B.V.
GEREGISTREERD

TM 9-771

J7-15

WAR DEPARTMENT TECHNICAL MANUAL

GEREGISTREERD
23 1952
LGKL BBV

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

CLASSIFICATION
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WAR DEPARTMENT • *14 JULY 1944*

EIGENDOM VAN BUREAU
BUITENLANDSE VOORSCHRIFTEN
Frederikkazerne, Gebouw I[1]
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WAR DEPARTMENT TECHNICAL MANUAL

TM 9-771

This manual supersedes all pertinent information from WD TB ORD 20, 24 January 1944.

SGV TD

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

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WAR DEPARTMENT
Washington 25, D.C., 14 July 1944

TM 9-771, Crane, Truck-mounted, M2 and Trailer, Clamshell, M16, is published for the information and guidance of all concerned.

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G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

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PART ONE

GENERAL

Secton I

INTRODUCTION

1. SCOPE.*

a. This technical manual is published for the information and guidance of the personnel to whom this equipment is assigned, contains information covering the operation and maintenance of the Truck-mounted Crane M2 and Clamshell Trailer M16, as well as descriptions of the major units and their functions in relation to the other components of this vehicle.

b. This manual has the following arrangement:

(1) Part One, General, contains description and data.

(2) Part Two, Operating Instructions, contains instructions for the operation of the vehicle and a description of the controls and instruments.

(3) Part Three, Lubrication and Scheduled Maintenance, contains information needed for the performance of the scheduled lubrication and preventive maintenance services, together with instructions for performing maintenance operations which are the responsibility of the using organizations (first and second echelons).

(4) Part Four, Vehicle Maintenance Instructions, contains information needed for performing maintenance operations which are the responsibility of the using organizations (first and second echelons).

(5) Part Five, Turntable Maintenance Instructions, contains information needed for performing maintenance operations which are the responsibility of the using organizations (first and second echelons).

(6) The Appendix contains instructions for shipment and limited storage, and a list of references, including standard nomenclature lists, technical manuals, and other publications, which are applicable to the vehicle.

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*To provide operating instructions with the materiel, this technical manual has been published in advance of complete technical review. Any errors or omissions will be corrected by changes or, if extensive, by an early revision.

2. RECORDS.

a. Forms and records applicable for use in performing prescribed operations are listed below with brief explanations of each.

(1) STANDARD FORM NO. 26, DRIVER'S REPORT—ACCIDENT, MOTOR TRANSPORTATION. One copy of this form will be kept with the vehicle at all times. In case of an accident resulting in injury or property damage, it will be filled out by the driver on the spot, or as promptly as practical thereafter.

(2) WAR DEPARTMENT FORM NO. 48, DRIVER'S TRIP TICKET AND PREVENTIVE MAINTENANCE SERVICE RECORD. This form, properly executed, will be furnished to the driver when his vehicle is dispatched on nontactical missions, and the driver and the official user of the vehicle will complete in detail appropriate parts of it. These forms need not be issued for vehicles in convoy or on tactical missions. The reverse side of this form contains the driver's daily and weekly preventive maintenance service reminder schedule.

(3) W.D., A.G.O. FORM NO. 478, MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD. This form will be used by all personnel completing a modification or major unit assembly (engine, transmission, transfer case, and axles) replacement to record clearly the description of work completed, date, vehicle hours, and/or mileage, and MWO number or nomenclature of unit assembly. Personnel performing the operation will initial in the column provided. Minor repairs, parts, and accessory replacements will not be recorded.

(4) W.D., A.G.O. FORM NO. 6, DUTY ROSTER. This form, slightly modified, will be used for scheduling and maintaining a record of vehicle maintenance operations. It may be used for lubrication records.

(5) W.D., A.G.O. FORM NO. 461, PREVENTIVE MAINTENANCE SERVICE AND TECHNICAL INSPECTION WORK SHEET FOR WHEELED AND HALF-TRACK VEHICLES. This form will be used for all 1,000-mile (monthly) and 6,000-mile (semiannual) maintenance services, and for all technical inspections performed on wheeled or half-track vehicles.

(6) W.D., O.O. FORM NO. 7353, SPOT-CHECK INSPECTION REPORT FOR ALL MOTOR VEHICLES. This form may be used by all commanding officers or their staff representatives in making spot-check inspections on all vehicles.

(7) W.D., A.G.O. FORM NO. 468, UNSATISFACTORY EQUIPMENT RECORD. This form will be used for reporting manufacturing, design, or operational defects in materiel, with a view to improving and correcting such defects, and for use in recommending modifications of materiel. This form will not be used for reporting failures, isolated materiel defects, or malfunctions of materiel resulting from fair wear

and tear or accidental damage; nor for the replacement, repair, or the issue of parts and equipment. It does not replace currently authorized operational or performance records.

(8) W.D., O.O. FORM No. 7370, EXCHANGE PART OR UNIT IDENTIFICATION TAG. This tag, properly executed, may be used when exchanging unserviceable items for like serviceable assemblies, parts, vehicles, and tools.

Section II

DESCRIPTION AND DATA

3. DESCRIPTION (figs. 1, 2, and 3).

a. Carrier. This vehicle is of special design, having a one-man, all-steel cab located on the left side of the vehicle on a specially reinforced frame. The vehicle, which is powered by a 6-cylinder, L-head, gasoline engine, has a 6-wheel drive. The vehicle transmission has 8 forward speeds and 2 reverse speeds, accomplished through the transfer case mounted to the rear of the transmission. The vehicle is equipped with air brakes *on all wheels*, and with a double-shoe propeller shaft brake mounted at the rear of the transfer case. The gasoline tank is mounted on the left frame side rail to the rear of the cab. The vehicle specification plate (figs. 5 and 8) is attached to the inner right side of the cab.

b. Turntable. The crane, with special type heavy-duty boom, is self-powered and is placed on a turntable above the rear axle bogie to accommodate the weight of the crane.

c. Trailer. A 2-wheeled trailer, which is of heavy construction and equipped with semielliptic springs, is attached to the pintle hook at the rear of the carrier and is used to transport the clamshell when not attached to the boom. Each trailer is equipped with 10 floats (mats) to be used as supports when the vehicle is operating in soft terrain.

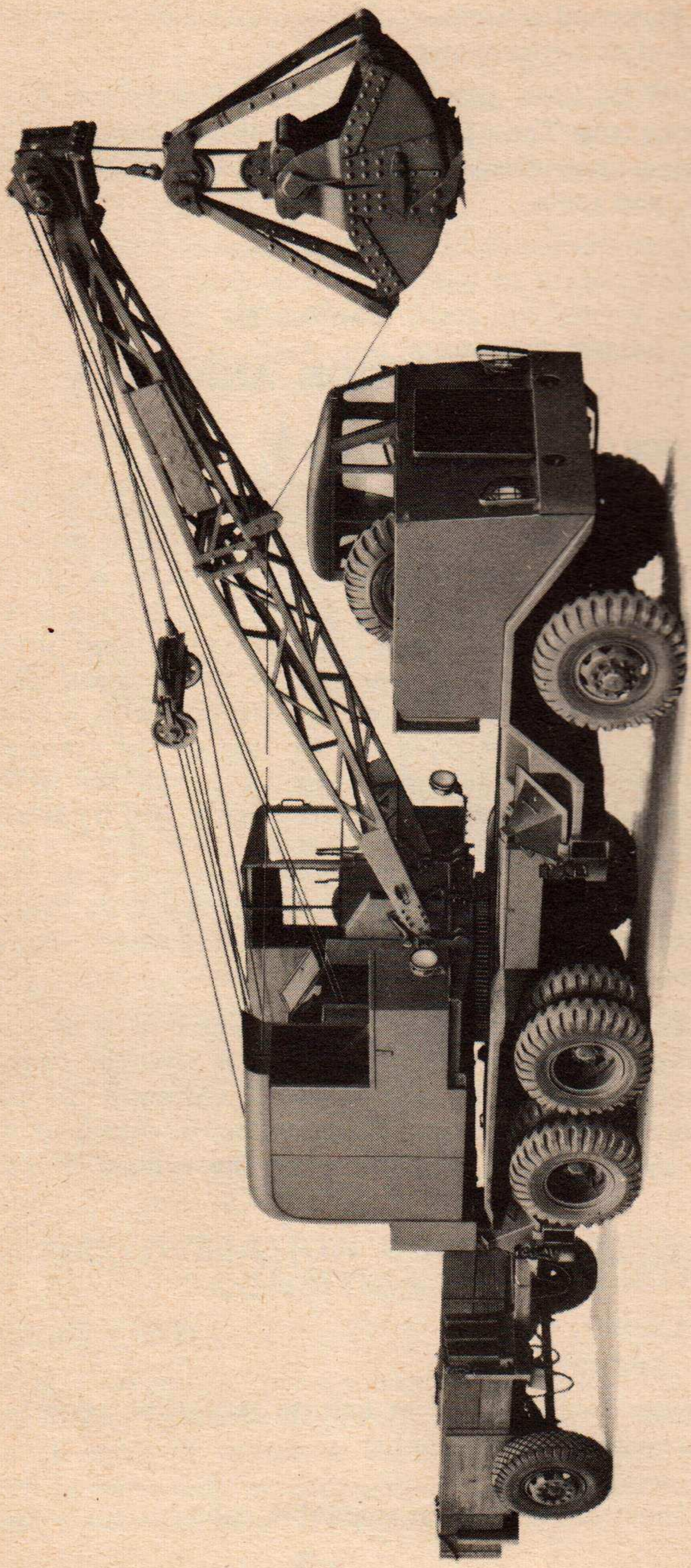
4. DATA.

a. Carrier.

(1) SPECIFICATIONS.

Wheelbase (centerline front axle to centerline bogie)	168½ in.
Length, over-all (chassis only)	299½ in.
Width, over-all	108 in.
Height, over-all (to top of turntable cab)	130½ in.

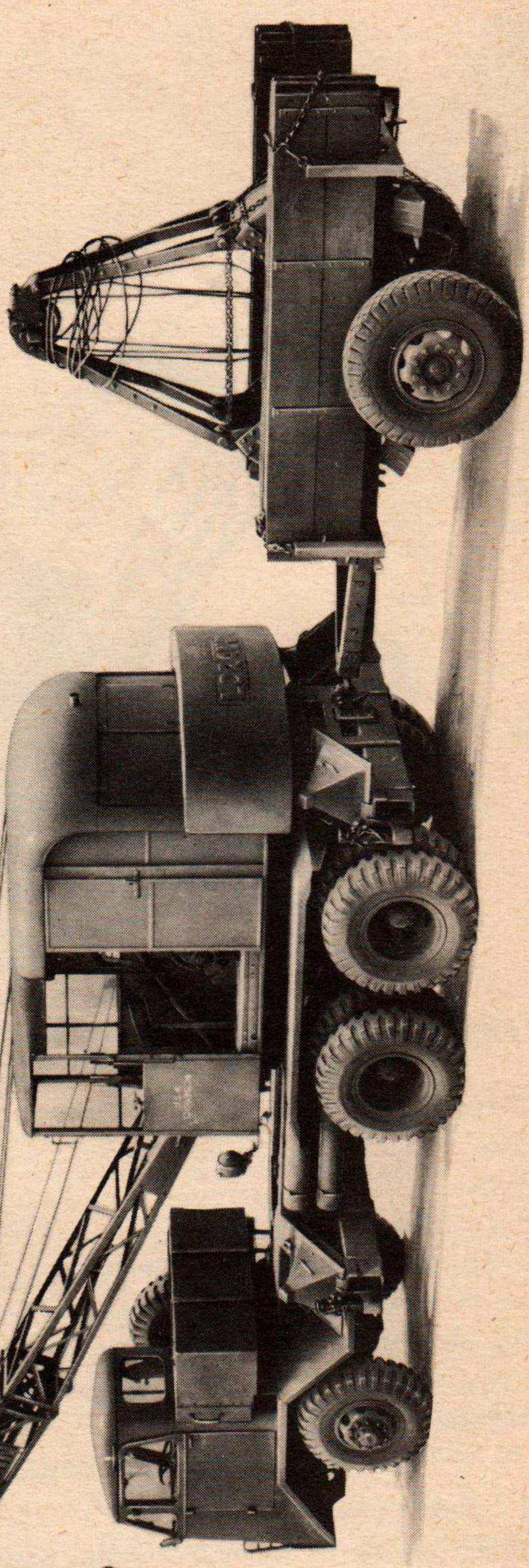
CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



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Figure 1—Truck-mounted Crane M2 and Clamshell Trailer M16—Right Side View

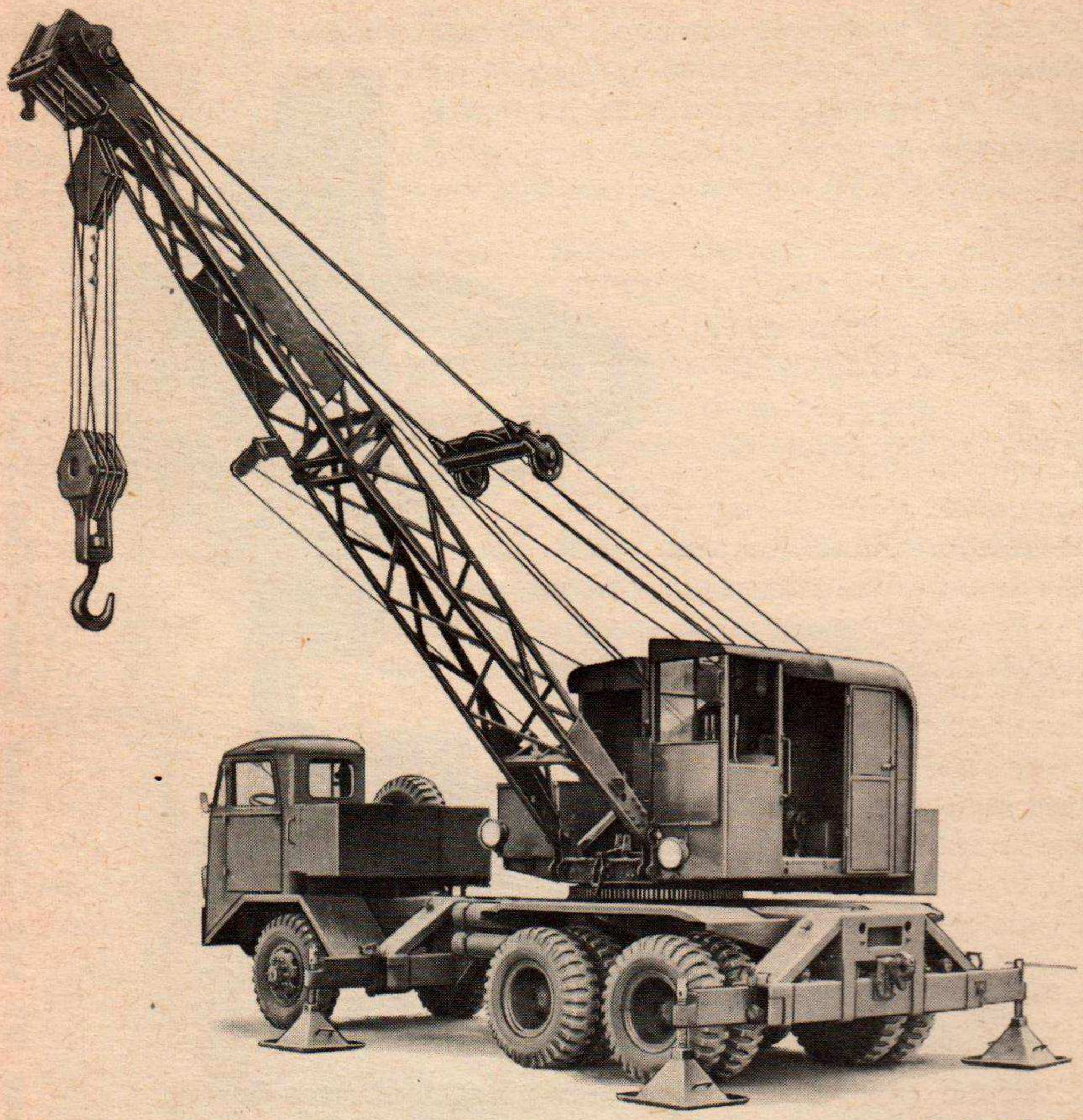
DESCRIPTION AND DATA



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Figure 2—Truck-mounted Crane M2 and Clamshell Trailer M16—Left Side View

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



RA PD 321048

Figure 3—Truck-mounted Crane M2—Left Rear View

Wheel type	Ventilated disk
Tire size	12.00 x 20
Tire type	Military ground grip
Tread (center to center)	Front—75 in.; Rear—80¼ in.
Crew (operating—crane and carrier)	2
Weight of vehicle (empty)	53,500 lb
Ground clearance (empty)	12½ in. under axle 18 in. under outriggers
Pintle height (center of hook)	33¼ in.
Kind of fuel	Gasoline

(2) PERFORMANCE.

Vehicle speeds in miles per hour with engine operating at 2,000 revolutions per minute.

DESCRIPTION AND DATA

	High Range Low	High Range High	Low Range Low	Low Range High
Reverse	4.2		0.6	
First	4.6		0.8	
Second		8.8		3.4
Third		17.1		6.7
Fourth		30.0		12.1

Approach angle ..... 31 deg
Departure angle ..... 24 deg
Minimum turning radius ..... 94 ft 4 in.—right
90 ft—left
Fording depth ..... 30 in.
Towing facilities ..... Front—2 tow hooks; Rear—pintle hook
Maximum grade ascent possible ..... 60 pct
Maximum allowable speed ..... 30 mph
Maximum allowable engine speed ..... 2,200 rpm

(3) CAPACITIES.

Transmission ..... 11 qt
Transfer case ..... 4 qt
Front axle center ..... 10 qt
Rear axle center (two) ..... 10 qt
Fuel tank ..... 100 gal
Cooling system ..... 64 qt
Crankcase (dry) (including oil filters) ..... 20 qt

b. Turntable Assembly.

(1) SPECIFICATIONS.

Maximum over-all length (including length of crane boom) with boom in travel position over front ..... 406 in.
Counterweight over-all maximum width for turntable assembly ..... 94 in.
Height of cab (top of turntable floor plate to extreme top of cab) ..... 66¾ in.
Width of cab ..... 91 in.
Tail swing (front centerline rotation to extreme rear of counterweight) ..... 107 in.
Boom foot pin to ground ..... 70½ in.
Boom foot pin to center rotation ..... 27 in.
Working weight equipped as crane (whip line and 6-part line) ..... 53,500 lb
Working weight equipped as clamshell ..... 57,400 lb with bucket
53,500 lb without bucket

(2) PERFORMANCE (MANEUVERABILITY).

Maximum turning circle diameter ..... Right—94 ft 4 in. to extreme corner
Left—90 ft to extreme corner

(3) OPERATING SPEEDS.

Swing speed of rotating base	4.19 rpm
Hoist speed—clamshell	149.8 fpm—rope speed
Boom hoisting time from horizontal to 10-ft radius	45 seconds (approx.)

(4) CAPACITIES.

Fuel tank	50 gal
Cooling system	31 qt
Crankcase (dry)	10 qt
Air cleaner	1 qt
Horizontal swing shaft gear case	1¾ lb in each clutch driven housing
Silent drive chain sight feed oiler	1 qt

c. Trailer.

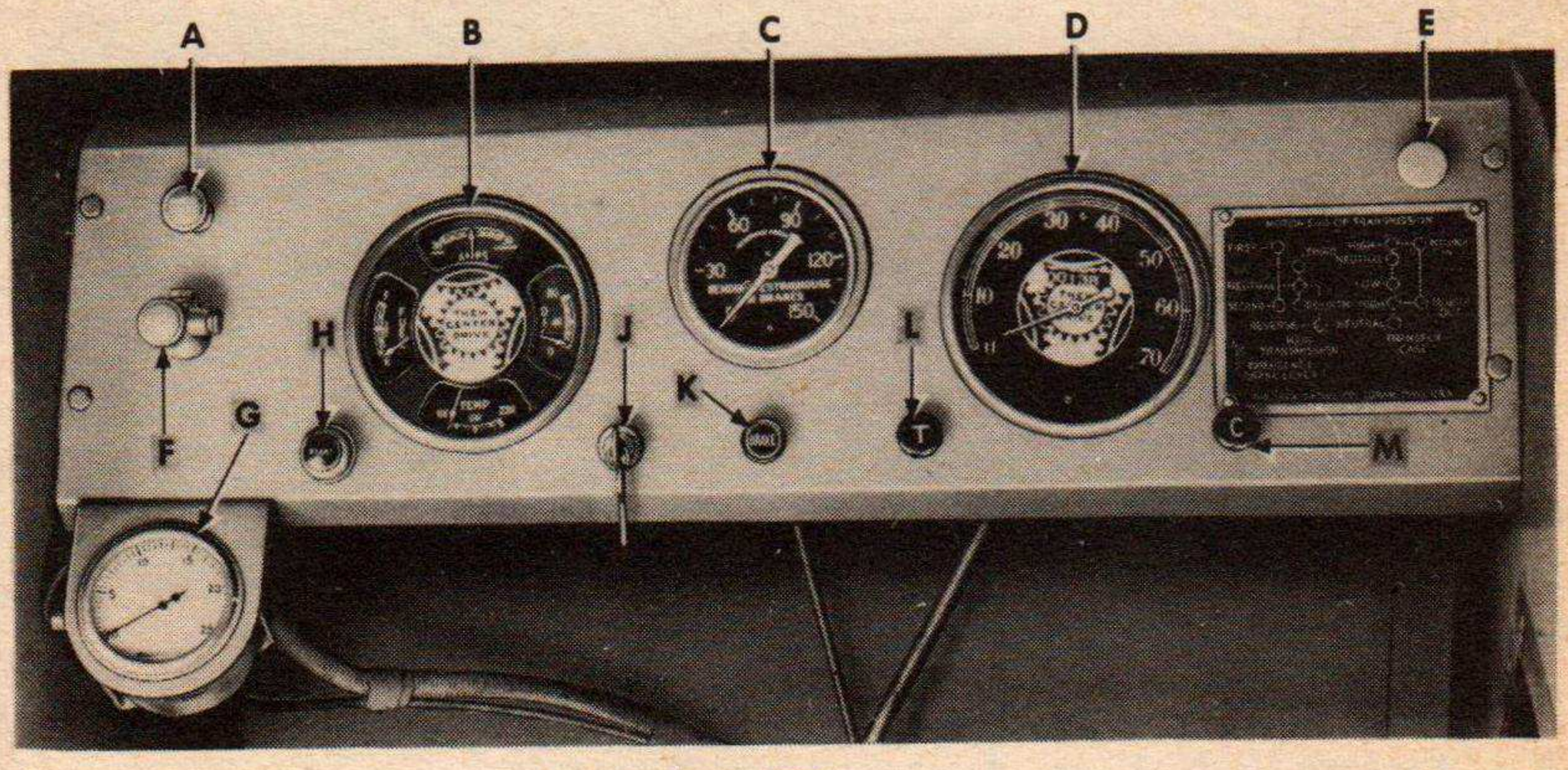
Length (empty)	159 in.
Length (loaded with 10 foot mats)	171 in.
Width	108 in.
Height (empty)	49½ in.
Height (loaded with clamshell)	128 in.
Weight (empty)	2,425 lb
Weight (loaded)	8,240 lb

PART TWO
OPERATING INSTRUCTIONS
Section III
CARRIER CONTROLS AND INSTRUMENTS

5. CONTROLS.

a. Controls on Instrument Panel.

(1) MAIN LIGHT SWITCH (fig. 4). The main light switch, located on the left side of the instrument panel, is a four-position, push-pull type. The switch is in its normal, or "OFF," position when pushed all the way in; it is first pulled out to "BLACKOUT" position, second to "SERVICE LIGHTS" position, and third all the way out to "STOP LIGHTS" position. The "STOP LIGHTS," or third, operating position is for the purpose of placing the stop lights in operation when the service head and taillights are not needed. The knob is automatically locked in the "BLACKOUT," or first, operating position when pulled out and must be released by pushing the release button on the right side of the switch before the service lights or stop lights may be turned on.



D—SPEEDOMETER

A—INSTRUMENT PANEL LIGHT SWITCH
B—FUEL, OIL PRESSURE, TEMPERATURE, AND AMMETER GAGES
C—AIR PRESSURE GAGE
E—WINDSHIELD WIPER BUTTON
F—MAIN LIGHT SWITCH
G—TACHOMETER
H—CRANKING MOTOR SWITCH BUTTON
J—IGNITION SWITCH
K—BRAKE STOP BUTTON
L—THROTTLE CONTROL BUTTON
M—CHOKE CONTROL BUTTON

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Figure 4—Carrier Instrument Panel

(2) INSTRUMENT PANEL LIGHT SWITCH (fig. 4). The instrument panel light switch, located above the main light switch, is a rheostat

type. The panel lights are off when the knob is turned to the extreme right (clockwise) position. The brilliance of the panel lights is increased by turning the knob counterclockwise. The panel lights operate only when the main light switch is on the "SERVICE LIGHTS" position.

(3) CRANKING MOTOR SWITCH (fig. 4). The cranking motor switch, which is operated by a push button, is located on the left side of the instrument panel. It is used to operate the cranking motor in starting the engine.

(4) IGNITION SWITCH (fig. 4). The ignition switch, located at the left center of the instrument panel, is the key type. The ignition switch is closed by turning key clockwise, opened by turning it counterclockwise.

(5) THROTTLE CONTROL (fig. 4). The hand throttle control, located at the lower right center of the instrument panel, is the push-pull rod type and may be pulled out to any desired position to regulate the throttle opening.

(6) CHOKE CONTROL (fig. 4). The hand choke control button, located on the right side of the instrument panel, is used to regulate the fuel mixture in the carburetor, particularly as an aid in starting the engine when cold. The control button is pulled out to enrich the mixture.

(7) WINDSHIELD WIPER. The windshield wiper is controlled by a separate electrical motor located on the top center of the windshield. The wiper is turned on by pulling out the control button, and stopped by pushing the button in.

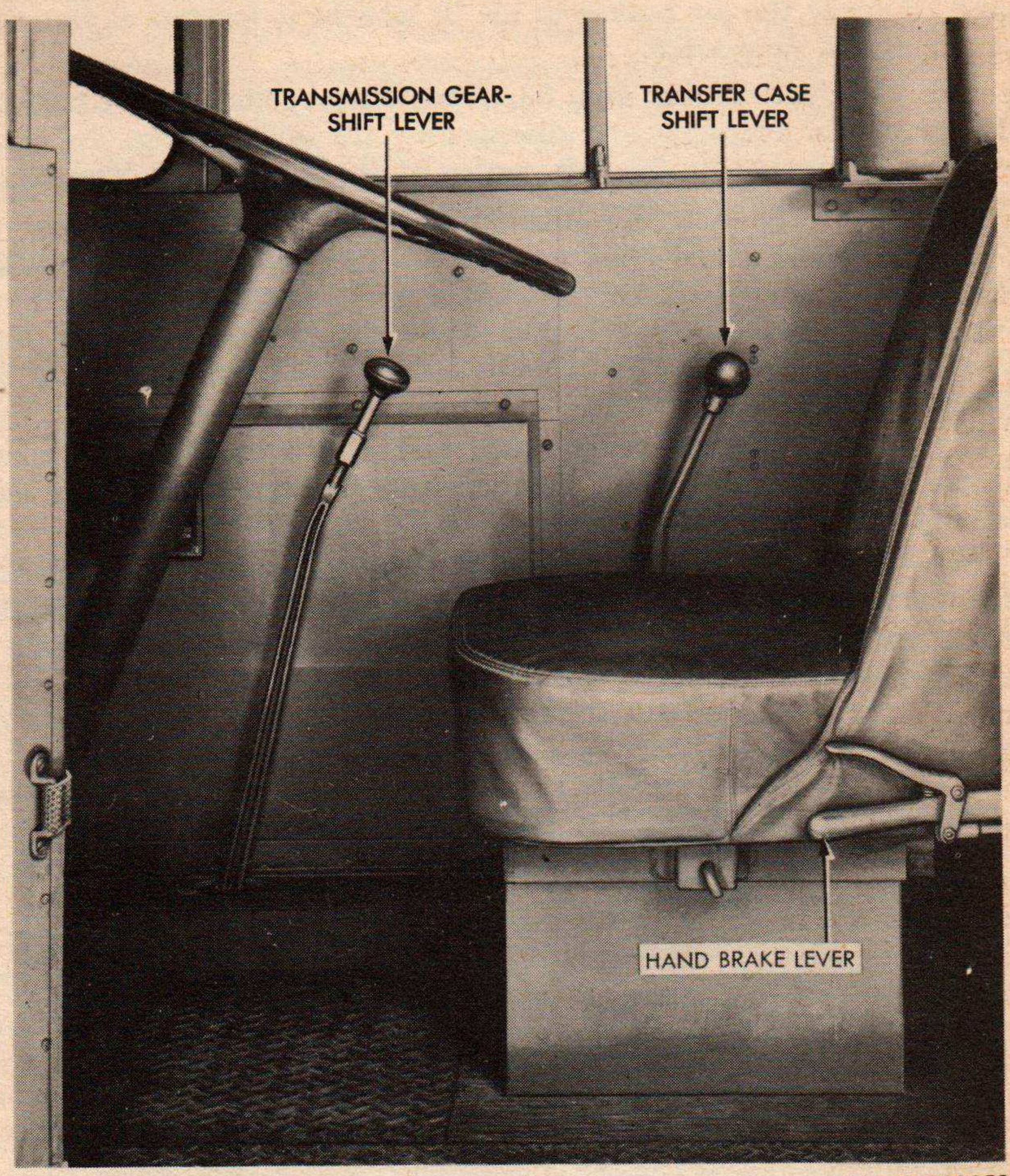
(8) BRAKE STOP (fig. 4). The brake stop button, which is located in the center of the instrument panel, controls the latch (fig. 6) on the right side of the brake pedal. After the brake pedal has been depressed, the button may be pulled out to lock the pedal in its depressed position and thus set the brakes.

b. Controls Not on Instrument Panel.

(1) HAND BRAKE LEVER (fig. 5). The hand brake lever operates a double-shoe, disk-type brake mounted on the crossmember at the rear of the transfer case. This lever is located at the left of the driver's seat; it is pulled up to apply the brake, down to release it. This brake should be used only for parking or emergency.

(2) TRANSMISSION GEARSHIFT LEVER (fig. 5). The transmission shift lever, which enables the operator to manually control the selection of transmission speeds (gear ratios), projects up from the floorboard at the right of the driver.

CARRIER CONTROLS AND INSTRUMENTS



RA PD 321053

Figure 5—Carrier Control Levers

(3) TRANSFER CASE SHIFT LEVER (fig. 5). The transfer case shift lever, which controls the high and low speed range, is located on the right side of the driver's seat.

(4) ACCELERATOR PEDAL (fig. 6). The accelerator pedal, which is used to control the speed of the carrier engine, is located on the far right-hand side of the floorboard. The pedal regulates the carburetor throttle valve, thereby controlling the amount of fuel mixture passing from the carburetor to the engine.

(5) SERVICE BRAKE PEDAL (fig. 6). The brake pedal, which is used to apply the air brakes to all 10 wheels, is located at the right center of the floorboard.

(6) CLUTCH PEDAL (fig. 6). The clutch pedal, which provides the means for engaging and disengaging the engine from the transmission, is located at the left center of the floorboard. The clutch is disengaged by depressing the pedal, engaged by releasing it.

(7) HEADLIGHT BEAM CONTROL SWITCH (fig. 6). The headlight beam control switch is located on the far left-hand side of the floorboard. The switch controls the headlight beams, low and high. Change from one beam to the other is effected by pressure of the operator's foot on the switch.

(8) HORN BUTTON. The horn button is located in the center of the steering wheel. This button is depressed to sound the electrically-operated horn.

(9) STEERING WHEEL (fig. 5). The steering wheel, attached securely to the top end of the steering gear shaft, controls the steering mechanism of the carrier and provides the means for steering it manually.

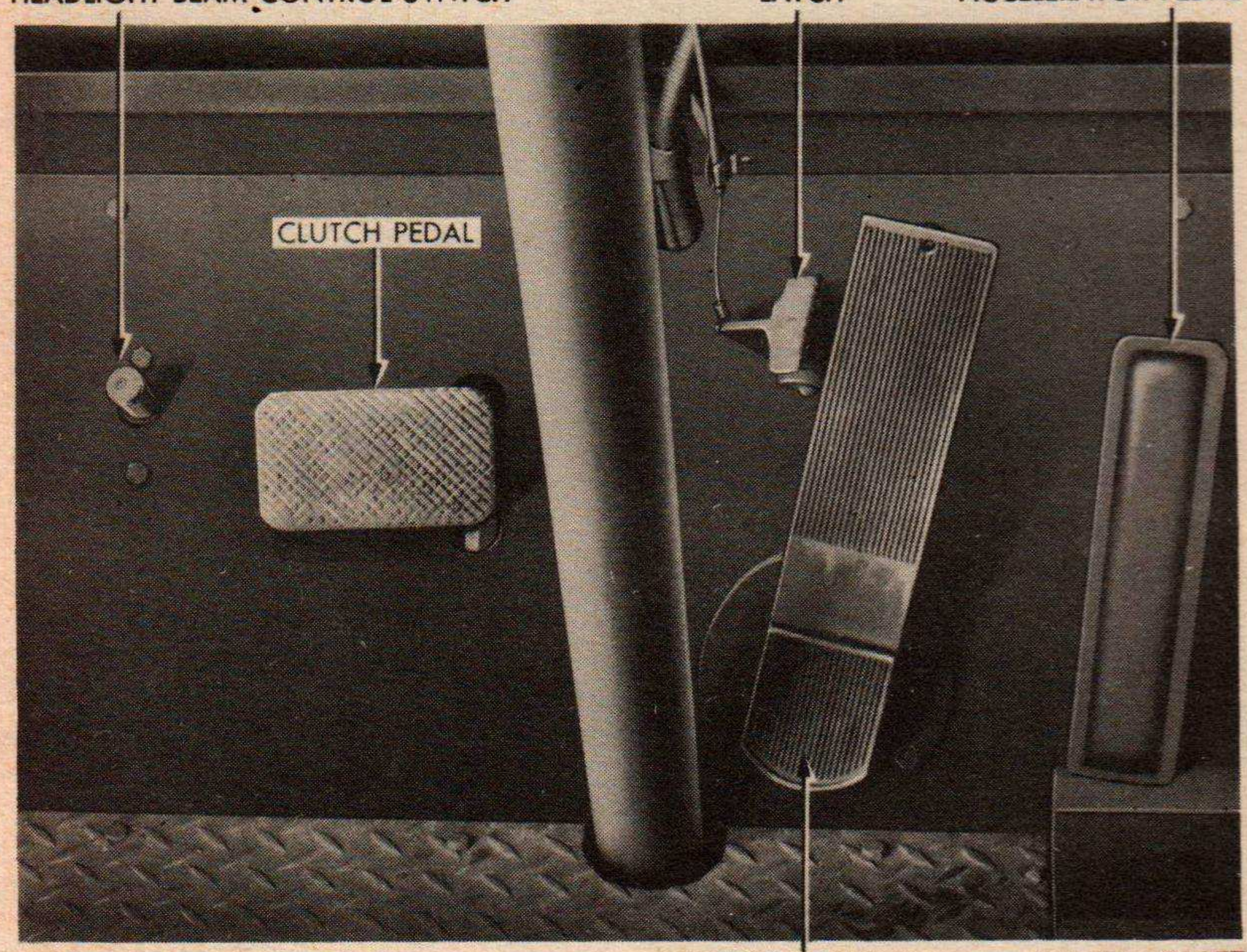


Figure 6—Carrier Control Pedals

CARRIER OPERATION UNDER ORDINARY CONDITIONS

6. INSTRUMENTS.

a. Fuel, Oil Pressure, Temperature, and Ammeter Gages (fig. 4). The fuel, oil pressure, temperature, and ammeter gages are all shown on one dial, divided into four sections and located on the left side of the instrument panel. The fuel gage registers the amount of fuel in the tank when the ignition switch is turned on; "F" indicates full (100 gal), "½" indicates half full (50 gal), and "E" indicates an empty tank. The oil pressure gage, which registers from 0 to 80 pounds, indicates the pressure at which oil is being forced through the lubricating system of the engine. This pressure should be 35 pounds when the engine is running at 1,600 revolutions per minute, 15 pounds when the engine is idling at 400 revolutions per minute. **CAUTION:** *If the oil pressure should fall below normal operating range during operation of the vehicle, the engine must be stopped immediately and the cause of the pressure failure determined.* The temperature gage, which registers 100° to 220°F, indicates the temperature of the liquid in the cooling system. The normal operating temperature is between 160° to 180°F. The ammeter gage, which registers —30 to +30 amperes, indicates either the amount of current being drawn from or supplied to the battery.

b. Air Pressure Gage (fig. 4). The air pressure gage shows the air pressure in the air brake reservoirs. Located in the center of the instrument panel, it registers 0 to 150 pounds. This gage must show a safe air pressure (60 lb) before vehicle is put in motion.

c. Speedometer (fig. 4). The speedometer, which is located at the right center of the instrument panel, indicates the speed in miles per hour at which the vehicle is being driven; its dial is graduated to register from 0 to 70 miles per hour. The row of figures in the center of the speedometer records the total miles the vehicle has been driven.

d. Tachometer (fig. 4). This instrument records the revolutions per minute of the engine, and is attached to the lower left side of the instrument panel. It registers from 0 to 2,500 revolutions per minute, the scale on the dial being separated into 25 units, each of which represents 100 revolutions.

Section IV

CARRIER OPERATION UNDER ORDINARY CONDITIONS

7. USE OF INSTRUMENTS AND CONTROLS IN VEHICULAR OPERATION.

a. New Vehicle Run-in Test. Before a new or reconditioned vehicle is placed in service, be sure that the new vehicle run-in test

described in paragraphs 21, 22, and 23 has been performed.

b. Before-operation Service. Perform the services in paragraph 25, items (1) through (6), before attempting to start the engine. Start and warm-up engine (subpar. **c** below), and complete the Before-operation Service.

c. Starting the Engine. Put the transmission shift lever in neutral position. Pull choke button out about ½ inch and pull throttle button out about one-fifth of the total travel. Turn ignition key to the right (clockwise). Depress clutch pedal and hold down until engine starts. Press cranking motor switch button. Release pressure on switch button as soon as engine starts. Push in throttle and choke button as soon as engine is warmed up; then release clutch pedal. Check reading of all gages to see that they register properly for vehicle operation. The oil gage must register a 15-pound pressure at idling speed, and 40 pounds at operating speed. At low engine speed, the ammeter gage may properly show a negative or discharge reading, but at operating speed a charge (+) reading must be shown.

Figure 7—Carrier Shifting Diagram

CARRIER OPERATION UNDER ORDINARY CONDITIONS

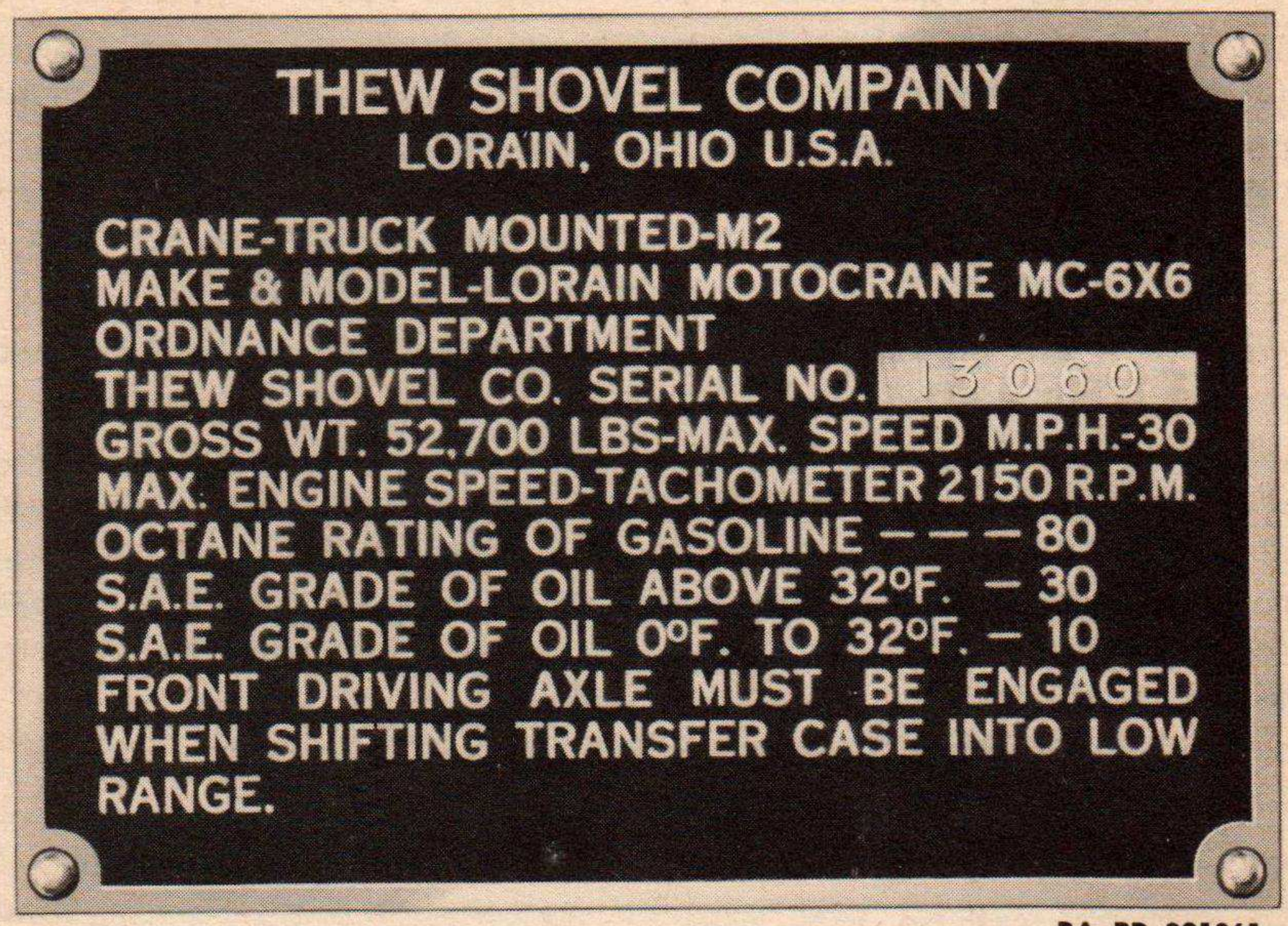


Figure 8—Vehicle Specification Plate

The temperature gage is at normal reading at 160°F and should not exceed 200°F. The fuel gage must register a sufficient quantity of fuel in the tank, and the air pressure gage must show a reading of 85 pounds.

d. Placing Vehicle in Motion. Disengage clutch by depressing clutch pedal. Move transfer shifting lever into proper speed range. Use high speed range for hard level ground, low speed range for operating on soft ground or up an incline. The carrier cannot be moved while this lever is in neutral position. Move main transmission gearshift lever to first gear position (fig. 7). Release hand brake lever while gradually increasing engine speed by depressing accelerator pedal, then slowly release clutch pedal until clutch is fully engaged. Increase engine speed to enable the engine to overcome the inertia of load, and put the vehicle into motion. As the vehicle gains speed, release the accelerator pedal, depress the clutch at the same time, and place gearshift lever in second gear position (fig. 7). Release clutch and increase speed. Do not exceed 2,200 revolutions per minute as indicated by tachometer. Repeat this operation, passing through all gears consecutively, until the highest gear is reached at which the engine pulls without laboring. Do not operate vehicle in the various gears at speeds in excess of the maximum as specified in paragraph 4 a (2).

e. Shifting Transmission and Transfer Case.

(1) TRANSFER CASE. To operate vehicle properly it is necessary that the driver understand the purpose of the transfer case shifting lever. This lever must be placed in position before axles can be operated. The transmission gearshift lever positions do not in any way affect the shifting selections in the transfer case. Operation of the transfer case shifting lever is described as follows:

(a) Vehicle may be driven by rear axles only or by front and rear axles, but not by front axle alone.

(b) To operate with rear axles only, place transfer case shifting lever in rear position (fig. 7). This will disengage front axle and automatically place transfer case gears in high range. In this position, transfer case may be operated only in high range. To place transfer case in neutral when operating in high range, pull shifting lever all the way back (fig. 7).

(c) To operate with front and rear axles, place transfer case shifting lever in the forward position (fig. 7). This will engage front axle and automatically place transfer case gears in low range. In this position, transfer case may be operated in high or low range (fig. 7). To place transfer case in neutral, position shifting lever between high and low speed positions (fig. 7).

(2) SHIFTING TRANSMISSION FROM LOW TO HIGH SPEEDS. When the transfer case is engaged in the proper range for road conditions, shifting the transmission from first to fourth speeds can be accomplished in successive stages as follows:

(a) Depress clutch pedal and release accelerator pedal.

(b) Place transmission shift lever in the forward left-hand (FIRST) position (fig. 7).

(c) Release clutch pedal slowly; at the same time gradually depress accelerator pedal.

(d) When clutch is fully engaged, accelerate engine until road speed is increased to approximately that indicated for permissible vehicle speeds. Refer to paragraph 4 a (2). NOTE: *Recommended road speeds for various transmission ratios differ when transfer case is operated in high range and low range.*

(e) After necessary road speed has been obtained in first speed, release accelerator pedal, depress clutch pedal, and pull shift lever straight back to the rear left-hand (SECOND) position.

(f) Slowly release clutch pedal, accelerate engine to proper road speed (par. 4 a (2)), and repeat operations in steps (a) through (e) above for each of the third and fourth speeds.

(3) SHIFTING TRANSMISSION FROM HIGH TO LOW SPEEDS. Always shift transmission into the next lower speed before engine

begins to labor, or before vehicle speed is appreciably decreased. Shifting into lower speeds will be generally necessary when ascending or descending a steep incline, or when more power is needed to pull the load through soft terrain. To shift transmission to a lower speed, proceed as follows:

(a) Depress clutch pedal, and at the same time release accelerator pedal.

(b) Place transmission shift lever in neutral position.

(c) Release clutch pedal, and momentarily accelerate engine to synchronize transmission gears.

(d) Again depress clutch pedal, and move transmission shift lever carefully into next lower speed position.

(e) Release clutch pedal, and accelerate engine to obtain desired road speed. Do not exceed maximum permissible speed as indicated in paragraph 4 a (2).

(f) Follow the above procedure to shift transmission successively into each of the next lower speeds as necessary.

(4) SHIFTING TRANSMISSION INTO REVERSE. Before transmission can be shifted into reverse, the vehicle must be brought to a dead stop. With transfer case in either high or low range, shift transmission into reverse as follows:

(a) Depress clutch pedal to disengage clutch.

(b) Depress brake pedal to stop vehicle.

(c) Pull transmission shifting lever straight back to reverse position.

(d) Release clutch pedal and accelerate engine to desired speed, providing it does not exceed maximum permissible speed as indicated in paragraph 4 a (2).

(5) SHIFTING TRANSFER CASE FROM HIGH TO LOW RANGE. If possible always shift transfer case into low range while vehicle is still on hard ground and before difficult terrain is encountered. Front axle will automatically be engaged when transfer case is shifted into low range.

(a) Depress clutch pedal, and push transfer case shift lever to the forward position. Then pull lever to left and backward to the neutral position (fig. 7).

(b) Release clutch pedal, and accelerate engine to a speed approximately double that of vehicle.

(c) Depress clutch pedal again, and move transfer case shifting lever forward into high speed or rearward to low speed, as desired. Do not use excessive pressure.

(d) Release clutch pedal and accelerate engine to desired speed, providing it does not exceed maximum permissible speed as indicated in paragraph 4 a (2).

(6) SHIFTING TRANSFER CASE FROM LOW TO HIGH RANGE. This shift may be accomplished regardless of vehicle speed. Proceed as follows:

(a) Depress clutch pedal and move transfer case shift lever forward, to right, rearward, to left, and then rearward again. This will disengage front axle and at the same time place transfer case gears in neutral in high range (fig. 7).

(b) Release clutch pedal, and accelerate engine to approximate vehicle speed.

(c) Again depress clutch pedal, and push transfer case shift lever forward into high position (fig. 7).

(d) Depress accelerator pedal to obtain desired vehicle speed. NOTE: *This should in no case exceed the maximum as specified in paragraph* 4 **a** (2).

f. Driving Precautions.

(1) When operating on dry, hard terrain, disengage front axle drive. In most cases the pulling ability of the two rear axles is sufficient. However, if steep inclines are encountered, or if vehicle is called upon to help move an additional load, the front axle must be engaged in order to utilize the pulling ability of all three axles. When pulling heavy loads, the front axle must be used in getting vehicle under way. Front axle may then be disengaged, providing the pulling ability of the two rear axles is sufficient to safely handle the additional load.

(2) Always have front axle drive engaged when operating off the road, on steep grades, or under hard pulling.

(3) When ascending steep grades, always shift into lower transmission speeds before vehicle begins to labor. This can be accomplished most successfully when vehicle still has sufficient momentum to permit changing gears without bringing vehicle to a stop. When shifting to a lower gear at any rate of vehicle speed, make sure the engine speed is synchronized with vehicle speed before clutch is engaged. If clutch is engaged when engine is operating at lower than relative vehicle speed, the drive line may be damaged.

(4) The importance of restraining speed of vehicle and speed of engine while descending grades cannot be overemphasized. Refer to paragraph 4 **a** (2) for specified speed at which vehicle may be safely operated in various gear ratios of transmission and ranges of transfer case. In general it is advisable to use the same transmission speed going down hill as would be required to climb the hill. The following should be observed when descending grades:

(a) Keep vehicle under control at all times.

(b) Reduce speed of vehicle with brakes several times during the descent of a hill.

CARRIER OPERATION UNDER ORDINARY CONDITIONS

(c) Do not use a lower gear ratio than would be required to ascend the same hill.

(d) Do not allow the vehicle to exceed the maximum permissible speed for the particular gear ratio (par. 4 a (2)).

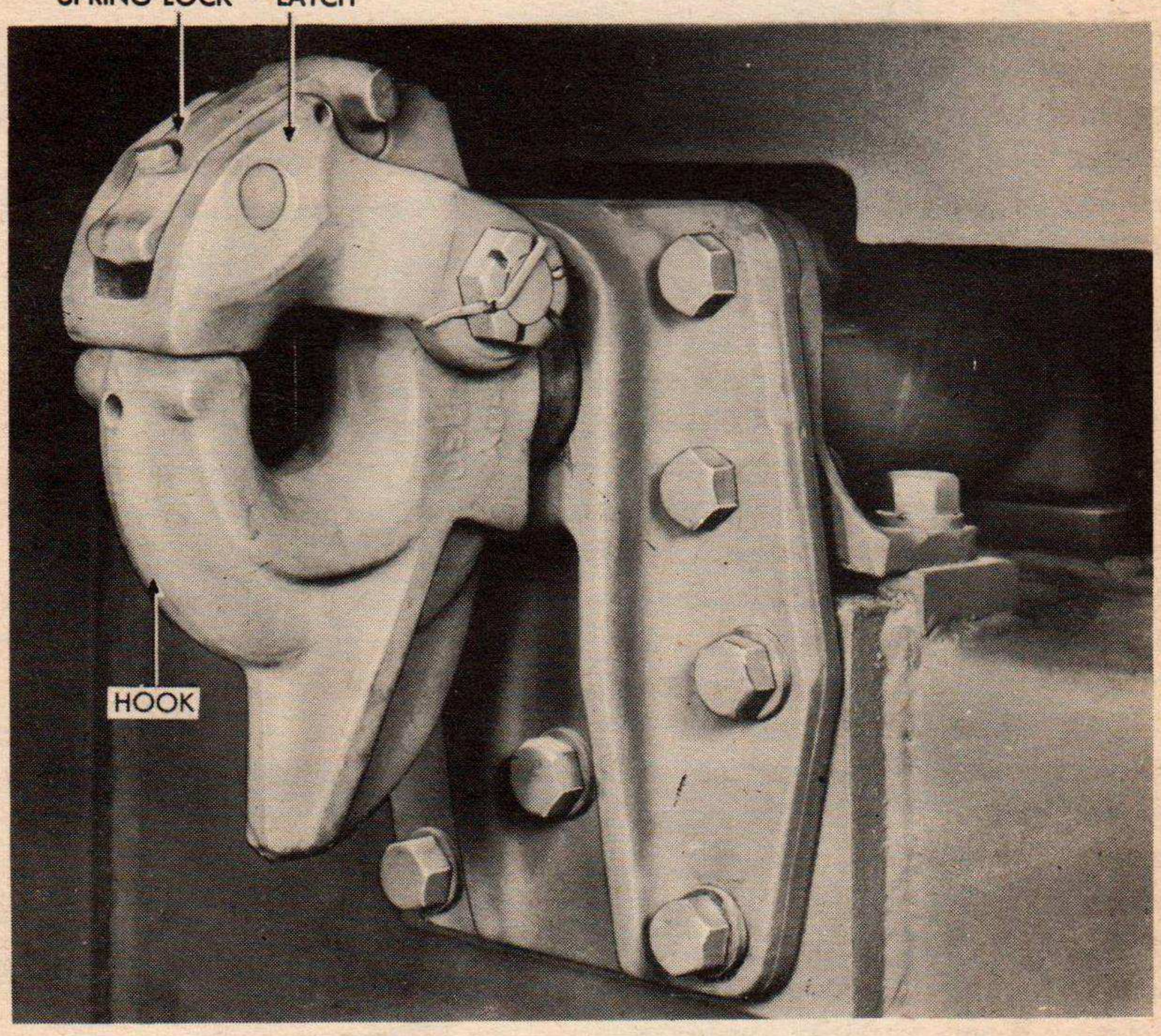
(e) Disengage front axle before using the transmission as a brake when going down a steep hill, especially before shifting to a lower gear.

(5) Always use tire chains, and use all driving axles at ratio low enough to steadily pull vehicle out of mud. When traction cannot be obtained, utilize the turntable assembly, if possible, to pull the vehicle to more solid ground. This action may be accomplished as follows:

(a) Use any stationary solid object as an anchor. This may be a large tree, another vehicle, or similar object.

(b) Unwind cable and hook block, and secure to this object.

(c) Power from turntable engine and carrier engine can then be utilized together to pull vehicle to more solid ground.



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Figure 9—Pintle Hook

(6) To pull vehicle from sand use same procedure as described above (step (5) *(a)*). If stationary or solid object is not available, decrease tires of about 30 percent of their air pressure to increase traction. CAUTION: *Deflating tires should not be undertaken except in extreme emergency, to prevent damage to tires on vehicle.*

g. Stopping the Vehicle. Release the accelerator pedal, and slowly depress the brake pedal. CAUTION: *Quick application of the air brakes may cause damage or injury.* When motion speed of the vehicle has decreased to approximately the idling speed of the engine, depress clutch pedal. When vehicle is at a complete stop, shift transmission into neutral position, release the clutch pedal, and pull the hand brake up as far as possible.

h. Stopping the Engine. When the vehicle is stopped, turn ignition off by turning ignition switch key to left (counterclockwise). CAUTION: *Before leaving the vehicle, check to see that hand brake is up and lights are turned off, so that battery will not continue to discharge.*

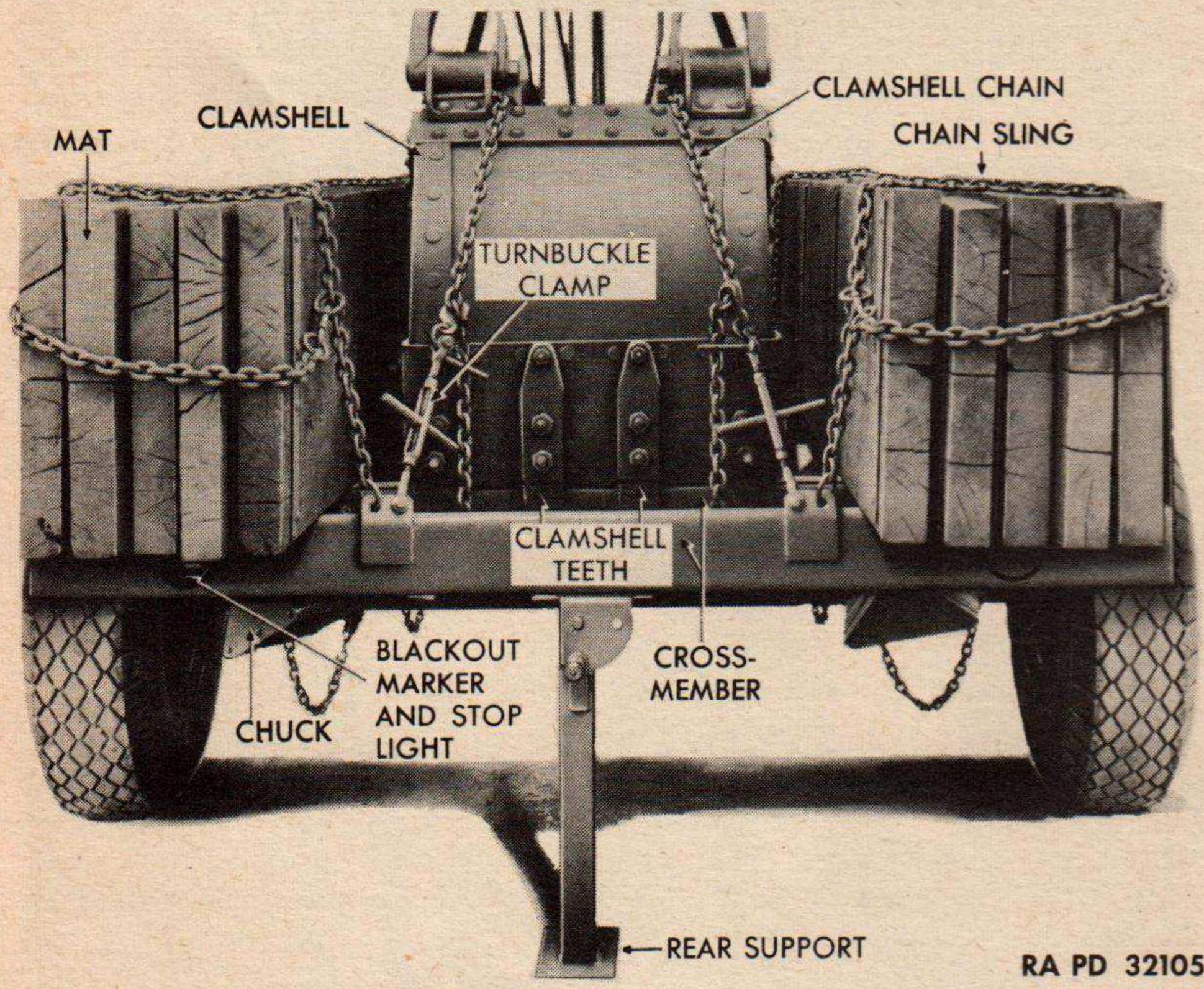


Figure 10—Trailer—Rear View

CARRIER OPERATION UNDER ORDINARY CONDITIONS

8. USE OF TRAILER.

a. Removing Trailer From Vehicle. Lower front and rear supports on unit (fig. 10). Disconnect jumper cable at right rear of carrier, and fasten to bracket on left side of trailer tongue (fig. 11). Release pintle spring lock, raise latch, lift trailer tongue from hook, and push back to free from carrier (fig. 9). Position chucks (fig. 10) attached to trailer at front and rear of each wheel to prevent trailer from moving.

b. Attaching Trailer to Vehicle. To attach the trailer to vehicle, reverse the procedure described in subparagraph a above.

c. Attaching Clamshell to Trailer (fig. 10). Before lowering clamshell on trailer, position five mats (floats) on each side of trailer chassis and chain securely. Clear clamshell chains from trailer chassis before lowering clamshell. Lower clamshell in open position, and insert clamshell teeth between trailer crossmembers. Have assistance available to facilitate positioning of clamshell in trailer, and attach chains securely with turnbuckle clamps. To remove clamshell from trailer, reverse the above procedure.

d. Trailer Lighting System.

(1) DESCRIPTION. The lighting system consists of a blackout marker and stop light (fig. 10), a service stop light, detachable jumper cable, light receptacle, light switch, and bracket for mounting lighting cable when not in use. The stop lights are located at the rear of trailer. The lighting receptacle, switch, and bracket are mounted on left side of trailer tongue (fig. 11). The light switch, located on the left-hand side of the trailer tongue (fig. 11), controls the blackout marker and stop lights. Turning switch right to "S" position connects service stop light; turning left to "BO" position connects blackout marker and stop light. Keep switch cover closed at all times.

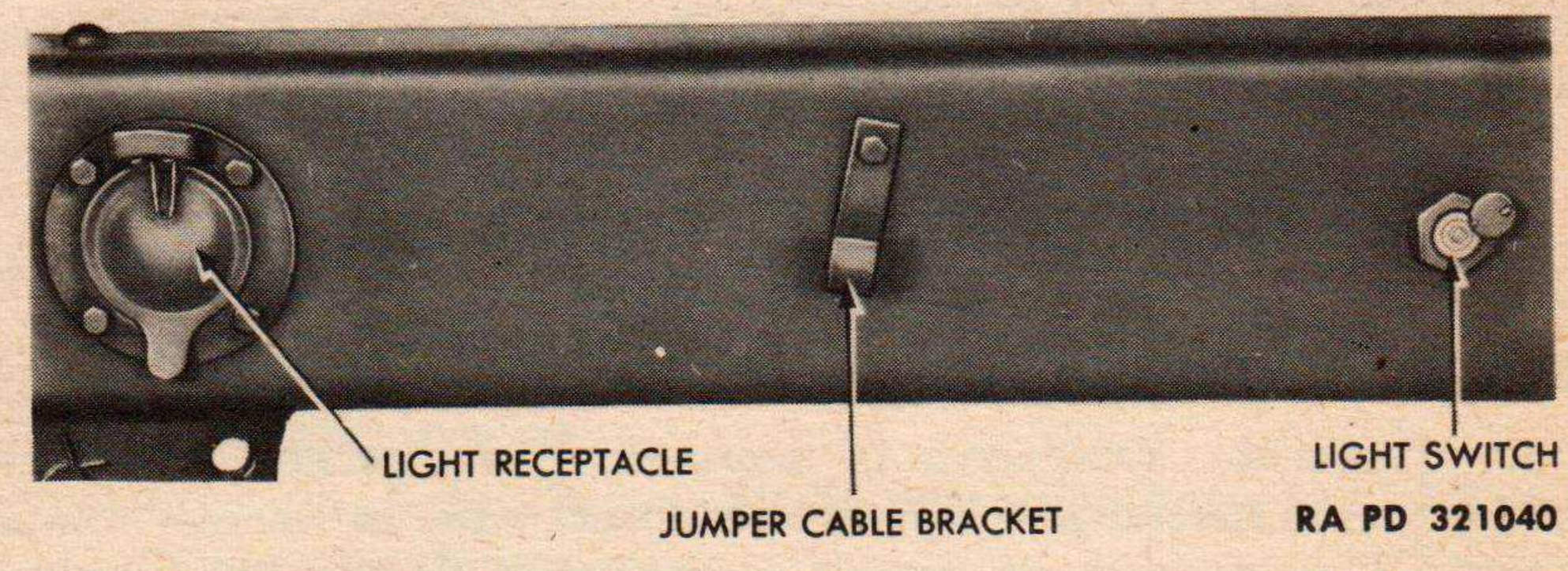


Figure 11—Trailer Tongue—Left Side View

(2) SERVICE.

(a) Inspection. Inspect trailer wiring carefully to detect any bare wire or other short circuit possibilities. Check jumper wire and connections to see that they are in good condition. Replace faulty parts.

(b) Lamp Replacement. To replace blackout light lamp-unit or service light lamp-unit, remove two screws that secure cover to lamp-unit. Replace faulty unit and install cover.

e. Trailer Mats (Floats) (fig. 10). Ten hardwood mats (floats), 3 inches x 24 inches x 10 feet, are attached to trailer, five on each side, for use in extremely soft terrain. Mats are held in position at front end of trailer by a chain and a bracket welded to trailer frame, and at rear end by a chain sling.

9. TOWING THE VEHICLE.

a. Towing to Start Vehicle. To start the engine by towing, place the transfer case in high range and the transmission in fourth, or high, gear. Disengage the clutch, and adjust choke and throttle button to suit climatic conditions. When vehicle has gained speed, turn on the ignition key and engage the clutch slowly. As soon as the engine is running smoothly, depress clutch pedal, shift transmission into neutral, and signal towing vehicle to stop. Be cautious in applying air brakes, to avoid running into towing vehicle.

b. Towing Disabled Vehicle. Method of towing a disabled vehicle depends upon the damage to the vehicle. If the wheels are not damaged, the vehicle can be towed by a connection made to one of the two hooks on the front end of the carrier or to the rear pintle hook. In case either of the ends remains undamaged, the damaged end can be raised with a conventional towing hoist and the vehicle towed to a repair station. Before starting, place the disabled vehicle in neutral gear with all drives disengaged. If the wheels are damaged so that they cannot be used to support either end of the vehicle, special recovery equipment must be procured. Refer to higher echelon.

Section V
CARRIER OPERATION UNDER UNUSUAL CONDITIONS

10. EXTREME COLD.

a. General. Operation of automotive equipment in extreme cold presents special problems which do not exist in warmer temperatures. The strength of metals is seriously decreased; lubricants coagulate and become stiff; coolant and battery fluids may solidify; and increased condensation of air may freeze brakes and steering

arms and valves, plug filler and filter openings, short electrical connections, or clog fuel lines and carburetor jets. Therefore, operators and maintenance personnel must observe special precautions and provide extra careful servicing to prevent functional failure. Systems and assemblies most likely to suffer from extreme cold are cooling, lubrication, fuel, electrical (battery), engine, and brakes.

b. Precautions.

(1) Inspect vehicle frequently for loosened or broken screws, bolts, nuts, and other metal parts. Shock resistant property of metals is greatly reduced by extremely low temperatures, while resistance to strain and stress is increased.

(2) Disconnect speedometer cable at drive end if vehicle is operated in temperatures below —30°F. These cables often fail to function properly at such temperatures, and frequently break due to high viscosity of lubricating oils.

(3) Remove oil from all air cleaners when temperature exceeds —40°F.

(4) Avoid risk of frozen brakes by keeping them in a released position. Block wheels to prevent vehicle from rolling.

(5) Keep blow torch handy to thaw frozen propeller shaft, brakes, or other frozen parts.

(6) Do not permit snow, ice or mud to cake on wheels, slack adjusters, steering knuckles, or steering arms.

(7) Inspect and clean mud, snow, or ice off radiator core, fan, fan belts, air brake safety valve, and all electrical connections.

c. Cooling System.

(1) Use only radiator antifreeze solutions which contain the prescribed ethylene-glycol type antifreeze compound.

Temperature (degrees F)	Pints of Antifreeze Compound per Gallon of System Capacity
30	1
20	1½
10	2
0	2½
—10	3
—20	3½
—30	4
—40	4½
—50	4½
—60	5
—70	5

(2) Observe the following precautions before using an antifreeze solution.

(a) Drain cooling system and flush with clean water. Refer to paragraph 70 c.

(b) Inspect entire system for leaks. Replace worn, rotted, or otherwise damaged hose connections. Make sure that all clamps are tight and all drain cocks properly closed.

(c) Lubricate water pump. Refer to figure 21.

(3) In an emergency, and when temperature is above 0°F, vehicle can be operated by using suitable improvised radiator covers. Keep radiator core sufficiently covered to keep coolant between 150° and 175°F. Drain system when stopping engine, and refill before starting.

d. Lubrication System. Check Lubrication Order (par. 20) for all lubrication in subzero temperatures. Observe also the following precautions:

(1) Keep vehicle in a warm place, if possible, when not in use.

(2) If vehicle cannot be kept in a heated enclosure, drain crankcase oil when engine is stopped. Do this while oil is still hot. Place warning tag in conspicuous place in cab to notify other personnel that crankcase is empty. Store oil in a warm place if possible. If not, heat oil to less than hand-burning temperature before reinstalling.

(3) When unprotected, cover cab and engine section with a tarpaulin. About three hours before use, place suitable type fire pots under tarpaulin. With proper care necessary to avoid fire hazard, flame may be applied directly to oil pan.

(4) Dilute crankcase oil with gasoline, or in an emergency, with Diesel fuel. If vehicle is to be left standing unprotected more than three hours after four or more hours of operation, redilute oil. Turn engine over several times to thoroughly mix oil and diluent. Use quantity as follows:

Temperature (degrees F)	Diluent	Quantity
0 to —20	Gasoline	½ qt to each 4½ qt of engine oil
0 to —20	Diesel fuel	½ qt to each 3½ qt of engine oil
Below —20	Gasoline	1 qt to each 5 qt of engine oil
Below —20	Diesel fuel	1 qt to each 4 qt of engine oil

NOTE: *Presence of diluent will increase engine oil consumption. Check oil level frequently.*

e. Fuel System.

(1) Whenever possible use a winter grade of gasoline meeting U. S. Army Specification 2-114.

(2) To overcome difficulties which will result from a certain inevitable amount of condensation from moisture in the air, observe the following precautions:

CARRIER OPERATION UNDER UNUSUAL CONDITIONS

(a) Strain fuel through a chamois skin or other suitable strainer that will prevent passage of water. CAUTION: *Use a good metallic conductor between container and fuel tank to "ground" static electricity.*

(b) Keep fuel tanks as full as possible at all times. This will minimize the volume of air from which moisture can condense.

(c) Keep all containers tightly closed to prevent the entrance of foreign matter.

(3) Check butterfly valve occasionally with full choke to see that it closes all the way as necessary for cold weather starting.

(4) Keep close check on carburetor and fuel pump to make sure they operate properly. Replace if faulty.

(5) Daily remove and clean fuel sediment bowl and strainers.

f. Electrical System. Battery energy diminishes considerably as temperatures lower, and without special care becomes almost nil at —40°F. To prevent this, observe the following precautions:

(1) Keep batteries fully charged (1.275 to 1.300 specific gravity). A fully charged battery will withstand most arctic temperatures, but an undercharged battery may freeze and break at 5°F.

(2) Do not add distillate to batteries in subzero weather unless batteries are to be charged immediately.

(3) At temperatures below —30°F, heat batteries before using them to start engine.

(4) Keep all wiring connections and battery terminals clean and tight.

(5) Inspect generator and cranking motor brushes, commutator, and bearings. Replace brushes if worn. Keep commutator clean. If cranking motor throw-out mechanism fails to engage flywheel, remove cranking motor and clean grease and dirt from throw-out mechanism.

(6) Check ignition coil for proper spark. Replace coil and condenser if spark is weak.

(7) Keep distributor points clean and properly adjusted. Refer to paragraph 53 **c.**

(8) Inspect spark plugs to see that they are clean and properly adjusted (par. 53 **b**). Reduce gap 0.005 inch if engine is difficult to fire.

(9) Check timing and adjust if necessary. Refer to paragraph 53 **d.**

(10) Check light connections for tightness and moisture around sockets. Tighten loose connections, and absorb moisture with a clean, dry cloth.

g. Cold Weather Accessories. Listed below are cold weather accessories commonly used to facilitate cold weather operation and maintenance. Use only with permission of officer in charge of materiel.

(1) Tarpaulins, tents, or collapsible sheds may be used to shelter vehicle.

(2) Extra batteries and battery charging equipment will be useful in starting vehicle.

(3) Insulation for fuel lines may be used to help prevent ice formations inside lines.

(4) Improvised radiator covers may be used to help control engine temperature.

(5) Steel drums may be used for heating crankcase oil.

11. DUSTY CONDITIONS.

a. General. Operation of mechanical equipment under dusty conditions requires observance of special precautions and service. Dust and fine sand have a tendency to penetrate bushings, bearings, air cleaners, filters, and other normally protected parts. Systems and units to which most attention must be given are lubrication, cooling, fuel, battery, engine, brakes, and moving parts which contain bushings and bearings.

b. Precautions.

(1) Keep idle vehicle protected as much as possible, especially during sand storms.

(2) Make 3- or 4-hour inspections of air cleaners, filters, and all moving parts where operating precision must be maintained.

(3) When operating in sand storm, cover air cleaners and filters with clean cloths or other porous material which will retard passage of dust and sand.

(4) Keep all doors, windows, covers, and other protective devices closed as much as possible to provide maximum protection from dust and sand.

(5) Use compressed air to remove sand and dust from inaccessible parts whenever practicable without subjecting part to possible damage.

(6) Whenever possible, position vehicle so that most protected side faces wind.

(7) Keep tire valve stem caps screwed down tight to prevent valves from becoming clogged.

(8) Inspect all breather caps to make sure that spring tension is sufficient to keep them properly closed.

CARRIER OPERATION UNDER UNUSUAL CONDITIONS

c. Cooling System.

(1) If engine overheats, inspect radiator core to make sure it is free from obstruction. Apply compressed air or water from rear of radiator to drive foreign matter from fins and tubes.

(2) Examine coolant daily to make sure it is free from dust and dirt which might prevent proper circulation and cause engine to overheat. If necessary, flush cooling system (par. 70 c) and replace coolant.

(3) Inspect all connections to make sure they are tight enough to prevent entry of foreign matter into system.

d. Lubrication System.

(1) Inspect crankcase oil daily for presence of sand, dust, or other foreign matter. Drain and refill if necessary.

(2) Every 4 hours remove and clean oil filter elements. Wipe sludge from all parts and replace securely.

(3) Every 4 hours remove wire mesh from crankcase breather cap. Wash in dry-cleaning solvent, and dry thoroughly before installing.

(4) Check open gears for excessive sand or other foreign matter which might cause wear. Clean gears thoroughly with dry-cleaning solvent and apply new lubricant. Refer to paragraph 20 for proper gear lubricant. NOTE: *Avoid excessive use of lubricants under dusty or sandy conditions. Exposed grease and oil may become grit-laden and work into fittings, causing unnecessary wear. Clean all fittings thoroughly before lubricating.*

e. Fuel System.

(1) Keep fuel tank filler neck vent holes open to ensure proper operation of fuel system.

(2) Every 4 hours remove screen and sediment bowl from fuel filter and pump (par. 55 a (2)). Clean screen and bowl thoroughly before installing.

(3) Every 4 hours remove element from carburetor air cleaner (par. 55 d (2)). Wash in dry-cleaning solvent and dry thoroughly before installing. Make sure cover is tightly secured to prevent entrance of dust and sand into carburetor.

f. Brake System.

(1) Every 4 hours under extreme dust conditions, remove element from air compressor air cleaner (par. 55 e (2)). Clean element with dry-cleaning solvent, and dry thoroughly before installing.

(2) Inspect all valves (especially safety valve) and connections to make sure they are not clogged with sand or other foreign matter. In a sand storm cover all connections with clean cloth.

(3) Inspect all exposed brake linings and shoes. Remove and clean if necessary.

g. Battery.

(1) Keep engine hood closed and battery inspection lid down as much as possible to afford maximum protection to batteries. Wipe or blow sand and dust from top of battery which, dampened, might cause a short-circuit. Make sure filler caps are tight and vent holes open to ensure proper functioning of battery.

(2) Exercise extreme care when filling battery under dusty conditions to make sure foreign matter does not get into battery cells.

h. Engine.

(1) Keep engine hood closed at all times to provide maximum protection to engine from dust and sand.

(2) Use air hose to remove sand which might work into distributor, carburetor, bearings and bushings in generator, cranking motor, and other engine accessories.

(3) Keep spark plugs and all wiring free from dust and sand which might cause short-circuit in engine electrical and generating systems.

(4) Make sure that valve cover plates, timing gear housing, and flywheel housing are tight to prevent penetration of sand and dust.

12. SUBMERSION.

a. General. When vehicle has been driven through deep water contaminated with dirt and abrasives, or completely submerged in water, certain precautions must be taken to avoid serious damage to such units as the engine, clutch, transmission, transfer case, axles, universal joints, steering gear, battery, fuel tank, brakes, and wheel bearings. If it is known that water, dirt, or abrasives have contaminated the various units of the vehicle, notify the proper authority at once. Each unit which has been submerged must be completely dismantled, cleaned, and lubricated.

b. Emergency Procedure. Whenever the vehicle has been subjected to damage from submersion in water, remove, disassemble, clean, and lubricate affected units to prevent all possible damage. When emergency conditions will not permit this, proceed as follows:
CAUTION: *To make sure that further damage will not result to affected units, notify the proper authorities immediately after emergency measures have been taken so that complete dismantling and cleansing of units can be performed.*

Section VI

TURNTABLE CONTROLS AND INSTRUMENTS

13. CONTROLS.

a. Swing Hand Lever. The swing hand lever (fig. 12) is the extreme left-hand lever in front of the operator. Its purpose is to engage and disengage either of the two swing clutches, and thus swing the turntable assembly to the right or left. Pulling the lever back engages the left-hand swing clutch, and swings the turntable assembly to the left. Pushing the lever forward engages the right-hand swing clutch, and swings the turntable assembly to the right. Both clutches are disengaged when the lever is in the vertical or center position.

b. Main Hoist Hand Lever. The main hoist hand lever (fig. 12) is the fourth lever, from left to right, in front of the operator. Its purpose is to engage and disengage the main hoist clutch, and thus raise the load of either the six-part hoist line or the clamshell closing line. Pushing the lever forward engages the clutch to the main hoist drum and causes the load to be raised. The clutch is disengaged when the lever is in the vertical position.

c. Secondary Hoist Hand Lever. The secondary hoist hand lever (fig. 12) is the second lever, from left to right, in front of the operator. Its purpose is to engage and disengage the secondary hoist clutch, and thereby raise the load of either the one-part hoist line (whip line) or the clamshell holding line. Placing the lever in the forward position engages the clutch to the secondary hoist drum, and causes the load to be raised. Placing the lever in the vertical position disengages the clutch.

d. Boom Hoist Hand Lever. The boom hoist hand lever (fig. 12) is the extreme right-hand lever in front of the operator. It is used to engage and disengage either the boom hoist clutch or the boom hoist brake. Pushing the lever forward engages the clutch to the boom hoist drum and causes the boom to raise. Pulling the lever backward decreases the tension of a powerful spring which holds the brake in constant engagement, and thus permits the boom to be lowered. The extent to which the lever is pulled back and the tension lessened governs the speed of lowering. Releasing the lever in the back position returns it automatically to the vertical or center position, in which the clutch is disengaged and the brake is set. The lever is held in the center position by a thumb-controlled ratchet and pawl.

e. Engine Clutch Hand Lever. The engine clutch hand lever (fig. 12) is the center lever in front of the operator. Used to engage and disengage the engine clutch, it is held in position by a thumb-controlled ratchet and pawl. The engine clutch is disengaged when this lever is

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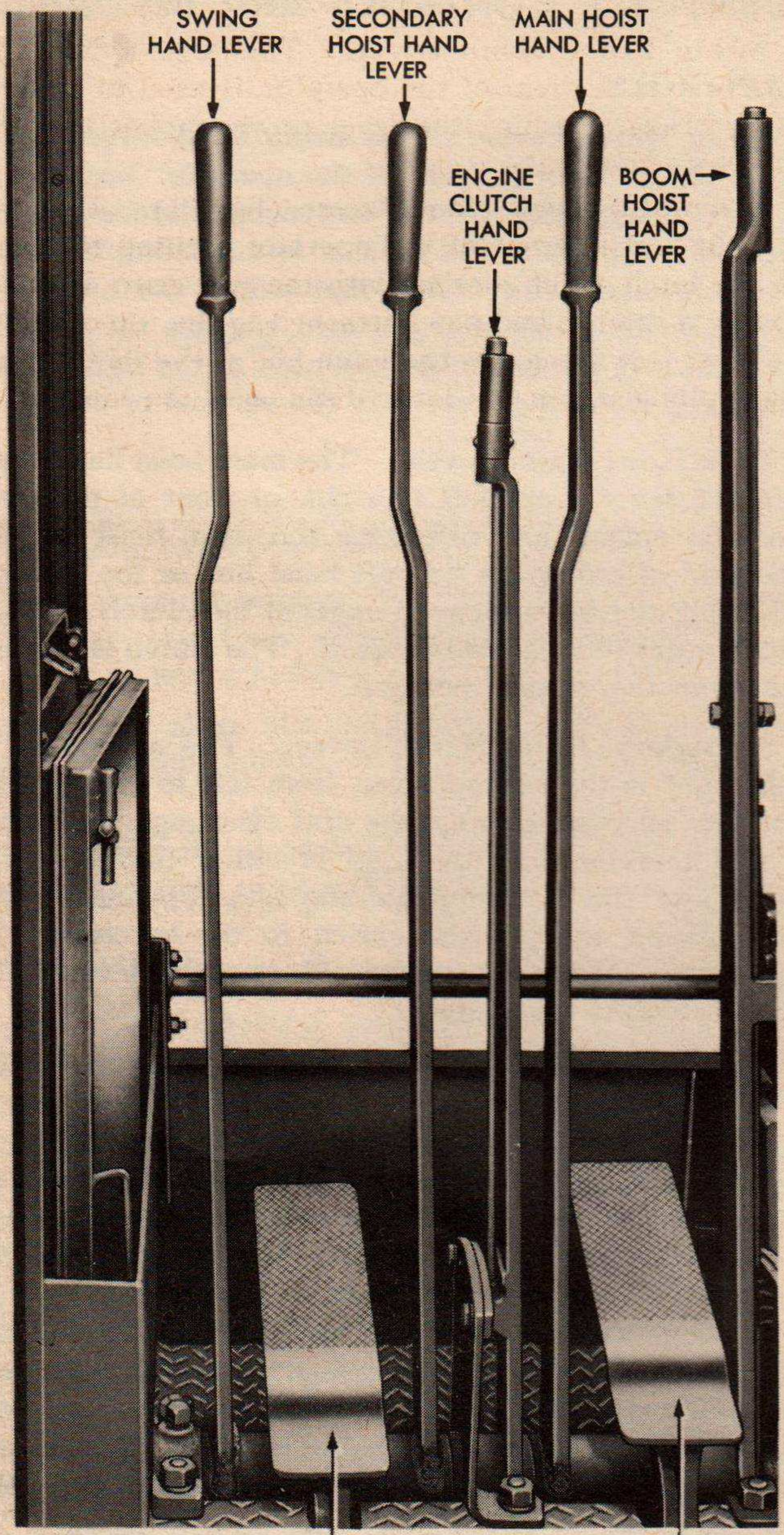
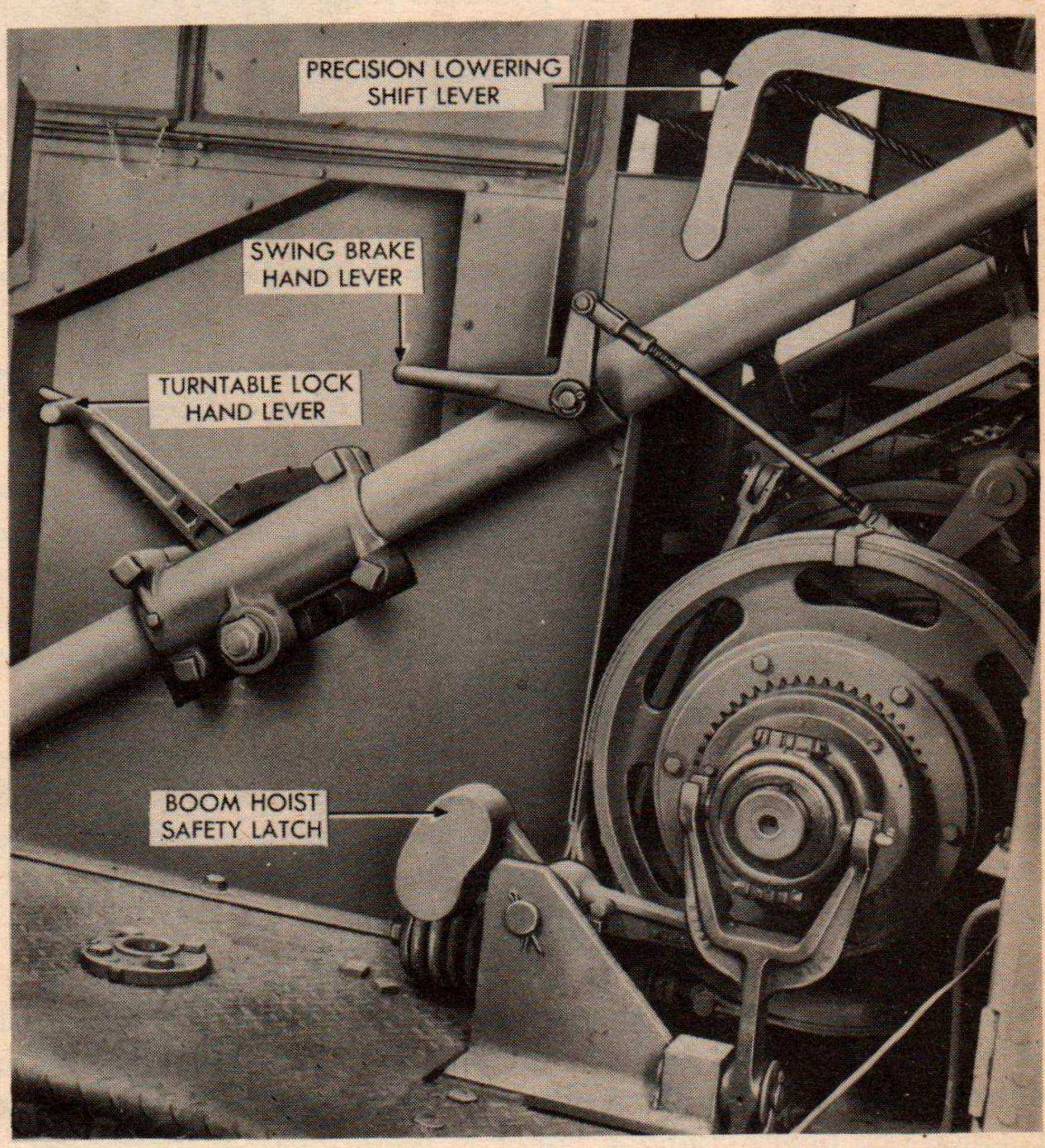


Figure 12—Turntable Control Levers and Brake Pedals

in the vertical position. Pulling the lever backward engages the engine clutch.

f. Swing Brake Hand Lever. This lever (fig. 13), located at the right and to the rear of the operator, is used to apply and release the swing brake. Pushing the lever down applies the brake; pulling it up releases the brake.

g. Turntable Lock Hand Lever (fig. 13). This lever, located at the right and in front of the operator, is used to engage and disengage the latch which meshes with the ring gear. It is held in either position by a ratchet and pawl attached to the top of the lever. Pushing the lever down engages the latch and prevents the turntable from moving; pulling up on the lever disengages the latch.



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Figure 13—Turntable Control Levers and Boom Hoist Safety Latch

h. Main Hoist Brake Pedal (fig. 12). This is the left-hand pedal in front of the operator. It is used to apply and release the main hoist brake. Pushing the pedal down applies the brake and holds the clamshell closing line load or six-part hoist line load stationary; releasing the pedal releases the brake. The pedal is held in applied position by a latch. Pushing down on the brake pedal heel engages the latch; pushing down on the brake pedal toe releases it.

i. Secondary Hoist Brake Pedal. This is the right-hand pedal (fig. 12) in front of the operator. It is used to apply and release the secondary hoist brake. Operation is the same as main hoist brake pedal (subpar. **h** above).

j. Precision Lowering Shift Lever. This hook-shaped lever (fig. 13), which is located at the right rear of the operator, is used to engage and disengage the precision lowering device. Pulling the lever out engages the precision lowering device to the hoist shaft, and prevents the boom from lowering faster than the engine permits the hoist shaft to turn. Pushing the lever in disengages the precision lowering device from the hoist shaft. CAUTION: *Never disengage the precision lowering device with boom raised, without first engaging safety ratchet. Also, make sure machinery is turning slowly, so that if pawls are locked to ratchet they can be disengaged without damaging them.*

k. Boom Hoist Safety Latch (fig. 13). This latch is mounted on the boom hoist brake dead end pin. It consists of a counterweight controlled pawl, which engages a ratchet on the boom hoist pinion and brake wheel. Pulling the counterweight forward engages the pawl to the ratchet and prevents the boom from lowering. Pushing the counterweight backward disengages the pawl and ratchet and permits the boom to be lowered under control of the boom hoist brake and the precision lowering device, or both. Keep safety latch engaged at all times except when lowering boom.

l. Ignition Switch (fig. 14). This single-pole, knife-type switch is mounted on the rear of the instrument panel and is accessible from the operator's station. Pushing the lever up to a vertical position closes the switch and makes a complete ignition circuit. Pulling the lever down opens the circuit and stops engine operation.

m. Cranking Motor Switch Button. (fig. 14). This spring-loaded button is located at the top of the instrument panel. Pushing in the button closes battery circuit and causes cranking motor to operate. Releasing button permits spring to return button to original position and opens cranking motor to battery circuit.

n. Choke Rod (fig. 14). This rod is mounted on the instrument

TURNTABLE CONTROLS AND INSTRUMENTS

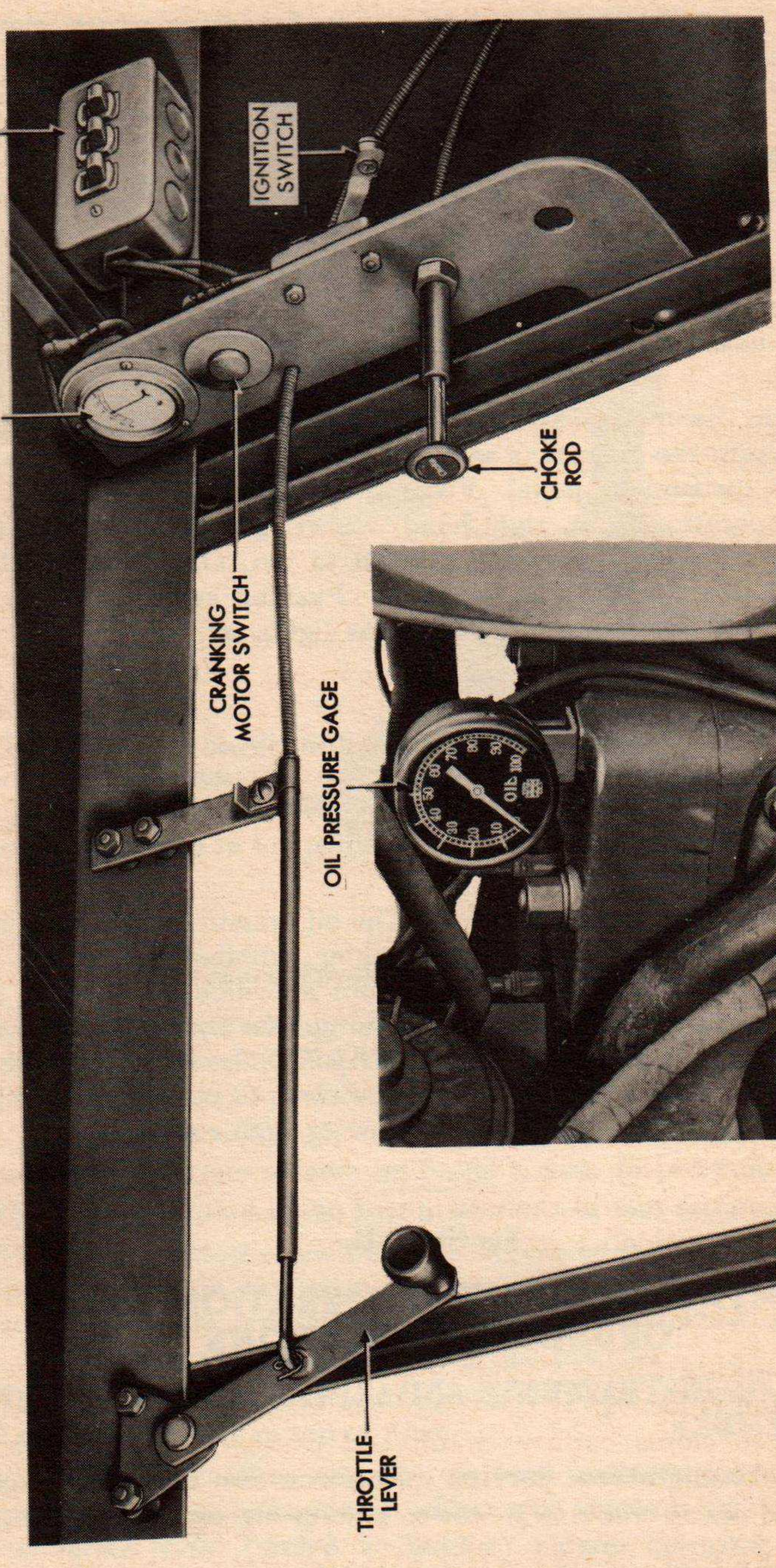


Figure 14—Turntable Instrument Panel and Controls

panel and controls the richness of the fuel mixture which may be injected into engine to aid starting and operation. Pulling rod out increases the gasoline to air ratio, providing a rich fuel mixture; pushing it back cuts the gasoline to air ratio and provides a leaner mixture for ordinary engine operation.

o. Throttle Lever (fig. 14). This lever is mounted on the cab at the upper right-hand side of the operator. It controls the volume of the gasoline mixture which governs engine speed. Pushing the lever ahead opens the throttle and increases engine speed. Pulling the lever back closes the throttle and returns the engine to normal idling speed.

p. Light Switches (fig. 14). Three toggle-type light switches, accessible from the operator's seat, are mounted at the top of the cab behind the instrument panel. From front to rear they control the left-hand operating light, right-hand operating light, and cab light, respectively. Pulling the switches down to the "ON" position closes circuit to battery and turns lights on. Pushing switches up to the "OFF" position breaks circuit and turns lights off.

14. INSTRUMENTS.

a. Ammeter Gage (fig. 14). The ammeter gage, located at the top of the instrument panel, indicates the amount of current being supplied to or drawn from the battery. When engine is idling, the gage may properly show a discharge reading, but at ordinary operating speeds the gage must show a charge.

b. Oil Pressure Gage (fig. 14). The oil pressure gage is mounted at the front right-hand corner of the engine cylinder head at the rear of the operator. It indicates the pressure at which oil is being supplied to the engine. At ordinary engine speeds the pressure should range between 15 and 40 pounds. WARNING: *Whenever the oil pressure is less than 15 pounds or greater than 40 pounds, stop engine immediately and determine cause of low or high reading.*

Section VII

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

15. USE OF INSTRUMENTS AND CONTROLS IN TURNTABLE ASSEMBLY.

a. Before-operation Service. Perform the services in paragraph 29 b (1) through (6), before attempting to start the engine. Start and warm-up engine (subpar. c below), and complete the Before-operation Service.

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

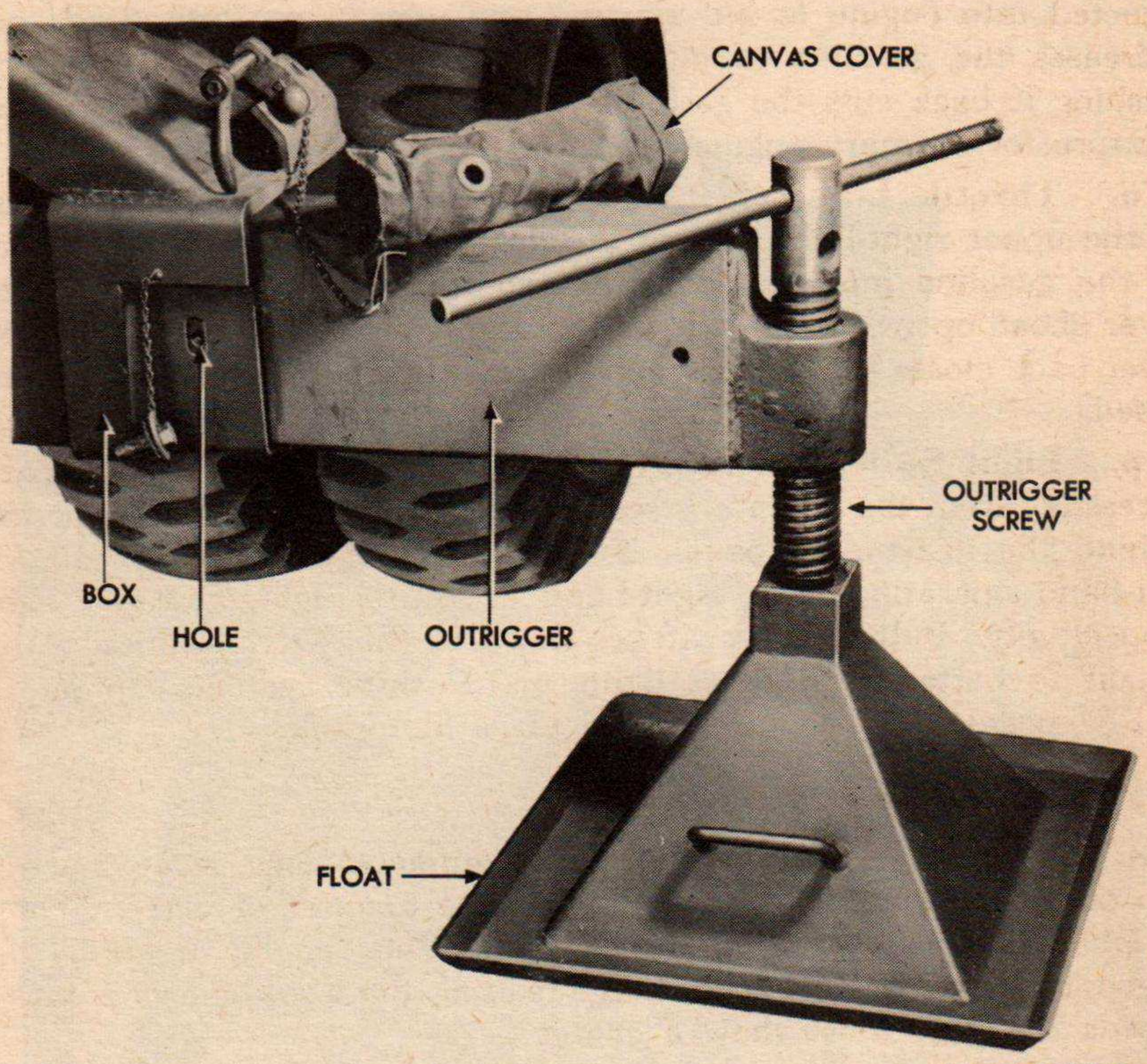


Figure 15—Outrigger Extended

b. Positioning Outriggers for Turntable Operation (figs. 15 and 16). Before attempting to operate turntable assembly, position outriggers and floats to provide necessary side support.

(1) Screw off wing nut, and remove screw keeper bolt which supports the outrigger screw and holds canvas in position.

(2) Swing screw keeper bolt bracket back and remove cover.

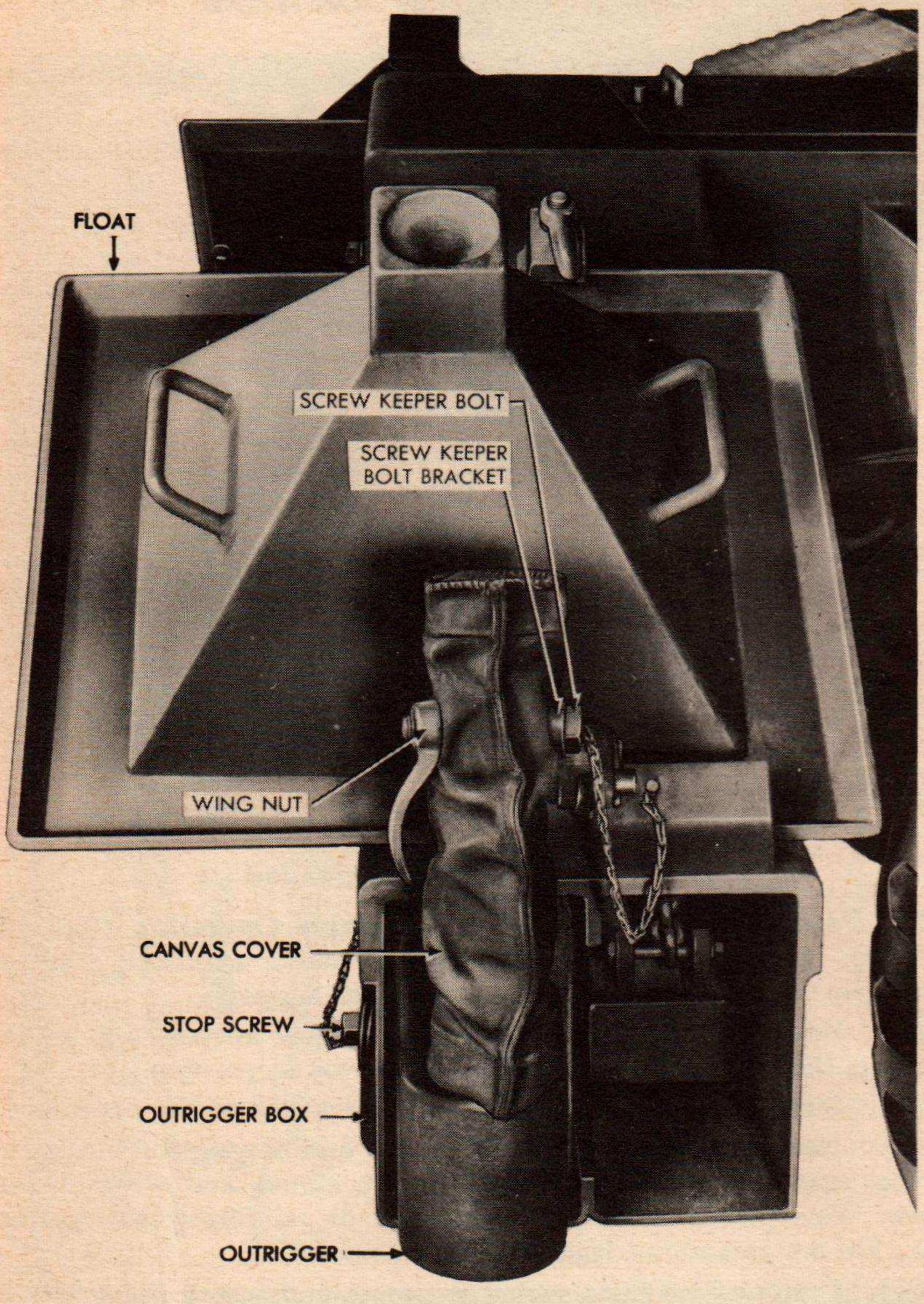
(3) Remove stop screw from outrigger and box, extend outrigger so that rear hole in outrigger and box are alined, and screw in set screw. This places stress from outrigger at reinforced position of box. Do not extend outrigger beyond this position.

(4) Position float under outrigger screw, and turn screw by hand until it seats properly in top of float.

(5) Swing turntable assembly so that counterweight is on side away from outrigger being set. This will remove the weight and permit screw to be turned easily.

(6) Turn outrigger screw down until vehicle is level and weight

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



RA PD 321128

Figure 16—Outrigger Retracted

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

is partially removed from tires. Use blocks or planks under floats if necessary. This will remove spring effect of tires and tend to stabilize vehicle.

(7) Swing counterweight around and repeat procedure for outriggers on opposite side of vehicle.

(8) Reverse the preceding steps to retract outriggers and prepare vehicle for travel.

c. Starting the Engine.

(1) Place the engine clutch hand lever in the disengaged position.

(2) Pull choke rod all the way out and push throttle forward about halfway of total opening.

(3) Close ignition switch and depress cranking motor switch button.

(4) Release cranking motor switch button as soon as engine fires, and push choke rod in about half way.

(5) When engine is running smoothly, push choke rod all the way in and pull throttle back to idling position.

(6) If the engine fails to start at first, wait 15 or 20 seconds, and then repeat starting procedure. Should the engine become overchoked, push choke rod in, release excess gas by opening throttle fully, and depress cranking motor switch button.

(7) When the engine starts, examine oil pressure gage and ammeter. If either fails to register properly, stop engine, and investigate cause.

d. Operating Clamshell.

(1) GENERAL. In clamshell, operation the load is carried in a bucket which consists of two half scoops, hinged together so that they will close when picking up material. The digging force consists only of the weight of the bucket plus the closing action, and therefore limits clamshell operation to the type of materials which are relatively soft. During operation, a tagline, attached to the bucket at one end and reeved to a counterweight at the other end, prevents the bucket from turning enough to twist cables.

(2) OPERATING PRECAUTIONS.

(a) Before operating clamshell, make sure that clutch spring for setting holding line clutch is attached to secondary hoist hand lever (fig. 90). When this spring is properly adjusted (par. 104 b (3)), it will pull hand lever forward enough to partially engage clutch, and thus remove slack from holding line when bucket is raised with closing line. NOTE: *Holding line brake must be fully released.*

(b) If it is necessary to operate vehicle on sloping ground, make sure that boom angle is not extreme enough to cause tipping when

load is raised or swung. Set brakes to prevent vehicle sliding forward or backward during operation.

(c) Inspect cables to make sure they are securely attached to bucket and properly wound on hoist drums.

(d) Check operating clutches and brakes for proper working adjustment, and see that machinery is free from obstruction.

(3) LOWERING BUCKET.

(a) With bucket above position where load is to be picked up and both hoist hand levers in the neutral position, release closing line brake (right-hand foot pedal) to permit weight of counterweight to open bucket. Keep enough tension on brake pedal to prevent excessive slackening off of cable.

(b) With bucket open, carefully release holding line brake (and closing line brake) to permit bucket to lower in open position. Keep just enough pressure on brake pedals to avoid unnecessary unwinding of cables.

(c) When bucket is solidly and squarely on ground, push main hoist lever forward and at the time release both brakes. This will cause bucket to first close and then raise from ground. NOTE: *Digging depth of bucket may be controlled by varying the tension of the holding line brake while bucket is closing.*

(4) HOISTING BUCKET.

(a) Keep main hoist hand lever in the forward or engaged position until bucket is hoisted to desired height.

(b) To stop hoisting action, apply main hoist brake and pull hoist hand lever back to neutral position. Brake should take hold just before closing line clutch is released. Wait about 10 seconds until slack is removed from holding line, and then apply secondary hoist brake.

(5) SWINGING.

(a) If load is to be swung past front of vehicle, make sure boom is derricked high enough, or load is hoisted high enough, to clear cab.

(b) Make sure turntable lock is disengaged, and swing brake is released before beginning swinging action. NOTE: *Keep turntable lock disengaged at all times except when traveling or locking up vehicle. Use swing brake only to prevent swinging when load is being hoisted or lowered.*

(c) With load and boom at proper height, engage swing hand lever. Pull backward to swing left; push forward to swing right. Engage swing clutch gradually so that swinging action will start slowly, especially when vehicle is setting on uneven ground. Swinging speed may be increased when load, boom angle, and position of

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

vehicle are such that there is no danger of tipping.

(d) When bucket reaches dumping point, move hand lever in opposite direction slightly past the neutral position. This will engage the opposite swing clutch, and stop the swing motion. Return hand lever to neutral position as soon as swinging stops. CAUTION: *Do not use swing brake to stop swinging except in an emergency. Continued use of brake for this purpose will wear brake out quickly, and necessitate frequent replacement of brake bands.*

(6) DUMPING.

(a) When bucket is in dumping position, release closing line brake (right-hand foot pedal) and hold holding line brake (left-

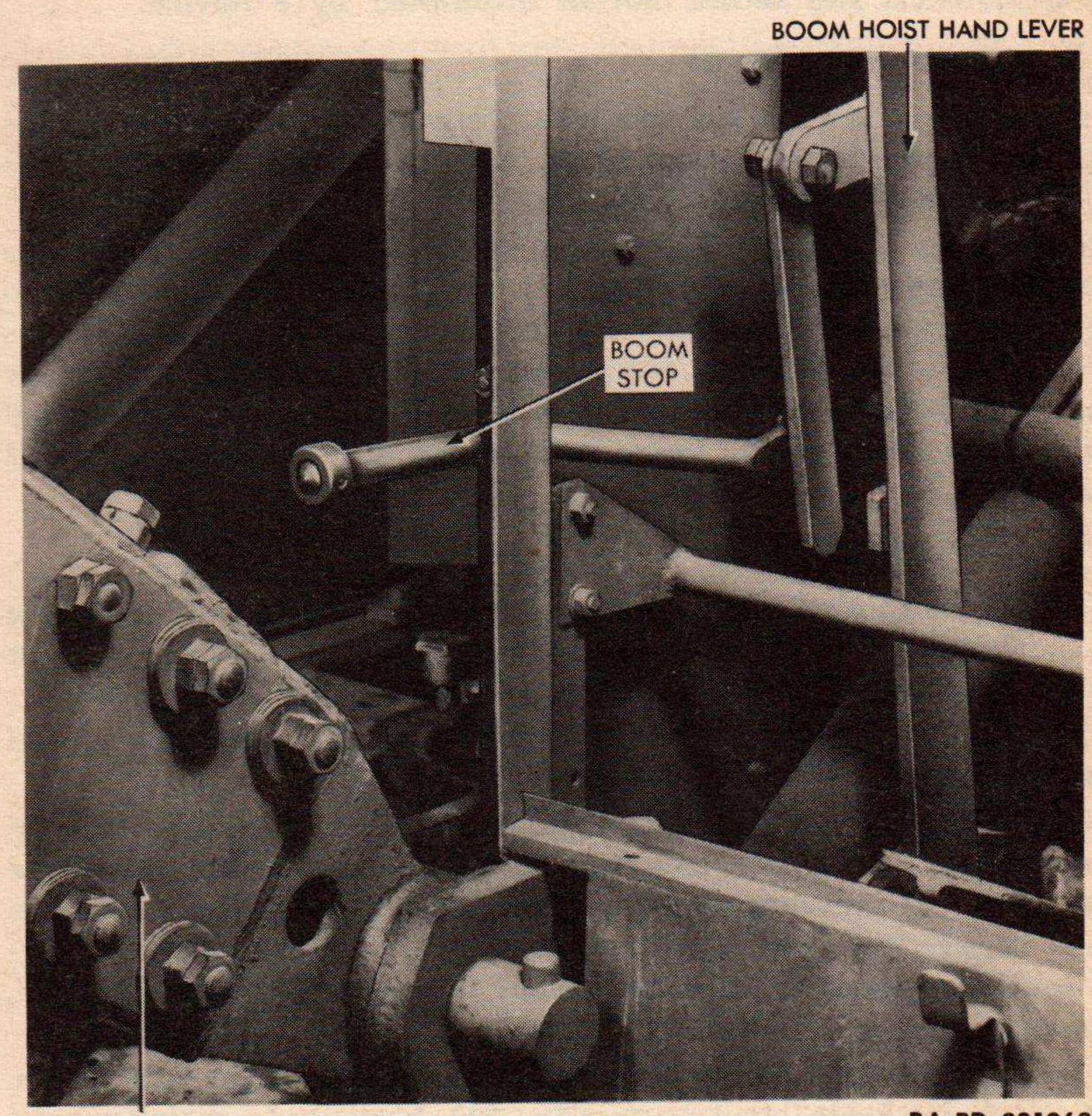


Figure 17—Boom Stop

hand foot pedal). This will permit weight of counterweight to open bucket and dump load. As soon as load is dumped, apply closing line brake (right-hand foot pedal) immediately. This is necessary to prevent closing line from unwinding and becoming fouled.

(b) Use the swinging motion (step (5) above) to return the bucket to position for lowering. Repeat procedures for continued operation.

(7) OPERATING CYCLE. As the operator becomes more experienced, he will soon learn to combine the operating steps into a smooth, even cycle. For example, when conditions permit, as the bucket is being hoisted, the swing motion may be started. Before swinging is completed, the dumping operation may be begun. Likewise, when swinging to the digging position the clamshell bucket may be lowered and opened. Operation of this sort will, of course, require practice and experience, and should not be attempted by a novice.

(8) DERRICKING BOOM.

(a) Push boom hoist hand lever forward until boom is raised to desired height; then return hand lever to neutral position. This will automatically set boom hoist brake and hold boom in position.

(b) When boom has been raised to necessary height, set safety latch to the engaged position (fig. 13). NOTE: *A special boom stop (fig. 17) is provided to prevent boom from being raised too high. As boom approaches the maximum safe derricking height, a boss on boom engages stop and forces hand lever backward to the neutral position, thus disengaging boom hoist clutch and setting boom hoist brake.*

(9) LOWERING BOOM.

(a) Before lowering boom make sure that load and boom angle will not cause vehicle to tip (see table, step (11) below). If in doubt, make test as described in subparagraph e (2) *(b)* below.

(b) Swing boom hoist safety latch backward to the disengaged position (fig. 13).

(c) Pull precision lowering hand lever out to engage precision lowering device. This device connects the boom hoist drum with the hoist shaft, and prevents the boom from lowering any faster than the engine permits the hoist shaft to turn. NOTE: *Keep precision lowering device engaged at all times except when backing down a load, subparagraph* e (6) *below.*

(d) With engine clutch lever (fig. 12) in the engaged position, pull the boom hoist hand lever (fig. 12) backward carefully until the precision pawls have contacted ratchet. This will release tension from the spring which holds the boom hoist brake in constant engagement, and will permit the boom to be lowered at engine speed.

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

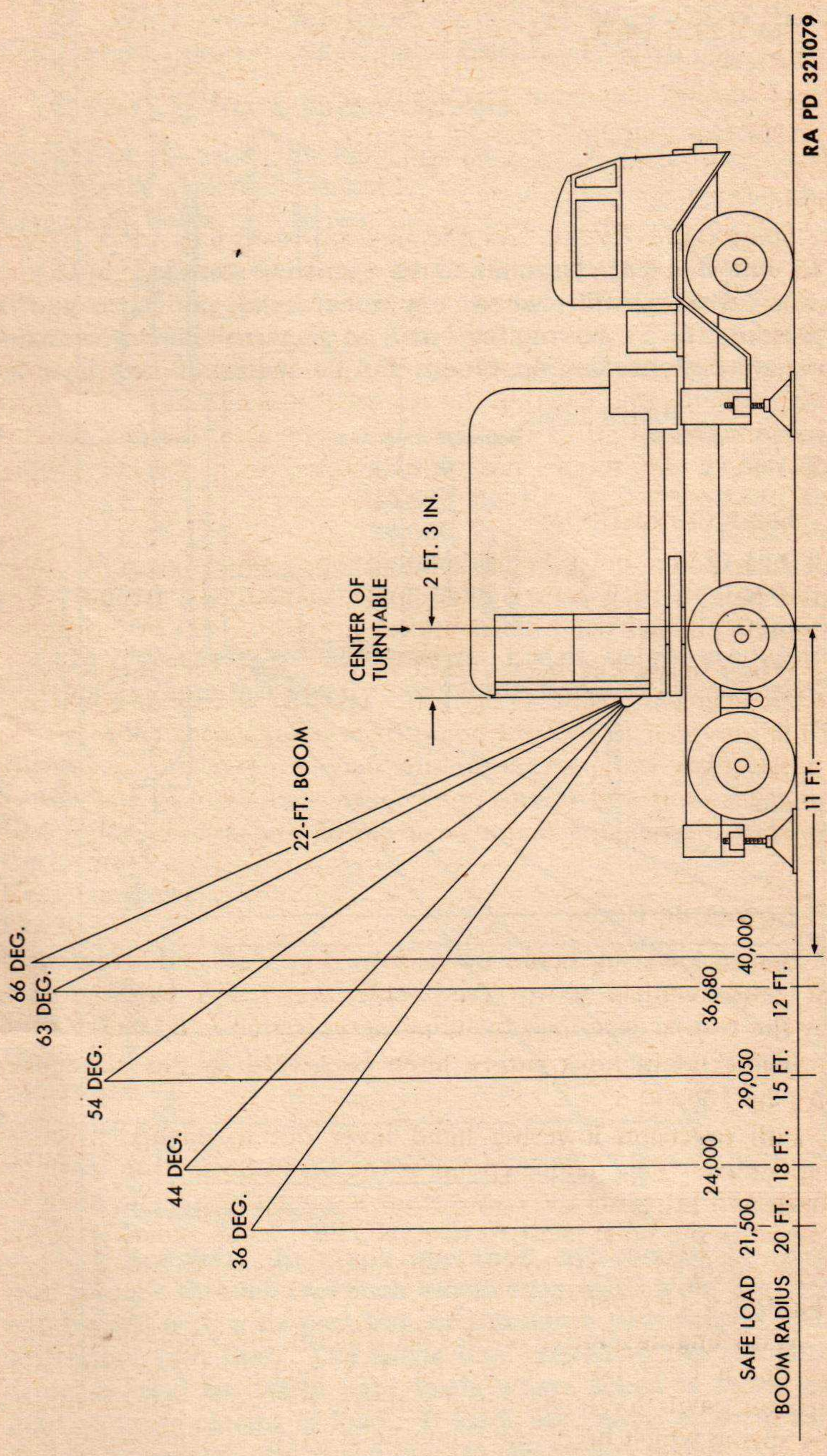


Figure 18—Safe Load Capacities—Outriggers Extended

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

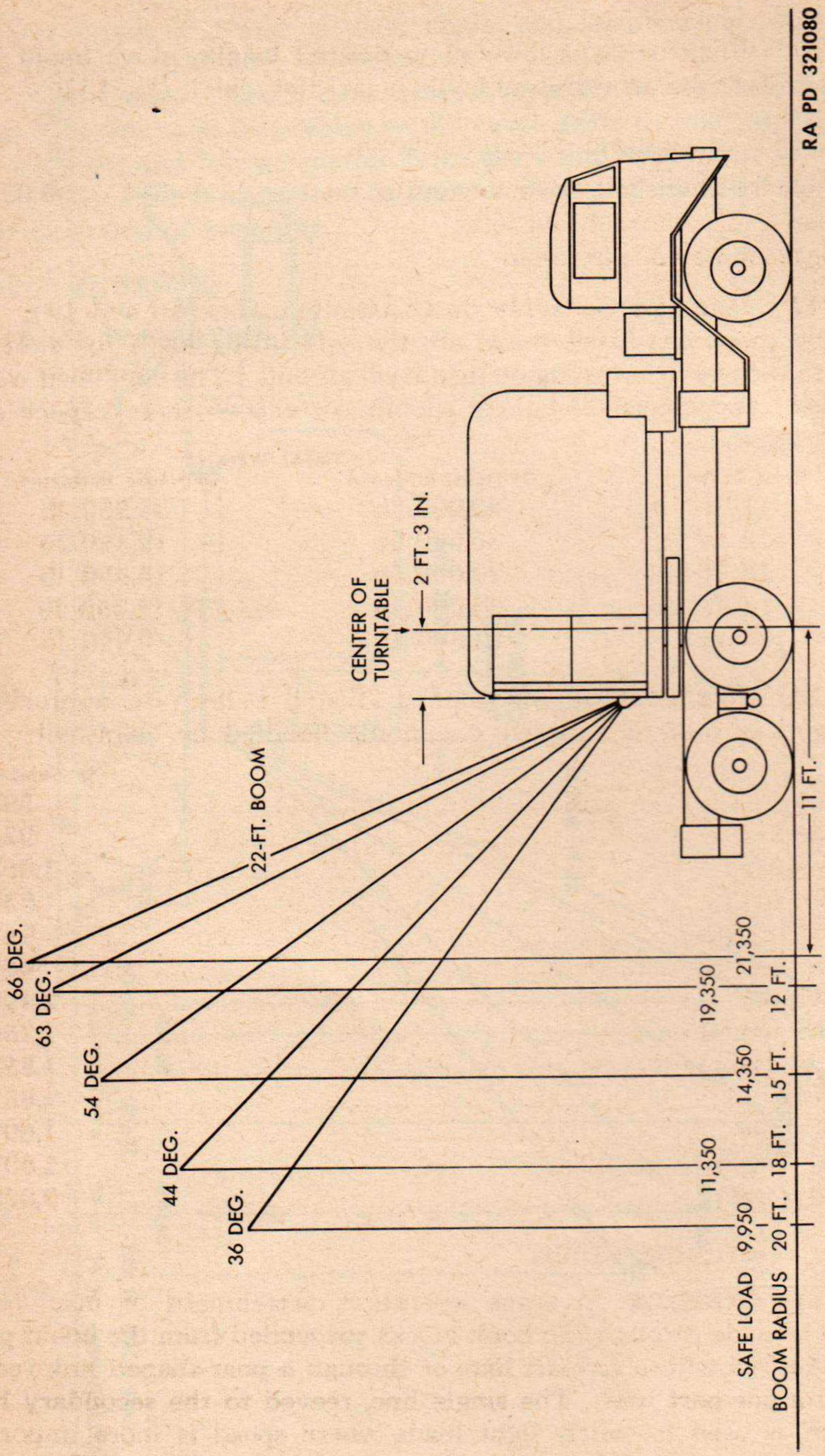


Figure 19—Safe Load Capacities—Outriggers Retracted

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

(e) When boom is lowered to desired height, move boom hoist hand lever to neutral and set boom hoist safety latch (fig. 13).

(10) CLAMSHELL SPECIFICATIONS.

Weight of clamshell bucket (approx.)	3,090 lb
Capacity of clamshell bucket	⅝ yd
Length of boom, pin-to-pin	22 ft

(11) LIFTING CAPACITY OF CLAMSHELL (figs. 18 and 19). The lifting capacities listed below are the safe lifting loads for a 22-foot boom with vehicle resting on firm level ground. The combined weight of load and clamshell bucket should not exceed these capacities.

Boom Radius	TOTAL WEIGHT Outrigger Extended	Outrigger Retracted
11 ft	40,000 lb	21,850 lb
12 ft	36,680 lb	19,350 lb
15 ft	29,050 lb	14,350 lb
18 ft	24,000 lb	11,350 lb
20 ft	21,500 lb	9,950 lb

(12) WEIGHTS OF MATERIALS. Listed below are approximate weights of materials mostly commonly handled by clamshell:

	⅝ Cubic Yard
Ashes	591 lb
Cinders	928 lb
Clay (dry)	1,063 lb
Clay (wet)	1,839 lb
Coal (broken)	945 lb
Coke	456 lb
Concrete	2,498 lb
Earth (dry)	1,266 lb
Earth (wet)	1,857 lb
Gravel	1,857 lb
Limestone	1,607 lb
Sand (dry)	1,607 lb
Sand (wet)	2,025 lb

e. Operating Crane.

(1) GENERAL. In crane operation, attachment of machine to load is made through two hook blocks suspended from the boom point and reeved with a six-part line, or through a pear-shaped link reeved with a one-part line. The single line, reeved to the secondary hoist drum, is used for fairly light loads where speed is more important than accurate placing of load. If loads are heavy, or accurate placing of load is desired, attach the load to the swivel hook.

(2) OPERATING PRECAUTIONS.

(a) Before operating crane, set service brakes and extend outriggers (subpar. b above) to give vehicle greatest possible stability.

(b) Check load capacities for boom radii (subpar. d (11) above) to make sure load will not tip machine. If in doubt, test lifting capacity as follows: Lift load not more than 1 foot from ground with boom extended from side of vehicle. Apply hoist brake and hold load in this position. Disengage boom hoist safety lock and with precision lowering device engaged, lower the boom until the vehicle begins to tip. Then raise boom slightly and swing turntable carefully. Keep foot on hoist brake pedal so that load may be dropped immediately to prevent tipping. Make this test on the low side when vehicle is off level ground. After test is completed, raise boom 2 feet to give added stability as a safety precaution. The greatest boom radius at which a load may be swung without tipping vehicle determines the maximum radius to which a boom may be lowered for safe operation.

(c) Inspect cables to make sure they are free from extreme wear, kinks, or breaks; that they are securely attached; and that they are wound evenly on cable drums.

