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WAR DEPARTMENT

U.S. Dept. of Army

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

FUZE SETTER T15

October 17, 1941

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TECHNICAL MANUAL }
No. 9-1641

WAR DEPARTMENT,
WASHINGTON, October 17, 1941.

ORDNANCE MAINTENANCE

*FUZE SETTER T15 (M13)

Prepared under direction of the
Chief of Ordnance

	Paragraph
General	1
Description	2
Operation	3
Major units	4
Inspection	5
Maintenance and repair	6
Care and preservation	7

	Page
APPENDIX. List of references	22

1. **General.**—*a. Purpose.*—This manual is published primarily for the information and guidance of ordnance maintenance personnel.

b. Scope.—This manual supplements the Technical Manuals which are prepared for the using arm. It contains general descriptive matter and detailed instructions for maintenance and repair of the fuze setter by ordnance personnel. Figures herein show the placement and method of fastening of each of the component parts of the fuze setter.

c. References.—See appendix for Standard Nomenclature Lists and other publications pertaining to the fuze setter.

2. **Description.**—*a.* The fuze setter T15 (figs. 1 and 2) is a manually operated device used for setting time fuzes of 90-mm anti-aircraft gun ammunition in accordance with electrically transmitted fire-control data.

b. The fuze setter is arranged to be mounted at the left of the gun mount, behind and below the breech. A short length of 13-conductor flexible cable fitted with a receptacle is provided for plugging into the gun junction box on the gun mount to connect the fuze setter to the circuits of the data transmission system (see app.) and to supply power for the lights.

c. The fuze setter is constructed to function accurately without regard to the initial axial position in which the round is inserted in the fuze setter, or to the initial setting of the fuze. A fuze previously set may be reset to any other setting by reinserting the round into the

*Fuze setter T15 was standardized as fuze setter M13 subsequent to preparation of this manual.

fuze setter and proceeding as with a new round. After a fuze has been set and as long as the round remains undisturbed in place in the fuze setter, the fuze can be adjusted to a new setting by continuing the setting operation.

d. A fuze is a mechanical device used with a projectile to detonate it at the time and under the circumstances desired. Fuzes may be classified in two principal types: those which function by time action

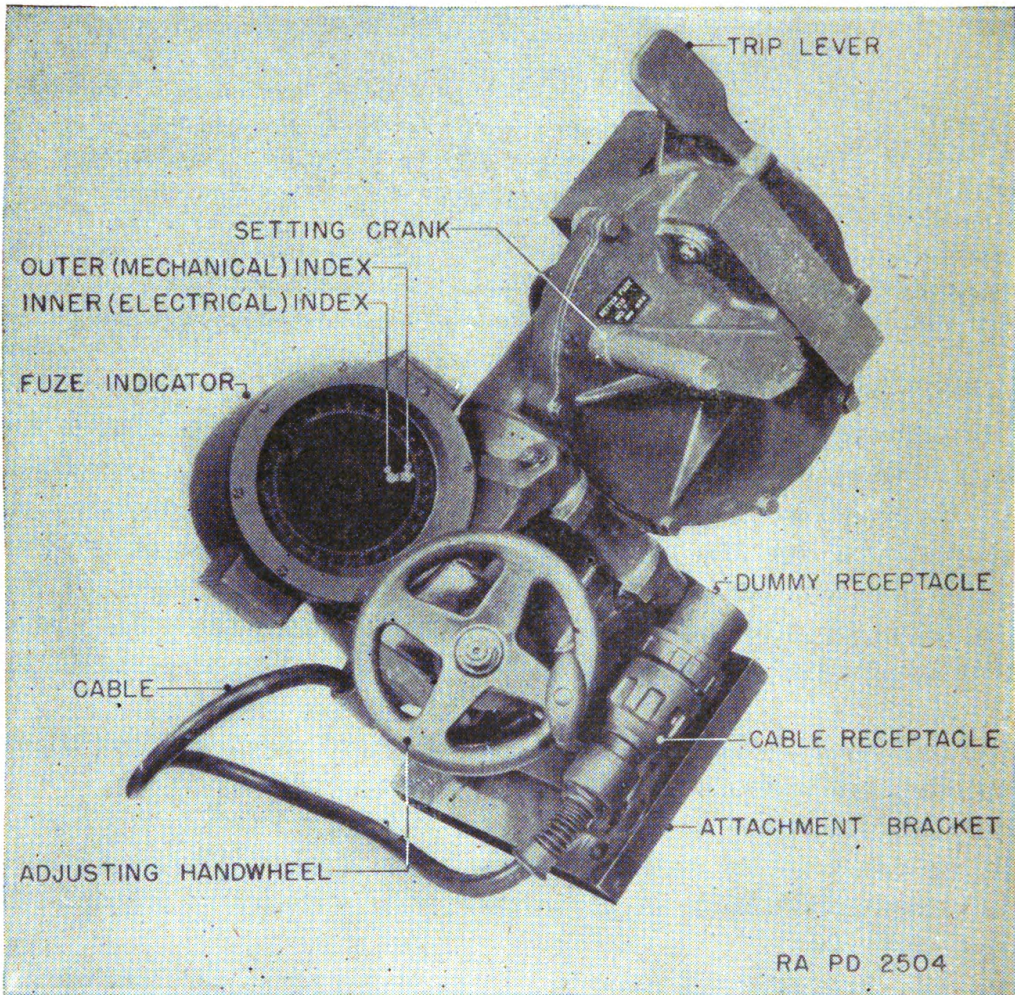


FIGURE 1.—Fuze setter T15—closed.

a certain number of seconds after firing; and those which function as the result of impact of the fuze or the projectile with a resistant object.

e. Adjustments are necessary on time fuzes in order to control their action at various distances from the gun. These settings are made by turning a graduated ring on the fuze body so that an index line points to the proper graduation of the movable ring.

f. The fuze setter consists principally of the fuze indicator, adjusting mechanism, and setting mechanism.

(1) The fuze indicator contains a standard a-c synchronous repeater which operates as part of the data transmission system (see app.). The inner (electrical) index is mounted on the repeater shaft. The outer (mechanical) index, which forms the other element of a follow-the-pointer drive, is geared (1:1 ratio) to the adjusting mechanism and also provides an indication of fuze range on the associated scale. When the two indexes are matched, the agreement of the position of the adjusting mechanism with the data received from the director is indicated.

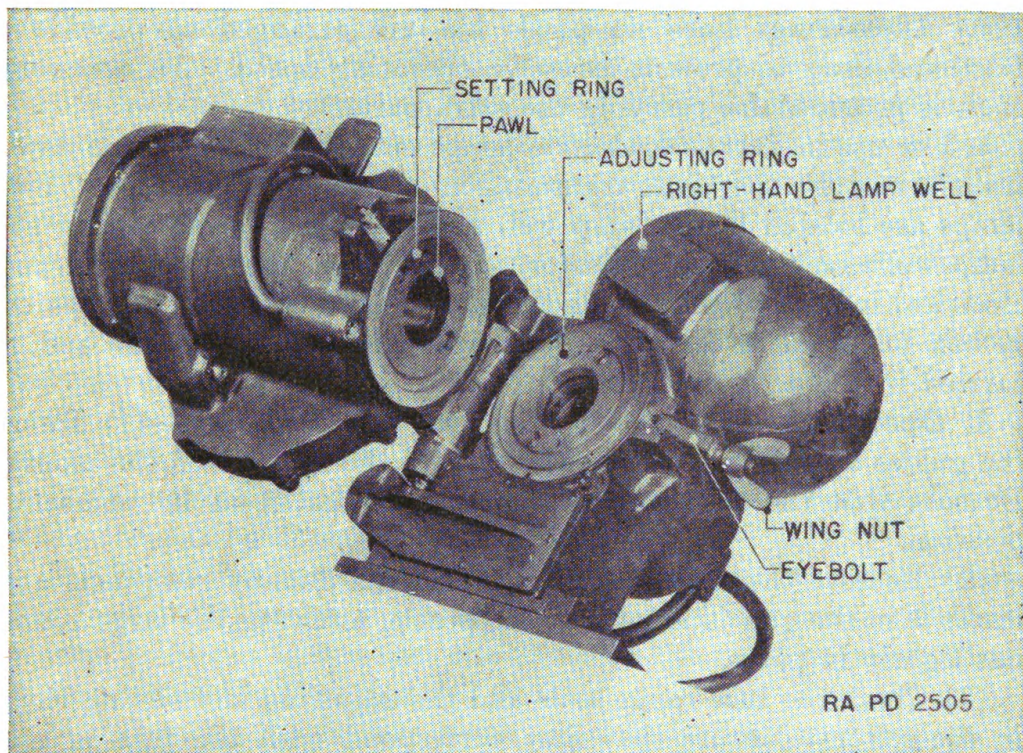


FIGURE 2.—Fuze setter T15—open.

