

TM 9-771

BBV  
REGISTERED

WAR DEPARTMENT TECHNICAL

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23  
1952  
LGKL BBV

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

CLASSIFICATION  
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EIGENDOM VAN BUREAU  
BUITENLANDSE VOORSCHRIFTEN

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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.

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SGV TD

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



WAR DEPARTMENT

14 JULY 1944

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

**PART ONE****GENERAL****Section 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.



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



**DESCRIPTION AND DATA**

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.

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**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.

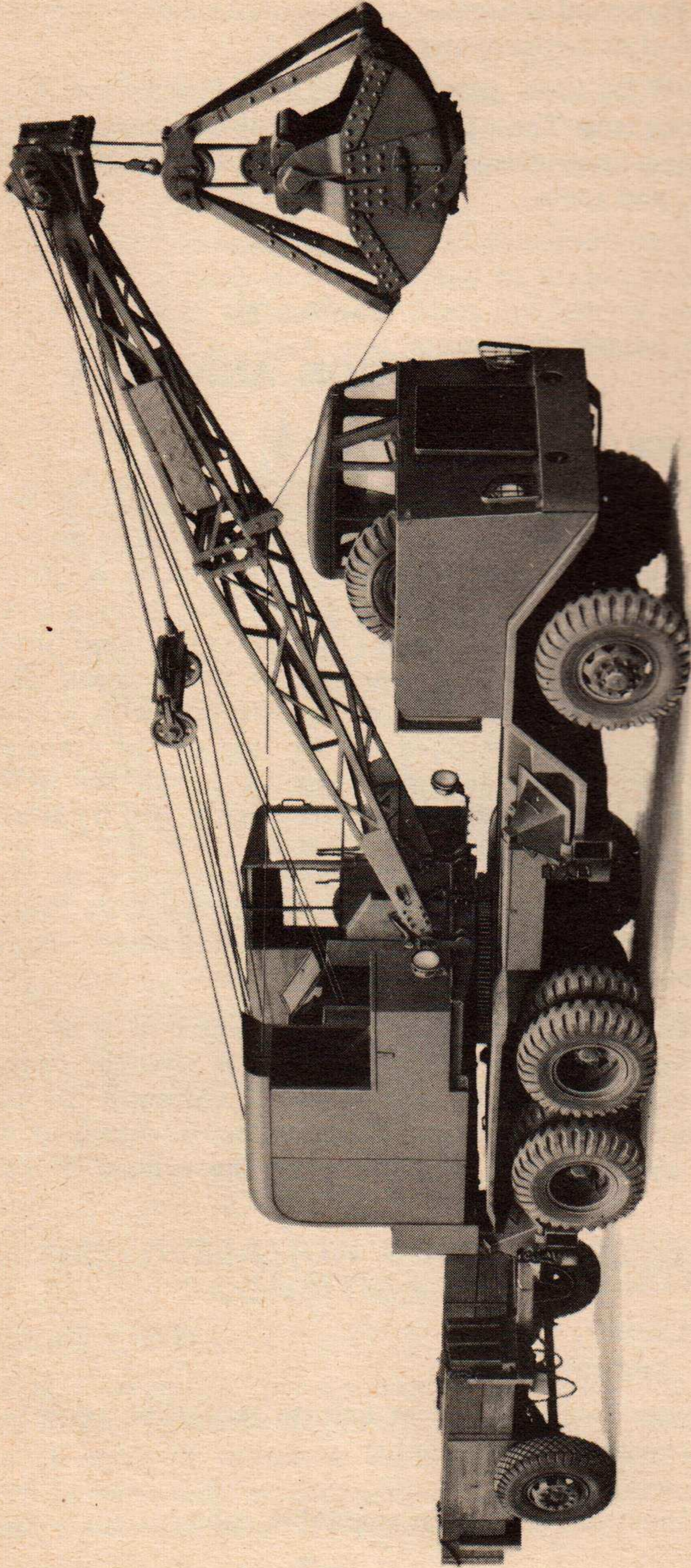
Wheelbase (centerline front axle to centerline bogie).....	168½ in.
Length, over-all (chassis only).....	299½ in.
Width, over-all.....	108 in.
Height, over-all (to top of turntable cab).....	130½ in.



