f*) In placing cutting charges on steel girder bridges, consider the possibility of the span jamming as it falls.

(*g*) Do not attempt to cut more than 3 ins of steel by the normal method. For plates or girders of greater thickness or for thick armour plate, special shaped charges are required. (*See* Sec 19.)

(*h*) For long continuous charges, *e.g.*, on masonry arches, initiate the charge every 5 ft. If attacking arches from below, double the charge.

(*j*) Do not attempt to use normal cutting charges on reinforced concrete beams. Best methods are either pressure charges (Sec 15) or shaped charges (Sec 19).

4. Adhesives for cutting charges.—To assist in fixing cutting charges to vertical surfaces Plasowax No. 11 or Shell Asbestos Compound (Waterproofing compound) may be used. It should only be used to assist in strutting or wiring and NOT as a permanent method of fixing. The surface should be dry or wiped before fixing the charge, which is previously coated with an $\frac{1}{8}$-in layer of the adhesive. Plasowax No. 11 is suitable for use between 40 deg F and 80 deg F but Shell Asbestos Compound should be used at higher temperatures.

SECTION 13.—BOREHOLE CHARGES

1. Borehole charges in brick, masonry or unreinforced concrete piers. *See* Fig 13 (*a*) :—

(*a*) Drill horizontal holes two-thirds thickness of pier.

(*b*) Fill holes half full with explosive up to a maximum of 5 lb.

(*c*) Spacing of holes 3 ft. Stagger holes in rows.

(*d*) Two rows for piers up to 6 ft thick. (Three rows if concrete.)

(*e*) Three rows for piers from 6 ft up to 9 ft.

(*f*) Distance between rows=depth of holes (minimum 3 ft).

(*g*) Use " 808 " or other plastic explosive.

(*h*) For recce purposes allow 5 lb per borehole.

(*j*) For piers over 9 ft, borehole charges not possible with unit compressor.

(*k*) Beehives (Sec 19) can be used to make boreholes in piers up to 7 ft 6 ins.

(*l*) In the case of arch bridges boreholes must be placed below the springing of the arch.

2. Drilling times with pneumatic tools and service compressor.

TABLE 11

Serial	Material	Feet drilled per hour per drill		
		2-in	1⅝-in	1¼-in
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
1	Brickwork	20	20	20
2	Concrete (unreinforced)	9	10	13
3	Sandstone	9	10	13
4	Limestone	8	9	11
5	Slate	7	8	10
6	Granite	5	6	7

These Notes refer to Table 11.

Notes

(*a*) Figures above are for horizontal holes. For vertical holes they can be doubled.

(*b*) They include normal stoppages, time for changing bits, and allowance for stuck drills, etc.

(*c*) Progress for holes over 6 ft deep will be only half as fast.

(*d*) Extra allowances must be made for drilling at awkward angles or from difficult positions.

(*e*) Recommended sizes of drills for boreholes are as follows :—

0–40 ins	... ...	2-in drill
40–60 ins	... ...	$1\frac{3}{4}$-in drill
60–72 ins	... ...	$1\frac{1}{2}$-in drill

3. Borehole charges in timber

(*a*) *Charge required in ozs of plastic explosive*

Circular section	$6\ D^2$	D = diameter in ft.
Rectangular section	6BT	B = breadth, T = thickness, both in ft.

(*b*) Use 2-in auger.

(*c*) For baulks of under 18-in diameter use one borehole.

(*d*) For baulks of over 18-in diameter use two boreholes. *See* Fig 13 (*b*).

4. Notes

(*a*) Using *compressor and pneumatic* drill it is difficult to drill holes higher than 4 ft 6 ins above ground level, unless truck or other improvised platform can be used. If platform cannot be improvised cut down distance between rows given in para 1 (*f*).

(*b*) Beehives normally slightly quicker than compressor:—

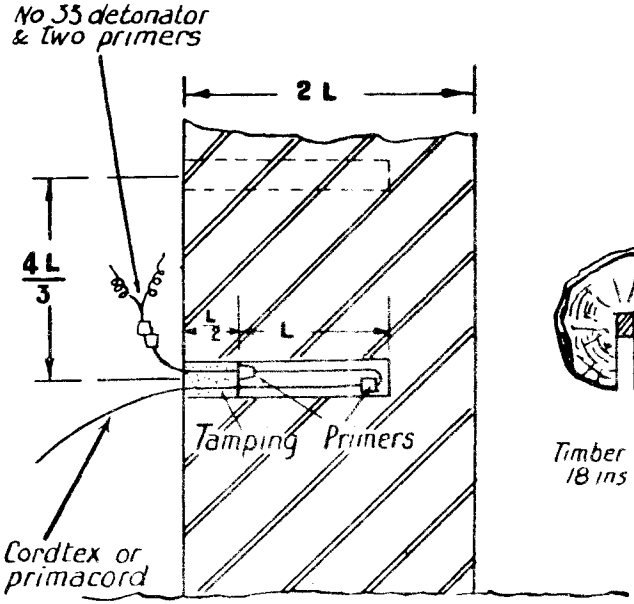
(i) 6-in Beehive will give a hole approximately 2 ft 6 ins deep in masonry.

Two fired successively over same hole will give 4 ft and 3 fired over same hole will give approximately 5 ft.

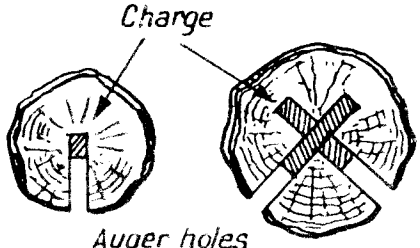
Take care to centre second and third beehives exactly over original hole.

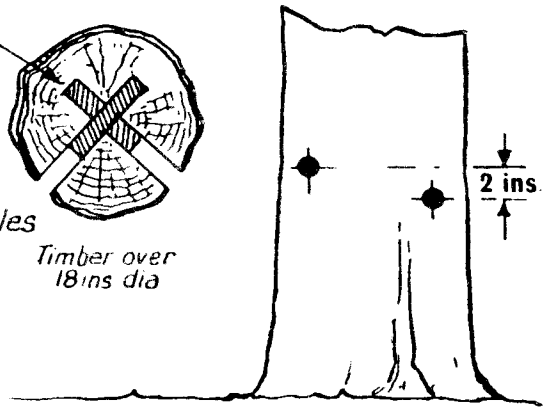
(ii) Boreholes drilled with 6-in Beehives must not be nearer than 3 ft to end of pier or other structure.

(iii) Boreholes drilled with Beehives must be cooled before filling.



14a.—Borehole Charges on Masonry Pier





14b.—Borehole Charges in Timber

FIG 13.—**BOREHOLE CHARGES**

(iv) With electrical firing Beehives must be at least 4 ft apart.

(v) Using detonating fuze leads of same length and fired from a junction box, Beehives must be at least 18 ins apart.

(*c*) Do not use boreholes for reinforced concrete piers or for abutments of any material.

(*d*) *Remember importance of tamping.*—Dry sand is the best. For horizontal boreholes use sand that is slightly damp.

5. TABLE 12.—EXPLOSIVES IN BOREHOLES

Serial	Diameter of borehole in ins	Weight per ft run of explosive		
		Military ammonal (unrammed)	808, 851, 852 (wrapped)	PE2 or PE3 (wrapped)
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
1	1½	0 lb 14 ozs	0 lb 14 ozs	1 lb 2 ozs
2	1¾	1 lb 3 ozs	1 lb 4 ozs	1 lb 8 ozs
3	2	1 lb 9 ozs	1 lb 11 ozs	2 lb 0 ozs

SECTION 14.—MINED CHARGES

1. "Hasty" estimation of large mined and cratering charges

(*a*) 70 lb explosive 7 ft deep give a crater of 20 to 25 ft dia.

