

**MODEL**     HTC-50      
**BOOK No.**     #382      
**SERIAL No.**                     

**CALIFORNIA**

**Proposition 65 Warning**

Diesel engine exhaust and some of its constituents, and certain vehicle components contain or emit chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm.

**MACHINE SERIAL NUMBER**

The machine serial number is on the Crane Rating Manual located inside the operator's cab. The serial number should always be furnished when ordering parts for the machine or when corresponding with the distributor or factory concerning the machine. Providing the serial number is the only way of ensuring the correct parts and/or information can be furnished.

In the event the serial number is not readable, a number is stamped on the upper revolving frame which can be used to identify the machine. On cable cranes this number is located on the right hand boom foot mounting lug. On hydraulic cranes and excavators the number is stamped just below the boom hoist cylinder mounting lugs.



# CAUTION

CONSTRUCTION EQUIPMENT CAN BE DANGEROUS IF IMPROPERLY OPERATED OR MAINTAINED. THIS MACHINE SHOULD BE OPERATED AND MAINTAINED ONLY BY TRAINED AND EXPERIENCED PEOPLE WHO HAVE READ, UNDERSTOOD, AND COMPLIED WITH THE OPERATORS MANUAL.

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The productive life of any machine depends largely on the care and consideration given it. This especially holds true of construction equipment.

Link-Belt® cranes embody the best of engineering knowledge, years of experience, and construction in accordance with the high standards of the Company. The present machine age and universal use of the automobile has taught most people to appreciate that systematic, periodical inspection and maintenance will be repaid with a longer period of satisfactory service.

This operator's and maintenance manual was compiled to explain the procedures and adjustments necessary for proper operation of this machine.

A study of this book will acquaint the operator and serviceman with the construction of this equipment and enable him to readily diagnose and remedy most problems which may arise. It is advisable to correct minor troubles before they develop into costly major shutdowns.

Any questions pertaining to the care and upkeep of this machine which have not been covered in this book should be directed to your nearest FMC distributor, or FMC Corporation, Crane and Excavator Division, 1201 Sixth Street, S.W., Cedar Rapids, Iowa 52404.

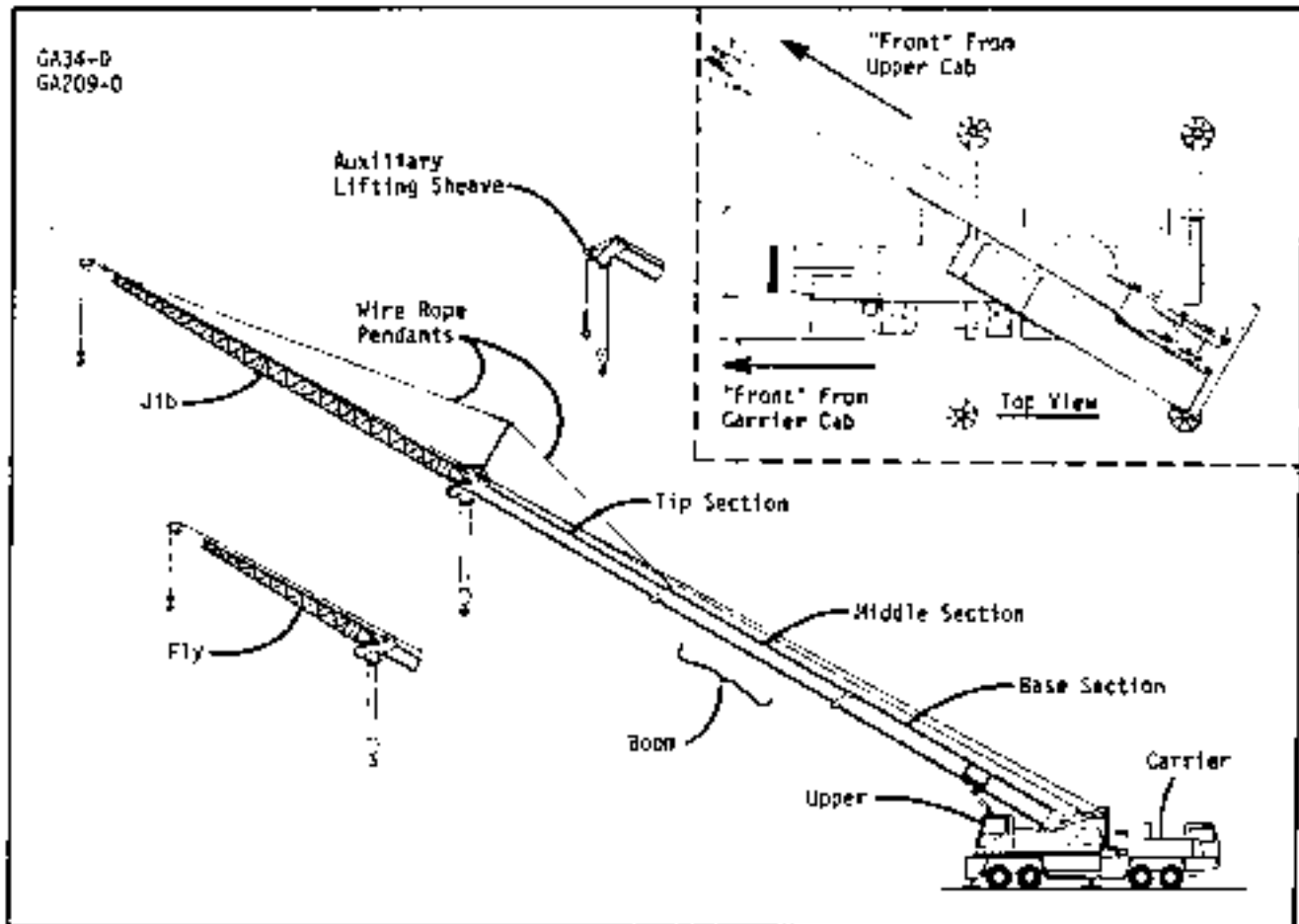
FMC Crane and Excavator Division reserves the right to make alterations or modifications in

this equipment at any time, which in their opinion may improve the performance or efficiency of the machine. The manufacturer is not obligated to make such alterations or modifications to machines already in service.

If any instruction, caution, warning or danger label, decal or plate becomes lost, damaged or unreadable, it should be replaced.

Replacement labels may be ordered through your distributor. Information contained on such labels is important and failure to follow it may result in an accident.

## Operator's Manual - Nomenclature



### Nomenclature

**Carrier:** The lower non-revolving portion of machine.

**Upper:** The revolving portion of the machine.

**Turntable Bearing:** The large antifriction bearing upon which the upper revolves.

**Boom:** The beam that projects from the upper. The boom assembly consists of base section and two power sections. The base section is pinned to the upper revolving frame.

**Jib:** An extension of the boom. The jib assembly consists of a top section, one or two straight extensions, and a folding adaptor. The jib assembly pins to the head machinery or the tip section of the boom and is supported at the

top of the jib by wire rope pendants.

**Fly:** A common term used for the cantilevered lattice section. The fly section assembly consists of a top section and a folding adaptor. The fly section assembly pins to the boom head machinery.

**Auxiliary Lifting Sheaves:** An optional part of the boom head machinery used in conjunction with a second hoist drum. The auxiliary lifting sheave is bolted to the end of the boom tip section.

**Front:** Straight ahead as viewed from the operator's seat.  
Example: The front of the carrier is the engine end as viewed from the carrier operator's seat. The upper operator's cab is toward the front of the upper as viewed from the upper operator's seat.

**Rear:** Straight back as viewed from the operator's seat. Example: The upper is mounted on the rear of the carrier as viewed from the carrier operator's seat. The counterweight is mounted on the rear of the upper as viewed from the upper operator's seat.

**Right Side-Left Side:** The right/left sides are determined from the operator's seat. Example: Both operators' cabs are located on the left side respectively of the carrier and the upper.

**Note:** Outrigger controls in the upper are oriented to the carrier and not the relative position of the upper.

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Read the following instructions in their entirety before attempting to operate the machine they contain information which is vital to safe machine operation.

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## Section 1A Operating Instructions

### OPTIONAL BUMPER OUTRIGGER (5th) Outrigger

The bumper outrigger allows 360° capacity when used with the four main outriggers.

**Bumper Outrigger Control Switch:** The control switch is located in the top center of the left headlight housing. It is a spring loaded toggle switch that returns to the "off position" when released. Pulling the switch to the front extends the jack, pushing the switch to the rear retracts the jack.

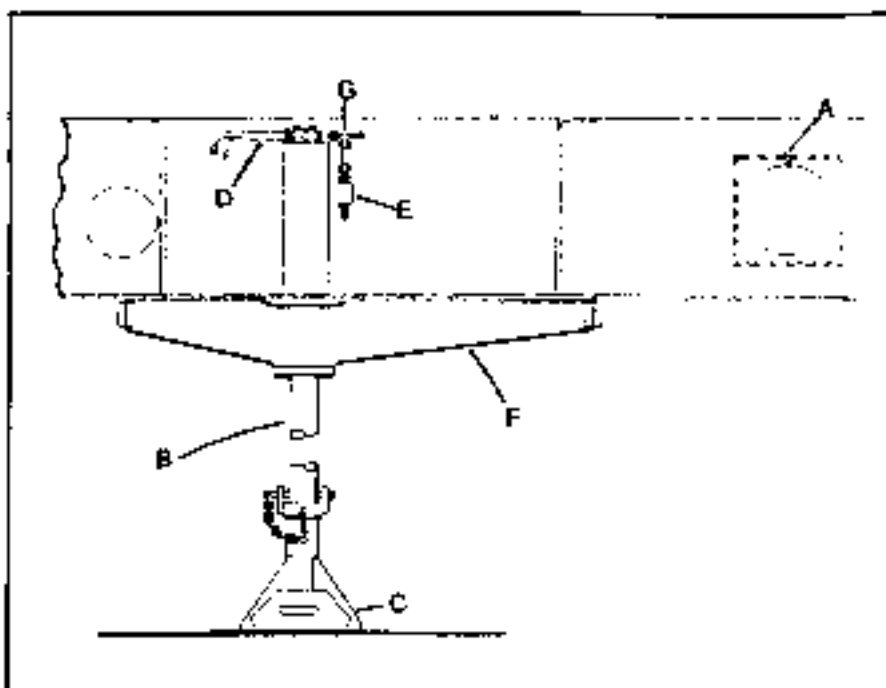


Fig. 1A-1

Bumper Outrigger

(A) Control Switch

(B) Jack Cylinder

(C) Pontoon

(D) Pressure Switch

(E) Relief Valve

(F) Bumper Outrigger Beam

(G) "Tee" Connection

### WARNING

Always Stand In Clear View Of The Jack When Operating. Be Sure Nothing Is In The Way Of The Jack To Avoid Possible Personal Injury Or Damage To Equipment.

**To Extend The Bumper Outrigger Jack:** Set the four main outriggers as described in Section 1 of the Operators Manual. Pin the pontoon (stowed on front of the right rear fender) to the outrigger jack. Extend the jack by pulling the control switch to the front. Hold the switch until:

1. The pontoon rests firmly on properly supported surface.
2. The cylinder stops moving and/or.
3. The cylinder hydraulic system goes over relief.

**To Retract The Bumper Outrigger Jack:** Retract the jack by pushing the control switch to the rear of the machine. Always retract the bumper outrigger before retracting the four main outriggers.

on the capacity chart; one for 360° and one for over the rear. Always be sure you are referring to the correct chart when making a lift. Use of the wrong capacities can result in machine damage and/or injury to personnel.

### CAUTION

Always Set The Four Main Outriggers Before Setting The Bumper Outrigger. Always Retract The Bumper Outrigger Before Retracting The Four Main Outriggers. The Bumper Outrigger Alone Will Not Support The Weight Of The Machine.

**Capacity Chart:** The machine has 360° capacity when the five outriggers are properly set. There are two columns

### WARNING

All Capacities Listed For Machine On Outriggers Are Based On Outrigger Beams Fully Extended, pontoons Properly Supported, And The Machine Level With All Tires Clear Of Any Supporting Surface. Reductions In The Machines Lifting Capacity And Unsafe Operating Conditions Will Result If These Conditions Are Not Met.

**Overload Warning System:** The bumper outrigger has a warning system built in to prevent excessive stress to the carrier frame. If the bumper outrigger is overloaded for any reason, a pressure sensitive switch mounted to the holding valve will sound the carrier horn. Under normal circumstances, the warning horn will not sound during operation within the correct capacities. If the horn sounds, immediately land the load and correct the cause.

## WARNING

If The Warning Horn Sounds When You Are Working The Machine, Immediately Land The Load And Determine The Cause. If The Outriggers Require Re-Setting, Check For Leaks Or Poor Ground Support. Correct The Cause Before Continuing Operation. Continuing To Work With The Outriggers Overloaded Can Result In Machine Damage And/Or Injury To Personnel.

**Relief Valve:** The purpose of the relief valve is to provide stable setting of the bumper outrigger without raising the machine. The correct pressure of the valve is 500 psi (3447kPa.).

## CAUTION

A Relief Valve Pressure Setting Higher Than 500 psi (3447kPa) Could Result In Structural Damage To The Machine.

To Check Relief Valve Pres-

sure:

1. Shut off engine, after engine stops, turn ignition key to "ON" to provide electrical circuit to bumper outrigger switch. Relieve system of pressure by operating the outrigger control switch in both directions enough times to relieve pressure.
2. Disconnect the pressure line from the directional valve at the "tee" on the relief valve and connect pressure gauge.
3. Start the engine, allow engine to warm up.
4. Extend the jack until the cylinder bottoms out. Read pressure gauge with engine at full throttle.

NOTE: Removing the front pontoon will make it more convenient to "bottom out" the cylinder.

To Adjust Pressure:

1. Remove the cap from the relief valve.
2. Loosen locknut.
3. With the cylinder bottomed out, turn the adjusting screw clockwise to increase the pressure or counter clockwise to decrease the pressure.
4. Tighten locknut.
5. Replace the cap.
6. Throttle engine back to idle, shut off engine. When engine stops, turn ignition key to the "ON" position to provide electrical circuit for outrigger control switch. Operate switch in both directions enough times to relieve pressure.
7. Remove the pressure gauge. Re-connect line.

Four Section Boom

The four section boom consists of a base, power inner-mid, power outer-mid, and a manual section. The boom is operated with two boom telescope control levers that are floor mounted in the left front corner of the operators cab. The left lever, (designated Tip) operates the outer-mid power section and is also used to extend and retract the manual section (see Fig. 1A-2). The right lever, (designated Middle) operated the inner-mid power section of the boom. (See Fig. 1A-2)

**CAUTION**

Power Telescoping Boom Sections Must Be Extended And Retracted Equally At All Times Capacities On The Capacity Chart Are Based On Both Sections Extended Equally. Consult The Capacity Chart For Maximum Radius, Boom Length, And Minimum Boom Angle At Which A Load May Be Handled Before Extending Or Retracting A Given Load.

Extending The Boom: Push both control levers forward away from the operator, and hold until the boom extends to the desired length.

NOTE: When extending the boom, wire rope must be wound off the drum at the same time to prevent jamming the hook block into the head machinery. See "Wire Rope Hoist Controls".

Retracting The Boom: Pull both control levers back to

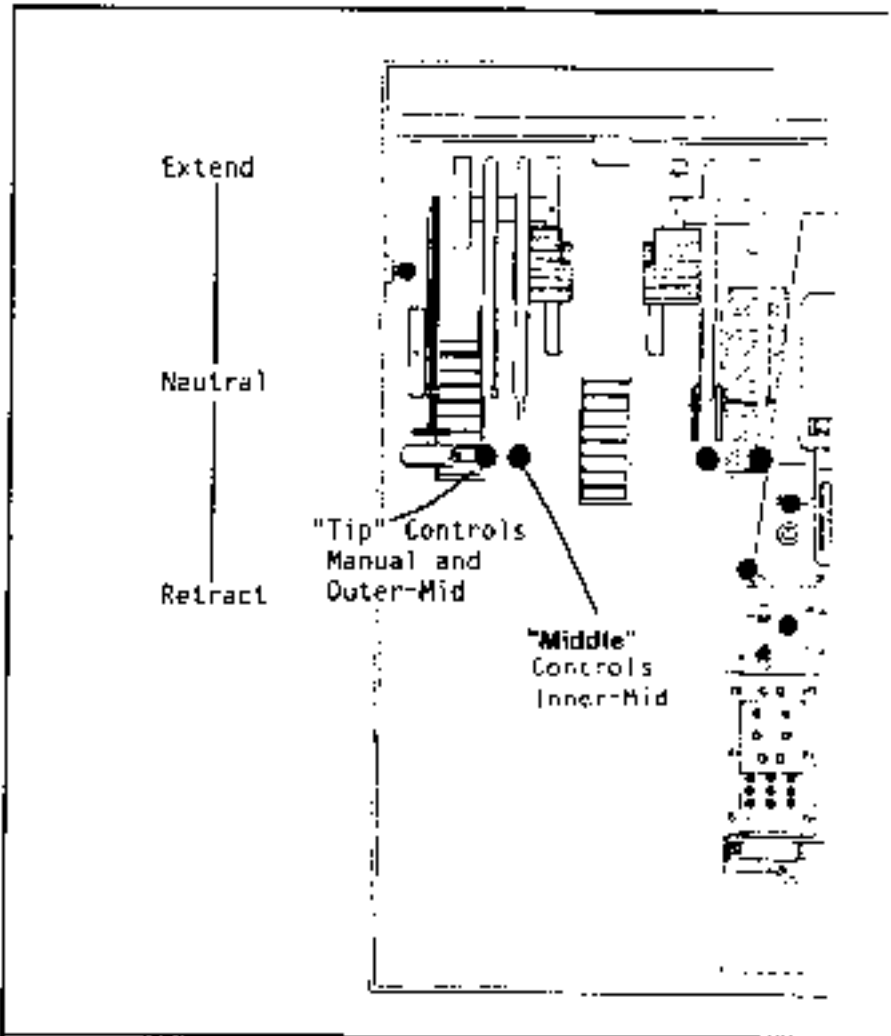


Fig. 1A-2  
Boom Telescope Controls

ward the operator and hold until the boom retracts to the desired length.

NOTE: When retracting the boom, the wire rope must be wound onto the drum at the same time to prevent the load from lowering. See "Wire Rope Hoist Controls".

Extend and retract the power boom sections equally at all times. If the sections do not extend or retract equally, operate the control levers individually to equalize the boom sections.

retraction of the boom is determined by engine speed and control lever position. The farther the control lever is moved in either direction, the faster the boom section will move. Increased engine speed will move the boom section faster.

The speed of extension or

## WARNING

Unequal Extension Of The Boom Sections Will Result In Serious Reductions In Capacities, Affect The Machine Stability, And May Result In A Tipping Condition And/Or Machine Damage.

### Extending The Manual Section:

## CAUTION

The Machine Must Be On Outriggers With The Beams Fully Extended, Levelled On Properly Supported Surface. The Counterweight Must Be Fully Extended Before Swinging The Boom Over Side.

1. The boom should be centered over the rear, fully lowered, and with all boom sections fully retracted.
2. Release the lower cylinder case from the outer power section by releasing the knives. To release the knives, insert the crank handle (stored in tool box) through the clearance holes at the right side base of the boom section, onto the crank shaft in the outer-mid section (See Fig. 1A-3). Turn the crank clockwise until the knives are in the released position and the crank cannot be turned any more. Remove the crank handle. Check position of the knives by looking through the viewing hole

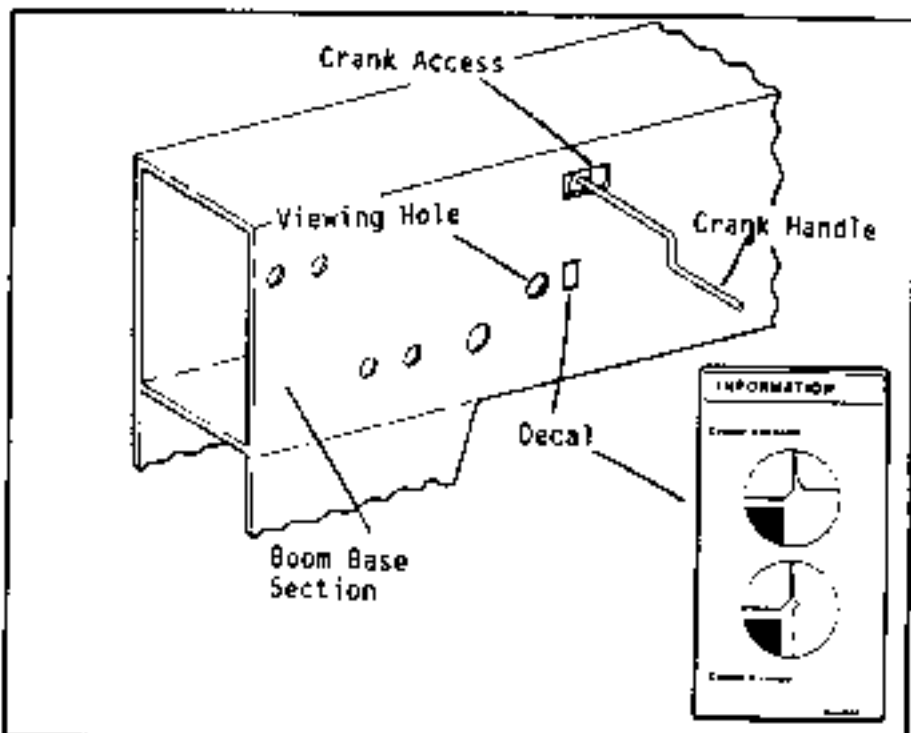


Fig. 1A-3  
Manual Cylinder Release System

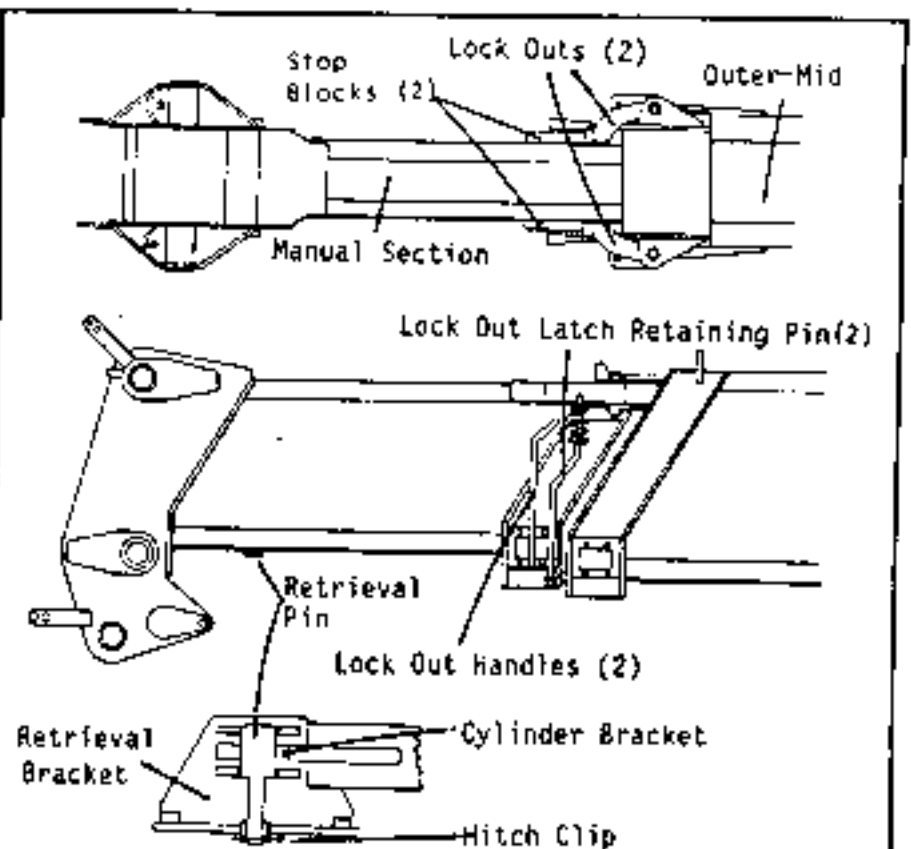


Fig. 1A-4  
Manual Lock Outs

on the right side of the boom base section. There is a decal by the viewing hole that shows the released and locked position of the knives. Ref. Fig. 1A-3.

3. Raise the boom to 70°  
This prevents the possibility of the outer-mid section extending.
4. Extend the lower cylinder fully by moving the tip section control lever forward. This extends the manual section.
5. Lower the boom fully.
6. Rotate the left and right locking latches (See Fig. 1A-4) to their extreme inward position against the manual section. To rotate the latches, pull down on retaining pins, (See Fig. 1A-4) hold the pins down and turn the latches to the locked position. Release the retaining pins and check that the latches are locked into position against the sides of the manual section. The latches must be behind the stop blocks. With the latches and the pins in proper position, the manual section is locked out in the extended position (See Fig. 1A-4).

**WARNING**

Before Attempting To Lift Any Load With The Manual Section Extended, Both Lockouts Must Be Locked In Position.

Failure To Follow The Above Instructions Could Result In Personal Injury And/Or Serious Damage To The Machine.

7. Release the lower cylinder from the manual boom section by removing the hitch clip from the retrieving pin on the bottom of the manual section (See Fig. 1A-3). Allow the retrieving pin to slide down, then place the hitch clip in the upper hole of the retrieving pin.
8. Retract the lower cylinder fully by moving the left telescope control lever to the rear. The manual section will remain extended.
9. Re-insert the crank as previously described. Connect the lower cylinder to the outer-mid power section by dropping the knives. Drop the knives by turning the crank counter clockwise until the knives are in the locked position and the crank cannot be turned any more. Check position of the knives by looking through the viewing hole on the right side of the boom base section. There is a decal by the viewing hole that shows the released and locked positions of the knives. Ref. Fig. 1A-3. Remove the crank handle and stow in the tool box. If the crank cannot be turned more and the knives are not in the locked position, check that the extend/retract cylinder has been retracted sufficiently for the knives to be dropped completely. Attempt additional retraction of the cylinder. If the cylinder cannot be retracted enough to allow clearance for knives, the retrieval bracket in the manual section of the boom can be adjusted.
10. Raise the boom to 70° until the gap between the lockout latches and the stop blocks are removed. Visually check that latches are snug against stop blocks before opening.

**CAUTION**

Visually Check That The Knives Are Completely Up (Released) Or Completely Down (Locked). Observe Position Of Knives By Looking Through The Viewing Hole On The Right Side Of The Boom Base Section. A Decal Located By The Hole Indicates The Released And Locked Position Of The Knives. Damage To The Machine Can Occur If Knives Are Not Completely In Position.

Retracting The Manual Section:

**CAUTION**

The Machine Must Be Level With All Outrigger Beams Fully Extended And All Tires Clear Of Any Supporting Surface. The Counterweight Must Be Fully Extended Before Swinging The Boom Over The Side.

1. The boom should be centered over the rear, fully lowered and with all boom sections fully retracted.
2. Release the lower cylinder case from the outer power section by releasing the knives. To release the knives, insert the crank handle through the clearance holes at

- the base of the boom section onto the crank shaft in the outer-mid section (See Fig. 1A-3). Turn the crank clockwise until the knives are in the released position and crank cannot be turned any more. Remove the crank handle. Check position of the knives by looking through the viewing hole on the right side of the boom base section. There is a decal by the viewing hole that shows the released and locked positions of the knives. Ref. Fig. 1A-3.
3. Raise the boom to 70°. This prevents the possibility of the outer-mid section extending.
  4. Extend the lower cylinder fully by moving the left telescope control lever forward. When the cylinder is fully extended, the bracket on the tang end will be in place in the retrieval bracket.
  5. Lower the boom fully.
  6. Connect the lower cylinder to the manual section by removing the hitch clip from the retrieving pin, push the retrieving pin up into the manual section and secure with the hitch clip.
  7. Release the locking latches by pulling down on the retaining pins, hold the pins down and rotate the locking latches away from the sides of the manual section. Secure the latches by releasing the retaining pins into the holes in the latches.
  8. Retract the lower cylinder by moving the left telescope control lever to the rear. This retracts the manual section.
  9. Re-insert the crank as previously described. Connect the lower cylinder to the outer-mid power section by dropping the knives. Drop the knives by turning the crank counter clockwise until the knives are in the locked position and the crank cannot be turned any more. Check position of the knives by looking through the viewing hole on the right side of the boom base section. There is a decal by the viewing hole that shows the released and locked positions of the knives. Ref. Fig. 1A-3. The manual section is now locked into the retracted position. Remove the crank handle and stow in the tool box. If the crank cannot be turned more and the knives are not in the locked position, refer to item 9 under Extending The Manual Section.

## CAUTION

Do Not Extend Or Retract The Cylinder Unless The Release System Is Fully Locked Or Fully Released.

Remove The Crank From Boom Before Extending Or Retracting The Cylinder.

Cylinder Must Be Retracted And Locked Before Extending The Outer Power Section And/Or Lifting Any Loads.

Failure To Follow The Above Instructions Could Result In Personal Injury And/Or Serious Damage To The Machine.

## Boom Length Indicator; Digital Readout System

The system consists of a control meter in the upper left side of the operator's cab (Fig. 1A-5), a transducer mounted on the side of the boom base section, and a cable from the transducer to a standoff assembly on the boom head machinery.

Both visual and audible alarms are activated when the boom length set point is reached. Reset of alarm is automatic when boom length is moved below the set point. A test switch is provided to check unit functions. The test switch does not test accuracy.

### Operation

The ignition switch must be "ON" for the system to operate. Place the toggle switch on the meter to "Read Boom" position to show boom length on digital readout.

### CAUTION

The Meter Reads Only The Length Of The Boom. Length Of Attachments Must Be Added.

### To Set Alarm Point

With the ignition switch "ON", place toggle switch on the meter to "Set Alarm" position. Turn the "Maximum Length" dial clockwise to increase or counter clockwise to decrease digital reading to desired length. Return switch to "Read Boom" position.

### To Test System

With the ignition switch "ON" and the meter toggle switch in either position, push the test button. The alarm should sound, the light come on, and numbers

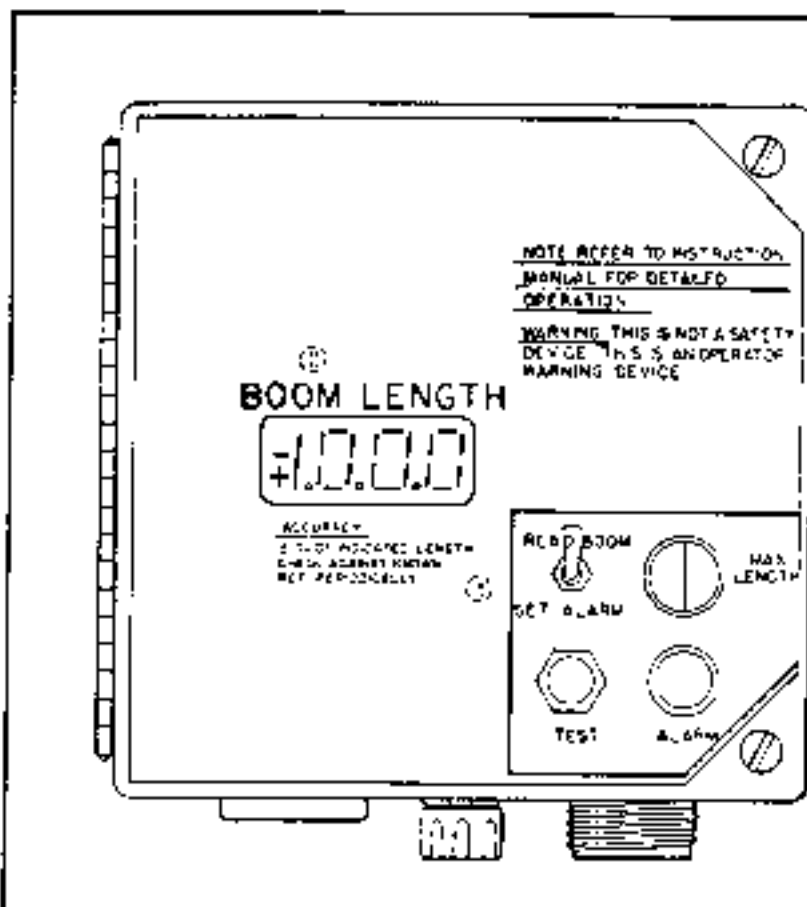


Fig. 1A-5  
Boom Length Indicator

appear on the digital readout. This test is for meter function only. If above does not occur, correct problem before using the boom length indicator system.

### CAUTION

This Is Not A Safety Device. This Is An Operating Warning System.

Refer to Section 3A for adjustment and calibration of this system.





## Operator's Manual - Section 1 - Operating Instructions

### On Delivery

On delivery of a new machine, make the following checks:

- (a) **General (Upper and Carrier)**
- (1) Check for any shortages or damages that may have occurred during transit. If any, notify the transportation company involved immediately.
  - (2) Clean dirt, paint, or any other foreign material from the machine. Remove all wires, wire ropes, and other hold down used during shipping.
  - (3) Check all gear compartments for the proper weight and level of lubricants. If necessary, change to meet local conditions (See Section 2 of this manual).
- (b) **Engine**
- (1) Check the fuel, oil, and water levels. Start the engine and check the oil pressure, water temperature, voltmeter, etc. For more information, consult the engine manufacturer's manuals supplied with the machine.
- (c) **Brake System:**
- (1) Check air pressure 110-130 PSI (758-896 kPa) operating range.
  - (2) Check low air pressure warning device for operation at 65 PSI (448 kPa).
  - (3) Check foot brake operation.
  - (4) Check park brake operation.
- (d) **Hydraulic System (Upper and Carrier)**
- (1) Check for leaks or damage.
  - (2) Check for correct operating pressure.
  - (3) Check for proper oil level in the hydraulic reservoir (sump tank). Add oil if necessary.
- (e) **Electrical Systems**
- (1) Check headlights, clearance lights, turn signals, parking lights, tail and stop lights, windshield wipers, horn, etc.
  - (2) Check all instrument panel gauges.
  - (3) Check battery water level. Fill if required.
- (f) **Lubrication**
- (1) Fully lubricate the machine as explained in Section 2 of this manual.
- Break In Period
- Operate a new machine at half throttle for the first 20 hours (two shifts) of operation. A break in period under moderate loads will assist in providing long, trouble free performance.
- Before Starting Operations
- Before starting daily operations, make the following checks:
- (a) **Engine**
- (1) Check the fuel, oil, and water levels.
  - (2) Fill as required.
- (b) **Hydraulic System**
- (1) Check all hoses for chaffing, bulging or other damage. Replace if necessary before operating.
  - (2) Check for external leaks. Repair them before operating.
  - (3) Check for proper oil level in the hydraulic reservoir (sump tank). Add oil if necessary.
- (c) **Gear Cases (Upper and Carrier)**
- (1) Visually inspect all gear cases for leakage or damage. If any, repair before operating.
  - (2) If leakage is evident, fill the case to proper level before operating.
- (d) **Controls**
- (1) Check all controls for proper operation. Adjust or repair if necessary before operating.
- (e) **Drive Train**
- (1) Check transmission and axle differentials for leakage and/or damage. Check lubricant level and fill as required.
  - (2) Check tires for damage and proper inflation pressure. (See Tire Inflation Chart in Section 3.)
  - (3) Check wheel lug nuts and tighten as required.
- (f) **Brakes**
- (1) Check air pressure 110-130 PSI (758-896 kPa) operating range.
  - (2) Check low air pressure warning device for operation at 65 PSI (448 kPa).
  - (3) Check foot brake operation.
  - (4) Check park brake operation.
- (g) **Electrical System**
- (1) Check headlights, clearance lights, turn signals, parking lights, tail and stop lights, windshield wiper, horn, etc.
  - (2) Check battery water level and fill if required.
  - (3) Check all instrument panel gauges for proper operation.
- (h) **General**
- (1) Visually inspect the entire machine for loose or missing bolts or cotter pins, cracked welds, frayed, worn, or damaged ropes, dented or damaged fly chords or lattice, etc. Repair or replace any damaged, worn, or missing components before operating the machine.

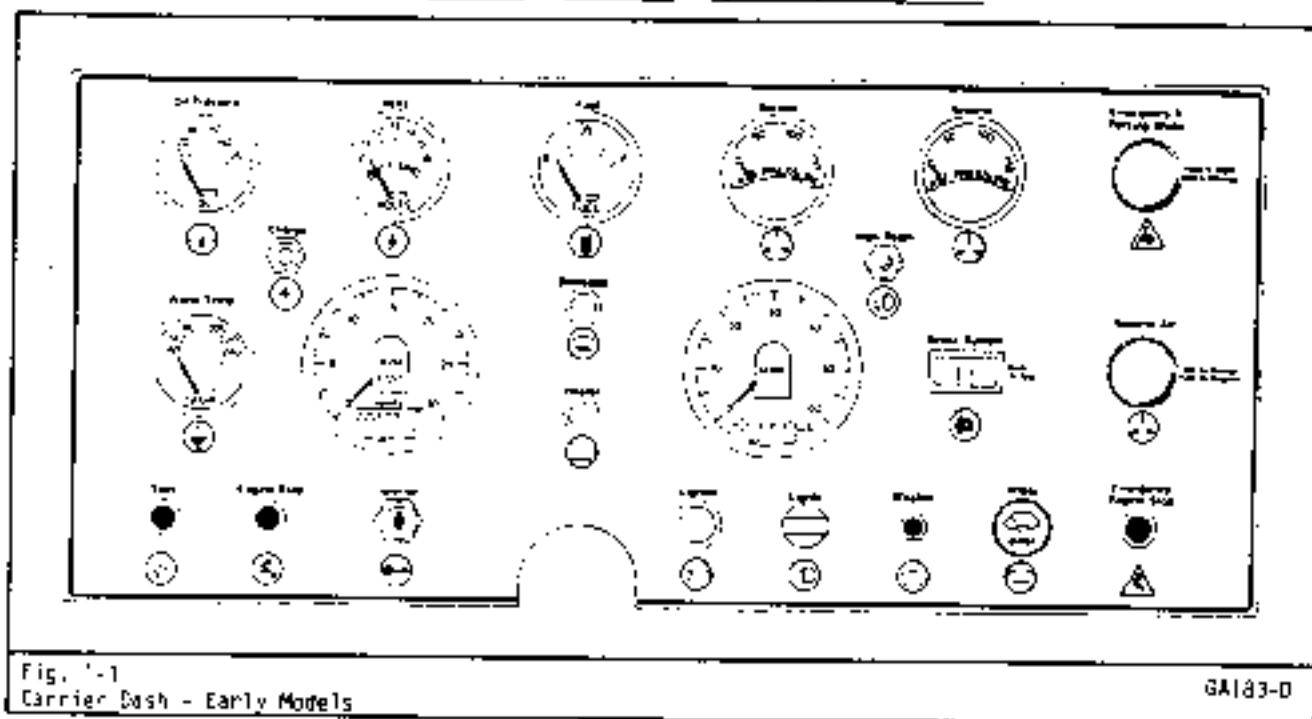


Fig. 1-1  
Carrier Dash - Early Models

GA183-D

### (1) Lubrication

- (a) Lubricate the machine as specified in Section 2 of this manual.

Note: Even though the operator may have nothing to do with the lubrication or maintenance of the machine, it would be advantageous for him to read the maintenance sections of this manual. Knowledge of preventive maintenance may allow the operator to spot a malfunction in the machine so repairs may be made with a minimum of downtime.

### Carrier Operating Controls

The following series of paragraphs explain the location and function of the carrier controls. This information must be read and thoroughly understood before attempting to operate the carrier.

Ignition Switch: The ignition switch is key operated to prevent starting by unauthorized personnel. The key switch energizes the instruments on the dashboard and prepares the engine for starting. When operating the carrier accessories, the switch

must be in the "on" position.

Start Button: The start button, when pushed, completes an electrical circuit which energizes the starter motor. Refer to "Engine Starting Procedures" for further details.

Engine Stop (G.M.): The engine stop button is used for normal engine shutdown. Push button and hold, to shut off flow of fuel to the engine. Refer to "Engine Shutdown Procedure" for further details.

Engine Stop (Cummins): Turning the ignition switch to the "off" position will shutdown the engine. Refer to "Engine Shutdown Procedure" for further details.

Emergency Engine Stop (G.M.): The emergency engine stop button is to be used only when normal engine shutdown procedure fails. Pressing the button will cut off all air flow to the engine. When the engine is stopped by this method, it must not be restarted until the cause of trouble is repaired. Manually reset shutdown on engine before restarting.

Oil Pressure Gauge: The engine oil pressure gauge indicates the engine lubricating oil pressure. Consult the engine manual for proper operating range.

Water Temperature Gauge: The water temperature gauge indicates the temperature of the cooling system coolant. Consult engine manual for proper operating range and coolant.

Tachometer-Hourmeter: The tachometer indicates engine speed in revolutions per minute (RPM). Refer to engine manual for suggestions on operating speeds. The hourmeter in lower portion of gauge shows number of hours of operation on the engine. Use the hourmeter in determining the lubrication schedule.

Charge Light (Early Models): This light acts as an ammeter in the electrical circuit. When the light is on, the battery is discharging. The light may be lit with the engine running at a slow idle. If light does not go out when engine speed is increased, check out charging system and correct the problem before continuing operation. As

# Operator's Manual Section 1 - Continued - Operating Instructions

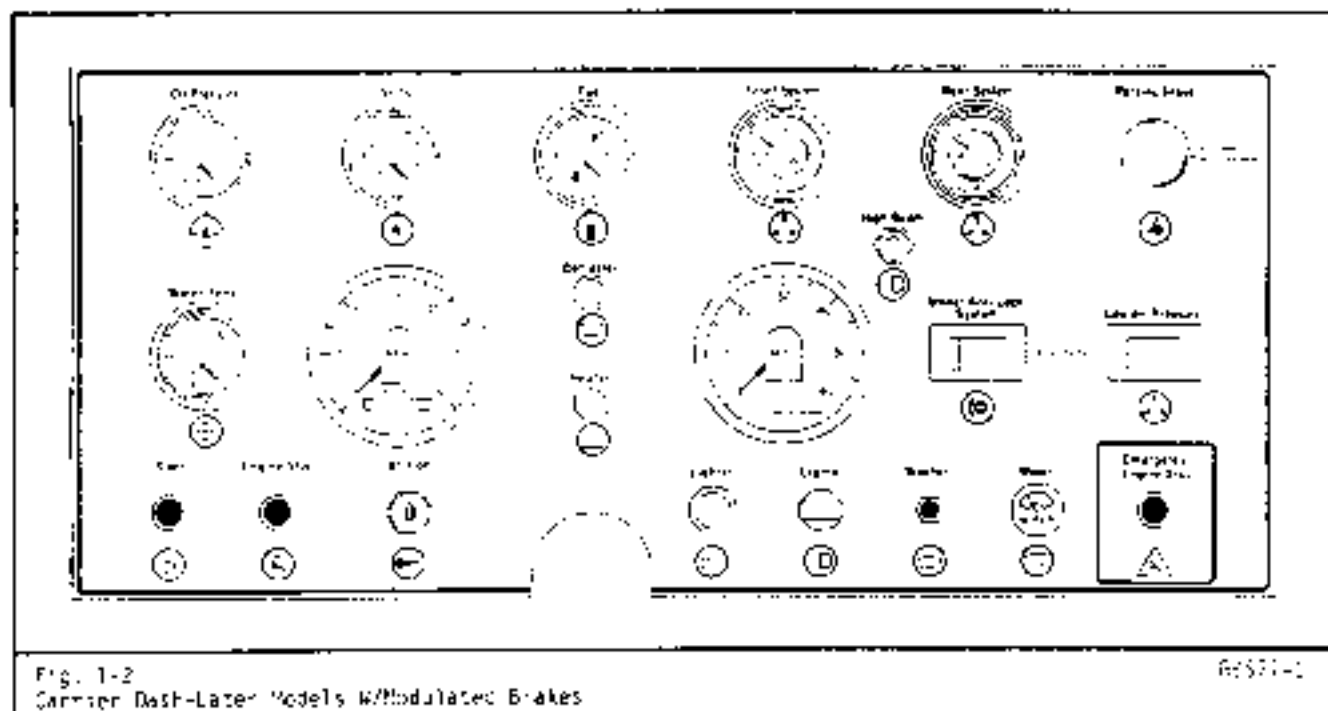


Fig. 1-2  
Carrier Dash-Later Models W/Modulated Brakes

a check on the bulb condition, the light should be lit when the ignition switch is "on" and the engine not running.

**Voltmeter:** The voltmeter indicates the battery condition. Refer to "Voltmeter Reading" for assistance in trouble shooting the electrical system.

**Fuel Gauge:** The fuel gauge indicates the fuel level in the fuel tank. Refer to the engine manual for proper grade of fuel.

**Heater & Defroster Switches:** The heater and defroster switches control a fan in each unit. Turn switch clockwise to turn on each fan. Turn switch counterclockwise to turn off the fan.

**Speedometer - Odometer:** The speedometer indicates the speed in miles per hour (MPH) that the machine is traveling. The built-in odometer indicates miles traveled and should be used as a guide for carrier lubrication. (See Section 7 "Lubrication and Preventive Maintenance.")

**Headlight Switch:** The push-pull light switch, when pulled out to the first position, will turn on the dash, clearance, and parking lights. When the light switch is pulled out to the second position, the headlights and taillights will come on in addition to the clearance and dash lights.

**Windshield Wiper Switch:** The wiper switch controls the operation of the electric windshield wipers. The switch has two positions, the first position for low speed, and the second position for high speed.

**Windshield Washer:** The washer is used to spray water or clearing solvent on the windshield. Use in conjunction with windshield wipers to clean window. With windshield wipers "on", press button marked "washer" to spray windshield.

**Skid-Stop® Wheel Anti-Lock System:** The Skid-Stop® indicator is an illuminated rocker switch. When lit, it indicates a failure in the anti-skid portion of the

brake system. The air brake system should continue to function normally, but without the anti-skid capabilities.

To check system operation, turn ignition switch "on", press rocker switch, and observe the indicator light in the switch core or when the switch is released, the light should go out and stay out. If the light fails to come on when tested, or stays on, a system check is required.

**Note:** The failure indicator switch checks only the electrical portion of the system. Therefore, a routine check of the air brake system should be made to be sure that the brake apply and that no air leaks are present.

When driving, if the failure indicator light comes on, proceed as follows:

- (a) Slow down and when traffic clears, apply the brake to be sure that normal braking exists.

## Operator's Manual Section 1 - Continued - Operating Instructions

- (b) If normal braking exists, proceed with caution until the system can be checked out and repaired.

### CAUTION

The Skid-Trail System Is Not A Cure All For Over-Driving Existing Road Conditions. It Will Still Take Longer To Stop On A Slippery Road Surface Than A Dry One And The Driver Should Proceed Accordingly.

**Service Air Pressure (Early Models):** This gauge indicates the amount of air pressure available to operate the service brakes. The gauge should read between 110 and 130 PSI (758 - 896 kPa) under normal conditions. If the gauge does not register in this pressure range, correct the problem before operating the carrier. If sufficient pressure is not available, adequate braking force may not be developed. If a pressure reading below 55 PSI (443 kPa) is registered, a low pressure indicator buzzer will sound warning of the situation. The buzzer will sound until system air pressure is built up above the 65 PSI (446 kPa) level.

**Reserve Air Pressure (Early Models):** This gauge indicates the amount of air pressure available for releasing the emergency brake in emergency situations. This gauge should read 110 to 130 (758-896 kPa). There must be a minimum of 65 PSI (443 kPa) in this system to release the emergency brakes.

**Emergency And Parking Brake Control (Early Models):** The emergency and parking brake is spring applied and air released. Apply the parking brake by pushing this control in. All air is released from the spring compartment allowing spring to apply the brakes. The carrier cannot be moved until sufficient air pressure to overcome the spring tension is re-admitted to the spring compartment. To

release the brake, pull the control knob out and let the pressure build up enough to release brakes.

**Reserve Air Control (Early Models):** If air pressure is lost while the carrier is being operated, the emergency brakes will automatically apply.

**Note:** Reserve air tank has capacity to release brakes only once.

In order to route reserve air pressure to release brakes, proceed as follows:

- Pull out on emergency and park brake control. This will route air to release brakes.
- Push in and hold reserve air control to deliver reserve air from reservoir to brake chamber.

This procedure will release the brakes long enough to move the carrier to the side of road. Releasing reserve air control will automatically reset emergency brakes.

**"Modulated" Brakes (Later Models):**

**Note:** "Modulated" brakes do not alter normal service brake, or anti-wheel locking operations.

Refer to later carrier dash panel in Fig. 1-2.

Air brake pressure gauges are labeled "Front System" and "Rear System" rather than the early style "Service" and "Reserve". Also, note that there is only one air control valve labeled "Parking Brake".

When operating, both "Front System" and "Rear System" gauges should read full system pressure of 110-130 PSI (758-896 kPa). If either system should fail to develop pressure, or lose pressure during operations, the "Low Air Pressure" warning light will come on and a buzzer will sound. Refer to gauges to determine which system is faulty. Warning light or buzzer signals indicate air pressures below recommended ranges. Repairs should be made

as soon as possible.

### Operation With Low Air Pressure

The air brakes may be operated in much the same fashion as when all systems are functioning properly, however, additional caution must be exercised as "smoothness" of braking may be impaired.

### CAUTION

The Modulated Air Brake System Is Designed To Prevent Abrupt Application Of The Emergency Brakes If There Is A Rear Air System Failure. When The Warning Devices Signal, Make Repairs As Soon As Possible As Control Of The Carrier May Be Impaired.

Careful use of the air brakes will yield adequate brakes for roading the machine. (Example: Do not waste air pressure by fanning the brakes.)

**Note:** If air pressure is lost in both the front and rear systems, the emergency brakes will apply and cannot be released before the cause of the failure is found and repaired.

**Parking Brake (Later Models):** The parking brake is spring applied and air released. To apply parking brake, pull out on the control knob. The carrier cannot be moved until sufficient air pressure is re-admitted to the spring compartment. To release the parking brake, push the control knob in and let the air pressure build up enough to release the brakes.

**Clutch Pedal:** Depressing the clutch pedal disengages the carrier engine from the rest of the drive train. Releasing pressure against the pedal will allow the clutch to engage.

**Air Brake Pedal:** Depressing the brake pedal actuates a valve which meters air pressure to the service brake actuators. The further the pedal is depressed,

## Operator's Manual Section 1- Continued - Operating Instructions

the greater the air pressure that is admitted to the actuator, and the harder the brakes apply. Releasing the brake pedal releases the air pressure from the actuators, allowing the brake shoe return springs, to release the brakes.

**Throttle Pedal:** The throttle pedal controls the amount of fuel to the engine. Depress the pedal to increase engine speed. Release pressure on the pedal to decrease engine speed.

**Throttle Selector (Later Models W/G.N. Engines):**  
The engine throttle can be controlled from only one location at a time. The throttle selector lever may be placed in either the "upper" or "lower" position. Always start a "cold" (low air pressure) engine with the switch in the "lower" position. Once normal system air pressure is built up, the switch can be changed to the "upper" position. An engine surge will occur whenever the switch is operated, but will return to idle in about 5 seconds.

**Dimmer Switch:** The dimmer switch controls the high and low beams of the headlights. Depress and release button to change from low to high beam or vice versa. The "high beam" indicator on the dash indicates when headlights are on high beam.

**Turnsignal Switch:** This lever actuates the directional signal lights at the front and rear of carrier. Move handle in direction turn is desired to actuate proper turnsignal lights.

**Emergency Flasher:** Flip this switch to actuate the turnsignal lights at all four corners simultaneously as an emergency warning. Do not use when traveling machine. Use of flags, flares, or reflectors is required when stopping on edge of roadway.

**Pump Disconnect:** This control is used to engage and disengage the main hydraulic pump from the engine. Refer to "Engaging and Disengaging Hydraulic Pump" procedure before operating this control.

**Inter-Axle Differential:** The

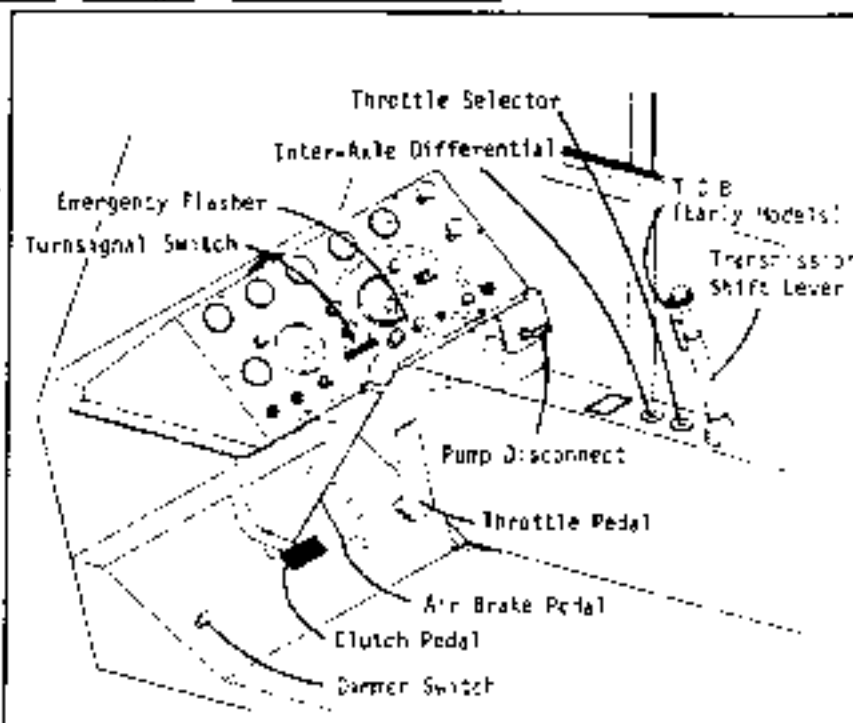


Fig. 1-3  
Carrier Controls

inter-axle differential assembly when "unlocked" divides the engine torque between the forward and rear axle. When the assembly is "locked", the forward and rear axles are converted to a through drive tandem. Locking or unlocking the inter-axle differential is accomplished by an air powered shift unit controlled by this lever. Refer to "inter-axle differential operation" for operating procedure.

**Transmission Shift Lever.** The transmission has thirteen progressive forward speeds and three reverse. It consists of a five-speed front section and three-range auxiliary section. Ratios in the front section are used once through low range of the auxiliary, once through intermediate range, and once through direct range of the auxiliary; however, only three ratios in the front section are used when the auxiliary is in low range. This gives a 3-5-5 repeat shift pattern. All speeds are controlled with one lever. The range selection is made with a three-position selector valve mounted on top of the gear shift lever. Refer to

"Shifting the transmission" for further details.

**Transmission Countershaft Brake (Early Models):** The transmission is equipped with a transmission countershaft brake (TCB). This is an air operated mechanical brake which slows down the transmission gearing by forcing a piston against the transmission PTO gear to assist initial engagement into first or reverse.

**Note:** Transmission countershaft brake (TCB) assists in shifting the transmission. It has no carrier stopping or holding function.

**Clutch Brake (Later Models):** The clutch brake is an integral part of the machine's main clutch and is operated by pushing the clutch pedal to within one inch (25mm) of the floorboard.

The purpose of the clutch brake is to stop the transmission gears from rotating to initially shift the transmission smoothly to first or reverse. The brake will also facilitate making smooth up shifts without double clutching.

## Operator's Manual Section 1 - Continued - Operating Instructions

### Starting The Engine

Before attempting to start the engine, the operator should carefully read the engine starting instructions in the engine manufacturer's operating manual. Attempting to start or run the engine before studying these instructions may result in damage.

The driver should learn and obey all applicable "rules of the road" and, if not already a competent driver, obtain instructions to attain the necessary driving skills.

With the engine fully serviced according to the engine operator's manual and the operator thoroughly familiar with the location and function of all controls, instruments, and switches, the engine may be started according to the following procedure:

- (a) Engage parking brake.
- (b) Disengage hydraulic pump as described in "engaging and disengaging the hydraulic pump".
- (c) Place carrier transmission shift lever in neutral position. Engine will not crank unless transmission is in neutral.
- (d) Turn key ignition switch to the right to energize the engine electrical system. With the engine throttle at idle, press the "start" button firmly. Release button immediately when engine starts. If the engine fails to start within 30 seconds, release starting button and allow the starting motor to cool a few minutes before trying again. If the engine fails to start after four attempts, refer to engine manual for further instructions.

(e) Warm-Up: Run the engine at part throttle and no load for approximately 5 minutes, allowing it to warm up before applying a load. While the engine is warming up, observe all carrier instruments for proper indications.

- (1) Engine Oil Pressure: If there is no oil pressure within 10 to 15 seconds after starting, stop the engine and check the lubrication system. Refer to engine manual for proper operating range.
- (2) Voltmeter: Observe reading on voltmeter and make sure it is in the proper operating range. Refer to "Voltmeter Reading".
- (3) Air Pressure: Allow air pressure to reach normal operating range of 110 to 130 PSI (758-896 kPa) before attempting to move machine. There must be a minimum of 65 PSI (448 kPa) air pressure in the reservoirs before the emergency brake can be released.

When the engine has fully warmed up, all operating pressures and temperatures are within requirements, and daily checks are made, the machine is ready for full operation.

### Engine Shutdown Procedure (Cummins):

- (a) Throttle engine back to idle.
- (b) Shift transmission to neutral and set parking brake.
- (c) Turning the ignition key to the "off" position will shutdown the engine. Remove key from the ignition switch.

### Engine Shutdown Procedure (G.M.):

- (a) Throttle engine back to idle.
- (b) Shift transmission to neutral and set parking brake.
- (c) Push engine stop button and hold until engine dies.
- (d) Turn key ignition switch left to the "off" position and remove key.

### Emergency Engine Shutdown (G.M.):

The emergency engine shutdown system should never be used to stop the engine except in an emergency.

Note: On Detroit Diesel, use of emergency shutdown when the engine is at full throttle will usually require replacing the blower seals. Repeated unnecessary use can have the same effect.

Note: After the engine has been shutdown by use of the emergency stop button, the air valve must be manually reset as directed in the engine manual. An attempt to restart the engine without resetting the air valve may result in damage to the blower.

Use the emergency engine shutdown only when normal engine shutdown procedure fails. Pressing the button will shut off all air flow to the engine. When the engine is stopped by this method it must not be restarted until the cause of the trouble is repaired.

### Shifting The Transmission

In the following instructions, it is assumed that the operator is familiar with and can coordinate the necessary movements of the shift lever and clutch pedal to make progressive and selective gear engagements in either direction, up or down.

### Upshifting (Early Models W/ECB):

- (a) With the transmission in neutral, start the engine and bring the air pressure up to the normal readings. Release the parking brake.

## Operator's Manual Section 1 - Continued - Operating Instructions

- (b) Make sure the selector valve is in low range position.
- (c) Disengage clutch, press down on the TCB control button on the side of gear shift lever, and shift transmission into the first gear position. Refer to Fig. 1-4 or Fig. 1-5. Release the TCB button.
- (d) Shift from first gear through second and to the third gear position.

Note: Use normal double clutching procedures between shifts.

### CAUTION

The Transmission Countershaft Brake (TCB) is To Be Used Only To Assist In Initial Gear Engagement In First Or Reverse When The Machine Is Standing Still.

- (e) Switch the range selector from low to intermediate range and immediately shift to the fourth gear position. After the range selector valve is switched, the auxiliary will shift as soon as there is a relief in torque.
- (f) Shift progressively from fourth through fifth, sixth, seventh, to the eighth gear position.
- (g) Switch the range selector from intermediate to direct range and immediately shift to the ninth gear position. The auxiliary section will automatically shift from intermediate to the direct range when the gear shift lever reaches neutral.
- (h) Shift upward from ninth through tenth, eleventh, twelfth, to the thirteenth gear position.

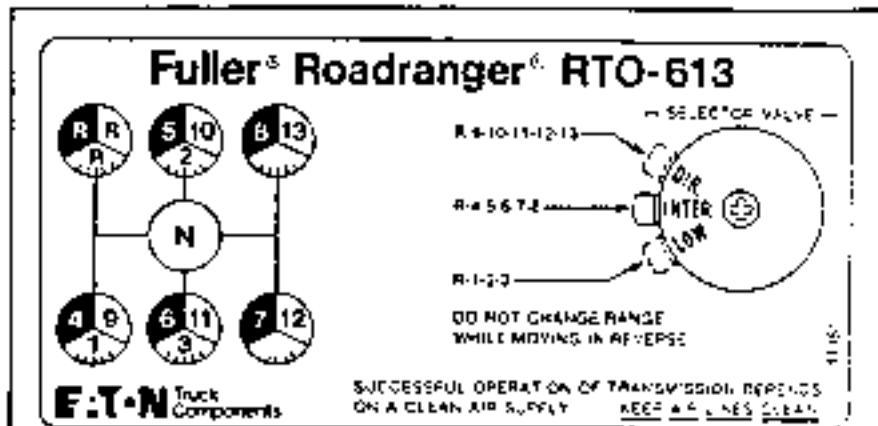


Fig. 1-4 RTO-613 Shift Pattern

6472-A

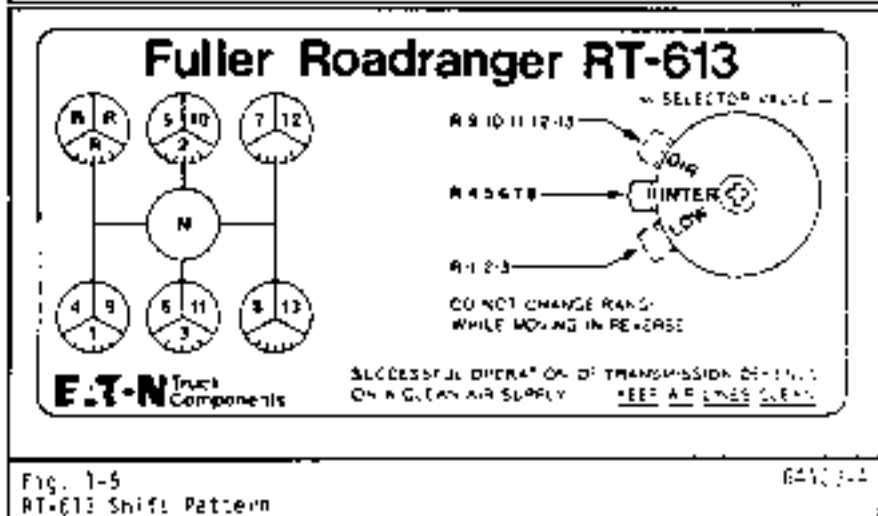


Fig. 1-5 RT-613 Shift Pattern

6473-A

### Upshifting (Later Models w/Clutch Brake)

- (a) With the transmission in neutral, start the engine and bring the air pressure up to normal readings. Release the parking brake.
- (b) Make sure the transmission selector valve is in the low range position.
- (c) Disengage clutch, press the clutch pedal to within one inch (25mm) of the floor-board to engage the clutch brake. Shift into the first gear position. Refer to Fig. 1-4 or Fig. 1-5.

- (d) Shift from first gear through second to the third gear position.

Note: The clutch brake will facilitate making smooth, "clutch free" upshifts by slowing down the transmission gears prior to gear engagement.

### CAUTION

The Clutch Brake Should Never Be Applied Before The Transmission Is Put In Neutral. Rapid Wear Of The Clutch Brake Discs Will Take Place.

## Operator's Manual Section 1 - Continued - Operating Instructions

(e) Switch the range selector from low to the intermediate range and immediately shift to the fourth gear position. After the range selector is switched, the auxiliary will shift as soon as there is a relief in torque.

(f) Shift progressively from fourth through fifth, sixth, seventh, to the eighth gear position.

(g) Switch the range selector from intermediate to the direct range and immediately shift to the ninth gear position. The auxiliary section will automatically shift from intermediate to the direct range when the gear shift lever reaches neutral.

(h) Shift upward from ninth through tenth, eleventh, twelfth, to the thirteenth gear position.

### Downshifting:

(a) Move the shift lever from the thirteenth gear position through each successive lower gear to the ninth gear position, as required.

### **CAUTION**

On Later Models, Never Apply the Clutch Brake When Down Shifting.

(b) When in ninth gear and ready for the next downshift, switch the range selector from direct to the intermediate range.

(c) Move the shift lever to the eighth gear position. As the lever reaches neutral, the auxiliary will automatically shift from direct to the intermediate range.

(d) Shift from the eighth gear position through each successive lower gear, as required, to the fourth gear position.

(e) Switch the range selector from intermediate to the low range and immediately shift to the third gear position. The auxiliary section will shift as soon as there is a relief in torque.

(f) Downshift from third, through second, to the first gear position.

### Voltmeter Reading

The voltmeter indicates the condition of the battery. It also indicates whether or not the voltage regulator and the alternator are working properly. Refer to the "Voltmeter Reading" chart in Fig. 1-7.

### Inter-Axle Differential Operation

Under normal operating conditions the selector should remain in the 'unlocked' position. This provides differential action between the axles eliminating 'wheel fight' when cornering or running over uneven road surfaces.

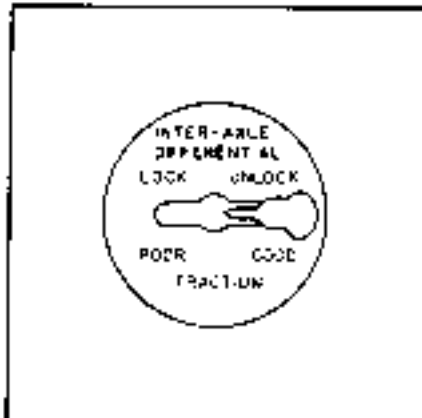


Fig. 1-6  
Inter-Axle Differential Selector

When the wheels are likely to slip because of rugged terrain, or climatic conditions, the selector should be moved to the 'locked' position to provide positive power to both axles.

### **CAUTION**

Do Not Actuate Selector While One Or More Wheels Are Actually Spinning Or Slipping As Damage To The Gearing May Result.

When additional traction is needed to get over rough and slippery terrain, shift the inter-axle differential as follows:

(a) Flip switch to "lock" position while maintaining vehicle speed.

(b) Let up momentarily on accelerator. This will engage differential lock.

(c) Proceed cautiously.

(d) Switch to "unlock" position when requirement of "lock" position has passed.

### Air Brake Operation

The distance the brake pedal is depressed regulates the amount of air pressure delivered to the brake chambers which, in turn, determines the braking force.

The best stop results when the brake application is as hard at first as vehicle speed and road conditions permit and then gradually released as the speed decreases. As the stop is completed there should be only enough air pressure in the brake chambers to hold the machine stationary.

Applying the brakes lightly at first and then harder as speed decreases results in a rough stop. Do not "fan" the brake pedal; this wastes compressed air and increases the stopping distance. The Skid-Trol system prevents wheel lock and should help maintain machine stability during hard braking or on adverse road conditions. Depressing the brake pedal fully is recommended only in cases of emergency. The engine can normally be used to assist the brakes if the throttle pedal is released completely while braking.



## Operator's Manual Section 1 - Continued - Operating Instructions

Periodically observe the dash gauges while driving. If the air pressure drops to a low point or if the warning buzzer indicates low air pressure, stop the vehicle and correct the trouble.

### CAUTION

Do Not Use The Service Brake System To Hold A Parked Vehicle. A Loss Of Air Pressure Could Allow Machine To Roll. Use Parking Brake And/Or Block Wheels.

### CAUTION

Avoid Using Parking/Emergency Brake As A Service Brake Except In Cases Of Emergency As Brake Wear Will Not Be Distributed Evenly And Emergency Brake Application Cannot Be As Easily Controlled.

### Engaging And Disengaging Main Hydraulic Pump

The main hydraulic pump is mounted in front of the carrier engine. All crane functions and hydraulic outriggers are run off this pump. Power to drive the pump is obtained from the carrier engine through a driveshaft and jaw clutch disconnect mechanism. The purpose of the disconnect is to allow disengagement of the pump from the carrier engine for highway travel. The pump must be disengaged when traveling to prevent unnecessary wear on the pump components. The disconnect handle for engaging and disengaging the pump is located under the right hand side of the carrier dash.

#### To Engage The Pump

- Warm up carrier engine using normal start-up and warm-up procedure.
- Park machine in desired position and set the park brake.
- Shift carrier transmission to neutral and shut down engine.

Engine not running or running at slow idle.

1. Dead or disconnected battery. Disconnected or badly connected meter.



Engine running fast enough to make alternator produce.

1. Disconnected meter. Engine could not run with dead or disconnected battery, unless circuit was completed around battery.

2. Very low battery charge. Engine might not start.



- 2-3. When meter pointer starts below 10.5 with the engine running fast enough to operate alternator, it shows that alternator is not operating or voltage regulator is out of adjustment or that current being drawn from battery by lights, heater fan, or other loads, exceeds alternator output.

3. Low battery charge. Constant reading in this area would indicate need for check on alternator and voltage regulator.



4. Well-charged battery. This indicates a good battery, and also that alternator and voltage regulator are operating properly.



- 4-5. When engine is started, pointer may rise in this area temporarily. If it is gradually rising to 12.5 as alternator warms, it is a good output.

5. The pointer might remain in this position temporarily, when the engine has been stopped after considerable use, due to a "surface charge" in the battery. To get a correct reading, turn on caution for a few minutes.



- 6-7. Under normal conditions, a 12V battery is fully charged at 12.6V. A slightly higher reading may occur under the conditions outlined in No. 5 but, generally speaking, any reading above 12.6 when the engine is stopped is not a true reading.



6. This is the area in which the pointer should be when alternator voltage regulator and battery are in good condition and working properly.



7. When the pointer goes above 15.0, the voltage regulator is set too high or is jammed and continued operation of the engine will burn out the battery.

Fig. 1-7  
Voltmeter Reading

- (d) Pull out on disconnect handle under dash marked "pump disconnect" until red mark on control cable is visible.

Note: Do not force into engagement. It may be necessary to hold engine stop button and bump the starter button to line up the two halves of the jaw clutch.

- (e) Rotate the handle clockwise to lock in position.

### To Disengage The Pump

- (a) Shut down the carrier engine.  
 (b) Rotate control handle 90° counterclockwise to unlock.  
 (c) Push handle "in" to disengage the jaw clutch members.

### CAUTION

Never Attempt To Engage Or Disengage Pump With the Engine Running Or Damage May Occur To Pump Or Pump Disconnect Jaw Clutch.

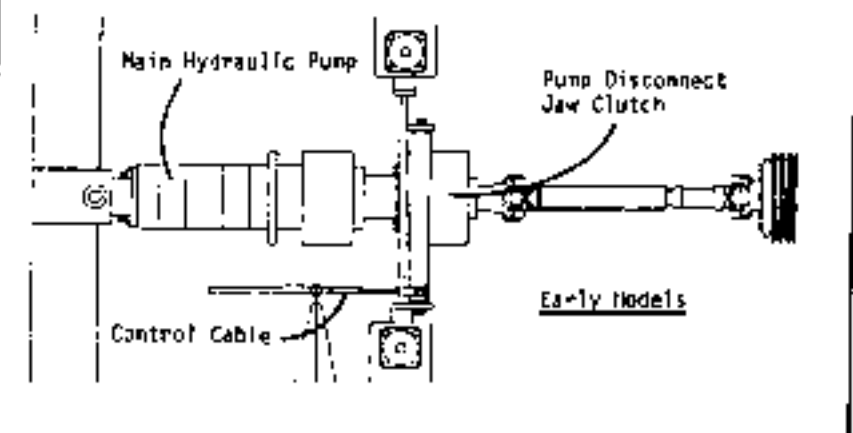
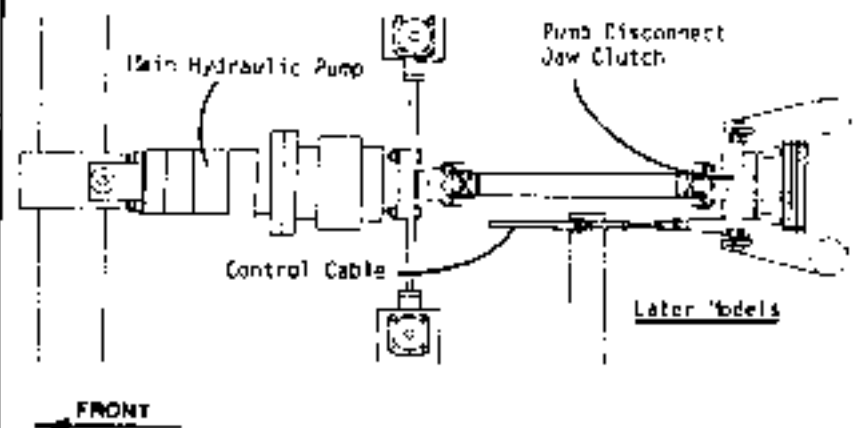
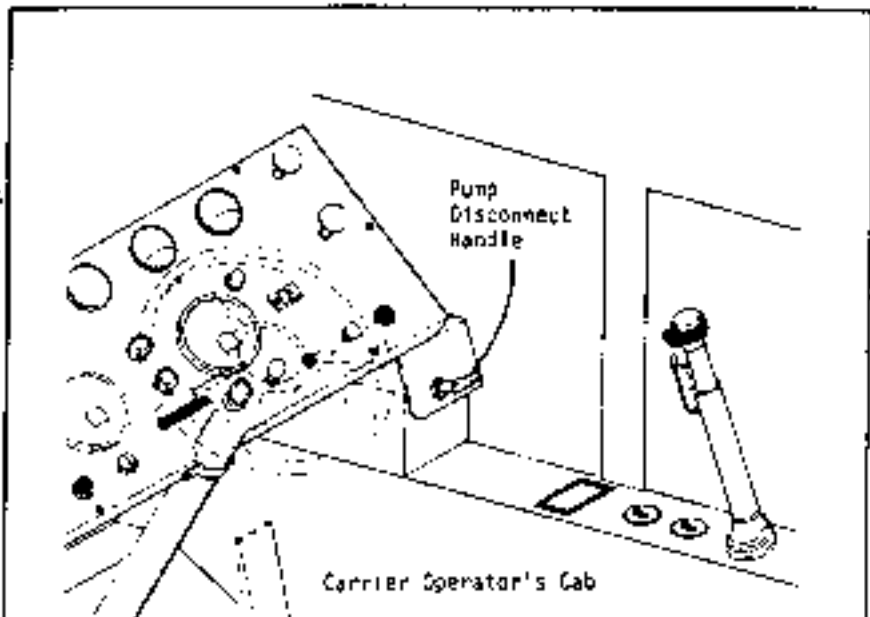
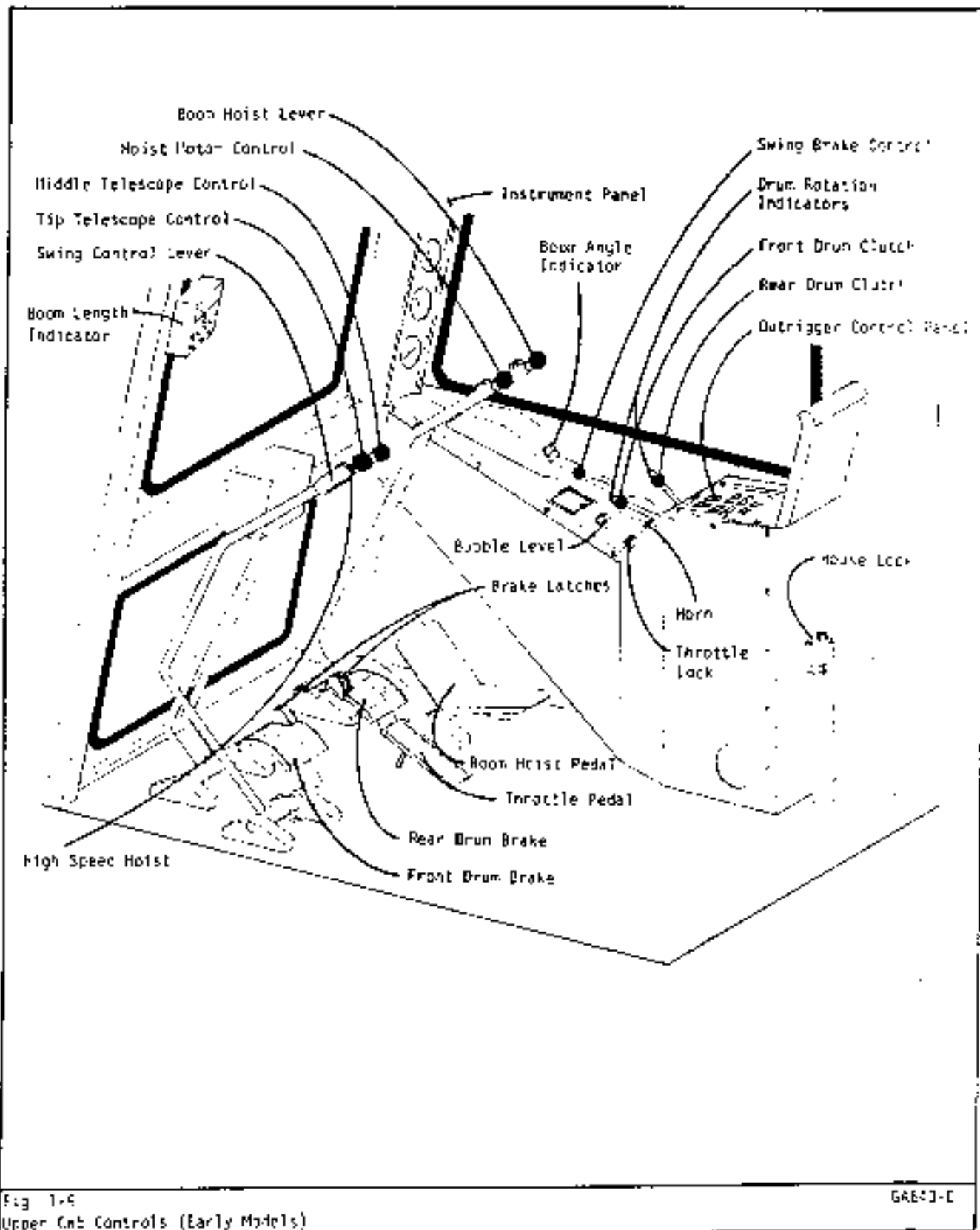


Fig. 1-8  
Pump Drive And Disconnect

GA56-D, GA125-C  
GA2'4-D

**Operator's Manual** Section 1 - Continued • Operating Instructions



## Operator's Manual Section 1 - Continued • Operating Instructions

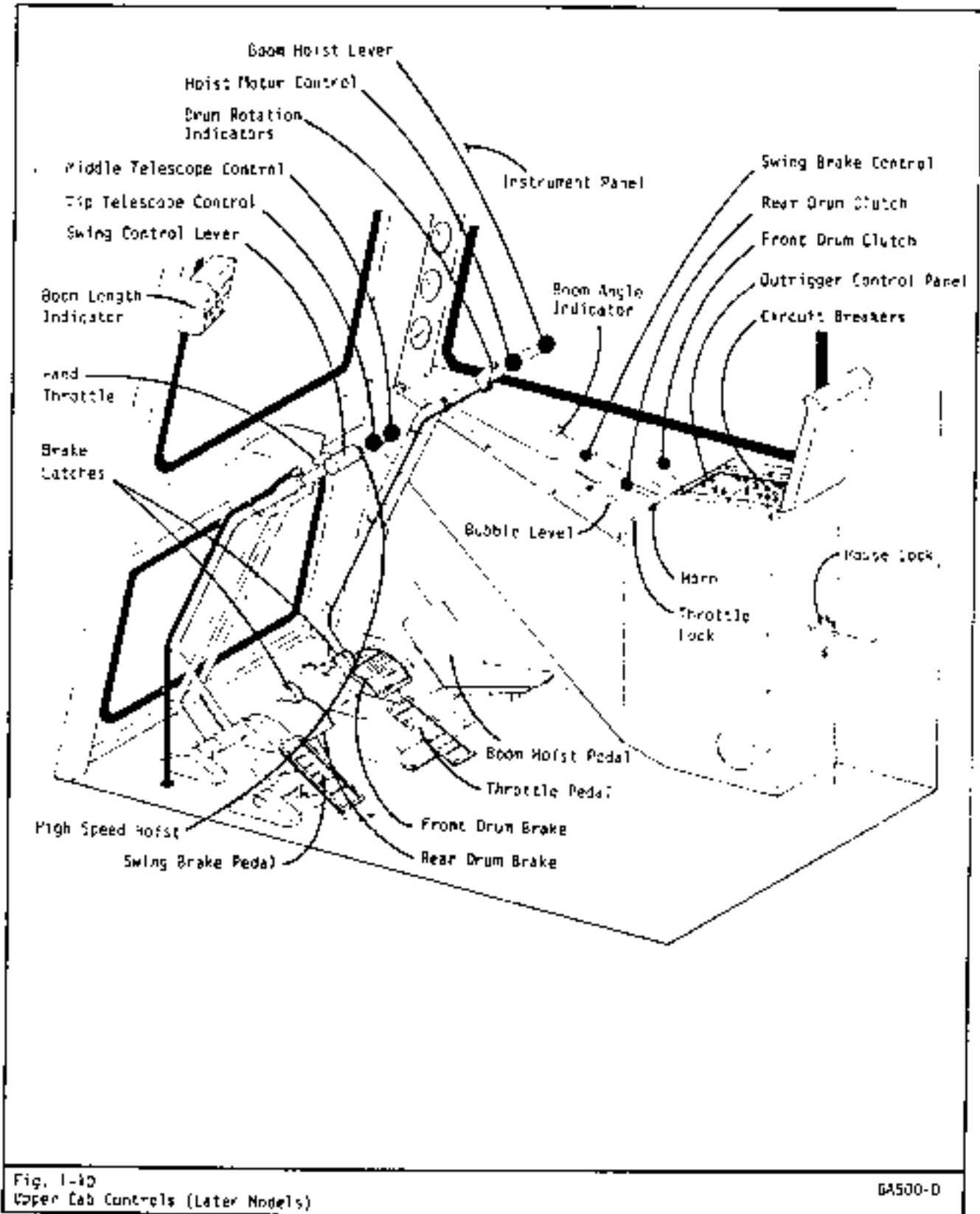


Fig. 1-10  
Upper Cab Controls (Later Models)

G4500-D

## Operator's Manual Section 1 - Continued - Operating Instructions

### Upper Operating Controls

The following series of paragraphs explain the location and function of the upper operating controls.

**Note:** Many of the operating controls have been changed or rearranged from early to later models. The operator must be familiar with the controls on his machine prior to operating. Refer to Fig. 1-9 for early model controls and Fig. 1-10 for later models.

The control functions listed on the following pages affect the capacity of the machine either by changing the boom angle (boom hoist), boom length (boom telescope), position of the upper relative to the carrier (swing), or altering the operating base (outriggers). The load radius is changed by a combination of boom length and boom angle, therefore, is controlled by more than one function (boom hoist and boom telescope).

### CAUTION

Do Not Attempt Any Operations Until All The Control Functions Are Completely Understood.

**Upper Instrument Panel (Refer to Fig. 1-11)**

**Defroster:** Flip toggle switch "up" to turn on the defroster blower.

**Wipers:** This switch controls the two-speed wiper motor. Turn control to the first position to turn wipers on low speed. Turn control to the second position to turn wipers on high speed.

**Emergency Stop (G.M.):** The emergency engine stop button is to be used only when normal engine shutdown procedure fails. Pressing, and holding the button will cut off all air flow to the engine. When the engine is stopped by this method,

it must not be restarted until the cause of trouble is repaired. Refer to "Emergency Engine Shutdown" for further details.

**Start:** The start button, when pushed, completes an electrical circuit which energizes the starter motor. Refer to "Starting The Engine" for further details.

**Ignition:** The ignition switch is key operated to prevent operation by unauthorized personnel. The key switch energizes the instruments on the dashboard and prepares the engine for starting. When operating the upper accessories, the switch must be in the "on" position.

**Note:** The upper starting circuit includes a switch actuated by the wire rope hoist control lever. If the WIRE ROPE HOIST control lever is not returned to the neutral position the engine cannot be started from the carrier. Upper operations are not interrupted.

