ITEM No. 3
FILE No. XXX-112

CONFIDENTIAL

FUZING SYSTEM OF GERMAN FZG 76 FLYING BOMB (V-1)

CONFIDENTIAL

COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE

CONFIDENTIAL

FUZING SYSTEM OF GERMAN FZG 76 FLYING BOMB(V-1)

Reported by
Lt. (jg) H.M. FOGEL,USNR.
NavTechMisEu

July 1945

CIOS Target Number 3a/154
Bombs and Fuses

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division, SHAEF (Rear) APO 413

Page 3 lost (1991)

2. Electrical System. (a)(cont'd)

the other two (2) are the electrical contacts. The electrical system of this fuse will be discussed with the operation of the entire system. Under the fuse head is a plastic moulding housing an electrical igniter. Below this a second housing contains a thermite pot around which are grouped three (3) spring loaded switches. One is held in its closed position by a polystyrene plug, the other two (2) are connected to the bottom of the thermite pot by means of lumps of Wood's metal. An inertia bolt switch rated at 150 G + 10 is mounted so that it will be activated on nose impact.

(b) Fuse Ent (106)

This component (Figure 1) is bolted to a circular bracket on the warhead, close to the El AZ 106 # . It resembles the 106 # in size and shape, except that it has no threads to take a gaine, but rather its base is closed by an aluminum plug. A locating pin is provided but serves no function. Half of the fuse head is painted green, the other half red. It contains a large tinfoil condenser, two (2) iron core choke coils, a 0.95 M. Ohm resistance all separated by bee's wax and held in plastic housings.

