RESTRICTED

FM 4–175

WAR DEPARTMENT

ANTIAIRCRAFT ARTILLERY FIELD MANUAL

SERVICE OF THE SEARCHLIGHT

22 December 1943

Dissemination of restricted matter.—The information contained in restricted documents and the essential characteristics of restricted material may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 18*b*, AR 380–5, 28 Sep 1942.)

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1943

WAR DEPARTMENT,
WASHINGTON 25, D. C., 22 December 1943.

FM 4–175, Antiaircraft Artillery Field Manual, Service of the Searchlight, is published for the information and guidance of all concerned.

[A. G. 300.7 (9 Nov 43).]

BY ORDER OF THE SECRETARY OF WAR:

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DISTRIBUTION:

Bn and H 44 (5); IBN and H 44 (3); IC 4, 44 (15).
(For explanation of symbols see FM 21–6.)

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ANTIAIRCRAFT ARTILLERY FIELD MANUAL

SERVICE OF THE SEARCHLIGHT

(This manual supersedes FM 4–175, 9 December 1942, including C 1, 27 March 1943.)

CHAPTER 1

GENERAL

Paragraphs
SECTION I. General 1–4
II. Organization of detector-searchlight section 5–7

SECTION I

GENERAL

■ 1. SCOPE.—This manual is designed for use by antiaircraft searchlight units as a guide in the functioning of matériel, selection of personnel, and service of the piece. Drills and instructions pertain especially to the later types of matériel, M1941, M1942, and M1942A.

■ 2. REFERENCES.—This manual should be studied in conjunction with the references listed in the appendix. The references include visual aids as well as textual materials.

■ 3. EQUIPMENT.—*a.* The present standard system for the detection, location, and illumination of targets includes the following matériel in addition to machine guns, and the necessary transportation, communication, and maintenance equipment. The arrangement of this equipment is shown schematically in figure 1.

(1) Radar.
(2) Power plant truck.
(3) Rectifier truck.
(4) Searchlight.

(5) Searchlight power plant.
(6) Control station.
(7) Connecting cables.

b. In the present Tables of Organization and Equipment, each of the three detector-searchlight sections (the three detector sections combined with three searchlight sections) of the searchlight platoon are equipped with radars. The three additional searchlight sections are not so equipped.

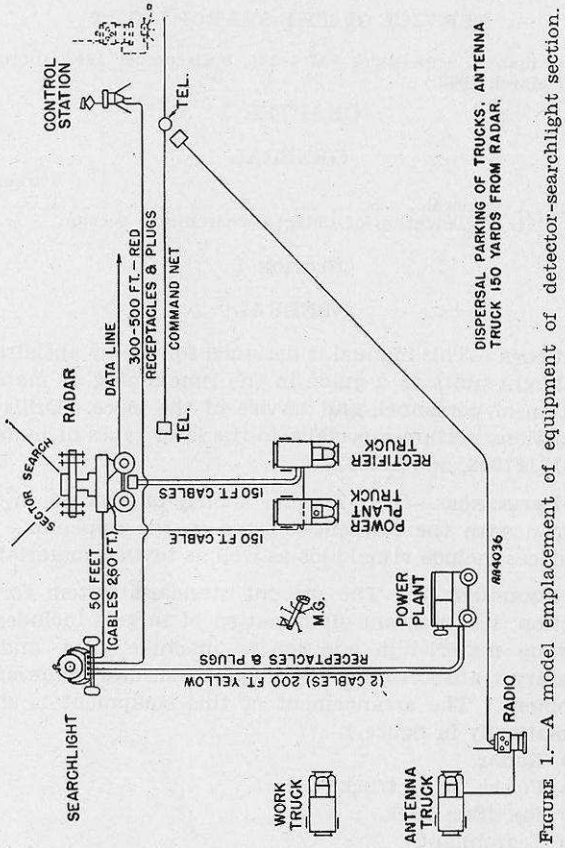


FIGURE 1.—A model emplacement of equipment of detector-searchlight section.

c. Figure 1 is a schematic diagram showing an arrangement of detector-searchlight matériel as limited by cable lengths. The power plant may be located up to 200 feet from the searchlight. Shortage of personnel may require that the searchlight power plant be set up in the vicinity of the radar power plant. A total of 260 feet of cable is available for connecting the radar and searchlight, but the radar is set up as near as practicable to the searchlight (approximately 50 feet) as there is no provision on the radar for a parallax correction for the displacement between the light and the radar. The searchlight is usually sited on one flank of the sector of search of the radar, and the control station at full cable length (300 to 500 feet) on the other flank. The radar power plant truck may be located within 150 feet of the radar. The water-cooled caliber .50 machine gun is emplaced so as to give the fullest measure of protection to all units of equipment and to command an all-round field of fire. The caliber .50 machine gun, HB, is sited so as to combine cover and concealment with additional fire power for the defense of the position. However, actual terrain conditions will usually determine the field lay-out which will give the greatest advantage. For a discussion of the factors to be considered in the selection of position and in the arrangement of matériel, see FM 4–106. The connecting cables between each element are shown in figure 1 as follows:

(1) Power cables from power plant to searchlight (yellow plugs and receptacles).

(2) Data transmission cable or combination director-adapter cable to searchlight from radar (cable fits into blue receptacle at searchlight).

(3) Distant electric control cable from the control station to the searchlight (red plugs and receptacles).

(4) Low voltage, high voltage, and remote control cables (the last two via rectifier truck) from the power plant truck to the radar.

■ 4. POSITION FINDING.—*a.* The antiaircraft searchlight unit must determine the present position of a hostile target in order to direct or point the searchlight at the target. This present position is located by means of a radar which determines the azimuth and angular height of the target and simultaneously transmits these directional data to the

searchlight by a self-synchronous transmission system. (See FM 4–176.) When the searchlight and radar are properly oriented and synchronized, zero reading volt-meters on the searchlight and control station indicate the relative positions of radar and light, and the light is actually traversed and elevated by distant electric control from the control station. However, in the 1942 searchlight models, the light may be moved by remote control from the control station or moved directly from the radar by means of azimuth and elevation motor-amplidyne generator sets.

b. For those units still equipped with sound locators for position finding see TM 9–1660 and TM 9–2660.

SECTION II

ORGANIZATION OF DETECTOR-SEARCHLIGHT SECTION

■ 5. FIRE UNIT.—A fire unit is the smallest subdivision of an AAA organization that can actively engage the enemy. The fire unit of the searchlight battery is the searchlight section. It consists of a searchlight, with its control station and power plant, and a caliber .50 machine gun, together with the necessary personnel to man the weapons and equipment.

■ 6. DETECTOR-SEARCHLIGHT SECTION.—*a.* A detector-searchlight section is formed by augmenting the fire unit defined in paragraph 5 by a radar. This will increase the equipment of the section by an additional .50 caliber HB machine gun on an M32 mount and the special vehicles for the radar.

b. The following manning table shows the personnel assigned to the detector-searchlight section:

ORGANIZATION, DETECTOR-SEARCHLIGHT SECTION

	Detector-searchlight section	
	Detector section	Search-light section
Sergeant, including	1	1
Chief radar operator (774)	(1)	
Chief of section (539)		(1)
T–4 Operators	3	
Radar (514)	(3)	
T–5 Operators	3	2
Radar (514)[1]	(2)	
Power plant (846)[1]	(1)	(1)
Chief controller (544)		(1)
Privates and privates first class	6	4
Operator, radar (514)	(2)	
Operator, radio (776)[2]		(1)
Operator, telephone (704)	(1)	
Operator, searchlight (763)		(1)
Operator, control station (544)		(2)
Chauffeur (245 or 345)[2]	(1)	
Reader (742)	(2)	
Total	13	7

[1] Drives truck, 2½-ton van body.
[2] See T/O 44–138 for ratings possible.

c. The detector-searchlight section is organized as follows:

(1) The chief of section of the searchlight section acts as chief of the combined detector-searchlight section, regardless of the relative rank of the chief radar operator.

(2) The detector section consists of the chief radar operator (CRO) and the following personnel:

No. 1, range oscilloscope operator.
No. 2, azimuth oscilloscope operator.
No. 3, elevation oscilloscope operator.
No. 4, keyer-modulator attendant (driver work truck).
No. 5, power plant operator (driver rectifier truck).
No. 6, azimuth data reader.
No. 7, range data reader.
No. 8, telephone operator.
No. 9, radar operator (driver antenna truck).

No. 10, radar operator.
No. 11, radar operator.
No. 12, chauffeur of power plant truck (asst. power plant operator).

(3) The searchlight section consists of the chief of section (CS) and the following personnel:

No. 1, azimuth controller (operator control station).
No. 2, elevation controller (operator control station).
No. 3, searchlight operator.
No. 4, power plant operator.
No. 5, radio operator.
No. 6, chief controller (operator, control station).

■ 7. FORMATION.—The detector-searchlight section is formed as shown in figure 17. For section drill, the chief of section takes post 3 paces in front of the center of the section. The posts of the crews of the detector and searchlight section are shown in figure 18.

CHAPTER 2

DUTIES OF PERSONNEL

■ 8. PLATOON COMMANDER.—*a.* Since the fundamental principle of the tactical operation of searchlights is decentralization of control, the tactical control of the individual searchlight sections is in the hands of the chiefs of sections except for supervision and corrective action by the platoon commander.

b. However, due to the distances involved in the disposition of searchlights, the platoon commander has heavy responsibilities for the efficient operation of the units in his platoon and for the searchlight defense as a whole.

c. The platoon commander is responsible for the thorough basic training of personnel in the actual operation of matériel, its care and maintenance, and destruction. He must assure himself that the chief of section, chief radar operator, and platoon sergeant are thoroughly indoctrinated in tactical training for operation with guns and fighter aviation.

d. The platoon commander and his party make a reconnaissance for light positions, locating them as near as possible to the points indicated on the map prepared by higher command. He selects positions accessible to heavy radar equipment and suitable for camouflage and screening, and prepares an accurate overlay to show the positions and wire communication routes selected. He obtains the information necessary to secure property releases (nonactive theater).

e. One of his most important duties is the supervision of the AAAIS searchlight operation of his platoon, and he is responsible that conditions of readiness are maintained. He reports to the searchlight operations officer poor visibility due to fog or rain over his area during the hours of darkness.

f. The platoon commander is the highest tactical commander of a searchlight battery, although his control is only supervisory and extends only to the correction of errors that he sees being made by one of his chiefs of sections. In order to insure better results in tactics, the platoon commander must check his sections on detector tuning and alignment, orientation, and synchronization at every opportunity.

g. The platoon commander is also responsible for the following duties:

(1) Laying of the platoon command net, and its maintenance.

(2) Instruction of noncommissioned officers in camouflage, and frequent checks to determine whether it is used properly.

(3) Administrative duties with regard to mess, supply, transportation, reports, and medical care.

(4) Maintenance of high morale among personnel.

h. For details as to the tactical operation of the searchlight section, reconnaissance and selection of positions, and communication nets, see FM 4–106.

■ 9. CHIEF OF SECTION.—*a.* (1) The chief of section is responsible for the administration, training, and discipline of all personnel in the searchlight and detector sections and for the organization of the position. Tactical control of the searchlight is decentralized to the chief of section which places the responsibility for selection of target upon him, together with the responsibility for subsequent searchlight action, to include putting the searchlight in and out of action and changing target according to tactical doctrine outlined in FM 4–106.

(2) The chief of section must *never* operate the binoculars at the control station during action for he must not confine his attention to the relatively limited view which can be seen through the binoculars. He must be freed from any duties which prevent his using in an intelligent manner the tactical control given him, for he must have a thorough knowledge and complete understanding of the situation confronting him.

b. The chief of section should take his post in the vicinity of the control station and about 10 or 15 feet from it. His primary duty is to watch the skies for signs of action, so that he can keep himself constantly aware of the general situation. He must *never* make the mistake of confining his attention to his own searchlight beam alone when it is in action because he must prepare himself in advance for the next action by observing the general situation. He receives from the telephone operator at the control station information on targets which are contacted and tracked by his own radar, and also general information concerning the operation of all

the other sections in his platoon. The platoon command post relays to him, through the control station telephone operator, information on approaching targets which are being plotted on the AAA Operations Board, but which have not yet been illuminated.

c. The searchlight should be put in or out of action only on direct orders from the chief of section. He gives the command IN or OUT from his position to one side of the control station, and the chief controller relays the commands to the searchlight operator by means of the buzzer system connected between the control station and the searchlight. Even when the telehone operator at the control station receives the command IN or OUT from the platoon CP, the chief controller (No. 6) must wait for the chief of section to give the order himself before he (the chief controller) signals the searchlight operator. The same principles apply to other orders or information which may come in to the chief controller.

d. The chief of section is responsible that all personnel know the compass bearings and the direction of all adjacent searchlights. On the first night after the defense is installed, a suggested plan is to place all lights in action vertically for 1 minute according to a prearranged schedule provided by higher command. Adjacent positions can be located in this way and stakes set out to indicate the direction of each nearby position. Stakes should be marked with the appropriate light designations which can be seen with the aid of a flashlight.

■ 10. CHIEF RADAR OPERATOR.—*a.* (1) The chief radar operator, under the supervision of the chief of section, is primarily responsible for the *tactical* operation of the radar, to the end that incoming aerial targets are detected at the maximum range of the radar. His tactical duties follow a more or less fixed routine and are the same, regardless of whether he is in command of a radar or of a sound locator.

(2) The chief radar operator, during action, should station himself on the radar platform where he supervises the selection of targets and tracking by the oscilloscope operators. The radar telephone operator on the platoon command net keeps the chief radar operator informed of action being

taken by other sections in the platoon, by repeating aloud all the commands and announcements which are transmitted over the net. Information on approaching targets being plotted on the AAA Operations Board is also relayed to him through the platoon CP.

b. In a sound locator section, the chief radar operator moves to a position in front of the horns when giving commands, so that he can be clearly heard. When the order CHANGE TARGET is given, he indicates the direction to which the horns are to be turned by using the commands TRAVERSE RIGHT, TRAVERSE LEFT, ELEVATE, DEPRESS. He gives the same commands to a detector section.

c. Like the chief of section, the chief radar operator must know the direction of all adjacent searchlights and must set stakes out around the position he occupies during action, to assist him in determining these directions.

d. He must be able to supervise the radar operators as they conduct the search for the target and as they track it to within illumination range. He must know the requirements for a good radar position so that interference may be reduced to the minimum; also the maximum screening effect consistent with operation obtained. He must be able to direct accurate orientation and synchronization of the radar with associated searchlight equipment, and the necessary checks on orientation and on the calibration of the radar sight. He must be familiar with methods of destruction.

■ 11. CHIEF CONTROLLER (No. 6).—*a.* The duty of the chief controller (No. 6) is to watch for "flicks" when a searchlight goes into action, and to take over the distant electric controls as soon as a flick is observed, in order to maintain illumination of the target by visual tracking. Even before the light goes into action, he watches the sky through the binoculars when the radar is on the target and transmitting data on an approaching airplane. The azimuth and elevation controllers, by keeping their needles at zero, train the binoculars in the direction indicated by the data from the radar. Occasionally, the chief controller may be able to pick up a target when he sees it cross in front of the moon or stars. If the chief controller picks up a target in this manner before the light is put in action, he immediately takes over the controls and continues to track the target; he must not, however, give

the signal to put the light in action unless the chief of section so orders.

b. When he receives the command CHANGE TARGET, the chief controller ceases to look through the binoculars and determines from the chief of section the direction of the new target. He then swings the beam, without using the binoculars, as rapidly as possible to the new target; when the beam is approximately on the target, he picks it up in the binoculars and resumes tracking.

■ 12. SEARCHLIGHT OPERATORS.—*a.* The searchlight operator must understand and be able to perform the following:

(1) Setting up and taking down light.
(2) Leveling the light.
(3) Two methods of orienting and synchronizing the light.
(4) Striking the arc.
(5) Semiautomatic and manual lamp control.
(6) Maintaining the proper protrusion of the positive carbon.
(7) Adjustment of the beam by the use of the focusing knob.
(8) Keeping the arc voltage and amperage at the proper values.
(9) Recarboning the light.
(10) Replacement of fuses.
(11) Using the extended hand controller for movement of the light in azimuth and elevation.
(12) Technique of spreading the searchlight beam (see par. 17).
(13) First echelon maintenance of the searchlight.
(14) Destruction of the searchlight.

b. It is important that the light operator be able to manually control the searchlight and its arc, in order that the change from automatic to semiautomatic or manual control may be made without confusion and loss of efficiency.

c. It is also of high importance that the searchlight operator be able to prepare the light for movement to a new position. Serious breakage and injury to equipment often result from improper procedure in preparing and securing the light for march order.

■ 13. POWER PLANT OPERATORS.—Each power plant operator must be able to perform first echelon maintenance and the mechanics of starting, running, and stopping the power plant engine. He must know how to operate the voltage rheostat on the power panel and the correct method of voltage and current regulation. He must be able to replace fuses. He must also understand the manual operation of the power plant to insure its continued operation in case the automatic devices fail.

■ 14. CHAUFFEURS.—*a.* Chauffeurs must be able to perform first echelon maintenance and understand the military regulations relative to driving motor vehicles and convoy discipline. They must perform preventive maintenance of the truck and trailer and must lubricate these vehicles. (See FM 25–10, TM 10–460, and 21–300.)

b. Chauffeurs must understand methods used in towing the trailer and power plants. They must be familiar with operation of the safety devices and the break-away feature of these towed vehicles. They must be able to drive at night without the use of lights. They must be able to negotiate roads rutted with mud and sand and gravel, and maneuver in rocky and scrubby country. Chauffeurs must be able to estimate quickly and accurately the road clearances of truck, trailer, and power plant and to clear sidehills, hummocks, and outcroppings. They must know the proper use of the lower gear ratios.

■ 15. TELEPHONE OPERATORS.—*a.* One of the best men in the section must be chosen as telephone operator. The telephone operator must have an even temperament, common sense, and the ability to keep cool under stress. Numerous messages come over the telephone or radio, so he must, without confusion, select the order directed to his own unit. He must receive and deliver the message to the chief of section or chief radar operator just as it was dispatched from the other end of the line. The telephone operator must use the correct command for every action and help to reduce communication over the line to commands and necessary instructions only.

b. Although speed is a most important factor in antiaircraft communication, the operator must repeat and record

every message that comes over the wire which pertains to his section. Every message must be recorded as to source, nature, and time, and every item must be included regardless of how unimportant it may seem. A log book is kept at the platoon CP and at each section for this purpose.

c. The telephone operator must be able to perform trouble shooting and diagnose simple troubles in the telephone line. He must be able to recognize the symptoms of a short circuit, an open circuit, a ground, or other source of trouble. It is his responsibility to begin checking immediately from his end of the line as soon as trouble develops, while the men from the regular communication section start checking from the other end. This is extremely important in order to insure the reestablishment of communication at the earliest possible moment after a break-down. For a detailed discussion of telephone trouble shooting see FM 24–5.

d. The searchlight unit has been issued a two-way radio and remote control unit. The radio operator sets up the radio near either the work or the antenna truck (equipped with suppressors) and prepares it for communication. By use of a head set and microphone he tunes to the proper frequencies for communication with other units. He operates the radio and the remote control unit in order to transmit messages from and receive messages for an operator (remote control telephone operator) at a field telephone near the chief of section (see ch. 5). An alternate plan of siting the radio is to locate it at the control station. In this case the remote control unit is not used but power must be supplied by the hand generator. In active theaters, the radio operator takes all precautions and preventive measures to reduce the effectiveness of enemy jamming. For a detailed explanation of radio maintenance and trouble shooting see TM 11–454.

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CHAPTER 3

FUNCTIONING OF MATÉRIEL

		Paragraphs
SECTION I.	Searchlight matériel	16
II.	Spread beam searchlights	17
III.	Position-finding equipment	18–19
IV.	Vehicles	20–22

SECTION I

SEARCHLIGHT MATÉRIEL

■ 16. GENERAL.—For a description and instructions concerning the operation and maintenance of searchlight matériel with which the unit is equipped see TM 5–7045, 5–7046, or 5–7047.