**Engine Stop (G.M.):** The engine stop button is used for normal engine shutdown. Push button to shut off flow of fuel to the engine. Refer to "Engine Shutdown Procedure".

**Alternator (Early Models):** This light acts as an ammeter in the electrical system. When the light is lit, the battery is discharging. If the light comes on, stop operations until the problem is corrected. Refer to "Voltmeter Reading" for additional electrical information.

**Note:** The alternator light will come on when the ignition switch is turned "on" and the engine not running. Use this as a check on bulb condition.

**Engine Oil Pressure:** The oil pressure gauge indicates the engine lubricating oil pressure. Consult the engine manual for proper operating range.

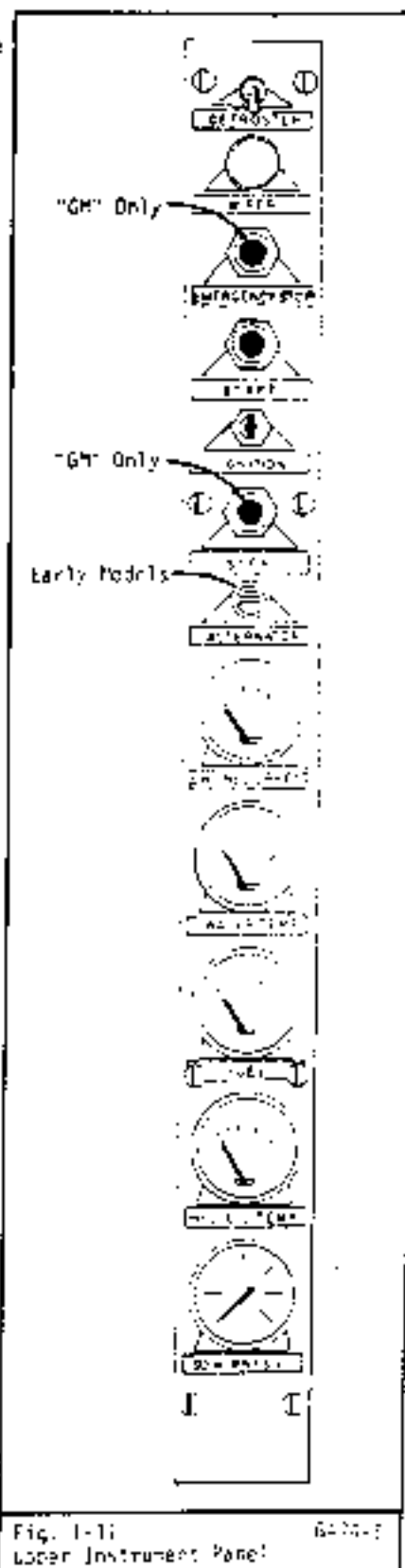


Fig. 1-11 Upper Instrument Panel

## Operator's Manual Section 1 - Continued - Operating Instructions

**Engine Water Temperature:** The engine water temperature gauge indicates the temperature of the cooling system coolant. Consult the engine manual for proper operating range and coolant for the system.

**Fuel:** The fuel gauge indicates the fuel level in the fuel tank. Refer to the engine manual for proper grade of fuel to use in the system.

**Hydraulic Oil Temperature:** This gauge indicates the temperature of oil in main hydraulic system. Normal operating range varies with oil used in different climates. Refer to Section 2 for proper weights and operating temperature ranges. If the temperature exceeds the maximum operating range, shut down immediately and correct the problem before continuing operations.

**S-u-H Pressure:** The gauge indicates the working pressure of the S-u-H control system. During normal operations the system should operate in a range between 900 and 1050 PSI (5206 and 7240 kPa). If the system malfunctions and is working over the relief pressure of 1250 PSI (8619 kPa), stop operations until the problem is found.

**Side Console Controls (Refer To Fig. 1-9 or 1-10)**

**Horn:** The horn button is located on the side console to the operator's right. Push button to sound horn.

**Throttle Lock:** The throttle lock button (switch) is located beside the horn button on the side console. Refer to operating procedure under "Upper Throttle Control".

**Bubble Level:** The purpose of the bubble level is to assist the operator when leveling the machine.

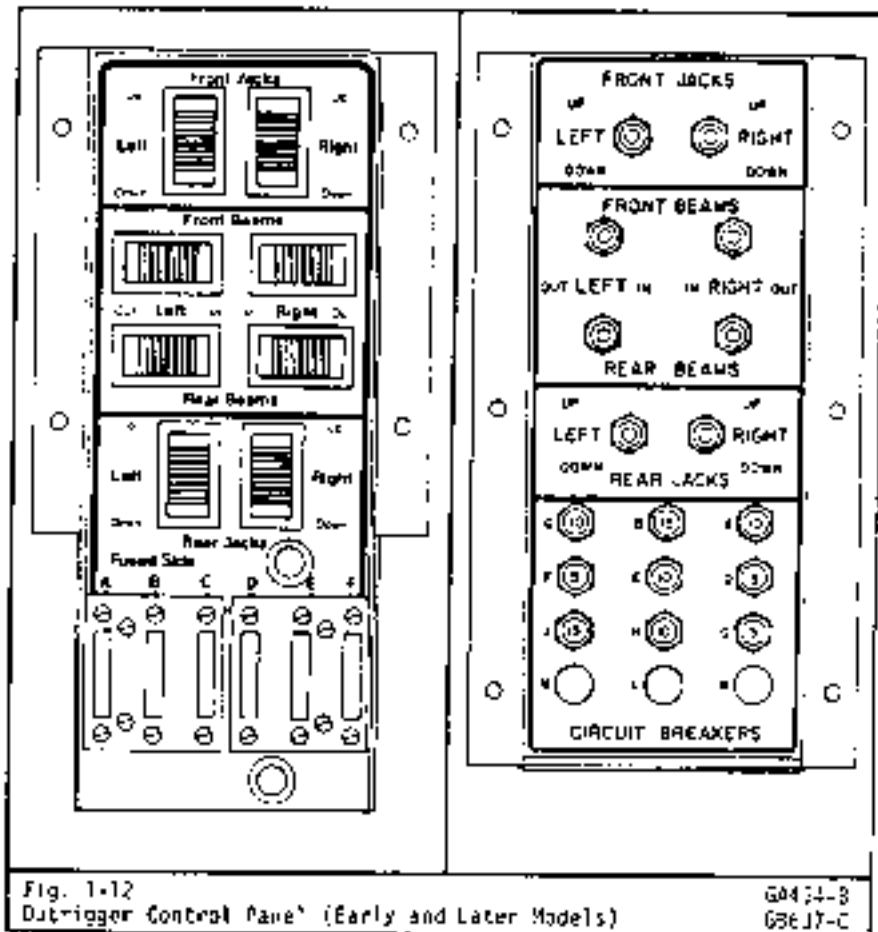


Fig. 1-12  
Outrigger Control Panel (Early and Later Models)

G0424-B  
G0617-C

**Outrigger Control Panel:** This panel of switches, located under the arm rest, control the operation of the hydraulic outriggers. Refer to "Outrigger Operation" below for details.

**Note:** The layout of the switches may vary between early and later models, but their functions are unchanged. Refer to Fig. 1-12.

### Outrigger Operation

The hydraulic outriggers operate with pressure from the main hydraulic pump. The pump must be engaged before attempting to operate the outriggers. See "Engaging and Disengaging Main Hydraulic Pump". The pressure from the pump is routed through

a series of solenoid valves. The solenoid valves are operated by rocker switches on the outrigger control panel under the arm rest in the upper cab. Each outrigger jack cylinder and beam cylinder has a switch controlling its operation.

The speed of extending or retracting either a jack or beam cylinder is controlled by varying the engine speed.

Outrigger pontoons must be on solid, smooth footing, flush with the ground (no hills or valleys under pontoons), otherwise pontoon may be damaged or destroyed. If there is any doubt as to conditions of surface, use mats. Check outrigger footing before and frequently during operation.

## Operator's Manual Section 1 - Continued - Operating Instructions

If floats are allowed to settle into the ground they may lose their effectiveness, making continued operation unsafe.

### CAUTION

All Capacities Listed For The Machine, When On Outriggers, Are Based On: All Tires Clear Of Ground, The Outrigger Beams Fully Extended, And The Machine Setting Level On A Firm Solid Surface. Serious Reductions In The Machine's Lifting Capacity And Unsafe Operating Conditions May Result If These Conditions Are Not Met.

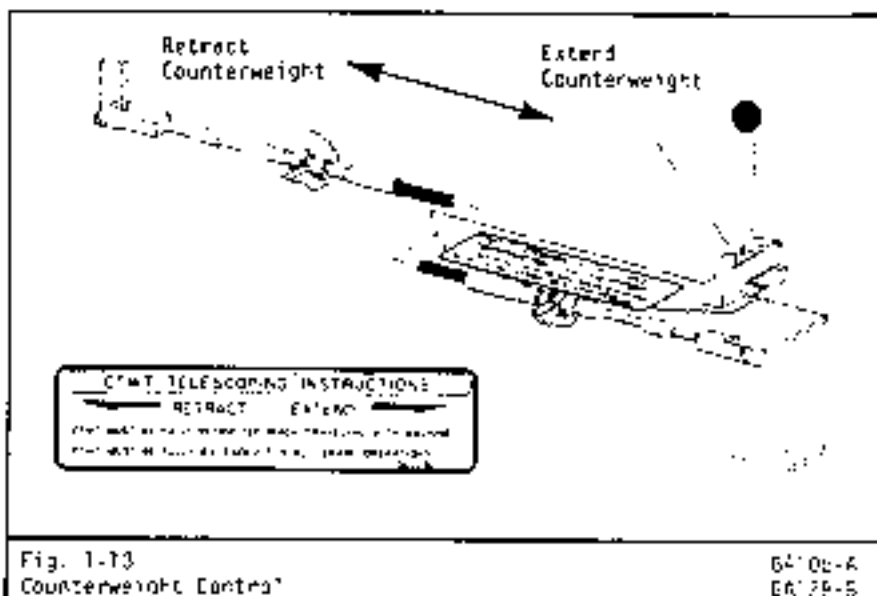
#### To Extend Outriggers

- With the upper facing over the front of the carrier, park the machine in the desired location and engage the park brake.
- Shut down the engine and engage main hydraulic pump. Refer to "Engaging And Disengaging the Main Hydraulic Pump" on page 1-9.
- Pin outrigger floats to the outrigger jack cylinders.
- Start engine from the carrier.
- Fully extend the counterweight. Refer to "Counterweight Control" on page 1-15.
- From the upper cab, fully extend outrigger beams one at a time by actuating the proper switch on the outrigger control panel.

### CAUTION

Never Extend Or Retract An Outrigger Beam Or Jack Unless It Is In Full View Of The Operator Or A Signalman. Before Extending Any Beam Or Jack, Be Sure All Personnel And Obstructions Are Clear From The Path Of The Machinery.

- Extend all outrigger jacks down one at a time and raise machine until all tires clear ground by



- actuating the proper switch.
- Level machine using outrigger jacks and be certain tires remain clear of ground. A bubble level is provided on the side console at the operator's right.
- Boom up to clear boom rest and carrier cab, disengage house lock and swing upper over the rear or side of carrier to operate.

### CAUTION

Boom Must Be Fully Retracted And The Counterweight Must Be Fully Extended Before Swinging Over The Side On Tires.

Do Not Swing Over The Side With The Jib Or Fly Erected Unless The Outriggers Are Set. A Tipping Condition May Exist.

#### To Retract Outriggers

- Swing upper over front of carrier and engage house lock.
- Boom down to set boom on boom rest.
- Lower machine until all tires touch ground by raising outrigger jacks up one at a time.

- Fully retract (up) all outrigger jacks by actuating the proper switch.
- Fully retract all outrigger beams in by actuating the proper switch.
- Stow pontoons in the storage racks provided.

#### Counterweight Control

The hydraulically extendible counterweight is operated by a control lever mounted at the left rear corner of the upper. The rear door must be opened for access to the control lever.

The counterweight must be fully extended when operating upper. Capacities on capacity chart are based on fully extended counterweight. The counterweight must be fully retracted when traveling machine.

The basic counterweight is one piece. This counterweight is used when the machine is equipped with two hoist drums. If the machine is equipped with only one hoist drum an auxiliary counterweight is required.

#### Auxiliary Counterweight

Recesses in the main counterweight are provided to mount the two auxiliary counterweights. Auxiliary counterweights are

## Operator's Manual Section 1 - Continued - Operating Instructions

used only on machines equipped without the optional front drum. If a machine is reworked to add an optional front drum the auxiliary counterweight must be removed.

### CAUTION

Do Not Add Additional Counterweight To The Machine. This Could Offset The Backward Stability Of The Machine, Particularly Over The Side. It Also Encourages Overloading Of The Machine, Which Could Cause Material Failure, Or A Tipping Condition.

#### To Extend Counterweight

Push the control lever toward the counterweight. Hold lever until counterweight is fully extended. Counterweight will extend 24" (610mm). Refer to Fig. 1-13.

Note: If counterweight does not extend fully, correct problem before operating machine.

#### To Retract Counterweight

Pull the control lever away from the counterweight. Hold lever until counterweight is fully retracted. Do not travel machine unless counterweight is fully retracted.

### CAUTION

To Prevent Personal Injury, Do Not Stand Between Counterweight And Upper Frame Area When Retracting Counterweight.

#### Houselock Operation

The houselock consists of a vertical sliding pin located in the right rear corner of the operator's cab. The lock is a two-position lock. It can only be engaged when the upper faces directly over the front or directly over the rear of the

carrier. Refer to Fig. 1-14.

#### To Engage Houselock

- Position the upper facing either directly over the front or directly over the rear of the carrier.
- Remove keeper pin from bracket. Raise handle above top of frame, turn handle 90° and lower it into the engagement slot.
- Check to make sure the pin drops into ring on the carrier. Place keeper pin in the lower hole in bracket (above the handle) to hold pin in place.

#### To Disengage Houselock

- Remove keeper pin.
- Raise handle up, and turn 90°. Place the handle in disengagement slot.
- Place keeper pin in the top set of holes in bracket to prevent pin from dropping into the hole accidentally.

#### Swing Control

The swing control lever is located to the operator's far left. Refer to Fig. 1-15. The control lever is hand actuated. To swing the upper, disengage the houselock and swing brake before moving the swing control lever.

**To Swing Left:** Pull the control lever toward operator.

**To Swing Right:** Push the control lever away from operator.

#### To Stop Swing:

- Apply the swing brake gently. Refer to "Swing brake control".
- Or ease the swing control lever in the opposite direction of swing.

Swing speed is determined by engine speed and the swing lever position. The higher the engine speed, the faster the upper will swing. The farther the control lever is moved, the faster the upper will turn.

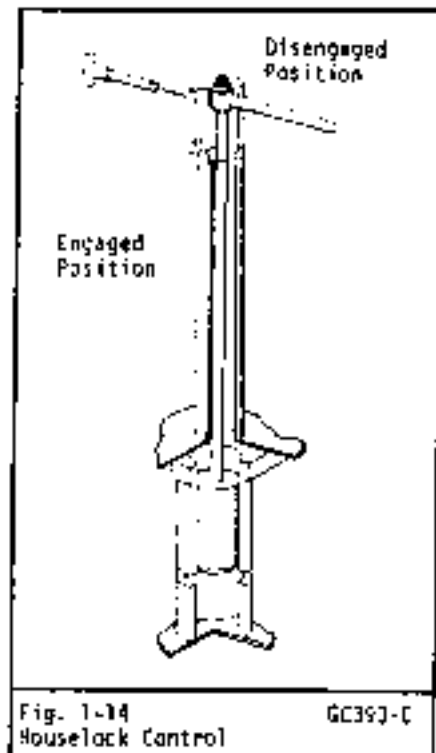


Fig. 1-14 Houselock Control

GC39J-C

### CAUTION

The Counterweight Must Always Be Extended Before Swinging.

Set Machine On Outriggers Before Swinging Upper Over The Side Of Carrier. The Machine May Tip Over If Swung Over The Side While On Tires And The Boom Partially Extended, Or If Fly Is In Working Position.

The Boom Must Be Clear Of Boom Rest And The Carrier Cab Prior To Swinging The Upper.

#### Swing Brake Control

The swing brake control operates a two-shoe swing brake mounted on the swing speed reducer.

**To Apply Swing Brake:** Pull the swing brake lever to the rear, toward the operator.



## Operator's Manual Section 1 - Continued - Operating Instructions

To Release Swing Brake: Push the swing brake lever away from the operator.

The swing brake may be left partially applied to allow some drag when spotting loads or working in tight quarters where free swing is not desired.

### CAUTION

Never Use The Swing Brake As A Houselock When Traveling, Transporting, Or Leaving The Machine For Any Reason. The Swing Brake Is Intended For Maintaining Position Of Upper During Operations.

Avoid Using The Swing Brake For Making Sudden Stops. An Damage To The Upper Machinery May Result Or The Load May Get Out Of Control.

### Swing Brake Pedal (Later Models)

The swing brake can also be applied with the operator's left foot by depressing the swing brake pedal to apply the desired amount of drag. This control is connected to the same two-shoe brake as the hand operated swing brake.

The pedal linkage is designed with a spring return. To release the foot operated swing brake, release the pedal.

### Boom Telescope Controls

The boom telescope controls are located in front of and to the operator's near left. Refer to Fig. 1-16. The left lever of the two boom telescope controls operates the tip section of the boom. The right lever operates the middle section of the boom.

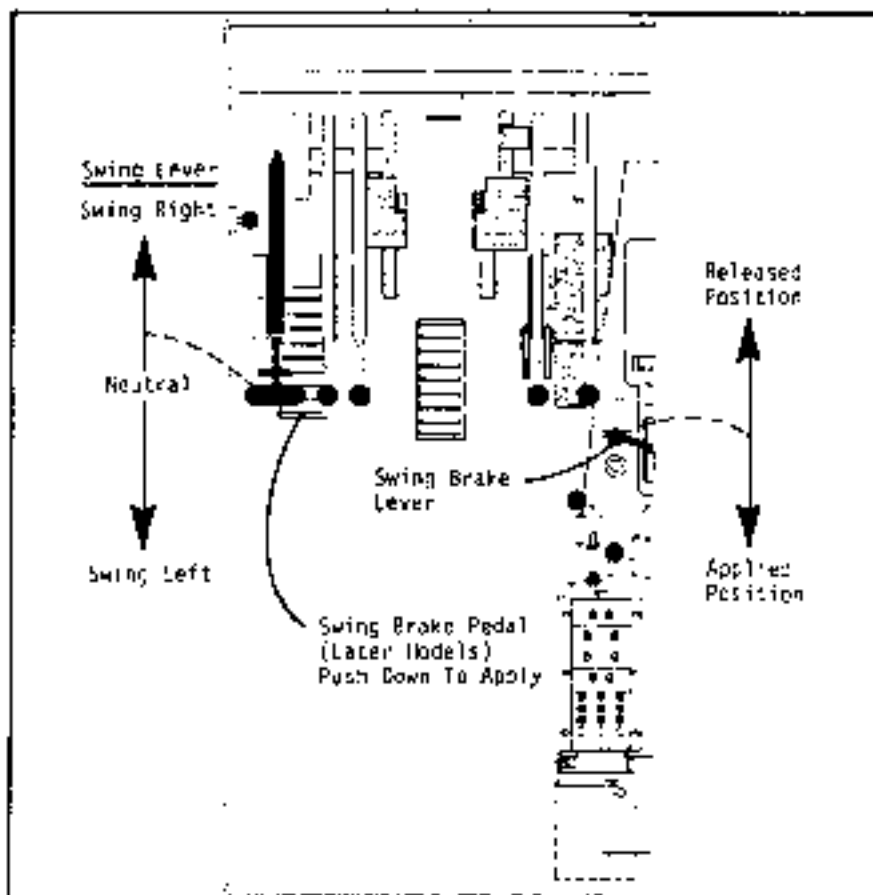


Fig. 1-15  
Swing Controls

GA48E-C

### CAUTION

Power Telescoping Boom Sections Must Be Extended And Retracted Equally At All Times, Except During Pendant Supported Jib Operation. Capacities On The Capacity Chart Are Based On Both Sections Extended Equally. Consult The Capacity Chart For Maximum Radius, Boom Length, And Minimum Boom Angle At Which A Load May Be Handled Before Extending Or Retracting With A Given Load.

### Extending The Boom

Push both control levers forward, away from the operator, and hold until boom extends to the desired length.

Note: When extending the boom, wire rope must be wound off the drum simultaneously to prevent jamming the hook block into the boom head machinery. See "Wire rope hoist controls".

### Retracting The Boom

Pull both control levers back toward the operator and hold until boom retracts to the desired length.

Note: When retracting the boom, the hoist rope must be wound on to the drum (hoist) to prevent the load from lowering. See "Wire rope hoist controls".

Extend and retract all boom sections equally at all times. If the sections do not extend or retract equally, the control levers may be operated individually, as necessary, to

## Operator's Manual Section 1 - Continued - Operating Instructions

equalize the boom sections.

The speed of extension or retraction of the boom is determined by engine speed and control lever position. The farther the control lever is moved in either direction, the faster the boom will react.

### CAUTION

Unequal Extension Of The Boom Sections May Result In Serious Reductions In Material Strength, Capacities, Or Affect The Machine Stability And May Result In Boom Failure Or A Tipping Condition.

### Boom Length Indicator

A boom length indicating system is provided on this machine for determining the active boom length. Use this system in conjunction with the machine capacity chart to determine the rated operating conditions of the machine. The system consists of a control meter mounted in the upper left hand side of the operator's cab (Fig. 1-17), a sensor mounted at the base of the boom, and a DC converter located behind the right side console panel. The unit is equipped with a manually adjustable set point.

Both visual and audible alarms are activated when the boom length set point is reached or exceeded. Reset of alarms is automatic when boom length is moved away from the limit on the safe side. A test switch is provided to check operation of the unit.

### Operation

For the system to operate, the ignition switch must be "on". To read boom length, turn the meter "on/off" switch to "on" and place the alarm set toggle switch to the "read boom" position. When the crane is using an attached jib or fly in the working position, place the

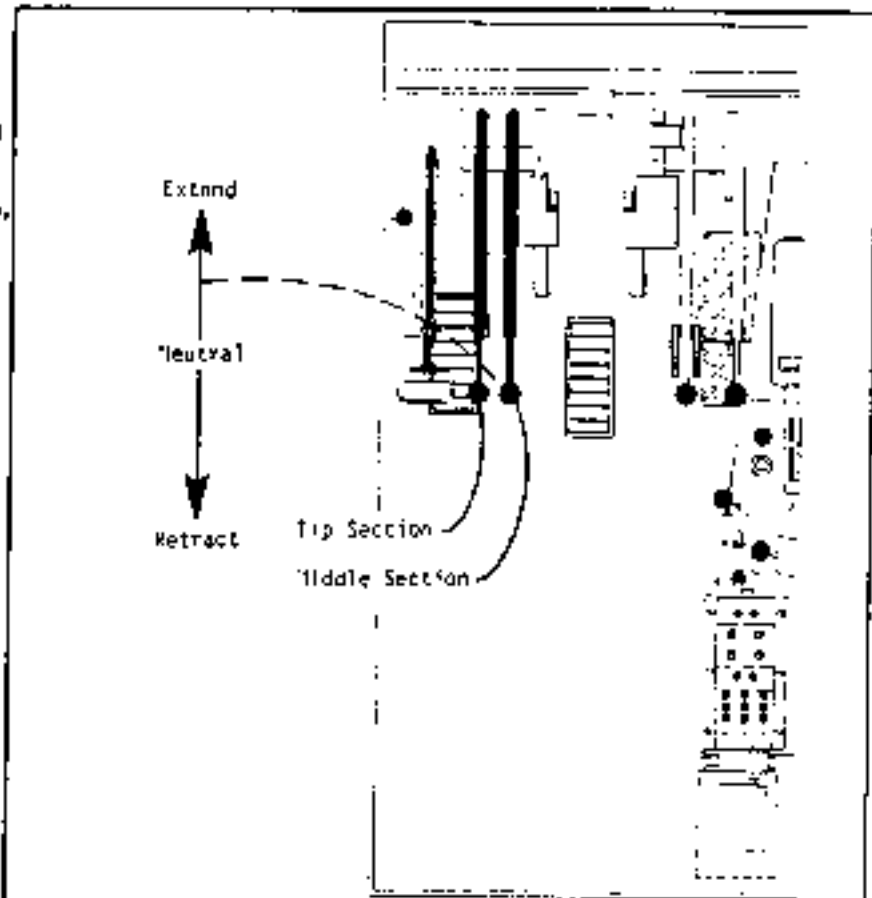


Fig. 1-16  
Boom Telescope Controls

GA428-C

"Main/Jib" switch to the switch setting that was calibrated for the specific attachment length. When no jib is used, leave the switch in the "Main" position. Jib one setting is used for the cantilevered fly section, Jib two setting is used for the 60' pendant supported jib, Jib three setting is used for the 80' pendant supported jib.

Note: When using pendant supported jib, true boom length indication applies only when jib is erected in line with the boom. Refer to Section 4.

To set the alarm set point, place the alarm set toggle switch in the "set alarm" position. Adjust the set point by pushing in and turning the control knob marked "adjust". As the knob is pushed and rotated, the meter needle

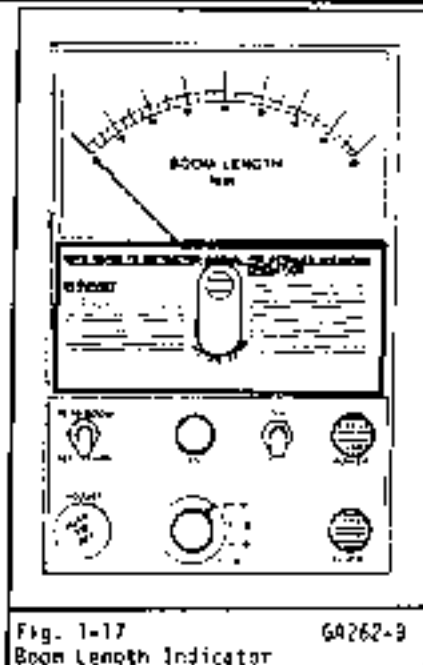


Fig. 1-17  
Boom Length Indicator

GA262-9

## Operator's Manual Section 1 - Continued - Operating Instructions

will respond and indicate the alarm set point to which it is adjusted. The alarms should continuously operate with the switch in the "set alarm" position. Return the switch to "read boom" position after the alarm point is set and the knob is locked in position.

### To Test System

- (A) With the ignition switch "on" and the meter "on/off" switch "off", the meter needle should rest in its minimum position.
- (B) Move the "on/off" switch to the "on" position, press the "test" button and the meter should read its full scale value  $\pm$  one foot. This indicates the system is working.

Refer to Section 3 for adjustment and calibration of this system.

### Boom Length Markings

When the boom length indicator is not in use, the boom length markings must be used to determine boom length in figuring the machine capacities, and to assure that the boom sections are extended proportionally. Boom Sections Must Always Be Extended Equally except when the jib is in the working position.

### CAUTION

Unequal Extension Of The Boom Sections May Result In Serious Reductions In Material Strength Capacities, Or Affect The Machine Stability And May Result In Boom Failure Or A Tipping Condition.

### To Proportion Boom Sections

When extending the boom, push both extend levers simultaneously. For details refer to "boom telescope controls". To check whether boom sections are extended equally, a ground man (the designated signalman)

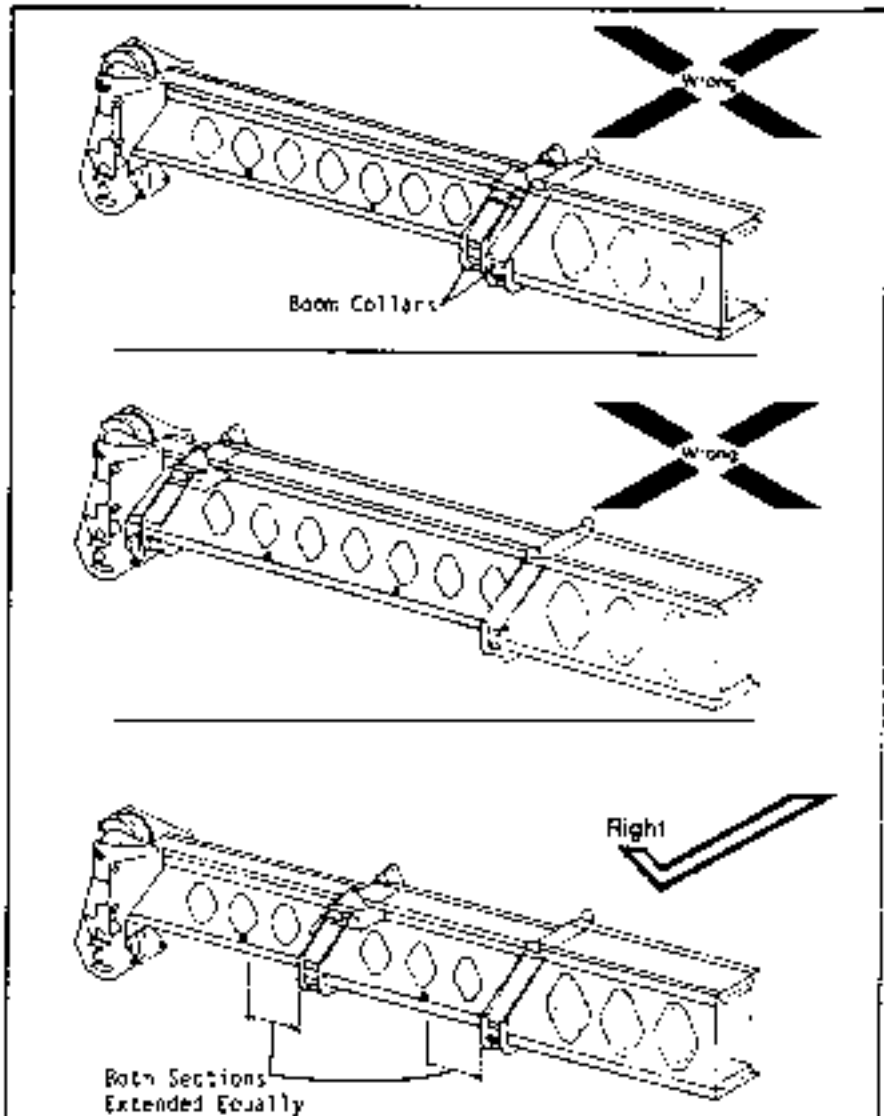


Fig. 1-18 Proportioning Boom Sections

GC353-A, GC354-A  
GC363-A, GC355-A

should watch as markings appear on the side of the boom. When the numbers or intermediate marks on each boom section are the same distance from the boom collars, the boom sections are proportionally (equally) extended. Refer to illustrations in Fig. 1-18 for proper spacing to achieve proportionality.

Do not attempt to use the diamond shaped depressions and cutouts to proportion the boom sections as diamond spacing is not equal on each boom section.

Note: On extension, the section will move very nearly at the same speed, but on retracting, the two sections will move at different speeds. Care must be taken to make sure that sections are properly proportioned before lifts are attempted.

The designated signalman and operator must both be familiar with this procedure and appropriate hand signals co-ordinated to make this procedure a simple and routine part of their working operation.

## Operator's Manual Section 1 - Continued - Operating Instructions

### Boom Length with Jib Erected

When the jib is in the working position, pendant supports are attached to the boom collar on the middle section and the tip section must be manually locked in position. When the jib is connected in this position, the tip section cannot be extended or retracted. In this case, boom length markings are not used for proportioning the boom sections, but they can be used to determine the boom length.

### Determining Boom Length

To estimate the boom, fly, and jib lengths when determining lifting capacities, use the boom length markings in conjunction with the appropriate table on the following page. Refer to the "Table Chart" in Fig. 1-19 to select the appropriate table for the machine in use.

Examples of how to use the tables follow and are intended to demonstrate the manner in which the tables are to be used for all machines.

#### Example: Table 1

The fully retracted boom length is 35' (10.67m). When the first set of intermediate markers appear on both the tip, and middle boom sections, the actual boom length is 42' (12.80m).

Continued equal and proportional extension of the boom sections reveal additional numbers and markers at approximately 7 ft. (2.13m) intervals (3.5 ft. [1.07m] per boom section) continuing up to the 90' (27.43m) fully extended boom length.

When operating with the 32' (9.75m) fly, 32' (9.75m) must be added to the boom lengths obtained from the table.

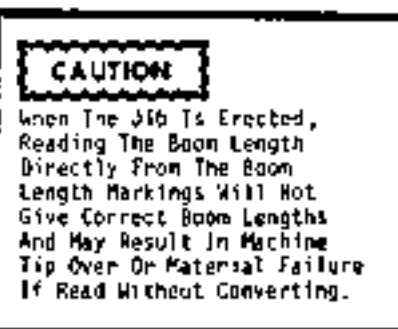
Note: Some boom lengths, in the tables, do not correspond with the lengths specified on the capacity chart. The markings at these points are intended for visually checking the proportionality of the boom sections.

Table	Application
TABLE 1	90' (27.43m) Main Boom 90' (27.43m) Boom + 32' (9.75m) Fly
TABLE 2	90' (27.43m) Boom + 60' (18.28m) Jib 90' (27.43m) Boom + 80' (24.38m) Jib
TABLE 3	80' (24.38m) Main Boom 80' (24.38m) Boom + 28' (8.53m) Fly
TABLE 4	80' (24.38m) Boom + 50' (15.24m) Jib

Fig. 1-19  
Table Chart

#### Example: Table 2

Table 2 lists main boom lengths with the boom tip section fully extended and locked in place. When operating with a jib, the jib length must be added to the boom lengths obtained from the table. Example: The retracted boom length in Table 2 is 62.5' (19.05m). To obtain the total attachment length when using a 60' (18.28m) jib, the two lengths must be added together. Therefore, 62.5' (19.05m) + 60' (18.28m) = 122.5' (37.33m) total attachment length.



### Wire Rope Hoist Controls

Load hoisting and lowering is controlled by the combined use of controls. Refer to Fig. 1-21.

**Hoist Motor Control:** The hydraulic motor is controlled by the second floor mounted control lever from the operator's right. The lever controls the

speed, and direction of rotation, of the hoist motor.

Note: The upper starting circuit includes a switch activated by the hoist motor control lever. If the hoist motor control lever is not returned to neutral, the engine cannot be started from the carrier. Upper operations are not interrupted.

**S-O-M Clutch Control:** The S-O-M Clutch control lever is located on the control panel to the operator's right. The levers control the hoist drum clutches. The left hand lever controls the rear (main) drum clutch. If the machine is equipped with an auxiliary front drum, the right lever will control it. See caution following "Drum Brakes". Pull the control lever back to engage the clutch with the drum. Push the lever forward to disengage the clutch.

**Drum Brakes:** The wire rope drum brake pedals are located in front of the operator on the floor. The left brake pedal controls the rear (main) drum brake. If the machine is equipped with an auxiliary front drum, the right brake pedal will control it. See caution below. The brake pedals are equipped with pedal latches to lock the drum brakes in the applied position. The latches allow the operator to keep drums from turning during traveling the machine or to allow the operator to rest his legs when suspending a load for a short period of time. Refer

# Operator's Manual

Section 1 - Continued - Operating Instructions

TABLE 1 - MAIN BOOM LENGTHS			TABLE 2 - MAIN BOOM LENGTHS (TIP LOCKED OFF)		
Tip Section	Middle Section	Actual Boom Length	Tip Section	Middle Section	Actual Boom Length
*	*	35.00' (10.67m) Boom Fully Retracted	90	**	62.50' (19.05m) Middle Fully Retracted
-	-	42.00' (12.80m)	90	--	66.00' (20.12m)
49	49	49.00' (14.94m)	90	49	69.50' (21.18m)
-	-	55.75' (16.99m)	90	--	72.00' (22.01m)
62.5	62.5	52.50' (15.99m)	90	62.5	76.25' (23.20m)
-	-	59.25' (18.11m)	90	--	79.63' (24.27m)
76	76	76.00' (23.16m)	90	76	83.00' (25.30m)
-	-	83.00' (25.30m)	90	--	86.50' (26.37m)
90	90	90.00' (27.43m) Boom Fully Extended	90	90	90.00' (27.43m) Boom Fully Extended
<p>* No Numbers Showing On Either Boom Section</p> <p>Note: <u>The Boom Sections Must Be Equally Extended At All Times.</u></p> <p>USE FOR MAIN BOOM OPERATIONS.</p> <p>USE FOR FLY OPERATIONS BY ADDING 32' (9.75m) TO THE LENGTHS LISTED ABOVE.</p>			<p>** No Numbers Showing On The Boom Middle Section</p> <p>Note: <u>Boom Tip Section Fully Extended And Locked In Place.</u></p> <p>USE FOR JIB OPERATIONS BY ADDING 60' (18.29m) OR 60' (21.58m) TO THE LENGTHS LISTED ABOVE.</p>		
TABLE 3 - MAIN BOOM LENGTHS			TABLE 4 - MAIN BOOM LENGTHS (TIP LOCKED OFF)		
Tip Section	Middle Section	Actual Boom Length	Tip Section	Middle Section	Actual Boom Length
*	*	32' (9.75m) Boom Fully Retracted	80	**	56' (17.07m) Middle Fully Retracted
-	-	38' (11.58m)	80	--	59' (17.93m)
44	44	44' (13.41m)	80	44	62' (18.90m)
-	-	50' (15.24m)	80	--	65' (19.81m)
56	56	56' (17.07m)	80	56	68' (20.73m)
-	-	62' (18.90m)	80	--	71' (21.64m)
68	68	68' (20.73m)	80	68	74' (22.56m)
-	-	75' (22.58m)	80	--	77' (23.47m)
80	80	80' (24.38m) Boom Fully Extended	80	80	80' (24.38m) Boom Fully Extended
<p>* No Numbers Showing On Either</p> <p>Note: <u>The Boom Sections Must Be Equally Extended At All Times.</u></p> <p>USE FOR MAIN BOOM OPERATIONS.</p> <p>USE FOR FLY OPERATIONS BY ADDING 28' (8.53m) TO THE LENGTHS LISTED ABOVE.</p>			<p>** No Numbers Showing On The Boom Middle Section</p> <p>Note: <u>Boom Tip Section Fully Extended And Locked In Place.</u></p> <p>USE FOR JIB OPERATIONS BY ADDING 50' (15.24m) TO THE LENGTHS LISTED ABOVE.</p>		

Fig. 1-20  
Tables 1 through 4

## Operator's Manual Section I - Continued - Operating Instructions

to "Pedal Latch Operation". The operator must remain in the seat with his feet on the brake pedals when suspending a load. Always land a load and apply brakes before leaving the machine for any reason.

**To Apply Brake:** With foot on latch and pedal, push down.

**To Release Brake:** Allow pedal to come up.

### CAUTION

On Early Models, The Rear Hoist Drum (Main) Was Controlled By The Right Brake Pedal And S-O-M Clutch Lever. The Front Hoist Drum (Auxiliary) Was Controlled By The Left Brake Pedal And S-O-N Clutch Lever. The Operator Must Be Familiar With The Brake And Clutch Arrangement On His Machine Prior To Operating.

### Pedal Latch Operation

- During normal operations, the operator's foot should be in position "A" as in Fig. 1-22.
- Latch the pedal to engage and lock the hoist brake. Depress foot pedal as in position "A". Pivot foot to position "B" while holding the pedal down.
- To release latch, depress pedal and latch at the same time as shown in position "A".

### Brake Pedal Warning

When the engine is shut down a warning alarm will sound in the upper unless the foot actuated brake(s) is applied and latched.

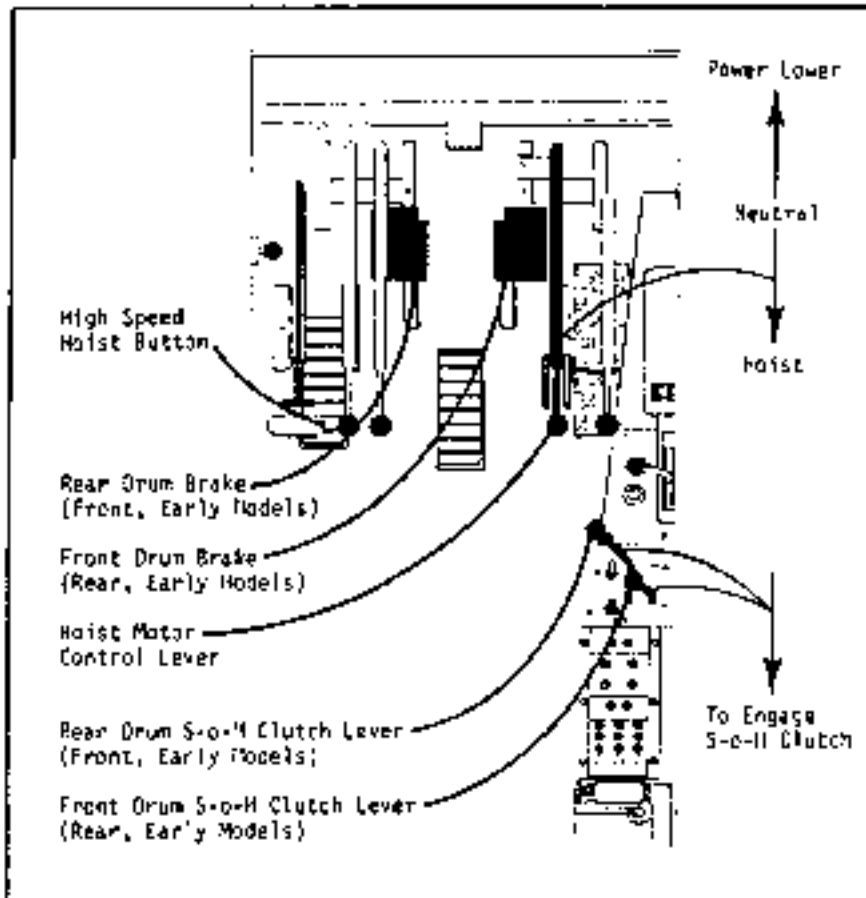


Fig. 1-21  
Wire Rope Hoist Controls

64428-C

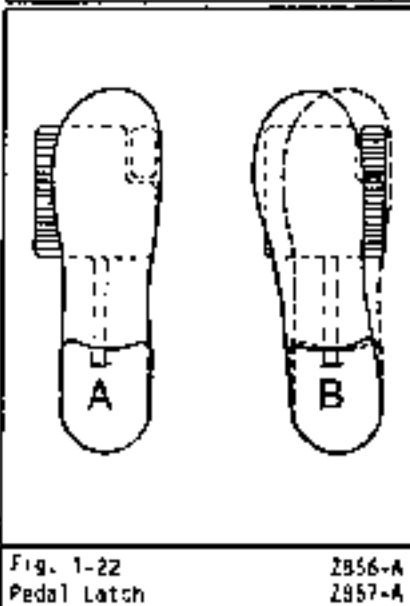


Fig. 1-22  
Pedal Latch  
2856-A  
2857-A

### CAUTION

Apply And Latch Foot Actuated Drum Brakes Whenever Leaving The Cab And Any Time The Crane Is Shut Down. Failure To Do So May Allow The Hoist Line To Drift Or Fall.

On machines equipped with two hoist drums, both brake pedals must be applied and latched.

### Wire Rope Hoist Operation

Two methods of hoist drum operation may be used on this machine.

## Operator's Manual Section 1 - Continued - Operating Instructions

### Method 1 - Hoisting With The Clutch

This method of operation provides the maximum line pull.

Lock (toggle in) the hoist motor control lever in the hoist position. This will put the hoist gear train into continuous rotation.

#### CAUTION

The S-O-M Clutch Control Levers Must Be In Neutral And Drum Brakes Applied Or The Drums Will Turn When The Hoist Motor Control Lever Is Engaged.

#### To Raise The Load (Method 1)

Apply power to the lagging by pulling the appropriate S-O-M clutch control lever to the rear to engage clutch. Release the drum brake pedal when the clutch starts to engage. When load reaches the desired height, apply drum brake and disengage the clutch at the same time. The speed of hoisting the load, in this case, is controlled by the engine speed. To increase the lifting speed, increase engine speed.

#### To Lower The Load (Method 1)

Release the drum brake foot pedal and allow the load to lower by gravity (free fall). Control the rate of descent by partially applying the drum brake.

#### CAUTION

To Hold A Load In Position, The Drum Brake Must Be Applied.

#### Automatic Hoist Brake (Later Models)

An automatic hoist brake system is standard equipment on later models.

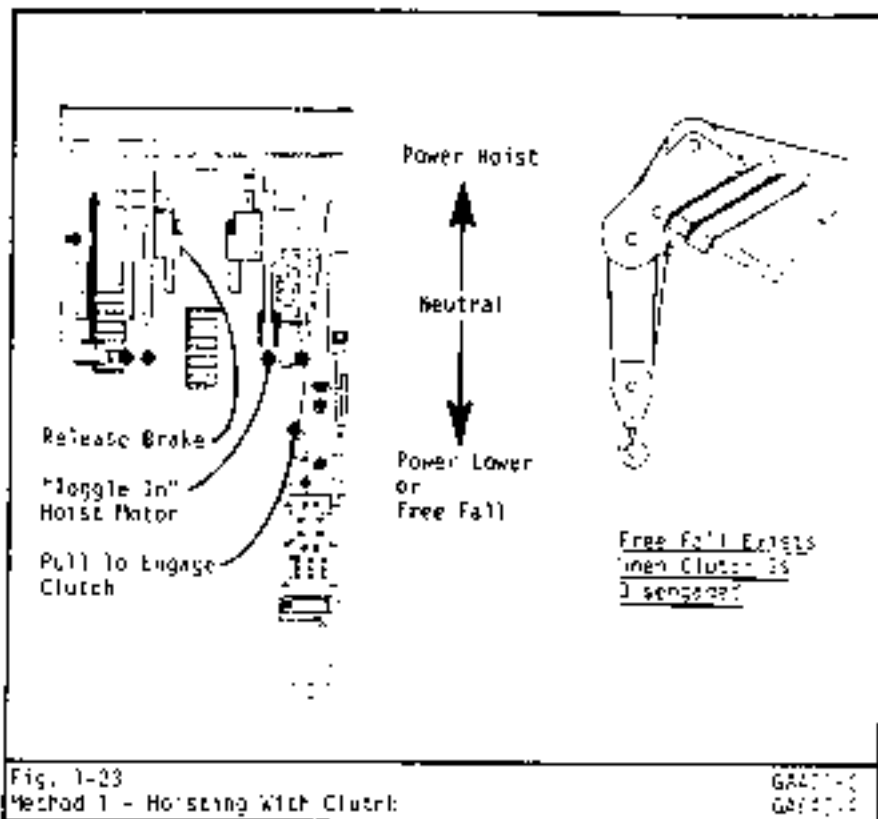


Fig. 1-23 Method 1 - Hoisting With Clutch

GA001-10  
GA001-10

The spring applied, hydraulically released automatic brake is held out of engagement when oil under pressure is routed to the hoist motor in the lowering cycle. When the hoist motor control is returned to neutral the brake is automatically applied. An over-running clutch allows hoisting with the automatic brake applied.

The automatic brake does not interfere with free fall, hoisting, or power load lowering when the hoist motor control is "tagged in" and operating with the S-O-M clutch control lever (Method 1). It is necessary to use the foot brake to handle the load in the Method 1 operational mode as outlined previously.

### Method 2 - Hoisting With The Hoist Motor

This method of operation provides fine control of loads and line speeds. This method allows both hoisting and power lowering.

With the hoist motor control in the neutral position, pull the appropriate S-O-M clutch control lever to the rear until it locks in position. This engages the drum shaft with the drum lagging.

Note: Do not "toggle in" both clutch levers unless movement of both drum laggings at the same speed and direction is desired.

The speed of hoisting and power lowering in this method is

#### CAUTION

The Automatic Brake May Not Prevent The Hook Block Or Headache Ball From Drifting Or Falling When The Engine Is Shut Down Or If The S-O-M Pump Is Not Functioning. Apply The Foot Actuated Drum Brake(s) And Latch To Secure The Load.

For an added degree of safety, it is recommended that the operator be prepared to apply the foot actuated drum brake in the event that a load drifts or falls.

## Operator's Manual Section 1 - Continued - Operating Instructions

Controlled by engine speed and by how far the hoist motor control lever is moved. To move the load very slowly, just barely move the control lever.

### CAUTION

When Operating Only One Hoist Drum On A Machine Equipped With Two Hoist Drums, Apply And Latch The Foot Actuated Drum Brake On The Unused Drum To Prevent The Unused Hoist Line From Drafting Or Falling.

#### To Raise The Load (Method 2)

Pull the hoist motor control lever to the rear. When the load has reached the desired height, return the control to the neutral position. When the control returns to neutral, apply the drum brake. (On later models, the automatic brake will apply when the lever returns to neutral.)

#### To Power Lower A Load (Method 2)

Push the hoist motor control lever forward. When the load has reached the desired height, return the control lever to the neutral position. When the control returns to neutral, apply the drum brake. (On later models, the automatic brake will apply when the lever returns to neutral.)

**High Speed Button** - Depressing the high speed button (mounted on the swing control lever) will cause the hydraulic motor to operate at double its normal speed, with a resultant of 50% decrease in line pull. When lifting or power lowering a light load, depress button to increase line speed. Releasing button will return hydraulic motor to normal speed and line pull. (It is recommended to depress the button before engaging the hoist motor control lever.

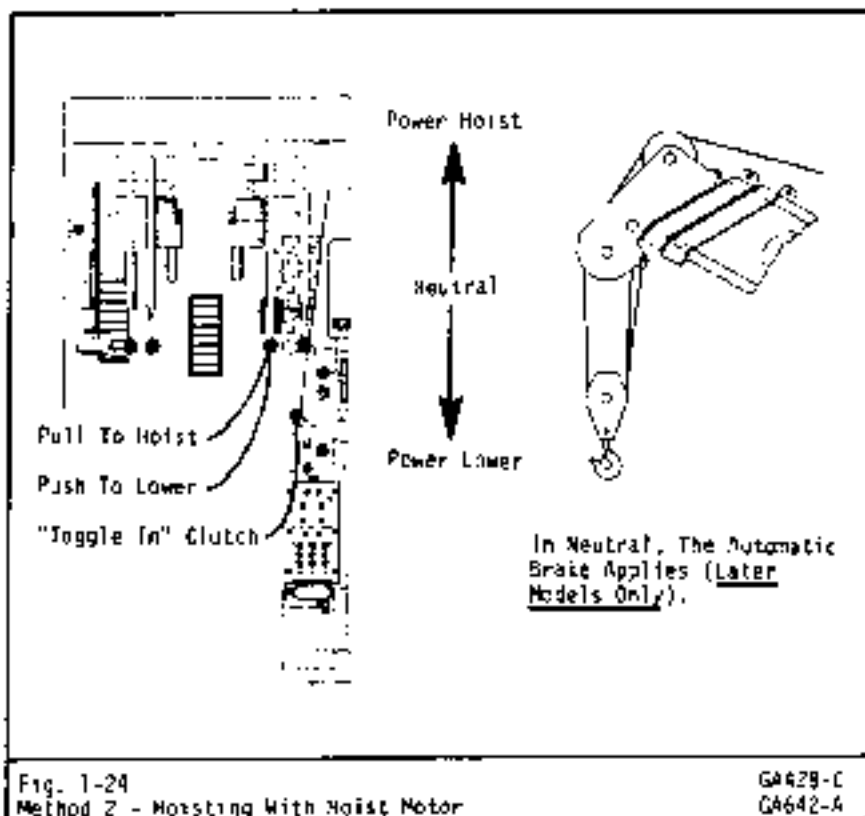


Fig. 1-24  
Method 2 - Hoisting With Hoist Motor

GA429-C  
GA642-A

#### Drum Rotation Indicator (Early Models)

This hydraulic signalling device is a piston in the center of the S-O-M clutch knob at the operator's right. Refer to Fig. 1-9 on page 1-11. The operator must press down on the piston with his thumb, which causes a lever to engage with a cam on the hoist drum. At each high point on the cam, the operator will feel the piston rise under his thumb.

The rate of oscillation of the piston indicates the speed of drum rotation. The faster the drum rotates, the faster the piston oscillates.

#### Drum Rotation Indicator (Later Models)

This signalling device is a mechanical lever on the hoist motor control. Refer to Fig. 1-9 on page 1-12. The operator must press down on the lever with his finger, which causes a cam follower to engage on a cam on the hoist drum. At each high point on the cam, the operator will feel the lever rise under his finger.

The rate of oscillation of the lever indicates the speed of drum rotation. The faster the drum rotates, the faster the lever will rise and fall.

**Note:** The drum rotation indicator is intended to aid the operator when "inching" a load into position.



## Operator's Manual Section 1 - Continued - Operating Instructions

### Boom Hoist Controls

The boom hoist control lever is located to the operator's far right. This lever controls the elevation of the boom. The speed with which the boom is raised or lowered is controlled by how far the control lever is moved and the engine speed. To move the boom very slowly, just barely move the control lever.

To Raise The Boom (Boom Up):  
Full the boom hoist control lever to the rear.

To Lower The Boom (Boom Down):  
Push the boom hoist control lever forward.

To Stop The Boom in Position:  
Return the control lever to neutral.

A foot pedal is located on the bottom portion of the control lever. This foot pedal may be used to operate the boom hoist when multiple functions are being performed. Push down on heel of pedal to boom up. Push down on toe of pedal to boom down.

### **CAUTION**

Do Not Lift Loads In Excess Of Capacity Chart Or Machine Damage Or An Accident May Occur. Remember That Capacities Decrease With Increased Boom Length And Load Radius. Check The Capacity Chart For Minimum Boom Angle For Load Being Handled

### Boom Angle Indicator

The boom angle indicator located on the control panel to the operator's right gives, in degrees, the angle of the boom from horizontal. Take the reading from drum where the gravity compensated pointer indicates.

Refer to boom angle indicator frequently to check boom angle for use with capacity chart.

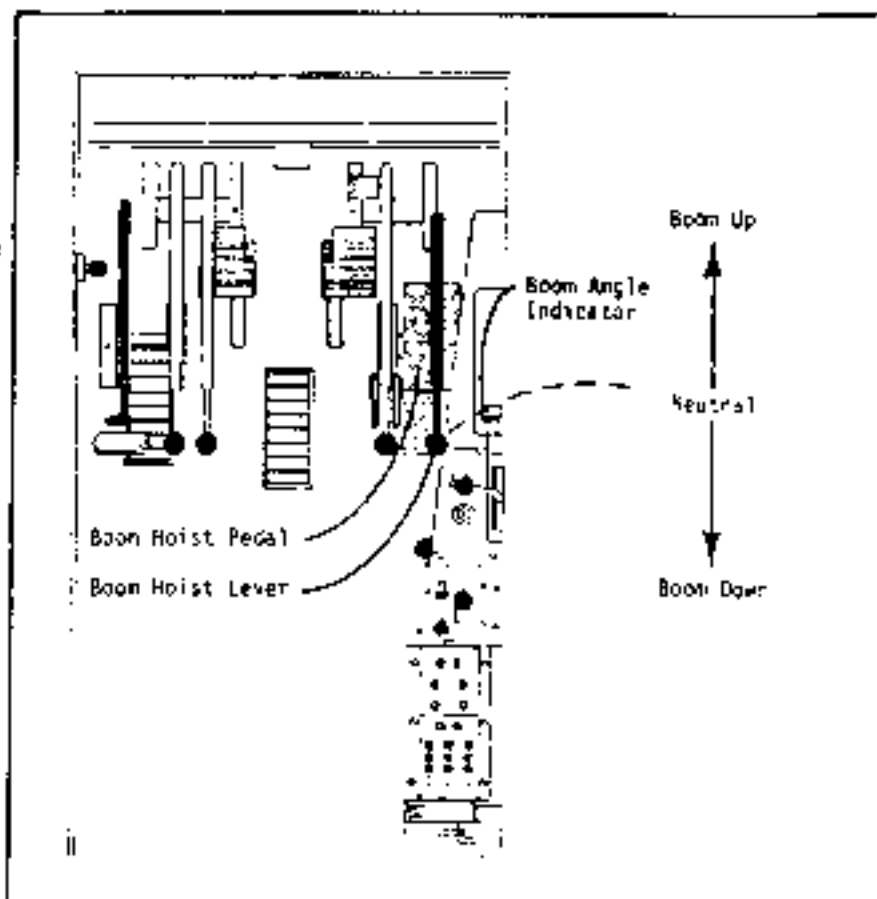


Fig. 1-25  
Boom Hoist Controls

64421-C

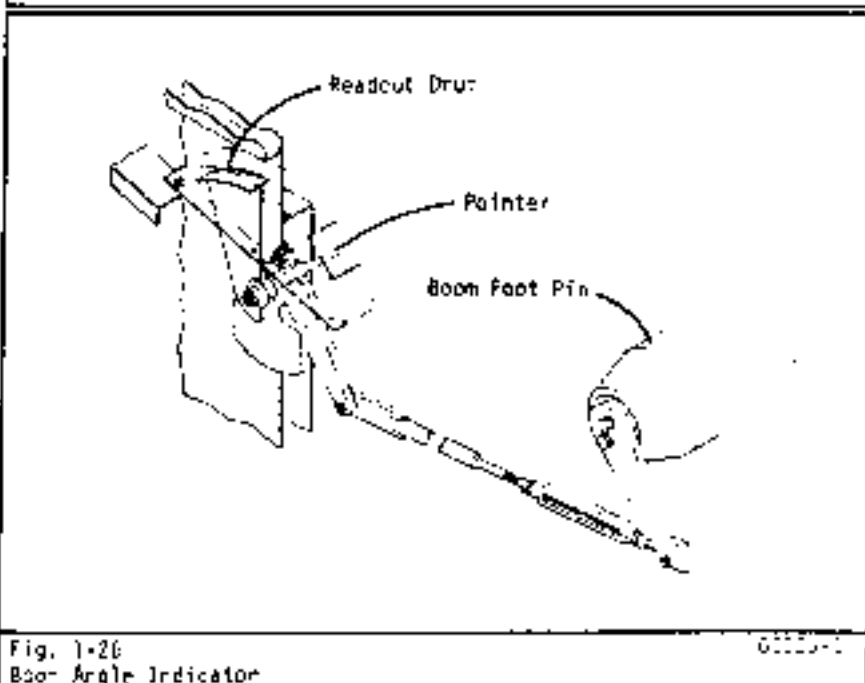


Fig. 1-26  
Boom Angle Indicator

61125-C

## Operator's Manual Section 1 - Continued - Operating Instructions

### Hydraulic Throttle Control (Early Models)

The upper throttle controls consist of a throttle pedal and a throttle lock button. The foot operated throttle pedal is mounted on the cab floor directly in front of the operator. The throttle lock button is mounted on the side console to the operator's right. Refer to Fig. 1-27

To Increase Engine Speed: Depress the throttle pedal until the desired engine RPM is reached.

To Decrease Engine Speed: Partially or completely release the throttle pedal.

#### To Maintain Engine Speed:

- (a) Depress the throttle lock button.
- (b) Depress the throttle pedal until the desired engine RPM is reached.
- (c) Release the throttle lock button.
- (d) Release the throttle pedal.

To release Throttle lock: Depress throttle pedal and release. The engine RPM should return to idle.

Note: Increased engine RPM increases the speed of operations.

### Air Throttle Control (Later Models)

The engine RPM is controlled from the upper by a throttle pedal, which is mounted on the cab floor directly in front of the operator. In addition to the throttle pedal, there is a hand operated throttle control mounted on the swing control lever.

Note: On later model HIC series machines with G.M. engines, the throttle selector switch, in the carrier cab, must be placed in the "upper" position prior to any upper throttle control.

Included in the air throttle system is a lock valve. The throttle lock switch is mounted on the side console to the operator's right. Refer to Fig. 1-28

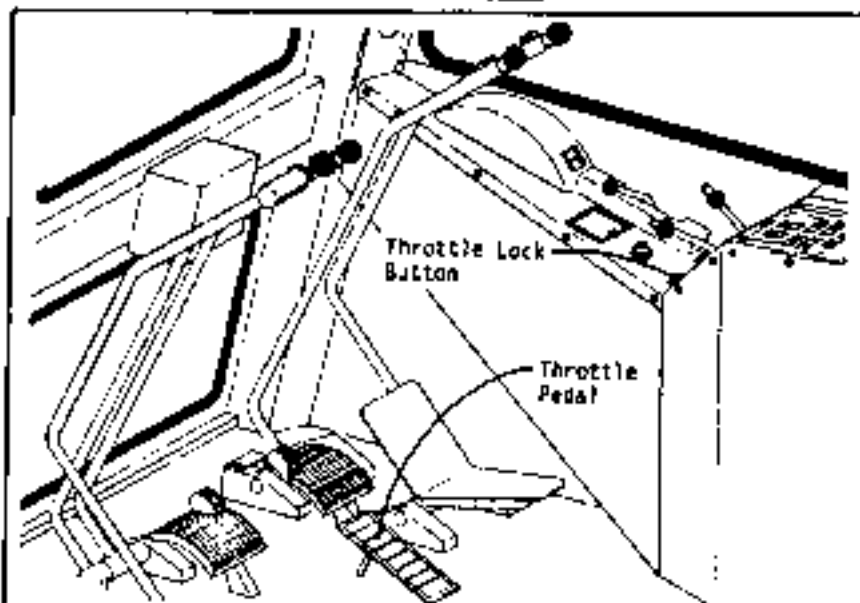


Fig. 1-27  
Throttle Controls (Early Models)

GA643-C

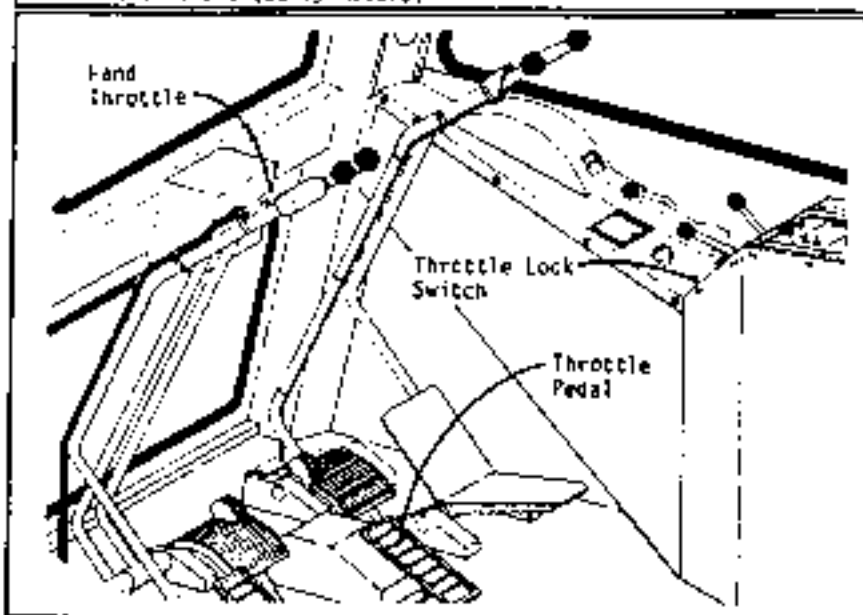


Fig. 1-28  
Throttle Controls (Later Models)

GA500-0

To Increase Engine Speed: Depress the throttle pedal, or pull back on the hand throttle, until the desired engine RPM is reached.

To Decrease Engine Speed: Partially or completely release the throttle pedal or hand throttle.

#### To Maintain Engine Speed:

- (a) Apply the throttle control pedal or hand throttle, as described above, until the desired engine RPM is reached.
- (b) Flip the throttle lock switch forward.

## Operator's Manual Section 1 - Continued - Operating Instructions

- (c) Release the throttle pedal or hand throttle and the engine RPM should remain constant.

**To Release Throttle Lock:** Flip the throttle lock switch to the rear and the engine RPM should return to idle.

### Gasoline Heater Operation (Early Models)

This machine may be equipped with a gasoline heater for the upper cab. The heater and its controls are located behind the operator's seat. Refer to Fig. 1-29.

#### To Start Heater:

- Check the fuel tank for adequate fuel supply. Use only regular gasoline for heater operation. The fuel tank is located directly in front of the tool box in the upper house.
- Flip the main control toggle switch to the "Hi" or "Lo" position as desired.
- Rotate the thermostat towards "Increase" until the heater starts. If the heater fails to start within 45 seconds, depress the "Cold Start" switch with the main control switch or "Hi" or "Lo" until combustion takes place.
- If heater fails to start, a heater malfunction has taken place. Troubleshoot heater as outlined in the heater service manual.

#### To Shut Down Heater:

- Turn the thermostat down until the flame goes out.
- Let the blower run for at least five minutes longer to cool the heat exchanger.
- Shut the blower off by flipping the main control toggle switch to the "off" position.

### CAUTION

Shut Down The Engine And Heater Prior To Adding Fuel To The Fuel Tank. Do Not Allow Smoking Or Open Flames When Handling Fuel.

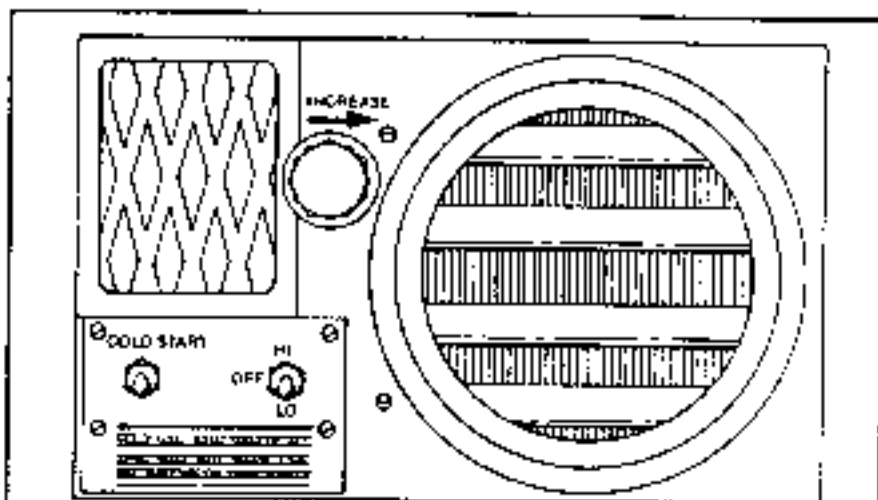


Fig. 1-29 Gasoline Heater Controls

6571-1

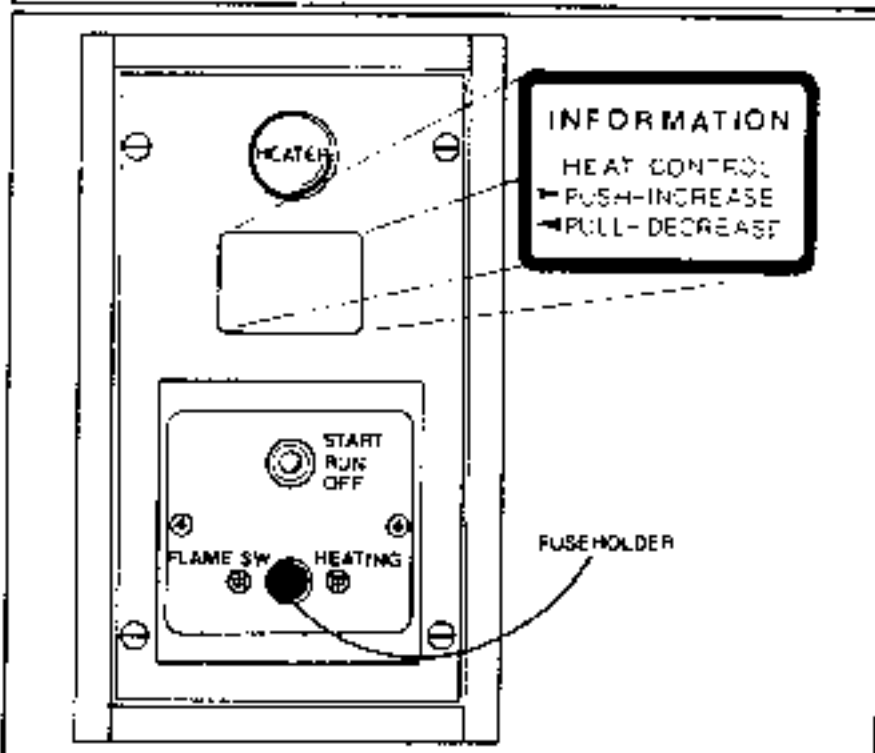


Fig. 1-30 Propane Heater Controls

6580-1

### Propane Heater Operation (Later Models)

This machine may be equipped with a propane heater for the upper cab. The heater controls are located behind the operator's seat. Refer to Fig. 1-30. The

regulator, lines, controls, and ducting are supplied with the heater. The customer must supply the propane tank and an approved connecting hose.

## Operator's Manual Section 1 - Continued - Operating Instructions

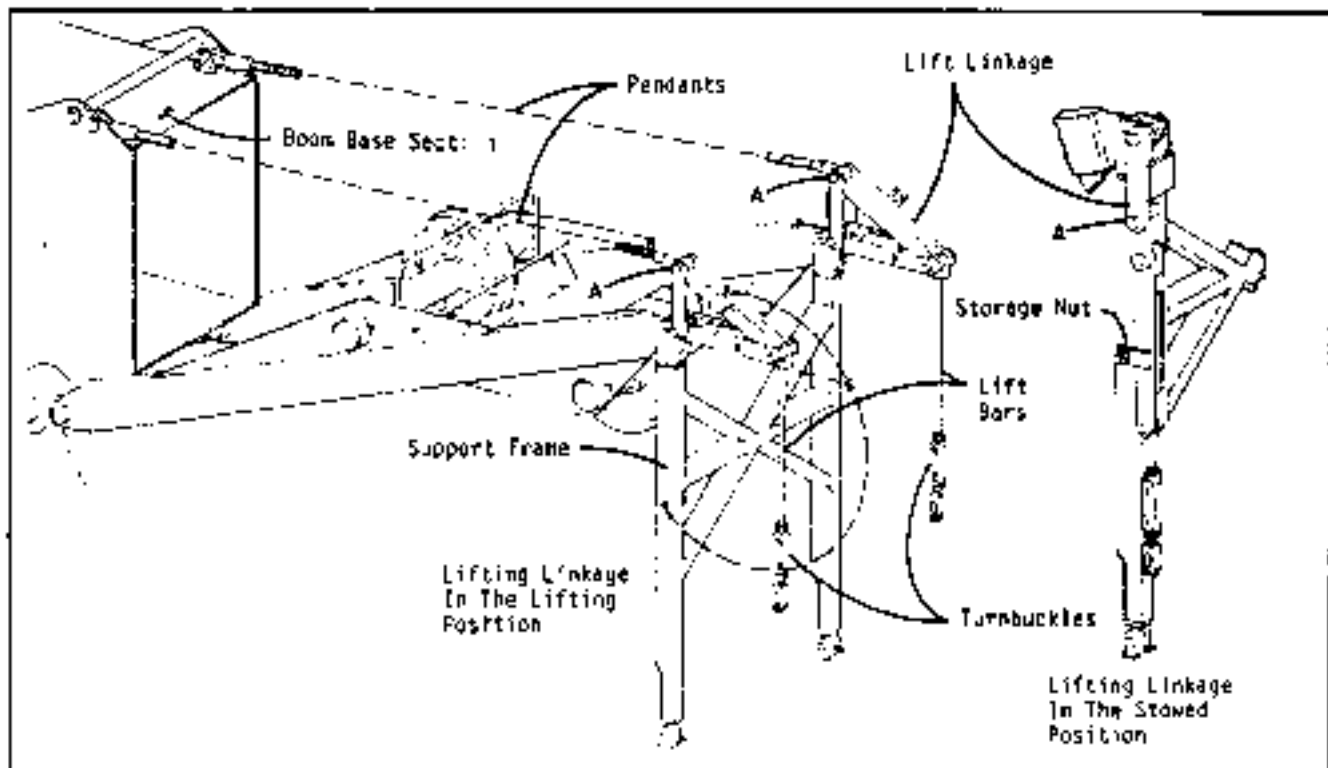


Fig. 1-31 Counterweight Removal Linkage (Cast Counterweight)

G4647-C  
G4111-A

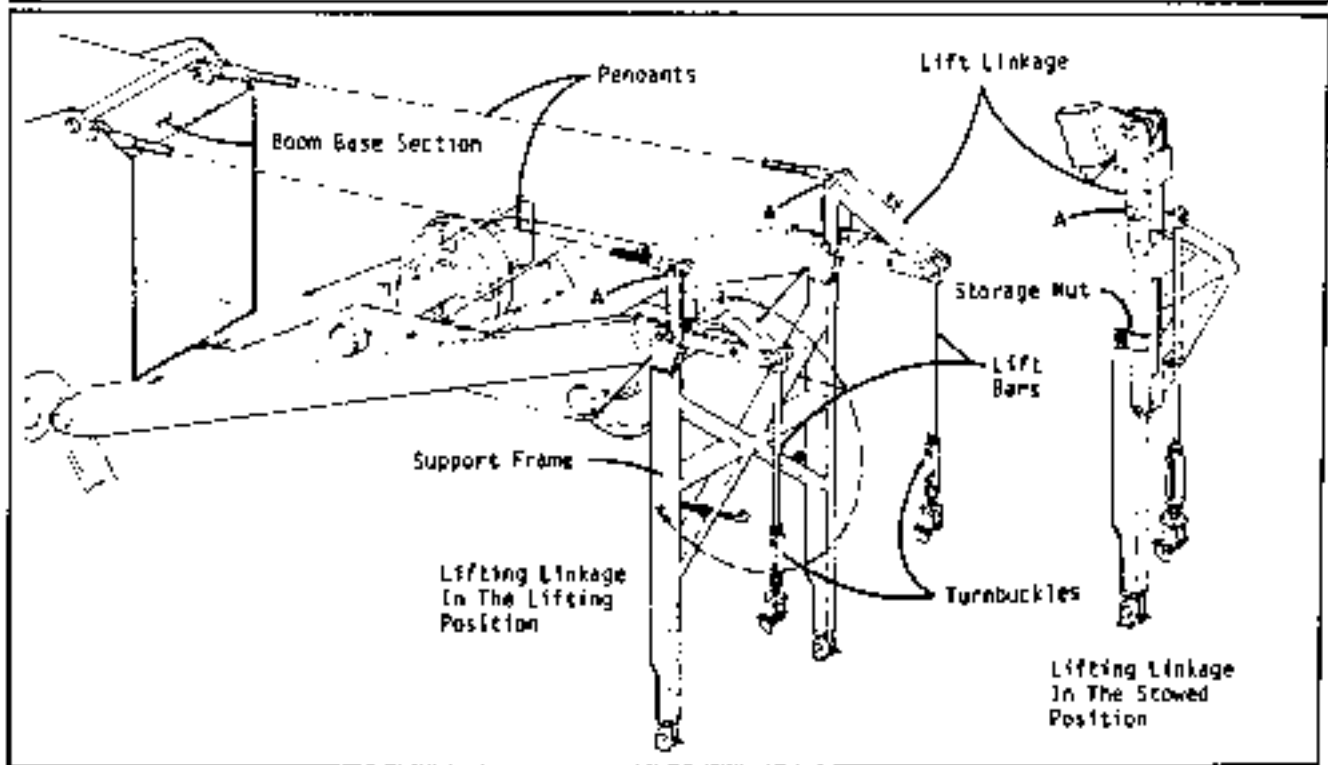


Fig. 1-32 Counterweight Removal Linkage (Fabricated Counterweight)

G4648-C  
G4112-A

## Operator's Manual Section 1 - Continued - Operating Instructions

### To Start Heater:

- Raise the toggle switch on the heater control panel, to the "Start" position. The green (heating) indicator must light. Hold the switch in this position approximately 30 to 45 seconds. (On later model propane heaters, hold the switch in the "Start" position until the amber "Flame SW" indicator lights.)
- Release toggle switch to the "Run" position. The green (heating) indicator light should stay on. If the green indicator goes out, repeat the starting cycle.
- If the indicator light goes out while the heater is operating, a malfunction has occurred in the heater. Shut down heater and repair before re-operating.

### To Shut Down Heater:

Place the toggle switch in the "Off" position. The green indicator light should go out immediately. (On later model propane heaters, the amber "Flame SW" indicator will go out as soon as the heater cools down.) The blower will continue to run until all fuel in the burner is consumed and the heater has cooled sufficiently.

### Counterweight Removal:

Under some circumstances it may be necessary to remove the counterweight for transport. Use the following counterweight removal procedure.

The machine will be equipped with either a cast or fabricated counterweight. Refer to Figs. 1-31 and 1-32 for differences in the lift linkages. The following procedure will cover both counterweights.

### CAUTION

The Machine Must Be Level On Fully Extended Outriggers, and Setting On A Firm Supporting Surface To Avoid Tipping During The Following Procedure.

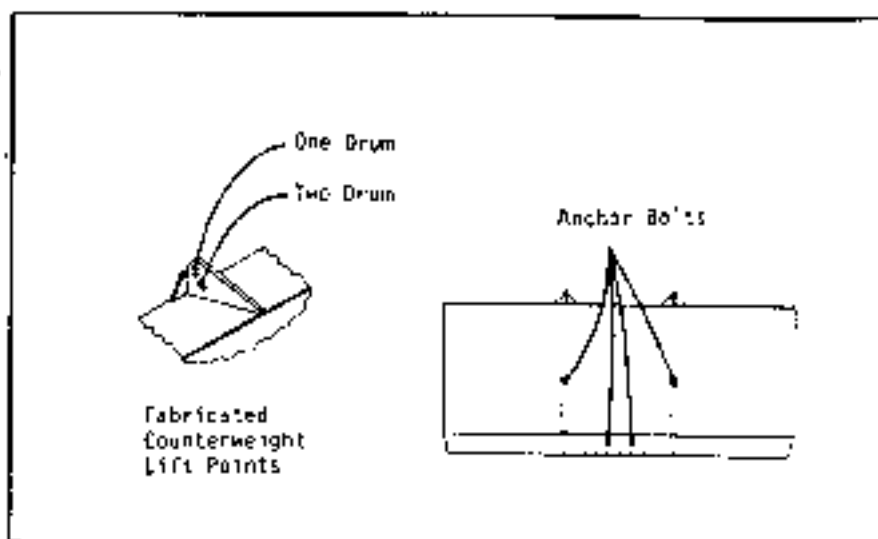


Fig. 1-33  
Counterweight Lift Points

GA240-C

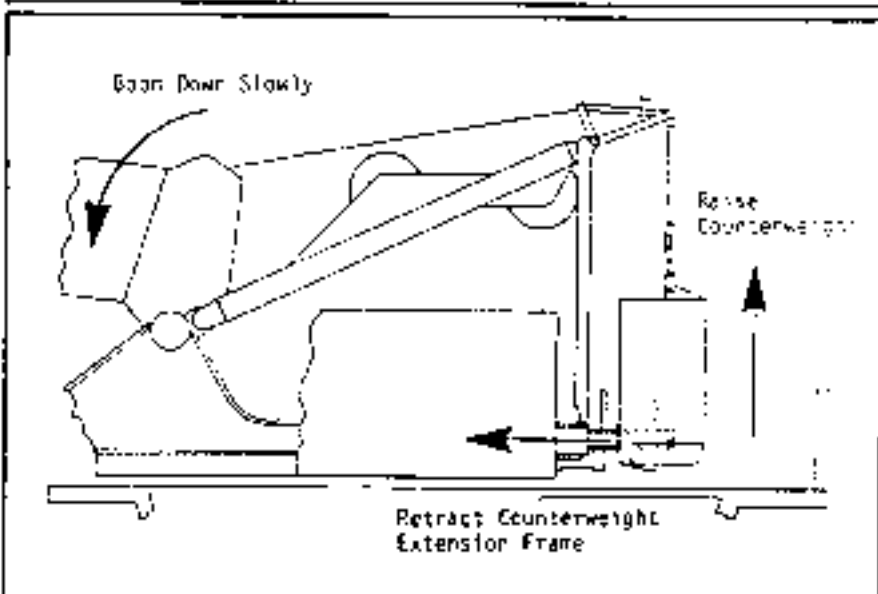


Fig. 1-34  
Lifting Counterweight

GA240-C

- Position upper facing directly over the rear of carrier and engage the house lock.
- Fully extend the counterweight.
- Raise the boom to approximately 6 degrees. Loosen storage nuts securing the lift linkage to the support frame. Remove pins "A" and erect the linkage into the lifting position as shown in Figs. 1-31 or 1-32.

Attach theendants (using pins "A") between the 1-45 linkage and the boom base section.

- Slowly retract the counterweight until the lift brackets on the counterweight are directly below the lift bars. (Refer to Fig. 1-33 for correct lift points for the fabricated counterweight.) Pin the lift bars to the lift brackets on the counterweight and secure with safety clips.

## Operator's Manual Section 1 - Continued - Operating Instructions

### CAUTION

If Counterweight Brackets Are Not Directly Beneath The Lift Bars, The Counterweight May Swing Into The Upper When Raised.

- (e) Remove the counterweight anchor nuts and bolts, and store in the tool box. Refer to Fig. 1-33.
- (f) Lower the boom until counterweight clears the rear flange of the counterweight extension frame as in Fig. 1-34.

Note: If the pendants do not tighten evenly, adjust the turnbuckles on the lift bars. When installing or removing the counterweight, it must remain level.

Fully retract the counterweight extension frame.

- (g) Boom up until the counterweight rests on the carrier frame and pendants become slack. Refer to Fig. 1-35.

### CAUTION

Do Not Travel Machine With The Counterweight On The Carrier As It Was Not Designed For This Purpose.

- (h) Disconnect pendants and return the lift linkage to the stowed position.
- (i) Disengage house lock. Raise the retracted boom to approximately 70 degrees and swing the upper to face directly over the front.

Note: Swing slowly and be certain the counterweight extension frame clears the counterweight. Lift the counterweight from the carrier frame and set aside.

### CAUTION

When Installing Or Removing The Counterweight, Use Fully Retracted Boom Only. Do Not Handle The Counterweight Beyond The Load Radius Listed Below. The Machine Must Be Level On Fully Extended Outriggers During These Operations. A Tipping Condition Could Result From Not Following These Precautions.