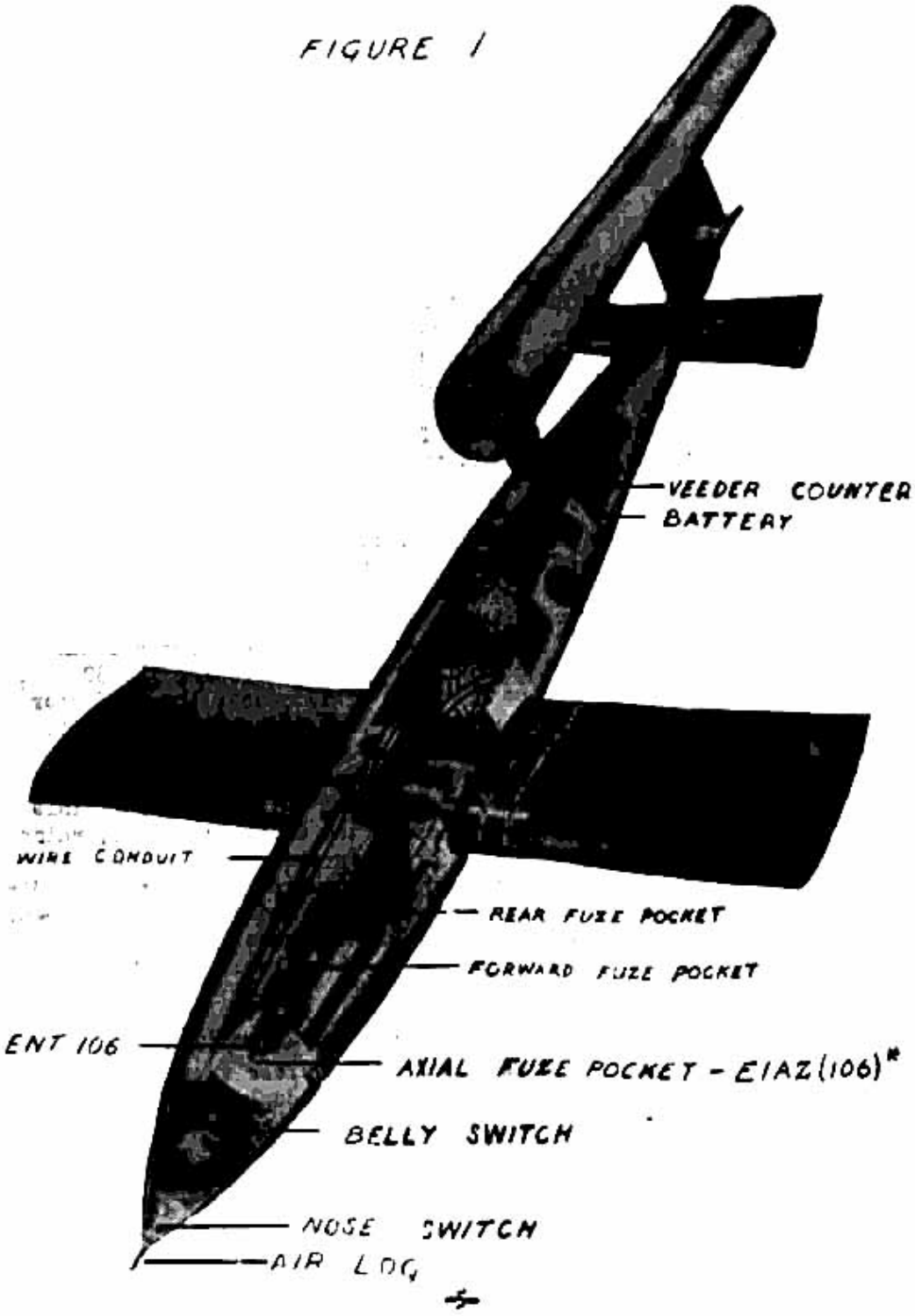
(c) Nose Switch

Directly behind the rear end of the air log shaft is the nose switch (Figure 1). This consists of a diaphragm switch that is mounted on a collapsible rod. On impact this nose switch can be closed either by the shaft of the air log being driven back closing the diaphragm switch or the outer tube may collapse and make contact with the inner tube, completing the circuit. These two (2) switches will therefore operate only if the nose of the bomb itself is subjected to impact and distortion.

(d) Belly Switch

On the underside of the nose housing is a projection or "Blister" in which is housed the belly switch (Figure 1). This is a push button type switch consisting of a boat shaped plastic moulding hinged at the aft end to a recessed metal plate, a metal bridge piece and coil spring. It is intended to function in case the bomb glides to the ground.

FIGURE 1


FEEDER COUNTER
BATTERY
WIRE CONDUIT
REAR FUZE POCKET
FORWARD FUZE POCKET
ENT 106
AXIAL FUZE POCKET - E1AZ(106)*
BELLY SWITCH
NOSE SWITCH
AIR LOG

2. Electrical System. (cont'd)

(e) Operation

(1) Safety. For a short period after the bomb has been launched from its ramp the fuzing system remains unarmed (Figure 2). In this unarmed state switch #3 is closed, shorting out igniter #3 should the nose or belly switches be accidentally closed. Also switch #2 is open to prevent igniter #1 from functioning should the inertia bolt switch close. These switches #2 and #3 are therefore safety devices to insure that the fuze will not function until after it is armed. This is very important as it would be highly undesirable to have flying bombs accidentally hitting the ground shortly after launching detonate. The debris of crashed bombs around launching ramps shows that this safety device in many cases was successful.

(2) Arming. As the bomb progresses through the air, the airscrew of the air log rotates and through an electrical linkage causing the Veeder counter to rotate backward toward zero. The length of the safety period is determined by the initial setting of this Veeder counter. After it has turned a predetermined number of times, an electrical contact is closed, throwing the 30 volt dry battery into the fuze circuit. This causes the condenser in the ENT 106 component to become charged and fires the electric bridge through switch #1. This electric bridge ignites the thermite pot directly below it, which in turn melts the polystyrene plug of spring loaded switch #1, causing the switch to open. This prevents a possible battery drawn across the electric bridge, which after igniting the thermite pot is of no further value to the circuit. The heat from the thermite pot also melts the lumps of Wood's metal at its base, causing switch #2 to close and switch #3 to open. This movement of switches removes the shunt across igniter #2 and puts the return line to the battery into the circuit. The electrical fuzing system at this point is fully armed.