(*b*) Space charges 10 ft apart.

(*c*) In abutments place these charges 5 ft back from abutments.

(*d*) Use plastic explosives; in dry sites where charge is to be blown at once ammonal may be used.

2. "Hasty" estimation of small mined charges

(*a*) Place immediately behind abutment or at centre of pier.

(*b*) Use charges of 20 lb at 5 ft spacing, maximum depth 5 ft.

(*c*) For depths of over 5 ft use charges estimated as in para 1.

3. "Hasty" estimation of camouflet charges

(*a*) *Use of camouflet equipment*

(i) Maximum depth of charge : 7 ft.

(ii) Camouflet charge : 5 primers.

(*b*) *Spacing of craters*

(i) Lines of craters 80 ft apart.

(ii) Individual craters—*see* para 1 above.

(*c*) *Working parties and times*

(i) Single crater : one section, one hour.

(ii) Group of three craters : one section, two hours.

(*d*) *Use of earth auger 9-in*

(i) The earth auger in suitable ground will give depth of 9 ft 6 ins.

(ii) Hole may be made in some soils to take normal ammonal tin.

4. Estimation of large mined charges where "hasty" rules do not apply

(*a*) Formula $C = \frac{D^3}{100}$ C = charge in lb.
D = diameter of crater required in ft.

Charge calculated from this formula should be doubled in rock or behind heavy abutments including *all* reinforced concrete abutments.

In very soft soils charge may be halved.

(*b*) *Position of charge*

(i) Optimum depth : approx $\frac{D}{3}$

(ii) Optimum distance behind abutment face : $\frac{2D}{9}$

(iii) Depth of charge if buried must NEVER be less than its distance from abutment face.

5. Estimation of small mined charges where "hasty" rules do not apply

(*a*) Formula $C = \frac{L^3}{6}$ for ammonal.

$C = \frac{L^3}{8}$ for "808" or other plastic explosive.

C = charge in lb.

L = least line of resistance in ft measured from the centre of the charge to the nearest face of object to be destroyed.

(*b*) Charges are placed L ft from end of abutment and 4/3 L apart.

(*c*) They must ALWAYS be in contact with the inside surface of object attacked.

6. **Note**

Keep each mined charge well concentrated, using bags or boxes *where necessary*.

SECTION 15.—PRESSURE CHARGES

(*see* Fig 14)

1. Estimation of pressure charges

(*a*) *RC beams.*—Over middle of each beam place a charge in lb equal to 20 times depth of beam plus roadway in ft.

(*b*) *RC slabs.*—Over middle of slab place a row of charges 4 ft apart with each charge in lb equal to 20 times depth of slab plus roadway in feet.

(*c*) If economy of explosives is desirable, individual charges in (*a*) above should be calculated from the formula $C = 4H^2T$ lb, where H is the depth of the beam plus roadway in feet and T is the thickness of the beam in feet. (Minimum values for H and T, 1 ft).

2. Notes

(*a*) Effect of pressure charge is to overload beam or slab; therefore always place charges at centre of span.

(*b*) If main girders are attacked there is no need to cut roadway between girders. No excavation is required.

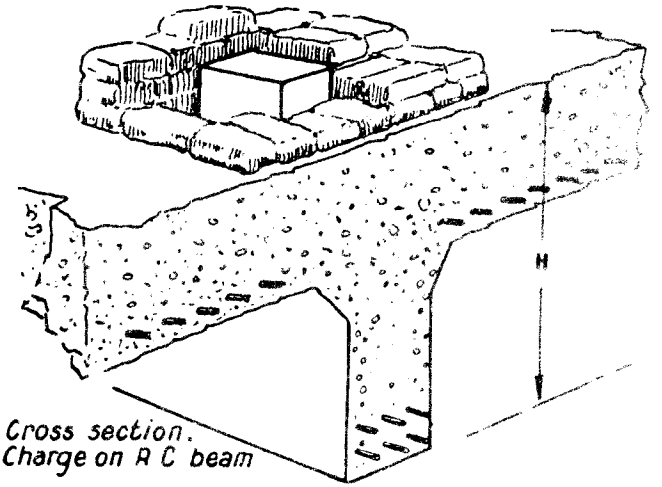
(*c*) Unless charges demolition No. 2 (General Wades) are used, *tamping is most important.* For tamping use one filled sandbag per lb of charge.

(*d*) Length of charge along given beam should be approximately twice its width and twice its height.

(*e*) Any explosive may be used.

(*f*) Pressure charges are NOT suitable for steel girders.

(*g*) When time permits, the end of the span in the abutment or pier should be attacked simultaneously with the span to increase the turning effect and ensure a complete demolition.



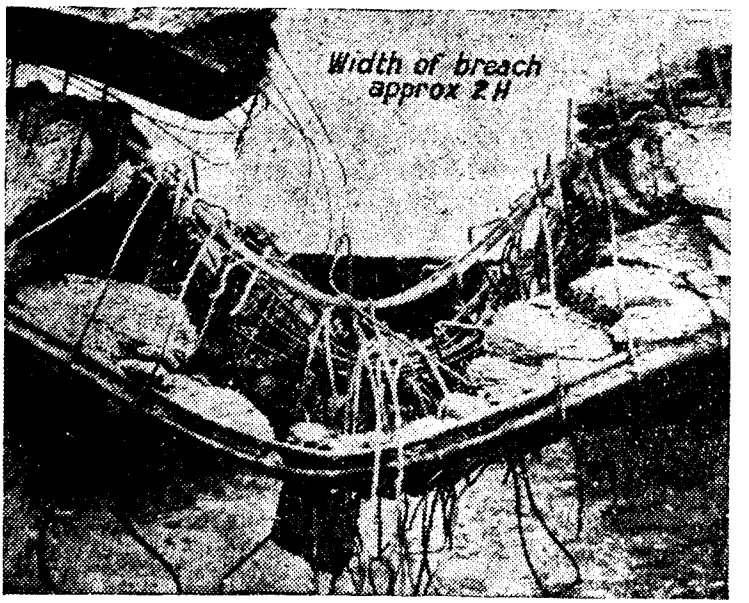


FIG 14.—PRESSURE CHARGES

SECTION 16.—FOOTING CHARGES

(*see* Fig 16)

1. Estimation of footing charges

(*a*) For piers up to 6 ft thick, individual charges in lb = 10 times thickness of pier in ft, spaced thickness of pier apart.

(*b*) For piers over 6 ft up to 9 ft thick individual charges in lb = 20 times thickness of pier in ft, spaced thickness of pier apart.

(*c*) Number of charges = width of pier ÷ thickness.

2. Notes

(*a*) This is quickest method of demolishing piers where ground level on one side is higher than on other.

(*b*) Place charges against face of pier where ground level is higher.

(*c*) Sink charges so that top of each charge is at, or just below ground level

(*d*) Sometimes where pier is on level ground it may be possible to excavate sufficient earth on one side to make it possible to place footing charges on the other. Cut away earth for full thickness of pier on side away from charges. Angledozer may be able to do this very quickly if site is accessible.

SECTION 17.—BREACHING CHARGES

1. Estimation of breaching charges.

(*a*) *RC obstacles* (*e.g.*, dragon's teeth)

(i) Use 1 lb per cu ft to be removed.

(ii) Spread charge over large area and keep thickness under 6 ins.

(iii) Centre of charge one-third height of obstacle from ground.

(*b*) *RC walls*

(i) Use 2 lb per cu ft to be removed.

(ii) Outline bottom and sides of gap with ¾ charge. Bottom of charge not more than 2 ft and not less than 1 ft above ground.

(iii) Place remainder of charge in centre of required gap.

(*c*) *Masonry obstacles and walls.*—Above charges may be halved.

(*d*) Charges should be placed in direct contact with the target, and explosive should be removed from packing before it is placed in position.

