OP 1330: MINE DISPOSAL HANDBOOK PART 2 OF 4*

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MINE DISPOSAL HANDBOOK

E.C.HADERLIE

PART III

BRITISH UNDERWATER ORDNANCE

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MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

. CHAPTER 1

BRITISH INFLUENCE MINES

				3.8			
Remarks	1500 lbs. The "A" Marks III and approx. If are 17,83 in diameter. May be used as a bomb.	1000 lbs. May be used as a approx. bomb.	1800 lbs. May be used as a approx.	1050 lbs. May be used as a approx.			Has been used as a controlled mine.
Total Wt.	1500 lbs. approx.	1000 lbs.	1800 lbs. approx.	1050 lbs. approx.	1130 lbs. or 1320 lbs.	1800 lbs. approx.	2300 lbs.
Type and Wt.	750 lbs. TNT or 775 lbs. Minol	625 lbs. Amatol or 675 lbs. Minol	950 lbs. Amatol	620 lbs. Amatol	320 lbs. TNT or 500 lbs. Amatol	1000 lbs. Amatol or 1800 lbs. 1060 lbs. Minol approx.	1600 lbs. Amatol or 2300 lbs. Has been used as 1750 lbs. Minol
Diameter	1771	1575	18:53	16:8	"Oħ	21"	27"
Length	13 ft. 8 in.	6 ft. 9 in.	9 ft. 1 in.	7 ft. 6 in.	5 ft. 4 in.	3 rt.	5 ft. 10 in.
Laid By	Surface or Aircraft	Aircraft	Surface or Aircraft	Aircraft	Surface	Submarine or 8 ft.	Surface
Type	Ground	Ground	Ground	Ground	Moored	Ground	Ground
Desig- nation	"A" MK, I-IV	"A" MK. V	"A" MK. VI	"A" Mk. VII	"M" MK. I	"M" MK. II	"M" Mc. III

Table 1 - Influence Mines

Introduction

- 1. British Influence Mines fall into two general categories as follows:
 - (a) The "A" group primarily sircreft-laid, ground influence mines, although they must be laid by surface craft. All these mines are cylindrical with slant noses and are laid with small parachutes to prevent damage on impact. Nose fairings which shear on water impact are fitted to give good air trajectory, and the slant noses are designed to make the mine sink horizontally and to prevent it from diving to the bottom.
 - (b) The "M" group various types of influence mines, ground and moored, laid by other than aircraft. These mines do not have any generally similar characteristics since they are all shaped differently and are laid by submarine and/or surface craft according to the design of the individual mine.
- Each of the above types is designed to take a large number of different and almost completely interchangeable firing unit assemblies. Consequently the mines' operational characteristics are almost entirely dependent on the assembly fitted.
- 3. An "Assembly number", which serves to identify the unit fitted, is painted on every mine of the "A" group and consists generally of the letters "ASY" (meaning "Assembly") followed by a letter and three figures. Thus "ASY B204" would indicate that the mine was fitted with Assembly 204. Pollowing is a key to the various letter prefixes to assembly numbers:
 - (a) "A" Units single-pole, magnetic induction firing.
 - (b) "B" Units bi-polar, magnetic induction firing, requiring two actuations of opposite polarity. ASY B204 also incorporates impact firing if the mine drops on land or in shallow water.
 - (c) "C" Units bi-polar, magnetic induction firing, requires two actuations of opposite polarity within a certain time limit.
 - (d) "D" Units acoustic firing. ASY D416 also incorporates impact firing if the mine drops on land or in shallow water.
 - (e) "E" Units delay action bomb firing, controlled by a delay clock.
 - (f) "F" Units ASY F602 through F614 employ instantaneous bomb firing with the exception of F612 which operates as a delay action mine. F616 and above indicate a special firing unit developed for a particular mission.
 - (g) "G" Units combination magnetic induction and acoustic firing.
 - (h) "K" Units acoustic firing.
- 4. In addition to the basic firing systems outlined above, the following variations may be encountered:
 - (a) N.A.C. (non-anticountermining system) an "A" unit, without A/C device, used in conjunction with an "F" unit.
 - (b) Anti-Minesweeper Systems designed to destroy particular types of minesweeping gear. These include instantaneous firing "A" units and insensitive "D" units for use against aircraft and surface minesweepers respectively.
- 5. The following general precautions should be observed when dealing with mines of this type:
 - (a) Do not attempt RMS except in extreme emergency.
 - (b) Allow no movement of magnetic material near the mine.
 - (c) If an acoustic unit is known to be fitted, or if the type of unit fitted is unknown, observe acoustic procedure as follows:
 - (1) Keep all necessary noise to a minimum.
 - (2) Make no noise lasting longer than one second.
 - (3) Allow a three-second interval between each interval of sound.
 - (d) Do not move or jar the mine except from a safe distance.
 - (e) Note that hydrostatically-operated safety arming devices do not disarm the mine upon release of hydrostatic pressure.

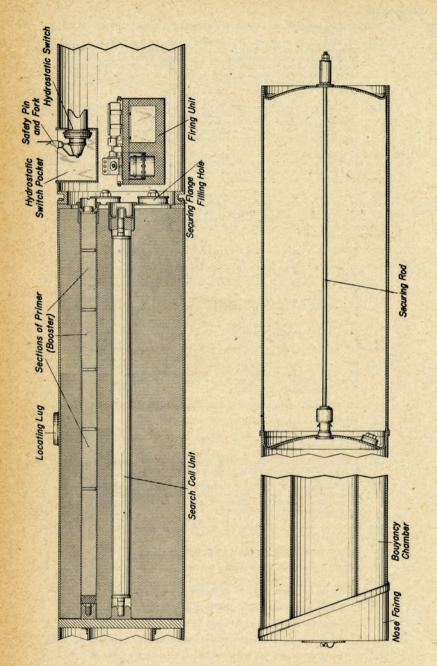


Fig. 1 - Mines "A" Mks. I-IV, Sectional View

"A" Mark I ("A" Mark II, III and IV)

General

- 1. Ground, magnetic induction or acoustic mine.
- 2. Laid by surface craft or by aircraft with parachute or tail.
- Offensive mine, for use in varying depths of water, depending on the type of firing unit fitted, against surface craft or submarines. May also be used as an instantaneous or delayed-action firing bomb.

Description

1. Case

Cylindrical with slant nose. Fitted with nose fairing, Shape

Black or dark green. Color

Material Steel

17.7 Diameter

Length 13' 8" 7' 3" 4' 2" 2' 3" Overall Forward section

After section Charge 750 lbs. Amatol or 775 lbs. Minol.

Total weight in air 1500 lbs. approx.

2. External fittings

3.5 diam., in pocket on top center line of after section, 8" abaft for-ward section, secured by keep ring. Hydrostatic switch

Detonator cover plate

4"5 diam., on after section, 300° from top center line, 4"75 abaft forward section.

17" diam., dish shaped, en-closes after section, welded to case. After end plate

On top center line of forward section, 31" forward of after section. Locating lug

Lifting eye In center of nose.

Tail or parachute boss In center of after end plate.

Inspection bung 2.8 diam., on after end plate, 6.5 from center.

17.7 diam., welded to forward end of after section, drilled with 40 evenly Securing flange spaced stud holes.

- When fitted as a bomb, the mine charge is increased to about 1100 lbs. and the total weight is about 1850 lbs.
- 4. The "A" Marks II, III and IV differ from the "A" Mark I mainly in that they are made by different manufacturers and the "A" Marks III and IV are 17:83 in diameter.



Fig. 2 - Mines "A" Mks. I-IV, View with Tail

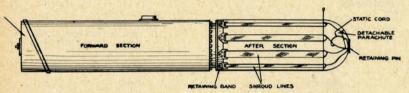


Fig. 3 - Mines "A" Mks. I-IV, with Parachute

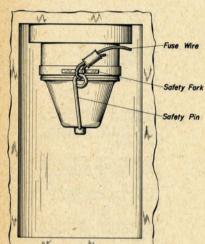
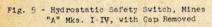
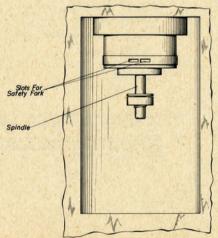


Fig. 4 - Hydrostatic Safety Switch, Mines "A" Mks. I-IV





Operation

- 1. Upon launching or dropping, a safety fork and pin are withdrawn from the hydrostatic switch and a safety pin from the parachute housing (if fitted). Impact with the water, if aircraft laid, shears the nose fairing and operates the parachute or tail release. Dissolution of a soluble plug allows the hydrostatic safety switch to close and the firing unit begins its arming period.
- 2. No self-disarming devices are fitted.

Precautions

1. See Introduction.

RMS

- 1. Insert a safety fork and pin in the hydrostatic switch.
- 2. Remove the detonator cover plate.
- 3. Cut and tape each lead to the detonator separately.
- 4. Remove the booster locking nut.
- Remove the four sections of the booster and separate the detonator from the end section.
- 6. Dispose of detonator, booster and charge.

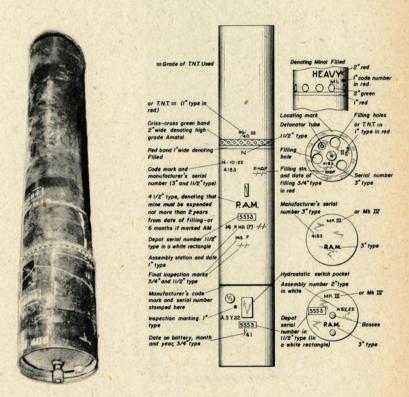


Fig. 6 - Mine "A" Mk. III

Fig. 7 - Markings on Mines "A" Mks. III-IV

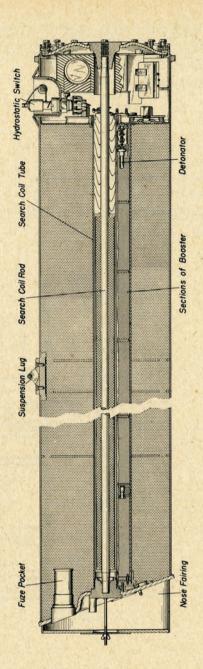


Fig. 8 - Mine "A" Mk. V, Sectional View

"A" Mark V

General

- 1. Ground, magnetic induction or acoustic mine.
- 2. Laid by aircraft with parachute.
- Offensive mine for use in varying depths of water, depending on the type of firing unit fitted, against surface craft or submarines. M be used as a bomb.

Description

1. Case

Shape Cylindrical, fitted with nose fairing.

Black or dark green. Material Steel

Length 61 9" Diameter 15.75

Charge 625 lbs. Amatol or 675 lbs. Minol.

Total weight in air 1000 lbs. approx.

2. External fittings

Color

1.75 diam., in pocket on top center line, 8" for-ward of tail, secured by keep ring. Hydrostatic switch

Booster cover plate 4" diam., on nose.

Two, 1"7 diam.; one 180° from top center line, 8" from after end; one 190° from top center line, 5"5 from after end. Inspection bungs

Impact fuze pocket cover 2.75 diam., on nose, 5.5 from center.

On top center line, 39" aft the nose.

Operation

Upon dropping, a safety pin and cover are removed from the hydrostatic switch. Impact with the water operates the parachute release and shears the nose fairing. Dissolution of a soluble plug allows the hydrostatic switch to close in 10 ft. of water and mine unit begins its arming cycle.

Precautions

1. See Introduction.

Suspension lug

RMS

- 1. Insert a safety pin in the hydrostatic switch.
- 2. Remove the booster cover plate and the gland plate beneath.
- Remove the nut beneath the gland plate. This nut will either be fitted with two pin holes or a single hexagonal hole. 3.
- Remove the booster support. If the nut mentioned in (3) above is fitted with the hexagonal hole, this support will come out with the nut.
- Remove the four sections of the booster. The innermost section will require a sharp pull to free the detonator from its jack.
- Separate the two split sleeves holding the detonator assembly, and remove the detonator.
- 7. Dispose of detonator, booster and charge.

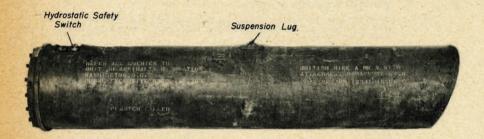
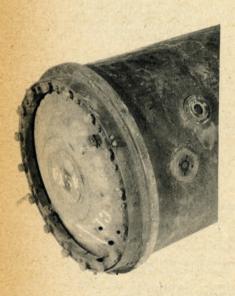


Fig. 9 - Mine "A" Mk. V



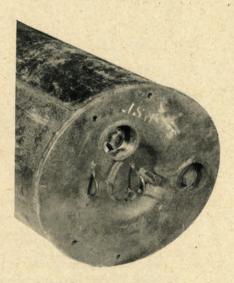


Fig. 10 - Mine "A" Mk. V, After End Fig. 11 - Mine "A" Mk. V, Forward End

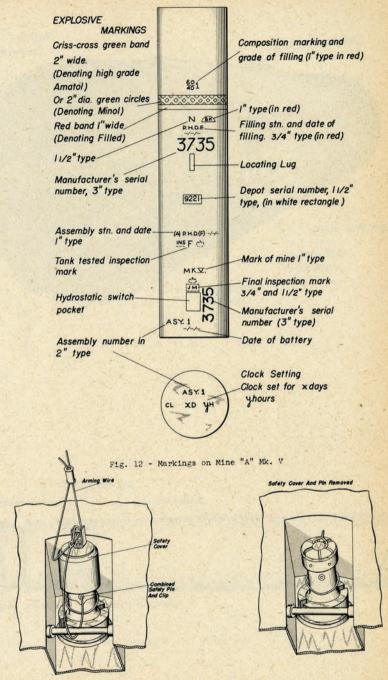


Fig. 13 - Hydrostatic Safety Switch, Mine "A" Mk. V

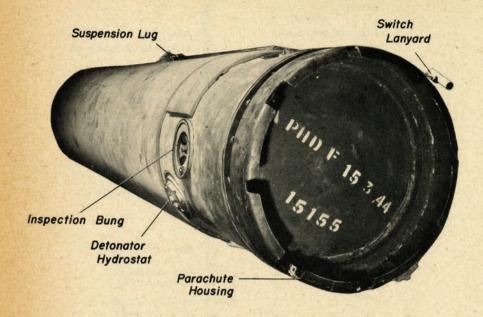


Fig. 14 - Mine "A" Mk. VI

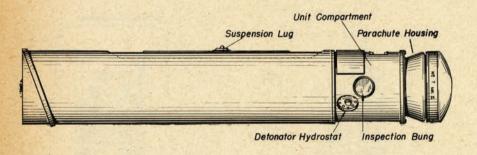


Fig. 15 - Mine "A" Mk. VI, Elevation View

"A" Mark VI

General

- 1. Ground, magnetic induction or acoustic mine.
- 2. Laid by surface craft or by aircraft with parachute.
- Offensive mine, for use in varying depths of water, depending on the type of firing unit fitted, against surface craft or submarines. May be used as an instantaneous or delayed action bomb.

Description

1. Case

Shape

Color

Material

Diameter Maximum

Forward section After section

Length Overall Forward section After section Parachute housing Parachute

Charge

Total weight in air

2. External fittings

Hydrostatic switch

Detonator hydrostat

Suspension lug

Lifting eye

Inspection bungs

Impact fuze pocket cover

Recessed channel

Cylindrical with slant nose. Fitted with nose fairing.

Black or dark green.

Steel.

9' 1" 6' 11" 18" 4"75

950 lbs. Amatol with Tetryl booster.

1800 lbs. approx.

2.5 diam., in pocket on top center line of after section, 10.5 from after end, secured by keep ring.

4.5 diam., 19.5 from after end, 240° from top center line.

On top center line, 50" from forward end.

On nose, 6" from center.

Two, 4.5 diam., 15.5 from after end, 90° and 270° respectively from top center line.

2.75 diam., screwed into nose, 8" from center.

On top center line, 4.5 wide, 1.5 deep and 55" long.

Operation

- Upon dropping, a safety pin or safety wire is withdrawn from the hydrostatic safety switch. Impact with the water operates the parachute release and shears the nose fairing. Dissolution of their respective soluble plugs allows the hydrostatic safety switch and the detonator hydrostat to operate. The former closes the arming circuit and the latter places the detonator in the firing circuit and aligns the detonator with the booster.
- 2. No self-disaming devices are fitted.

Precautions

1. See Introduction.





Fig. 17 - Detonator Hydrostat, Mines "A" Mks. VI-VII

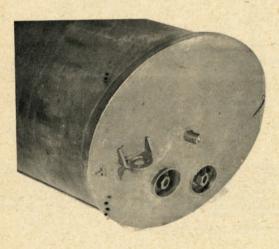


Fig. 18 - Mine "A" Mk. VI, Forward End

"A" Mark VI (cont'd.)

RMS

- 1. Remove the detonator hydrostat keep ring.
- 2. Remove the detonator hydrostat.
- 3. Remove the booster cover plate and the gland plate beneath.
- 4. Remove the nut beneath the gland plate and the booster support.
- 5. Remove the separate sections of the booster using a suction tool.
- 6. Dispose of detonator, booster and charge.

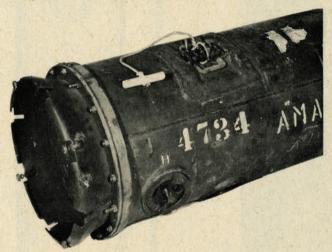


Fig. 19 - Mine "A" Mk. VII, After End

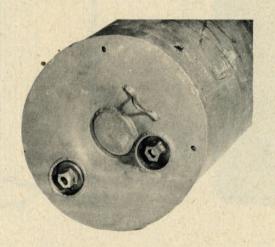


Fig. 20 - Mine "A" Mk. VII, Forward End

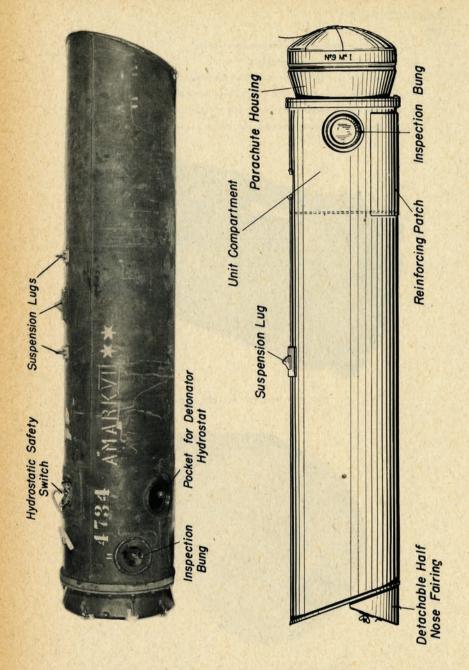


Fig. 21 - Mine "A" Mk. VII

Fig. 22 - Mine "A" Mk. VII, Elevation View



"A" Mark VII

General

- 1. Ground, acoustic or magnetic induction mine.
- 2. Laid by aircraft with parachute.
- Offensive mine, for use in varying depths of water, depending on the type of firing unit fitted, against surface craft or submarines. May be used as a bomb.

Description

1. Case

Shape

Cylindrical with slant nose. Fitted with half nose fairing.

Color

Black or dark green.

Material

Steel 15.75

Diameter

Length Overall with parachute Parachute housing

7' 6"

Charge

620 lbs. Amatol.

Total weight in air

1050 lbs. approx.

2. External fittings

Hydrostatic switch

2"5 diam., in pocket on top center line, 16" from after end, secured by keep ring.

Detonator hydrostat

4.5 diam., 16.5 from after end, 120° from top center line, secured by locking nut and scissors ring.

Inspection bungs

Two, 4.5 diam., 90° and 270° from top center line, 9" forward of after end, secured by locking nut and scissors ring.

Impact fuze pocket cover

2.75 diam., screwed into nose, 6.5 from center.

Suspension lugs

One, British type, on top center line, 39" abaft for-ward end; or two, U.S. type, on top center line, 32" and 46" respectively abaft for-ward end.

Operation

- Upon dropping, a safety pin or safety wire is withdrawn from the hydrostatic safety switch. Impact with the water operates the parachute release and shears the nose fairing. Dissolution of their soluble plugs allows the hydrostatic safety switch and detonator safety hydrostat to operate. The former closes the arming circuit and the latter places the detonator in the firing circuit and aligns the detonator with the booster.
- 2. No self-disarming devices are fitted.

Precautions

1. See Introduction.

RMS

1. Same as "A" Mark VI.

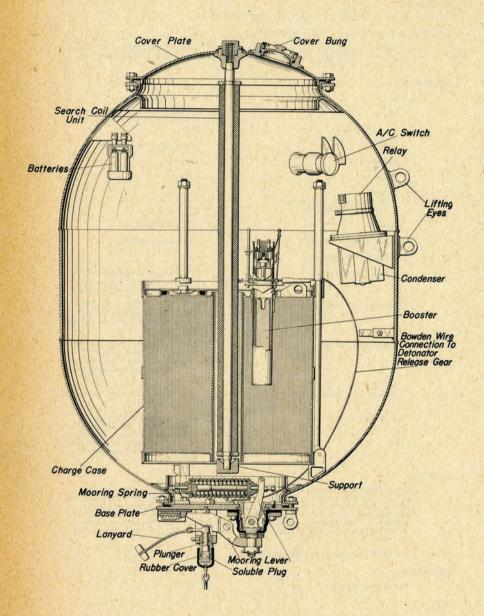


Fig. 23 - Mine "M" Mk. I, Sectional View

"M" Mark I

General

- 1. Moored, magnetic induction mine.
- 2. Laid by surface craft.
- Defensive mine, for use in maximum depth of water of 3000 ft. against submarines or surface craft. Maximum depth of case when moored is 300

Description

1. Case

Two hemispheres, joined by a 13"5 cylindrical mid-section. Shape

Color Black

Material Steel

Diameter 40"

64" Length

Charge 320 lbs. or 500 lbs. TNT or Amatol.

Total weight in air 1130 lbs. or 1320 lbs.

2. External fittings

Lifting eyes

21" diam., in center of up-per hemisphere, lap-fitted, secured by 20 bolts. Cover plate

Base plate 13.5 diam., in center of low-

er hemisphere, lap-fitted, secured by bolts. Fitted with mooring lever and soluble plug gear.

Cover bung 5" diam., in cover plate, 6" from center, secured by keep ring or strongback and screw.

Three, equally spaced around upper hemisphere.

Operation

- Mine takes depth by plummet. Dissolution of a soluble plug allows mooring tension to pull out the mooring lever, closing the mooring safety switch and tripping a bowden wire which operates the detonator release mechanism. Mine is now armed.
- Mine fires when subject to a sufficient rate of change in the sur-rounding magnetic field.
- 3. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension. Mines of this type laid before November 1942 were fitted with a wedge-locking device which held the mooring lever in the "out" position once the mine had armed.

Precautions

Check the mooring lever. Do not attempt RMS unless the head of the bolt mounted on the free end of the mooring lever bears against the base plate.

RMS

- 1. Remove the cover bung.
- Push back the catch on the detonator release mechanism and pull the detonator out by its leads. Release the leads from their spring-loaded
- Remove the booster by tipping the mine or by wedging a pointed stick into the detonator envelope. In either case, the catch on the detonator release mechanism must be pushed back to allow the booster to slide out.
- 4. Dispose of detonator, booster and charge.

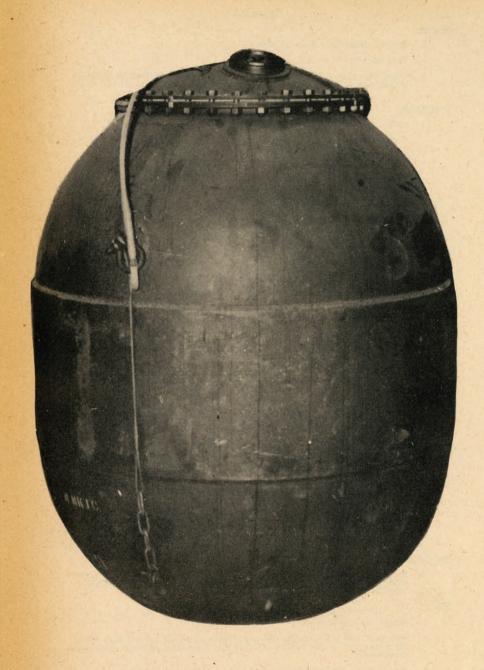


Fig. 24 - Mine "M" Mk. I

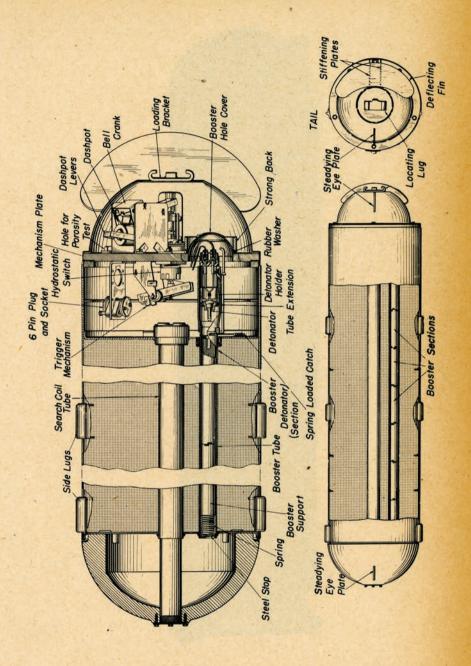


Fig. 25 - Mine "M" Mk. II, Sectional and End Views



Fig. 26 - Mine "M" Mk. II

"M" Mark II

General

- 1. Ground, magnetic induction or acoustic mine.
- 2. Laid by submarine or surface craft.
- Offensive mine, for use in maximum depth of water of 300 ft. against submarines or surface craft.

Description

1. Case

Shape

Cylindrical, with hemi-spherical nose and rounded tail cover secured to flanges on each end of case by bolts. Rudder plate on tail cover.

Color

Material

Diameter

Length Overall

Charge

Total weight in air

2. External fittings

Nose plate

Lifting eyes

Locating lug

Positioning lugs

Bottom rubbing strip

Black or dark green.

Steel 21"

6' 1"

1000 lbs. Amatol or 1060 lbs. Minol with Tetryl booster.

1800 lbs. approx.

2.5 diam., in center of nose, secured by four bolts.

Two; one on nose on top center line, 8" from center; one on tail on top center line, 8"5 from center.

One, on top center line of case, 22.6 from forward end of case.

Six; three 90° from top center line; three 270° from top center line, 3", 30".7 and 50".5 aft the forward

flange. 4" wide, 180° from top center line, extends full length of case.

No other external fittings are visible. The fittings for the main operating parts are mounted on the after bulkhead inside the tail

Operation

- A safety pin is withdrawn when the mine is inserted into the tube. Launching of the mine releases a spring-loaded lever arm on the tail, unlocking the hydrostatic switch. As the mine sinks, the hydrostatic switch closes after a delay given by a dashpot and starts the arming clock. The clock runs off its pre-set delay period and the mine is armed.
- 2. No self-disarming devices are fitted.

Precautions

Never attempt RMS by disassembly. In cases of extreme emergency, the after end of the case may be cut using shaped charge liners, but results cannot be guaranteed or even predicted.

RMS

1. No RM3 procedure is known.

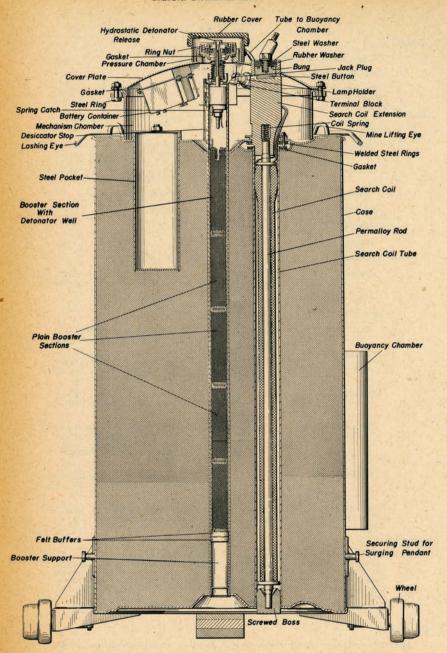


Fig. 27 - Mine "M" Mk. III, Sectional View

"M" Mark III

General

- 1. Ground, magnetic induction mine.
- 2. Laid by surface craft.
- Defensive mine, for use in varying depths of water, depending on the type of unit fitted, against surface craft or submarines.

Description

1. Case

Shape

Cylindrical, with smaller mechanism chamber on top and larger protruding buoyancy chamber at lower part of case. Supported by wheeled truck.

Color

Material

Diameter

Body Mechanism chamber Pressure chamber

Height Overall Mechanism chamber Body

Charge

Total weight in air

2. External fittings

Cover plate

Pressure chamber cover

Lifting eyes

Hydrostatic switch

Search coil bung

Connecting tube

Black

Steel

5! 10" 5"75 4' 7"5

1600 lbs. Amatol or 1750 lbs. Minol.

2300 lbs.

25.5 diam., on top of case, lap-fitted, secured by 24

6.7 diam., in center of cov-er plate, secured by ring clip.

Nine; three, (painted red) equally spaced around cover plate, 9"5 from center, for lifting cover only; three, on top of body for lifting mine; two, on top at side for securing lashings; one, forward, not used.

2"5 diam., on cover plate, 7" from center.

4.2 diam., on cover plate, 4.8 from center.

Extends from pressure chamber to buoyancy chamber.

Operation

 Operation of the hydrostatic switch removes a shunt from the search coil unit, closes a break in the firing circuit and starts the arming clock. The clock runs off its pre-set delay period and the mine is armed.

Precautions

1. See Introduction.

RMS

1. No RMS procedure has been developed.

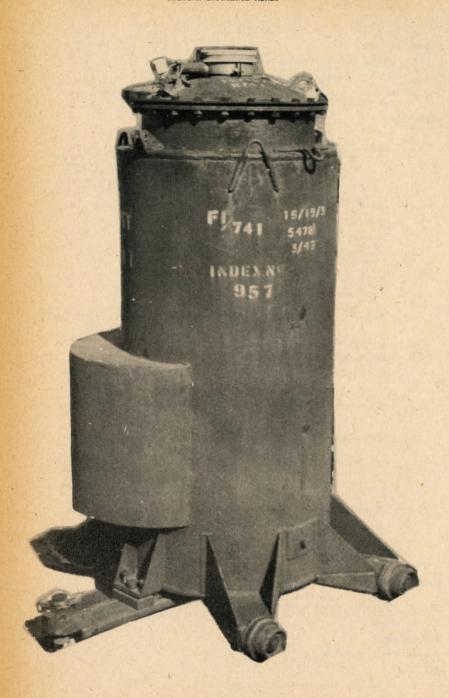


Fig. 28 - Mine "M" Mk. III

MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 2

BRITISH CONTACT MINES

				BELL	BRIT	rish (CONTAC	T MI	NES		3-1			
Remarks	Obsolescent	Obsolescent	Obsolescent	8" mid-section	13,5 mid-section	4"5 mid-section	Same as MK. XIV except switch	Anti-submarine	Shallow plant	Lover Antenna	Surface Antenna	Surface Snag Line.	Same as XIX ³ except has snag line.	一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一
Total Wt. (1bs.)	700	800	770 or 950 approx.	1015 or 1205	1070 or 1250	1075	1010 to 1200	290	310 approx.	1050 or 1230	1050 or 1230	1230	330 approx.	
Type and Wt. of Charge (lbs.)	320 TWT or Amatol	440 TNT or Amatol	320 or 500 TNT or Ametol	320 or 500 TWT or Amatol	320 or 500 TNT or Amatol	320 TWT or Amatol	320 or 500 TWT or Amatol	100 TWT or Amatol	100 TWT or Amatol	320 or 500 TNT or Amatol	320 or 500 TNT or Amatol	500 TNT or Amatol	100 TNT or Amatol	
Length (in.)	38	47 approx.	41	52 approx.	57.5 approx.	48.5 approx.	52 approx.	31	31	52 approx.	52 approx.	52 approx.	31	
Diameter (in.)	38	36.5	1,1	04	04	01	04	31	31	04	04	0#	31	
Leid By	Surface Craft	Surface Craft or Submarine	Surface Craft or Submarine	Surface Craft	Surface Craft	Surface Craft or Submarine	Surface Craft	Surface Craft	Surface Craft	Surface Craft	Surface Craft	Surface Craft	Surface Craft	
How Fired	Chemical Horn	Chemical Horn	Chemical Horn or Antenna	Chemical Horn	Switch Horn	Chemical Horn	Switch Horn	Switch Horn	Switch Horn	Switch Horn and Antenna	Switch Horn and Antenna	Switch Horn and Snag Line	Switch Horn and Snag Line	
Desig- nation	H'II Mk. II	"T" Mk. III	Vickers	MR. XIV	Mc. XV	Mk. XVI	Mk. XVII	MR. XIX	Mk, XIX ⁸	MK. XX	Mk. XXII	Mk. XXV	Mk. XXVII	

Table 1 - Contact Mines

Introduction

- Of the sixteen mines treated herein, thirteen have cases which are modifications of the following two basic case designs:
 - (a) Two hemispheres joined by a cylindrical mid-section. This case is 40" in diameter; its mid-section may vary from 4".5 to 13".5 in width. It is always fitted with the standard 21" cover plate and the 13".5 base plate, the latter being fitted with a mooring lever and soluble plug gear.
 - (b) A spherical case, 31" in diameter, fitted with a 17" cover plate and no base plate.

The other mines are older models which are obsolete or obsolescent.

- The following four types of firing devices are employed, singly or in combination:
 - (a) Chemical horn.
 - (b) Switch horn (with or without snag line).
 - (c) Antenna (galvanic action).
 - (d) Acoustic.
- The mines and firing devices may be grouped together substantially as follows:
 - (a) Any of the four firing devices in various combinations will be used with mines described in Par. 1 (a).
 - (b) The mines described in Par. 1 (b) use only the switch horn firing device, with or without snag line.
 - (c) The acoustic-firing mechanism may be found in any of the larger cases but is not listed as a part of any standard mine assembly.
 - (1) Any mine fitted with the acoustic firing mechanism may be identified readily by an examination of the cover plate, upon which will be found a perforated, circular steel plate mounted over a diaphragm and secured by a keep ring, 5"7 in diameter. This fitting is mounted 8" from the center of the cover plate, 9"7 clockwise and 10"5 counterclockwise from the two lifting eyes which are 180° apart and 7" from the center. The standard 4"5 cover bung is fitted to the center of the cover plate and a blank horn hole is located 7" from the center and 180° from the steel plate.

Note: All measurements in this paragraph and hereinafter with respect to cover plates are taken from the centers of the various fittings and are measured in a straight line, disregarding any curvature of the plate.

- (2) Once it has been ascertained that the mooring lever on the base plate has retracted, no additional precautions need be taken due to the presence of the acoustic firing device. Retraction of the mooring spindle opens the acoustic circuit in addition to opening the contact firing circuit.
- 4. All mines are laid by surface craft, although some were originally designed for laying by submarines. Similarly, all mines take depth by plummet with the exception that submarine-laid mines take depth by the loose-bight hydrostat system. All cases are of mild steel and take a charge of Amatol or TNT.
- 5. Detonators and boosters are married in all but a few cases by a bowden wire-operated shutter release which withdraws a shutter from under the detonator carrier, allowing it to drop down onto the booster. Three methods of tripping the bowden wire are employed:
 - (a) Withdrawal of the mooring lever.
 - (b) Operation of a spring-loaded plunger.
 - (c) Operation of a hydrostatic plunger.
- 6. The following general precautions should be observed when dealing with mines of this type:



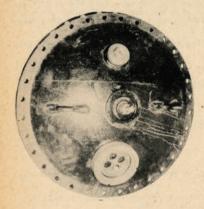


Fig. 1 - Acoustic Cover Plate

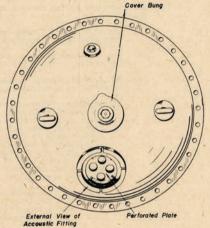


Fig. 2 - Acoustic Cover Plate, Exterior View



Fig. 3 - Acoustic Cover Plate, Interior View

BRITISH CONTACT MINES

Introduction Cont.

- (a) Keep all necessary noise to a minimum while examining the mine until certain that the mooring lever has retracted and/or there is no acoustic firing device fitted.
- (b) Do not bend or damage the horns in any way.
- (c) Do not allow metallic objects to contact antennae or electrodes.
- (d) Do not move or jar a mine except from a safe distance.
- (e) Note that the boosters and detonators are permanently married after the mine has armed.
- (f) Note that the self-disarming devices are all operated by spring tension and therefore cannot be relied upon to operate as designed.

H II Mark II

General

- 1. Moored, contact, chemical horn mine.
- Laid by surface craft.
- Defensive mine. May be used as a controlled mine. 3.

Description

1. Case

> Spherical Shape

Color Black or dark grey with brown patches.

Material Steel

38" Diameter

Charge 320 lbs. TNT or Amatol.

Total weight in air 700 lbs.

External fittings

Cover plate

Seven; one in center of cover plate; four equally spaced around upper hemi-sphere; two, mounted on brackets on lower hemi-Horns

sphere.

15" diam., in center of upper hemisphere, lap-fitted,

secured by bolts.

Base plate

15.5 diam. approx., in center of lower hemisphere, lap-fit-ted, secured by 18 bolts. Fitted with mooring spindle and detonator strongback.

Operation

- Mine takes depth by plummet or loose-bight hydrostat system.
- Mooring tension shears a shear pin and withdraws the mooring spindle. This closes the mooring safety switch and operates the booster release. The mine is then armed.
- Mine fires by action of stondard chemical horns. 3.
- The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

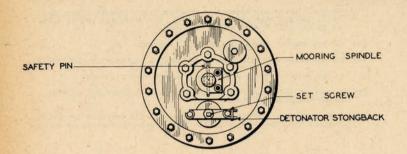


Fig. 4 - Base Plate, H II Mk. II Mine, Plan View

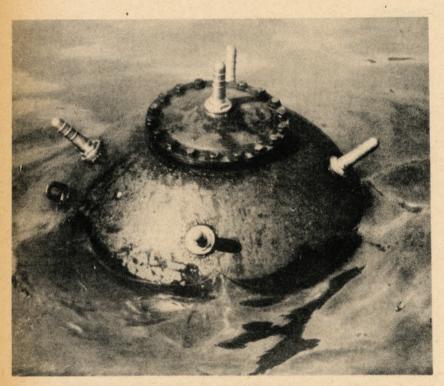


Fig. 5 - H II Mk. II Mine, Floating

H II Mark II (cont'd.)

Precautions

 Check the mooring spindle. Do not attempt RMS unless a safety pin can be inserted in the mooring spindle in the hole provided.

- Loosen the set screw in the detonator strongback and swing the strongback clear.
- Pry out the detonator holder with a screwdriver or other suitable means. Booster is spring-loaded and should follow detonator out.
- 3. Dispose of detonator, booster and charge.

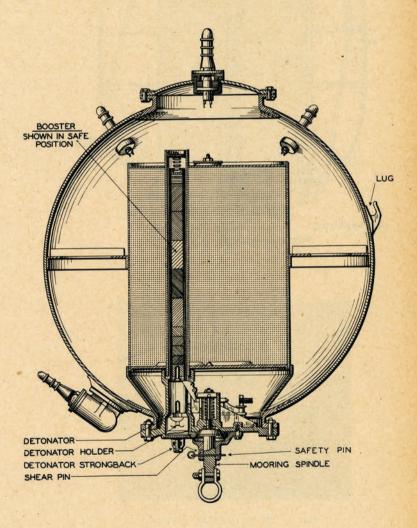


Fig. 6 - H II Mk. II Mine, Sectional View

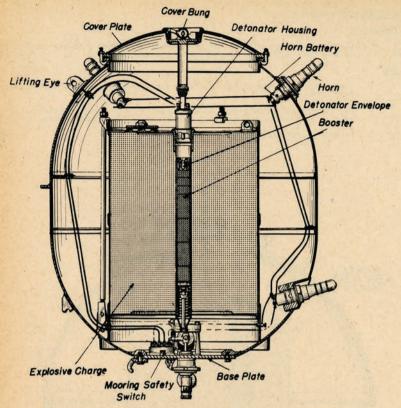


Fig. 7 - "T" Mk. III Mine, Sectional View

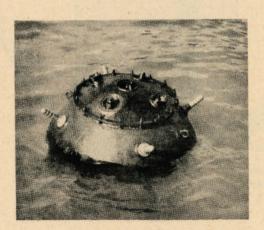


Fig. 8 - "T" Mk. III Mine, Floating

"T" Mark III

General

- Moored, contact, chemical horn mine. 1.
- Laid by surface craft or submarine. 2.
- Defensive or offensive mine. 3.

Description

1. Case

> Two hemispheres, joined by an 8.3 cylindrical mid-sec-Shape tion.

Black Color

Steel Material 36"5 Diameter 47" approx. Length

440 lbs. TNT or Amatol Charge

Total weight in air 2. External fittings

Six; four equally spaced around upper hemisphere; two, on lower hemisphere, mounted on brackets. Horns

20.5 diam., in center of upper hemisphere, lap-fitted, secured by bolts. Cover plate

In center of cover plate, secured by keep ring or strong-back and screw. Cover bung

In center of lower hemi-sphere, lap-fitted, secured by bolts. Fitted with moor-ing lever.

800 lbs. approx.

Operation

Mine takes depth by plummet.

Base plate

- Mine arms by dissolution of a soluble plug allowing mooring tension to pull out the mooring lever. This closes the mooring safety switch, thereby operating a spring-loaded booster release.
- 3. Mine fires by action of standard chemical horns.
- The only self-disarming device is the mooring safety switch, which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

Precautions

Check the mooring lever. Do not attempt RMS unless the bolt on the free end of the mooring lever bears against the base plate.

- Remove the cover bung and distance piece. 1.
- 2. Cut and tape detonator leads.
- Remove the detonator and booster. 3.
- Dispose of detonator, booster and charge.

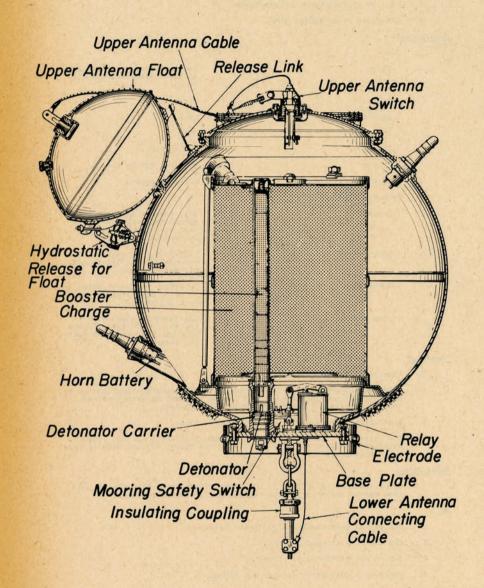


Fig. 9 - Vickers Antenna Mine, Sectional View

Vickers Antenna Mine

General

- Moored, contact, chemical horn mine. May be fitted with upper and/or lover antennae.
- 2. Laid by surface craft or submarine.
- 3. Defensive or offensive mine, for use against surface craft or submar-

Description

1. Case

Shape

Color Material

Diameter

Charge

2. External fittings

Total weight in air

TOUGH HOLDIN IN --

Horns

Cover plate

Electrode ring

Lower antenna attachments

Hydrostatic float release

Base plate

Spherical

Black

Steel

41"

320 or 500 lbs. TMT or

Amatol.

770 or 950 lbs. approx.

Six; four equally spaced around upper hemisphere; two, 180° apart on lower nemisphere.

In center of upper hemisphere, lap-fitted, secured by bolts. Contains upper antenna attachment and antenna safety switch.

Bolted to periphery of base plate.

Two, on lower hemisphere, 1800 apart.

our apart.

On upper hemisphere, just above center weld.

In center of lower hemisphere, lap-fitted, secured by bolts. Fitted with mooring lever, soluble plug gear, lower antenna connector, detonator strongback.

Operation

- Mine takes depth by plummet or loose-bight hydrostat system. Upper and lower antennae are streamed respectively by the operation of the hydrostatic float release and separation of the anchor and case.
- Mine arms by dissolution of a soluble plug which allows mooring tension to pull out the mooring lever. This closes the mooring safety switch and operates the spring-loaded booster release.
- 3. Mine fires by action of standard antennae or chemical horns.
- 4. The mooring safety switch is designed to disarm the mine by opening the firing circuit upon release of mooring tension. The upper antenna safety switch is designed to render the antenna inoperative upon release of tension on the antenna.

Precautions

 Check the mooring lever. Do not attempt RMS unless the bolt on the free end of the lever bears against the base plate.



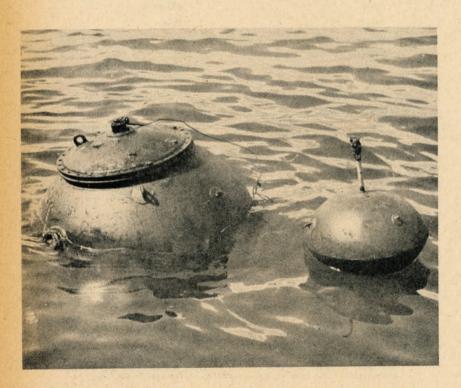


Fig. 10 - Vickers Antenna Mine, Floating

Vickers Antenna Mine (cont'd.)

- Loosen the set screw in the detonator strongback and swing the strongback clear.
- Pry out the detonator holder with a screwdriver or by other suitable means. Booster should follow detonator out.
- 3. Dispose of detonator, booster and charge.

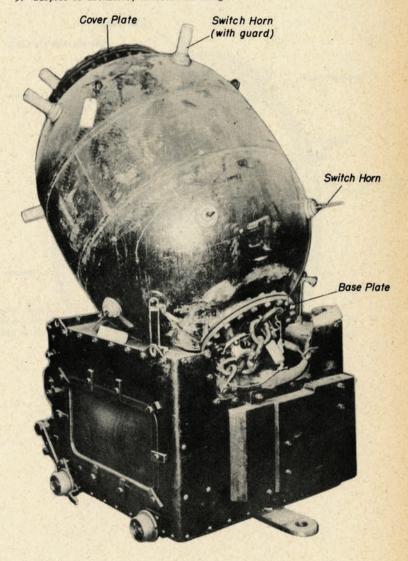


Fig. 11 - Mk. XV Mine, with Anchor

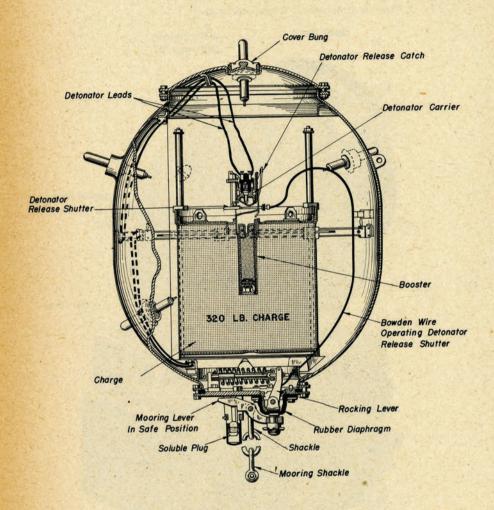


Fig. 12 - Mk. XIV Mine, Sectional View

Mark XIV (Mark XV, XVI and XVII)

General

- 1. Moored, contact, chemical horn mine.
- 2. Laid by surface craft.
- 3. Offensive or defensive mine. Maximum case depth when moored is 100 ft.

Description

1. Case

Two hemispheres, joined by an 8" cylindrical mid-section. Shape

Black

Color

Material Steel 40" Diameter

52" est. Length

320 lbs. or 500 lbs. TNT or Charge Amatol.

Total weight in air 1015 or 1205 lbs.

2. External fittings

Eleven; two 180° apart on cover plate; five equally spaced around upper hemi-sphere; four equally spaced around lower hemisphere. Homes

21" diam., in center of up-per hemisphere, lap-fitted, secured by 24 bolts. Cover plate

13.5 diam., in center of lower hemisphere, lap-fitted secured by 20 bolts. Fitted with mooring lever and solu-Base plate

ble plug gear.

4"5 diam., in center of cover plate, secured by keep ring or strongback and Cover bung

screw.

Two, on cover plate, 180° apart, 7.75 from center. Flooder clocks (optional)

Two, on cover plate, 180° apart, 9" from center, 11"5 clockwise and 7" counter-clockwise from the clocks Explosive flooders (optional) and horns respectively.

- 3. The Mark XV differs from the Mark XIV as follows:
 - (a) It is fitted with 11 switch horns.
 - (b) Its cylindrical mid-section is 13.5 wide.
 - (c) Its total weight in air is 1070 lbs. or 1260 lbs.
- 4. The Mark XVI differs from the Mark XIV as follows:
 - (a) It may be submarine laid, and takes depth by loose-bight hydro-stat system.
 - (b) It is fitted with nine chemical horns: two 180° apart on the cover plate; four equally spaced around the upper hemisphere; three equally spaced around lower hemisphere.

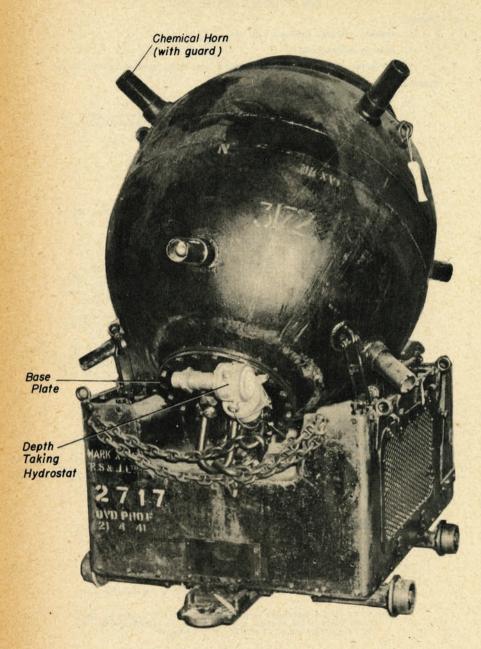


Fig. 13 - Mk. XVI Mine, with Anchor

Mark XIV (Mark XV, XVI and XVII) (cont'd.)

- (c) Its cylindrical mid-section is 4.5 wide.
- (d) Its total weight in air is 1075 lbs.
- 5. The Mark XVII differs from the Mark XIV as follows:
 - (a) It is fitted with 11 switch horns.

Operation

- 1. Mine takes depth by plummet.
- Mine arms by dissolution of a soluble plug which allows mooring tension to pull out the mooring lever. This closes the mooring safety switch and trips a bowden wire which operates the detonator release mechanism.
- 3. Mine fires by action of standard chemical horns.
- 4. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

Precautions

 Check the mooring lever. Do not attempt RMS unless the head of the bolt mounted on the free end of the mooring lever bears against the base plate.

RMS

- 1. Remove the cover bung.
- Push back the catch on the detonator-release mechanism, and pull the detonator carrier out by its leads. Release the leads from their spring-loaded terminals. (See Note below.)
- Remove the booster by tipping the mine or by wedging a pointed stick into the detonator envelope. In either case, the catch on the detonator-release mechanism must be pushed back to allow the booster to slide out.
- 4. Dispose of detonator, booster and charge.

Note: If the mine is fitted with switch horns, it will carry a battery under the cover bung. This battery must be removed before the detonator carrier can be reached.

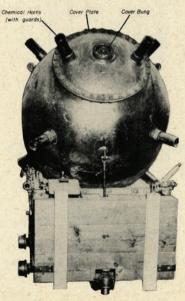


Fig. 14 - Mk. XVI Mine, with Anchor

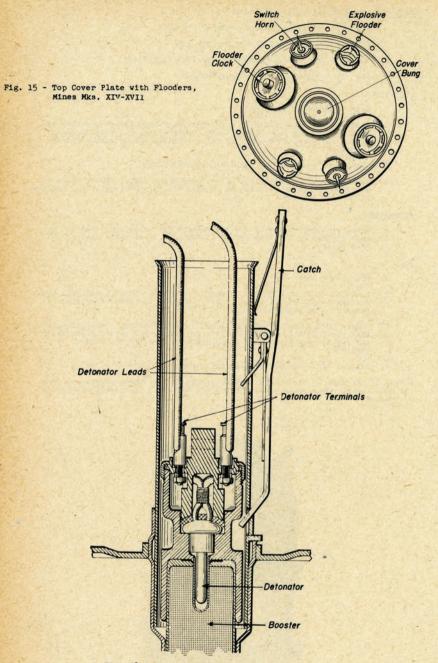


Fig. 16 - Detonator Holder and Booster Tube, Mk. XIV Mine, in armed position, Sectional View

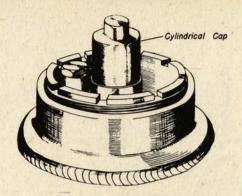


Fig. 17 - Flooder Clock, Perspective View

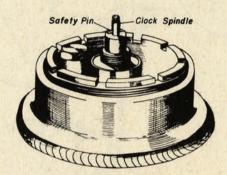


Fig. 18 - Flooder Clock with Cap Removed, Perspective View

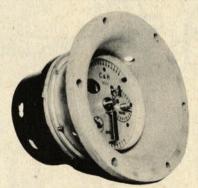


Fig. 19 - Flooder Clock, Interior View

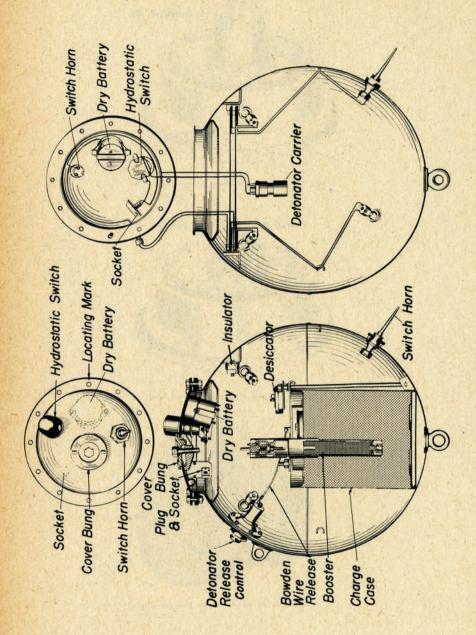


Fig. 20 - Mk. XIX Mine, Sectional View

Mark XIX

General

- 1. Moored, contact, switch horn mine.
- 2. Laid by surface craft.
- Defensive mine, for use in maximum depth of water of 300 ft. against submarines.

Description

1. Case

Shape

Color

Material Diameter

Charge

Total weight in air

2. External fittings

Horns

Cover plate

Cover bung

Hydrostatic safety

Detonator-release

control

Mooring eye

Lifting eyes

Spherical

Black

Steel

31"

100 lbs. TNT or Amatol with Tetryl booster.

290 lbs.

Eight: one on cover plate Fight: one on cover plate 4" from center; four equally spaced around upper hemisphere 9" above center weld; three equally spaced around lower hemisphere, 9" below center weld.

17" diam., in center of up-per hemisphere, lap-fitted, secured by 12 bolts.

4.5 diam., in center of cover plate, secured by nut and bolt.

2.5 diam., screwed into cover plate, 4" from center.

2.5 diam., screwed into up-per hemisphere, 9" above center weld.

In center of lower hemisphere.

Three, approx. 1200 apart, 20" from center of upper hemisphere.

- Mine takes depth by plummet. During this operation a hydrostatic det-onator-release control operates in 25 feet of water.
- Mine arms by dissolution of a soluble plug which allows the hydrostatic safety switch to close at a depth between 37 and 52 feet.
- 3. Mine fires by action of standard switch horns.
- 4. The only self-disarming device is the hydrostatic safety switch which is designed to disarm the mine by opening the firing circuit when the mine rises to a depth of less than 35 feet.

Precautions

Operation

Check the safety switch spindle. Do not attempt RMS unless the spindle
has retracted sufficiently to permit insertion of a safety pin in the
hole provided. Certain early models of this mine were not fitted with
spindle safety pin holes. It is impossible to determine the armed or
unarmed condition of such mines from an examination of the safety
switch, and they should be disposed of by means other than RMS.

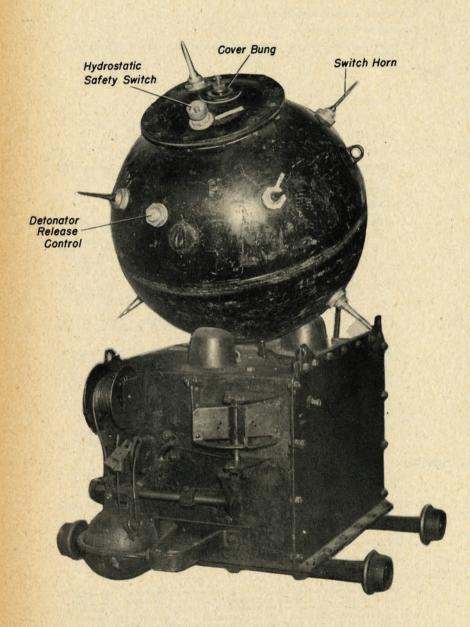


Fig. 21 - Mk. XIX Mine, with Anchor

Mark XIX (cont'd.)

- 1. Remove the cover bung.
- 2. Remove the detonator and booster. (See Mark XIV.)
- 3. Dispose of detonator, booster and charge.

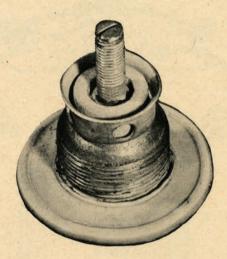


Fig. 22 - Hydrostatic Safety Switch, Mk. XIX Mine, with Cap Removed Showing Soluble Plug

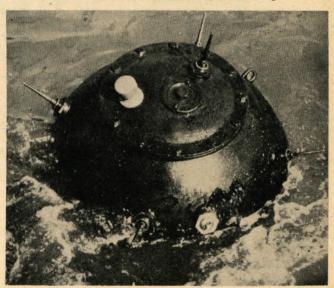


Fig. 23 - Mk. XIX Mine, Floating

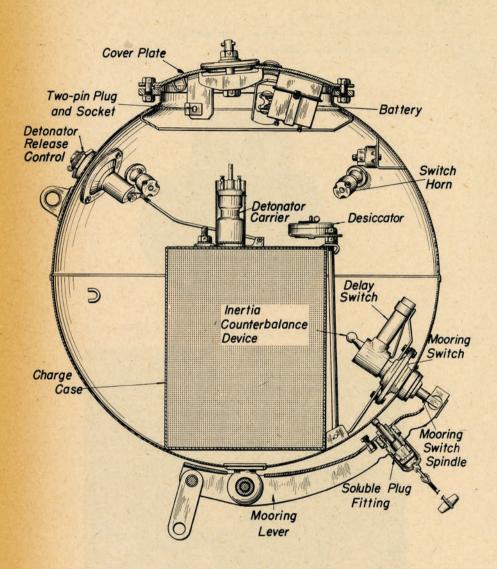


Fig. 24 - Mk. XIXS Mine, Sectional View

Mark XIXS (Mark XXVII)

General

- 1. Moored, contact, switch horn mine.
- 2. Laid by surface craft.
- 3. Anti-invasion mine, for use against small, shallow-draft surface craft.

Description

1. Case

Same as Mark XIX.

2. External fittings.

Homa

Seven: one on cover plate 4" from center; four equally spaced around upper hemisphere 9" above center weld; two, 120° apart, on lower hemisphere 9" below center weld.

Cover plate

17" diam., in center of up-per hemisphere, lap-fitted, secured by 12 bolts.

Cover bung

4.5 diam., in center of cover plate, secured by nut and bolt.

Detonator release control

2"5 diam., screwed into up-per hemisphere 9" above cen-ter weld.

Mooring switch

2.5 diam., fitted in horn pocket on lower hemisphere, 120° from lower horns.

Mooring lever

23" long, extends from center of lower hemisphere to mooring switch.

Lifting eyes

Three, approx. 120° apart, 20" from center of upper hemisphere.

- 3. The Mark XXVII differs from the Mark XIX3 as follows:
 - (a) It has no horn on its cover plate.
 - (b) It is fitted with two explosive flooders, 2.5 diam., 9.5 above the center weld and 7" apart.
 - (c) It is fitted with a 75 ft. snag line buoyed by 25 cork floats three ft. apart. A circular snag-line stowage trough, 24.5 diam., and 2.5 high, is bolted to the periphery of the cover plate. The snag line, one end of which is attached to a horn on the upper hemi-sphere, is released by dissolution of a soluble plug attached to the trough.
 - (d) Its mooring switch is designed to lock in the "out" or "SAFE" posi-tion if mooring tension is removed for more than 25 sec.
 - (e) It may be fired by tension on the snag line.

Note: This mine may occasionally be found without a snag line and stowage trough. In this case, a switch horn is fitted to the cover plate.

Operation

- Mine takes depth by plummet. The detonator release control operates upon separation of the anchor and case.
- Mine arms by dissolution of a soluble plug which allows mooring tension to close the mooring switch.
- 3. Mine fires by action of standard switch horns.

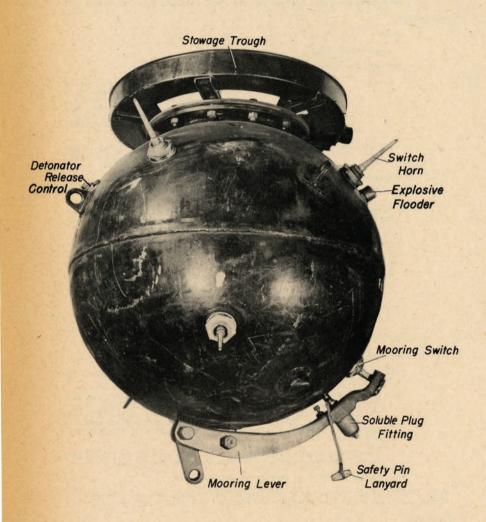


Fig. 25 - Mk. XXVII Mine

Mark XIXS (Mark XXVII) (cont'd.)

4. The only self-disarming device is the mooring switch which is designed to disarm the mine by opening the firing circuit 25 sec. after release of mooring tension.

Precautions

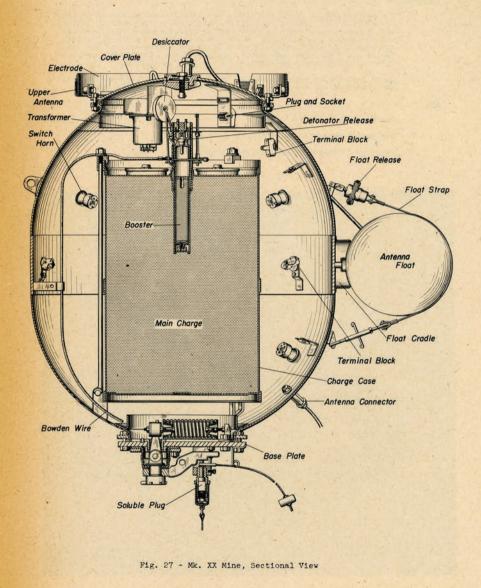
- 1. The mooring switch is fitted with a mechanical delay mechanism designed to keep the mine from disarming when subjected to wave motion. The delay mechanism operates after the mooring switch spindle has retracted and provides a 25 sec. delay between retraction of the mooring spindle and opening of the firing circuit. Therefore, retraction of the spindle is not a positive indication that the firing circuit is open because of the possible malfunction of the delay mechanism.
- Check the mooring switch spindle. Do not attempt RMS unless the spindle has retracted and a safety pin can be inserted in the hole provided.

- 1. Remove the cover bung.
- 2. Remove the detonator and booster. (See Mark XIV)
- 3. Dispose of detonator, booster and charge.



Fig. 26 - Mk. XIX8 Mine, Floating





Mark XX (Mark XX*)

General

- 1. Moored, contact, switch horn mine; may be fitted with lower antenna.
- 2. Laid by surface craft.
- Defensive mine, for use in maximum depth of water of 900 ft. against surface craft or submarines.

Description

1. Case

Same as Mark XIV.

2. External fittings

Horns

Eight: four equally spaced around both upper and lower hemispheres.

Cover plate

21" diam., in center of upper hemisphere, lap-fitted, secured by 24 bolts.

Base plate

13.5 diam., in center of lower hemisphere, lap-fitted, secured by 20 bolts. Fitted with mooring lever and soluble plug gear.

Cover bung

4"5 diam., on cover plate, 1" from center, secured by keep ring or strongback and

Copper electrode

Full-ring or segment, secured to periphery of cover plate. (See Par. #3 below)

Upper antenna connector Off center on cover plate.

Lower antenna connector On lower hemisphere.

- 3. There are three models of this mine as follows:
 - (a) Mark XX, Type 1 fitted with full-ring electrode and lower antenna.
 - (b) Mark XX, Type 2 fitted with segment electrode and lower antenna.
 - (c) Mark XX, Type 3 straight switch horn mine, not fitted with electrode or antenna.
- 4. Upper antennae were designed for these mines, but none has been issued to the service.
- 5. The Mark XX* differs from the Mark XX as follows:
 - (a) It is fitted with a cup-shaped copper electrode on its lower hemisphere which replaces the ring electrode used on the Mark XX, Type 1 and 2.

Operation

- 1. Mine takes depth by plummet.
- Mine arms by dissolution of a soluble plug which allows mooring tension to pull out the mooring lever. This closes the mooring safety switch and trips a bowden wire which operates the detonator release mechanism.
- 3. Mine fires by action of standard antenna or switch horns.
- 4. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

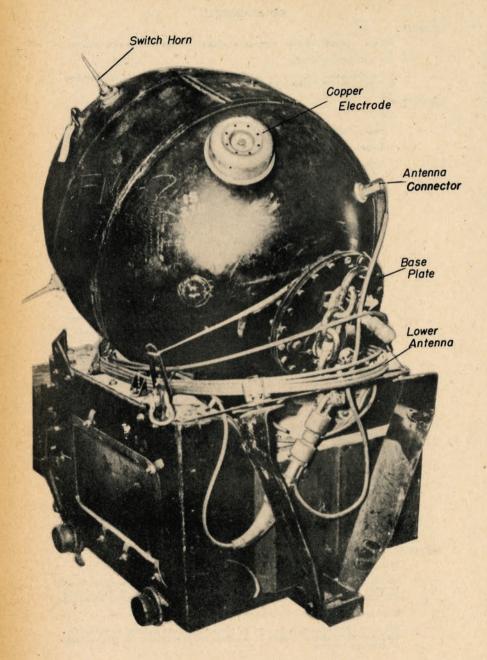


Fig. 28 - Mk. XX* Mine, with Anchor

Mark XX (Mark XX*) (cont'd.)