(3) Functioning. If the bomb strikes nose first the diaphragm or tube switch in the nose device may close causing igniter #2 to function. If the bomb comes in on a gradual glide the belly switch, connected in parallel to the nose switches, should also cause igniter #2 to function. If these switches fail to close the circuit to igniter #2 due to faulty wiring or damage from flak,

2. Electrical System. (e)(Cont'd)

The bomb on impact should cause the interia bolt switch rated at 150 G ± 10 to close, completing the circuit through igniter #1. Also if the electric cable in the wire conduit leading from the battery in the rear of the plane should become severed due to flak, the condenser inthe ENT 106 component should hold a sufficient charge to fire the igniters. The iron core choke coils seem to be included to keep excessive voltage fluctuations due to the Vedder mechanism from entering the circuit. The functioning of either or both of the igniters functions the gaine, which through the explosive train, causes the main filling to detonate.

3. Electrical Testing Equipment.

A kit for testing the electrical fuzing system for the FZG 76 is contained in a wooded box 13" x 10½" x 6" (Figure 3). It is painted grey overall and marked on the lid in white stencil:

" Z L P M 76 , 18 - 949A - 1 "

(a) Purpose

This kit is intended to check if the circuit leading to the fuze is complete and in good condition. It is not intended to test the fuze itself.

(b) Description

The circuit testing kit contains the following parts:

(1) Voltmeter - range 0 - 30 - 300 v., for battery testing.
(2) Ohm Meter - range 0 - 10 - 00 m. ohms for testing connections and circuits.
(3) Plugs for testing items 1 and 2.
(4) Cable
(5) Fuze tightening wrench
(6) Screw driver
(7) Spanner wrench
(8) Testing Instruction Booklet for FZG 76
(9) Testing Instruction Booklet for Commercial Ohm meter.
10) Cleaning implements - for cleaning threads in fuze pocket.