(d) Observe gears, drums, and levers to see that they are free from obstruction and check adjustment of all operating clutches and brakes.

(e) Keep the unused hoist line out of the way as much as possible. Engage hoist clutch to pull link or hook block up to boom point. Set hoist brake to hold in this position. NOTE: *When lowering boom release unused cable to prevent cable from pulling into boom point sheaves.*

(3) HOISTING.

(a) With load attached, release hoist brake and engage hoist clutch at same time to raise load.

(b) When load is at desired height, apply hoist brake and at the same time disengage hoist clutch. Time these steps so that hoist brake takes hold a moment before hoist clutch is disengaged. This will prevent load from slipping. If necessary, depress rear part of brake pedal to lock brake in set position.

(4) SWINGING.

(a) With necessary precautions taken to prevent tipping (step (2) *(b)* above), engaging swing clutch as necessary to turn vehicle in desired direction.

(b) When load reaches desired point, engage opposite swing clutch lightly until swinging motion is stopped. Then immediately disengage clutch.

TURNTABLE ASSEMBLY OPERATION UNDER ORDINARY CONDITIONS

(c) When accuracy is required in spotting load, engage the swing brake to hold turntable assembly in position.

(5) BOOM DERRICKING.

(a) If load requires spotting on a different level, it may be necessary to derrick or lower boom.

(b) To derrick boom, follow instructions in subparagraph d (8) above.

(c) To lower boom, follow instructions in subparagraph d (9) above.

(6) BACKING DOWN LOAD.

(a) Make sure boom hoist latch is engaged before attempting to back down load.

(b) With load at desired height, hoist brake set, and hoist clutch in the neutral position, disengage precision lowering device. CAUTION: *Failure to disengage precision lowering device before backing down load may break precision chain, or raise boom and bring load in toward vehicle.*

(c) Disengage engine clutch, engage hoist clutch, and carefully release hoist brake. The machinery, which will be turning in reverse, will be relieved of a large part of the load. With the load thus lightened, the backing down speed of the load can be controlled with extreme precision by the hoist brake. NOTE: *In an emergency, additional braking power can be provided by engaging secondary hoist clutch and applying secondary hoist brake.*

(7) LIFTING CAPACITY OF CRANE. The lifting capacities listed below are the safe lifting loads for a 22-foot boom with vehicle resting on firm, level ground. The combined weight of hook blocks, slings, and load should not exceed these capacities:

	TOTAL WEIGHT	
Boom Radius	Outriggers Extended	Outriggers Retracted
11 ft	40,000 lb	21,850 lb
12 ft	36,680 lb	19,350 lb
15 ft	29,050 lb	14,350 lb
18 ft	24,000 lb	11,350 lb
20 ft	21,500 lb	9,950 lb

f. Stopping the Engine.

(1) Make sure that boom hoist lock is engaged, turntable lock is engaged, and load is removed from hoist cables.

(2) Throttle engine to idling speed and permit it to run at this speed for several minutes.

(3) Disengage engine clutch and open ignition switch.

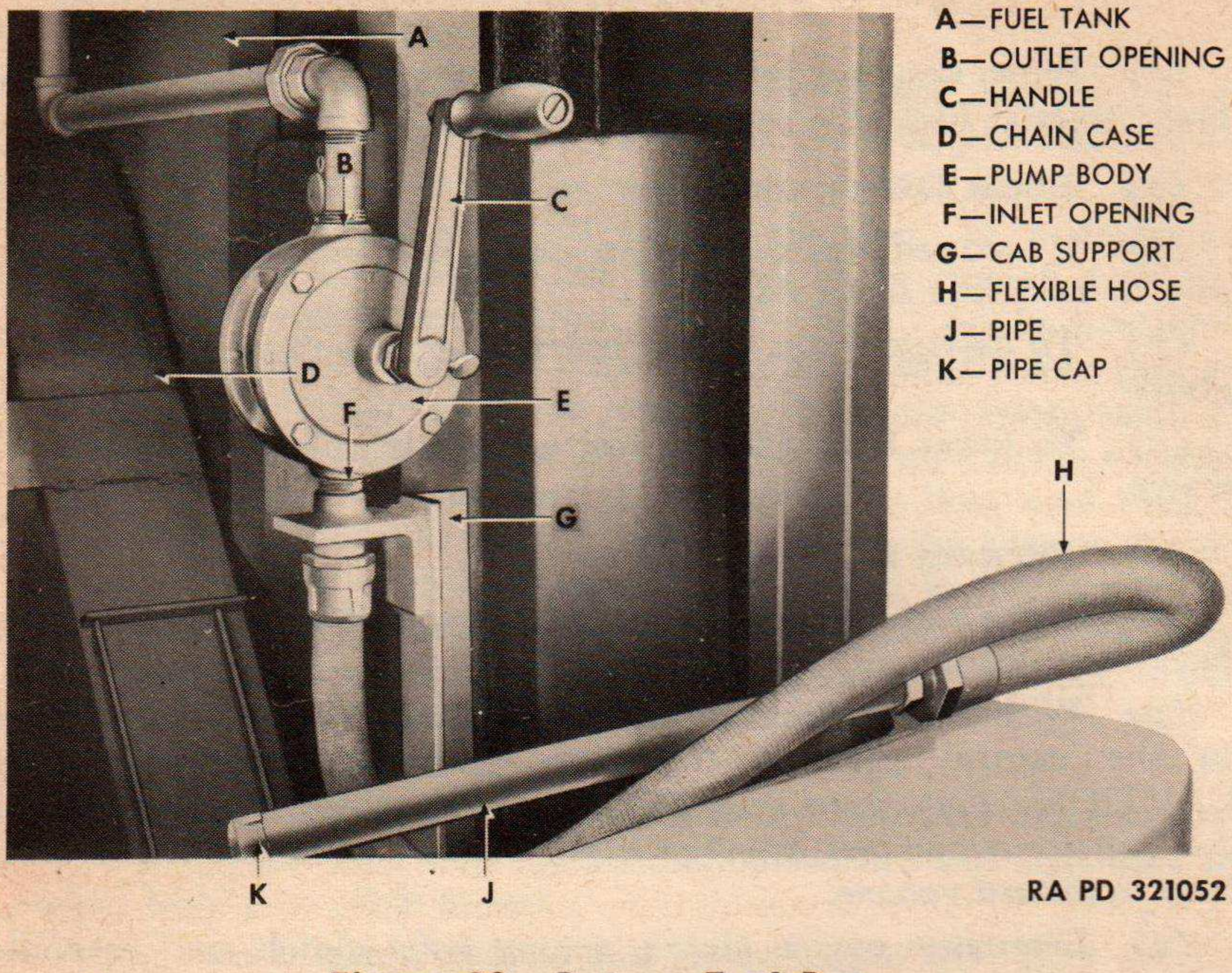


Figure 20—Rotary Fuel Pump

(4) Make sure that all lights are turned off so that battery will not be run down when assembly is inoperative.

g. Operating Rotary Fuel Pump.

(1) DESCRIPTION. The rotary fuel pump, mounted on cab support at rear of chain case, is a rotary-vane, hand-operated type pump. The pump outlet opening is piped to a flange welded to the turntable fuel tank by a pipe nipple. A 48¾-inch pipe is attached by a long flexible hose to the pump inlet opening. This permits fuel to be pumped from fuel drum on ground, from vehicle fuel tank when turntable assembly is swung around, or from other points at a reasonable distance.

(2) OPERATION (fig. 20). Make sure pipe and hose connections are tight. Unscrew cap from end of pipe. Place pipe in container from which fuel is to be pumped so that end is below surface. Turn pump handle slowly to right until fuel is sucked into pump body. When desired amount of fuel has been pumped into fuel tank, stop pumping, and permit fuel below pump to drain back into container. Remove pipe and screw on cap. Lay pipe and hose on counterweight or other suitable place.

Section VIII

TURNTABLE OPERATION UNDER UNUSUAL CONDITIONS

16. EXTREME COLD.

a. Cooling System. Refer to paragraph 10 c.

b. Engine. Refer to paragraph 10.

c. Battery. Make sure that battery is fully charged, with hydrometer reading between 1.275 and 1.300. A well-charged battery will withstand low temperatures and lessen danger of damage from freezing. CAUTION: *When water is added to battery during sub-zero temperatures, charge battery, or run engine to make sure water becomes thoroughly mixed with battery solution. Failure to do this will allow water to freeze and damage battery.*

17. DUSTY CONDITIONS.

a. Inspection and Lubrication. Fine sand or dust has a tendency to penetrate into bushings and bearings. Because of this, the assembly must be inspected, lubricated, and cleaned at more frequent intervals. Remove accumulations of sand and dirt, and clean all lubricators thoroughly before attaching grease gun. Do not grease operating clutches more than necessary. Excessive grease may spread to clutch lining surfaces where sand would adhere and cause damage to drums.

b. Fuel System. Keep fuel tank filter caps tight to prevent sand or dust from entering fuel tank and fuel containers. Service fuel pump bowl frequently to keep it free from sand and grit.

c. Turntable Roller Path. Operation under extreme sandy or dusty conditions will require frequent inspections of turntable roller path and ring gear to keep them free from sand. CAUTION: *Never apply nor allow lubricant to collect on roller path, as this will collect dirt and sand, and cause rollers and path to wear excessively.*

d. Clutches and Brakes. Inspect clutch and brake bands frequently, and blow out or wipe off accumulations of sand and dirt. Failure to keep bands clean will result in worn bands, scored drums, and unsatisfactory operation.

e. Cables. Keep all unused cables in equipment box provided for this purpose. Keep doors over hoist drums and swing drums closed. Clean and lubricate operating cables frequently to prevent excessive cable wear and ensure satisfactory operation.

f. Silent Drive Chain. In extremely dusty or sandy conditions, frequently remove cover and drain plug from silent drive chain case, and wash chain and case thoroughly with dry-cleaning solvent. Install

plug, pour 1 pint of engine oil over chain, and install cover. Keep chain oiler filled with SAE 10 engine oil.

g. Open Gears. Check open gears frequently to see that they are free from sand and dirt, which would cause gears to wear rapidly. Wash lubricant and foreign matter from gears and apply new lubricant. NOTE: *This is important, to prevent wear and maintain satisfactory operation of assembly.*

18. SUBMERSION.

a. Refer to paragraph 12.

PART THREE

LUBRICATION AND SCHEDULED MAINTENANCE

Section IX

LUBRICATION

19. LUBRICATION.

a. Reproduction of War Department Lubrication Orders No. 135 and No. 135A (figs. 21, 22, 23, and 24) prescribe first and second echelon lubrication maintenance above 0°F for the Truck-mounted Crane M2. Figure 25 prescribes lubrication maintenance for the Clamshell Trailer M16. For lubrication below 0°F, refer to paragraph 20.

b. A Lubrication Order is placed on or is issued with each item of materiel and is to be carried with it at all times. In the event the materiel is received without such a copy, the using arm shall immediately requisition a replacement from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Mich.

c. Instructions on the Lubrication Order are binding on all echelons of maintenance, and there shall be no deviation from these instructions.

d. Service intervals specified on the Lubrication Orders are for normal operating conditions during active service above 0°F. Reduce these intervals under extreme conditions such as excessively high or low temperatures, prolonged periods of high speed, continued operation in sand or dust, immersion in water, or exposure to moisture, any one of which may quickly destroy the protective qualities of the lubricant and require servicing in order to prevent malfunctioning or damage to the materiel.

e. Lubricants are prescribed in the "Key" in accordance with three temperature ranges, "above +32°F," "+32°F to 0°F," and "below 0°F." The time to change grades of lubricants is determined by maintaining a close check on operation of the materiel during the approach to change-over periods. Sluggish starting is an indication that lubricants are thickening, and is the signal to change to grades prescribed for the next lower temperature range. Ordinarily it will be necessary to change grades of lubricants only when air temperatures are consistently in the next higher or lower range.

f. Refer to paragraphs 10 and 16 for lubrication instructions under extreme cold and operation below 0°F.

(This material covered by Lubrication Orders No. 135 and No. 135A.) **No. 135**

WAR DEPARTMENT LUBRICATION ORDER

ORDNANCE DEPARTMENT

CRANE, TRUCK MOUNTED, M2

SNL G-172

For detailed instructions, refer to TM9-771

Clean fittings before lubricating. Lubricate after washing.

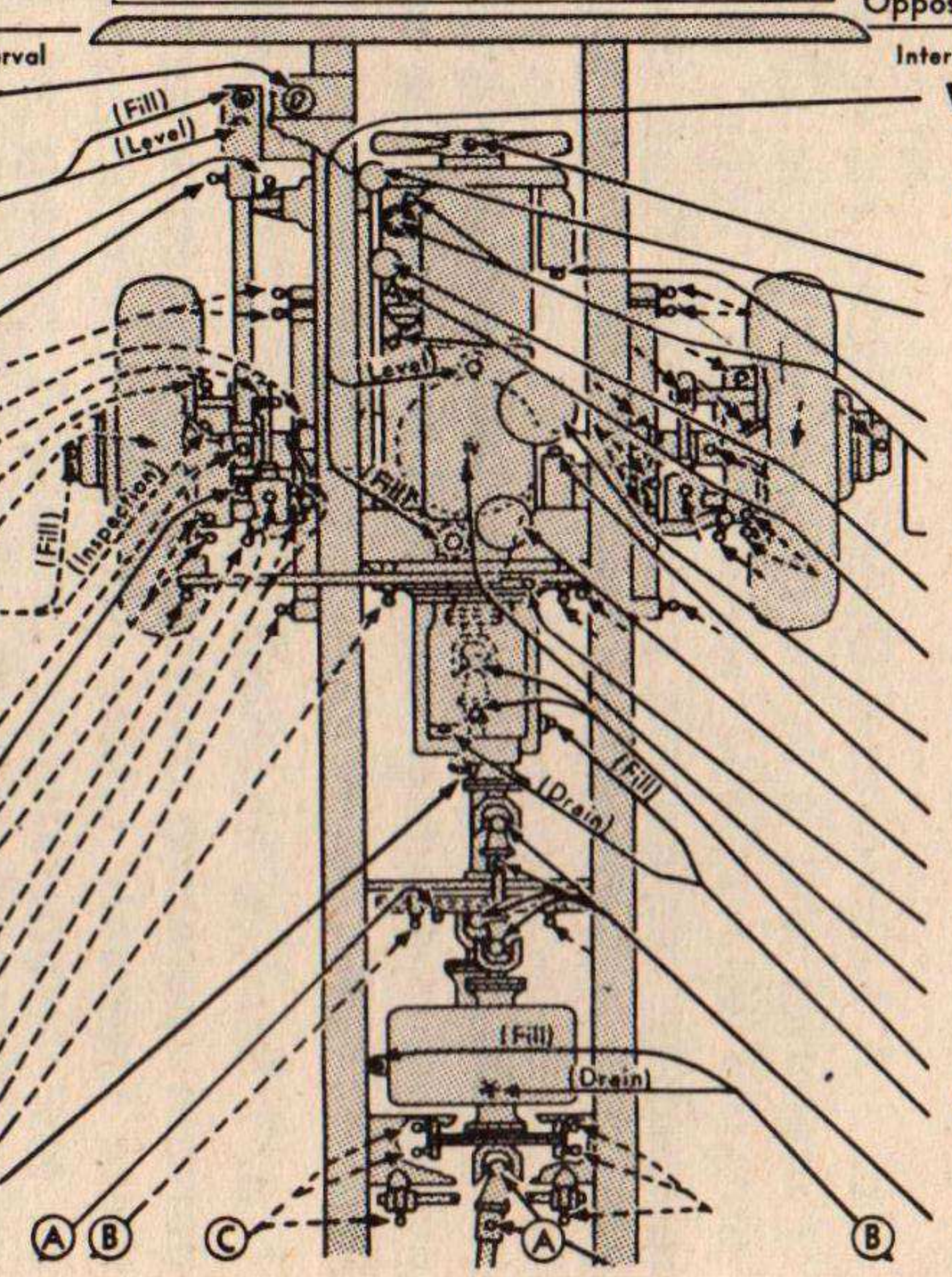
Clean parts with SOLVENT, dry-cleaning or OIL, fuel, Diesel. Dry before lubricating.

Requisition replacement Lubrication Order from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Michigan

Reduce intervals under severe operating conditions.

Lubricate dotted arrow points on both sides. Opposite points are shown by short arrows.

		Lubricant	Interval
F, Fig. 25	Foot Pedal Valve (oiler) 6 to 8 drops (Serviced from inside cab)	OE	1
C, Fig. 26	Steering Gear Fill and Level (See Gear Case Note)	GO	1
A, Fig. 25	Clutch Pedal Shaft	CG	1
C, Fig. 35	Drag Link	CG	1
C & D, Fig. 29	Spring Shackle	CG	1
A, Fig. 30	Shock Absorber	SA	6
C, Fig. 34	Slack Adjuster	CG	6
C, Fig. 34	Brake Cam Shaft Sparingly	CG	1
B, Fig. 29	Front Wheel Bearings Remove, clean and repack	WB	6
D, Fig. 34	Universal Joint and Steering Knuckle Lower Bearing (See Universal Joint Note)	CG	1
F, Fig. 34	Steering Knuckle Upper Brg.	CG	1
D, Fig. 35	Drag Link	CG	1
A, Fig. 36	Brake Anchor Pins (Fitting)	CG	1
D, Fig. 25	Emergency Brake Cross Shaft	CG	1
A, Fig. 34	Tie Rod	CG	1
B, Fig. 34	Brake Cylinder Drain moisture daily	CG	1
E & F, Fig. 35	Shock Absorber Links	CG	1
A, Fig. 35	Spring Bolt	CG	1
E, Fig. 25	Clutch Throw-out Shaft	CG	1
	Speedometer Cable Remove core, coat lightly with No. 0	CG	6

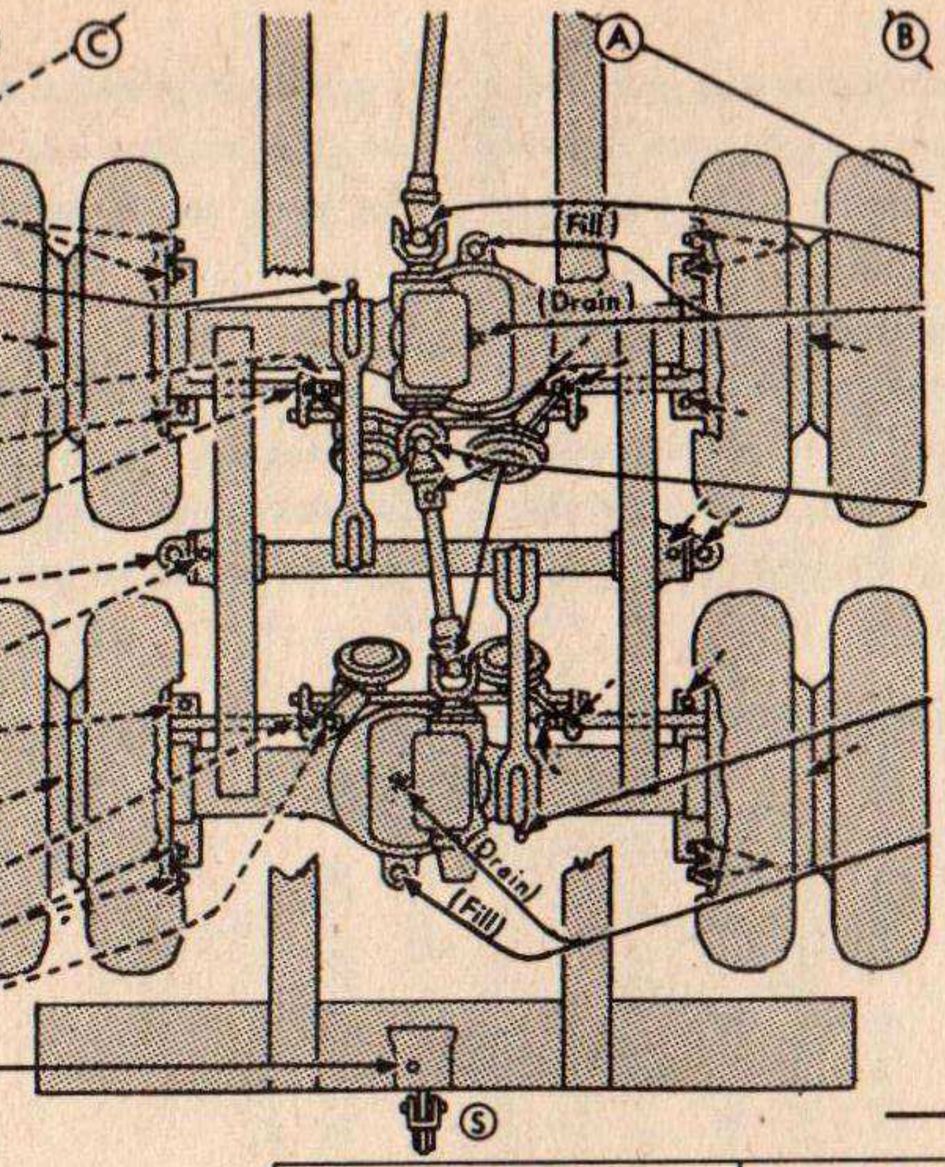


Interval	Lubricant		
W	GO	Front Axle Differential Fill and Level Check level (See Gear Case Note)	C, Fig. 30
		Serviced From Under Hood	
6	CG	Fan (plug)	B, Fig. 31
1	OE	Crankcase Check level Drain, refill every 1000 miles. Cap. 16 qt. (See Note)	B, Fig. 37
1	OE	Generator 6 to 8 drops	F, Fig. 31
1	WB	Distributor Shaft Turn cup down 1 full turn, refill as required	A, Fig. 31
6		Distributor (See Note)	
D	OE	Air Compressor Air Cleaner Check level (See Air Cleaner Note)	B, Fig. 32
1	WP	Water Pump Refill cups, turn 1 full turn	E, Fig. 31
D	OE	Air Cleaner (See Note) Check level	A, Fig. 32
1	OE	Starter 6 to 8 drops	D, Fig. 31
1		*Oil Filter* Drain Sediment (See Note)	
1	CG	Clutch Release Bearing (fitting) Sparingly	C, Fig. 25
6		*Front Axle Differential Drain* Drain and refill. Cap. 10 qt.	
1	CG	Universal and Slip Joint	A, Fig. 26
W	GO	Transmission Check level Drain, refill every 6000 miles. Cap. 11 qt. (See Gear Case Note)	F, Fig. 30
1	CG	Universal and Slip Joints	

RA PD 322155

Figure 21—Lubrication

	Declutch Cross Shaft	CG 1	Ⓐ Ⓑ Ⓒ
B, Fig. 25	Transfer Case Cross Shaft	CG 1	
B & D, Fig. 26	Disc Brake	CG 1	
	Brake Anchor Pins (plug)	CG 1	
	Upper Torque Rod	CG 1	
	Rear Wheel Bearings Remove, clean and repack	WB 6	
F, Fig. 29	Brake Cam Shaft Outer Brg.	CG 1	
A, Fig. 29	Brake Cam Shaft Inner Brg. Sparingly	CG 1	
	Slack Adjuster	CG 6	
	Rear Axle Beam Center Tube	GO 1	
	Rear Axle Beam	CG 1	
	Brake Cam Shaft Inner Brg. Sparingly	CG 1	
	Rear Wheel Bearings Remove, clean and repack	WB 6	
	Slack Adjuster	CG 6	
	Brake Anchor Pins (plug)	CG 1	
	Brake Cam Shaft Outer Brg.	CG 1	
F, Fig. 26	Pintle Hook (plug)	CG M	



Ⓑ W	GO	Transfer Case Check level . . . . . D, Fig. 30 Drain, refill every 6000 miles. Cap. 4 qt. (See Gear Case Note)
1	CG	Universal and Slip Joint
1	CG	Universal Joint . . . . . E, Fig. 26
W	GO	Rear Axle Differential Check level Drain, refill every 6000 miles. Cap. 10 qt. (See Gear Case Note)
1	CG	Universal and Slip Joints
1	CG	Upper Torque Rod . . . . . E, Fig. 29
W	GO	Rear Axle Differential . . . . . B, Fig. 30 Check level Drain, refill every 6000 miles. Cap. 10 qt. (See Gear Case Note)

For CRANE and CLAMSHELL BUCKET lubrication see Lubrication Order No. 135A.

NOTES

(SEE REVERSE SIDE)

KEY

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
	above + 32°F.	+ 32°F. to 0°F.	below 0°F.
OE—OIL, engine			
Crankcase	SAE 30	SAE 10	See OFSB 6-11
Other Points	SAE 30	SAE 10	**PS**
GO—LUBRICANT, gear, universal	SAE 90	SAE 80	Grade 75
CG—GREASE, general purpose	No. 1	No. 0	No. 0
WB—GREASE, general purpose, No. 2—All temperatures			
WP—GREASE, water pump—All temperatures			
HB—FLUID, hydraulic brake—All temperatures			
SA—FLUID, shock-absorber, heavy-All temperatures			
OH—OIL, hydraulic—From 0°F. to —40°F.			
PS—OIL, lubricating, preservative, special			

INTERVALS
D—Daily
W—Weekly
M—Monthly
1—1,000 miles
6—6,000 miles

COLD WEATHER: For Lubrication and Service below 0°F., refer to TM 9-771 and OFSB 6-11.

8 Apr. 44
Supersedes all previous issues.

No. 135 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Ordnance.]

RA PD 322155B

(This material covered by Lubrication Orders No. 135 and No. 135A.) No. 135

WAR DEPARTMENT LUBRICATION ORDER

ORDNANCE DEPARTMENT

CRANE, TRUCK MOUNTED, M2

SNL G-172

For detailed instructions, refer to TM9-771

NOTES

COLD WEATHER: For Lubrication and Service below 0°F., refer to TM 9-771 and OFSB 6-11.

AIR CLEANERS—Use used crankcase oil or OE above 0°F., OH between 0°F. and —40°F. Below —40°F. remove oil and operate dry. Every 1,000 miles, remove air cleaners and wash all parts. CAUTION: Keep all connections clean and tight.

CRANKCASE—Drain only when engine is hot. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level. CAUTION: Be sure pressure gage indicates oil is circulating.

UNIVERSAL JOINTS (Front Wheels)—With vehicle on level ground, remove inspection plug in rear of joint and remove hub plate on front axle shaft; fill through fitting in wheel hub with CG until lubricant comes out inspection plug hole. CAUTION: Replace plug.

DISTRIBUTOR — Every 6,000 miles, wipe distributor breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 or 2 drops of OE.

RA PD 322156

Figure 22—Lubrication

OIL FILTER — Every 6,000 miles, before crankcase is drained, remove filter element, clean case and renew element.

GEAR CASES—Weekly, check level with truck on level ground and, if necessary, add lubricant to within 1/2 in. of plug level when cold or to plug level when hot. Drain and refill as indicated at points on Lubrication Order. Drain only after operation. Fill steering gear through plug hole until lubricant runs out of vent hole in jacket tube. Axle housing, transfer case and steering gear breathers will be cleaned each time oil is checked and each time truck is operated under extremely dirty or muddy conditions. *(Transfer Case Declutching Unit, Front Axle Double Reduction Gear Case)* Upon reassembly of cases, fill through plug opening with GO.

OIL CAN POINTS—Every 1,000 miles, lubricate throttle and accelerator linkage, transfer case shift linkage, declutch shift linkage, emergency brake cable sheave and linkage, brake pedal pull rod clevis pins, clutch pedal linkage, brake pedal shaft, air compressor rocker arm, outrigger float screws, hinges and locks with OE.

RUBBER BUSHINGS—Every 1,000 miles, apply HB to torque rod bushings. CAUTION: Do not use oil.

POINTS REQUIRING NO LUBRICATION SERVICE — Springs, Air Compressor, Clutch Pilot Bearing.

Copy of this Order will be carried on the materiel at all times. These lubrication instructions are binding on all echelons of maintenance.

By Order of the Secretary of War:
G. C. Marshall, Chief of Staff.

No. 135 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Ordnance.]

8 Apr. 44
Supersedes all previous instructions.

RA PD 322156B

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

RA PD 322157

WAR DEPARTMENT
ORDNANCE

LUBRICATION ORDER
DEPARTMENT

(This material covered on Lubrication Order No. 135 and No. 135A) No. 135A

CRANE, TRUCK MOUNTED, M2

For detailed instructions, refer to TM 9-771

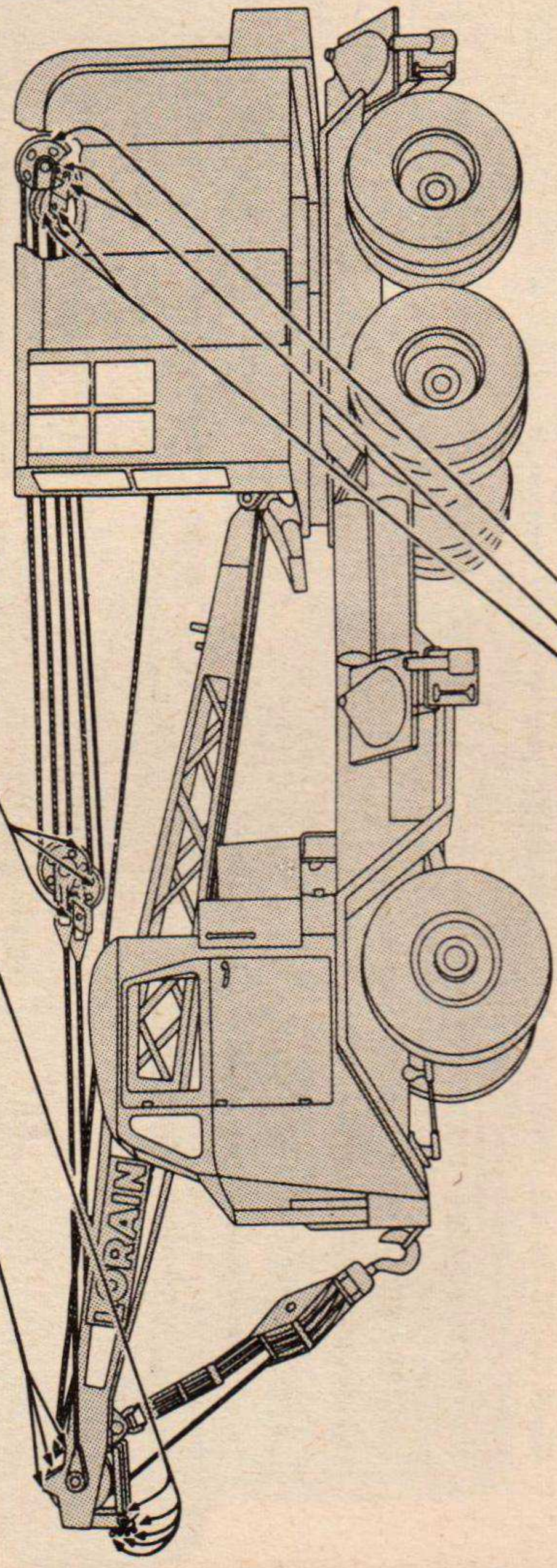
Interval • Lubricant

4 CG Boom Point Sheaves . . . . . B, Fig. 28

4 CG Cable Guide Rollers . . . . . A, Fig. 28

4 CG Boom Harness Sheaves . . . . . C, Fig. 28

NOTE—See Reverse Side for lubrication of points on TURNTABLE



Lubricant • Interval

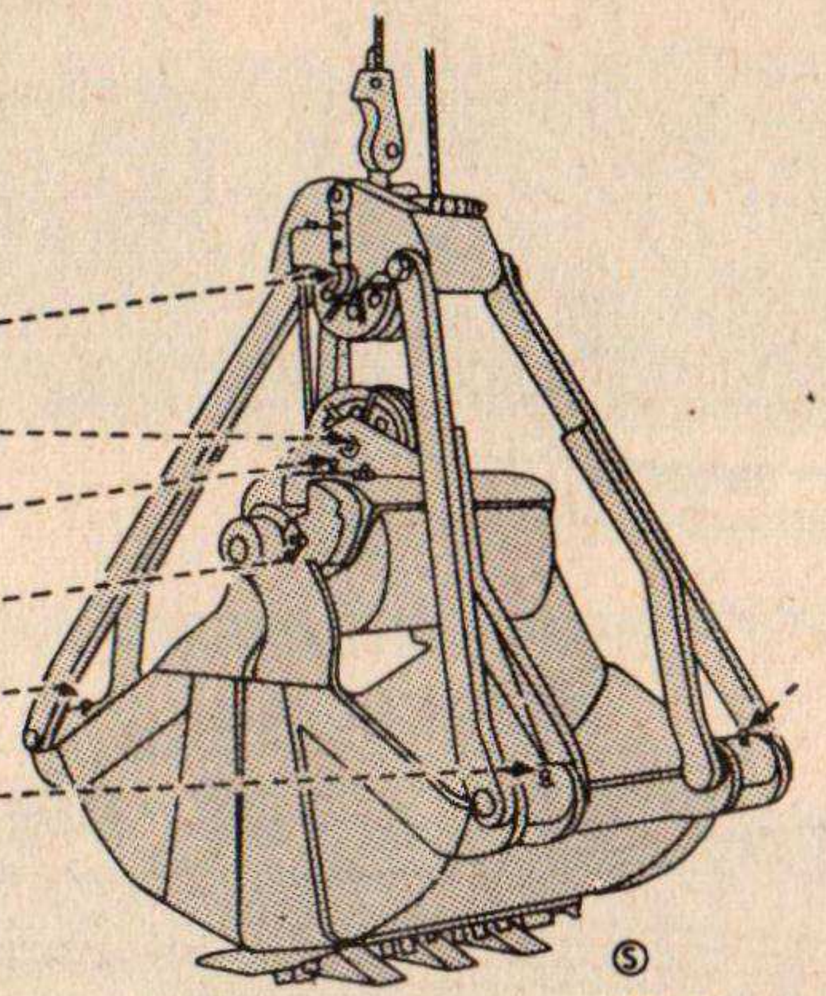
D, Fig. 28. . . . . "A" Frame Harness Sheaves CG 4

D, Fig. 28. . . . . "A" Frame Cross Shaft CG 4

E, Fig. 28. . . . . "A" Frame Pin Sheave CG 4

SNL G-172

Figure 23—Lubrication Order—



Lubricant • Interval

D, Fig. 37 — Top Sheave Block CG 4

E, Fig. 37 — Bottom Sheave Block CG 4
Counterweight Bearing CG 4
Bucket Hinge Bearing CG 4

C, Fig. 37 — Arm Bracket CG 4
Arm Bracket CG 4

KEY

(This Side only)

CLAMSHELL BUCKET

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
	above + 32°F.	+ 32°F. to 0°F.	below 0°F.
OE—OIL, engine	SAE 30	SAE 10	PS
CG—GREASE, general purpose	No. 1	No. 0	No. 0
CW—OIL, lubricating, chain and wire rope, grade 2			**INTERVALS** 4—4 hours
PS—OIL, lubricating, preservative, special.			

COLD WEATHER: For Lubrication and Service below 0°F., refer to TM 9-771 and OFSB 6-11.

NOTES

(Notes continued from Reverse Side)

STARTER REDUCTION GEAR CASE—Every 6 months, remove plug in top of housing and refill with CG. CAUTION: Use low pressure gun and do not overfill.

DISTRIBUTOR—Every 6 months, wipe distributor breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 or 2 drops of OE.

Ⓢ

CABLES—Weekly, clean and lubricate hoist cable with heated CW. Monthly, lubricate all cables with heated CW except those coming in constant contact with dirt, in which case, cables will be cleaned and lightly coated with OE.

OPEN GEARS—Weekly, or more often if necessary, clean and coat with CW.

OIL CAN POINTS—Every 48 hours, lubricate lever connections, control rod clevises, precision boom chain idler, sliding sleeve yoke bearings, throttle control cables and linkage, hinges, latches, etc., with OE.

Copy of this Order will be carried on the materiel at all times. These lubrication instructions are binding on all echelons of maintenance.

By Order of the Secretary of War:
G. C. Marshall, Chief of Staff.

8 Apr 44
Supersedes all previous issues.

No. 135A [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Ordnance.]

(This material covered on Lubrication Orders No. 135 and No. 135A) **No. 135A**

WAR DEPARTMENT LUBRICATION ORDER

ORDNANCE DEPARTMENT

CRANE, TRUCK MOUNTED, M2

SNL G-172

For detailed instructions, refer to TM 9-771

Clean fittings before lubricating. Lubricate after washing.

Clean parts with SOLVENT, dry-cleaning or OIL, fuel, Diesel. Dry before lubricating.

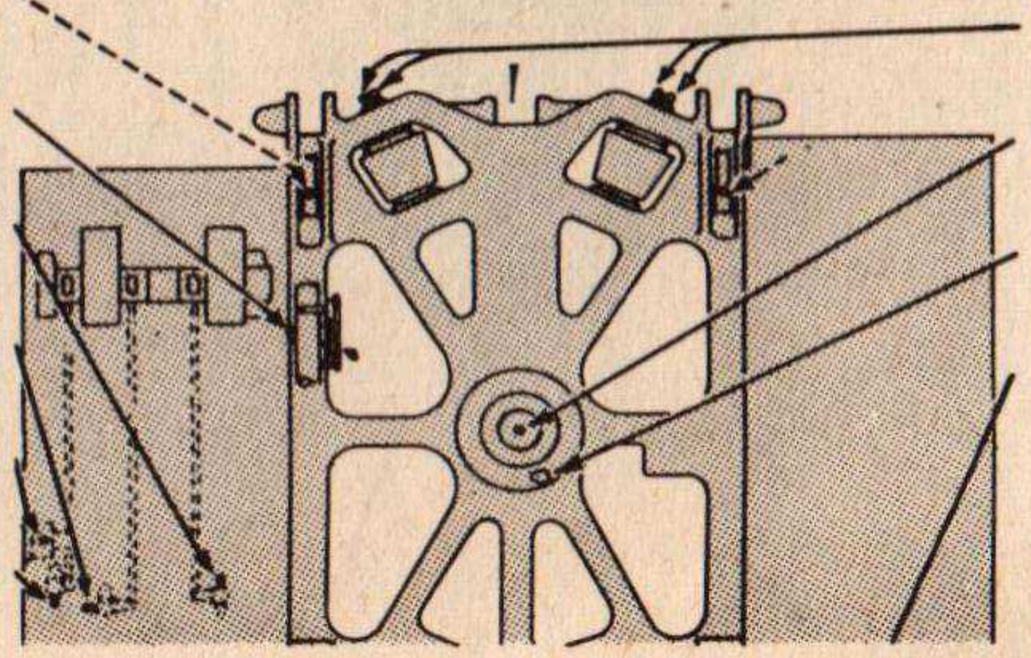
Requisition replacement Lubrication Order from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Michigan.

Reduce intervals under severe operating conditions.

Lubricate dotted arrow points on both sides. Opposite points are shown by short arrows.

NOTE— See Reverse Side for lubrication of BOOM and CLAMSHELL BUCKET

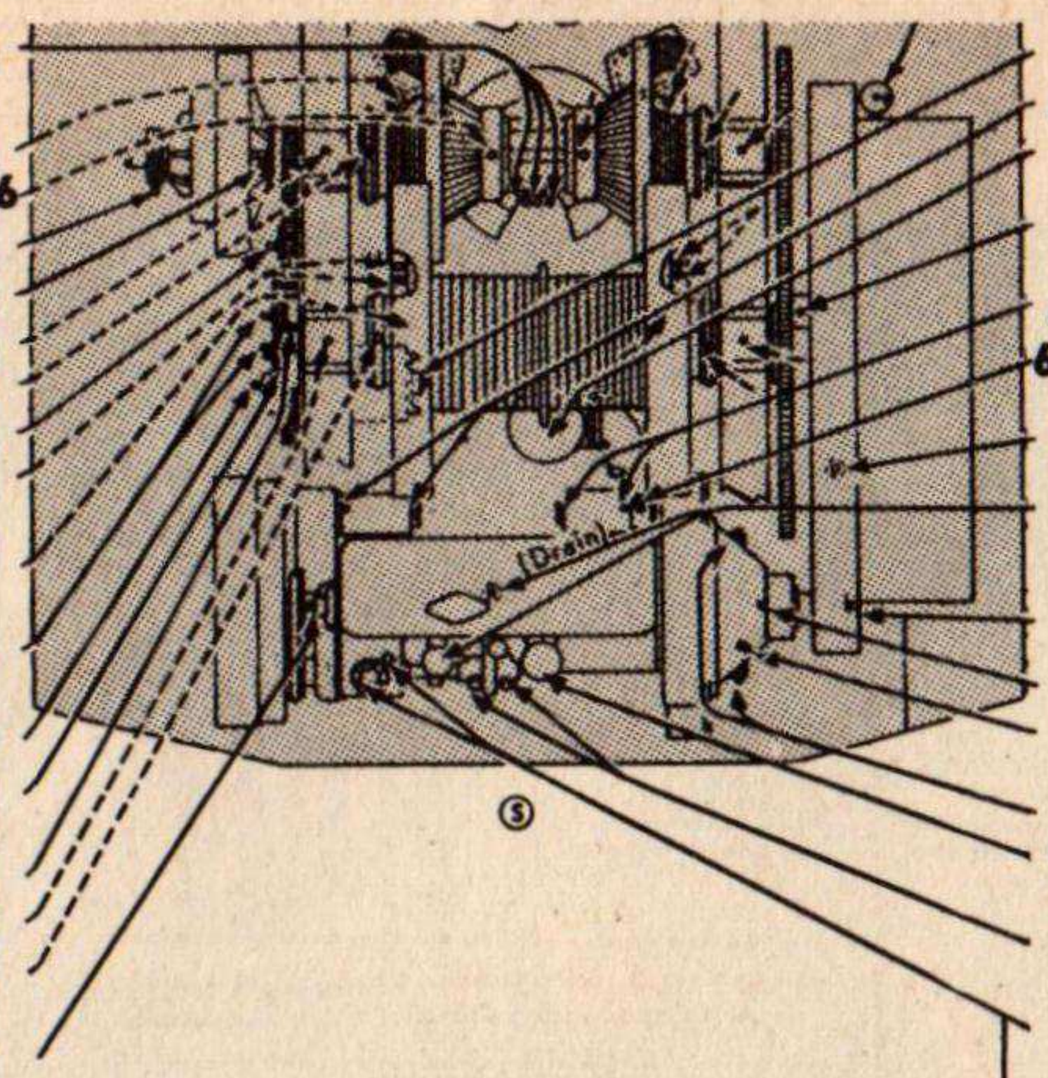
Lubricant • Interval			Interval • Lubricant		
B, Fig. 27	Boom Foot Pin	CG 4	8 CG	Turntable Roller	
	Swing Lock Lever Shaft	OE 8	8 CG	Center Pin	A, Fig. 39
	Hoist Lever Bell Crank	CG 8	8 OE	Center Pin Bushing	A, Fig. 39
	Swing Lever Bell Crank	CG 8	4 OE	Power Take-off Chain (Keep reservoir filled (See Note))	C, Fig. 39
	Hoist Brake Shaft Brg.	CG 8			
	Clam Lever Bell Crank	CG 8			



RA PD 322158

Figure 24—Lubrication

C & F, Fig. 27	Vertical Swing Pinion Shaft Bushings	CG 8
A & D, Fig. 27	Turntable Roller	CG 8
E, Fig. 32	Swing Clutch Drum Brgs.	WB 96
E, Fig. 33	Boom Hoist Sliding Sleeve	CG 8
D, Fig. 39	Boom Hoist Brake Wheel Brg.	CG 4
D, Fig. 33	Swing Shaft Bearing	CG 4
D, Fig. 33	Swing Shaft Sliding Sleeve	CG 8
A, Fig. 33	Boom Hoist Idler Gear	CG 8
	Hoist and Clam Spool Bushing (Turn drum to reach fittings)	CG 4
	Hoist and Clam Clutches (3 oil holes)	OE 8
F, Fig. 33	Precision Boom Hoist Sprockets	CG 8
C, Fig. 33	Boom Hoist Drum Shaft Brg.	CG 4
	Precision Boom Hoist Chain Apply sparingly with oil can	OE 8
F, Fig. 33	Precision Boom Hoist Ratchet	CG 8
F, Fig. 33	Hoist Shaft Bearing	CG 4
B, Fig. 33	Hoist and Clam Drum Sliding Sleeve	CG 4
E, Fig. 38	Fan	CG 8



TURNTABLE

(See Lubrication Order No. 135 for lubrication of TRUCK)

4 CG	Boom Hoist Drum Bearing	D, Fig. 32
48 OE	Generator 6 or 8 drops	
8 OE	Air Cleaner (See Note) Check level	F, Fig. 39
8 WB	Center Drive Shaft Brgs. Add ½ oz. (plug)	F, Fig. 32
48 OE	Starter 6 or 8 drops	
6M CG	Starter Reduction Gear Case (See Note)	
M	*Power Take-off Chain Case Drain* (See Note)	
D OE	Crankcase Check level Drain, refill every 48 hours (See Note) Cap. 11 qt.	E, Fig. 27
8 CG	Clutch Pilot Bearing Sparingly	F, Fig. 38
8 CG	Power Take-off Bearing	A, Fig. 38
8 CG	Clutch Throwout Bearing Sparingly	A, Fig. 38
8 OE	Clutch Cross Shaft	D, Fig. 38
48	*Oil Filter* Drain Every 96 hours renew element	
8 WP	Water Pump Turn cup down 1 full turn, refill as needed	B, Fig. 38
8 WB	Distributor Shaft Turn cup down 1 full turn, refill as needed	C, Fig. 38
6M	Distributor (See Note)	

KEY

(This Side only)

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
OE—OIL, engine	above + 32°F.	+ 32°F. to 0°F.	below 0°F.
Crankcase	SAE 30	SAE 10	See OFSB 6-11
Other Points	SAE 30	SAE 10	**PS**
CG—GREASE, general purpose	No. 1	No. 0	No. 0
WB—GREASE, general purpose, No. 2—All temperatures			
WP—GREASE, water pump—All temperatures			
OH—OIL, hydraulic—From 0°F. to —40°F.			
PS—OIL, lubricating, preservative, special			

INTERVALS
4— 4 hours
8— 8 hours
48—48 hours
96—96 hours
M—Monthly
6M—6 months

COLD WEATHER: For Lubrication and Service below 0°F., refer to TM 9-771 and OFSB 6-11.

NOTES

AIR CLEANERS—Every 8 hours, refill engine air cleaner oil reservoir to bead level with used crankcase oil or OE. Use OH between 0°F. to —40°F. Below —40°F. remove oil and operate dry. Every 48 hours, remove entire air cleaner and wash all parts. Keep connection between air cleaner and manifold tight. At each oil change, remove crankcase breather air cleaner filler cap, wash and reoil with used crankcase oil or OE. Use OH between 0°F. to —40°F. Below —40°F. remove oil and operate dry.

CRANKCASE—Drain only when engine is hot. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level. CAUTION: Be sure pressure gage indicates oil is circulating.

POWER TAKE-OFF CHAIN CASE—The power take-off chain is not designed to operate in oil. Every month, remove plug and drain. Chain is lubricated by sight feed oiler.

(Notes Continued on Reverse Side)

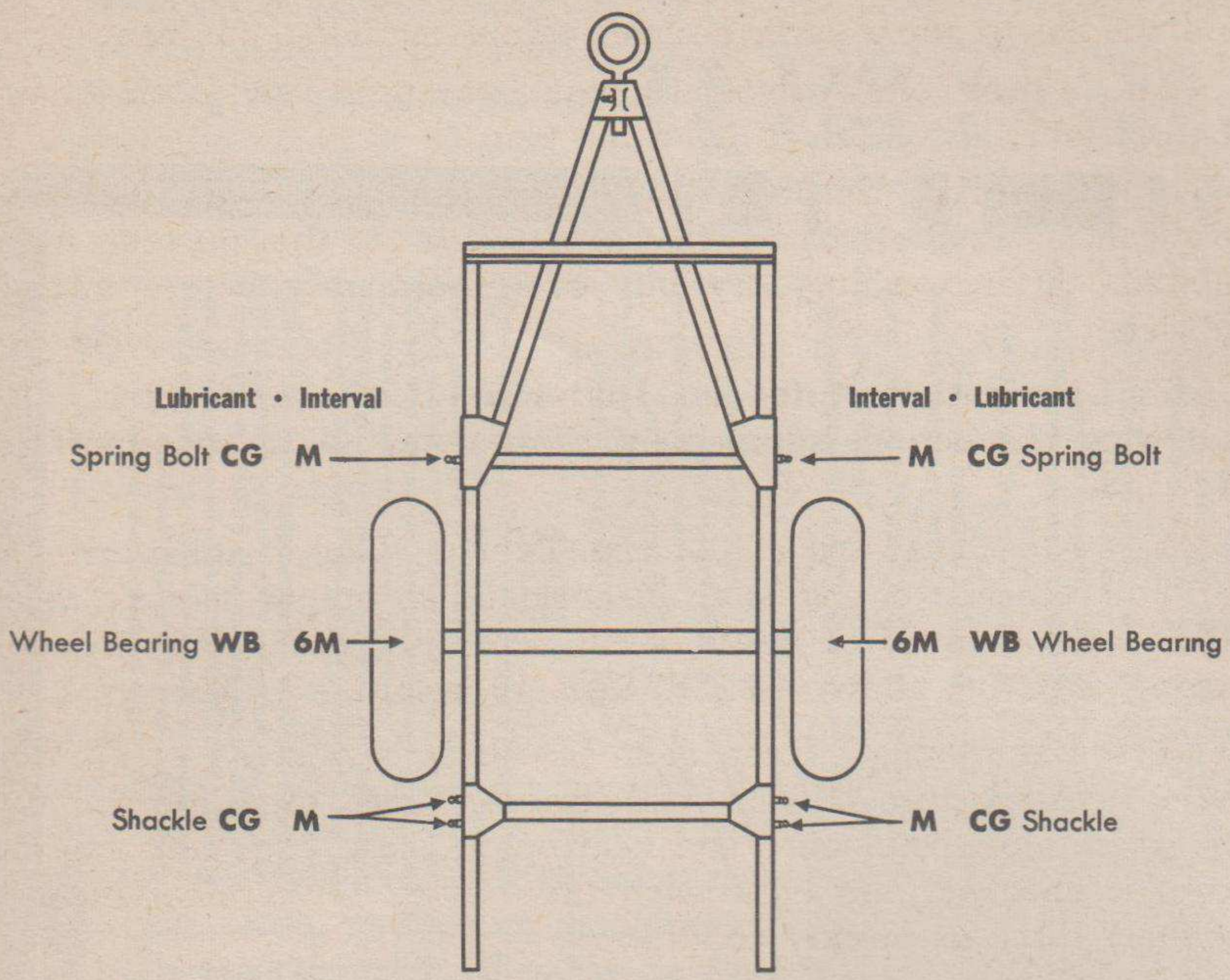
No. 135A

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8 Apr 44
Supersedes all previous issues.

RA PD 322158B

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



KEY

Lubricants	Intervals
CG—GREASE, general purpose No. 1 (above + 32°F.) No. 0 (+ 32°F. to 0°F.) **WB**—GREASE, general purpose No. 2	**M**—Monthly **6M**—6 Months

RA PD 321031

Figure 25—Lubrication Order—Clamshell Trailer M16

20. DETAILED LUBRICATION INSTRUCTIONS.

a. Lubrication Equipment. Each item of materiel is supplied with lubrication equipment adequate to maintain the materiel. Be sure to clean this equipment both before and after use. Operate lubricating guns carefully and in such manner as to ensure a proper distribution of the lubricant.

b. Points of Application.

(1) Lubrication fittings, grease cups, oilers, and oilholes are

LUBRICATION

readily located by reference to the Lubrication Order. Wipe them and the surrounding surface clean before applying lubricant.

(2) Where relief valves are provided, apply new lubricant until the old lubricant is forced from the vent.

c. Cleaning. Use SOLVENT, dry-cleaning, or OIL, fuel, Diesel, to clean or wash all parts. Use of gasoline for this purpose is prohibited. After washing, dry all parts thoroughly before applying lubricant.

d. Lubrication Notes on Individual Units and Parts. The following instructions supplement these notes on Lubrication Order No. 135:

(1) AIR CLEANERS (OIL-BATH TYPE). Daily, check level and refill oil reservoir of engine air cleaner and air compressor air cleaner to oil level stamped on inside of cup, with used crankcase oil or OIL, engine, SAE 30, above +32°F, SAE 10 below +32°F.

(2) BREATHERS. Keep gear case breathers clean at all times. Axle housing, transmission and transfer case, and steering gear breathers must be cleaned and kept open. Clean each time lubricant level is checked, and after each time truck is operated under extremely dirty or muddy conditions.

(3) CRANKCASE. Daily, check level and refill to "FULL" mark with OIL, engine, SAE 30, above +32°F; or SAE 10 from +32°F to 0°F. Below 0°F, refer to paragraph 10. Every 1,000 miles, remove drain plug from bottom of crankcase and completely drain case. Drain only when engine is hot. After thoroughly draining, replace drain plug and refill crankcase to "FULL" mark on gage with correct lubricant to meet temperature requirements. Run engine a few minutes, recheck level, and add oil if required. Be sure pressure gage indicates oil is circulating.

(4) DISTRIBUTOR. Every 1,000 miles, lubricate distributor shaft by turning down cup one turn, refill as required with GREASE, general purpose, No. 2. Every 6,000 miles, wipe the distributor breaker cam lightly with GREASE, general purpose, No. 1, above +32°F, and No. 0 below +32°F. Also lubricate the breaker arm pivot and wick under rotor with one to two drops of OIL, engine, SAE 30, above +32°F; SAE 10 from +32°F to 0°F; or OIL, lubricating, preservative, special, below 0°F.

(5) GEAR CASES (TRANSMISSION, DIFFERENTIALS, AND TRANSFER CASE). Weekly check level with truck on level ground, and if necessary, add lubricant to within ½ inch of plug level when cold, or to plug level when hot. Every 6,000 miles drain and refill. Drain only after operation when gear lubricant is warm. Refill with LUBRICANT, gear, universal, SAE 90, above +32°F; SAE 80 from +32°F

to 0°F; or grade 75 below 0°F. Fill steering gear through plug hole until lubricant runs out of vent hole in jacket tube. (TRANSFER CASE DECLUTCHNG UNIT, FRONT AXLE DOUBLE REDUCTION GEAR CASE). Upon reassembly of cases, fill through plug opening with LUBRICANT, gear, universal, SAE 90, above +32°F, SAE 80 from +32°F to 0°F, grade 75 below 0°F.

(6) OIL FILTER. Every 1,000 miles, remove drain plug from oil filter to drain sediment. Every 6,000 miles while crankcase is being drained, remove filter element, clean inside of case, and install new element.

(7) SPEEDOMETER CABLE. Every 6,000 miles, remove core, clean and coat lightly with GREASE, general purpose, No. 0. CAUTION: *Do not pack lubricant into housing.*

(8) UNIVERSAL JOINTS (FRONT WHEELS). With vehicle on level ground, remove inspection plug in rear of joint, and remove hub plate on front axle shaft; fill through fitting in wheel hub with GREASE, general purpose, No. 1, above +32°F, or No. 0 below +32°F until lubricant comes out inspection plug hole. CAUTION: *Replace plug.*

(9) UNIVERSAL JOINTS AND SLIP JOINTS. Use GREASE, general purpose, No. 1, for temperatures above +32°F; or GREASE, general purpose, No. 0, below +32°F. Apply grease to universal joint until it overflows at the relief valve, and to the slip joint until lubricant is forced from the vent at the universal joint end of the spline.

(10) WHEEL BEARINGS. Remove bearing cone assemblies from hub. Wash bearings, cones, spindle, and inside of hub, and dry thoroughly. Do not use compressed air. Inspect bearing races and replace if damaged. Coat the spindle and inside of hub and hub cap with GREASE, general purpose, No. 2, to a maximum thickness of $\frac{1}{16}$ inch only, to retard rust. Lubricate bearings with GREASE, general purpose, No. 2, with a packer or by hand, kneading lubricant into all spaces in the bearing. Use extreme care to protect the bearings from dirt, and immediately reassemble and replace wheel. Do not fill hub or hub cap. The lubricant in the bearing is sufficient to provide lubrication until the next service period. Any excess might result in leakage into the drum. Adjust bearings in accordance with instructions in paragraph 61 b.

(11) OILCAN POINTS. Every 1,000 miles, lubricate throttle and accelerator linkage, transfer case shift linkage, declutch shift linkage, emergency brake cable sheave and linkage, brake pedal pull rod clevis pins, clutch pedal linkage, brake pedal shaft, air compressor rocker arm, outrigger float screws, hinges, locks, etc., with OIL, engine,

LUBRICATION

SAE 30, above +32°F, SAE 10 from +32°F to 0°F, or OIL, lubricating, preservative, special, below 0°F.

(12) RUBBER BUSHING. Every 1,000 miles, apply FLUID, brake, hydraulic, to torque rod bushings. Do not use oil.

(13) POINTS REQUIRING NO LUBRICATION SERVICE. Clutch pilot bearing, air compressor, and springs require no lubrication services.

(14) DISASSEMBLED PERIODICALLY BY ORDNANCE PERSONNEL. None.

e. Lubrication Notes on Individual Units and Parts. The following instructions supplement these notes on Lubrication Order No. 136A:

(1) AIR CLEANER. Every 8 hours, refill engine air cleaner oil reservoir to bead level with used crankcase oil or OIL, engine, SAE, 30, above +32°F, SAE 10 below +32°F. Every 48 hours, remove entire air cleaner and wash all parts. Keep connection between air cleaner and manifold tight. At each oil change, remove crankcase breather air cleaner filler cap, wash, and reoil with used crankcase oil or OIL, engine, SAE 30, above +32°F, SAE 10 below +32°F.

(2) CRANKCASE. Drain only when engine is hot. Refill to "FULL" mark on gage. Run engine a few minutes and recheck oil level. CAUTION: *Be sure pressure gage indicates oil is circulating.*

(3) OIL FILTER. At time of crankcase oil change, drain filter case. Every 96 hours, while crankcase is being drained, clean inside of case and renew element.

(4) POWER TAKE-OFF CHAIN CASE. The power take-off chain is not designed to operate in oil. Every month, remove plug and drain. Chain is lubricated by sight feed oiler.

(5) STARTER REDUCTION GEAR CASE. Every 6 months, remove plug in top of housing and refill with GREASE, general purpose, No. 1, above +32°F, or No. 0 below +32°F. CAUTION: *Use low pressure gun and do not overfill.*

(6) DISTRIBUTOR. Every 6 months, wipe distributor breaker cam lightly with GREASE, general purpose, No. 1, above +32°F, or No. 0 below +32°F, and lubricate breaker arm pivot and wick under rotor with one or two drops of OIL, engine, SAE 30, above +32°F; SAE 10 for +32°F to 0°F; OIL, lubricating, preservative, special, for below 0°F.

(7) CABLES. Weekly, clean and lubricate hoist cable with heated OIL, lubricating, chain and wire rope, grade 2. Monthly, lubricate all cables with heated OIL, lubricating, chain and wire rope, grade 2,

except those coming in constant contact with dirt, in which case cables will be cleaned and lightly coated with OIL, engine, SAE 30, above +32°F, SAE 10 below +32°F, OIL, lubricating, preservative, special, below 0°F.

(8) OPEN GEARS. Weekly, clean and coat with OIL, lubricating, chain and wire rope, grade 2.

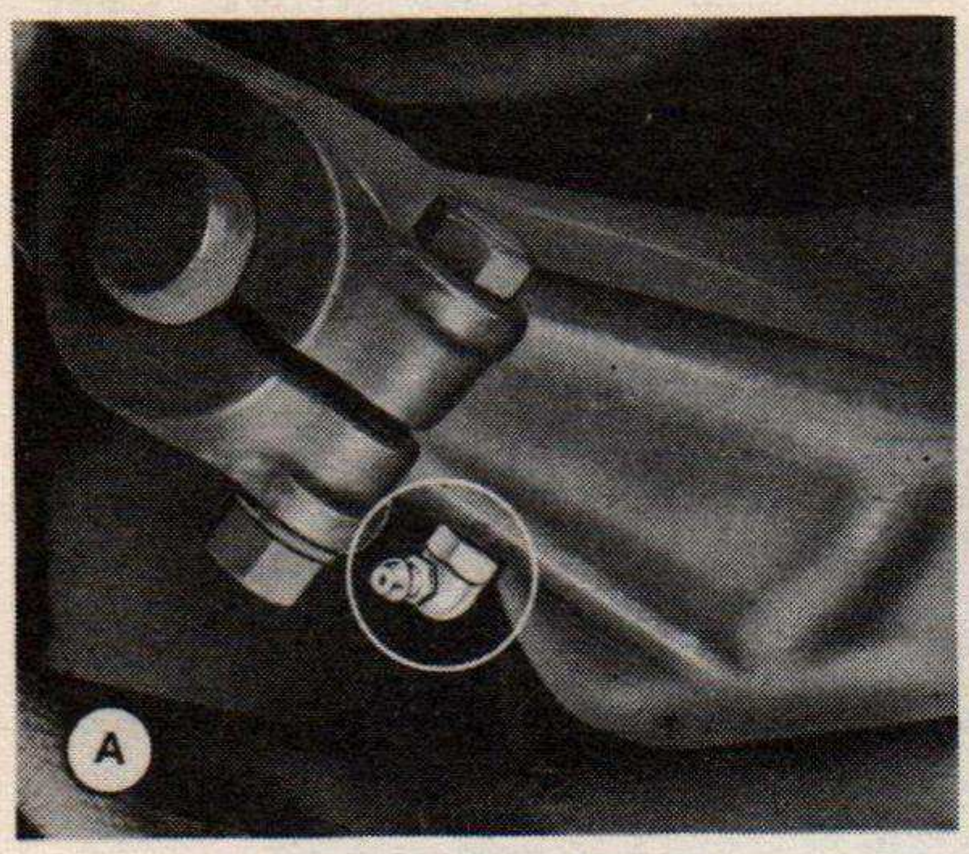
(9) OILCAN POINTS. Every 48 hours, lubricate lever connections, control rod clevises, precision boom chain idler, sliding sleeve yoke bearings, throttle control cables and linkage, hinges, latches, etc., with OIL, engine, SAE 30 above +32°F; SAE 10 between +32°F and 0°F; or OIL, lubricating, preservative, special for below 0°F.

f. Reports and Records.

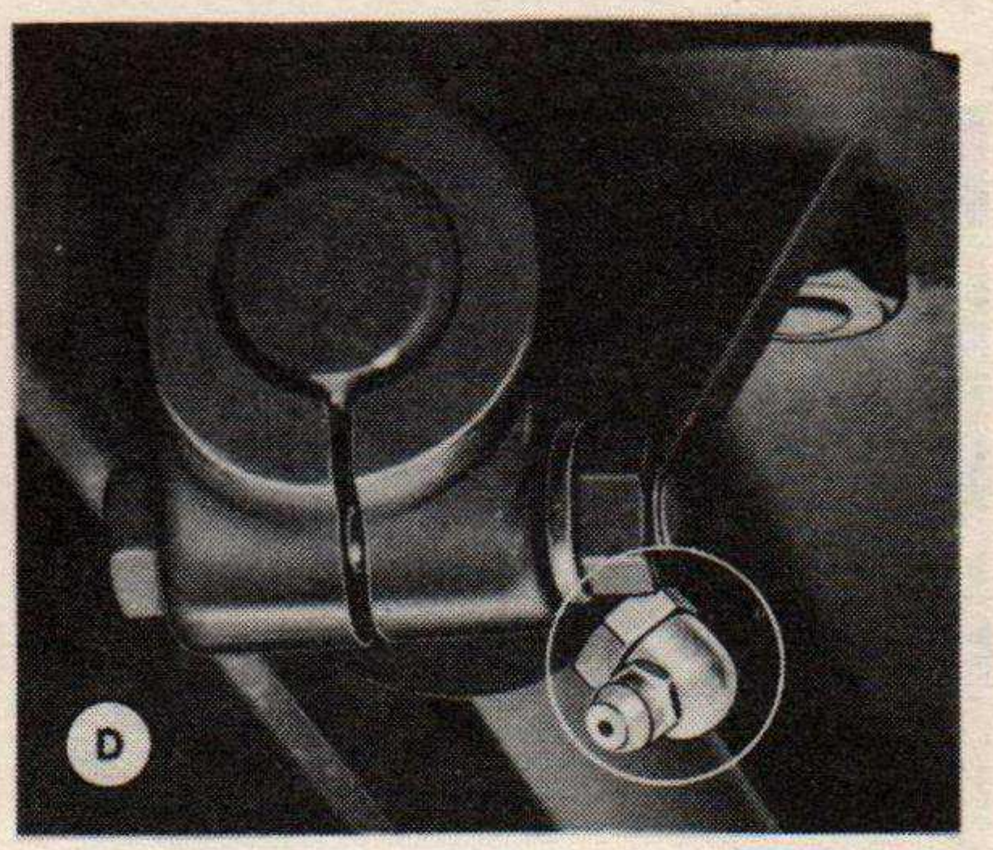
(1) Report unsatisfactory performance of materiel to the ordnance officer responsible for maintenance, in accordance with TM 38-250.

(2) A record of lubrication may be maintained in the Duty Roster (W.D., A.G.O. Form No. 6).

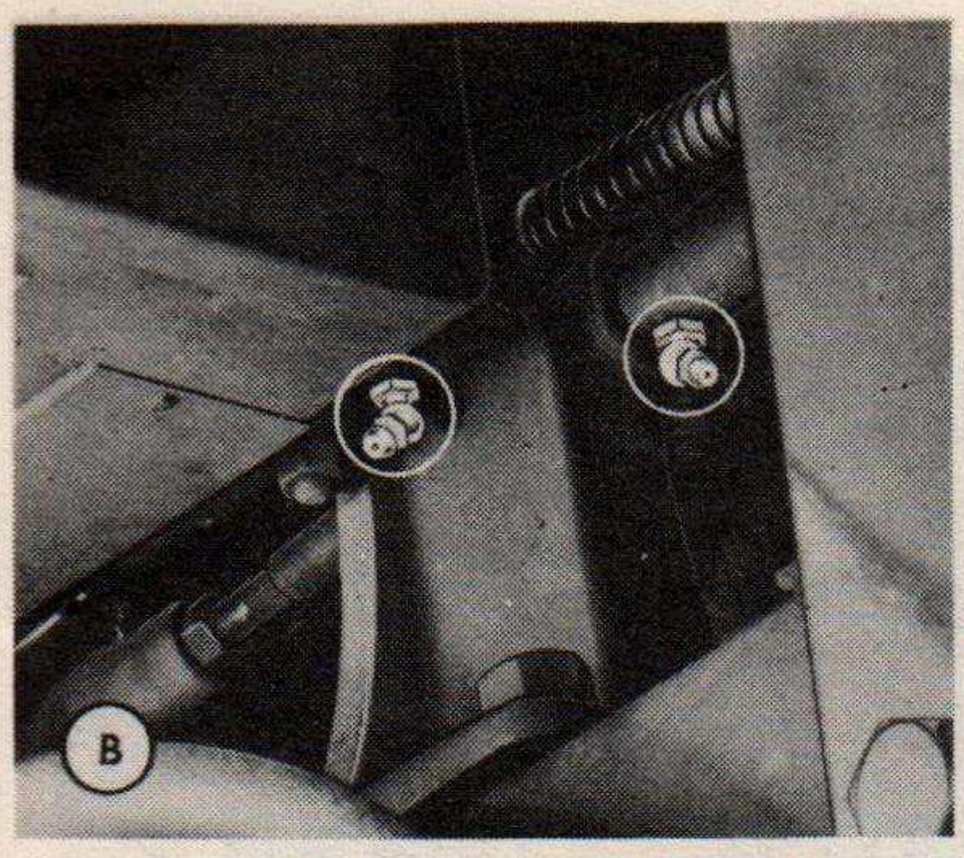
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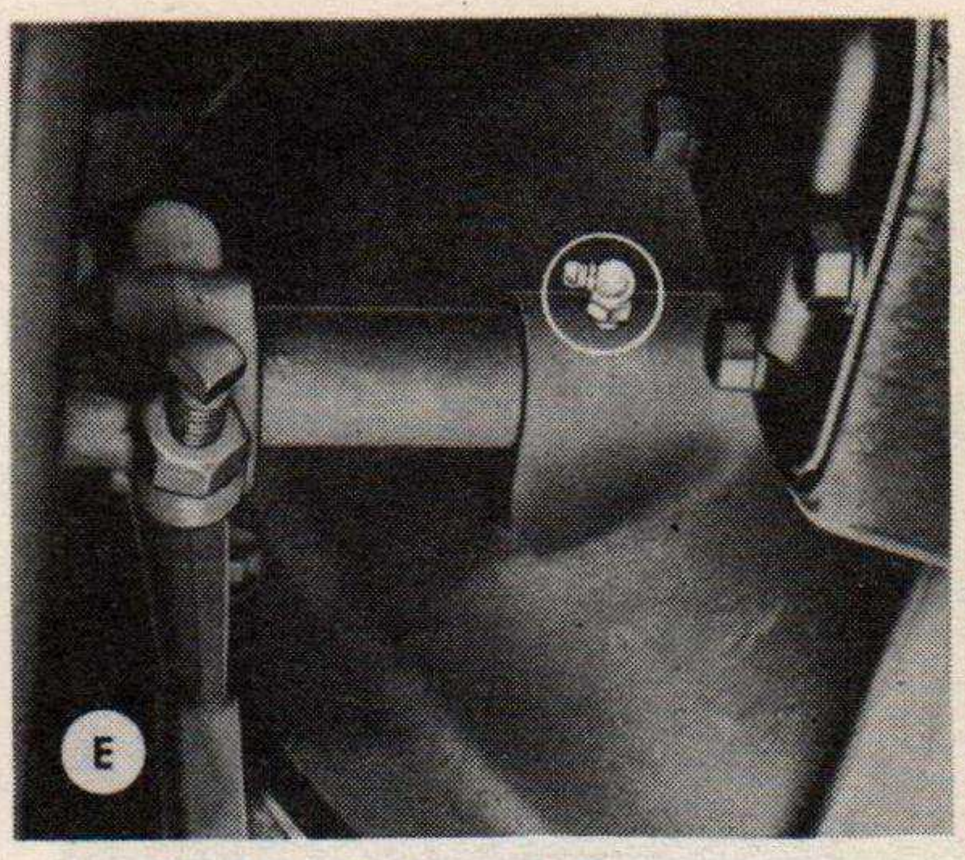
CLUTCH PEDAL SHAFT



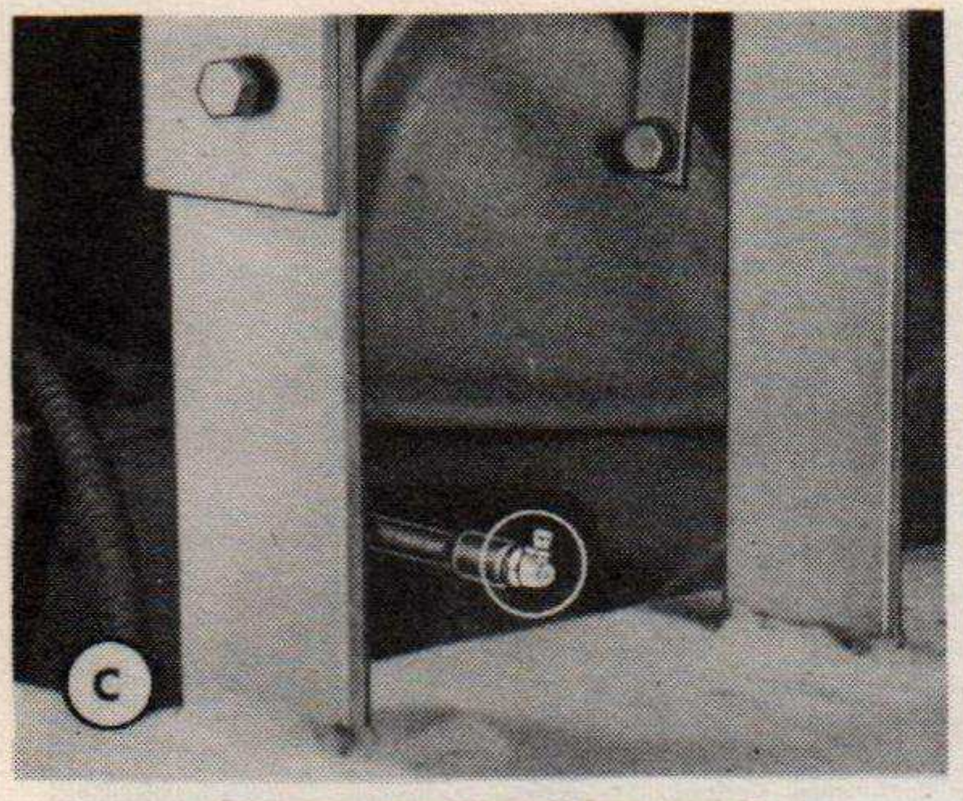
EMERGENCY BRAKE CROSS SHAFT



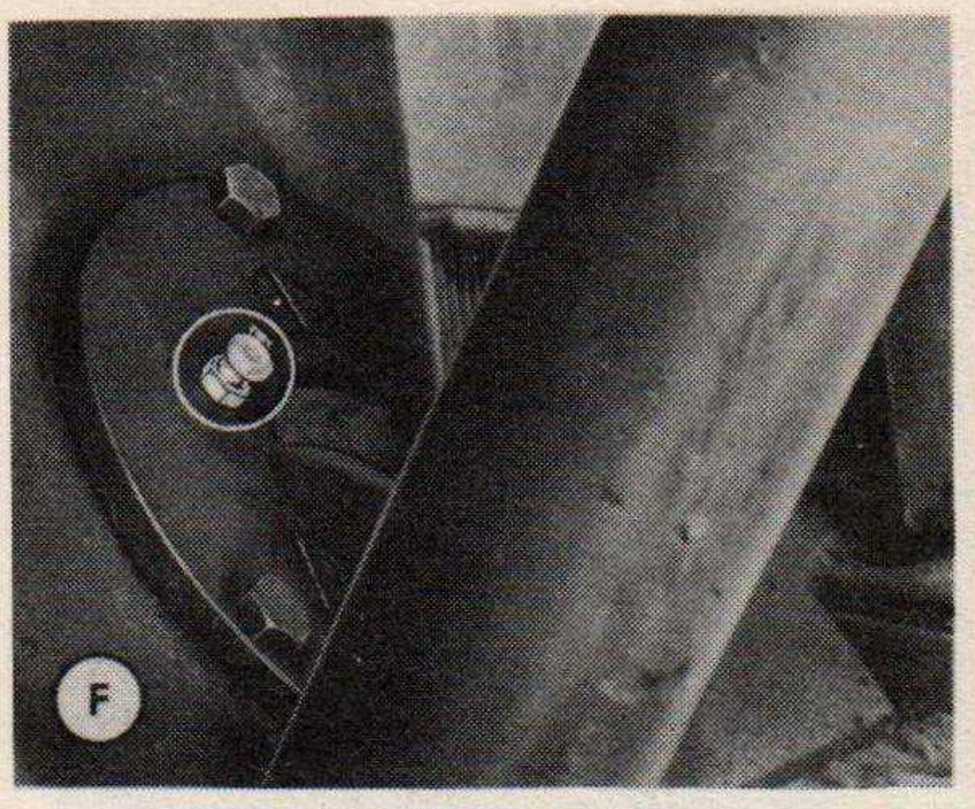
TRANSFER CASE CROSS SHAFT
CLUTCH CROSS SHAFT



CLUTCH THROW-OUT SHAFT



CLUTCH RELEASE BEARING

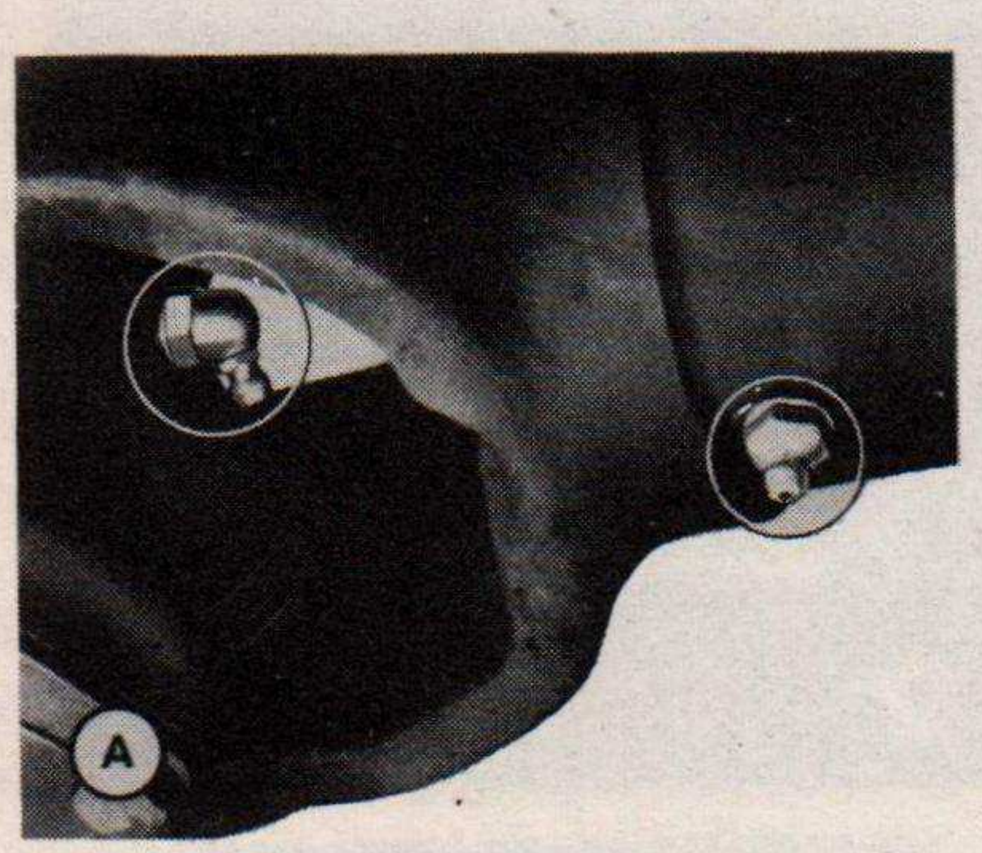


FOOT PEDAL VALVE

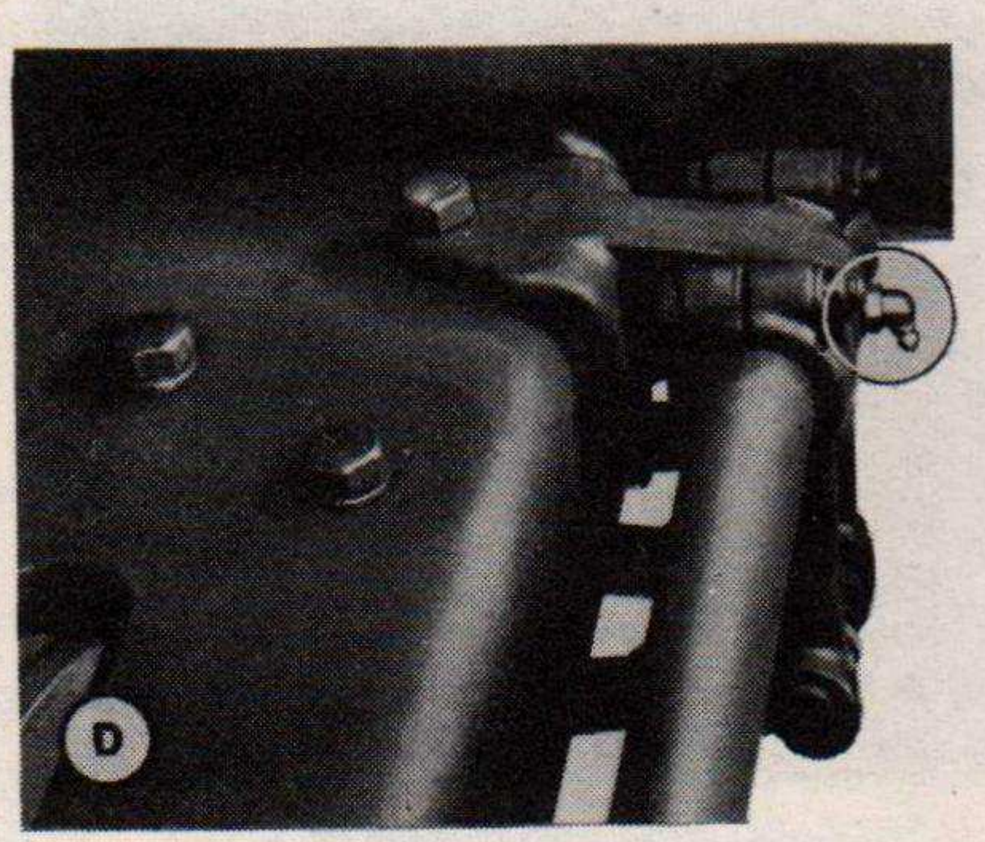
RA PD 321075

Figure 26—Localized Lubrication Views—1

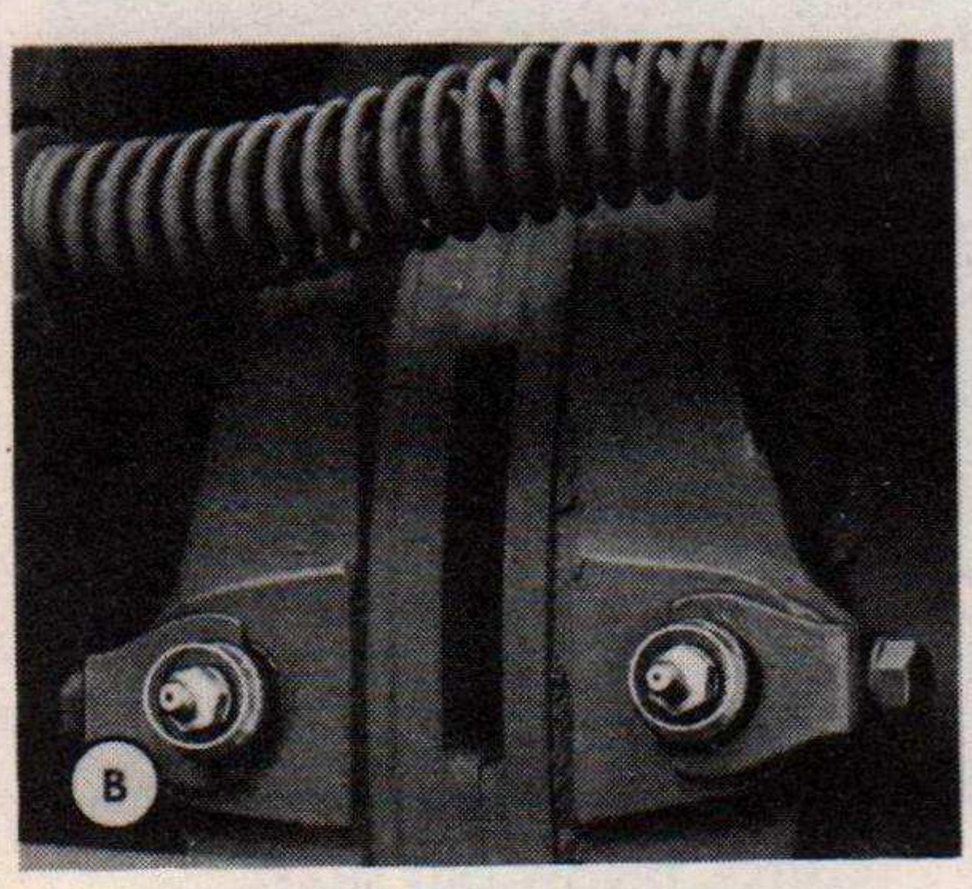
CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



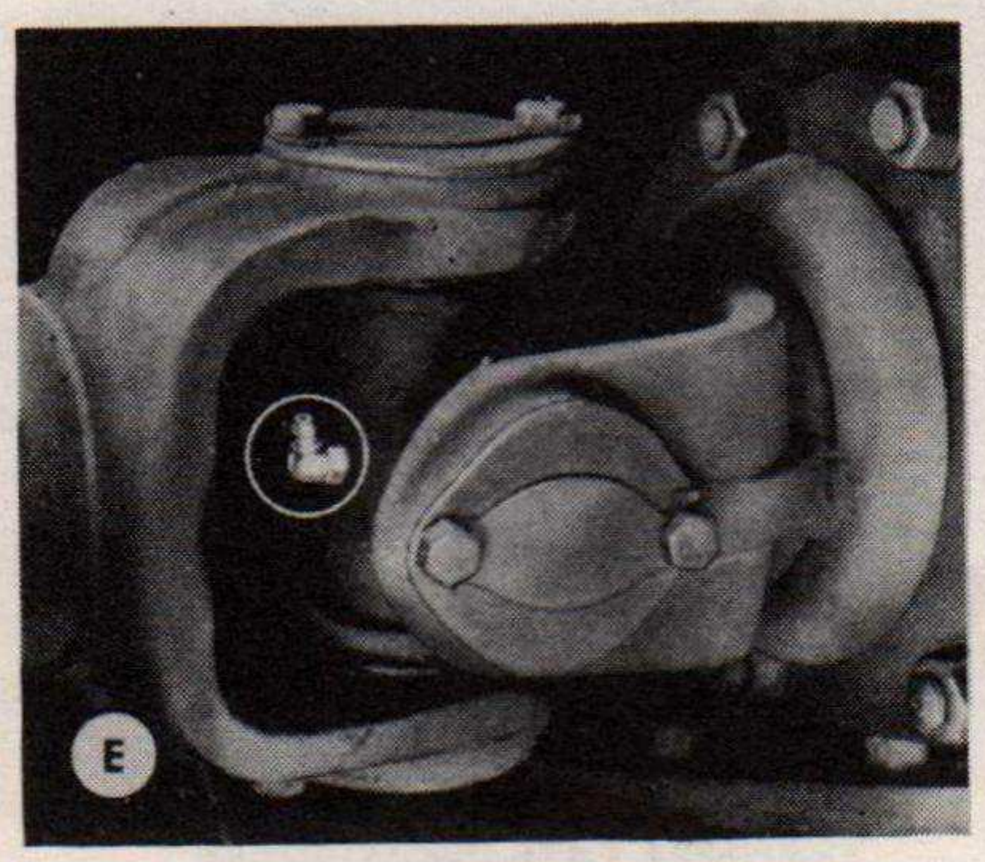
UNIVERSAL AND SLIP JOINTS



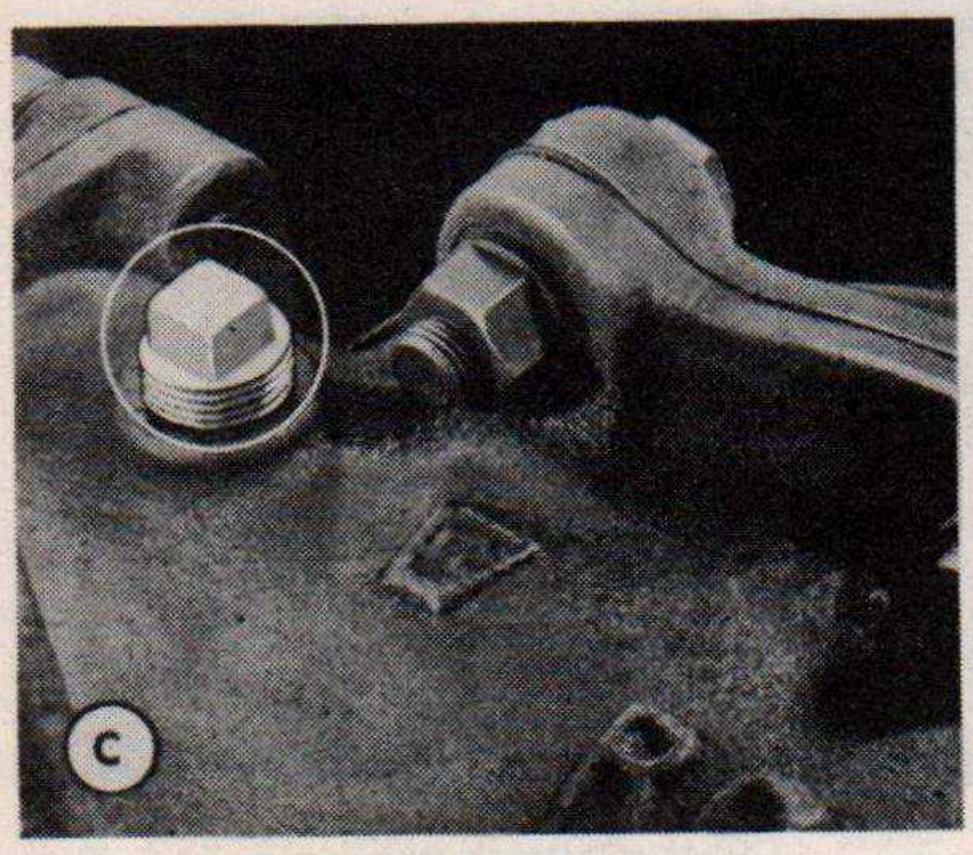
DISK BRAKE (SHAFT)



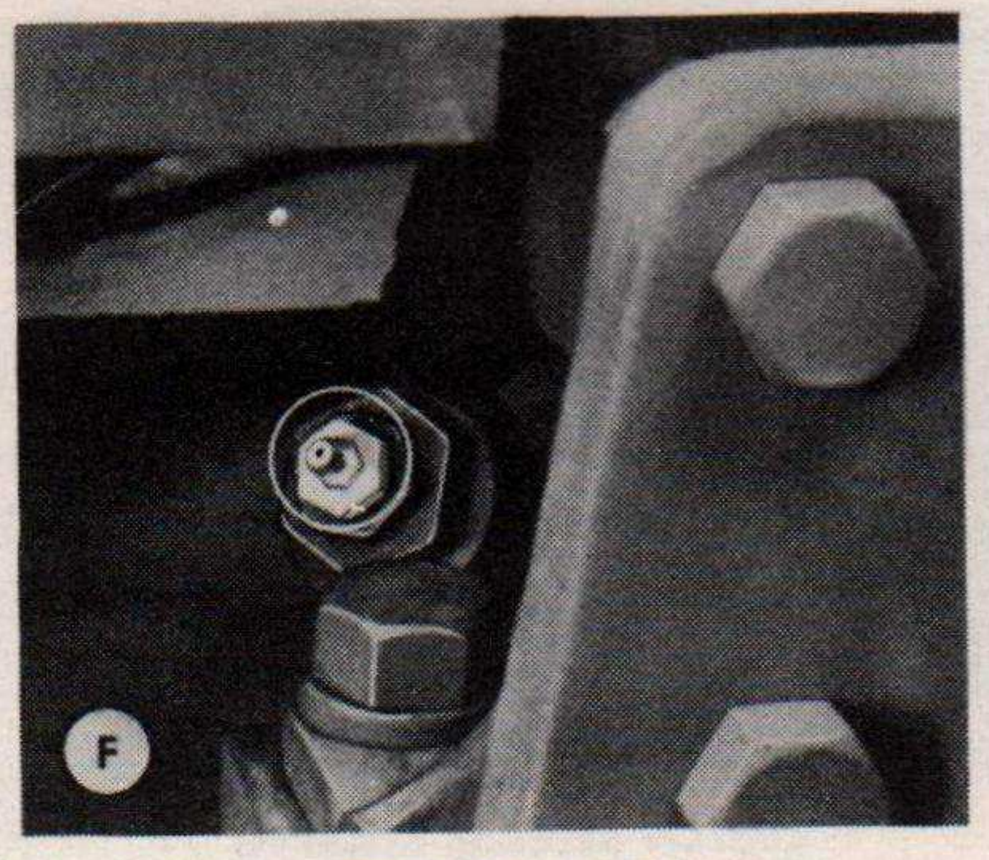
DISK BRAKE (PINS)



UNIVERSAL JOINT



STEERING GEAR (FILL PLUG)

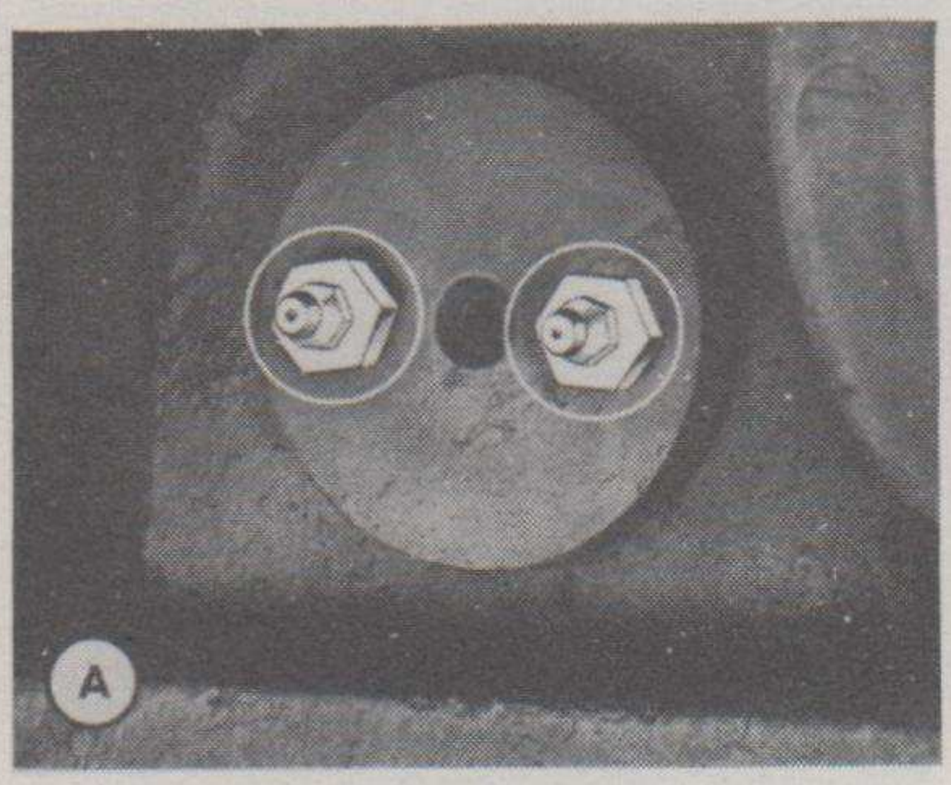


PINTLE HOOK

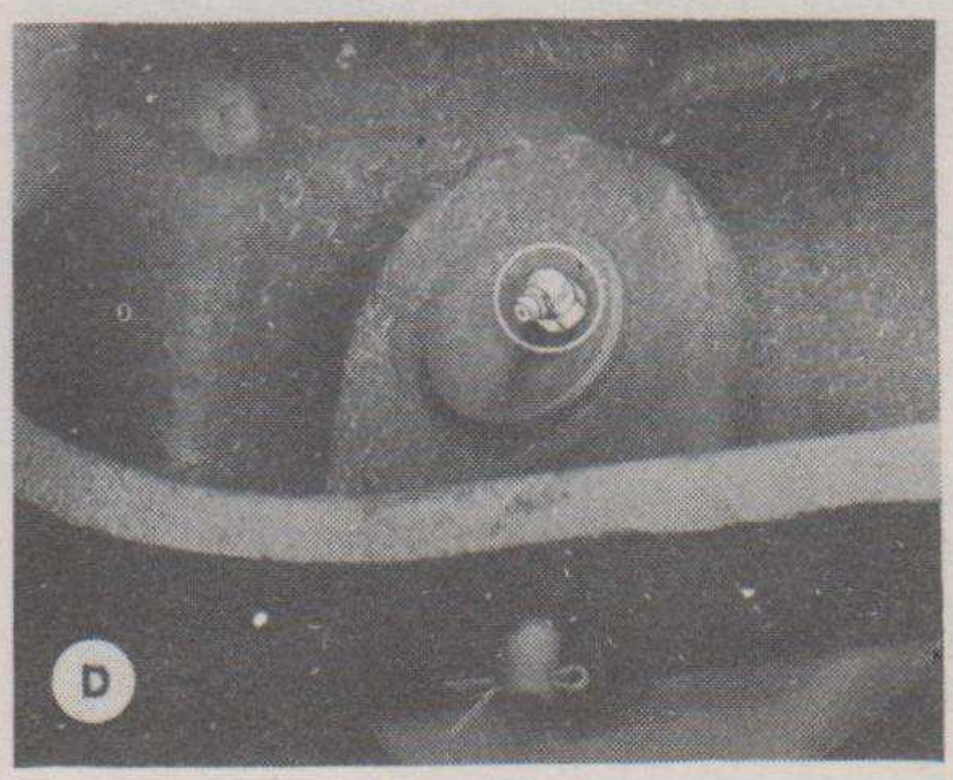
RA PD 321081

Figure 27—Localized Lubrication Views—2

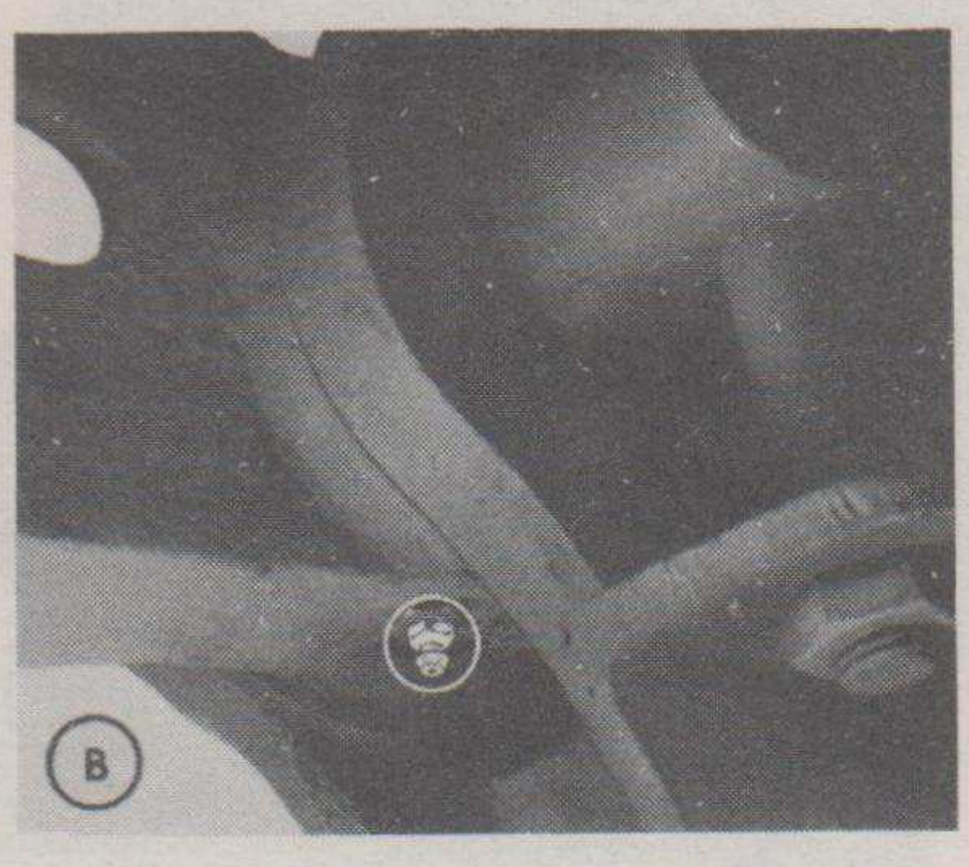
LUBRICATION



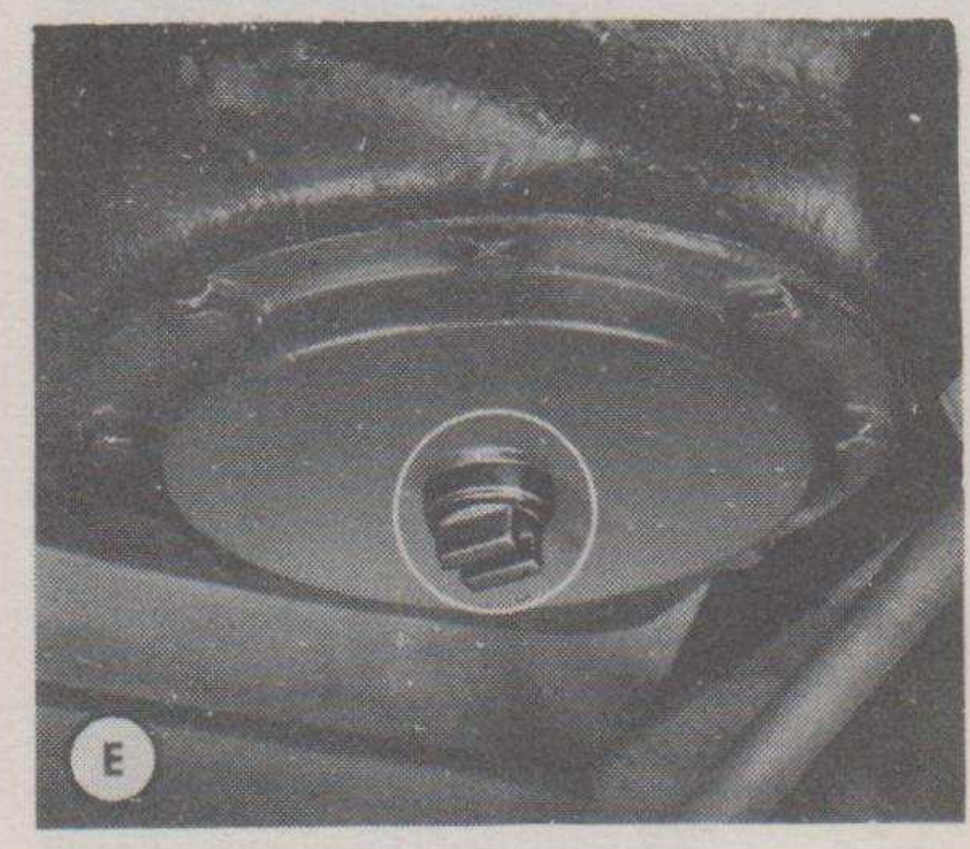
TURNTABLE ROLLER (FRONT)



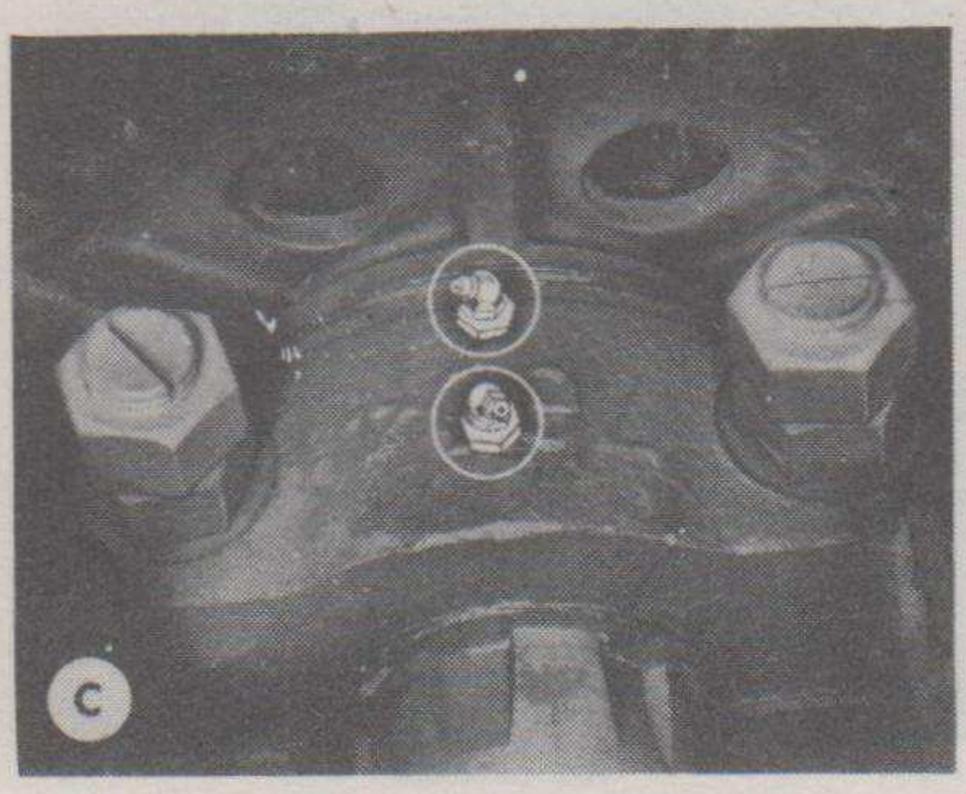
TURNTABLE ROLLER (REAR)



BOOM FOOT PIN



CRANKCASE (DRAIN PLUG)



VERTICAL SWING PINION SHAFT BUSHINGS (UPPER)

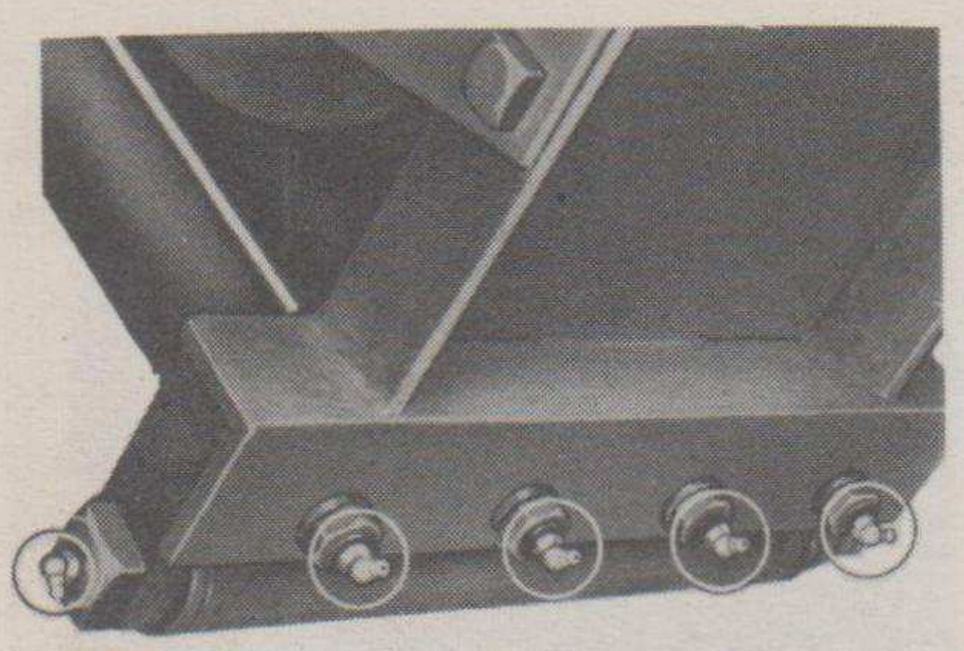


VERTICAL SWING PINION SHAFT BUSHING (LOWER)

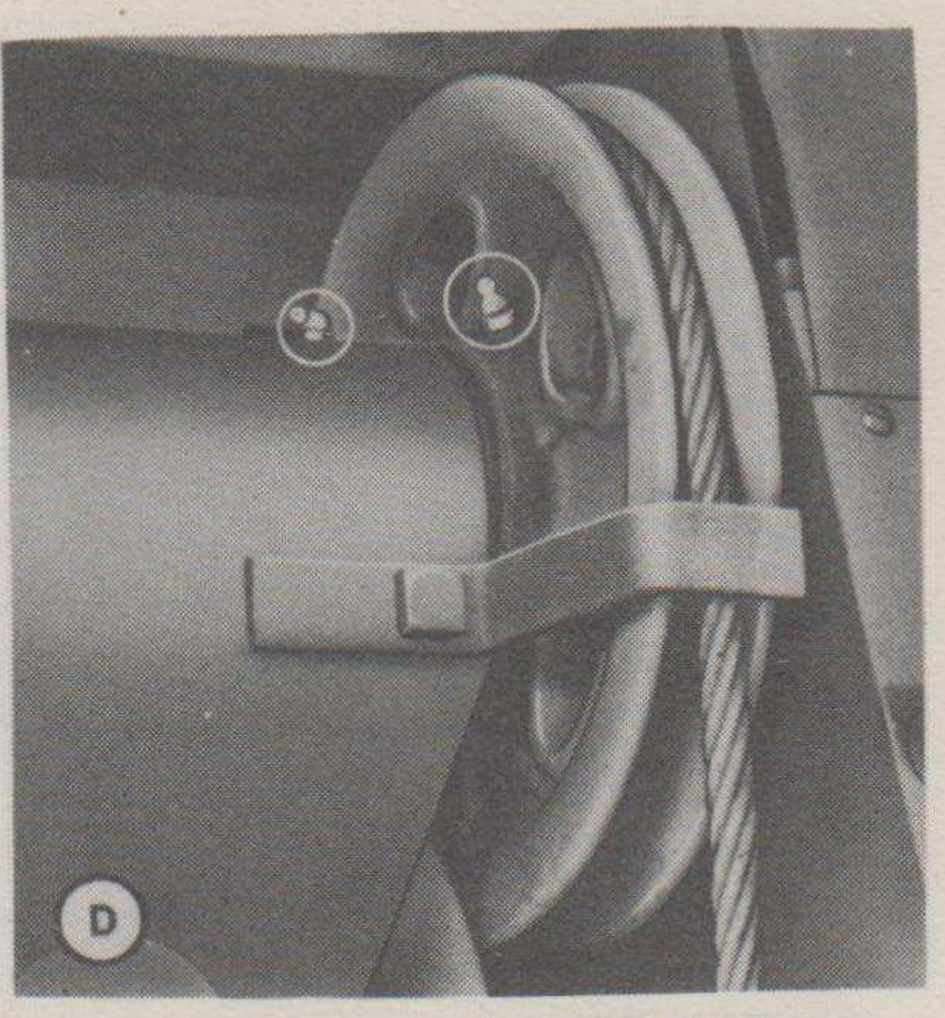
RA PD 321088

Figure 28—Localized Lubrication Views—3

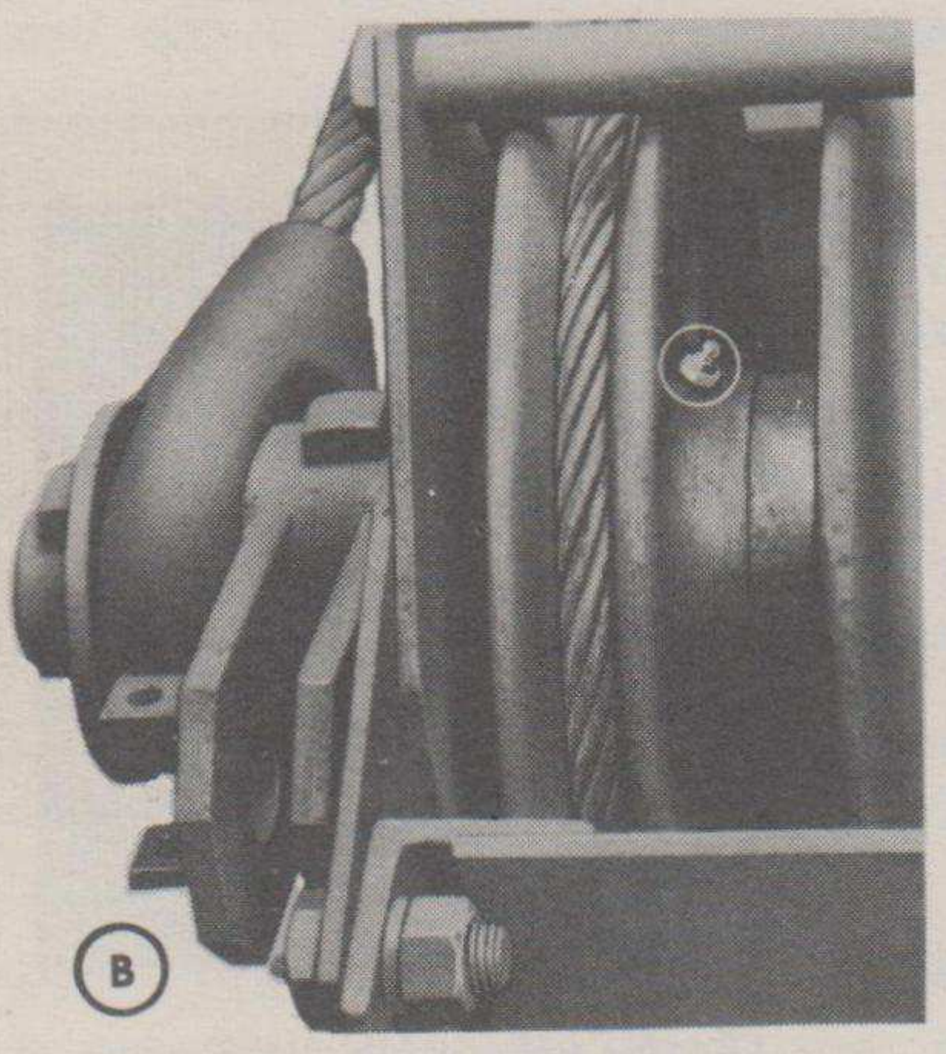
CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16



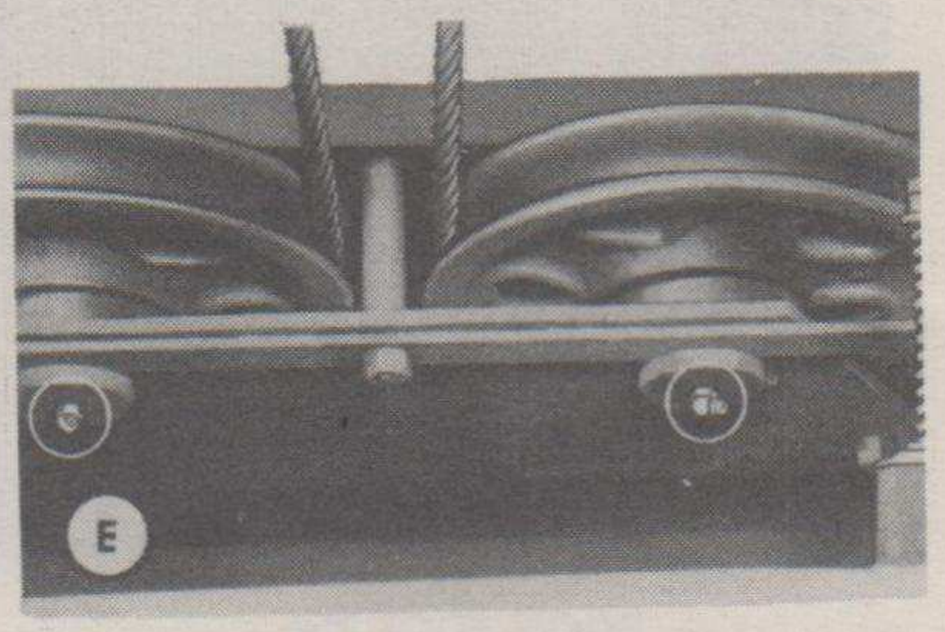
CABLE GUIDE ROLLERS



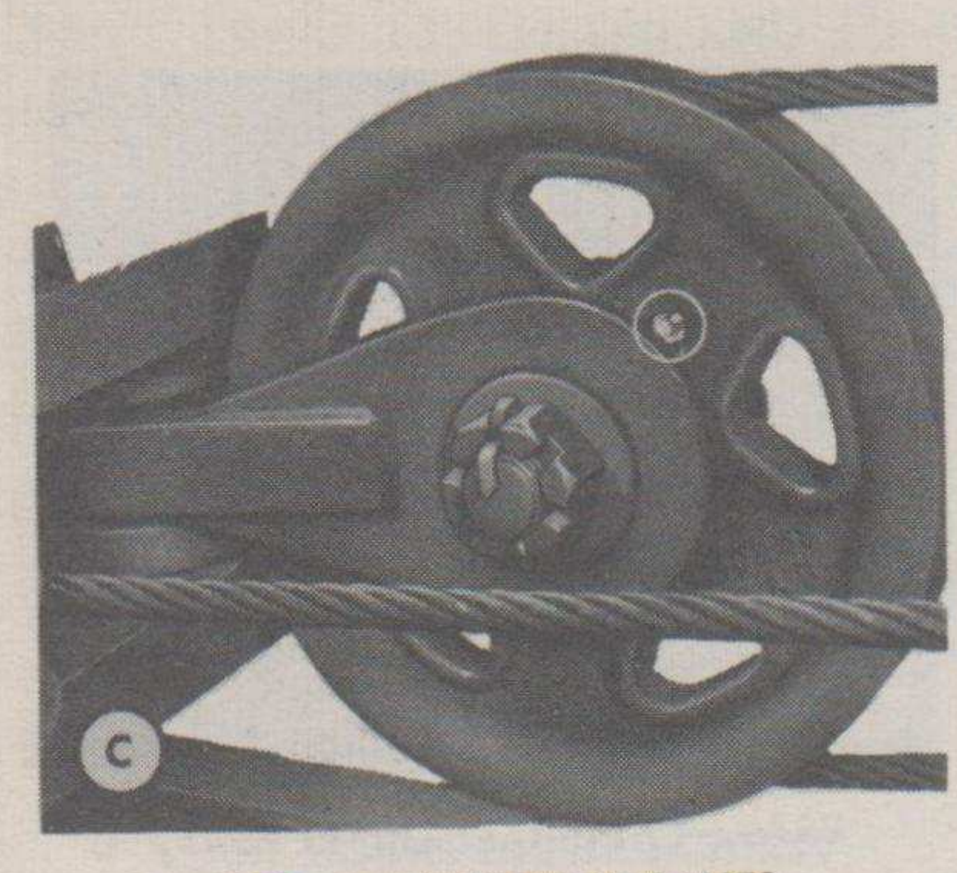
A–FRAME HARNESS SHEAVES
A–FRAME CROSS SHAFT



