GALION
ROLLERS • GRADERS • CRANES

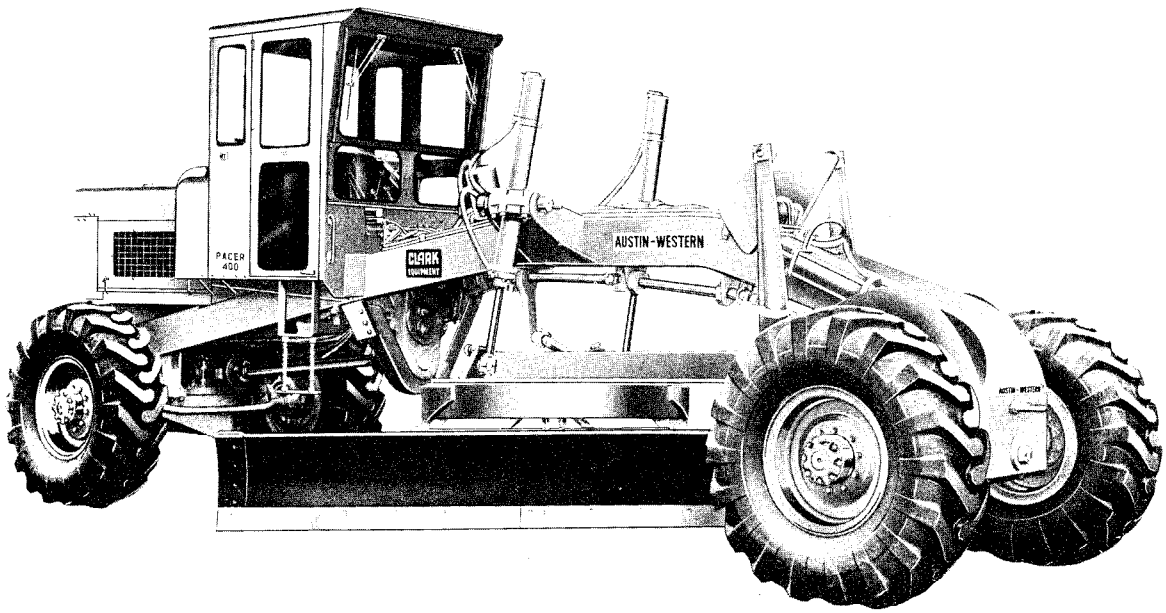
COMPETITIVE DATA

THIS MATERIAL IS REPRODUCED FOR THE SOLE PURPOSE OF ENABLING PROSPECTIVE PURCHASERS TO MAKE COMPARISONS BETWEEN GALION'S PRODUCTS AND THOSE OF COMPETITIVE MANUFACTURER. THE GALION IRON WORKS & MFG. COMPANY MAKES NO REPRESENTATION AS TO THE ACCURACY OR CURRENT STATUS OF THIS MATERIAL.

NUMBER AD-2899
EFFECTIVE DATE 6-71
REPLACES AD-2790-R1
FILE IN SECTION B

THE GALION IRON WORKS & MFG. COMPANY division of Jeffrey Galion Inc. Galion, Ohio 44833, U.S.A.

AUSTIN-WESTERN
Pacer 400 Power Grader



AUSTIN-WESTERN
DIVISION
CLARK EQUIPMENT
CLARK EQUIPMENT COMPANY
Aurora, Illinois 60507

FOUR-WHEEL DRIVE
•
FOUR-WHEEL STEER
•
ALL HYDRAULIC OPERATION
•
FULL BLADE CONTROL

Austin-Western Pacer 400 Power Grader Specifications

STANDARD EQUIPMENT — All-wheel drive and steer; power sideshift blade, hydraulic controls throughout; power tiller bar steering included. Diesel engine with electric starting, 30 amp alternator, accelerator-decelerator and tool box. Full 360° reversible 13-foot (3962 mm) blade, hydraulic brakes and 14.00x24-12 ply tubeless tires. Gauges; ammeter, water temperature, oil pressure.

WEIGHT (APPROX.)

	Oil Clutch	Torque Converter
Total weight	26,850 (12 179 kg)	27,200 (12 338 kg)
Weight on front axle	11,800 (5352 kg)	11,850 (5375 kg)
Weight on rear axle	15,050 (6827 kg)	15,350 (6963 kg)
Blade pressure	21,818 (9897 kg)	21,911 (9939 kg)
Scarifier pressure	13,688 (6209 kg)	13,746 (6235 kg)
Blade pull	16,110 (7307 kg)	16,320 (7403 kg)

Blade Pull is based on a coefficient of friction of .6 on dirt.

DIMENSIONS

Length—overall	26'-1½" (7963 mm)
Width—overall	7'-10¾" (2407 mm)
Height—with cab	10'-6⅞" (3223 mm)
—without cab	9'-10½" (3010 mm)
Wheelbase	19'-8¼" (6001 mm)
Turning radius	33'-8" (10 262 mm)

BLADE

Dimensions	13'x26"x¾" (3962x660x19 mm)
Cut below ground	17½" (445 mm)
Lift above ground	17" (432 mm)
Blade base	108½" (2756 mm)
Total sideshift	97¾" (2483 mm)
Maximum blade reach beyond tire	112⅞" (2867 mm)
High lift	Up to 90°
Lift speed (inches per second)	5.2 (132 mm)

Shim adjusted ball sockets on blade lift cylinder.

CIRCLE

Diameter	5'-2" (1575 mm)
Circle sideshift	21¾" (552 mm)
Circle section	5"x6"x1⅜" (127x152x35 mm)
Rotation	360°

DRAWBAR

Type	"A" form welded—4"x6"x⅞" (102x152x22 mm)
Average weight per foot (m)	27.2 lbs. (12,3 kg)
Draft connection	5" (127 mm) ball and socket—shim adjustment

FRAME

Size and shape	4"x10" (102x254 mm) solid steel bar
Average wt. per ft. (m) of total frame	387 lbs. (176 kg)

FRONT AXLE

Type—power driven, full floating, double reduction, with differential	
Oscillation	15° each way
Steering range	25° each way
Drive and steering knuckles	Rzeppa type

REAR AXLE

Type—power driven, full floating, double reduction, no differential	
Steering range	15° each way
Type steering	Steering in knuckles
Drive and steering knuckles	Rzeppa type

HYDRAULIC DATA

Pump	Vane type
Capacity	25 G.P.M. (98 liters P.M.)

CONTROLS

Type ..... Full Hydraulic with Positive Hydraulic Blade Locks

ENGINES—DIESEL

	GM 4-71	GM 4-71N
No. of cylinders	4	4
Bore and stroke	4.25 x 5 (108 x 127 mm)	4.25 x 5 (108 x 127 mm)
Piston displacement	283.7 cu. in. (5 liters)	283.7 cu. in. (5 liters)
Cycle	2	2
Governed speed	2200	2200
H.P. at gov. speed (sea level 60°)	151	160
Cooling system (gals. with heater)	9 (34 liters)	9 (34 liters)
Electric system	12V	12V
Fuel tank capacity (Gal.)	75 (284 liters)	75 (284 liters)
	Cummins (*) C-464-C	**Cummins (*) CS-464-C**
No. of cylinders	6	6
Bore and stroke	4 7/16 x 5 (113 x 127 mm)	4 7/16 x 5 (113 x 127 mm)
Piston displacement	464 cu. in. (7,6 liters)	464 cu. in. (7,6 liters)
Cycle	4	4
Governed speed	2200	2200
H.P. at gov. speed (sea level 60°)	149	160
Cooling system (gals. with heater)	8.5 (32 liters)	8.5 (32 liters)
Electric system	12V	12V
Fuel tank capacity (Gal.)	75 (284 liters)	75 (284 liters)

SPEED IN M.P.H. (and KILOMETERS/HR.)

1	2.76 (4,44 km/hr)	4	8.58 (13,81 km/hr)
2	4.51 (7,26 km/hr)	5	14.04 (22,59 km/hr)
3	6.54 (10,52 km/hr)	6	22.00 (35,40 km/hr)
Low reverse	3.86 (6,21 km/hr)		
High reverse	12.01 (19,32 km/hr)		

TORQUE CONVERTER

Make	Allison
Torque multiplication	2.5 to 1

OIL CLUTCH

Size	13½" (343 mm)
Plates	3

Oil pump, filter and reservoirs are an independent system.

BRAKES

Foot operated service brake (17"x4") (432x102 mm) self adjusting, hydraulic expanding, and hand operating mechanical expanding parking brake. Brake assembly mounted on transfer case away from mud and water encountered in off-the-road operation to brake both front and rear propeller shafts and thus effectively brake front and rear wheels.

STEERING

Type ..... Hydraulic Power with Tiller Bar

ATTACHMENTS

Cab	Reversible type Snow Plow
Bulldozer	"V" type Snow Plow
Scarifier (V type)	Rotary Snow Plow
Power tilt blade	Snow Wing

OPTIONAL ITEMS

Blade ext. 1 ft. (305 mm)	High altitude radiator
Blade ext. 2 ft. (610 mm)	Hoodsides
Brake—auxiliary	Hourmeter
Defroster	Lights
Drawbar-rear	Orbitrol Power Steer
Floating blade	Radiator shutters-automatic
Fuel gauge	Tire pump
Heater	

(*) Standard equipped with Dry Type Air Cleaner, 55 Amp Extra Heavy Duty Alternator.

WARRANTY

In accordance with our established policy of constantly improving our products, we reserve the right to change or modify our products or our product specifications at any time without notice. THE ONLY WARRANTY APPLICABLE TO OUR PRODUCTS IS OUR STANDARD WRITTEN WARRANTY WHICH WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. No person is authorized to change or otherwise modify this warranty, a copy of which is available upon request.

AD-2899 (replaces AD-2790-R1) 15M-6-71 PRINTED IN U.S.A.

1. PACER 400 POWER GRADER SPECIFICATIONS.

STANDARD EQUIPMENT.- All-wheel drive and steer; dry clutch transmission; hydraulic control throughout, including steering; Diesel motor with electric starter, battery and generating unit; adjustable upholstered seat; 13-foot moldboard; hydraulic foot-operated service brake, and hand-operated mechanical parking brake on drive shaft. Single 14.00 x 24, 12-ply tires. (See tire option below). No cab or hood sides for engine are included as standard equipment.

ENGINES (DIESEL)		
Make	GMC 471	Cummins C-160
Number of cylinders	4	6
Bore and stroke	4.25x5	4-7/16x5
Gov. speed	2000	2060
H.P. at gov. speed (sea level 60°)	143	143
Cu. in. displacement	283.7	464
Fuel tank capacity	75 g.	75 g.
Cooling system (gallons)	9	8½
Electric system	12V	12V
Electric starter	Yes	Yes
Ignition	Comp.	Comp.
Crank Case oil capacity	4-1/4g.	5 g.
Crank Case oil filter capacity	2 Qts.	2 Qts.
Air Cleaner oil capacity	3 3/4 Qts.	3 Qts.
Type Crank Case oil & fuel oil	See separate engine instruction books.	
Oil pressure-hot engine (full Throttle)	50 P.S.I.	50 P.S.I.
OPERATING WEIGHTS		
NO SCARIFIER: Total weight	25,120	25,155
WITH SCARIFIER: Total weight	26,420	26,455
ADD 450 LBS. TO TOTAL WEIGHT FOR SHIPPING.		

DIMENSIONS:

Wheelbase..... 19'-8¼"
Overall length..24'-10¾"
Overall height, no cab..... 9'-10½"
Overall height, with cab.....10'-3 7/8"
Overall width... 7'-10¾"
Turning radius approx..... 33'-8"

BLADE:

Length, standard. 13'-0"
Width (curved height, moldboard and bit). 26"
Thickness, moldboard..... 3/4"
Cut below ground... 17½"
Lift above ground.. 17"
Circle side shift 21¾"
Blade side shift (precision)..... 50"
Blade base.....108½"
Total side shift (by power).....71¾"
Added side shift (manual)..... 26"
Total side shift (power and manual) 97¾"
Max. blade reach beyond tire(frame straight)91⅛"
High lift.....up to 90°

DRIVES:

Front with differential. Full floating axles.
Type of universal wheel joints.....Rzeppa
Rear is rigid; no differential. Full floating axles.

CONTROLS:

Hydraulic, operated from the cab.
Steer-front & rear wheels.
Raise and lower blade, including high lift.
Side shift blade.
Reverse blade circle.
Side shift circle frame.
Operate scarifier, bulldozer, snow plows, snow wing and roller.