(2) The adjusting mechanism, housed below the fuze indicator and geared thereto, contains the adjusting ring (fig. 11), the pawls of which engage with the movable (forward) ring of the fuze. This mechanism is driven by the adjusting handwheel.

(3) The setting mechanism is located behind the adjusting mechanism and is pivoted on a hinge pin to permit the setting mechanism to be swung open for cleaning. This mechanism contains the setting ring (fig. 11), the pawls of which engage the fixed (rear) ring of the fuze, and is driven by the setting crank. By means of an

internal ratchet-and-stop arrangement, the setting crank is released when the trip lever is pressed and it may then be rotated a full turn before again encountering a stop. This motion rotates the setting ring exactly two full turns. During the first turn, the pawls thereof engage with the fixed ring of the fuze. The entire round turns for the remainder of the limited travel, in the course of which the movable ring of the fuze is also engaged by the pawls of the adjusting ring.

g. For use with different types of fuzes, separate scales, setting rings, and adjusting rings are furnished. These parts are clearly marked to indicate the fuze type. The rings provided for the dummy fuze consist of an adjusting ring and a brake ring assembly (fig. 12). These rings have no pawls but are arranged to provide a frictional drag to prevent excessive operating speed. An accessory chest is provided for carrying the extra parts.

h. For use in darkness, electric lamps energized from a step-down transformer in the data transmission system are provided. Two lamps are located in the lamp well above the guide, and two in the lamp wells on the fuze indicator. In addition, the mechanical and electrical indexes of the fuze indicator are filled with luminous paint. A box of 10 spare lamps is furnished with the fuze setter and is carried in the accessory chest.

3. Operation.—*a. To place fuze setter in operation.*—(1) Insert the guides on the bracket into the slots in the support on the mount. Be sure that the fuze setter is completely seated in its operating position.

(2) Remove the cable receptacle from the dummy receptacle and insert it in the gun junction box receptacle, screwing the large round nut tightly in place.

(3) Check the fuze range scale and the adjusting and setting rings in the setter to insure that they correspond with the fuze in use. The fuze setter may be swung open for examination by backing off the wing nut on the eyebolt. Instruction for changing scales and rings, when necessary, is given in *f* and *g* below. Be sure that the fuze setter is closed and the wing nut tightened before attempting to set fuzes or to lift the fuze setter.

b. To set fuzes.—(1) Two operators are required, one for the setting mechanism and one for the adjusting mechanism. In addition, certain operations are to be performed by personnel of the loading detail.

(2) The operator of the adjusting mechanism continuously keeps the mechanical (outer) index matched with the electrical (inner)

index regardless of whether a round is in the setter or not. In lieu of matching indexes, he may instead set the mechanical (outer) index to a desired indication on the fuze range scale.

(3) The operator of the setting mechanism maintains a light pressure on the setting crank in a counterclockwise direction. As soon as the crank is free to move, he turns it one full turn counterclockwise until a stop is encountered.

(4) The fuze setter server inserts the round fully into the setter, then momentarily depresses the trip lever releasing the setting crank. As the seated round is not locked in the setter, the revolution of the setting crank should be completed while the fuze setter server keeps the round seated in the setter by a slight pressure of the palm of his hand against the base of the cartridge case. The use of a heavy glove on the right hand of the fuze setter server will reduce materially the friction between his hand and the rotating cartridge base. Immediately after the fuze is set, the fuze setter server steps aside and the relayer withdraws the round, being careful not to turn it until the fuze is entirely disengaged from the setter pawls.

c. To reset fuze previously set.—Follow the same procedure as given above for making the initial setting.

d. Rules for accurate setting of fuzes.—Accurate setting of fuzes is dependent on—

(1) Placing the round into the fuze setter and allowing it to settle into position before touching the release lever.

(2) Keeping the indexes of the fuze indicator matched at all times while the setting operation is in progress.

(3) Exercising care not to turn the round when removing it from the fuze setter, at least not before the round has been withdrawn several inches to insure that the pawls in the rings are clear of the setting elements of the fuze.

(4) Turning the setting crank until it is definitely stopped by the stopping pawl.

(5) Keeping the pawls in the adjusting and setting rings lubricated and free from chips of metal, paint, or other foreign substance.

e. To place fuze setter in traveling position.—Remove the cable receptacle from the gun junction box and attach it to the dummy receptacle, wrapping the cable around the fuze setter. Grasp the fuze setter by one of the large main castings, lift it from the bracket provided for operating, and place it in the bracket provided for traveling. Cover it with the canvas cover provided.

f. To change setting and adjusting rings.—(1) The fuze setter is issued with setting and adjusting rings for the dummy fuze

M44A2 and scale for the 30-second mechanical time fuze M43 in place. It will therefore be necessary to install the other setting and adjusting rings before any other fuzes can be set.

(2) To set up the fuze setter for use with ammunition fuze with the 30-second mechanical time fuze, remove the rings for the dummy fuze and assemble those marked "mechanical time fuze M43." To change the rings, open the fuze setter and remove the screws holding the dummy fuze rings in place. Then assemble the adjusting ring to the adapter and the setting ring to the socket. Tighten all screws securely. Check pawls to see that they operate freely.

g. To change fuze range scale.—(1) If the fuze setter has been used with ammunition fuze with the 25-second powder train time fuze, and if the 25-second scale is still in place in the fuze indicator, it will be necessary to replace the 25-second scale with the 30-second scale before using ammunition fuze with mechanical time fuze M43. The fuze range scale for the 25-second powder train time fuze is no longer issued.

(2) To change the scales, carefully remove the fuze indicator window frame so as not to injure the gasket. Next remove the six screws and the ring which clamps the scale in place. Carefully remove the scale, wrap it in soft tissue paper, and place it in the lid of the accessory chest. Set the other scale in place with its outer rim in the groove. Replace the clamping ring and insert the six retaining screws, leaving the screws just loose enough to allow the scale to be moved. Place a round in the fuze setter, set the fuze, and read the setting on the fuze as closely as possible. Insert a blunt point in the hole in the scale and slide the scale around under the ring until the value set on the fuze is opposite the indicating mark on the outer index. Recheck at another fuze setting and if setting of scale is correct, tighten the clamping screws securely. See that all three dials are clear and do not rub when the handwheel is turned through a complete cycle.

h. To replace electric lamps.—To replace electric lamps, the covers over the lamp wells may be removed and replaced, care being exercised to see that the gaskets are not injured and are properly replaced. Use only 3-cp, 6-8 volt miniature lamps with G-6 bulb and double contact bayonet base for replacement.

i. Field tests and adjustments.—(1) Check the indications of the mechanical index on fuze range scale frequently against the actual value of fuze range indicated on the fuze. Adjusting procedure is given in *g*(2) above.