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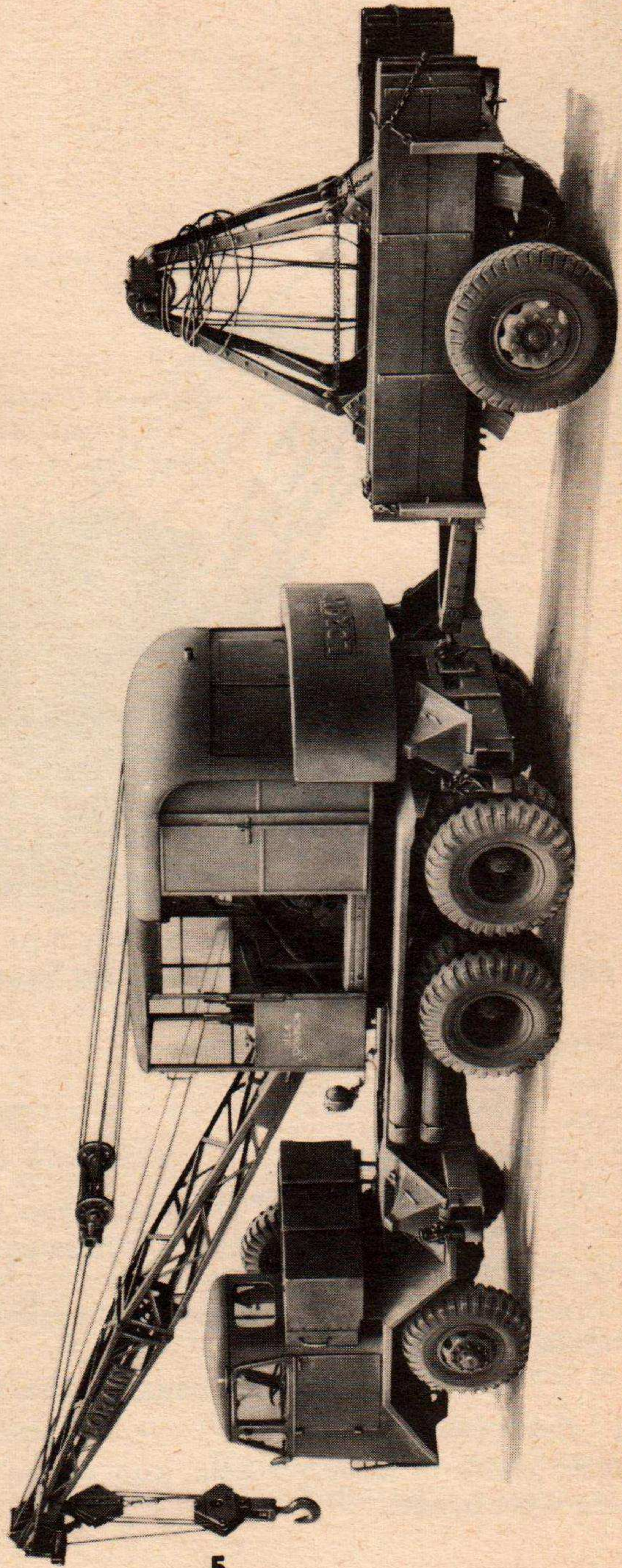


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Figure 1—Truck-mounted Crane M2 and Clamshell Trailer M16—Right Side View



DESCRIPTION AND DATA

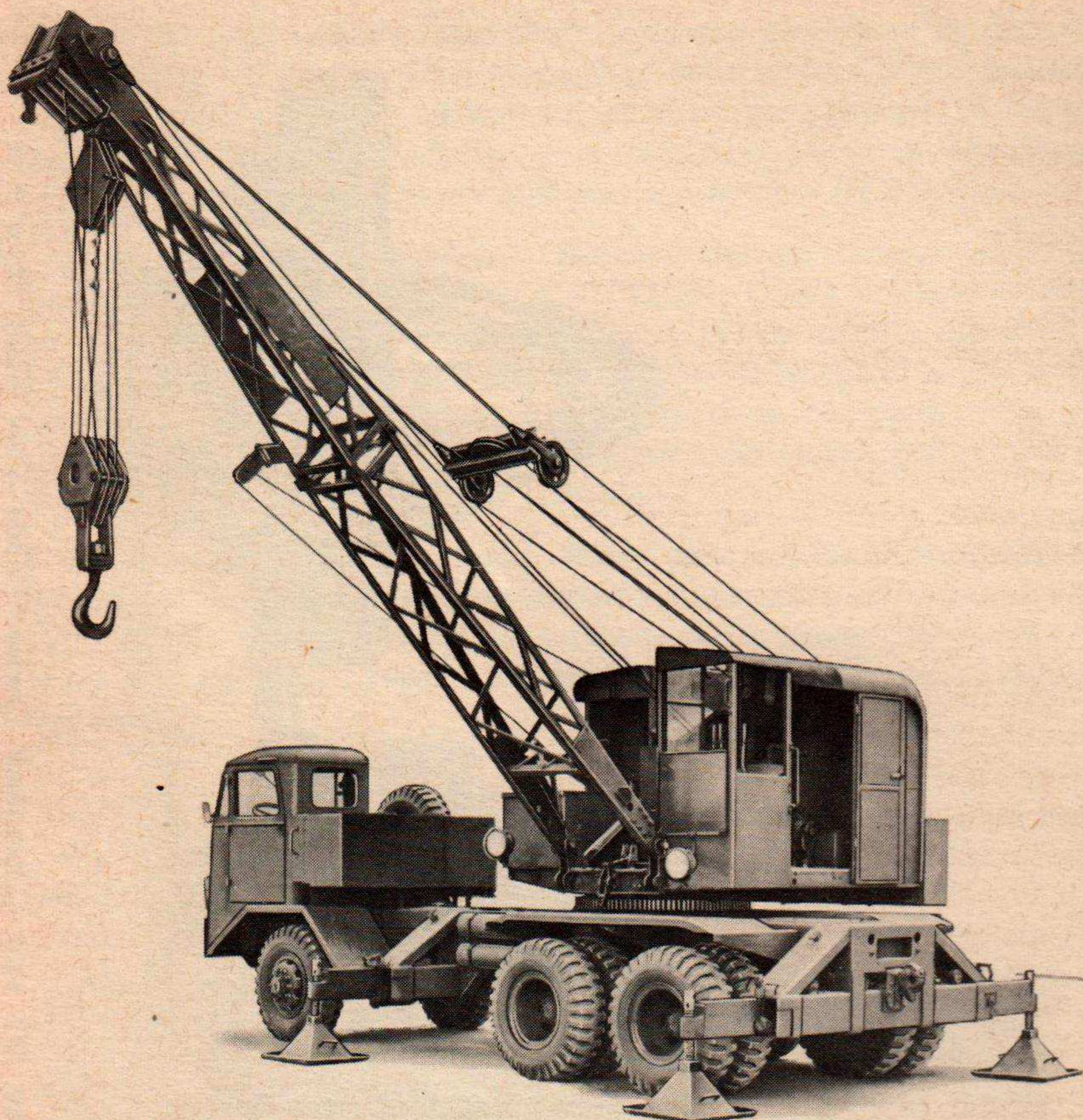


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Figure 2—Truck-mounted Crane M2 and Clamshell Trailer M16—Left Side View