SECTION II

SPREAD BEAM SEARCHLIGHTS

■ 17. GENERAL.—*a.* (1) All antiaircraft searchlights have additional means of tactical employment due to the adoption of a modification which permits the searchlight beam to be spread from a narrow beam of about 1¼° to a maximum spread of about 15°. The spreading of the beam is accomplished by a modification of the lamp head and control rod which permits the lamp head to be displaced 4½ inches to the rear of the normal focal point. The lamp head may be moved from the in-focus position to the maximum spread position in about 2 seconds, and returned in the same time to its normal position at the focal point of the mirror. It may be stopped at any desired point within the limits of its movement. Upon the return of the lamp head to its forward position it may be made to stop at the correct in-focus point for the standard long range 1¼° beam. The operation of the electro-mechanical feed system, by which the positive carbon is fed forward as it burns back, is not affected by the addition of the spread beam device.

(2) For the use and tactical employment of the spread beam searchlight see FM 4–106.

b. Optical principles of beam spreading.—(1) *Normal beam.*—The standard 60-inch antiaircraft searchlights employ a mirror constructed in the form of a parabola. When light is emitted from a point source located at a specific point in front of the mirror's center axis, the parabolic reflecting surface of the mirror directs the reflected light from its surface in parallel lines. The point source which results in the reflection of rays of light in parallel lines is called the focal point of the parabolic mirror. This principle of reflection is illustrated in figure 2. Due to the fact that the light's source at the focal point of the searchlight is not a point source of light but actually a globule of incandescent gas in the crater of the positive carbon, there is a normal beam spread of the reflected rays from the mirror of about 1¼°. (See Fig. 2.)

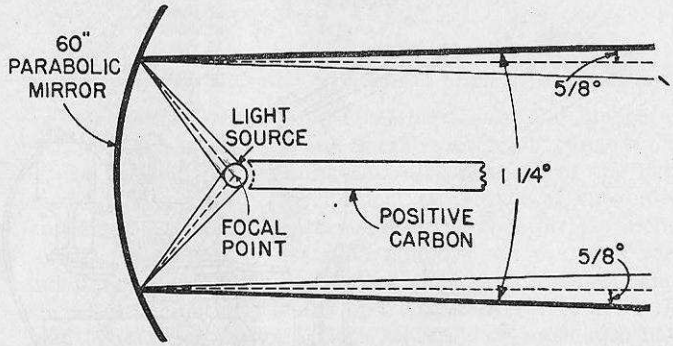


FIGURE 2.—Beam spread (exaggerated) of a 60-inch AA searchlight (in focus).

(2) *Spread beam.*—The properties of the parabolic mirror are such that if the light source, the globule of incandescent gas, is moved along the focal axis of the mirror to a position close to the mirror, the reflected rays emitted from the mirror tend to spread outward, and the degree of this spread varies directly as the distance out of focus that the light source is moved, thereby accomplishing a variable beam spread. Figure 3 illustrates a beam which has been spread by the movement of the source of light to the rear of the focal point of the mirror.

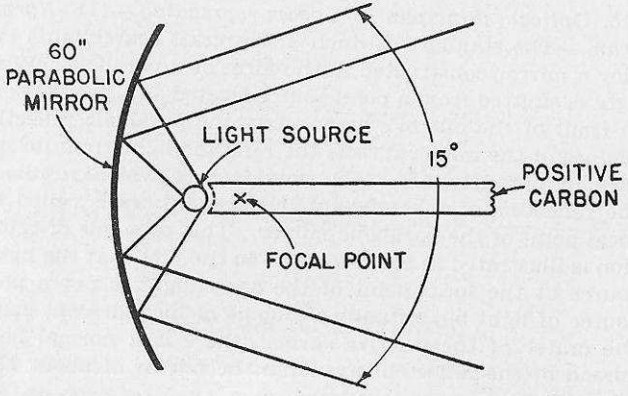


FIGURE 3.—Beam spread (exaggerated) of a 60-inch AA searchlight (out of focus).

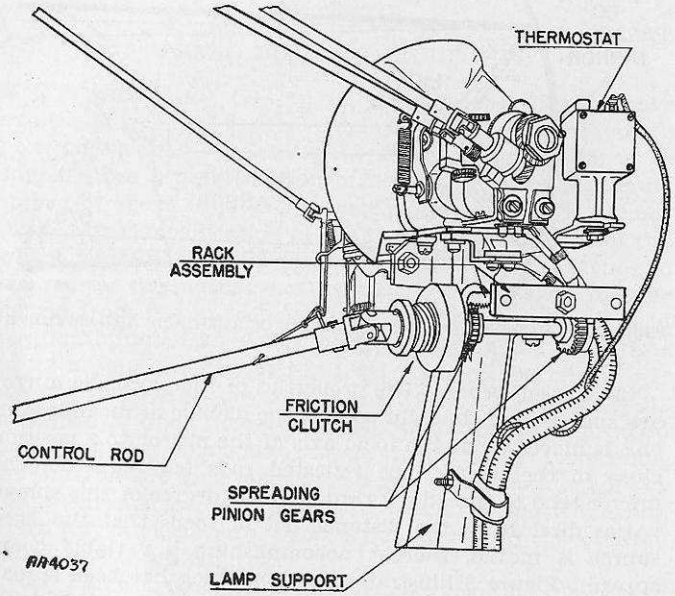


FIGURE 4.—General Electric lamp unit with spread beam devices—schematic.

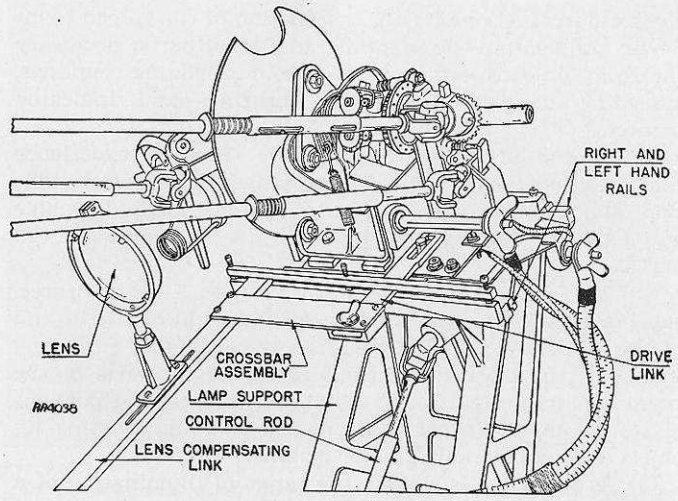


FIGURE 5.—Sperry lamp unit with spread beam device—schematic.

c. Mechanical features.—(1) *General.*—In the models of both the General Electric and Sperry searchlights (figs. 4 and 5), the method of obtaining this displacement of the light source is a system of mechanical movement of the entire lamp head a maximum distance of approximately 4½ inches toward the mirror. This plan employs the use of a rack and pinion head changing device, with a spreading handwheel for the actual turning of the pinion gear to drive the head to its new position. Both searchlights must also have an additional sliding coupling joint, placed in each of the control rods to accommodate for the shortened length of each control rod which is due to the lamp head being displaced toward the rear. The additional joints adjust the lengths of the control rods for the position of the lamp head, so that the feed mechanism may continue to operate the positive and negative carbons easily without any tendency toward jamming or sticking.

(2) *Modification kits.*—Existing searchlights will be supplied with modification kits which will permit them to be modified for additional use as spread beam lights by the battery maintenance section. The modification kits include

complete instructions for the installation of the spread beam device and contain the following additional parts: necessary rack and pinion, beam spread control rod, sliding couplings, spreading handwheel, universal bearing, and indicator pointers.

d. Operational characteristics.—(1) Present experience indicates that the spread beam searchlight will furnish sufficient illumination of the target at maximum spread to enable automatic weapons to fire at ranges of approximately 1,000 yards.

(2) The spreading of the beam, even to a slight degree, substantially affects the intensity of illumination at the end of the beam and on the edges. As the extent of spreading increases, the intensity of illumination of all parts of the beam rapidly decreases, but notably in the central portions of the beam, the edges reaching out and illuminating an object at a considerably greater distance.

(3) As the beam is spread, the range of illumination of a target is rapidly reduced. The range is reduced most notably during the first degree of spread and then gradually decreases until the maximum spread of 15° is reached.

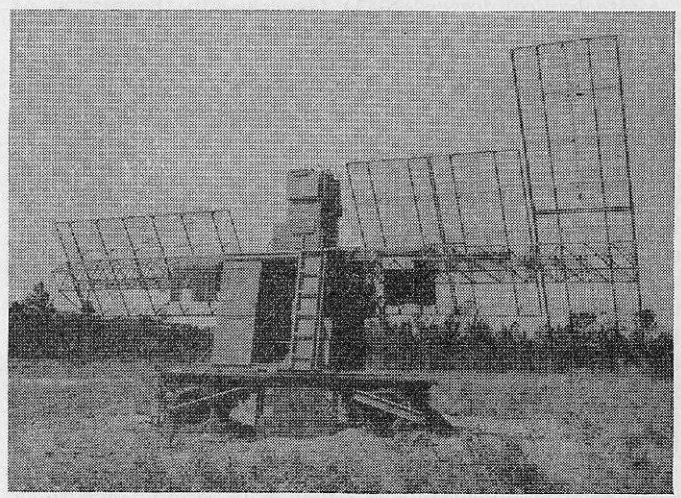


FIGURE 6.—The radar (SCR–268) in operating position showing the three antenna arrays.

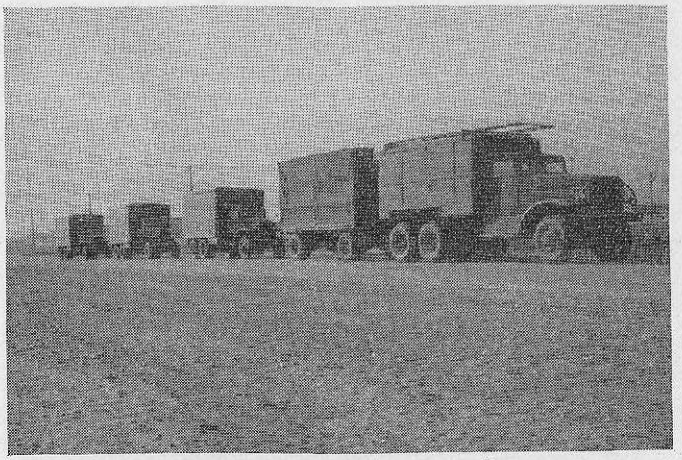


FIGURE 7.—The radar in traveling position on road showing the four trucks and trailer mount required for transportation. The fourth truck (shop truck) is not issued to all units.

(4) As the lamp mechanism is moved to the rear, the rays of the beam are diverged, and the area illuminated naturally becomes greater although the intensity of illumination becomes less.

SECTION III

POSITION-FINDING EQUIPMENT

■ 18. RADAR.—*a.* Radar is one of the more recent and more effective devices which have been developed for the detection and tracking of aircraft under all kinds of atmospheric conditions. The data supplied by the radar to the searchlight are azimuth and angular height. These data are electrically transmitted to the searchlight by means of a self-synchronous transmission system (A-C synchronous repeaters). One of the radar units now in use with searchlights is shown in figure 6.

b. For a detailed description of a radar and technical explanation of its operation, see FM 4–176.

■ 19. SOUND LOCATOR M2.—*a.* Certain organizations in the field may use the sound locator M2 as the equipment for locating the position of the target and for directing the searchlight at the target.

b. For a detailed discussion of the theory of sound location and an explanation of the operation of the sound locator, see TM 9–1660 and TM 9–2660.

SECTION IV

VEHICLES

■ 20. GENERAL.—*a.* Transportation for the equipment of the detector-searchlight section consists of the vehicles of the detector section and those of the searchlight section.

b. Transportation of the detector section is included in FM 4–176. It consists of four trucks and a trailer mount (see fig. 7). In some units the fourth truck (shop truck) is not issued.

c. Searchlight equipment is transported by two standard 2½-ton trucks, one towing an M1 antiaircraft searchlight trailer in which is loaded the searchlight, and the other truck towing the power plant. (See fig. 8.) Each of the trucks has a cargo body of 80 by 108 inches and is equipped with hold-down devices or bolts, designed for the security of

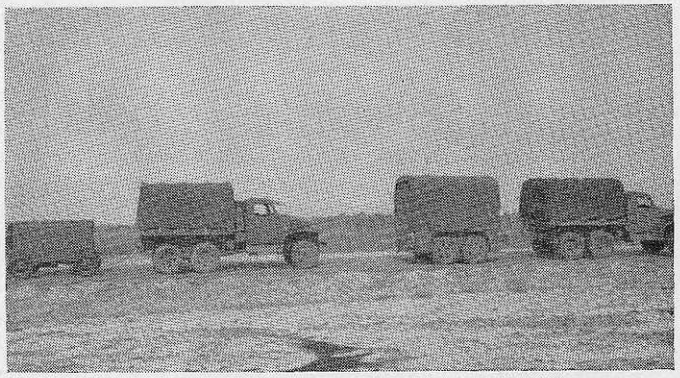


FIGURE 8.—Transportation of searchlight section showing two 2½-ton trucks, M1 trailer, and searchlight power plant.

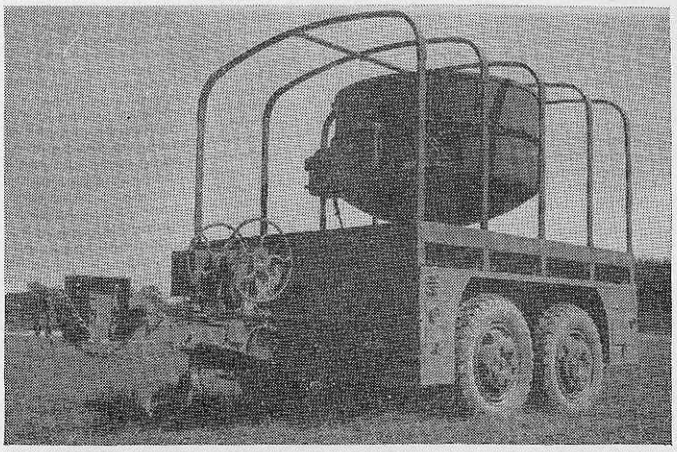


FIGURE 9.—M1 antiaircraft searchlight trailer (cover removed).

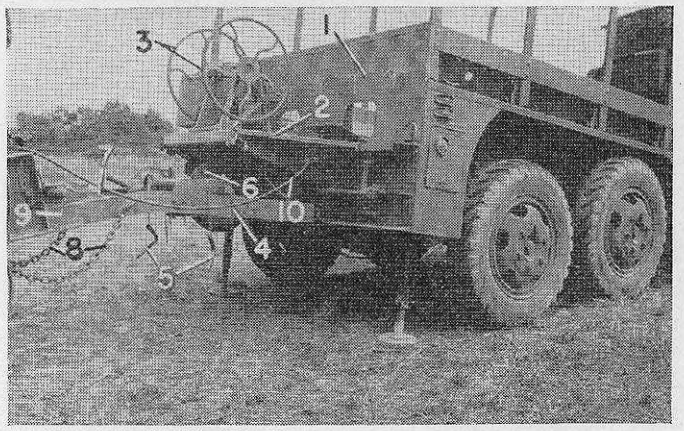
searchlight matériel. The automotive features of these trucks are covered in the maintenance manual for each vehicle.

■ 21. M1 TRAILER FOR THE ANTIAIRCRAFT SEARCHLIGHT.—*a.* The standard trailer used for the transportation of searchlight equipment is the M1 trailer. It is a four-wheel, pneumatic-tired, low-bed, tilting trailer with integral body. (See fig. 9.) Its capacity is 4,000 pounds. The four wheels are mounted by pairs in tandem so that the unit will operate as a two-wheel trailer and have the load capacity of a four-wheel vehicle.

b. The steel deck forward of the front bulkhead provides a mounting for the winch and brake handwheel, and also serves as a means of locking the tilting frame to the drawbar arms (see fig. 10). The drawbar arms are hinged at the rear to permit tilting of the frame, when loading and unloading, without uncoupling from the truck. When not coupled to the truck, the trailer is tilted for unloading by removing the front pins from each side of the winch deck and pushing down on the drawbar arms. When coupled to the truck, the pins are removed as before, and the trailer is tilted by simultaneously lifting the front of the trailer body and forcing

the rear of the body downward. The drawbar is equipped with an adjustable rubber-tired caster wheel to support the front end when uncoupled from the truck. (See fig. 9.)

c. A hand-operated, double-cranking winch, with a chain which is hooked to the searchlight, is used in the loading and unloading of the trailer. (See fig. 10.)



1. Front bulkhead.
2. Steel deck.
3. Winch.
4. Drawbar arms.
5. Front pins.
6. Caster wheel.
7. Drawbar tongue.
8. Safety chains.
9. Break-away chain.
10. Jumper cord.

FIGURE 10.—M1 antiaircraft searchlight trailer in position for unloading searchlight—front view.

d. Truck and trailer are connected by a lunette at the forward end of the drawbar tongue which fits into a pintle hook at the rear of the truck.

e. Two heavy safety chains connect the drawbar arms with the truck.

f. Mechanical hand parking brakes are operated by means of a handwheel on the trailer front deck.

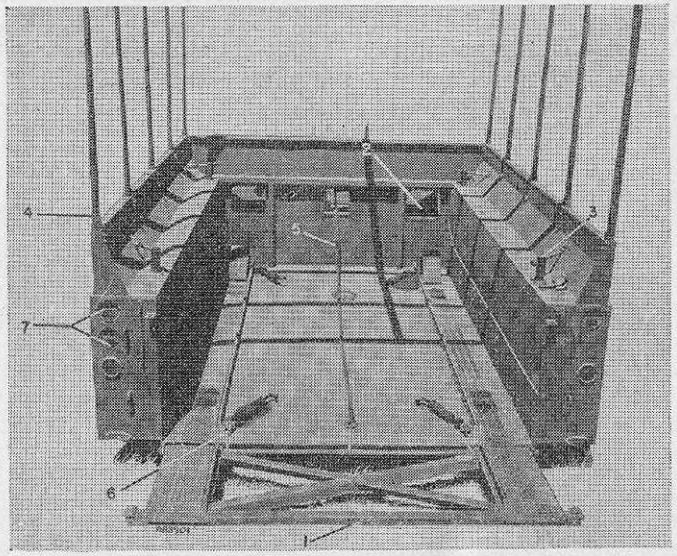
g. Electric brakes on all four wheels of the trailer are controlled from the cab of the truck. This brake system is provided with standard emergency break-away features.

h. A jumper cord or cable, from truck to trailer, supplies the current for the brake and lamp circuits of the trailer.

i. The switch for the selection of either the normal tail and stop lights or the blackout tail and stop lights is located on the right supporting member of the steel deck on the front of the trailer (in some cases the switch is on the top right-hand member of the drawbar about 1 foot from the trailer body).

j. The trailer tailgate is hinged at the bottom so that it acts as a ramp for the loading and unloading of equipment. (See fig. 11.)

k. Each trailer is provided with hold-down devices consisting of four turnbuckles. Hinged doors in the front bulkhead provide access to the forward turnbuckles which fasten the searchlight to the trailer.



1. Tailgate (ramp for loading).
2. Hinged door in front bulkhead.
3. Hand crank of corner jack.
4. Removable bows.
5. Winch chain.
6. Rear turnbuckle.
7. Blackout, stop, and tail light.

FIGURE 11.—H1 antiaircraft searchlight trailer in position for loading searchlight—rear view.

l. Corner jacks, which are used when tires or wheels are changed, are fastened to each corner of the frame. They are adjustable by the use of hand cranks extending through the top of the side walls. These corner jacks are also used to stabilize the vehicle when time does not permit the unloading of the light, and it must be operated from the trailer.

m. Removable bows and canvas covers inclose the body of the trailer.