BOOM POINT SHEAVES



A–FRAME PIN SHEAVE



BOOM HARNESS SHEAVES



SWIVEL HOOK

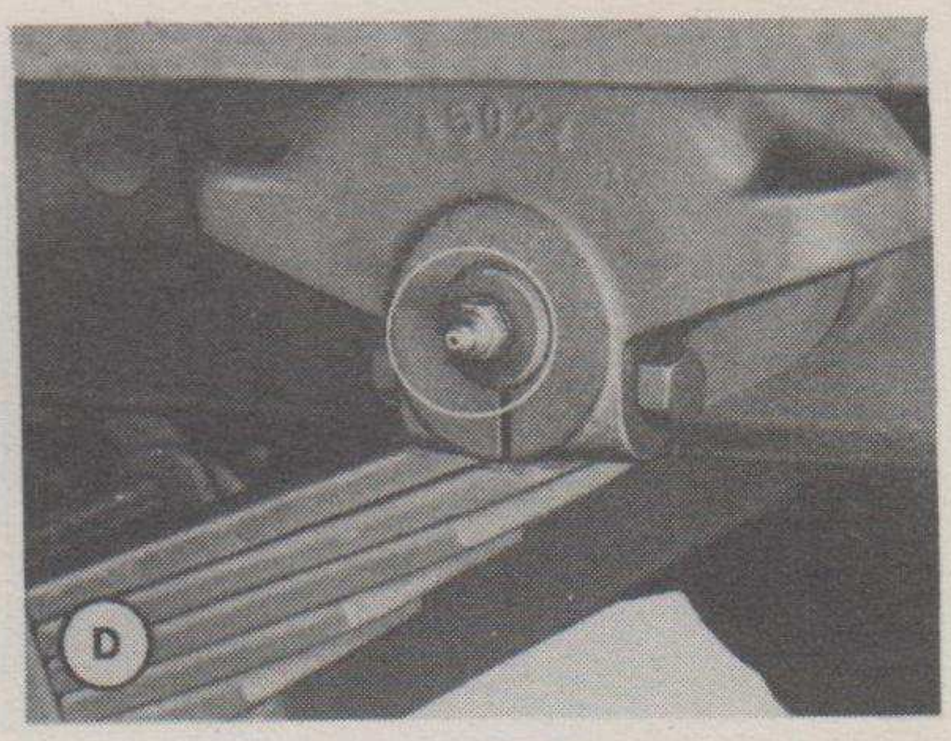
RA PD 321100

Figure 29—Localized Lubrication Views—4

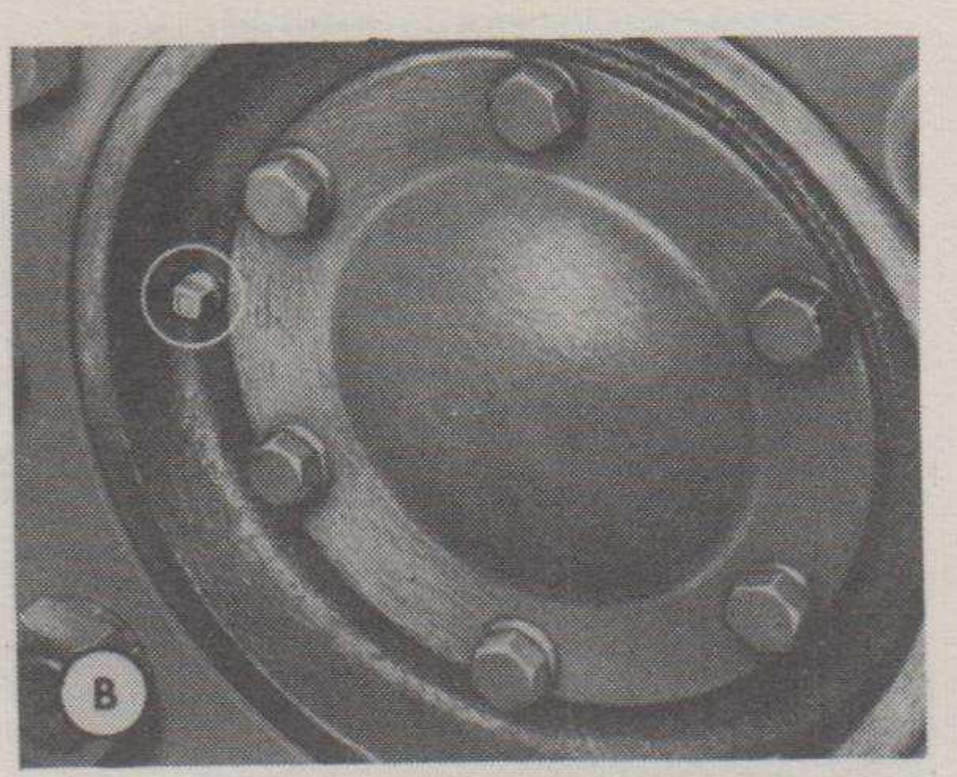
LUBRICATION



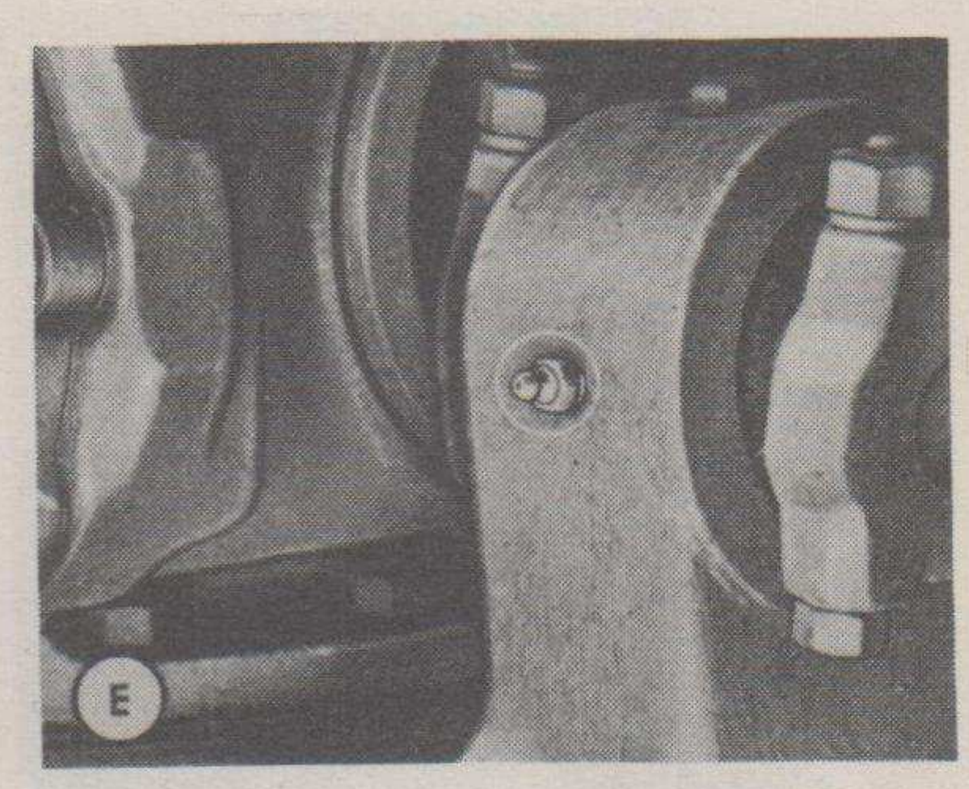
BRAKE CAMSHAFT INNER BEARING



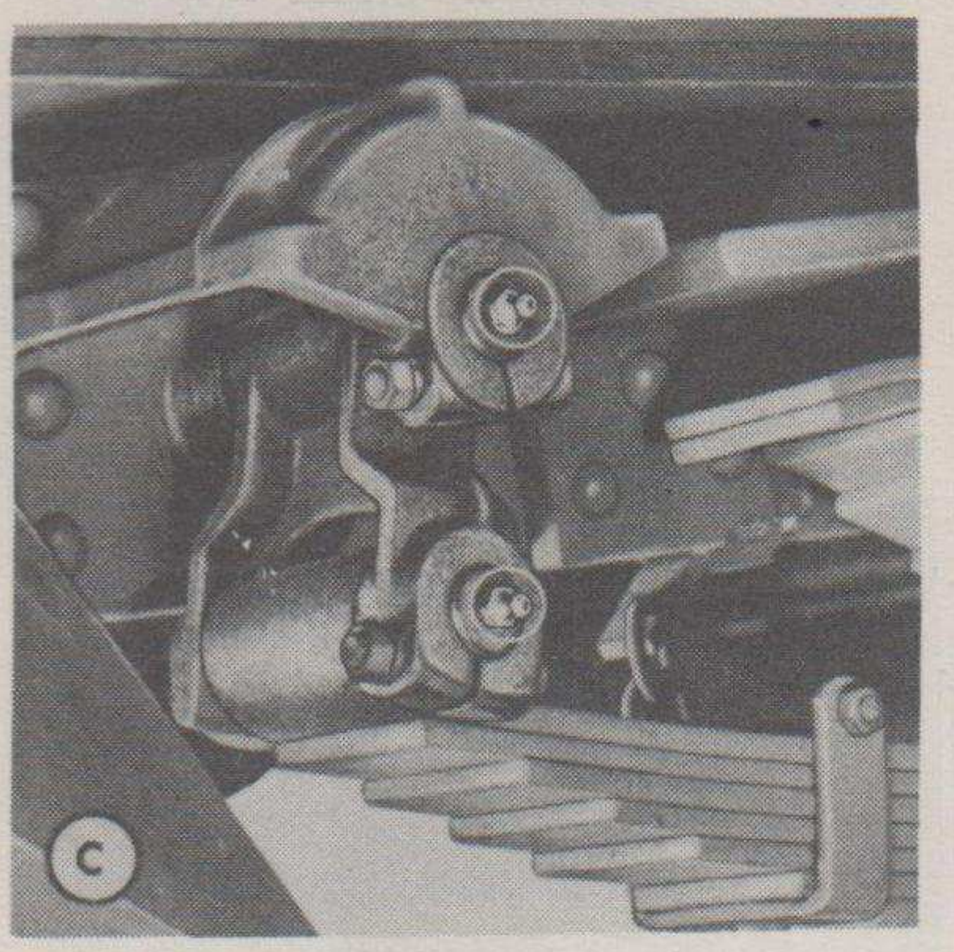
SPRING BOLT



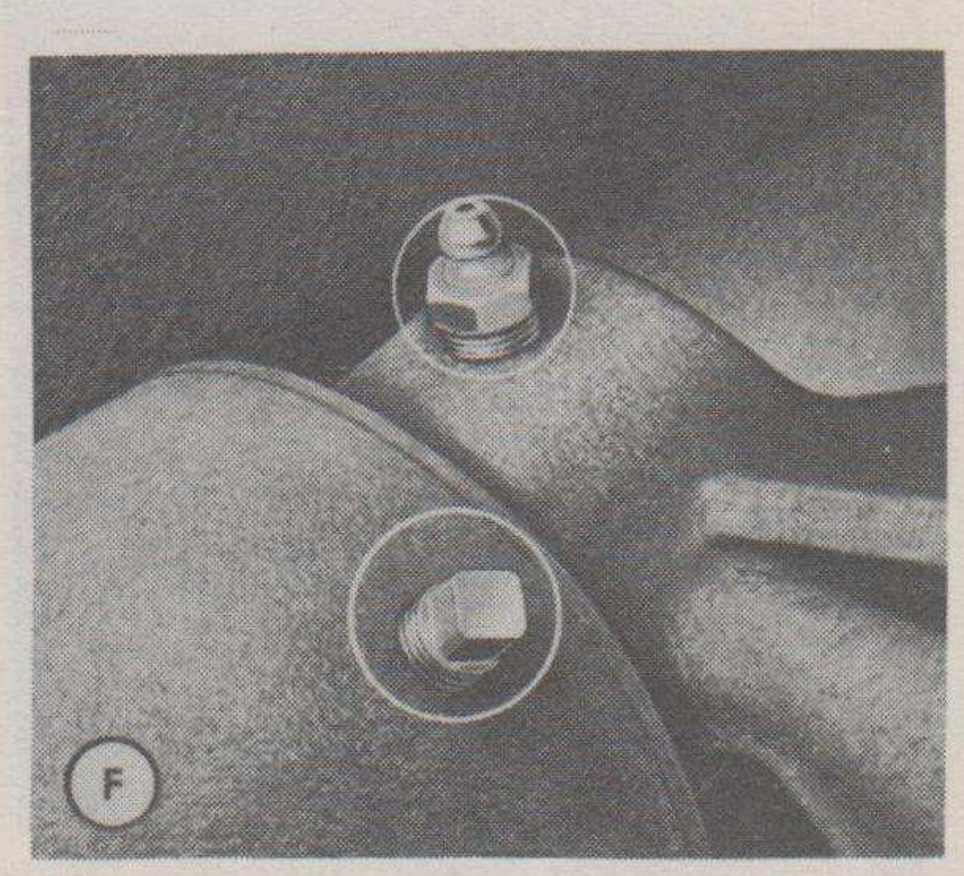
WHEEL BEARING



UPPER TORQUE ROD



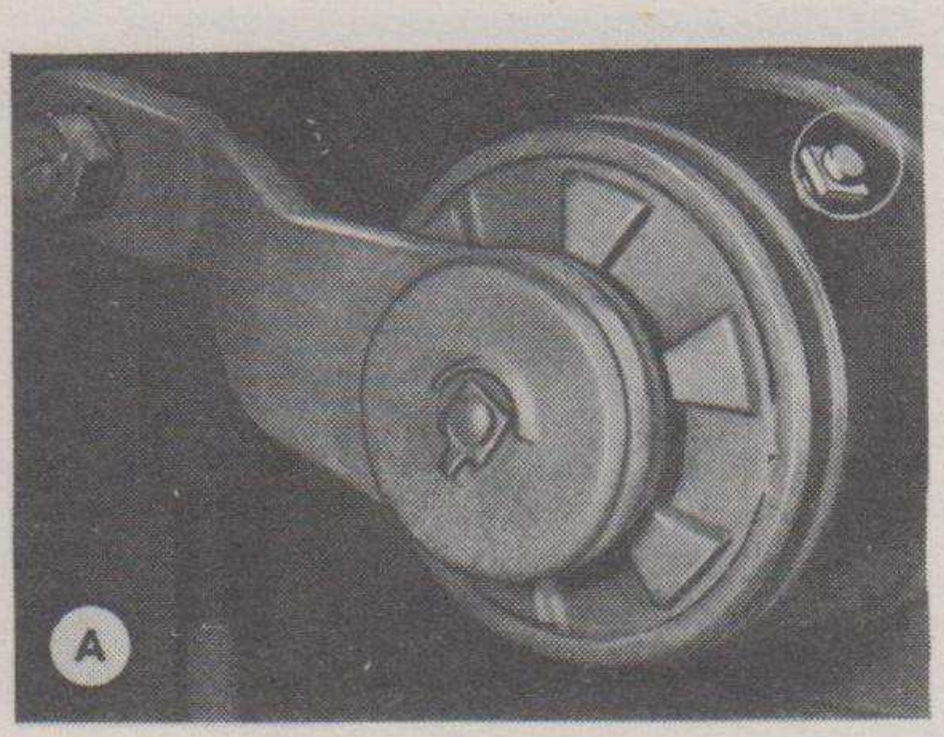
SPRING SHACKLE



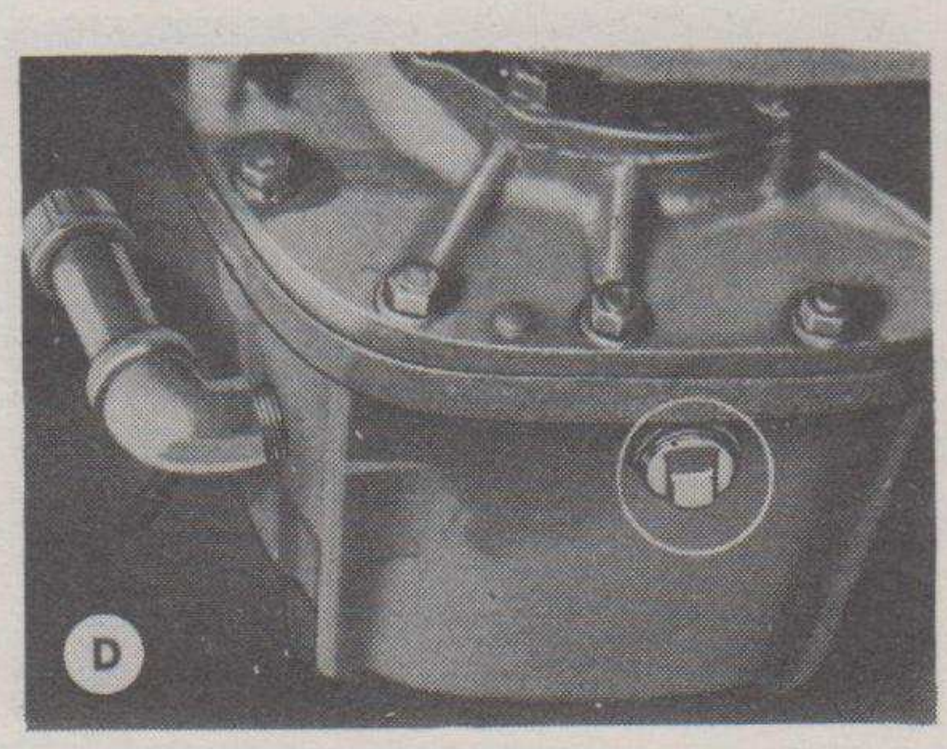
BRAKE CAMSHAFT OUTER BEARING

RA PD 321076

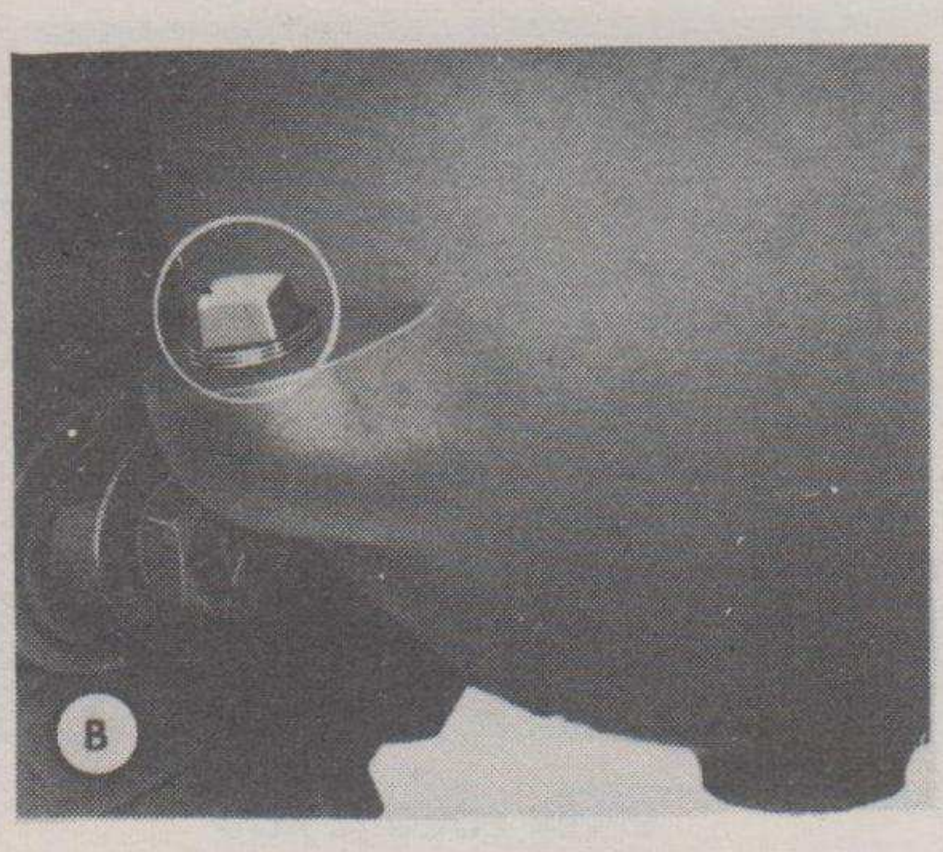
Figure 30—Localized Lubrication Views—5



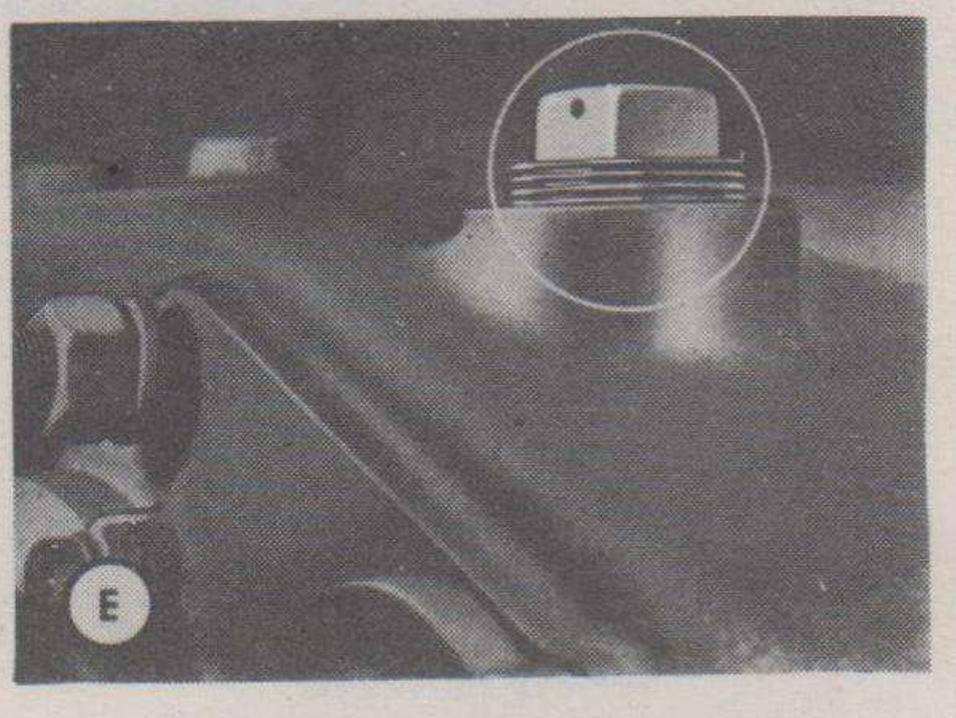
SHOCK ABSORBER (FILL PLUG)



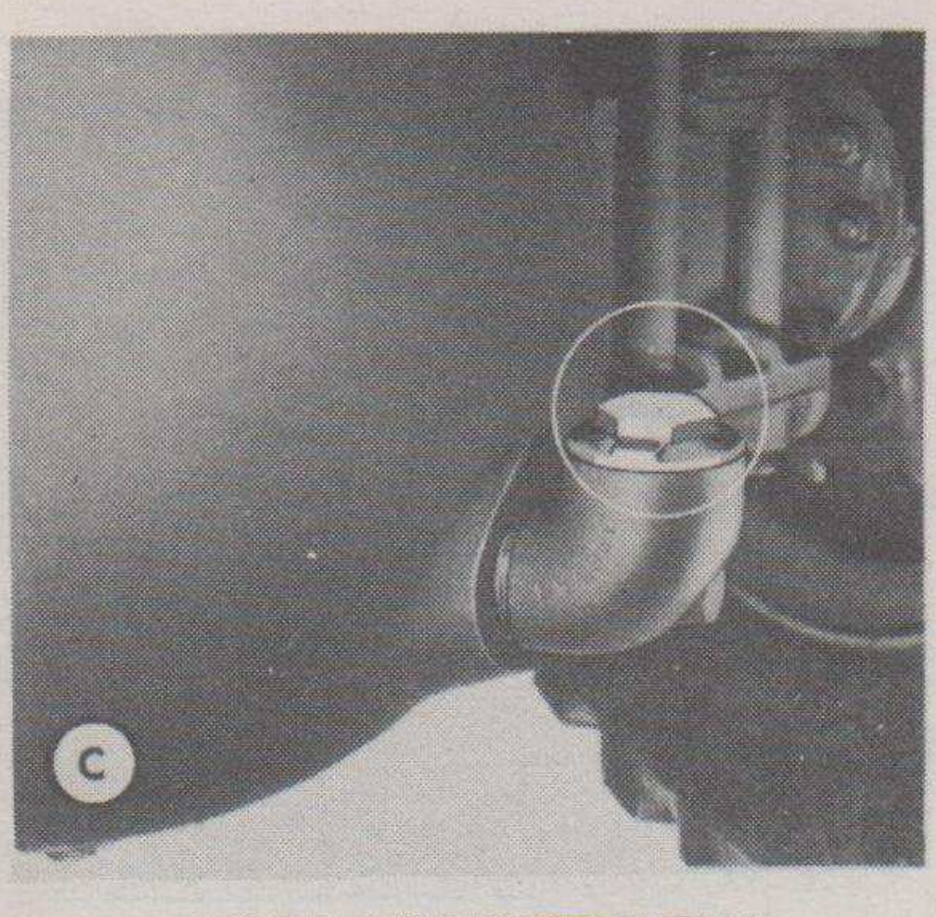
TRANSFER CASE (FILL PIPE)
(DRAIN PLUG)



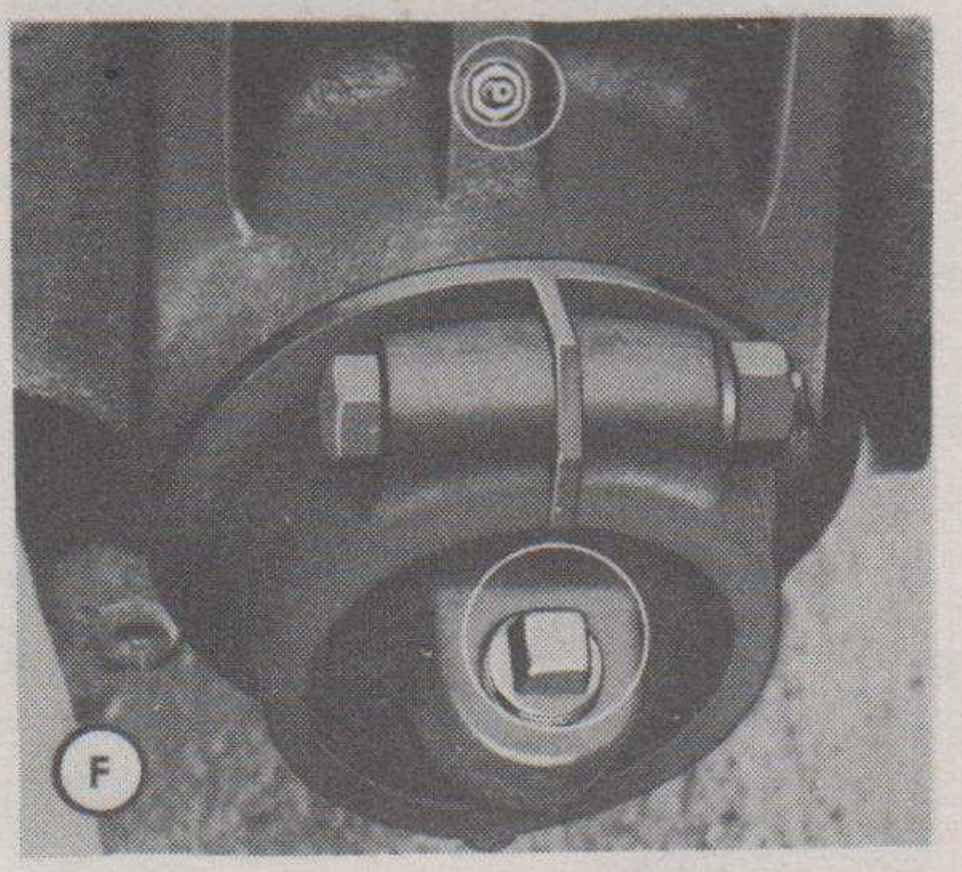
REAR AXLE DIFFERENTIAL
(FILL PLUG)



TRANSMISSION (FILL PLUG)



FRONT AXLE DIFFERENTIAL
(FILL PLUG)

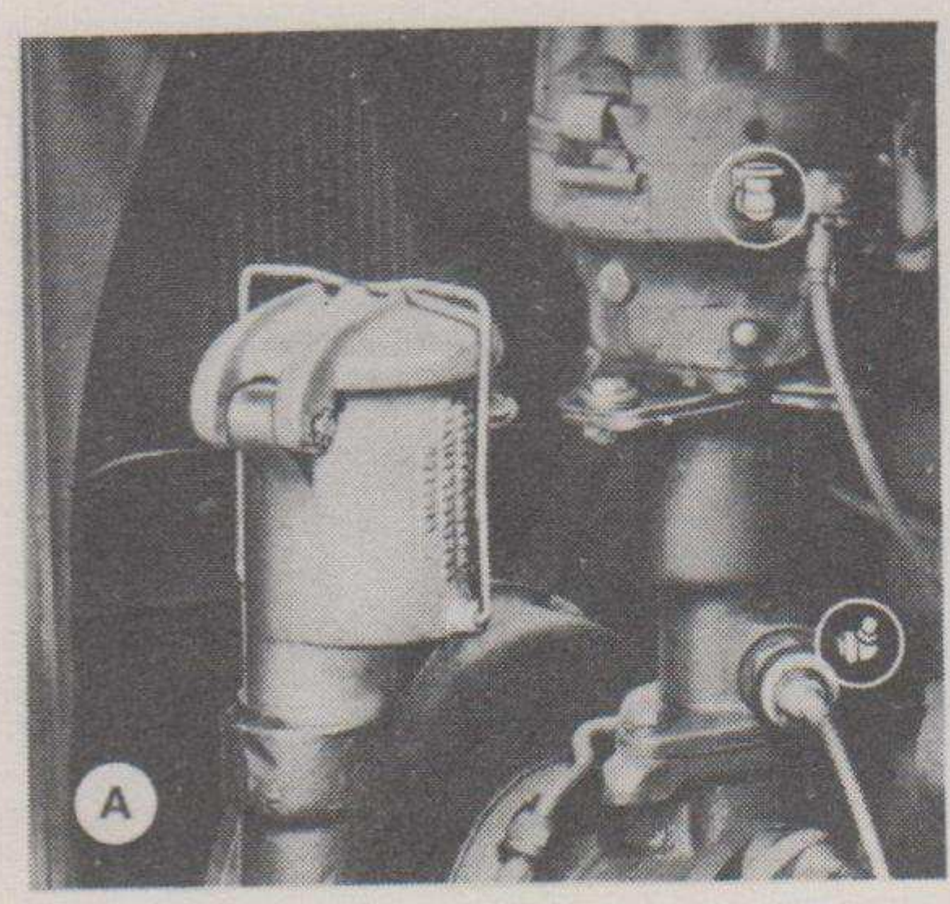


REAR AXLE BEAM
REAR AXLE BEAM CENTER TUBE

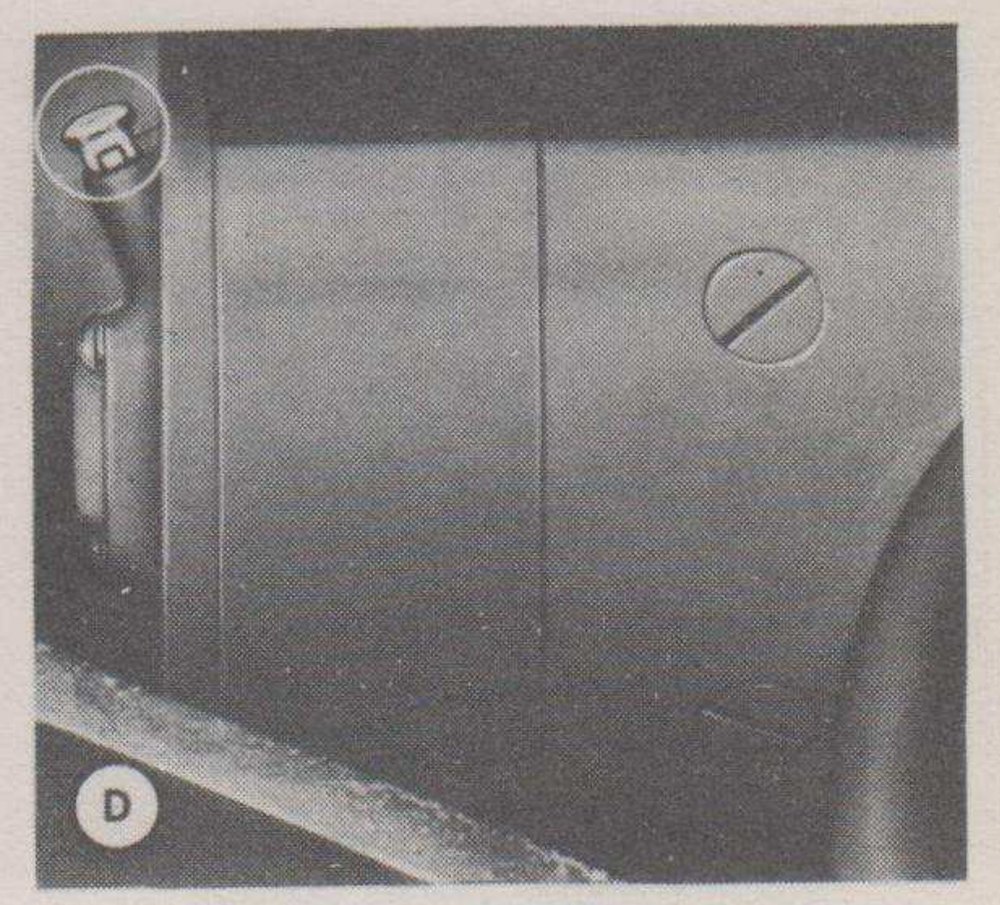
RA PD 321101

Figure 31—Localized Lubrication Views—6

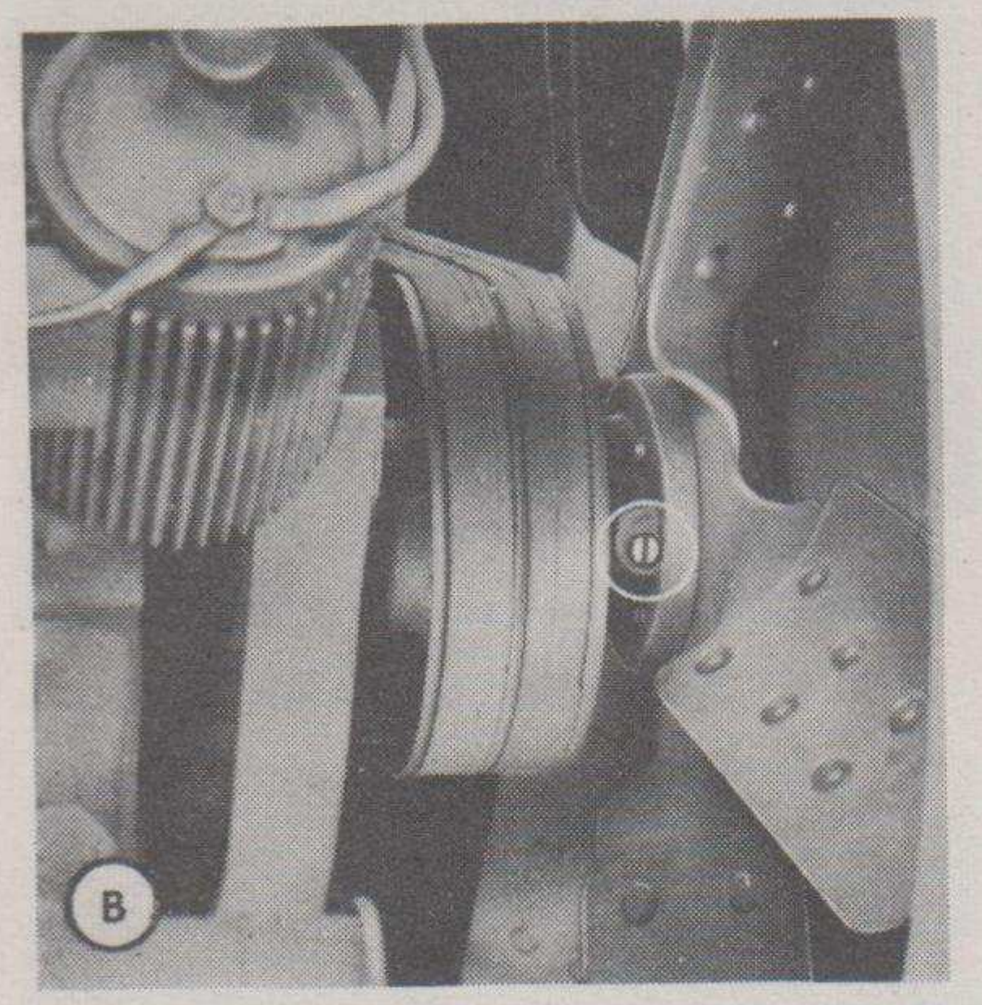
LUBRICATION



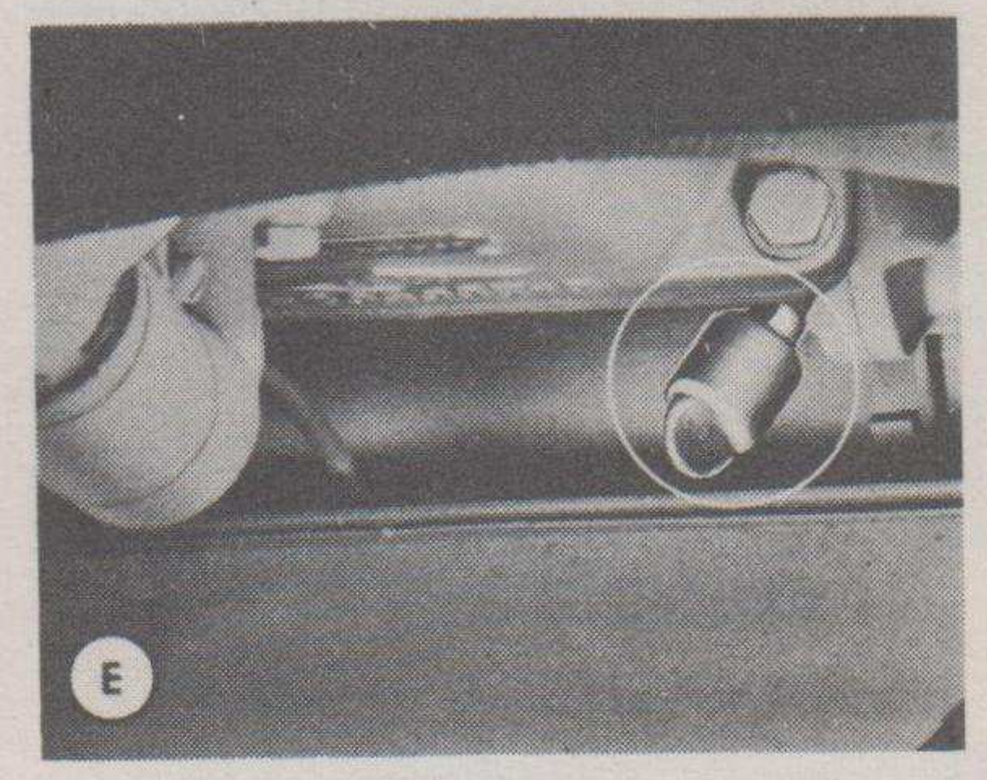
DISTRIBUTOR SHAFT TACHOMETER
ADAPTER CRANKCASE BREATHER



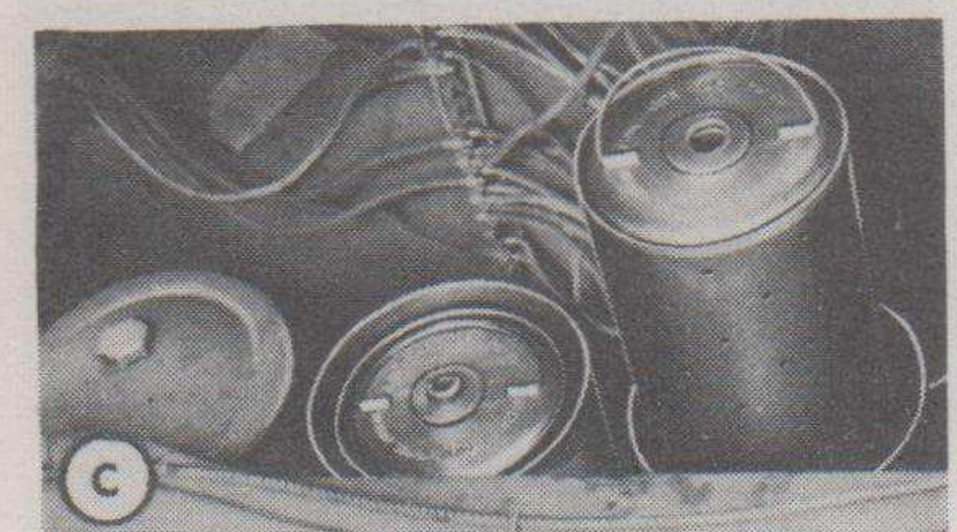
CRANKING MOTOR



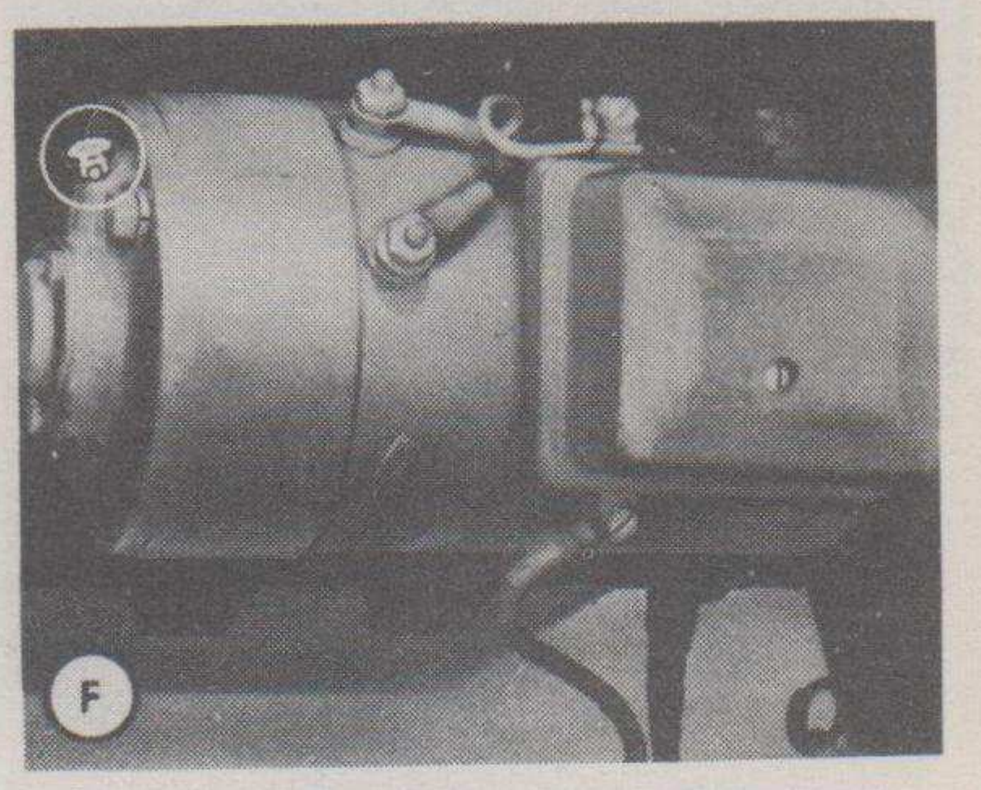
FAN (PLUG)



WATER PUMP



OIL FILTERS



GENERATOR

RA PD 321116

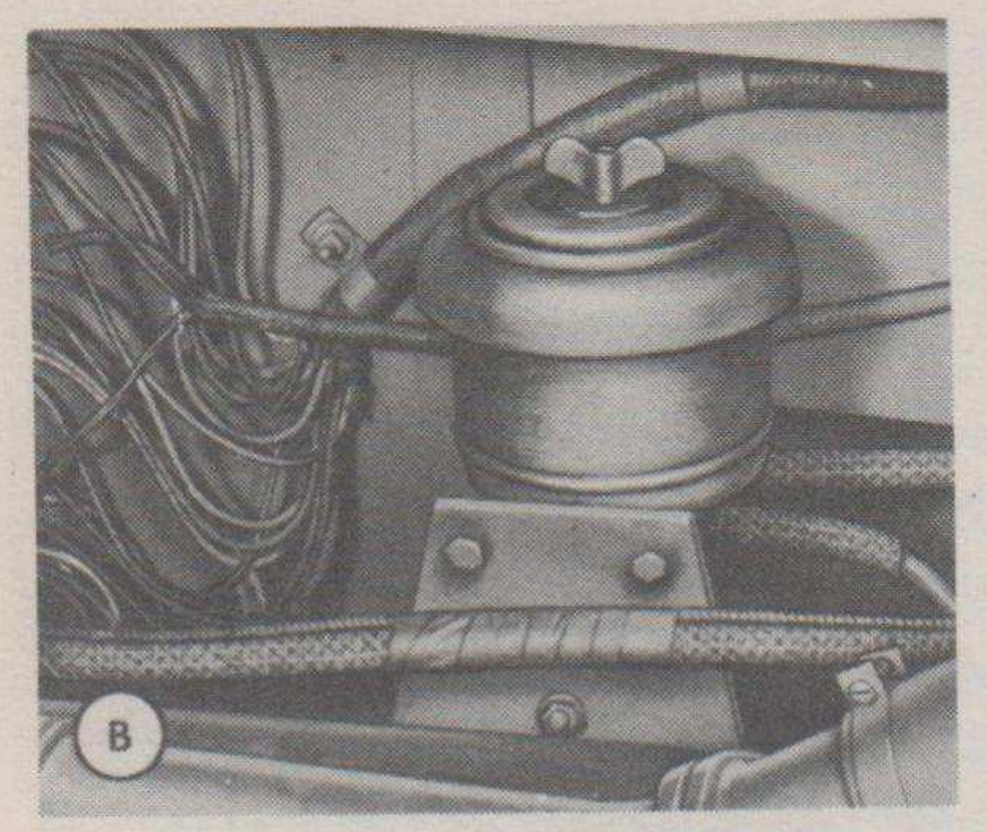
Figure 32—Localized Lubrication Views—7



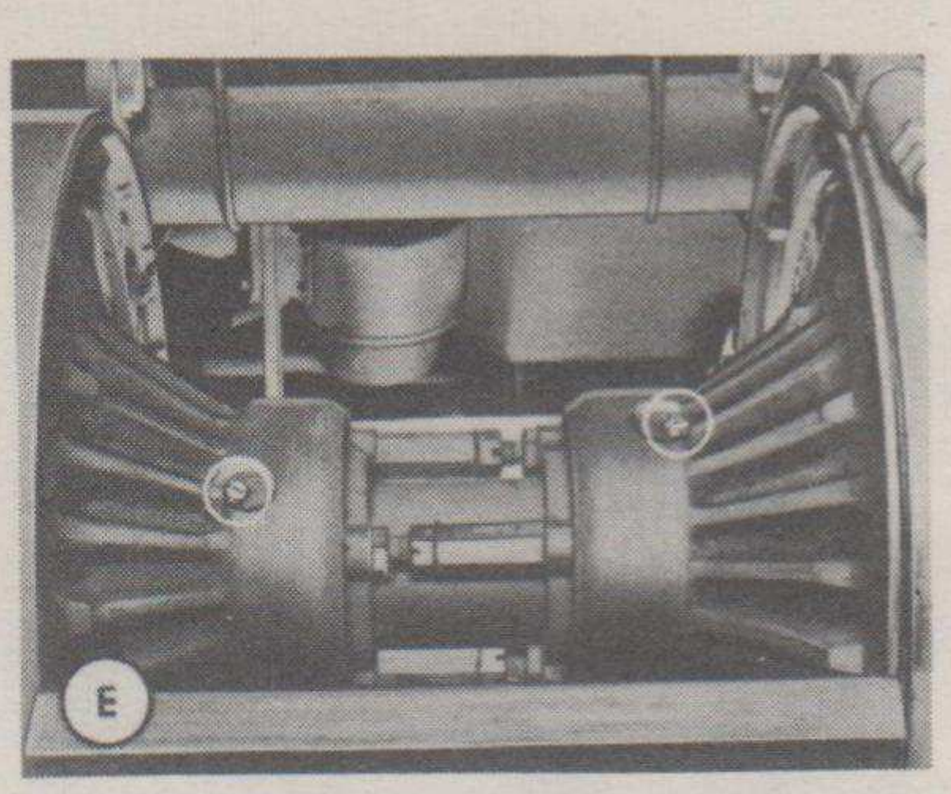
AIR CLEANER



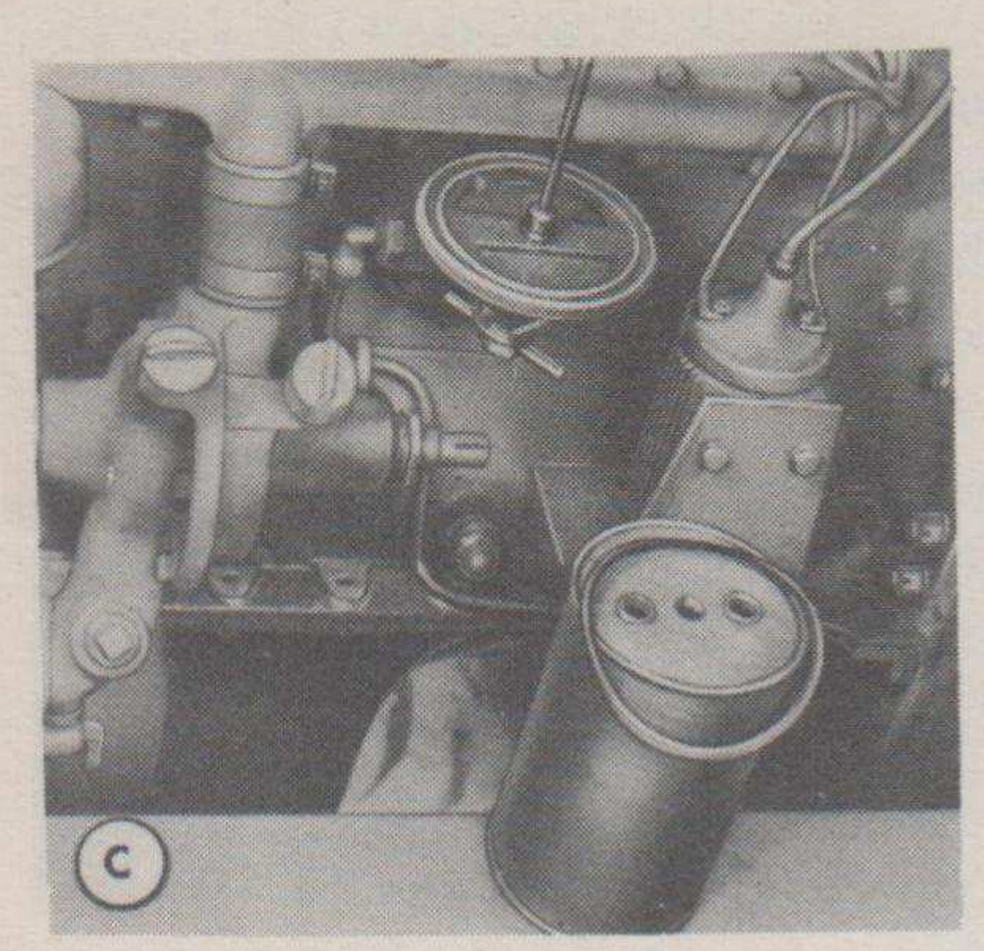
GENERATOR



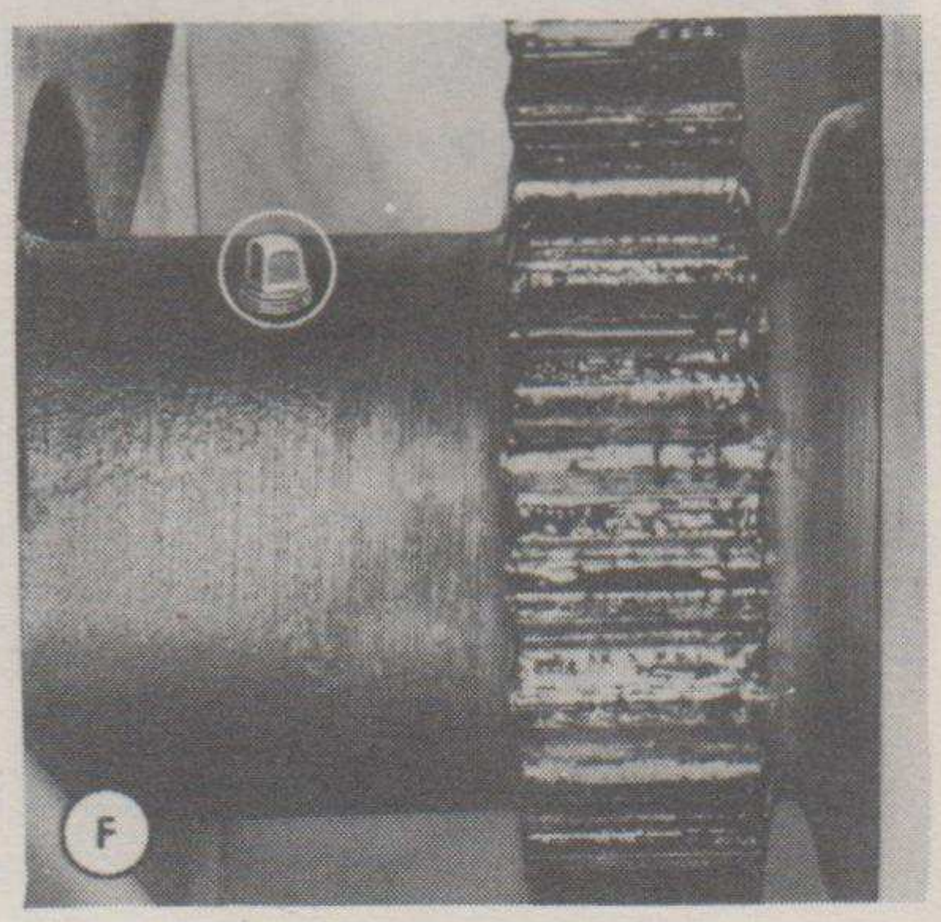
AIR COMPRESSOR AIR CLEANER



SWING CLUTCH DRUM BEARINGS (PLUG)



OIL FILTER

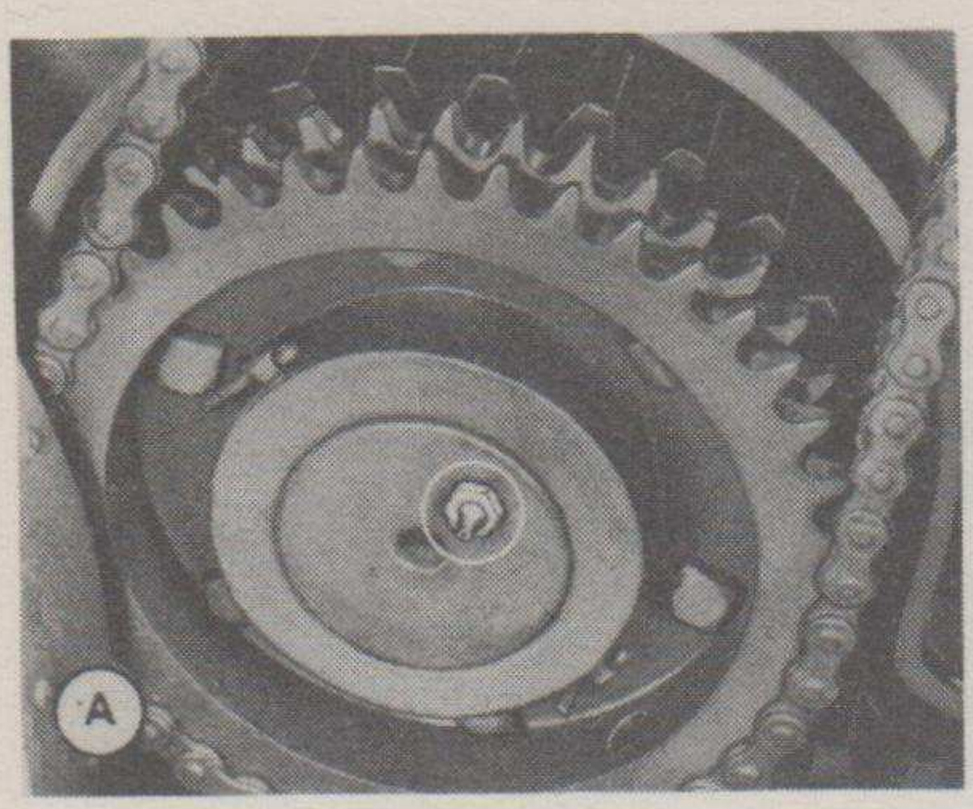


CENTER DRIVE SHAFT BEARINGS

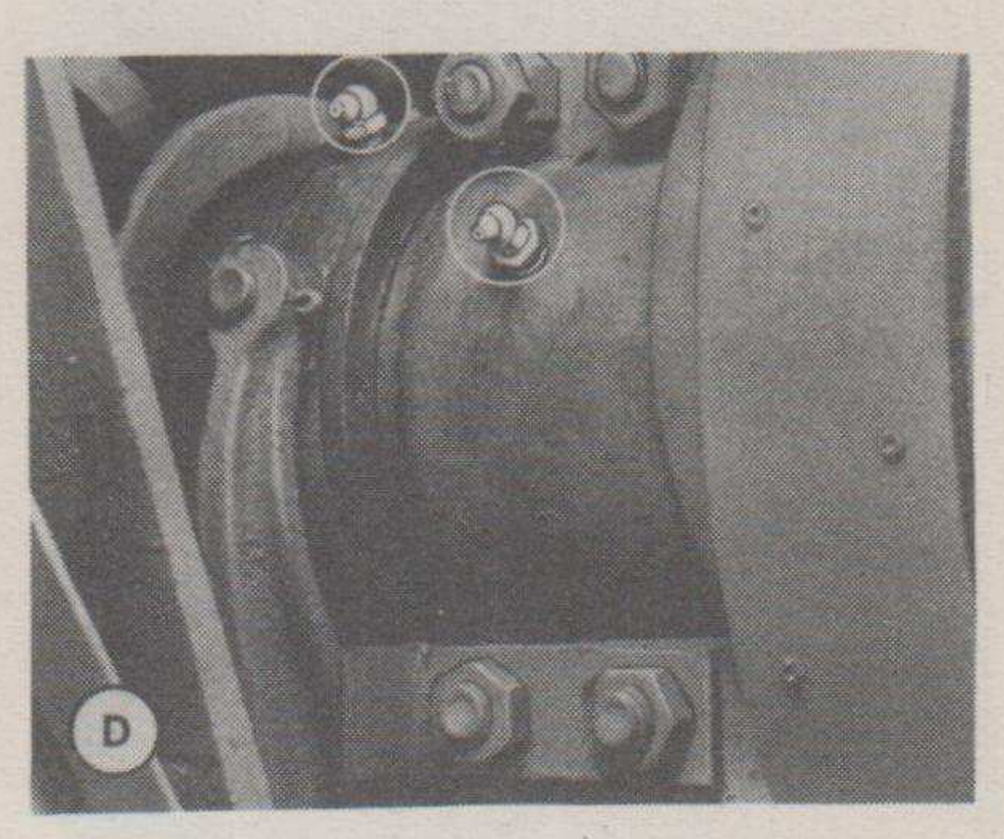
RA PD 321098

Figure 33—Localized Lubrication Views—8

LUBRICATION



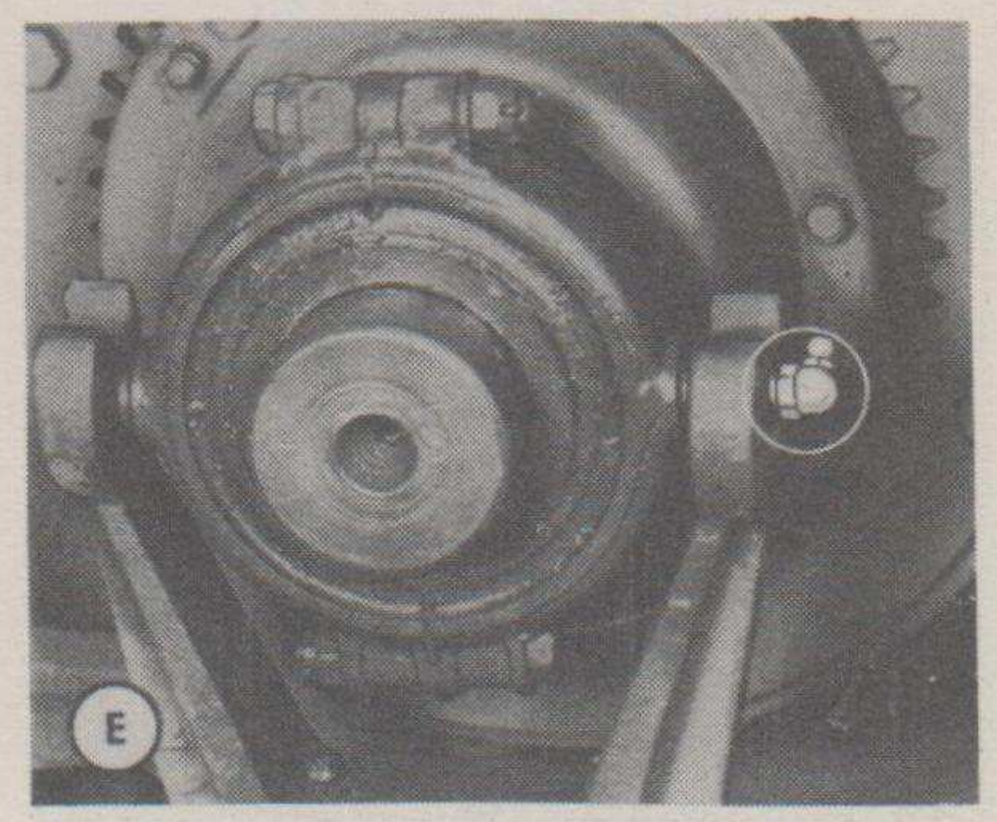
BOOM HOIST IDLER GEAR



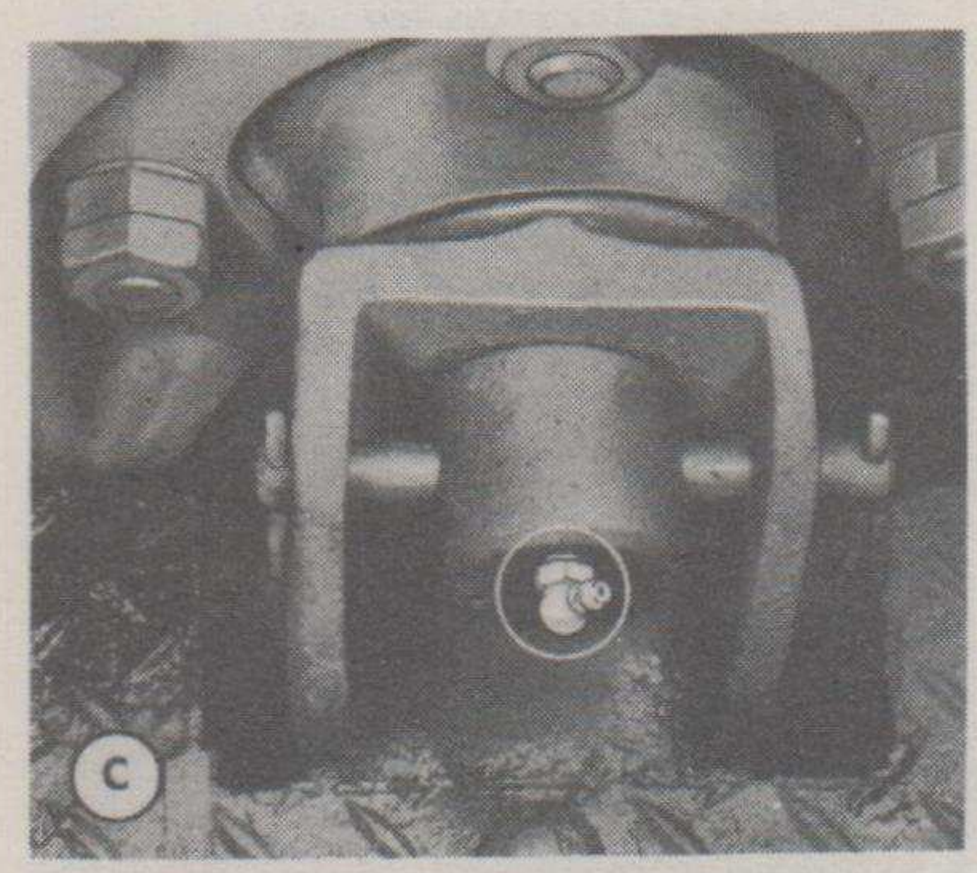
SWING SHAFT BEARING
SWING SHAFT SLIDING SLEEVE



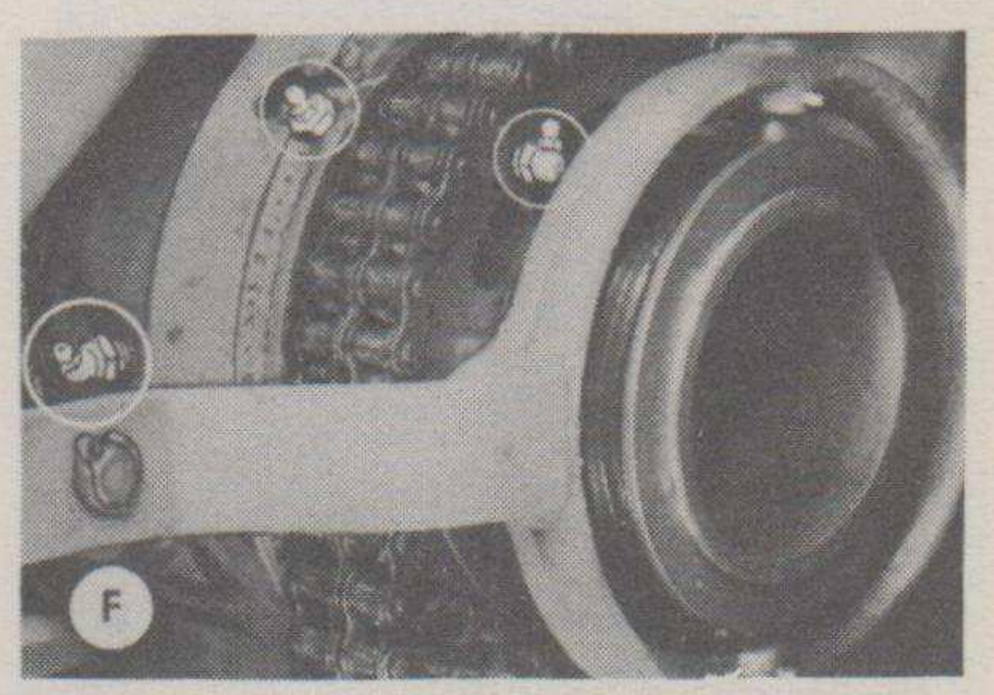
HOIST AND CLAM DRUM
SLIDING SLEEVE



BOOM HOIST SLIDING SLEEVE



BOOM HOIST DRUM SHAFT BEARING



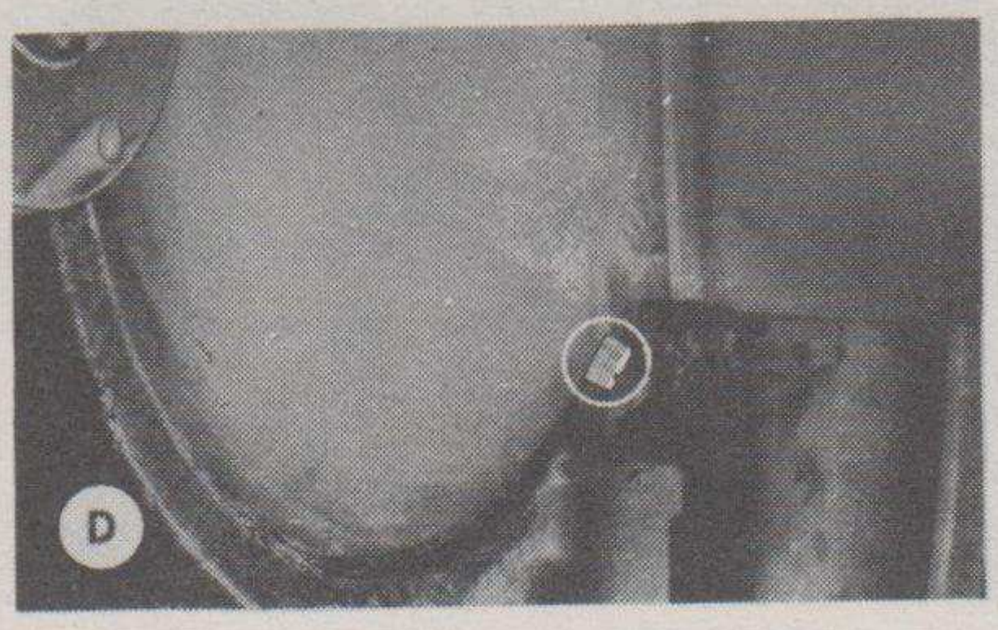
PRECISION BOOM HOIST RATCHET
HOIST SHAFT BEARING
PRECISION BOOM HOIST SPROCKET

RA PD 321054

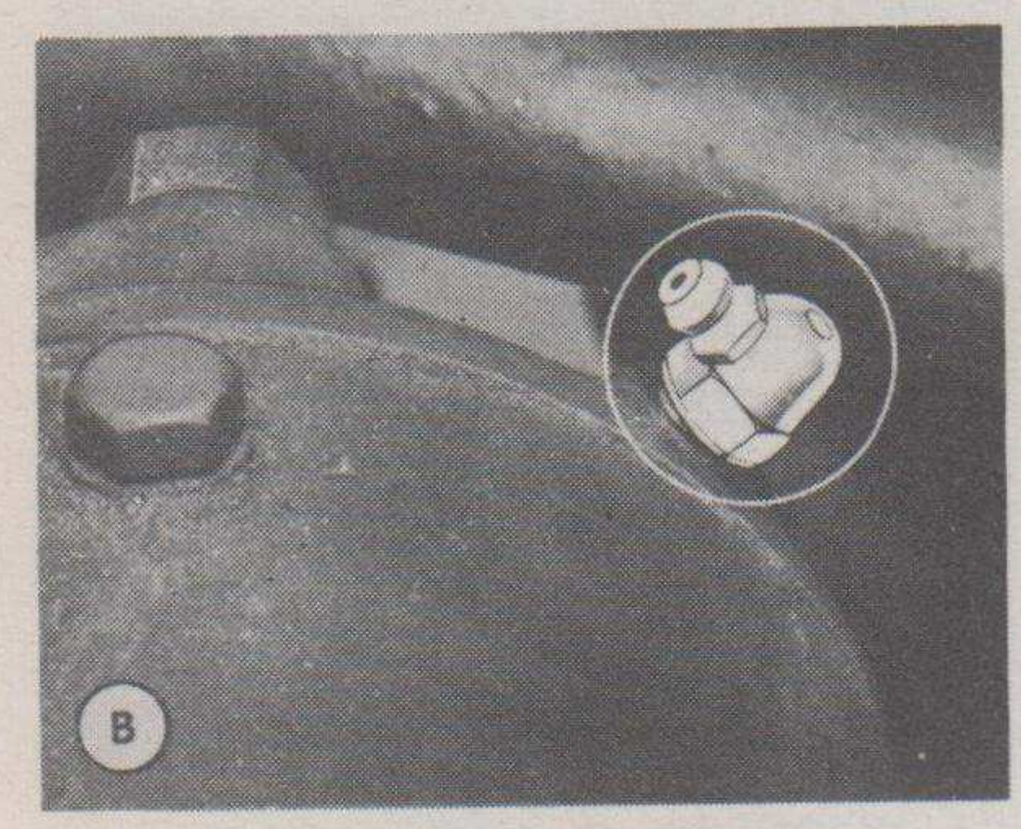
Figure 34—Localized Lubrication Views—9



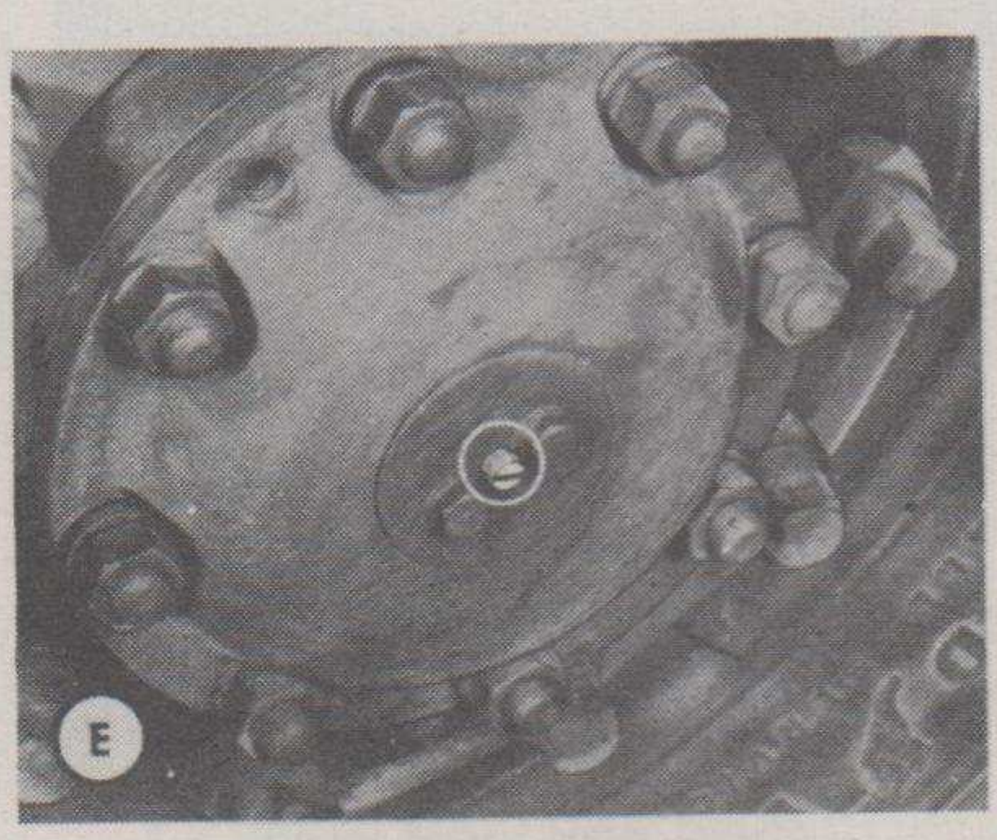
TIE ROD BRAKE ANCHOR PIN



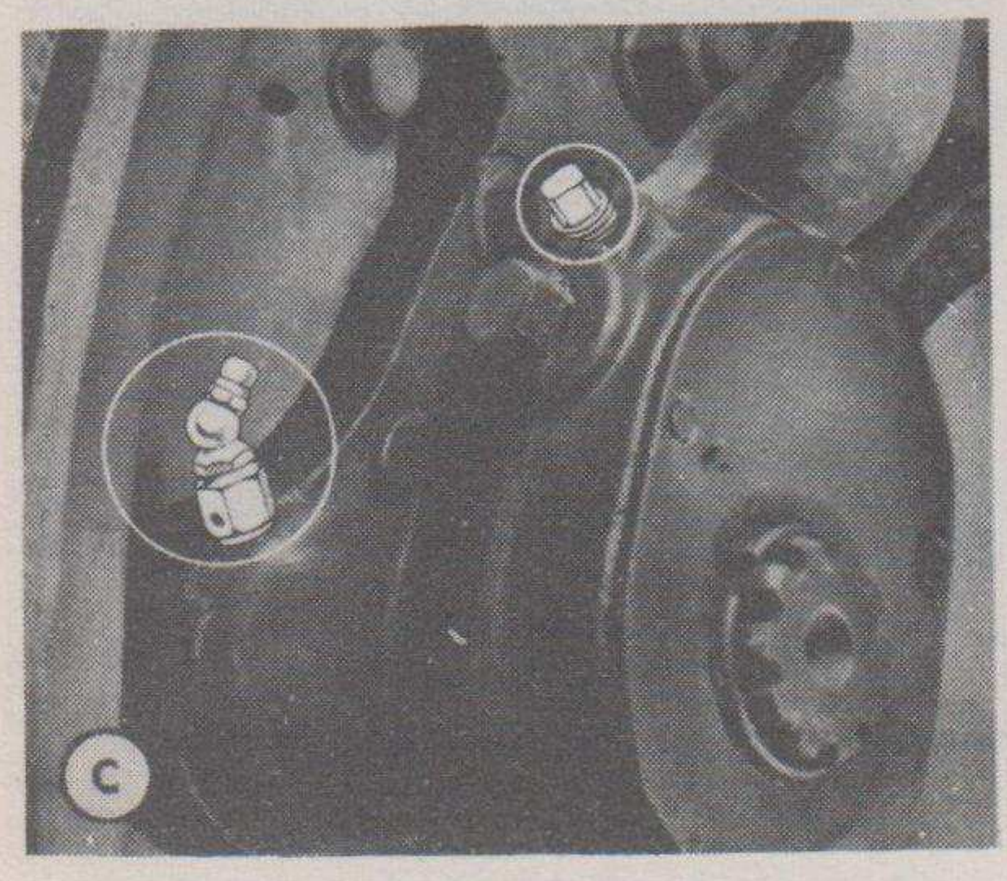
UNIVERSAL JOINT AND
STEERING KNUCKLE LOWER BEARING
(INSPECTION PLUG)



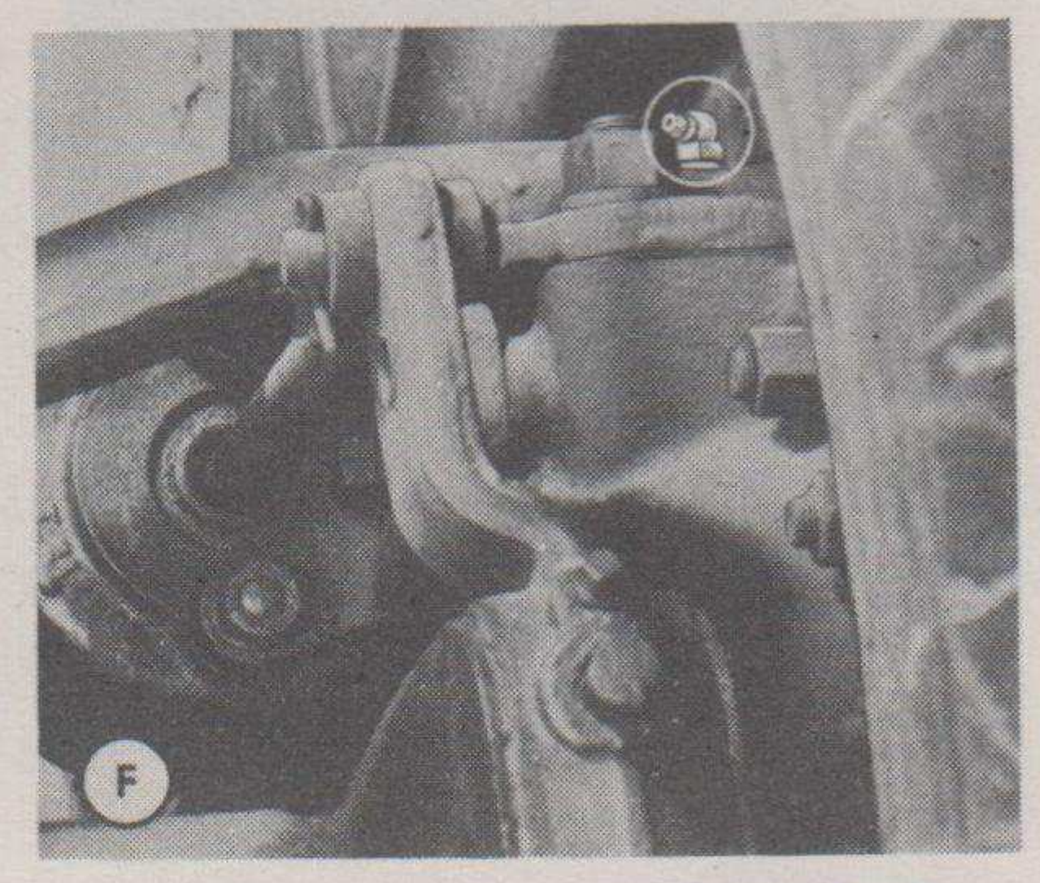
BRAKE CYLINDER



UNIVERSAL JOINT AND
STEERING KNUCKLE
LOWER BEARING (FILL PLUG)



BRAKE CAMSHAFT
SLACK ADJUSTER (PLUG)

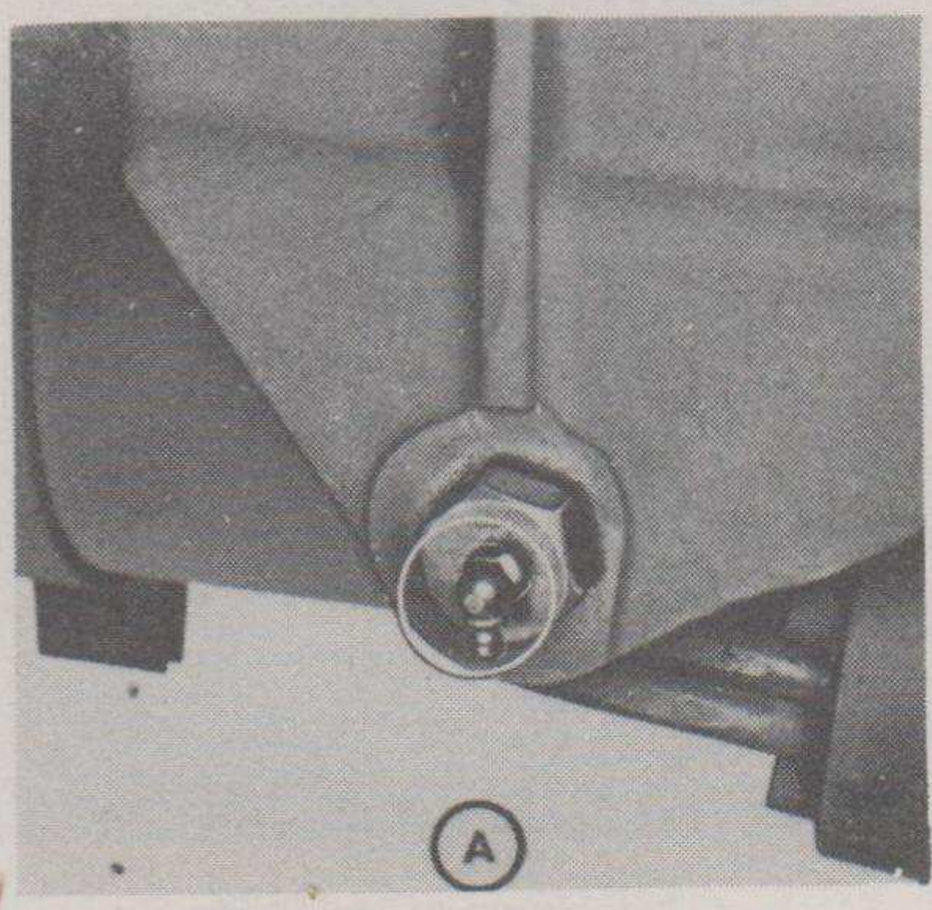


STEERING KNUCKLE UPPER BEARING

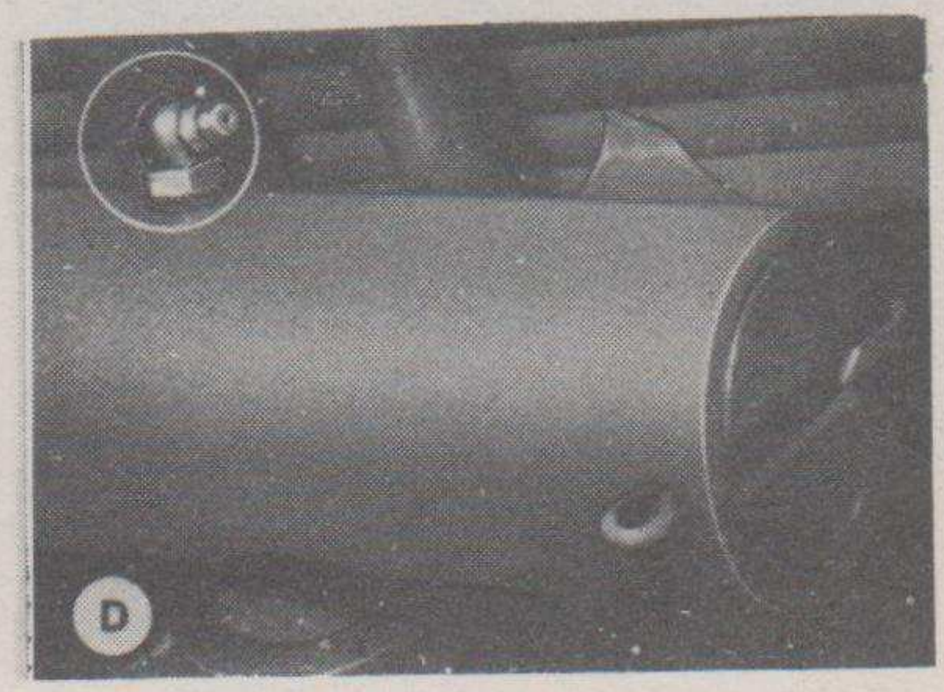
RA PD 321060

Figure 35—Localized Lubrication Views—10

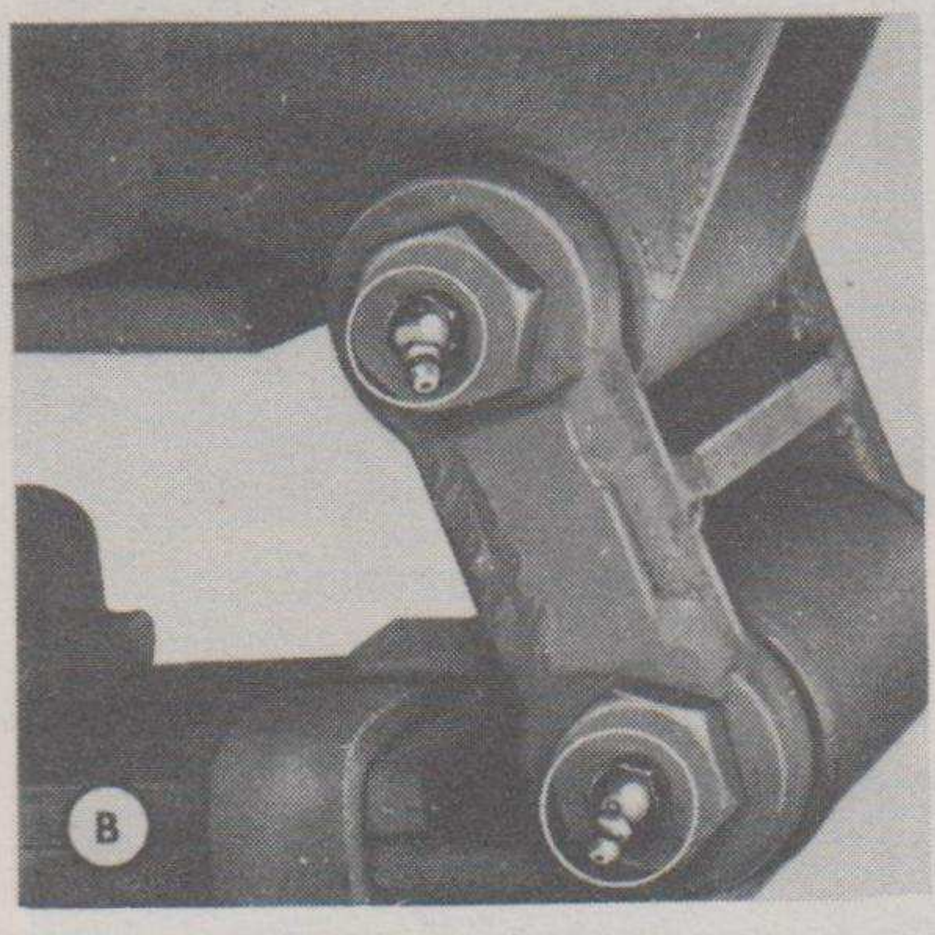
LUBRICATION



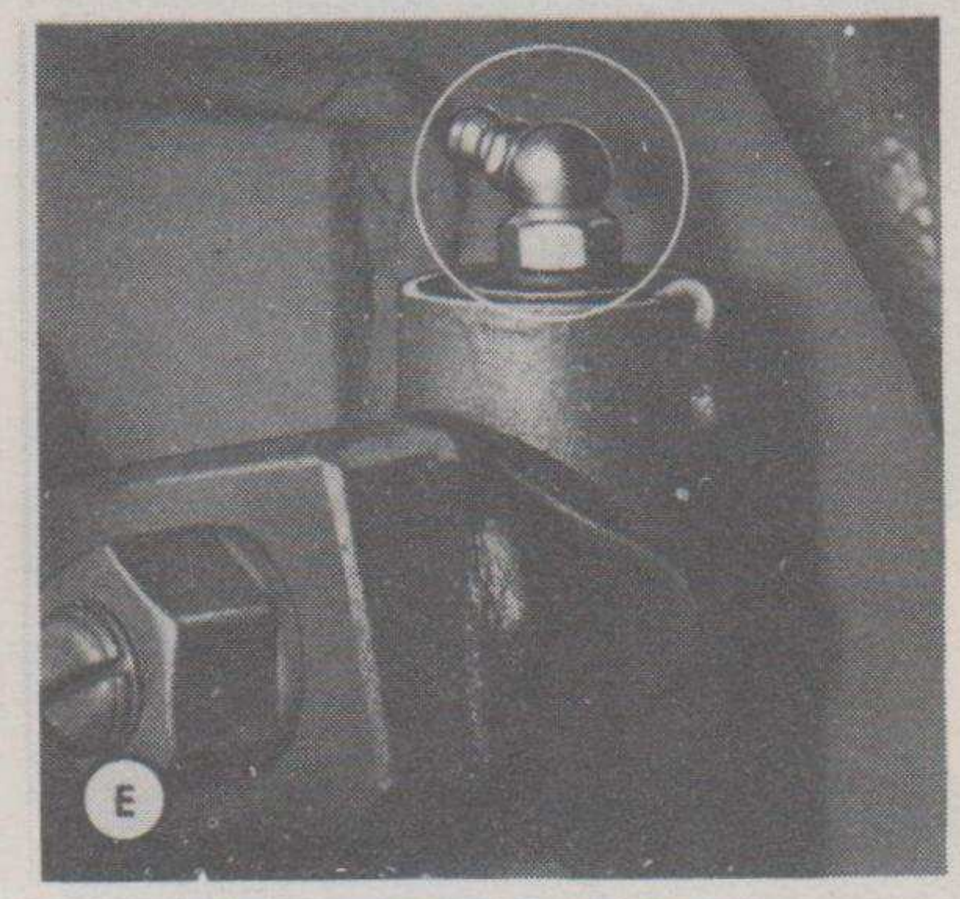
SPRING BOLT



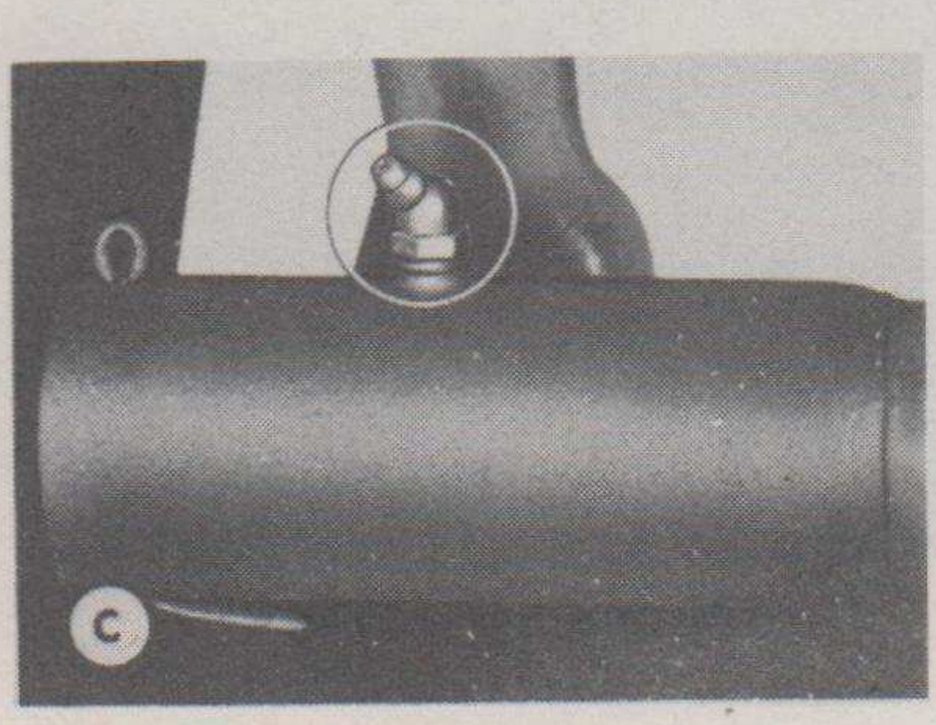
DRAG LINK (REAR END)



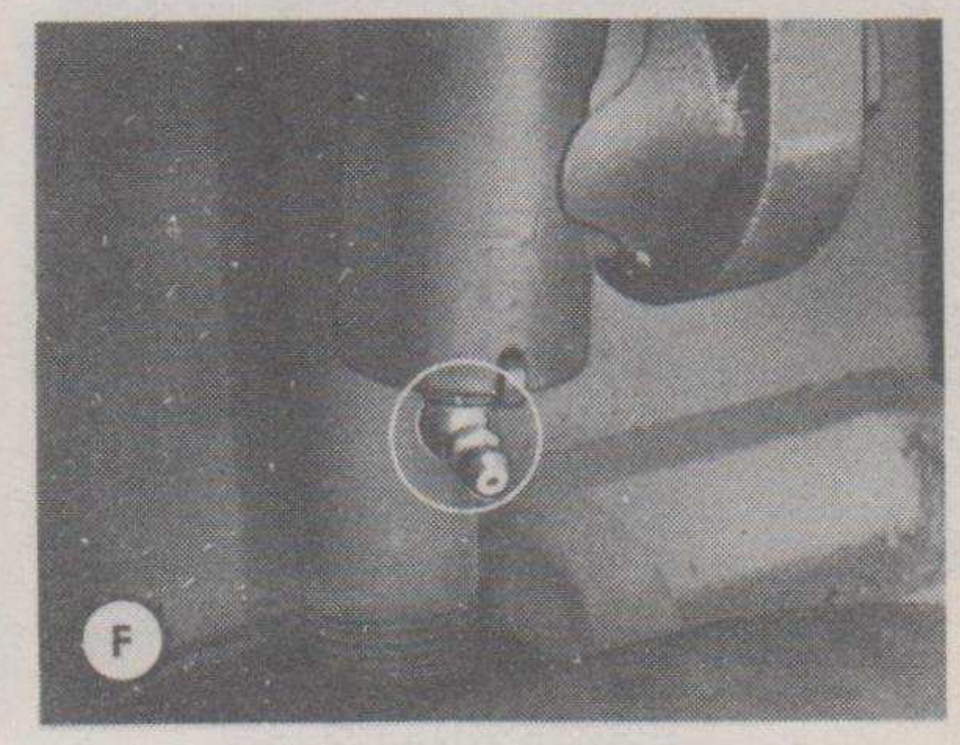
SPRING SHACKLE



SHOCK ABSORBER LINKS (TOP)



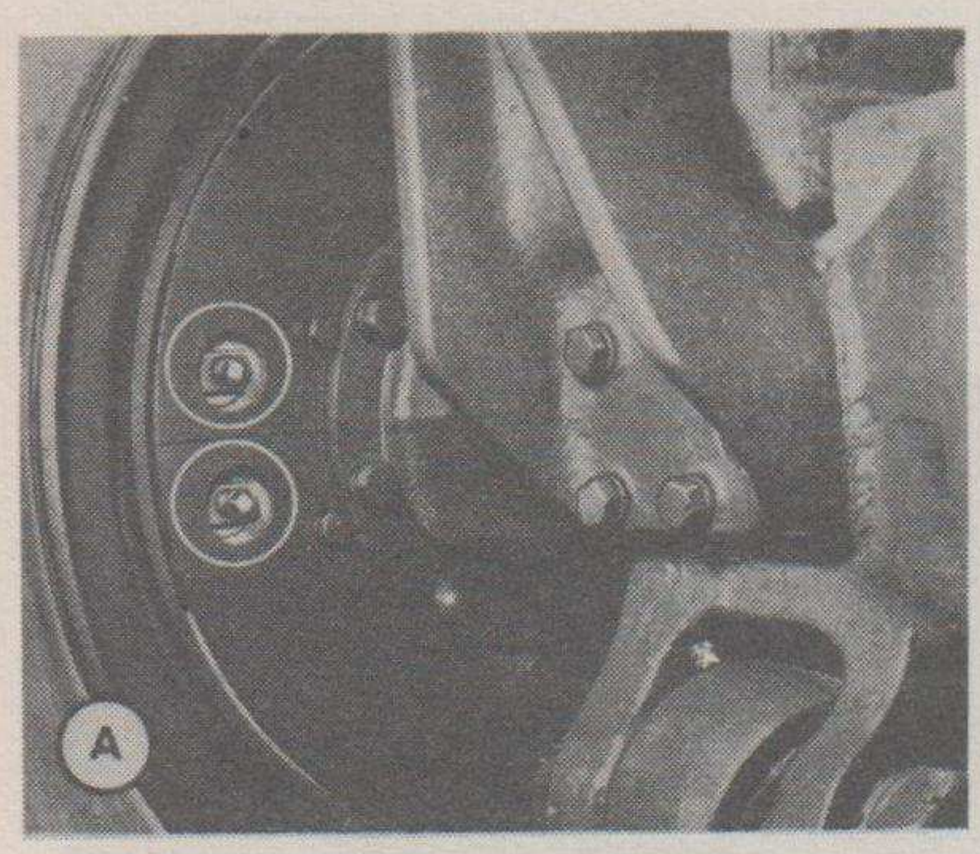
DRAG LINK (FRONT END)



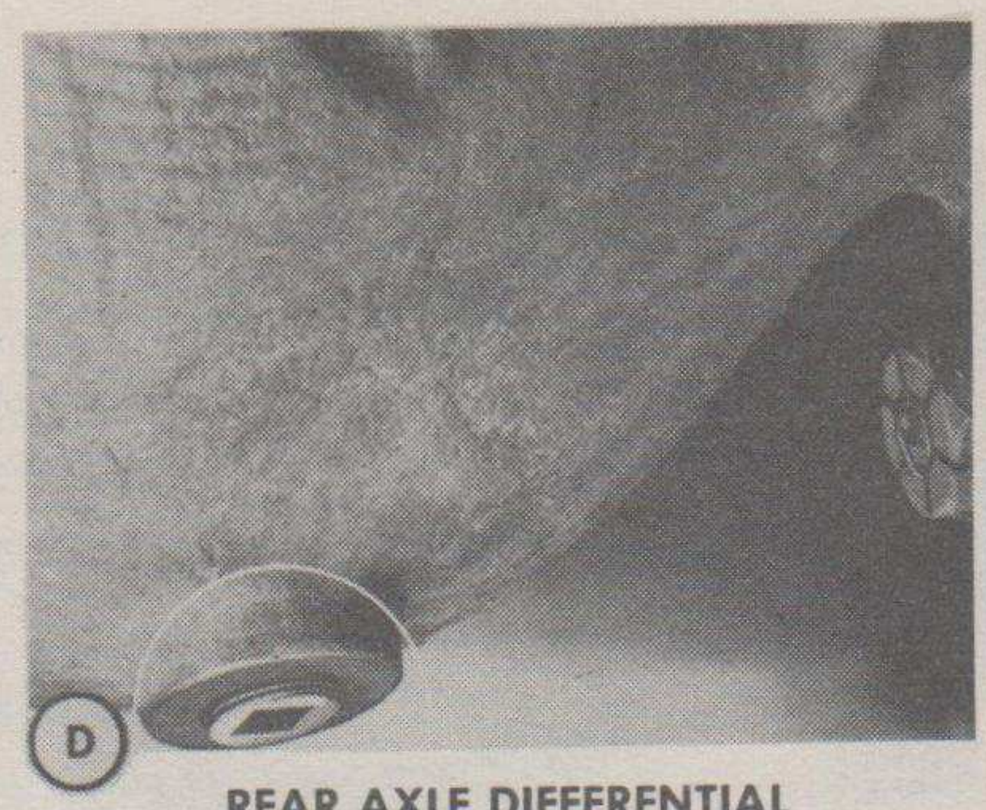
SHOCK ABSORBER LINKS (BOTTOM)

RA PD 321097

Figure 36—Localized Lubrication Views—11



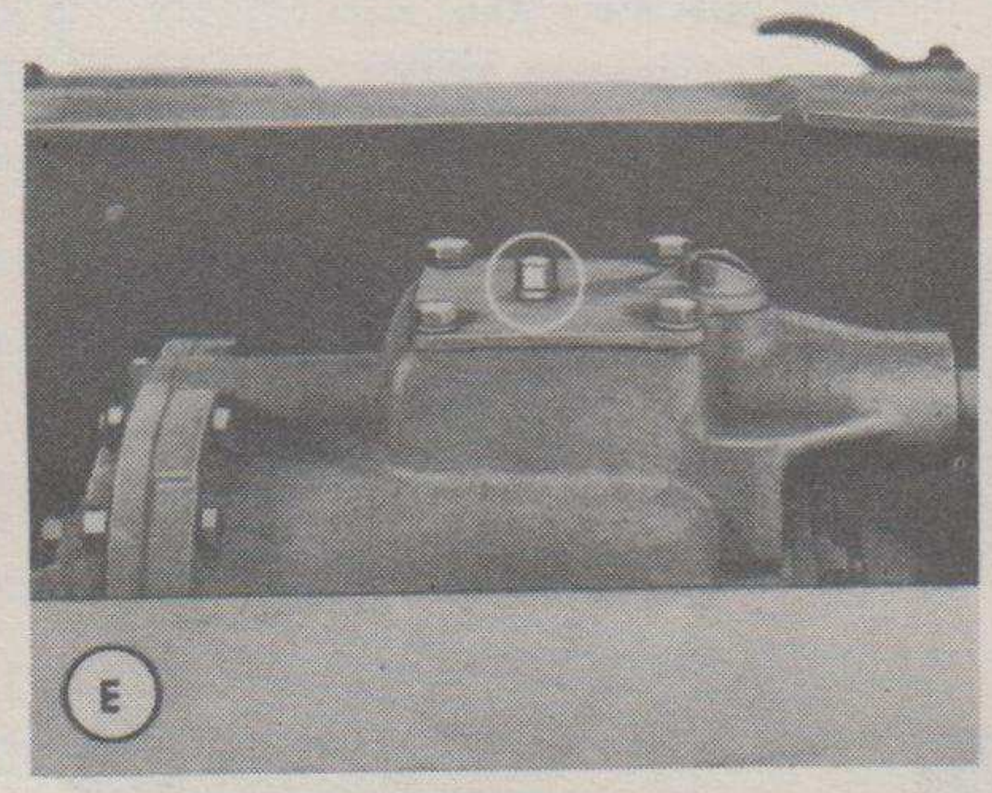
BRAKE ANCHOR PIN (PLUG) REAR



REAR AXLE DIFFERENTIAL DRAIN PLUG



TRANSMISSION DRAIN PLUG



TRANSFER CASE BREATHER

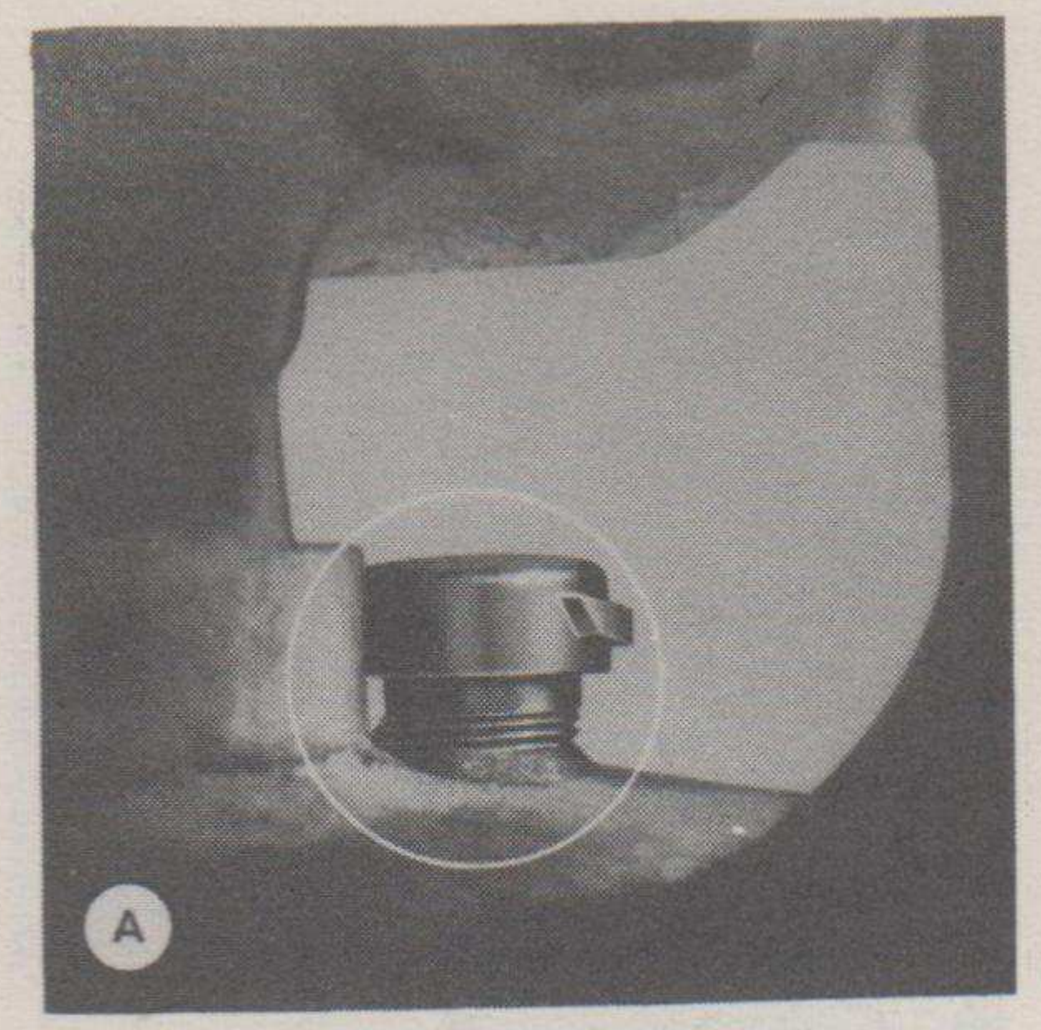
FRONT AXLE BREATHER

STEERING GEAR LEVEL (PLUG)

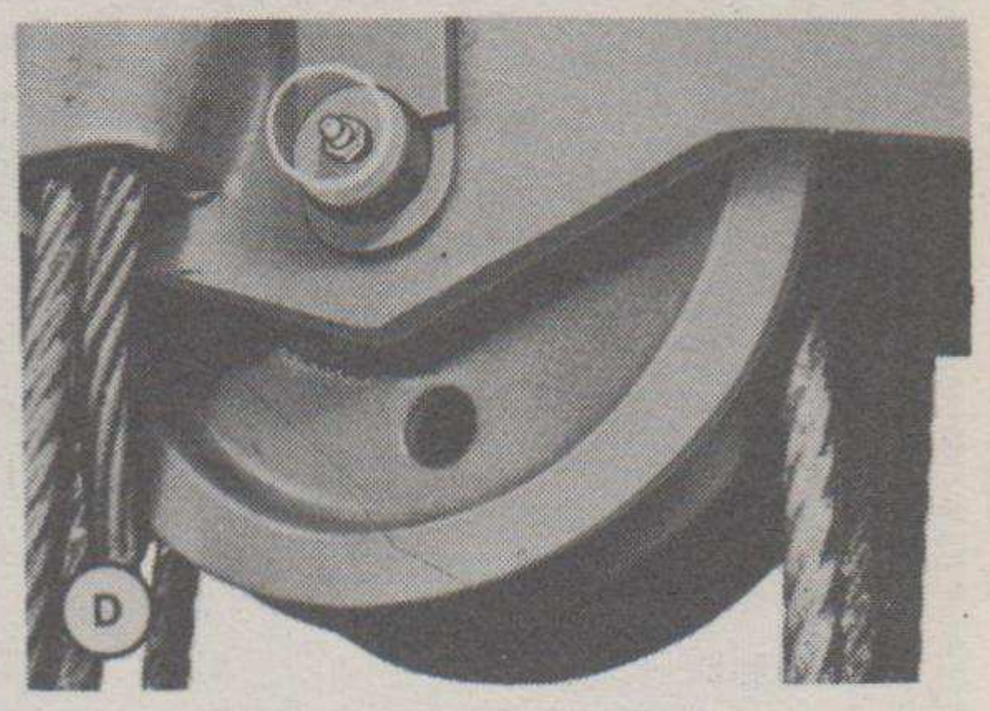
RA PD 321096

Figure 37—Localized Lubrication Views—12

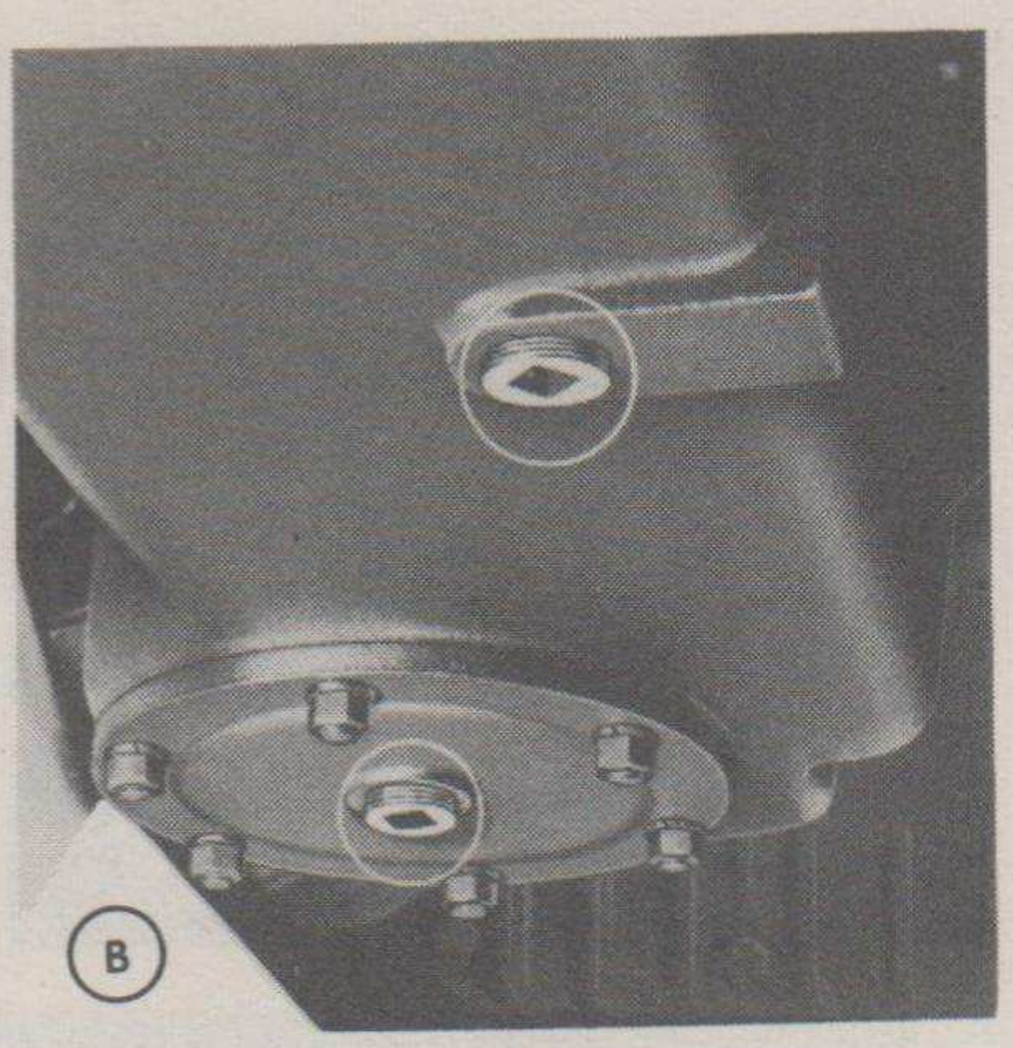
LUBRICATION



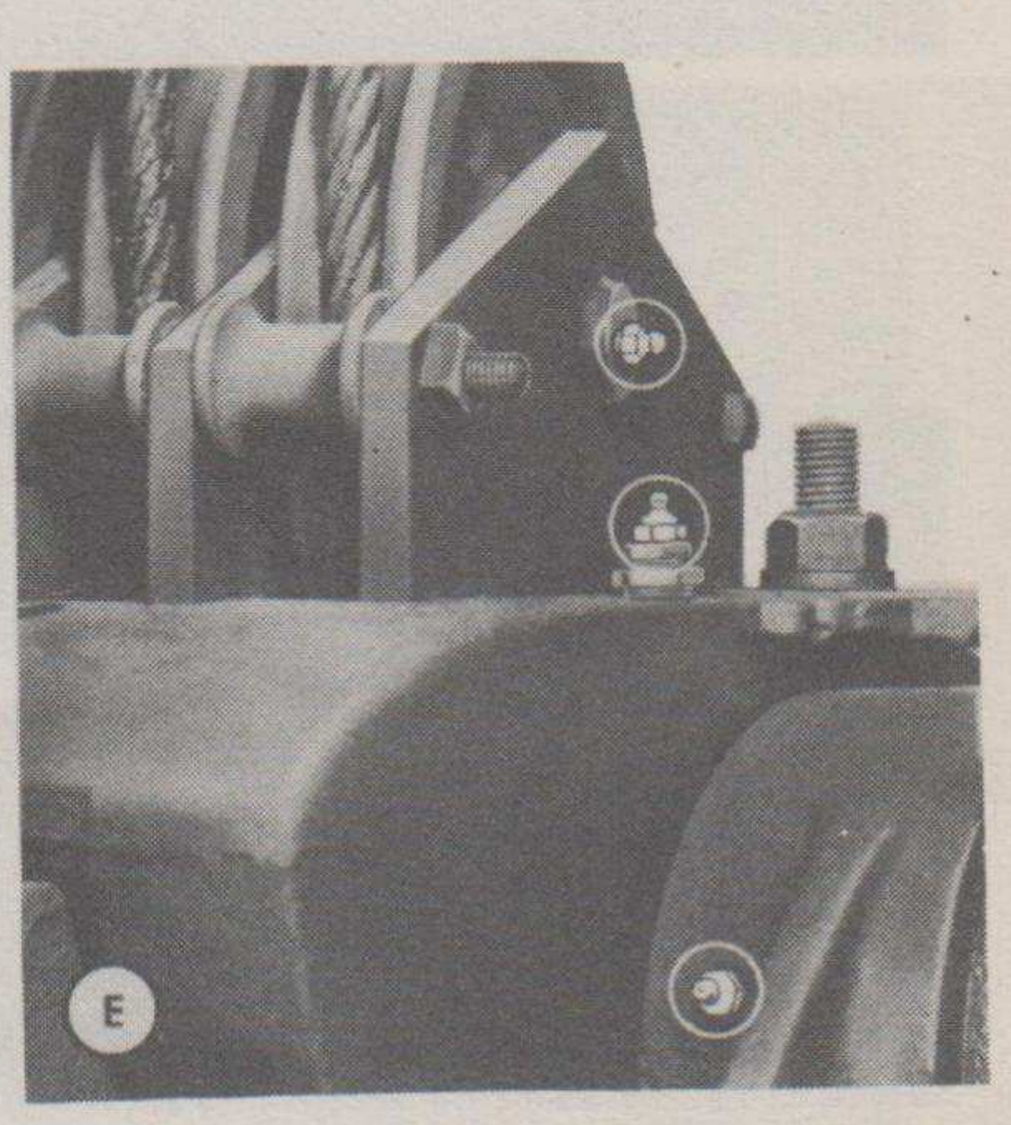
REAR AXLE BREATHER



TOP SHEAVE BLOCK



CRANKCASE (DRAIN PLUGS)



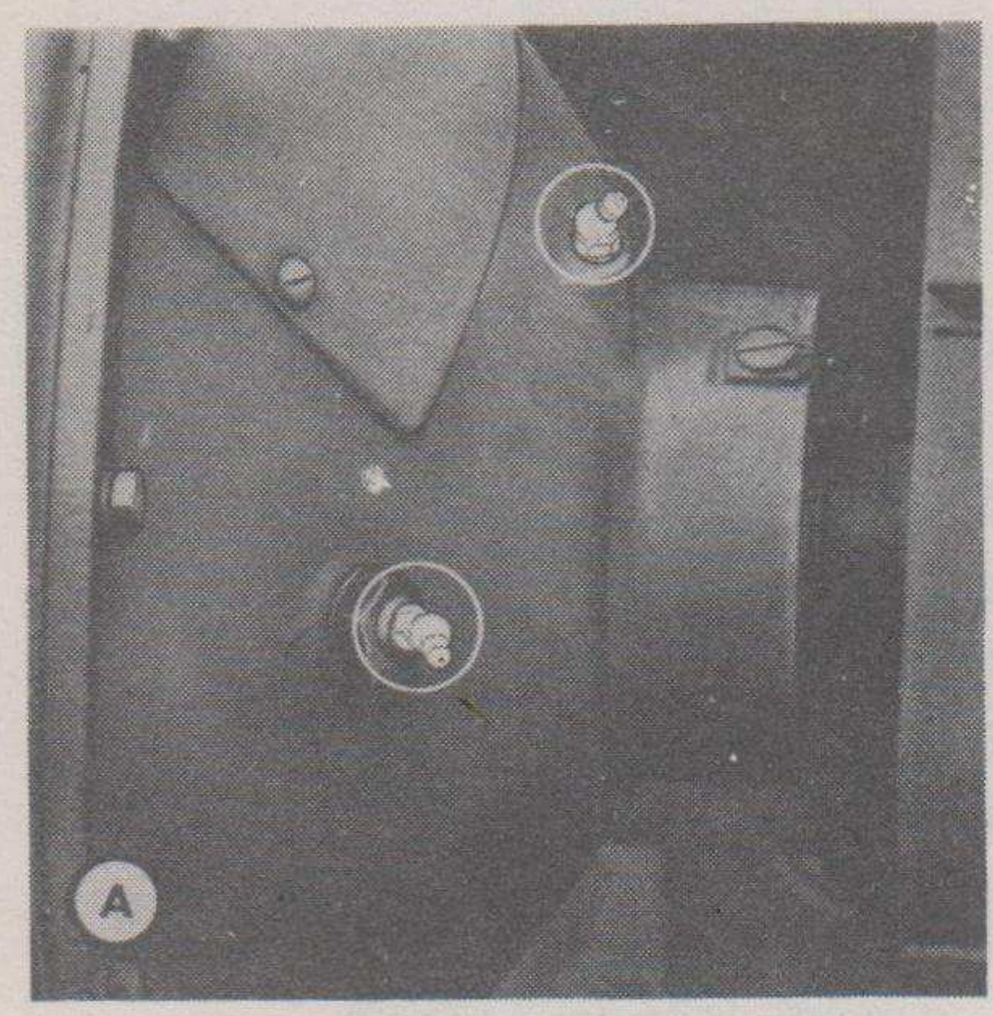
BOTTOM SHEAVE BLOCK
COUNTERWEIGHT BEARING
BUCKET HINGE BEARING

ARM BRACKET

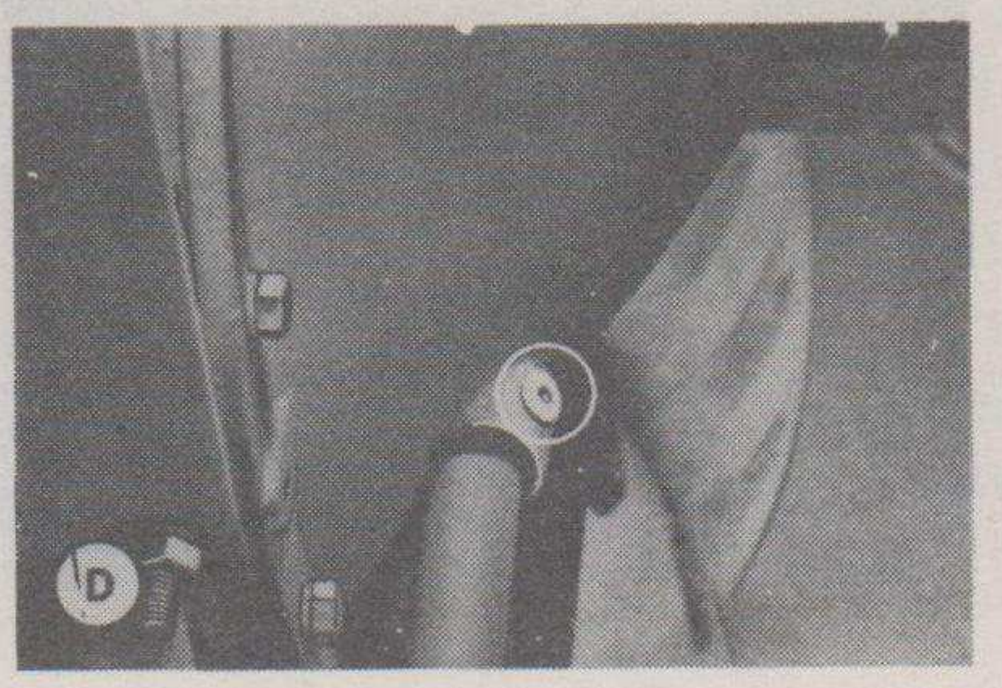
HEAD HINGE BEARING

RA PD 321068

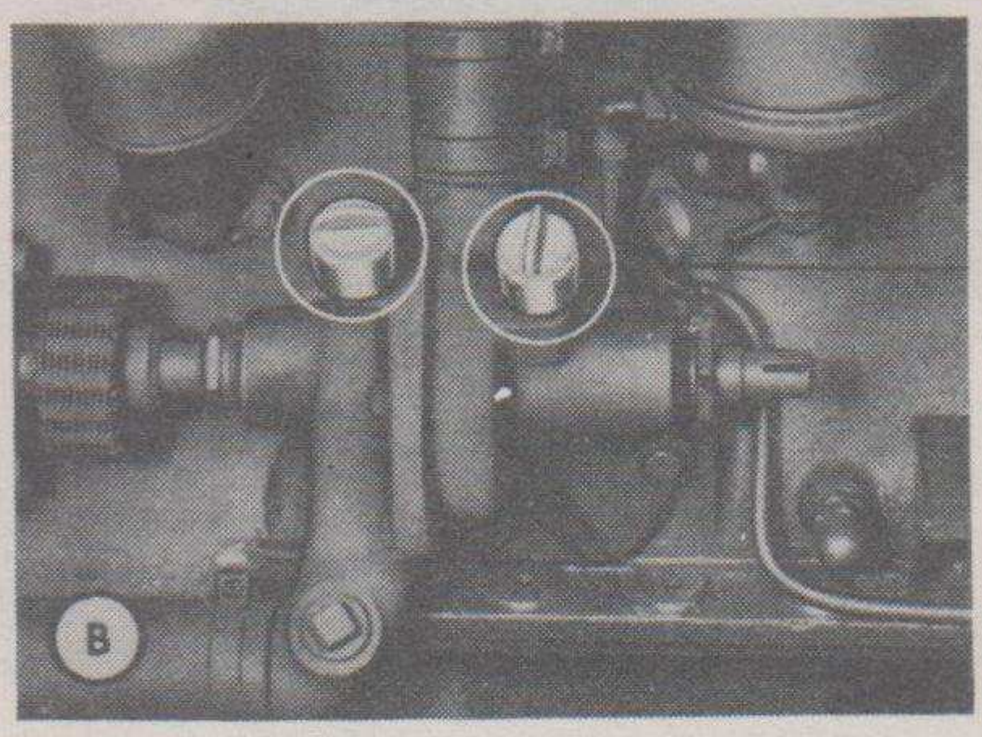
Figure 38—Localized Lubrication Views—13



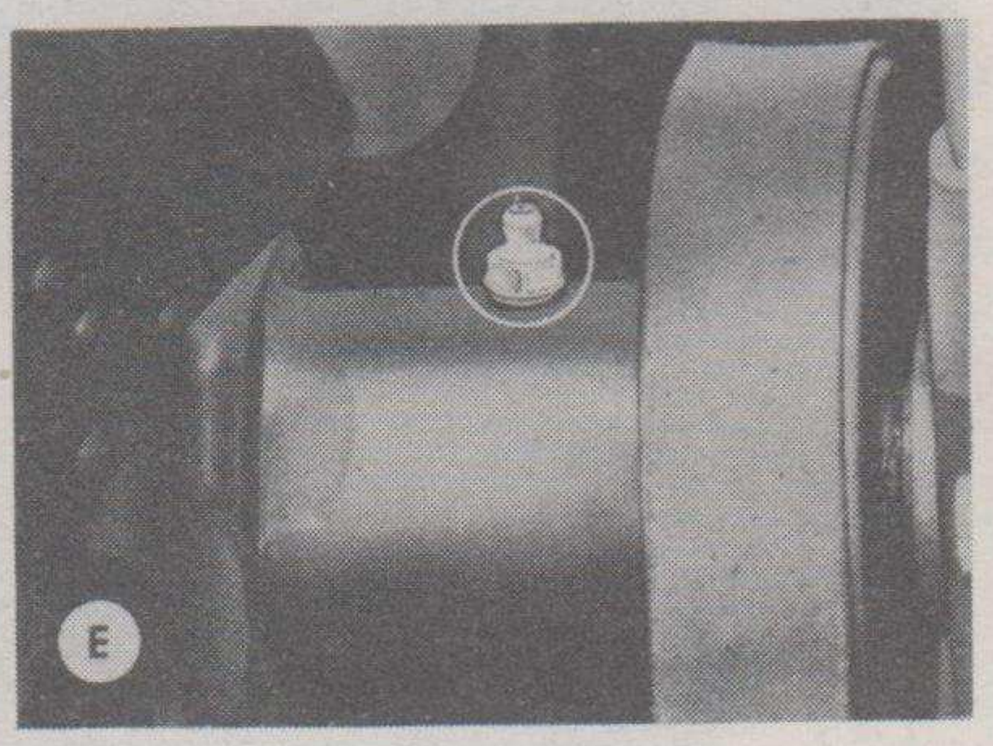
CLUTCH THROW-OUT BEARING
POWER TAKE-OFF BEARING



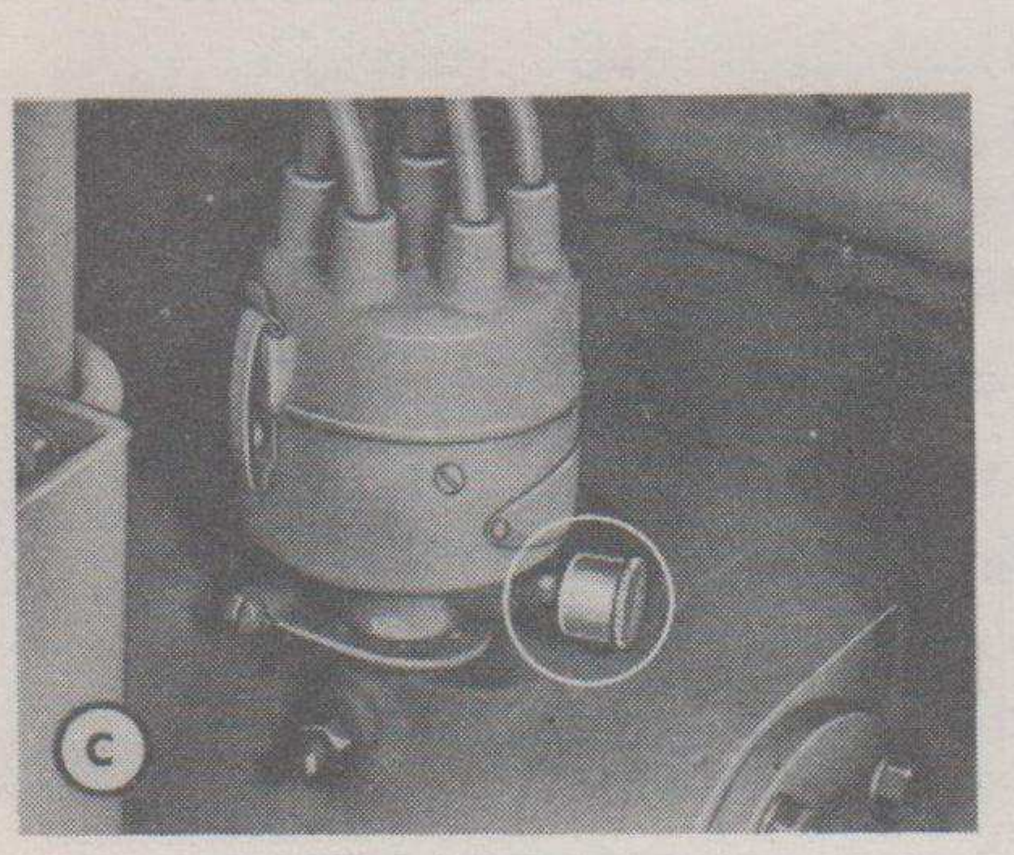
CLUTCH CROSS SHAFT BEARING



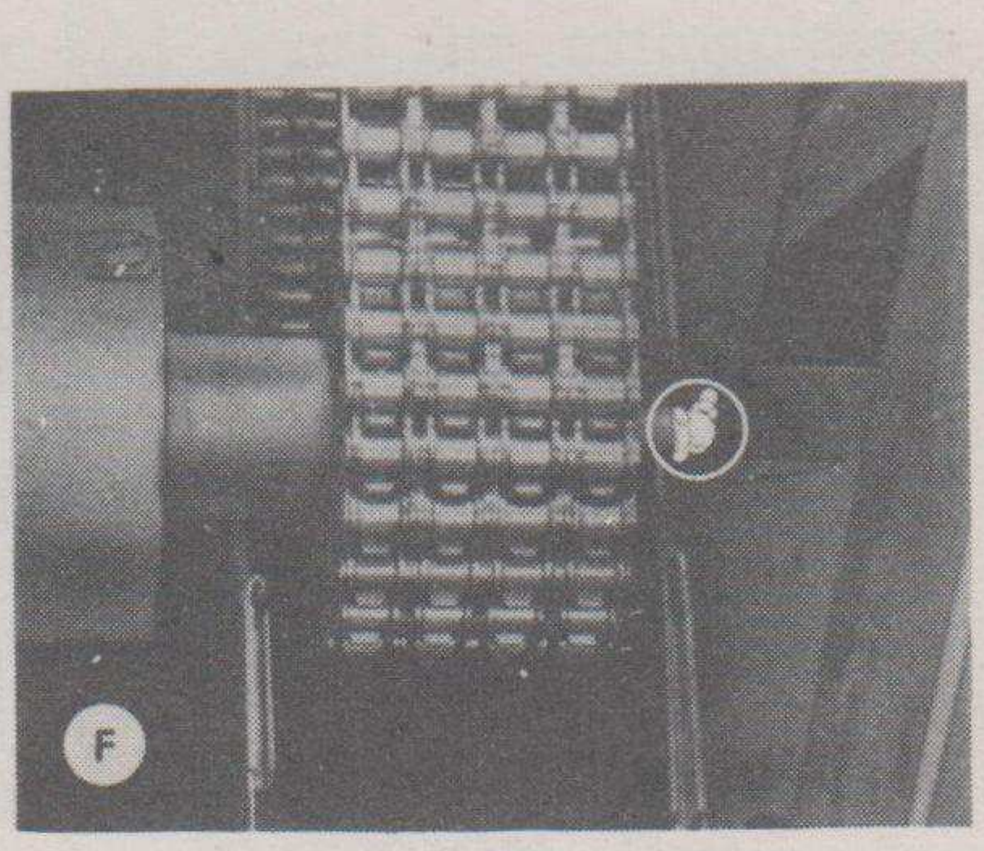
WATER PUMP
OIL LEVEL GAGE



FAN



DISTRIBUTOR SHAFT

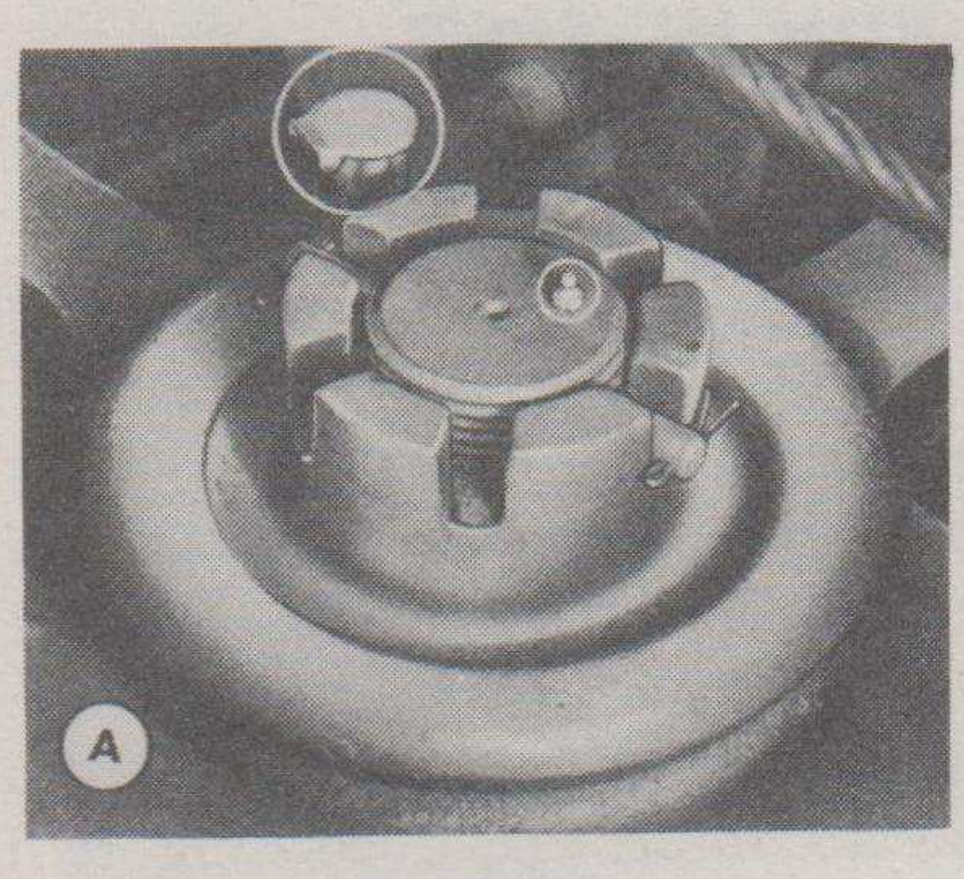


CLUTCH PILOT BEARING

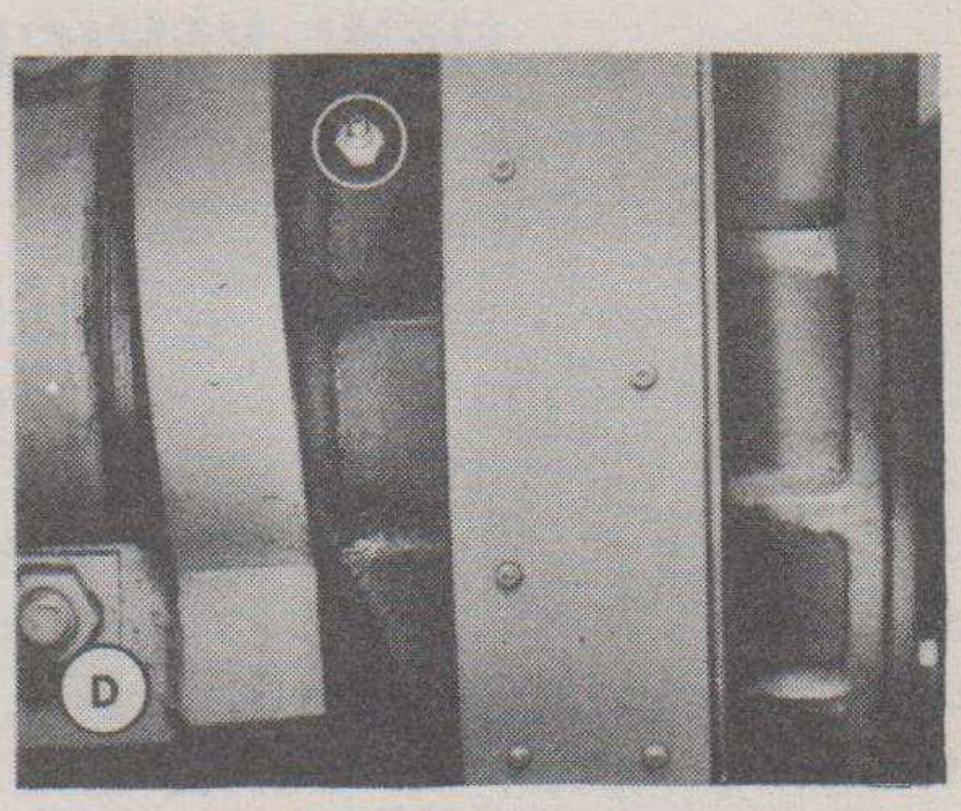
RA PD 321115

Figure 39—Localized Lubrication Views—14

LUBRICATION



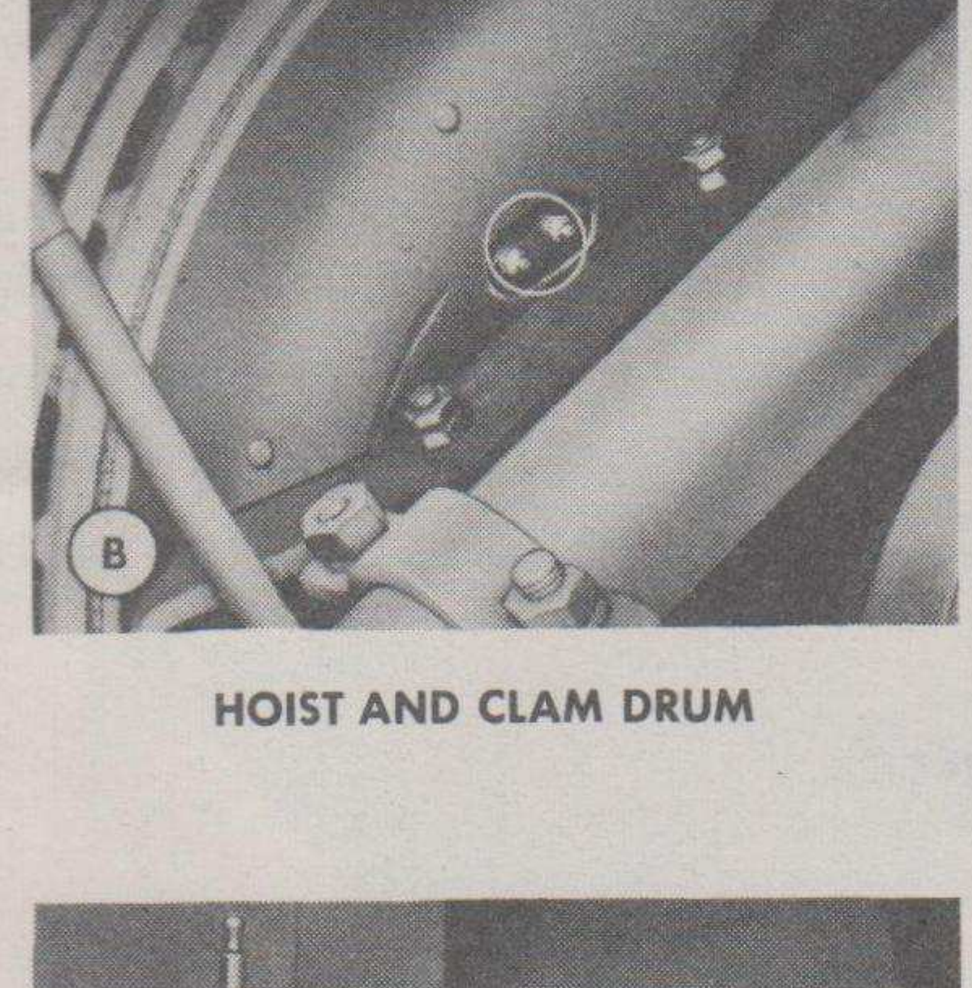
CENTER PIN



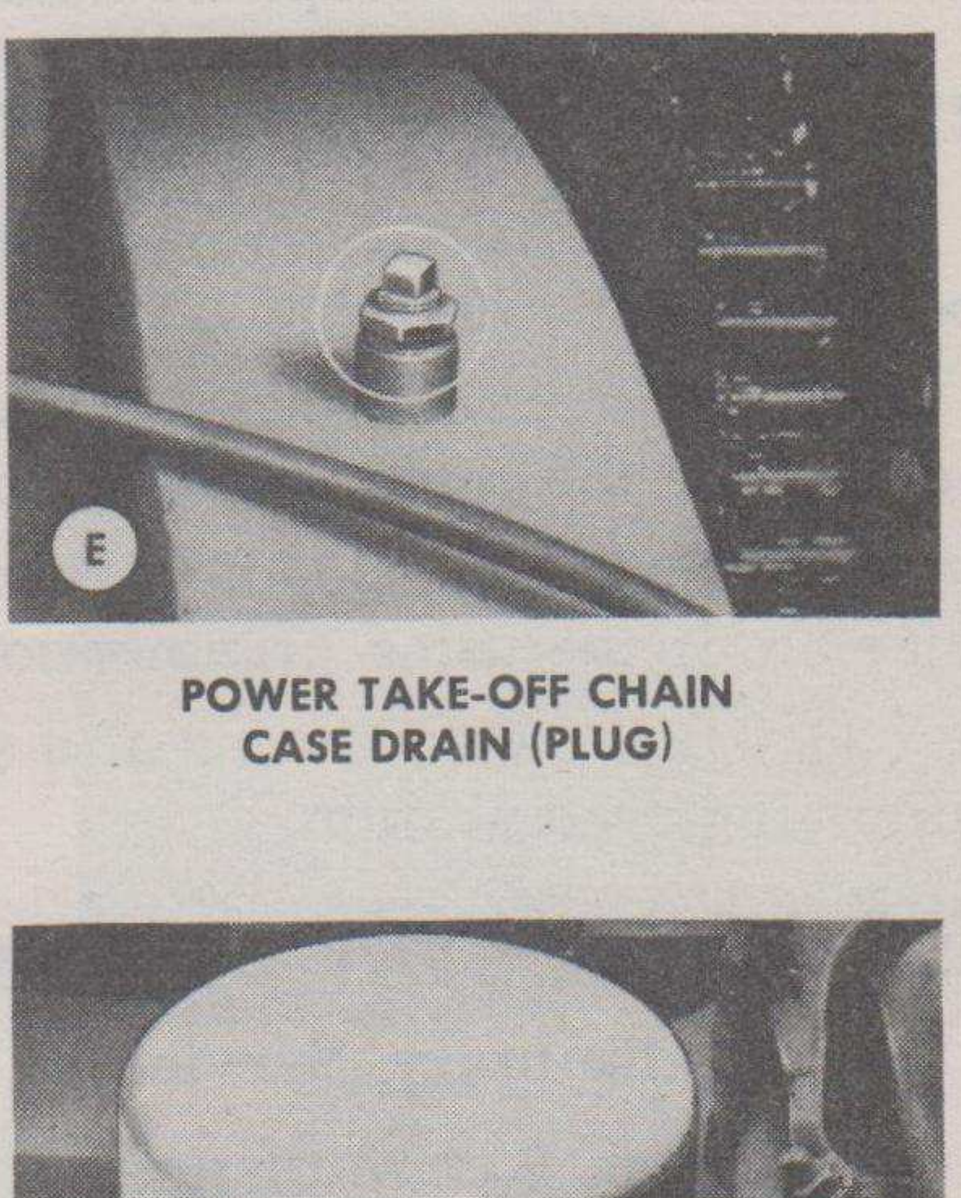
BOOM HOIST BRAKE WHEEL BEARING

HOIST AND CLAM DRUM

POWER TAKE-OFF CHAIN CASE DRAIN (PLUG)



POWER TAKE-OFF CHAIN (OILER)



AIR CLEANER

RA PD 321069

Figure 40—Localized Lubrication Views—15

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

Section X

NEW VEHICLE RUN-IN TEST

21. PURPOSE.

a. When a new or reconditioned vehicle is first received at the using organization, it is necessary for second echelon personnel to determine whether or not it will operate satisfactorily when placed in service. For this purpose, inspect all accessories, subassemblies, assemblies, tools, and equipment to see that they are in place and correctly adjusted. In addition, they will perform a run-in test of at least 50 miles on carrier and make an operating test of the crane as directed in AR 850-15 paragraph 25 table III, according to the procedures in paragraph 23 below.