HYDRAULIC OIL:

Capacity entire system, initial fill...96 Qts.
Pressure relief valve unloads at 1200 P.S.I. (Grader stopped, wide open throttle.)

LUBRICATION - High Pressure.

BRAKES: Foot operated service brake, hydraulic expanding; and hand operating mechanical expanding parking brake.

OPTIONAL EQUIPMENT

TRANSMISSIONS:

Torque Converter:
Make.....Austin-Western
Element.....Torcon
Type.....Single stage, three element.
Multiplication...3.15:1
For converter use type A Hydraulic Transmission Fluid.
Capacity initial fill.. .....28 Qts.
Maximum hot oil pressure at wide open throttle..(No load).50 P.S.I.
Sustained-maximum Converter oil temperature.. ...not more than 240° F. (See page 128).
Speeds.....6 forward
2 reverse
Power Reversing Clutch:
Type.....Hydraulically actuated, oil cooled.
Use type A Fluid. When Converter and Power Reversing Clutch are used in combination, the oil initial fill will be.. .....32 Qts.
Speeds.....4 forward
4 reverse
Power Shift:
Type..... Allison
Speeds.....4 forward
2 reverse
See separate Allison CT-3340 instruction book for complete oil specifications, at various operating temperatures.

SCARIFIER ("V" TYPE):

Hydraulic Control.
Weight, approx. shipping, lbs.....**1,300
Number of teeth.....11
Spacing, center to center..... 4½"
Total swath..... 46"
All teeth are hooked; have removable points; measure 1"x3", and are made of hardened alloy steel.

SNOW PLOW:

Hydraulic Control.
Giant "V" Type.
Plowing width.....9'-2"
Height.....7'-2"
Overall width....12'-7"
Weight, approx. shipping, lbs.....*3,200
**3,500

SNOW WING:
Hydraulic Control.

BULLDOZER:

Hydraulic Control.
Weight, approx. shipping, lbs.....*1,650
**1,950
Length.....9'-0"
Height.....40"
Lift above grade.....17"
Drop below grade.....16"

POWER TILT MOLDBOARD:
Hydraulic Control.

TIRES:
....16:00 x 24 12-ply

CAB:

Headroom.....6'-4"
(Approx. shipping weight, lbs.):
Open Type..... 270
Cab enclosure..... 455
Enclosed type..... 725
Windshield wiper standard with cab.

HOOD SIDES FOR ENGINE:
Weight, lbs.....31

ELECTRIC LIGHTS:

Head, tail, stop, directional, cab mounted flasher, back-up, spot, identification, dome, clearance, moldboard.

TIRE PUMP:

Single cylinder, self contained; electric driven.
Weight.....53 lbs.

BLADE EXTENSION:

1' or 2' for either right or left side.
Weight..60 lbs. per foot.

ODOMETER:
Located in cab.

AUXILIARY BRAKE.

BOOSTER STEER.

DUO-MATIC STEER:
2 speed, hydraulic, with wheel.

HEATER (TWIN FAN):
Type.....Hot Water

WINDSHIELD DEFROSTER:
Type.....Fan

HOUR METER.

*Weight of attachment that will use the operating parts already mounted on grader.
**Weight of attachment complete, including all necessary operating parts.

GALION
ROLLERS • GRADERS • CRANES
2-4-72

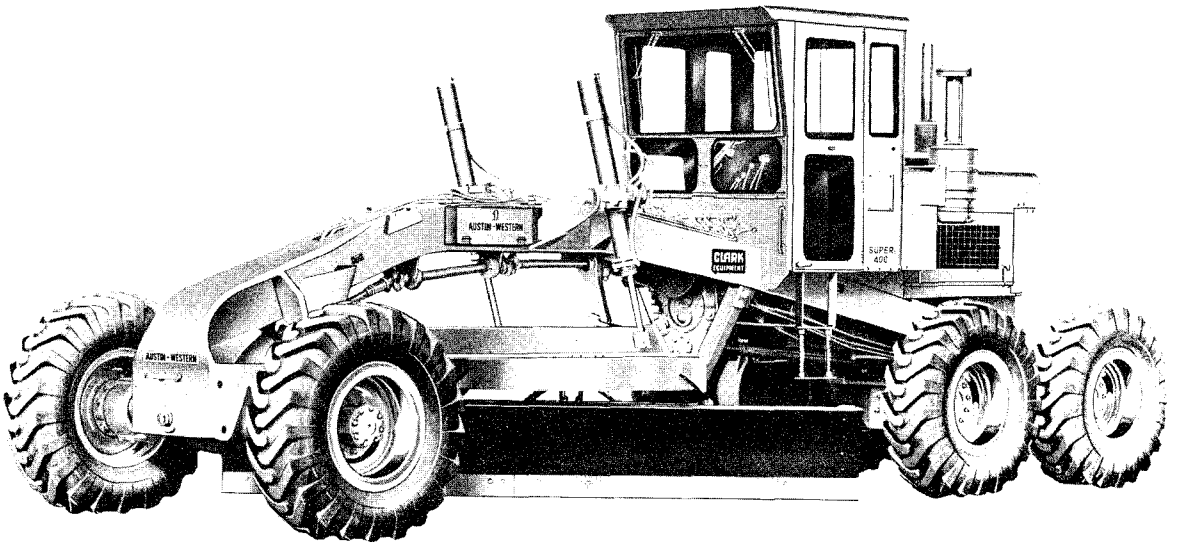
COMPETITIVE DATA

THIS MATERIAL IS REPRODUCED FOR THE SOLE PURPOSE OF ENABLING PROSPECTIVE PURCHASERS TO MAKE COMPARISONS BETWEEN GALION'S PRODUCTS AND THOSE OF COMPETITIVE MANUFACTURER. THE GALION IRON WORKS & MFG. COMPANY MAKES NO REPRESENTATION AS TO THE ACCURACY OR CURRENT STATUS OF THIS MATERIAL.

NUMBER AD-2901
EFFECTIVE DATE 6-71
REPLACES AD-2792R2
FILE IN SECTION: B

THE GALION IRON WORKS & MFG. COMPANY division of Jeffrey Galion Inc. Galion, Ohio 44833, U.S.A.

AUSTIN-WESTERN
Super 400 Power Grader



AUSTIN-WESTERN
DIVISION

CLARK EQUIPMENT

CLARK EQUIPMENT COMPANY
Aurora, Illinois 60507

SIX-WHEEL DRIVE
•
SIX-WHEEL STEER
•
ALL HYDRAULIC OPERATION
•
FULL BLADE CONTROL

Austin-Western Super 400 Power Grader Specifications

STANDARD EQUIPMENT — All-wheel drive and steer; power sideshift blade, hydraulic controls throughout; power tiller bar steering included. Diesel engine with electric starting, 30 amp alternator, accelerator-decelerator and tool box. Full 360° reversible 13-ft. (3962 mm) blade, hydraulic brakes and 13.00x24-12 ply tubeless tires. Gauges; ammeter, water temperature, oil pressure.

WEIGHT (APPROX.)

	Oil Clutch	Torque Converter
Total weight	29,500 (13 381 kg)	29,850 (13 540 kg)
Weight on front axle	11,500 (5216 kg)	11,550 (5239 kg)
Weight on rear axle	18,000 (8165 kg)	18,300 (8301 kg)
Blade pressure	21,264 (9645 kg)	21,356 (9687 kg)
Scarifier pressure	13,340 (6051 kg)	13,398 (6077 kg)
Blade pull	17,700 (8029 kg)	17,910 (8124 kg)

Blade Pull is based on a coefficient of friction of .6 on dirt.

DIMENSIONS

Length—overall ..... 26'-3¼" (8008 mm)
Width—overall ..... 8'-0" (2438 mm)
Height—with cab ..... 10'-6¼" (3207 mm)
—without cab ..... 9'-9¾" (2991 mm)
Wheelbase ..... 19'-8¼" (6001 mm)
Distance between centers of tandem wheels ..... 60" (1524 mm)
Turning radius ..... 34'-6" (10 515 mm)

BLADE

Dimensions ..... 13'x26"x¾" (3962x660x19 mm)
Cut below ground ..... 18⅛" (461 mm)
Lift above ground ..... 16⅜" (416 mm)
Blade base ..... 108½" (2756 mm)
Total sideshift ..... 97¾" (2483 mm)
Maximum blade reach beyond tire ..... 112½" (2857 mm)
High lift ..... Up to 90°
Lift speed (inches per second) ..... 5.2 (132 mm)
Shim adjusted ball sockets on blade lift cylinder.

CIRCLE

Diameter ..... 5'-2" (1575 mm)
Circle sideshift ..... 21¾" (552 mm)
Circle section ..... 5"x6"x1⅜" (127x152x35 mm)
Rotation ..... 360°

DRAWBAR

Type ..... "A" form welded—4"x6"x⅞" (102x152x22 mm)
Average weight per foot (m) ..... 27.2 lbs. (12,3 kg)
Draft connection ..... 5" (127 mm) ball and socket—shim adjustment

FRAME

Size and shape ..... 4"x10" (102x254 mm) solid steel bar
Average wt. per ft. (m) of total frame ..... 387 lbs. (176 kg)

FRONT AXLE

Type—power driven, full floating, double reduction, with differential
Oscillation ..... 15° each way
Steering range ..... 25° each way
Drive and steering knuckles ..... Cardan type

REAR AXLE

Type ..... Power driven, full floating, double reduction
Rigid type ..... No differential
Steering range ..... 15° each way
Type steering ..... 5th wheel
Chain ..... 2" pitch (51 mm)

HYDRAULIC DATA

Pump ..... Vane type
Capacity ..... 25 G.P.M. (98 liter P.M.)

CONTROLS

Type ..... Full Hydraulic with Positive Hydraulic Blade Locks

ENGINES—DIESEL

	GM 4-71	GM 4-71N
No. of cylinders	4	4
Bore and stroke	4.25 x 5 (108 x 127 mm)	4.25 x 5 (108 x 127 mm)
Piston displacement	283.7 cu. in. (5 liters)	283.7 cu. in. (5 liters)
Cycle	2	2
Governed speed	2200	2200
H.P. at gov. speed (sea level 60°)	151	160
Cooling system (gals. with heater)	9 (34 liters)	9 (34 liters)
Electric system	12V	12V
Fuel tank capacity (Gal.)	75 (284 liters)	75 (284 liters)
	Cummins (*) C-464-C	**Cummins (*) CS-464-C**
No. of cylinders	6	6
Bore and stroke	4 7/16 x 5 (113 x 127 mm)	4 7/16 x 5 (113 x 127 mm)
Piston displacement	464 cu. in. (7,6 liters)	464 cu. in. (7,6 liters)
Cycle	4	4
Governed speed	2200	2200
H.P. at gov. speed (sea level 60°)	149	160
Cooling system (gals. with heater)	8.5 (32 liters)	8.5 (32 liters)
Electric system	12V	12V
Fuel tank capacity (Gal.)	75 (284 liters)	75 (284 liters)

SPEED IN M.P.H. (and KILOMETERS/HR.)

1. ..... 2.69 (4,33 km/hr)
2. ..... 4.41 (7,10 km/hr)
3. ..... 6.39 (10,28 km/hr)
4. ..... 8.36 (13,45 km/hr)
5. ..... 13.69 (22,02 km/hr)
6. ..... 21.40 (34,43 km/hr)
Low reverse ..... 3.77 (6,07 km/hr)
High reverse ..... 11.70 (18,83 km/hr)

TORQUE CONVERTER

Make ..... Allison
Torque multiplication ..... 2.5 to 1

OIL CLUTCH

Size ..... 13½" (343 mm)
Plates 3
Oil pump, filter and reservoirs are an independent system.

BRAKES

Foot operated service brake (17"x4") (432x102 mm) self adjusting, hydraulic expanding, and hand operating mechanical expanding parking brake. Brake assembly mounted on transfer case away from mud and water encountered in off-the-road operation to brake both front and rear propeller shafts and thus effectively brake front and rear wheels.

STEERING

Type ..... Hydraulic Power with Tiller Bar

ATTACHMENTS

Cab
Bulldozer
Scarifier (V type)
Power tilt blade
Reversible type Snow Plow
"V" type Snow Plow
Rotary Snow Plow
Snow Wing

OPTIONAL ITEMS

Blade 13 ft.-1" (3987 mm)
Blade ext. 1 ft. (305 mm)
Blade ext. 2 ft. (610 mm)
Brake—auxiliary
Defroster
Drawbar-rear
Floating blade
Fuel gauge
Heater
High altitude radiator
Hoodsides
Hourmeter
Lights
Orbitrol power steer
Radiator shutters automatic
Tire pump

(*) Standard equipped with Dry Type Air Cleaner, 55 Amp Extra Heavy Duty Alternator.