■ 22. TRANSPORTATION OF THE POWER PLANT.—The power plant is towed behind the power plant prime mover of the searchlight section. For connecting truck and power plant, the lunette on the forward end of the tow bar of the power plant is locked in the pintle hook at the rear of the truck. The power plant is equipped with safety chains and a standard break-away feature which acts as a safety device in case the power plant should become uncoupled from the truck.

CHAPTER 4

THE SEARCHLIGHT SECTION IN FIELD POSITION

		Paragraphs
SECTION I.	Occupation of position	23–26
II.	Organization of position	27–31
III.	Protective measures	32–35
IV.	Movement out of position	36–39

SECTION I

OCCUPATION OF POSITION

■ 23. SCOPE.—This section covers the loading of vehicles of the searchlight section, the motor movement of the detector-searchlight section on the road, the selection of position, and the occupation of the position.

■ 24. LOADING OF SEARCHLIGHT SECTION EQUIPMENT.—*a.* For a description of loading of equipment and personnel of the searchlight section see FM 4–106.

b. The equipment is loaded and the personnel placed according to the arrangement shown in figures 12 and 13.

c. For the loading of the detector section and arrangement for transportation of personnel see FM 4–176.

■ 25. MOTOR MOVEMENT.—For a discussion of motor movement of the searchlight section see FM 4–106.

■ 26. SELECTION AND OCCUPATION OF POSITION.—For a discussion of selection and occupation of position see FM 4–106.

SECTION II

ORGANIZATION OF POSITION

■ 27. NORMAL EMPLACEMENT FOR DETECTOR-SEARCHLIGHT SECTION.—*a.* The normal field emplacement of the equipment of the detector-searchlight section is shown in figure 14, and the emplacement of the carry light section is shown in figure 15. In these figures, cables are buried and transportation is concealed or undercover.

b. The radar is located according to factors outlined in FM 4–106 and FM 4–176.

c. The searchlight and control station must be placed on level or slightly elevated ground so as to secure an unobstructed field of view in all directions.

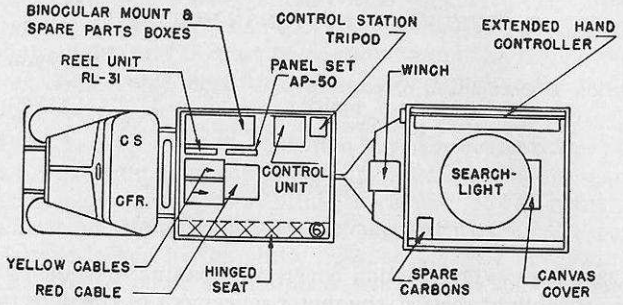


FIGURE 12.—Loading of equipment and personnel, searchlight section (searchlight prime mover).

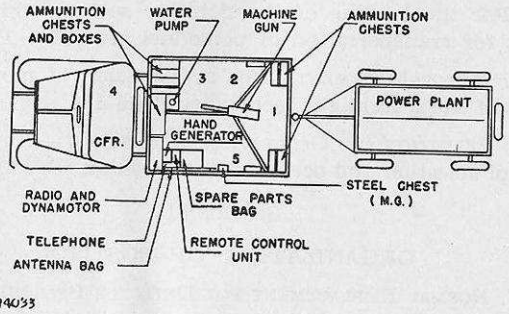


FIGURE 13.—Loading of equipment and personnel, searchlight section (power plant prime mover).

d. The control station should be located at the maximum distance from the light permitted by terrain features affecting mask, and by the length of the red cable (300 to 500 feet).

The searchlight should be located approximately 50 feet from the detector and on one flank in relation to the searching sector.

e. Terrain features determine actual emplacement of matériel. Figure 14 illustrates a favorable siting of equipment. The radar faces the normal sector of search. The light is located on one flank of radar, the control station at full cable length on the other flank.

f. The radar power plant and rectifier trucks are located in concealed and dispersed positions within cable lengths of the radar. The work and antenna trucks are sited in concealed and dispersed positions.

g. The searchlight power plant, in order to conserve personnel, may be set up in a fortified position in the vicinity of the radar power plant.

h. The water-cooled machine gun is sited so as to give maximum all-round protection from attack by air and ground forces to all searchlight equipment. In the location of the machine gun, protection to the radar and light will be the most important factors.

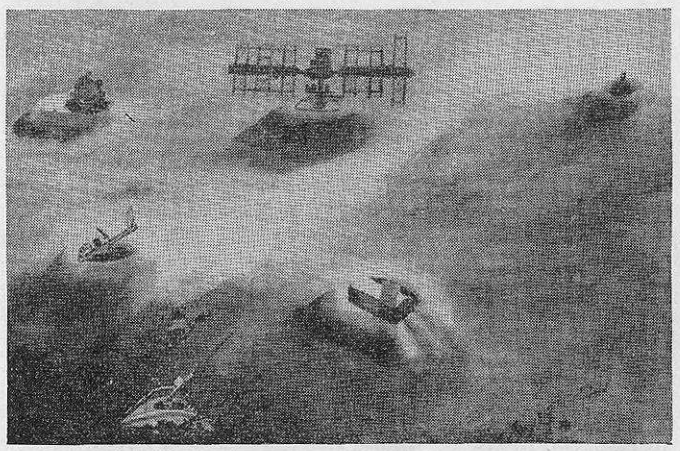


FIGURE 14.—Field emplacement of equipment of detector-searchsection (control station is shown closer to the searchlight than in the normal situation, and camouflage has been removed except that cables are buried or concealed and transportation is under cover).



FIGURE 15.—Field emplacement of equipment of carry searchlight section (control station is shown closer to the searchlight than in the normal situation, and camouflage has been removed except that cables are buried or concealed).

i. The radio is placed near either the work or the antenna truck, the battery of which can be used as a source of power for the dynamotor of the radio. A remote control unit permits two-way radio communication by means of a field telephone located at the control station. The radio may also be placed near the control station. In this case, the handcrank generator must be used when messages are transmitted.

■ 28. ACTION OF DETECTOR SECTION AT PREPARE FOR ACTION.—When the radar is moved from one location to another, the mount must be disassembled and its component parts fastened securely for march order. The unit therefore arrives at its new location in a packed condition, and must be reassembled for operation. For the methods of assembly of the radar unit, and preparation of the detector section for action, see FM 4–176.

■ 29. ACTIONS OF SEARCHLIGHT PRIME MOVER AT PREPARE FOR ACTION.—*a.* At the command PREPARE FOR ACTION, the searchlight prime mover, towing the M1 trailer, proceeds to the indicated searchlight position (see fig. 16 and ch. 5), where the caster wheel of the trailer is lowered into parking position and the trailer is disconnected from the truck. After the searchlight is unloaded from the trailer, the trailer is picked up by power plant prime mover and towed to the battery motor pool.

b. The chauffeur of searchlight prime mover drives from the light position to the control station location. The red control station cable is unreeled on the way.

c. At the control station position the control station is unloaded and set up.

d. Searchlight prime mover is then driven back to the light position and over to the power plant. The yellow power cables are unreeled as the truck moves from light to power plant. The truck is then returned to the battery motor pool (or is used to lay light phone wire to the nearest intersection with platoon command net).

NOTE.—*IT WILL NOT ALWAYS BE PRACTICABLE TO PROCEED WITH THE TRUCKS TO THE EXACT POSITION SELECTED BEFORE EQUIPMENT IS REMOVED. IN THE MAJORITY OF CASES, IN ORDER TO MAINTAIN CAMOUFLAGE DISCIPLINE IN THE POSITION, IT WILL BE NECESSARY FOR THE SECTION TO MANHANDLE SUCH ITEMS OF EQUIPMENT AS SEARCHLIGHT, POWER PLANT, CONTROL STATION, MACHINE GUN, AND CABLES RATHER THAN USE MOTOR TRANSPORTATION TO PLACE THEM.*

■ 30. ACTIONS OF POWER PLANT PRIME MOVER AT PREPARE FOR ACTION.—At the command PREPARE FOR ACTION, the power plant prime mover proceeds to the power plant position. (See fig. 16 and ch. 5.) The power plant is uncoupled from the truck. The truck is then driven to the site for the machine gun where the machine gun, complete with water pump, ammunition chests, and ammunition boxes, is unloaded. The power plant prime mover is then driven to the location selected for the radio. Here the radio and accessories are unloaded. The truck returns to the searchlight position, picks up the trailer, tows it to a suitable position under cover, and stands by to join the searchlight prime mover on the return to the battery motor pool. (See note, par. 29.)

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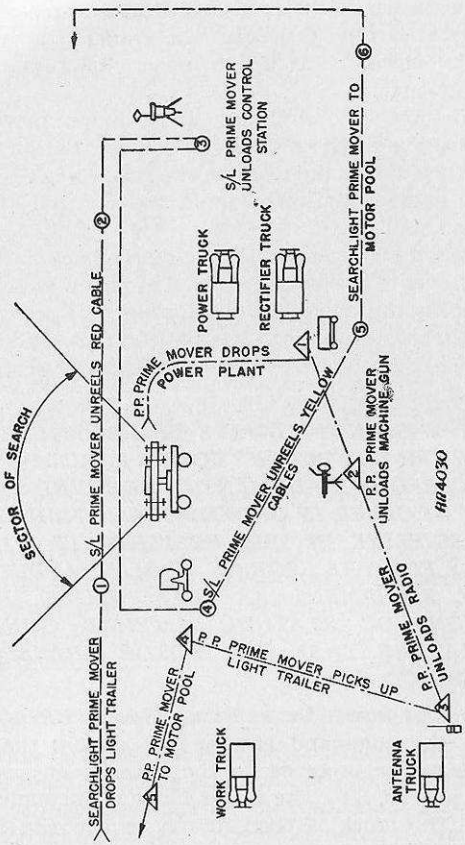


FIGURE 16.—Routes of trucks in field emplacement of equipment of searchlight section. (See note, par. 29.)

■ 31. COMMUNICATION.—*a.* Telephone and radio communications are established in accordance with FM 4–106.

b. Searchlight SOP's will include a plan to establish complete telephone communication within a battalion as soon as possible and in a manner that will provide reasonable protection against damage to wire by existing traffic until the communications details can thoroughly police and improve the lines to the best advantage. All available personnel and transportation in the searchlight and detector sections will be

utilized to establish the wire communications. The plan will consider reconnaissance of line route, determine the lines to be laid by the searchlight sections or the communications details, and prescribe definite assignment of personnel for maintenance of specific lines.

c. Wire should be laid well off the road *with plenty of slack* so that it can be tied and staked at curves and road crossings. Where it cannot be carried overhead at road crossings, it should be buried or run through culverts taking care to protect the insulation where abrasion is likely. After the wire communications are established, the communications details thoroughly police the lines, securing it off the ground on poles, trees, and fences where practicable, and make all possible improvements.

SECTION III

PROTECTIVE MEASURES

■ 32. GENERAL.—For a discussion of the various protective measures as applied to searchlight matériel, see FM 4–106, 5–15, 5–20, and list of references in the Appendix.

■ 33. FIELD FORTIFICATIONS, CAMOUFLAGE, AND CONCEALMENT.—For a complete discussion of field fortifications, camouflage, and concealment see FM 5–15.

■ 34. LOCAL SECURITY.—For a discussion of local security see FM 4–106.

■ 35. DEFENSE AGAINST CHEMICAL ATTACK.—*a.* For a detailed discussion of defense against chemical attack, see FM 21–40.

b. For an explanation of methods of decontamination, see TM 3–220.

SECTION IV

MOVEMENT OUT OF POSITION

■ 36. GENERAL.—*a.* This section describes the routes of the trucks in loading searchlight section equipment and the connecting cables.

b. For a detailed description of the disassembling and packing of the detector section equipment, see FM 4–176.

■ 37. OPERATING POSITION.—When the command MARCH ORDER is given, the light unit is in operating position with the crew distributed as shown in figure 18. The radar trucks are under cover, concealed, and dispersed. The searchlight section equipment is transported by trucks dispatched from the battery motor pool.

■ 38. ACTIONS OF SEARCHLIGHT PRIME MOVER AT MARCH ORDER.—*a.* At the command MARCH ORDER, the searchlight prime mover is driven to the searchlight position where the trailer is detached. The truck is then driven to the power plant position. The yellow cables from the power plant to the searchlight are reeled in as the truck moves to the searchlight.

b. The searchlight prime mover is driven to the control station. The control station is disassembled, loaded on the truck, and fastened in place by hold-down devices.

c. From the control station the truck is driven to the searchlight position, the red control station cable being reeled in on the way. The searchlight is placed in traveling position and secured in the trailer by means of the four turnbuckles provided. The trailer is coupled to the searchlight prime mover.

d. The searchlight prime mover then proceeds to its designated position on the road and awaits further orders. (See note, par. 29.)

■ 39. ACTIONS OF POWER PLANT PRIME MOVER AT MARCH ORDER.—*a.* At the common MARCH ORDER, the power plant prime mover is driven to the radio position, where the assembled radio and its accessories are placed in the vehicle.

b. The truck is then driven to the machine-gun position. When the detector-searchlight section is almost ready for the road, the complete machine gun with water pump, ammunition chests, and boxes is lifted into the truck.

c. The power plant prime mover moves to the power plant location. The power plant is attached to the truck which proceeds to its designated position on the road behind the searchlight prime mover.

d. When ready for the road, the equipment and personnel are loaded on the two trucks as shown in figures 12 and 13. (See note, par. 29.)

CHAPTER 5

SERVICE OF THE PIECE

	Paragraphs
SECTION I. General	40
II. Drill of detector-searchlight section	41–53
III. Notes on service of the piece	54–59

SECTION I

GENERAL

■ 40. PLATOON COMMAND NET.—*a.* The platoon command net connects the six sections of a platoon with each other and with the platoon CP. There may be as many as thirteen telephones on this net if all the sections of a given platoon are equipped with radars, one at each radar, one at each control station, and one at the platoon CP. The phones at the control stations are numbered to agree with the lights in their respective sections, 1 to 6. The phones at the radars are numbered to agree with the respective detector designations, D1 to D6. The phone at the platoon command post is designated CP.

b. It is not necessary to ring to call any phone because the circuit is always closed during operation, and each operator "rides the line." Each operator wears a head and chest set, and responds by reporting his station designation in answer to a call. For example, the platoon commander may call the radar phone at section 2, by calling over the platoon net "D2," or he may call the phone at the control station in section 2 by calling over the net "2." If the platoon commander calls, "All radars," the radar phone operators answer immediately and in sequence, "D1," "D2," etc. The phone operators at the control stations respond in the same sequence, if called.

c. All commands or information given by a chief of section or chief radar operator are immediately transmitted over the platoon net by the telephone operator. In each case, the telephone operator prefixes the command he is repeating with his station designation, for identification. For example, if the chief radar operator in section 2 announces, "On target," his telephone operator immediately transmits over the

platoon net, "D2, on target"; or if the chief of section in section 2 commands: IN, his telephone operator announces over the phone, "2 in."

d. The telephone operators keep the chiefs of sections and chief radar operators informed of the general situation by repeating aloud all information and commands which they hear on the platoon net. For instance, if the radar in section 2 makes a contact, the D2 telephone operator calls over the net, "D2, contact," and immediately each telephone operator should repeat, "D2, contact," in a voice loud enough to be heard by his respective chief of section and chief radar operator. Operators must be careful to keep the switch open on their transmitters while repeating information in this manner to avoid jamming the net with constant repetitions.

e. Information or commands which do not pertain directly to his section should be repeated by a telephpone operator in a conversational tone. Commands pertaining to a particular section should be repeated by the telephone operator of that section with more emphasis and in a tone of command, although action is taken by the members of the section only on the command of the chief of section or chief radar operator, and not on commands repeated by the telephone operator.

f. The control station telephone operator keeps a log in which he records the time of each illumination, the direction of flight, approximate altitude, and type of airplane. Such a log entry might appear as follows:

2211:20—In—SW to NE—7000—Ju 88
2212:15—Out

Other information and data relative to the operation of the unit are also recorded in the log.

SECTION II

DRILL OF DETECTOR-SEARCHLIGHT SECTION

■ 41. GENERAL.—*a.* This section outlines a detailed drill for a detector-searchlight section. The duties of the chief of section and of the searchlight section of the detector-searchlight section are covered in detail. The duties of the chief radar operator, oscilloscope operators, azimuth and range readers, and radar telephone operator are described to the extent that these duties directly pertain to the functioning of the

searchlight section as part of the tactical team for locating and illuminating the target. For complete detailed drill of all members of the detector section, see FM 4–176.

b. THE DRILL IS PARTICULARLY APPLICABLE TO THE M1942 SEARCHLIGHTS, BUT REQUIRES ONLY SLIGHT CHANGES FOR USE WITH 1941 EQUIPMENT. FOR DETAILS OF DRILL ON 1941 EQUIPMENT, COMPARE DESCRIPTION HEREIN WITH APPROPRIATE OPERATOR'S MANUAL.

c. The drill is presented in chronological sequence of action. Paragraph titles in this section agree with primary commands. Each command is followed by the individual actions performed under that command. Each action begins with the abbreviation or numbers signifying the members of the unit concerned in that action; these numbers or abbreviations are in bold-face type, at the left margin. Each main operation performed under any primary command is separated from other main operations by a space containing a row of dashes. Each group or series of actions performed concurrently or consecutively under a command is separated from other such actions by a space only.

d. (1) In paragraph 42, and in this section on drill, the letter "R" is added to numbers of members of the detector section. This will avoid confusion with corresponding numbers of the searchlight section.

(2) In referring to a section of a platoon, as an illustration of action common to all the sections, "section 2" is arbitrarily chosen as representative.

■ 42. PERSONNEL.—The members of the detector-searchlight unit are referred to in this section by the following numbers and abbreviations:

SEARCHLIGHT SECTION

CS	chief of section.
1	azimuth controller (operator, control station).
2	elevation controller (operator, control station).
3	searchlight operator.
4	power plant operator.
5	radio operator.
6	chief controller (operator, control station).

MG machine gunner (the chief of section will designate one of the six men of the searchlight section as machine gunner. Usually this man will be 1, 2, or 4.)

DETECTOR SECTION

CRO chief radar operator.
R1 range oscilloscope operator.
R2 azimuth oscilloscope operator.
R3 elevation oscilloscope operator.
R4 keyer-modulator attendant.
R5 power plant operator.
R6 azimuth data reader.
R7 range data reader.
R8 telephone operator.
R9 radar operator.
R10 radar operator.
R11 radar operator.
R12 chauffeur.

■ 43. FORMING AND POSTING SECTION.—*a.* During the initial training period, in order to develop order and discipline and to train men in their specific duties, the section is formed and posted as explained below. The section will also be formed in this manner in the field when being inspected by a higher commander. During the later period of training, and *always under field conditions,* the men go to their assigned places immediately on arrival in a position, or upon command **STAND BY**, without formality of a formation and posting.

b. As illustrated in figure 17, each detector-searchlight section assembles in two ranks with 4 inches between the files, and 40 inches between ranks. There is an interval of 1 pace between the searchlight section and the detector section. Within each group, men form in numerical order with odd numbers in the rear rank and even numbers in the front rank. The post of the chief radar operator is in the front rank of the detector section and 1 pace to the right of No. 2. For section drill the chief of section takes post 3 paces in front of the center line on which the front rank is to form. For inspections by higher commanders, CS takes post in front rank 1 pace to right of No. 2 after forming the section.