22. CORRECTION OF DEFICIENCIES.

a. Deficiencies disclosed during the course of the run-in test will be treated as follows:

(1) Correct any deficiencies within the scope of the maintenance echelon of the using organization before they are placed in service.

(2) Refer deficiencies beyond the scope of the maintenance echelon of the using organization to a higher echelon for correction.

(3) Bring deficiencies of a serious nature to the attention of the supplying organization.

23. RUN-IN TEST PROCEDURES.

a. Preliminary Service.

(1) FIRE EXTINGUISHER.

(a) Carrier. See that carrier and crane fire extinguishers are fully charged, securely mounted, and not damaged. Look for evidence of opened operating valve or leakage. Remove filler plug of liquid type to determine contents; carbon-dioxide type must be weighed.

(b) Crane. Inspect in same manner as in step *(a)* above.

(2) FUEL, OIL, AND WATER.

(a) Carrier. Fill carrier fuel tank. Check engine crankcase and coolant supply, and add oil and coolant as necessary to bring to correct levels. Allow room for expansion in fuel tank and radiator. During freezing weather, test value of antifreeze, and add as necessary to protect cooling system against freezing. CAUTION: *If there is a tag attached to filler cap or steering wheel concerning engine oil in crankcase, follow instructions on tag before driving vehicle.*

(b) Crane. Fill crane fuel tank, using the hand pump. Check

engine crankcase oil and coolant supply, and service in same manner as in step *(a)* above.

(3) FUEL FILTER.

(a) Carrier. Inspect carrier engine fuel filter for leaks, damage, secure mountings, and connections. Drain off accumulated dirt and water. Drain only till fuel runs clean. If an appreciable amount of dirt or water is evident, close fuel shut-off valve, remove sediment bowl; and wash sediment bowl and screen in dry-cleaning solvent; replace, using new gasket if necessary. Turn on fuel valve and recheck for leaks.

(b) Crane. Inspect and service crane engine fuel filter in same manner as in step *(a)* above.

(4) BATTERIES.

(a) Carrier. Make a hydrometer and voltage test of both batteries; if necessary, bring electrolyte level up to ½ inch above plates with distilled or clean water.

(b) Crane. Inspect and service in same manner as step *(a)* above.

(5) AIR BRAKE TANKS. Drain all water from carrier air brake tanks and close cocks. See that all connections including tire inflation take-off are secure and not leaking.

(6) AIR CLEANERS AND BREATHER CAP.

(a) Carrier. Examine carburetor and air compressor air cleaners, and crankcase breather cap, to see if they are in good condition and secure. Remove elements, and wash thoroughly in dry-cleaning solvent. Fill reservoirs to bead level with fresh oil, and reinstall securely. Be sure all gaskets are in good condition, and that duct and air horn connections are tight.

(b) Crane. Examine and service crane engine carburetor air cleaner, and crankcase breather cap, in the same manner as in step *(a)* above.

(7) ACCESSORIES AND BELTS.

(a) Carrier. See that carrier accessories such as carburetor, generator, regulator, cranking motor, water pump, fan, oil filters, and air compressor are securely mounted. Make sure drive belts are adjusted to have ½-to ¾-inch finger-pressure deflection.

(b) Crane. Inspect crane engine accessories in same manner as in step *(a)* above, and make sure drive belts are adjusted to have ½-to ¾-inch finger-pressure deflection.

(8) ELECTRICAL WIRING.

(a) Carrier. Examine all accessible carrier wiring and conduits to see if they are in good condition, securely connected, and properly supported.

(b) Crane. Examine crane wiring in same manner as in step *(a)* above.

(9) TIRES. See that all carrier tires, including spares, are properly inflated to 85 pounds (maximum), cool. All valve stems should be in correct position, and all caps present and finger-tight. Remove objects lodged in treads, carcasses, and between duals and inspect for damage. See that spares are secure in carriers.

(10) WHEEL AND FLANGE NUTS. See that all wheel mounting, and axle flange nuts are present, and secure.

(11) FENDERS, RUNNING BOARDS, FLOATS, AND FLOAT SCREWS. Inspect fenders, running boards, floats, float screws, and brush guards for looseness and damage.

(12) TOWING CONNECTIONS. Examine all towing shackles and pintle hook for looseness and damage, and see that pintle latch operates properly and locks securely.

(13) CAB AND TARPAULIN.

(a) Carrier. Examine all carrier cab mountings, attachments, hardware, glass, seat, and door to see that they are in good condition and secure. Clean all glass. If furnished, see that tarpaulin is properly installed and lashed securely, or properly stowed.

(b) Crane. Inspect crane cab mountings, attachments, glass, seat, door, and panels to see that they are in good condition and secure. Clean all glass.

(14) CRANE WINCH AND HOIST MECHANISM. Inspect crane frame, drums, cables, sheaves, clamshell shovel; and all connections, linkage, and controls to see that they are in good condition, correctly assembled, and secure. See that power take-off drive chain is adjusted correctly, to have not more than 4½-inch deflection. After starting crane engine, step (21) below, test clutches and brakes to see if they appear to be correctly adjusted and operate properly.

(15) LUBRICATE.

(a) Carrier. Perform a complete lubrication service on the carrier covering all intervals, according to the instructions on the Lubrication Order, paragraph 20, except gear cases, and other units previously lubricated or serviced in steps (1) to (14). Check all gear case oil levels, and add as necessary to bring to correct levels. Change only if condition of oil indicates the necessity, or if gear oil is not of proper grade for existing atmospheric temperature. NOTE: *Perform steps (16) to (19) during lubrication.*

(b) Crane. Perform a complete lubrication service on the crane equipment, covering all intervals, according to the instructions on the Lubrication Order, paragraph 20, except units previously lubricated or serviced in applicable items, steps (1) to (14).

NEW VEHICLE RUN-IN TEST

(16) SPRINGS, WALKING BEAMS, AND SUSPENSIONS. Inspect carrier front springs, front shock absorbers, rear walking beams, and rear radius rods, to see that they are in good condition, correctly assembled, secure, and not leaking excessively at any oil seals.

(17) STEERING LINKAGE. See that all steering arms, rods, and connections are in good condition and secure; and that gear case is securely mounted and not leaking excessively.

(18) PROPELLER SHAFTS, CENTER BEARING, AND VENTS. Inspect carrier propeller shafts and universal joints to see that they are in good condition, properly alined, secure, and not leaking excessively at seals. Be sure that vents are in good condition, secure, and not clogged.

(19) AXLE AND TRANSFER VENTS. See that carrier axle and transfer vents are present, in good condition, and not clogged.

(20) CHOKE.

(a) Carrier. Observe choke to be sure it opens and closes fully in response to operation of choke button.

(b) Crane. When starting crane engine, observe choke action as in *(a)* above.

(21) ENGINE WARM-UP.

(a) Carrier. Start engine, noting if cranking motor action is satisfactory, and if there is any tendency toward hard starting. Set hand throttle to run engine at fast idle during warm-up. During warm-up, reset choke button so that engine will run smoothly, and to prevent overchoking and oil dilution.

(b) Crane. Start crane engine and make same observations as in step *(a)* above.

(22) INSTRUMENTS.

(a) Oil Pressure Gages.

1. Carrier. Oil pressure gage should indicate 35 pounds pressure at normal operating speed, 1,600 revolutions per minute, and 15 pounds pressure at idling speed, 400 revolutions per minute. CAUTION: *Stop engine if oil pressure is too low for safe engine operation.*

2. Crane. Oil pressure gage should indicate 40 pounds pressure at maximum speed and 15 pounds pressure at idling speed. CAUTION: *Stop engine if oil pressure is too low or too high for safe engine operation.*

(b) Ammeters.

1. Carrier. Ammeter should show a positive (+) charge for short period after starting engine until generator restores to battery the current used in starting.

2. *Crane.* Check in same manner as in step *(b) 1* above.

(c) Engine Temperature Gage. Carrier engine temperature gage should increase gradually during engine warm-up to normal operating temperature 160°F to 180°F. Maximum safe operating temperature, 200°F. NOTE: *Do not move vehicle until temperature reaches 135°F.*

(d) Tachometer. Carrier tachometer should indicate actual engine revolutions per minute. Recommended maximum governed engine speed is 2,150 revolutions per minute.

(e) Air Pressure Gage. During warm-up, carrier air pressure should build up to 105 pounds. Governor should cut-off at this pressure and cut-in when pressure in lines and reservoirs is reduced to 85 pounds.

(f) Fuel Gage. Carrier fuel gage should register approximate amount of fuel in carrier fuel tank.

(23) ENGINE CONTROLS.

(a) Carrier. Observe if engine responds properly to controls, and if controls operate without excessive looseness or binding.

(b) Crane. Observe operation of crane engine controls in same manner as in step *(a)* above.

(24) HORN AND WINDSHIELD WIPER. Observe if carrier horn and windshield wiper are in good condition and secure. If tactical situation permits, test horn for proper operation and tone. Observe if wiper operates properly through full stroke, and if wiper blade contacts glass evenly and firmly.

(25) GLASS AND REAR VIEW MIRROR.

(a) Carrier. Clean all cab glass and mirrors, and inspect for looseness and damage. Adjust rear view mirror for correct vision.

(b) Crane. Clean and inspect crane cab glass as in step *(a)* above.

(26) LAMPS (LIGHTS).

(a) Carrier. Clean carrier light lenses, and inspect all lights for looseness and damage. If tactical situation permits, open and close all switches to see if lamps respond properly.

(b) Crane. Clean, inspect and test crane lights as in step *(a)* above.

(27) LEAKS, GENERAL.

(a) Carrier. Look under vehicle, and within engine compartment, for indications of fuel, oil, and coolant leaks. Trace any leaks found to source, and correct or report them to designated authority.

(b) Crane. Inspect in same manner as in step *(a)* above.

NEW VEHICLE RUN-IN TEST

(28) TOOLS AND EQUIPMENT.

(a) Carrier. Check tools and items of equipment, to be sure all items are present, and see that they are serviceable and properly mounted or stowed.

(b) Crane. Check in same manner as in step *(a)* above.

b. Run-in Test. Perform the following procedure, steps (1) to (11) inclusive, during the road test of the vehicle. On vehicles which have been driven 50 miles or more in the course of delivery from the supply to the using organization, reduce the length of the road test to the least mileage necessary to make observations listed below. CAUTION: *Continuous operation of the vehicle at speeds approaching the maximums indicated on the caution plate should be avoided during the test.* Make operating test of crane equipment as outlined in step *(b)* of each applicable item.

(1) AIR PRESSURE. Observe whether the carrier brake air pressure cuts in at the specified minimum operating pressure (85 lb) and builds up to the specified maximum pressure (105 lb), then cuts off.

(2) DASH INSTRUMENTS AND GAGES.

(a) Carrier. Observe readings of pertinent instruments frequently to be sure they are indicating the proper function of the units to which they apply.

(b) Crane. Observe pertinent instruments as in step *(a)* above.

(3) BRAKES; FOOT AND HAND. Test carrier service air brakes to see if they stop vehicle effectively without side pull, chatter, or squealing. See that foot brake locking latch operates properly. Be sure air brake application valve closes when pedal pressure is released, and that there is not an excessive drop in air pressure when brakes are applied. Parking brakes should hold vehicle on a reasonable incline, with one-half lever ratchet travel in reserve, and should lock securely in applied position. CAUTION: *Avoid long application of brakes until shoes have become seated. Do not apply full pressure, except for an emergency stop.*

(4) CLUTCH. Test carrier clutch to see that it operates smoothly without grab, chatter, or squeal on engagement and does not slip under load when fully engaged. Be sure pedal has the correct amount of free travel, as nearly 2½ inches as possible (pars. 57 and 58). CAUTION: *Do not ride clutch pedal at any time, and do not engage or disengage new clutch severely or unnecessarily until clutch plates have become properly worn in.*

(5) TRANSMISSION AND TRANSFER.

(a) Carrier. Gearshift mechanism should operate easily and smoothly, and gears should engage without unusual noise, and not slip out of mesh during operation.

(b) Crane (Power Take-off). Crane power take-off mechanism

should engage easily and smoothly and without unusual noise, and not slip out of mesh during operation.

(6) STEERING. Observe carrier steering action for binding or looseness and note any excessive pull to one side, wander, shimmy, or wheel tramp. See that column, bracket, and wheel are secure.

(7) ENGINE.

(a) Carrier. Be on the alert for any abnormal carrier engine operating characteristics or unusual noise, such as lack of pulling power or acceleration, backfiring, misfiring, stalling, overheating, or excessive exhaust smoke. Observe if engine responds properly to all controls.

(b) Crane. During operation of crane engine make same observations as in step *(a)* above.

(8) UNUSUAL NOISES.

(a) Carrier. Be on the alert throughout road test for any unusual noise from carrier cab and attachments, running gear, suspensions, or wheels, that might indicate looseness, damage, wear, inadequate lubrication, or underinflated tires.

(b) Crane. Be on the alert throughout crane test for any unusual noise from power take-off, hoist, winches, turntable, cables, cable sheaves, clamshell shovel, or other attachments that might indicate looseness, damage, wear, or inadequate lubrication.

(9) HALT VEHICLE AT 10-MILE INTERVALS, OR LESS, FOR SERVICES IN STEPS (11) TO (13) BELOW.

(10) AIR BRAKES SYSTEM LEAKS. With air pressure at governed maximum pressure (105 pounds), and carrier brakes applied, stop engine. There should not be a noticeable drop in pressure in 1 minute.

(11) TEMPERATURES.

(a) Carrier. Cautiously hand-feel each brake drum and wheel hub for abnormal temperatures. Examine transmission, transfer, and rear axle housings for indications of overheating, or excessive lubricant leaks at seals, gaskets, or vents.

(b) Crane. Stop crane at intervals during operating test, and cautiously hand-feel each brake drum, drum hub, shaft bearing, and sheave bearing for abnormal temperatures. Examine power take-off for indications of overheating or excessive lubricant leaks.

(12) LEAKS.

(a) Carrier. With engine running, and fuel, engine oil, and cooling systems under pressure, look within engine compartment and under vehicle for indications of leaks.

(b) Crane. Check in same manner as in step *(a)* above.

(c) Publications and Reports.

1. Publications. See that carrier and crane technical manuals

and Lubrication Orders, Standard Form No. 26 (Driver's Report-Accident, Motor Transportation) and W.D., A.G.O. Form No. 478 (MWO and Major Unit Assembly Replacement Record), are present, legible, and properly stowed. NOTE: *U. S. A. registration number and vehicle nomenclature must be filled in on Form No. 478, for new vehicles.*

2. *Reports.* Upon completion of the run-in test, correct or report any deficiencies found. Report general condition of the vehicle to designated individual in authority.

Section XI

FIRST ECHELON PREVENTIVE MAINTENANCE SERVICE

24. PURPOSE.

a. To ensure mechanical efficiency it is necessary that this truck-mounted crane and trailer be systematically inspected as a unit at intervals each day they are operated and weekly, so that defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. The services set forth in this section are those performed by driver or crew before operation, during operation, at halt, and after operation and weekly.

b. Driver preventive maintenance services are listed on the back of "Driver's Trip Ticket and Preventive Maintenance Service Record," W.D. Form No. 48, to cover vehicles of all types and models. Items peculiar to specific vehicles but not listed on W.D. Form No. 48, are covered in manual procedures under the items to which they are related. Certain items listed on the form that do not pertain to the vehicles involved are eliminated from the procedures as written into the manual. Every organization must thoroughly school each driver and operator in performing the maintenance procedures set forth in manuals, whether they are listed specifically on W.D., Form No. 48, or not.

c. The items listed on W.D. Form No. 48 that apply to these vehicles are expanded in this manual to provide specific procedures for accomplishment of the inspections and services. These services are arranged to facilitate inspection and conserve the time of the driver and operator, and are not necessarily in the same numerical order as shown on W.D. Form No. 48. The item numbers, however, are identical with those shown on that form.

d. The general inspection of each item applies also to any supporting member or connection, and generally includes a check to see whether the items are in good condition, correctly assembled, secure, or excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether it is in its normal assembled position in the vehicle.

(3) The inspection of a unit to determine if it is "secure" is usually an external visual examination, a wrench, hand-feel, or a pry-bar check for looseness. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in assembly.

(4) "Excessively worn" will be understood to mean worn close-to, or beyond, serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

e. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority.

25. BEFORE-OPERATION SERVICE (CARRIER AND TRAILER).

a. Purpose. This inspection schedule is designed primarily as a check to see that this carrier and trailer have not been damaged, tampered with, or sabotaged since the After-operation Service was performed. Various combat conditions may have rendered the vehicles unsafe for operation, and it is the duty of the driver to determine whether or not they are in condition to carry out any mission to which they may be assigned. This operation will not be entirely omitted, even in extreme tactical situations.

b. Procedures. Before-operation Service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

(1) ITEM 1, TAMPERING AND DAMAGE. Look for any injury to the carrier and trailer, their accessories and equipment, caused by tampering or sabotage, collision, falling debris, or shell fire since parking. Look in carrier engine compartment for evidence of above

conditions, and for loosened or damaged engine accessories or drive belts, loose fuel, oil, or coolant lines, or disconnected control linkage.

(2) ITEM 2, FIRE EXTINGUISHER. See that extinguisher is fully charged, securely mounted, and not damaged; and look for evidence of opened operating valve or leakage. Remove filter plug to check contents.

(3) ITEM 3, FUEL, OIL, AND WATER. Check amount of fuel in the carrier supply tank and level of oil in engine crankcase, and add as necessary. Check level and condition of coolant in radiator. If any great amount of water has to be added during period when antifreeze is in use, have hydrometer test made of coolant, and add antifreeze as needed. See that all spare fuel, oil, and water cans are filled. NOTE: *Any appreciable drop in levels of fuel, oil, and coolant since After-operation Service should be investigated, and cause corrected or reported.*

(4) ITEM 4, ACCESSORIES AND DRIVES. Examine carrier units such as carburetor, air cleaners, air compressor, generator, regulator, cranking motor, fuel pump, and oil filters to see that they are in good condition, and securely mounted and connected. Be sure drive belts are in good condition and have approximately ½-inch finger-pressure deflection.

(5) ITEM 5, AIR BRAKE TANKS. Inspect carrier air brake tanks to see that they are in good condition and securely mounted, and that air lines and connections are secure. Be sure condensation (water) has been drained from tanks and that drain cocks are closed.

(6) ITEM 6, LEAKS, GENERAL. Look under vehicle and in engine compartment for indications of fuel, oil, water and gear oil leaks. Trace all leaks found to their source, and correct or report them.

(7) ITEM 8, CHOKE. As carrier engine is being started, observe if choke valve opens and closes properly in response to operation of control.

(8) ITEM 7, ENGINE WARM-UP. Start carrier engine and note any indication of hard starting; observe action of cranking motor, particularly if it has adequate cranking speed; and engages and disengages properly without unusual noise during operation. Set hand throttle to idle engine at approximately 800 revolutions per minute during warm-up period, and proceed with the following Before-operation Services. CAUTION: *Stop engine if desired oil pressure is not evident in 30 seconds, and correct or report the trouble.* During warm-up, listen for any unusual engine noises; watch instrument indications, and investigate any poor engine performance such as misfiring and rapid temperature rise. As engine warms up, reset choke as required for engine to run smoothly, and to prevent over-choking and dilution of engine oil.

(9) INSTRUMENTS.

(a) Oil Pressure Gage. Oil pressure should be 35 pounds at 1,600 revolutions per minute, and 15 pounds when the engine is idling at 400 revolutions per minute.

(b) Ammeter. Ammeter may indicate high charging rate until generator restores to battery the current used in starting, and then register zero or a slight discharge (—) with the engine idling, and zero or a slight positive (+) charge with the engine running at operating speed.

(c) Engine Temperature Gage. Gage reading should increase gradually during warm-up period to normal operating temperature, 160°F to 180°F. Maximum safe temperature is 200°F. NOTE: *Do not move carrier until temperature reaches minimum operating temperature of 140°F.*

(d) Tachometer. Observe tachometer to see that it indicates approximate engine revolutions per minute, and that it registers accumulating revolutions. Engine idles at 400 revolutions per minute; maximum engine speed is 2,150 revolutions per minute.

(e) Air Pressure Gage. Gage should register pressure in air tanks; operating pressure is 85 to 105 pounds. CAUTION: *Do not move carrier until gage registers 85 pounds.*

(f) Fuel Gage. Observe gage to see that it indicates approximate amount of fuel in tank. Ordinarily tank will be filled after operation, and gage should register "FULL."

(10) ITEM 10, HORN AND WINDSHIELD WIPER. If tactical situation permits, test horn for proper operation and tone. Test wiper to see that it operates properly, and that the wiper blade contacts the glass evenly through its full range.

(11) ITEM 11, GLASS AND REAR VIEW MIRROR. Clean all glass and inspect for damage. Aim rear view mirror properly and see that it is secure.

(12) ITEM 12, LAMPS (LIGHTS) AND REFLECTORS. Clean all carrier and trailer lights and warning reflectors. Examine them for looseness or damage. If tactical situation permits, check operation of all switches and lights.

(13) ITEM 13, WHEEL AND FLANGE NUTS. Inspect all carrier and trailer axle flange and wheel mounting nuts, to see that they are present and secure.

(14) ITEM 14, TIRES. Inspect all carrier and trailer tires including spares for damage and excessive wear; remove all foreign objects lodged in carcasses and between duals. Check tires for underinflation. Proper pressures are: truck tires 85 pounds cool, trailer tires 60 pounds cool.

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(15) ITEM 15, SPRINGS AND SUSPENSIONS. Examine carrier and trailer springs, carrier front shock absorbers, and rear walking beams or bogie and torque rods, to see that they are not damaged or loose. See that all assembly and mounting nuts are secure, and that shock absorbers are not leaking.

(16) ITEM 16, STEERING LINKAGE. Inspect carrier steering arms, rods, joints, and connections for looseness or damage, and check gear case for loose mountings and excessive lubricant leaks.

(17) ITEM 17, FENDERS, RUNNING BOARDS, AND FLOATS. Inspect carrier fenders and running boards, floats and float screws, to see that they are in good condition and securely mounted. See that the screws operate properly.

(18) ITEM 18, TOWING CONNECTIONS. Inspect carrier towing hooks for looseness or damage, and pintle hook for proper operation and to see that it locks securely. Examine trailer tongue, and lunette and tongue support to see that they are not damaged or excessively worn. Be sure support will raise and lower properly, and lock in up or down position securely.

(19) ITEM 19, BODY, LOAD, AND TARPAULIN. Inspect carrier cab and attachments for looseness and damage; see that windshield and door, and all hardware, operate properly. Examine trailer to see that float mats are properly racked and secure. Tarpaulin (if used) should be in good condition and properly installed and lashed, or properly stowed.

(20) ITEM 20, DECONTAMINATOR. Inspect contaminator for damage, and see that it is fully charged and securely mounted.

(21) ITEM 21, TOOLS AND EQUIPMENT. See that carrier and trailer tools and equipment are present, serviceable, and properly mounted or stowed.

(22) ITEM 22, ENGINE OPERATION. After warm-up engine should idle smoothly without stalling with accelerator fully released. Accelerate and decelerate the engine and listen for any unusual vibrations or noise. Note any unsatisfactory operating characteristics or excessive exhaust smoke.

(23) ITEM 23, DRIVER'S PERMIT AND FORM NO. 26. Driver must have his operator's permit on his person. Check to see that Standard Accident-Report Form No. 26, Operator's Manual, Lubrication Order, and W.D., A.G.O. Form No. 478 are present in carrier, legible, and properly stowed.

26. DURING-OPERATION SERVICE (TRUCK AND TRAILER).

a. Preliminary Inspection. While the vehicles are in motion, listen for any sounds such as rattles, knocks, squeals, or hums that may indicate trouble. Look for indications of trouble in carrier cool-

ing system and smoke from any part of the vehicles. Be on the alert to detect any odor of overheated components or units such as generator, brakes or clutch, fuel vapor from a leak in the fuel system, exhaust gas or other signs of trouble. Any time the brakes are used, gears shifted, or vehicles turned, consider this a test and notice any unsatisfactory or unusual performance. Watch the instruments constantly. Notice promptly any unusual instrument indication that may signify possible trouble in system to which the instrument applies.

b. Procedures. During-operation Service consists of observing items listed below according to the procedures following each item, and investigating any indications of serious trouble. Notice minor deficiencies to be corrected or reported at earliest opportunity, usually at next scheduled halt.

(1) ITEM 27, FOOT AND HAND BRAKE. Carrier foot brakes should stop vehicle smoothly and effectively with normal pedal pressure, without side pull, grab, or chatter, and return to "OFF" position immediately foot pressure is released. See that foot brake locking latch holds pedal in applied position. Hand brake should hold vehicle on a reasonable incline, leaving one-half ratchet travel in reserve, and should lock securely in applied position.

(2) ITEM 28, CLUTCH. Carrier clutch should not grab, chatter, or squeal during engagement or slip when fully engaged under load. Pedal should have as near as possible to 2½ inches of free travel before meeting resistance.

(3) ITEM 29, TRANSMISSION. Carrier transmission gears should shift smoothly, operate without unusual noise, and should not creep out of mesh during operation.

(4) ITEM 30, TRANSFER. Carrier transfer unit gears and declutching mechanism should shift easily, operate without unusual noise, and not creep out of mesh during operation.

(5) ITEM 31, ENGINE AND CONTROLS. The driver must be on the alert for deficiencies in the carrier engine performance, such as lack of usual power, misfiring or stalling, unusual noise or vibration, indications of overheating, or excessive exhaust smoke. Observe if engine responds to all controls, and if controls operate without excessive looseness or binding. NOTE: *If radio interference is reported during operation, the driver will cooperate with the radio operator in locating its source.*

(6) ITEM 32, INSTRUMENTS. Observe readings of all instruments frequently during operation of the carrier, to be sure units to which they apply are functioning satisfactorily. Speedometer should

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indicate vehicle speed and odometer should register the accumulating mileage.

(7) ITEM 33, STEERING GEAR. While the carrier is being operated, note any indication of looseness or binding, pulling to one side, wandering, shimmy, wheel tramp, or unusual noise in the steering gear or its connections.

(8) ITEM 34, RUNNING GEAR. Listen for any unusual noise from carrier and trailer wheels of springs, carrier rear walking beams (bogie), and propeller shafts.

(9) ITEM 35, BODY AND TRAILER. Be on the alert for noise or motion that would indicate shifting carrier or trailer load, loose or damaged mountings, floats, hardware, or mounted body attachments.

27. AT-HALT SERVICES (CARRIER AND TRAILER).

a. Purpose. At-halt Services may be regarded as minimum maintenance procedures and should be performed under all tactical condition even though more extensive maintenance services must be slighted or omitted altogether.

b. Procedures. At-halt Service consists of investigating any deficiencies noted during operation, inspecting items listed below according to the procedures following the items, and correcting any deficiencies found. Deficiencies not corrected should be reported promptly to the designated individual in authority.

(1) ITEM 38, FUEL, OIL, AND WATER. See that fuel, engine oil, and coolant supply is adequate to operate carrier to the next stop. Install all filler caps securely. CAUTION: *If engine is hot, fill radiator slowly while engine is running at fast idle.*

(2) ITEM 39, TEMPERATURES. Place hand cautiously on carrier brake drums, and carrier and trailer wheel hubs to see if they are abnormally hot. Inspect carrier transmission, transfer, and axle housings for overheating and excessive lubricant leakage. NOTE: *Transfer case temperatures will normally run considerably higher than other gear cases.*

(3) ITEM 40, AXLE AND TRANSFER VENTS. Wipe clean and inspect these vents for damage or clogging. Vents must be kept open.

(4) ITEM 41, PROPELLER SHAFTS. Inspect all carrier propeller shafts and universal joints for looseness, damage, and excessive lubricant leaks. Remove any foreign matter wound around shafts or joints.

(5) ITEM 42, SPRINGS AND SUSPENSIONS. Inspect carrier and trailer for broken or shifted spring leaves, damaged or loose U-bolts, eye bolts, shackles, or rebound clips. Examine carrier for loose or damaged front shock absorbers, rear walking beams, and torque rods.

(6) ITEM 43, STEERING LINKAGE. Examine all carrier steering control mechanism, arms, and linkage joints for looseness or damage. Investigate any unusual condition noted during operation.

(7) ITEM 44, WHEEL AND FLANGE NUTS. Inspect carrier and trailer wheel and axle flange nuts to see that they are all present and secure.

(8) ITEM 45, TIRES. Check carrier and trailer tires for underinflation or damage. Remove embedded objects in treads and carcasses and from between duals. See that spares are properly inflated and secure in carrier.

(9) ITEM 46, LEAKS, GENERAL. Look under vehicle and within engine compartment for indications of fuel, oil, or coolant leaks. Trace any leaks found to their source, and correct or report them.

(10) ITEM 47, ACCESSORIES AND BELTS. Examine all accessible carrier accessories such as generator, cranking motor, filters, air compressor, and carburetor for looseness or damage. Be sure drive belts have ½-to ¾-inch finger-pressure deflection halfway between pulleys. If radio interference was reported during operation, examine the wiring and noise suppression units in engine compartment for loose connections or mounting. Give special attention to resistor-suppressors at spark plugs and distributor.

(11) ITEM 48, AIR CLEANER. If operating vehicle under extremely dusty or sandy conditions, inspect air cleaner and breather cap at each halt, to see that they are in condition to deliver clean air properly. Service as required.

(12) ITEM 49, FENDERS, RUNNING BOARDS, AND FLOATS. Inspect carrier fenders, running boards, floats, and float screws to see that they are in good condition and securely mounted. See that float screws operate properly.

(13) ITEM 50, TOWING CONNECTIONS. Inspect carrier towing eyes and pintle hook to see that they are in good condition, and that pintle hook locking device operates properly. Examine trailer tongue, lunette, and tongue support for damage, or loose mounting. See that tongue support locks securely in raised or lowered position. Examine trailer light connections for good contact and security of mountings.

(14) ITEM 51, BODY, LOAD AND TARPAULIN. Inspect carrier cab, windshield, and door to see that they are in good condition and that the door and windshield operate properly. See that float mats and clamshell shovel are properly racked on trailer and securely anchored. When boom is in forward position be sure it is securely attached to carrier towing eyes. When used, be sure tarpaulin is securely attached or stowed.

(15) ITEM 52, GLASS. Clean carrier windshield and rear view mirror, and carrier and trailer light lenses, and inspect for damage.

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28. AFTER-OPERATION AND WEEKLY SERVICE (CARRIER AND TRAILER).

a. Purpose. After-operation Service is particularly important because at this time the driver inspects his vehicles to detect any deficiencies that may have developed, and corrects those he is permitted to handle. He should report promptly, to the designated individual in authority, the results of his inspection. If this schedule is performed thoroughly, the units should be ready to operate again on a moment's notice. The Before-operation Service, with a few exceptions, is then necessary only to ascertain whether the units are in the same condition in which they were left upon completion of the After-operation Service. The After-operation Service should never be entirely omitted even in extreme tactical situations, but may be reduced to the bare fundamental services outlined for the At-halt Service, if necessary.

b. Procedures. When performing the After-operation Service the driver must remember and consider any irregularities noticed during the day in the Before-operation, During-operation, and At-halt Services. The After-operation Service consists of inspecting and servicing the following items. Those items of the After-operation that are marked by an asterisk (*) require additional Weekly Services, the procedures for which are indicated in sub-step *(b)* of each applicable item.

(1) ITEM 55, ENGINE OPERATION. Test carrier engine for satisfactory performance and smooth idle. Accelerate and decelerate engine, and note any tendency to miss or backfire. Listen for any unusual noise or vibration that may indicate worn or inadequately lubricated parts, loose mountings, incorrect fuel mixture or faulty ignition. Note any unusual exhaust smoke. Investigate and correct or report any deficiencies noted during operation.

(2) ITEM 56, INSTRUMENTS. Check all pertinent carrier instruments to be sure they are operating properly and continue to register or indicate correct performance of the units to which they apply.

(3) ITEM 54, FUEL, OIL AND WATER. Fill carrier fuel tank, and see that fuel gage registers "FULL". Check crankcase oil and coolant supply and add as necessary to bring them to correct levels. NOTE: *Do not overfill fuel tank or radiator; allow room for expansion.* In freezing weather, if any appreciable amount of water is added, have antifreeze value check, and add antifreeze as necessary to protect cooling system against freezing. Fill all spare fuel, oil, and water cans, if supply has been used.

(4) ITEM 57, HORN AND WINDSHIELD WIPER. If tactical situation permits, test horn for operation and tone. See that windshield

wiper operates properly, and that wiper blade contacts glass evenly and firmly through its entire stroke.

(5) ITEM 58, GLASS AND REAR VIEW MIRROR. Clean all carrier glass and rear view mirror, inspect for damage, and see that mountings are secure.

(6) ITEM 59, LAMPS (LIGHTS) AND REFLECTORS. Clean all carrier and trailer light lenses, examine for broken parts, and security of mountings. If tactical situation permits, open and close all switches, and see that all lights respond properly.

(7) ITEM 60, FIRE EXTINGUISHER. Inspect carrier fire extinguisher for full charge, good condition, and security of mounting. See that nozzle is not clogged. Remove filler plug to determine contents.

(8) ITEM 61, DECONTAMINATOR. Inspect carrier decontaminator for full contents, damage, and security of mounting. Remove filler plug to check contents.

(9) ITEM 62, *BATTERY.

(a) Inspect carrier battery for damage, leakage, security of mountings and connections.

(b) Weekly. Add clean water as necessary to bring electrolyte level ½ inch above top of plates. NOTE: *In freezing weather, do not add water until carrier is about to be operated.* Clean and tighten terminals if loose or dirty, and coat them lightly with grease. Tighten loose battery hold-down devices carefully so as not to damage battery.

(10) ITEM 63, *ACCESSORIES AND BELTS.

(a) Inspect carrier accessories such as carburetor, generator, cranking motor, filters, regulator unit and air compressor for looseness, damage, or leakage. Check fan belts for proper adjustment; there should be ½- to ¾-inch finger-pressure deflection halfway between pulleys. Investigate and correct or report any deficiencies noted during operation.

(b) Weekly. Tighten mountings and connections of all accessories. If loose, fan belts should be adjusted to correct tension.

(11) ITEM 64, *ELECTRICAL WIRING.

(a) Examine all accessible ignition and low voltage wiring for looseness or damage; wipe off grease or moisture. Be sure all wiring is supported so it does not chafe against other vehicle parts.

(b) Weekly. Tighten all radio noise suppressor bond straps and accessible capacitor mountings and connections, paying particular attention that spark plug and distributor suppression units are secure.

(12) ITEM 65, AIR CLEANERS AND BREATHER CAPS. Inspect carrier carburetor and air compressor air cleaners, and crankcase breather

caps, to see that they are in good condition and securely mounted. Clean and service if excessively dirty, according to Lubrication Order (par. 20).

(13) ITEM 66, *FUEL FILTERS.

(a) Inspect for looseness, damage, or leaks.

(b) Weekly. Remove carrier fuel filter sediment bowl and screen and carburetor screen, drain off fuel until it runs clear, wash sediment bowl and screens in dry-cleaning solvent. Replace all unserviceable gaskets and reassemble. NOTE: *If excessive water is present, report to higher echelon for further cleaning of fuel system.*

(14) ITEM 67, ENGINE CONTROLS. Examine carrier engine controls for looseness, damage, disconnected linkage, and adequate lubrication.

(15) ITEM 68, *TIRES.

(a) Inspect all carrier and trailer tires, including spares, for damage and excessive wear. Remove all embedded foreign objects from carcasses and between duals. Check all tires for low pressure, proper position of valve stems, and presence of valve caps. Inflate carrier tires to 85 pounds pressure (cool), and trailer tires to 60 pounds pressure (cool).

(b) Weekly. Replace badly worn or otherwise unserviceable tires on carrier and trailer. Serviceable tires which show abnormal wear should be relocated to other wheels to even the wear. Apparent mechanical deficiencies causing such wear should be reported, for attention by higher echelon.

(16) ITEM 69, *SPRINGS AND SUSPENSIONS.

(a) Inspect carrier and trailer springs for broken or shifted leaves and for damaged or loose clips, U-bolts, eye bolts, and shackles. Examine carrier, front shock absorbers and linkage, and the rear walking beams and radius rods for damage and looseness.

(b) Weekly. Tighten all carrier and trailer spring and suspension mountings, connections, and linkage.

(17) ITEM 70, STEERING LINKAGE. Inspect carrier steering linkage, arms, knuckles, and rods for looseness or damage. Examine knuckle housing and gear case for excessive leaks.

(18) ITEM 71, PROPELLER SHAFTS, CENTER BEARING, AND VENTS. Inspect carrier propeller shafts, U-joints, and pillow block (center bearing), for looseness, damage, or excessive leaks.

(19) ITEM 72, *AXLE AND TRANSMISSION AND TRANSFER VENTS.

(a) See that all carrier axle housing, transmission, transfer, and pillow block (center bearing) vents are present, in good condition and clean. Inspect for excessive lubricant leakage at vents.

(b) Weekly. Remove vents and clean out passages. Reinstall vents securely.

(20) ITEM 73, LEAKS—GENERAL. Look in carrier engine compartment and under vehicle for indications of fuel, engine oil, coolant, and gear oil leaks. Examine trailer wheel hubs for excessive lubricant leaks.

(21) ITEM 74, *GEAR OIL LEVELS (WEEKLY ONLY). Check gear oil levels in truck rear axles, transfer, transmission, and steering gear cases and report if low. Correct levels are from lower edge of filler hole, hot, to ½ inch below when cool.

(22) ITEM 75, *AIR BRAKE TANKS.

(a) Inspect tanks and lines for looseness and damage. Open drain cocks, and drain off all accumulated water.

(b) Weekly. Tighten tank mountings and line connections where necessary. Clean air line rubber hose of all grease and oil.

(23) ITEM 76, FENDERS, RUNNING BOARDS, AND FLOATS. Inspect carrier fenders, running boards, floats, and float screws to see that they are in good condition and securely mounted. See that float screws operate properly and tighten all mountings that appear loose.

(24) ITEM 77, *TOWING CONNECTIONS.

(a) Inspect carrier towing eyes and pintle hook for looseness, damage, or excessive wear. See that pintle hook locking device operates properly. Examine trailer tongue, lunette, and tongue support for looseness or damage. See that trailer tongue support locks securely in both raised and lowered positions.

(b) Weekly. Tighten all towing and locking devices and mountings.

(25) ITEM 78, BODY AND TARPAULIN. Inspect carrier cab, windshield, and door for damage or missing parts. See that float mats and clamshell shovel are properly racked on trailer and securely anchored. When boom is lowered in forward position, be sure it is securely attached to carrier forward towing eyes. When used, see that tarpaulin is securely attached or stowed.

(26) ITEM 82, *TIGHTEN.

(a) Tighten all carrier and trailer items which inspection indicates require tightening.

(b) Weekly. Tighten all wheel and axle flange nuts and cap screws, spring clip and U-bolt nuts, and spring shackle bolt nuts that inspection or experience indicates require tightening on a weekly or mileage basis.

(27) ITEM 83, *LUBRICATION.

(a) Lubricate all points of the carrier and trailer indicated on the Lubrication Order as requiring daily attention.

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(b) Weekly. Lubricate all points which carrier and trailer Lubrication Order indicates as necessary on a weekly or mileage basis, or any points that condition and experience indicate need additional lubrication.

(28) ITEM 84, *CLEANING.

(a) Clean dirt and grease or oil from inside of cab and from engine compartment. Wipe off excess dirt or grease from carrier and trailer.

(b) Weekly. Wash carrier and trailer when possible. If not possible, wipe off thoroughly. Inspect paint or camouflage pattern for rust or bright spots which might cause glare. CAUTION: *If carrier and trailer are driven into water for washing, care must be taken to see that water or dirt does not get into wheel bearings, gear cases, brakes, or on electrical units or wiring.*

(29) ITEM 85, *TOOLS AND EQUIPMENT.

(a) Check carrier and trailer tools and equipment, to be sure all items are present, in good condition, and properly mounted or stowed.

(b) Weekly. Clean all carrier and trailer tools and equipment, see that tools with cutting edges are sharp and properly protected, and that all items are securely mounted.

29. BEFORE-OPERATION SERVICE (CRANE).

a. Purpose. This inspection schedule is designed primarily as a check to see that the crane equipment has not been damaged, tampered with, or sabotaged since the After-operation Service was performed. Various combat conditions may have rendered the unit unsafe for operation, and it is the duty of the operator to determine whether or not the unit is in condition to carry out any mission to which it is assigned. This operation will not be entirely omitted, even in extreme tactical situations.

b. Procedures. Before-operation Service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

(1) ITEM 1, TAMPERING AND DAMAGE. Look for any injury to the crane, its accessories, or equipment caused by tampering or sabotage, collision, falling debris, or shell fire since leaving the crane.

(2) ITEM 2, FIRE EXTINGUISHER. Inspect in same manner as carrier item 2, paragraph 25.

(3) ITEM 3, FUEL, OIL, AND WATER. Perform in same manner as carrier item 3, paragraph 25.

(4) ITEM 4, ACCESSORIES AND DRIVES. Examine crane units such as carburetor, air cleaner, generator, regulator, cranking motor, fuel pump, and oil filters to see that they are in good condition, and securely mounted and connected. Be sure drive belts are in good condition and have approximately ½- to ¾-inch finger-pressure deflection.

(5) ITEM 6, LEAKS, GENERAL. Look under crane and in engine compartment for indications of fuel, oil, and water leaks. Trace all leaks found to their source, and correct or report them.

(6) ITEM 8, CHOKE. Observe in same manner as carrier item 8, paragraph 25.

(7) ITEM 7, ENGINE WARM-UP. Perform in same manner as carrier item 7, paragraph 25.

(8) ITEM 9, INSTRUMENTS.

(a) Oil Pressure Gage. Oil pressure should be 40 pounds at normal operating speed, and 15 pounds when the engine is idling.

(b) Ammeter. Ammeter may indicate a high charging rate until generator restores to battery current used in starting, and then zero or slight discharge (—) with the engine idling, and zero or a slight positive (+) charge with engine running at operating speed.

(9) ITEM 11, GLASS. Clean all cab glass and inspect it for looseness or damage.

(10) ITEM 12, LAMPS (LIGHTS). Clean all light lenses, and if tactical situation permits, check operation of all lights.

(11) ITEM 19, CAB AND TARPAULIN. Inspect cab and attachments for looseness and damage; see that door and cab panels open properly and latch securely when closed. Tarpaulin (if used) should be in good condition and properly installed and lashed, or properly stowed.

(12) ITEM 20, DECONTAMINATOR. Inspect decontaminator for damage, and see that it is fully charged and securely mounted. Remove filler plug to determine contents.

(13) ITEM 21, TOOLS AND EQUIPMENT. See that crane tools and equipment are present, serviceable, and properly mounted or stowed.

(14) ITEM 22, ENGINE OPERATION. Observe in same manner as carrier item 22, paragraph 25.

30. DURING-OPERATION SERVICE (CRANE).

a. Preliminary Inspection. While crane is in operation, listen for any sounds such as rattles, knocks, squeals or hums that may indicate trouble. Look for indication of trouble in crane cooling system and smoke from any part of the crane. Be on the alert to detect any odor of overheated components or units such as generator, brakes or clutches, fuel vapor from a leak in the fuel system, exhaust

gas or other signs of trouble. Any time the boom is hoisted or lowered, brakes are used, turntable turned or clamshell shovel used, consider this a test and notice any unsatisfactory or unusual performance. Watch the instruments constantly for any unusual instrument indication that may signify possible trouble in system to which the instrument applies.

b. Procedures. During-operation Service consists of observing items listed below according to the procedures following the items, and correcting any deficiencies found. Deficiencies not corrected should be reported promptly to the designated individual in authority.

(1) ITEM 27, FOOT AND HAND BRAKES. Crane foot and hand brakes should stop units to which they apply, smoothly and effectively, with normal pressure and without grab or chatter, and return to free position immediately that pressure is released. Pedal and levers provided with latches or ratchets should remain in applied position, when locked, leaving sufficient reserve travel still available.

(2) ITEM 28, CLUTCH. Crane clutch should not grab, chatter, or squeal during engagement, or slip when fully engaged under load. Lever should have a small amount of free travel before meeting resistance.

(3) ITEM 29, TRANSMISSION POWER TAKE-OFF. Crane power take-off chain should operate without unusual noise or excessive slack. Sprockets should be secure and properly alined.

(4) ITEM 31, ENGINE AND CONTROLS. Perform in same manner as carrier item 31, paragraph 26 **b** (5).

(5) ITEM 32, INSTRUMENTS. Observe readings of crane engine instruments frequently during operation of crane to be sure units to which they apply are functioning satisfactorily.

(6) ITEM 35, BODY. Be on the alert for noise or any abnormal condition that would indicate loose or damaged crane cab, door or panels, hardware, floor plates, or mounted cab attachments.

(7) ITEM 36, ELEVATING AND TRAVERSING CONTROLS. Check all controls to see that crane elevating and traversing mechanisms respond properly without looseness or binding.

31. AT-HALT SERVICE (CRANE).

a. Importance. At-halt Services may be regarded as minimum maintenance procedures, and should be performed under all tactical conditions, even though more extensive maintenance services must be slighted or omitted altogether.

b. Procedures. At-halt Service consists of investigating any deficiencies noted during operation, inspecting items listed below according to the procedures following the items, and correcting any

deficiencies found. Deficiencies not corrected should be reported promptly to the designated individual in authority.

(1) ITEM 38, FUEL, OIL, AND WATER. Check the crane engine fuel, oil, and water supply and replenish as necessary. When refueling with hand pump, use safety precautions for grounding static electricity, and allow space for expansion in filler neck. Fuel tank filler cap vents must be open, and cap gasket must be in good condition.

(2) ITEM 39, TEMPERATURES. Place hand cautiously on each brake drum, hoist drum hub, and on all accessible bearings to see if they are abnormally hot. Note any excessive lubricant leaks.

(3) ITEM 46, LEAKS, GENERAL. Look under crane and within engine compartment for indications of fuel, oil, or coolant leaks. Trace any found to their source, and correct or report them.

(4) ITEM 47, ACCESSORIES AND BELTS. Examine all accessible crane accessories for looseness and damage. Be sure drive belts have ½- to ¾-inch finger-pressure deflection.

(5) ITEM 48, AIR CLEANERS. Inspect crane engine air cleaners to see that they are secure and in condition to deliver clean air properly.

(6) ITEM 51, BODY AND TARPAULIN. Inspect crane cab and all attachments for looseness or damage, and see that tarpaulin (if used) is securely lashed or stowed.

(7) ITEM 52, APPEARANCE AND GLASS. Clean all crane cab glass and inspect for damage.

32. AFTER-OPERATION AND WEEKLY SERVICE (CRANE).

a. Purpose. After-operation Service is particularly important because at this time the operator inspects the crane equipment to detect any deficiencies that may have developed, and corrects those he is permitted to handle. He should report promptly, to the designated individual in authority, the result of his inspection. If this schedule is performed thoroughly, the crane should be ready to operate again on a moment's notice. The Before-operation Service, with a few exceptions, is then necessary only to ascertain whether the crane equipment is in the same condition in which it was left upon completion of the After-operation Service. The After-operation Service should never be entirely omitted even in extreme tactical situations, but may be reduced to the bare fundamental services outlined for the At-halt Service, if necessary.

(1) ITEM 55, ENGINE OPERATION. Perform in same manner as carrier item 55, paragraph 28 **b** (1).

(2) ITEM 56, INSTRUMENTS. Perform in same manner as carrier item 56, paragraph 28 **b** (2).

FIRST ECHELON PREVENTIVE MAINTENANCE SERVICE

(3) ITEM 54, FUEL, OIL, AND WATER. Perform in same manner as carrier item 54, paragraph 28 b (3).

(4) ITEM 58, GLASS. Clean all crane cab and door glass, and inspect for looseness and damage.

(5) ITEM 59, LAMPS (LIGHTS). Perform in same manner as carrier item 59, paragraph 28 b (6).

(6) ITEM 60, FIRE EXTINGUISHER. Perform in same manner as carrier item 60, paragraph 28 b (7).

(7) ITEM 61, DECONTAMINATOR. Perform in same manner as carrier item 61, paragraph 28 b (8).

(8) ITEM 62, *BATTERY. Perform in same manner as carrier item 62, paragraph 28 b (9).

(9) ITEM 63, *ACCESSORIES AND BELTS.

(a) Inspect crane items, such as generator, cranking motor, filters, and regulator unit, for looseness, damage, or leakage. Check fan belts for proper adjustment, there should be ½- to ¾-inch finger-pressure deflection halfway between pulleys. Investigate and correct or report any deficiencies noted during operation.

(b) Weekly. Tighten mountings and connections of all accessories. If loose, fan belts should be adjusted to correct tension.

(10) ITEM 64, *ELECTRICAL WIRING. Perform in same manner as carrier item 64, paragraph 28 b (11).

(11) ITEM 65, *AIR CLEANERS AND BREATHER CAP. Perform services in same manner as carrier item 65, paragraph 28 b (12).

(12) ITEM 66, *FUEL FILTERS. Perform in same manner as carrier item 66, paragraph 28 b (13).

(13) ITEM 67, ENGINE CONTROLS. Perform in same manner as carrier item 67, paragraph 28 b (14).

(14) ITEM 73, LEAKS, GENERAL. Perform in same manner as carrier item 73, paragraph 28 b (20).

(15) ITEM 78, BODY AND TARPAULIN. Inspect crane cab carefully for damage and loose parts. See that cab door and panels open properly and latch securely when closed. See that tarpaulin (if used) is securely lashed or properly stowed.

(16) ITEM 81, ELEVATING AND TRAVERSING CONTROLS. Check crane boom elevating and turntable traversing controls to see that they operate without looseness or binding and that units to which they apply respond properly.

(17) ITEM 82, *TIGHTEN.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

(a) Tighten all crane items which daily inspection indicates require tightening.

(b) Weekly. Tighten all crane mounting and assembly bolts, nuts, and screws that inspection or experience indicate require tightening on a weekly or mileage basis.

(18) ITEM 83, *LUBRICATION.

(a) Lubricate all points of the crane indicated on the Lubrication Order as requiring daily attention.

(b) Weekly. Lubricate all points which crane Lubrication Order indicates as necessary on a weekly or mileage basis, or any points where conditions and experience indicate need of additional lubrication.

(19) ITEM 84, CLEANING.

(a) Clean dirt and grease or oils from inside of crane cab and from engine compartment. Clean off excess mud from clamshell shovel.

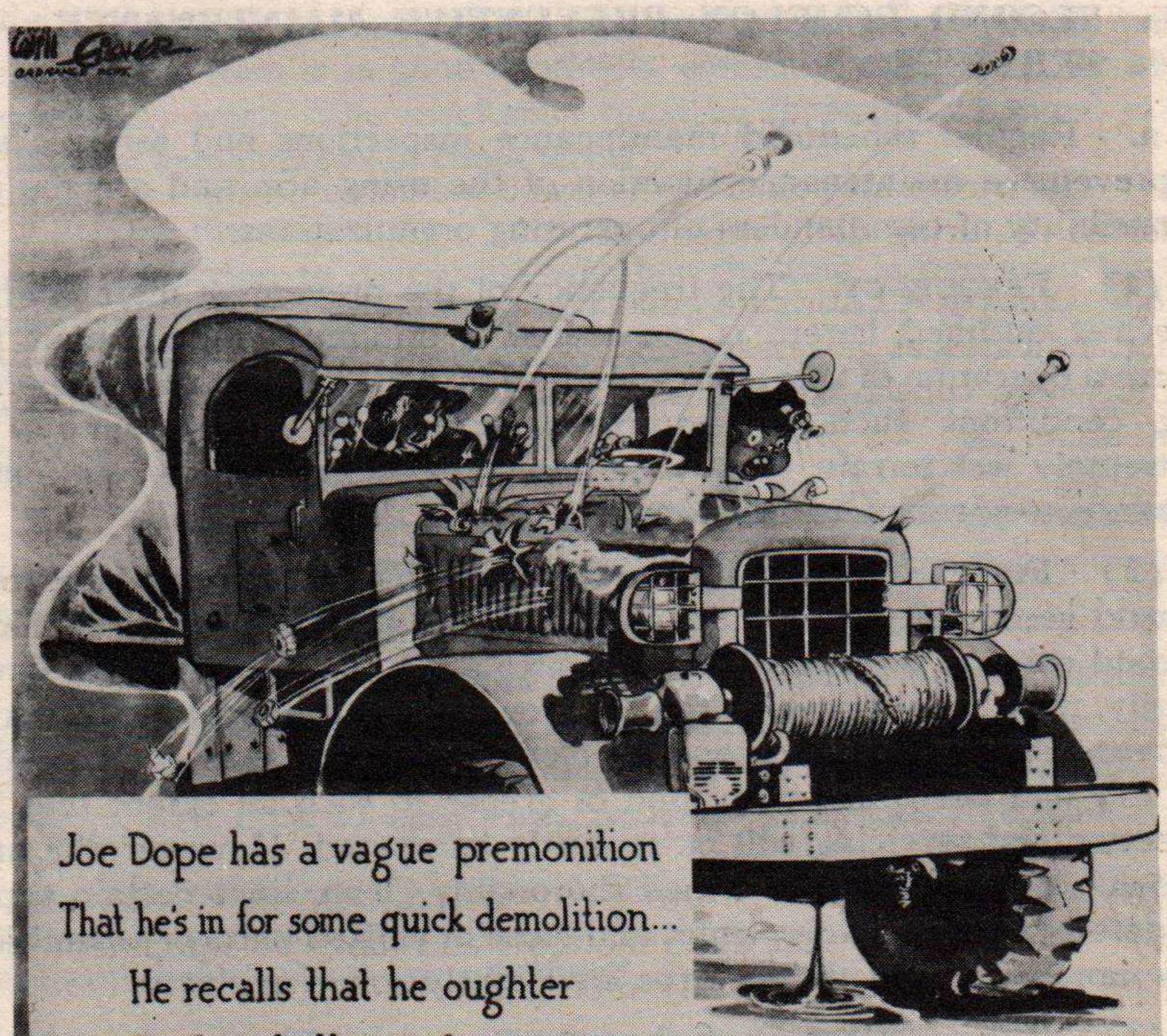
(b) Weekly. Wash crane equipment when possible. If not possible, wipe off thoroughly. Inspect paint or camouflage pattern for rust or bright spots which might cause glare.

(20) ITEM 85, *TOOLS AND EQUIPMENT.

(a) Check to see that all crane tools and items of equipment are in good condition, and properly mounted or stowed.

(b) Weekly. Clean all crane tools and equipment, and see that tools with cutting edges are sharp, properly protected, and that all items are securely mounted or stowed.

FIRST ECHELON PREVENTIVE MAINTENANCE SERVICE



Joe Dope has a vague premonition
That he's in for some quick demolition...
He recalls that he oughter
Replenish the water
To keep the old bus in condition.

Don't be a dope —

HANDLE EQUIPMENT RIGHT !

Section XII

SECOND ECHELON PREVENTIVE MAINTENANCE

33. SECOND ECHELON PREVENTIVE MAINTENANCE SERVICES.

a. Regular scheduled maintenance inspections and services are a preventive maintenance function of the using arm and are the responsibility of commanders of operating organizations.

(1) FREQUENCY. The frequency of the preventive maintenance services outlined herein is considered a minimum requirement for normal operation of this truck-mounted crane. Under unusual operating conditions such as extreme temperatures, dusty, sandy, or extremely wet terrain, it may be necessary to perform certain maintenance services more frequently.

(2) FIRST ECHELON PARTICIPATION. The drivers or operators should accompany their units and assist the mechanics while periodic second echelon preventive maintenance services are performed. Ordinarily, they should present the unit for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry and not caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the unit should not be washed or wiped thoroughly clean, since certain types of defects such as cracks, leaks, and loose or shifted parts or assemblies are more evident if the surfaces are slightly soiled or dusty.

(3) If instructions other than those contained in the general procedures in step (4) or the specific procedures in step (5) which follow, are required for the correct performance of a preventive maintenance service or for correction of a deficiency, other sections of this manual pertaining to the item involved, or a designated individual in authority, should be consulted.

(4) GENERAL PROCEDURES. These general procedures are basic instructions which are to be followed when performing the services on the items listed in the specific procedures. NOTE: *The second echelon personnel must be thoroughly trained in these procedures so that they will apply them automatically.*

(a) When new or overhauled subassemblies are installed to correct deficiencies, care should be taken to see that they are clean, correctly installed, and properly lubricated and adjusted.

(b) When installing new lubricant retainer seals, a coating of the lubricant should be wiped over the sealing surface of the lip of the seal. When the new seal is a leather seal, it should be soaked in SAE 10 engine oil (warm, if practicable), for at least 30 minutes.

Then, the leather lip should be worked carefully by hand before installing the seal. The lip must not be scratched or marred.

(c) The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn. The mechanics must be thoroughly trained in the following explanations of these terms:

1. The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

2. The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether it is in its normal assembled position in the vehicle.

3. The inspection of a unit to determine if it is "secure" is usually an external visual examination, a wrench, hand-feel, or a pry-bar check for looseness. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in assembly.

4. "Excessively worn" will be understood to mean worn close-to, or beyond, serviceable limits and likely to result in a failure if not replaced before the next scheduled inspection.

(d) Special Services. These are indicated by repeating the item numbers in the columns which show the interval at which the services are to be performed, and show that the parts or assemblies are to receive certain mandatory services. For example, an item number in one or both columns opposite a TIGHTEN procedure, means that the actual tightening of the object must be performed. The special services include:

1. Adjust. Make all necessary adjustments in accordance with the pertinent section of the vehicle operators manual, special bulletins, or other current directives.

2. Clean. Clean units of the vehicle with dry-cleaning solvent to remove excess lubricant, dirt, and other foreign material. After the parts are cleaned, rinse them in clean dry-cleaning solvent, and dry them thoroughly. Take care to keep the parts clean until reassembled, and be certain to keep dry-cleaning solvent away from rubber or other material which it will damage. Clean the protective grease coating from new parts, since this material is usually not a good lubricant.

3. Special lubrication. This applies both to lubrication operations that do not appear on the vehicle Lubrication Order, and to items that do appear on such orders but should be performed in connection with the maintenance operations, if parts have to be disassembled for inspection or service.

4. Serve. This usually consists of performing special operations, such as replenishing battery water, draining and refilling units with oil, and changing or cleaning the oil filter, air cleaner, or cartridges.

5. Tighten. All tightening operations should be performed with sufficient wrench-torque (force on the wrench handle) to tighten the unit according to good mechanical practice. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, locking wire, or cotter pins provided to secure the tightening.

(e) When conditions make it difficult to perform the complete preventive maintenance procedures at one time, they can sometimes be handled in sections; however, all operations should be completed within the week, if possible. All available time at halts and in bivouac areas must be utilized, if necessary, to assure that maintenance operations are completed. When limited by the tactical situation, items with special services in the columns should be given first consideration.

(f) The numbers of the preventive maintenance procedures that follow are identical with those outlined on W.D., A.G.O. Form No. 461, which is the "Preventive Maintenance Service Work Sheet for Wheeled and Half-track Vehicles." Certain items on the work sheet that do not apply to this vehicle are not included in the procedures in this manual. In general, the numerical sequence of items on the work sheet is followed in the manual procedures, but in some instances there is deviation for conservation of the mechanic's time and effort.

(5) SPECIFIC PROCEDURES. The procedures for performing each item in the 1,000-mile (monthly) and 6,000-mile (6-month) maintenance procedures, whichever occur first, are described in the following chart. Each page of the chart has two columns at its left edge corresponding to the 6,000-mile and the 1,000-mile maintenance respectively. Very often it will be found that a particular procedure does not apply to both scheduled maintenances. In order to determine which procedure to follow, look down the column corresponding to the maintenance due, and wherever an item number appears, perform the operations indicated opposite the number.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile

ROAD TEST

NOTE: *When the tactical situation does not permit a full road test, perform those items which require little or no movement of the vehicle. If a road test of the carrier is possible, it should be for preferably 5 miles, and not over 10 miles. An operating test should also be performed on the crane equipment in conjunction with the road test.*

1 | 1 **Before-operation Service.** Perform the Before-operation Service as outlined in paragraph 25.

2 | 2 **Air-Pressure (Build-up and Governor Cut-off).** During warm-up period, operate carrier engine at fast idle long enough to observe if air brake pressure builds up at normal rate to specified maximum 105 pounds, and if governor then cuts off air from compressor. With engine at normal idling speed, bleed air pressure from system by repeated brake application, and observe if compressor cuts in at about 85 pounds. Any abnormal drop in air pressure except from brake application, should be investigated by making soap suds test, paragraph 63 **d.** CAUTION: *Do not move vehicle until pressure reaches 85 pounds.*

3 | 3 **Dash Instruments and Gages.**

a. OIL PRESSURE GAGES.

(1) (Carrier). Oil pressure gage should indicate 35 pounds pressure at normal operating speed (1,600 revolutions per minute), and 15 pounds pressure at idling speed (400 revolutions per minute). CAUTION: *Stop engine if oil pressure gage is too low for safe engine operation.*

(2) (Crane). Oil pressure gage should indicate 40 pounds pressure at normal operating speed, and approximately 15 pounds pressure at idling speed. CAUTION: *Stop engine if oil pressure is too low or too high for safe engine operation.*

b. AMMETERS.

(1) (Carrier). Ammeter should show a positive (+) charge for a short period after starting engine, until generator restores to battery the current used in starting. After stopping engine, investigate any continued discharge (—) readings noted while engine was running with lights and accessories turned off.

(2) (Crane). Check in same manner as for above carrier item.

MAINTENANCE	
6,000 Mile	1,000 Mile

MAINTENANCE		
6,000 Mile	1,000 Mile	
		paragraph 58 b. CAUTION: *Never allow pedal free play to become less than ½ inch.* Observe any unusual noise when pedal is depressed, which may indicate defective or dry release bearing. With transmission in gear, note any tendency to chatter or grab when clutch is engaged, or slip when fully engaged under load.
6	6	b. (CRANE). Test operation on all crane clutches for free play. Clutches should not chatter or grab when being applied, or slip when under load. Check all accessible clutches for uniform clearance when fully released, paragraph 104.
7	7	**Transmission and Transfer.** Carrier transmission and transfer levers should move into each gear range position easily, operate without unusual noise, and not slip out of mesh during operation. Test declutching lever to see that front axle engages properly. Note any vibration that may indicate loose mountings, or any noise that may indicate damaged, excessively worn, or inadequately lubricated parts.
8	8	**Steering.** With carrier in motion, move steering wheel fully in both directions, and observe whether there is any indication of looseness or binding. Note any tendency to wander, shimmy, or pull to one side. See that steering column and wheel are in good condition and secure.
9	9	**Engines.** Observe engine operating characteristics as follows: a. (CARRIER). *Idle.* Engine should idle smoothly without stalling, with choke fully open and accelerator released. *Unusual Noises.* Listen for knocks and rattles as the engine is accelerated and decelerated and while it is under both light and heavy loads. *Acceleration and Power.* Operate the engine at various speeds in all gear ratios, noting if the vehicle has normal pulling power and acceleration. Note any tendency to stall while shifting. A slight "ping" during fast acceleration is normal. Continued or heavy "ping" may indicate early timing or heavy accumulation of carbon. *Governed Speed.* With the truck in a low gear, slowly depress the accelerator to the toeboard. Observe tachometer reading and note if the engine will reach

MAINTENANCE	
6,000 Mile	1,000 Mile
9	9

but not exceed the specified speed of 2,150 revolutions per minute. If necessary, adjust governor according to paragraph 54 **b.**

b. (CRANE).

Idle. Engine should idle smoothly without stalling, with choke fully open, and throttle released.

Unusual Noise. Listen for knocks and rattles as the engine is accelerated and decelerated, and while it is under both light and heavy loads.

Acceleration and Power. Operate the engine at various speeds, noting if it has normal power and acceleration. Note any tendency to stall while engaging. A slight "ping" during fast acceleration is normal, while continued or heavy "ping" may indicate early timing or heavy accumulation of carbon.

Governed Speed. Observe whether or not the engine exceeds the specified governed speed and if necessary, adjust governor according to paragraph 54 **b.**

10	10	**Unusual Noises.**
		a. (CARRIER). Be on the alert during road test for any noise in carrier or trailer that may indicate loose or damaged attachments mounted on carrier or trailer. Listen for loose carrier cab mountings, floor plates, door, windshield, or hardware. Listen particularly for indications of loose wheel mountings on carrier and trailer.
10	10	b. (CRANE). Be on the alert during crane test for noise that may indicate loose or damaged equipment or attachments mounted on crane, loose cab mountings, floor plates, door, or hardware. Listen particularly for indications of misalined sheaves, loose sheave pins, or clamshell bucket hinge pins, boom mountings, or attachments.
12	12	**Air Brake System Leaks.** With the air pressure at the governed maximum and the carrier brakes applied, stop the engine. There should not be a noticeable drop in pressure within 1 minute. If any pressure drop occurs during this check, test the air brake system for leaks by the soap suds method, paragraph 63 **d.**
13	13	**Temperatures.**
		a. (CARRIER). Place hand cautiously on carrier brake drums and carrier and trailer wheel hubs, to see if they are abnormally hot. Inspect carrier axle housings, transmission, and transfer case for indications of overheating.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile
13	13
14	14
14	14
18	18
18	18
	19
19	

b. (CRANE). Place hand cautiously on all crane winch brake drums, clutches, and all accessible bearings to see if they are abnormally hot. Inspect clutches and shaft bushings and power take-off, for indications of overheating.

Leaks (Engine Oil, Fuel, and Water).

a. (CARRIER). Look in carrier engine compartment and under vehicle for indications of engine oil, coolant, or fuel leaks. Trace any leaks to their source, and correct or report them.

b. (CRANE). Check in same manner as for above carrier item.

MAINTENANCE OPERATIONS

Cylinder Head and Gaskets.

a. (CARRIER). Look for cracks in cylinder head or indications of oil, coolant, or compression leaks around studs, cap screws, and gaskets. CAUTION: *Cylinder head should not be tightened unless there is definite evidence of looseness or leaks.* If tightening is necessary, tighten in proper sequence. Do not use a wrench over 16 inches long.

b. (CRANE). Inspect in same manner as for above carrier item. If tightening is necessary, tighten in proper sequence.

Valve Mechanism (Clearance, Cover Gaskets).

a. (CARRIER). Adjust valve stem clearance only if noisy, or if engine performance indicates the necessity. Intake clearance, 0.010 inch hot; exhaust clearance, 0.016 inch hot.

Adjust. Set valve stem clearances to above specifications. See if valve stems, tappets, tappet cluster brackets, springs, seats, and locks are in good condition, correctly assembled, and secure. Inspect valve covers to be sure they are in good condition. Reinstall them securely, using new gaskets, if necessary.

b. (CRANE). Adjust crane engine valve stem clearance only if noisy, or if engine performance indicates the necessity. Intake 0.011- to 0.013-inch, exhaust 0.021- to 0.023-inch running clearance.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

MAINTENANCE	
6,000 Mile	1,000 Mile
19	

Adjust. Perform adjustment and inspect in same manner as for above carrier item, using clearance in step (b).

	20	**Spark Plugs (Gaps, Deposits).**
		a. (CARRIER). Without removal, wipe off plugs and examine insulators for damage or indications of compression leaks.
20		Remove all plugs and examine to see if they are in good condition. Pay particular attention to broken insulators, excessive carbon deposits, and to electrodes burned thin. Clean plugs thoroughly. If plug cleaner is not available, install new or reconditioned plugs. Set plug gaps to 0.025 inch, paragraph 53.
	20	b. (CRANE). Perform in same manner as for above carrier item.
20		Perform in same manner as for above carrier item.
22	22	**Batteries (Cables, Hold-down, Carrier, Record Gravity and Voltage).**
		a. (CARRIER). Inspect battery case for cracks and leaks. Clean top of battery. Inspect cables, terminals, bolts, posts, straps, and hold-downs for good condition. Test specific gravity and voltage, and record on W.D., A.G.O. Form No. 461. Specific gravity readings below 1.225 at normal temperature, indicate battery should be recharged or replaced. For freezing temperatures, see specifications in paragraph 67 **b** (4).
22		Perform high-rate discharge test according to instructions for "condition" test which accompany test instrument, and record voltage on W.D., A.G.O. Form No. 461. Cell variation should not be more than 30 percent. NOTE: *Specific gravity must be above 1.225 to make this test.*
22	22	Bring electrolyte to proper level, ½ inch above plates, by adding clean water. Clean entire battery and carrier. Repaint carrier if corroded. Clean battery cable terminals, and tighten terminal bolts and hold-downs carefully to avoid damage to battery.
22	22	b. (CRANE). Perform procedure same as for above carrier item.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile.
22	
22	22
23	23
24	24
24	24
25	25

Perform procedure same as for above carrier item.

Perform procedure same as for above truck item.

Crankcases (Leaks, Oil Level).

a. (CARRIER). With engine idling, examine crankcase, valve covers, timing gear cover, and clutch housing for oil leaks. Stop engine and after oil has drained into crankcase, check to see if it is up to proper level. If an oil change is due, or condition of oil indicates the necessity, drain crankcase and refill to correct level with fresh specified oil. See Lubrication Order, paragraph 20. Same procedure applies to auxiliary air compressor. NOTE: *Do not start engine again until item 24 has been performed.*

b. (CRANE). With engine idling, examine crankcase, valve covers, and timing gear cover for oil leaks. Stop engine and after oil has drained into crankcase, check to see if it is up to proper level. If oil change is due, or condition of oil indicates the necessity, drain crankcase and refill to correct level with fresh specified oil. See Lubrication Order, paragraph 20. NOTE: *Do not start engine again until item 24 has been performed.*

Oil Filters and Lines.

a. (CARRIER). Inspect filters and external engine oil lines to see if they are in good condition, secure, and not leaking. Remove filter body drain plugs and drain off contents. Remove filter cartridge and check condition. If cartridge change is due, or condition indicates the necessity, replace with new cartridge, being sure gaskets are in place; tighten covers and drain plugs securely. CAUTION: *Start engine momentarily until oil pressure is indicated. Stop engine, recheck oil level in crankcase, and add as necessary to bring to running mark.*

b. (CRANE). Perform in same manner as for above carrier item.

Radiators (Core, Shell, Mountings, Hose, Cap and Gasket, Antifreeze Record, Overflow Pipe).

a. (CARRIER). Inspect all applicable items to see if they are in good condition, secure, and not leaking. Be sure overflow pipe is not kinked or clogged. Examine

MAINTENANCE	
6,000 Mile	1,000 Mile

condition of coolant to see whether it is so contaminated that cooling system should be cleaned. If cleaning is necessary, proceed only according to current directives covering proper procedure and recommended cleaner, neutralizer, and inhibitor materials, paragraph 70. Clean all insects, dirt, or grease deposits from core air passage and inspect for bent cooling fins. If antifreeze is in use, test its protective value and record in space provided on back of work sheet, Form No. 461.

25 — *Tighten.* Tighten all loose radiator mountings, water connections, hose clamps, and radio noise suppression bond straps, particularly points where internal-external toothed lock washers are used for bonding.

25 | 25 — b. (CRANE). Perform in same manner as for above carrier item.

25 — *Tighten.* Perform in same manner as for above carrier item.

26 | 26 — **Water Pumps and Fans.**

a. (CARRIER). Inspect pump to see if it is in good condition, secure, and not leaking. Examine shaft for end play or bearing looseness. Inspect fan to see if it is in good condition, and make sure that blades and hub are secure. Loosen drive belts, and examine fan hub for bearing wear. Leave drive belts loose until adjustment is made (item 29).

26 — *Tighten.* Carefully tighten water pump and fan assembly and mounting nuts or screws. Tighten water pump packing gland nuts until they are just snug. CAUTION: *Overtightening of packing gland nuts will cause premature packing and shaft wear, and will result in leaks.*

26 | 26 — b. (CRANE). Perform in same manner as for the above carrier item.

26 — *Tighten.* Perform in same manner as for the above carrier item.

27 | 27 — **Generators, Cranking Motors, and Switches.**

a. (CARRIER). Inspect carrier generator, cranking motor, and switch, to see that they are in good condition, securely mounted, and if wiring connections are clean and secure. See that radio noise suppression capacitor on generator is securely mounted and connected.

27 — *Serve.* Remove generator and cranking motor inspection covers, and examine commutators and brushes to see if they are in good condition, clean, and not exces-

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile
	sively worn. See that brushes are free in holders and have sufficient spring tension to hold them in proper contact with commutators, and if brush connection wires are secure and not grounding.
	Clean. Blow out commutator end of generator and cranking motor with compressed air. If commutators are dirty, clean only with flint paper 2/0 (do not use emery), and again blow out with air.
	Tighten. Tighten cranking motor and generator mountings securely.
27	27	b. (CRANE). Perform in the same manner as for above carrier item.
27		*Serve.* Perform in the same manner as for above carrier item.
		Clean. Perform in the same manner as for above carrier item.
		Tighten. Perform in the same manner as for above carrier item.
28	28	**Air Compressor (Unloader Valve, Governor, Lines).** Inspect the carrier air compressor to see that it is in good condition, properly alined and secure. Check unloader valve clearance (0.010 to 0.015 inch). See if the governor is in good condition and secure, if all compressor, water, oil, and air lines within engine compartment are in good condition, secure, and not leaking.
28		*Clean.* Clean compressor and governor air strainers in dry-cleaning solvent; dry, apply a thin film of engine oil to strainers, and reinstall securely.
28		*Special Lubrication.* Apply a few drops of engine oil to the unloader valve fulcrum pin. Apply a few drops of kerosene or dry-cleaning solvent to upper valve stem of governor.
28		*Adjust.* Adjust unloader valve clearances to from 0.010 to 0.015 inch.
29	29	**Drive Belts and Pulleys.**
		a. (CARRIER). Examine all drive belts for evidence of fraying condition, excessive wear and deterioration. Inspect all drive pulleys and hubs to see if they are in good condition and securely mounted.
29		*Adjust.* Adjust drive belts to have ½- to ¾-inch finger-pressure deflection halfway between pulleys, paragraph 71 **b.**

MAINTENANCE	
6,000 Mile	1,000 Mile
29	29

b. (CRANE). Perform in the same manner as for above carrier item.

30	30

Tachometer Drive and Adapter. Inspect these carrier units to see if they are in good condition, correctly assembled, and secure. Examine the flexible drive shaft for kinks, and connections for indications of oil leaks.

31	31

Distributors (Cap, Rotor, Points, Shaft, Advance Units).

a. (CARRIER). Observe if distributor body and external attachments are in good condition and secure. Examine other parts as follows:

Cap, Rotor, and Points. Remove cap and clean. Look for cracks and carbon streaks in cap and rotor, corrosion of terminals and connections. See that points are well-alined and adjusted to from 0.018 to 0.020 inch, when wide open. If inside of distributor is dirty, remove assembly, clean in dry-cleaning solvent, dry thoroughly with compressed air, and lubricate according to Lubrication Order, paragraph 20.

CAUTION: *When cleaning distributor assembly, remove wick and lubrication cup and replace after cleaning.* If breaker points are pitted, burned, or worn to an unserviceable degree, replace points and condenser. When cleaning points, use contact point dresser or flint paper 2/0 (never use emery), and blow out filings with compressed air.

Shaft. Test by hand-feel for excessive wear in shaft or bushings.

Centrifugal Advance. Install rotor on shaft and turn clockwise as far as it will go; note if it will return to its original position, when released, without hang-up or binding.

Special Lubrication. Lubricate cam surfaces, breaker arm pin, and wick according to Lubrication Order (par. 20).

31	

Adjust. Set breaker point gaps to 0.018 to 0.024 inch, when wide open.

31	31

b. (CRANE). Inspect and clean in same manner as for above carrier item.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile
31	

Special Lubrication. Perform in same manner as for above carrier item.

Adjust. Perform in the same manner as above carrier item.

32	32	**Coils and Wiring.** a. (CARRIER). Inspect coil, ignition wiring, shielding, and conduits to see if they are in good condition, clean, securely connected, and properly mounted. Inspect all low voltage wiring in engine compartment in like manner. Make sure spark plug and distributor to coil wire resistor-suppressors are firmly attached to wires and not scorched or cracked, and that coil ground strap connections are secure.
32	32	b. (CRANE). Perform in the same manner as for the above carrier item.
33	33	**Manifolds and Gaskets.** a. (CARRIER). Inspect all carrier engine manifolds for damage, exhaust leaks at gaskets, and loose mounting or assembly nuts or screws. Look for evidence of cracks and sand holes usually indicated by carbon streaks.
33		*Tighten.* Tighten all manifold assembly and mounting nuts securely.
33	33	b. (CRANE). Perform in the same manner as for above carrier item.
34	34	**Air Cleaners.** a. (CARRIER). Inspect carburetor and air compressor air cleaners to see if they are in good condition, securely mounted and connected, and not leaking. Remove reservoir and element, clean in dry-cleaning solvent, dry, fill reservoir to proper level with clean engine oil, and reassemble. See Lubrication Order, paragraph 20. Be sure gaskets are in place and that all joints and air horn connections are tight.
34	34	b. (CRANE). Inspect and service carburetor air cleaner in same manner as for above carrier item.
35	35	**Breather Caps.** a. (CARRIER). Inspect crankcase breather cap to see if it is in good condition, secure, and not leaking. Remove oil reservoir and element, wash clean in dry-cleaning solvent, refill reservoir with fresh engine oil, and reassemble securely. See Lubrication Order, paragraph 20.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

MAINTENANCE		
6,000 Mile	1,000 Mile	
35	35	b. (CRANE). Perform in the same manner as for above carrier item.
36	36	**Carburetors and Governors.**
		a. (CARRIER). See if these units are in good condition, correctly assembled and securely installed; that carburetor does not leak; that control linkage, including choke and throttle shaft, is not excessively worn; if choke valve opens fully when the control is in its released position; if throttle valve opens fully when the accelerator is fully depressed; and if the governor is secure and properly sealed.
36	36	b. (CRANE). Perform in the same manner as for above carrier item.
37	37	**Fuel Filters and Lines.**
		a. (CARRIER). Examine carrier fuel filter to see if it is in good condition, securely mounted and connected, and not leaking. *Clean.* Close fuel valve, and remove sediment bowl and element. Drain fuel until it runs clear. Wash sediment bowl and element in dry-cleaning solvent, and reinstall using new gasket. Turn on fuel valve, and check sediment bowl and lines for leaks.
37	37	b. (CRANE). Perform in same manner as for the above carrier item.
38	38	**Fuel Pumps.**
		a. (CARRIER). Inspect pump to see if it is in good condition, securely mounted, and not leaking. Remove sediment bowl and screen, and wash in dry-cleaning solvent. Be sure gasket is in place and serviceable when bowl is reinstalled.
38		Attach gage to pressure side of fuel pump, and after starting engine as in item 39, see that pressure is 3½ pounds minimum and 5 pounds maximum at idle speed.
38	38	b. (CRANE). Perform in the same manner as for the above carrier item.
38		Perform in the same manner as for the above carrier item.

MAINTENANCE		
6000 Mile	1,000 Mile	
39	39	**Cranking Motor.** a. (CARRIER). Start the engine, observing if general action of cranking motor is satisfactory, particularly if it engages and operates properly without excessive noise, has adequate cranking speed, and if the engine starts readily. Also, as soon as engine starts, note whether oil pressure gage and ammeter indications are satisfactory.
39	39	b. (CRANE). Perform in same manner as for above carrier item.
40	40	**Leaks (Engine Oil, Fuel, and Water).** a. (CARRIER). With engine running, recheck all points of oil, fuel, and cooling system for leaks. Trace any leaks found to their source, and correct or report them.
40	40	b. (CRANE). Perform in the same manner as for above carrier item.
41	41	**Ignition Timing (Advance).** a. (CARRIER). With engine running, and a neon timing light connected, observe if ignition timing is correct (par. 53). Also note whether automatic controls advance the timing as engine is accelerated gradually.
41		*Adjust.* Adjust ignition timing to specifications in paragraph 53.
41	41	b. (CRANE). Perform in the same manner as for the above carrier item.
41		*Adjust.* Set ignition timing according to instructions in paragraph 89.
42	42	**Engine Idle and Vacuum Test.** a. (CARRIER). Inspect as follows: *Adjust.* Connect a vacuum gage to intake manifold, adjust engine to its normal idle speed by means of throttle stop screw, and then adjust the idle mixture adjusting needle until vacuum gage indicates a steady maximum reading. NOTE: *If these latter adjustments are made simultaneously, time will be saved.*
42	42	*Vacuum Test.* With the engine running at normal idling speed, vacuum gage should read about 18 to 21 inches, and pointer should be steady. A badly fluctuating needle between 10 and 15 inches may indicate a

MAINTENANCE	
6,000 Mile	1,000 Mile
	defective cylinder head gasket or valve. An extremely low reading may indicate a leak in intake manifold or gasket. Accelerate and decelerate engine quickly. If vacuum gage indicator fails to drop to approximately 2 inches as throttle is opened, and then fails to recoil to at least 24 inches as throttle is closed, it may be an indication of diluted oil, poor piston ring sealing, or abnormal restriction in carburetor, air cleaner, or exhaust. NOTE: *Above readings apply to sea level. There will be approximately a 1-inch drop for each 1,000 feet of altitude.*
42	42	b. (CRANE). Perform idle and vacuum tests in the same manner as for the above carrier item.
43	43	**Regulator Unit.** a. (CARRIER). Inspect regulator unit to see if it is in good condition, securely mounted and connected, and clean.
43		*Test.* Connect a low voltage circuit tester and observe if generator output is properly controlled by voltage regulator, current regulator, and cut-out. Follow instructions in this manual, or those which accompany test instruments. CAUTION: *This test should be made only after regulator unit has reached normal operating temperature.*
43	43	b. (CRANE). Perform in the same manner as for the above carrier item.
43		*Test.* Perform in the same manner as for the above carrier item.
		RAISE VEHICLE AND BLOCK SAFELY
16	16	**Gear Oil Level and Leaks.** Remove plugs in carrier front and rear axles, transmission and transfer case, and check lubricant levels. Proper level is from lower edge of filler hole (when hot) to ½ inch below when cool. Allow sufficient time for foaming to subside before checking levels. If an oil change is due, in any of these units, or condition of lubricant indicates an oil change is necessary, drain and refill units according to Lubrication Order, paragraph 20. Note any indications of excessive lubricant leaks at oil seals or gaskets.

MAINTENANCE	
6,000 Mile	1,000 Mile
17	17

Unusual Noises.

a. (CARRIER). With carrier engine running, observe as follows:

Engine, Belts, and Accessories. Accelerate and decelerate the engine momentarily, and listen for any unusual noise in these units that might indicate damage, loose or excessively worn engine parts, drive belts, or accessories. Also be sure to locate and correct or report any unusual noise heard during road test.

Transmission, Transfer, Propeller Shafts and Joints, Axles, and Wheel Bearings. With the carrier transmission in an intermediate gear, and front driving axle engaged, operate these units at a constant, moderate speed and listen for any unusual noise that might indicate loose, damaged, or excessively worn unit parts. Also observe all propeller shafts and wheels for vibration and run-out, which may indicate looseness or unbalance. Be sure to locate and correct or report any noise noted during road test. Turn trailer wheels to test for run-out or unbalance, and listen for any unusual noise that might indicate loose, damaged, or inadequately lubricated wheel bearings.

17	17	b. (CRANE). Perform inspection of engine, belts, and accessories in same manner as for above carrier item.
44	44	**Power Tire Inflation.** Inspect carrier tire inflation connection at air tank to see that it is in good condition and clean. Be sure cap is present and connected by safety chain, that air valve turns easily and closes securely. Connect hose and see that it is in good condition and functions properly, while performing item 47.
47	47	***Tires and Rims (Valve Stems and Caps, Condition, Direction, Matching and Spares).** Inspect carrier and trailer tires as follows:

VALVE STEMS AND CAPS. Observe if all valve stems are in good condition, and in correct position, and if all valve caps are present and installed securely. Do not tighten with pliers.

CONDITION. Examine all tires for cuts, bruises, breaks, and blisters. Remove embedded glass, nails, and stones. Look for irregular tread wear, watching for any sign

MAINTENANCE	
6,000 Mile	1,000 Mile

of flat spots, cupping, feather edges, and one-sided wear. Remove tires worn thin at center of tread (or otherwise unserviceable tires), and exchange for new or retreaded tires. Any mechanical deficiencies causing such conditions should be determined, and corrected or reported. Wheel positions of tires with irregular wear should be rotated to even-up wear. Front carrier tires, worn irregularly, should be moved diagonally to rear wheel positions.

DIRECTION. Directional tires and non-directional tires should not be installed on same vehicle. Directional tires on rear carrier wheels should be mounted so that the "V" of chevron will point down when viewed from the front. Directional tires on carrier front wheels and trailer wheels, will ordinarily be mounted so that "V" of chevrons will point up when viewed from front of vehicle.

MATCHING. With tires properly inflated, inspect them to see if they are matched according to over-all circumference and type of tread.

Spare Tire Carrier. See whether spare tire carrier is in good condition and secure.

Rims. All truck and trailer rims and their lock rings or flanges should be in good condition and secure.

47 TIGHTEN. Tighten all wheel rim flange or lug nuts securely.

47 **Serve.** With tires properly inflated to 85 pounds on carrier and 60 pounds on trailer (cool), check over-all circumference of all tires, including spares. Select tires to be mounted on duals or on driving axles, so they will not have differences in over-all circumference exceeding the ¾-inch limits specified in current directives and bulletins. Mount all dual tires with the larger tire on the outside. The valve stem on inner wheels should point out, and the valve stem on outer wheel should point in, and should be opposite each other.

NOTE: *Spares must be matched properly and mounted for use on one of the road wheels at intervals not exceeding 90 days. A convenient time to do this is during these maintenance services. After performing the tire-matching service, do not reinstall wheels until wheel-bearing services are completed.*

48 **Rear Brakes (Drums, Supports, Cams, and Shafts).** Inspect and service carrier rear brakes as follows, with

MAINTENANCE	
6,000 Mile.	1,000 Mile

rear wheels removed: NOTE: *On 6,000-mile maintenance, several wheel bearing and brake items up to 52 are group services and thus overlap. Perform in best order for economy of time and orderly reassembly.*

Drums and Supports. Clean dirt and grease from drums and supports (dust shields), keeping dry-cleaning solvent away from linings. Examine drums and supports to see if they are in good condition, securely mounted, and if drums are excessively worn or scored.

Cams and Shafts. See if cams and shafts, where they contact, are excessively worn; also determine if cam shafts operate freely in collar, and if shafts and collars are worn.

TIGHTEN. Tighten brake support cap screws and hub to drum nuts securely.

49 **Rear Brake Shoes (Linings, Anchors, Springs).** Examine linings through inspection holes to see if they are so worn that rivet heads may contact drums within next 100 miles of operation. If vehicle has been operated in deep water, mud, or loose sand, remove forward right wheel hub and drum and examine lining for damage. If this lining must be replaced, remove all wheel hubs and drums, check their brakes, and service as necessary, being sure to clean, lubricate, and adjust all removed wheel bearings as described in item 52 below for 6,000-mile service.

ADJUST. Adjust shoes by minor method if necessary.

49 While rear wheels are removed, inspect linings to see if they are in good condition, tightly secured to brake shoes, in good wearing contact with drums, free of dirt or lubricant, and not excessively worn. Also see if shoes are in good condition, properly secured to anchors, guides, and retracting springs; make sure that springs have sufficient tension to return shoes properly to released position. Thickness of lining at most worn point should be enough for at least 1,000 miles of service before rivet heads are likely to contact drums.

CLEAN. Clean all dirt and grease from linings with wire brush, cloth, or compressed air.

ADJUST. After subsequent related items to 60 inclusive are completed, adjust shoes by minor method. If new linings have been installed, adjust as described in

MAINTENANCE	
6,000 Mile	1,000 Mile
50	50

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE		
6,000 Mile	1,000 Mile	
53		Remove front wheels, and inspect and service as follows: DRUMS AND SUPPORTS. Clean and inspect in same manner as in item 48. CAMS AND SHAFTS. Inspect in same manner as in item 48.
	54	**Front Brake Shoes (Linings, Anchors, Springs).** Inspect carrier front brake shoes in same manner as in item 49.
54		ADJUST. Adjust by minor method if necessary. CLEAN. Clean in same manner as in item 49.
54	54	ADJUST. Adjust in same manner as in item 49 after subsequent related items to 60 inclusive are completed.
55	55	**Steering Knuckles (Joints, Bearings, Seals).** Inspect to see if carrier steering knuckle housings are in good condition. Look particularly for cracks around steering arms. See if outside knuckle felt seals and seal flanges are in good condition and secure. Remove lubrication plug and examine sample of lubricant to see if it appears to be contaminated.
55		CLEAN. Remove constant velocity universal joint assembly. Wash thoroughly in dry-cleaning solvent and, without disassembly of universal joint, inspect parts to see if they are in good condition and not excessively worn. Pay particular attention to universal joint washers, balls, cage, races, axle splines, flanges, and pivot bearings.
55		SPECIAL LUBRICATION. Lubricate constant velocity universal joints according to Lubrication Order, paragraph 20.
55		ADJUST. Use every precaution to reinstall shims and spacers in the original position from which they were removed at disassembly, to insure correct pivot bearing and axle end play adjustment.
56	56	***Front Springs (Clips, Leaves, U-bolts, Hangers, and Shackles).** See if carrier front springs and trailer springs are in good condition, correctly assembled, and secure. Spring clips and bolts should be in place; spring leaves should not be shifted out of their correct position. This

MAINTENANCE	
6,000 Mile	1,000 Mile
57	57
57	
58	58
58	
60	60
60	
60	
60	

latter condition may be an indication of a sheared center bolt. Note if deflection of both springs is normal and approximately the same. Test hangers and bolts for excessive wear by means of a pry bar.

TIGHTEN. Tighten all spring U-bolts securely and uniformly.

Steering (Arms, Tie Rods, Drag Link, Seals and Boots, Pitman Arm, Gear, Column, and Wheel). See if these carrier items are in good condition, correctly and securely assembled and mounted, if steering gear case is leaking lubricant, and if lubricant is at proper level. Pay particular attention to Pitman arm to see if it is securely mounted and not bent out of its normal shape. Also observe if steering system is in good adjustment.

TIGHTEN. Tighten Pitman arm shaft nut securely. Also tighten steering gear case assembly and mounting nuts or screws, taking care not to disturb adjusting screws and lock nuts. CAUTION: *Loosen steering column bracket when tightening steering case mounting nuts, so as not to distort column.*

Front Shock Absorbers and Links. Inspect carrier front shock absorbers, to see that they are in good condition, secure to frame, and not leaking; if links are secure and not damaged. If rubber bushings are hard or cracked, apply brake fluid to exposed surfaces.

SERVE. Fill shock absorber bodies with specified fluid (par. 20).

Front Wheels (Bearings, Seals, Flanges, Axle End Play, and Nuts). Inspect carrier front wheels, bearings, seals, drive flange, and nuts in same manner as in item 52 for similar rear wheel items.

CLEAN. Disassemble, clean, and inspect the carrier front wheel bearings and oil seals in the same manner as described in item 52, taking care to check the universal joint end play as the drive flanges are removed, so that the end play adjustment may be made conveniently when reassembling.

SPECIAL LUBRICATION. Apply in same manner as described in item 52.

ADJUST. Adjust front wheel bearings in same manner as described in item 52, and adjust the brake shoes as described in item 49.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE		
6,000 Mile	1,000 Mile	
61	61	**Front Axle (Pinion End Play, Seals, Vents and Alinement).** If carrier front axle appears to be out of line, measure distance from front spring eyebolt to center of axle spring pad on each side. Distance should be equal. Inspect axle housing to see if it is in good condition and not leaking. Examine pinion shaft for excessive end play, and check seal for leaks.
		CLEAN. Clean axle housing vent thoroughly.
62	62	**Front Propeller Shafts (Joints, Alinement, Seals and Yokes).** See if these carrier units are in good condition, correctly and securely assembled and mounted; if the universal joints are properly alined with each other and are not excessively worn; that the slip joint is free, not excessively worn, and well lubricated; and that the seals on the universal joints and slip joint do not leak.
62		TIGHTEN. Tighten all universal joint assembly and yoke cap screws securely.
63	63	**Engines (Mountings, Ground Straps and Side Pans).** a. (CARRIER). Inspect carrier engine mountings and engine side pans to see that they are in good condition and securely mounted. Examine radio bond straps to see that they are in good condition, securely mounted and connected.
63	63	b. (CRANE). Inspect crane engine mountings to see if they are in good condition, and if mounting bolt nuts and bond straps are secure.
64	64	**Hand Brakes (Ratchet and Pawl, Linkage, Disk Lining).** Examine carrier hand brake to see that the ratchet pawl and linkage are in good condition, operate properly, and that lever remains in applied position with one-half ratchet travel in reverse. See that the disk is not scored or oily, and the lining is not worn too thin or oil-soaked.
		ADJUST. Set lining to disk clearance at $\frac{1}{32}$ inch. See paragraph 65 b.
65	65	**Clutch Pedal or Lever (Free Travel, Linkage and Return Springs).** a. (CARRIER). Check carrier clutch pedal free travel. Free travel should never be allowed to become less than ½ inch before meeting resistance. Examine to see if pedal is securely mounted to shaft, if clutch operat-

MAINTENANCE	
6,000 Mile	1,000 Mile
65	

ing linkage is in good condition, secure and not excessively worn at friction joints. See if return spring has proper tension to bring pedal to correct released position.

Adjust. Adjust clutch plate so clutch pedal free travel is as nearly 2¼ inches as possible, with toeboard clearance of ¾ inch. For correct procedure, see paragraph 58 **b.** CAUTION: *No pedal adjustment should be made except for toeboard clearance.*

65	65

b. (CRANE). Test operation of crane twin-disk clutch lever to be sure it operates properly without excessive play or binding; if sleeve is free, if thumb latch locking device functions properly, and if ratchet and pawl hold lever securely in any position. Examine lever, linkage, ratchet, and pawl to see if they are in good condition, and securely assembled or mounted. Inspect operating mechanism for excessive wear.

65	

Adjust. If clutch is too loose or too tight, make adjustment according to paragraph 93 **b.**

66	66

Brake Pedal (Free Travel, Linkage, Return of Springs, and Latch). Observe action of carrier brake pedal to see that it meets resistance 1/16 inch from fully released position and operates easily. Brake pedal locking latch should operate easily and fully engage pedal when in applied position. See that pedal, linkage pin, roller, and spring are in good condition and secure, and that return spring brings pedal to released position. Adjust as necessary to maintain the 1/16-inch clearance.

69	69

Air Brake Application Valve and Strainer. Observe the action of carrier air brake application valve to see if it operates properly and if connecting linkage is in good condition, correctly assembled, and secure. See that valve closes fully when brake pedal is released.

69	

CLEAN. Remove and clean strainer in dry-cleaning solvent, dry, and reinstall securely.

70	70

Air Brake Reservoirs. Inspect truck air brake reservoirs to see that they are in good condition, mounted and connected securely, and not leaking. Open drain cocks and drain off water.

71	71

Transmission and Power Take-off (Mountings, Seals, Linkage, Chains and Sprockets).

a. (CARRIER). Inspect carrier transmission to see if the case is in good condition and securely mounted.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile
71	71

Examine it for lubricant leaks at seals and gaskets. See that control linkage and shaft mechanism are not damaged or excessively worn.

b. (CRANE). Examine crane power take-off shaft, sprockets, chain and chain adjusting idler, to see if they are in good condition, secure, and not excessively worn. Inspect chain for excessive slack. If slack exceeds 4¾ inches, one link should be removed. See instructions, paragraph 102.

72	72	**Transfer (Mountings, Linkage, Seals, Vents).** See if carrier transfer case is in good condition and securely mounted, that gear range and declutching control linkage and shift mechanism are securely connected and not damaged, and if vent is open. Look for evidence of lubrication leaks at seals and gaskets. Clean vent passage, if clogged.
72		TIGHTEN. Draw up all external assembly and mounting nuts securely.
73	73	**Rear Propeller Shafts.** Perform in the same manner as for carrier item 62.
74	74	**Center Bearing (Seals, Vent, Oil Level, Mountings).** Inspect carrier drive shaft center bearing (pillow block) to see if it is in good condition, securely mounted, and not leaking. See that vent is not damaged or clogged, and that it has the correct amount of lubricant.
75	75	**Rear Axles (Pinion End Play, Seals, Vent, Alinement).** Inspect carrier rear axles in the same manner as for item 61 for front axle. Clean axle housing vent thoroughly.
76	76	**Rear Air Brake (Chambers, Rods, Seals, and Slack Adjusters).** Inspect carrier to see that these items are in good condition, and securely mounted and connected. Examine rods for excessive wear and seals for lubricant leaks.
77	77	**Rear Walking Beams (U-bolts, Hangers).** Inspect rear walking beams and suspensions to see if they are in good condition, securely assembled and mounted, and in proper alinement. Be sure U-bolts and hanger brackets are not loose or damaged.
79	79	**Cab Mountings.** a. (CARRIER). Inspect carrier cab mountings to see that they are in good condition and secure.

MAINTENANCE	
6,000 Mile	1,000 Mile
79	

Tighten. Tighten carrier cab mountings securely and evenly, taking care to loosen the steering column clamp before alining or tightening cab. After completing this service, be sure to tighten steering column clamp.

79	79

b. (CRANE). Perform crane operation in same manner as for above truck item.

79	

Tighten. Tighten all crane cab mountings securely, taking care to tighten them evenly to keep doors and panels properly alined.

80	80

***Frame (Rails and Crossmembers).**

a. (CARRIER AND TRAILER). Inspect carrier and trailer frames, frame brackets, side rails, crossmembers and outrigger, to see that they are in good condition and properly alined. See that all welds, nuts, screws, and rivets are in good condition and secure. If frame appears to be out of line, report condition.

80	80

b. (CRANE-VERTICAL SWING, RING, AND PINION GEAR). Inspect crane ring gear to see that it is in good condition, properly mounted to carrier frame, and secure. Examine ring and pinion gears for damage or excessive wear.

80	

Tighten. Tighten all ring gear mountings securely.

81	81

***Wiring, Conduits and Grommets.**

a. (CARRIER AND TRAILER). Inspect all exposed carrier and trailer wiring, conduits, and grommets to see that they are in good condition, well supported, and securely connected. See that terminal block or boxes are secure. Be sure radio noise suppression capacitors, conduit clips and bondings are in good condition, clean, and securely mounted and connected.

81	81

b. (CRANE). Perform in same manner as for above carrier item.

82	82

Fuel Tank, Fittings, and Lines.

a. (CARRIER). Inspect carrier fuel tank to see if it is in good condition and securely mounted. Examine cap for defective gasket or plugged vent. See that filler neck is in good condition, and that cap fits securely. Examine tank and connections for leaks.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile
82	

Serve. Remove fuel tank drain plug and drain off accumulated water and dirt in bottom of tank. Drain only until fuel runs clear. Use necessary precautions against fire.

82	82

b. (CRANE). On crane, perform in same manner as for above carrier item.

82	

Serve. On crane, perform in same manner as for above carrier item.

83	83

Brake Lines (Fittings, Hose). Inspect all carrier air brake lines, hose, fittings, and connections to see that they are in good condition, and securely connected and supported so that lines or hose will not chafe against other vehicle parts.

84	84

Exhaust Pipes and Muffler.

a. (CARRIER). Examine exhaust pipe to see if it is securely attached to exhaust manifold, that gasket or packing does not show visible evidence of leakage, and that the other end of exhaust pipe is clamped securely to muffler. Inspect muffler to see if it is in good condition and securely mounted. Check tail pipe to see if it is securely clamped to muffler, and properly supported and unobstructed at its outer end. See that drain holes in muffler are at lowest point and not clogged.

84	84

b. (CRANE). On crane, perform in same manner as for above carrier item.

85	85

***Lubrication.**

a. (CARRIER AND TRAILER). If due, lubricate carrier and trailer in accordance with Lubrication Order (par. 20) and current lubrication directives, using only clean lubricant and omitting only those items that have had special lubrication during this service. Replace damaged or missing fittings, vents, flexible lines, or plugs.

85	85

b. (CRANE). On crane, perform in same manner as for above carrier item. See paragraph 20.

LOWER CARRIER AND TRAILER TO GROUND

86	86

Tow-in and Turning Stop. With carrier front wheels on ground and in straight-ahead position, use a toe-in gage to determine if adjustment is as specified ($\frac{1}{8}$ to $\frac{3}{16}$ in.). Turn wheels fully in both directions, and see

MAINTENANCE	
6,000 Mile	1,000 Mile
89	89
90	90

that tires clear all parts of vehicle. If there is abnormal front drive universal joint wear, report for check of turning angle by higher echelon.

Carrier to Trailer Wiring and Connections. Inspect carrier to trailer wiring and connections to see that they are in good condition, are properly supported, and that connections make secure contact.

Crane Hoist and Clamshell Shovel (Frame, Boom, Mountings, Clutches, Brakes, Drums, Cables, Sheaves, Drives, and Controls). Inspect and service as follows:

FRAME, BOOM, AND MOUNTINGS. Inspect all components of the A-frame, boom, superstructure, and all mountings to see if they are in good condition, properly assembled, and secure.

CLUTCHES. Examine the operating mechanism of the swing, boom, and hoist clutches to see if all accessible components are in good condition, correctly assembled, secure, and not excessively worn or binding.

Adjust. If necessary, adjust clutches according to instructions, paragraphs 98, 104, 110.

BRAKES. Examine the swing, boom, and hoist, and brake mechanisms to see if all components are in good condition, correctly assembled, and secure; that they operate without binding, and are not excessively worn. Be sure linings are secure to brake bands and that linings are not oil-soaked or so thin that rivets will score drums before next scheduled maintenance service.

Adjust. If necessary, adjust brakes according to instructions in paragraphs 100, 101, and 106.

DRUMS. Inspect boom and hoist cable drums to be sure they are in good condition and securely and correctly assembled and mounted. Examine for excessive drum shaft or bearing wear or cracked flanges.

CABLES. Unwind and inspect all cables for kinks, broken strands, and rust. Clean cables with light, new, or clean used oil. As cables are rewound evenly and tightly on drums, apply a film of clean engine oil to entire length of cables. See Lubrication Order, paragraph 20.

SHEAVES. Inspect all sheave blocks to be sure they are in good condition, correctly and securely assembled and installed, and not excessively worn.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile	1,000 Mile

DRIVES. Inspect all drive gears for excessive wear, and be sure they are properly alined and secure.

CONTROLS. Examine all swing, boom, and hoist, operating levers or pedals, cross shafts, rods and connections, locking devices, and retracting springs to be sure they are in good condition, correctly assembled, securely attached or mounted, and not excessively worn. See that retracting springs have sufficient tension. Test all controls to see if they operate properly without excessive looseness or binding, and see if all units which they control, respond properly.

CLAMSHELL SHOVEL. Inspect clamshell shovel to see if it is in good condition; that all assembly nuts, pins, and rivets are secure; that locking device operates properly and latches securely. If not mounted for use, be sure shovel is properly stowed on trailer and securely lashed.

Tighten. Tighten all loose crane hoist and shovel assembly or mounting nuts or screws securely.

91		**Lamps (Lights).** a. (CARRIER). Operate all carrier light switches, and observe if all carrier and, when connected, trailer lights, respond properly. Examine all lights to see if they are in good condition, securely mounted, and that lenses are clean.
91		*Adjust.* Adjust all lamp-unit beams.
91	91	b. (CRANE). On crane, perform in same manner as for above carrier item.
92	92	**Safety Reflectors.** See if all carrier and trailer safety reflectors are present, in good condition, clean, and secure.
93	93	**Front Tow Hooks, Brush Guards, and Grilles (Carrier).** Inspect these carrier items to see that they are in good condition, secure, and that grilles and guards are not obstructed.
94	94	**Hood (Carrier) (Hinges, Fasteners, and Bond Straps).** Inspect carrier hood to see that it is in good condition, and that fasteners hold hood securely. Examine radio bond straps to see that they are in good condition, and securely mounted and connected.
95	95	**Front Fenders, Running Boards, Floats and Float Screws (Carrier).** Examine carrier front fenders, run-

MAINTENANCE	
6,000 Mile	1,000 Mile
95	

ning boards, outrigger boxes, and floats to see that they are in good condition and securely mounted. See that float screws operate properly.

TIGHTEN. Tighten all fender, running board, outrigger, and float mounting nuts securely.

96	96

Cab (Door, Hardware, Glass, Seat, and Floorboards).

a. (CARRIER). Inspect all of these carrier items to see that they are in good condition and secure; that hardware, door, and windshield operate properly and are adequately lubricated. See that door and windshield are properly alined with their openings, engage their bumpers and strikers properly, and latch securely in closed position. See that seat is in its proper position and floorboards are securely fastened.

96	96

b. (CRANE) (DOOR, HARDWARE, GLASS, PANELS, AND SEAT). Examine applicable crane cab items in same manner as for above carrier item.

98	98

Junction Box. Inspect carrier junction box to see that it is in good condition, securely mounted, and that all connections are secure.

99	99

Rear Fenders, Floats, and Float Screws. Examine these carrier items to see that they are in good condition and securely mounted. See that float screws operate correctly.

99	

TIGHTEN. Tighten all fender and float mounting nuts securely.

101	101

Rear Pintle Hook (Draw Bar, Latch, and Lock Pin). Inspect carrier rear pintle hook to see that it is in good condition and securely mounted to frame. Test pintle and latch to see if they operate correctly, are adequately lubricated, and if pin is present and securely attached by chain. Pay particular attention for broken draw bar spring or excessively worn bar.

103	103

Paint and Markings.

a. (CARRIER). Examine paint of carrier and trailer to see that it is in good condition, paying particular attention to any bright spots in finish that might cause glare or rust. Carrier and trailer markings should be legible unless covered for tactical reasons.

103	103

b. (CRANE). Examine crane paint markings in same manner as for above carrier and trailer item.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE		
6,000 Mile	1,000 Mile	
104	104	**Radio Bonding (Carrier) (Suppressors, Filters, Condensers, and Shielding).** See that all carrier radio suppression units not covered in foregoing procedures are in good condition, securely mounted, and connected.
104	104	**Radio Bonding (Crane) (Suppressors, Filters, Condensers, and Shielding).** On crane, perform in same manner as for above carrier.
124	124	**Tow Hitch (Lunette and Tongue).** Inspect trailer lunette and tongue to see that they are in good condition, correctly assembled, and securely mounted.
125	125	**Electric Connections.** Examine carrier to trailer electrical connections to see that they are in good condition, clean, and securely supported.
127	127	**Landing Gear.** Inspect the trailer landing supports to see that they are in good condition, operate properly, and lock in raised and lowered positions.
		TOOLS AND EQUIPMENT
131	131	**Tools.**
		a. (CARRIER). Inspect standard carrier and trailer and Pioneer tools to see if they are all present, in good condition, clean and properly stowed, or securely mounted; and if tool box is in good condition and securely mounted and locked. Also examine tools which have cutting edges to see that they are sharp. Any tools mounted on outside of vehicle which have bright or polished surfaces, should be painted or otherwise treated to prevent rust, glare, or reflection.
131	131	b. (CRANE). On crane, inspect in same manner as for above carrier item.
132	132	**Fire Extinguisher.**
		a. (CARRIER). Inspect carrier fire extinguisher to see that it is in good condition and securely mounted. Examine operating valve for evidence of having been opened, or for leakage. Remove filler plug to determine contents.
132	132	b. (CRANE). On crane, inspect in same manner as for above carrier item. NOTE: *If extinguisher is CO^2 type, weigh cylinder to determine contents.*

MAINTENANCE	
6,000 Mile	1,000 Mile
133	133
133	133
134	134
135	135
135	135
136	136
137	137
139	139
139	139
141	141

Decontaminator.

a. (CARRIER). See if decontaminator is in good condition, securely mounted, and fully charged. Make the latter check by removing filler plug. NOTE: *This solution must be replaced every 3 months, as it deteriorates.*

b. (CRANE). Perform in same manner as for above carrier item.