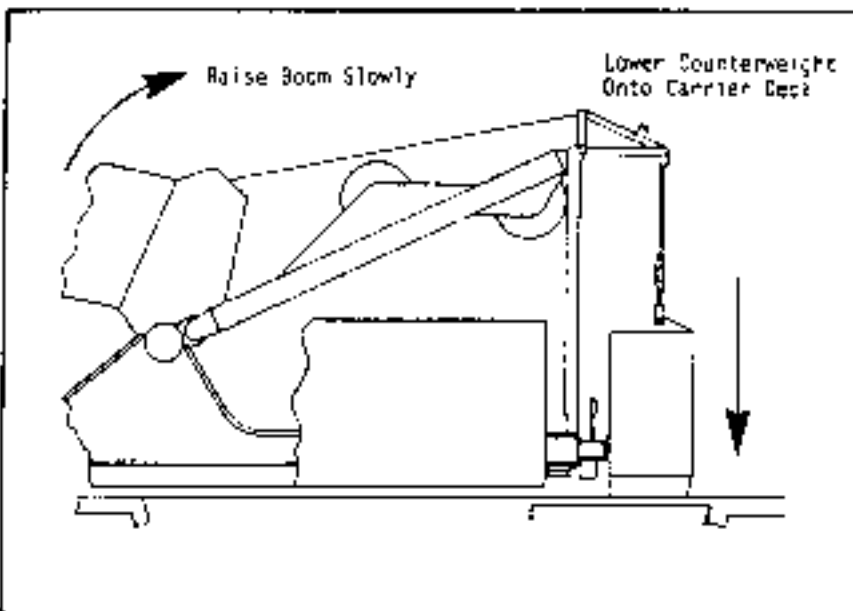


Fig. 1-35  
Setting Counterweight On Carrier

GA454-D

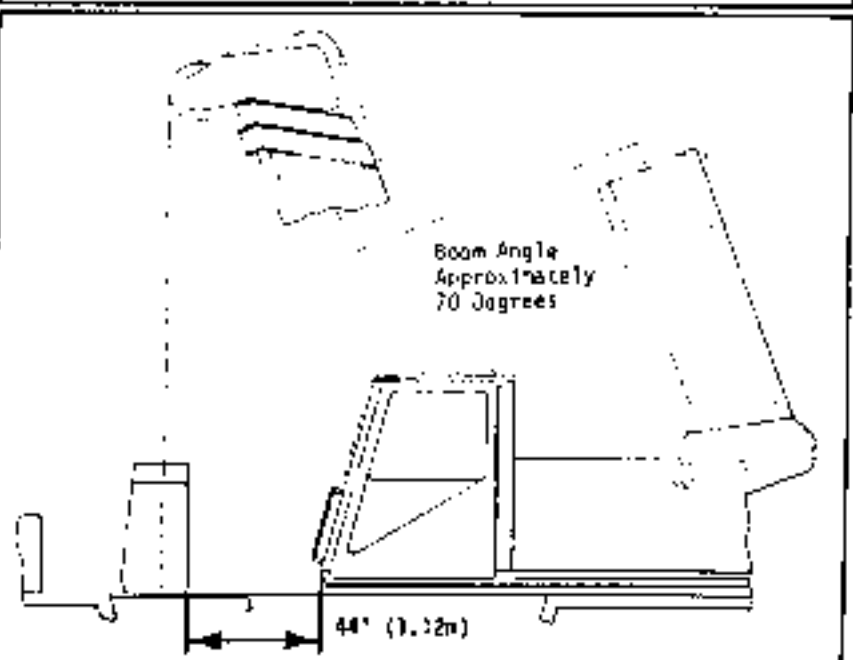


Fig. 1-36  
Counterweight Placement

GA112-C

Machine Series	Maximum Counterweight Load Radius
HTC-50	30' (9.14m)
HTC-34,35	25' (7.62m)

## Operator's Manual Section 1 - Continued - Operating Instructions

### Counterweight Installation

#### CAUTION

The Machine Must Be Level On Fully Extended Outriggers, And Setting On A Firm Supporting Surface To Avoid Tipping During The Following Procedure.

- (a) With the boom fully retracted and a boom angle of approximately 70 degrees, set the counterweight, centered on the carrier frame, 46' (1.52m) from the upper cab. Refer to Fig. 1-36.

#### CAUTION

When Installing Or Removing The Counterweight, Use Fully Retracted Boom Only. Do Not Handle The Counterweight Beyond The Radius Listed In Step (i) Under 'Counterweight Removal'. The Machine Must Be Level On Fully Extended Outriggers During These Operations. A Tipping Condition Could Result From Not Following These Precautions.

- (b) With the counterweight extension frame fully retracted, swing the upper 180 degrees to face directly over the rear of carrier. Engage the house lock.

Note: Swing slowly and be certain the counterweight extension frame clears the counterweight.

- (c) Lower the boom to approximately 8 degrees. Erect the lift linkage into the lifting position as shown in Fig. 1-31 or 1-32.
- (d) Pin the lift bars to the counterweight and secure with safety clips. (Refer to Fig. 1-33 for correct lift points for the fabricated counterweight.)

- (e) Boom down until the counterweight clears the counterweight extension frame. Refer to Fig. 1-37.

Note: If the pendants do not tighten evenly, adjust the turnbuckles on the lift bars. When installing or removing the counterweight, it must remain level.

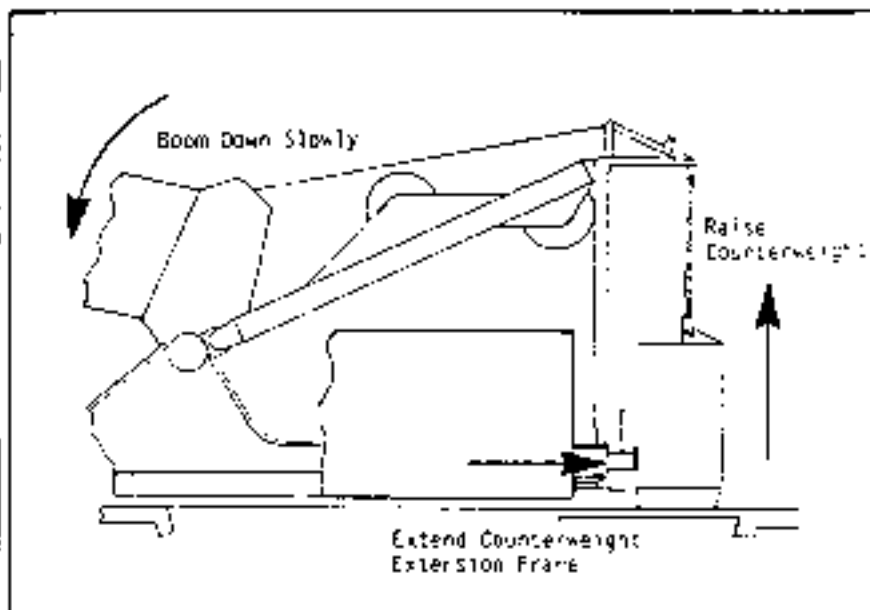


Fig. 1-37 Attaching Counterweight

04454-D

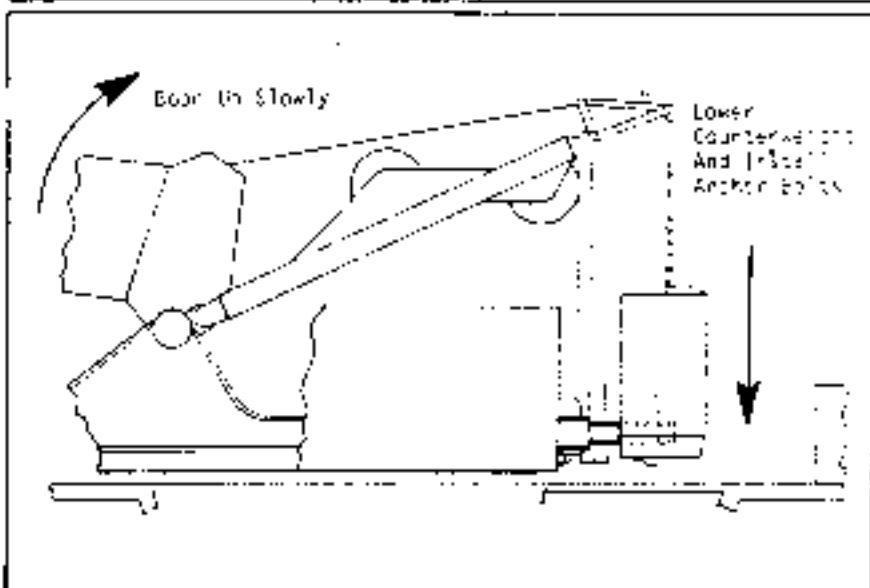


Fig. 1-38 Anchoring Counterweight

04454-D

Extend the counterweight extension frame until it engages in the counterweight slots. Refer to Fig. 1-38.

- (f) Boom up until the counterweight rests on the extension frame, and the anchor bolt holes are aligned.
- (g) Install the (4) anchor bolts and nuts. Lubricate the

bolts and tighten to 480 ft./lbs. (641 N·m) torque.

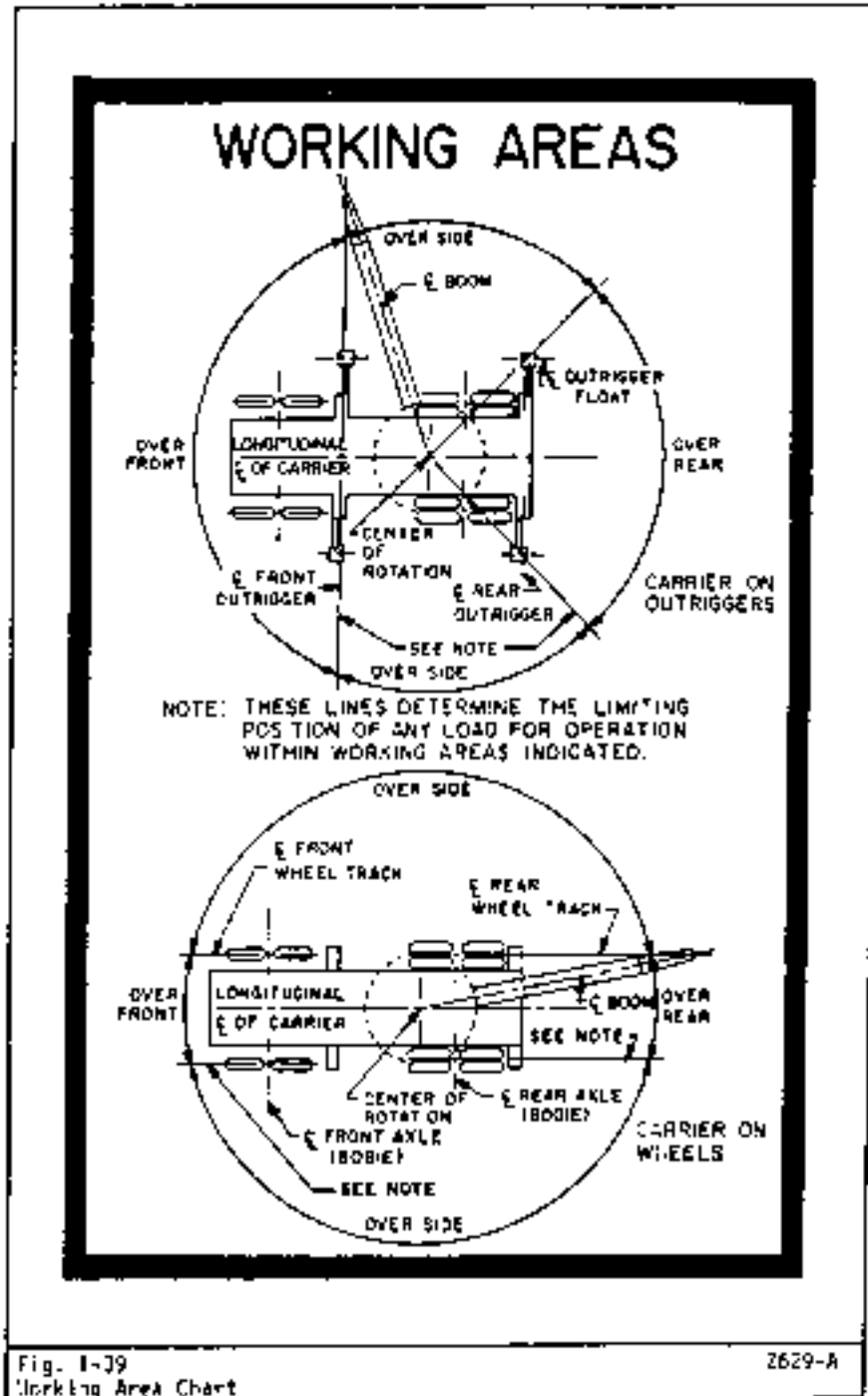
- (h) Boom up until the pendants are slack. Return the lift linkage to the stowed position as shown in Fig. 1-31 or Fig. 1-32.

## Operator's Manual Section 1 - Continued - Operating Instructions

### Crane Operations

The crane attachment is used primarily for making heavy lifts. In order to do this with maximum safety, certain procedures must be followed. The following is a suggested procedure for making a typical lift:

- (1) Determine the weight to be lifted. Be sure to add the weight of the hook block slings, rigging, etc. Determine the height the load must be lifted to.
- (2) Consult the capacity chart, working area and working range plate located in the upper cab. Find the shortest boom length and load radius that will accomplish the job.
- (3) Position the machine so minimum swing is necessary. Do not work over the front of the carrier.
- (4) The machine must be standing on a good, solid, level surface before starting to lift. All capacities on the crane capacity chart are based on the machine being level in all directions. If the machine is not level, out swing or side swing of load will greatly reduce lifting capacities and could cause machine damage or accident. If the ground is soft, use mats.
- (5) If outriggers are used, the following points must be observed:
  - (a) The outrigger beams must be fully extended to pick the loads shown on the capacity chart. Serious reductions in lifting capacity will result if beams are not fully extended, and this could lead to serious machine damage or an accident.
  - (b) Outrigger pontoons must be on solid, smooth footing, flush with the ground (no hills, or valleys under pontoons), otherwise pontoon may be damaged or destroyed. If there is any doubt, use mats.



- (c) All capacities listed for the machine on outriggers are based upon all tires being clear of the ground and the machine setting level. A level is mounted on the upper control panel to assist in leveling the machine.
- (6) Counterweight must be fully extended when making lifts and fully retracted when traveling.
- (7) When making lifts on tires, all tires must be inflated to pressures shown under "Maximum Lifts On Tires" on the tire chart in the upper



## Operator's Manual Section i - Continued - Operating Instructions

- cab. Always apply the emergency brake when working on tires.
- (8) Raise the boom and swing over load. Extend the boom to the desired length.
  - (9) Drop the hook block down and fasten onto the load. The following points must be observed when picking the load:
    - (a) The boom peak must be directly above the load. Booms are made to lift, and should never be used to drag a load sideways.
    - (b) Always use chains, wire ropes, or slings of ample size, and make periodic check of their conditions.
    - (c) Always use sufficient parts of line. Consult wire rope capacity chart on operator's cab for number of parts of line needed for a given lift.
    - (d) When lifting heavy loads, care should be taken to prevent sudden loading or unloading of the hoist line. Ease into the load. Lift the load a few inches off the ground and hold to check the brakes.
  - (10) Lift the load to the desired height. Boom to the desired angle. Be careful when booming down, or swinging load (but swing from centrifugal force) as these increase load radius with a resultant decrease in capacity. Make sure the load being lifted remains within the lifting capacity of the machine at the boom length and radius being used.
  - (11) Control the load at all times. Use hand lines to guide the load. Don't guide loads into place with your hands. Swing slowly and smoothly. Avoid jerks when starting or stopping swings.
  - (12) Lifting loads or having the upper positioned over the side when on tires is prohibited, as machine may tip over.
  - (12) A: pick and carry operations must be over the rear, lifting off main head. Travel on smooth, firm, level surface at speeds less than one MPH (1.6 km/h).

### During Operation

The operator must remain alert to possible malfunctioning of the machine while operating. If the machine does malfunction, land the load and shut machine down until the problem is found and corrected. During operation the operator must:

- (1) Remain alert to any noise, loss of power, or bad response to control of the engine. Watch the engine oil pressure and water temperature gauges for proper operating range. Consult the engine manufacturer or his nearest dealer for repair work.
- (2) Watch the hydraulic system oil temperature gauge. If the temperature on the gauge reads 200°F or more, shut down the machine until the problem is corrected.
- (3) Listen for any unusual noises in the hydraulic system gear train, or the speed reducers. If any, shut down machine and correct problem.
- (4) Watch the S-O-M pressure gauge. The gauge should read 900-1050 PSI (6206 - 7242 kPa). If not, shut down the machine until the problem is corrected.
- (5) Watch for oil leaks or any loss of control. If any develop, correct before continuing operation.
- (6) Make sure all controls work freely and easily, with no sticking or binding. Lubricate or adjust as necessary.
- (7) If working on outriggers, periodically check the outriggers to make sure the machine is level and stable. If working on rubber, make sure the tires are inflated to the proper pressure.
- (8) Heed all warnings and caution labels. Observe good safety practices at all times.

### Hand Signals

Since proper hand signals are important to the proper operation of a crane, a hand signal chart is included in this section. These signals should be used at all times unless voice instructions with a radio or telephone are being used. One man should be designated as a signaller and his signals only obeyed by the operator. The operator should obey a stop signal no matter who gives it.

### Operating Safety

Read this every day - someone's life may depend on it, maybe your own.

Hydraulic machines are easy to operate. So easy in fact, that almost anyone can do it. This very "ease of operation" leads to careless operation, or operation by unqualified personnel. Either of the above can result in an accident.

When a hydraulic machine is maintained and used properly, it can be a safe, highly useful piece of equipment, but as with many commonly used things such as a lawn mower, a motor boat, or even a kitchen knife, if not used properly it can be dangerous.

Think safety. You, the operator, are in charge of an important piece of equipment. It is very important that you know what it can do. It is also important that you know what it should not do. No set of instructions can anticipate all of the situations you will run into. The rules given here cover general usage, and some of the more specific cases. If conditions arise not covered by these rules, consult the manufacturer. A phone call may save someone's life.

### General Safety Rules

- (1) Read the operator's manual and heed it. The manual contains important information.

- (2) Whenever an operator leaves the control station for any reason, the following must be done:
- Lower the load to the ground.
  - Engage the house lock. Engage the hoist drum brakes. Shut off the engine. Engage the park brake.
  - Never depend upon the hoist brake to suspend a load unless the operator is at the controls, alert and ready to handle the load. Brake slippage, vandalism, mechanical malfunctions, could cause the load to drop if left in the air unattended.

Note The brake pedal locks are intended to allow the operator to rest his legs when suspending a load for a short period of time, but the operator must remain in his seat with his feet on the pedals. Failure to follow these instructions could lead to an accident.

- An operator must not eat, read, or otherwise divert his attention while operating a machine. Remember - operating is a full time job.
- Don't allow crane loads to pass over people, or endanger their safety. Remove all loose objects from load. All non-operating personnel should leave the immediate area when machine is operating.
- Don't let anyone ride the hook block or load. These machines are intended to lift objects - not people. They are not elevators.
- Be sure your work area is clear. Make sure you have proper clearance for machine, boom, or load. Don't swing, travel, hoist or lower load, raise or lower boom, extend or retract outrigger beams, raise or lower jacks, without first making sure no one is in the way. If your vision is obscured, locate a signalman so you can see him, and he can see all areas you can't. Follow

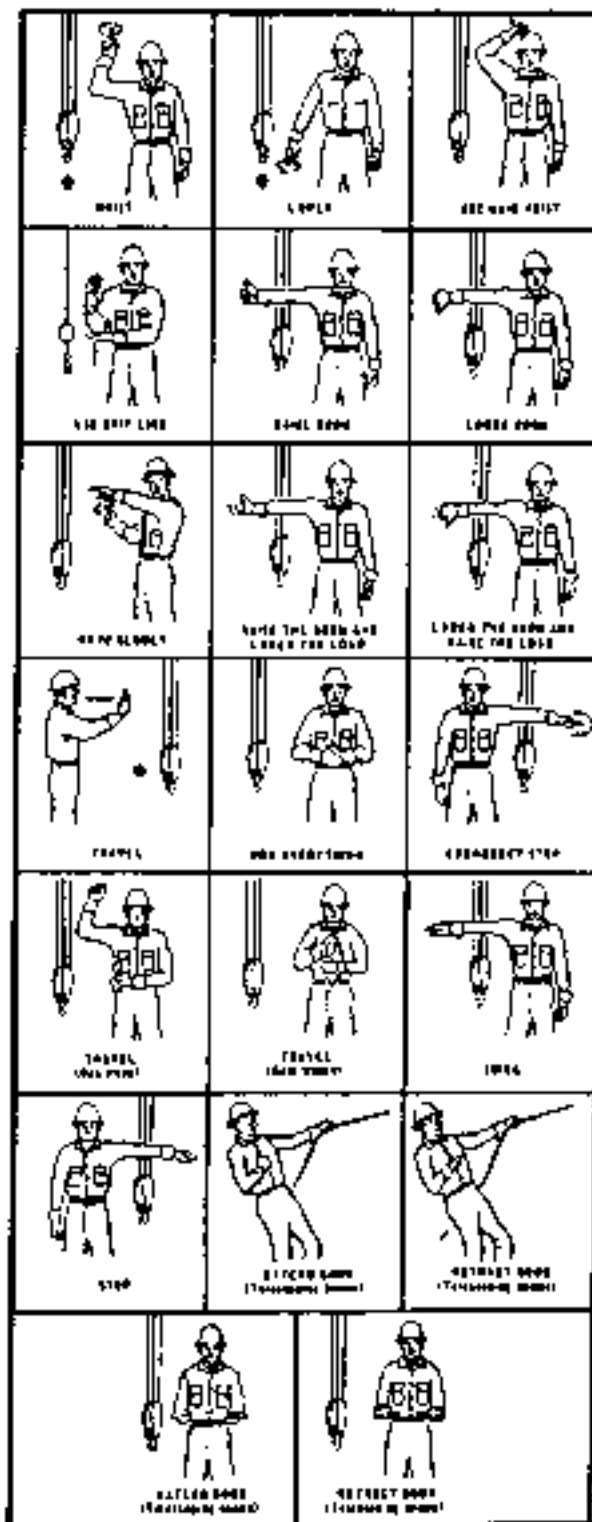


Fig. 1-42  
Hand Signal Chart

2652-0

## Operator's Manual Section 1 - Continued - Operating Instructions

his signals. Be sure you and the signaler understand each others signals (See hand signal chart.) Use the horn to signal or warn. Make sure everyone on the job understands signals before starting operations.

- (7) Inspect the machine daily. Don't operate a damaged or poorly maintained machine. Pay particular attention to the clutches, brakes, attachment, and wire ropes. If a component is worn or damaged, replace it before operating. Remember - parts are cheaper than people.

Be sure clutch and brake surfaces are clean and dry. A small amount of clutch or brake slippage may dry out wet linings. Avoid excessive heating; it shortens lining life. If oil or grease gets on linings, clean them

immediately with a non-flammable, low toxicity solvent. If linings are saturated, replace them. OSHA (Occupational Safety And Health Act) regulations state, "a thorough inspection of all ropes shall be made once a month and a full written, dated and signed report of rope condition kept on file where readily available". Replace any worn or damaged rope. Pay particular attention to hoist ropes and jib pendants. Check end connections (pins, sockets, wedges, etc.) for wear or damage.

- (8) Don't let the load or bucket hit the boom, fly, or jib. Don't let the attachment rest on, or hit against, a building or any other object. A bent or damaged boom may result, which will weaken the boom. If the damage is severe, the boom may fall loose. If a "attice" or "dragon" bracing member or the fly or jib is broken or cracked, replace it. If bent, straighten it.

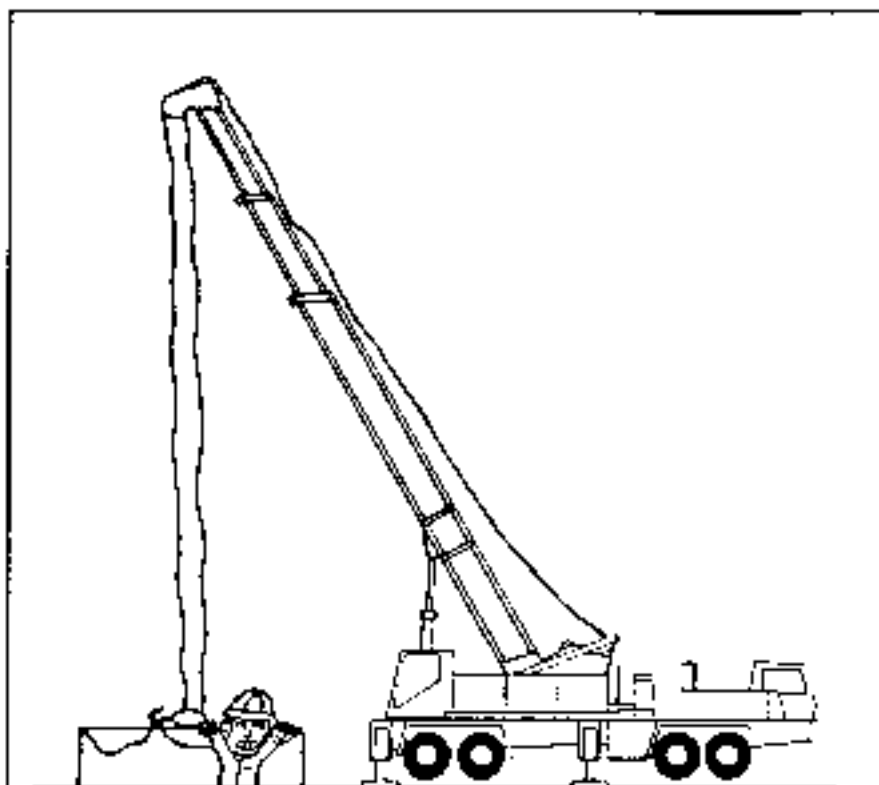


Fig. 1-41  
Never Leave A Load Suspended, It May Fall

GP650-2

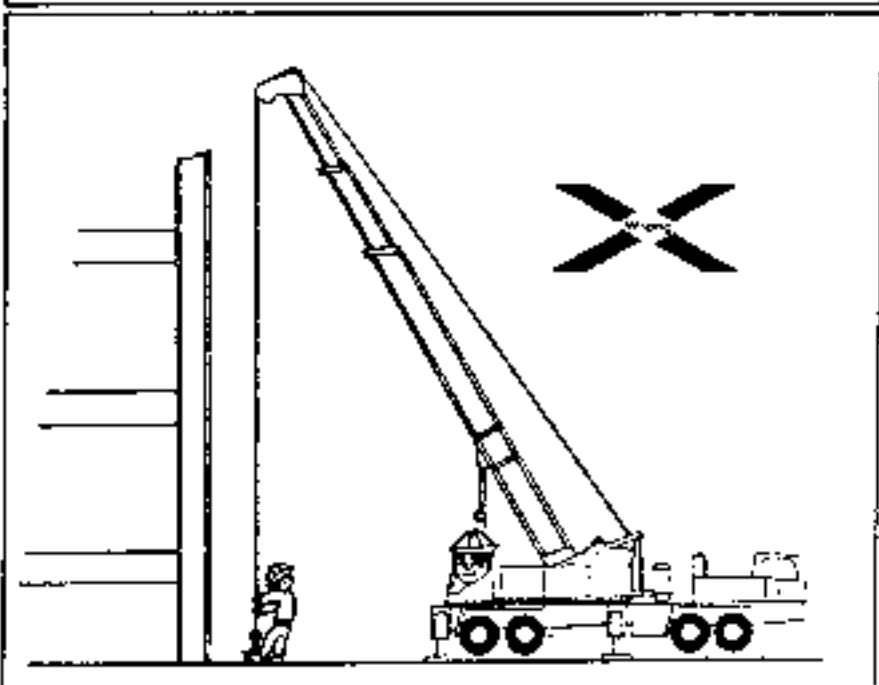


Fig. 1-42  
Wrong - Don't Let Anyone Hitch A Ride

GP650-1

## Operator's Manual Section 1 - Continued - Operating Instructions

If the boom, fly, or jib is struck or damaged, by anything, stop. The loading on a boom increases as the boom is lowered; therefore a damaged boom or boom suspension system may collapse during lowering. Use a helper crane to assist in lowering a damaged boom.

- (9) Always replace protective guards and panels before operating machine.
- (10) Always wear hard hats, safety glasses, steel toe shoes, and any other safety equipment required by local or job conditions or regulations.
- (11) Never get on or off a machine in motion. Use both hands when climbing onto a machine. If a ladder is provided, use it.
- (12) Keep your machine clean, in good repair, and in proper adjustment. Oil or grease on the decks may cause falls. Improper adjustments can lead to machine damage, load dropping, or other malfunction.
- (13) Keep a dry chemical or carbon dioxide fire extinguisher of 5BC rating or larger in the cab or in the immediate vicinity of the machine at all times. Instruct all operating and maintenance personnel in proper use of the extinguisher. Check periodically to make sure it is fully charged and is in working order.
- (14) Never tamper with safety devices. Keep them in good repair and properly adjusted. They were put on the machine for your protection.
- (15) Don't smoke when fueling, or fuel up near an open flame. Keep the nozzle in contact with the filler neck to prevent static electric sparks. Shut off the engine when fueling.
- (16) Before performing repairs or adjustments, lower attachment to the ground, or onto blocking. Be sure of safe footing before standing on

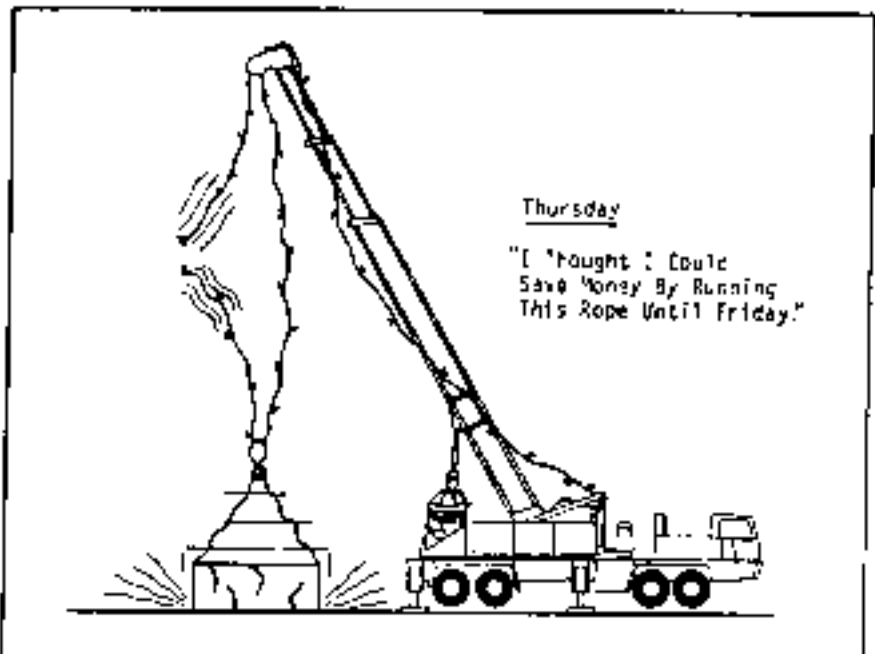


Fig. 1-43  
Never Operate With Worn Or Damaged Rope

GA657-4

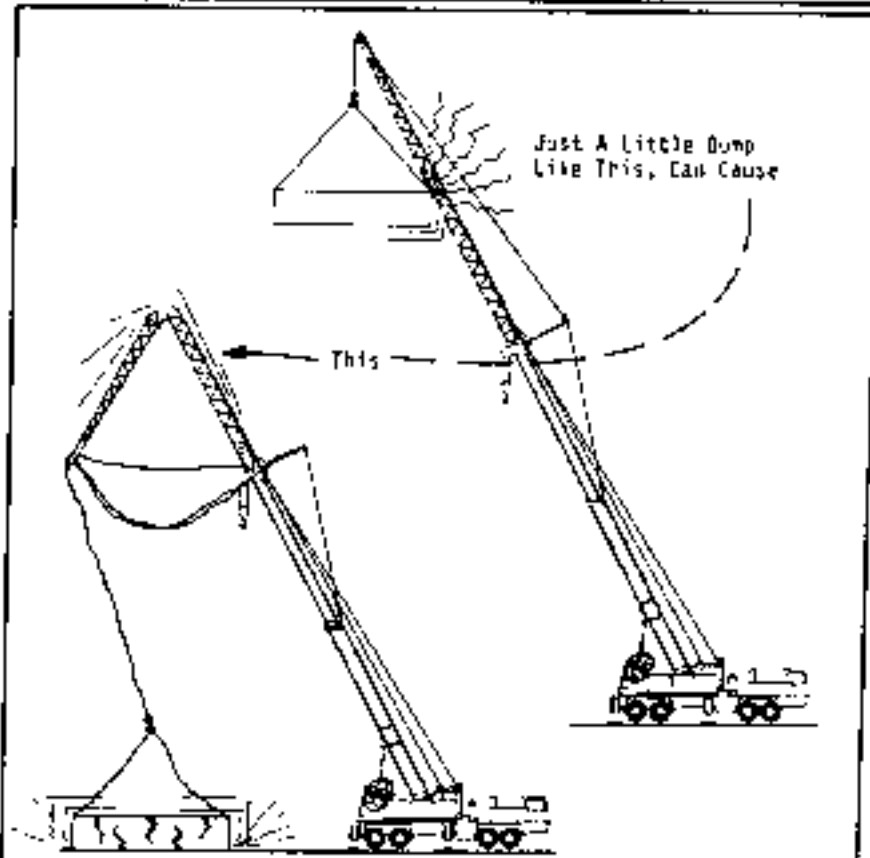


Fig. 1-44  
Don't Let The Load Hit The Boom

GA661-8

## Operator's Manual Section 1 - Continued • Operating Instructions

walking on boom or jib. Use a ladder, planking or lift platform to prevent falls. On truck mounted machines, lower machine off the outriggers. If this is not possible, block securely under the outrigger beams. Lock the starter, or remove battery cables so machine can't be started. Remove ignition key. Post warning signs in cab so no one will try to start the engine.

- (17) Always reduce pressure in hydraulic system to zero before working on any part of the system. Work control levers back and forth with engine shut down to reduce the pressure to zero.
- (18) Keep fingers, feet and clothing away from sheaves, drums, and ropes unless the machine is shut down and everyone knows what you are doing. Never place a hand on lines when climbing to the top of the machine. A sudden movement may pull them into the drum or sheaves.
- (19) When checking battery level, use a flashlight - not an open flame. Battery gas is explosive. If the battery explodes you may get acid in your eyes, which may cause blindness. Don't check battery charge by shorting across posts. The resulting spark could cause the battery to explode. Check with a tester or hydrometer. Don't smoke near batteries, especially when they are being charged.

When using jumper cables to start an engine be sure to connect negative post to negative post, and positive post to positive post. Always connect the two positive posts together first, and the two negative posts last to prevent spark when the cables are connected. This spark could cause the battery to explode.

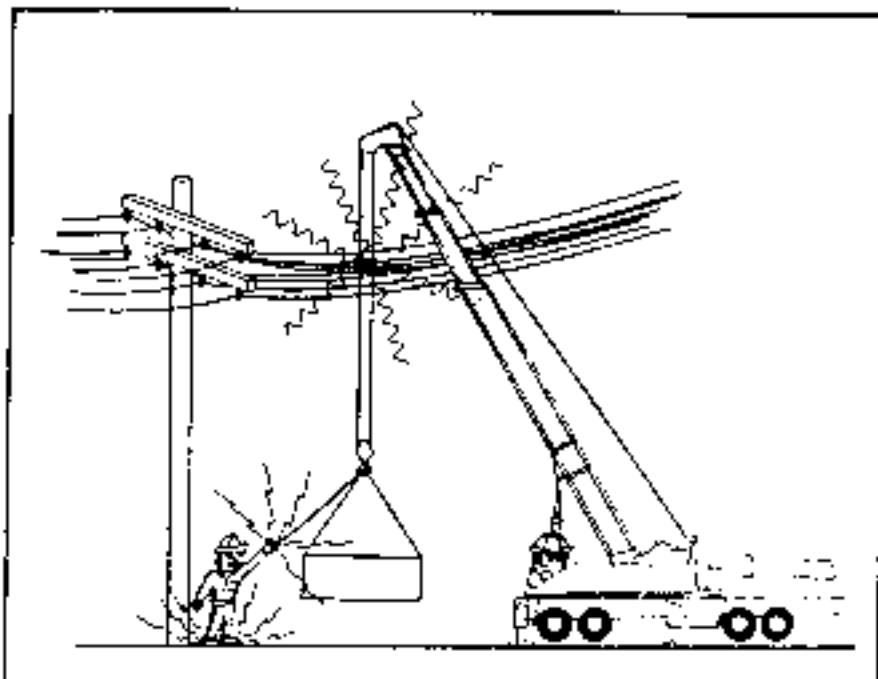


Fig. 1-45  
Stay Away From Power Lines

- (20) When working inside a building, check clearance to avoid a collision. Check load limits on floors or ramps so you won't crash through. Always check for areas for dangerous features. Don't operate close to an overhang or deep ditch. Avoid caving edges, falling rocks, slips, etc. Never park machine where a bail can fall on it, or it can fall in an excavation. Don't park where rain can wash out footings.
- (21) Pinch points, which result from relative motion between mechanical parts can cause injury. Keep clear of rotating upper or moving parts.
- (22) Use extreme caution when removing radiator caps, drain plugs, grease fittings, hydraulic pressure cans, etc. They may fly off and hit you or you may be burned by hot oil, water or steam.
- (23) Always wear safety glasses when drilling, grinding, or hammering on metal. If you do not wear safety glasses, flying chips may injure the eyes.



Fig. 1-46  
Never Use An Open Flame To Check A Battery

- (24) All electrical power lines are dangerous. Contact with them, whether insulated or not, can cause death or injury. When operating near power lines, the best rule is to have the power company cut off the power and ground the lines. However, in some cases, you will be unable to have the power cut off. Follow these rules whether the power is cut off or not.

## Operator's Manual Section 1 - Continued - Operating Instructions

- (a) Be alert. You are working around conditions which can cause death.
- (b) Keep all parts of the machine, fall lines, hook block and load, at least 15 ft. (4.57m) from the line, or other distance specified by applicable code. Slow down machine operation.
- (c) Assume that every line is "hot".
- (d) Appoint a reliable person equipped with a loud signal (whistle or horn) to warn the operator when any part of the machine or load moves near the power line. This person should have no other duties while the machine is working around the power line.
- (e) Warn all personnel of danger. Allow no unnecessary persons in the area. Don't allow anyone to lean against or touch the machine. Don't allow strong men or load handlers to hold load, lines, or rigging near unless absolutely necessary. Use dry hemp or dry plastic ropes as tether lines. Make certain everyone stays 15 ft. (4.57m) away from the load, or such distance as required by applicable code.
- (f) The use of boom point guards, proximity devices, insulated hooks, or blocks, or swing limit stops do not assure safety. Even if codes or regulations require the use of such devices you must follow rules listed here. If you do not follow them, the result may be serious injury or death.
- (g) Grounding the machine may increase the danger. Poor grounding such as a pipe driven into the ground, gives little or no protection. In addition, a grounded machine

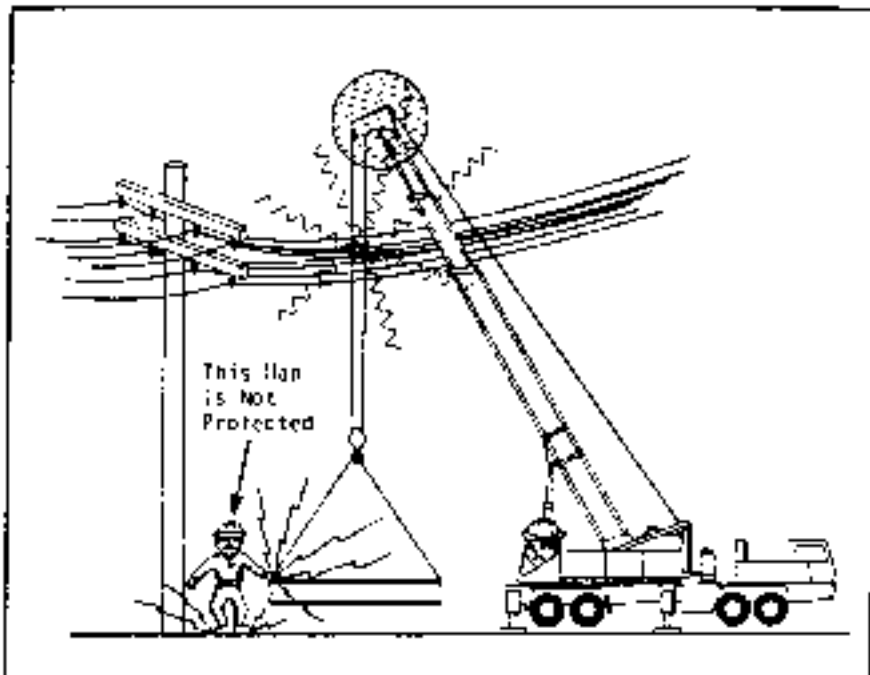


Fig. 1-47  
Crane Equipped With Proximity Device

24664-4

Shaded area shows sensitivity zone with probe near boom point, and adjusted for a 10 foot (3.00m) clearance. Contact can be made outside this zone by the fall lines, hoist ropes, cab, boom, etc. In such cases, the alarm will not sound until the machine is electrified and deadly.

- (a) may strike an arc so heavy that a live line may be burned down. This could cause the machine and the area around it to be electrified.
- (b) When operating near radio or T.V. transmitting stations, high voltage can be induced in metal parts of cranes, or in their loads. This can occur even if the machine is some distance from the transmitter or antenna. Painful, dangerous shocks may occur. Consult trained electronic personnel before operating machine to determine how to avoid electrical hazards.
- (25) What do you do if a power line is touched by machine or load?
  - (a) Keep cool - think - a mistake can kill someone.
  - (b) Warn all personnel to keep clear.
  - (c) If machine will still operate, try to move it away from contact. Fall the operator, are reasonably safe in the cab unless the machine is on fire or an arc is cutting through the cab near you.
  - (d) Move away from contact in reverse to that which caused the contact. Example: If you swing left into wire, swing to the right to break contact. Remember - once an arc has been struck, it will stretch out much further than you think before it breaks. Keep moving away from the line until arc breaks.
  - (e) When the arc breaks, continue moving away until you are at least 15 ft. (4.57m) away from

## Operator's Manual Section 1 - Continued - Operating Instructions

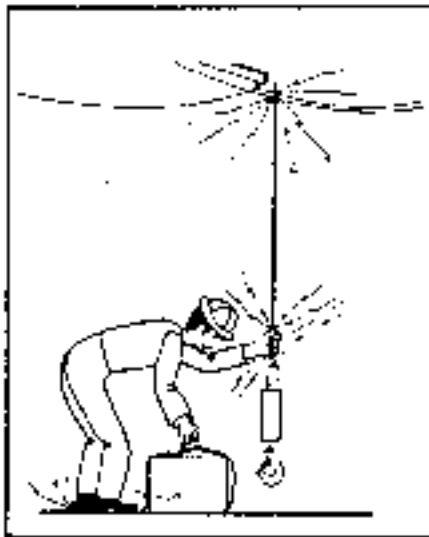


Fig. 1-45 2690-A  
Crane equipped with insulating tank and boom peak guard. In this situation, the car is not protected.

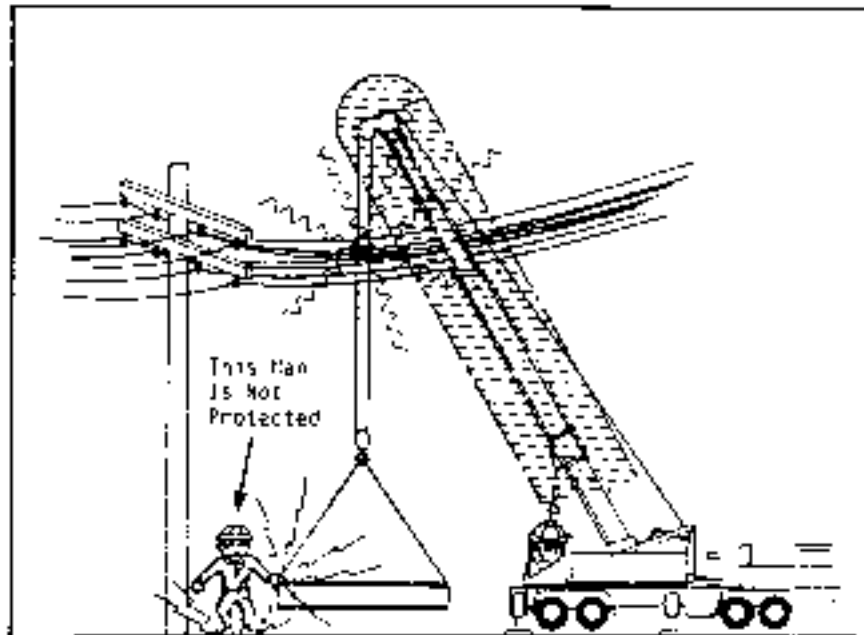


Fig. 1-46 2616-A  
Crane Equipped with Proximity Warning Device

Shaded area shows 'sensitivity zone' with full boom length sensor used, and adjusted for 10 foot (3.048) clearance. Contact can be made outside this zone by the fall lines, hoist ropes, cab, etc. In such cases, the alarm will not sound until the machine is electrified and dead.

- as specified by local code.) Stop the machine. Thoroughly inspect the machine for damage. Repair any damage before further use.
- (f) If you cannot disengage from the line, and machine is not on fire or no arc is cutting through the car, stay in your seat until power line can be shut off.
- (k) If you must leave the machine, don't step off. Leap from the machine as far as you can.
- (26) When using a magnet:
  - (a) Lifting magnet generators produce voltages in excess of 200 volts and present an electrical shock hazard. Only trained personnel should work on the magnet, controller, or wiring. Never open the controller door with the generator running.
  - (b) Do not let workers touch magnet or load.
  - (c) Do not let worker get between magnet and a metal object.
  - (d) If necessary to position a load, use a dry, wooden stick.

- (e) Oper magnet disconnect switch at magnet control panel before connecting or disconnecting leads.
- (27) The operator, supervisor, or person in charge of the load must observe the following rules:
  - (a) Loads must be well secured before lifting. Be sure that the rigging can't slip off or pull away from the load, or get out of position on the load. Be sure load is rigged so it won't fall over.
  - (b) Chains and slings must be of adequate size, in good condition, and not twisted around each other.
  - (c) The load must not latch on an obstruction when lifting or swinging. Be sure load, fall lines or any other part of machine does not snag or strike any obstruction.
  - (d) Avoid sudden starts and stops. Lift carefully. Swing gently, brake smoothly, lower and set loads carefully. Denset; the load, swinging and plugging the swing brake roughly, lowering the load rapidly, and slamming on the brakes, will put shock loadings and possible side loadings on the boom. Cowboys sometimes use rough treatment to break horses, rough treatment can also break a machine. Unnecessary abuse labels the operator as a beginner. Be a professional.
  - (e) Never wrap the hoist line around the load. Never use discarded, worn, or damaged rope for slings. They may break and drop the load.

## Operator's Manual Section I - Continued - Operating Instructions

(17) The machine must be level before making a lift. Use "level" if the machine is so equipped. If not, use a good carpenter's level placed on a smooth horizontal surface on the upper or lower frame. Remember, a three degree side tilt can reduce capacities by 50% or more.

The hook block and fall lines can be used as a "plumb bob" to level a machine. Pick up a compact load (2000-3000 lbs./ 907-1360 kg) a few inches above the ground. If machine is level, fall lines will hang directly between the boom feet, as you face the boom. How swing over the side. The lines should still hang directly between the boom feet. Don't use this method on a windy day.

(18) The hoist line must be vertical when starting to lift. If not, load will swing in, out, or sideways when lifted from the ground.

When picking a heavy load, machine will lean toward the boom. This is caused by elasticity of the machine and the boom. The lean is more noticeable when picking over the side on rubber. The lean will increase operating radius so the load will swing outward when it clears the ground. This outswing is dangerous to anything in the path of the load and because of the increase in load radius may overload the machine. To overcome this outswing, boom up as the load is lifted so fall lines remain vertical. When setting the load on the ground, lower boom after load touches down to avoid hook block swing when it is unhooked from load.

(19) When swinging a load from over end to over side, the lean described above will increase. This is especially noticeable when operating on tires. Since tilt acts to increase load radius, it must be compensated for when swinging the load. Swing

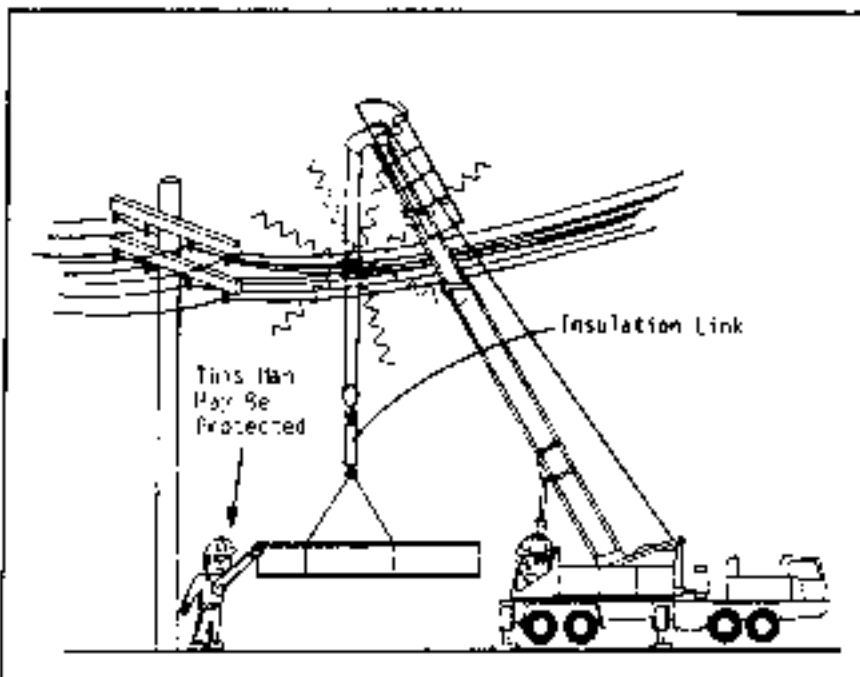


Fig. 1-53  
Crane equipped with both an insulation link, and an insulating boom point guard.

GA656-A

slowly. Change boom angle (raise or lower boom), while swinging, to maintain a constant radius, and prevent inswing or outswing of load. If not, a dangerous condition may result.

(20) Know your load. Don't try to guess or estimate the load. Use a scale weight, carefully calculated weight, a hook scale, or a load indicating system. Remember - the weight you are lifting includes the weight of any lifting slings, or gear, the hook block, and any overhead weights. If picking off the boom with the jib installed, the weight of the jib and rigging must also be considered part of the load. The total load weight must never exceed the rated capacity of the machine, as listed on the capacity chart, for the position, boom length, load radius and condition of operation being used.

Remember - capacity chart ratings are based on ideal conditions:

- (a) Standing on firm, level surface
- (b) Calm wind
- (c) No side loads or outswing of load
- (d) Good visibility
- (e) Machine in A-1 condition and equipped as when leaving the factory

If such conditions cannot be attained, loads being handled must be reduced to compensate. The amount loads are reduced depends upon how good, or how poor, the actual operating conditions are. It is a matter of judgment and experience. Some factors which may require reduction of loads below listed ratings are:

- (a) Soft or unpredictable supporting surfaces.
- (b) Wind
- (c) Hazardous surroundings
- (d) Inexperienced personnel
- (e) Poor visibility
- (f) Fragile loads
- (g) Machine in poor condition



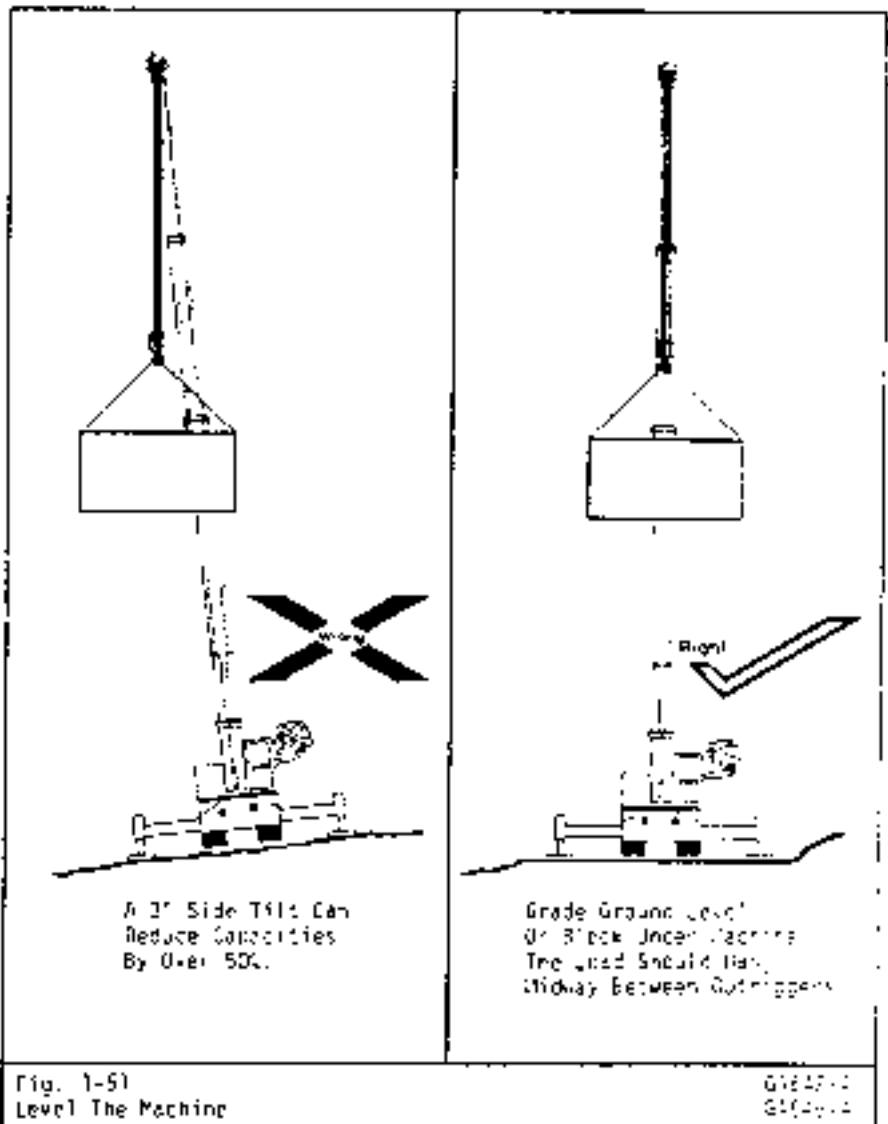
## Operator's Manual Section 1 - Continued - Operating Instructions

When in doubt, don't take a chance. Reduce ratings more than you think you need to.

Avoid working a machine in high winds. If you must work in a wind, reduce capacities considerably below those shown on the capacity chart. Wind blowing against the load and the boom produces a side load on the boom and reduces its capacity.

When lifting large loads such as building panels in a wind, the movement of the load may pose a danger to workmen or building structures. Outswing of a load will increase load radius, and may overload the machine. This could lead to boom failure or machine tipping.

- (31) Don't operate at radii and boom lengths where the capacity chart lists no capacity. Don't use longer booms or jibs than listed on the chart. Any of the above can tip the machine over, or cause boom and/or jib failure.
- (32) Keep the load lines as short as possible to prevent excessive swinging. Always use the shortest boom length which will do the job. Remember, the shorter the boom, the stronger it is.
- (33) Watch out for centrifugal force when swinging a load. Swing gently. Centrifugal force tends to increase load radius. This increase in radius could overload the machine and cause machine damage and tipping. When stopping the swing, overswing of the load can side load the boom.
- (34) Know the load radius. Don't guess it. Determine radius by using the boom angle indicator, the boom length, and the capacity chart, or measure it with a steel tape. Remember - radius is the horizontal distance from the



- centerline of rotation of the upper to the center of gravity of the load when the load is hanging free.
- (35) Know the boom length. Don't guess. Use of an incorrect boom length can cause an accident.
- (36) Use at least the number of parts of hoist line specified in the wire rope capacity plate to handle the load. Local codes may require more parts of line than shown. Check code requirements and use them where applicable.

- (37) Test the hoist brake by raising the load a few inches and holding. It should hold easily. It takes more brake to hold a load in the air when the drum is full of rope, than a few inches above the ground with only one wrap on the drum.
- (38) Don't pull sideways on the boom, not even a little bit. Lift straight up or even load. Moving trucks, rail cars, barges, or anything else by pulling sideways with the hoist line is

## Operator's Manual Section 1 - Continued - Operating Instructions

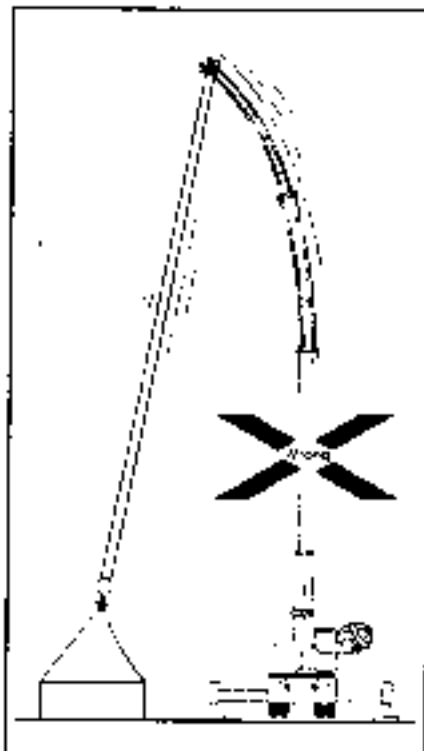


Fig. 1-52 G4650-A  
Never Use The Boom To Pull Loads Sideways

liable to buckle the boom. It may also damage the swing mechanism. Pulling sideways on a boom set at a high angle can turn the machine over sideways.

- (39) Never move a crane away from the load while handling near capacity loads. Due to load inertia (weight) the load will tend to stay in position when the machine starts to move, and then will swing in toward the machine. The inertia effect will tend to increase load radius and decrease stability. This could lead to boom failure or machine tipping.
- (40) When operating on outriggers, the beams must be fully extended. Jacks must be extended so all tires are clear of ground, and machine is level. Be sure that blocking or pontoons are set on firm surface, adequate to support the blocking or pontoon

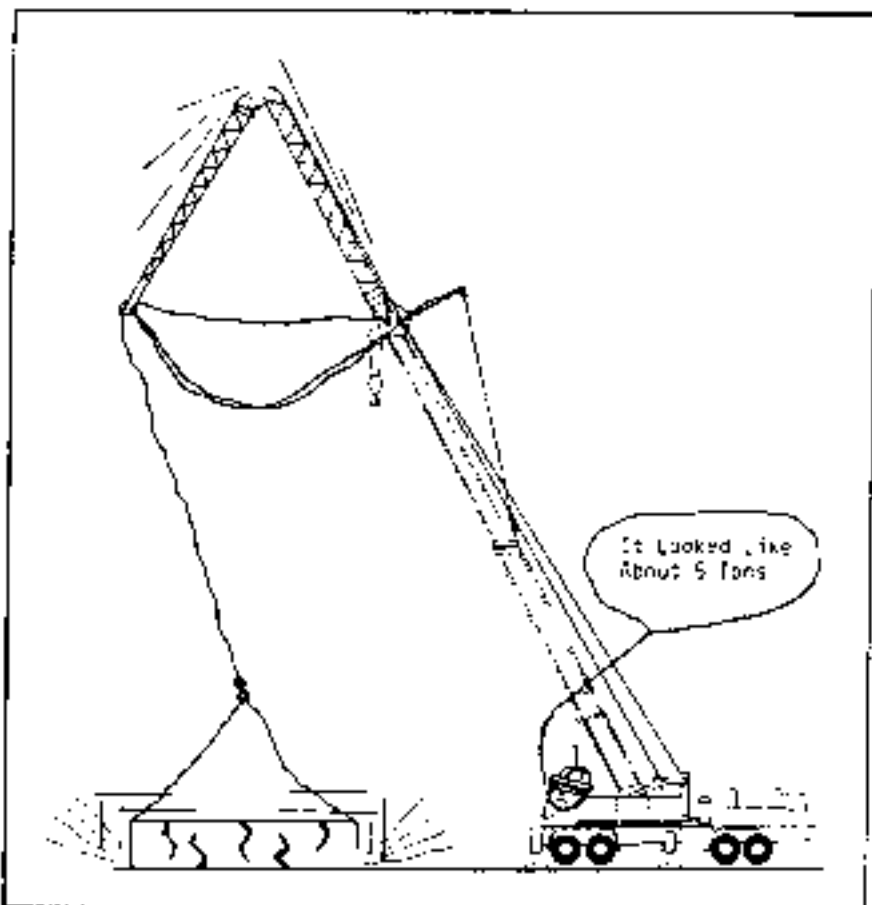


Fig. 1-53 G4652-9  
Know Your Load

loading without settling, slipping, or collapse. Blocking or matting under pontoons must form a smooth level surface under the entire pontoon, however, do not also block under outrigger beams inside of pontoons as this reduces stability. Remember - there are tremendous loadings on pontoons and blocking, the weight of the entire machine plus any load.

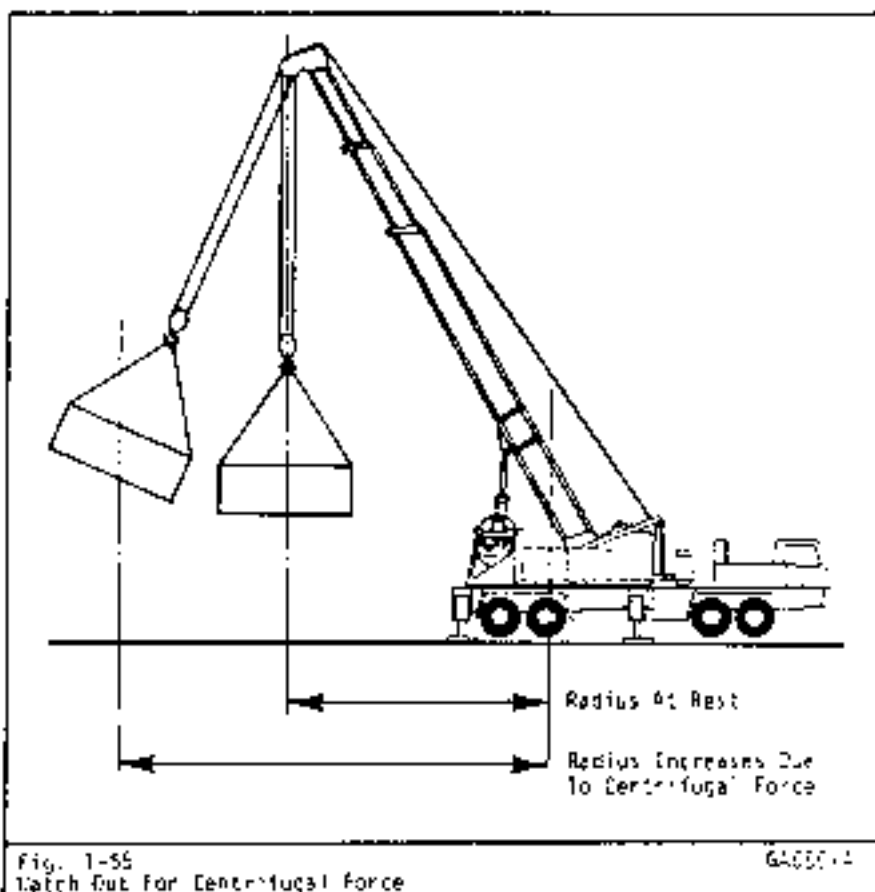
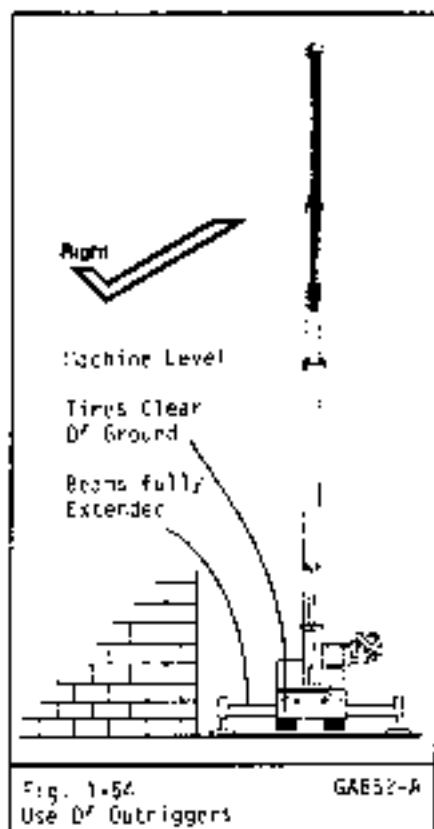
When blocking or matting under pontoons, be sure that each pontoon is supported fully - no unsupported pontoon area is permissible. Be sure pontoons are on a smooth surface. Rough surface, rocks, etc. under pontoon will cause unequal

loadings, may puncture it, and cause collapse.

Capacities are based on outriggers fully extended. Working with outriggers partially retracted will reduce capacities and machine stability considerably and may cause an accident. If it is absolutely necessary to operate a machine with outrigger beams partially retracted, reduce capacities to those shown on the chart for "on rubber". Remember, the machine must be level.

Avoid working with only rear outriggers extended. If you swing over the side, the machine may tip over, or the boom may be damaged from side loadings because the machine is not level.

## Operator's Manual Section 1 - Continued - Operating Instructions



- (41) Don't alter any part of the machine. Additions to or changes in any part of the equipment can create loadings which the machine was not designed for. Such changes may seriously affect the useable capacities and make the entire capacity chart invalid. Such changes can dangerously overload or weaken critical parts and may cause disastrous failure.
- (42) Don't operate over the front of the machine, either on tires, or on outriggers. Lifting loads over the front can cause damage to the carrier. Also the operator's vision may be obscured by the front of the carrier. If it is absolutely necessary to work over the front, consult the factory for special instructions and load ratings.
- (43) Don't exceed the rated capacities of the machine under any circumstances. While a crane has more stability

- when lifting over a corner (as compared to straight over the side) the machine capacity is not increased. Any time you exceed the rated capacities listed on the capacity chart in the operator's cab, you are overloading the machine. Overloads can damage the machine and such damage may cause failure and accidents.
- (44) Don't pick loads on main hoist and jib at the same time, even if total load weight is within machine capacity. Loads on the jib stress the boom and drastically reduce its ability to handle loads.
- (45) Never use longer jibs than specified for your machine. Never use a jib on a longer boom than specified for your machine. Tipping may result.
- (46) Don't increase the counterweight. Don't add anything to the machine that will act

- as additional counterweight. Remember that anything which has weight, if carried beyond machine's tipping point, acts as counterweight. Adding counterweight affects backward stability of the machine, particularly when working over the side. It also encourages overloading of the machine which can cause a disastrous accident.
- (47) Traveling with a suspended load should be avoided if possible. It is especially hazardous when terrain is rough or irregular, on a side slope, or in hilly areas. When traveling with a load, observe the following rules:
- Tether the load to reduce load swing. Don't tether to boom structure.
  - Travel by the smoothest, most level route. If a smooth level route is not available, don't travel

## Operator's Manual Section 1 - Continued - Operating Instructions

with a suspended load unless the route to be taken is graded to provide a smooth level path. If it's not possible to grade the route, move the load by stepping. Pick the load and set it down along side the travel route. Travel unloaded machine beyond load, pick load, swing, and set down farther along route. Continue procedure until load is at its destination.

- (c) Carry load as close to the ground as possible.
- (d) Avoid side swing of load. If tethering won't hold load directly below boom, swing until boom points directly downhill. While this may reduce stability of the machine, it will reduce boom side loadings also. Carrying the load near the ground will reduce the danger of overturning.
- (e) Don't attempt to carry loads which approach the machine's rating.
- (f) Don't travel with a load on soft ground. If machine sinks into ground stability can be affected to the point of tipping the machine over.
- (g) Keep all personnel clear of machine and load. Be prepared to set load down quickly at any time.
- (h) When traveling up or down slopes keep the upper facing downhill to reduce the tendency for the boom to fall over the cab. If necessary to face uphill, keep the boom down.
- (i) Fully extend outrigger beams. Extend or retract jacks until pointers just clear the ground.
- (j) Inflate carrier tires as shown on tire inflation chart for making lifts on rubber.

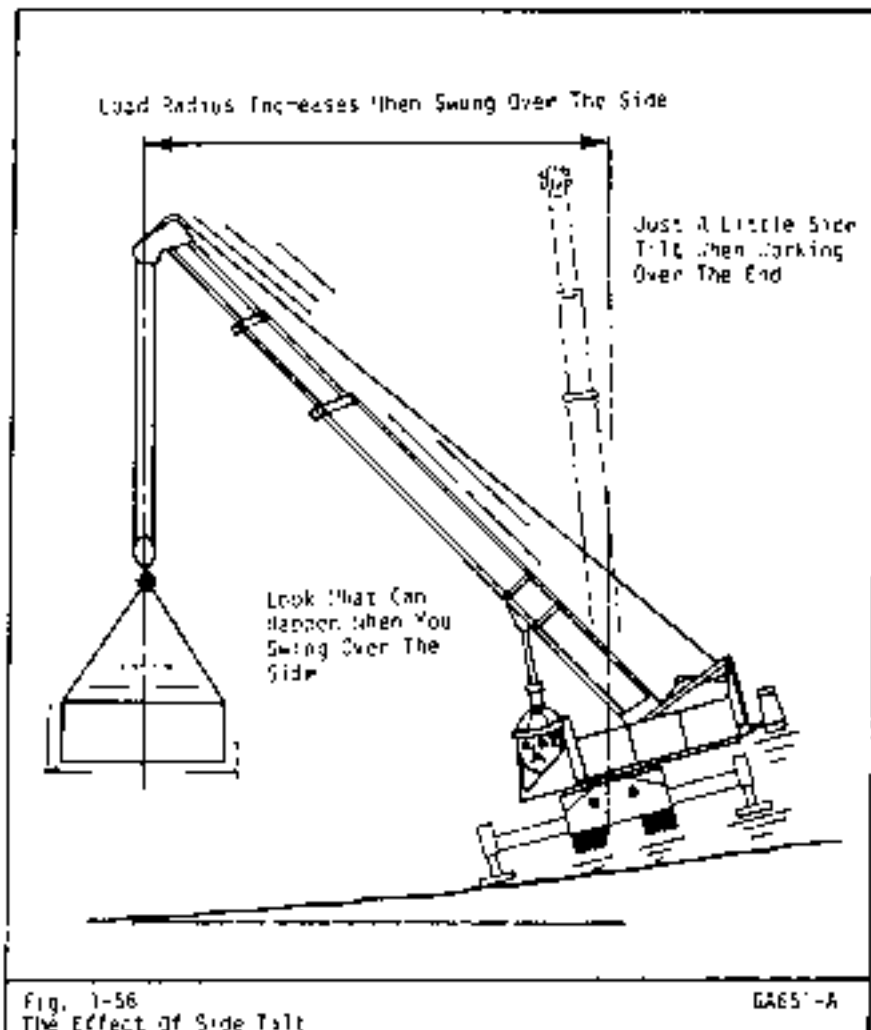


Fig. 1-56  
The Effect of Side Tilt

- (48) Lifts where two or more cranes work together can be hazardous and should be avoided. Such lifts should be made only under the direction of a qualified engineer. If a multiple crane lift is unavoidable, observe the following rules:
  - (a) Cranes must be level and located on firm surfaces.
  - (b) Cranes should be the same size and capacity, use the same boom length, and be reeved similarly.
  - (c) Cranes must be completely supported on fully extended outriggers.
  - (d) Cranes must be positioned so that each boom point is directly over its load attaching point. Fall lines must be vertical during all phases of the lift.
  - (e) Rigging must be placed so each crane lifts a share of the load well within the crane's capacity.
  - (f) During handling be sure that more load is not transferred to any crane than it can handle.

## Operator's Manual Section I - Continued • Operating Instructions

- (g) Don't attempt to travel when making multiple crane lifts.
- (h) Coordinate plans with the other operator before beginning to lift.
- (i) Use only one signalman.
- (j) Use of an operable load and angle indicating system is desirable.
- (49) Don't lift more than one separately rigged load at a time, even if both loads combined don't exceed the crane's capacity. Your full attention cannot be given to both loads, creating a dangerous situation.
- (50) Watch out for "two blocking" (pulling hook block into both sheaves). This can cause rope breakage, resulting in an accident.
- (51) When operating a machine equipped with any form of load indicating mechanism, overload warning system, or any automatic safety device, remember that such devices cannot replace the skill and judgment of a good operator. For instance such devices cannot tell when a machine is located on a supporting surface that will give way, or that too few parts of line are being used to hoist a load, or correct for the effects of wind, or warn that the device may be improperly adjusted, or correct for side pulls on the boom, or for many conditions which may occur and which may create hazards. It requires all the skill, experience, judgment, and safety consciousness that a good operator can develop to attain safe operation. Many safety devices can assist the operator in performing his duties, but he should not depend on them to keep him out of trouble.
- (52) Don't lash a machine down unless you are using an operable load indicating system, or are sure of the weight of every load. Lashing a machine down encourages overloading, and, if machine can't trip you can be seriously overloaded with

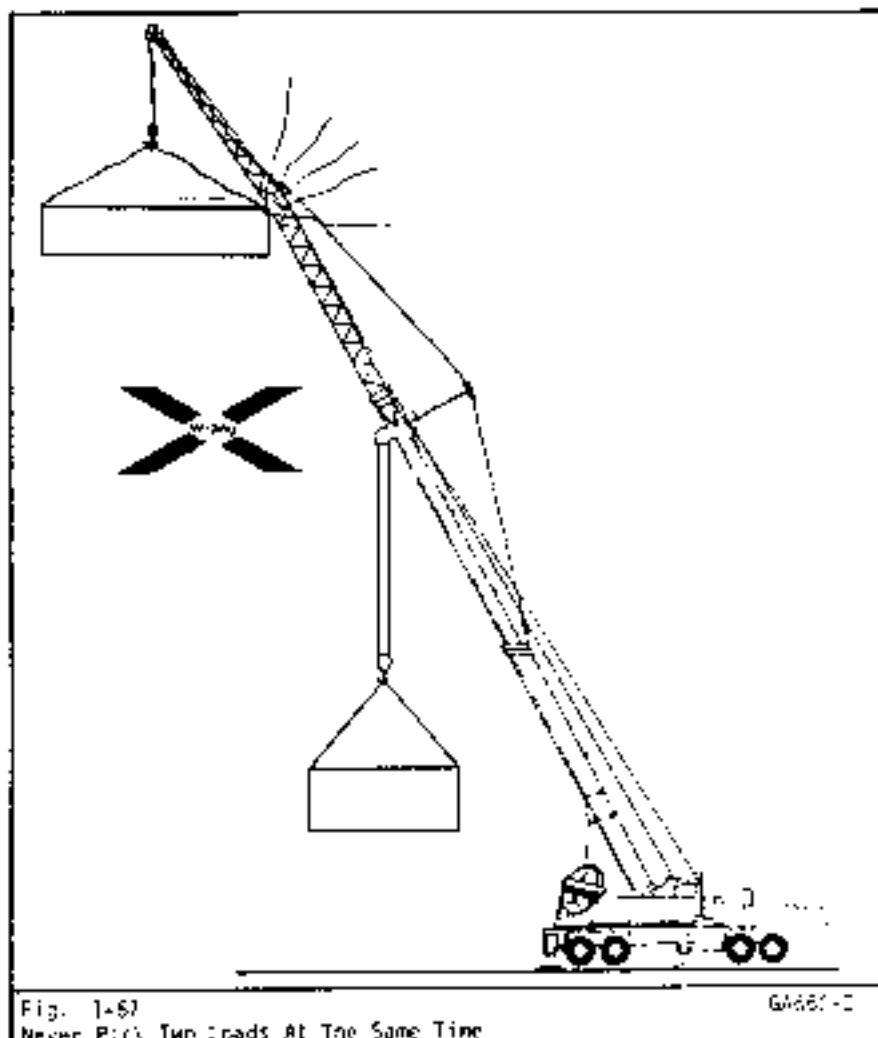


Fig. 1-67  
Never Pick Two Loads At The Same Time

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- (53) Working areas for machines are defined as "over front", "over side", "over rear", or "360 degrees." Permissible loads per the machine capacity chart will vary from lifting quadrant to lifting quadrant. The operator must make sure capacity ratings are not exceeded no matter what quadrant he is operating, or when swinging from one quadrant to another.
- (54) After slack rope operation, make sure rope is properly seated in sheaves and on drums before continuing to operate. Use a stick or mallet to seat the rope, not your hands.
- (55) Never lower the boom or load beyond the point where two full wraps of rope are left on the drum. This condition could occur when lowering a load below ground level. If all the rope runs off the drum, the load will jerk which could break the rope and drop the load.
- (56) Make sure there is a latch on the hook, and that it works properly. Without a latch, it is possible for slings or chains to come off the hook and allow the load to fall.
- (57) When lifting submerged loads, the suction caused by the load resting on the bottom acts to increase the weight of the load in some cases to many times the actual load weight. This same effect can occur on land, for example, when a load is imbedded in mud. To

## Operator's Manual Section 1 - Continued - Operating Instructions

break a load loose from suction, don't pull sideways or the boom may collapse. If possible, rig the load so it is lifted from one end. Don't yank or jerk on the load. A steady pull, maintained for some time will often free the load without overloading the equipment.

When a submerged load reaches the surface, don't attempt to lift it out of the water all at once. It may be saturated with water and weigh many times what you expect. Allow it to drain as you raise the load slowly. Be patient, since draining may take a long time. A load when removed from the water, even when fully drained, will have a greater effective weight than it will when submerged because of buoyancy.

- (58) Don't extract piling, casings or other such loads by yanking or jerking on them. The practice of pulling on the load until the machine has tipped, then releasing the hoist line, allowing the machine to drop back and catching the hoist line on a clutch or brake may break the boom. If the piling, or casing won't pull out with a smooth, steady pull, use an extractor, pulling frame, or some similar rigging intended for this purpose. Pulling on a load that is not free to be lifted can develop loadings in the machine far in excess of the normal weight of the load. Imposing such loads on a machine can damage the machine and may cause disastrous failure. When using a pile extractor, use a shock or vibration insulator unit.
- (59) Operation with auxiliary equipment such as pile driver leads, pile hammers, or caisson boring attachments imposes additional loading on the machine. This causes a major reduction in lifting capacities of the machine.

Changes in augers and Kelly bar lengths with drilling attachments and in pile hammer attachments further complicate the manner in which lifting capacities are reduced. The weight of each piece of auxiliary equipment is to be considered a part of the live load acting at the radius of the center of gravity of the piece.

- (60) Demolition work can be particularly hazardous. Shock loadings and side loadings from demolition ball and clamshell bucket work can be severe. The repetitive nature of such work imposes heavy demands on all parts of the machine. Restrict demolition ball weights to not to exceed over 50% of machine capacity (in tire capacities for truck cranes) at maximum radius at which you handle the ball, with the boom length you are using. In no case however, should the ball weight exceed 50% of the available line pull.
- When using demolition ball, avoid sudden clutch and brake applications. Work steadily and smoothly. Don't try to knock the whole structure down with one blow. Use good aim. If the ball misses its target, outswing could cause machine tipping or overload. When swinging back, ball may hit the boom and damage it.
- (61) When dismantling a structure where a portion is being cut loose while suspended by a crane, be sure the weight of the portion being cut loose is known, and the crane pull on the load is equal to the weight. The point of attachment must be directly above the center of gravity of the load. The fall lines must be vertical. This is an extremely hazardous operation. The services of a professional engineer should be used to plan and supervise such lifts.
- (62) Road the machine safely. Watch for narrow bridges and low clearances. When

### Use A Guard For Safety



Fig. 1-58  
Be Careful Inflating Tires

maneuvering in tight places, post a signman on the ground to guide you. Check load limits, height, width, and length restrictions in the area you are traveling. Make sure your machine complies with all regulations.

- (63) When roading the machine, note the following:
- Operate with lights on. Use proper warning signs, flags, and other such devices. Use an escort service if required.
  - Engage house lock in upper unless you are traveling with boom installed and it is necessary to swing the cover for clearance, or if boom is on dolly.
  - Lash down or otherwise restrain the noon block.
  - Check operator's manual for maximum allowable travel speed, maximum amount of boom that can be transported, and any other travel limitations. Don't exceed these maximums. Machine damage or accident will result.
  - When traveling with outriggers retracted, secure them in retracted position. If they should accidentally extend while the machine is traveling, a serious accident may result.
  - When roading a machine, store portcoons in scarpage areas provided, and fasten them down securely.

## Operator's Manual Section 1 - Continued - Operating Instructions

- If a portoon should fall off the machine, it could cause a serious accident.
- (64) Check tires daily for correct pressure. Never stand in front of a tire when inflating. The lock ring may fly off and injure you. Use a clip on inflator, and stand behind the tire tread. Use a guard in front of tire.
  - (65) When working on rubber, tires must be inflated to pressures shown on tire inflation chart to make the lifts shown on the capacity chart.
  - (66) Shift carrier transmission to neutral before operating upper. Machine rocking may damage transmission or drive line. If necessary, leave the engine running to maintain air pressure.

When parking a wheeled crane, shift to neutral and apply park brake. Block wheels if on a hill.

- (67) When swinging upper, be careful of carrier cab. Swinging into the cab will damage it, and probably the boom too. Always engage the swing lock when loading the machine.
- (68) If your carrier is equipped with safety belts or shoulder harness, use them. They are there for your protection.
- (69) Brake firmly in one application. Avoid fanning the brakes. This may exhaust air pressure so fast the compressor can't keep up.
- (70) If a machine must be towed, move slowly. Take up slack in chain or rope. Don't jerk, it may break. Keep chain or rope taut while towing.
- (71) Before attempting to move the carrier, make sure there is enough air pressure to operate the brakes. Always check brake operation before driving the machine.
- (72) Always lock before you back up, or better yet, post a signman to guide you. If your machine is equipped with a back-up alarm, make sure it is working properly.

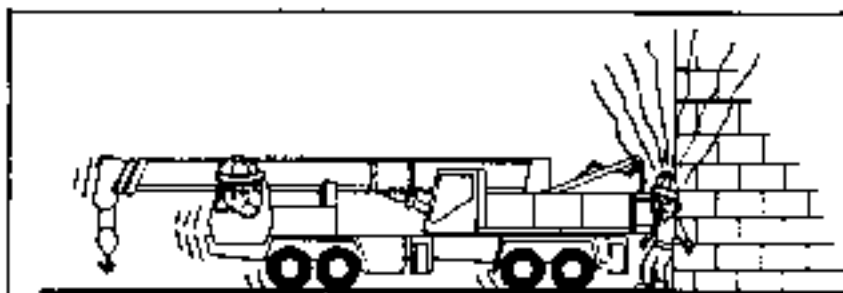


Fig. 1-59  
Back The Machine Safely

24655-A

If not, use the horn as a signal. Use a code such as one beep - stop, two beeps - forward, three beeps - backward. Make sure everyone on the job site knows the code. If machine is equipped with a back-up alarm, make sure it works properly.

- (73) Never coast downhill with clutch disengaged or transmission in neutral. [Better practice makes control of the vehicle more difficult, and less safe.]
- (74) Never leave carrier unattended with the engine running.
- (75) Never work on a hydraulic machine without doing the following:
  - (a) On cranes, fully retract the boom. Lower boom to the limit of the boom hoist cylinders or into cradle. Lower the machine down off the outriggers.
  - (b) Disengage the pump disconnect. Shut off the engine. Work all control levers back and forth to relieve pressure and relax the attachment.
  - (c) If the above instructions cannot be followed, block securely under the attachment so it cannot move.
  - (d) Hydraulic oil becomes hot during operation. In some cases it becomes hot enough to cause severe burns. Be careful not to let hot hydraulic oil contact the skin.



Fig. 1-60  
Be Careful Of Carrier Cab

24655-A

- (e) On machines equipped with a pressurized or precharged sump tank, relieve the pressure before working on the hydraulic system. This pressure can push oil out of a connection, drain plug, etc., as it is loosened. This could cause an injury.
- (76) When setting pressures, never exceed manufacturer's ratings. Always follow instructions to the letter. Over pressure can cause hydraulic component damage or failure. Over pressure in hydraulic circuits can also lead to damage or failure of mechanical parts on a machine. Any of the above can lead to an accident.
- (77) Never put any part of your body into a hole on the hydraulic boom. A sudden movement of the boom could cut it off.
- (78) Never make a lift which is not in plain sight without a signman. This is particularly true on hydraulic yard cranes where the operator does not swing with the boom. This can lead to an accident or machine damage.

## Operator's Manual

### Section 1 - Continued - Operating Instructions

- (79) When you pick a load with any crane, the load radius will increase. Due to the design of hydraulic crane booms (cantilever boom, supported by cylinders, overlapping sections) this increase is much more pronounced. The increase or outswing of the load can overload the boom, and lead to boom failure or tipping. Also, movement of the load can cause it to hit something. Make sure the load being lifted will remain within capacity as it is lifted and the boom deflects.
- (80) Never use a hydraulic crane boom to push or pull. It is not designed for this purpose. Such action can damage the boom and lead to an accident later on.

