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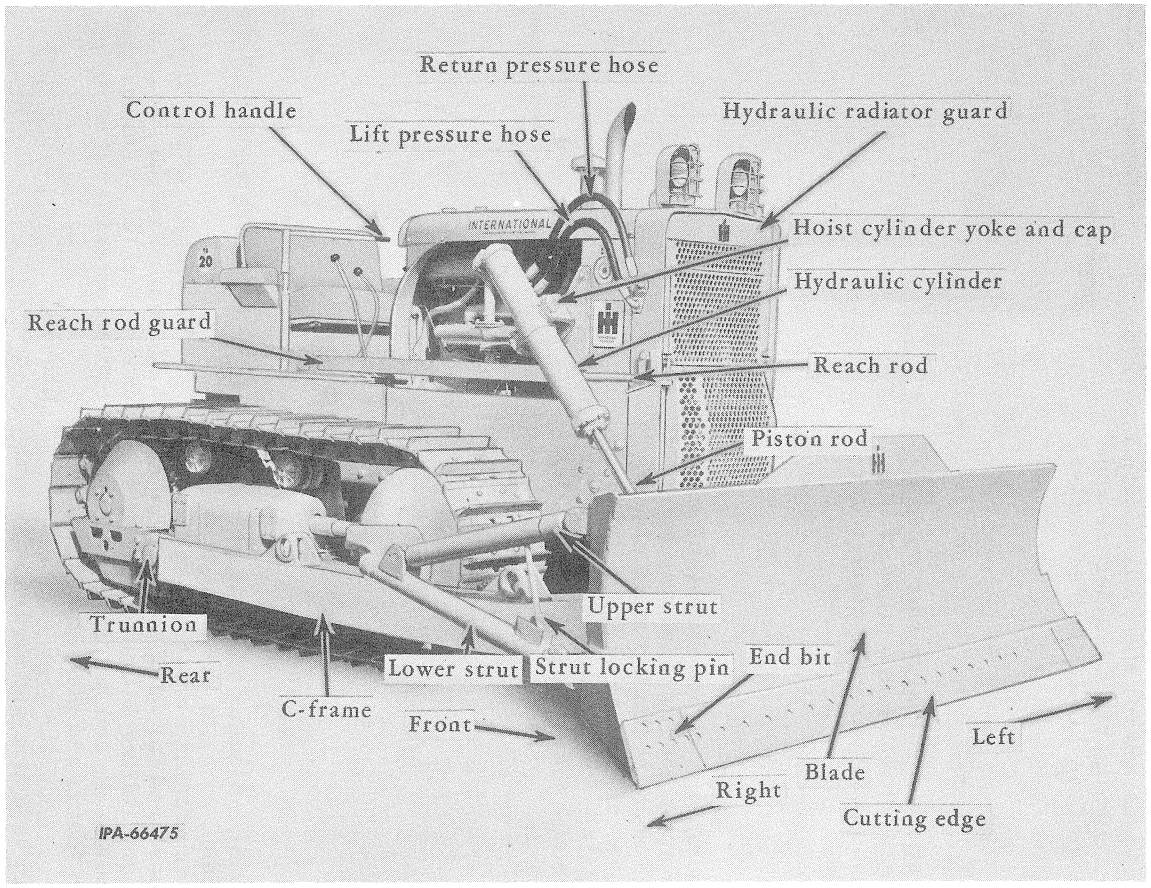


Illust. 1

Principal components of the 20G-2 bullgrader.

INTRODUCTION

Throughout this manual the use of the terms "left" and "right" and "front" and "rear" must be understood to avoid confusion when following instructions. (Refer to Illust. 1.)

This manual contains operation, lubrication, maintenance and installing instructions for the 20D-2 and 20G-2 hydraulically operated bulldozers and bullgraders and for the 20D-1, 20G-1, 20D-3 and 20G-3 cable operated bulldozers and bullgraders used with the TD-20 (201 series) crawler tractors.

Some illustrations and text in this manual are for general application to machines of this model and may not show your equipment accurately in all details.

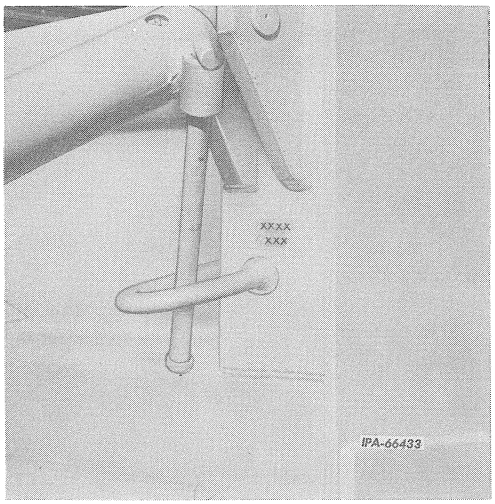
The serial number and model designation for the bulldozer and the bullgrader are stamped on the back of the blade at the top right corner (Illust. 2). The serial number is to be used when ordering parts. For ready reference, we suggest that you write these serial numbers in the spaces provided.

Bulldozers:

Serial No. 20D-1 _____
20D-2 _____
20D-3 _____

Bullgraders:

Serial No. 20G-1 _____
20G-2 _____
20G-3 _____



Illust. 2
Serial number.

DESCRIPTION

A bullgrader or bulldozer consists primarily of a blade and push frame, in the front of a tractor, to be used for grading or pushing materials. The blades are designed for easy penetration and efficient suction and rolling action. The difference between a bulldozer and bullgrader is entirely in the push frame and blade construction.

The bulldozer is a straight blade dozer with struts attached to the blade so the blade is held at a right angle to the center-line of the tractor. The blade can be pitched (changing to the suction angle) and tilted vertically so one end of the blade is above the other end.

The bullgrader blade is attached to the C-frame by a swivel at the center, and supported at the ends by the upper and lower struts. This construction makes it possible to angle the blade horizontally, and also to tilt it vertically.

CABLE OPERATED BULLDOZERS AND BULLGRADERS

The major assemblies of the bulldozer and bullgrader are the radiator guard, blade, push frame, cable, sheaves, cable control unit and cable control levers.

Controls

20D-1 and 20G-1

The control lever, which is used to raise or lower the blade, is mounted on the tractor at the right side of the operator.

20D-3 and 20G-3

The control levers are mounted at the rear of the tractor, behind the operator. The lower

lever controls the right drum, which is used to raise or lower the blade. The upper lever controls the left drum.

HYDRAULIC OPERATED BULLDOZERS AND BULLGRADERS

The major assemblies of the bulldozer and bullgrader are the hydraulic cylinders, radiator guard with integral oil tank, hydraulic pump and valve, cylinder hose connections, blade, push frame, controls and trunnion brackets.

The hydraulic system consists of the hydraulic pump, oil strainer, control valve with control handle, oil tank, hydraulic cylinders and hoses.

The hydraulic pump forces oil to the cylinders, on each side of the unit, for raising or lowering the blade. The direction of the oil flow for raising, holding, lowering and floating the blade is controlled by the operating plunger (located in the valve housing).

Pressure control is established at the hydraulic pump where a pressure relief valve is located. This pressure relief valve is set at the factory at a pressure of 1650 pounds per square inch (at full throttle), and automatically by-passes oil when that pressure is reached.

Relief by-pass ports in each piston head automatically eliminate momentary high pressure caused by the piston reaching the end of the cylinder.

MODEL DESIGNATION OF TRACTOR EQUIPMENT

20D-2	Bulldozer	- Direct Lift Hydraulic
20G-2	Bullgrader	- Direct Lift Hydraulic
20D-1	Bulldozer	- Front C.C.U.
20D-3	Bulldozer	- Rear C.C.U.
20G-1	Bullgrader	- Front C.C.U.
20G-3	Bullgrader	- Rear C.C.U.

SPECIFICATIONS

	20D-2	20G-2	20D-1 20D-3	20G-1 20G-3
Blade:				
Length	10' 3-1/4"	12' 8-1/4"	10' 3-1/4"	12' 8-1/4"
Height	43-3/4"	- - - - -	43"	- - - - -
Height, including spillboard	50-1/2"	45-1/2"	50-1/2"	45-1/2"
Maximum lift	43"	42"	47-1/2"	44"
Maximum drop below ground level.	16"	15-1/2"	Not limited	Not limited
Maximum tilt adjustment	12"	- - - - -	12"	- - - - -
Maximum pitch adjustment	8°	- - - - -	8°	- - - - -
Moldboard:				
Construction	Box framed	Box framed	Box framed	Box framed
Cutting Edge (reversible):				
Length	7' 5-7/8"	10' 3-1/8"	7' 5-7/8"	10' 3-1/8"
Width	10"	10"	10"	10"
Thickness	3/4"	3/4"	3/4"	3/4"
Material	High carbon steel	High carbon steel	High carbon steel	High carbon steel
End Bit (2):				
Length	16-9/16"	15-3/4"	16-9/16"	15-3/4"
Width	10"	10"	10"	10"
Thickness	1"	1"	1"	1"
Material	High carbon steel	High carbon steel	High carbon steel	High carbon steel
Hydraulic System:				
Oil capacity, gallons	7	7	- - - - -	- - - - -
Pump capacity, gpm	85	85	- - - - -	- - - - -
Pump type	Gear	Gear	- - - - -	- - - - -
Operating oil pressure (normal) psi	1650	1650	- - - - -	- - - - -
Cylinders (double acting) bore and stroke	5-1/4 x 34-13/16"	5-1/4 x 34-13/16"	- - - - -	- - - - -

Continued on next page.

	20D-2	20G-2	20D-1 20D-3	20G-1 20G-3
Sheave diameter	- - - - -	- - - - -	8"	8"
Number of lifting strands	- - - - -	- - - - -	4	4
Cable required (1/2" 6 x 25 wire rope core):				
20D-1 and 20G-1	- - - - -	- - - - -	50' 0"	50' 0"
20D-3 and 20G-3	- - - - -	- - - - -	70' 0"	70' 0"
Cable control unit required:				
20D-1 and 20G-1	- - - - -	- - - - -	110	110
20D-3 and 20G-3	- - - - -	- - - - -	P-25 or P-29	P-25 or P-29

Specifications subject to change without notice.

INSTALLATION

INSTALLATIONS OF COMPONENTS

General

Installing this type of equipment should be done in a shop that is equipped with some type of hoisting equipment.

MODELS 20D-2 AND 20G-2 ONLY: Have available seven gallons of clean Grade-10W heavy duty motor oil that contains an anti-foaming agent.

Remove all parts from their containers. Check all parts against the packing list included in the envelope attached to the container.

CAUTION: After installing the equipment, lubricate it completely before operating.

Front Power Take-off Adapter and Shaft Assembly (Illust. 3)

1. Mount the front power take-off coupling adapter (11) to the fan drive pulley and secure with six 3/8 inch cap screws and lock washers.

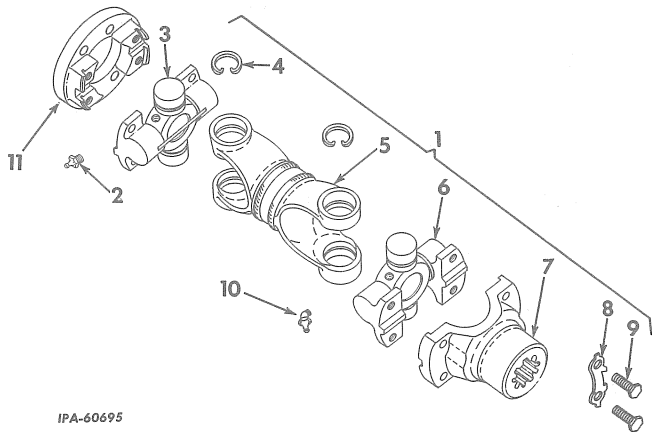
2. Install the flange of the spider (3) to the slots in the adapter (11) and secure with four 3/8 inch cap screws and lock washers.

Radiator Guard (Models 20D-2 and 20G-2 Only)

To install a radiator guard for use with the hydraulic bulldozers or bullgraders, proceed as follows:

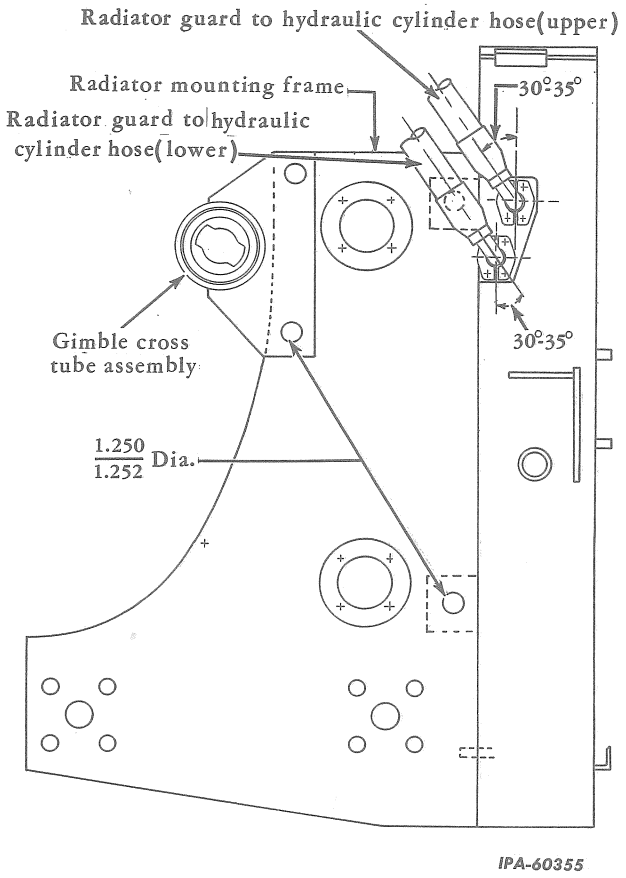
1. Remove the hood, radiator guard and the radiator from the mounting frame.

2. Attach the Gimbal crosstube assembly to the radiator mounting frame by installing the top mounting dowels and retainers. Line ream the lower mounting holes to 1.250 - 1.252 inch diameter and install the dowels and retainers. (Illust. 4.)



Illust. 3
Power take-off adapter and shaft assembly.

1. Shaft w/universal joint assembly.
2. Fitting, lubrication.
3. Spider w/bearings.
4. Ring, snap.
5. Tube.
6. Spider w/bearings.
7. Yoke, fitting.
8. Plate, lock.
9. Bolt.
10. Fitting, lubrication.
11. Adapter, front power take-off coupling.



Illust. 4
Radiator guard and radiator guard-to-hydraulic cylinder hose installation diagram (models 20D-2 and 20G-2 only).

3. Use an overhead hoist and mount the new radiator guard by installing the top mounting dowels and dowel retainers. Locate the lower dowel holes and line ream them to 1.250 - 1.252 inch diameter. Install the lower mounting dowels and retainers. (Illust. 4.)

4. Reinstall the radiator. Connect the water inlet and outlet water hoses. Replace the hood and secure it.

Hoist Cylinder Yokes (Models 20D-2 and 20G-2 Only)

Before assembling the hoist yoke bracket into the Gimbal crosstube, apply lubricant to the bearing surfaces of the yoke and inside of the bushings. After the brackets are in position, pump lubricant through the lubrication fittings until the housing cavity is completely packed and lubricant appears around the outer bearing.

Install the inner and outer bushings in the ends of the crosstube. Insert the shaft of the cylinder yoke in the Gimbal crosstube as far as it will go. For the right side, turn the yoke about one-quarter turn to the left (counterclockwise). For the left side, turn the yoke about one-quarter turn to the right (clockwise). The turning action will lock the yoke in the proper position.

Mounting the Pump and Valve to the Radiator Guard (Models 20D-2 and 20G-2 Only) (Illust. 5)

NOTE: Before mounting the pump and valve to the radiator guard, install the power take-off (refer to "Installing Front Power Take-off Adapter and Shaft Assembly").

1. Clean off the top mounting surface of the hydraulic pump adapter (5) and the bottom mounting surface of the pump.

2. One 2-1/8 x 2-3/8 x 1/8 inch "O" ring and one 2-3/4 x 3-x 1/8 inch "O" ring fit in the recess of the bottom mounting surface of the hydraulic pump. Coat the "O" rings with cup grease to hold them firmly in place in the base of the pump.

3. Place the gasket (17) on the top surface of the bottom tank of the radiator guard.

4. Mount the adapter (5) over the gasket (17). Align the holes in the adapter and gasket with the tapped holes in the bottom tank of the radiator guard and secure with four 1/2 inch cap screws.

5. Fasten a rope around the hydraulic pump and valve. Using an overhead hoist, set the pump and valve onto the hydraulic pump adapter (5).

6. Slide the yoke (7, Illust. 3) onto the splined shaft projecting from the rear of the pump.

7. Line up the holes in the hydraulic pump base with the holes in the adapter (5), taking care not to disturb the "O" rings.