Precautions

 Check the mooring lever. Do not attempt RMS unless the head of the bolt mounted on the free end of the mooring lever bears against the base plate.

- 1. Remove the cover bung.
- 2. Remove the battery.
 - 3. Remove the detonator and booster. (See Mark XIV.)
 - 4. Dispose of detonator, booster and charge.

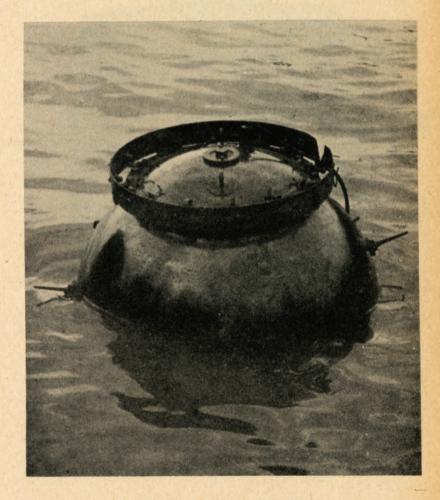


Fig. 29 - Mk. XX Mine. Floating

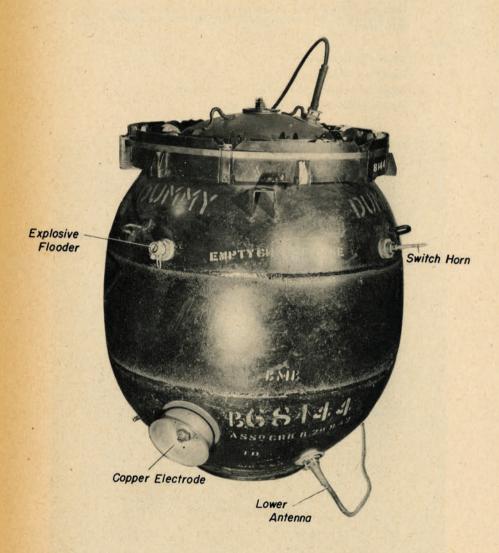


Fig. 30 - Mk. XXII Mine

Mark XXII (Mark XXII*)

General

- 1. Moored, contact, switch horn mine, fitted with upper antenna.
- 2. Laid by surface craft.
- 3. Defensive mine, for use against surface craft.

Description

1. Case

Same as Mark XIV.

2. External fittings.

Horns

Cover plate

outer pract

Base plate

Cover bung

Explosive Flooders (Optional)

Antenna connector

Antenna stowage trough

Copper electrode

Pad eyes

Four, equally spaced around upper hemisphere.

21" diam., in center of upper hemisphere, lap-fitted, secured by 24 bolts.

13.5 diam., in center of lower hemisphere, lap-fitted, secured by 20 bolts. Fitted with mooring lever and soluble plug gear.

4.5 diam., in center of cover plate, secured by keep ring or strongback and screw.

Two, 2.5 diam., 180° apart on upper hemisphere, 2.5 above mid-section.

2.5 diam., on cover plate, 7" from center.

34" diam., bolted to periphery of cover plate.

8" diam., on lower hemisphere, 6" below mid-section.

Five; two, 180° apart on cover plate, 7" from center; three, equally spaced around upper hemisphere, 3"5 above mid-section weld.

- 3. The Mark XXII* differs from the Mark XXII as follows:
 - (a) It may be fitted with a lower antenna.

Operation

- Mine takes depth by plummet. Dissolution of a soluble plug unlocks the antenna release mechanism.
- Mine arms by dissolution of a soluble plug which allows mooring tension to pull out the mooring lever. This closes the mooring safety switch and trips a bowden wire which operates the detonator release mechanism.
- 3. Mine fires by action of standard antenna or switch horns.
- 4. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

Precautions

 Check the mooring lever. Do not attempt RMS unless the head of the bolt mounted on the free end of the mooring lever bears against the base plate.

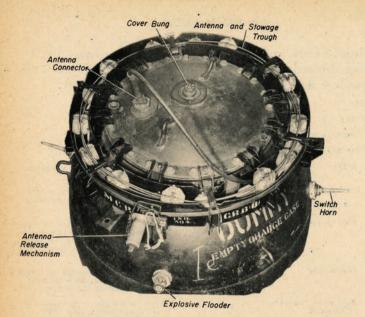


Fig. 31 - Mk: XXII Mine

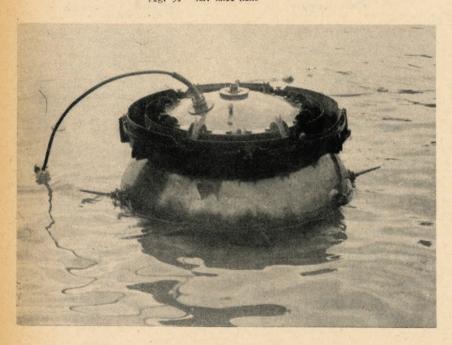


Fig. 32 - Mk. XXII Mine, Floating

Mark XXII (Mark XXII*) (cont'd.)

- 1. Remove the cover bung.
- 2. Remove the battery.
- 3. Remove the detonator and booster. (See Mark XIV.)
- 4. Dispose of detonator, booster and charge.

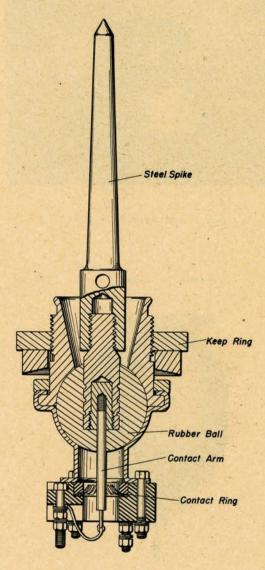


Fig. 33 - Switch Horn Detail

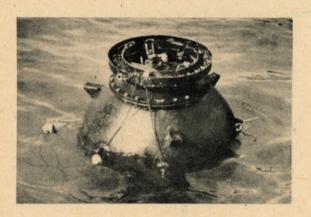


Fig. 34 - Mk. XXV Mine, Floating

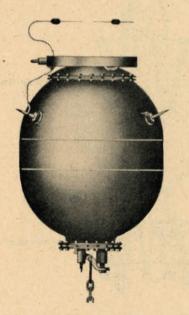


Fig. 35 - Mk. XXV Mine, Elevation View

Mark XXV

General

- 1. Moored, contact, switch horn mine, fitted with snag line.
- 2. Laid by surface craft.
- 3. Defensive mine, for use against shallow draft surface craft.

Description

1. Case

Same as Mark XIV.

2. External fittings

Horns

Four, equally spaced around upper hemisphere.

Cover plate

21" diam., in center of up-per hemisphere, lap-fitted, secured by 24 bolts.

Base plate

13.5 diam., in center of low-er hemisphere, lap-fitted se-cured by 20 bolts. Fitted with mooring lever and solu-

ble plug gear.

Cover bung

4.5 diam., in center of cover plate, secured by keep ring or strongback and screw.

Two, 180° apart on cover plate.

Explosive flooders Snag line stowage

Circular, bolted to periphery of cover plate.

trough

Snag line

75 ft. long, buoyed by 25 cork floats three ft. apart, secured to a horn on the up-

per hemisphere.

Operation

- Mine takes depth by plummet. Dissolution of a soluble plug unlocks the snag line release mechanism.
- Mine arms when dissolution of another soluble plug allows mooring ten-sion to pull out the mooring lever. This closes the mooring safety switch and trips a bowden wire which operates the detonator release mechanism.
- 3. Mine fires by action of standard switch horns.
- The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

Precautions

Check the mooring lever. Do not attempt RMS unless the head of the bolt mounted on the free end of the mooring lever bears against the base plate.

- 1. Remove the cover bung.
- 2. Remove the battery.
- 3. Remove the detonator and booster. (See Mark XIV.)
- 4. Dispose of detonator, booster and charge.

MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 3

BRITISH TORPEDOES

Туре	Use		Length of Torpedo less war- head	Approx.Wt. with Heav- iest War- head and Pistol	Speed for Legend Range*. Knots Yards	Status	Remarks
18" Mk. VII****	м.т.в.	18" Mk.VII	176.1	1740 lbs.	35 5000 29 7000		
18" Mk. VIII- VIII* FAA3 FAA4, MTBT and MTBT 2	FAA and MTB	18" Mk. VIII	157.6	1446 lbs.	35 2500 29 4000	Service	e .
18" Mk. VIII MTB	MTB			п	31.5 2200 25.3 3000		
18" Mk. XII XII*	FAA and MTB	18" Mk.XII and Mk.XVI 18" Mk.XII		1738 lbs.	40 1500 27 3500		
18" Mk. XII**- XII***	FAA	C and D		1741 lbs.	40 1750 27 4000	Service	NAME OF THE PARTY
18" Mk.	FAA and MTB	18" Mk.XII and Mk.XVI 18" Mk.XII C and D		1801 lbs.	40 2500 30 4000	Service	The use of the Mk.XII and XVB he- ad is con- fined to
18" Mk.	"	•		1794 lbs.	40 2000 30 4000		the RAF and for MTB.For FAA use the Mk.XIIC and D is sup- plied.
21" Mk. II II*****	Destroy- ers and Submar- ines	See Remarks	228	3001 lbs.	35 4500 29 8000 23 12000	Service	There are many types of Mk. II Torpedoes and the 21" Mk. II or the 21" Mk. IV-V Warhead is used depending upon th type of torpedo Certain types have only one speed setting of 35 knots.
21" Mk. IV-IV*	Old Cruis- ers, Sub- marines, Destroy- ers and M.T.B.	Mk.VIII	225.7	3182 lbs.	35 6500 29 9500 25 12500 Certain types: - 40 5000 30 8500	Service	

Torpedoes Cont.

Type	Use	Warhead	Length of Torpedo less war- head	Approx.Wt. with Heav- iest War- head and Pistol	Speed for Legend Range*. Knots Yards	Status	Remarks
21" MOk.	м.т.в.	21" Mk.IV-	233.2	3414 lbs.	35 7000 25 13000	Service	6 Maril
21" Mk. VII C	Cruis- ers	21" Mk. VII C	248.52	4094 lbs.	35 6500	Service	
21" Mk. VIII- VIII*	Submar- ines and M.T.B.'s	21" Mk. VIII	204.95	3452 lbs.	41 5000 31 10000		
21" Mk. VIII* and EB	Submar- ines	21" Mk. VIII	204.95	3452 lbs.	41 7000	Service	
21" Mk. VIII**	Submar- ines & M.T.B.'s	•			45½ 5000 41 7000 One type 41 knots only	,	
21" MG.	Destroy- ers and Cruisers	Second seminores	232	3657 lbs.	35 10500 30 13500		
21" Mk.	10 to 10				35 11000 30 14000		
21" Mk.	,		10.		40 11000 35 15000		
24½" Mk	Battle- ship Rodney	24½"Mk. 1	267.6	5287 lbs.	35 15000 30 20000		

^{*} Legend Range: Maximum range guaranteed with speed maintained within one knot of that set.

Table 1 - Torpedoes

BRITISH TORPEDOES

Warheads

Mk.	Case Material	Type Nose Screw-in (old) Quick-inser- tion (new)	length (in.)	Wt. of Charge	Type of Charge	Pistol used with	Remarks
18" Mk. VII	Steel	old .	37.3	320	T.N.T.	18" Above Water.	None
18" Mk. VIII	Steel	Old	37.3	319	T.N.T.	18" Above Water or Type 3.	None
18" Mk. XIIA	Steel	New	47.4	445	T.N.T.	Type 3.	Heads now in use are TPX filled.
18" Mk.	Steel	New	47.4	338	T.N.T.	Duplex (Impact only) or Type 3.	the visco
21" Mk. II	Bronze or Steel	Old	31.5	400	T.N.T.	Above Water or Type 3.	None
21" Mk. IV-VB	Bronze or Steel	Old	41.3	500 (Bronze) 514 (Steel)	T.N.T.	Above Water or Type 3.	None
21" Mk. IV-VC	Steel	old	41.3	518	T.N.T.		None
21" Mk. IV-VD	Steel	Old	41.3	513	T.N.T.	н	None
21" Mk. IV-VE	Steel	New	41.3	513	T.N.T.	A.W. & Type 3.	None
21" Mk. VII	Steel	New	51.8	741	T.N.T.	Type 3.	None
21" Mk. VIIIA	Steel	New	53.8	750	T.N.T.	Type 3.	None
21" Mk. VIIIB	Steel	New	53.8	722 805	T.N.T. T.X.	Duplex or C.C.R.	None
21" Mk. VIIIC	Steel	New	53.8	722 805	T.N.T.	Duplex or Type 3.	None
21" Mk.	Steel	New	53.8	750	T.N.T.	Type 3.	None
21" Mk. IXB	Steel	New	53.8	731 805	T.N.T.	Duplex or C.C.R.	None
21" Mk.	Steel	New	53.8	727	T.N.T.	Duplex or Type 3.	None
24½" Mk.	Steel	New	44	742.5	T.N.T.	Type 3.	None

Table 2 - Torpedo Warheads



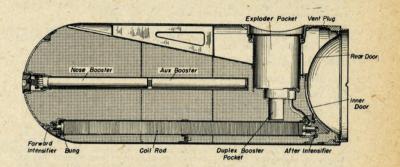


Fig. 1 - 18" Mk. XIIC Warhead, Sectional View

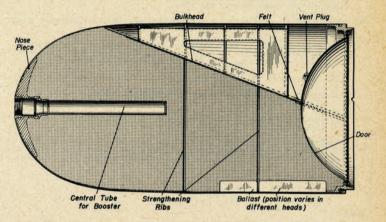


Fig. 2 - 21" Warhead for Mks. IV, IV* and V Torpedoes, Sectional View

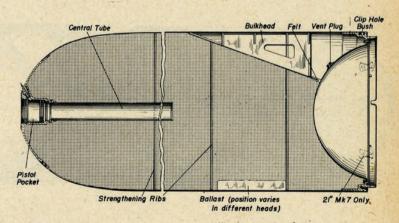


Fig. 3 - 21" Warhead for Mks. VII - IX* and 24.5 Mk. I Torpedoes, Sectional View



Introduction

- The torpedoes of the Royal Navy, Fleet Air Arm and Royal Air Force are all air-driven weapons employing four cylinder engines. The torpedoes are of three sizes by diameter, being 18", 21" or 24".
- The British are developing an electric torpedo which is not yet in service. Early in the war a two cylinder air torpedo of Whitehead design was in service but has since been withdrawn.
- 3. Three types of exploders are used as follows:
 - (a) Impact, direct action type.
 - (b) Impact-inertia type.
 - (c) Combination impact-inertia magnetic induction type.

It should be noted that all except one of the types of exploders listed in (b) and (c) above (the 18" Duplex Exploder, Mark II) may be in an extremely dangerous condition when found due to the fact that they lock in the firing position upon receipt of a firing blow. When the exploder fires, an electrical circuit is completed between the battery and detonator. If dud-firing occurs, this circuit remains closed and represents a constant danger as the malfunction may correct itself and cause the exploder to fire at any time. Therefore, all exploders of these types should be rendered safe only in extreme emergencies and must be handled with great care at all times.

- 4. The following additional general precautions should be observed at all times when dealing with torpedoes of this type:
 - (a) Carefully secure the propellers with a length of chain or other suitable means before beginning disposal operations. The propellers are dangerous and may start to run at any time.
 - (b) Do not move or jar the torpedo except from a distance.
 - (c) Do not move or turn the exploder arming impellers except as hereinafter prescribed.
 - (d) Avoid all unnecessary contact with any firing whiskers which may be fitted.
- Rendering these torpedoes safe involves disposing of the particular exploder which may be fitted. Consequently, the following describes the operation of each exploder, and the approved procedure for rendering it safe.

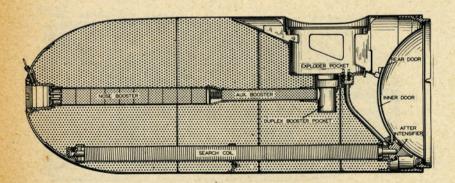


Fig. 4 - 21" Warhead Mks. IX - IX** Pattern C, Sectional View 21" Warhead Mk. VIII Pattern C is similiar.

21" Duplex Impact-Only Exploder, Mark I and I**

General

- 1. Impact-inertia type.
- 2. Fitted in pocket on top center line on after end of 21" Duplex warheads.
- The magnetic section of this exploder proved unsatisfactory and all such exploders are now manufactured for or converted to firing by impact only. Minor constructional details differentiate the Mark I and I**.

Description

1. External

- (a) The face of the exploder is oval-shaped, being 11"25 long and 8"9 in maximum diamèter. A water trough extends fore and aft on the port side of the face and houses a five-bladed impeller which is attached, by means of a gear system, to the upper end of the range shaft which protrudes from the center of the face. The impeller is locked, prior to launching, by a safety flap. The safety flap is a small, brass blade pivoted in the water trough about three inches forward of the impeller and held in the path of the impeller blades by its own weight.
- (b) A detonator indicator arm is pivoted on the same shaft with the safety flap. The after end of the water trough contains an inoperative "duplex-impact" switch (in later models, a blank plug). A small inspection port is fitted to the after starboard side of the face for viewing the magnetic arming range indicator (inoperative if fitted). The words, 21 DUPLEX EXPLODER MARK I (OR I**), are stamped on the starboard side of the exploder face and the words, FLUSH-DETS: "OUT" DOWN DETS: "IN", on the forward starboard rim of the water trough.

2. Internal

The range shaft, the lower portion of which is threaded, extends vertically down through the exploder body and threads to a central travelling sleeve. The operating parts of the exploder are located around this sleeve as follows:

- (a) Worm gear located directly above the range shaft threads. Drives the magnetic arming wheel through a gear train.
- (b) Inertia pendulum firing device screwed to the forward starboard side of the exploder body. Its inertia block is locked, prior to arming, by a detent pin mounted on an extension of the travelling sleeve.
- (c) Detonator carrier secured to the lower end of the travelling sleeve by a single screw.
- (d) Arming switch contacts mounted on each side of the lower end of the travelling sleeve.
- (e) Lever arm attached to travelling sleeve. Operates the detonator indicator arm.
- (f) Booster keyed to the exploder body below the travelling sleeve. Fitted with two detonator envelopes. A nose booster and an auxiliary booster are fitted through a booster tube in the nose of the warhead.
- (g) Batteries Three, dry cell type, mounted on exploder body.

3. Method of mounting

(a) The exploder is secured to the exploder pocket by eight body screws.

Operation

- Upon launching of the torpedo, water travel raises the safety flap and rotates the impeller, driving the range shaft and causing the travelling sleeve to move downward. This performs the following arming functions:
 - (a) It unlocks the inertia firing device by removing the detent pin from the inertia block.

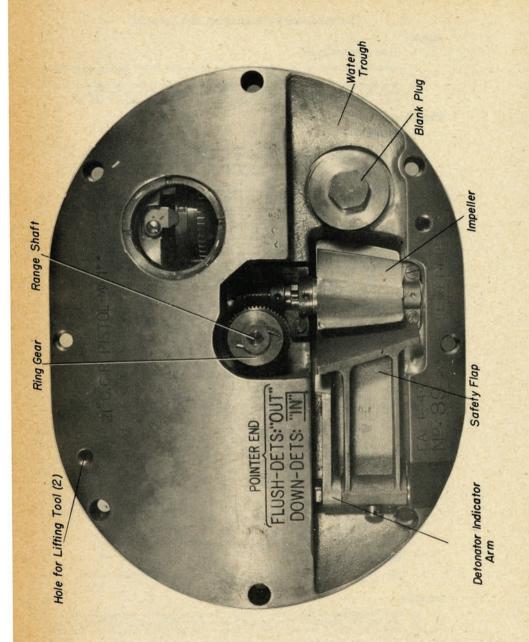


Fig. 5 - 21" C.C.R. Exploder, Top View

21" Duplex Impact-Only Exploder, Mark I and I** (cont'd.)

- (b) It causes the arming switch contacts to complete the detonator circuit.
- (c) It houses the detonators in the booster.
- (d) It operates the detonator indicator arm on the exploder face, moving it down to the armed position.

The exploder arms upon approximately 10 complete turns of the travelling sleeve, which requires about 100 yards of water travel; the travelling sleeve clears the threads on the arming shaft which then idles for the remainder of the torpedo run.

The exploder fires upon receipt of a blow sufficient to cause the in-ertia pendulum to rock and lift an inertia slider against a pair of contacts, closing the firing circuit. The slider is locked in the fir-ing position by a spring-loaded plunger.

Precautions

- The inertia slider locks in the firing position upon receipt of a firing blow. Therefore, any exploder found in the armed condition r .t be considered to have dud-fired and likely to fire at any time.
- Check the detonator indicator arm. If the free end of the arm bears against the bottom of the water trough, the exploder is fully armed. Conversely, if the free end of the arm is flush with the face of the exploder, the exploder is safe.
- 3. Do not attempt to render safe an armed exploder of this type unless absolutely necessary. Whenever possible, wait a minimum of six hours for the battery to discharge before removing the exploder. The battery will discharge only if the exploder has dud-fired.

Rendering Safe Procedure

- Break the firing circuit by removing the blank plug, removing the two terminals that lie beneath it, and disconnecting the link joining them.
- Remove the cotter pin and washer which secure the ring gear to the range shaft.
- 3. Invert the ring gear over the range shaft and rotate the range shaft counterclockwise while exerting mild upward pressure on the free end of the detonator indicator arm. When the indicator arm is flush with the face of the exploder, the detonators are unhoused, the inertia block is locked, and the detonator circuit is broken.

Note: If the exploder has dud-fired, it will be impossible to disarm the exploder as prescribed above because the detent pin will not be aligned with the hole in the inertia block, making it impossible to raise the travelling sleeve to retract the detonators. Under such conditions, no further rendering safe should be undertaken except in case of extreme emergency.

- 4. Remove the eight body screws
- From a safe distance, remove the exploder from the warhead using standard U.S. or British torpedo exploder handling tools.
- Remove the booster keep ring and remove the booster from the exploder.
- Remove the set screw on the starboard side of the detonator carrier and separate the detonator carrier from the central sleeve.
- 8. Dispose of detonator, booster and charge.



Ring Gear (Reversed for RMS)

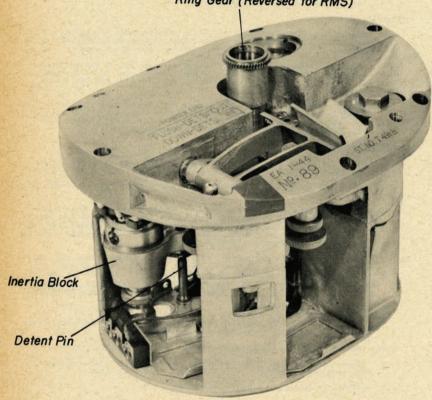


Fig. 6 - 21" C.C.R. Exploder with Ring Gear Reversed for Rendering Safe



C. C. R. Exploder, Mark I and I**

General

- 1. Combination impact-inertia, magnetic induction type.
- 2. Fitted in pocket on top center line of after end of 21" Duplex warheads.
- 3. The exploder may be converted to or issued as an "impact-only" inertia type by rendering the magnetic circuit inoperative. Minor constructional details differentiate the Mark I and the Mark I**.

Description

1. External

The face of the exploder differs from that of the 21" Duplex exploder as follows:

- (a) The "duplex-impact" setting switch is replaced by a screwed plug which gives access to a magnetic testing socket.
- (b) The words 21" C. C. R. PISTOL MARK I (OR I**), are stamped on the starboard side.

2. Internal

- (a) The impact-inertia arming and firing sections of this exploder are identical with those fitted to the 21" Duplex exploder.
- (b) The magnetic section consists of a search coil, 42" long, inserted through the after end of the warhead, and an amplifier assembly, consisting of a thyratron tube and two amplifier tubes, mounted on the after port side of the exploder body. Three 45-volt batteries are mounted on the exploder body forward to starboard and to port, with an ebonite terminal board mounted on the forward battery. A second terminal board is mounted above the amplifier assembly and incorporates a test socket. The magnetic unit arming wheel is mounted and geared as in the 21" Duplex exploder and a low voltage battery is mounted on the after starboard part of the exploder body.

3. Method of mounting

(a) The exploder is secured to the exploder pocket by eight body screws.

Operation

1. (a) Inertia-impact section.

Same as 21" Duplex exploder.

(b) Magnetic section.

Downward movement of the travelling sleeve closes (a) the filament switch, which, after a short period necessary for warning up the tubes, provides for the amplification of the output from the search coil, and (b) the detonator isolating switch. Finally, at the end of the preset arming range a further switch is closed, completing the detonator firing circuit and allowing for the operation of the exploder should the output of the search coil reach the required proportion.

2. (a) Inertia-impact section.

Same as 21" Duplex exploder.

(b) Magnetic section.

The exploder fires when the torpedo enters a magnetic field and the search coil delivers sufficient current to the amplifier tubes to enable them to raise the potential on the grid of the thyratron. Raising of the thyratron potential enables the high voltage batteries to pass current through the detonators.

Precautions

1. Allow no movement of magnetic material near the torpedo.

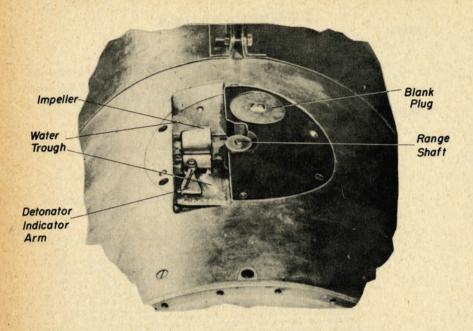


Fig. 7 - 18" Duplex Exploder fitted to Warhead

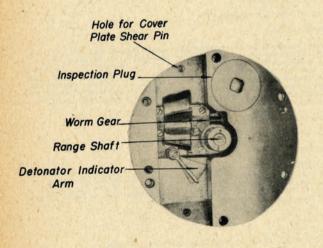


Fig. 8 - 18" Duplex Exploder, Top View



C. C. R. Exploder, Mark I and I** (cont'd.)

- Check the detonator indicator arm. If the free end of the arm bears against the bottom of the water trough, the exploder is fully armed. Conversely, if the free end of the arm is flush with the face of the exploder, the exploder is safe.
- The inertia slider locks in the firing position upon receipt of a firing blow. Therefore, any exploder found in the armed condition must be considered to have dud-fired and likely to fire at any time.
- 4. Never attempt to render safe an armed exploder of this type unless absolutely necessary. Whenever possible, wait a minimum of six hours for the battery to discharge before removing the exploder. The battery will discharge only if the exploder has dud-fired.

Rendering Safe Procedure

 Same as for 21" Duplex exploder. Before removing the booster, it will be necessary to remove the after terminal board cover and cut and tape the red lead between the #2 terminal and the forward battery.

18" Duplex Exploder Mark I (Mark II)

General

- 1. Impact-inertia type.
- 2. Fitted in pocket on top center line of after end of 18" Duplex warheads.
- The magnetic section of this exploder proved unsatisfactory and all such exploders are now manufactured for or converted to impact firing only.

Description

1. External

(a) The face of the exploder is circular and is fitted with a water trough and impeller mounting similar to that fitted to the 21" Duplex exploder. A detonator indicator arm is mounted in the water trough aft the impeller; a screwed plug, originally used for ingress to the testing terminals of the magnetic unit, is located on the forward starboard part of the face.

2. Internal

(a) The range shaft and travelling spindle are similar to those fitted in the 21" Duplex exploder. The internal parts of the exploder are mounted around the shaft and spindle in two sections. The upper layer, reading clockwise, contains the negative relay and 20 ohm shunt. The lower layer contains the three batteries. The detonator carrier, inertia block detent pin, arming switch contacts and boosters are fitted as in the 21" Duplex exploder.

3. Method of mounting

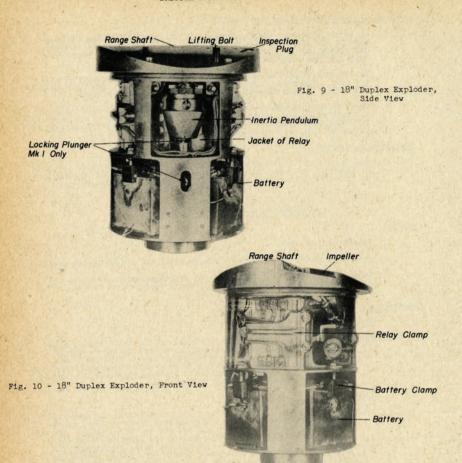
- (a) The exploder is secured to the exploder pocket by six body screws.
- 4. The 18" Duplex Exploder Mark II differs from the Mark I as follows:
 - (a) It is not fitted with the inertia block detent pin.
 - (b) Its inertia firing device does not lock upon firing.

Operation

 The exploder arms and fires in a manner similar to the 21" Duplex exploder.

Precautions

 The inertia slider of the Mark I exploder locks in the firing position upon receipt of a firing blow. Therefore any exploder found in the armed condition must be considered to have dud-fired and likely to fire at any time.



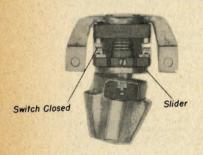


Fig. 11 - Inertia Switch, 18" Duplex Exploder, Pendulum Displaced

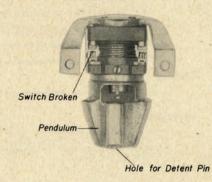


Fig. 12 - Inertia Switch, 18" Duplex Exploder, Pendulum Centered

18" Duplex Exploder Mark I (Mark II) (cont'd.)

- Check the detonator indicator arm. If the free end of the arm points to "DETS OUT", the exploder is safe. Conversely, if the arm points to "DETS IN", the exploder is armed.
- Do not attempt to render safe an armed exploder of this type unless absolutely necessary.

Rendering Safe Procedure

- Remove the inspection plug on the face of the exploder and break the firing circuit as follows:
 - (a) In a Mark I exploder, loosen the two terminals directly beneath and disconnect the jumper which connects them.
 - (b) In a Mark II exploder, remove the screw from the hole marked
- 2. Remove the cotter pin and worm wheel at the top of the range shaft and revolve the range shaft clockwise by means of the reversed worm wheel until the detonator indicator arm shows the detonators to be fully retracted. If increased resistance is felt while rotating the range shaft, stop at once. Rendering safe can be continued in this case only at the risk of removing the pistol while the detonators remain housed in the booster.
- 3. Remove the six body screws.
- From a safe distance, remove the exploder from the warhead, using standard U.S. or British torpedo exploder handling tools.
- 5. Remove the booster keep ring and remove the booster from the exploder.
- Remove the screw on the starboard side of the detonator carrier and separate the detonator carrier from the exploder.
- 7. Dispose of detonator, booster and charge.

Above-Water Exploder

General

- 1. Impact, direct action type.
- 2. Fitted in nose pocket of 18" and 21" warheads.

Description

1. External

- (a) The part of the exploder which protrudes from the warhead is similar in shape to a truncated cone while the threaded section which screws into the warhead is cylindrical and slightly smaller in diameter than the base of the conical section. An impeller with a span of either 10" or 12".4 is fitted to the apex of the conical section.
- (b) A spring loaded flap arm interposed between two of the impeller blades prevents impeller rotation prior to launching. An additional safety pin, removed manually upon launching, may also be fitted to serve the same purpose.

2. Internal

An internally threaded sleeve is positioned in the exploder body by a single guide screw which fits into a 0.5 keyway on the sleeve body. This sleeve houses a striker, fitted with an internal interrupted thread to engage the sleeve thread. A revolving fork is secured to the impeller by a set screw and extends aft into the exploder body. Its prongs engage the interrupted portion of the striker and serve to rotate it in the sleeve. The detonator carrier, to which the detonator is secured by a small keep ring, is mounted on the inner end of the striker and secured by a single shear pin. The booster, a cylindrical can with a detonator envelope in its forward end, screws into the exploder body.



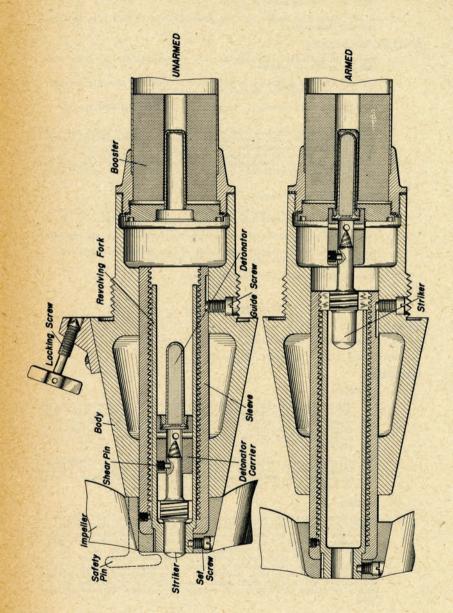


Fig. 13 - Above-Water Exploder, Sectional View

Above-Water Exploder (cont'd.)

3. Method of mounting

The exploder is screwed into the warhead and secured by a single locking screw.

- 4. When the exploder is used with aircraft torpedoes, the following slight modifications are incorporated:
 - (a) The safety pin is replaced by a light shear wire.
 - (b) A slot is cut in the body of the exploder to prevent any burr on the end or sides of the keyway on the threaded sleeve from fouling the exploder body.
 - (c) An auxiliary booster is fitted.

Operation

- 1. The safety pin (if fitted) is removed before launching. Water travel shears the shear pin (if fitted) and removes the spring loaded flap arm from the path of the impeller blades. The impeller and fork are then free to rotate. Since the sleeve is prevented from rotating by the guide screw, the striker and detonator carrier move aft toward the booster. After about 25 yards of water travel, the detonator is housed in the booster and the detonator carrier is flush with the booster can. Further rotation of the impeller forces the impeller and sleeve forward to the limit of the sleeve keyway. At this point the fork is free of the striker and the impeller and fork rotate idly.
- The exploder fires upon receipt of a blow on the impeller equivalent to 400 pounds. Tension is transferred from the impeller to the sleeve and striker, shearing the shear pin and allowing the striker to impinge upon the detonator.

Precautions

- 1. Check the condition of the exploder.
 - (a) If unarmed, the rounded end of the striker is housed in or protruding slightly from the impeller hub.
 - (b) If armed, the end of the striker is not visible and about 0.5 space is present between the impeller and the exploder body.
 - (c) If the end of the striker is not visible and little or no space is present between the impeller and the exploder body, the exploder may have dud-fired.
- Do not attempt to render safe an exploder which has dud-fired except in extreme emergency.

Rendering Safe Procedure

- Insert wedges in the space between the impeller and the exploder body in such a manner as to prevent the impeller from transmitting any motion to the sleeve.
- 2. Remove the locking screw and unscrew the exploder from the warhead.
- Unscrew the booster from the exploder body. If it does not come off readily, countermine the pistol and booster.
- Remove the guide screw and gently withdraw the impeller, sleeve and fork from the exploder body.
- Rotate the impeller clockwise until the detonator carrier protrudes from the after end of the sleeve.
- 6. Unscrew the detonator keep ring and remove the detonator.
- 7. Remove the auxiliary booster from the exploder pocket (if fitted).
- 8. Dispose of detonator, booster(s) and charge.

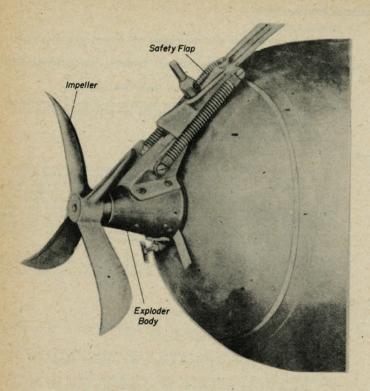


Fig. 14 - Above-Water Exploder fitted to Warhead

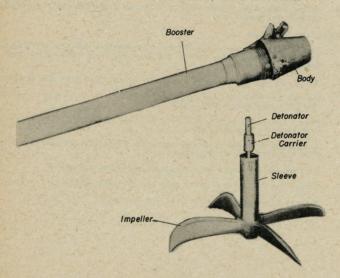


Fig. 15 - Above-Water Exploder, Component Parts



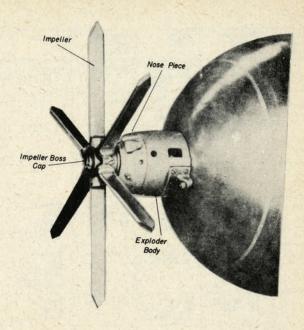


Fig. 17 - Type 3 Exploder, Screwed-In Type

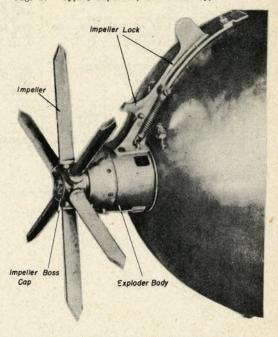


Fig. 16 - Type 3 Exploder, Quick-Insertion Type

Exploder Type and Stamp No.	Warheads Used In	Where Used	Impeller Safety Device	Booster	Impeller Diameter	
3A T.273	21" Mk.II, IV, V	Mk.II,21" sub.exter- nal tube	Lever Arm	Type D 1 1b.10.5 oz.	16.5	
3A T.273A	•	Mk. IV,21" sub.inter- nal tube	Flap		"	
3A* T.265		Mk.II,21" A.W. and Sub.exter- nal tube	Lever Arm		"	
3A* T.265A	•	Mk.IV,21" sub.inter- nal tube	Flap		n	
3A** T.298	18" Mk.XIA, XIIA	Fleet and RAF 18" aircraft torpedoes	Wire loop on impell- er	Type D plus Type A l lb.l oz. auxiliary	15.75	
3A** T.298A	18" Mk.XIIC	Mk.XII 18" in MTB's	Lever Arm	Type D plus Type B 1 lb.6 oz. auxiliary	•	
3F T.272	21" MK.VII, IXA, IXC	Mk. VII, Mk. IX, 21" A.W. Tubes	Lever Arm	Type A* or B 4 1b.4.5 oz.	16.5	
3F T.272A	"-		Lever Arm	Same plus Type B auxiliary		
3F T.272B	21" Mk. VIII A VIII C and CM	Mk.VIII 21" subs, MTB, external tubes	Lever Arm	Type A* or B 4 1b. 4.5 oz.	* "	
3F T.274		Mk.VIII 21" sub.inter- nal tube MTB's	Flap	Same plus Type B auxiliary with MK.VIII C and CM W.H.	"	
3F T.274A	n		Modified Flap	n	"	
3E T.266	24.5 Mk. I	Battleships	Lever Arm	Type A* or B 4 lb. 4.5 oz.	21.8	

Table 3 - Type 3 - Torpedo Exploders

Type 3 Exploder

General

- 1. Impact, direct action type.
- 2. Fitted to nose pocket of 18", 21" and 24.5 warheads.

Description

1. External

- (a) The part of the exploder which protrudes from the warhead is cylindrical, tapering at its forward end to which is attached a conical nose piece. The inner section which slips or screws into the exploder pocket is also cylindrical but is slightly smaller in diameter. An impeller with a span of either 15.75, 16.5, or 21.8 is fitted to the apex of the nose piece.
- (b) One of the following two impeller safety devices is fitted to the exploder;
 - A spring-loaded lever which is interposed between the blades of the impeller.
 - (2) A spring-loaded flap which is arched over the impeller.
- (c) In addition to the safety devices listed above, a safety fork, removed manually before launching, is interposed between the nose piece and the impeller blades.

2. Internal

- (a) A striking sleeve, located in the forward part of the exploder body by three shear pins, houses the forward end of a hammer tube which is free to rotate within the sleeve. The hammer tube is threaded internally with two threads, one being a fine "vee" thread and the other a course square thread superimposed on the fine one. The travelling spindle screws into the hammer tube. Prior to arming, the striking sleeve shear pins are protected from any strain by three preventer locking bolts, each of which is held in the exploder body by leaf-locking springs on the nose piece. Prior to launching, the hammer tube is positioned by its inner flange which bears against the inner shoulder of the exploder body. A ball race is fitted to the forward part of this flange, with a loose collar forward of the ball race. The firing spring fits between the collar and an annular recess in the striking sleeve.
- (b) The forward end of the striking sleeve is shaped to provide a rocker-type seat for a conical hammer located in the exploder nose. The hammer houses a driving sleeve and driving bush. The forward end of the driving sleeve is connected to the impeller boss by two ratchet pavls; the after end houses, and is keyed to, the forward end of the key sleeve. A locating spring tends to force the key sleeve aft.
- (c) The travelling spindle, to which are attached the strikers and detonator carrier, is housed in the key sleeve and the forward end of the hammer tube prior to arming. The spindle is a sliding fit into the key sleeve although it is not free to rotate, being prevented by a guide fork which is mounted on the pistol body and secured by a keep ring. Two types of travelling spindles are used with this exploder, one with coarse square threads being used for a 100 yard arming range, and one with fine "vee" threads being used for a 1000 yard arming range.

3. Method of mounting

- (a) The type 3A exploder is screwed into the warhead pocket and secured by a pointed locking screw.
- (b) The type 3E exploder is slipped into the warhead pocket and secured by spring locking pins.
- (c) The type 3F exploder is slipped into the warhead pocket and is secured either by spring locking pins or by locking bolts.
- 4. See table of type 3 exploders for differences in 12 modifications.

Operation

(a) The safety clip is removed before launching. Water travel forces
the impeller lock aft and impeller rotation then rotates the driving sleeve and key sleeve. The key sleeve in turn rotates the



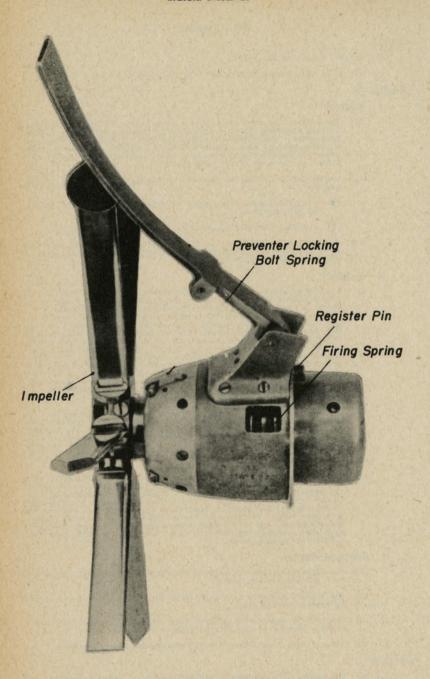


Fig. 18 - Type 3F Exploder



Type 3 Exploder (cont'd.)

driving bush and hammer tube. The guide fork prevents any rotation of the travelling spindle and therefore the spindle moves aft on the threads of the hammer tube until the detonators are fully housed in the detonator envelopes in the booster.

- (b) Since further movement of the spindle is then impossible, the hammer tube moves forward on the threads of the travelling spindle, compressing the firing spring and forcing the key sleeve forward against the pressure of the locating spring. The forward shoulder of the hammer tube cams the actuating rods outward, forcing the preventer locking bolts clear of the striking sleeve, so that the latter is held only by the three shear pins. Further forward motion of the hammer sleeve forces the key sleeve are positioned in an annular recess in the driving bush, thus disengaging the key sleeve from the driving bush and thereby stopping further rotation of the hammer tube. The exploder is now armed.
- The exploder fires upon receipt of a blow on the impeller or impeller boss sufficient to shear the striking sleeve and striker shear pins and force the strikers down onto the detonators.

Precautions

- 1. Check the condition of the exploder.
 - (a) If unarmed, the forward end of the travelling spindle is visible through a hole in the impeller boss cap.
 - (b) If armed, the preventer locking bolts protrude from the exploder body up to 0.4.
- Do not remove the exploder from its pocket in an armed condition except in extreme emergency.
- Do not attempt to wedge the impeller forward unless a special safety clip is available.

Rendering Safe Procedure

- 1. Disarm the exploder as follows:
 - (a) Insert a broad-bladed screw driver in the slot in the impeller boss cap.
 - (b) Gently rotate the impeller counterclockwise (looking aft) until the forward end of the travelling spindle is seen or felt to come up against the impeller boss cap.
- 2. Remove the exploder from the warhead as follows:
 - (a) Type 3A exploder.
 - Unscrew the pointed locking screw, bend the lock washer (if fitted) back against the warhead, and unscrew the exploder.
 - (b) Type 3F and 3E exploder secured by spring locking pins.
 - Pull back the locking pins and remove the exploder.

(c) Type 3F exploder secured by screwed locking bolts.

- Remove the wire from the flange of each locking balt and unscrew the bolt from the exploder body. Pull or lift out the exploder.
- Set the exploder down on the impeller and rotate the exploder body until the detonator carrier becomes accessible.
- 4. Unscrew the detonator keep rings and remove both detonators.
- 5. Dispose of detonators, booster and charge.

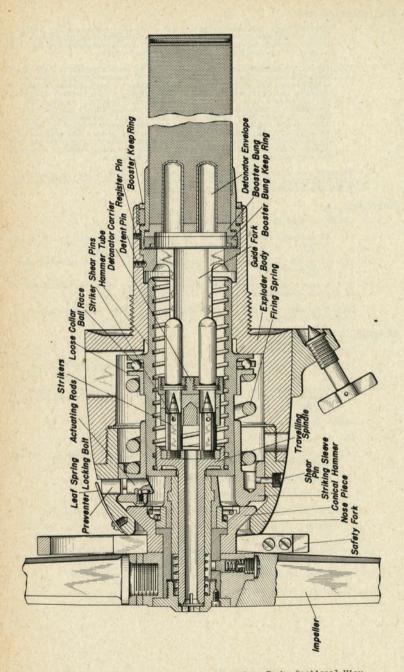


Fig. 19 - Type 3A Exploder with Safety Fork, Sectional View

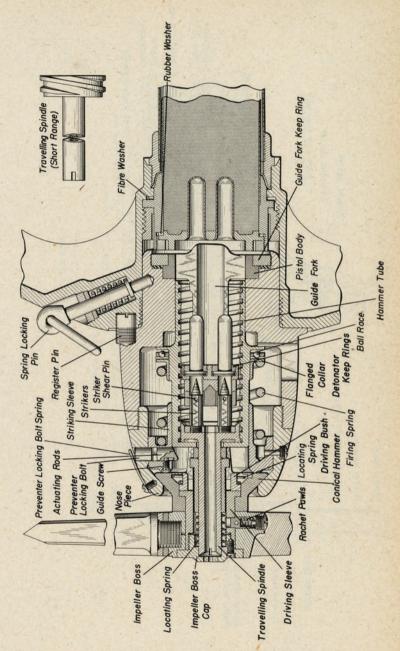


Fig. 20 - Type 3F Exploder, Sectional View

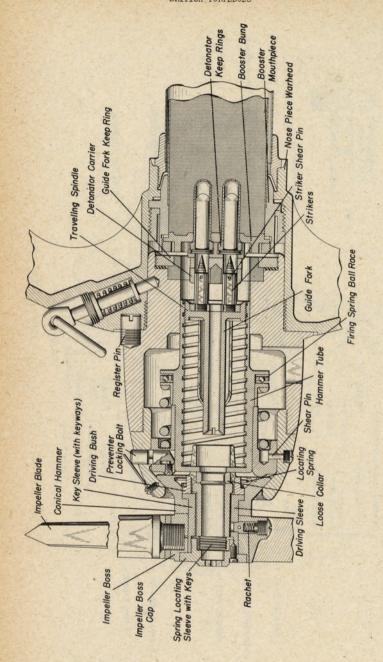


Fig. 21 - Type 3F Exploder in Armed Position, Sectional View

MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 4

BRITISH DEPTH CHARGES

_	1	-	1	1	1	-			-
Remarks	None	Case is shorter to fit U. S. racks	145 lb. cast from wt. at- tached to pistol end.	Length with tail is 57"5. Fitted with "spoiler" nose.	Same as Mk. VIII except nose is shaped for "spoil- er" effect.	Same as Mk. XI except for extra suspension lugs and type of pistol and tail	Glant size depth charge.	See Article for minor dif- ferences between Mk. X and X*.	None
Launched From	Surface Craft		•	Aircraft			Above water torpedo tubes		M.T.B.
Booster Used	Mark VII Primer	Mark VII No. 2 Primer	Mark VII Primer	Mark VIII Primer	•	=	See Article		Mark X Primer
Charge Wt. Pistols Used (1bs.)	VII, VII*, VII*A, VIII*A, VIII, VIII*, VIII*		IX,IX*,IX**, IX***	XIII, XIIIA, XIII*, XIV, XIV*, XVI, XVI*		*X	XI,XI*,XI*C, XV,XVC	XIC,XVC	XXI
Charge Wt. (1bs.)	300	-	=	160			2000 ,		50
Type	Amatol	Amatol or Minol	Amatol	Amatol or Torpex	=		Amatol		Minol
Length Diameter Total Wt. Type (in.) (in.) Charge	844		560	295			3060		100
Diameter (in.)	17.5			11.00		/	20.95		11.00
Length (in.)	Cylin- 27.75 drical	27.62	27.75	38.5			216	=	17.10
Shape	Cylin- drical			-		-	•		
Mark	VII	vII.	VII (Heavy)	VIII	TX.	XIX	×	**	XII

Table 1 - Depth Charges

Introduction

- 1. The British employ four basic depth charge cases, each of which may be fitted with a number of different pistols. Both aircraft and surface craft launching are employed, with nose und/or tail fairings being fitted to aircraft-launched charges. All cases are made of mild steel and are fitted with Amatol, Minol or Torpex charges. Case color will vary, in surface-launched cases, with the theatre of operations. The cases are camouflaged to blend with the basic camouflage design for ships operating in a particular area. All aircraft and tube-launched cases are painted black.
- A number of pistols are used with each case, all pistols operating on the water seepage-hole principle. Both single-depth and variable-depth firing types are used, although all the different models are variations or modifications of a single, basic pistol design.
- 3. It is doubtful whether one of these depth charges will ever be found in a critically dangerous condition. Normally its pistol will fire, if launched operationally, even at depths much shallower than the minimum possible setting on the pistol dial. However, the following general precautions should be observed when dealing with depth charges of this type:
 - (a) Do not move or jar the charge except from a safe distance.
 - (b) Do not move or rotate the depth setting dial while rendering safe.
 - (c) If the charge is found underwater, raise it to the surface before rendering safe.

Stee 1

17:5

27175

300 lb. Amatol

448 lb. approx.

3 25

Cylindrical, with concave ends.

Two on booster end of case, 1800 apart.

Three; two on pistol end of case; one on booster end. All fitted with lift-

Mark VII (Mark VII*, Mark XIII)

General

1. Launched from surface craft.

Description

1. Case

Shape

Material

Diameter

Case Central tube

Length

Charge

Total weight in air

2. External fittings

Filling holes

Lifting eyes

Standard accessories for case

Pistols - Mark VII, VII*, VII*A, VII**, VII**A, VIII, VIII*, VIII**,

ing rings.

Booster - Primer Mark VII with or without Primer Placer (booster extender) Mk I or I*.

- 4. The Mark VII* differs from the Mark VII as follows:
 - (a) Its case is 0:125 shorter, permitting the charge to be launched from U. S. racks.
 - (b) Its charge may be either Amatol or Minol.
 - (c) It uses the Mark VII, No. 2 primer (booster).

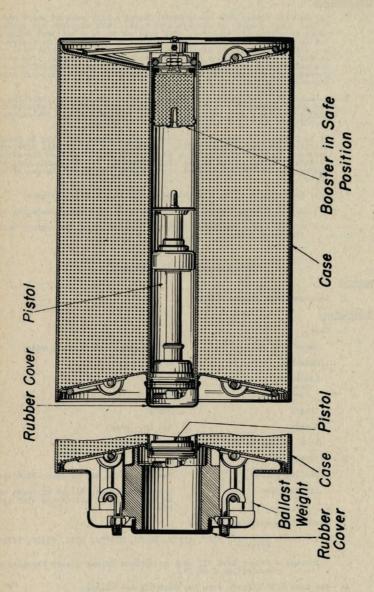


Fig. 1 - Mark VII Depth Charge, Sectional View, with Modifications for use as Mark VII (Heavy)



Mark VII (Mark VII*, Mark XIII) (Cont'd.)

- 5. The Mark XIII differs from the Mark VII* as follows:
 - (a) It is a slow-sinking depth charge for use by slow-moving coastal patrol craft.
 - (b) Its charge is 122 lb. Minol and its total weight in air, 248 lb. The reduced charge and total weight are caused by the addition of an intermediate bulkhead in the charge compartment. This also creates a buoyancy chamber, thereby decreasing the negative buoyancy of the charge.
 - (c) It uses the Pistol Mark XXV* and the Primer Placer (booster extender) Mark I*.

Rendering Safe Procedure

- 1. Loosen the booster handle to facilitate withdrawal of the booster.
- 2. Remove the booster or booster extender.
- 3. Loosen the pistol keep ring.
- 4. Remove the pistol.
- 5. Loosen the set screw, and remove the detonator carrier.
- 6. Dispose of detonator, booster and charge.

Mark VII (Heavy)

General

1. Launched from surface craft.

Description

1. Case

Shape Cylindrical with concave ends. Fitted with disc-shaped, 145 lb. cast iron ballast weight on pistol end of case.

Material Steel

Diameter
Case 17"5
Central tube 3"5

Length 27.75
Case Overall (including ballast weight) 32725

Charge 300 lb. Amatol

Total weight in air 560 lb. approx.

2. External fittings

Filling holes

Two on booster end of case, 1800 apart.

Lifting eyes

Three; two on ballast weight, one on booster end. All fitted with lifting rings.

3. Standard accessories for case

Pistols - Mark IX, IX*, IX**, IX***.

Booster - Primer Mark VII with or without Primer Placer (booster extender) Mark I or I*.

Rendering Safe Procedure

1. Same as Mark VII.



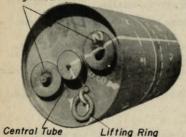
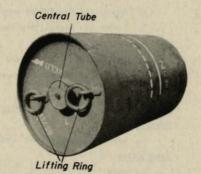


Fig. 2 - Mk VII Depth Charge

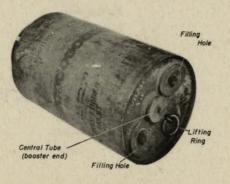
Fig. 3 - Mk VII Depth Charge



Lifting Ring

Fig. 4 - Mk VII (Heavy) Depth Charge

Fig. 5 - Mk VII (Heavy) Depth Charge



Added 15 April 1945 (Change No. 3)

Mark VIII (Mark XI, XI*)

General

1. Launched from aircraft.

Description

1. Case

Shape Cylindrical with concave ends. Fitted with "spoiler" nose and break-off tail section.

11"

Material Steel

Diameter Case Pistol pocket

 Length
 38."

 Case
 57."

 Pistol pocket
 19."

Charge 160 lbs. Amatol or Torpex.

Total weight in air 295 lbs. approx.

2. External fittings

Filling bungs Two on pistol end of case.

Tail securing lugs Six on pistol end of case.

3. Standard accessories for case

Pistols - Marks XIII, XIIIA, XIII*, XIV, XIV*, XVI, XVI*. Booster - Primer Mark VIII.

- 4. The Mark XI differs from the Mark VIII as follows:
 - (a) It is not fitted with a "spoiler" nose fitting. Instead, the front end cover is welded to the case in such a manner as to create the same effect as the "spoiler" nose fitting.
- 5. The Mark XI* differs from the Mark XI as follows:
 - (a) It is fitted with twin suspension lugs for use by U.S. aircraft.
 - (b) It takes the Mark XX* pistol and the Mark IV* tail with air arming vane.

Rendering Safe Procedure

- 1. Remove the tail (if present).
- 2. Loosen the pistol keep ring.
- 3. Remove the pistol.
- 4. Loosen the set screw and remove the detonator carrier.
- 5. Remove the booster from the pistol pocket.
- 6. Dispose of detonator, booster and charge.

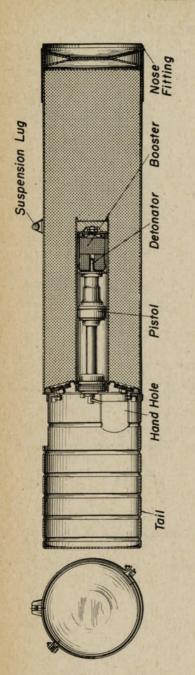


Fig. 6 - Mark "III Depth Charge, Sectional "iew

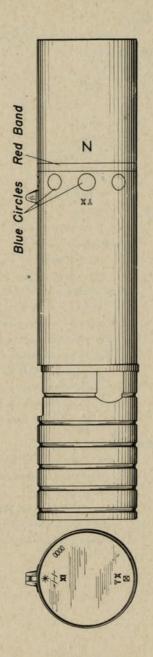


Fig. 7 - Mk. XI Depth Charge, Sectional View



Suspension Lug

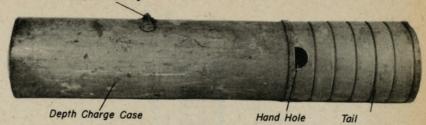


Fig. 8 - Mk. VIII Depth Charge



Fig. 9 - Mk. XI Depth Charge, Without Tail

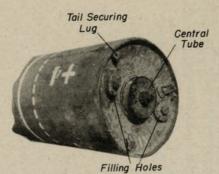


Fig. 10 - Mk. XI Depth Charge, After End



Fig. 11 - Mk. XI Depth Charge, Forward End

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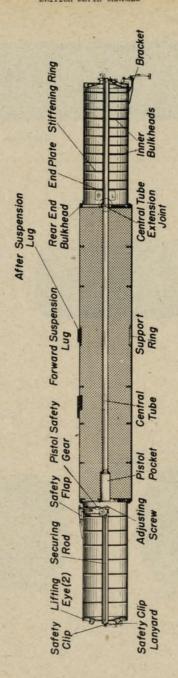


Fig. 12 - Mk. X Depth Charge, Sectional View

Mark X (Mark X*)

General

1. Launched from above-water 21" torpedo tubes.

Description

1. Case

Shape

Cylindrical charge case with smaller, cylindrical buoyancy chambers fitted to each end. Forward buoy-ancy chamber nose is rounded.

Material

Diameter Charge case Buoyancy chambers Central tube (charge case)

Central tube (buoy-ancy chambers)

Length Charge case Buoyancy chambers Overall

Charge

Total weight in air

2. External fittings

(a) Charge case

Lifting rings

Filling bungs

Lifting hooks

Inspection bung

Securing flanges

20"95

2"12 except for 11" length at forward end which is 3".75 diam. to accommodate pistol.

2:25

10 ft. 4 ft. each 18 ft.

2000 lbs. Amatol.

3060 lbs.

Three, on forward bulkhead, 1200 apart.

Three, on forward bulkhead, 120° apart.

Two, on after bulkhead, 180° apart.

One, on after bulkhead, 90° from lifting hooks.

One on each bulkhead, containing 24 bolt holes for securing buoyancy chambers.

Various combinations of support and suspension lugs are fitted to the case to insure proper positioning of the charge in different types of torpedo tubes.

(b) Forward buoyancy chambers, Marks I and II

Securing flange

Circular, 20.95 diam., on after end, containing 24 bolt holes for securing to charge case.

Lifting eyes

Two, on forward bulkhead, approximately 180° apart.

Safety flap

On top center line, near after end. Not fitted to Mark II.

(c) After buoyancy chamber

Securing flange

Circular, 20.95 diam., on forward end, containing 24 bolt holes for securing to charge case.

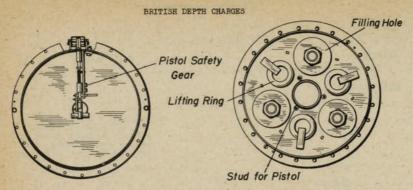


Fig. 13 - Buoyancy Chamber, Mk. I, Forward End View

Fig. 14 - Mk. X Depth Charge Case, Forward End View

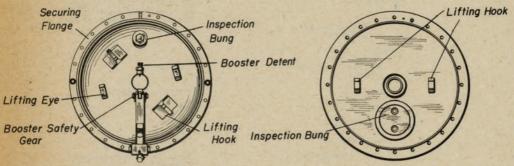


Fig. 15 - Buoyancy Chamber Mc. I, After End View

Fig. 16 - Mk. X Depth Charge Case, After End View

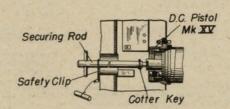


Fig. 17 - Buoyancy Chamber Mk. II, Safety Gear

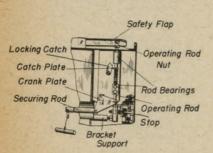


Fig. 18 - Buoyancy Chamber Mk. I, Safety Gear

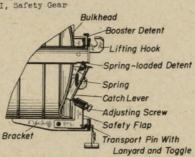


Fig. 19 - Mk. X Depth Charge, Booster Safety Gear

Mark X Cont.

Booster safety gear

Lifting hooks

Lifting eyes

Inspection bung

Inspection plate

Booster rod detent

Central tube housing

Safety flap

On after bulkhead.

Two, 180° apart, on after bulkhead.

1800 apart, on after Two, 1800 bulkhead.

On after bulkhead, 180° from booster safety gear.

On side, near forward end.

On after bulkhead, on central tube housing.

Protrudes from center of

after bulkhead.

On after end, 180° from top center line.

- 3. (a) The central tube of the Forward Chamber, Mark I, extends from the forward bulkhead to the after bulkhead, 4"5 from the after end of the chamber. The central tube houses a pistol securing rod which is connected, by means of a mechanical linkage, to the safety flap; and a pistol safety stop which restrains the pistol safety rod prior to launching. An additional safety device is provided by a safety clip which engages the outer end of the securing rod prior to launching. The Forward Chamber, Mark II, does not have the safety flap or mechanical linkage fitted, the securing rod being attached directly to the spring-loaded valve stem in the depth charge pistol. The valve is prevented from seating prior to launching by the safety clip on the outer end of the securing rod. securing rod.
 - (b) The central tube of the after buoyancy chamber extends the full length of the chamber and houses a booster rod which is, in effect, an extension of the booster proper although it contains no explosive. The safety flap is connected, by means of a mechanical linkage, to a spring-loaded detent which engages a slot in the booster rod prior to launching and prevents the booster from moving toward the detonator. A second detent, 180° from the one mentioned above, prevents the booster rod from falling out of the central tube.
- 4. Standard accessories for case

Pistols - Marks XI, XI* and XI*C (with Forward Chamber Mark I).

Marks XV and XVC (with Forward Chamber, Mark II).

Booster - One Mark XIA Mine Primer (detonator section) and 10 Mark VII Mine Primers (plain section).

- 5. The Mark X* differs from the Mark X as follows:
 - (a) A special bridge fitting may replace the forward chamber for deep firing.
 - (b) Only the Mark XIC or XVC pistol is used with the bridge fitting.
 - (c) Its after buoyancy chamber is more rigidly constructed.

Operation

1. (a) With Pistol Mark XI, XI* or XI*C and Forward Chamber, Mark I.

The safety clip is withdrawn manually from the end of the pistol securing rod before launching. As the charge leaves the tube, both the safety flaps spring out, operating their respective mechanical linkages. Operation of the forward flap moves the securing rod aft and removes the pistol safety stop from the pistol safety rod. Operation of the after flap removes the detent from the slot on the booster rod, and leaves the booster free to move toward the detonator upon application of water pressure.

(b) With Pistol Mark XV or XVC and Forward Chamber, Mark II.

The safety clip is withdrawn from the end of the securing rod before launching, allowing the spring-loaded pistol valve stem to seat itself. As the charge leaves the tube, the after flap operates as above.



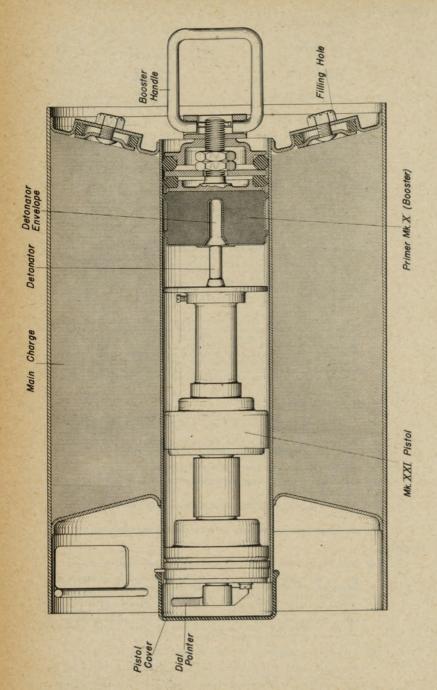


Fig. 20 - Mk. XII Depth Charge, Sectional View

Mark X Cont.

Rendering Safe Procedure

- Remove the forward chamber. If the Forward Chamber, Mark II, is fitted, it will first be necessary to remove the cotter key which connects the securing rod to the pistol valve stem.
- 2. Loosen the pistol securing screws and remove the pistol.
- 3. Unscrew the detonator carrier from the pistol.
- 4. Remove the after chamber.
- Push the various sections of the booster out the after end of the central tube using a wooden probe or other suitable means.
- 6. Dispose of detonator, booster and charge.