First Aid Kit (If Specified). See if carrier kit is in good condition, and that all of its items are present and properly packed. Report any deficiencies immediately.

Publications and Form No. 26.

a. (CARRIER). The vehicle and equipment manuals, Lubrication Order, Standard Form No. 26 (Accident-Report Form), and W.D., A.G.O. Form No. 478, must be present in carrier, legible, and properly stowed.

b. (CRANE). The crane and equipment manuals, Lubrication Order, and W.D., A.G.O. Form No. 478 must be present, legible, and properly stowed.

Traction Devices (Chains) (Carrier). Examine tire chains to be sure they are in good condition, clean (if not in use), not excessively worn, protected against rust, and properly mounted or stowed.

Tow (Chains and Cables). See if the carrier towing devices are in good condition, clean, and properly stowed. Towing devices should be protected against rust when not in use.

Fuel and Water Cans and Bracket.

a. (CARRIER). Observe if these items are in good condition and secure; if the caps fit tightly, and are secured to the can with a chain; and if cans are leaking.

b. (CRANE). On crane, perform in same manner as for above carrier item.

Modifications (MWO's Completed).

a. (CARRIER). Inspect the vehicle to determine if all Modification Work Orders have been completed and entered on W.D., A.G.O. Form No. 478. Enter any replacement of major unit assembly made at time of this service.

SECOND ECHELON PREVENTIVE MAINTENANCE

MAINTENANCE	
6,000 Mile.	1,000 Mile
141	141
142	142
142	142

b. (CRANE). On crane, perform in the same manner as for above carrier item.

Final Road Test (Carrier). Make a final road test of carrier and trailer, checking items 2 to 15 inclusive, and also be sure to recheck the transmission, transfer case, and all driving axles to see that the lubricant is at the correct level and not leaking. Confine this road test to the minimum distance necessary to make satisfactory observations. NOTE: *Correct or report all deficiencies found during final road test.*

Final Test (Crane). Make a final test of crane, rechecking applicable items 2 to 15 inclusive, and also be sure to recheck the transmission power take-off, to see that it is properly lubricated. Confine this test to the minimum time necessary to make satisfactory observations. NOTE: *Correct or report any deficiencies found during this final test.*

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

PART FOUR

CARRIER MAINTENANCE INSTRUCTIONS

Section XIII

TROUBLE SHOOTING

34. GENERAL.

a. This section contains trouble shooting information pertaining to operation of the carrier under average climatic conditions (above 32°F). Each trouble symptom listed under the unit or system involved is followed by a list of possible causes of the trouble. Tests to determine the exact trouble are explained after each possible cause.

35. ENGINE.

a. Engine Will Not Turn.

(1) PISTON LOCK OR SEIZURE. Remove the spark plugs from the engine, put carrier transmission into high gear, and pull vehicle. This action should revolve the crankshaft and relieve the seizure. If the crankshaft turns, stop towing, install spark plugs, and attempt to start vehicle with cranking motor. If the engine does not respond, internal damage is indicated. Report to higher authority.

(2) CRANKING MOTOR INOPERATIVE. Refer to paragraph 39.

(3) INCORRECT CRANKCASE OIL VISCOSITY. Drain crankcase and refill with proper grade of oil.

b. Engine Turns, But Will Not Start.

(1) LACK OF FUEL. Fill tanks with proper grade of fuel.

(2) IMPROPER GRADE OF FUEL. Change to proper grade of fuel only.

(3) INOPERATIVE IGNITION SYSTEM. Remove cable from a spark plug. Turn ignition switch on, and crank the engine with cranking motor while holding the spark plug cable terminal ¼ inch from the cylinder head. If a spark does not jump this gap to the cylinder head, this indicates a faulty ignition. Refer to paragraph 53.

(4) INOPERATIVE FUEL SYSTEM. Unscrew coupling nut at carburetor intake fuel line fitting; then crank engine with cranking motor, with ignition switch off. If a weak flow or no flow is apparent, this indicates that no fuel is reaching the carburetor due to a defective fuel pump or clogged fuel lines. Refer to paragraph 36. If fuel flows freely, trouble in the carburetor is indicated. Repair or replace faulty carburetor.

(5) CRANKING SPEED TOO SLOW. Refer to paragraph 39.

c. Engine Does Not Develop Full Power.

(1) FAULTY IGNITION. Refer to paragraph 38.

(2) IMPROPER GRADE OF FUEL. Check, drain, and fill tanks with proper grade.

(3) PREIGNITION. If the proper grade of fuel and proper spark plugs are being used, check ignition timing (par. 38). If this check does not locate the trouble, internal engine trouble is indicated. Report to higher authority.

(4) FAULTY OPERATION OF FUEL SYSTEM. Refer to paragraph 36.

(5) LOW ENGINE COMPRESSION. Test engine cylinder compression. If found to be below recommended limits, report to higher authority.

(6) IMPROPER VALVE TIMING. With satisfactory performance of fuel and ignition systems, proper compression, and sufficient oil in lubricating system, improper valve timing is indicated. Report to higher authority.

d. Engine Misfires.

(1) FAULTY IGNITION SYSTEM. Refer to paragraph 38.

(2) LOW ENGINE COMPRESSION. Refer to subparagraph c (5) above.

(3) IMPROPER CARBURETOR ADJUSTMENT. Adjust carburetor (par. 54 b).

(4) CLOGGED FUEL TANK CAP VENTS OR FUEL LINES. Refer to paragraph 36.

(5) FOREIGN SUBSTANCE IN FUEL. Remove filter bowls of fuel pump and carburetor and examine for water, oil, dirt, etc.

e. Engine "Knocks" or "Pings."

(1) IMPROPER DISTRIBUTOR SETTING. A sharp knock heard upon quick acceleration indicates improper setting of the distributor for the fuel being used. Check distributor spark setting (par. 38). If the distributor is properly set, the knock indicates excessive carbon in the combustion chamber.

(2) WORN OR FAULTY INTERNAL PARTS. A sharp, hollow, slapping sound when pulling on level ground or when starting a cold engine indicates a worn piston or piston pin. Refer to higher authority. A dull, regular knock in time with crankshaft speed indicates a loose or burned connecting rod or main bearing. Report to higher authority.

f. Engine Overheats.

(1) LACK OF COOLANT IN SYSTEM. Fill cooling system.

(2) FROZEN OR CLOGGED COOLING SYSTEM. Refer to paragraph 37 a (6).

(3) IMPROPER CARBURETOR ADJUSTMENT. A too-lean mixture of fuel in the carburetor will cause slow overheating of the engine. Check and adjust the fuel mixture (par. 54 b).

g. Engine Pops and Spits When Running.

(1) WEAK OR BROKEN VALVE SPRINGS. Remove valve cover plates and observe action of valve springs with engine running. Report finding of faulty parts to proper authority.

(2) EARLY VALVE TIMING. If valve spring operation is satisfactory and the engine continues to pop and spit, early valve timing is indicated. Refer to paragraph 52 b.

h. Excessive Oil Consumption.

(1) IMPROPER OIL VISCOSITY. Check, drain, and refill with proper grade oil.

(2) EXTERNAL OIL LEAKS. Inspect for leaks. Replace faulty gaskets.

i. Engine Will Not Stop.

(1) OVERHEATED COMBUSTION CHAMBERS. When engine continues to run after ignition key is turned off, this indicates excessive heat in the combustion chambers caused by improper adjustment of fuel mixture, or carbon deposits. Remove carbon and adjust fuel mixture (par. 54 b).

(2) FAULTY OPERATION OF IGNITION SWITCH. After engine is stopped, turn ignition key on and off while observing ammeter and fuel gages. A defective switch will not deflect these pointers. If this condition exists, replace ignition switch.

36. FUEL SYSTEM.

a. No Fuel Flow at Carburetor.

(1) LEAKAGE IN SYSTEM. Check entire system from fitting at bottom of fuel tank along the lines to the fuel filter, fuel pump, and carburetor for evidence of fuel leaks. Tighten loose fittings, and replace defective parts.

(2) CLOGGED FUEL SYSTEM. Check the entire system for obstructions in the units, starting at the fuel tank end of the system.

(3) FAULTY FUEL PUMP. Check the operation of the fuel pump by cranking the engine with ignition off, after disconnecting the pump

to carburetor fuel line at the front of the fuel pump. If the pump produces satisfactory pressure, this indicates faulty carburetor operation.

b. Faulty Engine Performance With Sufficient Fuel Flow at Carburetor.

(1) IMPURITIES IN SYSTEM. Impurities, such as water and oil, can be detected in the sediment bowls of the fuel pump and fuel filter. Remove these units, being careful not to empty them in doing so. By slowly pouring out the contents, any foreign elements can be seen at once, as they will not mix with the fuel. Condensation of air, caused by rapid temperature changes, often produces a considerable amount of water in the fuel tank. If the check shows water deposits in the sediment bowls, clean them; then drain the tank of a gallon of fuel. This should remove the water from the system.

(2) CLOGGED AIR CLEANER SYSTEM. Check air cleaner screens for clogged condition. Wash screens in dry-cleaning solvent and replace filter oil.

(3) FAULTY CARBURETOR ACTION. With engine running, adjust carburetor mixture at spring screw at top of carburetor. If this fails to improve engine performance, report to higher authority.

(4) FAULTY CARBURETOR CONTROLS. Check the setting and operation of the choke butterfly valve in the carburetor intake. Make sure that its normal position (wide-open) is maintained. If its operation is faulty, report to proper authority.

37. COOLING SYSTEM.

a. Engine Cooling System Overheats.

(1) LACK OF COOLANT. Refill system.

(2) FAULTY THERMOSTAT OPERATION. Remove and test thermostat by dropping it in water heated to 180°F. If it fails to open, replace it.

(3) FAULTY WATER PUMP OPERATION. Test flow; replace pump if faulty.

(4) CLOGGED SYSTEM. Flush and clean system (par. 70).

(5) HOSE LEAKING. Tighten clamps or replace faulty hose.

(6) FROZEN RADIATOR OR LINES. When the engine overheats quickly, this indicates a complete clogging of the cooling system, either by ice, slush, or other obstruction. If evidence of freezing is found, cover the radiator with a heavy cloth or tarpaulin and run the engine slowly, shutting it off each time the engine temperature gage passes 200°F. Repeat this operation until coolant thaws. If the obstruction is not slush or ice, flush the cooling system (par. 70 c).

(7) LOOSE, OPEN, OR DEFECTIVE DRAIN COCKS AND PLUGS. Inspect drain cocks to make sure they are closed and attached securely. Replace if defective.

(8) DAMAGED RADIATOR CORE. Inspect radiator for broken or cracked tubes or bent fins. Straighten fins and repair damaged tubes. If this does not correct condition, replace radiator.

38. IGNITION SYSTEM.

a. No Contact at Spark Plugs.

(1) FAULTY CABLES OR TERMINALS. Inspect all cables and terminals to see that they are clean, undamaged, and tightly secured. Replace defective parts.

(2) FAULTY IGNITION COIL. Pull the coil distributor cable from the terminal at the center of the distributor head and hold it about 3/8 inch from any convenient metal ground. Make and break the primary circuit by operating the cranking motor with the ignition switch on. A weak spark or no spark indicates a faulty coil. Replace coil. If a hot spark is obtained, install the cable in the distributor terminal and proceed.

(3) FAULTY DISTRIBUTOR OPERATION. Check inside and outside of distributor cover for cracks and moisture. Turn on ignition switch, crank the engine, and with the distributor head removed, check for excessive arcing at the breaker points. This will indicate a defective distributor condenser. Replace condenser. Pull coil distributor cable from terminal at center of distributor. Remove cover and hold the the cable terminal 3/8 inch from the rotor. Create secondary voltage by making and breaking primary circuit (step (2) above). If a spark occurs, this indicates a grounded rotor. Replace rotor.

b. Full Spark at Plugs, With Faulty Engine Performance, Because Ignition Is Out of Time.

Time ignition (par. 53 d).

39. STARTING AND GENERATING SYSTEMS.

a. No Action From Cranking Motor When Switch Is Closed.

(1) FAULTY CRANKING MOTOR SWITCH. Test lights and horn for battery power. Push cranking motor switch button and observe ammeter on instrument panel. No deflection of this gage (with ignition switch on) indicates a faulty cranking motor switch. Replace faulty unit.

(2) FAULTY OPERATION OF SOLENOID. When switch is depressed and no sound or action is obtained at cranking motor, this indicates an open circuit to the cranking motor. Check for broken cables or loose terminals. If these are found satisfactory, and the ammeter deflects when cranking motor switch button is pushed, failure of the solenoid switch is indicated. Replace solenoid switch.

(3) CRANKING MOTOR INOPERATIVE. A clicking sound when the cranking motor switch button is depressed indicates operation of the solenoid. If this is obtained, it indicates a grounded or inoperative cranking motor. Replace cranking motor.

b. Cranking Motor Hums When Cranking Motor Switch Is Closed.

(1) CRANKING MOTOR DRIVE DEFECTIVE. Clean cranking motor drive. If still inoperative, replace cranking motor.

(2) CRANKING MOTOR MOUNTING BOLTS LOOSE, CAUSING MISALINEMENT. Tighten mounting bolts.

c. Cranking Motor Unable to Start Engine.

(1) BATTERY WEAK OR COMPLETELY DISCHARGED. Recharge or replace battery.

(2) LOOSE OR CORRODED CONNECTIONS. Tighten and clean connections. Coat with grease.

(3) CRANKING MOTOR COMMUTATOR BURNED OR DIRTY. Inspect, and clean or replace.

(4) CRANKING MOTOR ARMATURE BURNED. Replace cranking motor.

d. Cranking Motor Turns Engine Over, But Will Not Start It.

(1) WEAK BATTERY. Recharge or replace battery.

(2) BATTERY TERMINALS CORRODED OR LOOSE CONNECTIONS. Tighten and clean connections. Coat with grease.

e. Running Engine Misses Because Battery Terminals Are Corroded or Loose Connections. Tighten and clean connections. Coat battery posts with grease.

f. Battery Not Receiving Charge From Generator.

(1) CIRCUIT BREAKER FAULTY. If the ammeter on the instrument panel shows a heavy discharge when the generator is not running, and all switches are off except the battery master switch, disconnect the battery lead marked "B" in the regulator terminal box. If the condition is corrected, the regulator circuit breaker contact points are stuck. If the ammeter on the instrument panel does not show charge until generator is running at high speed, the regulator circuit breaker is adjusted to operate at too high a voltage. In either of these cases, replace regulator.

(2) REGULATOR INOPERATIVE. Start the engine and observe ammeter on the instrument panel. If no charging rate is indicated, connect the battery and armature terminals marked "B" and "A" together

in the regulator terminal box, using a short piece of insulated wire. Hold jumper wire across the two terminals and watch ammeter. If reading is obtained, the regulator is not connecting generator to battery. If this test does not reveal the trouble, connect the battery and field terminals together with the jumper wire. If a reading is obtained, the regulator is not allowing current to reach the generator field coils, thus preventing charge. If excessive charge is experienced and the batteries and circuits test properly, the trouble is caused by improper regulator adjustment. In either case the regulator is inoperative and must be replaced.

(3) GENERATOR INOPERATIVE. If the regulator tests have been made and no charge is obtained, connect a test voltmeter between armature terminal marked "A" in regulator terminal box, and ground. This test will show if generator is charging. If no voltage reading is shown, leave the voltmeter connected and connect the battery and field terminals marked "S" and "F" together with a jumper wire. A flash will be seen and the test voltmeter will show a reading when the jumper wire is connected if the circuit is complete. Check the ammeter on the instrument panel. If a charge is shown, the trouble has been corrected by flashing the fields, which has increased the magnetism or properly polarized the field coil shoes. If no reading is obtained on the voltmeter, inspect the terminals at the generator for loose or broken connections. If no trouble is observed in the connections or leads, the generator is inoperative and must be replaced.

g. Ammeter Does Not Register Charge.

(1) GENERATOR CIRCUIT BREAKER OPEN. Reset generator circuit breaker.

(2) AMMETER INOPERATIVE. If the ammeter fails to register a charge, turn on all lights and see if a discharge is shown. If no discharge is observed, connect a new ammeter temporarily to the leads in the instrument panel. If a reading is obtained, the ammeter is faulty. If no reading is obtained, test wiring from ammeter to shunt for open circuit.

(3) REGULATOR INOPERATIVE. Refer to subparagraph f (2) above.

(4) GENERATOR INOPERATIVE. Refer to subparagraph f (3) above.

(5) LOOSE OR CORRODED CONNECTIONS. Clean and tighten connections.

(6) GENERATOR WIRING LOOSE OR BROKEN. Inspect all wiring. Clean and tighten all connections. Replace or repair broken or poorly insulated wires.

TROUBLE SHOOTING

h. Ammeter Shows Excessive Charge.

(1) CURRENT REGULATOR IMPROPERLY ADJUSTED. Refer to subparagraph f (2) above.

(2) BATTERIES RUN DOWN. Test batteries. Recharge or replace.

(3) BATTERIES SHORTED INTERNALLY. Test batteries and replace if faulty.

i. Ammeter Shows Discharge With Engine Running.

(1) GENERATOR NOT OPERATING. Refer to subparagraph f (3) above.

(2) REGULATOR CIRCUIT BREAKER CUT-IN VOLTAGE TOO HIGH. Refer to subparagraph f (1) above.

j. Ammeter Shows Heavy Discharge With Engine Stopped.

(1) SHORTED CIRCUITS. Check system for current leads.

(2) REGULATOR CIRCUIT BREAKER POINTS STUCK. Refer to subparagraph f (1) above.

(3) AMMETER HAND STICKING OR AMMETER BURNED OUT. Tap ammeter with heel of hand; if not corrected, replace instrument cluster.

k. Ammeter Hand Fluctuates Rapidly.

(1) GENERATOR DRIVE BELTS LOOSE. Tighten or replace belts.

(2) GENERATOR WIRING LOOSE OR BROKEN. Inspect all wiring. Clean and tighten all connections. Replace or repair broken or poorly insulated wires.

(3) REGULATOR CIRCUIT BREAKER CUT-IN VOLTAGE TOO LOW OR CONTACTS BURNED. Refer to subparagraph f (2) above.

(4) REGULATOR LOOSE, NOT PROPERLY GROUNDED, OR VIBRATING AGAINST OTHER EQUIPMENT. Tighten regulator on mountings, inspect wiring, and relieve interference.

(5) GENERATOR OR REGULATOR FAULTY. If ammeter needle fluctuates rapidly while generator is running, test all regulator and generator mountings to see if they are tight, and inspect for broken ground straps. If ground straps and mountings are satisfactory, the condition is caused by incorrect setting of regulator circuit breaker, worn generator brushes, faulty generator or drive belts, or regulator bumping against other equipment. If inspection reveals that the generator drive belts are properly adjusted and there is no interference with the regulator, connect a jumper wire between battery terminal marked "B" and armature terminal marked "A" in the regulator terminal box. If the fluctuation stops with the jumper wire connected, indicating that the regulator circuit breaker points have been

vibrating, replace the regulator. If fluctuation continues, indicating that the generator is at fault, replace generator.

40. CLUTCH.

a. Slipping.

(1) WORN CLUTCH FACINGS. Report to higher authority.

(2) IMPROPER ADJUSTMENT. Adjust clutch (par. 57 b).

(3) STICKING CLUTCH SLEEVE. Report to higher authority.

(4) WORN CLUTCH SPRINGS. Report to higher authority.

(5) OILY PRESSURE FACINGS. Clean and correct cause. Inspect rear crankshaft oil seal. Check for excessive lubrication of pilot bearing. Replace pressure plate assembly if proper condition cannot be restored.

b. Rattling.

(1) WEAK OR BROKEN PULL-BACK SPRINGS. Report to higher authority.

(2) LOOSE RELEASE YOKE. Report to higher authority.

(3) IMPROPER PEDAL ADJUSTMENT. Adjust pedal (par. 58 b).

c. Chattering.

(1) OILY OR BURNED FACINGS. Clean driven member assembly, or report to higher authority.

(2) STICKING CLUTCH SLEEVE. Report to higher authority.

(3) BROKEN PULL-BACK SPRINGS. Report to higher authority.

41. TRANSMISSION.

a. Stiffness in Gear Shifting.

(1) INSUFFICIENT LUBRICATION. Fill to plug level with proper lubricant.

(2) IMPROPER LUBRICANT. Change to proper grade.

b. Impossible to Shift Gears.

(1) SHIFTING YOKE BROKEN OR BENT. Replace complete assembly, or report to higher authority.

(2) BROKEN GEAR TOOTH. Replace complete assembly, or report to higher authority.

(3) HOUSING AND ASSEMBLY OUT OF ALINEMENT. Inspect and relocate. If the unit is damaged, replace complete assembly, or report to higher authority.

TROUBLE SHOOTING

c. Excessive Noise in Operation.

(1) FAULTY GEARS, BEARINGS, OR WORN SHAFT SPLINES. Report to higher authority or replace transmission.

(2) ASSEMBLY OUT OF ALINEMENT. Relocate and tighten holding bolts.

(3) IMPROPER LUBRICANT. Drain and refill with proper grade (par. 20).

(4) INSUFFICIENT LUBRICANT. Fill to plug level with proper lubricant (par. 20).

d. Excess Heat in Operation.

(1) LACK OF LUBRICANT. Drain and refill with proper lubricant (par. 20).

(2) ASSEMBLY OUT OF ALINEMENT. Relocate and tighten holding bolts.

42. TRANSFER CASE.

a. Excessive Noise in Operation.

(1) WORN GEAR OR SHAFT BEARINGS. Replace complete assembly, or report to higher authority.

(2) MISALINEMENT OF UNIT. Relocate unit and tighten supports.

(3) INSUFFICIENT LUBRICANT. Fill to plug level with proper lubricant (par 20).

(4) IMPROPER LUBRICANT. Drain and fill with proper lubricant (par. 20).

b. Overheating.

(1) INSUFFICIENT LUBRICANT. Fill to plug level with proper lubricant.

(2) IMPROPER LUBRICANT. Drain and fill with proper lubricant.

c. Loss of Lubricant.

(1) DEFECTIVE GASKETS OR SEALS. Report to higher authority.

(2) CRACKED OR BROKEN HOUSING. Report to higher authority.

(3) IMPROPER GRADE LUBRICANT. Drain and refill with proper lubricant (par. 20).

43. FRONT AXLE.

a. Hard Steering.

(1) FRONT AXLE SHIFTED. Relocate and tighten spring clip nuts.

(2) LACK OF LUBRICATION. Add lubricant of proper grade (par. 20).

(3) EXCESSIVE TOE-IN. Adjust tie rod yoke (par. 61 **d**).

(4) EXCESSIVE CASTER. Report to higher authority.

(5) TIGHT ADJUSTMENT IN STEERING GEAR. Inspect and correct adjustment of steering gear and alinement of steering column (par. 60 b). Lubricate steering gear (par. 20).

(6) TIRES UNDERINFLATED. Inspect and inflate to proper pressure (85 lb).

b. Shimmy.

(1) WORN OR LOOSE WHEEL BEARINGS. Adjust (par. 61 b); replace if adjustment does not correct.

(2) TIE ROD LOOSE. Tighten or replace worn parts.

(3) LOOSE OR WORN STEERING MECHANISM. Inspect, and adjust or replace ball joints, bracket, steering gear to frame, spring shackles, and spring U-bolts.

(4) DRAGGING FRONT WHEEL BRAKES. Adjust brakes (par. 64 b).

(5) TIRES UNDERINFLATED. Inflate to proper pressure (85 lb).

(6) IMPROPER CASTER. Report to higher authority.

(7) ECCENTRIC WHEELS. Replace wheel or tire.

c. Wandering.

(1) LOOSE STEERING LINKAGE. Adjust linkage (par. 60 b).

(2) LOOSE FRONT WHEEL BEARINGS. Adjust bearings (par. 61 b).

(3) REVERSE CAMBER. Report to higher authority.

(4) BENT AXLE PARTS. Report to higher authority.

(5) LOOSE WHEELS. Inspect and tighten wheel nuts.

(6) TIRES UNDERINFLATED. Inflate to proper pressure (85 lb).

44. REAR AXLES.

a. Axle Noises.

(1) CONTINUOUS HUM. Adjust wheel bearings (par. 61 b). Fill axle centers to plug level with proper lubricants (par. 20).

(2) COASTING HUM. Inspect wheel bearings. If source of trouble is not located, report to higher authority.

(3) PULLING HUM. Report to higher authority.

b. Backlash.

(1) LOOSE AXLE SHAFT FLANGE. Tighten axle flange nuts.

(2) EXCESSIVE CLEARANCE AT AXLE SHAFT SPLINES. Report to higher authority.

c. Grease Leakage.

(1) GREASE APPEARING ON BRAKES. Inspect seals and replace if faulty.

TROUBLE SHOOTING

d. Dull Thud in Time With Speed of Carrier.

(1) BROKEN GEAR TOOTH IN AXLE. Report to higher authority.

45. BRAKE SYSTEM.

SGV TD

a. No Resistance to Pressure on Foot Pedal.

(1) LINING WEAR. Adjust brakes for lining wear (par. 64 b).

(2) INCORRECT BRAKE SHOE ADJUSTMENT. Adjust brake shoes.

(3) LEAKAGE IN SYSTEM. Inspect the diaphragms and brake air lines for evidence of leaks. If caused by loose fittings, tighten the fitting. If caused by faulty or broken parts, replace the faulty unit.

b. No Brake Action With Hard Pedal Pressure.

(1) IMPROPERLY ADJUSTED BRAKE SHOES. Adjust brake shoes.

(2) FAULTY OPERATION OF SLACK ADJUSTER. Replace unit or report to higher authority.

(3) WORN BRAKE LININGS. Replace brake shoes.

c. All Brakes Drag (With Pedal Released).

(1) INSUFFICIENT BRAKE SHOE CLEARANCE. Inspect and adjust clearance if insufficient (par. 64 b).

(2) WEAK OR BROKEN PEDAL RETURN SPRING. Replace faulty spring.

d. One Brake Drags.

(1) WEAK OR BROKEN BRAKE SHOE RETURN SPRING. Replace faulty unit.

(2) BRAKE SHOE BINDING ON ANCHOR PIN. Remove shoe; clean and lubricate anchor pin.

(3) INSUFFICIENT BRAKE SHOE CLEARANCE. Inspect, and adjust clearance if insufficient.

e. Brakes "Grab" When Pedal Is Depressed.

(1) BRAKE SHOE CLEARANCE TOO GREAT. Adjust clearance.

(2) GREASE OR OIL ON LININGS. Clean linings.

f. Noisy Brakes.

(1) BENT OR BROKEN BACKING PLATE. Replace backing plate.

(2) DAMAGED BRAKE SHOES. Replace shoes.

(3) BRAKE DRUMS OUT-OF-ROUND. Replace drums, or report to higher authority.

(4) DIRT IN LININGS. Clean brake linings.

g. Hand Brake Does Not Hold When Applied.

(1) LININGS WORN OUT. Replace shoe and lining assemblies.

(2) GREASE OR OIL ON LININGS. Clean linings.

(3) LININGS AND BRAKE SHOES IMPROPERLY ADJUSTED. Adjust brake (par. 65 b).

46. WHEELS.

a. Hard Steering.

(1) TIRES UNDERINFLATED. Inflate to proper pressure (85 lb).

(2) DEFECTIVE WHEEL BEARING. Replace defective units.

(3) UNEQUAL CAMBER. Report to higher authority.

(4) BENT OR DAMAGED WHEEL. Replace wheel or report to higher authority.

(5) LOOSE WHEEL. Tighten wheel nuts.

b. Noisy Operation.

(1) DAMAGED WHEEL. Replace wheel.

(2) LOOSE WHEEL NUTS. Tighten nuts.

(3) LACK OF LUBRICANT. Grease wheel bearings. Refer to paragraph 20.

c. Air Leakage.

(1) DEFECTIVE VALVE CORE. Replace with new core.

(2) PUNCTURE OR TORN TUBE. Repair if possible, or replace.

47. SPRINGS.

a. Hard Riding.

(1) DRY SPRING SHACKLES OR BOLTS. Lubricate units (par. 20).

(2) BROKEN SHACKLE PINS. Replace shackle pins.

b. Excessive Spring Action.

(1) BROKEN LEAVES. Replace spring.

(2) BROKEN SPRING CLIPS. Replace clips.

c. Hard Steering.

(1) SPRING SHIFTED. Relocate spring and tighten clips.

(2) BROKEN LEAVES. Replace spring.

d. Noisy Operation.

(1) DRY SHACKLES OR BOLTS. Lubricate units (par. 20).

(2) BROKEN BRACKETS OR SHACKLES. Replace defective unit.

TROUBLE SHOOTING

48. STEERING.

a. Hard Steering.

(1) TIRES UNDERINFLATED. Inspect and inflate to proper pressure (85 lb).

(2) EXCESSIVE FRICTION IN TIE ROD OR DRAG LINK JOINTS. Inspect and adjust or lubricate as required (par. 20).

(3) EXCESSIVE FRICTION IN STEERING GEAR ASSEMBLY. Check lubrication. If friction persists after proper lubrication, report to higher authority.

b. Shimmy.

(1) TIRE UNDERINFLATED. Inspect and inflate to proper pressure (85 lb).

(2) TOO MUCH OR TOO LITTLE CASTER. Report to higher authority.

(3) LOOSE FRONT WHEEL BEARINGS. Adjust bearings (par. 61 **b**).

(4) LOOSE OR WORN STEERING MECHANISM. Inspect, and adjust or replace ball joints, steering gear mounting, spring shackles, and U-bolts.

(5) UNEQUAL FRONT WHEEL CAMBER. Report to higher authority.

(6) WEAK OR SAGGED FRONT SPRINGS. Inspect for broken leaves and replace. Check for excessive lubrication and wash off excess oil.

(7) DRAG LINK OUT OF LINE. Inspect and correct alinement.

(8) FRONT BRAKE DRUMS OUT-OF-ROUND (SHIMMY ONLY WHEN BRAKES ARE APPLIED). Report to higher authority.

(9) ECCENTRIC WHEELS. Replace wheel or tire.

(10) DAMAGED WHEEL DISKS. Replace wheel or report to higher authority.

(11) FRONT WHEELS OUT OF BALANCE. Report to higher authority.

(12) DRAGGING FRONT WHEEL BRAKES. Adjust brakes (par. 64 **b**).

c. Steering Wander.

(1) TIRES UNDERINFLATED. Inflate to proper pressure (85 lb).

(2) IMPROPER TOE-IN ADJUSTMENT. Correct toe-in (par. 61 **d**).

(3) AXLE SHIFTED IN SPRINGS. Relocate and tighten.

(4) TIGHT STEERING ASSEMBLY. Adjust (par. 60 **b**).

(5) LOOSE WHEELS. Inspect stud nuts and tighten if necessary.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

49. WINDSHIELD WIPER.

a. Wiper Moves Too Slowly.

(1) INSUFFICIENT PRESSURE. Inspect lines and connections for leakage and replace if necessary.

(2) CLOGGED PORTS. Replace wiper assembly.

(3) LACK OF LUBRICANT. Replace wiper assembly.

b. Wiper Will Not Oscillate.

(1) ONE SET OF PORTS CLOGGED. Replace wiper assembly.

(2) LACK OF LUBRICANT. Replace wiper assembly.

(3) LINE SPLIT OR CONNECTION BROKEN. Inspect and replace damaged parts.

(4) WIPER BLADE STUCK. Free blade and check operation.

c. Wiper Blade Streaking Windshield.

(1) DIRT ON WINDSHIELD. Clean windshield.

(2) WORN OR DAMAGED BLADE. Replace blade assembly.

50. LIGHTING AND SWITCHES.

a. Engine Will Not Start.

(1) IGNITION SWITCH OFF. Turn on switch.

b. Lights of Vehicle Go Very Dim or Out When Cranking Motor Switch Is Closed.

(1) DISCHARGED BATTERY. Replace or recharge battery.

(2) POOR CONNECTION AT BATTERY TERMINALS OR ELSEWHERE IN CIRCUIT. Check and tighten connections.

Section XIV

CARRIER ENGINE AND ACCESSORIES

51. DESCRIPTION AND DATA.

a. The engine (fig. 41) is a 4-cycle, 6-cylinder, L-head type, with cylinders cast three in a block, a design that makes them removable from the crankcase in two separate parts. The two cylinder heads are held in place by stud nuts on long through studs, extending from above the cylinder heads down through the cylinder blocks, crankcase, and main bearing caps. These hold all main engine assemblies in place and have an eccentric section set into the upper part of the crankcase, which keeps them rigidly in place regardless of disconnections to the block assembly. The gear-type oil pump is located at the bottom of the engine, and is secured to the crankcase and driven off the camshaft by a spiral gear.

CARRIER ENGINE AND ACCESSORIES

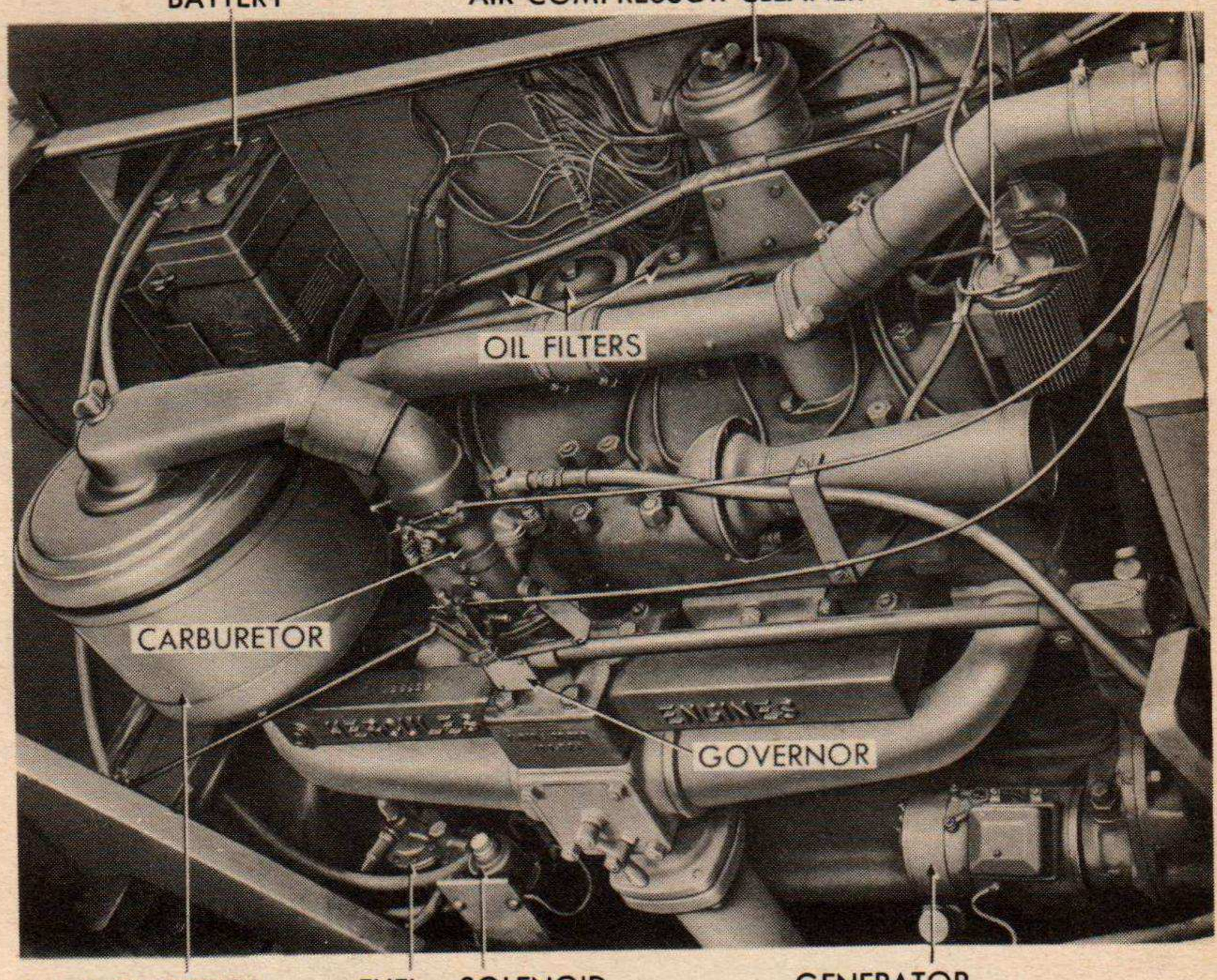


Figure 41—Engine

b. Data.

Model	Hercules HXC
Cylinders	6
Bore	5¼ in.
Stroke	6 in.
Displacement	779 cu in.
Compression ratio	5.69 to 1
A.M.A. horsepower	66.2
Brake horsepower (developed at rpm)	179 hp at 2,150 rpm
Torque (ft-lb at rpm)	550 ft-lb at 1,900 rpm
Crankcase capacity (dry)	16 qt
Cooling system capacity	64 qt
Oil filler location	Front left
Oil drain location	Bottom
Water drain location	One on left side of each block
	One on water pump
	One on radiator outlet

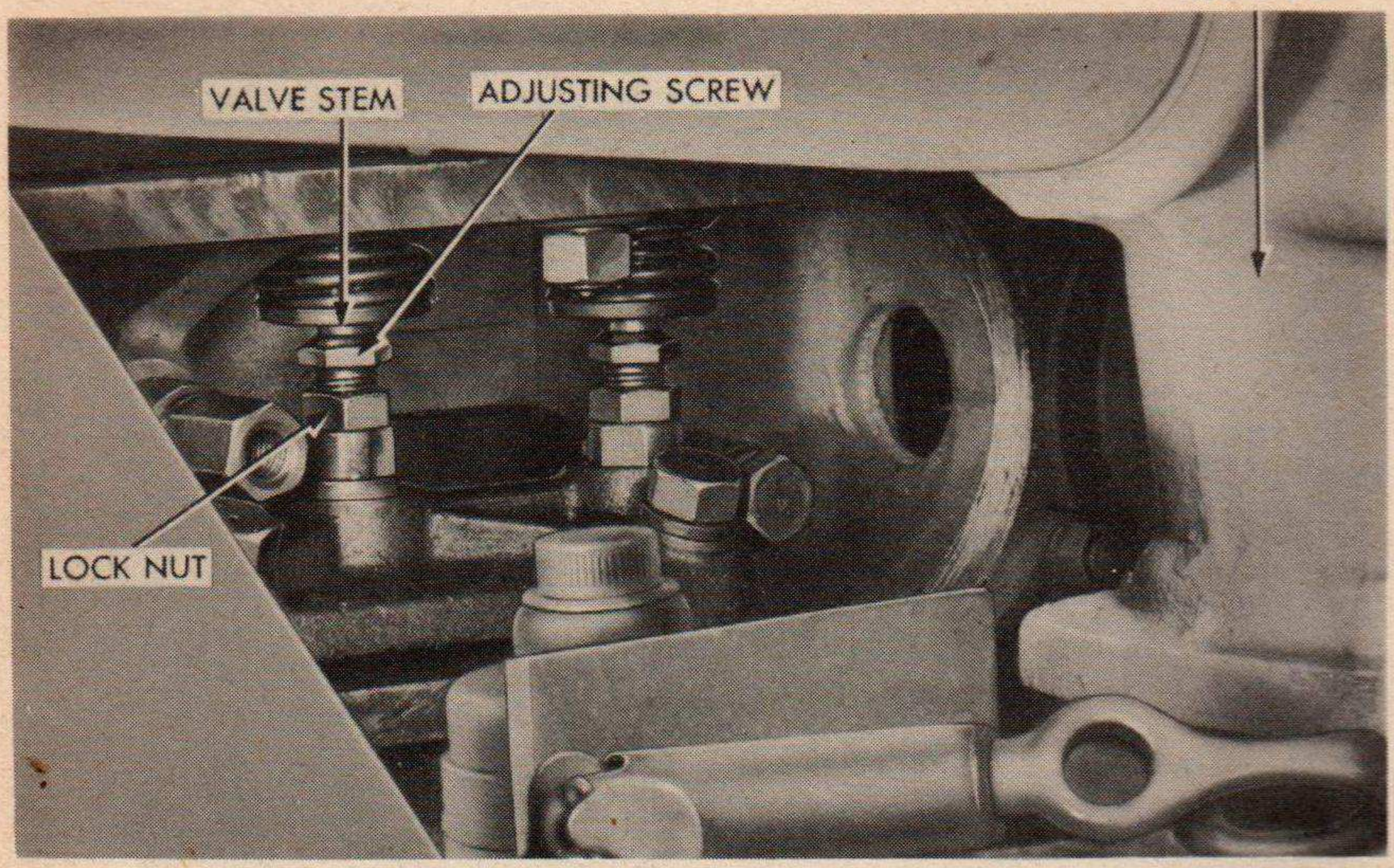


Figure 42—Valve Adjustment

52. VALVES.

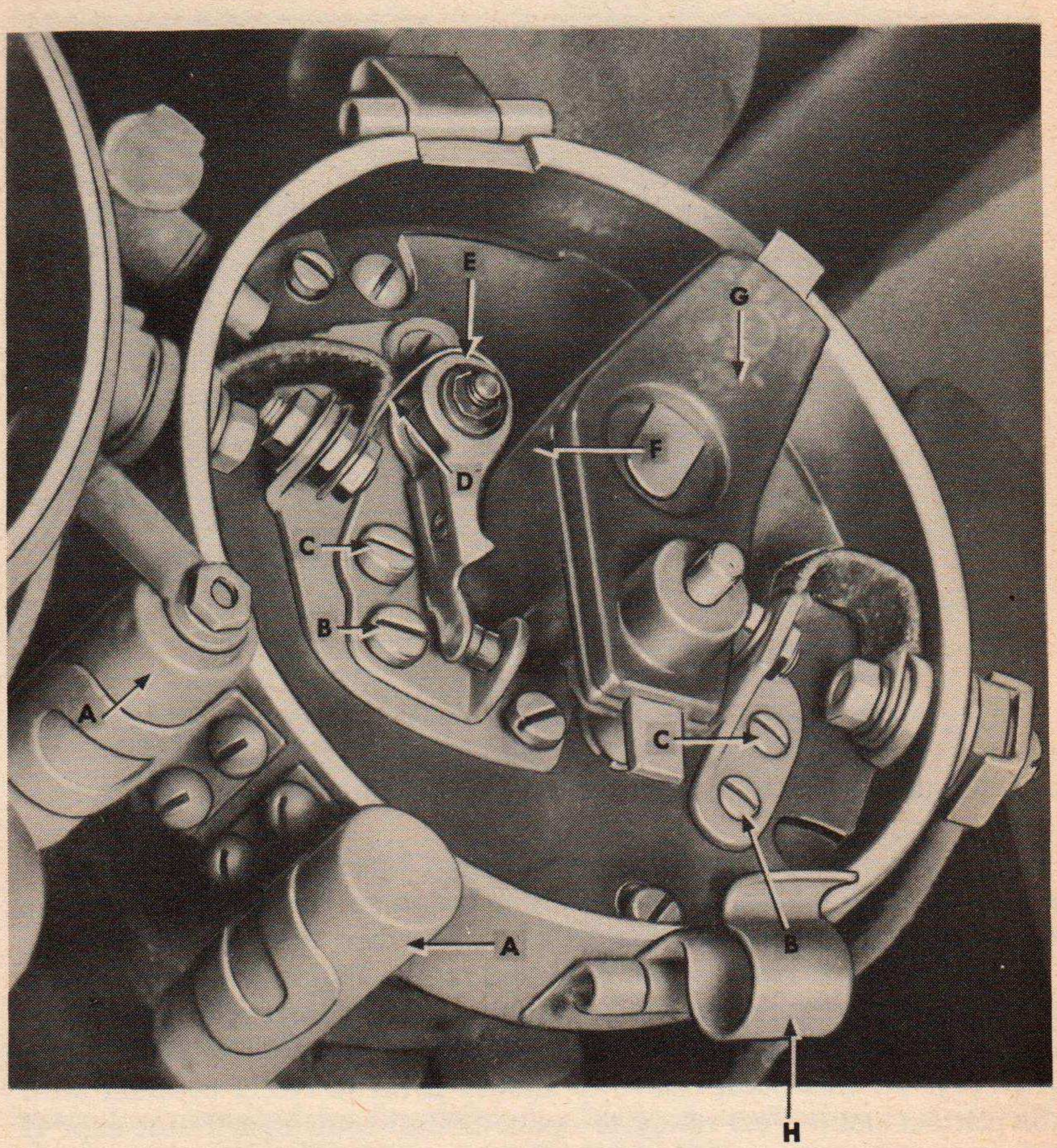
a. Description. The valves are the poppet type with a 30-degree angle seat. Valve tappets are the mushroom type, and each is provided with a screw and lock nut to allow adjustment of valve-stem clearance. The valve tappets are guided in removable clusters bolted to the crankcase.

b. Adjustment. When testing or setting valve clearance, crank the engine to the firing position of the cylinder related to each valve before setting that valve. With engine hot, measure clearance between tappet and valve stem. Loosen the lock nut and adjust intake valve to 0.010 inch and the exhaust valve to 0.016-inch clearance. Hold adjusting screw stationary, and tighten the lock nut (fig. 42). After tightening lock nut securely, check with feeler gage for proper clearance.

53. IGNITION SYSTEM.

a. Description. The ignition system is composed of the battery, ignition coil, distributor, condenser, low- and high-tension wiring, and spark plugs, and is divided into two distinct circuits. The primary (low-tension) circuit includes the source of energy, the distributor contact points, and circuit-breaking mechanism, the primary of the ignition coil, and the condenser. The secondary (high-tension) circuit includes the secondary of the ignition coil, rotor and distributor cap, high-tension wiring, and spark plugs.

CARRIER ENGINE AND ACCESSORIES



A—CONDENSER
B—LOCK SCREW
C—ECCENTRIC SCREW
D—BREAKER ARM SPRING
E—BREAKER ARM
F—BREAKER CAM
G—ROTOR
H—CAP SPRING

RA PD 321125

Figure 43—Carrier Distributor Adjustment

b. Spark Plug Adjustment. Remove and clean spark plugs, and check gaps with a round feeler gage every 500 miles. Use a resistance tester every 4,000 miles. Set gap at 0.025 inch.

c. Distributor Adjustment (fig. 43).

(1) Contact point opening may be checked with a feeler gage, a dial indicator, or a cam angle meter. The correct point opening is 0.018 to 0.024 inch. Cam angle is the number of degrees the cam rotates between the instant the points close and the instant they open again. This cam angle increases as point opening is increased.

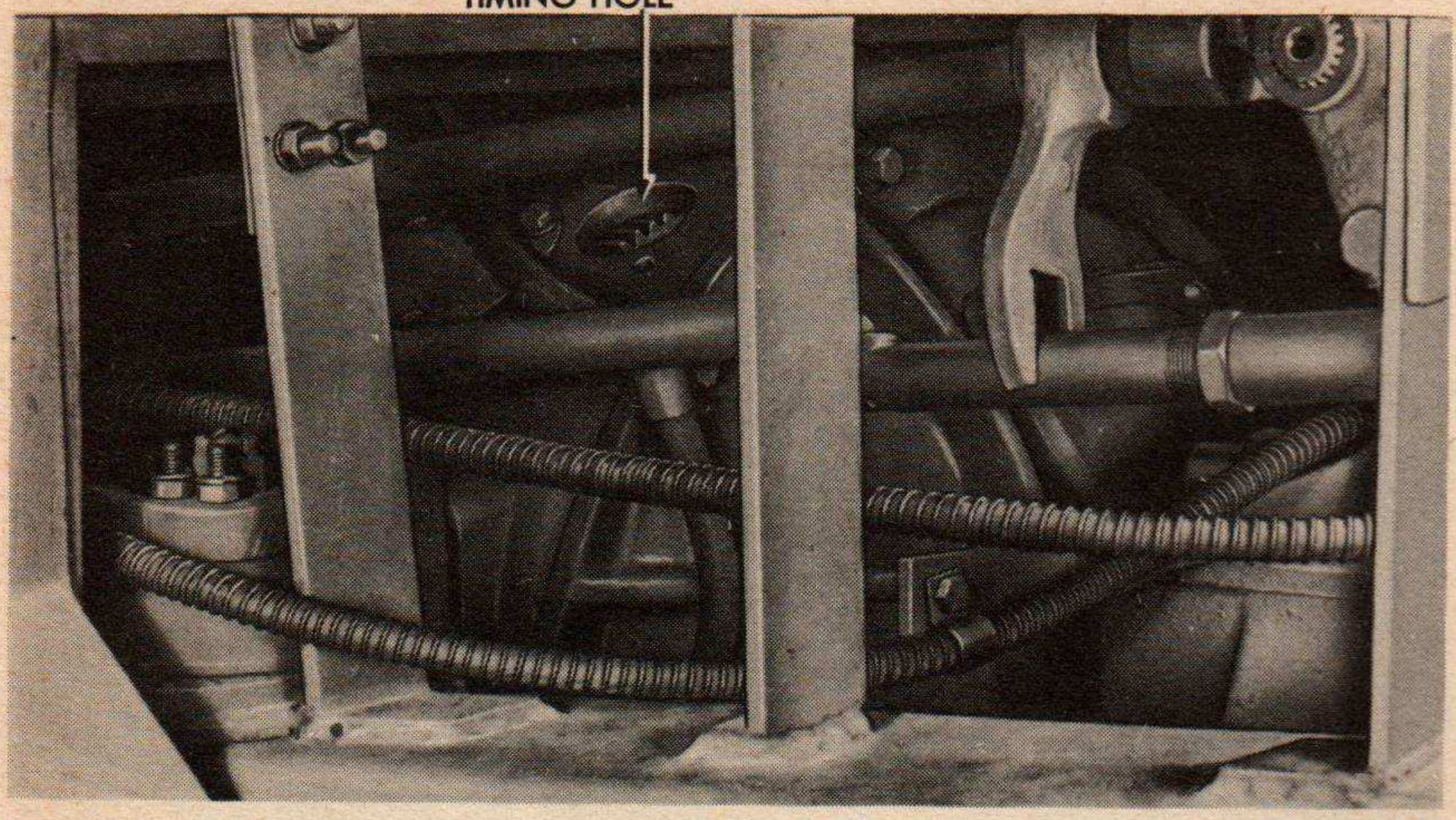


Figure 44—Carrier Engine Timing Hole

(2) Adjust cam angle by loosening locking screw which holds stationary contact support and then turning the eccentric. After adjustment is made, tighten locking screw and recheck setting.

d. Engine Timing.

(1) Remove distributor cap assembly (fig. 43). Check the breaker points carefully to make sure that they are in good condition and have the correct gap (0.018-inch to 0.024-inch) when fully separated.

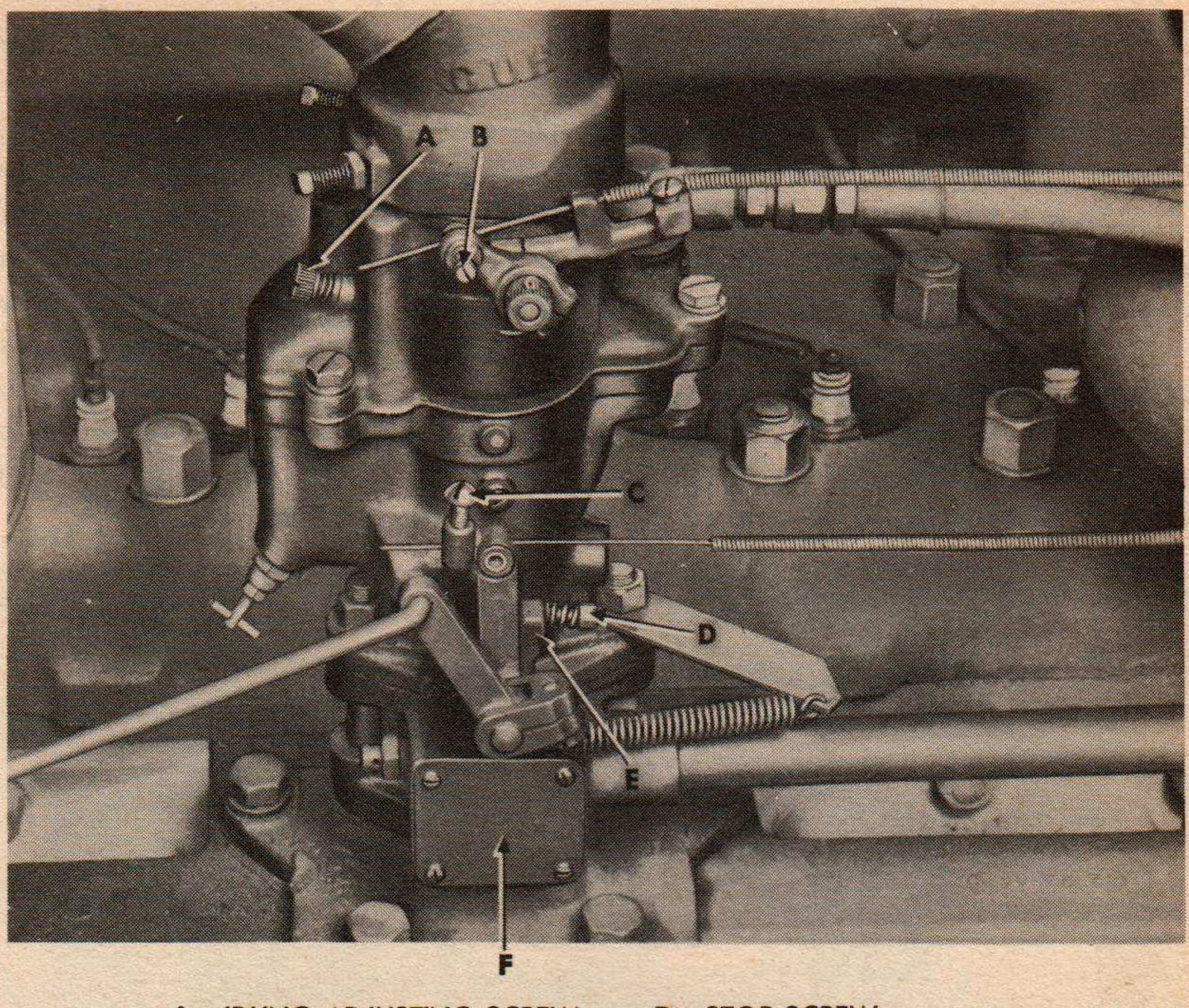
(2) Remove No. 1 spark plug and rotate engine with hand crank until No. 1 piston reaches dead center on the compression stroke as indicated by "d-c" mark on flywheel lining up in center of timing hole (fig. 44). At this point the rotor should point to No. 1 cylinder with the contact points just ready to open. Install rotor distributor cap. If the above directions are carefully followed, ignition timing should be correct. Make final check for distributor to engine timing, using a neon timing light as follows:

(*a*) Fasten one lead of the timing light to No. 1 spark plug, and the other to No. 1 spark plug wire.

(*b*) Mark housing with narrow chalk mark in line with "d-c" mark on flywheel. Start engine and run at idle speed. Direct flash of timing light on opening in flywheel housing, and check position of d-c line in relation to chalk at flywheel hole. The lines will coincide if timing is correct. If the lines do not coincide, loosen the distributor advance arm clamp, and rotate the distributor to advanced or retarded position.

54. CARBURETOR AND GOVERNOR.

a. Description. The carburetor is a downdraft, balanced type using a secondary venturi (mixing chamber). It is designed with a vacuum control power jet and accelerating system which provides



A—IDLING ADJUSTING SCREW
B—SET SCREW
C—SET SCREW
D—STOP SCREW
E—STOP PIN
F—GOVERNOR HOUSING

RA PD 321130

Figure 45—Carburetor and Governor Adjustment

extra fuel required for heavy loads. Located on the upper right side of the engine (fig. 41), it is manually controlled as to acceleration and choke valve operation. The governor, operated from a special gear in timing gear train, cuts down amount of fuel mixture (as engine speed increases) through closing of a butterfly valve in the intake manifold.

b. Carburetor and Governor Adjustment (fig. 45). Tighten the stop screw in carburetor (lower right side) against the stop pin to hold the throttle plate slightly open, and provide the desired idling speed of the engine. The idling adjusting screw (top cover, with spring) should be 1 to 1½ turns off its seat. Turning this screw down eliminates the air, making the idling fuel mixture richer, while unscrewing it provides a leaner fuel mixture. Check governor at regular intervals for proper setting (2,150 rpm on tachometer). Should engine speed exceed this, turn adjustment nut on top of governor housing and retest. Repeat until engine shows top speed of 2,200 rpm.

c. Linkage Adjustment (fig. 45). This adjustment concerns the choke and throttle control linkage on the carburetor. If engine is not idling properly after throttle and choke button have been pushed in, this is caused by either weak spring on carburetor throttle valve, or improper adjustment of linkage. Loosen two set screws on carburetor which secure linkage to carburetor. Push throttle and choke button in. Check to see that choke valve is closed and throttle valve set screw is against stop pin. Adjust to proper idling, and replace linkage wire; tighten screws, and check whether throttle and choke buttons are pushed in at instrument panel. CAUTION: *Do not set engine idle speed at less than 800 revolutions per minute. This is required to keep battery charged and to ensure complete combustion of fuel.*

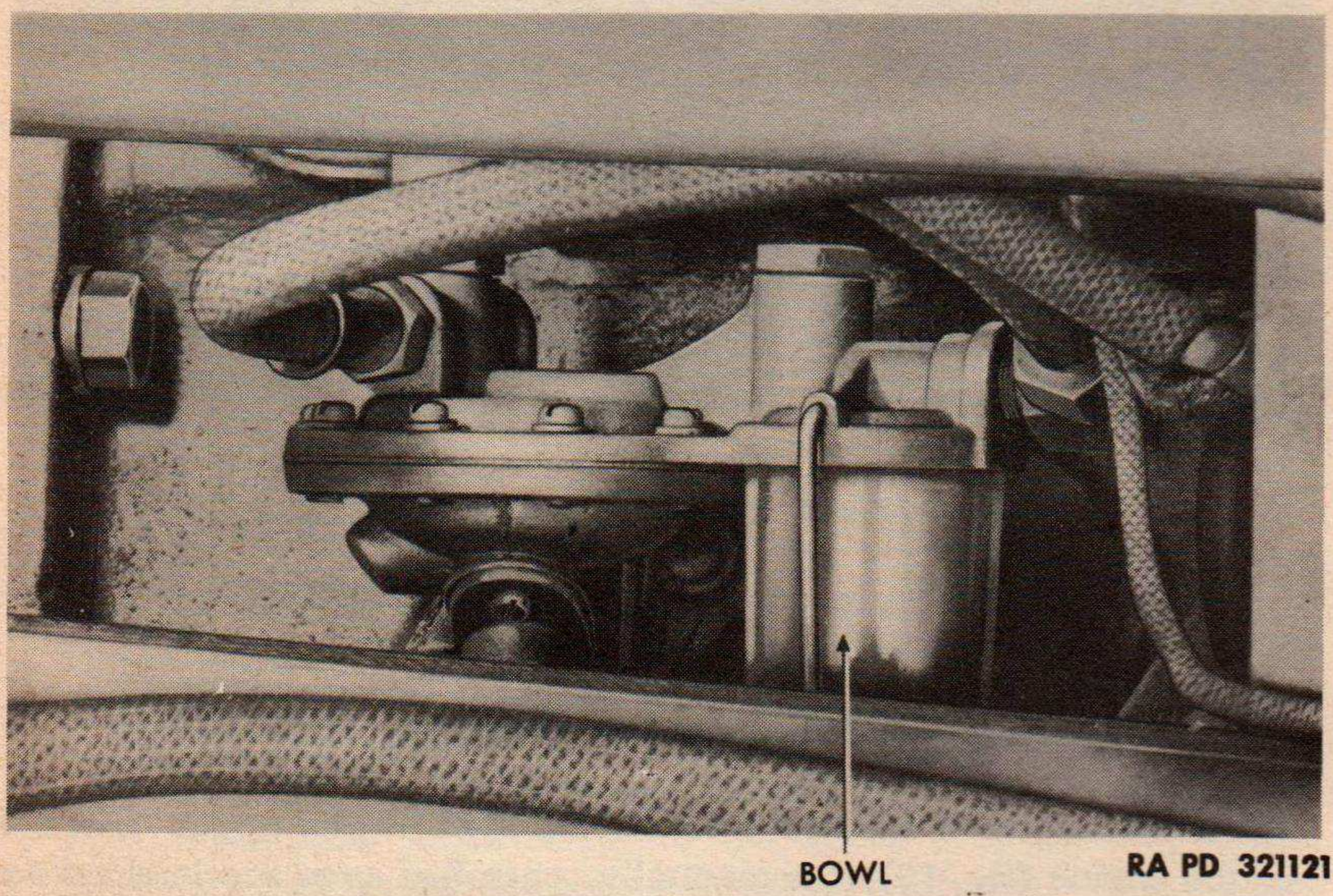


Figure 46—Fuel Pump and Filter

55. FILTERS.

a. Fuel Filter.

(1) DESCRIPTION. This unit, a metal-cased filter with a glass sediment bowl, is mounted on right frame side rail opposite right front wheel (fig. 41). It filters gasoline before it passes into fuel pump.

(2) SERVICING (fig. 46). Inspect filter and clean at regular intervals. Close shut-off cock under fuel tank. Remove nut from bottom center of bowl, remove screen, and swish in dry-cleaning solvent. Dry unit and place in position in assembly. Place bowl in position, and insert and tighten nut on bottom of bowl. Open shut-off cock.

b. Oil Filter.

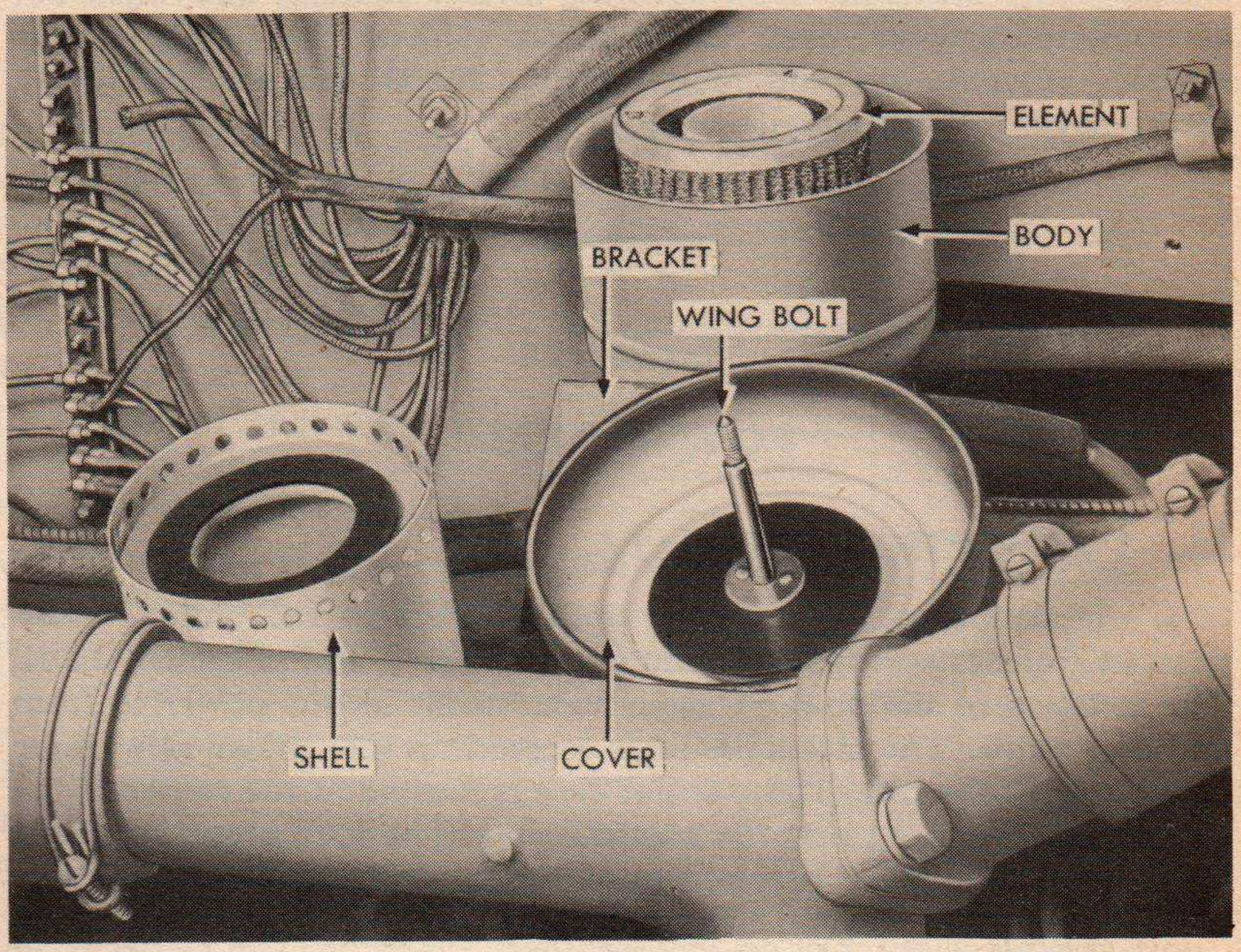
(1) DESCRIPTION. The oil filter (fig. 41) is of the three-stage, replaceable-element type, which strains all oil through filtering elements after it leaves the oil pump and before it contacts the bearings.

(2) SERVICING. Inspect the filter elements at regular intervals to detect any sludge formation on the outer surface of the elements. Unscrew retaining cap screw, lift off covers, and lift elements from filters. If filters show evidence of being clogged with sludge, drain crankcase. Before insertion of cleaned or new elements, drain filter housings and wash entirely with dry-cleaning solvent. After elements are inserted, install covers and secure with cap screws.

c. Crankcase Breather.

(1) DESCRIPTION. The breather located at the upper left side of the engine is an oil-bath type with a removable cap and screen. It filters air entering the crankcase through oil and a wire mesh screen element.

(2) SERVICING. Remove cap and screen and clean in dry-cleaning solvent. Dry screen, install screen and cap, and secure with snap fasteners.



RA PD 321108

Figure 47—Air Compressor Air Cleaner

d. Carburetor Air Cleaner.

(1) DESCRIPTION. This unit (fig. 41), mounted on a bracket attached to the rear right-hand side of the cylinder block, is an oil-bath and screen type, and is connected to the carburetor with a flexible hose.

(2) SERVICING. Unscrew wing bolt which clamps connecting pipe to air cleaner housing. Loosen clamp which secures flexible hose at other end of pipe to carburetor; swing pipe back, and lift filter assembly. Wash out accumulated grit and dust in sump and refill with clean, crankcase grade oil to lower bead of bowl. Clean screens by swishing thoroughly in dry-cleaning solvent, and allow to dry. Install filter in bowl and secure hood to bowl with wing bolt attached to connecting pipe.

e. Air Compressor Air Cleaner.

(1) DESCRIPTION. The compressor air cleaner (fig. 47), mounted on a bracket attached to the left front side of the cylinder block, is an oil-bath and screen type, and is connected to the air compressor with a hose and pipe connection.

(2) SERVICING. Unscrew wing bolt which secures cover to air cleaner body. Remove shell covering screen element and wash out accumulated grit and dust. Clean screen element thoroughly in dry-cleaning solvent; dry and reoil lightly. Install element and shell; secure cover to housing with wing bolt.

Section XV

POWER TRAIN

56. DESCRIPTION AND DATA.

a. Description. The power train consists of the clutch, transmission, transfer case, axles (front and two rear), and propeller shafts. The function of the power train is to transmit engine power to front and rear axles. The transmission is located on the carrier side frame at the rear of the cab. The transfer case is located at the center of the carrier side frame behind the transmission. The four propeller shafts are located as follows: between transmission and transfer case (intermediate propeller shaft), transfer case to rear axle (rear axle propeller shaft), rear axle to rear axle (interaxle propeller shaft), and transfer case to front axle (front axle propeller shaft).

b. Data.

	Make	Model
Transmission	Fuller	4A86
Transfer case	Timken	T77-3-8
Front axle	Timken	F-409-CW
Rear axle	Timken	SD-462-W
Propeller shafts	Blood	

57. CLUTCH.

a. Description. The clutch is a single-plate, dry-disk type, which is attached to the flywheel housing at the rear of the engine. Its function is to transmit power from the engine to the transmission. When the clutch pedal is disengaged, the clutch sleeve moves toward the flywheel, providing an action on the hinged levers that is opposed to the spring pressure on these levers. This removes pressure against the pressure plate, allowing the retractor spring to prevent contact of the pressure plate and the driven plates. When the pedal is engaged, the pressure spring acts upon the hinged levers, increasing the pressure of the spring, and engaging the friction face tightly with the flywheel. CAUTION: *Do not ride clutch pedal when driving. Avoid slipping the clutch and then racing engine to free vehicle from bad location.*

b. Adjustment (fig. 48).

(1) PREPARE FOR ADJUSTMENT. Place clutch pedal in released position, using block or jack. This is important because otherwise the adjusting straps and studs may be damaged, or the threads of the stud or nut become stripped.

(2) LOOSEN ADJUSTING NUTS. Release six adjusting nuts five full turns.

(3) FREEING ADJUSTING PLATE. Engage the clutch by removing block or jack. This will permit the adjusting plate to move out of contact with the adjusting shims.

(4) REMOVING SHIMS. Remove one shim from under each of the adjusting straps with a pair of sharp-nosed pliers, or insert cotter pin puller in small hole of shim. CAUTION: *Be sure no portion of the shim is left between the adjusting plate and the flywheel ring. This clutch is equipped with eight shims.*

(5) TIGHTEN ADJUSTING NUTS. Place clutch pedal in released position as in step (1) above; then tighten all adjusting strap nuts.

(6) CHECK ADJUSTMENT.

(*a*) Measure the distance from machined surface which supports the shims to face of clutch sleeve against which the release bearing acts. The correct distance is $1\frac{1}{8}$ inch plus $\frac{1}{16}$ inch to minus 0 inch.

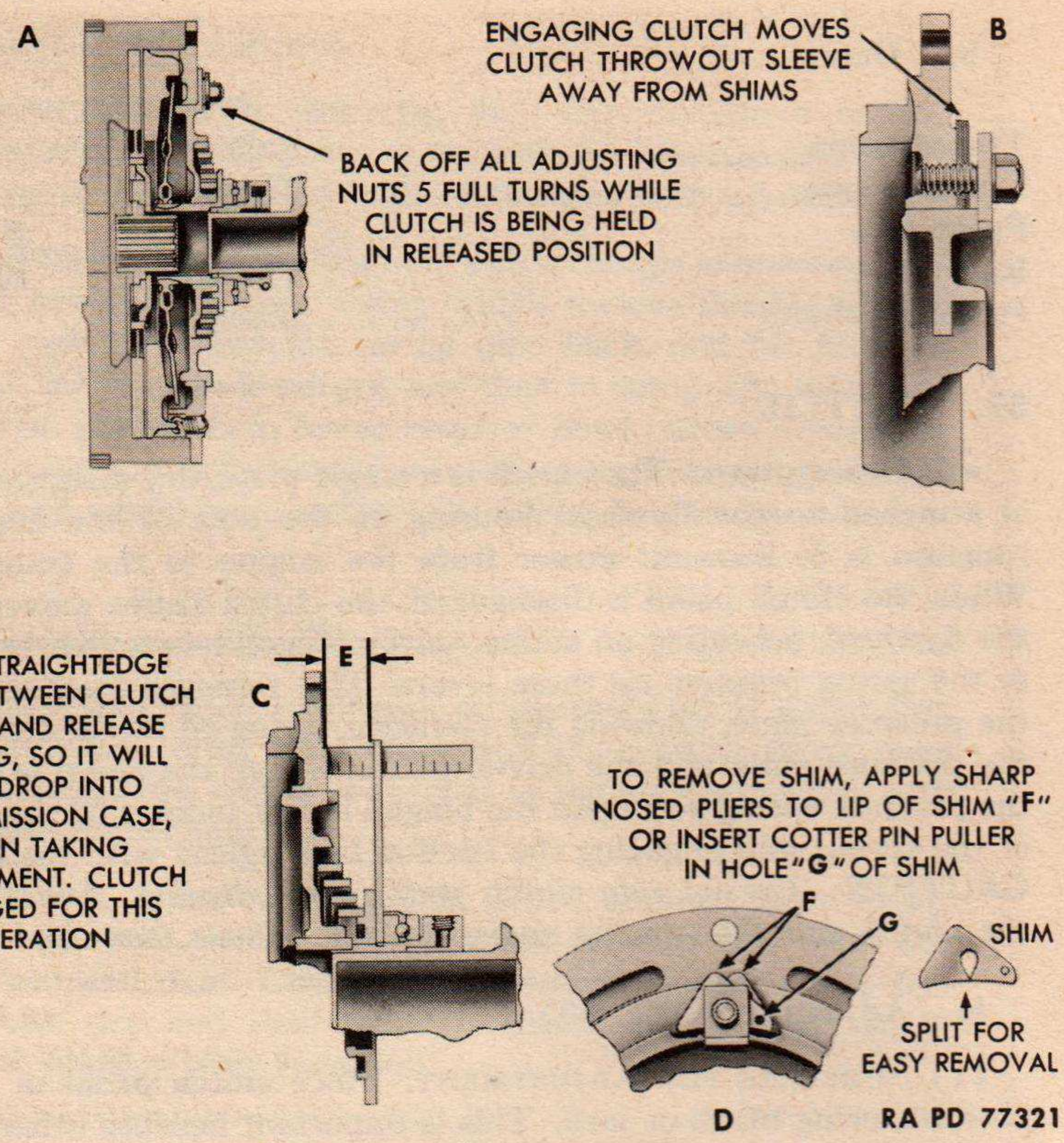


Figure 48—Clutch Adjustment

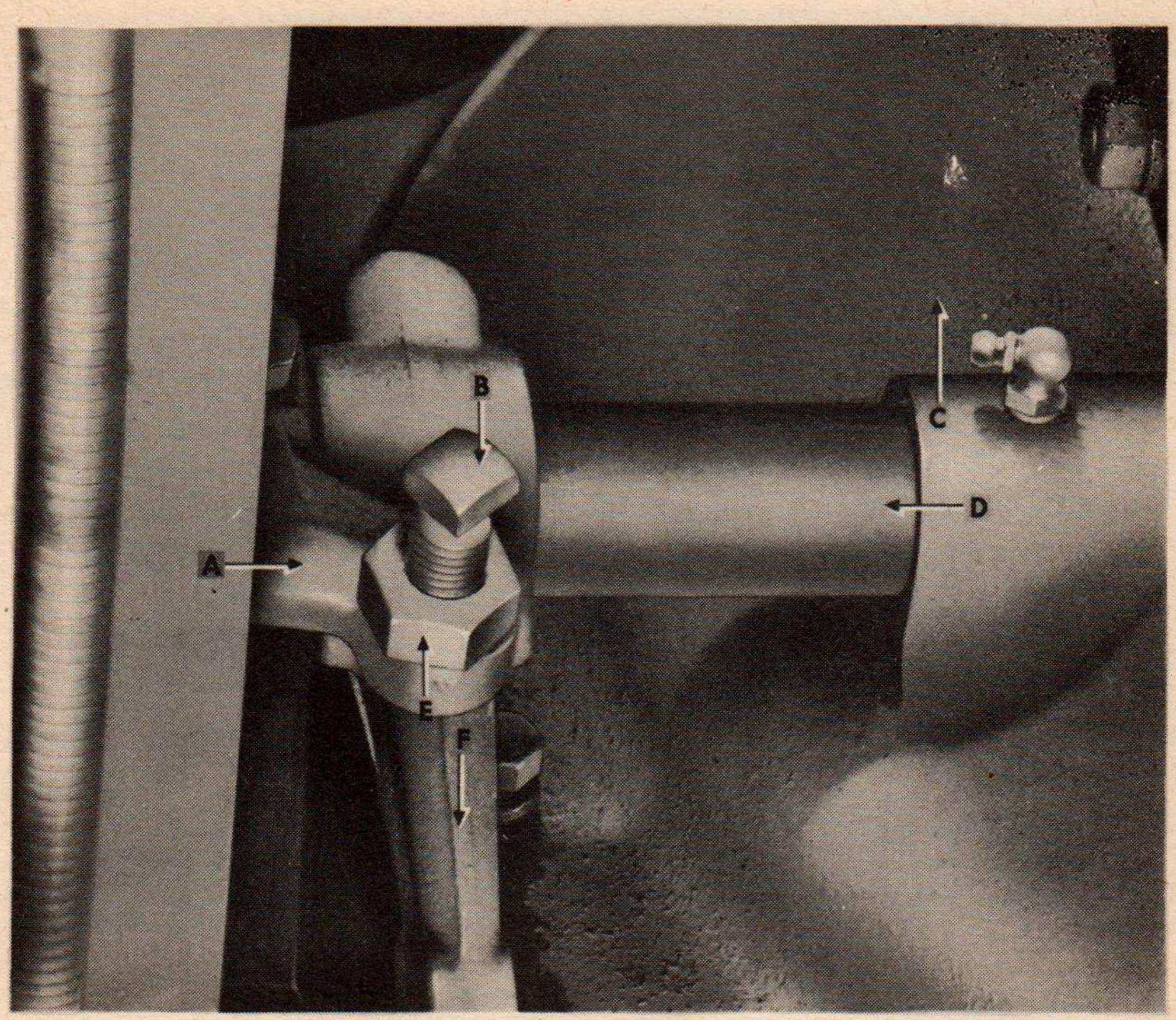
(*b*) After clutch is adjusted in accordance with specified dimensions, check the distance from the release bearing to the clutch sleeve. The bearing should be ⅛ to $\frac{5}{32}$ inch away from the clutch sleeve.

58. CLUTCH LINKAGE.

a. Description. The clutch linkage consists of the clutch pedal, clutch release shaft bracket, clutch release shaft, and the clutch release shaft lever; and is positioned between the operator's compartment and the clutch. It provides the means with which the operator can engage and disengage the clutch.

b. Adjustment (fig. 49). Loosen lock nut on adjusting link, and turn adjusting nut in or out as may be required to obtain proper free travel of foot pedal before clutch starts to release. Adjust to 2½-inches free travel if facings are new. If making readjustment, free travel

POWER TRAIN



RA PD 321059

A—CLUTCH RELEASE SHAFT BRACKET
B—ADJUSTING SCREW
C—CLUTCH HOUSING
D—CLUTCH RELEASE SHAFT
E—LOCK NUT
F—CLUTCH RELEASE SHAFT LEVER

Figure 49—Clutch Pedal Adjustment

should be as near 2½ inches as possible, as long as satisfactory release can be obtained and adjustment linkage will permit. With pedal free travel definitely established, turn lock nut firmly against adjusting nut to prevent adjustment from coming loose.

Section XVI

STEERING SYSTEM AND WHEELS

59. DESCRIPTION AND DATA.

a. Description. This vehicle is equipped with eleven 20 x 11, 10-stud, disk-type wheels. The rear wheels are dually mounted, four on each axle, to carry the weight of the turntable assembly. The front wheels are installed singly. The spare wheel is mounted on the front right side of engine. A conventional-type steering mechanism, positioned between the cab and front wheels, controls the steering of the vehicle.

b. Data.

(1) WHEELS.

Make	Motor Wheel
Model	82170

(2) STEERING.

Make	Ross
Model	T-74

60. STEERING.

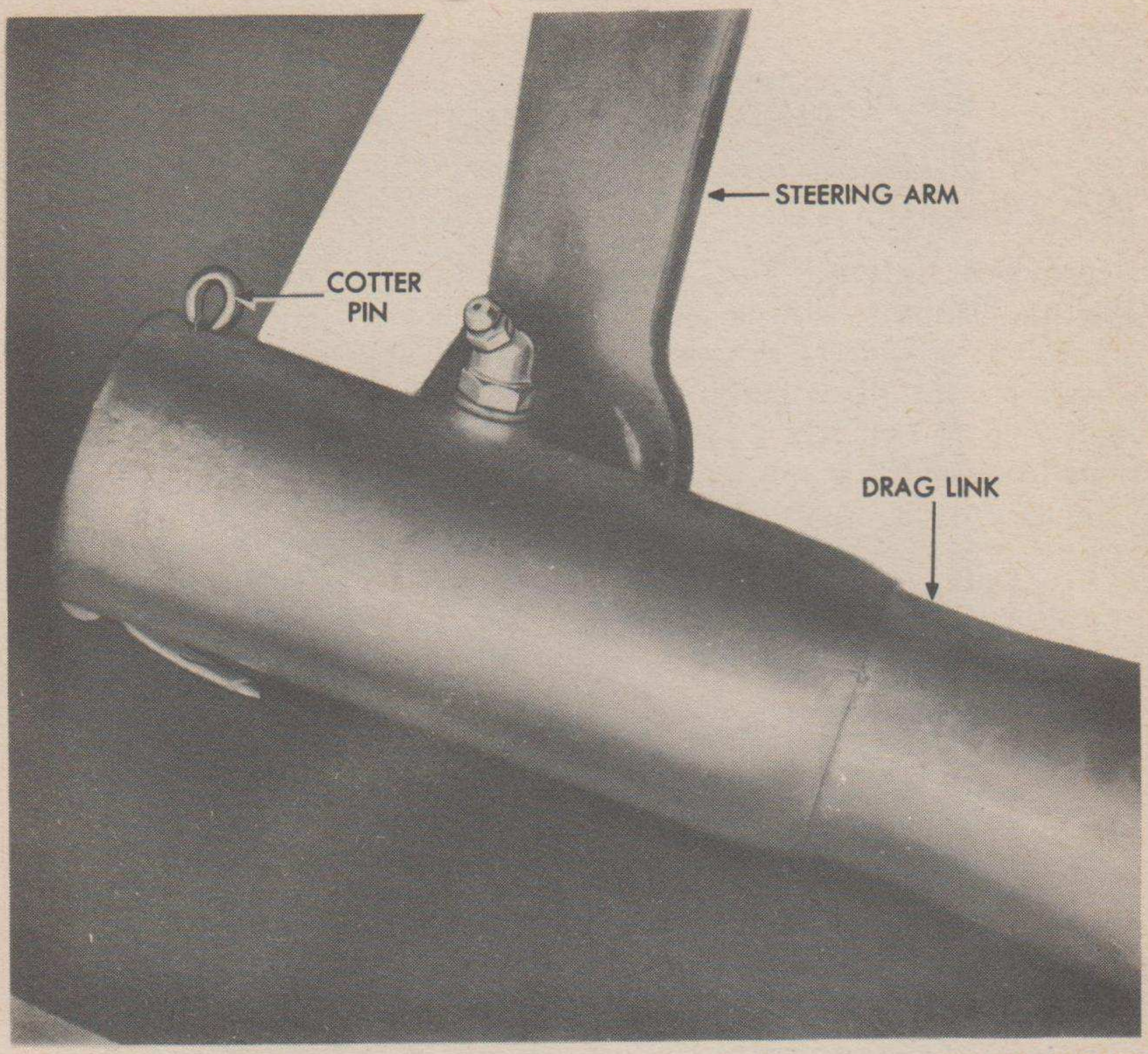
a. Description. The steering gear is attached to the frame side coil at the front left side of vehicle. It extends from the steering arm attached to the left front wheel assembly, through the steering gear housing to the steering wheel in the cab. The steering gear is the cam and twin-lever type and is mounted in an all-tight housing, which permits external adjustments to the gears. The turning action of steering wheel is relayed to the steering arm through a cam engaged to two studs mounted in tapered roller bearings on the lever shaft.

b. Adjustment. To adjust steering gear proceed as follows:

(1) DISCONNECT DRAG LINK FROM STEERING ARM (fig. 50). Remove cotter pin from end of drag link, release adjusting screw, and pull drag link from steering arm to free steering gear of all load.

(2) ADJUST BALL THRUST BEARING ON CAM (fig. 51). Loosen the housing side cover adjusting screw to free studs in cam groove. Unscrew the four nuts that secure housing upper cover to housing. Lift cover upward to permit removal of shims. (Shims are 0.002, 0.003, and 0.010 in. thick.) Remove or replace shim as required. Install housing upper cover, and tighten all four nuts. The adjustment is right when steering wheel can be turned freely with thumb and forefinger lightly gripping the rim.

STEERING SYSTEM AND WHEELS



RA PD 321087

Figure 50—Drag Link and Steering Arm

(3) ADJUST FOR MINIMUM BACKLASH (fig. 51). This adjustment is made by tightening side cover adjusting screw until a very slight drag is felt through the midposition. When proper adjustment is made, tighten lock nut which adjoins adjusting screw. Test adjustment by turning steering wheel slowly from one extreme position to the other. Secure all points loosened prior to making adjustment, and check tightness of all bolts.

(4) ADJUST DRAG LINK END PLAY. Remove cotter pin, and tighten adjusting screw at both ends of drag link as necessary to remove noticeable end play. Insert cotter pin to hold adjustment.

61. WHEELS.

a. Description. The vehicle is furnished with eleven 20 x 11 wheels (including one spare), which are the demountable, 10-stud, ventilated-disk type. They have 10 mounting holes and are mounted to the brake drums. They are equipped with 12.00 x 20 tires of

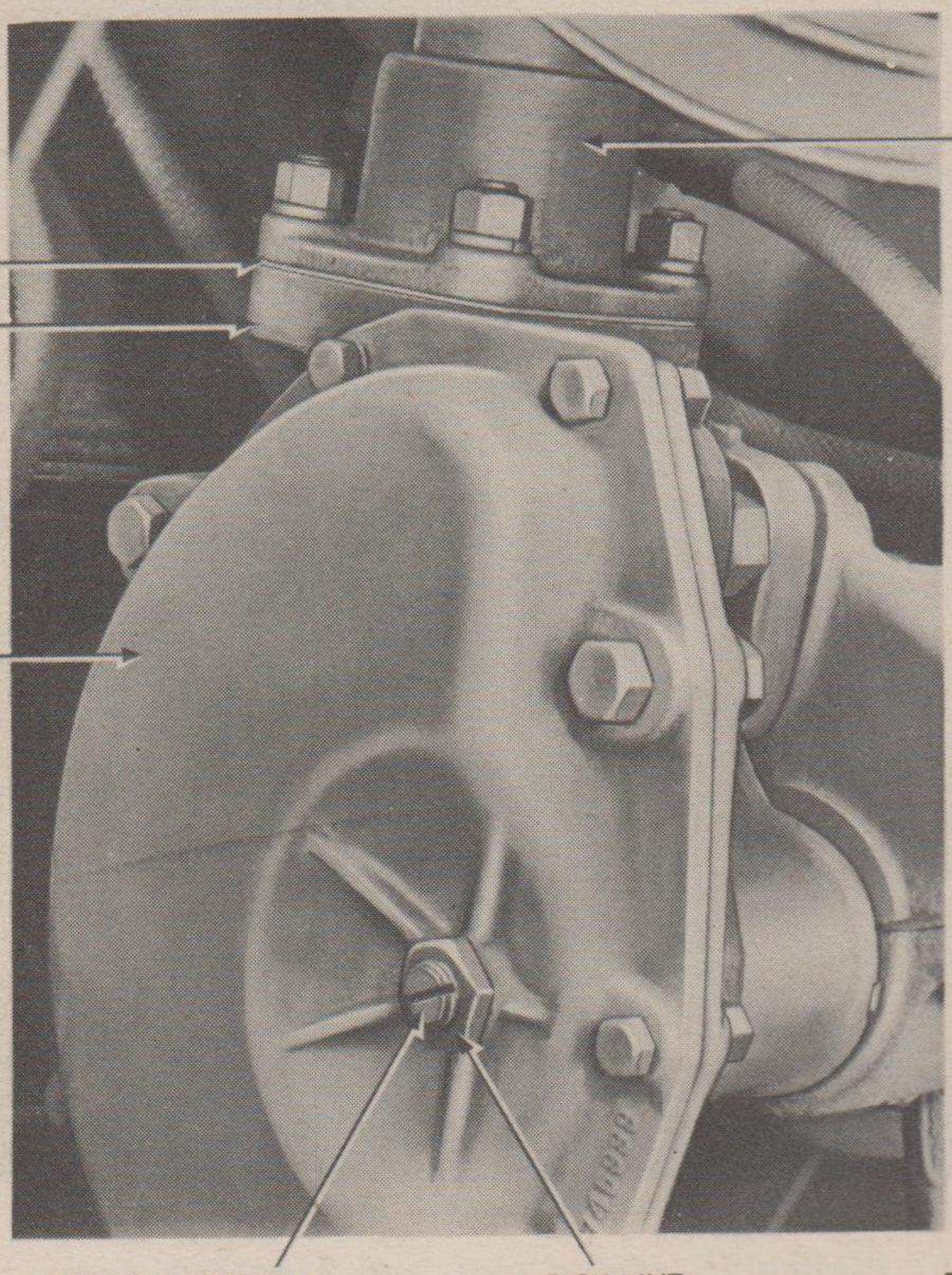


Figure 51—Steering Adjustment

military ground-grip type, and require 85 pounds pressure for efficient operation. NOTE: *It is very important that all rear tires be maintained at exactly the same correct inflation to prevent roll of rear end during operation of vehicle.* The wheel studs are of special design, seating on the tapered holes of the wheels. Right- and left-hand threads are used on all wheel studs to ensure tightness of these units.

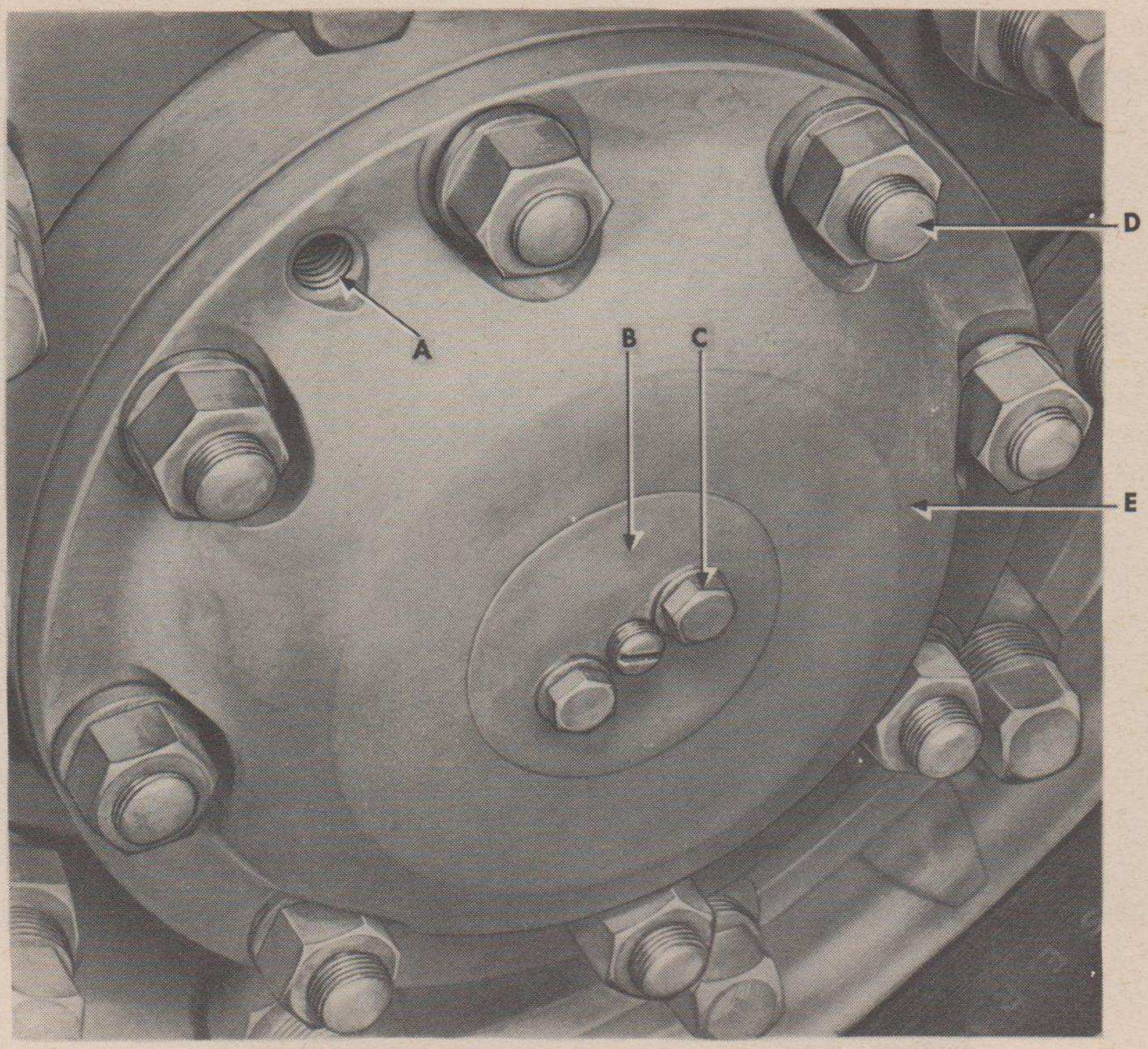
b. Bearing Adjustment.

(1) Raise wheel off ground.

(2) Remove two cap screws and lock washers which secure drive shaft retainer; then remove retainer (fig. 52).

(3) Remove eight nuts and lock washers from driving flange studs (fig. 52).

STEERING SYSTEM AND WHEELS



A—PULLER HOLE B—DRIVE SHAFT RETAINER C—CAP SCREW
D—DRIVING FLANGE STUD E—FLANGE RA PD 321138

Figure 52—Front Wheel Hub

(4) Tap flange with hammer to loosen it from studs (fig. 52).

(5) Use two long cap screws from rear axle flange. Thread them through special puller holes (fig. 52) in flange and pull flange loose from wheel hub.

(6) Straighten lock washer lip to free jam nut (fig. 53).

(7) Unscrew wheel bearing jam nut (fig. 53).

(8) Remove jam nut washer and wheel bearing nut lock ring (fig. 53).

(9) Spin the wheel slowly, and tighten adjusting nut until wheel binds slightly when rotated. Then back off nut ⅛ turn.

(10) Place lock ring in position in slot and on special lug. Install and tighten jam nut and washer (fig. 53). Spin wheel and recheck for binding. If adjustment is satisfactory, reverse the above procedure and assemble wheel.

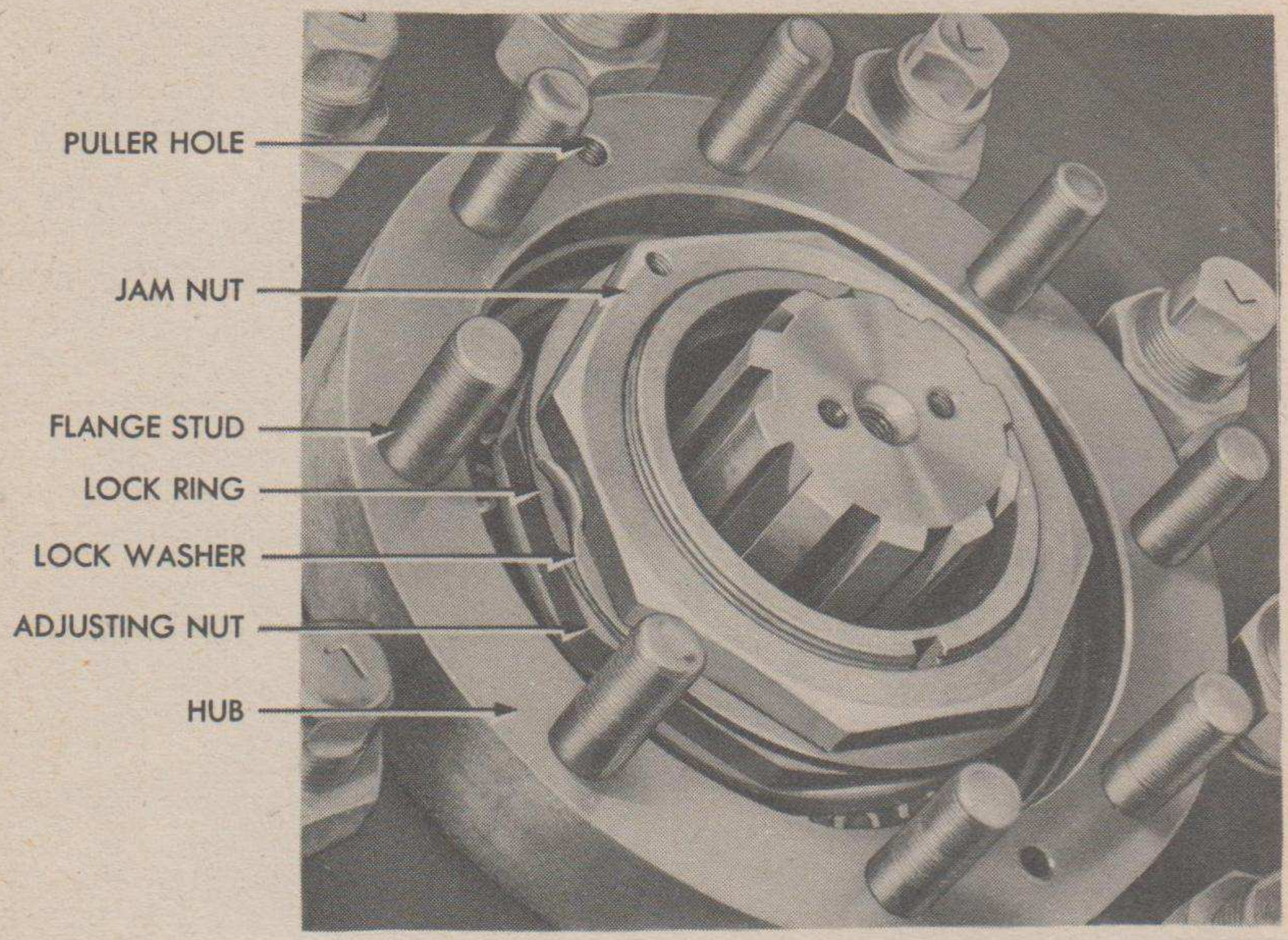


Figure 53—Wheel Bearing Adjustment

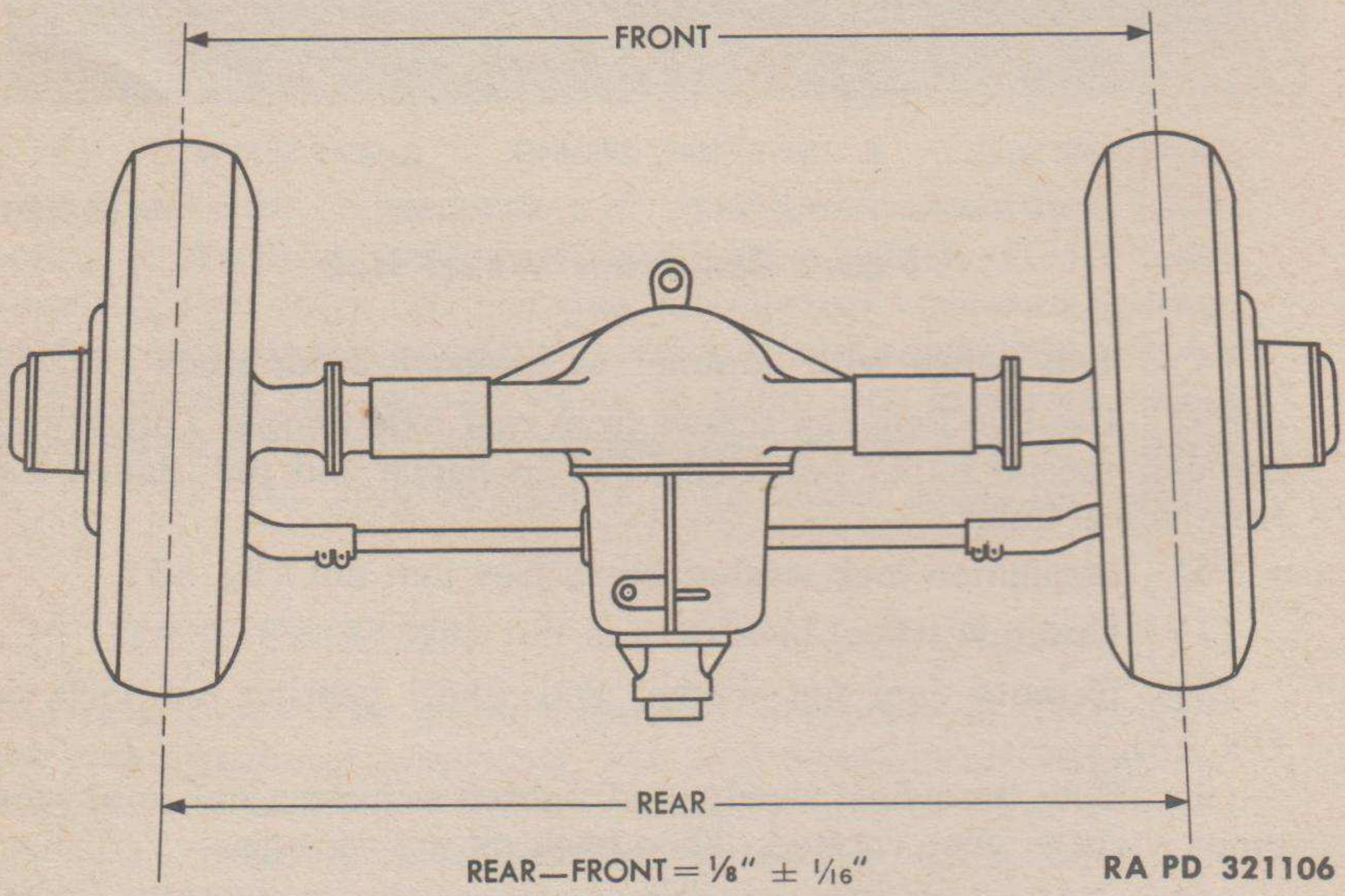


Figure 54—Toe-in of Front Wheels

c. Toe-in Test (fig. 54). Position wheels straight ahead on level ground. Mark both tires at front tire centerlines. Measure distance between lines at the center height of wheels. Measure distance between centerlines at rear of the front wheels at center height. Difference between front and rear cross measurements determine amount of toe-in. This must be $\frac{1}{16}$ to $\frac{1}{8}$ inch. Adjust if necessary (subpar. **d** below).

d. Toe-in Adjustment. The drop-center type tie rod connects right- and left-hand steering knuckles by means of a threaded yoke at each end. Right-hand side has 32 threads (coarse adjustment); the left-hand side has 16 threads (fine adjustment). Adjustment is made by lengthening or shortening the tie rod assembly. Proceed as follows for proper adjustment: Disconnect right-hand yoke, and loosen lock nut and two binder bolts on left yoke. Swing right-hand yoke toward rear of carrier about 18 inches. Hold right yoke rigid, and turn center of yoke in the desired direction. This will increase or decrease its effective length; which should be adjusted to accomplish specified toe-in.

Section XVII

BRAKE SYSTEM

62. DESCRIPTION AND DATA.

a. The vehicle is equipped with service brakes and a hand brake, the latter for parking and emergency use. The service brakes (fig. 55) are the conventional shoe-type mechanical brakes applied by air pressure to the brake drums. The hand brake is a four-shoe disk-type attached to the power train between the transfer case and the rear propeller shaft.

b. Data.

(1) SERVICE BRAKE.

Make	Bendix-Westinghouse
Compressor model	221288
Operating pressure	85 to 105 lb

(2) HAND BRAKE.

Make	American Chain and Cable
Model	L-550
Type	4-shoe disk

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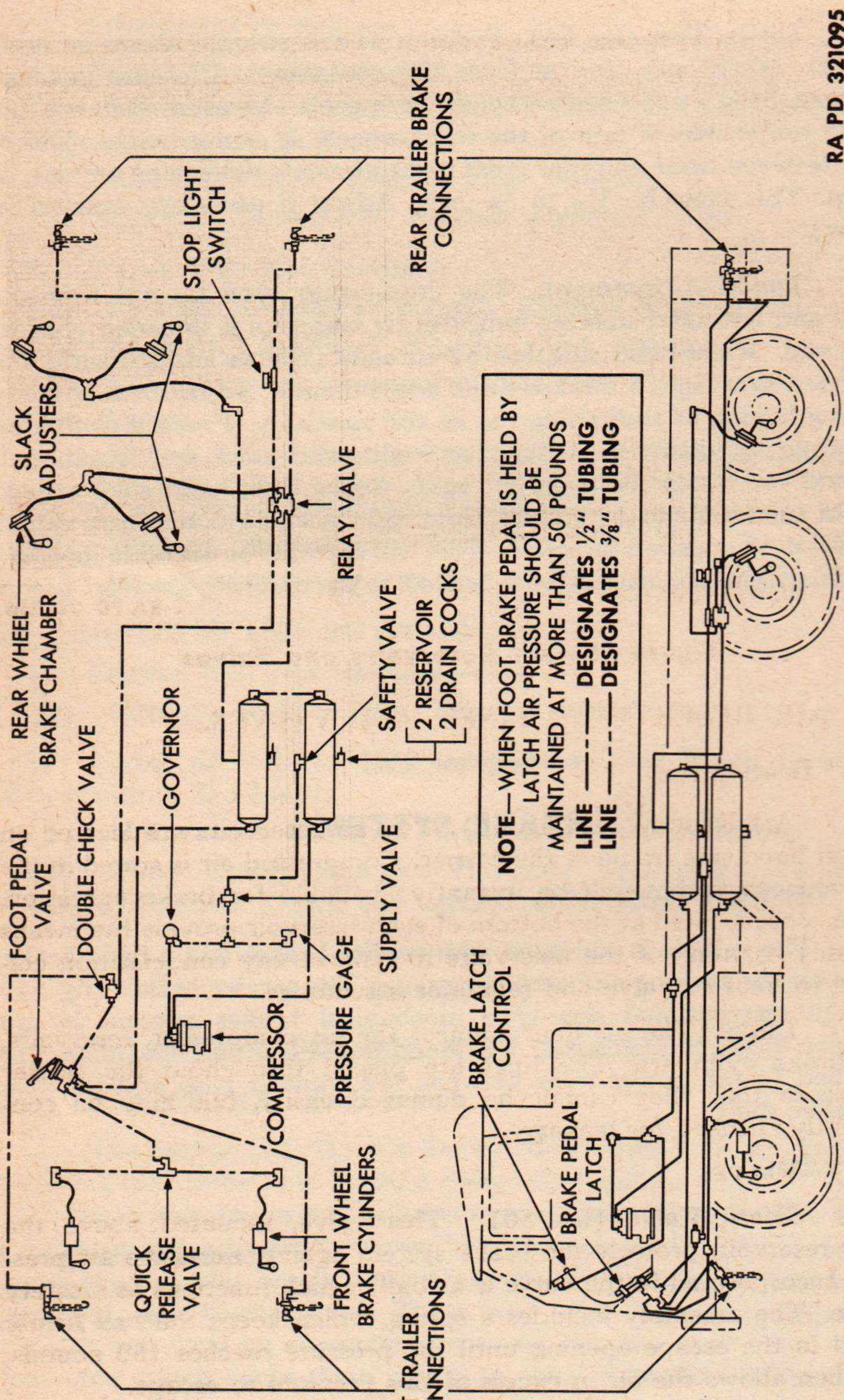


Figure 55—Service (Air) Brake System

BRAKE SYSTEM

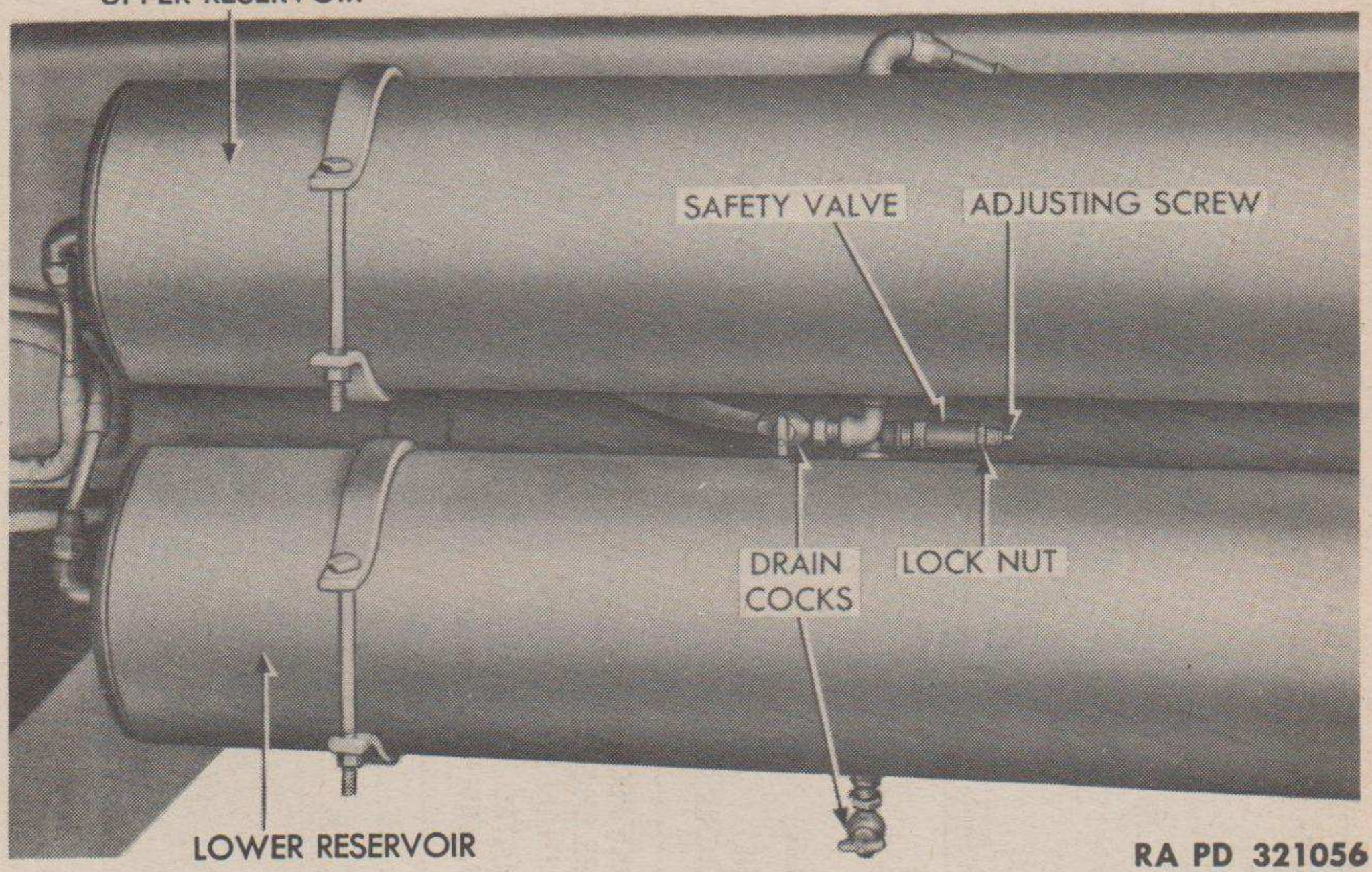


Figure 56—Air Reservoirs and Valves

63. AIR RESERVOIRS, LINES, AND VALVES.

a. Description

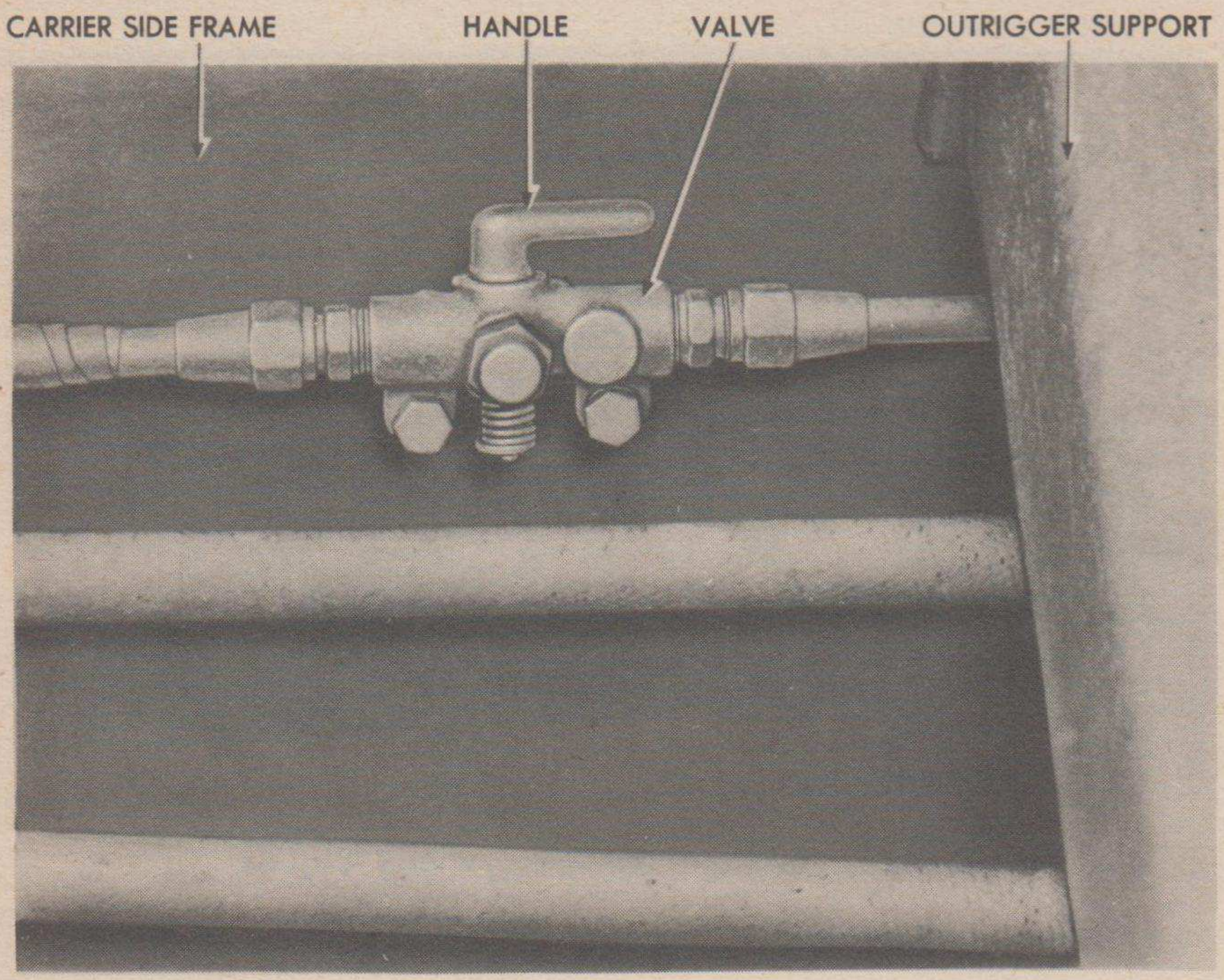
(1) AIR RESERVOIRS (fig. 56). Two air reservoirs are located on the left-hand side frame of the carrier. Compressed air is stored in the reservoirs so that it will be instantly available for brake operation. Drain cocks located at the bottom of each reservoir provide the means for daily draining of the reservoirs to remove any condensation collected in lines or valve and regulator assemblies.

(2) LINES. The air lines connect the air compressor, reservoirs, and brake cylinders. The lines are placed throughout the carrier chassis so that they cannot be damaged easily, but may be conveniently checked for leakage.

(3) VALVES.

(a) Safety Valve (fig. 56). This valve, mounted above the lower reservoir, protects the brake system against excessive air pressure. Incorporated in the valve is a "ball" which functions as a safety device. The assembly includes a spring, which keeps the ball firmly seated in the escape opening until the pressure reaches 150 pounds, and then allows the air in excess of this pressure to escape.

(b) Brake Valve. This valve is located below the foot pedal. Its function is to control the air pressure delivered to the brake chambers, and through it the braking force.



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Figure 57—Supply Valve

(c) Relay Valve. This valve is located at the left side frame in front of the front rear axle. It functions as a relay station to hasten the release of air pressure to rear brake chambers.

(d) Supply Valve (fig. 57). This valve, located on carrier left-hand side frame in front of the outrigger support, is used to supply an air hose for inflating tires. The valve in open position cuts off the governor, which allows the compressor to build up air pressure to 150 pounds; the handle of the supply valve is kept in a closed position except when valve is being used.

b. Valve Adjustment (fig. 56).

(1) SAFETY VALVE. To adjust the pressure setting on the safety valve, proceed as follows: Loosen lock nut; to raise pressure setting turn adjusting screw clockwise, to lower pressure setting turn adjusting screw counterclockwise. Set pressure at 150 pounds. Check with test gage or pressure gage. If adjustment is satisfactory, tighten lock nut.

(2) BRAKE VALVE. The brake valve adjustment consists of maintaining the clearance not to exceed $\frac{1}{16}$ inch between bottom of brake

pedal and adjusting screw at top of valve. Turn screw to right (clockwise) to increase clearance, to left (counterclockwise) to decrease clearance.

c. Service Brake Valve. Remove strainer at bottom of brake valve and clean thoroughly with dry-cleaning solvent.

d. Test. Weekly, or oftener if necessary, check air brake system valves for leakage. Place soap suds over valve outlets and over front part of brake valve with pedal in released and applied positions. Leakage of a 3-inch bubble in 3 seconds is permissible. Leakage greater than this indicates that valves are worn and must be replaced. Refer to higher echelon.

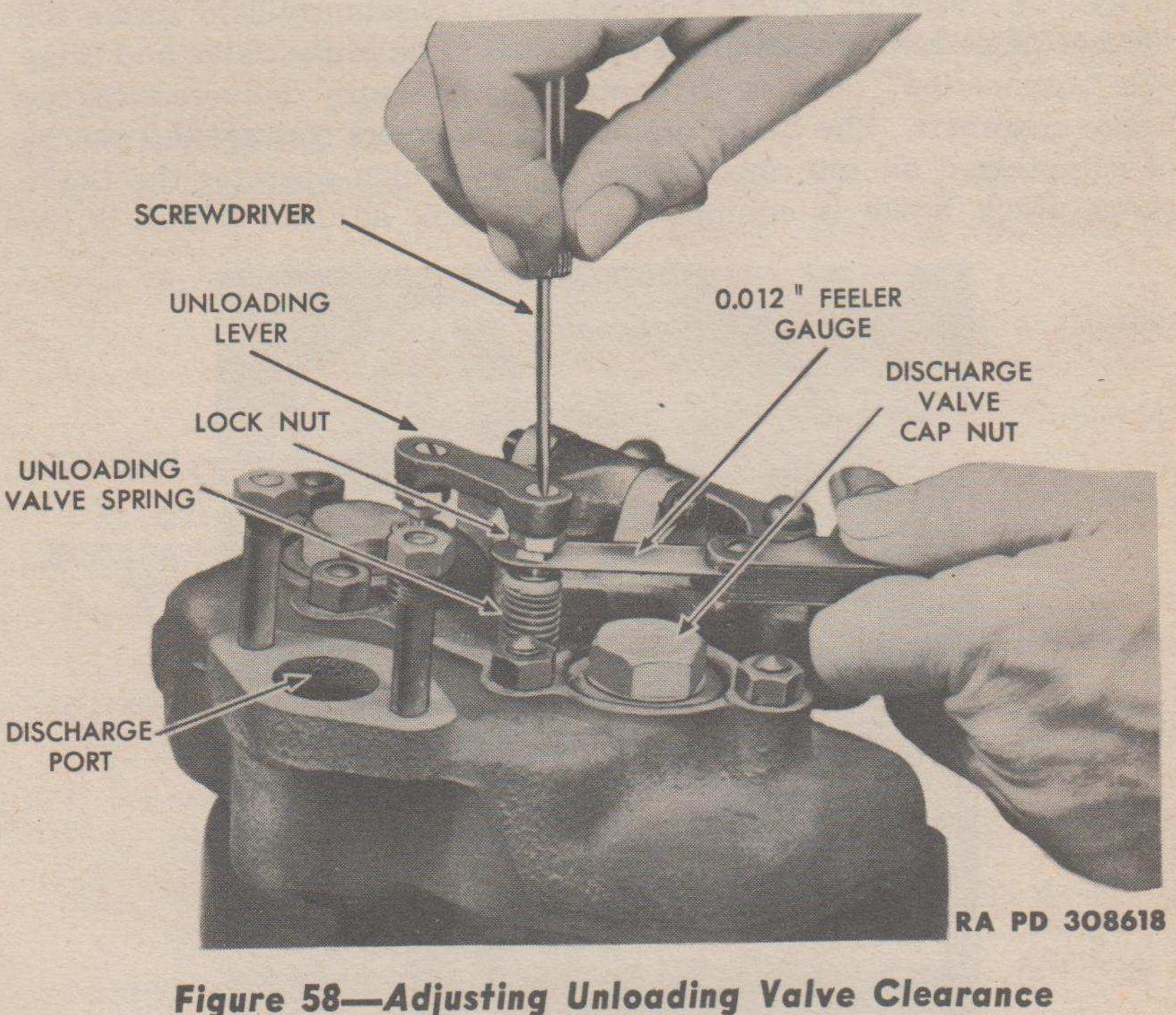


Figure 58—Adjusting Unloading Valve Clearance

e. Air Compressor.

(1) DESCRIPTION. The air compressor is mounted on the left side of the engine. It is a twin-cylinder unit driven by the two fan belts. Its function is to charge the two reservoir tanks with air pressure needed to operate the brakes. Air pressure is obtained when the pistons force the air out of the cylinder bores past the discharge valves into the reservoirs. Lubrication is obtained from the engine pressure

system by direct connections. Cooling is accomplished by connections from the engine cooling system.

(2) SERVICE AND ADJUSTMENT (fig. 58). Check unloader valve clearance with feeler gage. Correct clearance is 0.010 to 0.015 inch. Remove cap nuts and check discharge valve seat for carbon. If carbon is excessive, remove cylinder head and use a wire brush to clean carbon from valve seats, chambers, and springs. Use new gasket when installing head.