8. Secure the pump to the adapter (5) with four 3/4 inch cap screws and lock washers.

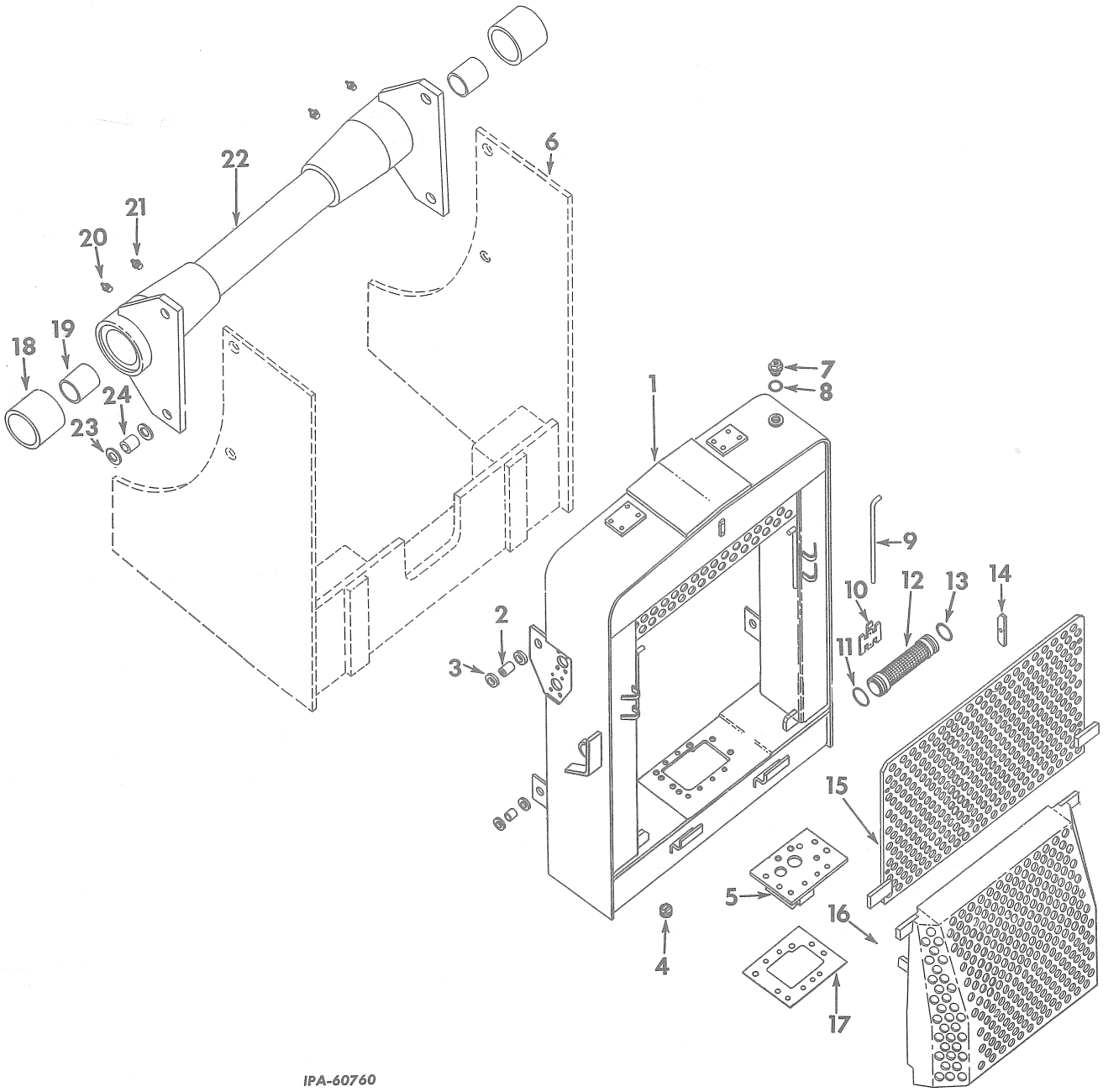
9. Coat the "O" rings (11 and 13) with chassis lubricant and place them in the grooves of the strainer (12).

10. Install the oil strainer (12) through the opening in the lower left side of the radiator guard (1) so it contacts the strainer support guide.

Continued on next page.

NOTE: The strainer must be installed so the two tapped holes of the strainer are towards the outside of the guard.

11. Place one retainer plate (14) in the groove with the chamfered end in the groove of the strainer (12).



Illust. 5

Hydraulic radiator guard and components (models 20D-2 and 20G -2 only).

1. Guard, radiator.
2. Dowel, mounting.
3. Retainer, mounting.
4. Plug, magnetic drain.
5. Adapter, pump.
6. Frame, mounting.
7. Plug, oil filler.
8. Ring, sealing.
9. Pin, door hinge.
10. Emblem.
11. Ring, sealing.
12. Strainer, oil.
13. Ring, sealing.
14. Plate, strainer retainer.
15. Door, upper.
16. Door, lower.
17. Gasket, pump adapter.
18. Bushing, yoke (outer).
19. Bushing, yoke (inner).
20. Fitting, lubrication (outer bushing).
21. Fitting, lubrication (inner bushing).
22. Crosstube, Gimbal.
23. Retainer, mounting.
24. Dowel, mounting.

12. Align the hole in the plate (14) with the tapped hole in the strainer (12) and secure with a 3/8 inch cap screw and lock washer. Install the other retainer plate in the same manner.

CAUTION: Do not attempt to start the tractor engine for any reason after the hydraulic pump and valve have been installed until all piping and connecting linkage is completed and the hydraulic system is filled with oil.

Radiator Guard (Models 20D-1, 20D-3, 20G-1 and 20G-3 Only)

To install a radiator guard for use with the cable bullgraders or bulldozers, proceed as follows:

1. Remove the hood, radiator guard and radiator from the mounting frame.

2. Use an overhead hoist to install the new radiator guard. Install the top mounting dowels and dowel retainers. Locate the lower dowel holes and line ream them to 1.250 - 1.252 inch diameter. Install the lower mounting dowels and retainers. (Illust. 6.)

3. Reinstall the radiator. Connect the inlet and outlet water hoses. Replace and secure the hood.

Mounting the 110 Cable Control Unit (Models 20D-1 and 20G-1 Only)

Install the cable control unit support to the radiator guard, using two 5/8 inch cap screws and nuts. Using an overhead hoist, install the cable control unit and line the pinion shaft on the cable control unit with the yoke (7, Illust. 3) on the universal joint. Line up the four holes on the lower end of the cable control unit with the holes in the bracket welded to the radiator guard. Secure the cable control unit with the cap screws and nuts provided.

Mounting the P-25 or P-29 Cable Control Unit (Models 20D-3 and 20G-3 Only)

Refer to the "P-25 and P-29 Cable Control Units Operator's Manual" for mounting instructions.

Connecting Linkage and Controls (Models 20D-1, 20D-2, 20G-1 and 20G-2 Only) (Illust. 7)

1. Mount the control bracket (7) to the seat side sheet on the right side of the tractor. Secure by bolting together through the existing hole (A, Illust. 8) in the front seat support with a 3/8 x 7/8 inch cap screw, lock washer and nut.

NOTE: The oil seals (5) and bearings (6) come assembled in the bracket (7).

2. Using the bracket (7) as a template, drill five 25/64 inch diameter holes (B, Illust. 8); then complete securing with five 3/8 x 3/4 inch cap screws, lock washers and nuts.

3. Insert the shaft (10) up through the bottom of bracket (7) with the shaft lever at the bottom.

NOTE: The race (9) comes assembled to the rear control shaft (10).

4. Install the washer (4A); then install the collar (4) over the top of the shaft (10). Align the hole in the collar with the hole in the shaft and secure with a 5/16 inch cap screw, lock washer and nut.

5. Install the control handle (3) onto the shaft (10) and secure with two 1/2 inch cap screws and lock washers.

6. Insert the handle and grip (1) into the control handle (3) and secure with a 1/2 inch cap screw and lock washer.

7. Connect the reach rod (15) to the lever of the control shaft (10) and secure with a 1/2 inch cap screw and jam nut.

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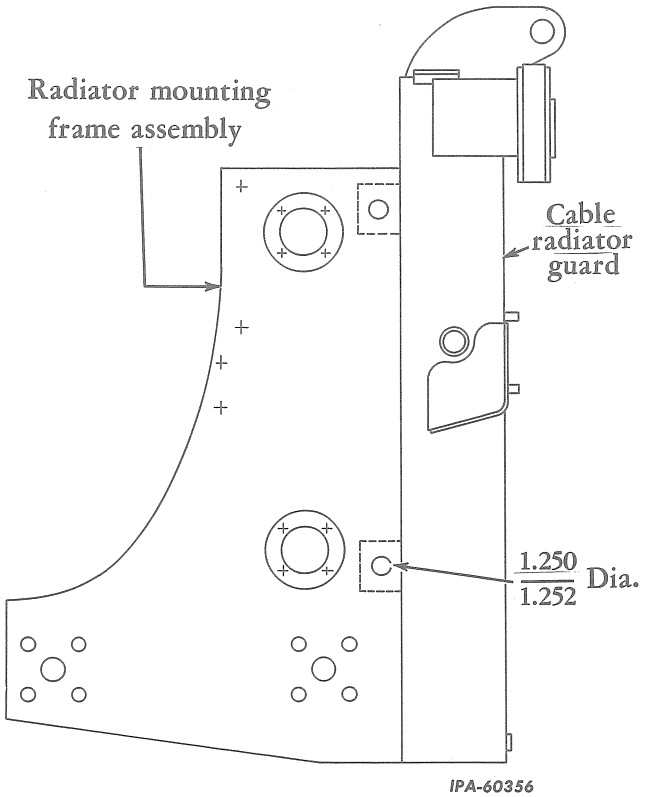


Illust. 6
Radiator guard installation diagram (models 20D-1, 20D-3, 20G-1 and 20G-3 only).

NOTE: The bearings (14) come assembled to the reach rod (15).

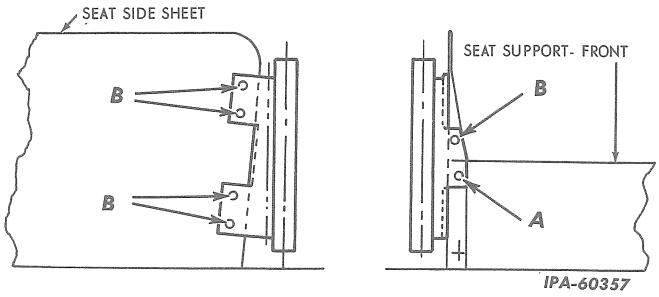
8. Press a bearing (6) into each end of the radiator guard control support tube.

9. Press a seal (5) into each end of the radiator guard control support tube so it contacts the bearings (6).

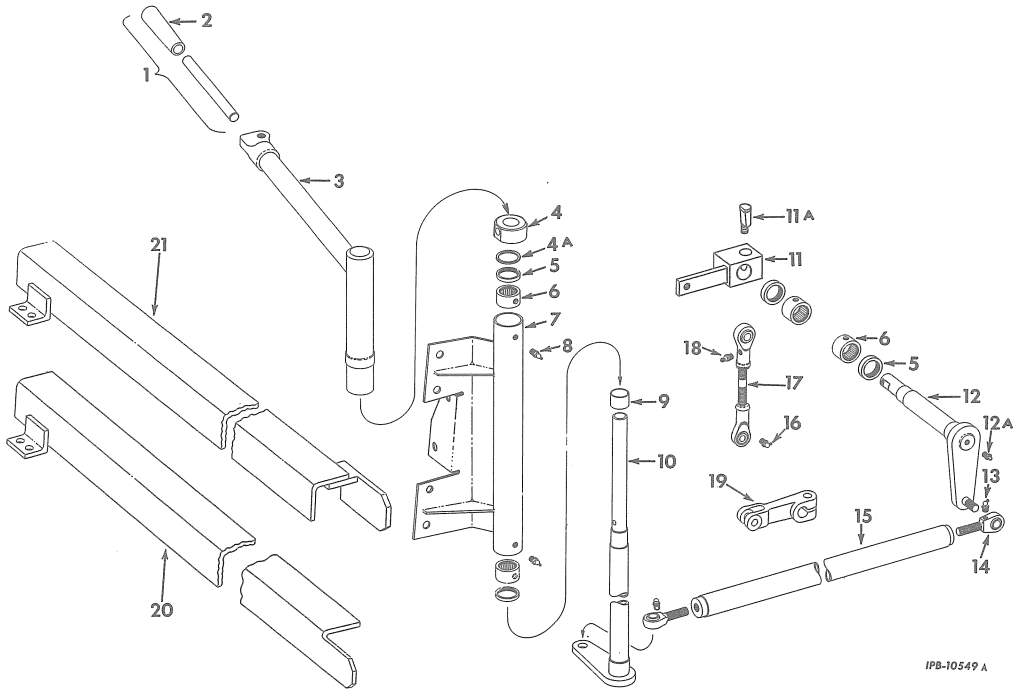
CAUTION: The lip of the seal must face towards the end of the radiator guard support tube.

10. Insert the front control shaft (12) through the hole in the right side of the radiator guard.

11. Install the inner control lever (11) (with the off-set of the lever facing to the left side of the tractor, refer to Illust. 7) on the control shaft (12). Secure with the locking bolt (11A) and a 5/16 inch Stover lock nut.



Illust. 8
Control bracket installation diagram (models 20D-1, 20D-2, 20G-1 and 20G-2 only).



Illust. 7
Connecting linkage and controls (models 20D-1, 20D-2, 20G-1 and 20G-2 only).

1. Grip, hand control adjustable.
2. Grip, hand.
3. Handle, control.
4. Collar, rear control shaft.
4A. Washer, flat.
5. Oil seal, front and rear control shaft.
6. Bearing, needle.
7. Bracket, rear control shaft.
8. Fitting, lubrication.
9. Race, inner.
10. Shaft, rear control.
11. Lever, front control (inner).
11A. Bolt, control lever locking.
12. Shaft, front control.
12A. Fitting, lubrication.
13. Fitting, lubrication.
14. Bearing, end.
15. Rod, side reach.
16. Fitting, lubrication.
17. Link, control.
18. Fitting, lubrication.
19. Lever, valve control (Models 20D-2 and 20G-2 only).
20. Guard, reach rod (Models 20D-1 and 20G-1 only).
21. Guard, reach rod (Models 20D-2 and 20G-2 only).

12. Connect the reach rod (15) to the shaft (12), securing it with a 1/2 inch slotted nut and 3/32 x 1-1/2 inch cotter pin.

13. Connect the top end of the control link (17) to the lever (11) and secure with a 1/2 inch cap screw and nut.

14. MODELS 20D-1 AND 20G-1 ONLY: Connect the bottom end of the control link (17) to the clutch lever located at the top of the cable control unit and secure with a 1/2 inch cap screw, lock washer and nut.

15. MODELS 20D-2 AND 20G-2 ONLY: Connect the valve control lever (19) onto the valve plunger shaft located on the hydraulic pump and secure with a 3/8 inch cap screw and 3/8 inch Stover lock nut.

16. MODELS 20D-2 AND 20G-2 ONLY: Insert the bottom end of the control link (17) into the clevis of the valve control lever (19) and secure with a 1/2 inch cap screw and nut.

17. Insert the end of the reach rod guard (20 or 21) in the reach rod guard support mounted on the inside of the mounting frame (right side). Secure the opposite end to the fender with two 1/2 inch cap screws, lock washers and nuts.

18. Insert the two lubrication fittings (8) into the control bracket (7), two fittings (13) into the reach rod end bearings (14), one fitting (12A) into the front control shaft (12) and two fittings (16 and 18) into the control link (17).

Controls (Models 20D-3 and 20G-3 Only)

Two adjustable operating levers, one for each cable drum, are furnished.

Slide the operating levers down over the operating shafts on the control unit. Clamp them in the desired position by tightening the 1/2 inch cap screws in each lever.

NOTE: Both levers are adjustable vertically and radially to suit the operator's reach.

Cable Guide Tube (Models 20D-3 and 20G-3 Only)

Slide the cable guide tube (28, Illust. 11) into the tube guide welded to the side of the side sheave bracket. Secure the guide tube to the fender with two 7/16 x 2 inch and two 7/16 x 1-1/2 inch cap screws, nuts and lock washers.

Hydraulic Cylinders (Models 20D-2 and 20G-2 Only)

1. Remove the hoist cylinder yoke cap and cap bushing from the hoist cylinder yoke. Coat the Gimbal trunnion hub of the hydraulic cylinder and the inside and the outside of the cap bushing with a chassis lubricant. Place the bushing over the Gimbal trunnion hub and hoist the hydraulic cylinder into place.

2. Place the hydraulic cylinders in the hoist cylinder yokes with the cylinder manifold next to the engine hood and the manifold holes facing forward. (Illust. 9.)

3. Place the hoist cylinder yoke caps in position (refer to the following "NOTE") and secure with 5/8 inch cap screws and lock washers.

NOTE: The hoist cylinder yoke and cap are a matched set, and have matched numbers stamped on them. Be sure, when replacing the cap on the yoke, that the numbers are matched.