(2) Lost motion in the setting mechanism may be detected by making the above check first with pressure exerted on the setting crank

in one direction, then in the other, after the setting has been made. Lost motion in the adjusting mechanism may be detected by approaching the indication on the fuze range scale first in one direction, then in the other. In either case, no appreciable difference in the actual value of fuze range indicated on the fuze for the two directions should be noted.

(3) Check the indications of the electrical index frequently. With the data transmission system connected and energized, set mechanical (outer) index to the same value of fuze range indicated on the associated director dial. If the electrical (inner) index is not in agreement, repeat check at several values throughout operating range. Any necessary adjustment (synchronization) of the electrical index is performed as follows:

(a) If a small movement of the electrical index is required, remove cover over right-hand lamp well and turn slotted shaft projecting above lamp until indexes are properly aligned. Replace cover and gasket. This motion is limited to approximately 35° in either direction from a central position.

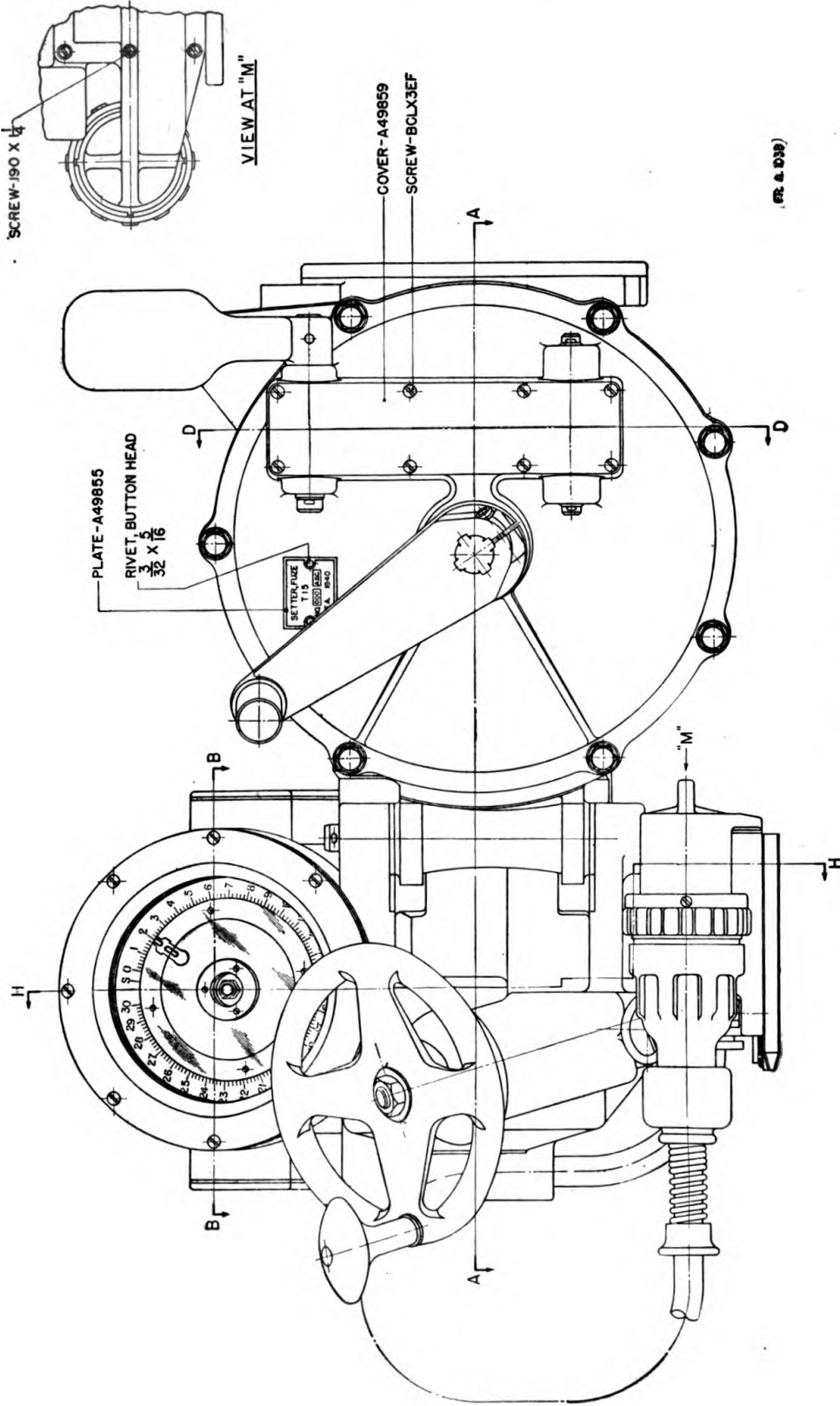
(b) For greater movement, remove window frame, loosen the three screws in central clamping ring, and rotate electrical (inner) index to the desired position by pressing lightly with the finger on two points 180° apart. Tighten screws, shut off power, and check to see that index clears without rubbing throughout a full revolution. Replace window frame.

4. Major units.—For location of parts see figures 3 to 9, inclusive. For electrical connections see figure 10.

a. The fuze indicator and adjusting mechanism are inclosed within the case (D29073, fig. 5), and the setting mechanism is housed within the body (D29365). The body is hinged to the case by means of the hinge pin (A48270).

b. The fuze indicator (figs. 8 and 9) consists of an a-c synchronous repeater (C56701) mounted in the upper portion of the case (D29073) in such a manner that its housing may be rotated approximately 35° in either direction. The rotation is effected by means of the worm (A46090) which is connected to the flexible shaft (B136485A), and is for the purpose of synchronizing the inner (electrical) index (B136516) with the outer (mechanical) index (C56916) when the latter is set to the fuze setting indicated by the director.

c. The adjusting mechanism is contained in the lower portion of the case (D29073) beneath the fuze indicator. The adjusting ring (C69699) is rotated by means of the adjusting handwheel (B137241, fig. 7). Movement of the adjusting ring is transmitted to the fuze



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FIGURE 3.—Fuze setter T15—assembled view.