2. Notes

(*a*) Charges given in para 1 are for medium reinforced concrete. For heavy reinforcement (10-in cube mesh or heavier) double the charge.

(*b*) When deciding shape of the charge, keep thickness/height ratio about 1 : 4.

(*c*) Charge demolition No. 2 (General Wade) was designed for wall and obstacle breaching (*see* Table 13).

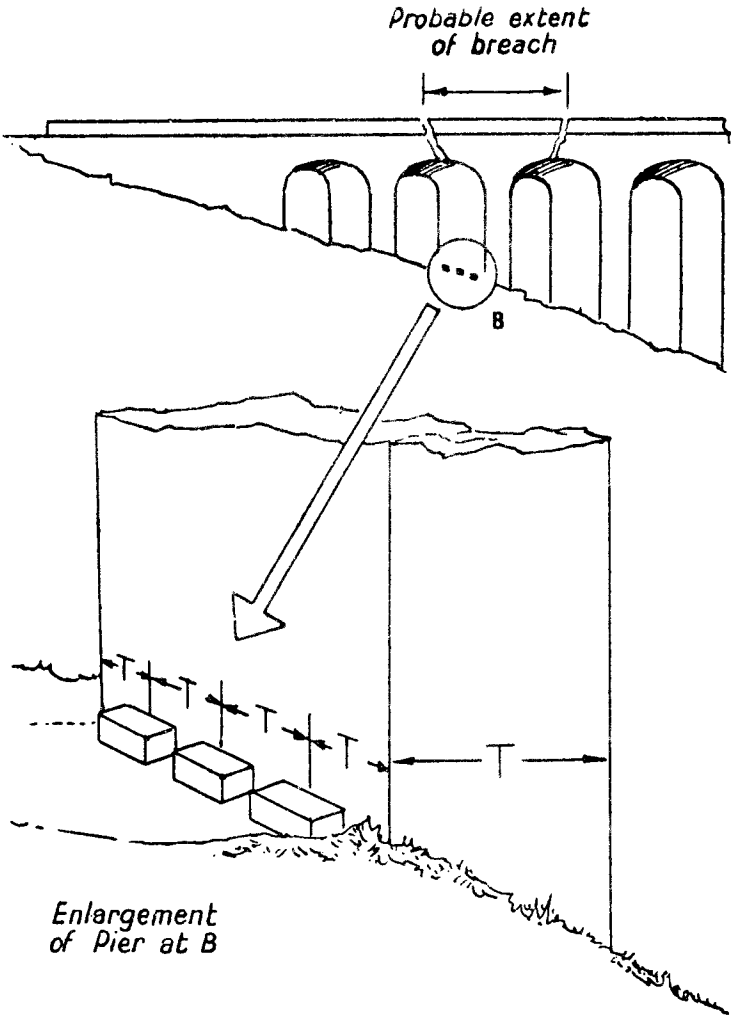


FIG 15.—USE OF PIER FOOTING CHARGES

SECTION 18.—CONCUSSION CHARGES

1. Estimation of concussion charges. (*See* Fig 16)

Formula : $C = KT\sqrt{VT}$.

Where C = charge in lb.

T = wall thickness in feet (where roof thickness is both greater than wall thickness and one-third internal height, then T = roof thickness in feet).

V = internal volume of structure in cubic feet (including all internal walls, floors, etc).

K is a factor, depending on :—

(i) the strength of the materials used in construction ;

(ii) the shape of the structure ;

(iii) the number of openings or weak spots in the walls and/or roof, through which the effect of the charge may be dissipated.

Values of K for different types of structure are given below. These values are given as a guide, and may be modified in the light of experience :—

Type of structure	Value of K
Brickwork structures up to 1,000 cu ft internal volume, with RC roofs up to 2 ft thick (surface or semi-buried types)	0·1
Brickwork structures of larger internal volume	0·2–0·4
RC fortifications, walls up to 2 ft thick (with light reinforcement). Large RC air raid shelters with walls of any thickness, surface (or below ground up to 5-ft cover)	0·4
RC tunnels in normal soil	1·0
NOTE.—Charge should be calculated for each 100-ft run of tunnel.	
RC fortifications, walls 4 ft thick or more (with heavy reinforcement)	1·1

2. Notes

(*a*) Close all windows and doors, and tamp other openings by filling with sandbags. In emergency lighter materials may be used as tamping, but results will not be so good. Always aim to have building completely enclosed.

(*b*) Place calculated charge in lots of 50–100 or 200 lb, close to the strongest features (*eg*, corners or junctions of walls). Where adjoining rooms have the same volume, and walls of approximately the same strength, use the principle of unbalanced blow ; calculate total charge for rooms, and split between rooms in ratio 2 : 1 ; fire simultaneously.

(*c*) Concussion charges are not effective if one enclosing surface (walls or roof) is much weaker than the others, *eg*, buildings with thick masonry walls and corrugated iron roof.

(*d*) Concussion charges cannot be used for framed buildings, *ie*, buildings of steel or RC, which do not rely on their main walls for structural strength. In these buildings the framework must be demolished by cutting or borehole charges.

(*e*) In the case of light brick structures, the charge need only be calculated for, and placed on the ground floor. For heavier structures of more than one floor, charges must be calculated for, and placed on all floors.

(*f*) Do not use concussion charges when it is desirable to do as little damage as possible to adjoining buildings. Instead use cutting charges for thin walls (up to 18 ins thick) and for thicker walls use small borehole charges, 5–8 oz explosive at 12- to 18-in centres.

(*g*) For hasty calculation for light brickwork structures (*eg*, for clearing field of fire) the following formula may be used :—

$$C = \frac{VT}{100}$$

where the min value for T is 1.

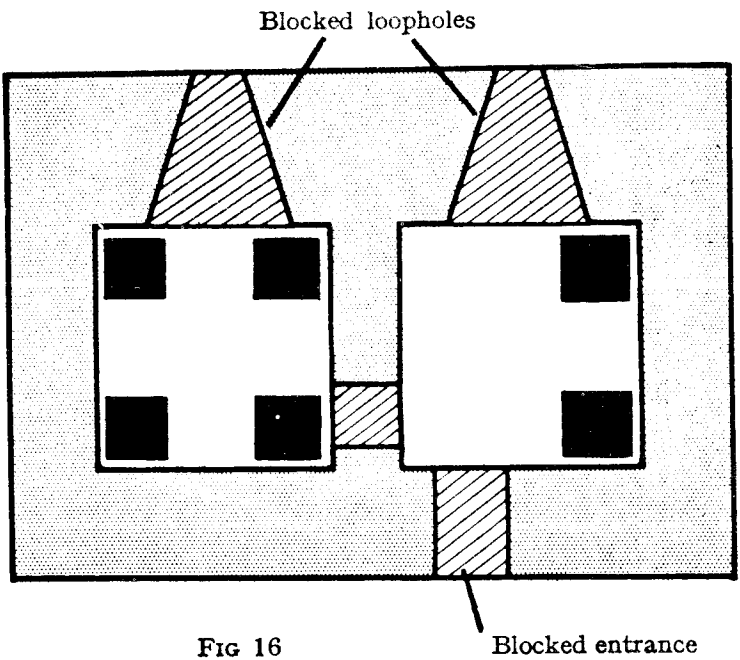


FIG 16

CONCUSSION CHARGE IN RC FORTIFICATIONS

SECTION 19.—SHAPED CHARGES—DESCRIPTION AND USES

TABLE 13.—SHAPED CHARGES

Serial	Name	Description	Supply	Use	Initiation	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	Bangalore torpedo 1½-in.	6-ft lengths of 1½-in pipe filled amatol. Weight per 6-ft length: 14 lb. Male and female ends with spring clip joint. Packed in sets of four with one nose.	"Q" channels as for ammunition. 24 carried in pioneer pl of inf bn.	Breaching wire obstacles. Produces gap at least 10 ft wide in wire fence depending on spacing and type of main pickets.	Priming charge incorporated at male end with hole for detonator or detonating fuze. Use 1 ft cordtex and double safety fuze and igniter set made up as in Fig 3.	Made-up initiating devices are unsatisfactory. Ready made igniter may soon be on issue.
2	Charge Demolition No. 1 ("Beehive"), Mk 3.	6-in diameter hollow cone with three 6-in fixed legs. Contents: 6¾ lb HE. Total weight: 10 lb. Packed 4 in a container. Weight: 53½ lb.	Ditto. Field Coys/Sqns carry 72 in their G 1098.	Drilling tool. Used for quick excavation of boreholes (*see* Sec 13) May also be used for breaking up non-reinforced concrete blocks, boulders, etc. Will penetrate 9-in mild steel. Will penetrate 6-in armour plate.	Detonator or detonating fuze inserted in priming charge on top of beehive. Critical distance apart, if firing more than one: 4 ft fired electrically, 18 ins fired with cordtex leads of same length.	REMEMBER TO COOL BOREHOLES. Penetration in RC: 30 ins.