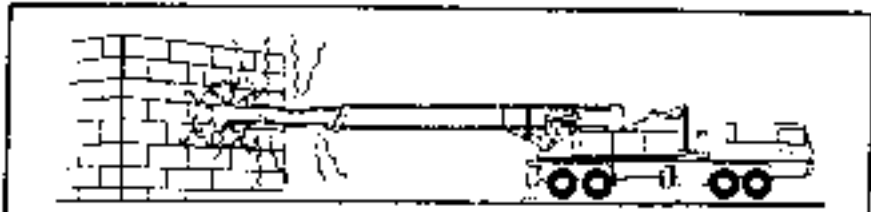


Fig. 1-61  
Don't Push With The Boom

GA653-A

- (81) Never operate a hydraulic crane at radii or boom lengths where capacity chart shows no capacity. In some cases the machine can tip over with no load on the hook. This is particularly true over the side where on rubber, where these machines are the least stable. Also, if the boom is fully extended at a low angle, the machine may tip until the boom touches the ground. In any case, injury or machine damage may result.
- (82) When lowering or retracting the boom, the load will lower. To compensate for this, the operator must take up on the hoist rope. Otherwise, movement of the load may cause an accident.

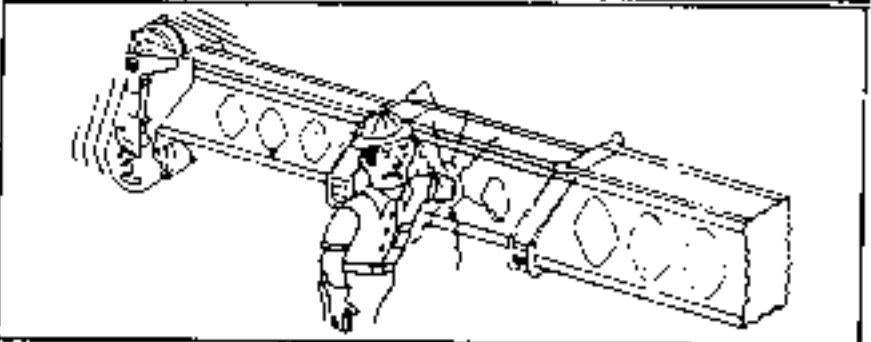


Fig. 1-62  
Do Not Reach Inside Boom Cutouts

GA641-A

- When extending the boom, the load will raise. The operator must let off on the hoist rope to keep the load in place. Extending the boom without letting off on the rope can lead to "two blocking". This is when the head sheaves contact the hook sheaves or ball. Two blocking can lead to machine damage, rope breakage, and load dropping.
- (83) When extending or lowering a boom with a load, the load radius increases. As radius increases, capacity decreases. If capacity is

exceeded, the boom may bend as the safety factor in the boom hoist cylinders exceeds the strength of the boom, or the machine may tip over. Sometimes, at low angles, a hydraulic crane boom can be extended with a load, but cannot be retracted. This is because more power is available in the boom cylinders to extend than to retract. If an operator extends his boom under load, thinking he can retract if he gets into a precarious condition, it may cause an accident.

- (84) Most capacities on hydraulic machines are based on strength of materials. In these cases, overloads will cause something on the machine to break, before it will tip. Never use signs of tip as warning of overload.
- (85) When operating off the boom with the jib installed, deductions from the capacity chart must be made. The weight of the jib, backstops, stays, etc. must be subtracted from the capacity on the chart to obtain a

"net" capacity. Failure to do so will result in an overload condition which can cause boom failure or

- (86) The boom must be extended in the correct manner before making a lift. On machines with two-lever control, telescope the boom sections out equally. Load charts for these machines are based on equally extended boom sections.
- (87) Know the load radius. This is particularly important on hydraulic cranes. Any two of three variables: (1) boom length, (2) boom angle, (3) load radius must be known to properly figure what load can be lifted. On hydraulic cranes, it is difficult to figure the boom length. This fact makes it imperative that load radius and boom angle be known. Measure the radius with a steel tape. Find the boom angle by reading the angle indicator.



## Operator's Manual Section 2 - Lubrication And Preventive Maintenance

### General Lubrication Information

The machine should be regularly and systematically lubricated in accordance with the lubrication charts shown later in this section of the manual. A similar chart is inside one of the machinery cab doors on the machine. The time interval shown on the lubrication chart is intended as a guide only. Under unusual working conditions, such as working in dry dusty conditions, in water or mud, around a corrosive atmosphere, more frequent lubrication will be necessary. In these cases, the operator must use his own good sense and work out his own lubrication schedule.

The following procedures are important for proper lubrication of the machine.

### CAUTION

Shut Down Engine Before Fueling Or Lubricating Machine. To Avoid A Fire Hazard, Do Not Smoke Or Handle Fuel Around An Open Flame. To Avoid Machine Damage And To Prevent Serious Injury, Do Not Lubricate Gears Or Any Assembly While It Is In Motion.

- (a) Wipe the grease gun nozzle and the grease fitting before lubricating. This will help keep dirt and grit from entering the bushing or bearing.
- (b) Keep all grease and oil cans and containers clean. Always replace the lid on containers when through to prevent entry of foreign materials. Wipe off oil can covers before using.

- (c) Drain oil cases when not to drain off accumulated sludge.
- (d) Watch for signs of incorrect lubrication such as failure of clear grease to exude the old grease.
- (e) Bleed off hydraulic pressure before opening or removing a line or fitting.
- (f) Replace all guards before starting machine.
- (g) Use a clean funnel equipped with a strainer for pouring lubricants. Clean the area around fill or check plugs before removing to prevent entry of foreign material.

Note: See specific instructions later in this section for lubrication check and change procedures on all gear components.

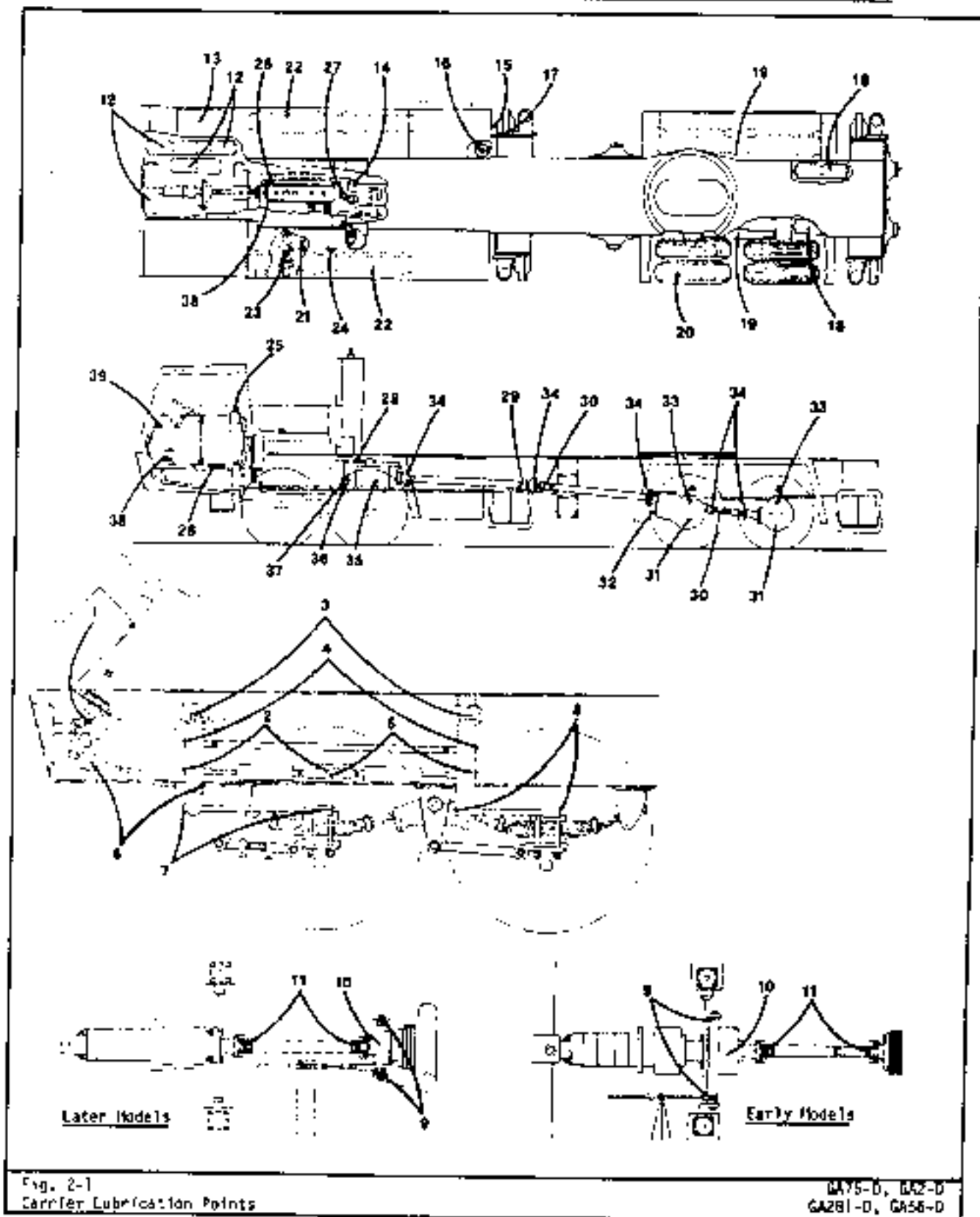
### LUBRICANT CAPACITY CHART

Location	Type	Quantity HTC-50	HTC-34, 35
Hydraulic System	*	266.0 Gal. (1010 L)	236.0 Gal. (893 L)
Hydraulic Reservoir (Sump Tank)	*	140.0 Gal. (537 L)	136.0 Gal. (522 L)
Steering Gear	(E)	2.5 Pt. (.9 L)	2.5 Pt. (.9 L)
Power Steering Reservoir	(F)	4.0 Pt. (1.9 L)	4.0 Pt. (1.9 L)
Front Rear Axle Differential	(E)	32.0 Pt. (15.1 L)	34.0 Pt. (16.1 L)
Rear Rear Axle Differential	(E)	28.0 Pt. (13.25 L)	31.0 Pt. (14.7 L)
Transmission	(D)	16.0 Pt. (7.6 L)	16.0 Pt. (7.6 L)
Swing Speed Reducer	(M)	7.0 Gal. (26.5 L)	7.0 Gal. (26.5 L)
Swing Gear Head (Later Models)	(E)	.42 Pt. (.19 L)	.42 Pt. (.19 L)
Drum Gear Housing	(M)	5.0 Gal. (18.9 L)	5.0 Gal. (18.9 L)
Automatic Brake (Later Models)	(E)	1.0 Pt. (.47 L)	1.0 Pt. (.47 L)
Drum Speed Indicator (Early Models)	(FF)	.5 Pt. (.24 L)	.5 Pt. (.24 L)
Hydraulic Throttle (Early Models)	(T)	1.0 Pt. (.47 L)	1.0 Pt. (.47 L)

\* Refer to page 2-11 for the appropriate oil for different ambient temperatures.

Key: (A),(B),(C),(D), etc. - See "Lubrication Specifications" on page 2-10.

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance



## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

CARRIER LUBRICATION CHART		Number of Points	Daily, 10 Hrs	Weekly, 50 Hours	Monthly, 250 Hours, 1000 Miles	Seasonally, 1600 Hours, 5000 Miles	Annually
1	Steering Gear	1			* (E)		
2	Front Steer Cylinder	2			(A)		
3	Idler Arm Pivots	2			(A)		
4	Drag Link	2			(A)		
5	Rear Steer Cylinder	2			(A)		
6	Drag Link	2			(A)		
7	Drag Link	2			(A)		
8	Drag Link	2			(A)		
9	Pump Disconnect Arm	1		(A)			
10	Pump Disconnect Collar	2		(A)			
11	Pump Drive "U" Joints	2		(A)			
12	Front Air Reservoirs	All	Drain				
13	Batteries	All	*				
14	Lower Steering Reservoir	1	* (F)				
15	Hyd. Reservoir (Sump Tank)	1	*				Change [1]
16	Hydraulic System Filters	2 [2]		Inspect	Change		Change
17	Vacuum Pressure Valve	1				Clean	
18	Rear Air Reservoirs	All	Drain				
19	Rear Bogie Beams	2			(A)		
20	Tires	All	*				
21	Tie Rod Ends	4			(A)		
22	Wheel Bearings	4				(B)	
23	King Pins	4			(A)		
24	Air Cleaner	1				Change [3]	
25	Radiator	1	* [4]				
26	Engine	1	[5]				
27	Air Compressor Strainer	1	[5]				
28	Transmission Shift Linkage	3			(A)		
29	Midpoint Bearing	1			(A)		
30	Drive Tube Slip Yokes	2			(A)		
31	Rear Axle Differentials	2			*	Change (E)	
32	Front Rear Axle Filter (HTC 34,35)	1				Change	
33	Rear Axle Vents	2				Clean	
34	Drive Tube "U" Joints	5			(A)		
35	Transmission	1			*	Change (D)	
36	Clutch Release Bearing	1			(A)		
37	Clutch Housing Shaft	2			(A)		
38	Throttle Linkage	All			(C)		
39	Clutch Pedal Shaft	1			(C)		

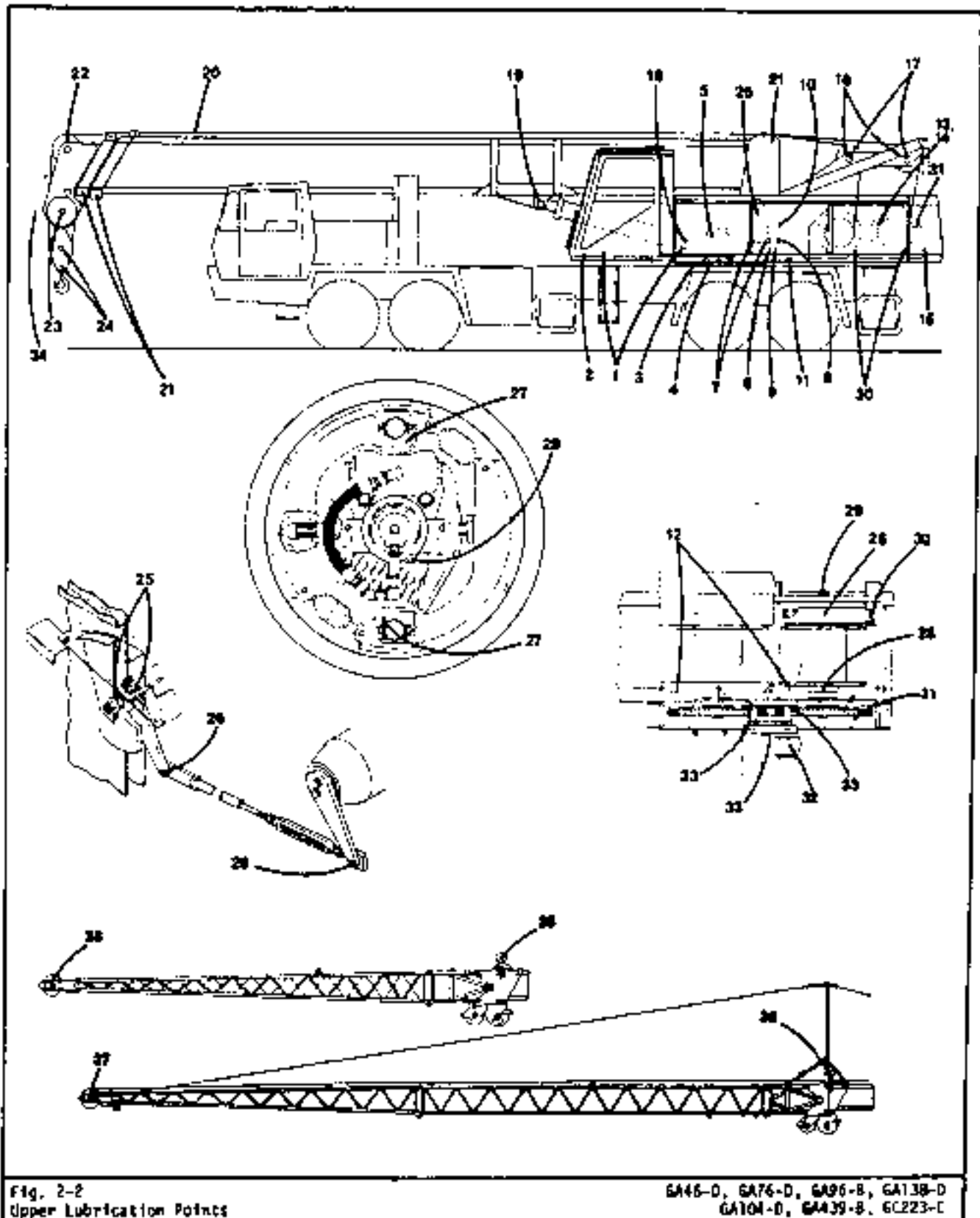
Key: \* - Check and fill as required.

(A), (B), (C), etc. - Refer to "Lubrication Specifications".

[1] - Refer to "Hydraulic Reservoir (Sump Tank)".

[2] - Refer to "Hydraulic System Filters".

[5] - Refer to the engine manufacturer's operator's manual for proper maintenance and lubrication.



## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

UPPER LUBRICATION CHART		Number Of Points □	Daily, 10 Hrs.	Weekly, 50 Hrs.	Monthly, 250 Hrs.	Seasonally, 1000 Hrs.
1	Control Linkages	All			(H)	
2	Hydraulic Throttle (Early Models)	1		* (T)		
3	Turntable Bearing Teeth	All	(H)			
4	Turntable Bearing	1		(A)		
5	Rotating Joint	1	(A)			Inspect
6	Swing Speed Reducer	1		*		Change (M)
7	Swing Speed Reducer Fittings	2		(A)		
8	Swing Gear Head (Later Models)	1		*		Change (M)
9	Swing Brake Linkage	All			(M)	
10	Swing Motor Fitting	1			(A) □	
11	Drum Rotation Ind. (Early Models)	1		* (FF)		
12	Drum Rotation Ind. (Later Models)	All			(H)	
13	Speed-o-Matic Filter	1		□	Change	
14	In-line Filters (Later Models)	2		□	Change	
15	Counterweight Extension Frame	2	(A) □			
16	Fleeting Sheave	2	(A)			
17	Fleeting Sheave Shaft	2		(A) □		
18	Lower Boom Hoist Cyl. Pins	2		(A)		
19	Upper Boom Hoist Cyl. Pins	2	(A)			
20	Wire Rope	All	□			
21	Boom Sliding Surfaces	All			(A)	
22	Deflector Sheaves	2		(A)		
23	Head Sheaves	All		(A)		
24	Hook Block	All		(A)		
25	Boom Angle Indicator	2			(C)	Clear
26	Boom Angle Ind. Linkage	2		(C)		
27	Clutch Shoe Dead Ends	4		(M)		
28	Drum Bearings	4		(A)		
29	Shaft Bearings	2		(A)		
30	Hoist Brake Bell Cranks	All			(M)	
31	Drum Gear Housing	1		*		Change (M)
32	Automatic Brake (Later Models)	1		*		Change (M)
33	Reduction Shaft Bearings	3		(A)		
34	Auxiliary Lifting Sheave	1		(A)		
35	Keeper Sheave	1		(A)		
36	Fly Head Sheave	1		(A)		
37	Jib Head Sheave	1		(A)		

Key: \* - Check and fill as required

(A), (B), (C), Etc. - See "Lubrication Specifications".

□ - All quantities for 2-drum machine.

□ - Refer to "Swing Motor Fitting" before lubricating.

□ - Refer to "Hydraulic System Filters".

□ - Lubricate as required

□ - Cold weather, use SAE 10. oil.

□ - Inspect as explained in Section 5.

□ - Refer to "Boom Lubrication"

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

CARRIER PREVENTIVE MAINTENANCE TIMETABLE	
Every 10 Hours or Daily	
Operation	Remarks
Engine	Provide lubrication and maintenance as recommended by engine manufacturer.
Radiator	Check coolant level. Test anti-freeze in winter.
Battery	Check electrolyte level. Fill as required.
<div style="border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>CAUTION</b> </div> <p>When Checking Battery Level, Never Use An Open Flame. Battery Gas Is Explosive. If The Battery Explodes, Acid May Cause Blindness.</p>	
Tires	Test for proper inflation pressure. Refer to Section 3.
Brakes	<ol style="list-style-type: none"> <li>(1) Check air pressure for 130 PSI (896 kPa) maximum.</li> <li>(2) Check low air pressure warning devices for operation at 60 PSI (414 kPa).</li> <li>(3) Check foot brake and emergency brake operation.</li> <li>(4) Check Skid-Trol system with test light on dash.</li> </ol>
Air Reservoirs	Drain accumulated water.
Power Steering Reservoir	<ol style="list-style-type: none"> <li>(1) Check oil level. Should be 1 inch (25mm) from top of reservoir when oil is at operating temperature.</li> <li>(2) Inspect the hydraulic fluid for foreign particles. If contaminated, the system should be drained and refilled with new fluid.</li> </ol>
General	<ol style="list-style-type: none"> <li>(1) Keep the machine clean.</li> <li>(2) Check for loose or broken bolts, nuts, cotter pins, or other fasteners. If any, retighten or replace before operating.</li> <li>(3) Inspect all welds for cracking and repair. If in doubt as to the repair procedure, contact distributor.</li> <li>(4) Lubricate machine per the lubrication charts.</li> </ol>
Every 50 Hours or Weekly (Perform Operations Listed Under "10 Hours or Daily" First)	
Operation	Remarks
Engine	Provide lubrication and maintenance as recommended by engine manufacturer.
Pump Drive "U" Joints	Lubricate "U" joints with a low pressure gun to avoid seal damage.
Monthly or 1000 Miles (Perform Operations Listed Under "50 Hours or Weekly" First)	
Operation	Remarks
Engine	Provide lubrication and maintenance as recommended by engine manufacturer.

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

Monthly or 1000 Miles (continued)	
Operation	Remarks
Transmission Rear Axle Differentials Steering Gear	Check lubricant level and fill as required.
Chassis Lubrication	Provide complete chassis lubrication. Force lubricant into fittings until old lubricant, dirt, and water are expelled.
Universal and Slip Joints	Lubricate with a low pressure grease gun to avoid damaging seals.
Control Linkage	Lubricate all rod and cable fittings.
Throttle Linkage	Lubricate with engine oil.
Clutch	Lubricate the fittings on the cross shaft, housing shaft and release bearing. Avoid over lubrication to prevent grease from reaching the clutch facing.

2

Seasonally or 5000 Miles (Perform Operations Listed Under "Monthly or 1000 Miles" First)	
Operation	Remarks
Engine	Provide lubrication and maintenance as recommended by engine manufacturer.
Air Filter (Early Models)	Replace. Refer to "Engine Air Cleaner (Early Models)".
Air Filter (Later Models)	Clean or replace. Refer to "Engine Air Cleaner (Later Models)".
Front Wheel Bearings	Re-pack with grease. Visually inspect wheel hardware. Refer to Section Three.
Transmission and Rear Axles	Drain and refill with specified lubricant.
Front Rear Fuel Filter (HTL 34, 15)	Replace filter with above lubricant change.

### UPPER AND HYDRAULIC PREVENTIVE MAINTENANCE TIMETABLE

Every 10 Hours or Daily	
Operation	Remarks
Hydraulic System	(1) Check hydraulic reservoir oil level. Fill as required. (2) Check all lines, hoses, fittings and components for leaks or damage. If any, repair before operating. (3) Drain water from hydraulic reservoir (sump tank). (4) Check hoses for chafing or bulges. Replace as required.
Turntable Gear Teeth	Lubricate by brushing grease on teeth. Do not swing while greasing.
Boom Hoist Cylinder (Upper) Rotating Joint Flighting Sheave	Lubricate sufficiently to force out old grease, water and dirt.

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

Every 10 Hours or Daily (continued)	
Operation	Remarks
Drum Rotation Indicator (Early Models)	Check reservoir oil level and add as required.
Boom Length Indicator	Test for proper adjustment. See procedure in Section Three.
Wire Rope	Inspect as explained in Section Five.
Jib or Fly Attachments	Inspect all parts of fly and jib, paying close attention to chords and lattice.  Note: If chords or lattice are damaged, the attachment may collapse.

Every 50 Hours or Weekly (Perform Operations Listed Under "10 Hours or Daily" First)	
Operations	Remarks
Hydraulic System Filters In-line Filters (Later Models)	The hydraulic system filter and S-3-1 filter must be changed after the first 50 hours of operation on a new machine as explained later in this section. On later models, the additional in-line filters must also be changed.
Turntable Bearings	Lubricate through the grease tube to the inside of bearing. Pump grease until clean grease comes out bearing. Rotate the upper a few degrees and repeat greasing. Lubricate bearing through a full 360 degrees.
Swing Speed Reducer Fittings	Lubricate top gear case bearings.
Control Linkage Grave Linkage Boom Angle Indicator Clutch Shoe Lead Ends	Lubricate all pivot points.
Pump Disconnect Arm and Collar Boom Head Sheaves Fleeting Sheave Shaft Hook Block Auxiliary Lifting Sheave Jib or Fly Sheave	Lubricate sufficiently to force out old grease, water, dirt, etc.
Drum Bearing Drum Shaft Bearing Input and Reduction Shaft	Lubricate
Collector Ring Assembly	(1) Inspect for brush wear. Replace if necessary. (2) Check for loose or damaged wires. Repair if any. (3) Inspect commutator ring for wear, corrosion, or damage. Clean or replace before operating.
Drum Gear Housing Swing Speed Reducer Automatic Brake (Later Models) Swing Gear Head (Later Models)	(1) Check oil level and fill as required. (2) Check for leaks or damage. Repair before operating.



## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

Every 250 Hours or Monthly (Perform Operations Listed Under "50 Hours or Weekly" First)	
Operation	Remarks
Hydraulic System Filters Inline Filters (Later Models)	Change main hydraulic system filter and S-O-M filter. Change earlier if indicator on main filter shows that filter is dirty. On later models, the inline filters must also be changed.
Drum Clutches Drum Brakes	(1) Check all clutches and brakes and adjust if necessary. (2) Greasy, aged, or worn linings must be replaced as continued operations may be unsafe. (3) Check linings for foreign materials which may score the machined surfaces.
Boom Length Indicator	Check system for accuracy and adjust if necessary. Refer to the adjustment procedure in Section Three.
Boom Angle Indicator	Lubricate bearing for gravity compensated pointer.
Drum Rotation Indicator	Lubricate all pivot points with light oil.
Swing Speed Reducer Breather Vacuum Pressure Valve	Clean
Boom Hoist Cylinder (Lower) Brake Bell Crank Pins Swing Beam Linkage Pins	Lubricate
Boom Sliding Surfaces	Lubricate wear shoes and wear surfaces on boom. Refer to "boom lubrication" later in this section.

2

Every 500 Hours (Perform Operations Listed Under "250 Hours or Monthly" First)	
Operation	Remarks
Boom	(1) Visually inspect all boom sections for damaged or cracked members or welds. (2) Check boom wear shoes and bumper pads for proper adjustment and correct if necessary. Turn to adjustment procedure outlined in Section Three of this manual. (3) Check for leaking or damaged hoses, fittings, or cylinders. Repair or replace before operating.
Swing Motor Fitting	One shot of grease. Do not overgrease. Refer to "Swing Motor Fitting" later in this section.

Every 1000 hours or Seasonally (Perform Operations Listed Under "500 Hours" First)	
Operation	Remarks
Drum Gear Housing Automatic Brake (Later Models) Swing Speed Reducer Swing Gear Head (Later Models)	Drain, clean, and refill as explained later in this section.
Turntable Gear Swing Pinion Input and Reduction Gears Spur Gears	Inspect all gears for wear or damage. Repair or replace the parts, if required, before further operations.
Hydraulic Reservoir (Sump Tank)	Refer to "Hydraulic Reservoir (Sump Tank)" for oil change schedule and procedure.

## Operator's Manual Section 2- Continued - Lubrication And Preventive Maintenance

### Lubrication Specifications

The following specifications are approved lubricants for use in Link-Belt machines. The specifications are identified by a code letter. When a code letter appears on a lubrication chart, it may be "looked up" in the specification sheets, to find the proper lubricant. These lubricants are listed by specification and by one brand name. Most reputable oil companies can provide a lubricant to match a particular specification, and this lubricant may then be used in the machine no matter what the brand name.

<p><b>A</b> Bearing Grease (NLGI Grade No. 2)</p> <p>This grease shall be a homogeneous combination of refined mineral oil and lithium soap. This grease shall not contain any fillers which adversely affect the lubricating qualities of the product. It may have additives that give a high degree of protection against corrosion of metals and oxidation of the grease. It shall be free of any disagreeable odor.</p> <p>The product shall be non-corrosive, short fiber grease of excellent mechanical and storage stability.</p> <p>The mineral oil shall meet the following specifications:</p> <p>Viscosity at 210° F. (S.U.S.).....40-100 Viscosity Index..... 65 min. Timken Test Lever Load..... 40 min. Pour Point.....+15° F max.</p> <p>The grease shall have the following physical and chemical properties:</p> <p>Penetration, Worm 977° F. (60 Strokes) Units...265-295 Penetration Change After 10,000 Strokes.....15% max. Dropping Point.....+350° F min. Lithium Soap.....6-14% Water.....0.10% max.</p> <p>Texaco MultiFak E.P. 2 or Equal Application: Bearings</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p><b>B</b> Wheel Bearing Grease (NLGI Grade No.2)</p> <p>This grease shall be a homogeneous combination of refined mineral oil and sodium soap, with a maximum of 2% calcium soap permissible. This grease shall not contain any fillers which adversely affect the lubricating qualities of the product. It may have additives that give a high degree of protection against corrosion of metals and oxidation of the grease. It shall be free of any disagreeable odor.</p> <p>The product shall be a non-corrosive, medium fiber grease, of excellent mechanical and storage stability.</p> <p>The mineral oil shall meet the following specifications:</p> <p>Viscosity at 210° F. (S.U.S.)..... 60-100 Viscosity Index.....65 min. Flash Point.....+190°F min. Pour Point.....+75°F min.</p> <p>The grease shall have the following physical and chemical properties:</p> <p>Penetration, Wormed (60 Strokes) Units...265-295 Penetration Change After 10,000 Strokes.....15% max. Dropping Point.....+350°F min. Sodium Soap.....9-14% Free Fatty Acid (As Di-oleic).....0.3% max. Water.....0.25%</p> <p>Texaco MarFak No. 2 or Equal. Application: Automotive wheel bearings.</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p><b>C</b> SAE 10W30 Detergent Engine Oil</p> <p>A heavy duty refined petroleum product (with detergent and anti-oxidant additives) to meet internal combustion engine supplement or specifications.</p> <p>A.P.I. Gravity.....27.0 min. Flash Point.....425 min. Viscosity at 210° (S.U.S.).....61-100 Carbon Residue % ( includes Ash from Additives)......3 max. Viscosity Index.....90 min.</p> <p>Mobile Delvac Or Equal</p> <p>The supplier assumes all responsibility of product and patent liability.</p> <hr/> <p><b>D</b> SAE 90 Gear Lubricant</p> <p>A straight mineral gear oil.</p> <p>A.P.I. Gravity.....70.0 min. Flash Point.....410° F min. Viscosity at 210°F. (S.U.S.).....75-100 Viscosity Index.....55 min. Clayel Point.....0° F. min.</p> <p>Texaco Thuban 90 or Equal</p> <p>The supplier assumes all responsibility of product and patent liability.</p>
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# Operator's Manual Section 2- Continued: Lubrication And Preventive Maintenance

<p><b>E</b> SAE 90 Extreme Pressure Gear Lubricant</p> <p>An extreme pressure gear lubricant containing ceftoamant additives. It must meet or exceed U.S.A. Government Specification MIL-L-2105.</p> <p>A.P.I. Gravity.....19.0 min. Flash Point.....350 min. S.U.S. Viscosity at 210° F.....80-115 Viscosity Index.....65 min. Channel Point.....0° F, max.</p> <p>Dinken test (lever load - 70 lb. min. Mobil Motrex or Equal.</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p><b>M</b> SAE 50 Oil</p> <p>A refined petroleum base product with anti-rust and anti-oxidation inhibitors meeting the following specifications.</p> <p>Viscosity At 100° F.....1050 SUV Approx. Viscosity at 210°.....88-92 SUV Pour Point.....+10° F</p> <p>Note: Use in temperatures above 32° F. Compa Dectol 92 R &amp; C or Equal.</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p>Hydraulic System Oil</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"><b>IMPORTANT</b></div> <p>Use Only FMC Hydraulic Oil. Warranty is void if incorrect oil is used. Incorrect Oil May Result In Damage To Hydraulic Components. Substitute Oil Must Meet FMC Approval. FMC Hydraulic Oil is Available Through Your FMC Distributor In The Following Viscosities And Quantities:</p> <p>FMC Hi Performance Hyd. Oil (Prefiltered)</p>
<p><b>F</b> Automatic Transmission Fluid Type A-Suffix A (Armour Research Qualified)</p> <p>A high grade, heavy duty, refined mineral oil lubricant. Ansling point must be between 202°F - 250° F. (Test method ASTM test #D11).</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p><b>T</b> SAE 70R3 Heavy Duty Type Hydraulic Brake Fluid</p> <p>A non-petroleum fluid for use in motor vehicle hydraulic brake or hydraulic clutch systems. Must meet or exceed SAE specification 70R3.</p> <p>Min. Flash .....139.6° F Rolling Point.....374° F Evaporation......80% by Wt.</p> <p>The supplier assumes all responsibility for product and patent liability.</p>	<p><b>5 Vis</b></p> <p>Temperature Range: -35° F thru 20° F Ambient -37° C thru 7° C Ambient Maximum System Temp. 130° F Maximum System Temp. 55° C 5 Gal. (19.9L) 830 662 C01 55 Gal. (208 L) 830 662 C02</p>
<p><b>H</b> Open Gear Grease</p> <p>This grease shall be a homogeneous combination of carefully blended mineral oil and calcium soap.</p> <p>Mineral Oil Specifications:</p> <p>A.P.I.....18.5 Flash, COC ° F.....410 Viscosity at 210° F (S.U.S.).....178</p> <p>Grease Specifications: Penetrations, ASTM (Worked at 77° F).....27e (Unworked at 77° F).....24e Dropping Point.....224°F Calcium Soap.....9.17</p> <p>Texaco Crater Compound or Equal</p> <p>The supplier assumes all responsibility of product and patent liability.</p>	<p><b>FF</b> Controloyle "A"</p> <p>An oil meeting government specification MIL-D-5606. A supplier is Seery Products, Inc.</p>	<p><b>5 Vis 20</b></p> <p>Temperature Range: -5° F thru 65° F Ambient -20° C thru 18° C Ambient Maximum System Temp. 135° F Maximum System Temp. 58° C 5 Gal. (18.9L) 830 662 C01 55 Gal. (208 L) 830 662 C02</p>
		<p><b>10 Vis 20</b></p> <p>Temperature Range: 10° F thru 90° F Ambient -12 C thru 32° C Ambient Maximum System Temp. 185° F Maximum System Temp. 91° F 5 Gal. (18.9L) 830 662 C01 55 Gal. (208 L) 830 662 C02</p>
		<p><b>10Vis40</b></p> <p>Temperature Range: 30° F thru 135° F Ambient -1° C thru 46° C Ambient Maximum System Temp. 215° F Maximum System Temp. 102° C 5 Gal. (16.9L) 830 664 C01 55 Gal. (208 L) 830 664 C02</p>

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

### Engine Air Cleaner (Later Models)

Although air cleaner elements are normally considered expendable, proper and careful cleaning can extend their life. Service intervals may vary from once a day, to once a year, depending upon the dust conditions the engine is working in. Work out a schedule which is frequent enough to avoid down time. Cleaner should be serviced as follows: (Refer to Fig. 2-3)

- (a) Empty the dust cup. Remove the baffle from the dust cup and empty the dust. Replace the baffle in the dust cup, making sure the baffle is properly seated. Check the dust cup sealing edge for damage. Check the dust cup gasket, if so equipped. Replace the dust cup and make sure it is properly positioned on the air cleaner body.

Note: On horizontally mounted models, the proper cup position is indicated by the arrows located on the bottom of the cup. Also, the slot in the dust cup baffle must be at the top.

- (b) Remove the main element from the air cleaner. Washing in water or blowing with compressed air are two accepted methods of cleaning the element. If the element regularly contains amounts of soot or oil, washing in water is best. If the contaminant is mostly dust, either method works well.

Elements cleaned with air can be immediately put back into service. Washed elements must be dried before use. Some elements are partially covered by a plastic sleeve with fins. The covered portion of the filter can be cleaned with air or water without removing sleeve. Use a stiff fiber (not wire) brush to remove oil and grease deposits from the fins.

Note: The air cleaner is equipped with a "vacuator valve" This continuously eliminates dust and moisture. When servicing the air cleaner check to see that the vacuator is clear and not clogged.

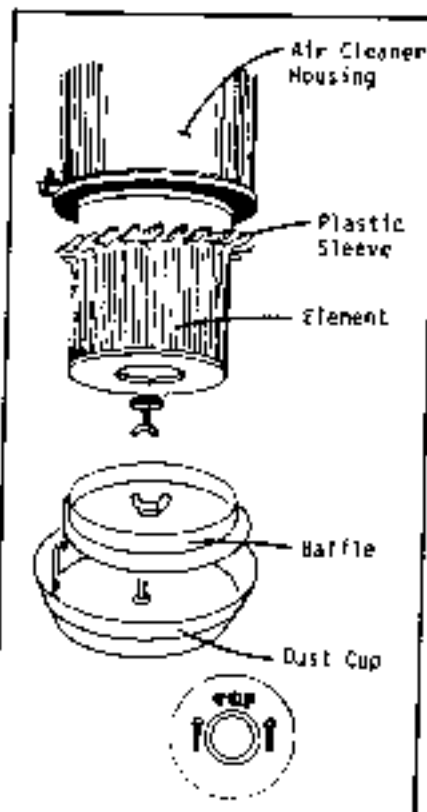


Fig. 2-3 2664-A  
Engine Air Cleaner (Later Models)

Note: Do not remove the plastic sleeve with the fins from the element.

**Cleaning With Compressed Air:** Direct air through element in the direction opposite to normal air flow through the element. Move nozzle up and down while rotating element. Keep nozzle at least one inch from pleated paper.

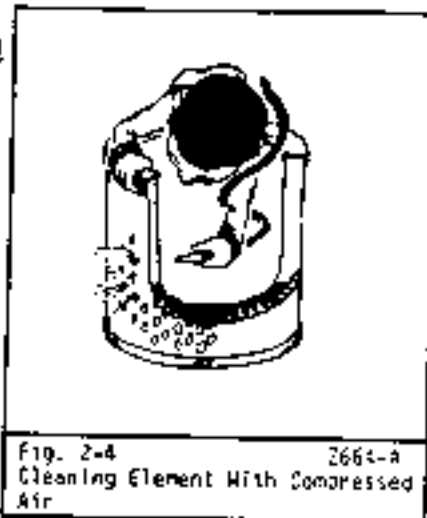


Fig. 2-4 2664-A  
Cleaning Element With Compressed Air

**Cleaning With Water:** Filter elements can be cleaned by washing with water and a good non-sudsing detergent. Use two ounces (5.9 CL) of detergent per gallon of water for washing elements. Soak the element in the solution for at least 15 minutes (a warm solution 100°F, (38°C) works best). Agitate the element for two minutes to loosen and remove dirt.

Rinse the element with clean water until the water coming through the element is clean. (Maximum water pressure: 40 PSI, (276 kPa).

Air dry or use warm flowing air, maximum 150°F (71°C). Do not use compressed air or light bulbs.

**Inspecting Element:** Place bright light inside element and rotate element slowly. If any rupture, holes or damaged gaskets are discovered, replace.

### Engine Air Cleaner (Early Models)

The engine air cleaner is located behind operator's cab on the deck of carrier. During operation, care must be taken to keep leaves, rags, etc., from obstructing the face of air cleaner.

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

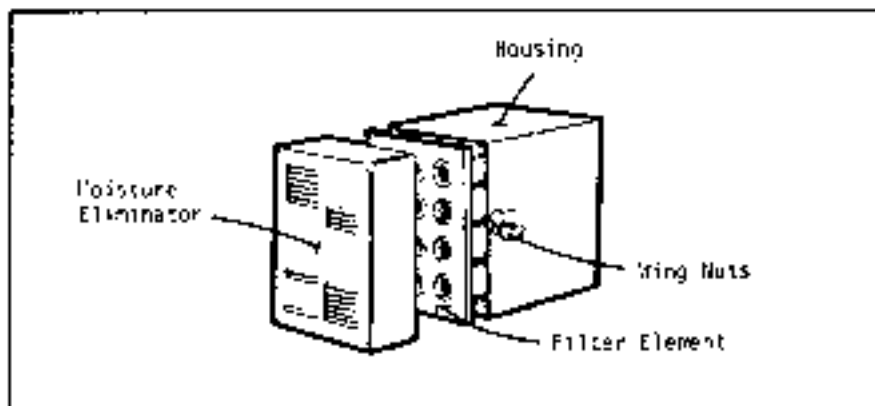


Fig. 2-5  
Engine Air Cleaner (Early Models)

- To replace filter element:
- Loosen fasteners on air cleaner housing. Remove moisture eliminator and rain guard.
  - Remove dirty filter and discard. Do not clean or reuse filter. To remove dirty filter, insert fingers in tube openings using a "pooling ball grip". Loosen all four corners of the filter one at a time by pulling straight out. After seal has been broken, pull the filter straight out and slightly up so the filter will clear the housing frame and edges of the air cleaner housing. (See Fig. 2-6 & 2-7.)
  - Inspect the inside of air cleaner housing to be sure it is free of all foreign material.
  - Install new filter. To install a new filter, hold filter in same manner as when removing it from housing. Insert clean filter into housing. Avoid hitting the filter tubes against the sealing flange on the edges of the air cleaner housing.

Because the air cleaner requires no separate gaskets or seals, care must be taken to make sure filter is properly seated within the housing. Firmly press all edges and corners of the filter to cause a positive air seal against the sealing flange of the housing.

### CAUTION

Do Not Pound Or Punch Filter Element In The Center To Establish Seal Or Damage To Filter Will Occur.

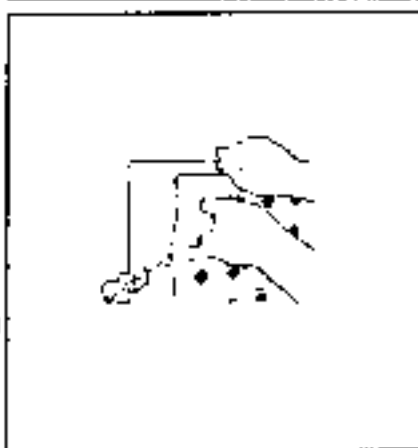


Fig. 2-E  
Breaking The Seal

- Clean and replace moisture eliminator and rain guard.
- Lock in place by tightening all nuts down evenly, criss-crossing from corner to corner. After tightening wing nuts as far as possible by hand, take two more turns with a small wrench.

If flanged nuts are used, torque to 70 inch-pounds (8 Nm).

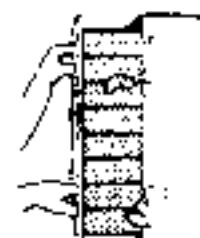


Fig. 2-7  
Install New Filter

### Transmission Lubrication

- To check lubricant level:
- Park machine on firm level ground or level machine with outriggers.
  - Clean area around both fill plugs to prevent entry of foreign material. Refer to Fig. 2-9.
  - Remove both fill plugs. Oil level must be at bottom of both fill holes.

- To add lubricant:
- Add oil through rear fill hole to level of opening.
  - Add oil through front opening until oil runs out rear opening.
  - Install both plugs.

Consult capacity chart for proper lubricant. Do not overfill. Overfilling will cause oil to be forced out of case through the main shaft openings.

- To change lubricant:
- Operate carrier to warm, and stir up the lubricant.
  - Park machine on level ground or level on outriggers.
  - Remove both drain plugs from bottom of transmission case (one at the bottom of front case and one at bottom of intermediate case).

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

- (d) Replace both drain plugs and flush case with clean flushing oil or kerosene.
- (e) Drain flushing oil or kerosene and clean drain plugs.
- (f) Reinstall drain plugs and fill with lubricant.

Change oil on schedule as stated on lubrication chart or more frequent as necessary.

### Axle Differential Lubrication Check and Fill Plugs

On each of the rear axle differentials on HTE machines there is a check and fill plug to verify the proper lubrication level inside the case. This check and fill plug may be confused with the pinion drive gear backlash adjusting screw.

Do not tamper with the backlash adjusting screw opposite the check and fill plug. The adjusting screw is held by a jam nut. The check and fill plug is a conventional pipe plug. (Refer to Fig. 2-8.)

### **CAUTION**

Tampering with the Pinion Drive Gear Backlash Adjusting Screw May Result in Extensive Damage to the Axle Differential.

### Rear Axle Lubrication

The lubricant level in both of the rear axle housings must be checked at regular intervals as indicated on lubrication chart. Refer to Fig. 2-10.

To check lubricant level:

- (a) Operate the machine.
- (b) Park machine on level ground and shut down engine.
- (c) Clean area surrounding both check plugs to prevent entry of foreign material.

	Check and Fill Plug	Adjusting Screw
Front Rear Axles	Left Side of Case	Right Side of Case
Rear Rear Axles	Right Side of Case	Left Side of Case

Fig. 2-8  
Check and Fill Plug Location Chart

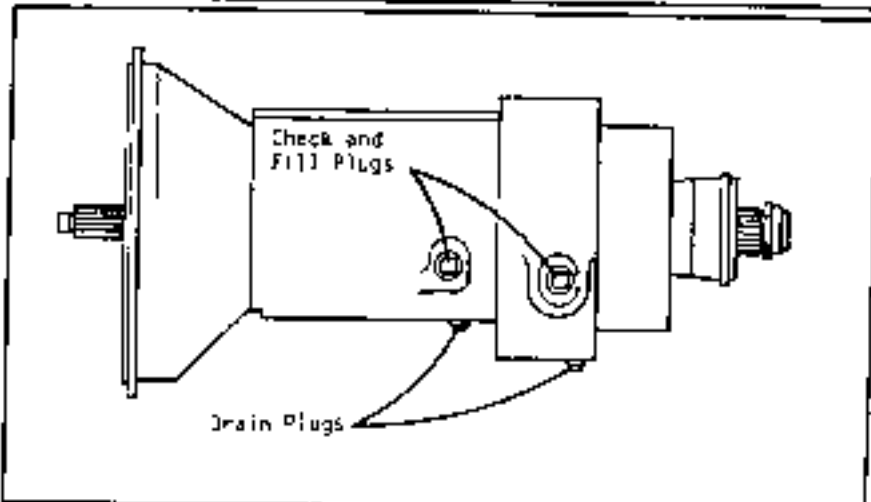


Fig. 2-9  
Carrier Transmission

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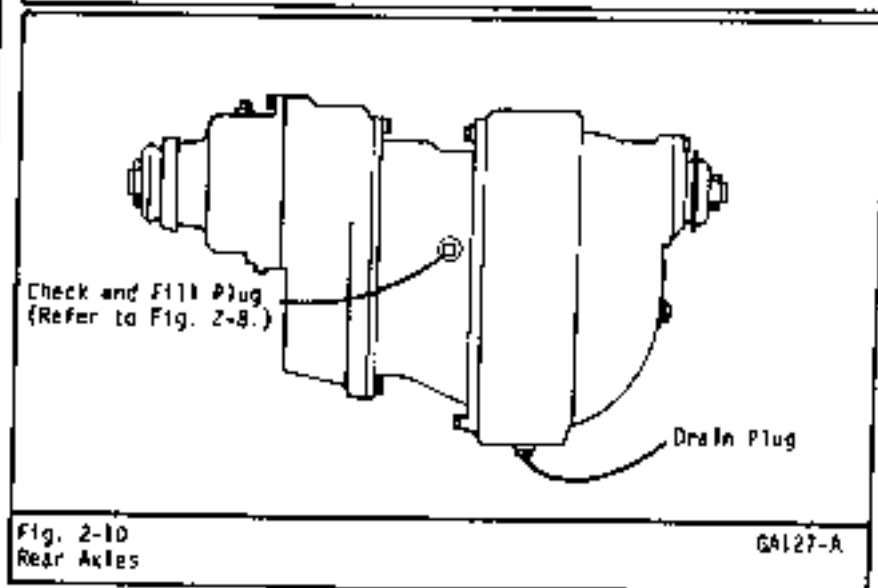


Fig. 2-10  
Rear Axles

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## Operator's Manual

### Section 2 - Continued - Lubrication and Preventive Maintenance

- (d) Remove both check plugs. Lubricant should be level with the bottom of each check plug hole.
- (e) If additional lubricant is required, add until oil starts to run out of check plug hole.

**To Change Lubricant:** The best time to drain the rear axles is just after the machine has been driven for a while. The lubricant will then be warm and easily drained. This procedure is especially desirable in cold weather conditions. Park machine on level ground and shut down engine. To drain the differential, remove the drain plug in the bottom of housing. Flush the differential with kerosene or clean flushing oil before refilling. Clean and replace magnetic drain plug.

Clear area around check plug before removing plug. Replace drain plug and fill housing with lubricant specified in lubrication chart. Fill to bottom of check plug hole.

#### NTC-30,35, Rear Axle Filter

On these machines, the front rear axle differential is equipped with an oil filter element. The filter element should be replaced at the same time the axle lubricant is changed. The filter is of the spin on type similar to an automobile engine oil filter. Refer to parts manual for part number.

**To replace filter:**

- (1) Drain axle lubricant as specified above.
- (2) Remove the two oil pump rear filter valve capscrews securing the filter cover. Remove oil filter cover from gear case.
- (3) Remove filter element by turning counterclockwise with a filter strap wrench.
- (4) Coat face of gasket on new filter element with the specified drive unit lubricant and install filter on adaptor by turning in clockwise direction. Tighten only one full turn after gasket

contacts have. Do not over-tighten.

- (5) Assemble filter cover over filter and secure with capscrews and washers. Tighten capscrews to 22-26 foot/lbs. (29-37 Nm) torque.
- (6) Fill axle with lubricant as specified earlier in Section Two.

#### Outrigger Hoses

Special precautions must be taken when tightening fittings on the outrigger jack hoses to avoid twisting and catching the hoses on beam cylinder supports. Refer to Fig. 2-11. Make adjustments as follows:

- (a) Hold the hoses firmly while tightening to prevent twisting. Use flare wrench to hold hoses on the nut band provided on each hose end.
- (b) Remove cover panel on the anchored end of the beam and observe the location of the hoses on the inside. Use a flashlight to make certain hoses are not twisted or lying against beam cylinders or cylinder support.
- (c) Loosen and retighten hoses so hoses rest against outer walls of the outrigger beams if hoses are improperly aligned.

#### Pump Disconnect Lubrication

##### **CAUTION**

Lubricating The Pump Drive Disconnect Jaw Clutch In The Engaged Position May Not Provide Adequate Lubrication To Solined Surfaces.

**Recommended Lubrication Procedure:**(Refer to Fig. 2-12.)

- (a) Park the carrier, set the parking brake and shut down the engine.
- (b) Disengage pump disconnect in the carrier operator's cab.
- (c) Lubricate disconnect jaw clutch fitting.
- (d) From the carrier operator's cab slide the pump disconnect handle in and out of engagement several times to

distribute grease.

#### Drum Gear Housing

The drum gear housing encloses the drive mechanism for the wire rope hoist system. The gears in this housing run in oil. Refer to Fig. 2-13.

**To check lubricant level:**

- (a) Park machine on firm level ground or level machine with outriggers.
- (b) Clean area around check plug on left side of gear housing.
- (c) Remove check plug. Oil level must be level with bottom of check plug hole.
- (d) Add oil as necessary through fill plug hole in top of case.

##### **CAUTION**

When Using Cleaning Solvents, Use A Low Toxicity, Non-flammable Solvent In A Ventilated Area.

**To change lubricant:** Drain the housing at the end of a work period when the oil is warm and agitated.

- (a) Clean the area around all three plugs.
- (b) Completely drain the housing of lubricant.
- (c) Fill with flushing oil or kerosene and operate hoist slowly to flush the housing completely.
- (d) Drain flushing oil or kerosene.
- (e) Thoroughly clean magnetic check and drain plugs.
- (f) Add quantity and type of lubricant specified on page 2-4 of this section.
- (g) Check lubricant level as described above.
- (h) Lubricate reduction gears as specified below.

#### Reduction Gear Lubrication

The reduction gears are supported above the oil level in the drum gear housing.

Lubricate all three bearings through the grease fittings on the outside of the housing (one on the left side and two on the right).

#### CAUTION

Failure To Grease The Reduction Gear Bearings After Flushing May Result In Damage To The Bearings.

#### Automatic Hoist Brake (Later Models)

The spring applied, hydraulically released brake is wet disc type brake. The oil inside the brake helps prevent overheating and provides lubrication. Refer to the lube chart for proper type and quantity of lubricant. Refer to Fig. 2-13.

To check lubricant level:

- Clean the area around the check plug on the rear of the brake case and remove.
- Fluid level should be up to the check plug hole.
- Add lubricant as required through the check plug hole.
- Clean and replace the check plug.

To change lubricant:

- Clean the area surrounding the check and drain plugs before removing the plugs.
- Allow case to drain completely.
- Clean and replace the drain plug.
- Fill case through the check plug hole then check lube level as described above.
- Clean and replace the check plug.

Note: Do not use flushing oil or solvent to clean this case. Just drain completely and re-fill.

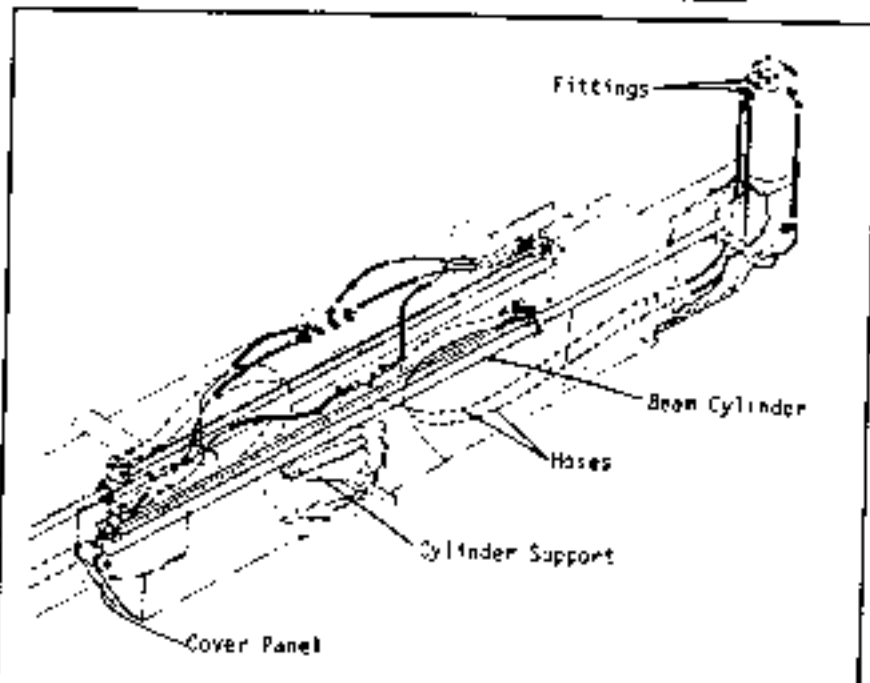


Fig. 2-11  
Outrigger Hoses

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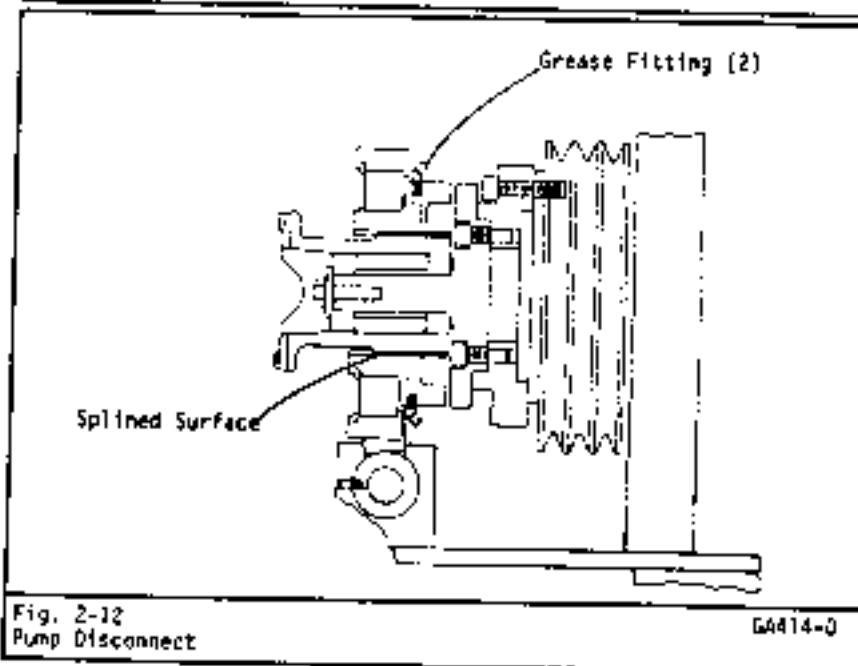


Fig. 2-12  
Pump Disconnect

G4414-0

Note: Some early model FMC's are equipped with an automatic brake sandwiched between the hoist motor and the drum gear housing.



## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

### Swing Speed Reducer

The swing speed reducer is a double reduction gear box. The internal gears run in oil.

To check lubricant level:

- (a) Level machine as in drum gear housing oil check procedure.
- (b) Clean an area around the check plug to prevent entry of foreign material.
- (c) Remove check plug. The lubricant must be level with bottom of the check plug hole. Add lubricant as necessary through the fill plug (later models), inspection cover (early models). Consult the capacity chart on page 2-1 for proper lubricant.
- (d) Check the inspection cover gasket and replace if damaged (early models).
- (e) Lubricate two grease fittings on top of speed reducer.

To change lubricant: Drain oil at the end of a working day, when the oil is warm and agitated.

- (a) Remove the drain plug and allow housing to drain thoroughly.
- (b) Replace the drain plug and fill housing to full level with clear flushing oil or kerosene.
- (c) Swing machine in both directions several times and then drain flushing oil.
- (d) Clean and replace drain plug.
- (e) Refill speed reducer with lubricant until level with check plug hole. Consult lubrication chart for proper quantity and type of lubricant.

#### CAUTION

Failure To Grease The Swing Speed Reducer Bearings After Flushing May Result In Damage To The Bearings.

#### CAUTION

Care Must Be Taken When Handling Lubricants Near The Swing Brake Drum. Oil Or Grease On The Brake Drum Linings Will Cause Brake Slippage.

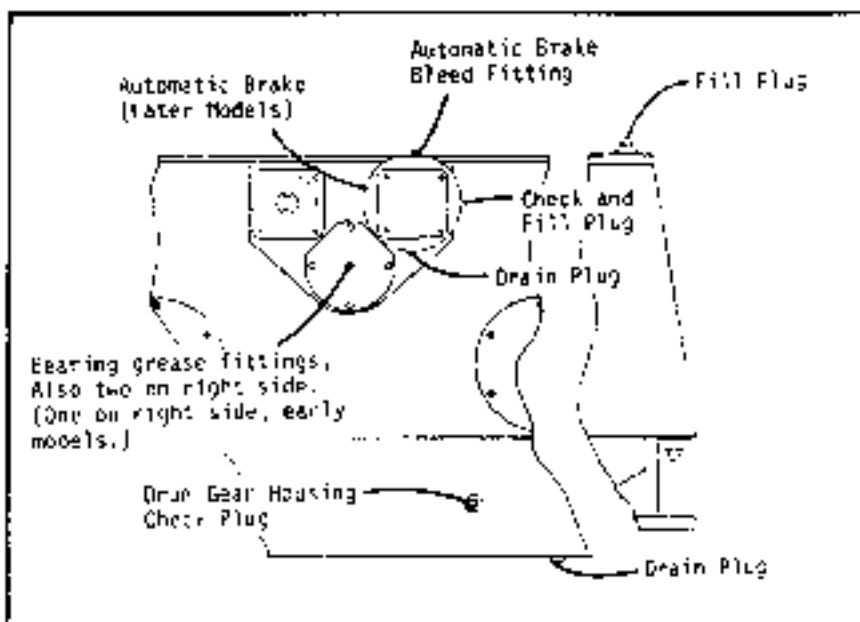


Fig. 2-13  
Drum Gear Housing

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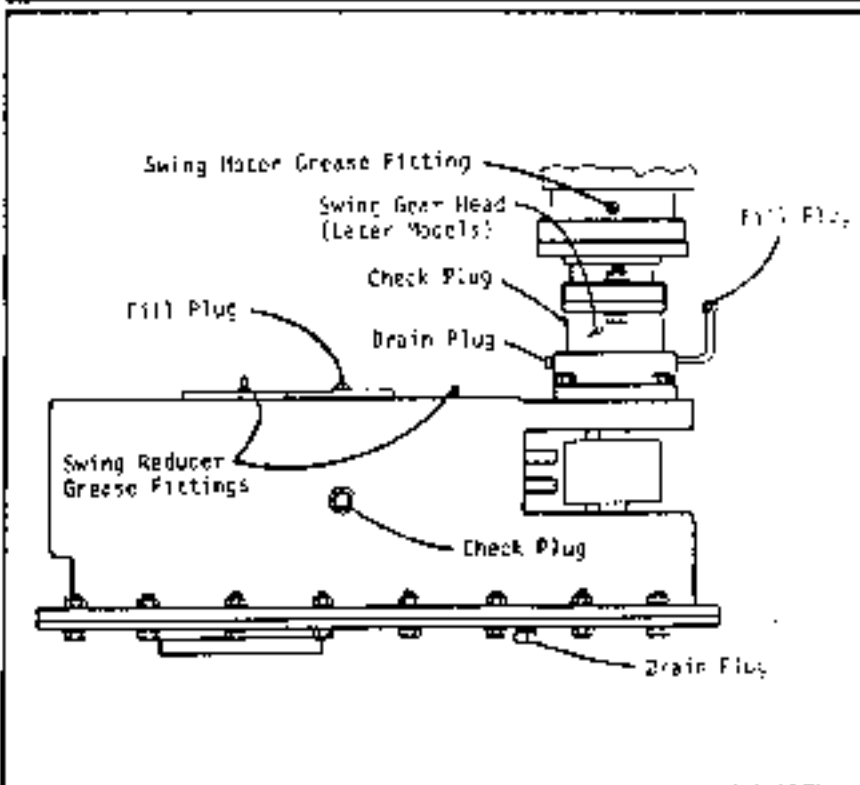


Fig. 2-14  
Swing Speed Reducer

6423-2

Note: Any time lubricants are applied near the swing brake drum, be careful in handling lubricants and wipe up all spills on the swing brake may get oily and lose its effectiveness.

### Swing Gear Head (Later Models)

Check the lubricant level of the swing gear head at the same time the swing speed reducer is checked. Refer to Fig. 2-14.

To check lubricant level:

- Level the machine as in the drum gear housing lubricant level check procedure above.
- Clean the area around the check plug to prevent the entry of foreign materials.
- Remove the check plug. The oil level must be level with the check plug hole. Add lubricant through the fill tube until lubricant runs out the check plug hole.

To Change Lubricant:

Drain lubricant at the end of a working day when it is warm and agitated.

- Remove the drain plug and allow housing to drain thoroughly.
- Replace the drain plug and fill housing to full level with clean flushing oil or kerosene.
- Swing machine in both directions several times and then drain flushing oil.
- Clean and replace drain plug.
- Refill with lubricant until level with the check plug hole. Consult the capacity chart on page 2-1 for proper quantity and type of lubricant.

### Swing Motor Fitting

A grease fitting is provided to lube the output shaft bearing on the hydraulic swing motor. Refer to Fig. 2-14.

Apply one (1) shot of grease every 500 hours.

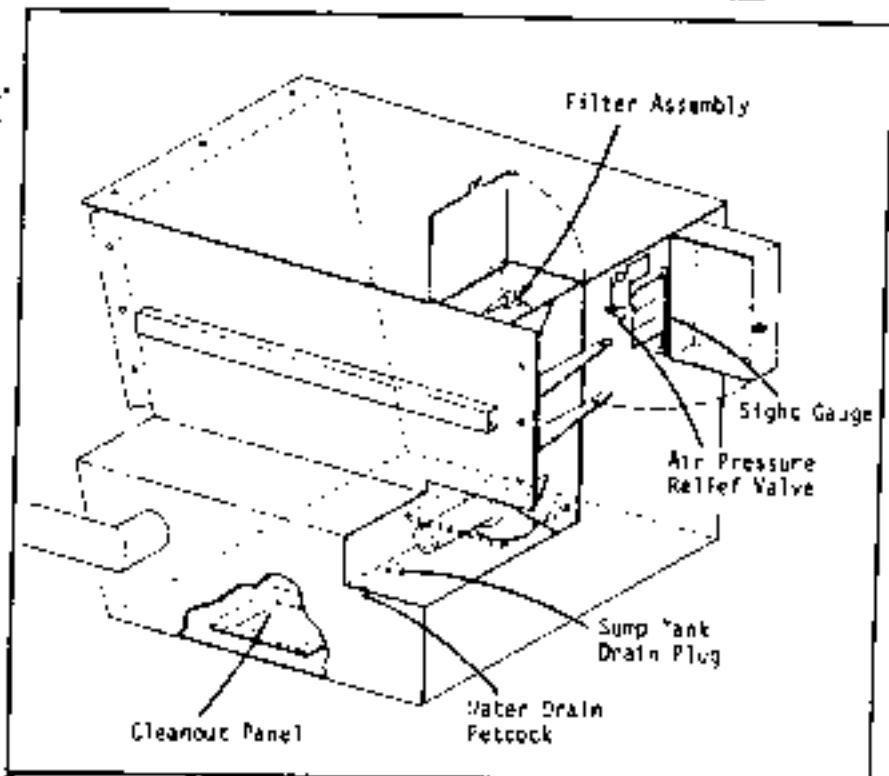


Fig. 2-15  
Hydraulic Reservoir (Sump Tank)

G0113-C

Note: Do not plug the grease hole opposite the grease fitting.

### CAUTION

Overlubricating The Swing Motor Fitting May Cause Seal Damage To The Swing Motor Or Gear Head. Do Not Overgrease.

### Hydraulic Reservoir (Sump Tank)

The hydraulic reservoir serves as a reservoir for working and reserve hydraulic oil needed to operate all hydraulic functions on the machine.

In order to assure adequate flow to the hydraulic pumps there is an air pressure charge of 6 PSI (.42 kg/cm<sup>2</sup>) over the fluid level in the hydraulic reservoir.

Air pressure from the air brake system is reduced to the desired pressure. When the engine is started and air pressure is developed in the air brake system, the preload will develop over the hydraulic reservoir fluid level.

Whenever the hydraulic reservoir or hydraulic filters are opened for servicing, the air pre-charge must be released to avoid spraying oil on equipment and personnel.

Check the hydraulic reservoir oil level daily. The oil level must be maintained at full level at all times. Operating with below full oil level will eventually cause pump failure.

To Check Oil Level: (See Fig. 2-15)

- Park machine on level ground.
- Retract all hydraulic cylinders on motor and all butterfly cylinders on carrier.

## Operator's Manual Section 2 - Continued - Lubrication and Preventive Maintenance

- (c) With the oil cold (approximately 62°F [17°C] before start-up conditions) and engine shut down, the oil level must be between the two marks on decal by the sight gauge.
- (d) If oil level is below full, add oil. Use only specified hydraulic oil in the system.

### CAUTION

Use Only S-o-M Oil In This System. S-o-M Oil Is Available Through Your FMC Distributor.

#### To Add Oil:

- (a) Shut down engine and turn ignition off.
- (b) Depressurize hydraulic reservoir by pulling air relief valve on breather assembly.
- (c) Wipe external dirt from filter housing to minimize contaminants entering system.
- (d) Loosen top wing nut and remove filter head.
- (e) Add oil through filter.

### CAUTION

The hydraulic Reservoir Is Pressurized - Before Removing Drain Plug Or Servicing The Hydraulic System, Relieve Pressure By Pulling Pressure Release Valve Or The Hydraulic Reservoir Until Pressure Is Relieved.

#### Water Drain

Drain water from the hydraulic reservoir daily. Drain before daily start-up. Open petcock on bottom side of sump tank until all water has drained out. Close petcock when oil starts to drain out of petcock.

#### Hydraulic System Oil Change

A complete hydraulic system oil change is required annually. A seasonal oil change schedule may be required if a wide range of temperature extremes exist.

Refer to page 2-11 for proper weight and temperature range.

Change the oil at the end of a working day so that the oil will be warm and any foreign particles will be in suspension. If this is not possible, cycle the machine for at least 15 minutes prior to changing the oil.

Change oil as follows:

- (a) Fully retract all cylinders on the machine. Shut down Engine.
- (b) Release pressure from hydraulic system by pulling out on the air relief valve and working control levers back and forth.
- (c) Remove the drain plug from bottom of hydraulic reservoir and allow tank to drain thoroughly.
- (d) Remove the oil filter as explained later in this section.
- (e) Remove the two clean out covers from bottom of hydraulic reservoir. Inspect inside of the tank for foreign matter. Clean inside of tank with diesel fuel or kerosene.
- (f) Unscrew and remove suction strainer from hydraulic reservoir. Clean strainer with diesel fuel or approved solvent. Reinstall suction strainer in the reservoir.
- (g) Clean and replace the clean out covers and drain plug. Be careful not to overtighten hardware. Replace gaskets if cracked or torn.
- (h) Install the new filter as explained later in this section.
- (i) Fill the hydraulic reservoir with oil. When filling system with oil, keep the oil clean and uncontaminated. Pour the oil through a clean funnel equipped with a screen strainer. Store unused oil in clean closed container.
- (j) Install baffle and filter head.

### CAUTION

The Suction Line Must Be Bleed Prior To Start Up To Prevent Cavitation Of The Pump And Any Resultant Damage.

Note: The pressurized hydraulic reservoir and suction line are bled by turning on ignition and allowing air pressure to bleed the line before pushing starter button.

- (k) Engage the pump and start the engine. Allow the engine to idle for several minutes to make sure oil is being cycled through the system. Cycle each cylinder on the machine several times to work all air out of the system.
- (l) Check the oil level as explained earlier in this section. Add oil as required.

Note: In case of a component failure, a much more thorough oil change procedure is required. Consult your FMC distributor for this procedure.

#### Hydraulic System Filters

All system filters must be changed after the first 50 hours of operation, on a new machine, and every 250 hours thereafter, or any time the hydraulic reservoir filter indicator is at the bottom of the indicator window, at full throttle.

#### Hydraulic Reservoir (Sump Tank) Filter Change

Complete steps (a) through (d) from "to add oil" procedure above.

- (a) Remove element and indicator assembly by lifting it out.
- (b) Remove indicator from element by twisting slightly with a side loading force. Do not try to pull indicator straight out or pry loose. If indicator comes out too easily, the snap-in lugs are worn and the indicator must be replaced.
- (c) Discard oil filter element and inspect indicator and "O" ring seals.

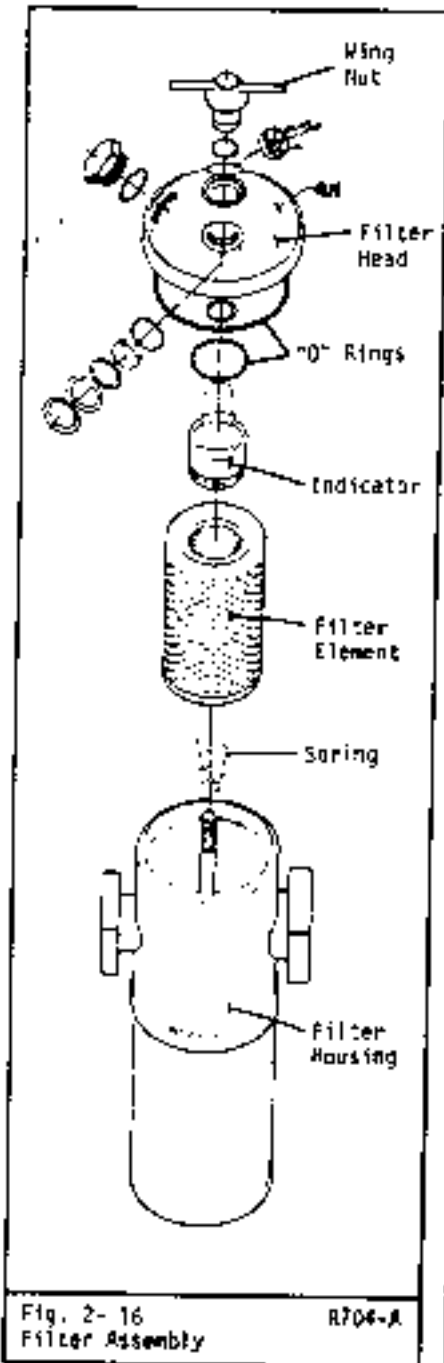


Fig. 2-16 R704-A  
Filter Assembly

- (d) Snap indicator into open end of a new filter.
- (e) Place new element and indicator assembly into filter housing making sure center bolt passes through indicator centering hole.

- (f) Inspect head "O" ring and install head on filter making sure indicator ears appear in window.
- (g) Hand tighten wing nut snug.
- (h) Start engine with pump engaged and check for oil leaks. Repair before putting machine into operation.

### S-o-M System Filter Change

The S-o-M system filter is a high pressure full flow type mounted on the pressure side of the pump. A by-pass valve is included in the filter element to permit oil flow if the filter element clogs up due to contamination or cold, thick oil.

The filter must be changed after the first 50 hours of operation on a new machine and every 250 hours thereafter. The element is changed as follows:

- (a) Shut down engine and decrease the system pressure to zero by working the clutch control levers back and forth until S-o-M gauge in upper reads zero.

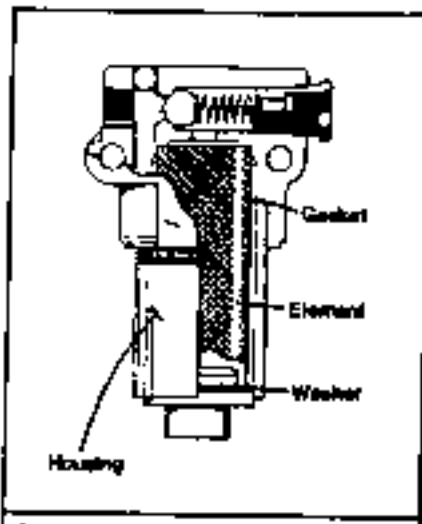


Fig. 2-17 2146-8  
S-o-M Filter

- (b) Remove filter housing and element.
- (c) Remove filter element from the housing.

- (d) Remove the gasket from the filter head and the rubber washer from the housing.
- (e) Thoroughly clean all parts in kerosene or similar solvent.
- (f) Install a new rubber washer and filter element in the housing.
- (g) Install a gasket in the head.
- (h) Install and tighten down the filter housing to approximately 150 ft/lbs. (200 N·m)

### Inline Filter Change (Later Models)

On later model HFC machines, additional inline filters have been placed in the boom hoist, and hoist motor hydraulic lines. The inline filters must be changed at the same interval as the hydraulic reservoir (sump tank) and S-o-M filters. Change both inline filters as follows:

- (a) Shut down engine and decrease the system pressure to zero by working the boom hoist and hoist motor control levers back and forth.
- (b) Disassemble the inline filter and remove the filter element.
- (c) Install a new filter element #313406 and reassemble the inline filter.

Note: Replace any damaged or worn "O" rings.

### Boom Lubrication

Boom lubrication is important to extending wear shoe life and to aid in smooth performance of boom extend-retract functions. Lubrication involves covering boom sliding surfaces with a film of grease. This is accomplished either by applying grease directly to boom surfaces or by greasing shoes that slide on the boom surfaces.

### CAUTION

Do Not Put Any Part Of The Body Inside The Diamond Shaped Cutouts In The Boom Sections. Movement Of The Boom Sections Could Cause Serious Injury.

## Operator's Manual Section 7 - Continued - Lubrication and Preventive Maintenance

### Top Rear Wear Shoes (Early Models)

Completely retract both boom sections and shut down engine. Lube all four grease fittings generously. Completely extend then retract boom sections, shut down engine and re-grease fittings. Grease fittings are located inside the rear of the base boom section, near the wear shoes.

### Top Rear Wear Shoes (Later Models)

Slowly extend the tip and middle sections of the boom and pump grease into fittings as the boom moves. Fittings for the tip section are located on the left side of the head machinery. Fittings for the middle section are under the boom collar at the centerline of the middle section.

### Rear Bottom And Middle Side Shoes

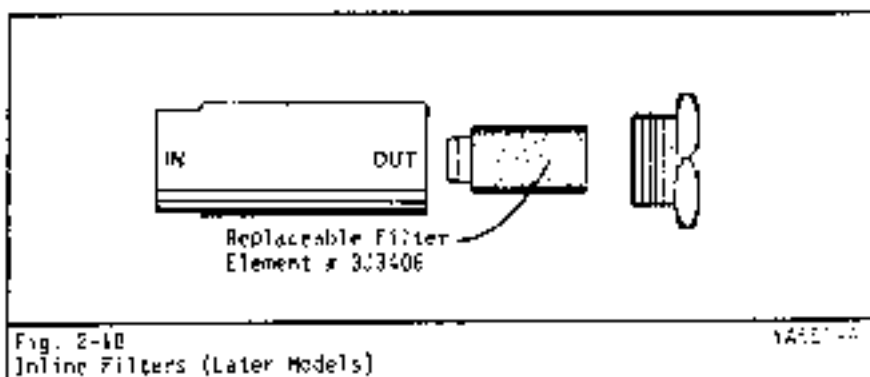
These shoes do not require lubrication.

### Front Bottom Wear Shoes

Slowly extend boom section and pump grease into fitting as boom moves. Apply on left and right sides of the middle and tip sections.

### Front Side And Front Top Wear Shoes

Slowly extend boom section and apply grease to sliding surfaces as boom moves. Use a brush or putty knife to apply grease. Repeat for both sides of middle and tip sections.



14527-00



## Digital Readout Boom Length Meter Calibration

Boom length calibration should be performed daily as follows:

1. The machine must be on outriggers with the beams fully extended, leveled on properly supported pontoons, and all tires clear of any supporting surface. Extend counterweight fully.
2. Fully extend boom and check readout meter for correct maximum boom length.
3. Fully retract boom and check readout meter for correct minimum boom length.
4. Monitor readout meter during extending and retracting to verify correct intermediate lengths.

The following procedures are used to adjust the meter.

1. Turn ignition switch on in the operator's cab. If battery voltage is less than 12.1 volts, calibrate with engine running to assure sufficient voltage.
2. Open front panel of control unit by loosening two screws on front and swinging panel open.
3. With boom fully retracted, adjust calibration potentiometer A (Refer to Fig. 3A-1) until the digital indicator displays the correct minimum boom length (minus sign should not be present).

If desired length cannot be obtained through this adjustment, center calibration potentiometer A by turning it 21 turns in one direction and then 10 turns in the

other direction. Make adjustment for minimum boom length using the zeroing potentiometer D. Refer to Fig. 3A-1.

4. To adjust reading that appears when "Test" button is depressed, turn potentiometer B (Fig. 3A-1) while keeping button depressed. The test reading is normally set to read 100.0 ft. This number will change if calibration potentiometer A is changed. The "Test" readout is for checking function only and is not an accuracy check.
5. With boom fully extended, adjust span potentiometer C (Fig. 3A-1) until the digital indicator displays the correct maximum boom length.
6. Fully retract boom and check that minimum boom length reading is still accurate. If reading is correct, calibration is complete and cover may be closed on readout meter. If reading is not correct, readjust calibration potentiometer A or zeroing potentiometer D, whichever was used for adjustment of original setting, to obtain minimum boom length reading.
7. Extend boom again and recheck maximum boom length reading. Readjust span potentiometer C if necessary. If span potentiometer is readjusted, repeat step 6.
8. When adjustment is complete, close panel and tighten screws.