WARRANTY
In accordance with our established policy of constantly improving our products, we reserve the right to change or modify our products or our product specifications at any time without notice. THE ONLY WARRANTY APPLICABLE TO OUR PRODUCTS IS OUR STANDARD WRITTEN WARRANTY WHICH WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. No person is authorized to change or otherwise modify this warranty, a copy of which is available upon request.

AD-2901 (replaces AD-2792-R2) 15M-6-71 PRINTED IN U.S.A.

2. SUPER 400 POWER GRADER SPECIFICATIONS.

STANDARD EQUIPMENT.- All-wheel drive and steer; dry clutch transmission; hydraulic control throughout, including steering; Diesel motor with electric starter, battery and generating unit; adjustable upholstered seat; 13-foot moldboard; hydraulic foot-operated service brake and hand-operated mechanical parking brake on drive shaft. Single 13.00 x 24, 12-ply tires. (See tire options below). No cab or hood sides for engine are included as standard equipment.

ENGINES (DIESEL)		
Make	GMC 471	Cummins C-160
Number of cylinders	4	6
Bore and stroke	4.25x5	4-7/16x5
Gov. speed	2000	2060
H.P. at gov. speed (sea level 60°)	143	143
Cu. in. displacement	283.7	464
Fuel tank capacity	75 g.	75 g.
Cooling system (gallons)	9	8½
Electric system	12V	12V
Electric starter	Yes	Yes
Ignition	Comp.	Comp.
Crank Case oil capacity	4-1/4g.	5 g.
Crank Case oil filter capacity	2 Qts.	2 Qts.
Air Cleaner oil capacity	3 3/4 Qts.	3 Qts.
Type Crank Case oil & Fuel oil	See separate engine instruction books.	
Oil pressure-hot engine (full throttle)	50 P.S.I.	50 P.S.I.
OPERATING WEIGHTS		
NO SCARIFIER: Total weight	27,690	27,725
WITH SCARIFIER: Total weight	28,990	29,025
ADD 450 LBS. TO TOTAL WEIGHT FOR SHIPPING		

DIMENSIONS:

Wheelbase..... 19'-8¼"
Overall length.. 26'-5"
Overall height, no cab..... 9'-9¾"
Overall height, with cab..... 10'-3¼"
Overall width..7'-11-7/8"
Turning radius.. 35'-5"

BLADE:

Length, standard..13'-0"
Width (curved height, moldboard and bit)..26"
Thickness, moldboard..... 3/4"
Cut below ground... 18⅛"
Lift above ground.. 16⅜"
Blade base.....108½"
Blade side shift (precision)..... 50"
Circle side shift.. 21¾"
Total side shift (by power)..... 71¾"
Added side shift (manual)..... 26"
Total side shift (power and manual) 97¾"
Max.blade reach beyond tire(frame straight)90¾"
High lift..... up to 90°

DRIVES:

Front with differential.
Full floating axles.
Type of universal wheel Joints.....Cardan
Rear is rigid; no differential.
Semi-floating axles.
Type rear steer.5th wheel

CONTROLS:

Hydraulic, operated from the cab.
Steer front & rear wheels.
Raise and lower blade, including high lift.
Side shift blade.
Reverse blade circle.
Side shift circle frame.
Operate scarifier, bulldozer, snow plows and snow wing.
Kind of oil... SAE No.-10W
Oil capacity-entire system, initial fill..96 Qts.
Pressure relief valve unloads at.... 1500 P.S.I. (Grader stopped, wide open throttle.)

LUBRICATION - High Pressure.

BRAKES: Foot operated service brake, hydraulic expanding; and hand operating mechanical expanding parking brake.

OPTIONAL EQUIPMENT

TRANSMISSIONS:

Torque Converter:
Make.....Austin-Western
Element.....Torcon
Type.....Single stage, three element.
Multiplication...3.15:1
For converter use type A Hydraulic Transmission Fluid.
Capacity initial fill.. .....28 Qts.
Maximum hot oil pressure at wide open throttle...(No load)50 P.S.I.
Sustained-maximum Converter oil temperature.. ... not more than 240°F. (See page 128).
Speeds.....6 forward
2 reverse
Power Reversing Clutch:
Type.....Hydraulically actuated, oil cooled.
Use type A Fluid. When Converter and Power Reversing Clutch are used in combination, the oil initial fill will be .. ..32 Qts.
Speeds..... 4 forward
4 reverse
Power Shift:
Type....CT3340 Allison.
See separate Allison CT-3340 instruction book for complete oil specifications, at various operating temperatures.
Speeds.....4 forward
2 reverse

SCARIFIER ("V" Type):

Hydraulic Control.
Weight, approx. shipping,lbs.....**1,300
Number of teeth.....11
Spacing, center to center.....4½"
Total swath.....46"
All teeth are hooked; have removable points; measure 1"x3", and are made of hardened alloy steel.

SNOW PLOW:

Hydraulic Control.
Giant "V" Type.
Plowing width.....9'-2"
Height.....7'-2"
Overall width....12'-7"
Weight, approx. shipping, lbs.....*3,200
**3,500

SNOW WING:
Hydraulic Control.

BULLDOZER:

Hydraulic Control.
Weight, approx. shipping, lbs.....*1,650
**1,950
Length.....9'-0"
Height.....40"
Lift above grade.....16"
Drop below grade.....17"

POWER TILT MOLDBOARD:
Hydraulic control.

TIRES:
14:00 x 24 10-ply
16:00 x 24 12-ply
14:00 x 24 12-ply

CAB:

Headroom.....6'-4"
(Approx. shipping weight, lbs.):
Open Type.....270
Cab enclosure.....455
Enclosed type.....725
Windshield wiper standard with cab.

HOOD SIDES FOR ENGINE:
Weight, lbs.....31

ELECTRIC LIGHTS:

Head, tail, stop, directional, cab mounted flasher, back-up, spot, identification, dome, clearance, moldboard.

TIRE PUMP:

Single cylinder, self contained; electric driven.
Weight..... 53 lbs.

BLADE EXTENSION:

1' or 2' for either right or left side.
Weight..60 lbs. per foot.

ODOMETER:
Located in cab.

AUXILIARY BRAKE.

BOOSTER STEER.

DUO-MATIC STEER:
2 speed, hydraulic, with wheel.

HEATER (TWIN FAN):
Type.....Hot Water

WINDSHIELD DEFROSTER:
Type.....Fan

HOUR METER.

* Weight of attachment that will use the operating parts already mounted on grader.
** Weight of attachment complete, including all necessary operating parts.
All fluid capacities are approximate.

INDEX

NOTE: HOW TO USE THIS INSTRUCTION MANUAL
(All information in this manual is subject to the change without notice)

This manual, No. 491, is composed of three sections as follows:

SECTION 1

GENERAL INSTRUCTIONS TO OPERATOR (pages 1 to 35 inclusive).
(Pages 2,3,4,5 and 6 include lubrication on basic grader only.
See separate manuals for engine lubrication specifications.)

SECTION 2

EARTH ROAD CONSTRUCTION (pages 36 to 61 inclusive).

SECTION 3

POWER GRADER MAINTENANCE AND OVERHAULING (pages 62 to 173 inclusive). (Includes maintenance, dismantling, and assembly of all basic grader parts.)

(continued)

INDEX

(continued)

GENERAL INSTRUCTIONS TO OPERATOR

3. INSPECTION BEFORE UNLOADING GRADER.

a. General.

Before unloading the grader check it thoroughly for damage during shipment.

Inspect the tires carefully, also the glass and the cab, if so equipped.

The tool packing list should be checked carefully and any shortage or damage should be immediately reported to an authorized agent of the transportation company involved. In case of damage or pilferage, you have a right to demand that your copy of the transportation document be noted by the transportation company, showing whatever shortage or damage is involved.

b. Before Starting Diesel Engine.

Check oil level in the crankcase. Add lubricants as required. (See separate engine manuals for oil specifications; see page D or F for capacities of water and lubricants.)

See tag wired to hood near radiator indicating water is drained from cooling system. Also see data on card regarding oil placed in the crankcase of engine before it left the factory. Find and install water drain plug wired to engine, and fill complete system with clean water or ethylene glycol Anti-freeze.

Open fuel valve at diesel fuel tank. (See Ref. 2, page 22.)

c. Hydraulic System.

Consult hydraulic section on page 105, paragraph b., for oil specifications.

Check oil level in oil reservoir. Fill to oil level shown on page 105, paragraph c-4.

Wipe all dust, gum and grime from exposed ends of all hydraulic piston rods. Do not relubricate piston rods.

d. Unloading Motor Grader.

Remove blocks from front, sides and rear of all wheels. Pull spikes from car floor.

See Transmission Shift Charts, pages 9 and 11.

Start engine. See GM starting instructions, pages 14 and 15. (See Cummins starting instructions, pages 159 and 160.)

Test brakes before moving off car. Move grader slowly off rail car or trailer in low gear.

Wash all grime and dust laden grease from all exposed machined parts, such as hydraulic ram piston rods, back of all wheel trunnion sockets, and circle.

The piston rods and trunnion sockets need not be relubricated. Use a handful of high pressure grease and apply lubricant to the inside bore of the circle, also the under side of same. Do not lubricate the top side of the circle.

Lubricate balance of grader with grease gun provided. (See pages 3,4,5 and 6 for points to be lubricated and lubricant specifications.)

Fill brake master cylinder with fluid and retest brakes.

Check tire pressures. Do not over or under inflate tires. (See page 30.)

Check clutch pedal clearance. (See page 93, paragraph b.

EXTREME PRESSURE LUBRICANTS (APPROVED LIST)

4. (For Use in Front and Rear Axle Housings, Transfer Case, Transmission, and Rear Axle Pivot Cases.)

We recommend that the owner use the lubricant shipped with the machine in the above housings and when a seasonal change becomes necessary, the housing should be thoroughly drained, flushed, and refilled.

We suggest that the owner, rather than add to the original oil, drain out and refill with an approved EXTREME PRESSURE LUBRICANT obtainable in his locality. We prefer this rather than mixing two unknown brands.

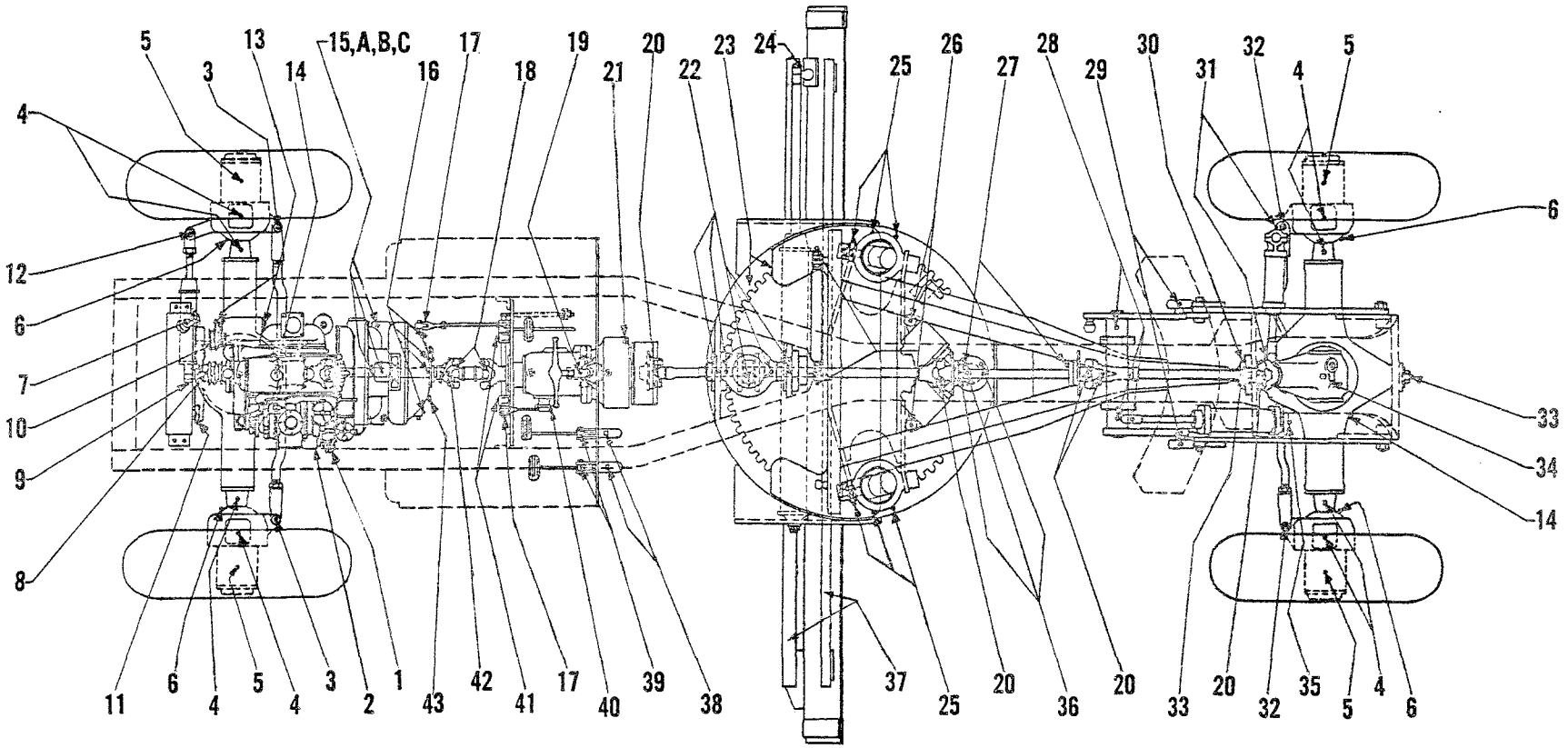
In flushing out the housings, use a regular flushing oil in preference to kerosene, gasoline, or other thin fuels.