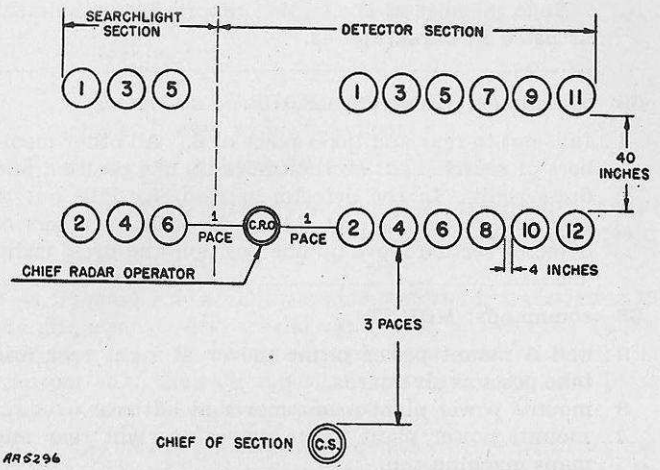


FIGURE 17.—Formation of antiaircraft detector-searchlight section.

c. The following is an analysis of duties that must be performed by the members of the section. The drill is organized in a sequence suitable for training. Each member of the section must be trained in the duties of other members of the section as training progresses.

CS commands: **FALL IN.**

The detector-searchlight section forms as illustrated in figure 17. The chief of section then dresses ranks, calls the roll, and inspects the personnel.

The section being in formation,

CS commands: **COUNT OFF.**

1 to 6 of the searchlight section report their numbers consecutively.

CRO reports, "Chief radar operator."

R1 to R12 of the detector section report their numbers consecutively.

The section being in formation,

CS commands: **CALL OFF.**

Each member of the section reports his assignment as listed in paragraph 42.

CS commands: **CHANGE ORDER.**

1 falls out to rear and takes place of 6. All other members of search-light section move up one position and dress right. In the detector section, R1 falls out to rear and takes place of R12. All other members of detector section move up one position and dress right.

CS commands: **MOUNT.**

2 and 3 mount power prime mover at right rear and take posts as air guards.
3 mounts power plant prime mover at left rear.
1 mounts power plant prime mover at right rear and mans machine gun.
5 fastens safety strap.
4 takes seat in cab beside chauffeur.
6 mounts searchlight prime mover at left rear and fastens safety strap.
CS takes seat in cab of searchlight prime mover beside chauffeur.

CS commands: **DISMOUNT.**

CS dismounts from cab of searchlight prime mover.
6 unfastens safety strap and dismounts.
4 dismounts from cab of power plant prime mover.
5 unfastens safety strap.
1 dismounts from right rear unless instructed to remain in truck.
2 and 3 dismount from right rear.
5 dismounts from left rear.

All members having dismounted, form as at the command **FALL IN.**

The section being in formation,
CS commands: **DETAILS, POST.**

All the personnel go to their assigned posts. (See fig. 18.)

The section being in formation in new positions, with vehicles loaded with equipment,

CS commands: **PREPARE FOR ACTION.**

The section follows procedure as described in paragraph 44. During preparation for action, men remain under cover as much as possible.

■ 44. PREPARE FOR ACTION.—Radar matériel is transported in the prime mover and special van trucks provided by Tables of Equipment. The equipment of the searchlight section is transported to the section position by vehicles and chauffeurs supplied from the battery motor pool.

As all the vehicles of the detector-searchlight section move into a selected position, the trucks come to a halt upon signal from CS.

CS dismounts and commands: **DISMOUNT.** He then indicates the locations for the radar mount, power plant truck, rectifier truck, machine gun, searchlight, control station, power plant, radio, and the parking area for the vehicles. At the same time he indicates whether the equipment is to be towed into position by the vehicles or whether it is to be manhandled from its present position to the designated spots. CS then commands: **PREPARE FOR ACTION.** In the following drill it is assumed that the vehicles will be used to transport the equipment. If the equipment is actually manhandled into position, obviously modifications in the drill must be made.

The chauffeur of power plant prime mover drives to the power plant position.

1 and 2 release safety belt and dismount.
1 (on left) removes the power plant lighting plug and places it on the guide chain.
2 (on right) disconnects the break-away chain from its connection at the rear of the truck, loops around tow bar near lunette, or places in tool box.

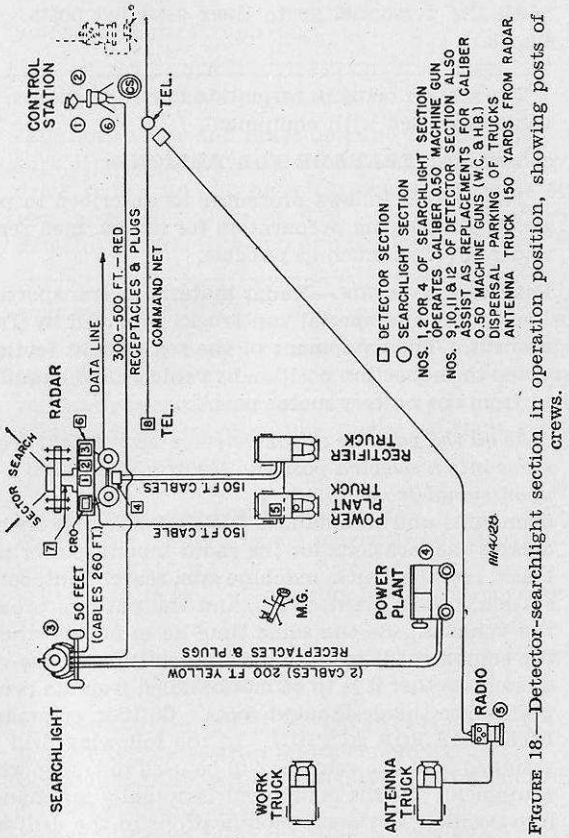


FIGURE 18.—Detector-searchlight section in operation position, showing posts of crews.

1 removes cotter pin from pintle hook and raises the pintle hook.
1 and 2 release lunette of tow bar from pintle hook and push power plant slightly to the rear, dropping the tow bar.
1 receives power plant exhaust extension from 5; places under power plant.
1 and 2 mount truck, fasten safety belt.

Power plant prime mover is then driven to the machine gun position.

The chauffeur of searchlight prime mover drives to the searchlight position.

6 dismounts and goes to the machine-gun position.

Power plant prime mover being at the machine gun position.

CS commands: EMPLACE MACHINE GUN. He then supervises unloading of machine gun, complete with ammunition chests and water pump.

1 and 2 disconnect safety belt and lower tailgate.
5 and 6 unload feedway and chamber of machine gun.
5 clamps machine gun at horizontal and swings muzzle toward cab of truck.
4, CS, 3, 2, and 1 (dismounted) take post facing tailgate of truck, in order named (CS slightly to left of center).
5 dismounts; takes post at left of 4.
6 removes ammunition chest and passes it to 4, who places it near machine gun site and returns to rear of truck.
6 pushes water chest and machine gun to rear of truck.
1 and 2 place water chest under tailgate.
CS and 3 pull left tripod leg off truck.
1 and 2 take right tripod leg.
4 and 5 take front tripod leg.
6 on truck steadies machine gun by barrel.
5, 4, CS, 3, 2, and 1 emplace machine gun.
6 passes machine gun ammunition and tools to 1 and 2, dismounts.
6 assisted by 1 and 2 places water chest to left of machine gun, replaces ammunition chest.
4 takes post as machine gunner and prepares gun for immediate action; unclamps machine gun in elevation, loads, and remains ready to fire.
1 and 2 raise tailgate; fasten safety belt.

CS, 1, 2, 3, and 6 move to searchlight position. The chauffeur of power plant prime mover and 5 drive over to location for radio near work or antenna truck.

NOTE.—*The radio may be sited on power plant if the power plant is equipped with suppressors, and if the "background noise" from the radar does not unduly interfere with radio operation. The radio may also be sited near control station. In this case, the hand generator must be used to supply power for transmission of messages. The radio is mounted on the dynamotor unit or on legs packed in the antenna bag.*

Power plant prime mover being at radio position,
5 dismounts; disconnects battery cables from truck battery (if radio has been used on road) and unscrews antenna (mast sections 49 through 53); mounts and makes battery cables secure; removes power cord; disconnects the antenna lead and ground lead from the mast bracket; removes head-set plugs and microphone plugs from jacks; places head sets and microphone in spare parts bag; closes radio door.
5 releases radio from hold-down devices; moves radio to rear of truck; moves spare parts bag, antenna bag, remote control unit, generator unit, field telephone, and extra wire to rear of truck.

The chauffeur of power plant prime mover takes radio and accessories and places them at the radio position.
5 lowers radio door; removes vibrator pack from case and places it in the power unit compartment at upper right side of panel; inserts plug in vibrator pack; removes remote control unit (4½-volt battery installed) from case; places on top of radio; inserts RECEIVER and MICROPHONE jacks on radio; plugs operator's head set and microphone plugs into jacks provided on remote control unit; inserts key plug in KEY jack. Places antenna base insulator in holders; inserts antenna lead into bottom of insulator, and connects lead to binding post marked ANTENNA; adjusts the switch on the power unit to either 6-volt or 12-volt position

as determined by voltages of the vehicle battery; opens power unit compartment and adjusts switch of receiver power unit to proper position as determined by voltage of the vehicle battery; turns transmitter MAIN SWITCH and STANDBY SWITCH to OFF. Connects power cable between receptacle and power unit (female plug into receptacle); checks that antenna selector switch is on ROD ANTENNA position No. 1; unreels the two counterpoise sections and bolts them together at the center; places the center under the radio set and spreads the eight wires out radially on the ground; connects center of counterpoise to binding post marked GROUND. Opens battery case of either the work or antenna truck; removes nuts on battery terminals and connects battery cables from radio (negative to negative, positive to positive); replaces nuts on battery terminals; opens antenna bag and removes mast sections (mast sections 52 through 56 for 15-foot antenna or sections 49 through 56 for 25-foot antenna supported by guy wires); assembles sections (matching ends which have same color code) and places antenna in insulator; connects field wire to terminals L_1 and L_2 of remote control unit; runs field wire to field telephone; ties loops around metal ring on leather case; connects field wire to L_1 and L_2 terminals; closes circuit breaker switches in power unit; turns STANDBY SWITCH to HIGH, MAIN SWITCH to CW for tuning; sets receiver tuning dial to operating frequency and sets transmitter from calibration chart. (For details of the procedure to put the set in operation, see the instructions on cover of set, or instruction manual.)

If hand generator is to be used as a source of power,
5 unpacks generator legs and crank of the hand generator set; removes generator from case; attaches legs of generator by slipping legs through the D-rings on the unit and attaches crank; connects power cable from power receptacles on radio and generator, respectively;

removes vibrator pack and replaces in case; inserts battery; turns STANDBY SWITCH to LOW.

NOTE.—*The radio may be set on the dynamotor unit, or on legs packed in antenna bag. Other preparations are outlined above.*

Searchlight prime mover and trailer being at the searchlight position,

CS commands: EMPLACE SEARCHLIGHT. He then supervises unloading the searchlight from the trailer.
2 (on right) sets the hand brake.
1 disconnects the jumper cord and places it in tool compartment; disconnects left safety chain and break-away chain.
2 disconnects the right safety chain; removes cotter pin from pintle hook, and raises pintle hook.
1 removes hand-locking pin from the caster wheel bracket, and allows caster wheel to swing down; replaces locking pin, securing the wheel in the parking position; assisted by 3, adjusts caster wheel to proper height so that lunette will clear the pintle hook (adjust caster wheel so it will be turned in rear position); signals chauffeur to drive truck forward clear of the trailer (about 30 to 40 feet).
6 (on right) and 3 (on left) unlace back canvas curtain of trailer; roll up and fasten canvas.
3 enters trailer and fastens winch chain hook to eyebolt of searchlight chassis; removes towing bar from bracket.
1 feeds winch chain through opening to 3.
1 tightens winch chain and locks winch with ratchet.
1 and 2 pull cotter pins and remove front pins from each side of winch deck.
1 and 2 break the trailer by pressing down the lunette end of the drawbar tongue (caster wheel turned in rear position).
3 and 6 loosen rear turnbuckles and remove rear chocks; lower tailgate.
3 assisted by 6, attaches towing bar to searchlight.

1 and 2 loosen front turnbuckles on left and right by opening doors on each side of front bulkhead.
1 and 2 release winch from ratchet and slowly pay out the winch chain as the light rolls out of trailer.
3 using tow bar, guides light out of trailer; checks to see that mirror does not point at sun.
6 disconnects the winch chain from the eyebolt.
3 and 6, assisted by 1 and 2, move the searchlight to its operating position.
3 detaches towing bar and places in brackets.
6 removes the can of spare carbons from holder; places carbons under the light.
1 removes blocks of wood for leveling light.
2 removes the extended hand controller from the trailer and places it near the light.
3 and 6 remove cover from searchlight; fold and place cover under light.
3 and 6 raise tailgate.
1 secures winch chain hook and attaches it to drawbar; throws winch ratchet.
1 and 2 take up on winch, lifting drawbar; replace left and right front pins on each side of winch deck; release winch chain hook and wind up chain, fastening hook.
3 and 6 roll down and fasten rear canvas cover.

Power plant prime mover having returned from radio location to searchlight position,

2 turns adjustment wheel so that caster wheel is adjusted to the proper height for lunette to clear pintle hook.
1 directs truck as it backs toward trailer. Signals chauffeur to "cut" so lunette will just clear pintle hook; fastens pintle hook.
1 removes the handlocking pin from the caster wheel bracket and swings the caster wheel up; replaces pin to secure it in traveling position.
2 assisted by 1 turns adjustment wheel; guides caster wheel into place.
1 fastens break-away chain and left safety chain; checks to determine that safety lever is in rear, or OFF posi-

tion; gets jumper cord and connects it to truck and trailer.

2 connects right safety chain and releases hand brake.

The chauffeur of power plant prime mover tows the trailer to cover, ready to proceed to battery motor pool.

3 remains with light to set it up, level it, and prepare it for action.

The driver of searchlight prime mover drives toward the control station.

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3 sets elevation brake on searchlight; unpins the transportation bar from the drums and lowers the transportation bar to its supports on the chassis; releases elevation brake; depresses light from 1,600 mils to zero mils; engages elevation brake.

If the searchlight is supported by A-frames in its traveling position,

3 sets elevation brake; releases elevation stowing spring from the lug on the rear of the drum, and secures it to storage hook on the turntable arm; releases A-frames by loosening the clamps on the turntable arms, swings them downward to an approximately horizontal position; disengages the frames from the chassis, and stores them on the ground under the chassis; releases elevation brake; lowers drum to zero elevation position; resets elevation brake.

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3 releases azimuth traveling lock; pulls out pin; lifts up azimuth lock handle; releases it; removes it and places it in position on azimuth D. E. C. clutch lever; leaves clutch in HAND position.

Leveling searchlight by use of one level bubble

3 lowers all four jackscrews (on blocks of wood if available) until wheels are just clear of ground; uncovers one level; traverses the light until level is in line diagonally with two of the jackscrews; adjusts these two jackscrews until the level bubble is centered; traverses

light until the level is in line diagonally with the other two jackscrews; adjusts these jackscrews until level bubble is centered; traverses light to positions 1600 mils apart and adjusts jackscrews if necessary.

Leveling searchlight by use of both levels.

3 traverses light until mirror faces out over junction box (one level is now parallel to I-beam, one level parallel with cross section pieces); adjusts two jackscrews at rear of light until level bubbles are centered (if position is not level, adjusts jackscrews on lower end of chassis); traverses light through stages of 1,600 mils; adjusts the same two levels; checks through 6,400 mils; covers levels.

3 checks that both amplidyne switches are OFF and that both clutch handles are in D. E. C. position; sets drum on zero elevation and engages elevation brake; turns on recarboning lamp switch; opens the left drum access door; releases positive and negative levers on the lamp; inserts a positive carbon through the center opening of the front glass door and the hole in the lamp positive-head mechanism until it projects about ¾ inch (thickness of the thumb) beyond the mirror end of the positive nose cap; checks that positive carbon extends at least 2 inches beyond front door glass; operates positive lever to engage the carbon with the positive feed rollers; inserts pointed end of a negative carbon through the negative head until its tip is within approximately ¼ inch of the tip of the positive carbon; operates the negative lever to engage the carbon with the negative rollers; closes drum door *securely;* switches off the recarboning lamp; releases the elevation brake. Connects red and yellow cables after the *laying of all the cables has been completed.* The data transmission cable from radar (director-adapter cable) is delivered to 3 by one of radar crew. 3 inserts radar cable plug in blue receptacle.

To cover light with canvas,

3 depresses drum to minimum elevation; starts cover over front door glass and top; elevates light to traveling position, raising the canvas at the same time; pulls

canvas remainder of the way over light; fastens canvas down by tying rope under jackscrews to chassis.

Searchlight prime mover being driven between searchlight and control station positions,

CS supervises laying of cable between light and control station.

1 takes red plug of control station cable; hands plug to 2 who stands by on ground at rear of truck; stands back of reel and slowly reels off cable as truck drives slowly between searchlight and control station position.

2 follows directly behind truck; feeds cable to 6.

6 places red plug of cable near searchlight junction box; follows 15 to 25 feet behind 2; lays cable on ground in straight line.

The red cable being laid from the searchlight to the control station.

2 releases control station tripod from hold-down device; hands tripod to 6 who sets it up and latches leg braces; hands canvas cover to 6.

1 and 2 remove binocular mount and spare parts boxes from hold-down devices; move boxes to rear of truck; move rack and reel of field wire to rear of truck; move panel set to rear of truck.

CS and 6 remove equipment from truck to ground.

1 and 2 release controller from hold-down devices; move it to rear of truck.

CS and 6 take controller and place it in position on tripod (they check to see that receptacle and centering flange pass through the hole in the tripod top).

2 dismounts and guides controller so that three shoulders on tripod top engage the holes in controller base; secures controller by three knurled thumbscrews on the tripod top; plugs cable in receptacle.

6 loosens binocular mount clamp; removes the binocular mount socket cover; carefully inserts the bottom of the binocular mount column into the mount socket of the controller until the aligning slot engages the aligning key; clamps the binocular mount column; adjusts binocular mount linkage to proper height by means of height adjustment crank; removes the binocular linkage pin and sets the linkage in its operating position; replaces pin to lock the linkage; uses adjusting handles to bring elevation index to its mark; removes binoculars from case; places binocular hinge in the slot of the binocular mounting block (lettering on binoculars should be right side up); unscrews the clamp screw on the open sight as far as possible; inserts index end of the sight bar in the front of the slot; tightens the clamp screw to secure the binoculars in place.

1 uncovers levels on control station; slews control unit around until one of levels is in line with any two of tripod jackscrews; raises or lowers these two jackscrews to center the level bubble; centers second level bubble by adjusting the third jack; makes final check on leveling by slewing the control station in stages through 360°; covers levels.

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1 and 2 mount searchlight prime mover which is driven to the searchlight position.

At the searchlight position,

1 releases yellow plugs of power cables; hands them to 2 on ground at rear of truck; as truck moves slowly toward power plant, stands near reel and reels out two power cables to 2.

2 places yellow plugs near searchlight junction box; as truck moves off, follows in rear, receiving power cables from 1 and feeding them to CS.

CS follows 15 to 25 feet behind 2, laying cables in straight line.

1 relieves 4 at machine gun.

NOTE.—*No. 1 will remain on guard at the machine gun until the command* ***STAND BY*** *is given. At this command he returns to control station, and No. 4 stands by at the machine gun. The radar power plant operator checks operation of the searchlight power plant. In many cases a member of the detector section will*

be available to act as machine gunner. In those sections not equipped with radars, either No. 1 or No. 2 will normally act as the machine gunner.

The chauffeur of searchlight prime mover drives his truck back to the battery motor pool.

NOTE.—*If it has not been practicable to lay the telephone line from the platoon net while the section was moving along the road toward its position, and if the line from the platoon command net has not been laid down to the section position by the platoon headquarters section, it will often be necessary for the telephone operators to mount the searchlight prime mover, drive to nearest intersection with the platoon net, and to tie on to this net. They use telephone set and test clamps to check communications as they lay wire from the wire reel which is placed in the rear of the truck. At the section position telephones are connected at the stations of the chief of section and of the chief radar operator. Communications over the platoon net are tested, and the telephone operator reports the condition of communications to the chief of section. The data line to the radar is established by the battalion headquarters communications detail assisted by available personnel from the searchlight sections and supervised by searchlight defense communications officer.*

Having been relieved at the machine gun, and having returned to power plant.