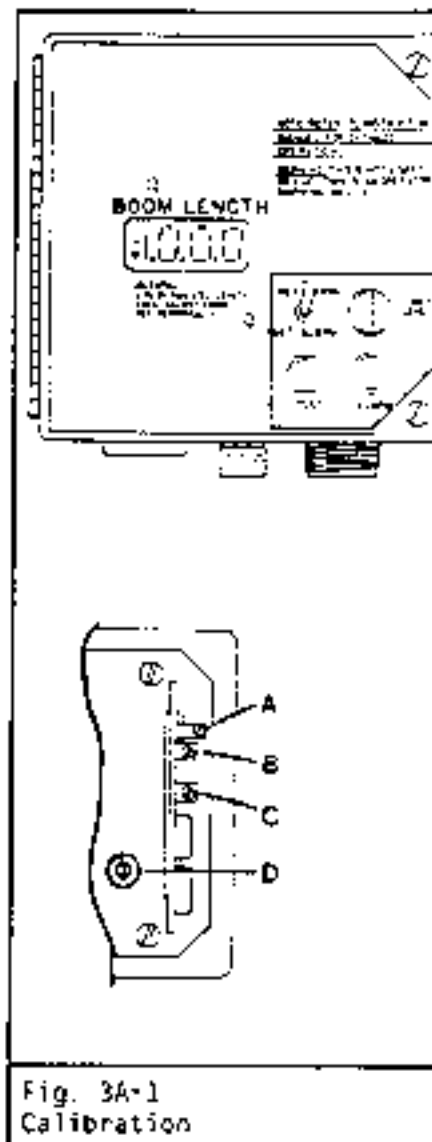


Fig. 3A-1  
Calibration





Operator's Manual Section 3 - Periodic Adjustments

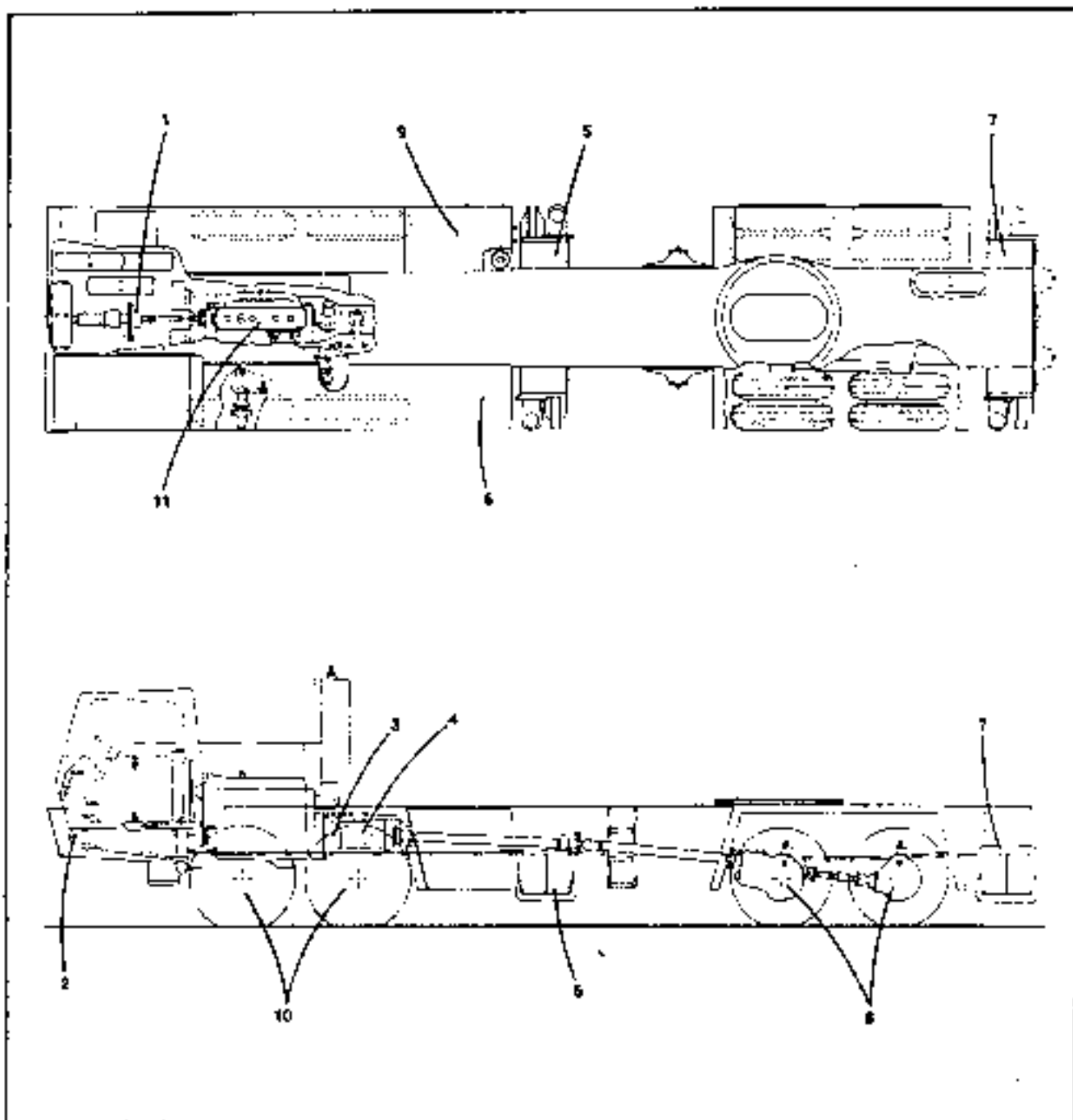


Fig. 3-1

Carrier Assembly

- |                               |                           |                                     |
|-------------------------------|---------------------------|-------------------------------------|
| (1) Hydraulic Pump Disconnect | (5) Front Outrigger Box   | (9) Hydraulic Reservoir (Sumo Tank) |
| (2) Steering Gear             | (6) Fuel Tank             | (10) Front Axles and Brakes         |
| (3) Carrier Clutch            | (7) Rear Outrigger Box    | (11) Carrier Engine                 |
| (4) Transmission              | (8) Rear Axles and Brakes |                                     |

## Operator's Manual Section 3 - Continued - Periodic Adjustments

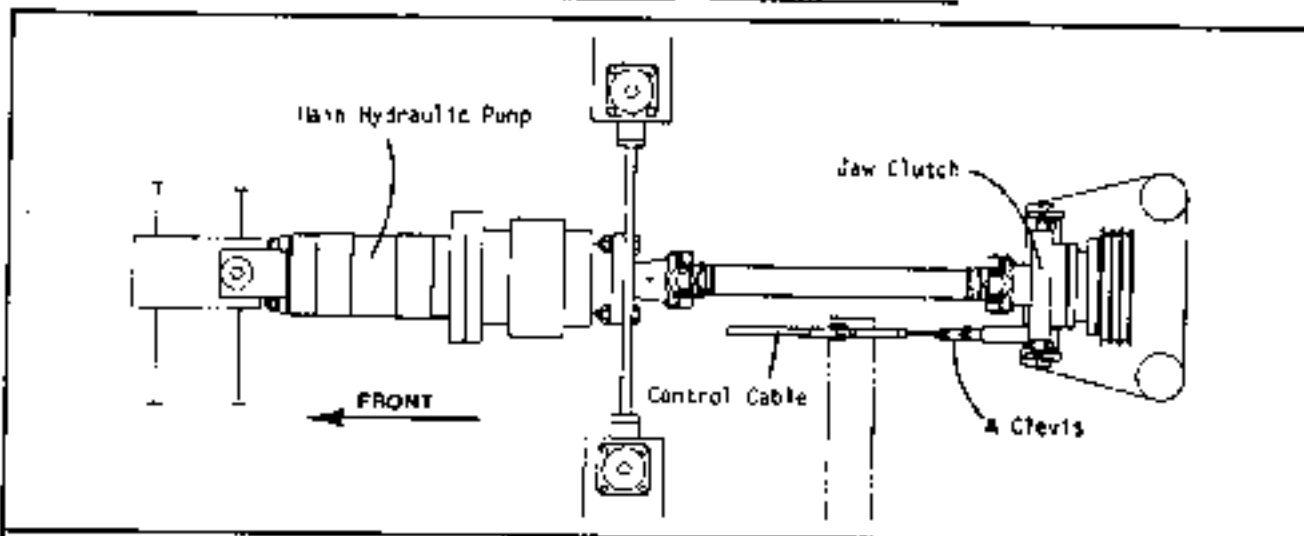


Fig. 3-2  
Pump Drive And Disconnect

G414-D

### Pump Drive And Disconnect

The main hydraulic pump is driven off of the front of the carrier engine by a driveshaft. A sliding jaw clutch disconnect is incorporated in the system as a means of disconnecting the pump for highway travel. The disconnect must be adjusted periodically as follows:

- Disengage pump by pushing the control handle in carrier cab all the way in. (See procedure in Section 1 "Engaging and Disengaging Hydraulic Pump".)
- With handle pushed all the way in, adjust clevis on cable (A) for  $1/8" \pm 1/32"$  ( $3.2 \pm .8\text{mm}$ ) clearance between jaw teeth as shown in Fig. 3-3 at (B).

Note: Early models may have a different pump disconnect arrangement but the dimension at (B) remains the same.

If the cable is replaced, the new cable should be marked to show complete engagement of the pump disconnect. To mark the control cable:

- Pull out on control handle until jaw clutch is fully engaged.
- Punch mark the top of handle shaft near the mounting nut.

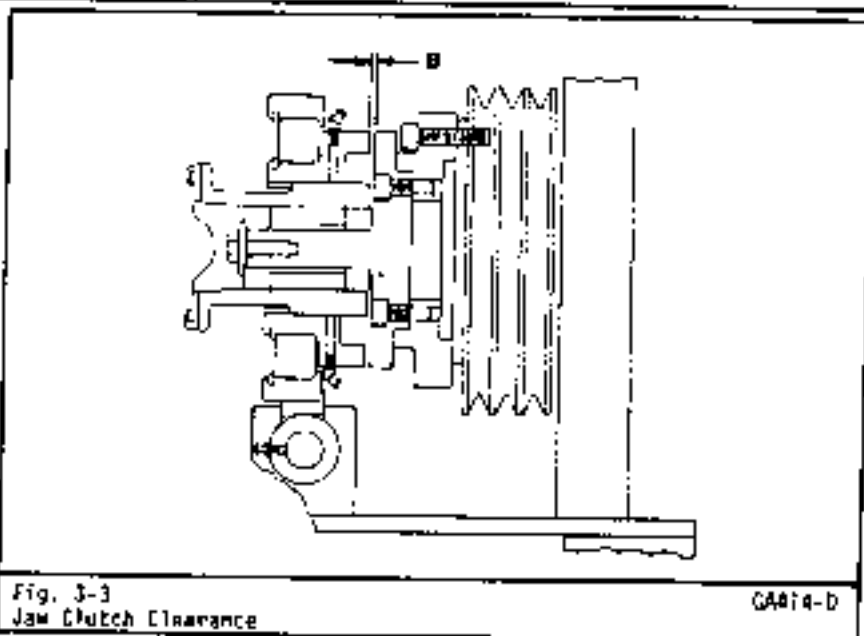


Fig. 3-3  
Jaw Clutch Clearance

G414-D

- Fill punch mark with red paint.

Note: This red mark, when visible, indicates full jaw clutch engagement.

### Wheel Torque Procedure

One of the primary causes of misalignment of tire and rim assemblies mounted on spoke wheels is improper tightening of wheel studs. Incorrect torque on a dual spoke wheel can result in over

$3/4"$  (19mm) of wobble, causing accelerated torque loss and severe tire wear.

The recommended procedure for torquing cast wheels is by "tri-angulation". The correct procedure is as follows: (Refer to Fig. 3-4).

- Turn nut #1 until snug.
- Rotate wheel-rim assembly until nut #2 is in the top position. Turn the nut until snug.

## Operator's Manual Section 3 - Continued • Periodic Adjustments

- (c) Rotate the wheel assembly until nut #3 is in the top position. Turn the nut until snug.

Since the entire weight of the tire and rim assembly is on the top spoke position, this procedure allows even application of force against three pairs of the rim for proper alignment. Now turn nuts #1 and #5 until they are snug.

- (d) Repeat the triangulation procedure, this time bringing all nuts to recommended torque value.

This procedure must be followed every time a tire/rim assembly is changed.

Note: Even when the triangulation is used, nuts will still lose torque when the vehicle is operating. This is caused by the "seating in" of the rim assembly to the wheel. After 50-100 miles (80.3 - 160.6 km) of travel, the nuts should be re-tightened to the recommended torque.

### CAUTION

Extreme Care Must Be Taken In Removing Wheel Nuts. Rim Clamps Can Snap Off The Rim And Could Cause Serious Injury.

#### Rim Clamp Removal

- Loosen all wheel nuts but allow full thread engagement of nuts.
- Unseat rim clamps with a sharp blow with a hammer or tire tool.
- Check each rim clamp to be certain it is unseated. Repeat step (b) as necessary.
- Proceed to disassemble as with any wheel assembly.

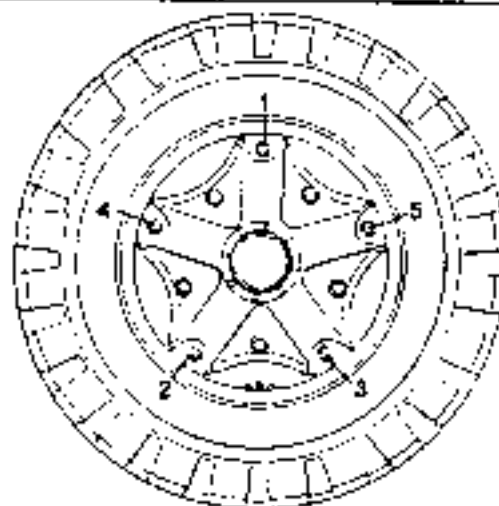


Fig. 3-4  
Wheel Torque Sequence

2435-4

Stud Size	Torque
1/2" (12.7mm)	50 ft/lbs. (120 Nm)
5/8" (15.9mm)	150-175 ft/lbs. (1200-234 Nm)
3/4" (19.1mm)	175-200 ft/lbs. (1344-267 Nm)

#### Tires and Tire Inflation

Dual wheel and tires must be installed so the valve stem of the inner tire is 180° opposite the valve stem of the outer tire. All tires of the same weight and size are interchangeable. Inspect wheel rims, clamps, nuts, studs, etc., on a weekly basis. If any damage is apparent, repair or replace before operating the carrier or making lifts on tires.

Check the tires daily for proper inflation pressures for type of operation. The inflation chart (Fig. 3-5) lists the recommended pressures for different operating conditions. Check pressure with the tires cool.

A tire inflation hose assembly is shipped with each machine. This hose assembly can be connected to the carrier air brake system and used to inflate the tires.

The engine should be running when using tire inflation hose so that adequate air pressure is maintained.

A gauge is included in the inflation hose assembly to check pressure. The hose is equipped with a clip-on chuck, and is long enough to allow the sensor checking or inflating the tires to stand to one side and to the lock ring. A guard should be used to protect against a lock ring flying off when inflating or deflating tires.

To assure best vehicle performance and increased tire life, use highway pressures as high as possible. When making lifts on rubber, use static maximum lift pressures shown. The carrier must not be driven with the tires inflated at maximum static lift pressures.

## Operator's Manual Section 3 - Continued - Periodic Adjustments



Fig. 3-5 2809-A  
Warning Label 2609-A

### Brake Adjustment

The service brakes are air applied and spring released. The emergency parking brake is spring applied and air released. In the event that system air pressure is lost or is insufficient to adequately apply the service brakes, the emergency brakes will automatically apply. The emergency spring power actuators on the rear brake are assembled piggyback on the air chambers. A minimum of 60 PSI (411 kPa) air pressure is required to release the emergency-parking brakes.

The spring power actuators are equipped with a manual caging bolt to allow releasing of the emergency-parking brakes for adjustment or repairs. To cage (compress) the spring, turn caging bolt clockwise approximately 18 to 21 full turns. Uncaging the spring is accomplished by reversing the procedure. Springs must always be uncaged before traveling or operating machine.

### CAUTION

Spring Must Be Compressed Manually With Caging Bolt Before Removing Clamp Ring To Avoid Possible Injury.

Seasonally check the drum to lining clearance with a feeler gauge. With the brakes fully released, the clearance should be no more than .060" (15mm).

Adjust brake manually as follows if clearance is greater than .060" (15mm):

- Using hydraulic outriggers, raise machine until tires are clear of ground and machine is setting level.
- Release emergency-parking brake (or manually cage all four of the power spring actuators).

NOTICE						
READ OPERATOR'S MANUAL FOR THIS MACHINE BEFORE OPERATING OR PERFORMING MAINTENANCE FUNCTIONS.						
FMC TIRE INFLATION CHART						
SIZE	LOAD RANGE	PLY. RATING	INFLATION			
			MAXIMUM LIFTS ON RUBBER, STATIC TO 1 M.P.H. MAX.		50 M.P.H. MAX.	
			SINGLES	DUALS	SGLS.	DUALS
8.00 x 20	E	10	30	30	40	70
9.00 x 20	F	12	100	100	95	85
10.00 x 20	F	12	95	95	85	75
10.00 x 20	G	14	100	130	100	90
11.00 x 20	F	12	95	95	85	75
11.00 x 20	G	14	100	95	100	90
12.00 x 20	G	14	95	85	90	80
12.00 x 20	H	16	100	100	100	95
*14.00 x 20	J	18	100	100	95	85
*14.00 x 20	L	20	100	130	100	100
*14.00 x 24	J	18	100	100	95	85
*14.00 x 24	L	20	100	100	100	100
15.00 x 22.5	M	16	100		100	
16.50 x 22.5	H	16	100		90	

\* A 30 MINUTE REST PERIOD IS REQUIRED EVERY 50 MILES OF CONTINUOUS TRAVEL.

THIS CHART APPROVED BY TIRE MANUFACTURER FOR THE SPECIFIC TIRES FURNISHED AS ORIGINAL EQUIPMENT ON THIS MACHINE. DO NOT CHANGE BRAND, SIZE, OR PLY RATING WITHOUT FMC APPROVAL.

564JSL3

Fig. 3-6  
Tire Inflation Chart

CA136-A

## Operator's Manual Section 3 - Continued - Periodic Adjustments

- (c) Remove dust covers from adjusting slots in two places on each brake (adjusting slots are below the forward and above the rear power unit).
- (d) Adjusting bolts have right hand threads. With an adjusting spoon, turn the adjusting bolt until a heavy drum drag is developed, then back off on the adjusting bolt until there is only a very light drag on the drum. Repeat for other shoe on brake. Replace dust covers in adjusting slots.
- (e) Repeat for two service brakes on front axle and four emergency/parking brakes on rear axles.
- (f) Release all four caging bolts by turning counterclockwise 16-21 turns.

### Wheel Bearings

Front wheel bearings should be removed, inspected, cleaned with kerosene or diesel fuel, and repacked with grease at intervals specified on lubrication chart. Use only bearing grease which meets specifications in Section 2. Examine the felt washer which retains grease and replace as required. The wheel bearings must be handled with care and kept free of dirt and water, whenever they are removed from the machine. When re-assembling, care must be taken not to allow any foreign material to enter bearings.

Two types of Skid-Trol sensors have been used on HTC series carriers. Early machines used a spring mounted bracket and later machines a rigid mount. Use the appropriate wheel bearing adjustment based on the sensor type on the machine that you are working on.

Note: For machines equipped without Skid-Trol system, use "Bearing Adjustment, Rigid Mounted Sensor".

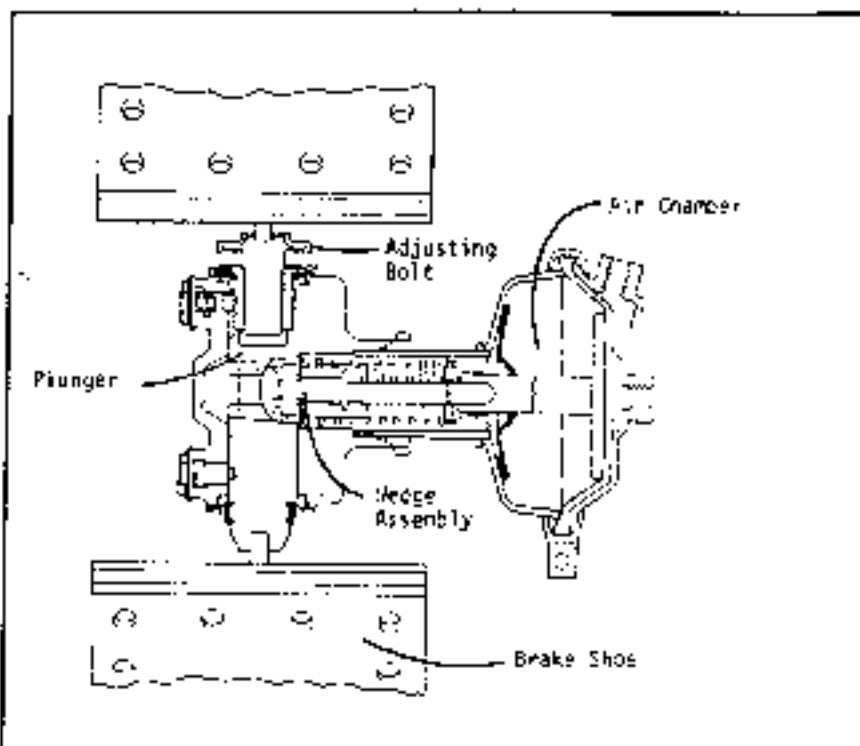


Fig. 3-7  
Service Brake Assembly

647-3

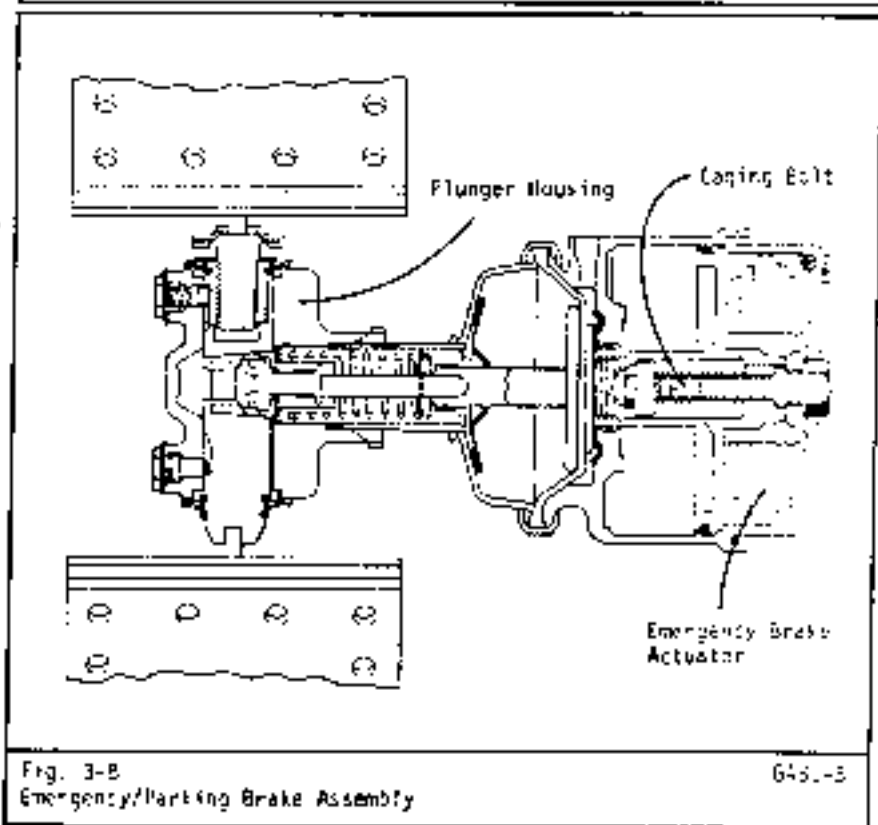


Fig. 3-8  
Emergency/Parking Brake Assembly

648-3

### Bearing Adjustment (Spring Mounted Sensor)

On machines equipped with Skid-Trol® brakes, certain precautions must be taken when servicing the wheel-end assemblies (hubs, drums or bearings). It is possible to disturb the sensor that monitors wheel speed. This sensor is designed to be pushed in by the rotor mounted on the drum as the wheel-end assembly is installed. To prevent pushing sensor in too far, use the following procedure to remount wheel assembly:

- (1) Upon removal of the wheel-end assembly always release the sensor and spring from mounting bracket. A screw-driver may be used to release the sensor.
- (2) Reset the front face of sensor at an initial adjustment of 7/16 inch (11mm) from mounting bracket.
- (3) If the wear ribs are worn off but the white nylon bobbins are not exposed, adhere a .015 - .020 inch (.38 - .51mm) non-metallic shim (i.e. paper) to the face of sensor. Hold in place with a light coat of grease. This shim will drop out later when wheel is turned.
- (4) Pack wheel bearings with grease and install inner bearing in wheel assembly.
- (5) Install wheel assembly on the axle spindle only to the extent the bearing adjusting nut can be started. Install the outer bearing, thrust washer and bearing nut.
- (6) Draw the wheel assembly on with the nut. Tighten adjusting nut to 100 Ft/Lbs. (134 N-m) of torque while rotating wheel in both directions.
- (7) Back off adjusting nut 1/6 - 1/4 turn and install cotter pin.
- (8) Install felt washer and end cap.

### Bearing Adjustment (Rigid Mounted Sensor)

On machine equipped with Skid-Trol® brakes, certain precautions must be taken when servicing wheel end assemblies. Take care

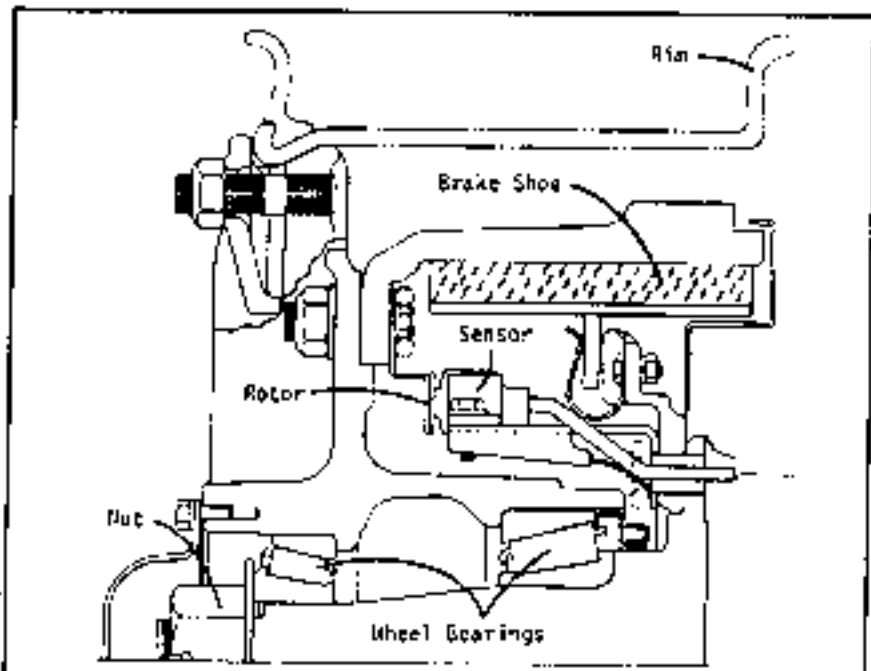


Fig. 3-9  
Wheel-End And Bearing

G4149-C

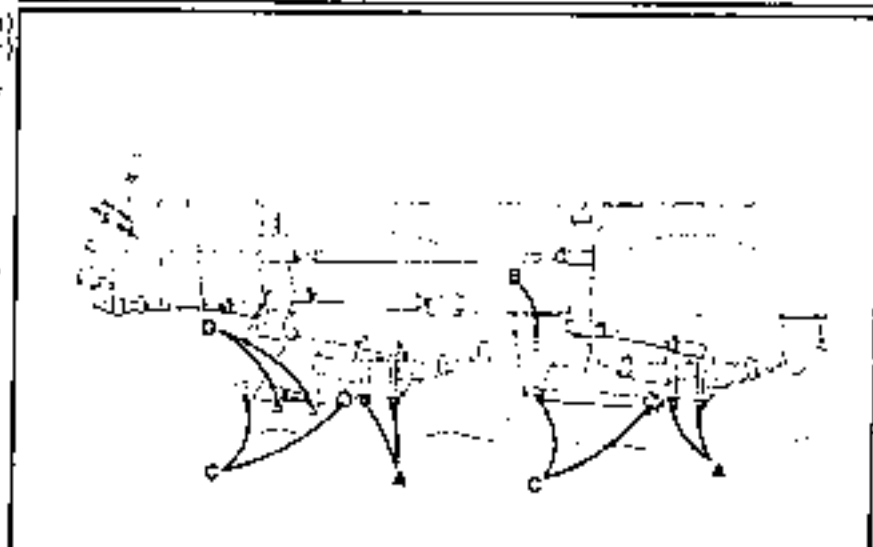


Fig. 3-10  
Torque Inspection Points

G8230-0

not to damage rotor or move sensor. Once properly installed these components should not require regular adjustments. Proceed to disassemble and repack wheel bearings without disturbing these components.

- (1) Remove wheel end assembly.
- (2) Thoroughly clean bearing and repack being careful that grease penetrates entire bearing.
- (3) Install inner bearing in hub.

## Operator's Manual Section 3 - Continued - Periodic Adjustments

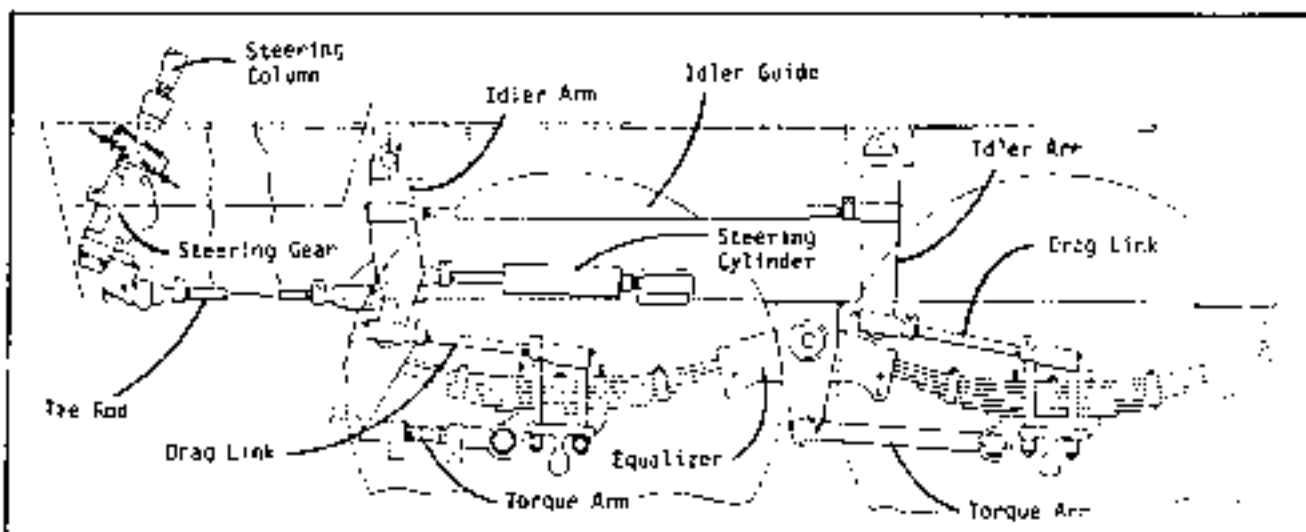


Fig. 3-11  
Front Steering Geometry

GE237-C

- (4) Install hub and wheel assembly or axle spindle only far enough to start adjusting nut.
- (5) Install outer bearing, thrust washers and tightening nut.
- (6) Slowly tighten adjusting nut to draw hub and bearing snug.
- (7) Tighten nut to 100 ft/lbs. (134 N·m) torque while rotating wheel back and forth to avoid seizing.
- (8) Back off on adjusting nut 1/6 - 1/4 turn and install cotter pin.
- (9) Install felt washer and cap.

### Front Suspension

The tandem front axles are spring mounted to the carrier frame. The springs are to absorb road bumps and irregularities and to keep the wheels on the ground. The front axles are also equipped with axle stabilizers to absorb any torque caused by the tendency of the axles to turn forward or backward on their axles due to starting or stopping inertia.

The front suspension requires periodic checks to assure continued trouble free performance. After the first 1,000 miles (1,600 km), and every six months

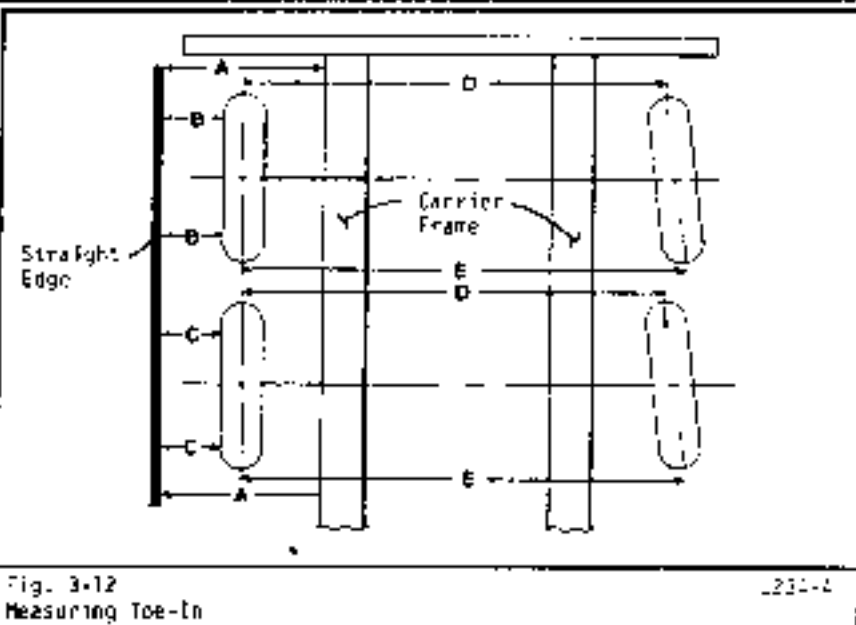


Fig. 3-12  
Measuring Toe-In

231-4

thereafter, the following inspection procedure should be followed: Refer to Fig. 3-10.

- (1) Check U-bolt nuts (A) to assure maintenance of 300 ft/lbs. (401 N·m) torque.
- (2) Check equalizer nuts (equalizer bolts) (B) to assure that 200 ft/lbs. (267 N·m) torque is maintained.
- (3) Check torque arm bolts (C) to assure that 200 ft/lbs. (267 N·m) torque is maintained.

- (4) Check torque arm tube clamps (D) to assure that 80 ft/lbs. (107 N·m) torque is maintained.

- (5) Check the fit of springs to hangers, and equalizers to assure continued good riding characteristics.

### Front Wheel Alignment

For maximum tire life, front wheel alignment must be checked periodically. The following steps are necessary for checking

## Operator's Manual Section 3 - Continued - Periodic Adjustments

front wheel alignment:

- (a) Inflate tires to proper traveling pressure.
- (b) Jack up carrier with but-riggers and level the machine with tires just clear of the ground.
- (c) Line up left front wheels so that they are parallel with the carrier frame and pointing straight ahead.

Note: See Fig. 3-12. One means of lining up left wheels is to place a straight edge parallel to the carrier frame by measuring the distance (A) at each end of the straight edge. Once the straight edge is located parallel to carrier, measure the distance between the straight edge and the milled surface on the wheel hub used to locate the tie lugs. These four dimensions are represented by the letters (B) and (C). Both distances (B) must be the same as well as both distances (C) must be the same. Dimension (D) does not have to equal (C). Adjust appropriate cranks to correct any mis-alignment.

- (c) Once the left front wheels are lined up, check for proper toe-in. Check toe-in by scribing a line around the circumference of the tire tread at the centerline of the tire tread. The difference between the distances (D) on the front and (E) on the rear of the tire indicates the amount of toe-in. Toe-in should be  $1/8" + 1/32"$  (3.2mm + 0.79mm). Measurement must be made with the weight of the machine on the axle. Adjust appropriate tie rod to correct any deviation in toe-in.
- (e) With left front wheels pointing straight ahead and parallel with carrier and machine setting level, both idler arms must be vertical. If idler arms are not vertical, adjust idler guide and draglink until both idler arms are vertical.
- (f) Center steering wheel. Left front wheels should be pointing straight ahead. If not, adjust pitman arm on

steering gear or adjust length of tie rod.

- (g) Turn wheels to maximum turning angle with steering cylinder bottomed out. Set wheel stops for a clearance of .020" (.51mm) with cylinder(s) bottomed out.

### Clutch Pedal Adjustment (Early Models Without Clutch Brake)

The carrier clutch is initially adjusted so there is approximately  $1/8"$  (3.2mm) clearance between the clutch release fingers and clutch throwout bearing. It is this clearance that results in "free travel" at the clutch pedal. The amount of "free travel" depends on the type and ratio of the clutch pedal linkage.

As the clutch facing wears, the clutch throwout bearing clearance and clutch pedal "free travel" decrease. If allowed to decrease excessively, the throwout bearing will eventually contact the release fingers, causing the clutch to slip. It therefore becomes necessary to periodically adjust the clutch in order to maintain proper throwout bearing clearance. This adjustment is made at the adjusting screw on the clutch housing shaft. Replace all excessively worn parts before adjusting.

Check clutch pedal "free travel" by hand. "Free travel" is the first easy movement of the pedal. Proper clutch pedal "free travel" is approximately  $1-1/2"$  (38mm). The gradual reduction from this is caused by clutch wear and is normal.

Note: Excessive clutch pedal "free travel" may prevent complete clutch disengagement while insufficient clutch pedal "free travel" will cause slippage, and shorten clutch life.

Clutch Adjustment (Refer to Figs. 3-13 and 3-14):

- (a) Remove the cover plate from the clutch housing.
- (b) Check the release bearing clearance. It should be  $1/8"$  (3.2mm).
- (c) To adjust clearance, loosen jam nut and turn adjusting bolt on linkage outside clutch housing.

### Clutch Brake Adjustment (Later Models)

The proper release travel clearance between the release bearing and the clutch brake is  $1/2$  inch (13mm). This adjustment is important to obtain the one inch (25mm) from floorboard brake engagement. Adjust clearance as follows (Refer to figure 3-16).

- (a) Remove inspection plate from clutch bell housing.
- (b) Unlock sleeve locknut "A".
- (c) Turn sleeve assembly adjusting nut "B" to obtain a clearance of  $1/2$  inch (13mm) between the release bearing and the clutch brake.
- (c) Lock sleeve locknut "A".

Note: Always disengage the clutch while the sleeve locknut "A" is being locked or unlocked, but have the clutch engaged while turning the sleeve assembly adjusting nut "B". When adjusting the sleeve assembly, keep light tension on the release yoke to eliminate any "play" in the clutch linkage.

### Clutch Adjustment (Later Models With Clutch Brake)

Never wait for a clutch to slip before adjusting it. Once it starts to slip it is too late to make an adjustment. Once the facings are burned through slippage, they will quickly wear out.

The clutch must be kept in proper adjustment by frequent inspections of the clutch pedal free travel.



## Operator's Manual Section 3 - Continued - Periodic Adjustments

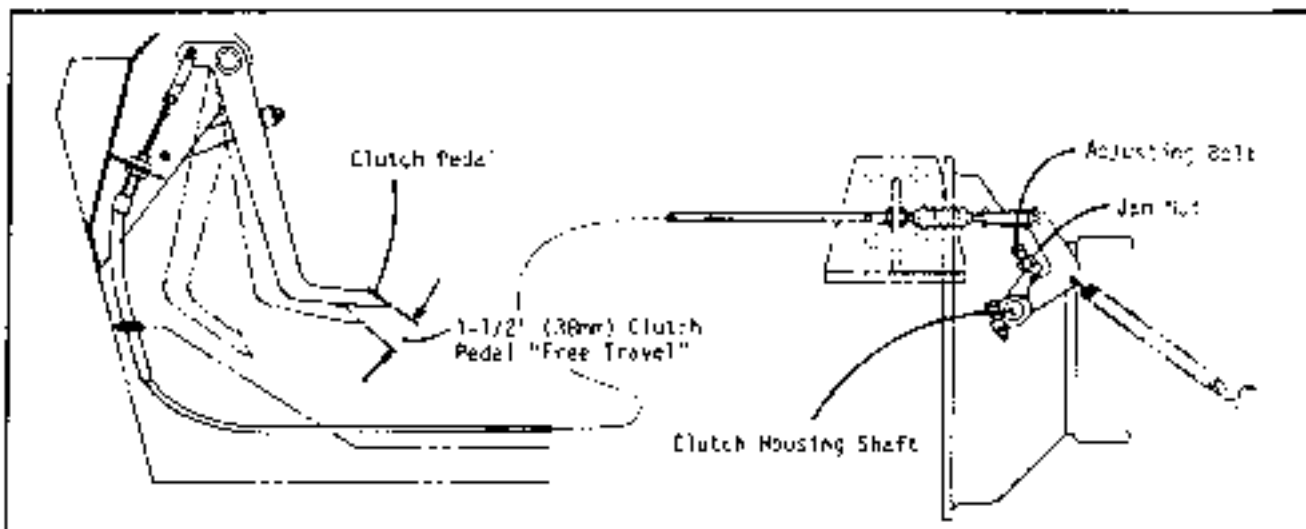


Fig. 3-13  
Carrier Clutch Adjustment (Early Models Without Clutch Brake)

GA530-3

Check the free travel by pushing the pedal down with your hand. Make sure the free travel is a result of actual release bearing clearance, and not worn linkage.

1-1/2 inches (38mm) clutch pedal free travel will result in about the required 1/8 inch (3.2mm) clearance between the release yoke and the release bearing pads. Adjust the clutch pedal free travel by turning in or out on the adjusting capscrew. (Refer to Figure 3-15.)

After the preliminary adjustment of the clutch pedal free travel has been made, remove the bell housing inspection plate. Check the 1/8 inch (3.2mm) yoke clearance dimension. (Refer to Figure 3-16.) Also, check the travel of the release bearing by pressing down on the clutch pedal. The release bearing should contact the clutch brake when the clutch pedal is within one inch (25mm) above the floorboard. If not, repeat "Clutch Brake Adjustment".

### Swing Brake Adjustment

Engage the house lock when working on the swing brake.

- With the foot pedal (later models) at approximately 45° and the brake handle in the released position (pushed forward), adjust rod (6) to obtain 2 inches (51mm) at "X". Refer to Fig. 3-17.
- Adjust bulkhead connectors (9) so that the cable is bottomed out in this position.
- Pull back on the brake handle until dimension "X" is equal to 1-1/2" (38mm).
- Lubricate the nut on rod (6) and tighten to 70 in/lbs (8.6 Nm) while maintaining the 1-1/2" (38mm) dimension.

### Drum Clutch Adjustment

Each drum clutch has two shoes which are hydraulically applied and spring released. To apply the clutch, the control valve at the operator's right hand is pulled, sending hydraulic pressure to the clutch cylinder which forces the shoes out into engagement with the clutch drum. When the valve is returned to the neutral position, porting is opened allowing the oil in the clutch cylinder to return to sump. While this is happening, the clutch return spring disengages the clutch. Drum clutch adjustment should be checked upon delivery, and every 50 hours

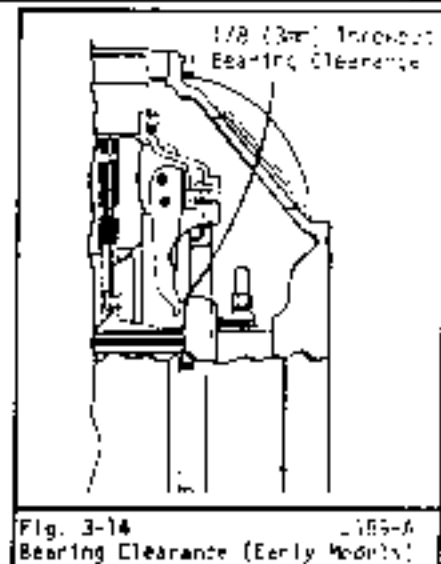


Fig. 3-14  
Bearing Clearance (Early Models)

GA530-4

thereafter. Refer to Fig. 3-18.

Note: Adjust clutches with drum brakes released. This will require that the house block or headache ball be lowered to the ground.

## Operator's Manual Section 3 - Continued • Periodic Adjustments

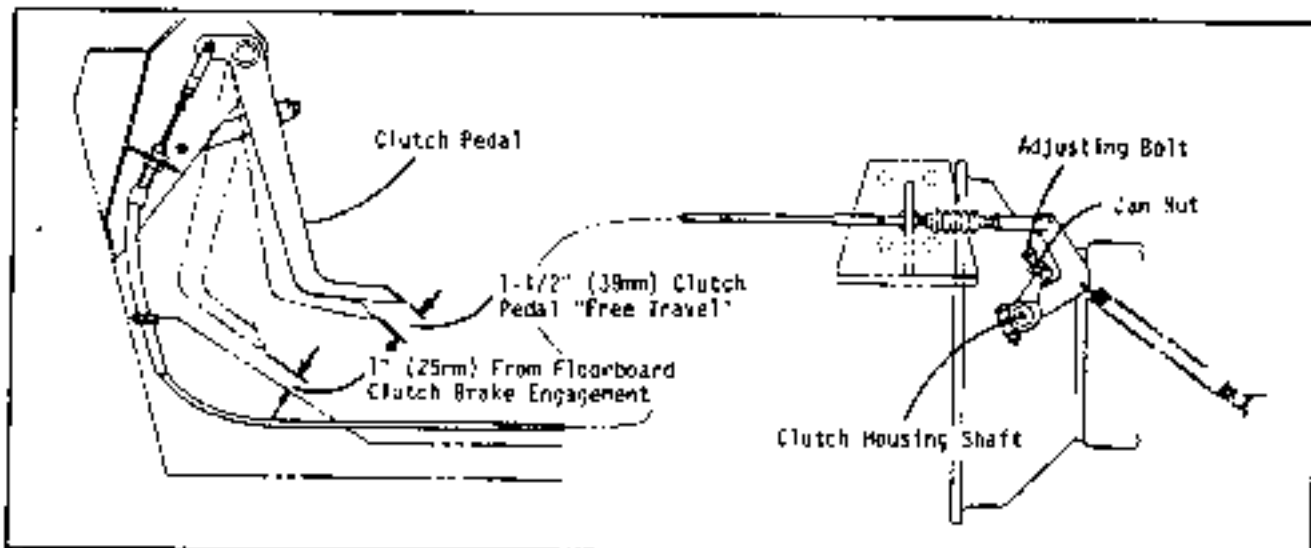


Fig. 3-15  
Carrier Clutch Adjustment (Later Models With Clutch Brake)

GA633-B

- (a) Loosen jam nut (15) and adjust bolt (14).
- (b) Turn adjusting bolt until the toe of the clutch shoe just contacts the clutch drum.
- (c) Remove cotter pin (2) and shin cover (3) from heel end of shoe.
- (d) Add shims as necessary between the bottom of the dead end block (1) and the shoe, until the heel of the shoe contacts the drum.
- (e) Turn the adjusting bolt and check for .015"-.025" (.38-.64mm) clearance. It may be necessary to add or subtract shims (12) in conjunction with turning the bolt to obtain an even clearance of .015"-.025" (.38mm-.64mm) the length of the shoe.
- (f) Oil the dead end pin. Be careful not to get oil on the clutch shoe.
- (g) Replace shin cover and cotter pin.
- (h) Tighten the jam nut.
- (i) Repeat the above procedure on each shoe in each clutch assembly.

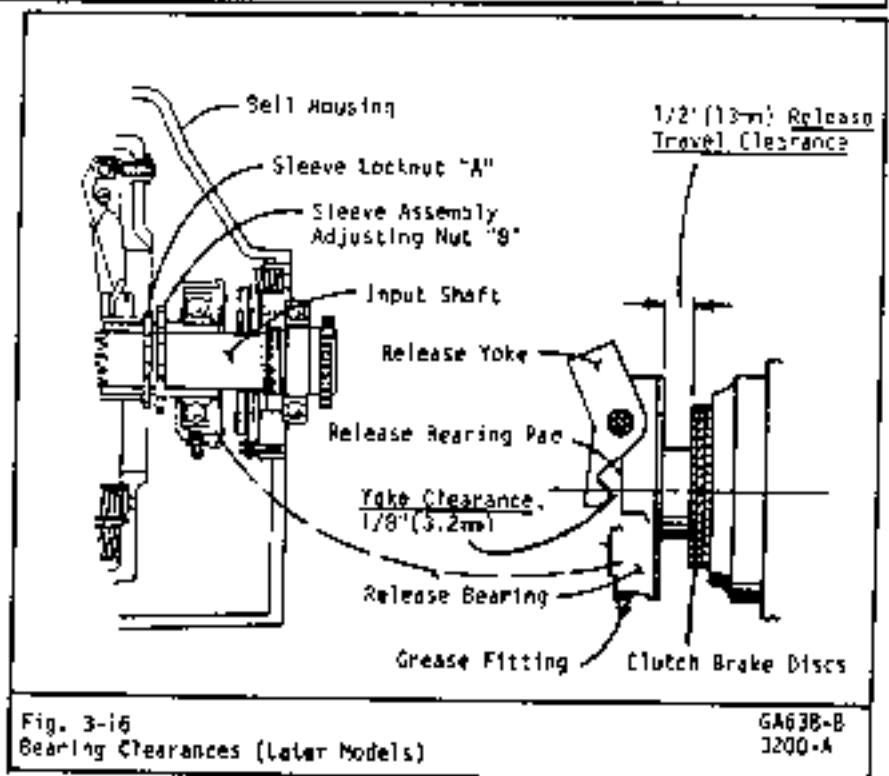


Fig. 3-16  
Bearing Clearances (Later Models)

GA638-B  
J200-A

## Operator's Manual Section 3 - Continued - Periodic Adjustments

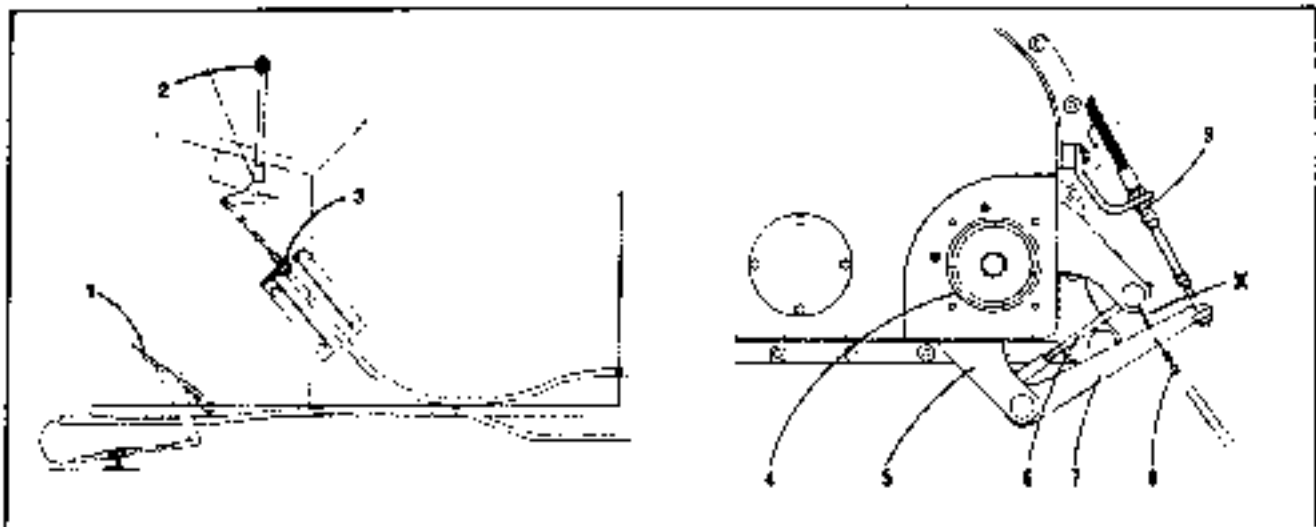


Fig. 3-17

Swing Brake Adjustment

62437-3

- (1) Foot Pedal (Later Models)
- (2) Brake Handle
- (3) Bulkhead Connector

- (4) Brake Drum
- (5) Brake Shoe Arm
- (6) Rod

- (7) Bellcrank
- (8) Return Spring
- (9) Bulkhead Connectors

### Clutch Control Adjustment

Adjustment of the clutch control levers should be checked occasionally to assure full operating pressure at the clutch cylinders. To adjust the linkage, proceed as follows: (Refer to Fig. 3-18.)

- (a) Remove the cover panel over the S-C-M clutch valves to gain access.
- (b) Loosen jam nut and engage lever (pull back). Roll pin should be in line with the centerline of the valve body.
- (c) Tighten the adjusting nut until the valve spool bottoms out in the valve body.
- (d) Back off on the adjusting nut 1/4 turn and tighten jam nut. It should be possible to pull the lever and have the roll pin go over center of the valve body.
- (e) Adjust nut (A) until linkage is positioned as in View One.
- (f) Adjust nut (B) so that roll pin centers over the sight hole as in View Two.

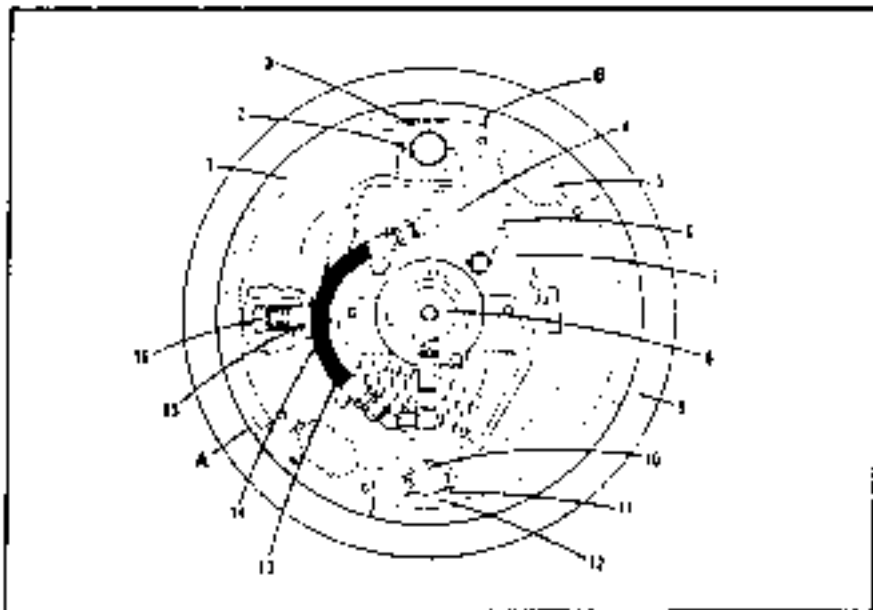


Fig. 3-18

Drum Clutch Assembly

62437-4

- (A) Toe of Clutch Shoe
- (1) Clutch Shoe
- (2) Cotter Pin
- (3) Shim Cover
- (4) Clutch Cylinder
- (5) Shoe Spring
- (6) Push Rod
- (7) Clutch Arm
- (16) Rotating Joint

- (8) Heel of Clutch Shoe
- (9) Clutch Drum
- (10) Pin
- (11) Dead End Block
- (12) Dead End Shims
- (13) Hydraulic Hose
- (14) Adjusting Bolt
- (15) Jam Nut
- (16) Adjusting Nut

## Operator's Manual Section 3 - Continued - Periodic Adjustments

- (g) Repeat for both control valves if machine is equipped with two hoist crans.  
 (h) Replace cover panel.

Note: Adjustment of the linkage must always allow maximum pressure in the operating cylinders, otherwise clutch slippage may result.

### Drum Brakes

The drum brakes are applied by a foot pedal connected to a series of control rods and bellcranks. As pressure is applied to the pedal the band will be forced around drum braking surface.

#### CAUTION

Badly Worn Brake Linings Or Improperly Adjusted Linkage Will Limit Effectiveness Of The Load Holding Ability Of The Brakes.

### Adjustment Procedure For Drum Brakes

Check the front and rear drum brake adjustment upon delivery of a new machine, and every 50 hours thereafter as follows:

- (a) Brake lining wear and adjustment is taken up by means of an adjusting bolt and nut located at the split in the band.

Tightening this bolt will take up on the band, while loosening will increase clearance between the drum and brake band. The band must be adjusted tight enough to hold the load when the pedal is operated in the lower half of its travel. By adjusting the band in this manner, the maximum available leverage is being used. Over tightening the band will result in a much harder working crane, improper brake release, abnormal lining wear and will make it difficult to lock the pedal in the fully applied position.

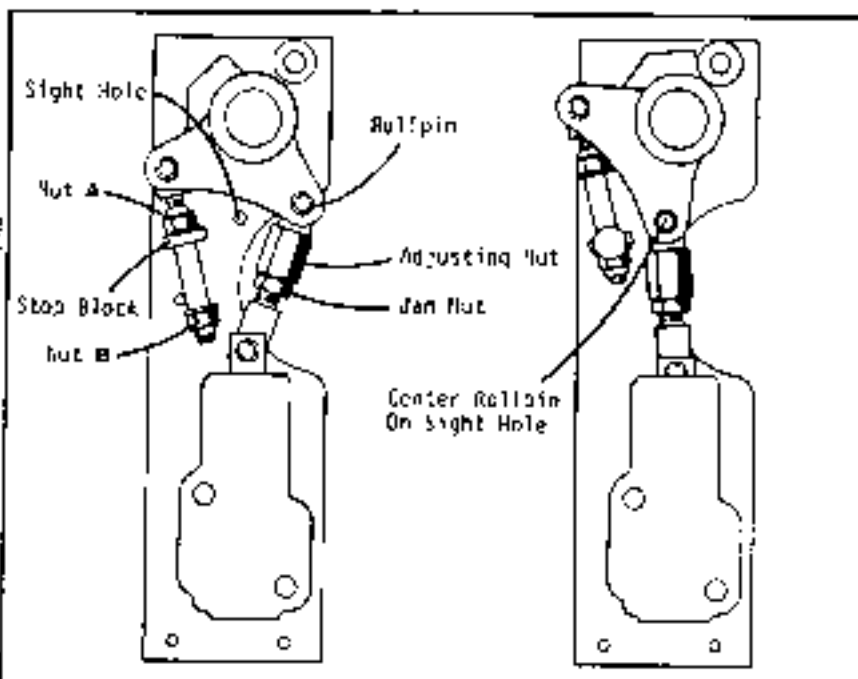


Fig. 3-19  
5-c-M Clutch Valve Adjustment

GA104-3

- (b) The brake band must be centered with the brake drum. See Fig. 3-22. The band is centered with the brake drum by shimming between the dead end lugs and the dead end mounting bracket on the frame. Allow 1/4" (6mm) clearance between brake band and flange on brake drum.  
 (c) Adjust standoff bolts "F" so there is even clearance between the band and the brake drum surface when the brake is released, all the way around the drum. This is required for maximum brake band cooling and to prevent brake band drag when powering down or free falling a load.

### Brake Linkage Adjustment

Brake pedal linkage should be checked and adjusted any time a component of the brake system is replaced or any time an adjustment is deemed necessary. Reach rod lengths shown in Fig. 3-21 are meant for

starting points only. Final adjustments are as follows: (Refer to Fig. 3-20)

- (a) With pedal supported in mid-stroke (B), adjust linkage (J) and (I) so cross shaft bellcranks (D) are vertical.  
 (b) Latch pedals in applied position (A).  
 (c) Adjust reach rods (K) and (L) so drum bellcranks (E) are vertical.  
 (d) Adjust return springs to dimension (H). See Fig. 3-21.  
 (e) Adjust jam nut ahead of return spring to dimension (G) to obtain the proper pedal travel to return pedal to vertical (C) when released.  
 (f) Tighten all jam nuts.

## Operator's Manual Section 3 - Continued - Periodic Adjustments

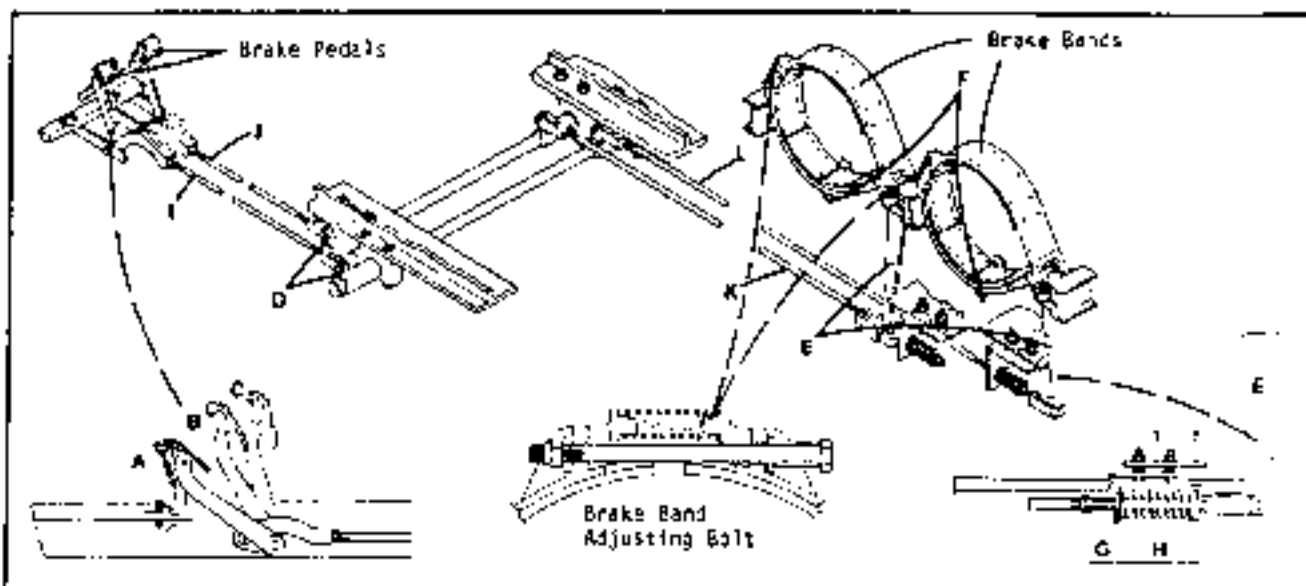


Fig. 3-20  
Drum Brakes

(A) Pedal Applied  
(B) Pedal in Midstroke Position

(C) Pedal in Released Position  
(D) Cross Shaft Bellcranks

(E) Drum Bellcranks  
(F) Standoff Bolt

84491-Z  
G1231-A  
G1282-F

Dimension	HTC-50	HTC-34 HTC-35
G	1-5/8" (41mm)	1-5/8" (41mm)
I	4-9/16" (116mm)	4-9/16" (116mm)
J	103-1/2" (2.63m)	105-3/16" (2.67m)
K	99" (2.51m)	100-11/16" (2.56m)
L	85-7/16" (2.27m)	85-15/16" (2.18m)

Fig. 3-21  
Reach Rod Length Chart

### Drum Brake Pedal Switch Adjust- ment (Fig. 3-22)

The electrical switch in the drum brake warning circuit should be periodically checked for proper adjustment and corrected if necessary. Adjust as follows:

- With the brake pedal latched down, the latch should just activate the switch.
- A minimum of 1/8" (3mm) additional plunger travel is required to avoid damage to the switch.
- If necessary, loosen the capscrews and slide the switch in the slotted hole provided to reach the proper adjustment.
- Repeat the procedure for both brake pedals if the machine is equipped with two hoist drums.

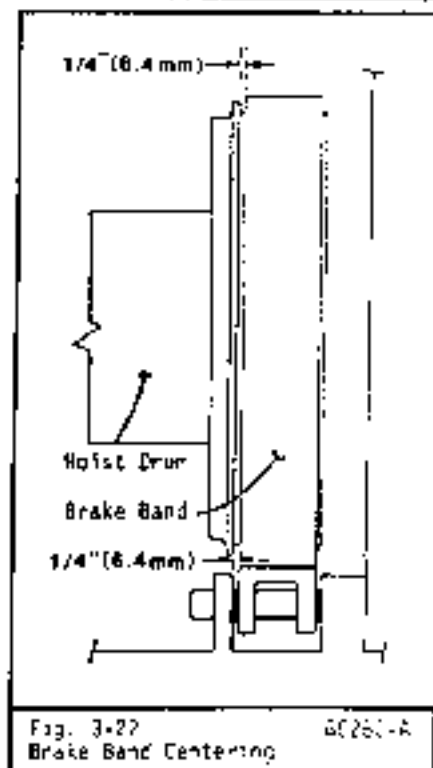


Fig. 3-22  
Brake Band Centering

G1261-A

## Operator's Manual Section J - Continued - Periodic Adjustments

### Boom Angle Indicator

The boom angle indicator, when properly adjusted, will provide the operator with the angle of the boom from horizontal. This angle is critical in figuring capacities per the machine capacity chart and therefore must be kept properly adjusted. Accurate readings also rely on firm, level supporting surfaces and proper boom wear shoe adjustment. See boom adjustment, page J-18.

### Boom Angle Indicator Adjustment

- Adjust boom angle indicator as follows: (Refer to Fig. J-24.)
- Level machine on outriggers.
  - Boom up until boom foot lever arm (7) is vertical. Check by scribing a line from the centerline of boom foot pin (8) to center of pin (6). Use plumb glass on a level or a plumb bob to check for vertical.
  - Remove cover panel outside operator's cab to expose readout lever arm (9). Adjust turnbuckle and jam nut (5) until readout lever arm (9) is vertical. Check by scribing a line through the centerlines of capscrew (2) and pin (3). Check by same method as in step (b) above.
  - Having completed steps (a) through (c) above, tighten jam nuts on turnbuckle (5).
  - Boom up to minimum radius and check boom angle with an inclinometer placed along the longitudinal centerline of the boom base section. Loosen capscrew (2) and adjust readout drum (1) to read the same as the inclinometer and tighten capscrew (2).
  - Boom down to horizontal and check with a level on the boom base section.
  - Check readout drum for 0° reading. If reading is not 0°, arms (7) and (9) are not parallel. Repeat adjustment procedure above.

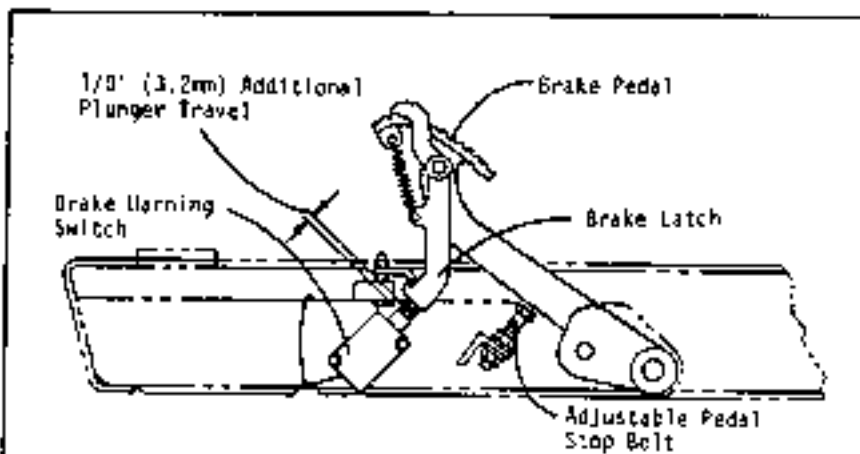


Fig. J-23  
Drum Brake Pedal Switch Adjustment

SA520-C

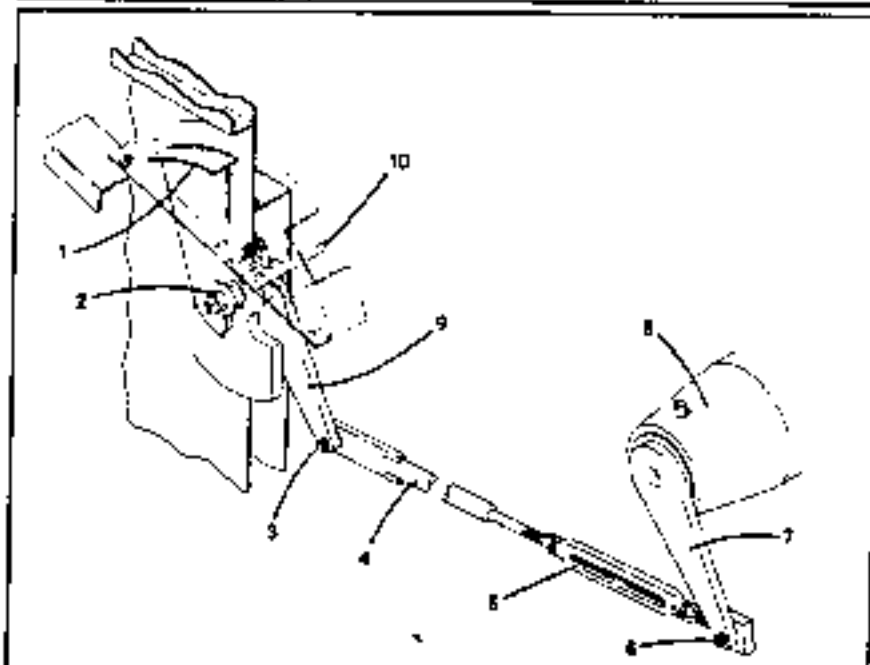


Fig. J-24  
Boom Angle Indicator

(1) Readout Drum	(6) Pin
(2) Capscrew	(7) Boom Foot Lever Arm
(3) Pin	(8) Boom Foot Pin
(4) Reach Rod	(9) Readout Lever Arm
(5) Turnbuckle and Jam Nut	(10) Pointer

GA100-C

## Operator's Manual Section 3 • Continued • Periodic Adjustments

Note: If the drum reads properly at minimum radius and is not more than +1° to -3° off with boom horizontal, angle indicator adjustment is sufficient for use. If the variance is greater than +1° to -3° at horizontal position, arms (7) and (9) are not parallel and must be re-adjusted as in steps (a) through (g).

(h) Replace panel outside operator's cab.

### Boom Length Indicator Calibration

Boom length indicator settings should be checked on a daily basis and recalibrated any time settings differ from those given in the chart in Fig. 3-28.

Calibrate system as follows:

- (a) With meter power switch "off", adjust meter needle to read 25' by using meter zero adjustment screw on face of meter.
- (b) With boom fully retracted make sure cable from transducer is threaded through eyebolt on middle boom section and firmly attached to tip boom section.
- (c) Turn meter power switch "on". Turn jib/main switch to "main" position. Retract boom fully. Remove calibration screw cover located on the outside surface of transducer. (See Figure 3-25.)
- (d) With a small thin bladed screwdriver, adjust the calibration screw until the panel meter reads the retracted main boom length. (See chart.)
- (e) Replace calibration screw cover.
- (f) Main boom circuit is ready for operation. A check of system may be made at any known boom length and the system recalibrated as necessary.

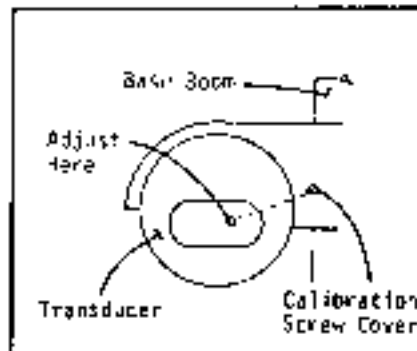


Fig. 3-25  
Transducer

- (g) Remove the bottom cover plate on the control meter by removing the two screws. Removal will reveal calibration screws for jib positions. (See Fig. 3-27.)
- (h) With power switch "on" and boom fully retracted, set the jib/main switch in the "jib 1" position.

Note: "Fully retracted", when a pendant supported jib attachment is used, means only the boom middle section is fully retracted. (See notes in Fig. 3-28.)

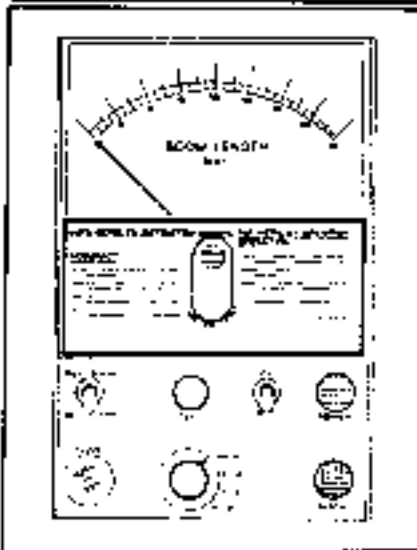


Fig. 3-26  
Meter GA2E2-9

- (i) Using a small thin bladed screwdriver, adjust screw "1" until meter reads length indicated in chart for "jib 1" setting. (Clockwise adjustment will increase reading.)
- (j) Set jib/main switch in "jib 2" position, adjust "screw 2" to read length indicated for "jib 2" setting.
- (k) Check settings by rotating jib/main switch to each of the positions and check for correct lengths as given in chart.
- (l) Replace bottom cover and secure screws.

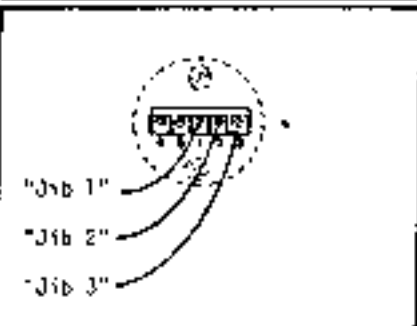


Fig. 3-27  
Control/Meter Calibration (Jibs)

## Operator's Manual Section 3 - Continued - Periodic Adjustments

### BOOM LENGTH CHART

Selector Switch	Conditions	HTC-50	HTC-34, HTC-35
Main	Main boom length fully retracted	35' (10.73m)	32' (9.87m)
	Main boom length with middle section fully retracted and tip section fully extended*	62.5' (19.29m)	55' (17.27m)
	Main boom length fully extended	90' (27.76m)	80' (24.57m)
Jib 1	Jib length	32' (9.87m)	28' (8.64m)
	Main boom fully retracted plus fly	67' (20.66m)	60' (18.50m)
	Main boom fully extended plus fly	112' (34.54m)	108' (33.31m)
Jib 2	Jib length	50' (15.50m)	50' (15.42m)
	Main boom retracted plus jib*	122.5' (37.79m)	106' (32.59m)
	Main boom fully extended plus jib	150' (46.26m)	130' (40.09m)
Jib 3	Jib length	80' (24.57m)	NA
	Main boom retracted plus jib*	142.5' (43.95m)	NA
	Main boom fully extended plus jib	170' (52.43m)	NA

\* For pendant supported jib operations, main boom lengths are with the tip section fully extended and manually locked in place to provide for pendant supports.

Fig. 3-28

Boom Length Chart



Operator's Manual Section 3 - Continued - Periodic Adjustments

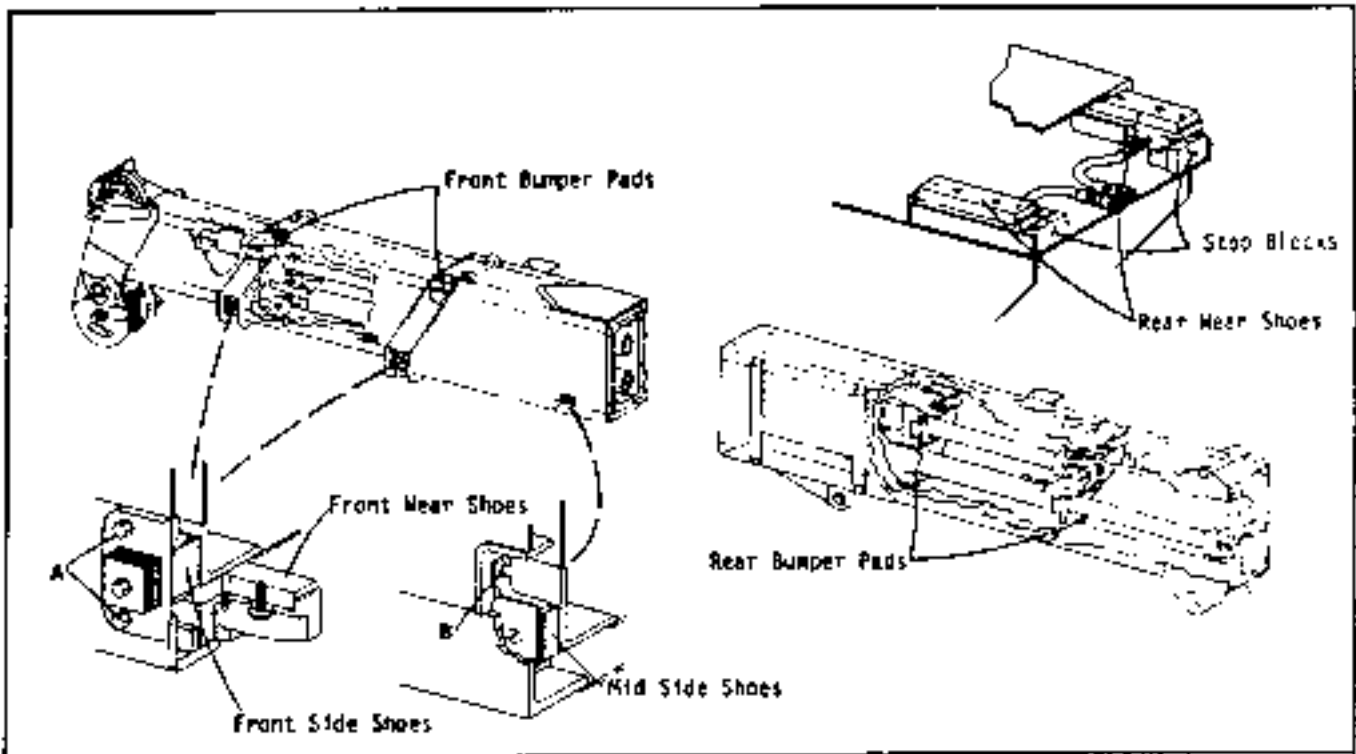


Fig. 3-29  
Boom Assembly

YC545-2

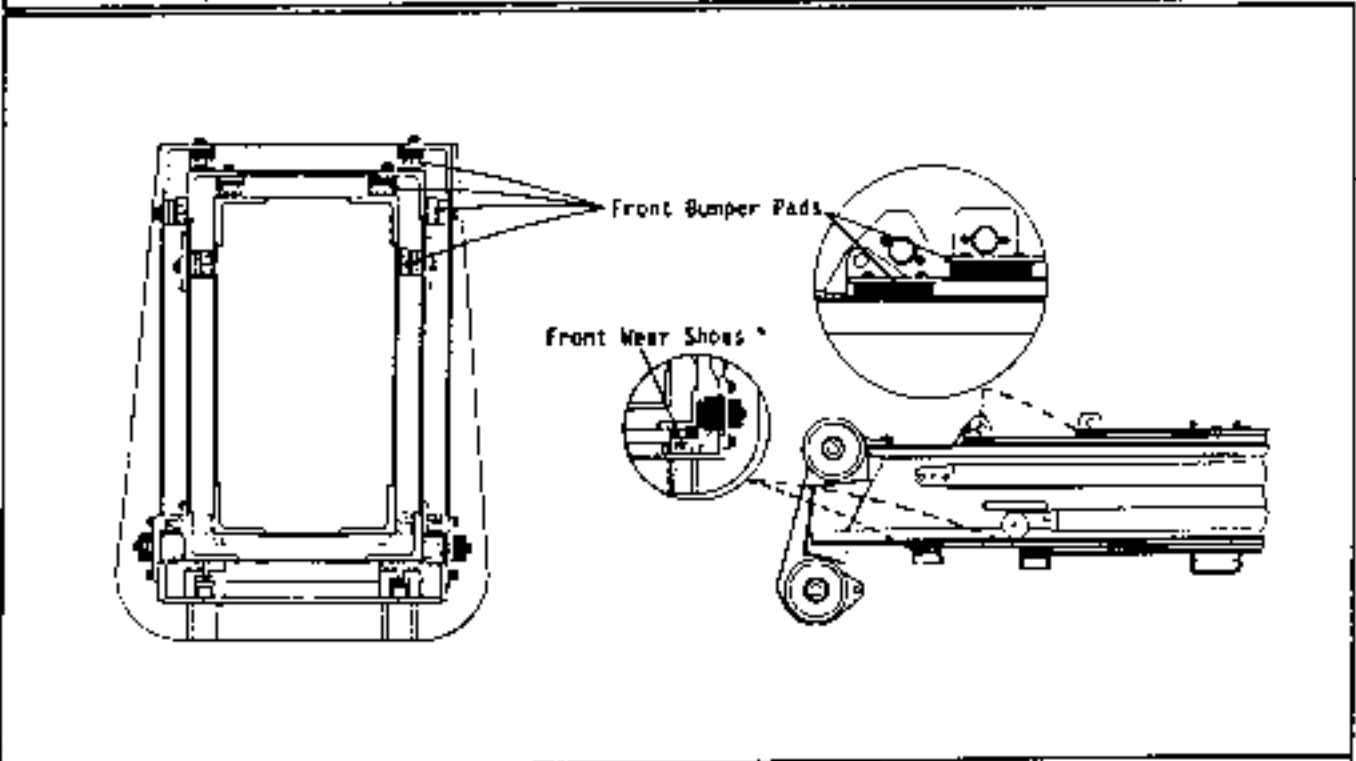


Fig. 3-30  
Boom Wear Shoes and Bumper Pads

GC215-2

## Operator's Manual Section 3 - Continued - Periodic Adjustments

### Boom Adjustments (Fig. 3-29 & 30)

The boom is provided with adjustments required to keep the boom working smoothly. Side wear shoes are used to prevent excessive sideways movement of the boom sections within each other. Rear shoes are used at the top rear and bottom front of the boom sections. Bumper pads are used on the top front and bottom rear of each boom section to prevent excessive up and down movement between sections.

Wear shoes and pads must be kept snug to minimize boom deflection.

#### CAUTION

Excessive Boom Deflection Will Affect Boom Angle And Load Radius. At Or Near Maximum Capacity Lifts, Deflection May Cause Overloading And Possible Flipping Conditions.

#### CAUTION

Do Not Climb Or Walk On Top Of Boom. Movement Of The Boom Or Upper, Or Sliding Presents A Falling Hazard. Use A Well Secured Ladder For Working On Boom To Avoid A Fall.

### Boom Side Shoes

Check boom side shoes periodically for wear or improper adjustment. To adjust boom side shoes, shim as follows:

- Position machine on fully extended outriggers facing directly over the front with the boom fully extended.
- Boom down until head machinery touches ground.
- Remove capscrews at (A) on both sides of boom.
- Remove all four front side shoe assemblies.
- Remove capscrews at (B) on four mid shoe assemblies and lift out shoe assemblies.
- Align boom sections with respect to each other to obtain a straight boom by disengaging swing brake and manually pushing on side of boom.

- Add or remove shims between wear pad and shoe retainer so there will be 1/16" (2mm) clearance between wear pads and the boom section it wears against when replaced in boom. Additional shims are stored on front side shoe assemblies.
- Replace all shoe assemblies and tighten retaining capscrews at (A) and (B).
- Retract boom completely and then re-extend. If at any point boom sections bind due to side shoes being too tight, stop boom and reshim side shoes at that point. Boom sections must not bind on extending or retracting of boom. Lubricate boom shoes before operating.

### Shimming Bumper Pads

Shim bumper pads to obtain 1/8" (3mm) clearance between pads and boom section. As wear shoes become worn, the pads will require reshimming.

### Boom Wear Shoe Inspection And Replacement

All wear pads on boom must be replaced any time the clearance between recessed end of retaining capscrew and the wear surface of pad is less than 1/32" (0.79mm). If pads are allowed to wear farther, the capscrews may damage the boom sections by gouging or scraping. Inspect and replace pads as follows:

- Extend each boom section two to three feet (0.61 - 0.91m).
- Remove front bumper pads and shims from top of middle boom section and base section by removing capscrews.
- Lift boom sections with helper crane to obtain clearance to lift out front rocker shoe assemblies.

#### CAUTION

Care Must Be Taken To Support The Boom Sections To Avoid A Pinching Hazard Between The Sections When Removing Wear Shoes.

- Inspect shoes for wear and replace as required.
- Reshim bumper pads on replacement.

### Rear Wear Shoe Removal:

- Fully retract boom.
- Remove stop block at rear of boom wear shoe brackets by removing capscrews.
- Loosen grease fitting line from shoe assembly.
- Slide shoe assembly out rear of boom.
- Inspect wear pads and replace as required.
- Replace shoe assemblies in brackets on boom section.
- Replace grease line and stop block.
- Reshim bottom bumper pad as required.
- Lubricate shoes before operating.

#### CAUTION

Lube All Boom Sliding Surfaces After Adjustments Have Been Made To Avoid Damage To The Boom Or Excessive Wear Of Shoes Or Pads.

### Hydraulic Pressure Adjustment

The following instructions cover setting of all relief valves on this machine. All machines are tested and properly adjusted before leaving the factory, and shouldn't need checking when first put into operation. After the first 200 hours of operation, and every 200 hours thereafter, the pressures should be checked. A drop in pressure settings may be noticed when making the first check. This is normal, and is probably caused by lessening of spring tension, or stress relief in the relief valve parts.

## Operator's Manual Section 3 - Continued - Periodic Adjustments

### CAUTION

Relief valves are for hydraulic system protection. The pressures listed in this section have been established by our Engineering Department and are the maximum allowable pressures for proper and efficient machine operation. Increasing the relief valve settings will not increase machine speed, as the available volume of oil will not be changed. Only the pressure changes when relief valve settings are changed. Do not increase pressure to settings higher than those specified.

### Tips for Accurate Pressure Settings:

- (a) Use a gauge of known accuracy. If accuracy is not known, have the gauge calibrated.
- (b) Use a shutoff or gate valve in the gauge to reduce shock loadings in the gauge.
- (c) Obtain each final pressure by bringing the pressure up to the proper setting, not by backing down.
- (d) Be certain that all pressure is exhausted from the lines by shutting down the engine and working the control levers back and forth to relax the attachment before removing any test station plugs, or removing the gauge after setting a pressure.
- (e) If a new pump is installed, all relief valves must be backed off and the pressures reset as outlined in this section before putting machine back into operation. This is to avoid the possibility of failing the new pump from over pressure if the relief valves are set incorrectly.
- (f) Do not operate the machine over relief for extended periods of time because it will cause the oil to over heat.
- (g) When using full throttle to check pressures, make sure the throttle is backed off before machine is shut down.
- (h) Set relief valve pressures with the hydraulic system at operating temperature.

