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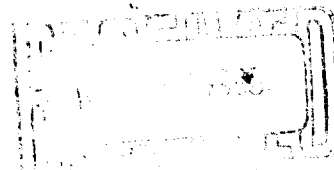
DM-63-1

NOTES ON DEVELOPMENT TYPE MATERIEL
FUZE, PIBD, T278E8

407 355

Louis Richmond

15 April 1963



HARRY DIAMOND LABORATORIES
FORMERLY: DIAMOND ORDNANCE FUZE LABORATORIES
ARMY MATERIEL COMMAND
WASHINGTON 25, D. C.

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(2) To perform research and engineering in fluid amplification and fluid-actuated control systems.

(3) To perform research and engineering in instrumentation and measurement in support of the above.

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(5) To perform research and engineering on materials, components, and subsystems in support of above.

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(7) To provide consultative services to other Government agencies when requested.

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HARRY DIAMOND LABORATORIES
WASHINGTON 25, D.C.

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15 April 1963

DM-63-1

NOTES ON DEVELOPMENT TYPE MATERIEL
FUZE, PIBD, T278E8

Louis Richmond

FOR THE COMMANDER:
Approved by



Robert S. Hoff
R. S. Hoff
Chief, Laboratory 400

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ABSTRACT

Fuze, Point Initiated, Base Detonating, T278E8 (M530A1) is described. The fuze is a modified M530 (T278E7), and is intended for use in the M371 90-mm recoilless HEAT cartridge. The T278E8 was developed to provide a minimum arming range of 30 feet for the M371 cartridge, as required by the military characteristics. The arming range provided by the M530 fuze is about 16 feet. The T278E8 fuze has been standardized as Fuze, PIBD, M530A1, Standard A for the M371 Cartridge.

1. INTRODUCTION

The development of Fuze, PIBD, T278E8 was initiated by a letter dated 1 June 1959 from Picatinny Arsenal to the Diamond Ordnance Fuze Laboratories. The objective of this development program was to increase the arming range of the M530 (T278E7) fuze from about 16 ft. to a minimum of 30 ft. when fired in the M371 90-mm recoilless HEAT cartridge. The 30-ft minimum arming range was specified in the OTCM for this cartridge (ref 1).

The M530 is an electromechanical base-mounted PIBD fuze (ref 2) that was standardized for use in the M371 in 1959. It consists essentially of a mechanical acceleration-sensitive arming system, an electrically initiated explosive train, and a mechanical graze-initiation mechanism. The fuze is electrically connected to a piezoelectric (lucky) power source mounted in the nose of the shell. (This piezoelectric element is not part of the fuze.) Upon nose impact, the piezoelectric element develops electrical energy to fire the electric detonator in the fuze. Upon grazing impact, an inertia-operated firing pin overcomes a creep spring and initiates a stab primer, which in turn initiates the electric detonator. The only essential difference between the M530 and the T278E8 (fig. 4) is in the delayed arming feature, which has been incorporated in the latter fuze.

The T278E8 fuze was developed specifically for use in the M371 cartridge whose 700-fps muzzle velocity is the lowest of its class of HEAT artillery ammunition. The fuze has not been tested in any other round. However, it should perform satisfactorily in similar HEAT ammunition, where the drag deceleration of the round does not exceed about 20 g. At higher levels of drag, frictional forces prevent reliable rotor arming.

The T278E8 fuze has been standardized as Fuze, PIBD, M530A1, Standard A for the M371 Cartridge per AMTC 642 dated 21 March 1963.

2. GENERAL DESCRIPTION

The T278E8 fuze (fig. 1 through 8), i.e., the base element, consists of three major subassemblies: (1) a release (arming) mechanism and rotor assembly, (2) a rotor housing assembly, and (3) an aluminum shield assembly. The rotor housing provides a mounting base for both the release mechanism and rotor assembly, and the aluminum shield assembly. The former

The electrical circuit consists of an insulated contact bushing with a screw connection to the piezoelectric lead wire on the fuze base, and a contact surface in the rotor cavity (fig. 6). Also included is a bleeder resistor (between the lead wire connection and rotor housing), which prevents accumulation of electrical energy in the otherwise open piezoelectric circuit.

2.1.3 Aluminum Shield Assembly

The aluminum shield is shown in figures 1 and 6. The shield provides for fuze detonator safety by confining the explosion of the detonator and primer if either is initiated when the fuze is unarmed, protects the fuze mechanism from contamination by foreign matter, and provides a housing for the tetryl lead and booster pellet in the forward end of the fuze.

2.2 Method of Operation

When the fuze is safe (unarmed), the rotor is restrained in a position such that the electric detonator is 90° out of line with the tetryl lead and booster in the shield assembly (fig. 7). In this position, the detonator is also out of line with the stab primer in the rotor housing. The electric detonator is electrically isolated from the piezoelectric power source, and is short-circuited by the metal rotor housing. The graze plunger is locked in the safe position by the boss on the rotor.

When the round is fired, sustained acceleration creates setback forces that act on the sequential-leaf setback release mechanism. With a minimum acceleration of 2500 to 3400 g sustained for a minimum of 3 milliseconds, the pivoted leaves are sequentially displaced by the setback forces. The third leaf on reaching its rearmost position is locked by the antireset spring latch, which prevents the leaf from bouncing back to the locking position.

Setback of the third leaf releases the rotor locking pin, thereby freeing the rotor. However, the rotor cannot begin to rotate toward the armed position until the firing acceleration has fallen to 25 to 50 g. At higher accelerations, the rotor seats in the rotor cavity and frictional forces between the rotor and cavity surfaces prevent rotation.

