UNITED STATES

ROCKETS AND FUZES

15 MAY 1945

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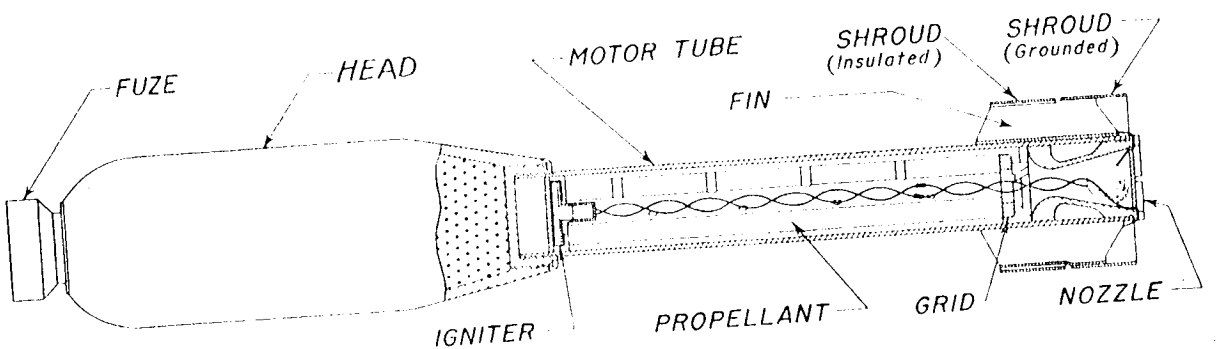
INDEX

INDEX - continued.

ROCKET FUZES

ROCKETS



COMPONENTS OF TYPICAL ROCKET

INTRODUCTION

Rockets cannot be classified exactly as either bombs or projectiles, since they utilize an entirely distinctive propulsive feature. Whereas bombs are dropped from aircraft and projectiles are fired by means of a charge placed in the gun, rockets are propelled by a charge which is carried with the rocket in its flight. Hence, though rockets often are launched from tubes which may resemble the barrel of a gun, the launchers are merely guiding devices to direct the initial flight of the rocket. Launchers also contain contact points whereby the electrical circuit through the igniter can be completed.

The propelling unit of the rocket is called the motor and contains the propellant charge. The motor is usually attached to the body or heads which contains the payload and the initiating device, by external or internal threads on the forward end and thread to the head or an adapter. The motor is closed on the forward end and partially open at the after end. The propellant is a relatively slow burning double-base smokeless powder called ballistite, which is discussed more completely further in the introduction.

The principle of the rocket is a simple one: expanding gases exert an equal pressure in all directions. As the ballistite is burned, hot gases are generated which expand and exert pressure against the confines of the motor tube. Since the hot gases exert an equal pressure in all directions, the pressures against the side walls counter-balance each other; however, the pressure against the forward closed end of the tube is not counteracted by pressure against the aft end, since that end is partially open. The resultant force, then, is a thrust against the closed forward end of the motor, and hence the rocket is propelled in that direction. In order that the pressure of the gases will not be expended too rapidly, and that the propellant can be retained in flight, the aft end of the motor tube is partially closed by the nozzle attachment, which is built into the inside of the tube. This nozzle restricts the ejection of the hot gases and also, by means of its rear taper, furnishes a canted surface against which the rapidly expanding emitted gases may act to increase the forward thrust of the rocket.

The ballistite propellant is ignited by a black powder charge or charges, the initiating device for which is an electric squib with a small bridge wire of low resistance which, when heated by an electrical current, ignites a violent match composition. The black powder charge sends a flash over the entire surface of the ballistite and gives off hot gases which raise the temperature of the ballistite to the ignition point. Upon ignition, the ballistite burns evenly and relatively slowly; this type of burning is necessary to prevent sudden and excessive pressures being exerted against the thin walls of the motor tube. Rocket motors operate at much lower pressures than guns, and correspondingly longer times are required for the complete combustion of the rocket propellant. Burning times of American rockets range from about 0.15 second to as much as 1.5 seconds, depending on the web thickness of the grain and the temperature of the propellant; and burning distances range from a few feet to several hundred feet at high velocities. Hence, most of the burning of the rocket propellant usually occurs after the projectile has left the launcher.

The early productions of rockets were of the fin stabilized type because of their use by the British and partially because of the inherent simplicity associated with fin stabilization. Because of many factors such as the effect of temperature on the burning rate of the propellant, difficulties in controlling to a fine degree the pressures exerted by the expanding gases inside the motor tube, the effect of the expansion of emitted gases against the rear taper of the nozzle, etc., rockets cannot be launched with that degree of accuracy characteristic of gun projectiles. The mean deviation in deflection for most standard land or shipboard launched, fin stabilized rockets is on the average of 30 to 40 mils while those fin stabilized rockets launched from aircraft have a mean deviation of about 5 to 10 mils. The increased accuracy of aircraft launched rockets is attributed to the immediate stabilizing effect given to the fins during the initial stages of flight by the rapid travel of the plane through the air. Fins on rockets exert an appreciable restoring force in flight only at a high velocity and thus a greater degree of accuracy is achieved if rockets are launched from aircraft or if the acceleration occurs to a large extent on the launcher.

Spin stabilized rockets are now in service use with stabilization being dependent on the rotation of the round. Although their accuracy is not comparable to that of gun projectiles, they are generally more accurate than fin-stabilized rockets at short ranges. The use of spin stabilized rockets will be particularly advantageous to ground and amphibious forces inasmuch as they do not have fins, the rocket is shorter, and the launching gear is more compact, which facilitates the loading and stowage problems. Both fin-stabilized and spin-stabilized rockets have inherent advantages and disadvantages, and the method of stabilization employed will be dependent on the required characteristics for each individual case.

As against their disadvantages, rockets have many advantages over gun-propelled projectiles. The most important is the lack of recoil imparted to the

~~CONFIDENTIAL~~

INTRODUCTION - continued.

launcher. Since the forces of the expanding gases are utilized in the propulsion of the rocket, there is no recoil action on the part of the launcher; hence, rockets may be launched from small trucks, amphibious ships, and aircraft which could not withstand the recoil forces exerted by equivalent projectiles fired from guns. Other advantages to rockets are cheapness, simplicity, and portability of the launchers as compared to guns. Rocket launchers in general are more easily replaceable and hence can be considered as more expendable than even light artillery pieces.

COMPONENTS OF A ROCKET PROJECTILE:

The components of a rocket projectile, and the functions which they perform are briefly outlined below. The exact construction of these components varies somewhat according to the particular rocket for which they are designed, and there is some difference between the character and nomenclature of Army and Navy designed components, but these differences will be noted in the discussions of the individual rockets.

Body: This carries the payload and generally the initiating device.

Head: This is a broader term than body and refers to that assembly to which the motor tube is threaded. This is standard terminology for the Navy; however as to the Army, if the head is of one piece construction, the terms head and body may be synonymous as contrasted to some rockets in which the head consists of the body, the drive, and the body union (see drawing page ____).

Motor tube: This contains the propellant charge and igniter. It is a combustion chamber in which the propellant is burned to provide the motive power for the rocket. It generally threads to the rocket head (body) or an adapter, and is usually shipped separate from the head (body) and fuze. The diameter of the motor is generally less than the diameter of the body with which it is used. For details of particular rockets, refer to section on rocket heads.

Grid or Trap Assembly: The Navy refers to the assembly which supports the powder grain as the Grid. This grid supports the grain in such a position that sufficient clearance is allowed between the grain and the motor tube to allow the gas to flow from the propellant to the nozzle. The Army uses a Trap assembly, which is somewhat more complicated than the Navy grid. The trap assembly consists of spacing discs and wires running between them on which the sticks of ballistite are supported. Such an assembly is necessary where numerous small grains are used.

Nozzle: The number of nozzles varies as to the type of motor and method of stabilization. The nozzle has two functions: (1) it directs the gas jet in the desired direction; (2) it provides for expansion of the hot gas in the exit cone, thus giving additional thrust (about 33%) over that obtainable from a simple orifice; and (3) in spin-stabilized rockets, it imparts a clockwise rotation to the rocket when launched.

Fins: These provide stability in flight, prevent tumbling, and insure head-on impact. During burning, the action of the air against the fins gives a restoring moment against side forces at the nozzle and improves the accuracy of fire. When there is a tail shroud, the latter supports the rear end of the projectile in the launcher and may also be utilized to provide electrical contacts for firing. Spin-stabilized rockets do not have fins and stabilization is achieved through the rotary motion of the round.

Propellant and Igniter: The igniter contains loosely packed black powder and an electric squib with a low resistance bridge running through a violent match composition. The propellant used by the United States is a double base smokeless powder called ballistite, which burns slowly and uniformly. Production of ballistite differs somewhat for the Army and the Navy, the Army preferring the solvent extrusion process and the Navy specifying the solventless extrusion process. The solvent extrusion process is impractical for grains having a web of more than 1-1/4".

Grain shapes also vary somewhat with Army rockets generally propelled by several small cylindrical grains of ballistite, with an axial hole and several small radial holes to increase the burning surface and uniformity of burning. The Navy rockets use either a single solid cruciform grain without perforations or a single cylindrical grain with an axial hole and radial perforations. The latter, usually used in Navy ground or shipboard mounted rockets, is characterized by three ridges 120° removed and running longitudinally along the grain. Inhibitors are not used on this type. The cruciform grain, usually found in Navy aircraft rockets in section is a symmetrical cross with rounded ends. If all of the exterior surface of this grain were permitted to burn, there would be a gradual decrease of area, and a markedly regressive behavior would result in the burning rate. Since this type of burning would be detrimental to the desired uniform burning rate, a number of slower burning cellulose acetate strips are bonded to certain parts of the area exposed on the outer curved ends of the arms. By inhibiting a suitable fraction of the surfaces along the ends of the arms, the proper combination of increasing and decreasing surfaces may be obtained to give desired burning characteristics.

~~CONFIDENTIAL~~

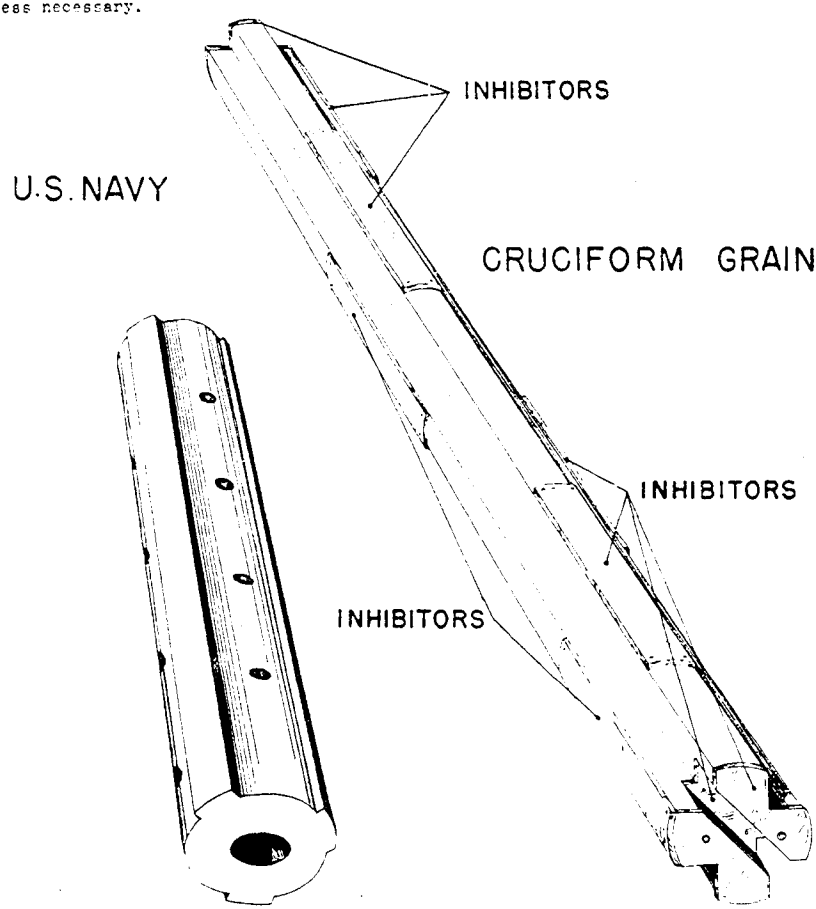
INTRODUCTION - continued.

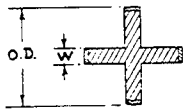
STORAGE OF ROCKETS:

In order to decrease hazards in handling, storage, and transportation, rocket bodies and motors are generally shipped and stored separately. Motors with large grains are kept in a non-propulsive state until final assembly for field use is necessary. The seals at both ends of the motors are light and easily displaceable by pressure developed inside the tube and should the igniter and grain ignite, the closures would fail quickly to relieve the pressure without more than a slight movement of the motor.

It is necessary that loaded motors be kept at moderate temperatures as much as possible. Smokeless powder is subject to deterioration when stored for extended periods at a high temperature, as well as the possibility existing of the motor reacting spontaneously. Even though ignition should not take place, the powder should not be stored where temperatures exceed 100°F. because such conditions tend to markedly decrease the stable life of the propellant. Because of the presence of the electric squib, rocket motors should not be stored near radio apparatus or antenna leads.

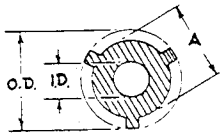
Although there is very little possibility of a motor firing as a result of falling or rough handling, such treatment is likely to cause malfunctioning of the rounds and should be carefully avoided. For this reason, the ammunition should be kept in packing containers or ready boxes, and should not be handled in a loose condition unless necessary.





PROPELLANT GRAINS

U. S. NAVY



MK	MOD	SHAPE	DIMENSIONS					INHIBITED WEIGHT IN LBS	LENGTH	MOTORS USED IN
			CRUCIFORM		CYLINDRICAL					
			W	O.D.	O.D.	I.D.	A			
1	-	Cylindrical	-	-	1.97	.59	1.70	1.499	11.60	2.25 R.M. Mk 1,3,7,8 & 9
2	-	Cylindrical	-	-	1.97	.43	1.70	1.551	11.60	2.25 R.M.Mk 3
3	-	Cylindrical	-	-	1.97	.51	1.72	1.503	11.60	2.25 R.M.Mk 3
3	1	Cylindrical	-	-	1.97	.51	1.70	1.503	11.60	2.25 R.M.Mk
4	-	Cylindrical	-	-	1.10	.50	.99	.207	5.80	
4	1	Cylindrical	-	-	1.10	.53	.99	.207	6.10	
5	-	Cylindrical	-	-	1.10	.50	.99	.142	4.10	
5	1	Cylindrical	-	-	1.10	.53	.99	.142	4.40	
6	-	Cylindrical	-	-	2.95	1.41	2.49	1.800	8.60	3.25 R.M.Mk 1
6	1	Cylindrical	-	-	2.96	1.42	2.51	1.800	8.70	3.25 R.M.Mk 1
7	-	Cylindrical	-	-	2.96	1.38	2.49	2.800	13.00	3.25 R.M.Mk 2
7	1	Cylindrical	-	-	2.96	1.37	2.51	2.800	13.00	3.25 R.M.Mk 2
8	-	Cylindrical	-	-	2.96	1.38	2.49	4.140	19.30	3.25 R.M.Mk 3
8	1	Cylindrical	-	-	2.96	1.37	2.51	4.140	19.55	3.25 R.M.Mk 3
9	-	Cylindrical	-	-	2.96	1.42	2.51	1.690	8.15	3.25 R.M.Mk 4
10	-	Cylindrical	-	-	1.97	1.63	1.70	1.397	11.50	2.25 R.M.Mk 5
11	-	Cylindrical	-	-	2.96	1.05	2.55	5.250	20.25	3.25 R.M.Mk 5
11	1	Cylindrical	-	-	2.96	1.03	2.55	5.250	20.25	3.25 R.M.Mk 5
12	-	Cylindrical	-	-	1.10	.53	.99	.298	8.300	1.25 R.M.Mk 4 & Mk 4 Mod 1
12	1	Cylindrical	-	-	1.10	.53	.99	.298	8.800	1.25 R.M.Mk 4 & Mk 4 Mod 1
13	-	Cruciform	.990	2.930	-	-	-	8.83	34.000	3.25 Mk 7 (Aircraft)
14	-	Cylindrical	-	-	2.96	1.03	2.55	3.77	14.600	Mk 10 Rocket Target
15	-	Cylindrical	-	-	2.96	1.03	2.55	2.60	10.100	Mk 11 Rocket
16	-	Cylindrical	-	-	1.97	.26	1.70	1.75	13.287	2.25 Mk 10
16	1	Cylindrical	-	-	1.97	.26	1.66	1.75	14.037	2.25 Mk 10 Mk 10-1, Mk 11 and Mods
17	-	Cylindrical	-	-	1.97	.26	1.66	1.12	9.350	2.25 Mk 12, Mk 13 & Mods
18	0	Cruciform	1.540	4.530	-	-	-	24.83	39.750	5.0 Mk 1, Mk 1
19	0	Cruciform	1.540	4.530	-	-	-	38.00	59.750	11.75 Mk 1. 4 grains required for one assembly
20	0	Cruciform	.990	2.93	-	-	-	8.83	34.000	3.25 Mk 7 FF (Aircraft)
21	0	Cruciform	1.540	4.53	-	-	-	10.38	16.750	5.0 Mk 3 (HVSP)
22	0	Cruciform	1.540	4.53	-	-	-	5.83	9.350	5.0 Mk 4 (HCSP)
23	0	Cruciform	.990	2.93	-	-	-	2.50	9.950	3.50 SSR Mk 13
24	0	Cruciform								5.0 SS Mk 5
25	0	Cruciform								5.0 SS Mk 6

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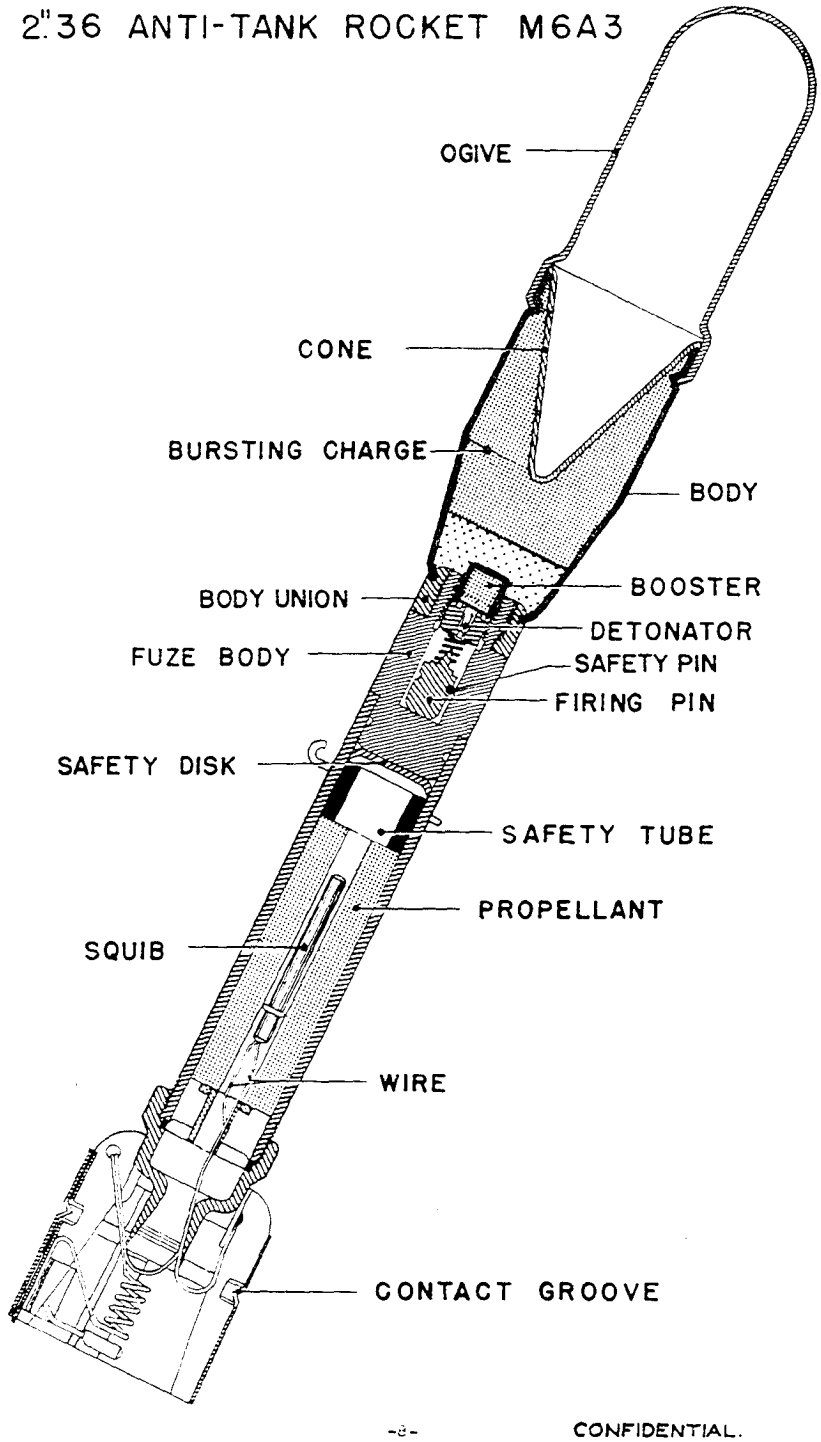
2.36 ANTI-TANK ROCKET M6A3



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U. S. ARMY

2.36" ANTITANK ROCKET

M 6A4, M 6A3, M 6A1 Service
M 7A4, M 7A3, M 7A1 Practice

M 6A1 & M 6A3

OVERALL LENGTH	21.6 in.
TOTAL WEIGHT	3.5 in.
HEAD LENGTH	8.6 in.
BODY LENGTH	4.11 in.
BODY DIAMETER	2.23 in.
BODY WALL THICKNESS	0.087 in.
OGIVE LENGTH:	
M 6A1 (cone shaped)	4.5 in.
M 6A3 (hemispherical)	4.56 in.
OGIVE DIAMETER (at flange)	2.245 in.
MOTOR TUBE LENGTH	6.32 in.
MOTOR TUBE (inner diameter)	1.06 in.
MOTOR TUBE WALL THICKNESS	0.095 in.
MAXIMUM RANGE	700 yds.
EFFECTIVE RANGE	300 yds.
MUZZLE VELOCITY	265 ft/sec
COLOR	Olive drab
EXPLOSIVE	Pentolite

TARGET:

Pill boxes, tanks, and armored vehicles. Can also be used in a stationary emplacement for demolition or as an anti-tank mine or a booby trap. The rocket can penetrate 3" of homogeneous-steel armor plate at all ranges and at angles of impact as low as 30 degrees, employing explosive in the form of a shaped charge.

LAUNCHER:

The Rocket Launcher, M 1A1, commonly called the "bazooka", is an electrically operated weapon of the open tube type, fired from the shoulder, and weighing 13.26 lbs.

CONSTRUCTION:

The M 6A1 and M 6A3 are identical except for difference in the ogive and the tail assembly. In other respects the two rockets are similar, consisting of a hollow ogive crimped onto the body, a body union fitting into the base of the body with internal threads to receive the motor, and a fuze which is located in the forward end of the motor tube. The M 6A1 has a conical ogive, whereas the M 6A3 has a hemispherical ogive which gives better penetration by forming a stronger stand-off piece for the shaped charge effect of the explosive.

TAIL ASSEMBLY:

The M 6A1 has six fins (5½" long) spot welded to the nozzle, a steel cup internally threaded at the forward end to screw onto the motor tube. The M 6A3 has a different type of tail assembly to obtain a greater fin area and thereby counteract the change of the center of gravity effected by the use of the hemispherical nose. This tail assembly consists of four sheet steel fins 2-5/16" long, each of which is curved over an arc of 90 degrees on its outboard edge to form a blade. Each fin is joined to the other by welding, with an overlap of approximately 1/2 inch to form a circular drum which is actually nothing more than a continuation of the four fins. The bases of the fins are spot welded to the nozzle.

PROPELLANT:

The propellant consists of five sticks of ballistite, each 0.36" in diameter and 4.15" long. On an average, the propellant weighs approximately 61½ grams, though it is not loaded by weight but by length of powder stick to keep the pressure for various rounds at a relatively constant value.

FUZE:

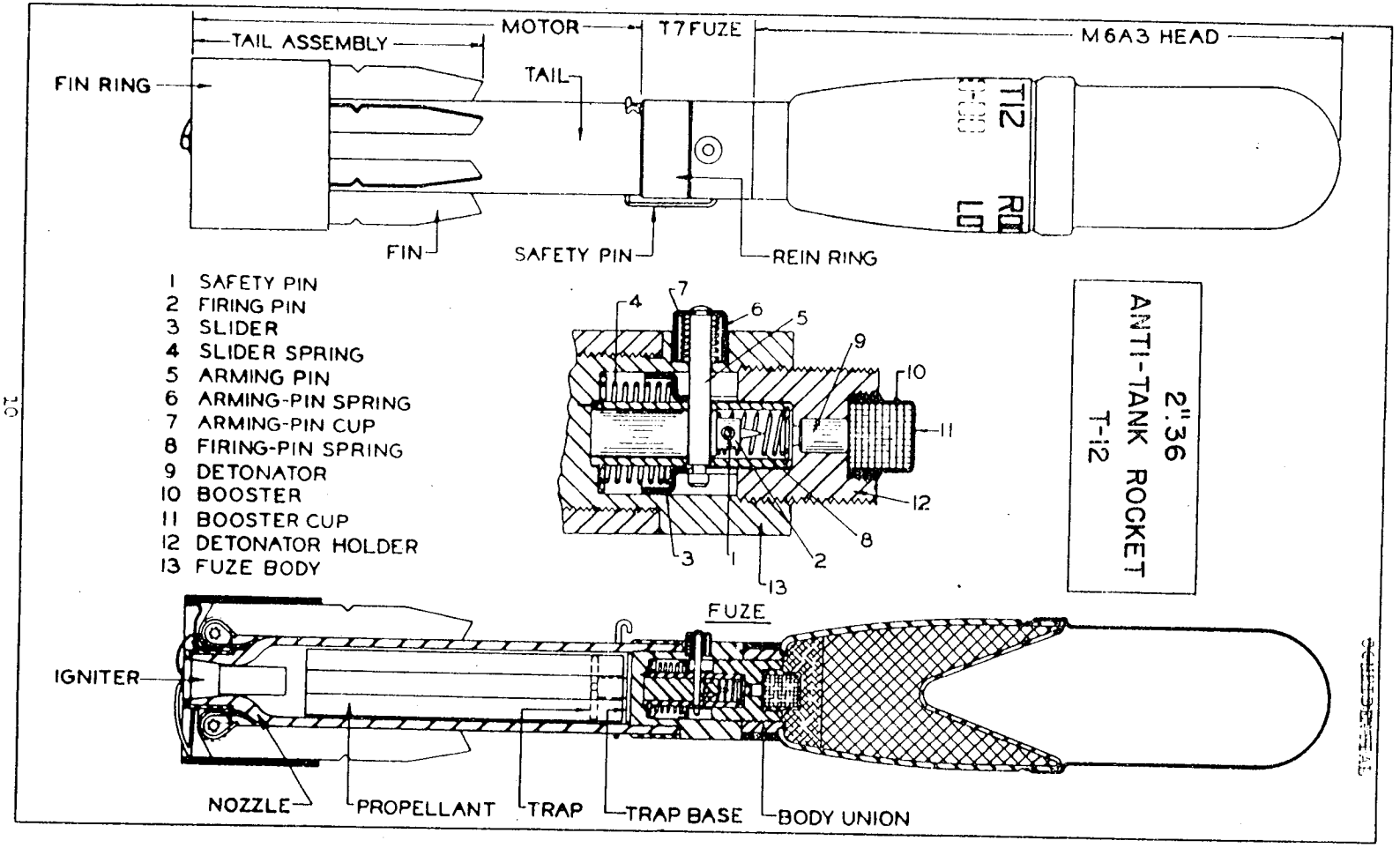
The fuze consists of a steel firing pin which slips into the central cavity of the fuze body, where it is held in a rearward position by the firing pin spring. A circumferential groove midway down the length of the firing pin receives the safety pin, which extends through the motor tube. When the safety pin is removed the firing pin is free to move forward, restrained only by the action of the firing pin spring. After the safety pin has been removed, the firing pin will overcome the spring and detonate the rocket if it is dropped over four feet. The fuze body contains the M 18 detonator of lead azide and tetryl, and the booster charge of tetryl.

PRACTICE ROCKETS, M 7A1, M 7A3:

These are similar in design and construction to the M 6A1 and the M 6A3 rockets respectively. A steel rod 5.33 inches long is fitted into the fuze body to make up the weight of the explosive charge and the fuze.

M 6A4 and M 7A4 ROCKETS:

The M 6A4 is similar to the M 6A3, differing only in that high strength alloys were used to reduce the weight and improve performance, and the bore safe fuze, M 400, was incorporated (see drawing of fuze page 10). The M 7A4 is the practice rocket.


TAIL ASSEMBLY
MOTOR
T7 FUZE
M6A3 HEAD
FIN RING
TAIL
T12 RD LOADED
FIN
SAFETY PIN
REIN RING
1 SAFETY PIN
2 FIRING PIN
3 SLIDER
4 SLIDER SPRING
5 ARMING PIN
6 ARMING-PIN SPRING
7 ARMING-PIN CUP
8 FIRING-PIN SPRING
9 DETONATOR
10 BOOSTER
11 BOOSTER CUP
12 DETONATOR HOLDER
13 FUZE BODY
FUZE
IGNITER
NOZZLE
PROPELLANT
TRAP
TRAP BASE
BODY UNION
2.36 ANTI-TANK ROCKET T-12

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U. S. ARMY ROCKET

2."36 ANTI-TANK ROCKET

T 12

OVERALL LENGTH	17.16 in.
LENGTH OF HEAD	8.25 in.
LENGTH OF MOTOR	7.5 in.
LENGTH OF FIN	3.93 in.
WEIGHT OF FILLING	.5 lbs.
WEIGHT OF PROPELLANT	.14 lbs.
WEIGHT OF ROCKET	3.72 lbs.
MAXIMUM RANGE	700 yds.
COLOR	Olive drab
EXPLOSIVE	Pentolite

GENERAL: The T 12 was developed to incorporate the good qualities of other 2"36 rockets and to achieve greater stability in flight, safe operation through a greater temperature range, a bore safe fuze, and a more sensitive fuze to ensure detonation of rocket on ground impact.

CONSTRUCTION OF HEAD: The head is similar to the M6A3 with a hollow ogive crimped onto the body, a body union fitting into the base of the body with external threads to receive the motor, and a fuze which is located in the forward end of the motor tube.

MOTOR ASSEMBLY: The tail is a seamless steel tube 7.5 inches long and 1.3 inches in diameter, internally threaded on the forward end with a rein ring shrunk onto the forward end for strengthening. The fin assembly consists of six fins, six brackets, and a fin ring. The brackets are spot welded to the motor tube and the fins are held in place between the brackets by rivets. The fins are free to rotate 120 degrees. The fin ring which holds the fins in place along the motor, is removed when the rocket is placed in the launcher.

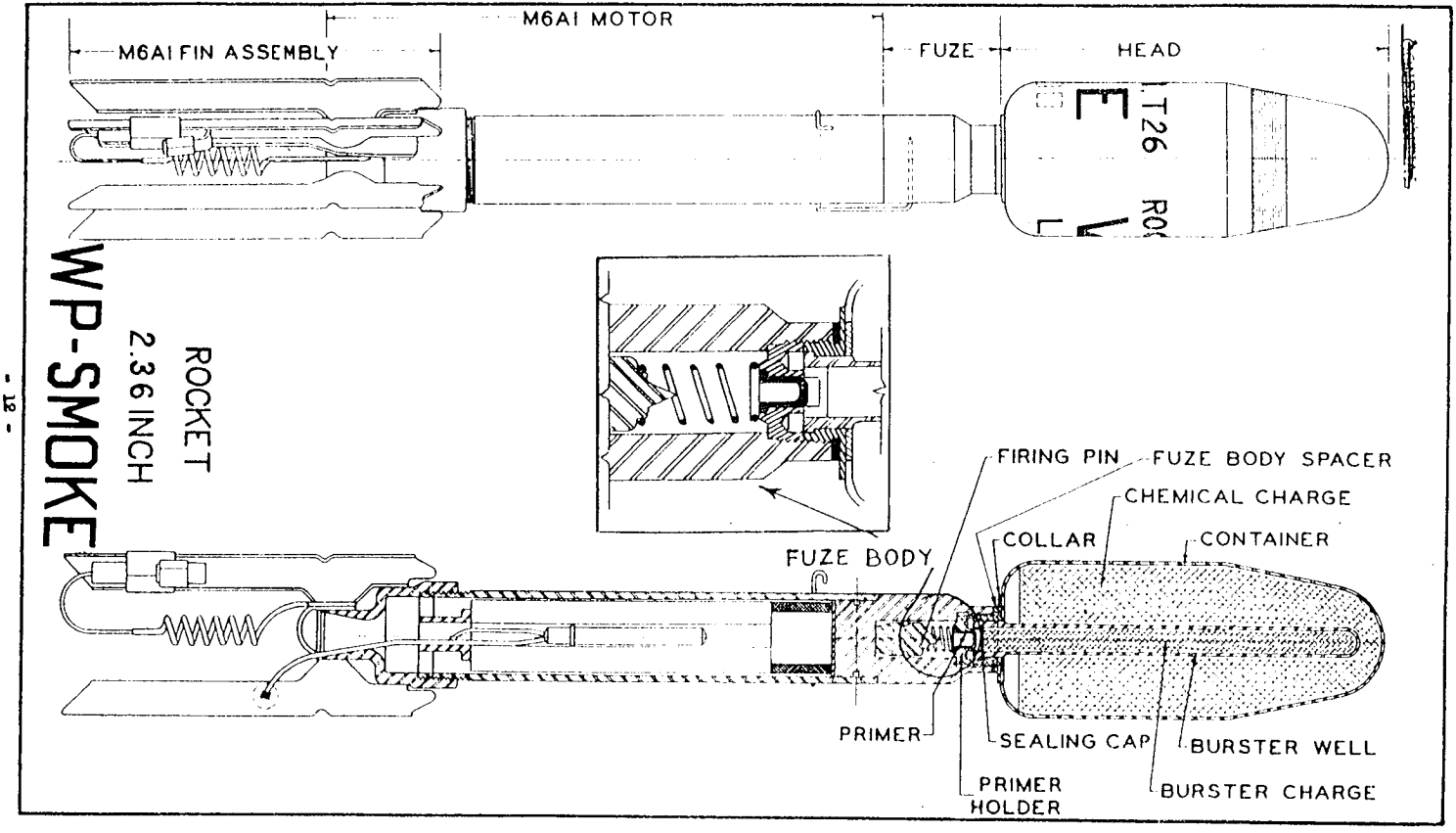
The propellant consists of five sticks of ballistite, each 0.37 inches in diameter and 4.15 inches long.

FUZE: M 400 The safety pin passes through the firing pin and holds it in place. The slider spring presses forward against the shoulder of the slider. The slider, which is slotted in its forward rim, hooks into a groove in the inner end of the arming pin, holding the arming pin in position.

When the safety pin is withdrawn, the firing pin is held in place by the arming pin. On setback, the slider is forced back against the tension of the slider spring to release the arming pin. The arming pin spring forces the arming pin out until it strikes the wall of the launcher, the inner end of the arming pin still partially engaging the firing pin for bore safety.

As the rocket clears the launcher, the arming pin and cap are forced out by the arming pin spring; the firing pin is held in position by the anti-creep spring. On impact, the firing pin moves forward by inertia to overcome the anti-creep spring and strike the detonator.

The M 400 fuze is also used in the M 6A4 Rocket.


M6A1 MOTOR
M6A1 FIN ASSEMBLY
FUZE
HEAD
T26
WP-SMOKE
ROCKET
2.36 INCH
FIRING PIN
FUZE BODY SPACER
CHEMICAL CHARGE
COLLAR
CONTAINER
FUZE BODY
PRIMER
SEALING CAP
BURSTER WELL
PRIMER HOLDER
BURSTER CHARGE

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OVERALL LENGTH . . . . . 19-5/16" TOTAL WEIGHT . . . . . 3.4 lbs. LENGTH OF HEAD . . . . . 5⅜" MAX. DIAMETER . . . . . 2.36" DIAMETER OF HEAD . . . . . 2.30" WP CHARGE . . . . . 405 gm. BURSTER CHARGE . . . . . 4 gm. EFFECTIVE RANGE . . . . . 300 yd. COLOR . . . . . Motor: Olive drab Head: Blue grey	U. S. ARMY **2.36 SMOKE (W.P.) ROCKET** M 10

TARGET: This rocket is designed not only as a screening agent, but also to cause casualties. WP in smoke form has little effect upon the human body, but particles cause small burns. This rocket makes an effective weapon for dislodging enemy troops from dug-outs and foxholes.

LAUNCHER: The M 10 rocket is fired from the 2.36 Rocket Launcher M1A1 or M9, commonly known as the "bazooka".

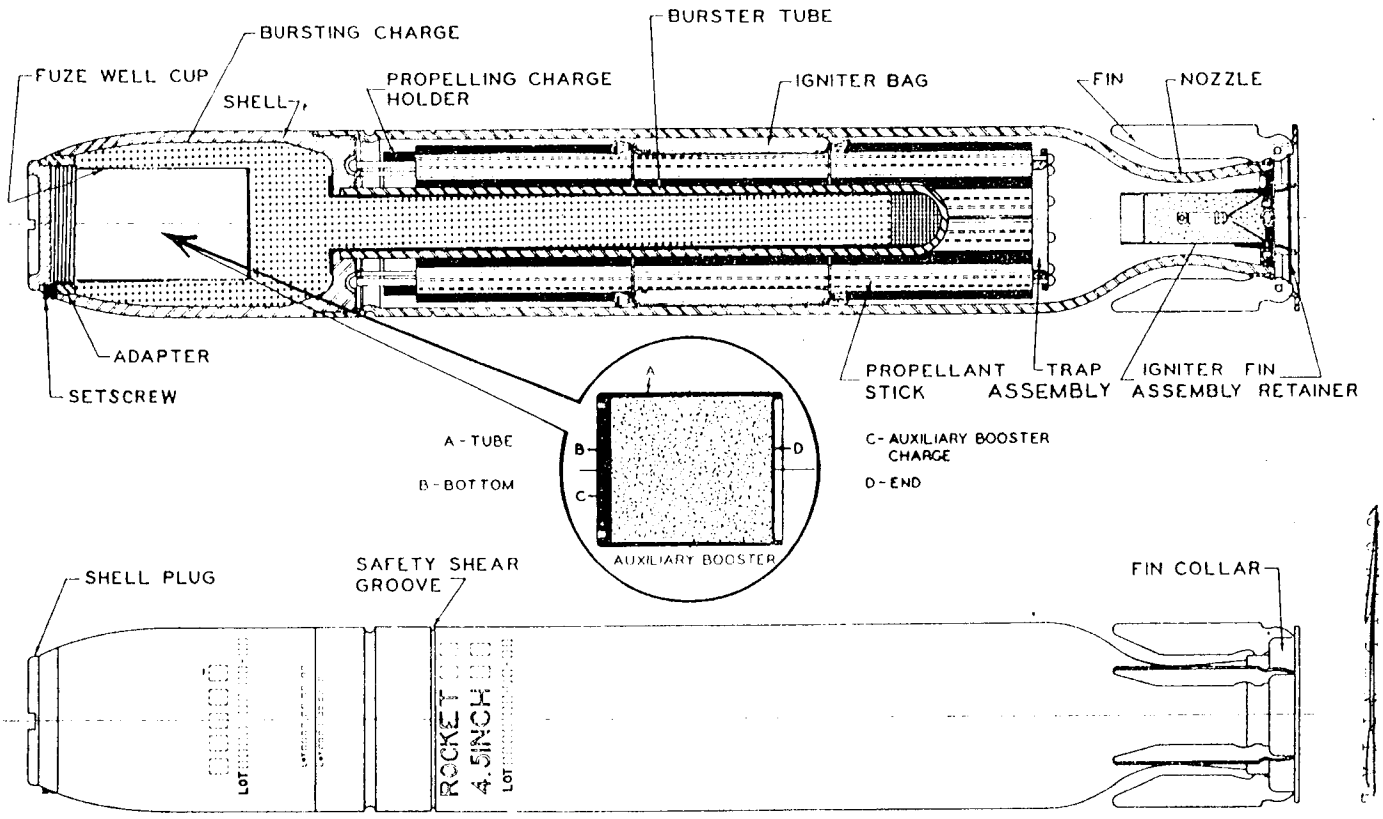
CONSTRUCTION: The components of this rocket are the motor assembly and the head assembly. The motors presently used are the M6A1 (see drawing) which is being replaced by the M6A3 (see motor on page 8). As new motors are developed, it is contemplated that this rocket will be modified.