Hydraulic Hoses (Models 20D-2 and 20G-2 Only) (Illust. 10)

There are four hydraulic hoses (8, 9, 10 and 11) that connect between the hydraulic pump

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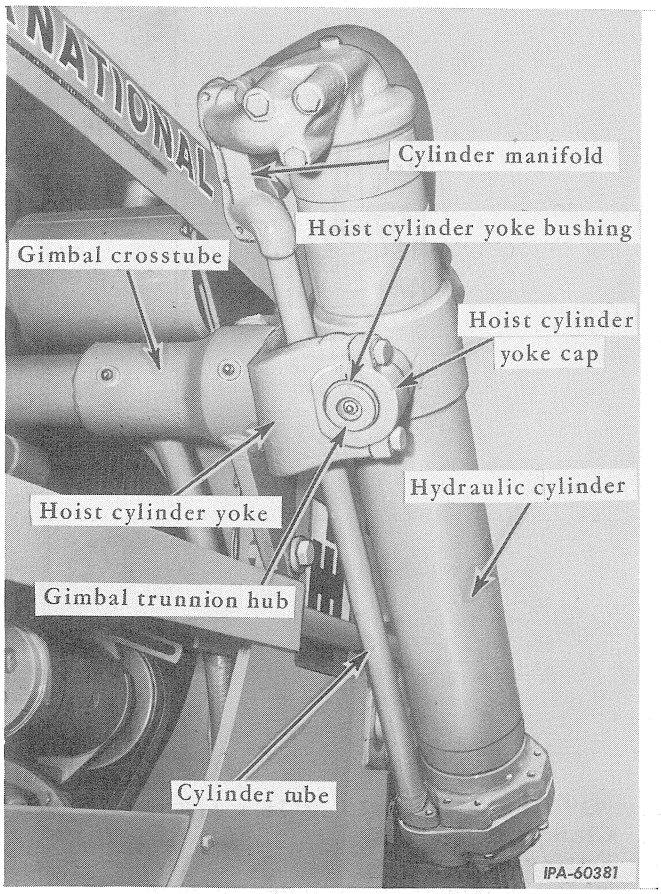
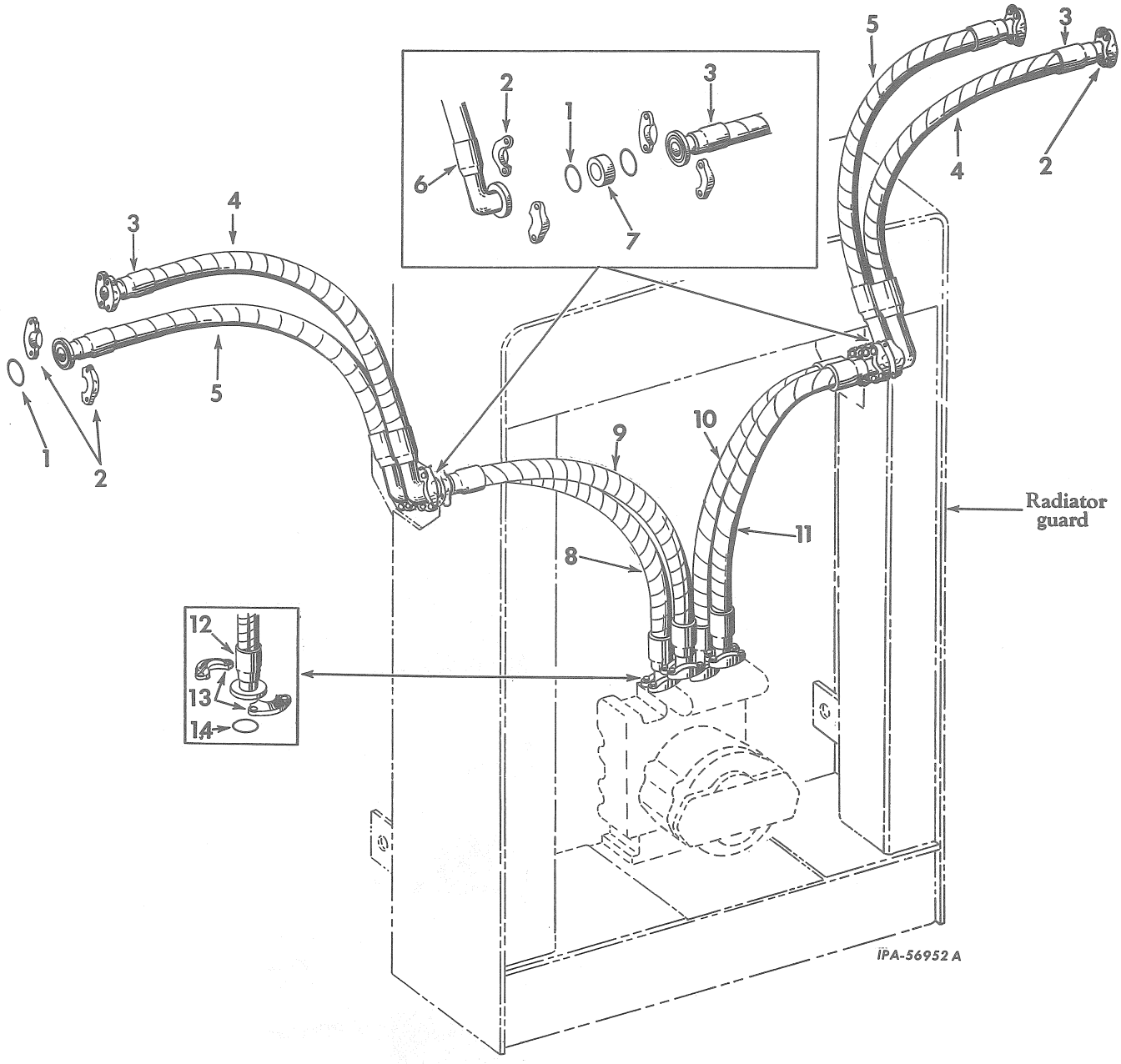


Illust. 9
Principal components of the hoist cylinder yoke and hydraulic cylinder.

and the left and right bulkhead of the radiator guard. The lower right hose (8) and upper right hose (9) are 33 inches long including fittings. The upper left hose (11) and lower left hose (10) are 30 inches long including fittings.

There are four hydraulic hoses (4 and 5) that connect between the left and right cylinder manifolds and left and right bulkhead of the radiator guard. Both upper hoses (4) are 43-1/2



Illust. 10
Hydraulic hose connections
(Models 20D-2 and 20G-2 only).

1. "O" ring (1-5/16 x 1-9/16 x 1/8 inch).
2. Clamp, half.
3. Fitting.
4. Hose, bulkhead to cylinder (upper).
5. Hose, bulkhead to cylinder (lower).
6. Fitting.
7. Tube, "O" ring seat.
8. Hose, pump to bulkhead (Lower RH).
9. Hose, pump to bulkhead (Upper RH).
10. Hose, pump to bulkhead (Lower LH).
11. Hose, pump to bulkhead (Upper LH).
12. Fitting.
13. Clamp, half.
14. "O" ring (1-1/2 x 1-3/4 x 1/8 inch).

inches long including fittings and both lower hoses (5) are 38 inches long including fittings.

Installation of hoses and connections as outlined here are for the right side. Installation is identical for the left side of the tractor.

1. Install the tube (7) into the bulkhead fitting on the radiator guard.

2. Clean the hydraulic cylinder manifold holes. Clean the recesses of the fittings (3 and 6).

3. Coat the "O" rings (1) with cup grease and place them in the recesses of the fittings (3 and 6).

CAUTION: Before installing hoses, be sure that all of the "O" rings are in the proper location.

4. Position the short hose (5) with the fitting (3) over the bottom hole of the cylinder manifold.

5. Place two hose clamp-halves (2) over the hose, catching the shoulder of the fitting (3). Secure the clamp-halves to the manifold with four 3/8 x 1-1/4 inch cap screws and lock washers.

6. Position the long hose (4) with the fitting (3) over the top hole of the cylinder manifold.

7. Secure the long hose as outlined in Step 5.

8. Position the hoses (4 and 5) with the fittings (6) at the bulkhead.

9. Place four clamp-halves (2) over the hoses (4 and 5), catching the shoulder of the fittings (6). Insert eight 3/8 x 2-1/2 inch cap screws through the clamp-halves and bulkhead to hold the hoses (4 and 5) into position.

10. Clean the hose ports in the hydraulic pump and anti-cavitation valve. Place an "O" ring (14) into the recess of the fittings (3 and 12).

CAUTION: Before installing the hoses, be sure that all of the "O" rings are in the proper location.

11. Position the hose (8) over the port in the hydraulic pump. Place two clamp-halves (13) over the hose, catching the shoulder of the fitting (12). Secure the hose and clamp-halves to the pump with four 7/16 x 1-3/8 inch cap screws and lock washers.

12. Position the hose (9) over the port in the anti-cavitation valve and secure with one 7/16 x 1-3/8 inch, three 7/16 x 4-3/4 inch cap screws and lock washers.

13. Position the hoses (8 and 9) with the fittings (3) at the bulkhead.

14. Place two clamp-halves (2) over each hose, catching the shoulder of the fittings (3).

15. Align the holes in the clamp-halves with the eight cap screws projecting from the bulkhead and loosely secure with eight 3/8 inch nuts and lock washers.

16. Position the hoses (4 and 5) as shown in Illust. 4. Tighten the eight nuts and cap screws.

CAUTION: The 30 to 35 degrees tolerance must be held as close as possible to help prolong the life of the hydraulic hoses.

17. Complete the installation of the hydraulic hoses for the left side of the tractor as outlined in the preceding steps.

18. Fill and vent the hydraulic system. Refer to the "HYDRAULIC SYSTEM" in the "MAINTENANCE" section.

Upper and Lower Grille Doors

Install the upper and lower grille doors by locking them to the radiator guard with the two grille latch pins.

Sheaves and Sheave Blocks (Models 20D-1, 20G-1, 20D-3 and 20G-3 only)

1. Assemble the bearings (3, 7, 16 and 26) and rings (2, 6, 15 and 25) into the sheaves (1, 5, 14 and 24).

2. Install the assembled corner sheave (1) into the corner sheave bracket welded on the top right corner of the radiator guard.

3. Insert the shaft (4) through the hole in the corner sheave bracket and secure with a 5/8 inch cap screw.

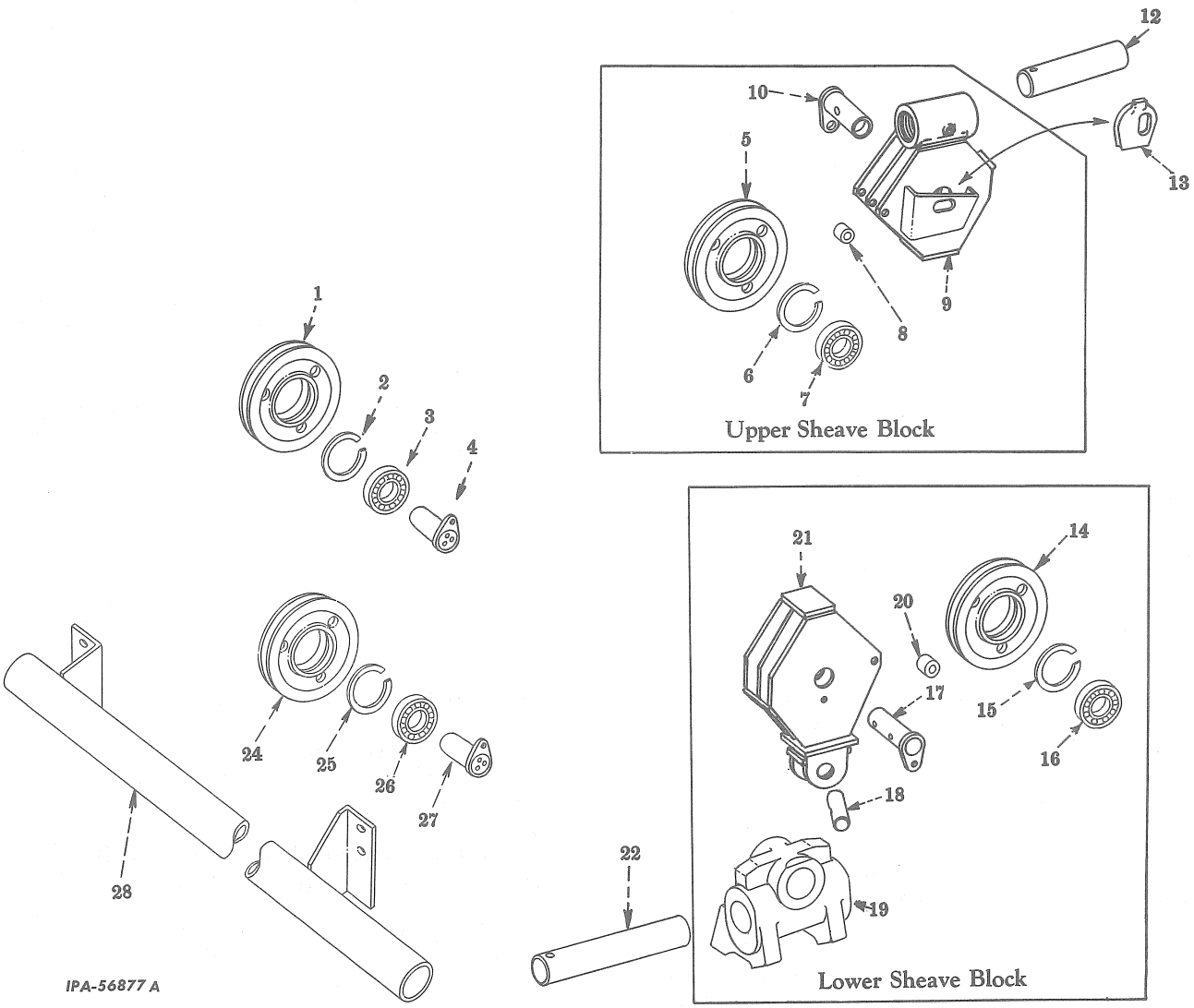
4. MODELS 20D-3 AND 20G-3 ONLY: Install the assembled side sheave (24) into the side sheave bracket welded on the right side of the radiator guard and secure as outlined in Step 3.

5. MODELS 20D-3 AND 20G-3 ONLY: Install the assembled cable control unit adapter

Continued on next page.

sheave (24) into the sheave bracket on the rear cable control unit.

6. MODELS 20D-3 AND 20G-3 ONLY: Insert the shaft (27) through the hole in the sheave bracket and secure with a 5/8 inch cap screw.



Illust. 11
Sheaves and Sheave Blocks (Models 20D-1, 20G-1, 20D-3 and 20G-3 only).

1. Sheave, corner.
2. Ring, sheave bearing retainer.
3. Bearing, corner sheave.
4. Shaft, corner sheave.
5. Sheave, upper.
6. Ring, sheave bearing retainer.
7. Bearing, upper sheave.
8. Spacer, upper sheave block cheek plate.
9. Block, upper sheave.
10. Shaft, upper sheave.
12. Shaft, upper sheave block mounting.
13. Lock, cable.
14. Sheave, lower.
15. Ring, sheave bearing retainer.
16. Bearing, lower sheave.
17. Shaft, lower sheave.
18. Shaft, lower sheave block universal.
19. Universal, lower sheave block.
20. Spacer, lower sheave block cheek plate.
21. Block, lower sheave.
22. Shaft, lower sheave block mounting.
24. Sheave, side and/or cable control unit adapter.
25. Ring, sheave bearing retainer.
26. Bearing, side and/or cable control unit adapter sheave.
27. Shaft, side and/or cable control unit adapter sheave.
28. Tube, cable guide (Models 20D-3 and 20G-3 only).

7. Install the assembled upper and lower sheaves (5 and 14) into the upper and lower sheave blocks (9 and 21).

8. Insert the shafts (10 and 17) through the holes in the blocks (9 and 21) and secure with 5/8 inch cap screws.

9. Insert the spacers (8 and 20) between the cheek plates of the sheave blocks (9 and 21).

10. Insert a 1/2 x 5 inch cap screw through the holes in the cheek plates and secure with a 1/2 inch nut.

11. Install the assembled upper sheave block (9) between the radiator guard center mounting brackets. Insert the mounting shaft (12) through the brackets and secure with a 1/2 inch cap screw and lock nut.

12. Install the assembled lower sheave block (21) to the universal (19). Insert the shaft (18) into the universal (19) with the notched surface facing down.

13. Reeve the tractor. Refer to "REEVING."

Trunnions

MODELS 20G-1, 20G-2 AND 20G-3 ONLY (Illust. 12): Mount both the right hand and left hand trunnions to the trunnion mounting pad on the track frame with the trunnion pilot in the front pilot hole of the mounting pad. Secure with six 7/8 inch cap screws.

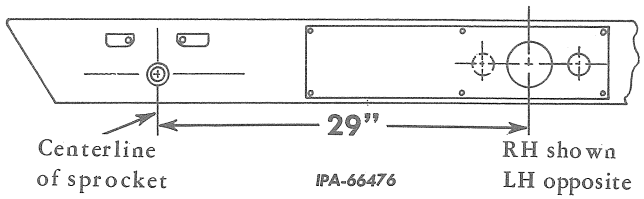
MODELS 20D-1 AND 20D-3 ONLY (Illust. 13): Mount both the right hand and left hand trunnions to the trunnion mounting pad on the track frame with the trunnion pilot in the front pilot hole of the mounting pad. Secure with six 7/8 inch cap screws.

MODEL 20D-2 ONLY (Illust. 14): Mount both the right hand and left hand trunnions to the trunnion mounting pad on the track frame with the trunnion pilot in the rear hole of the mounting pad. Secure with six 7/8 inch cap screws.

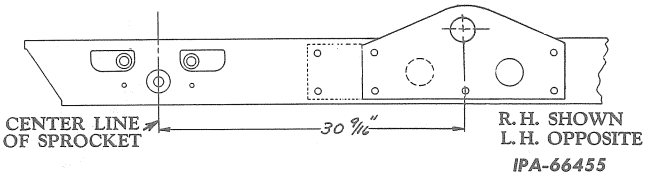
NOTE: After the initial four and twelve hours of operation following the installation, inspect and tighten the trunnion cap screws. Thereafter, make periodic inspections.

Push Arms on the Blade (Models 20D-1, 20D-2 and 20D-3 Only) (Illust. 16)

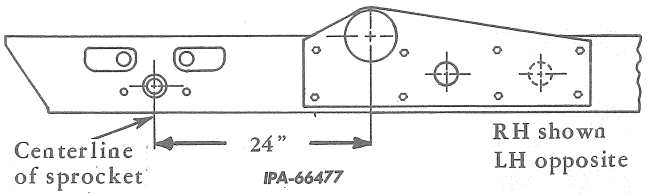
Attach the push arms to the blade with the push arm bracket pins. These pins must be installed with the pin lock hole toward the center of the blade. Install the push arm bracket pin locks.



Illust. 12
Trunnion bracket installation diagram (models 20G-1, 20G-2 and 20G-3 only).



Illust. 13
Trunnion bracket installation diagram (models 20D-1 and 20D-3 only).



Illust. 14
Trunnion bracket installation diagram (model 20D-2 only).

Diagonal and Upper Struts (Model 20D-1, 20D-2 and 20D-3 Only) (Illust. 16)

1. Adjust the upper struts so the gap between the shoulder of the eyebolt, clevis and the upper strut body is 9/16 inch on each end. (Illust. 17.) Insert a spring eyepin through the hole in the strut body near the clevis end of the strut. This pin will pass through the slot in the end of the clevis, locking the strut so the adjustment will not change once the strut is mounted between the blade and push arm.