3	Charge Demolition No. 2. ("General Wade"), Mk 1	Arch shaped charge. For dimensions *see* Fig 18. Filling: 25 lb HE. Total weight: 30 lb. Packed 1 in a wooden box complete with detonating fuze branch. Weight: 46 lb.	Only issued at present for special operations.	Designed as wall-breaching charge Has combined cutting and pressure effect. May also be used as pressure charge, requiring no tamping.	Priming charge in centre of top arch, with hole for special detonator or detonating fuze. Earlier types have 12 ins of cordtex fixed in primer.	14 are required to cut a 15-ft gap in a 4-ft RC wall, 25 for a 6-ft wall, 64 for a 9-ft wall. For pressure charges divide normally calculated charge in lb by 25. Penetration in RC: 9 ins.
4	Charge Demolition No. 3 ("Hayrick"), Mk 1.	"V"-shaped charge. For dimensions *see* Fig 19. HE content: 15 lb. Total weight: 30 lb. Packed 2 in a wood box. Weight: 95 lb.	Through Engineer channels only.	Made-up cutting charge, designed for attacking the tension reinforcement from the underside of RC beams or barrel arches. Will penetrate 24 ins RC or 9 ins mild steel.	Two primers are built in to top of charge with holes for detonator or cordtex.	Charge should overlap beam by at least 3 ins at each end. A special Hayrick frame is provided which will clamp up to 5 Hayricks on the underside of a beam. (Max. thickness of beam: 2 ft). To fix the frame on the underside of beams inaccessible from above a special erection gear is provided. (*See* PWI.)

Serial	Name	Description	Supply	Use	Initiation	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)
5	Charge Demolition No. 6. (16-lb "Beehive.")	Similar in appearance to 6-in Beehive. HE content: 16 lb. Total weight: 25 lb. Packed 2 in a wood box. Weight 72 lb.	Issued only for special operations.	As for 6-in Beehive. Will penetrate 3 ft of reinforced concrete with heavy flaking and blast effect inside.	As for 6-in Beehive.	For light pillbox neutralization. Penetration in RC: 32 ins.
6	Charge Demolition No. 11. (30-lb Nesting Beehive.)	Large Beehives which will fit over each other to give increased effect. HE content: 30 lb. Total weight: 50 lb. Packed 2 in a wood box. Weight: 135 lb.	Issued only for special operations.	As for 6-in Beehive. Designed for use against heavy RC.	As for 6-in Beehive.	Penetration in RC:— One—75 ins. Two (nested)—95—114 ins. Diameter of hole 6-8 ins.
7	Charge Demolition No. 12. 5-oz and 7-oz (Stook).	Small waterproofed Hayrick with one strand of detonating fuze running through the top for initiating purposes. 5-oz stook is 4 ins long, 7-oz stook is 6 ins long.	Issued only for special operations.	Cutting steel under water. Will cut up to 1-in mild steel.	Detonating fuze leads incorporated in charge attached to cordtex main.	Has wires at each end for quick attachment to target.

These Notes refer to Table 13.

2. Notes

(*a*) *Bangalore torpedo,* 1½-in, *Mk* 1

(i) This torpedo is now standard issue. The 2-in Mk 1 is no longer being made ; old stocks may still be encountered.

(ii) When using against wire, place torpedo against main uprights in fence about 18 ins above ground. Clear gap will normally result as far as adjoining upright on either side.

(iii) See that firing party retire at least 20 yds directly behind torpedo and lie down. Men on flanks lying down not safe nearer than 100 yds, unless behind splinter-proof cover.

(iv) Bangalore torpedoes NOT reliable method of clearing mines. Crater formed by torpedo is reasonably safe path for men on foot but anti-tank mines in this path may be rendered hyper-sensitive by blast. Therefore, always search path for mines if possible before used by infantry.

(v) Torpedoes can easily be improvised with iron piping and "808."