The head assembly consists of a container for the smoke charge with a long burster well containing PETN inserted from its after end. A collar is soldered to the base of the container. The spacer slips over the threads of the collar and is held against the flat surfaces of the collar by the fuze body, forming a joint between the two. The primer holder is threaded into the fuze body.

TAIL ASSEMBLY: The M 10 rocket has the standard tail assembly for the M6A1 or M6A3 motors.

FUZING: The fuze is similar to that used in the M6A3 AT Rocket.

4.5 H.E. ROCKET M8



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U. S. ARMY

4".5 H.E. ROCKET

M8, M8A1, M8A2

(Fired from aircraft or ground launchers)

OVERALL LENGTH	33.19 in.
TOTAL WEIGHT	36 lbs.
BODY LENGTH	7.5 in.
BODY DIAMETER	4.5 in.
WALL THICKNESS	0.2 in.
BURSTER TUBE LENGTH	15.5 in.
FIN LENGTH	4-1/8 in.
BURSTING CHARGE (TNT)	4.3 lb.
MAXIMUM RANGE	4,500 yds.
MUZZLE VELOCITY	900 ft/sec
COLOR	Olive drab
MARKINGS	The designation, lot number, etc., are stenciled on the body with yellow paint.
FUZING	M4, M 4A1, M 4A2. See page 83.

USE:

For use against ground targets such as personnel, airplanes on the ground, light installations, etc. This bomb gives good fragmentation, as well as blast effect because of the relatively high explosive charge in the head. The initial issue of the rocket went to the Army Air Forces for projection from aircraft launchers against ground targets. Inasmuch as the rocket was originally designed for use from ground launchers, its use in aircraft is being discontinued in favor of Navy designed aircraft rockets.

LAUNCHERS:

From aircraft, the rockets are launched from the 3-tube 4.5" A.C. launcher. This consists of three tubes in a cluster under each wing, the tubes being smooth-bore elastic, approximately 10 feet in length. The rocket can be used in either single or multiple-barreled ground launchers.

CONSTRUCTION:

As can be seen in the accompanying diagram, the construction of this rocket is considerably different from the normal type of rocket. Except for a slight tapering at the nose and the narrow base end forming the nozzle, the rocket has a constant diameter of 4.5" throughout its length. The forward end of the rocket consists of the shell, with an adapter to receive the nose fuze. The head and motor are combined into one in this rocket in the form of a tube which threads onto the shell with a central burster tube extending back into the motor. The explosive content of the rocket is contained partly in the shell and partly in the burster tube. This design furnishes much better fragmentation of the motor tube than in the normal type rockets with the separate head and motor. The trap assembly is a wire cage housed in the motor tube which provides a framework to hold the propellant in the proper position. This assembly consists of a trap ring, 10 trap wires, and a trap plate. Before the head is screwed into the tube, the trap assembly is slipped, trap-ring first, into the threaded end until the trap plate comes to rest on the internal bulge of the nozzle.

The fin assembly for the rocket opens and guides the rocket in flight only after the rocket has cleared the launcher. The fins of the assembly are held in place by the fin retainer, which is expelled by the blast of the escaping gas, and after clearing the launcher the fins snap to their outstretched position. There are six fins, all identical.

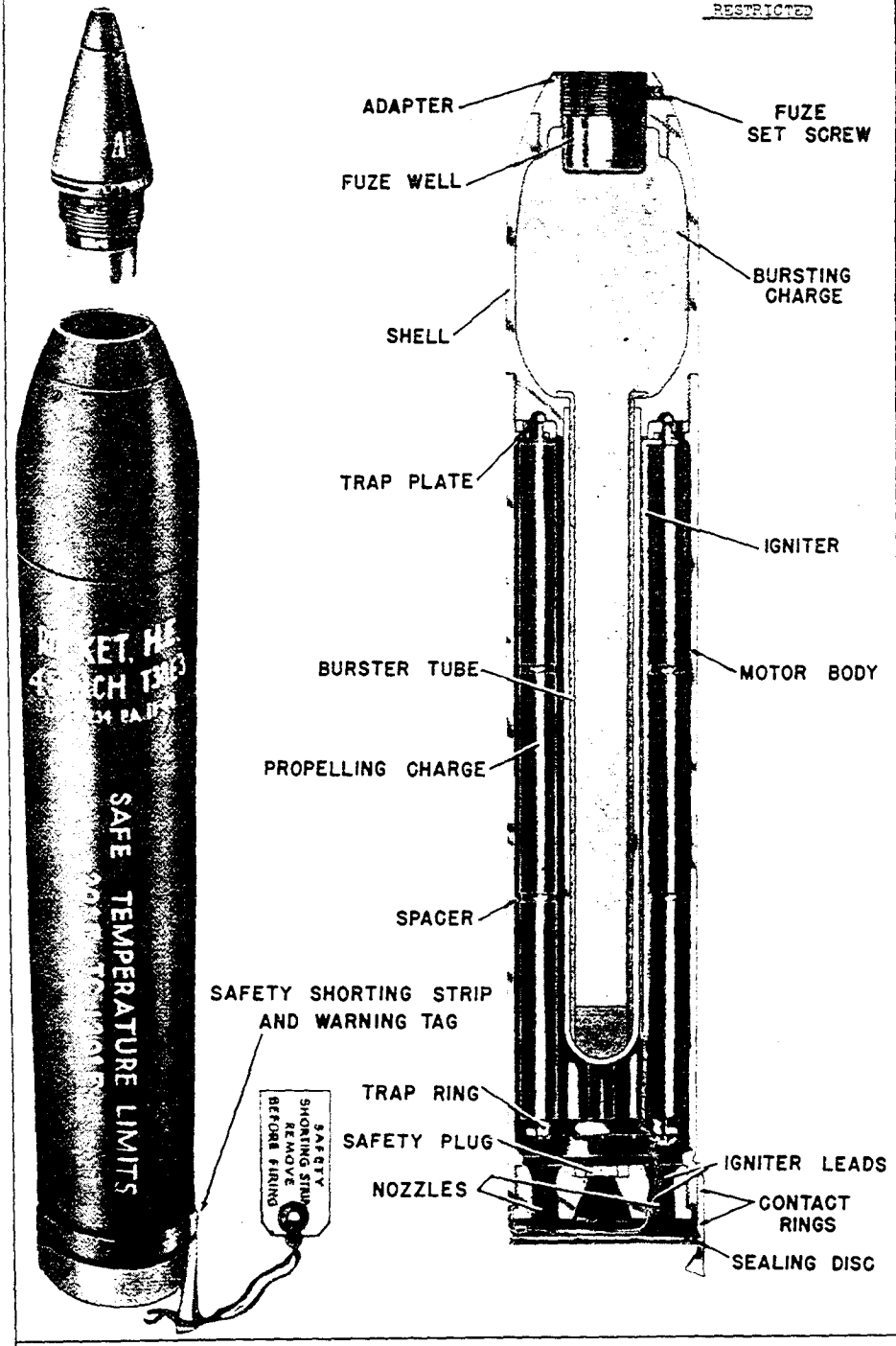
The M 8A1 involved a change in the design of the motor tube to strengthen it on the threaded end. The head of the M 8 was used by machining new base threads. Tests on the M 8A1 indicated that the base of the modified head was weak and a new head was designed for use with the motor of the M 8A1. This rocket, the M 8A2, will supersede the M 8 and M 8A1.

PROPELLANT:

The propellant consists of 30 sticks of ballistite. Each stick is 5" long and 7/8" in diameter with a 1/4" axial hole. Three sticks are placed on each trap wire, and there is sufficient clearance between the sticks and the wire to allow burning of the inner stick wall simultaneously with the burning of the outer wall. Two igniter-bag assemblies are bound on two opposite columns of the propellant, the bags assisting the ignition of the propellant by catching the flame of the igniter and in turn igniting the upper propellant sticks.

PRACTICE ROCKETS: M9, M 9A1, M 9A2

Similar in design and construction to the M 8 series, lacking only the explosive charge and live fuze. The M 4 fuze and booster may be assembled and used in the M 9 as a spotting charge.



4.5" H.E. ROCKET M 16

RESTRICTED

U. S. ARMY

4.5 ROCKET SPIN STABILIZED

M16, M17
M20, M21

OVERALL LENGTH	31 in.
TOTAL WEIGHT (with fuze)	42.5 lbs.
HEAD DIAMETER	4.5 in.
HEAD LENGTH (with burster tube)	23.29 in.
BURSTING CHARGE (TNT)	4.3 lbs.
MAXIMUM RANGE	5,250 yds.
MAXIMUM VELOCITY	830 f/s
COLOR	Olive drab
FUZING	M81

GENERAL: The M16 is a spin stabilized rocket, the construction of which is somewhat similar to the 4.5 fin stabilized rocket M8. (See page 15). The M16 (T38E3) is the H.E. round and the M17 (T39E3) is the practice round.

DESCRIPTION: The head, loaded with high explosive, contains a fuze well cup and a burster tube. The burster tube projects about 15 inches into the center of the rocket motor to secure additional fragmentation. The motor body is a steel tube threaded at each end to receive the head and the nozzle plate, which contains eight nozzles equally spaced in a circle and one nozzle in the center. The eight nozzles are set at an angle in order to impart rotation to the round when fired. The center nozzle is normally closed by a blow-out disc which is designed to fail when the internal pressure in the body surpasses a predetermined limit. The nozzle openings are protected by a plastic sealing disc which remains in place during firing and is blown out by the rocket blast.

The propelling charge consists of 30 grains of ballistite strung on wires of a cage-like trap. The igniter consists of a charge of black powder enclosed in a plastic tube attached to the trap and running the length of the charge. The tube also contains an electric squib. The leads of the squib pass through one of the nozzles, one lead being grounded to the motor body and the other connected to a contact ring.

PRACTICE ROCKET, M17: The M17 is similar in design and construction to the M16 but lacks in the explosive charge and live fuze.

H. E. ROCKET, M20: The M20 is similar in design and construction to the M16, differing only in that the ignition wires are attached to spools rather than contact rings.

PRACTICE ROCKET, M21: The M21 is similar in design and construction to the M20 but lacks in the explosive charge and the live fuze.

OVERALL LENGTH	59 in.
DIAMETER	3.25 in.
WIDTH ACROSS FINS	24 in.
WEIGHT	37.5 lb.
PROPELLING CHARGE WEIGHT	3.2 lb.
IGNITER WEIGHT (black powder)	0.78 oz.

U. S. ARMY

3.25" TARGET ROCKET

M 2
M 2 A1 (flare)

USE:

High speed target for firing practice with automatic anti-aircraft weapons.

COMPONENTS:

The rocket consists of a motor, motor extension, nose, and three plywood fins. This rocket is very similar to the Navy TR, and is a direct copy of the British 3 inch U.P. projectile.

PROPELLANT:

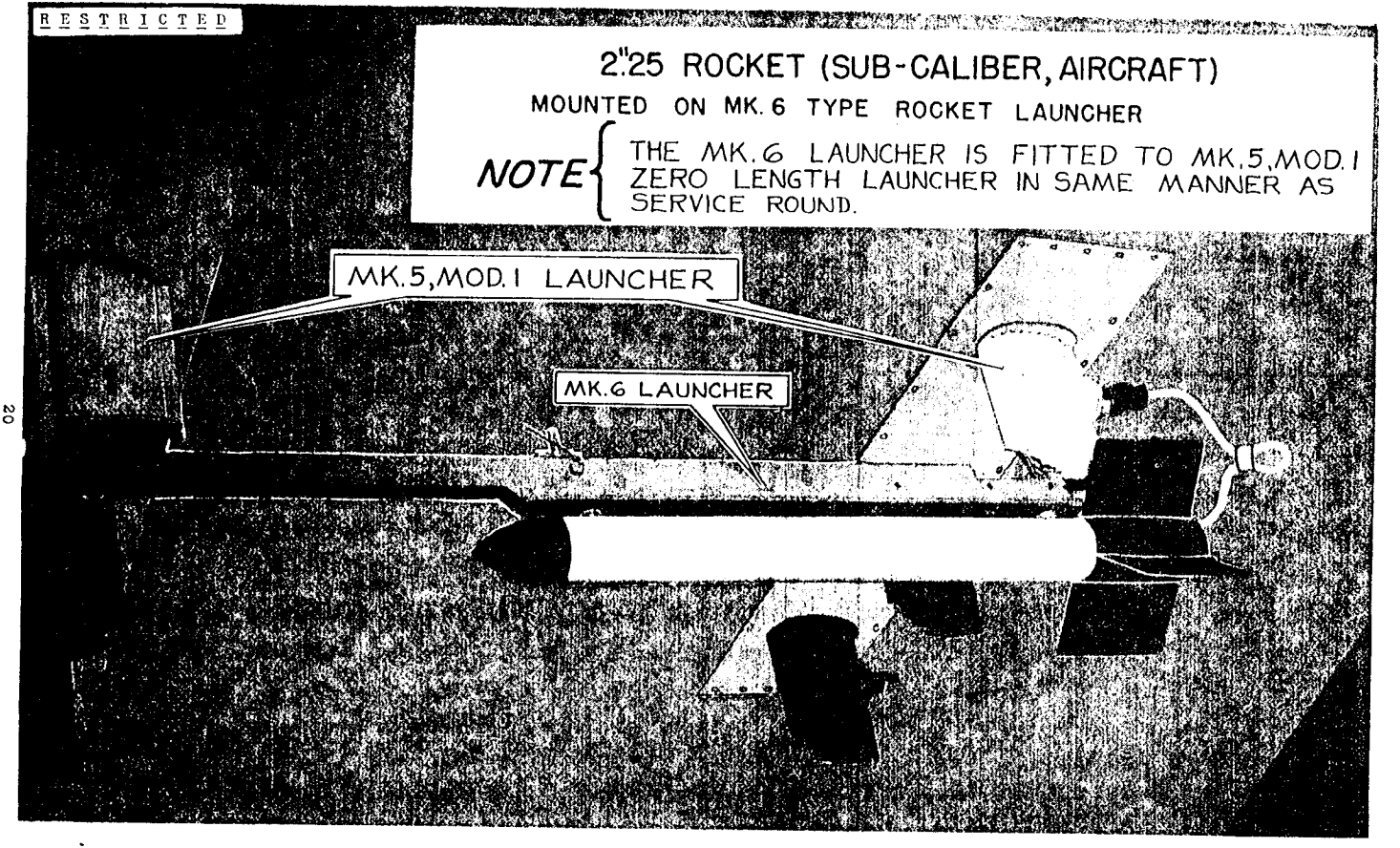
The propellant is a solvent-extruded double-base powder (40 percent nitrocellulose), extruded into cylindrical grains 5" long and 7/8" in diameter, with a 5/16" axial hole. The propelling charge is ignited by an electric squib assembled within the rocket.

M 2A1, FLARE, MODIFICATION:

When a flare is added to the M 2 rocket for anti-aircraft target practice at night, the resulting projectile is designated as the rocket, target, anti-aircraft 3.25", M 2A1. The flare burns for 15 to 20 seconds from the beginning of flight.

LAUNCHER:

These rockets are launched from the Target Rocket Projector, M 1.


2"·25 ROCKET (SUB-CALIBER, AIRCRAFT)
MOUNTED ON MK. 6 TYPE ROCKET LAUNCHER
NOTE
THE MK. 6 LAUNCHER IS FITTED TO MK. 5, MOD. 1 ZERO LENGTH LAUNCHER IN SAME MANNER AS SERVICE ROUND.
MK. 5, MOD. 1 LAUNCHER
MK. 6 LAUNCHER

The 2.25 sub-caliber rocket for aircraft use was developed for training purposes. Initially two types were designed to approximate the trajectory of both the 5"/5 and 5"/0 rockets; however, it is believed that only one rocket will be standardized for future use. The rocket with Motor Mk 11 and the body Mk 3 Mod 2 is the assembly which probably will be used in future training.

The Mk 1, a CIT production, was issued until adopted and issued by BuOrd as the Mk 3 Mod 2. The Mk 2, a CIT production, was designed as a slow sub-caliber rocket. The complete assembly for the latter is no longer available.

U. S. Navy

2.25" ROCKET

SUB-CALIBER, AIRCRAFT

Motor	Body	Velocity	Approximates Trajectory of:
2"25 Mk 10 or 11	5"25 Mk 1 or 3 (1.6 lbs.)	1150 ft/sec	3"/5 Rocket (5"25 Motor)
2"25 Mk 12 or 13	5"25 Mk 1 or 3 (1.6 lbs.)	810 ft/sec	5"/0 Rocket (5"25 Motor)
2"25 Mk 10 or 11	5"25 Mk 2 (8.6 lbs.)	810 ft/sec	5"/0 Rocket (5"25 Motor)

The 2"25 Motor Mark 10 and 11 are similar to each other as are the 2"25 Motor Mark 12 and 13. The Motors Mark 10 and 11 differ from the Mark 12 and 13 in that the diameter of the nozzle on the latter are smaller and the weight of propellant of the Mark 10 and 11 is 1.73 lbs. as compared to the weight of 1.12 lbs. in the Mark 12 and 13.

The external dimensions of these rockets are the same. For recognition purposes, the 2"25 Motors Mark 10 and 11 are painted white with black fins while the Motors Mark 12 and 13 are grey with black fins.

MOTOR MK 11 AND BODY MK 2 MOD 3

Overall length of the rocket is 29 inches. Two button type lugs are provided on the motor tube spaced approximately 19 inches apart. Four fins are welded to the aft end of the motor tube and are not removable as is the case with most service rockets.

The 2"25 motor Mark 11 contains essentially the following parts:

(1) Propellant. The propellant is an extruded cylindrical grain of ballistite weighing approximately 1-3/4 pounds. Inhibitor discs cemented to the ends of the grain control the burning area.

(2) Igniter. A 14 gram black powder igniter in a plastic case is located at the forward end of the motor. This igniter is set off by an electrical squib.

(3) Grid. The grid supports the propellant grain. During burning it prevents the grain from sliding rearward and clogging the nozzle opening.

(4) Nozzle. The nozzle is a steel venturi through which the gases flow. It directs the gas jet in the desired direction and also provides for the expansion of the gases in the exit cone.

(5) Nozzle closure. The nozzle closure seals the rear end of the motor. It is crimped to the electrical pigtail, providing a moisture proof seal.

(6) Pigtail. The electrical pigtail extends from the nozzle end and is the same design as that used in service rockets.

When the body is screwed to the motor in assembly, a luting compound (white or red lead) is used to effect a tight seal between the two parts.

LAUNCHERS

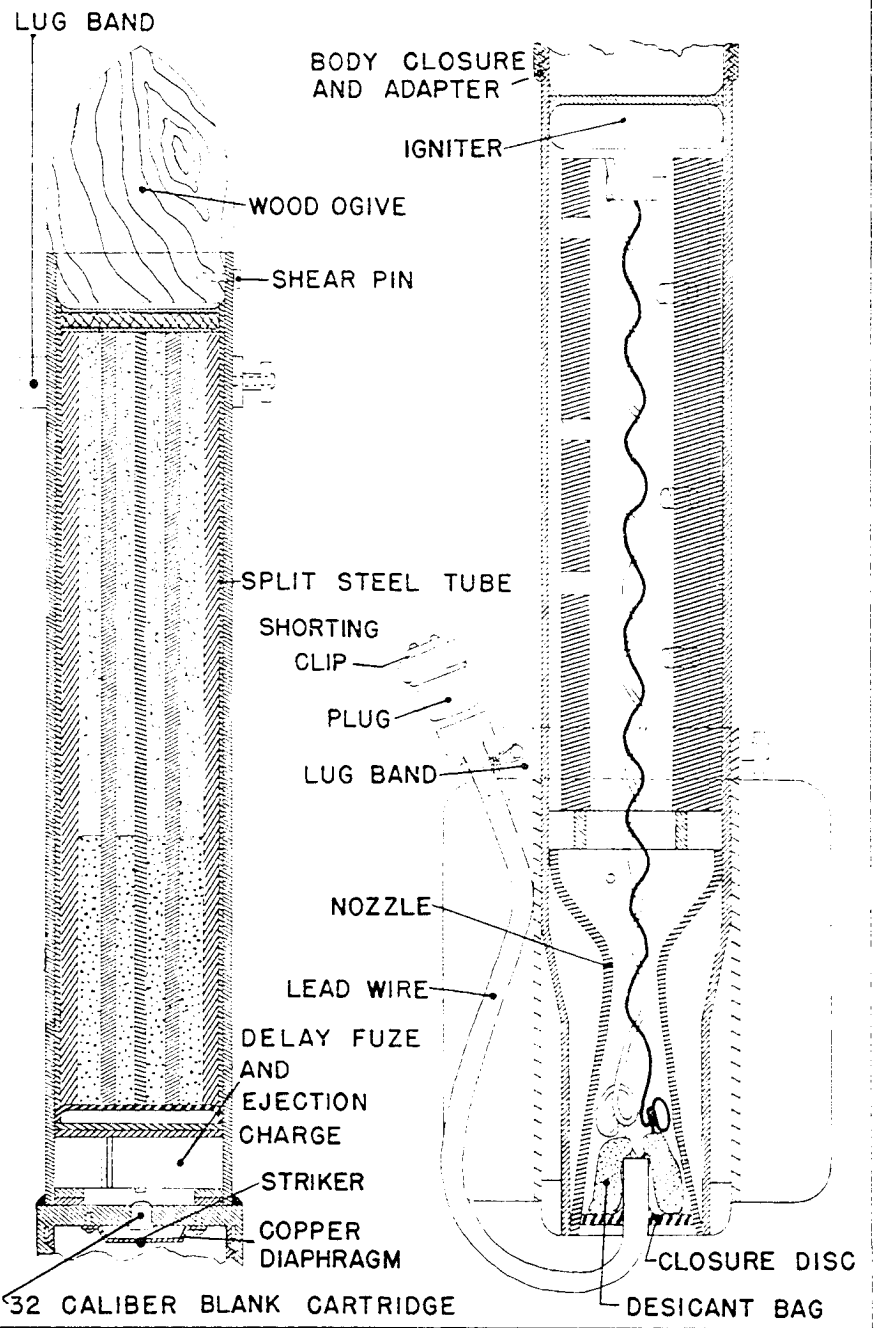
Rocket launcher Mark 6 is actually an adapter for accommodating the relatively short 2"25 sub-caliber rocket to the Mark 5 Mod 1 zero length launcher. The rocket launcher Mark 6 is placed on the Mark 5 Mod 1 zero length launcher in the same manner as a standard service round would be installed.

The 2"25 sub-caliber rocket is inserted in the rail slot of the Mark 6 launcher and is secured by a shear wire (#18 gauge soft copper) which is inserted through a latch arrangement.

Another type adapter known as the Mark 6 Mod 1 consists essentially of a rocket launcher Mark 6 with a special attachment for use on the Brunswick type zero length launcher.

The sub-caliber 2"25 rocket will fit the rail type, 12 inch Rocket Launcher Mark 4 directly without the use of an adapter.

3".5 WINDOW ROCKET



U. S. NAVY

3.5" WINDOW ROCKET

OVERALL LENGTH	45.1" approx.
TOTAL WEIGHT	32 lbs.
HEAD DIAMETER	3.25"
HEAD LENGTH	23.2"
HEAD WEIGHT	14.25 lbs. (loaded)
MOTOR LENGTH	23"
MOTOR DIAMETER	3.25"
WIDTH OF TAIL FINS	9.2"
LENGTH OF TAIL FINS	8.0"
FUZES	Base Fuze Mk 174.

GENERAL:

The "Window Rocket" is designed to be fired from Naval vessels equipped with a modification of the present shipboard launcher. The round carries a payload of paper-coated metal foil strips which are scattered in the air by a delayed-action charge. The pay-load is ejected at an altitude of 1000 ft. and range of 2000 yds at 45° elevation.

The purpose of the rocket is to interrupt enemy Radar, providing a screen behind which our ships may approach or maneuver undetected, or to provide a false target for enemy Radar.

DESCRIPTION:

The "Window Rocket" consists of the complete round Assembly No. 3.5SP010 (3"5 Rocket Head, Mk 10-0 and 3"25 Motor Mk 10-0). The Mk 10-0 Motor uses the Mk 7 Mod 1, (solventless extruded cylindrical) propellant grain, weighing 2.80 lbs.

The Rocket head Mk 11-0 contains a 3"5 Rocket head load Mk 1 or Mk 2 which is housed in a split steel ejection liner, a closure adapter on the after end, an obturator cup for sealing the front end, and a wooden drive cap held in by three aluminum rivets. The closure adapter welded to the after end carries a copper diaphragm plate with a firing pin and also serves as a chamber for the Cal. 30 blank cartridge which ignites the fuse. The Mk 174 fuze consists of a plastic case containing a length of Ensign Bickford fuse and an ejector charge of black powder (20 grams).

The head load, Mk 1, is approximately 6700 paper-coated strips of aluminum foil .003" thick, 3/16" wide, and of varying lengths, housed in a wooden case approximately 2-53/64" diameter and 18 in. long. This load is enclosed in two metal half cylinders for protection during expulsion.

OPERATION:

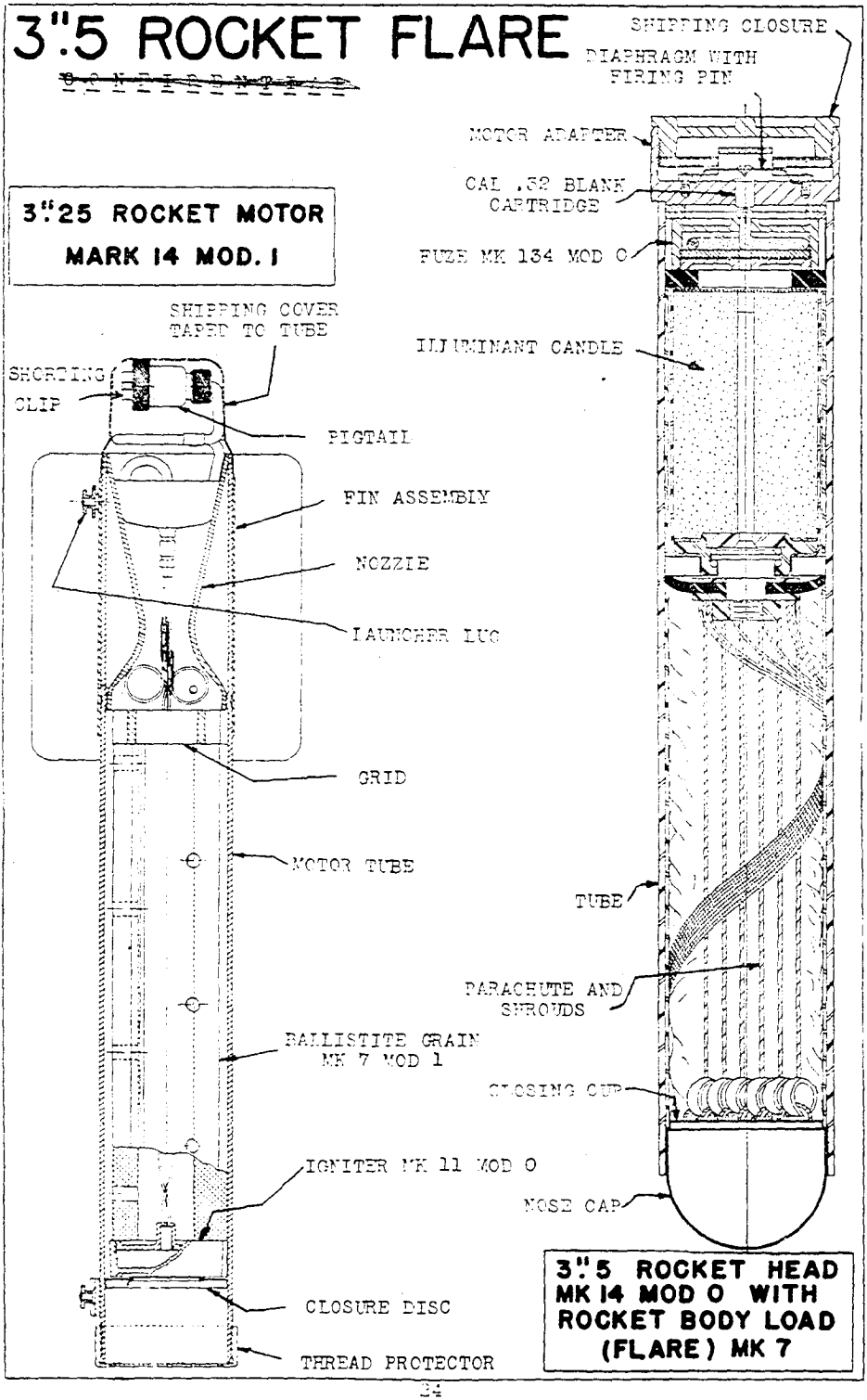
When the rocket is fired, gas pressure blows out the forward closure disc and exerts force on the diaphragm plate in the base of the motor adapter. The diaphragm collapses and the firing pin is forced into the primer, firing the blank cartridge. The flash from the cartridge ignites the fuse which burns 15 seconds and then ignites the black powder ejector charge. The firing of the ejector charge shears the rivets holding the wooden drive cap, and pushes the load forward out of the head. The metal strips are then dispersed.

REMARKS:

A modified design is the 3"5 Rocket Assembly No. 3.5SP028, consisting of the 3"25 Motor Mk 14 and 3"5 head Mk 14. This motor is designed like the 3"25 motor Mk 7, and the head differs from the Mk 10 head primarily in having a hollow steel drive instead of a wooden one. See details of motor and head on page 25.

3".5 ROCKET FLARE

CONFIDENTIAL



3".25 ROCKET MOTOR MARK 14 MOD. 1

3".5 ROCKET HEAD MK 14 MOD 0 WITH ROCKET BODY LOAD (FLARE) MK 7

3"5 Mk 14-0 Head

U. S. NAVY

3."5 ROCKET FLARE

OVERALL LENGTH	47 in. aprrox.
TOTAL WEIGHT	33.5 lbs.
HEAD DIAMETER	3.25 in.
HEAD LENGTH	03 in.
HEAD WEIGHT	16.5 lbs.
MOTOR LENGTH	24.5 in.
MOTOR DIAMETER	3.25 in.
FUZE	Mk 174 base fuze

GENERAL: The 3"5 Rocket Flare was developed for use from surface ships, particularly Motor Torpedo boats. The illuminant candle produces an average of 800,000 C.P. for approximately 00 seconds. The rocket motor carries the flare out 1800 yards before ignition.

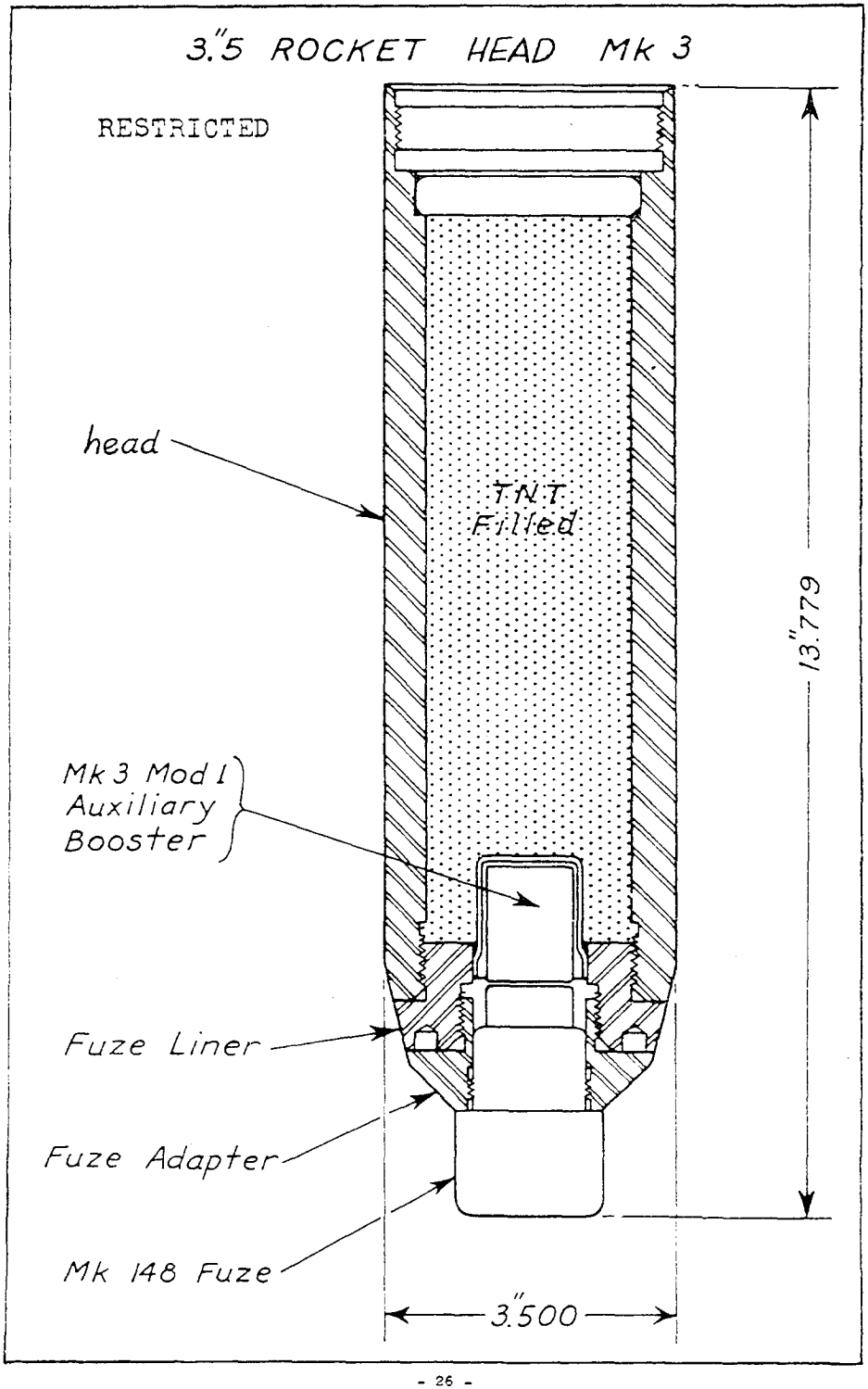
The 3"5 Rocket Flare consists of the following three major components: 3"5 Rocket Motor Mk 10-0, the Mk 14-0, or the Mk 14-1; 3"5 Rocket head Mk 10-0, the Mk 14-0, or the Mk 15-0; and the Rocket body load (flare) Mk 7-0.

ROCKET HEADS: The head is the carrying unit for the flare and parachute components. All of the heads are interchangeable and differ only in minor details. The Mk 10-0 has a wooden nose piece held in place by three shear pins (see page ___) while the Mk 14-0 and the Mk 15-0 have a sheet metal nose piece press fitted in place. The Mk 15-0 is one inch longer than the other two.

The head consists of a 3"25 seamless steel tube which incorporates a 3"5 diameter closure adapter welded to the after end. This closure adapter carries a copper diaphragm plate with a firing pin and serves as a chamber for the Cal..30 blank cartridge which ignites the fuse. The Mk 174-0 fuse consists of a plastic case containing a length of Ensign Bickford fuze and a 90 gram charge of black powder. The balance of the head is taken up by the Rocket Body Load (Flare) Mk 7 which consists of the candle and parachute from the 4 inch illuminating projectile, the composition of the candle having been slightly changed to increase the candlepower with a shorter burning time.

ROCKET MOTORS: The three motors are similar and interchangeable. The principal distinguishing feature of the Mk 14-1 is the use of welded on launcher lugs replacing the lug bands employed on the earlier models. The motor housing is a 3"25 seamless steel tube containing a forward closure disc, Igniter Mk 11 Mod 0, tubular ballistite grain Mk 7 Mod 1 (weight: 9.5 lbs.), steel grid, welded nozzle, and nine tail. Four tail fins, 3 inches by 6 inches, are mounted on a sleeve fixed to the after end. A thread protector on the forward end and shipping cover fitted on the after end protect the motor in shipment. The Mk 12-0 motor does not have a shipping cover on the after end.

OPERATION: When the rocket is fired, the pressure blows out the forward closure disc and exerts force on the diaphragm plate in the base of the motor adapter. The diaphragm collapses and the firing pin is forced into the primer, firing the blank cartridge. The flash from the cartridge ignites the fuse which burns 18 seconds and then ignites the black powder ejector charge. The firing of the ejector charge ignites the candle and simultaneously pushes the load forward out of the head. The parachute opens and the candle burns for approximately 29 seconds.


3."5 ROCKET HEAD Mk 3
RESTRICTED
head
TNT
Filled
13."779
Mk 3 Mod 1
Auxiliary
Booster
Fuze Liner
Fuze Adapter
Mk 148 Fuze
3."500

RESTRICTED

U. S. NAVY

3.5" & 5.0" ROCKETS

The 3"5 rockets were originally designed to be used against smaller targets such as submarines and tanks. For larger targets such as transports and light warcraft, the 5"0 was developed from the 5" Mk 5E anti-aircraft shell. The 3"5 Mk 8 solid head and the 3"5 Mk 6 FS smoke filled are the only ones now being issued. The 3"5 H.E. heads were replaced by the 5"0, the former never being issued because of the small load of TNT carried as compared to the 5"0 heads.

TABLE OF ROCKET HEADS AND MOTOR

Head	Head Wt.	Filling Wt.	Head Length	Total Weight	Total Length	Fusing
3"5 Mks 1,2	20 lb.	3 lb.	9.7"	53.8 lb.	54.7"	None
3"5 Mks 3,5	19.9	9.6	13.8	53.7	58.9*	Mk 148, Mk 149
3"5 Mk 4	20.2	1.0	13.4	53.9	58.5	Mk 148
3"5 Mks 6,9	20.0	9.4	11.8;13.6	53.8	58; 58.8	Mk 148, Mk 149 Mk 155
3"5 Mk 8	20	0	11.75	53.8	57.75	None
5"0 Mk 1	46.5	9.6	19.7	81.8	84.8	Mk 148, Mk 149, Mk 148, Mk 157 Mk 166

All heads use the 3"25 Mk 7 Motor
(Motor length: 46 in; Motor weight: 33.8 lb.)

*Length includes the Mk 148 fuse.

ROCKET HEADS:

3"5 Mks 1 and 2: The head is of solid steel and contains no high explosive or fuse. The shape of the round gives a relatively long under-water travel at shallow depth of entry angles (about 20 degrees), and it is used as a semi-armor piercing projectile against submarines or tanks. The Mk 1 was the OIT production which was aborted by BuOrd and designed the Mk 2.

3"5 Mks 3 and 5: The head is filled with TNT and fitted with an adapter in the nose to take the Mk 149 fuse. With a second adapter, the diameter is reduced to 1.5 in. to take the Mk 148 fuse. These rounds were not issued and were replaced by the 5"0 heads which contain a greater load of high explosive.

3"5 Mk 4: The head has a semi-armor piercing nose and is filled with TNT. This round was not issued because of small load of high explosive and was replaced by the 5"0 heads.

3"5 Mks 6 and 9: The head is filled with FS smoke. The Mk 9 was the initial OIT production but was not issued. BuOrd in adopting this head, increased the length 1" and issued the round as the Mk 6.

3"5 Mk 8: The head is of solid steel and contains no high explosive or fuse. The round was developed to give better underwater travel and will replace the 3"5 Mk 2.