When the firing acceleration has fallen sufficiently, the rotor torsion spring turns the rotor until the rotor locking pin butts against the end of a slot in the inner bearing plate (approximately 270°). With the rotor in this position (fig. 6), the detonator is in the armed position in line with the tetryl lead and booster, and the blow-through hole in the rotor is aligned with the stab primer. Also, the spring-loaded contact plunger within the rotor makes contact with the insulated contact bushing in the rotor housing. This removes the detonator short-circuit and completes the electrical circuit to the piezoelectric element in the nose of the shell. The locking pin on the graze plunger becomes aligned with a slot in the rotor boss, and the plunger is then free to move forward in response to any shell

deceleration sufficiently large to overcome the 20- to 30-g creep spring. Alignment of the rotor thus mechanically and electrically arms the fuze.

Rotation of the rotor to the armed position is retarded by the arming delay mechanism. The time required for the rotor to turn from the safe to the armed position is dependent to some extent on the external ballistics (drag, spin) and temperature of the round. The average static rotor arming time, about 50 milliseconds, provides delayed arming of about 40 ft in the M371 round.

With the fuze armed and on nose impact with the target, the piezoelectric element generates an electrical impulse that is conducted to the T74 electric detonator through the insulated circuit. This impulse initiates the detonator, which in turn initiates the tetryl lead and booster. Upon grazing impact, deceleration of the round causes the graze plunger to compress the creep spring and initiate the stab primer. The primer detonation initiates the T74 detonator via the blow-through hole.

2.3 Characteristics

The Fuze, PIBD, T278E8 is a point-initiated, base-detonating fuze containing a graze-sensitive mechanism. The fuze is intended for use in the M371 fin-stabilized HEAT cartridge and has the following characteristics:

- a. The fuze provides mechanical safety by maintaining the electric detonator in an out-of-line position in relation to the booster lead cup assembly until the fuze has armed.
- b. The fuze provides electrical safety by maintaining an open circuit from the piezoelectric element to the detonator and by short-circuiting the detonator until the fuze has armed. Fuze electrical initiation on arming is prevented by a bleeder resistor that drains off any electrical energy generated in the piezoelectric circuit prior to or during firing of the round.
- c. The fuze is jolt safe when tested in accordance with MIL-STD-300.
- d. The fuze is jumble safe when tested in accordance with MIL-STD-301.
- e. The fuze is drop safe when tested in accordance with MIL-STD-302 and MIL-STD-358.
- f. The fuze is safe and operable when tested in accordance with MIL-STD-303 (Transportation-Vibration).
- g. The fuze is detonator safe when tested in accordance with MIL-STD-315.
- h. The fuze does not begin to arm until subjected to a setback force of at least 2500 g but will begin arming before setback forces reach

3400 g. The fuze does not complete arming as long as the firing acceleration is greater than 25 to 50 g. (The arming cycle may not be completed if drag deceleration is greater than about 25 g.)

i. The fuze when used in the M371 shell arms after the projectile has traveled about 35 to 50 ft from the muzzle of the M67 gun.

j. The fuze is not damaged when subjected to firing accelerations as high as 40,000 g.

k. The fuze contains 0.97 grains of tetryl in the lead charge and 114.5 grains of tetryl in the booster pellet.

l. The fuze is 1.963 in. (max) in length and 1.35 in. (max) in diameter.

3. PREPARATION FOR USE

The fuze is assembled to the round of ammunition prior to shipping for field use. No preparation of the fuze is necessary in the field.

4. PRECAUTION IN USE, HANDLING AND STORAGE

All precautions normally followed in the storage, shipment, handling, and use of high-explosive ammunition should be followed.

The ICC classification for the fuze when packed for interplant shipment is "Detonating Fuzes—Handle Carefully." The fuze should be stored in accordance with Ordnance Safety Manual, ORD M7-224.

The ICC classification and precautions in handling and storage of the fuze when assembled in a complete round are given in Notes on Development Type Materiel for the appropriate complete round.

5. REFERENCES

(1) OTCM 35040 dated 5 Nov 1952

(2) DOFL Report No. TR-655, "Notes on Development Type Materiel, Fuze, PIBD, T278E7," December 1958.

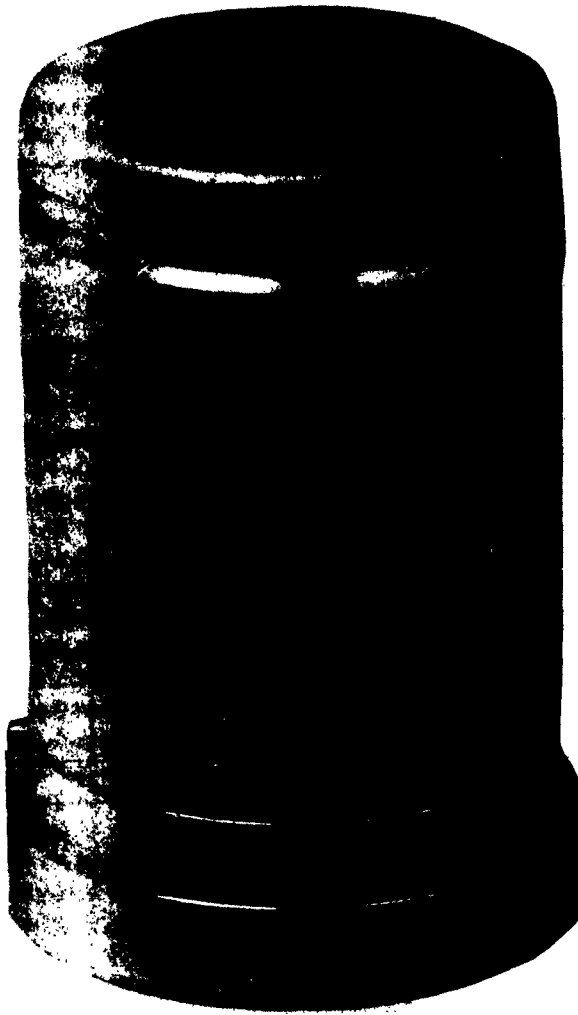


Figure 1. T278E8 fuze, fully assembled.