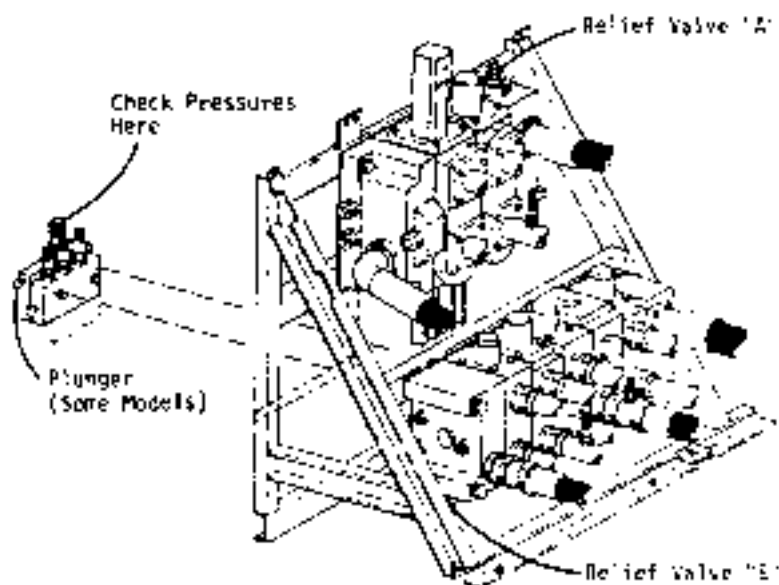


Fig. 3-31 Control Valve Assembly (Early models with pressure checking manifold)

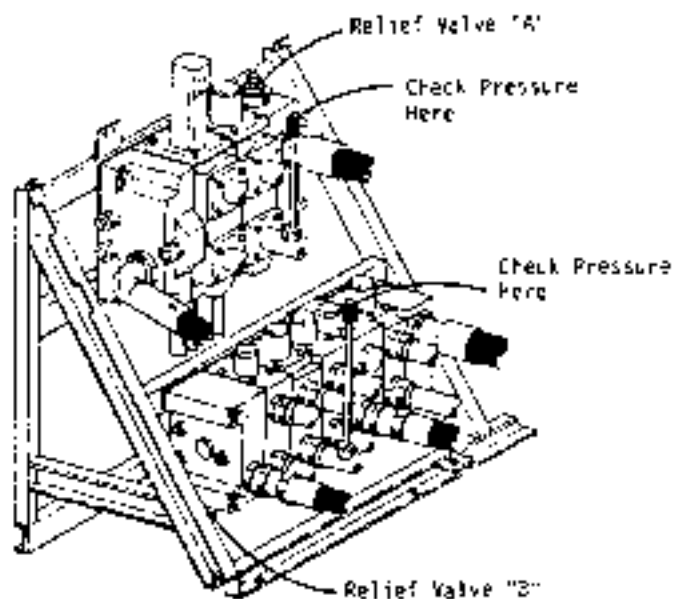


Fig. 3-32 Control Valve Assembly (Later models with separate quick disconnects)

## Operator's Manual Section 3 - Continued - Periodic Adjustments

- (E) Every attempt should be made to set pressures to within plus or minus 25 PSI (1.76 kg/cm<sup>2</sup>) of recommended values.

### Hydraulic Pressure Setting Procedure

All pressure adjustments on the machine work the same. That is, all adjusting screws turn clockwise to increase pressure. Relief valves must be functioning (relieving oil under pressure) to be properly adjusted. Holding a control valve open after an attachment cylinder is completely extended or retracted will force the system relief valves into operation. All pressures are to be set with the engine running at full throttle.

### Pressure Checking Manifold (Early Models)

Refer to Fig. 3-31. Plug pressure gauge equipped with quick disconnect into the coupling on the pressure checking manifold behind the main manifold and main valve frame.

To check pressures push in and hold plunger. Plunger is spring centered and will return to neutral when released.

Note: Some early models may not have a plunger.

Use pressure checking manifold when adjusting boom hoist, hoist motor, swing and boom tip section circuits.

### Separate Quick Disconnects (Later Models)

Later model HTC's have been equipped with two separate quick disconnects. (Refer to Fig. 3-32.) The quick disconnect located on the top valve stack is used to check pressures in the boom hoist and hoist motor circuits. The quick disconnect located on the bottom valve stack is used to check pressures in the swing and boom tip section circuits.

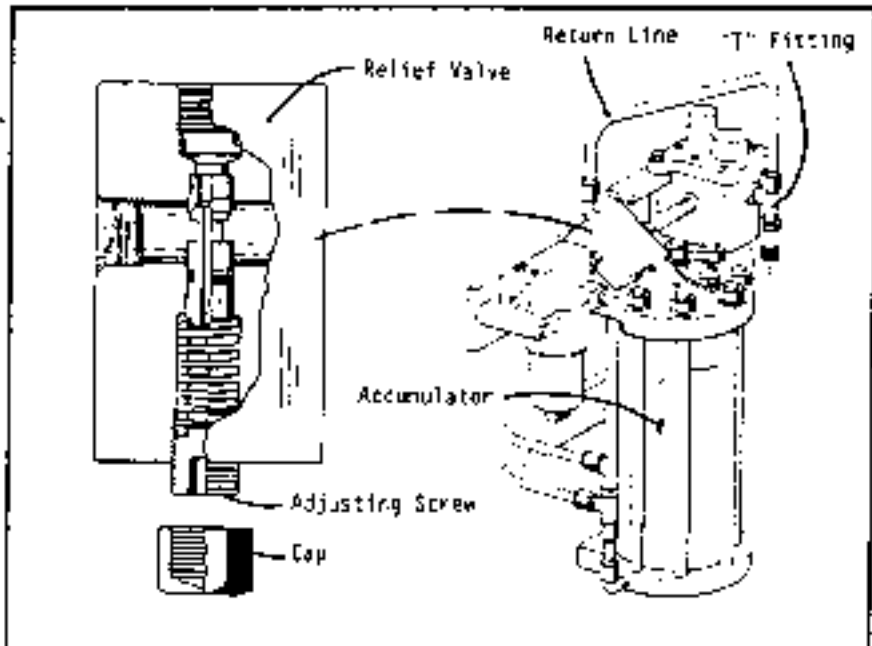


Fig. 3-31  
S-O-M Relief Valve Adjustment

GA62-E  
H179-A

Circuit	Relief Valve Setting
Boom Hoist Hoist Motor	2600 PSI (183 kg/cm <sup>2</sup> )
Swing Boom Tip Section	2500 PSI (176 kg/cm <sup>2</sup> )
Outriggers Boom Middle Section	2500 PSI (176 kg/cm <sup>2</sup> )
S-O-M	1250 PSI (87.9 kg/cm <sup>2</sup> )

### Checking Boom Hoist and Hoist Motor Circuits

- With boom fully retracted and over rear of carrier, slowly push boom hoist control lever forward all the way and hold.
- Read pressure on gauge after boom hoist cylinders have bottomed out in fully retracted position.
- If adjustment is required, adjust relief valve "A".

- Adjust valve "A" by removing acorn nut, loosening locknut and adjusting relief valve screws. Tighten locknut and replace acorn nut.

### Checking Swing and Boom Tip Section Circuits

- With boom fully retracted, slowly pull boom tip section control lever all the way back and hold.
- Read pressure on gauge after cylinder is completely retracted.

## Operator's Manual Section 3 - Continued - Periodic Adjustments

- (c) If adjustment is necessary, adjust relief valve "E".
- (d) Adjust relief valve "B" by removing acorn nut, loosening locknut and turning relief valve screw. Tighten locknut and replace acorn nut.
- (e) If adjustment is required, adjust by removing cap, loosening locknut and turning adjusting screw in the relief valve with an allen wrench. After adjustment, tighten locknut and replace cap.

### Checking Boom Middle Section and Outrigger Circuits

- (a) Position machine on level surface on lines with emergency/parking brake engaged. Shut down the engine.
- (b) Plug pressure gauge into quick disconnect fitting on relief valve located under the carrier between the sump tank and fuel tank.
- (c) Retract one outrigger jack cylinder and increase engine speed to full throttle. Read pressure on gauge when jack cylinder is bottomed out.
- (d) If adjustment is required, adjust the relief valve by removing cap, loosening locknut and turning adjusting screw. Tighten locknut and replace cap after pressure is set.
- (e) Remove pressure gauge.

### S-O-H System Relief Valve Adjustment

The relief valve must be adjusted as follows:

- (a) With the engine shut down, reduce operating pressures to zero by working the clutch control levers back and forth until S-O-H pressure gauge reads zero.
- (b) Disconnect the "T" fitting from the unloading valve. Plug the unloading valve hole with a pipe plug to force the system pressure over relief. Place a cap on the "T" fitting to retain the oil.
- (c) Start the engine, and providing the gauge in the upper instrument panel is accurate, the pressure may be read directly from it.

### **CAUTION**

If the Gauge Reading Is 1300 PSI Or More, Immediately Shut Down The Engine. This Would Indicate Too High A Setting Or A Stuck Valve Spool. Too High Of A Setting May Damage Some Component In The System.



Boom, Fly And Jib For 4 Section Boom

Boom Assembly (Optional 4 Section)

The boom assembly consists of a base section, two telescoping power sections, and a manually telescoped tip section. The base section is anchored to the upper frame by one boom foot pin. Ref. Fig. 4A-1.

The boom is extended and retracted by two extend-retract cylinders. The lower cylinder is anchored between the outer-mid power section and the inner-mid power section. The lower cylinder controls the outer-mid power section and/or the manual tip section, dependent upon the position of the cylinder release mechanism and the retrieval pin (Refer to Section 1, Four Section Boom Operation and Controls). The upper cylinder is anchored between the base section and the inner-mid power section. The upper cylinder controls the inner mid power section.

The power boom sections are controlled from the upper operator's cab. Refer to Section 1, Four Section Boom Operation and Controls, for operating instructions.

Auxiliary Lifting Sheave (Optional)

The auxiliary lifting sheave assembly is bolted to the end of the boom manual section. Refer to Fig 4A-2. The auxiliary lifting sheave can be reeved with one or two parts of line. See Reeving Diagrams this section. Once installed, the assembly will not interfere with fly

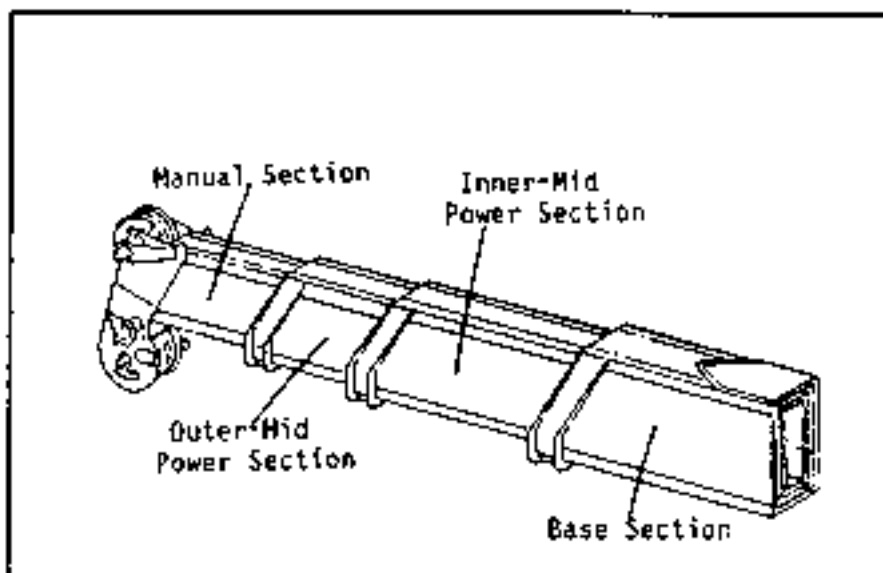


Fig. 4A-1  
Boom Assembly

or jib erection, stowing or operation.

Note: The auxiliary lifting sheave extends the effective boom length by two feet and must be considered when figuring lifting capacities for loads off auxiliary lifting sheave.

Fly And Jib For 4 Section Boom

Fly Section (Optional)

The fly section is a lattice type boom extension that is attached at the boom head (Refer to Fig. 4A-3). This attachment is a one piece unit supported only by its attachment at the boom head

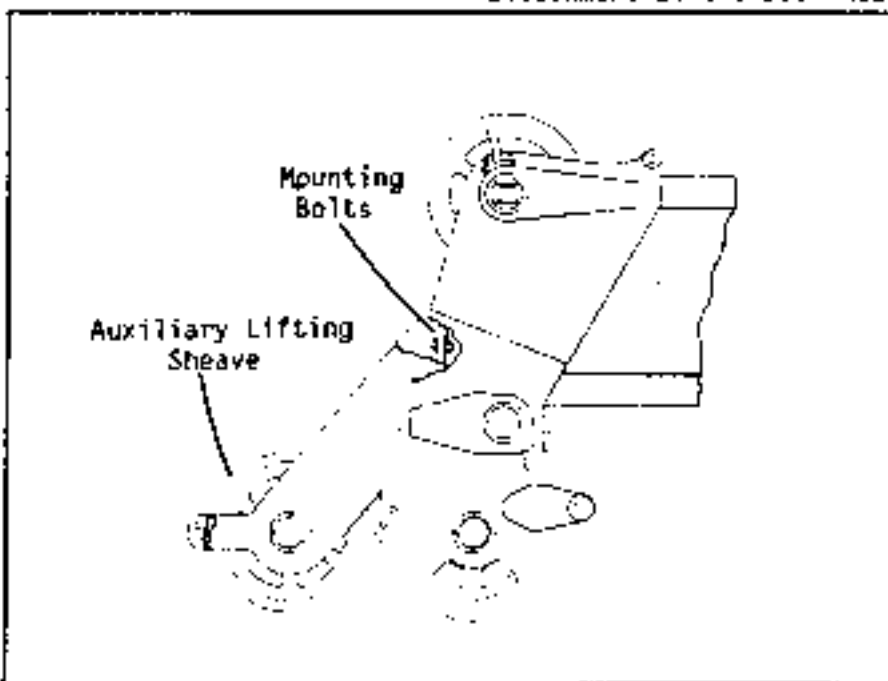


Fig. 4A-2  
Auxiliary Lifting Sheave

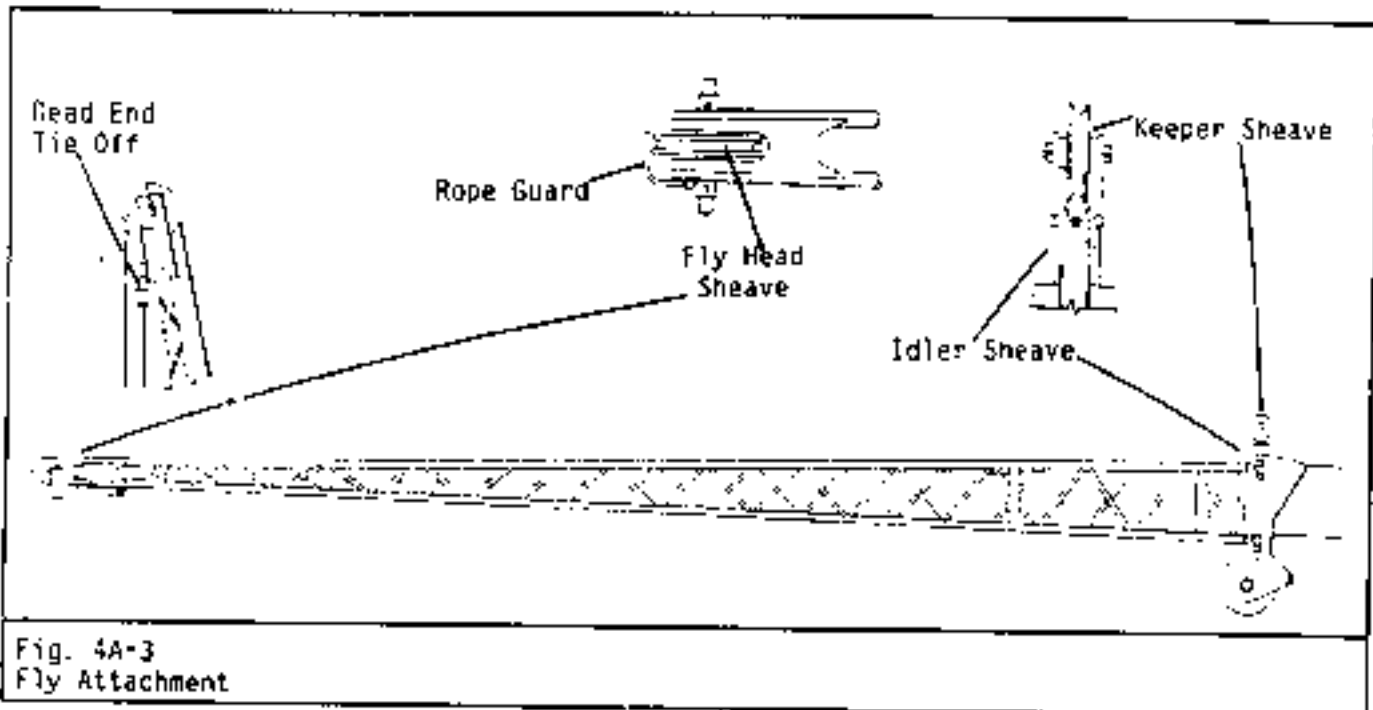


Fig. 4A-3  
Fly Attachment

The fly is also used to erect an optional pendant supported jib attachment (Refer to page 4A-6).

The fly section hoist line must pass between the keeper sheave and the center idler sheave on the boom head. (Refer to Fig. 4A-3).

The rope guard on the fly section head sheave must be pinned in place to hold the hoist rope on the sheave while operating.

The fly section swings at the boom head to stow on the right side of the boom base section.

Note: Do not pick any load from the fly section when machine is on tires. Level machine on outriggers before operating with fly.

#### Installing Fly Section

Use the following procedure to install the fly section onto the machine.

1. The machine must be on

outriggers with the beams fully extended, leveled on properly supported pontoons, and all tires clear of any supporting surface. Extend counterweight fully and position boom directly over the rear.

2. Securely block up fly section directly behind the carrier. Refer to Fig. 4A-4.
3. Move hoist rope out of way when installing fly section.
4. Lower the boom and extend the outer-mid power section to engage the four lugs on the fly section with the cross shafts on the boom head. Install the four pins and keeper pins at A, B, C, D, to connect the fly to the boom. (Refer to Fig. 4A-4).
5. Reeve hoist rope between the keeper sheave and the idler sheave on the boom head and over the head sheave at the end of the fly. Pin the rope guard to the fly sheave over

the hoist rope to hold in place.

#### WARNING

When Operating With The Fly Section, The Inner Mid And Outer Mid Power Sections Must Be Extended Equally. Failure To Do So May Result In Boom Failure Or A Possible Tipping Condition.

#### Removing The Fly Section

Use the following procedure to remove the fly section from the machine.

1. The machine must be on outriggers with the beams fully extended, leveled on properly supported pontoons, and all tires clear of any supporting surface. With the counterweight fully extended, position the boom directly over the rear.
2. The inner mid power boom section is to be fully retracted. The outer mid



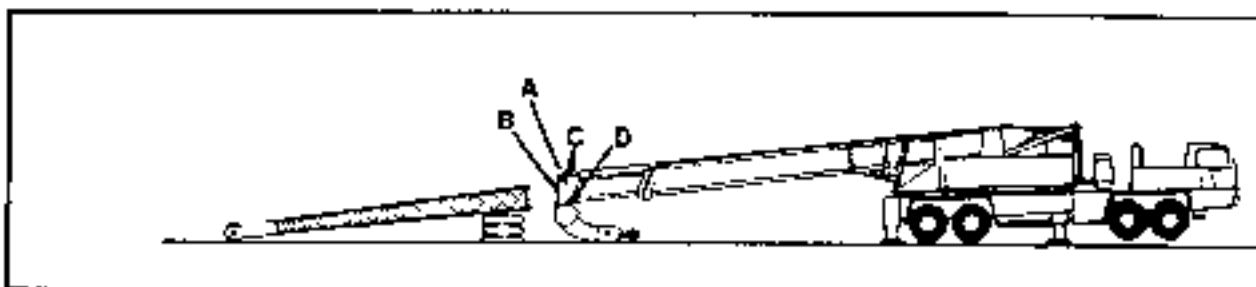


Fig. 4A-4  
Fly Section Installation And Removal

power boom section is to be extended approximately five or six feet.

3. Boom down until the fly head sheave rests lightly on the ground.

Note: The machine may be tilted slightly to the rear by lowering the rear outrigger jacks and/or raising the front outrigger jacks to allow the fly sheave to rest on the ground.

4. Place blocking securely under the fly section as shown in Fig. 4A-4 to support the fly when the boom is removed.
5. Remove the hoist rope and lay aside out of the way.
6. Remove the four pins at A, B, C, D, only after the fly section has been firmly supported by the blocking. Refer to Fig. 4A-4.
7. Retract the boom head away from the fly section. Stow pins and hoist line.

Erecting Fly Section From Stowed Position

Use the following procedure to erect the fly from the stowed position.

1. The machine must be on outriggers with the beams fully extended, leveled on properly supported pontoons, and all tires clear of any supporting

surface. Extend the counterweight fully and position the boom directly over the rear.

2. With boom in a horizontal position, fully retract boom to engage the lugs of the fly section with the cross shafts on the boom head. Install pins and keeper pins at A and B.
3. Move the hoist rope out of the way.
4. Remove keeper pin at E (Fig. 4A-5) at front storage bracket. If equipped with jib, release link lock at F (Fig. 4A-5). Remove keeper pin and pin from hole at G and install in hole H at rear storage bracket (Fig. 4A-5). Extend either power boom section enough to pull fly clear of front and rear storage brackets.

**WARNING**

Do Not Remove The Stowing Pin At E, F, And G Until The Fly Section Is Supported By Pins At A And B, Blocking, Or By Another Crane. Removing The Stowing Pins Without The Fly Being Supported Could Allow The Fly To Fall, Causing Damage To The Fly And/Or Personal Injury.

**WARNING**

When The Fly Is Properly Pinned At A And B And The Storage Bracket Pins Removed, The Fly Section Is Free To Swing Away From The Boom. Before Removing The Storage Bracket Pins, Control The Fly Section With A Hand Line To Prevent The Fly From Swinging Out Suddenly And Causing Possible Personal Injury.

5. Swing the fly section around the boom head until the holes in the lugs on the fly section align with the holes in the

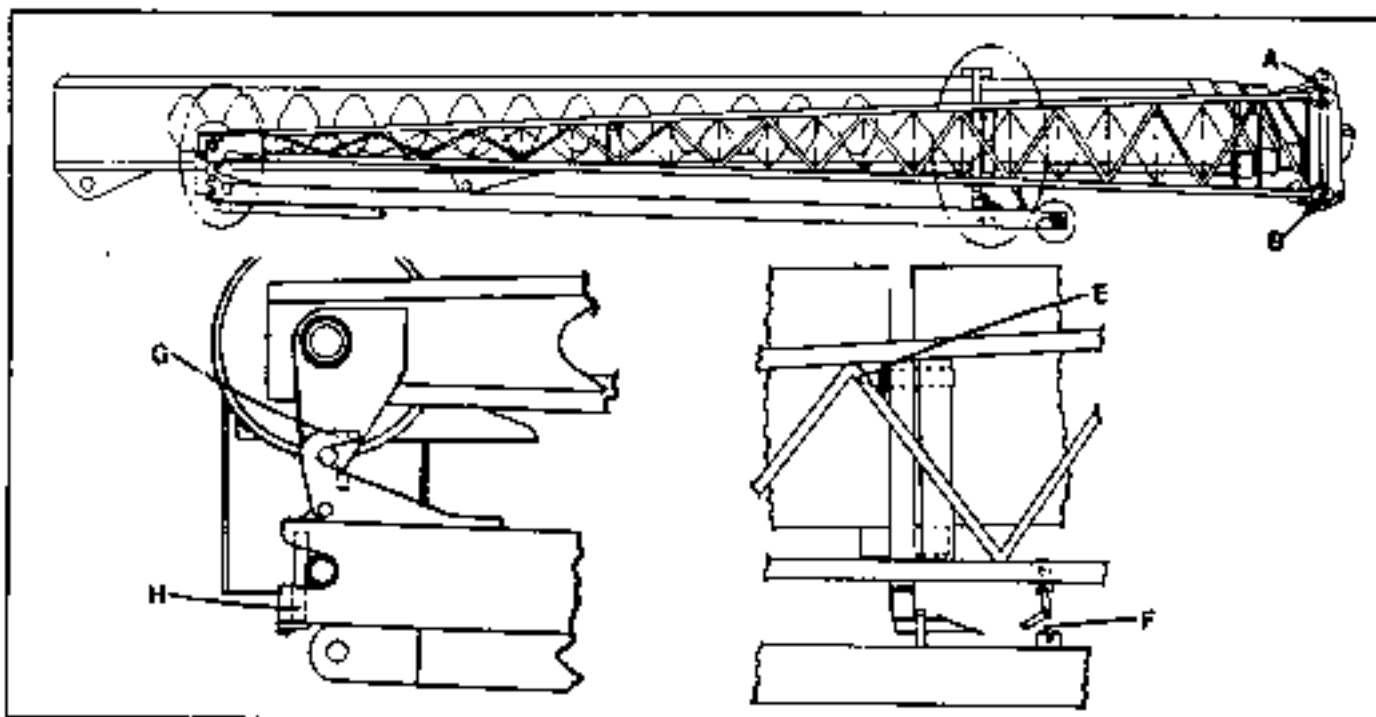


Fig. 4A-5  
Stowed Jib And Fly

boom head cross shafts at C and D on the left side of the boom head. Install pins and keeper pins at C and D. Refer to Fig. 4A-6.

## WARNING

Use A Hand Line To Prevent The Fly From Swinging Out Suddenly And Causing Possible Personal Injury.

5. The stowing pins may be stowed in the storage brackets or the tool box.

### Stowing Fly Section From Erected Position

Use the following procedure to stow fly from erected position:

1. The machine must be on outriggers with the beams

fully extended, leveled on properly supported pontoons and all tires clear of any supporting surface. Extend the counterweight fully and position the boom directly over the rear.

2. Lower the boom to a horizontal position or lower. Unpin the rope guard from the fly head sheave. Remove the hoist rope from the fly section and lay aside out of way.
3. Remove the pins at C and D that secure the fly section to the left side of the boom. Ref. Fig. 4A-6.

## WARNING

Extreme Care Is To Be Used When Removing Tapered Pins Connecting Fly And Boom. The Pins May Jump Out Suddenly And Can Cause Injury.

4. Swing the fly section around the boom head to line up with the storage brackets. Slowly hoisting the boom will assist swinging the fly into storage position. Use a hand line to control swing of fly.

**WARNING**

Keep The Area Between The Swinging Fly Section And The Boom Clear Of Personnel To Prevent Possible Injury.

When the pin on the fly (Fig. 4A-5) is in line with the hole in the front storage bracket, slowly retract the boom allowing the pin to slide into the hole in the front storage bracket and the fly head to slide on to the rear storage bracket.

5. Secure the fly section in position with keeper pin at E in Fig. 4A-5.
6. Remove pins at A and B and stow.

**CAUTION**

When operating With Boom Only, Pins At A And B Must Be Removed Before Extending The Boom Or Damage Will Occur To Fly Section And/Or Boom. Never Remove Pins At A And B Unless The Fly Is Securely Supported By The Storage Brackets And Keeper Pin Is Attached At E Or Fly Is Supported By Blocking Or Another Crane.

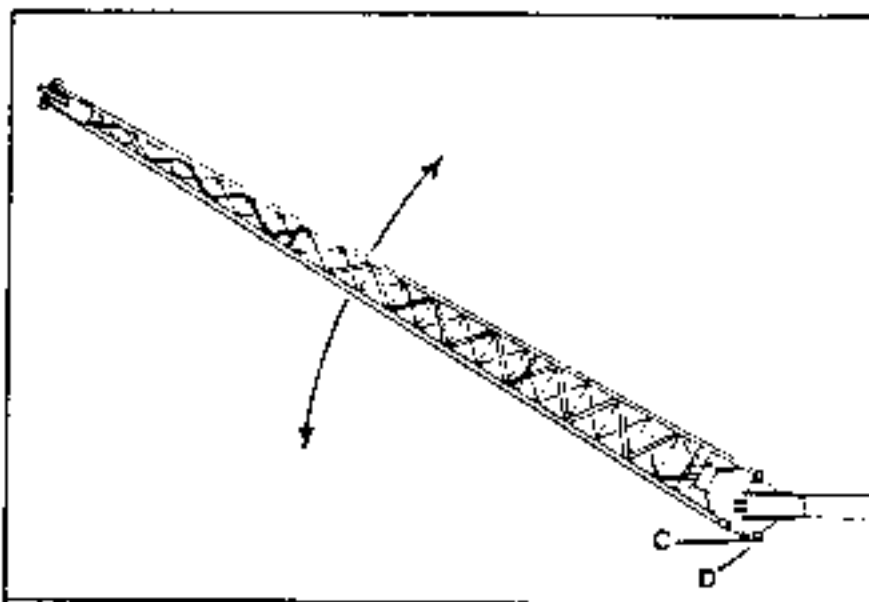
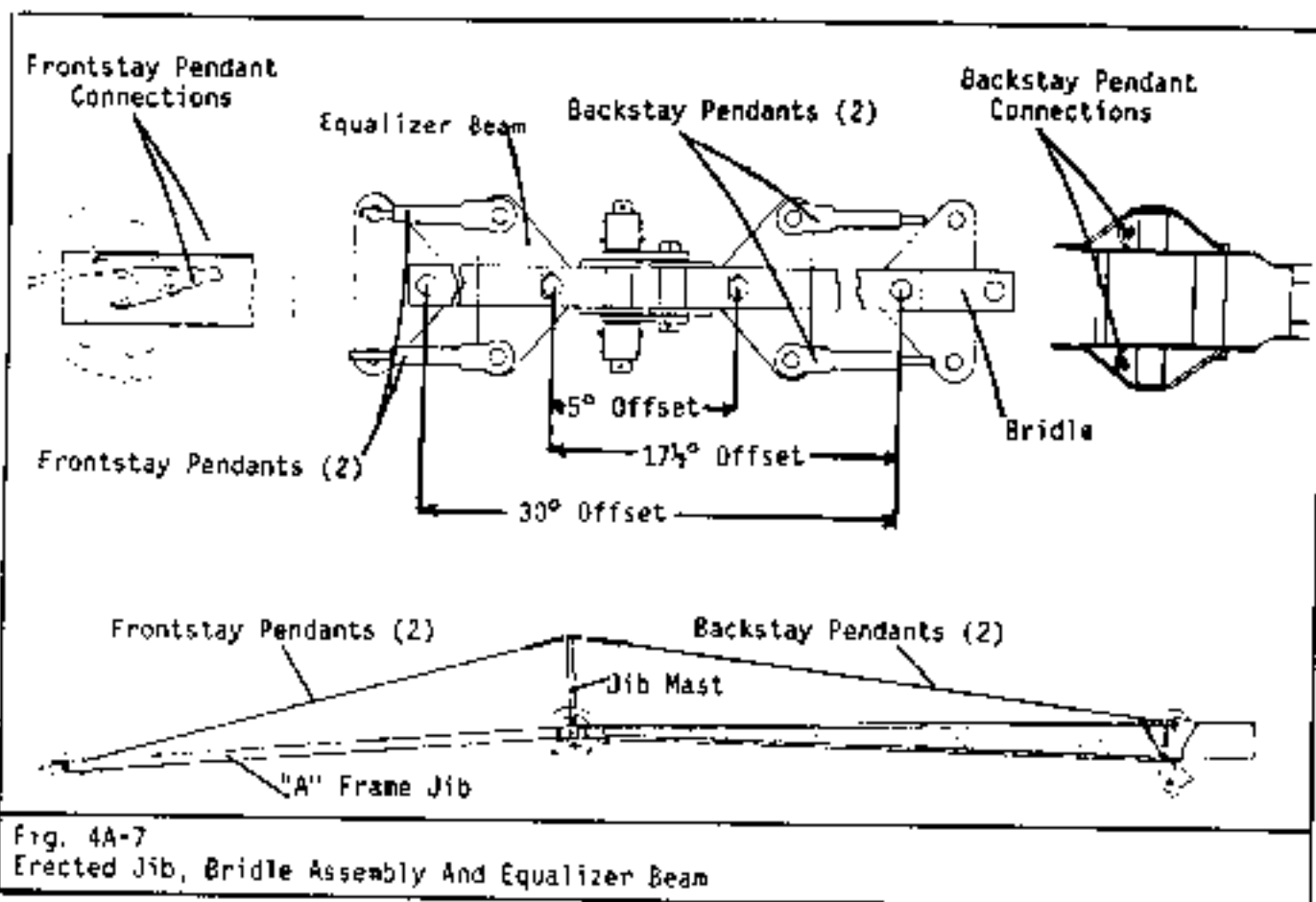


Fig. 4A-6  
Fly Erection



### Jib Assembly (Optional)

The jib assembly consists of the one piece fly and an "A" frame jib. In the erected position, the jib is supported by a jib mast and two pairs of pendant lines. Refer to Fig. 4A-7. The frontstay pendants pin to the lugs at the jib head sheave shaft and to the equalizer beam at the mast. The backstay pendants pin to the equalizer beam and to the lugs on the boom head machinery assembly.

The jib may be erected with a 5°, 17.5° or 30° offset by pinning the equalizer beams in different locations. Refer to Fig. 4A-7.

Note: All rope guards on the boom and jib must be in position before operating the

hoists.

### WARNING

A Possible Tipping Situation May Occur At Lower Boom Angles With Extended Boom And Erected Jib, Even With No Load. Consult Machine Capacity Chart For Maximum Boom Length And Minimum Angle Of Operation.

### WARNING

Do Not Stand Or Walk On Boom Or Fly During Jib Erection Or Machine Operation. Use A Ladder Or Similar Method To Reach Necessary Areas To Prevent Unsafe Conditions.

Note: The "A" frame jib can only be erected with the fly section. It cannot be erected to the main boom only.

Installing The "A" Frame Jib  
Use the following procedure to install the "A" frame jib onto the machine.

1. Erect fly using applicable procedure previously described. Refer to page 4A-3.
2. Securely block up jib section directly behind carrier. Refer to Fig. 4A-8.
3. Remove hoist rope from the fly head sheave and lay aside out of way.
4. Raise or lower boom to align horizontal shaft on fly with openings on jib. Refer to Fig. 4A-8.
5. Remove pins from end of jib at G and/or H. Refer

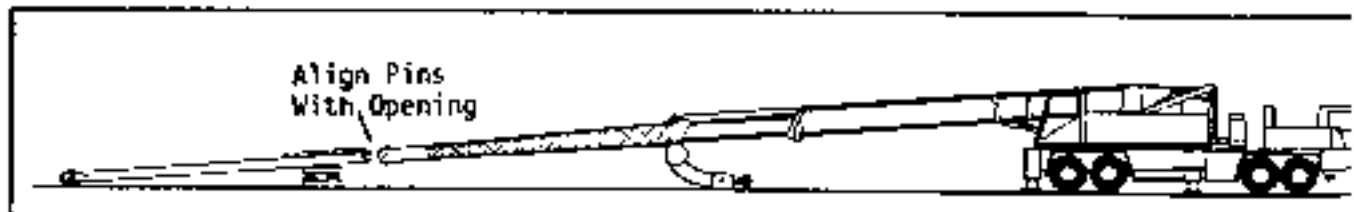


Fig. 4A-8  
Jib Assembly

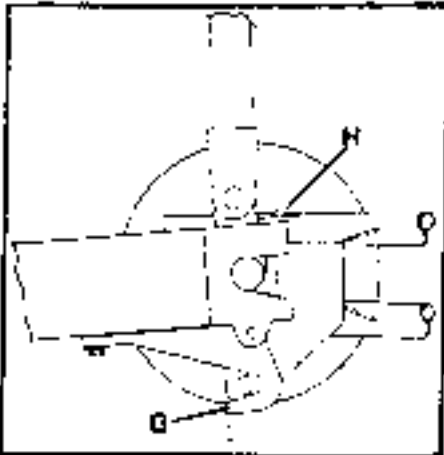


Fig. 4A-9  
Jib And Fly Connection

- to Fig. 4A-9.
6. Extend boom to extend fly into jib connections.
  7. Pin fly to jib by installing connecting pins and lock pins in holes H.
  8. Erect jib mast and attach frontstay and backstay pendant lines as described in "Jib Erection From Stowage" on page 4A-7.

Note: When the "A" frame jib has been attached to the fly, the fly and jib can both be stowed at the side of the boom. Once attached, the "A" frame jib can remain stowed on the boom while using only the fly.

Erecting The Jib From The Stowed Position

Use the following procedure to erect the jib from storage.

1. The machine must be on outriggers with the beams

- fully extended, leveled on properly supported pontoons, and all tires clear of any supporting surface. Extend the counterweight fully and position the boom directly over the rear.
2. With the boom over the rear and fully retracted, lower boom to approximate  $-5^\circ$ . Install pins at A and B to connect lugs on the fly to boom head. Refer to Fig. 4A-5.

and D to connect left side of fly to boom head (See Fig. 4A-6).

**WARNING**

When The Power Section Is Extended To Pull The Fly From The Storage Bracket, The Fly Is Free To Swing. Use A Hand Line To Control Swing. Keep Area Of Fly Swing Radius Clear Of Personnel.



Fig. 4A-10  
Winch And Link Lock

3. Remove pins from holes H and install in holes G. Refer to Fig. 4A-5. The link lock must be attached to the fly and jib as shown at F in Fig. 4A-10. Extend either power boom section enough to move fly and jib off of the storage brackets.
4. Swing fly and jib around boom head and install pins and keeper pins at C

5. Before releasing the link lock, attach the manual winch cable to the bracket on the fly at I (Fig. 4A-10). Winch the jib up to relieve the tension of the link lock. Release the link lock and winch the jib down to rest on the ground. See Fig. 4A-10.
6. Remove the pin from hole J in the rope guard on the jib head sheave, turn rope guard down and push back. Insert pin into hole K, to allow jib sheave to roll on the ground. (See Fig. 4A-11)

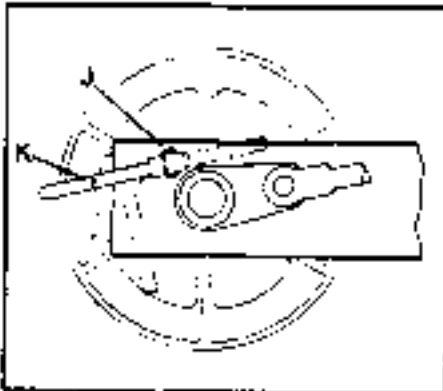


Fig. 4A-11  
Rope Guard

7. Raise boom up allowing the jib sheave to roll on the ground until the jib is past vertical. Lower the boom, slowly pushing the jib out in front of the fly. Lower the boom until the jib is in line with the fly. (See Fig. 4A-13).

### CAUTION

Do Not Bear Down On Jib With Boom When Jib Is Hanging Vertical And Jib Sheave Is On The Ground, Or The Jib May Be Damaged. Use A Hand Line To Pull The Jib Past Vertical.

8. Remove pin from hole G and place in hole H as in Fig. 4A-9.
9. Remove pins holding backstay and frontstay pendants in storage. Refer to Fig. 4A-12.

Note: Frontstay pendants can be stowed attached at both ends and backstay pendants can be stowed attached to equalizer beam with other end loose.

10. Pull backstay pendants from storage and lay out of way.
11. Pull frontstay pendants

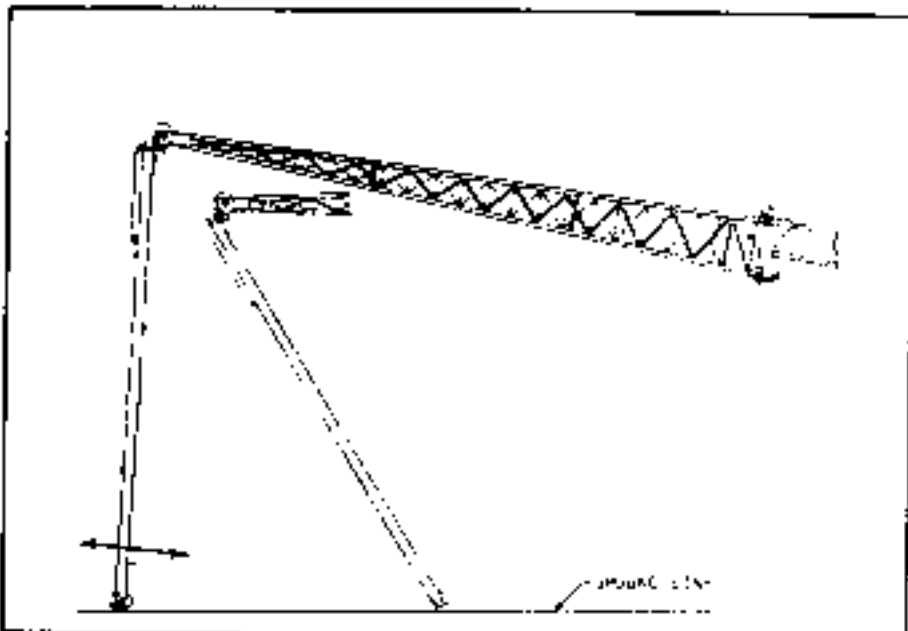


Fig. 4A-13  
Jib Erection Or Storage

12. Unpin jib mast. Put pins back into holes for storage. Refer to Fig. 4A-14.



Fig. 4A-12  
Pendant Storage

13. Pin equalizer beam into position for desired offset. Refer to Fig. 4A-7.
14. Connect hoist line to end hole in top bridle plate using pin that connects socket to hook block or

- ball.
15. Raise jib mast by slowly spooling hoist line onto drum until jib mast is near vertical.

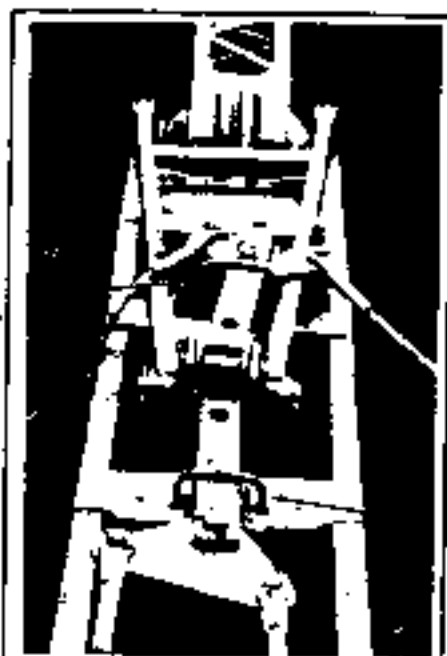


Fig. 4A-14  
Mast And Beam Storage

16. Fasten backstay pendants to lugs on boom head.
17. Spool out hoist line to

- allow enough slack to unpin hoist line.
18. Unpin hoist line from bridle. Reeve line over jib sheave.
  19. Return rope guard to operating position over hoist line by removing pin from hole K, pulling guard outward, turning to horizontal position and installing pin in hole J.
  20. Boom up for operating.
7. Leave frontstay pendants attached and stow in jib.
  8. Stow backstay pendants over frontstay pendants and secure with pins.
  9. Remove hoist line.
  10. Secure jib mast and bridle assembly to jib with pins.
  11. Remove pin from hole H and place in hole G.
  12. Raise boom up allowing jib sheave to roll on the ground until jib is past vertical. Slowly lower boom down pushing jib back towards the crane to a boom angle of approximately  $-5^{\circ}$ . See Fig. 4A-13.

**Jib Stowage From Working Position**

Use the following procedure to stow jib from the working position.

1. The machine must be on outriggers with the beams fully extended, leveled on properly supported pontoons, and all tires clear of any supporting surface. Extend the counterweight fully and position the boom over the rear.
2. With the boom over the rear and either power section extended approximately 2 feet, boom down until the jib sheave touches the ground.
3. Remove pin from hole J in jib sheave rope guard, turn the guard down and push in, insert pin in hole K.
4. Unfasten hoist line from hook block or ball and spool up enough to connect to bridle on mast using same pin as for hook block or ball. Spool up hoist line enough to relieve tension on backstay pendants.
5. Disconnect backstay pendants from boom head and lay out of way. Leave backstay pendants attached to equalizer beams.
6. Spool off hoist line slowly and allow jib mast to lower onto top of jib.

**CAUTION**

Do Not Bear Down On Jib With Boom When Jib Is Vertical And Jib Sheave Is On The Ground Or Jib May Be Damaged. If Necessary, Use A Hand Line To Pull Jib Past Vertical.

13. Attach winch cable to bracket on fly. Winch jib up to fly and fasten link lock.
14. Remove and stow pins at C and D.
15. Swing fly and jib around to right side of boom head.

**WARNING**

When Pins At C And D Are Removed From Lugs Connecting The Fly To The Boom Head, The Fly Can Swing Freely. Keep Area Between Fly And Right Side Of Boom Clear Of Personnel To Avoid Possible Injury. Use A Hand Line To Control Swing Of Fly.

16. Boom up to horizontal higher to slowly swing fly against side of boom. Retract boom slowly keeping storage pin on fly aligned with hole in front storage bracket. When boom is fully retracted, pin on fly should be through hole on front storage bracket and bracket on jib should be suspended from front storage bracket. Put keeper pin through hole of pin on fly, securing fly in storage bracket.
17. Remove pin from hole G and place in hole H.
18. Remove pins at A and B from fly and boom head connection.

**Traveling Machine With Erected Attachments**

A machine with no load may be traveled on the job site with:

1. The fly erected and all boom sections fully retracted.
2. The manual boom section fully extended and both boom power sections fully retracted.
3. The fly erected and the manual boom section fully extended and both boom power sections fully retracted.

**CAUTION**

Travel Is Not Permitted With The Jib Erected.

Travel is permitted on surface that is solid, smooth, and level. Speed is not to exceed 1MPH (1.6km/h.).

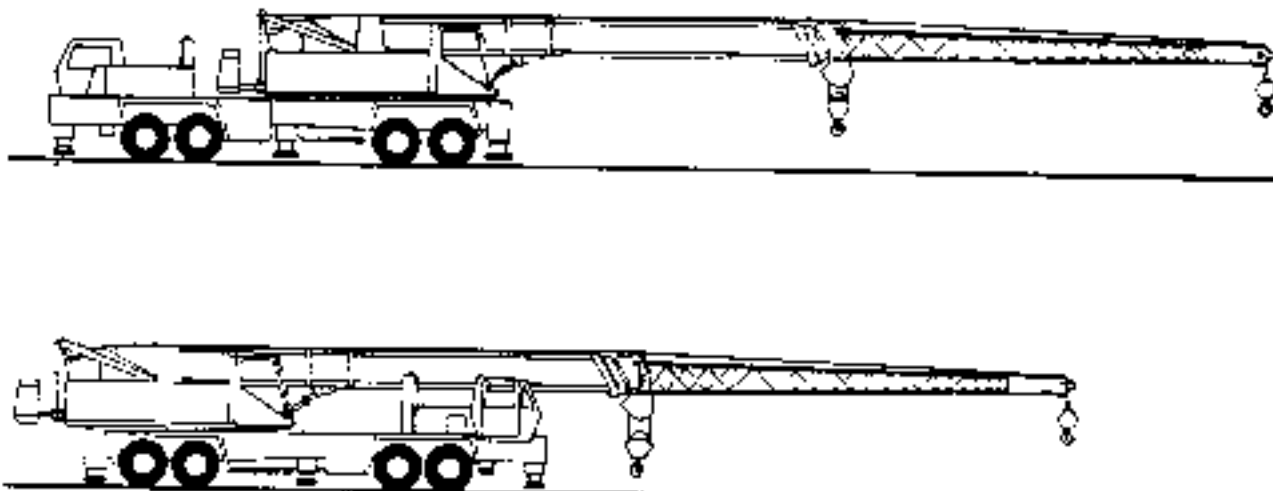


Fig. 4A-15  
Travel With Erected Attachments

## CAUTION

All Attachments Must Be Stowed For Speeds Greater Than 1MPH (1.6km/h.) Or If The Surface Is Not Solid, Smooth, And Level.

## WARNING

House Lock Must Be Engaged When Traveling Machine.

To travel machine with erected attachments over rear, proceed as follows:  
Refer to Fig. 4A-15.

1. Refer to Section 3 of the operator's manual or tire inflation decal and inflate all tires to pressures listed in the "Tire Inflation Chart" for 1MPH (1.6km/h.) maximum speed.
2. With machine setting level on fully extended outriggers and counterweight fully extended, retract boom sections completely.
3. Position upper facing

4. Boom down to horizontal (0° boom angle).
5. Retract all outrigger jacks just clear of ground, but leave beams fully extended.
6. Carefully travel machine at no more than 1MPH (1.6 km/h.). Take extra care due to the increased boom length and maintain a safe distance from all obstructions, structures, and power lines.
7. Level machine on outriggers before resuming operations.
8. Correct tire pressure prior to traveling faster than 1MPH (1.6km/h.).

Note: Refer to "Travel Speeds" on page 4A-11 to determine the 1MPH (1.6km/h.) travel speed.

To travel machine with erected attachments over front, proceed as follows:  
Refer to Fig. 4A-15.

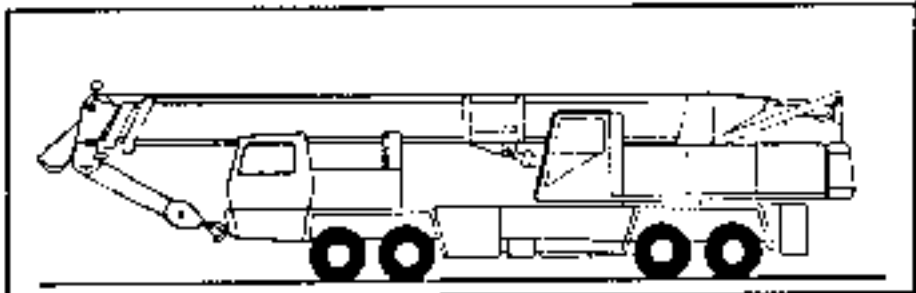
1. Refer to Section 3 of the operator's manual or tire

- inflation decal and inflate all tires to pressures listed in the "Tire Inflation Chart" for 1MPH (1.6km/h.) maximum speed.
2. With machine setting level on fully extended outriggers, and counterweight fully extended, retract boom sections completely.
3. Position upper facing directly over front and engage house lock.
4. Boom down to boom rest or until attachment is just clear of ground.

Note: The boom may be anywhere between 75° boom angle and horizontal. The lowest boom angle is recommended because the machine is most stable for traveling with lowered attachment.

5. Retract all outrigger jacks just clear of ground, but leave beams fully extended.
6. Carefully travel machine at no more than 1MPH (1.6 km/h.). Take extra care due to the increased boom





**Fig. 4A-16  
Road Travel**

length and maintain a safe distance from all obstructions, structures, and power lines.

7. Level machine on outriggers before resuming operations.
8. Correct tire pressure prior to traveling faster than 1MPH (1.6km/h.).

Note: Refer to "Travel Speeds" on page 4A-11 to determine the 1MPH (1.6km/h.) travel speed.

Travel Speeds

The 1MPH (1.6km/h.) maximum speed allowed for traveling with erected attachments can be obtained by shifting transmission into first gear and reading tachometer as follows:

HTC50W, 45W	-	900 RPM
HTC50	-	800 RPM
HTC35, 34	-	1000 RPM
HTC25, 20, 14	-	900 RPM

Preparing Machine For Road Travel

Before roading the machine, it is necessary to take certain precautions by performing the following: (Refer to Fig. 4A-16).

1. The jib or fly section must be stowed before traveling machine. Refer to stowage procedures earlier in this section.
2. Fully retract the boom.
3. Fully retract all out-

riggers and stow pontoons as explained in "Outrigger Operation" on page 1-10.

4. With the upper facing directly over the front, engage the house lock.
5. Boom down until the boom sets on the boom rest.
6. Secure the hook block to the carrier front bumper to prevent excessive swinging.
7. Fully retract the counterweight or remove it from the machine, as required.
8. All upper controls must be in their neutral positions clutches disengaged, and hoist brakes engaged, and latched.
9. Shut down the engine from upper and remove the key.
10. Close and latch upper windows and door. Lock the upper cab and house doors.
11. Disengage the main hydraulic pump as explained in "Engaging and Disengaging the Main Hydraulic Pump" on page 1-7.



## Operator's Manual Section 4 - Attachments

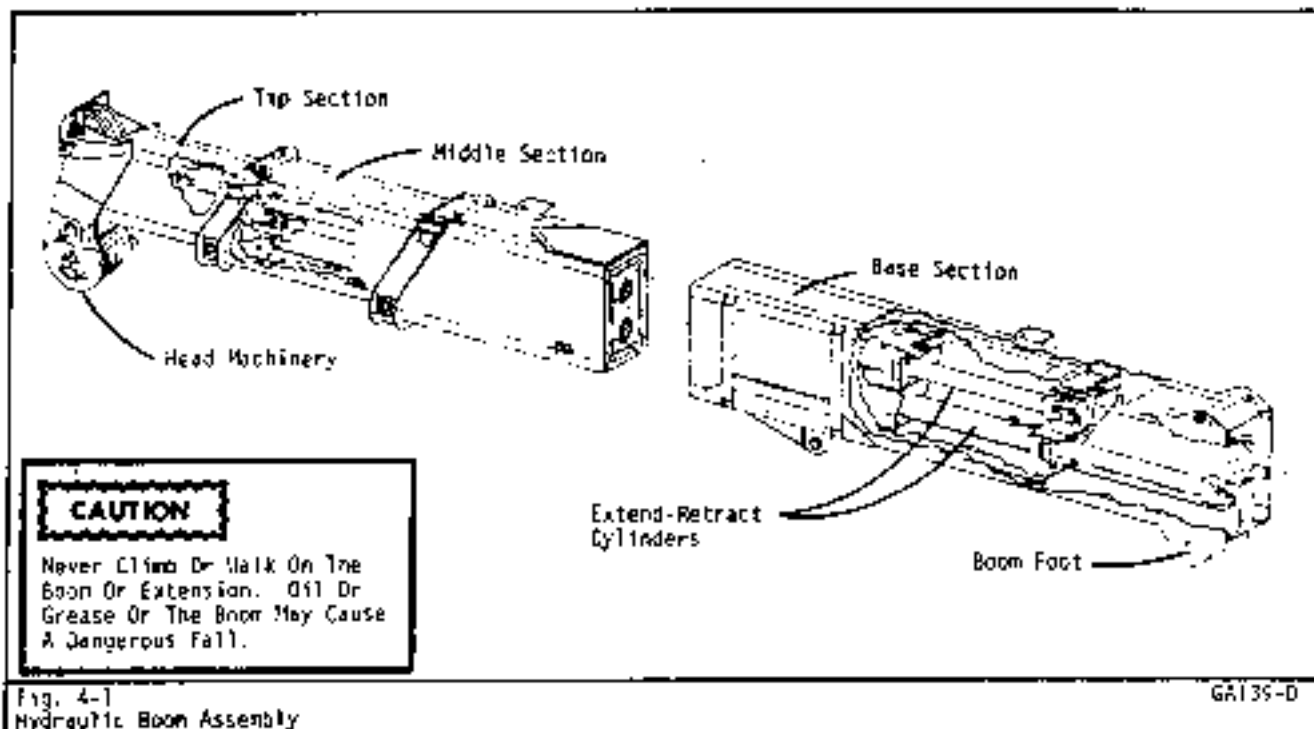


Fig. 4-1  
Hydraulic Boom Assembly

### Boom Assembly

The boom assembly consists of a base section and two telescoping power sections. The base section is anchored to the upper frame by one boom foot pin. The boom is raised and lowered by two hydraulic boom hoist cylinders.

The boom is extended and retracted by two extend-retract cylinders. The bottom cylinder is anchored between the base section and the middle boom section and will extend the middle boom section when operated. The top cylinder is anchored between the middle boom section and the tip boom section and will extend the tip boom section when operated.

Each boom section is individually controlled from the upper operator's cab. See Section 1 for operating instructions.

### Auxiliary Lifting Sheave

The optional auxiliary lifting sheave assembly is bolted to the end of the boom tip section. The auxiliary lifting sheave can be

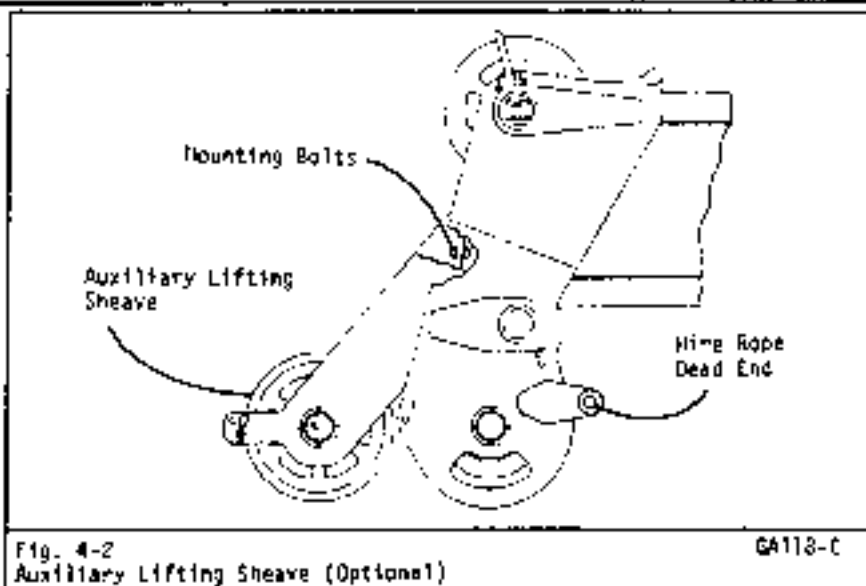
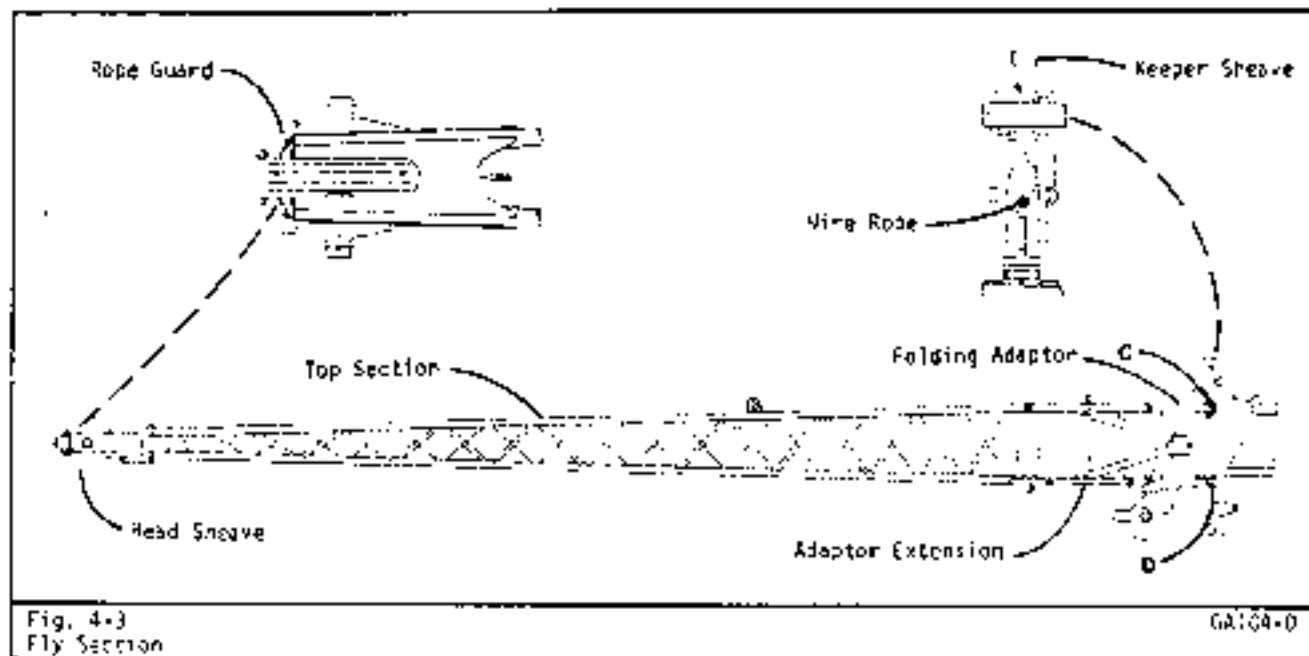


Fig. 4-2  
Auxiliary Lifting Sheave (Optional)

reeved with one or two parts of line. See reeving diagrams later in this section.

Once installed, the assembly may be left in place and will not interfere with fly or jib erection, stowing, or any other operation.

Note: The auxiliary lifting sheave extends the effective boom length by 24" (610mm). This must be taken into consideration when figuring lifting capacities for loads raised with the auxiliary lifting sheave.



### Fly Section

The fly section is a cantilevered boom extension that is attached to the boom head. The fly is a three-piece unit consisting of the top section, adaptor extension and the folding adaptor. Refer to Fig. 4-3. These three pieces are also used to erect the optional pendant supported jib attachment (see page 4-4).

The hoist line must pass between the keeper sheave and the center idler sheave of the boom head. The head sheave rope guard must be pinned in place to hold the hoist rope on the sheave while operating. Refer to Fig. 4-3.

The fly section may be stowed on the right side of the boom base section. Refer to "Stowing The Fly Section".

**Note:** Do not pick any loads with the fly while on tires. Level the machine on outriggers before operating.

### Installing The Fly Section

To install the fly section on machine, use the following procedure:

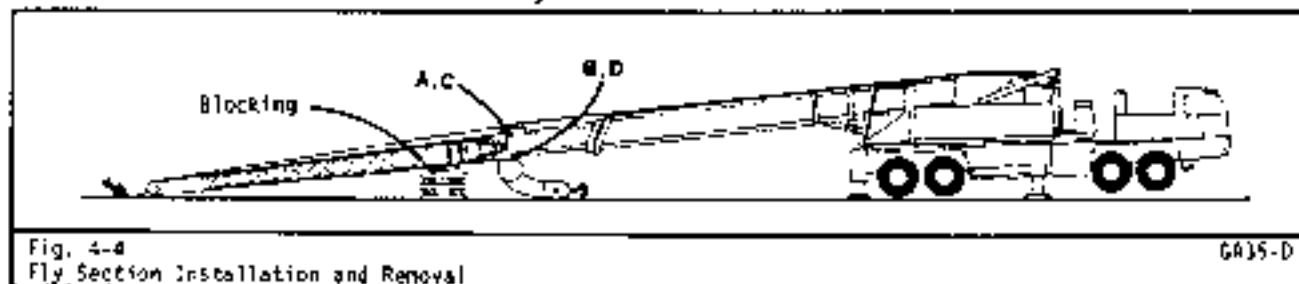
- Level the machine on fully extended outriggers, upper facing over rear. (House lock engaged.)
- Securely block up the fly section as shown in Fig. 4-4.
- Remove the hoist rope from the auxiliary lifting sheave, if so equipped, and move the rope out of the way.
- Lower, and extend the boom to engage the four lugs on the folding adaptor with the lugs on the boom head. Install the four pins and keepers at A, B, C, and D. Refer to Fig. 4-4.

- Install the keeper sheave and reeve the hoist rope between it and the boom head idler sheave. Pin the rope guard over the hoist rope to keep the rope on the sheave. Refer to Fig. 4-3.

### **CAUTION**

When Operating With The Fly Section, The Tip And Middle Boom Sections Must Be Equally Extended At All Times.

The Counterweight Must Always Be Extended When Operating The Upper.



## Operator's Manual Section 4 - Continued - Attachments

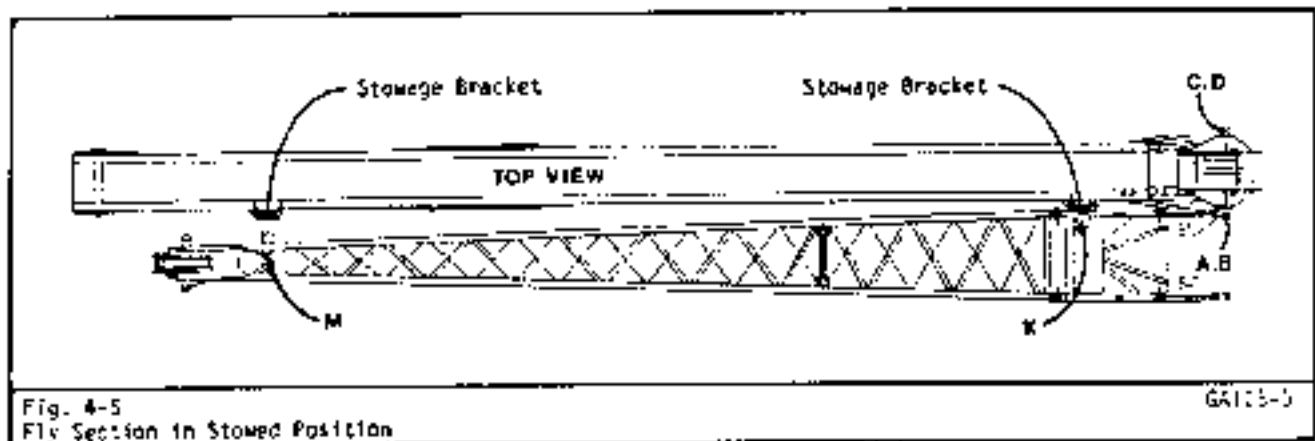


Fig. 4-5  
Fly Section in Stowed Position

GA105-5

### Stowing The Fly Section

To stow the fly section on the right side of the boom base section, proceed as follows:

- The machine must be level on fully extended outriggers, and facing over the rear of carrier. (House lock engaged.)
- Fully retract the boom and lower it to horizontal (0° boom angle). Remove the rope guard and keeper sheave. Remove the hoist line from the fly and move it out of the way.
- Remove the two pins at "C" and "D" securing the fly section to the boom left side. Refer to Fig. 4-3.
- Swing the fly section around, by hand, into the storage brackets on the base boom right side. Boom up slightly to assist sliding the fly section into the storage brackets.

Note: Do not boom up until the fly is bearing against the storage brackets.

- Secure the fly section to the storage brackets with pins and stowing block at "K" and "M". Secure all pins with keepers. Refer to Fig. 4-5.

Note: The stowing block must be used at "M" or possible damage to the fly may occur.

- Remove pins at "A" and "B" and stow the pins on the folding adaptor.

### CAUTION

Pins At "A" And "B" Must Be Removed Before Extending The Boom Or Damage Will Occur To Fly Section And/Or Boom. Never Remove Pins At "A" And "B" Unless The Fly Section Is Secured By Pins "K" And "M".

- Reeve the hoist line on the auxiliary lifting sheave or spool onto drum as desired.

### Erecting The Fly Section

To erect the fly section from the stowed position, proceed as follows:

- The machine must be level on fully extended outriggers, and facing over the rear of carrier. (House lock engaged.)
- Fully retract the boom and lower it to horizontal (0° boom angle). Install pins and keepers at "A" and "B". Refer to Fig. 4-5.
- Remove the hoist line from the auxiliary lifting sheave, if so equipped, and move the rope out of the way.
- Remove the stowing pins at "K" and "M" securing the fly section to the storage brackets.

### CAUTION

Do Not Remove Pins At "K" And "M" Until The Fly Section Is Supported By Pins At "A" And "B".

- Swing the fly section around, by hand, until the fly section lugs align with the boom head lugs at "C" and "D". Install pins and keepers. Refer to Fig. 4-3.
- Install the keeper sheave and reeve the hoist rope between it and the boom head idler sheave. Pin the rope guard over the hoist rope to keep the rope on the sheave.

### Removing The Fly Section

To remove the fly section from machine, use the following procedure.

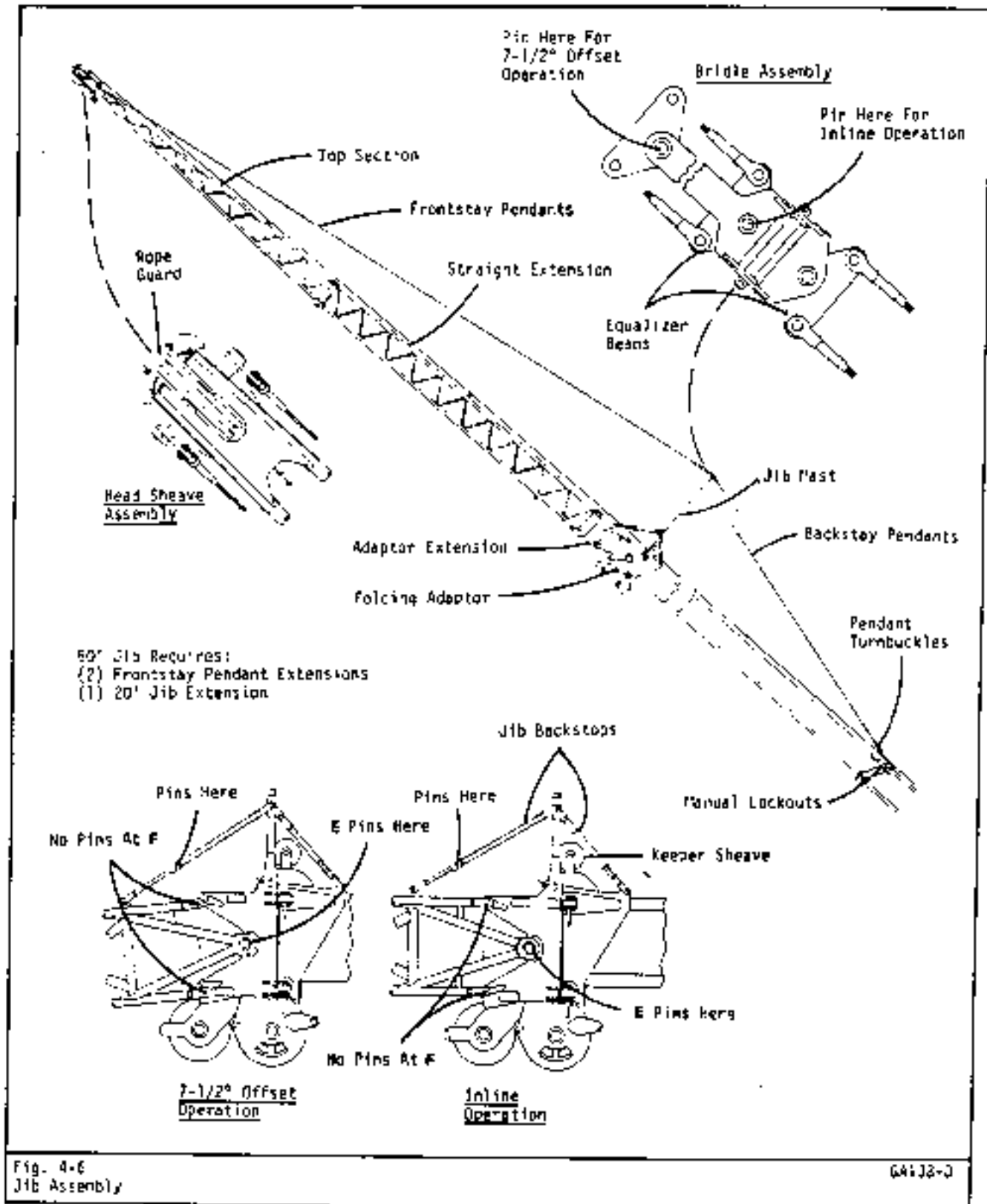
- Level the machine on fully extended outriggers, upper facing over rear. (House lock engaged.)
- Fully retract the boom middle section and extend the tip section approximately 6 ft. (1.83m).
- Boom down until the fly head sheave rests on the ground.

Note: The machine may be tilted to the rear by lowering the rear outrigger jacks, or raising the front jacks to enable the fly head sheave to rest on the ground.

- Securely block under the fly section as shown in Fig. 4-4.
- Remove the four pins at "A", "B", "C", and "D" only after the fly section is firmly supported. Retract the boom tip section.

4

## Operator's Manual Section 4 - Continued - Attachments



## Operator's Manual Section 4 - Continued - Attachments

### Jib Assembly

The jib assembly consists of a top section, one straight extension, a folding adaptor, and the adaptor extension. The top section, folding adaptor, and adaptor extension are fly section components. In the erected position, the jib is supported by four wire rope pendants. Refer to Fig. 4-6. The front-stay pendants pin between the head sheave shaft and the bridle assembly equalizer beam. The backstay pendants pin between the bridle assembly and the boom center section.

During operations, the jib pivots on the two pins at "F". The four pins at "F" must be removed before operating and only after checking pins at "E" for proper installation.

The jib may be erected in either of two positions: the inline, or the 1-1/2 degree offset. To change the jib from the inline to the offset position, re-pin the adjustable equalizer beam as shown in Fig. 4-6.

Note: All rope guards on the boom and jib must be in position prior to operating.

### Manual Lockouts

The boom tip section must be fully extended when operating with the jib. Manual lockouts are provided on both sides of the boom middle section to prevent accidental retraction of the tip section. Refer to Fig. 4-8.

#### To Engage Lockouts:

- With boom horizontal and upper facing over the rear, fully extend the tip section.
- Remove pin "P" and swing the latch in, against the boom.

- Re-insert pin "P" to secure the latch in the engaged position.

#### To Disengage Lockouts:

- With boom horizontal and upper facing over the rear, fully extend the tip section.
- Remove pin "P" and swing the latch out, away from the boom.
- Re-insert pin "P" to secure the latch in the disengaged position.

### **CAUTION**

The Manual Lockouts Must Be Engaged For All Jib Operations Or Jib May Collapse.

### Pendant Turnbuckle Adjustment

Both backstay pendants are equipped with a turnbuckle for adjusting the pendant lengths. The turnbuckles need only an initial adjustment for length. The correct pendant length is determined by the alignment of lugs at "F" in Fig. 4-6.

#### To Adjust Pendants:

- Erect the jib in the inline position.
- With the jib head sheave clear of ground, the holes at "F" must align.
- Remove the cotter pins and loosen jam nuts on the turnbuckles. Refer to Fig. 4-7.
- Adjust the turnbuckles evenly until the holes at "F" are aligned. The jib weight must be supported by the pendants alone.

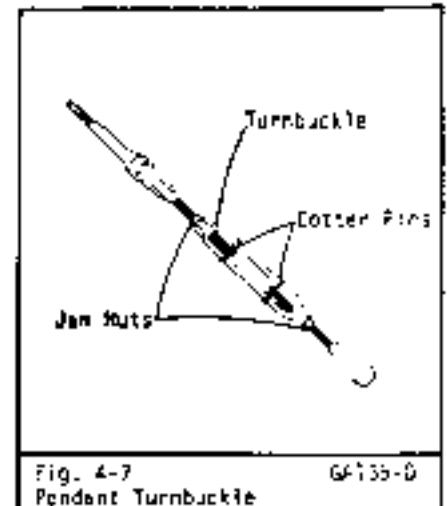


Fig. 4-7  
Pendant Turnbuckle GA:35-D

- After the adjustment, lighten the jam nuts and replace the cotter pins. Wrap the end of each cotter pin around the turnbuckle to prevent it from backing out.

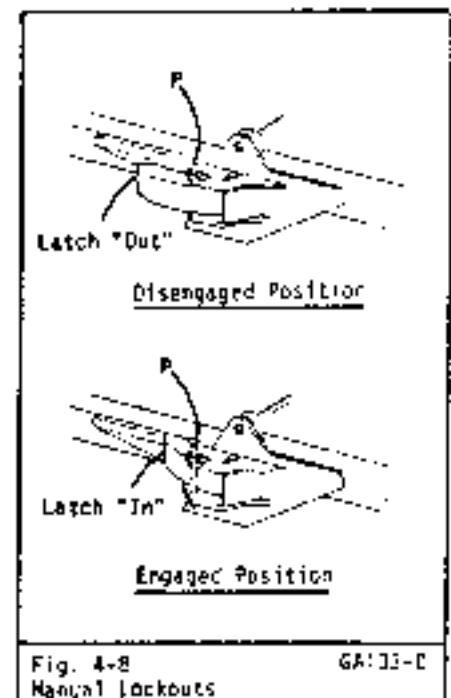


Fig. 4-8  
Manual Lockouts GA:33-D

## Operator's Manual Section 4 - Continued • Attachments

Remove Hoist Line



Fig. 4-9  
Fly Section Removal

GA35-0

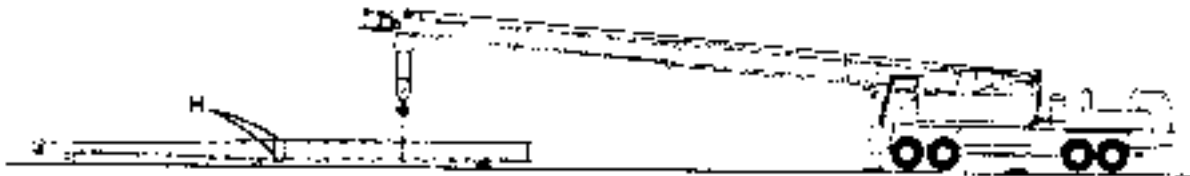


Fig. 4-10  
Adding Jib Extension

GA35-0



Fig. 4-11  
Jib Alignment

GA35-0



Fig. 4-12  
Attaching The Jib

GA35-0



## Operator's Manual Section 4 - Continued - Attachments

For additional steps on jib erection see "Jib Erection" below.

For additional steps on jib stowage see "Jib Stowage" below.

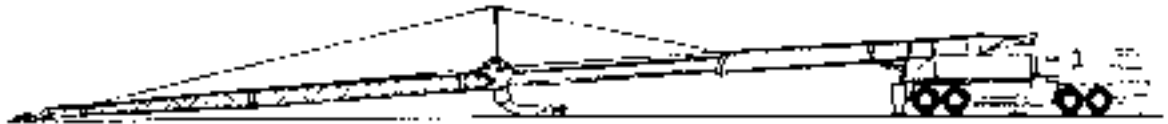


Fig. 4-13  
Further Jib Erection

GA35-E

### Interchange Sequence - Fly Section To JIB Assembly

The machine must be setting on fully extended outriggers with the counterweight fully extended. The upper must be facing directly over the rear of carrier with the house lock engaged.

**Step 1:** Extend the boom about 4 Ft. (1.2m) and boom down completely. Lower the rear outrigger jacks until the head sheave rests on the ground. Remove the fly hoist line.

**Step 2:** Position stable blocking as shown in Fig. 4-9 to support the rear end of the top section. Blocking must be positioned forward of the pins at "G".

#### CAUTION

The Fly Can Fall When Pins Are Removed. Do Not Remove Pins Until The Fly Is Supported By The Head Sheave And Secure Blocking.

**Step 3:** Remove the four pins at "G" and carefully retract the boom away from the top section.

#### CAUTION

Care Must Be Taken Not To Pull Or Knock The Top Section From Blocking. Serious Injury Or Damage May Result.

**Step 4:** Level the machine. Using the main hoist, raise the rear end of the top section and re-block level as shown in Fig. 4-10.

**Step 5:** Position the jib extension in place as shown and install the four pins at "H". Secure all pins with keepers.

**Step 6:** Reposition the assembled jib on blocking about 35 Ft. (10.7m) from carrier. Refer to Fig. 4-11. The jib assembly bottom lugs should be about 48" (1.2m) from the ground.

**Step 7:** Retract the boom clear of the jib assembly and boom down completely. Line up the boom with the jib assembly by raising or lowering the front outrigger jacks. Extend the boom carefully to engage the top lugs at "G". Install pins and keepers.

**Step 8:** Raise the boom slightly to engage the bottom lugs at "G". Refer to Fig. 4-12. Make certain of proper pin installation at "E" to support the jib. Level the machine on outriggers.

#### CAUTION

No Picks Should Be Made With The Jib In This Position. Refer To The Following Procedures To Further Erect Or Stow The Jib Assembly.

### Jib Erection

The jib assembly may be further erected from this position. Refer to "Jib Erection From Stowage" (early models), step (10) on page 4-20 for additional steps.

### Jib Stowage

The jib assembly may be stowed from this position. Refer to "Jib Stowage From Working Position" (early models), step (8) on page 4-22 for additional steps.

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## Operator's Manual Section 4 - Continued - Attachments

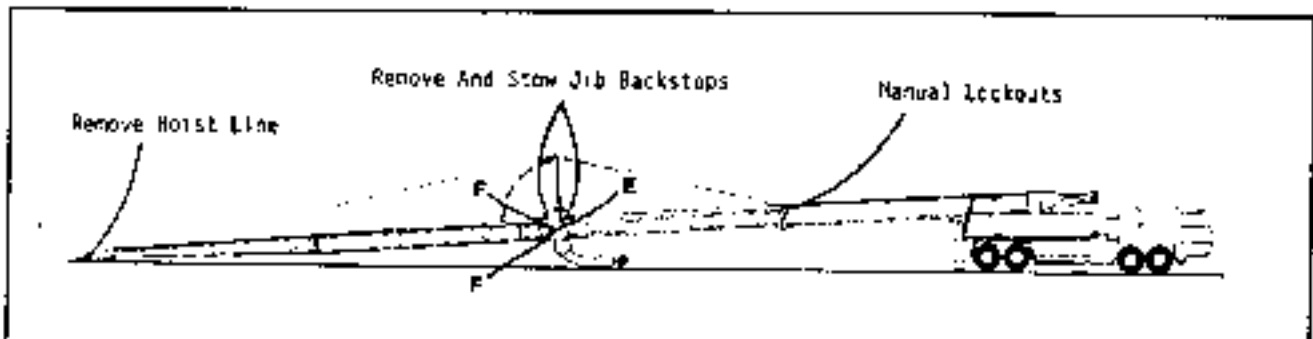


Fig. 4-14  
Installing Pins "F"

GA35-D

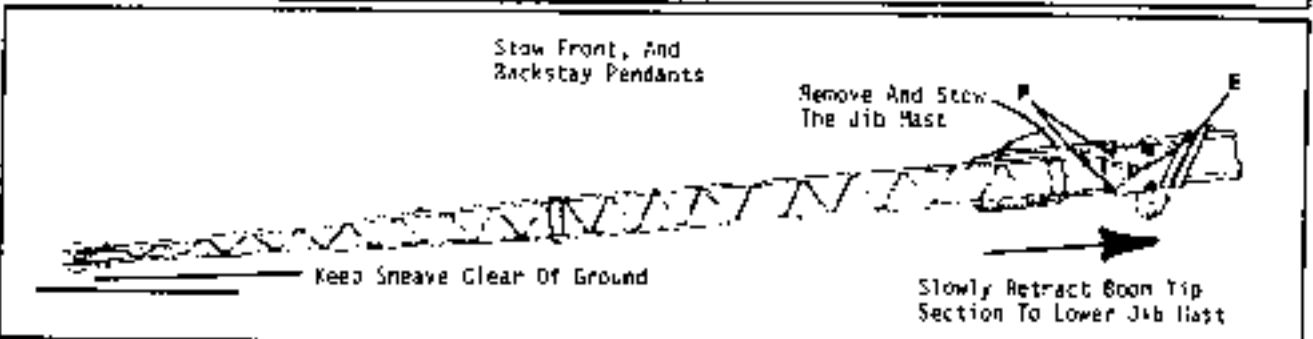


Fig. 4-15  
Retracting Tip Section

GA35-D

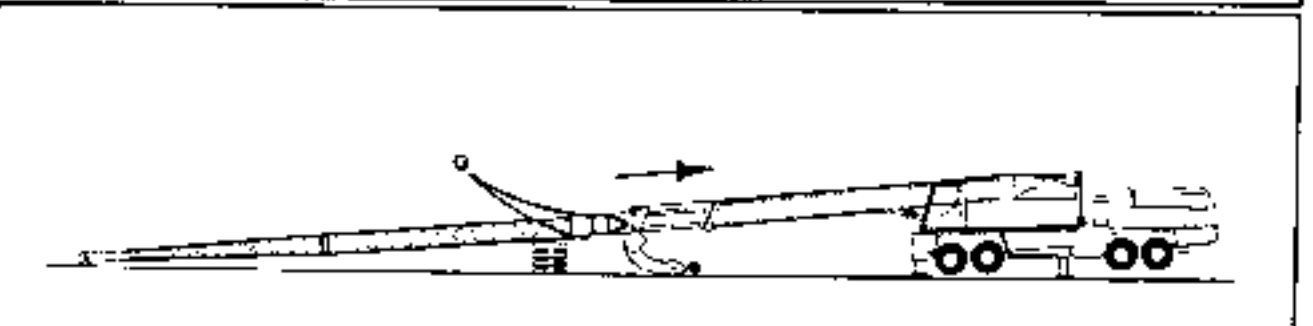


Fig. 4-16  
Disconnecting Jib Extension

GA35-D

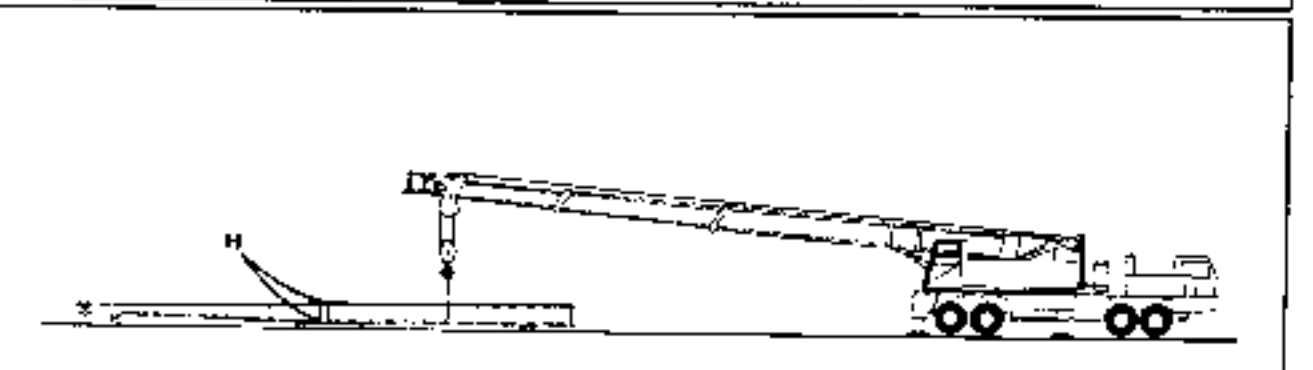


Fig. 4-17  
Extension Removal

GA35-D

## Operator's Manual Section 4 - Continued - Attachments

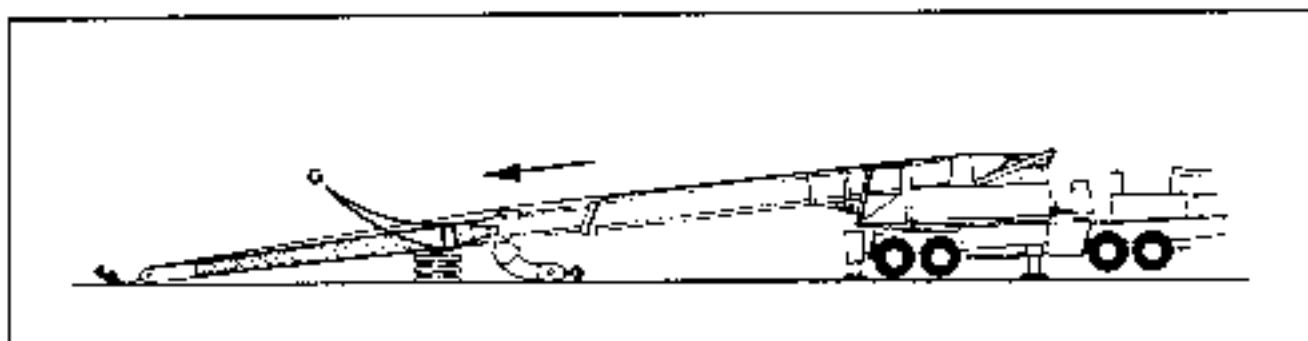


Fig. 4-18  
Attaching Top Section

6435-D

### Interchange Sequence - Jib Assembly To Fly Section

The machine must be level or fully extended outriggers with the counterweight fully extended. The upper must be facing directly over the rear of carrier with the house lock engaged.