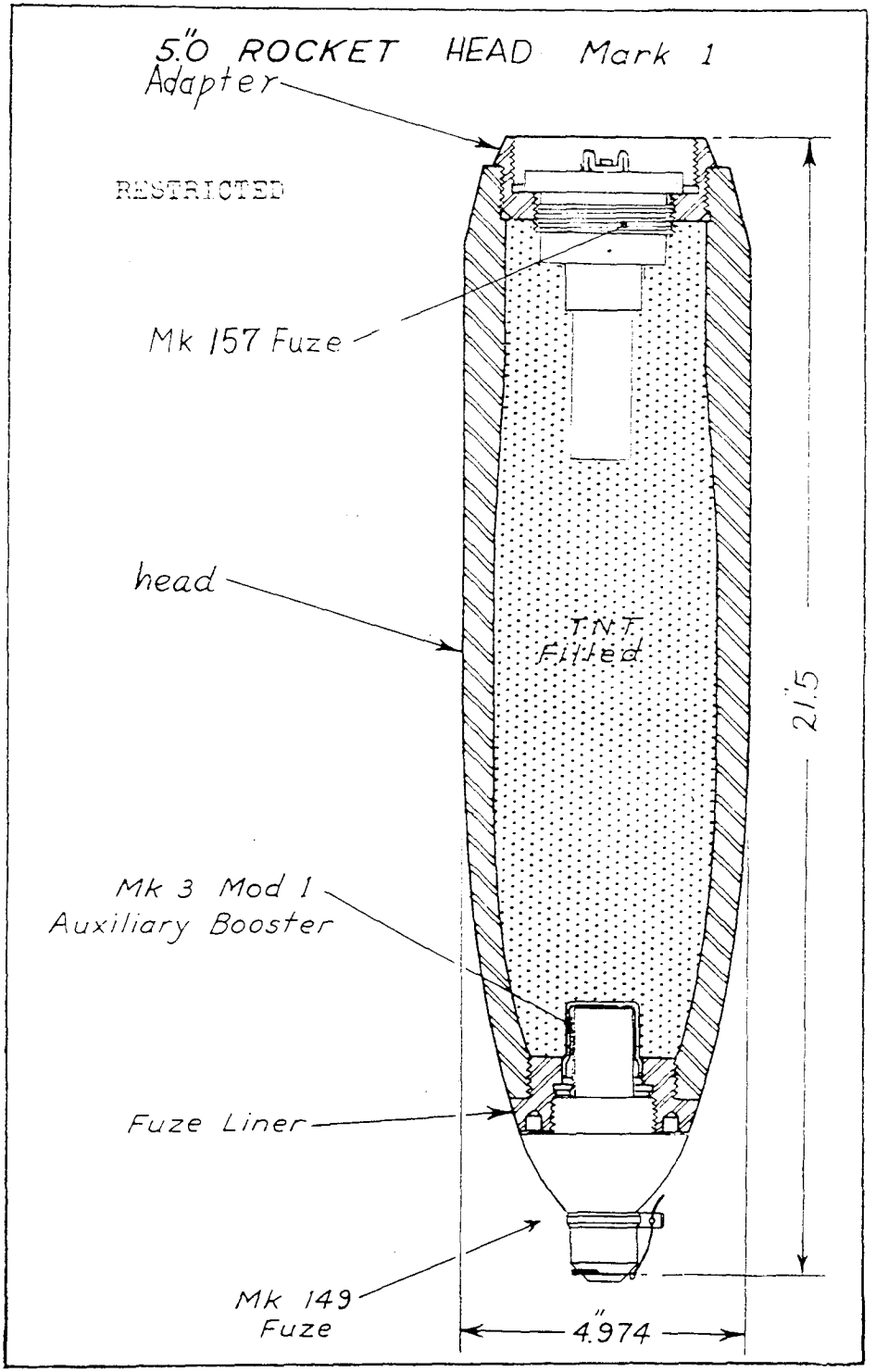
5"0 Mk 1: The head is filled with TNT and weighs 46.6 lbs. when fitted with a Mk 148 fuse. The same adapter rings are used as on the 3"5 Mk 5. Head issued with nose plug. Nose fuse must always be assembled in head before firing. Fire with fuze on "safe" if delay is desired. Head shipped with base fuse sealed in place. Base fuse must not be removed.

5"0 Mk 1 Mod 1: This head differs from the 5"0 Mk 1 Mod 0 only in that the nose is especially cavetized to take the Mk 178-0 fuse which is longer than the Mk 148 or other nose fuses and therefore is not interchangeable with them.

3"25 Mk 7 Motor: (See drawing page 30)

The 3"25 Mk 7 motor is used with the 3"5 and 5"0 heads described above. At the forward end of the motor is a black powder igniter and an electric sq 1b. Two electric leads extend through the motor and out the aft end to a cable and plug connection. At the aft end of the motor there is a venturi tube which acts as a nozzle, and a bag of silica gel which acts as a dehydrating agent in keeping moisture from the ballistite grain. The ballistite grain used is the cruciform type with inhibitors, being 33" long, 9.75" in diameter, and weighing 8.5 lbs. Burning time of the ballistite varies from .62 seconds to 1.46 seconds, depending on the temperature.

The tail consists of 4 sheet metal fins set 90° apart and welded to a central cylinder. The tail is slipped over the aft end of the motor and is secured by a tail locking ring, which screws on.

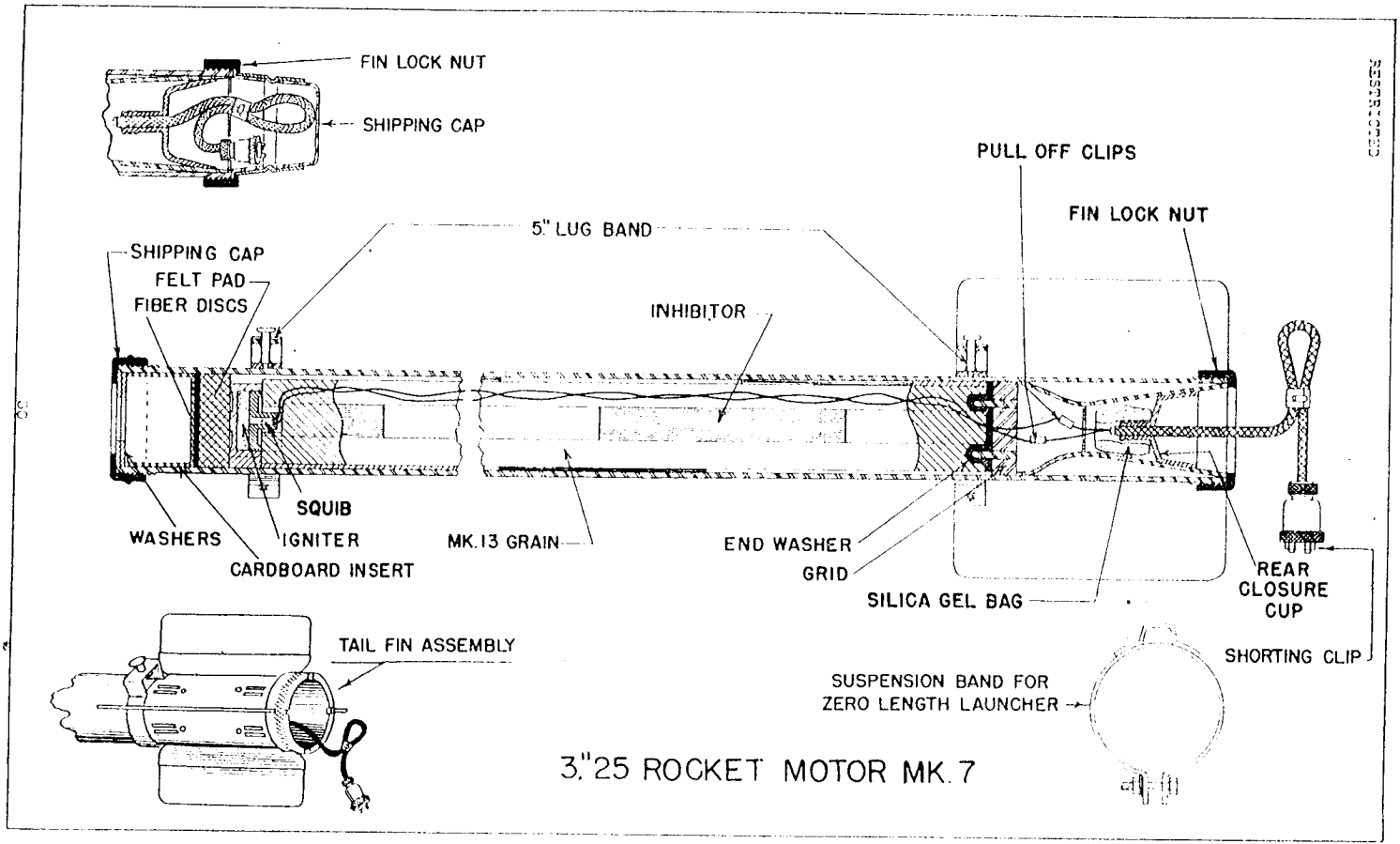

5.0 ROCKET HEAD Mark 1
Adapter
RESTRICTED
Mk 157 Fuze
head
T.N.T. Filled
21.5
Mk 3 Mod 1
Auxiliary Booster
Fuze Liner
Mk 149
Fuze
4.974

REMARKS:

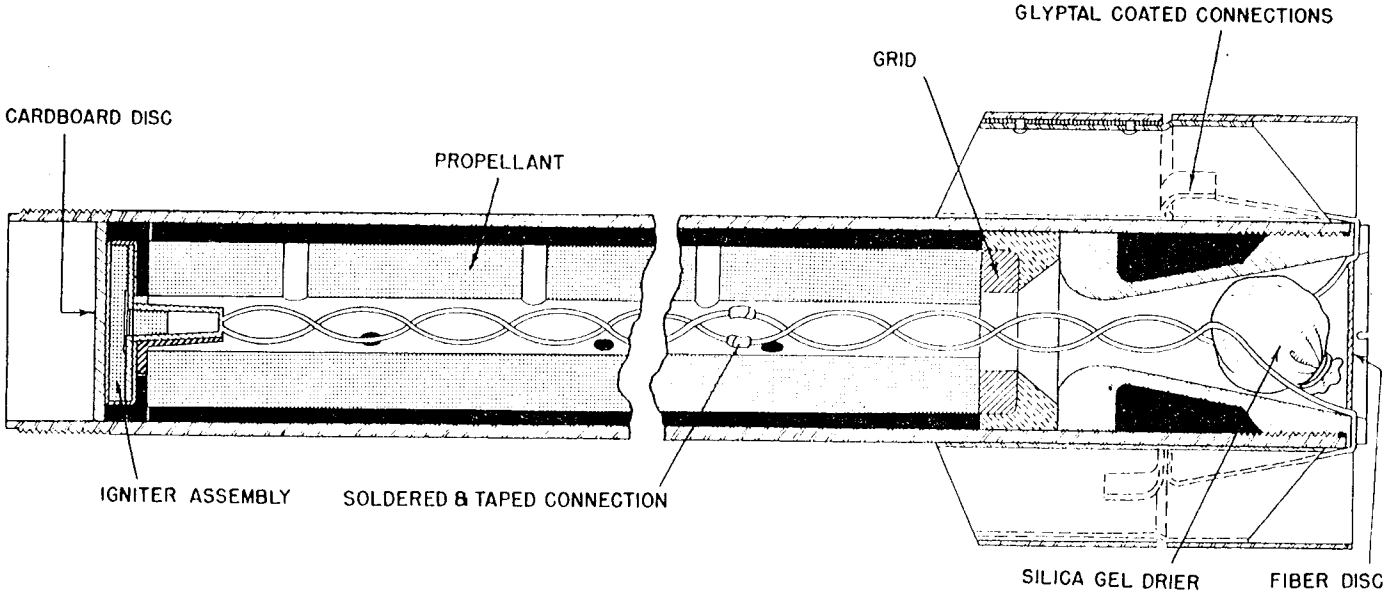
(1) CIT refers to the California Institute of Technology which develops rockets for the Bureau of Ordnance. As the rockets are adopted by BuOrd, new mark or mod numbers are assigned.

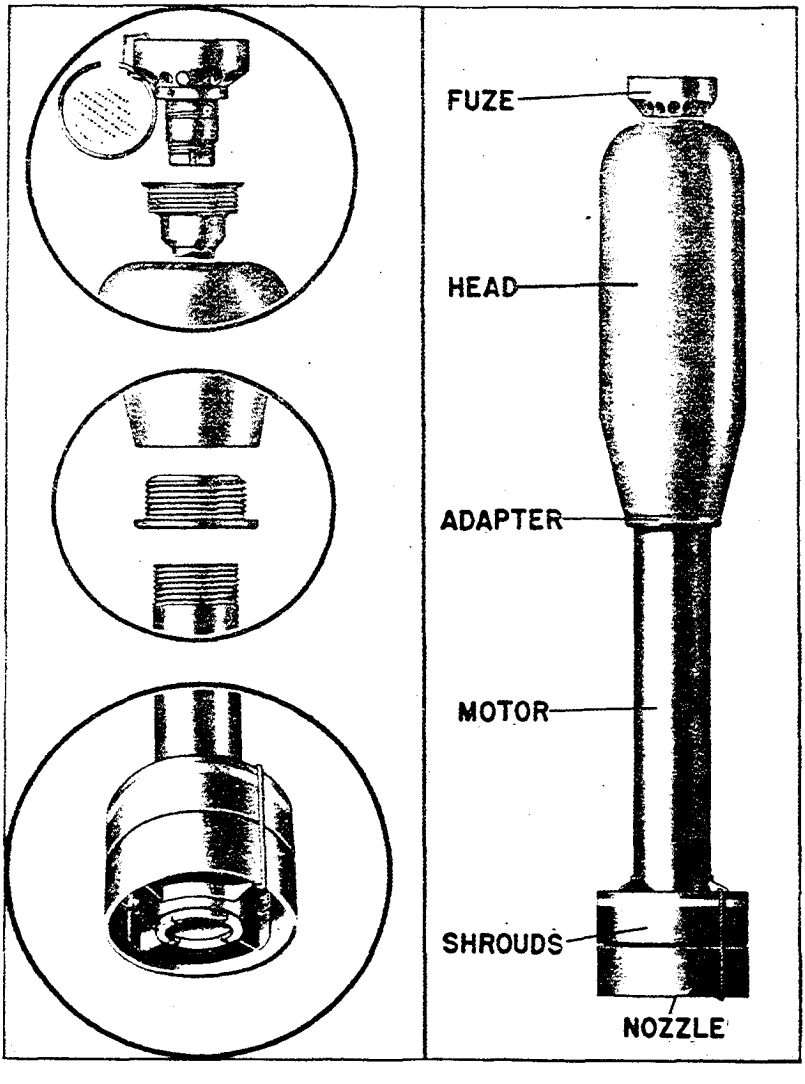
(2) Rockets fired from aircraft are more accurate than those fired from the ground. The 3"5 fired from an aircraft traveling at 300 to 500 ft/sec has a mean deviation in dispersion of about 5 mils; when fired from the ground, the dispersion is 26 mils.

(3) The 3"5 (H.E. and FS) have a maximum velocity of 1900 ft/sec. exclusive of plane speed as compared to 800 ft/ sec. for the 5"0 H.E.


FIN LOCK NUT
SHIPPING CAP
PULL OFF CLIPS
FIN LOCK NUT
5" LUG BAND
SHIPPING CAP
FELT PAD
FIBER DISCS
INHIBITOR
SQUIB
WASHERS
IGNITER
CARDBOARD INSERT
MK.13 GRAIN
END WASHER
GRID
SILICA GEL BAG
REAR CLOSURE CUP
SHORTING CLIP
TAIL FIN ASSEMBLY
SUSPENSION BAND FOR ZERO LENGTH LAUNCHER
3."25 ROCKET MOTOR MK. 7

MOTOR AND TAIL ASSEMBLY FOR 4".5 BARRAGE ROCKET





4.5" BARRAGE ROCKET

UNCLASSIFIED

U. S. NAVY

4.5" BARRAGE ROCKET(BR)

With Mk 3 Head

OVERALL LENGTH	30.0 in.
TOTAL WEIGHT	38.7 lbs.
HEAD LENGTH	14.0 in.
HEAD DIAMETER	4.5 in.
HEAD WEIGHT	19.6 lbs.
WALL THICKNESS	0.25 in.
MOTOR LENGTH	15.5 in.
MOTOR DIAMETER	2.25 in.
RANGE	1000-1100 yds.
EXPLOSIVE CHARGE (TNT)	6.5 lbs.
FUZES	Mk 137 or Mk 145

USE:

The 4"5 Barrage Rocket (BR) is a light demolition rocket intended for launching from landing boats, amphibious trucks or other vehicles where the recoil of guns or mortars would be objectionable and from portable launchers of one or more rails. This rocket is especially valuable in amphibious landing operations to give the attacking forces fire power during the time between cessation of naval shelling and the time when small arms fire becomes effective (about 600 yds.)

4"5 SERVICE BARRAGE ROCKETS

Head	Filler	Motor	Grain	Fuze	Nominal Velocity
Mk 3	TNT	2.25" Mk 9	Mk 1	Mk 137	355 ft/sec
Mk 5	FS, WP	2.25" Mk 9	Mk 1	Mk 137	
				Mk 154-3	355 ft/sec
Mk 7*	FS, WP	2.25" Mk 9	Mk 1	Mk 137	
				Mk 154-3	355 ft/sec
Mk 8	TNT	2.25" Mk 9	Mk 1	Mk 145	355 ft/sec

The Mk 5 was a OIT Production which is replaced by the BuOrd production Mk 7.

* Mk 7 head is longer, giving overall length of 37.0"

FS - Sulphur trioxide in chlorosulfonic acid
WP - White Phosphorous

HEAD CONSTRUCTION:

The head and motor are coupled by means of a threaded adapter, and the fuze screws into the nose of the head. The head is cylindrical, the forward end hemispherical and the rear end reduced. About 6.5 lbs. of high explosive can be loaded through a 2-3/4" hole in the rear, which is sealed later with a motor adapter. The fuze liner, in the nose of the head, contains a booster charge of granular T.N.T.

MOTOR:

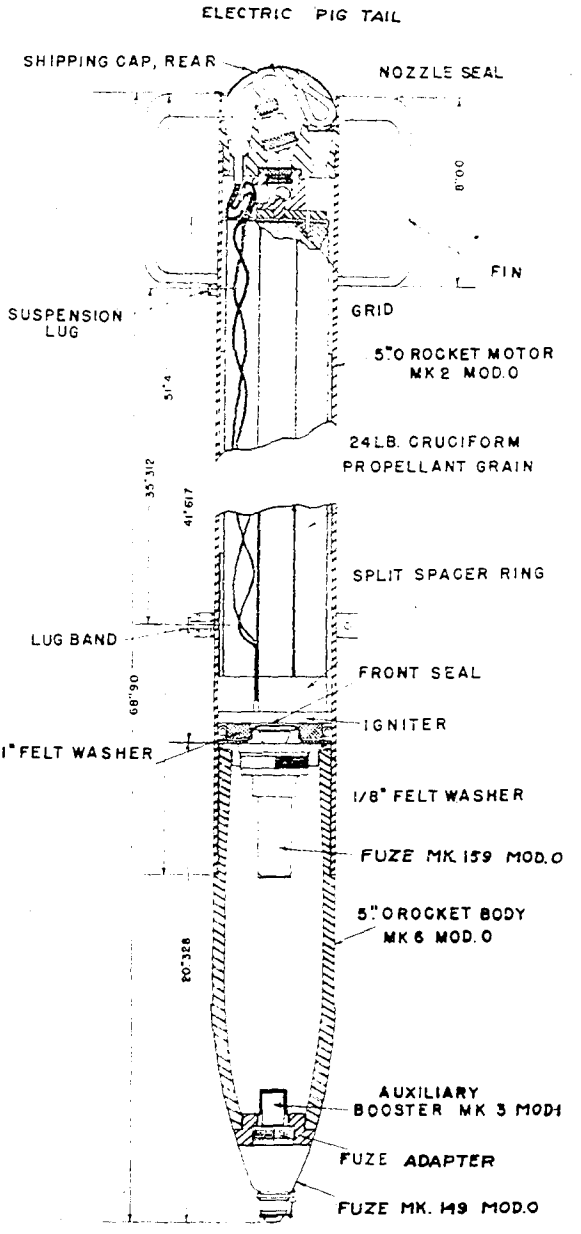
The motor consists of a seamless steel tube fitted with a nozzle at the aft end and sealed by the adapter to the head at the front.

TAIL ASSEMBLY:

Two circular shrouds, the same diameter as the body, are attached to supporting fins at the rear of the motor. The two shrouds serve to align the round while on the launcher and to stabilize it in flight. Two wires brought out through the powder grain and the nozzle connect to the two shrouds. The forward shroud is insulated from the rest of the rocket to prevent a short circuit to the after (grounded) shroud.

PROPELLANT:

Single cylindrical grain of ballistite 11" long with 1.7" outer diameter. The ballistite is ignited by black powder fired by an electric squib. The burning continues for about 0.3 seconds, during which time the rocket travels about 60 feet.



5"O ROCKET
(5"O MOTOR)

RESTRICTED

U. S. NAVY

5.0" ROCKET
5.0" MOTOR

(unofficially designated as the H.V.A.R.)

OVERALL LENGTH	69"
TOTAL WEIGHT	140 lbs.
DIAMETER OF HEAD	5.0"
LENGTH OF HEAD	20.3"
WEIGHT OF HEAD	52 lbs.
WALL THICKNESS	
MOTOR LENGTH	51.4"
MOTOR DIAMETER	5.0"
RANGE	
FUZES: Mk 5-0 and Mk 6-0	Nose Fuze Mk 148
	Nose Fuze Mk 149
	Base Fuze Mk 157-0
	Base Fuze Mk 159-0
Mk 6-1 (only)	Base Fuze Mk 159-1
	Base Fuze Mk 164-0

ROCKET HEAD: The rocket heads used are the 5"0, Mk 6 Mods 0 and 1. The Mk 6 Mod 0 is filled with TNT and is equipped with a base fuze and a nose plug. When thus used, the head will have the penetration and fragmentation characteristics at comparable velocities of the 5"/38 AA Common projectile, of which it is a modified design. All 5"0 rocket heads Mk 6 Mods 0 and 1 are shipped with a base fuze installed and staked in place. No attempt shall be made to remove the base fuze from the head prior to the firing. A metal cup-shaped thread protector protects the external threads on the base of the head and on the base fuze. The Mk 6 Mod 1 is similar to the Mk 6 Mod 0 with a gas seal added to the bomb fuze seat. The 5"0 body Mk 5 Mod 0 is the initial CIT production which was adopted by BuOrd as the Mk 6 Mod 0. The two bodies are identical.

ROCKET MOTOR: The 5"0 Rocket Motor Mk 2 Mod 0 consists of a seamless steel tube with internal threads on both ends. Into the rear end is screwed the nozzle plate having 8 nozzles arranged in a circle, and a central blow-out nozzle. The central nozzle is closed by a disc of 0.024" thick copper, insulated against the heat of the motor by asbestos and hard fiber plugs. The thickness of the disc is such that it shears and blows out at a pressure of approximately 2400 lbs. per square inch, which is the normal maximum motor pressure when the propellant grain is at a temperature of 100°F. If the pressure rises above this, the disc and plug are ejected; this increases the usable temperature range of the rocket by about 40° F.

Seven of the eight nozzles are sealed individually by a light steel cup and sealing compound. The eighth nozzle accommodates the electric connector cable which is crimped into the steel nozzle closure. In shipment, a dome-shaped steel shipping cap fits into the sleeve of the fin assembly, acting as an auxiliary seal and at the same time serving to enclose and protect the electrical pig-tail in shipment.

Lugs for attaching the fins are mounted on the nozzle end of the motor. The fins are shipped with the motor and are attached when the round is assembled. The fins are held in place by spring-loaded latches within the fin itself. The fin lugs and rear suspension lugs are welded to the bands of the fin assembly, which is slipped on over the nozzle end of the motor. The front lug band is strapped to the motor. The motor is shipped with lug attachments on the motor tube for use with aircraft launcher Mk 5 Mod 1. An extra rail type lug is provided in the shipping box to adapt the rocket for use on the aircraft launcher Mk 4.

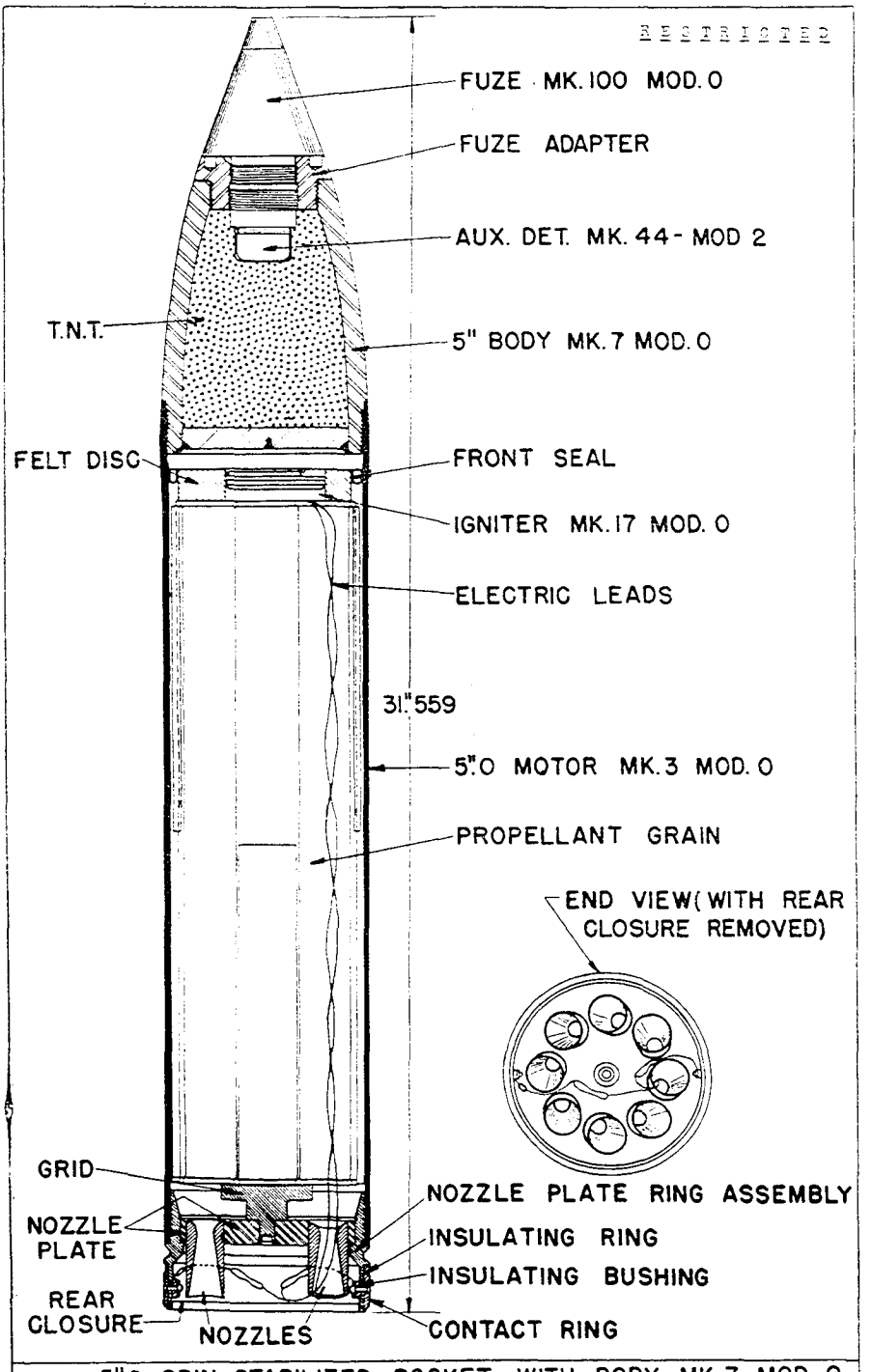
The front end of the motor is sealed by a steel diaphragm equipped with a blow-out disc in the center to allow easy passage of the motor gases to the pressure arming fuze in the base of the body. In shipment, a cylindrical metal thread protector extends into the motor the same depth as the body and seats on a felt rim glued to the diaphragm seal.

The propellant is a grain of cruciform shaped ballistite weighing 24 lbs. The grain is inhibited on the outer web surface and is supported by a spacer and steel grid at the nozzle end. The propellant is ignited by a metal case igniter containing 35 grams of black powder.

The 5"0 Mk 2 Mod 1 motor was never produced. The Mk 2 Mod 2 differs in that the tail fins are welded to a sleeve which slips over the base of the tube and is clamped in place. The fin assembly is complete and seperate from the motor. The rear suspension lug for use with the Mk 5 Mod 1 launcher is on an independent band. The Mk 2 Mod 3 ,which will supercede the Mod 0 and 2, is similar to the Mod 2 except except the nozzle ring is of slightly different construction.

The 5"0 Mk 1 Mod 0 rocket motor (CIT Production) is the prototype of the Mk 2 Mod 0 (BuOrd issue). The two motors vary only in that the suspension lugs on the former are welded directly to the rocket motor.

REMARKS: 1. Using fuze Mk 159 Mod 0, this rocket will penetrate 3.75 ft. of reinforced concrete at normal incidence. At an angle of 30° obliquity, it should penetrate 2.75 ft. Fired from a plane traveling at 300 knots, fuzed with the Mk 149 Mod 0 fuze, serious damage will be caused to armor up to 1-5/8" in thickness. Using the Mk 159 Mod 0 fuze and a steel nose plug, this rocket will penetrate armor 1.0" thick before detonation.



5".0 SPIN STABILIZED ROCKET WITH BODY MK.7 MOD.0 (GENERAL PURPOSE) AND MOTOR MK.3 MOD.0

RESTRICTED

U. S. NAVY

5"0 ROCKET SPIN STABILIZED

Spin stabilized rockets are intended primarily for shipboard use. The general purpose and Common rounds are particularly adapted for P.T. boat attacks at ranges less than 11,000 yards. The High Capacity rockets are suitable for barrages at 3,000 to 8,000 yards.

The spin stabilized rockets must be used in the specially designed launchers Mk 50 Mods 0 and 1, Mk 51 Mods 0 and 1; and in launcher assemblies Mk 101 Mod 0 or Mk 102 Mod 0.

TYPE	GENERAL PURPOSE	COMMON	HIGH CAPACITY
Head	5"0 Mk 7 All Mods	5"0 Mk 9 All Mods	5"0 Mk 10 All Mods
Motor	5"0 Mk 3 All Mods	5"0 Mk 3 All Mods	5"0 Mk 4 All Mods
Propellant Grain	Mk 21 Mod 0	Mk 21 Mod 0	Mk 22 Mod 0
Igniter	Mk 17 Mod 0	Mk 17 Mod 0	Mk 18 Mod 0
Length Head (Fuzed)	10.5 in.	7.54 in.	18.38 in.
Length Motor	22.5 in.	22.5 in.	18.28 in.
Overall Length(Fuzed)	31.5 in.	28.8 in.	36.2 in.
Weight of body	20 lbs.	20 lbs.	34.6 lbs.
Filler	T.N.T.	Explosive "D"	T.N.T.
Weight of Filler	1.75 lbs.	1.68 lbs.	0.6 lbs.
Total Weight	48.1 lbs.	50.8 lbs.	58.2 lbs.
Fuzes:			
Nose	Mk 100 Mod 0	None	Mk 30 Mod 3
Base	None	Mk 31 Mod 0	None
Aux. Det.	Mk 44 Mod 2	None	Mk 44 Mod 1
Range (45° elev.)	11,000 yds.	11,000 yds.	8,250 yds.
Velocity	1,550 ft/sec.	1600 ft/sec.	950 ft/sec.

ROCKET HEADS:

5"0 Rocket Head Mk 7 (General Purpose): This head is threaded externally at the aft end to accommodate the motor. It is threaded internally at the forward end to accommodate the fuze adapter for rocket fuze Mk 100 Mod 0. Two spanner holes are located in the aft end of the head spaced 180° apart to facilitate assembly. The fuze adapter is internally threaded for Auxiliary Detonator Fuze Mk 44 Mod 2. The nose fuze Mk 100 Mod 0 is screwed in over the Auxiliary Detonating Fuze. (NOTE: The fuze adapter and Aux. Det. Mk 44 Mod 2 are shipped installed in the head.)

5"0 Head Mk 9 and Mods (Common): This head is internally threaded at the aft end to take base fuze Mk 31. It has two spanner holes 180° apart to facilitate assembly operations.

WARNING: Do not remove the base fuze which is shipped in place in the head.

5"0 Head Mk 10 and Mods (High Capacity): The nose of this head is internally threaded to fit nose fuze Mk 30 Mod 3 and a fuze adapter. It has two spanner holes 180° apart near the base end to facilitate assembly operations. The fuze adapter is internally threaded to hold Auxiliary Detonator Fuze Mk 44 Mod 1 and the nose fuze Mk 30 Mod 3 fits over the Auxiliary Detonator.

ROCKET MOTORS:

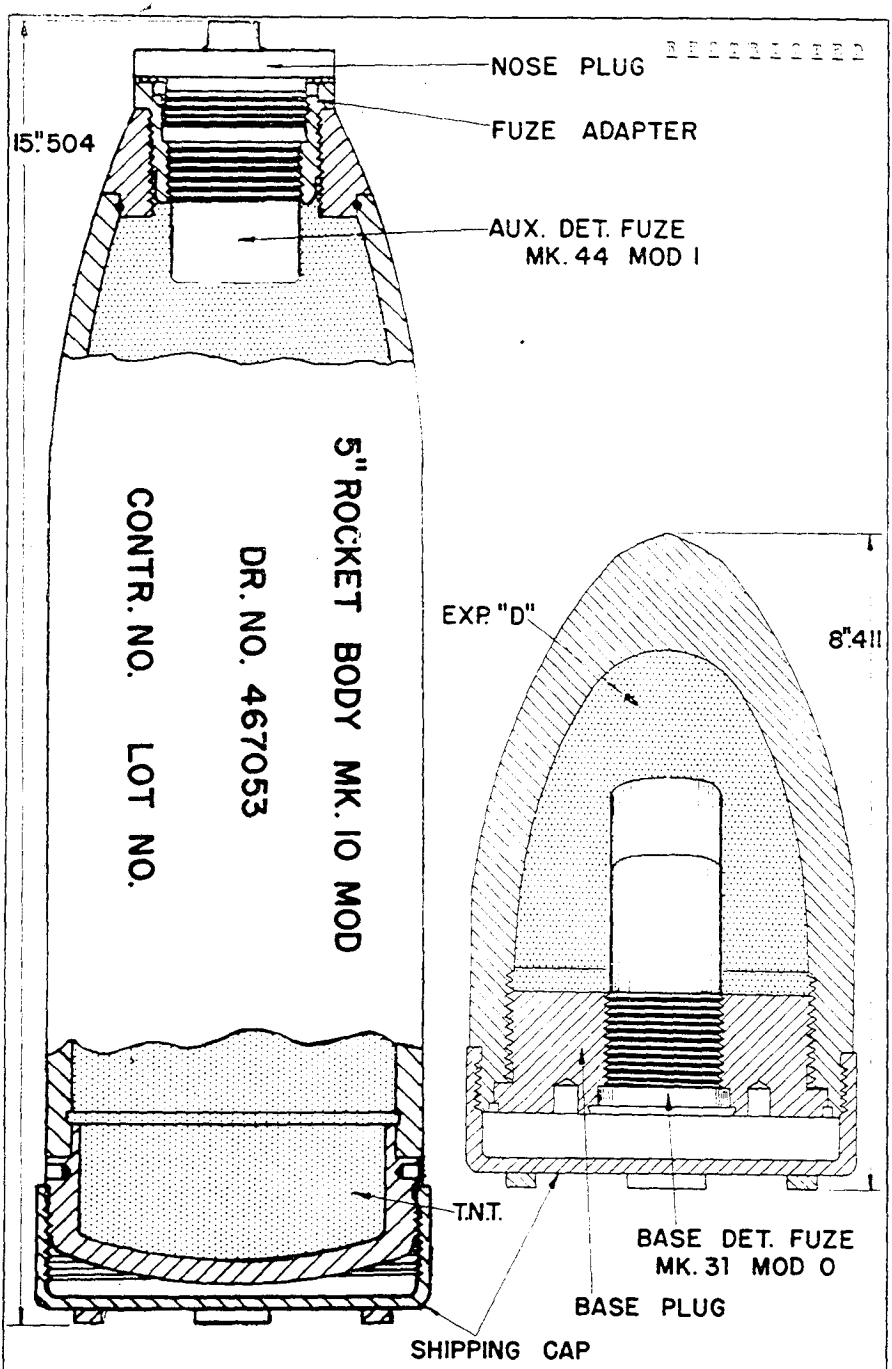
5"0 Rocket Motor Mk 3 and Mods: The motor Mk 3 and Mods, as used with rocket heads Mk 7 and Mk 9 consist of the following parts:

The motor tube consists of a seamless steel tube with internal threads at both ends which acts as a combustion chamber for the propellant. It is machined with a bourrelet ring at each end. The bourrelet acts as a bearing surface when fired from the tubular launcher.

The shipping can is located in the forward end and must be removed when fitting the head to the motor.

The front closure is a steel disc pressed in position near the front end of the motor tube. Its purpose is to seal the front end from moisture, dirt, etc., and also retains the igniter and propellant grain in place. A thin felt pad cushions any contact between the front closure and the igniter.

The igniter Mk 17 Mod 0 consists of a flat tin case containing 35 grams of black powder and an electric squib. Two leads from the squib pass to the rear of the motor tube where one lead is connected to the contact ring and the other lead is grounded to the motor tube at the nozzle plate ring.



5".0 ROCKET BODY
MK.10 MOD.0
(HIGH CAPACITY)

5".0 ROCKET BODY
MK.8 MOD. 1
(COMMON)

ROCKET MOTORS: (cont'd)

A felt disc 1" thick protects the grain from accidental shock. It has an eccentrically placed hole which houses and forms a snug fit for the igniter case.

The propellant is an inhibited, cruciform-shaped, extruded grain of ballistite weighing approximately ten lbs. The surface of the grain is inhibited with plastic strips to control the burning surface of the grain.

The nozzle plate assembly consists of eight nozzles and a grid mounted on a nozzle plate. The cylindrical "J" shaped steel grid is pressed into place and peened in position in a center hole in the nozzle plate. It supports the propellant grain and acts as a spacer between the grain and the nozzle plate, creating a chamber which equalizes the pressure to all nozzles during firing. The nozzles are press fitted into the nozzle plate and are canted 12° to give a clockwise rotation.

The nozzle plate ring assembly consists of a nozzle plate ring and the insulated contact ring. The contact ring is a steel band around the nozzle plate ring and is electrically insulated from it. The nozzle plate ring and contact ring are the two terminals of the igniter electrical circuit. The rings are short circuited by a short circuiting band locked around the nozzle plate ring assembly in such a manner that it creates a short circuit between the nozzle plate ring and contact ring. The short circuiting band must be removed when preparing the rocket for firing.

The rear closure is a thin aluminum cap cemented in place at the aft end of the motor and blows out after the motor pressure builds up.