4 connects the yellow cables; checks fuel, oil, water, and battery water; unlocks and fastens control panel door; opens left power unit door; releases front door lock; opens front door for ventilation; closes left power unit door; opens main power switch; turns rheostat clockwise to minimum voltage position; removes cap from exhaust.

■ 45. EXAMINE EQUIPMENT.—As soon as all items of equipment of the entire section are in their proper positions and all cables are connected,

CS commands: EXAMINE EQUIPMENT. Inspects power plant, searchlight, control station, machine gun, and radar; verifies functioning of all equipment.

1 and 2 check operation of traversing and elevating mechanisms; verify level of control station through 360°; check operation of buzzer signal from control station to searchlight.

6 supervises operation check of control station; turns height adjustment crank to adjust the binoculars to his height; adjusts focus of binocular eyepieces to his vision; checks to determine that D. E. C. transfer switch is in AUTOMATIC position (M1941 control station: that D. E. C. switch is OFF).

NOTE.—*Operation of D. E. C. system is checked during procedure of orientation and synchronization.*

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3 examines the searchlight to see that all plugs are properly connected in receptacles; checks for availability of spare positive and negative carbons and searchlight tools; checks recarboning and scale lamp switches; checks to determine that elevation and azimuth D. E. C. clutch levers are in HAND position and elevation brake is disengaged; checks that azimuth and elevation amplidyne switches are OFF; examines extended hand controller.

NOTE.—*To check operation of extended hand controller: elevation and azimuth clutch levers in HAND position; elevation and azimuth amplidyne switches OFF. Press extended hand controller socket latch, and remove the socket cover. Insert extended hand controller in socket. Press slightly toward searchlight and rotate the handwheel until hand controller coupling falls into place. Rotate outer tube until latch falls into its notch. The searchlight turns freely in elevation with rotation of the handwheel, and the light is traversed in azimuth as the operator moves in clockwise or counterclockwise direction. Azimuth or elevation control of the searchlight in following radar data is obtained by movement of extended hand con-*

troller to keep zero indicator centered. However, after the arc has been struck and the target picked up, the light is moved by direct observation of target and not by centering zero indicators.

3 checks following before striking arc: positive drive crank, positive feed button, and negative drive crank in OUT or lower positions; positive feed rate knob at minimum feed position; ground glass finder cover and peep sight cover open; drum access doors closed. Covers front of light with canvas, or points light at ground (if at night) and strikes arc; observes voltmeter, ammeter, and ground glass finder to see if arc is functioning normally and carbons are feeding properly; listens to determine that fan is running; checks that negative carbon withdraws; checks voltmeter for 78 volts and ammeter for 150 amperes (arc current). For voltage adjustment, signals power plant operator; for current adjustment, turns thumbscrew on the arc current regulator in the lamp control box until the ammeter reads 150 amperes; checks that image of the positive crater tip is maintained exactly on the black or focal line on the ground glass finder.

NOTES.—1. *Semiautomatic lamp control.—If thermostat control fails, lamp strike can be obtained and the protrusion of the positive carbon regulated by turning positive feed rate knob clockwise toward its maximum feed position. Operate negative carbon, as in automatic control above, by adjusting thumbscrew on the arc-current regulator in the lamp control box.*

2. *Manual lamp control.—If automatic lamp control fails, control of lamp may be maintained as follows: close arc switch; push in and turn negative drive crank in clockwise direction until arc is struck with positive carbon, then reverse rotation of negative drive crank until ammeter reads 150 amperes; push in and continuously rotate the positive drive crank; to keep carbon tip at focal position, push in on positive feed button while the positive drive crank is rotated.*

3 opens arc switch as soon as possible.

NOTE.—*The instructions above apply specifically to the General Electric 1941 and 1942 model lights. For slight difference in nomenclature and operation with other equipment, see Operator's Manual.*

4 pulls out choke and throttle half way; turns on ignition switch; presses starter button (after operating engine for a few minutes); pushes in choke and pulls out throttle all the way; closes 100-volt switch which controls 100-volt control panel light.

NOTE.—*Manual starting.—Pull out choke and throttle slightly; turn on ignition switch; pull hand crank one-half revolution. After engine fires, adjust choke and throttle.*

4 adjust generator field rheostat so that voltmeter indicates 105 to 110 volts; closes main power switch; for tracking-load voltage, checks voltmeter for 105–110 volts (after arc is struck at searchlight and is burning steadily); adjusts generator field rheostat so that voltmeter will read 78 volts *at light* or approximately 100 volts *at power plant.*

NOTE.—*Manual operation.—If governor control fails, or manual control is desired, temporarily block governor lever in forward position (or disconnect governor rod between carburetor and governor) to prevent interference from mechanical governor; check for 1250 rpm. engine speed; regulate speed by hand throttle; when arc switch is opened, quickly push in throttle to avoid excessive engine speed and voltage.*

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5 tunes radio to proper frequencies to communicate with platoon command post or other units; tests operation of remote control unit and line to remote control telephone at control station.

If 5 acts as telephone operator on platoon command net, checks telephone terminals for any corrosion and the condition of the telephone line; tests communication with the platoon command post, and makes a line

check if communications are not established properly.

The machine gunner examines the operation of the machine gun, the water pump and connections; checks the supply of ammunition.

■ 46. REPORT.—When it is evident that members of the section have completed their duties under command **EXAMINE EQUIPMENT,**

CS commands: **REPORT.**

3, 4, 5, 6, CRO, and MG report to CS, *"In order,"* or report any deficiencies.

■ 47. ORIENT.—When all equipment is reported in order to CS, and when he has assured himself that radar, searchlight, and control station are accurately leveled,

CS commands: **ORIENT,** and designates the orienting point; supervises orientation of radar with associated equipment.

NOTE.—*The radar is a primary source of information in the continuous AAAIS for close-in warning purposes. The radar data must be transmitted in a form readily applicable to relocation boards. It is therefore necessary to orient radar in azimuth referred to north (south in Southern Hemisphere). Such an azimuth is determined from magnetic compass, oriented map, watch, or bearing of the sun or other celestial body if a bearing chart is available. The two methods of orientation explained below are provided so that the detector-searchlight section may be oriented prior to going into operation. Such orientation will be checked at night by sighting on Polaris (stake placed to mark direction of Polaris) or some other star. Sighting on a celestial body makes parallax negligible, and assures an accurate azimuth bearing. For details concerning azimuth determination, see TM 4–226 (when published), FM 4–118 (when published), and FS 4–37. This description of orientation and synchronization should be studied in connection with the corresponding subject matter in FM 4–176 and TF 4–610.*

CRO supervises the antenna alignment of the radar; directs procedure by which electrical axis of the azimuth antenna is aligned with the mechanical axis of the radar mount and with the sight, electrical axis of the elevation antenna is aligned with the mechanical axis of the radar mount and the sight, angular height counter is adjusted to indicate the true angular height of the electrical axis, and range orientation is completed. Determines north direction from radar by means of compass, oriented map, or other method; orders stake set out in this direction; determines azimuth bearing of distant orienting point; informs R6 of correct bearing.

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a. Orientation and synchronization of M1942 General Electric searchlight on a distant aiming point.

CS at searchlight, checks that azimuth and elevation amplidyne switches are OFF and azimuth and elevation D. E. C. clutches in HAND position. Signals 4 to start searchlight power plant.

6 at control station, checks that D. E. C. transfer switch is on AUTOMATIC.

4 at power plant, throws main power switch to ON.

CRO supervises the process of pointing the radar at the distant aiming point and of synchronization of radar with associated equipment.

R2 and R3 traverse and elevate radar to direct it toward distant aiming point.

R1 sights through orienting sight and guides R2 and R3 until distant aiming point is centered on cross wire of orienting sight. (See fig. 19.)

R2 applies azimuth foot brake to hold radar on distant aiming point.

R1 reports to chief of section, "Radar on point."

R6 loosens clamps on radar azimuth ring and turns scale until azimuth bearing of distant aiming point is under azimuth pointer index; reports to chief of section, "Set."

CS manually moves searchlight in azimuth and elevation until the distant aiming point is sighted at the cross-

wire intersection of the orienting sight (see fig. 19).

3 holds light on point by turning azimuth and elevation D. E. C. clutches to D. E. C. position.

CS observes azimuth zero indicator to determine whether needle is on zero or on GO RIGHT or GO LEFT sector of azimuth indicator; directs 3 as he turns AZIMUTH CORRECTOR; signals him when needle of azimuth zero indicator is centered.

3 loosens locking clamp, and turns AZIMUTH CORRECTOR in direction indicated on the azimuth corrector name plate (clockwise for GO RIGHT or counterclockwise for GO LEFT) until needle on zero indicator is centered; tightens clamp.

CS checks sensing (needle deflection) on azimuth zero indicator; directs 3 to place azimuth D. E. C. clutch to HAND position; swings light manually in clockwise direction; checks that needle moves (clockwise) to GO RIGHT sector; brings light back on distant aiming point. Directs 3 to place azimuth D. E. C. clutch in D. E. C. position.

NOTE.—*If the needle moves in the wrong direction, CS returns light to distant aiming point; directs 3 to turn AZIMUTH CORRECTOR continuously in one direction until needle on azimuth indicator moves off scale and then back to zero reading again. CS again checks for correct sensing; brings light back on point; directs 3 to place azimuth D. E. C. clutch in D. E. C. position.*

CS observes elevation zero indicator to determine whether needle is on ZERO, or on ELEVATE or DEPRESS sector of indicator; if needle is not on ZERO, directs 3 as he turns ELEVATION CORRECTOR screw; signals him when needle of elevation zero indicator is centered.

3 loosens locking clamp and turns ELEVATION CORRECTOR screw in direction indicated on elevation zero indicator (clockwise for DEPRESS, counterclockwise for ELEVATE) until needle on zero indicator is centered; tightens clamp.

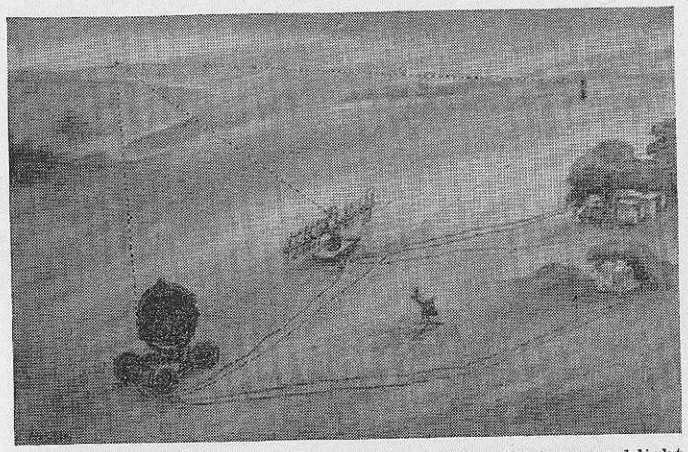


FIGURE 19.—Orientation on a distant point, detector-searchlight section.

CS places elevation D. E. C. clutch in HAND position; checks sensing (needle deflection) on elevation zero indicator; elevates and depresses light manually; checks that needle moves (clockwise) to ELEVATE when the light is depressed; brings light back on distant aiming point; directs 3 to place elevation D. E. C. clutch in D. E. C. position.

NOTE.—*If the needle moves in the wrong direction, CS returns light to distant aiming point and directs 3 to turn ELEVATION CORRECTOR screw continuously in one direction until the needle on the elevation zero indicator moves off the scale and then back to zero reading again.*

CS again checks for correct sensing. Brings light back on distant aiming point. Directs 3 to place elevation D. E. C. clutch in D. E. C. position.

CS turns azimuth and elevation amplidyne switches ON; sights through orienting sight and makes accurate check on orientation on distant aiming point; if necessary, directs 3 to make close adjustment by turning AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw.

CS directs 3 to loosen clamping screws on azimuth scale of searchlight and turn scale until the correct azimuth reading (same azimuth as that set on radar azimuth scale) appears under the pointer index. 3 tightens clamping screws.

CS signals R2 to traverse the radar to the right. The searchlight should also follow in the same direction.

If the searchlight rotates to the left,

CS signals R2 to return radar and searchlight to the aiming point; turns azimuth amplidyne switch to OFF position; signals R6 to throw the COARSE AZIMUTH reversing switch in the terminal box of the radar; checks azimuth zero indicator and directs 3 to turn AZIMUTH CORRECTOR until zero needle is centered; directs 3 to place azimuth D. E. C. clutch in HAND position; checks for sensing.

CS signals R3 to elevate the radar. The searchlight should also elevate.

If the searchlight depresses,

CS signals R3 to return radar and searchlight to aiming point; turns elevation amplidyne switch to OFF position; signals R6 to throw the COARSE ELEVATION reversing switch in the terminal box of the radar; checks elevation zero indicator and directs 3 to turn ELEVATION CORRECTOR until the zero needle is centered; places elevation D. E. C. clutch in HAND position; checks for sensing.

If sensing in both azimuth and elevation is correct,

CS brings searchlight back on the aiming point; directs 3 to place azimuth and elevation D. E. C. clutches in D. E. C. position; turns azimuth and elevation amplidyne switches to ON; makes close adjustment on distant aiming point by the AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw.

To orient and synchronize the M1942 General Electric control station,

CS directs that the radar be aimed at the distant aiming point.

6 checks to determine that D. E. C. transfer switch is still on AUTOMATIC; turns azimuth zero indicator operator's handwheel until the zero indicator needle is on zero; checks for sensing; turns azimuth zero indicator operator's handwheel in clockwise (right) direction; checks that azimuth zero indicator needle also moves in clockwise (right) direction.

NOTE.—*If the needle moves in the wrong direction, 6 continues to turn the azimuth zero indicator operator's handwheel until the needle moves off the zero indicator scale and returns again to a new zero reading. 6 again checks sensing, and zeroes needle.*

6 turns elevation zero indicator operator's handwheel until needle of zero indicator is on zero; checks for sensing; turns elevation zero indicator operator's handwheel in clockwise (right) direction; checks that elevation zero indicator needle also moves in a clockwise (right) direction.

NOTE.—*If the needle moves in the wrong direction, 6 continues to turn the azimuth zero indicator operator's handwheel until the needle moves off the zero indicator scale and returns again to a zero reading. 6 again checks sensing and zeroes needle.*

6 adjusts binocular mount so that binoculars are pointing away from the observer's handwheels; slews the control unit (without moving handwheels) on its friction clutch, and adjusts binoculars by means of adjusting handles until the distant aiming point is centered accurately in the binocular field of view; turns D. E. C. transfer switch to MANUAL.

b. Orientation and synchronization of the 1942 General Electric searchlight by backsighting on equipment.

The radar, searchlight, and control station being accurately leveled, and the azimuth scale of the radar set in azimuth referred to north,

CS directs that the radar be pointed away from the searchlight.

CS directs 3 to place azimuth and elevation D. E. C. clutches in HAND position; checks to determine that azimuth and elevation amplidyne switches are in OFF position; traverses and elevates searchlight until light is pointed approximately at the radar orienting sight; directs 3 to reengage azimuth and elevation D. E. C. clutches in D. E. C. position.

4 starts searchlight power plant.

6 checks to determine that D. E. C. transfer switch is in AUTOMATIC.

4 throws main power switch at searchlight power plant to ON.

CS sights through searchlight orienting sight and carefully aims the sight at the eyepiece of the radar sight; holds light in stationary position (fig. 20).

R1 at radar, *backsights* through the radar sight; directs R2 and R3 to traverse and elevate until radar sight is carefully aimed on cross-wire intersection of searchlight orienting sight. The radar and the light are now pointed in the same direction.

CS assisted by 3, synchronizes in azimuth by turning AZIMUTH CORRECTOR and synchronizes in elevation by turning ELEVATION CORRECTOR screw (see *a* above); checks sensing in azimuth and elevation (see *a* above); traverses and elevates light until azimuth and elevation needles are on zero (searchlight sight on radar sight); places azimuth and elevation D. E. C. clutches in D. E. C. position; turns azimuth and elevation amplidyne switches to ON; checks that orienting sight is accurately aimed at radar sight; turns AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw if necessary.

CS directs 3 to loosen clamping screws on azimuth scale of searchlight and move scale until correct azimuth reading (azimuth reading set on radar azimuth scale) appears under the azimuth pointer index; tightens clamps; calls for reading of angular height counter at radar; checks angular height reading with elevation scale reading of searchlight. The readings should be the same.

CS assisted by R3 and the radar crew, checks azimuth direction of rotation. (See *a* above.) If the direction of rotation in azimuth is incorrect, the radar and light are brought back to their original positions.

CS assisted by 3 turns azimuth amplidyne switch to OFF, signals R6 to throw COARSE AZIMUTH reversing switch in the terminal box of radar; brings the azimuth zero indicator to zero by turning AZIMUTH CORRECTOR; places azimuth D. E. C. clutch in HAND position; checks sensing. (See *a* above.)

If rotation in elevation is incorrect, the radar and light are brought back to their original positions.

CS assisted by 3, turns elevation amplidyne switch to OFF; signals R6 to throw COARSE ELEVATION reversing switch in terminal box of radar; brings the elevation zero indicator to zero by turning ELEVATION CORRECTOR screw; places elevation D. E. C. clutch in HAND position; checks sensing. (See *a* above.)

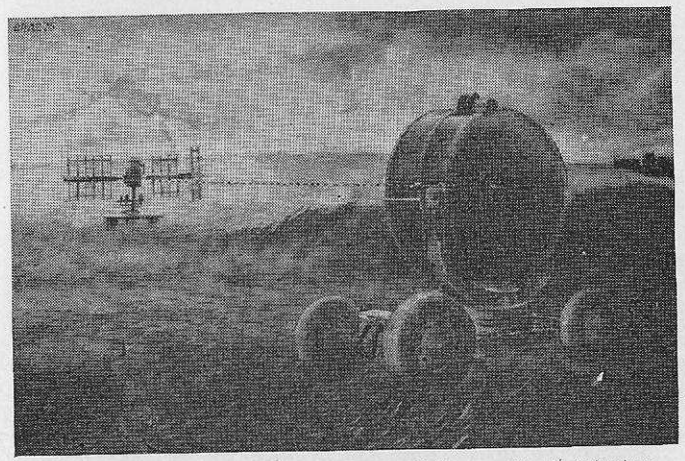


FIGURE 20.—Orientation by the backsighting method, detector-searchlight section (orientation of radar and searchlight).

If sensing in both azimuth and elevation is correct,

CS assisted by 3, again aims the searchlight at the radar; places azimuth and elevation D. E. C. clutches in

D. E. C. position; turns azimuth and elevation amplidynes to ON; sights accurately on the eyepiece of the radar by turning the AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw.

To orient and synchronize the M1942 General Electric control station by backsighting on equipment.

The amplidyne switches at searchlight being in OFF position,

CS signals R2 and R3 to point the radar away from the control station.

R1 *backsights* through radar orienting sight, and directs R2 and R3 to traverse and elevate until the orienting sight is carefully aimed at the binoculars at the control station.

6 turns D. E. C. transfer switch to MANUAL; turns azimuth and elevation zero indicator operator's handwheels until needles are zero with correct sensing (see *a* above); adjusts the binocular mount so that binoculars are pointing away from the observer's handwheels; slews the control unit in azimuth (without moving handwheels) and moves adjusting handles until the binoculars of the control station are directed at the eyepiece of the orienting sight of the radar.

NOTE.—*The radar will not be depressed below zero as this requires several steps. If it should be necessary to depress below zero to align the sights as described, stop at zero, then zero the zero indicators at the control station. Slew the control station in azimuth until sights are aligned in azimuth only, then set the binoculars at their zero reference mark in elevation.*

6 turns the D. E. C. transfer switch to AUTOMATIC position.

c. To orient and synchronize the M1942 General Electric searchlight by sighting on Polaris.