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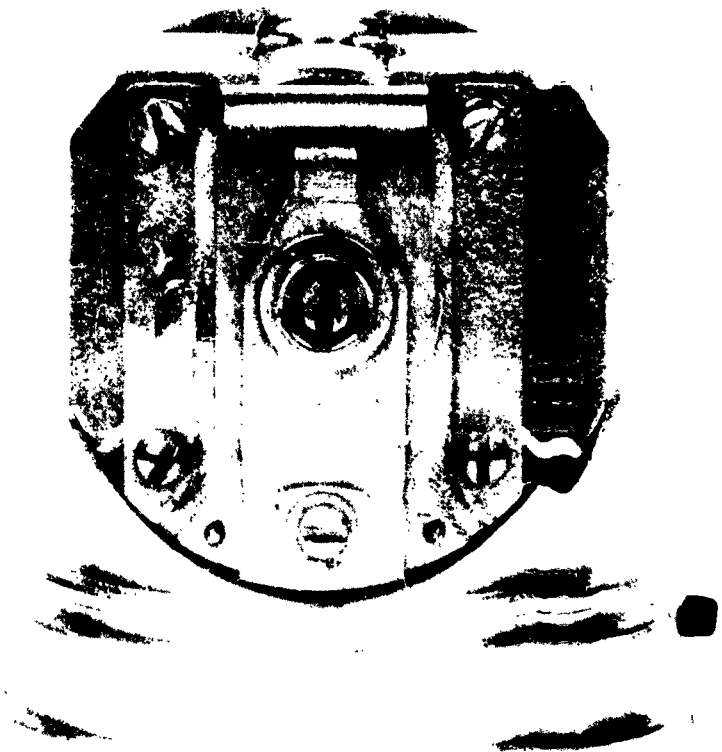
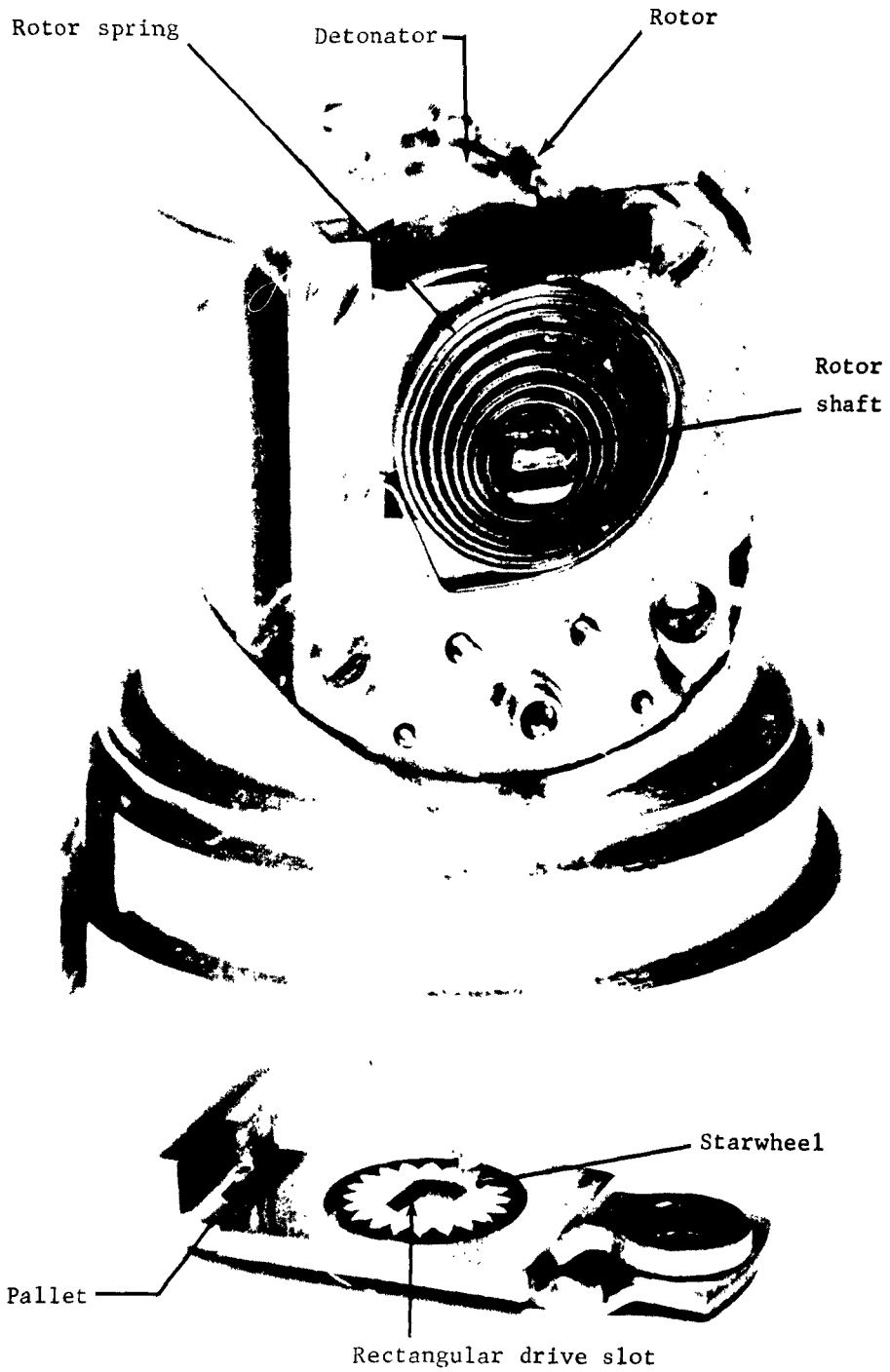


Figure 2. 127 EN muzzle (without shield).