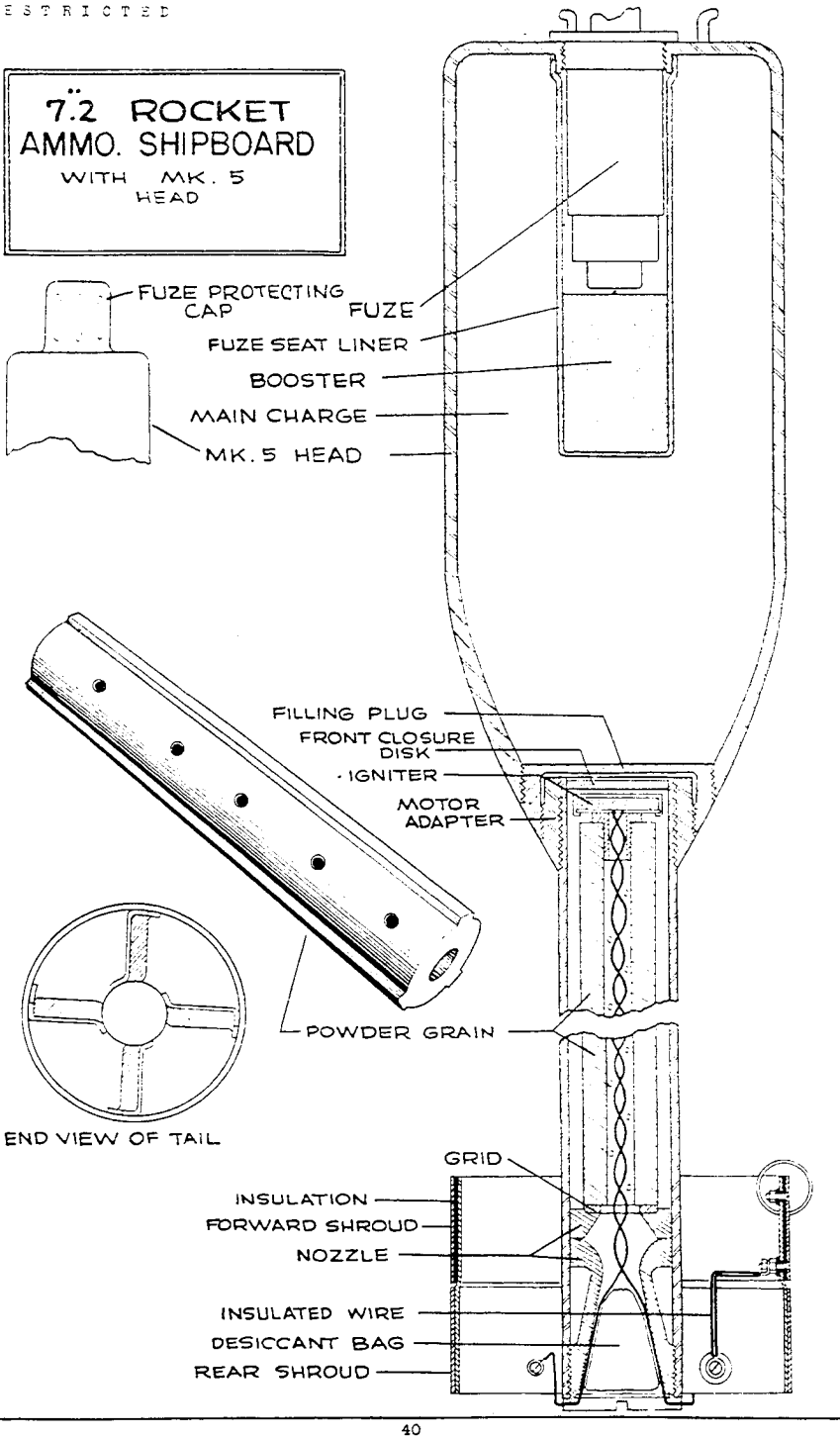
NOTE: The front and rear closures should not be tampered with.

The 5"O rocket motor MK 4 and MOD: The 5"O rocket motor MK 4 is similar to the MK 3 discussed above except:

1. The motor tube is only 10.6" long or 7" shorter than the motor MK 3.
2. The MK 1 igniter is used and differs only in that it has shorter leads.
3. Propellant grain MK 23 MOD 0 is used and differs only in that it is shorter in length, and weighs approx. 5.5 lbs.
4. The nozzle in the nozzle plate assembly has a smaller throat diameter.

OPERATION: Electrical current to fire the rocket is fed to the motor by means of a contact ring at the rear of the motor. The electrical impulse passes from the contact ring through the squib causing the squib to set off the black powder in the igniter. Burning of the igniter fills the interior of the motor tube with hot burning gas under high pressure. As soon as the propellant begins to burn, it generates a large quantity of gas and increases the pressure. A force is thus exerted in all directions blowing out the rear closure disc. The gas is then free to rush out of the nozzle end. The gas also exerts full force on the corresponding area of the closed forward end of the motor, creating a net force or thrust which drives the rocket forward. The 12° cant of the nozzles gives the rocket its clockwise rotation or spin, which is required to arm the fuzes and stabilize the rocket in flight.

7.2 ROCKET AMMO. SHIPBOARD WITH MK. 5 HEAD



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U. S. NAVY

7.2 ROCKET AMMO. SHIPBOARD

OVERALL LENGTH	38.8 in.
BODY LENGTH	19.0 in.
BODY DIAMETER	7.2 in.
BODY WEIGHT	17.9 lbs.
FILLER WEIGHT (TNT)	31.0 lbs.
WALL THICKNESS	0.2 in.
MOTOR LENGTH	15.9 in.
MOTOR DIAMETER	2.25 in.
MOTOR WEIGHT	8.1 lbs.
TAIL WIDTH	7.0 in.
COLOR	Grey
TOTAL WEIGHT	65 lbs.

TARGET:

For use by patrol vessels against submarines. The most common installation consists of two 4-rail launchers, Mk 20 with a fixed elevation of 45° mounted on the fore deck with firing controlled from the bridge.

FUZING:

The Mk 131 and Mk 140 fuzes are replaced by the Mk 156.

COMPLETE ROUND ASSEMBLY:

At present some nine models of the 7.2 Rocket for shipboard use are in service or contemplated. The most common unit now in service is the Mk 6, for which the above data is given. Following are the service assembly rounds which are being used and will be used.*

Complete Round	Body	Filling	Motor	Grain	Fuze
Mk 6	7.2 Mk 4	TNT	2.25 Mk 3	Mk 3	Mk 131-Mk 156
Mk 7	5	CPX	3	3	Mk 131-Mk 156
Mk 8	5	CPX	3	3	Mk 140-Mk 156
Mk 9	5	TNT	3	10	Mk 131-Mk 156
Mk 10	5	TNT	3	10	Mk 140-Mk 156
Mk 15	4	TNT	3	3	Mk 140-Mk 156

The most common unit now in service is the Mk 6.

*In addition to the service rounds included in the table, there are the 7.2 Rockets Mks 106 and 109 filled with plaster for target practice, and the Mks 206 and 209 filled with plaster for drill.

BODY CONSTRUCTION:

The projectile consists of a flat nosed body with a conical tail fairing and parallel sides amidships. The adapter and fuze thread into the nose and the motor unit threads into the base of the unit.

MOTOR:

The motor unit contains a long single pellet of smokeless powder which, when ignited by a black powder primer fired by an electric squib, burns at a pressure of 1000 to 9500 lbs. per sq. in. The gases are forced out aft through the nozzle in the rear end of the motor tube. The propulsion is completely independent of any agent which would introduce a recoil problem. The burning continues for from .2 to .7 of a second during which time the missile travels about 30 feet, at which point propulsion ceases and the projectile is free in flight. This projector charge is intended for use on the Mk 20, 21, or 22 7.2 Rocket Launchers.

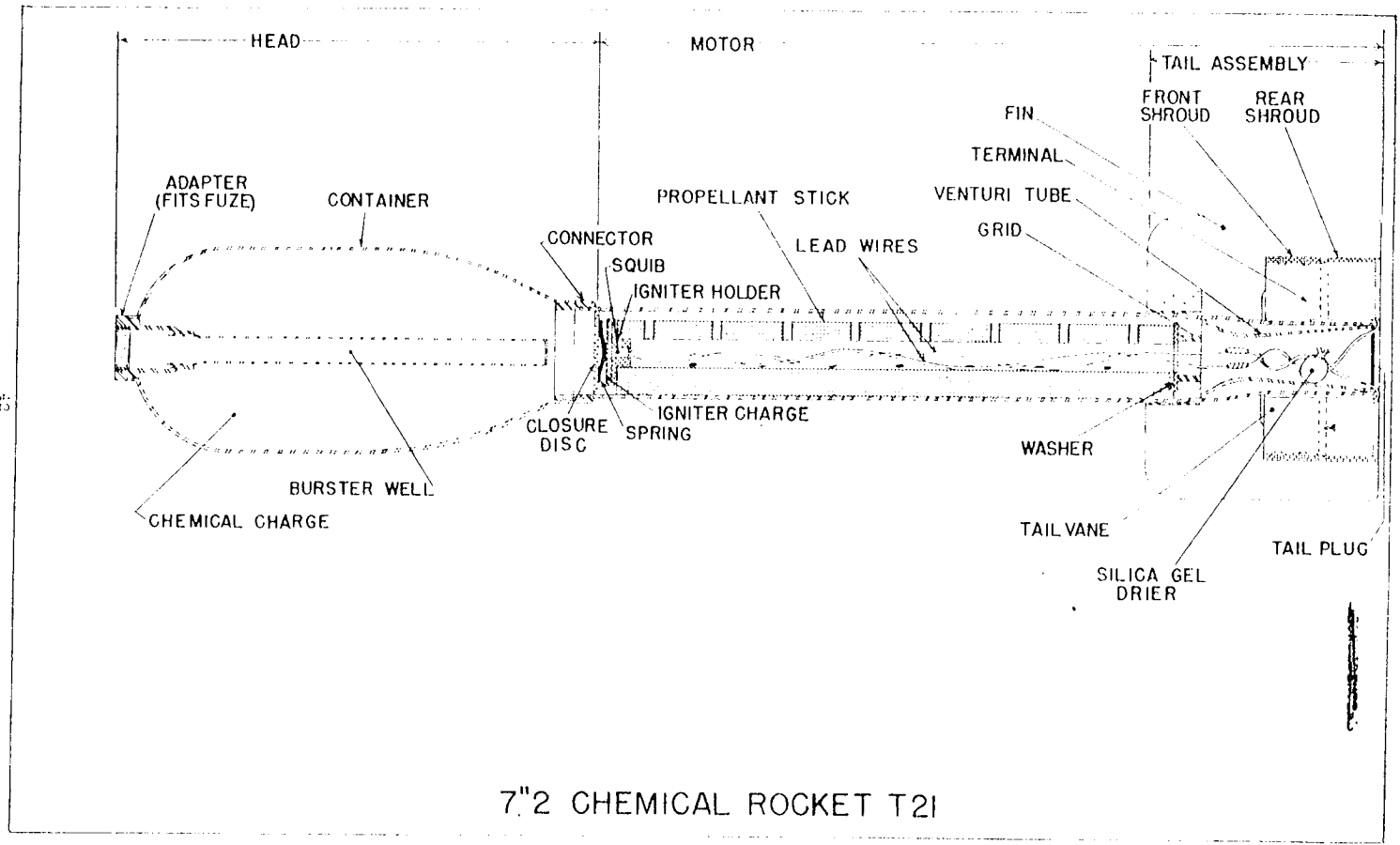
TAIL CONSTRUCTION:

Steel tube attached to body by a threaded joint; tail fins with two circular drums attached to the after end to give stabilized trajectory. The vanes have a 10 degree twist to give a slow rotation and prevent ruddering. The two vane support drums also act as contact rings, the wiring from the electric squib passing from the primer aft to the two rings which serve as firing contacts.

REMARKS:

1. When Torpex is used, the weight is increased by approximately 2.5 lbs.

2. The 2.5 (sub-caliber) Rocket, consisting of the 1.25 Mk 1 motor and 2.5 Mk 1 head, is a miniature of the regular rocket and is used in practice. The motor, fabricated of steel, contains a single tubular powder grain, an igniter, and lead wires. The tail fins, supported by a shroud, are offset 5 degrees to impart some rotation to the round with the object of improving underwater travel. The Mk 1 head has a cavity for a shot gun shell; the Mk 1 Mod 2 head is solid.



7.2 CHEMICAL ROCKET T21

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U. S. ARMY-NAVY

7.2" CHEMICAL ROCKET

Motor Mk 5 and Head Mk 7

OVERALL LENGTH	48.1 in.
HEAD WIDTH	7.2 in.
HEAD LENGTH	18.75 in.
MOTOR LENGTH	29.0 in.
PROPELLANT	Mk 11 ballistite grain
PROPELLANT LENGTH	20.25 in.
FILLER	Any chemical filler with sp. gr. over 1.0
FILLER WEIGHT (PS)	16.7 lbs.
PROPELLANT WEIGHT	5.25 lbs.
TOTAL WEIGHT	53.2 lbs.
RANGE (approx.)	3500 yds.
FUZING	Nose: Mk 147 or Mk 147-1 Mk 137 or Mk 137-1
COLOR (head)	Gray, with yellow nose band
COLOR (motor)	Olive drab with nomenclature stencilled in yellow.

USE: Laying smoke screens or disseminating chemical agents among enemy troops.

LAUNCHER: This rocket is fired from a 24-rail demountable, variable-elevation launcher carried in a 2½ ton truck. The salvo is fired in 2½ seconds, and the launcher can be reloaded in 1-1/2 minutes.

GENERAL: These two rockets are identical, and are under production by the Army as the 7.2 T21 rocket, though the rocket is of Navy design and takes a Navy fuze. The only essential difference between the rockets as used by the Army and Navy is in the propellant, as is mentioned above.

CONSTRUCTION: The head consists of the container, adapter, burster tube, burster charge, chemical charge, shipping plug, and connecter. The container is a bulb-shaped steel tube open at both ends. The adapter fits inside the flange on the forward end of the container and is brazed thereto. The wide forward end of the adapter is internally threaded to seat the fuze. The burster tube, made of steel, fits inside the adapter and extends downward into the container. The tube and adapter are held together by a press fit and sealed with white lead paste. The rear end of the tube is closed.

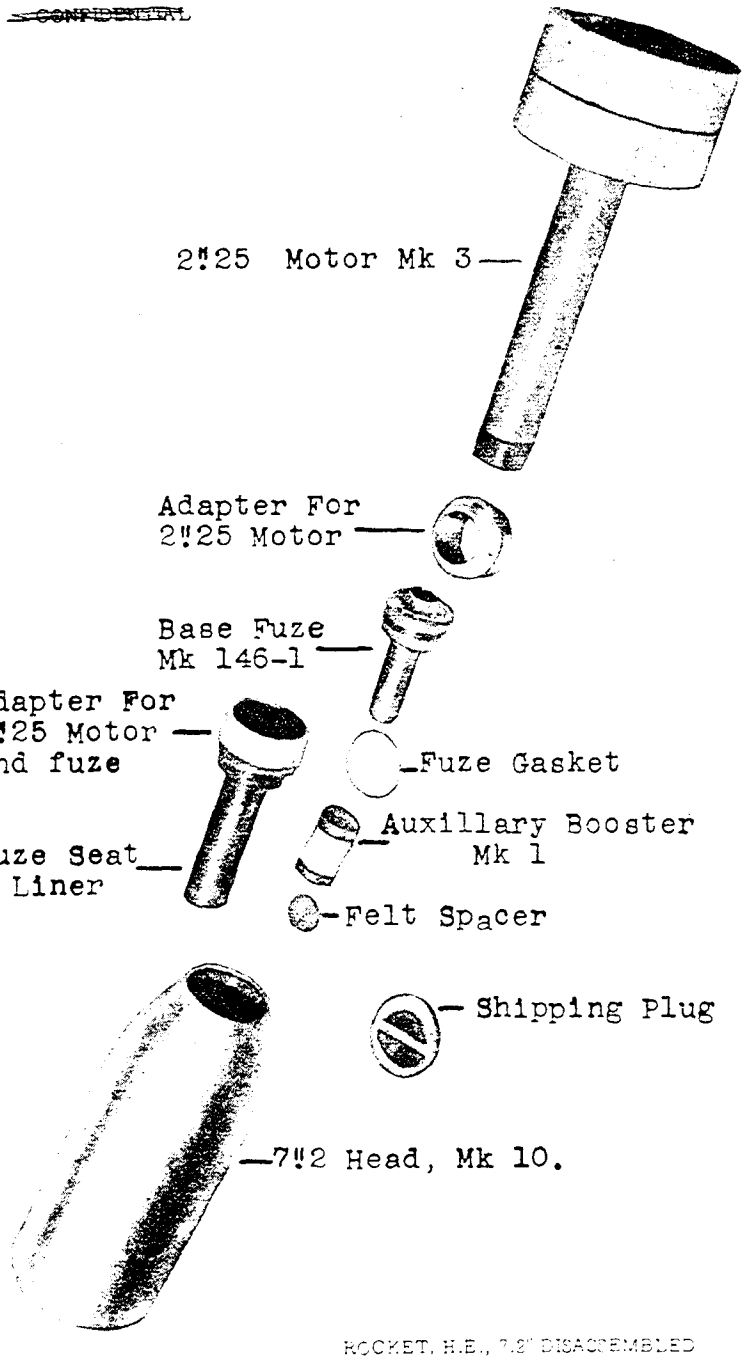
MOTOR: The motor is a steel tube, the forward end of which is externally threaded to screw into the connector of the head. The venturi tube, or nozzle is slipped down thru the large, open end of the motor body, and the end is welded to the inner edge of the motor-body rim.

TAIL ASSEMBLY: The tail assembly consists of two tail vanes, a front and four fins. Each vane is made of steel and is shaped roughly like a W. The two shrouds fit over the vanes. The terminals for the igniter lead wires are attached to the inner surfaces of the two shrouds. The steel fins are welded to the outside of the motor body just forward of the taper, with the aft ends cut out to fit over the shrouds.

PROPELLANT: 7.2 MR-X: As produced for the Navy, the propellant consists of a single grain of solventless extruded ballistite with an outer diameter of 2.5" and inner diameter of 1.0". This is the Mk 11 grain.

7.2 T21 Army Chemical Rocket: When used by the Army, however, the propellant used consists of four sticks of ballistite, with a 1.0" axial hole, placed end to end with a washer between each. The sticks are 3-ridged, and each has eight sets of three holes radially through it. Overall length of the four sticks is 20.5".

REMARKS: This rocket is in current production by the Army as the "7.2 T21 Rocket."



ROCKET, H.E., 7.2" DISASSEMBLED

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Mk 10 Rocket Body

OVERALL LENGTH	35 in.
HEAD DIAMETER	7.2 in.
MOTOR DIAMETER	2.25 in.
EXPLOSIVE WEIGHT (C-2)	33 lbs.
LOADED WEIGHT	60 lbs.
MAXIMUM RANGE	275 yds.
FUZE	See below.
HEAD DESIGNATION	7.2 Mk 10
MOTOR DESIGNATION	2.25 Mk 3

U. S. NAVY

7.2" DEMOLITION ROCKET(DR)

USE:

The 7.2 DR, a modification of the 7.2 Rocket Ammo (Shipboard), is used for demolition of anti-tank obstacles.

DESCRIPTION:

The rocket head is designed to provide for a base detonating fuze and has a thin steel head to give the maximum blast effect. The propellant is a single unperforated cruciform grain. The body can be fitted with any one of a number of rocket motors to give velocities from 175 to 400 ft/sec. The mean lateral deviation is 10 mils (from 90 in. launcher).

The base fuzes, Mk 146 and Mk 161-0, are armed during flight by the pressure of the gas evolved from the burning propellant acting on diaphragm. The Mk 10-1 is the Mk 10 head slightly altered to accommodate the new motor adapter of the Mk 161-0.

FUZING:

The Mk 5 head	:	Nose - Mk 152 or Mk 141
The Mk 10 head	:	Base - Mk 146
The Mk 10-1 head	:	Base - Mk 161-0

LAUNCHER:

In its most common use, the 7.2 DR is projected from a 20-rail armored launcher mounted on the turret of the M 4 tank. It is usually fired at point-blank range and has proved effective against concrete obstacles at ranges of 100 to 150 ft. The launcher was designed and is produced by the Army Ordnance Department.

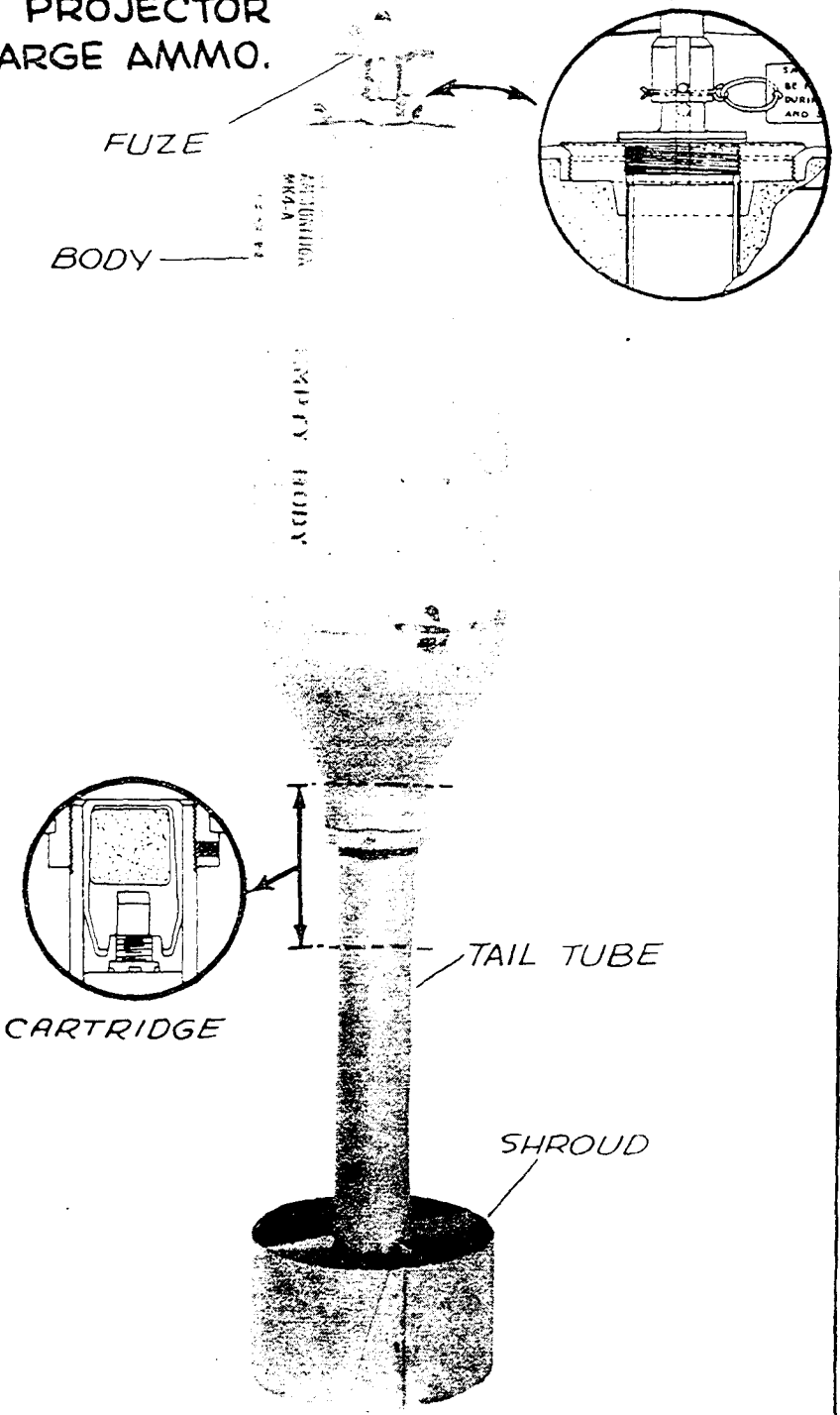
REMARKS:

This rocket is in production by BuOrd.

Complete Round Assemblies 7.2 Rockets Demolition

Complete Round			Head					Motor							
					Filler			Booster				Grain			
Assembly Number	Nom. Wt. Lbs.	Nom. Vel. Ft. Sec.	Mk.	Nom. Wt. Lbs.	Type	Nom. Wt.	Letter Prefixing Ammn. Lot Nos.	Mk.	No.	Size In.	Mk.	Mk.	Wt. Lbs.	Letter Prefixing Ammn. Lot Nos.
								1	1					
7.2HE601	58	175	5	47	TNT	32	RBDA	2	1	2.25	3	10	1.4	RMBD
7.2HE602	58	175	5	47	TNT	32	RBDA	1	1	2.25	3	10	1.4	RMBD
7.2HE603	60	175	10	50	TNT	31	RBDA	1	1	2.25	3	10	1.4	RMBD

7.2 PROJECTOR CHARGE AMMO.



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7"2 PROJECTOR CHARGE AMMO.

(This is not a rocket, but a projectile; it is included here because of its similarity to the Mousetrap)

OVERALL LENGTH	38.6 in.
HEAD LENGTH	19.0 in.
HEAD DIAMETER	7.0 in.
HEAD WEIGHT	17.0 lbs.
FILLER WEIGHT (PAT)	31.1 lbs.
WALL THICKNESS	0.0 in.
TAIL TUBE DIAMETER	1.75 in.
TAIL LENGTH	16.5 in.
TAIL WIDTH	7.0 in.
TAIL WEIGHT	9.3 lbs.

TARGET: For use by patrol vessels against submarines.

FUZING: Nose: The Mk 136 and the Mk 140 are replaced by the Mk 159.

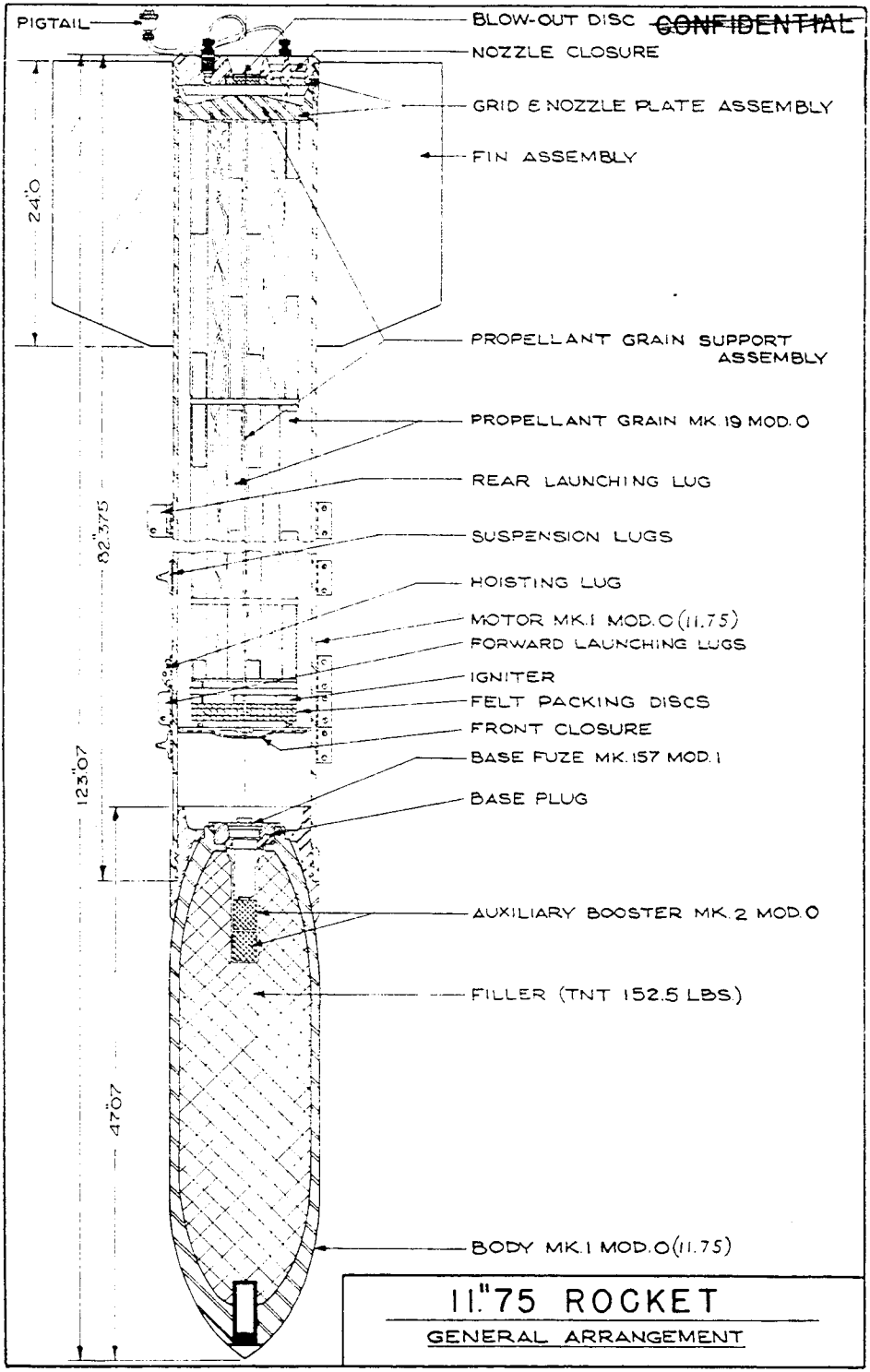
BODY CONSTRUCTION: The projectile consists of a flat nosed head with a conical tail fairing and parallel sides. The adapter and fuze thread into the nose. The motor unit consists of a smokeless powder cartridge with primer which is loaded forward in the tail tube, the tube fitting over a firing rost. The primer is detonated by electric contacts in the rost, resulting in firing the cartridge which propels the charge of the projector. This projector charge is adapted for use on the projectors Mks 10 & 11.

TAIL CONSTRUCTION: A steel tube attached to head by a threaded joint. Tail fins have a 10 degree twist and are attached with a drum support in order to give a slow rotation and stabilized trajectory.

REMARKS: (1) When Perpex is used, the weight is increased by approximately 2.6 lbs.

(2) Formerly known as the Hedgehog.

(3) The above data is based on the 7"2 head Mk 4A and the 1"75 F.C. tail Mk 4A. These are being replaced by 7"2 head Mk 4 Mod 0 and the 1"75 F.C. tail Mk 6 Mod 0.



11.75 ROCKET

GENERAL ARRANGEMENT

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U. S. NAVY

11.75" ROCKET AIRCRAFT

DATA HEAD: MK 1 MOD 0; MOTOR: MK 1 MOD 0

OVERALL LENGTH	133.0"
TOTAL WEIGHT	1953 lbs.
HEAD DIAMETER	11.75"
HEAD LENGTH	47"
HEAD WEIGHT	600 lbs.
WALL THICKNESS	
MOTOR LENGTH	82.4"
MOTOR DIAMETER	11.75"
FILLING	[illegible]
WEIGHT OF FILLING	169.6 lbs.
FUZES: Mk 1 Mod 0	Mk 157 Mod 1
Mk 1 Mod 1	Mk 157 Mod 2
Mk 3 Mod 0	Mk 157 Mod 3, Mk 163 Mod 0

ROCKET HEAD:

The Mk 1 Mod 0 (a CIT production) consists of a standard 500 lb. SAP AN-M58A1 bomb modified for this particular use. The changes include the removal of the suspension lugs, increase in number of threads securing the base plate, use of a new base plug to take the Mk 157 Mod 1 fuze, and the use of an adapter ring welded around after end as a means for attaching the Rocket Motor. The motor gases are sealed from the high explosive in the body by coating the threads of the base plate with a luting compound and a gasket under the fuze body flange.

The Mk 1 Mod 1 (a CIT production) is similar to the Mk 1 Mod 0 except a projectile type gas seal is added around the head of the fuze which is the Mk 157-2.

The Mk 3 Mod 0 (a BuOrd production) was developed from the Mk 1 Mod 1. This head differs in that it has a solid nosed "Common" head and a base plate modified to take three Mk 157-3 base fuzes. The projectile type gas seal is used around all fuzes and also between the base plate and the forged steel body. The Mk 157-2 fuze is used with one Mk 1-0 auxiliary booster or the Mk 163-0 with one Mk 19-0 auxiliary booster.

The Mk 3 Mod 1 head was issued for practice to simulate the Mk 3-0.

The bodies are shipped loaded and fuzed. A cuff protects the threads on the adapter ring and the fuze during shipment.

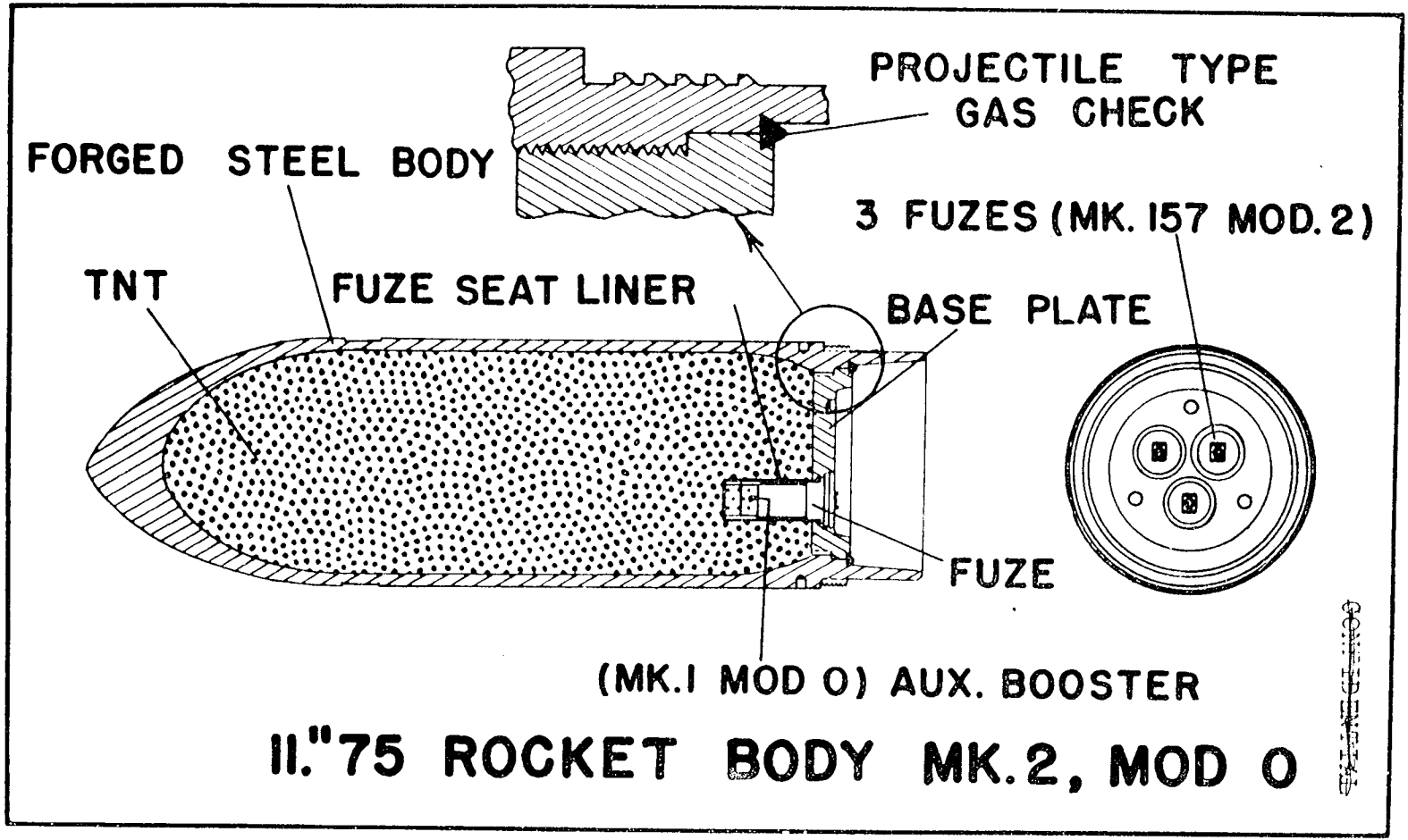
ROCKET MOTOR:

The Mk 1 Mod 0 (a CIT production) consists of a steel tube, the after end of which is threaded to receive a plate having twenty-five nozzles. The motor tube contains four propellant grains of solventless extruded ballistite of cruciform cross-section, weighing 147 lbs. The grains are shielded from each other by an "X"-shaped partition which extends longitudinally for almost the full length of the motor tube. The grains and the partition are supported by the grid and are strapped together by aluminum bands.

In normal operation the gases from the burning powder do not pass through the central nozzle, which is closed by a copper shear disc (blowout disc). Only when the pressure in the motor exceeds approximately 2250 lb./in.^{2} is this disc expelled, bringing the central nozzle into operation. The use of a blow-out disc allows the rocket motor to perform satisfactorily over a greater temperature range. It has one disadvantage, however, in that at motor temperatures of about 100° F, where the normal operating pressure is just enough to shear the disc, it is impossible to predict whether it will blow out or not. If it does, the burning time is lengthened and the gravity drop is increased so that the rocket may miss the target.

Four black powder charges of about 0.5 lb. each, contained in plastic cases at the front ends of the grains, provide the ignition for the propellant. They are set off by two small electric squibs in each case which are connected to receptacles in the nozzle plate. The burning of the propellant is markedly affected by its moisture content. Consequently, the motors are sealed at both ends. Each of the 24 peripheral nozzles is sealed with a thin steel cup. The front end is sealed with a thin steel disc having in its center a small "blow-out window". This window is blown out by the motor pressure, thereby allowing the propellant gases free access to the base fuze. These closures should not be removed.

The igniter Mk 19 Mod 0 has recently been developed for use in 11.75 AR motors. Known as a tin-plate case igniter, it consists of a single metal case 3.38" in diameter and 1.8" deep, with a wall thickness of .01". Four clips are soldered to the base of the case, for attachment to the motor charge support. The case contains 330 grams of FFFG black powder. Contained in the case are two electric squibs connected in parallel to the igniter lead wires.



11."75 ROCKET BODY MK.2, MOD 0

11.75 ROCKET: (continued)

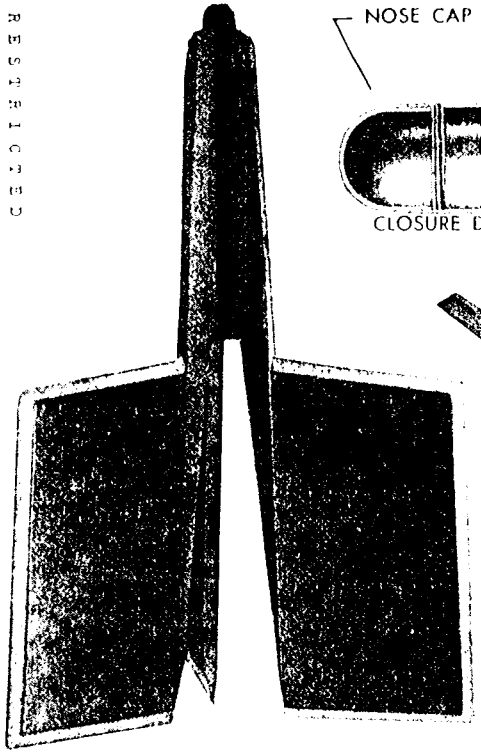
ROCKET MOTOR - continued: Motors must never be fired above the rated temperature stencilled on the motor because they are likely to burst. Below the lower rated temperature, occasional ignition failures and interrupted burning may be experiences although none has been found in six rounds fired at -40° F.

The Mk 1 Mod 1 motor is the BuOrd production. This motor is identical to the Mk 1 Mod 0 except that the motor tube is of higher tensile strength and the pigtail connection has been replaced by two receptacles built in the base plate.

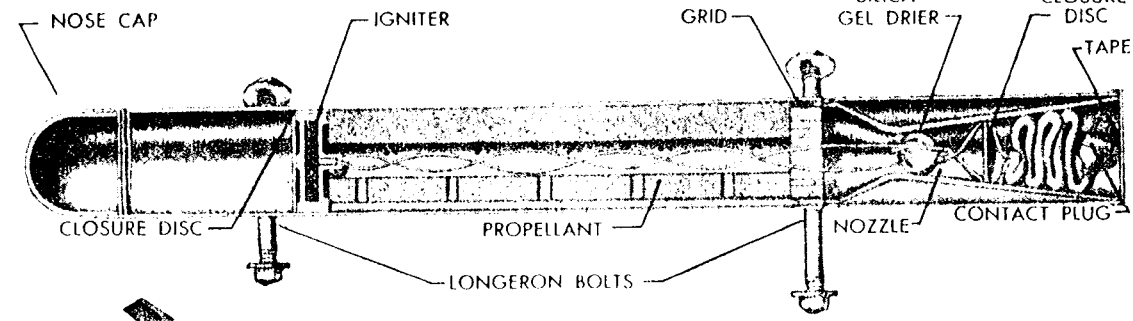
The Mk 1 Mod 2 motor is a CIT production in which the dead space between the forward motor closure and the base of the rocket head has been eliminated. This motor is similar in other respects to the Mk 1 Mod 0 except that the overall length was reduced to 75.75 inches and the pigtail connection has been replaced by two receptacles built in the base plate.