WIRING DIAGRAM

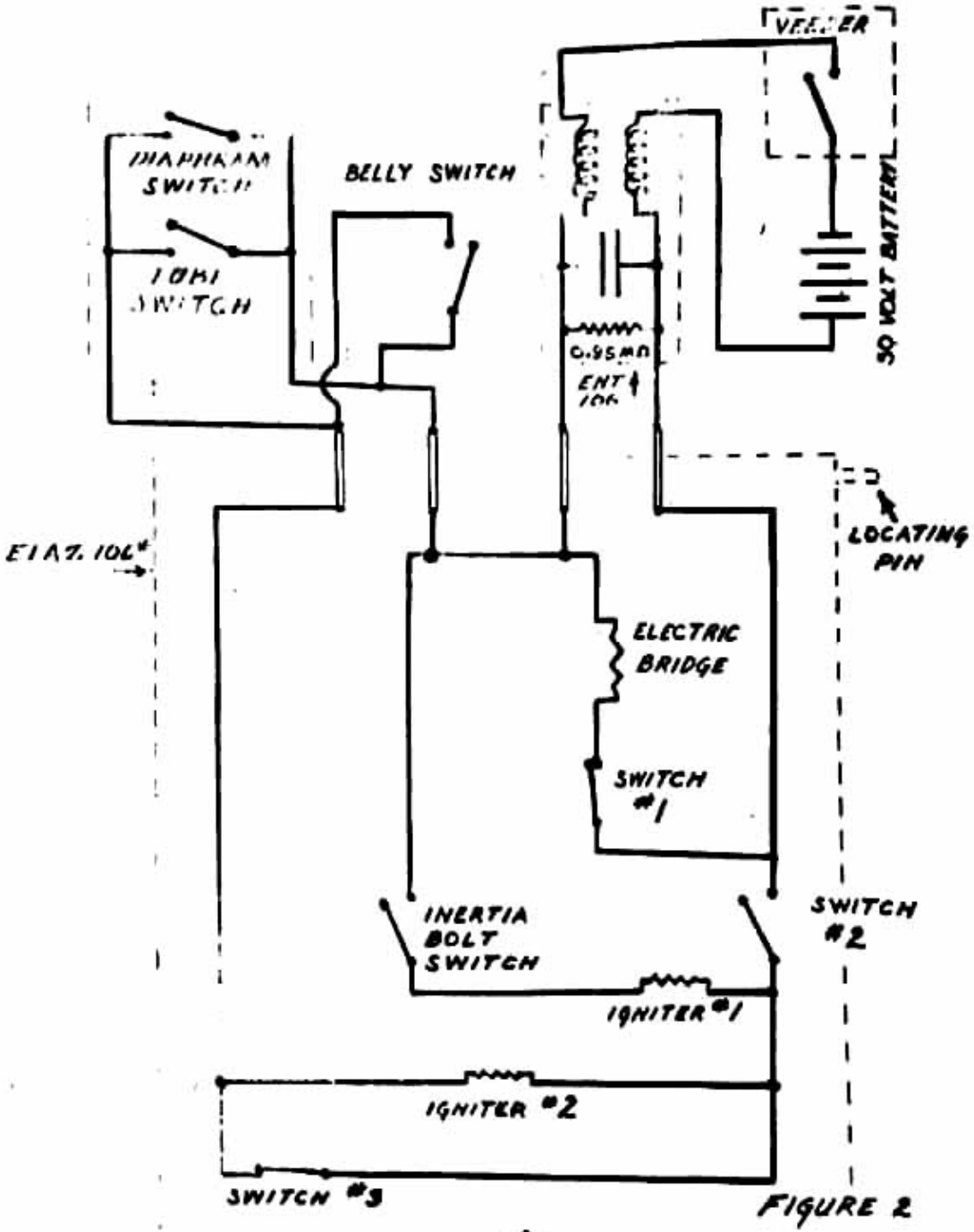
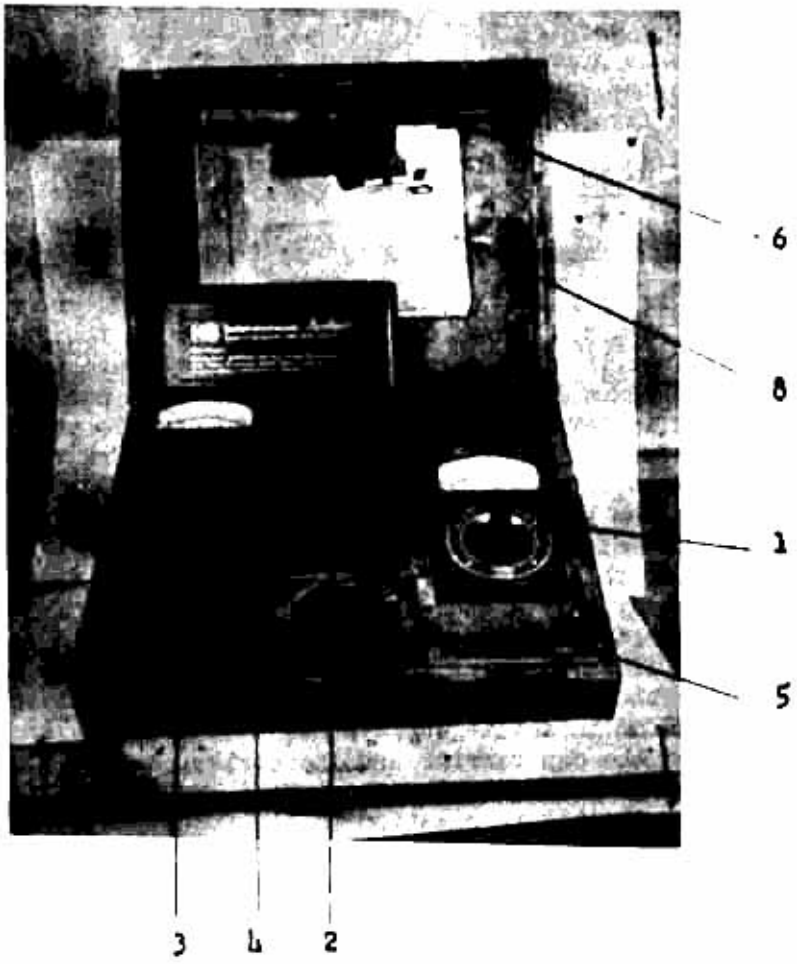