2. Assemble both the upper struts to the blade and push arms. The upper strut pins must be installed with the hole for the pin lock toward the center of the blade. Install the upper strut pin locks.

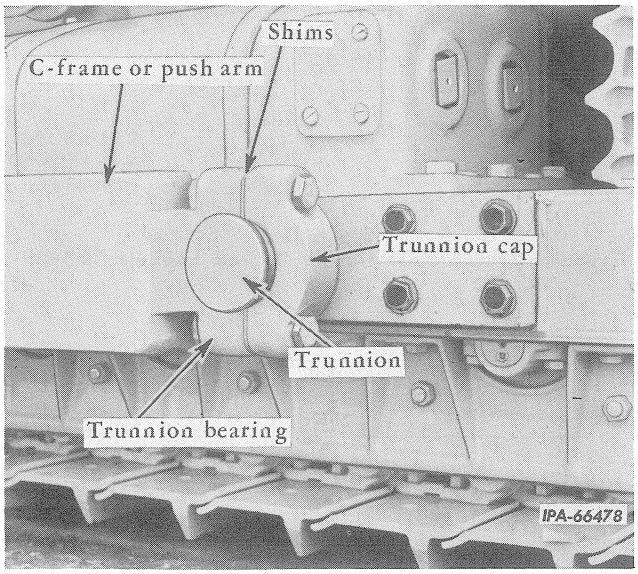
3. Adjust the diagonal struts so the gap between the shoulder of the eyebolt and the diagonal strut is 1/2 inch on each end. (Illust. 18.) Assemble both diagonal struts to the blade and push arms. Mount the end of the strut that

Continued on next page.

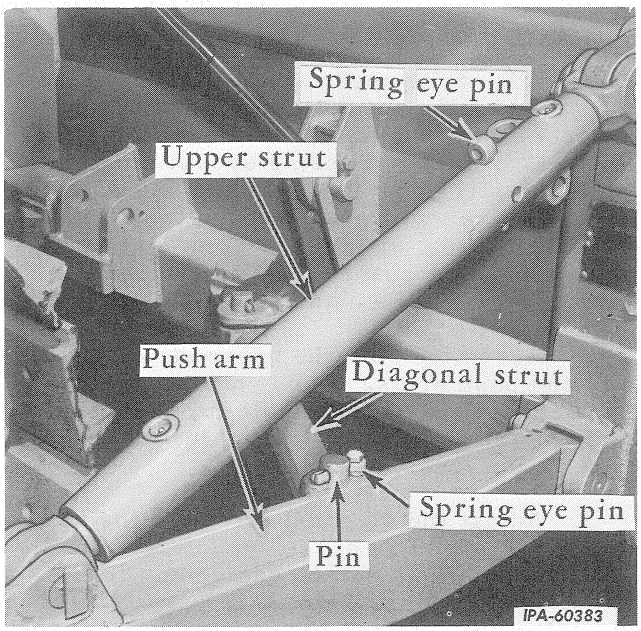
has the bushing to the blade. Use the spring eyepins to secure the diagonal strut pins. Final adjustment of the diagonal strut will be done later.

Push Arms and Blade on the Tractor (Models 20D-1, 20D-2 and 20D-3 Only)

1. Block the rear ends of the push arms up to the height of the trunnions.



Illust. 15
Trunnion components
(for trunnion installation, see Illust. 11, 12 and 13).



Illust. 16
Upper and diagonal struts installed
(models 20D-1, 20D-2 and 20D-3 only).

2. Drive the tractor between the bulldozer push arms and attach the ends of the push arms to the trunnions with the trunnion caps. The gap between the trunnion cap and the trunnion bearing will be approximately 3/16 inch. Eight 1/16 inch thick shims have been provided to fill this gap and provide 1/16 inch minimum clearance (four shims at the top and four at the bottom). (Illust. 15.) It may be necessary to adjust the diagonal struts to move the push arms either in or out before attaching them to the trunnions.

3. MODEL 20D-2 ONLY: Start the tractor engine and place the control handle in the "LOWER" position, allowing the piston rods to advance downward. Line up the piston rod holes with the connecting holes of the hydraulic jack brackets on the back of the blade. Connect the piston rods to the hydraulic cylinder pins, and secure with cap screws and lock nuts.

3. MODELS 20D-1 AND 20D-3 ONLY (Illust. 11): Mount the universal (19) with the attached sheave block (21) between the lift lugs on the back of the blade. Insert the shaft (22) through the universal (19) and secure with a 1/2 inch cap screw and lock nut.

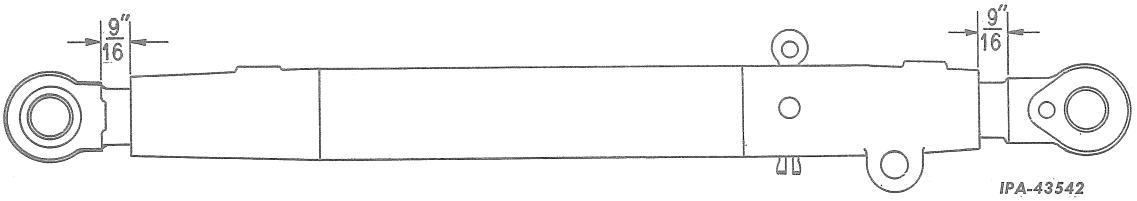
4. Raise the blade and adjust the diagonal struts so the distance between the push arms and a fixed point on the track frame is the same on both sides of the tractor.

5. Re-adjust the diagonal struts so there is no compression strain on the arm. To do this, remove the pin at the push arm bracket connection. Adjust the strut by lining up the holes in the strut eye and bracket. Make the strut as long as possible without interfering with the installation of the pin. Install the pin, lockbolt and nut at the bracket connection, and tighten the threaded clamp cap screw on the strut so it cannot turn.

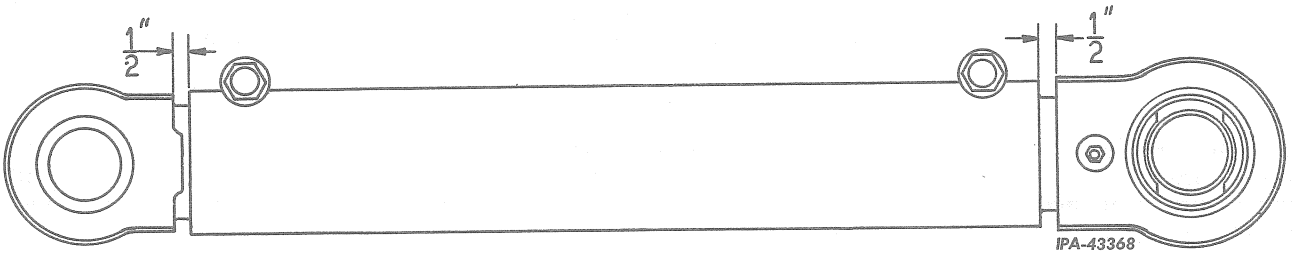
CAUTION: If the machine is to be used for pushing scrapers or rippers, the blade must be protected in the contact area by a pusher block or push plate.

C-frame on the Tractor (Models 20G-1, 20G-2 and 20G-3 Only)

1. Block the rear ends of the C-frame to the height of the trunnions. Drive the tractor into the C-frame and attach the ends of the C-frame to the trunnions with the trunnion caps. The gap between the trunnion caps and the trunnion bearings will be approximately 3/16 inch. Eight 1/16 inch thick shims have been provided to fill this gap and provide 1/16 inch minimum clearance (four shims at the top and four at the bottom). (Illust. 15.)



Illust. 17
Upper strut adjustment - bulldozer.



Illust. 18
Diagonal strut adjustment - bulldozer (models 20D-1, 20D-2 and 20D-3 Only).

2. MODEL 20G-2 ONLY: Start the tractor engine and place the control handle in the "LOWER" position, allowing the piston rods to advance downward. Line up the piston rod holes with the connecting holes of the hydraulic jack brackets on the C-frame.

3. MODEL 20G-2 ONLY: Connect the piston rods to the hydraulic jack brackets using the hydraulic cylinder pins, and secure with the cap screws and lock nuts.

Blade on the C-frame (Models 20G-1, 20G-2 and 20G-3 Only)

1. Drive the tractor up to the blade. Align the holes in the crosshead swivel pin with the holes in the crosshead clevis mounted on the blade. Insert the crosshead clevis pin and lock it in position with the crosshead clevis pin nut and a 3/8 x 3-1/4 inch cotter pin.

2. MODELS 20G-1 AND 20G-3 ONLY (Illust. 11): Mount the universal (19) with the attached sheave block (21) between the lift lugs on the C-frame. Insert the shaft (22) through the universal (19) and secure with a 1/2 inch cap screw and lock nut.

Lower Struts (Models 20G-1, 20G-2 and 20G-3 Only)

Install the upper and lower struts with the blade angled in the extreme positions first. The center positions will line up without further adjustment of the struts.

NOTE: Assemble the upper and lower strut clevis pins so the hole in the clevis pins line up with the holes in the clevises or brackets. All pins should be flush with the outside surface of the clevises or brackets.

1. Adjust the clevis end of the lower strut so the gap between the shoulder of the clevis and the strut body is 1-37/64 inches. (Illust. 20.)

2. When the blade is angled, assemble the first lower strut to the part of the blade that is to the rear of the tractor. The upper strut clevis on the body of the lower strut should face upward.

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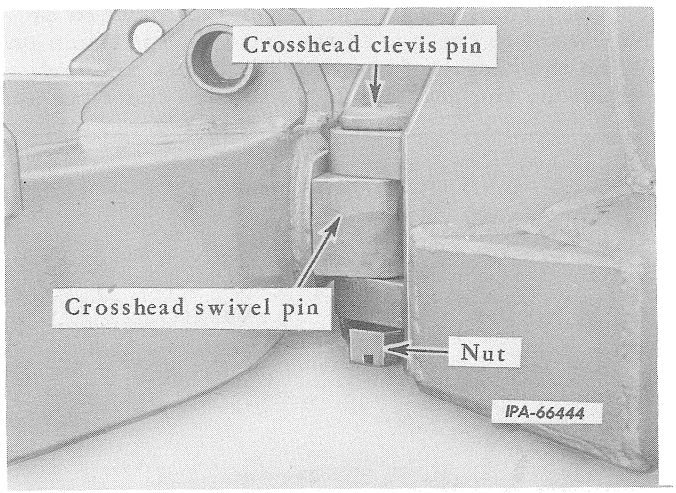
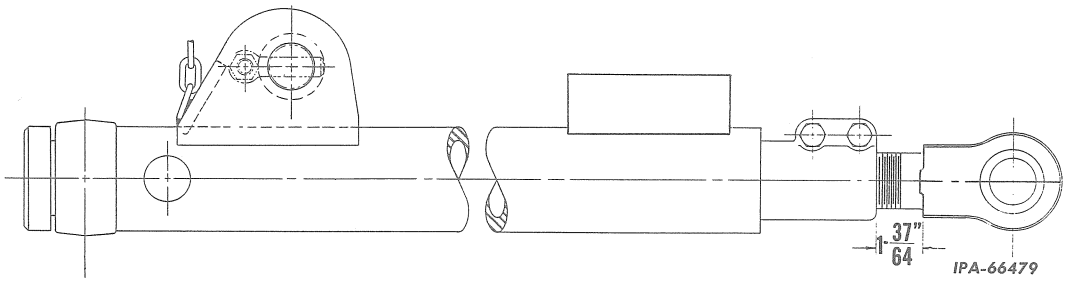


Illust. 19
C-frame with blade installed
(models 20G-1, 20G-2 and 20G-3 only).



Illust. 20
Lower strut adjustment - bullgrader (models 20G-1, 20G-2 and 20G-3 only).

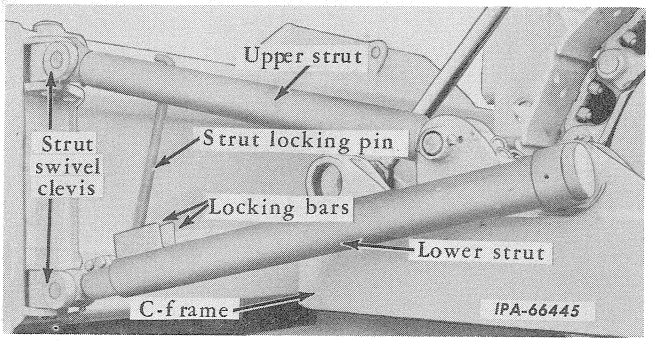
3. Place the lower strut eyebolt between the holes in the lower strut swivel clevis on the blade. Install the lower strut pin through the hole in the strut swivel clevis and the strut clevis. Align the hole in the clevis so the cap screw and lock nut can be assembled to hold the pin in place.

4. Assemble the lower strut trunnion into the rear strut trunnion bracket on the C-frame, and secure it with the lower strut trunnion retainer pin.

5. Assemble the lower strut on the opposite side of the blade by placing the lower strut trunnion into the front strut trunnion bracket of the C-frame. Secure it with the lower strut trunnion retainer pin. Install the clevis end of the lower strut between the holes in the lower strut swivel clevis on the blade. Install the lower strut pin through the hole in the strut swivel clevis and the strut eyebolt. Align the hole in the pin with the hole in the clevis so the cap screw and lock nut can be assembled to hold the pin in place.

6. The lower strut can move forward or backward in the eye of the lower strut trunnion. When the clevis of the lower strut is properly adjusted, the gap should be toward the rear so the body of the lower strut is tight against the trunnion swivel eye of the lower strut. The gaps between the shoulder of the clevis and the lower strut body should be identical on both lower struts. (Illust. 20.) If the gaps do not occur simultaneously, the clevis in the lower struts may be adjusted to lengthen or shorten the lower strut as desired.

7. The blade should now be angled in the opposite direction and the above adjustments rechecked, making corrections if necessary. After completing the lower strut adjustment, clamp the thread securely by tightening the cap screws and nuts.



Illust. 21
Upper and lower struts installed (models 20G-1, 20G-2 and 20G-3 only).

Upper Struts (Models 20G-1, 20G-2 and 20G-3 Only)

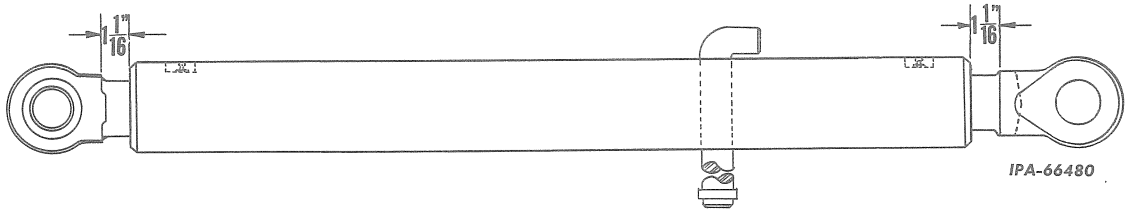
1. Adjust the upper struts so the gap between the shoulder of the eyebolt, clevis and the upper strut body is 1-1/16 inches on each end. (Illust. 22.)

2. Place the strut locking pin end of the upper strut (Illust. 21) between the holes in the upper strut swivel clevis on the blade. Install the upper strut pin through the hole in the strut swivel and the strut eyebolt. Align the hole in the pin with the hole in the clevis so the cap screw and lock nut can be assembled to hold the pin in place.

3. Assemble the other end of the upper strut to the clevis (mounted on the lower strut) by inserting the strut pin and locking it in position with the cap screw and lock nut.

4. Position the upper strut locking pins between the locking bars on the lower struts (Illust. 21). This will lock the upper struts so the adjustment will not change.

NOTE: Raise the blade above the ground about 12 inches. Adjust the upper struts to a "NEUTRAL" position (no compression or tension) so the blade connecting pins are free in their brackets.



Illust. 22
Upper strut adjustment - bullgrader (models 20G-1, 20G-2 and 20G-3 only).

CAUTION: If the machine is to be used for pushing scrapers or rippers, protect the blade in the contact area by a pusher block or push plate.

HYDRAULIC TESTS AFTER INSTALLATION (MODELS 20D-2 AND 20G-2 ONLY)

1. Prepare the unit for the test by being sure the hydraulic system has been filled with proper oil and purged of air. Wipe all oil from external surfaces and connections.

2. Operate the unit through the "RAISE," "HOLD," "LOWER" and "FLOAT" cycles five to six times to assure proper function without unusual pump noise. If no operational defect or leakage is obvious, proceed to the next phase.

3. Operate the unit in "LOWER" position under full throttle until the temperature of the hydraulic system reaches 160° F. Reduce the engine speed to half throttle, maintaining the "LOWER" position and make visual examination for leakage at the cylinders, pump, control valve and connections.

NOTE: This portion of the test should not exceed a ten minute duration.

4. Raise the blade to the maximum height and place the valve in the "HOLD" position. Wait 60 seconds and check for excessive drift.

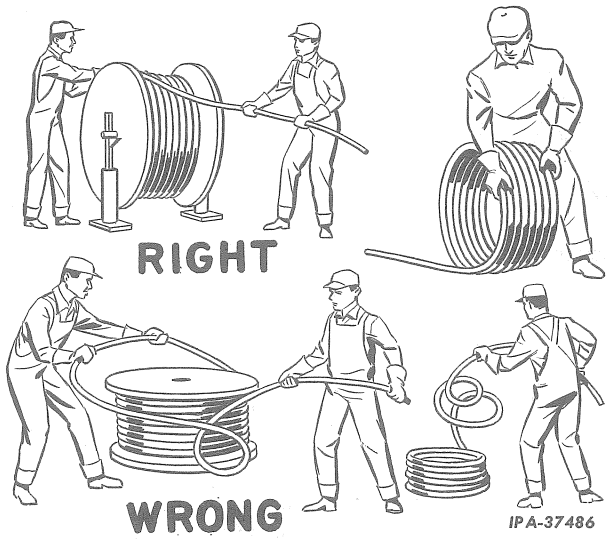
NOTE: The piston rods should not travel out of the cylinder more than 5/16 of an inch in 60 seconds.