The Mk 1 Mod 3 motor is the BuOrd production of the Mk 1 Mod 2.

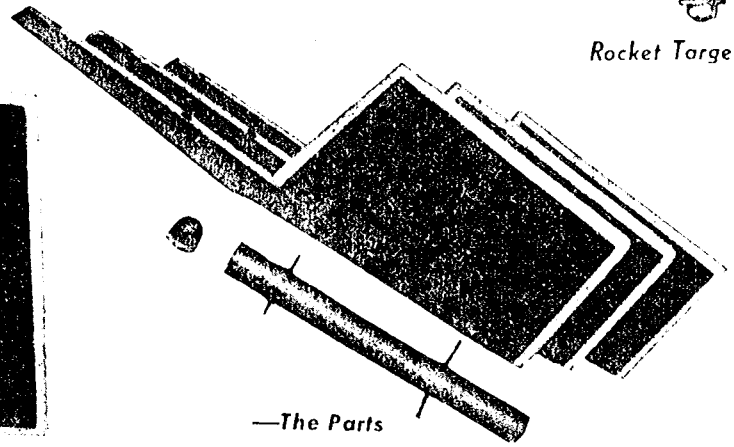
REMARKS: (1) C.I.T. refers to the California Institute of Technology which develops the rockets for the Bureau of Ordnance. As the rockets are adopted by BuOrd, new Mark or Mod numbers are assigned.



Assembled Rocket Target



Rocket Target Motor and Flares.



—The Parts

FLARE MARK 1 MOD. 1

FLARE MARK 1 MOD. 0

U. S. NAVY

ROCKET TARGETS
DRIFT SIGNAL ROCKETS

ROCKET TARGET: (RT)

As a target for anti-aircraft gunners, the rocket target is projected into the air with speeds and courses approximating those of an aircraft in flight and attack. It consists essentially of a rocket propulsive unit to which are attached large stabilizing fins, arranged for maximum visibility.

The rocket targets are referred to by their Mark number (old designation) or by their assembly number (new designation) as indicated below. They all consist of a simple rocket motor with three large fins which consist of wooden frames and light weight fibre board. The fins are 120 degrees apart, each attached by two lugs.

Mk	Designation Assembly No.	Approx. Initial Velocity (M.p.h.)	Approx. Range (Q.e.45°) Ft.	Approx. Max. Elevation (Q.e.45°) Ft.	3"25 Motor Mark No.	Fin Mark No.	Flare Mk No.
1	3"25 RT001	425			Mk 8	Mk 1	Flare
1	3"25 RT002	425			Mk 8	Mk 1	None
2	3"25 RT003	300			Mk 9	Mk 1	Flare
2	3"25 RT004	300			Mk 9	Mk 1	None
3	3"25 RT005	425	4500	1600	Mk 10 Mod 0	Mk 2 Mod 0	Mk 1 All Mods
3	3"25 RT006	425	5000	1750	Mk 10 Mod 0	Mk 2 Mod 0	None
4	3"25 RT007	300	3100	950	Mk 11 Mod 0	Mk 2 Mod 0	Mk 1 All Mods
4	3"25 RT008	300	3400	1050	Mk 11 Mod 0	Mk 2 Mod 0	None

(a) The Mk 1 and 2 consist of a Motor 36 inches long to which fins 18 inches by 34 inches are attached. An electrical connection is made by a standard 110 volt plug. Mk 1 is standardized at 425 m.p.h. and the Mk 2 at 300 m.p.h. On some models a screamer is put over the nose end.

(b) The Mks 3 and 4 differ from Mks 1 and 2 in construction details: the motor is heavier and the fins are held on by threaded studs instead of lugs. The ballistics are similar, Mk 3 is like Mk 1, and Mk 4 is like Mk 2.

DRIFT SIGNAL ROCKETS:

Four 3"0 drift signal service rockets for retro- firing have been developed. All of these rockets use the 1"25 motor and have a total weight of 4.5 to 4.8 pounds. The firing of the motor of the drift signal rocket initiates a delay train in the signal which initiates the flare some 10 to 20 seconds later. The motor separates from the signal during the free fall and the signal floats in water, burning for 10 to 15 minutes. They are launched from the aircraft launcher Mk 2.

Rockets, Signal, Night, Drift—Complete Round Assemblies

Complete rounds			Head				Motor				
Assembly Number	Nom. Wt. Lbs.	Nom. Vel. Ft./Sec.	An-Mk.	Mod.	Assembly Dwg. No.	Size In.	Mk.	Type of Elect. Plug	Loading Assembly Dwg. No.	Grain Mk.	Grain Wt. Lbs.	Letters prefixing Amm. Lot Nos.
PY001	4.8	300	5	1	344551	1.25	2	[1]HH	375026	4	.2	RMAB
PY002	4.6	200	5	1	344551	1.25	3	[1]HH	388832	5	.14	RMAC

[1] HH is abbreviation for Household Type of Electrical Connector.

ROCKET FUZES

INTRODUCTION

The construction and operation of Rocket fuzes is characterized by the service in which they are used: Army or Navy; by the type of rocket in which they are used: fin stabilized or spin stabilized; and by the position in which they are used: nose or base.

NAVY

Navy Fin Stabilized Rocket Fuzes:

The Navy fuzes for use in the nose of fin stabilized rockets, other than anti-submarine shipboard rockets (and projector charge ammunition), are air arming and impact (or impulse, VT) firing. Anti-submarine shipboard rocket fuzes are designed to arm because of hydrostatic pressure or travel through the water and to fire on impact with the submerged target.

The base fuzes are armed by the pressure of gases from the burning motor and fired by impact with the target.

Navy Spin Stabilized Rocket Fuzes:

The Navy fuzes for use in the nose or base of spin stabilized rockets are armed by centrifugal force and fire on impact.

The rocket fuzes have a common safety factor; viz, an interrupted firing train. The fuzes (nose and base) currently produced for rockets fired from aircraft, utilize the acceleration of the rocket to obtain a positive delay in arming until the termination of the burning of the rocket motor.

ARMY

Only four Army fuzes are considered in this section since the fuzes in the 0130 rockets are integral with the motor.

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ROCKET FUZES

MK	POSITION	METHOD OF ARMING	FUNCTIONING	REMARKS
30-3	Nose	Creep & centrifugal force	Instantaneous	Used in 5"/0 spin-stabilized rockets. This fuze is the Mk 30-3 Point Detonating Projectile Fuze.
31	Base	Creep and centrifugal force	Instantaneous	Used in 5"/0 spin-stabilized rockets. This fuze is the Mk 31 Base Detonating Projectile Fuze.
29	Nose	Creep and centrifugal force	Instantaneous or .05 sec. delay	Used in spin-stabilized rockets. This fuze is the Mk 29 Point Detonating Projectile Fuze, with the .05 sec. delay plunger assembly from the Army projectile fuze, M 48A2.
131 & Mods	Nose	Water travel	Instantaneous Impact	Used in 7"/2 Rocket Ammunition Shirboard. Fuze being replaced by the Mk 156.
134	Base		15 sec. delay	Used in 3"/5 Rocket Flare & Window Rocket. Fuze consists of a .32 cal blank cartridge and a length of safety fuse.
135	Nose	Hydrostatic Pressure	Instantaneous Impact	Obsolete; used in 7"/2 Rocket Ammunition Shirboard.
136 & Mods	Nose	Water Travel	Instantaneous Impact	Similar to Mk 131 with the addition of a collar shear wire. Used in 7"/2 Projector Charge Ammunition. Fuze is being replaced by the Mk 148.
137 137-1 137-2	Nose	Air	Instantaneous Impact	Used in 4"/5 Barrage H.E. Rocket, 4"/5 Barrage F.S. Rocket (Mk 5 head), and in 7"/2 Demolition Rocket (Mk 9 head). The Mk 137-1 differs in that it has ten arming vanes instead of eight and also has a split spacer sleeve. The Mk 137-2 is similar to the Mk 134-3.
139	Nose	Spring	Instantaneous Impact	Obsolete; used in 7"/2 Retrobomb.
140	Nose	Hydrostatic Pressure	Instantaneous Impact	Orders issued that fuze not to be used and it will be recalled. This fuze was issued to replace the Mk 131 and Mk 135 in 7"/2 Rocket Ammunition Shirboard and the 7"/2 Projector Charge Ammunition. Fuze can be used by blimps in 7"/2 heads without the motor and dropped as bombs.
141	Nose	Air	Instantaneous Impact. Water discriminating	Used in 7"/2 Demolition Rocket (Mk 5 head) to replace Mk 132. Two Mk 1 auxiliary boosters required. Fuze is a modified AN-M 110A1 bomb fuze.
145-0 145-1	Nose	Air	.02 sec. delay	Used in 4"/5 Barrage Rocket. Fuze is similar to Mk 137 with a .02 sec. delay in detonator.

ROCKET FUZES - continued.

MK	POSITION	METHOD OF ARMING	FUNCTIONING	REMARKS
146-0 146-1	Base	Gas Pressure	Instantaneous Impact	Used in 3"5 Mk 4 and 5."0 Mk 1 Rocket heads and the 7"2 Mk 10 Demolition Rocket head. The Mk 146-1 has a more sensitive firing train. Fuze replaced in 5"0 Rocket by Mk 157-0.
147-0 147-1	Nose	Air	Instantaneous Impact	Used in 7"2 CWR; the fuze is similar to the Mk 148 except it does not have an arming wire guide and instead of a booster, it has an adapter to receive a burster tube. The Mk 147-1 is identical to the Mk 147 but has a protective cap instead of a vane guard.
148	Nose	Air	Instantaneous Impact	Used in 3"5 Mks 3,5,6, & 9; and also the 5"0 Mk 1, Mk 5 and Mk 6 Rocket Heads. Fuze is similar to Mk 137, but has smaller vanes. The fuze has no vane guard, but is shipped with a protective cap in place. The fuze is equipped with arming wire brackets for use with A.R. heads.
149	Nose	Air	Instantaneous Impact	Used in 3"5 Mks 3,5,6, & 9; and the 5"0 Mk 1, Mk 5 and Mk 6 heads. The working parts are similar to the Mk 148 which this fuze is replacing. Positive delay arming until deceleration begins is incorporated by the use of the shutter locking pin. Spring loaded weather cap remains in place to protect vanes until arming wire is pulled.
152	Nose	Air	Instantaneous Impact	Used in 7"2 Demolition Rocket (Mk 5 head). Fuze is the Mk 219 bomb fuze which has been pre-armed 50 turns, the vane angle increased to 40 degrees, and a safety cotter arming pin added. The Mk 219 depth bomb adapter ring is used when fuzing the rocket.
154-3	Nose	Air	Instantaneous Impact	Used in 4"5 Rocket (WP) Smoke Rocket (Mk 5 and Mk 7 heads) Mk 137 Mod 2 with a 14 inch burster tube.
155	Nose	Air	Instantaneous Impact	Used in Mks 6 and 9, smoke filled 3"5 Aircraft rocket bodies. Fuze is similar to the Mk 149 with a burster tube instead of a booster charge.
156	Nose	Air	Instantaneous Impact	Used in 7"2 Rocket Ammunition Shipboard to replace the Mk 131. Fuze differs from Mk 131 in that it has a longer firing pin sleeve, a radial shear wire on the vane hub instead of a vertical shear wire, a heavier metal is used in the vanes, a locking detent on the detonator shutter and the fuze body above the gasket has been strengthened.

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ROCKET FUZES - continued

MK	POSITION	METHOD OF ARMING	FUNCTIONING	REMARKS
157-0 157-1 157-2	Base	Gas Pressure	.02 sec. delay	The Mk 157-0 is used in 5"0 Mk 1 head. The fuze is being replaced in the 5"0 Mk 5 and Mk 6 heads by the Mk 159-0 and Mk 159-1. Fuze is similar to Mk 146 with a .02 sec. delay detonator and a thin lock wire between the firing pin and firing pin body. The Mk 157-1 used in the 11"75 Mk 1 head, differs in that the body is of stronger material and the number of external threads has been doubled. The Mk 157-2 used in 11"75 Mk 1-1 and Mk 2 heads, consists of the Mk 157-1 with a projectile type gas seal. All fuzes are shipped assembled in the rocket head.
158	Nose	Water	Instantaneous Impact	Used in 7"2 Projector Charge Ammo. to replace the Mk 136. Fuze is similar to Mk 156 with the addition of a shear wire in the set-back collar.
159-0 159-1	Base	Gas Pressure	.015 sec. delay	The Mk 159-0 is used in the 5"0 AR (Mk 5 and Mk 6 heads). The fuze differs from the Mk 157-0 in that the delay is changed to .015 seconds, the shear wire is stronger, the inlet screen and washer are replaced by a brass washer, and the number of external threads is increased. The Mk 159-1, used in the 5"0 AR (Mk 6-1 head), is the Mk 159-0 with a projectile type gas seal. Fuzes are shipped assembled in the rocket heads.
160-0	Base	Gas Pressure	.02 sec. delay	Designed for use in 5"0 AR (Mk 1 head). Never issued. Fuze consisted of Mk 157-0 with a motor adapter. Fuze replaced by Mk 166-0.
161-0	Base	Gas Pressure	Instantaneous Impact	Used in 7"2 Demolition Rocket Mk 10-1 head to replace the Mk 146-1. Fuze is the Mk 146-1 incorporated with a motor adapter.
162-0	Base	Gas Pressure	.02 sec. delay	Used in 11"75 AR (Mk 2 head) to replace the Mk 157-2. Fuze is the Mk 157-2 with a booster approximately .3 inches longer and an improved detonator shutter locking arrangement.
164-0	Base	Gas Pressure	.015 sec. delay	Used in 5"0 AR (Mk 6-1 head) to replace the Mk 159-1. Fuze is the Mk 159-1 with a booster approximately .3 inches longer and an improved detonator shutter locking arrangement.
166-0	Base	Gas Pressure	.02 sec. delay	Used in 5"0 AR (Mk 1 head) to replace the Mk 157-0. Fuze is the Mk 157-0 with a booster approximately .3 inches longer, a motor adapter incorporated in the fuze, and an improved detonator shutter locking arrangement.

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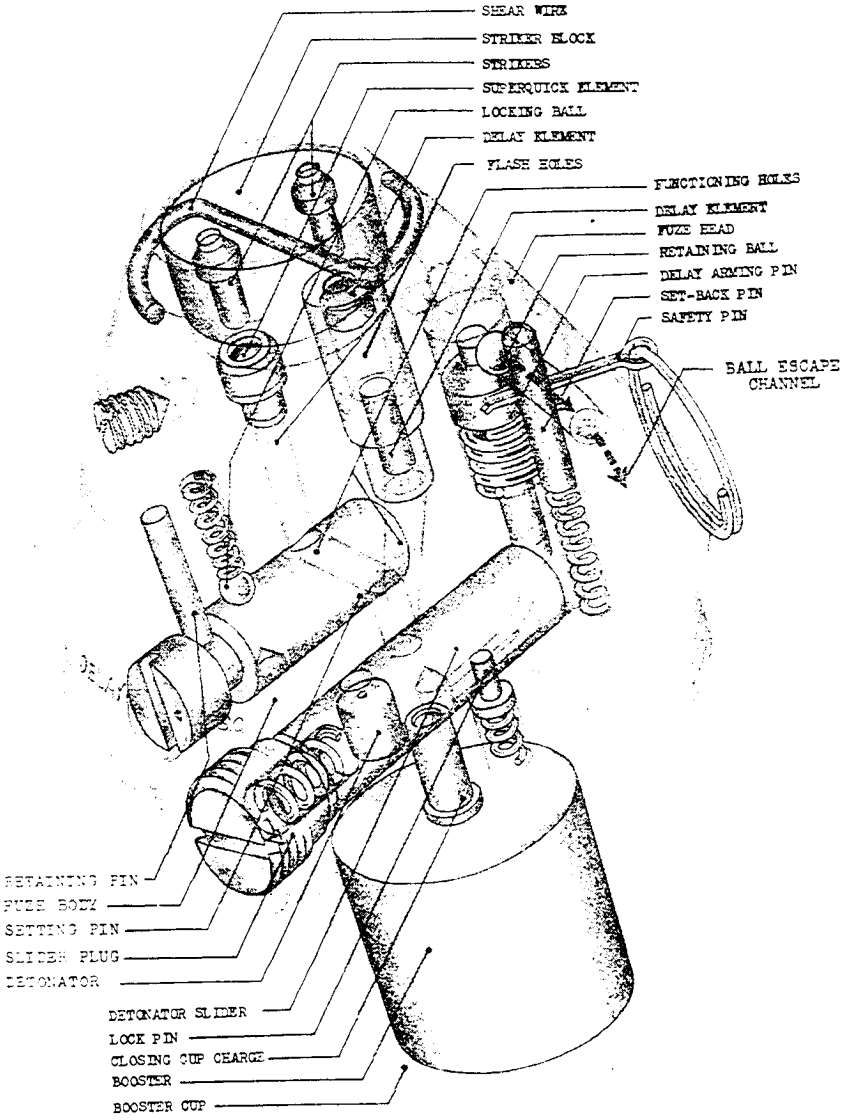
ROCKET FUZES - continued.

MK	POSITION	METHOD OF ARMING	FUNCTIONING	REMARKS
172-0	Nose	Air	Impulse, instantaneous	This is a VT fuze. Used in 5"0 Mk 1 Mod 1 heads for air and ground
44-1	Nose	Centrifugal Force	By gas pressure from nose fuze, instantaneous	This is an auxiliary detonating fuze used in 5"0 Mk 10 head with nose fuze Mk 30-3. Fuze is similar to Mk 44 Navy Auxiliary Detonating projectile fuze.
44-2	Nose	Centrifugal Force	By gas pressure from nose fuze, instantaneous	This is an auxiliary Detonating fuze used in 5"0 Mk 7 head with nose fuze Mk 100. The Mk 44-2 differs from the Mk 44-1 in that the hole is drilled through the closing disc and a thin copper disc is used for sealing.

ARMY

M	POSITION	METHOD OF ARMING	FUNCTIONING	REMARKS
M4A2	Nose	Armed by setback and creep	Aircraft: Instantaneous or .015 sec. delay. Ground: Instantaneous or .1 sec. delay.	Used in 4"5 Rocket heads, M8 and Mods
M21	Nose	Fuze arms by setback and creep; the booster by centrifugal force	Instantaneous or .05 sec. delay	Used in 4"5 (M16 head) spin stabilized rockets. Fuze consists of M4A2 with M21A1 booster staked in place; the M24 booster may be used as an alternate.
T5	Nose	Air	Impulse, instantaneous	This is a VT fuze used in 4"5 (M8 and Mods heads) fin stabilized rockets for plane to plane, plane to ground, and plane to water firing. Fuze has self destruction unit to operate in 3 to 6 seconds.
T6	Nose	Air	Impulse, instantaneous	This is a VT fuze used in 4"5 (M8 and Mods heads) fin stabilized rockets for ground to ground firing. Fuze differs from T5 in use, arming delay, & has no self destruction unit.
M21A1 (booster)	Nose	Centrifugal Force	Initiated by action of fuze, instantaneous	Termed a booster by the Army but action is similar to a Navy Auxiliary Detonating Fuze. Booster is staked in the P.D. M4A2 fuze to form the P.D. M21 fuze.
M24 (booster)	Nose	Centrifugal Force	Initiated by action of fuze, instantaneous	Designed to be used as an alternate for the M21A1 booster. See above.

ARMY ROCKET NOSE FUZE M4A2



U. S. ARMY NOSE FUZE

M 4A2

ROCKET USED IN	U.S.Army 4.5 H.E. Rocket, M 8.
FUNCTIONING	Air, .015 sec. delay or instant. Ground, .1 sec. delay or instant.
ARMED CONDITION . . .	No external indication, as it is armed by setback action on an internal part.
FUZES USED WITH . . .	None
ARMING TIME	Armed when forward acceleration ceases, and deceleration permits delay arming pin to free slider.
MAX. BODY DIAMETER . .	3.21"
OVERALL LENGTH . . .	2.51" (without booster)

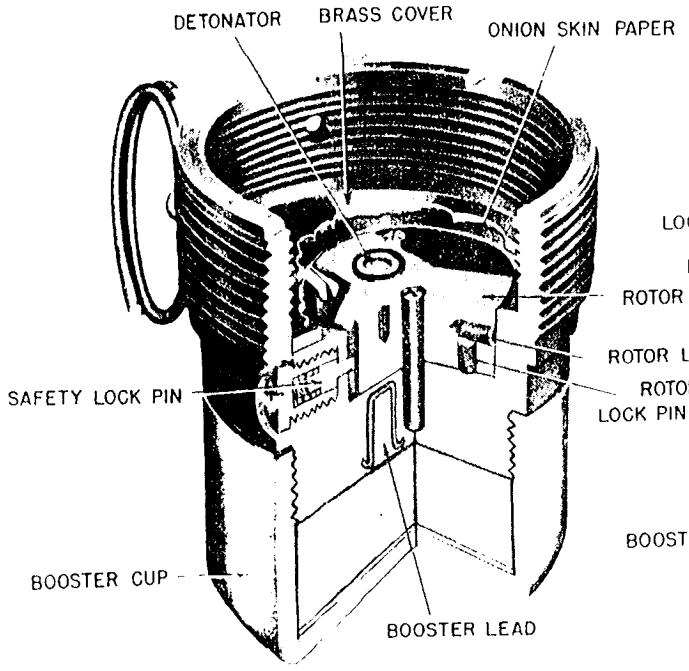
GENERAL: The M 4A2 fuze has been designed to be bore safe for firing from launcher tubes on aircraft or from the ground. There are two different issues of the fuze, identical except for the delay time, which is slightly less in the rockets fired from aircraft because of the increased velocity of those rockets as compared to rockets fired from ground launchers.

OPERATION: Before the rocket is loaded on the launcher, the fuze is set for either instantaneous (super-quick) action or delay action as desired. This is accomplished by rotating the setting pin. For instantaneous action the pin is rotated so that the functioning hole (flash channel) in the setting pin mates with the flash hole from the super-quick element. For delay action the setting pin is rotated 180 degrees so that the flash hole from the superquick element is obstructed and the delay firing channel is the only one open. In either position the setting pin is secured by the spring-loaded locking ball fitting into either of two recesses in the setting pin. The cotter pin is then removed so that the setback pin will be free to move back on setback.

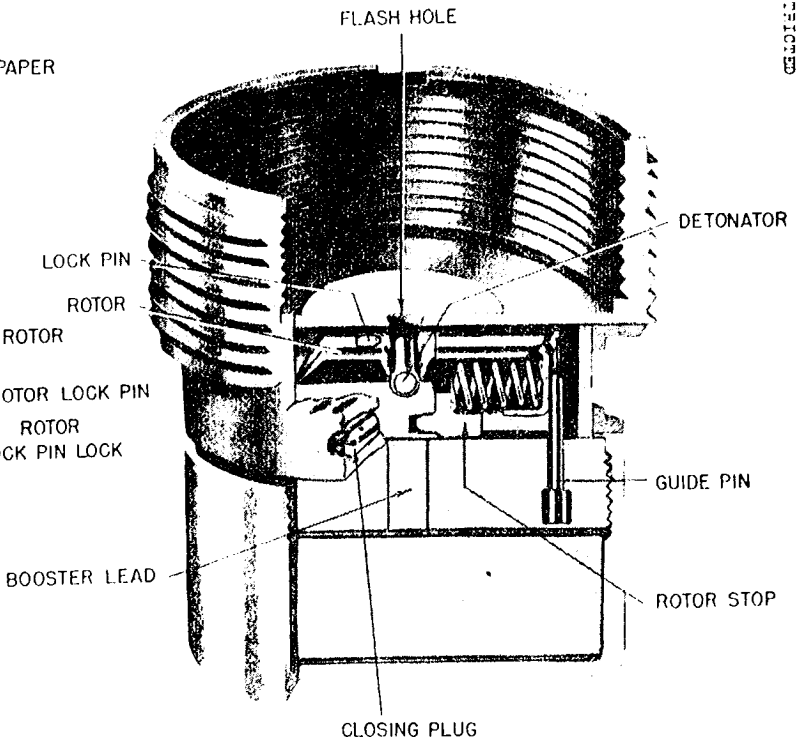
When the rocket is fired, acceleration causes the setback pin to move rearward, the spring offering sufficient resistance so that the pin reaches its most rearward position only after the rocket has cleared the launcher. This frees the retaining ball to be forced into an escape hole by the spring-loaded delay arming pin as deceleration sets in. As the lower end of the delay arming pin clears the inner end of the detonator slider, the slider is moved over to the armed position by the slider spring. The spring-loaded lock pin rides in a keyway on the underside of the slider and snaps into a recess when the slider reaches the armed position. The firing train is now lined up. On impact, the head of the fuze is crushed, the shear wire is sheared, and both strikers are driven inward, initiating both primers. Thus, both the superquick and delay elements are ignited irrespective of the setting of the fuze. If set for instantaneous action, the flash from the superquick element ignites the detonator before the delay element functions. If set for delay, the flash from the superquick element will be obstructed by the setting pin and the flash from the delay element will ignite the detonator .015 sec. later if used in an aircraft launched rocket, .1 sec. later if used in a ground launched rocket.

EARLY DESIGNS: The M 4A1 has a longer setting pin, with double flash holes, so that the flash from either the superquick or delay elements had to pass through the setting pin. Hence, if the setting pin was not rotated to exactly the proper point where the setting pin flash holes matched with those from the initiating elements, the fuze would not function. In the M 4A2, this condition was remedied by the shorter setting pin, so that even if the pin is not rotated to match with the flash hole from the superquick element, the delay flash hole will permit firing of the fuze after the slight delay. The M 4A1 also had a heavier detonator slider, which occasionally sheared the lock pin and did not stay properly lined up in the armed condition. The M 4A2 has a lighter, aluminum slider detonator.

The original M 4 had only one issue for both ground and aircraft launched rockets with either instantaneous or .1 sec delay settings. The M 4A1 had two issues, with either .015 sec or .1 sec delays and instantaneous settings. The original M 4 also had thicker walls and was consequently heavier, and had stronger springs under the setback pin and delay arming pin, requiring greater acceleration to arm.



BOOSTER, M21A1



BOOSTER, M24

RESTRICTED

U. S. ARMY

M81

ROCKETS USED IN . . . . . 4.5 M16 head.

FUNCTIONING . . . . . Instantaneous or .05 sec. delay.

ARMED CONDITION . . . . . No external indication

FUZES USED WITH . . . . . None

MAX. BODY DIAMETER . . . 3.81 in.

OVERALL LENGTH . . . . . 3.81 in. (without booster)

GENERAL: The M81 consists of the M4A2 fuze described on page 63 with a .05 second delay and an M81A1 booster staked in place. The M84 booster has been standardized as an alternate for all modifications of the M81 boosters and may be used in place of the M81A1 with the M4A2 fuze.

BOOSTER M81A1: The M81A1 consists of a booster cup which contains a tetryl charge and threads into the base of the body containing a tetryl booster lead and the rotor assembly. The rotor assembly consists of a rotor containing the lead azide detonator, a safety lock pin, a rotor stop pin, a rotor lock pin, and a rotor lock pin lock. The rotor is carried on the pivot pin and rotates under centrifugal force. The mechanism is covered by a thin brass disc which has a flash hole 1/4 inch in diameter to permit the transmission of the fuze action to the detonator. The flash hole is covered by a thin disc of onion skin paper.

When rocket is launched and reaches required rotational velocity, the safety lock pin moves outward against its spring under centrifugal force. This releases the rotor which rotates on the pivot pin to the aligned or armed position. The rotor is locked in the armed position by the rotor lock pin which moves outward into a cavity of the body under centrifugal force and the rotor lock pin lock moves forward by creep to prevent the rotor lock pin from returning to its original position. The booster is armed in flight and the detonator is initiated by action of the fuze.

BOOSTER M84: The rotor assembly of the M84 consists of a rotor which contains the detonator, a centrifugal rotor stop which holds the rotor in the unarmed position, a guide pin and plate which closes the rotor chamber.

When rocket is launched, centrifugal force causes the rotor stop to move outward against the spring and release the rotor, which turns so that the detonator is aligned with the flash hole and the booster lead. The rotor is locked in the armed position by the lock pin which enters the lock pin cavity as far as the closing plug. The booster charge consists of a tetryl pellet. The booster is armed in flight and the detonator is initiated by the action of the fuze.

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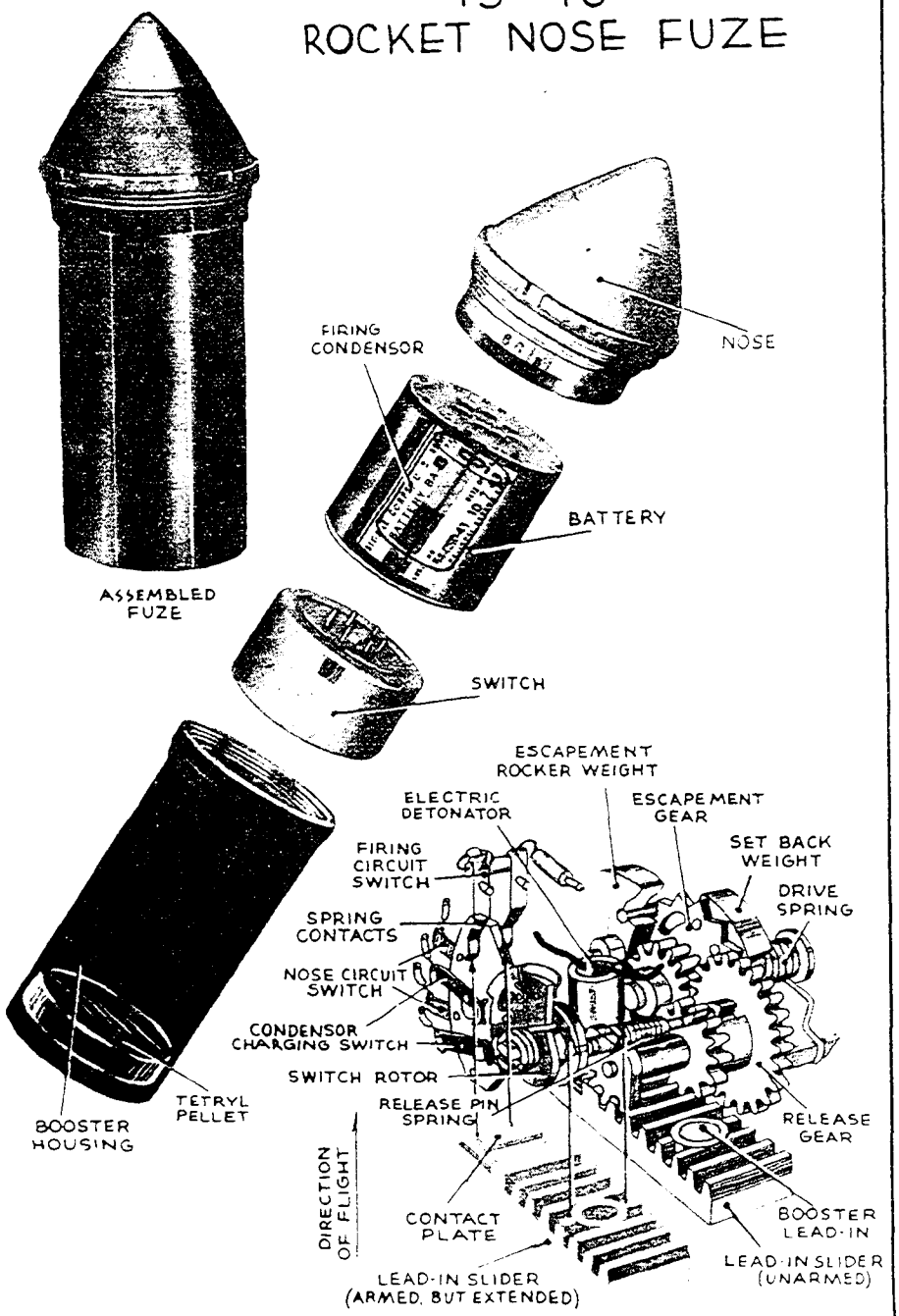
T5 – T6
ROCKET NOSE FUZE



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U. S. ARMY NOSE FUZES

T5
T6

ROCKETS USED IN	4.5 M6, M8A3, T30, T74, (M8A1, M8A1B1, M8A2 heads)
FUNCTIONING	Functions by impulse on approach to target
FUZES USED WITH	None
DELAY TO ARM	T5: 1 sec. T6: 3-6 sec.
MAX. BODY DIAMETER	3.18 in.
OVERALL LENGTH	7.5 in.

GENERAL: The T5 and T6 are of the electro-magnetic type and are similar in outward appearance; they differ in their application, delay time to arm, and self destructive action. The T5 is installed in aircraft rockets for plane to plane, plane to ground, and plane to water use; the T6 is installed for ground to ground use. The T5 has a 1-second delay in arming and has a self destruction feature which acts 6 - 12 seconds after launching. The T6 has a 3-second delay in arming and does not have a self destruction feature.

The T5 and T6 screw directly into all standard loaded 4.5 Army rockets and are directly interchangeable with P.D. M4 series rocket fuzes both physically and ballistically.

DESCRIPTION: The fuzes as issued are not complete. A battery must be installed and the components assembled prior to use. The four major components are the nose, battery, switch, and booster housing.

NOSE MC-382( ): The nose model number may be followed by the manufacturer's code letter in parenthesis. Noses MC-382 ( ) with the letters A, B, C, D, and E are interchangeable. The nose unit contains the basic electric equipment which initiates the air burst by influence of the target. It is completely sealed and requires no adjustment.

When issued for the T5 fuze, the nose contains equipment for self destructive action 6 - 12 seconds after launching. In this instance the electrical element is short circuited by a clip across #1 and #5 contact pins which protrude from the base of the nose.

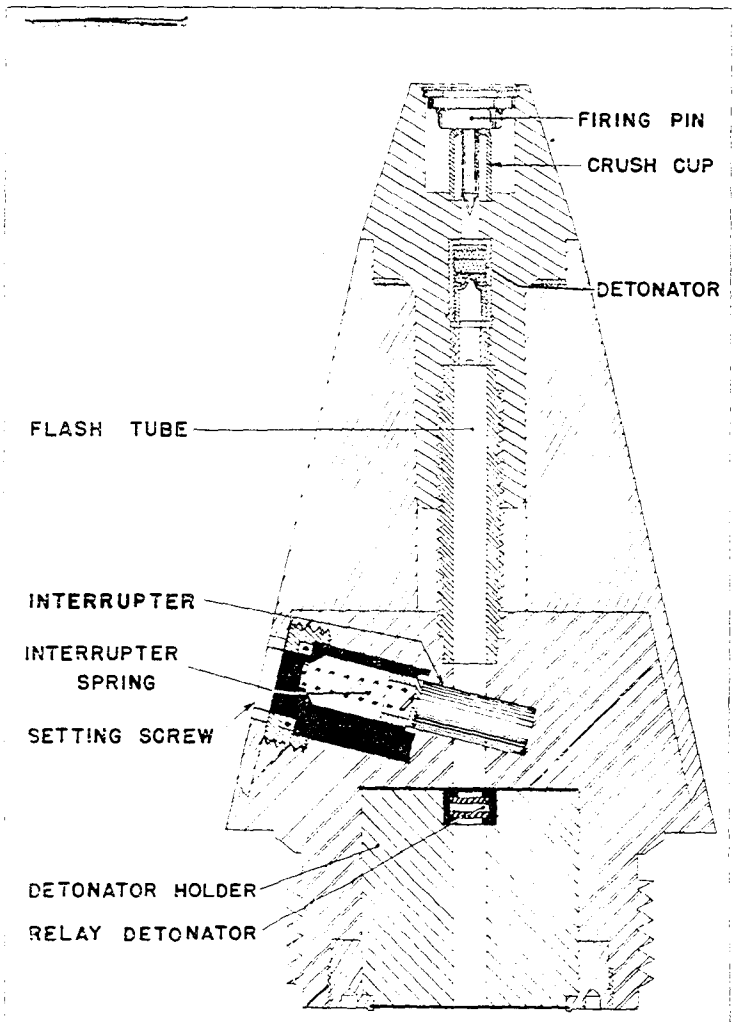
Externally the nose has a plastic drive with a metallic cap. The shoulder is provided with four slots for the fuze wrench. The base of the nose has two sets of threads, the smaller diameter threads being for assembly to the booster housing, and the larger diameter threads for assembly to the rocket. Seven electrical contact pins project from the base for connection to the battery. A red guide mark and groove provide a means for proper alignment and assembly in daylight and also at night.

BATTERY BA-78: The battery unit provides the power supply for operation of the fuze. It is encased in a black bakelite cylinder. Externally the top plate is marked "AMP" and provides a 7-pin socket to receive the nose pins. The bottom plate of tan fiber contains a 6-pin socket to receive the switch pins. This plate has a notch for proper assembly to the switch in the dark. Decalomania is fixed to the side of the unit giving battery identification, a red guide strip for alignment with the nose and a green guide strip for alignment with the switch.

SWITCH SW230A or SW230C: (Note: Either of these switches may have a 1 sec. or a 5 sec. delay. The 1 sec. delay switch is shipped with the T5 while the 5 sec. delay switch is shipped with the T6.)

The switch unit contains mechanical and electrical devices necessary to arm the fuze, an electric detonator and a firing train interrupter for safety during handling and launching. Externally the unit has contact pins on top for assembly to the battery. A fiber terminal disc supports the contact pins. A top plate and safety key must be removed before assembly in accordance with instructions on the plate or attached to the key. A bakelite plug at the center of the fiber disc holds the electric detonator in place. The metallic case forms a sturdy protector for the enclosed mechanism and explosive. A green guide mark and groove are located on the side of the switch to assist in aligning switch pins and battery. The bottom plate contains a small tetryl pellet for detonating the booster charge.

BOOSTER HOUSING M-381: The booster housing forms a case for the battery and switch. This unit screws onto the lower threads of nose MC-382 ( ). In the bottom of this housing is a chamber containing a tetryl booster charge.