Mark XII

General

1. Launched from motor torpedo boats.

Description

1. Case

Shape

Material

Diameter

Length

Charge

Total weight in air

2. External fittings

Filling holes

3. Standard accessories for case

Pistol - Mark XXI

Booster - Primer Mark X

Rendering Safe Procedure

- 1. Remove the pistol.
- 2. Unscrew the keep ring and remove the detonator carrier.
- 3. Remove the booster.
- 4. Dispose of detonator, booster and charge.

Cylindrical

Steel

11"

17"1

50 lbs. Minol

100 lbs.

Two, on the booster end



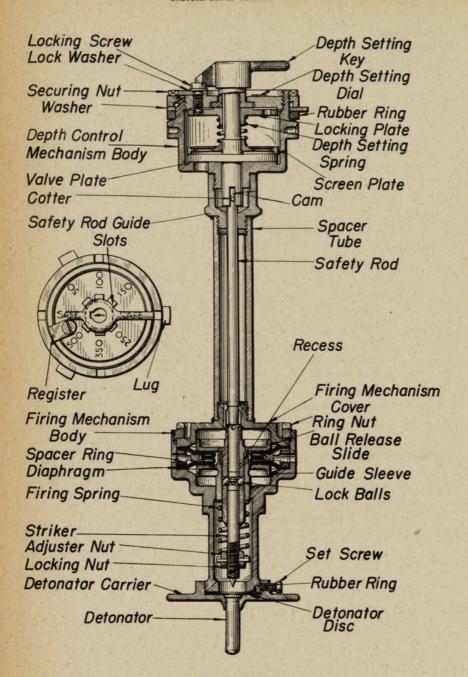


Fig. 21 - Mk. VII*, VII*A, VIII, VIII** and IX Pistols

Pistols

Mark VII

- Surface-launched seepage-hole type with settings of 50, 100, 150, 250, 350, 500 ft. and "SAFE". Its static firing pressure is between 46 and 50 ft. of water.
- 2. The pistol is cylindrical, approximately 16" in overall length, 3".48 in maximum diameter; about 10 lbs. in weight and is composed of the following main parts:
 - (a) An upper section, which contains the upper part of the safety rod and the depth control machanism. The latter consists of a cylindrical body into which is fitted a valve plate containing six seepage holes of different sizes which correspond to the depth settings. This plate is mounted on a valve stem which is fitted with a depth-setting key on one end and a slot to engage the safety rod on the other end. Rotation of the valve stem by the depth-setting key rotates the safety rod and valve plate causing the various seepage holes to line up with the main inlet hole in the valve seat and leaving the diaphragm free to expand.
 - (b) A lower section which contains the firing mechanism and the detonator. The firing mechanism consists of a spring-loaded firing pin held by two (in later models four) lock balls on a ball release slide and enclosed in an outer guide sleeve. The ball release slide and guide sleeve are separated by a double-washer type of diaphragm and a spacer ring. The detonator carrier is screwed to the bottom of the section and the two sections are joined by a spacer tube which houses the safety rod.
- The pistol is secured to the depth charge by a bayonet joint and locking washer and is positioned in the central tube by a shoulder on the firing mechanism body.
- 4. Before launching, the depth-setting key is turned to the desired setting. Water enters the pistol through holes in the depth control mechanism, locking plate and screen, passes through the valve plate and out into the central tube at a rate controlled by the size of the seepage hole and the rate of increase in pressure. As the central tube fills, water is forced into the firing mechanism body through inlet holes. Increasing pressure spreads the diaphragm, forcing the ball release slide and guide sleeve in opposite directions. This movement compresses the firing spring and, when the balls fall into the ball recess, allows the spring-loaded firing pin to impinge on the detonator.

Mark VII*

 This pistol differs from the Mark VII in that it is positioned in the central tube by a flange on the detonator carrier rather than by a shoulder on the pistol body.

Mark VII*A

 This pistol differs from the Mark VII in that a permanent safety stop has been fitted to the depth setting dial, thereby eliminating the 50 and 100 ft. settings. This modification permits use of the Mark VII depth charge by slov-moving merchant craft.

Mark VII** and VII**A

These pistols differ from the Mark VII* and VII*A respectively in that
the safety rod bears against the ball release slide as well as against
the firing pin.

Mark VIII

- 1. This pistol differs from the Mark VII as follows:
 - (a) It is fitted with a lighter firing spring and a thinner diaphragm.
 - (b) Its depth-setting dial is marked with settings of 60, 100, 170, 280 ft. and "SAFE".
 - (c) Its static firing pressure is between 23 and 25 ft. of water.
- These modifications permit use of the Mark VII and VIII depth charges by harbor defense craft.



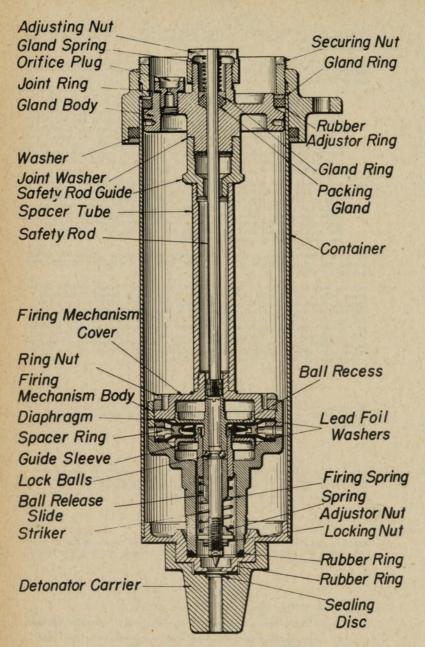


Fig. 22 - Mk. XI Pistol, Sectional View

Pistols (cont'd.)

Mark VIII*, VIII** and VIII***

 These pistols differ from the Mark VIII only in minor details of the safety rod and firing spring.

Mark IX

 This pistol differs from the Mark VII in that it has settings of 140, 225, 300 and 500 ft.

Mark IX*

 This pistol differs from the Mark IX only in minor details of the safety rod.

Mark IX**

 This pistol differs from the Mark IX in that a "DEEP" setting has been added to the depth-setting dial. When set on "DEEP", the pistol fires when hydrostatic pressure shears a pin on the safety rod at a depth of about 900 ft.

Mark IX***

 This pistol differs from the Mark IX** in that a depth setting of 700 ft. has been added.

Mark XI

- 1. This pistol differs from the Mark VII as follows:
 - (a) It is a single seepage-hole type, fitted with a special gland packing in place of the depth-control mechanism with an orifice plug screwed into the gland. Water entry to the interior of the pistol is limited by the size of the orifice.
 - (b) The entire pistol is enclosed in a cylindrical, watertight casing.
 - (c) It is 16" long, 3.75 in diameter, 5.5 across the top flange and weighs 15.75 lbs. It is secured to the depth charge by three studs through the pistol flange.
 - (d) Its normal operating depth is about 220 ft. and its static firing pressure is about 80 ft. of water.

Mark XI*

 This pistol differs from the Mark XI only in minor details of packing and sealing.

Mark XI*C

 This pistol differs from the Mark XI* in that it is fitted with a smaller orifice which increases the operating depth to about 640 ft.

Mark XIII

- 1. This pistol differs from the Mark VII as follows:
 - (a) Its static firing pressure is 20-24 ft. of water.
 - (b) It is fitted with a lighter firing spring and a thinner disphragm.
 - (c) It is fitted with an automatic depth-setting device for aircraft launching. This consists of a spring-loaded barrel on the depth-

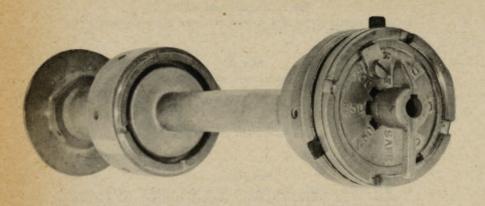


Fig. 23 - Mk. VII** Pistol

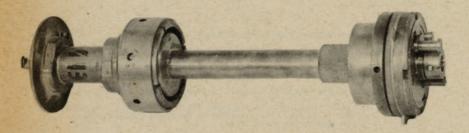


Fig. 24 - Mk. XIII* Pistol

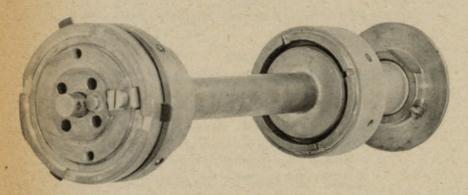


Fig. 25 - Mk. XVI Pistol

Pistols (cont'd.)

Mark XIII Cont.

setting dial to which is secured a pointer, slotted for use as a winding tool. Coupled to the barrel and the depth-setting dial is a tension spring which tends to rotate the pointer and valve plate clockwise. Removal of a safety clip from the depth-setting dial allows spring tension to rotate the pointer to a stop pin fitted to the dial at the desired setting.

(d) Its valve plate has but three seepage holes which correspond respectively to dial settings of 50, 100 and 150 ft.

Mark XIIIA

This pistol differs from the Mark XIII in that it is fitted with an additional collar inside the pistol body which prevents undue motion of the ball release slide and guide sleeve which might be caused by improper manufacturing tolerances.

Mark XIII*

This pistol differs from the Mark XIII in that its water inlet channels
have been modified slightly to give less restricted entry of water.

Mark XIV

- 1. This pistol differs from the Mark VII as follows:
 - (a) It is fitted with a special water inlet valve for aircraft launching in place of the depth control mechanism. This inlet valve, prior to launching, is held off its seat by a safety clip allowing water to enter both sides of the disphragm, thereby rendering it inoperative. An explosive safety clip release is used to remove the safety clip upon launching, seating the valve so that water enters only to the operating side of the disphragm. Water entry into the central tube is unrestricted at all times.
 - (b) Its firing mechanism body diameter is increased, thereby reducing the back pressure in the pistol during operation and also the static firing pressure.
 - (c) Its operating depth is 20-23 ft. and its static firing pressure is 16 ft. of water.
 - (d) The spacer ring between the ball release slide and guide sleeve is cut away to allow movement of the complete firing mechanism and thereby prevent inertia firing on impact.

Mark XIV*

 This pistol differs from the Mark XIV in that slight modifications have been made to permit the addition of an extra inertia safety clip to the inlet valve and more secure positioning of the pistol in the central tube

Mark XV

 This pistol differs from the Mark XI in that it is fitted with an inlet valve safety mechanism similar to that used in the Mark XIV rather than the safety rod used with the Mark VII series. The presence or absence of the safety clip on the inlet valve, rather than the position of a safety rod, determines whether or not the pistol is operative.

Mark XVC

 This pistol differs from the Mark XV in that it is fitted with a smaller orifice which increases its operating depth to about 640 ft.



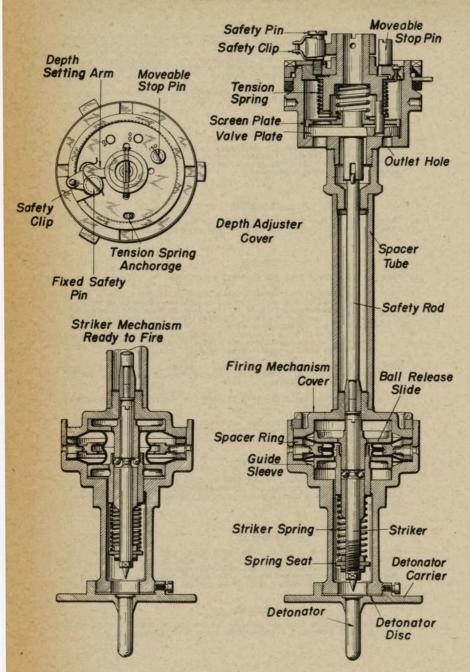


Fig. 26 - Mk. XIII* Pistol, Sectional View

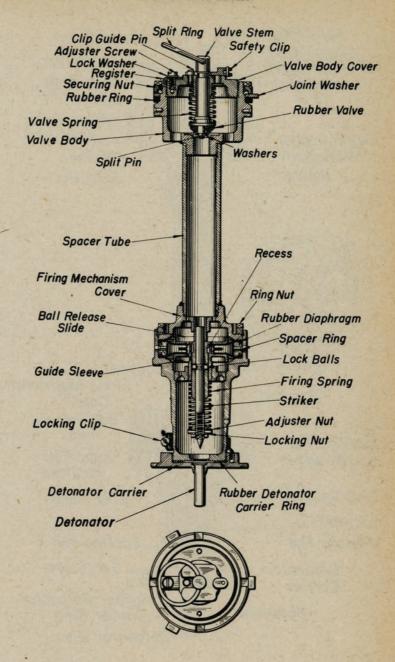


Fig. 27 - Mk. XIV Pistol, Sectional View

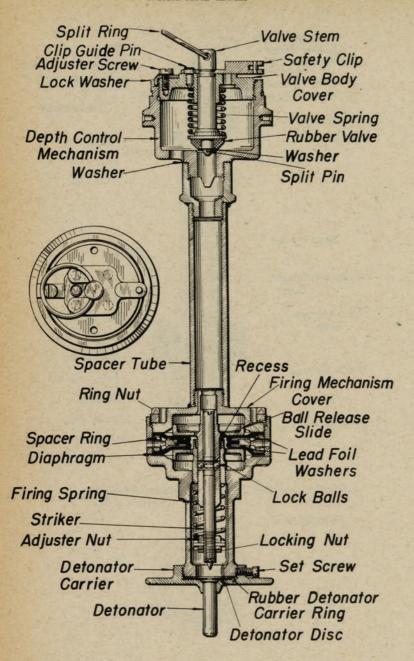
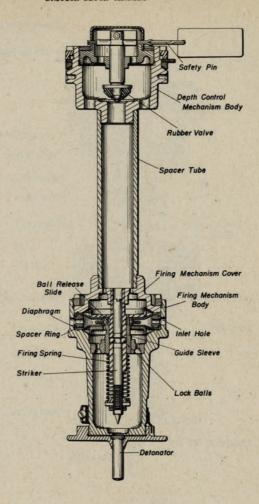


Fig. 28 - Mk. XVI Pistol, Sectional View



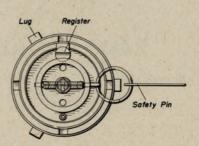


Fig. 29 - Mk. XX* Fistol, Sectional View

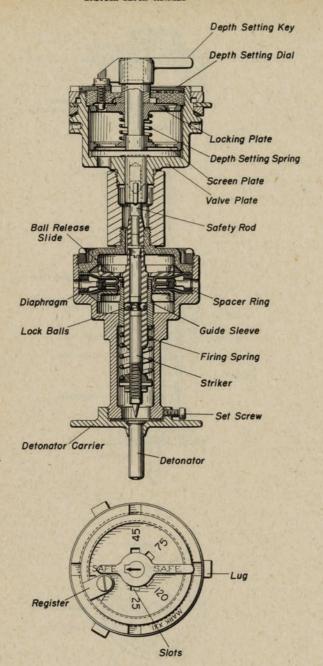


Fig. 30 - Mk. XXI Pistol, Sectional View

Mark XVI

 This pistol consists of a firing mechanism identical with that used in the Mark XIII* and the water inlet valve assembly used in the Mark XIV. The Mark XVI is not fitted with a safety rod.

Mark XVI*

 This pistol differs from the Mark XVI in that slight modifications have been made to permit the addition of an extra inertia safety clip to the inlet valve and more secure positioning of the pistol in the central tube.

Mark XIX

 This pistol differs from the Mark XVI in that the inlet valve is seated by an air impeller in the depth charge tail. This impeller is freed by withdrawal of an arming wire upon launching.

Mark XX

 This pistol differs from the Mark XIV in that the inlet valve is seated by an air impeller in the depth charge tail. This impeller is freed by withdrawal of an arming wire upon launching.

Mark XX*

1. This pistol differs from the Mark XX in that slight modifications have been made in the arming wire release mechanism.

Mark XXI

 This pistol differs from the Wark VII** in that it is slightly shorter and has depth settings of 25, 45, 75 and 120 ft.

Mark XXV*

 This pistol differs from the Mark VII** in that it is fitted with a lighter firing spring so that, when the pistol dial (identical with Mark VII*) is set to 50 ft., the pistol fires at a depth of 18 ft. Other settings are possible but are contrary to regulations.

British Depth Charge Primers (Boosters)

- Mark VII a brass cylinder, 4.75 long, 3.73 in maximum diameter weighing 5.25 lb. The booster can contains a charge of 1.5 lb. of Tetryl and is fitted with an envelope on its inner end to receive a detonator. A handle, 8.75 long, is threaded to a spindle which protrudes from the outer end of the booster can. The booster can is secured in the central tube by means of central tube stopper screwed onto an expanding rubber washer.
- Mark VII, No. 2 differs from the Mark VII in that the handle, central tube stopper and washer are not fitted. It is used with booster safety gear in Mark VII* depth charges.
- 3. Mark VIII differs from the Mark VII in that the handle and central tube stopper are not fitted.
- 4. Mark XIA Mine Primer (detonator section) a metal cylinder 8737 long, 1793 in maximum diameter and weighing 1.9 lb. No detonator envelope is fitted, the directional effect of the detonator being sufficient to set up the charge.
- 5. Mark VII Mine Primer (plain section) a metal cylinder, 8772 long, 1788 in diameter, weighing 2 lb. Its charge is Tetryl. When used in a charge with the Mark XIA Mine Primer described above, the booster sections are fitted into a booster tube which is then inserted in the central tube of the depth charge.
- Mark X differs from the Mark VII only in size. It is 274 long, (772
 with handle extended) 375 in maximum diameter and weighs 3.75 lb. Its
 charge is 10 oz. Tetryl.

Added 15 April 1945 (Change No. 3)

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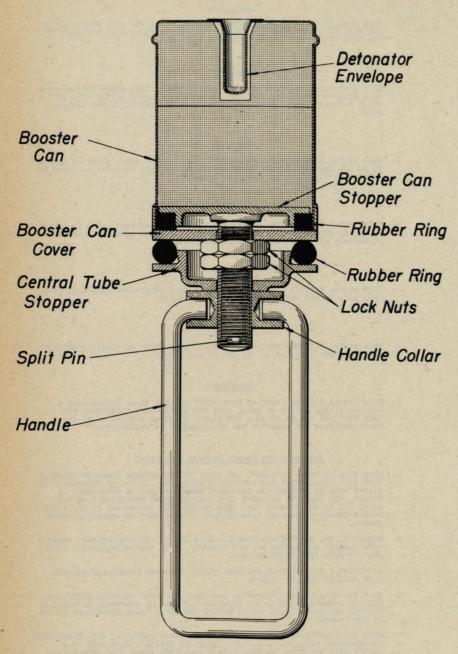


Fig. 31 - Mk VII Depth Charge Primer (Booster), Sectional View

British Depth Charge Primer Placers (Booster Extenders)

General

 These hydrostatically-operated devices serve the same purpose as U.S. booster extenders although they are much simpler in design. They are gradually being put into service and will in time be used in most depth charges in place of the present method of booster housing wherein hydrostatic pressure acts directly on the booster.

Mark I

- 1. This device consists of a cylindrical body, 4.75 long and 3.75 in diameter, fitted with bayonet joint lugs on its outer end. A spring-loaded spindle passes through the longitudinal axis of the body and through a rubber diaphragm which makes a watertight joint at the outer end of the spindle. The booster is bolted to the inner end of the spindle and the outer end of the spindle is engaged by a safety fork prior to launching.
- 2. Although this device was designed to completely arm the booster upon application of hydrostatic pressure, it has proved unsatisfactory in shallow depths (50 ft. or less). When the extender is used in shallow depths, a special spring is inserted between the extender body and the booster to house the booster immediately upon removal of the safety fork.

Mark I*

1. This booster extender differs from the Wark I only in that a stronger safety fork is fitted.



MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 5

BRITISH DEPTH BOMBS

British Desig- nation	Total Weight (1bs.)	Type & Wt. of Charge(lbs.)	Shape of Nose	Max. Diam.	Overall Length (in.)	Fuzing	Markings	Status
Mk. I	100	45 RDX/TNT or 49 Torpex	Round	8.05	42	Nose Fuze # 32	Dark green overall, 2"	Obsolescent
Mk. II	100		"	n,	11		red band 1" from nose, 1" light green band 6" from nose. Early de- signs, yellow	
Mk. III	100		"	n	11			
Mk. IV	100	п	"					п
Mk. VI	100	H.	See Note 1	н	See Note 1	n.	overall.	Service
Mk. I	250	149 Baratol or 140 TNT-	Round	11.2	59	Nose Fuze # 32	Same as -100 lb. class, except that light	Obsolescent
Mk. II	250	п	"	n	"	H		п
Mk. III	250		"	п	п	н		(H)
Mk. IV	250	134 RDX/TNT 132 TNT		11.35	58	Tail Pistols #28 or #30	green band is 4½" from nose.	Service
Mk. I	500	291 TNT	Round	14.0	74	Nose Fuze # 32	Same as	Obsolescent
Mk. II	500	"		"	"		class except that light	
Mk. III	500	308 Baratol	"	14.3	76	" _		
Mk. IV	500	282 TNT	"		72.5	Tail Pistols #28 or #30	green band is 6" from nose.	
Mk. I	600	432 Minol 439 Torpex	Concave	17.5	56.7	Tail Fuze # 862	Same gen- eral mark- ings.	Service

Note
1. Attachment welded to nose to prevent ricochet, increasing the overall length of 42 inches by several inches.

Table 1 - British Depth Bombs

British Desig- nation	Location	Fitted in the follow- ing bombs	Means of Arming	Means of Firing	Max. Diam.	Length	Status
No. 32 Fuze	Nose	Mk. I,II,III series.	Air vanes. 200 ft.at 100 m/hr.	Impact with de- lays of 0.5,1.0, 1.5,2.0 seconds.	2.5	7.0	Obsolescent.
No. 30 Pistol No. 28 Pistol	Tail	Mk. IV, VI Series.	Air vane. 13 revo- lutions	Impact with de- lays up to 11 seconds.	2.0	3"88	Service. # 28 is for land bombardment.
No. 862 Fuze	Tail	Mk. I 600 lbs.	Arming wire with- drawn.	Hydro- static Pressure 30 ft. depth.	2.0	5.5	Service.
No. 875 & 895 Fuzes	Tail	Mk. VI 100 lb. Mk. I 600 lb.		Hydro- static Pressure.	2:13	4.75	Service 895 is re- placing 875.

Table 2 - British Depth Bomb Fuzes and Pistols



Introduction

- 1. The British employ four sizes and types of depth bombs:
 - (a) 100 lb. Marks I, II, III, IV and VI.
 - (b) 250 lb. Marks I, II, III and IV.
 - (c) 500 lb. Marks I, II, III and IV.
 - (d) 600 lb. Mark I.
- Service depth bombs are ordinarily fuzed in the tail only, although earlier models, now obsolescent, employ only nose fuzes. In rare cases, both nose and tail fuzes may be encountered. Two methods are employed to obtain depth firing:
 - (a) Delay firing detonators and powder trains.
 - (b) Hydrostatic fuzes.
- 3. All service depth bombs are painted dark green overall although earlier models are painted yellow. A 1" light green band is painted around the nose just abaft an 0.5 red band.
- 4. The bomb cases are either cylindrical with round ends or tear-drop shaped, and are fitted with the standard British single suspension lug on the top center line. The 600 lb. Mark I may also be fitted with double suspension lugs for use with U.S. aircraft.
- 5. The tail sections for these bombs consist of a cone fitted with four fins mounted radially at 90° to each other and enclosed in a cylindrical shroud. On these bombs which take vane-armed impact-firing tail fuzes, a cylindrical vane extension rod extends from the after end of the tail body through its longitudinal axis to the fuze body in the bomb case. This rod serves as an arming spindle, the arming vane being attached to its outer end while its forked inner end engages an arming nut on the fuze. All tail sections are secured to the bomb cases by four spring clips except in the case of the 100 lb. Mark VI, the tail section of which is secured by four bolts. The clip-secured tail sections are designed to break off on impact with the water.
- 6. The following general precautions should be observed when dealing with bombs of this type:
 - (a) Obtain all possible information covering the type of bomb and the type and condition of the fuze or fuzes fitted before attempting any disposal operations.
 - (b) Do not attempt to render safe unless absolutely necessary. Destroy the bomb by countermining whenever feasible.
 - (c) Do not move or jar the bomb unnecessarily.
 - (d) Never move or rotate the arming vanes.
 - (e) When diving operations are necessary, raise the bomb before proceeding to render it safe.
 - (f) If a fuze is jammed in its pocket, make every effort to dispose of it by means other than withdrawal or disassembly. If it is not feasible to countermine the bomb where it lies, it may be more desirable to transport it to a demolition area for countermining than to attempt to render it safe.
 - (g) When dealing with a bomb which has multiple fuzing, dispose of the nose and tail fuzes in that order.
 - (h) Mine Disposal personnel should not attempt disassembly of fuzes fitted except as hereinafter indicated.
- Rendering these bombs safe consists of disposing of the particular fuze or fuzes which may be fitted. A brief description and operation of each fuze, together with the approved procedure for rendering safe, is included below.

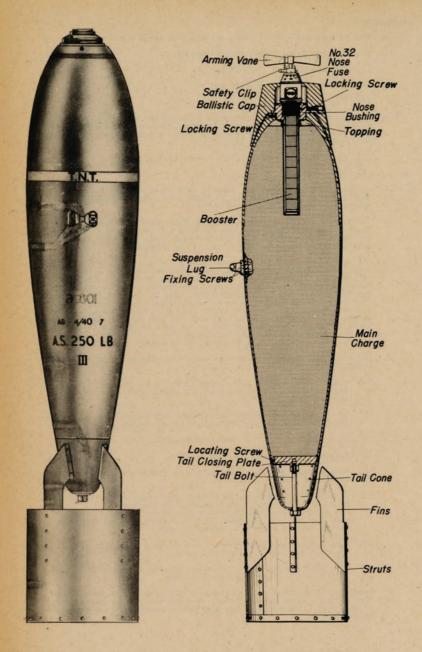


Fig. 1 - Mk. I, II and III Series of 100, Fig. 2 - Mk. I, II and III Series of 100, 200 and 500 lb. Depth Bombs, Elevation Sectional View

consequence it's

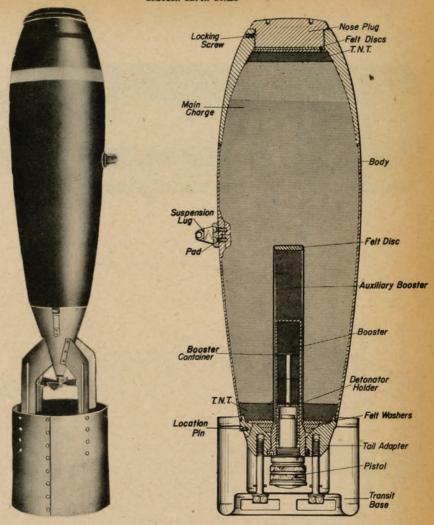


Fig. 3 - Mk. IV Series of 100, 250 and 500 lb. Depth Bombs, Elevation

Fig. 4 - Mk. IV Series of 100, 250 and 500 lb. Depth Bombs, Sectional View

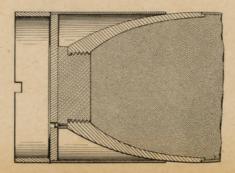


Fig. 5

Nose Modification for Converting Mk. IV 100 lb. to Mk. VI 100 lb. Depth Bomb



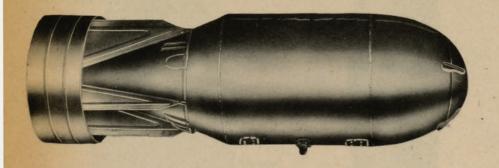


Fig. 6 - Mk. I, 600 lb. Depth Bomb, Elevation

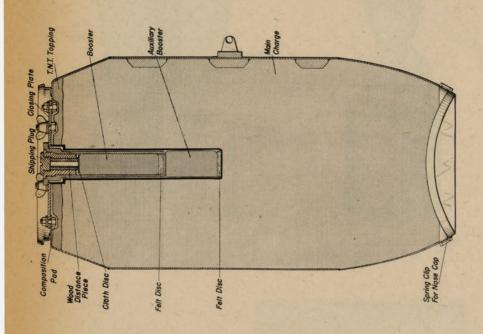


Fig. 7 - Mk. I, 600 lb. Depth Bomb without Tail or Nose Cap, Sectional View

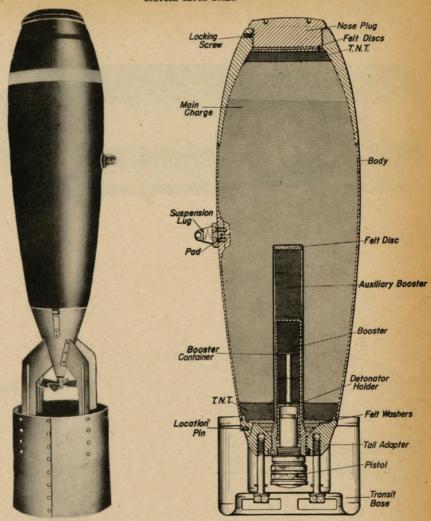


Fig. 3 - Mk. IV Series of 100, 250 and 500 lb. Depth Bombs, Elevation

Fig. 4 - Mk. IV Series of 100, 250 and 500 lb. Depth Bombs, Sectional View

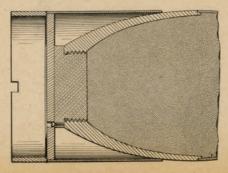


Fig. 5

Nose Modification for Converting Mk. IV 100 lb. to Mk. VI 100 lb. Depth Bomb



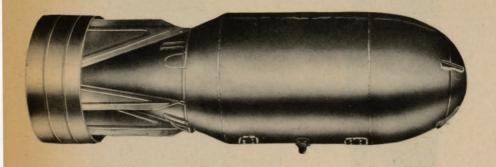


Fig. 6 - Mk. I, 600 lb. Depth Bomb, Elevation

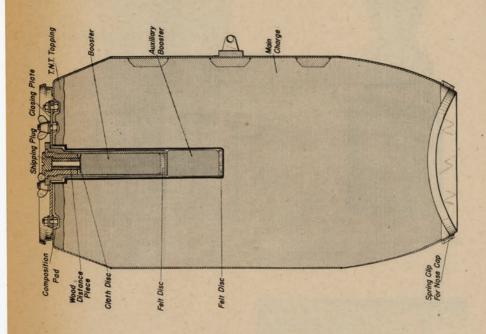


Fig. 7 - Mk. I, 600 lb. Depth Bomb without Tail or Nose Cap, Sectional View

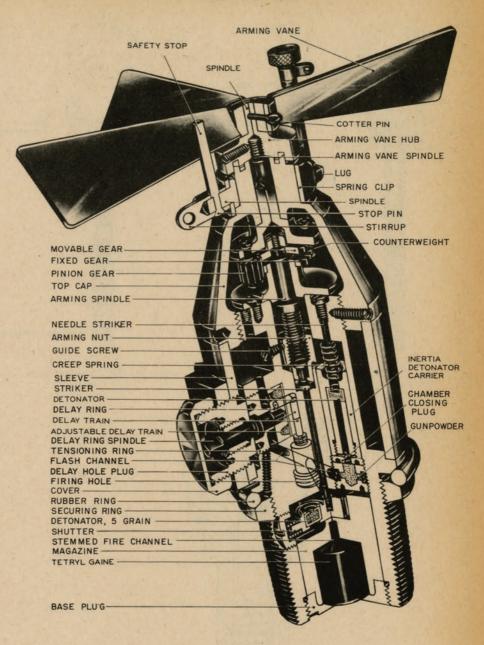


Fig. 8 - Nose Fuze #32, Sectional View

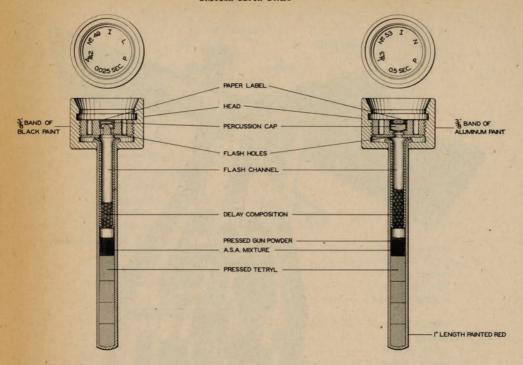


Fig. 9 - No. 49 Detonator, Mk. I, Sectional View

Fig. 10 - No. 53 Detonator, Mk. I, Sectional View

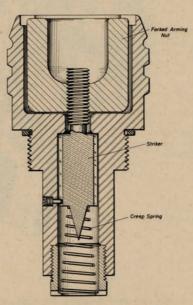


Fig. 11 - Tail Pistol #28, Sectional View. (Tail Pistol #30 is identical except for round-nosed striker.)

Nose Fuze #32, Marks II* and III

Description

- Instantaneous or short delay impact fuze incorporating firing delays of 0.5, 1, 1.5, or 2 seconds. The fuze screws into a pocket in a booster container which in turn screws into the bomb case and is locked by a single set screw. A rubber washer and securing ring make a watertight joint around the fuze body.
- 2. The fuze is 7" long and 2"2 in maximum diameter. .
- There is no means of determining the armed or unarmed condition of the fuze from an exterior examination.

Operation

 Armed by an air vane which rotates the working parts of the fuze through a gear train until the striker and detonator are aligned. Impact sufficient to crush the upper fuze body forces the striker down onto the detonator. Impact with water or any impact insufficient to crush the upper body ignites a delay powder train when inertia causes a detonator carrier to move against a striker.

Rendering Safe Procedure

- 1. Tape the air vane to the fuze body.
- 2. Unscrew the fuze from the booster container.
- 3. Loosen the set screw and unscrew the booster container from the bomb
- 4. Dispose of all explosive elements.

Tail Pistols #28, Marks II*, III and IV, and #30, Marks III* and IV

Description

- 1. Instantaneous, impact pistol (fuze), screwed into a booster container and locked by a cylindrical locking ring which encircles the pistol body. Although the pistol operates instantaneously upon impact, a 0.025 second delay detonator is ordinarily used with the #28 pistol and a 0.5 second delay detonator with the #30 in order to achieve depth firing. These detonators are not a part of the fuze proper and are fitted loosely into the detonator envelope in the booster container.
- 2. The pistol is 3.9 long and 2" in maximum diameter.
- The pistol is not visible unless the tail section of the bomb is removed.
 If armed, the forked arming nut will not be present and the threaded
 striker spindle will be visible.

Operation

 Armed by an air vane which unscrews the forked arming nut from the striker spindle after thirteen complete revolutions. Removal of the arming nut leaves the striker restrained only by 2 creep spring which is overcome by inertia on impact.

Rendering Safe Procedure

- 1. Remove the tail section (if present).
- 2. Unscrew the pistol from the booster container.
- Remove the detonator from the booster container using a small-gauge wire hook or other suitable means.
- 4. Loosen the set screw and unscrew the booster container from the bomb case.
- 5. Dispose of all explosive elements.



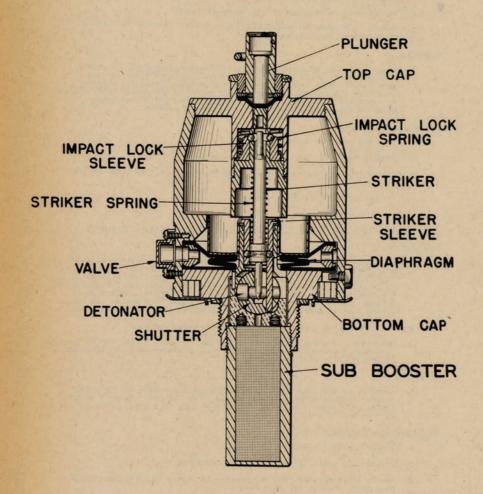


Fig. 12 - Tail Fuze #895, Sectional View

Tail Fuzes #895A, Mark I, #875A, #875B and #875C

Description

- Hydrostatically operated. #895A, Mark I fires at a mean depth of 18 ft. while #875A, #875B and #875C fire at 18 ft., 22 ft. and 30 ft. respectively. All these fuzes screw into a booster container and are locked by a lock washer.
- 2. The fuzes are 4.75 long and 2.2 in maximum diameter.
- The fuzes are operative unless the arming wire is in place. However, they should be safe to handle if out of water.

Operation

1. The arming wire is removed when the bomb is dropped. As the bomb sinks, water enters the fuze body. Hydrostatic pressure expands the diaphragm which raises the firing sleeve, thereby compressing the striker spring and operating a rotary shutter. This aligns the detonator with the striker. When the firing sleeve rises sufficiently to allow the lock balls to clear a stationary sleeve, the balls fall into a recess and the striker impinges on the detonator.

Rendering Safe Procedure

- 1. Remove the tail section.
- 2. Unscrew the fuze from the booster container.
- 3. Loosen the set screw and unscrew the booster container from the bomb
- 4. Dispose of all explosive elements.

Tail Fuze #862, Marks I and II

Description

- Hydrostatically-operated fuze with a firing depth of 30 ft. The fuze screws into the booster container; a rubber washer and securing ring make a watertight joint around the fuze body.
- 2. The fuze is 5.5 long and 2" in maximum diameter.
- The fuze is operative unless the arming wire is in place. However, it should be safe to handle if out of water.

Operation

1. The arming wire is removed when the bomb is dropped. As the bomb sinks, water enters the fuze body. Hydrostatic pressure operates a shutter which aligns the detonator with the striker. It also compresses the diaphragm which forces the striker down toward the detonator, thereby pushing the striker levers down and the spring-loaded lever-blocks out. When the levers move past a position where they make an angle of 90° with the striker, the lever-block springs force the blocks inward and the levers snap the striker down onto the detonator.

Rendering Safe Procedure

- 1. Remove the tail section (if present).
- Loosen the locking ring. Although considerable force may be necessary to accomplish this, the fuze is not sensitive to impact or shock and the operation is not unduly dangerous.
- 3. Unscrew the fuze from the booster container.
- Loosen the set screw and unscrew the boostor container from the bomb case.
- 5. Dispose of all explosive elements.

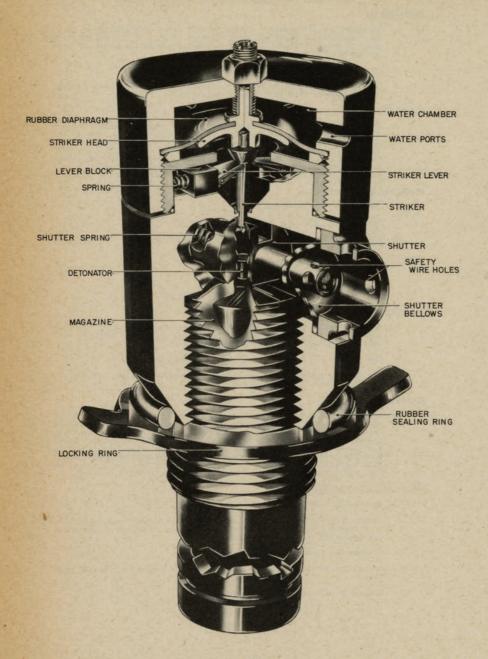


Fig. 13 - Tail Fuze #862, Sectional View



MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 6

BRITISH AHEAD-THROWN ANTI-SUBMARINE WEAPONS

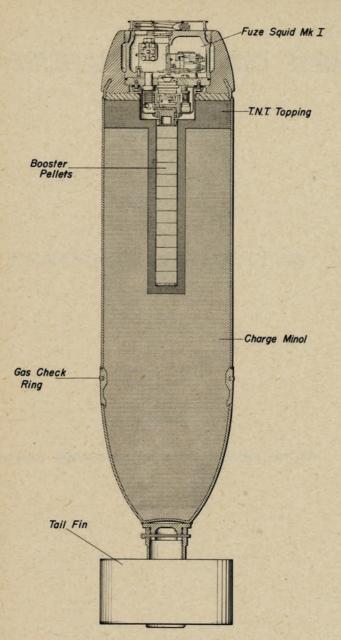


Fig. 1 - Squid, Sectional View

BRITISH AHEAD-THROWN ANTI-SUBMARINE WEAPONS

Introduction

- This chapter deals with the British Hedgehog and Squid projectiles, and the fuzes which may be fitted to them.
- All of the fuzes are extremely sensitive and dangerous to handle when armed. For this reason they should be rendered safe only in extreme emergencies.

Hedgehog

- This weapon differs from the U.S. 7.2 Ahead-Thrown Projector Charge (Hedgehog) as follows:
 - (a) Its cartridge propellent charge is Cordite rather than smokeless powder.
 - (b) Its high explosive charge is invariably Torpex.
- Except for the changes noted above and minor constructional details, the weapon is identical with the U.S. Hedgehog. The fuze fitted to the British charge is the No. 420 Mark I. It is very similar to the U.S. Mark 136 fuze.
- 3. For further details and the approved rendering safe procedure, see Part II, Chapter 6. In step No. 1 of the rendering safe procedure it is emphasized that, while rotating the arming vane to disarm, the space referred to should never be closed to a distance less than about 3/16".

Squid

General

- 1. Ahead-thrown anti-submarine projectile.
- Launched in patterns of three or six from mortar-type projectors on the forecastle of patrol vessels.

Description

1. Case

Shape	Cylindrical, with hemi- spherical ends. Fitted
	with helical, finned tail.

Material Steel
Diameter 11"93
Length with tail 56".5

Charge 207 lbs. Minol.

Total weight in air 400 lbs. approx.

- 2. Fuze, Squid, Mark I
 - (a) This fuze, a combination inertia-hydrodynamic-clockwork firing device, is mounted in a pocket in the nose of the projectile and secured by a keep ring. A small water-entry port sealed by a wax covering is located on the nose of the fuze along with a safety key.
 - (b) The fuze may be set to fire at depths between 20 and 800 ft. by variable settings on its delay clock. Automatic depth setting by remote control is made by an electrical mechanism attached to the Asdic. Recorded contacts on the Asdic are transmitted to the fuze through cables which are sheared upon launching.

Operation

When the projectile is inserted in the projector, the fuze safety key
is turned clockwise 90° and then removed, thereby unlocking the inertiaoperated arming mechanism. Initial setback upon launching displaces
an inertia block which unlocks the hydrodynamic erming mechanism. The
inertia block is locked in the armed position by a spring-loaded detent.



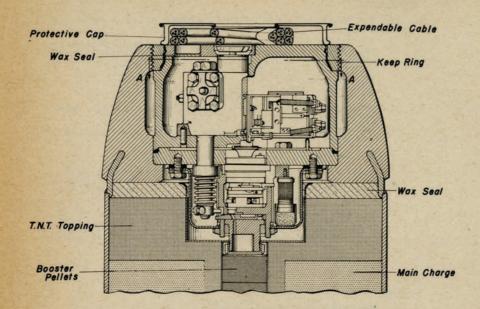


Fig. 2 - Puze, Squid, Mark I, Sectional View

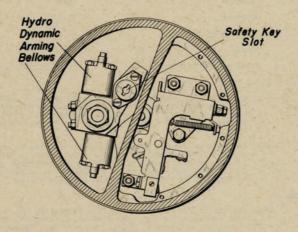


Fig. 3 - Fuze, Squid, Mark I, Section A-A



"Squid" Cont.

Impact with the water breaks the wax seal on the water entry port allowing water to enter the fuze body. Hydrodynamic pressure operates a rotary shutter which aligns the detonator with the striker and booster, and starts the delay firing clock.

The fuze and projectile fire when the clock runs off its delay setting, releasing the striker to impinge on the detonator.

Precautions

- Note that there is no positive means of determining the armed or unarmed condition of the fuze from an exterior examination. However, if the wax seal on the water entry port is broken, the fuze has probably armed.
- Do not move or jar the projectile except from a safe distance. The fact that the fuze fires by a clock delay makes it extremely dangerous.
- Never attempt to render the projectile safe by removal or disassembly of the fuze. Countermine the projectile whenever feasible. In extreme emergency, thermite burning offers a possible solution to the disposal problem, but it cannot be recommended.

Rendering Safe Procedure

1. None known.

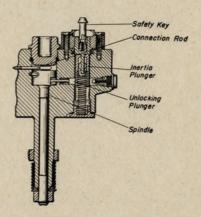


Fig. 4 - Squid Inertia Arming Mechanism, Sectional View

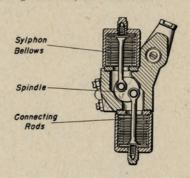
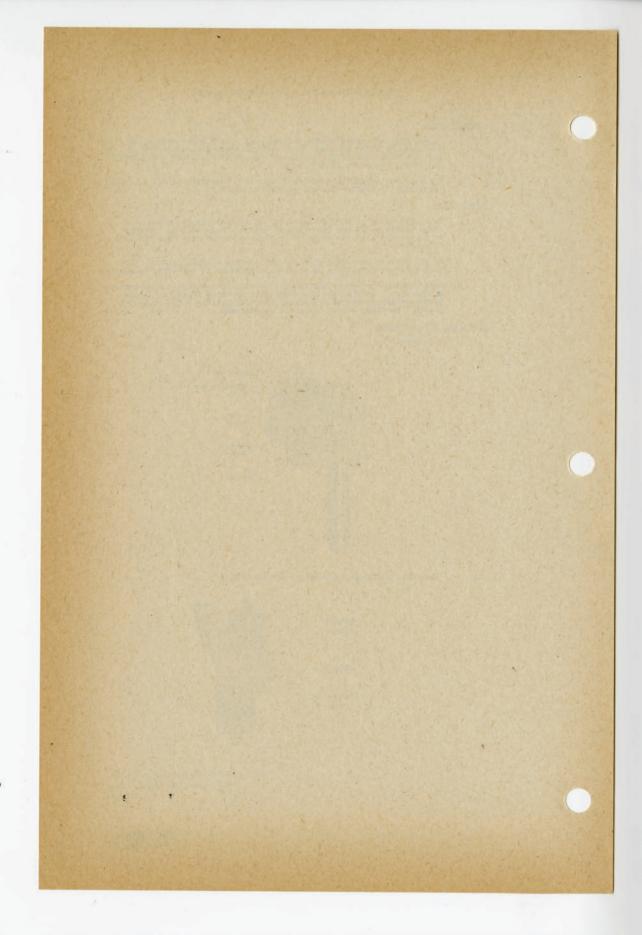


Fig. 5 - Squid Hydrodynamic Arming Mechanism, Sectional View



MINE DISPOSAL HANDBOOK

PART III

BRITISH UNDERWATER ORDNANCE

CHAPTER 7

BRITISH CONTROLLED MINES

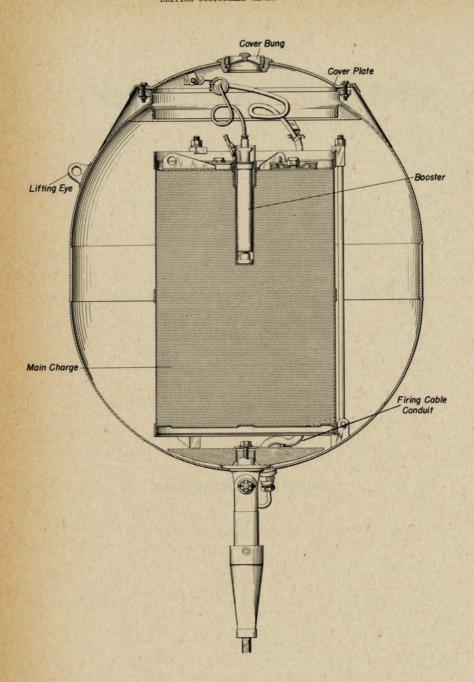


Fig. 1 - L Mk. II Mine, Sectional View

BRITISH CONTROLLED MINES

L Mark I (L Mark II)

General

- 1. Moored, controlled mine.
- 2. Laid by surface craft.
- 3. Defensive mine, used primarily for harbor protection.

Description

1. Case

Shape Two hemispheres, joined by a 6.5 cylindrical mid-section. Color Black

Steel Material Diameter 38.5

Length 50" approx.

500 lbs. TNT or Amatol Charge Total weight in air 1100 lbs. approx.

2. External fittings

In center of upper hemisphere, secured by bolts. Cover plate

In center of lower hemisphere, lap-fitted, secured by bolts. Fitted with gland in center for firing cable. Base plate

In cover plate, secured by keep ring or strongback and screw. Cover bung

Protective cover Shaped like section of trun-cated cone, fits over top of case.

Three, on upper hemisphere. Mine recovery chain is suspended from two eyes. Lifting eyes

- 3. The L Mk. II differs from the L Mk. I as follows:
 - (a) Its protective cover does not completely enclose the top of the
 - (b) It is not fitted with a base plate.
 - (c) Firing cable gland is fitted on lower hemisphere.
 - (d) Its diameter is 40".

Operation

- 1. Mine is armed manually prior to laying.
- 2. An observer fires the mine electrically from a distance.
- 3. No self-disarming devices are fitted.

RMS (L Mk. I)

- 1. Cut and tape the firing cable lead.
- 2. Remove the protective cover and cover bung.
- 3. Cut and tape each detonator lead separately.
- 4. Remove spring clip retaining the booster.
- 5. Turn detonator and booster to right and remove from bayonet joint.
- 6. Dispose of detonator, booster and charge.

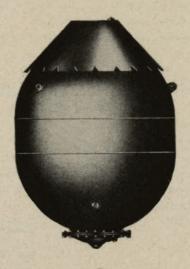


Fig. 2 - L Mk. I Mine



Fig. 3 - L Mk. I Mine, Floating



BRITISH CONTROLLED MINES

L Mark I (L Mark II) Cont.

RMS (L Mk. II)

- 1. Cut and tape the firing cable lead.
- 2. Remove cover bung.
- 3. Reach in and remove the rubber box connector from its clip.
- 4. Press booster retaining pawl inward and withdraw detonator and booster.
- 5. Dispose of detonator, booster and charge.

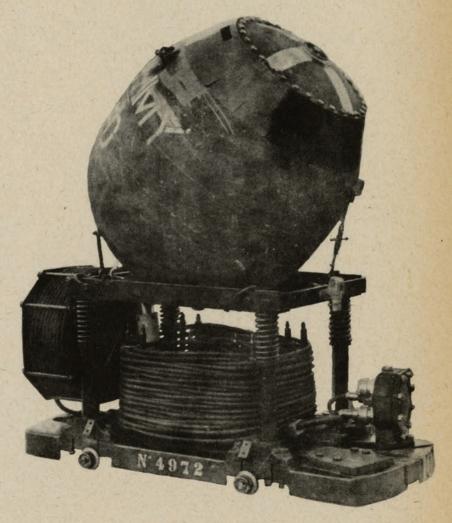


Fig. 4 - L Mk. II Mine

MINE DISPOSAL HANDBOOK

E.C.HADERLIE

PART IV

GERMAN UNDERWATER ORDNANCE

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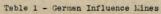
PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER I

Type	German	Nature	Lai	d By	Case	Shape	Dime	nsions
	Desig- nation		Primary	Secondary	Mat'l.		Diam.	Length
GA		Ground	Aircraft Parachute	Surface Craft	Al	Cylin- drical	26 "	518"
GA*		n,	"					"
GB		"	"		"			818"
GC ₁	LMB	"	"		"		"	- "
GC ₂	"		Surface Craft		,			7'4"
GD	LMA	*	Aircraft Parachute	Surface Craft	n	,		5'8"
GE		-			"	ñ		
GG ₁	BM 1000		Aircraft		Manga- nese Steel	Bomb Shaped		6'4"
GG ₂			"					617"
GG3			"	-10 V	,		"	6'1"
GH	RMA		Surface Craft		Al	Hemi- spheri- cal	50"	3'3" (height)
GI	RMH				Wood	Cu- boidal	3'5" x 3'10"	3'1 1/2" x
GN	TMC	"	Sub- marine	Surface Craft	Al	Cylin- drical	21"	11'
G0 ₁	EMF	Moored				Spher- ical	46"	
G0 ₂			Surface Craft				44"	
GO3					,	"	46"	
GP	LMF		Aircraft Parachute	Surface Craft		Tor- pedo Shaped	26"	7'8"
GS	тмв	Ground	Sub- marine			Cylin- drical	21"	717"
GT	TMA	Moored				Tor- pedo Shaped	•	9i 3 1/2"

Type	Wt.	How Fitted	Wt. in Air (lbs.)	Bomb Fuze	Clock	Found	Units Possibly Fitted	(1	Depths	Remarks
GA	676	Cast	1173	24 A	Mk II hydro-	M Mk I		15	Max. 120'	Obsolete - six anti-rolling
GA*	11	"	11	"	static.	-	100	**	"	horns on nose.
GB	1536	"	2175	24 A	Mk I	M Mk I,		"	100	
GC ₁		"		34 A	hydro- static.	M Mk II		"	180	
				A*, B	Mk I, II III, IV, IVa, V hydro- static. Mk I RAM.	series, IV, IVa A Mk I, II,III, VI, AM Mk I				
00		100	2007	21 1		MP Mk I				Share Market
GC ₂			2076	34 A, A*, B	E			•		
GD	676	"	1173	none	"	M Mk II	A Mk I,I	1"	120	Obsolescent
				34 A,		series, IV, IVa	IIII. IV			
GE			2	34 A	Mk II hydro- static,	None			FR	Booby trap only - 3 PSE's only two laid.
GG ₁		•	2060	157/3		M Mk V, VI,VIII IX, A Mk IV,V AP Mk I		24	180	Delay bomb firing in shallow water.
GG ₂	H.		*	"	"	AM Mk II		15	"	* *
GG ₃				"	Mk II RAM	AP Mk I	M Mk V, VI, VIII,	24	"	
							IX, A Mk IV,			
GH		Block fitted	2700	None	Not known	None	M Mk II	15		Has been used a controlled mine.
GI	1935 Vari- able		2285	None		M Mk II series	DOM:	"	200	
GN	2000	,	2360	"	hydro- static. 80-day	M Mk II		•	•	Has been used a sabotage mine.
	750	Block fitted	1331		Mk IIIa special hydro- static. 80-day SDM 12- hr test ing.	M Mk IV		42	120	Offensive-laid by 1600 ton sub marine mine- layer.
G0 ₂	-	-	1270		The same of the sa	M Mk IVe		15		Offensive
-03			11		Mk IIIa special hydro- static. 12-hour					Defensive
GP	612	Cast		"	testing		A 3/16 T	-	111	
			1035		Mk IIIa and V hydro- static. 12-hour testing		A Mk I, II,III, VI	54	114	Has been used a controlled mine for demolition. Moored from end; float horizontally.
	1220		1540		Mk III special hydro- static. 80-day SDM	M Mk III	A Mk VI	15		Has been used a a sabotage mine
GT	475		874	н	Mk II, III Special hydro- static.	M Mk VII		48	114	Moored from end floats horizont ally.



Туре	Found in Mine Type	Mechan- ism	tion of firing		Fea- ture			tivity (mg.)	to Fire	Remarks
Mk I	GA,GA* GB	Needle	One way Red or Blue #	None	Pendu- lum	None	None	50-80	3	Hand set lat- itude adjust- ment -
M Mk II	GB,GC ₁			Mechan- ical		"		20-30	2 1/2-	Obsolete
M Mk III	GS,GN		7" 14	"		6-place Item #1	"		2 1/2-	
Mk II Revised			One way Red or Blue		"		6-day	10-20	2 1/2-	One found with R.I.M. Obsolescent.
MK IV	GC ₁ ,GC ₂ ,			Magnet- ic	None	None	None	20-40	less than one sec.	Obsolete
M Mk IVa	GC1,GO		"	"		15-place Item #3	6-day	20-30	"	
MKV	GG1		Red or	Electro magnet- ic		None	None	20-35	3-4	Only two found, Obso- lete.
M Mk VI	GG1	"	"	1	"	3-place	"		5-7	Obsolete
Mk VII	GT		*	Mechan- ical	Iner- tia switch	None		30-40	3-4	Counter bal- ance system to counteract wave motion, Obsolete.
Mk VII	GG ₁			Electro magnet- ic		10-place Item #5	"	15-30	5-7	Obsolescent
MK IX	GC1			Electro magnet- ic		9-place Item #6		15-25	3-4	

Table 2 - German Magnetic Firing Units

Туре	Found in Mine Type	Micro- phone Used	Period		R.A.M.	cies	Firing Sensitivi- ties (dynes per so. cm.	Time to Fire	Remarks
A Mk I	GC1,GC2	lever	12 sec.		6-day	175-325	30-50 15@250 cps	1 1/2-	Only one found. Obso- lete
A Mk II	GC ₁ ,GC ₂	Canti- lever	80 sec.		*	175-325 700-1100	15@250 cps		Obsolete
A Mk III	GC ₁ ,GC ₂ , GS, GN			12- place Item#2		175-325		1 1/2-	
A Mk IV	GG ₁		tion of	10- place Item#8	None	1000		1/2	Obsolescent
A Mk V	GG ₁		tion of	Item#9					Anti-sweep circuit.
A Mk VI	GC ₁ ,GC ₂	"	Dura- tion of	12-	6-day	88 238	650 800		Anti-mine- sweeper unit. Insensitive microphone.

Table 3 - German Acoustic Firing Units

Туре	Found		Mag	netic			1000			oustic			
		ing Mech.	tion	P.D.M.	R.A.M.	Sensi- tivity (mg.)			ing Fre- quen- cies	ing	to Fire	Active (Sec.)	
AM MkI	GC2, GS		One way, Red or Blue	12-place Item #2	6-day	3-9	Canti- lever		175- 325		1/2- 1 sec	45	3-4
AM Mk II	GG ₂	M Mk	Bi- polar, Red and Blue		None	12-15	phragm	9- place Item #7		*		40	

Table 4 - German Magnetic-Acoustic Firing Units

Тур	eFound		Pres		See 5		er Unit			Combi	nation	
	Mine Type	Direction Pressure Charge	Mech.	Sensi-	fire (sec.)	Com- bined With	tion in	Fea- ture	oper- ates first, other unit may oper- ate to fire	If other unit oper- ates first, "p" unit may oper- ate to fire	P.D.M.	R.A.M.
AP Mk		Nega- tive (Decr- ease)	Integrating	2 1/2	7	Mk V		as A Mk IV	Within 45 sec- onds af- ter "P"	only at comple- tion of "A" act- uation.	17 7	80- hour
MP		Nega- tive (Decr- ease)	Non- Inte- grat- ing		9	Re-	Sensi- tivity 5 mg. Red only	M Mk II	tion of "P" act. uation.	25 sec- onds	None	6-day

Table 5 - German Pressure-Operated Firing Units

Туре	Found in Mine Type	Actuated By	Firing Principle	Delay Arming	Factors Deter- mining Method of Opera- tion	Nature and Amount of Delay Opera- tion	Remarks
24 A	GA, GA*	Inertia	Percus- sion	10 sec. clock- work	Choice by pilot	Pyro- tech- nic delay	Pilot makes choice whether mine or bomb. If lanyard is not pulled, bomb fuze is dormant.
34 A	GB, GC ₁ ,	Inertia	Percus- sion	5 sec. clock- work	Setting of fuze and hy- drostat- ic pres- sure.	21 sec. clock- work	"A" setting: Fires with delay after impact, unless un- der 15' water pressure. Fires if pressure is re- leased.
							"B" setting: Be- comes safe under 15' water pres- sure.
				None	Setting of bomb fuze	26 sec. clock- work	"C" setting: Aeri- al burst - not a design feature and never used.
34 A*	GC ₁ , GD	Inertia	Percus- sion	9 sec. clock- work	See 34A	17 sec. clock- work	Modification of 34A to give longer safe arming period, to allow parachute to open.
				None	Setting of bomb fuze	26 sec. clock- work	See 34A.
34 B	GC1	Inertia	Percus- sion	7 sec. clock- work	Hydro- static pressure	25 sec. clock- work	Modified 34A. "A" setting only.
				None	See 34A	32 sec. clock- work	See 34A.
157/3	GG ₁ , GG ₂ , GG ₃	Inertia	Elect- rical	0.013 sec. elect- rical	Deceler- ation 200 g or more	instan-	Inertia bolt switch.
A PARTY		Vibration	Elect- rical	None	Decler- ation 20 g or more	None, instan- taneous	Vibratory "trem- bler" switches. Close master switch in mine firing unit.

Table 6 - Bomb Fuzes used in German Aircraft Mines

Туре	Operating Depth (ft	Time	rostatic Arming Clocks Switches	Delay Starting	
Mk I	15	17 min.	a-g 5 1/2 min. b-c 17 min. (b-h) (2 min.)	Soluble	#5 Requires con- tinuous hydro- static pres- sure.
Mk II	15	17 min.	STATE OF THE PARTY	None	Types " #1,S,T
Mk III	15	1/2-6 hours	b-c end of sec period		Types Once started, #1,S.Truns down.
Mk III	a15			None	Types Once started, #1,3,0runs to end of set period.
Mk IV	15			None	Type Once started, #2 runs down.
Mk IVa	15		A SECTION OF THE SECTION	None	Type Same as Mk #2 IIIa.
Mk V	15			None	Types Requires con- tinuous hydro- static pres- sure. Stops at end of set period.

Type	Type of Spindle	Anti-Recovery Switch	Locking Balls	
#1	Short	None	None	None
#2		Yes		
#1 #2 #3	Long			Hole in spindle for safety pin.
#4		None		
#4				Hole in spindle for safety pin. T-connection for soluble plug use.
0			Held by moor- ing spindle.	surface laid type; non-return detent on submarine type.
S			Held by cap and safety bar.	Soluble plug may be fitted to cap.
T			Held by cap and lever system.	Non-return detent locks spindle in when depressed.

mile		100 1 V I I + -	Other Clocks Switches	Purpose
Type 6-day	RAM, RIM	O-6 days	1-2) at end of set period	Delay arming, in-
	in GC, GD, GS, GN		4-57	erting (Influence Mines)
80-day	SDM, RIM (RAM) in GO, GS,	1-80 days	E (7-10) Close at end of 24 min. F (8-9)	Mines)
	GN		A (2-5) Close at end of set	Inerting (Ground Mines)
			C period or if clock fails.	(Possibly delay arming)
12-hour	Testing in GO, GP	1-12 hours	H-6-4 and 5-1-2 H-6 closed until end of set period when 6-4 closes. 5-1 closed unless heater I is ener- gized, in which case 1-2 closes.	Testing clock to determine whether or not mine is properly laid.
80-hour	RAM in GG	0-80 hours	Master switch closed at end of set period.	Delay arming for GG only.

Table 7 - Clocks and Clock Accessories used in German Mines



Item	Type (Mark)	Units Fitted to	Units Possibly Fitted to	Mine Found in	Setting	Interval (sec)	Remarks
1	Clock- work (Mk I) (Z.K.)	M Mk II Rev. M Mk III	M Mk VII	GC ₁ , GD,	6 Max.	45	Obsolete
2	Clock- work (Mk II (Z.K. II)	A Mk III A Mk II AM Mk I	A Mk II	gc	12 Max.	120	
3	Clock- work	M Mk IVa		GC, GD, GO, GP	15 Max.	85-115	Mechanism built integral with M Mk IVa unit. May possibly be re-actuated af- ter 60% of in- terval.
4	Fuse Delay Switch	M Mk VI		GG1	3	50-60	Obsolete
5	Fuse Delay Switch	M Mk VIII		GG ₁	10 Max.	30-50	(g) (E)
6	Fuse Delay Switch	M Mk IX		GG ₂	9 Max.	45-60	
7	Fuse Delay Switch	AM Mk II		GG3	9 Max.	30-50	Completely var- iable as requir- ed. Number of stages selected
8	Fuse Delay Switch	A Mk IV	CISTOR!	GG ₁	10 Max.	55-70	by inserting switches as desired.
9	Fuse Delay Switch	A Mk V AP Mk I		GG ₂ , GG ₃	10 Max.	70-90	

Table 8 - German Period Delay Mechanisms

	Used with					Length	Remarks
Number	Mine Type		Top (in)	Bottom (in)	Sides (in)	Shrouds	ANNOUNCE OF THE PARTY OF THE PA
I	GC ₁	28	7	33	96	18'6"	
11	GD	24	7	33	73	No data available	
111	GD	24	6 1/2	35	72	No data available	
IV	GC ₁	32	5	34	11'9"	25'	Parallel Lattic Type.
V	GC1	16	No data available	No data available	No data available	No data available	Barber-Pole type. 18 cords to each loop of 2 shrouds.
VI	GG ₂	10	No data available	No data available	No data available	No data available	Small para- chute. Drogue only.

Table 9 - Parachutes used with German Mines

Туре	Found Fitted to		Firing Principle	Fires When	Armed By	Location of Safety Plug
PSE Mk I	Tail door	GC, GD	Electri- cal	Tail door is removed.	Safety pin	Locking forward, 24" clockwise from top center line: 6" forward of joint.
PSE Mk Ia	Mechanism plate	GT		Mech. plate is removed or mine is separated.	Safety pin	Under screw on mech. plate, 180 degrees from bowden wire channel.
PSE Mk II	Firing de- vice	GG1, GG3	Photo- electric		Firing de- vice arm- ing	None
PSE Mk III	Tail door	GC, GD	Percus- sion	Tail door is removed,	Safety pin	Looking forward, 20 1/2" clockwise from top center line; on flange.
PSE Mk IV	Firing de- vice	GG ₃	Galvanic	Moisture enters fir- ing device.		None
Zus-40	Under bomb fuze	GC (GG1,GD)	Percus- sion	Bomb fuze is with- drawn 0.6 inches.	Impact	
statio	clock plate of hydro- static clock Mk IV, IVa, V.	GP	Electri- cal	Hydrostatic pressure falls below 15 feet.	vice arm-	
"	Firing de- vice	GG ₁ , GG	"	Hydrostatic pressure falls below 24 feet.		
		GG3		Hydrostatic pressure falls below 15 feet.	50 02 0 M	
Clock work bomb fuze 34 A 34 B		GC ₁ , GD	Percus- sion		Impact	

Table 10 - PSE and other Anti-Recovery Devices found in German Mines



GERMAN THEILIENCE MINES

Introduction

- 1. German influence mines exist in so many varieties that few generalizations can be drawn with respect to the mines as a group. Most of them can be and have been fitted with a variety of firing units upon which the mines' operational characteristics are dependent. The various individual characteristics of the mine assemblies, firing units and other associated fittings are shown in tabular form on the preceding pages. Detailed information on the operation of each firing unit will follow. Only two pertinent generalizations can be drawn as follows:
 - (a) All mine cases are made of non-magnetic material.
 - (b) All mine cases to date have contained Hexanite charges, either block-fitted or cast.
- It is not possible to definitely establish maximum and minimum effective depths for employment of influence mines because of the large number of variables involved. However, the following generalizations may be drawn:

(a) Moored influence mines

- (1) Minimum case depths are generally dependent on the minimum depths at which the hydrostatic arming devices will operate
- (2) Maximum case depths are generally dependent on the maximum depths at which the hydrostatic depth-taking devices will moor the case properly.
- (3) Maximum depths of moored mine assemblies (i.e. maximum anchor depths) are generally the sum of the maximum case depth and the maximum length of mooring cable.
- (4) In the case of mines in which separation of case and anchor takes place on the bottom, the maximum laying depth will be dependent on the crushing depth of the case and fittings.