FIGURE 2



FIOURE 3

3. Electrical Testing Equipment. (b)(cont'd)

The electrical instruments are both Hartman and Braun commercial meters. This kit is a collection of tools and meters to use in the assembly shop for testing the wiring before installation of the fuses. The warning that the fuses themselves are not to be tested with this apparatus is repeated many times in the instructions because the current used to operate the ohm meter may be sufficient to fire the electric igniters in the fuse.

4. Mechanical System.

(a) Fuse 80 A

This is an allways action, clockwork armed, mechanical impact fuse (Figure 4) similar in construction to the VZ 80 fuse. This fuse is usually used in the forward fuse pocket of the warhead (Figure 1) but it may be used in both pockets. When the bomb is launched a lanyard must be used to pull out the ring fitted arming wire. This permits the clockwork mechanism to function, and after running from 45 seconds to 8 minutes (depending on the setting) the restraining arm moves free from the striker detent, permitting it to move upward under action of its spring. At this point the striker is held away from the percussion cap by only a weak anti-creep spring; the fuse is fully armed. On impact at any angle, the striker moves into the cap, the resulting flash carrying through the channel in the cap carrier and a hole in the base of the fuse to the gaine detonator. This allways action on impact is achieved by having the walls of the fuse that hold the cap carrier and the striker assembly machined in a truncated conical shape. Thus on impact with line of force other than on the horisontal in relation to the fuse, the striker and cap carrier will move in relation to the fuse body, which action will cause the striker to move into the percussion cap.

(b) Fuse Z. 17 Bm

This fuze was believed at one time to be left in flying bombs by accident, being primarily intended only as a demolition fuse. However it has been found in bombs that have malfunctioned on impact and also other bombs that have failed to detonate on

4. Mechanical System. (b)(cont'd.)

impact have exploed within the time range of this fuze. It is therefore assumed that this fuze may be used in place of an 80 A in the rear fuze pocket (Figure) 1.) As in the 80 A, it is assumed that the arming ring and pin are withdrawn from the fuse by a lanyard on launching of the flying bomb. This permits a pin from the clockwork mechanism to be pushed out, allowing the clock to start functioning, and it is also withdraws a safety catch under the head of the striker. After the lapse of the set delay time (4 to 132 minutes) the timing disc has rotated to permit a release nib to move into a slot in the disc. This permits the spring loaded striker to move forward against the cap. The flash from the cap moves through a channel to the gaine. Thismechanical fuze is fitted in the bomb to guarantee that the bomb will be destroyed if the rst of the fuzing system fails on impact. This fuze is similar to the El AZ (17) B using the same type clock. The main difference is that the 17Bm uses a mechanical pull put pin for arming in place of the electrical system employed in the Al AZ (17)B.

5. Fuze Modifications.

(a) 80 A Series Fuzes

Three (3) fuzes have been recovered that are the same in size, shape and general constructionto the 80 A with minor modifications (Figure 4).

(1) Characteristics.

	80 A	80 E	80 F	Re 4b
Powder train to gaine	No	Yes	Yes	Yes
Clock setting time	unmarked	1 min.	1 min	1 min
Clock running time	6 min 15 sec	1 min.5 sec	58 sec	1 min3sec
Clock markings	eov (95)h	eov (32)h	eov (99)h	eov(32)h
Overall Color	Grey	Grey	Grey	Green
Striker	pointed	needle	needle	needle
Percussion cap secured to carriage	Washer	screw	Washer	washer

5. Fuse Modifications. (a)(cont'd)

(2) Markings.

FUZE	CAP (black stencil)	PULL PIN (red stencil)	SIDE OF BODY (white stencil)
80 A	None	80 A (stamped)	None
80 E	80 E	80 E (stenciled on stamp)	Re 4 b
80 F	80 F	80 F (stenciled on stamp)	Re 4 c 80 F
Re 4 b	None	80 E (stenciled on stamp)	Re 4 b (red stencil)

(3) Conclusions.