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



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**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—80 <sup>1</sup> / <sub>4</sub> in.
Crew (operating—crane and carrier).....	2
Weight of vehicle (empty).....	53,500 lb
Ground clearance (empty).....	12 <sup>1</sup> / <sub>2</sub> in. under axle 18 in. under outriggers
Pintle height (center of hook).....	33 <sup>1</sup> / <sub>4</sub> 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 Range	
	Low	High	Low	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) .....	66 <sup>3</sup> / <sub>4</sub> in.
Width of cab.....	91 in.
Tail swing (front centerline rotation to extreme rear of counterweight) .....	107 in.
Boom foot pin to ground.....	70 <sup>1</sup> / <sub>2</sub> 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
--	---



**CRANE, TRUCK-MOUNTED, M2 AND TRAILER, CLAMSHELL, M16****(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....	1 <sup>3</sup> / <sub>4</sub> 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) .....	49 <sup>1</sup> / <sub>2</sub> in.
Height (loaded with clamshell) .....	128 in.
Weight (empty) .....	2,425 lb
Weight (loaded) .....	8,240 lb



**PART TWO**  
**OPERATING INSTRUCTIONS**

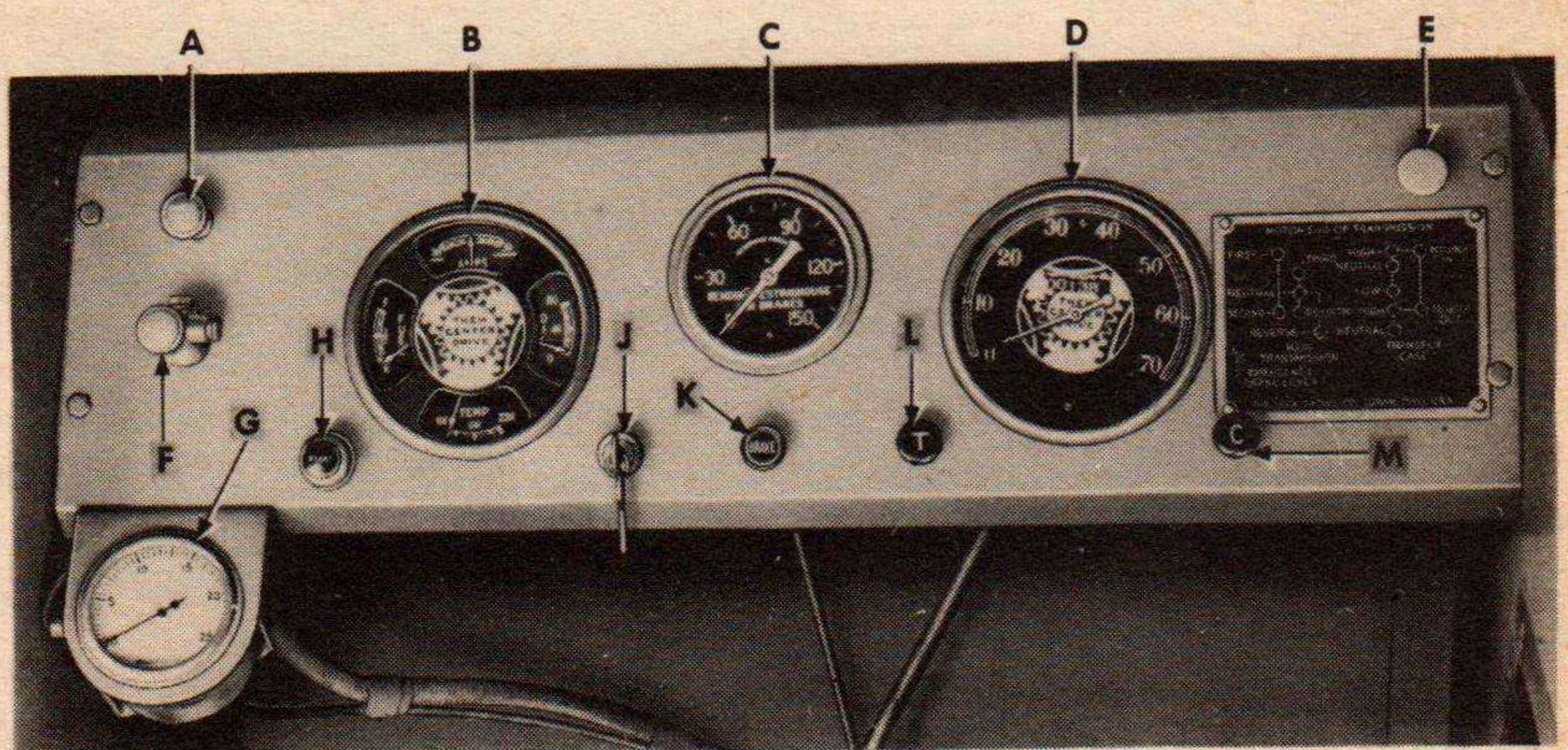
**Section III**

**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.



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



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

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**

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**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.