FUZE SETTER T15

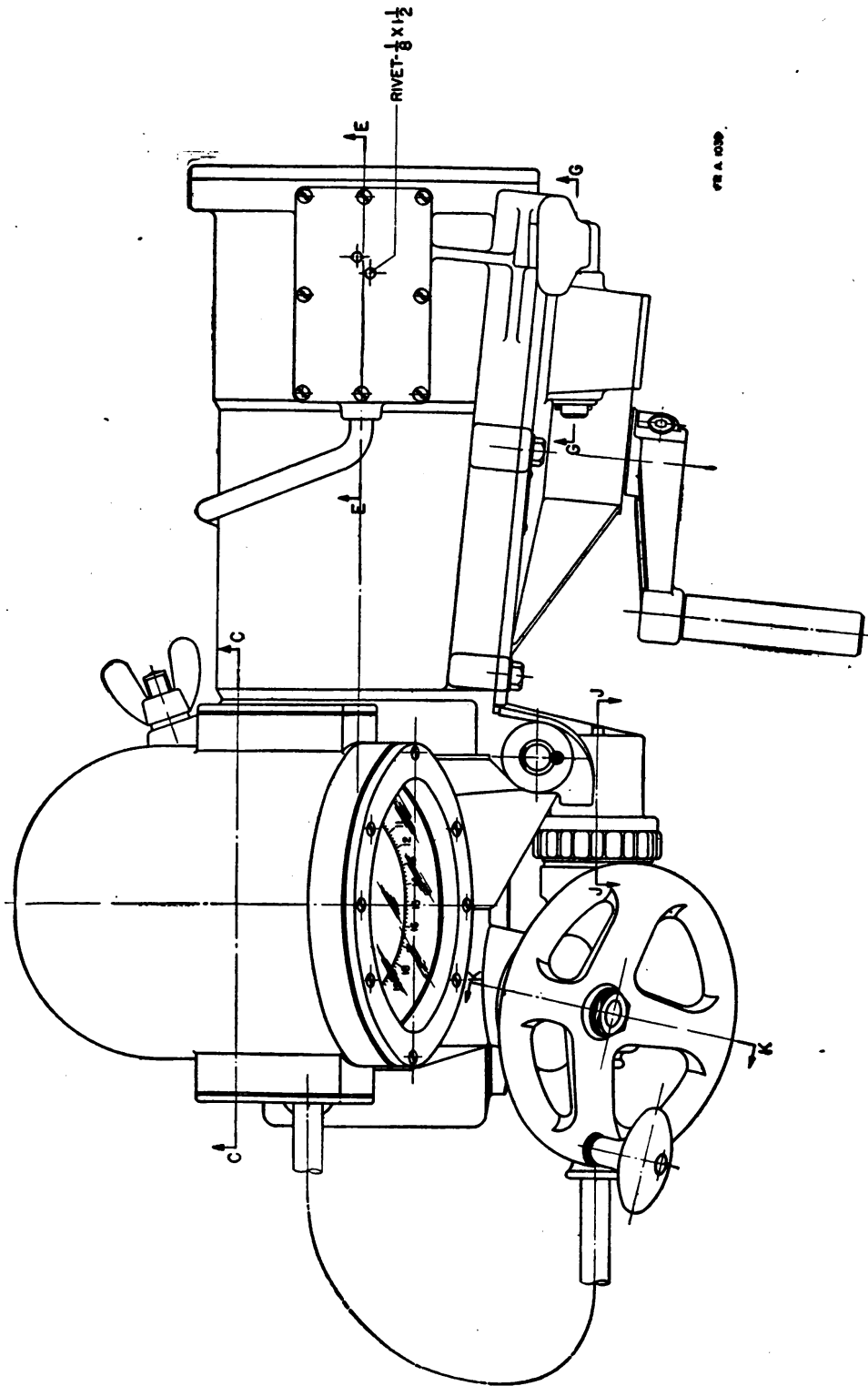


FIGURE 4.—Fuze setter T15— assembled view.

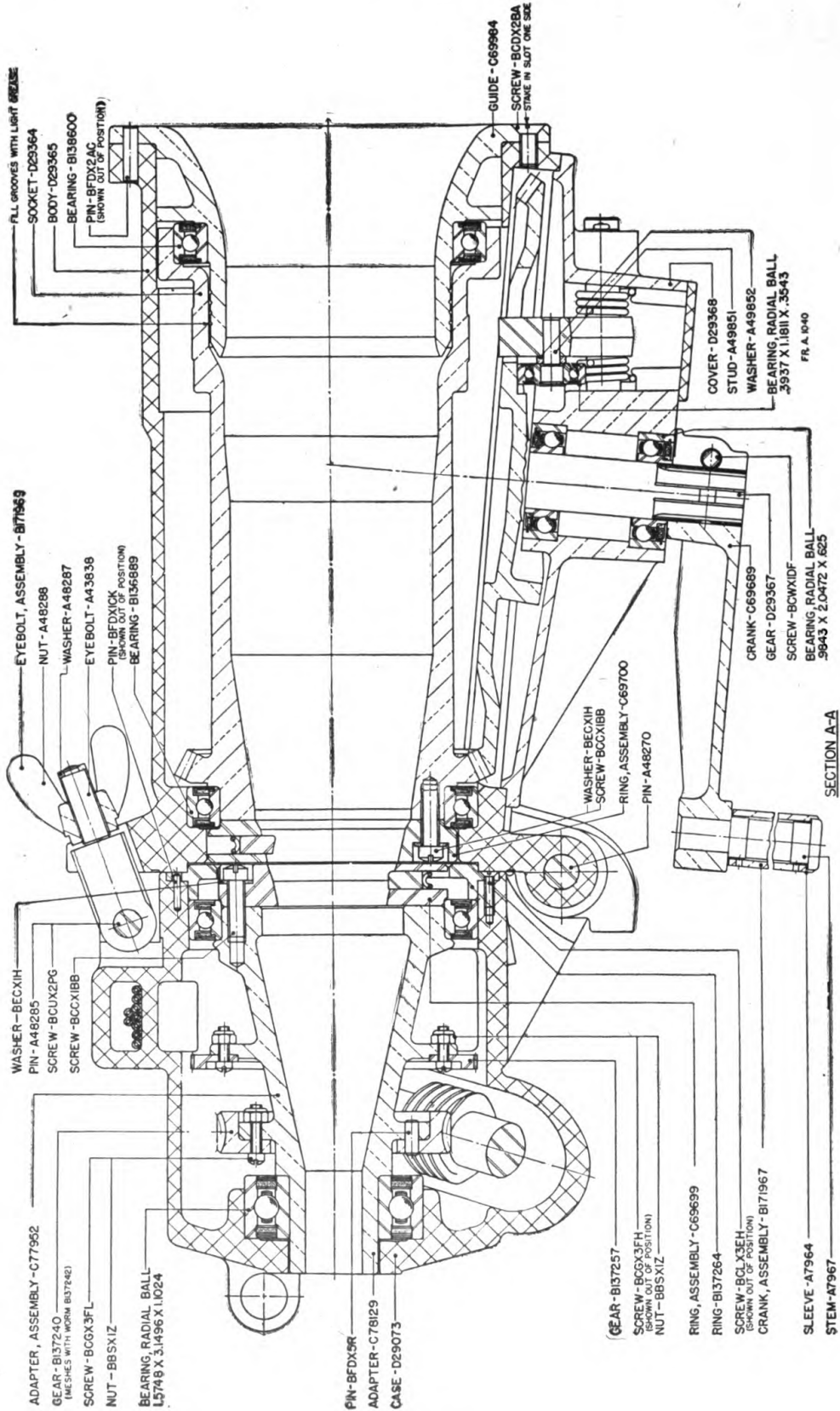


FIGURE 5.—Fuze setter T15—sectioned views.