We recommend the following brands of EXTREME PRESSURE LUBRICANTS for summer and winter use in Austin-Western Graders where the LUBRICATION CHART specifies its use.

In case these lubricants are not available in your territory, secure SAE-90 or equivalent grades of stable inactive types. The following are of the stable or inactive types of EXTREME PRESSURE LUBRICANTS and contain either combined sulphur, chlorine, phosphorous, leaded soaps or combinations.

APPROVED LIST OF EXTREME PRESSURE LUBRICANTS

Extreme Pressure Lubricants for Year Around Temperatures.		MANUFACTURER
NAME	NO.	
"Alemite" Alduragear Lubricant	SAE-90	Alemite Corp., Chicago, Ill.
Multipurpose Gear Lubricant	SAE-90	Cities Service Oil Co., New York, N.Y.
Multipurpose Gear Lubricant	SAE-90	Continental Oil Co., Ponca City, Okla.
Multipurpose Gear Lubricant	SAE-90	D-A Lubricant Co., Inc., Indianapolis, Ind.
Multi-Purpose Gear Lubricant	SAE-90	Gulf Oil Corp., Pittsburgh, Penna.
Multipurpose Gear Lubricant	SAE-90	Kendall Refining Co., Bradford, Penna.
Multipurpose Gear Lubricant	SAE-90	Pennzoil Co., Oil City, Penna.
Philube All Purpose Gear Oil	SAE-90	Phillips Petroleum Co., Kansas City, Mo.
Multipurpose Gear Lubricant	SAE-90	Pure Oil Co., Chicago, Ill.
Shell Spirex E P	SAE-90	Shell Oil Co., New York, N.Y.
Multipurpose Gear Lubricant	SAE-90	Standard Oil - Indiana Chicago, Ill.
Multipurpose Gear Lubricant	SAE-90	Standard Oil - Ohio Cleveland, Ohio
Texaco Univ. Gear Lubricant EP-90 or Texaco Meropa Lub.-3	SAE-90	Texas Inc., New York, N.Y.
Multipurpose Gear Lubricant	SAE-90	Tidewater Oil Co., New York, N.Y.
Multipurpose Gear Lubricant	SAE-90	Union Oil Co. - Calif. Los Angeles, Calif.



"PACER" GRADER LUBRICATION CHART.

See next page for Reference Numbers

5. Key to Lubricants. (See page 4 for application.)

* Multipurpose Lithium Type Grease. 2 Strokes of lubricator to each fitting.

Ь Multipurpose Lithium Type Grease. For wheel bearings.

@ Multipurpose-Type lubricant. Extreme Pressure, SAE-90 all year around. See page 2 for approved list of lubricants.)

X Hydraulic Oil. SAE-10W for temperature above 32° F.

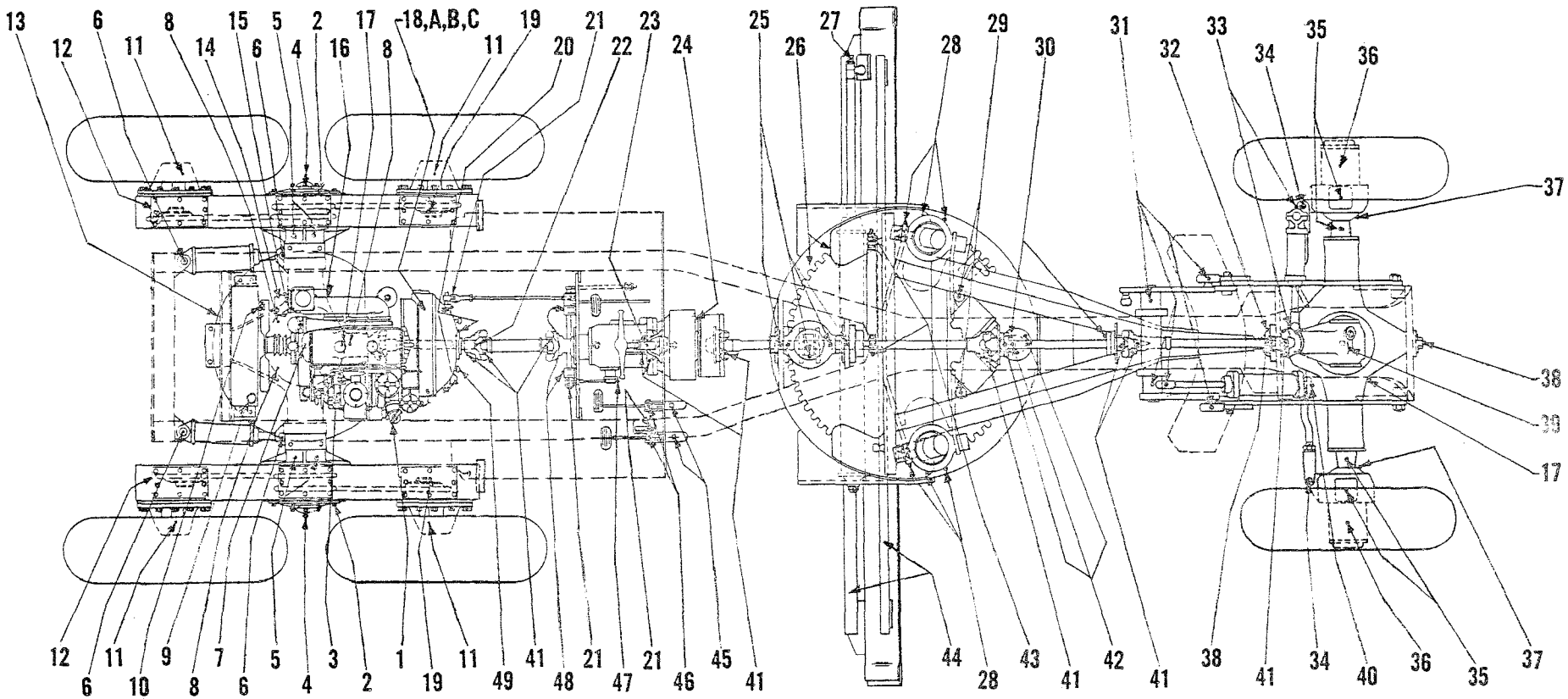
Clean, stable, antifoam Paraffin or Asphalt Oil is acceptable. (See page 105 paragraph 94 for preventive maintenance, and cold operating temperatures approaching 32° F, and lower, using SAE-5W).

Z Hydraulic Transmission Fluid, Type A. (See page 129 paragraph D and page 144 paragraph E for preventive maintenance applying to the A-W Converter and A-W Power-Reverse groups).

Note: See Previous Page for Illustration.

5A. PACER GRADER LUBRICATION CHART.

REF.	POINT OF LUBRICATION	METHOD	HOURS	KEY
1.	Engine. See separate instruction book.			
1A.	Air Cleaner. (See page 17 para. 21)		50	
2.	Starter. Lubricated at time of assembly.			
3.	Tie Rod. Bearings. (Both sides)	2 Fittings	50	*
4.	Trunnion. Rear and Front Axle (Both sides).	8 Fittings	50	*
5.	Wheel Bearings. Repack; see page 63 para. 46 .	4 Wheels	2000	Ь
6.	Trunnion Sockets. Grease level test plugs.	4 Plugs	50	*
7.	Hydraulic Oil. Add as required. (Remove tube and clean screen at lower end. Every 1000 hours.) (See Ref. 11.) Initial fill 96 quarts - entire system.	1 Cap	50	X
8.	Water Pump and Fan. See separate engine instruction book.			
9.	Rear Steer Ram. Ball.	1 Fitting	50	*
10.	Hydraulic Pump. Belt tension. See page 15 para. 18-d-3.		50	
11.	Hydraulic Tank. Keep oil level up to top cock. (Initial fill - 28 quarts.)	2 Cocks	50	X
12.	Rear Steer Ram. Bearing.	1 Fitting	50	*
13.	Generator. Add 2 or 3 drops of engine oil.	2 Cups	50	
14.	Gear Carrier. Front and Rear Axle. Keep oil level up to plug hole at side of axle housing. Rear capacity 46 quarts. Front capacity 32 quarts.	2 Plugs	50	@
15.	Converter Oil. Type A Hydraulic Transmission Fluid. Keep oil level up to bayonet full mark - engine idling. Initial fill capacity 28 quarts.	1 Breather	50	Z
15A.	Tail Shaft Governor. Test level at end plug. Add engine oil.	1 Cup	50	
15B.	Power Reverse Clutch. All of Ref. 15 applies here plus four additional quarts because both oil compartments are interconnected at bottom.			Z
15C.	Allison Power Shift Transmission. See separate Instruction Book.		50	
16.	Clutch Throwout Shaft and Bearings.	4 Fittings	50	*
17.	Pins. Add 2 or 3 drops of engine oil.		50	
18.	Universal Joints. Propeller Shaft (upper and lower).	6 Fittings	50	*
19.	Steering Post. Bearing.	1 Fitting	50	*
20.	Universal Joints. Between brake drum and front axle.	5 Fittings	50	*
21.	Transmission - Transfer Case. Oil level and filler plug. Combined capacity approximately 14 quarts.	1 Filler Plug	50	@
22.	High Lift Ram. Bearings.	5 Fittings	50	*
23.	Circle. Apply grease by hand under circle teeth only.		50	*
24.	Blade. Ball.	1 Fitting	50	*
25.	Blade Lift Rams. Bearings (both sides).	6 Fittings	50	*
26.	Circle Reverse Motors. Bearings. (High Lift link balls.)	4 Fittings	50	*
27.	Propeller Shaft Support. Bearings.	2 Fittings	50	*
28.	Scarifier Shaft. Bearings.	3 Fittings	50	*
29.	Scarifier Shaft. Balls.	2 Fittings	50	*
30.	Draw Bar. Ball.	1 Fitting	50	*
31.	Front Steer Ram. Balls	2 Fittings	50	*
32.	Tie Rod Ends. Front Axle (both sides).	2 Fittings	50	*
33.	Pivot Shafts. Front Axle. Front and rear.	2 Fittings	50	*
34.	Vents. Top of (Front-Rear) Carriers. Keep open.	2 Vents	50	
35.	Scarifier Base. Bearings.	1 Fitting	50	*
36.	Circle Reverse Motors. Bearings.	3 Fittings	50	*
37.	Rods. On Blade. Keep clean and oiled.		50	
38.	Master Cylinders. Use Lockheed #21 brake fluid	2 Plugs	50	
39.	Pedals Bearings.	2 Fittings	50	*
40.	Clutch Brake.	1 Fitting	50	*
41.	Clutch Pedal. Cross Shaft Bearings.	2 Fittings	50	*
42.	Clutch. Pilot Bearing. Rifle drilled shaft.	1 Fitting	100	*
43.	Breathers. Bell Housing. Wash in Diesel fuel; replace.		100	



"SUPER" GRADER LUBRICATION CHART.

See next page for Reference Numbers

6. Key to Lubricants. (See page 6 for application).

* Multipurpose Lithium Type Grease. 2 Strokes of lubricator to each fitting.

L Multipurpose Lithium Type Grease. For wheel bearing.