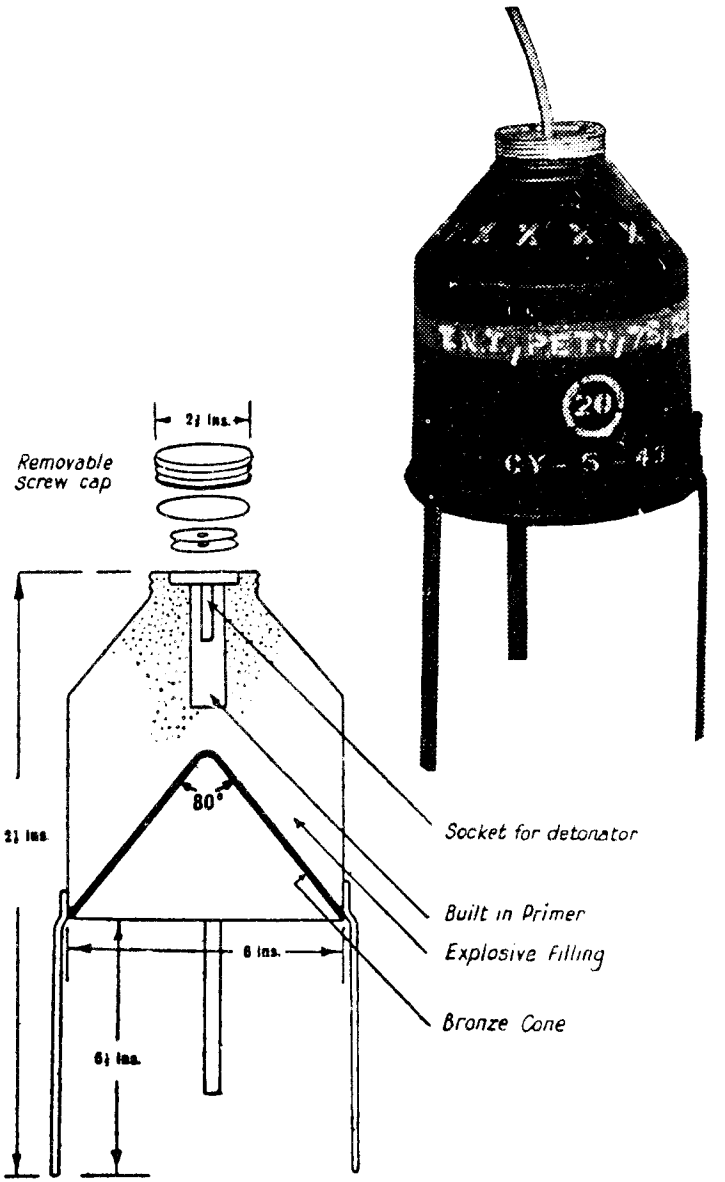


FIG 17

CHARGE DEMOLITION No. 1, BEEHIVE, 6-IN

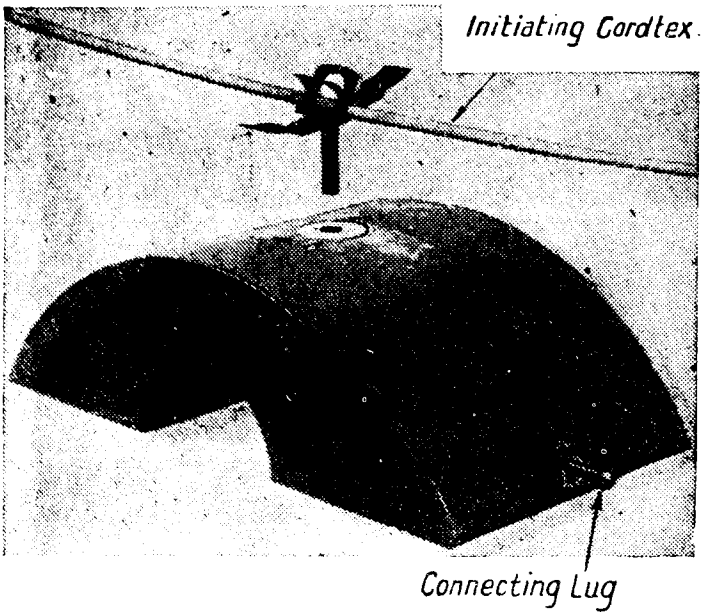


FIG. 18.—CHARGE DEMOLITION No. 2 GENERAL WADE

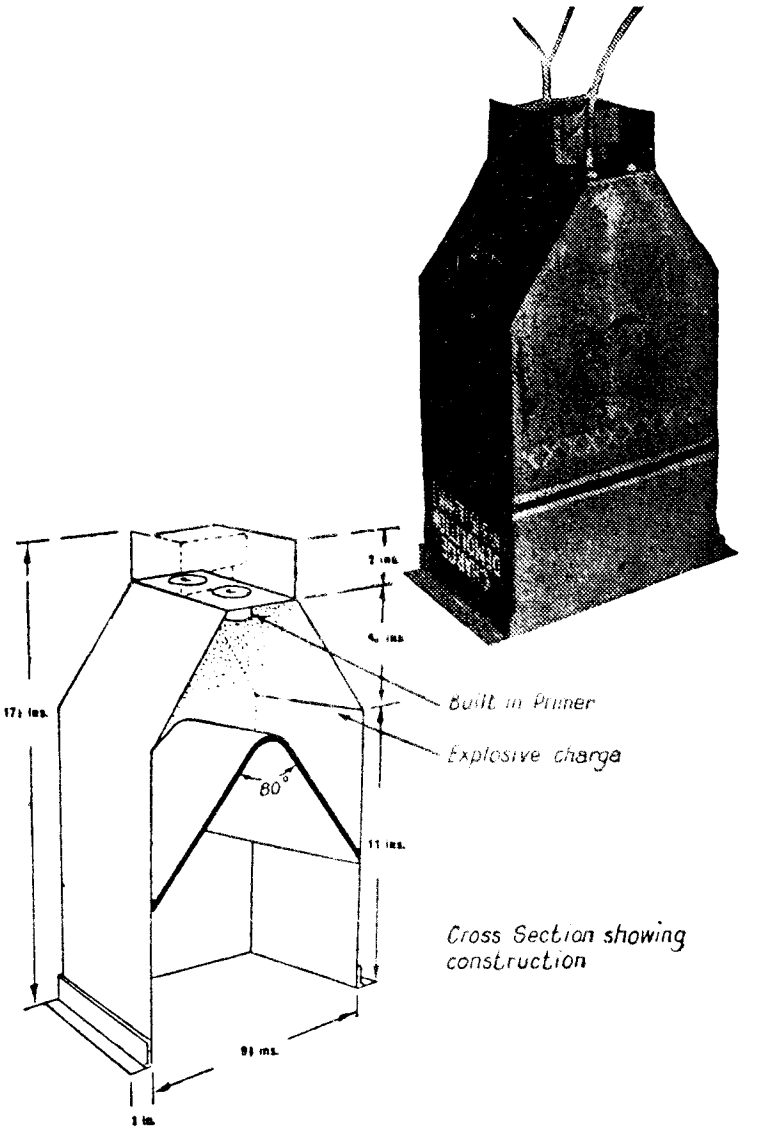


FIG 19.—CHARGE DEMOLITION No. 3, HAYRICK

SECTION 20.—MISCELLANEOUS DEMOLITION TECHNIQUE

1. General.—Notes on methods of demolition of various targets are given in RE RPB. Sec 34, para 10.

2. Excavation for gunpits, etc

(*a*) 1 lb explosive buried 2 ft in ground will form crater of loose, easily excavated soil for radius of 2 ft and depth of 3 ft in hard or rocky soil.

(*b*) Spitlock gunpit or other excavation to correct shape and bury charges over it at 4-ft centres. Blow simultaneously with ring main.

(*c*) *Method is NOT suitable*

(i) Where soil is heavy clay or equivalent, which will not form a firm foundation after excavation by this method.

(ii) Where blowing of charges may give position away to enemy.

(iii) When spoil scattered over ground may betray position to enemy aerial recce.

(*d*) *Do not use this method for weapon slits.*—Area of loosened soil is too wide and walls will not be firm enough to give protection against AFVs overrunning position.

3. Destruction of explosives

(*a*) Explosives, if in bad condition, should be destroyed by burning in small lots of not more than 5 lb. Place in trenches if possible, and ignite with petrol-soaked sandbags from down wind.

(*b*) CE/TNT will not often deteriorate unless millboard cover of slabs is damaged. This explosive will not burn unless a very hot flame is applied. It should be detonated in small quantities.

(*c*) Explosives contaminated by war gases are liable to become dangerous in varying degrees within a short period of contamination. *Do not attempt to decontaminate with bleach.* This may cause ignition or detonation. Soak with water and then split into small lots and destroy by burning as already described.

TABLE 14.—HASTY ESTIMATION OF IN THE PREPARATION

NOTE.—These are average figures and it is most unlikely that reconnaissance of each bridge

Serial No.	Nature of bridge	Width	Span	Single cut across one span (Slab or plastic explosive)		
		ft	ft	secs	Time hrs	Explosive lb
1	Brick, masonry or mass concrete arches, piers and abutments	Up to 20	10–40	1	4*	80
2			40–80	1	5*	140
3		20–40	10–40	1	6*	160
4			40–80	2	6*	280
	Steel girder					
5	Spans	Up to 20	10–40	1	4	60
6	Piers and abutments		40–80	1	5	150
7	as in serials 1–4		80–130	1	6	290
8		20–40	10–40	1	4	120
9			40–80	1	6	300
10			80–130	2	6	440
11	RC slabs	Up to 20	10–40	1	4	160‡
12	Beams and girders ..		40–80	1	5	350‡
13	RC piers and abutments		80–130	1	6	500‡
14		20–40	10–40	2	4	320‡
15			40–80	2	5	700‡
16			80–130	2	6	1,000‡
17	RC arches	Up to 20	10–40	2	8*	500§
18	Piers and abutments ..		40–80	2	12*	800§
19			80–130	2	16*	1,000§
20		Over 40	10–40	3	12*	1,000§
21			40–80	3	16*	1,600
22			80–130	3	20*	2,400

NOTES.—* May need compressor to break road surface.

† Compressor required for three-quarters of this time. If Beehives are used—half time.

‡ Use pressure charges. Alternatively attack with hayricks from underneath.

§ Dig down and place pressure charges at crown and both ¼ spans. If available, use hayricks at crown and both ¼ spans.

MEN, TIME AND EXPLOSIVES REQUIRED OF A DEMOLITION BELT

these will be correct for any one bridge, and a detailed will always be necessary.