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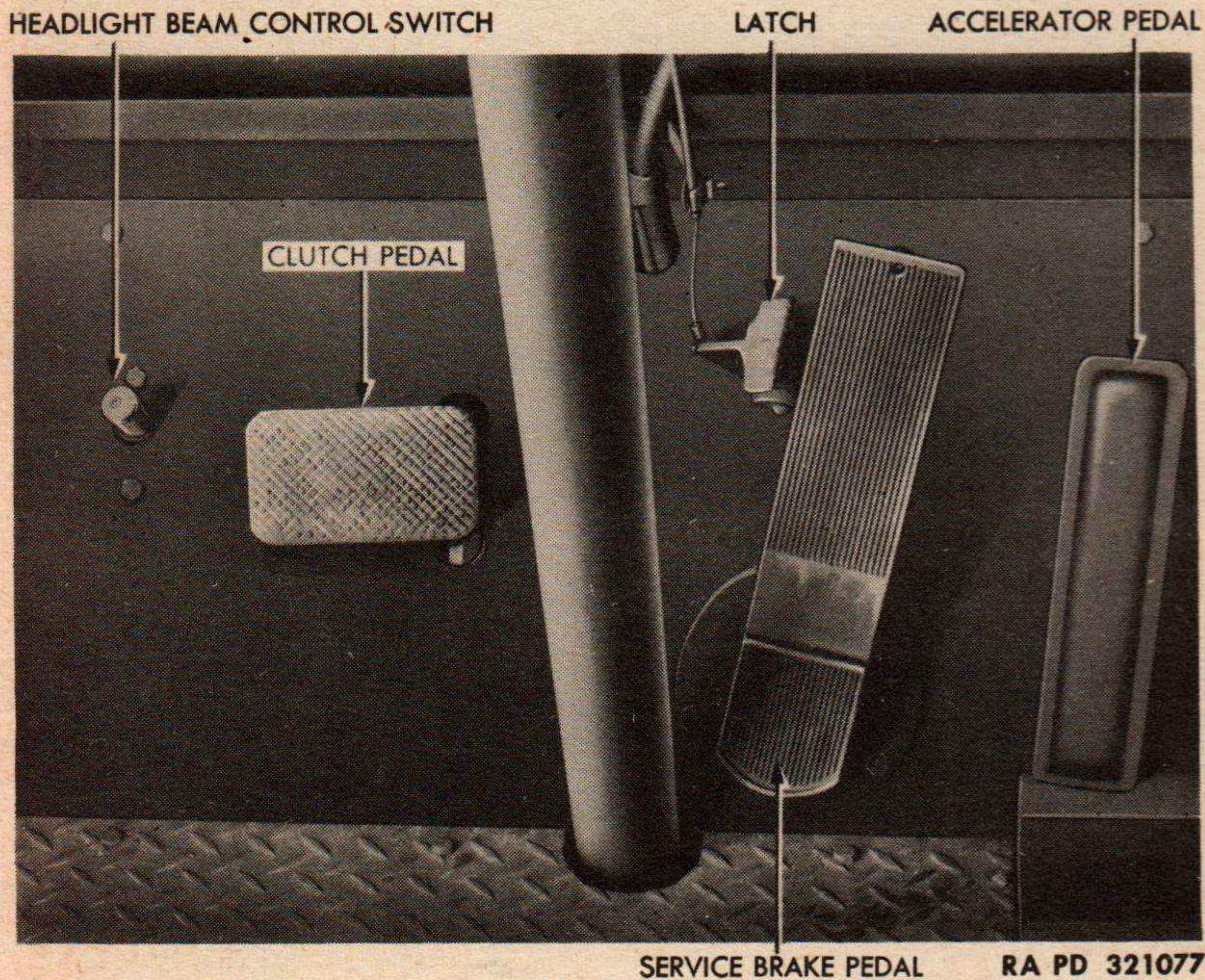
(5) **SERVICE BRAKE PEDAL** (fig. 6). The brake pedal, which is used to apply the air brakes to all 10 wheels, is located at the right center of the floorboard.

(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), "1/2" 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.

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**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