@ Multipurpose-Type lubricant. Extreme Pressure, SAE 90 all year around. See page 2 for approved list of lubricants).

X Hydraulic Oil. SAE-10W for temperatures above 32° F.

Clean, stable, antifoam Paraffin or Asphalt Oil is acceptable. (See page 105 paragraph 94 for preventive maintenance, and cold operating temperatures approaching 32° F, and lower, using SAE-5W).

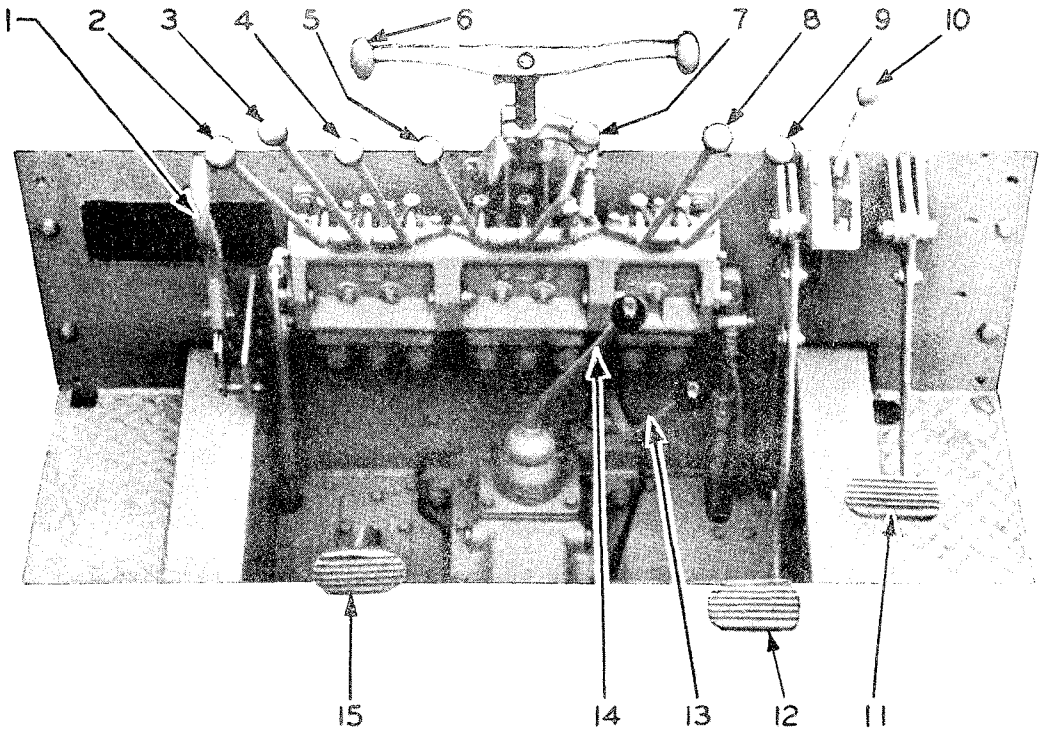
Z Hydraulic Transmission Fluid, Type A. (See page 129 paragraph D and page 144 paragraph E for preventive maintenance applying to the A-W Converter, and A-W Power Reverse groups).

Note: See Previous Page for Illustration.

6A. SUPER GRADER LUBRICATION CHART.

REF.	POINT OF LUBRICATION	METHOD	HOURS	KEY
1.	Engine. (Water pump and fan) See separate instruction book.		50	
1A.	Air Cleaners. (See page 17 para.21)		50	
2.	Pivot Cases. Oil Level Plugs. (Both sides). (See item 19.) Initial fill 28 quarts each.	2 Plugs	50	@
3.	Starter. Lubricated at time of assembly.			
4.	Axle Shaft. Bearings. (Both sides).	2 Fittings	50	*
5.	Pivot Cases. Bearings. (Both sides). Six strokes of lubrication - one fitting at top and one at bottom of housing.	4 Fittings	50	*
6.	Rear Steer Rams. One fitting at both ends of rams.	4 Fittings	50	*
7.	Vent at Top of Gear Carrier. Keep open.	1 Vent	50	
8.	Rear Axle Bushing. At top of circle, under engine.	3 Fittings	50	*
9.	Hydraulic Oil. Add as required. (See Ref. 10). (Remove tube and clean screen at lower end, every 1000 hours.)	1 Cap	50	X
10.	Hydraulic Oil Tank. Keep oil up to top cock. (Initial fill 28 quarts)(Entire System 96 Qts.)	2 Cocks	50	X
11.	Rear Wheels. Bearings. (Both sides).	4 Wheels	2000	L
12.	Pivot Case Covers.	6 Covers	50	@
13.	Clean Large Plate - apply grease by hand - top and bottom of plate.		100	*
14.	Pump. Hydraulic. Belt Tension. See page 15 para. 18-d-3.		50	
15. and 16.	Generator. Add 2 or 3 drops of engine oil.	2 Cups	50	
17.	Gear Carriers. (Front and Rear.) Keep oil level up to plug hole at side of axle housing. Rear capacity 46 quarts. Front capacity 32 quarts.	2 Plugs	50	@
18.	Converter Oil Type A Hydraulic Transmission Fluid. Keep oil level up to bayonet full mark. Engine idling. Initial fill 28 quarts.	1 Breather	50	Z
18A.	Tail Shaft Governor. Test level at end plug. Add engine oil.		50	
18B.	Power Reverse Clutch. All of Ref. 18 applies here plus four additional quarts because both oil compartments are interconnected at bottom.		50	Z
18C.	Allison Power Shift Transmission. See separate Instruction Book.		50	
19.	Pivot Case Oil Filler Plugs. Keep vent holes open in plugs.	2 Plugs	50	

REF.	POINT OF LUBRICATION	METHOD	HOURS	KEY
20.	Clutch Throwout Shaft and Bearings.	4 Fittings	50	*
21.	Pins. Add 2 or 3 drops of engine oil.		50	
22.	Clutch Pilot Bearing. Rifle drilled shaft.	1 Fitting	100	*
23.	Steering Post. Bearing.	1 Fitting	50	*
24.	Transmission-Transfer Cases. Oil level and filler plug. (Combined capacity approximately 14 quarts.)	1 Filler Plug	50	@
25.	High Lift Ram. Bearings.	5 Fittings	50	*
26.	Circle. Apply grease by hand under circle teeth.		50	*
27.	Blade. Ball.	1 Fitting	50	*
28.	Blade Lift Rams. Bearings. (Both sides).	6 Fittings	50	*
29.	Circle Reverse Motors. Bearings.	2 Fittings	50	*
30.	Propeller Shaft Support. Bearings.	2 Fittings	50	*
31.	Scarifier Shaft. Bearings.	5 Fittings	50	*
32.	Draw Bar. Ball.	1 Fitting	50	*
33.	Front Steer Ram. Balls.	2 Fittings	50	*
34.	Tie Rod Ends. Front axle. (Both sides).	2 Fittings	50	*
35.	Trunnions. Front Axle. (Both sides).	4 Fittings	50	*
36.	Wheel Bearings. Repack. See page 63 para. 46.	4 Wheels	2000	L
37.	Trunnion Sockets. Grease level test plugs.	2 Plugs	50	*
38.	Pivot Shafts. Front Axle. Front and rear.	2 Fittings	50	*
39.	Vent. Top of Gear Carrier. Keep open.	1 Vent	50	
40.	Scarifier Base. Bearing.	1 Fitting	50	*
41.	Universal Joints. Between Front Axle and Brake Drum; also between Transfer Case and Rear Axle; also between Clutch and Transmission.	11 Fittings	50	*
42.	Circle Reverse Motors. Bearings.	3 Fittings	50	*
43.	High Lift Link. Balls.	2 Fittings	50	*
44.	Rods on Blade. Keep clean and oiled.		10	
45.	Master Cylinders. Use Lockheed #21 Brake Fluid.	2 Plugs	50	
46.	Pedal Shafts. Bearings.	2 Fittings	50	*
47.	Clutch Brake. Bearing.	1 Fitting	50	*
48.	Clutch Pedal. Cross Shaft.	2 Fittings	50	*
49.	Breathers. Bell Housing. Wash in Diesel fuel; replace.		100	



7. GRADER OPERATING CONTROLS.
(See page 8 for engine instrument panel.)

There are important differences between various graders; therefore, regardless of previous experience with other graders, the operator will secure the best results if he fully understands what each control is for and how to use it. See pages 9 and 11 for various shift charts and page 35 for travel speeds.

(1) HAND BRAKE. (To apply, pull back. Press the lock and push forward to release.

(2) CIRCLE ROTATION. (Pull back to rotate circle anti-clockwise. Push forward to rotate circle clockwise).

(3) LEFT HAND BLADE LIFT. (Pull back to raise blade. Push forward to lower blade).

(4) MOLDBOARD SIDE SHIFT. (Pull back to shift left direction. Push forward to shift right direction).

(5) CIRCLE SIDE SHIFT. (Pull back to side shift left direction. Push forward to side shift right direction).

(6) FRONT STEER. (Pull back to steer left. Push forward to steer right).

(7) REAR STEER. (Pull back to steer right. Push forward to steer left).

(8) RIGHT HAND BLADE LIFT. (Pull back to raise blade. Push forward to lower blade).

(9) SCARIFIER. (Pull back to raise scarifier. Push forward to lower scarifier).

(10) ENGINE SPEED CONTROL. (Pull back to increase speed. Opposite to reduce speed or shut-off.)

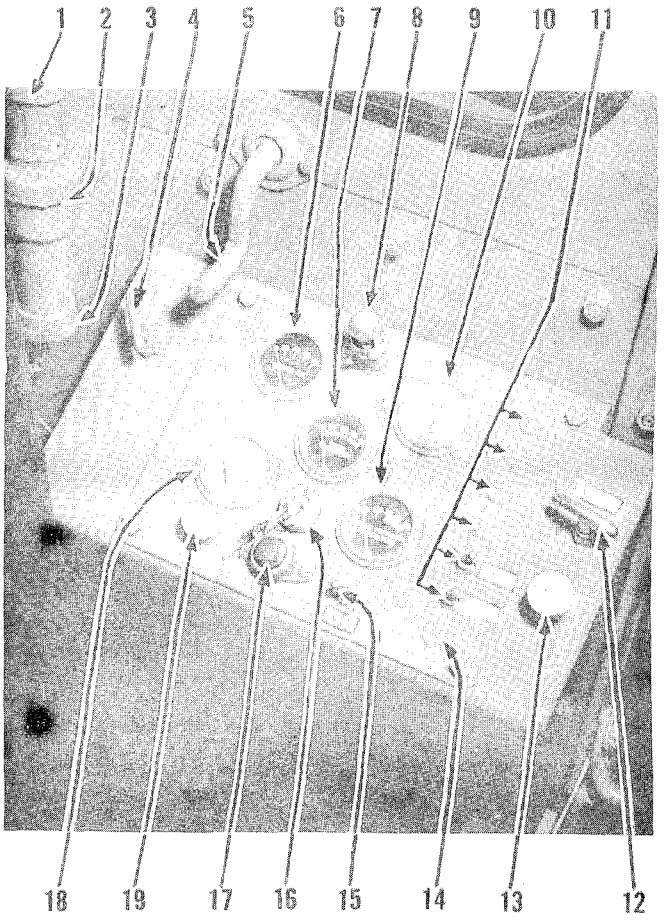
(11) CIRCLE LATCH. (Step on pedal to release the circle latch).

(12) FOOT BRAKE. (Step on pedal to apply brake).

(13) TRANSFER CASE 2 SPEED GEAR SHIFT. (See page 9 for shift chart for speeds). Note: Used with dry clutch or A-W converter only.

(14) TRANSMISSION GEAR SHIFT. (See page 9 for shift chart for speeds). Note: Used with dry clutch or A-W converter or A-W Power Reverse only. NOTE: For A-W Power Reverse data, see pages 9 and 10. For Allison Power Shift Transmission data see pages 11 and 12.

(15) CLUTCH PEDAL. (Step on pedal to release clutch. Do not ride this pedal with your foot). Note: Used with dry clutch or A-W converter only.



8. ENGINE INSTRUMENTS AND CONTROLS. (Shown above)

a. The operator should thoroughly familiarize himself with the operating instruments and controls. Regardless of previous experience with other engines, the operator will secure the best results if he fully understands what each control is for and how to use it.

b. NOTE: Before actually starting and stopping the GMC Engine, read and comply with the instructions shown on pages 13 to 16 inclusive. (For Cummins starting instructions see pages 159 and 160.)