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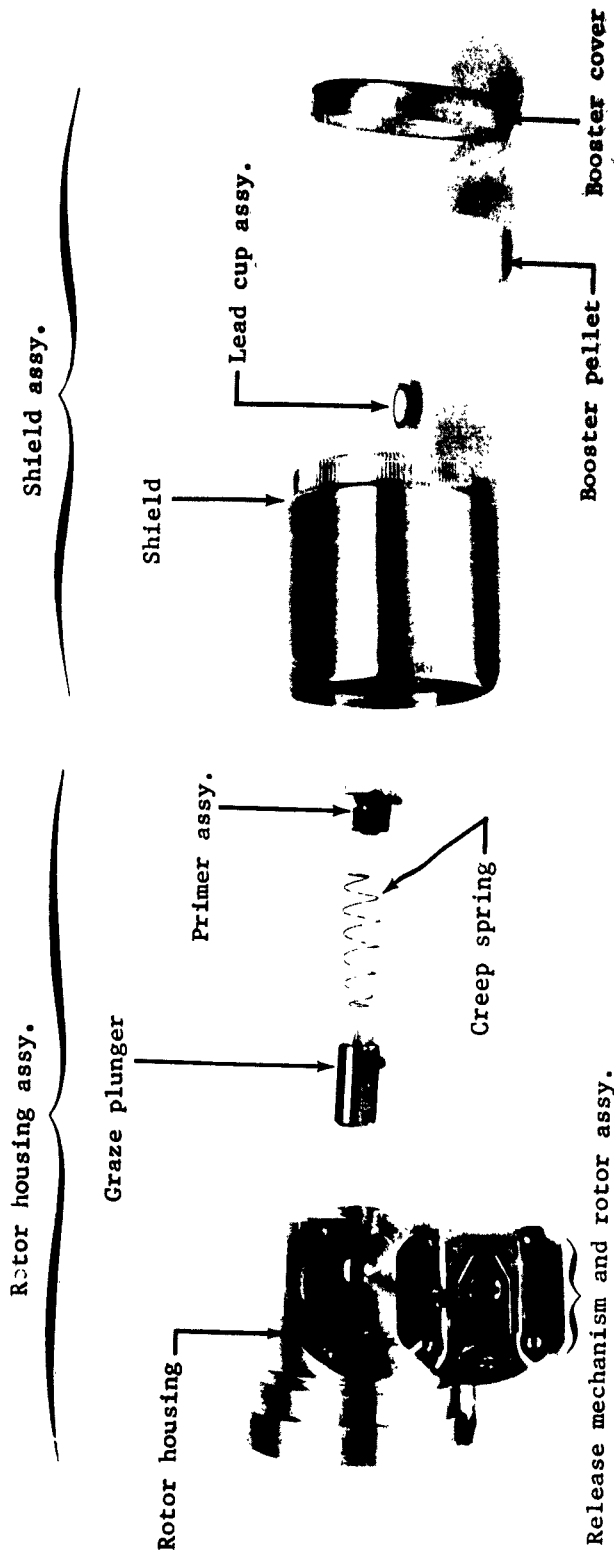


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Figure 3. T278E8 fuze, with arming delay mechanism removed.



Figure 4. T278E7 M530 fuze (left), and T278E8 fuze with arming delay mechanism removed.



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Figure 5. T278E8 Fuze (exploded view)