(b) Ground influence mines

- (1) Minimum depths are dependent on the minimum depths at which hydrostatic arming devices will operate.
- (2) Maximum depths are dependent on the crushing strength of the case and fittings. (This consideration is generally pertinent only for anti-submarine purposes.)
- (c) In addition to the above-mentioned structural considerations, maximum effective depths are dependent upon:
 - The distance from a ship at which detonation of the mine will result in effective damage to the ship. This is dependent on the relation between the power of the explosive charge and the structural strength of the ship.
- (d) Despite the variables involved, it appears that a reasonably constant relationship exists between the weight and type of explosive charge and the maximum effective depth against typical surface craft. If the explosive charge is Hexanite, this relationship is approximately as follows:

Weight of Charge	Maximum Effective Dept			
(pounds)	(fathoms)			
700	20			
1200	25			
1500-1600	30			
2000	35			

- 3. Hydrostatic arming clocks are fitted to almost all German influence mines and represent a danger to mine disposal personnel particularly because of the anti-recovery switches which may be fitted. These switches are designed to close upon release of hydrostatic pressure after the clock has been subjected to initial arming pressure, although they may be closed by shock or impact even if the mine has never entered the water. Before attempting to render safe a mine whose clock is ticking, gag the clock as follows:
 - (a) Insert a piece of phosphor-bronze wire through the water entry hole in the clock plate and make sure that it comes out the other side.
 - (b) Twist the ends of the wire securely together.

Introduction (Cont'd.)

- 4. Two exceptions to the procedure described in Par. 3 above are as follows:
 - (a) The clocks fitted to Mines Type GO, GT, GS and GN are inaccessible, cannot be gagged and need not be gagged.
 - (b) Clocks fitted with extended pistons (See Table # 7) cannot be gagged because of structural peculiarities. When dealing with mines fitted with these clocks, the procedure to be followed will depend on the local stuation. If practicable, wait a period of six days before attempting to deal with it. The clock will then have completed its maximum arming period and the anti-recovery switch, if operative, will have fired the mine. If, however, RMS is necessary, it should be undertaken immediately with the intent of completely disarming the mine before the clock completes its delay period. It must be emphasized that this last procedure is extremely dangerous and should be undertaken only in extreme emergency.
- 5. The following precautions should generally be observed when dealing with mines of this type:
 - (a) Do not attempt RMS unless absolutely necessary.
 - (b) Observe acoustic procedure as follows:
 - (1) Keep all necessary noise to a minimum.
 - (2) Make no noise lasting longer than one second, or as in the case of Mine Type GG, one half second.
 - (3) Allow a three second interval between each interval of sound.
 - (c) Allow no movement of magnetic material near the mine.
 - (d) Do not move or jar the mine except from a safe distance.
 - (e) Observe all case markings carefully for clues as to the type of firing unit fitted.
 - (f) Remove all fittings from a safe distance whenever feasible. Prior to removal of such fittings as cover plates etc., test for spring pressure or unnatural stiffness which might indicate the presence of a booby trap.
 - (g) Do not, except in extreme emergency, raise any ground mine from underwater without first gagging the bomb fuze (if fitted) and the clock. Use remote control lifting gear for this operation.
 - (h) Observe all precautions listed in Part I, Chapter 1 with regard to diving on influence mines.

Influence Firing Devices

Introduction

- 1. German influence firing devices (units) are designated by the Allies with a letter prefix and a mark number. The prefix indicates the type of firing influence or influences employed as: M-magnetic, A-acoustic, AM-magnetic-acoustic, AP-acoustic-pressure and MP-magnetic-pressure. The mark number indicates the individual unit, the numbers being assigned in sequence of recovery with little attention paid to the design of the particular unit.
- A brief chronology and classification of the various unit types and individual units follows below. A detailed description of the operation of each unit circuit together with various unit accessories follows thereafter.

Magnetic Units

- Magnetic units are all of the needle type and operate on the vertical component of the magnetic field of the earth or other magnetic body. These units are herein subdivided according to the type of automatic latitude adjustment (A.L.A.) which each employs and thus fall into three groups as follows:
 - three groups as follows:

 (a) Mechanical A.L.A. includes M Mark II (obsolete), M Mark III (obsolete), M Mark II(revised) and M Mark VII. Units in this group are subsequent developments of the obsolete M Mark I which was designed with no provision for A.L.A. All are unipolar and may be set to fire on either RED or BLUE actuations. The M Mark II, III and II(revised) are commonly referred to as the M Mark II, group and are designed for use in submarine, surface craft and aircraft-parachute-laid ground mines. They cannot be used in moored mines because of the pendulum-type anticountermining device fitted. M Mark I, a needle-type unit without A.L.A., was the basic unit. M Mark II differs from it by the incorporation of an A.L.A., making possible more sensitive settings than were practicable with M Mark II. M Mark II (revised) and M Mark III contain the further refinement of a trip switch for use during A.L.A. to help eliminate premature firing. The trip switch in M Mark II (revised) is a refinement over M Mark III in that it does not operate as the pre-set sensitivity is applied during A.L.A. unless the needle is stuck on its firing contact. In addition, M Mark III is mounted in a smaller ring to permit its use in 21" diameter mine cases. M Mark VII is designed for use in moored mines, this being made possible by the incorporation of a needle counterpoise system which counteracts wave motion and natural disturbances. It has been used only in mines laid by submarine or surface craft.
 - (b) Magnetic A.L.A. includes M Mark IV (obsolete) and M Mark IVa. Units in this group contain an armature-type, vertically-pivoted needle and represent an improvement over the M Mark II group in that they are more compact, incorporate bi-polar firing and can be made in mass production. No anticountermining device is fitted and the units fire more readily due to motion. Nevertheless, these units have been used with considerable success in moored and ground mines laid by submarine, surface craft and by aircraft with parachute. M Mark IVa incorporates a special, 15-place mechanical P.D.M. as an integral part of the unit.
 - (c) Electromagnetic A.L.A. includes M Mark V (obsolete), M Mark VI (obsolete), M Mark VIII and M Mark IX. Units in this group contain an armature-type, horizontally-pivoted needle, are especially sturdy in construction and are made with a minimum of moving parts, being designed for aircraft laying without parachute. All except M Mark IX are unipolar and may be set to fire on either RED or BIUE actuations. M Mark V is the basic unit and M Mark VI and VIII are modified by the addition of specially-designed electrical F.D.M.'s. M Mark IX is essentially a bipolar M Mark VIII.

Acoustic Units

1. All acoustic units use the carbon-button type of microphone which requires constant battery power to remain alive. Thus the life of the unit depends largely on the life of its microphone batteries. The microphones are of the resonant, cantilever type and use the mine case as a diaphragm. The units use rectified signal current for all phases of operation, no vacuum tubes being fitted to date. Each unit is fitted with an anticountermining device designed to render the unit passive if the sound level rises too rapidly. The units fall into two basic groups, depending on the number of relays used, as follows:



- (a) Two-Relay Type includes A Mark I (obsolete), A Mark II (obsolete)

 A Mark III and A Mark VI. Units in this group are designed for
 use in ground mines laid by submarine, surface craft and by aircraft with parachute. A Mark I is the basic unit and A Mark II
 is the same except that the microphone is provided with its own
 separate battery to give longer effective life. In addition, the
 anticountermining feature is altered slightly to make it more
 positive. A Mark III differs from A Mark II in that it is fitted
 with a filter which renders it more selective to firing frequencies and it may be fitted with a mechanical P.D.M. A Mark VI
 is a special modification of A Mark III, designed as an antiminesweeper unit, employing a long firing delay and an insensitive microphone. Although an additional relay is used in this
 unit, it is functionally a two-relay type.
- (b) Three-Relay Type includes A Mark IV (obsolete) and A Mark V.
 Units in this group are especially sturdy in construction and are
 made with a minimum of moving parts, being designed for aircraft
 laying without parachute. The two units are nearly identical although certain wiring differences create slightly different operational characteristics. A Mark V differs from A Mark IV as
 follows:
 - (1) Its microphone circuit is more sensitive and efficient.
 - (2) It is not fitted with a frequency filter.
 - (3) It requires a pre-determined rate of sound level increase which is limited both by maximum rate and, unlike any other German acoustic unit, minimum rate as well. This in itself constitutes an anti-sweep circuit.

Magnetic-Acoustic Units

1. Magnetic-acoustic units overcome the short-life weakness of the acoustic units in that they are magnetically armed and acoustically fired. The acoustic component does not draw on the microphone batteries until a magnetic actuation has been recorded and then only for a short period. In addition, these units present a more difficult problem for minesweepers. Each unit is composed of a standard-type magnetic unit (slightly modified) designed to arm a special acoustic component which employs a vacuum tube amplifier suited to the combination. The magnetic component selected determines the way in which the complete unit will be employed. AM Mark I is armed by M Mark II (revised) and AM Mark II, by M Mark IX.

Pressure-Operated Units

- Pressure-operated units consist of a pressure component in combination with another influence-operated component. Two types of pressureoperated units have been used as follows:
 - (a) Integrating Type AP Mark I. AP Mark I is a combination of a pressure detecting device, fitted with an integrating circuit, used with a slightly modified A Mark V unit. It is classified as an integrating type of circuit due to its property of registering cumulatively a series of short pressure pulses, provided the pulses occur frequently enough, with the result that a series of pressure pulses of less than the designed length may cause actuation in the same manner as one pulse of the designed length. This feature, a definite fault in design, tends to decrease the difficulty of sweeping.
 - (b) Non-Integrating Type MP Mark I. MP Mark I is a combination of essentially the same pressure detecting device employed with AP Mark I, fitted with a non-integrating circuit and used with a slightly modified M Mark II (revised) unit. It is classified as a non-integrating type of circuit due to its property of totally disregarding pressure pulses other than those of at least the designed length. This arrangement is a considerable improvement over the integrating type making the development of countermeasures much more difficult.
- The influence-operated component used in combination with the pressure component determines the way in which the complete unit may be employed.

Influence Units

General

1. In connection with the following description of German influence unit circuits, it should be borne in mind that these units exist in a large number of slightly varying forms. One of the most common variations appears to be in the delay arming clocks fitted (See Table #%), resulting in minor variations in the delay arming cycle, but having no effect on the basic operation of the unit. The following descriptions attempt to present typical assemblies as they have been found, particularly in so far as the delay arming clocks are concerned and make no attempt to enumerate the large number of variations which are possible.

M Mark II Unit Circuit - Operation

Arming

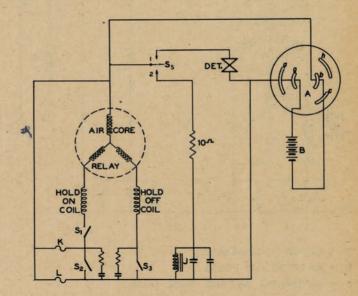
5 1/2 minutes after the six-day clock starts, a-g closes and b-c closes 11 1/2 minutes later. B then blows L, unlocking the needle and starting A.L.A. Upon completion of A.L.A., S₂ closes and B blows K, allowing the preset sensitivity to be applied to the unit. As the preset sensitivity is applied, S₂ opens and, upon completion of this operation, S₁ closes. The unit is now alive.

Normal Firing

 A firing actuation closes S₂. This energizes the hold-on coil and the relay, closing S₅ to contact #1 and completing the circuit through the detonator.

Normal Anticountermining

- A countermining shock closes S₃. This energizes the hold-off coil and the relay, closing S₅ to contact #2. The unit remains passive until S₃ settles down.
- A countermining shock during A.L.A. closes S₂. The hold-off coil and relay operate as above, energizing J which holds the A.L.A. arm inoperative until S₃ settles down.



A - CLOCK (HYDROSTATIC)

B - BATTERY - IS VOLTS

K - AUTOMATIC SETTING FUSE (ALA)

L - MAGNET RELEASE FUSE (ALA)

J - ELECTROMAGNET

S, - SENSITIVITY SETTING SWITCH

S2 - NEEDLE SWITCH

Sa - PENDULUM SWITCH

S. - AIR CORE RELAY SWITCH

Fig. 1 - M Mk. II Unit Circuit and Key

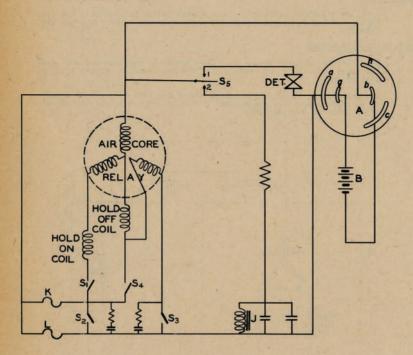
M Mark II(revised) Unit Circuit - Operation

Arming

 Same as M Mark II except that if S₂ does not open properly as the preset sensitivity is applied, the A.L.A. arm momentarily closes S₁, completing the circuit through the hold-off coil and S₂, opening S₂.

Normal Firing and Anticountermining

1. Same as M Mark II.



- A CLOCK (HYDROSTATIC)
- B BATTERY 15 VOLTS
- K AUTOMATIC SETTING FUSE (ALA)
- L MAGNET RELEASE FUSE (ALA)
- J ELECTROMAGNET
- S, SENSITIVITY SETTING SWITCH
- S. NEEDLE SWITCH
- S3 PENDULUM SWITCH
- S4 TRIP SWITCH
- S. AIR CORE RELAY SWITCH

Fig. 2 - N Mk. II (revised) Unit Circuit end key



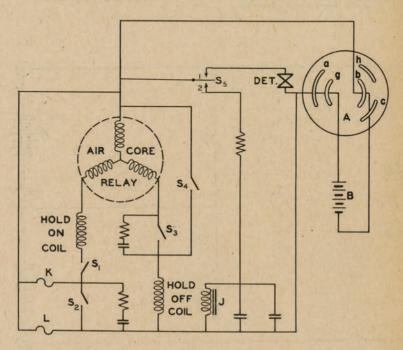
M Mark III Unit Circuit - Operation

Arming

Same as M Mark II except that as the preset sensitivity is applied, S₄ closes momentarily even if S₂ has opened properly, the purpose being to make doubly sure that S₂ is open at the completion of the operation.

Normal Firing and Anticountermining

1. Same as M Mark II.



A - CLOCK (HYDROSTATIC)

B - BATTERY - 15 VOLTS

K - AUTOMATIC SETTING FUSE (ALA)

L - MAGNET RELEASE FUSE (ALA)

J - ELECTROMAGNET

S, - SENSITIVITY SETTING SWITCH

S2 - NEEDLE SWITCH

S3 - PENDULUM SWITCH

S4 - TRIP SWITCH

S. - AIR CORE RELAY SWITCH

Fig. 3 - M Mk. III Unit Circuit and Key

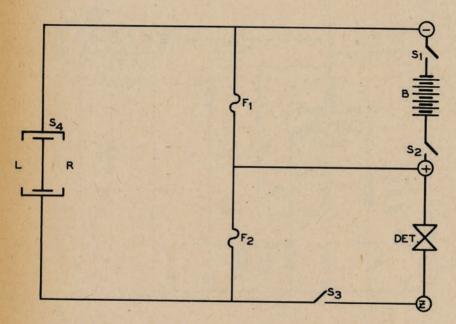
M Mark IV Unit Circuit - Operation

Arming

When the hydrostatic clock runs off its delay period, S₁ and S₂ close, blowing fuse #1. This releases a clock escapement and starts A.L.A. S₄ makes and breaks during A.L.A., blowing fuse #2. Upon completion of A.L.A., S₃ closes and the unit is alive.

Normal Firing

A RED or BLUE actuation closes S₄ to the proper contact, completing the circuit through the detonator.



B - BATTERY 9 VOLTS

FUSE

FUSE

S1 HYDROSTATIC CLOCK SWITCH

S2 HYDROSTATIC CLOCK SWITCH S3 CAM SWITCH

S4 NEEDLE SWITCH

Fig. 4 - N Mk. IV Unit Circuit and Key



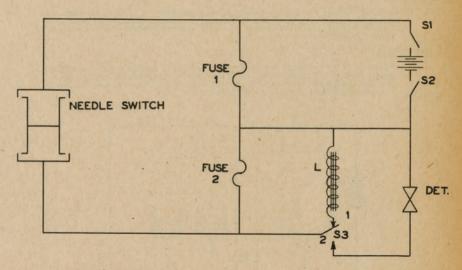
M Mark IVa Unit Circuit - Operation

Arming

When the hydrostatic clock runs off its delay period, S₁ and S₂ close, blowing fuse #1. This releases a clock escapement and Starts A.L.A. During A.L.A. the needle switch closes, blowing fuse #2 and energizing L. When fuse #2 blows, the needle switch reopens and L is deenergized. Upon completion of the P.D.M. cycle, the unit returns to normal. After a maximum of 14 "blind" actuations, S₂ changes from contact #1 to contact #2, cutting out the P.D.M. and putting the detonator in the circuit.

Normal Firing

 An additional RED or BLUE actuation closes the needle switch, completing the circuit through the detonator.



S1 S2-CLOCK SWITCHES. S3- P.D.M. SWITCH. L- P.D.M. SOLENOID.

Fig. 5 - M Mk. IVe Unit Circuit and Key

M Mark V Unit Circuit - Operation

Arming

- 1. When the mine is dropped, action of the Rheinmetall fuze closes the master switch F. The thermostatic clapper switch A is normally closed at temperatures above 32°F. If the mine reaches a depth of 24 ft. or more, the hydrostatic switch G closes to contact #2 and the battery BB energizes fuse delay switch B through fuse W. Upon completion of its delay period, B shorts its heater coil and W blows due to the increased current in the circuit. Battery current is then applied to the magnetic firing circuit.
- 2. Switch K is normally closed to contact #2 due to the BLUE field of a local magnet. When current energizes coil S, this magnet is depermed by rapid making and breaking of contact #2 until K no longer tends to close to contact #2. Thermistor M then heats until fuse R blows and isolates the A.L.A. circuit. The unit is now alive.

Delay Action Bomb Firing

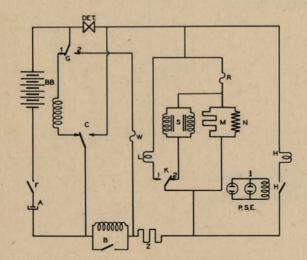
If the mine does not reach a depth of 24 ft., G remains on contact #1
and BB energizes C. Upon completion of its delay period, C switches
over, completing the circuit through the detonator.

Normal Firing

A RED actuation closes K to contact #1, completing a circuit through the detonator, hold-on coil L and thermistor Z. When Z has heated sufficiently, L holds K on contact #1 and a current increase to 1/4 amperefires the detonator.

P.S.E. Firing

The unit is fitted with two photo-electric cells designed to be energized upon exposure to light. The resultant current operates relay H, com-pleting a circuit through H, Z and the detonator. The detonator will fire as above when Z heats sufficiently.



- A CLAPPER SWITCH
 B FUSE DELAY SWITCH
 BB BATTERY 15 VOLT
 C FUSE DELAY SWITCH
 F MASTER SWITCH
 G HYDROSTATIC SWITCH
 H PHOTOCELL RELAY AND
 HOLD-ON
- PHOTOCELL

- LZZES
- NEEDLE SWITCH
 HOLD-ON COIL FOR K
 THERMISTOR
 RESISTOR
 FUSE
 LATITUDE ADJUSTMENT COILS
 FUSE
 THERMISTOR

Fig. 6 - M Mk. V Unit Circuit end Key

GREMAN INFILIRNCE MINES

M Mark VI Unit Circuit - Operation

Arming

1. Same as M Mark V.

Delay Action Bomb Firing

1. Same as M Mark V.

Normal Firing with P.D.M.

- 1. A RED actuation closes K to contact #1, completing a circuit through thermistor Y, fuse V and hold-on coil L. As Y heats, L holds K on its contact and V blows, energizing fuse delay switch D. Upon completion of its delay period, D switches over, completing a circuit through thermistor X and fuse U. X, being cold, cannot pass enough current to operate L and the circuit returns to normal.
- A second RED actuation causes repetition of the above, with X heating, U blowing and fuse delay switch E switching in the detonator and thermistor Z. Z, being cold, cannot pass enough current to operate L and the circuit again returns to normal.
- A third RED actuation completes the circuit through Z, L and the detonator which fires when the current rises to 1/4 ampere.

P.S.E. Firing

1. Same as M Mark V.

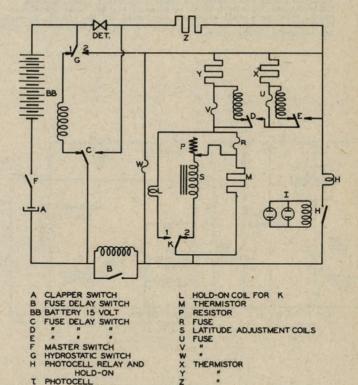


Fig. 7 - M Mk. VI Unit Circuit and Key

K NEEDLE SWITCH

M Mark VII Unit Circuit - Operation

Arming

- When the hydrostatic clock runs off its delay setting, a-g and b-c close, blowing the detonator release fuse and starting A.L.A. which is performed as in M Mark II. The M Mark VII differs from M Mark II as follows:
 - (a) Firing current passes directly through the needle switch.
 - (b) The anticountermining device is of a different type.
 - (c) The needle switch consists of eight flat needles mounted on a horizontal shaft with the needle edges in the vertical plane. The shaft is reverse-geared to a counterbalance system of weights and lever arms so that the moments of inertia of the needles and counterbalance systems are equal and opposite. The above change in construction permits the unit to tilt as much as 45° from the vertical without closing the needle switch. The net result of this modification, then, is that the opposing inertia moments prevent the unit from firing from shock or tilting whereas the needles may depress and close the needle switch upon receipt of a firing actuation without affecting the counterbalance system.

Normal Firing

 A firing actuation closes the needle switch, operating the hold-on coil and completing the circuit through the detonator.

Normal Anticountermining

 A countermining shock opens the inertia-operated, clockwork-type anticountermining switch which is normally closed. When the switch opens, it winds a small clockwork escapement and the circuit is broken until the escapement runs down in 3-10 seconds, varying directly with the intensity of the shock.

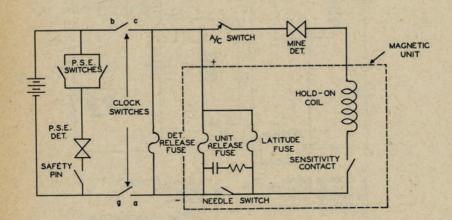


Fig. 8 - M Mk. VII Unit Circuit and Koy

M Mark VIII Unit Circuit - Operation

Arming

1. When the mine is dropped, action of the Rheinmetall fuze closes the master switch F. The thermostatic clapper switch A is normally closed at temperatures above 32°F. If the mine reaches a depth of 24 ft. or more, the hydrostatic switch G closes to contact #2 and the battery energizes fuse delay switches B, D and E in that order. Upon completion of the delay period of E, battery current starts A.L.A. in the magnetic unit through the by-pass fuse of fuse delay switch #1 and thermistor Y. Upon completion of A.L.A., as in M Mark V fuse R will have blown and K will be just clear of contact #2.

Delay Action Bomb Firing

1. Same as M Mark V.

Normal Firing with P.D.M.

- 1. A RED actuation closes K to contact #1, completing a circuit from the battery through the by-pass fuse of fuse delay switch #1, thermistor Y and hold-on coil L. When Y heats sufficiently, L holds K on its contact, the by-pass fuse blows and switch #1 is energized. Upon completion of its delay period, switch #1 switches over, breaking the hold-on circuit, allowing L, Y and K to return to normal and cutting in switch #2 which passes current through a by-pass. Upon completion of its delay period, switch #2 switches over, cutting in switch #3. After a maximum of nine "blind" actuations, switches #17 and #18 will have operated, closing switch N and putting the detonator in the firing circuit.
- A final RED actuation completes a circuit L, N, thermistor Z and the detonator. When Z has heated sufficiently, L holds K on its contact and a current increase to 1/4 ampere fires the detonator.

P.S.E. Firing

1. Photo-electric cells may be fitted as in the M Mark V.

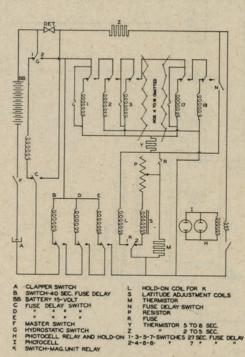


Fig. 9 - M Mk. VIII Unit Circuit and Key

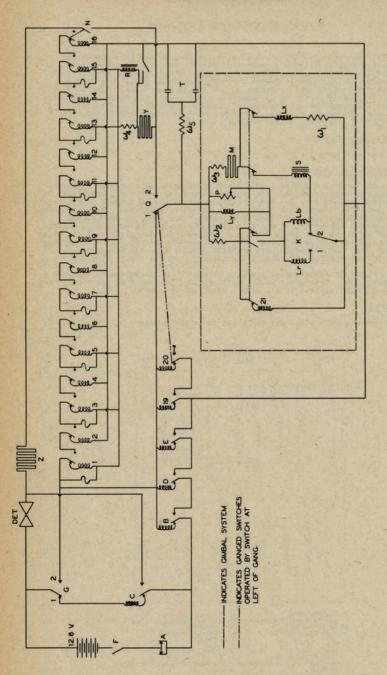


Fig. 10 - M Mk. IX Unit Circuit



M Mark IX Unit Circuit - Operation

Arming

- When the mine is dropped, action of the Rheinmetall fuze closes the Master Switch F. The thermostatic clapper switch A is normally closed at temper-atures above 32°P. If the mine reaches a depth of 24 ft. or more, the hydrostatic switch 6 closes to contact #2 and fuse delay switches B, D and E are energized in that order. Upon completion of the delay period of E:
 - (a) Battery current energizes the gimbal system in which fuse delay switch #21 controls four circuits in addition to its own. Battery current energizes coil S which deperms its own magnetic core to a point where switch K is just clear of contact #2. All the current in this parellel circuit now flows through L, which provides an increasing RED field due to heating of thermistor M. This assures that K does not remake contact #2 and further deperm S. During the above operation, L, has been introducing a BUDE field roughly equivalent to the unit sensitivity. The strength of the Ly field is adjustable by varying P. When switch #21 switches over after completion of A.L.A., it breaks its own circuit, isolates S, breaks the circuit to Ly, and breaks the circuit to the compensating coil Ly and P so that K goes to equilibrium between the two contacts.
 - (b) Battery current energizes switches #19 and #20 in that order. Up completion of its delay period, #20 switches over to a blank con-tact and mechanically switches Q from contact #1 to contact #2, putting the bi-polar gimbal unit in the P.D.M. circuit.

Delay Action Bomb Firing

1. Same as M Mark V.

Normal Firing with P.D.M.

- 1. A RED or BLUE actuation closes K to the appropriate contact and battery current heats thermistor Y until it passes sufficient current to operate hold-on coil L. or L. When the current reaches 100 ma., the by-pass fuse on fuse delay switch #1 blows and the fuse delay switch then carries the total current. The increasing current operates relay R which provides its own holding current through a lead which by-passes the gimbal portion of the unit. Hold-on current for K is then reduced to a point where K opens. Upon completion of its delay period, switch #1 switches over, de-energizing R which then returns to normal and cutting in switch #2. Upon completion of its delay period, switch #2 switches over and the unit returns to normal.
- After a maximum of eight "blind" actuations, switch #16 closes switch N, completing the circuit through the detonator and thermistor Z. A final actuation fires the detonator as in M Mark VIII.

P.S.E. Firing

1. Photo-electric cells may be fitted as in M Mark V.

- CLAPPER SWITCH

B,C,D,E - FUSE DELAY SWITCH

- MASTER SWITCH

G - HYDROSTATIC SWITCH

K - NEEDLE SWITCH

Lr - RED HOLD - ON COIL

LA - BLUE HOLD - ON COIL

Lx - AUXILIARY COIL

Ly - COMPENSATING COIL

MYZ - THERMISTORS

N - SWITCH OPERATED BY FUSE DELAY SW. #16

- POTENTIOMETER

Q - SWITCH OPERATED BY FUSE DELAY SW. #20

R - SOLENOID RELAY S - LATITUDE ADJUSTER COIL

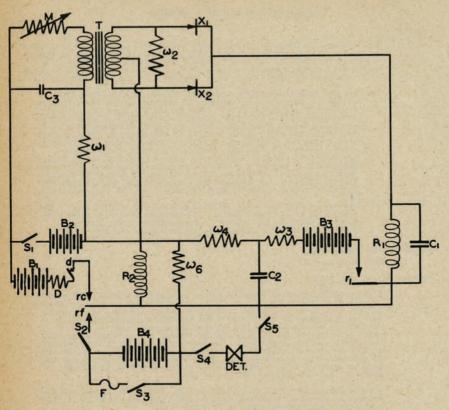
- CONDENSERS

ω1, ω2, ω3, ω4, ω5 - RESISTORS

16 - P.D.M. FUSE DELAY SWITCHES

#19 #20 - DELAY ARMING FUSE DELAY SWITCHES

\$21 - A.L.A. FUSE DELAY SWITCH



B	9 VOLTS	F	FUSE TO START DELAY CLOCK
B2	9 VOLTS	SIS2	SWITCHES CLOSED BY DELAY CLOCK
B ₂	15 VOLTS	S3	TRANSIENT CONTACT ON HYDR. CLOCK
BA	9 VOLTS	SA	HYDROSTATIC CLOCK SWITCH (a-g)
Ci	280 MICROFARADS	SE	HYDROSTATIC CLOCK SWITCH (b-c)
Co	330 MICROFARADS	S4 S5 T	MICROPHONE TRANSFORMER
CZ	10 MICROFARADS	M	MICROPHONE
834 C C C S	25 OHMS	Xı	COPPER OXIDE RECTIFIER
Wo	3000 OHMS	X2	COPPER OXIDE RECTIFIER
Wz	5000 OHMS	Ri	RELAY-SENSITIVITY 116 MICROAMPS
Wa	5000 OHMS		TO ri
W2 W3 W4 W5	1000 OHMS	R ₂	RELAY-SENSITIVITY 440 MICROAMPS
A TOTAL			1110 MICROAMPS
			TO rf
		D	THERMAL DELAY HEATER
		d	THERMAL DELAY SWITCH

Fig. 12 - A Mk. I Unit Circuit and Key

A Mark I Unit Circuit - Operation

Arming

Two minutes after the hydrostatic clock starts, s₃ closes, blowing fuse
F and starting the delay clock. When the hydrostatic clock runs off
its delay period, (17 minutes) s₁ and s₅ close, putting the detonator
in the circuit. When the delay dlock runs off its period (6 days max.),
s₁ and s₂ close and the unit is alive.

Normal Firing

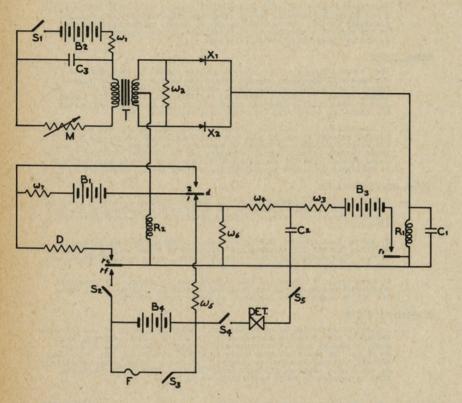
- When sound impinges on the microphone, the change in microphone resisistance will appear as current variations on the primary of transformer T and as alternating signal current on the secondary of T. The signal current is then rectified by rectifiers X₁ and X₂ with direct current then flowing from the secondary through two relays in series, the first, R₁ being more sensitive than the second, R₂.
- 2. If the sound is of suitable intensity for normal firing, the current flowing through R_1 and R_2 will not be strong enough to operate R_2 . If the sound persists long enough to charge C_1 , R_1 closes to r_1 . B_3 now sends current through R_2 which opposes and is stronger than the induced current from the secondary of T. The direction of this current is such that R_2 closes to contact r_f , putting the detonator across B_4 .

Normal Anticountermining

- A loud sound which produces a strong current through R₁ and R₂ tends to operate both relays. Because of the delay in R₁ occasioned by C₁, R₂ operates first and, because of the direction of the actuating current, closes to r_a.
- B₁ and B₂ then apply a locking voltage, preventing R₁ from operating, blocking further current from the secondary of T and keeping R₂ closed to r₀. This condition persists until thermal delay heater D heats and opens its switch d after about 12 seconds.
- R₂ then opens, d closes and the unit returns to normal. If frequent anticountermining shocks are received, D will heat to the point where the unit's inert period may be as short as three seconds.

Intermediate State

1. A sound which builds up uniformly and rapidly to a point of considerable intensity may produce a current which is strong enough, after R₁ operates, to cancel out the current from B₃ which would ordinarily close R₂ to r_f. R₂ would not then close to either contact and the unit would neither fire nor be rendered passive. If such a signal ceased abruptly, R₁ would open although the unit would probably fire due to discharge from C₂ through R₂ which would close to r_f.



B₁ - 15 VOLTS
B₂ - 9 VOLTS
B₃ - 15 VOLTS
B₄ - 9 VOLTS
C₁ - 315 MICROFARADS
C₂ - 365 MICROFA RADS
C₃ - 10 MICROFA RADS
W₁ - 25 OHMS
W₂ - 5000 OHMS
W₃ - 5000 OHMS
W₄ - 5000 OHMS
W₆ - 1000 OHMS
W₆ - 5000 OHMS
W₇ - 20 OHMS

SI.SZ SWITCHES CLOSED BY DELAY CLOCK TRANSIENT CONTACT ON HYDR. 53 CLOCK 54 HYDROSTATIC CLOCK SWITCH (4-9) HYDROSTATIC CLOCK SWITCH (6-c) MICROPHONE TRANSFORMER DF THERMAL DELAY HEATER-100 OHMS FUSE R RELAY-SENSITIVITY 123 MICROAMPS TO ri RELAY-SENSITIVITY 700 MICROAMPS TOrc 975 MICROAMPS TOP M MICROPHONE

COPPER OXIDE RECTIFIER COPPER OXIDE RECTIFER

Fig. 13 - A Mk. II Unit Circuit and Key

XI

X2

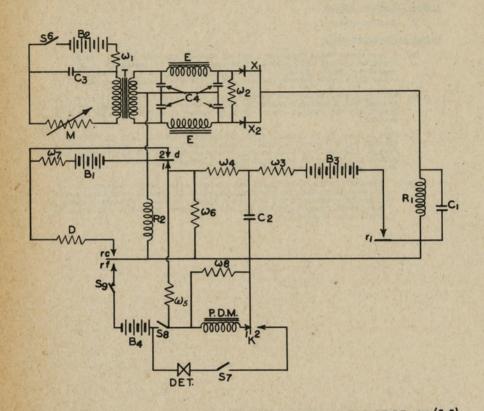
A Mark II Unit Circuit - Operation

Arming and Normal Firing

1. Same as A Mark I.

Normal Anticountermining

- A loud sound which produces a strong current through both R₁ and R₂ tends to operate both relays. However, because of the delay in R₁ occasioned by C₁, R₂ will close to r_c first, imposing a blocking potential from B₁ across the secondary, thereby holding R₁ open.
- With R2 closed to r6, the circuit from B1 through D is completed and the thermal delay switch D starts to heat. After about 35 seconds, d1 is broken and the contact starts to move toward d2 which makes in about 30 seconds.
- 3. When contact d₂ is closed, B₁ is shorted through W₂, hold-on current through R₂ is reduced to a small amount and r_c opens. Since the circuit from B₁ through D is then broken, D begins to cool and the thermal delay switch starts moving back from d₂ to d₁, requiring about 15 seconds (total period of cycle is 80 seconds).
- Note: The unit is not alive until the thermal delay switch returns to \mathbf{d}_1 because, although the blocking potential is removed from the secondary upon opening of \mathbf{R}_2 , even if a signal causes \mathbf{R}_1 to close, there is no circuit from \mathbf{B}_3 through \mathbf{R}_2 , and \mathbf{R}_2 cannot, therefore, be moved to its firing contact \mathbf{r}_1 .



BI - 15 VOLTS B2 - 9 VOLTS B3 - 15 VOLTS B4 - 9 VOLTS CI - 315 MICROFARADS 365 MICROFARADS C2 C3 10 MICROFARADS C4 - 0.6 MICROFARADS D E WI - 25 OHMS W2 - 5000 OHMS M T 5000 OHMS - 5000 OHMS - 1000 OHMS 5000 OHMS XI COPPER OXIDE RECTIFIER
X2 COPPER OXIDE RECTIFIER 20 OHMS 100 OHMS

S6 SWITCH-CLOSES AT END OF DELAY (a-g) S7 SWITCH- CLOSES AT END OF DELAY (b-c) S8 SWITCH-CLOSES SHORTLY AFTER S6 AND S7 (e-f) SWITCH ON P.D.M. Sg SWITCH ON P.D.M. (STAYS ON 1 UNTIL RUN OFF) THERMAL DELAY HEATER-100 OHMS FILTER CHOKES MICROPHONE TRANSFORMER RI RELAY-SENSITIVITY 123 MICROAMPS TO FI RELAY-SENSITIVITY 700 MICROAMPS TO re 975 MICROAMPS TO rf

Fig. 14 - A Mk. III Uni | Ircuit and Key



A Mark III Unit Circuit - Operation

Arming

1. At the end of its preset period, the hydrostatic clock closes switches $\mathbf{S}_6,\ \mathbf{S}_7$ and $\mathbf{S}_8.$

Normal Firing

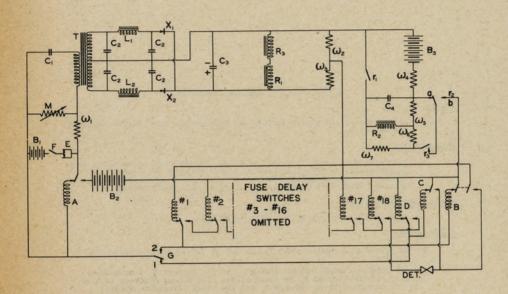
 Same as A Mark I and II except that the incorporation of an extra choke condenser filter (E-C,) eliminates signal currents of 700-1000 cps. frequency, thereby making the unit more selective as to the frequencies of sound which will cause normal firing or anticountermining.

Normal Anticountermining

1. Same as A Mark I and II except as noted above.

P.D.M. Action

- In addition, a twelve-place P.D.M. may be fitted which operates as follows:
 - (a) When a firing impulse closes R_2 to r_f , battery B_L puts hold-on current through R_2 by means of W_5 . The P.D.M. solenoid is also energized by B_L through K_1 and the P.D.M. clockwork starts.
 - (b) When S₂ breaks, R₂ hold-on current is broken and the P.D.M. solemoid is de-energized. The circuit then remains dorment until the P.D.M. interval is run off and S₂ recloses. When the final "blind" actuation is run off, K₁ breaks and K₂ makes, putting the detonator in the circuit.
 - (c) Detailed operation of the P.D.M. is the same as that of the standard P.D.M. described on Page 56. S₉ corresponds to P-Q, K₁ R-S and K₂ to S-T in Fig.



```
A,B,C,D - FUSE DELAY SWITCHES
B<sub>1</sub> - BATTERY - 3 VOLTS
B<sub>2</sub> = " - 7.5 VOLTS
C<sub>1</sub> - CONDENSER - 240. MFD. - ELECTROLYTIC
C<sub>2</sub> - " - 0.5 " - ELECTROLYTIC
C<sub>3</sub> - " - 100. " - ELECTROLYTIC
C<sub>4</sub> - " " " - 100. " - ELECTROLYTIC
C<sub>4</sub> - " " - 100. " - ELECTROLYTIC
C<sub>5</sub> - " - 100. " - ELECTROLYTIC
C<sub>6</sub> - " " - MASTER SWITCH
C<sub>7</sub> - MASTER SWITCH
C<sub>8</sub> - MASTER SWITCH
C<sub>8</sub> - MASTER SWITCH
C<sub>8</sub> - FILTER CHOKES
M - CARBON MICROPHONE
R<sub>1</sub> - RELAY (INITIATING) - 500^ F<sub>2</sub> - R<sub>2</sub> "
C<sub>8</sub> - " (TIMING) - 500^ F<sub>2</sub> - R<sub>3</sub> "
T - MICROPHONE TRANSFORMER
X, X<sub>2</sub> - COPPER OXIDE RECTIFIERS
M<sub>1</sub> - B<sub>1</sub> - P.D.M. FUSE DELAY SWITCHES
C<sub>9</sub> - 5000^
C<sub>1</sub> - 10^
C<sub>2</sub> - 5000^
C<sub>2</sub> - 5000^
C<sub>2</sub> - 5000^
C<sub>3</sub> - 2000^
C<sub>3</sub> - 2000^
C<sub>3</sub> - 2000^
C<sub>4</sub> - 5000^
C<sub>7</sub> - 5000^
C<sub>7</sub> - 5000^
C<sub>9</sub> - 200^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 200^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 5000^
C<sub>9</sub> - 200^
C<sub>9</sub> - 5000^
```

Fig. 15 - A Mk. IV Unit Circuit and Key

A Mark IV Unit Circuit - Operation

Arming

- When the mine is dropped, action of the Rheinmetall fuze closes Master Switch F. Since the thermostatic switch E is normally closed at temperatures between 23° and 95°F, B₁ energizes the microphone M through w₁ and fuse delay switch A. Upon completion of its delay period, A switches over, putting B₂ in series with B₁ with respect to all parts of the circuit except the microphone circuit.
- 2. If the mine reaches a depth of 24 ft. or more, hydrostatic switch G closes to contact #2 and, upon completion of the operations described in Par. 1 above, B, and B₂ energize fuse delay switch B. Upon completion of its delay period, B switches over, cuts itself out and puts the detonator in the circuit.

Delay Action Bomb Firing

 If the mine does not reach a depth of 24 ft., the hydrostatic switch remains on contact #1 and, upon completion of the operations described in Par. 1 above, B₁ and B₂ energize switches C and D in parallel. Upon completion of their respective delay periods, C and D switch over, putting the detonator across the batteries.

Normal Firing with P.D.M.

- 1. When sound impinges on the microphone, the change in microphone resistance appears as current variations on the primary of transformer T and as alternating signal current on the secondary of T. The signal current is filtered by L₁, L₂ and C₂, rectified by X₁ and X₂ with direct current then flowing through R₁ and R₃, charging C₃. R₁ is more sensitive than R₃, the sound level at which R₁ operates being the initiating level and the level at which R₃ operates being the firing level.
- 2. When the sound reaches the initiating level, R₁ closes r₁, causing B₃ to start charging C_L. After 1/2 second, C_L will be sufficiently charged to operate R₂, thereby breaking r₂a and making r₂b. If the sound then reaches the firing level, R₃ closes r₃, completing a circuit from B₁ and B₂ through fuse delay switch #1, w₂, r₁, w₇, r₃ and r₂b. Potential drop through w₂ holds R₁ and R₃ operative and, since r₁ is held closed, B₃ holds R₂ operative.
- 3. Upon completion of its delay period, switch #1 switches over, cutting in switch #2 and by-passing the holding circuit which, if the sound has ceased, allows the circuit to return to normal. Upon completion of its delay period, switch #2 switches over, cutting in switch #3 and the circuit is normally alive again. After a maximum of nine wblind actuations, switches #17 and #18 operate, putting the detonator in the firing circuit and an additional firing actuation will fire the detonator.

Normal Anticountermining

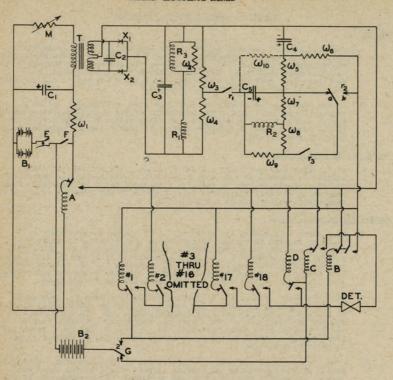
- If at any time during the life of the unit, the relays operate in such a sequence that R₃ operates before R₂, the unit is rendered passive for the duration of the sound which causes the condition. If the sound reaches the firing level within 1/2 second after r₁ closes, R₃ will close r₃, making an almost direct short across C₄, via r₂a. R₂ then cannot operate.
- If the sound then drops below the initiating level, all relays return to normal. If the sound drops below the firing level, but not below the initiating level, and then rises to the firing level after a 1/2 second delay, the unit will fire normally.

-33-

P.S.E. Firing

1. Photo-electric cells may be fitted as in M Mark V.





```
A,B,C,D - FUSE DELAY SWITCHES
E - THERMOSTATIC SWITCH (CLOSED AT >23°F AND <95°F)
F - MASTER SWITCH
            HYDROSTATIC SWITCH (24 FT.)
3 VOLTS
10 "
            CONDENSER - 240 MFD. - ELECTROLYTIC
                                 0.2 MFD.
                                 100
                                                  - ELECTROLYTIC
            CARBON MICROPHONE
                                                    r<sub>1</sub> - R<sub>1</sub> CONTACT
r<sub>2</sub> - R<sub>2</sub> "
r<sub>3</sub> - R<sub>3</sub> "
                      (TIMING)
                         (FIRING)
            MICROPHONE TRANSFORMER
COPPER OXIDE RECTIFIERS
- P.D.M. FUSE DELAY SWITCHES
                10 2
             3,000 ∧
                 5 1
            10,000 ~
            15,000 1
                 QIA
            15,000 1
            5,000 ↑
                 5. 1
```

Fig. 16 - A Mk. V Unit Circuit and Key



A Mark V Unit Circuit - Operation

Arming

- When the mine is dropped, action of the Rheinmetall fuze closes the Master Switch F. Since the thermostatic switch E is normally closed between temperatures of 23° and 95°F, B₁ energizes the microphone M through w₁ and fuse delay switch A. Upon completion of its delay period, A switches over, putting B₂ in the circuit.
- 2. If the mine reaches a depth of 24 ft. or more, hydrostatic switch G closes to contact #2 and, upon completion of the operations described in Par. 1 above, B2 energizes fuse delay switch B. Upon completion of its delay period, B2 switches over, cuts itself out and puts the detonator in the circuit. B2 charges C4 after a 15 second delay due to the resistance of w6.

Delay Action Bomb Firing

1. Same as A Mark IV except that all current is supplied by B2.

Normal Firing with P.D.M.

- When sound impinges on the microphone, the change in microphone resistance appears as current variations on the primary of the transformer T and as alternating signal current on the secondary of T. T signal current is rectified by X₁ and X₂ with direct current then flowing through R₁ and R₂, charging C₂. R₁ is more sensitive than R₃, the sound level at Which R₃ operates being the initiating level and the level at which R₃ operates being the firing level.
- 2. When the sound reaches the initiating level, R₁ closes r₁, causing C_k to start charging C₅ in an attempt to operate R₂. After 1/2 second, C₅ will be sufficiently charged to operate R₂, thereby breaking r₂ and making r₂b. If the sound then reaches the firing level before C₁ and C₅ discharge (10 sec.), R₃ closes r₃, completing a circuit through fuse delay switch #1, r₂b, r₃, w₀, r₁ and w₃. Potential drop through w₃ holds R₁ and R₃ operative and, since r₁ is held closed, C_k and C₅ hold R₂ operative.
- 3. Upon completion of its delay period, switch #1 switches over, cutting in switch #2 and by-passing the holding circuit which, if the sound has ceased, allows the circuit to return to normal. Upon completion of its delay period, switch #2 switches over, cutting in switch #3 and the circuit is normally alive again. After a maximum of nine "blind" actuations, switches #17 and #18 operate, putting the detonator in the firing circuit and an additional actuation will fire the detonator.

Normal Anticountermining

- 1. Normal anticountermining may occur in one of two ways as follows:
 - (a) If the sound level rises too fast, the unit will be rendered passive in the same manner as the A Mark IV except that if the sound ceases or drops below the firing level, the unit will not again be normally alive for a period of 15 seconds maximum.
 - (b) If the sound level rises too slowly after reaching the initiating level, C, and C, may discharge to the point where they will no longer hold r₂b closed. In such a case, r₂a will again close after a 10 second delay and the unit will not again be normally alive for a period of 15 seconds or until B₂ can recharge C₄ through w₆.

P.S.E. Firing

1. Photo-electric cells may be fitted as in M Mark V.

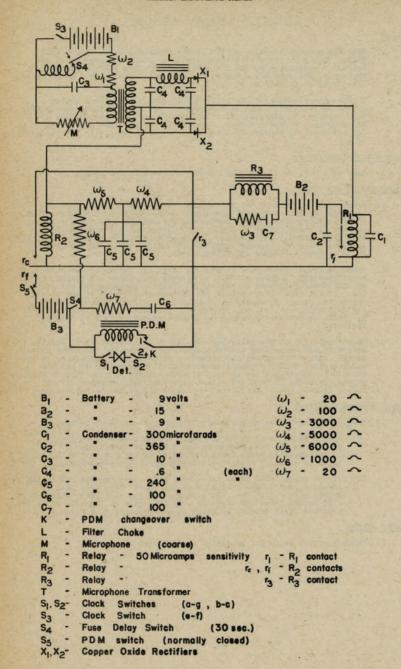


Fig. 17 - A Mk. VJ Unit Circuit and Key

A Mark VI Unit Circuit - Operation

Arming

When the hydrostatic clock completes its delay period, s₁ and s₂ close, putting the detonator into the circuit. Eighteen minutes later, s₃ closes and B₁ energizes fuse delay switch S₄ and the microphone M. Upon completion of its delay period, S₄ switches over, cutting out its heater, putting full battery current on the microphone and closing an extra contact of S₄ which arms the holding circuit of B₃ on R₂.

Normal Firing with P.D.M.

When sound impinges upon the microphone, it causes resistance variations which appear as alternating current upon the secondary of transformer T. This current is filtered and rectified in a manner similar to that employed in the A Mark III with the intensity of the rectified current directly variable with the intensity of the sound. An insensitive microphone is used so that the amount of current through the relay coils will be small compared to that produced in the A Mark III.
 Since R₁ is more sensitive than R₂, normal sound of the type produced by an approaching minesweeper will operate R₁ but R₂ will not operate until the sweeper is fairly close. When R₁ closes, it completes a circuit through R₃, w₄, w₅ and R₂. Due to the high resistance of the circuit, R₃ does not operate.

3. If the sound persists for 3-3 1/2 seconds, however, C5 charges sufficiently to let R2 close to rf, whereupon B3 energizes a holding circuit through w6 and the P.D.M. solenoid. During the P.D.M. cycle, S5 breaks, de-energizing the holding circuit. After a maximum of ll "blind" actuations, switch K breaks contact #1 and makes contact #2 and an additional firing actuation will fire the mine.

Normal Anticountermining

1. If the sound impinging on the microphone is of a very high intensity, such as might be produced by an underwater explosion, both R₁ and R₂ operate. R₂, however, closes to r₀ so that the circuit from B₂ through R₃ is one of very low resistance. R₃ operates, closing r₃ which provides a self-holding current for R₃ through r₁, thus preventing C₅ from charging and R₂ from closing to r_f. This condition will persist until the sound level drops below that necessary to keep R₁ operative. At this point, R₃ is restored to normal and the unit is alive to normal actuation.

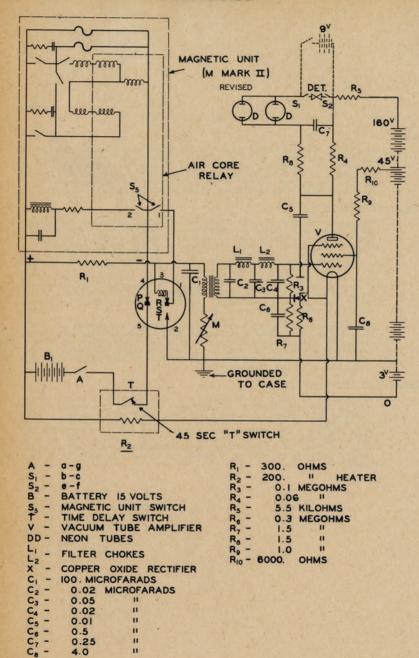


Fig. 18 - AM Mk. I Unit Circuit and Key

0.5

4.0

0.25

11

11

Magnetic-Acoustic Firing Units

General

- AM Mark I consists of a constantly active magnetic component, an
 acoustic component and a twelve-place P.D.M. When the magnetic component is actuated, it steps off stages on the P.D.M. and, when the
 final "blind" actuation is run off, operates as if the P.D.M. were not
 fitted as follows:
 - (a) A magnetic actuation operates the magnetic component which, instead of firing the detonator, energizes the microphone circuit, vacuum tube amplifier and "T" switch heater. The acoustic component is then active and if a sound of proper frequency, intensity and duration impinges on the microphone, it is transformed into an electric signal, passes through a filter circuit which eliminates undesirable frequencies and then to the energized vacuum tube amplifier and the detonator.
 - (b) If, after the acoustic component is energized, no proper sound impinges on the microphone, the "T" switch opens after 45 sec., due to its heater, and cuts off the energizing current from the microphone, amplifier and its own heater and breaks the holding circuit in the magnetic component. The entire unit then returns to normal.
- 2. AM Mark II consists of a constantly active magnetic, bi-polar component, an acoustic component, a nine place P.D.M. and a galvanic P.S.E. Its operation differs from that of the AM Mark I in that the P.D.M. "blind" actuations are run off by actuation of both the acoustic and magnetic components together rather than by actuation of the magnetic component alone; i.e. when the magnetic component is actuated, it immediately puts the acoustic component in the circuit and when sound impinges on the microphone, the P.D.M. advances one step. If acoustic actuation does not occur within 40 sec. after magnetic actuation, the "T" switch returns the entire unit to normal as in AM Mark I. Excessive moisture or humidity in the unit will operate a galvanic P.S.E. and fire the detonator after a short delay.

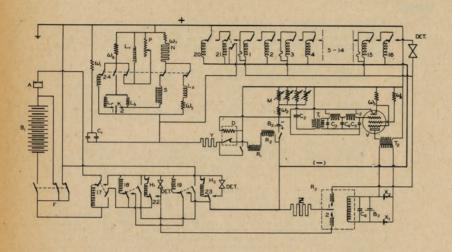
AM Mark I Unit Circuit - Operation

Arming with P.D.M.

- When the hydrostatic clock runs off its delay period, switches A and s₁ close. When A closes, B₁ blows the magnet clamp fuse in the magnetic component, starting normal A.L.A., resulting in a constantly-alive magnetic component. Eighteen minutes later S₂ closes, putting the detonator into the firing circuit.
- 2. A magnetic actuation closes S₅ to contact #1, energizing the hold-on circuit. B₁ energizes the P.D.M. solenoid through contact R-S. P-Q breaks after each blind actuation to break the magnetic hold-on and allow the needle to recover. When the final "blind" actuation has run off, R-S breaks and S-T makes and the unit then acts as if no P.D.M. had been fitted.

Normal Firing

- 1. A magnetic actuation then causes current to flow through the microphone (M), the filament of the vacuum tube V, and R2, the mpm switch heater. If no firing actuation impinges on the microphone within 45 seconds, the bi-metallic mpm switch opens, breaking the circuit to all the energized components, including the magnetic component hold-on, and the entire unit returns to normal.
- 2. If sound impinges on the microphone, current variations appear on the transformer coils, pass through the filter and appear on the grid of the vacuum tube V. Potential variations on the grid are amplified in V and are partially fed back to the grid circuit by Cr. Due to the half-wave rectifying action of X, the potential at the grid end of R becomes more and more positive, resulting in a larger current through V and R, as the sound persists and increases.
- 3. Current through R_4 causes a voltage drop across R_4 which charges C_7 with a delay due to R_3 . When C_7 is charged to a potential of 110 volts, the neon tubes DD break down and conduct current and the detonator fires.



```
A - THERMOSTATIC SWITCH - (CLOSED AT > 23°F & < 95°F)
B<sub>1</sub> - BATTERY - 13.5 VOLTS
B<sub>2</sub> - " - 1.5 "
B<sub>3</sub> - SEA BATTERY - (PSE MARK IX) FORMED BY
MOISTURE IN UNIT.
C<sub>1</sub> - CONDENSER - MFD.
C<sub>2</sub> - " - "
C<sub>3</sub> - " - "
C<sub>4</sub> - " - "
C<sub>5</sub> - " - "
C<sub>6</sub> - " - "
D - THERMAL DELAY SWITCH & HEATER (40 SEC.)
F - MASTER SWITCH
H,H<sub>2</sub> - HYDROSTATIC SWITCH - (CLOSED AT < 15 FT.)
K - NEEDLE SWITCH
L;L<sub>2</sub> - FILTER CHOKES
L<sub>X</sub> - AUXILIARY COIL
L<sub>Y</sub> - COMPENSATING COIL
M - MICROPHONES (4)
N,Y,Z - THERMISTORS
P - POTENTIOMETER
R,R<sub>2</sub> - SOLENOID RELAYS
R<sub>3</sub> - SENSITIVE RELAY
S - LATITUDE ADJUSTER COIL
T, - MICROPHONE TRANSFORMER
T<sub>2</sub> - OUTPUT TRANSFORMER
T<sub>2</sub> - OUTPUT TRANSFORMER
T<sub>2</sub> - OUTPUT TRANSFORMER
V - VACUUM TUBE (PENTODE)

ω<sub>3</sub> "
ω<sub>4</sub> "
ω<sub>5</sub> "
ω<sub>6</sub> "
ω<sub>7</sub> "
γ, - COPPER OXIDE RECTIFIER
X<sub>1</sub> - COPPER OXIDE RECTIFIER
X<sub>1</sub> - SPID. FUSE DELAY SWITCHES
#1 - #16 - PDM. FUSE DELAY SWITCHES
#22, #23 - DELAY BOMB FIRING FUSE DELAY SWITCHES
```

Fig. 19 - AM Mk. II Unit Circuit and Key

AM Mark II Unit Circuit - Operation

Arming

- When the mine is dropped, action of the Rheinmetall fuze closes the Master Switch F, making one contact and breaking two. Thermostatic switch A is normally closed at temperatures between 29° and 95°F. B1 energizes fuse delay switch #17 which, upon completion of its delay period, cuts in fuse delay switches #18 and #22. Hydrostatic switches H1 and H2 open when the mine reaches a depth of 15 ft. or more. Upon completion of its delay period, switch #18 switches over, cutting in switch #19 which, upon completion of its delay period, connects the battery to the main positive and negative terminals of the unit.
- 2. The magnetic component (M Mark IX unit slightly modified) then goes through A.L.A., upon the completion of which the only parts of the magnetic component remaining in the circuit are w₆, L_T or L_D, and K. During A.L.A., switches #20 and #21 operate, switching in the P.D.M. fuse delay switches and breaking the negative return contact to the magnetic component.

Delay Action Bomb Firing

- 1. Two different methods of accomplishing delay action bomb firing may be employed as follows:
 - If the mine does not reach a depth of 15 ft., H₁ remains closed and when fuse delay switch #22 switches over, a detonator is put across the battery and the mine fires.
 - (b) If the mine does not reach a depth of 15 ft., H₂ also remains closed. When fuse delay switch #19 switches over and connects the battery to the positive and negative leads of the unit, switch #23 will operate and fire the mine if H₂ has not opened. (H₂ is provided to allow an alternative method of delay bomb firing in case H₁ does not operate properly.)

Normal Firing with P.D.M.

- 1. A RED or BLUE actuation will close K to contact #1 or #2, respectively, and current will then pass from the main positive lead through w6, L, or Lb, K, thermistor Y, the normally-closed contact of thermal delay switch D and the operating coils of relays R1 and R2. When Y has heated sufficiently, the hold-on coil will operate and R1 and R2 close. Closing of R1 provides a self-holding circuit for R1 and R2 through the contact of D. Closing of R2 energizes the heater of D, energizes the four microphones M through w2 and energizes the vacuum tube filament through w2. The self-holding circuit of R1 and R2 shunts out the needle system, reducing the hold-on current to such a low level that K breaks its contacts and Y cools. The main circuit through R1 and R2 will persist until D breaks its contact due to heating action.

 2. If sound impinges on the microphone before D breaks its contact, the change in microphone resistance appears as current variations in transformer T1 and passes through the filter circuit to the control grid of pentode V. This vacuum tube amplifies the signal which then appears as current variations on transformer T2. The output of T2 is fed to the operating coil of sensitive relay R2. Since the rectifier X1 allows current to pass only in the direction of its allow and since the current output from T2 is alternating, X1 passes current half the time to the operating coil of R3 with a slight delay due to C6. Rectifier X2 acts as an overload feature to by-pass heavy currents. The signal current from T2 and X1 closes R3 to contact #1.
- 3. When R3 closes to contact #1, a circuit is completed from (*) through the by-passing fuse of fuse delay switch #1, the holding coil of R3 and thermistor Z to (-). If the sound persists long enough, Z heats and passes enough current to operate the holding coil, the by-pass fuse blows, and fuse delay switch #1 carries the total load until completion of its delay period when it switches over to switch #2, thereby cutting out the holding circuit and allowing R3 and Z to return to normal. Before switch #2 completes its delay period, D breaks its contact, cutting out R and R2 holding circuit, its own heater current, the microphone current and the vacuum tube current. When switch #2 switches over to #3, the entire unit is again normal and ready for re-actuation. A maximum of eight "blind" actuations operates switches #15 and #16, putting the detonator in the circuit and an additional magnetic-accoustic actuation fires the mine. ation fires the mine.

P.S.E. Firing

If water or excessive moisture enters the unit, a cell is formed between two dissimilar metals. Current will flow through the opera-ting coil of R₂ in such a direction that R₃ closes to contact #2, making a complete circuit from (f) through the closed contacts of switches #18 and #19, a detonator, the R₂ holding coil and Z to (-). When Z has heated sufficiently, the current holds the relay closed and the mine fires.

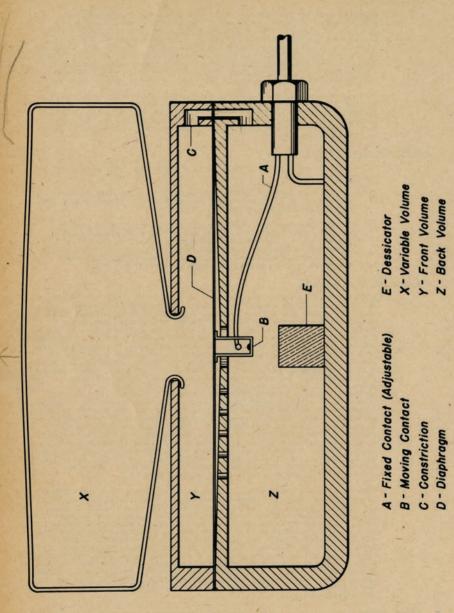


Fig. 20 - Pressure Detecting Device

Pressure Detecting Device

General

- The pressure component which the Germans have successfully combined with their acoustic and magnetic firing units consists essentially of a pressure detecting device which detects and operates on negative pressure differentials; an associated electrical circuit is controlled by the device. When a negative pressure differential is detected by the device, a switch contact is made for the duration of the detected differential, provided that the actuation falls within the design limits of the device.
- 2. The operational characteristics of the two types of pressure components are controlled, with the exception of sensitivity, by the arrangement and constants of the electrical circuits associated with each. These constants determine the period of circuit closure required to record an actuation and also determine whether the pressure component will be of the integrating or non-integrating type. Indirectly, they also determine the degree to which such disturbing effects as wave motion will effect the pressure component.
- 3. The pressure detecting device serves as the detecting mechanism of the pressure component of firing units which employ pressure firing. It has been used to date only in combination with units operating by other influences as follows:
 - (a) In Mine Type GG in combination with a modified A Mark V unit, the complete assembly being designated GG/AP Mark I, and the firing unit, AP Mark I.
 - (b) In Mine Type GC in combination with a modified M Mark II(revised) unit, the complete assembly being designated GC/MP Mark I, and the firing unit, MP Mark I.

Description

- 1. The pressure detecting device consists of three volume tanks, X, Y and Z, of which only X is variable. Y and Z, although separated by diaphragm D, are connected through constriction C. The overall unit consists of a machined aluminum casting surmounted by a collapsible rubber bag. Volume Y serves only as a connecting link between X and the diaphragm. Z is entirely closed except for the constriction C which is filled with adjustable, fibrous material (not shown on drawing). This serves as a variable resistance and regulates, within limits, the passage of air through the constriction.
- 2. D is backed up, except for a small circular area in the center, by aluminum reinforcing which forms part of the main casting. The surface of the casting is well machined and is bored with five small holes which prevent the diaphragm from sticking due to a possible vacuum seal.
- 3. The switch consists of two contacts, one fixed and one movable. The movable contact consists of a stirrup mounted on the center of the diaphragm inside Z. The fixed contact is mounted as indicated in the drawing, and is adjustable. Leads from the two contacts are taken out of the device through a packing gland by a double-conductor cable, pass through another packing gland into the main body of the mine case (as in GC) or the firing unit (as in GG).
- 4. It should be noted that the accompanying drawing of the pressure detecting device is schematic in nature and omits some of the refinements present in the actual device.