REF. DESCRIPTION

1. Chevron starting capsule-puncturing plunger. (For GM and Cummins engines).

2. Ref. 1. Unscrews at Ref. 2.

3. Threaded lower clean-out base and strainer.

4. GM engine emergency shut off control. Pull out to stop engine. Push clear down to run engine. (Also used with Cummins Engine with dry clutch.)

5. Cab hand crank. This crank is used to lock cab door in open position.

6. Engine oil pressure gauge.

7. Engine water temperature gauge.

8. Panel dash light.

9. Converter oil temperature gauge. (Maximum not more than 250° F.)

10. Ammeter.

11. Ample room to add electric accessory switches.

12. GM-Engine fuel shut off. Pull out to stop engine.

13. Chevron starting primer plunger.

14. Cummins (only) electric starter-toggle switch. Hold to left until engine oil pressure shows approximately 25 P.S.I.

15. Electric starter - toggle switch. (Used with GM engine; see item (16) also.) (Used with Cummins engine, see pages 159 and 160.)

16. Keyed ignition lock.

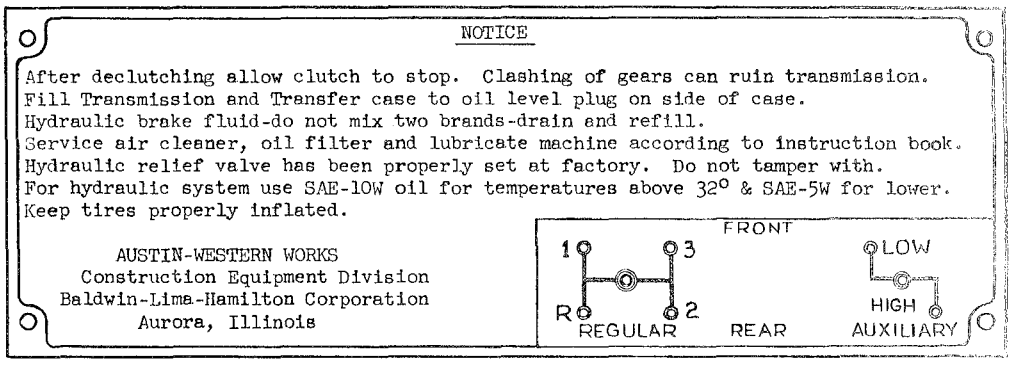
Key must be turned to on position before GM and Cummins engines can be started. When the engines are stopped, the key must be turned to off position to prevent discharge of the electric-storage batteries. (Also control for Cummins engine fuel pump-solenoid shut off valve.)

17. Horn button.

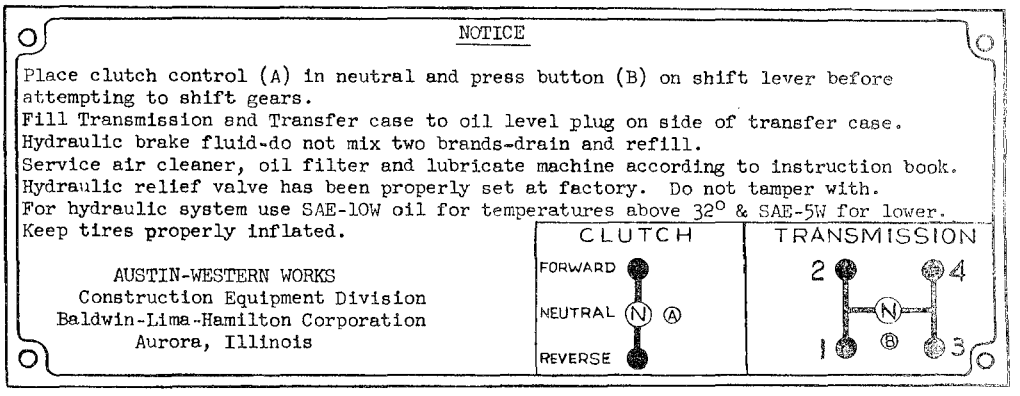
18. Converter Oil Pressure Gauge.
Power Reverse Oil Pressure Gauge.
Allison Power Shift Oil Pressure Gauge.
(See Repair Parts Book.)

19. Light Switch.

NOTE: The electrical system is protected by a circuit breaker; see page 21 Ref. A, and page 23 Ref. B.



9. A-W Transmission-Transfer Case Shift Chart. (6 speeds forward and 2 speeds in reverse. See page 88 for assembled group.) The above instruction plate is used with graders fitted with dry clutch only or A-W Torcon Converter. All of the controls shown on page 7 are used with this arrangement. The grader travel speeds, together with the various tire sizes used with this group are shown on the left column of page 35. Caution: Never let converter temperature exceed 250° F. Downshift first.



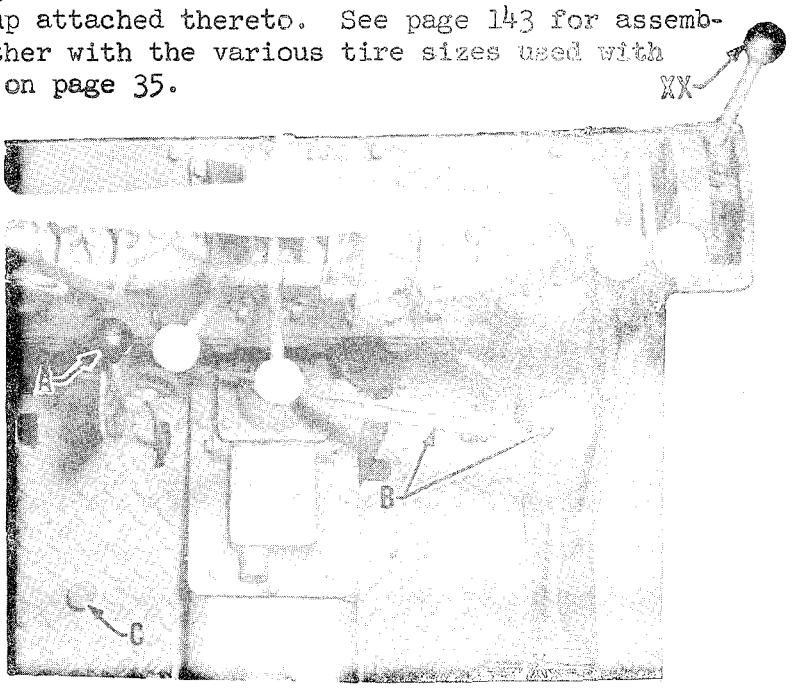
10. A-W Power Reverse Clutch Shift Chart. (4 speeds forward and 4 speeds in reverse.) The above instruction plate is used with graders fitted with the A-W Torcon Converter and with the A-W Power Reverse Clutch group attached thereto. See page 143 for assembled group. The grader travel speeds together with the various tire sizes used with this group are shown in the center column on page 35.

a. Reverse Clutch Selector Valve Control Lever (A) at right has 3 positions, namely: Neutral. Engine starting position or Grader stopped.
Forward. Grader moves Forward.
Reverse. Grader moves in Reverse.

Lever (A) is used only when a change in travel direction is required, or when the neutral position is in use.

b. Transmission:
Lever (B) has 5 positions, namely:
Neutral. Engine starting position or Grader stopped.

First, Second, Third, or Fourth, traveling position speed.



(continued)

The hand-knob (B) has an electric switch button incorporated under it. Squeezing with the finger tips, will result in energizing a solenoid located at the transmission brake. The energized brake momentarily retards and slowly stops the spinning countershaft gears during gear changing intervals.

The grader should always be stopped when shifting of gears is attempted.

c. Depressing the foot pedal (C), will stop the grader from traveling in either forward or reverse direction. To resume travel, lift the pedal.

Pedal (C) controls and operates an oil disconnect valve. It is used only to stop the grader momentarily, such as emergency stops, changing transmission gear speeds, or during other functions which may involve grading or snow plowing operation.

d. Diesel Engines used with the A-W Converter - Power Reverse Clutch Group - are as follows:

1. The GM-471 Engine has a Limiting Speed Governor. The high idle, no load, wide open throttle speed, is 2120 RPM. (Governed RPM is 2000).

1-A. See page 143 for assembled group including the belt driven Tail Shaft Governor which is attached to the Torcon Converter housing.

2. The Cummins C-160 Engine has a Limiting Speed Governor. The high idle, no load, wide open throttle speed, is 2200 RPM. (Governed RPM is 2060).

2-A. The Converter Tail Shaft Governor Group will be the same as item (1-A) above.

e. Engine speed control.

The hand throttle lever (XX) page 9, is shown in the front or shut-off position.

When the lever (XX) is positioned clear back, it will be in wide open position, and the Engine RPM will be controlled by the Limiting Speed Governor, which is attached to the Engine.

When the lever (XX) is positioned at the 4th open notch, the Engine RPM, approximately 1650, will be controlled by the belt driven Tail Shaft Governor which is attached to the Torcon Converter housing.

f. To Operate the A-W Power Reverse Clutch. (Engine stopped).

Apply the foot brake pedal (X). Move the forward and reversing lever (A) and transmission shift lever (B) to neutral position. Start and warm the engine.

Run the engine on Tail Shaft Governor, 4th notch throttle (XX) speed. Then press the switch button at knob (B). Wait 3 seconds, then move the shift lever (B) into the desired traveling speed position. (Position the moldboard as required and release the brake (X).

If forward travel is desired, move lever (A) into forward position. If reverse travel is desired, move lever (A) into reverse position.

To increase the engine speed, move lever (XX) backward. (Forward, to reduce speed).

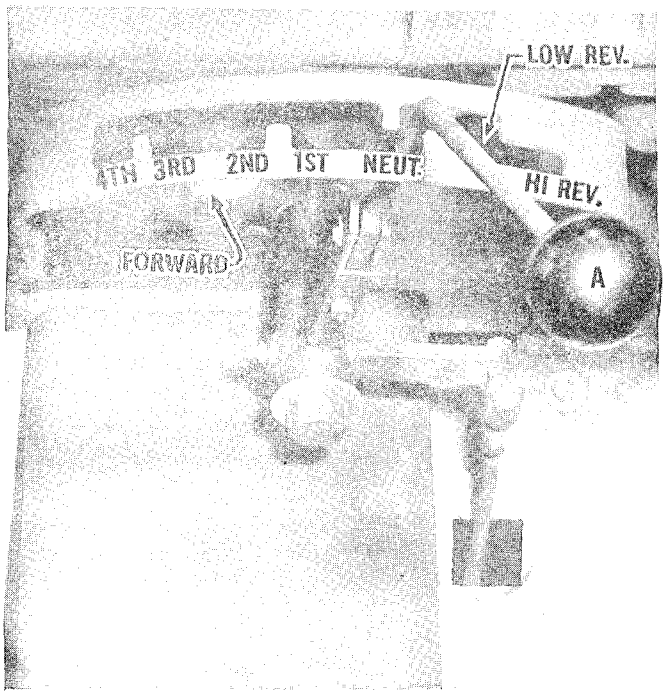
In emergency depress pedal (C) to stop the grader - or move lever (XX) forward.

Note:
See Converter oil temperature gauge page 8, Ref. 9. For most efficient operation the converter oil temperature should be kept between 200° F, and 240° F. Caution: Never let converter temperature exceed 250° F. Downshift First.

g. To operate the A-W Power Reverse Clutch. (During travel operation).

When it becomes necessary to increase or decrease the transmission (B) travel speed, proceed as follows: Depress pedal (C) - wait until grader stops. First-press the switch under knob (B). Wait three seconds - then move shift lever (B) into the desired traveling speed position.

Lift the pedal (C) to resume travel. In this particular case - no other action on the operator's part is required at levers (XX) and (A) to make traveling speed changes at (B).



11. - Allison "Torqmatic" Power Shift Transmission, Shift Chart.

a. See separate Allison instruction manual, for lubrication data and preventive maintenance. See page 158 for assembled group. The grader travel speeds together with the various tire sizes used with this group are shown in the right column of page 35.

b. Diesel Engines used with the Allison "Torqmatic" Power Shift Transmission - are as follows:

1. The GM-471 Engine has a Limiting Speed Governor. The high idle, no load, wide open throttle speed, is 2120 RPM. (Governed RPM is 2000).

1-A. See page 132 for assembled group including the belt driven Tail Shaft Governor which is attached to the "Torqmatic"housing.

2. The Cummins C-160 has a Limiting Speed Governor. The high idle, no load wide open throttle speed, is 2200 RPM. (Governed RPM is 2060).

2-A. The converter Tail Shaft Governor group will be the same as item 1-A.

c. Engine speed control.