Step 1: Fully retract the boom middle section. Boom down until the jib nears ground. Swing back the rope guard on the head sheave and pin in place. Remove the jib hoist rope and move it out of the way. Carefully boom down until the jib head sheave rests on ground and the pendants become slack. Remove and stow the jib backstops. Boom up or down slightly to align lugs at "F" and install the four pins and keepers. Pins at "E" need not be removed. Refer to Fig. 4-14.

Note: The machine may be tilted slightly to the rear by lowering the rear outrigger jacks or raising the front. Booming down or adjusting the outrigger jacks should be done carefully as the head sheave rests gently on ground. Do not bear down hard or damage may result.

Step 2: Fully extend the boom tip section and disengage the manual lock-outs on the boom middle section.

Step 3: Slowly retract the boom tip section keeping the jib head sheave clear of ground. The mast will lower onto the jib as the tip section retracts. Refer to Fig. 4-15.

Step 4: Disconnect the front, and backslay pendants and stow. Stow the jib mast.

Step 5: Remove the lower pins at "G". Refer to Fig. 4-16 and construct blocking that is secure and stable.

**CAUTION**

Care Must Be Taken Not To Pull Or Knock The Top Section From Blocking. Serious Injury Or Damage May Result.

Boom down slowly allowing the jib extension to rest on blocking.

Step 6: Remove the top pins at "G" and retract the boom tip section. Level the machine. Using the main hoist, raise the rear end of the jib extension and re-block level as in Fig. 4-17.

Step 7: Make certain of stable blocking and remove pins at "M". Remove the jib extension and set aside.

Step 8: Reposition the top section on blocking as shown in Fig. 4-18. The bottom lugs at "G" should be about 30' (9.0m) off the ground and 20 ft. (6.1m) from the rear of carrier.

Step 9: Boom down completely. Line up the boom with the fly top section by raising or lowering the front outrigger jacks. Extend the boom carefully to engage the top lugs at "G". Install pins and keepers.

Step 10: Raise the boom slightly to engage the bottom lugs at "G". Install pins and keepers.

Note: The fly section can be stowed from this position. Refer to "Stowing The Fly Section" on page 4-3 for correct procedure.

Step 11: Reeve the fly section hoist line to the head sheave and pin the rope guard in place. The fly section is ready for operations.

4

## Operator's Manual

### Section 4 - Continued - Attachments

#### Quick Jib Erection (Later Models)

The machine must be level on fully extended outriggers, and with counterweight fully extended. Proceed as follows:

- Step 1: Fully retract both boom sections and lower the boom to horizontal.
- Step 2: Refer to Fig. 4-19. Use binder provided on boom head to line up pin holes. Install pins and keepers at "A" and "B" to connect the jib to boom. Pins are stored on the folding adaptor.

#### CAUTION

Do Not Extend The Boom With Pins At "A" And "B" Installed, And Storage Bracket Pins In Place, Or Damage May Occur To The Boom, Jib, Or Storage Brackets.

- Step 3: Remove pins at "K" and "L" that hold the jib in the storage brackets.
- Step 4: Swing the folded jib around to align with the boom head. Install pins and keepers at "C" and "D" to secure jib to left side of boom head as in Fig. 4-20.
- Step 5: Place cribbing adjacent to the roller as in Fig. 4-21.

#### CAUTION

Care Must Be Taken To Prevent The Jib Top Section From Slipping Off Cribbing Because Lattice Or Jib Peak May Be Damaged.

All Bearing Pressure Must Be On The Chords And Not On The Lattice. Serious Damage And Reductions In Capacity May Result If Lattice Is Bent Or Bent.

Cribbing Must Be Approximately 30" (.76m) Across To Assure All Contact Is On The Chords.

Cribbing Must Be Wood Or Other Soft Material To Prevent Damage To The Chords.

Note: The jib chords are the outside larger diameter members that run lengthwise.

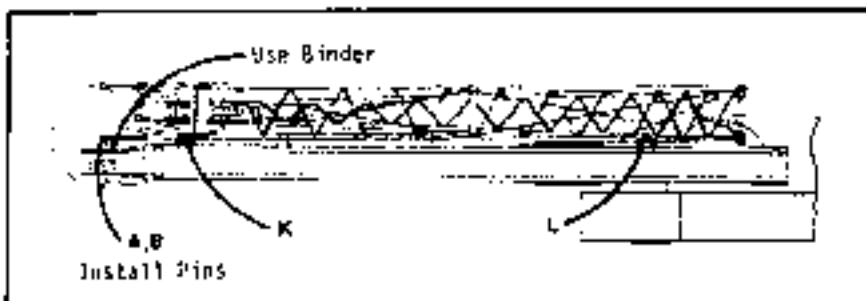


Fig. 4-19  
Disconnecting Storage Brackets

GA444-D

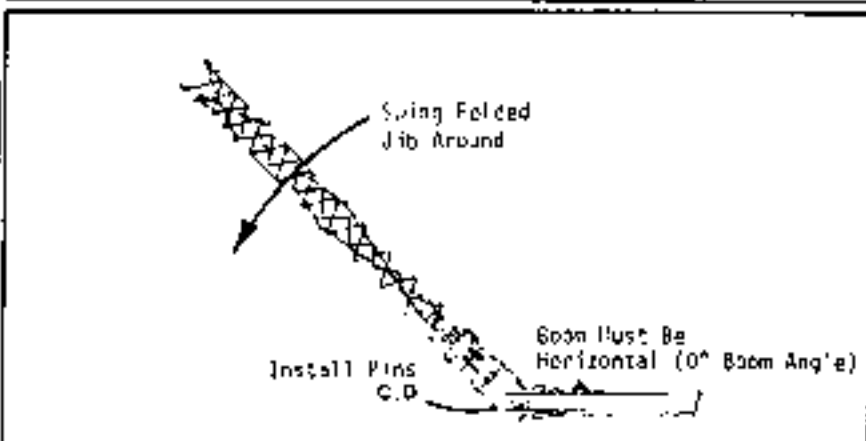


Fig. 4-20  
Swinging Jib Into Position

GA444-D

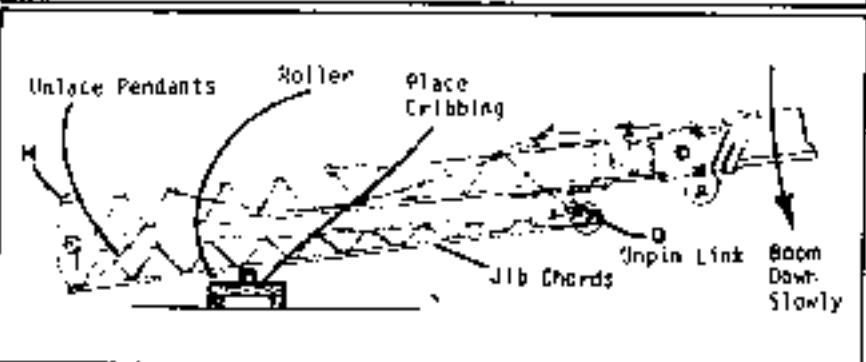


Fig. 4-21  
Disconnecting Folding Link

GA631-D  
GA451-C

- Step 6: Unlace backstay pendants from the straight extension & pin the turn-buckle ends to the lugs on top of the middle section and secure with keeper pins.

- Step 7: Remove pins at "H" and unlace forestay pendants. Let forestay pendants hang over the side of jib so they do not catch on jib, or obstructions.

- Step 8: Boom down on cribbing until link at "D" can be removed.

#### CAUTION

Take Care Not To Force The Jib Top Section Into The Under Side Of The Straight Extension Or Damage May Result.

## Operator's Manual Section 4 - Continued - Attachments

Step 9: Boom up slowly allowing the jib peak to gently lower onto ground. Remove the cribbing and continue booming up until the jib top section rolls into vertical position and is suspended above the ground as in Fig. 4-22.

### CAUTION

Do Not Bear Down On Jib With Boom When Jib Is Hanging Vertical, And Jib Sheave Is On Ground. Jib May Be Damaged.

Step 10: Swing jib top section forward of vertical and carefully boom down until jib sheave rests on ground as in Fig. 4-23. Continue booming down taking care that jib sheave rolls smoothly until lugs at "H" engage.

### CAUTION

Do Not Bear Down On Jib After Lugs At "H" Have Come Into Contact Because Lattice Or Jib Sheave May Be Damaged.

Install pins at "H" and secure with keeper pins. Remove pin securing the jib mast in the stowed position. Refer to Fig. 4-24.

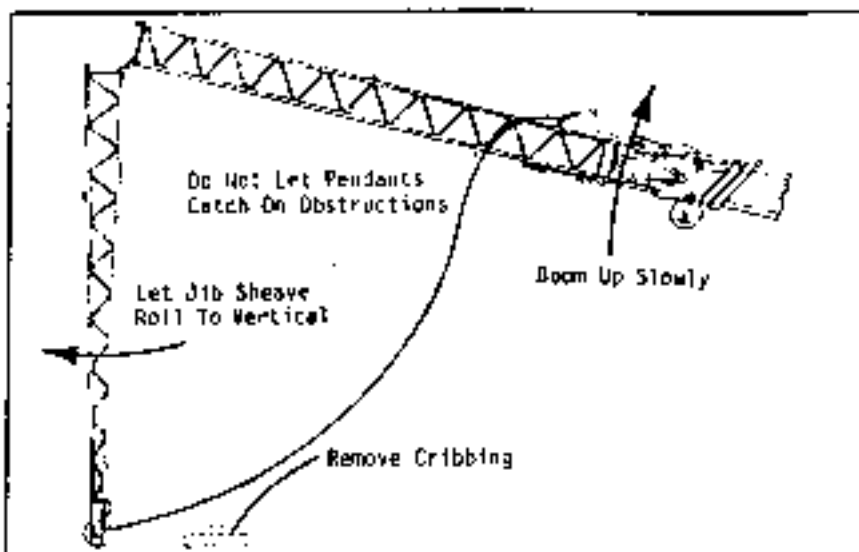


Fig. 4-22 Letting Jib Peak Hang Vertical

GAE31-C  
GAE51-C

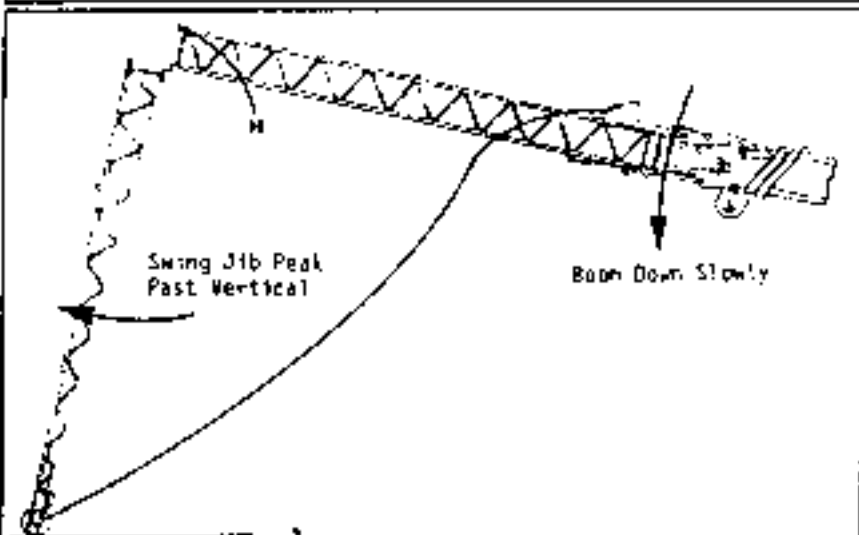


Fig. 4-23 Jib Folding

04451-E

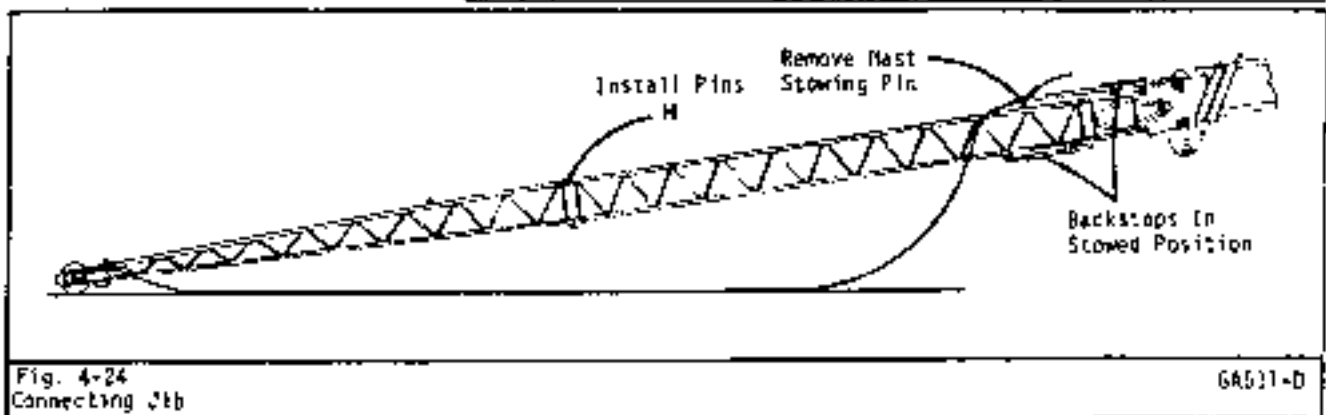


Fig. 4-24 Connecting Jib

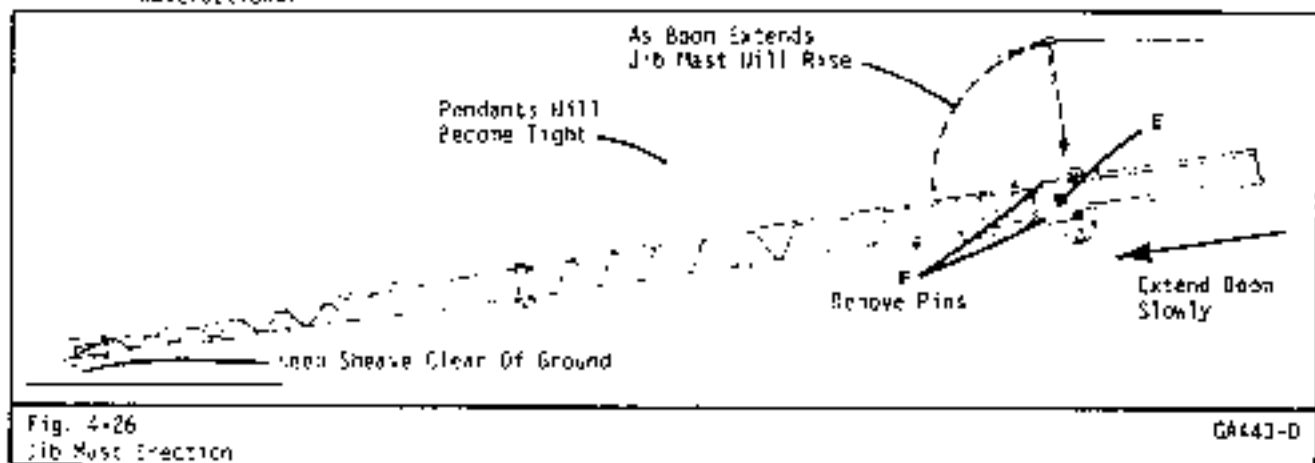
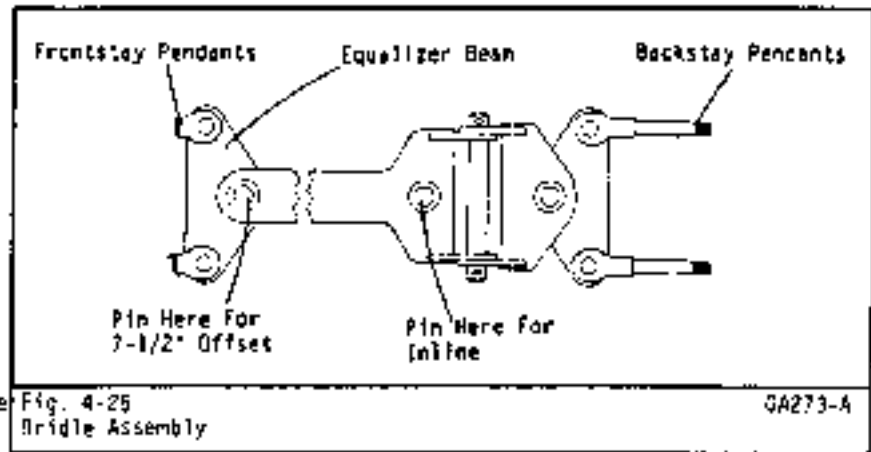
GAE31-D

## Operator's Manual

### Section 4 - Continued - Attachments

Step 12: Pin adjustable equalizer beam to the bridle assembly in either the inline or the 7-1/2° offset position, Fig. 4-25.

Step 13: Extend boom tip section keeping the jib sheave off the ground. Jib mast will raise into the working position as backstay pendants draw tight. Refer to Fig. 4-26. Exercise caution that jib pendants & jib mast do not catch on any obstructions. Do not force the jib sheave against any obstructions.



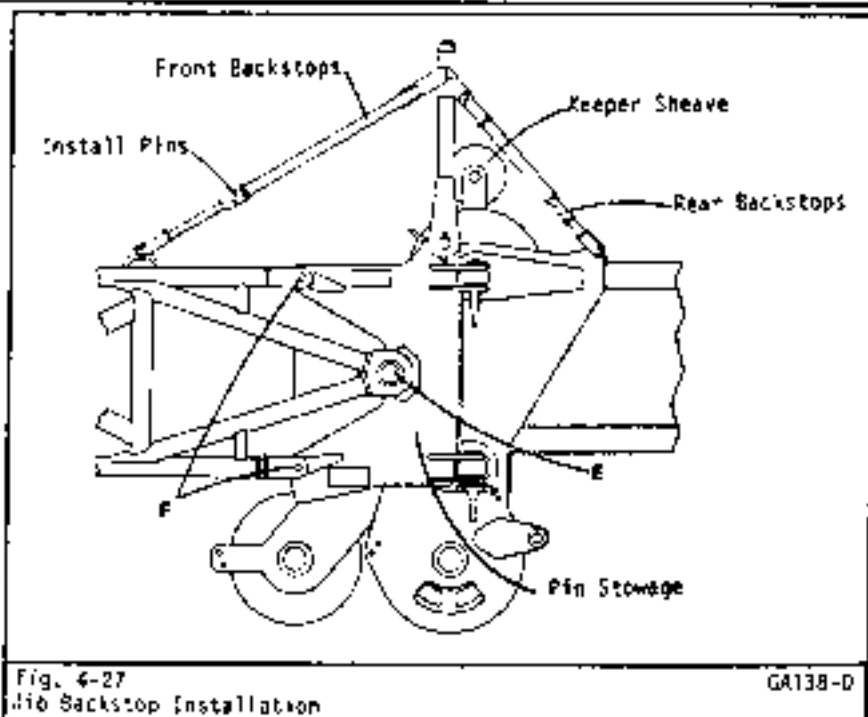
Step 14: Remove the four pins at "P" and stow on the following adapter.

### CAUTION

Pins At "E" Must Be In Place Before Removing Pins At "P". Pins At "F" Must Be Removed Before Operating Or Jib May Collapse.

Step 15: Remove backstops from storage position and pin into working position as in Fig. 4-27.

Step 16: Refer to Fig. 4-28. With tip section of boom fully extended, remove pins at "P" from both lockout mechanisms. Swing lockout arms into engaged position behind stops on boom tip section. Replace pins at "P" behind lockout arms to hold arms in against boom. Replace both keeper pins.



## Operator's Manual Section 4 - Continued - Attachments

- Step 17: Reeve hoist rope between keeper sheave and deflector sheave and over jib sheave. Swing jib sheave rope guard into position over rope and pin.
- Step 18: With middle boom section completely retracted, boom up into working position.

### CAUTION

Do not raise boom from horizontal position unless boom middle section is fully retracted. A tipping condition may result. The machine must be level on fully extended outriggers, and fully extended counterweight before raising boom.

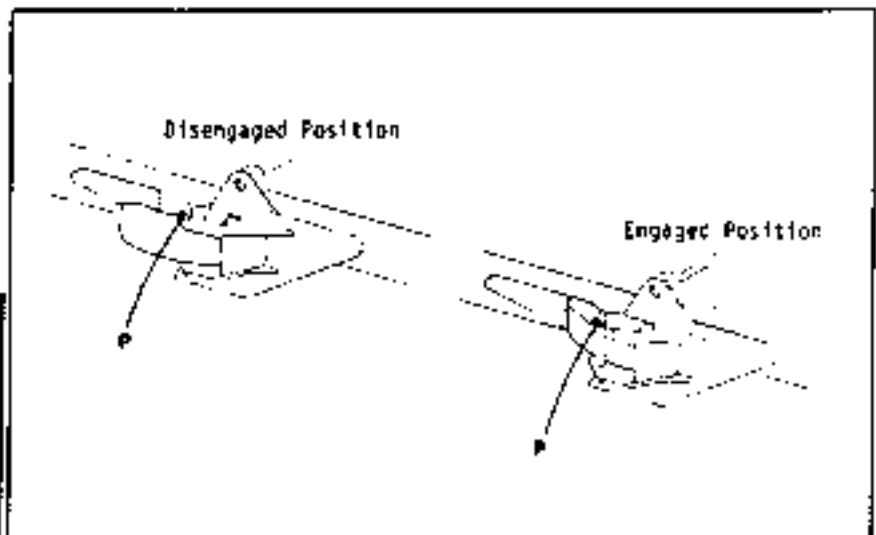


Fig. 4-28 Engaging Manual Lockouts

G4139-1

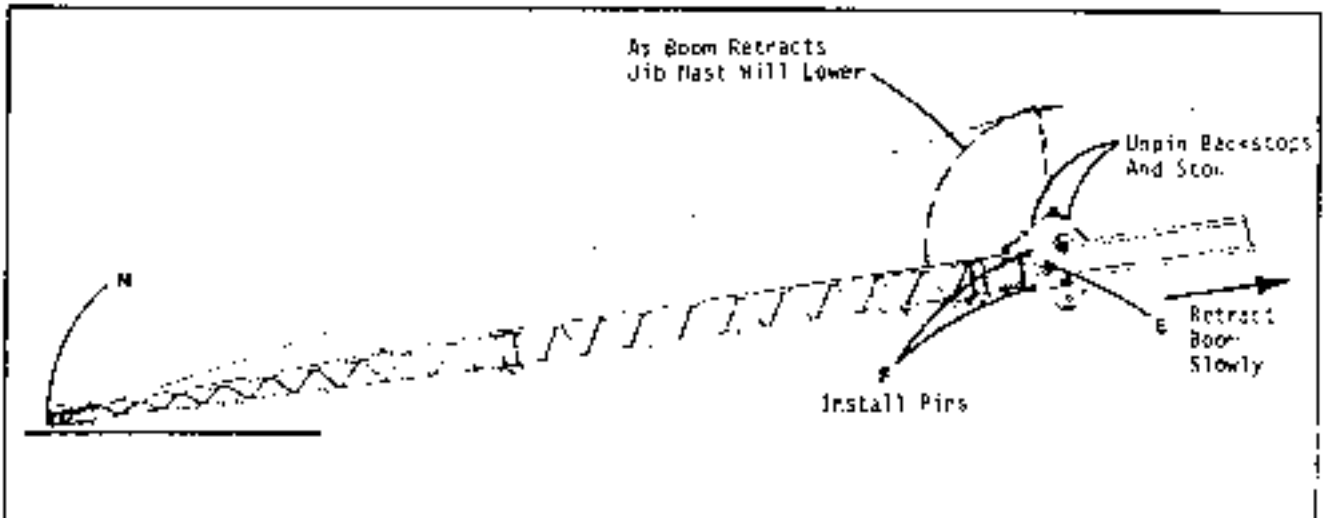


Fig. 4-29 Starting Jib Stowage

G4443-0

### Quick Jib Stowage (Later Models)

The machine must be level on fully extended outriggers, extended counterweight, and facing over the rear. Proceed as follows:

- Step 1: Fully retract the boom middle section and slowly boom down until the jib head sheave touches the ground. Make sure jib hoist rope is not under the jib peak. Refer to Fig. 4-29.
- Step 2: Install pins and keepers at "F". Pins at "E" need

- not be removed.
- Step 3: Remove pin "M", swing back sheave guard, and lock with hitch pin. Move jib hoist rope out of the way.
- Step 4: Disengage manual lockouts at the top of the boom middle section. Refer to Fig. 4-28.
- Step 5: Unpin rear backstops and swing up to the stowed position on the jib mast. Take front backstops off and stow on the under side of the straight

- extension.
- Step 6: Retract the boom tip section slowly until the jib mast rests on top the straight extension. Refer to Fig. 4-30.

**Note:** Keep jib peak just clear of the ground and avoid catching on structures or obstructions.

Pin jib mast to the straight extension.

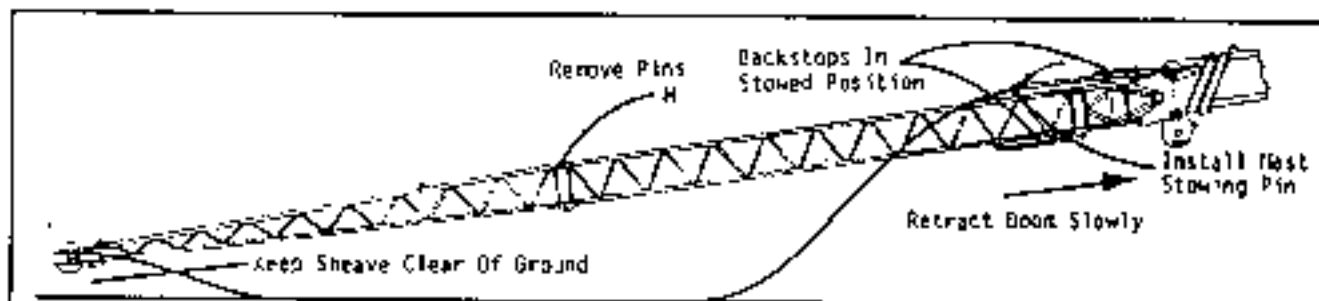


Fig. 4-30  
Jib Mast Stowage

GA631-D

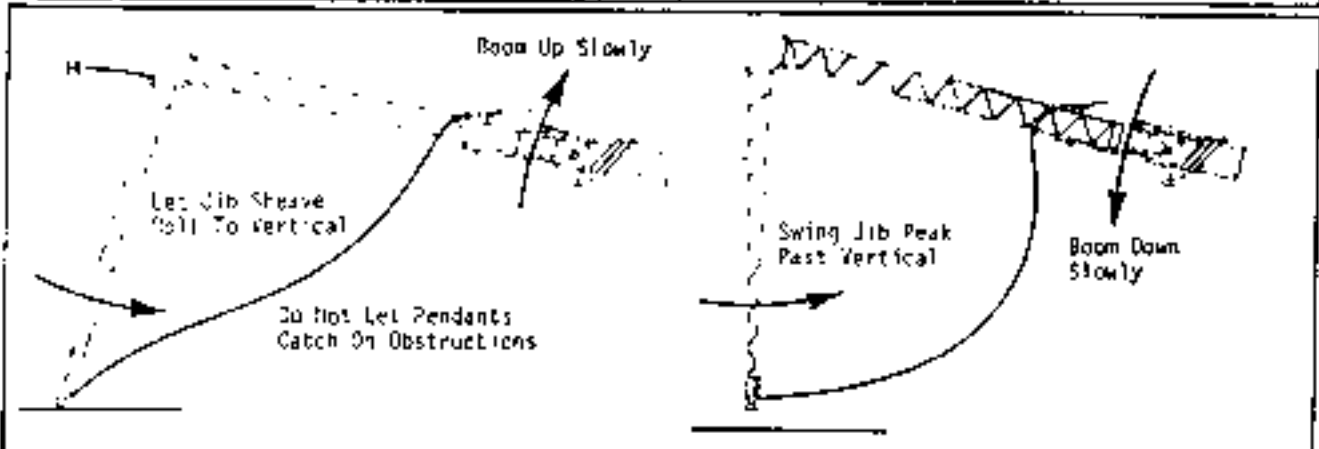


Fig. 4-31  
Folding Jib Top Section

GA451-C  
GA631-D

Step 7: Boom down slightly to take load off top pins at "H" and remove them.

### CAUTION

Do Not Remove Bottom Pins At "H" Or Jib May Collapse. Do Not Stand Under The Jib At Any Time.

Step 8: Refer to Fig. 4-31 & 32. Boom up letting the jib sheave roll on ground until the jib top section is hanging vertical.

### CAUTION

Do Not Bear Down On Jib With Boom When Jib Is Hanging Vertical And Jib Sheave Is On The Ground. Jib May Be Damaged.

Step 9: Swing the top section rearward of vertical and carefully boom down until boom is horizontal (0° boom angle).

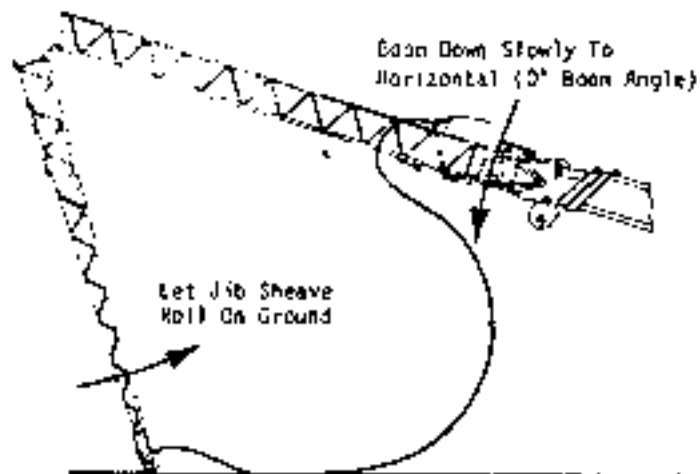


Fig. 4-32  
Folding Jib Top Section

GA631-D



## Operator's Manual

### Section 4 - Continued - Attachments

Step 10: Place cribbing adjacent to the roller as in Fig. 4-33.

#### CAUTION

Care Must Be Taken To Prevent Having The Jib Peak Slip Off Cribbing. The Chords, Or Lattice May Be Damaged.

All Bearing Pressure Must Be On The Chords And Not On The Lattice. Serious Damage And Reductions In Capacity May Result If Lattice Is Dented Or Bent.

Cribbing Must Be Approximately 30" (.76m) Across To Assure All Contact Is On The Chords.

Cribbing Is To Be Wood Or Other Soft Material To Prevent Damage To Chords.

Note: The jib chords are the outside larger diameter members that run lengthwise.

Step 11: Boom down on cribbing until link "O" can be connected to support the jib top section. Refer to Fig. 4-34.

#### CAUTION

Take Care Not To Force The Jib Top Section Into The Under Side Of The Straight Extension Or Damage May Result.

Step 12: Unpin turnbuckles from the boom middle section and lace backstay pendants. Pendants may remain pinned to the top of the jib mast. Lace forestay pendants in similar fashion and place pins at "H" to retain the forestay pendants. Forestay pendants likewise need not be unpinned from the equalizer beam or the jib peak.

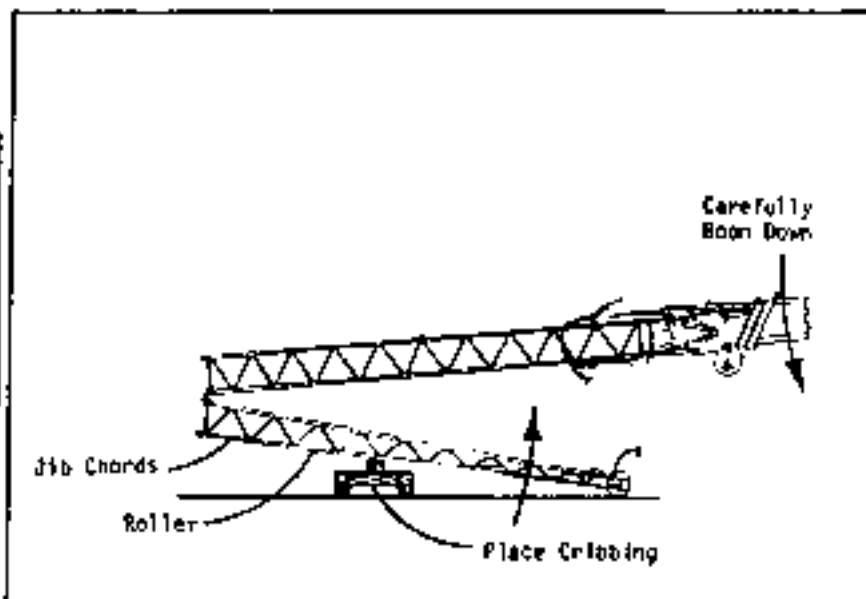


Fig. 4-33  
Placement Of Cribbing

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GA45-C

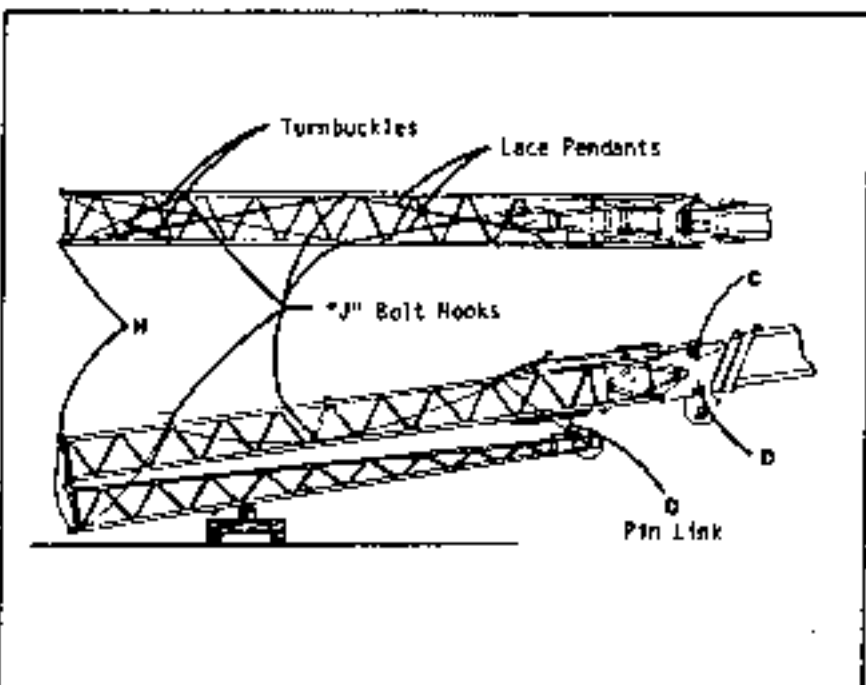


Fig. 4-34  
Slowing Jib Pendants

GA631-C  
GA451-C

Step 13: Boom up off cribbing to horizontal (0° boom angle). Fully retract both boom sections. Remove pins at "C" & "D" and store on the side of the folding adapter.

Note: Jib must be fully folded and pendants laced before attempting to swing onto the right side scowage brackets.

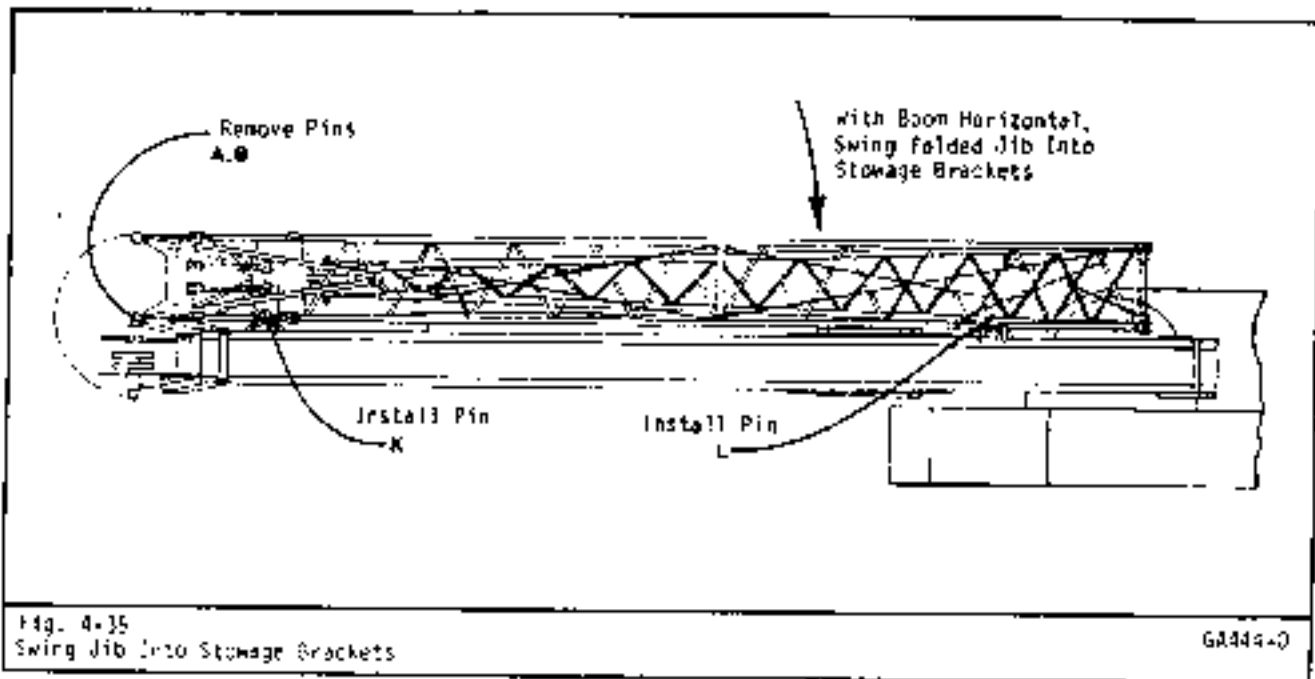


Fig. 4-35  
Swing Jib Into Storage Brackets

GR444-0

Step 14: Swing the folded jib around to stow on the right side of the boom. Install pins at "K" and "L" to secure the folded jib in the storage brackets. Refer to Fig. 4-35 & 36.

Step 15: Remove the two pins at "A" and "B" to disconnect the jib folding adaptor from the boom head, and stow pins on the folding adaptor.

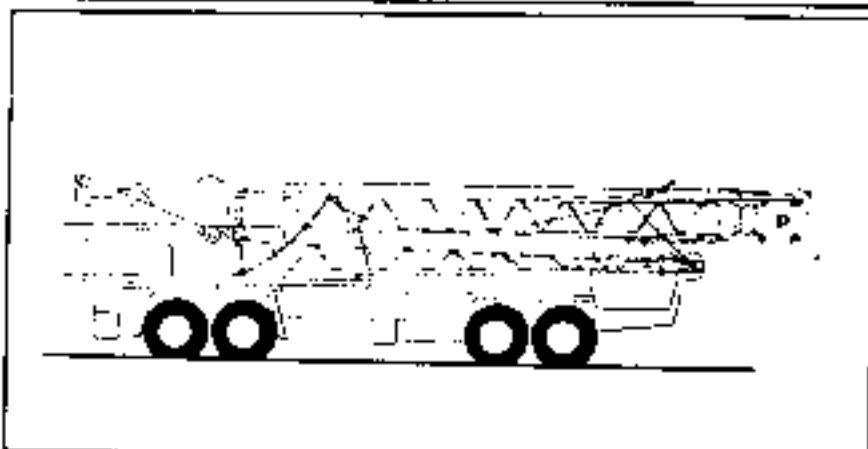


Fig. 4-36  
Jib Stowed

GR444-0

### CAUTION

Do Not Extend The Boom Until Pins At "A" And "B" Are Removed Or Damage May Occur To The Boom, Jib, Or The Storage Brackets.

Step 16: Level the machine on outriggers and commence operations with the jib stowed on the side of the boom or prepare machine for travel as desired.

### Jib Installation

The machine must be level on fully extended outriggers with the counterweight fully extended. Position the upper facing directly over the rear and proceed as follows:

- Pin the jib sections together on the ground. Position the assembled jib on blocking directly behind the machine as shown in Fig. 4-37. The bottom lugs at "B" and

"D" should be approximately 5 Ft. (1.52m) above the ground. Remove the hoist rope from the auxiliary lifting sheave, if so equipped, and set it aside.

- Fully retract the boom and lower it to align the jib lugs with the head machinery. Carefully extend the boom tip section until the lugs engage. Install the four pins and keepers at "A", "B", "C", and "D".

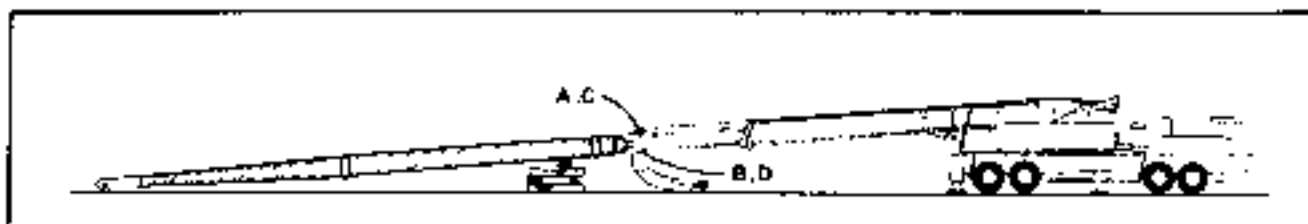


Fig. 4-37  
Jib Installation And Removal

GR35-2

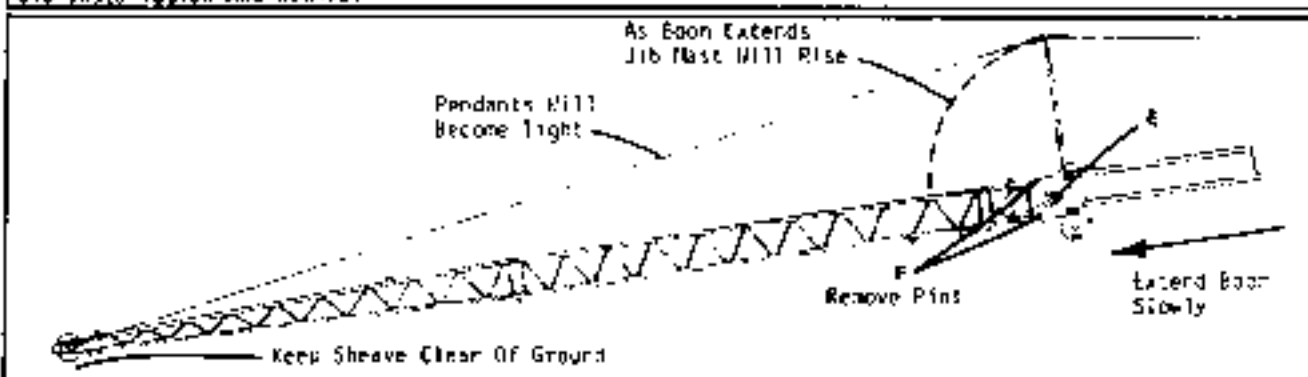


Fig. 4-38  
Extending The Jib Section

6443-D

### CAUTION

Care Must Be Taken Not To Push Or Knock The Jib Assembly Off Blocking. Serious Injury Or Damage May Result.

- (c) Pin the jib mast in position and lay it forward on top the jib. Pin the frontstay pendants between the jib head and the bridle assembly equalizer beam. The front equalizer beam can be pinned in either the inline, or 7-1/2° offset position. Pin the backstay pendants between the bridle assembly and the boom center section.
- (d) Refer to Fig. 4-38. Carefully extend the boom tip section fully, keeping the jib head sheave off the ground. The mast will raise into working position as the backstay pendants draw tight.

Note: Make certain the jib pendants and mast do not catch on any obstructions. Do not force the jib head sheave against any obstructions.

- (e) Remove the four pins at "F" and stop. Pin the jib backstops in working position as shown in Fig. 4-40. With the boom tip section fully extended, engage the manual lockouts.

### CAUTION

The Two Pins At "E" Must Be In Place Before Removing Pins At "F". Pins At "F" Must Be Removed Before Operating Or Jib May Collapse

- (f) Reeve the auxiliary hoist rope through the keeper sheave and over the jib head sheave. Swing the jib sheave rope guard into position over the rope and pin.

- (g) With the boom middle section fully retracted, the jib is ready to boom up and start operations.

### CAUTION

Do Not Raise The Jib Unless The Boom Middle Section Is Fully Retracted. A Tipping Condition May Result. Consult The Machine Capacity Chart For Maximum Boom Lengths And Minimum Angles Of Operation.

### Jib Removal

The machine must be level on fully extended outriggers with the counterweight fully extended. Position the upper facing directly over the rear and fully retract the boom center section. Proceed as follows:

- (a) Boom down until the jib head sheave gently rests on the ground. Remove the jib hoist rope and spool onto the drum. Refer to Fig. 4-40

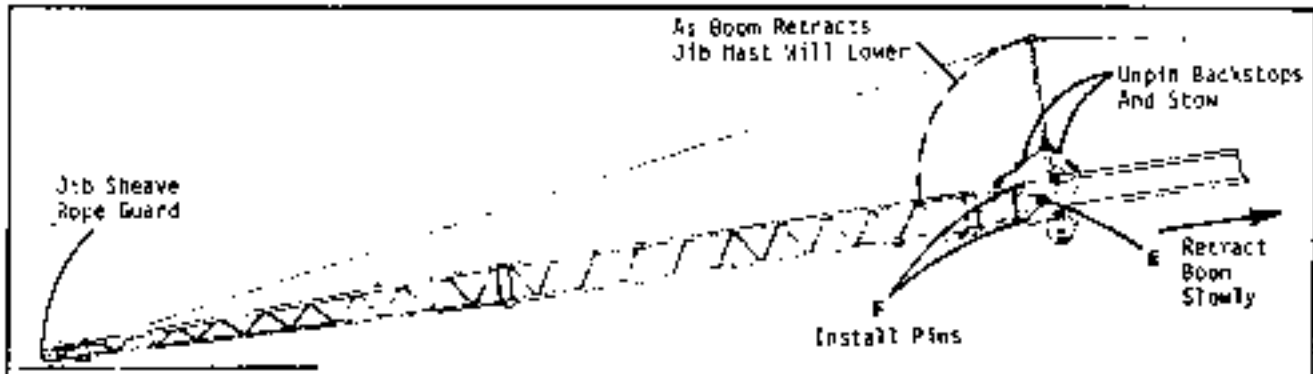


Fig. 4-39  
Retracting The Tip Section

GA443-D

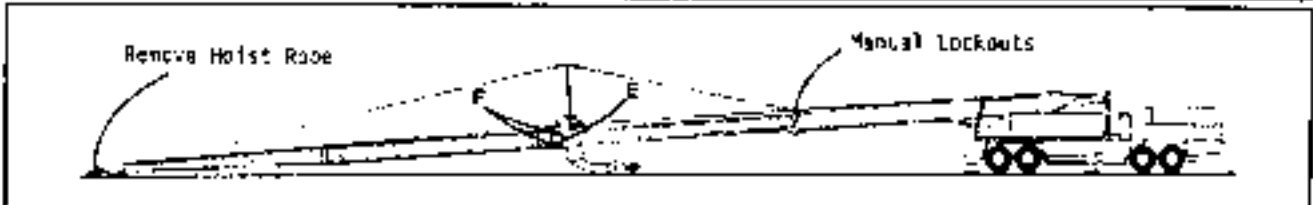


Fig. 4-40  
Jib Installation And Removal

GA35-B

- (b) Remove the jib backstops and stow. Boom up or down slightly to align lugs at "F" and install the four pins and keepers. Pins at "I" need not be removed. Fully extend the boom tip section and disengage the manual lockouts.
- (c) Carefully retract the boom tip section until the jib mast lowers forward on the jib. When retracting the tip section, keep the jib head sheave off the ground. Refer to Fig. 4-39.

Note: Make certain the jib pendants and mast do not catch on any obstructions.

- (d) Remove and stow the front, and backstay pendants. Remove and stow the jib mast.
- (e) Boom down on secure and stable blocking as shown in Fig. 4-37.
- (f) Remove pins at "A", "B", "C", and "D". Carefully retract the tip section to disengage the jib lugs from the boom head machinery.

#### CAUTION

Care Must Be Taken Not To Pull Or Knock The Jib Assembly Off Blocking. Serious Injury Or Damage May Occur.

#### Jib Erection (Early Models)

The machine must be level on fully extended outriggers, and with counterweight fully extended. Proceed as follows:

- Step 1: Position the upper to face directly over the rear and engage house lock.
- Step 2: Fully retract both boom sections and lower the boom to horizontal (0° boom angle). Remove the hoist rope from the auxiliary lifting sheave, if so equipped, and move it out of the way.

- Step 3: Install pins and keepers at "A" and "B" to connect the jib to the boom head. Refer to Fig. 4-41.

#### CAUTION

Do Not Extend The Boom With Pins At "A" And "B" Installed, And Stowage Bracket Pins At "K" And "L" In Place, Or Damage May Occur To The Boom, Jib, Or Stowage Brackets.

- Step 4: Remove pins and block at "K" and "L" that hold the folded jib in stowage brackets.
- Step 5: Swing the folded jib around, by hand, to align with the boom head. Install pins and keepers at "C" and "D" to secure the jib to left side of boom as in Fig. 4-42.

## Operator's Manual Section 4 - Continued - Attachments

Step 6: Swing back ears of jib sheave rope guard and pin. Reeve hoist rope between the center deflector sheave and keeper sheave, under the jib head sheave and pin at "J" as shown.

Step 7: Carefully hoist in on hoist rope enough to take pressure off the carrying link at "Q". Remove pins and link at "Q" and stow in the tool box.

### CAUTION

Take Care Not To Force The Jib Top Section Into The Underside Of The Straight Extension Or Damage May Result.

Step 8 Boom up while slowly paying out hoist rope until the jib top section hangs vertical. Remove the hoist rope from the jib top section. Refer to Fig. 4-43.

Step 9: Carefully boom down until the jib head sheave rests on the ground. Push the jib top section forward of vertical and continue booming down letting the jib head sheave roll on the ground. Boom down until the lugs engage at "H". Install pins and keepers at "H". Refer to Fig. 4-44.

### CAUTION

Do Not Bear Down On Jib With Boom When The Jib Top Section Is Hanging Vertical. Jib May Be Damaged.

Do Not Bear Down On Jib After Lugs At "H" Have Come Into Contact. Jib Lattice Or Head Sheave May Be Damaged.

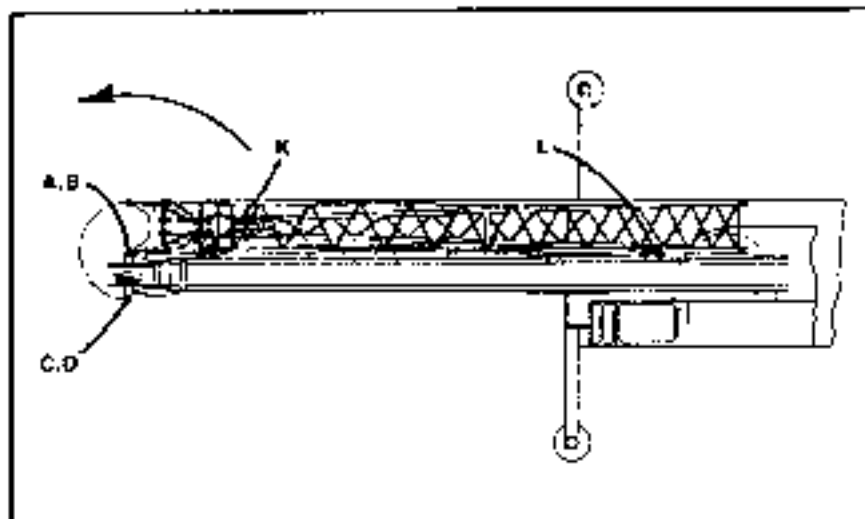


Fig. 4-41  
Unpin Stowage Brackets

GA36-C

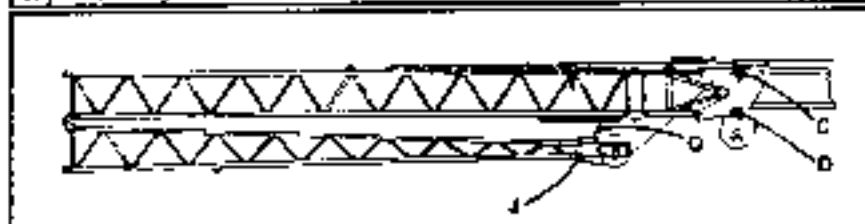


Fig. 4-42  
Unpin Carrying Link

GA36-D

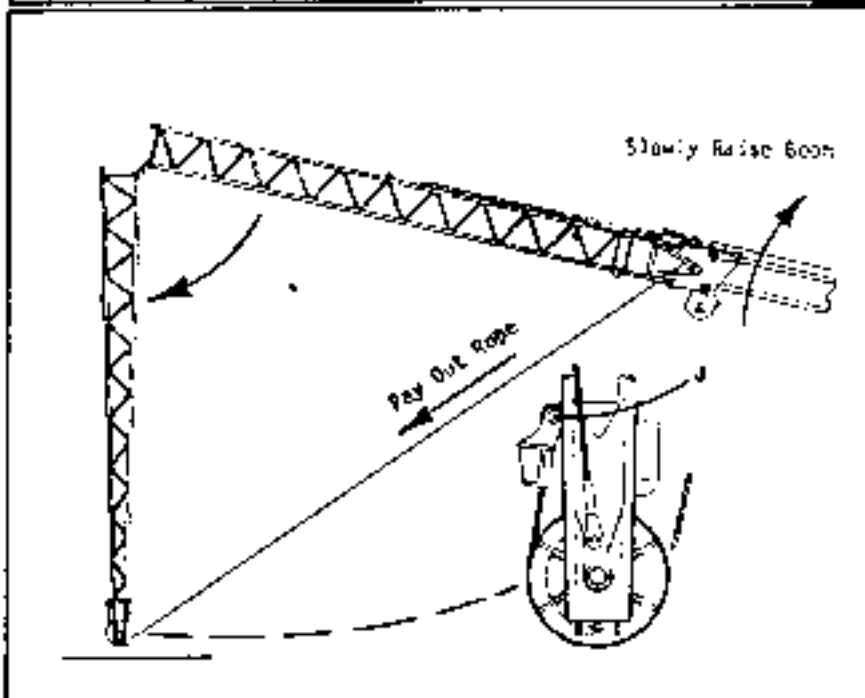


Fig. 4-43  
Unfolding Top Section

GA35-D  
GA36-E

## Operator's Manual Section 4 - Continued - Attachments

Step 10: Remove pin securing the jib mast in the stowed position. Pin the adjustable equalizer to the bridge assembly in either the in-line, or the 7-1/2° offset position. Refer to Fig. 4-45.

Step 11: Pin the frontstay pendants between the jib head sheave and the front equalizer beam. Pin the backstay pendants between the rear equalizer beam and the boom center section.

Step 12: Refer to Fig. 4-46. Slowly extend the boom tip section keeping the jib sheave off the ground. The jib mast will raise into working position as backstay pendants draw tight. Exercise caution that jib pendants and jib mast do not catch on any obstructions. Do not force the jib sheave against any obstructions.

Step 13: With the boom tip section fully ex-

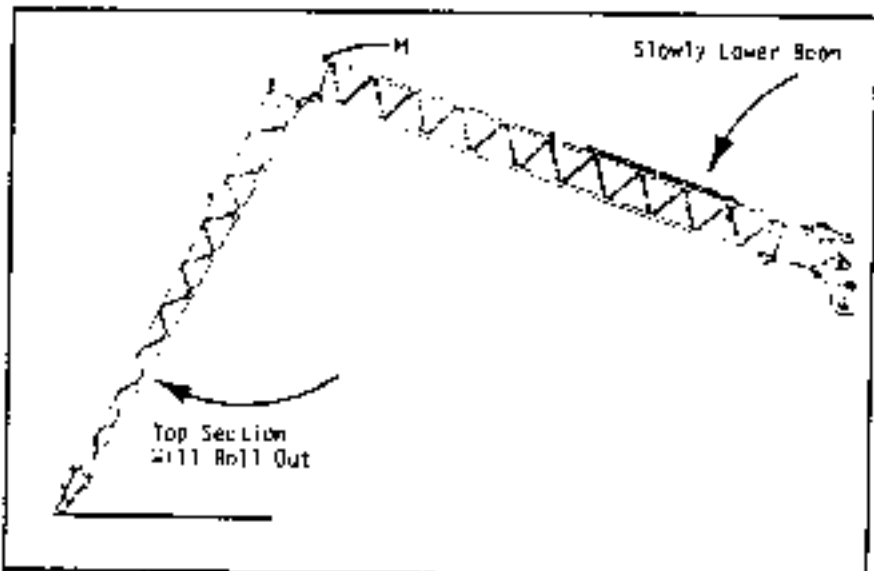


Fig. 4-44  
Connecting Top Section

GA36-D

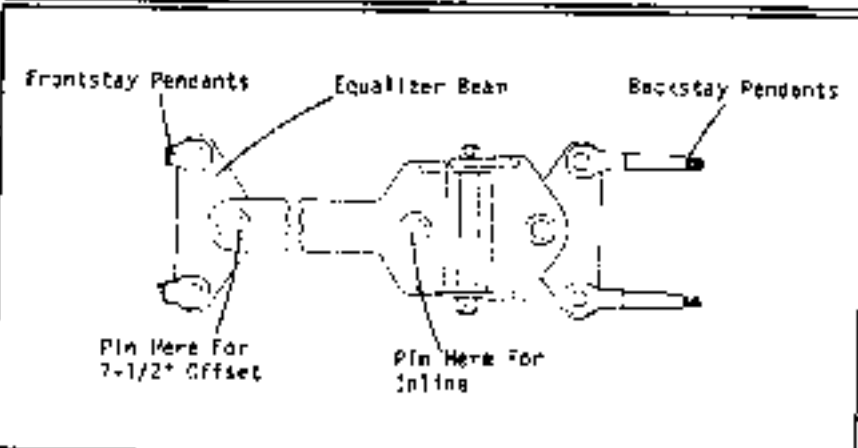


Fig. 4-45  
Bridge Assembly

GA38-D

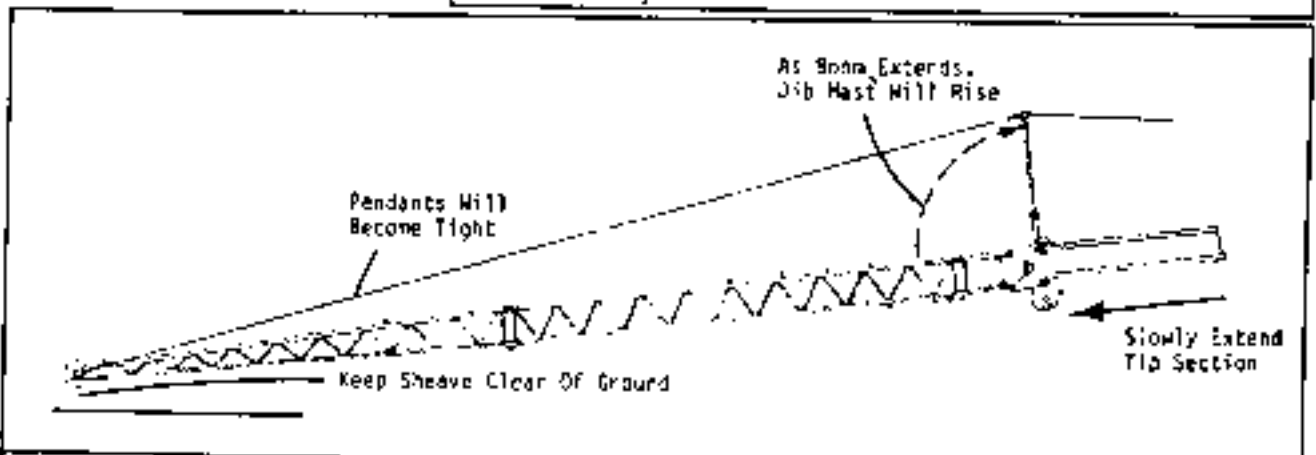


Fig. 4-46  
Extending Tip Section

GA36-D

## Operator's Manual Section 4 - Continued - Attachments

tended, engage the manual lockouts on the boom middle section. Refer to Fig. 4-47.

- Step 14: Remove the four pins at "F" and stow. Refer to Fig. 4-4E.

### CAUTION

Pins At "E" Must Be In Place Before Removing Pins At "F". Pins At "F" Must Be Removed Before Operating Or Jib May Collapse.

- Step 15: Remove the jib backstops from stowed position and pin into working position.

- Step 16: Reeve the hoist rope between the keeper sheave and deflector sheave, and over the jib head sheave. Swing the head sheave rope guard into position, over rope, and pin.

- Step 17: With the boom middle section completely retracted, boom up to working position.

### CAUTION

Do Not Raise The Boom From Horizontal Position Unless The Boom Middle Section Is Fully Retracted. A Tipping Condition May Result. Consult The Machine Capacity Chart For Maximum Boom Lengths And Minimum Angles Of Operation.

### Jib Stowage (Early Models)

The machine must be level on fully extended outriggers, and with counterweight fully extended. Proceed as follows:

- Step 1: Position the upper to face directly over the rear and engage the house lock.

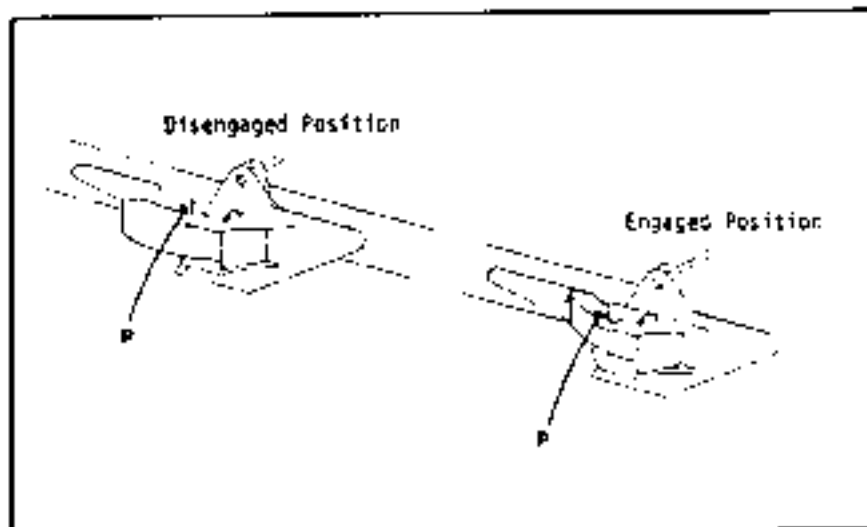


Fig. 4-47  
Manual lockouts

64135-D

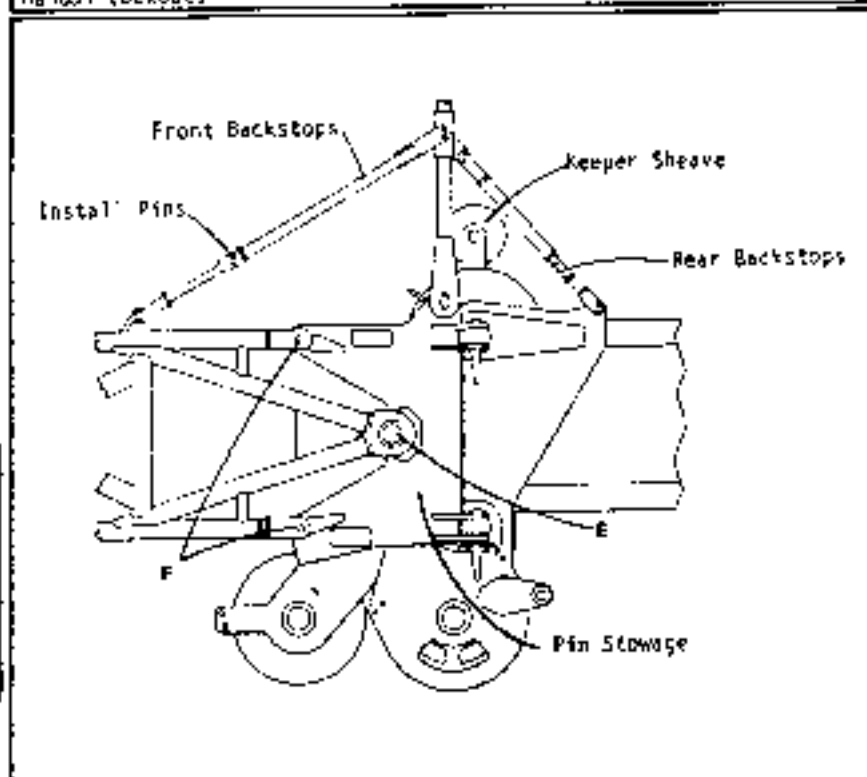


Fig. 4-49  
Backstop Installation

64135-D

- Step 2: Fully retract the boom middle section and boom down until the jib head sheave gently rests on the ground. Jib hoist rope must not be under jib sheave.

### CAUTION

Do Not Bear Down On Jib After The Head Sheave Touches The Ground Or Damage To Jib May Result.

## Operator's Manual Section 4 - Continued - Attachments

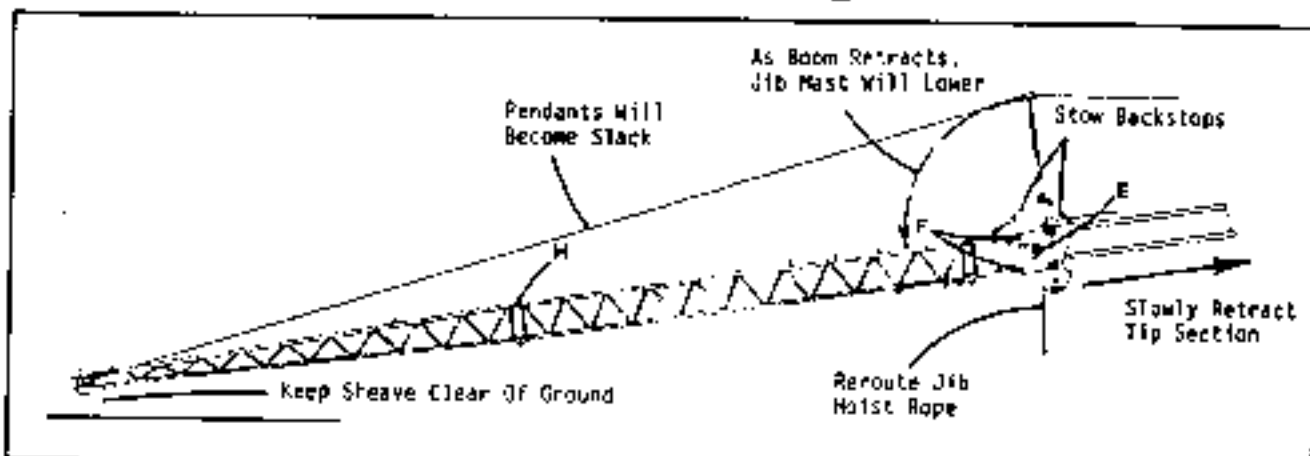


Fig. 4-49  
Retracting Tip Section

GA36-D

- Step 3: Swing back ears of jib sheave rope guard and pin. Remove the hoist rope from the jib sheave and reroute through the boom head machinery as shown in Fig. 4-49.
- Step 4: Install the four pins and keepers at "F". Pins at "E" need not be removed.
- Step 5: Unpin the rear backstops and swing up to stow on the mast. Unpin the front backstops and stow on the underside of the straight extension.
- Step 6: Fully extend the boom tip section and disengage the manual lockouts.
- Step 7: Slowly retract the boom tip section. The jib mast will lower itself onto the jib as the tip section retracts.

Note: Keep the jib head sheave clear of ground. Avoid catching pendants or jib mast on structures or obstructions.

Pin the jib mast in the stowed position. Unpin and stow the front, and backstay pendants.

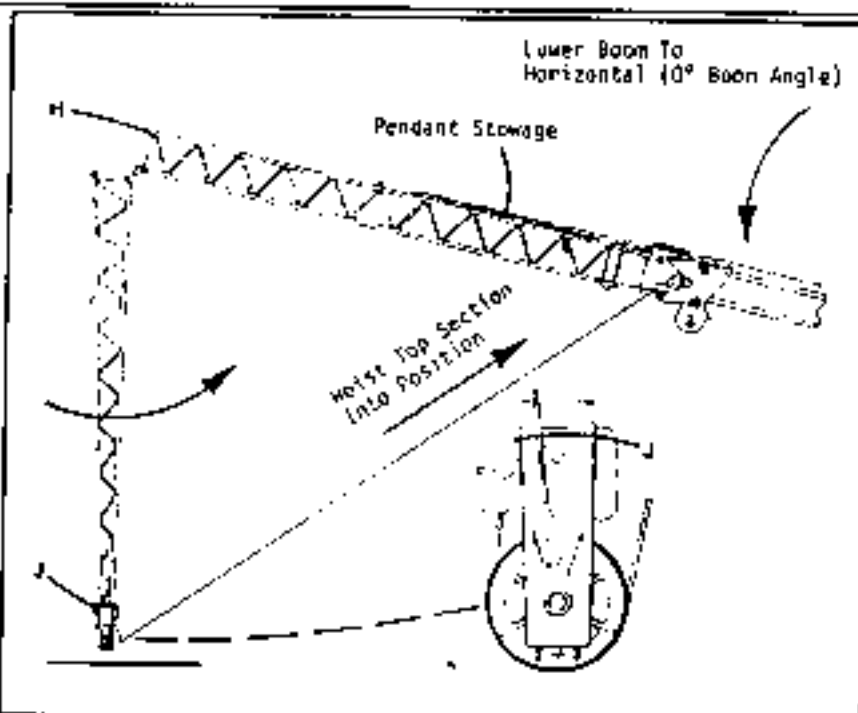


Fig. 4-50  
Folding Top Section

GA36-D  
GA138-D

Step 8: Boom down slightly to take pressure off the top two pins at "H" and remove.

Step 9: Refer to Fig. 4-50. Boom up slowly, allowing the jib sheave to roll on ground, until the jib top section is hanging vertical and clear of ground.

### CAUTION

Do Not Remove The Bottom Pins At "H" Or The Jib May Collapse. Do Not Stand Under The Jib At Any Time.



## Operator's Manual Section 4 - Continued • Attachments

### CAUTION

Do Not Bear Down When The Jib Is Hanging Vertical And Jib Head Sheave Is On The Ground. Jib May Be Damaged.

Step 10: Connect the hoist rope at "J" with dead end socket as shown in Fig. 4-50. The hoist rope must pass under the jib head sheave.

Step 11: Carefully hoist the jib top section into position under the straight extension while lowering the boom to horizontal (D° boom angle).

### CAUTION

Take Care Not To Force The Jib Top Section Into The Underside Of The Straight Extension Or Damage To Jib May Result.

Step 12: Refer to Fig. 4-51. Suspend the jib top section from the straight extension by pinning carrying link "Q" in place. When securely pinned, remove the hoist rope.

Step 13: With the boom horizontal and fully retracted, remove the two pins at "C" and "D" and stow on folding adaptor.

Step 14: Swing the folded jib around, by hand, to stow on the right side of the boom base section. Install pins at "K" and "L" to secure the folded jib in the stowage brackets. Refer to Fig. 4-52.

Step 15: Remove the two pins at "A" and "B" to disconnect the stowed jib from the head machinery. Stow the pins on the folding adaptor.

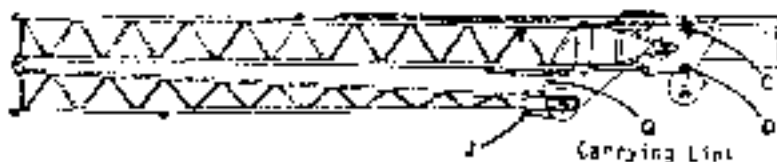


Fig. 4-51  
Pin Carrying Link

GA25-C

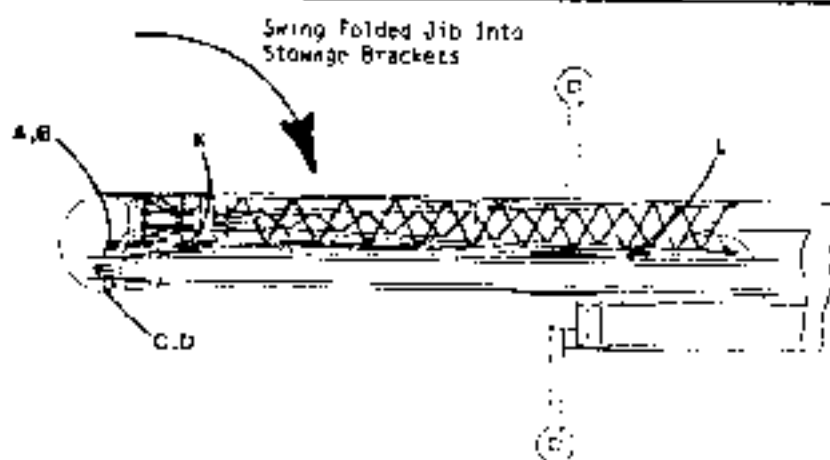


Fig. 4-52  
Swing Folded Jib

BA17-D

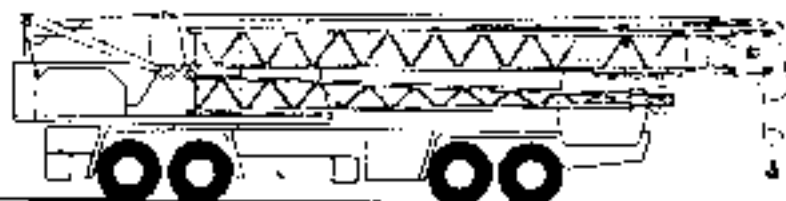


Fig. 4-53  
Jib Stowed

GA37-E

### CAUTION

Pins At "A" And "B" Must Be Removed Before Extending The Boom Or Damage Will Occur To Fly Section And/Or Boom. Never Remove Pins At "A" And "B" Unless The Jib Assembly Is Secured By Pins At "K" And "L".

Step 15: Level the machine on outriggers and commence operations with the jib stowed on the side of the boom, or prepare machine for travel, as desired.

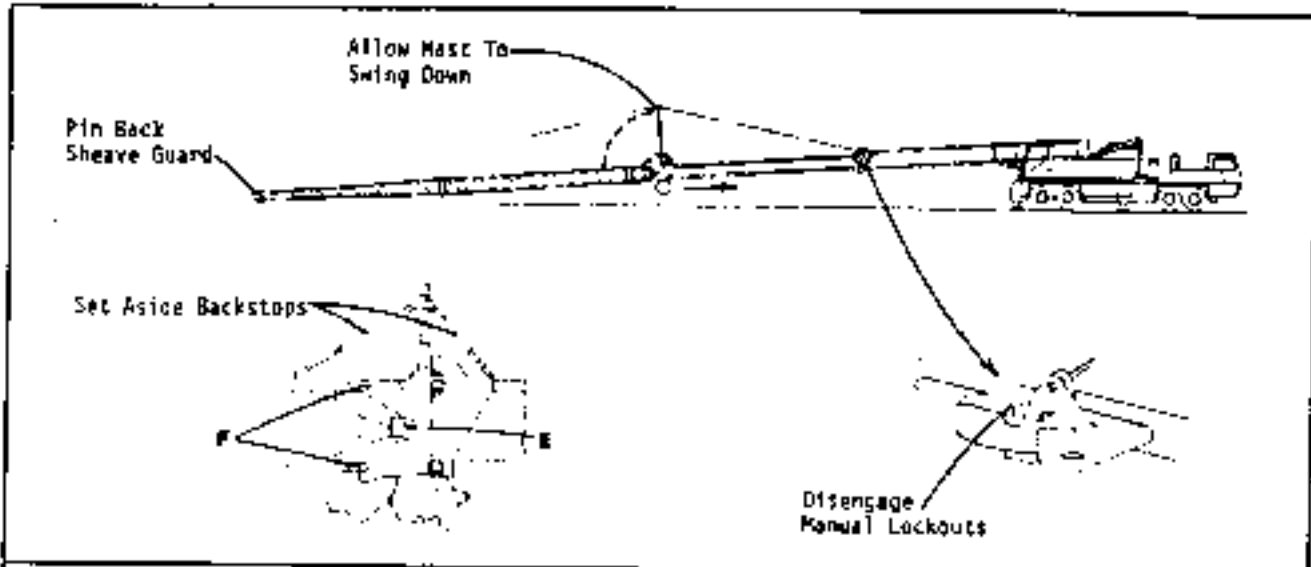


Fig. 4-54  
Preparing 60' Jib

GA35-D, GA138-D  
GA139-D

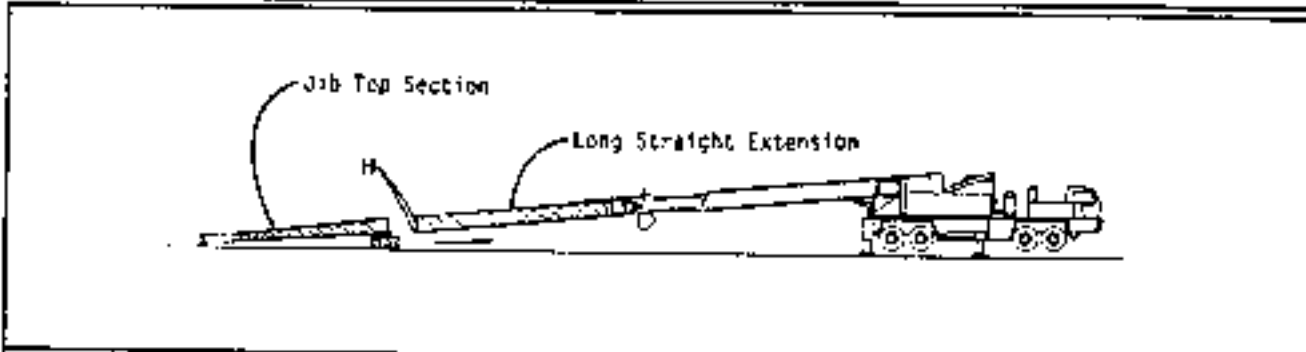


Fig. 4-55  
Disconnecting Jib Top Section

GA259-D

#### Interchange Sequence 60' Jib - 60' Jib 47C-50 Only

- Step 1: With machine level on fully extended outriggers, position upper over rear, engage house lock, and fully retract boom middle section.
- Step 2: Boom down until jib nears ground. Swing back sheave guards on jib peak and pin in place. Remove jib hoist rope and move it out of the way. Boom down until jib peak rests on ground. Remove jib backstops and set aside.
- Step 3: Fully extend boom tip section and disengage manual lockouts on boom middle section.

Note: Machine may be tilted slightly to the rear by lowering rear outrigger jacks or raising front outrigger jacks to enable jib sheave to rest on ground.

Booming down or adjusting outrigger jacks should be done carefully so jib peak rests gently on ground. Do not bear down hard or damage may result.

- Step 4: Retract boom tip section slowly, allowing jib mast to lower onto the jib long straight extension. Refer to Fig. 4-54.
- Step 5: When jib mast is resting on the long straight extension, disconnect frontstay and backstay pendants from the jib mast and set aside. Boom

- up or down slightly and align lugs at "F" and install pins and keepers. Leave pins in place at "E". Refer to Fig. 4-54.
- Step 6: Construct blocking that is secure and stable. Take care not to bump, or knock jib sections from blocking. Boom down onto blocking as in Fig. 4-55. Remove pins at "H" to disconnect top section from the long straight extension; Retract boom tip section.

#### CAUTION

Jib Can Fall When Pins Are Removed. Do Not Remove Pins Until Jib Is Firmly Supported By Jib Sheave And Blocking.