The modifications of the 80 A seems to be the addition of a powder train in place of a flash hole in the base of the fuse. Also the clockwork varies slightly in material of construction; visual inspection shows no difference other than that the clocks in the 80 E, F and Re 4 b fuses are set at manufacture and have the setting times (1 minute) engraved on them, while the clock in the 80 A is unmarked and set on installation.

(b) Fuse Re 4 A

A number of fuses marked " El A Z (106) * " had the "(106)" obliterated by an "X" and stamped below was the marking " Re 4 A" (Figure 5). Internally the fuse appeared the same in construction as the El A Z (106)*. Externally it is noted that the electric leads entering the socket adjacent to the locating pin (1) are permanently attached by staking (2). The reasons for this modification and change in designation are unknown.

(c) Fuse Re 4 c

This new fuse (Figure 6) was found in quantity at a fuse dump of a V-1 assembly plant at Dannenburg, Germany.

5. **Fuze Modifications (c)(Cont'd.)**

(1) Marking: On cover cap and on the safety pin retaining plate in a white stencil: "El AZ Re 4 c c y f a"

(2) Overall Color: Bright Blue

(3) Length: 4-3/4" (Longest of any V-1 fuzes)

(4) Construction: This fuze is composed of parts and features of three (3) other V-1 fuzes. It is thought that the Germans redesigned a fuze using the delayed clockwork arming of the 80 A, the charge holding condenser of the Ent (106) component, and the safety switches, inertia bolts and igniters from the El AZ(106)*, using the best features from three (3) fuzes and reducing them into one fuze. The head of the fuze resembles an 80 A with a pull ring (1) held in place by a thin retaining plate (2). Two electric leads (3) enter the fuze head, their free end being attached to a threeprong plug (4). This plug varies from the type found in the El AZ Re 4 in that it is oblong instead of round, in the normal manner one of the pins serves for locating only.

The clockwork mechanism is of the normal 80 A type and is started operating by the withdrawal of the pull ring (1) and pin. After running for one minute (in the samples tested) a pin is released. But different from the 80 A where this pin served as a safety holding the all-ways striker away from the cap, this pin jumping upwards allows two (2) spring loaded switches to close, putting the external leads into the circuit. The fuze is then ready to be armed by the application of electricity to the leads, charging the internal condenser. There are two (2) inertia bolt switches connected inaprallelm one rated at 350 G ± 10 percent while the other rated 150 G ± 20 percent. The switch that takes less G to operate it is connected to a delay type igniter, while the one requiring 350 G is connected to a normal electric squib. Two resistances rated at 1.0 M. Ohms are fitted in the charging circuit. The condenser is the same type and size found in the Ent (106) component. This fuze may have been intended for use in conjunction with the piloted flying bomb.