REEVING (MODELS 20D-1, 20G-1, 20D-3 AND 20G-3 ONLY)

CAUTION: Reeving must be done with the blade resting on level ground and the tractor engine stopped.

When reeving, follow the reeving diagram for your bullgrader or bulldozer on the next page.

In following the steps shown on these diagrams, start with sheave one and reeve to the



Illust. 23
Removing the cable from the reel or coil.

cable control unit drum, in the numerical order indicated.

Always fasten the live end of the cable to the cable drum before anchoring the dead end.

Machines using the Model 110 cable control unit should have approximately five wraps of cable on the drum. Machines using the Model P-25 or P-29 cable control unit, should have approximately four wraps of cable on the cable drum. This is approximately 13 feet of cable on the Model 110 and 11 feet of cable on the Model P-25 and P-29, which will allow for average digging depth.

Use of 6 x 25, preformed, right hand regular lay, independent wire rope center, improved plow steel, 1/2 inch wire rope is recommended.

NOTE: For maximum cable life, replace worn cable with cable of the recommended specifications. Abuse or kinking affects cable life materially.

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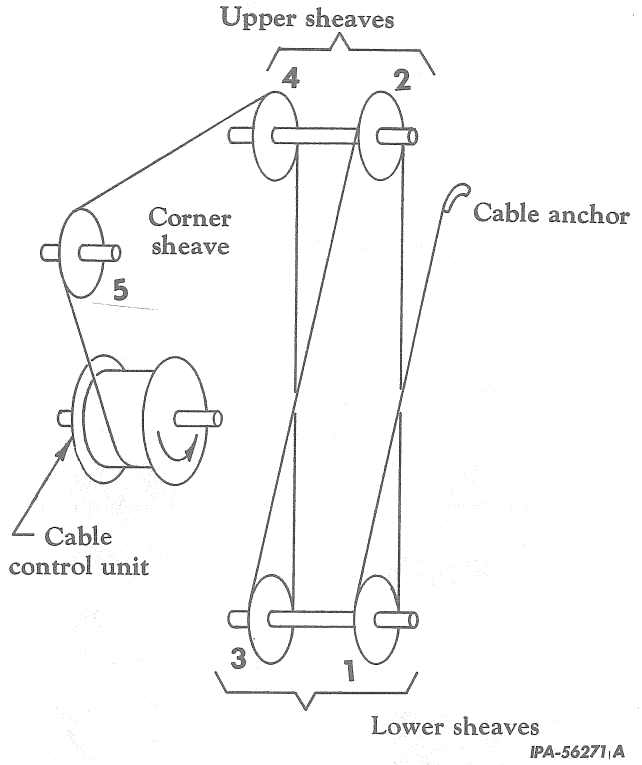
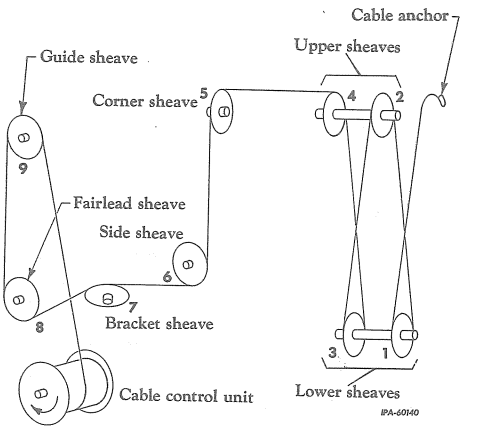


Illust. 24
Cable reeving diagram (models 20D-1 and 20G-1 only).

Removing the cable from a reel or coil without revolving it results in a twist as each turn is taken off. If this twist is not removed and the cable straightened before being placed under tension, kinks are apt to result.



Illust. 25
Cable reeving diagram (models 20D-3 and 20G-3 only).

To prevent kinking the cable when removing it from a reel, revolve the reel and take the cable off in the same way it was put on the reel. Put a shaft through the center of the reel and jack it up so the reel will revolve freely. Pull the cable straight ahead, keeping it tight to prevent it from loosening on the reel. A board held against one flange may be used as a brake to keep the reel from revolving too fast.

To prevent kinking a cable when uncoiling it, remove the ties and roll the coil along the ground so the cable lies straight. There will be no twist or kink in the cable if these instructions are followed. (Illust. 23.)

CONTROL HANDLE POSITIONS (ILLUST. 26) (MODELS 20D-2 AND 20G-2 ONLY)

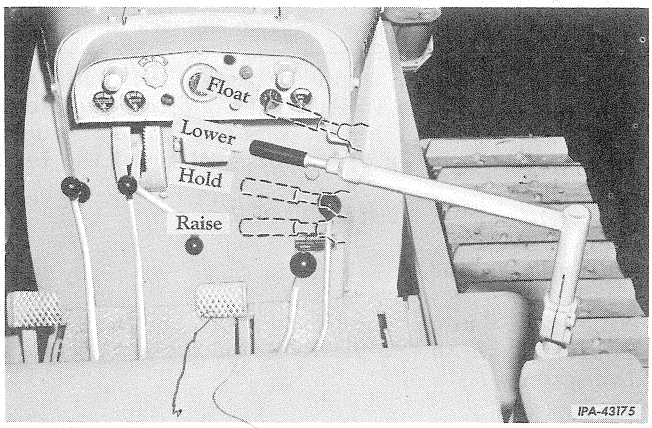
The positions of the operating control handle are the same for the bulldozer and bull-grader. The four positions of the handle, named in order from the rear, are: 1. RAISE; 2. HOLD; 3. LOWER; 4. FLOAT. Operation follows the natural reaction; pull back on the handle to raise and push forward to lower.

NOTE: After using the "RAISE" or "LOWER" position, the control handle will automatically return to "HOLD" position. Holding the hydraulic control handle in "RAISE" or "LOWER" position for a five minute interval upon reaching the limit of piston travel, will not damage the hydraulic system. However, extended holding in these positions will produce excessive heat, which may affect blade performance, and cause the pump to overheat. The correct procedure is to switch to the "HOLD" position at the limit of travel if it is desired to hold this position for several minutes.

RAISE: To raise the blade, pull the control handle back as far as it will go. In this position, oil forces the piston and rod back to the top of the cylinder.

HOLD: To hold the blade in any fixed position, move the control handle to the second position. This blocks the oil in the cylinders and holds the pistons and blade stationary. The blade is held in place until released.

To hold the blade level and prevent disturbances by track oscillation (as the tractor passes over bumps or rough ground), there is a connection between the cylinders. This connection permits the oil to flow back and forth between the rear ends and the front ends of the cylinders (but not past the piston head) so the blade pressure remains equalized. The "HOLD" position, therefore, holds the general position of the blade, but permits equalizing action to adjust against roughness in ground surface encountered by the tracks.



Illust. 26
Control handle positions (models 20D-2 and 20G-2 only).

LOWER: To lower the blade under power, move the control handle to the third position. Oil forces the piston and rod downward in the cylinder and forces the blade into the ground. Note that lowering the blade in this position is not just a matter of letting the weight lower the blade, but of forcing the blade down under power as for hard ground conditions. The lowering thrust, which is so powerful that it can easily lift the front end of the tractor off the ground, concentrates one third of the weight of the tractor plus that of the blade mechanism on the cutting edge of the blade.

FLOAT: To float the blade, move the control handle to the fourth position. This interconnects the cylinders so the pistons are free to move back and forth, as the blade follows the ground surface, or to lower by its own weight. The "FLOAT" position provides a convenient and quick method of returning the blade from carrying to ground level because of the high speed gravity drop which is faster than the powered "LOWER" position.

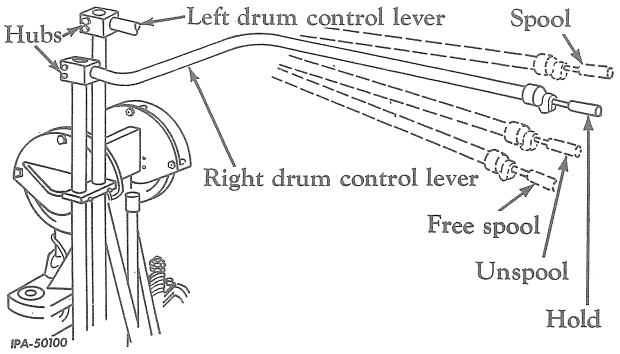
CONTROL LEVER POSITIONS (MODELS 20D-1, 20G-1, 20D-3 AND 20G-3 ONLY)

Model P-25 and P-29 Cable Control Units (Models 20D-3 and 20G-3 Only)

The positions of the operating control lever are the same for the bulldozer and bull-grader. The four positions of the lever, named in order from the right of the operator, are: 1. SPOOL; 2. HOLD; 3. UNSPOOL; 4. FREE SPOOL. Operation follows the natural reaction; pull the lever to the left to spool in the cable and push to the right to unspool the cable. When the control lever is in the "SPOOL" or "UNSPOOL" position, it will return automatically to the "HOLD" position when released. (Illust. 27.)

Pushing the control lever to the right, just past the "UNSPOOL" position, will lock the lever in the "FREE SPOOL" position. In this position, the brake drum is free to turn in either direction so the operator may step down from the tractor and, with no assistance, reeve or change the cable on the drum.

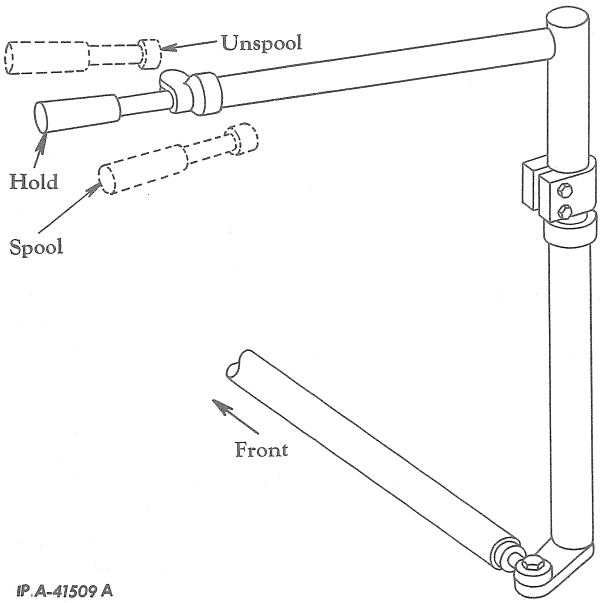
CAUTION: Always stop the engine during this operation.



Illust. 27
Models P-25 and P-29 control lever positions.

Model 110 Cable Control Unit (Model 20D-1 and 20G-1 Only)

The positions of the operating control lever are the same for the bulldozer and bullgrader. The three positions of the lever, named in order from the rear, are: 1. SPOOL; 2. HOLD; 3. UNSPOOL. Operation follows the natural reaction; pull back on the lever to spool in the cable and push forward to unspool the cable. When the control lever is in the "SPOOL" or "UNSPOOL" position it will automatically return to the "HOLD" position when released. (Illust. 28.)



Illust. 28
Model 110 control lever positions.

BULLDOZER

Tilting the Blade

1. Raise the blade about a foot above the ground.

2. Remove the spring eyepin and extend the upper strut on the side of the blade to be raised. Adjust this strut to tilt the blade about half of the desired tilt.

3. Adjust the upper strut on the opposite side of the blade by shortening it to obtain the balance of the desired tilt. Reinstall the spring eyepins.

NOTE: Do not tilt the blade in excess of 12 inches tip to tip.

Pitching the Blade

1. To pitch the blade forward (decreasing the suction angle), raise the blade a few inches above the ground. Extend the upper struts on each side of the blade.

NOTE: Do not extend beyond the marker groove in the eyebolt.

2. To pitch the blade backward (increasing the suction angle), the upper struts must be shortened.

NOTE: When increasing or decreasing the suction angle, the upper struts must be extended or shortened equally on both sides.

3. After making the adjustment, secure each strut with the spring eyepin so it will not rotate.

Leveling the Blade

To level the blade, lift the blade a few inches above the ground, and adjust both upper struts so the gap between the shoulder of the eyebolt, clevis and the upper strut body is 9/16 of an inch on each end. (Illust. 17.) This will position the blade in its neutral pitch position. If the blade is not level, a half turn of the upper strut in either direction will level the blade.

BULLGRADER

Angling the Blade

1. To angle the blade from the straight position, raise the blade a few inches above the ground.

2. Remove the strut trunnion from the strut trunnion bracket (on the side of the blade

that is to be angled to the rear) and position it close to the C-frame.

3. Remove the strut trunnion from the opposite side of the blade, and swing the strut assembly out as far as it will go.

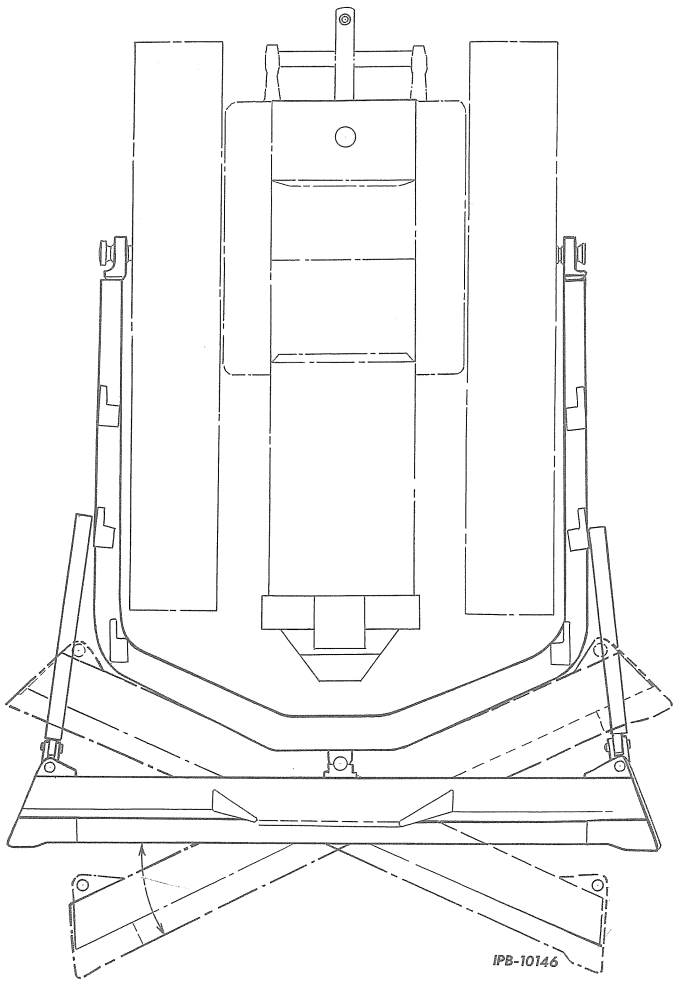
CAUTION: The blade will drop on the side where the strut is extended due to the loss of balance.

4. Return to the starting side of the blade, and swing the strut assembly outward.

5. Level the blade and maintain this level position while angling the blade.

NOTE: Perform the following operations in the order given to maintain the balance of the blade during the installation of the first strut trunnion.

6. First, install the strut trunnion that is angled to the rear of the tractor.



Illust. 29
Blade angling positions.

7. Install the other strut trunnion to its bracket on the C-frame. If necessary, adjust the upper strut to align the strut trunnion with the strut trunnion bracket.

8. Level the blade so when the blade is resting on the ground, one corner does not dig in more than the other. If only a small amount of adjustment is required, this may be accomplished by adjusting the upper struts.

9. To raise one end of the blade, lengthen the upper strut on the side to be raised. To lower one end of the blade, shorten the upper strut on the side to be lowered.

10. After leveling the blade, raise the blade above the ground about 12 inches. Adjust the upper struts to a "NEUTRAL" position (no compression or tension) so the blade connecting pins are free in their brackets.

Changing the Angle of the Blade

1. To change the angle of the blade, when it is already angled away from the straight position, raise the blade a few inches above the ground.

2. Remove the strut trunnion from its bracket on the other side, and swing the strut assembly all the way out.

3. Proceed as previously outlined under "Angling the Blade" if it is desired to make the blade sidecast in the opposite direction.

4. If it is desired to position the blade straight across the front of the tractor, angle the blade until it is straight. Maintain the blade in a level position during the process of angling.

5. Move either strut assembly until the assembly contacts the C-frame.

CAUTION: The blade will drop on the side where the strut is extended due to the loss of balance.

6. Move the strut assembly on the other side of the blade until it contacts the C-frame, and level the blade.

7. Assemble this strut trunnion into its trunnion bracket on the C-frame.

8. Assemble the strut trunnion on the opposite side into its trunnion bracket on the C-frame. If necessary, adjust the upper strut to align the strut trunnion with the trunnion bracket.

Continued on next page.

9. Level the blade so, when the blade is resting on the ground, one corner does not dig in more than the other. If only a small amount of adjustment is required, this may be accomplished by adjusting the upper struts.

10. To raise one end of the blade, lengthen the upper strut on the side to be raised. To lower one end of the blade, shorten the upper strut on the side to be lowered.

11. After leveling the blade, raise the blade above the ground about 12 inches. Adjust the upper struts to a "NEUTRAL" position (no compression or tension) so the blade connecting pins are free in their brackets.

Tilting the Blade

1. To tilt the blade, raise the blade about a foot above the ground.

2. Remove the strut trunnion from its bracket on the side to be raised, and position the strut close to the C-frame.

3. Adjust the opposite side to get the desired tilt by shortening the upper strut. Adjust this strut to tilt the blade about half of the desired tilt. Always adjust the side being lowered first, so change of balance will not cause the loose strut assembly to swing out and cause unexpected damage.

4. Return to the side of the tractor on which the strut assembly was disengaged, and lengthen the upper strut until the strut trunnion can be inserted in its bracket on the C-frame.

NOTE: Do not tilt the blade in excess of 12 inches tip to tip.