64. SERVICE BRAKE.

a. Description. The compressor, governor, gage, and safety valve are air-controlled devices used to build up and maintain air pressure in the two reservoirs so that this pressure is constantly held within the normal range for efficient brake operation. The brake valve and relay are "application" devices to control air pressure delivered to the brake chambers. The brake diaphragm chambers convert the energy of compressed air into mechanical energy which operates the brake cams. Each brake is equipped with a slack adjuster which is the

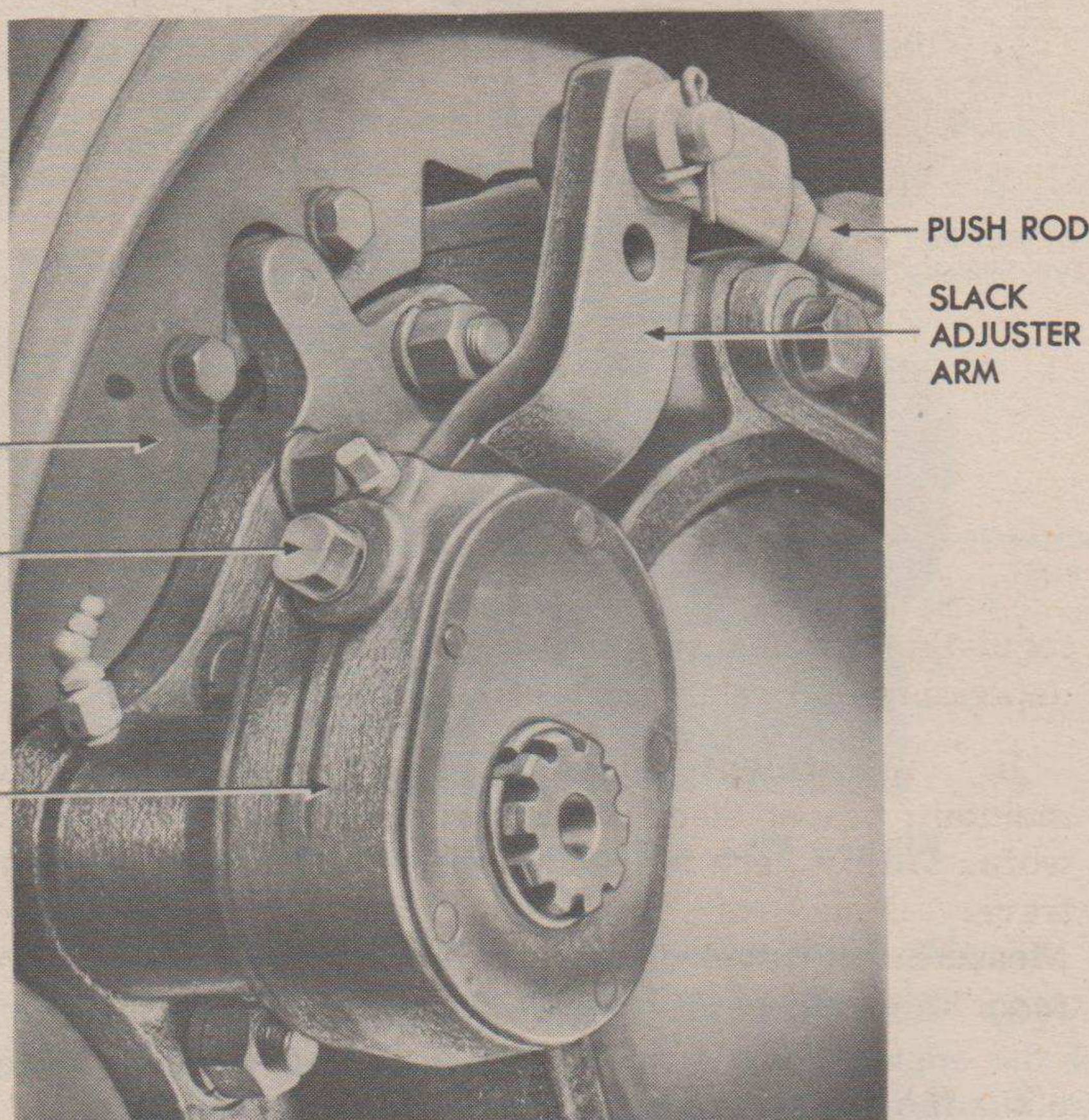
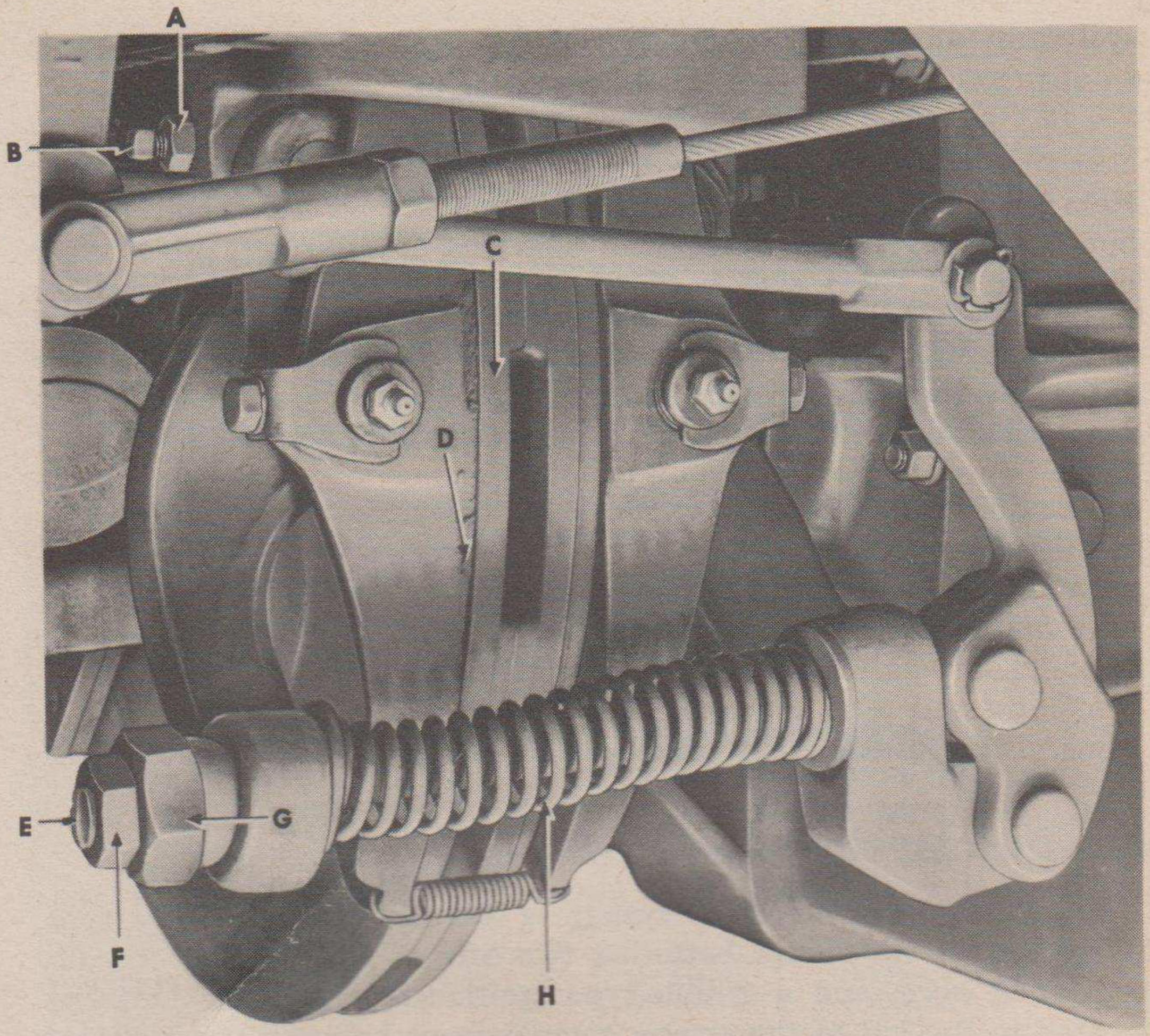


Figure 59—Slack Adjuster Adjustment

BRAKE SYSTEM



A—LOCK NUT
B—SET SCREW
C—DISK
D—SHOE
E—END BOLT
F—LOCK NUT
G—ADJUSTING NUT
H—RELEASE SPRING

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Figure 60—Hand Brake Adjustment

regulating mechanism of the brake. The brakes are controlled by depressing and releasing brake pedal.

b. Adjustment (fig. 59). The brake adjustment necessary to maintain proper slack adjustment is made by turning the adjusting worm. Adjust each brake chamber so that all have the same push rod travel distance on all wheels to ensure equal brake application. Measure the travel distance carefully. NOTE: *Push rod travel distance in excess of 1¾ inches requires adjustment.*

65. HAND BRAKE.

a. Description. The hand brake is the mechanical four-shoe disk type, and is mounted on a crossmember to the rear of the transfer

case, with the brake disk mounted on the propeller shaft compression flanges. The brake is controlled by a lever in the operator's cab.

b. Adjustment (fig. 60). Release hand lever to full release position. Loosen lock nut, and tighten adjusting nut on end bolt on which release spring is mounted to obtain $\frac{1}{32}$-inch clearance between shoes and disk. Use feeler gage to check clearance at bottom of each shoe. When proper adjustment has been obtained, tighten lock nut against adjusting nut. Loosen lock nut and adjust set screw at top of brake so that clearance is the same as that of the bottom. Use feeler gage to check clearance. If adjustment is satisfactory, tighten lock nut.

Section XVIII

CARRIER ELECTRICAL SYSTEM

66. DESCRIPTION (fig. 61).

a. The carrier electrical system is the 12-volt automotive type. It consists of two 6-volt batteries, two sets of lights, an electrically controlled horn, and a double-type ignition system. The batteries, located to the left of the engine compartment between the fuel tank and the cab, are charged by a generator attached to and driven by the engine. The lights consist of the service lights, blackout marker lights, and blackout driving lights. Driving lights are mounted at the front of the vehicles, stop lights and marker lights at the rear. The horn is mounted at the front right-hand side of the engine and is controlled by a button mounted in the center of the steering wheel. The single distributor unit, mounted on the front left-hand side of the engine, fires the double-type ignition system by means of a two-end rotor which fires two contact points at a time. The function of the assembly is to supply necessary current for firing the engine and operating lights.

67. BATTERY.

a. Description (fig. 62). Two 6-volt, 19-plate, 153-ampere hour batteries are located in a compartment between the fuel tank and the operator's cab. They incorporate "safety-fill" caps and a vent system, which prevent overfilling. The batteries are connected by a jumper cable leading from the positive pole of one battery to the negative pole of the other. Easy access to batteries is provided by raising the hinged door at the top of the compartment.

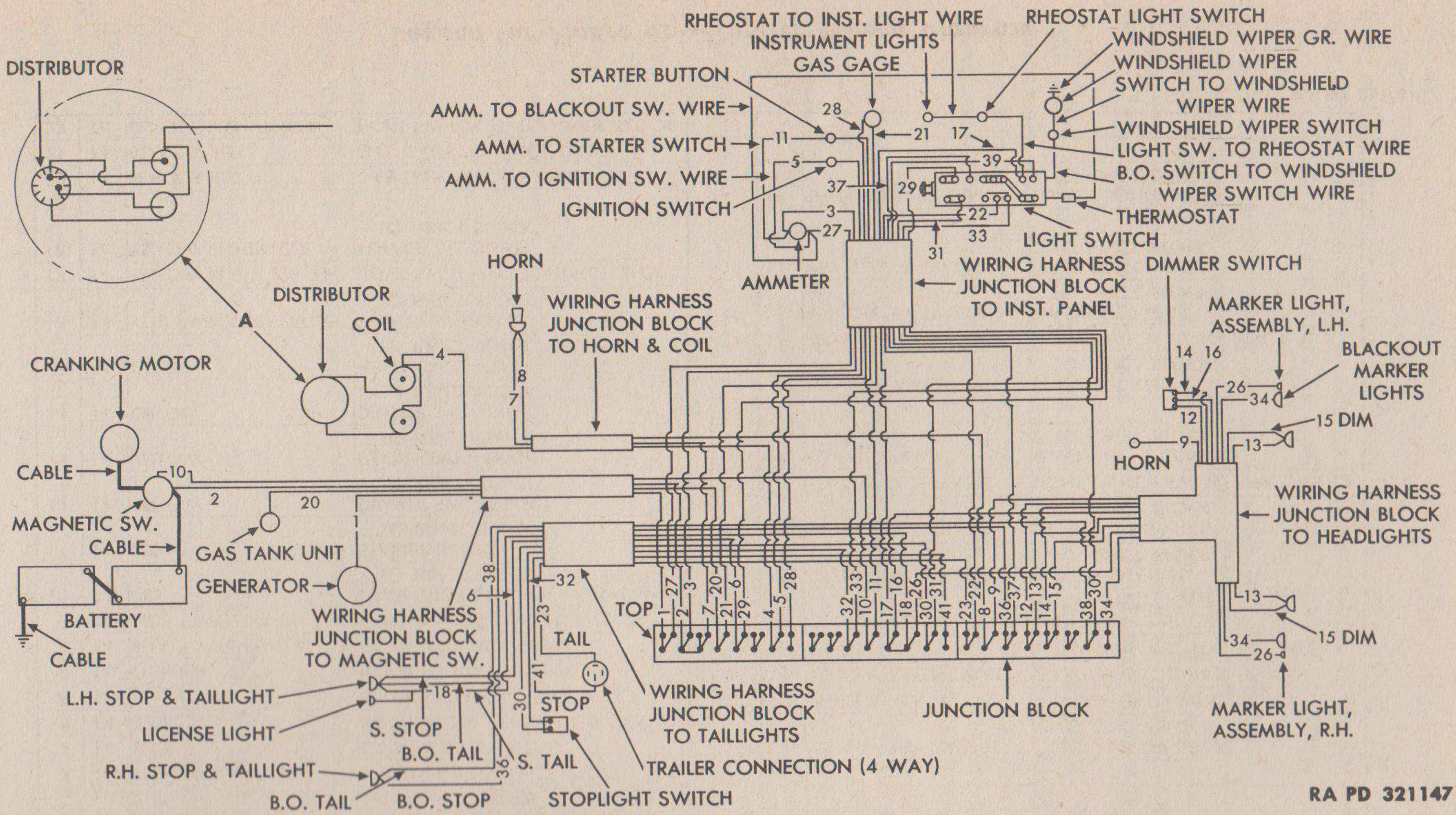


Figure 61—Carrier Wiring Diagram

NO.	SIZE	COLOR	
1	10	WHITE-BLACK TRACER	GENERATOR TO JUNCTION BLOCK
2	12	RED-BLACK TRACER	+BATT. TERM. ON MAGNETIC SW. TO JUNCT. BLOCK
3	10	RED-BLACK TRACER	+AMMETER TO JUNCT. BLOCK
4	14	BLUE	COIL TO JUNCT. BLOCK
5	14	BLUE	IGNITION SW. TO JUNCT. BLOCK
6	16	BLACK	SERVICE STOP TO JUNCT. BLOCK
7	14	ORANGE	HORN TO JUNCT. BLOCK
8	14	BLUE-WHITE TRACER	HORN TO JUNCT. BLOCK
9	14	BLUE-WHITE TRACER	HORN BUTTON TO JUNCT. BLOCK
10	14	RED	MAGNETIC CRANKING MOTOR SW. TO JUNCT. BLOCK
11	14	RED	STARTER BUTTON TO JUNCT. BLOCK
12	14	YELLOW	DIMMER SW.—BRIGHT TO JUNCT. BLOCK
13	14	YELLOW	HEADLIGHTS—BRIGHT TO JUNCT. BLOCK
14	14	GREEN	DIMMER SW.—DIM TO JUNCT. BLOCK
15	14	GREEN	HEADLIGHTS—DIM TO JUNCT. BLOCK
16	14	YELLOW-BLACK TRACER	DIMMER SWITCH BATT. TO JUNCT. BLOCK
17	14	YELLOW-BLACK TRACER	LIGHT SWITCH HT. TO JUNCT. BLOCK
18	16	YELLOW-RED TRACER	SERVICE TAIL LIGHT TO JUNCT. BLOCK
19			
20	16	BLACK & RED	GAS TANK UNIT TO JUNCT. BLOCK
21	16	BLACK & RED	GAS GAGE TO JUNCT. BLOCK
22	16	BLACK-GREEN TRACER	LIGHT SWITCH TT. TO JUNCT. BLOCK
23	14	BLACK-GREEN TRACER	TRAILER CONN.—TAIL LT. TO JUNCT. BLOCK
24			
25			
26	14	YELLOW-RED TRACER	TRUCK MARKER LIGHTS TO JUNCT. BLOCK
27	10	WHITE-BLACK TRACER	—AMMETER TO JUNCT. BLOCK
28	16	YELLOW-GREEN TRACER	GAS GAGE TO JUNCT. BLOCK
29	16	BLACK	LIGHT SWITCH S. TO JUNCT. BLOCK
30	16	GREEN-BLACK TRACER	STOP LIGHT SWITCH TO JUNCT. BLOCK
31	16	GREEN-BLACK TRACER	LIGHT SWITCH SS. TO JUNCT. BLOCK
32	16	YELLOW-BLUE TRACER	STOP LIGHT SWITCH TO JUNCT. BLOCK
33	14	YELLOW-BLUE TRACER	LIGHT SWITCH SW. TO JUNCT. BLOCK
34	14	BLUE-RED TRACER	BLACKOUT HEADLIGHTS TO JUNCT. BLOCK
35			
36	16	RED-BLUE TRACER	BLACKOUT STOP LT. TO JUNCT. BLOCK
37	16	RED-BLUE TRACER	LIGHT SWITCH BS. TO JUNCT. BLOCK
38	16	RED-YELLOW TRACER	BLACKOUT TAIL LT. TO JUNCT. BLOCK
39	14	RED-YELLOW TRACER	LIGHT SWITCH BHT. TO JUNCT. BLOCK
41	14	GREEN-YELLOW TRACER	TRAILER CONN.—STOP TO JUNCT. BLOCK
42			
43			

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Legend for Figure 61—Carrier Wiring Diagram

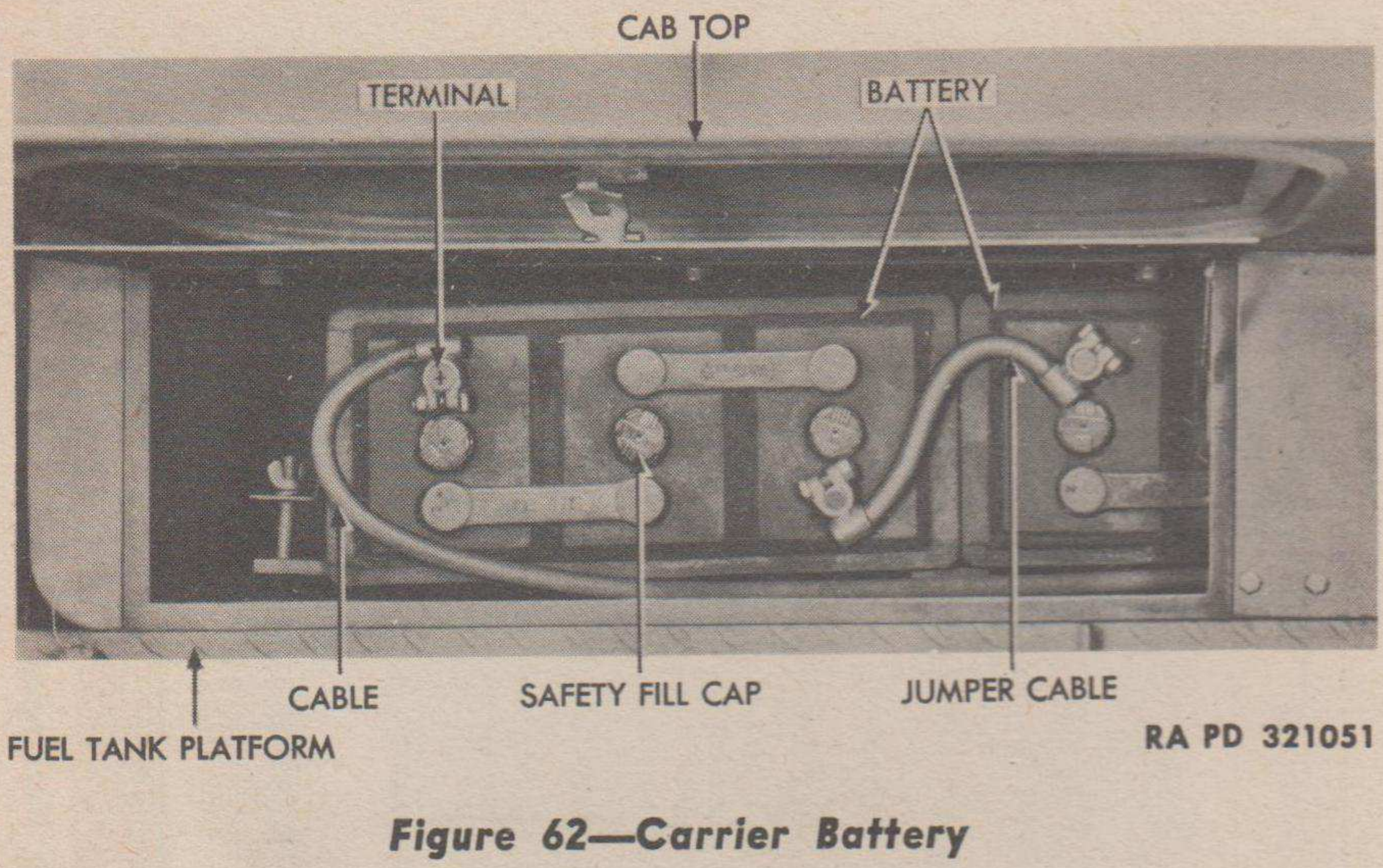


Figure 62—Carrier Battery

beam. These are controlled by a foot switch located in the operator's cab. The blackout driving lights are located alongside the headlights and are operated from the operator's cab. Two small marker lights are mounted on the top front of the carrier and are in operation only when the service light switch is in contact. The carrier is equipped with a combination service taillight, service stop light, and blackout taillight on the left side, and with a blackout marker and taillight on the right side. The horn, located on the right front side of engine, is of the vibrator type. Current to operate the horn is drawn directly from the ammeter through a relay switch controlled by the horn button.

b. Horn Adjustment (fig. 65). The horn does not require adjustment unless it has been tampered with or otherwise damaged. If adjustment is necessary, proceed as follows: Remove horn cover screw and lift cover from horn. Loosen adjusting nut lock. Screw or unscrew adjusting nut until desired pitch is obtained. Keep adjusting nut from turning, and tighten lock nut. Install cover on horn and secure with cover screw.

c. Headlight Adjustment (fig. 66). If lights are out of focus, adjust as follows: Release pressure of adjusting nut so that shell can be easily tilted on bracket to accomplish correct focus adjustment. When proper adjustment is obtained, secure adjusting nut tightly to bracket.

d. Replacement.

(1) HEADLIGHT SEALED BEAM LAMP-UNIT. To remove, unscrew clamp screw from rim and lift off rim. Unscrew three hold-down

CARRIER ELECTRICAL SYSTEM

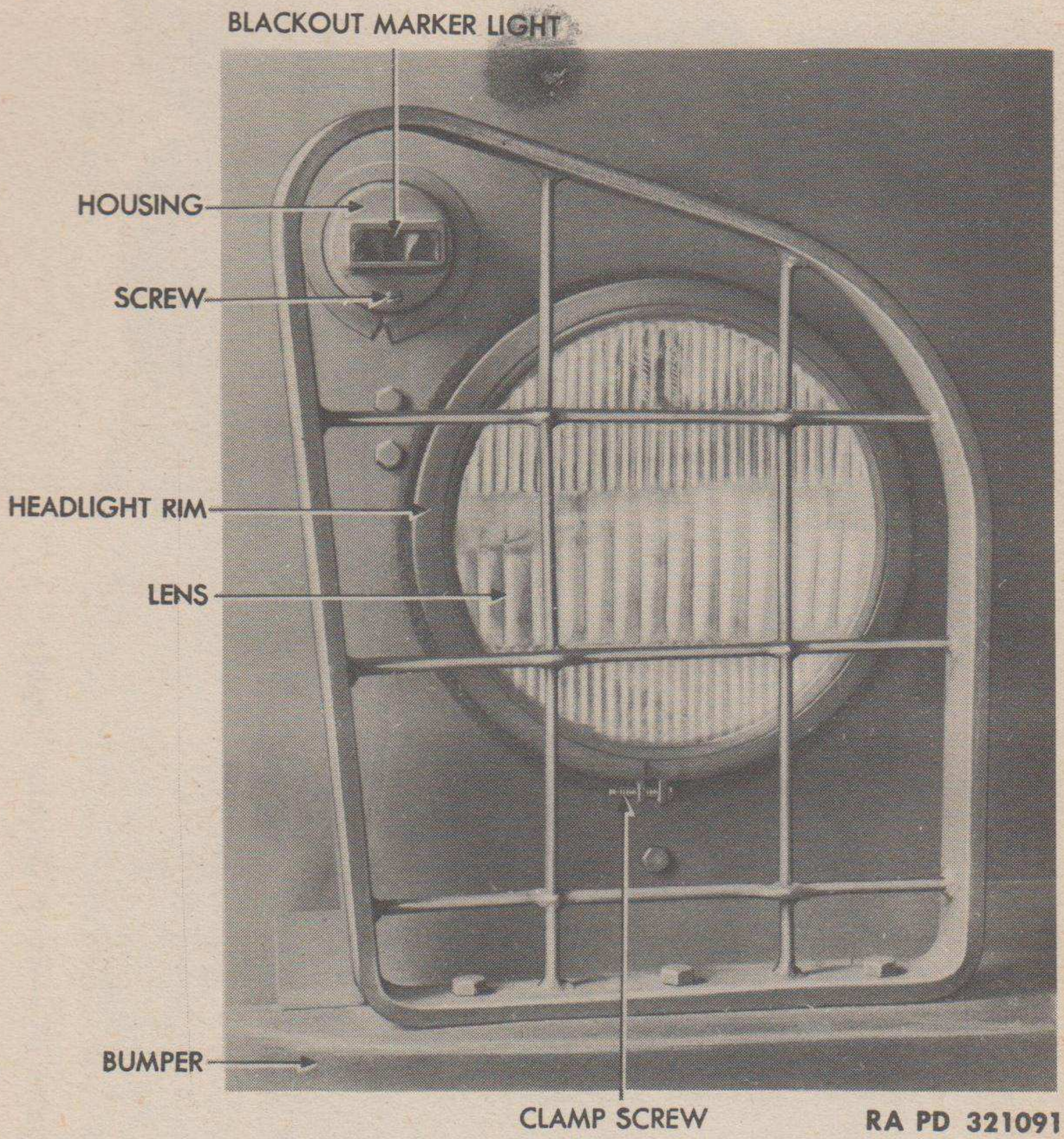


Figure 63—Front Carrier Lights

screws in retainer ring and remove ring. Pull lamp-unit partially out and release from wiring plug at rear of unit. Reverse above procedure to install new unit.

(2) BLACKOUT DRIVING LIGHT SEALED BEAM LAMP-UNIT (fig. 63). To remove unit, unscrew and remove one screw at bottom of housing. Pull housing face free of back cover. Disconnect the two wires at rear of sealed beam lamp-unit. Unsnap three clamping springs from inside rim of light, releasing lamp-unit. Reverse above procedure to install new unit.

(3) TAILLIGHTS. Unscrew two nuts from taillight housing at rear of carrier (fig. 64). Remove taillight face carefully to avoid breaking glass, and remove bad unit. Install new unit, replace taillight face to lamp body, and secure tightly with nuts.

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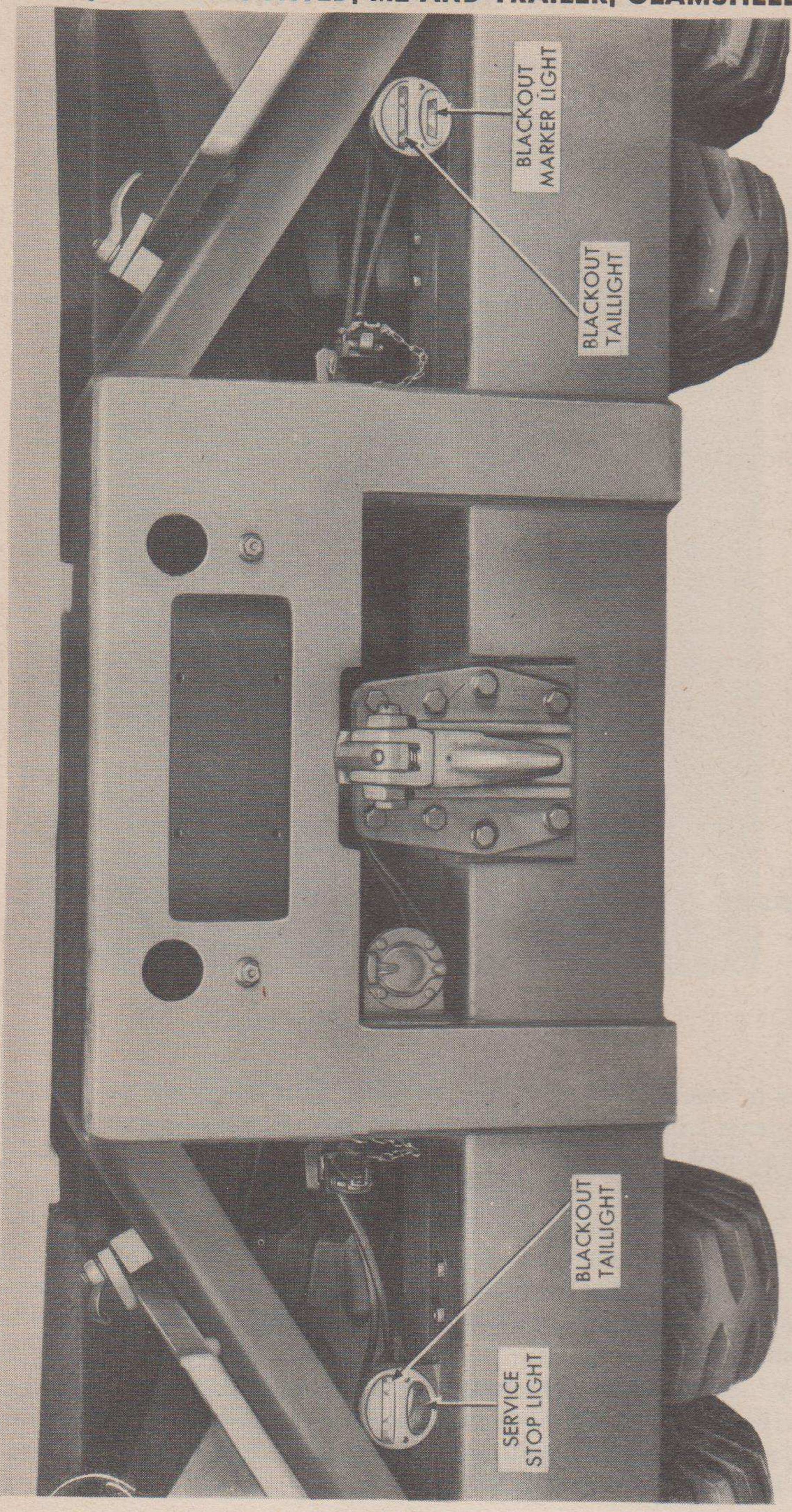


Figure 64—Rear Carrier Lights

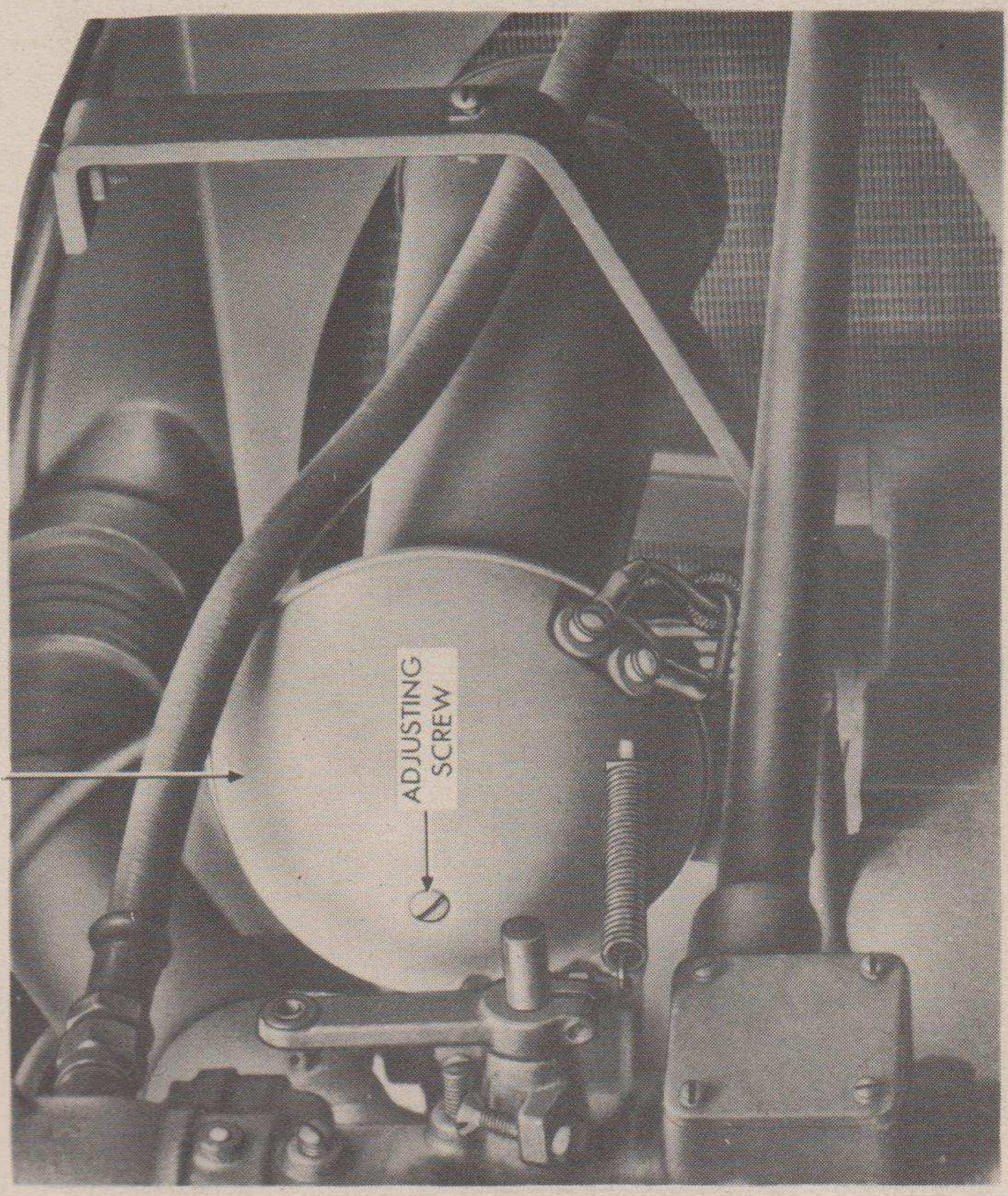
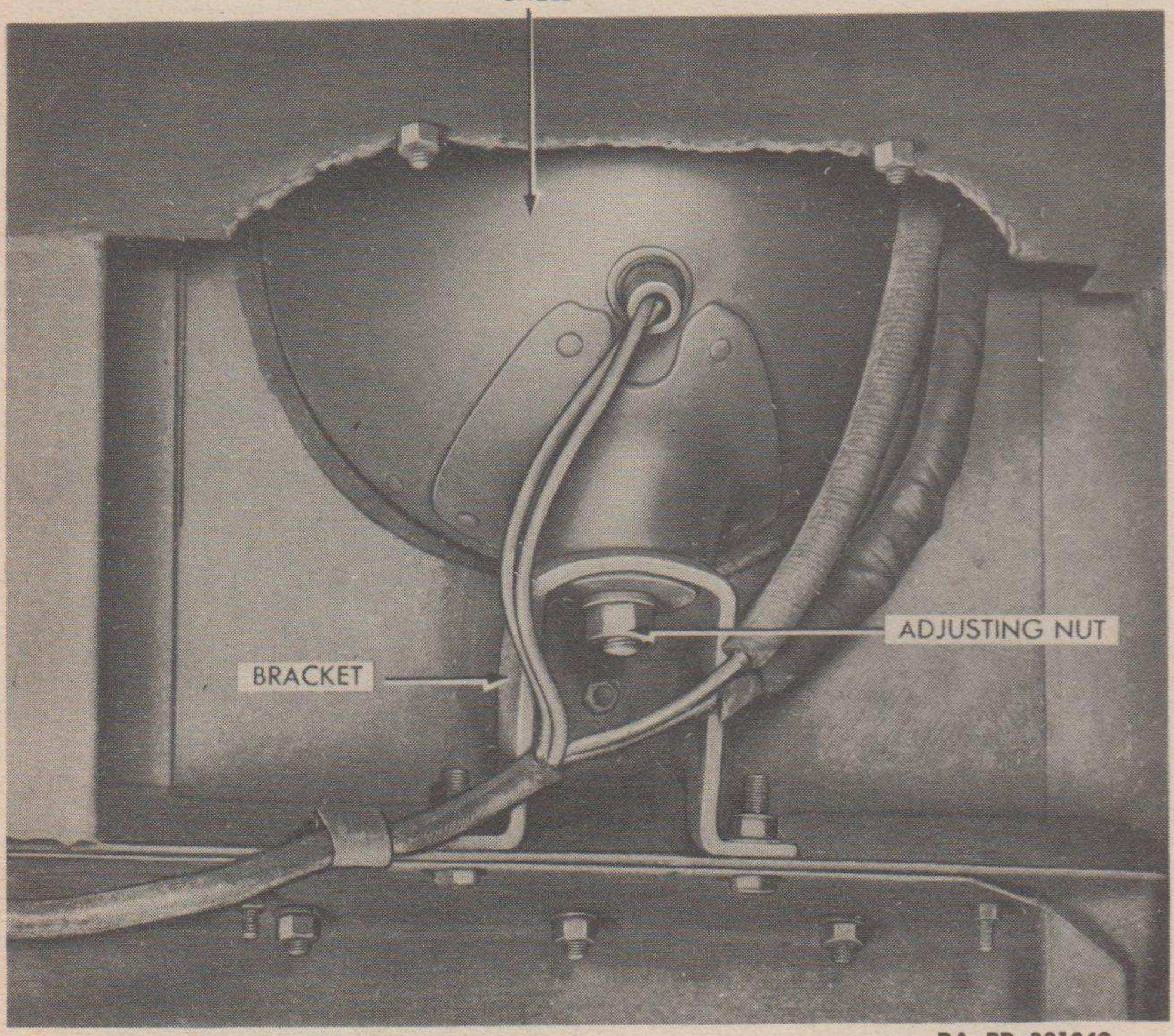


Figure 65—Horn Adjustment

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Figure 66—Carrier Headlight Adjustment

Section XIX

COOLING SYSTEM

69. DESCRIPTION AND DATA.

a. Description. The cooling system consists of a radiator, thermostat, heat indicator, water pump, fan, belts, water jackets in the engine block surrounding the cylinders, and connecting pipes and hoses. The tubular-type radiator is equipped with fan shrouds. The thermostat, located in the water outlet passage, is provided with a small by-pass hole to relieve steam pressure.

b. Data.

(1) RADIATOR.

Make ..... Perfex
Type ..... Tubular
Capacity ..... 64 qt

COOLING SYSTEM

(2) FAN.

Make ..... Service Products
Type ..... 24 in., 6 blade

(3) WATER PUMP.

Make ..... Hercules
Type ..... Vane

(4) THERMOSTAT.

Make ..... Fulton Sylphon
Type ..... Bellows
Part number 3631-A

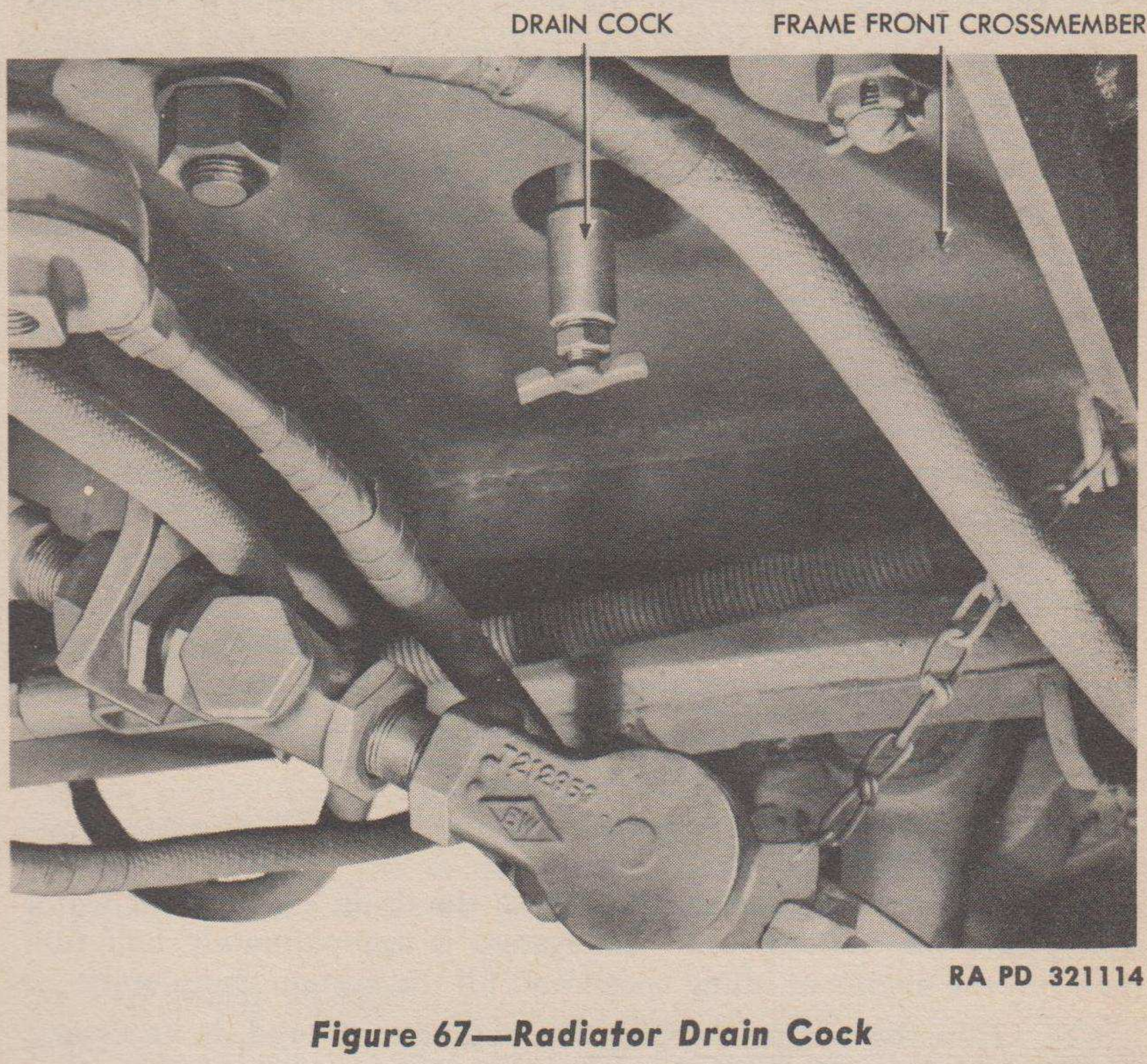


Figure 67—Radiator Drain Cock

70. SERVICE.

a. Cleaning. It is recommended that the cooling system should be cleaned at least twice a year: before the antifreeze compound (ethylene-glycol type) is put into the system, and again after it is removed.

(1) Run the engine until the temperature is within operating range. Stop the engine, remove the radiator cap, and drain the sys-

tem by opening the drain cock (fig. 67) in the radiator base and two drain cocks located one on the left side of each block.

(2) Allow the engine to cool. Close the drain cocks; pour water slowly into the radiator until system is approximately half full; then start the engine and set at idling speed. Add the cleaning compound in the proportion of one container of cleaner to every 4 gallons of cooling system capacity. Then complete filling the system with water. NOTE: *Never mix the water and the cleaning compound before putting them into the system.*

(3) Place a clean drain pan in position to collect the overflow, using the overflow to maintain the level in the radiator, if necessary.

(4) Replace the radiator cap and run the engine at fast idling speed, covering the radiator, if necessary, until the coolant reaches a temperature above 180°F, but not over 200°F. Do not drive the carrier. Constantly check the level in the radiator.

(5) Stop the engine after it has run for 30 minutes at a temperature of at least 180°F, but not over 200°F. Remove the radiator cap, and drain the system completely.

b. Neutralizing.

(1) Allow engine to cool. Close drain cocks; pour water slowly into the radiator until the system is approximately half full; then start engine and set at idling speed. Add the neutralizer compound in the proportion of one container of neutralizer to every 4 gallons of cooling system capacity. Then fill the system with water.

(2) With the radiator covered, let the engine idle for at least 5 minutes at the normal operating temperature; then stop the engine.

(3) Drain the system completely by removing the radiator cap and opening all the drain cocks.

c. Flushing.

(1) Allow the engine to cool. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed and fill the system completely.

(2) Run the engine, keeping the radiator covered, if necessary, until the coolant is heated to the normal operating temperature.

(3) Drain the system by removing the radiator cap and opening all the drain cocks. Repeat the flushing operation until the drain water is clear.

(4) Allow the engine to cool and then clean all sediment from the radiator cap valves and the overflow pipe. Blow insects and dirt from the radiator core air passages with compressed air, blowing from the rear. Use water to soften obstructions if necessary.

d. Leaks. After completing the flushing operation, make certain that the engine has been allowed to cool again. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed, and fill the system completely. Stop the engine when cooling system is completely full. Examine the entire cooling system for leaks. This is important because the cleaning solution uncovers leaks which already exist, but are plugged with rust or corrosion. Leaks that cannot be corrected by using organization should be reported to higher authority.

e. Coolant Service.

(1) When servicing the vehicle for summer, fill the system nearly full with clear water. Add corrosion inhibitor compound in the proportion of one container of inhibitor to each 4 gallons of cooling system capacity; then complete filling the system with water.

(2) When servicing for winter, fill the system about one-quarter full of clean water. Add sufficient antifreeze compound (ethylene-glycol type) for protection against the lowest anticipated temperature. Add water until the system is nearly full; then run the engine until the normal operating temperature is reached. Add sufficient water to fill the system to the proper level.

71. FAN.

a. Description. The fan, which has six 24-inch blades, is mounted to a hub on a bracket attached to the crankcase forward of the cylinder block. It is driven by two V-type belts.

b. Adjustment of Fan Belts. Loosen large hex nut between fan bracket and front cylinder block. Loosen lock nut on long adjusting screw. Turn adjusting screw to left to loosen, or right to tighten, fan belt tension. When a light pressure halfway between the pulleys will deflect the belts ½ inch to ¾ inch, they are properly adjusted. Tighten lock nut. Tighten large hex nut.

72. WATER PUMP.

a. Description. The impeller-type water pump is mounted on the lower left side of the engine and is driven from the accessory drive through a chain coupling. It has graphite-type packing in each end of the shaft to prevent water leakage.

b. Adjustment. To prevent leakage of water, keep packing nuts finger-tight, plus enough pressure with spanner wrench to allow the snap lock to drop into one of the notches. If this fails to stop leakage, replace packing.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

Section XX

TURNTABLE TROUBLE SHOOTING

73. PURPOSE.

a. The purpose of this section is to provide information which can be used to help diagnose and correct unsatisfactory operation or failure of the various components of the turntable assembly. Trouble symptoms followed by a list of possible causes and suggested remedies are listed under titles of assemblies or systems. To correct faulty operation, first determine in which particular system or assembly it is located, then identify the symptom or symptoms, and follow the suggested procedure for correction.

74. BOOM.

a. Boom Will Not Raise

(1) BOOM HOIST CLUTCH SLIPPING.

(a) Adjust clutch (par. 98 b).

(b) Remove grease or oil from linings.

(c) Replace clutch (refer to higher echelon).

(2) BOOM HOIST BRAKE DOES NOT RELEASE. Adjust brake (par. 100 b).

(3) CABLE WEDGED OR OFF SHEAVES.

(a) Attach auxiliary cable to boom point and machinery frame head shaft, release boom hoist safety latch, slack off boom hoist cable, and place on sheaves.

(b) Lean boom against tree or building, slack off cable, and install on sheaves.

(4) BOOM HOIST LINKAGE DISENGAGED. Inspect linkage and replace broken, damaged, or disengaged pins.

(5) ENGINE CLUTCH SLIPS. Adjust engine clutch (par. 93 b).

b. Boom Will Not Lower.

(1) SAFETY LATCH NOT DISENGAGED. Disengage safety latch.

(2) BOOM HOIST BRAKE DRAGS. Adjust brake. Refer to paragraph 100 b.

(3) CABLE OFF SHEAVES. Refer to subparagraph a (3) above.

c. Boom Operation Jerky.

(1) CABLES CROSSED ON DRUMS. Remove cables and aline.

(2) BOOM HOIST BRAKE DRAGS OR GRABS.

(a) Clean brake linings and housings.

(b) Adjust brake. Refer to paragraph 100 b.

TURNTABLE TROUBLE SHOOTING

75. CABLES.

a. Cable Operation Jerky.

(1) SLACK IN CLAMSHELL HOLDING LINE. Adjust secondary hoist clutch spring so that clutch will engage enough to remove slack.

(2) CABLE KINKED OR WOUND UNEVENLY ON DRUM. Remove cable, straighten, and aline.

(3) CABLE DRUM BRAKES DRAGGING OR GRABBING.

(a) Clean linings and housing.

(b) Adjust brakes. Refer to paragraph 106 b.

(c) Replace brakes (refer to higher echelon).

b. Cables Wear Out Quickly.

(1) SHEAVE BUSHINGS DRY. Lubricate thoroughly.

(2) CABLES IMPROPERLY INSTALLED OR STRETCHED. Detach load from cables and permit them to unwind.

(3) CABLES LACK SUFFICIENT GREASE. Lubricate cables thoroughly.

(4) CABLES TWISTED, KINKED, OR CROSSED ON DRUMS. Remove cables, straighten, and aline.

c. Cables Tend to Flatten Out.

(1) SHEAVE CHANNEL CLEARANCE TOO GREAT. Replace sheaves. Refer to paragraph 121.

(2) CABLES CROSSED ON DRUMS. Remove and aline cables.

d. Cables Twist During Operation. Remove load and allow cables to untwist.

e. Slack in Cable.

(1) SECONDARY HOIST CLUTCH SPRING TOO LOOSE. Tighten spring.

(2) TAGLINE IMPROPERLY REEVED. Remove and install tagline properly.

76. CLUTCHES AND BRAKES.

a. Clutch and Brake Linings Wear Out Quickly.

(1) LININGS DRAGGING. Adjust clutches on brakes.

(2) DIRT OR OTHER FOREIGN MATTER BETWEEN LININGS AND HOUSING. Clean linings and housing.

b. Clutches and Brakes Slip.

(1) GREASE OR OIL ON LININGS. Clean linings thoroughly.

(2) IMPROPER ADJUSTMENT. Adjust brakes, clutches, and linkage.

77. ENGINE.

a. Engine Labors During Operation.

(1) AIR CLEANER CLOGGED. Service air cleaner (par. 91 d).

(2) CABLE DRUM BRAKES DRAGGING. Adjust brakes.

b. Engine Will Not Turn Because of Incorrect Oil Viscosity.

Drain and refill crankcase with proper grade of engine oil.

c. Engine Turns But Will Not Start.

(1) COMBUSTION CHAMBER FLOODED WITH FUEL. Crank engine with throttle wide open. If flooding condition continues and engine will not start, refer to higher echelon.

(2) FUEL DOES NOT REACH CARBURETOR. Disconnect fuel tube at carburetor, and turn engine with cranking motor. This should cause fuel to flow from open tube. If this is not evident, fuel is not reaching carburetor. Refer to higher echelon.

(3) FUEL DOES NOT REACH CYLINDERS. Remove air cleaner, and check choke adjustment. Hold choke valve partially open, and note whether or not fuel is delivered to carburetor throat when engine is cranked. If fuel delivery is not evident, refer to higher echelon.

(4) IMPROPER IGNITION. Remove wire from spark plug. Hold end of wire about an inch from cylinder head, and crank engine. If spark does not jump ¼-inch gap, spark is inadequate. Refer to higher echelon.

d. Engine Misfires Because of Insufficient Fuel Delivery.

(1) Inspect and clean fuel lines and filter (par. 91 a).

(2) Check carburetor adjustment (par. 90 b).

e. Engine Overheating.

(1) IMPROPER CIRCULATION OF COOLANT. Check level of cooling solution. With engine running, check flow of coolant through outlet (upper) hose. If good circulation is not apparent, remove and inspect the water pump. If cooling solution builds up in top of radiator, reverse-flush the radiator to remove any obstruction that may have formed in the radiator core.

(2) IMPROPER CIRCULATION OF AIR. Inspect fan belt and adjust if necessary. Clean foreign matter from exterior of radiator core. Keep rear and side doors open to permit maximum circulation of air.

f. Low or No Oil Pressure.

(1) OIL LEVEL BELOW PUMP STRAINER. Fill crankcase to proper level.

TURNTABLE TROUBLE SHOOTING

(2) OIL LEAKAGE. Inspect oil tubes and connections at filter, gage, and cylinder block. If external leak is not apparent, refer to higher echelon.

(3) OIL PRESSURE PLUG VALVE NOT SEATING PROPERLY. Remove and clean valve (par. 91 e).

g. Excessive Oil Consumption.

(1) OIL LEVEL TOO HIGH. Keep oil at proper level on oil level gage.

(2) OIL LEAKAGE. Inspect tubes and connections for external leaks.

h. Excessive Fuel Consumption.

(1) AIR CLEANER RESTRICTED. Service air cleaner (par. 91 d (2)).

(2) CHOKE DOES NOT OPEN FULLY. Inspect and adjust choke.

i. Valve Noise.

(1) VALVE TAPPETS IMPROPERLY ADJUSTED. Adjust valves (par. 88 b).

j. Spark Knock or Ping (a Sharp Metallic Knock When Operating Under a Full Load) Because of Ignition Timing Too Early for Grade of Fuel Used. Adjust timing (par. 89).

78. FUEL SYSTEM.

a. Fuel in Tank Does Not Reach Carburetor.

(1) FUEL FILTER CLOGGED. Service fuel filter (par. 91 a (2)).

b. Fuel Reaches Carburetor But Does Not Enter Cylinders Due to Float Valve Being Stuck. Check fuel level in the carburetor float bowl and if low, inspect float valve for being stuck on seat.

79. GENERATING SYSTEM.

a. Charging Rate Not Within Specifications Due to Loose Wiring Connections. Inspect wiring to make certain it is properly connected to the generator and regulator.

80. IGNITION SYSTEM.

a. Improper Ignition.

(1) MOISTURE ON IGNITION UNITS. Wipe distributor cap terminals, cables, spark plugs, and coil with dry cloth or cloth saturated with carbon tetrachloride.

(2) DISTRIBUTOR FAULTY. Remove distributor cap and rotor; inspect for cracks and carbon. Clean contact points, adjust (par. 89 c)

or replace if excessively burned. Examine condenser lead wire for breakage or loose connections. Crank engine and note whether distributor shaft turns; if not, shaft may be broken. Refer to higher echelon.

81. LIGHTING SYSTEM.

a. Lights Will Not Burn.

(1) DEFECTIVE OR BURNED-OUT LAMPS. Replace defective lamps.

(2) SHORT IN WIRING. Examine wiring, and repair or replace, if damaged.

(3) TUMBLER SWITCHES DISCONNECTED OR BROKEN. Repair or replace switches.

(4) LOOSE WIRING CONNECTION. Examine wiring and tighten loose connections.

82. TURNTABLE OPERATION.

a. Turntable Teeters During Operation.

(1) ROLLERS OUT OF ADJUSTMENT. Adjust turntable rollers (par. 117 b).

(2) LOAD TOO HEAVY FOR BOOM ANGLE. Change boom angle to conform with chart (figs. 18 and 19).

(3) VEHICLE POSITIONED ON SOFT OR UNEVEN TERRAIN. Change position of vehicle.

(4) ROLLER BUSHINGS WORN. Refer to higher authority.

b. Turntable Base Turns During Travel.

(1) TURNTABLE LOCK DISENGAGED. Engage turntable lock.

(2) TURNTABLE LOCK DOES NOT ENGAGE PROPERLY. Adjust turntable lock (par. 115 b).

c. Turntable Base Will Not Swing.

(1) ENGINE CLUTCH SLIPS. Adjust engine clutch (par 93 b).

(2) SWING CLUTCHES SLIP. Adjust swing clutches (par. 110 b).

d. Turntable Base Drifts During Operation.

(1) SWING HAND LEVER LINKAGE IMPROPERLY ADJUSTED. Adjust linkage (par. 111 b).

(2) VEHICLE ON UNEVEN GROUND. Move vehicle to more level ground.

e. Swing Operation Jerky Due to Worn Ring Gear Teeth or Vertical Swing Shaft Teeth. Refer to higher echelon.

TURNTABLE TROUBLE SHOOTING

83. ROLLERS.

a. Rollers Wear Excessively.

(1) ADJUSTMENT TOO TIGHT. Adjust turntable rollers (par. 117 b).

(2) ABRASIVE MATTERS ON ROLLER PATHS. Clean roller paths thoroughly.

b. Rollers Wear Unevenly Because of Being Frozen on Pins. Refer to higher echelon.

84. SHAFTS.

a. Shafts Chatter During Operation.

(1) BEARING CAPS LOOSE. Adjust bearing caps (par. 113 b).

(2) BEARINGS DRY. Lubricate thoroughly (par. 20).

(3) BRAKE OR CLUTCH LININGS WORN. Refer to higher echelon.

(4) LOOSE PINS IN CLUTCH OR BRAKE ASSEMBLIES. Inspect assemblies and replace loose pins.

b. Shafts Become Extremely Hot, Squeak, or Smoke Because of Dry Bushings and Bearings. Lubricate thoroughly (par. 20).

85. STARTING SYSTEM.

a. Cranking Motor Will Not Crank Engine.

(1) IGNITION SWITCH OFF. Turn on ignition switch.

(2) LOOSE OR CORRODED BATTERY CONNECTIONS. Clean and tighten battery cable connections at battery and ground.

(3) NO CURRENT TO CRANKING MOTOR SOLENOID SWITCH. Disconnect wire which runs from cranking motor switch to solenoid unit at the solenoid. With the ignition switch on and the cranking motor switch depressed, touch the end of the wire to the cranking motor body. If spark occurs, current is being supplied to the solenoid. If no spark occurs, refer to higher echelon.

(4) CRANKING MOTOR DRIVE DAMAGED. If the cranking motor spins, crank the engine by hand. Refer to higher echelon.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

PART FIVE

TURNTABLE ASSEMBLY MAINTENANCE INSTRUCTIONS

Section XXI

TURNTABLE ENGINE AND ACCESSORIES

86. DESCRIPTION.

a. The turntable assembly engine (figs. 68 and 69), mounted on the rear of the turntable base, is a 6-cylinder, L-head, gasoline-burning type, with liquid cooling and pressure lubrication. The cast-iron block has a detachable head which permits inspection and cleaning of cylinders, cylinder walls, and valve heads. Efficient cooling is provided by water jackets which run the full length of the cylinder bore. The crankshaft is mounted on replaceable babbitt-on-steel type precision bearings, which are accessible for inspection or replacement with the oil pan removed. All bearings as well as piston pins, valve tappets, and cylinder walls are lubricated by engine oil drawn through a strainer from the oil pan and forced under pressure through drilled passages in the cylinder block. Oil pressure is controlled by a relief valve mounted in the main oil passage at the left side of the engine (fig. 69). Description of engine accessories will be found in subsequent paragraphs in this section.

87. DATA.

a. Engine.

Make	Waukesha
Model	6 MZR
Type	L-head
Number of cylinders	6
Bore	4¼ in.
Stroke	4¾ in.
Piston displacement	404 cu in.
Brake horsepower (gross)	42.5 hp at 1,600 rpm (full-load speed)
Firing order	1, 5, 3, 6, 2, 4

b. Valves.

Type	Poppet
Intake (running clearance)	0.011 to 0.013 in.
Exhaust (running clearance)	0.021 to 0.023 in.
Seat angle	30 deg

TURNTABLE ENGINE AND ACCESSORIES

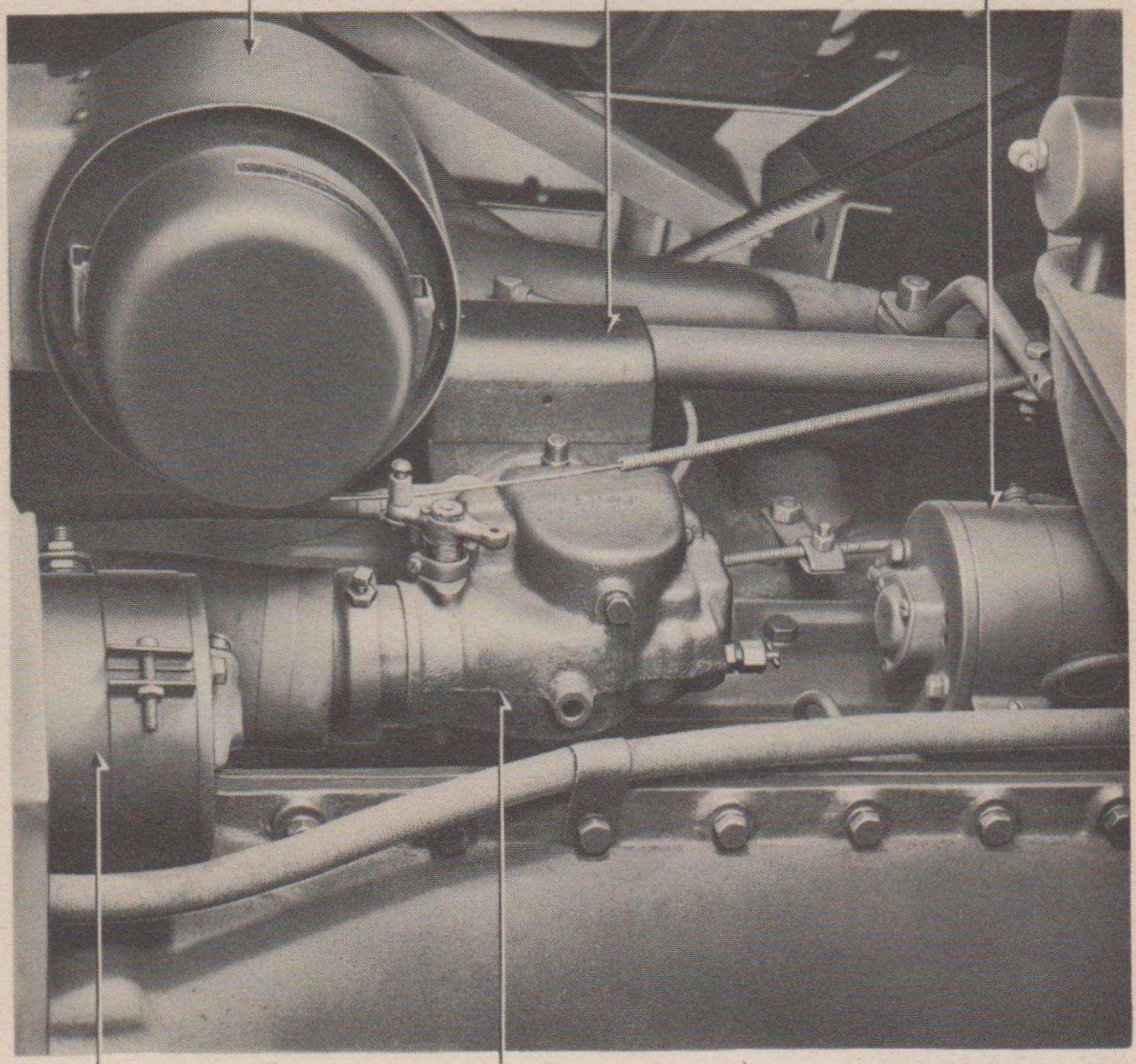


Figure 68—Turntable Engine—Right View

c. Valve Tappets.

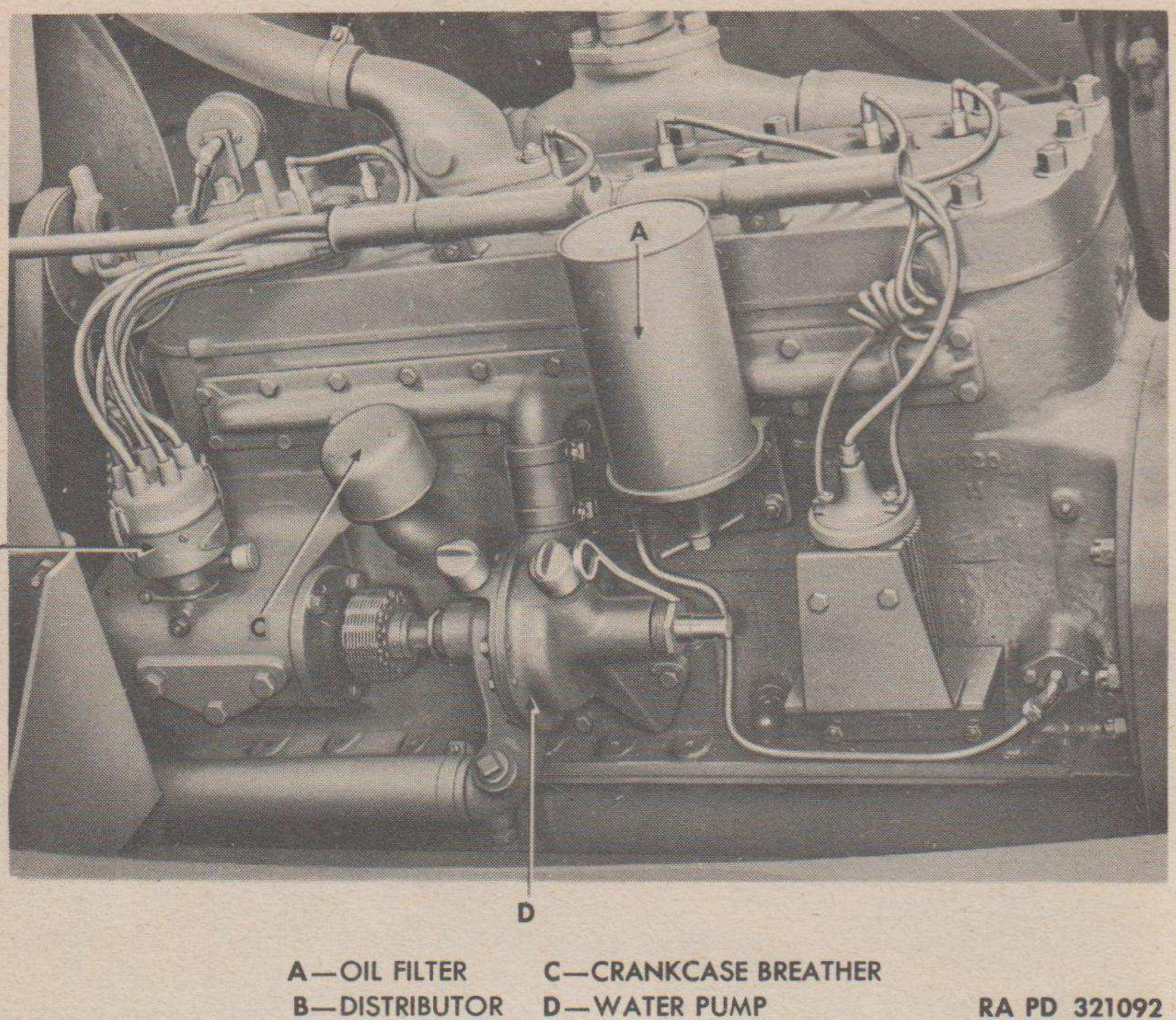
Type.....Mushroom, self-locking adjusting screw

d. Valve Timing.

Intake opens	8 deg ATDC
Intake closes	47 deg ABDC
Exhaust opens	50 deg BBDC
Exhaust closes	8 deg ATDC

e. Spark Plugs.

Make	AC
Type	86
Size	18-mm
Gap	0.025 to 0.030 in.



A—OIL FILTER C—CRANKCASE BREATHER
B—DISTRIBUTOR D—WATER PUMP RA PD 321092

Figure 69—Turntable Engine—Left View

f. Distributor.

Make	Delco-Remy
Model	640-Z
Breaker point gap	0.018 to 0.024 in.

g. Carburetor.

Make	Zenith
Model	456

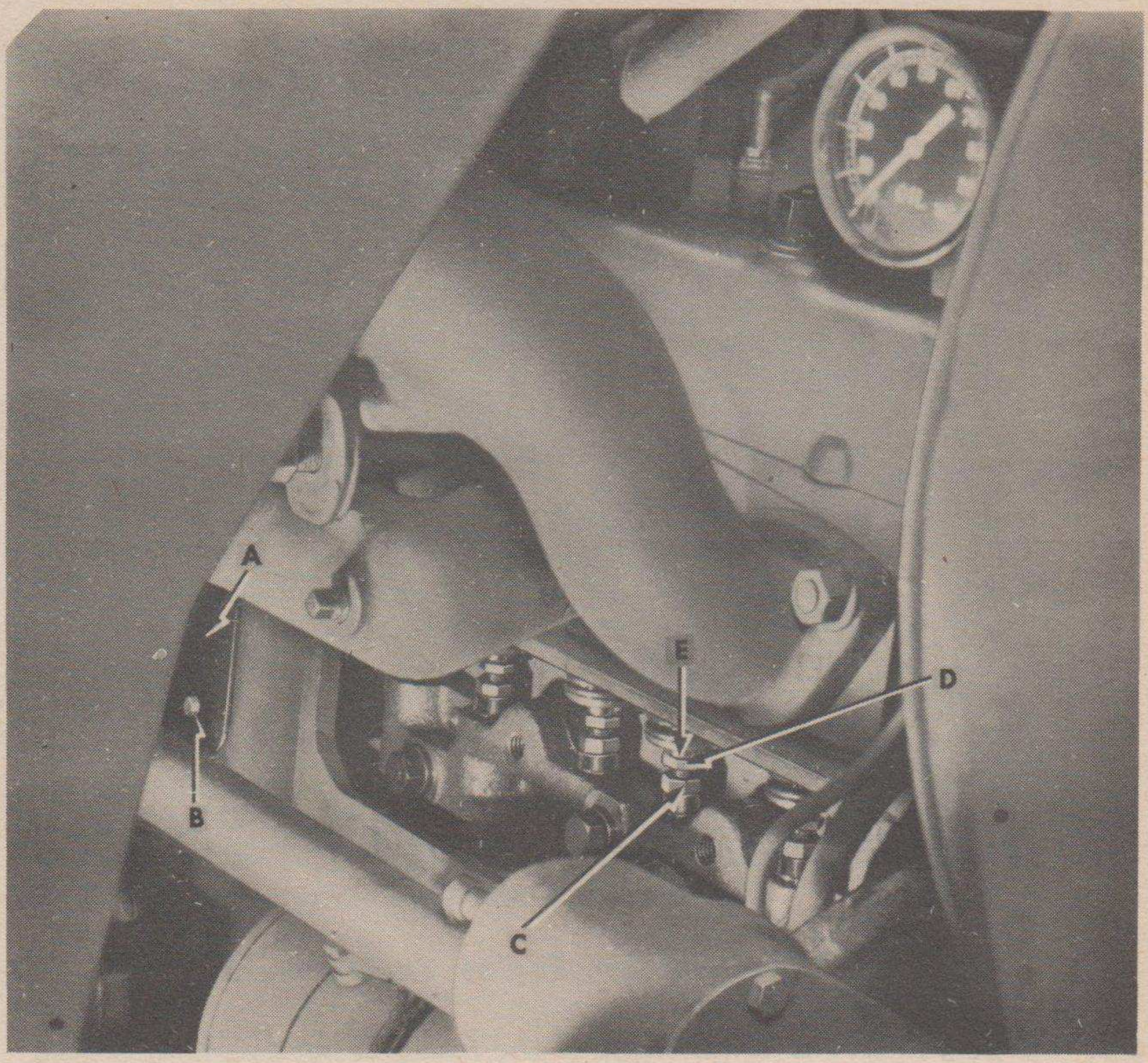
h. Governor.

Make	Waukesha

88. VALVES.

a. Description. The valves are of the poppet type with 30-degree angle seat. Hardened steel valve seat inserts are installed in the exhaust valve ports; the intake valve seats are machined into the cylinder block. The valve tappets are of the mushroom type with self-locking adjusting screws. The valves are accessible for inspection and adjustment with the valve spring covers removed.

TURNTABLE ENGINE AND ACCESSORIES



A—VALVE SPRING COVER B—CAP SCREW C—LOCK NUT
D—ADJUSTING SCREW E—VALVE STEM RA PD 321123

Figure 70—Valve Adjustment

b. Valve Adjustment (fig. 70). Unscrew the cap screws and lock washers which secure each valve spring cover to engine block, and remove covers and gaskets. Loosen lock nut and turn adjusting screw until clearance between tappet and valve stem is 0.010 inch for intake valve and 0.016 inch for exhaust valve. Use feeler gage to test clearance. When proper adjustment has been made, hold adjusting screw and tighten lock nut. Check adjustment after lock nut is tight. Make adjustment when engine is hot. CAUTION: *Do not use heavy wrenches on valve tappet adjusting screws, as they are likely to break tappet.*

c. Timing Adjustment. Before adjusting valve timing, make sure that valve tappets are adjusted to proper clearances (subpar. **b** above). Remove the engine timing hole cover from the flywheel housing (fig. 71), and turn engine until pointer is over flywheel mark "IN-O." With flywheel in this position, the intake valve should be just starting to open, and a very thin feeler placed between tappet

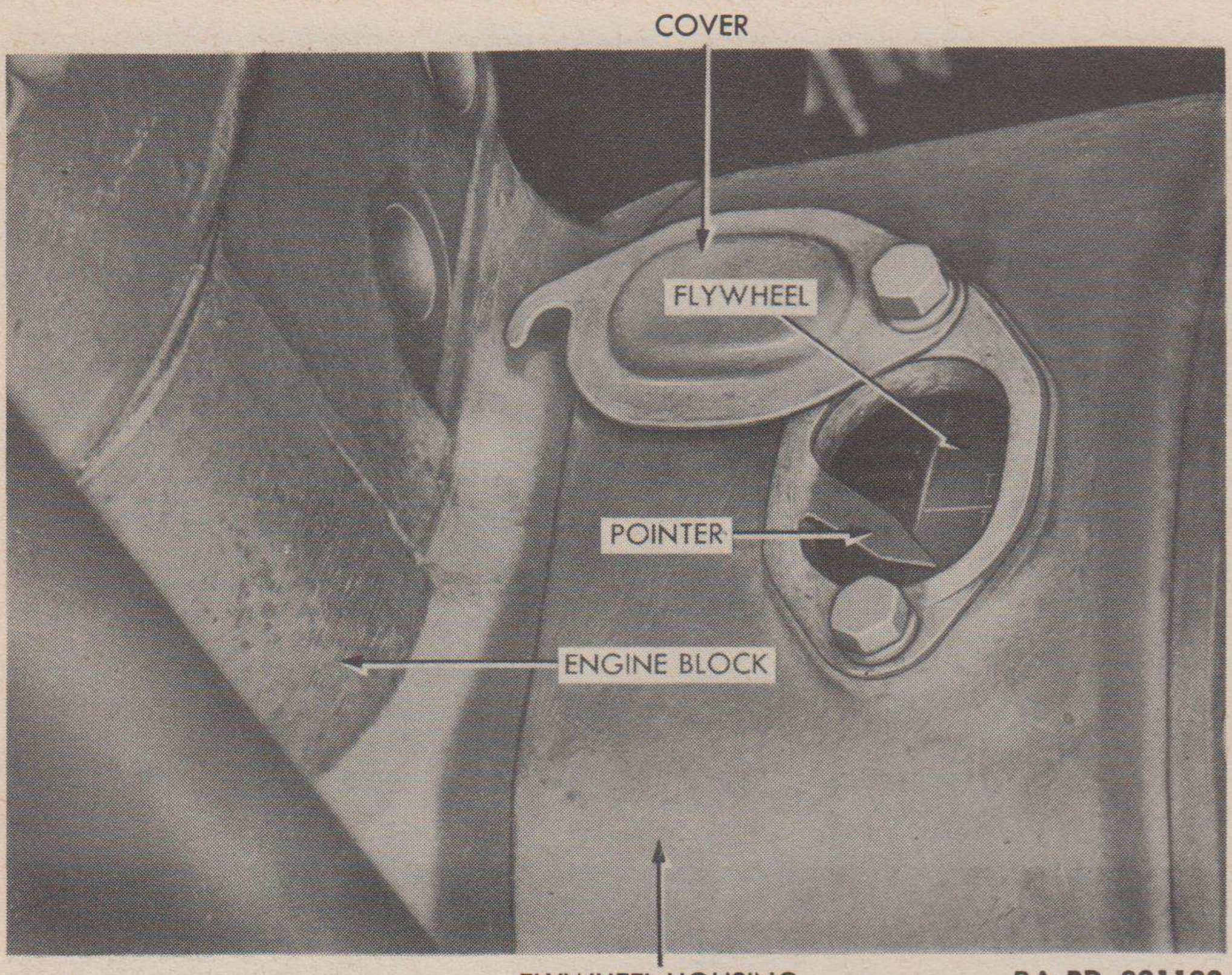


Figure 71—Turntable Engine Timing Hole

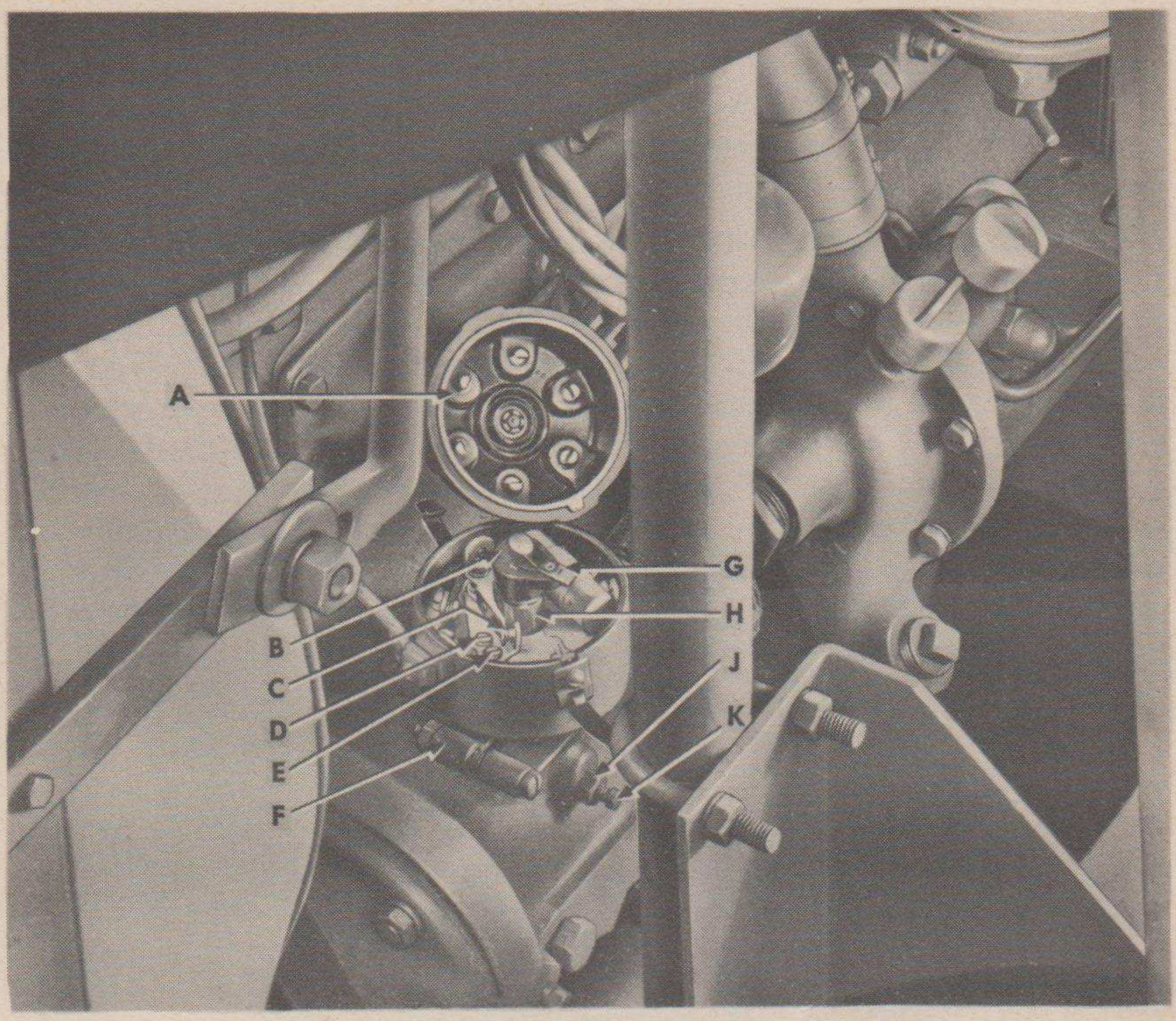
and valve stem should be pinched. If the feeler is not pinched, engine may be on the power stroke. Turn engine one complete revolution to the point where the intake stroke begins. Make adjustment as described in subparagraph **b** above. After timing, reset tappets for proper clearance. **NOTE:** *Since all the cams are forged integrally with the camshaft, if one valve is properly timed all the rest will be correctly timed when the tappet clearances are properly adjusted.*

89. IGNITION SYSTEM.

a. Description. The battery-type ignition system consists chiefly of spark plugs, coil, condenser, and distributor. The coil is mounted on the left side of the engine; the distributor on the left side of the front cylinder head; and the spark plugs in the cylinder head, one for each cylinder. All components are connected by specially insulated high and low tension wires.

b. Spark Plug Adjustment. Remove spark plugs and remove carbon by scraping or brushing them with gasoline. If badly carbonized, use blow torch to burn off carbon. CAUTION: *Do not use emery or flint paper to clean porcelain, as it removes the glaze and ruins the plug.* Set spark plug points about $\frac{1}{32}$ inch apart, 0.025 to 0.030 inch. Use feeler gage to check clearance.

TURNTABLE ENGINE AND ACCESSORIES



A—CAP
B—CAM
C—BREAKER POINTS
D—ECCENTRIC SCREW
E—LOCK SCREW
F—DISTRIBUTOR ADVANCE
G—BREAKER ARM
H—VERTICAL DRIVE SHAFT
J—LOCK NUT
K—SET SCREW

RA PD 321111

Figure 72—Distributor Adjustment

c. Distributor Adjustment.

(1) BRING NO. 1 CYLINDER TO DEAD CENTER. Remove timing hole cover in flywheel housing (fig. 71), and turn engine over to position "DC-1" mark on flywheel beneath pointer. If it is impossible to see the marks on the flywheel, remove No. 1 spark plug, place thumb over opening, and have the engine cranked slowly by hand. When compression reaches a maximum, No. 1 piston will be at top dead center (TDC).

(2) POSITION DISTRIBUTOR BREAKER ARM. Observe the position of No. 1 spark plug wire. Remove the distributor cap (fig. 72), and note whether the distributor breaker arm is under the wire from No. 1 spark plug. If not, loosen lock nut and set screw in housing which holds distributor in place. Lift unit high enough to disengage

driving gears and turn as necessary to place distributor breaker arm under No. 1 spark plug wire. When arm is properly positioned, install unit carefully to prevent disturbing the setting as the driving gears are engaged.

(3) SET BREAKER POINTS. Set distributor advance (fig. 72) in full retard position. Release cam from vertical drive shaft, and turn it until breaker points are just opening. The correct opening is from 0.018 to 0.024 inch. Check with feeler gage. Connect cam to vertical drive shaft and lock in this position. Install distributor cap so that wire from No. 1 spark plug is over distributor breaker arm. NOTE: *If wires are accidentally pulled loose from distributor cap, install correctly as follows: Place wire from No. 1 spark plug in distributor cap over breaker arm. Proceeding to right (clockwise), set wires in order from spark plugs No. 5, No. 3, No. 6, No. 2, and No. 4. This will produce the proper firing order of 1 – 5 – 3 – 6 – 2 – 4.*

(4) SET SPARK ADVANCE. Proper setting for spark advance will vary with type of fuel used and conditions of operation. Generally speaking, the more advanced the spark, with quiet engine detonation, the greater will be the fuel economy and engine power. Recommended spark advance for full-load speed (1,600 rpm) is 24 degrees.

90. CARBURETOR AND GOVERNOR.

a. Description. The carburetor, mounted on the right side of the engine, is the conventional downdraft type with manual control of acceleration and choke. The function of carburetor is to mix fuel and air in proportion necessary for efficient combustion in the cylinder combustion chambers. The governor, attached to the carburetor, is of centrifugal type and is gear-driven. As engine speed increases, centrifugal force causes two weights to actuate a rod which closes a butterfly valve in the intake manifold. The function of the governor is to prevent damage to engine from overspeeding, and to automatically maintain constant speeds under varying loads.

b. Carburetor Adjustment (fig. 73). To adjust idling speed, turn throttle stop screw in against stop pin until desired idling speed is obtained. To adjust fuel mixture, turn idling adjusting screw to right for leaner mixture, to left for richer mixture. The most satisfactory adjustment will usually be obtained with screw 1 to 1½ turns off its seat. Adjust throttle and choke linkage as follows: Loosen set screws which secure linkage to carburetor. Push choke control and throttle control buttons (fig. 14) into closed position. See that choke valve is closed and throttle valve stop screw is against stop pin. Tighten linkage set screws.

TURNTABLE ENGINE AND ACCESSORIES

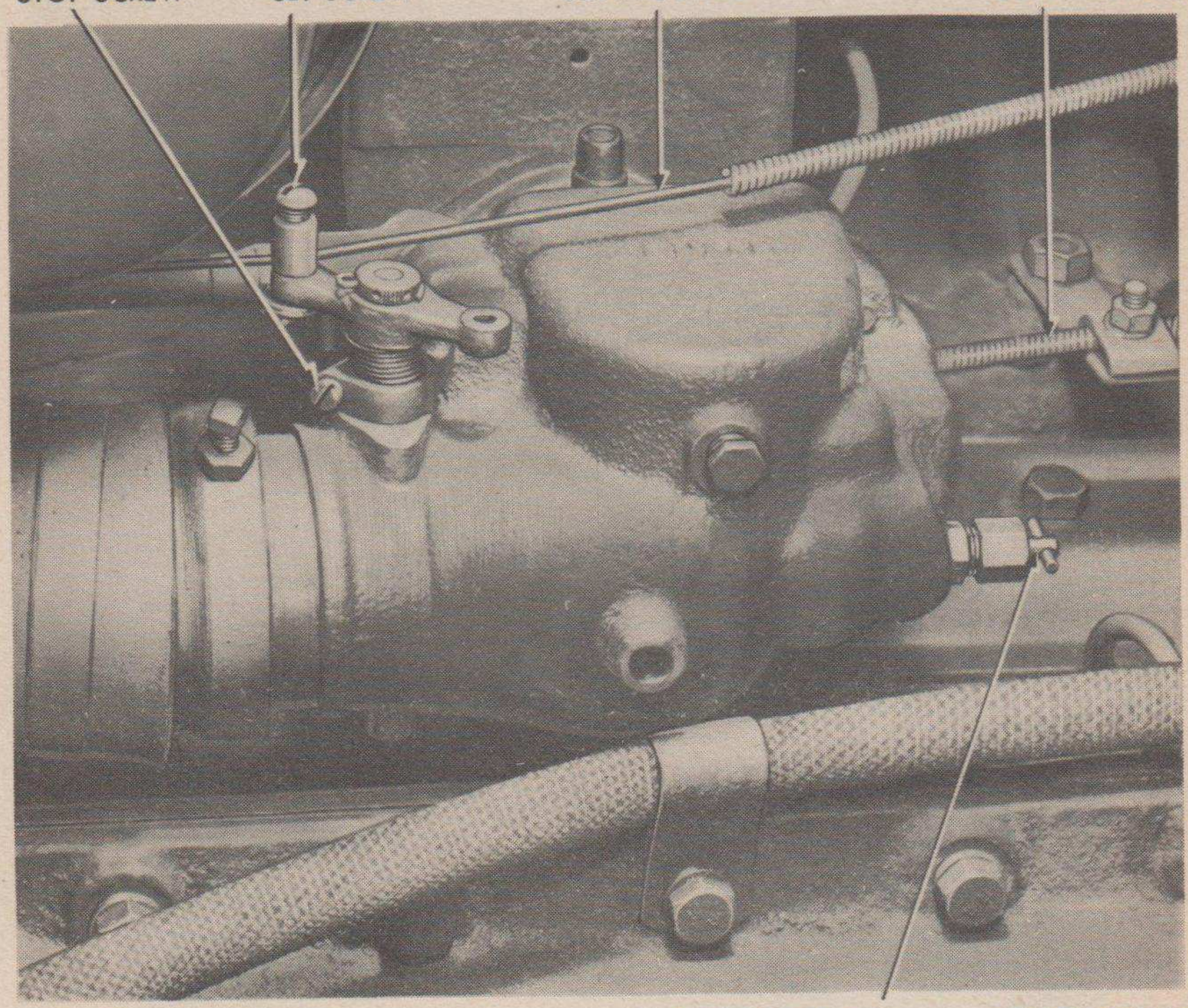


Figure 73—Carburetor Adjustment

c. Governor Adjustment. Adjustment of governor has been set at the factory and should not be changed. If governor adjustments are disturbed through removal of governor or attached parts, readjust as follows: Make sure that ball joint lock nut is tight. Adjust length of rod so that throttle stands a trifle toward the closing position when engine is stopped. Any variation in recommended speed, 1,600 revolutions per minute (full load) or 2,200 revolutions per minute (idling), can be corrected by turning screw clockwise to increase maximum speed; counterclockwise to decrease maximum speed.

91. FILTERS.

a. Fuel Filter.

(1) DESCRIPTION. The fuel filter, mounted at the lower right side of the engine, consists chiefly of a screen filter and a glass trap. The function of the filter is to remove dirt and other foreign material from engine fuel before delivery to carburetor.

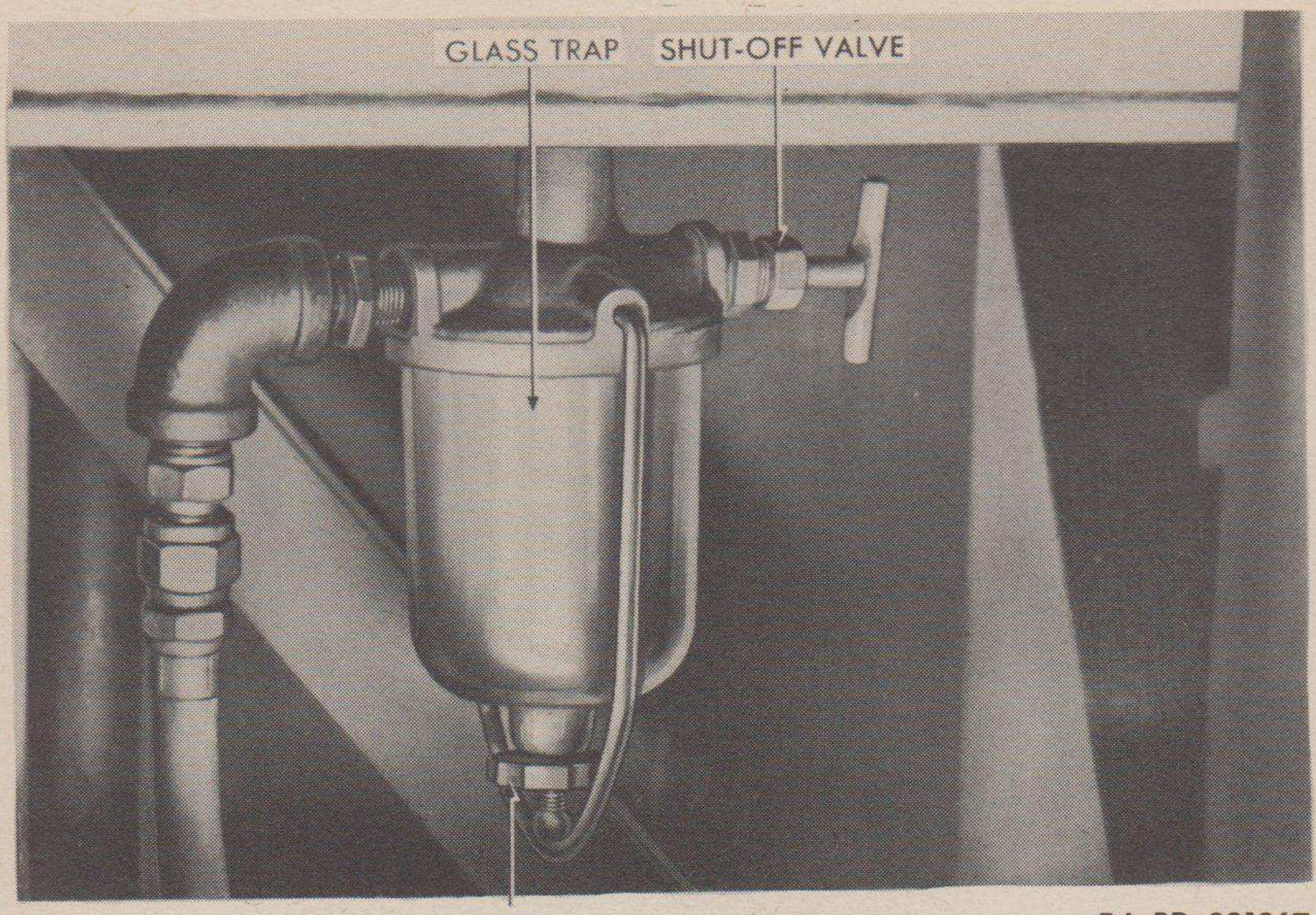


Figure 74—Fuel Filter

(2) SERVICING. Loosen nut at bottom of filter (fig. 74), and remove glass trap and screen. Clean both trap and screen thoroughly, dry, and install.

b. Oil Filter.

(1) DESCRIPTION (fig. 75). The oil filter, located at the left side of the engine (fig. 69), is the waste-packed type. It consists of a base with drilled passage, a central tube, and a filter shell. Oil passing through the central tube is forced through the white cotton waste, and returns to the oil line through the drilled passages in the base casting. A rubber gasket between can and base prevents oil from leaking outside filter.

(2) SERVICING. Unscrew retaining nut at bottom of filter, and remove waste-filled can. Install new can, and replace gasket if necessary.

c. Crankcase Breather.

(1) DESCRIPTION. The oil-bath type crankcase breather is mounted at the front left side of the engine (fig. 69) and is accessible through the cab rear doors. It consists of a removable cap and screen which filters air entering the crankcase through oil, and a wire mesh screen element.

(2) SERVICING. Remove cap and screen and wash in dry-cleaning solvent. Dry screen thoroughly, and install cap and screen.

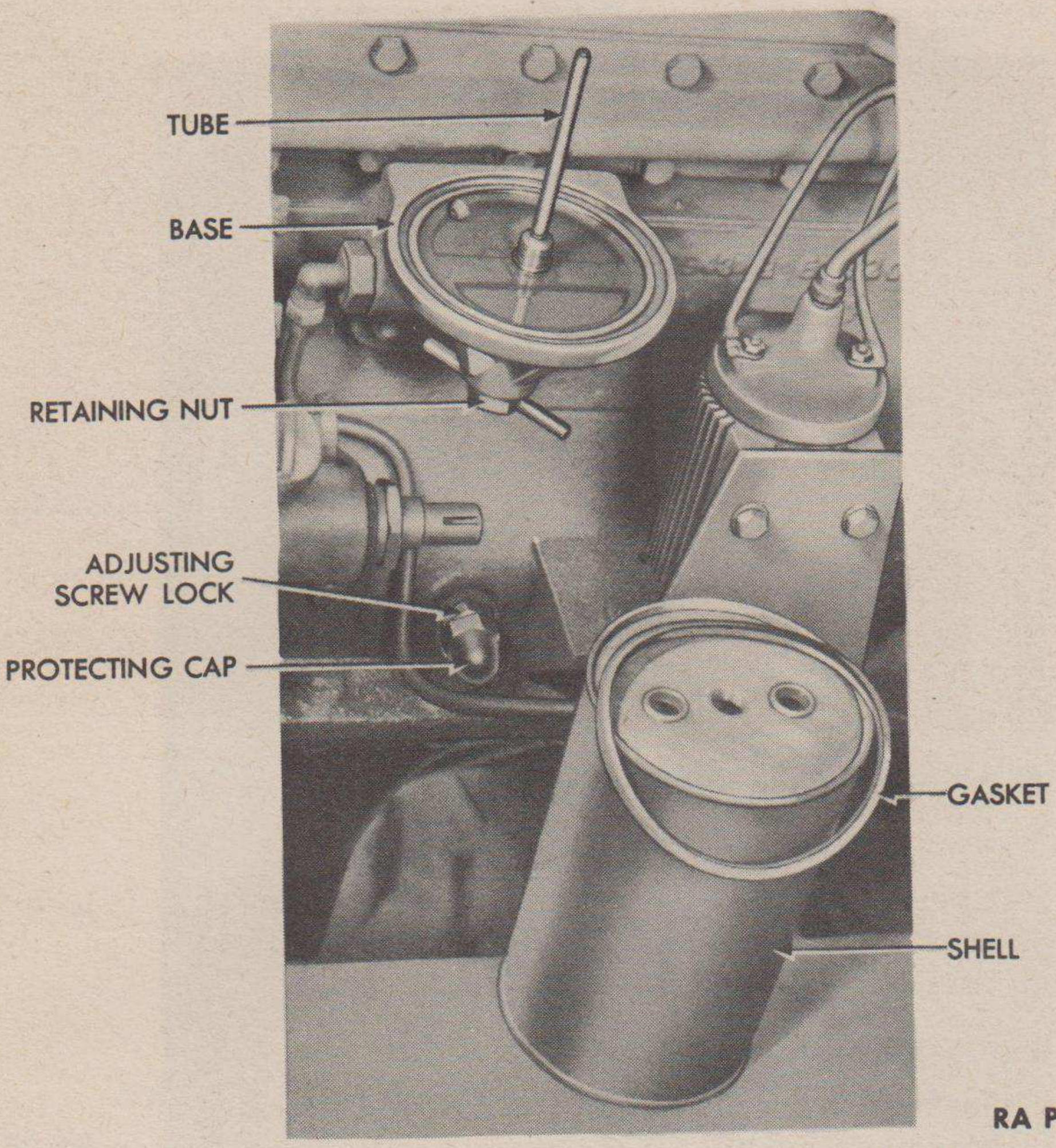


Figure 75—Oil Filter

d. Carburetor Air Cleaner.

(1) DESCRIPTION (fig. 76). A conventional oil-bath type carburetor air cleaner is mounted on the right side of the engine block and is easily accessible from below when the position of the turntable assembly to the carrier is reversed. The function of the cleaner is to filter all air which enters the engine through the carburetor.

(2) SERVICING. With turntable assembly facing the rear of the carrier, approach engine from underside. Turn air cleaner base to left, and remove base and insert. Remove old oil and sludge from both, and wash thoroughly with dry-cleaning solvent. Fill base with new engine oil (light) until level reaches top of boss marked "OIL LEVEL" inside base. Add oil whenever necessary to keep level proper. Clean mesh filter when oil in base becomes extremely

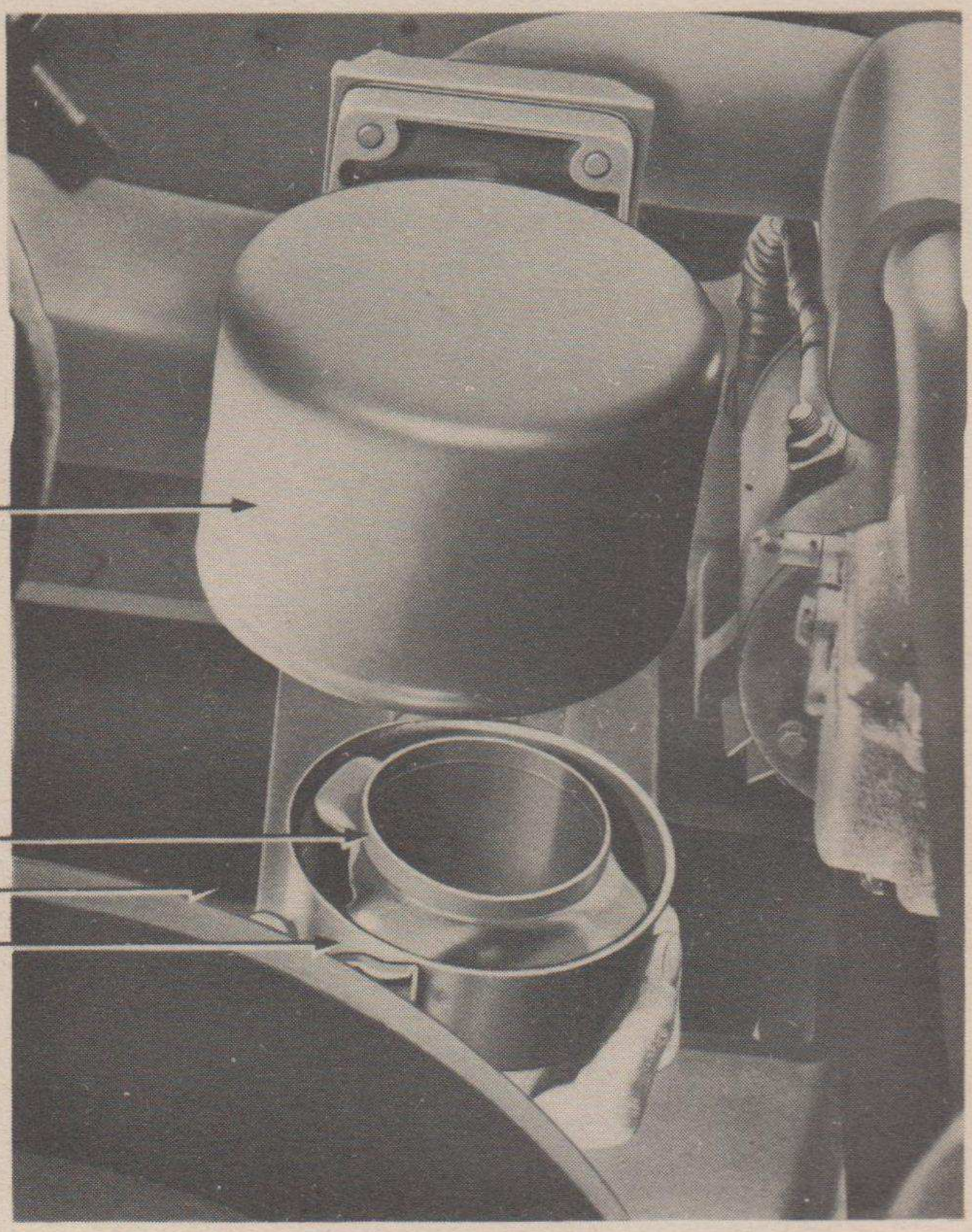


Figure 76—Carburetor Air Cleaner

dirty, or when oil is depleted rapidly by coagulating in filter. Remove the four cap screws and lock washers which hold filter body to block. Clean mesh filter thoroughly with dry-cleaning solvent, dry, and install.

e. Oil Pressure Plug (fig. 75).

(1) DESCRIPTION. A special oil pressure plug is built into the crankcase on the left side below the oil filter. It consists of a spring-loaded relief valve which controls the oil pressure by constricting the opening of the oil supply jets.

(2) ADJUSTMENT. Unscrew protecting cap, loosen adjusting screw lock, and turn adjusting screw to right to increase oil pressure,

to left to decrease it. When proper adjustment is obtained, tighten lock nut and screw on protecting cap. Proper pressure of engine oil ranges from 5 pounds (at idling speed) to 40 pounds (at full operating speed).

Section XXII

POWER TRAIN

92. DESCRIPTION.

a. The power train consists mainly of the engine clutch, roller drive chain, and center drive shaft. The sprocket on the center drive shaft, from which all operating shafts are driven, is in line with a pinion attached to the outer end of the clutch shaft. Power is transmitted from pinion to sprocket by a roller drive chain.

93. ENGINE CLUTCH.

a. Description. The clutch assembly, mounted on the flywheel housing at the rear of the engine, is the dry-disk type. The clutch is adjusted by hand through an inspection hole in the clutch housing. The function of the clutch is to transmit engine power through the power train to the operating shafts.

b. Adjustment (fig. 77).

(1) CLUTCH.

(a) Remove handhole cover, and turn clutch until adjusting lock pin is accessible through handhole.

(b) To tighten clutch, pull out adjusting lock pin and turn adjusting yoke to right (clockwise). Clutch is properly adjusted when clutch hand lever (fig. 12) causes it to engage with a distinct snap. When proper adjustment has been obtained, lock adjusting pin into nearest hole.

(c) To loosen clutch, turn adjusting yoke to left (counterclockwise). Complete adjustment as described above. CAUTION: *Do not use this clutch in place of operating clutches on hoist and swing shafts.*

(2) SHAFT (fig. 78). Remove screw and lock washer from lock on slotted nut. Tighten slotted nut at end of shaft to remove end play in clutch shaft. Use suitable pointed tool to turn nut to right (clockwise) until end play is eliminated. Secure with lock.

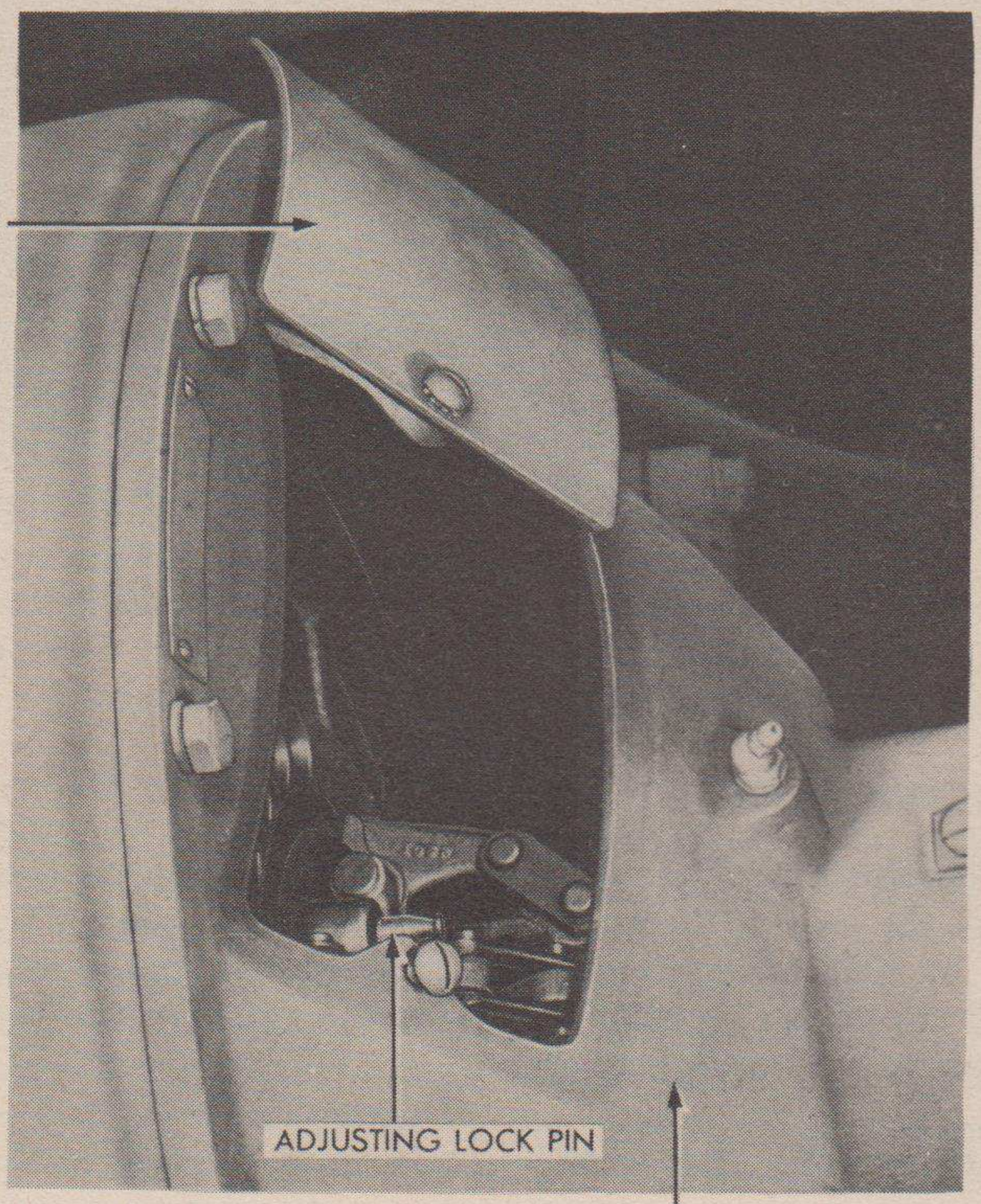


Figure 77—Turntable Engine Clutch Adjustment

94. ENGINE CLUTCH LINKAGE.

a. Description. The engine clutch linkage is positioned between the clutch hand lever in the operator's compartment and the clutch at the rear of the engine. It consists of a number of rods, rod ends, bell cranks, and lever arms. This linkage enables the operator to engage and disengage the engine clutch from his station.

b. Adjustment. When the clutch is in a fully released position, engine clutch hand lever (fig. 12) should be in the central or vertical position. If linkage requires adjustment to obtain this position, proceed as follows:

(1) Remove cotter pin and pin which secure rod to hand lever (fig. 79).

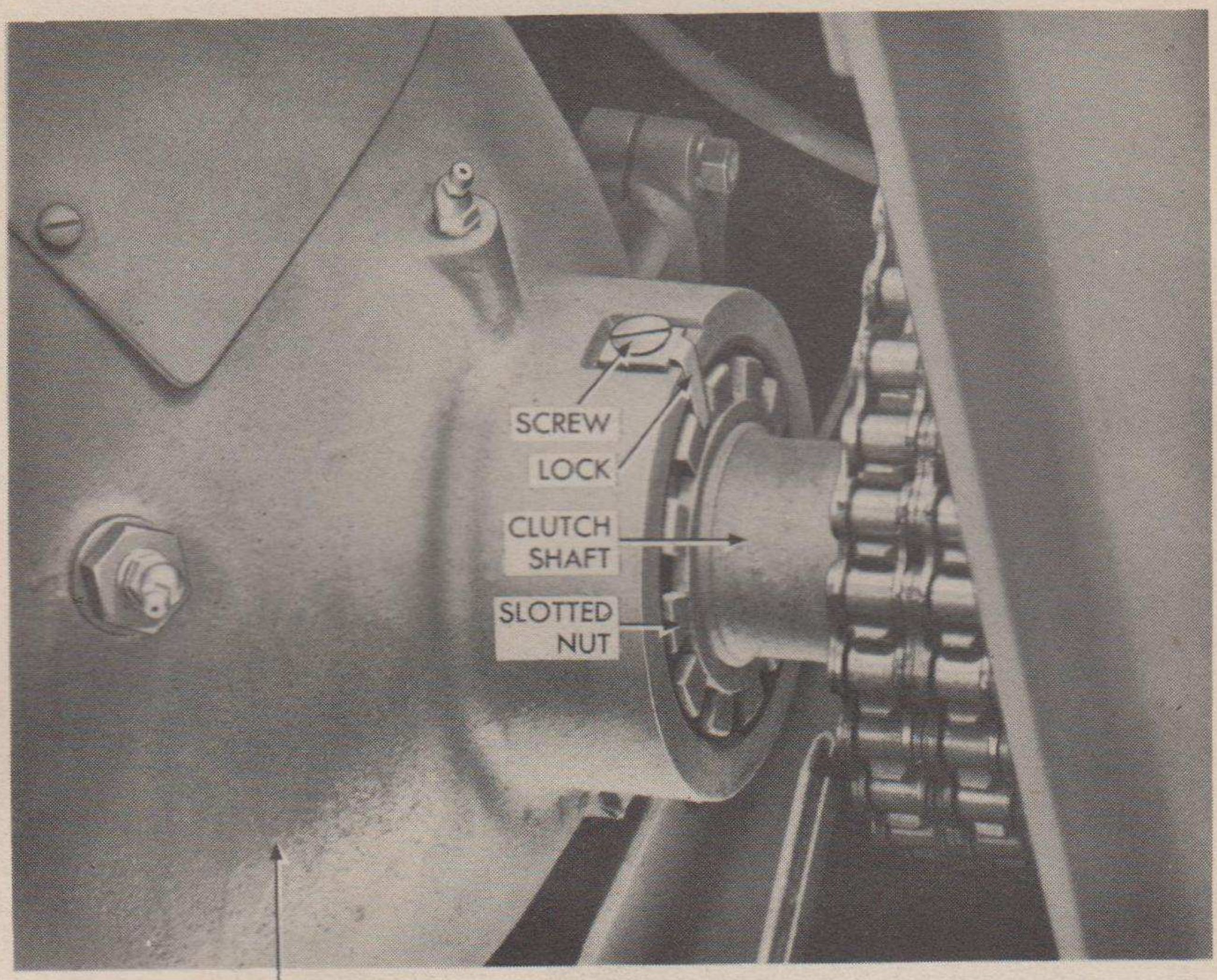


Figure 78—Clutch Shaft Adjustment

(2) Turn rod end to left to lengthen rod, to right to shorten rod.

(3) When rod has been adjusted to proper length, position rod to hand lever, insert pin, and secure with cotter pin.

95. ROLLER DRIVE CHAIN, SPROCKET, AND PINION.

a. Description (fig. 80). The roller drive chain is mounted around the sprocket on the center drive shaft and the pinion at the rear end of the clutch shaft. A two-section chain case covers the entire chain. The chain consists of a number of plates, spools, and pins riveted together as a unit. The ends of the chain are joined by two removable connecting links which permit the chain to be lengthened or shortened. Connecting links may be easily identified because their slip-fit center plates are the only plates in the entire chain without beveled edges.

b. Adjustment (fig. 81). Proper adjustment of roller drive chain at all times is necessary for satisfactory operation. A chain that is too tight will wear excessively and cause engine to labor during operation. A chain that is too loose may slip or cause operation to be jerky.

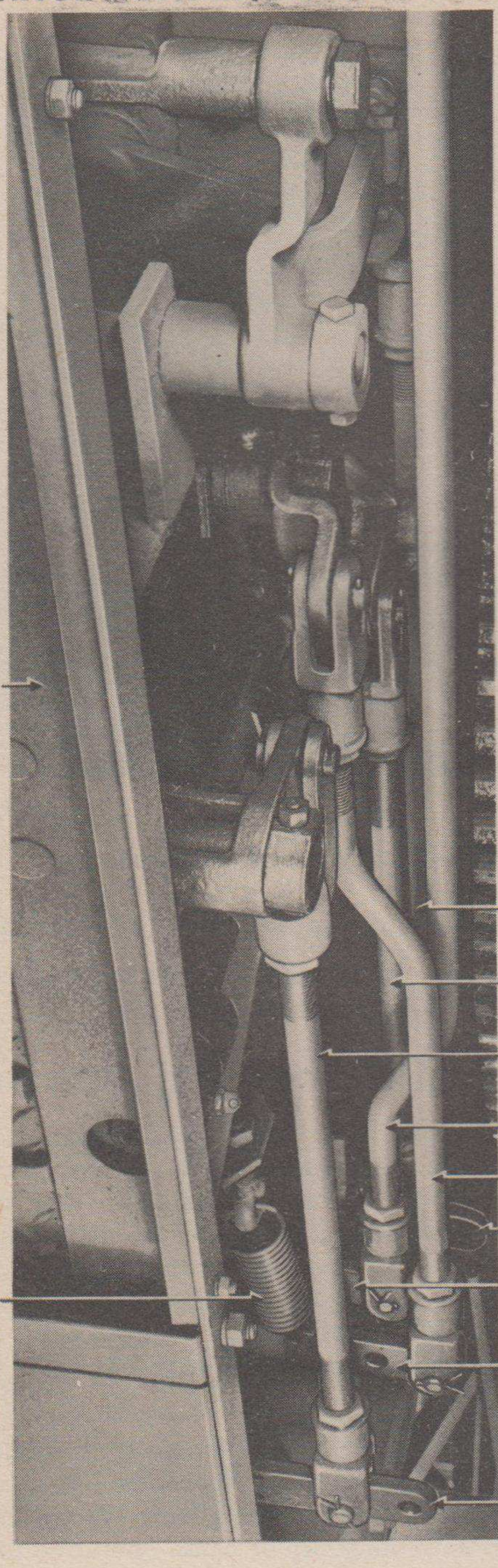
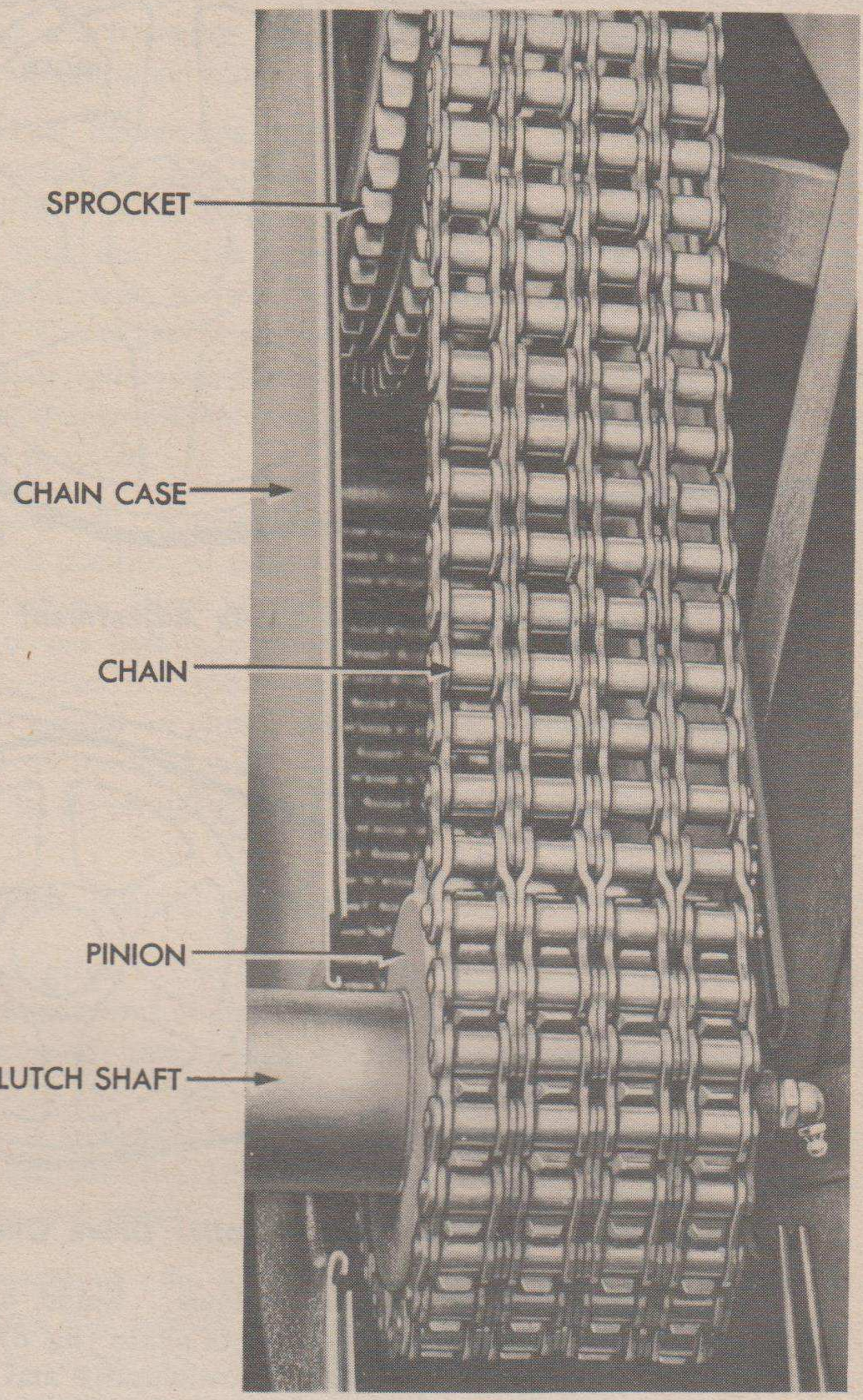


Figure 79—Turntable Control Linkage

POWER TRAIN



RA PD 321117

Figure 80—Roller Drive Chain

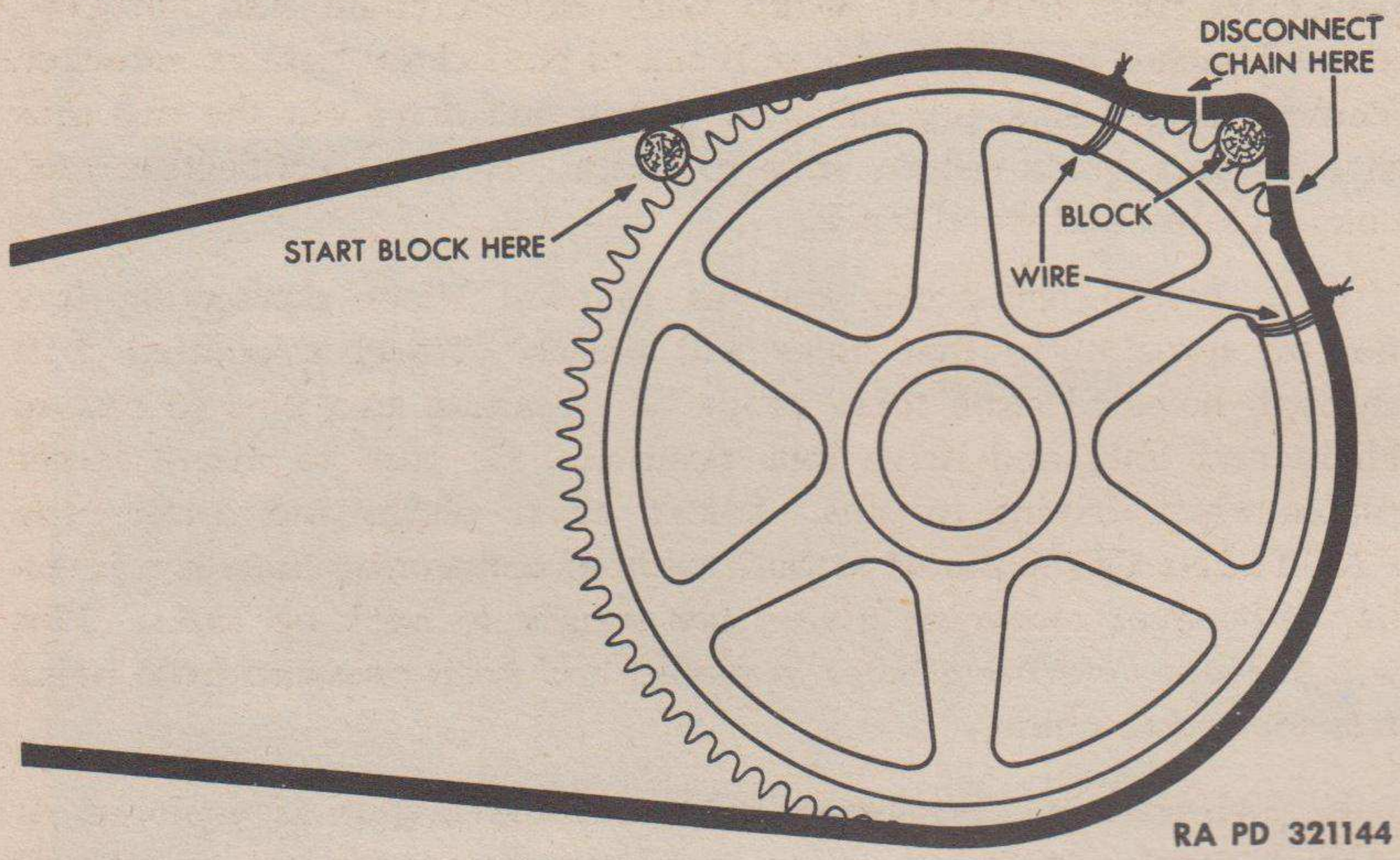


Figure 81—Roller Drive Chain Adjustment

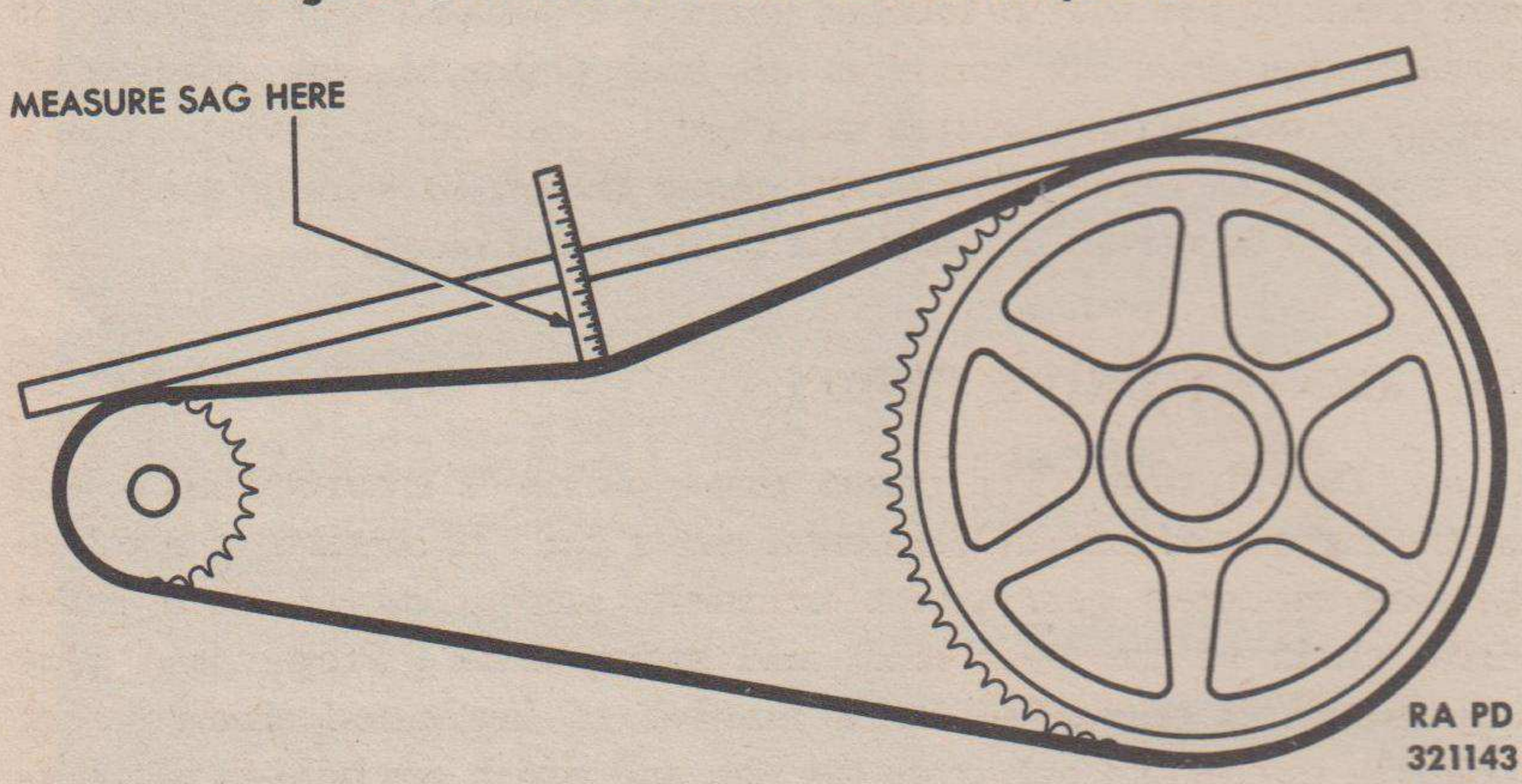


Figure 82—Measuring Sag in Roller Drive Chain

(1) Test adjustment of chain as follows: Stand on chain to bring slack to top, place straightedge on top of chain (fig. 82), measure distance at center between lower edge of straightedge and upper part of chain. If this distance is 4¾ inches or over, replace connecting link with one that has one less link.