1. The hand throttle lever (XX) page 9 is shown in the front or shut-off position.

2. When the lever (XX) is locked clear back, it will be in wide open position, and the Engine RPM will be controlled by the Limiting Speed Governor, which is attached to the Engine.

Maximum RPM is sometimes required during operations such as snow plowing, or to develop maximum travel speed in forward or backward direction.

Wide open throttle (XX) position is generally used during long runs and when the general surroundings will permit high speed operation with safety.

3. When lever (XX) is positioned at the 4th open notch, the engine RPM will be lowered somewhat-to approximately 1650 RPM. However, in this case the "Tail Shaft Governor" will be in full control of any work load placed on the engine. (Up to maximum engine fuel injection. Thereafter a down shift is required).

At any time the foot brake pedal is applied, the engine immediately comes to low idle. This is accomplished by a hydraulic actuated decelerator connected to the hydraulic brake circuit.

d. "Torqmatic" Power Shift Transmission operation:

1. CAUTION: Always shift the "Torqmatic" speed change lever (A) page 11, to Neutral Position before starting the engine, or when the grader is parked and the engine running. Bring the grader to a Full Stop before reversing traveling direction.

2. It is possible to upshift or downshift at wide open throttle regardless of load. However a downshift should not be made if the grader speed exceeds the maximum speed normally attained in the next lower gear. Example: For safety reasons when coasting or descending grades, do not downshift from 4th to 3rd or from high reverse to low reverse, (or make any other downshift) with the idea in mind of using the downshift as a means to brake or to slow down the grader traveling speed.

When descending steep grades-be safe-stop the grader at the brow of the grade, then downshift 2 gear steps lower than would be ordinarily required to propel the grader up the grade.

3. See the "Torqmatic" oil temperature gauge page 8, Ref. 9. For most efficient operation the "Torqmatic" oil temperature should be kept between 200° F. and 240° F. CAUTION: Never let the oil temperature exceed 250° F. Downshift first.

4. See the "Torqmatic" oil pressure gauge page 8, Ref. 18. The gauge PSI range, for use with the "Torqmatic" Transmission is 0 to 300 PSI. The various operating pressures are as follows:

"Torqmatic" - full throttle, no load, 60 PSI maximum.

"Torqmatic" Clutch pressures (PSI) as follows:

Full throttle maximum grader speed forward travel, 120 to 140 modulated.

Reverse Travel, at maximum grader speed, 165 to 190 modulated.

e. To operate the "Torqmatic" transmission with tail shaft governor control.

1. Apply brake. Move "Torqmatic" speed change lever (A) page 11, into neutral position as shown in the photo. Start and warm the engine.

2. When operating the grader in close quarters or congested areas, it is best to operate the grader with the hand throttle lever (XX) page 9, in nearly closed or engine idle position.

Position the moldboard as required and release the brake.

3. The "Torqmatic" Speed change lever (A), page 11, may now be shifted either to the right or left direction, for speed and travel direction as required.

It is suggested the operator position the lever (A) in 1st speed forward or 1st speed reverse, and then apply moderate throttle control to slowly move the grader and in this way become acquainted with the shift arrangement and controls.

4. Added engine power can be applied by opening hand throttle to required speed. Speed may be reduced by applying foot brake.

Watch the "Torqmatic" oil temperature gauge Page 8, Ref. (9). For most efficient operation the "Torqmatic" oil temperature should be kept between 200° F. and 240° F. Never let the oil temperature exceed 250° F. Downshift first.

5. Caution: To make an emergency stop, depress brake pedal (X). Do not downshift "Torqmatic" speed change lever (A) page 11.

f. To operate the "Torqmatic" transmission with hand throttle only, use lever (XX) page 9.

1. This type of operation will involve operations such as snow plowing, or when grading long sections, or when transporting the grader. (Not in close quarters or congested areas).

2. Apply brake. Move the "Torqmatic" speed change lever (A) page 11 into neutral position. Start and warm the engine.

3. Pull the throttle lever (XX) page 9 clear back. The Engine Limiting Governor is now in control. It will not permit the maximum GM Engine RPM to exceed 2120. (Cummins 2200 RPM)

4. The "Torqmatic" speed change lever (A) may now be shifted to the right or left direction for speed and travel direction as required, release brake pedal. Additional Engine power cannot be secured because the hand throttle is already in the wide open position. Watch the "Torqmatic" oil temperature gauge page 8, Ref. 9. For most efficient operation the "Torqmatic" oil temperature should be kept between 200° F. and 240° F. Never let the oil temperature exceed 250° F. Downshift first.

CAUTION:

5. To make an emergency stop, depress brake pedal (X). Do not downshift speed change lever (A) page 11.

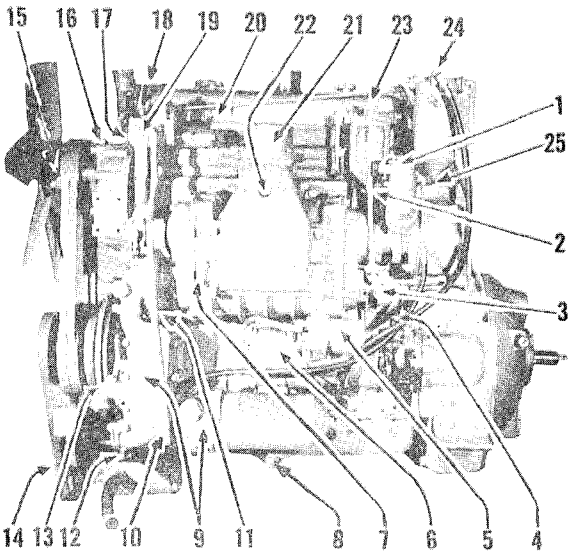
g. Hydraulic Fluids for use with A-W Allison "Torqmatic" Power Shift Transmission.

Above - 10° F., Hydraulic Transmission Fluid type C-1.

- 10° F. to -25° F., Automatic Transmission Fluid Type A, Suffix A identification.

Below -25° F., Hydraulic Transmission Fluid Type C-1 or Automatic Transmission Fluid Type A, Suffix A identification.

Auxiliary pre-heat required to raise temperature in sump and external circuit. (This supersedes similar oil specs shown in Section 1, page 10, paragraph 7, of Allison Manual #SA1096.)



12. GM-471 Engine, Blower Side - Dry Clutch. (See separate GM - Engine Operator's Manual.)

REF.	DESCRIPTION
1.	Engine oil filler neck.
2.	Fuel filter drain cock.
3.	Fuel pump.
4.	Engine oil level bayonet gauge.
5.	Starter Solenoid.
6.	Starter.
7.	Emergency shut-off lever.
8.	Engine oil drain plug.
9.	Engine oil cooler. (Full flow oil filter on side of oil cooler body.)
10.	Engine breather tube.
11.	Water pump drain cock.
12.	Oil cooler water drain cock.
13.	Cab heater hose inlet.
14.	Hydraulic pump drive pulley.
15.	Fan shaft lubrication plug.
16.	Fan belt adjustment bracket.
17.	Thermostat elbow drain cock.
18.	Air vent plug. (Ref. (17) and (18) must be opened when refilling drained engine.)
19.	Engine governor. (Limiting speed).
20.	Options and accessory plate.
21.	Engine air intake pipe.
22.	Ether starting fluid nozzle.
23.	Secondary fuel filter vent plug.
24.	Primary fuel strainer vent plug.
25.	Primary fuel strainer drain cock.

13. BEFORE STARTING GENERAL MOTORS DIESEL ENGINE. (Please read and comply with the separate GM Engine Operator's Manual.)

a. Install (or close) cooling system drain cocks or plugs. (See (11) and (12) page 13. Fill cooling system with soft water to within 2" of overflow outlet. At freezing temperatures, use a non-evaporating type of anti-freeze.

WARNING: Be sure to open points (17) and (18) page 13 in order to permit air in the system to be bled off, otherwise steam pockets will develop, causing the cylinder sleeves and pistons to score and seize due to overheating.

b. Fill crankcase (1) with lubricating oil to "Full" mark on dip stick (4). See separate General Motors Operator's Engine Manual for recommended oils. If engine has not been operated for considerable time, remove valve cover and pour one quart of engine oil over valve mechanism. Fill oil bath type air cleaner to indicated level with clean engine oil.

c. Fill fuel tank with High-Speed Diesel Engine Fuel. See separate GM Operator's Engine Manual for recommended fuel oil. Open the fuel tank lower shut-off valve. Remove the plugs (24) and (23) to bleed air from filters. Reinstall plug (24) when oil shows at port. Reinstall plug (23) when oil shows at port.

14. STARTING THE G.M. ENGINE.

a. Place the transmission shifting lever in disengaged or neutral position. (See pages 9 and 11 for shift charts.)

b. The diesel fuel line from the supply tank to primary filter (24), page 13, is equipped with a shut-off valve located at the lower right end of the fuel tank. Make sure this valve is open.

c. After the operator has checked over the engine and accessories and top vented and filled the fuel filters (23) and (24), page 13, place the engine speed control lever (10), page 7, in wide open position of the notched quadrant. (Pull lever back.)

d. When the engine is cold or when the air temperature is below 40° F., starting of this engine requires use of a cold starting aid consisting of a starting fluid primer. (Drain the transmission - transfer case and refill it with an oil that flows readily at temperatures encountered.)

The photo on page 8 shows the location of the "Chevron" starting chamber (1) and hand primer (13). To operate this starting expedient proceed as follows:

1. Unscrew (counter-clockwise) the upper chamber cap of puncturing tool (2). Place one or two capsules of fluid (large or small, depending upon requirements established by trial) in the chamber. Screw (clockwise) upper chamber cup (2) tightly onto the lower chamber (3). Adjust engine throttle lever to starting position.

2. Press down on clutch pedal (15) page 7.

3. Push puncturing plunger to bottom, thus puncturing capsule(s) and releasing fluid. Unlock primer plunger (13) by turning counter-clockwise. Simultaneously crank engine starting switch (15) and pump primer plunger (13) until engine starts. Continue to pump primer plunger until engine runs normally on regular fuel and until all fluid in entire applicator is injected into engine.

4. The engine should start in about 2 seconds if engine is warm. Never operate the starting motor more than five seconds at a time. Allow starting motor to cool one minute and repeat the starting operation.

As soon as the engine has started, reduce the engine speed to about one-fourth open position. Push the speed control lever (10) page 7, forward as required in order to prevent over speeding the engine.

After the engine has started, check the oil pressure gauge. It should register approximately 50 pounds in 3 seconds time. (See separate G.M. Engine Operator's Manual for more information.)

Continue to operate the engine at minimum speed until the water temperature gauge starts to move. Avoid prolonged idling. Recheck the water level in radiator. The desirable cooling water temperature is 160-180° F.

Relock primer plunger (13). Again unscrew upper chamber cap of puncturing tool (1). Remove and discard empty capsule(s), observing precautions against fire and toxic hazards and cutting hand on barbs near bottom end of puncturing plunger. Again screw upper chamber cap (1) tightly into lower chamber (2). Occasionally remove the lower screen (3), and carefully clean out all broken pieces of capsules. Also remove the fitting (22) which screws into the intake manifold, page 13, and clean the small nozzle hole. Clogged nozzles, pipes, or base will prevent fuel from flowing into the intake manifold and result in hard starting.

PRECAUTIONS: Chevron starting fluid is highly inflammable, explosive, and toxic. Gelatine capsules dissolve in water and soften at high temperatures. Puncturing plunger carries barbs near bottom to help retract empty capsules from lower chamber. Therefore safe handling of fluid, capsules and plunger requires extreme caution in avoiding: Proximity of fluid capsules to open flame, sparks or hot surfaces. Spillage or leakage of fluid. Breathing of fumes from fluid. Contact of capsules with water. Subjection of capsules to high ambient temperatures (about 120° F.). Cutting of hand by barbs on puncturing plunger. "Chevron Starting Capsules" may be procured from your fuel oil supplier.

5. When Engine Fails to Start at Temperature Above Freezing (32° F.).

1. Throttle not in starting position, improperly adjusted, or emergency shut-off control button not pushed down. CORRECTION: Check adjustment and open throttle. (See General Motors Operator's Manual.)

2. Fuel tank empty. Fuel supply valve closed. Fuel supply insufficient. CORRECTION: Check for choked fuel oil filter elements as follows:

a. Disconnect fuel return line near the top of the fuel tank, and place exposed end of hose into a suitable can. then run engine at approximately 1200 R.P.M. and measure fuel being returned from fuel return manifold. At 1200 engine R.P.M. the return should be approximately 1/2 gallon per minute.

b. When checking flow, observe if air is being pumped through the fuel system which will be indicated by air bubbles mixed with the fuel and will appear as foam on the fuel. If air is present, correct this condition by tightening all fuel connections on suction side of fuel pump.

c. Check for dirt or chips in fuel lines. (Consult the General Motors Operator's Manual for further assistance.)