FUZE SETTER T15

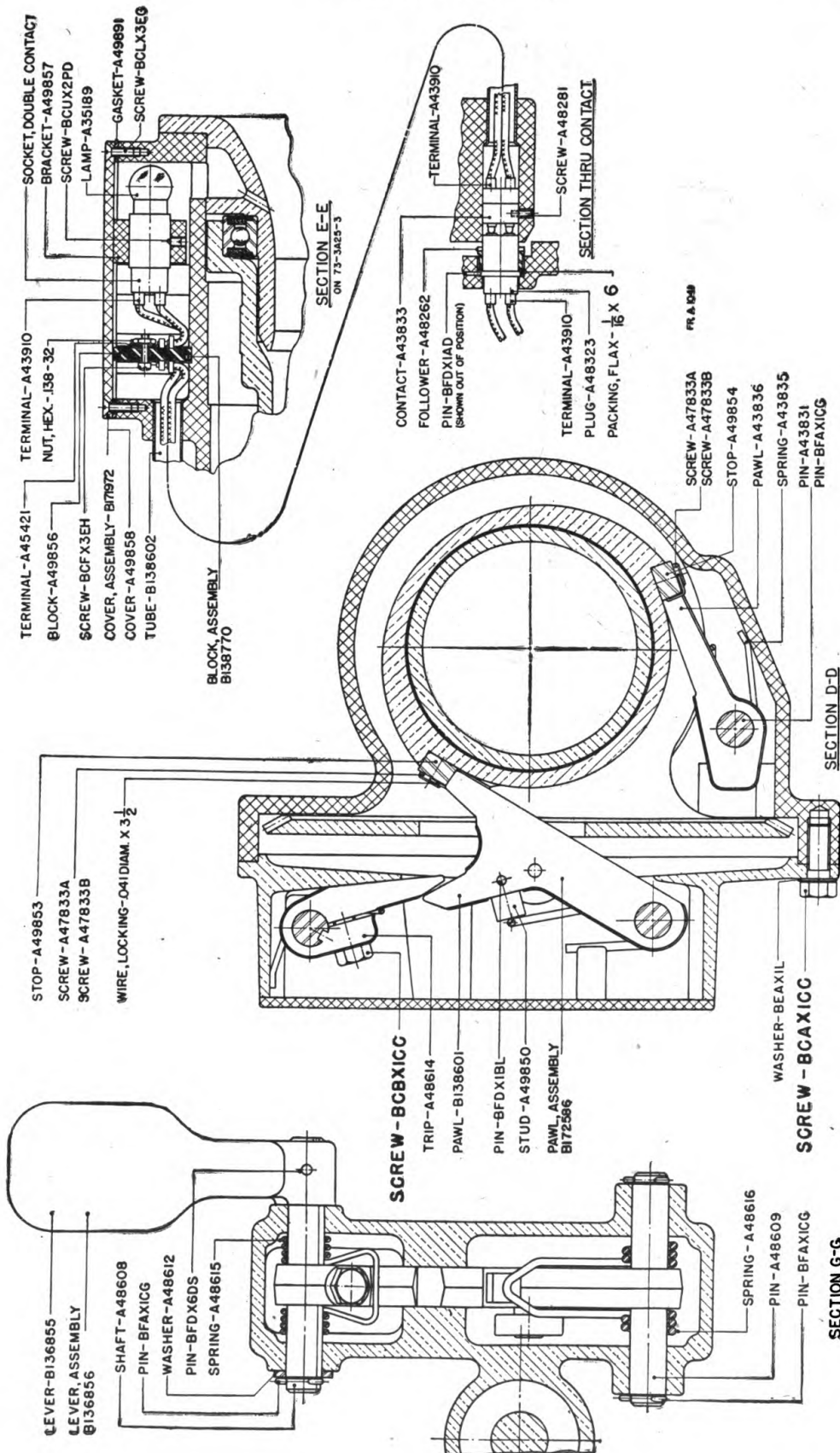


Figure 6.—Fuze setter T15—sectioned views.

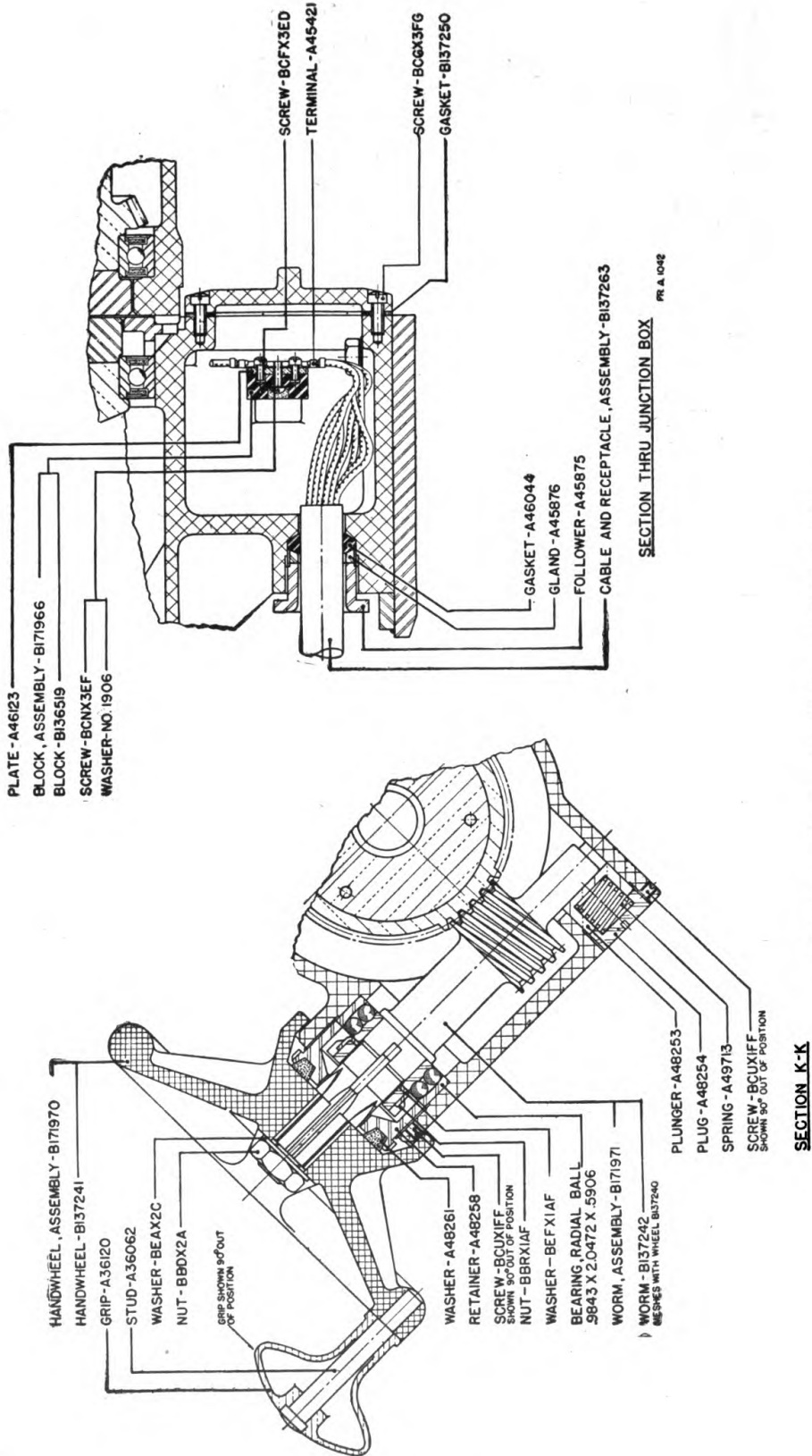


FIGURE 7.—Fuze setter T15—sectioned views.