Orientation and synchronization is accomplished by exactly the same procedure as described for orientation and synchronization on a distant aiming point. (See *a* above.) However, in this case, radar and

searchlight azimuth scales are both set at zero as soon as sights are accurately aimed at Polaris.

d. To check orientation and synchronization of M1942 General Electric searchlight by sighting on Polaris.

It is assumed that accurate orientation and synchronization have already been accomplished by means of the distant aiming method or by the backsighting method; and that the searchlight power plant is in operation with main power switch ON, azimuth and elevation D. E. C. clutches at searchlight are in D. E. C., amplidyne switches at searchlight are OFF and D. E. C. transfer switch at control station is on AUTOMATIC.

CS directs that radar, searchlight, and control station be sighted accurately on Polaris.

R1 sights through radar orienting sight while R2 and R3 traverse and elevate radar, if necessary, to aim sight at Polaris.

R6 moves azimuth ring, if necessary, until zero appears under pointer index.

3 turns azimuth and elevation amplidyne switches to ON.

CS aims through orienting sight and makes a close adjustment on Polaris.

3 turns AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw, if necessary, to point light accurately at Polaris; loosens clamping screws on the azimuth scale and turns it until zero on the scale is under the pointer index.

6 directs that 1 and 2 center needles at zero indicators; slews the control unit on its friction clutch and adjusts the binoculars by means of the adjusting handles until Polaris is accurately centered in the open sight.

e. To orient and synchronize the M1942 General Electric searchlight and control station (carry light section).

If a distant aiming point is used. (It is assumed that main power switch of searchlight power plant is ON, the amplidyne switches are OFF and that D. E. C. transfer switch at control station is in MANUAL.)

CS directs 3 to place azimuth and elevation D. E. C. clutches in HAND position; manually traverses and elevates light until azimuth and elevation zero indicators are centered; checks sensing in azimuth and elevation, makes correction for incorrect sensing, if necessary, by turning AZIMUTH CORRECTOR and ELEVATION CORRECTOR screw (see *a* above); directs 3 to place azimuth and elevation D. E. C. clutches in D. E. C. position; turns amplidyne switches to ON.

6 at control station, turns observer's handwheels to traverse and elevate light until it is aimed accurately at distant aiming point; slews control unit in azimuth and adjusts binoculars by adjusting handles until the distant aiming point is sighted through the binoculars.

3 loosens azimuth scale clamping screws and turns the azimuth scale until the correct azimuth referred to north (if known) appears under the pointer index; tightens clamping screws.

f. Orientation and synchronization of M1942 Sperry searchlight on a distant aiming point.

It is assumed the radar, searchlight, and control station are accurately leveled and the radar accurately aligned as covered at beginning of paragraph 47.

CS at searchlight, checks that the azimuth and elevation amplidyne switch is OFF and azimuth and elevation D. E. C. clutches are in OPERATION and MOTOR DRIVE positions respectively. Signals 4 to start searchlight power plant.

6 at control station, checks that D. E. C. transfer switch is on AUTOMATIC.

4 at power plant, throws main power switch to ON.

CRO supervises the process of pointing the radar at the distant aiming point and of synchronizing the radar with associated equipment.

R2 and R3 traverse and elevate radar to direct it toward distant aiming point.

R1 sights through orienting sight and guides R2 and R3 until distant aiming point is centered on cross wire of orienting sight. (See fig. 19.)

R2 applies azimuth foot brake to hold radar on distant aiming point.

R1 reports to chief of section, "Radar on point."

R6 loosens clamps on radar azimuth ring and turns scale until azimuth bearing of distant aiming point is under azimuth pointer index; reports to chief of section, "Set."

CS manually moves searchlight in azimuth until azimuth zero indicator is centered; checks sensing (needle deflection ; swings light manually in clockwise direction; checks that needle moves clockwise.

NOTE.—*If needle moves in wrong direction, CS swings light manually through 180° until the azimuth zero indicator moves off the scale and returns to the other zero position; checks sensing.*

3 places azimuth D. E. C. clutch in TRANSPORTATION position.

CS manually moves searchlight until the distant aiming point is sighted at the cross-wire intersection of the orienting sight. (See fig. 19.)

3 engages azimuth D. E. C. clutch in OPERATION position.

NOTE.—*It may be necessary to move the light slightly in azimuth in order to engage the azimuth D. E. C. clutch.*

CS manually brings light back on distant aiming point if it has been moved off slightly and directs 3 to turn azimuth corrector crank until azimuth zero needle is brought back to zero.

CS directs 3 to loosen clamping screws on azimuth scale of searchlight and turn scale until the correct azimuth reading (same azimuth as that set on radar azimuth scale) appears under the pointer index. 3 tightens clamping screws.

R3 brings radar to zero elevation.

3 sets elevation D. E. C. clutch to HAND DRIVE.

CS manually moves light to zero elevation and directs CRO to turn COARSE ELEVATION SELSYN adjustment at the radar until elevation zero needle at the

searchlight is centered; checks sensing (needle deflection)—depresses light manually; checks that needle moves clockwise (right).

3 sets elevation D. E. C. clutch in MOTOR DRIVE position.

CS turns azimuth and elevation amplidyne switch ON.

CS signals R2 to traverse the radar to the right. The searchlight should also follow in the same direction.

If the searchlight rotates to the left,

CS signals R2 and R3 to return radar and searchlight to distant aiming point; turns azimuth and elevation amplidyne switch to OFF position; signals R6 to throw the COARSE AZIMUTH reversing switch in the terminal box of the radar; checks azimuth zero indicator and directs 3 to turn azimuth corrector crank until zero needle is centered; checks for sensing.

CS checks to see that azimuth and elevation amplidyne switch is at ON position; signals R3 to elevate the radar. The searchlight should also elevate.

If the searchlight depresses,

CS signals R3 to return the radar and searchlight to zero elevation; turns azimuth and elevation amplidyne switch to OFF position; signals R6 to throw the COARSE ELEVATION reversing switch in the terminal box of the radar; checks elevation zero indicator and directs CRO to turn COARSE ELEVATION SELSYN adjustment at radar until the zero needle is centered; directs 3 to place elevation D. E. C. clutch in HAND DRIVE position; checks for sensing; returns light to zero elevation; directs 3 to place elevation D. E. C. clutch in MOTOR DRIVE position.

If sensing in both azimuth and elevation is correct,

CS turns azimuth and elevation amplidyne switch to ON; directs 3 to make close adjustment in azimuth on distant aiming point by the azimuth corrector crank; directs CRO to make close adjustment at the COARSE ELEVATION selsyn of the radar to bring the searchlight to zero elevation.

To orient and synchronize the M1942 Sperry control station,

CS directs that the radar be aimed at the distant aiming point.

6 checks to determine that D. E. C. transfer switch is still on AUTOMATIC; turns azimuth zero indicator operator's handwheel until the zero indicator needle is on zero; checks for sensing; turns azimuth zero indicator operator's handwheel in clockwise (right) direction; checks that azimuth zero indicator needle also moves in clockwise (right) direction.

NOTE.—*If the needle moves in the wrong direction, 6 continues to turn the azimuth zero indicator operator's handwheel until the needle moves off the zero indicator scale and returns again to a new zero reading. 6 again checks for sensing and zeroes needle.*

6 turns elevation zero indicator operator's handwheel until needle of zero indicator is on zero; checks for sensing; turns elevation zero indicator operator's handwheel in clockwise (right) direction; checks that elevation zero indicator needle also moves in a clockwise (right) direction.

NOTE.—*If the needle moves in the wrong direction, 6 continues to turn the elevation zero indicator operator's handwheel until the needle moves off the zero indicator scale and returns again to a zero reading. 6 again checks sensing and zeroes needle.*

6 adjusts binocular mount so that binoculars are pointing away from the observer's handwheels; slews the control unit (without moving handwheels) on its friction clutch, and adjusts binoculars by means of adjusting handles until the distant aiming point is accurately centered in the binocular field of view; turns D. E. C. transfer switch to MANUAL.

g. Orientation and synchronization of the M1942 Sperry searchlight by backsighting on equipment.

The radar, searchlight, and control station being accurately leveled, and the azimuth scale of the radar set in azimuth referred to north,

CS directs that the radar be pointed away from the searchlight.

CS at searchlight, checks to see that azimuth and elevation D. E. C. clutches are in OPERATION and MOTOR DRIVE positions respectively and that azimuth and elevation amplidyne switch is in OFF position. Signals 4 to start searchlight power plant.

6 at control station, checks that D. E. C. transfer switch in on AUTOMATIC.

4 at power plant, throws main power switch to ON.

CS manually moves searchlight in azimuth until azimuth zero indicator is centered—checks sensing. (See *f* above.)

3 places azimuth D. E. C. clutch in TRANSPORTATION position.

CS manually moves searchlight until it is pointing approximately at the radar orienting sight.

3 places azimuth D. E. C. clutch in OPERATION position.

NOTE.—*It may be necessary to move the light slightly in azimuth in order to engage the azimuth D. E. C. clutch.*

3 places elevation D. E. C. clutch in HAND DRIVE position.

CS manually moves light in elevation until elevation zero indicator is centered—checks sensing. (See *f* above.)

3 places elevation D. E. C. clutch in MOTOR DRIVE position.

CS turns azimuth and elevation amplidyne switch ON; sights through orienting sight of searchlight and directs 3 to turn azimuth corrector crank and CR0 to turn COARSE ELEVATION SELSYN adjustment at the radar until the sight is carefully aimed at the eyepiece of the radar sight.

R1 at radar, *backsights* through the radar sight; directs R2 and R3 to traverse and elevate until radar sight is carefully aimed on cross-wire intersection of searchlight orienting sight. The radar and the searchlight are now pointed in the same direction. (See fig. 20.)

CS directs 3 to loosen clamping screws on azimuth scale

of searchlight and move scale until correct azimuth (azimuth reading set on radar azimuth scale) appears under the azimuth pointer index; tightens clamps; calls for reading of angular height counter at radar; checks angular height reading with elevation scale reading of searchlight. The readings should be the same.

CS assisted by 3 and the radar crew, checks azimuth and elevation direction of rotation. (See *f* above.)

To orient and synchronize the M1942 Sperry control station by backsighting on equipment.

The azimuth and elevation amplidyne switch at the searchlight being in OFF position,

CS signals R2 and R3 to point radar away from the control station.

R1 *backsights* through radar orienting sight, and directs R2 and R3 to traverse and elevate until the orienting sight is carefully aimed at the binoculars at the control station.

6 turns D. E. C. transfer switch to MANUAL; turns azimuth and elevation zero indicator operator's handwheel until needles are zero with correct sensing (see *f* above); adjusts the binocular mount so that the binoculars are pointing away from the observer's handwheels; slews control unit in azimuth (without moving handwheels) and moves adjusting handles until the binoculars of the control station are directed at the eyepiece of the orienting sight of the radar.

NOTE.—*The radar will not be depressed below zero as this requires several steps. If it should be necessary to depress below zero to align the sights as described, stop at zero, then zero the zero indicators at the control station. Slew the control station in azimuth until sights are aligned in azimuth only, then set the binoculars at their zero reference mark in elevation.*

6 turns D. E. C. transfer switch to AUTOMATIC position.

h. To orient and synchronize the M1942 Sperry searchlight by sighting on Polaris.

Orientation and synchronization is accomplished by the same procedure as described for orientation and synchronization on a distant aiming point. (See *f* above.) However, in this case, radar and searchlight are both sighted on Polaris and the azimuth scales are both set at zero as soon as sights are accurately aimed at Polaris.

i. To orient and synchronize the M1942 Sperry searchlight and control station (carry light section) on distant aiming point.

It is assumed that main power switch at the searchlight power plant is ON, that azimuth and elevation amplidyne switch is OFF and that D. E. C. transfer switch at control station is in MANUAL position.

CS directs 3 to place azimuth and elevation D. E. C. clutches in OPERATION and HAND DRIVE positions respectively; manually traverses and elevates light until azimuth and elevation zero indicators are centered; checks sensing in azimuth and elevation. (See *f* above.)

3 places elevation D. E. C. clutch in MOTOR DRIVE position.

CS turns azimuth and elevation amplidyne switch ON.

6 at control station, turns observer's handwheels to traverse and elevate light until it is aimed accurately at distant aiming point; slews control unit in azimuth and adjusts binoculars by adjusting handles until the distant aiming point is sighted through the binoculars.

3 loosens azimuth scale clamping screws and turns azimuth scale until the correct azimuth referred to north (if known) appears under the pointer index; tightens clamping screws.

j. To orient and synchronize the General Electric and Sperry searchlights, M1941. (*See par. 41b.*)

(1) *On distant aiming point.*

(*a*) Determine the azimuth of the orienting point. Traverse and elevate the radar until the distant aiming point is sighted through the orienting sight. Set the azimuth ring to the azimuth of the point.

(*b*) At the searchlight disengage the azimuth clutch knob by pulling the azimuth clutch handle in direction indicated as OUT on the Sperry searchlight or indicated as HAND CONTROL on the General Electric searchlight. Move elevation clutch lever to HAND position.

(*c*) Turn the searchlight manually until it points at the aiming point, sighting by means of the orienting sight on the searchlight, and reengage the azimuth clutch by pushing the clutch lever in the direction indicated as IN on the Sperry and D. E. C. on the General Electric. Turn elevation clutch lever to D. E. C. position.

(*d*) On the Sperry and General Electric searchlights, start the power plant, throw the main switch ON. Be sure the dynamotor switch is ON and the dynamotor is running.

NOTE.—*For orientation in elevation, it may be more practicable to hold radar and searchlight at zero elevation, or any selected elevation.*

(*e*) Observe the azimuth reading at the radar, and set the azimuth scale at the searchlight so that the same reading appears under the pointer index.

(*f*) If the azimuth zero indicators at the searchlight and control station do not read zero, they are centered by means of the AZIMUTH SYNCHRONIZING knob (Sperry) or the AZIMUTH CORRECTOR (General Electric). If the elevation zero indicators do not read zero, they are centered by means of the adjustment knob (Sperry) or by turning the COARSE ELEVATION SELSYN adjustment at the radar (General Electric).

NOTE.—*On the General Electric, the adjustment of zero indicators may also be made by removing the cover of the elevation data receiver housing, loosening the three screws, and rotating the stator of the selsyn.*

(*g*) It is possible to obtain two zero readings by rotating the azimuth receiver stator. The correct zero reading is obtained when the needle of the azimuth zero indicator on the searchlight moves clockwise

(right) when the searchlight is manually traversed clockwise. If the needle moves in the wrong direction, return it to zero and hold the searchlight on the distant aiming point. Turn the synchronizing knob continuously in one direction until the needle moves off scale and then returns to zero reading again.

(*h*) It is possible to obtain two zero readings by rotating the elevation receiver stator. The correct zero reading is obtained when the needle of the elevation zero indicator at the searchlight moves clockwise (right) when the searchlight is manually depressed. If the needle moves in the wrong direction, return the searchlight to the aiming point and turn the COARSE ELEVATION SELSYN adjustment at the radar continuously in one direction until the needle moves off scale and then returns to zero reading again.

NOTE.—*The radar has a stop limiting its rotation. If the stop is encountered, rotate back to the first zero reading position, and then continue to rotate in same direction until the needle moves off scale and then returns to zero reading again.*

(*i*) Turn the D-C (Sperry) or D. E. C. (General Electric) switch at the control station to the ON position and bring the needles of the azimuth and elevation zero indicators back to the zero position by adjustment of the tracking handwheels. Adjust the binocular mount until the binoculars are pointing away from the observer's handwheels, using the azimuth reference mark if available. Slew the control unit on its friction clutch, and adjust the binoculars by means of adjusting handles until the distant aiming point is accurately centered in the binocular field of view.

(*j*)

1. Traverse the radar, keeping the zero indicator needle centered at the control station by means of the azimuth zero indicator operator's handwheel. As the radar is traversed in a clockwise direction, the searchlight should traverse in a clockwise direction. If the direction of rotation is incorrect,

return the radar and searchlight to the distant aiming point. Then throw the COARSE AZIMUTH reversing switch in the terminal box of the radar. Sight both units exactly on the aiming point, and zero the zero indicators again. Again check the sensing of the azimuth zero indicator needles. Again check the direction of rotation.

2. Elevate the radar, keeping the elevation zero indicator centered by means of the elevation zero indicator operator's handwheel at the control station. The searchlight should also elevate. If the searchlight depresses, return radar and searchlight to the aiming point. Throw the COARSE ELEVATION reversing switch in the terminal box of the radar. Sight both units exactly on the aiming point, and zero the zero indicators again. Again check the sensing of the zero needles. Again check the direction of rotation.

(2) *By backsighting.*

(*a*) Direct the radar away from the searchlight.

(*b*) Disengage the azimuth and elevation clutches, turn the searchlight until it points approximately at the sight on the radar, then reengage azimuth and elevation clutches in D. E. C. position. (See (1) above.)

(*c*) On the Sperry and General Electric searchlights, start the power plant, throw the main switch ON. Be sure the dynamotor is running.

(*d*) The searchlight is aimed carefully at the eyepiece of the radar. The light is moved in azimuth and elevation manually.

(*e*) At the same time, a man looks *backward* through the radar sight, and directs azimuth and elevation operators until this sight is aimed at the searchlight orienting sight.

(*f*) Note the azimuth reading at the radar, and set the azimuth scale at the searchlight so that the same reading appears under the pointer index.

(*g*) Read the angular height counter at the radar,

and check it against the elevation scale at the searchlight. These readings should be the same, indicating that radar and light are oriented in elevation.

(*h*) Synchronize the searchlight and radar. Zero the zero indicators, check sensing, and check direction of rotation. (See (1) above.)

(*i*) Traverse and elevate or depress the radar until a man looking backward through the radar sight sees that this sight is directed toward the binoculars at the control station.

(*j*) Turn the D-C (Sperry) or D. E. C. (General Electric) switch at the control station to the ON position. Turn the zero indicator operators' handwheels until both zero indicators are zero with correct sensing. Adjust the binocular mount until the binoculars are pointing away from the observer's handwheels, using the azimuth reference mark if available. Slew the control unit in azimuth and elevation until the binoculars of the control station are directed at the eyepiece of the orienting sight on the radar.

(*k*) Do not attempt to depress the radar below zero as this requires several steps. If it should become necessary to depress below zero, then align the sights as described, stop at zero, then zero the zero indicators and slew the control unit in azimuth until the sights are aligned in azimuth only. Then set the binoculars at their zero reference mark in elevation.

NOTE.—*For a detailed discussion of the process of orientation and synchronization by the use of the test modulator, see FM 4–176, TF 4–609 and 4–610. For an explanation of the method of orientation and synchronization on an airplane during daytime, or on an illuminated airplane at night, see FM 4–176.*

After orientation and synchronization have been completed, the CS directs 5 to report, "2 ready for action."

Under the supervision of the CS, all available members of the detector-searchlight section improve the section position and provide for local security, field sanitation, camouflage, and camouflage discipline.

■ 48. STAND BY.—Since the radar supplies intelligence for the AAAIS and operates continuously for long periods during both day and night, its status of alert is often different from that of the searchlight section. Therefore, the detector may make contact on an approaching target, or information on an approaching target may come in over the platoon net, while the searchlight section is alert and in the vicinity of equipment but not actually in "battle condition."

In either case,

CS commands: **STAND BY.**

All personnel of the entire detector-searchlight section take their posts and stand ready for immediate action.

CRO commands: **SEARCH SECTOR.** CRO gives this command in case of instructions from higher authority, or in compliance with SOP instructions currently in force.

R1, R2, and R3 search the assigned sector. If one of oscilloscope operators detects an echo, he announces, "Contact."

R8 repeats, "D2 contact" immediately over the command net, to alert the searchlight section, other sections of the platoon, and the platoon CP.

3 turns azimuth and elevation amplidyne switches to ON.

R6 repeats, "Contact" over the data line to alert the plotter at the AAA Operations Board.