## Operator's Manual Section 4 - Continued - Attachments

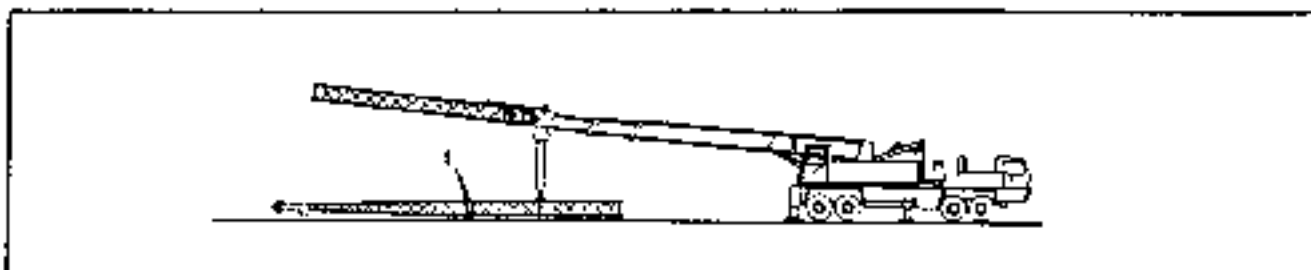


Fig. 4-56  
Installing Short Straight Extension

G4269-D

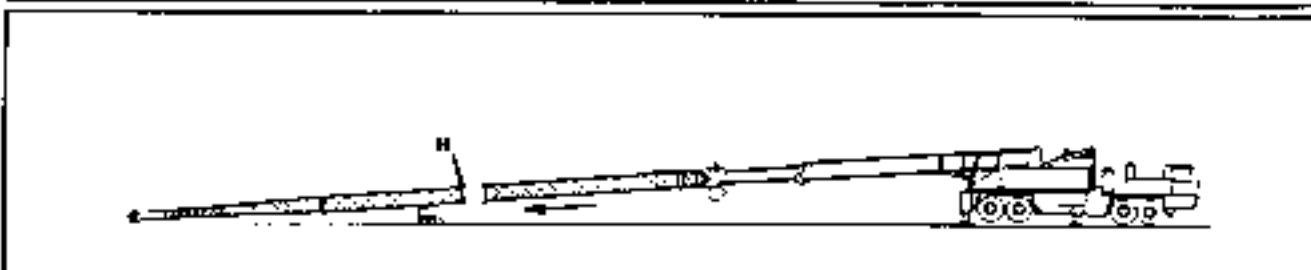


Fig. 4-57  
Connecting 80' Jib

G4269-D

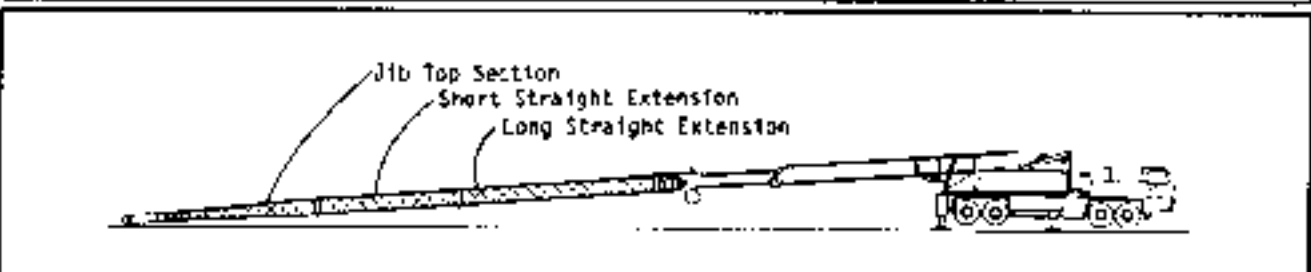


Fig. 4-58  
Connected 80' Jib

G4269-D

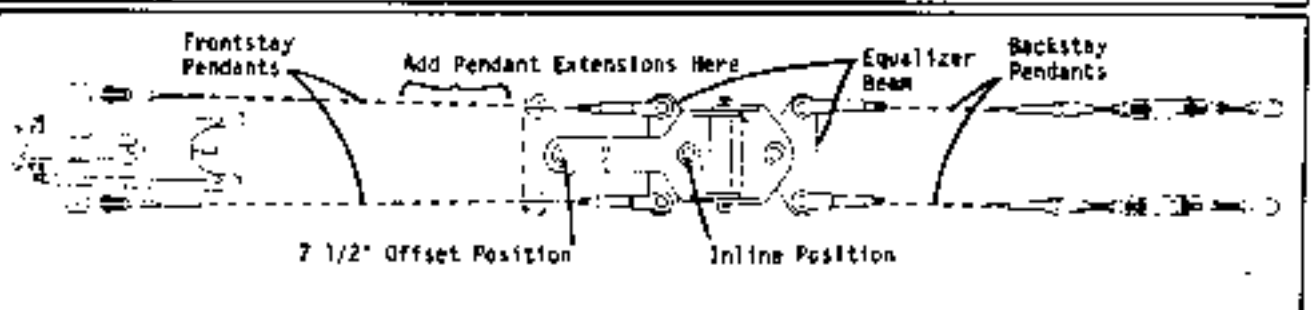


Fig. 4-59  
Pendant Changes

G4139-D

Step 7: Reposition and level the machine approximately 40' from jib top section as in Fig. 4-56. Use hoist to reposition jib top section and to connect the short straight extension. Insert pins and keepers at "J". Reposition top section

and extension on blocking as in Fig. 4-57. Bottom lug at "H" to be approx. 30 in. (762mm) above ground.

Step 8: Reposition the machine approx. 60' from blocking. Fully retract boom middle section. Extend boom tip section to engage top lugs

at "H". Connect with pins and keepers. Boom up slightly to engage bottom lugs & secure with pins and keepers.

Step 9: Refer to Fig. 4-59. Position equalizer beam pin in either 7-1/2" offset or the inline position.

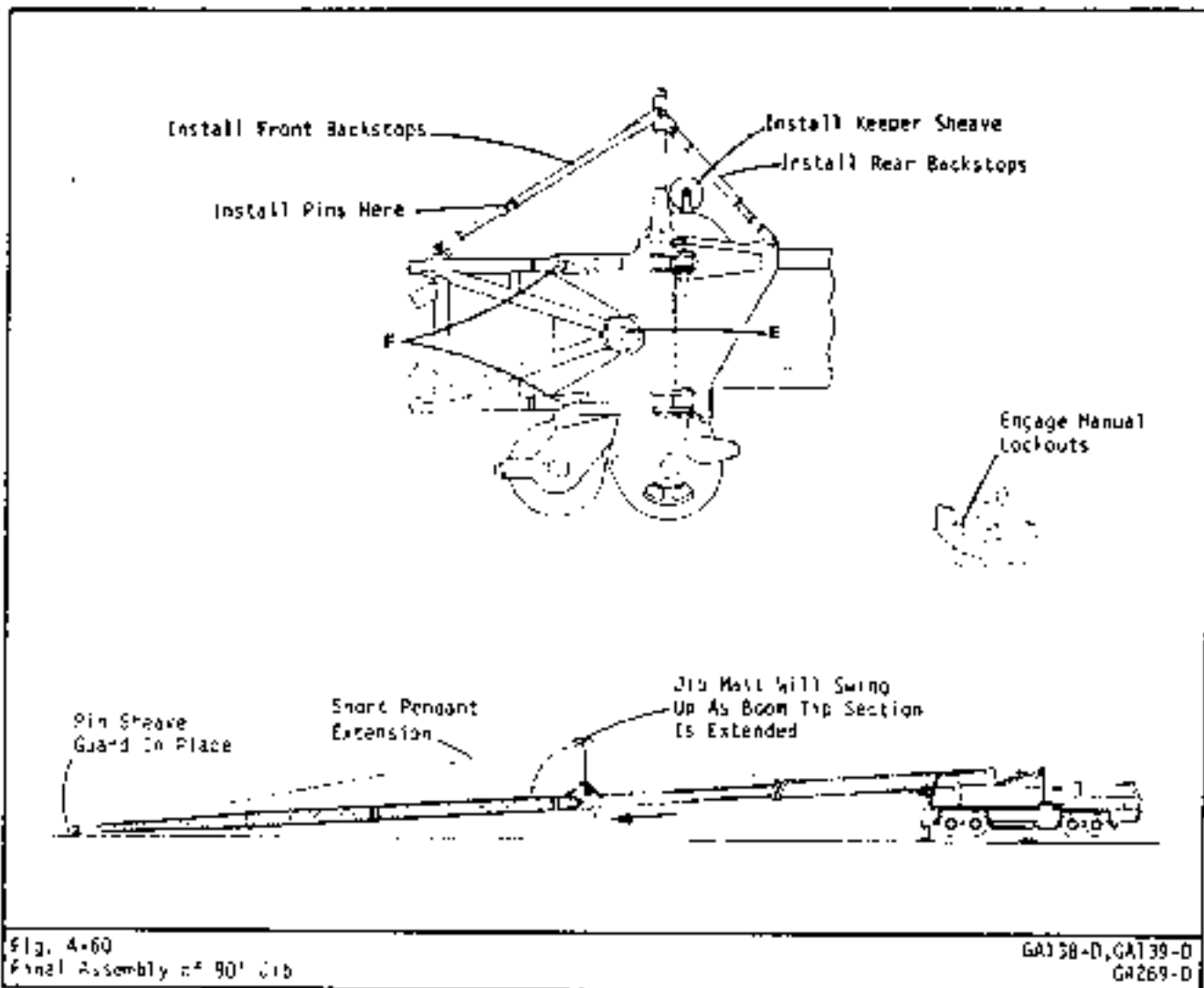


Fig. 4-60  
Final Assembly of 90' Jib

GA138-D, GA139-D  
GA269-D

attach backstay pendants to jib mast equalizer. Next, attach short pendant extensions to frontstay pendants and equalizer beam. Secure all pendants with pins and cotter pins.

Step 10: Refer to Fig. 4-60. Make certain of proper pin installation at "E". Remove pins at "F" and store. Extend boom tip section slowly to raise jib mast into working

position and boom up slightly to avoid damaging lugs at "F". Do not allow pendants to get caught on jib, boom, or any obstruction.

Step 11: With boom tip section fully extended, engage manual lockouts on boom middle section. Install front and rear backstops as in Fig. 4-60. Reeve hoist rope thru jib head sheave and secure sheave guard in place. Install keeper sheave.

Step 12: Make sure the boom middle section is fully retracted and the machine is setting level. The 80' jib is now ready to boom up and start operations.

Note: Changed jib length requires use of different capacity listings. Consult machine capacity chart and working range diagram before making lifts.

## Operator's Manual

Section 4 - Continued - Attachments

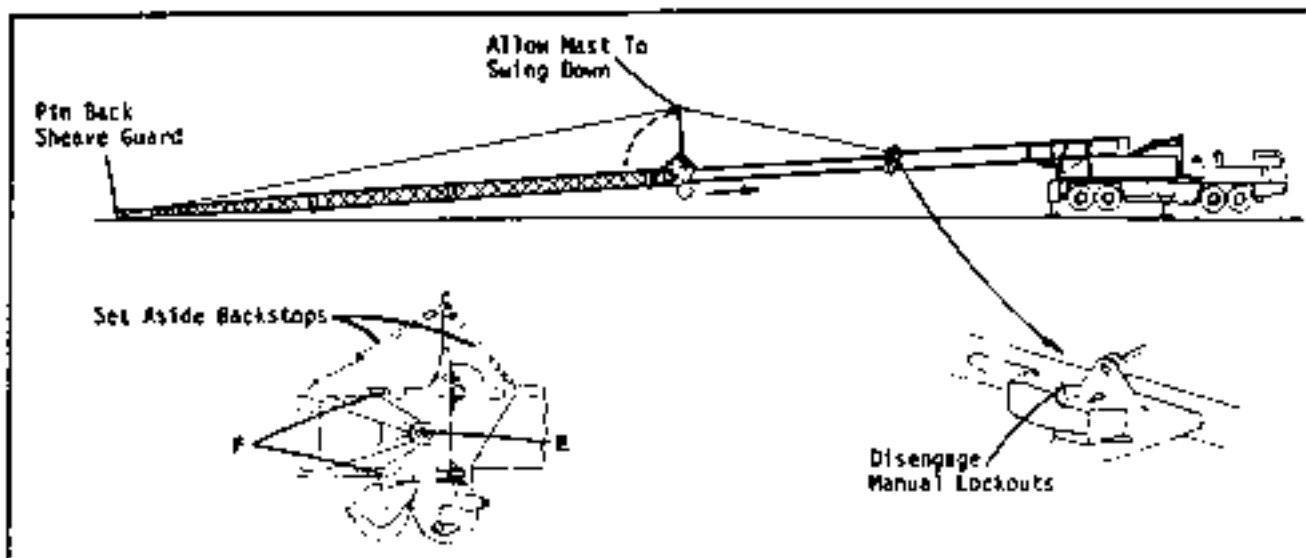


Fig. 4-61  
Preparing 80' Jib

GA269-D, GA139-D  
GA139-D

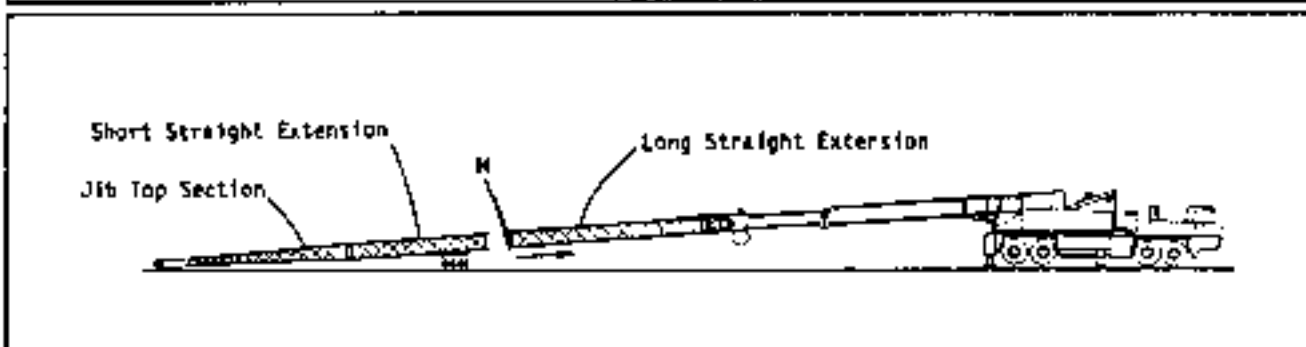


Fig. 4-62  
Disconnecting Short Straight Extension and Jib Top Section

GA269-D

### Interchange Sequence 80' Jib - 60 Jib ATC-50 Only

- Step 1:** With machine level on fully extended outriggers, position upper over rear, engage house lock, and fully retract boom middle section.
- Step 2:** Boom down until jib nears ground. Swing back sheave guards on jib peak and pin in place. Remove jib hoist rope and move it out of the way. Boom down until jib peak rests on ground. Remove jib backstops and set aside.
- Step 3:** Fully extend boom tip section and disengage manual lockouts on boom middle section.

**Note:** Machine may be tilted slightly to the rear by lowering rear outrigger jacks or raising front outrigger jacks to enable jib sheave to rest on ground.

**Booming down or adjusting outrigger jacks should be done carefully so jib peak rests gently on ground. Do not bear down hard or damage may result.**

- Step 4:** Retract boom tip section slowly, allowing jib mast to lower onto the jib long straight extension. Refer to Fig. 4-61.
- Step 5:** When jib mast is resting on the long straight extension, disconnect

- frontstay and backstay pendants from the jib mast and set aside. Boom up or down slightly to align lugs at "F" and install pins and keepers. Leave pins in place at "C". Refer to Fig. 4-61.
- Step 6:** Construct blocking that is secure and stable. Take care not to bump, or knock jib sections from blocking. Boom down onto blocking as in Fig. 4-62. Remove pins at "H" to disconnect the short straight extension from the long straight extension. Retract boom tip section.



Fig. 4-63  
Removing Short Straight Extension

GA269-D

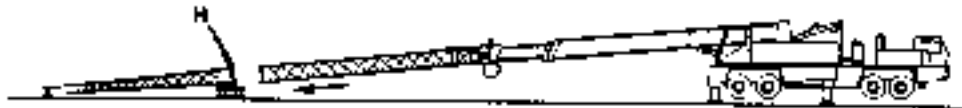


Fig. 4-64  
Connecting 60' Jib

GA269-D

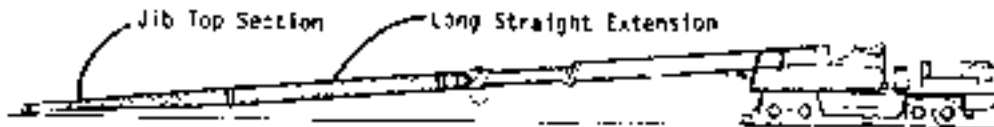


Fig. 4-65  
Connected 60' Jib

GA35-D

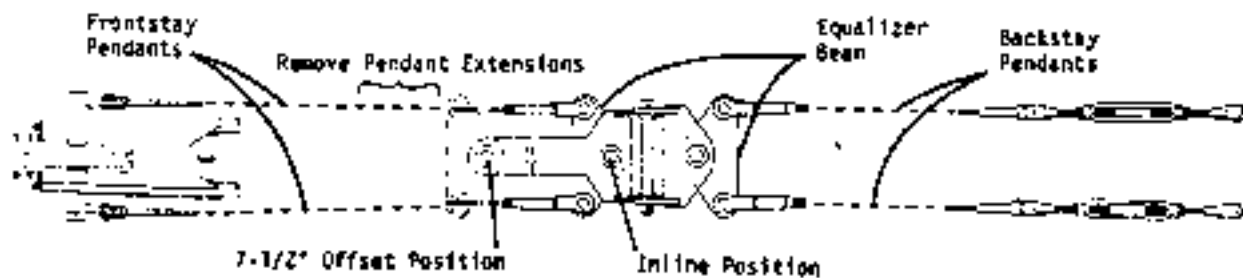


Fig. 4-66  
Pendant Changes

GAT38-D

### CAUTION

Jib Can Fall When Pins Are Removed. Do Not Remove Pins Until Jib Is Firmly Supported By Jib Sheave And Blocking.

Step 7: Reposition and level the machine approximately 40' from the short straight extension. See Fig. 4-63. Use main hoist to reposition jib top section and to remove the short straight extension. Remove pins at "I" and set

short straight extension aside. Reposition top section on blocking as in Fig. 4-64.

Step 8: Reposition the machine approximately 60' from blocking. Fully retract boom middle section. Extend boom tip section

## Operator's Manual

Section 4 - Continued - Attachments

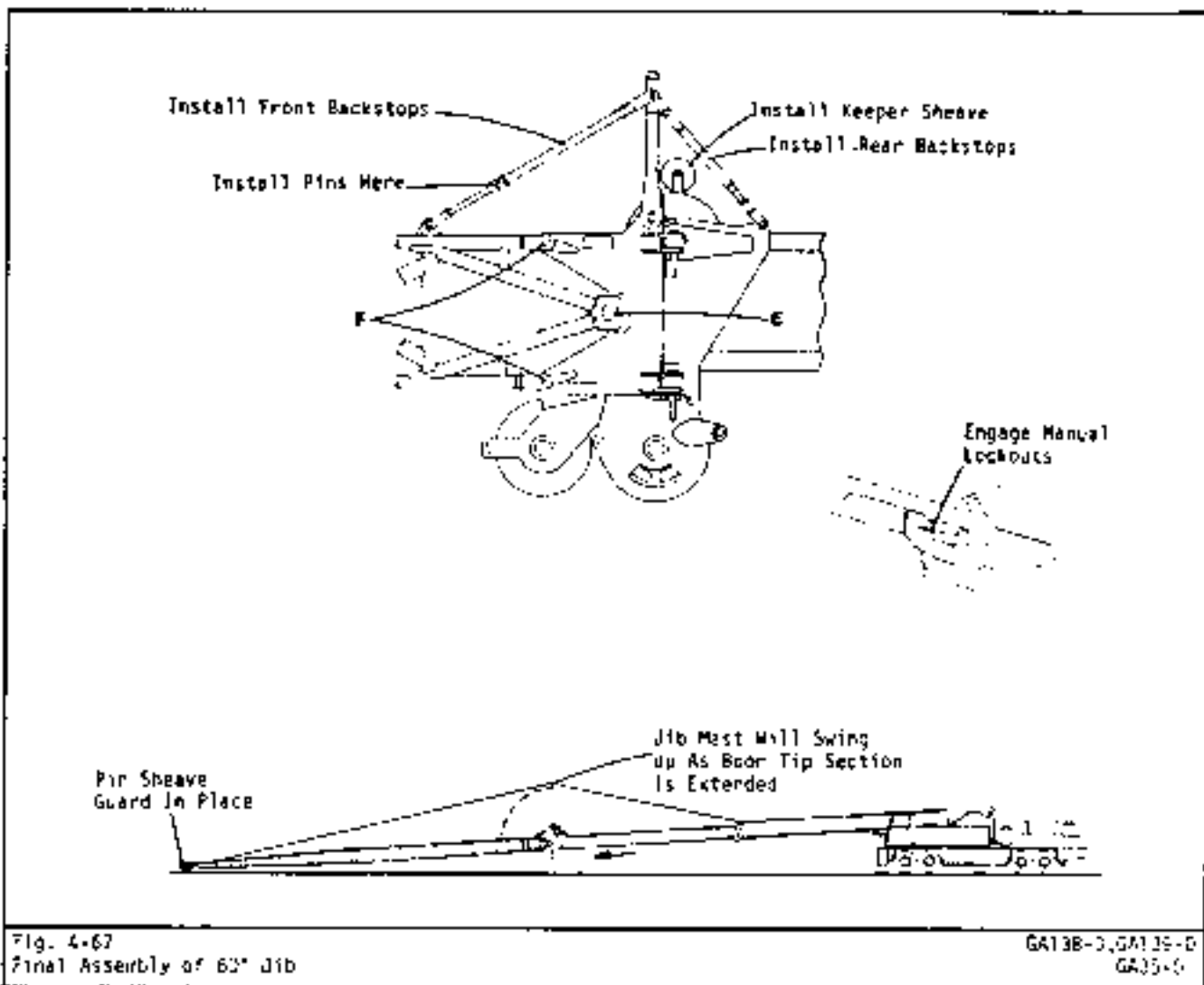


Fig. 4-67  
Final Assembly of 60' Jib

GA13B-3, GA13C-D  
GA13-E

- to engage top lugs at "H". Connect with pins and keepers. Boom up slightly to engage bottom lugs and secure with pins and keepers.
- Step 9: Refer to Fig. 4-66 and position equalizer bearing pin in either 7-1/2' offset or the inline position. Attach backstay pendants to jib mast equalizer. Next, remove short pendant extensions from frontstay pendants and stow. Attach frontstay pendants to equalizer beam. Secure all pendants with pins and cotter pins.
- Step 10: Refer to Fig. 4-67. Make certain of proper pin

- installation at "E". Remove pins at "F" and store. Extend boom tip section slowly to raise jib mast into working position and boom up slightly to avoid damaging lugs at "F". Do not allow pendants to get caught on jib, boom, or any obstruction.
- Step 11: With boom tip section fully extended, engage manual lockouts on boom middle section. Install front and rear backstops as in Fig. 4-67. Reeve hoist rope thru jib head sheave and secure sheave guard in place. Install keeper sheaves.
- Step 12: Make sure the boom mid-

dle section is fully retracted and the machine is setting level. The 60' jib is now ready to boom up and start operations.

Note: Changed jib length requires use of different capacity listings. Consult machine capacity chart and working range diagram before making lifts.

## Operator's Manual Section 4 - Continued - Attachments

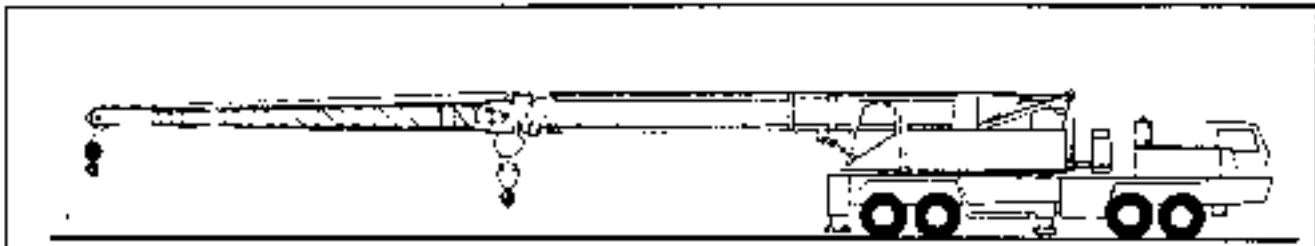


Fig. 4-68  
Traveling with Erected Fly Over Rear

GC634-D

### Traveling Machine with Erected Attachments

A machine with an erected fly or jib can be moved on the job site at a speed of 1 MPH (1.6 km/hr.) or less, and when the ground surface is solid, smooth, and level.

#### CAUTION

The Attachment Must Be Slowly Travel Machine Faster Than 1 MPH (1.6 km/hr.), Or When The Ground Conditions Are Not Solid, Smooth, And Level.

To travel machine with fly erected, and upper facing over rear, proceed as follows. Refer to Fig. 4-68.

1. Refer to Section 3 of the operator's manual and inflate all tires to pressures listed in the "Tire Inflation Chart" for 1 MPH (1.6 km/hr.) maximum speed.
2. With machine setting level on fully extended outriggers,

and counterweight fully extended, retract both boom sections completely.

3. Position upper facing directly over rear and engage house lock.
4. Boom down to horizontal (0° boom angle).
5. Retract all outrigger jacks just clear of ground, but leave beams fully extended.
5. Carefully travel machine at no more than 1 MPH (1.6 km/hr.). Take extra care due to the increased boom length and maintain a safe distance from all obstructions, structures, and power lines.
7. Level machine on outriggers before resuming operations.
8. Correct tire pressures prior to traveling faster than 1 MPH (1.6 km/hr.).

Note: Refer to "Travel Speeds" on page 4-32 to determine the 1 MPH (1.6 km/hr.) travel speed.

To travel machine with fly or jib erected, and upper facing over front, proceed as follows. Refer to Figs. 4-69 & 4-70.

1. Refer to Section 3 of the operator's manual and inflate all tires to pressures listed in the "Tire Inflation Chart" for 1 MPH (1.6 km/hr.) maximum speed.
2. With machine setting level on fully extended outriggers, and counterweight fully extended, retract both boom sections completely. (With jib, retract boom middle section only.)
3. Position upper facing directly over front and engage house lock.
4. Boom down to boom rest or until attachment is just clear of ground.

Note: The boom may be anywhere between 75° boom angle and horizontal. The lowest boom angle is recommended because the machine is most stable for traveling with lowered attachment.

5. Retract all outrigger jacks just clear of ground, but

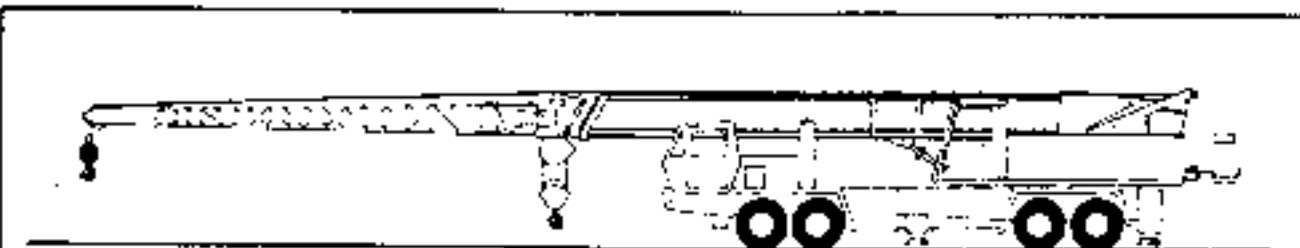


Fig. 4-69  
Traveling With Erected Fly Over front

GC634-D



## Operator's Manual Section 4 - Continued - Attachments

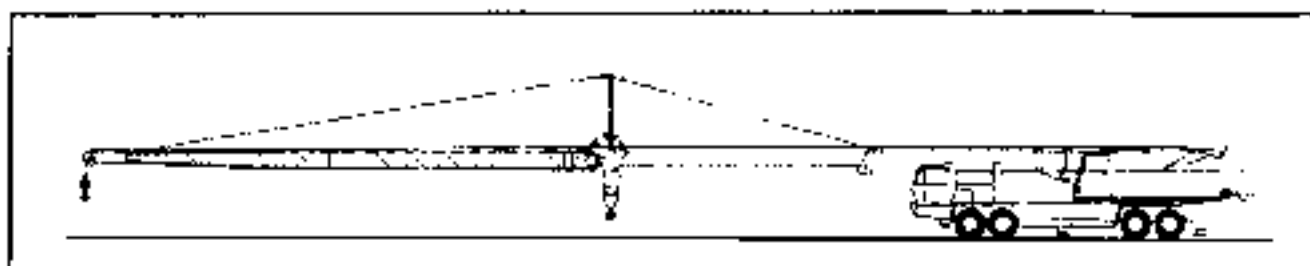


Fig. 4-70  
Traveling With Erected Jib Over Front

GC634-D

leave beams fully extended

- Carefully travel machine at no more than 1 MPH (1.6 km/hr.). Take extra care due to the increased boom length and maintain a safe distance from all obstructions, structures, and power lines.

- Level machine on outriggers before resuming operations.

- Correct tire pressures prior to traveling faster than 1 MPH (1.6 km/hr.).

Note: Refer to "Travel Speeds" on page 4-32 to determine the 1 MPH (1.6 km/hr.) travel speed.

### Traveling Machine With Cantilevered Jib

The overall travel length of an erected jib can be shortened by cantilevering the attachment. A machine with a cantilevered jib can be moved on the job site at a speed of 1 MPH (1.6 km/hr.) or less, and when the ground surface is solid, smooth, and level.

### CAUTION

The Jib Must Be Stowed To Travel Machine Faster Than 1 MPH (1.6 km/hr.), Or When The Ground Conditions Are Not Solid, Smooth, And Level.

To travel machine with jib cantilevered, and upper facing over front, proceed as follows: Refer to Figs. 4-71 & 4-72.

- Refer to Section 3 of the operator's manual and inflate all tires to pressures listed in the "Tire Inflation Chart" for 1 MPH (1.6 km/hr.) maximum speed.
- With machine setting level on fully extended outriggers, counterweight fully extended, and upper facing directly over the rear, retract boom middle section.
- Boom down until jib nears ground. Remove headache ball and secure jib hoist line to jib peak.

- Boom down until jib peak rests on ground. Install the four pins at 'F' to secure jib in the cantilevered position. Remove jib backstops and set aside. Disengage manual lockouts on boom middle section.

- Retract the boom tip section slowly, keeping the jib sheave off ground. Jib mast will lower itself onto jib as boom retracts. Place pendants on top jib to keep them out of the way.

- Boom up to no less than 45° boom angle and swing upper directly over front. Engage house lock.

- Boom down to horizontal (0° boom angle).

- Retract all outrigger jacks just clear of ground, but leave beams fully extended.

- Carefully travel machine at no more than 1 MPH

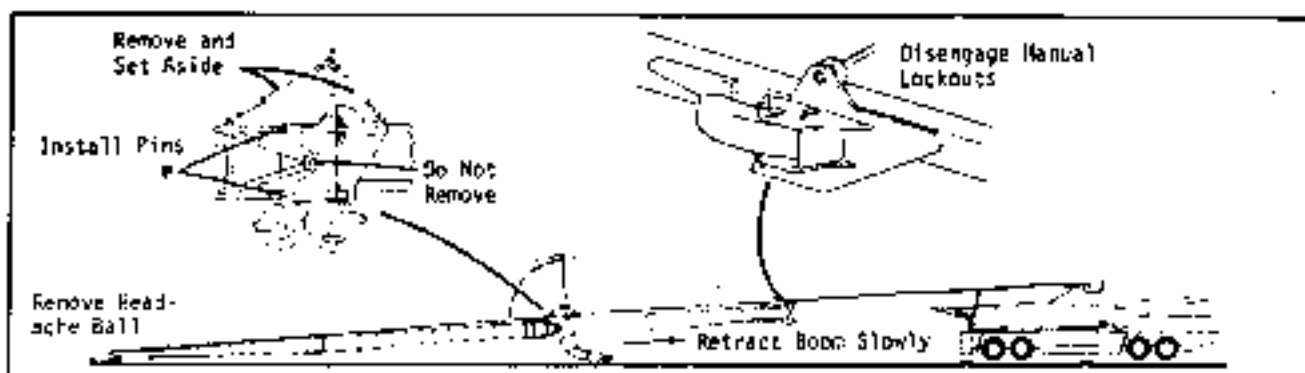
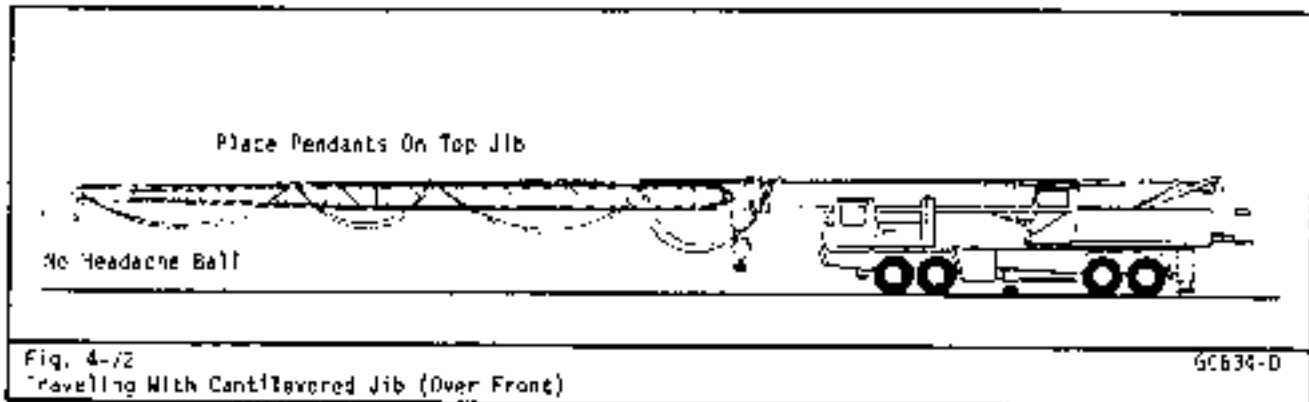


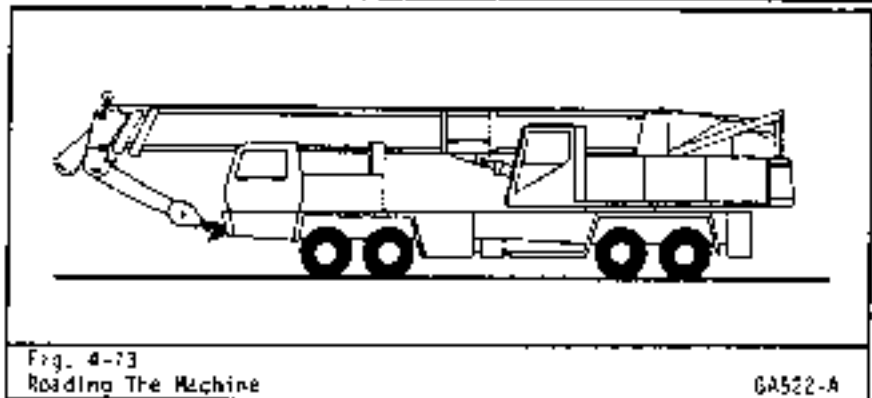
Fig. 4-71  
Preparing The Cantilevered Jib

GC634-D



(1.6 km/hr.) Take extra care due to the increased boom length and maintain a safe distance from all obstructions, structures, and power lines.

10. Level machine on outriggers and reassemble the erected jib prior to resuming operations. Correct tire pressures prior to travelling faster than 1 MPH (1.6 km/hr.).



Note: Refer to 'Travel Speeds' below to determine the 1 MPH (1.6 km/hr.) travel speed.

#### CAUTION

Do Not Attempt To Make Any Lifts With The Cantilevered Jib, Damage To Jib May Occur.

Be Certain To Remove The 4 Pins At 'F' When Reassembling The Jib Or Damage May Occur During Lifts.

#### Travel Speeds

The 1 MPH (1.6 km/hr.) maximum speed required for traveling with erected attachments can be obtained by shifting transmission into first gear and reading tachometer as follows:

HTC50, 45W	- 900 RPM
HTC50	- 800 RPM
HTC35, 34	- 1000 RPM
HTC25, 20, 14	- 900 RPM

#### Preparing Machine For Road Travel

Before roading the machine, it is necessary to take certain precautions by performing the following: (Refer to Fig. 4-73)

- (a) The jib or fly section must be stowed before traveling machine. Refer to stowage procedures earlier in this section.
- (b) Fully retract the main boom.
- (c) Fully retract all outriggers as explained in "Outrigger Operation" on page 7-14.
- (d) With the upper facing directly over the front, engage the house lock.
- (e) Boom down until the boom sets on the boom rest.
- (f) Secure the hook block to the carrier front bumper to prevent excessive swinging.
- (g) Fully retract the counterweight or remove it from the machine, as required.
- (h) All upper controls must be in their neutral positions (clutches disengaged) and hoist brakes engaged, and latched.
- (i) Shut down the engine from upper and remove the key.
- (j) Close and latch upper windows and door. Lock the upper cab and house doors.
- (k) Disengage the main hydraulic pump as explained in "Engaging and Disengaging the Main Hydraulic Pump" on page 3-9.

## Operator's Manual Section 4 - Continued - Attachments

### Wire Rope Capacity Chart

The chart shown in Fig. 4-74 gives the maximum lifting capacities based on wire rope strength. This chart is in the upper operator's cab. This chart lists the maximum amount that may be lifted with different sizes and types of wire rope with from one to ten parts of line. The weights shown are based on wire rope strength alone and exceeding the limits may result in rope breakage.

Before making a lift, compare the weight being lifted (remember to add the weight of the hook block, slings, and riggings to the actual load weight) with the column on the chart covering the size of rope being used. Check the column of the number of parts of line required to make the lift. Use at least this number of parts of line to make the lift.

### CAUTION

When Making A Lift, Never Exceed The Capacities Listed for Wire Rope Strength Or Machine Capacity, Whichever Is Less. Serious Injury Or Damage May Result.

Note: Refer to the parts manual for proper types and lengths of hoist ropes.

### Wire Rope Reeving

The HFC machines may use from one to eight parts of line when reeving the main hoist line, depending on the lift being made. The fly section may be reeved with two parts of line for better line control but can lift no more than with a single part of line due to structural capacities of the fly section.

When reeving the main hoist line, odd parts of line dead end at the hook block and even parts dead end at the boom peak. Fig. 4-76 gives the proper reeving for various parts of line. The reeving patterns illustrated must be used at all times. To determine how many parts of line to use for a particular lift, consult the wire rope capacity chart.

## FMC Maximum lifting capacities based on wire rope strength

Type No. Dia.	Parts of line									
	1	2	3	4	5	6	7	8	9	10
1-1/2	7,800	18,900	23,900	29,900	36,000	43,900	53,900	67,900	86,900	110,000
2-1/8"	9,800	24,700	31,800	39,900	48,900	59,900	74,900	94,900	120,000	150,000
3"	11,700	29,800	38,900	48,900	59,900	74,900	94,900	120,000	150,000	190,000
3-1/4"	16,800	43,800	58,900	74,900	94,900	120,000	150,000	190,000	240,000	300,000
4"	22,700	59,800	80,900	100,900	125,900	155,900	195,900	245,900	310,000	390,000

Type	Description
A	6 x 25 (6 x 18 class) - 1100 wire - 2 1/2" diameter steel - preferred - L.B.A.C. - right lay - regular lay

Capacities shown on crane capacity plate must not be exceeded. Study Operator's Manual for wire rope inspection procedures.

FMC Corporation Crane and Excavator Division, Cedar Rapids, Iowa

38P0003

Fig. 4-74  
Wire Rope Capacity Chart

GA185-A

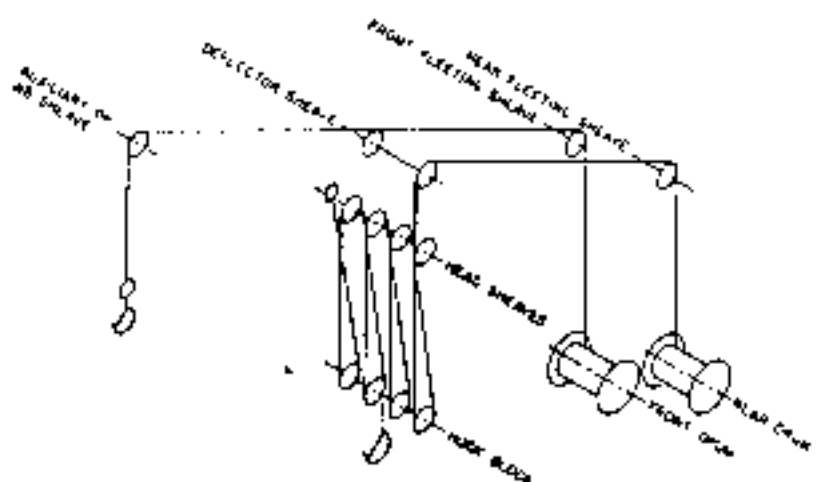


Fig. 4-75  
Main Reeving Diagram

GA34-D

Note: Rope guards must be pinned in place to prevent wire rope from jumping sheave and must always be used. Pin guards in position nearest the sheaves.

### Wire Rope Care

Refer to Section Five for instructions on wire rope care, lubrication, inspection and replacement.

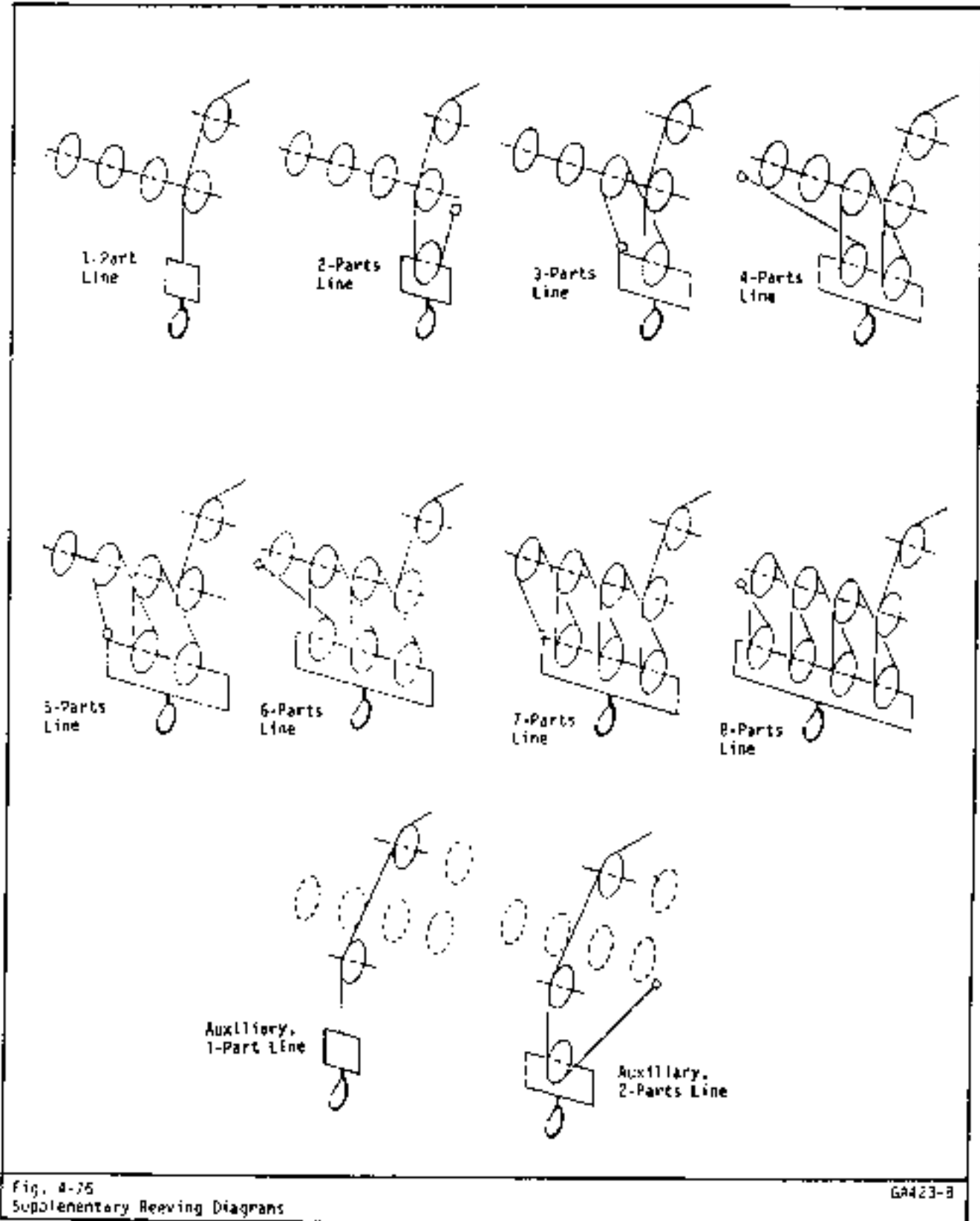


Fig. 4-25  
Supplementary Reeving Diagrams

GA423-B

## Operator's Manual Section 5 - Specifications and General Information

Dimensions	HTC-50		HTC-35, HTC-34	
Overall Length	45' 4-3/8"	(13.87m)	41' 10"	(12.75m)
Overall Height	10' 11"	(3.33m)	10' 0"	(3.05m)
Overall Width, Outriggers Extended	20' 0"	(6.10m)	18' 0"	(5.49m)
Outriggers Retracted	8' 0"	(2.44m)	8' 0"	(2.44m)
Wheel Base	19' 0"	(5.79m)	19' 0"	(5.79m)
Turning Radius	39' 0"	(11.89m)	37' 0"	(11.27m)
Minimum Ground Clearance	9-1/2"	(.24m)	10-1/8"	(.24m)
Boom Extend Over The Front Of Carrier	8' 3"	(2.51m)	5' 0"	(1.53m)
Tailswing	13' 11"	(4.24m)	13' 7-3/4"	(4.16m)
Weights	HTC-50		HTC-34, HTC-35	
Working Weight (One Drum, Basic Boom and Hook Block)	69,470 lbs.	(31,512 kg)	60,695 lbs.	(27,531 kg)
Counterweight With One Drum	6,900 lbs.	(3,130 kg)	7,700 lbs.	(3,493 kg)
Counterweight With Two Drums	5,800 lbs.	(2,631 kg)	6,700 lbs.	(3,039 kg)
Swing Gear Reducer	600 lbs.	(272 kg)	600 lbs.	(272 kg)
Retracted Boom Without Fly, Jib, Or Auxiliary Head Machinery	15,865 lbs.	(7,196 kg)	12,150 lbs.	(5,511 kg)
Folding Adaptor	530 lbs.	(240 kg)	430 lbs.	(191 kg)
Jib Top Section	805 lbs.	(365 kg)	440 lbs.	(200 kg)
Jib 28' Extension	755 lbs.	(342 kg)	420 lbs.	(189 kg)
Jib 20' Extension	560 lbs.	(254 kg)	---	---
Hook Block	800 lbs.	(363 kg)	---	---
Auxiliary Head Machinery	150 lbs.	(68 kg)	---	---
Boom and Attachment Specs	HTC-50		HTC-34, HTC-35	
Main Boom, Retracted	35'	(10.67m)	32'	(9.85m)
Extended	90'	(27.43m)	80'	(24.38m)
Maximum Travel Length Of:				
Tip Section	27' 6"	(8.38m)	24' 0"	(7.32m)
Middle Section	27' 6"	(8.38m)	24' 0"	(7.32m)
Attachment Lengths:				
Fly Section	32'	(9.75m)	28'	(8.53m)
Jib	60'	(18.29m)	50'	(15.24m)
Jib	80'	(24.38m)	---	---
HTC-50	Standard		Optional	
Engine Specifications				
Make	General Motors		Cummins	
Displacement	GM6-71N		K1CC-230	
Maximum Power	426 cubic inches (6982 cc)		855 cubic inches (14,011 cc)	
Peak Torque	244 HP @ 2300 RPM (182 kW @ 2300 RPM)		230 HP @ 2100 RPM (172 kW @ 2100 RPM)	
Low Idle	632 ft./lbs. @ 1600 RPM (846 N·m @ 1600 RPM)		650 ft./lbs. @ 1300 RPM (886 N·m @ 1300 RPM)	
High Idle	500 RPM		600 RPM	
Full Load Speed	2450 RPM		2400 RPM	
Crankcase Capacity	2300 RPM		2100 RPM	
Lube System Capacity	30.5 Qts. (28.9L)		7.0 Gal. (26.5L)	
Cooling System Capacity	---		11.5 Gal. (43.5L)	
Cooling Capacity (Block)	12 Gal. (45.4L)		51.3 Qts. (188.4L)	
	---		20 Qts. (75.9L)	

## Operator's Manual Section 5 - Continued - Specifications and General Information

HTC-35, HTC-34 Engine Specifications	Standard	Optional
Make	General Motors	Cummins
Displacement	G46V-53N 318 cubic inches (5212cc)	VT-555-225 555 cubic inches (9096cc)
Maximum Power	216 HP @ 2800 RPM (161 kw @ 2800 RPM)	218 HP @ 2800 RPM (163 kw @ 2800 RPM)
Peak Torque	446 ft/lbs. @ 1800 RPM (596 N-m @ 1800 RPM)	445 ft/lbs. @ 1900 RPM (595 N-m @ 1900 RPM)
Low Idle	500 RPM	500 RPM
High Idle	2970 RPM	2900 RPM
Full Load Speed	2800 RPM	N.A.
Crankcase Capacity	16 Qts. (15.1L)	-----
Lube System Capacity	-----	8.5 Gal. (32.2L)
Cooling System Capacity	12 Gal. (45.4L)	-----
Cooling Capacity (Block)	-----	4 Gal. (15.1L)

Hydraulic System	HTC-50	HTC-35, HTC-34
System Capacity	266 Gal. (1010L)	236 Gal. (893L)
Sump Tank Capacity	140 Gal. (537L)	138 Gal. (522L)
Pump Output - 1st Section	95 GPM @ 2600 PSI (359.6 L/Min. @ 17,927 kPa)	73 GPM @ 2750 PSI (276.3 L/Min. @ 18,961 kPa)
2nd Section	34 GPM @ 2500 PSI (128.7 L/Min. @ 17,237 kPa)	28 GPM @ 2500 PSI (106.0 L/Min. @ 17,237 kPa)
3rd Section	34 GPM @ 2500 PSI (128.7 L/Min. @ 17,237 kPa)	28 GPM @ 2500 PSI (106.0 L/Min. @ 17,237 kPa)

Tool Kits Provided With Each Machine					
Item No.	Qty.	Description	Item No.	Qty.	Description
3E9TB	1	Upper Tool Kit	2CJ990	2	"0" Ring
JC1868	1	S-O-N Filter Element	2ZJ3041	2	"0" Ring
9C45	2	Grease Gun	2JK23	2	"0" Ring
P6150	1	Grease Gun Hose	25P19	1	Clutch Adjusting Wrench
A4433	1	Hose	31J179	2	"0" Ring
1A4402	1	Dust Cap	31P113	1	Filter Element
1C79	2	Clutch Shim, 12 Ga.	36D154	1	Hydr. Extension
1C79	2	Clutch Shim, 16 Ga.	36J742	2	"0" Ring
1C80	9	Clutch Shim, 20 Ga.	36J747	2	"0" Ring
1J2700	2	"0" Ring	36J748	2	"0" Ring
1X812	3	Grease Fitting, 1/8" Straight	8P941	1	Clutch Adjusting Wrench
1X816	3	Grease Fitting, 1/8", 67.5°	8P942	1	Clutch Adjusting Wrench
1X1800	3	Grease Fitting, 1/8", 90°			
1X1804	1	Cap Plug	3EA1285	1	Carrier Tool Kit
1BA1975	2	"0" Ring	12A2818	1	Hose Assembly
2CJ770	2	"0" Ring	19A1856	1	Remove Tire Inflation
2CJ771	2	"0" Ring	8A4018	1	Lug Wrench
2CJ772	2	"0" Ring			

### Bolt Torque Specifications

Proper tightening of bolts, cap-screws, studs and nuts is very important when assembling or installing any component on a machine. The chart on the facing page lists bolt torque for most popular sizes of bolts, including grade 5 and grade 8. The chart also applies to tightening studs, or tightening nuts. Refer to the

chart whenever a bolt must be tightened on a machine.

The information shown on the chart is applicable in all cases, except where other torque data is published in an operator's or shop manual. Two columns of figures are shown for each type of bolt, dry and lubricated. The "dry" column would cover bolts as they come from the package, or

bolts with no external lubrication applied. The second column covers bolts externally lubricated with oil, white lead, anti-seize, graphite, etc. This column should also be used to tighten bolts which are being located.

Torque specifications are listed in English (ft/lbs.) and metric (Newton meters, N-m).

**Operator's Manual** Section 5 - Continued - Specifications and General Information

GRADE 2				ALLOY STEEL FASTENERS				
Dimension (Inches)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Min. Torque (Inch-Lbs)	
1/4	100-140	11.4-11.5	80-95	9.0-9.15	180-190	21.00-21.5	150-140	10.0-11.00
5/16	170-210	23.4-23.7	140-170	15.5-17.1	320-340	36.7-37.8	270-275	20.0-21.5
3/8	270-330	37.0-37.3	240-280	27.0-28.5	540-570	61.4-62.5	460-475	35.0-37.5
7/8	910-970	121.0-121.5	810-870	90.0-91.5	1800-1900	203.0-205.0	1500-1550	115.0-120.0

Grade	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)
1/2	270-330	37.0-37.3	240-280	27.0-28.5
5/8	410-470	54.0-54.5	370-410	41.0-42.5
3/4	550-610	72.0-72.5	490-530	56.0-57.5
1	710-770	93.0-93.5	640-680	74.0-75.5
1 1/8	900-960	118.0-118.5	810-850	95.0-96.5
1 1/4	1100-1160	145.0-145.5	990-1030	121.0-121.5
1 3/8	1310-1370	173.0-173.5	1180-1220	149.0-149.5
1 1/2	1530-1590	202.0-202.5	1390-1430	178.0-178.5
1 3/4	1770-1830	232.0-232.5	1620-1660	208.0-208.5
2	2030-2090	263.0-263.5	1870-1910	239.0-239.5
2 1/4	2310-2370	295.0-295.5	2140-2180	271.0-271.5
2 3/4	2610-2670	328.0-328.5	2430-2470	304.0-304.5
3	2930-2990	362.0-362.5	2740-2780	338.0-338.5

**Notes:**  
 1. Conditions - Max. height of 15' Point Head  
 2. Nut - See Illustration Below  
 3. Do not Exceed Values or Settings  
 4. Ratings - Markings

GRADE 5				GRADE 8			
Dimension (Inches)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)	Dimension (Inches)	Min. Torque (Inch-Lbs)	Max. Torque (Inch-Lbs)
1/4	100-140	11.4-11.5	100-140	11.4-11.5	1/4	180-200	21.0-21.5
5/16	170-210	23.4-23.7	170-210	23.4-23.7	5/16	320-340	36.7-37.8
3/8	270-330	37.0-37.3	270-330	37.0-37.3	3/8	540-570	61.4-62.5
7/8	910-970	121.0-121.5	910-970	121.0-121.5	7/8	1800-1900	203.0-205.0
1	1100-1160	145.0-145.5	1100-1160	145.0-145.5	1	2000-2100	227.0-229.0
1 1/8	1310-1370	173.0-173.5	1310-1370	173.0-173.5	1 1/8	2300-2400	257.0-259.0
1 1/4	1530-1590	202.0-202.5	1530-1590	202.0-202.5	1 1/4	2600-2700	287.0-289.0
1 3/8	1770-1830	232.0-232.5	1770-1830	232.0-232.5	1 3/8	2900-3000	317.0-319.0
1 1/2	2030-2090	263.0-263.5	2030-2090	263.0-263.5	1 1/2	3200-3300	347.0-349.0
1 3/4	2310-2370	295.0-295.5	2310-2370	295.0-295.5	1 3/4	3500-3600	377.0-379.0
2	2610-2670	328.0-328.5	2610-2670	328.0-328.5	2	3800-3900	407.0-409.0
2 1/4	2930-2990	362.0-362.5	2930-2990	362.0-362.5	2 1/4	4200-4300	447.0-449.0
2 3/4	3270-3330	397.0-397.5	3270-3330	397.0-397.5	2 3/4	4600-4700	487.0-489.0
3	3630-3690	433.0-433.5	3630-3690	433.0-433.5	3	5000-5100	527.0-529.0
3 1/4	4010-4070	470.0-470.5	4010-4070	470.0-470.5	3 1/4	5400-5500	567.0-569.0
3 1/2	4410-4470	508.0-508.5	4410-4470	508.0-508.5	3 1/2	5800-5900	607.0-609.0
3 3/4	4830-4890	547.0-547.5	4830-4890	547.0-547.5	3 3/4	6200-6300	647.0-649.0
4	5270-5330	587.0-587.5	5270-5330	587.0-587.5	4	6600-6700	687.0-689.0
4 1/4	5730-5790	628.0-628.5	5730-5790	628.0-628.5	4 1/4	7000-7100	727.0-729.0
4 1/2	6210-6270	670.0-670.5	6210-6270	670.0-670.5	4 1/2	7400-7500	767.0-769.0
4 3/4	6710-6770	713.0-713.5	6710-6770	713.0-713.5	4 3/4	7800-7900	807.0-809.0
5	7230-7290	757.0-757.5	7230-7290	757.0-757.5	5	8200-8300	847.0-849.0

**Notes:**  
 1. Conditions - Max.  
 2. Nut - See Illustration Below  
 3. Do not Exceed Values or Settings  
 4. Ratings - Markings

## Operator's Manual Section 5 - Continued - Specifications and General Information

### Wire Rope Types

Wire ropes are made with two types of "lay". Lay refers to the direction in which the wires and strands are twisted to form the rope. Refer to Fig. 5-1.

Regular lay as opposed to lang lay denotes the direction of wire twist in the individual strands. In regular lay rope, the wires in each strand twist in the opposite direction from the strands.

In lang lay rope the wires in each strand twist in the same direction as the strands.

Right or left are used to refer to the direction of twist of the strands.

Right regular lay rope is the most commonly used, and will be furnished on an order unless other lay is specified.

Ropes are commonly preferred to extend service life. In pre-forming, both individual wires and strands are helically formed into the shape they will assume in the finished rope.

### Measuring Wire Rope Diameter

As the illustrations in Fig. 5-2 indicate, there is a right and wrong way to measure wire rope diameter. Wire rope is always measured across the largest diameter that will fit inside a true circle.

Wire rope is always made larger, not smaller, than the nominal diameter. However, wear tends to reduce rope diameter. The allowable tolerances for new wire rope diameters are:

Nominal Diameter	Allowable Over Size
up to 3/4"	1/32"
13/16" to 1-1/8"	3/64"
1-3/16" to 1-1/2"	1/16"
1-9/16" to 2-1/4"	3/32"
2-5/16" and larger	1/8"
up to 19.05mm	0.79mm
20.64mm to 29.58mm	1.19mm
30.16mm to 38.15mm	1.52mm
39.65mm to 57.15mm	2.18mm
58.74mm and larger	3.18mm

In standard practice, the nominal diameter is the minimum diameter. A rope is not considered oversized until its diameter exceeds the maximums listed above.

### Ordering Wire Rope

When ordering wire ropes, the following information must be furnished, to be sure of receiving the correct wire rope. This is especially true when ordering wire rope from other sources than FMC Corporation.

- (a) Length required.
- (b) Nominal diameter.
- (c) Construction (type and number of strands, and wires per strand).
- (d) Type of core (nemp or wire center).
- (e) Grade of steel.
- (f) Direction of lay (right or left lay).
- (g) Regular lay or lang lay.
- (h) Class of service wire rope is intended for; that is, drag wire rope on a drag line, hoist wire rope on a shovel, etc.
- (i) Preformed or not preformed.

When the above information is not specified, the wire rope manufacturer will generally furnish right, regular lay, ordinary fabrication, nemp center wire ropes.

### Wire Rope Inspection And Replacement

All wire ropes will eventually deteriorate to the point where it must be replaced. There are three basic reasons for this deterioration, as follows:

- (1) Abrasion or wear.
- (2) Corrosion.
- (3) Damage caused by fatigue bending, crushing, kinking, forces or abuse acting against the rope during normal usage.

When the wire rope is replaced, use type specified in the parts manual. Machines are designed to use a specific type and size of rope. Using anything but the recommended rope may result in short life or even breakage.

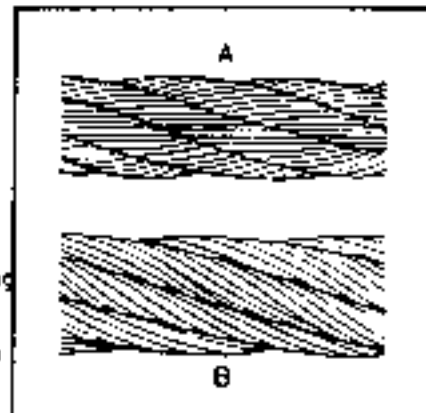


Fig. 5-1 2:15-A  
Wire Rope  
(A) Right Regular Lay  
(B) Right Lang Lay

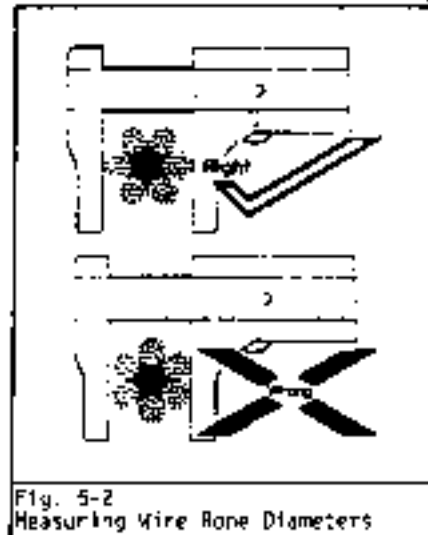


Fig. 5-2  
Measuring Wire Rope Diameters

All wire ropes in active service must be inspected daily. Dated records should be kept on this inspection. A sample inspection report is shown in Fig. 5-3.

This inspection should determine the degree of deterioration at the worst rope lay, as this will determine the suitability of the rope for continued service. By definition, a rope lay is the axial distance along the rope in which one strand makes one complete turn around the rope. Conditions such as the following would be reason to question rope safety:





## Operator's Manual Section 5 - Continued - Specifications and General Information

- (5) Severe kinking, severe crushing, or other damage resulting in distortion of the rope structure.
- (6) Evidence of any heat damage resulting from a torch or arc caused by contact with electrical wires.
- (7) Reduction from nominal diameter of more than 3/54 inch diameters up to and including 3/4"; 1/16" for diameters 7/8 to 1-1/8"; 3/32" for diameters 1-1/4 to 1-1/2". Marked reduction in diameter indicates deterioration of the core resulting in lack of proper support for the load carrying strands. Excessive rope stretch or elongation may also be an indication of internal deterioration.
- (8) Evidence of "bird-caging" or other distortion resulting in some members of the rope structure carrying more load than others.
- (9) Noticeable rusting or development of broken wires in the vicinity of attachments.

Note: If this condition is localized in an operating rope and the section in question can be eliminated by making a new attachment, this can be done rather than replacing the entire rope.

### Wire Rope Lubrication

Wire rope is a machine. Each time a wire rope bends over a sheave, or straightens from a slack position, many wires move against each other. Lubrication is necessary to help prevent wear caused by this movement. Lubrication also helps prevent deterioration of wire rope due to rust and corrosion.

Note: Rusty rope is dangerous since there is no way of determining its remaining strength.

Most wire ropes are lubricated during manufacture, but the lubricant doesn't last the life of the rope. The lubricant is squeezed out of the rope as it runs over sheaves under tension, washed off by rain, etc.

For the above reasons, wire ropes must be periodically relubricated. Crude or used oils and grease should not be used as lubricants because they may be grit or acid laden. Either of these conditions would be bad for the rope.

No set rule can be given for lubrication frequency. This will depend on the conditions the rope is operating under. A rope operating in wet conditions, would need lubrication more often than one operating under dry conditions to prevent rust and corrosion.

Lubricants used for wire rope lubrication should have the following properties:

- (a) They must contain no acids or alkalis.
- (b) They must have enough adhesive strength to stay on the rope.
- (c) They must be able to penetrate between the wires and strands.
- (d) They must have high film strength.
- (e) They must resist oxidation.
- (f) They must remain soft and pliable.

### Application of Lubricant

Wire ropes that have been in service must be cleaned before lubrication. Use a wire brush, and compressed air to clean the rope. All possible foreign material and old lubricant must be removed from the rope before lubrication. Use one of the following methods to apply the lubricant:

- (a) Continuous Bath: Run the rope through a container filled with lubricant. A sheave mounted in the center of the container will hold the rope submerged as it passes through the container. Use swabbing to remove excess lubricant as the rope leaves the container.

- (b) Dripping: Place a container above a sheave so that a spigot may be opened to drip oil on the wire rope as it passes through the sheave groove.

- (c) Swabbing and Painting: Two fast methods are swabbing the lubricant on with rags, or painting it on with a brush.

- (d) Spraying: Light lubricants may be applied with a spray gun. Aerosol cans of lubricant are also available.

### Unreeling Wire Rope

When unreeling wire rope, set the reel up horizontally so it can rotate as the rope is reeled off. Reel the rope off slowly, so the reel won't tend to "throw" the rope off. Avoid reverse bends. If installing rope over the top (over winding drum), of a drum, set the reel up so the rope is removed over the top of the reel.

When installing rope around the bottom of a drum (underwinding drum) set the reel up so rope is removed under the bottom of the reel. To obtain snug and uniform winding on the drum, brake the reel with a large timber to provide back tension.

Proper winding of the first rope layer on a multiple wrap drum is important. If the first layer is properly wound, succeeding layers will automatically be controlled. This is especially important on ungrooved drums. When starting new wire rope on such drums, drive each wrap of the first layer lightly with a wooden mallet so each wrap barely contacts the preceding one.

When uncoiling the wire rope, roll the coil along the ground and the rope will be as straight as it was before being coiled for shipment. Don't uncoil rope where it may be run over by trucks or other equipment. Refer to Fig. 5-4.

## Operator's Manual SECTION 5 - Continued - Specifications and General Information

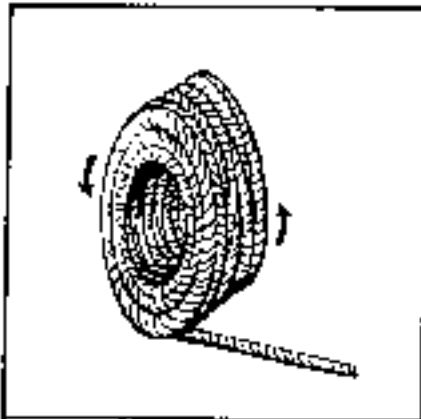


Fig. 5-4 1254-A  
Uncoiling Wire Rope

Note: A new rope should be broken in by running it slowly through its working cycle for a short period under a light load.

### Sheave Inspection

Whenever wire rope is replaced, the sheaves and grooves in drums should be checked for wear or damage and replaced if necessary. Damaged, worn or undersized sheaves will damage the rope. On older equipment remember that new rope is always bigger in diameter than the worn rope it replaces. The sheave grooves may be worn to the smaller diameter of the old rope.

### Cutting Wire Rope

When wire rope is to be cut, seizings should be placed on each side of the point where the rope is to be cut, to keep the strands in place. On preformed rope, one seizing on each side of the cut is enough. On non-preformed rope less than 7/8" diameter, two seizings are recommended. On non-preformed ropes over 7/8" diameter, three seizings are recommended.

Three basic methods of cutting wire rope are recommended:

- (1) Abrasive cutting tools
- (2) Shearing tools. (Wire cutters on small rope, a wire rope cutter and hammer for larger ropes).
- (3) Acetylene cutting torch.

### Socket and Wedge Connections

The correct and incorrect methods of attaching a wedge and socket to wire rope are shown in Fig. 5-5. The dead end of the wire rope must always be on the sloped portion of the socket. The load line must be in a straight line pull with the eye of the socket. If the rope is installed backwards as shown in "B" in Fig. 5-5, a kink will develop at the point where the rope enters the socket.

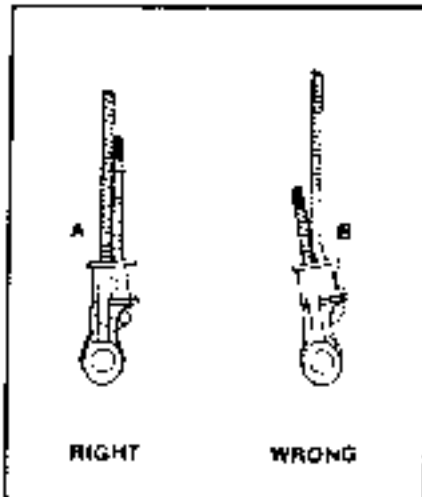


Fig. 5-5  
Wedge Type Connections

Note: The use of wire rope clips with socket and wedge connections is not recommended. Addition of wire rope clips will actually weaken the connections.

### **CAUTION**

Use The Proper Size Wedge With A Wire Rope Socket Or Lagging. The Use Of An Offsize Wedge In A Socket Or Lagging Is Dangerous As It May Not Hold. Wedges And Sockets Shipped From FMC Corporation Are Stamped With Size And Type Identification. A Lagging Or Socket May Be Stamped For Two Or More Sizes Of Rope, And A Wedge For One Or Two. The Size On The Lagging, Socket And Wedge Must Correspond To The Rope Size Used.

### Wire Rope Clip Installation

The correct method of installing wire rope clips is as shown in Fig. 5-6. The "U" bolt must always be over the short end of the wire rope, and the base must always contact the long end.

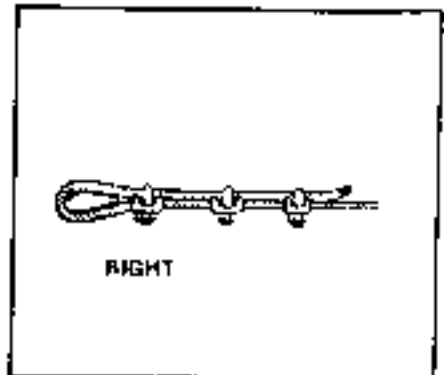


Fig. 5-6  
Wire Rope Clip Installation

Clips should not be staggered, that is, "U" bolt of one clip over short end, "U" bolt of next clip over long end, etc. This practice will not only distort the wire rope excessively, but will prevent maximum strength of this type fastening. Placing all clips with the "U" bolt over the long end of the wire rope will damage strands, and result in an unsafe condition.

The distance between clips should be not less than six times the wire rope diameter. In relation to size of wire rope, the minimum number of clips recommended for a safe connection is as shown on page 5-8.

### **CAUTION**

Apply The Initial Load And Retighten Nuts To The Recommended Torque. Rope Will Stretch And Shrink In Diameter When Loads Are Applied. Inspect Periodically And Retighten As Required.

### Use Of Wire Rope Clips With Sockets

Some codes require the use of a wire rope clip in conjunction with a wedge socket. In some cases, particularly in wrecking

ball work, there is a chance that the wedge can loosen, releasing the socket from the rope. This could be caused by the banging action, and alternate loading and unloading of the rope that occurs during this type of work.

As noted before, use of wire rope clips with a wedge socket connection can weaken the connection. Do not attach the dead end of the rope to the live side with the clip as this will seriously weaken the connection. The clip will ultimately take the load and may deform or break the rope. Refer to Fig. 5-7.

Either install the clip on the dead end of the rope, or loop the dead end over and install a clip. The loop thus formed must not be allowed to enter the wedge, or the connection will be weakened.

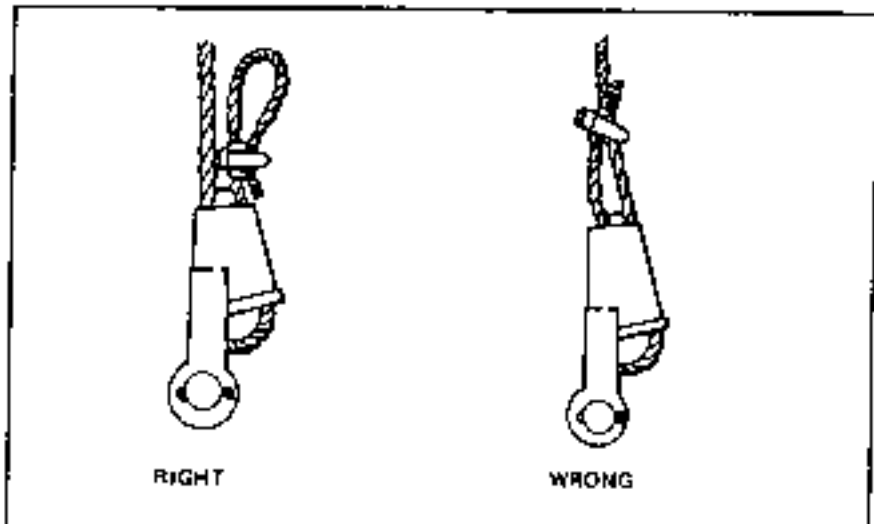


Fig. 5-7  
Wire Rope Clip with Socket

RAS

Clip Size	Minimum No. Of Clips	Amount Of Rope To Turn Back	Tightening Torque (In Ft./ lbs. (N·m))
1/8" (3.175mm)	2	3-1/4" (8.26cm)	-
3/16" (4.763mm)	2	3-3/4" (9.53cm)	-
1/4" (6.350mm)	2	4-3/4" (12.07cm)	15 (20.04)
5/16" (7.918mm)	2	5-1/4" (13.34cm)	30 (40.07)
3/8" (9.525mm)	2	6-1/2" (16.51cm)	45 (60.11)
7/16" (11.113mm)	2	7" (17.78cm)	65 (86.93)
1/2" (12.700mm)	3	11-1/2" (29.27cm)	65 (86.93)
9/16" (14.288mm)	3	12" (30.30cm)	95 (126.90)
5/8" (15.875mm)	3	12" (30.30cm)	95 (126.90)
3/4" (19.050mm)	4	19" (48.16cm)	130 (173.65)
7/8" (22.225mm)	4	19" (48.16cm)	225 (300.56)
1" (25.400mm)	5	26" (66.04cm)	225 (300.56)
1-1/8" (29.575mm)	6	34" (86.36cm)	225 (300.56)
1-1/4" (31.740mm)	6	37" (94.17cm)	360 (480.89)
1-3/8" (34.925mm)	7	44" (111.82cm)	360 (480.89)
1-1/2" (39.100mm)	7	46" (116.83cm)	360 (480.89)
1-5/8" (41.275mm)	7	51" (129.54cm)	430 (574.39)
1-3/4" (44.450mm)	7	53" (134.62cm)	590 (788.12)
2" (50.800mm)	8	71" (177.81cm)	750 (1001.35)
2-1/4" (57.150mm)	8	73" (185.42cm)	750 (1001.35)
2-1/2" (63.500mm)	9	84" (213.36cm)	750 (1001.35)
2-3/4" (69.850mm)	10	100" (254.00cm)	750 (1001.35)
3" (76.200mm)	10	106" (269.26cm)	1200 (1622.96)

If a greater number of clips are used than shown in the table, the amount of rope turnback should be increased proportionately.

## Operator's Manual Section 5 - Continued - Specifications and General Information

### Fundamental Terms

**Accumulator:** A container in which fluid is stored under pressure as a source of hydraulic energy.

**Actuator:** A device for converting hydraulic energy into mechanical energy. A motor or cylinder.

**Aeration:** Aeration is the condition when air is present in the hydraulic fluid. This causes the fluid to appear milky and components operate erratically because of the compressibility of the air trapped in the fluid.

**Assembly:** An assembly is a connector of parts that forms a unit. Assembly drawings show the parts that make up a working unit.

**Attachment:** An alternate designation for front end equipment. Also, any other device that may be added as a complete unit or assembly.

**Back Pressure:** Back pressure usually refers to the pressure existing on the discharge side of a load. It adds to the pressure required to move the load.

**Backward Stability:** Resistance to overturning of the machine in rearward direction.

**Boom Angle:** The angle above or below horizontal of the longitudinal axis of the boom base section.

**Boom Foot:** Base of boom where it attaches to revolving superstructure.

**Boom Head:** Sheaves and pins at top or peak of boom, or any other mechanism at boom head.

**Boom Hoist:** Mechanical or hydraulic device used to control the boom angle.

**Boom Length:** The straight line through the centerline of the boom foot pin to the centerline of the boom head sheave shaft, measured along the longitudinal axis of the boom.

**Boom Sections:** Hydraulically operated segments, which, when assembled, form the boom.

**Brake Band:** A circular steel member lined with heat resistant friction material.

**Breather:** A device which permits air to move in and out of a container or component to maintain atmospheric pressure.

**By-Pass:** A by-pass is a secondary passage of fluid flow.

**Cable:** A flexible electrical conductor.

**Canilever:** A member projecting beyond the point of suspension

**Cavitation:** A condition where air is induced into a cavity, line, or chamber normally filled with oil. This condition can cause damage to pumps, cylinder walls, etc.

**Chamber:** A chamber is a compartment within a hydraulic component.

**Charge (Supercharge):** (1) To replenish a hydraulic system above atmospheric pressure. (2) To fill an accumulator with fluid under pressure.

**Check Valve:** A valve which permits flow of fluid in one direction only.

**Circuit:** A complete or partial path over which current or fluid may flow.

**Closed Center Circuit:** The condition where the fluid only flows to the main control valves when a control valve spool is actuated. This can be done two different ways: (1) Using a pressure compensated pump or (2) Using a fixed displacement pump, unloading valve and an accumulator

**Component:** Any part of an assembly on a machine when referred to individually.

**Compressibility:** The change in volume of fluid, when it is subjected to a unit change in pressure.

**Cooler:** A heat exchanger used to remove heat from the hydraulic fluid.

**Counter Balance Valve:** See holding valve.

**Counterweight:** Weight used to supplement the weight of the machine in providing stability for lifting working loads.

**Cracking Pressure:** The pressure at which a pressure actuated valve begins to pass fluid.

**Cylinder:** A cylinder is a device which converts fluid power into linear mechanical force and motion. It usually consists of a movable element, such as a piston and piston rod, which operates within a cylindrical bore.

**Delivery:** The volume of fluid discharged by a pump in a given time, usually expressed in gallons per minute (GPM).

**Displacement:** The quantity of fluid which can pass through a pump, motor, or cylinder in a single revolution or stroke.

**Double Acting Cylinder:** A cylinder in which fluid force can be applied in either direction.

**Drain:** A passage in, or a line from, a hydraulic component which returns leakage fluid independently to the reservoir or manifold.

**Drum (Rope):** A rotating cylinder with side flanges on which wire rope used in machine operations is wrapped.

**Filter:** A device whose primary function is the removal by a porous media of insoluble contaminants from a fluid.

## Operator's Manual Section 5 - Continued - Specifications and General Information

**Flow Divider:** A valve which divides a flow of oil into two streams of a set gallage.

**Force:** A force is any cause which tends to produce or modify motion. In hydraulics, total force is expressed by the product of pressure (P) and the area of the surface (A) on which the pressure acts. ( $F = P \times A$ ).

**Fly Section:** Boom tip extension supported only at its base.

**Frame:** Structure on which either upper or lower machinery is situated.

**Free Fall:** Lowering of the hook without being coupled to the power train, with a lowering speed controlled by a retarding device, such as a brake.

**Friction:** The property which tends to resist the relative motion of one surface in contact with another surface. It always exerts a definite drag in opposite to motion and thus consumes power.

**Full Flow:** In a filter, the condition where all the fluid must pass through the filter element.

**Full Load Speed:** The speed at which an engine runs when it is delivering its full rated horse power.

**Head:** The pressure exerted by a column or body of fluid due to its height and weight.

**Heat Exchange:** See cooler.

**High Idle:** Governed engine speed at full throttle and no load.

**Hoist:** Function of lifting and lowering loads.

**Holding Valve (Counterbalance Valve):** A valve which maintains resistance to flow in one direction, but permits free flow in the other.

**Jib:** Boom tip extension supported at both its base and peak.

**Lifting Capacities:** The rated load for any given load radius and boom angle under specified operating conditions.

**Mats:** Supports or floats used for supporting machine on soft ground. Usually of timber construction.

**Micron:** One millionth of a meter or .00004 inch.

**Motor (Hydraulic):** A rotary motion device which changes hydraulic energy into mechanical energy; a rotary actuator.

**Open Center Circuit:** A circuit where the pump continuously circulates fluid through the control valves to the reservoir in the neutral position.

**Outriggers:** Extendible arms attached to the mounting base, which rest on supports at the outer ends to increase stability.

**Passage:** A machine or cored connection within a hydraulic component which acts as a conductor of fluid.

**Pilot Pressure:** Auxiliary pressure used to actuate or control hydraulic components.

**Pinion:** A pinion is usually the small gear in a gear train and drives the other gears.

**Pitch Diameter:** The root diameter of a drum lagging or sheave plus the diameter of wire rope.

**Poppet:** A poppet is a disc or cone shaped part of certain valves which when closed against a seat prevents flow.

**Port:** The open end of a passage. May be within or at the surface of a hydraulic component housing or body.

**Preload:** The condition of an antifriction bearing when it is compressed or loaded in such a way as to eliminate initial looseness.

**Pressure:** Pressure equals force per unit of area, usually expressed in pounds per square inch (PSI).

**Pressure Drop:** The reduction in pressure between two points in a line or passage due to the energy lost in maintaining flow.

**Pressure Reducing Valve:** A valve which limits the maximum pressure at its outlet, regardless of the inlet pressure.

**Pump (Hydraulic):** A device which converts mechanical force and motion into hydraulic fluid power.

**Radius Of Load:** The horizontal distance from the center of rotation of the machine to the center of gravity of a suspended load.

**Rated Load:** See lifting capacity.

**Rear End Radius:** See tailswing

**Reduction Shaft:** A shaft assembly used for reducing speed.

**Reeving:** Passing of ropes over pulleys or sheaves.

**Relief Valve:** A pressure operated valve which by-passes pump delivery to the reservoir, limiting system pressure to a predetermined maximum value.

**Reservoir:** A container for storage of fluid in a fluid power system.

**Restriction:** A reduced cross-sectional area in a line or passage which produces a pressure drop.

**Revolving frame:** A structure on which the power unit and machinery for the upper assembly is situated.

**Ring Gear:** See turntable bearing.

**Rope:** See wire rope.

**Rotating Joint:** Component which transfers hydraulic fluid between a stationary and rotating member.

## Operator's Manual Section 5 - Continued - Specifications and General Information

**Schematic:** A schematic diagram is a representation of a system showing everything in a simple way. No attempt is made to show the various devices in their actual relative positions. A schematic points out the operation of a circuit for troubleshooting purposes.

**Spool:** This term is loosely applied to almost any moving cylindrically shaped part of a hydraulic component which moves to direct flow through the component.

**Strainer:** A device for the removal of coarse solids from a fluid. (See Filter).

**Strokes:** The length of travel of a piston or spool.

**Suction Line:** The hydraulic line connecting the pump inlet port to the reservoir or tank.

**Sump Tank (Hydraulic Reservoir):** The storage compartment for hydraulic fluid.

**Surge:** A transient rise in hydraulic pressure in the circuit.

**Swing:** The swing motion is the rotation of the upper platform machinery, and attachments in either direction. It is possible to swing the upper of this machine through a full, continuous 360 degrees.

**Swing:** The swing radius from center of rotation to the extreme rear extension of the revolving superstructure.

**Tank:** See reservoir.

**Torque:** Torque is a turning or twisting effort (usually) measured in ft/lbs. or in/lbs.

**Turntable Bearing:** A large antifriction bearing which the upper superstructure revolves upon.

**Unloading Valve:** A valve which by-passes flow to tank when a set pressure is maintained on its pilot port.

**Valve:** A device for controlling flow rate, flow direction, or pressure of a fluid.

**Viscosity:** The resistance of oil to flow is termed viscosity. High viscosity indicates a high resistance to flow; low viscosity indicates a low resistance to flow. Viscosity is expressed in seconds, Saybolt Universal (SSU or SUS).

**Viscosity Index (V.I.):** A measure of an oil's characteristic tendency to thin with temperature increase and thicken with temperature decrease. A high V.I. figure indicates a relatively low rate of change of viscosity with respect to temperature.

**Wire Rope:** A flexible, multi-wired member usually consisting of a core member around which a number of multi-wired strands are helically bent.

**Wiring Diagram:** A wiring diagram includes all the devices in an electrical system and shows their physical relationship to each other. Such a diagram gives the necessary information for actual wiring or physically tracing lines when troubleshooting is necessary.

**Working Weight:** Weight of machine with full radiator, half full fuel tank and attachment installed.