5. After tilting the blade, raise the blade above the ground about 12 inches. Adjust the upper struts to a "NEUTRAL" position (no compression or tension) so the blade connecting pins are free in their brackets.

SCHEDULED MAINTENANCE

Scheduled maintenance and periodic inspections are two very important functions which every owner and/or operator must follow to assure the maximum performance of the unit.

Scheduled maintenance and inspections must be performed at the specified intervals given below. The periodic maintenance and inspections listed below will also help keep your unit operating at top efficiency.

SCHEDULED

Point of Inspection	Remarks
After Every 10 Hours of Operation	
Lubrication points	Refer to the "LUBRICATION GUIDES."
Hydraulic system	Remove filler plug and check oil level. Refer to "HYDRAULIC SYSTEM."
After Every 250 Hours of Operation	
Lubrication points	Refer to the "LUBRICATION GUIDES."
After Every 1000 Hours of Operation	
Hydraulic system	Drain and refill with clean oil. Refer to "HYDRAULIC SYSTEM."
Oil strainer	Remove and clean strainer. Refer to "HYDRAULIC SYSTEM."
PERIODIC	
Cables	Inspect for wear or kinking. Refer to "REEVING."
Cap screws, nuts or pins	Inspect for loose or broken cap screws, nuts or pins.
Cutting edge and end bits	Inspect for wear. Refer to "CUTTING EDGES AND END BITS."
Trunnion cap screws	Tighten.

LUBRICATION

Thorough lubrication service, performed at definite intervals and according to an established routine, will aid greatly in prolonging the life of the tractor equipment and in reducing operating expense. In the "LUBRICATION GUIDES" the recommended intervals between lubrication periods are approximate, being based on average operating conditions. The type of work being done, load, ground and weather conditions are all factors to consider in the frequency of lubrication. The life and performance of a machine depend on the care that it is given. Proper lubrication is the most important maintenance service for your equipment.

Regular lubrication at recommended intervals also provides an opportunity for a general routine inspection of the equipment.

More frequent lubrication is required under adverse operating conditions such as excessively high or low temperatures, continued operation in sand or dust, immersion in water or exposure to moisture. Any one of these conditions may quickly destroy the protective qualities of the lubricants.

All lubrication fittings are 1/8 inch fittings. Use a chassis lubricant at all temperatures to lubricate all fittings. Before applying the lubricant, clean all the fittings to avoid forcing dirt or abrasives into the working parts. Apply the new lubricant until the old lubricant is forced through the bearing and starts to seep out the edges of the bearing lubricated.

Hydraulic System

The hydraulic system (tank and cylinders) will hold seven gallons of oil. Tank and cylinders must be drained after every 1000 hours of engine operation. Remove the oil strainer element and clean it in kerosene or fuel oil.

Hydraulic system oil meeting the following specifications is essential and must be used: MIL-L-2104A, SUP-1, DEF-2101B, SERIES 3, or MIL-L-45199.

NOTE: If the tractor is shipped from the factory with a hydraulic unit mounted on it, it will already have hydraulic oil in the system and will not need to be changed until 1000 hours of operation.

Cable Control Unit

Lubricate the cable control units as outlined in the Model 110 or P-25 and P-29 Cable Control Units Operator's Manuals.

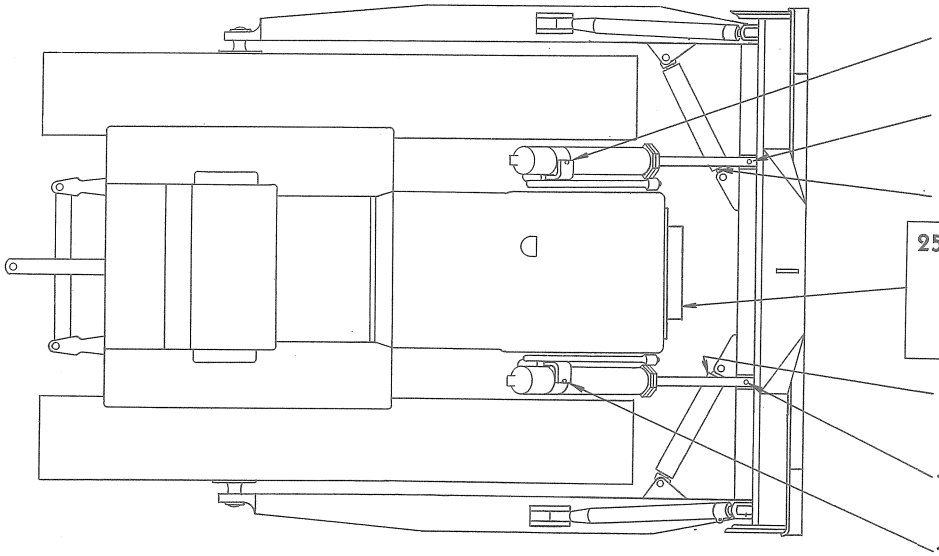
LUBRICATION GUIDE
(HYDRAULIC UNITS)

KEY CL (Chassis lubricant)—Use as pressure-gun grease; all temperatures

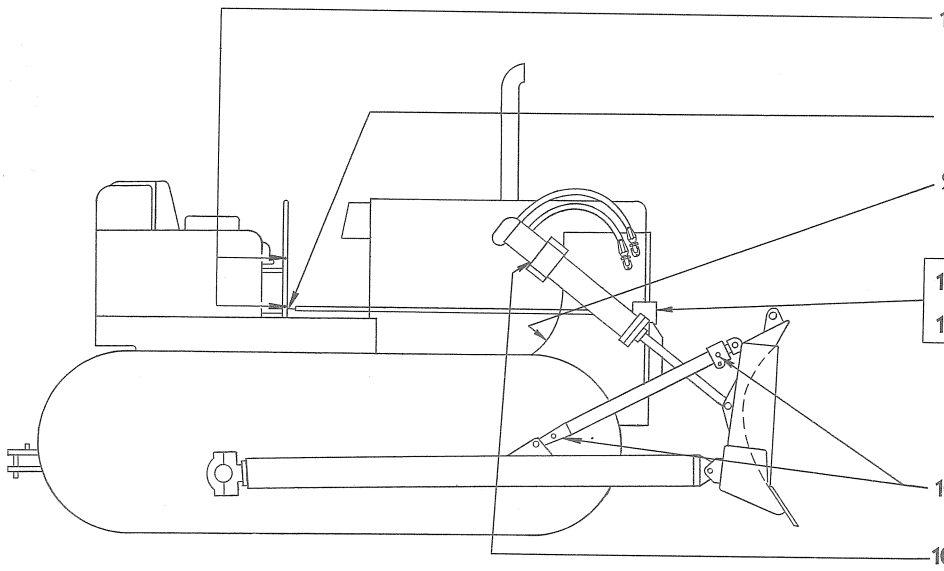
Points of lubrication are individually explained under "TRACTOR EQUIPMENT LUBRICATION POINTS." They are identified by item numbers corresponding with those listed along each side of the Lubrication Guide.

Always use clean containers. Keep lubricators clean. Wipe dirt from fittings before applying lubricators.

Note: Intervals of time between lubrication services are based on average operating conditions. Under unusually severe conditions of operation, reduce the interval of time between services.

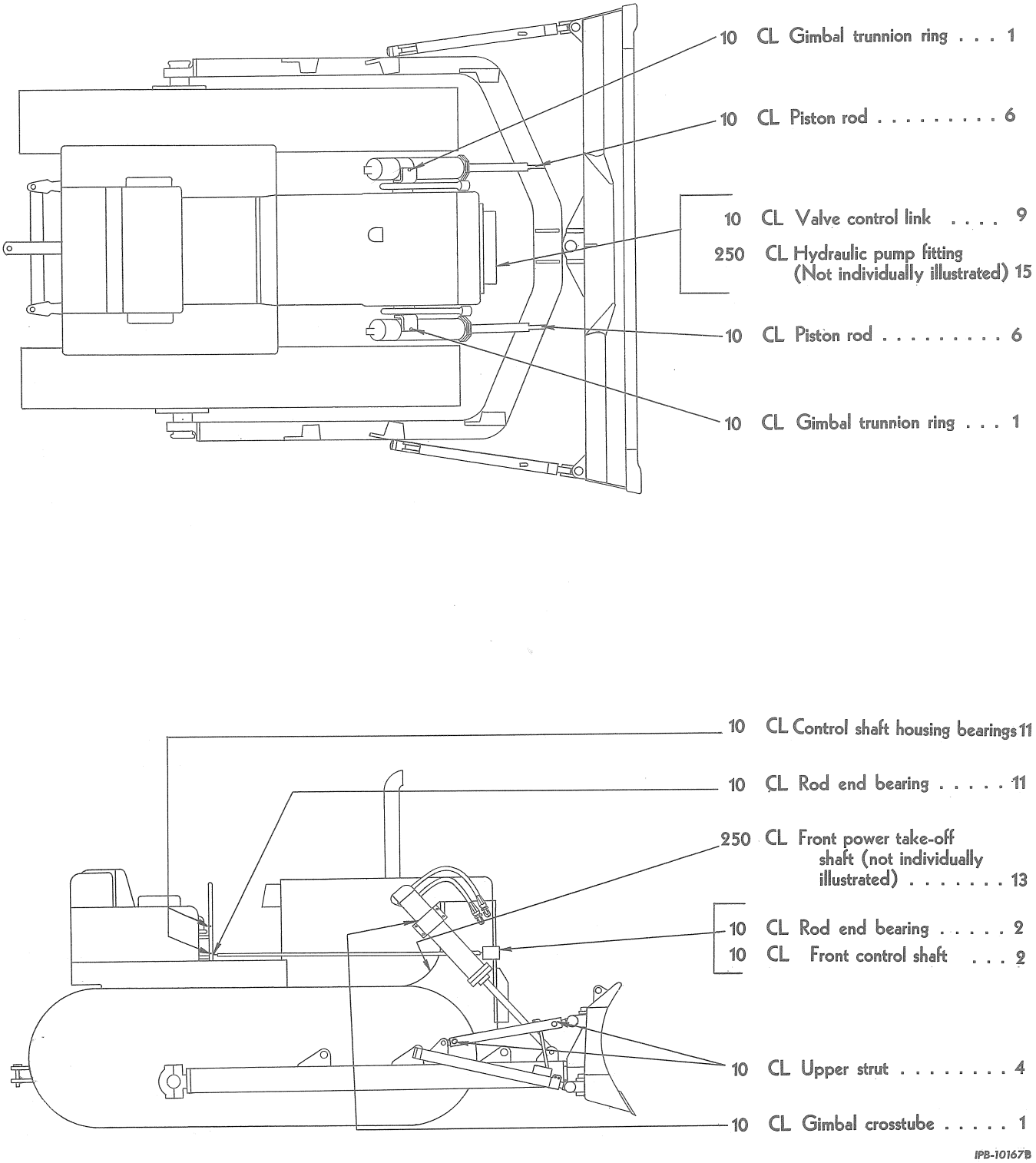


Hours	Lubricant	Point of Lubrication	Item No.
10	CL	Gimbal trunnion ring	1
10	CL	Piston rod	7
10	CL	Diagonal strut	7
250	CL	Hydraulic pump fitting (Not individually illustrated)	15
10	CL	Valve control link (not individually illustrated)	9
10	CL	Diagonal strut	7
10	CL	Piston rod	7
10	CL	Gimbal trunnion ring	1



Hours	Lubricant	Point of Lubrication	Item No.
10	CL	Control shaft housing bearing	11
10	CL	Rod end bearing	11
250	CL	Front power take-off shaft (not individually illustrated)	13
10	CL	Rod end bearing	2
10	CL	Front control shaft	2
10	CL	Upper strut	7
10	CL	Gimbal crosstube	1

IPB-10166 C



Hours	Lubricant	Point of Lubrication	Item No.
10	CL	Gimbal trunnion ring	1
10	CL	Piston rod	6
10	CL	Valve control link	9
250	CL	Hydraulic pump fitting (Not individually illustrated)	15
10	CL	Piston rod	6
10	CL	Gimbal trunnion ring	1
10	CL	Control shaft housing bearings	11
10	CL	Rod end bearing	11
250	CL	Front power take-off shaft (not individually illustrated)	13
10	CL	Rod end bearing	2
10	CL	Front control shaft	2
10	CL	Upper strut	4
10	CL	Gimbal crosstube	1

IPB-10167B

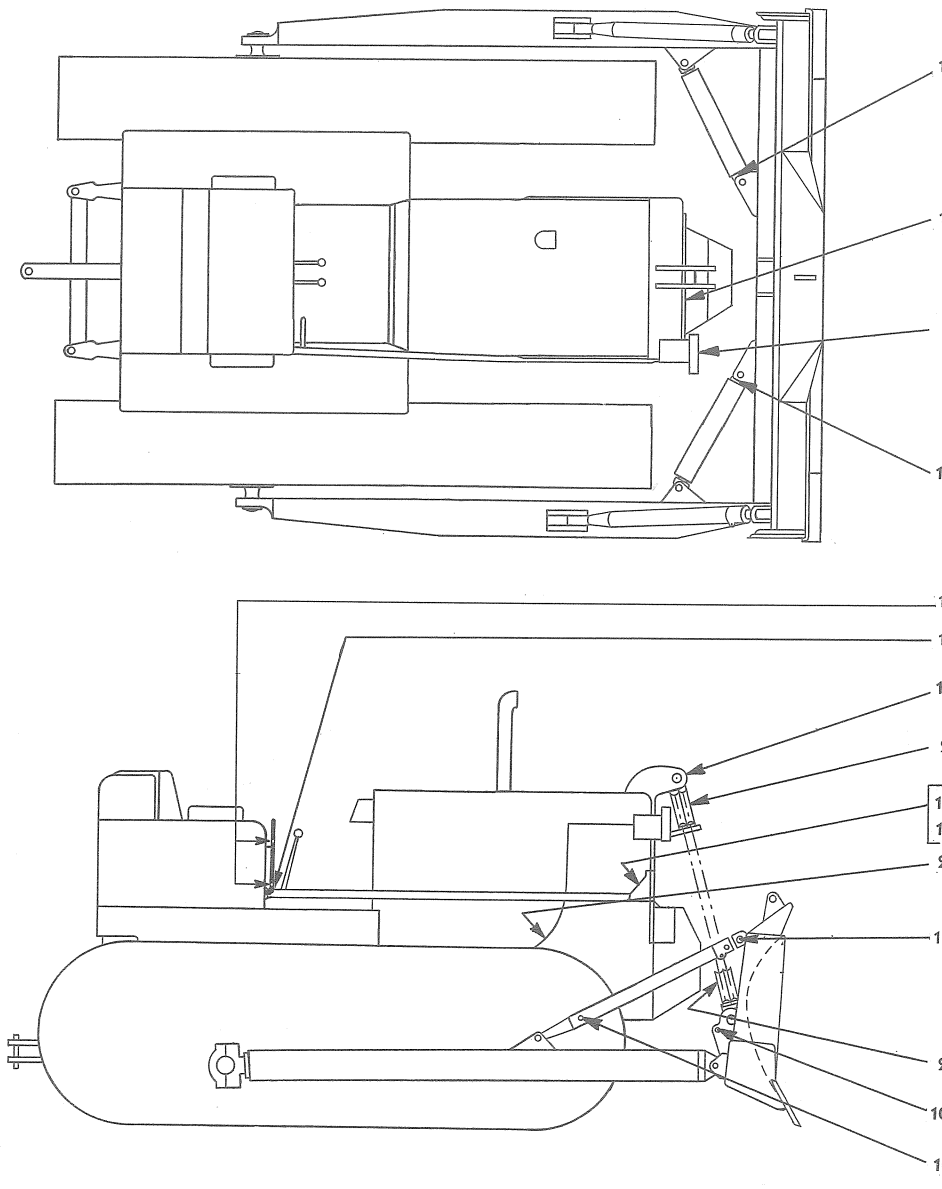
LUBRICATION GUIDE

KEY CL (chassis lubricant)—Use as Pressure-gun grease, all temperatures.

Points of lubrication are individually explained under "TRACTOR EQUIPMENT LUBRICATION POINTS." They are identified by item numbers corresponding with those listed along each side of the Lubrication Guide.

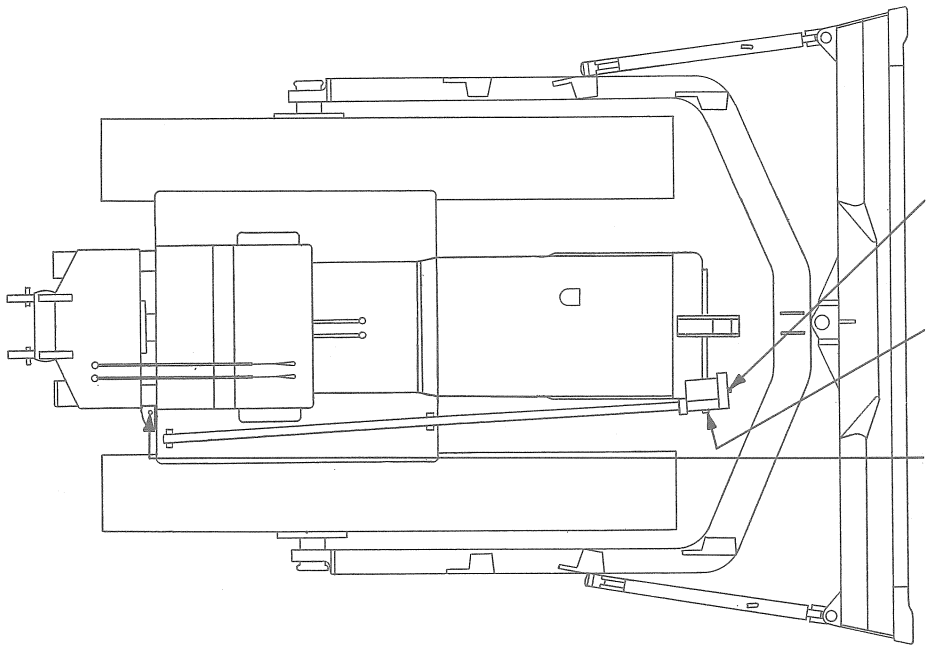
Always use clean containers. Keep lubricators clean. Wipe dirt from fittings before applying lubricators.