Operation

- * 1. When the mine is dropped, it sinks rapidly to the bottom with a resulting rapid increase in hydrostatic pressure head, proportional to the depth of water. This pressure is transferred to X which is compressed thereby. Compression of X creates a pressure differential between Y and Z, causing the disphragm to move inward toward Z and opening the switch wider than usual. The pressure differential leaks off through C and, when it has been reduced to zero, D and the fixed contact resume normal condition and contact gap. (0.007").
 - 2. Any negative pressure differential on X, equal to about 2 1/2" of water, will cause X to expand and allow the contact to close, provided that the change in pressure occurs quickly enough. Pressure differentials caused by natural causes such as tides and seiches occur over periods too long to be effective due to the fact that C allows the pressure to equalize without expanding the diaphragm sufficiently to make contact. However, a large pressure differential caused by action of a ship, or even by a large wave or swell, will affect the diaphragm sufficiently to close the contact since C cannot equalize the pressure rapidly enough. From this point on, the associated electrical circuits of the pressure component govern further operation with the pressure detecting device serving only to close its switch for the duration of the pressure differential.



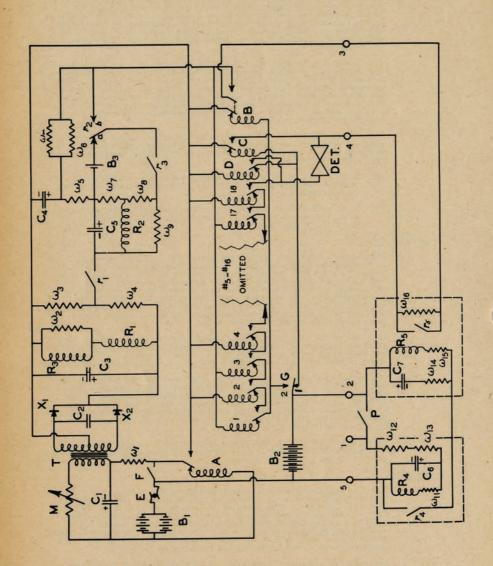


Fig. 20a - AP Mk. I Unit Circuit

AP Mark I Unit Circuit - Operation

General

- The acoustic component of AP Mark I, A Mark V, is transformed into an acoustic-pressure unit by the addition of a pressure detecting device and its associated relays $R_{\rm h}$ and $R_{\rm 5}$. It is further modified by the addition of $w_{\rm 10}$ which changes its hormal anticountermining action so that it operates more like an A Mark IV than an A Mark V. Addition of $w_{\rm 10}$ reduces the resistance of the charging circuit from $B_{\rm 2}$ to $C_{\rm 4}$. There will therefore be no discharging of $C_{\rm 4}$ and $C_{\rm 5}$ if the sound does not rise rapidly from initiating level to firing level.
- After the unit is armed, both the acoustic and pressure components are continuously alive. "Blind" P.D.M. actuations (9 max.) are run off by the acoustic component only and, upon completion of the P.D.M. actu-ations, the unit is receptive to acoustic-pressure firing.

Acoustic Actuation

1. An acoustic firing actuation operates R_1 , R_2 and R_3 in order, closing them to contacts r_1 , r_2 b and r_3 respectively. This completes the circuit from B_2 through the three contacts above, through w_3 , w_0 , w_1 6, and the detonator. The addition of w_{16} to the A Mark V circuit raises its resistance to a point where the current flow is not sufficient to fire the detonator nor to hold the relays closed. If the sound falls off, the circuit and relays return to normal.

Pressure Actuation

 A decrease in hydrostatic pressure closes pressure switch P. This causes B₂ to start charging C₆ through w₁₂ and w₁₃ in an attempt to operate R₁ through w₁₁. If P remains closed for a sufficient period, r₁ makes and B₂ charges C₇ through w₁₁, in an attempt to operate R₅ through w₁₅. If r₅ makes, it shorts w₁₆ and reduces the resistance of the detonator circuit, leaving the unit receptive to acoustic firing. firing.

Combination Actuation

- l. If acoustic actuation occurs first, the sound must be maintained at firing level until pressure actuation is complete. In this case, t closing of \mathbf{r}_5 by actuation of the pressure component, allows the acoustic unit to fire the detonator. In this case, the
- 2. If pressure actuation occurs first, acoustic actuation may reach completion at any time thereafter up to 45 seconds, because, after P opens, the charge on ${\rm C}_6$ and ${\rm C}_7$ keeps ${\rm r}_5$ made until the charge drains off.

Integrating Firing Feature

1. The pressure component is designed to register an actuation if P is closed continuously for a period of seven seconds. This interval, however, may be somewhat decreased if C, and C, are partially charged at the time of actuation since the arrangement and constants of the circuit do not permit rapid condenser discharge. If the condensers are partially charged by a P switch closure of less than seven seconds duration and if, before the charge leaks off, another P switch closure occurs, it is possible for additional closures, none of which may be seven seconds long, to register a complete actuation. Such an actuation is, of course, dependent upon the short-interval closures occurring close together. This effect may be produced by wave action under certain conditions and thereby cause the pressure component to be continuously actuated. If this occurs, the unit is, in effect, a straight acoustic unit. acoustic unit.

MP Mark I Unit Circuit - Operation

General

 The magnetic component of MP Mark I is an M Mark II(revised) unit
modified as in AM Mark I for increased sensitivity. It is fitted with
a thormal delay switch as in AM Mark I which determines the interval
after magnetic actuation during which pressure actuation may fire the mine.

Arming

When the hydrostatic clock runs off its delay setting, a-g and b-c close. B then charges C through w, and the closed contact (4-5) of R₁. When C is charged, R₂ operates, breaking 4-5 and making 4-3, thereby removing the detonator from the circuit. Eighteen minutes later, e-f closes, the magnetic component goes through A.L.A. and is armed.

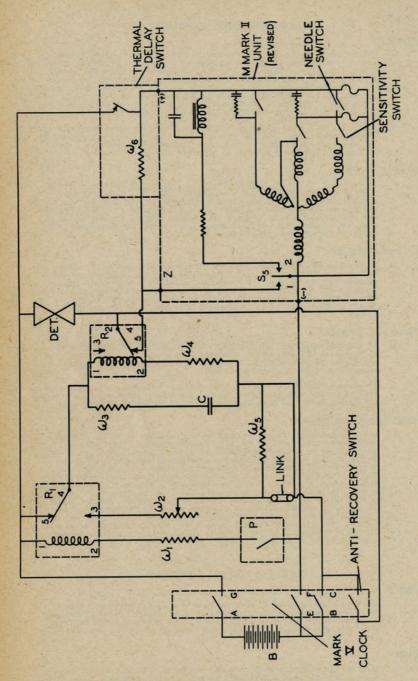


Fig. 21 - MT Mk. I Unit Circuit and Key

Magnetic Actuation

Actuation of the magnetic component closes the needle switch and operates the air core relay, thereby closing S₅ to contact #1. Hold-on current and thermal delay switch heater current pass through the normally-closed contact of the thermal delay switch. This condition persists until the thermal delay switch opens, breaking magnetic hold-on and heater current. The magnetic component then returns to normal.

Pressure Actuation

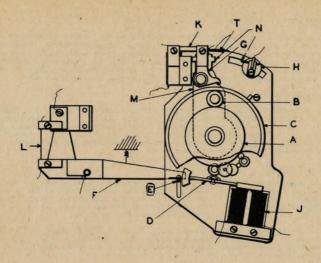
1. A decrease in hydrostatic pressure closes pressure switch P. This causes B to energize R₁, breaking 4-5 and making 4-3. Battery current to C is thereby cut off, causing C to discharge through w₁ and R₂. When C has discharged sufficiently, it no longer holds 4-5 open. The foregoing constitutes a single pressure actuation for which nine seconds continuous closure of P is required.

Combination Actuation

- If magnetic actuation occurs first, pressure actuation may be completed at any time within 25 seconds thereafter. At the end of the 25 second period, the thermal delay switch breaks the magnetic circuit. Pressure actuation within the 25-second interval causes contact 4-5 of R₂ to make, firing the detonator through contact #1 of S₅.
- If pressure actuation occurs first, P must be held closed until the
 magnetic actuation is complete if the detonator is to fire. Otherwise,
 opening P deenergizes R, recharging C and thereby opening 4-5 which
 takes the detonator out of the firing circuit.

Non-Integrating Firing Feature

1. The pressure component is designed to register an actuation if P is closed continuously for a period of nine seconds. This interval is not subject to decrease due to partially-charged condensers as is the case in AP Mark I. In the MP Mark I unit, the arrangement and constants of the circuit allow C to recharge fully through w; if P opens for 1/4 seconds or more. This feature is due primarily to the low resistance of w; and the lack of delay on R. The pressure component, then, is unlikely to be seriously affected by natural causes such as waves and swells.



- A GEAR TRAIN
- B "
- C " '
- D ESCAPEMENT LEVER
- E ESCAPEMENT LEVER CLAMPING ARM
- F MAGNET RELEASE LEVER
- G PAWL

- H SENSITIVITY SETTING STOP
- J ELECTROMAGNET
- K SENSITIVITY SETTING FUSE
- L MAGNET RELEASE FUSE
- M PAWL ARM
- N CONTACTS
- T TRIP SWITCH

Fig. 22 - Mechanical ALA, Side View, with Key

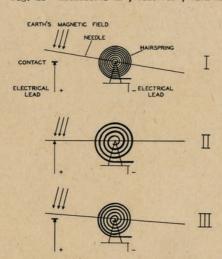


Fig. 23 - Schematic Explanation of Mechanical ALA Operation

A.L.A. - Automatic Latitude Adjustment Devices

Mechanical A.L.A. - Operation

- 1. When the hydrostatic clock completes its delay period, fuse L blows, seating the needle on its knife edges. Rotation of F allows E to rotate on its pivot and the A.L.A. clockwork starts to run. Oscillation of escapement lever D drives C in a clockwise direction, with M and G being restrained by fuse K. Clockwise rotation of C drives B counterclockwise and, since A is geared to B, A rotates clockwise. Counterclockwise rotation of A decreases tension on the needle hair-spring to which A is
- 2. When hair-spring tension on the needle axis decreases so that the forces acting on the needle are equal and opposite to the force of the earth's magnetic field, the needle makes its contacts, blowing fuse K. When K blows, a small hair-spring rotates G until it engages A. Blowing of K also releases M allowing the pawl to look the gear system. Since C is still rotating clockwise, the entire assembly consisting of A, B, C, G and M rotates clockwise. This puts tension back on the needle spring and opens the needle contacts. To assure that the needle contacts open at this point, rotation of M closes switch T momentarily, thereby energizing the hold-off circuit.
- 3. The assembly rotates as noted above until M comes up against H, the distance traveled by M before contacting H determining the amount of hair-spring tension on the needle and thereby the sensitivity setting of the unit. If at any time during the above process a countermining shock is received, closure of the pendulum switch energizes J which holds D inoperative until the pendulum switch reopens.

Magnetic A.L.A.

- This mechanism consists primarily of two permalloy rods, offset and made into pole pieces with a magnetized spider or disc on a vertically oriented pivot between them (See Fig. 25). Fig. 25 shows the adjusting magnets D and D₁ which are fitted to concentric shafts. Rotation of these magnets is controlled by the clockwork escapement (Fig. 24).
- 2. Prior to operation, fuse #1 holds the lower arm against spring tension and the arm in turn holds the spring-loaded V-clip arm in at the top. Fuse #2 also holds a spring-loaded arm in the upright position. The needle extension arm lies between two sets of fixed contacts, so oriented that it tends to rotate toward the contact and hold-on magnet (L) on the left side. This is due to the vertical earth's field which is fed to the needle arm through the vertical pole pieces.
- 3. When F₁ blows, the A.L.A. escapement starts and the V-clip moves to midposition; i.e. it restrains the needle extension arm on the Red (left) side only. The escapement rotates magnet D and, in so doing, introduces a constantly increasing component of its field into the pole pieces around the needle body. This component is Blue and tends to counteract the earth's field.
- 4. When a point of equilibrium between the two magnetic fields is reached, the needle extension no longer bears against the Y-olip and, since the escapement continues to run, an excess Blue field is brought to bear on the needle, carrying it over to the Blue (right) contact. When contact is made, F₂ blows and the following operations are performed almost simultaneously:
 - (a) The spring-loaded arm (Par. #2 above) is released and flies to its limit stop (Fig. 24).
 - (b) The A.L.A. escapement stops and magnet D stops rotating. D₁ is rotated by the spring-loaded arm a sufficient amount to remove the excess blue magnetic field on the needle.
 - (c) The resetting clamp points BB₁ are freed and fly apart due to the action of the spring which pulls AA₁ together and snaps the needle extension arm to the center.
- 5. The needle is now in mechanical and magnetic equilibrium. Rotation of the resetting cam is controlled by a separate escapement in the M Mark IV unit and by the PDM assembly in the M Mark IVa. This rotation will separate clamp points CC₁ and thus free the needle arm by spreading of AA.

Electromagnetic A.L.A.

 The needle consists of an aluminum drum, mounted horizontally and fitted with a magnetic belt which is magnetized diametrically. It is placed between two sets of vertical pole pieces which conduct the vertical component of the earth's field through the needle. The needle G thus tends to rotate counterclockwise due to the Red field effect.

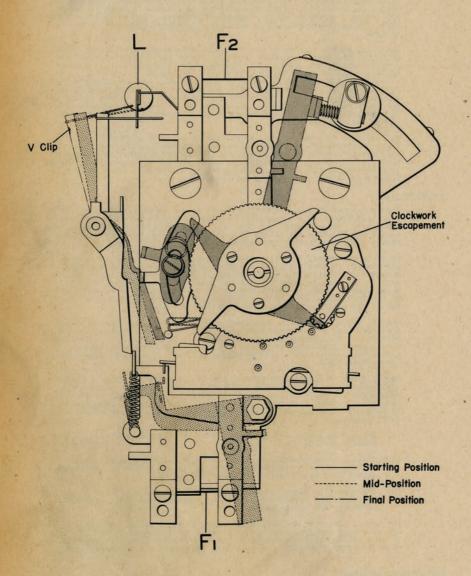
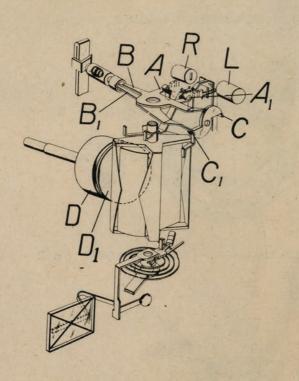
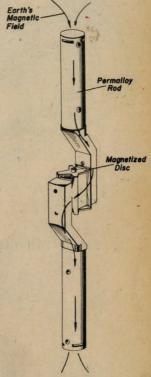
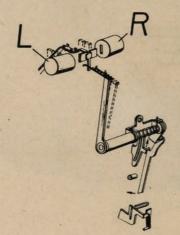


Fig. 24 - Magnetic ALA, Elevation View, showing Clockwork ; Escapement and Needle arrangement







KEY TO OPERATING POSITION

----- Starting Position
---- Mid-Position
---- Final Position

AAI BBI Resetting Clamp Fingers CC,

D - Disc Magnet (A.L.A.)

D₁ - Disc Magnet (Compensating)

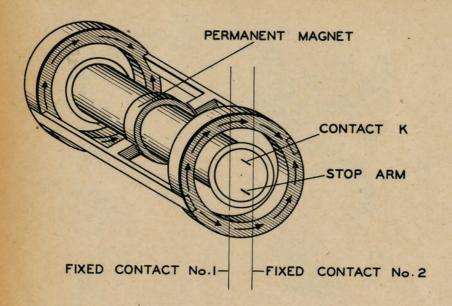
F, - Fuse #1 F. - Fuse #2

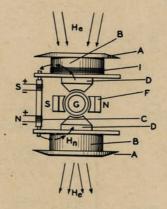
- Hold-on Magnet (Left)

R Hold-on Magnet (Right)

Fig. 25 - Magnetic ALA, Component Perts

MMN IV Unit





A CAPS (SOFT IRON)
B INTENSIFIERS (SOFT IRON)
C LOCAL MAGNET
D POLE PIECES
E PERMANENT MAGNET CORE
F SEPARATE POLE PIECES (RING)
G MAGNETIC DRUM
H EARTH'S MAGNETIC FIELD
H FIELD OF MAGNET
I HOLD-ON COIL

Fig. 26 - Electromagnetic ALA, Component Parts

A.L.A. - Automatic Latitude Adjustment Devices (Cont'd.)

- 2. A separate local magnet J, wound with a coil, is also fitted to the unit. Its polarity is such that it puts out a Blue magnetic field which tends to rotate the needle clockwise. This Blue field is stronger than the earth's field and, as a result, the needle rotates clockwise to its limit stop.
- 3. A contact K is mounted on the drum and two vertical wires are placed in such a position that clockwise or counterclockwise rotation of the drum causes K to make contact #2 or #1 respectively. Thus, contact #1 becomes the Red contact and contact #2, the Blue contact and since the field of the local magnet is stronger than that of the earth, the needle will make contact K2 when the mine is laid.
- 4. When the unit is energized by the battery, current through fuse R energizes the latitude adjuster coil S and thermistor M. S is wound on the local magnet and is energized so that the field produced will be opposite to that of its core (i.e. the local magnet). The field produced be energizing S is strong enough to overcome the Blue field of the local magnet, causing the needle to break contact K2, thereby breaking the electromagnetic field of S. Since the residual magnetiem of the local magnet is strong enough to swing the needle back again, contact K2 is again made and S reenergized.
- 5. This pulsing, or deperming, continues until the residual magnetism of the local magnet is no longer capable of making switch K2. This process is assisted by the heating of thermistor M whose decreasing resistance allows it to pass more current, thereby decreasing the pulsing current through S.
- 6. When the needle breaks K2 for the last time, M heats enough to pass 50 milliamperes, thereby blowing fuse R and isolating the A.L.A. from the circuit. The firing unit is now rendered active and receptive to a Red actuation. This device is used with M Mark V and modifications thereof.

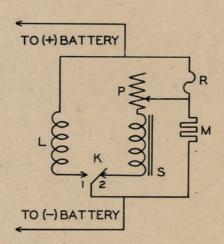


Fig. 27 - Electromagnetic ALA Circuit



Special Clocks

RAM - Rendering Active Mechanism (Arming Clock)

- The hydrostatic clock switch a-g closes after a 5 1/2 minute delay, causing battery B to blow fuse F, starting the arming clock which may be set for any period up to six days.
- 2. The hydrostatic clock switch b-c closes after 17 minutes and, when the arming clock runs off its set period, it closes the switch 1-2, putting battery voltage on the firing unit and rendering it active. Used with M Mark II units and Mark I or II hydrostatic clocks.

RIM - Rendering Inert Mechanism (Scuttling Clock)

- The hydrostatic clock switch a-g closes after a 5 1/2 second delay. Battery B blows fuse F starting the scuttling clock which may be set for any period up to six days.
- 2. The hydrostatic clock switch b-c closes after 17 minutes and, when the scuttling clock runs off its set period, it closes a switch which puts a direct short across the battery and rendering the mine inert. Used with M Mark II units and Mark I or II hydrostatic clocks.

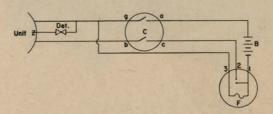


Fig. 27a - RAM Circuit

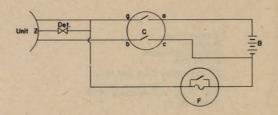
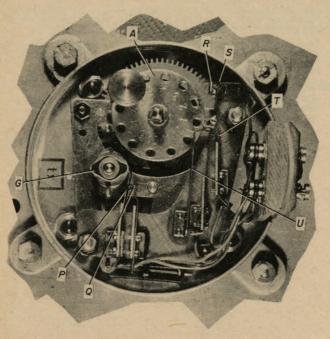
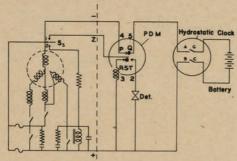


Fig. 27b - RIM Circuit





A-PDM Wheel
B-Battery
C-Clock-hydrostatic
G-PDM Cam
a-g-Hydrostatic Clock Switches
b-c-Hydrostatic Clock Switches
R-S-T-PDM Changeover Switch
P-Q-PDM De-energizing Switch
U-Cam Spring

Fig. 28 - Mechanical PDM with Circuit and Key



P.D.M. - Period Delay Mechanisms

Mechanical P.D.M.

- The unit and P.D.M. are rendered active when the hydrostatic clock switches close. A magnetic actuation closes the needle switch and the air core relay closes S_E to contact #1 and energizes the P.D.M. solenoid through contacts R-S. The solenoid releases wheel G and the P.D.M. clockwork.
 - (a) In the twelve-place P.D.M., G rotates one revolution while A rotates 1/12 of a revolution clockwise.
 - (b) In the six place P.D.M., G rotates one revolution while A rotates 1/6 of a revolution clockwise.
- After 11 seconds of rotation, G allows P-Q to break, de-energizing the unit hold-on coil and the P.D.M. solenoid. After 120 (45) seconds, P-Q remakes and the wheel stops.
- 3. A movable pin with a flanged collar may be put in any setting hole, and is indicated as being in hole #6 in the accompanying photograph. In the case illustrated, five actuations of the P.D.M. would cause the flanged collar to bear against the U-bend in the spring contact S, causing it to break contact with R and make with T. This substitutes the detonator for the P.D.M. solenoid in the circuit.
- 4. The six-place P.D.M. is used with M Mark II units and has a 45 second operating period per "blind" actuation. The twelve-place P.D.M. is used with A Mark III and AM Mark I units and has a 120 second operating period per "blind" actuation.

Electrical P.D.M. - Fuse Delay Switch

- 1. The accompanying diagram shows a typical fuse delay switch type P.D.M. set to "3". If an actuation is registered on the unit detector, current from the battery flows through fuse delay switch #1 although in some cases a by-pass fuse is used to reduce the resistance of the circuit to a value low enough to allow rapid holding in the detecting circuit. After a short delay period, switch #1 switches over, cutting out its own heater coil, opening the holding circuit and passing all current through switch #2 for a period long enough to allow the detecting circuit to recover.
- 2. When switch #2 operates, it puts switch #3 in the circuit and the unit is alive again. As this process is repeated, switches #3 and #4, operate in a like manner with a third actuation firing the detonator. P.D.M's of this type may have as many settings as can be fitted to the unit's P.D.M. terminal board with the P.D.M. setting of any unit being determined as follows:
 - (a) x = 2n 2, where x = the number of fuse delay switches and n = the P.D.M. setting.
- 3. This device is used with Mine Type GG.

P.D.M. for use with M Mark IVa Unit

- 1. This mechanism consists of a planetary gear train driven by a small escapement. The escapement is tripped by an electro-magnetically-operated detent, which, upon actuation, releases the notched wheel I. Wheel A is the main clockwork drive and, upon release of I, rotates the system. Since I can only rotate 180° before the detent falls into the next notch, and since the gear ratio between A and H is 4:1, A will rotate counterclockwise 45°, carrying the indicator wheel G with it. G is connected to A by means of a small shaft K.
- 2. Rotation of the resetting cam J resets the needle switch and then frees it. Since B and its shaft are fixed to each other and to the unit, C and D rotate about it, being free on shaft K. Their rotation is 45° clockwise since B and C have the same gear ratio. Since D and E are geared in a ratio of 1:2 and since D is rotated 45° counterclockwise, E rotates 22 1/2° clockwise relative to D or 22 1/2° counterclockwise absolute. Since E drives F, F rotates in the same direction as G at half the speed. The net result, then, is that F rotates one division or step in the direction of decreasing numbers for each stage of P.D.M.
- 3. When the final P.D.M. setting is run off, rotation of G brings stud Q around behind the free arm L and, at the point where the dial indicator is at the zero position, causes it to force down lever M. This changes the switch contact from N-O to O-P, cutting out the electromagnet and putting the detonator in the circuit.
- 4. Due to the fact that the escapement drive spring runs down during P.D.M. operation, the dead interval on the unit is extended from 85 seconds to 115 seconds in the last blind stage of P.D.M.

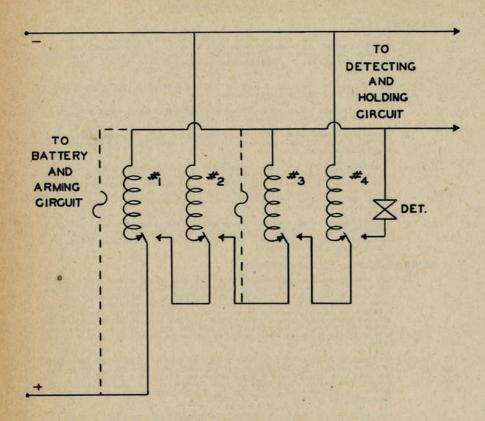


Fig. 29 - Electrical PDM (Fuse Delay Switch) Circuit

A,B,C,D,E,H	-	Gear Train
F	-	Indicating Pointer
G	-	Numbered Indicating Disc
T. P. S.	-	Release Wheel
J	-	Resetting Clamp Cam
K	-	Shaft
L	-	Free Arm
M	-	Lever
N, O, P	-	Switch Contacts
Q'		Stud

Fig. 30 - Key for Fig. 31



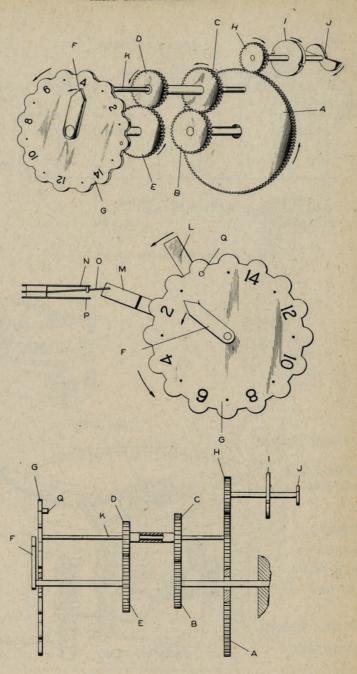


Fig. 31 - PDM used with M Mark IVe Unit (see Fig. 30 for key)

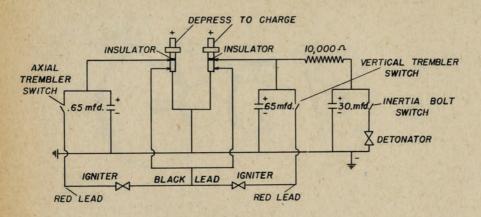


Fig. 32 - Rheinmetall Fuze Circuit

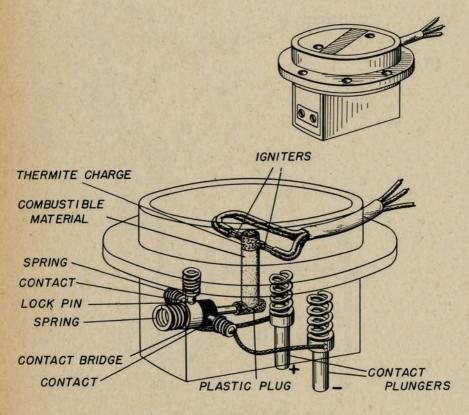


Fig. 33 - Mine Type GG, Master Switch

Special Accessories Used With Mine Type GG

Rheinmetall Bomb Fuze - Type 157/3

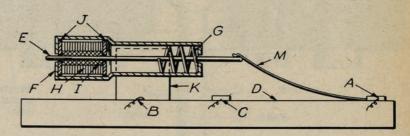
- While the mine is being carried by the laying aircraft, the two springloaded charging plungers are depressed. As the mine is released and starts to drop, a potential of 180 volts is applied to the plungers which act as a positive terminal, the fuze body being the negative terminal. When the mine clears the plane, the plungers spring up and arm the fuze firing circuit.
- 2. The fuze has two functions as follows:
 - (a) If the mine strikes a hard surface producing a deceleration of over 200g, an inertia bolt switch closes, firing the instantaneous detonator.
 - (b) If the mine strikes a surface producing a deceleration of between 20 and 200g, one or both of two vibrating "trembler" switches closes, discharging the condenser through an electric igniter in the Master Switch.

Master Switch

- The master switch is a positive-locking, single pole, single throw type, the body of which contains two spring-loaded contact plungers which bear against a contact block inside the firing device. Each of these plungers in turn is connected to an additional spring-loaded contact plunger which bears against an insulated portion of the contact bridge plunger.
- 2. When the Rheinmetall fuze discharges through one or both of the switch igniters, a thermit cartridge ignites. This in turn ignites combustible material inside the switch, and the resulting heat melts a plastic plug which holds the contact bridge open. Spring tension then forces the contact bridge plunger into the molten plug, thereby bridging the two side contact plungers and closing a switch in the firing circuit. A springloaded detent holds the contact bridge plunger in the closed position.

Fuse Delay Switch

1. This switch is an electrically-operated delay type used in conjunction with delay bomb firing and PDM operation in this mine. It consists of a small, cylindrical shell F mounted in a fuse clip K on an insulating board D. A circuit is made from A to B through the spring copper strip K down the spring-loaded spindle E which is held in place by the adhesive action of a soft solder plug I. The circuit continues from the spindle into the heater coil H and out through the shell F. At the end of a heating period predetermined by the basic switch design, the solder melts and spring G forces spindle E to the left, thus breaking the circuit from A to B and making a circuit from A to C through the conducting strip M.



A, B, C - CONTACTS

D - INSULATING BOARD

E - SPRING LOADED SPINDLE

F - SWITCH SHELL

G - SPRING

H - HEATER COIL

1 - SOLDER

J - HEATER COIL END BLOCKS

K - SWITCH CLIP

M - SPRING COPPER STRIP

Fig. 34 - Fuse Delay Switch

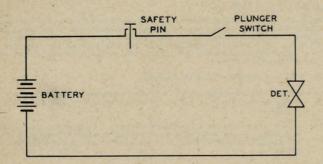


Fig. 35 - Mk. I PSE Circuit

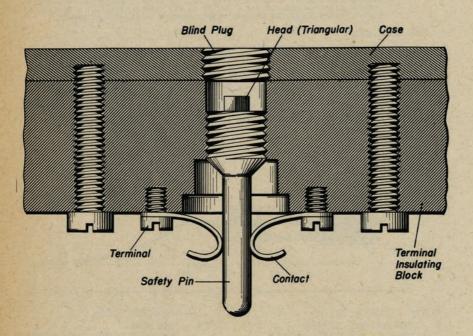


Fig. 36 - Mk. I PSE Sefety Pin Arrangement

P.S.E. - Prevent Stripping Equipment

- Various devices of this type, commonly called "booby traps", have been used by the Germans to preserve the security of their mine assemblies. They are ordinarily fitted as case accessories, designed to prevent access to the interior of the case at the most obvious points of entry such as cover plates and tail doors. However, as shown below, they may be incorporated as unit accessories or as integral parts of the unit.
- 2. Mark I P.S.E. (used with Mines Type GC and GD)
 - (a) This device consists of a plunger switch which is held open when the tail door or mechanism plate to which it is attached is in its normal position, i.e., mine completely assembled. If an attempt is made to remove the mechanism plate or tail door, the spring-loaded plunger is released during removal and completes a circuit from the main mine battery through a special P.S.E. detonator, firing a small two pound charge.
 - (b) The device is armed prior to launching by inserting a safety pin which closes a break in the P.S.E. circuit. This pin is inserted in the mine case through a plug hole, 135° from the top center line, 6° forward of the tail door flange. If the P.S.E. is fitted to the case, this hole will be present, although filled and painted over so as not to be obvious.
- 3. Mark Ia P.S.E. (used with Mine Type GT)
 - (a) This device is essentially the same as the Mark I although it is rigged so as to operate if the mechanism plate is removed or if the case is separated at the flange. It is armed in the same manner as the Mark I, the safety pin being inserted underneath a screw on the mechanism plate, 180° from the bowden wire channel.
- 4. Mark II P.S.E. (used with Mine Type GG)
 - (a) This device consists of two photo-electric cells, mounted on either side of the firing unit, which, when exposed to light, operate a relay and close the unit firing circuit, firing the main charge. The device becomes armed when the firing unit arms. It may be fitted to any Mine Type GG which is fitted with a firing unit which incorporates M Mark V or subsequent modifications thereof. The presence or absence of this device cannot be determined from an examination of the exterior of the mine case.
- 5. Mark III P.S.E. (used with Mines Type GC and GD)
 - (a) This device consists of a spring-loaded firing pin which is held by two lock balls when the tail door or mechanism plate to which it is attached is in its normal position, i.e., mine completely assembled. If an attempt is made to remove the tail door or mechanism plate, movement of a spring-loaded spindle allows the lock balls to move into a recess, releasing the spring-loaded firing pin to impinge on a special P.S.E. detonator, firing a two pound charge.
 - (b) The device is armed prior to launching by removal of a safety pin which leaves the firing pin restrained only by the lock balls. The safety pin is removed from the mine case through a plug which is located, 90° from the top center line on the flange.
- 6. Mark IV P.S.E. (used with AM Mark II unit in Mine Type GG
 - (a) This device consists of two wires, made of dissimilar metals, which are coated with a salt and laid side by side in a small trough. If humidity or moisture enter the trough, the salt dissolves, creating a small battery cell. The cell operates a sensitive relay, completing a circuit from the main mine battery to a special P.S.E. detonator, firing the main charge.
 - (b) The device becomes armed when the firing unit arms and has only been found fitted to AM Mark II in Mine Type GG. The presence or absence of this device cannot be determined from an examination of the exterior of the mine case.
- 7. ZUS-40 Anti-Withdrawal Device
 - (a) This device consists of a spring-loaded firing pin which is designed to be released when the accessory under which it is fitted is removed. When the mine is dropped, impact with the surface causes a lock ball to fall away, leaving the firing pin restrained only by its extension arm as shown in the accompanying drawings. If the accessory is withdrawn 076, the extension arm moves clear of the body of the accessory, releasing the firing pin to impinge on a special detonator, firing the main charge.

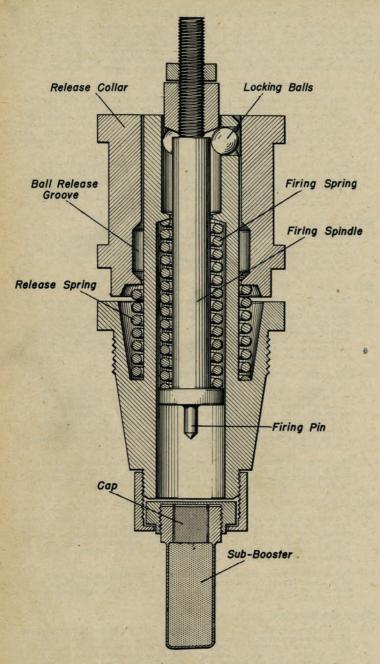
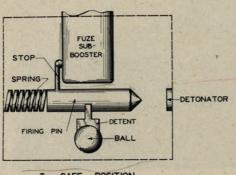


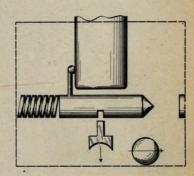
Fig. 37 - Mk. III PSE, Sectional View

P.S.E. - Prevent Stripping Equipment (Cont'd.)

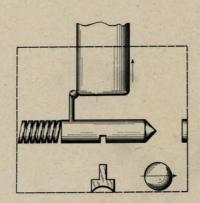
(b) This device was originally designed to be fitted under bomb fuzes and its use in mines is thereby restricted, by its basic design, to Mines Type GC, GD and GG, the only mines which have contained bomb fuzes. It should be noted however that this device may be used under any fitting the physical construction of which would permit effective operation.



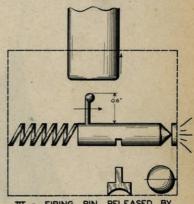
I - SAFE POSITION



II - ARMING ON IMPACT



BOMB FUZE PARTIALLY REMOVED



IV - FIRING PIN RELEASED REMOVAL OF BOMB FUZE

Fig. 38 - ZU3-40 anti-Withdrawel Device

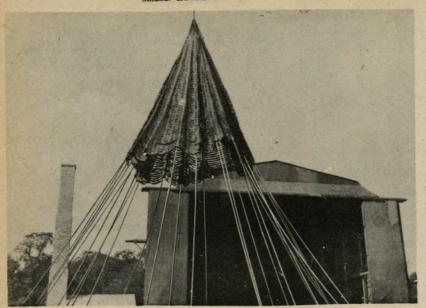


Fig. 39 - Lattice-Type Parachute (Parallel Lattice)

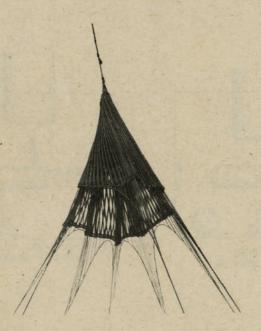


Fig. 40 - Lettice-Type Parachute (Barber Pole Type)

German Mine Parachutes

- A knowledge of the various types of German parachutes is often useful in identifying mines which have accidentally been dropped on land. Although the mine may be completely buried, the parachute often is left on the surface and, since each type is distinctive and is ordinarily used with but one type of mine, an examination of the parachute may prove extremely valuable.
- 2. Two main types of parachutes are employed:
 - (a) The canopy type this parachute closely resembles the standard type aviator's parachute.
 - (b) The lattice type this parachute differs from the canopy type in that the canopy which catches the air and slows the mine's descent is not solid but is composed of a lattice work design. The various lattice work strips may run perallel to the edge of the parachute (parallel lattice type) or may be set in a manner similar to the stripes on a barber pole (barber pole type). The latter type apparently causes the mine to spin during descent, thereby permitting greater accuracy in laying.
- 3. The third type of parachute used is in reality a small drogue. Although it may serve to lessen the rate of descent through the air, it is believed that its primary purpose is to slow the mine's descent through the water. All available data with respect to these parachutes will be found in Table # 9.

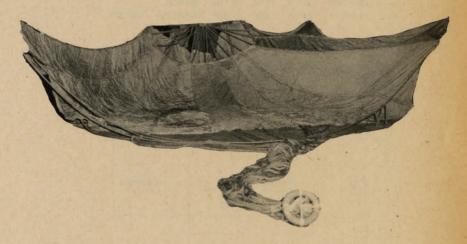
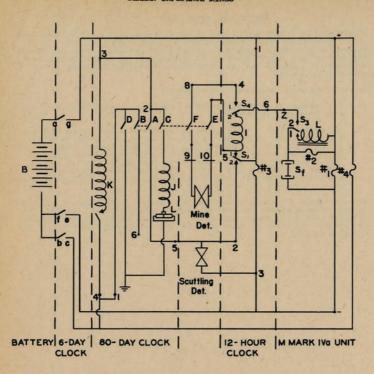


Fig. 41 - Canopy-Type Parachute



1 - 12 - HOUR CLOCK FUSE DELAY SWITCH

J - 80 - DAY CLOCK FUSE DELAY SWITCH

K - 80 - DAY CLOCK FUSE DELAY STARTING DEVICE

Fig. 42 - Mine Type GO, Testing Circuit

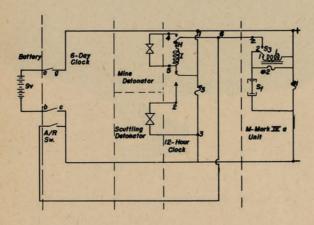


Fig. 43 - Kine Type GP, Testing Circuit

Special Mine Circuits

Mine Type GO Testing Circuit - Operation

- When the hydrostatic clock runs off its delay period, switches a-g and b-c close, causing the battery to blow fuse #4 and operate the fuse delay device K.
 - (a) Blowing of fuse #4 releases the lower portion of the M Mark IVa unit and leaves the unit swinging freely from its upper gimbal and spring suspension.
 - (b) Operation of K throws the release arm which starts the 80-day clock and, simultaneously, operates a switch which cuts K out of the circuit.
- Eighteen minutes after a-g and b-c close, e-f closes, causing the battery to blow fuses #1 and #3.
 - (a) Blowing of fuse #1 starts the A.L.A. During A.L.A. operation, fuse #2 blows, and the unit is rendered alive.
 - (b) Blowing of fuse #3 starts the twelve-hour clock, thereby starting the unit testing cycle. During the period set on this clock, if unsatisfactory laying conditions, such as excessive currents or wave motion, should fire the unit, the small scuttling charge is detonated.
- Twenty four minutes after the 80tday clock starts, switches C, D, E and F close.
 - (a) C and D render the clock-failure scuttling device active. This device includes fuse delay switch J and slip-ring assembly L.
 - (b) E and F connect the main mine detonator to the testing circuit.
- 4. When the M Mark IVa unit is rendered active, it is receptive to blind actuations. If magnetic actuation occurs or if the mine is tilted sufficiently, the needle switch Sr closes, energizing I and stepping off one place on the P.D.M. setting (15 maximum). If this occurs a number of times equal to the P.D.M. setting, switch Sr closes to contact #2. Upon receipt of another actuation, Sr closes, energizing the fuse delay switch I of the 12-hour clock, provided that all these actuations occur within the set period of the clock. When I is energized, contact #1 of Sr breaks after ten seconds and contact #2 of Sr is made, the battery fires the scuttling charge and the mine sinks. If these actuations do not occur within the period of the twelve-hour clock, Sr changes over from contact #2 to contact #1 when the clock runs off. The scuttling detonator is then cut out of the circuit and the main mine detonator is put in.
- 5. If the mine does not fire normally within the set period on the 80-day clock, the clock opens C, E and F, removing the detonator from the firing circuit and disarming the clock-failure scuttling device, and A and B close, firing the scuttling charge.
- 6. If the 80-day clock should fail at any time during its run after C, D, E and F close, a contact is made in the slip-ring assembly L, causing the battery to energize J. After a ten-second delay, J moves a cam which closes A and B as in Par. #5 above and the scuttling charge fires.

Mine Type GP Testing Circuit - Operation

- 1. Differs from the Mine Type GO as follows:
 - (a) No 80-day clock is fitted.
 - (b) An anti-recovery switch is fitted to the hydrostatic clock which, at any time after a-g and b-c close, fires the scuttling charge or the main mine charge upon release of hydrostatic pressure. If hydrostatic pressure is released during the period of the twelvehour clock, the scuttling charge is fired and if pressure is released after the period of the twelve hour clock, the main charge is fired.

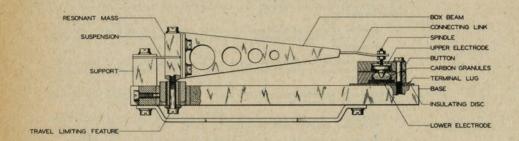


Fig. 44 - Cantilever Microphone

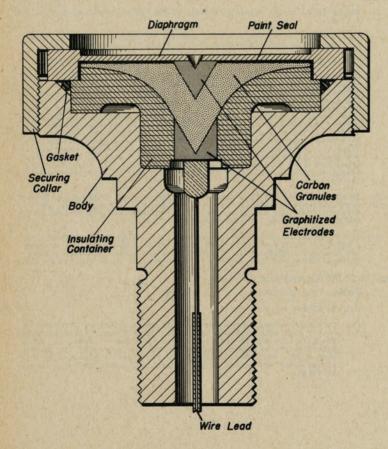


Fig. 45 - Diaphragm Microphone



Cantilever Microphone

General

 This microphone is used with all acoustic and acoustic combination units except the AM Mark II. It is a carbon button type and acts electrically like a variable resistor the resistance of which varies directly with the vibration to which it is subjected.

Description

1. The microphone consists of an aluminum base rigidly attached to the mine case which acts as a diaphragm. The button (resistor element) and an upright support are rigidly secured to the base. An amplifying box beam and a resonant mass are attached to the support by means of a steel suspension piece. Only two leads are necessary; one each to lower and upper electrodes. The resistance element consists of carbon granules between two graphitized electrodes, one of which is fixed and the other, movable. In order to be active, the microphone must be energized constantly by battery current.

Operation

- Vibration causes the resonant mass to oscillate according to the frequency and amplitude of the sound with the light box-beam amplifying this movement. The box beam also causes oscillation on the part of the upper electrode of the resistive element to which it is attached by means of a brass connecting link and spindle.
- The elastic granules are thereby compressed and expanded, and since their resistance is a function of the amount of surface they present to each other, the resistance of the element is varied by sound vibration.
- 3. In most cases, the resonant frequency is about 250 cps.

Diaphragm Microphone

General

 This microphone has been found used only in conjunction with the AM Mark II unit and has been found wired in parallel in groups of four. Its general operation is the same as that of the cantilever microphone.

Description

- 1. The microphone consists of a conical aluminum fitting covered at the base by a steel diaphragm which is held by a steel keep ring. The resistive element consists of two graphitized conical electrodes; one fixed to the diaphragm and one held in the body of the microphone in an insulating bakelite block. The space between the bakelite block and the diaphragm is filled with carbon granules and the inner surface of the diaphragm is painted so that only the electrode surface comes in contact with the granules.
- 2. The microphone is exposed to the water and is attached to the firing unit by a threaded portion on its apex and is secured by a nut. Only two leads are necessary; one to the electrode in the insulated block and the other to the diaphragm through a ground connection.

Operation

The microphone operates in much the same manner as the cantilever type.
 Its resonant frequency is about 250 cps., its sensitivity varying inversely with the depth of water due to increasing pressure on the diaphragm at greater depths.

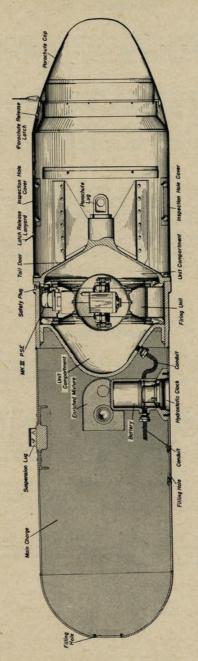


Fig. 46 - Mine Type GC, Sectional View

Mine Type GC1 (GC2)

General

- Ground, influence mine, laid by aircraft with parachute. Magnetic needle, acoustic, magnetic-acoustic or magnetic-pressure firing.
- 2. German designation, "LMB".
- 3. Offensive mine, for use against surface craft.

Description

1. Case

Shape Cylindrical, with hemispherical nose and tapered tail.

Color Dark green or black.

Material Aluminum

Diameter 26"

Length Overall Case 9'9 1/2" 5'8 1/2" Tail door Parachute housing Parachute cap 19" 2'11 1/2"

1535 lbs. cast Hexanite.

Total weight in air 2175 lbs.

2. External fittings

Suspension lug On top center line, 3'5" abaft the nose.

Parachute lug Inside parachute housing, on center of tail door.

4" diam., 270° from top center line, 3'8" abaft the nose, secured by keep Booster release mechanism

ring.

6" diam., 180° from top center line, 4' abaft the nose, secured by keep Hydrostatic clock

ring.

4 1/2" diam., 90° from top center line, 3'8" abaft the nose, secured by four screws. Detonator Cover Plate

3" diam., 270° from top center line 4'1" abaft the nose, secured by keep ring. Bomb fuze

Filling hole covers

Four, 6" diam. One, in center of nose. One, 180° from top center line, 2'll" abart the nose. Two, 135° and 225° respectively from top center line, 4'l" abart the nose, each secured by four screws.

Two, 7" x 9". One on top center line, 21" from other end. One 180° from top center line, 21" from other end; each secured by four lock-screws. Inspection hole covers

1/2" diam., on top center line, 2'2" from after end. Parachute releas atch

Six, 1/2" diam., equally spaced on after end. Ejecting plungers

3. In some cases the Mine Type CCl has been fitted with an additional clockwork bomb fuse to reduce the possibility of a mine being found unexploded on land. The additional bomb fuse is mounted in place of the booster release mechanism and the booster is permanently housed over the detonutor. The bomb fuse is mounted in an adapter tube which is screwed in the pocket in place of the booster release mechanism and

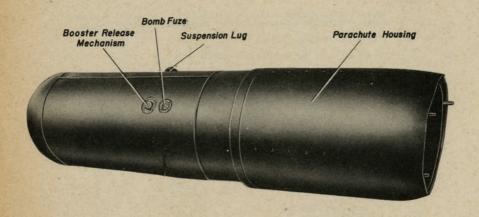


Fig. 47 - Mine Type GC1

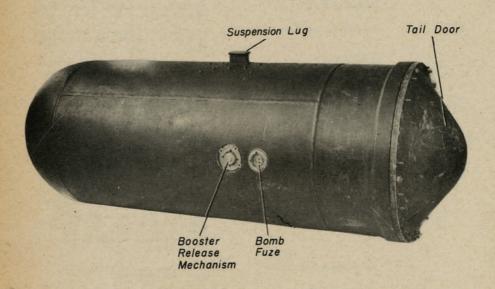


Fig. 48 - Mine Type GC²

Mine Type GC1 (GC2) (Cont'd.)

spring. The remaining space is filled with booster pellets and wooden blocks.

- 4. Mine Type ${\rm GC}^2$, a surface-craft-laid model of ${\rm GC}^1$, differs from ${\rm GC}^1$ as follows:
 - (a) It is not fitted with a parachute housing or parachute lug.
 - (b) Its after end is rounded rather than tapered.
 - (c) It may not be fitted with a bomb fuse. If the fuze is fitted, it will probably be inoperative.
 - (d) Other significant features are as follows:

(1) Total weight in air 2076 lbs.
(2) Length 0verall 7'4" 7 1/2" Case 5'8 1/2"

Operation

- (a) When the mine is dropped, two lanyards are pulled performing the following arming functions:
 - (1) One lanyard releases the parachute cap latch and the cap then serves as a pilot chute. When the main chute is fully streamed, the cap falls away.
 - (2) The second lanyard, a split type, removes the bomb fuze safety pin and the booster release mechanism safety fork. Removal of the safety pin allows the bomb fuze to arm after a short safety interval controlled by clockwork. Removal of the safety fork allows the booster to house over the detonator.
 - (b) Upon impact with any surface, the bomb fuze clockwork starts again and, after a 17 second delay, the bomb fuze fires the mine unless it has reached a depth of 15 ft. or more. Upon reaching this depth, the bomb fuze is again rendered passive and may or may not become active again if the mine is raised, depending on the fuze fitted (See Table 6).
 - (c) Dissolution of a soluble plug (may not be fitted) allows water pressure to depress the clock spindle at a depth of 15 ft., starting the clock. The clock runs off its delay setting and the firing unit begins its arming cycle. Dissolution of a soluble plug releases the parachute.
 - (d) GC² operates in the same manner as GC¹ except that no parachute is fitted and the bomb fuze, if fitted, will probably have the safety pin still in place.
- 2. See Table #1 for possible firing units fitted. In some cases the mine has been rigged as a shallow water depth bomb by replacing the hydrostatic clock with a hydrostatic switch which operates at a depth of 50 ft. and by plugging the bomb fuze so that it cannot be rendered passive by hydrostatic pressure.
- 3. No self-disarming devices are fitted.

Precautions

- 1. See Introduction.
- Do not remove the tail door of the mine. It is possible that either the Mark I or Mark III P.S.E. will be fitted thereto.

RMS

- 1. If the clock is running, gag it.
- 2. Gag the bomb fuze(s) as follows:
 - (a) Type 34A or 34A* using threepenny bit type gag.
 - (1) Remove the hydrostatic cover screw and cover.
 - (2) Insert the gag pin in the water entry hole.
 - (3) Insert the threaded spindle in the hole and screw down as far as possible without forcing.
 - (4) Screw on the gag protective cylinder.



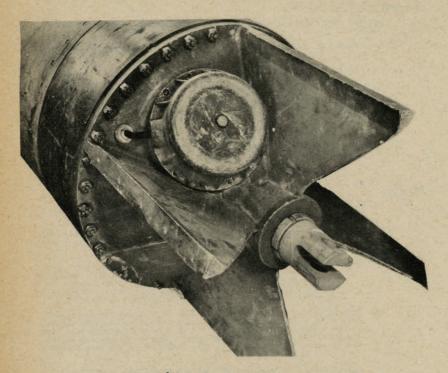


Fig. 49 - Mine Type GCl, End View Showing Pressure-Detecting Device

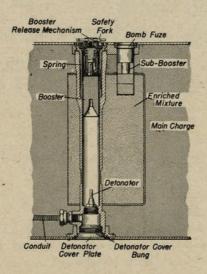


Fig. 50 - Mine Type GC, Detonator-Booster Assembly

Mine Type GC1 (GC2) (Cont'd.)

- (b) Type 34B using British mechanical gag.
 - (1) Cock the gag.
 - (2) Remove the cap screw which covers the clockwork release pin in the bomb fuze.
 - (3) Screw the gag into the hole.
 - (4) Push the gag plunger in as far as it will go.

3. Remove the bomb fuze(s) as follows:

- (a) Loosen the keep ring two complete turns and test for ZUS-40. If spring pressure or unnatural stiffness is detected, tighten the keep ring and proceed with step #4 below. Otherwise, proceed as indicated immediately below.
- (b) Remove the keep ring, taking precautions against the bomb fuze falling out.
- (c) Attach a length of white line to the gag protective cylinder or gag and, from a safe distance, withdraw the bomb fuze. Use an even, steady pull.
- (d) Remove the sub-booster from the bomb fuze.
- 4. Remove the detonator as follows:
 - (a) Remove the detonator cover plate.
 - (b) Remove the plastic detonator cover bung.
 - (c) Cut and tape each lead separately, being especially careful not to short or ground any lead to the mine case.
 - (d) Remove the detonator.

5. Remove the booster as follows:

- (a) Remove the keep ring using one thumb to hold in the booster release mechanism.
- (b) Allow the booster release spring to expand sufficiently to obtain a firm grip on it. Remove the booster release mechanism and spring with a single quick motion.
- (c) Insert the booster removal tool and remove the booster.
- 6. Remove the hydrostatic clock as follows:
 - (a) Loosen the keep ring two full turns and test for spring pressure. If detected, tighten the keep ring and cease operations on the clock, Otherwise, remove the keep ring, taking precautions against the clock falling out.
 - (b) Remove the clock.
 - (c) Cut and tape each lead separately.
 - (d) Remove the locking ring and battery or relay pack.
- Dispose of all explosive elements including the picric acid peliets in bomb fuze pocket.

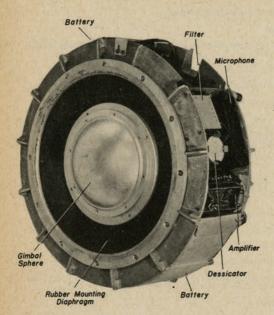


Fig. 51 - AM Mk. I Unit as fitted to Mine Type GC

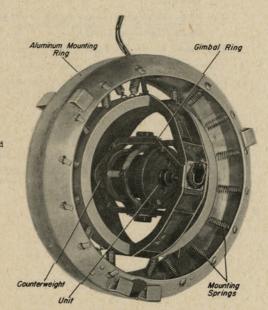


Fig. 52 - M Mck. IVe Unit as Fitted to Mines Types GC or GP

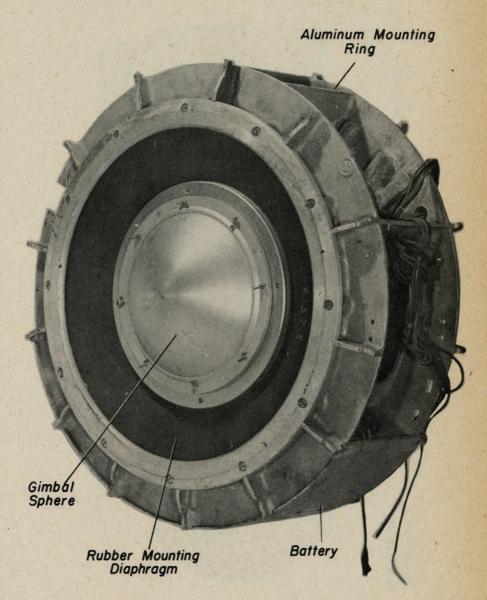


Fig. 53 - M Mk. II (revised) Unit as fitted to Mines Types GC and GD

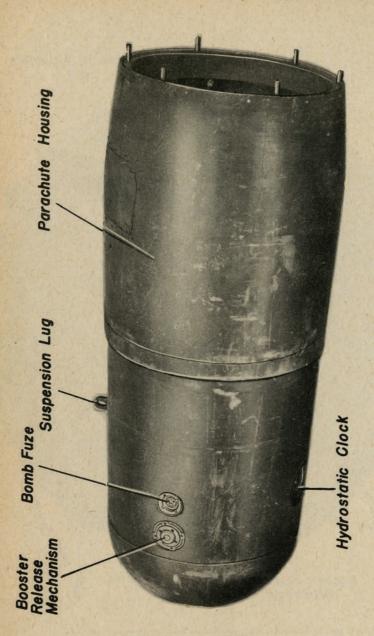


Fig. 54 - Mine Type GD

Mine Type GD

General

- Ground, influence mine, laid by aircraft with parachute. Found to date with magnetic needle firing only although it may be fitted with the same firing units as Mine Type GC.
- 2. German designation, "IMA".
- 3. This mine is a smaller model of Mine Type GC and is now considered ob-

Description

1. Case

Cylindrical, with hemispherical nose and tapered tail. Shape

Dark green or black. Color

Material Aluminum

26" Diameter

Length Overall

6'9 1/2" 3'4 1/2" 2'3 1/2" Case Parachute housing Tail door 19" 13 1/2" Parachute cap

674 lbs. cast Hexanite. Charge

875 lbs. Total weight in air

2. External fittings

on top center line, 24" abaft the Suspension lug nose.

Inside parachute housing, on center of tail door. Parachute lug

4" diam., 270° from top center line, 15 1/2" abaft the nose, secured by Booster release mechanism

keep ring.

6" diam., 180° from top center line, 18 1/2" abaft the nose, secured by keep ring. Hydrostatic clock

4 1/2" diam., 90° from top center line, 15 1/2" abaft the nose, secured by keep ring. Detonator cover plate

3" diam., 270° from top center line, 20 1/2" abaft the nose, secured by Bomb fuze

keep ring.

Three, 6" diam.; one in center of nose; two, 135° and 225° respectively from top center line, 19" abaft the nose. Each secured by Filling hole covers

four screws.

Two, 7" x 9"; on top center line and 180° from top center line respectively, 12 1/2" from after end. Each secured by four screws. Inspection hole covers

1/2" diam., on top center line, 22" from after end. Parachute release latch

Six, 1/2" diam., equally spaced on after end. Ejecting plungers

Operation

- 1. Same as Mine Type GC1 except as follows:
 - (a) It has never been known to be fitted with acoustic or magnetic-acoustic units.



Fuze in place





Cap screw removed

Cocking gag



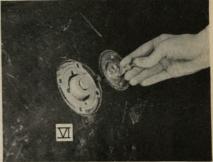
Mine Type GD (Cont'd.)

- (b) It has never been known to be rigged as a depth bomb.
- (c) It has never been known to be fitted with two bomb fuzes.

Precautions and RMS

1. Same as Mine Type GC1.





Gag in position

Plunger depressed



Fuze gagged

Fig. 55 - Use of British Mechanical Gag to gag 34B Bomb Fuze

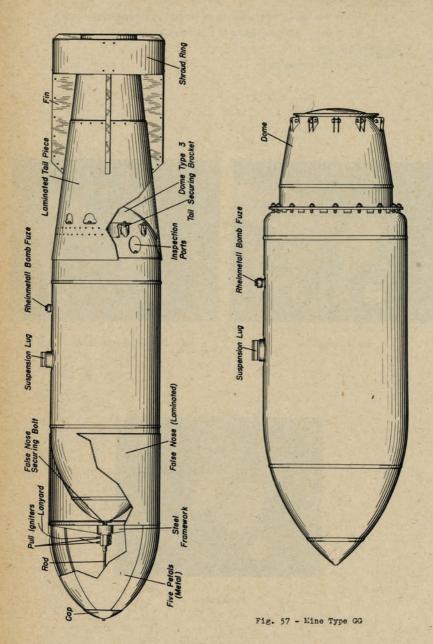


Fig. 56 -Nine Type GG with Cap, False Nose and Tail

Mine Type GG1 (GG2, GG3 and GG4)

General

- Ground, influence mine, laid by aircraft. Magnetic needle, acoustic, magnetic-acoustic or acoustic-pressure firing.
- 2. German designation, "BM 1000".
- 3. Offensive mine, for use against surface craft.

Description

1. Case

Shape

Cylindrical, with ogival nose and truncated cone dome on tail. Fitted with break-off tail section. Possibly fitted with false nose.

Color

Material

Manganese steel

Diameter /

Length
Overall
Case
Dome (Type #1)
False nose
Ogival section
Cylindrical section
Tail section

10'6 1/2" 5' 16"

Charge

20" 3'7 1/2" 1600 lbs. cast Hexanite with picric

Buff or light blue.

Total weight in air

acid booster.

2169 lbs:

2. External fittings

Rheinmetall bomb fuze

3" diam., on top center line, 4'2 1/2" abaft the nose.

Suspension lug

On top center line, 3'0" abaft the nose.

nos

Dome (Type #1)

Secured to after end of case by 10 studs (see below).

- 3. Mine Type GG2 differs from Mine Type GG1 as follows:
 - (a) It is fitted with Dome Type #2 (see below).
 - (b) Its case length, including dome, is 6'7" and its total weight in air is 2126 lbs.
 - (c) It is laid with a drogue or small parachute, the tail section being omitted. The false nose may also be omitted.
- 4. Mine Type GG3 differs from Mine Type GG1 as follows:
 - (a) It is fitted with Dome Type #3 (see below).
 - (b) Its case length, including dome, is 6'l" and its total weight in air is 2173 lbs.
- 5. Mine Type GG4 (tentative desig.) differs from Mine Type GG1 as follows:
 - (a) It is fitted with Dome Type #4 (tentative desig.) (see below).
 - (b) Its case length, including dome, is 6'7" and its total weight in air is 2126 lbs.
 - (c) No complete mines of this type have been recovered, although single domes have been found. It has been reported to be a surface-laid version of GG but evidence is not sufficiently conclusive to warrant any definite assumptions.
- 6. The four types of domes are as follows:
 - (a) Type #1 a truncated cone, rounded at its after end and fitted with a flange at its forward end. It is 26" in diameter at the flange, 20" in maximum diameter on the conical section and 16"

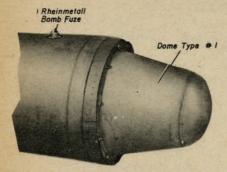
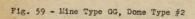
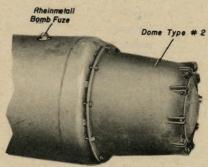


Fig. 58 - Mine Type GG, Dome Type #1





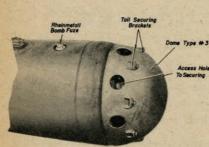
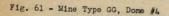


Fig. 60 - Mine Type GG, Dome #3





Mine Type GG1 (GG2, GG3 and GG4) (Cont'd.)

long. It is secured to the charge case by 10 studs. Magnetic needle, acoustic, or acoustic-pressure units may be fitted.

- Type #2 a truncated cone with a cylindrical base, rounded at its after end and fitted with a flenge at its forward end. It is 26" in diameter at the flenge, 19" in maximum diameter on the conical section and 19" long. It is secured to the charge case by 10 studs. Ten equally-spaced drogue securing lugs are fitted around the after end of the dome and a metal ring, 8" in diameter, is welded to this end. Magnetic needle, acoustic or acoustic-pressure units may be titted. fitted.
- (c) Type #3 a hemisphere, 26" in diameter, fitted with eight holes, 3 1/4" in diameter, around its periphery. These holes give access to the eight studs which secure the dome to the charge case. It i fitted with eight equally-spaced brackets for securing the tail section. Only magnetic-acoustic units may be fitted.
- (d) Type #4 a truncated cone with a cylindrical base, rounded at its after end and fitted with a flange at its forward end. It is 26" in diameter at the flange, 19" in maximum diameter on the conical section and 19" long. It is secured to the charge case by 10 studs. Magnetic needle, acoustic or acoustic-pressure units may be fitted.
- The two types of laminated paper break-off tail sections are as follows:
 - (a) ${\rm GG}^1$ consists of a truncated cone fitted with four radial fins enclosed in a shroud ring secured to the dome by rivets. None has been recovered.
 - (b) GG³ consists of a truncated cone with radial fins and shroud ring as on GG¹. The section is 4'8" long, 25" in diameter at its forward end and 13" in diameter at its after end. The shroud ring is 8" long and 25" in diameter. Eight equally-spaced holes give access to the bolts which secure the section to the dome.
- 8. The false nose fitted to GG mines is composed of two parts as follows:
 - (a) A cylindrical, laminated paper section, 20" long and 26" in diameter, open at its after end and drilled with a hole through the longitudinal axis of the forward end. This hole receives a securing rod, the after end of which is secured to a threaded recess in the charge case.
 - (b) A steel ogival section, 23" long and 26" in diameter consisting of six, overlapping, petal-shaped pieces held together at their for-ward and after ends respectively by a small nose cap and a steel ring. One petal is drilled with a 1" hole to allow passage of an arming wire to two small delay detonators on the charge case. This section is secured to the plastic afterbody by six screws. The securing rod, which also passes through the longitudinal axis of this section, secures at its forward end to the small nose cap and serves to attach both the forward section and afterbody to the charge case. charge case.
- 9. Markings found on the mine case may be of assistance in identifying the type of unit fitted. The markings, consisting of a letter followed by three numbers, may be found in any one of three places: adjacent to the carrying lug, on the nose, or on the dome. The letter prefix determines the type of influence firing and the numbers, the specific but Examples are as follows: Examples are as follows:
 - (a) M 101 M Mark VIII M 103 M Mark IX A 105 A Mark V MA 101 AM Mark II AD 104 AP Mark I AD 104b - AP Mark I with 80 hour RAM.