R2 announces, "Azimuth on target" to indicate to the chief radar operator that the radar is centered on the target in azimuth.

R3 announces, "Elevation on target" to indicate to the chief radar operator that the radar is centered on the target in elevation.

R1 announces, "Range on target" to indicate to chief radar operator that the range data are accurate.

CRO reports, "On target" when the oscilloscope operators have reported, "On target" (altitude data may not be accurate at first).

R8 reports, "D2 on target" over command net.

R6 reports, "On target" over the data line, and also reports any information announced by the oscilloscope operators concerning the numbers of planes being tracked and IFF indications. As soon as the plotter at AAA Operations Board has received this report, R6 commands: TAKE and immediately reads azimuth of target over the data line to plotter.

When the radar has thus been centered on the target and accurate data are being furnished, the target is *tracked* without specific command.

After the command TAKE, given by R6,

R6 reads azimuth (to nearest 10 mils) over the data line.

R7 reads range (to nearest 100 yards) over the data line. The range reader will not normally read elevation data during the first four or five reports over the data line; in those initial readings he reports, "Altitude unknown." When altitude data become more accurate, and after R3 has balanced pips and has reported, "Elevation on target," he reads the altitude, to the nearest 100 yards, to the plotter. Altitude is repeated for the next three or four readings and on every fourth or fifth reading thereafter.

NOTE.—*In all of these reports over the data line, numerals are pronounced as prescribed in FM 24–5. Immediately after the range reader has transmitted the initial range and altitude, the azimuth reader gives the command* ***TAKE*** *and the azimuth and range readers read their respective data* ***SIMULTANEOUSLY****. The azimuth reader reports the azimuth reading, followed by the range reader reporting the range reading. This process is repeated continuously until the target is illuminated or lost.*

CR0 announces, "Off target" if the radar loses the target and is no longer supplying accurate data. The report is immediately transmitted over the data line by R6

and over the platoon command net by R8.

NOTE.—*The plotter at the AAA Operations Board (on direction by the searchlight plot observer) relays the command* ***CEASE DATA*** *if the target is identified as friendly, or if the target is outgoing, or if the target is carried out of the normal front and is picked up by another radar. In this case, the azimuth and range data readers no longer read data to the plotter. However, the tracking of the target continues unless a new target is assigned by* ***CRO****, or sector search is resumed.*

CR0 announces, "Range" to indicate the radar is on the target, and that the target is at the proper range for the searchlight to go into action for an initial pick-up.

R8 reports, "D2 Range" over the platoon command net.

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6 turns D. E. C. transfer switch to AUTOMATIC. On report, "Contact," supervises 1 and 2 as they direct the control station by zeroing the zero indicators.

1 and 2 stand at their posts at the control station. As soon as they hear "Contact" indicating that the radar has located and is tracking the target, they center the zero indicators by moving their handwheels the necessary amount and direction; as tracking proceeds they continuously center their zero indicators.

3 stands by at the searchlight ready to close the arc switch; observes his instruments noting that voltage is approximately 100 volts; if voltage is not correct, notifies the power plant operator.

4 keeps the power plant operating on tracking load; checks his instruments to see that the voltage and current remain at proper value.

5 stands by at the radio and remote control unit, transmitting and receiving all radio messages.

NOTE.—*If 5 acts as telephone operator at control station, he stands by at the telephone for the transmitting and receiving of all messages over the platoon net—when "Contact," "On target," "Off target," "Range," and "Change target" are announced over the platoon*

command net by the chief radar operator, closes his telephone switch and relays report to CS. "Range" is used as basis for light going into action for the initial pick-up.

The machine gunner continues his normal duties at the machine gun.

■ 49. IN.

CS alertly scans the skies for action in any direction. He seeks to keep informed of the exact tactical situation so that he may be ready for instant action if necessary. He receives from 5 reports on operation of other sections in the platoon, and also information from the AAA operations room, as to targets which are approaching, but which have not yet been illuminated.

CS commands: IN after he receives report, "Range" from CRO, indicating the target is in the proper position for the initial pick-up and when he is satisfied chief controller is ready and control station operators have their needles at zero.

6 relays command to 3 by means of buzzer system.

3 Closes the arc switch immediately.

5 Reports, "2 in" over the platoon command net.

1 and 2 center their zero indicators exactly on radar data.

NOTE.—*1 AND 2 MUST OPERATE THEIR HANDWHEELS AS SMOOTHLY AS POSSIBLE IN ORDER TO FACILITATE THE TARGET PICK-UP. THIS IS PARTICULARLY IMPORTANT AT THE INSTANT OF ARC STRIKE IN ORDER TO MINIMIZE THE JUMP WHICH MAY OCCUR DUE TO THE D-C SUPPLY VOLTAGE MOMENTARILY DECREASING.*

1 and 2 *conduct no search for target.* When 6 calls, "Flick," they release their handwheels and relinquish control to 6.

6 observes the light beam through the binoculars, alert for a flick. When the target is flicked, he commands: FLICK; turns D. E. C. transfer switch to MANUAL; takes over operation of the control station by turning the observer's handwheels, and carries the target in his binoculars.

If the target is caught in the searchlight beam, and is being tracked,

6 calls, "Target illuminated."

5 transmits message, "2, target illuminated" over the platoon command net.

R8 receives message from 5 and repeats, "2, target illuminated" to CRO.

CRO calls, "Target illuminated" so that announcement can be heard by radar crew.

R6 transmits message over data line.

CRO (if his section has transmitted data on the target) calls, "Intersection" as soon as intersection of two searchlight beams has been formed on or near the target.

R6 transmits, "Intersection" over the data line to the plotter.

3 keeps watch on his instruments, seeing that the arc operates at 78 volts and 150 amperes; checks that image of positive crater tip is on black or focal line; recarbons the arc at the first break in operations after the positive carbon has been consumed until about 1 inch protrudes from the outside of front glass door (somewhat less protrusion necessary if operator has gloves and tongs).

NOTE.—*Replacement of carbons.—Turn both amplidyne switches to OFF position, but leave azimuth and elevation D. E. C. clutch handles in their "D. E. C." positions; set drum at zero elevation, and engage elevation brake; light recarboning lamp; enter drum through left drum access door; always use a pair of full length carbons for recarboning; push the lower end of the negative carbon release lever toward the positive nose cap; remove negative stub by means of tongs; raise the positive carbon clamping lever; withdraw the hot carbon, using tongs; push new carbon into feed end of the positive head, forcing out used stub; check for positive carbon protrusion (beyond nose cap) of approximately ¾ inch; reengage the positive carbon clamping lever; insert the painted end of the new negative carbon into the rear of the negative*

head, and push the carbon forward until it is within ¼ inch of touching the positive carbon; release the negative lever; close both drum doors fully; turn off recarboning light; release elevation brake.

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4 continues to operate the power plant checking to insure that the current and voltage are at the proper arc-load values.

5 stands by at the radio (or control station telephone) reporting to CS any information or commands over the platoon net, and transmitting information.

The machine gunner continues his normal duties.

■ 50. CHANGE TARGET.

The command **CHANGE TARGET** followed by the designation of the new target will be given by CS or CRO when he desires that the light or radar drop one target and pick up another. The command is immediately repeated over the platoon command net and, for CRO, over the data line.

NOTE.—*CHANGE TARGET will normally be given by CRO when target is held securely by minimum number of beams specified. However, if atmospheric conditions are such as to require continuation of radar data to hold target in beam, CS commands: R2, CONTINUE TRACKING. 5 repeats command over platoon command net for benefit of CRO.*

CS commands: **CHANGE TARGET**; moves to control station and points out new target to 6.

6 ceases to look through binoculars and swings the searchlight beam to the new target; when the target is approximately caught in the searchlight beam, picks up the airplane in his binoculars and resumes tracking.

5 Reports "2, changing target."

1 and 2 stand by at control station.

3, 4, and 5, and the machine gunner continue their normal duties.

If the new target has not yet been illuminated by a searchlight beam, but is being tracked by the radar and is within searchlight range,

CS commands: **OUT**, followed immediately by **CHANGE TARGET**; then directs the control station operators **ON DATA** so that the controllers will again zero the azimuth and elevation zero indicators.

6 signals 3 to open arc switch.

3 opens arc switch.

5 reports "2, out."

1 and 2 center zero indicators at command **ON DATA** thereby pointing the darkened searchlight in the direction of the new target.

6 turns DEC transfer switch to **AUTOMATIC**; reports "On data" to CS when indicators are zeroed.

CS commands: **IN**.

6 signals 3 to close arc switch.

3 closes arc switch at searchlight on buzzer switch from 6.

5 reports "2, in."

A carry light will also go out of action on **OUT, CHANGE TARGETS**, if the new target, already illuminated by other lights, has not yet reached proper angular height for illumination by that light.

When the target which has been tracked by the radar has been illuminated, and held securely by at least two beams,

CRO commands: **CHANGE TARGET**. He then commands: **TRAVERSE RIGHT (LEFT)** or **ELEVATE (DEPRESS)** to indicate the direction of the new target.

R8 reports, "D2, changing target."

The oscilloscope operators search for a new contact.

■ 51. OUT.

CS commands: **OUT**.

5 reports, "2 out" over the platoon command net.

6 ceases to track the target in his binoculars, and stands by for further orders.

1 and 2, after the light has gone out of action, center their zero indicators without command.

6 (if radar is already tracking another target) turns D. E. C. transfer switch to AUTOMATIC after zero indicators are centered.

3 opens the arc switch; stands by the light, ready to close the arc switch on command; observes the voltmeter to see that proper tracking load voltage is maintained (105 volts); recarbons if necessary.

4, 5 and the machine gunner continue normal duties.

■ 52. REST.

When no action is imminent.

CS commands: **REST.**

For rest periods, the chief of section and the chief radar operator arrange relief schedules for the section, according to the status of alert ordered.

R2 and R3 normally remain on the radar, and one man at each of the following positions: telephone, each power plant, machine gun (another man close by at all times), air guard, and local security guard. The other members of the section crew not on duty remain in the vicinity of the equipment so that they may go into action with a minimum of delay.

■ 53. MARCH ORDER.

When it is desired to prepare the detector-searchlight section for movement on the road,

CS commands: **MARCH ORDER**, and closely supervises the loading of equipment in vehicles; assuring himself that all cables are assembled without injury, that all matériel is properly secured by held-down devices, and that safety and breakaway chains are connected.

CRO commands: **MARCH ORDER** to detector section. For a detailed description of the disassembly and packing of the detector section equipment, see **FM 4–176** and **TF 4–606.**

1 relieves 4 at the machine gun.

4 prepares the power plant for traveling. After load has been removed, opens main power switch; turns generator field rheostat clockwise to minimum voltage

position; after idling engine a few minutes (to avoid excessive heating of water) pushes in ignition switch; pushes in throttle; checks that all panel switches are OFF; opens left power unit door; closes and bolts front door; closes left power unit door; closes panel door and locks it; disconnects yellow cables; places cap on exhaust; clamps receptacle and plug caps in place.

3 prepares the searchlight for traveling. Turns amplidyne switches OFF; disconnects yellow, red, and blue (radar) cables; clamps plug and receptacle caps in place; removes carbon stubs from lamp; checks drive rods and focusing rod couplings for security; ties them in place if necessary for safety to mirror; closes access doors; releases the elevation brake; sets the elevation and azimuth D. E. C. clutch levers to HAND position; removes azimuth lock handle from azimuth D. E. C. clutch lever and replaces it on azimuth traveling lock; locks azimuth traveling lock.

If searchlight is supported by A-frames in its traveling position,

3 places the drum at approximately 1,600 mils in elevation, and engages the elevation stowing spring with the stowing spring lug on the rear of the drum—rotates the turntable and engages the A-frames with the chassis joint supports—swings up A-frames and secures them by A-frame clamps.

If searchlight is not equipped with "A"-frames,

3 places the drum at approximately 1,600 mils in elevation, and secures it at that position with the transportation bar and its pin and spring cotter; raises jacks and secures them with their locking chains—connects towing bar; folds canvas cover.

2 and 6 prepare the control station for traveling.

2 removes red plug from receptacle; clamps receptacle cap; removes the binoculars and open sight from the binocular mount; places in binocular mount box.

6 cranks up binocular mount about 4 inches; swings mount around 180° in azimuth; removes linkage pin;

collapses linkage and repins in stowing position; cranks the column down until binocular mount head ring fits snugly against elevation crank housing; releases binocular mount clamp and removes mount from controller socket; clamps socket cover; stows mount box.

2 releases three knurled thumbscrews on the under side of the tripod top.

2 and 6 go to power plant.

The chauffeur of searchlight prime mover drives the truck and trailer from the battery motor pool to the searchlight position.

3 and the chauffeur detach the trailer (see par. 44); set hand brake.

NOTE.—*If it is not provided that platoon headquarters pick up the wire down to the section position, and if wire cannot be picked up as loaded trucks leave position, it will often be necessary for 5 and R8 to mount searchlight prime mover and reel in the telephone wire up to the point of intersection with the platoon net. The truck is then driven back to the section position to load equipment.*

4 returns to man the machine gun.

1 goes to the power plant position where he is joined by 2 and 6. The chauffeur of searchlight prime mover drives to the power plant.

1, 2, and 6 assemble yellow power plant cables from power plant to searchlight.

1 mounts truck and turns crank on reel to wind in cable.

2 stands in rear of reel and guides cables on reel.

6 walks just behind truck and feeds cables to 2.

1 clamps cables in holding brackets.

CS, 2, and 6 mount truck at searchlight position.

The driver of searchlight prime mover drives from the searchlight to the control station,

1 and 2 remain in truck to load equipment.

CS and 6 load rack and reel of field wire (if it has been left at control station).

CS and 6 lift controller by carrying bars and hand to 2 and 3, who secure it by hold-down devices.

6 unlatches tripod leg braces and collapses legs; hands tripod to 2 who secures it by hold-down devices.

CS and 6 lift binocular mount and spare parts boxes; hand boxes to 1 and 2, who secure them in truck by hold-down devices.

6 loads panel set; folds control station canvas cover and loads it.

1, 2, and 6 assemble red control station cable as searchlight prime mover is driven from the control station position to the searchlight.

1 remains in truck and turns reel crank to assemble cable.

2 stands in truck in rear of reel; guides cable as 1 assembles it on reel.

6 follows immediately behind truck; feeds cable to 2.

1 secures plugs in holding brackets.

Searchlight prime mover and trailer (detached) being at the searchlight position,

CS supervises loading of searchlight.

3 and 6 roll up and fasten rear curtain of trailer.

2 checks that hand brake is set.

1 (on left) and 2 (on right) remove the front pins from each side of the winch deck; tilt trailer by pushing down on drawbar tongue; pay out winch chain to 3.

3 and 6 drop tail gate of trailer.

1, 2, 3 and 6 move searchlight to rear of trailer.

3 connects winch chain hook to searchlight chassis eyebolt; guides searchlight into trailer with towing bar.

1 and 2 take up on windlass, slowly drawing searchlight into trailer; throw ratchet on winch; fasten front turnbuckles.

3 and 6 replace chocks; fasten rear turnbuckles.

3 removes winch chain hook; removes tow bar and places on searchlight chassis rack; places canvas cover

on top of searchlight turntable; places box of spare carbons in its bracket; replaces extended hand controller.

1 and 2 release ratchet on winch; fasten winch chain hook to drawbar, lifting up drawbar; replace front pins on each side of winch deck; lower drawbar which brings trailer to horizontal; wind up winch chain, and secure hook.

3 and 6 raise tail gate; roll down and fasten rear curtain.

2 then turns adjustment wheel so lunette of drawbar will clear the pintle hook of the truck.

1 signals truck driver to back truck into position; connects lunette to pintle hook, as 2 turns adjustment wheel to lower drawbar.

2 removes the handlocking pin from the caster wheel bracket; swings caster wheel up; replaces pin.

2 turns adjustment wheel; 1 guides caster wheel in place.

1 and 2 fasten safety chains.

1 fastens break away chain; secures jumper cord from tool compartment and connects; checks that break away switch is in rear or **OFF** position.

2 releases hand brake.

Searchlight prime mover and trailer are driven off to cover ready for the road.

CS, 1, 2, 3, and 6 go to machine-gun position.

The chauffeur of power plant prime mover (from battery motor pool) drives truck to position convenient for loading the radio. Unless specific instructions to the contrary are given by platoon or higher headquarters, communications are maintained to last possible moment. Even after **MARCH ORDER** has been given, the platoon commander may wish to send out last minute changes or instructions. If telephone communication is not available, the radio must be used for this purpose.

5 when directed by CS, reports to the platoon command post, "2 closing station"; receives final instructions and transmits to CS; opens all switches on radio panel

and power unit; unplugs earphones, microphone, telegraph key, and remote control plugs and disconnects power cable; removes vibrator pack and places in carrying case (unless radio is to be used on road); places earphones and microphone along with power cable, in spare parts bag; places remote control unit in case; disconnects ground and antenna leads; pulls up guy wire pins; places pins in spare parts bag; removes antenna from insulator and disconnects guy wires; disassembles mast sections and places in antenna bag; places insulator in spare parts bag; disassembles counterpoise, winds it up on reel and places in spare parts bag; disconnects battery cables and secures them to radio; disassembles and packs generator unit (if generator has been used for power); closes front door of radio set, collects field wire to field telephone at control station and picks up telephone; returns to power plant prime mover.

The chauffeur loads radio and all accessories on rear of truck.

5 moves radio equipment to proper location in truck and secures radio by hold-down devices; prepares radio for communication on road (if radio communication en route is authorized).

Power plant prime mover is driven to the machine-gun position.

Power plant prime mover being at the machine-gun position,

CS supervises the loading of the machine gun, complete with ammunition chests and water pump.

CS and 4 release safety belt and lower tail gate.

5 and 6 unload chamber and remove ammunition from feedway.

5 clamps mount at horizontal, swings muzzle toward truck cab.

6 removes ammunition chest and passes it to 4 if situation is not urgent.

4 places ammunition chest on truck.

1 and 2, assisted by 6, place water chest under tail gate.

6 mounts truck and places ammunition chest so that it will not interfere with loading the machine gun on the truck.
5, 4, CS, 3, 2, and 1 grasp tripod as during emplacement, lift machine gun on truck reversing procedure for emplacement.
6 on truck steadies machine gun by barrel, pulls gun into position, replaces ammunition chest, raises top cover, places first round behind holding pawl and closes top cover.
1 and 2 place water chest, ammunition, and tool box on truck.
CS and 6 raise tail gate.
2 fastens safety belt.
1 takes place as machine gunner and prepares gun for immediate action assisted by 2 and 3 who also act as air guards.

Power plant prime mover and personnel are driven to power plant, CS and 6 prepare to mount searchlight prime mover.

Power plant prime mover being at the power plant position,
2 and 3 release safety belt; dismount.
3 releases hand brake on power plant.
2 and 3 grasp tow bar and pull power plant to position when lunette fits over pintle hook; fasten pintle hook; connect safety chains.
2 connects power plant lighting plug to the receptacle on truck.
3 checks that break-away chain is connected to brake cable; fastens break-away chain to bumper of truck.
2 and 3 mount and fasten safety belt.

On direction of CS, power plant prime mover moves out of position behind searchlight prime mover.

SECTION III

NOTES ON SERVICE OF THE PIECE

■ 54. GENERAL.—*a.* The detector-searchlight crews must avoid haste and confusion and work toward efficiency in time

and effort. It will rarely be necessary to execute **PREPARE FOR ACTION** or **MARCH ORDER** with great speed. *In all training, stress should be laid on the saving of time during the operation of locating the target by radar, that is, between the time the first echoes are received and the time the set is smoothly tracking the target and transmitting data to its associated equipment.*

b. The service of the piece is conducted with as few orders as possible. Except for the necessary orders, reports, and instructions, talking is not permitted.

c. The service of the piece as described in section II gives only an outline of the duties of each man at the various commands. A knowledge of what to do must be supplemented by continuous practice until the unit can operate, if necessary, without commands. The procedure in locating, picking up, and carrying the target must become second nature if the platoon is to be capable of coping with multiplane attacks and other strategems of an attacking air force.