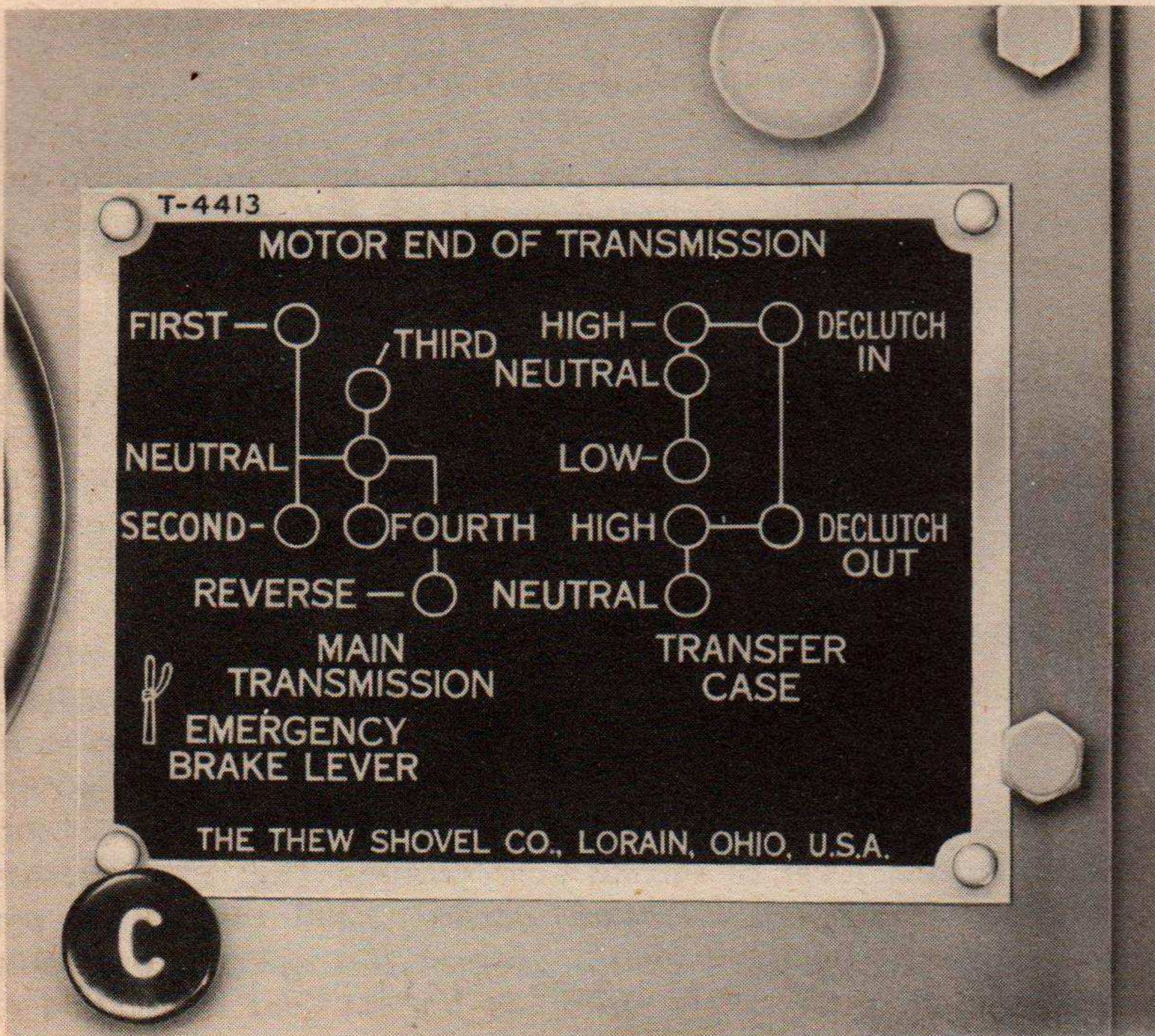


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described in paragraphs 21, 22, and 23 has been performed.

**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.

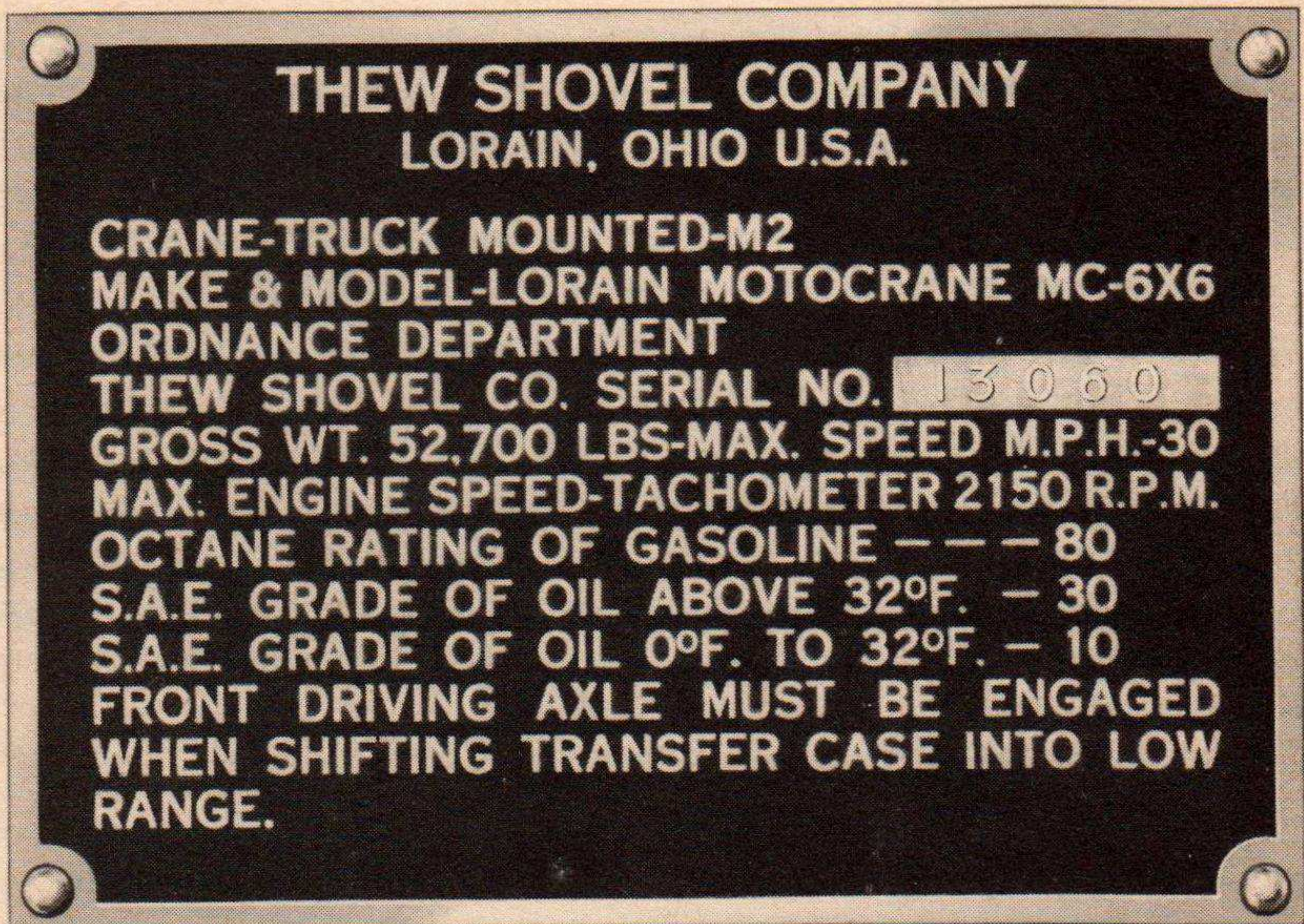
**c. Starting the Engine.** Put the transmission shift lever in neutral position. Pull choke button out about 1/2 inch and pull throttle button out about one-fifth of the total travel. Turn ignition key to the right (clockwise). Depress clutch pedal and hold down until engine starts. Press cranking motor 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.