MK.30 MOD.3 POINT DETONATING FUZE

~~CONFIDENTIAL~~

U. S. NAVY NOSE FUZE

MK. 30 MOD. 3

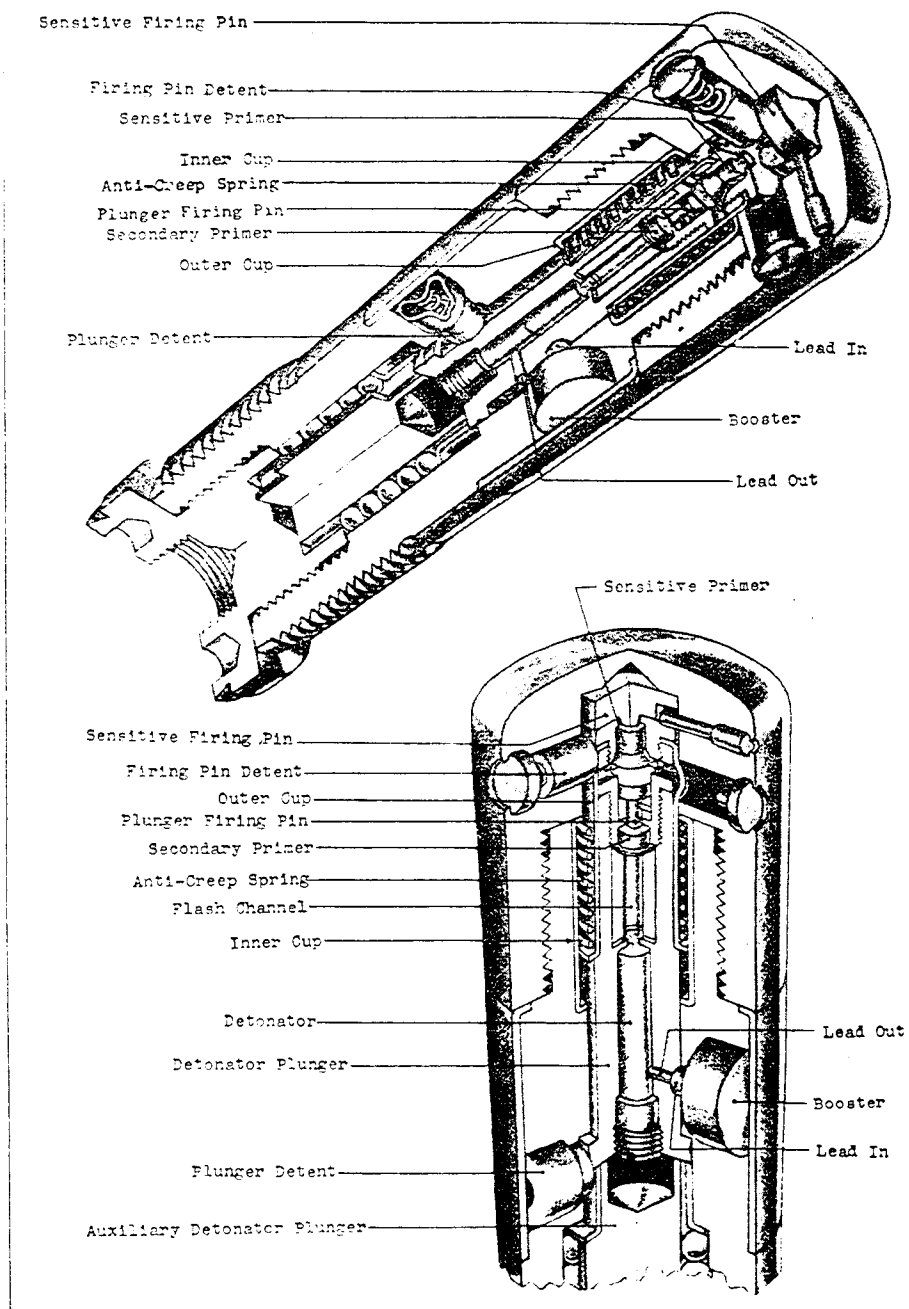
Air Arming, Impact Firing
Rocket Propelled

ROCKETS USED IN	5.0 Mk 10 and Mods
FUNCTIONING	Instantaneous
ARMED CONDITION	No external indication
FUZES USED WITH	None
ARMING SPEED	1500-2000 r.p.m.
MAX. BODY DIAMETER . . .	2.4 in.
OVERALL LENGTH	4.55 in.
WEIGHT	1.51 lbs.

GENERAL: The Mk 30-3 Rocket fuze is similar to the Navy Point Detonating projectile fuze, Mk 30-3. This fuze is armed by creep and centrifugal force and thus can only be used in spin-stabilized rockets. The fuze is designed to function on impact with super-quick (instantaneous) action.

DESCRIPTION: The fuze consists of four principal parts: the base which contains the relay detonator, holder, and setting device; the nose or detonator assembly which contains the striker and detonator; the plastic ogive; and the flash tube which is fitted in the center of the ogive and holds the nose and the base together. The striker is held in position by a gilding metal cap which collapses on impact. The setting device consists of an interruptor plunger, a spring, and a setting sleeve. The hole in the setting sleeve is off center and the position of the sleeve determines whether the hole is aligned with the interruptor ("SQ" or "On" setting) or whether the wide shoulder of the sleeve engages the interruptor ("OFF" setting). If the sleeve is set for "SQ" or "ON", the interruptor is free to move outward by creep and centrifugal force to compress the action. If the sleeve is set on "OFF", the wide shoulder engages the interruptor to prevent it from moving outward and the interruptor blocks the flash tube.

OPERATION: The fuze is designed for super-quick action on impact. The "OFF" setting is a safety feature to prevent premature detonation and the setting sleeve must be turned to "SQ" or "ON" before rocket is launched. When rocket is launched the interruptor moves outward by creep and centrifugal force to compress the spring and open the flash tube. On impact, the gilded metal cap collapses and the striker is driven into the detonator, the flash of which initiates the relay detonator and the main charge.



MK. 31
BASE DETONATING FUZE

RESTRICTED

U. S. NAVY BASE FUZE

MK. 31

Air Arming, Impact Firing, Rocket Propelled

ROCKETS USED IN	5"O Mk 8 and Mods
FUNCTIONING	Instantaneous
ARMED CONDITION	
FUZES USED WITH	None
ARMING SPEED	
MAX. BODY DIAMETER	1.8 in.
OVERALL LENGTH	4.68 in.

GENERAL: The Mk 31 Rocket base fuze is identical to the Navy Base Detonating Projectile fuze, Mk 31. This fuze is armed by centrifugal force and thus can only be used in spin-stabilized rockets. The fuze is designed for instantaneous action on impact. The fuze is shipped installed in the base of the rocket body.

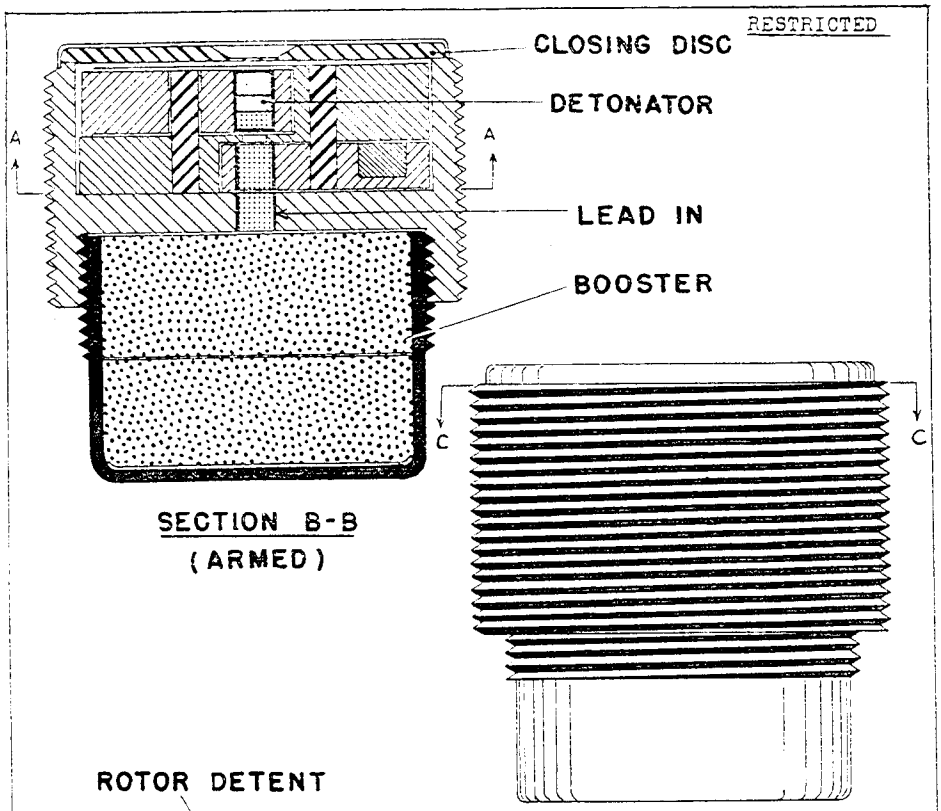
DESCRIPTION: The fuze is composed of two major parts: the fuze body and the nose cap. The body contains the auxiliary detonator plunger the detonator plunger, the detonator plunger detents, the anti-creep spring assembly and the firing train. The auxiliary detonator plunger is surrounded by twenty ball bearings and bears against the bottom of the detonator plunger. Fitted over the top of the detonator plunger is the anti-creep spring assembly consisting of an inner and outer cup separated by an anti-creep spring. The outer cup will not move and the inner cup is crimped over the top of the detonator plunger and held in position by the sensitive primer holder. The firing train consists of the sensitive primer, plunger firing pin, secondary primer, detonator, and booster lead-ins and lead-outs which are out of line in the unarmed position.

The nose cap, which is secured to the end of the body by a threaded joint houses the sensitive firing pin and firing pin detents. The sensitive firing pin is held in place by two stakes, but is referred to as a "floating" firing pin since it can move downward slightly. Ninety degrees removed from the two detents are two holes in the nose cap. A locking pin is provided to lock the nose cap in position.

OPERATION: The force of setback causes the sensitive firing pin to move back on the firing pin detents and hold them in by friction. When the motor burns out, creep causes the firing pin to move forward and release the detents. Centrifugal force will move both sets of detents outward against their springs and the fuze is then completely armed. The detonator plunger is prevented from moving forward on creep because of the anti-creep spring, but on impact the auxiliary plunger acting as an inertia weight pushes the detonator plunger forward. This action moves the inner cup forward thus compressing the anti-creep spring and brings the booster lead-ins and lead-outs in line. The sensitive primer in the top of the detonator plunger is carried on to the sensitive firing pin and the explosion of the sensitive primer accomplishes two things;

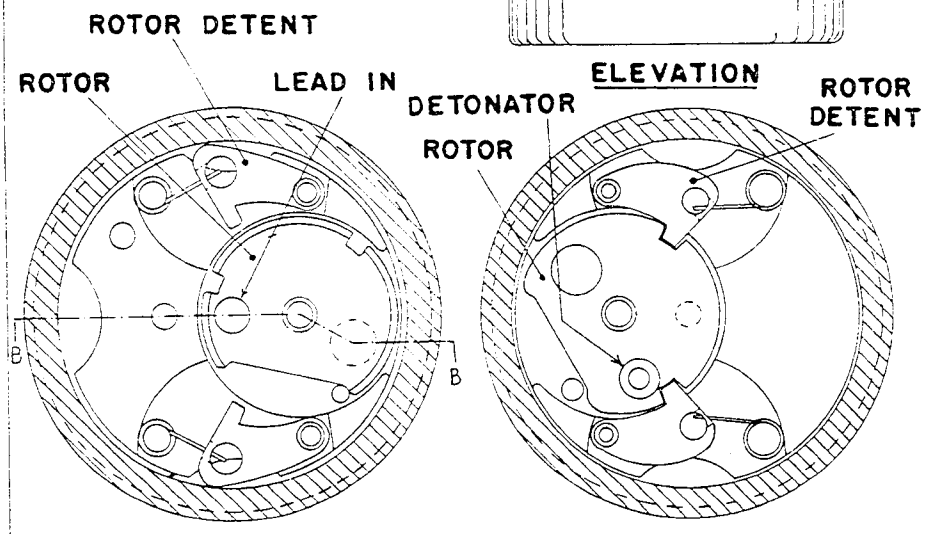
1. The gases resulting from the explosion pass through the port holes on the side of the primer container and build up a high pressure expanding that part of the cup which is adjacent to the holes in the nose cap. This action locks the detonator plunger in the fired position and keeps the firing train lined up.

2. The shear wire that has been holding up the secondary firing pin is broken and the secondary firing pin is driven down into the secondary plunger and the flash sets off the detonator and booster elements.



SECTION B-B
(ARMED)

ELEVATION



SECTION A-A
(ARMED)

SECTION C-C
(UNARMED)

MK. 44 MOD. 1
AUXILIARY DETONATING FUZE

RESTRICTED

U. S. NAVY

MK. 44-1
MK. 44-2

Auxiliary Detonating Fuze

ROCKETS USED IN . . . . . Mk 44-1: 5"0 Mk 10 Head
Mk 44-2: 5"0 Mk 7 head

FUZES FOUND WITH . . . . Mk 44-1: Mk 30-3
Mk 44-2: Mk 100

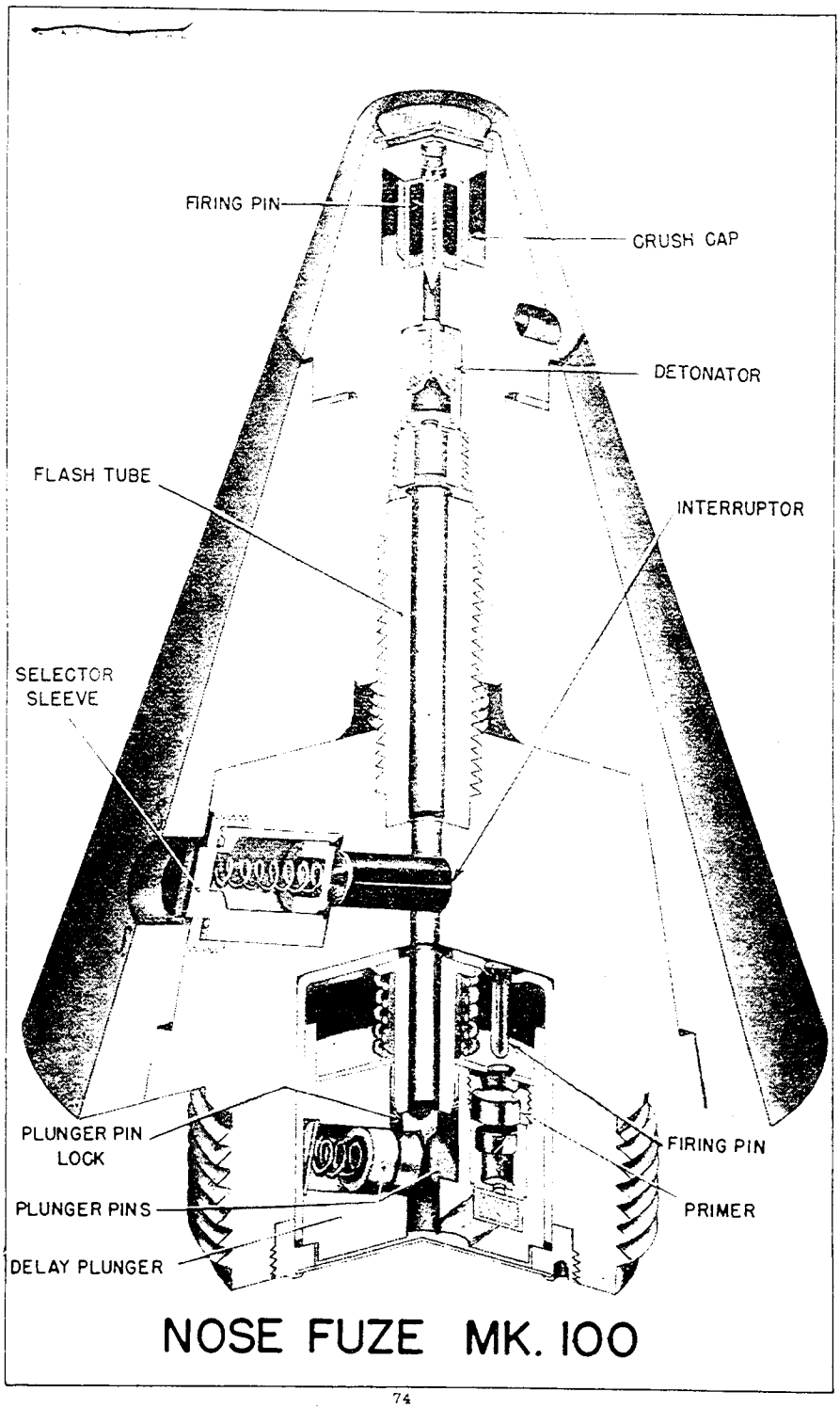
OVERALL LENGTH . . . . . 1.8 in.

DIAMETER:
Rotor Housing . . . 1.5 in.
Booster Cup . . . . 1.25 in.

DESCRIPTION — Fuze is constructed in two parts, a rotor housing into the bottom of which is screwed a booster cup. Rotor housing contains a double rotor, one rotor above the other. The upper rotor contains a primer detonator incorporating Lead azide. The lower rotor contains a booster lead-in of Tetryl. In the assembled condition, each rotor is locked by two centrifugal detents so that the firing train is out of line.

OPERATION — This fuze is armed by centrifugal force. When the rocket is launched, centrifugal force moves the two detents on each rotor out against their springs. The rotors are then revolved by centrifugal force until their motion is arrested by contact with the stop pin. At that time the firing train is in line, with the detonator being immediately above the booster lead-in; the fuze is now armed. When the nose fuze functions, the gas pressure generated forces through the weakened part of the closing disc to fire the detonator. The firing train is then booster lead-in, booster, main charge.

Mk 44 Mod.2: — The Mk 44 Mod 2 is the same as the Mk 44 Mod 1 except that the hole in the closing disc over the detonator is drilled completely through and a copper sealing disc, 0.02 inches thick, is placed over the closing disc.



NOSE FUZE MK. 100

~~CONFIDENTIAL~~

ROCKETS USED IN	5"0 Mk 7 and Mods (spin-stabilized)
FUNCTIONING	Instantaneous or .05 sec. delay.
ARMED CONDITION	No external indication
FUZES USED WITH	None
ARMING SPEED	1500-2000 r.p.m.
MAX. BODY DIAMETER . . .	3.0 in.
OVERALL LENGTH	4.15 in.

U. S. NAVY NOSE FUZE

MK.100

Centrifugal, Impact Firing
Rocket Propelled

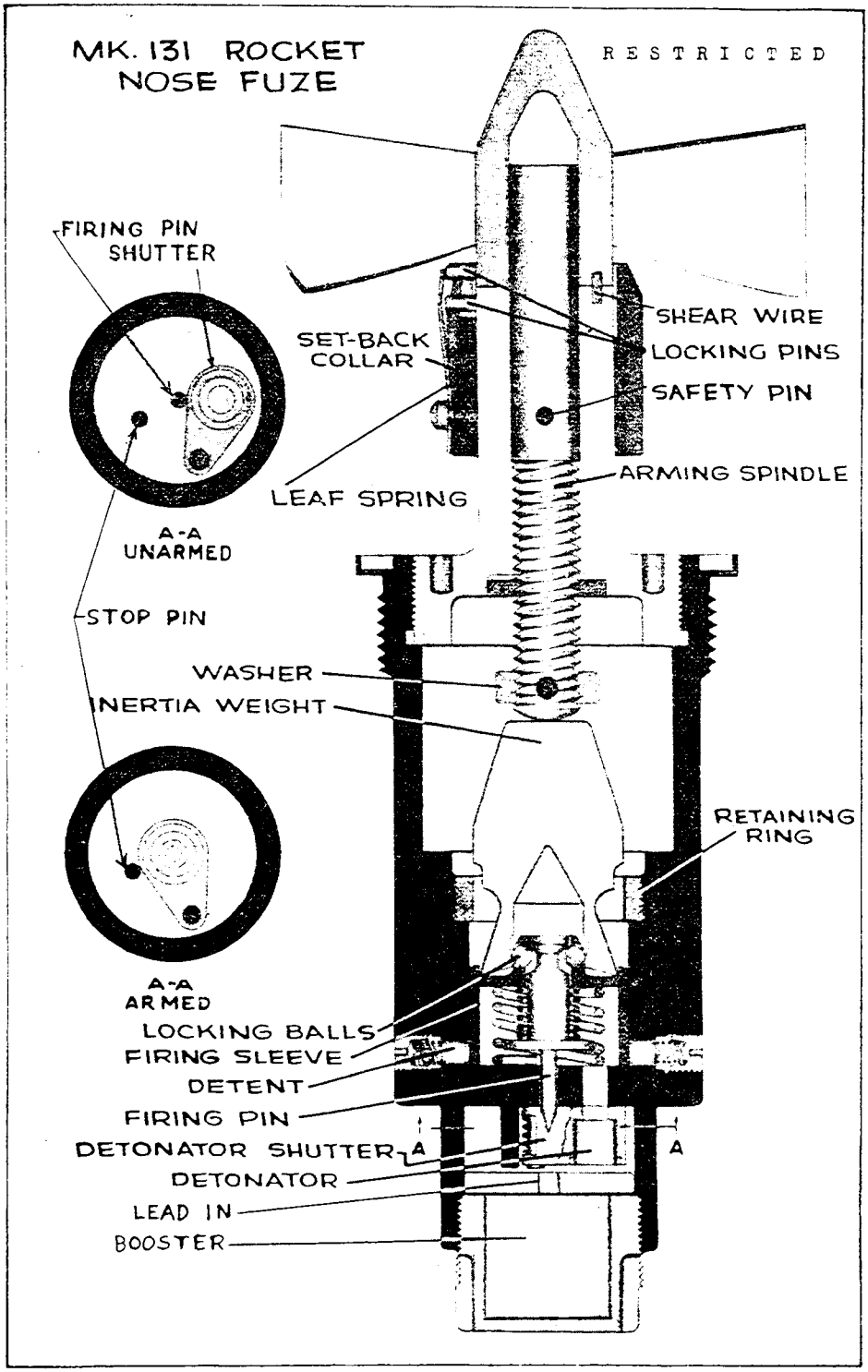
GENERAL: The Mk 100 is similar to the Navy Point Detonating Projectile Fuze, Mk 9?, with the addition of the delay plunger assembly from the Army projectile fuze, M 48A2. The fuze can function either super-quick (instantaneous action) or with a .05 second delay according to the setting of the key on the drive. This fuze can only be used in spin-stabilized rockets as the fuze is armed by rotation or centrifugal force.

DESCRIPTION: The fuze consists of four principal parts: the base which houses the Army delay plunger assembly, the nose or detonator assembly which contains the striker and detonator Mk 95 Mod 0 for super-quick action, the electric drive, and the flash tube which is fitted in the center of the drive and holds the nose and base together.

In the nose, the striker is held in position by a gilding metal cap which collapses on impact and permits the striker to fire the detonator. The setting device consists of a plunger or interruptor, a spring, and a selector sleeve. The hole in the selector sleeve is off center, and the setting of this sleeve determines whether the interruptor is aligned with the hole or whether the wide shoulder of the sleeve engages the plunger. If the selector sleeve is set on "SQ", the interruptor is free to move outward under centrifugal force to compress the spring and thereby open the flash tube for super-quick or instantaneous action. If the sleeve is set for delay, the wide shoulder engages the interruptor to prevent it from moving outward by centrifugal force. In this instance, the interruptor will block the flash tube and the delay plunger assembly operates to detonate the rocket head. The delay plunger assembly includes a firing pin, primer, black powder delay pellet, and a relay pellet.

OPERATION: The fuze is designed to arm at 1500 to 2000 r.p.m. When set for superquick action (SQ), centrifugal force causes the interruptor to move outward against the spring and thereby open the flash tube. At the same time the two plunger pins locking the delay assembly in the unarmed position also move outward under centrifugal force. These plunger pins are prevented from returning to the unarmed position by the plunger-pin lock which swings on its pivot to place an arm against the inner end of each. Upon impact, the firing pin crushes the gilding metal cap and is driven against the detonator to initiate the super-quick action. Inertia causes the delay plunger to move forward, driving the primer against the delay action firing pin and initiating the delay action. In normal functioning, the delay action will have no effect as the super-quick train will have caused the shell to explode; however, if the super-quick action should fail, the delay action would function to prevent the rocket from being a dud.

When fuze set for delay action (D), the interruptor would block the flash tube and nullify the effect of the super-quick train. The delay plunger assembly would operate to detonate the rocket.


MK. 131 ROCKET
NOSE FUZE
FIRING PIN
SHUTTER
SET-BACK
COLLAR
SHEAR WIRE
LOCKING PINS
SAFETY PIN
LEAF SPRING
ARMING SPINDLE
A-A
UNARMED
STOP PIN
WASHER
INERTIA WEIGHT
RETAINING
RING
A-A
ARMED
LOCKING BALLS
FIRING SLEEVE
DETENT
FIRING PIN
DETONATOR SHUTTER
DETONATOR
LEAD IN
BOOSTER
A
A

RESTRICTED

U. S. NAVY NOSE FUZES

MK. 131
MK. 136

Mk 131 used in 7"2 Rocket Ammo (Shipboard)
Mk 136 used in 7"2 Projector Charge Ammo

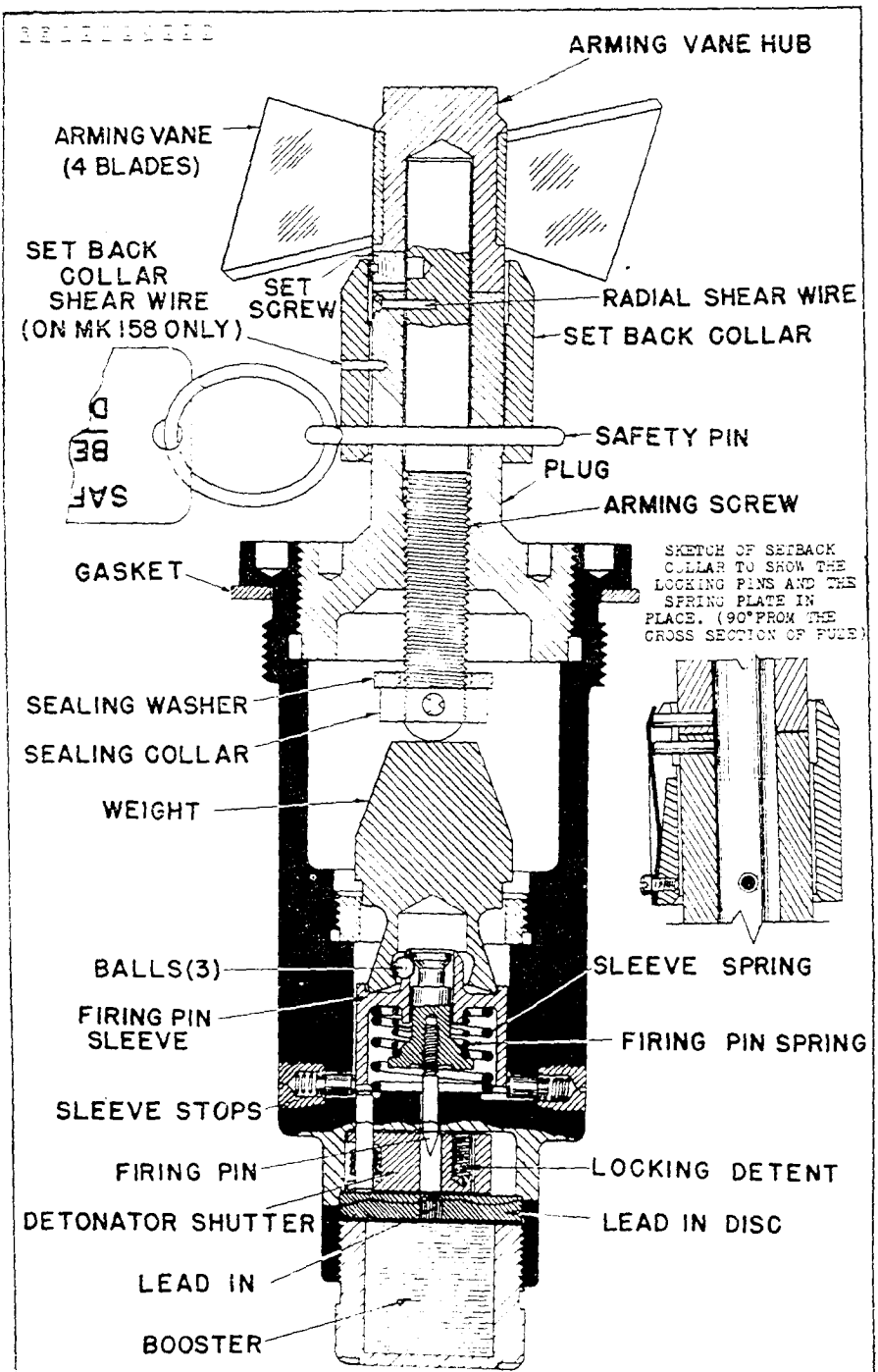
ROCKETS USED IN	7"2 Rocket Ammo (Shipboard) and 7"2 Projector Charge Ammo.
FUNCTIONING	Arms during water travel, instantaneous firing on impact.
IDENTIFICATION	The Mk 131 has red paint on nose of vane hub.
ARMED CONDITION	When vanes have risen 1/4" from neck of fuze.
FUZES USED WITH	None
ARMING TIME	4 to 5 vane revolutions, or 9 to 15 feet water travel.
VANE SPAN	3.195" (4 vanes)
MAX. BODY DIAMETER	3.25"
OVERALL LENGTH	7.2" (without booster.

GENERAL: These two fuzes are identical, except that the Mk 136 has a shear wire through the setback collar. Both fuzes were to be replaced by the Mk 140; however, this fuze is being recalled from the field. The Mk 131 is being replaced by the Mk 140 fuze and the Mk 136 is being replaced by the Mk 139-0.

OPERATION: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the setback collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the setback collar moves back (breaking the shear wire in the Mk 136) freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes causes a torque sufficient to shear the vertical shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring (cocked against a collar on the firing pin) rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded detents in the fuze body (just above the firing pin guide), the detents spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring after rising approximately 1/4". On contact with a submarine or other underwater obstruction, the three locking balls are forced inward, as inertia causes the weight to move forward on normal impact or laterally on oblique impact. As the weight moves clear, the locking balls are forced outward by the bevelled edge of the spring-loaded striker, which is then free to be driven into the detonator.

REMARKS: The detents in the fuze body which spring out under the sleeve, are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

DO NOT REMOVE THESE FUZES FROM A PROJECTILE WITH ANY TOOL OTHER THAN THE SPANNER WHICH IS ISSUED WITH THE FUZE. SEPARATION OF THE TWO PARTS OF THE FUZE BODY ARMS THE FUZE.



NOSE FUZE MK.156 MOD. 0 & MK.158 MOD.0

RESTRICTED

U. S. NAVY NOSE FUZES

MK 156
MK 158

Mk 156 Mod 0 used in Rocket Ammo (Shipboard)
Mk 158 Mod 0 used in Projector Charge Ammo

ROCKETS USED IN . . . . . Mk 156 Mod 0: 7"2 Rocket Ammo (Shipboard)
Mk 158 Mod 0: 7"2 Projector Charge Ammo.

FUNCTIONING . . . . . Arms during water travel; instantaneous firing on impact.

IDENTIFICATION . . . . .

ARMED CONDITION . . . . . When vanes have risen 1/4" from neck of fuze

FUZES USED WITH . . . . . None

ARMING TIME . . . . . 4 to 5 vane revolutions or 15 to 25 feet water travel.

VANE SPAN . . . . .

MAX. BODY DIAMETER . . . 2.85"

OVERALL LENGTH . . . . . 5.9" (without booster)

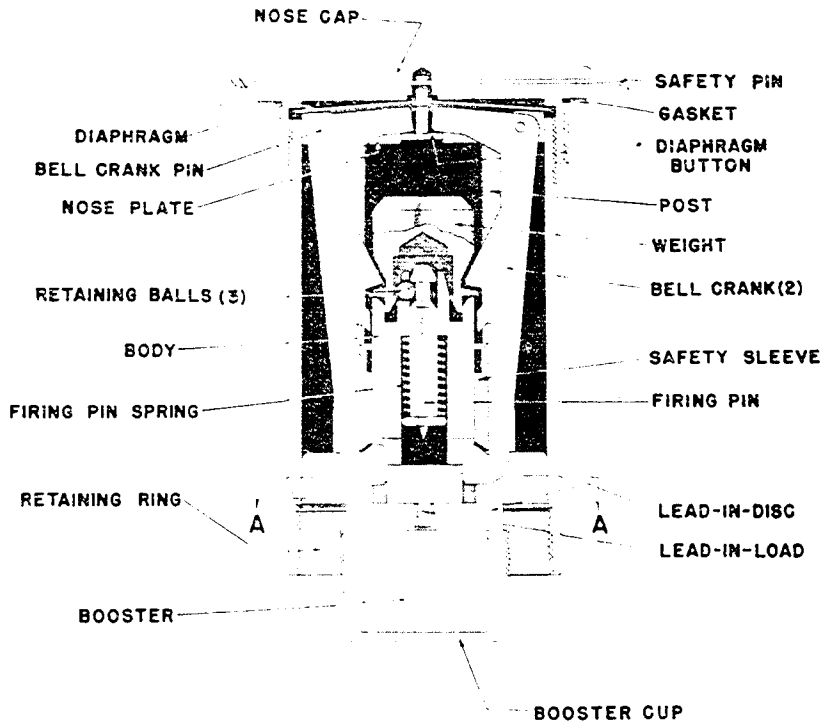
GENERAL: Both fuzes are identical except that the Mk 158 Mod 0 has a shear wire in the setback collar. These fuzes were designed to replace the Mk 151 and Mk 152 respectively.

OPERATION: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the setback collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the setback collar moves back (breaking the shear wire in the Mk 158), freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes causes a torque sufficient to shear the radial shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring (cocked against a collar on the firing pin) rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded sleeve stops in the fuze body just above the firing pin guide, they spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The detonator shutter is locked in position by a spring-loaded detent. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring. On contact with a submarine or other underwater obstruction, inertia causes the weight to move forward on normal impact or laterally on oblique impact, thereby allowing the three locking balls to jump out and release the spring-loaded firing pin.

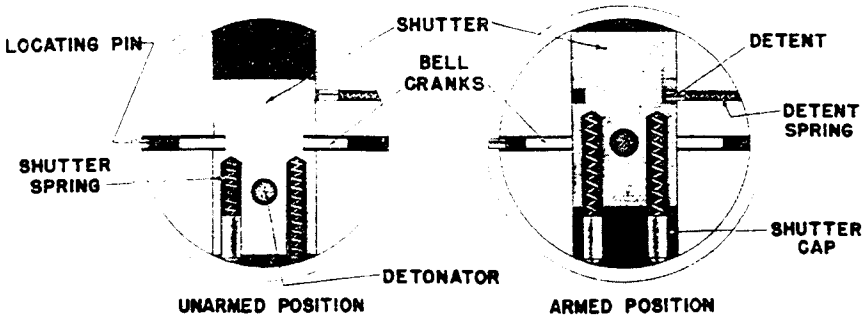
REMARKS: The sleeve stops in the fuze body which spring out under the sleeve are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

DO NOT REMOVE THESE FUZES FROM A PROJECTILE WITH ANY TOOL OTHER THAN THE SPANNER WHICH IS ISSUED WITH THE FUZE. SEPARATION OF THE TWO PARTS OF THE FUZE BODY ARMS THE FUZE.

MARK 135 H.I.R. NOSE FUZE



SECTION A-A



RESTRICTED

ROCKET USED IN	Mk 108: 7"2 Rocket Ammunition for Shipboard use.
FUNCTIONING	Instantaneous: impact.
ARMED CONDITION	No external indication
FUSES USED WITH	None
ARMING TIME	15-20 feet water travel (30 ft. static water pressure)
MAX. BODY DIAMETER . . .	3.25"
OVERALL LENGTH	5"

U.S. NAVY NOSE FUZE

MK 135

(ARMSCOPE)

Hydrostatic Arming, Impact Firing
Rocket Propelled

GENERAL: The fuze consists of a nose cap with two water ports which is screwed on the upper fuze housing. A phosphor-bronze diaphragm is housed in the lower end of the fuze. This diaphragm works against the diaphragm button and two bell cranks. The bell cranks are pivoted on pins fixed to the halves of the nose plate. In the unarmed position the cranks engage the shutter and also keep the body and weight locked together. In this position the firing pin is locked, with spring compressed, by three balls. A freely moving safety sleeve, on setback, engages recess in the bell cranks and prevents air pressure from arming the fuze. On deceleration in the water this safety sleeve engages the bell cranks to reduce the possibility of premature functioning.

A retaining ring screwed into the lower fuze housing secures the booster magazine and booster lead-in disc in the fuze. A gasket is located on the under surface of the shoulder of the nose cap to provide a water-tight seat in the rocket. A safety pin is inserted through the nose cap and diaphragm button nut, thereby locking the diaphragm in the unarmed position.

OPERATION: When the fuzed rocket, with safety pin removed, enters the water, pressure of the water which enters the water ports in the nose cap acts on the diaphragm. When the projectile has reached a depth of 15 to 20 feet, the diaphragm is "popped" or inverted. This diaphragm action moves the two bell cranks out of engagement with the shutter, which is forced by its spring into position under the striker. The shutter is locked in this position by a detent housed in the body. At the same time the bell cranks also move out of engagement with the body and the weight. The fuze is then fully armed.

If the fuze should arm prematurely, before the charge has slowed down sufficiently, the weight will be pulled off by its own inertia when the bell cranks move outward, allowing the firing pin to function before the shutter will have moved into place. The result will be a dud.

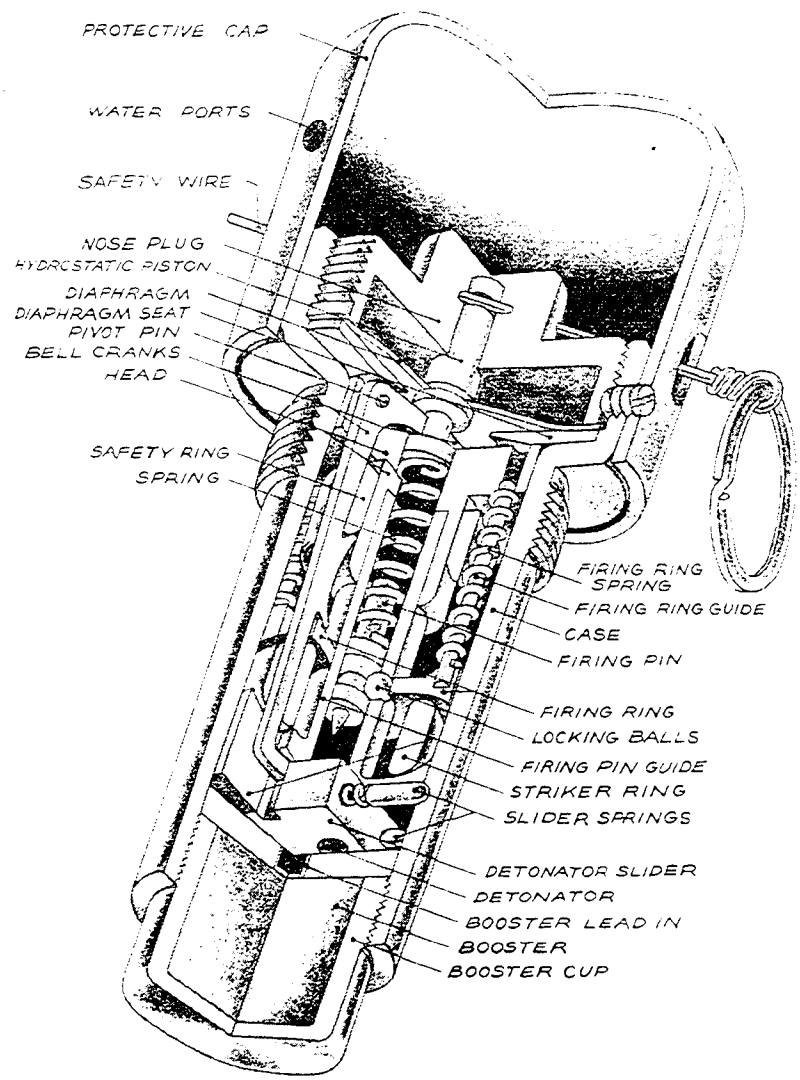
The fuze is designed to function upon impact with a solid object but not on impact with soft objects such as muddy or sandy bottoms. Upon solid impact the sudden deceleration pulls the weight forward, forcing the three balls inward. This frees the weight, allowing it to fall out of its engagement with the body. The three balls are then ejected by the force of the firing pin working against its compressed firing pin spring. The firing pin is now free to be forced by its spring against the detonator, thus actuating the fuze. A glancing blow causes the weight to pivot about a point on the edge where it is supported against the body and releases the three balls. The sensitivity to forward and sidewise impact is about equal.

REMARKS: 1. The fuze will function under water on angles of impact up to 75°.

2. Mods 1 and 2 of this fuze are similar to the Mark 135 in general design, except that the sensitivity has been about doubled, and the static pressure to arm has been increased to a head of approximately 40 feet. The fuzes, when fired from launchers, arm at a depth of 20 feet. The Mod 2 differs from the Mod 1 in that detents lock the bell cranks in the armed position and the safety pin arrangement in the nose has been slightly altered.