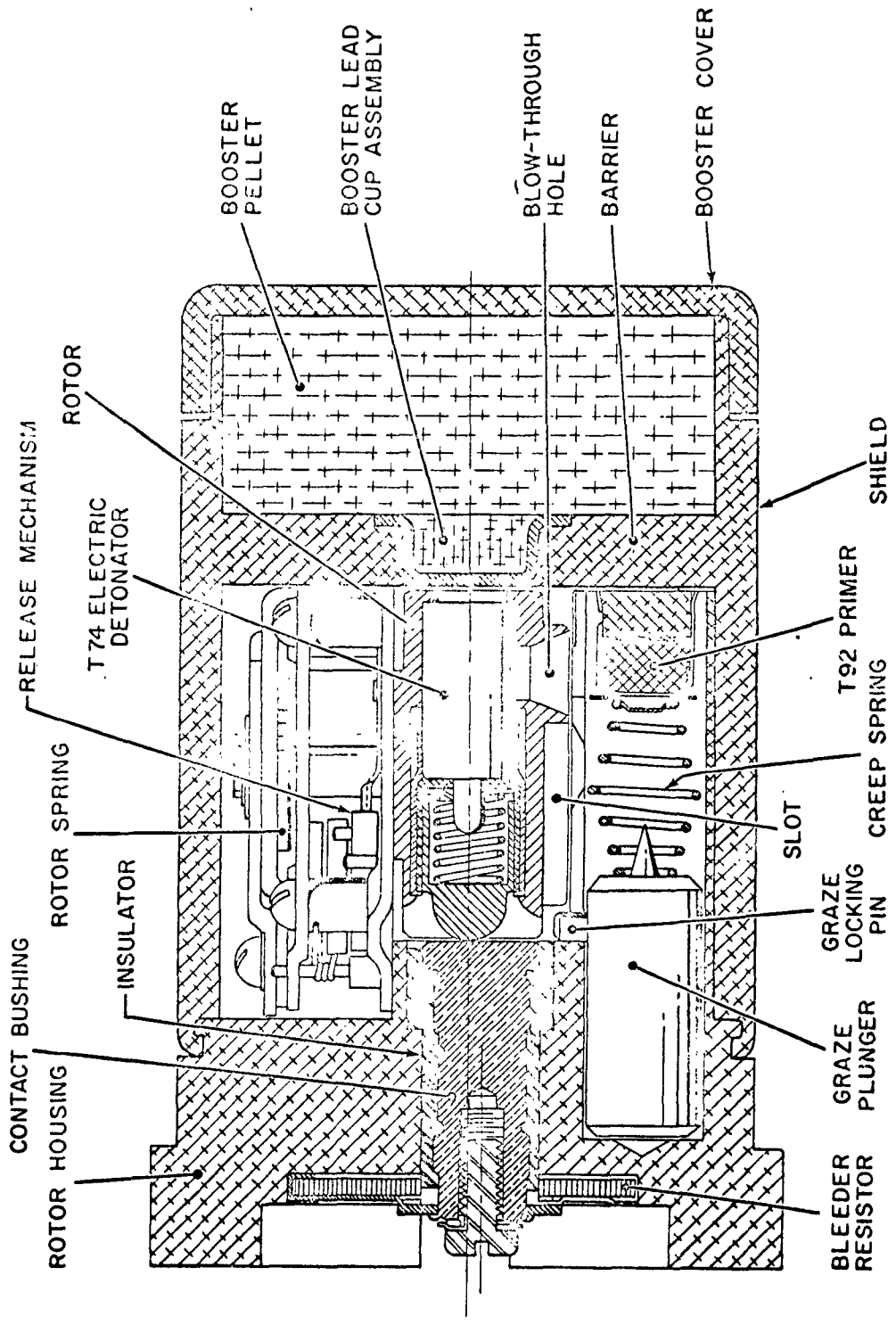


Figure 6. Fuze, PIBD, T278E8 (armed).

ACCELERATION

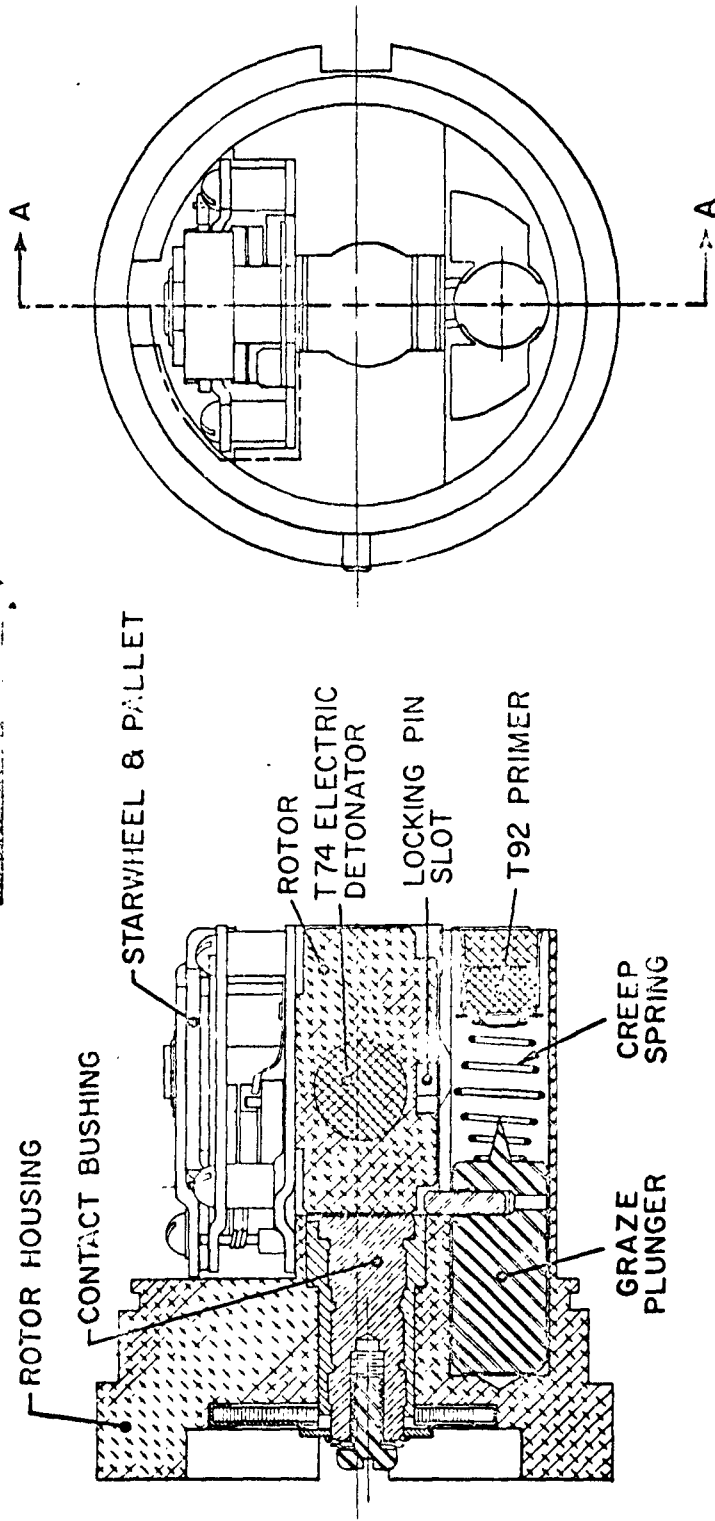


Figure 7. Rotor housing and release assembly (unarmed).