FUZE SETTER T15

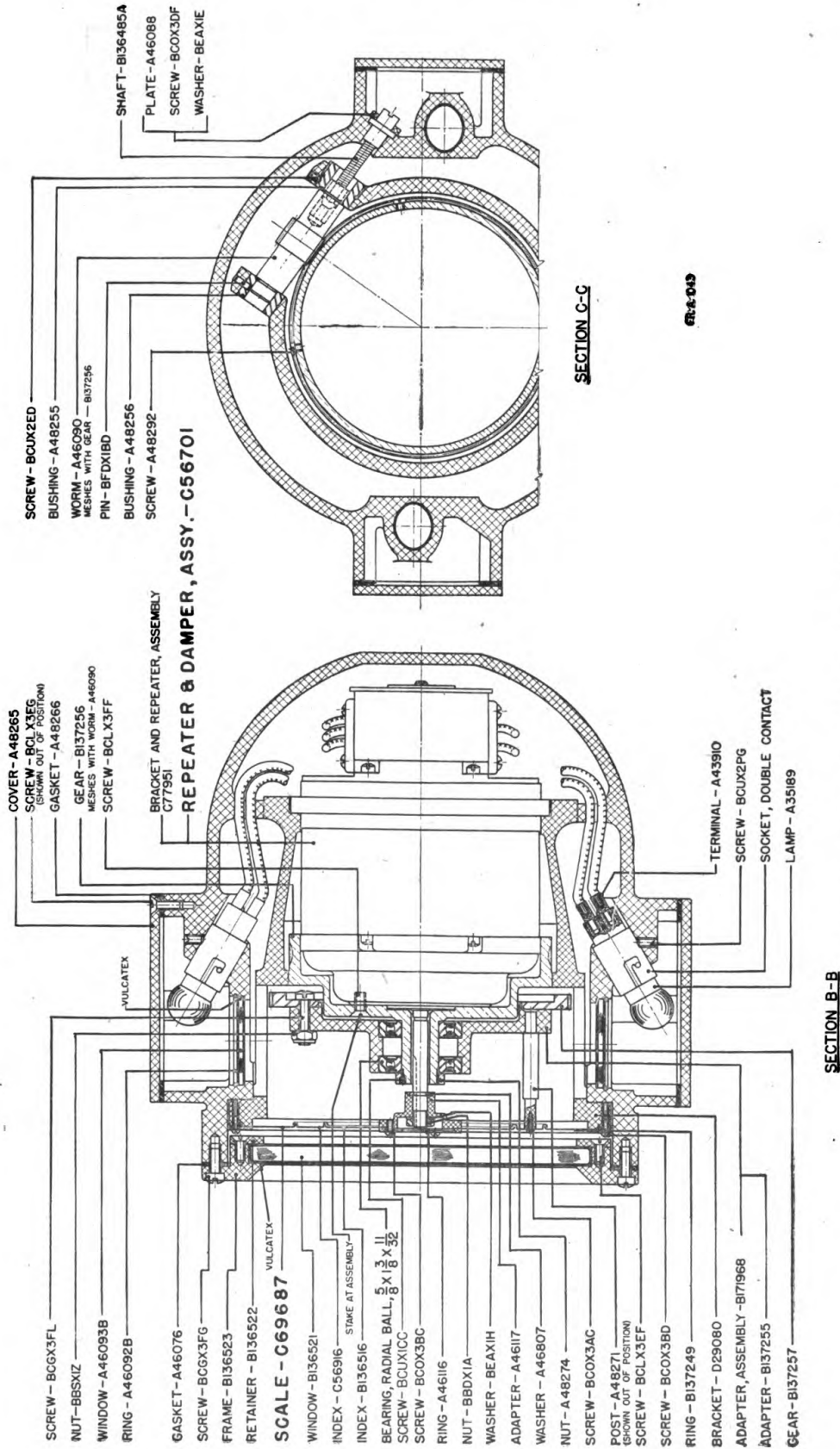


FIGURE 8.—Fuze setter T15—sectioned views.

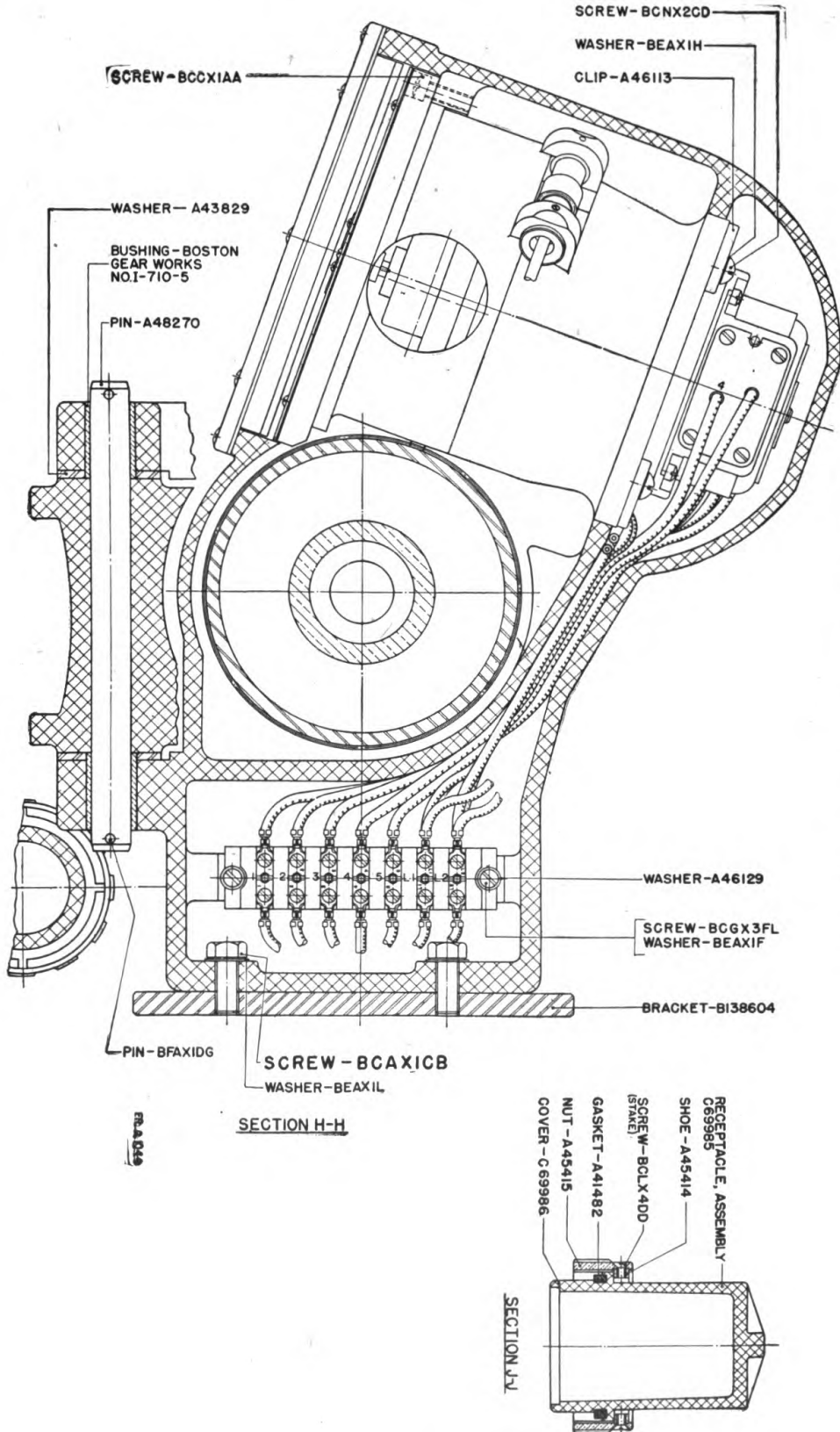


Figure 9.—Fuze setter T15—sectioned views.

range scale by a spiral gear (B137257, fig. 5) on the adjusting ring adapter (C77952) meshing with a similar spiral gear (fig. 9) in the fuze indicator.

d. The setting ring (C69700) is rotated by means of the setting crank (C69689, fig. 5). The setting ring makes two complete turns during the setting cycle, equal to a complete turn of the setting crank. The locking and release of the setting ring and crank is controlled by the stopping pawl (B138601) and rebound pawl (A43836, fig. 6). The stopping pawl is disengaged at the start of the setting cycle by striking the trip lever (B136855) which causes the trip (A48614) to lift the stopping pawl clear of the stop (A49853). A ball bearing