RA PD 321142

**Figure 7—Carrier Shifting Diagram**



**CARRIER OPERATION UNDER ORDINARY CONDITIONS**

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**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).



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



**CARRIER OPERATION UNDER ORDINARY CONDITIONS**

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).



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(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)).

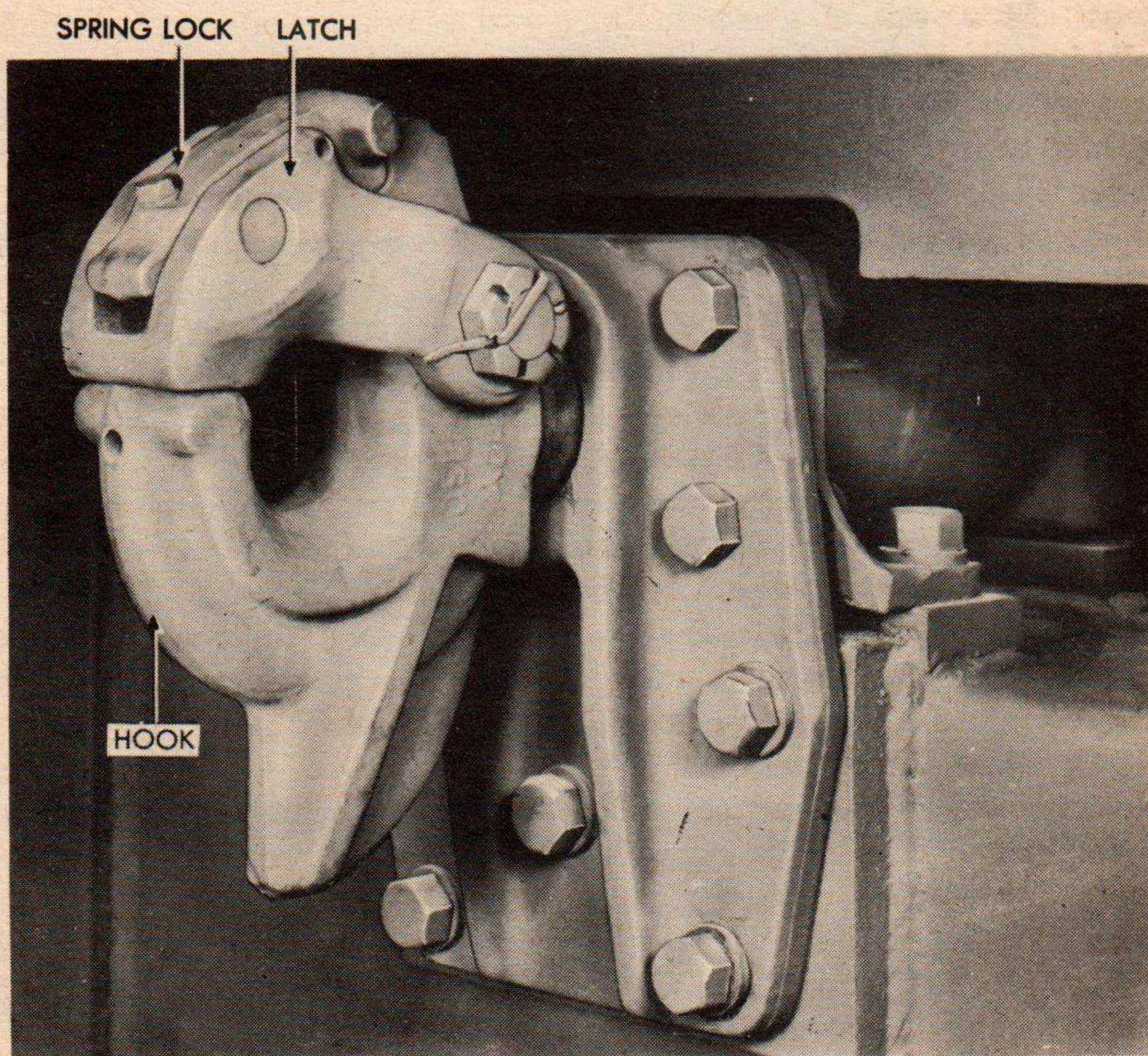
(e) Disengage front axle before using the transmission as a brake when going down a steep hill, especially before shifting to a lower gear.