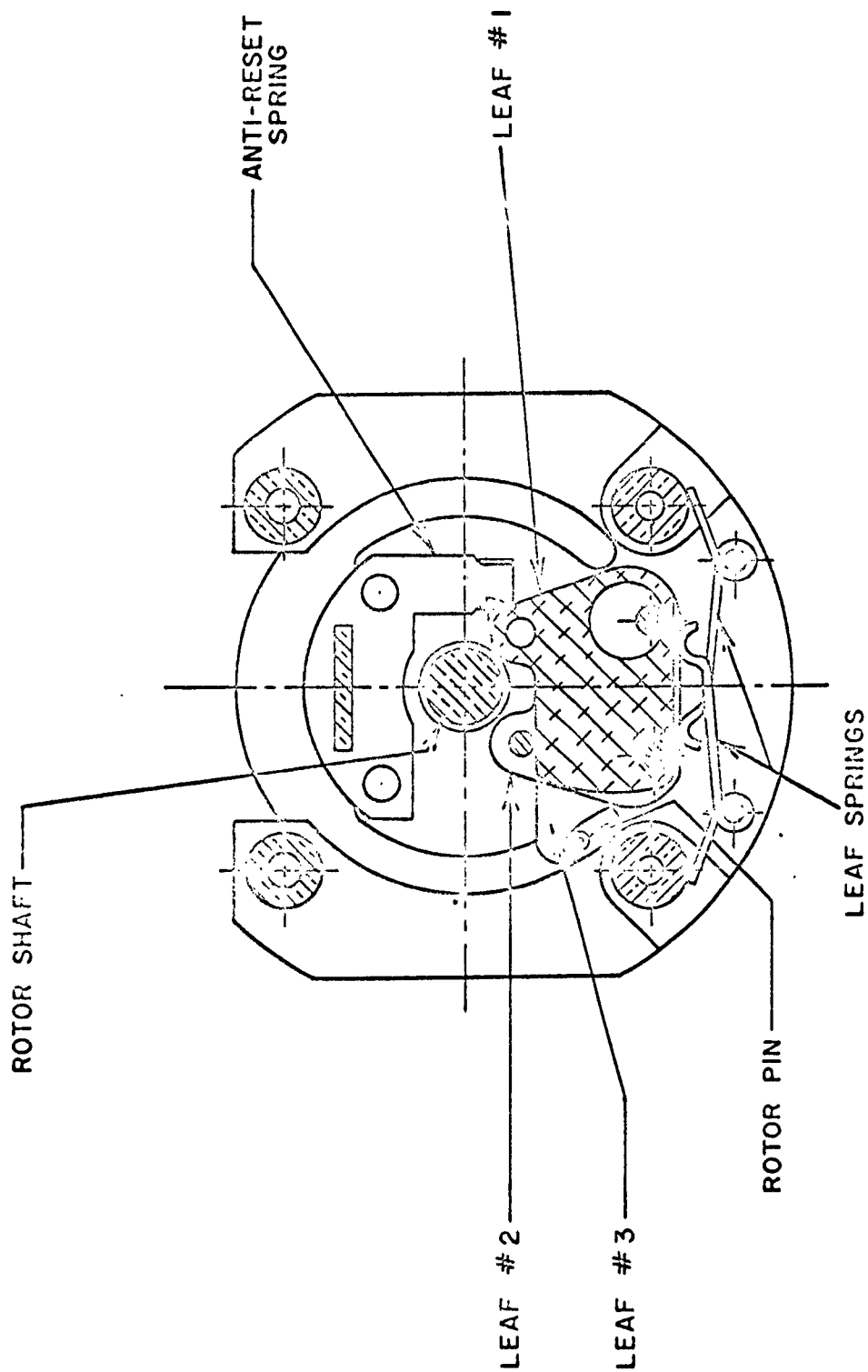


Figure 8. Sequential leaf setback release mechanism.