Note—Intervals of time between lubrication services are based on average operating conditions. Under unusually severe conditions of operation reduce the interval of time between services.

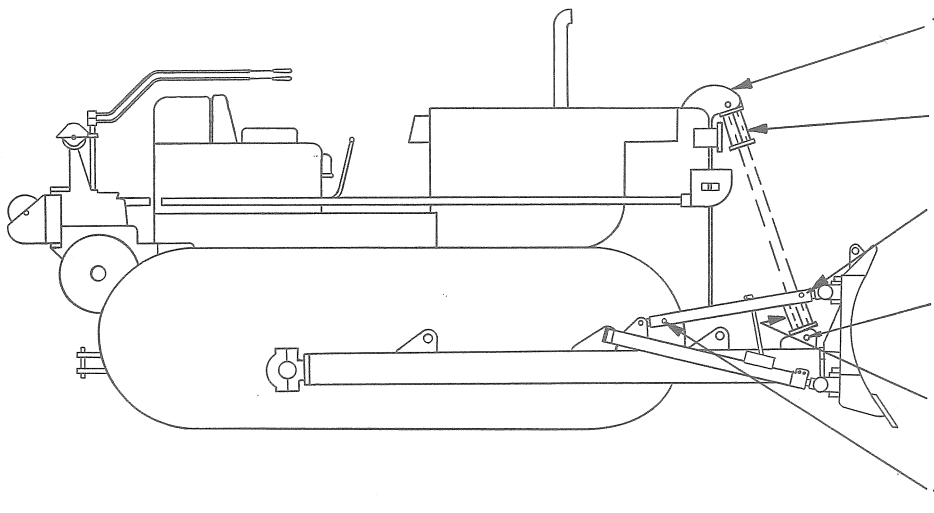


Hours	Lubricant	Point of Lubrication	Item No.
10	CL	Diagonal strut	8
10	CL	Control link	10
250	CL	Corner sheave	14
10	CL	Diagonal strut	8
10	CL	Control shaft housing bearing	11
10	CL	Rod end bearing	11
10	CL	Mounting shaft	12
250		Upper sheave	17
10	CL	Rod end bearing	3
10	CL	Front control shaft	3
250	CL	Front power take-off adapter and shaft (not individually illustrated)	13
10	CL	Upper strut	8
250	CL	Lower sheave	18
10	CL	Universal	5
10	CL	Upper strut	8

IPB-10147 D



Hours	Lubricant	Point of Lubrication	Item No.
250	CL	Corner sheave	14
250	CL	Side sheave	14
250	CL	Bracket sheave	16



Hours	Lubricant	Point of Lubrication	Item No.
10	CL	Mounting shaft	12
250	CL	Upper sheave	17
10	CL	Upper strut	4
10	CL	Universal	5
250	CL	Lower sheave	18
10	CL	Upper strut	4

IPB-10149 E

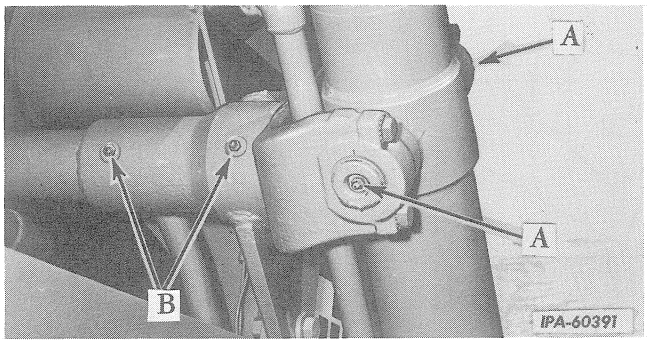
TRACTOR EQUIPMENT LUBRICATION POINTS

Service After Every 10 Hours of Operation

Item 1 - Gimbal Crosstube and Gimbal Trunnion Ring (Models 20D-2 and 20G-2 Only) (Illust. 30)

Apply three or four strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Gimbal trunnion ring (two fittings on each cylinder).
B - Gimbal crosstube (two fittings on each side).

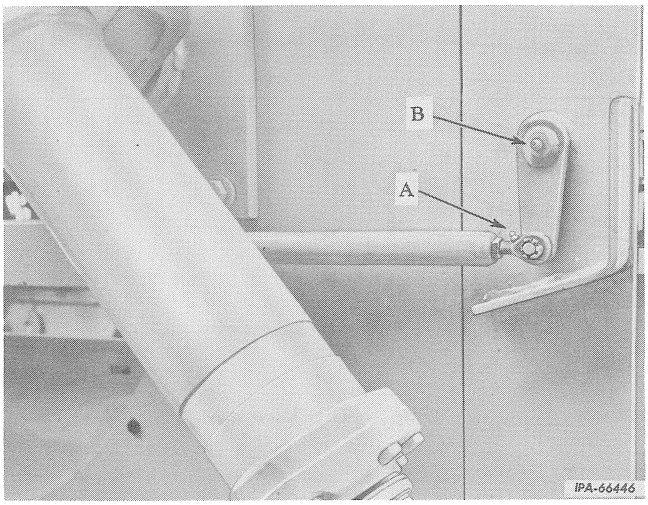


Illust. 30

Item 2 - Rod EndBearing and Front Control Shaft (Models 20D-2 and 20G-2 Only) (Illust. 31)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Rod end bearing.
B - Front control shaft.



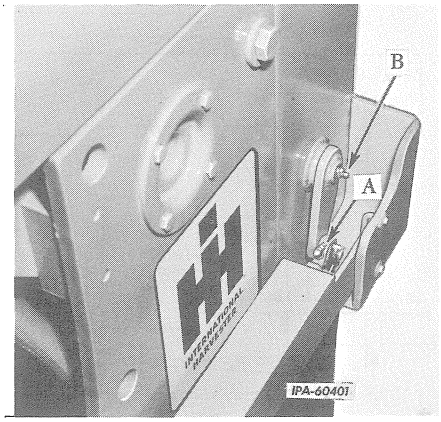
Illust. 31

Item 3 - Rod End Bearing and Front Control Shaft (Models 20D-1 and 20G-1 Only) (Illust. 32)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Front end bearing.

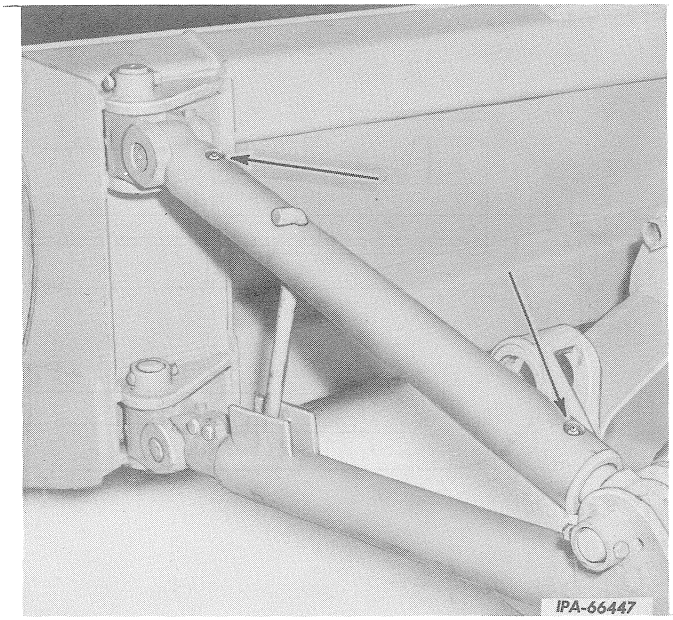
B - Front control shaft.



Illust. 32

Item 4 - Upper Strut (Models 20G-1, 20G-2 and 20G-3 Only) (Illust. 33)

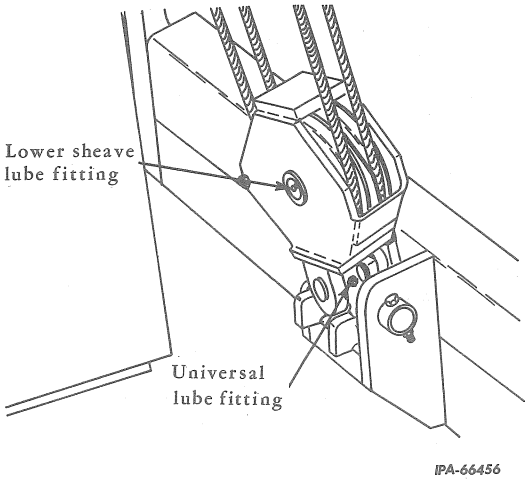
Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 33

Item 5 - Universal (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only) (Illust. 34)

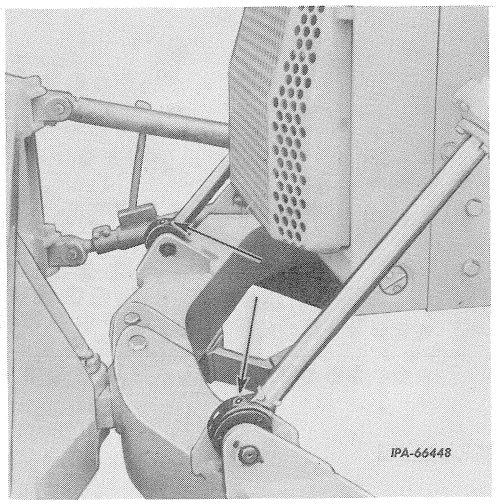
Apply two or three strokes of the lubricator to the fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 34

Item 6 - Piston Rods (Model 20G-2 Only) (Illust. 35)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 35

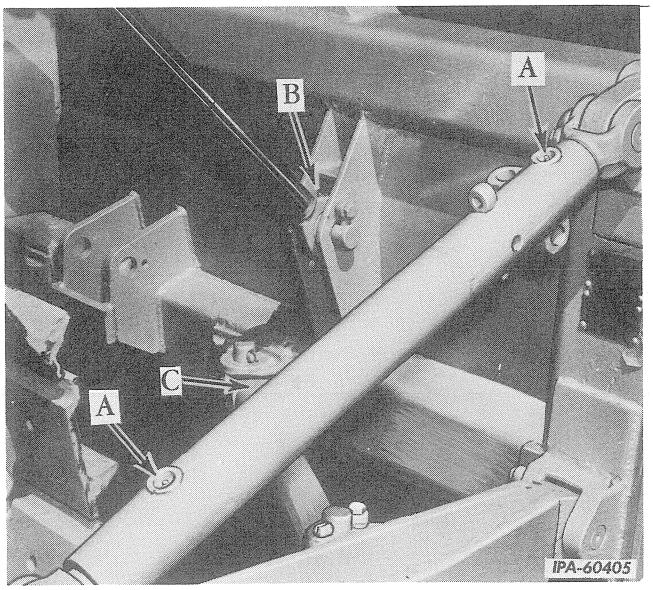
Item 7 - Diagonal Strut, Piston Rod and Upper Strut (Model 20D-2 Only) (Illust. 36)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Upper strut (two fittings on each strut).

B - Piston rod (one fitting on each rod).

C - Diagonal strut (one fitting on each strut).



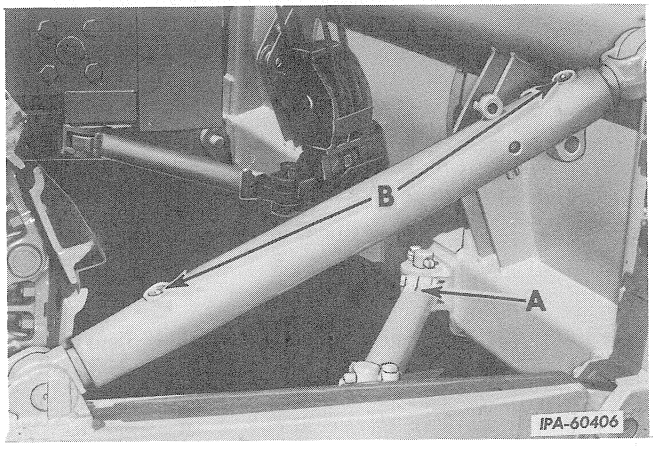
Illust. 36

Item 8 - Diagonal Struts and Upper Struts (Models 20D-1 and 20D-3 Only) (Illust. 37)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Diagonal struts.

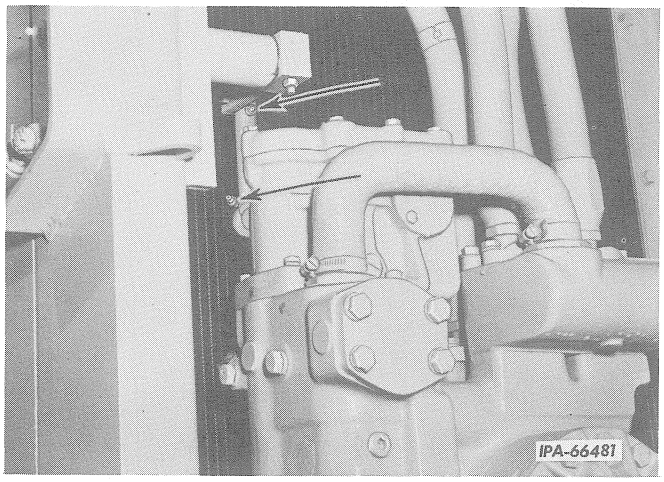
B - Upper struts (two fittings on each strut).



Illust. 37

Item 9 - Valve Control Link (Models 20D-2 and 20G-2 Only) (Illust. 38)

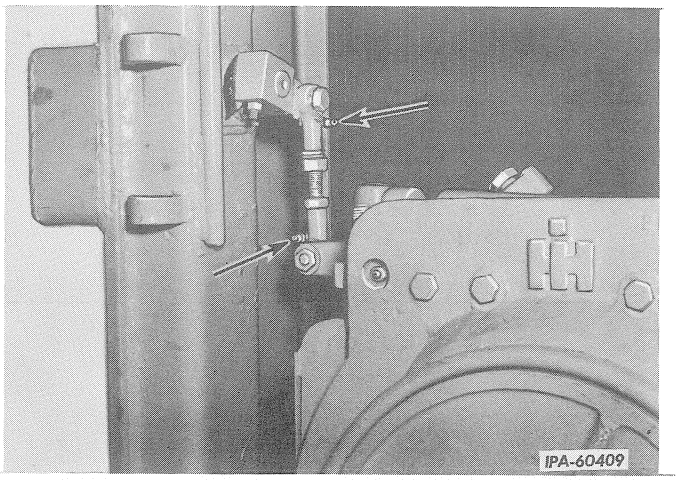
Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 38

Item 10 - Control Link (Models 20D-1 and 20G-1 Only) (Illust.39)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.



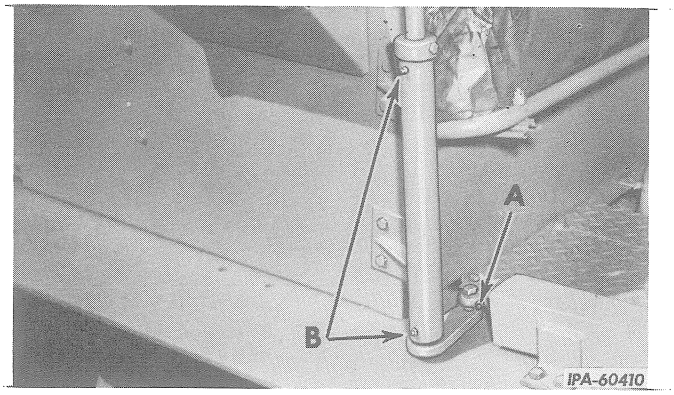
Illust. 39

Item 11 - Rod End Bearing and Control Shaft Housing (Models 20D-1, 20D-2, 20G-1 and 20G-2 Only) (Illust. 40)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Rod end bearing.

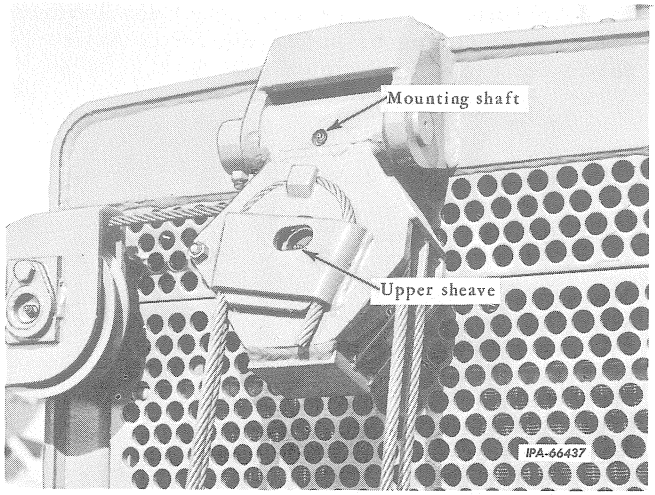
B - Control shaft housing.



Illust. 40

Item 12 - Mounting Shaft (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only) (Illust. 41)

Apply two or three strokes of the lubricator to the fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 41

Service After Every 250 Hours of Operation

Item 13 - Front Power Take-off and Shaft (Models 20D-1, 20G-1, 20D-2 and 20G-2 Only)

Two fittings are located on the spiders (3 and 6) (refer to Illust. 3).