(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**

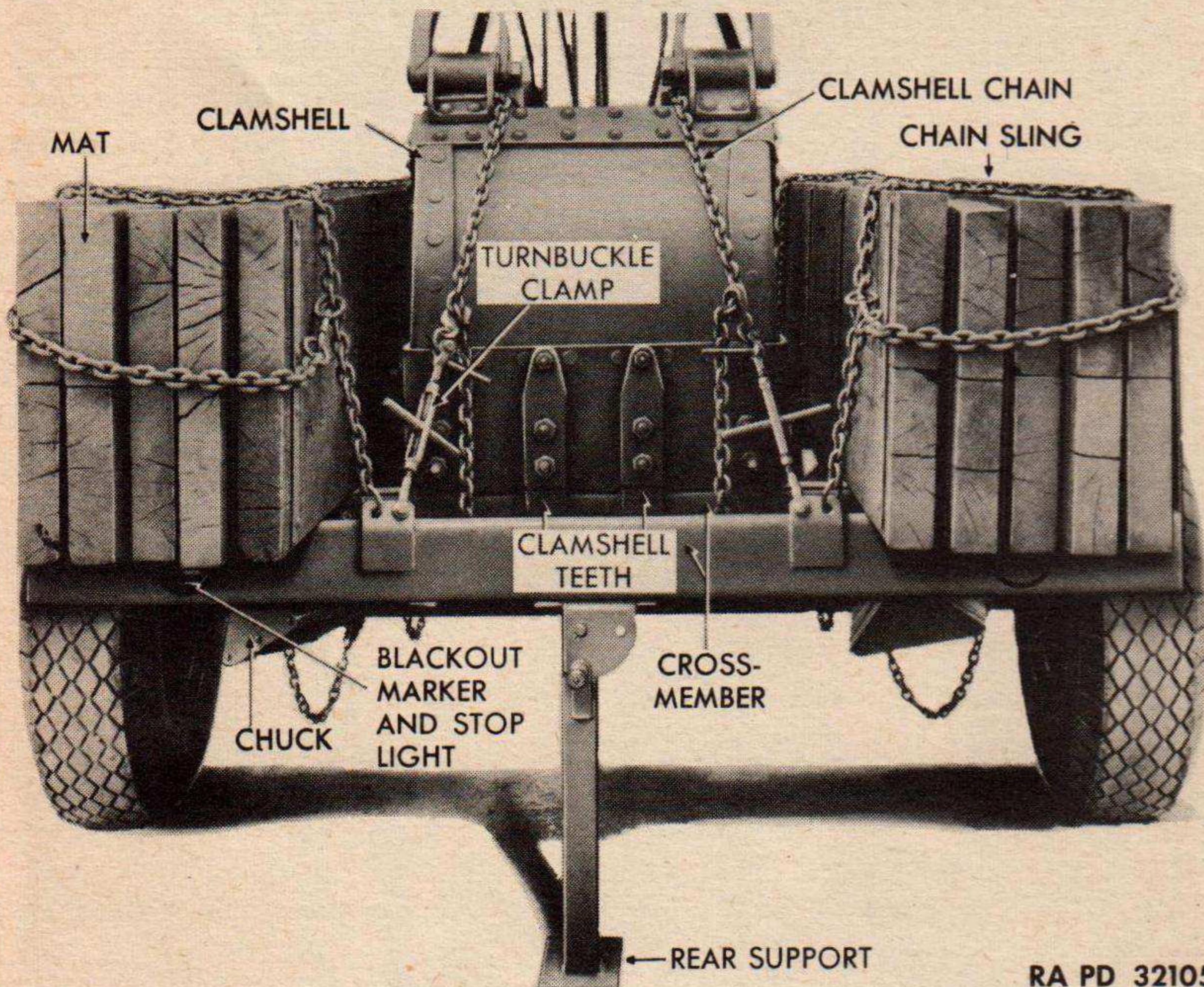


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(6) To pull vehicle from sand use same procedure as described above (step (5) (a)). If stationary or solid object is not available, decrease tires of about 30 percent of their air pressure to increase traction. **CAUTION:** *Deflating tires should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

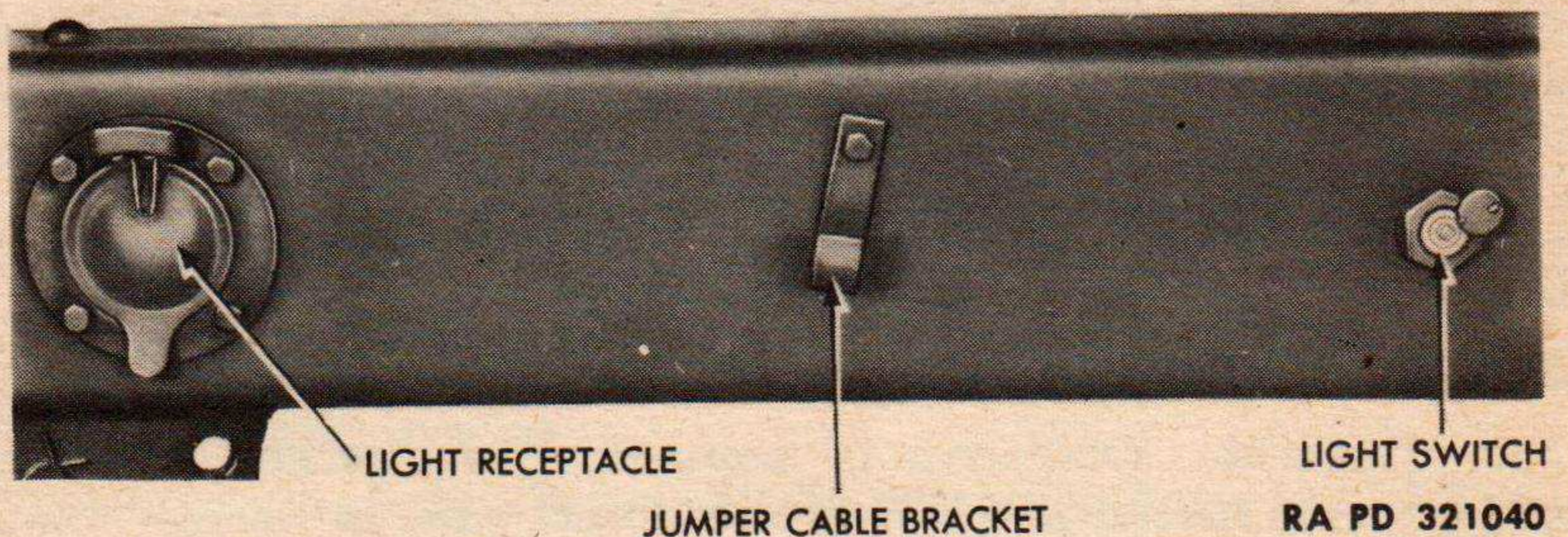
a. **Removing Trailer From Vehicle.** Lower front and rear supports on unit (fig. 10). Disconnect jumper cable at right rear of carrier, and fasten to bracket on left side of trailer tongue (fig. 11). Release pintle spring lock, raise latch, lift trailer tongue from hook, and push back to free from carrier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