Operation

- When the mine is dropped, the Rheinmetall fuze condenser receives a charge and a split lanyard attached to the false nose is pulled, thereby igniting the two small delay detonators on the charge case. After a short delay, the delay detonators fire, driving the securing rod forward and thereby removing the small nose cap from the forward end of the false nose. Air travel then forces the patals outward and they fall away (GG² employs standard parachute laying). Upon impact with a surface, the Rheinmetall bomb fuze operates as follows:
 - (a) If the rate of deceleration is 20-200g, as in the case of impact with a soft surface such as water or loose earth, the trembler switches close, firing the igniters in the master switch. If the mine does not reach a depth of 2½ within 90 seconds (15 ft. in 105 sec. for GG³), the mine will fire as a delay action bomb.

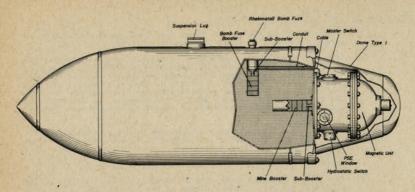


Fig. 62 - Mine Type GG fitted with Magnetic Unit, Sectional View

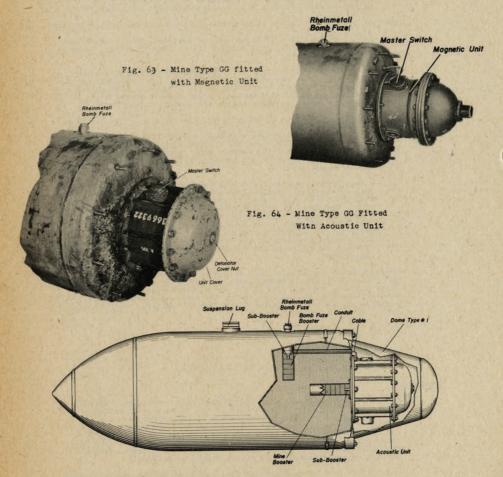


Fig. 65 - Mine Type GG Fitted With Acoustic Unit, Sectional View

Mine Type GG1 (GG2, GG3 and GG4) (Cont'd.)

If the mine does reach the proper depth within the appointed time, fhe firing unit is put into the circuit and starts its arming cycle.

- (b) If the rate of deceleration is greater than 200g, as in the case of impact with a hard surface such as concrete or rock, the mine fires as an instantaneous bomb.
- 2. See Table #1 for possible firing units fitted.
- 3. No self-disarming devices are fitted.

Precautions

- 1. See Introduction.
- 2. Make every effort to identify the unit fitted before proceding with RMS.
- if the mine is found underwater, it should be raised only by remote lifting gear due to the fact that the delay action bomb firing may be reactuated when the mine is raised to a depth less than 24 ft. See Par. 1 (a) of Operation.
- 4. Do not expose a unit not definitely established as other than magnetic to light, due to the possibility that the Mark II P.S.E. may be fitted.
- Do not allow moisture or high humidity to enter an AM Mark II unit due to the presence of the Mark IV P.S. 2.
- If the firing unit has not been definitely established as other than acoustic, observe special acoustic procedure as follows:
 - (a) Keep all necessary noise to a minimum.
 - (b) Make no noise lasting longer than one-half second.
 - (c) Allow a three-second interval between each interval of sound.
- Be particularly cautious when dealing with a mine of this type which appears to be damaged. Such mines have been known to be active due to dents depressing the hydrostatic switch.
- 8. Russian reports state that ZUS-40 has been found beneath the Rheinmetall bomb fuze. Due precautions should be taken.

RMS

- 1. Remove the dome as follows:
 - (a) Remove all but two of the securing nuts.
 - (b) Remove the two remaining securing nuts in darkness.
 - (c) Remove the dome, observing all precautions.
- Identify the firing unit fitted (Par. 9 of Description) and follow the procedure prescribed for the appropriate unit (Par. 7-10 below).
- After removing the unit from the mine, remove the booster by unscrewing the eight bolts which secure it to the unit.
- 4. Unscrew the sub-booster from the booster.
- 5. Remove the Rheinmetall bomb fuze.
- Dispose of all explosive elements including the picric acid pellets from the bomb fuze pocket.
- 7. Procedure A Magnetic Unit
 - (a) Remove the master switch in darkness as follows:
 - (1) Remove the six securing screws.
 - (2) Lift out the switch.
 - (3) Cover the hole with a watertight plug.
 - (4) Slit the cable to the Rheinmetall fuze; cut and tape each lead separately.
 - (b) Remove the unit from the mine as follows:
 - (1) Remove the eight nuts which secure the unit to the case.

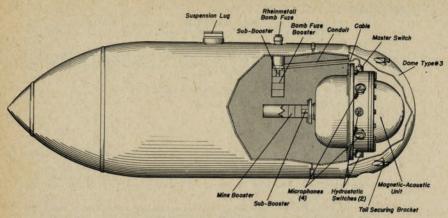


Fig. 66 - Mine Type CG fitted with Acoustic Megnetic Unit, Sectional View

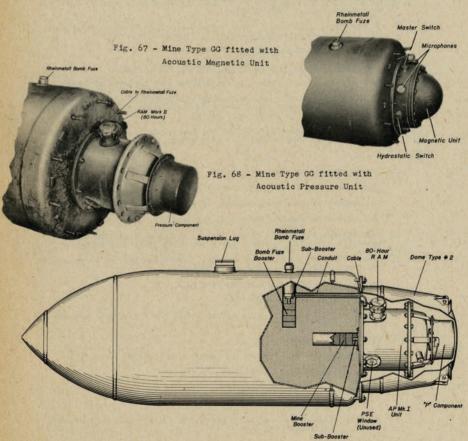


Fig. 69 - Mine Type GG fitted with Acoustic Pressure Unit, Sectional View

Nine Type GG1 (GG2, GG3 and GG4) (Cont'd.)

(2) Withdraw the unit carefully.

8. Procedure B - Acoustic Unit

- (a) Remove the detonator as follows:
 - (1) Remove the nut in the center of the unit cover.
 - (2) Remove the detonator carrier by pulling on its spring with a small wire hook or other suitable tool.
- (b) Remove the master switch as follows:
 - (1) Remove the six securing screws.
 - (2) Lift out the switch.
 - (3) Cut and tape separately each lead under the master switch.
 - (4) Cover the hole with a watertight plug.
 - (5) Slit the cable to the Rheinmetall fuze; cut and tape each lead separately.
- (c) Remove the unit as in Procedure A above.

9. Procedure C - Acoustic-Pressure Unit

- (a) Slit the double-conductor cable from the pressure unit to the acoustic unit; cut and tape each lead separately.
- (b) Remove the master switch as in Procedure B above.
- (c) Remove the unit as in Procedure A above.

10. Procedure D - Magnetic-Acoustic Unit

- (a) Remove the magnetic sphere as follows:
 - (1) Remove the eight long bolts from the flange of the unit hemisphere. These bolts are located between the fittings on the unit frame.
 - (2) Separate the unit sphere from the unit frame. It may be necessary to pry it loose.
- (b) Cut and tape separately the five leads which extend from the P.D.M. board to the detonator.
- (c) Slit the cable from the Rheinmetall fuze to the master switch; cut and tape each lead separately.
- (d) Remove the unit as in Procedure A above.

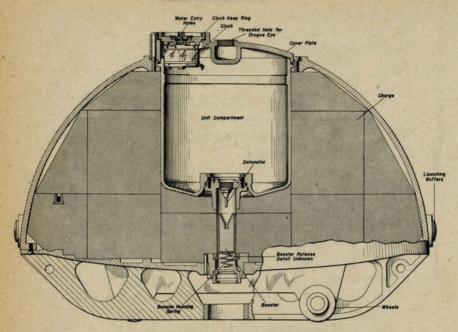


Fig. 70 - Mine Type GH, Sectional View



Fig. 71 - Mine Type CH

GERMAN INFILIENCE VINES

Mine Type GH

General

- 1. Ground, magnetic needle mine, laid by surface craft.
- 2. German designation, "RMA".
- 3. Defensive mine, for use against surface craft. May be used as a controlled mine.

Description

1. Case

Shape

Color

Material Diameter

Height

Charge

Total weight in air

2. External fittings

Cover plate

Drogue eye

Hydrostatic clock

Inspection plug

Launching buffers

Booster cover plate

Hemispherical. Supported by fourwheeled truck.

Dark blue

Aluminum

50"

1200 lbs. block-fitted Hexanite.

2700 lbs.

18 3/4" diam., on top center of case, flush type, secured by 18 screws.

Screwed into center of cover plate.

6" diam., 4" from drogue eye, secured by keep ring.

1" diam., 12" from center of cover plate, screwed into case.

Two pairs on bottom edge of hemisphere, 180° apart. The buffers in each pair are 18" apart.

4 1/4" diam., screwed into bottom center of case.

Operation

- When the mine is launched, water pressure operates the booster release mechanism and, at a depth of 15 ft., depresses the clock spindle, starting the clock. The clock runs off its delay setting and the firing unit begins its arming cycle.
- 2. See Table #1 for possible firing units fitted.
- 3. No self-disarming devices are fitted.

Precautions

- Since the mine may be rigged as a controlled mine, examine it carefully for a firing cable leading through a stuffing box where the hydrostatic clock is normally fitted to the cover plate. If none is observed, the mine must be assumed to be fitted with an influence firing unit.
- No attempt should be made to remove the detonator in the field since it is sealed in place and may fire if handled roughly.

RMS

- 1. Remove the clock as in Mine Type GC.
- 2. Remove the booster cover plate and spring.
- 3. Remove the booster as in Mine Type GC.
- 4. Dispose of booster and charge, leaving the detonator in place.

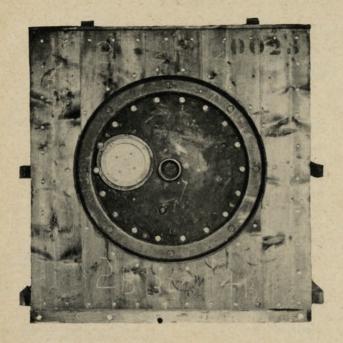


Fig. 72 - Mine Type GI

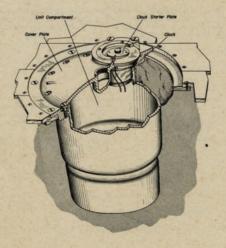


Fig. 73 - Mine Type GI Unit Compartment, Sectional View

Mine Type GI

General

- 1. Ground, magnetic needle mine, laid by surface craft.
- 2. German designation, "RMH".
- 3. Defensive mine, for use against surface craft. May be used as a controlled mine.

Description

1. Case

Cuboidal. Supported by four-wheeled truck. Shape . Brown Color Wood Material 315" Length 3'1 1/2" Width

3'10" Height 1935 lbs. cast Hexanite.

2285 lbs. approx. Total weight in air

2. External fittings

Charge

18 3/4" diam., flush type, on side of case, secured by 18 screws. Cover plate

Screwed to center of cover plate. Consists of eye bolt, housing and space for soluble plug. Drogue eve

3" diam., aluminum, in center of side of case opposite cover plate. Booster cover plate

6" diam., 4" from drogue eye, secured by keep ring. Hydrostatic clock

3. The mine has been found with the cover plate on top and with varying weights of charge. It is believed that the exact dimensions of the case, weight of charge and other details will vary at the discretion of the local Mining Officer and will be limited only by his ingenuity and the type and amount of materials available.

Operation

- When the mine is launched, it is oriented by a drogue during descent.
 Water pressure operates the booster release mechanism and, at a depth
 of 15 ft., depresses the clock spindle, starting the clock. The clock
 runs off its delay setting and the firing unit begins its arming cycle.
 Dissolution of a soluble plug releases the drogue.
- 2. See Table #1 for possible firing units fitted.
- 3. No self-disarming devices are fitted.

Precautions and RMS

1. Same as Mine Type GH.

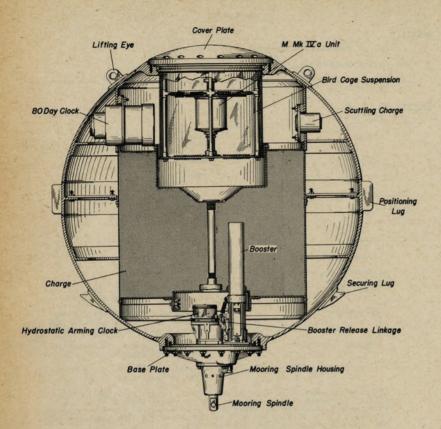


Fig. 74 - Mine Type GO1, Sectional View



Fig. 75 - Mine Type Gol

Mine Type Go1 (GO2 and GO3)

General

- 1. Moored, magnetic needle mine, laid by submarine.
- 2. German designation. "EMF".
- Offensive or defensive mine for use in maximum depth of water of 1445 ft. against surface craft.

Description

1. Case

Shape

Two hemispheres, joined by a 5" cylindrical mid-section.

Color

Dark green Aluminum.

Diameter

46"

Length

750 lbs. block-fitted Hexanite.

Total weight in air

1290 lbs.

2. External fittings

Cover plate

19" diam., in center of upper hemisphere, flush type, secured by 18 bolts.

bolts.

Base plate

15" diam., in center of lower hemisphere, lap-fitted, secured by 18 studs. Fitted with straight - shank mooring spindle and detonator strongback.

Lifting eyes

Two, 180° apart on upper hemisphere, 24 1/2" from center.

Anchor securing lugs

Three, angular-shaped, 1200 apart on lower hemisphere, 29 1/2" from

center.

Positioning lugs

Two, fin-shaped, 180° apart on cylindrical mid-section.

- 3. Mine Type GO2 differs from Mine Type GO1 as follows:
 - (a) Its case is designed for surface laying and is therefore of lighter construction; for use in maximum depth of water of 1650 ft.
 - (b) The base plate fitted, although similar to that fitted to GO¹, differs in that a soluble washer and a "Y-Z" switch are fitted. The function of the latter is not known.
 - (c) Its case differs as follows:

(1) Shape

Two hemispheres, joined by a 2-5" cylindrical mid-section.

(2) Color

Light blue

(3) Diameter

1 45"

(4) Length

50" (approx.)

(5) Charge

700 lbs. block-fitted Hexanite.

(6) Total weight in air

1270 lbs.

- (d) External fittings differ as follows:
 - (1) Lifting eyes

Two, 60° apart on upper hemisphere, 20 1/2" from center.

(2) Anchor securing lugs

Three, hook shaped; two on lower hemisphere, 160° apart, 11 1/2" from center; one on upper hemisphere, 28 1/2" from center.

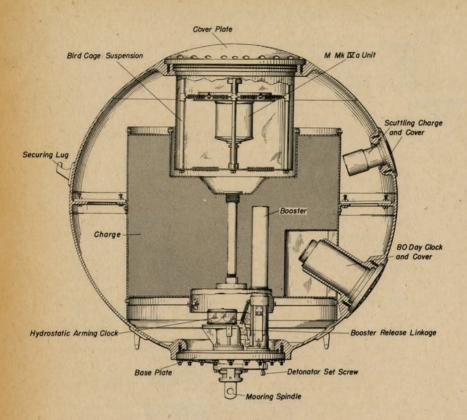


Fig. 76 - Mine Type GO2, Sectional View

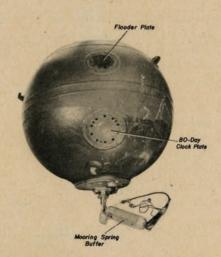


Fig. 77 - Mine Type GO2

Mine Type Go1 (Go2 and Go3) (Cont'd.)

(3) Flooder plate

6" diam., on upper hemisphere, 28 1/2" from center, secured by 10 bolts

(4) 80-day clock cover plate 8"

8" diam., on lower hemisphere, in line with flooder plate, 23 1/2" from center, secured by 10 bolts.

- 4. Mine Type GO3 differs from Mine Type GO2 as follows:
 - (a) Its case is spherical, consisting of two hemispheres welded together.
 - (b) Its flooder plate is located 26 1/2" from the center of the upper hemisphere. No 80-day clock cover plate is fitted, nor is there any other provision for fitting an 80-day clock.

Operation

- 1. Mine takes depth by loose-bight hydrostat system (GO² and GO², by plummet). Mooring tension pulls out the mooring spindle, tripping the booster release lever and releasing the locking balls from the clock-starting spindle. Water pressure depresses the clock spindle at a depth of 15 ft., starting the clock. The clock runs off its delay period and the unit starts its testing cycle (See Introduction for detailed operational analysis).
- 2. See Table #1 for possible firing units fitted.
- 3°. The only self-disarming device is the 80-day clock which is designed to scuttle the mine if the clock stops at any time prior to completion of its set period or upon completion of its set period.

Precautions

- 1. See Introduction.
- 2. Do not tamper with the "V-Z" switch.
- 3. Note that the mine, if found floating, is extremely dangerous because of the fact that very slight motion is sufficient to fire the unit. This may either fire the main charge or the scuttling charge, depending on how much of the arming process has been completed.

RMS

- Remove the detonator and booster as prescribed in the Introduction to Part IV, Chapter II.
- 2. Remove the base plate.
- Cut and tape each lead separately, starting with the two yellow leads from the scuttling charge to the 12-hour testing clock.
- 4. Remove the scuttling charge as follows:
 - (a) Gol
 - (1) Remove the cover plate.
 - (2) Remove the firing unit and its bird-cage suspension.
 - (3) Remove the scuttling charge from its securing bracket.
 - (b) G02 and G03
 - (1) Remove the flooder plate.
 - (2) Unscrew the scuttling charge.
- 5. Dispose of all explosive elements.

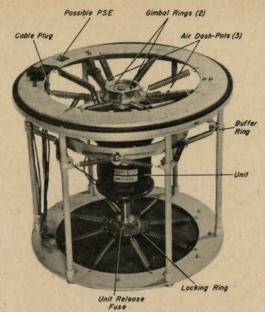


Fig. 78 - Mine Type GO, Bird Cage Suspension

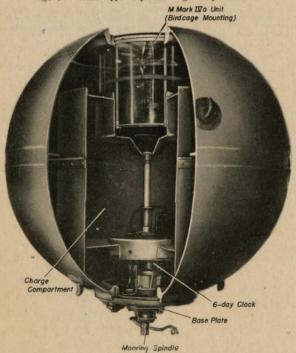


Fig. 79 - Mine Type GO, Cutaway View -100-

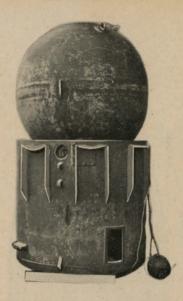


Fig. 80 - Mine Type Gol on Anchor



Fig. 81 - Mine Type GO1 Floating

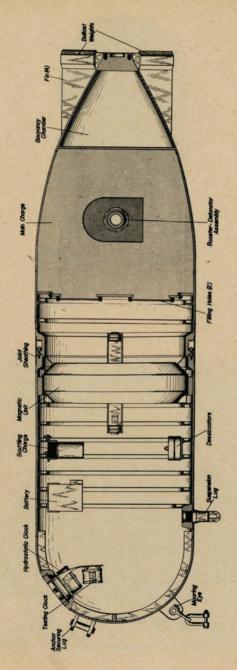


Fig. 82 - Mine Type GP, Sectional View

Mine Type GP

General

- Moored, influence mine, laid by aircraft with parachute. Found to date with needle firing only although it may be fitted with the same firing units as Mine Type GC. Found to date
- 2. German designation, "LMF".
- 3. Offensive mine, for use against surface craft.

Description

1. Case

Cylindrical, with hemispherical nose and tapered, finned tail. Shape

Black Color Material Aluminum.

26" Diameter

Length 718" Overall Forward section 316" After section After buoyancy chamber

612 lbs. cast Hexanite.

Total weight in air 1035 lbs.

2. External fittings

6" diam., on nose, 11" from center, secured by keep ring. Hydrostatic clock

4" diam., 270° from top center line, 2'5" from after end, screwed to Detonator cover plate case.

4" diam., 90° from top center line, 2'4" from after end, secured by keep ring. Booster release mechanism

Anchor securing lugs

Three, 1200 apart, 8" from center of nose.

On nose, 8" from center. Mooring ave

180° from top center line, 10" abaft the nose. Suspension lug

Joining flange

3'6" abaft the nose, fitted with 36 evenly spaced stud holes. Covered by two sections of semicircular sheathing, 2" wide.

Anchor positioning lugs

Three, 105°, 195° and 345° respectively from top center line, 17" from center of nose.

Ballast weights Six; one on end of each fin; one near end of each lower fin.

Four; 45°, 135°, 225° and 315° from top center line, at after end. 2'5" long, 10" wide.

Operation

Fins

- 1. When the mine is dropped, a safety fork is removed from the booster release mechanism, allowing the booster to house over the detonator. As the mine separates from its anchor, a pin is withdrawn from the hydrostatic clock. The mine then takes depth by loose-bight hydrostat system. Water pressure depresses the clock spindle at a depth of 15 ft., starting the clock. The clock runs off its delay period and the firing unit begins its testing cycle (See Introduction for detailed operational anglesis) al analysis).
- 2. See Table #1 for possible firing units fitted.
- 3. No self-disarming devices are fitted.



Fig. 83 - Mine Type GP



Fig. 84 - Mine Type GP, Floating

Mine Type GP (Cont'd.)

Precautions

- 1. See Introduction.
- Stay clear of the forward buoyancy chamber as far as possible during RLS.
 A small scuttling charge is fitted thereto.
- Note that the mine, if found floating, is extremely dangerous because of the fact that very slight motion is sufficient to fire the unit which may either fire the main charge or the scuttling charge, depending on how much of the arming process has been completed.
- 4. Although no booby traps have ever been encountered with this mine, it should be borne in mind that the piano wire booby trap fitted to Mine Type CT could easily be rigged to prevent separation of the case at the flange.

RKS

- 1. Remove the detonator as follows:
 - (a) Remove the detonator cover plate.
 - (b) Cut and tape each lead separately.
 - (c) Using a pin spanner or other suitable tool, remove the detonator holder.
- 2. Remove the booster release mechanism and booster as in Mine Type GC.
- Remove the clock as in Mine Type GC. This mine may be fitted with an additional 12-hour clock which is secured beneath the standard arming clock. Both clocks should come out together.
- 4. Unplug the battery. If this is impracticable, cut and tape separately each lead to the battery.
- 5. Slit the clock cable; cut and tape each lead separately.
- Inspect the interior of the forward section through the clock pocket.
 If nothing unusual is observed, remove the aluminum band and the nuts in the joining flange.
- 7. Separate the case at the flange.
- 8. Remove the firing unit.
- 9. Cut and tape separately each lead to the scuttling charge.
- 10. Loosen the four bolts and remove the scuttling charge.
- 11. Dispose of all explosive elements.

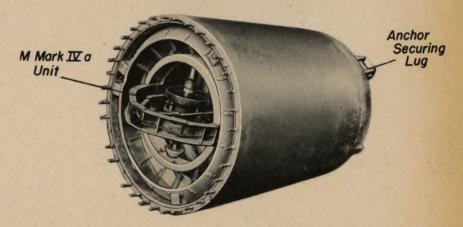


Fig. 85 - M Mk. IVa Unit as fitted to Forward Section of Mine Type GP

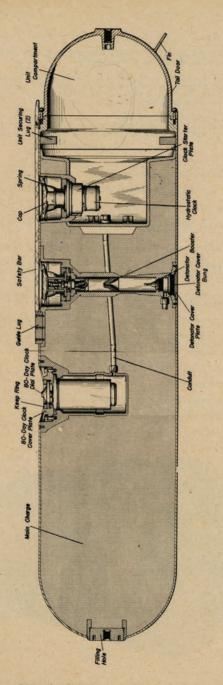


Fig. 86 - Mine Type GS, Sectional View

Mine Type GS (GN)

General

- Ground, influence mine, laid by submarine. Magnetic needle, acoustic or magnetic-acoustic firing.
- 2. German designation, "TMB".
- 3. Offensive mine, for use against surface craft.

Description

1. Case

Cylindrical, with hemispherical ends. Deflecting fin on tail door. Shape

Black or buff Color Material Aluminum. Diameter 21"

Length 7'7 1/2" Overall

Case Tail door 13 1/2" 1221 lbs. cast Hexanite. Charge

Total weight in air 1540 lbs.

2. External fittings

On top center line, 3'9 1/2" abaft Positioning lug the nose.

6" diam., on top center line, 5' 6 1/2" abaft the nose, secured by Hydrostatic clock

keep ring.

4" diam., on top center line, 4'5" abaft the nose, secured by keep Booster release mechanism ring.

8" diam., on top center line, 3'2" abaft the nose, secured by keep 80-day clock cover plate

ring.

4 3/4" diam., 180° from top center line, 4.6 1/2" abaft the nose, secured by keep ring. Detonator cover plate

Filling holes

Two; one, 5" diam., threaded to nose; one, 6" diam., 90° from top center line, 4' 6 1/2" abaft the nose; secured by four screws.

Safety bar clamp On top center line at after end.

- 3. Mine Type GN differs from Mine Type GS as follows:
 - (a) Its German designation is, "TMC".
 - (b) It is 11'1 1/2" long overall, carries a charge of 2000 lbs. and weights 2300 lbs.
 - It is fitted with extra filling holes due to the larger charge although all essential fittings are positioned identically measured from the tail.

Operation

- When the mine is launched, a spring-loaded safety bar is released from the top center line of the case, thereby unlocking the hydrostatic clock and booster release mechanism. Water pressure depresses the clock spindle and operates the booster release mechanism, respectively, at a depth of 15 ft., starting the clock and allowing the booster to house over the detonator. The clock runs off its delay setting and the firing unit begins its arming cycle.
- 2. See Table #1 for possible firing units fitted.
- The only self-disarming device is the 80-day clock which may be fitted to sterilize the mine at the end of its set period by shorting out the battery.

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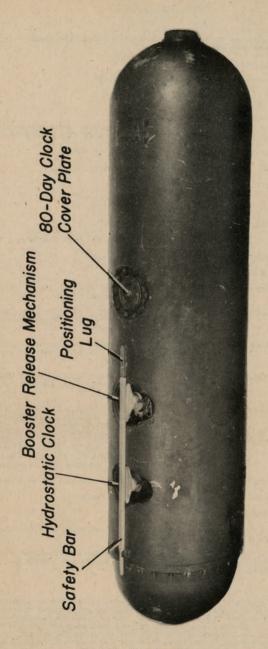


Fig. 87 - Mine Type GS

Mine Type GS (GN) (Cont'd.)

Precautions

- 1. See Introduction.
- Do not remove the tail door of the mine. It is possible that either the Mark I or Mark III P.S.E. will be fitted thereto.

RMS

- 1. Remove the detonator, booster and clock as in Mine Type GC.
- 2. Remove the 80-day clock as follows:
 - (a) Remove the keep ring.
 - (b) Remove the bolts or nuts securing the clock dial cover.
 - (c) Remove the clock (if fitted).
- 3. Dispose of detonator, booster and charge.



Fig. 88 - Mine Type GN

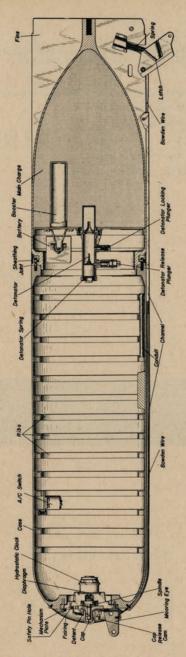


Fig. 89 - Mine Type GT, Sectional View

GERMAN INSTITUTENCE MINES

Mine Type GT

General

- 1. Moored, magnetic needle mine, laid by submarine.
- 2. German designation, "TMA".
- 3. Offensive mine, for use in maximum depth of water of 850 ft. against surface craft.

Description

1. Case

Cylindrical, with hemispherical nose and tapered, finned tail. Shape

Color Black or dark green.

Aluminum. Material 21"

Diameter 9'3 1/2" Length

475 lbs. cast Hexanite. Charge

874 lbs. Total weight in air

2. External fittings

180° from top center line, extends full length of case. Bowden wire channel

Positioning lugs

Five, on nose, 30°, 120°, 210°, 270°, and 300° respectively from top center line, 7" from center.

Two, on nose, 90° and 270° respectively from top center line, 7" from center. Securing lugs

Mechanism plate

11" diam., on nose, secured by 15 studs. Covered by fairing, 16" diam., which is cut-away to permit access to the mooring eye and securing lugs.

Safety latch

On lower fin, in line with bowden wire channel, spring-loaded, controls bowden wire.

5'6" abaft the nose, covered by two sections of semicircular sheathing, 2" wide. Joining flange

Four; 0°, 90°, 180° and 270° from top center line, at after end; 2'4" long, 9" wide. Fins

3. When the mine is fitted with the Mark Ia P.S.E., a painted band, 4" long, may be present on the case at the joint between the case and tail section. As this marking is made with water soluble paint, it rarely will serve as a positive indication of the presence or absence of a P.S.E.

Operation

- When the mine is launched, the safety latch springs out, pulling the bowden wire. This unlocks the spindle of a hydrostatic clock. Water pressure depresses the clock spindle at a depth of 15 ft., starting the clock. The clock spindle, once depressed, is locked in. The clock runs off its delay setting, allowing the detonator to house in the booster, and the firing unit begins its arming cycle.
- 2. See Table #1 for possible firing units fitted.
- 3. No self-disarming devices are fitted.

Precautions

 Do not remove the mechanism plate or attempt to separate the case and tail sections. These points of entry to the case may be guarded by a P.S.E.

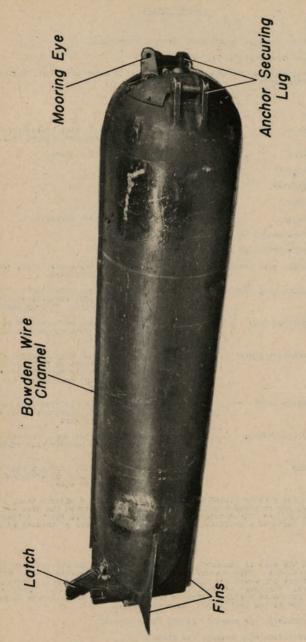


Fig. 90 - Mine Type GT

Mine Type GT (Cont'd.)

Do not attempt RMS by disassembly until after determining, as prescribed below, whether or not a P.S.E. is fitted.

RMS

- Cut a hole approximately 4" in diameter in the mine case 8" abaft the nose and 160° from the bowden wire channel, looking from aft forward. If a P.S.E. is fitted, the following fittings will be visible:
 - (a) Two P.S.E. switches mounted on a bracket directly under the hole. Each switch has two wire leads which run to
 - (b) A special P.S.E. terminal strip mounted on a bracket above the clock. If no P.S.E. is fitted, proceed with step 3.
- Cut the four P.S.E. switch leads and cut the slack wire lanyard to the smaller P.S.E. switch. Do not cut any taut wires.
- 3. Slit the blue clock cable; cut and tape each lead separately.
- 4. Carefully inspect the inside of the mechanism plate for P.S.E. fittings.

 If none are observed, remove the mechanism plate and inspect the interior.
- Cut three small inspection holes in the case, 120° apart, just forward
 of the joining flange and inspect the surface of the joint carefully.
- If no P.S.E. fittings are observed, separate the two sections of the case.
- Remove the detonator release mechanism and separate the detonator and booster.
- Remove the firing unit and separate the P.S.E. detonator, (if fitted) from its charge.
- 9. Dispose of all explosive elements.



Fig. 91 - Mine Type GT, Floating

MINE DISPOSAL HANDBOOK

PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER 2

GERMAN CONTACT MINES

				1				T	f- fay				80-			
Remarks									Addition of electrode plate and antenna connecter in place of cover plate dif- ferentiates from GX*. May have 80-day elock and flooder.	Addition of GV antenna fittings, differentiates from GY*.			Addition of cover plate flooder and 80-day olock differentiates from GX.		Differs from GY as GX* differs from GX.	
-				-			-	-	Add con fer clo	Add			Add	To the	Dif.	
Total Wt.	65	2090	92	99	380	350	420	870	775	1390	375	27.7	775	1390	1390	350
i. of	H.	ite			ite	ite	ite	1 te	1 te		ite	Ite	1te		-	1te
Type and Wt. of	- approx.	162 - Hexanite	- TNT	TNT -	120 - Hexanite	- Hexanite	- Hexanite	360 - Hexanite	330 - Hexanite	660 - Hexanite	150 - Hexanite	330 - Hexanite	330 - Hexanite	660 - Hexanite	660 - Hexanite	- Hexanite
Type e	25 -	- 29	25 -	- 77	- 02	- 88	- 06	- 09	30 -	- 09	150 - 1	30 -	30 - 1	- 09	- 09	- 99
100			1	7	-	80	6	-		9	70	-	~	9	9	9
Length				7/1 99		29 1/4	33 1/2			48 1/2				1/2	1/2	
	15	147	81	99	#	59	33	9#	07	84	34	07	07	48 1/2	1/2	32
Diameter (in)	15	17	15	17 3/4	26	29 1/4	33 1/2	34	04	94	34	04	04	911	94	32
186							100		150.29			e e		e B		
Type Base	None	None	None	None	Special	Type D	Type E	ne	Type C	Type C	None	Types A & B (obsolete)	Type C	Types A & B (obsolete)	Type C	Type D
	N N	No	No	No	Sp	Ty	Ty	o RINO	Ty	Ty	No	PO D	Ty	HOO O	Ty	Tyl
Laid By	8/0	s/c	Hand	Hand	A/C or S/C	8/0	s/c	S/C or SubNone	3/6	s/c	s/c	s/c	s/c	s/c	s/c	s/c
red											100				100	
How Fired	Chem. Horn	Chem. Horn	Contact An-		Le Clanche- cell Horn	Chem. Horn	Chem. and Switch Horns	Chem. Horn	Chem. Horn	Chem. Horn	Chem. Horns	Chem. Horn	Chem. Horn	Chem. Horn	Chem. Horn	Chem. and Switch Horns
ш		Che	Contac		Le cel.	Che	Che Swi	Сре	Сре	Che	СР	Che	Chei	Сред	Cher	Cher
Desig- nation	asl, as	GK	GL	GL-P	GM	99	GR	8	OV.	¢A.	GW	GX	cx*	GY	GY*	GZ

Table 1 - German Contact Mines



Introduction

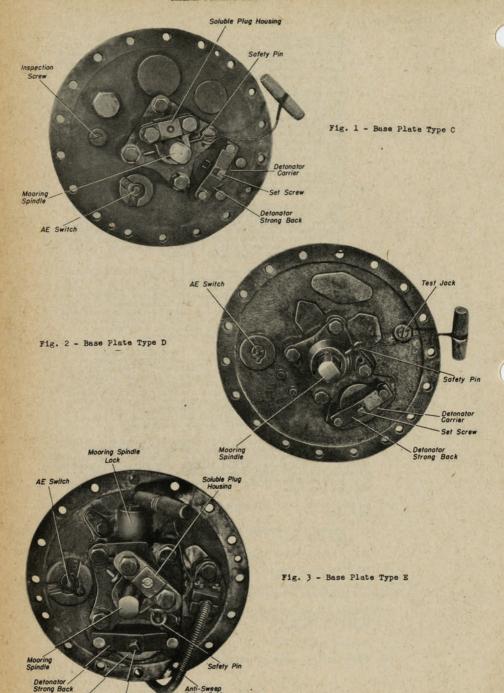
- The generalities drawn herein apply only to moored, contact mines. Each ground or drifting contact mine will be covered separately in the body of this chapter.
- 2. All German, moored, contact mines are spherical or have cases consisting of two hemispheres joined by a cylindrical mid-section. The cases are of mild steel, vary in diameter from 26" to 46" and are loaded either with cast or block-fitted Hexanite. Chemical and switch horns are employed, either singly or in combination.
- 3. Mines of this type usually depend on mooring tension for arming and disarming, these processes being controlled through the mooring spindle on the base plate. To date, five different types or base plates have been recovered and are arbitrarily designated Types A, B, C, D and E. The base plate fitted to Mine Type CM, a special type, is not considered here. General characteristics, common to all five types, are given below:
 - (a) All base plates are fitted with straight-shank mooring spindles which are withdrawn by mooring tension against tension of a coil spring mounted on the inside of the base plate.
 - (1) The withdrawn or retracted condition can be determined by checking the alignment of the respective safety pin holes in the mooring spindle and the mooring spindle boss.
 - (i) If the holes are aligned the spindle has retracted.
 - (ii) If the holes are not aligned the spindle is fully or partly withdrawn.
 - (2) Withdrawal of the mooring spindle performs the following functions:
 - (i) It trips the booster release lever.
 - (ii) It arms the SDM.
 - (iii) It closes the mooring safety switch.
 - (b) The booster release lever is mounted in the booster tube and is connected, by means of a mechanical linkage, to the mooring spindle. The lever holds the booster in the "Safe" position above the detonator until the mooring spindle is withdrawn, at which time the lever is tripped and the booster is freed to drop over the detonator.
 - (c) The SDM may be either an electrochemical internal horn (often referred to as the "eighth horn") used in the Type C base plate, or a rotary, two-position switch used in the Type B or D base plates.
 - (1) The horn-type SDM is mounted in a casting secured to the inside of the base plate by four bolts. Its operation is controlled by a mechanical linkage connected to the mooring spindle. Withdrawal of the spindle allows a cocking pin to move to the armed position and retraction of the spindle pivots the cocking pin, and releases a spring-loaded firing pin which shatters the electrolyte ampoule. The electrolyte then runs into a battery energizing it and producing a momentary current sufficient to fire the detonator and main charge, if the SDM is in the firing circuit.
 - (2) The switch-type SDM is mounted on a bracket on the inner end of the mooring spindle and is connected to the base plate by a mechanical linkage. Withdrawal of the spindle carries a small pin into position behind a cam. Retraction of the spindle carries the cam back with the pin and closes the switch.
 - (d) The various base plates use the following types of mooring safety switches:
 - (1) With base plate Type A a switch consisting of four contacts, two of which are mounted on the mooring spindle and two on the mooring spindle housing. Withdrawal of the spindle makes the contacts, arming the norn circuit. Retraction of the spindle breaks the contacts, disarming the horn circuit.

Нешы ткв	1350 from boos- Considered obsolete	Secured by 19 135° from boos- Considered obsoles- bolts ter tube	Fitted with lower antenna gland 1800 from booster tube. Cland blanked off with a hexagonal cap if no antenna is fitted.		Fitted with Tombac firing device gland, 1806 from *A.E. switch and with mooring spindle lock- ing defent, 1800 from booster tube.
Location of "A-E" Switch	1350 from booster tube	135º from boos- ter tube	90° from booster tube	135º from boos- ter tube	900 from booster tube
How Secured	Secured by 20 bolts	Secured by 19 bolts	Secured by 20 bolts	Secured by 19 bolts	Secured by 18 bolts
MOS	Chemical horn mounted in top of mooring spindle	Rotary two position switch	Chemical horn mounted beside mooring spindle	Rotary two position switch	None
Type of Booster Tube	8 1/2" long, op- en at top.	18" long, clos- ed at top.	18* long, clos- ed at top.	15" long, clos- ed at top.	15" long, closed at top.
Mooring Spindle Delay	Two oil dash pots	Two oil dash pots	Soluble	Two oil dash pots	Soluble
Material	Gunmetal	Steel	Steel	Steel	Steel
Diameter (in)	15	15	15	11 1/2	11 1/2
Where Used	GX and GY	GX and GY	GX and GY	20	GR
Base Plate	Type A	Type B	Type C	Type D	Type E

Table 2 - Standard German Base Plates

(Introduction, Cont'd.)

- (2) With base plates Types B and D a two-position rotary switch mounted on a bracket on the mooring spindle and connected to the base plate by a mechanical linkage. Withdrawal of the mooring spindle closes the switch, arming the horn circuit. Retraction of the spindle opens the switch, disarming the horn circuit.
- (3) With base plate Type C a switch consisting of two main parts: a cylindrical, bakelite housing mounted on the base plate and enclosing the inner end of the mooring spindle; two bakelite-covered brass cylinders mounted one above the other on the inner end of the mooring spindle. The latter are fitted with brass contact plees and the former with spring-loaded contacts. Withdrawal of the spindle pulls down the two cylinders with respect to the housing so that the contact pieces make their respective contacts, arming the horn and SDM circuits. Retraction of the spindle breaks the upper set of contacts, disarming the horn circuit. The lower set is in the SDM circuit and remains closed, being locked by a spring-loaded detent.
- (4) With base plate Type E a switch consisting of eight contacts, four of which are mounted on a cross-head on the mooring spindle and four on the mooring spindle housing. Withdrawal of the spindle makes the contacts, arming the horn circuit. Retraction of the spindle breaks the contacts, disarning the horn circuit. However, the mooring spindle is designed to lock in the "out" position.
- (e) A detonator carrier is fitted in a well located externally on the base plate beside the mooring spindle and is held in place by a strongback and a single set screw. The screw fits into a boss on the detonator carrier and is secured by a "U" pin which fits into an annular groove on the set screw. Two spring-loaded contacts are mounted on the inside of the base plate, extending vertically upward and then bending at an angle of 90° to enter the booster tube. These contacts make similar contacts on the detonator carrier when it is inserted in the booster tube.
- (f) A spindle which controls an internal, two-position rotary switch is mounted at either 90° or 135° from the detonator carrier. A red arrow is stemped on its face to indicate the switch setting and the letters "A" and "E" are stamped on the part of the base plate adjoining. This switch is in the circuit of the SDM except in base plate Type E where it is in the circuit of the "tombac" anti-sweep device. If the arrow points to "A" (painted white), the switch is open and the SDM or "tombac" is not in the circuit. If the arrow points to "E" (painted red), the SDM or "tombac" is in the circuit and both should operate as designed.
- (g) A soluble plug holder may be found alongside the mooring spindle, secured by a strongback. A black, plastic disc, about 1/2" in diameter, is fitted in the strongback. Withdrawal of the mooring spindle upon dissolution of the soluble plug pushes this disc out of the strongback. Note that the presence or absence of this disc provides a positive means of determining whether or not the mine has ever armed.
- (h) In some cases, the following additional base plate fittings may be found:
 - (1) A gland for connecting a lower antenna or "tombac" antisweep device.
 - (2) A slotted screw plug for applying a circuit tester.
- (i) See Table No. 2 for further base plate details and dimensions.
- 4. The following procedure should be employed to remove detonators and boosters from mines which take base plates of the type described above:
 - (a) Unscrew the set screw in the center of the detonator carrier strongback until the seal is broken and the detonator carrier starts to withdraw.
 - (b) Pull out the "U" pin.
 - (c) Remove the set screw and swing the strongback clear.



Detonator Carrier Set Screw

(Introduction, Cont'd.)

- (d) Remove the detonator carrier.
- (e) Press in the two spring-loaded contacts and remove the booster. If such a procedure is impractical, remove the base plate and then remove the booster.
- The following general precautions should be observed when dealing with all German contact mines:
 - (a) Do not bend or damage the horns.
 - (b) Keep clear of all antennae, snag lines or "tombac" anti-sweep devices which may be fitted.
 - (c) Do not move or jar the mine except from a safe distance.
 - (d) Keep clear of all flooder plates until the position of the mooring spindle has been determined. All flooder devices are rendered inoperative upon retraction of the mooring spindle.
 - (e) Check the mooring spindle and "A-E" switch. Do not attempt RMS except in extreme emergency:
 - (1) If the mooring spindle is withdrawn and a safety pin cannot be inserted in the hole provided.
 - (2) If the "A-E" switch is set on "E".

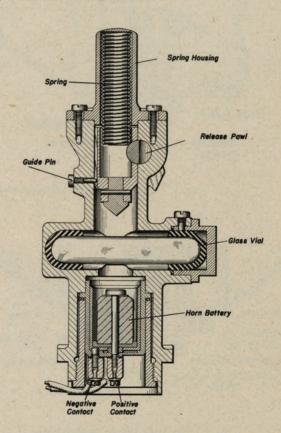


Fig. 4 - Electrochemical SDM ("eighth horn")

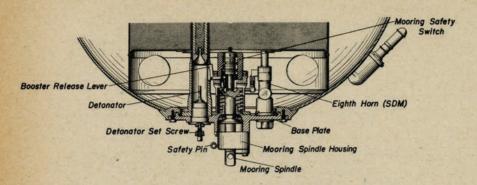


Fig. 5 - Base Plate Type C, Sectional View

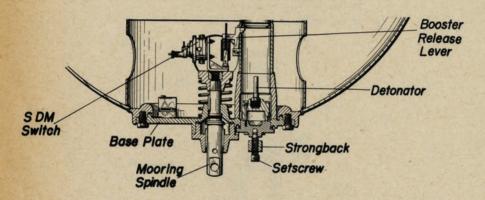


Fig. 6 - Base Plate Type D, Sectional View

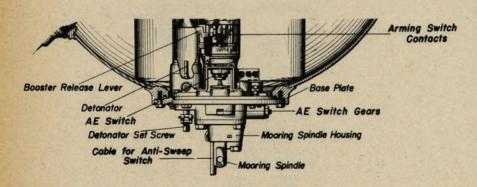


Fig. 7 - Base Plate Type E, Sectional View

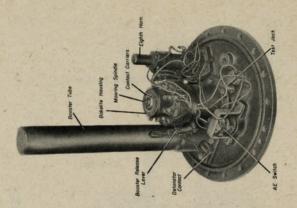


Fig. 8 - Base Plate Type C, Top View

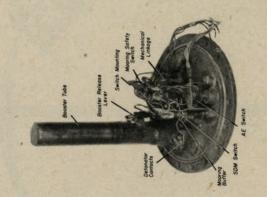


Fig. 9 - Base Plate Type D, Top View

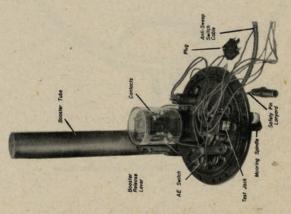


Fig. 10 - Base Plate Type E, Top View

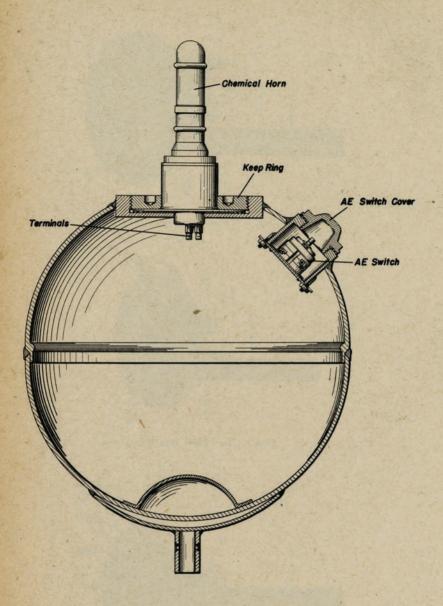


Fig. 11 - Mine Type GJ1, Sectional View

Mine Type GJ1 (GJ2 and GJ3)

General

- 1. Moored or ground, contact, chemical horn mine, laid by surface craft.
- 2. German designation unknown.
- Defensive mine for use in shallow water. May also be used as an antivehicular land mine on beaches or as a demolition charge. When used as a land mine, it is buried in the sand in a manner similar to the Types JE and JG mines.

Description

1. Case

Shape Slliptical
Color Black
Material Steel
Diameter 15"

Charge 25 lbs. approx.

Total weight in air 65 lbs. approx.

2. External fittings

Hern One, on top center of case, secured by keep ring.

Base plate In center of lower hemisphere.

Pockets

Four, staggered around upper hemisphere; three blank, fourth contains "A-E switch."

Lifting eyes Two, 180° apart on upper hemisphere.

- 3. Mine Type GJ2 differs from Mine Type GJ1 as follows:
 - (a) It is fitted with two horns on its upper hemisphere, 1800 apart, 900 from pad eyes. No horn is fitted to the top center of the case.
 - (b) It has not been found fitted with an "A-E" switch.
- 4. Mine Type GJ3 differs from Mine Type GJ1 as follows:
 - (a) It is fitted with neither "A-E" switch nor horns and is believed to be used as a demolition charge, possibly in conjunction with a delay clock.
 - (b) It has a booster tube to take standard diameter detonator and booster.

Operation

- Because no complete mines of this type have been recovered, information is not available as to the manner of depth-taking and mooring, the function of the "A-E" switch, or the method of housing the detonator.
- 2. Standard chemical horn firing.
- 3. No self-disarming devices are fitted.

Precautions

Due to the lack of information regarding this mine and the possibility
of its being used as a delayed action demolition charge, no attempt
should be made to render it safe except in extreme emergency.

RMS (tentative)

- 1. GJ1
 - (a) Remove the chemical horn keep ring.

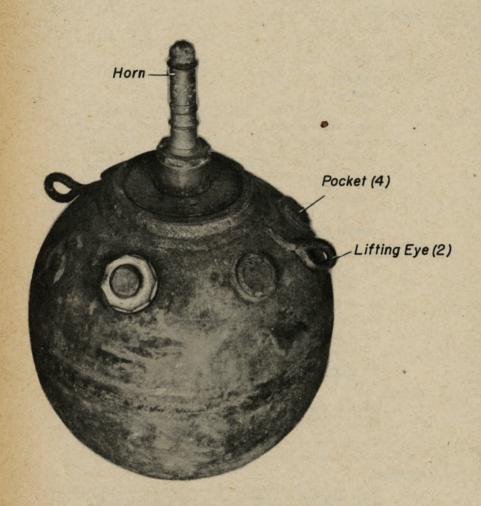


Fig. 12 - Mine Type GJ1

(Mine Type GJ1 (GJ2 and GJ3), Cont'd.)

- (b) Remove the horn assembly; cut and tape each lead separately.
- (c) Remove the detonator.
- (d) Remove the booster.
- (e) Dispose of detonator, booster and charge.
- 2. GJ2
 - (a) Remove the cover plate.
 - (b) Cut and tape separately all leads to the detonator and horns.
 - (c) Remove the detonator.
 - (d) Remove the booster.
 - (e) Dispose of detonator, booster and charge.
- 3. GJ3
 - (a) None known.

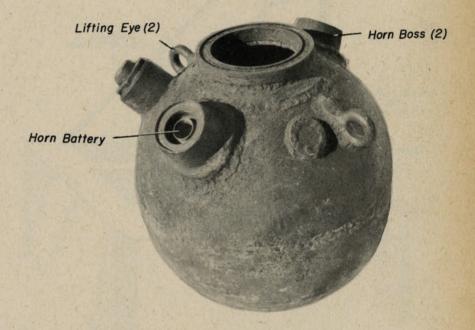


Fig. 13 - Mine Type GJ2

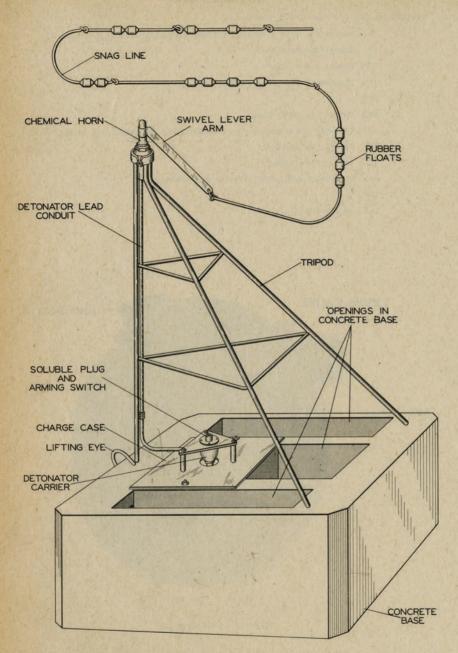


Fig. 14 - Mine Type GK, Elevation

Mine Type GK

General

- Ground, contact, chemical horn mine, laid by surface craft. Usually fitted with snag line.
- 2. German designation, "KMA".
- Anti-invasion mine, for use in maximum depth of water of 30 ft. against landing craft.

Description

1. Base

Shape

Color

Material

Length Width

Height

Charge

Rectangular, recessed concrete block, fitted with steel tripod 5'6" high on top.

cop.

White or gray (unpainted).

Concrete

47"

47"

47"

20" approx.

00.

162 lbs. cast Hexanite.

2090 lbs. approx.

2. External fittings

Overall

Horn

Charge container

Total weight in air

One, on top of tripod.

16 1/2" x 15 3/4" x 10 3/4", rounted in base. Fitted with cover, secured by two studs.

Detonator and booster housing

Plastic framework 62" long, 274 diam., on cover of charge container. Contains opening inside for detonator leads.

Detonator lead conduit

Extends from horn battery to detonator and booster housing; married to forward leg of tripod.

Swivel lever arm (for use with snag line)

Mounted on horn.

with snag line)
Lifting eyes

Three; one forward on base below forward leg of tripod; two aft on base.

Solubie plug gear and arming switch On top of detonator and booster housing.

Operation

- 1. Dissolution of the soluble plug permits the spring-loaded arming switch to close and arm the mine.
- 2. Standard chemical horn firing, either by direct contact or by tension on the snag line.
- 3. No self-disarming devices are fitted.

Precautions

 Do not remove the chemical horn underwater before breaking the arming switch.



Fig. 15 - Mine Type GK

(Mine Type GK, Cont'd.)

RMS

- 1. Remove the knurled nut inside the soluble plug cage.
- Screw special RMS tool (Fig. 16) onto threaded spindle and screw all the way home, thus withdrawing the spindle gently and breaking the arming switch.
- If the mine is underwater, raise it to the surface and dispose of detonator, booster and charge.

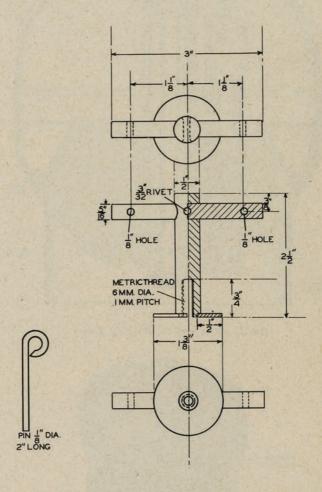


Fig. 16 - RMS Tool for Mine Type GK

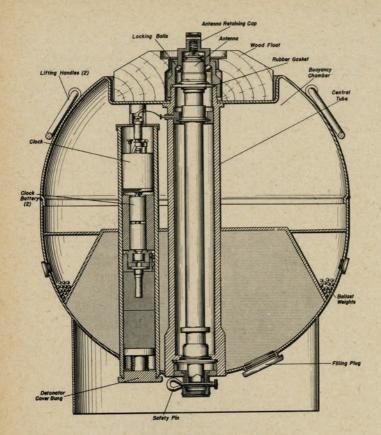


Fig. 17 - Mine Type GL, Sectional View

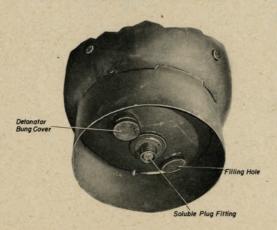


Fig. 18 - Mine Type GL, Bottom

Mine Type GL

General

- 1. Drifting, contact antenna-switch mine, laid manually.
- 2. German designation, "K. Tr. Mi. 41".
- Offensive mine, for use in rivers and harbors against bridges, dams, docks etc. Normal depth of case when drifting is one foot.

Description

1. Case

Shape Oval, with 475 skirt around base. Antenna protrudes from top center of case.

Color Dark green
Material Steel
Diameter 15"

Length
Overall (includes antenna)
Case
6'9"
18"

Charge 25 lbs. cast TNT.

Total weight in air 76 lbs.

2. External fittings

Antenna 5'3" long, brass, fitted to top of case. Consists of five telescopic, spring-loaded sections. Fitted with four snag wires at top.

Detonator cover bung 2 1/8" diam., 2 3/4" from center of bottom of mine.

Filling plug Screwed into base, 2 1/8" diam., 3 1/2" from center.

Wood float

774 diam., recessed into top center of case prior to laying. Free to rise and fall on lower section of antenna after mine is armed.

Soluble plug fitting In base of antenna housing.

Operation

- A safety pin is withdrawn from the base of the antenna prior to launching. When the mine is launched, dissolution of the soluble plug allows the lower section of the antenna to be forced downward, releasing locking balls and the antenna retaining cap, and allowing the antenna to extend to its full length. The wooden float takes position depending on the buoyancy of the mine which is then fully armed.
- Mine fires when the antenna is bent in any direction against its internal contact ring. A self-destroying clock with a maximum period of six hours may be fitted.
- 3. No self-disarming devices are fitted.

Precautions

- 1. Never attempt RMS by disassembly.
- Do not approach the mine unless absolutely necessary because the clock may fire the charge at any time.
- Although no RMS procedure can be recommended, the following countermeasures are suggested:
 - (a) If found floating, sink or explode by gunfire.

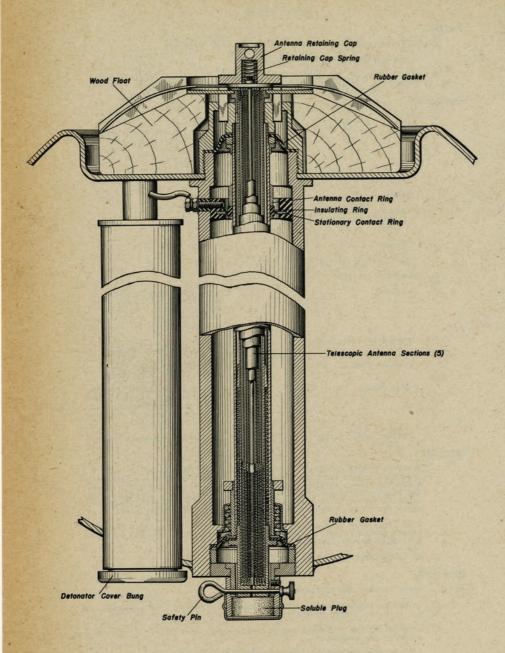


Fig. 19 - Mine Type GL. Antenna Housing and Release Gear, Sectional View

(Mine Type GL, Cont'd.)

(b) If found beached, haul a charge into position from a safe distance with all personnel taking cover and countermine.

RMS

1. No RMS procedure has been developed.



Fig. 20 - Mine Type GL

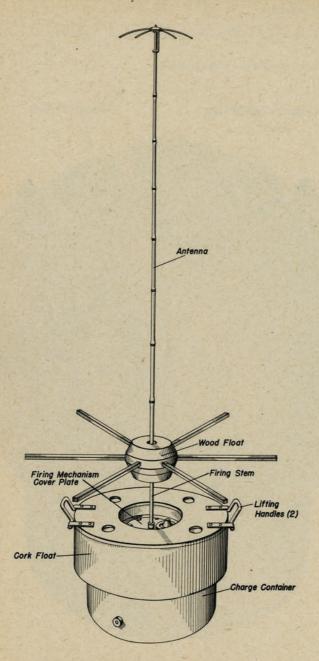


Fig. 22 - Mine Type GL-P, Elevation View

Mine Type GL-P

General

1. Same as Mine Type GL except that the German designation is not known.

Description

1. Case

Shape

Color

Material

Diameter Length

Charge

Total weight in air

2. External fittings

Antenna

Firing mechanism cover plate

Wood float

Lifting handles

Cylindrical with antenna protruding from top center of case.

Green or brown

Wood

17 3/4" 6 1/4"

44 lbs. TNT with Tetryl booster.

66 lbs.

4 1/2 ft. long, bamboo or hazelwood, fitted to top of metal firing stem on top center of case.

Threaded into well on top center of charge container.

Secured to firing stem, fit-ted with six wooden contact arms, each 13" long.

Two, 1800 apart, on top edge of case.

Operation

- 1. Mine is armed by a ten-minute arming clock in the firing mechanism.
- Mine fires by percussion upon impact. The arming clock is believed to be fitted with a self-destroying featur which will explode the charge after a maximum delay period of six hours.
- 3. No self-disarming devices are fitted.

Precautions and RMS

1. Same as Mine Type GL.

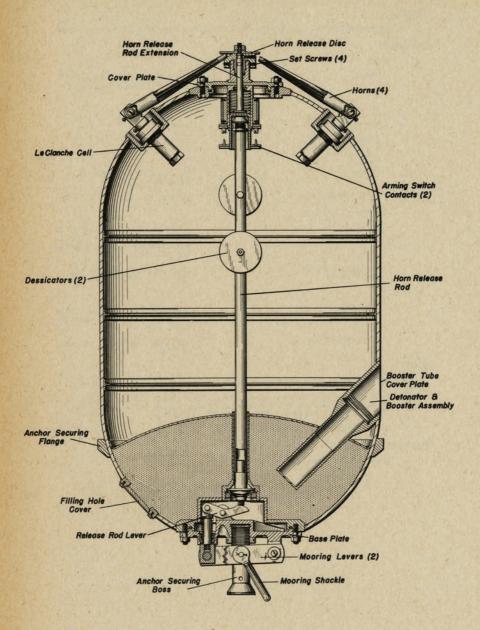


Fig. 23 - Mine Type GM, Sectional View

Mine Type GM

General

- Moored, contact, Le Clanche cell horn mine, laid by direraft or surface craft.
- 2. German designation, "BMC".
- Offensive or defensive mine, for use in maximum depth of water of 450 ft. against surface craft.

Description

1. Case

Shape

Two hemispheres, joined by a 22" cylindrical midsection.

Color

Material

Diameter

Length

Charge

Total weight in air

2. External fittings

Horns

Cover plate

Base plate

Horn release disc

Booster cover plate

Filling hole cover

Dark gray

Steel

26"

120 lbs. cast Hexanite

380 lbs.

Four, equally spaced around upper hemisphere, 11" from center.

8" diam., in center of upper hemisphere, flush type, se-cured by eight bolts.

ll" diam., in center of low-er hemisphere, flush type, secured by 16 bolts. Fitted with mooring lever and anchor securing boss.

2 3/4" diam., 1 3/8" above center of cover plate.

Oval-shaped, on cylindrical mid-section, 2 1/4" from an-chor securing flanges, se-cured by set screw.

4 1/4" diam., on lower hemisphere, 10 1/2" from center, secured by four bolts.

Operation

- 1. Mine takes depth by nydrostat. Mooring tension pulls out the mooring spinale against spring tension on the inside of the base plate. Withdrawal of the mooring spinale forces a catch upward, thereby actuating a horn release rod which extends through the longitudinal axis of the case to the cover plate. Movement of this rod forces the norn release disc upward, allowing the horns to snap out and lock in the "out" position, and closes the arming switch on the wiring panel. The mine is now armed.
- When a horn is bent, a brass tube at the base of the horn breaks, allowing sea water to enter a Le Clanche cell under the horn, energiz-ing it and producing a current sufficient to fire the detonator.
- The only self-disarming device is the arming switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.



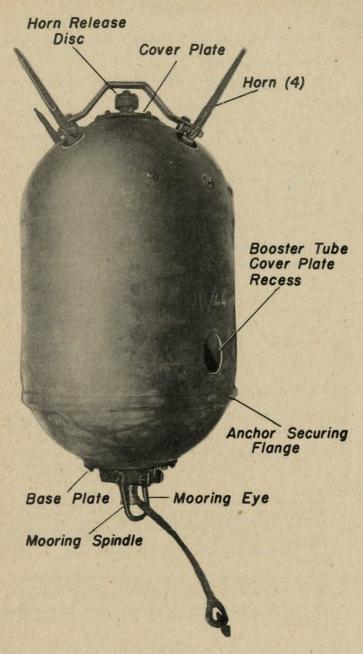


Fig. 24 - Mine Type GM

(Mine Type GM Cont'd.)

Precautions

- Note that the detonator and booster are permanently married and that the horns are of a particularly sensitive type.
- The fact that the mooring spindle has retracted is not a positive indication that the firing circuit is open because of the possibility of malfunction of the horn release rod assembly.

- 1. Remove the booster tube cover plate and the detonator cover keep ring beneath.
- 2. Remove the detonutor cover and bakelite spacer.
- 3. Cut and tape each detonator lead separately.
- 4. Remove the detonator and booster.
- Remove the cover plate and cut and tape separately each lead to the arming switch.
- 6. Dispose of detonator, booster and charge.

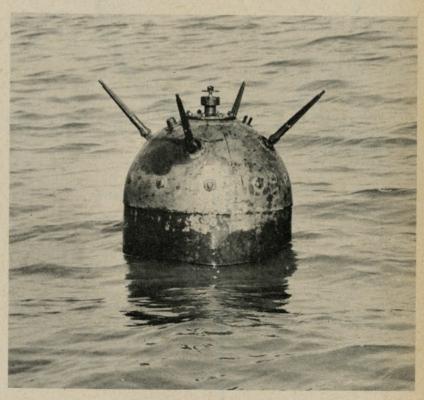


Fig. 25 - Mine Type GM, Floating

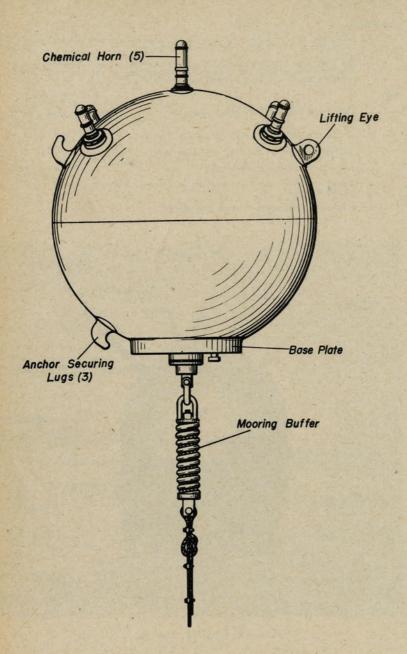


Fig. 26 - Mine Type GQ, Elevation

Mine Type GQ

General

- 1. Moored, contact, chemical horn mine, laid by surface craft.
- 2. German designation, "FMC."
- Offensive mine, for use in maximum depth of water of 470 ft. against surface craft.

Description

1. Case

Shape Spherical
Color Black
Material Steel

Diameter 29:25

Charge 88 lbs. block-fitted Hexanite.

Total weight in air 350 lbs. approx.