3. This fuze is now obsolete.

MK-140 H.I.R. ROCKET FUZE (NOSE)



RESTRICTED

U. S. NAVY NOSE FUZE

MK. 140

Hydrostatic arming, Impact firing
Rocket Propelled

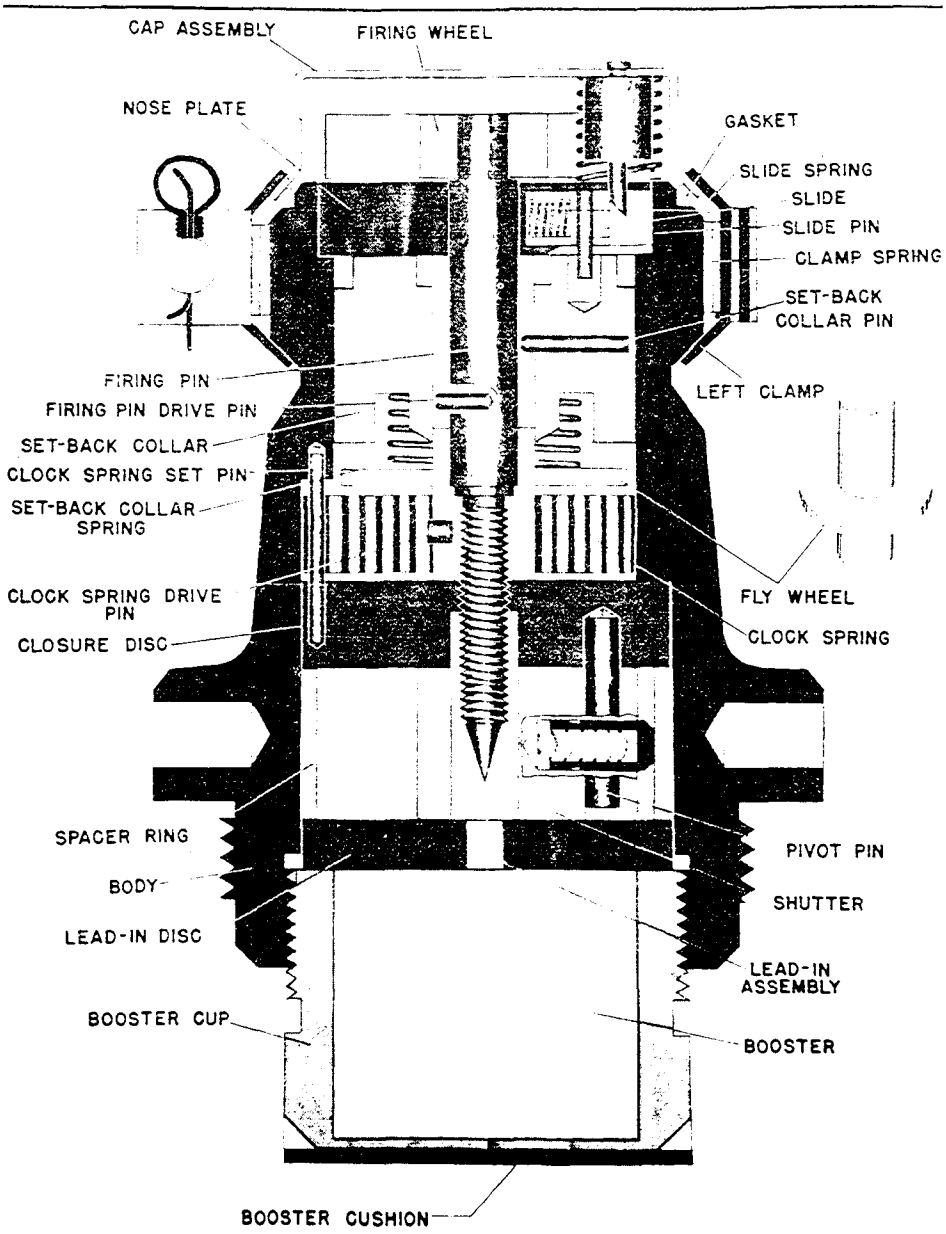
ROCKETS USED IN	7½ Rocket Ammunition Shipboard (Mousetrap) and 7½ Projector Charge Ammunition (Hedgehog)
FUNCTIONING	By inertia upon impact with solid object after armed by hydrostatic pressure.
ARMED CONDITION	No external indication
FUZES USED WITH	None
ARMING TIME	Arms under static pressure of approximately 30 feet of water. At the high velocity with which the rocket strikes the water dynamic pressure is built up on the head and it arms at depths from 8 to 15 feet.
MAX. BODY DIAMETER . . .	2.7 in.
OVERALL LENGTH	4.5 in.

GENERAL: This fuze was developed and issued to replace the Mk 131 and 136 in the 7½ Rocket Ammunition Shipboard (Mousetrap) and 7½ Projector Charge Ammunition (Hedgehog). It arms by hydrostatic pressure and has safety features which prevent it from firing either on setback or impact with the water. Its sidewise sensitivity is 1/8 to 1/4 of the nose sensitivity, and a glancing blow permits the fuze to function. Orders have been issued that fuze is not to be used and it will be recalled. The fuze can be used by Army in 7½ heads without the motor, when dropped as bombs.

OPERATION: When rocket is fired, the arming wire is pulled. On setback, the safety ring is forced down over the upper hooks on the two bell cranks, preventing them from spreading out and releasing the detonator slider. On impact with the water, the firing ring slips down a slight amount and engages the lower hooks on the bell cranks, thus preventing the bell cranks from spreading to release the detonator slider on water impact; the hooks on the crank also prevent the firing ring from dropping free of the locking balls. As the rocket travels through the water, water enters the ports in the protective cap and through the holes in the nose plug which formerly received the arming wire. After reaching a depth of from 8 to 15 feet, the pressure of the water will non the phosphor-bronze diaphragm, which presses down on the inner ends of the bell cranks. Since the bell cranks are pivoted about pivot pins, they swing clear of the detonator slider, which is forced over to the armed position by two springs, and locked there by a spring-loaded detent. On impact with a submarine or other hard surface, the firing ring is forced by inertia against its two firing ring springs, which are coiled around two guide pins. This action of the firing ring frees the locking balls which are forced outward by the spring loaded striker which is then driven into the detonator.

A glancing blow causes the loosely fitting striker ring to move sideways, camming the firing ring forward, releasing the locking balls and firing the fuze.

MARK 139 S.I.R. NOSE FUZE



U.S. NAVY NOSE FUZE

MK 139

(OBSOLETE)

Spring Arming, Impact Firing
Rocket Propelled

ROCKETS USED IN . . . . . 7"2 Retro-rockets

FUNCTIONING . . . . . Instantaneous; Impact.

ARMED CONDITION . . . . Cap assembly and clamps missing; firing pin and firing wheel raised.

FUZES USED WITH . . . . None

ARMING TIME . . . . About 3/4 sec. after launching.

MAX. BODY DIAMETER . . . 3.0"

OVERALL LENGTH . . . . 4.85"

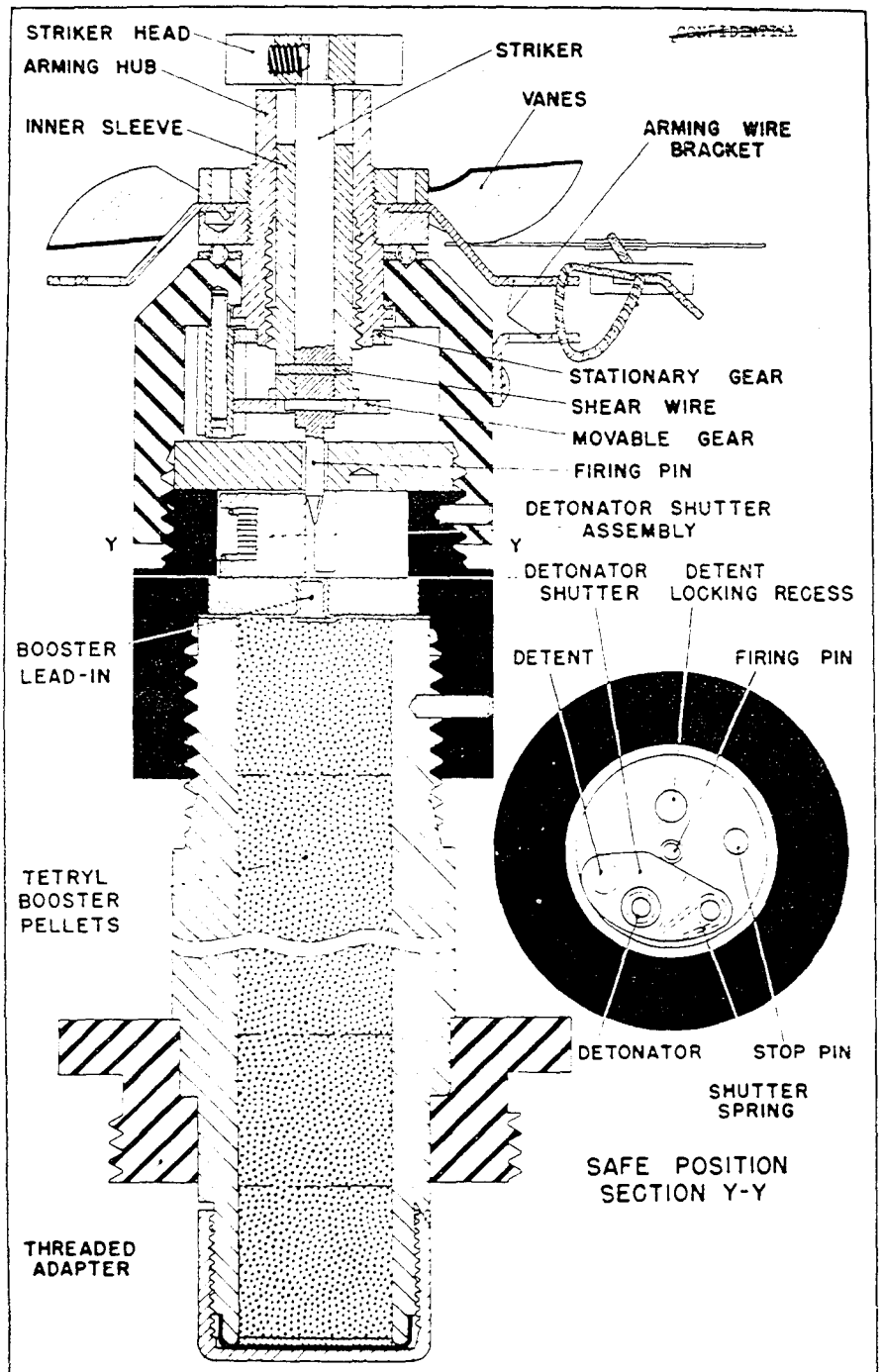
GENERAL: This fuze is designed for anti-submarine warfare and is used in rockets projected both from airplanes and small patrol craft. The fuze functions on impact with a hard object but not on water impact.

The fuze body encloses the functioning mechanism. A waterproof cap is affixed to the nose of the fuze and is held in position by two bands locked by a safety pin. Beneath the cap, a firing wheel is attached by a set-screw to the end of a firing pin. This wheel is formed like a cross to present less surface and prevent firing on water impact. The slide stop pin, riveted to the cap, engages a leg of the firing wheel. This pin also extends down into the nose plate, where it prevents a slide from moving outward. A flywheel and setback collar, separated by a spring and secured by the flywheel screw, form a sub-assembly. This assembly is placed on the shaft of the firing pin. A pin set in the slide engages the setback collar in order to prevent its rotation. A clock spring, secured on one end to the flywheel and on the other end to a pin on the closure disc, is assembled under tension so as to impart its force to the flywheel. The pin to which the clock spring is attached is anchored to the fuze body to prevent rotation of the closure disc. The firing pin is screwed into shear threads in the closure disc. A detonator shutter is affixed on a pin set in the lower surface of the closure disc. The firing pin extends into a cavity in the shutter. A tightly fitted spacer ring set in the body maintains a spring detent housed in the detonator shutter. This ring, interposed between the closing disc and lead-in disc, provides free movement of the shutter. The lead-in charge is contained in the lead-in disc, and the booster charge in a booster magazine which screws into the fuze body.

OPERATION: When the arming wire is withdrawn as the rocket is launched, the clamps are unlocked and forced off by the clamp spring. The waterproof cap flies off by the action of its compressed springs. Setback causes the setback collar to move back against its spring. This movement releases the slide pin in the nose cap, permitting the flywheel assembly to be rotated by the force of the clock spring. This rotation is transmitted to the firing pin, causing it to screw outward, thereby withdrawing the firing pin from engagement with the detonator shutter, which is forced by its spring into alignment with the firing pin. Once the shutter moves into the armed position it is locked by a spring-loaded detent.

On impact of the firing wheel with a solid object, the firing pin is driven backward and shears the shear threads of the closure disc. It then pierces the detonator, setting off the explosive train.

REMARKS: This fuze is now obsolete.



NOSE FUZE MK. 141 MOD 0

~~CONFIDENTIAL~~

ROCKETS USED IN	7"2 Demolition Rocket (Mark 5 head)
FUNCTIONING	Instantaneous Impact
ARMED CONDITION	When striker head has risen more than 1/8" above the arming hub.
FUZES USED WITH	None
ARMING TIME	90 - 130 vane revolutions.
MAX. BODY DIAMETER . . .	1.75"
OVERALL LENGTH	8.5"

U. S. NAVY NOSE FUZE

MK.141

Air Arming, Impact

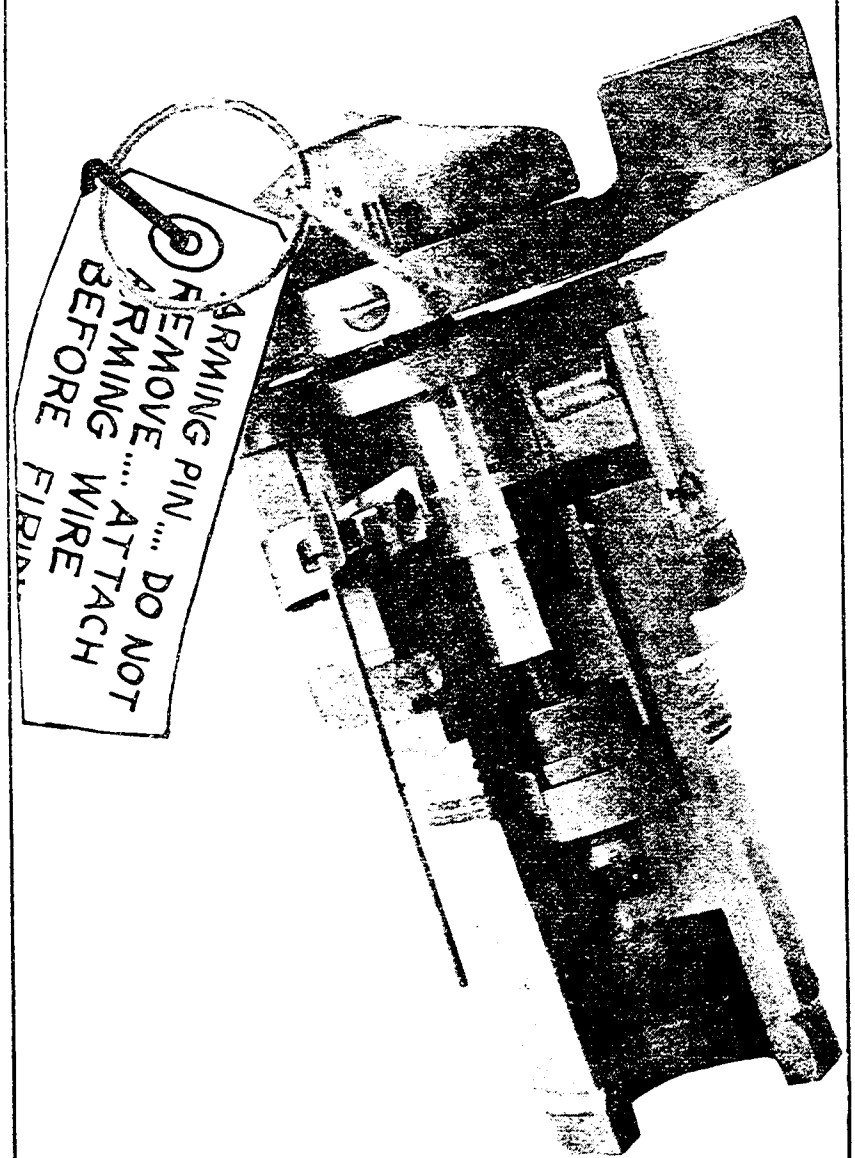
GENERAL: The Mk 141 Mod 0 is issued to amphibious groups for use in destroying beach obstacles. The fuze is water discriminating and so designed that it will not fire on impact with water but will be actuated by impact with the earth or soft sand, provided the water travel before impact is not more than twenty feet. The water discriminating feature is obtained by use of a copper shear wire. The Mk 141 Mod 0 will replace the Mk 150 in the 7"2 Demolition Rocket (Mk 5 head).

DESCRIPTION: The fuze was developed from the Bomb Nose Fuze AN-M 11CA1 and retains the upper body and gear reduction system used in that fuze. To obtain detonator safety, a pivoted detonator shutter has been added below the firing pin. The shutter is held in the safe position by the firing pin and when fuze is armed, the shutter is locked in position by a spring loaded detent. The safety block of the bomb fuze has been replaced by the arming hub, an integral extension of the stationary gear which locates the cross shaped striker head in the safe position. The movable gear in the Mk 141 Mod 0 acts to thread the striker assembly forward and out of the fuze body, thus withdrawing the firing pin from the detonator shutter slideway (releasing the shutter to move into the armed position), and moving the striker head away from the arming hub. The striker and firing pin are mounted, by a copper shear wire, in the inner sleeve which forms the threaded hub of the movable gear. The arming wire bracket of the bomb fuze has been retained and, in shipment, a safety wire ties the vanes to this bracket. To insure proper air flow past the fuze vanes, an elongated booster chamber has been added to the fuze. This cavity, loaded with tetryl increments, extends the tip of the fuze 6 inches beyond the rocket head. At the lower end of the booster chamber a threaded adapter has been fixed to adapt the 1½ inch diameter fuze to the 2 inch diameter fuze pocket. Two Mk 1 Mod 0 auxiliary boosters are required in the fuze pocket.

OPERATION: When rocket is fired, the arming wire is pulled, and the vanes are free to rotate. The rotation of the vanes acts through the reduction gears to thread the inner sleeve up in the arming hub and thereby withdraw the firing pin from the detonator shutter. The shutter is forced across the shutter cavity by its spring and is locked in the armed position by the spring loaded detent. On impact the striker is driven down, shearing the copper shear wire, and fires the detonator - booster lead-in - booster.

Restricted

NOSE FUZE MK 152



U.S. NAVY NOSE FUZE

MK 152

Air Armint, Impact Firing, Rocket Propelled

ROCKETS USED IN	7.2 Demolition Rocket, (Mk 5 head)
FUNCTIONING	Mk 152: Instantaneous, impact.
ARMED CONDITION	When striker flange has risen more than 5/16" from outer sleeve, and arming wire is gone.
FUZES USED WITH	None
ARMING TIME	120 vane revolutions
VANE SPAN	4.75" (4 vanes)
MAX. BODY DIAMETER	2.75"
OVERALL LENGTH	5.5" (w/booster).

GENERAL: This fuze is identical with the AN-Mk 219 bomb fuze (p.159), except that it has been partially armed fifty turns of the arming vanes and a metal fork inserted between the vane carrier and the fuze body to take up the space left by the prearming process. This fork must be removed before launching the fuzed rocket. In addition, the pitch of the vanes has been increased to 40 degrees instead of the 18 degrees on the AN-Mk 219.

The fuze is stamped "Mk 152", and the fuze packing case is marked "FOR USE IN 7.2 IN. ROCKETS ONLY". Great care must be taken not to confuse the two fuzes because of their similarity. The AN-Mk 219 must not be used in place of the Mk 152, and vice versa.

When installing the Mk 152 in demolition rockets, a regular adapter ring for the AN-Mk 219 fuze (same as that used when installing the AN-Mk 219 in the nose of the depth bomb) must be used. The fuze cavity in the rocket body is deep enough to necessitate the addition of the following with the Mk 152:- one Mk 2 Auxiliary booster (2 inches long); one Mk I Auxiliary booster (3 inches long); and one cardboard spacer (improvised) approximately 1/2 inch thick placed below the auxiliary boosters. Tests have indicated that a high order detonation can still be expected if an additional cardboard spacer is used in place of the auxiliary booster Mk 2; however, use of the booster is preferred.

When placed in the launcher, an arming wire, one end of which is attached to the launcher, replaces the safety pin. This assembly prevents fuzes of other rockets in the launcher from arming as a result of the blast from rockets already launched. Both safety pin and arming fork must be replaced if the rocket is not fired.

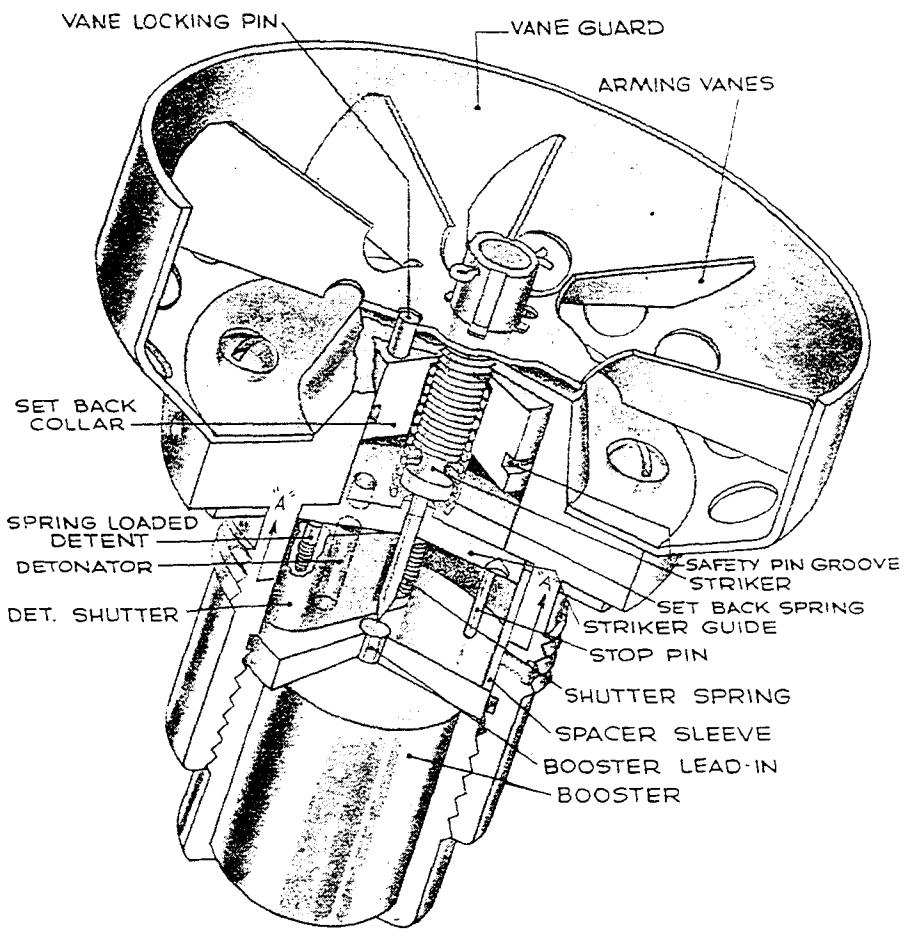
OPERATION: There are two stages of arming. During the first stage, the upper gear is free to rotate and the lower gear, being attached to the hammer carrier which in turn is locked by the inner sleeve, is held stationary. During the second stage, the hammer carrier has risen to clear the inner sleeve and the lower gear is free to rotate while the upper gear is held stationary as it is attached to the arming shaft which was threaded up until it locked against the shaft extension nut.

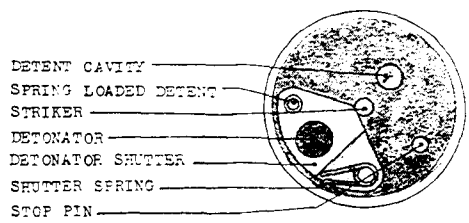
First stage: As the rocket is launched, the arming wire is withdrawn and the vanes are free to rotate. Thru the system of reduction gears, the upper gear rotates to thread the arming shaft up until the head of the screw on the shaft locks against the shaft extension nut. A collar on the shaft lifts the hammer carrier and the entire arming assembly. Simultaneously with the locking of the arming shaft and the upper gear, the hammer carrier clears the inner sleeve to free the lower gear.

Second stage: The lower gear and hammer carrier are rotated in a counter-clockwise direction. The aligning lug on the hammer carrier engages the firing pin carrier, lining up the firing pin extension with the firing pin. Further rotation causes the firing pin carrier to engage the detonator carrier, lining the firing pin up with the detonator. The hammer carrier, firing pin carrier, and detonator carrier continue to rotate through 180 degrees, until the lip on the detonator carrier engages the inner sleeve. Simultaneously, the spring-loaded detent in the striker snaps into a recess in the hammer carrier, thus locking the firing train components in an armed position. Since the upper and lower gears are now both locked, the two copper pins securing the lower gear to the hammer carrier are sheared and the vanes rotate freely. (If the air speed is less than 300 m.p.h., the air pressure will not be sufficient to shear the pins, and the vanes will merely cease rotating.)

The fuze is now fully armed. On impact, the entire upper assembly of the fuze is forced inward. The shear wire in the arming shaft is cut as the upper part of the shaft telescopes into the lower part and the shear wire thru the firing pin is cut as the firing pin extension forces the firing pin into the detonator. The detonator sets off the auxiliary booster lead-in, booster lead-in, booster, and main charge successively.

MK. 137 A.I.R. NOSE FUZE





SECTION "A-A"

RESTRICTED

U. S. NAVY NOSE FUZES

MK. 137 MK. 145 MK. 137-1 MK. 145-1

Air Arming, Impact Firing, Rocket Propelled

ROCKETS USED IN . . . . . Mk 137 Mods 0, 1, and 2: 4.5 High Explosive Barrage Rocket (Mk 3 head and Mk 5 head); 7.2" Demolition Rocket (Mk 9 head); 7.2" Chemical Rocket (Mk 7 head). Mk 145: 4.5" H.E. Barrage Rocket (Mk 3 head)

FUNCTIONING . . . . . Mk 137 - Instant. Impact Mk 145 - .02 sec. delay

ARMED CONDITION . . . . . When base of vane boss is 1/2" off top of fuze body.

FUZES USED WITH . . . . . None

ARMING TIME . . . . . 10 vane revolutions (approx. 100' air travel).

VANE GUARD DIAMETER . . . 2-3/4"

OVERALL LENGTH . . . . . 2-1/2" (including vane guard, without booster).

GENERAL: Fires upon water impact for velocities of 300 ft/sec and more. Fires at impact angles as small at 15° to 20°. Probably will not arm if the burning time is shorter than 0.2 sec. or the velocity is less than 300 ft/sec.

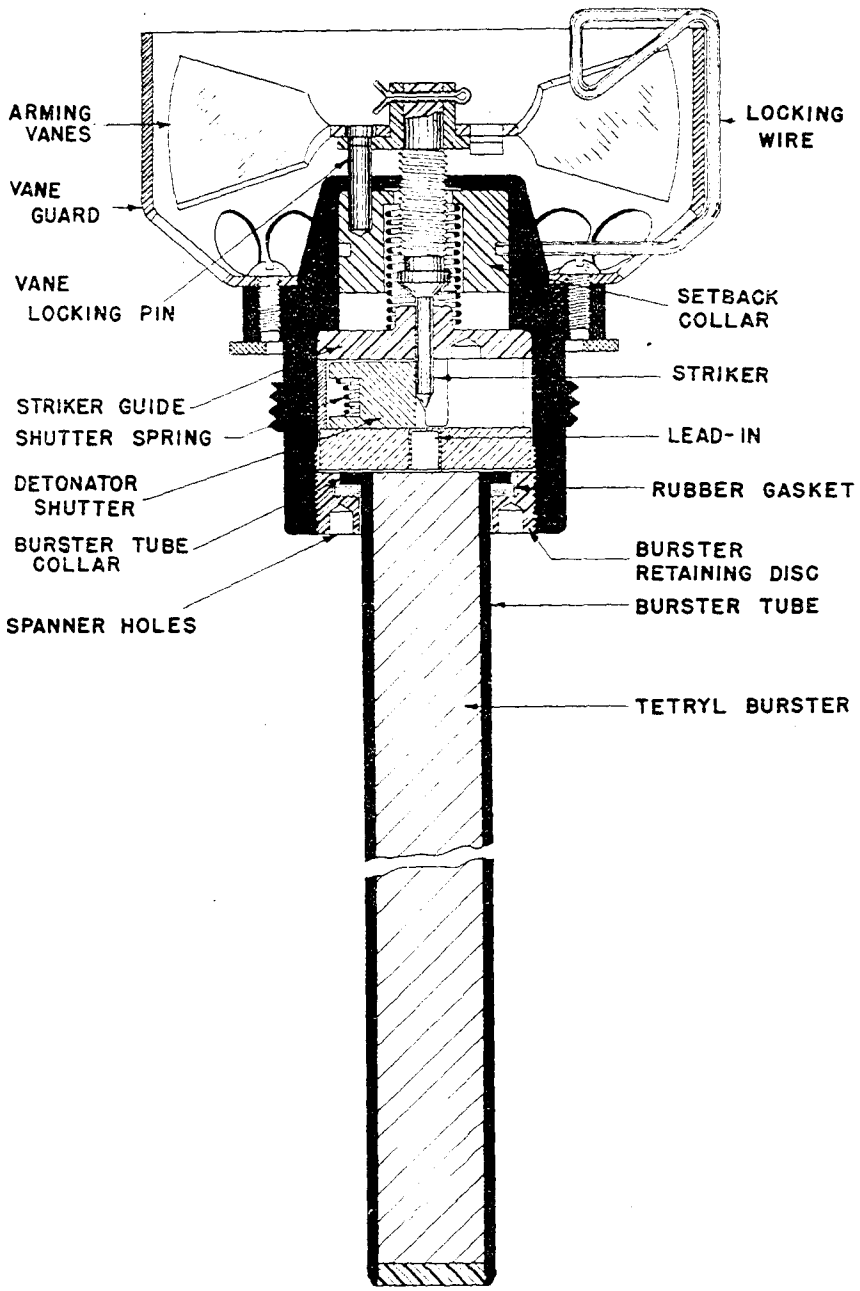
OPERATION: When the rocket is loaded on the launcher, the safety pin securing the setback collar is withdrawn. On firing the rocket, the setback collar is forced back by inertia, compressing the setback spring and withdrawing the vane locking pin from the hole in the vane boss. The vanes rotate freely, and after 3 to 4 rotations have unthreaded the striker spindle sufficiently that when deceleration occurs the vane locking pin cannot again engage the vane boss. After approximately 10 vane rotations, the striker spindle is unthreaded sufficiently to free the detonator shutter, which is forced across the shutter cavity by its spring. It is stopped by the stop pin and is locked in the armed position by a spring loaded detent housed in the shutter which slips into a recess in the striker guide. When the striker has reached the end of its threads it rotates freely with the vanes as the striker spindle collar rides in a groove in the underside of the fuze body. On impact, the threads on the fuze body are sheared as the striker is forced into the detonator.

Mk 137 Mod 1: The Mk 137 Mod 1 is similar to the 137 but has 10 blades on the arming vanes as compared to 8 and also has a split spacer sleeve.

Mk 137 Mod 2: The Mk 137 Mod 2 is similar to the Mk 154-3. A modified vane lock pin seat prevents premature arming.

Mk 145: The Mk 145 is similar to the Mk 137 but incorporates a .02 sec. delay in the detonator.

Mk 145 Mod 1: A modified vane lock pin seat prevents prevents premature arming.



NOSE FUZE MK. 154 MOD. 3

FOR USE IN 4.5 CHEMICAL ROCKET

U.S. NAVY NOSE FUZE

MK 154-3

Air Arming, Impact Firing, Rocket Propelled

ROCKETS USED IN . . . . . Mk 154-3: 4.5 Rocket (WP) Smoke Filled (Mk 7 head)

FUNCTIONING . . . . . Instantaneous; Impact

ARMED CONDITION . . . . . When base of vane boss is 1/2" off top of fuze body.

FUZES USED WITH . . . . . None

ARMING TIME . . . . . 100 vane revolutions (approx. 100' air travel)

VANE GUARD DIAMETER . . . 2-3/4"

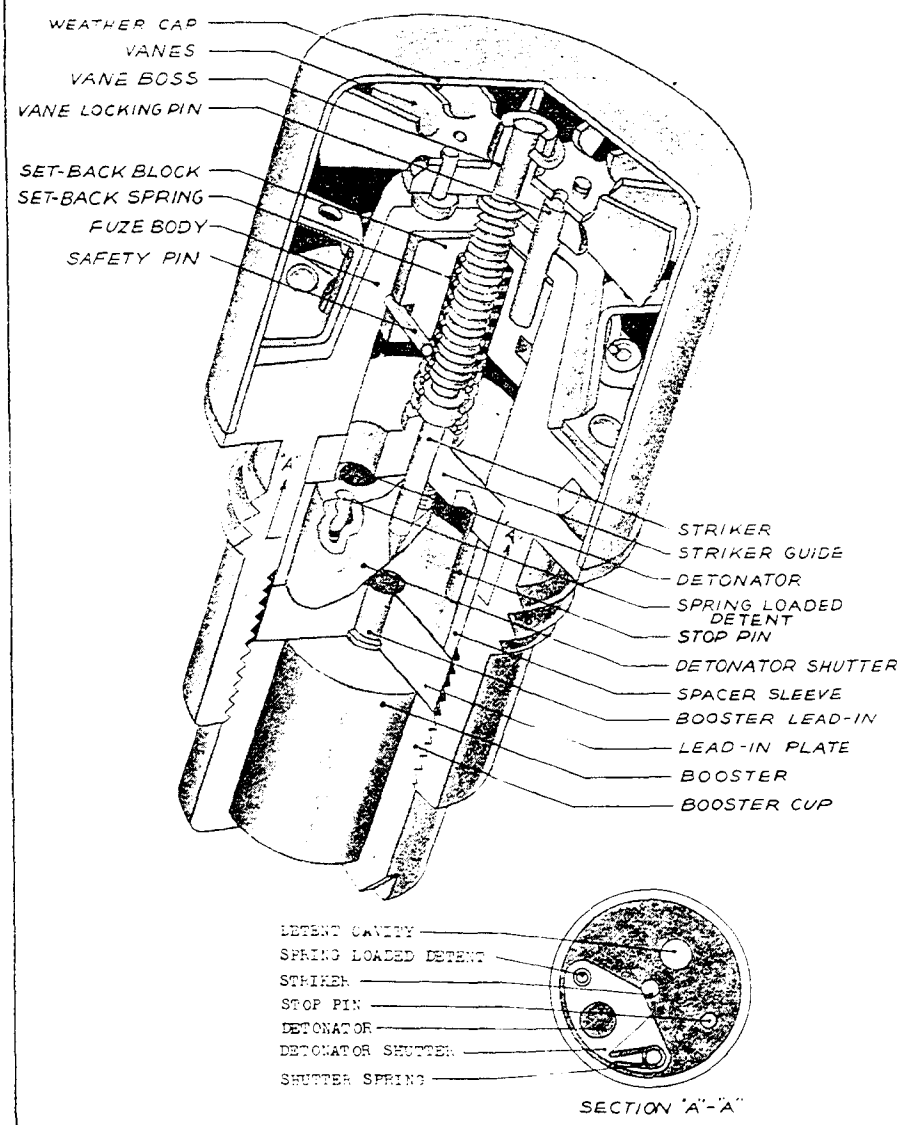
OVERALL LENGTH . . . . . 2-1/2" (including vane guard, without burster) 16.56" (with burster tube).

GENERAL: This fuze consists of a MK 137 Mod 2 fuze plus a 14.06" long tetryl burster tube. A steel collar is brazed to the upper end of the tube. A rubber gasket is inserted between the burster tube collar and the burster retaining disc. Between the wall of the burster tube and the inside wall of the burster retaining disc is left a clearance of approximately 0.03". This clearance in addition to the rubber gasket allows the burster tube a certain degree of flexibility which is desirable when installing the complete fuze assembly in the fuze adapter of the rocket body.

OPERATION: When the rocket is loaded on the launcher, the safety pin securing the setback collar is withdrawn. On firing the rocket, the setback collar is forced back by inertia, compressing the setback spring and withdrawing the vane locking pin from the hole in the vane boss. The vanes rotate freely, and after 3 to 4 rotations have unthreaded the striker spindle sufficiently that when deceleration occurs the vane locking pin can not again engage the vane boss. After approximately 10 vane rotations, the striker spindle is unthreaded sufficiently to free the detonator shutter, which is forced across the shutter cavity by its spring. It is stopped by the stop pin and is locked in the armed position by a spring loaded detent housed in the shutter and engaging in a recess in the striker guide. When the striker has reached the end of its threads it rotates freely with the vanes as the striker spindle collar rides in a groove in the underside of the fuze body. On impact, the threads on the fuze body are sheared as the striker is forced into the detonator.

REMARKS: No disassembly of this fuze is authorized.

MARK 148
A. I. R. NOSE FUZE



RESTRICTED

U. S. NAVY NOSE FUZES

MK. 147 (MOD. 1)

MK. 148

Air Arming, Impact Firing, Rocket Propelled

Mk 148

ROCKETS USED IN	315 Rockets (Mks 3, 5, 6 and 9 heads) 5?0 Rockets (Mks 1, 5 and 6 heads).
FUNCTIONING	Instantaneous Impact
ARMED CONDITION . . .	When base of vane boss is 1/2" from top of fuze body. Vanes do not come off.
FUZES USED WITH	Alone, or with Mk 1?8
ARMING TIME	9 vane revolutions
VANE SPAN	1¾"
MAX. BODY DIAMETER . .	1-3/4"
OVERALL LENGTH	9-1/4" (without booster)

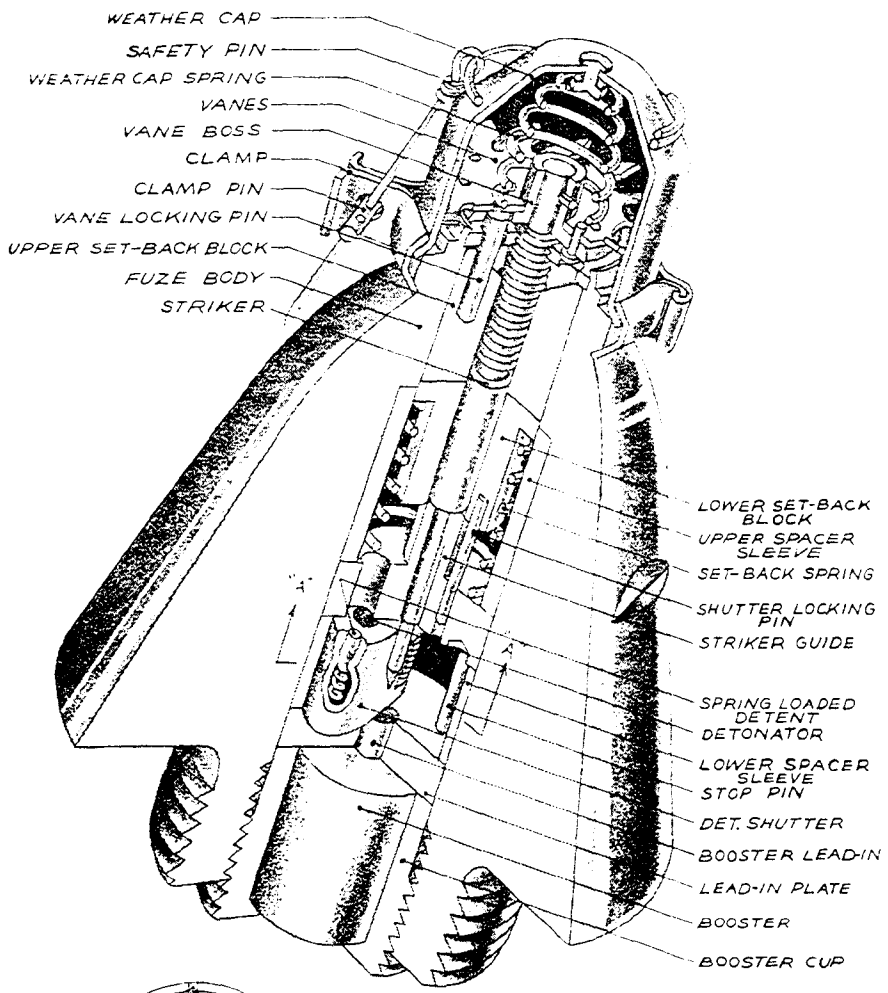
GENERAL: The Mk 148 is similar to the Mk 137 nose fuze, but has smaller vanes and instead of a vane guard, is shipped with a protective cap which is removed when loaded on plane. Fires at impact angles as low as 5° and 10° for water or land targets allowing slight penetration. On hard targets, fires at impact angles not less than 20° to 25°.