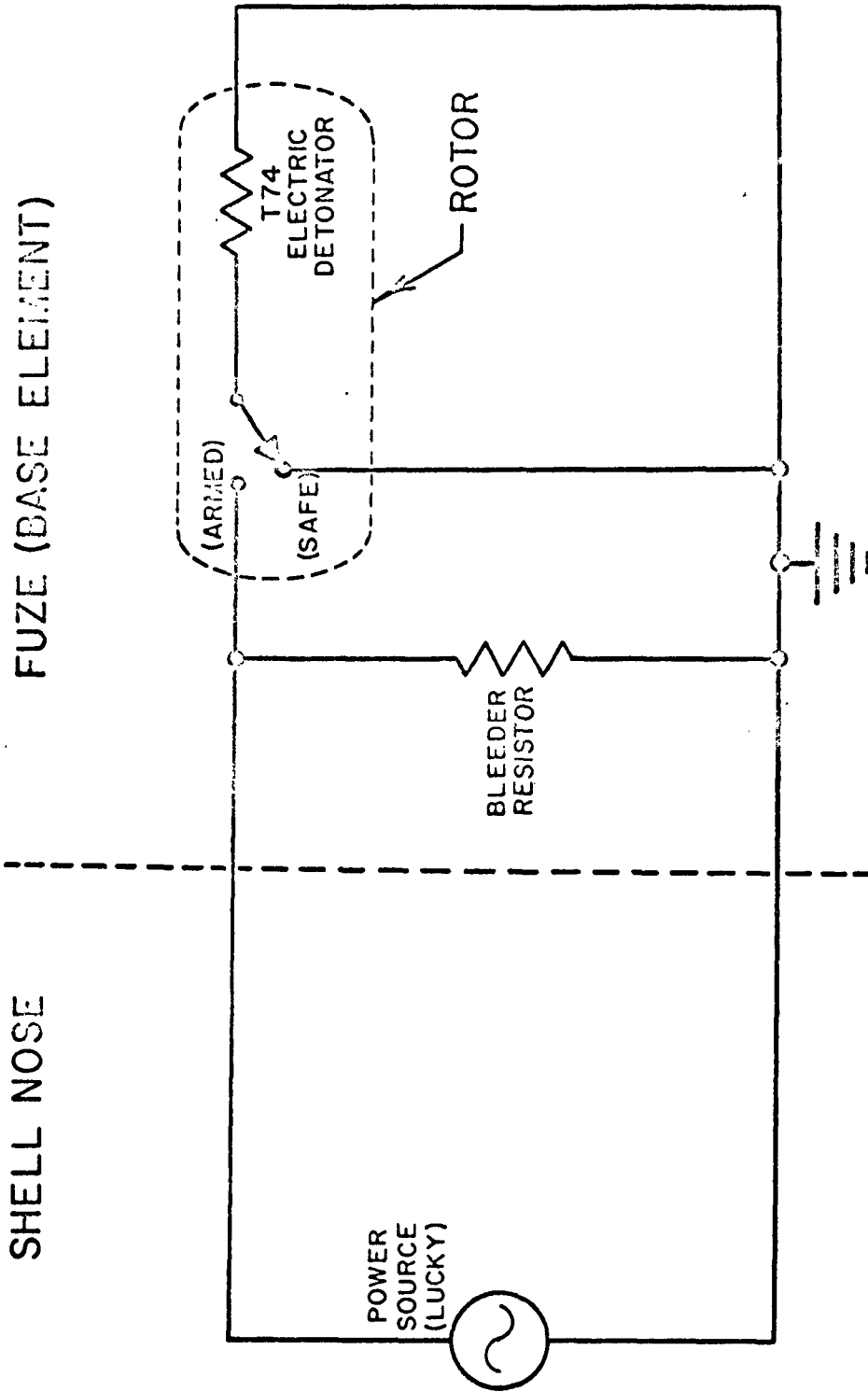


Figure 9. Circuit diagram for fuze, PIBD, T278E8.

ORDNANCE CORPS ENGINEERING PARTS LIST - LIST OF DRAWINGS						PARTS LIST NUMBER 10980600		
						SHEET 1 OF 1 SHEETS		
IDENTITY FUZE, PI, BD, T278E8						DRAWING NUMBER C10980600		
	COLUMN 1	DWG DATE	COLUMN 2	DWG. DATE	COLUMN 3	DWG. DATE	COLUMN 4	DWG. DATE
1	A10404109		B10404099		C10404061		P-85443	
2	A10404110		B10404100					
3			B10404101					
4	A10404112				C10404074		P-85700	
5			B10404103					
6	A10404114		B10404104					
7			B10404105		C10404082			
8	A10404116		B10404106					
9								
10			B10404108		C10404085			
11					C10404086			
12	B10404063							
13	B10404064		B10404111		C10404088			
14					C10404089			
15			B10404113					
16	B10404067				C10404096			
17	B10404068							
18	B10404069				C10404107			
19	B10404070							
20			B10980578		C10980580			
21			B10980579		C10980581			
22	B10404073				C10980582			
23								
24	B10404075		B10980583					
25			B10980584		C10980591		ADDITIONS	
26	B10404077		B10980585					
27	B10404078		B10980586					
28	B10404079				C10980594			
29	B10404080							
30	B10404081		B10980590					
31					C10980597			
32	B10404083				C10980598			
33	B10404084		B10980593		C10980599			
34					C10980600			
35								
36	B10404090		B10980596					
37	B10404091							
38					D10980589			
39	B10404093		B10980726					
40	B10404094		B10980727					
41	B10404095				D10980592			
42								
43	B10404097		B7544463					
44	B10404098				D10980595			

ORIGINAL DATE				PROCESSED BY				DIAMOND ORDNANCE FUZE LABORATORIES	
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									ORD CORPS
									APPROVED BY ORDER OF THE CHIEF OF ORDNANCE
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Figure 10. List of drawings, T278E8 fuze.

ORDNANCE CORPS ENGINEERING PARTS LIST - LIST OF DRAWINGS						PARTS LIST NUMBER 10980600		
						SHEET 1 OF 1 SHEETS		
IDENTITY FUZE, PI, BD, T278E8						DRAWING NUMBER C10980600		
	COLUMN 1	DWG. DATE	COLUMN 2	DWG. DATE	COLUMN 3	DWG. DATE	COLUMN 4	DWG. DATE
1	A10404109		B10404099		C10404061		P-85443	
2	A10404110		B10404100					
3			B10404101					
4	A10404112				C10404074		P-85700	
5			B10404103					
6	A10404114		B10404104					
7			B10404105		C10404082			
8	A10404116		B10404106					
9								
10			B10404108		C10404085			
11					C10404086			
12	B10404063							
13	B10404064		B10404111		C10404088			
14					C10404089			
15			B10404113					
16	B10404067				C10404096			
17	B10404068							
18	B10404069				C10404107			
19	B10404070							
20			B10980578		C10980580			
21			B10980579		C10980581			
22	B10404073				C10980582			
23								
24	B10404075		B10980583					
25			B10980584		C10980591		ADDITIONS	
26	B10404077		B10980585					
27	B10404078		B10980586					
28	B10404079				C10980594			
29	B10404080							
30	B10404081		B10980590					
31					C10980597			
32	B10404083				C10980598			
33	B10404084		B10980593		C10980599			
34					C10980600			
35								
36	B10404090		B10980596					
37	B10404091							
38					D10980589			
39	B10404093		B10980726					
40	B10404094		B10980727					
41	B10404095				D10980592			
42								
43	B10404097		B7544463					
44	B10404098				D10980595			

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									<i>E. D. Fisher</i>
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Figure 10. List of drawings, T278E8 fuze.