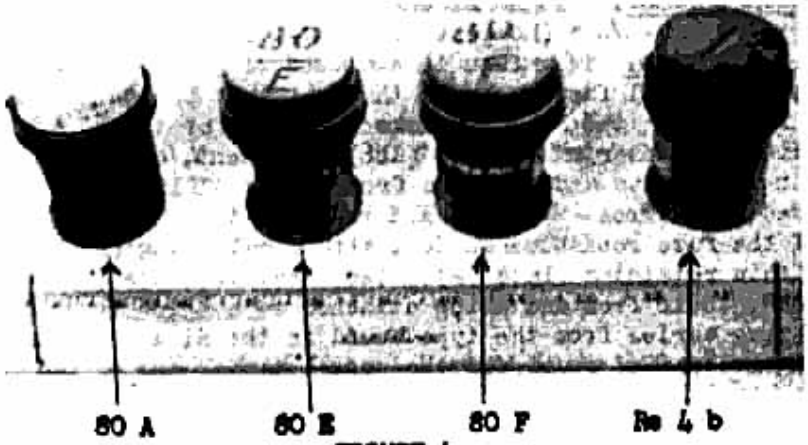
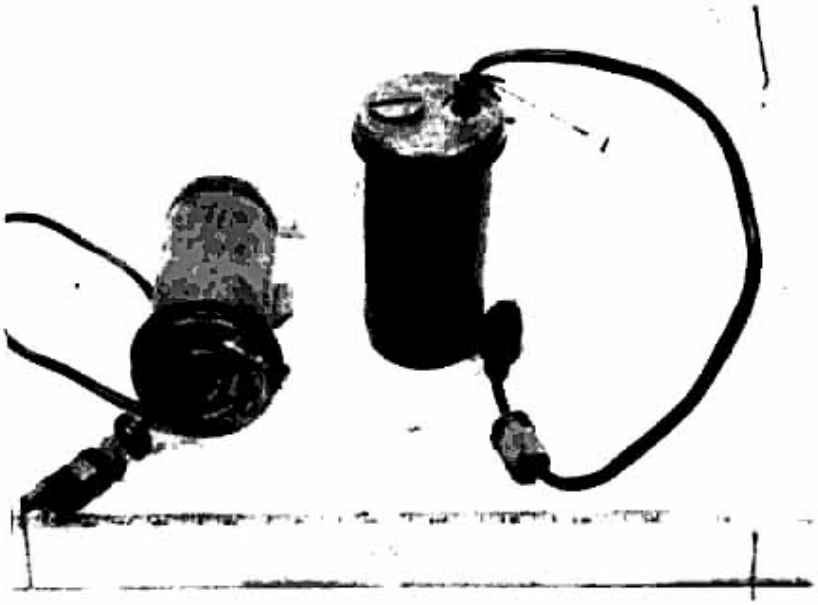
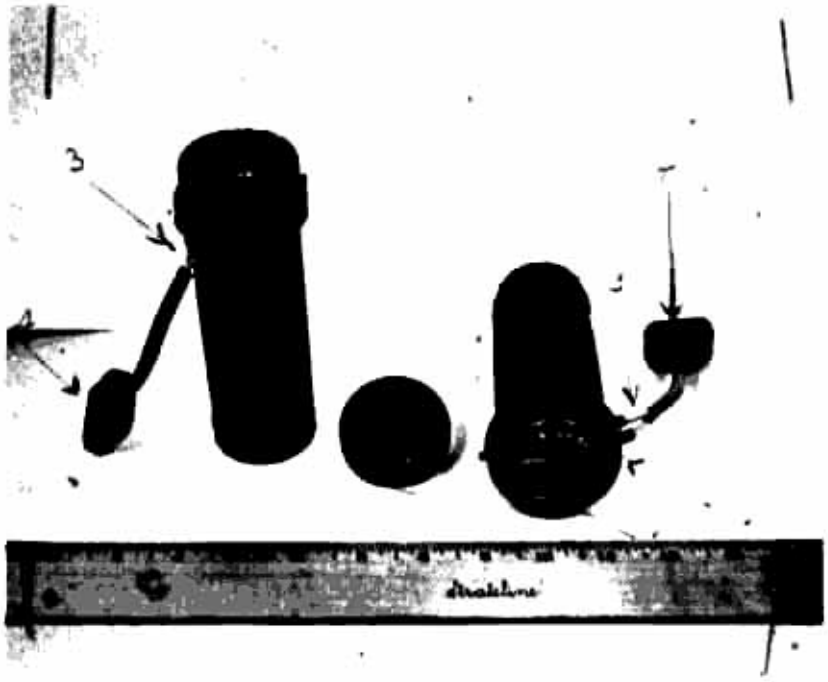


FIGURE 4



Re 4 A
FIGURE 5



Re 4 c

FIGURE 6

6. Shipments.

Samples of all the fuses mentioned in this report as well as the test kit and complete flying bombs of both the normal and piloted type have been shipped to the Ordnance Investigation Laboratory, Indian Head, Md., USA.

Prepared by:

Herman M. Fogel
Lt. (jg) USNR