■ 55. MARCH ORDER.—If the section is to move out of position, it is necessary to exercise special care at **MARCH ORDER**, as this command is generally given at dawn, when crews are tired, hungry, and anxious to get back to bivouacs. Noncommissioned officers must exercise close supervision to prevent damage to the matériel, both during the preparation of the matériel, for the road and the securing of the matériel in the vehicles.

■ 56. COMMANDS AND SIGNALS.—Commands are given in the prescribed form, signals (buzzer, flashlight, or whistle) being substituted for commands wherever practicable.

■ 57. SAFETY PRECAUTIONS.—*a.* The searchlight mirror is frequently injured by improper cleaning, by loose feed and focusing rods, and by carbons and carbon stubs which are allowed to fall on mirror surface. Injury also occurs if carbons are shaken out of drum racks, and when an operator carelessly permits metal buttons on his clothing, sandpaper, or tools to strike mirror. Greatest care must be exercised to prevent such injury.

b. Searchlight operators must not enter the drum when the main arc switch is on. When entering the drum while

the lamp is hot, the operator should be fully clothed and wear protective gloves to avoid injury.

c. Crews loading and unloading the matériel on and off the trucks and trailers must keep clear of the equipment being loaded or unloaded, so that no one will be hurt if a winch or cable fails.

■ 58. HANDLING EQUIPMENT.—*a.* Since much handling of equipment takes place under cover of darkness, special care must be exercised to avoid injury to personnel and damage to matériel.

b. As soon as matériel is unloaded from trucks it should be moved off the road. Matériel disassembled for loading must not be left in the road unless under guard. Cables are thrown to the side or off the road so as to avoid damage by vehicles; tractors or tanks passing over a cable will completely destroy it.

c. Chauffeurs must exercise special care when moving without lights, or with blackout lights, to avoid damage to equipment or injury to personnel. When backing the truck, if this is necessary, the chauffeur must be assisted by another member of the crew who walks in advance of the truck.

d. Cautions in handling cables.—As a high percentage of searchlight matériel failures are caused by cable difficulties, it is imperative that cables be handled with great care. Most cable failures take place within a foot of the plugs, which indicates that rough handling of the cable at the plug is a major source of difficulty. It has been found by actual experience that the observance of the rules given below greatly reduces cable failures.

(1) Carry or lift cables instead of dropping or jerking them.

(2) Remove plugs from receptacles by pulling on the *plug,* not on the cable. Pulling on the cable bends and breaks the soldered electrical connections at the plug.

(3) When moving the cables, pull on the *cable,* not on the plug. Pulling on the plug ruptures the electrical conductors.

(4) When moving the cables, *do not* allow the plugs to drag along the ground, catching on rocks, bushes, and other obstructions. Carry the cable so that the plug is clear of the ground.

(5) *Do not* lay the cable so that it is likely to be run over by vehicles.

(6) *Do not* kink the cables. Coil extra cable neatly. Neat cables are less likely to be stepped upon; cables not crossed will be damaged less if walked upon than crossed cables.

(7) *Do not* be in too much of a hurry to reel up the cables when **MARCH ORDER** is given. A few minutes saved the night before may cause hours of repair work the next day.

(8) *Do not* put cable plugs into receptacles until cables are *completely* laid and off the cable reels.

(9) In hot climates, deterioration of cables can be greatly reduced by burying them 4 inches underground in order to protect the cables from rain and from the sun's rays.

(10) In digging a shallow channel or ditch for a cable, one sidewall of ditch should be constructed in the form of a ledge or step 4 inches from the surface. The cable is then laid on this step. The lower part of the ditch provides drainage for the cable and helps to preserve it.

NOTE.—*When a searchlight is in action for prolonged periods, the buried power plant cables should be checked for excessive heating, due to the heat loss in the cables as the result of 165 amperes of direct current passing through them.*

(11) In cold climates, it is best to leave cables *above* ground unless sufficient time is available to build troughs in which to place the cable underground. Many cables have been rendered unserviceable while they were being removed from the frozen ground.

■ 59. ACTION ON THE MARCH.—*a.* Members of the searchlight section are given instructions relative to the action to be taken if attacked while on the march. The detector-searchlight section, with a number of heavy vehicles, is a fairly profitable target for low-flying light bombardment aviation, while units the size of a platoon or larger are most vulnerable to attack.

b. While on the road, the detector-searchlight section is defended by a caliber .50, HB, air-cooled machine gun on an M32 mount through the roof of the power plant truck cab, by caliber .45 submachine guns placed in gun boots on the hoods of all trucks, and by the caliber .50 machine gun which is set up ready for action in the rear of power plant prime

mover of the searchlight section. In addition, one out of every four searchlight trucks is equipped with a caliber .50 HB machine gun on M32 mount.

c. It is necessary to remove the bows and tarpaulin of the truck which carries the machine gun and to distribute load carefully in order to secure freedom of action and an all-round field of fire. Sandbags may be placed on the legs of the tripod mount to give stability. No. 1 acts as gunner, and is relieved by Nos. 2 and 3 who keep watch for hostile planes. When the unit stops along the road, the gunner remains at his post in the truck in order to give protection to the halted vehicles.

CHAPTER 6

CARE, MAINTENANCE, AND DESTRUCTION OF EQUIPMENT

Paragraphs
SECTION I. Care and maintenance of searchlight equipment.. 60–62
II. Destruction of searchlight equipment..... 63–77

SECTION I

CARE AND MAINTENANCE OF SEARCHLIGHT EQUIPMENT

■ 60. GENERAL.—*a.* The maintenance of the matériel of the detector-searchlight section requires the intelligent care and handling that any competent mechanic gives to any piece of fine machinery placed in his care. Equipment must be maintained in serviceable condition in accordance with the best electrical and mechanical equipment practice. Such maintenance provides for longer life and more efficient operation of the various units, and may save shut-downs for repairs during operating periods.

b. The wide dispersion of the section of a searchlight unit and a substantial reduction in transportation emphasizes the importance of the strictest requirements for the best care and maintenance. Under field conditions, maximum maintenance must be done at the section position.

c. As the searchlight equipment may be operated at irregular intervals and under wide variations of climatic conditions (excessive moisture, heat, cold, sand, salt air, dust), it is impossible to state the exact intervals of time which should elapse between successive oilings. The various parts of the equipment should be oiled as necessary.

d. (1) Special care must be taken in cleaning the mirror. A dirty mirror results in greatly reduced beam intensity. Improper cleaning frequently results in scratching and other damages to the reflecting surface of the mirror. Only the cleaning solutions supplied with the equipment should be used, and only clean cotton pads passed in a radial movement toward the center of the mirror. *A rotary motion must not*

be used. Do not allow cleaning solution or other moisture or dust to accumulate on the mirror-supporting clips. The camel's-hair brush is to be used only *lightly*.

(2) Lubrication is so applied as to reach all moving surfaces, and excess oil and grease are removed to prevent the collection of dirt.

(3) If gear teeth, bearings, or surfaces have collected dirt or foreign matter, *do not* add grease or oil until the part has been *thoroughly cleaned*.

e. Complete details for the care and maintenance of searchlight equipment, including first and second echelon maintenance, may be found in the Operator's Manual for the searchlight with which the unit is equipped. Trouble shooting, adjustments, and replacements are also covered in this manual.

f. For a discussion of the care and maintenance of the detector, see FM 4–176.

■ 61. RESPONSIBILITY FOR MAINTENANCE.—*a.* First echelon maintenance is the responsibility of the assigned operators of the equipment. This maintenance includes proper operation and handling of the equipment, cleaning, and lubrication. The operators work under the direction of the AA searchlight electrician of the battery maintenance section, and keep prescribed daily records of all maintenance performed.

b. Second echelon maintenance is the responsibility of the platoon electrician and other trained personnel. The work is performed as outlined in the Operator's Manuals. A standard service record, broken down into specific items of maintenance, is kept for each unit of equipment.

■ 62. PREVENTIVE MAINTENANCE CHART.—The following chart of first echelon maintenance will serve as a practical guide for checking the services to be done, and the time interval at which each service is performed.

PREVENTIVE MAINTENANCE RECORD
SEARCHLIGHT—MAINTENANCE BY OPERATOR

Item	Interval*	Cleaning	Lubrication
Outside surfaces	Daily	Damp cloth	None.
Drum interior	Daily	Cloth	None.
Mirror	Daily	Camel hair brush, cotton and special solution.	None.
Thermostat mirror	Daily	Same as mirror	None.
Front door glass	Daily	Damp cloth	None.
Peep sight glass	Daily	Damp cloth	None.
Ground-glass finder	Daily	Damp cloth	None.
Lamp positive-drive gearing.	4 hrs. of arc	None	Gredag.
Lamp head gearing	4 hrs. of arc	None	Brush with Aquadag while hot.
Positive brushes	15 hrs. of arc	Cleaning stone	None.
Negative brush	4 hrs. of arc	Cleaning stone	None.
Lamp control gears	4 hrs. of arc	None	Ball bearing grease.
Jack screws and feet	Weekly	Gasoline and cloth or brush.	SAE 10 oil or dry graphite.
Elevation rack and pinion.	Weekly	Gasoline and cloth	Oiled cloth.
Tires—inflate six-ply tires to 35 lbs., four-ply tires to 30 lbs.	Weekly	Wet cloth	None.
Steering tongue, pin and joint.	Weekly	Gasoline and cloth	SAE 10 oil.
Cable plugs	At once	Remove dirt	
Rust—machined parts.	At once	Crocus cloth	Oiled cloth.
Rust—rough castings	At once	Wire brush	Paint.
Worn paint	At once	Damp cloth	Paint.
Exposed insulation	At once	Remove all oil, grease, dirt, moisture.	

*Daily when used, otherwise weekly.

CONTROL STATION—MAINTENANCE BY OPERATOR

Item	Interval*	Cleaning	Lubrication
Outside surfaces	Daily	Damp cloth	None.
Rust	At once	Wire brush	Paint.
Worn paint	At once	Damp cloth	Paint.
Binocular lenses	Daily	Optical paper	None.
Jacks screws and feet	Weekly	Gasoline and cloth	SAE 10 oil or dry graphite.

*Daily when used, otherwise weekly.

POWER PLANT—MAINTENANCE BY OPERATOR

Item	Interval*	Maintenance required
Outside surfaces	Daily	Wipe with damp cloth.
Radiator	Daily	Add coolant when needed.
Oil level	Daily	Add oil when needed.
Battery	Weekly	Check charge and liquid level.
Air cleaner	Weekly	Empty and refill with oil.
Water pump	Weekly	One turn of grease cup.
Tires	Weekly	Inflate six-ply tires to 35 lb., four-ply tires to 30 lb.
Hood hinges	Weekly	SAE 10 oil.
Carburetor pivot pins	Weekly	SAE 10 oil.
Fuel filter and sediment bowl.	Weekly	Remove water and dirt from sediment bowl and carburetor filter.
Motor oil	30,000 hundred revolutions.	Change oil.
Motor surface	Monthly	Wipe clean.
Rust	At once	Wire brush and paint.
Cable plugs	At once	Keep free of dirt.
Cables and wiring	At once	Remove all oil, grease, dust, and moisture.
Wheel bearing grease retainers.	Weekly	Check.

*Daily when used, otherwise weekly.

SECTION II

DESTRUCTION OF SEARCHLIGHT EQUIPMENT

■ 63. GENERAL PRINCIPLES.—*a.* Tactical situations may arise when, due to limitations of time or transportation, it will become impossible to evacuate all equipment. In such situations it is imperative that all matériel which cannot be evacuated be destroyed to prevent—

(1) Its capture intact by the enemy.

(2) Its use by the enemy, if captured, against our own or allied troops.

b. The working principles to be followed are—

(1) Methods for the destruction of matériel subject to capture or abandonment in the combat zone must be adequate, uniform, and easily followed in the field.

(2) Destruction must be as complete as the available time, equipment, and personnel will permit. If thorough destruction of all parts cannot be completed, the most important features of the matériel should be destroyed, and parts essential to the operation or use of the matériel and which cannot be easily duplicated, ruined, or removed. *The same essential parts must be destroyed on all like units to prevent the enemy from constructing one complete unit from several damaged ones by "cannibalization."*

(3) THE DESTRUCTION OF MATÉRIEL IS A COMMAND DECISION TO BE IMPLEMENTED ONLY ON AUTHORITY DELEGATED BY THE DIVISION OR HIGHER COMMANDER.

c. To accomplish adequate and uniform destruction of matériel, it is essential that—

(1) All echelons prepare plans for the destruction of matériel in the event of imminent capture. Such plans must be flexible as to the available time, equipment, and personnel.

(2) All echelons be trained to effect the desired destruction of matériel issued to them. *Training will not involve the actual destruction of matériel.*

■ 64. METHODS.—*a.* The destruction procedures outlined are arranged *in order of effectiveness.* Destruction should be accomplished by Method No. 1, if possible. If Method No. 1

cannot be used, destruction should be accomplished by one of the other methods outlined, in the priority shown.

b. Whichever is used, the sequence outlined should be adhered to. Uniformity of destruction will then be obtained, whether or not the method is carried to completion.

c. Certain of the methods outlined require special tools and materials, such as TNT and incendiary grenades, which may not be items of issue normally. The issue of such special tools and material, the equipment for which issued, and the conditions under which destruction will be effected *are command decisions in each case,* according to the tactical situation.

■ 65. SMALL ARMS.—*a.* The firing pin points of all small arms, except the revolver, can be broken by inserting the points into the hole in the face of the bolt and bending the pins until the points break.

b. Barrels of the M1, M1903, and M1917 rifles, the Browning automatic rifles, and carbines can be bent by grasping the butt with both hands and swinging the barrel against a tree, rock, or firm ground. The barrels of the submachine gun, caliber .45, the machine gun, caliber .30, and machine gun, caliber .50, cannot be easily bent under field conditions.

c. Method No. 1.—Machine gun, caliber .50, M2—Field strip.—Use barrel as a sledge. Raise cover; lay bolt in feedway; lower cover on bolt; smash cover down over bolt. Deform backplate. Wedge buffer into rear of casing allowing depressor to protrude; break off depressors by striking with barrel. Lay barrel extension on its side. Hold down with one foot, break off the shank. Deform casing by striking sideplates just back of the feedway. Elapsed time: 3½ minutes.

d. Method No. 2.—Insert bullet point of complete round into muzzle and bend case slightly, distending mouth of case to permit pulling of bullet. Spill powder from case, retaining sufficient powder to cover the bottom of case to a depth of approximately ⅛ inch. Reinsert pulled bullet, *point first,* back into the case mouth. Chamber and fire this round with the reduced charge; the bullet will stick in the bore. Chamber one complete round, lay weapon on ground, and fire with a 30-foot lanyard. Use the best available cover as this means

of destruction may be dangerous to the person destroying the weapon. Elapsed time: 2 to 3 minutes.

e. For the destruction of other small arms with which the unit is equipped, see the appropriate Field Manual on each weapon.

■ 66. VEHICLES.—*a. Method No. 1.*—(1) Remove and empty portable fire extinguishers. Puncture the fuel tanks. Place a 2-pound TNT charge on top of clutch housing of trucks and on left side of engine as low as possible. Place a 2-pound TNT charge over axle inside each wheel of trailers. Insert tetryl nonelectric caps with at least 5 feet of safety fuze in each charge. Ignite the fuzes and take cover. Elapsed time: 1 to 2 minutes if charges are prepared beforehand and carried in the vehicle.

(2) If charges are prepared beforehand and carried in the vehicle, *keep the caps and fuzes separated from the charges until used.*

(3) For the destruction of pneumatic tires, see paragraph 67.

b. Method No. 2.—Remove and empty the portable fire extinguishers. Puncture the fuel tanks. Smash all vital elements (such as distributor, carburetor, radiator, engine block, air and oil cleaners, generator, control levers, crankcase, and transmission) with a heavy ax, pick, or sledge. Pour spare gasoline, oil, or distillate on entire unit and ignite.

c. If possible, detach and evacuate all machine guns mounted in vehicles prior to destroying the vehicle.

■ 67. PNEUMATIC TIRES.—*a. General.*—(1) Rubber is such a critical item that, whenever matériel is subject to capture or abandonment, an attempt to destroy pneumatic tires must always be made, *even if time will not permit destruction of the remainder of the vehicle.*

(2) With adequate planning and training, however, the destruction of tires may be accomplished in conjunction with destruction of the vehicle, without increasing the time necessary.

b. Method No. 1.—(1) Ignite an M14 incendiary grenade under each tire.

(2) To insure the best results when this method is combined with the destruction by TNT of vehicles, be certain that the incendiary fires are well started before detonating the TNT.

c. Method No. 2.—(1) Damage the tires with an ax, pick, or heavy machine-gun fire (deflate them before doing this, if possible). Pour spare gasoline on tires, dousing each one, and ignite.

(2) When used in conjunction with wheeled vehicle destruction (par. 66) the ensuing fire will adequately destroy the vehicle.

■ 68. SEARCHLIGHT.—*a.* Use an ax or sledge to completely smash all external electrical equipment, such as lamp control mechanism, arc control, azimuth and elevation controls, zero indicator and other meters, resistors, cable receptacles, and cables.

b. Break the glass and throw a hand grenade into the drum. If grenades or other explosives are not available, use an ax or sledge, or a concentrated burst of caliber .50 machine-gun fire to gain the same effect. Make certain that the lamp head is destroyed and that the mirror is thoroughly distorted and perforated.

c. If incendiary grenades are available, ignite one under each tire. If not available, fire a concentrated burst with the caliber .50 machine gun into each tire, and/or douse with gasoline and ignite.

■ 69. CONTROL STATION.—*a.* Remove the cover from the control unit and destroy all electrical equipment with an ax or sledge. Gasoline may then be poured into the unit and ignited.

b. Remove the binoculars. If possible to evacuate, carry the binoculars; if not, smash them with an ax or sledge.

■ 70. CABLES.—Smash all receptacles and plugs. Heap cables into a pile, douse with gasoline, and ignite. If time is available, cut cables into short lengths before burning.

■ 71. SOUND LOCATOR.—*a.* Smash the accoustic corrector and all electrical equipment with an ax or sledge.

b. Smash each horn in the same way.

c. If time and materials are available, pour gasoline over the horns and corrector mechanism, and ignite.

■ 72. RADIO.—Destroy by smashing thoroughly with an ax or similar instrument. If time and materials are available, pour gasoline on the remains and ignite.

■ 73. POWER PLANT.—In general, follow the methods outlined in paragraphs 66 and 67 for the destruction of vehicles and pneumatic tires. Destruction of the generator and generator panel must be assured.

■ 74. RADAR.—For methods of destruction for the radar, power plant, and rectifier, see FM 4–176.

■ 75. TELEPHONE EQUIPMENT.—Transmitter and receiver units of telephones, and head and chest sets will be destroyed by hammering. Field wire will be destroyed by cutting and burning.

■ 76. PLOTTING ROOM EQUIPMENT.—Most plotting room equipment can be satisfactorily destroyed by burning. Thoroughly smash all metal and electrical parts of such equipment with an ax or sledge.

■ 77. MISCELLANEOUS.—Destroy other equipment of the searchlight section by the most practical means available. Pile up the smashed equipment. If wood, sawdust, or other inflammable material is at hand, the smashed equipment is placed on this material. The mass is doused with gasoline or oil, and ignited.

APPENDIX

LIST OF REFERENCES

Machine gun, Browning, caliber .50, HB, M2	FM 4–155, TM 9–226
Radio set SCR–268	FM 4–176
Sound locator M2	TM 9–2660, TM 9–1160
Tactical employment of searchlights	FM 4–106
Training publications, list of	FM 21–6

For instructions for the operation of the unit's matériel, see also the Operator's Manual which is issued with the individual element of equipment.

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