ORDNANCE CORPS				PARTS LIST NO. 10980600			
ENGINEERING PARTS LIST - LIST OF PARTS				SHEET 1 OF 2		SHEETS	
IDENTITY						DRAWING NO.	
FUZE, FI, HD, T278E8						C10980600	
ITEM NO.	ORDNANCE DRAWING NUMBER	PART NUMBER	NOMENCLATURE - DESCRIPTION	REQ'D PLS UNIT	P L	NOTES	
1	B10404075	10404075	COVER, BOOSTER	1			
2	B10404113	10404113	PELLET, BOOSTER	1			
3	B10404070	10404070	LEAD CUP ASSEMBLY	1			
4	B10404073	10404073	CUP, LEAD	1			
5	A10404114	10404114	CHARGE	1			
6	C10980594	10980594	ROTOR HOUSING AND SHIELD ASSEMBLY	1			
7	C10404107	10404107	SHIELD (MACHINED)	1			
8	B10404106	10404106	SHIELD, BLANK	1			
9	D10980592	10980592	ROTOR HOUSING AND RELEASE ASSEMBLY	1			
10	B10404091	10404091	SCREW	2			
11	A10404112	10404112	LOCTITE	(2)			
12	C10980597	10980597	HOUSING ASSEMBLY	1			
13	C10404089	10404089	RESISTOR, BLEEDER	1			
14	B10404111	10404111	INSULATOR, RESISTOR	1			
15	B10404097	10404097	WASHER, CONDUCTING	1			
16	C10980599	10980599	HOUSING CONTACT AND PIN ASSEMBLY	1			
17	B10404068	10404068	HOUSING CONTACT ASSEMBLY	1			
18	B10404100	10404100	BUSHING, CONTACT	1			
19	C10980589	10980589	HOUSING, ROTOR	1			
20	B10404084	10404084	ROLL PIN	1			
21	B10404105	10404105	SCREW, TERMINAL	1			
22	B10404069	10404069	GRAZE PLUNGER ASSEMBLY	1			
23	C10404082	10404082	PLUNGER	1			
24	B10404083	10404083	PIN, GRAZE	1			
25	B10404094	10404094	SPRING, CREEP	1			
26	P85700	85700	PRIMER	1			
27	B10404099	10404099	SPACER, BACKUP	1			
28	C10404074	10404074	CLIP, SPEED	1			
29	C10980591	10980591	RELEASE MECHANISM AND ROTOR ASSEMBLY	1			
30	C10980598	10980598	ROTOR ASSEMBLY	1			
31	B10980596	10980596	ROTOR AND PIN ASSEMBLY	1			
32	B10404081	10404081	PIN, ROTOR	1			
33	C10980580	10980580	ROTOR	1			
34	B10404067	10404067	DETONATOR AND CONTACT ASSEMBLY	1			
35	P-85443	85443	T74 DETONATOR	1			
36	B10404077	10404077	HOUSING, CONTACT	1			
37	B10404108	10404108	INSULATOR, CONTACT	1			
38	B10404101	10404101	CONTACT	1			
39	B10404093	10404093	SPRING, CONTACT	1			
40	B10404078	10404078	SPEED NUT	1			
41	D10980595	10980595	RELEASE MECHANISM ASSEMBLY	1			

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Figure 11. List of parts, T278E8 fuze.

ORDNANCE CORPS						PARTS LIST NO. 10980600			
ENGINEERING PARTS LIST - LIST OF PARTS						SHEET 2 OF 2 SHEETS			
IDENTITY						DRAWING NO.			
FUZE, FI, ED, T278E8						C10980600			
LINE NO.	ORDNANCE DRAWING NUMBER	PART NUMBER	NOMENCLATURE - DESCRIPTION			REQ'D PER UNIT	NOTES		
1	C10404061	10404061	REAR BEARING PLATE AND STUD ASSY.			1			
2	C10404088	10404088	PLATE, BEARING, REAR			1			
3	E10404103	10404103	STUD, SPACER			2			
4	E10404104	10404104	STUD, SPRING			2			
5	E10404080	10404080	PIN, LEAF			2			
6	C10404096	10404096	SPRING, ANTI RESET			1			
7	E10404064	10404064	LEAF NO. 3 ASSEMBLY			1			
8	C10404086	10404086	LEAF NO. 3			1			
9	E10404079	10404079	DOG, LEAF			1			
10	E10404063	10404063	LEAF NO. 2 ASSEMBLY			1			
11	C10404085	10404085	LEAF, SETBACK			1			
12	E10404079	10404079	DOG, LEAF			1			
13	C10404085	10404085	LEAF, SETBACK			1			
14	E10404095	10404095	SPRING, LEAF			2			
15	E10980593	10980593	FRONT BEARING PLATE AND						
16			SPACER ASSEMBLY			1			
17	C10980581	10980581	PLATE, BEARING, FRONT			1			
18	E10404098	10404098	SPACER, PLATE			2			
19	E10980584	10980584	STUD, BRACKET			1			
20	E10404090	10404090	SCREW			2			
21	A10404112	10404112	LOCTITE			②			
22	E10980579	10980579	SPRING, ROTOR			1			
23	E10980727	10980727	KEEPER			1			
24	C10980582	10980582	PALLET			1			
25	E10980590	10980590	BRACKET AND STAR WHEEL ASSEMBLY			1			
26	E10980583	10980583	BRACKET			1			
27	E10980585	10980585	STAR WHEEL			1			
28	E10980586	10980586	WASHER, STAR WHEEL			1			
29	E10980578	10980578	WASHER, STUD			1			
30	E10980726	10980726	SCREW, PALLET			1			
31	E7544463	---	APPLICATION OF TOLERANCES						
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
ORIGINAL DATE						PROCESSED BY: DIAMOND ORDNANCE FUZE LABS			
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									APPROVED BY ORDER OF THE CHIEF OF ORDNANCE
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Figure 12. List of parts, T278E8 fuze.

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AMOS 5430.13.54010, SA Proj 4200, UNCLASSIFIED Report

Pump, Pump Initiator, Pump Bracketing, STRIP (NORMAL) is described. The pump is a modified M39 (STRIP), and is intended for use in the M37 90-mm recoilless M37 cartridge. The STRIP was developed to provide a minimum aiming range of 20 feet for the M37 cartridge, as required by the military characteristics. The STRIP range provided by the M39 pump is about 20 feet. The STRIP pump has been standardized as Pump, PUMP, M37, Standard A for the M37 Cartridge.

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