(2) Remove connecting link as follows: Place a round block of wood or an iron bar about 1¼ inches in diameter between chain and sprocket (fig. 81). Turn sprocket by hand so that block will take up slack as sprocket is turned. CAUTION: *Do not use engine*

power to turn sprocket. Wrap wire around chain and sprocket, about 5 inches from each side of block to hold chain tight to sprocket. Remove cotter pins, pry off cover plates, and drive out the two pins at each end which secure links to chain. Remove connecting link, center plates, and wood block.

(3) Install connecting link as follows: Place connecting link flat on sprocket so that holes will match. Insert a pointed drift through holes to aline them properly. Position two pins to end of chain and link, and drive into position. Be sure to insert center plates while driving in pins. Install cover plates and cotter pins. CAUTION: *Cover plates at both ends of connecting links are press-fit. Whenever removing plates, use weight to back up links. This will prevent deforming holes in plates, and keep pressure from being transmitted to chain.*

c. Alinement. Whenever the turntable engine is replaced or moved, check position of pinion in relation to sprocket to see that it is properly alined. Place straightedge on outer surface of both gears, and check to see that it touches gears at front and rear of each. If straightedge does not touch at all four points change position of engine or of pinion on clutch shaft until alinement is proper. Use a gear puller to move pinion out; move pinion in with a maul. If pinion is to be driven in, protect it with a wood block.

96. CENTER DRIVE PINION.

a. Description. The center drive pinion is mounted on a hub at the right-hand end of the center drive pin. It consists of a roller-bearing mounted gear which transmits engine power from roller drive chain to the hoist shaft and swing shaft. Proper end play adjustment is controlled by a number of laminated shims which hold the pinion and hub from the pin, and which are held in place by an end plate and gasket.

b. Adjustment (fig. 83). Remove upper half of chain case. Remove the two cap screws and lock washers which secure end plate and gasket to center pin. Add shims as necessary to remove end play or shake of center pinion during operation. Position gasket and end plate to center pin, and secure with the two lock washers and cap screws.

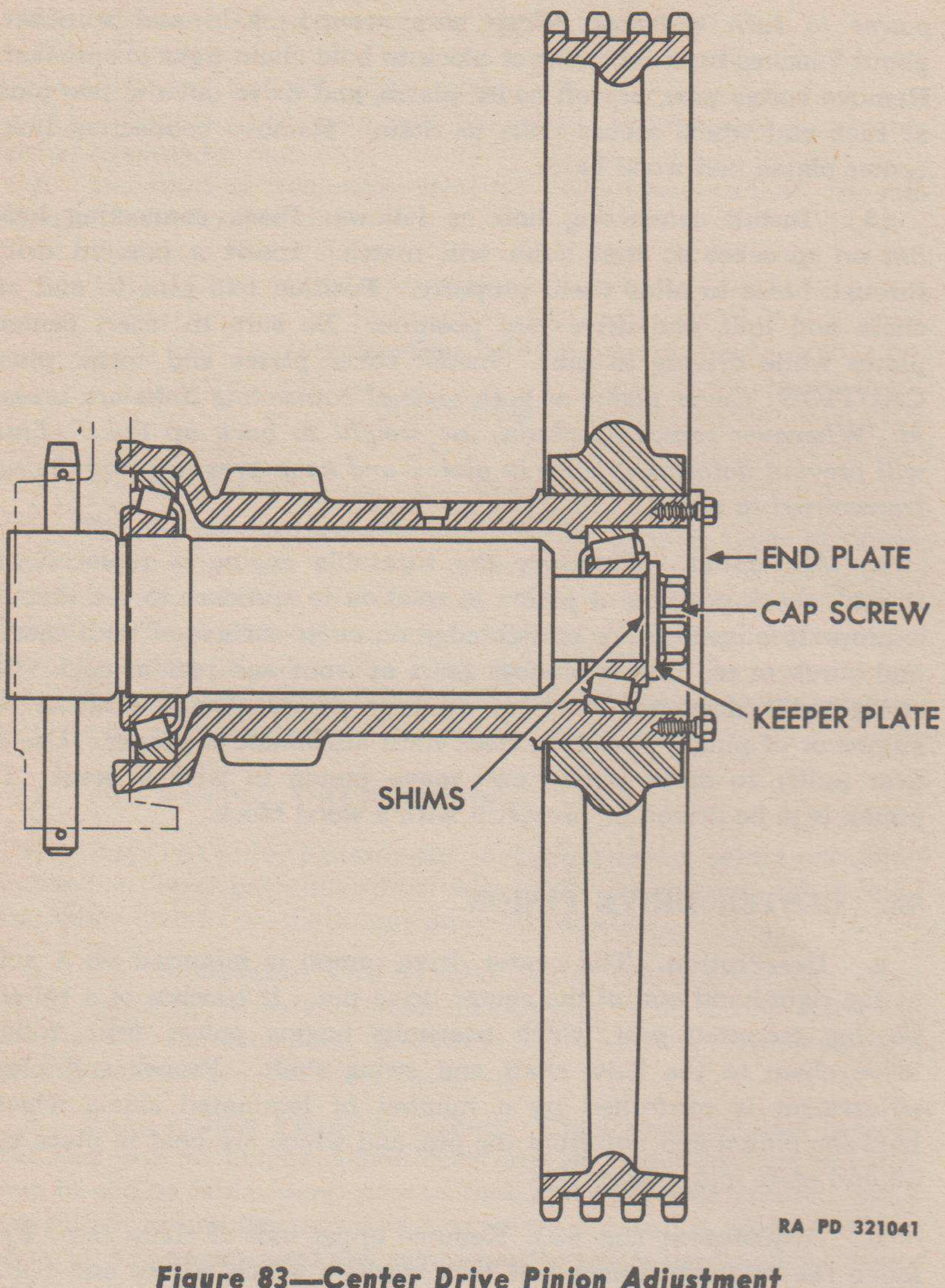


Figure 83—Center Drive Pinion Adjustment

Section XXIII

BOOM HOIST ASSEMBLY

97. DESCRIPTION AND DATA.

a. Description. The boom hoist assembly is mounted on the base of the left-hand machinery frame. It consists chiefly of cable drum, precision lowering device, pinion and brake wheel, clutch, brake, and a safety pawl. Individually mounted, the cable drum is geared to brake and pinion wheel at the left end of the horizontal swing shaft. Power from the swing shaft is transmitted to brake and pinion wheel through a clutch also mounted on the swing shaft. When the clutch is disengaged, a brake positioned around the wheel and a counter-weighted pawl, which engages a ratchet on the wheel, prevent wheel and cable drum from turning and thus hold the boom in a raised position. The precision lowering device engages the boom hoist cable drum to the hoist shaft, and thereby permits the hoist shaft and related machinery operating in reverse to control the lowering of the boom.

b. Data.

(1) CLUTCH.

Make	Twin Disc
Type	Single plate—dry
Size	19½ x 11½ in.

(2) BRAKE.

Make	Ferodo Asbestos
Type	Outside contracting—spring-loaded
Material (type)	Flexible weave
Size (lining)	¼ x 2¾ x 44 in.

(3) PRECISION CHAIN.

Make	Diamond Chain
Type	Roller

98. CLUTCH.

a. Description (fig. 84). The clutch, mounted on the left end of the horizontal swing shaft, is the same type as the engine clutch (par. 57). It is adjusted by moving a lock pin installed in the clutch housing. The clutch serves to transmit power from the engine through the power train and horizontal swing shaft to the boom hoist cable drum as necessary to raise the boom.

b. Adjustment. This clutch is adjusted in the same manner as the engine clutch (par. 57 **b**).

99. CLUTCH LINKAGE.

a. Description. The clutch linkage is positioned between the boom hoist hand lever and the clutch sliding sleeve collar. It con-

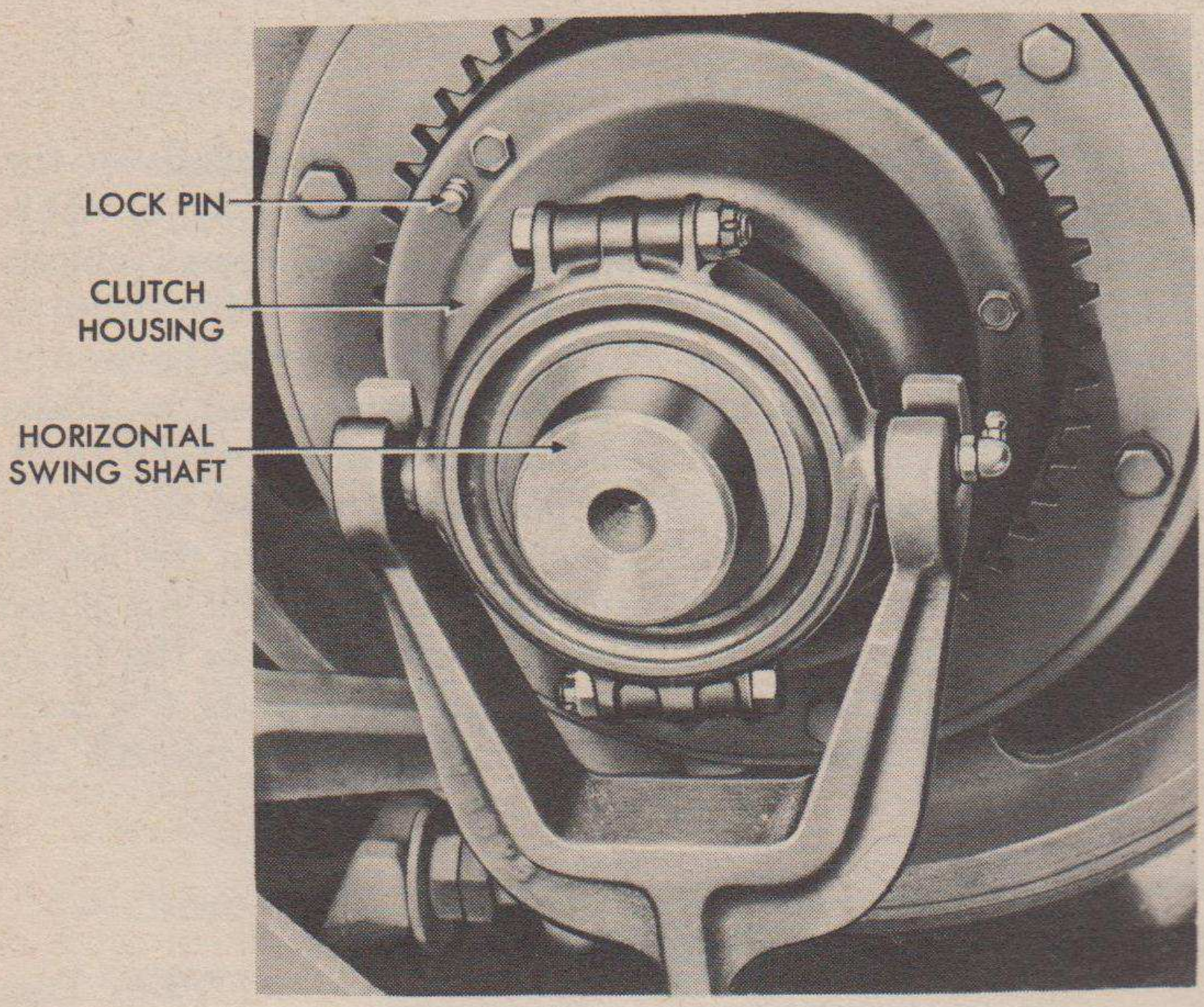


Figure 84—Boom Hoist Clutch

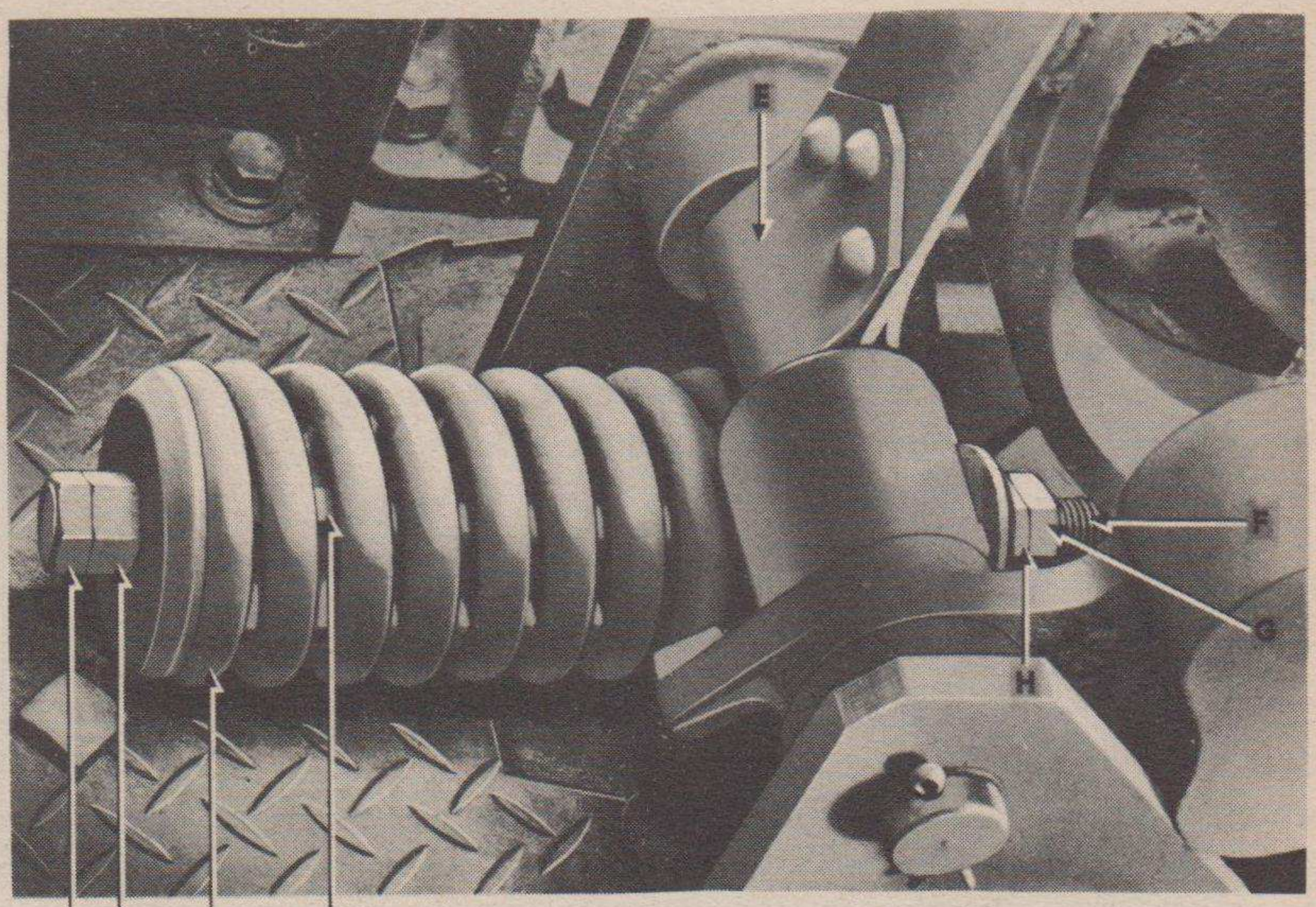
sists chiefly of a rod, two rod ends, bell crank, and a clutch shifter fork. The function of the linkage is to engage or disengage the clutch by means of the boom hoist hand lever.

b. Adjustment. Adjust rod ends so that with clutch in the fully released position (sliding sleeve at extreme left) boom hoist hand lever (fig. 12) will be in the neutral or vertical position. Remove cotter pin and pin which secure rod end to hand lever. Hold hand lever vertical, loosen lock nut, and turn rod end as necessary to aline holes to hole at bottom of hand lever. Insert pin and secure with cotter pin.

100. BRAKE.

a. Description. The boom hoist brake is positioned around the boom hoist pinion and brake wheel. It consists chiefly of a band, lining, eye bolt, and spring. The dead end of the band is held in a fixed position to the machinery frame. The brake is automatically held in engaged position by tension of an eye bolt and spring attached to live end of band. Proper adjustment of brake is maintained by adjustment of spring tension. The function of the brake is to prevent boom from lowering when boom hoist clutch is disengaged.

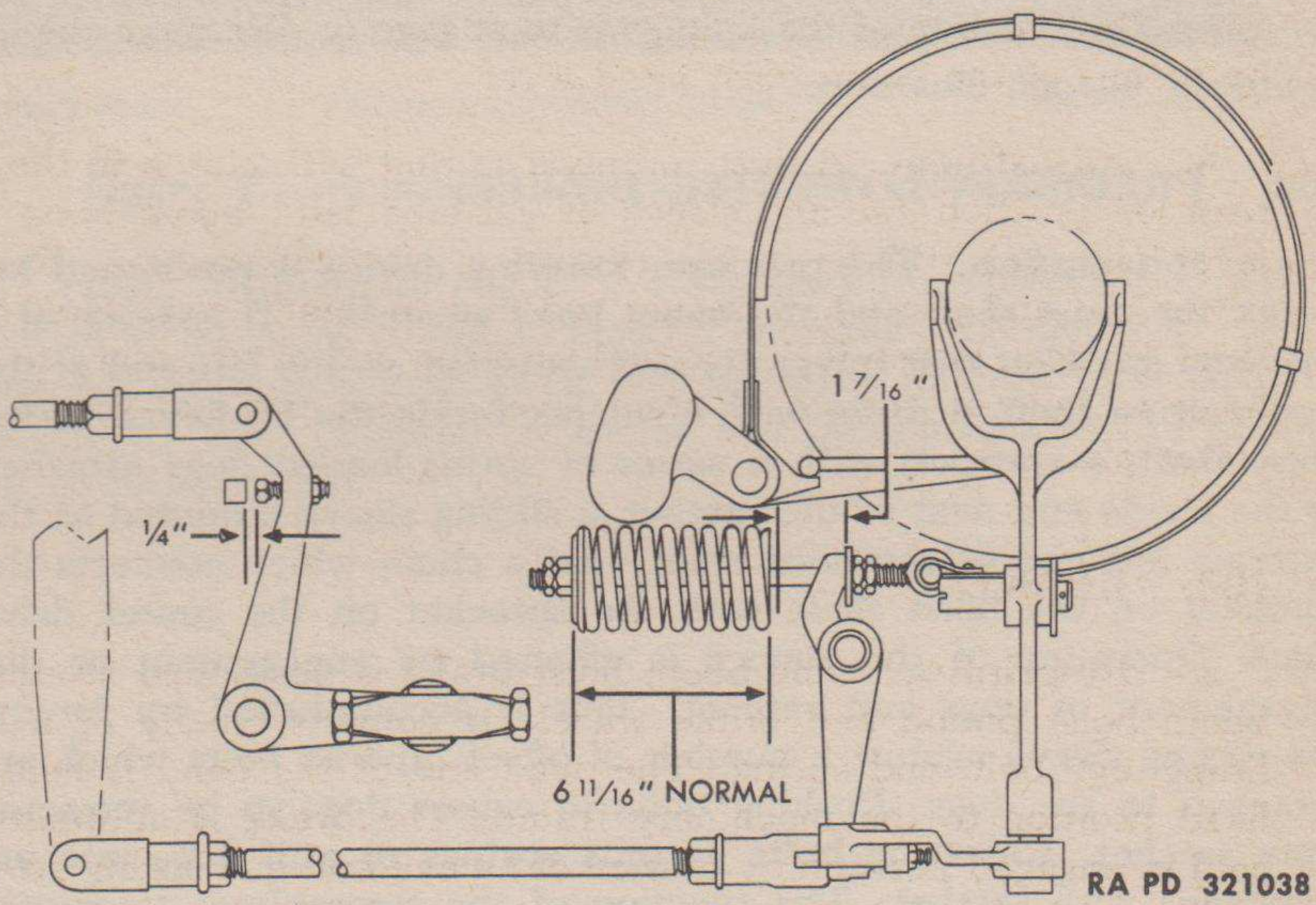
BOOM HOIST ASSEMBLY



RA PD 321118

A—LOCK NUT
B—ADJUSTING NUT
C—SPRING
D—EYE BOLT
E—BRAKE BAND (DEAD END)
F—EYE BOLT (EYE END)
G—LOCK NUT
H—ADJUSTING NUT

Figure 85—Boom Hoist Brake Adjustment



RA PD 321038

Figure 86—Boom Hoist Brake and Linkage Adjustment

b. Adjustment (fig. 85).

(1) Loosen lock nut at eye end of eye bolt, and turn adjusting nut to obtain a $1\frac{7}{16}$-inch clearance between rear of brake release crank upper end and rib of floor bracket. Tighten lock nut.

(2) Loosen lock nut at straight end of eye bolt, and turn adjusting nut to obtain a $6\frac{11}{16}$-inch over-all length of spring. Set lock nut to hold spring in this position. CAUTION: *Always test adjustment of boom hoist brake before operating turntable assembly. Raise boom (with load) slightly and release clutch. Brake is properly adjusted if boom holds.*

101. BRAKE LINKAGE.

a. Description. The brake linkage is positioned between the boom hoist hand lever and eye bolt at the live end of the brake hand. This linkage is the same as that used to engage the boom hoist clutch, with the addition of a brake release crank. This crank is an operating part of the linkage only when the boom hoist hand lever is pulled back. In this position the crank forces the eye bolt back, releasing the brake. The function of the linkage is to release the brake to permit the boom to be lowered.

b. Adjustment (fig. 86). With hand lever in the neutral position, loosen lock nut and turn set screw to obtain ¼-inch clearance between it and lower end of brake release crank. Tighten lock nut to hold set screw in this position. NOTE: *As clutch and brake linings become worn, set screw adjustment will require changing to maintain ¼-inch clearance.*

102. PRECISION LOWERING DEVICE.

a. Description. The precision lowering device is positioned between the hoist shaft and the boom hoist assembly. It consists of a gear and sprocket cast integrally and mounted on the left end of the center drive shaft, a drum with a ratchet inside the lip keyed to the hoist shaft, a sprocket with a series of spring-loaded dogs attached to the inside end next to the ratchet, a sliding sleeve mounted at the extreme left end of the hoist shaft, and a chain which connects the sprocket on the hoist shaft with the sprocket on the center drive shaft. Operation of this device is effected by engagement or disengagement of dogs and ratchet. This is accomplished by forcing the sliding sleeve against a number of offset tapered bolts which are attached to the dogs. Pushing bolts in causes dogs to be retracted from ratchet. Releasing bolts permits springs to pull dogs into engagement with ratchet. The function of the assembly is to engage the hoist shaft to boom hoist cable drum and thus permit controlled lowering of a boom.

BOOM HOIST ASSEMBLY

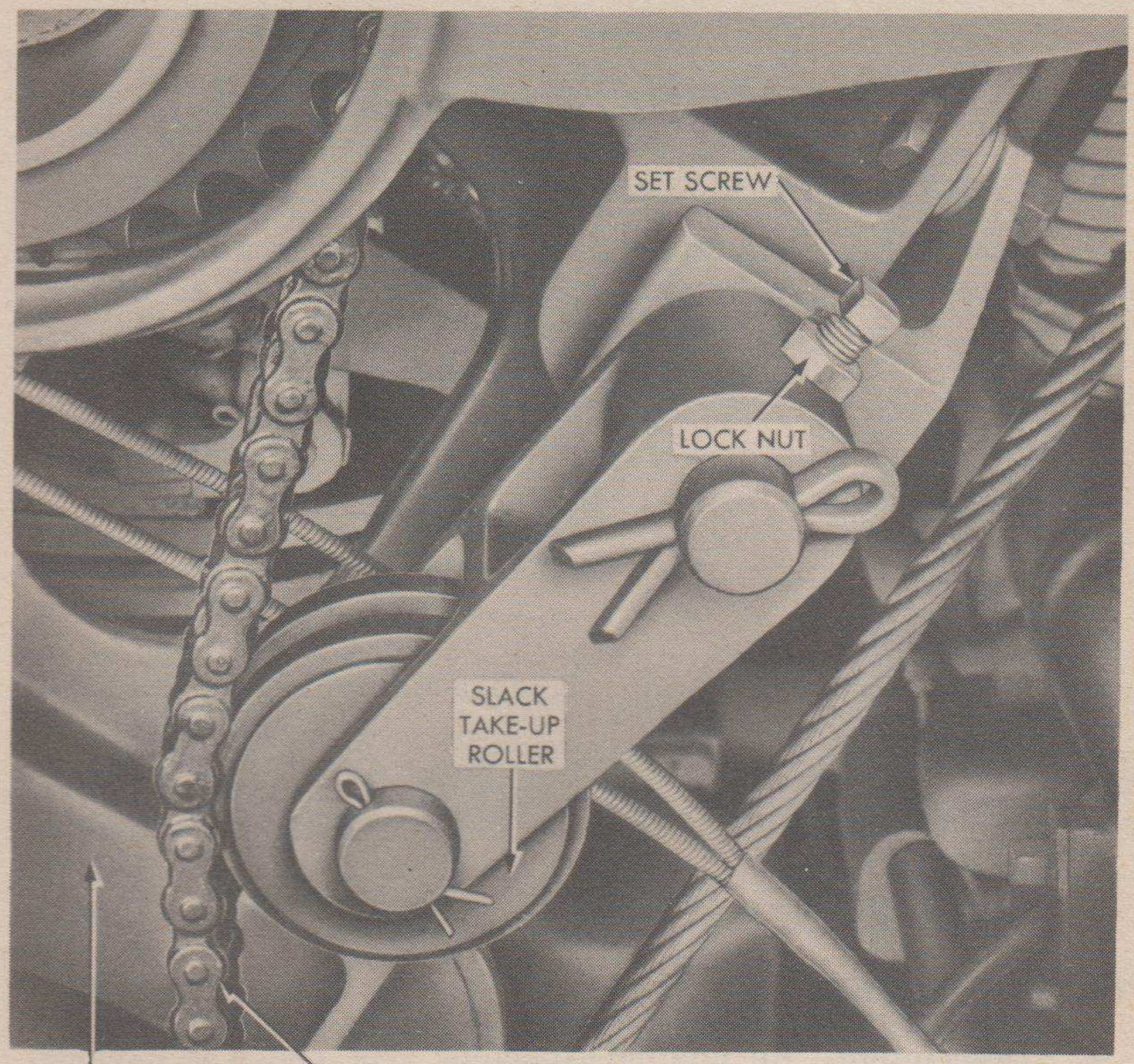


Figure 87—Precision Lowering Chain Adjustment

b. Chain Adjustment (fig. 87). Keep slack from precision lowering chain at all times to obtain smooth operation. Loosen lock nut, release set screw, and push slack take-up roller forward until chain is reasonably tight. Tighten set screw, and tighten lock nut to hold chain in this position.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

Section XXIV

HOIST SHAFT ASSEMBLY

103. DESCRIPTION AND DATA.

a. Description. The hoist shaft assembly is mounted on the front of the machinery frames, about halfway from top to bottom. It consists chiefly of two cable drums, two clutches, two brakes, and a hoist gear. The function of the assembly is to transfer engine power as necessary to raise, lower, or hold the boom load.

b. Data.

(1) CLUTCHES.

Make	Thew Shovel
Type	Internal expanding
Lining (size)	¼ x 2½ x 34 59/64 in.
Lining (material)	Johns-Mansville—Moulded 900

(2) BRAKES.

Make	Thew Shovel
Type	External contracting
Lining, short half (size)	¼ x 3½ x 13⅞ in.
long half (size)	¼ x 3½ x 17¼ in.

104. CLUTCHES.

a. Description. An internal-expanding type clutch is mounted on a spider inside the outer end of each hoist drum. Each consists chiefly of a two-part band, two linings, toggle arm, guide links, eye bolt, toggle link, trunnion block, band guides, and a bell crank. The function of the clutch is to engage hoist drum to hoist shaft.

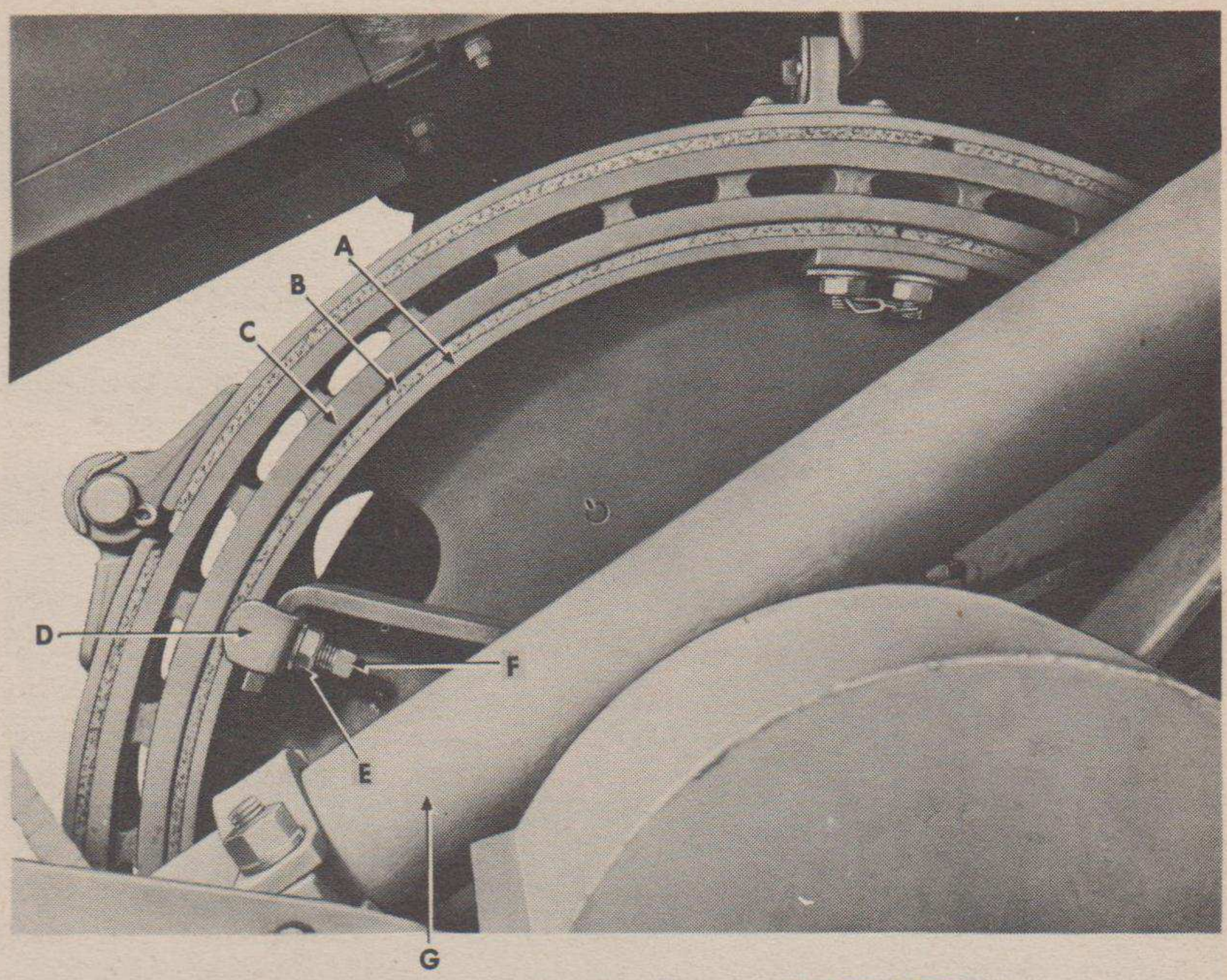
b. Adjustment.

(1) BAND GUIDES (fig. 88). Release lock nuts and turn set screws so that they will contact band when clutch is in fully released position and so that lining to drum clearance will be about 1/16 inch all the way around. Tighten lock nuts to hold set screws in this position.

(2) CLUTCH BANDS (fig. 89). Loosen lock nut at end of eye bolt. Slack off inner adjusting nut and tighten outer adjusting nut (or vice versa) so that when clutch is engaged lining will be tight against drum and toggle joints will completely knuckle in the lock. Tighten lock nut to hold this adjustment. CAUTION: *Make sure that lining does not drag against drum when clutch is fully released.*

(3) SECONDARY HOIST CLUTCH SPRING (fig. 90). When turntable is to be operated with clamshell, attach and adjust secondary

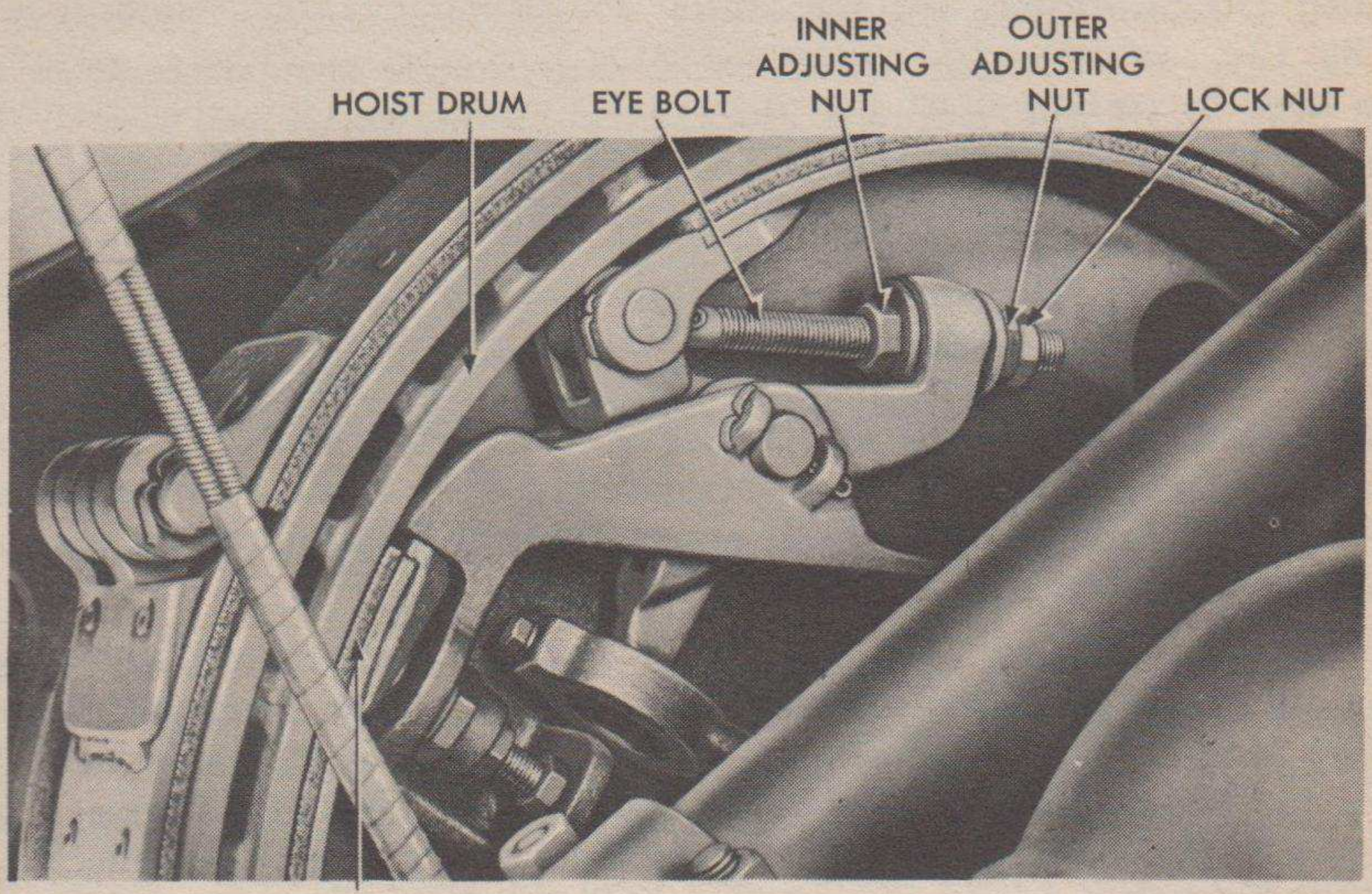
HOIST SHAFT ASSEMBLY



A—CLUTCH BAND
B—CLUTCH LINING
C—HOIST DRUM
D—BAND GUIDE
E—LOCK NUT
F—SET SCREW
G—FRONT GANTRY LEG

RA PD 321066

Figure 88—Hoist Clutch Band Guide Adjustment



RA PD 321047

Figure 89—Hoist Clutch Adjustment

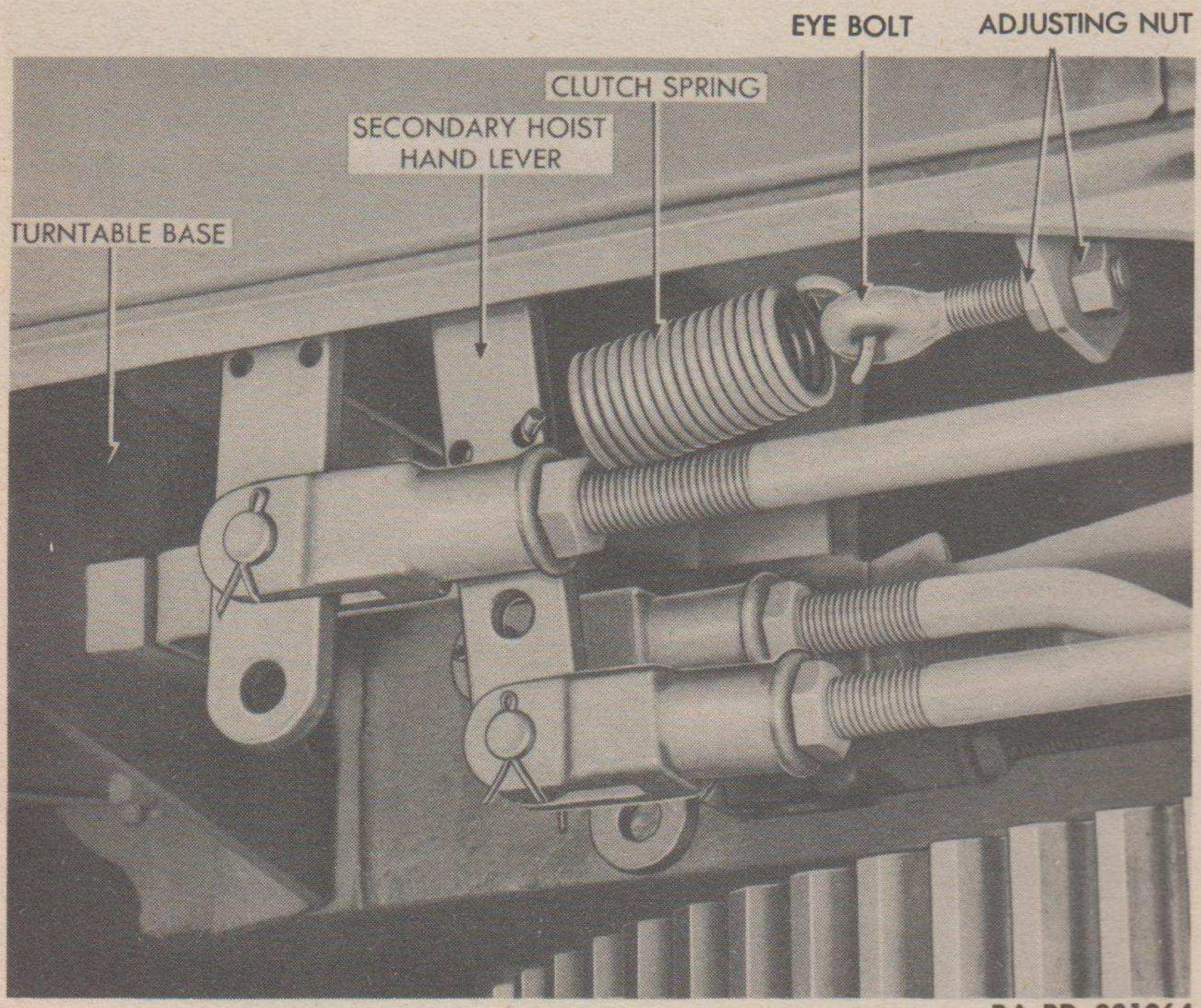


Figure 90—Secondary Hoist Clutch Spring Adjustment

hoist clutch spring. Attach spring to secondary hoist hand lever (fig. 12). Loosen and tighten adjusting nuts alternately as necessary to keep secondary hoist clutch partially engaged. This will produce just enough drag to keep holding the line taut when load is being lifted with closing line. Tighten both adjusting nuts to hold adjustment.

105. CLUTCH LINKAGE.

a. Description. The clutch linkage is positioned between the hoist hand lever and the sliding sleeve on the hoist shaft. It consists chiefly of two clutch shifter levers, bell crank, rod, and two rod ends. Purpose of linkage is to permit engagement of hoist clutch by means of the hand lever at the operator's station.

b. Adjustment. Adjustment of linkage consists of regulating length of rod so that with clutch fully released, hand lever will be in the neutral or vertical position. This adjustment is the same as that for the boom hoist clutch linkage (par. 99 b). NOTE: *Connecting rod to either hole in base of hoist hand lever is optional. Connection to upper hole permits operation of clutch with a minimum travel of lever; lower hole, maximum movement.*

HOIST SHAFT ASSEMBLY

106. BRAKES.

a. Description. An external-contracting type brake is mounted outside each cable drum. It consists chiefly of a two-part, hinge-attached band, two linings, and a release spring. The dead end of the band (short half) is attached to a brake anchor on the center drive pin. The live end (long half) is attached to eye bolt and fulcrum pin, which contracts brake when brake foot pedal is depressed. The function of the brake is to hold the hoist cable loads stationary.

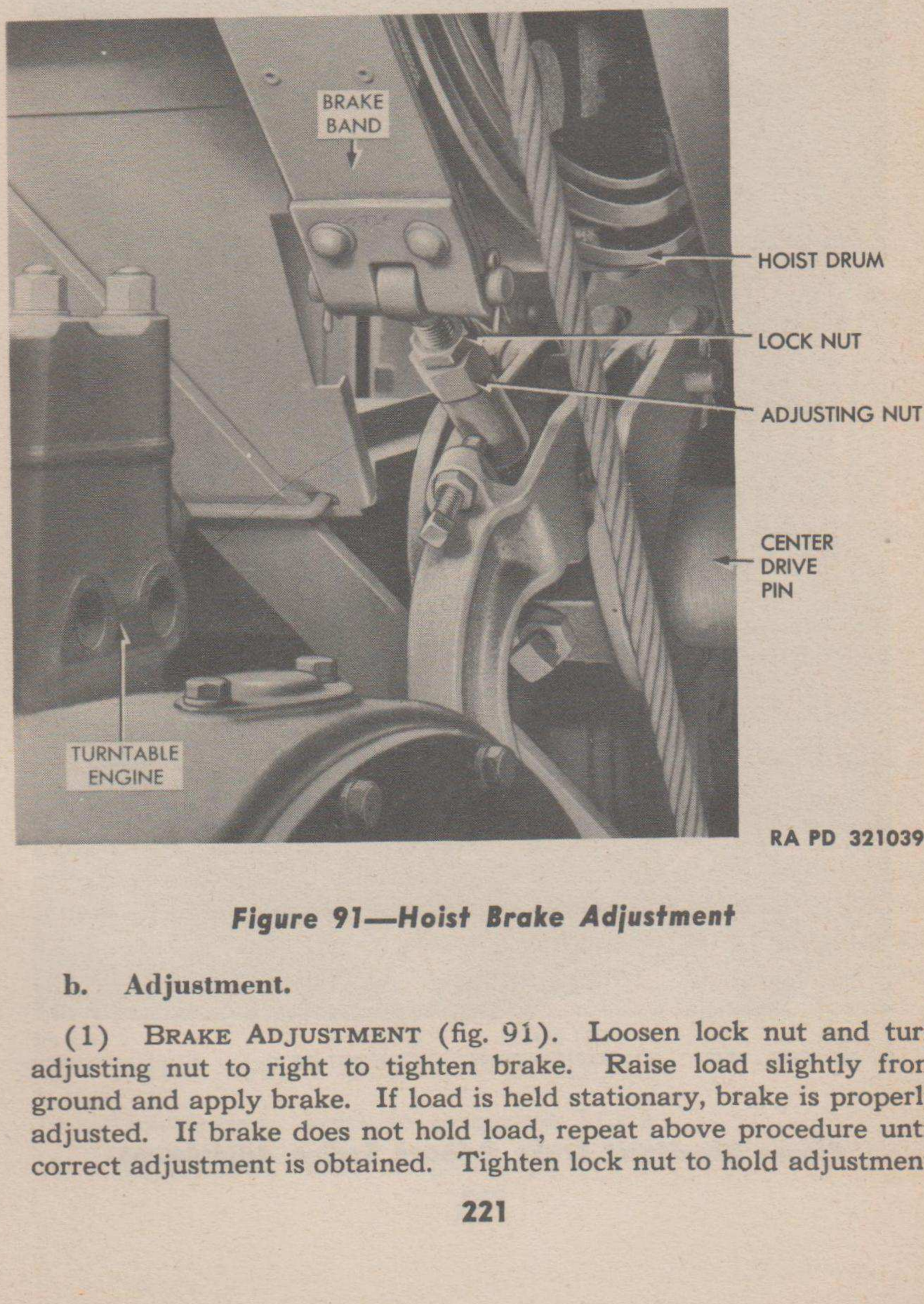
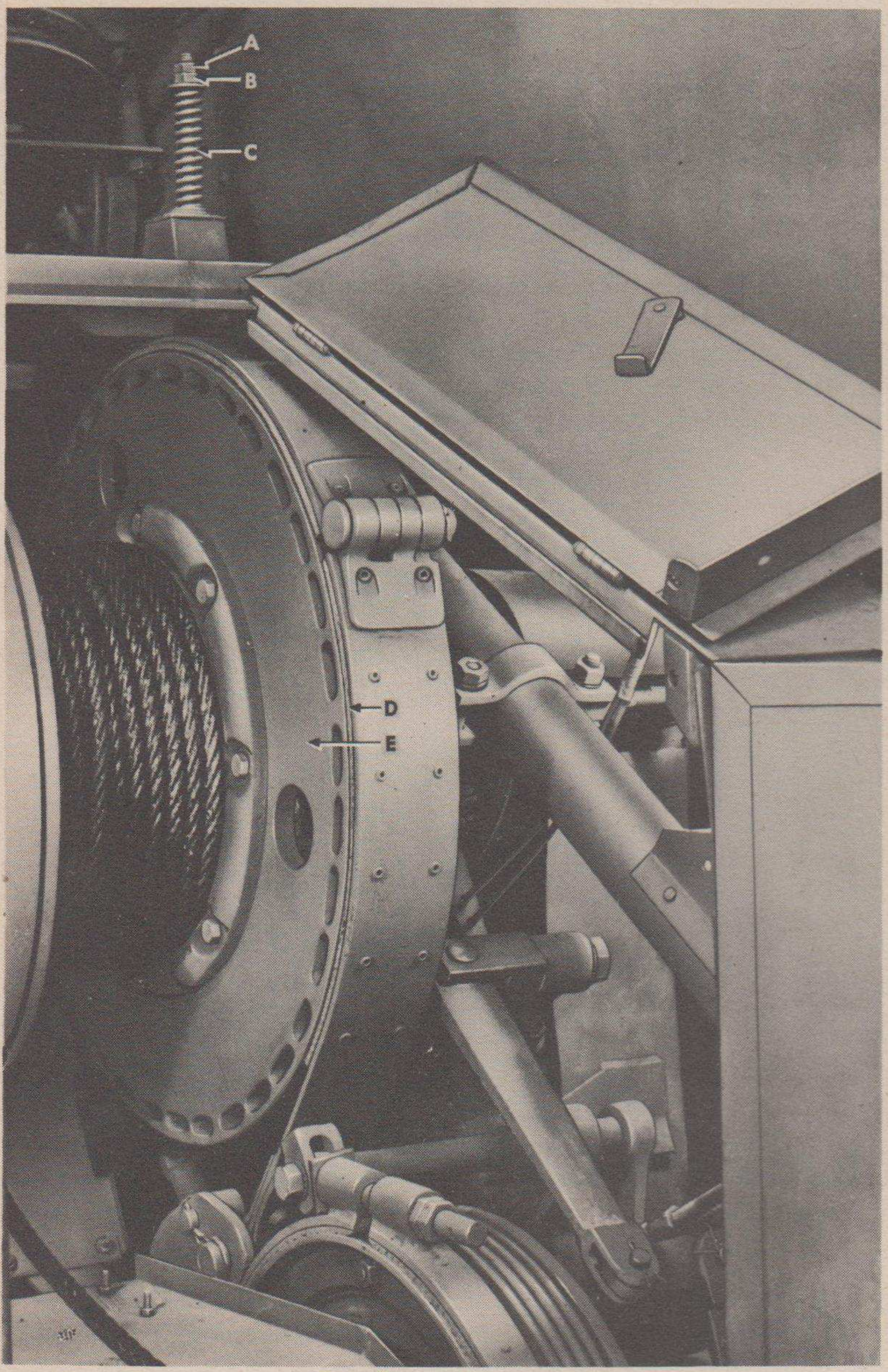


Figure 91—Hoist Brake Adjustment

b. Adjustment.

(1) BRAKE ADJUSTMENT (fig. 91). Loosen lock nut and turn adjusting nut to right to tighten brake. Raise load slightly from ground and apply brake. If load is held stationary, brake is properly adjusted. If brake does not hold load, repeat above procedure until correct adjustment is obtained. Tighten lock nut to hold adjustment.



A—LOCK NUT
B—ADJUSTING NUT
C—HOIST BRAKE RELEASE SPRING
D—LINING
E—HOIST DRUM
RA PD 321071

Figure 92—Hoist Brake Release Spring Adjustment

HOIST SHAFT ASSEMBLY

(2) BRAKE RELEASE SPRING ADJUSTMENT (fig. 92). Loosen lock nut and tighten adjusting nut to obtain a uniform clearance of brake band with brake in fully released position. CAUTION: *When both adjustments have been made, check lining to drum clearance to make sure that it does not drag.*

107. BRAKE LINKAGE.

a. Description. The linkage is positioned between the brake foot pedal and eye bolt attached to live end of band. It consists mainly of a brake anchor, foot lever spring, foot lever spring rod, brake lever, rod, and rod end. The function of the linkage is to apply the hoist brake by means of the foot pedal at the operator's station.

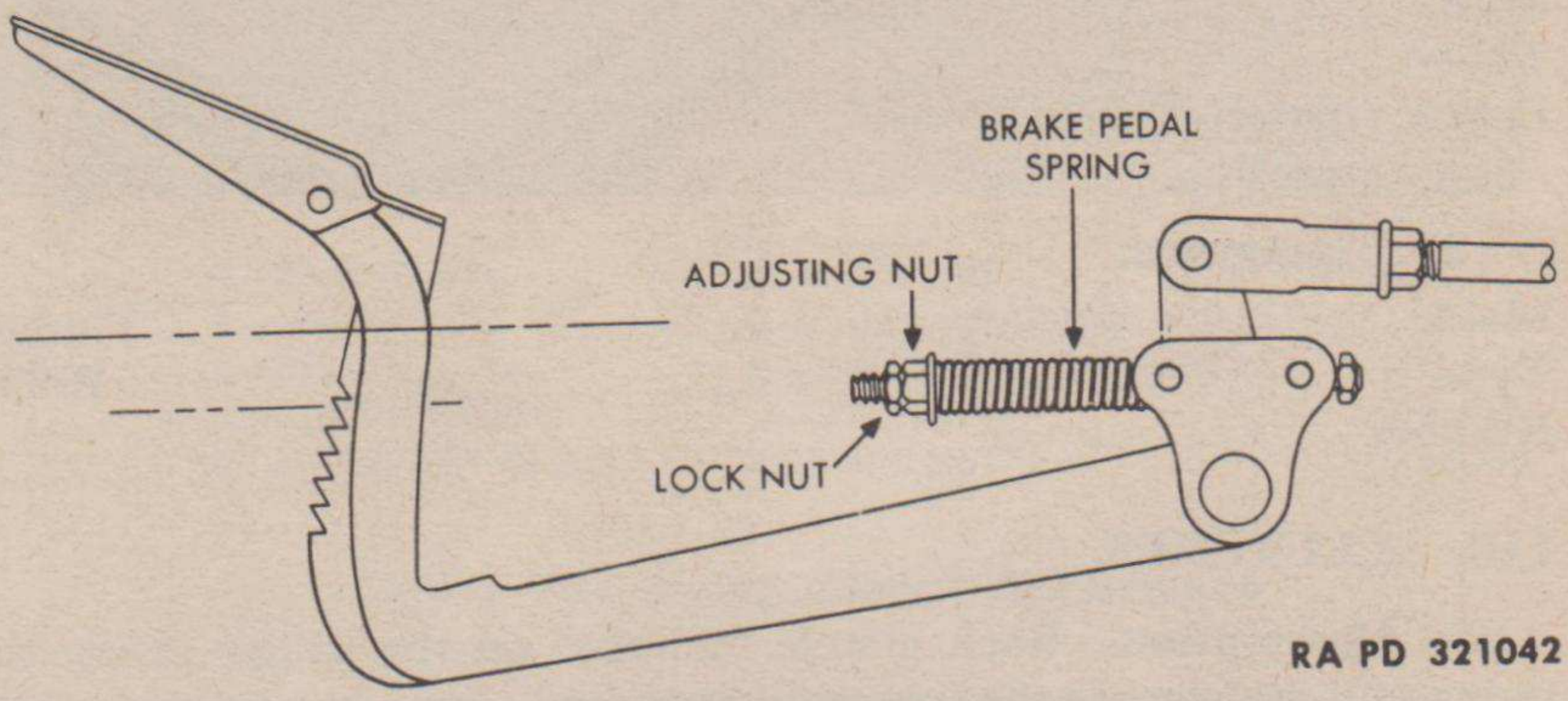


Figure 93—Brake Pedal Spring Adjustment

b. Adjustment.

(1) BRAKE PEDAL ADJUSTMENT. Remove cotter pin and pin which secures rod end to brake pedal. Loosen lock nut, place brake and foot pedal in fully released position, and turn rod end until holes are alined with hole in brake pedal. Insert pin and secure with cotter pin.

(2) BRAKE PEDAL SPRING ADJUSTMENT (fig. 93). Loosen lock nut at front end of brake lever spring rod, and turn adjusting nut to tighten spring as necessary to bring brake pedal to top position. Tighten lock nut to hold spring in this position. NOTE: *Make this adjustment before adjusting brake pedal.*

108. HOIST SHAFT BEARING BUSHINGS.

a. Description. Refer to paragraph 113 a.

b. Adjustment. Refer to paragraph 113 b.

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

Section XXV

HORIZONTAL SWING SHAFT ASSEMBLY

109. DESCRIPTION AND DATA.

a. Description. The horizontal swing shaft is attached to the bottom front of the machinery frames. It consists chiefly of two swing clutch drums, two clutch drum hub and bevel pinions, two clutches, bearings, and a spur gear. The assembly serves to convert engine power to raise the boom or to swing the turntable assembly.

b. Data.

(1) CLUTCHES.

Make	Thew Shovel
Type	Internal-expanding
Lining (material)	Ferodo 137-W
(size)	¼ x 2½ x 27 7/32 in.

(2) BEARINGS.

Make	Timken
Type	Roller
Number	4

110. CLUTCHES.

a. Description. Each clutch, mounted on the spider inside the swing clutch drum, is the internal expanding type. It consists mainly of a two-part clutch band, two linings, toggle arm, guide links, eye bolt, toggle link, trunnion block, band guides, and a bell crank. The function of clutch is to engage the swing clutch drum and clutch drum hub and bevel pinion to the swing shaft.

b. Adjustment (fig. 94).

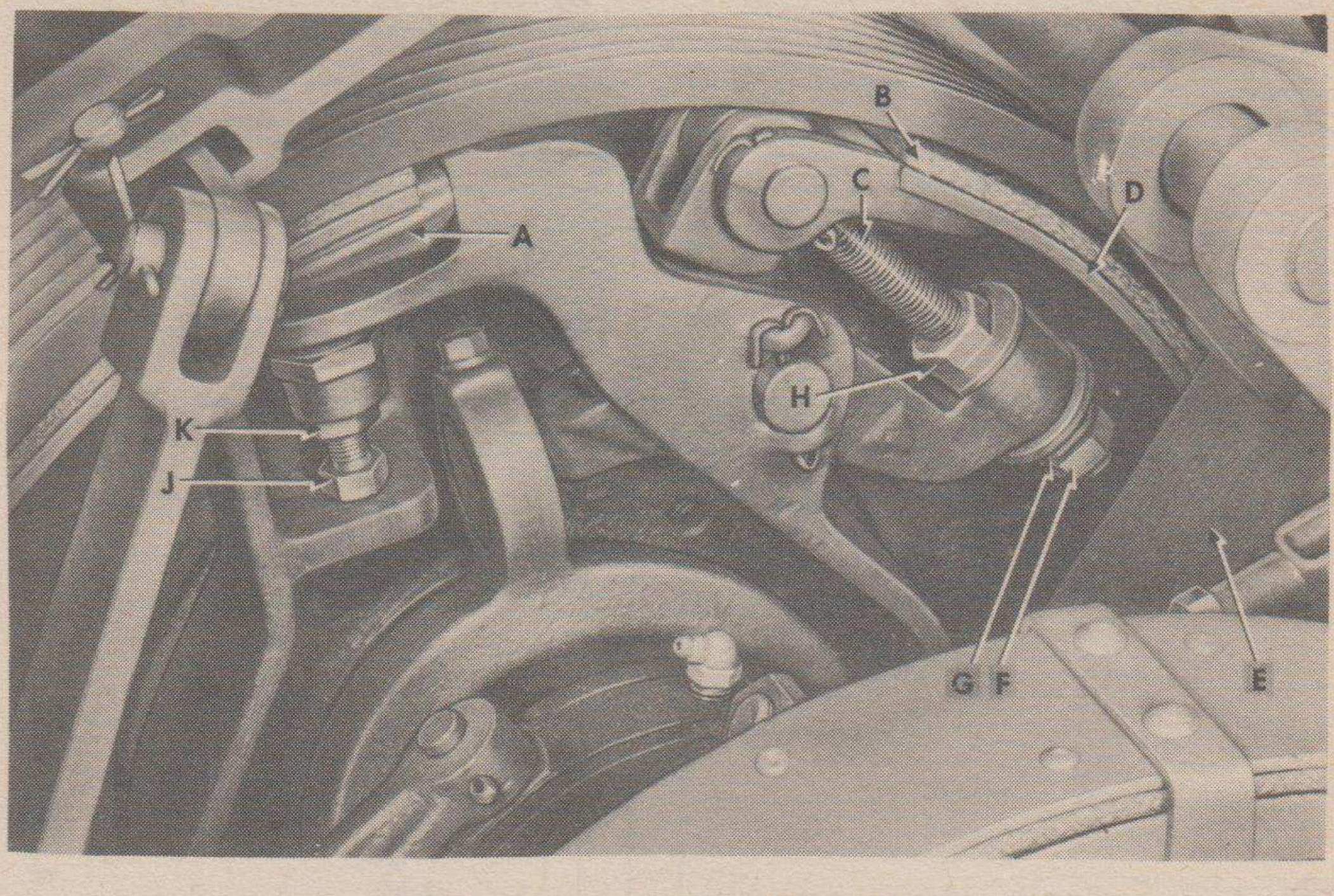
(1) CLUTCH. The swing clutch adjustment is the same for both swing clutches, and is identical to that given for the hoist clutch (par. 104).

(2) BAND GUIDES. Refer to paragraph 104 b.

111. CLUTCH LINKAGE.

a. Description. The swing clutch linkage is positioned between the clutch shifter rods and the swing hand lever. It consists chiefly of a swing lever rod, rod end, bell crank, eye bolt, two sleeve nuts, clutch shifter rod, two shifter rod springs, two shifter rod washers, pipe spacer, two adjusting nuts, and two lock nuts. The forked ends of the two clutch shifter levers (attached to clutch sliding sleeve)

HORIZONTAL SWING SHAFT ASSEMBLY



A—BAND GUIDE
B—LINING
C—EYE BOLT
D—CLUTCH BAND
E—MACHINERY FRAME
F—LOCK NUT
G—OUTER ADJUSTING NUT
H—INNER ADJUSTING NUT
J—SET SCREW
K—LOCK NUT

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321110

Figure 94—Swing Clutch Adjustment

are mounted around the clutch shifter rod between the springs and washers at each end of the pipe spacer. Inasmuch as the clutches are engaged from opposite directions, sideward movement of the clutch shifter rod causes the spring to engage one clutch while the pipe spacer and washer disengage the other. The two sleeve nuts provide adjustment so that at the midpoint of travel neither clutch will be engaged. The function of the assembly is to engage and disengage the swing clutches by means of the swing hand lever at the operator's station.

b. Adjustment (fig. 95).

(1) With swing hand lever in the vertical position, disconnect rod end from base of swing hand lever. Adjust the two sleeve nuts as necessary to place forked ends of clutch shifter levers midway between the spring center and washer on the left side, and the two spring centers on the right side.

(2) Release the two lock nuts, and tighten adjusting nuts as necessary to create a definite tension on shifter rod springs. This will keep clutches in positive engagement when set.

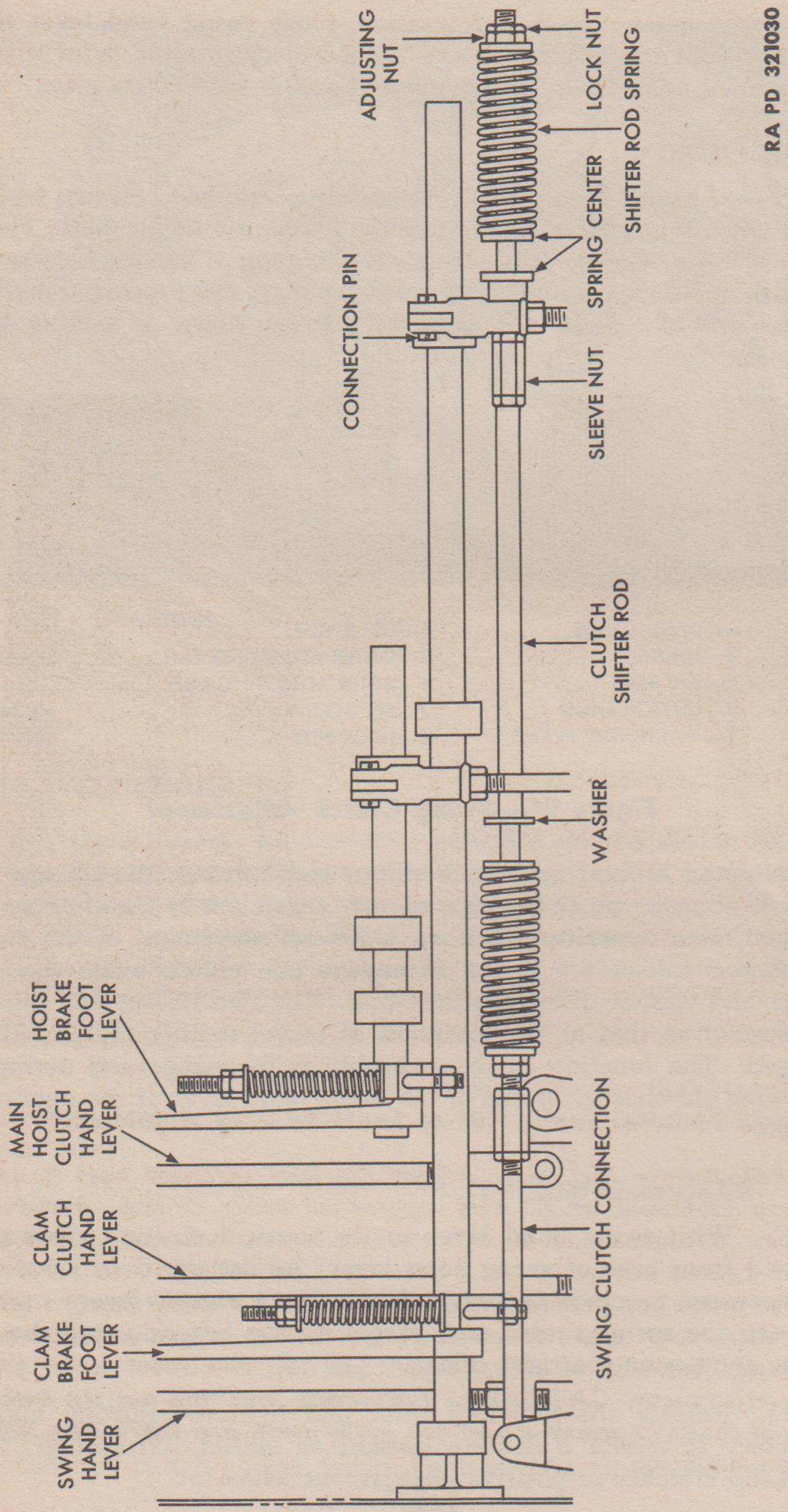


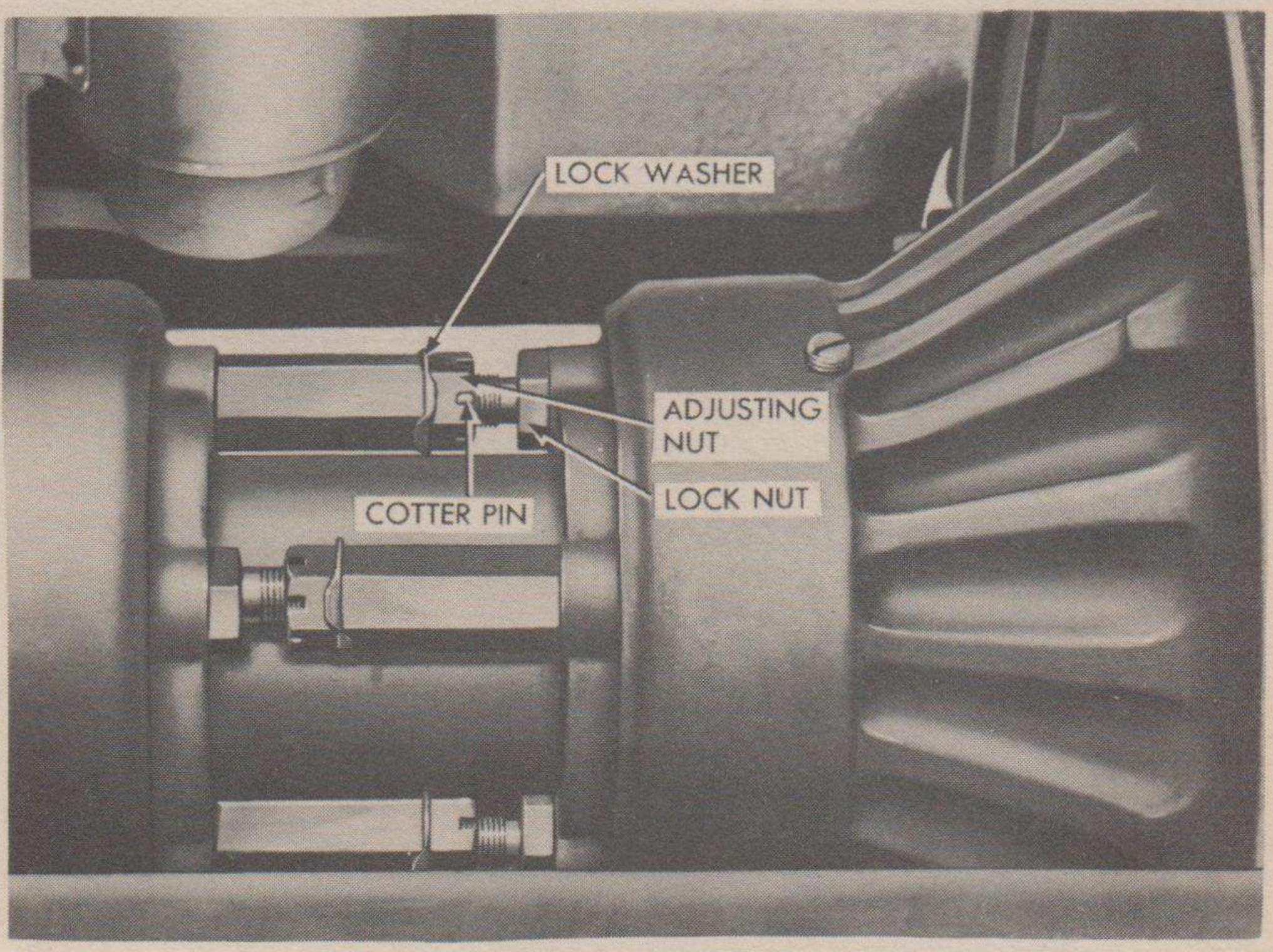
Figure 95—Swing Clutch Linkage Adjustment

HORIZONTAL SWING SHAFT ASSEMBLY

(3) Hold linkage in center position, place swing hand lever in neutral position, and adjust rod end as necessary to aline holes with hole in base of hand lever. Insert pin and secure with cotter pin.

112. BEARINGS.

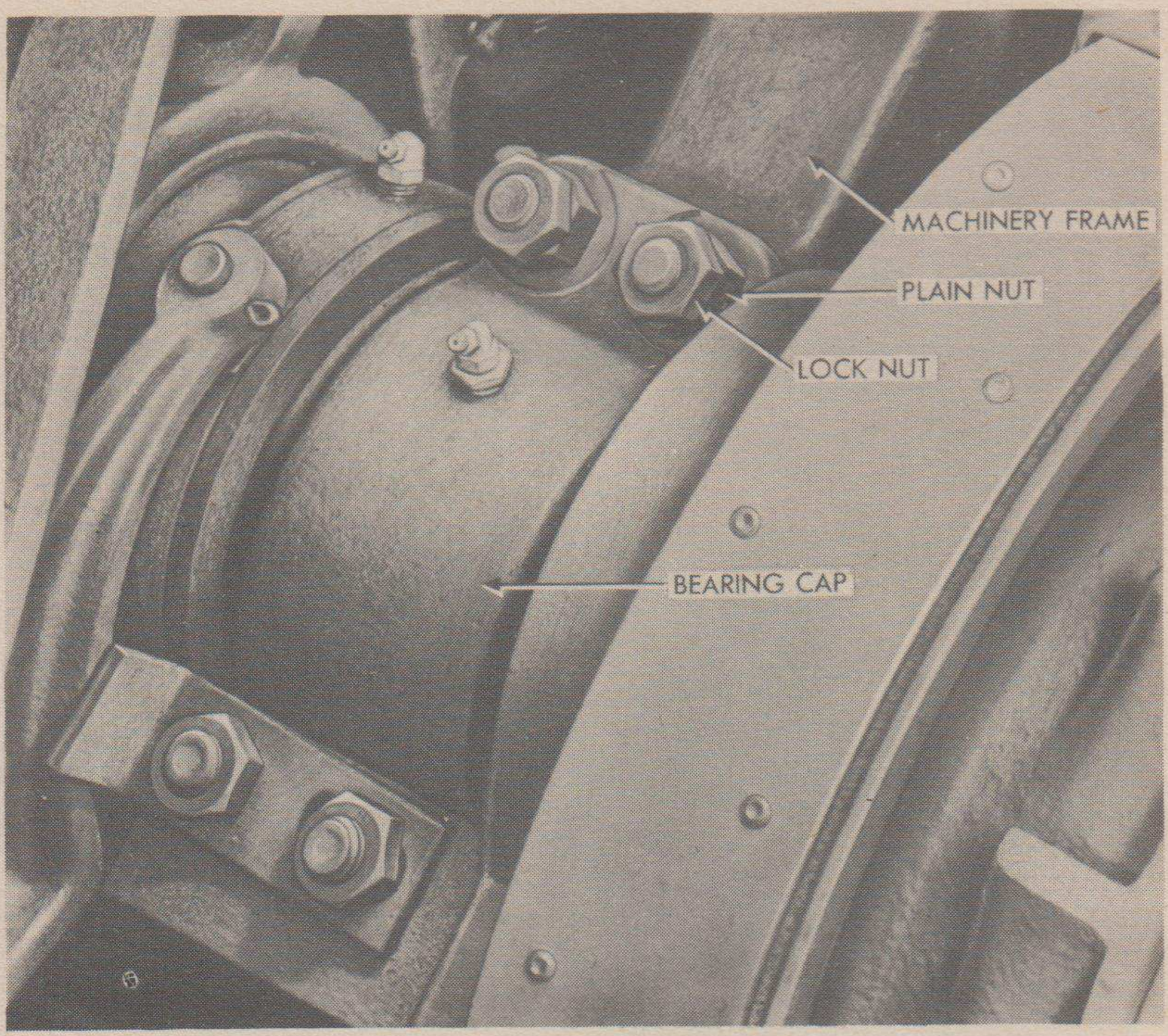
a. Description. Four roller bearings are positioned between each clutch drum hub and bevel pinion and the horizontal swing shaft. The function of these bearings is to provide a minimum of friction between swing shaft and bevel pinion. Four spreader studs are proportionately spaced around the shaft, and serve to prevent shake or wobble of the pinions.



RA PD 321137

Figure 96—Horizontal Swing Shaft Bearing Adjustment

b. Adjustment (fig. 96). Adjust the four spreader bars to remove any looseness which may appear in swing drums. Remove cotter pin. Straighten lip of lock washer, loosen lock nut at end of bar, and tighten adjusting nut (clockwise) as necessary to remove play. Use pinch bar between bevel pinion and turntable base to test adjustment. Absence of noticeable play indicates proper adjustment. Set lock nut, bend lip of lock washer over nut, and insert cotter pin to hold adjustment. CAUTION: *Turn each adjusting nut the same number of times to ensure a uniform adjustment, and make sure that drums do not bind.*



RA PD 321070

Figure 97—Horizontal Swing Shaft Bearing Bushing Adjustment

113. HORIZONTAL SWING SHAFT BEARING BUSHINGS.

a. Description. The horizontal swing shaft bearing bushings are mounted around the swing shaft at the point where it is connected to each machinery frame. These bushings are made in two halves, and are held in position on the swing shaft by two bearing caps which bolt to the machinery frame. The function of the bushings is to take wear off the shaft during operation. As bushings wear, bearing shims may be removed to maintain proper adjustment.

b. Adjustment (fig. 97). Remove the four lock nuts and plain nuts which secure each bearing cap to machinery frame. Remove shims as necessary to maintain a running fit of hoist shaft to machinery frame. Position bearing cap around shaft, and secure with the four plain nuts and lock nuts. Use pinch bar between shaft and machinery frame to test fit. When no play is noticeable, adjustment is satisfactory.

Section XXVI

TURNTABLE ASSEMBLY

114. DESCRIPTION AND DATA.

a. Description. The turntable assembly is mounted on the ring gear which is welded to the vehicle frame. Exclusive of all the assemblies described in other sections of part five, it consists chiefly of a swing lock, swing brake, two machinery frames, turntable rollers, cab, tagline counterweight, fuel tank, and counterweight. Purpose of assembly is to perform the operations necessary for digging and hoisting.

b. Data.

(1) SWING BRAKE.

Make ..... Thew Shovel
Type ..... External-contracting
Lining (material) ..... Johns-Manville—moulded 900
(size) ..... ¼ x 1½ x 31¾ in.

(2) ROLLERS.

Clearance (total between roller and roller path) ..... 1/16 in. (approx)

(3) FUEL TANK.

Capacity ..... 50 gal

(4) TAGLINE COUNTERWEIGHT.

Weight ..... 400 lb

(5) COUNTERWEIGHT.

Weight ..... 3,000 lb

115. TURNTABLE LOCK AND LINKAGE.

a. Description. The turntable lock and linkage is positioned between the operator's compartment and the ring gear at the front of the turntable assembly. It consists chiefly of a pawl, two eye bolts, adjusting nut, frame crane, spring frame, spring center collar, spring center, two lock cushion springs, lock crane lever shaft, and two lever shaft brackets. When the hand lever is forward, the spring tension keeps the pawl positively engaged. The function of the assembly is to engage the pawl and ring gear, which prevents the turntable from moving from the operator's station.

b. Adjustment (fig. 98). Set turntable lock hand lever in the forward or engaged position. Loosen lock nut, and turn adjusting nut as necessary to fully engage pawl with ring gear. Tighten lock nut when adjustment is satisfactory. If pawl engages ring gear before turntable lock hand lever is in the engaged position, reverse the above procedure to obtain satisfactory adjustment. NOTE: *Make sure pawl clears ring gear by at least ¼ inch when hand lever is pulled back to the disengaged position.*

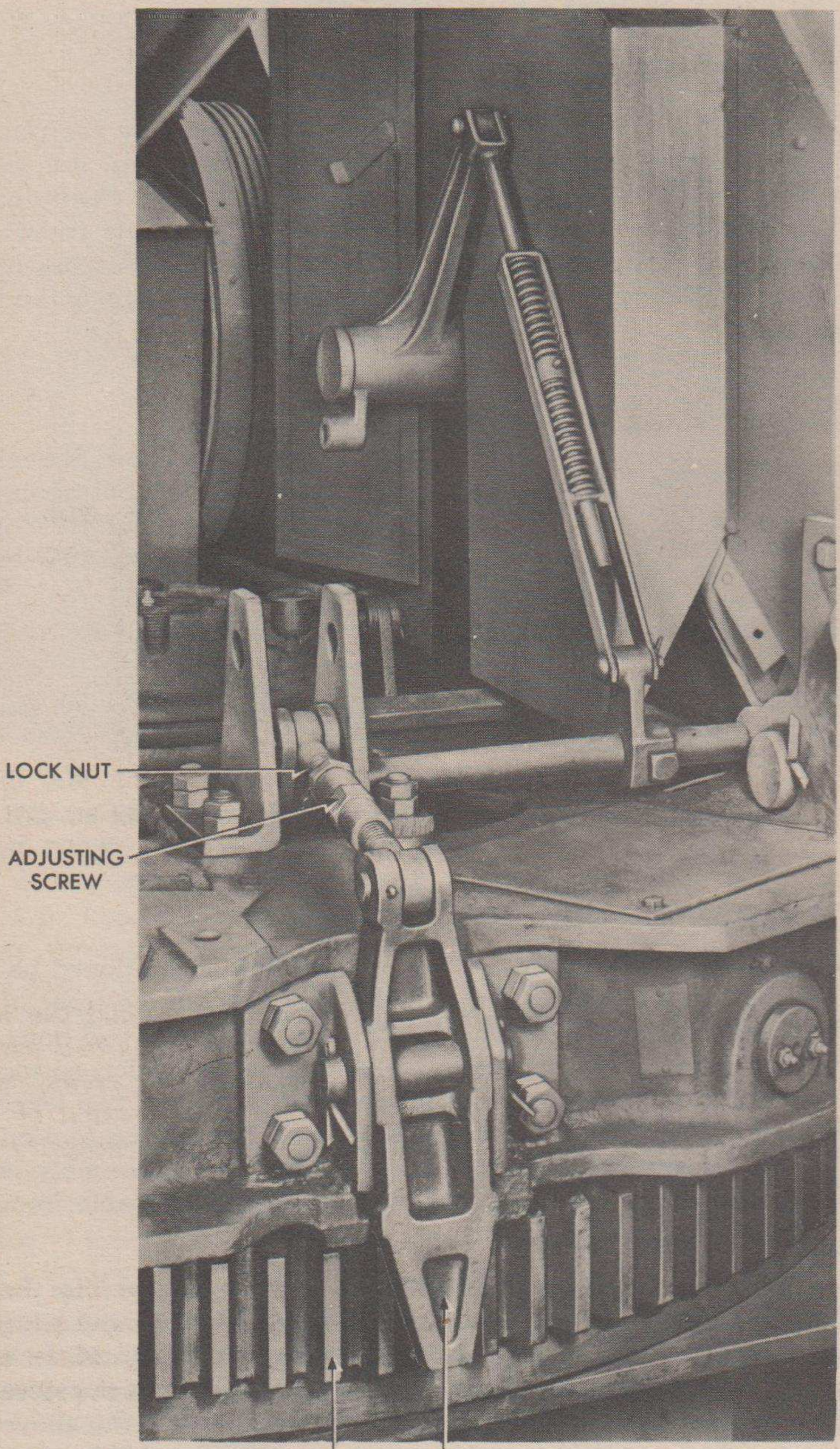


Figure 98—Turntable Lock Adjustment

TURNTABLE ASSEMBLY

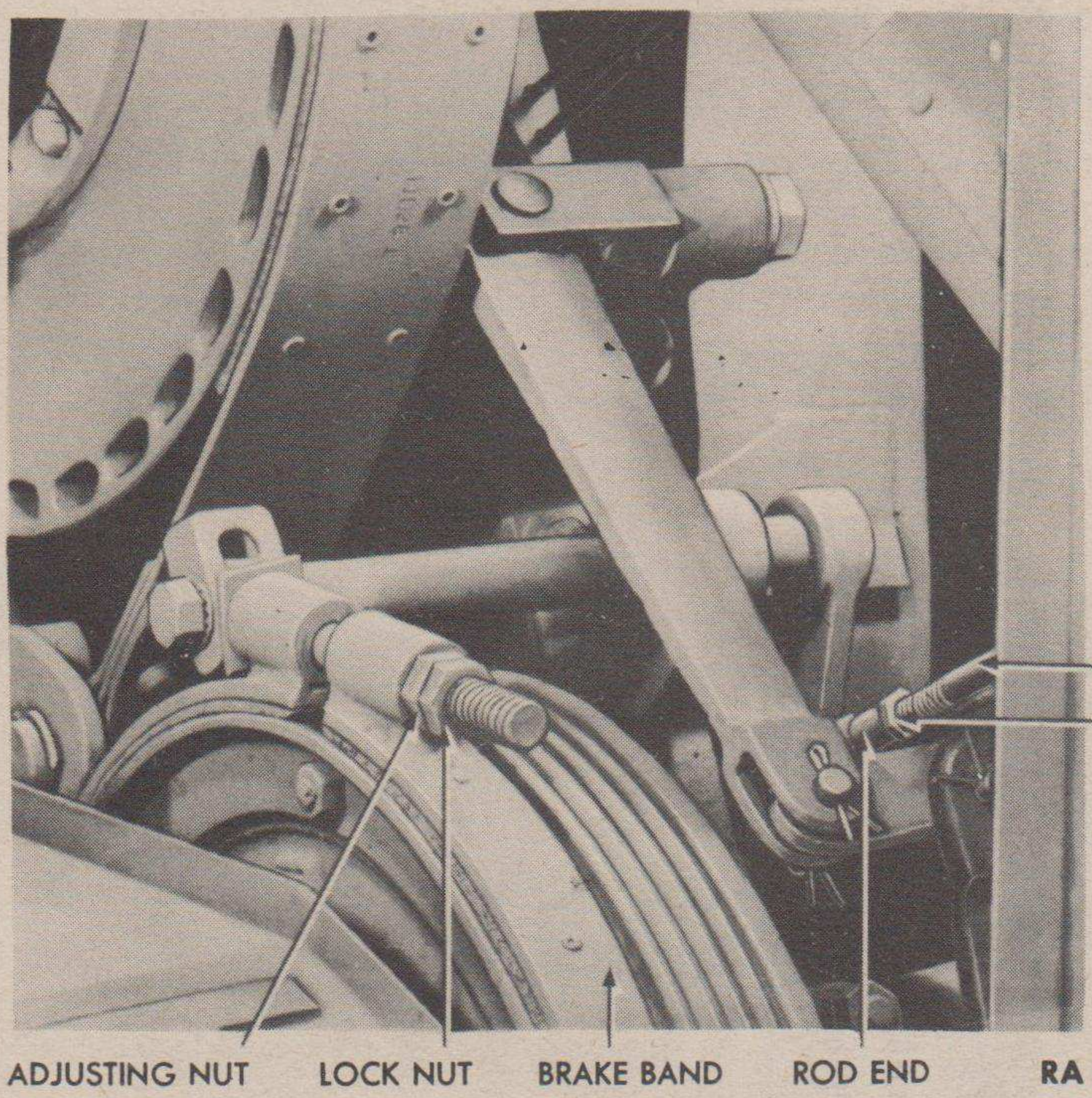


Figure 99—Swing Brake Adjustment

116. SWING BRAKE AND LINKAGE.

a. Description. The swing brake is mounted around the left-hand swing clutch drum. It consists chiefly of two brake half bands, band linings, dead end anchor, rod, two rod ends, shaft crank, operating shaft, adjusting screw, and hand lever. The function of the brake is to prevent the swing drum from turning as necessary for turntable operation.

b. Adjustment (fig. 99).

(1) Loosen jam nut, and tighten adjusting nut so that brake engages fully when swing brake hand lever is in the engaged position. Tighten jam nut when proper adjustment is obtained. Make sure brake releases uniformly and fully when hand lever is in the released position.

(2) Remove cotter pin and pin which secures rod to hand lever. Loosen lock nut and turn rod end as necessary to aline holes with

hand lever when it is in the "OFF" position. Install pin and cotter pin, and tighten lock nut.

117. TURNTABLE ROLLERS.

a. Description. Four rollers are mounted on the turntable base (two front and two rear) above the ring gear. Each roller consists of a solid tapered wheel which rides on a bearing mounted pin attached to a special bracket on the turntable base. The function of the rollers is to transfer the weight of the turntable assembly to the carrier, and to permit it to be turned as necessary for vehicle operation.

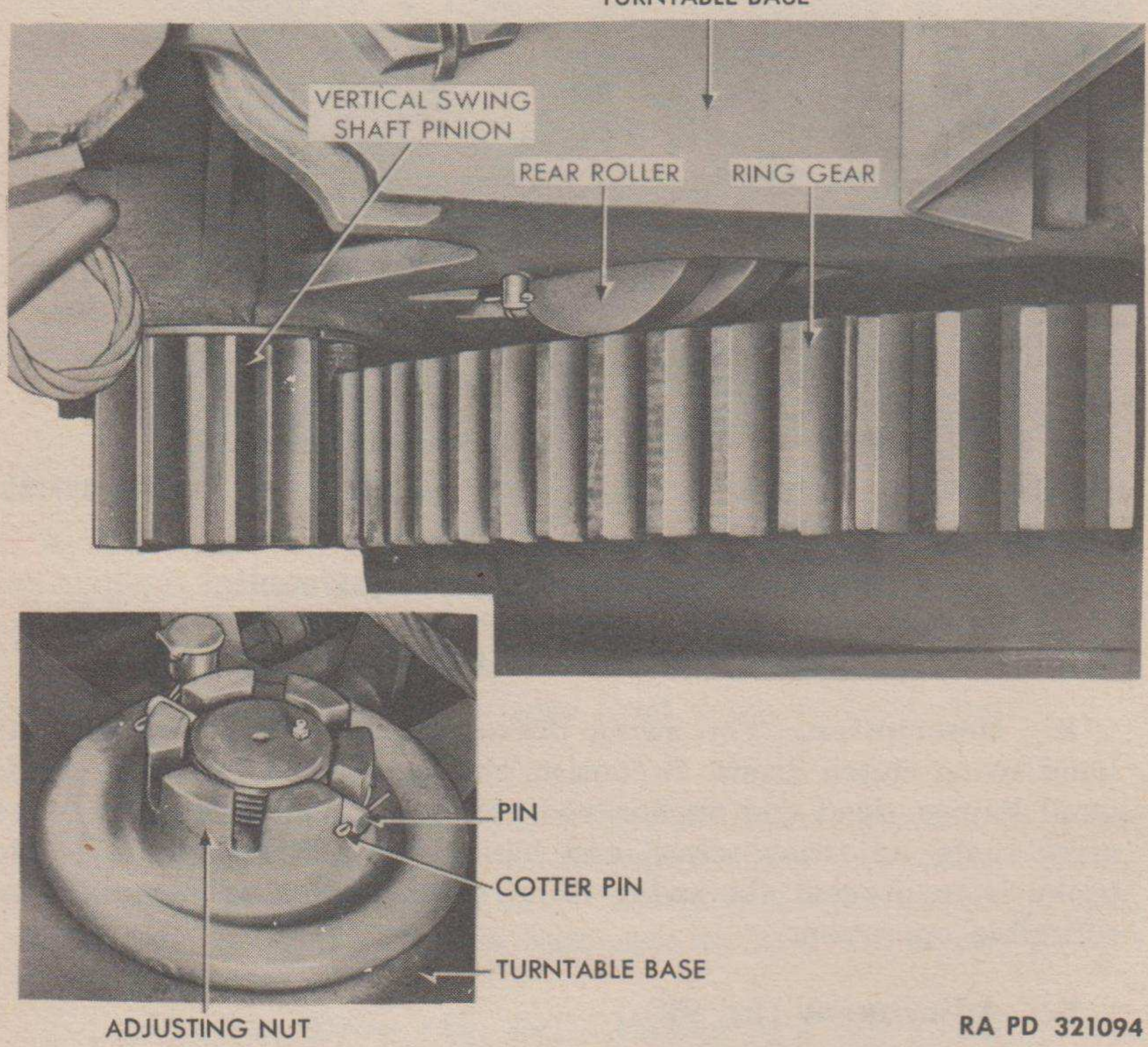


Figure 100—Turntable Roller Adjustment

b. Adjustment (fig. 100). The need for adjustment of the turntable rollers will depend on the extent to which the turntable assembly is used and the weight of loads lifted. Any sign of rocking or teetering of the turntable assembly is an indication that rollers need adjusting, as follows:

(1) Remove load from boom, and check position of vertical swing shaft pinion in relation to ring gear.

(2) Pick up load, and measure the difference in position of pinion to ring gear. If this difference is ¼ inch or greater, tighten center pin adjustment.

(3) Remove cotter pin and pin which holds adjusting nut in position. Turn adjusting nut to right until difference in position between pinion and ring gear with boom load and without boom load is ⅛ inch. Secure adjusting nut with pin and cotter pin.

Section XXVII

BOOM AND ACCESSORIES

118. DESCRIPTION AND DATA.

a. Description. A special 22-foot boom is mounted from the front of the turntable assembly, and is held in an inclined position by the boom hoist cable. At the top end of the boom is the boom point sheave assembly and rope roller guard assembly. At the center and above the boom is the boom harness assembly. The function of the boom and accessories is to extend load to the point where it can be moved with maximum efficiency.

b. Data.

(1) BOOM.

Length, short half	9½ ft
Length, long half	12½ ft
Type	Lattice
Construction	Welded

(2) SHEAVES.

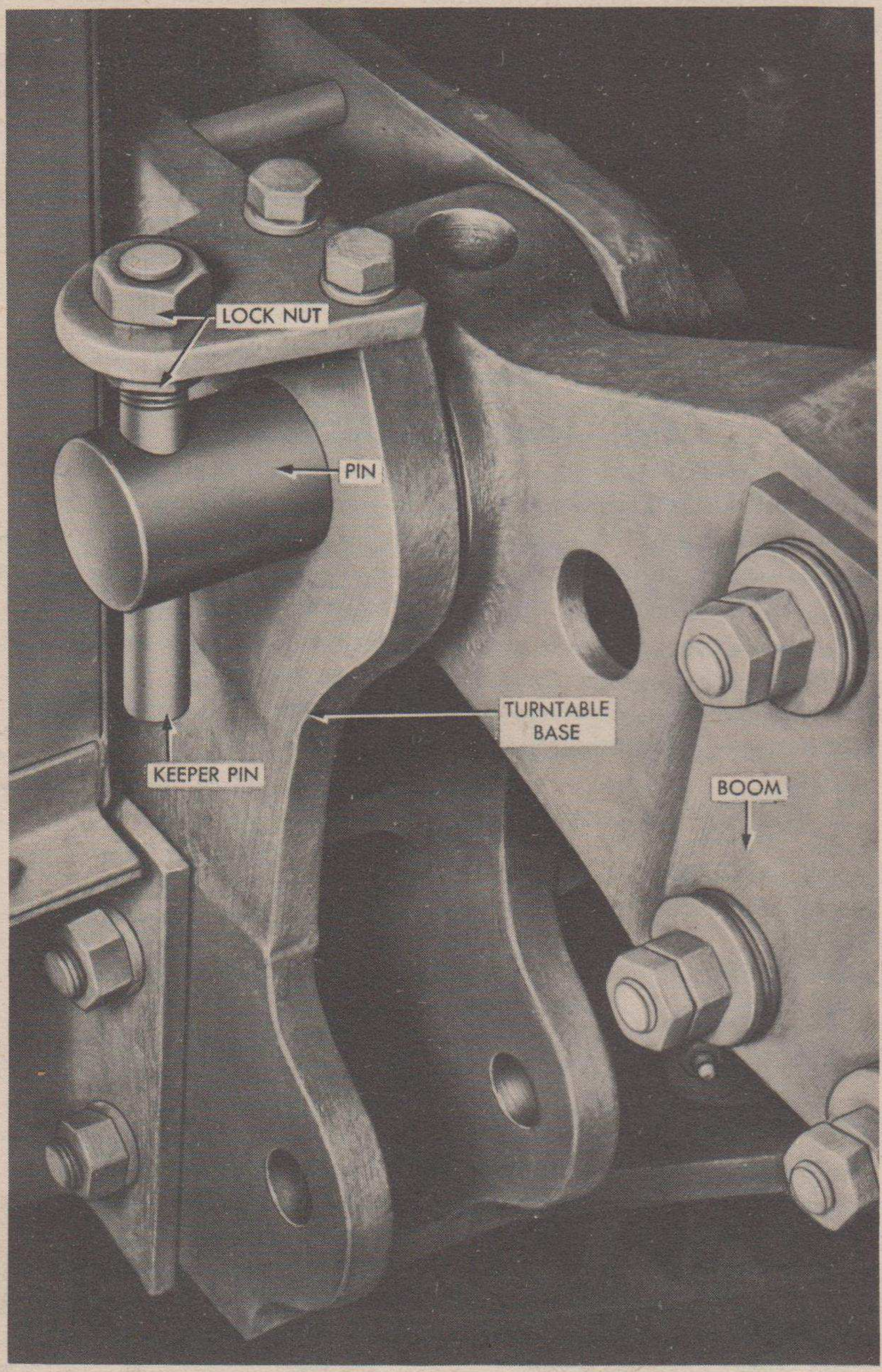
Channel to cable clearance	1/16 in. min to ⅛ in. max

119. BOOM.

a. Description. The all-welded, lattice-type boom is made in two sections especially designed for use with this vehicle. The method of bolting the sections together is purposely such that no extension can be inserted between them. The boom serves to mount the point shaft assembly, rope roller guard assembly, and boom harness assemblies, and to hold the load away from the vehicle.

b. Removal (fig. 101).

(1) Swing turntable assembly so that boom extends from rear of vehicle.



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Figure 101—Boom Foot

BOOM AND ACCESSORIES

(2) Detach load from hoist cables and wind cables on hoist drums.

(3) Erect suitable cribbing to level of boom foot pin holes at both ends of boom, and lower boom so that it will rest on cribbing.

(4) Detach boom harness cables from boom point shaft, and wind boom hoist cable on drum until harness is clear of boom.

(5) Remove the two lock nuts, keeper pin, and pin which secures boom to turntable base (fig. 101).

(6) Pry boom loose from base, and drive vehicles slowly forward until boom is completely detached.

c. Installation. Reverse removal procedure outlined in subparagraph **b** above.

120. GUIDE ROLLERS.

a. Description. Five cable guide rollers are mounted through two supports attached to the underside of the boom point. Each consists of a roller, shaft, and two bushings. The function of the rollers is to guide the cables through the boom point sheaves.

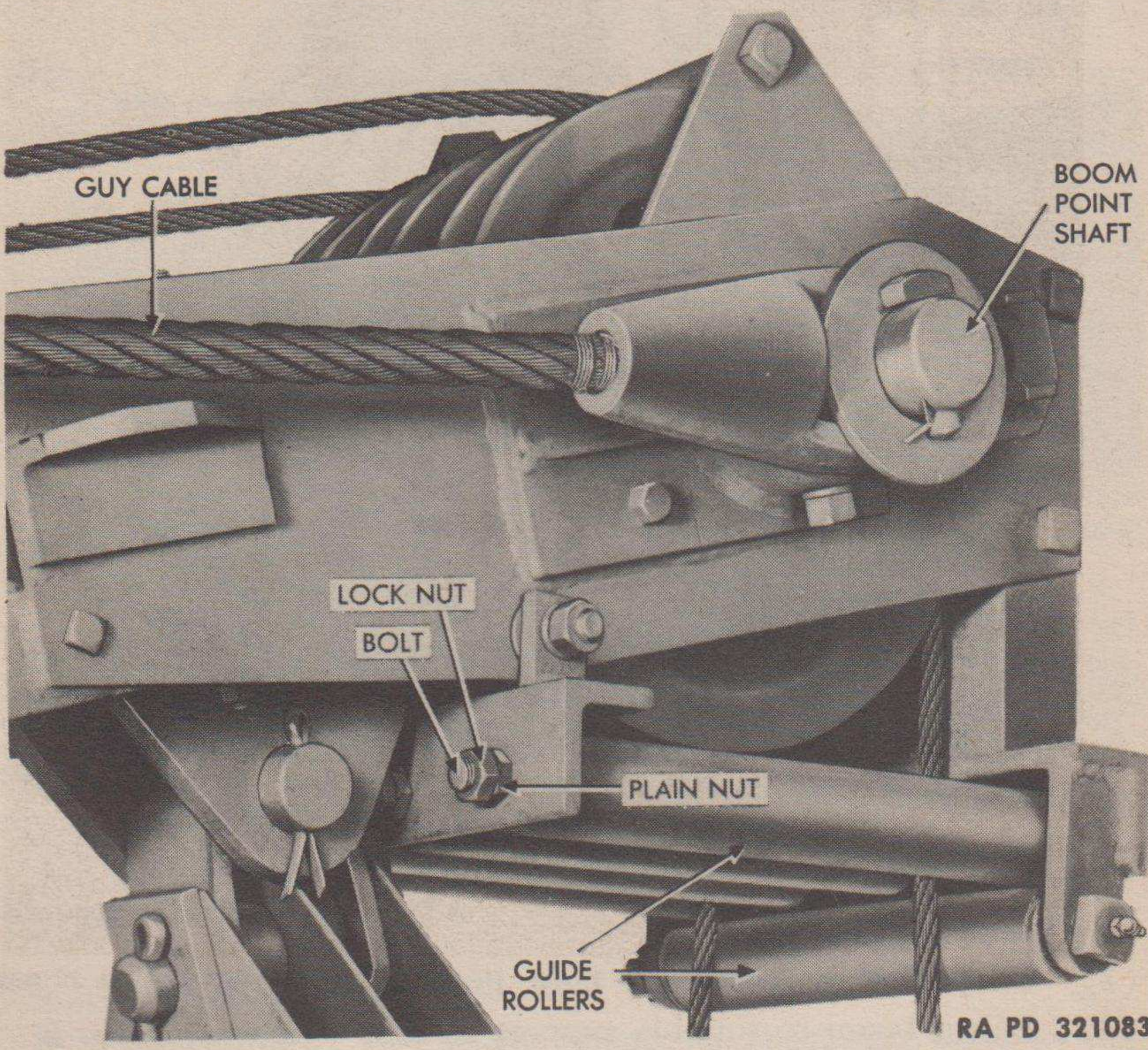


Figure 102—Cable Guide Rollers

b. Removal (fig. 102).

(1) Remove lock nut and plain nut which secures bolt to bracket.
(2) Drive bolt from roller and bracket and remove roller.

c. Installation (fig. 102).

(1) Position roller between supports and insert shaft.
(2) Install plain nut and lock nut which secure shaft to supports.

121. SHEAVES.

a. Description. Three boom point sheaves are mounted on a shaft positioned through the boom point. Each consists of a cast-iron wheel with a flanged or grooved outer edge. The function of the sheaves is to guide cables and to support cable load during operation. A small tagline sheave is mounted in a shackle bracket suspended from lower part of boom top section. It serves to guide the tagline and to prevent it from becoming fouled, especially when clamshell is working in close to vehicle.

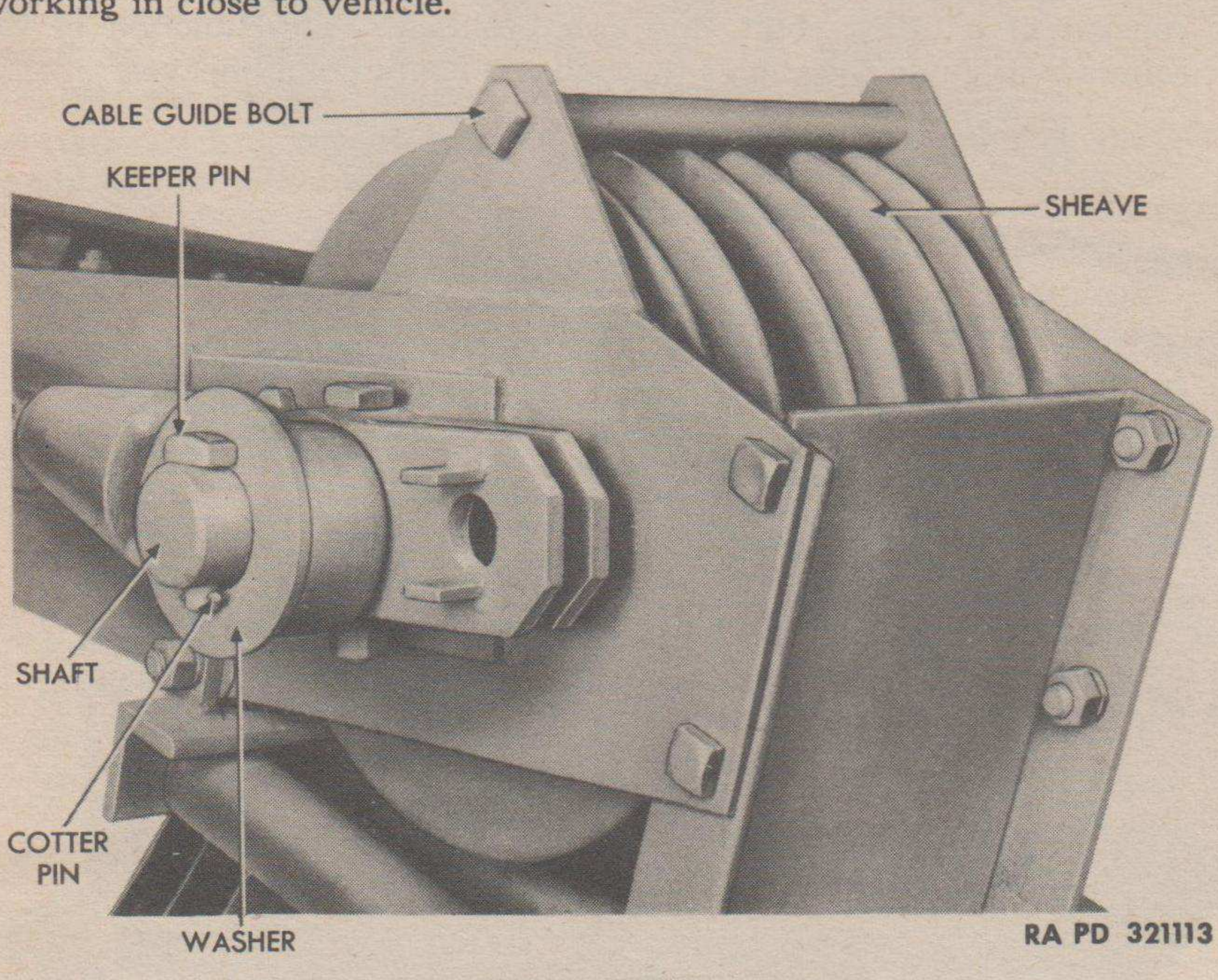


Figure 103—Boom Point Sheaves

b. Removal (fig. 103).

(1) Remove load from both hoist lines.
(2) Lower boom to suitable support so that weight of boom is removed from boom hoist cable.

(3) Remove cotter pin, keeper pin, washer, and cable socket from either end of boom point shaft.

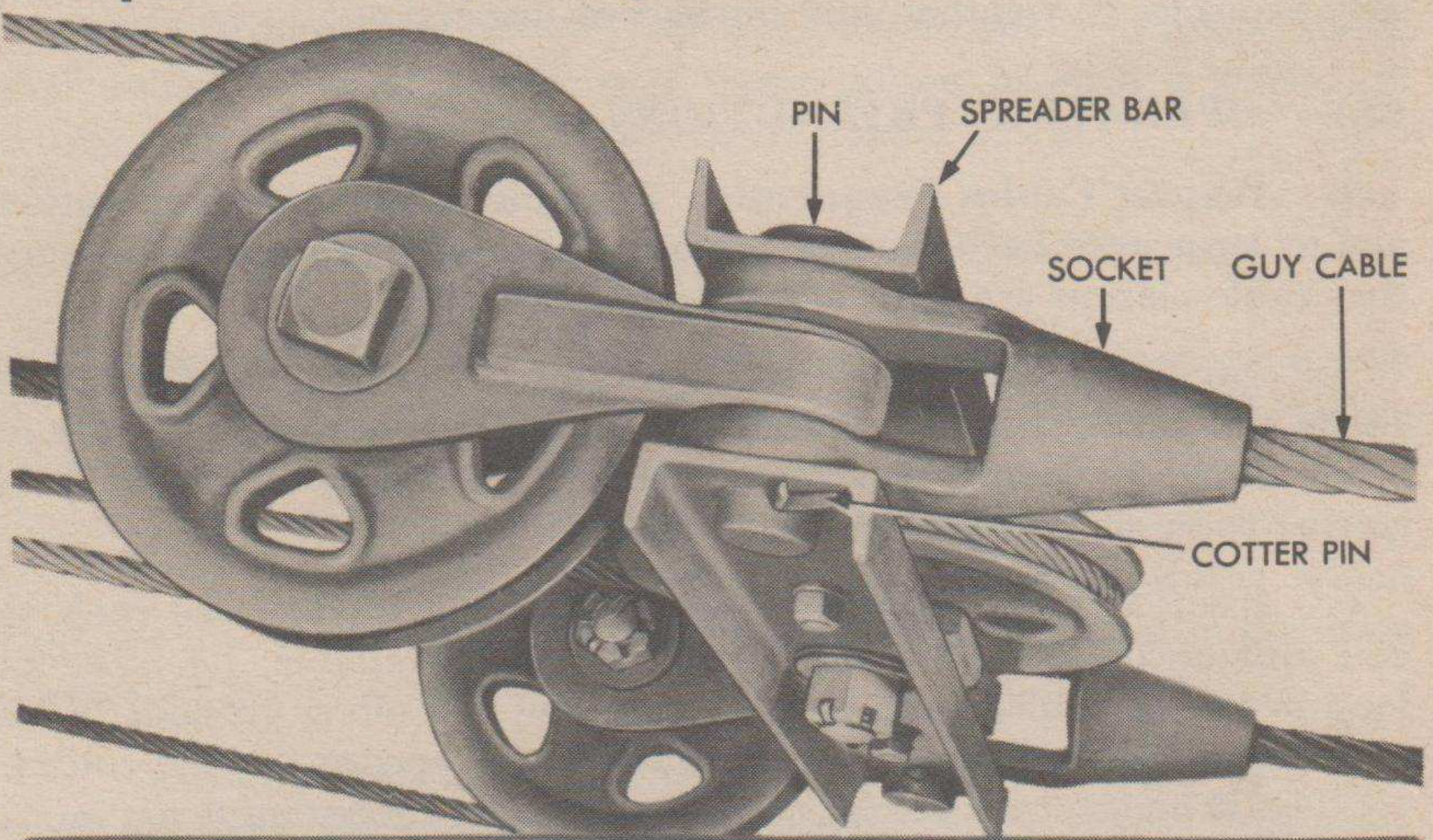
(4) Drive shaft from assembly.

(5) Remove cable guide bolt from boom point and lift sheaves out.

c. Installation. Reverse removal procedure outlined in subparagraph **b** above.

122. BOOM HARNESS.

a. Description. The boom harness is suspended by cables midway between the boom point and boom foot. It consists of three sheaves, two links, two spreader bars, two yoke-type cable sockets, two plain cable sockets, and two guy cables. One sheave is bolted between center of spreader bars in a horizontal position. Each of the other two sheaves is mounted in a link pinned through the guy rope sockets to each end of the spreader bars in a vertical position. The boom harness is held in suspended position at one end by boom hoist cable reeved through sheaves, at the other end by the two guy cables attached to boom point shaft. The function of the harness is to provide necessary leverage to facilitate derricking of the boom.



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Figure 104—Boom Harness

b. Removal (fig. 104).

(1) Lower boom to convenient support so that weight will be removed from boom hoist cable.

(2) Remove boom hoist cable (par. 128).

(3) Remove cotter pin, pin, and washer from each end of boom point shaft, and pull off cable socket.

(4) Remove cotter pin and pin which secures each guy cable socket to spreader bars.

c. Installation. Reverse removal procedure outlined in subparagraph **b** above.

Section XXVIII

REEVING

123. GENERAL.

a. Equipping the turntable assembly for various types of operation, or changing from one type to another requires the installation and removal of various sizes of cable. This is called "reeving." Satisfactory and safe operation demand proper handling, replacement, and lubrication of all cables. Extreme care must be exercised to prevent damage to cables through overloads, sudden stops, unnecessary exposure to weather, and infrequent inspection.

124. OPERATING PRECAUTIONS.

a. Inspect Cables Frequently. Examine cables before operation and at least once each day for broken or frayed strands. Make sure that cable clamps are tight and properly installed.

b. Do Not Operate With Kinked Cable. Use of cable with sharp bends will cause strands to break quickly and cable to fail. Carefully observe the recommended procedure for installing, removing, and storing cable to prevent it from kinking.

c. Keep Cables Properly Coiled. When available, use reels to coil and uncoil cables. When reels are not available, tie a 3-foot loop in end of cable, stand loop on end, and roll along ground. Wire cable together as frequently as necessary to ensure proper coiling. NOTE: *Whenever expedient, remove and coil a cable that is not being used.*

d. Operate Installed Cable With Light Load. Each time a cable is installed, operate it for a few minutes with a light load. This will permit it to become properly seated in sheaves and adjusted to working conditions. When cable is thoroughly seated, remove load and permit cable to turn by itself. This will eliminate any twists that may have developed.

e. Keep Cables Clean. Frequent use of cables may cause them to become embedded with dirt. Clean cables with dry-cleaning solvent and a stiff, nonabrasive brush. After cleaning, lubricate cables thoroughly.

f. Reverse Worn Cables and Inspect Sheaves. Remove and reverse cables that become worn in one place only. Inspect sheaves to determine cause of wear. Use file to remove burs from sheave channels. Replace sheaves that are scored or otherwise damaged.

g. Keep Cables Properly Alined on Cable Drums. To avoid sudden jerks and unnecessary cable wear during operation, make sure cables wind properly on drums. Remove and rewind cable if necessary to aline properly.

h. Use Cables of Specified Length. When a cable is unwound for maximum working requirements, at least 1½ turns must remain on cable drum. A smaller number of turns will exert excessive strain on cable drum socket and endanger operation and personnel. CAUTION: *Replace extremely worn or damaged cables promptly before they result in accidents and possible serious injuries to operators and maintenance personnel, and damage to vehicle.*

125. INSTALLING CABLE CLAMPS (fig. 105).

a. Locate Clamps. Position clamps around cables so that distance apart, center-to-center, is 6 times diameter of cable. For example, distance between clamps securing a ¾ inch cable should be 6 times ¾ inch, or 4½ inches.

b. Attach U-bolts Properly. Position U-bolts around dead end of cable and clamp securely to cable.

c. Inspect Clamps After Operation. After 2 hours of operation, check clamps to see that nuts and U-bolts have not worked loose. Inspect all cable connections for proper tightness at least every third shift.

126. INSTALLING AND REMOVING CABLE FROM SOCKET.

a. Installation (fig. 106).

(1) Drive wedge from cable socket.

(2) Reeve cable through socket basket and return, so that dead end extends about 3 inches. Leave large enough loop to permit insertion of wedge.

(3) Place narrow end of wedge into socket, and pull cable tight.

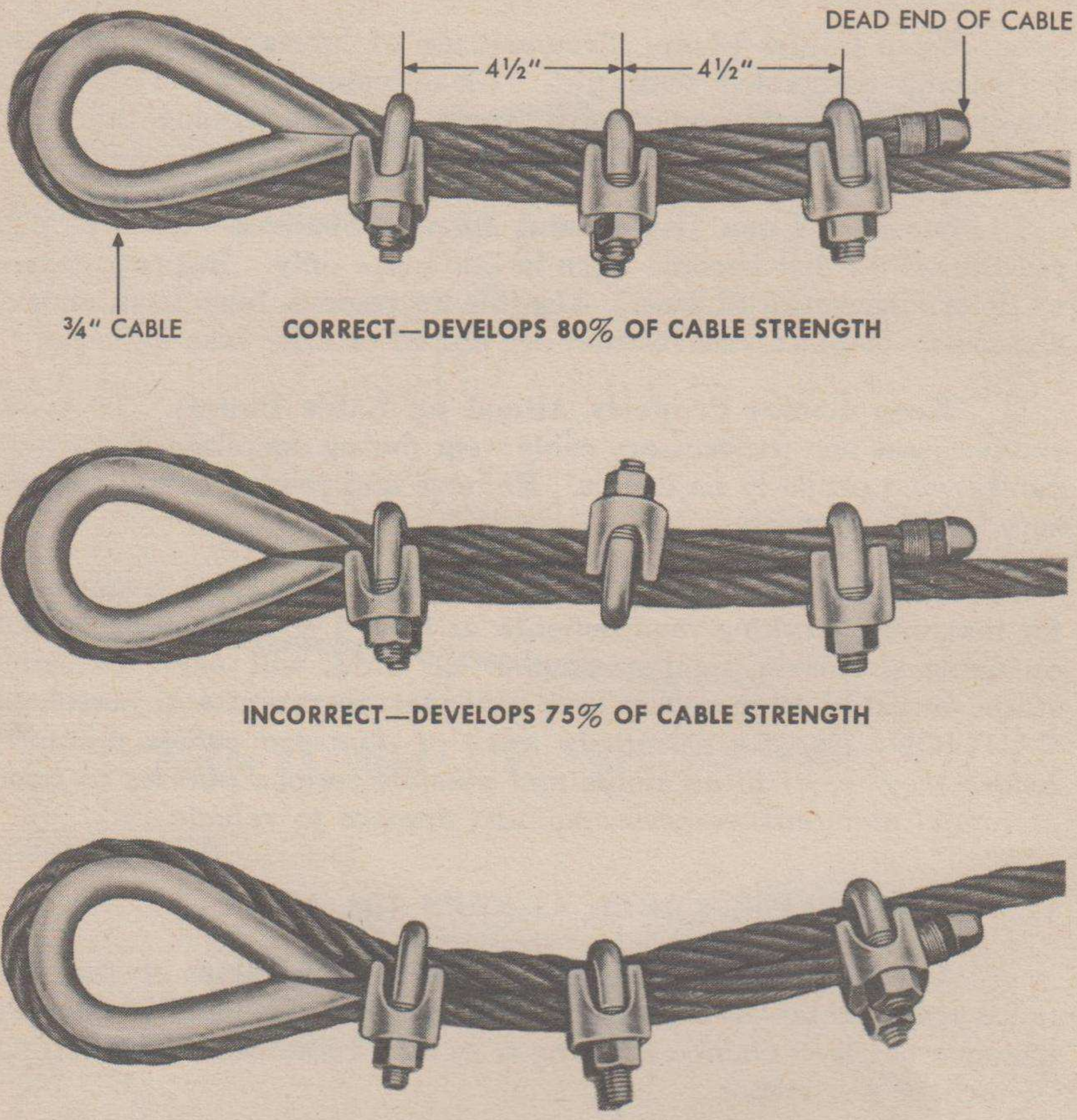


Figure 105—Installing Cable Clamps

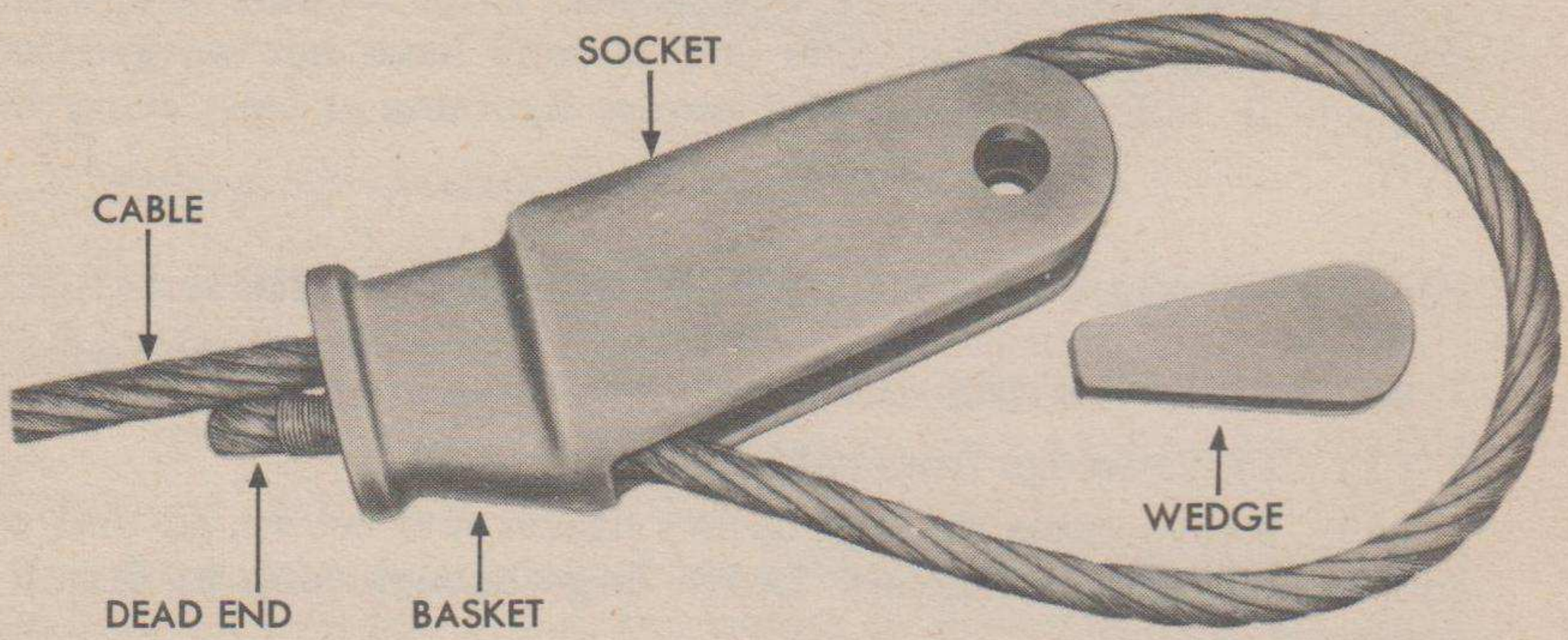


Figure 106—Installing Cable in Cable Socket

(4) Engage load to tighten wedge in basket. Test fit by attempting to push cable back from socket. Inability to remove cable indicates that wedge is tight.

b. Removal.

(1) Slack cable off.

(2) Position drift pin to small end of wedge, and drive wedge loose.

(3) Lift wedge out, and pull dead end of cable back through socket.

(4) Straighten cable out and remove socket. NOTE: *After being removed a few times, wedges may become flattened, misshaped, or scored. This will prevent them from seating properly, and will permit cable under strain to be pulled out or damaged. File or grind rough surfaces from wedges and replace when damaged otherwise.*

127. DATA.

a. Clamshell.

Operation	Construction (Strands-Wires)	Diameter	Length
Holding line	6 x 19	5/8 in.	61 ft
Closing line	6 x 19	5/8 in.	101 ft
Tag line	7 x 19	5/16 in.	86 ft
b. Crane.			
Hoist line (6-part)	6 x 19	5/8 in.	164 ft
(5-part)	6 x 19	5/8 in.	142 ft
(4-part)	6 x 19	5/8 in.	120 ft
(3-part)	6 x 19	5/8 in.	98 ft
(2-part)	6 x 19	5/8 in.	76 ft
Whip line (1-part)	6 x 19	5/8 in.	54 ft
c. Boom.			
Boom hoist line	6 x 19	5/8 in.	127 ft

128. BOOM HOIST LINE.

a. Installation.

(1) Attach machinery frame guy cables to boom point shaft (fig. 102).

(2) Position boom hoist cable, on reel or coiled, at front of turntable assembly.