Destruction of one pier						Destruction of one abutment					
Using borehole charges (Plastic explosive)			Using footing charges (Any explosive)			Using mined charges placed by Camouflet method (Plastic explosive or ammonal)			Using deliberate mined charges Formula $\frac{D^3}{50}$ (Any explosive)		
secs	Time hrs	Explosive lb	secs	Time hrs	Explosive lb	secs	Time hrs	Explosive lb	secs	Time hrs	Explosive lb
1	6†	75	1	2	450	1	2	140	2	48	600
1	8†	125	1	2	450	1	2	140	2	48	600
1	10†	150	1	3	800	1	2	210	2	72	2,000
1	12†	225	1	3	800	1	2	210	2	72	2,000
									2	72	2,000
1	5†	75	1	2	450	1	2	140	2	48	600
1	6†	125	1	2	450	1	2	140	2	48	600
1	7†	150	1	2	450	1	2	140	2	48	600
1	6†	150	1	3	800	1	2	210	2	72	2,000
1	7†	225	1	3	800	1	2	210	2	72	2,000
1	7†	225	1	3	900	1	2	210	2	72	2,000
1	6‡	100	Probably unsuitable			1	2	140	2	48	600
1	8†	150				1	2	140	2	48	600
1	10†	250				1	2	140	2	48	600
2	8†	200				1	2	210	2	72	2,000
2	10†	300				1	2	210	2	72	2,000
2	12†	500				1	2	210	2	72	2,000
Piers probably too thick to attack						Abutments probably too heavy for use of Camouflet charges			2	48	600
									2	48	600
									2	48	600
									2	72	2,000
									2	72	2,000
									2	72	2,000

CHAPTER 4

ALLIED DEMOLITION EQUIPMENT

SECTION 21.—AMERICAN DEMOLITION EQUIPMENT

TABLE 15.—AMERICAN DEMOLITION EQUIPMENT

Serial	Name	Description	Use	Initiation	Effect of moisture	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	TNT block ½-lb	½-lb TNT in cardboard container with metal ends. Hole for American detonator. Dimensions : 3⅜ × 1⅞ × 1⅞ ins	As for CF/TNT or GC slab. Cutting charges etc.	American detonator or British detonator and primer	Nil	Obsolescent. Being replaced by 1-lb block which is twice as long, otherwise similar.
2	Blocks demolition chain M.1	2½-lb Tetrytol blocks joined with two strands primacord. four-block or eight-block chains issued Dimensions : 11 × 2 × 2 ins.	Do	Primacord running through blocks. Initiate primacord by normal methods	Nil	Four-block chains issued with primacord, detonators and safety fuze in standard assault demolition pack
3	Block demolition M 3 (explosive C 2)	Plastic explosive in 2½-lb blocks in carton. Dimensions : 11 × 2 × 2 ins	All purposes (as for " 808 ")	As for " 808 "	Nil	Has same consistency and smell as plastic " 808 " but is not so likely to be set on fire by tracer, and handling does NOT cause headache

4	Shaped Charge M 2	Similar in size and shape to the British Charge Demolition No.1(Beehive, Mk 3), 6½ ins dia by 10½ ins deep. Filled 10 lb pentolite. Total weight : 13½ lb	As British Beehive	Hole for American detonator	Waterproo	Penetration : 3 ft, reinforced concrete; 12 ins armour plate
5	Bangalore torpedo	5-ft × 2-in metal tube. Total weight : 12 lb. Detachable nose and clip joint	As British 1¼-in torpedo	Hole for American detonator	Waterproof	Similar effect to British 1¼-in torpedo
6	Caps blasting non-electric (detonators)	Same diameter as British No. 27 but longer and more powerful. 2¾ × 0.23-ins dia	As British No. 27 detonator	Safety fuze. Detonating fuze	As British No. 27	Packed in tins—100 per tin.
7	Caps blasting electric (electric detonators)	Longer and thicker than British No. 33. More powerful filling. Leads 12 ft long. Dimensions : 3 ins long × 0.27-in diameter	As British No. 33 detonator	Exploder or batteries. Resistance : 2 ohms (British No. 33, resistance: 1·6 ohms)	As British No. 33 electric	
8	Fuze blasting time (safety fuze)	Orange or white fuze with black powder core. Average rate of burning 2 ft per minute	Safety fuze	As British safety fuze	As British safety fuze	ALWAYS TEST rate of burning. Same thickness as British safety fuze. (Do not confuse with British Instantaneous fuze)
9	Primacord (detonating fuze)	Already described. *See* Table 3. Use exactly as cordtex				

TABLE 15.—AMERICAN DEMOLITION EQUIPMENT (*contd*)

AMERICAN EXPLODERS

Serial	Type	Weight approx (lb)	Fusion test (0·0016 iridio-platinum wire, as fired by this operator) (ohms)	No. of dets (No. 33 or U.S. No. 6) which can be fired through 400 yds double E1, Mk 2 cable in the field	Remarks
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
1.	US-30 cap	20	210	50	Operated by rack with 5¾ in stroke; wooden case, fixed handle
2.	US-10 cap	5	65	15–20 NOTE.—Actual field test with good operator was 10 dets through additional 36 ohms	Operated by rotated driving spindle (120°) with a removable captive key. Needs EFFICIENT operator (*i.e.*, 60–65 ohms in fusion test) as its critical speed is high
3.	Atlas 2A blaster	5	35	10–15 NOTE.—Actual field test was 10 dets through additional 20 ohms	Similar to US-10 cap, but with loose key

These Notes refer to Table 15.

Notes

1. Weight for weight, American service explosives can be taken as having the same power as British.

2. Americans do not use primers. Their detonators are more powerful and priming charges are incorporated in their demolition blocks. But if British detonators are used, standard British technique should be employed for initiation. American detonating fuze is primacord which may also be issued to the RE. Treat it exactly as cordtex.

CHAPTER 5

SAFETY PRECAUTIONS

SECTION 22.—SAFETY PRECAUTIONS IN TRAINING AND OPERATIONS

1. General

(*a*) The following safety precautions MUST be observed on training. In operations they must be observed as far as is practicable.

(*b*) Never mix DUMMY and LIVE explosives.

(*c*) Treat all stores, including dummies, as LIVE.

(*d*) No smoking in the vicinity of explosives.

(*e*) Appoint NCO or spr to be in charge of all explosives.

(*f*) Check explosives before and after instructional periods.

(*g*) Keep detonators and primers well separated from bulk explosives.

(*h*) See that explosives are stored as laid down in Sec 11.

2. Practical firing of charges

(*a*) Before the beginning of the practice

(i) At every practice or demonstration with live explosives, an officer will be detailed to be in charge; he will be responsible that all safety precautions are carried out. As an exception, a fully qualified senior NCO instructor may be detailed to be in charge of practices, where charges being fired do not exceed 2 lb.

(ii) For every practice or demolition, an adequate danger area will be marked out with RED FLAGS; sentries will be posted on the perimeter of this area, to ensure that no one can enter the danger area during the practice.

(iii) The following safety distances should be observed at all times during training, unless splinterproof cover is available for spectators to take shelter during the firing of the charge; in operations they may have to be reduced and the risk accepted.

Firing detonators, primers and detonating fuze in the open	20 yds.
Firing small charges up to 5 lb.	100 yds.
Cutting charges on wood ...	300 yds.
Borehole charges in masonry ...	
Mined and cratering charges (up to 70 lb.)	
Cutting charges on metal ...	1,000 yds.

(NOTE.—This may be reduced if the charge is fired in a covered pit.)

(*b*) During the preparation of the charge

(i) Rate of burning of safety fuze will be timed; adequate length of fuze will be allowed to enable the firing party to reach the place of safety at a walk, before the charge can explode.