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(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.

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**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



**CARRIER OPERATION UNDER UNUSUAL CONDITIONS**

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  $-30^{\circ}\text{F}$ . 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  $-40^{\circ}\text{F}$ .

(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.



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(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	1/2 qt to each 4 1/2 qt of engine oil
0 to —20	Diesel fuel	1/2 qt to each 3 1/2 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  $-40^{\circ}\text{F}$ . 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  $5^{\circ}\text{F}$ .

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

(3) At temperatures below  $-30^{\circ}\text{F}$ , 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.



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**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.



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(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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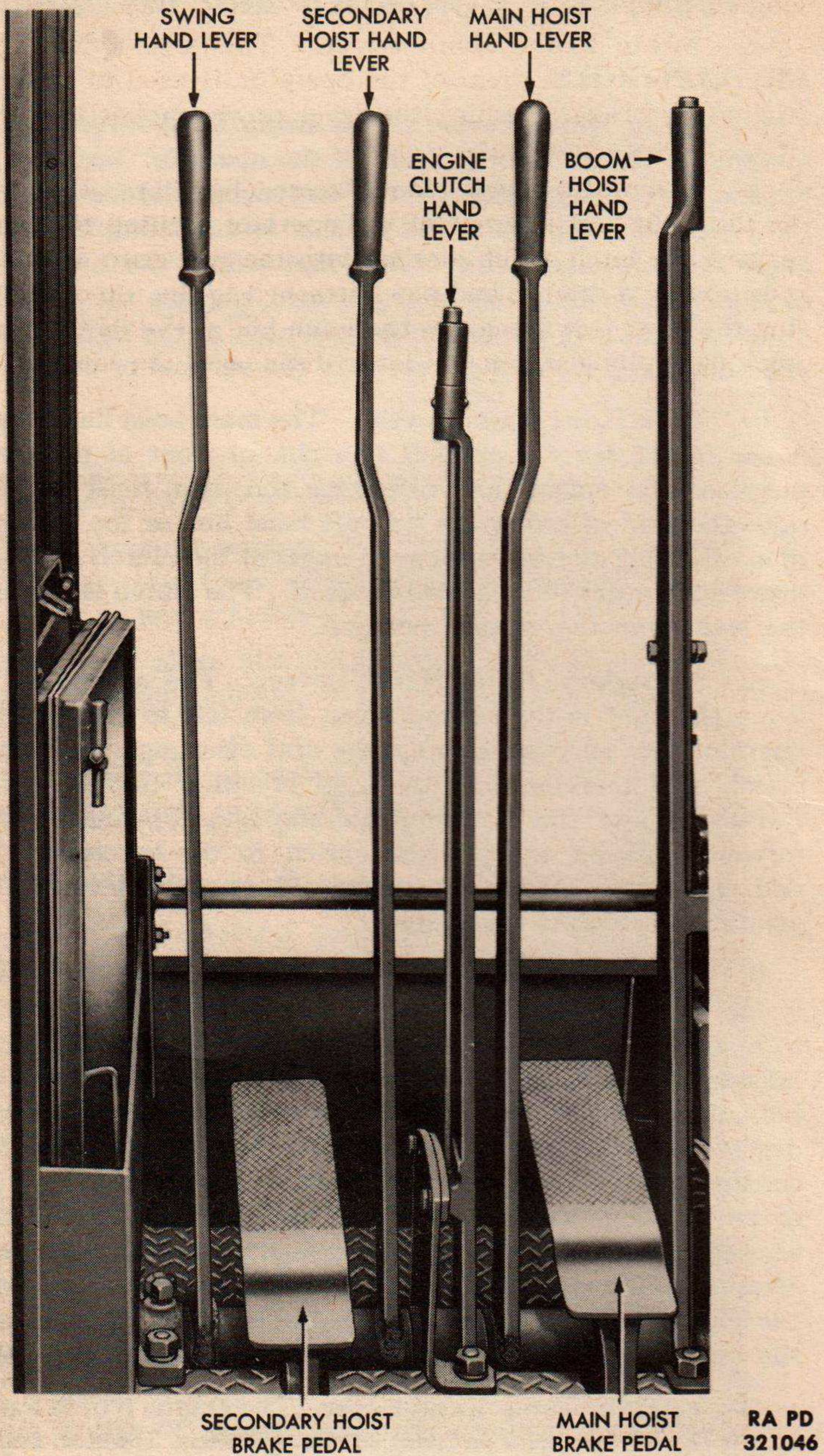


Figure 12—Turntable Control Levers and Brake Pedals