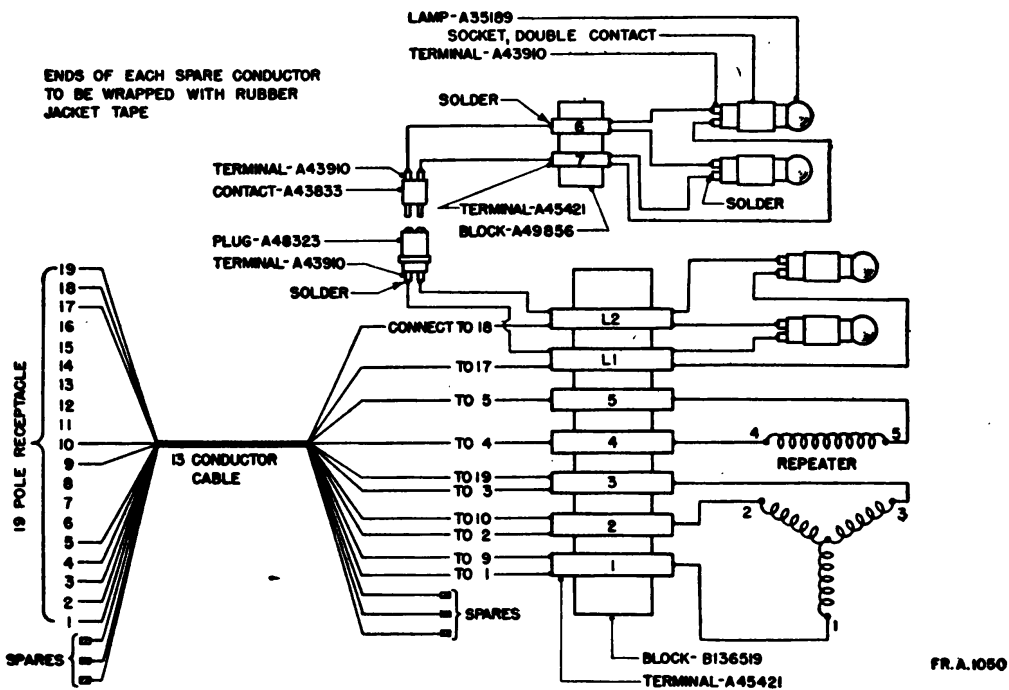


FIGURE 10.—Wiring diagram for fuze setter T15 (for color code of conductors see par. 4f).

on the stopping pawl rides on a cam surface of the setting gear (D29367, fig. 5), as the setting crank is rotated, thereby maintaining clearance of the stopping pawl during the setting cycle. At the end of the setting cycle, the stopping pawl drops back into engagement with its stop. At the same time, the rebound pawl (A43836, fig. 6) springs into engagement with its stop (A49854) thereby preventing reverse rotation of the setting mechanism. The fuze setter is then in readiness to repeat the setting cycle.

e. The adjusting and setting rings for use with ammunition fuzed with mechanical time fuze M43 are shown in figure 11. The adjusting and brake rings for use with dummy fuze M44A1 are shown in

figure 12. These ring combinations are interchangeable with each other, the proper combination depending on the fuze type.

f. The fuze setter is provided with a 19-hole receptacle on the end of a short section of 13-conductor flexible cable for connection to the gun junction box on the carriage. A dummy receptacle is provided for storing and sealing the cable receptacle when not connected to the gun junction box. The conductors of the transmission cable are color coded. The terminals to which each conductor is connected are shown in the table below :

Terminals		Color coding of conductors	Connected to—
Fuze setter	Cable receptacle ¹		
1.....	1	Orange—white tracer.....	Fuze range repeater armature.
2.....	2	Orange—black tracer.....	
3.....	3	Orange.....	
4.....	4	White.....	Power (115 volts).
5.....	5	Black.....	
Spare ²	Red—white tracer.....	Spare ² .
Spare ²	Red—black tracer.....	
Spare ²	Red.....	
1.....	9	Green—white tracer.....	Fuze range repeater armature.
2.....	10	Green—black tracer.....	
3.....	19	Green.....	
L1.....	17	White—black tracer.....	Power (6 volts).
L2.....	18	Black—white tracer.....	

¹ Receptacle terminals 6, 7, 8, and 11 to 16, inclusive, not connected.

² Ends to be wrapped with rubber jacket tape.

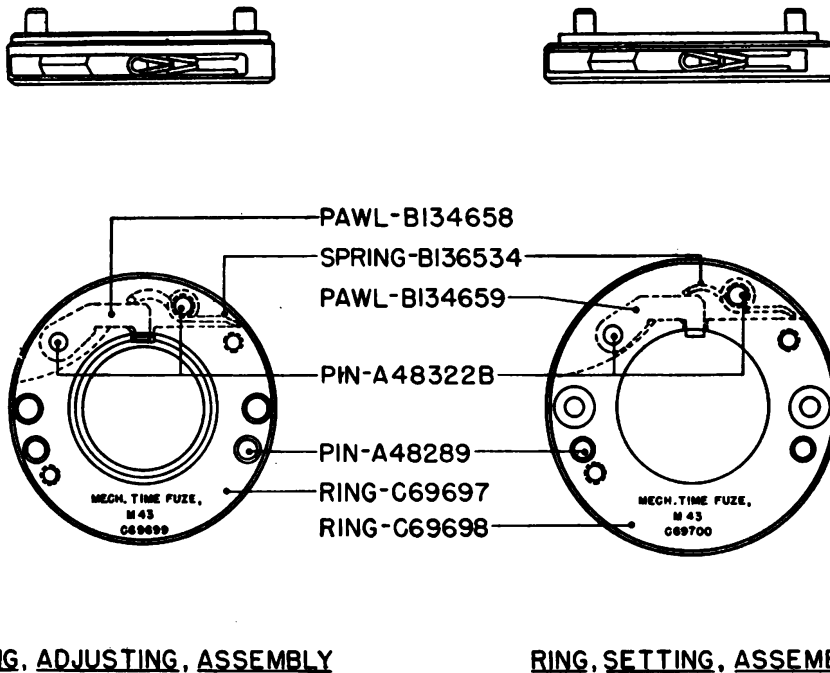
5. **Inspection.**—The purpose of inspection is to determine the condition of the fuze setter, whether repairs or adjustments are required, and the remedies necessary to insure serviceability and proper functioning. The listing below will serve as a general guide for inspection. (See figs. 3 to 9, incl., for location of parts.)

a. *Exposed mechanical parts.*—Note damaged or missing parts, loose or missing screws, and general appearance.

b. *Adjusting and setting rings.*—(1) See that the normal complement of rings accompanies the fuze setter (refer to SNL F-211).

The rings furnished for mechanical time fuze M43 are the adjusting ring assembly (C69699) and setting ring assembly (C69700). The rings furnished for dummy fuze M44A1 are adjusting ring (B172554) and brake ring assembly (B172891).

(2) Test adjusting and setting ring pawls (fig. 11) for snappy return when manually lifted from their seats. Spring pressure on each pawl should be a minimum of 16 pounds when pawl moves a maximum of 0.01 inch. Note any signs of excess wear, including upset edges, etc.



RING, ADJUSTING, ASSEMBLY

RING, SETTING, ASSEMBLY

RA PD 3047

FIGURE 11.—Adjusting and setting rings (mechanical time fuze M43).

(3) Check condition of brake ring assembly (fig. 12), with particular reference to friction facing and springs.

c. Setting mechanism.—Operate the unloaded fuze setter through several setting cycles. Stopping and rebound pawls should operate properly to limit the motion of the setting crank to a single turn in the counterclockwise direction. Setting crank should be in position shown in figure 3 when fuze setter is locked.