2. External fittings

Horns Five; one, in center of upper hemisphere; four, equally spaced around upper hemisphere.

Base plate Type D (modified). See Par. #1 below.

Anchor securing lugs Three; one on upper hemisphere, two on lower hemisphere.

Lifting eye On upper hemisphere

Operation

- Mine takes depth by plummet. Mooring tension pulls out the mooring spindle, closing the mooring safety switch and the "A-2" switch, tripping the booster release lever and the mine is armed. The "A-E" switch in this case serves only to open or close a switch in the horn circuit.
- 2. Standard chemical horn firing.
- The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension.

Precautions

1. See Introduction.

- 1. Remove the detonator and booster (see Introduction).
- 2. Remove the base plate; cut and tape each lead separately.
- 3. Dispose of detonator, booster and charge.

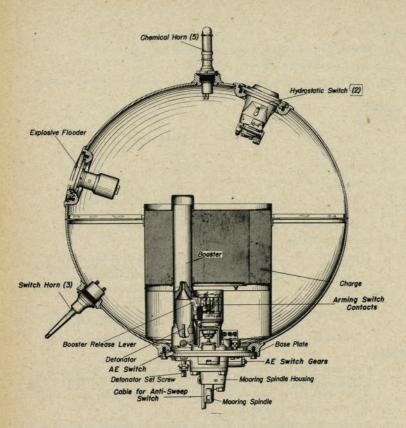


Fig. 27 - Mine Type GR, Sectional View



Fig. 28 - Mine Type GR, Floating

Mine Type GR

General

- Moored, contact, chemical and May be fitted with snag line. chemical and switch horn mine, laid by surface craft.
- 2. German designation, "UMB".
- Offensive or defensive mine, for use in maximum depth of water of 500 ft. Maximum depth of case when moored is 110 ft.

Description

1. Case

Shape

Color

Material

Diameter

Charge

Total weight in air

2. External fittings

Horns

Base plate

Hydrostatic switch covers

Explosive flooder cover

Securing lugs

Snag line (optional)

Spherical

Steel

3375

90 lbs. block-fitted Hexanite.

.420 lbs.

Bight: one, chemical, in center of upper hemisphere; four, chemical, equally spaced around upper hemi-sphere, 17" from center; three, switch, equally spac-ed around lower nemisphere, 17" from center.

Standard type E.

Two; 675 diam.; one, 775 from center of upper hemi-sphere; one, 17" from cen-ter of lower hemisphere.

6"5 dium., 23" from center of upper hemisphere.

Three; one, 20" from center of upper hemisphere; two, 200 apart 12" from center of lower hemisphere.

79 ft. long, secured to center of three ft. length of wire connecting two switch horns. When the mine is so rigged, the chemical horn directly above is blanked

- 3. (a) The hydrostatic scuttling switch on the upper hemisphere is an anti-shallow-plant hydrostat which controls a double-pole switch, normally made to one of its contacts. The hydrostat may be set to any one of four depths; 0, 5, 10 or 15 meters. If, upon laying, the mine moors at a depth shallower than that set on the hydrostat, the explosive flooder will fire upon closure of the mooring safety switch. If the mine moors correctly, (i.e. at a depth greater than that set on the hydrostat) the switch changes over to the other contact, permanently breaking the flooder circuit.
 - (b) The hydrostatic arming switch on the lower hemisphere is designed The hydrostatic arming switch on the lower healsphere is designed to open or close the firing circuit when the mine rises above or descends below a depth of six feet. A glycerine-filled dashpot delays the action of the switch for a period of 20 seconds. A screw plug, fitted to the center of the switch cover, is painted white when the switch is rigged to operate as described above. If the plug is painted red, however, it indicates that the switch has

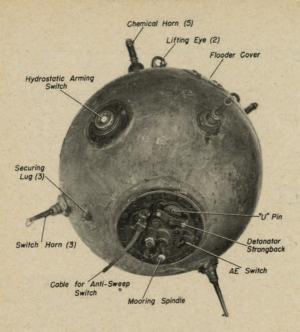


Fig. 29 - Mine Type GR



Fig. 30 - Mine Type GR

(Mine Type GR, Cont'd.)

been closed during assembly, being held in that position by a special extension arm added to the screw plug. In this case, the switch will not open under any circumstances.

Operation

- 1. Mine takes depth by plummet. The hydrostatic switch closes in six feet of water (if red screw plug is fitted, switch is permanently closed) and, if the mine moors at a depth greater than that set on the anti-shallow-plant hydrostatic switch, the flooder circuit is broken (see Par. 3 (a) above). Dissolution of a soluble plug allows mooring tension to pull out the mooring spindle, closing the mooring safety switch, and tripping the booster release lever and the mine is armed. A spring-loaded detent is usually fitted to lock the mooring spindle out.
- 2. Standard chemical or switch horn firing. An additional firing method may be incorporated by fitting a "tombao" anti-sweep tubing to the mooring cable. Upward movement of this tubing along the mooring cable, such as might be caused by a sweep wire contacting it, will close a switch on the tubing and fire the main charge. Mines fitted with snag lines will not normally be fitted with the 'tombao" anti-sweep device nor the locking detent on the mooring spindle.
- 3. The mooring safety switch is designed to disarm the mine by opening the firing circuit upon release of mooring tension except when the detent is fitted (see Par. 1 above). The hydrostatic arming switch is also designed to break the firing circuit if fitted with a white screw plug (see Par. 3 (b) of <u>Description</u>).

Precautions

 If any horn is bent or damaged, and if the screw plug in the hydrostatic arming switch is painted red, do not attempt RMS except in extreme emergency.

- 1. Remove the detonator and booster (see Introduction).
- 2. Remove the base plate; cut and tape each lead separately.
- 3. Remove the flooder plate and charge (if fitted).
- 4. Dispose of all explosive elements.

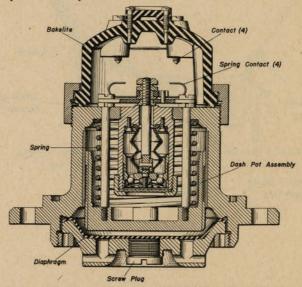


Fig. 31 - Mine Type GR, Hydrostatic Arming Switch, Sectional View

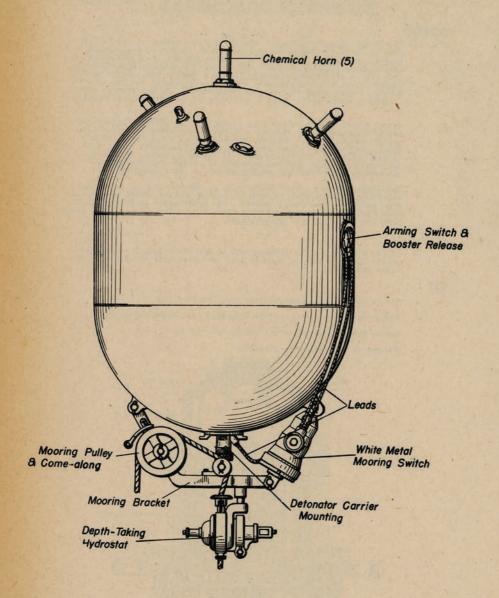


Fig. 32 - Mine Type GU,

Mine Type GU

General

- 1. Moored, contact, chemical horn mine, laid by surface craft or sub-
- 2. German designation, "EMA".
- 3. Offensive or defensive mine.

Description

1. Case

Color

Shape

Two hemispheres, joined by a 12" cylindrical midsection.

secti

Meterial Steel

Diameter 34"

Length 46"

Charge 360 lbs. block-fitted Hexanite.

Total weight in air 870 lbs. approx.

2. External fittings

Horns Five; one in center of upper hemisphere; four, equally spaced around upper hemi-

sphere.

Arming switch and On mid-section, secured by booster release keep ring.

Detonator carrier In bottom center of case.

Mooring bracket and white Bolted to two lugs on lower metal mooring switch hemisphere.

Mooring pulley and "come- Attached to extension of along" mooring bracket.

Depth taking hydrostat Bolted to extension on mooring bracket.

3. Two pair of electrical leads extend from the white metal mooring switch, one set to the detonator carrier, the other to the arming switch.

Operation

- 1. Mine takes depth by hydrostat. Separation of the anchor and case withdraws a safety pin from the arming switch and booster release, making the circuit from the horn batteries to the detonator and allowing the booster to drop over the detonator. Mooring tension extends the spindle of the white metal mooring switch, arming the circuit of the internal horn to arm the mine.
- 2. Standard chemical horn firing.
- 3. Early models of this mine were fitted with the same type of self-disarming device used by the Mine Type JA. (See Part VI, Chapter I.) However, the white metal mooring switch has been added to later models and is designed to shatter an internal horn and fire the mine upon release of mooring tension. It is possible that the "come-along" safety device might be fitted in conjunction with the white metal mooring switch to disarm the mine if the mooring switch failed to operate as designed, but no mines, so rigged, have been recovered.

Precautions

 Never move the mine until the leads from the white metal mooring switch have been cut and taped.

(Mine Type GU, Cont'd.)

Bear in mind that the white metal mooring switch is designed to fire
the mine charge upon release of mooring tension. Therefore, any mine
of this type found floating or beached should have fired and may fire
at any time.

- 1. Cut and tape separately each lead from the white metal switch to the detonator carrier.
- 2. Cut and tape separately each lead from the white metal switch to the arming switch.
- 3. Remove the detonator.
- 4. Remove the arming switch keep ring and the arming switch.
- 5. Unscrew the knurled cap from the top of the booster tube.
- 6. Unscrew the booster release mechanism wing nut, press back the catch, and remove the booster from the base of the mine.
- 7. Dispose of detonator, booster and charge.

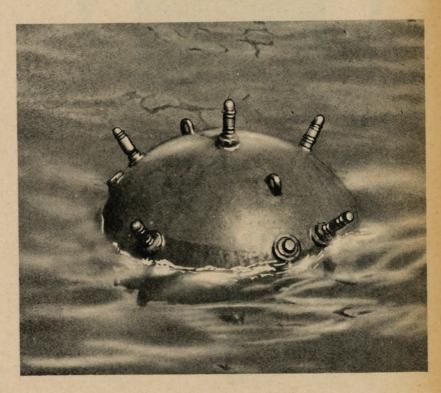


Fig. 33a - Mine Type GU, Floating

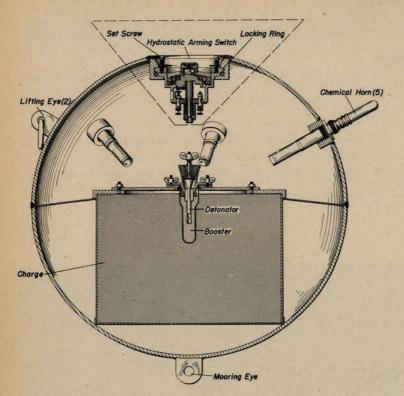


Fig. 34 - Mine Type GW, Sectional View

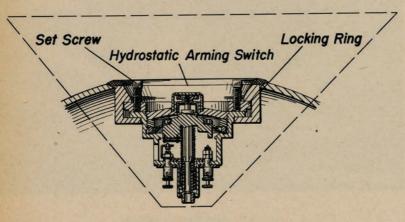


Fig. 35 - Mine Type GW, Hydrostatic Arming Switch

Mine Type GW

General

- 1. Moored, contact, chemical horn mine, laid by surface craft.
- 2. German designation unknown.
- 3. Defensive mine, for use in maximum depth of water of 300 ft. against

Description

1. Case

Shape Color Material

Steel 34" Diameter

150 lbs. cast TNT or Hexanite. Charge

Total weight in air 375 lbs. approx.

2. External fittings

Five, equally spaced around upper hemisphere, 15" from Horns center.

Spherical

Dark gray

7%5 diam., in pocket in center of upper hemisphere, secured by locking ring with four set screws. Hydrostatic switch

Two, 180° apart, 19" from center of upper hemisphere. Fitted with lifting rings. Lifting eyes

In center of lower hemi-Mooring eye sphere.

Operation

- Mine takes depth by plummet. Dissolution of a soluble plug allows water pressure to depress the spindle of the hydrostatic switch, clos-ing the firing circuit and the mine is armed.
- 2. Standard chemical horn firing.
- The only self-disarming device is the hydrostatic switch which is de-signed to disarm the mine by opening the firing circuit upon release of hydrostatic pressure.

Precautions

1. Note that the detonator and booster are permanently married.

- 1. Loosen the four set screws in the hydrostatic switch locking ring.
- 2. Break the bayonet joint and remove the locking ring.
- 3. Remove the hydrostatic switch; cut and tape all leads separately.
- 4. Remove the detonator and booster.
- 5. Dispose of detonator, booster and charge.

Hydrostatic Switch Pocket

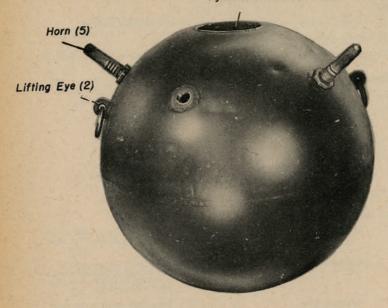


Fig. 36 - Mine Type GW

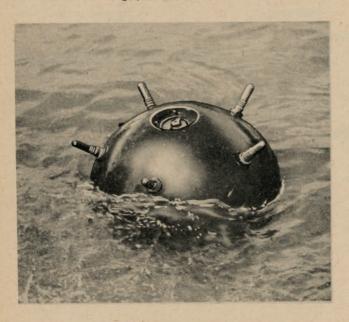


Fig. 37 - Mine Type GW, Floating

Mine Type GX (GX* GV)

General

- 1. Moored, contact, chemical horn mine, laid by surface craft.
- 2. German designation, "EMD".
- Offensive or defensive mine, for use in maximum depth of water of 1700 ft.

Description

1. Case

Shape Spherical
Color Black
Material Steel
Diameter 40"

Charge 330 lbs. block-fitted Hexenite.

Total weight in air 775 lbs. approx.

2. External fittings

Horns Five; one in center of cover plate; four equally spaced around upper hemisphere, 20" from center.

Cover plate 775 diam., in center of upper hemisphere, flush type, secured by 10 bolts.

Base plate Standard Type C.

Lifting eyes Two, 1675 apart, 2275 from center of upper hemisphere.

Securing lugs

Five; one 22.75 from center of upper hemisphere; one 31" from center of lower hemisphere; three, staggered, 12" from center of lower hemisphere.

- 3. Mine Type GX* differs from Mine Type GX as follows:
 - (a) It is fitted with an additional small cover plate, 675 diam., equidistant from the lifting eyes and 25" from the center of the upper hemisphere. Under this plate is a threaded boss which may take an explosive rlooder. When the flooder is fitted, the horn on the cover plate is blanked off with a small plate, beneath which is an 80-day clock.
- 4. Mine Type GV differs from Mine Type GX* as follows:
 - (a) Its German designation is, "MD mit antennenzundung".
 - (b) It is fitted with an upper antenna.
 - (c) No horn is fitted to its cover plate. An electrode plate mounted on a plastic cover plate replaces the cover plate fitted to Mine Type GX*. The plastic cover plate is secured to the case by 10 bolts. An upper antenna connector is fitted to the plastic cover plate, 1/2" from the center. The 80-day clock and flooder may be fitted as in Mine Type GX*.

Operation

- Mine takes depth by plummet. Mooring tension pulls out the mooring spindle, which closes the mooring safety switch, trips the booster release lever and arms the mine.
- 2. Standard chemical horn firing.

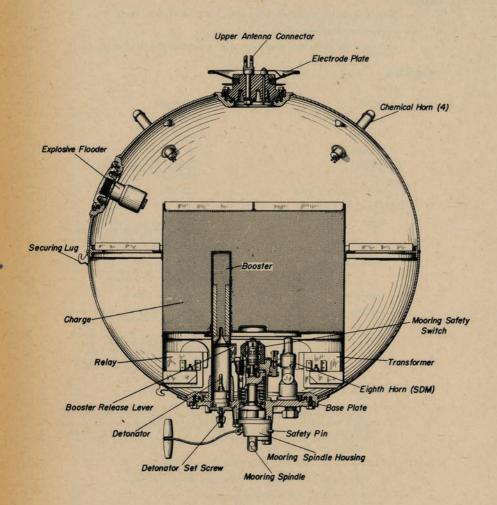


Fig. 38 - Mine Type GV, Sectional View

(Mine Type GX (GX* GV), Cont'd.)

3. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension. If the "A-E" switch is set to "E", however, the mine should fire upon release of mooring tension.

Precautions

1. See Introduction.

- 1. Remove the detonator and booster (see Introduction).
- 2. Remove the base plate; cut and tape each lead separately.
- 3. Remove the flooder plate and charge (if fitted).
- 4. Remove the cover plate and the 80-day clock (if fitted).
- 5. Dispose of all explosive elements.

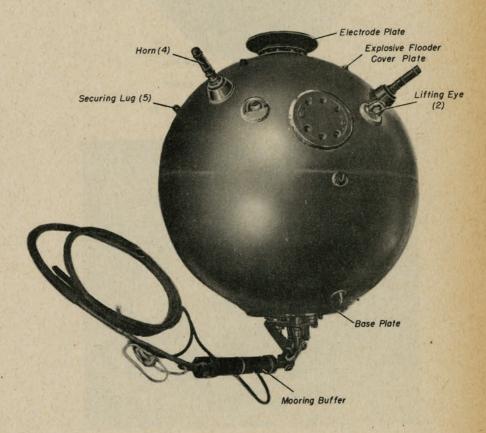


Fig. 39 - Mine Type GV



Fig. 40 - Mine Type GX*

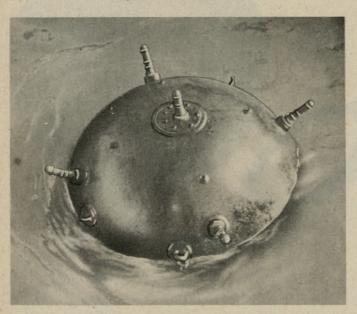


Fig. 41 - Mine Type GX*, Floating

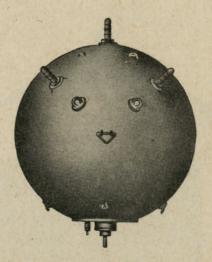


Fig. 42 - Mine Type GX,

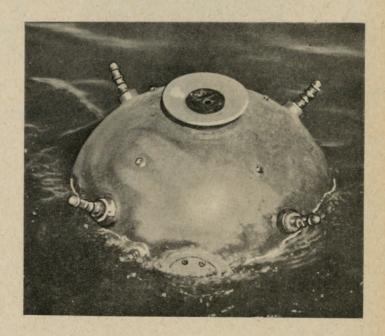


Fig. 43 - Mine Type GV, Floating

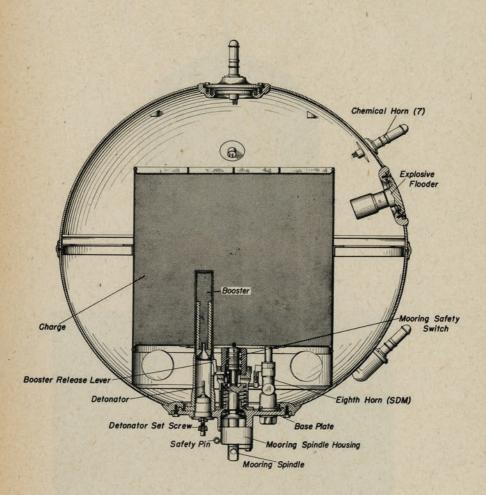


Fig. 44 - Mine Type GY*, Sectional View

Mine Type GY (GY*) (GV*)

General

- 1. Moored, contact, chemical horn mine, laid by surface craft.
- 2. German designation, "EMC".
- Offensive or defensive mine, for use in maximum depth of water of 1700 ft. Maximum depth of case when moored is 100 ft.

Description

1. Case

Two hemispheres, joined by a 2" cylindrical mid-section. Shape

Color Black Material Steel Diameter 46"

Length 4815

660 lbs. block-fitted Charge Hexanite.

Total weight in air 1390 lbs.

2. External fittings

Horns

Seven: one in center of cover plate; four equally spaced around upper hemisphere, 22" from center; two, on brackets, 39" apart, 17" from center of lower hemisphere.

7 1/2" diam., in center of upper hemisphere, flush type, secured by 10 bolts. Cover plate

Base plate Standard type C.

Two, 19" apart, 22" from center of upper hemisphere. Lifting eyes

- 3. This mine has been found rigged as follows:
 - (a) All lower horns blanked off.
 - (b) The horn on the cover plate replaced by a plate fitted with an eye to which was attached a 10 ft. wire pendant and an elliptical float.
 - (c) The spring omitted from the base plate resulting in permanent closure of the mooring safety switch upon planting.
 - (d) Concrete ballast poured around the charge case to reduce the buoyancy.
 - (e) A metal, ring-shaped weight, weighing 236 lbs., secured to the mooring cable.
 - (f) An R.A.M. clock fitted inside the base plate, the clock being started by turning the "A-E" switch to "E".
 - A "tombac" anti-sweep device fitted to the mooring cable (see Mine Type GR).
- 4. Mine Type GY* differs from Mine Type GY as follows:
 - (a) It is fitted with an additional small cover plate, 6"5 diam., equidistant from the lifting eyes and 28" from the center of the upper hemisphere. Under this plate is a threaded boss which may be fitted with an explosive flooder.

0

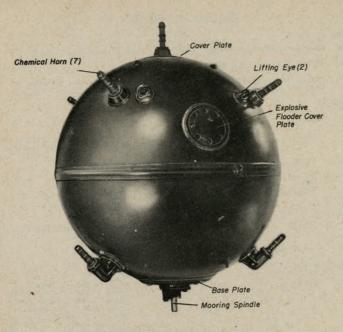


Fig. 45 - Mine Type GY*
Upper Antenna Connector

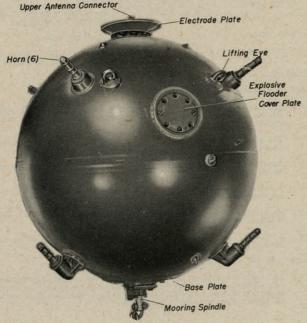


Fig. 46 - Mine Type GV*

(Mine Type GY (GY*) (GV*), Cont'd.)

 Mine Type GV* differs from Mine Type GY* in that it is fitted with the antenna attachments used with Mine Type GV. Its German designation is, "EMC mit antennenzundung".

Operation

- Mine takes depth by plummet. Mooring tension pulls out the mooring spindle, closing the mooring safety switch, tripping the booster release lever and the mine is armed.
- 2. Standard chemical horn firing.
- 3. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon release of mooring tension. If the "A-E" switch is set on "E", however, the mine should fire upon release of mooring tension.

Precautions

 If the mine is rigged as in Par. #3 of Description above, it will never disarm and is therefore especially dangerous if found floating or in the surf.

RMS

1. Same as Mine Type GX.



Fig. 47 - Mine Type GY, Floating

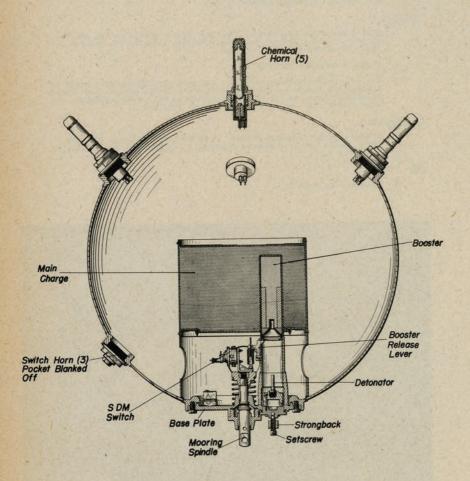


Fig. 48 - Mine Type GZ, Sectional View

Mine Type GZ

General

- 1. Moored, contact, chemical and switch horn mine, laid by surface craft.
- 2. German designation, "UMA".
- 3. Defensive mine, for use in maximum depth of water of 350 ft.

Description

1. Case

Shape

Material Diameter Charge

Total weight in air

2. External fittings

Horns

Base plate Lifting eye

Lifting lug

Spherical

Black Steel

32"

66 lbs. block-fitted Hexanite.

350 lbs. approx.

Eight: one chemical, in center of upper hemisphere; four, chemical, equally spaced around upper hemisphere, 15 1/2" from center; three, switch, equally spaced around lower hemisphere, 17" from center.

Standard Type D.

One, 19" from center of upper hemisphere.

One, 180° from lifting eye, 19" from center of upper hemisphere.

- 3. This mine has been found rigged as follows:
 - (a) The entire case surface camouflaged with green and white paint.
 - (b) All switch horns blanked off and the "A-E" switch and switch horn battery omitted.
 - (c) A metal, ring-shaped weight, weighing 194 lbs., secured to the mooring cable which may prevent the mooring spindle from retracting upon release of mooring tension.

Operation

- Mine takes depth by plummet. Mooring tension pulls out the mooring spindle, closing the mooring safety switch, tripping the booster release lever and the mine is armed.
 - 2. Standard chemical or switch horn firing.
 - 3. The only self-disarming device is the mooring safety switch which is designed to disarm the mine by opening the firing circuit upon relesse of mooring tension. If the "A-E" switch is set on "E", however, the mine should fire upon release of mooring tension.

Precautions

 If the mine is rigged as in Par. #3 of Description above, it probably will never disarm and is therefore especially dangerous if found floating or in the surf.

- 1. Remove the detonator and booster (see Introduction).
- 2. Remove the base plate; cut and tape each lead separately.
- 3. Dispose of detonator, booster and charge.

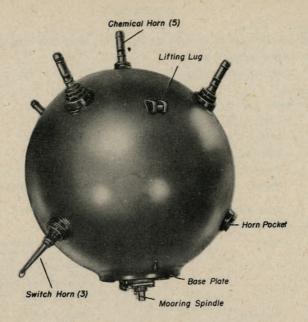


Fig. 49 - Mine Type GZ



Fig. 50 - Mine Type GZ, Floating

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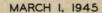
MINE DISPOSAL HANDBOOK

PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER 3

GERMAN TORPEDOES





GERMAN TORPEDOES

Length (in)	th Diameter) (in)	Pocket	Dimens	Dimensions Exploder Pocket	der	Exploder Used	Material	Torpedo Used	Markings	Material Torpedo Used Markings Provision for With
	-)iame	ter			100000000000000000000000000000000000000		Exploder
			Depth (in)	Inner (in)	Outer (in)					
91	21	Nose	22 1/2	4 1/4	7 1/2	P1-1 G7A-AZ G7A-MZ	Steel	т1, т2	Ка	4 holding screws
94	27	Nose	29	5 1/2	7 1/2	Pi-2, Pi-20	Bronze	T3	Kb, 318 or 32	4 holding screws
97	72	Nose	9 1/2	5 1/2	8 1/2	P1-3	Steel	TI	Ke, 31/82 or 82	Kc, S1/S26 screw holes or S2
94	21	Nose	16 1/2	5 1/2	8 1/2	P1-3		Tl	Kol, S2	
7	21 .	Top center line	13	3.1	3 1/2	P1-4c		T5	Kel, S2	3 screw holes
17	21	Top center	13	3.	3 1/2	P1-4c		T5	Ke, 31/32	
F5b 49 (Shallow Pocket)	18	Nose	7 1/4	4	9	F5S		F5b	None	Threuds for keep ring
64	18	Nose	19	4	6	F5S (?)	Bronze	F5b		
64	18	(2) Top center (2) 16 1/2 (2) 2 1/4 (2) 3 1/2 1/2 11ne	(2) 76 1/2	(1) 3 3/4 (2) 2 1/4	(2) \$ 3/4 (2) \$ 1/2	(1) P1428 (2) SIC Activator	Steel	Alreraft	GK2	(1) Threads for keep ring (2) Screw holes
64	18	Nose	п	3 3/4	5 3/4	P1428(el)		•	GK3	Threads for keep ring

Table 1 - German Torpedo Warheads



GERMAN TORPEDOES

Exploder	How Fired	Warhead Location	Arming Range(m)	No. of Whiskers	Warhead Known Used In	Remarks
Pi-1	Impact	Nose	150 or 300	4	Ka	B. Stell
Pi-le			1011	None	Ka	At Hotel
Pi-2	Impact Magnetic	"		4	Кр	
P1-2c			*	None	Kb	
P1-3			n	4	Кс	
P1-4c	Inertia Magnetic	Тор	Not known	None	Ke Kel	
P1428	Inertia	Nose		"	GK2	
Pi42s(el)	Inertia Magnetic	*	7		GK3	
F.5.S.	Impact			4	"F5B"	
G7A-AZ			150 or 300	4	Ka	Obsolete
G7A-MZ	Impact Magnetic			4	Ka	Obsolete

Table 2 - German Torpedo Exploders

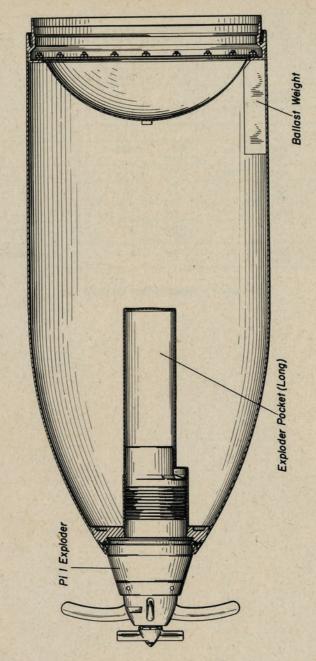


Fig. 1 - Ka Warhead, Sectional View

Introduction

- The torpedoes of the German Navy and Luftwaffe are 21" (53.3 cm) and 18" (45 cm) in diameter respectively and represent some of the most advanced stages of torpedo development now in service. All aircraftlaunched torpedoes are air-driven, while all the submarine-launched torpedoes, except T-l which is air-driven, utilize electric drive.
- 2. These torpedoes incorporate many intricate mechanisms which provide for eccentric tracking, homing on acoustic actuations and other actions of a similarly complex nature. Detailed information on the various torpedoes will not be presented here. This chapter will deal in detail with warheads and exploders only.

German Warheads

General

- 1. The accompanying table gives pertinent data with regard to all German warheads concerning which comprehensive information is available. It is possible for the various warheads to be used with many different torpedoes in various combinations. For this reason, and because the German policy with respect to use of warheads with torpedoes is not definitely known in all cases, the column headed, "Torpedoes Used With", lists only those torpedoes with which the warhead may definitely be assumed to be used, the information being verified either by recovery or reliable intelligence sources.
- 2. As noted in the table, the warhead designation is marked in black or grayish-white paint near the nose, along with various combinations of numerals with the letter "S". The significance of the latter is not known. In addition to these markings, many warheads contain a small, bronze plate on the warhead shell near the nose. This plate contains the warhead serial number and other data. A discussion of the various special fittings and accessories on and in the warheads follows below.

Kb Warhead

- 1. External
 - (a) Four screw holes, 9" abaft the nose, for securing the after ends of net cutters.
 - (b) Four single-lead jacks alongside the exploder pocket for receiving corresponding plugs on the exploder.

2. Internal

(a) A conduit, containing an electric cable, extends from the jacks to a battery connection projecting through the after bulkhead of the warhead.

Kc Warhead

- 1. External
 - (a) Four single-lead jacks alongside the exploder pocket as on Kb.
- Internal the following fittings are located between the after bulkhead of the warhead and the charge bulkhead:
 - (a) Two detecting coils, 4 1/2" in diameter, slightly forward of the after bulkhead on the top and bottom center lines, respectively.
 - (b) An amplifier unit on the starboard side and a battery on the port side.
 - (c) An air pressure switch on the charge bulkhead.
 - (d) A junction box on the charge bulkhead.
 - (e) Cables and leads as follows:
 - (1) A cable from each coil to the junction box.
 - (2) A cable from the junction box to the amplifier.
 - (3) A cable from the battery to the amplifier.
 - (4) A cable from the amplifier to the air pressure switch.
 - (5) A cable from the air pressure switch to the jack plugs.
 - (6) An air pressure line from the air pressure switch to a hole in the after bulkhead flange.

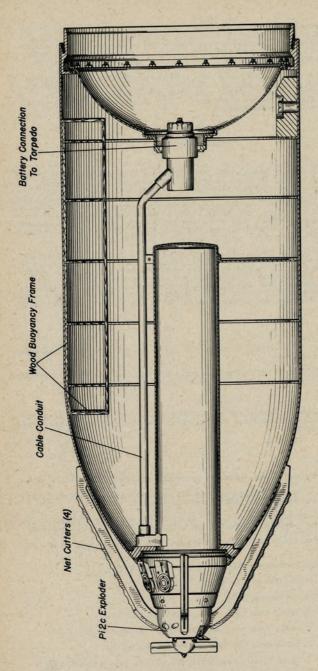


Fig. 2 - Kb Warhead, Sectional View

Pi-I Exploder

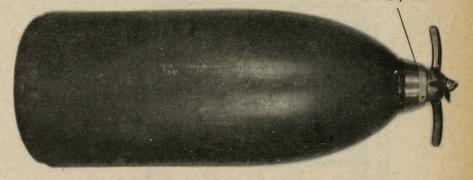


Fig. 3 - Ka Warhead

Pi2c Exploder

Net Cutters (4)

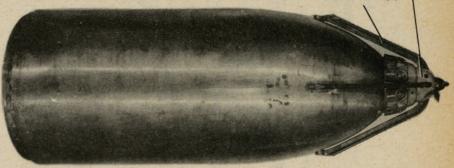


Fig. 4 - Kb Warhead

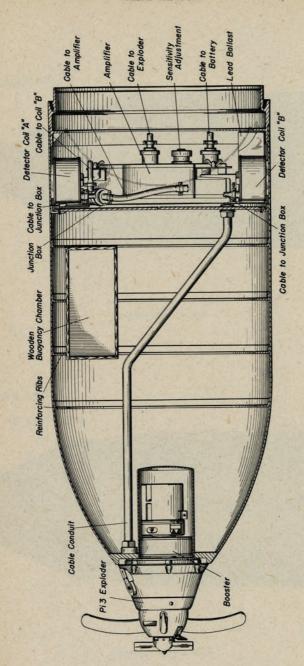


Fig. 5 - Kc Warhead, Sectional View

German Warheads (Cont'd.)

Kcl Warhead

- 1. This warhead differs from Kc as follows:
 - (a) Its exploder pocket is deeper.
 - (b) It is fitted with screw holes for securing net cutters, placed as

Kel Warhead

- External this warhead differs from all others recovered in that it does
 not comprise the nose section of the torpedo to which it is fitted,
 additional torpedo control gear being fitted forward of the warhead.
 Fittings are as follows:
 - (a) Two cover plates, 10 3/4" in diameter and secured by 16 bolts, on the top and bottom center lines, respectively, 7" abaft the forward edge.
 - (b) An impeller trough, 3" long and 1 1/2" wide, next to the exploder pocket.

2. Internal

- (a) Two detector coils mounted under the respective cover plates.
- (b) A junction box on the flange to which the after bulkhead secures.
- (c) A spring-loaded pin protruding through the bottom of the impeller trough
- (d) A solenoid around the bottom of the spring-loaded pin.
- (e) An activator coil around the exploder pocket.
- (f) A plug on the forward bulkhead.
- (g) Cables as follows:
 - (1) One from the junction box to the solenoid.
 - (2) One from the junction box to the activator coil.
 - (3) One from the junction box to a thin cavity along the after edge of the exploder pocket.
 - (4) One from a hole in the after bulkhead flange through a conduit to the plug on the forward bulkhead.
 - (5) One from a hole in the after bulkhead flange to each detector
 - (6) Two from holes in the after bulkhead flange to the junction box.

Ke Warhead

1. This warhead is very similar to the Kel, the main difference being that only one detector coil is fitted.

F5b Warhead

This warhead's German designation and the pistol ordinarily used with
it are not definitely known, although an F.5.S. pistol may be fitted
to the shallow pocket model. The warhead is arbitrarily designated,
"F5b", because it is known to be used with the torpedo so designated.
No special fittings are incorporated in either the smallow or deep
pocket model.

GK2 Warhead

- 1. External
 - (a) An SIC activator pocket 3 7/8" in diameter, on the top center line, 20 1/2" from the after edge,
 - (b) A pin fitted with a cross arm on top is mounted on each side of the activator pocket. A safety bar fitted with a spring and water flap is suspended between the pins prior to launching and serves to prevent the activator impeller from rotating.
- Internal this warhead is very similar internally to the Kc, differing as follows:

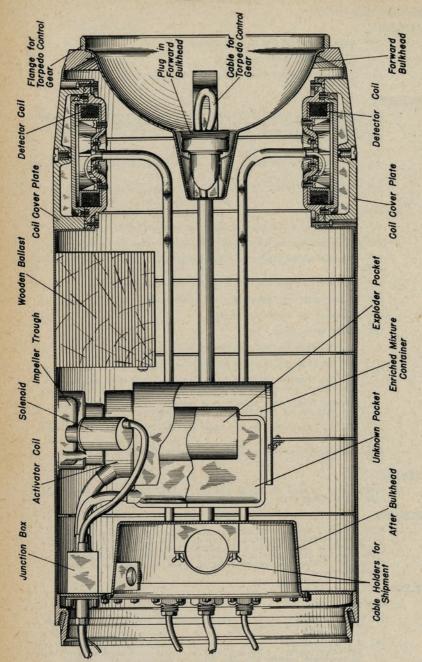


Fig. 6 - Kel Warhead, Sectional View



Fig. 7 - Kc Warhead

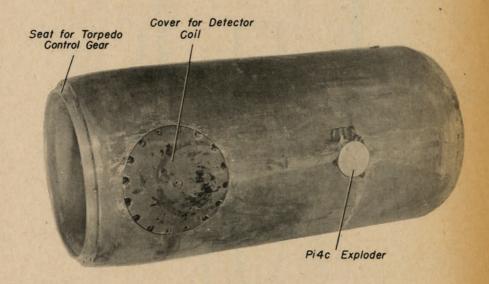


Fig. 8 - Kel Warhead

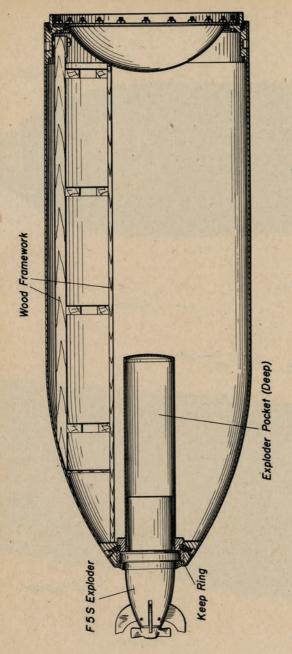


Fig. 9 - F5B Warhead, Sectional View

German Warheads (Cont'd.)

- (a) No pressure lead, pressure switch or junction box is fitted.
- (b) A test switch is fitted aft on the lower starboard side of the warnead shell.
- (c) Cables lead from the test switch to each of the coils and to the amplifier; an additional cable extending from the amplifier to switches on the after side of the activator pocket.

GK3 Warhead

- 1. External
 - (a) The warhead differs from the GK2 in that no SIC activator or accessories are fitted.
- Internal this warhead is very similar internally to the Kc, differing as follows:
 - (a) No pressure lead or pressure switch is fitted.
 - (b) The cable from the amplifier extends to the after end of the exploder pocket, ending in a six-lead plug inside the pocket. The P142s(el) exploder used with this warhead combines the functions of the SIC activator and the P142s exploder used with the GK2.

General Precautions

- The following precautions should be generally observed when dealing with German torpedoes:
 - (a) Carefully secure the propellers with a length of chain or other suitable means before beginning disposal operations. The propellers are dangerous and may start to run at any time.
 - (b) Do not move or jar the torpedo except from a safe distance.
 - (c) Do not move or turn the exploder arming impellers.
 - (d) Avoid all unnecessary contact with any firing whiskers which may be fitted.
 - (e) Allow no movement of magnetic material near the torpedo until its exploder has positively been identified as employing other than magnetic firing.
- Rendering safe German torpedoes involves disposing of the particular exploder which may be fitted. Consequently, the following describes briefly the operation of each exploder and gives the approved procedure for rendering it safe.

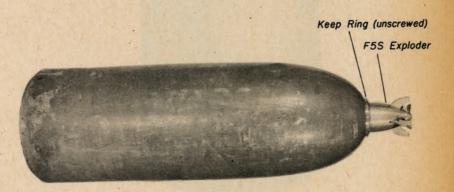


Fig. 10 - F5B Warhead

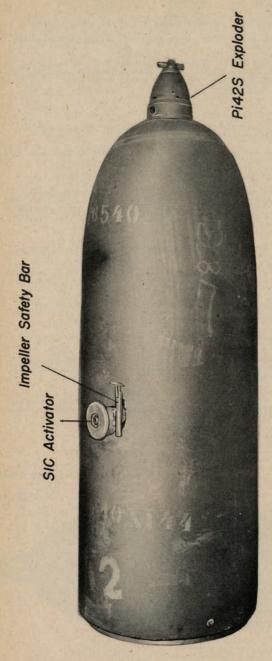


Fig. 11 - GK2 Warhead



Fig. 12 - GK3 Warhead

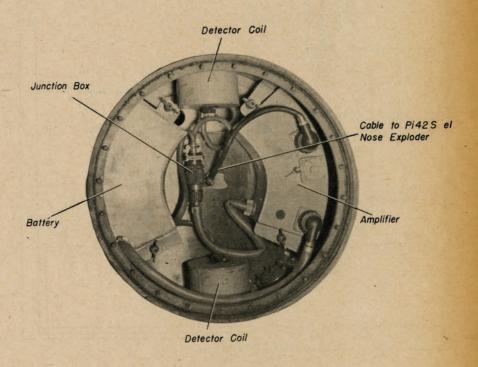


Fig. 13 - GK3 Warhead, After End View

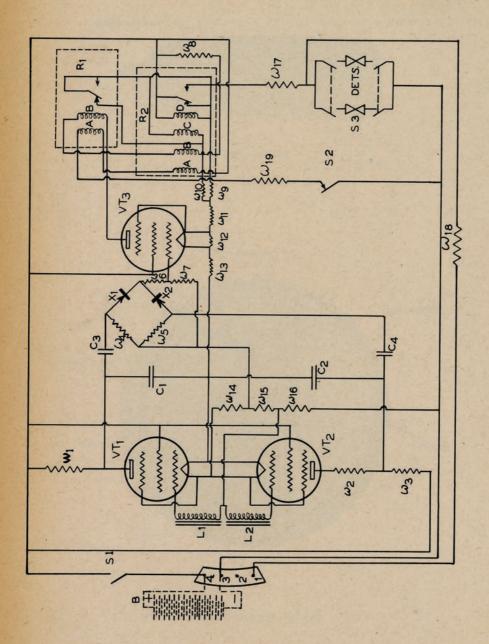


Fig. 14 - Pi-2 and Pi-2c Circuit Diagram

Pi-2 and Pi-2c Circuit - Operation

Arming

1. S₁ is closed manually prior to launching. When the torpedo is launched, B¹ is put in the circuit and energizes the A coils of R₁ and R₂ through S₂ and w₁₀. The A coils reset the relays and, when the arming distance has been run off, S₂ breaks and S₂ makes, deenergizing the A coils and putting the electric detonators in the circuit.

Normal Firing

- 1. The firing circuit consists essentially of three vacuum tubes, a full-wave rectifier, two relays and two electric detonators. The relays are normally closed to one of their contacts due to magnetic hold-on. The relay coils in the accompanying diagram are drawn so that current flow "down" through a coil causes the relay contact to swing to the "left" and vice versa.
- 2. When arming is complete, VT₁, VT₂ and VT₃ are heated in the circuit which includes w₀ and w₁₁-w₁₆. The tubes are biased to pass a small amount of current when so energized. A change of magnetic field induces current in L₁ and L₂, affecting the grid potentials of VT₁ and VT₂ in opposite directions, causing changing plate currents in these tubes. Each tube then feeds an output pulse to the full-wave rectifier circuit through C₃ and C₄.
- 3. The rectified output produces a more positive potential on the grid of VT, causing it to pass more plate current through the B coils of R, and Rp. Coil R₁B is the operating coil of R₁ and R₂B, the restraining coil of R₂. Current travels "up" through R₁B and "down" through R₂B, closing R₁ to the right contact if the change in magnetic field is sufficient.
- 4. Operation of R₁ breaks the shunt on R₂C, the operating coil of R₂, allowing it to pass current. R₂C is then energized and opposes R₂B. When the magnetic field falls off to a point where VT₃ does not pass sufficient current through R₂B to oppose R₂C, R₂ breaks its left contact, opening the circuit through R₂C and breaking the shunt of the booster coil R₂D. R₂D then makes R₂ to the right-hand contact, putting the battery across the detonators in series with w₁7. The circuit from contact #1 through w₁g is a test circuit and is not used during a firing actuation.

B - BATTERY - 104 VOLTS C1,C2,C3,C4,CONDENSERS 1Mfd EACH L1-SEARCH COIL 81,900-L2-SEARCH COIL 78,600-R1-RELAY#1 R1A-RESETTING COIL R1B-OPERATING COIL R2 - RELAY*2 ROA-RESETTING COIL ROB-RESTRAINING COIL R2C-OPERATING COIL ROD-BOOSTER COIL S 1-HAND-SET SWITCH ON PISTOL 2-ARMING SWITCH 3-DETONATOR PLUG CONTACTS VT1, VT2, VT3, - VACUUM TUBES

Fig. 15 - Pi-2 and Pi-2c Circuit Components

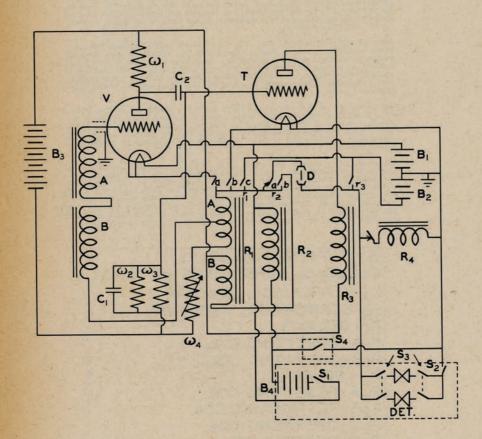


Fig. 16 - Pi-3 Circuit Diagram

Pi-3 Circuit - Operation

Arming

1. So is closed manually prior to launching. When the torpedo has run a short distance, So closes and Bo energizes Ro, causing it to operate ro. Operation of ro breaks roa and makes rob, putting Bo across both coils of Ro and across rheostat wo. Operation of Ro closes root, a, b, and c, causing Bo and Bo in series to heat the cathode of Vo and Bo to heat the cathode of T. When the arming distance has been run off, So closes.

Normal Firing

- 1. A and B are wired in series and wound in opposite directions so that the motion of the torpedo through the earth's field produces no effect on either one. When the torpedo passes near a magnetic mass, the field around A and B is distorted in such a manner and at a sufficient rate to produce a potential between the grid of V and w, via R1, the negative side of B3. This varies the plate current of V in such a manner as to produce a DC pulse across w. Through the comparative coupling C2, the pulse actuates the grid of T, allowing it to fire and make a complete circuit through B3, R3, the cathode of T, R1A and w4.
- 2. When R_2 is energized, it makes r_3 , putting B_2 across the detonators. The testing switch S_L and the buzzer R_L are parts of the original Italian SIC mechanism and are inoperative in this circuit.