(ii) Never bury safety fuze or detonators; connect charges up with detonating fuze.

(iii) Where more than one charge is being fired by safety fuze, they will be timed to fire at intervals of at least 10 seconds to enable explosions to be heard separately, as a check.

(iv) Treat all stores, especially detonators, with care. For crimping detonators use only the proper crimpers, as issued to units. Take care not to crimp near the closed end of detonators.

(v) Detonators will not be placed in charges until the order is given for the demolition to be at instant readiness. Electric detonators will be tested for continuity before being incorporated in the circuit (this also ensures that they are not over sensitive).

(vi) For the first test of continuity of a circuit, the detonators will be removed from the charges. On all tests, men will be clear of the charges.

(vii) Do not connect the leads of the exploder until immediately before firing. In training the key of the exploder will be kept by the officer-in-charge ; on operations the key will be kept under guard, near the exploder.

(viii) Never tamp with a metal instrument, or use force in tamping.

(ix) The minimum number of men will be used to prepare the charges ; men not working will be withdrawn under cover or outside the danger area.

(*c*) Before firing the charges

(i) Officer-in-charge will ensure that all sentries know their duties, and that the charge is about to be fired.

(ii) All men, other than the man detailed to light the safety fuze and the officer-in-charge, will withdraw to a place of safety.

(iii) If more than one charge is being fired by safety fuze, two NCOs will be detailed to count the explosions.

(iv) All spectators, if in the open, will be warned that they must look upwards for falling fragments.

(v) When satisfied that all is in order and the danger area is clear, the officer-in-charge will give the order to fire. The firing party will light the safety fuze and withdraw to the electric firing point.

(vi) When the firing party has reached the electric firing point, but NOT BEFORE, the electric leads will be connected to the exploder, and the charges fired electrically.

(*d*) After firing the charges

(i) The officer-in-charge will personally make an inspection to ensure that all charges have fired, and are safe ; he will then give the all clear signal.

(ii) No one will be allowed to enter the danger area, and spectators will not leave the place of safety till the all clear signal has been given by the officer-in-charge.

(*e*) In the event of a misfire

(i) No one will be allowed to enter the danger area or leave the place of safety till 10 minutes after the attempt to fire if electric method was used, or 30 minutes if safety fuze method was used.

(ii) The misfire will then be dealt with by the officer-in-charge, with the minimum number of assistants.

(iii) No attempt will be made to remove the misfired charge; it will be detonated by firing another charge adjacent to it.

(iv) When this charge has been fired, the officer-in-charge will inspect again personally, to ensure that it has detonated and is safe. If satisfied, he will give the all clear signal.

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ROYAL ENGINEERS SUPPLEMENTARY POCKET BOOK, No. 4

DEMOLITIONS, 1946

AMENDMENTS (No. 1)

1. Page 3. Section 2. Para. 2 (*l*). *Add* at end " (*See* RE RPB, Sec. 38.) ".

2. *Delete* pages 6 and 7 and *substitute* new pages 6 and 7 attached hereto.

3. Page 8. Serial 1.

Col. (*c*). *Delete* lines 5 to 10 and *substitute* " primer ".
Col. (*d*). *Delete* lines 6 to 9.

4. Page 9.

Serial 2. Col. (*l*). *Above* line 1 *insert* " Obsolescent.".

Below line 11. *Insert* " Can be used for training in lieu of PE2 or " 852 ". ".

Serial 3. Col. (*l*). *Delete* all detail and *substitute* :—

Amdt. 1/Sept./1947.

Standard plastic HE for tropical use, NOT suitable for tunnelling.

Serial 4. Col. (*l*). *Delete* all detail and *substitute* :—

Amdt. 1/Sept./1947

Standard plastic HE, NOT suitable for tunnelling.

5. Page 10. Serials 5 and 6. Col. (*l*). *Delete* all detail and *substitute* " Obsolescent, can be used for training in lieu of PE2 or " 852 ". ", in each case.

6. Page 11. *Delete* Serial 9 and all detail.

7. Page 12. *Delete* **Note** 1 and *renumber* **Notes** 2, 3, 4 and 5 as 1, 2, 3 and 4, respectively.

8. Page 13. Serial 1. Col. (*l*). *Add* at end :—

Amdt. 1/Sept./1947

Matches, fuzee ; Igniters, SF electric and Igniters, SF striking should only be used for training with " battle noises ".

9. Page 14. Serial 4. Col. (*l*). *Add* at end " Should only be used for training with " battle noises "."

Opposite Serial 6 in col. (*l*) *insert* " Obsolescent.".

10. Page 15.

Opposite Serial 8 in col. (*l*) *insert* " Obsolescent.".

Serial 9. Col. (*l*). *Add* at end " Used for booby trap training only ".

11. Page 17. *Delete* Serials 12 and 13 and all detail.

12. Page 18. Serial 14.

Col. (*c*). Line 1. *Delete* " Fig 2 " and *substitute* " Fig 18 ".

Col. (*l*). *Delete* all detail and *substitute* " Issued with General Wade charges. Obsolescent.".

13. Page 19. *Below* para 2 (*a*) (iv). *Delete* Note.

14. Page 20. Fig 2. *Delete* " IGNITER SAFETY FUZE, STRIKING " and all detail.

15. Page 22. Fig 4. *Delete* third sketch (showing the 2-hole primer) and all detail.

16. Page 25. Fig 7.

Legend F. *Delete* " igniting " and *substitute* " initiating".
Legend G. *Add* at end " (*See* page 29, Note 1(*c*).) ".

17. Page 28.

Serial 2. Col. (*g*). *Add* at end " Should only be used for training with " battle noises ". "

Serial 4. Col. (*b*). *Delete* lines 1 to 3 and *substitute* " Dynamo ".

18. Page 29.

Note 1 (*c*). *Add* at end :—

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This is in order to—

(i) Facilitate connecting of detonator at last minute.
(ii) Avoid accidental detonation when charges are being placed.
(iii) Keep electric circuit and detonators in most protected position.

Note 2 (*c*). *Delete* last 3 lines and *substitute* " Cable, electric, 0·002J (single, low)—2·56-ohms per 100 yds double.".

19. Page 30.

Delete Serial 1 and all detail.

Serial 2. Col. (*e*). *Add* at end " Obsolescent, can be used for training ".

20. Page 31.

Under **Notes** referring to Table 5 *delete* para. (*a*).

21. Page 33. *Delete* the first 3 lines and the figure opposite.

22. Page 34. Serial 2, Exploder test, *delete* (*a*) Mk. 7* and all detail.

23. Page 35. Serial 5. Cols. (*d*) and (*e*), *delete* " Test 2 " and *substitute* " Test 3 " in each case.

24. Page 36. **Note** 2. **Testing.**

Line 1. *Delete* " (*see* Fig 12) ".

Below line 1 *insert* :—

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(*a*) Make visual inspection of circuit before carrying out test.

Re-letter paras. (*a*), (*b*), (*c*) and (*d*) as (*b*), (*c*), (*d*) and (*e*), respectively.

25. Page 39.

Delete sub-para. (*c*).
Sub-para. (*f*), line 1, *delete* " or two-hole ".

26. Page 41. *Delete* last 3 lines and *substitute* :—

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NOTE.—These precautions are the practical minimum for operational conditions. In other conditions advice should be obtained from RAOC and standing orders should be framed accordingly.

27. Page 42. *Delete* **Note** (*c*).

28. Page 43. Table 10, headings.

Col. (*c*), *delete* " CE/TNT " and *substitute* " GC (or CE/TNT) ".

Col. (*d*), *delete* " " 808 ", " 852 ", PE3 " and *substitute* " PE2 or " 852 " ".

29. Page 44.

Para 3 (*b*), line 2. *Delete* " plastic " 808 " or other ".

Para. 3 (*d*). *Delete* lines 2 and 3.