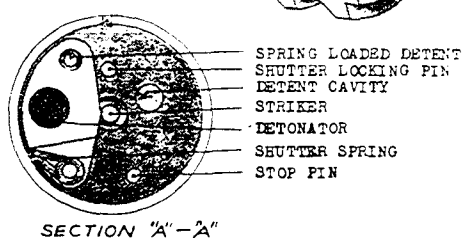
OPERATION: The weather cap is removed when the rocket is loaded on the launcher. After the rocket is loaded on the launcher, the safety wire is withdrawn and the arming wire is installed thru the arming wire guide. Two Fahnestock clips secure the arming wire. When the propellant is ignited, the forward motion of the rocket pulls the arming wire free and the force of inertia causes the setback block to set back against the setback spring. Since the vane locking pin is positively attached to the setback block, it is thus withdrawn to a position flush with or below the top of the fuze body. This frees the vanes to rotate, unscrewing the striker as they rotate. The vanes must make from 3 to 4 rotations during acceleration to unscrew the striker sufficiently to prevent re-engagement of the vane locking pin as the setback spring gradually forces the setback block and locking pin up. After 8 or 9 rotations of the vanes, the striker will have unthreaded sufficiently to free the spring-loaded detonator shutter. The latter is then rotated by the shutter spring into the armed position where it is stopped by the stop pin, lining the detonator up with the striker and booster lead-in. As the shutter reaches the armed position, a spring-loaded detent carried in the shutter is forced into a recess in the striker guide, locking the shutter in the armed position. After an additional rotation or two, the end of the threads on the striker spindle are reached, and the vanes rotate freely as the collar at the end of the threads ride in a groove in the fuze body. On impact, the striker is forced in, shearing the threads in the nose of the fuze body, and is driven into the lead azide detonator.

Mk 147: This fuze is used in the 7?2 CWR Model 15, and is similar to the Mk 148, except that it does not have an arming wire guide such as the Mk 148, and has no booster. Instead of the booster, there is an adapter which receives a burster tube to break open the rocket and eject the chemical filler. The fuze has a vane guard which consists of a cylindrical tube open at the top, with perforations around the tube just above the top of the fuze body.

Mk 147 Mod 1: This fuze is a later modification of the Mk 147, and is identical to it with the exception of the vane guard which has been replaced on the Mod 1 by a protective cap.

MARK 149
A.I.R. NOSE FUZE





SECTION "A"–"A"

RESTRICTED

	Mk 149
BOMBS USED IN	3"/5 AR, heads, Mk 3, 5, 6 and 9. 5"/0 AR, head, Marks 1,5,6 and 6 Mod.1
FUNCTIONING	Instantaneous impact.
ARMED CONDITION	When base of vane boss is 1/2" off fuze body.
FUZES USED WITH	Alone, or with Mk 146,157, 159,159-1,164,165.
ARMING TIME	8 vane revolutions
VANE SPAN	1-1/8" (12 vanes)

U. S. NAVY NOSE FUZE

MK. 149
MK. 155

Air arming, Impact firing, Rocket propelled.

MAX. BODY DIAMETER . . 3"

OVERALL LENGTH . . . . 3½" (without booster)

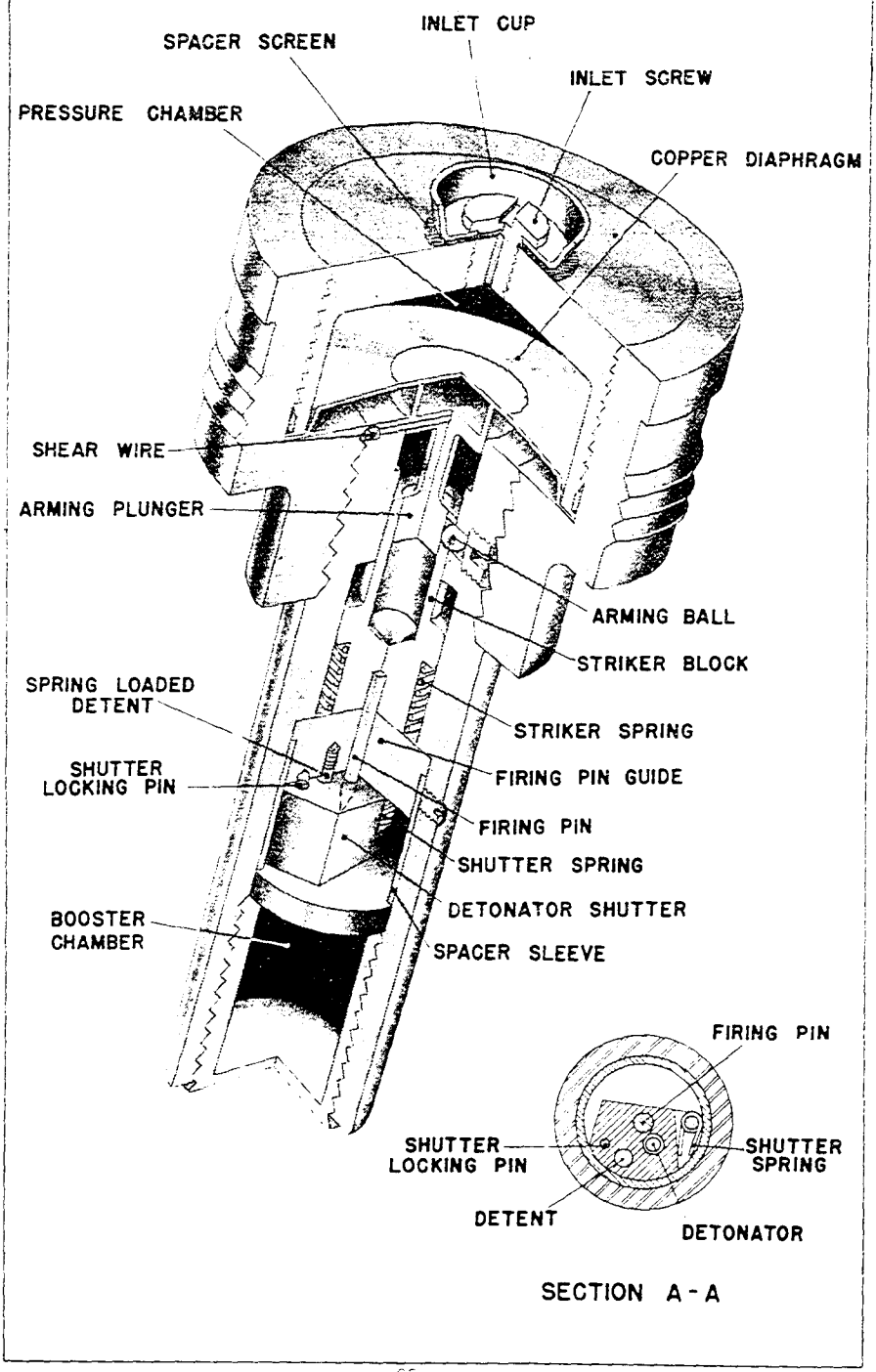
GENERAL: The body of this fuze is a converted nose plug from a 5" projectile. The working parts of the fuze are very similar to those of the Mk 148 A.I.R. fuze, which it is replacing. The essential changes are the addition of a second setback block, shutter locking pin, a nose cap and clamp, and smaller but less sharply pitched vanes. The fuze body itself is more streamlined. The addition of the spring loaded weather cap over the vanes protects the vanes from icing up during flight of the aircraft at high altitudes. This cap does not spring off until the arming wire is pulled from the clamp when the rocket is fired.

OPERATION: When the rocket is fired, the arming wire is pulled free from the clamp pin and the compressed weather cap spring forces the weather cap up, spreading the clamp until the weather cap is free. The force of inertia causes the two setback blocks to fall back against the pressure of the setback spring. This accomplishes two things: First, the vane locking pin is freed from the vane boss and the vanes are free to rotate and screw the striker upward. Second, the lower setback block forces the shutter locking pin down into the shutter cavity, preventing the shutter from moving over and lining up under the striker as long as the rocket is accelerating (i.e. as long as the rocket motor is burning). After 8 vane revolutions, the point of the striker will have risen clear of the shutter; and upon reaching the end of the threads, the spindle will rotate freely as the striker collar rides in the groove in the fuze body. After the rocket propellant has ceased burning, deceleration occurs and both setback blocks are forced up by the setback spring. The shutter locking pin is thus lifted from the shutter cavity and the shutter moves across the fuze under influence of its spring until stopped by the stop pin. A spring-loaded detent in the detonator shutter springs up into a recess in the striker guide, locking the shutter in the armed position. On impact, the striker shears the body threads and is driven into the detonator, setting off the booster lead-in and booster in succession.

MK 155: The Mk 155 is used in the Mks 6 and 9 stoke filled 3"/5 rocket heads. The fuze is similar to the Mk 149 with a burster tube instead of a booster charge.

RESTRICTED

MK. 146 P.I.R. BASE FUZE



SECTION A-A

RESTRICTED

U. S. NAVY BASE FUZE

MK. 146
MK. 146-1

Pressure arming, Impact firing
Rocket Propelled

ROCKETS USED IN	5"5 Rocket (Mk 4 head) 5"0 Rocket (Mk 1 head) 7"2 DR (Mk 10 head)
FUNCTIONING	Mk 146: Instant. Impact (with slight inherent delay). Sometimes has .02 second delay in detonator.
ARMED CONDITION	No external indication
FUZED USED WITH	Alone or with Mk 148 or Mk 149.
ARMING TIME	From ignition of propellant to .1 sec. after acceleration ceases.
MAX. BODY DIAMETER	2-15/16"
OVERALL LENGTH	8-1/2"

GENERAL: The fuze head screws into an adapter fixed in the base of the rocket body and the gasket and luting on the threads make a gas tight seal. The top of the fuze is exposed to the front end of the rocket motor. The Mk 146-1 differs in that it has a more sensitive firing train. These fuzes are being replaced in the 5"0 Rocket by the Mk 157-0 fuze. The Mk 146-1 is being replaced in the 7"2 Demolition Rocket Mk 10-1 head by the Mk 161-0.

The fuze is shipped assembled in the base of the rocket head and is not to be removed.

OPERATION: When the rocket is fired, gas under considerable pressure from the rocket motor passes through the inlet screen underneath the inlet screw and enters the pressure chamber. As the gas pressure builds up, the diaphragm bears against the arming plunger, breaking the shear wire and forcing the arming plunger inward. The locking ball, which is preventing the rearward movement of the striker block, is forced over by the pressure of the spring-loaded striker block into the narrow portion of the arming plunger. The striker spring forces the striker block rearward, retracting the firing pin from the detonator shutter. The shutter is still prevented from moving across the fuze by action of its spring until after deceleration begins, since the force of setback thrusts the shutter back and causes the shutter locking pin to engage in a recess in the firing pin guide. After burning of the propellant ceases and deceleration begins, the shutter rides forward, disengaging the locking pin from the guide. The shutter spring forces the shutter across the shutter cavity, where it is locked in the armed position by a detent which is housed in the firing pin guide and which engages a recess in the shutter. On impact, inertia drives the striker block forward against its spring, the firing pin striking the detonator.

REMARKS: (1) A delay of .02 sec. can be incorporated in the detonator to achieve greater penetration when used in high velocity aircraft rockets. (See Mk 157, page 101).

(2) The later models of this fuze have undergone the following modifications:

a. The inlet shield has been modified. The two outside "legs" are slightly longer than the flat base of the shield so that the inlet screen will not be crushed when the inlet screw is tightened.

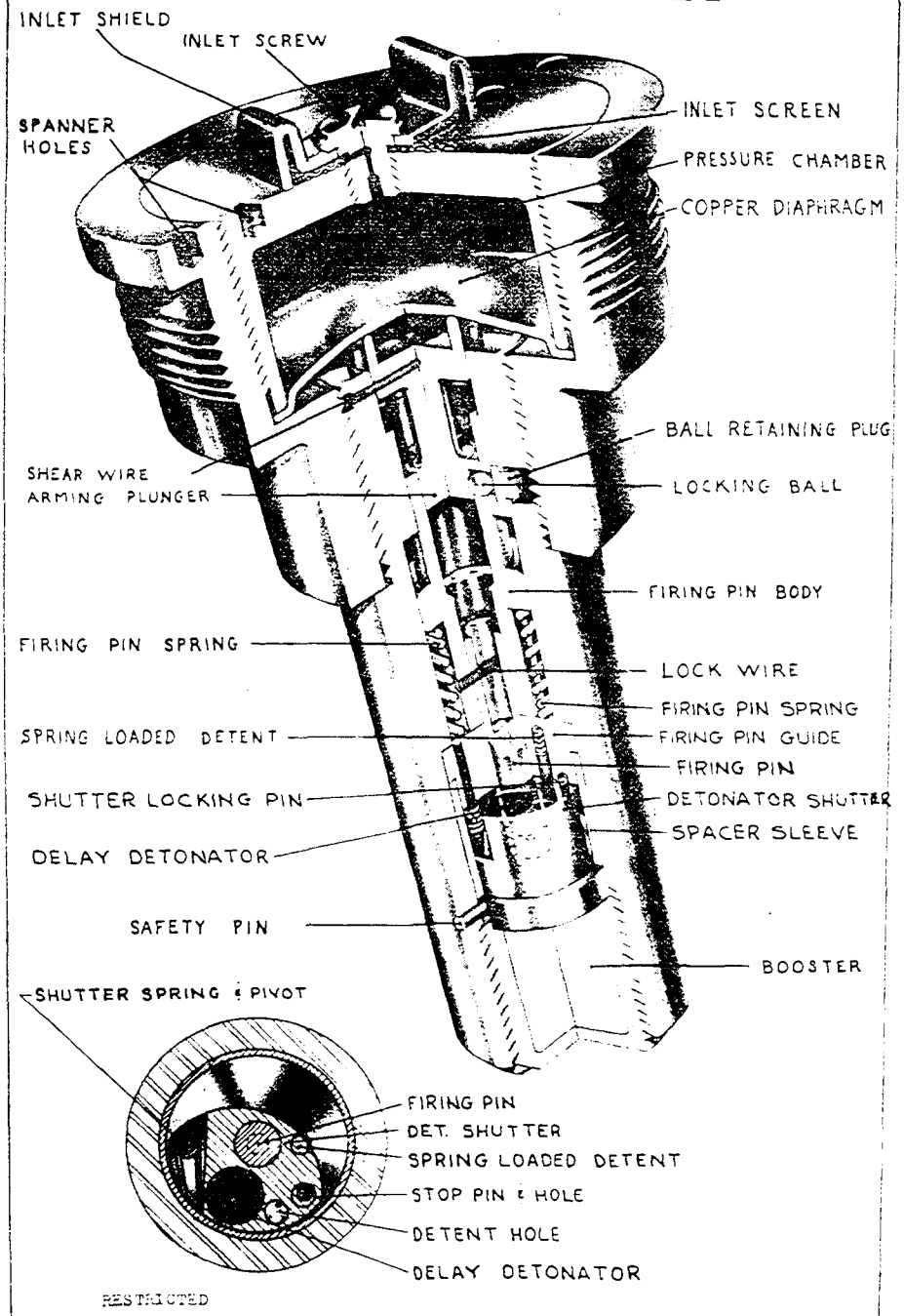
b. The ball retaining plug, staked in place, has replaced the screw plug.

c. A safety pin has been fitted below the spacer sleeve to facilitate assembly operations.

d. The detonator shutter has taken on an oval shape, eliminating the former squared corners.

e. The latest lots of Mk 146 fuzes have been further altered to increase the overall sensitivity of the fuze by using (1) a weaker creep spring, (2) a more sensitive primer, and (3) a more tapered firing point.

MK. 157 - BASE FUZE



RESTRICTED

ROCKETS USED IN	Mk 157: 5"0 Rockets (Mks 1, 5, and 6 heads). Mk 157-1: 11"75 Rockets (Mk 1 head)
FUNCTIONING	Mk 157 and Mod 1: .02 sec. delay; impact.
ARMED CONDITION	Alone, or with Mk 148 or Mk 149.
ARMING TIME	Armed .1 sec. after acceleration ceases.
MAX. BODY DIAMETER . .	2-15/16"
OVERALL LENGTH	5-1/2"

U. S. NAVY BASE FUZE

MK 157
MK 157-1
MK 159

Pressure Arming, Impact Firing
Rocket Propelled

GENERAL: The Mk 157-0 is essentially similar to the Mk 146 fuze, with the following differences: (1) a .02 second delay detonator replaces the non-delay detonator of the Mk 146; (2) the firing pin and the firing pin body are pinned together by a thin lock wire. The Mk 157-0 fuze has been developed to afford greater penetration of the target than was possible with the non-delay detonator of the Mk 146. The Mk 157-0 is being replaced by the Mk 165-0 which consists of the Mk 157-0 with a motor adapter and an improvised detonator shutter locking arrangement.

The Mk 157 Mod 1 differs from the Mk 157-0 in that the material for the fuze body has been considerably strengthened, and the number of external threads has been approximately doubled. In all other respects the fuzes are identical.

OPERATION: When the rocket is fired, gas under considerable pressure from the rocket motor passes through the inlet screen underneath the inlet screw and enters the pressure chamber. As the gas pressure builds up the diaphragm bears against the arming plunger, breaking the shear wire and forcing the arming plunger down. The locking ball, which is preventing the upward movement of the firing pin body, moves into the narrow portion of the arming plunger. The firing pin body is then forced upward by its compressed spring, carrying the firing pin out of the detonator shutter. The shutter, however, is not yet allowed to move over into the armed position. The force of set-back, which continues in effect while the rocket is accelerating throughout the burning period, has thrust the shutter upward engaging the shutter locking pin with the hole in the bottom of the firing pin guide.

At the end of the burning period of the rocket motor, deceleration begins and the shutter rides forward, disengaging the locking pin from the guide. The shutter spring moves the shutter over in the armed position where it is locked by a spring loaded detent which is housed in the firing pin guide and engages a recess in the shutter.

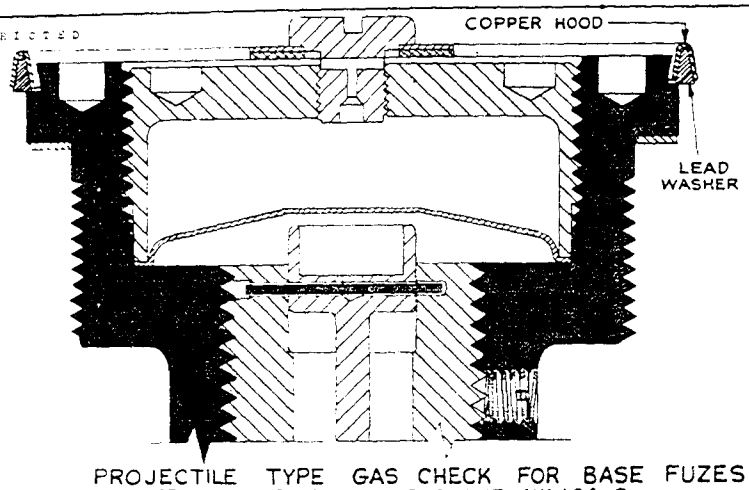
On impact the firing pin body and firing pin overcome the striker spring and ride down against the detonator, at the same time shearing the thin copper lock-wire which holds the firing pin and firing pin body together. The purpose of the lock-wire is to prevent crushing of the delay detonator by the combined weight of the firing pin body and the firing pin, which is blunt.

REMARKS: 1. The sensitivity of the Mk 157-0 fuze is somewhat less than that of the Mk 146 fuze since the percussion type primers used in delay explosive trains are inherently less sensitive than the 'stab' type primer caps used in instantaneous detonators.

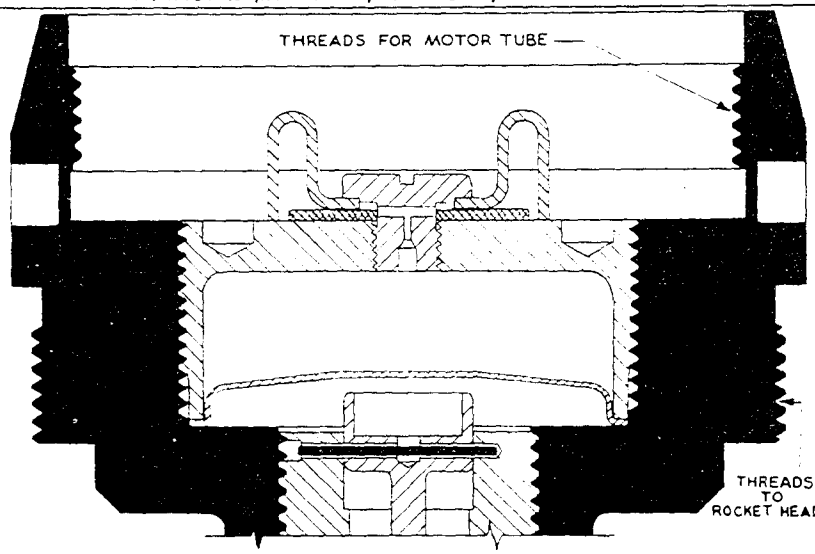
2. The Mk 157-0 and Mk 157-1 fuzes are always shipped to the field installed in the base of the rocket.

3. No attempt should ever be made to remove this fuze from the assembled round for any purpose prior to firing, e.g., to clean the fuze or substitute a base plug for the fuze. Anything less than a perfect seal between the fuze and the adapter in the base of the rocket body will allow the gases from the rocket motor to seep into the body and contact the H.E. filling. Premature explosion of the rocket is then highly probable.

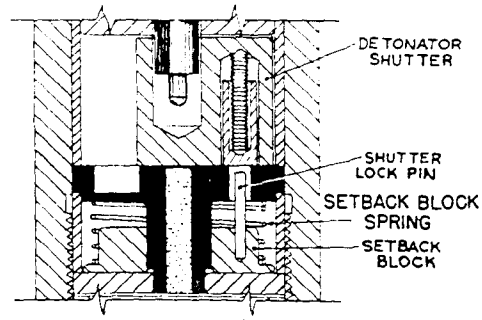
MK 159: The fuze Mk 159 is similar to the Mk 157, except that the delay time has been changed to 0.015 seconds. The fuze is used in the base of the 5"0 Rocket (5"0 Motor - Mks 5 and 6 heads). Other minor structural changes have been made as follows: (a) a slightly heavier shear wire; (b) the inlet screen and inlet washer have been replaced by a brass washer having one side flat and the other radially serrated. The radially serrated side faces the fuze head so that the motor gases can enter the fuze diaphragm chamber; (c) the number of external threads on the body has been increased and "run out" just below the flange to afford a snug fit for the sealing washer; (d) the fuze has been completely waterproofed. The Mk 159 is shipped to the field installed in the base of the rocket head.



PROJECTILE TYPE GAS CHECK FOR BASE FUZES MK.157-2, MK.159-1, MK.163-0, AND MK.164-0



INTEGRAL ROCKET MOTOR ADAPTER FOR BASE FUZES MK.161-0, AND MK.165-0



MODIFIED DETONATOR SHUTTER LOCK FOR BASE FUZES MK.163-0, MK.164-0, AND MK.165-0.

RESTRICTED

ROCKET HEADS USED IN:

Mk 157-2	11.75 Mk 1-1, Mk 2
Mk 159-1	5.0 Mk 6-1
Mk 161-0	7.2 D.R. Mk 10-1
Mk 163-0	11.75 Mk 1-1, Mk 2
Mk 164-0	5.0 Mk 6-1
Mk 165-0	5.0 Mk 1

FUNCTIONING:

Mk 157-2, Mk 163-0, Mk 165-0	0.2 sec. delay
Mk 159-1, Mk 164-0	.015 sec. delay
Mk 161	Instantaneous impact

U. S. NAVY BASE FUZES

MK 157-2 MK. 163
MK. 159-1 MK. 164
MK. 161 MK. 165

Gas Pressure Arming, Impact Firing, Rocket Propelled

Mk 157-2:
Mk 159-1:

In order to secure a more adequate sealing for the protection of the explosive in the 11.75 and 5.0 rocket heads from the hot gases during the burning of the motor, the base fuzes were modified in that a projectile type gas check was added around the fuze body ahead of the threads. The fuzes are shipped assembled in the base of the head. The lead washer, with copper hood is pressed into place at the loading activity and is not to be disturbed in the field.

The Mk 157-2 is the Mk 157-1 fuze (see page 101) with the projectile type gas seal; the Mk 159-1 is the Mk 159-0 fuze (see page 101) with a projectile type gas seal. These fuzes will be replaced by the Mk 163-0 and the Mk 164-0 respectively.

Mk 161-0:

The Mk 161-0 was developed from the Mk 146-1 (see page 99) to secure better sealing of the motor gases from the high explosive filling of the head and to eliminate the possible firing of an unfuzed round. The Mk 161-0 will replace the Mk 146-1 in the 7.2 Demolition Rocket (Mk 10 head).

The Mk 161-0 differs from the Mk 146-1 only in that the head of the fuze has been modified to receive the motor. The 7.2 Mk 10-1 head has been slightly altered to accommodate the new motor adapter. The 3.25 motor will thread into the fuze and a threaded reducer is supplied to permit use of the 2.25 motor.

Mk 163-0:
Mk 164-0:

The Mk 163-0 is similar to the Mk 157-2 and the Mk 164-0 is similar to the Mk 159-1. In addition to retaining the projectile type gas seal noted above, the Mk 163-0 and Mk 164-0 fuzes have an improved detonator shutter locking arrangement. Formerly, the shutter was retained in the safe position by a projection which locked in a recess of the body during setback, and was held in that position by the force of acceleration during the burning of the motor. This allowed the detonator upward movement as well as rotation which contributed to their malfunctioning.

The new design has removed the projection and replaced it with a shutter lock pin which is mounted in a setback block. The block is retained in position by a setback block spring. As the rocket is launched, the force of setback moves the block back to compress the setback block spring. The lock pin moves up to contact the detent to move upward and compress the detent spring. As the motor burns, the firing pin is withdrawn from the shutter to leave only the lock pin to prevent the shutter from pivoting. As the motor burns out and deceleration sets in, the setback block spring and the detent spring force the setback block forward, thereby withdrawing the lock pin from the shutter. This frees the detonator shutter and the spring acts to pivot the shutter over in the cavity and align the firing train.

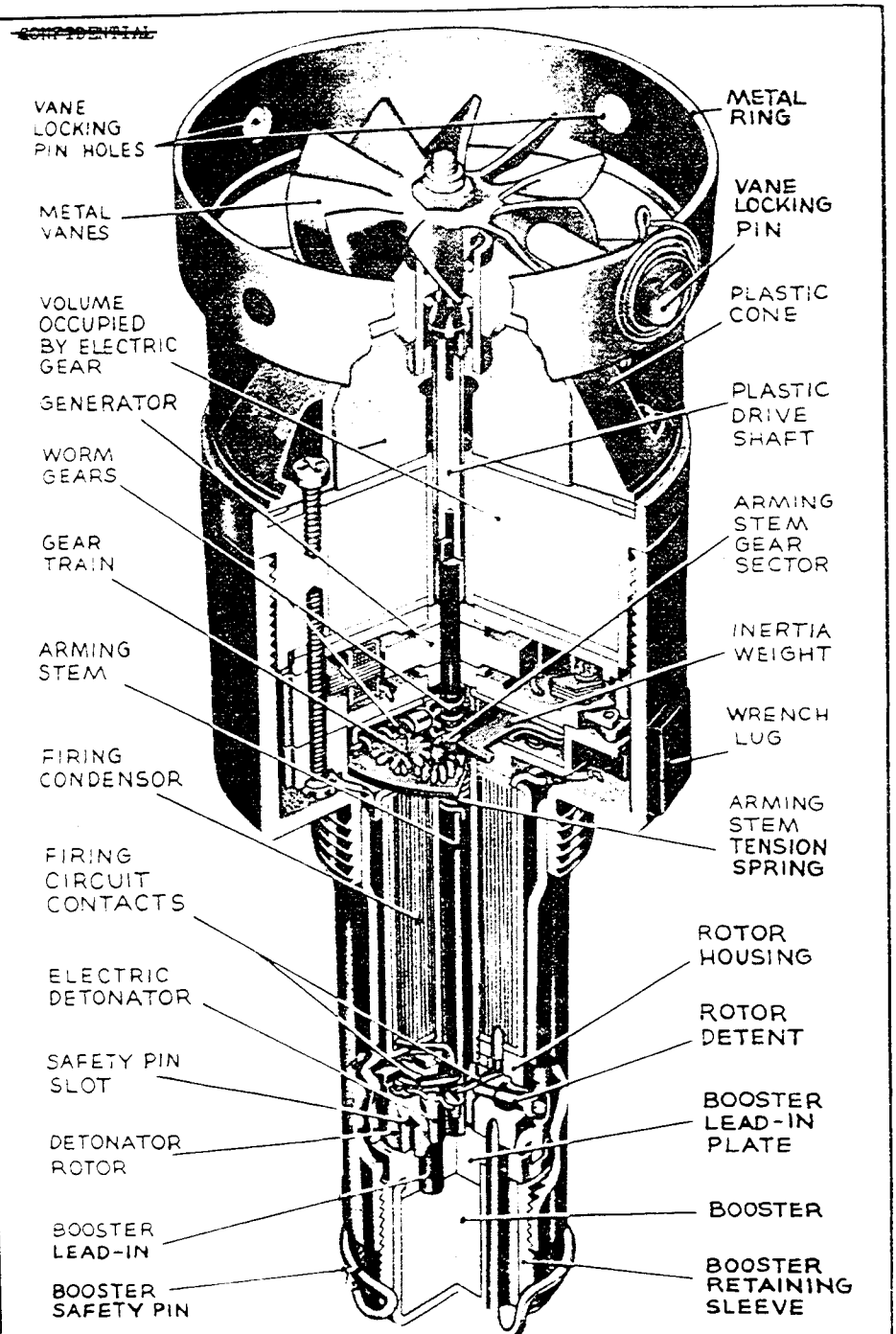
The Mk 163-0 will replace the Mk 157-2 in the 11.75 Mk 1-1 and Mk 2 heads; the Mk 164-0 will replace the Mk 159-1 in the 5.0 Mk 6-1 head.

Mk 165-0:

The Mk 165-0 differs from the Mk 157-0 only in that the head of the fuze has been modified to receive the motor and the booster is approximately .3 inch longer to incorporate the improved detonator shutter locking arrangement described in the preceding section.

The adapter in the fuze head is threaded to receive the 3.25 Mk 2 motor and the Mk 165-0 will replace the old motor adapter in the base of the 5.0 Mk 1 head as well as the Mk 157-0 fuze.

~~CONFIDENTIAL~~



MK 172 MOD. 0 VT ROCKET NOSE FUZE (ARMED)

~~CONFIDENTIAL~~

U. S. NAVY NOSE FUZES

MK. 172

ROCKETS USED IN	5"O Mk 1 Mod 1 Head
FUNCTIONING	Functions by impulse on approach to target
ARMED CONDITION	No external indication
FUZES USED WITH	Mk 157-0 or Mk 165-0
ARMING DISTANCE	340 yds at 0° F. 255 yds at 110° F.
MAX. BODY DIAMETER . . .	3.4 in.
OVERALL LENGTH	12.4 in.

GENERAL: The Mk 172-0 is a VT rocket nose fuze for Navy type fin stabilized rockets designed to function automatically upon approach to the target. It is used only where air burst of the rocket would be most effective to spray exposed personnel in foxholes and light materiel, with fragments. The complete fin stabilized rocket round is designated 'Rocket Assembly Mk 1 Mod 5'.

DESCRIPTION: In appearance, the Mk 172 is the same as the VT Ring type bomb fuze T50. The fuze may also be marked as the T2004 for use in Army Rockets. Internally the fuzes are also similar except that a setback feature has been added in the Mk 172-0.

OPERATION: When rocket is launched, the arming wire is withdrawn from the vane locking pin which in turn is forced out by its spring to free the vanes. At the same time, the setback produced by the sudden acceleration forces the hinged inertia weight back against its spring. The hinged inertia weight forces the locking dog from the arming stem gear sector by means of its lever linkage, freeing the gear train. The vanes rotate, driving the electric generator and the gear train. After approximately 100 vane revolutions, the gear sector on the arming stem has rotated 25 degrees clockwise to move clear of the gear train. As the gear sector clears the gear train, the tension spring snaps it 75 degrees clockwise where it is detained by the stop pin on the hinged inertia weight. Since the arming stem and detonator rotor are integral with the gear sector, they also move 95 degrees by vane rotation and 75 degrees by spring action. The vanes continue to rotate, driving the generator and the gear train which is disconnected from the arming stem. As acceleration ceases at the end of burning of the motor, the spring forces the hinged inertia weight forward, pulling the stop pin and freeing the gear sector. The tension gear snaps the gear sector 90 degrees clockwise into the armed position, lining up the detonator with the booster lead-in and making electrical connection to the firing circuit. The detonator is locked in position by a spring loaded detent in the detonator rotor. When the electric detonator is connected to the firing circuit, the firing condenser is charged. After .7 to 1.4 seconds, the condenser has stored up sufficient power and the fuze is armed. On approach to a target, the VT element activates the firing circuit which discharges the condenser through the electric detonator which initiates the explosive train.

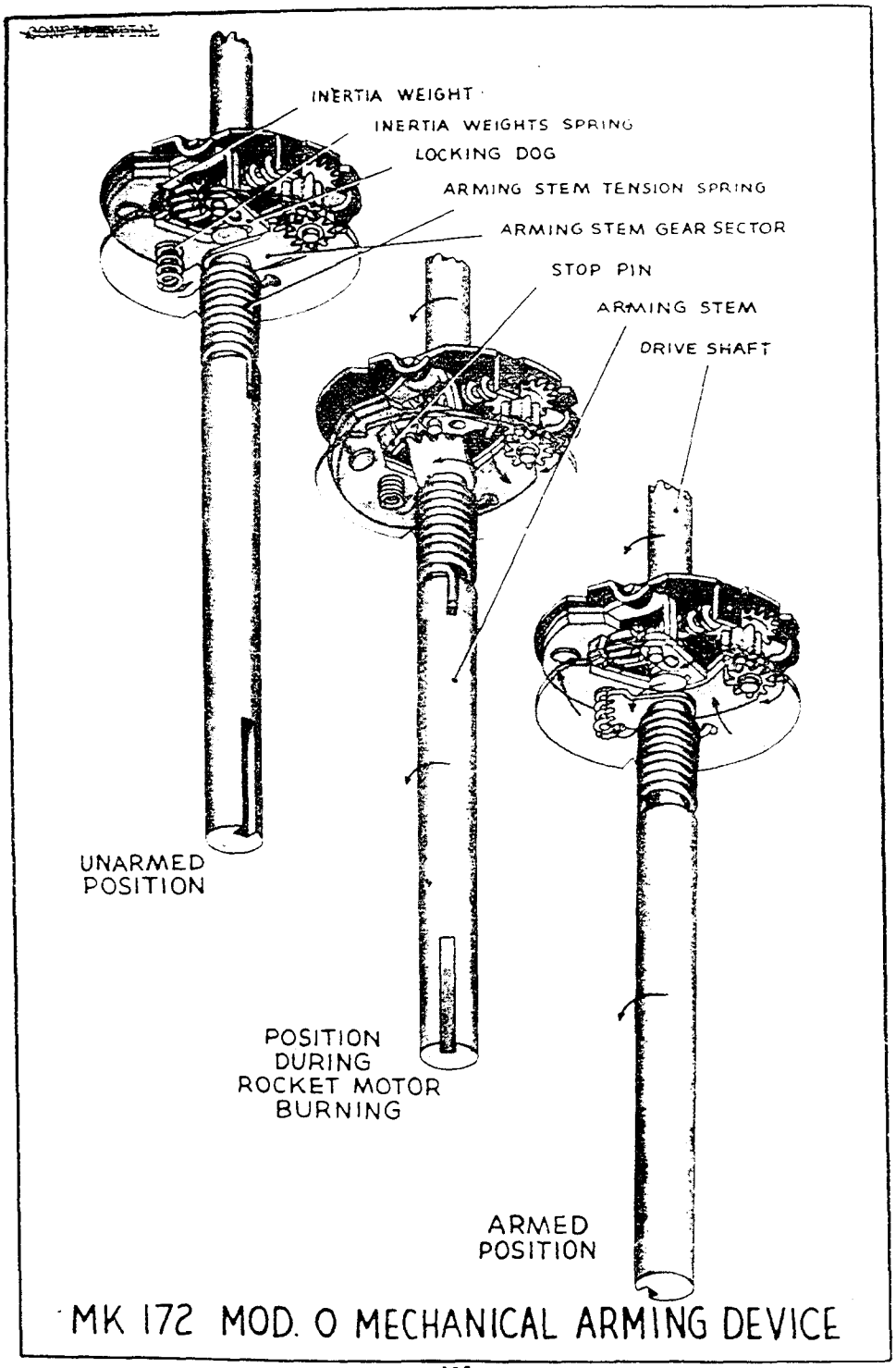
REMARKS: (1) Each fuze Mk 172 Mod 0 is shipped as a complete unit including a seal wire and booster safety pin. It will be recalled that the booster safety pin in this application, like that on the bomb fuzes, gives a visual indication that the detonator rotor is in its original or safe position, if upon removal of the pin it can be fully reinserted. If it cannot be reinserted, the detonator rotor will have moved out of position and hence, the fuze should be disposed of.

(2) The Mk 172 Mod 0 has neither self-destructive or impact functioning features. However, if the VT fuze is a complete dud the base fuze Mk 157 Mod 0 will cause detonation after impact. While the Mk 172 Mod 0 is designed primarily for air to ground firing, it could be used, though less effectively, for air to air firing. In this application the rocket would have to come within 20 feet of the aircraft target in order to function.

(3) A seal wire through a hole in the arming pin inserted at the factory prevents the vanes from rotating and insures that the arming mechanism is in the proper position. Any turning of the vanes, unless accompanied by setback will cause the rotor system to jam, stripping its gears, so that the fuze will be a dud. For this reason, the fuze cannot be pre-armed. If the seal wire is broken when the fuze is originally removed from the container, do not use the fuze. Fuzes in this condition could be disposed of in accordance with security regulations by lowering in deep water or by explosive demolition.

(4) High speed rotation of the vanes is necessary to produce the current to fire the fuze. Therefore, the fuze is actually only armed when in flight on the rocket at speeds in excess of 90 knots. Damaged fuzes may hold the electrical charge in the condenser for quite some time. For this reason, damaged fuzes and duds found on the ground should preferably be handled with care.

NO DISASSEMBLY OF THE Mk 172 Mod 0 IS AUTHORIZED BY FIELD PERSONNEL.



MK 172 MOD. 0 MECHANICAL ARMING DEVICE

Date_____

From:

To: Officer in Charge, U.S. Navy Bomb Disposal School

Subj: Confidential Document - Receipt of.

1. This certifies that the above named has received _____ copy(ies) of the U.S. Navy Bomb Disposal School publication entitled "UNITED STATES BOMBS AND FUZES". It is understood that this is a confidential document and is to be treated in accordance with Article 76 of U.S. Navy Regulations, 1920.

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