Self-Destroying Feature

1. Pin D is incorporated if a self-destroying feature is desired. When the circuit is armed, B_L energizes R_2 continuously until the unit fires or comes to rest without firing. In the latter case, B_L eventually runs down, allowing R_2 to recover gradually. When this occurs, the shorting contacts of r_2 are closed at the same time. Since r_2 b is closed, R_1 is still energized and r_1 c is closed. If D is fitted, B_2 is then put across the detonators through r_1 c, r_2 a and D.

```
A - THERMOSTATIC SWITCH - (CLOSED AT > 23^{\circ}F & <95^{\circ}F)  
B<sub>1</sub> - BATTERY - 13.5 VOLTS  
B<sub>2</sub> - " - 1.5 "
B<sub>3</sub> - SEA BATTERY - (PSE MARK IX) FORMED BY MOISTURE IN UNIT.

C<sub>1</sub> - CONDENSER - MFD.
C2-
C3-
C4-
 C5-
C6- "- "- "
D - THERMAL DELAY SWITCH & HEATER (40 SEC.)
F - MASTER SWITCH - (CLOSED AT < 15 FT.)
H_1H_2 - HYDROSTATIC SWITCH - (CLOSED AT < 15 FT.)

K - NEEDLE SWITCH

L_1L_2 - FILTER CHOKES
Lx - AUXILIARY COIL
Ly - COMPENSATING COIL
M - MICROPHONES (4)
N,Y,Z - THERMISTORS
     - POTENTIOMETER
R<sub>1</sub>R<sub>2</sub> - SOLENOID RELAYS
R<sub>3</sub> - SENSITIVE RELAY
S - LATITUDE ADJUSTER COIL
T<sub>1</sub> - MICROPHONE TRANSFORMER
T<sub>2</sub> - OUTPUT TRANSFORMER
V - VACUUM TUBE (PENTODE)

\( \omega_1 - \text{RESISTOR} \)
ω<sub>2</sub>
ω<sub>3</sub>
Wa
ω<sub>5</sub> ω<sub>6</sub>
67
      - COPPER OXIDE RECTIFIER
X,
#1-#16 - P.D.M. FUSE DELAY SWITCHES
#17-#21 - DELAY ARMING FUSE DELAY
                                                                  (INEFFICIENT)
#17-#21 - DELAY ARMING FUSE DELAY SWITCHES #22,#23 - DELAY BOMB FIRING FUSE DELAY SWITCHES -
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Fig. 17 - Pi-3 Circuit Components

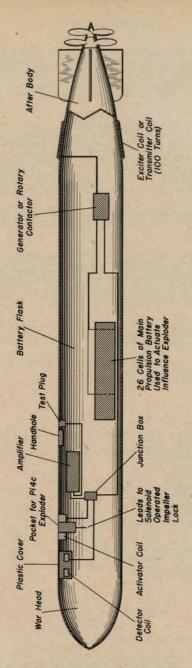


Fig. 18 - Pi-4c Influence Firing Assembly (Schematic)



Pi-4c Firing Device

- 1. This device is an electromagnetic, radiating type, influence firing mechanism, operating on the same basic principle as the U. S. Navy Ordnance Detector, Mark I (Part I, Chapter 2). A magnetic field is radiated by a transmitting coil around the tail of the torpedo. The coil receives A. C. power from a rotary contactor which in turn is supplied by the main torpedo propulsion batteries.
- 2. If the radiated signal is reflected by an electromagnetic discontinuity such as might be provided by a ship, the reflected signal is picked up by a detector coil or coils in the warhead. The coil transmits the signal to an amplifier which increases the signal current to a point where it is strong enough to operate two relays.
- 3. Closure of these relays puts battery current across the activator coil around the exploder pocket. When the activator coil is energized, it sets up a strong magnetic field, causing the main pendulum of the exploder to move forward and release the exploder firing pins.

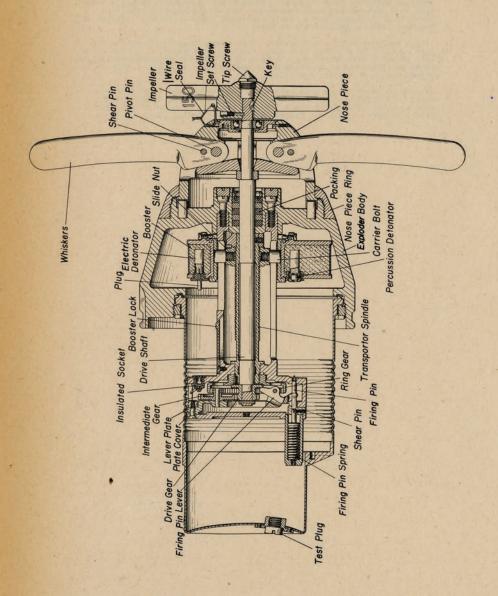


Fig. 19 - Pi-1 Exploder, Sectional View

Pi-1 (Pi-lc) Exploder

General

1. Impact, direct action type, fitted in nose pocket of 21" Ka warheads with T-1 and T-2 torpedoes: sometimes designated. "P1-G/H".

Description

1. External

- (a) The exploder is 17 1/2" long, 7" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 8 1/4" from the warhead, consisting of an exploder body, shaped like a truncated cone, to which is secured a rounded, cylindrical nose piece. Four curved whiskers protrude 5 3/4" from slots on the nose piece. A two-bladed impeller with a span of 5 1/2" is fitted to the center of the nose piece, being attached to the outer end of a drive shaft. A small, spring-loaded flap mounted on the side of the nose piece prevents impeller rotation prior to launching.
 - (2) An after section, consisting of a cylindrical steel canister, 8 1/2" long, is secured to the inner end of the exploder body. This canister houses the working parts of the exploder.
- (b) Markings on the exploder body and nose piece are as follows:
 - (1) The letters Pi-1 or G7H stamped on the nose piece.
 - (2) The exploder serial number stamped on the exploder body, nose piece or whiskers.
 - (3) One impeller blade painted red or blue. If red, the number 150 is painted on the blade in white and if blue, the number 300, the respective numbers indicating the arming range in meters.

2. Internal

- (a) The primary working parts of the exploder are as follows:
 - (1) A steel drive shaft which extends longitudinally through the exploder body.
 - (2) A firing pin housing which contains:
 - (i) A gear train which engages the after end of the drive shaft.
 - (ii) Four levers spaced radially around the after end of the drive shaft. Ordinarily, three of the levers are attached to firing pins, two of which are spring-loaded, and the fourth controls a small leaf switch. In some cases, however, all four levers are attached to firing pins, all of which are spring-loaded. A flange on the after end of the drive shaft bears against each lever.
 - (iii) Two female plug connections for electric detonators in the booster can.
 - (3) A hollow, threaded transporter spindle which encloses the drive shaft and engages the gear train at its after end.
 - (4) An annular booster can, secured around the transporter spindle, which contains two electric and either three or four percussion detonators.
- (b) Each of the whiskers is pivoted at its inner end and bears on a shoulder on the forward end of the drive shaft.

3. Method of Mounting

- (a) The exploder is slipped into the warhead and secured by four screws which pass through the warhead and engage a groove on the after part of the exploder body.
- 4. The Pi-lc differs from the Pi-l as follows:
 - (a) No whiskers are fitted, net cutters usually being fitted in their place. No whisker shear pins are fitted nor is there any provision for them.

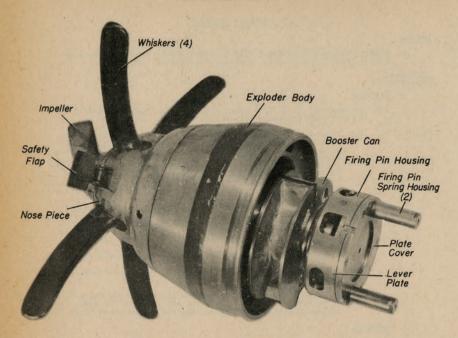


Fig. 20 - Pi-1 Exploder, Canister Removed

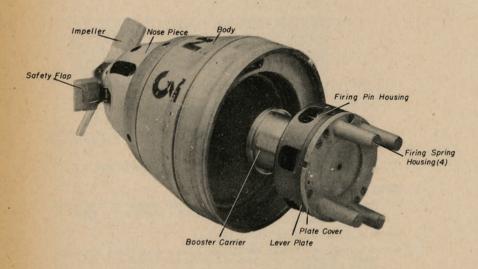


Fig. 21 - Pi-lc Exploder, Canister Removed

Pi-1 (Pi-1c) Exploder (Cont'd.)

- (b) The letters Pi-lc are stamped on the nose piece.
- (c) A modified, steel nose piece fitted abaft the impeller prevents the exploder from firing from a blow on the impeller unless the blow is of sufficient strength (5000 lbs. approx.) to force the steel tip screw through the impeller. The exploder design is such that it is believed to fire upon contact with a very hard surface but not upon contact with a torpedo net.

Operation

- 1. When the torpedo is launched, water travel shears a small wire attached to the impeller and nose piece and depresses the safety flap. Impeller rotation then turns the drive shaft clockwise, thereby rotating the transporter spindle counterclockwise through the gear train in the firing pin housing. Rotation of the transporter spindle moves the booster aft and, after a 150 or 300 meter run depending on the impeller fitted, the booster is adjacent to the firing pin housing. When the booster is in this position, the two electric detonators are plugged into their sockets and the percussion detonators are adjacent to the firing pins. At the end of its travel, the booster carrier disengages the threads of the transporter spindle and the booster locks in the armed position.
- 2. The exploder fires upon receipt of a blow on the whiskers or impeller as follows:
 - (a) A blow on a whisker shears a large shear pin in the whisker and forces the drive shaft aft about 1/k". The flange on the after end of the drive shaft pivots the firing pin levers, breaking their shear pins and allowing the firing pins to impinge on the respective detonators. When the drive shaft moves aft, it also closes the leaf switch to the electric detonators.
 - (b) A blow on the impeller shears two shear pins in the impeller seat forcing the drive shaft aft and firing the detonators as in (a) above.

Precautions

1. There is no means of determining the armed or unarmed condition of the exploder from an exterior examination.

Rendering Safe Procedure

- 1. Insert wedges abaft each whisker to prevent any movement.
- 2. Tape the impeller to the nose piece.
- 3. Remove the exploder securing screws.
- 4. From a safe distance, remove the exploder from the warhead.
- 5. Remove the keep ring which secures the canister to the exploder body.
- 6. Remove the canister.
- -7. Cut and tape separately the two leads from the battery to the electric detonator switch. These leads may not be fitted.
- 8. Remove the eight screws which secure the plate cover and lever plate to the firing pin housing.
- Remove the plate cover and lift off the lever plate which carries the levers and firing pins.
- 10. Remove the two screws which secure the booster can to the booster carrier. These screws are forward of the booster can and are accessible only if the booster is in the armed condition. If the booster is in the unarmed position, rotate the large gear in the firing pin housing clockwise until the screws become accessible.
- 11. Depress the booster lock while rotating the large gear counterclockwise until the booster moves forward about 1/2". This forward motion unplugs the electric detonators.
- Rotate the booster can and separate the booster from the booster carrier by breaking the bayonet joint. The booster will come off in two sections.
- 13. Remove the detonators from the booster.
- 14. Dispose of all explosive elements.

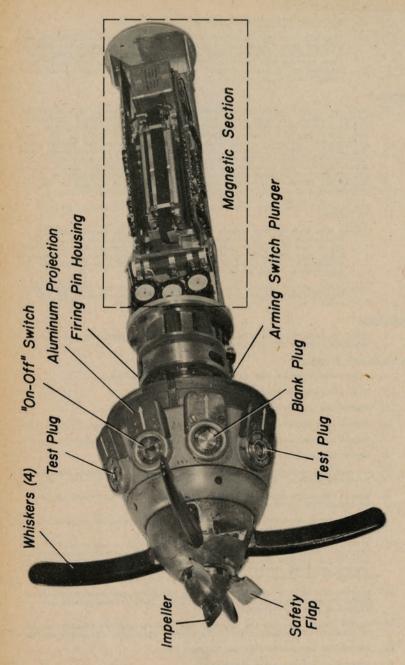


Fig. 22 - Pi-2 Exploder

Pi-2 (Pi-2c) Exploder

General

 Combination impact, direct action and magnetic induction type, fitted in nose pocket of 21" Kb warheads with T-3 torpedoes.

Description

1. External

- (a) The exploder is 3' long, 7" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 8 1/4" from the warhead, consisting of an exploder body and nose piece very similar to the forward section of the Pi-1. The main difference consists of the presence of four, raised, brass plug fittings, each 1 1/2" in diameter, mounted radially on the forward end of the exploder body. Reading clockwise and looking aft, the fittings are: test plug for magnetic circuit; "on-off" switch for magnetic circuit; blank plug; test plug for magnetic circuit. Four jack plugs, fitted to the after part of the exploder body, fit into corresponding jacks alongside the exploder pocket.
 - (2) An after section, consisting of a cylindrical steel canister, 28" long, is secured to the after end of the exploder body. This canister houses the mechanical and magnetic parts of the exploder. The extra length, as compared with the Pi-1, is necessary to accommodate the magnetic firing device.
- (b) Markings on the exploder body and nose piece are as follows:
 - (1) Same as Pi-1 except that the letters Pi-2 are stamped on the nose piece.

2. Internal

(a) The internal alignment of parts is similar to the Pi-l except that a magnetic firing device has been added. This device consists, essentially, of a search coil, three vacuum tubes, two relays and a full-wave rectifier. The firing pin housing differs from that on the Pi-l in that four percussion firing pins are fitted, three being spring-loaded.

3. Method of Mounting

- (a) Same as Pi-1.
- 4. The Pi-2c differs from the Pi-2 as follows:
 - (a) It is designed for use with one-man, human torpedoes and possibly other torpedoes.
 - (b) No whiskers nor whisker plate are fitted.
 - (c) The nose piece is made of steel instead of brass.
 - (d) The letters Pi-2c are stamped on the nose piece. The impact firing mechanism is similar to that in Pi-lc.

Operation

- 1. (a) Impact section
 - (1) Same as Pi-1.
 - (b) Magnetic section
 - As the booster can moves aft on the transporter spindle, the can depresses a plunger switch, arming the magnetic firing device.
- 2. (a) Impact section
 - (1) Same as Pi-1
 - (b) Magnetic section
 - (1) Magnetic firing occurs when the firing device is subjected to a sufficient rate of change in the surrounding magnetic field to induce the proper current in the induction coil. This causes relays to close and place the detonators across the battery. See Introduction for detailed operational analysis.

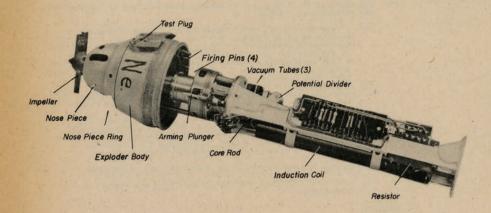


Fig. 23 - Pi-2c Exploder

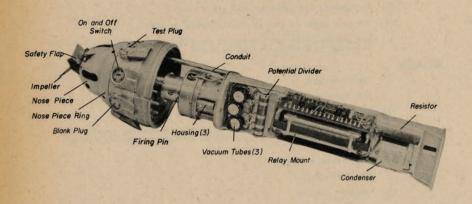


Fig. 24 - Pi-2c Exploder

Pi-2 (Pi-2c) Exploder (Cont'd.)

Precautions

- Note that there is no means of determining the armed or unarmed condition of the exploder from an exterior examination. The relative position of the "on-off" switch cannot be used for this purpose.
- Note that the magnetic firing device may incorporate a self-destroying feature. Except in extreme emergency, wait at least 24 hours before attempting to render safe.

Rendering Safe Procedure

- 1. Remove the two securing screws which hold the small aluminum projection against the after edge of the "on-off" switch. Remove the projection.
- 2. Remove the outer keep ring which holds the switch in place.
- 3. Remove the inner keep ring.
- 4. Remove the switch. Be sure to remove the small plastic disc which contains the switch contacts on its bottom face. The magnetic section is now inoperative.
- 5. Insert wedges abaft each whisker to prevent any movement.
- 6. Tape the impeller to the nose piece.
- 7. Remove the exploder securing screws.
- 8. From a safe distance, remove the exploder from the warhead.
- 9. Remove the keep ring which secures the canister to the exploder body.
- 10. Remove the canister.
- Separate the magnetic section frame from the firing pin housing by removing the six screws from the joint located about 21" forward of the after end of the frame. Cut and tape each lead separately.
- 12. Remove the two remaining screws which secure the plate cover to the lever plate.
- 13. Proceed with steps 9-14 as prescrited for Pi-1.

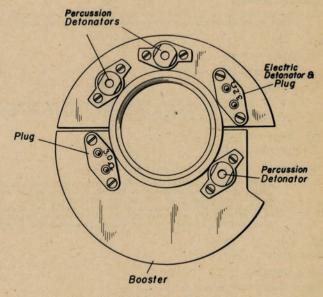


Fig. 25 - Pi-1 Booster, Elevation

Pi-3 Exploder

General

 Combination impact, direct action and magnetic induction type, fitted in nose pocket of 21" Ke warheads with T-1 torpedoes.

Description

1. External

- (a) The exploder is 17" long, 8 3/4" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 8 1/2" from the warhead, consisting of an exploder body and nose piece very similar to the forward section of the Pi-1 although the shape is somewhat modified. The main difference consists of the presence of two, raised, brass plug fittings, each 1 1/2" in diameter, mounted on the forward end of the exploder body. One fitting is the "on-off" switch fitted to the Pi-2 and the other, a test plug for the magnetic circuit. Four jack plugs, fitted to the after part of the exploder body, fit into corresponding jacks along side the exploder pocket.
 - (2) An after section, consisting of a cylindrical steel canister, 9" long, is secured to the inner end of the exploder body. This canister contains the mechanical working parts of the exploder.
- (b) Markings on the exploder body and nose piece are as follows:
 - (1) Same as Pi-1 except that the letters Pi-3 are stamped on the nose piece.

2. Internal

(a) The internal alignment of mechanical parts is similar to the Pi-l except that a 4.5 volt battery, enclosed in a cylindrical plastic container, is secured to the plate cover of the firing pin housing. The firing pin housing differs from that on the Pi-l in that four percussion firing pins are fitted, two being spring-loaded. The magnetic firing device is located in the after end of the warhead.

3. Method of Mounting

(a) The exploder is slipped into the warhead pocket and secured by six bolts which screw through the exploder body into the warhead.

Operation

- 1. (a) Impact section
 - (1) Same as Pi-l.
 - (b) Magnetic section
 - As the booster can moves aft on the transporter spindle, it releases a push button on the inside of the exploder body, arming the magnetic firing device.
- 2. (a) Impact section
 - (1) Same as Pi-1.
 - (b) Magnetic section
 - (1) Magnetic firing occurs when the field put out by the magnetic firing device is disturbed by any object whose electrical conductivity differs from that of the surrounding medium. This field distortion is recorded on detector coils and amplified to a point where the resultant current is strong enough to close certain relays, putting a battery across the detonators.

Precautions

1. Same as P1-2.

Rendering Safe Procedure

- 1. Remove the "off-on" switch as in Pi-2.
- 2. Insert wedges abaft each whisker to prevent any movement.
- 3. Tape the impeller to the nose piece.



Pi-3 Exploder (Cont'd.)

- 4. Using a 9/16" socket wrench or other suitable tool, remove the six exploder securing bolts.
- 5. From a safe distance, remove the exploder.
- 6. Remove the keep ring which secures the canister to the exploder body.
- 7. Remove the canister.
- 8. Slit the gray cable; cut and tape each lead separately.
- 9. Remove the two battery securing screws and remove the battery.
- 10. Proceed with steps 8-14 as in Pi-1.

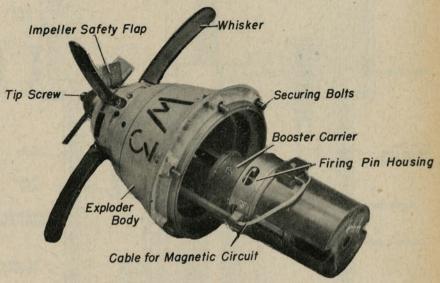
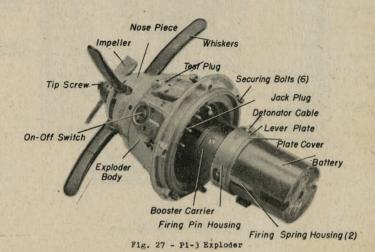


Fig. 26 - Pi-3 Exploder



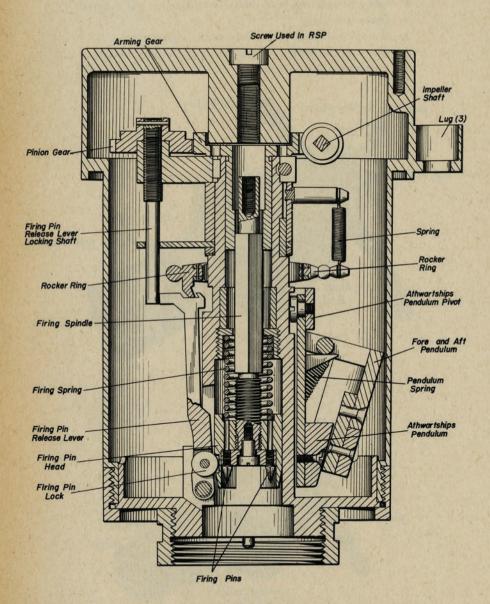


Fig. 28 - Pi-4c Exploder, Sectional View

Pi-4c Exploder

General

Combination impact-inertia, magnetic induction type, fitted in transverse pocket on top center line of 21" Ke and Kel warheads with T-5 toppedoes.

Description

1. External

(a) The exploder is cylindrical, 5 5/8" long and 3 7/8" in diameter, and is fitted on one side with a three-bladed, black, rubber impeller which rotates in an impeller trough adjoining the exploder pocket. A locking pin, withdrawn by a solenoid in the warhead when the motor starts, prevents impeller rotation prior to launching. The exploder serial number is stamped on the top face.

2. Internal

- (a) The primary working parts of the exploder are as follows:
 - (1) A worm gear driven by the impeller.
 - (2) An arming gear mounted on the vertical axis.
 - (3) A spring-loaded firing pin spindle fitted with two firing pins.
 - (4) Two inertia-operated pendulums, one of which operates on fore and art actuation and the other, athwartships actuation.
 - (5) A spring-loaded rocker ring controlled by the pendulums. This ring in turn controls the firing pin spindle release lever.
 - (6) A firing pin spindle release lever locking shaft and pinion gear.
- (b) The magnetic firing device is mounted elsewhere in the warhead and torpedo body.

3. Method of Mounting

(a) The exploder is slipped into the warhead and is secured by three, square-headed bolts.

Operation

- 1. When the torpedo is launched, energization of a solenoid by the main propulsion battery removes the impeller lock. Impeller rotation then turns the arming gear and worm gear, moving the firing pin spindle down until, after about 250 impeller rotations, the firing pins are in the armed position and the square section of the firing pin spindle disengages the square hole in the arming gear. Rotation of the arming gear also turns the pinion gear on the release lever locking shaft and, since this shaft is threaded to the frame, rotation moves the shaft upward until it disengages the firing pin spindle release lever and the pinion gear disengages the arming gear. The inertia pendulum system is now armed.
- 2. (a) Impact section
 - (1) The exploder fires when subjected to an impact of 7g fore and aft, 4g athwartships and on appropriate rates of deceleration at angles in between. The pendulums swing in the direction of impact and a lever system lifts the rocker ring, releasing the firing pin spindle release lever. The firing pin spindle spring compressed in assembly, then forces the firing pin spindle release lever out and the firing pins are freed to impinge on the detonators.

(b) Magnetic section

(1) The exploder fires when a detector coil is energized. This results in a strong current through an activator coil around the exploder pocket, thereby making pole pieces of the steel-backed fore and aft pendulum and the steel exploder base. The pendulum moves forward to decrease the gap, tripping the lever system, and the exploder fires as above. For further details, see Introduction.

Precautions

1. Same as Pi-2.



Fig. 29 - Pi-4c Exploder

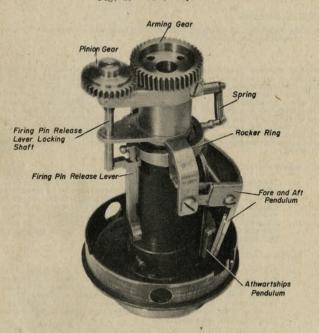


Fig. 30 - Pi-4c Exploder, Case Removed

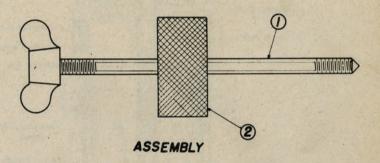
Pi-4c Exploder (Cont'd.)

Rendering Safe Procedure

- 1. Remove the screw from the center of the top of the exploder.
- Insert a special tool (Fig 30a) and screw it gently into the hole until it engages the threaded portion in the top of the firing pin spindle. Screw the knurled washer down until it bears against the exploder face. The firing pin spindle is now locked.

Note: Three exploders of a total of eighteen examined were not fitted with the screw in the center as above. The firing pin spindles of such exploders cannot be locked as prescribed and no attempt to render safe such exploders should be made except in extreme emergency. In such instances, proceed with steps 3 and 4 below. Upon removing the exploder from the warhead, destroy the exploder in situ without attempting disassembly. Exercise extreme caution to avoid jars or shocks.

- 3. Remove the exploder securing bolts.
- 4. From a safe distance, remove the exploder from the warhead.
- Remove the locking ring (left hand threads) and separate the booster from the exploder body.
- 6. Lift out the cylindrical detonator housing.
- 7. Dispose of all explosive elements.



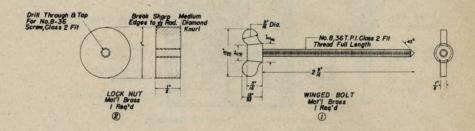


Fig. 30a - RSP Tool for Pi-4c Exploder

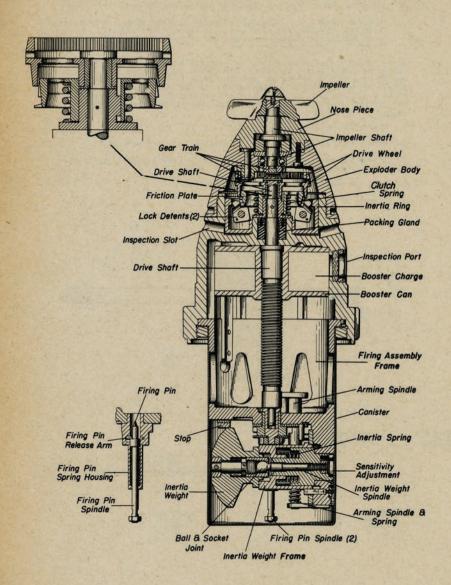


Fig. 31 - Pi42s Exploder, Sectional View

Pi42s Exploder

General

 Impact-inertia type, fitted in nose pocket of 18" GK-2 warhead in aircraft-launched torpedoes.

Description

1. External

- (a) The exploder is 12 3/4" long, 5 1/4" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 7" from the warhead, consisting of an exploder body and nose piece. A four-bladed impeller with a span of 2 3/4" is fitted to the center of the nose piece, being attached to the outer end of an impeller shaft. A small inspection port covered by a transparant plastic window, 1" in diameter, is fitted 5 1/2" aft the nose. No whiskers are fitted.
 - (2) An after section, consisting of a cylindrical steel canister, 6" long, is secured to the inner end of the exploder body. This canister houses the exploder firing mechanism.

2. Internal

- (a) The primary working parts of the exploder, reading from fore to art, are as follows:
 - (1) The impeller shaft, bearings, reduction gear train and drive
 - (2) An inertia-operated arming clutch mechanism, consisting of an inertia ring which, when in the unarmed position, holds two spring-loaded lock detents against the notched outer circumference of a spring-loaded friction plate.
 - (3) A threaded drive shaft to which the booster can is screwed and which is keyed to the friction plate. The booster can is prevented from rotating with the shaft by a projection attached to the firing assembly frame. This projection travels in one of two grooves on the circumference of the booster can. The booster is fitted with two percussion detonators.
 - (4) The inertia firing assembly, consisting of a cylindrical frame which contains the booster (when armed) and has the firing mechanism and spring-loaded firing pins mounted on its after face. The firing mechanism consists of the following parts:
 - A wheel-shaped inertia weight, suspended from a transverse spindle by a ball and socket joint.
 - (ii) A spring-loaded arming spindle which determines the armed or unarmed condition of the inertia weight and firing pins.
 - (iii) An air dashpot which damps the inertia weight.

3. Method of Mounting

(a) The exploder is slipped into the warhead and is secured by a keep ring.

Operation

- 1. When the torpedo is launched from aircraft, the impeller idles until the torpedo hits the water, at which time the inertia ring in the clutch mechanism is driven forward, thus allowing the two lock detents to move outward and release the friction plate. The friction plate is then driven forward by the clutch spring, wedging the beveled outer edge of the friction plate into the ring on the drive wheel. Impeller rotation is then transmitted through the drive wheel and friction plate to the drive shaft, and the booster is carried aft to its armed position in the firing assembly frame. As the booster reaches the fully armed position, it forces the arming spindle aft, performing the following arming functions:
 - (a) It rotates a ring, thereby releasing the cylindrical inertia weight frame and moves a stop, unlocking the inertia weight.
 - (b) It unlocks the two spring-loaded firing pins.
- 2. The exploder fires upon receipt of a blow sufficient to displace the

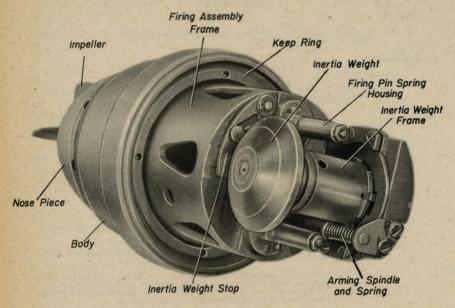


Fig. 32 - Pi42s Exploder, Canister Removed

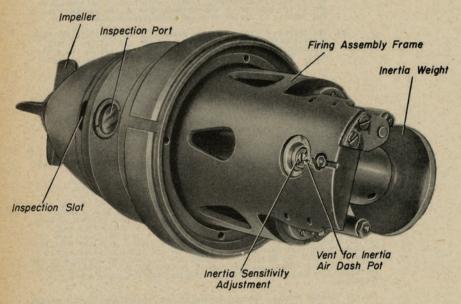


Fig. 33 - Pi42s Exploder, Canister Removed

Pi42s Exploder (Cont'd.)

inertia weight which, upon displacement, pushes its frame outward against the dashpot and a weak spring. A detent on the frame bears against a detent on a firing pin release arm, pivoting the arm and releasing the firing pins to impinge on the detonators.

Precautions

- Note that this exploder is used in a warhead which also contains the SIC activator. Should it be necessary to render safe such a warhead, deal with the activator first if practicable. If the activator is not accessible without moving the torpedo, the exploder should be rendered safe first.
- Note that the SIC magnetic firing device may incorporate a self-destroying feature. Except in extreme emergency, wait at least 24 hours before attempting to render safe.
- 3. Note that this exploder is exceptionally sensitive to shock or impact.
- 4. Check the inspection port.
 - (a) If the booster can is visible, the exploder is unarmed.
 - (b) If the booster can is not visible, the exploder must be assumed to be armed. Do not attempt to render safe an armed exploder of this type except in extreme emergency.
- An additional possible means of checking the condition of the exploder is as follows:
 - (a) If the inertia clutch mechanism has not operated, the white-painted inertia ring should nearly cover the inner opening of a 3/4" slot which perforates the exploder body about 1" forward of the inspection port. If the inertia ring has moved forward, only the after edge is visible, indicating that the clutch has operated. The booster is therefore probably in the armed position.

Rendering Safe Procedure

- 1. Tape the impeller to the exploder body.
- 2. Remove the keep ring which secures the exploder to the warhead.
- From a safe distance, remove the exploder from the warhead, being sure to provide some suitable means for cushioning its fall.

Note: At this point, unless there is positive evidence that the exploder is not armed, it should be sandbagged and blown in situ. It is possible to carry out the remainder of the rendering safe procedure as prescribed on an armed exploder, but such action is so dangerous as to be prohibitive.

- 4. Remove the keep ring which secures the canister and firing assembly to the exploder body.
- Remove the canister and firing assembly from the exploder body, thereby separating the firing pins and detonators.
- 6. Unscrew the booster can from the drive shaft.
- 7. Dispose of all explosive elements.

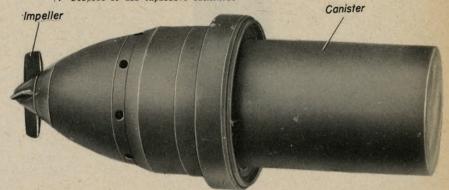


Fig. 34 - Pi42s Exploder

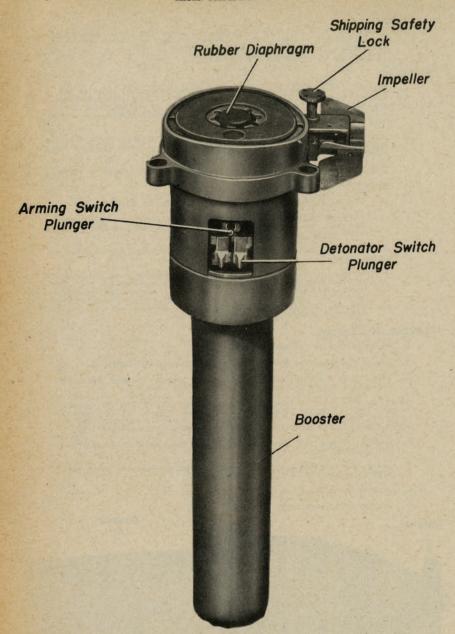


Fig. 35 - SIC Activator

SIC Activator

General

- Impeller-driven arming device, fitted in transverse pocket on top center line of GK2 warheads with aircraft-launched torpedoes.
- 2. This device, although not an exploder in the usual sense, is treated in detail herein because it performs arming and firing functions ordinarily carried out by an exploder. It therefore must be dealt with in rendering safe the torpedo to which it is fitted. The Pi42s exploder is fitted in the same warhead but is independent of the SIC activator.

Description

1. External

- (a) The activator is 16" long, 3 7/8" in maximum diameter, and is composed of the following main parts:
 - (1) An upper section, consisting of a cylindrical, brass housing 5" long, which encloses the main working parts of the device. A three-bladed impeller mounted on the end of an impeller shaft protrudes from the side of the housing and rotates in an impeller trough adjacent to the activator pocket. A safety bar, notched at each end and containing a spring and water flap, is suspended between two pins on the warhead and prevents impeller rotation prior to launching. A rubber diaphragm, 1" in diameter, is fitted to the center of the top cover and serves to keep the interior of the device watertight.
 - (2) A lower section, contained in a cylindrical, brass housing, ll" long and 2 1/4" in diameter, which encloses the booster and detonators.
- (b) The upper and lower sections are joined by six bolts.

2. Internal

- (a) The main working parts of the activator are as follows:
 - (1) The impeller and impeller shaft, the latter being fitted with a worm on its inner end which engages a spur gear.
 - (2) A threaded arming spindle which engages internal threads of the spur gear. The top of the spindle is square and fits into a corresponding hole in the top cover under the rubber diaphragm. The lower end of the spindle is secured to a spindle extension.
 - (3) Two lever systems, one of which controls an arming switch plunger while the other compresses the spring of the detonator switch plunger. The arming switch plunger, consisting of a brass pin mounted on a sliding frame, is held in the unarmed position by a spring clip which bears against the arming plunger lever system. The detonator switch plunger consists of two insulated, wedge-shaped contacts, each of which is fitted with an electrical lead below and an extension arm above. The leads go to the detonators and the extension arms rest against a leaf-spring, short-circuiting bridge when the detonator plunger switch is in the unarmed position.

3. Method of Mounting

(a) The activator is slipped into the warhead pocket and secured by

Operation

- 1. (a) When the torpedo is launched, the safety bar prevents impeller rotation during air travel. Upon impact with the water, pressure on the water flap forces the forward section of the safety bar aft against spring pressure until the bar is free and falls away. Impeller rotation then turns the worm and spur gears. The arming spindle, which is not free to rotate, rises up on the threads of the spur gear, carrying the spindle extension with it. As the spindle extension rises, it pivots a lever system against the spring clip, forcing the arming switch plunger aft and closing the arming switch which energizes the magnetic firing device located elsewhere in the warhead.
 - (b) Upward motion of the spindle extension also compresses the detonator switch plunger spring. After the arming switch plunger operates, further upward motion of the spindle extension aligns a slot in the spindle extension with detents on the detonator switch plunger, allowing the plunger to snap aft by spring pressure and make its double contact. Aftwise movement of the plunger also



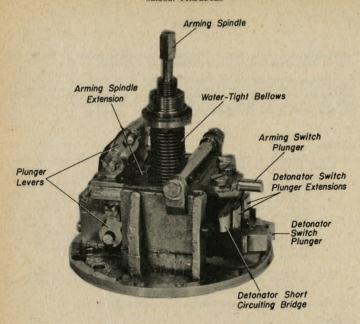


Fig. 36 - SIC Activator, Arming Assembly

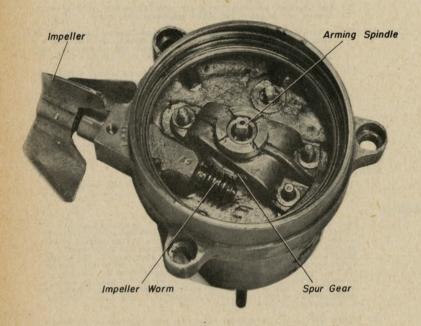


Fig. 37 - SIC Activator, Top Removed

GERMAN TORPEDOES

SIC Activator (Cont'd.)

breaks contact with the short-circuiting bridge and the detonator

- (c) Continued impeller rotation moves the square top of the arming spindle upward out of the square hole in the top cover stretching the rubber diaphragm, at which point upward motion of the spindle ceases as it may now rotate freely.
- The detonators fire when the detector coils in the magnetic firing device receive the proper signal and the amplifier completes the detonator circuit from the battery.

Precautions

- 1. Note that this activator is used in a warhead which also contains the P142s nose exploder. Should it be necessary to render safe a torpedo fitted with these devices, deal with the activator first if practicable. If the activator is not accessible without moving the torpedo, the exploder should be rendered safe first.
- Note that the activator cannot be withdrawn from the warhead when in an armed condition.
- The magnetic firing device may incorporate a self-destroying feature. Except in extreme emergency, wait at least 24 hours before attempting to render safe.
- 4. Check the condition of the activator as follows:
 - (a) Cut away the rubber diaphragm on the top cover.
 - (b) If the arming spindle projects more than 1/8" above the square hole, the magnetic firing device must be considered armed.

Rendering Safe Procedure

1. Unarmed

- (a) Tape the impeller to the warhead shell.
- (b) Remove the securing bolts.
- (c) From a safe distance, remove the activator.
- (d) Remove the six bolts and separate the upper and lower sections.
- (e) Dispose of detonators and booster.

2. Armed

- (a) Using the proper nitric acid solution (Part I, Chapter 7), cut a hole approximately 3" in diameter in the warhead shell, 3" abaft the after end of the activator pocket.
- (b) Slit the buff colored, rubberized cable beneath the hole; cut and tape separately each of its four leads. The magnetic section is

Note: If the nose exploder in the warhead has not yet been removed, it should be dealt with at this point.

- (c) Enlarge the hole until easy hand access is obtained.
- (d) Remove the keep ring which secures the switch to the after side of the activator; remove the switch.
- (e) Remove the keep ring which secures the top cover of the activator; remove the top cover.
- (f) Reach in through the hole and push the detonator switch plunger forward while rotating the arming spindle clockwise. Continue until the switch plunger retracts to the unarmed position.
- (g) The activator is now disarmed; proceed as in Par. 1 above.



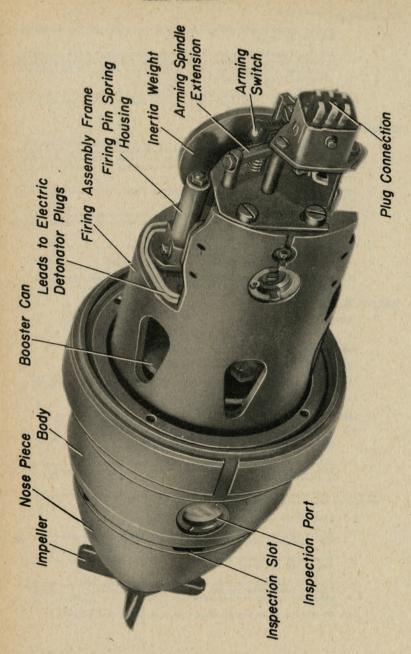


Fig. 38 - Pi42s(el) Exploder, Canister Removed

GERMAN TORREDORS

Pi42s(el) Exploder

General

 Combination impact-inertia exploder and SIC activator, fitted in nose pocket of 18" GK-3 warheads with aircraft-launched torpedoes.

Description

- 1. External
 - (a) Same as P142s except that a six-lead plug connection projects through the after end of the canister.

2. Internal

- (a) Same as Pi42s except as follows:
 - Two electric detonators with male connections are added to the booster. These detonators plug to female connections on the firing assembly frame when the booster is in the armed position.
 - (2) An electric, spring-loaded arming switch, containing one constant make and two make-break switches, is secured to the after end of the firing mechanism. One of the make-break switches has no leads fitted.
 - (3) An extension is added to the after end of the arming spindle and serves to restrain the arming switch so that the operative make-break switch is open when the exploder is unarmed.
 - (4) A small projection is added to the after end of the drive sheft and controls a small arm on the forward end of the arming spindle.
 - (5) Leads from the plug connection as follows:
 - (i) Four to the arming switch.
 - (ii) Two to the electric detonators.
- (b) The magnetic firing device is located elsewhere in the warhead.

Operation

- 1. (a) Impact section
 - (1) Same as P142s.
 - (b) Magnetic section
 - (1) The first revolution of the drive shaft causes the projection on its after end to come up against the arm on the forward end of the arming spindle, thereby rotating the spindle about 25°. This moves the extension on the after end of the arming spindle away from the arming switch, allowing the make-break switch to make and arm the magnetic circuit.
- 2. (a) Impact section
 - (1) Same as P1428.
 - (b) Magnetic section
 - (1) Similar to Pi3.

Precautions

- Bear in mind that the SIC magnetic firing device may incorporate a selfdestroying feature. Except in extreme emergency, wait at least 24 hours before attempting to render safe.
- Note that there is no means of differentiating this exploder from the P142s when it is mounted in the warhead. However, the P142s(el) is used with the GK3 warhead which does not contain the SIC activator on its top center line.
- 3. Note that this exploder is exceptionally sensitive to shock or impact.
- 4. Check the inspection port.
 - (a) If the booster can is visible, the exploder is unarmed.
 - (b) If the booster can is not visible, the exploder must be assumed to be armed. Do not attempt to render safe an armed exploder of this type except in extreme emergency.

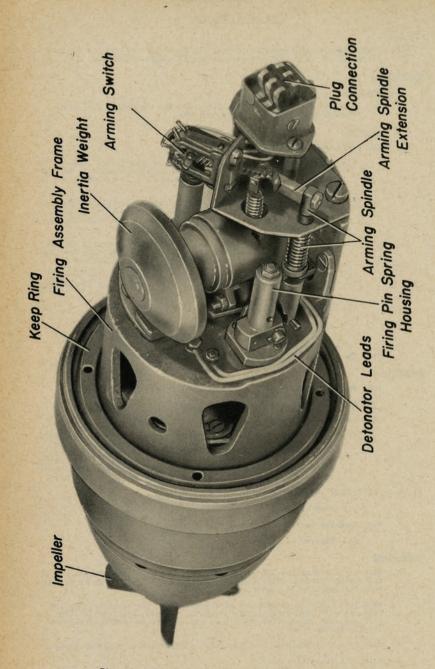


Fig. 39 - Pi42s(el) Exploder, Canister Removed

GERMAN TORPEDOES

Pi42s(el) Exploder (Cont'd.)

- An additional possible means of checking the condition of the exploder is as follows:
 - (a) If the inertia clutch mechanism has not operated, the white-painted inertia ring should nearly cover the inner opening of a 3/4" slot which perforates the exploder body about 1" forward of the inspection port. If the inertia ring has moved forward, only the after edge is visible, indicating that the clutch has operated. The booster is probably in the armed position.

- 1. Same as Pi42s except as follows:
 - (a) After removing the exploder from the warnead pocket, disconnect the plug on the after end from the cable in the warnead.

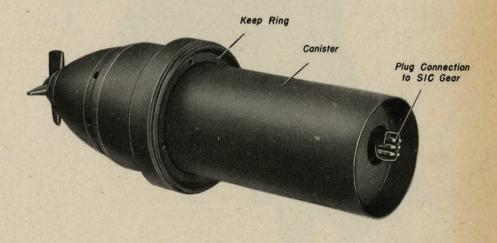


Fig. 40 - P142s(el) Exploder

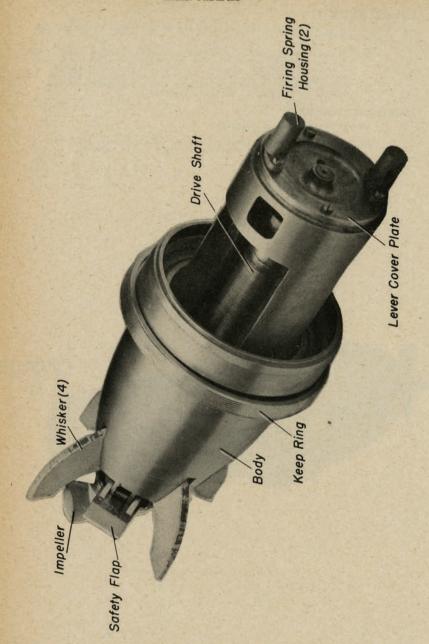


Fig. 41 - F5S Exploder

F.5.S. Exploder

General

 Impact, direct action type, fitted in nose pocket of 18" "F5B" warheads with F5B torpedoes.

Description

1. External

- (a) The exploder is 12 3/4" long, 4 1/2" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 7" from the warhead, consisting of an ogival exploder body. Four curved whiskers, flat end type, protrude 2" from slots on the exploder body. The whiskers are in a single casting and do not operate independently as in Fi-1. A two-bladed impeller with a span of 3 1/2" is fitted to the center of the nose, being attached to the forward end of a drive shaft. A small spring-loaded flap, mounted on the side of the nose, prevents impeller rotation prior to launching.
 - (2) An after section, consisting of a cylindrical steel canister 5 1/2" long, is secured to the inner end of the exploder body. This canister houses the working parts of the exploder.
- (b) Markings on the exploder body are as follows:
 - (1) The letters F.5.S. stamped on the exploder body.
 - (2) The exploder serial number stamped on the exploder body.
 - (3) Scribe marks in green paint on both the exploder body and whiskers which, when aligned, indicate the unfired position of the whiskers.

2. Internal

(a) The internal alignment of parts is similar to the Pi-l although the firing mechanism is simpler in design. The booster can is mounted directly on a threaded drive shaft and is prevented from rotating with the shaft by two longitudinal projections, 1800 apart, on the inside of the exploder body. These projections engage corresponding grooves on the outer circumference of the booster can. Only two firing pins are fitted and it is assumed that the booster can (none recovered) contains but two percussion detonators. The plate cover and lever plate fitted to the Pi-l are combined into a single lever cover plate.

3. Method of Mounting

(a) The exploder is slipped into the warhead and secured by a keep ring.

Operation

1. Similar to Pi-l although the arming range is not known.

Precautions

1. See Introduction.

- 1. Insert wedges abaft each whisker to prevent any movement.
- 2. Tape the impeller to the nose piece.
- 3. Remove the exploder keep ring.
- 4. From a safe distance, remove the exploder from the warhead.
- 5. Remove the keep ring which secures the canister to the exploder body.
- 6. Remove the canister.
- Remove the six screws which secure the lever cover plate to the firing pin housing and remove the lever cover plate.
- 8. Remove and dispose of all explosive elements as in Pi-1.



G7A-AZ Exploder

General

 Impact, direct action type, fitted in nose pocket of 21" torpedoes. Believed to be obsolete.

Description

1. External

- (a) The exploder is 18 1/2" long, 7 1/2" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section which protrudes 9" from the warhead consisting of an exploder body and nose piece very similar to the forward section of the Pi-1. Four flat end, steel-tipped whiskers, made in a single casting, protrude 3" from slots in the nose piece. A two-bladed impeller with a span of 5 1/2" and variable pitch is fitted to the center of the nose piece, being attached to the forward end of a drive shaft. The variable pitch permits different arming range settings. All other external features are very similar to the Pi-1 except that the nose piece is slightly smaller in diameter.
 - (2) An after section, consisting of a cylindrical steel canister 9" long, as secured to the inner end of the exploder body. The canister houses the main working parts of the exploder.
- (b) Markings on the exploder body and nose piece are as follows:
 - (1) The letters G7A-AZ stamped on the nose piece.

2. Internal

- (a) Same as Pi-l except as follows:
 - (1) None of the firing pins is spring-loaded.
 - (2) An electric switch is fitted inside and a battery is fitted to the after edge of the firing pin housing. These are used for electric firing on impact.
 - (3) The booster charge is slightly smaller and the booster can contains four percussion detonators and two electric detonators.

3. Method of Mounting

(a) Same as Pi-1.

Operation, Precautions and Rendering Safe Procedure

1. Same as Pi-1.

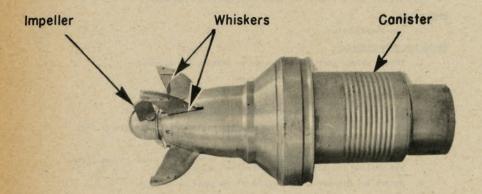


Fig. 42 - G7A-AZ Exploder



GERMAN TORPEDOES

G7A-MZ Exploder

General

 Combination impact, direct action and magnetic induction type, fitted in nose pocket in 21" torpedoes. Believed to be obsolete.

Description

1. External

- (a) The exploder is 28" long, 7 1/2" in maximum diameter, and is composed of the following main parts:
 - (1) A forward section, which protrudes 9" from the warhead, consisting of an exploder body and nose piece very similar to the forward section of the G7A-AZ. The main difference consists of two concentric setting rings around the forward part of the exploder body. The forward ring, used for latitude adjustment, has a single letter setting, "A", and number setting from -5 to 16. When the exploder is set on "A", the magnetic firing device is inoperative. The after ring, used to adjust the arming range, has settings from 120 to 4000 meters.
 - (2) An after section, consisting of a cylindrical steel canister, 19" long, is secured to the inner end of the exploder body. The canister houses the main working parts of the exploder.
- (b) Markings on the exploder body and nose piece are as follows:
 - (a) The letters G7A-MZ stamped on the nose piece.

2. Internal

- (a) The primary working parts of the impact arming and firing sections are similar to those fitted to the G7A-AZ except that an arming range adjusting mechanism and clutch have been added and four firing pins are fitted. The following additional parts are added for magnetic firing:
 - (1) A small, four-brush rotor.
 - (2) A movable compensating magnet for latitude adjustment.
 - (3) A battery relay and various magnets.

3. Method of Mounting

(a) Same as Pi-1.

Operation

- Safety range and latitude adjustments are made prior to launching. When
 the torpedo is launched, impeller rotation turns the drive shaft and
 generator rotor. After a variable period depending on the length of the
 arming range, the clutch operates, engaging the transporter spindle and
 the booster moves aft as in the Pi-1. The exploder is fully armed when
 the booster completes its travel.
- 2. (a) Impact section
 - (1) Same as Pi-1.
 - (b) Magnetic section
 - (1) The exploder fires when a magnetic field surrounds the rotor, whereupon it generates a small current which operates a sensitive relay, putting the electric detonators across the battery.

Precautions and Rendering Safe Procedure

- Same as Pi-l except that step #8 of the rendering safe procedure should be changed as follows:
 - (a) Remove the six screws which secure the lever plate, plate cover and magnetic firing device to the firing pin housing; remove the lever plate, plate cover and magnetic firing device.

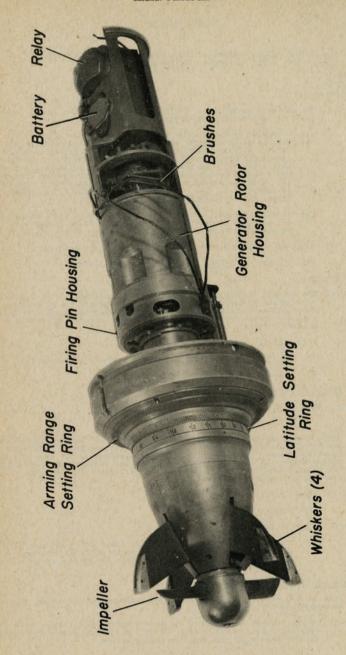


Fig. 43 - G7A-MZ Exploder

MINE DISPOSAL HANDBOOK

PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER 4

GERMAN DEPTH CHARGES

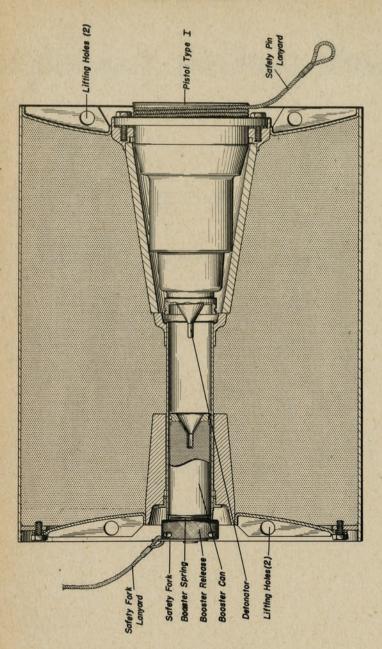


Fig. 1 - Depth Charge Type I, Sectional View

Introduction

- 1. Although only a single German depth charge case and four pistols have been recovered, it is believed that they are representative of German developments in this field. Recent intelligence reports indicate that at least three cases and six pistols are in common use, all the cases having the same dimensions and each of the pistols operating on the same basic principles as the recovered specimens. The Tactical Depth Charge, although not a depth charge in the usual sense, is included herein because of its similarity in appearance.
- The pistols employed fire by means of a hydrostatically driven, clockwork firing device. Both pistols and charge cases are herein given arbitrary designations, the specific German designations not being known, although depth charges as a group are designated by the Germans as "WB" or "Wasser Bomben."
- 3. The following precautions should generally be observed when dealing with depth charges of this type:
 - (a) Do not move or jar the charge except from a safe distance.
 - (b) Do not move or rotate the depth setting dial while rendering safe.
 - (c) If the charge is found underwater, raise it to the surface before rendering safe.

Depth Charge Type I

General

1. Launched by surface craft.

Description

1. Case

Shane Cylindrical Black. Ends may be painted red or Color Material Steel Diameter 17 1/2" Case Central tube Booster end Pistol end 2 1/4" Length 22 1/2" Charge 300 lbs. approx. Total weight in air 420 lbs. approx. Weight of case less explosive 120 lbs.

2. External fittings

End plate

16 1/8" diam., secured by eight bolts, encloses booster end. Fitted with six radial stiffening ribs, two of which are drilled with 1" lifting holes.

Filling hole covers

Two, 4" diam., on end plate, 1800 apart, secured by expanding rubber washers.

- 3. Standard accessories for case
 - (a) Pistols recovered with Type I. Type II, III and possibly others could be fitted.
 - (b) Standard booster release and booster assembly.

- Remove the pistol securing screws and break the pistol seal by screwing two of the screws into the extra holes in the pistol flange.
- 2. Remove the pistol from the central tube.



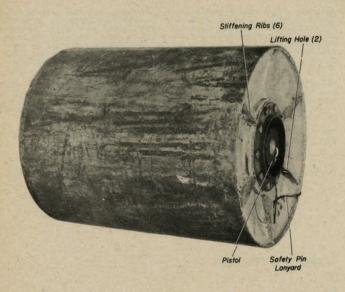


Fig. 2 - Depth Charge Type I, Pistol End

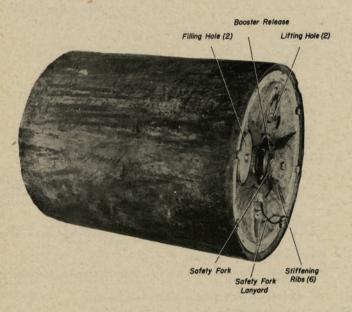


Fig. 3 - Depth Charge Type I, Booster End

Depth Charge Type I (Cont'd.)

- 3. If the booster can comes out with the pistol, separate it from the pistol after retracting the spring-loaded securing detents.
- 4. Unscrew the detonator from the pistol.
- If the booster has not come out with the pistol, remove it and the booster release mechanism from the central tube.
- 6. Dispose of detonator, booster and charge.

Type II Pistol

General

 Hydrostatic, clock-delay type, believed to be used in aircraft-launched depth charges.

Description

- The pistol is 10 5/8" long, 7 3/4" diameter at its top flange and is shaped roughly like a tapered cylinder. The case consists of two main parts as follows:
 - (a) An upper section, 7 3/8" long, 5 5/8" in maximum diameter, which houses the following parts:
 - A depth-setting dial and dial plate. Settings on the dial are 35, 60, 90, 120 (meters) and SAFE. The dial plate is removable and is used to make settings on the pistol, the small opening in the plate indicating setting.
 - (2) A rubber diaphragm which controls a hydrostatic piston assembly and which is held in the safe position prior to launching by four look balls. The look balls are held by a spring-loaded locking ring. A small setting boss on the locking ring protrudes from the top face of the pistol and is used to rotate the locking ring into position against spring tension. Once in position, it is held by a safety pin.
 - (3) A diaphragm spring and three housing springs which tend to hold the hydrostat in the "out" posttion.
 - (4) A spring-loaded firing pin spindle, centrally located, which passes through a release collur. The spindle is held in the safe position by a small detent mounted thereon which bears against the release collar. The collar is fitted with a small keyway or groove which permits the detent on the firing pin spindle to pass through upon firing.
 - (5) A driving rack, connected to the hydrostat assembly, which extends downward to engage the teeth of a pinion gear in the clockwork.
 - (b) A lower section, 3 1/2" long and 3 1/4" in diameter, threads internally to the upper section. A cylindrical ring mounted on its lower end serves as a booster seat and is equipped with three small spring-loaded detents which lock the booster in place. The lower section contains the following parts:
 - (1) A clockwork escapement geared to the release collar.
 - (2) The lower end of the firing pin spindle.
 - (3) The lower end of the driving rack.
 - (4) The detonator and small percussion cap.

2. Method of Mounting

(a) The pistol is secured to the case by ten body screws through the flange of its upper section. A round, cover plate, 5 7/8" in diameter, fits over the face of the upper section prior to launching.

Operation

 (a) The cover plate is removed and the depth setting made before launching. To set the depth, the dial plate is grasped, depressed and rotated to the proper position indicated by white numerals on the dial which represent meters. Rotation of the dial plate rotates the firing pin spindle, varying the distance from the detent on the firing pin spindle to the keyway in the release collar.



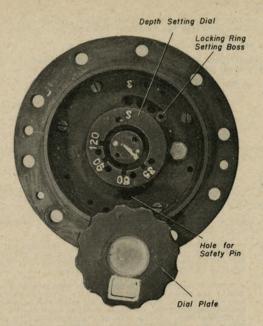


Fig. 4 - Depth Charge Pistol Type II



Fig. 5 - Depth Charge Pistol Type II, Top View

Type II Pistol (Cont'd.)

The greater the distance, the greater the depth setting since the clockwork must close the distance between the detent and keyway before firing can take place. Removal of the safety pin allows the spring-loaded locking ring to rotate about 45 degrees under the tension of the lock release spring, thereby releasing the lock balls and unlocking the diaphragm and hydrostatic piston.

(b) When the charge is launched, increasing hydrostatic pressure houses the booster over the detonator and depresses the hydrostatic piston against the tension of the three housing springs and diaphragm spring. Downward movement of the piston compresses the friing spring and depresses the driving rack, thereby driving the clock pinion gear. Operation of the clockwork rotates the release collar and, when the collar has rotated to the point where the firing pin spindle detent is in line with the keyway in the collar, the firing pin is freed to impinge on the detonator.

Type I Pistol

- 1. This pistol differs from the Type II as follows:
 - (a) Its depth settings are given both in meters, for firing depth, and in seconds, for time delay between launching and firing. The time delay figures are painted in red as follows: 5, 10, 15, 20, 26 and 33. The depth settings are painted in white, directly below the time settings, as follows: 15, 25, 35, 45, 60 and 75.
 - (b) The words "SEK" and "MeT" are painted on the dial plate alongside the window on the depth setting dial.

Type III Pistol

- This pistol, believed to be a surface-launched model of the Type II, differs from the Type II as follows:
 - (a) Settings on its depth-setting dial are 20, 35, 50, 70, 90 and 120 meters.
 - (b) The shape of the pistol body is modified slightly.

Type IV Pistol

1. This pistol, not recovered by U.S., is known to have settings of 20, 25, 55 and 90 (meters) but is believed to be otherwise identical to Type II.

Type V Pistol

- This pistol, apparently an older model of the Type II, is very similar internally to the Type II. Its case construction however, differs radically as follows:
 - (a) Its securing flange is positioned about in the center of the case rather than at the top of the upper section. Provision is made for eight securing screws instead of ten.
 - (b) A 4 1/2" tubular extension is added to the lower section or clock housing to accommodate the firing pin shaft. A special flange is fitted to this extension for the booster, detonator and percussion cap mounted on the lower end of the extension. Depth settings are the same as Type II.
 - (c) No information is available as to the type of booster fitted or how it is secured.

Standard Booster and Booster Release Mechanism

Booster

1. The German depth charge booster is similar to that used in Mine Type GC. It consists of a cylindrical container, 51/4" long and 21/8" in diameter, with an 11/16" grooved stem on its outer end. The detonator envelope screws into and seals the inner end of the container. It is known to be used with the pistols, Type I, II, and III in the depth charge Type I.

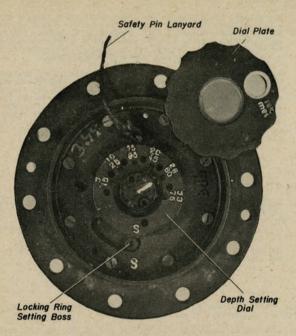


Fig. 6 - Depth Charge Pistol Type I



Fig. 7 - Depth Charge Pistol Type I, Top View

Dial Plate



Fig. 8 - Depth Charge Pistol Type III

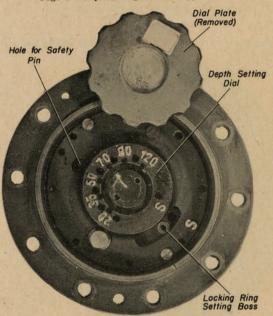


Fig. 9 - Depth Charge Pistol Type III, Top View



Fig. 10 - Depth Charge Pistol Type V

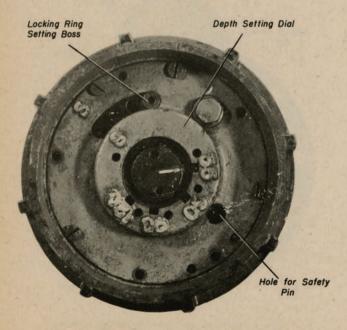


Fig. 11 - Depth Charge Pistol Type V, Top View

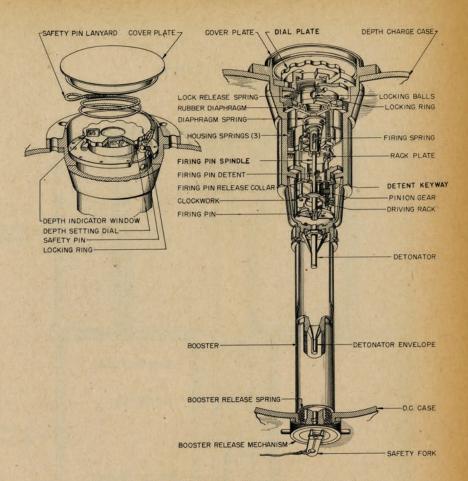


Fig. 12 - Depth Charge Pistol Type III, Sectional View

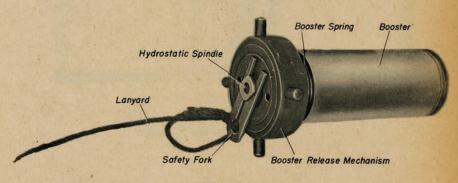


Fig. 13 - Depth Charge Booster Assembly

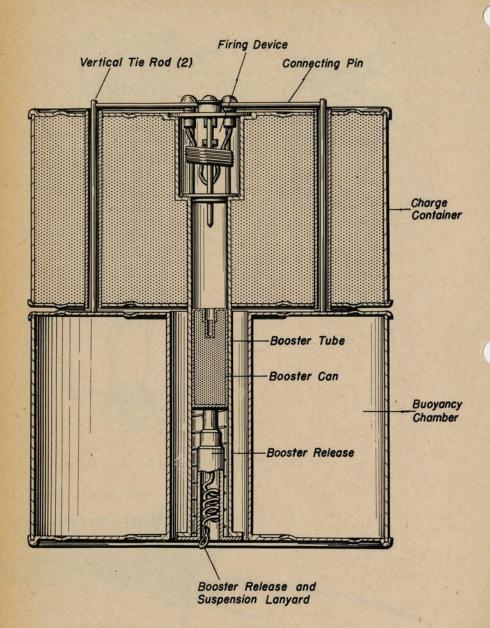


Fig. 14 - Tactical Depth Charge, Sectional View

Standard Booster and Booster Release Mechanism (Cont'd.)

Booster Release Mechanism

- 1. This device is a hydrostatically-actuated release mechanism housed in a cylindrical container, 3" in diameter and 1" long. The booster can stem fits into a recess on the inner side and is held by two locking detents. Hydrostatic pressure releases the detents and the booster is then housed over the detonator by spring pressure. The mechanism is locked prior to launching by a two-pronged safety fork.
- This mechanism is used with the depth charge, Type 1 and probably with all depth charges which take the pistols Type I, II, and III.

German Tactical Depth Charge

General

- 1. Buoyant, tactical explosive charge, launched from surface craft.
- 2. German designation unknown.
- Used defensively by surface craft to harass pursuing surface units.
 Designed to force pursuing ships to keep at a safe distance from the charges and thus give the pursued ship a tactical advantage.

Description

1. Case

Charge

Shape Cylindrical
Material Steel
Color Gray-green
Diameter 18"
Length 22"

engen 22"

Total weight in air 170 lbs. (approx.)

- 2. The charge is composed of five main parts as follows:
 - (a) The charge container a cylinder, 10" long and 18" in diameter, fitted with a booster tube, 21 1/2" long, which protrudes 11 1/2" below the container. A 4 1/2" length of the upper part of the tube is 3" in diameter and serves as a firing device pocket. The lower part which houses the booster is 2 1/4" in diameter. Two smaller tubes, 1/2" in diameter, 180° apart and 4" from the central tube, pass longitudinally through the container. The arabic numerals 30, 50, 70 and 200 are stenciled in white or black around the top of the container. A transparent, protective covering is fitted over the stenciled numbers which evidently indicate the burning time in seconds for the four fuze delays of the firing device. Two filling holes, 2 1/2" in diameter, are located at the bottom of the container.

130 lbs. Hexanite (approx.)

- (b) The buoyancy chamber a watertight cylinder, 12" long and 18" in diameter. Two vertical tie rods of the separating geer are secured to the top of the chamber and are so located as to fit into the 1/2" tubes in the charge container when the two sections are married. The chamber is fitted with a central tube, 4" in diameter, which houses the extension of the charge container booster tube when the two sections are married.
- (c) The firing device consists of a framework containing four pull Igniters with connecting fuze delay cords, a separating detonator and a main detonator. The igniters are mounted on the top face in postitions corresponding with the delay settings on the charge container. Each igniter is fitted with a short lanyard and is enclosed in a red, bulbous, protective cap. The four fuze delay cords are wound around the frame and terminate in a central junction box. An additional fuze train runs from the junction box to the separating detonator and a longer fuze extends downward to the main detonator.
- (d) The separating gear a simple system of connecting tie rods which secure the charge container to the buoyancy chamber and which, when the separating detonator fires, permit the charge container to drop free. The tie rods on the buoyancy chamber extend through the charge container and are secured at their upper ends by two connecting pins. One end of each pin engages a notch in its

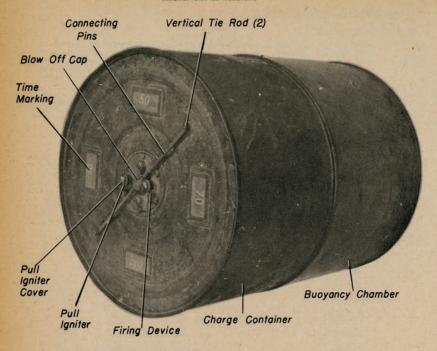


Fig. 15 - Tactical Depth Charge, Igniter End

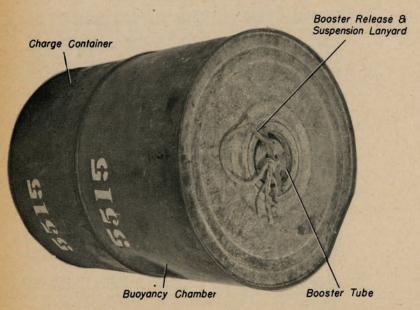


Fig. 16 - Tactical Depth Charge, Booster End

German Tactical Depth Charge (Cont'd.)

spective tie rod and the other ends of the two pins butt against each other at the center of the firing device and are secured thereto by a small, blow-off cap.

(e) The booster and booster release gear - the booster is similar to that fitted to Mine Type GC, being 4 3/4" long, 2 1/8" in diameter and fitted with a fork-shaped clip at one end. The booster release and spring are located at the bottom of the booster tube with the booster clip being locked to the release housing by the release rod. A booster release and suspension lanyard, believed to be about 6 1/2' long, is attached to the release rod at one end. Its other end is attached to a brace across the lower end of the buoyancy chamber central tube.

Operation

- 1. When the charge is launched, one of the four igniters is pulled, starting its appropriate fuze delay which burns while the charge remains on the surface. Shortly after the fuze burns to the junction box, the separating detonator fires, ripping loose the blow-off cap and allowing the connecting pins to drop free. The charge container is then released to drop to the end of the lanyard which, when it is pulled taut by the weight of the charge container, retracts the release rod and operates the booster release. The charge is now fully armed with the buoyancy chamber floating on the surface and the charge container below it at the end of the suspension lanyard.
- After a short delay period (believed to be about 10 seconds) provided by the delay fuze from the junction box to the main detonator, the charge fires.

Precautions

- 1. Avoid all contact with the igniters, fuzes and booster lanyard.
 - If any of the igniter covers is missing, the charge may be in a dangerous condition and must be treated as a hangfire.
 - If the charge container and buoyancy chamber have separated, the detonator and booster are probably married.

- 1. Remove the six screws which secure the firing device to its pocket.
- 2. Remove the firing device.
- 3. Destroy the firing device. Do not attempt to remove fuzes and detonators.
- 4. Dispose of all explosive elements.

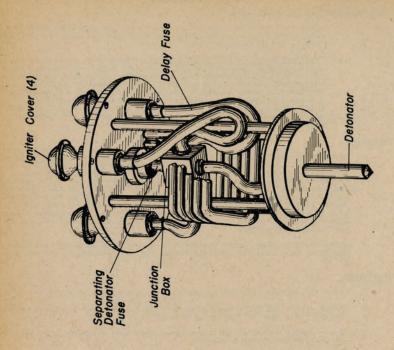


Fig. 17 - Tactical Depth Charge, Firing Device

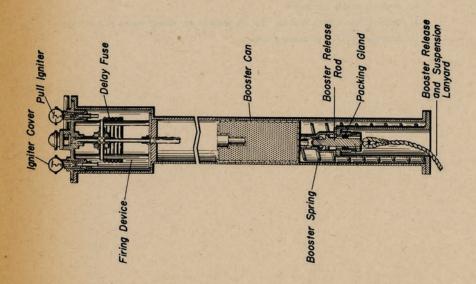


Fig. 18 - Tactical Depth Charge Accessories, Sectional View

MINE DISPOSAL HANDBOOK

PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER 5

GERMAN CONTROLLED MINES

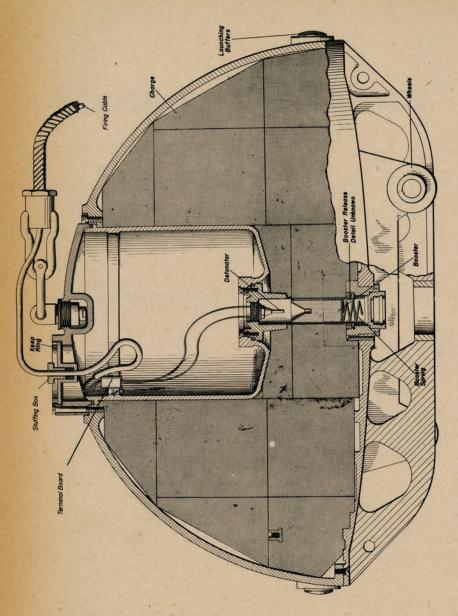


Fig. 1 - Mine Type GH, Sectional View

GERMAN CONTROLLED MINES

General

1. Although the Germans have made extensive use of various influence mines as prepared demolition charges, the only mines which are known to have been used underwater as tactical, controlled mines are the Mines Type GH and GI. This chapter incorporates all available information on the above controlled mine assemblies. Part IV, Chapter I, in which the mines are treated as influence mines, contains detailed information on the mine cases.

Controlled Mines Type GH and GI

Description

- A firing cable is led into the case through a stuffing box which replaces the clock pocket in the influence-fired model of each mine.
 The cable used is a four-conductor type although, in the mines recovered to date, the two respective black and white conductors were twisted together, making the cable a double-conductor type.
- 2. The two conductors are attached to two upper terminals on the mine terminal board and the detonator leads, to the corresponding lower terminals. Two detonators and boosters are sometimes used, in which case the detonators are wired in parallel. A galvanized cable connector is used to stop the firing cable to a drogue eye on the cover plate.

Operation

- 1. Mine is armed manually prior to launching.
- 2. Mine is fired electrically by an observer.
- 3. No self-disarming devices are fitted.

RMS

- 1. Slit the firing cable; cut and tape each lead separately.
- 2. Remove the booster cover plate; remove the booster.
- 3. Dispose of booster and charge, leaving the detonator in place.



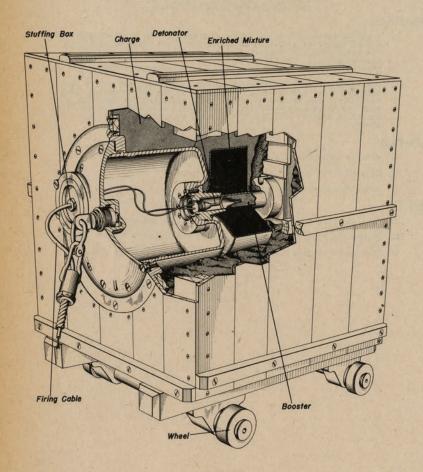


Fig. 2 - Mine Type GI, Sectional View

MINE DISPOSAL HANDBOOK

PART IV

GERMAN UNDERWATER ORDNANCE

CHAPTER 6

GERMAN SWEEP OBSTRUCTORS

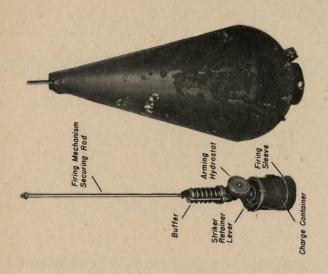


Fig. 1 - Explosive Conical Float Type 1.

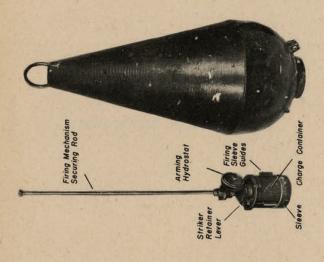


Fig. 2 - Explosive Conical Float Type 2.

GERMAN SWEEP OBSTRUCTORS

Introduction

German sweep obstructors, laid in and around moored mine fields, are
designed to cut sweep cables and prevent or hinder sweeping of the mine
field. They may contain explosives or merely support mechanical cutters
on their mooring cables. The various types of conical floats may be
indistinguishable when found afloat.

German Explosive Conical Float Type 1 (Type 2)

General

- 1. Moored, conical float sweep obstructor, laid by surface craft.
- 2. German designation, "Sprengboje."
- Defensive, anti-sweep device laid in and around moored mine fields. Maximum length of mooring cable is 360 feet.

Description

1. Case

Conical upper section welded to hemispherical lower section. Black Color Material Steel Diameter 15" 37" Length 1 1b. 13 oz. Charge 50 lbs. approx.

2. External fittings

Lifting eye Securing lugs Soluble plug fitting

Total weight in air

Firing assembly

At top of conical section.

Two, 180° apart on lower hemisphere.

Threaded into side of flange on lower hemisphere.

In pocket in base, secured by vertical rod and nut at top of float. Firing sleeve con-tains hole for safety pin.

- 3. Type 2 differs from Type 1 as follows:
 - (a) The base of the float contains no soluble plug fitting on flange.
 - (b) The arming hydrostat locks in the armed position.
 - (c) It is not fitted with an interlocking grip to release the float in case of firing failure.

Operation

- Float takes depth by a fixed mooring cable (vertical cylinder anchor with cable stop pin). A stop pin is inserted aboard the laying vessel and determines the length of cable that will unwind from the cylinder. A hydrostat in the firing mechanism unlocks the spring-loaded firing pin in 7 feet of water. Dissolution of a soluble plug unlocks the firing sleeve and the firing mechanism is armed.
- 2. The spring-loaded firing pin is released by a rotating cam operated by a lever system connected to the firing sleeve. A sweep wire riding up the mooring cable will lift the firing sleeve, operating the lever. Thirty pounds pressure will operate the sleeve. If the explosive gear fails, further pressure will be exerted on the charge case. At about 200 lbs. pressure, a spring-loaded interlocking grip mounted above the hydrostat releases, dropping the mooring with charge still attached and freeing the float only.
- The only self-disarming feature is a device which locks the firing pin when the float surfaces. This is extremely unreliable.

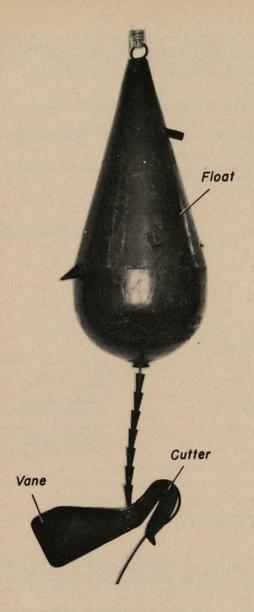


Fig. 3 - Static Conical Sweep Obstructor

GERMAN SWEEP OBSTRUCTORS

German Explosive Conical Float Type 1 (Type 2) (Cont'd.)

Precautions

- The float should not be moved or touched, due to the extremely sensitive firing mechanism. Countermine whenever possible.
- Type 1, which is fitted with a soluble plug, may be rendered safe, as
 prescribed below, but only in extreme emergencies. Type 2, having no
 soluble plug, must always be rendered safe by means other than disassembly.

Rendering Safe Procedure (Type 1 only)

- 1. Insert a safety pin to hold the sleeve out; lash the pin in place.
- Remove the cotter key and nut from the upper end of the float. From a safe distance withdraw the unit from base of float.
- Back out the screw at the elbow joint between the sleeve and the firing pin.
- 4. Remove and lift off the keep ring and locking ring from around the edge of the charge.
- 5. Unscrew the charge from the firing pin unit, using gripes if necessary.
- Remove the sub-booster from the firing pin unit. A small grub screw must be removed to do this. The detonator will come off with the subbooster.
- 7. Remove the match cap by separating its holder from the firing pin unit.
- The booster may now be removed from the charge and the firing pin unit broken down with safety.
- 9. Dispose of all explosive elements.

Static Conical Sweep Obstructor

General

- 1. Moored, conical float, laid by surface craft. Fitted with mechanical cutters on mooring cable.
- 2. Non-explosive, anti-sweep device, laid in and around moored mine fields.

Description

1. Float

Shape Conical; resembles explosive conical floats, Type 1 and 2.

Color Black
Material Steel

Diameter (base) 19"
Length 44"

2. The float is moored to a concrete block, 33" x 27" x 28", which is surmounted by a steel drum, 33" high and 25" in diameter. The mooring cable (300 ft. max.) is fitted with four mechanical cutters. The uppermost cutter is attached two feet below the float and the others, at 4'3" intervals. Seven cone-shaped, steel beads are woven into the mooring cable between the float and the uppermost cutter.

Operation

 A stop pin is inserted in the anchor prior to laying to adjust the depth setting. The float therefore takes depth by fixed mooring cable setting. Dissolution of a soluble plug releases the float from its anchor. The float then rises, pulling the cutters from brackets inside the drum and unrealing the cable.

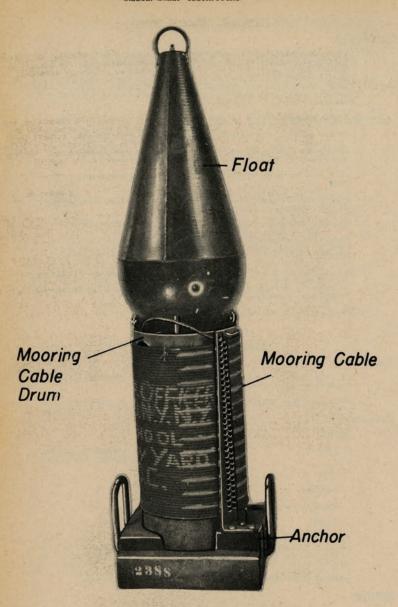


Fig. 4 - Explosive Conical Float, with Anchor

GERMAN SWEEP OBSTRUCTORS

Aircraft-Laid Sweep Obstructor

General

 The German aircraft-laid sweep obstructor is 8'5 1/2" long, 25 1/2" in maximum diameter and weighs 2021 lbs. When assembled for laying, it resembles very closely a Mine Type GG with tail fairings attached.

Description

- 1. Component parts are as follows:
 - (a) The anchor a steel cylinder with an ogival nose resembling the case of Mine Type GG. It is 62" long and weighs about 1000 lbs. Approximately 865 lbs. of cement are cast into the forward part, the after end of the casting being formed to provide (1) positioning seats for two cutters and (2) a mooring cable drum. The following fittings are bolted to the after end of the casting:
 - (1) A wooden block which serves as a float seat.
 - (2) A circular, cutaway rubber buffer pad which is believed to serve as a shock absorber upon impact.
 - (b) The float this component has the appearance of two cones welded together at their bases. It is 32" long overall, 21" in maximum diameter and has a positive buoyancy of about 65 lbs. The mooring cable is attached to a lug at one end.
 - (c) The tail consists of a truncated cone fitted with four radial fins which are enclosed by a shroud ring, 8" long and 25 1/2" in diameter. The conical section is 43 1/2" long, 25 1/2" in diameter at its forward end and 8" in diameter at its after end. The tail is attached to the after end of the anchor by eight bolts.
 - (d) The cutters these are standard German mechanical cutters, two in number, secured to the mooring cable three feet and nine feet respectively below the float.
 - (e) The mooring cable consists of a 125 ft. length of 5/8" steel wire. One end is attached to the float and the other end, to a short length of chain which in turn is attached to a bolt on the anchor case. The chain serves to prevent the mooring cable from parting due to chafing on the anchor. Prior to laying, the cable is wound around the cement casting in the anchor.

Operation

Impact with the water shears the tail. The buoyancy of its case and
the expelling effect of the rubber buffer pad cause the float to rise
toward the surface as the anchor sinks. As the anchor continues to
sink, the entire length of mooring cable pays off the mooring drum and
the float and cutters take depth according to the depth of the water.

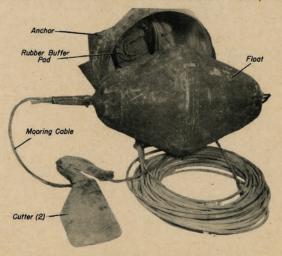


Fig. 5 - Aircraft-Laid Sweep Obstructor