Para. 3 (*h*), line 3. *Delete* " double the charge " and *substitute* :—

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take the effective thickness to be cut as TWICE the thickness of the arch ring.

Delete para. 4.

30. Page 45. Para. 1 (*g*). *Delete* " " 808 " or other ".

Delete para. 1 (*k*) and *substitute* :—

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(*k*) Beehives (Sec 19) can be used to make boreholes 5 ft deep, and so can be used to make boreholes in piers of thicknesses up to 7 ft 6 in.

31. *Delete* page 47 and *substitute* new page 47 attached hereto.

32. Page 48. Table 12, heading.

Col. (*d*), *delete* " 808, 851,".

Col. (*e*), *delete* " or PE3 ".

Section 14. Para. 2 (*b*). *Delete* " maximum depth 5 ft " and *substitute* " maximum distance behind abutment face 5 ft ".

33. Page 49. Para. 5 (*a*). Line 6 from bottom of page. *Delete* " " 808 " or other ".

34. Page 50. Para. 6.

Line 1. *Delete* "**Note**" and *substitute* "**Notes**".
Line 2. *Before* "Keep" in line 2 *insert* "(*a*)".

Below line 3 *insert* :—

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(*b*) With arched bridges, charges should always be placed below the level of the springing.

35. Page 52. Section 16.

Below heading *delete* "Fig 16" and *substitute* "Fig 15".

Para. 2 (*a*). Line 2. *After* "other" *insert* "by at least 18 ins".

Para. 2 (*c*). *Add* at end "TAMP thoroughly.".

36. Page 56.

Serial 1.
Col. (*c*), line 1. *After* 6-ft *insert* "or 10-ft".
Col. (*g*). *Delete* all detail.
Serial 2. Col. (*f*), line 6. *Delete* "Critical" and *substitute* "Minimum".

37. Page 57. Serial 3.

Col. (*c*), line 11. *After* "branch" *insert* "junction".
Col. (*g*). *Add* at end "Obsolescent.".

38. Page 58. *Delete* Serials 5 and 7 and all detail.

39. Page 59. Last line. *Delete* ""808"" and *substitute* "any plastic HE.".

40. Page 62. Bottom diagram. *Insert* "6 ins" near the left bottom edge of the diagram to indicate the width of the hayrick.

41. Page 67.

Serial 4. Col. (*f*). *Delete* "Waterproo" and *substitute* "Waterproof".
Serial 6. Col. (*b*). Lines 2 and 3. *Delete* "non-electric (detonators)" and *substitute* "(non-electric detonators)".

TABLE 1.—DEMOLITION STORES AND EQUIPMENT IN RE FIELD UNITS AND EXPLOSIVE LORRY

Serial (a)	Item (b)		Quantity carried		Suggested distribution	
			Explosive lorry (c)	Fd Sqn (d)	Sec (e)	Tp Hq (f)
1	Slabs, explosive (GC 1-lb)		840	840	14	224
2	(a) Plastic explosive (PE 2)	lb	1,920	1,920	20	640
3	Primers 1-oz (GC or CE)		1,800	1,800	60	360
4	Detonators No. 27		600	600	25	100
5	Detonators, electric No. 33		600	600	—	200
6	Fuze, safety No. 11	ft	864	864	48	96
7	Cordtex (Plastic covered)	ft	7,500	7,500	500	500
8	(b) 6-in Beehives (CD 1)		72	72	4	8
9	Nesting Beehives (CD 11)		6	6	—	2
10	Tubes, fuze sealing, Mk 2		1,200*	1,200	—	400
11	Compound, sealing	pts	12*	12	—	4
12	Crimpers	prs	24*	24	2	—
13	Tape, insulating ¾-in	reels	36*	36	2	4
14	Igniters, SF percussion, Mk 3		240†	240	20	—
15	Switches No. 4 (Pull Mk 1)		30†	30	—	10
16	Switches No. 5 (Press Mk 1)		30†	30	—	10
17	Switches No. 6 (Release Mk 1)		30†	30	—	10
18	Switches No. 9 (L Delay Mk 1)		60†	60	—	20
19	Wire, trip (·032-in dia)	yds	300†	300	—	100
20	Tubes, camouflet		4	—	—	—
21	Points, camouflet		30	—	—	—

22	Cable, electric, J single low ... ... miles	1½	1½	—	½
23	Dynamo condensers	—	12	—	4
24	Boxes, fusion, test	—	12	—	4
25	Test, set demolition	—	12	—	4

(*a*) Will be replaced by Explosive "852" in tropical climates.

(*b*) CD = Charge Demolition.

(*c*) Cable E1 Mk II is the standard demolition cable, but cable, electric, J, single, low, will normally be issued to units in the UK owing to large surplus stocks.

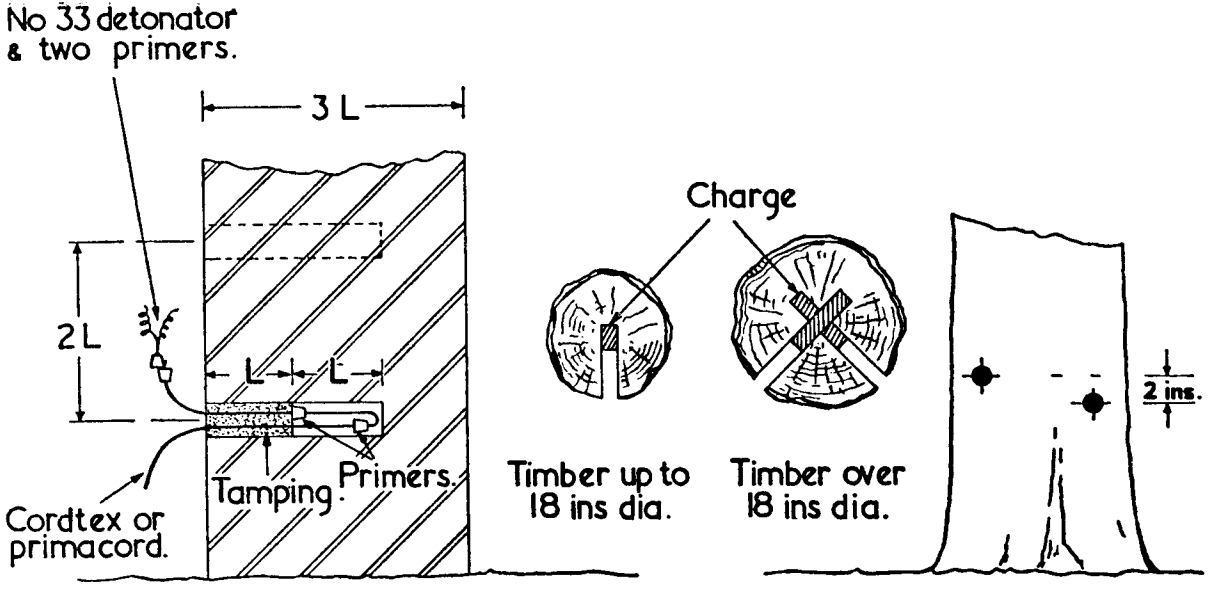
On 3-ton lorry small items marked * and small items marked † are packed, for convenience, in two separate boxes.

1. Explosives are an ordnance supply, obtained like ammunition through "Q" channels.

2. They are carried by the RASC, apart from G 1098 holdings of field units.

3. RASC have a standard loading for their 3-ton explosive lorry (*see* table above) which practically duplicates the G 1098 holding of the Fd Sqn RE. Div RASC hold one such lorry per Fd Sqn RE.

4. No camouflet sets are now carried except by the Fd Pk Sqn RE which holds 3 sets.



13a – Borehole Charges on Masonry Pier. 13b – Borehole Charges in Timber.

FIG 13.—**BOREHOLE CHARGES**