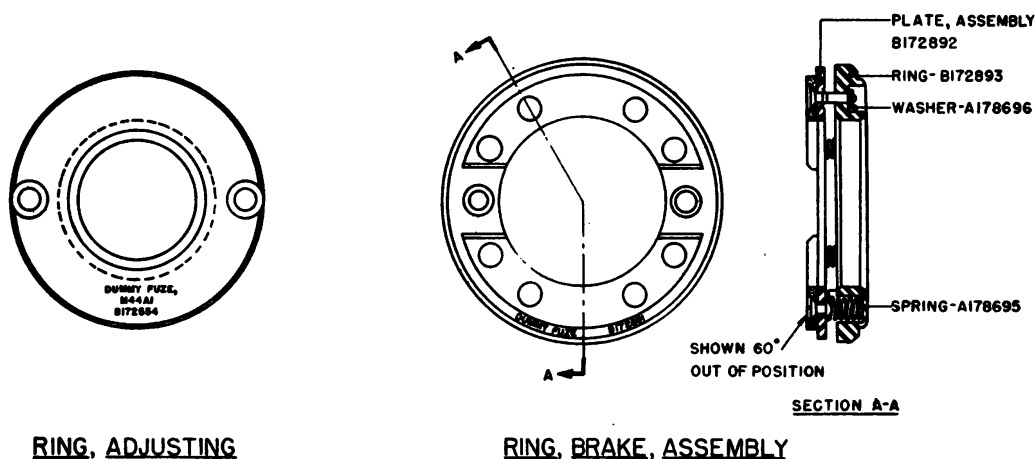
d. Adjusting mechanism.—Adjusting handwheel should operate with a smooth, uniform motion in either direction, and should transmit motion properly to the adjusting ring and to the mechanical (outer) index of the fuze indicator.

e. *Fuze indicator.*—For information pertaining to troubles encountered in synchronous repeaters and their remedies, see TM 9-1656.

f. *Illumination.*—Apply power and check illumination of the two lamps in the fuze indicator housing and the two lamps above the guide. Replace defective lamps if necessary. If this does not rectify the trouble, attempt to localize it by inspecting lamp sockets, terminal connections (fig. 10), contact (fig. 6), and wiring. Covers over terminal blocks and lamp wells are removable to permit inspection.

g. *Gaskets.*—Gasketed joints of the fuze setter should be weather-proof.

6. **Maintenance and repair.**—a. *Disassembly and assembly.*—The assembled and sectioned views and other illustrations show the loca-



RA PD 3046

FIGURE 12.—Adjusting and brake rings (dummy fuze M44A1).

tion of the various parts and the means by which they are held in place. These figures should be studied carefully before attempting any disassembling or assembling operation. When practicable, all extensive disassembly and cleaning should be performed in a closed shop room equipped with a dummy mounting bracket for clamping the instrument in a heavy vise or securing it to a workbench. Always check performance by several setting operations after reassembly.

(1) *To disassemble and assemble setting mechanism.*—(a) Remove the screws (BCEA1CC) and washers which secure the setting gear cover (D29368) and lift off the cover. The setting gear (D29367), the pawl assembly (B172586), the setting gear crank assembly (B171967), and the trip mechanism are all assembled to the cover and can therefore be removed as a unit. Removal of the cover also gives access to the

rebound pawl (A43836) and the gear teeth on the shell socket (D29364) thus permitting examination, cleaning, and lubrication of these parts.

(b) To remove shell socket (D29364) remove setting ring and guide (C69984). Screws (BCDX2BA) which secure the guide are staked in a slot on one side.

(c) Reassemble in reverse order of disassembly. Exercise care to have the tooth space on the setting gear marked "2" meshed with the tooth marked "2" on the socket.

(2) *To disassemble and assemble adjusting mechanism.*—(a) Remove handwheel assembly (B171970), secured by nut (BBDX2A, fig. 7). Loosen locking screw (BCUX1FF) which secures worm plunger plug (A48254) and remove worm plunger plug with plunger and spring. Unscrew worm bearing retainer (A48258). Remove worm assembly (B171971).

(b) Remove adjusting ring. Remove adapter bearing retaining ring (B137264, fig. 5), secured by screws (BCLX3EH) and locating pin (BFDX1CK). Extract adapter assembly (C77952). Exercise care to avoid damaging gear teeth when removing the adapter assembly.

(c) Reassemble in reverse order of disassembly. Exercise care to have the marked teeth on the adapter spiral gear and fuze indicator spiral gear meshed with each other.

(3) *To disassemble and assemble the fuze indicator mechanism.*—(a) To remove the bracket and repeater assembly (C77951, fig. 8) from the indicator housing, remove the window frame (B136523) and disconnect the lead wires from the terminal block below the adjusting mechanism (fig. 9). Disconnect the flexible shaft (B136485A) by removing the retaining plate (A46088). Remove five screws (BCCX1AA) found under fuze range scale. The bracket and repeater assembly may then be withdrawn from the indicator housing. Exercise care to avoid damaging gear teeth.

(b) Reassemble in reverse order of disassembly. Exercise care to have the marked teeth on the adapter spiral gear and fuze indicator spiral gear meshed with each other.

(c) When replacing windows, seal the joints at edges with gray Vulcatex cement, knife grade.

b. Lubrication of internal moving parts.—(1) When the fuze setter is given a general overhaul (at intervals determined by service conditions) the internal moving parts should be cleaned and freshly lubricated.

(2) Grooves in shell guide (C69984) should be filled with grease, special, low temperature. Gears and other parts requiring grease should be lubricated with this same kind of grease.

(3) Parts requiring oil should be lubricated only with oil, lubricating, for aircraft instruments and machine guns.

(4) For cleaning parts prior to lubrication, use solvent, dry-cleaning. Exercise care to avoid touching machined surfaces with the hands during this operation.

7. Care and preservation.—a. Handling.—(1) Care must be exercised in handling scales and indexes when adjusting them. They are very thin and easily deformed or damaged.

(2) When removing or replacing the covers or window frame, care should be taken not to damage the gaskets. The gaskets should be properly assembled before tightening the parts.

(3) Care should be exercised when handling the fuze setter not to bump any part of the device. Always grasp the large main casting when handling. Do not lay it down; place it in its support on the gun mount or in the traveling bracket.

(4) The adjusting and setting rings are constructed with the guide for the pawls unsymmetrically located in the heavy part of the ring, thereby causing the metal on one side of the guide to be rather thin. These thin sides if bent inward will clamp the pawls, rendering them inoperative or irregular in operation, causing erroneous fuze settings. Therefore, care should be exercised in handling the rings. They should be examined before and after assembling in the fuze setter to insure free operation of the pawls.

b. Tightening.—The screws which fasten the adjusting and setting rings in place should be kept tight at all times. The lock washers should be under the screwheads to prevent the screws from loosening. The screws should be checked frequently as they have a tendency to loosen when the fuze setter is in constant use.

c. Cleaning and oiling.—(1) Open the fuze setter frequently and remove the setting and adjusting rings for cleaning and lubricating. Coat the rings with grease to prevent rusting and lubricate the pawls and guides with a light film of oil.

(2) A few drops of oil should be applied to the hinge between the body and the case, and on the eyebolt. Oil the handle on the setting crank and the grip on the adjusting handwheel occasionally.

(3) Where lubrication with oil is indicated, use oil, lubricating, for aircraft instruments and machine guns. Where lubrication with grease is indicated, use grease, special, low temperature.

(4) No provision has been made to lubricate any of the internal moving parts in the field as the entire device should be torn down and serviced at regular intervals by trained ordnance maintenance personnel.

(5) To prevent accumulation of dust and grit, wipe off all lubricant which seeps from around the moving parts.

d. Storing.—(1) Keep the fuze setter covered with the canvas cover at all times when it is not in use.

(2) When the cable receptacle is not connected to the gun junction box, it should be stowed on the dummy receptacle.

(3) Rings which are not in use should be stored in the accessory chest.

(4) The alternate scale should be wrapped in soft tissue paper and kept in the recess in the block fastened in the lid of the accessory chest.

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

Setter, fuze, T15.....	SNL F-211
System, data transmission, M4 (for director M4) (for mobile batteries).....	SNL F-179
Material, cleaning and preserving, and tools and equipment used therewith.....	SNL K-1
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications Supply Index"	OPSI

2. Technical Manuals.

Cleaning and preserving materials.....	TM 9-850
(now published as TR 1395-A)	
Instruction guide, fuze setter T15.....	TM 9-2641
Ordnance maintenance:	
Director M4.....	TM 9-1655
Data transmission system M4.....	TM 9-1656

3. Ordnance Field Service Bulletin,

Lubrication of fire-control instruments.....	OFSB 6-F-1
[A. G. 062.11 (8-7-41).]	

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(For explanation of symbols see FM 21-6.)