(3) Bring end of cable over left-hand machinery frame harness sheave and attach to boom hoist drum (fig. 109).

(4) Start engine, and wind bulk of cable on drum.

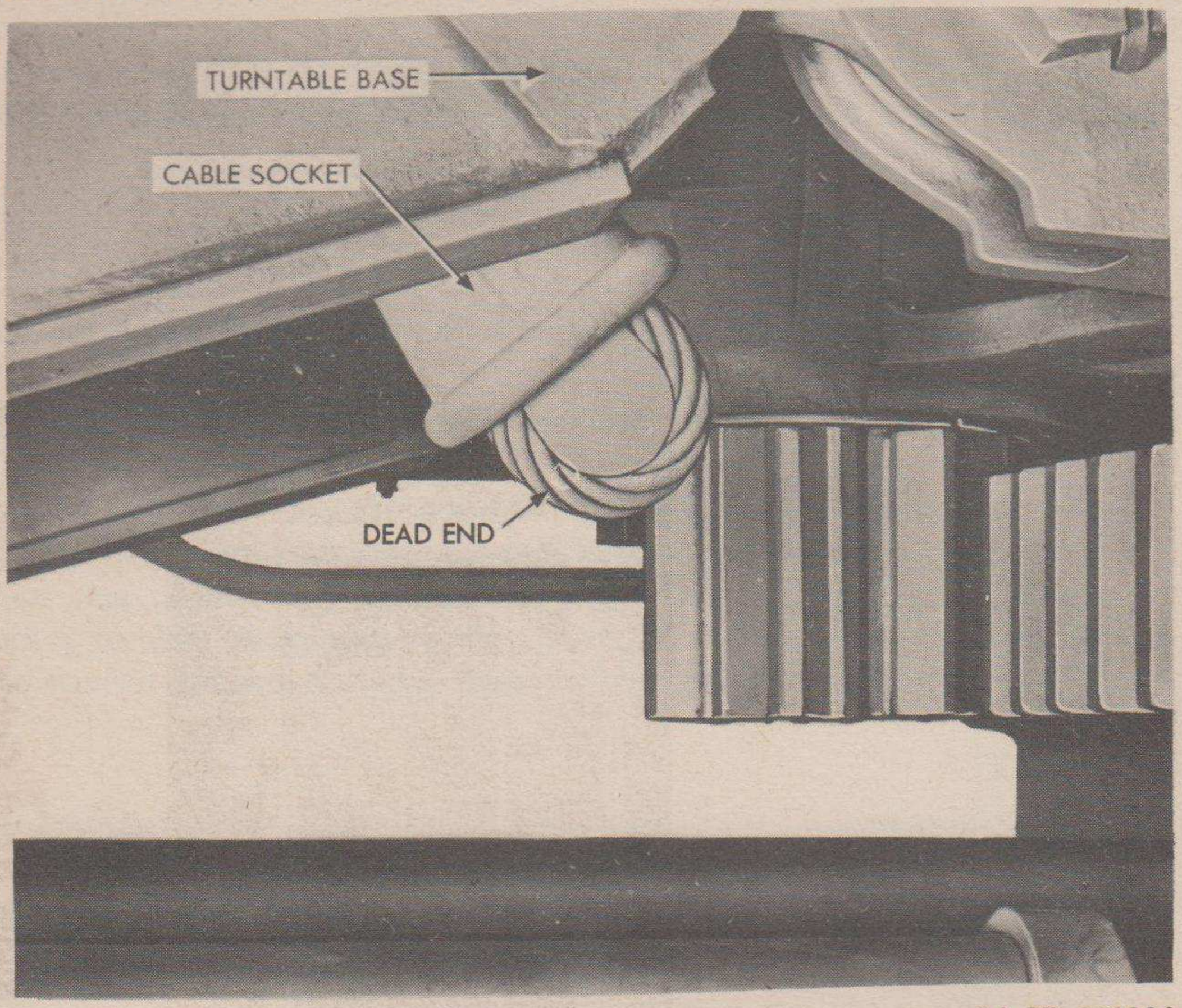


Figure 107—Anchoring Boom Hoist Cable

(5) Pull boom hoist hand lever back and block in this position. This will free drum and permit cable to be unwound as necessary to complete reeving procedure.

(6) Pass cable over top of left-hand boom harness sheave, and continue reeving sheaves from left to right in both harness assemblies (fig. 108).

(7) Pull cable over right-hand machinery frame harness sheave, and attach dead end to cable socket at bottom of turntable base (fig. 107).

b. Removal. To remove boom hoist line, reverse procedure outlined in subparagraph a above.

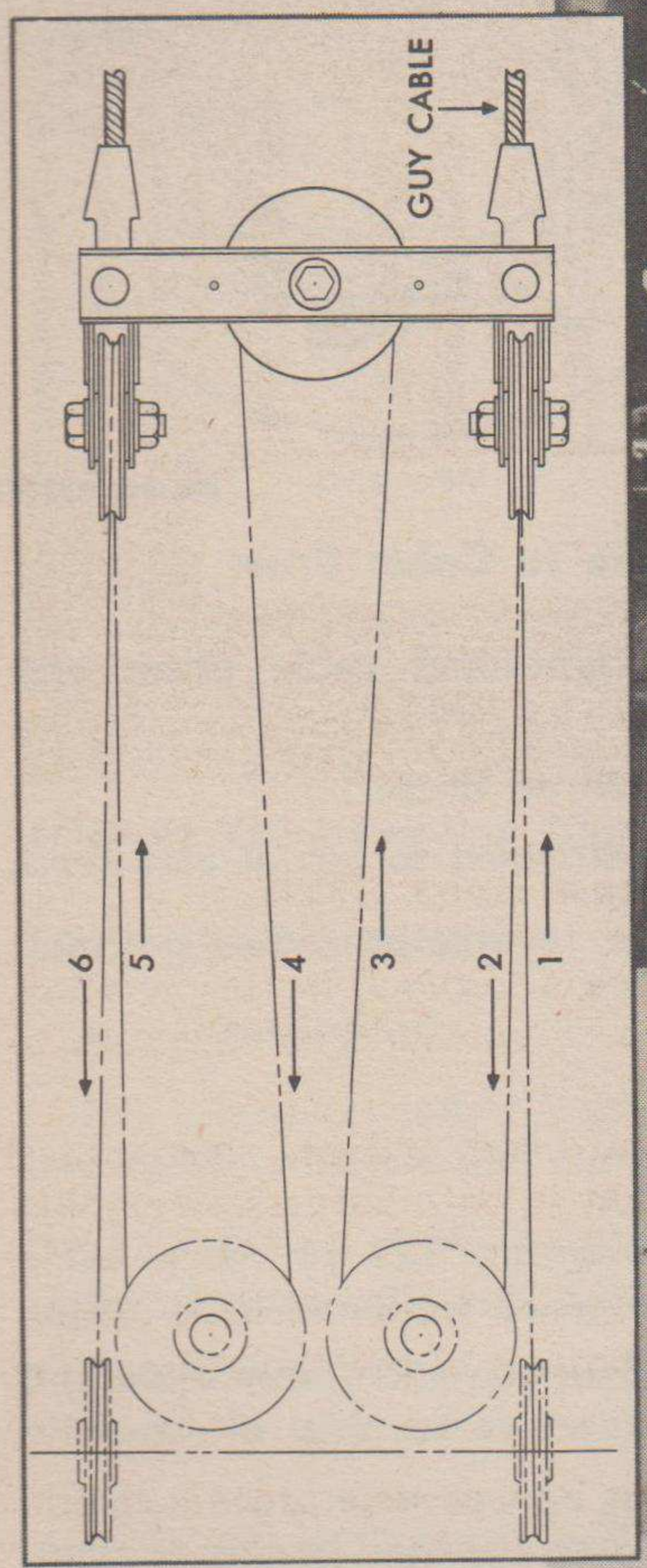
129. CLAMSHELL HOLDING LINE.

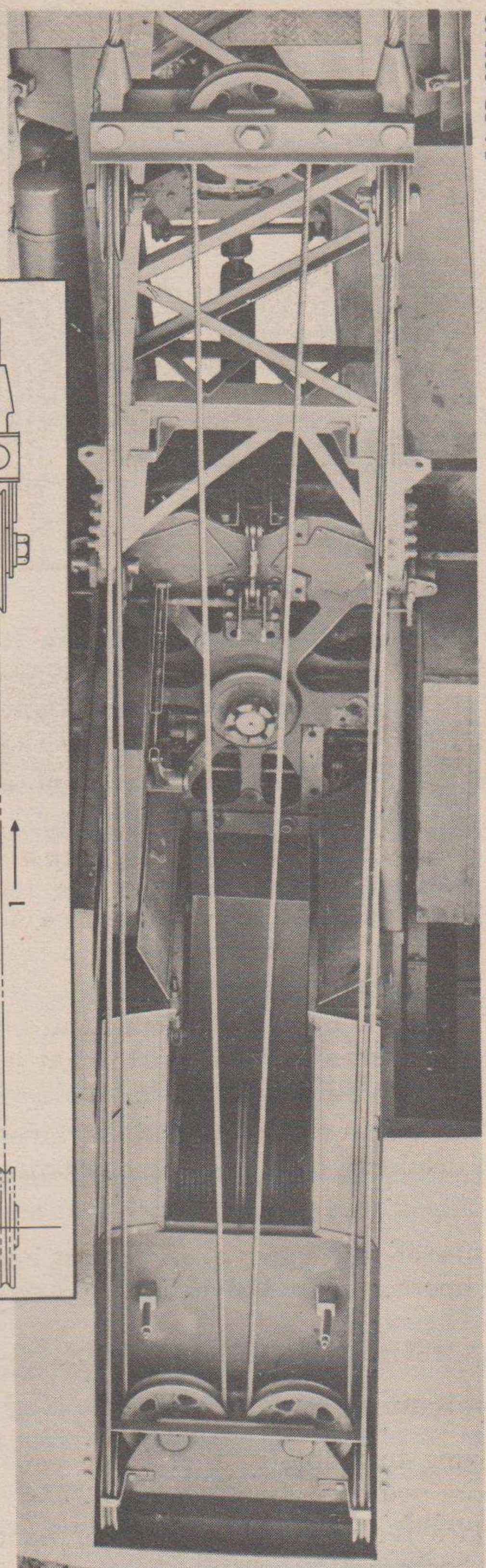
a. Installation (fig. 110).

(1) Swing turntable so that boom can be lowered to facilitate reeving boom point sheaves.

(2) Place reeled cable in front of boom, and pass cable over right-hand boom point sheave.

REEVING





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Figure 108—Reeving Boom Hoist Cable

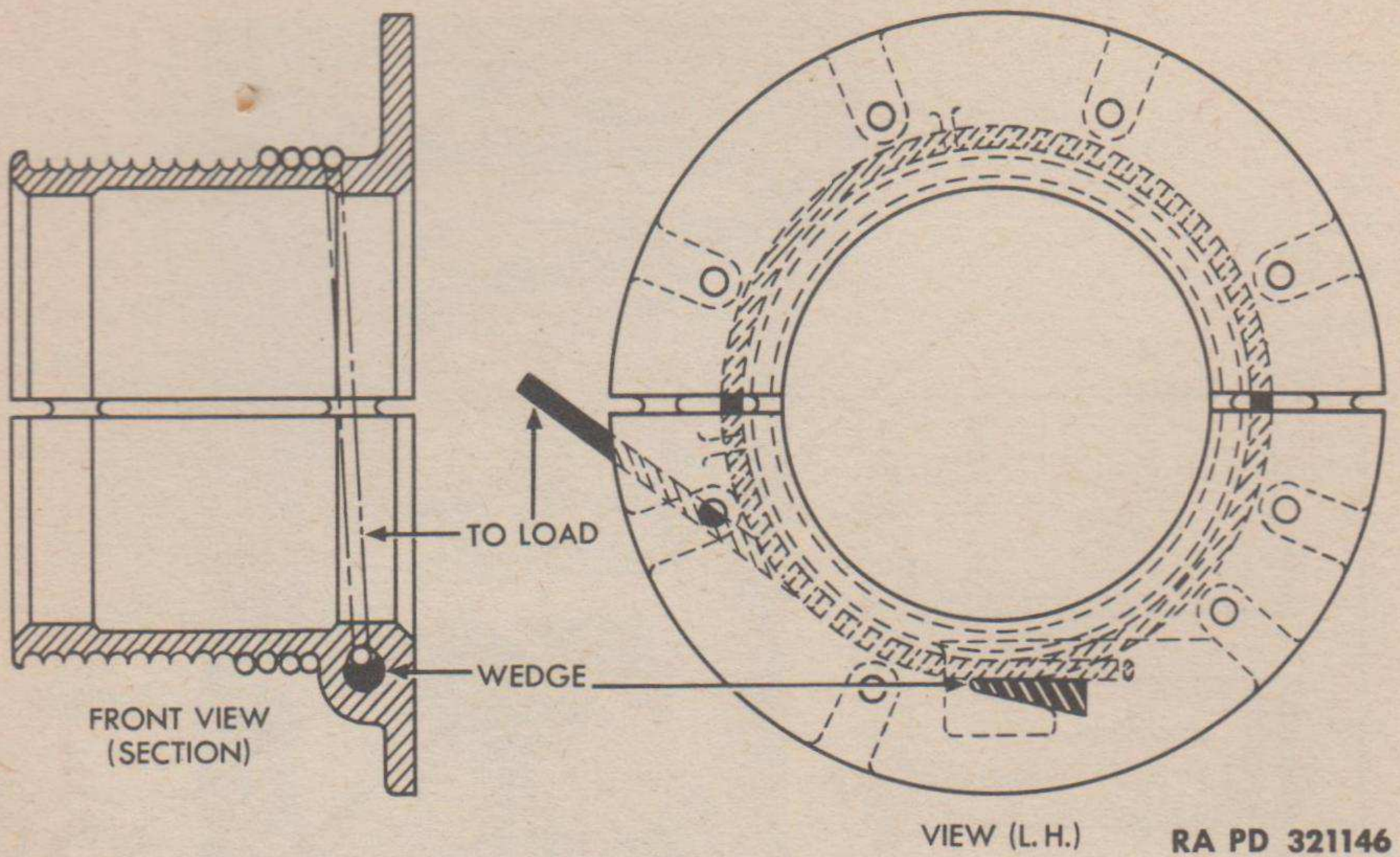


Figure 109—Attaching Cable to Cable Drum

(3) Pull cable back and under right-hand cable drum and attach (fig. 109).

(4) Use engine power to wind cable on drum.

(5) Connect cable to cable socket attached to top of clamshell.

b. To remove clamshell holding line, reverse procedure outlined in subparagraph **a** above.

130. CLAMSHELL CLOSING LINE.

a. Installation.

(1) Use procedure outlined in paragraph 129 to reeve cable over left-hand boom point sheave and wind on left-hand cable drum.

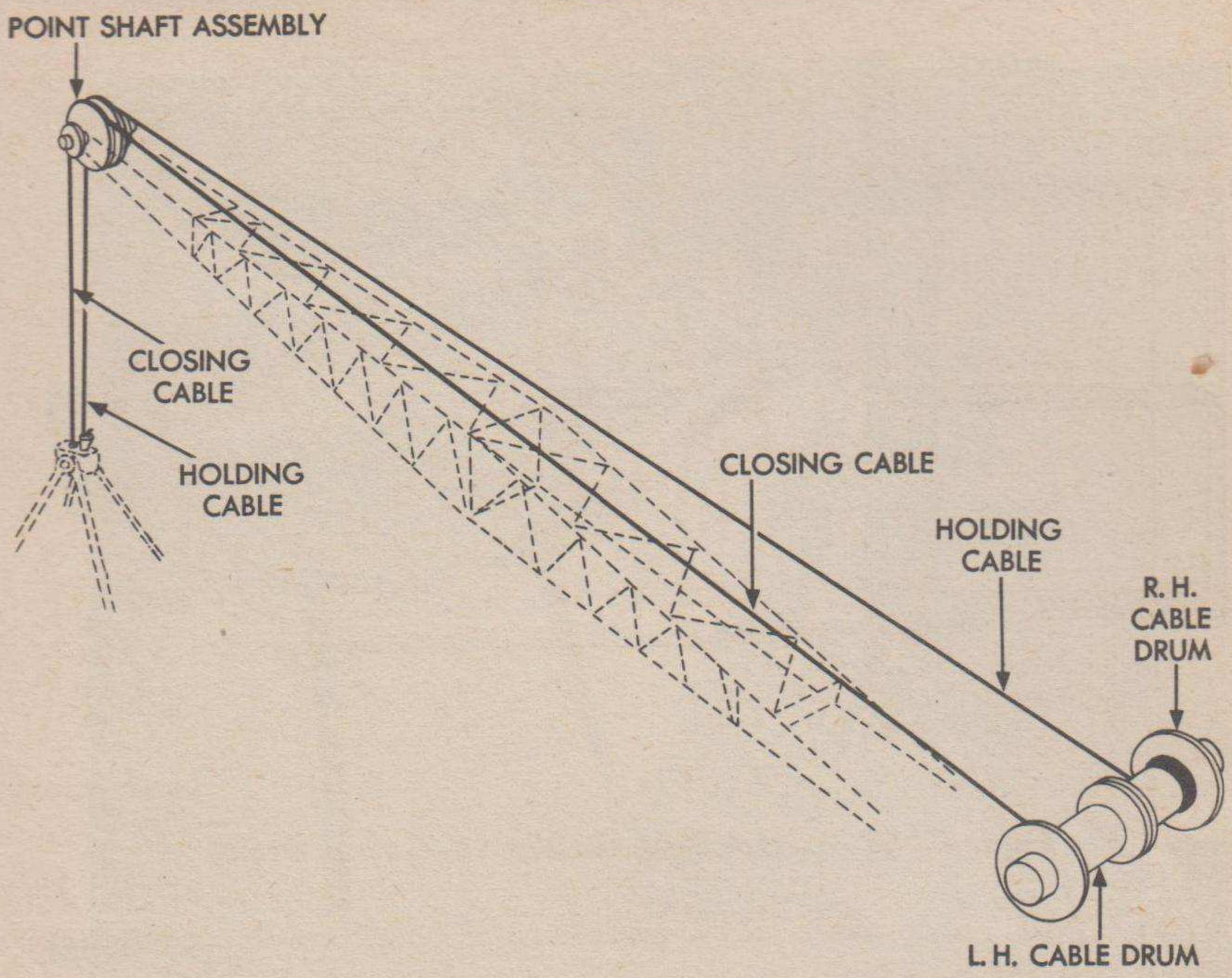
(2) Reeve cable alternately around upper and lower clamshell sheaves. Make sure cable passes around same side of opposite sheaves.

(3) Connect dead end of cable to socket attached to side of clamshell bucket head.

(4) After clamshell bucket has been raised and operated (without load) several times, detach both holding and closing cables, and permit them to turn as necessary to remove any twists or kinks that may have developed during reeving.

b. Removal. To remove closing line (cable), reverse procedure outlined in subparagraph **a** above.

REEVING



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Figure 110—Reeving Clamshell Holding Line and Closing Line

131. HOIST LINE.

a. Installation.

(1) Position upper hoist cable block shackle to boom bracket, and secure with pin and cotter pin (fig. 111).

(2) Attach cable to right-hand hoist drum according to procedure outlined in paragraph 129.

(3) Begin with lower block and reeve cables alternately through sheaves of upper and lower hoist cable blocks.

(4) Pass dead end of cable around lower spool of upper block and secure with three cable clamps.

b. Removal. Reverse procedure outlined in subparagraph **a** above.

132. TAGLINE (fig. 112).

a. Installation.

(1) Attach tagline to right-hand side of counterweight shaft.

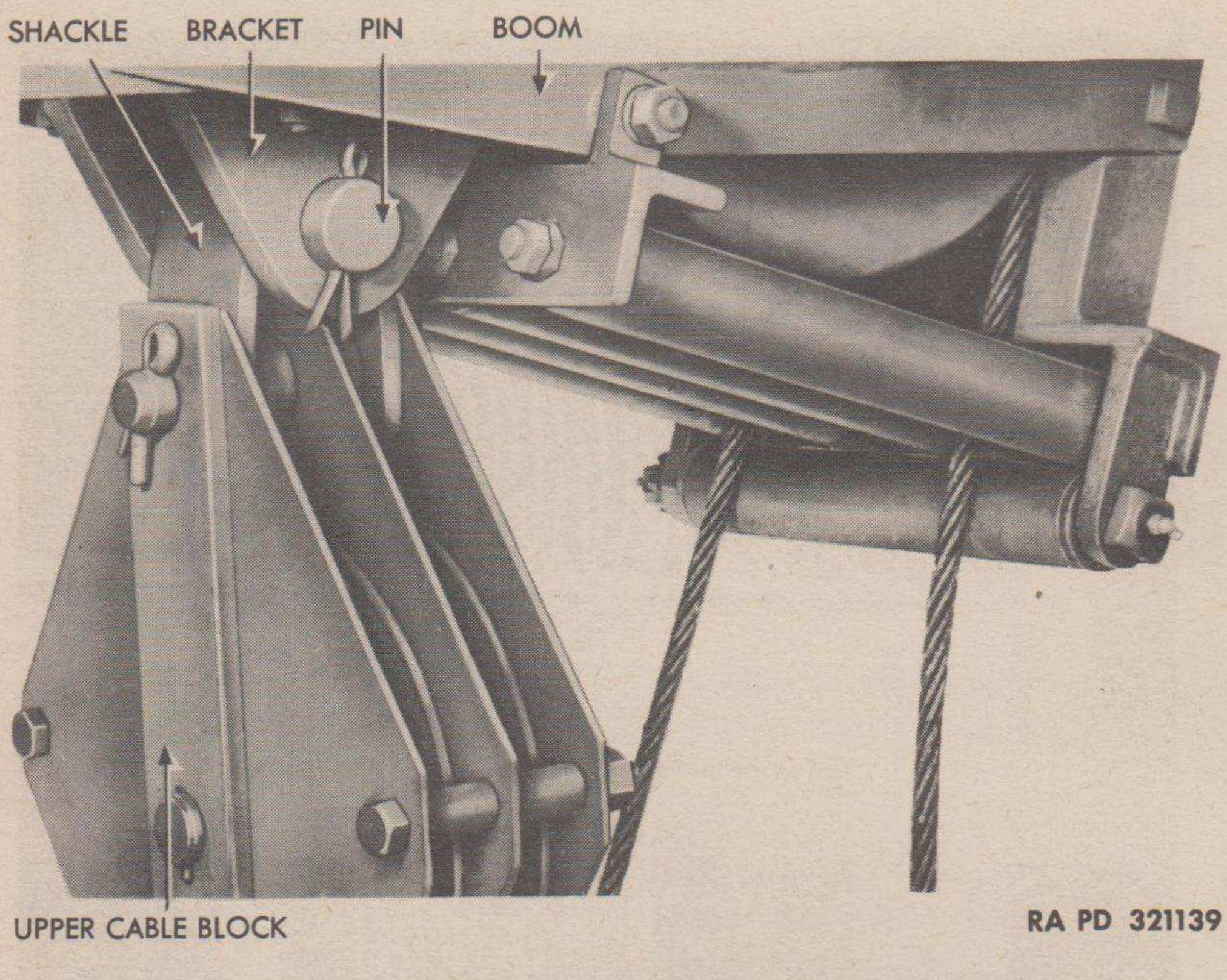


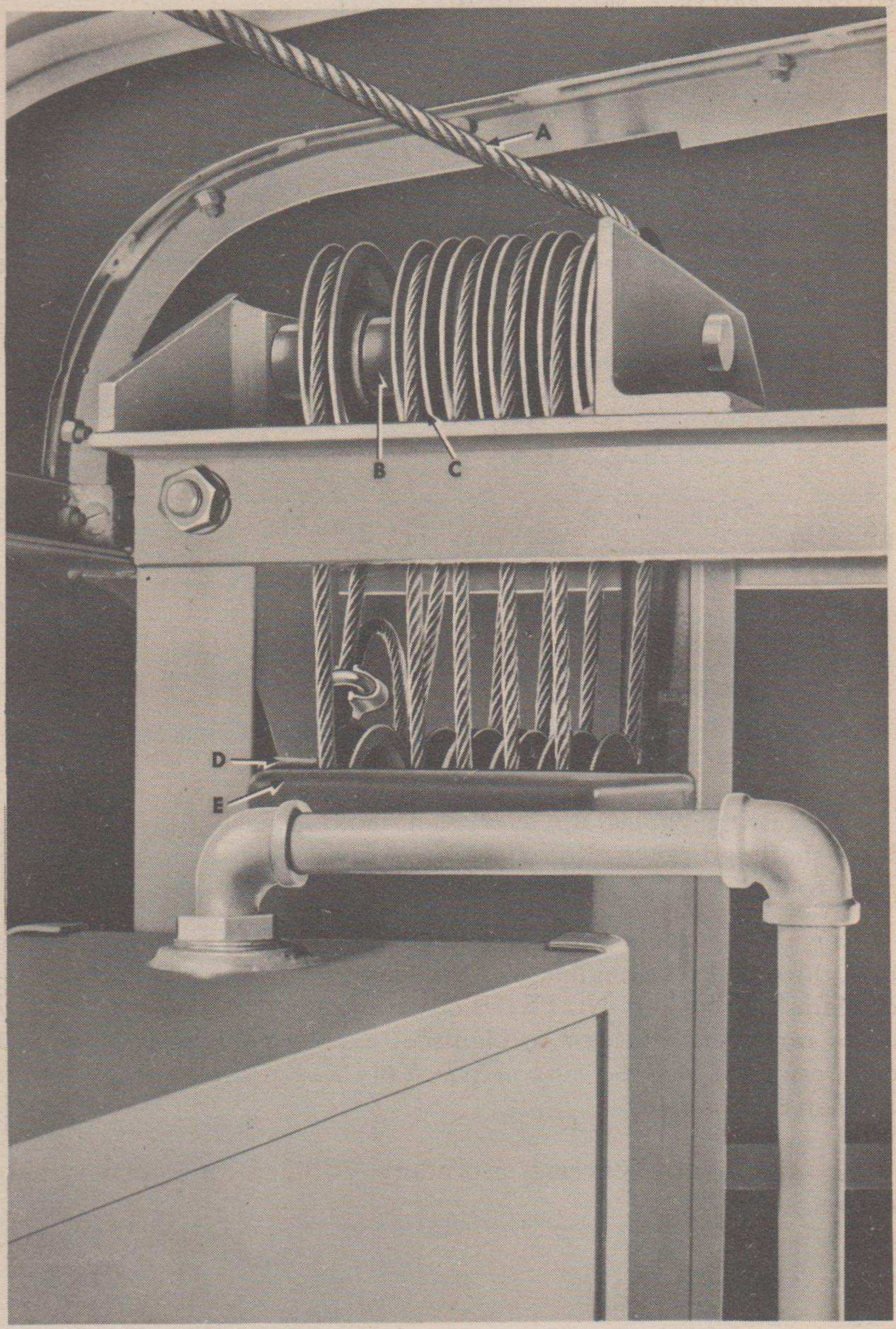
Figure 111—Upper Hoist Cable Block Installed

(2) Bring cables up over right-hand sheave of counterweight head shaft and reeve alternately through all sheaves, proceeding from right to left.

(3) Bring cable through two rollers at front right-hand side of cab, through boom tagline sheave, and attach to right rear arm pin of clamshell bucket. NOTE: *Block up tagline counterweight so that when tagline is attached to clamshell bucket and block is removed, counterweight will be suspended. This will provide necessary drag to keep tagline taut.*

b. Removal. Reverse procedure outlined in subparagraph **a** above.

REEVING



A—TAGLINE
B—COUNTERWEIGHT HEAD SHAFT
C—SHEAVE
D—COUNTERWEIGHT SHAFT
E—COUNTERWEIGHT

RA PD 321072

Figure 112—Reeving Tagline

CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16

Section XXIX

TURNTABLE ASSEMBLY ELECTRIC SYSTEM

133. DESCRIPTION AND DATA.

a. Description (figs. 113 and 114). The turntable electrical system consists mainly of two operating lights, three tumbler switches, brackets, ammeter, two ceiling light sockets, and battery. Sufficient No. 14 gage wire to connect electric plant is clamped to inside of cab. The function of the electrical system is to provide adequate lighting for machine operation when other means of lighting are unavailable.

b. Data.

(1) OPERATING LIGHTS.

Make ..... Guide
Model 536-A

(2) SWITCHES.

Make ..... Allen
Type ..... Tumbler

(3) CEILING LIGHTS.

Make ..... Moto Meter Gage and Equipment
Model G-524

(4) BATTERY.

Make ..... Willard
Type 6-volt

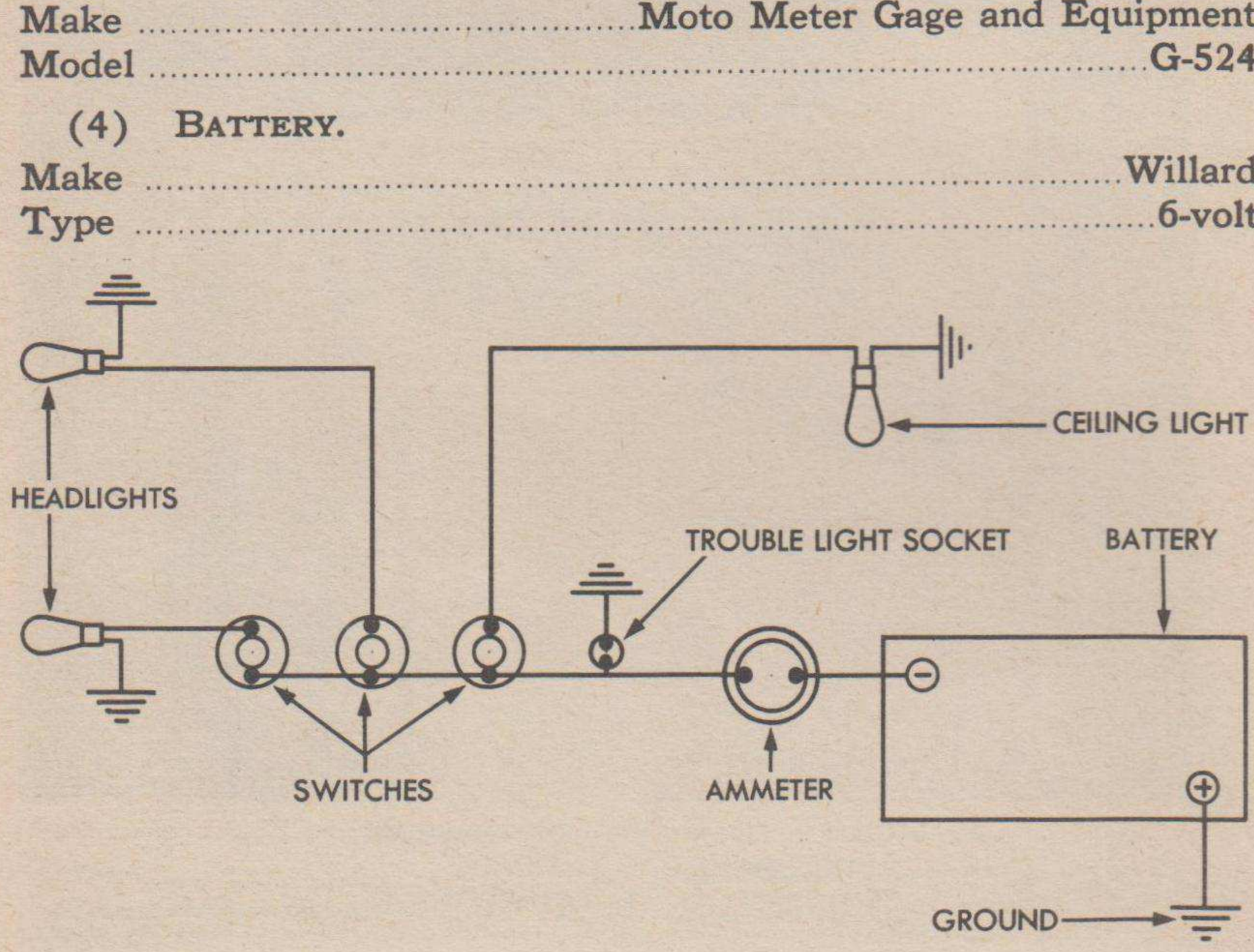


Figure 113—Turntable Wiring Diagram for Lights

TURNTABLE ASSEMBLY ELECTRIC SYSTEM

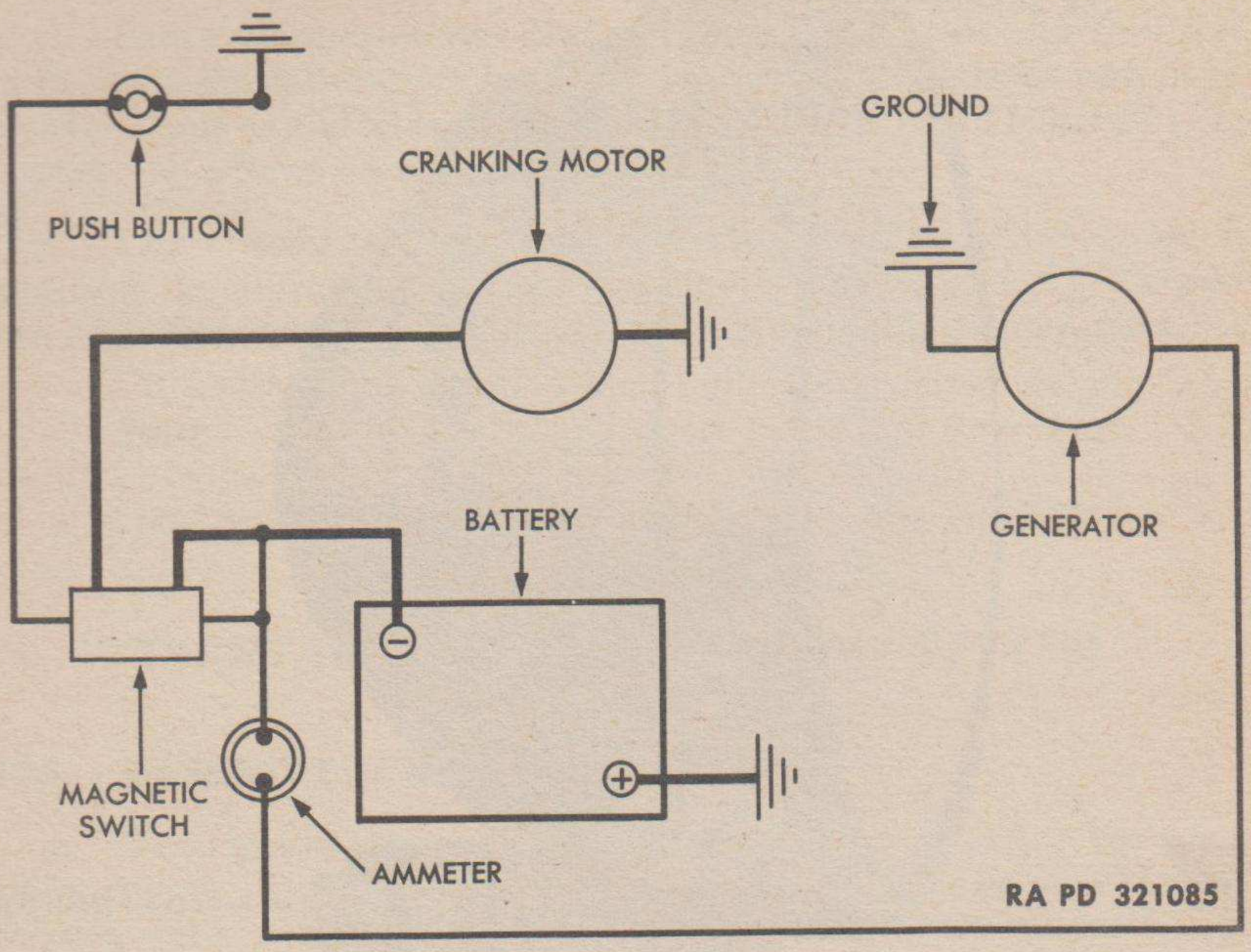


Figure 114—Turntable Wiring Diagram for Starting

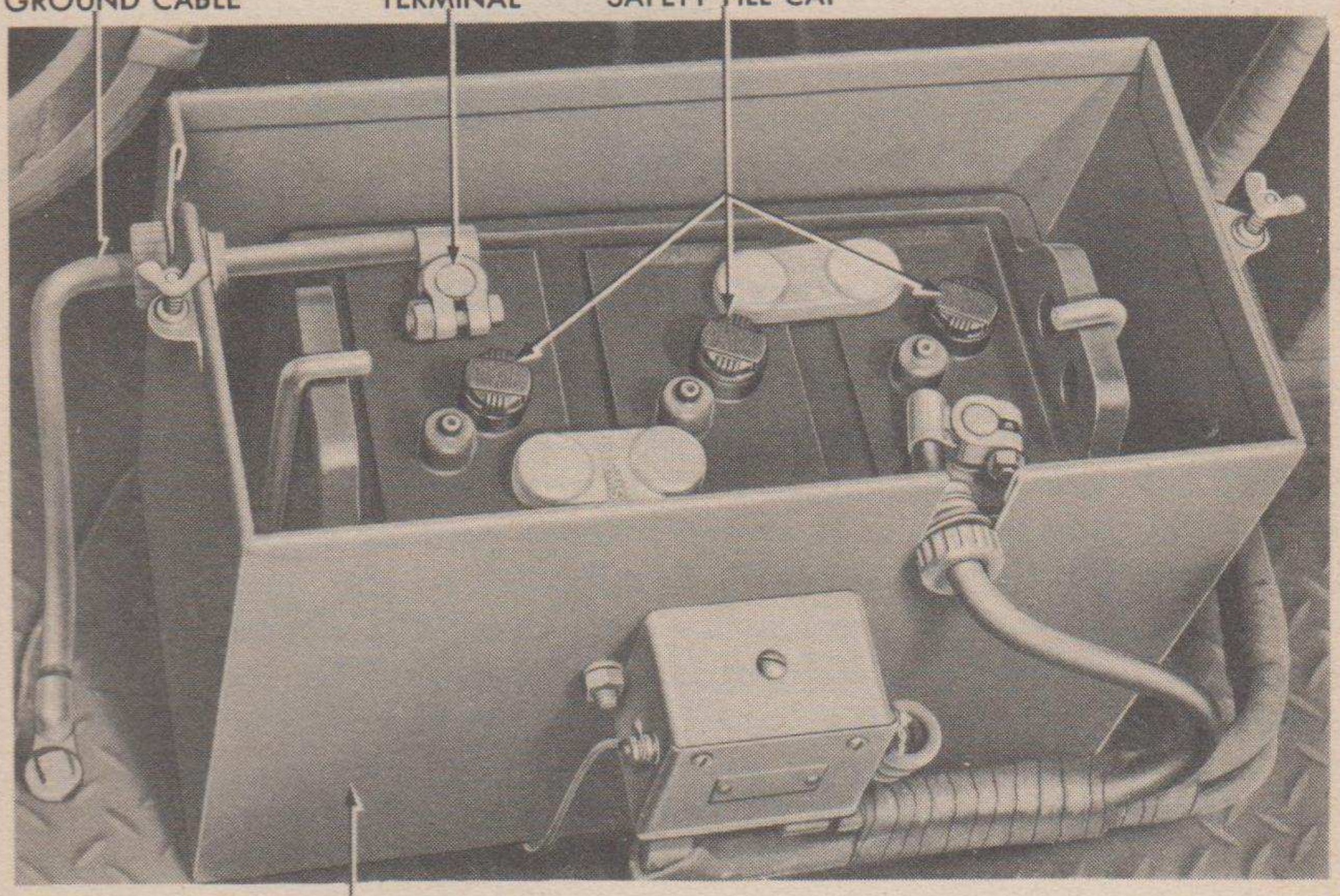


Figure 115—Turntable Battery

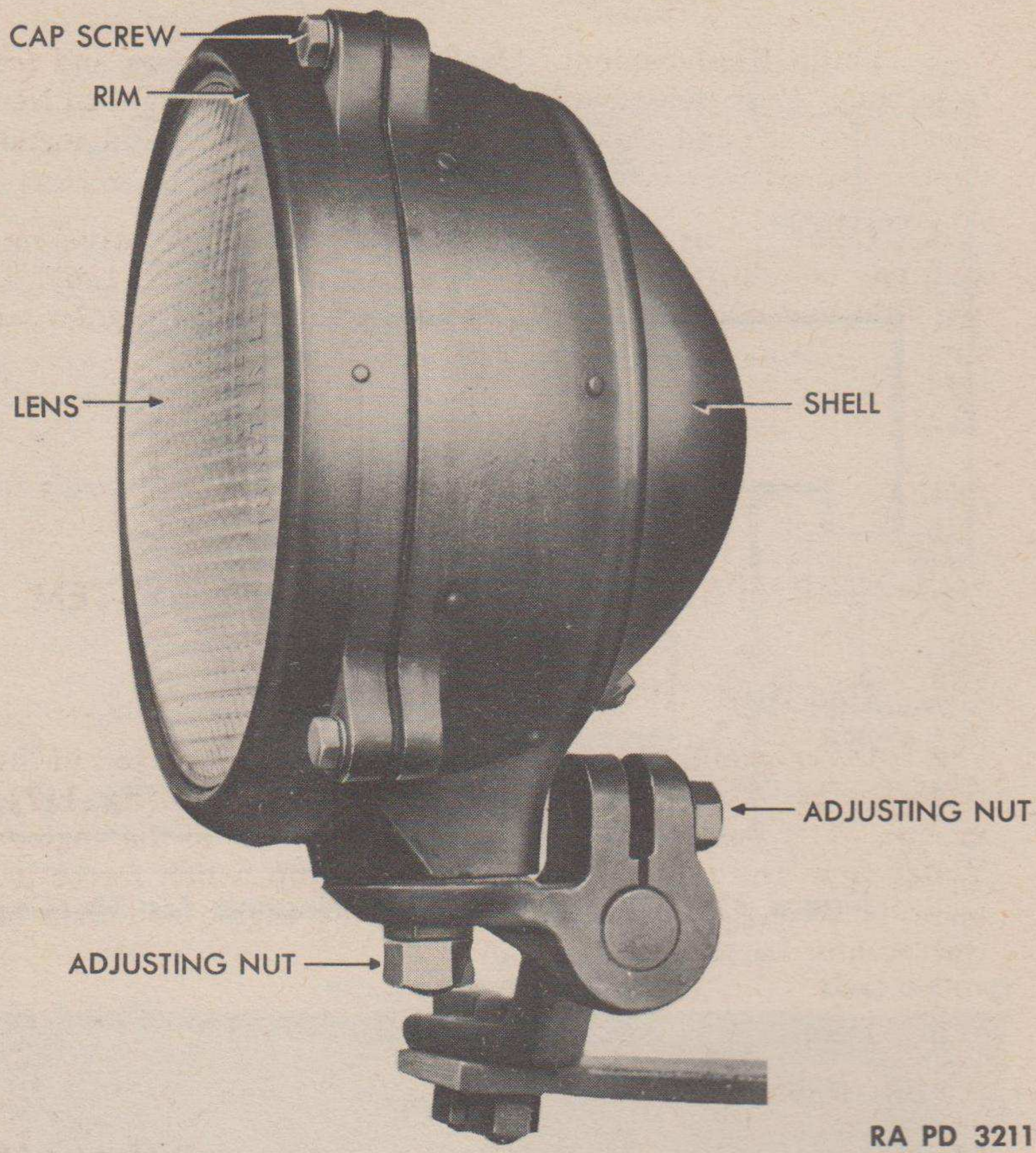


Figure 116—Turntable Operating Light

134. BATTERY AND LIGHTS.

a. Description. The 6-volt type battery (fig. 115) is located at the left rear side of the cab in front of the radiator. It incorporates "safety-fill" caps and a vent system, which prevent overfilling. The lights are controlled by a switch box located at the top right-hand side of the cab behind the instrument panel. The operating lights, located at the front of the turntable, are operated by the first two switches; the left operating light by the first switch, and the right operating light by the second switch. The third switch controls the ceiling lights located at the rear of the cab over the engine. The ceiling light consists of a double-socket fixture, one part to be used for a lamp and the other to connect a trouble light.

b. Battery Service. Refer to paragraph 67.

c. Lamp Replacement. Unscrew four cap screws and free rim from body. Push defective lamp inward and to the right to free from socket. Inspect and clean reflector. Replace lamp and install rim; tighten cap screws securely.

d. Light Adjustment. Each operating light is swivel-mounted and may be adjusted to change direction of light (fig. 116). Loosen two adjusting nuts, tilt light to desired position, and tighten nuts.

Section XXX

TURNTABLE ENGINE COOLING SYSTEM

135. DESCRIPTION AND DATA.

a. Description. A pump cooling system is employed in the turntable engine. This system consists of the radiator (fig. 117), thermostat, water pump, fan belts, and water jackets in the engine block. Water from the radiator is fed to the pump which forces it under pressure through the water jackets of the engine and then back to the radiator for cooling.

b. Data.

(1) RADIATOR.

Make	Perfex or McCord
Type	Fin-and-tube
Capacity	10 gal

(2) FAN.

Make	Waukesha
Type	4-blade
Bearings	Timken

(3) WATER PUMP.

Make	Waukesha
Type	Centrifugal

(4) THERMOSTAT.

Make	Dole
Make (element)	Sylphon
Type	Balanced-valve

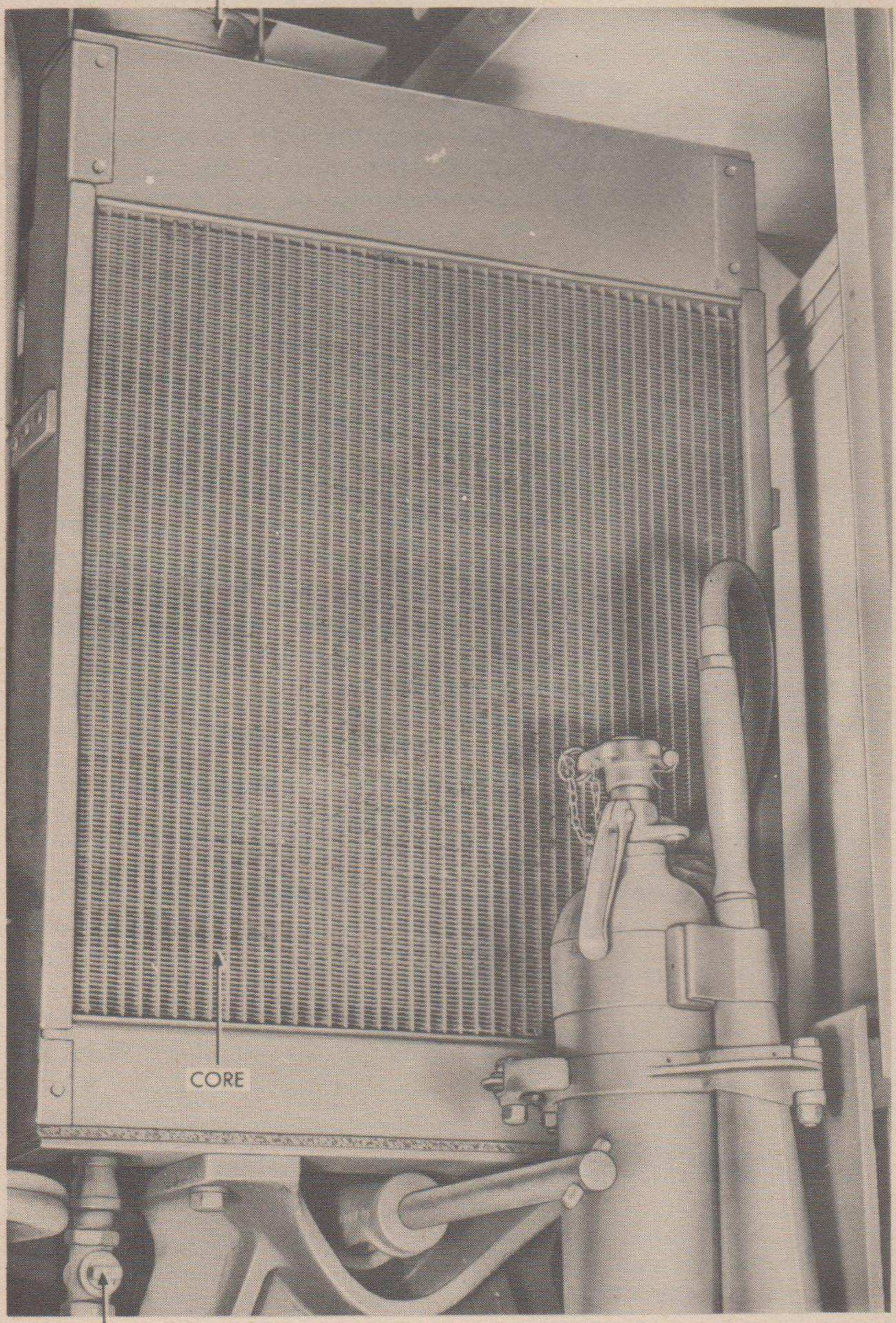


Figure 117—Turntable Radiator

TURNTABLE ENGINE COOLING SYSTEM

136. SERVICE.

a. Refer to paragraph 37.

137. FAN BELT.

a. **Description.** Two V-type fan belts drive the fan, which is mounted to a hub on a bracket attached to the crankcase, forward of the cylinder block.

b. **Replacement.** To replace fan belt assembly, follow procedure applicable to carrier engine fan (par. 71).

c. **Adjustment.** For adjustment of fan belt, refer to paragraph 71 b.

138. WATER PUMP.

a. **Description.** The water pump, which is a shaft-driven type, is located at the center left side of the engine, and is driven by a coupling through the timing gears. It uses graphite-type packing in each end of the shaft to prevent water leakage.

b. **Packing.** Remove all the old packing, clean shaft and gland box, and replace with new packing. Secure packing nuts enough to stop any leaks, but not so tight as to act as a brake on the pump shaft.

APPENDIX

Section XXXI

SHIPMENT AND LIMITED STORAGE

139. GENERAL INSTRUCTIONS.

a. Preparation for domestic shipment of the vehicle is the same as preparation for limited storage or bivouac. Preparation for shipment by rail includes instructions for loading and unloading the vehicle, blocking necessary to secure the vehicle on freight cars, number of vehicles per freight car, clearance, weight, and other information necessary to properly prepare the vehicle for rail shipment. For more detailed information and for preparation for indefinite storage refer to AR 850-18.

140. PREPARATION FOR LIMITED STORAGE OR DOMESTIC SHIPMENT.

a. Vehicles to be prepared for limited storage or domestic shipment are those ready for immediate service but not used for less than 30 days. If vehicles are to be indefinitely stored after shipment by rail, they will be prepared for such storage at their destination.

b. If the vehicles are to be placed in limited storage, or bivouacked, take the following precautions:

(1) LUBRICATION. Lubricate the vehicle completely (par. 20).

(2) BATTERY. Check battery and terminals for corrosion and if necessary, clean and thoroughly service battery (par. 67).

(3) ROAD TEST. The preparation for limited storage will include a road test of at least 5 miles, after the battery and lubrication services have been made, to check on general condition of the vehicle. Correct any defects noted in the vehicle operation before the vehicle is stored, or note on a tag attached to the steering wheel, stating the repairs needed or describing the condition present. A written report of these items will then be made to the officer in charge.

(4) FUEL IN TANKS. It is not necessary to remove the fuel from the tanks for shipment within the United States, nor to label the tanks under Interstate Commerce Commission Regulations. Leave fuel in the tanks except when storing in locations where Fire Ordinances or other local regulations require removal of all gasoline before storage.

(5) EXTERIOR OF VEHICLE. Remove rust appearing on any part of the vehicle with flint paper. Repaint painted surfaces whenever necessary to protect wood or metal. Coat exposed polished metal surfaces

susceptible to rust, such as winch cables, chains, with medium grade preventive lubricating oil. Close firmly all cab doors, windows, and windshields. Make sure paulins are in place and firmly secured. Equipment such as Pioneer and truck tools, tire chains, and fire extinguishers will remain in place in the vehicle.

(6) INSPECTION. Make a systematic inspection just before shipment or limited storage to ensure that all above steps have been covered, and that the vehicle is ready for operation on call. Make a list of all missing or damaged items and attach it to the steering wheel. Refer to Before-operation Service (par. 25).

(7) ENGINE. To prepare the engine for storage, remove the air cleaner from the carburetor. Start the engine and set the throttle to run the engine at a fast idle, pour 1 pint of medium grade preservative lubricating oil, Ordnance Department Specification AXS-674, of the latest issue in effect, into the carburetor throat, being careful not to choke the engine. Turn off the ignition switch as quickly as possible after the oil has been poured into the carburetor. With the engine switch off, open the throttle wide and turn the engine five complete revolutions by means of the cranking motor. If the engine cannot be turned by the cranking motor with the switch off, turn it by hand, or disconnect the high-tension lead and ground it before turning the engine by means of the cranking motor. Then reinstall the air cleaner.

(8) BRAKES. Release brakes and chock the wheels.

c. Inspections in Limited Storage.

(1) Vehicles in limited storage will be inspected weekly for condition of battery. If water is added when freezing weather is anticipated, recharge the battery with a portable charger, or remove the battery for charging. Do not attempt to charge the battery by running the engine.

141. LOADING AND BLOCKING FOR RAIL SHIPMENT.

a. Preparation. In addition to the preparation described in paragraph 140, when ordnance vehicles are prepared for domestic shipment, the following preparations and precautions will be taken:

(1) EXTERIOR. Cover the body of the vehicle with a canvas cover supplied as an accessory.

(2) BATTERY. Disconnect the battery to prevent its discharge by vandalism or accident. This may be accomplished by disconnecting the positive lead, taping it back away from the battery.

(3) BRAKES. The brakes must be applied and the transmission placed in low gear after the vehicle has been placed in position with a railroad car brake wheel clearance of at least 6 inches (A, fig. 118).

(4) All cars containing ordnance vehicles must be placarded "DO NOT HUMP."

(5) Ordnance vehicles may be shipped on flat cars, end-door box cars, side-door box cars, or drop-end gondola cars, whichever type car is the most convenient.

b. Facilities for Loading. Whenever possible, load and unload vehicles from open cars under their own power, using permanent end ramps and spanning platforms. Movement from one flat car to another along the length of the train is made possible by cross-over plates or spanning platforms. If no permanent end ramp is available, an improvised ramp can be made from railroad ties. Vehicles may be loaded in gondola cars without drop ends by using a crane. In case of shipment in side-door box cars, use a dolly-type jack to warp the vehicles into position within the car.

c. Securing Vehicles. In securing or blocking a vehicle, three motions, lengthwise, sidewise, and bouncing, must be prevented. There are two approved methods of blocking tracked landing vehicles on freight cars, as described below.

(1) METHOD 1.

(a) Carrier (fig. 118). Locate eight blocks (B) one to the front and one to the rear of each front wheel, one to the front of each forward rear wheel, and one to the back of each rearward wheel. Nail the heel of each block to the car floor with five 40-penny nails, and toenail the portion of each block under the tire to the freight car floor with two 40-penny nails. Locate two cleats (D) against the outside face of each wheel. Nail the lower cleat (D) to the freight car floor with three 40-penny nails, and the top cleat to the cleat below with three 40-penny nails. Pass four strands, two wrappings, of No. 8 gage, black annealed wire (C, figure 118) through the holes in the wheels, and pass through the stake pockets. Tighten wires enough to remove slack.

(b) Trailer (Including Clamshell). Locate trailer on freight car in front of carrier under front section of boom (fig. 118). Lower front and rear support on trailer (fig. 118). Pass four strands, two wrappings of No. 8 gage, black annealed wire (C), from lunette eye to each side of freight car through nearest stake pocket, and tighten enough to remove slack. Locate four blocks (B) one to the front and one to the rear of each wheel. Nail the heel of each block to the car floor with five 40-penny nails. Locate two cleats (D) against the outside face of each wheel. Nail the lower cleat (D) to the freight car floor with three 40-penny nails, and the top cleat to the cleat below with three 40-penny nails. Pass four strands, two wrappings, of No. 8 gage, black an-

SHIPMENT AND LIMITED STORAGE

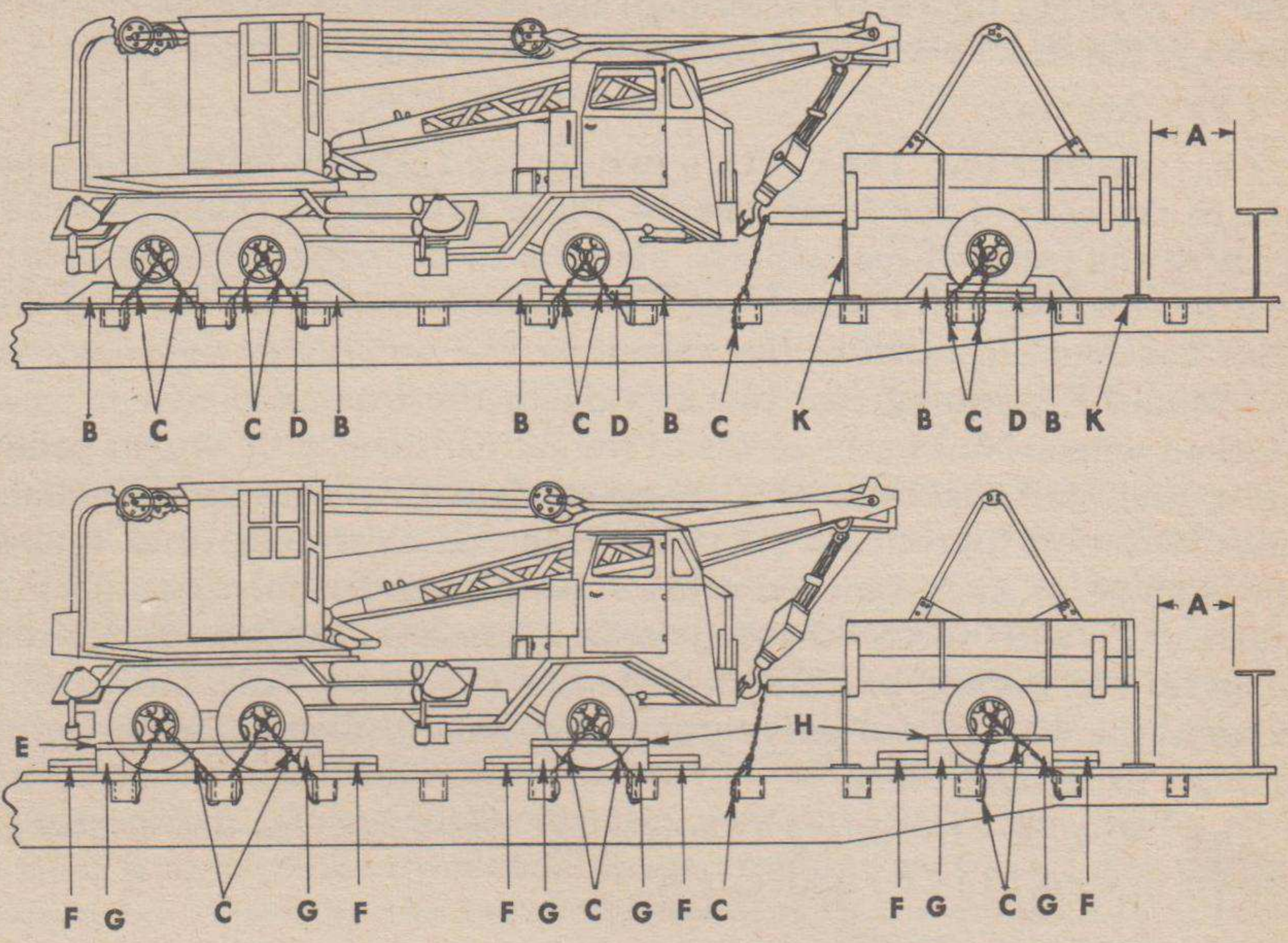


Figure 118—Blocking Requirements for Rail Shipment

nealed wire (C, figure 117) through the holes in the wheels, and pass through the stake pockets. Tighten wires enough to remove slack.

(2) METHOD 2.

(a) Carrier (fig. 118). Place two blocks (G) one to the front and one to the rear of the front wheels. Place two blocks (G) one to the front of the forward rear wheels, and one to the back of the rearward rear wheels. NOTE: *These blocks (G) must be at least 8 inches wider than the over-all width of the vehicle at the freight car floor.* Locate 16 cleats (F), two against blocks (G) to the front and rear of each blocked wheel. Nail lower cleats to freight car floor with five 40-penny nails, then nail top cleat (F) to lower cleat (F) with five 40-penny nails. Position four cleats (H) one over two cleats (G) and against the outside of each blocked wheel. Nail each end of cleat (H) to cleats (G) with three 40-penny nails. Pass four strands, two wrappings, of No. 8 gage, black annealed wire (C, figure 118) through the holes in the wheels, and pass through the stake pockets. Tighten wires enough to remove slack.

(b) Trailer (Including Clamshell). Block and secure trailer as shown in step (1) *(b)* above.

d. Shipping Data.

	Carrier	Trailer
Length, over-all (including boom)	406 in.	171 in.
Width, over-all	108 in.	108 in.
Height	130½ in.	128 in.
Shipping weight per vehicle	53,500 lb	8,240 lb
Area of car floor occupied per vehicle (sq ft)	305	128.25
Volume occupied per vehicle (cu ft)	3312	1367
Bearing pressure (lbs per sq ft of area occupied per vehicle)	176	71

Section XXXII

REFERENCES

142. PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to materiel covered in this manual:

Introduction to Ordnance Catalog (explaining SNL system)	ASF Cat. ORD 1 IOC
Ordnance Publications for Supply Index (index to SNL's)	ASF Cat. ORD 2 OPSI
Index to Ordnance Publications (listing FM's, TM's, TC's and TB's of interest to Ordnance personnel, OPSR, FSMWO's, BSD, S of SR's, OSSC's, and OFSB's and including alphabetical listing of Ordnance major items with publications pertaining thereto)	OFSB 1-1
List of Publications for Training (listing MR's, MTP's, FM's, TM's, TR's, TB's, MWO's, SB's, WDLO's, and FT's	FM 21-6
List of Training Films, Film Strips and Film Bulletins (listing TF's, FS's, and FB's by serial number and subject)	FM 21-7
Military Training Aids (listing graphic training aids, models, devices, and displays)	FM 21-8

143. STANDARD NOMENCLATURE LISTS.

Crane, truck-mounted, M2 (T6) (Thew Shovel, Model MC-6x6), (for 240-mm howitzer and 8-in. gun materiel)	SNL G-172
Trailer, clamshell, M16	SNL G-201
Cleaning, preserving, and lubricating materials; recoil fluids, special oils, and miscellaneous related items	SNL K-1
Soldering, brazing and welding material, gases and related items	SNL K-2
Tool sets, motor transport	SNL N-19

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144. EXPLANATORY PUBLICATIONS.

a. Fundamental Principles.

Automotive electricity	TM 10-580
Automotive power transmission units	TM 10-585
Basic maintenance manual	TM 38-250
Chassis, body, and trailer units	TM 10-560
Driver's manual	TM 10-460
Driver selection and training	TM 21-300
Electrical fundamentals	TM 1-455
Military motor transportation	TM 10-505
Military motor vehicles	AR 850-15
Motor vehicle inspections and preventive maintenance services	TM 9-2810
Precautions in handling gasoline	AR 850-20
Standard military motor vehicles	TM 9-2800
The internal combustion engine	TM 10-570

b. Maintenance and Repair.

Cleaning, preserving, lubricating and welding materials and similar items issued by the Ordnance Department	TM 9-850
Cold weather lubrication and service of combat vehicles and automotive materiel	OFSB 6-11
Maintenance and care of pneumatic tires and rubber treads	TM 31-200
Ordnance maintenance: Carburetors (Zenith)	TM 9-1826C
Ordnance maintenance: Electrical equipment (Delco-Remy)	TM 9-1825A
Ordnance maintenance: Fuel pumps	TM 9-1828A
Ordnance maintenance: Power brake systems (Bendix-Westinghouse)	TM 9-1827A
Ordnance maintenance: Speedometers, tachometers, and recorders	TM 9-1829A

c. Protection of Materiel.

Camouflage	FM 5-20
Decontamination	TM 3-220
Decontamination of armored force vehicles	FM 17-59
Defense against chemical attack	FM 21-40
Explosives and demolitions	FM 5-25

REFERENCES

d. Storage and Shipment.

Ordnance storage and shipment chart, group G-Major items	OSSC-G
Registration of motor vehicles	AR 850-10
Rules governing the loading of mechanized and motorized army equipment, also major caliber guns, for the United States Army and Navy, on open top equipment published by Operations and Maintenance Department of Association of American Railroads.	
Storage of motor vehicle equipment	AR 850-18

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TECHNICAL MANUAL

CRANE, TRUCK-MOUNTED, M2, AND TRAILER, CLAMSHELL, M16

CHANGES No. 1

WAR DEPARTMENT
WASHINGTON 25, D. C., 29 January 1946

TM 9–771, 14 July 1944, is changed as follows:

4. DATA.

* * * * * * *

b. Turntable assembly.

* * * * * * *

(4) CAPACITIES.

* * * * * * *

Cooling system	31 qt
Crankcase (dry)	11 qt
Air cleaner	1 qt

* * * * * * *

6. INSTRUMENTS.

* * * * * * *

b. Air Pressure Gauge (fig. 4). The air pressure * * * to 150 pounds. This gauge must show a safe air pressure (85 lb) before vehicle is placed in motion.

* * * * * * *

7. USE OF INSTRUMENTS AND CONTROLS IN VEHICULAR OPERATION.

* * * * * * *

e. Shifting Transmission and Transfer Case.

* * * * * * *

(5) SHIFTING TRANSFER CASE FROM HIGH TO LOW RANGE. Always shift transfer case into low range while vehicle is stationary on hard ground and before difficult terrain is encountered. Front axle will * * * into low range.

* * * * * * *

10. EXTREME COLD.

* * * * * * *

b. Precautions.

* * * * * *

(3) (Superseded). Use engine oil (OE 10) in all air cleaners in temperatures below 0° F.

* * * * * *

c. Cooling System.

(1) ANTIFREEZE (superseded). Only antifreeze compound (ethylene-glycol type) is prescribed for protection of cooling systems. (*If cooling system needs cleaning, see par. 70.*) The following table gives the quantity of antifreeze compound to be added to the cooling system on this vehicle to prevent freezing at the temperatures indicated:

ANTIFREEZE COMPOUND CHART

(For cooling system of carrier engine (64 qt), and turntable engine (31 qt))

Freezing points	*Quarts of antifreeze required*	
	Carrier	*Turntable*
+10° F	16	8
0° F	20	10
−10° F	24	12
−20° F	28	13
−30° F	32	15½
−40° F	38	18
−50° F	40	19

* * * * * *

d. CARRIER AND TURNTABLE ENGINE LUBRICATION SYSTEMS (Superseded). *Methods for keeping crankcase oil sufficiently fluid for proper lubrication are listed below in order of preference:*

(1) Keep vehicle in a heated inclosure when not in use.

(2) When engine is stopped, drain crankcase oil while still hot. Tag vehicle in a conspicuous place in the driver's compartment to warn personnel that crankcase is empty. Store oil in a warm place if possible. Otherwise heat oil before reinstalling. CAUTION: *Do not overheat oil: heat only to a point where bare hand can be inserted without burning.*

(3) Dilute crankcase oil with gasoline.

(4) If the vehicle is to be kept outdoors, and if the crankcase cannot be drained, shelter the engine compartment with a tarpaulin. About 3 hours before engine is to be started, place fire pots under the tarpaulin. A Van Prag, Primus-type or other type blowtorch or ordinary kerosene lanterns may be used. With due consideration for the fire hazard involved, the flame may be applied directly to the oil pan.

e. Carrier and Turntable Transmissions, Transfer Cases, Power Take-offs, and Differential.

(1) Where the use of engine oil (OE 10) is prescribed for use at temperatures of +32° F. to 0°F., it may also be used undiluted for operation below 0° F.

(2) Use universal gear lubricant (GO–90) for temperatures above 0° F. When temperatures below 0° F. are expected, use universal gear lubricant (GO–75), undiluted. Universal gear lubricant (GO–75) may be used for temperatures up to +32° F. and need not be replaced unless temperatures above +32° F. are expected.

(3) After carrier engine has been warmed up, as provided in paragraph 7c, put transmission in low (first) gear, and drive vehicle for 100 yards, being careful not to stall engine. This will heat gear lubricants to the point where normal operation can be expected.

Reletter subparagraphs e, f, and g to read f, g, and h.

f. Fuel System.

* * * * * * *

(6) (Added). Add 1 quart of denatured alcohol (grade 2) at start of season and ½ pint each time tank is filled thereafter.

13. CONTROLS.

* * * * * * *

d. Boom Hoist Hand Lever. The boom hoist * * * boom to raise. Pulling the lever to the rear disengages the clutch and decreases the tension of a powerful spring which holds the brake in constant engagement, and thus permits the boom to be lowered. For precision in lowering, a lever has been provided which is described in j below. Releasing the lever in the back position returns it automatically to the vertical or center position, in which the clutch is also disengaged and the brake is set. The lever is * * * ratchet and pawl.

e. Engine Clutch Hand Lever. The engine clutch * * * the vertical position. Pushing the lever forward engages the engine clutch.

* * * * * * *

h. Main Hoist Brake Pedal (fig. 12). This is the right-hand pedal in front of the operator. It is used * * * toe releases it.

i. Secondary Hoist Brake Pedal. This is the left-hand pedal (fig. 12) in front of the operator. It is used * * * (subpar. h above).

* * * * * * *

17. DUSTY CONDITIONS.

* * * * * * *

f. Silent Drive Chain. In extremely dusty * * * and install cover. Keep chain oiler filled with engine oil.

* * * * * * *

19. LUBRICATION ORDER.

a. Reproduction of War Department Lubrication Order **9–771** (figs. 21, 22, 23, and 24) prescribes first and second echelon lubrication maintenance above 0° F. For lubrication below 0° F., refer to **sections V and VIII.**

b. A Lubrication Order * * * at all times. In the event the matériel is received without **a lubrication order,** the using arm **will** immediately requisition **a copy in conformance with instructions and lists in FM 21–6.**

c. Instructions on the Lubrication Order are binding on all echelons of maintenance, and there **will** be no deviations.

d. Service intervals specified on the lubrication order are for normal operating conditions. Reduce these intervals * * * to the matériel. **Extend calendar intervals when vehicle is not in use. To standardize and simplify the scheduling of first and second echelon preventive maintenance services, convert hourly and mileage intervals to calendar intervals. The calendar intervals comparable to mileage and hourly intervals are:**

Weekly	**48 hours.**
Semimonthly	**96 hours.**
Monthly	**1,000 miles.**
Semiannually	**6,000 miles.**

e. Lubricants are prescribed * * * lower temperature range. Ordinarily it will be necessary to change grades of lubricants ***only when air temperatures are consistently in the next higher or lower range.***

f. Rescinded.

20. DETAILED LUBRICATION INSTRUCTIONS.

* * * * * * *

c. Cleaning. Use **dry cleaning solvent or Diesel fuel oil** to clean or wash all parts. Use of gasoline for this purpose is prohibited. After washing, dry all parts thoroughly before applying lubricant.

d. Wheel bearings (superseded). The following instructions supplement the notes on the lubrication order.

(1) Remove bearing cone assemblies from hub.

(2) Wash bearings, cones, spindle, and inside of hub and dry thoroughly. Do not use compressed air.

(3) Inspect bearing races and replace if damaged.

(4) Coat the spindle and inside of hub and cap with grease to a maximum thickness of 1/16-inch to retard rust. Do not fill hub or hub cap. The lubricant in the bearing is sufficient to provide lubrication until the next service period. Any excess might result in leakage into the drum.

(5) Lubricate bearings with general purpose grease (No. 2) using a packer, or by hand, kneading the lubricant into all spaces in the bearing. Use extreme care to protect the bearings from dirt.

(6) Immediately reassemble and replace wheel. Adjust bearings in accordance with instructions in paragraph 61**b**.

e. Reports and records (superseded).

(1) Report unsatisfactory performance of matériel to the ordnance officer responsible for maintenance in accordance with TM 37–250.

(2) A record of lubrication may be maintained in the Preventive Maintenance Roster (WD AGO Form 460).

f. Rescinded.

23. RUN-IN TEST PROCEDURES.

a. Preliminary Service.

* * * * * * *

(6) AIR CLEANERS AND BREATHER CAP.

(*a*) *Carrier*. Examine carburetor and * * * dry-cleaning solvent. Fill reservoirs to bead level with **used crankcase oil or engine** oil, and reinstall securely. Be sure all * * * connections are tight.

* * * * * * *

(14) CRANE WINCH AND HOIST MECHANISM. Inspect crane frame * * * assembled, and secure. See that power take-off drive chain is adjusted correctly, to have not more than **4 3/4**-inch deflection. After starting crane * * * and operate properly.

* * * * * * *

b. Run-in Test. Perform the following * * * observations listed below.

CAUTION: *Continuous operation of the vehicle at speeds approaching the* ***maximum*** *on the* ***vehicle specification*** *plate should be avoided.* Make operating test * * * each applicable item.

* * * * * * *

WAR DEPARTMENT LUBRICATION ORDER LO 9-771

20 FEBRUARY 1945 (Supersedes WDLO 135, 135A, 8 April 1944)

CRANE, TRUCK MOUNTED, M2
TRAILER, CLAMSHELL, M16

References: ORD 7 SNL G-172, TM 9-771

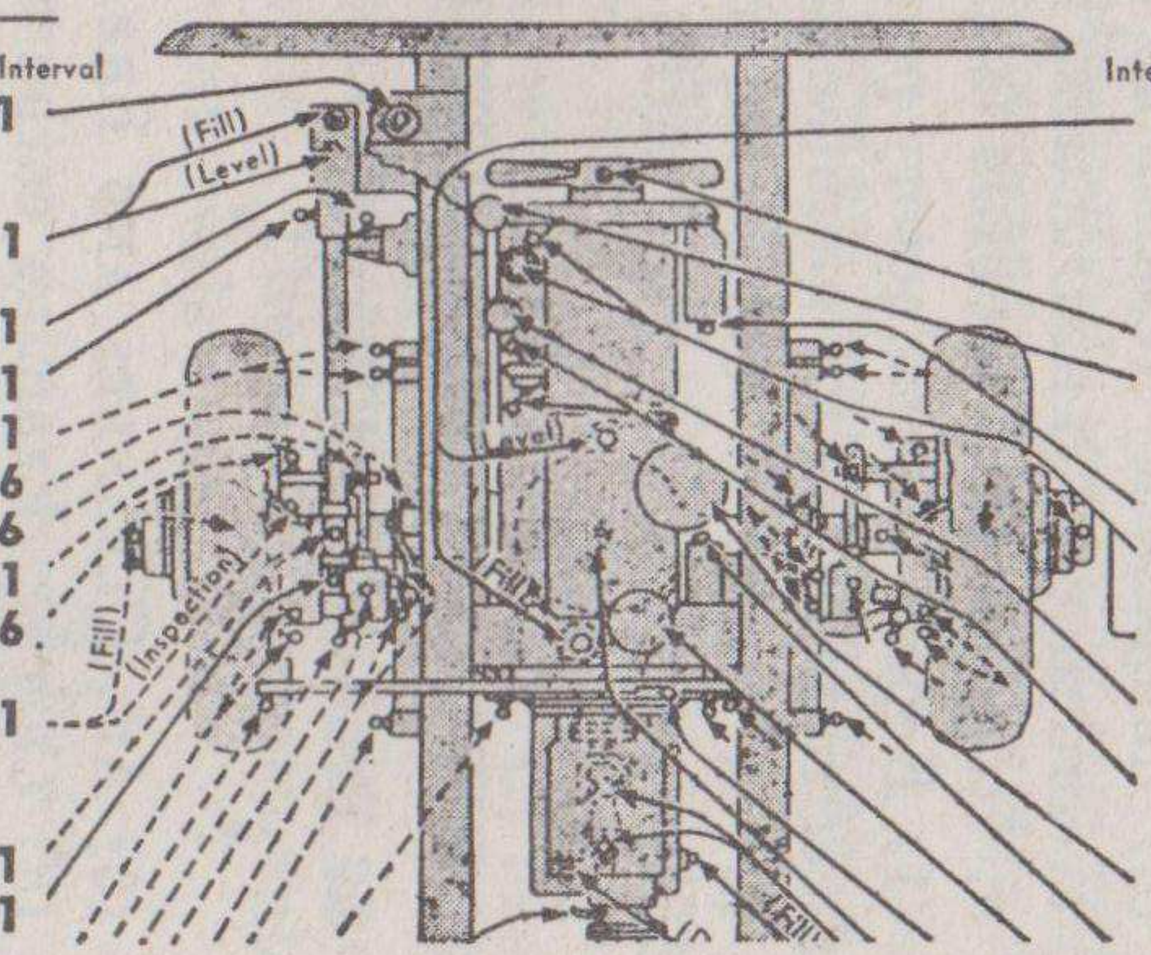
Clean fittings before lubricating. Lubricate after washing and deep water fording.

Clean parts with SOLVENT, dry cleaning or OIL, fuel, Diesel. Dry before lubricating.

Intervals are based on actual operation under normal conditions. Reduce under severe conditions. Extend when not in use.

Lubricate dotted arrow points on both sides. Opposite points are shown by short arrows.

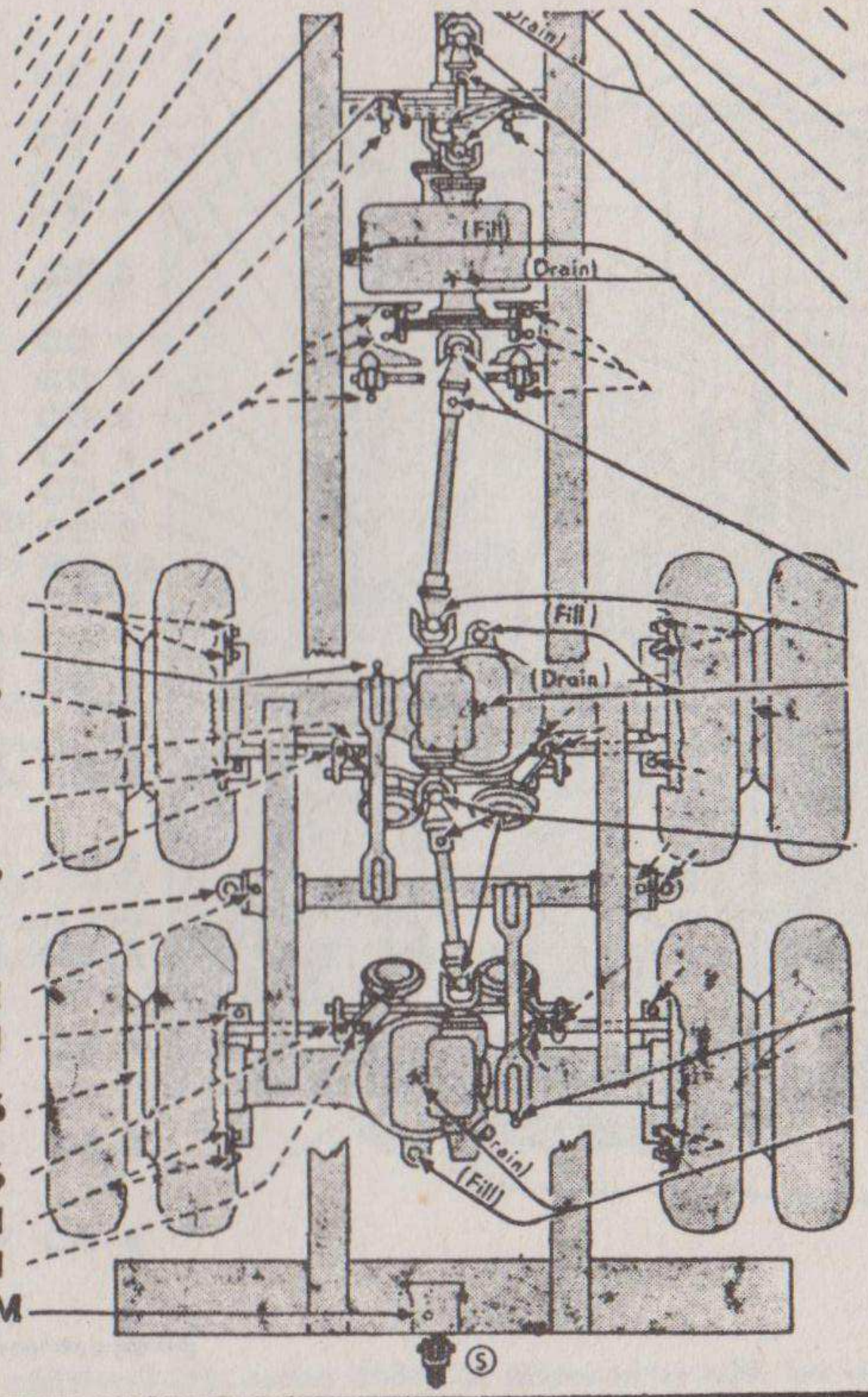
		Lubricant • Interval
F, FIG. 26	Foot Pedal Valve (oiler) 6 to 8 drops (Serviced from inside cab)	OE 1
C, FIG. 27 AND F, FIG. 37	Steering Gear Fill and Level (See Gear Case Note)	GO 1
A, FIG. 26	Clutch Pedal Shaft	CG 1
C, FIG. 36	Drag Link	CG 1
C, FIG. 30	Spring Shackle	CG 1
A, FIG. 31	Shock Absorber	SAH 6
C, FIG. 35	Slack Adjuster	CG 6
C, FIG. 35	Brake Cam Shaft Sparingly	CG 1
B, FIG. 30	Front Wheel Bearings Remove, clean and repack	WB 6
D AND E, FIG. 35	Universal Joint and Steering Knuckle Lower Bearing (See Universal Joint Note)	CG 1
F, FIG. 35	Steering Knuckle Upper Brg.	CG 1
D, FIG. 36	Drag Link	CG 1



Interval • Lubricant		
W GO	Front Axle Differential Fill and Level Check level (See Gear Case Note)	C, FIG. 31
Serviced From Under Hood		
6 CG	Fan (plug)	B, FIG. 32
D OE	Crankcase Check level Drain, refill every 1000 miles. Cap. 16 qt. (See Note)	
1 OE	Generator 6 to 8 drops	F, FIG. 32
1 WB	Distributor Shaft Turn cup down 1 full turn, refill as required	A, FIG. 32
6	Distributor (See Note)	
D OE	Air Compressor Air Cleaner Check level (See Air Cleaner Note)	B, FIG. 33
1 WP	Water Pump Refill cups, turn 1 full turn	E, FIG. 32
D OE	Air Cleaner (See Note) Check level.	A, FIG. 33

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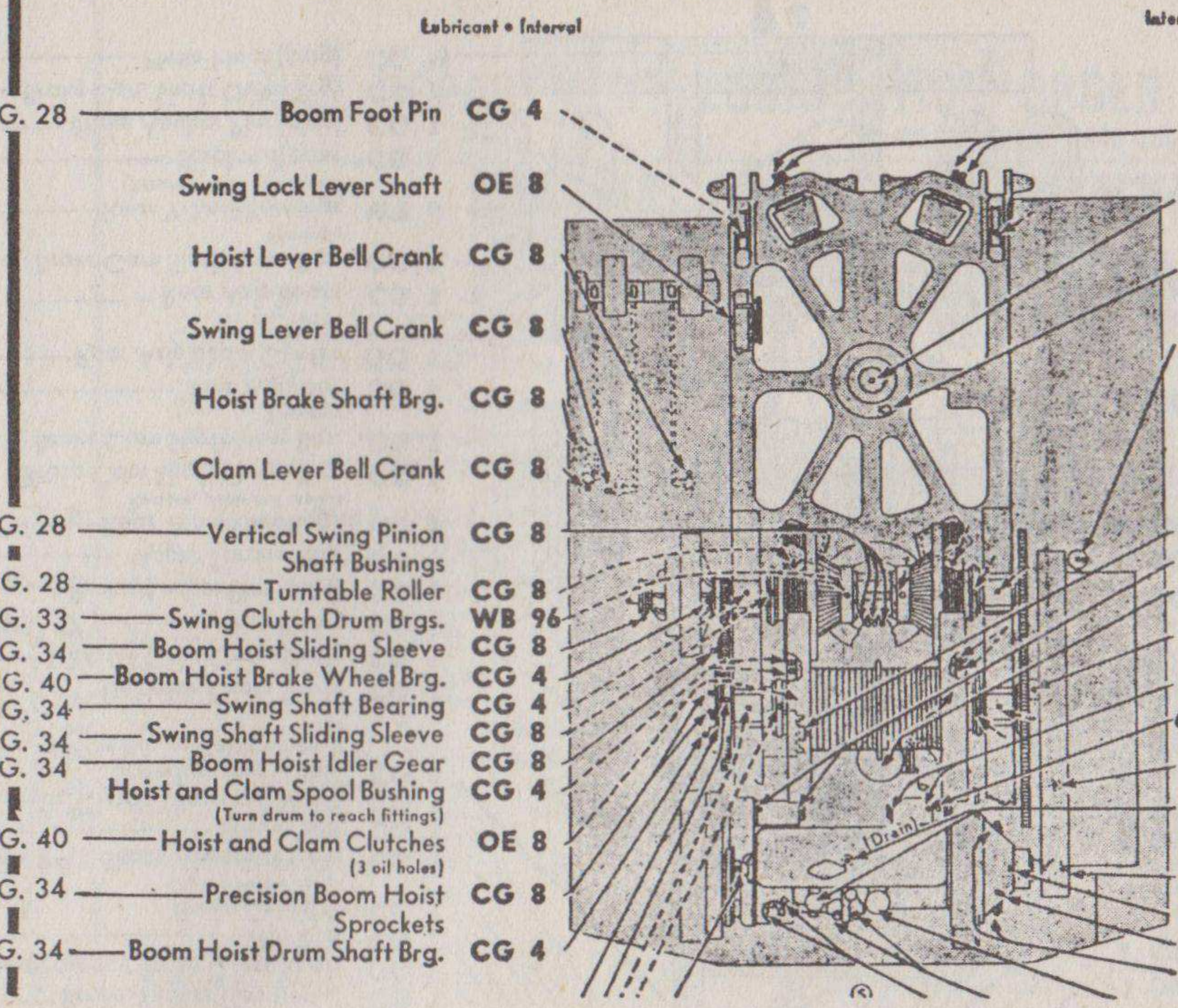
A, FIG. 35 — Brake Anchor Pins (Fitting) — CG 1
D, FIG. 26 – Emergency Brake Cross Shaft — CG 1
A, FIG. 35 — Tie Rod — CG 1
Brake Cylinder — CG 1
Drain moisture daily
E AND F, FIG. 36 – Shock Absorber Links — CG 1
D, FIG. 30 — Spring Bolt — CG 1
E, FIG. 26 — Clutch Throw-out Shaft — CG 1
Speedometer Cable — CG 6
Remove core, coat lightly with No. 0
Declutch Cross Shaft — CG 1
B, FIG. 26 — Transfer Case Cross Shaft — CG 1
B AND D, FIG. 27 — Disc Brake — CG 1
A, FIG. 37 — Brake Anchor Pins (plug) — CG 1
E, FIG. 30 — Upper Torque Rod — CG 1
B, FIG. 30 — Rear Wheel Bearings — WB 6
Remove, clean and repack
F, FIG. 30 — Brake Cam Shaft Outer Brg. — CG 1
A, FIG. 30 — Brake Cam Shaft Inner Brg. — CG 1
Sparingly
C, FIG. 35 — Slack Adjuster — CG 6
F, FIG. 31 — Rear Axle Beam Center Tube — GO 1
F, FIG. 31 — Rear Axle Beam — CG 1
A, FIG. 30 — Brake Cam Shaft Inner Brg. — CG 1
Sparingly
B, FIG. 30 — Rear Wheel Bearings — WB 6
Remove, clean and repack
C, FIG. 35 — Slack Adjuster — CG 6
A, FIG. 37 — Brake Anchor Pins (plug) — CG 1
F, FIG. 30 — Brake Cam Shaft Outer Brg. — CG 1
F, FIG. 27 — Pintle Hook (plug) — CG M



1 OE Starter 6 to 8 drops — D, FIG. 32
1 *Oil Filter* Drain Sediment (See Note) — C, FIG. 32
1 CG Clutch Release Bearing — C, FIG. 26
fitting) Sparingly
6 *Front Axle Differential Drain*
Drain and refill. Cap. 10 qt.
1 CG Universal and Slip Joint — A, FIG. 27
W GO Transmission Check level – E, FIG. 31 AND, A, B, FIG. 37
Drain, refill every 6000 miles. Cap. 11 qt.
(See Gear Case Note)
1 CG Universal and Slip Joints — A, FIG. 27
W GO Transfer Case Check level — D, FIG. 31
Drain, refill every 6000 miles. Cap. 4 qt.
(See Gear Case Note)
1 CG Universal and Slip Joint — A, FIG. 27
1 CG Universal Joint — E, FIG. 27
W GO Rear Axle Differential – B, FIG. 31 AND D, FIG. 37
Check level
Drain, refill every 6000 miles. Cap. 10 qt.
(See Gear Case Note)
1 CG Universal and Slip Joints — A, FIG. 27
1 CG Upper Torque Rod — E, FIG. 30
W GO Rear Axle Differential — B, FIG. 31
Check level
Drain, refill every 6000 miles. Cap. 10 qt.
(See Gear Case Note)

RA PD 348147B

Figure 21—Lubrication Order—Chassis.


Lubricant • Interval
Interval • Lubricant
B, FIG. 28 — Boom Foot Pin CG 4
Swing Lock Lever Shaft OE 8
Hoist Lever Bell Crank CG 8
Swing Lever Bell Crank CG 8
Hoist Brake Shaft Brg. CG 8
Clam Lever Bell Crank CG 8
C, FIG. 28 — Vertical Swing Pinion Shaft Bushings CG 8
D, FIG. 28 — Turntable Roller CG 8
E, FIG. 33 — Swing Clutch Drum Brgs. WB 96
E, FIG. 34 — Boom Hoist Sliding Sleeve CG 8
D, FIG. 40 — Boom Hoist Brake Wheel Brg. CG 4
D, FIG. 34 — Swing Shaft Bearing CG 4
D, FIG. 34 — Swing Shaft Sliding Sleeve CG 8
A, FIG. 34 — Boom Hoist Idler Gear CG 8
Hoist and Clam Spool Bushing CG 4
(Turn drum to reach fittings)
B, FIG. 40 — Hoist and Clam Clutches OE 8
(3 oil holes)
F, FIG. 34 — Precision Boom Hoist Sprockets CG 8
C, FIG. 34 — Boom Hoist Drum Shaft Brg. CG 4
8 CG Turntable Roller — A, FIG. 28
8 CG Center Pin — A, FIG. 40
8 OE Center Pin Bushing — C, FIG. 40
4 OE Power Take-off Chain
Keep reservoir filled (See Note)
4 CG Boom Hoist Drum Bearing
48 OE Generator 6 or 8 drops — D, FIG. 33
8 OE Air Cleaner (See Note) — F, FIG. 40
Check level
8 WB Center Drive Shaft Brgs. — F, FIG. 33
Add ½ oz. (plug)
48 OE Starter 6 or 8 drops
6M CG Starter Reduction Gear Case
(See Note)
M Power Take-off Chain Case Drain — E, FIG. 40
(See Note)
D OE Crankcase Check level — B, FIG. 38
Drain, refill every 48 hours (See Notes)
Cap, 11 qt.
8 CG Clutch Pilot Bearing Sparingly — F, FIG. 39
8 CG Power Take-off Bearing — A, FIG. 39
8 CG Clutch Throwout Bearing Sparingly — A, FIG. 39
8 OE Clutch Cross Shaft — D, FIG. 39
(Drain)

RA PD 348148

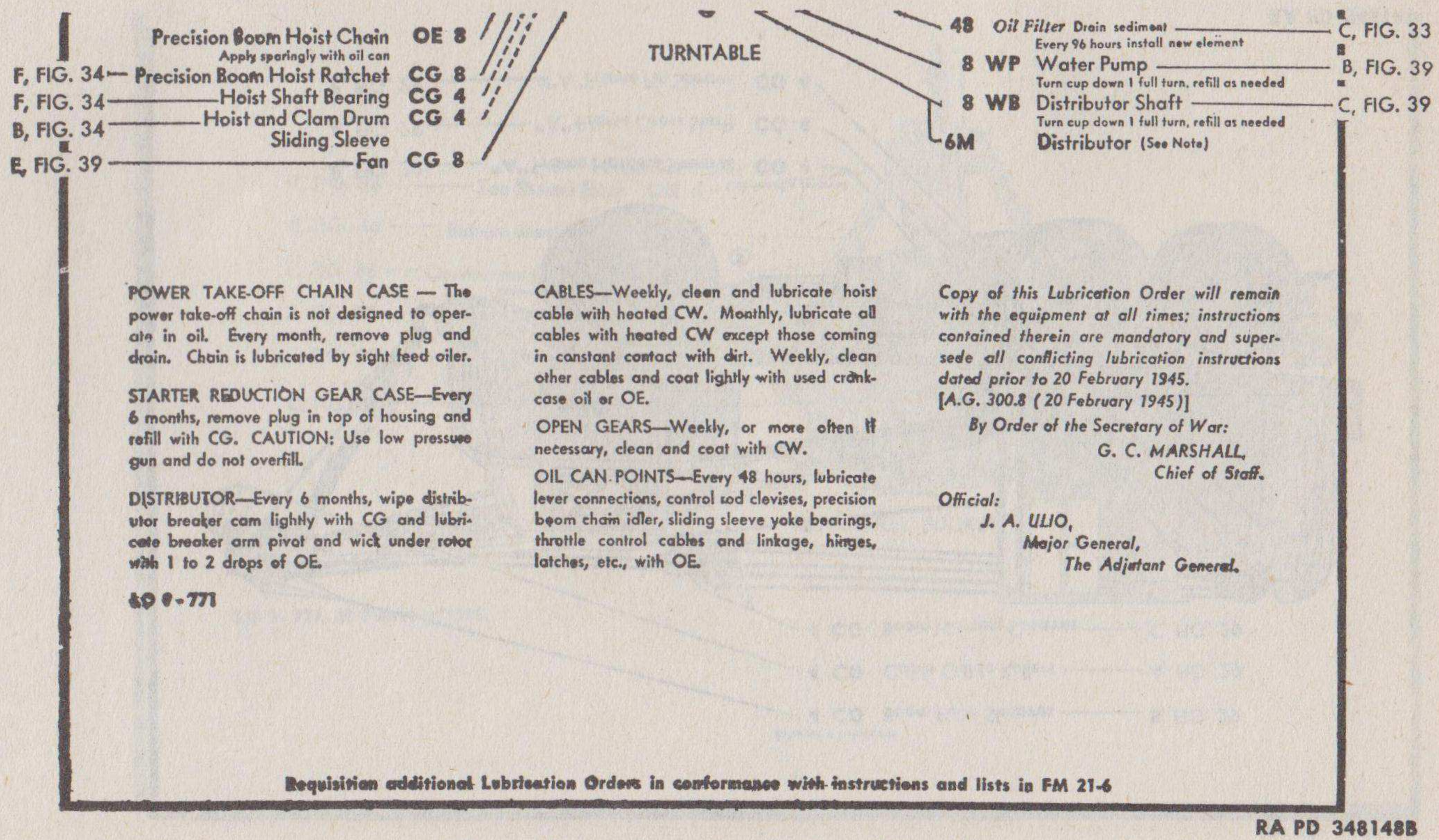
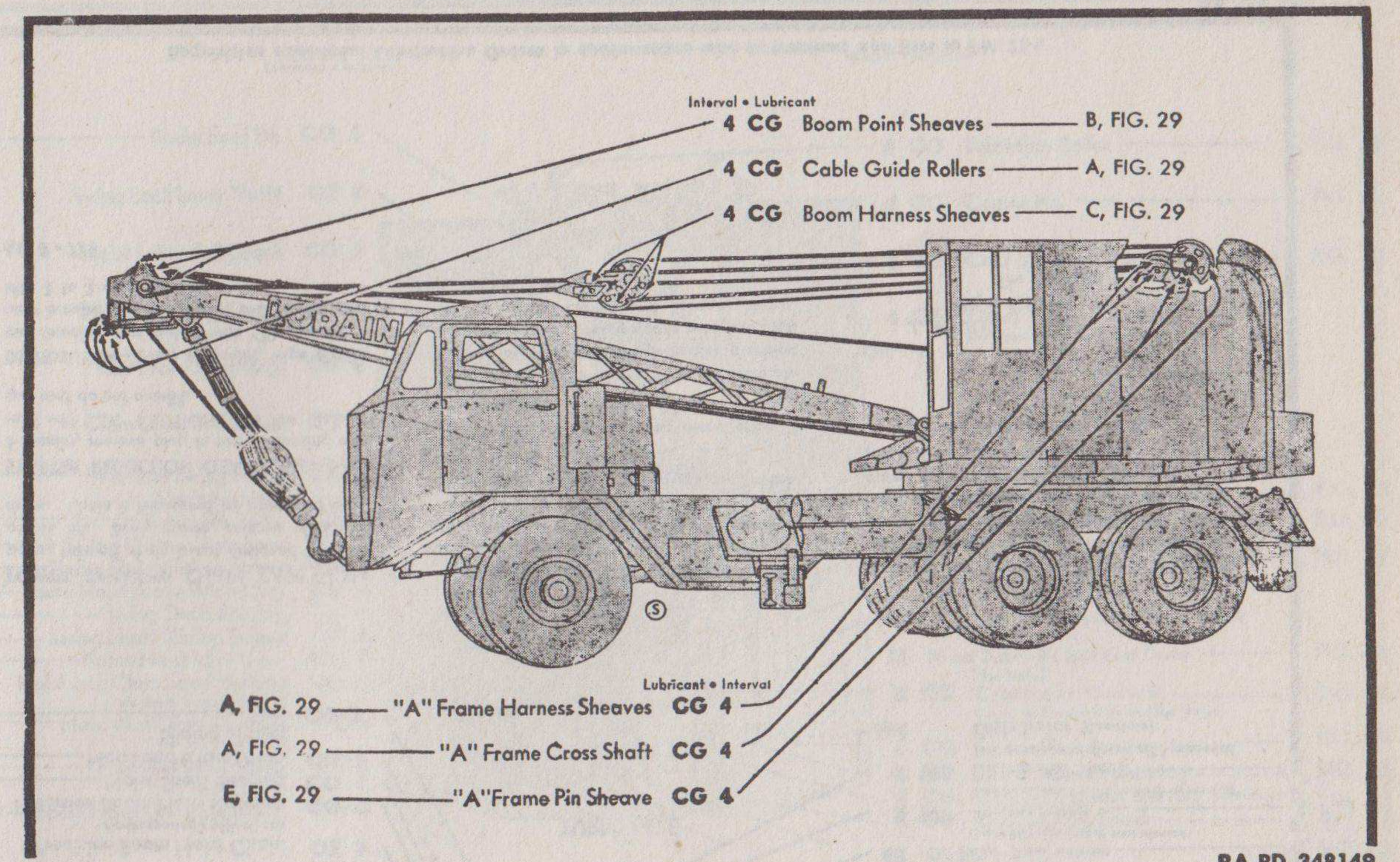
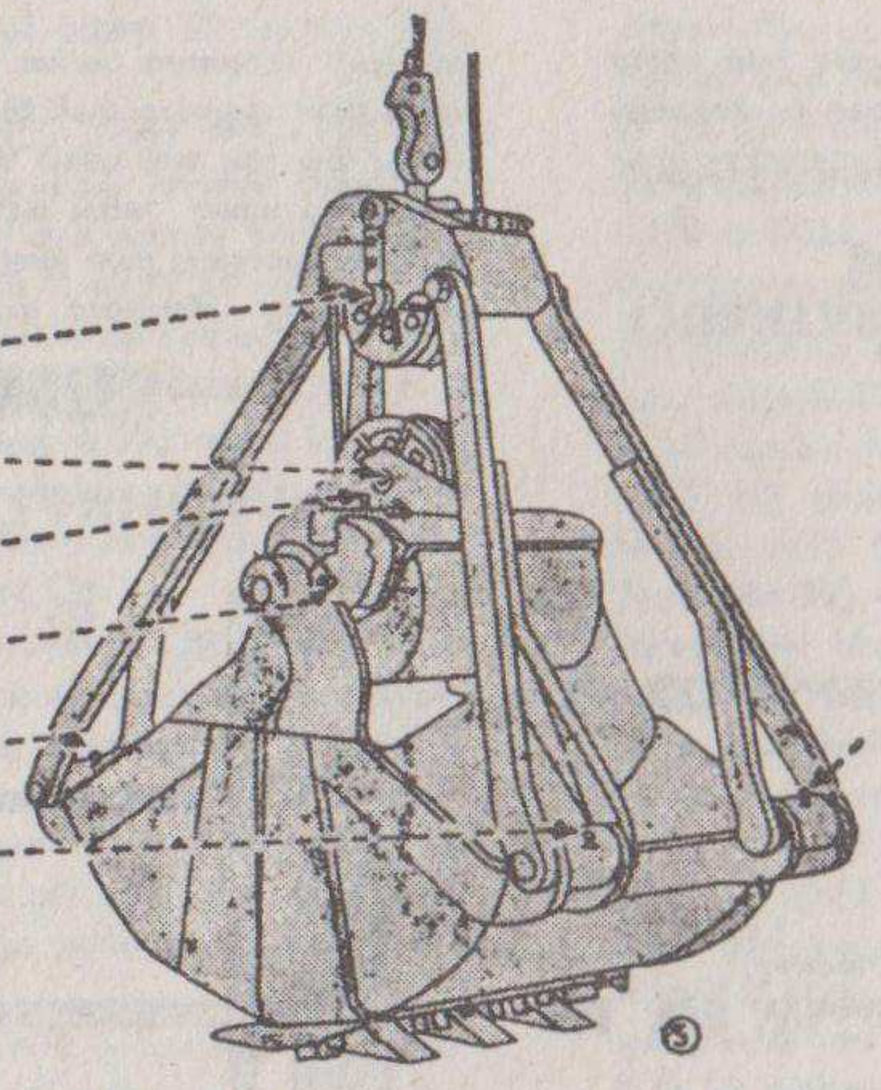


Figure 22—Lubrication Order—Turntable.


Interval • Lubricant
4 CG Boom Point Sheaves — B, FIG. 29
4 CG Cable Guide Rollers — A, FIG. 29
4 CG Boom Harness Sheaves — C, FIG. 29
Lubricant • Interval
A, FIG. 29 — "A" Frame Harness Sheaves CG 4
A, FIG. 29 — "A" Frame Cross Shaft CG 4
E, FIG. 29 — "A" Frame Pin Sheave CG 4
RA PD 348149

		Lubricant • Interval
D, FIG. 38	Top Sheave Block	CG 4
E, FIG. 38	Bottom Sheave Block	CG 4
E, FIG. 38	Counterweight Bearing	CG 4
E, FIG. 38	Bucket Hinge Bearing	CG 4
C, FIG. 38	Arm Bracket	CG 4
C, FIG. 38	Arm Bracket	CG 4

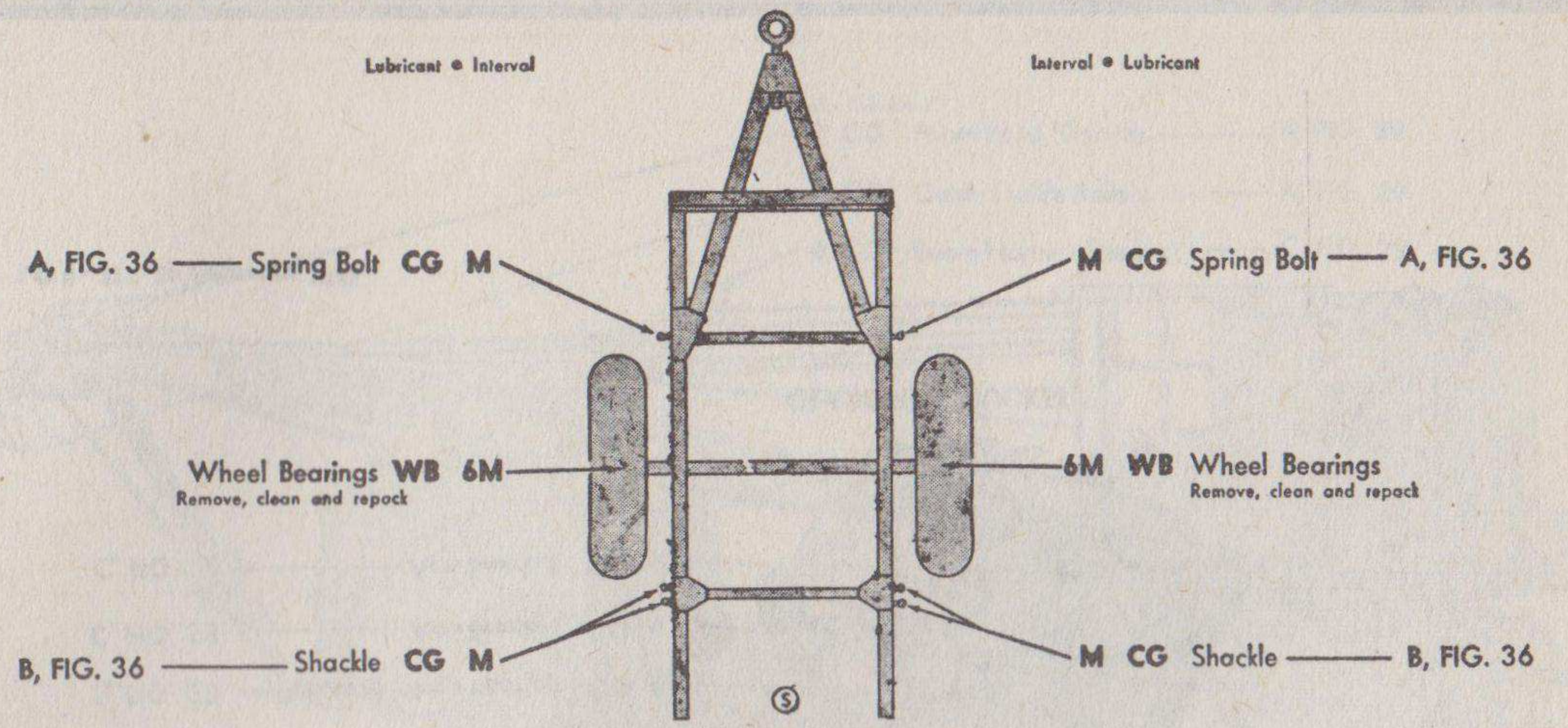


CLAMSHELL BUCKET

LO 9-771, 20 February 1945.

RA PD 348149B

Figure 23—Lubrication Order—Boom and Clamshell.



TRAILER, CLAMSHELL, M16

NOTES

(TRUCK ONLY)

AIR CLEANERS — Fill to bead levels. Use used crankcase oil or OE above 0°F., or OE (SAE 10) below 0°F. Every 1,000 miles, remove engine and air compressor air cleaners and wash all parts.

operation and after draining. Fill steering gear through plug hole until lubricant runs out of vent hole in jacket tube. Drain only after operation. Weekly, clean axle housing, transfer case and steering gear breathers and after truck is operated under extremely dirty or

(TURNTABLE AND CLAMSHELL BUCKET ONLY)

AIR CLEANERS—Fill engine air cleaner oil reservair to bead level. Every 48 hours, remove and wash all parts. Keep connection

CRANKCASE—Drain only when engine is hot. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level.

CRANKCASE BELOW 0°F.—If heated storage, winterization kit or heater are available or oil can be drained after operation, use OE (SAE 10) undiluted. Otherwise, dilute as follows: Add OE (SAE 10) to FULL mark. Then add 4¾ qt. gasoline. Run engine 5 to 10 minutes. Mark new higher level on dipstick with file. CAUTION: Check level every 4 hours of operation, add OE (SAE 10) to regular FULL mark as required. After operation, check level. If level is below regular FULL mark, add OE (SAE 10) to regular FULL mark. Then add gasoline to new higher level mark. If level is at or above regular FULL mark, add gasoline to new higher level mark. Run engine 5 to 10 minutes to mix oil and diluent.

OIL FILTER—Every 6,000 miles, while crankcase is being drained, remove filter element, clean inside of case and install new element.

GEAR CASES—Fill to plug levels before muddy conditions. *(Transfer Case Declutching Unit, Front Axle Double Reduction Gear Case)* Upon reassembly of cases, fill through plug opening with GO.

UNIVERSAL JOINTS (Front Wheels)—With vehicle on level ground, remove inspection plug in rear of joint and remove hub plate on front axle shaft; fill through fitting in wheel hub with CG until lubricant comes out inspection plug hole. CAUTION: Replace plug.

DISTRIBUTOR—Every 6,000 miles, wipe distributor breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 or 2 drops of OE.

OIL CAN POINTS—Every 1,000 miles, lubricate throttle and accelerator linkage, transfer case shift linkage, declutch shift linkage, emergency brake cable sheave and linkage, air compressor rocker arm, outrigger float screws, brake pedal pull rod clevis pins, clutch pedal linkage, brake pedal shaft, hinges and locks, with OE.

DO NOT LUBRICATE—Springs, Air Compressor, Clutch Pilot Bearing.

between air cleaner and manifold tight. Every 48 hours, remove crankcase breather air cleaner filler cap, wash and reoil. Air cleaners require used crankcase oil or OE above 0°F., or OE (SAE 10) below 0°F.

CRANKCASE—Drain only when engine is hot. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level.

CRANKCASE BELOW 0°F.—If heated storage, winterization kit or heater are available or oil can be drained after operation, use OE (SAE 10) undiluted. Otherwise, dilute as follows: Add OE (SAE 10) to FULL mark. Then add 3¼ qt. gasoline. Run engine 5 to 10 minutes. Mark new higher level on dipstick with file. CAUTION: Check level every 4 hours of operation, add OE (SAE 10) to regular FULL mark as required. After operation, check level. If level is below regular FULL mark, add OE (SAE 10) to regular FULL mark. Then add gasoline to new higher level mark. If level is at or above regular FULL mark, add gasoline to new higher level mark. Run engine 5 to 10 minutes to mix oil and diluent.

(Continued)

KEY

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
	above +32°F.	+32°F. to 0°F.	below 0°F.
OE—OIL, engine			
Crankcase	SAE 30	SAE 10	See Note
Other Points	SAE 30	SAE 10	**PS**
GO—LUBRICANT, gear, universal	Grade 90	Grade 90	Grade 75
CG—GREASE, general purpose	No. 1	No. 0	No. 0

LUBRICANTS
WB—GREASE, general purpose, No. 2
WP—GREASE, water pump
HB—FLUID, hydraulic brake
SAH—FLUID, shock absorber, heavy
CW—LUBRICANT, exposed gears, chains and wire rope, Grade 2
PS—OIL, lubricating, preservative, special

INTERVALS	
(Hourly intervals are based on actual hours of operation)	
4—4 hours	**W**—Weekly
8—8 hours	**M**—Monthly
48—48 hours	**6M**—6 months
96—96 hours	**1**—1,000 miles
D—Daily	**6**—6,000 miles

LO 9-771, 20 February 1945.

RA PD 348150B

Figure 24—Lubrication Order—Clamshell Trailer.

33. SECOND ECHELON PREVENTIVE MAINTENANCE SERVICES.

a. Regular scheduled maintenance * * * of operating organizations.

* * * * * * *

(5) SPECIFIC PROCEDURES.

* * * * * * *

ROAD TEST

MAINTENANCE		
Semi-annually	Monthly	
*	*	* * * * *
23	23	**Crankcases (Leaks, Oil Level).** *a.* (CARRIER). With engine idling * * * to proper level. If an oil change is due, drain crankcase and refill to correct level with fresh specified oil. See Lubrication Order * * * *has been performed.* *b.* (CRANE). With engine idling * * * to proper level. If oil change is due, drain crankcase and refill to correct level with fresh specified oil. See Lubrication Order * * * *has been performed.*
*	*	* * * * *
28	28	**Air Compressor (Unloader Valve, Governor, Lines).** Inspect the carrier * * * and reinstall securely.
28		*Special lubrication.* Apply a few * * * valve fulcrum pin. Apply a few drops of dry-cleaning solvent to upper valve stem of governor.
*	*	* * * * *
34	34	**Air Cleaners.** a. (CARRIER). Inspect carburetor and * * * and not leaking. Remove reservoir and element, clean in dry-cleaning solvent, dry, fill reservoir to proper level with **used crankcase oil or** engine oil, and reassemble. See Lubrication Order * * * connections are tight.
*	*	* * * * *

(Added). **References to paragraph 20 for lubrication, except item 52, be deleted.**

NOTE: *When the tactical * * the road test.*

* * * * *

MAINTENANCE		
Semi-annually	Monthly	
35	35	**Breather Caps.** a. (CARRIER). Inspect crankcase breather * * * and not leaking. Remove oil reservoir and element, wash clean in dry-cleaning solvent, refill reservoir with **used crankcase oil or** engine oil, and reassemble securely.
*	*	* * * * *
72	72	**Transfer (Mountings, Linkage, Seals, Vents).** See if carrier * * * seals and gaskets. Clean vent passage.
*	*	* * * * *
90	90	**Crane Hoist and Clamshell Shovel (Frame, Boom, Mountings, Clutches, Brakes, Drums, Cables, Sheaves, Drives, and Controls).** Inspect and service as follows:
*	*	* * * * *
		CABLES. Unwind and inspect * * * strands, and rust. Clean cables with **dry-cleaning solvent.** As cables are rewound evenly and tightly on drums, apply a film of **used crankcase oil or** engine oil to entire length of cables.
*	*	* * * * *

Section XII–A (Added)

SPECIAL TOOLS

33.1 SPECIAL TOOLS (Added).

Tool	*Federal stock number*
ADAPTER, eye, motor lifting	41–A–14–325
BOLT, eye, engine lifting with 4-in. ring attached, $\frac{5}{8}$-in. 18NF–3	41–B–1586–180
EYE, engine lifting, $1\frac{1}{16}$-in.–16NF, thread (female)	41–E–629
REMOVER, pin (lower), torque rod	41–R–2372–555
REMOVER, pin, torque rod (upper and lower), wedge type	41–R–2372–562
WRENCH, engineer's 15-degree angle, single head, open end, normal duty, carbon steel, $2\frac{5}{8}$ in	41–W–1422

Tool	*Federal stock number*
WRENCH, socket (detachable) ¾-in. square drive, 12-point opening 2⅛ in	41–W–3057
WRENCH, socket (detachable) ¾-in. square drive, 12-point opening, 2⅜ in	41–W–3057–50

40. CLUTCH.

a. Slipping.

* * * * * * *

(5) OILY PRESSURE FACINGS. Clean and correct * * * crankshaft oil seal. Replace pressure plate * * * cannot be restored.

* * * * * * *

41. TRANSMISSION.

a. Stiffness in Gear Shifting.

(1) INSUFFICIENT **Lubricant.** Fill to **correct** level with proper lubricant.

* * * * * * *

c. Excessive Noise in Operation.

* * * * * * *

(4) INSUFFICIENT LUBRICANT. Fill to **correct** level with proper lubricant.

* * * * * * *

42. TRANSFER CASE.

a. Excessive Noise in Operation.

* * * * * * *

(3) INSUFFICIENT LUBRICANT. Fill to **correct** level with proper lubricant.

* * * * * * *

b. Overheating.

(1) INSUFFICIENT LUBRICANT. Fill to **correct** level with proper lubricant.

* * * * * * *

53. IGNITION SYSTEM.

* * * * * * *

b. Spark Plug Adjustment. Remove and clean spark plugs, and check gaps with a round feeler gauge. Set gap at 0.025 inch.

c. Distributor Adjustment (fig. 43).

(1) Contact point opening may be checked with a feeler gauge. The correct point * * * to 0.024 inch.

(2) Adjust cam **opening** by loosening locking screw which holds stationary contact support and then turning the eccentric. After adjustment is * * * and recheck setting.

* * * * * *

54. CARBURETOR AND GOVERNOR.

* * * * * *

c. Linkage Adjustment (fig. 45). This adjustment concerns * * * at instrument panel. CAUTION: *Do not set engine idle speed at less than 400 revolutions per minute. This is required* * * * *combustion of fuel.*

55. FILTERS.

* * * * * *

b. Oil Filter.

* * * * * *

(2) SERVICING. Inspect the filter * * * sludge, drain crankcase. Before insertion of new elements, drain filter housings and wash entirely with dry-cleaning solvent. After elements are * * * with cap screws.

* * * * * *

d. Carburetor Air Cleaner.

* * * * * *

(2) SERVICING. Unscrew wing bolt * * * lift filter assembly. Wash out accumulated grit and dust in sump and refill with oil to lower bead of bowl. Clean screens by * * * to connecting pipe.

* * * * * *



Figure 53.1—Use of toe-in aligning wheel gauge (41–G–510).

61. WHEELS.

* * * * * *

c. Toe-in Test (figs. 53.1 and 54) (Superseded). Inflate tires to correct pressure (**a** above), and place vehicle on a smooth, level surface with wheels in straight-ahead position. Place the toe-in aligning wheel gauge between the wheels ahead of the axle, with ends of the gauge

bearing against the tire side walls and with both pendant chains just touching the ground. Set gauge so pointer registers zero. Move vehicle forward until gauge is brought into position in back of the axle, with both pendant chains just touching the ground. The gauge pointer will indicate the amount of toe-in or toe-out. Correct toe-in must be 1/16 to 1/8 inch. Adjust if necessary. (See **d** below.)

* * * * * *

63. AIR RESERVOIRS, LINES, AND VALVES.

* * * * * *

e. Air Compressor.

* * * * * *

(2) SERVICE AND ADJUSTMENT (fig. 58). Check unloader valve * * * 0.010 to 0.015 inch. **If adjustment is necessary, adjust to 0.012 inch clearance.** Remove cap nuts * * * when installing head.

67. BATTERY.

* * * * * *

b. Service.

* * * * * *

(2) TERMINALS (fig. 62). Clean terminals with * * * and wash surface. Coat terminals with **general-purpose grease or rust preventive compound (light)** to prevent corrosion.

* * * * * *

68. LIGHTS AND HORN.

* * * * * *

c. Headlight Adjustment (fig. 66). If lights are **not properly aimed,** adjust as follows: Release pressure of adjusting nut so that shell can be easily tilted on bracket to accomplish correct **aiming** adjustment. When proper adjustment * * * tightly to bracket.

* * * * * *

75. CABLES.

* * * * * *

b. Cables Wear Out Quickly.

* * * * * *

(3) CABLES LACK SUFFICIENT **Lubricant.** Lubricate cables thoroughly.

* * * * * *

82. TURNTABLE OPERATION.

a. Turntable Teeters During Operation.

* * * * * * *

(4) ROLLER **Bearings** WORN. Refer to higher authority.

* * * * * * *

87. DATA.

* * * * * * *

b. Valves.

Type	Poppet
Intake (running clearance)	**0.008** in.
Exhaust (running clearance)	**0.010** in.
Seat angle	30 deg

* * * * * * *

88. VALVES.

* * * * * * *

b. Valve Adjustment (fig. 70). Unscrew the cap * * * covers and gaskets. Loosen lock nut and turn adjusting screw until clearance between tappet and valve stem is **0.008** inch for intake valve and **0.010** inch for exhaust valve. Use feeler gauge * * * *to break tappet.*

* * * * * * *

89. IGNITION SYSTEM.

* * * * * * *

b. Spark Plug Adjustment. Remove spark plug. **Clean with spark plug cleaner and tester.** CAUTION: *Do not use* * * * to check clearance.

c. Distributor Adjustment.

* * * * * * *

(4) SET SPARK ADVANCE. Proper setting for * * * and engine power. **Set spark advance with timing light to show approximately 24 degrees for full-load speed (1,600 rpm).**

91. FILTERS.

* * * * * * *

d. Carburetor Air Cleaner.

* * * * * * *

(2) SERVICING. With turntable assembly * * * dry-cleaning solvent. Fill base with **used crankcase oil or** engine oil until level reaches top of boss marked "OIL LEVEL" inside base. Add oil whenever * * * dry, and install.

* * * * * * *

114. DESCRIPTION AND DATA.

* * * * * * *

b. Data.

* * * * * * *

(2) ROLLERS.

Clearance (total between roller and roller path)_____ **1/8 in. to 1/4 in.**

* * * * * * *

140. PREPARATION FOR LIMITED STORAGE OR DOMESTIC SHIPMENT.

* * * * * * *

b. If the vehicles * * * the following precautions:

* * * * * * *

(5) EXTERIOR OF VEHICLE. Remove rust appearing * * * wood or metal. Coat exposed polished metal surfaces susceptible to rust, such as winch cables, chains, with **preservative** lubricating oil (**medium**). Close firmly **all** * * * in the vehicle.

* * * * * * *

(7) ENGINE. To prepare the * * * from the carburetor. Start the engine and set the throttle to run the engine at a fast idle, pour 1 pint of **the proper** grade **of** preservative **engine** oil, into the carburetor throat, being careful not to choke the engine. Turn off the * * * the air cleaner.

* * * * * * *

142. PUBLICATIONS INDEXES (Superseded).

The following publications indexes should be consulted frequently for latest changes to or revisions of references given in this section and for new publications relating to matériel covered in this manual:

Introduction to the Ordnance Catalog (IOC)	ASF Cat. ORD 1
Index (formerly Ordnance publications for supply index (OPSI))	ASF Cat. ORD 2
Ordnance major items and combinations, and pertinent publications	SB 9–1
List and index of War Department publications	FM 21–6
List of War Department films, film strips, and recognition film slides	FM 21–7
Military training aids	FM 21–8

143. STANDARD NOMENCLATURE LISTS (Superseded).

a. Vehicular.

Crane, truck-mounted, M2 and trailer, clamshell M16	ASF Cat. ORD 7 SNL G–172

b. Maintenance.

Antifriction bearings and related items	ASF Cat. ORD 5 SNL H–12
Cleaning, preserving, and lubricating materials, recoil fluids, special oils, and miscellaneous related items	ASF Cat. ORD 5 SNL K–1
Elements, oil filter	ASF Cat. ORD 5 SNL K–4
Lubricating equipment, accessories, and related dispensers	ASF Cat. ORD 5 SNL K–3
Miscellaneous hardware	ASF Cat. ORD 5 SNL H–2
Soldering, brazing, and welding materials, gases, and related items	ASF Cat. ORD 5 SNL K–2
Standard hardware	ASF Cat. ORD 5 SNL H–1
Tires, tubes, tire valves, and patches, etc.	ASF Cat. ORD 5 SNL H–14
Tools, maintenance for repair of motor vehicles. Section 1—Tool sets (special), motor vehicles	ASF Cat. ORD 6 SNL G–27
Tools, maintenance for repair of motor vehicles. Section 2—Tool sets (common), specialists' and organizational	ASF Cat. ORD 6 SNL G–27

144. EXPLANATORY PUBLICATIONS.

a. Fundamental Principles.

* * * * * * *

Chassis, body, and trailer units	TM 10–560
Drivers' manual	**TM 21–305**
Driver selection and training	TM 21–300

* * * * * * *

Standard military motor vehicles	TM 9–2800

b. Maintenance and Repair.

Cleaning, preserving, **sealing,** lubricating, and **related** materials issued **for** ordnance **matériel**	TM 9–850
Maintenance and care of pneumatic tires and rubber treads	TM 31–200

* * * * * *

d. Storage and Shipment.

Ordnance storage, and shipment chart, group G	**SB 9–OSSC–G**
Registration of motor vehicles	AR 850–10

* * * * * *

[AG 300.7 (9 Aug 45)]

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