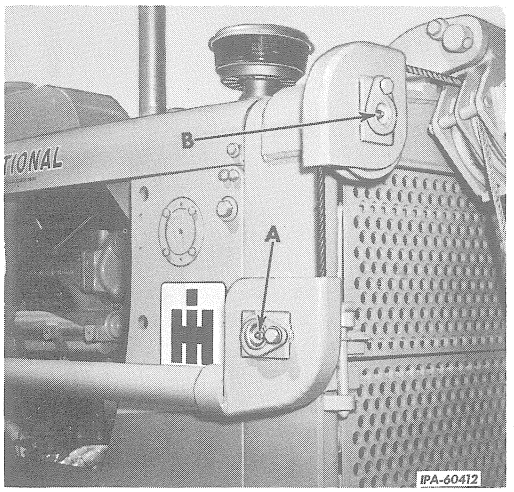
Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

Item 14 - Side and Corner Sheaves (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only) (Illust. 42)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

A - Side sheave, Models 20D-3 and 20G-3 only.

B - Corner sheave, Models 20D-1, 20D-3, 20G-1 and 20G-3 only.



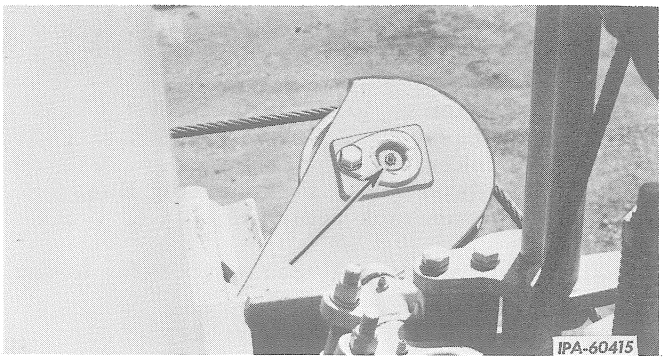
Illust. 42

Item 15 - Hydraulic Pump Fitting (Models 20D-2 and 20G-2 Only)

Apply two or three strokes of the lubricator to the fitting which is located at the lower rear of the hydraulic pump.

Item 16 - Bracket Sheave (Models 20D-3 and 20G-3 Only) (Illust. 43)

Apply two or three strokes of the lubricator to the fitting or sufficient lubricant to force out the old lubricant and dirt.



Illust. 43

Item 17 - Upper Sheave (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only) (Illust. 41)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

Item 18 - Lower Sheave (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only) (Illust. 34)

Apply two or three strokes of the lubricator to each fitting or sufficient lubricant to force out the old lubricant and dirt.

CHECKING MECHANICAL PROBLEMS OF HYDRAULIC SYSTEM

PROBABLE CAUSE	REMEDY
No Motion of Hydraulic System When First Started	
1. Low oil level due to leakage	Examine hydraulic lines, etc., for leaks and correct.
2. Oil viscosity too heavy	Use oil recommended.
3. Air leak in pump inlet passage	Inspect pump line mountings for leakage and correct.
4. Restricted pump inlet passage	Examine oil strainer and clean.
5. Broken pump drive shaft or power take-off shaft	Replace.*
6. Pressure relief valve plunger leaking and/or defective	*
7. Pump not rotating	Check for broken pump drive shaft or power take-off shaft.
8. Pump worn out	*

Continued on next page.

*Consult your authorized International Construction Equipment distributor or dealer.

PROBABLE CAUSE	REMEDY
9. Control lever linkage broken	Remove and replace.*
10. Broken hydraulic lines	Repair.*
11. Broken relief valve spring	*

Loss of Motion During Operation

Insufficient oil supply	Check level of oil in oil tank and add oil if necessary.
A. Broken or loose pump inlet passage	Replace or tighten.
B. Broken outlet passage	Replace.
C. Broken cylinder connecting lines	*
D. Broken tank return line	*

NOTE: For additional "causes," refer to the items listed under "No Motion of Hydraulic System When First Started."

Slow Motion

1. Pump wearing out	*
2. Partially clogged pump inlet	Clean hydraulic system and clean oil strainer.
3. Air leak in pump inlet	Inspect pump line mountings for leakage and correct.
4. Pressure relief valve plunger leaking	*
5. Badly scored relief valve plunger seat	Replace.*
6. Aerated oil supply (foam in tank)	Check hydraulic system for air leaks.
7. Worn or scored piston packing or cups	*
8. Inside diameter of cylinder tube badly scored or nicked	*
9. Linkage to valve plunger bent	Remove and replace.*

Jerky Motion in Upstroke

1. Air in system	Vent hydraulic system.
2. Cylinder packing too tight	*

Jerky Motion in Downstroke

1. Dashpot plunger spring or cap broken	*
2. Float control plunger spring broken	*

Noisy Operation

1. Air in system	Vent hydraulic system.
2. Insufficient oil supply	Check level of oil in oil tank and add oil if necessary.
3. Pump bearings worn out	*
4. Pump and coupling worn out	*
5. Partially blocked pump inlet	Drain hydraulic system and clean strainer.
6. Pump squealing caused by:	
A. Air in system	Vent hydraulic system.
B. Insufficient oil supply	Check level of oil in oil tank and add oil if necessary.
C. Partially blocked pump inlet	Drain hydraulic system and clean strainer.
7. Chattering relief valve spring	*
8. Broken flow control plunger spring	*
9. Broken dashpot plunger spring or cap	*

*Consult your authorized International Construction Equipment distributor or dealer.

PROBABLE CAUSE	REMEDY
Load Slowly Drops (Valve Plunger in Hold Position)	
1. Oil leaking by valve plunger	*
2. Oil by-passing from holding side to opposite side of piston	*
3. Oil leaks at fittings or in cylinder connecting lines	Check hydraulic system.
Momentary Drop of Load When Valve Plunger is Actuated from Hold to Raise or Raise to Hold	
1. Scored or worn check valve plunger or seat	*
2. Check valve plunger held off its seat . . .	Clean system. Check for foreign matter.
3. Broken check valve spring	*
Sticking Valve Plunger	
1. Scored or burred lands in plunger bore . .	*
2. Mounting face not level, thereby distorting housing	*
3. Mounting bolts too tight or improperly tightened	Loosen and retighten to proper torque (50 lbs).
4. Detent poppets worn or damaged (positive position type only)	*
5. Dirt or foreign matter	*
6. Warped valve plunger	*

*Consult your authorized International Construction Equipment distributor or dealer.

MAINTENANCE

HYDRAULIC SYSTEM (MODELS 20D-2 AND 20G-2 ONLY)

Draining the Hydraulic System

After every 1000 hours of operation, drain the hydraulic system and clean the oil strainer.

To drain the system (including the cylinder), proceed as outlined below:

1. Operate the system to warm the oil for easy draining.

2. Position the tractor to permit the blade to drop below ground level, so the blade is entirely supported by both cylinders at maximum dig position. This is necessary to cause the relief stems in the hydraulic cylinder piston to open and permit draining of the cylinders.

3. Place the control handle into the "FLOAT" position and stop the tractor engine.

CAUTION: Always loosen the vent plugs and filler plug slowly in case there is still some pressure in the system.

4. Remove the filler plug from the top left side of the radiator guard and loosen the vent plug on the top of each hydraulic cylinder to allow air pressure to escape.

5. Remove the drain plug (4, Illust. 5) from the bottom of the radiator guard and remove the drain plug from the bottom of each hydraulic cylinder.

6. Remove the two oil strainer retainer plates (14, Illust. 5). Remove the oil strainer (12, Illust. 5) and clean it in kerosene or fuel oil.

NOTE: The oil strainer must be cleaned whenever the hydraulic system is drained.

7. Inspect the oil strainer "O" rings (11 and 13, Illust. 5) and replace if worn or cut.

8. Reinstall the oil strainer and secure.

9. Reinstall and tighten all the drain plugs.

Filling and Venting the Hydraulic System

CAUTION: Use clean oil from a clean container. Keep oil in the system clean. Maintain all packings and fittings against leakage.

To fill the hydraulic system, use seven gallons of Grade-10W heavy duty engine oil that contains an anti-foaming agent.

1. Remove the filler plug from the top left side of the radiator guard tank and loosen the vent plugs in the top of the hydraulic cylinders. With the control handle in "HOLD" position, fill the oil tank to the top of the filler hole. Replace the filler plug.

2. Start the tractor engine and run at low idle speed.

3. Place the control handle into the "RAISE" position and hold it there for a few seconds; then shift the valve into the "HOLD" position.

CAUTION: Loosen the filler plug slowly in case there is still some pressure in the system.

4. Remove the filler plug and check the oil level. Add oil if necessary.

5. Repeat this procedure until a solid stream of oil (no air) drains out from the vent plug in the top of each cylinder and until the oil level remains constant.

6. Tighten the vent plug in the top of each cylinder, and tighten the filler plug.

FAN BELTS

Removal (Models 20D-1, 20G-1, 20D-2 and 20G-2 Only)

1. Disconnect the coil-to-distributor cable at the coil end to eliminate any possibility of accidentally starting the engine.

2. Decrease the fan belt tension as outlined in the tractor operator's manual.

3. Remove the four cap screws and lock washers holding the spider (3, Illust. 3) to the fan drive pulley. Slide the power take-off shaft forward on the pump shaft and/or cable control unit shaft and drop the power take-off shaft down.

4. Working with one belt at a time, remove the belts from the generator pulley.

5. Turn the fan by hand and work the belts over the fan blades until the belts can be removed.

Installation (Models 20D-1, 20G-1, 20D-2 and 20G-2 Only)

Reverse the procedure outlined under "Removal."

CUTTING EDGES AND END BITS

Service the cutting edge or end bits before wear occurs on the cutting edge back-up plate or drift board.

To service the cutting edge, raise the blade to the maximum height, set the control handle in the "HOLD" position, and securely block the C-frame or push arms. Shut off the engine.

CAUTION: To avoid serious injury, never work underneath the blade, trusting the hydraulic control unit or cable control unit to hold the blade elevated. Someone may move the control handle accidentally, while climbing on the tractor or reaching for tools, and drop the blade.

Remove the cutting edge and end bits by taking out the attaching plow bolts. The life of the cutting edge may be increased by reversing it. If the end bits are worn, rebuild them with hard surface welding rods or replace.

Install the cutting edge and end bits and bolt securely.

NOTE: Firmly seat the end bits against the shear blocks. Use only manufacturer's heat-treated plow bolts, which can be secured from your distributor.

DISASSEMBLY OF THE BULLDOZER AND BULLGRADER

Removing the C-frame or Push Arms (Bulldozer and Bullgrader)

1. Block up the C-frame or push arms, before disconnecting them from the tractor, to maintain the proper height for reassembling.

2. MODELS 20D-2 AND 20G-2 ONLY: Remove the hydraulic cylinder piston rods from the hydraulic jack brackets on the back of the blade of the bulldozer, or from the hydraulic jack brackets on the C-frame of the bullgrader by removing the cap screws, lock nuts and cylinder pins.

2. MODELS 20D-1, 20G-1, 20D-3 AND 20G-3 ONLY: Remove the cap screw and nut holding the lower sheave block universal mounting shaft; then remove the shaft, universal and sheave block from the blade or C-frame.

3. Remove two cap screws, nuts and shims from the left and right trunnion bearing caps located at the rear of the C-frame or push arms.

4. Having both sides disconnected, back the tractor out and away from the C-frame or push arms.

Removing the C-frame or Push Arm Trunnions (Bulldozer and Bullgrader)

Remove the six cap screws and lock washers from the right and left side trunnions to disconnect the trunnions from trunnion support plates.

Removing the Upper Struts

Bullgrader

To remove the upper struts from the lower struts and strut swivel clevis on the right and left side of the bullgrader, take out the cap screws and remove the upper strut pins from the strut swivel clevis on the blade. Remove the upper strut pins from the upper strut clevis on the lower strut.

Bulldozer

CAUTION: Secure the blade with a hoist so it does not fall when removing the upper struts.

Remove the cap screws, lock washers and eyepins from the blade and push arm brackets and take out the pins which hold the upper struts in position.

Removing the Lower Struts (Bullgrader)

Remove the cap screws and take out the strut swivel pins from strut swivel clevis on the blade. To remove the lower struts from the C-frame take out the strut trunnion pin attached to the chain and remove the strut trunnion from the trunnion bracket on the C-frame.

Removing the Blade from the C-frame (Bullgrader)

Block up the front of the C-frame to prevent its falling when disconnected from the blade.

CAUTION: Attach a hoist to the lifting eye on the blade to prevent the blade from falling when disconnected from the C-frame.

The upper and lower struts must be removed (refer to the removal procedures listed above). The blade is also connected at the front center section of the C-frame. Take out the cotter pin, remove the nut and take out the crosshead swivel pin.

Removing the Diagonal Struts (Bulldozer)

Take out the cap screws, lock washers and eyepins from the blade brackets and push arm brackets, and remove the pins which hold the struts in position.

Removing the Blade from the Push Arms (Bulldozer)

1. Block up the push arms to prevent them from falling when disconnecting them from the blade.

2. HYDRAULIC UNITS ONLY: Remove the cylinder piston rods from the hydraulic jack brackets on the back of the blade by removing the cap screws and cylinder pins.

2. CABLE UNITS ONLY: Remove the cap screw and nut holding the lower sheave block mounting shaft; then remove the shaft, lower sheave block and universal.

3. Remove the upper and diagonal struts. (Refer to procedure for removal of the upper and diagonal struts from the bulldozer on the preceding page.)

CAUTION: Attach a hoist to the lifting eye on the blade to prevent the blade from falling when it is disconnected from the push arms.

4. The lower right and left sides of the blade are connected to the push arms. Remove the cap screws, lock washers and eyepins from the blade brackets.

5. Remove the pins which connect the blade to the push arms.

Removing the Grille Doors

Take out the cotter pins and hinge pins and remove the doors.

Removing the Connecting Linkage and Controls (Models 20D-1, 20D-2, 20G-1 and 20G-2 Only)

Reverse the installation procedure (refer to "Connecting Linkage and Controls" in the "INSTALLATION" section).

Removing the Hydraulic Cylinder Hoses and Pump Hoses (Models 20D-2 and 20G-2 Only)

Reverse the installation procedure (refer to "Hydraulic Hoses" in the "INSTALLATION" section).

Removing the Hydraulic Pump and Valve (Models 20D-2 and 20G-2 Only)

Fasten a rope around the hydraulic pump and valve, and remove the cap screws and lock washers. Using an overhead hoist, pick up the pump and valve just enough so it will be free of the radiator guard. Back the pump and valve away from the radiator guard slowly until the power take-off shaft assembly is free of the pump.

NOTE: Block up the power take-off shaft assembly to avoid damage while it is being disengaged from the pump and valve.

Removing the Power Take-off Shaft (Models 20D-1, 20D-2, 20G-1 and 20G-2 Only)

Remove the cap screws and lock washers at the flange end of the power take-off adapter and shaft attached to the fan drive pulley. Remove the power take-off adapter and shaft.

Removing the Hydraulic Cylinders (Models 20D-2 and 20G-2 Only)

Attach an overhead hoist to the hydraulic cylinder. Remove the cap screws and lock washers from the cylinder yoke cap; then remove the cap and bushings. Remove the cylinder. Keep the cap bushings with the cap to prevent them from being lost.

Removing the Hoist Cylinder Yokes (Models 20D-2 and 20G-2 Only)

Reverse the procedure for mounting the hoist cylinder yokes. (Refer to the "INSTALLATION" section.)

Removing the Cable Control Unit (Models 20D-1, 20G-1, 20D-3 and 20G-3 Only)

MODELS 20D-1 AND 20G-1 ONLY: Reverse the mounting instructions listed under "Mounting the 110 Cable Control Unit" in the "INSTALLATION" section. Instructions for servicing this cable control unit will be found in the "Model 110 Single Drum Cable Control Unit Operator's Manual."

MODELS 20D-3 AND 20G-3 ONLY: Reverse the mounting instructions found in the "P-25 and P-29 Cable Control Units Operator's Manual." Instructions for servicing these cable control units will also be found in the cable control units operator's manual.

Removing the Radiator Guard

Remove the cap screws, spacers and spacer retainers securing the guard. Remove the guard.

STEEL CABLE MAINTENANCE

When a new cable has been installed, operate with light loads or no loads for a short period of time after installation. This "break-in" period will prolong cable life.

Avoid sudden "shock" loads to the cable. The sudden impact of a load, especially if there is any cable slack, places excessive stress on

the cable which causes cable strain and could possibly break the cable.

To prolong cable life, the cable must be periodically cleaned and lubricated. Lubricating the cable will help to reduce wearing, cracking or fraying.

More frequent application of lubricant produces better results, then heavy coatings of lubricant less frequently applied.

Lubrication

To prepare the cable for lubrication, use compressed air, live steam or a wire brush to clean the cable. After cleaning the cable, allow it to dry completely.

Use clean Grade-10W oil to lubricate the cable. Apply a sufficient amount of oil to the entire cable to thoroughly lubricate all of the cable without saturating the cable with oil.

BLADE EQUIPMENT STORAGE

The following procedure covers the storage maintenance of the bulldozer and bullgrader equipment. This procedure must be performed every 30 days when this equipment is stored outdoors.

NOTE: All parts to be protected must be clean and dry before proceeding with the following:

1. Lubricate all points as indicated on the "LUBRICATION GUIDES."

2. Lubricate the cable control unit. (Refer to the cable control unit operator's manual.) When a cable control unit is to be stored for an extended period of time, the brake and clutch bands must be protected from taking a set as follows:

MODEL 110: Block the control lever into the "UNSPOOL" position.

MODELS P-25 AND P-29: Place the control lever into the "FREE SPOOL" position. The rear mounted cable control levers will lock into this position.

3. Coat the blade, cutting edge, end bits and all bolts and connecting pins on the blade with chassis grease.

NOTE: When storing, the blade and push arms or C-frame should always be blocked up to avoid contact with the ground.

4. Coat the exposed portions of the hydraulic cylinder piston rods and rod end bearings with chassis grease. Secure the cylinders to the tractor to avoid damage.

5. Thoroughly oil all connections, joints, nuts, pins, shafts and bushings of the control linkage which are not provided with a lubrication fitting.

6. Lubricate the steel cable. (Refer to "STEEL CABLE MAINTENANCE.")