15. STOPPING THE G.M. ENGINE.

The engine should idle for at least five minutes before being stopped, the idling being necessary so the engine may cool off gradually and uniformly.

When an engine is running under load there are parts of it that will be hot, particularly the top of piston and bottom of the cylinder head.

Stopping suddenly without allowing the engine to cool will cause the water close to these hot spots to boil, creating steam with probable distortion of engine parts.

After the engine has been idled a sufficient length of time, push speed control lever (10), page 7, forward. To stop engine, pull up on fuel shut-off (12), page 8. (If engine does not stop, pull up on the engine emergency shut-off control (4), page 8, until the engine completely stops.)

16. BEFORE STARTING THE DAYS OPERATION. (Every 8 hours of operation)

a. Check the oil level with the bayonet gauge (4) page 13, in the crankcase. Stop the engine and let it stand for at least five minutes, before reading the oil level, as shown on the bayonet gauge.

b. Check air cleaner and see that all joints and connections are air tight. Clean the oil cup and refill with fresh oil, the same weight as used in the crankcase.

In very dusty conditions, this may be necessary every two or three hours to clean the cup and refill with fresh oil.

c. Check radiator (read paragraph 13-a, page 13). Refill with fresh clean water or suitable anti-freeze to within 2" of top. If water with high mineral content is all that is available, add a neutralizing agent as shown in the General Motors Operator's Manual.

Check the fins and passages between the tubes of the radiator and make sure that they are free from any foreign substance that the fan may have drawn in.

d. Check the fan belt tension. See that the belt slack is 3/4" to 1".

e. Make a visual inspection for loose connections, loose nuts, bolts, capscrews and oil and fuel lines.

f. Check fuel oil supply.

g. Every 8 hours: Drain small quantity of fuel from both fuel oil filters, (see (23) and (24), page 13, to remove water and sediment.

17. AFTER EVERY 100 HOURS OF OPERATION.

a. Change the oil in crankcase with the recommended oil.

Change engine oil filter elements.

Drain the old oil out of the crankcase while the engine is hot.

b. Apply a few drops of oil along the surface of the flexible tube for the emergency stop control and with the fingers flex the tubing a little to allow the oil to penetrate through the wire.

c. Clean air cleaner top tube and element by washing in fuel oil.

d. Drain one fourth pint of fuel oil out of lower cocks at (2) and (25), page (13).

e. Oil generator with a few drops of engine oil.

Do not oil excessively.

Check the water level of the batteries.

In freezing weather, do not add water to batteries after shutting down operation.

Add water at the start of operation to avoid freezing.

f. Engine Tune-up.

(1) After first 100 hours and every 500 hours thereafter, check valve lash.

(2) Check injector timing, adjust governor if necessary and check injector rack position.

Consult General Motors Operator's Manual for performing engine tune-up procedures.

18. AFTER EVERY 300 HOURS OF OPERATION.

a. Replace secondary fuel oil filter element. (See (23), page 13.)

b. Replace primary fuel oil strainer. (See (24), page 13.)

c. Drain water and sediment from fuel oil tank.

d. Check fan, generator, and hydraulic pump belt tension. (See photo on page 16.)

(1) To tighten fan belts, loosen the two capscrews (A) page 16, then move slotted bracket upward until belts have about 3/4" total movement at one side.

(2) To tighten generator belt loosen capscrew at (13) page 16, then move generator outward, until belt has about 3/4" total movement at one side.

(3) To tighten the hydraulic pump belt loosen the lock bolt and nut near Ref. (14) page 16, then turn the vertical adjusting screw downward (right hand thread) in the required amount so belt deflection is not more than 1/2" at one side. Retighten lock bolt and nut.

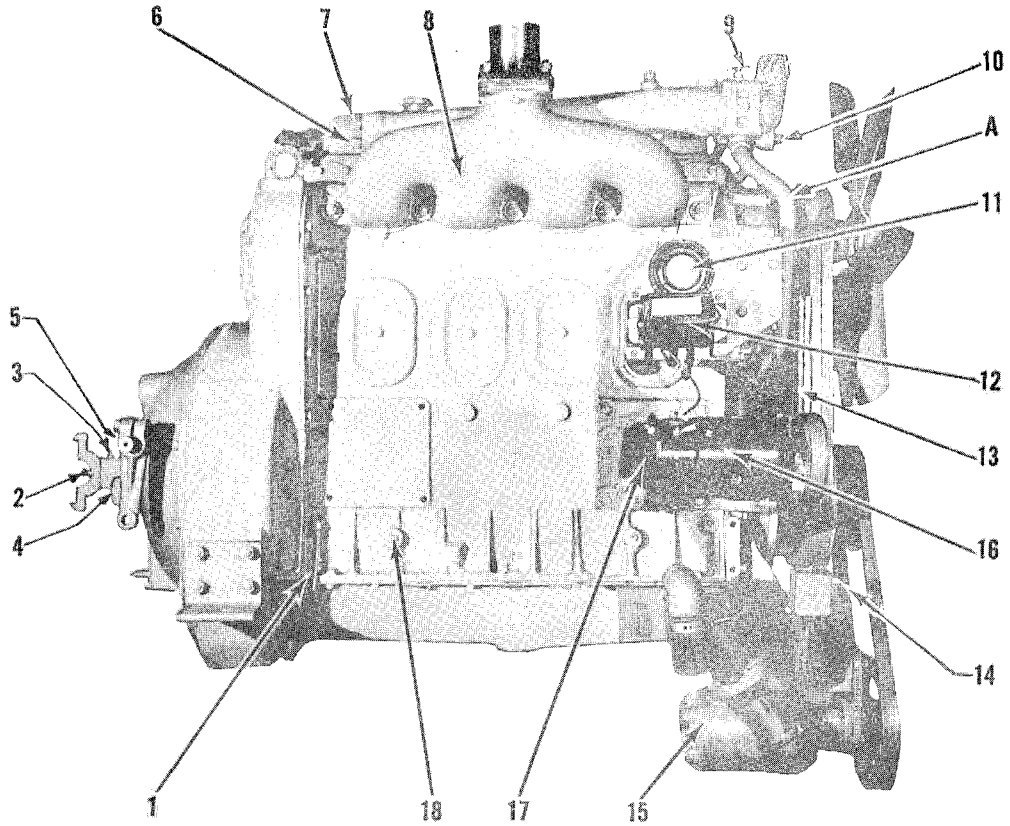
19. AFTER EVERY 1000 HOURS OF OPERATION.

a. Clean the outside of the engine by washing with kerosene, distillate, or a grease solvent. If the dirt is thick, allow to soak for ten minutes, then wash off the dirt with hose and water.

b. Flush the radiator with standard flushing compound (Read Paragraph 33, Sub-paragraphs a, b, c and d, page 27.)

c. Inspect the battery cables and all electric wiring. Replace frayed, worn, or oil soaked wires with new ones of the same dimensions.

d. Consult General Motors Operator's Manual for further instructions relative to "Preventive Maintenance".



20. GM-471 ENGINE (GENERATOR SIDE - DRY CLUTCH)
(See separate General Motors Engine Operator's Manual.)

REF.	DESCRIPTION
1.	Air Box drain tube.
2.	Clutch-fly wheel pilot bearing lubrication fitting.
3.	Slip yoke spline lubrication fitting.
4.	Bell housing breather caps.
5.	Clutch throwout cross shaft lubrication fitting.
6.	Water temperature sender.
7.	Cab heater hose outlet.
8.	Exhaust manifold.
9.	Air vent plug (Rev. 9 and 10 must be opened when refilling drained engine).
10.	Thermostat elbow drain cock.
11.	Hourmeter.
12.	Voltage regulator.
13.	Generator adjustment bracket.
14.	Adjusting screw for tightening the Hydraulic pump belt tension.
15.	Hydraulic pump.
16.	Generator.
17.	Generator lubrication fitting.
18.	Engine oil pressure sender.

21. AIR CLEANER. (Oil Bath Type - Standard Equipment.)

a. General.

Clean air for combustion is assured by an oil type air cleaner. (See photo at right.) A heavy screen in the air intake cap (1) prevents large particles from entering the air cleaner. The air then passes to the oil cup (5), where it goes through a bath of oil. As the air rises to the intake manifold it passes through a series of oil-bathed screens and the fine dust is removed. As the oil from the screens works back down, it carries the dirt with it and the dirt settles in the oil cup (5).

b. Refilling Oil Cup (Daily).

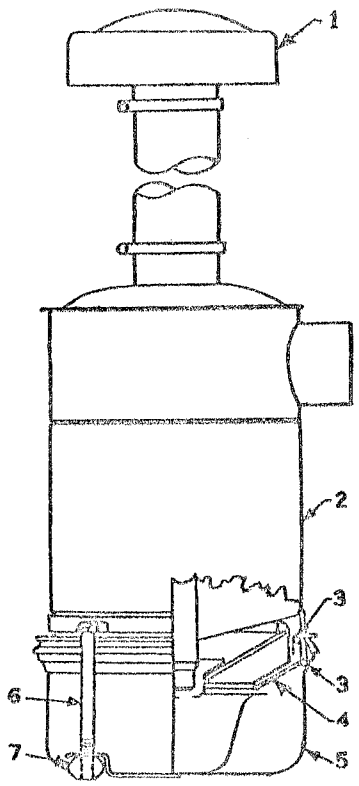
Loosen the two wing nuts (7) and remove the cup (5). Remove the lower tray (4) for cleaning purposes.

Clean and completely refill the oil cup every day, or after every eight hours of operation (every two or three hours when operating under dust conditions). Refill the oil cup (5) to the oil level bead with the grade of engine oil that is used. (Fill the inner cup also.) Note that the oil level mark is on the inside of the oil cup. Do not overfill the oil cup.

Before replacing the oil cup, clean or wipe any oil or grit from the top bead of the oil cup and the removable tray. The lower tray (4) and the oil cup (5) are fitted with rubber gaskets or "O" rings (3) to insure an airtight connection at these points. Caution must be used to be sure these "O" ring gaskets are in place and undamaged when the air cleaner is serviced. If "O" rings are cut or damaged they must be replaced.

c. Air Intake Cap and Screen.

The screen in the air intake cap (1) prevents chaff and other coarse dirt from getting into the air cleaner.



This screen should be checked every 40 hours and kept clean and free from all chaff, oil, dust, or paint, as clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

d. Washing the Cleaner.

(1) After every 40 hours of operation, particularly if the air is heavily laden with dust, chaff, or lint, remove the entire air cleaner from the engine, completely disassemble it and wash the parts thoroughly in kerosene.

Be sure to clean out the air intake pipe.

After all the parts have been thoroughly cleaned, replace the air cleaner body on the power unit. Make sure all joints are air-tight and pipes lined up.

Replace the air intake cap.

(continued)

Completely fill the oil cup (5) to the proper level with the specified grade of oil and replace it on the air cleaner. Be sure it is held securely in place and that the cup clamps (6) are tightened equally.

e. General Precautions.

As an added precaution against dirt getting into the engine, frequently inspect the flexible rubber hose connection between the air cleaner and the cleaner pipe. If it shows any sign of deterioration, replace it.

Inspect the air cleaner hose clamps periodically, keeping them in place and drawn up tight.

CAUTION: Failure to service the air cleaner as explained in paragraphs (b), (c) and (d), will result in dust entering the engine, causing rapid premature wear to the internal engine parts, such as piston and sleeve groups, also valves and crank shaft assembly. The costs are borne by the owner, including labor parts installation.

22. ELECTRICAL EQUIPMENT.
(12 volt system)

a. Adjustment.

Improper adjustment of any of the electrical units may result in serious damage to the equipment.

It is recommended that unless the mechanic is familiar with the operation and adjustment of the units, he make no attempt to do this work.

If repair or adjustment is required, it is suggested that a qualified electrical mechanic do the actual work, as he will have the necessary testing equipment and technical information required to perform this job.

Before working on any part of the electrical system, first disconnect one battery cable. Do not reconnect the cable until all other equipment has been connected. This will avoid shorting and causing damage to any of the electrical units.

Be sure all terminals are clean and securely fastened and that there are no broken wires anywhere in the electrical system.

b. Specifications.

The wiring diagrams of the 12 volt wiring system are shown on pages 21 or 23.

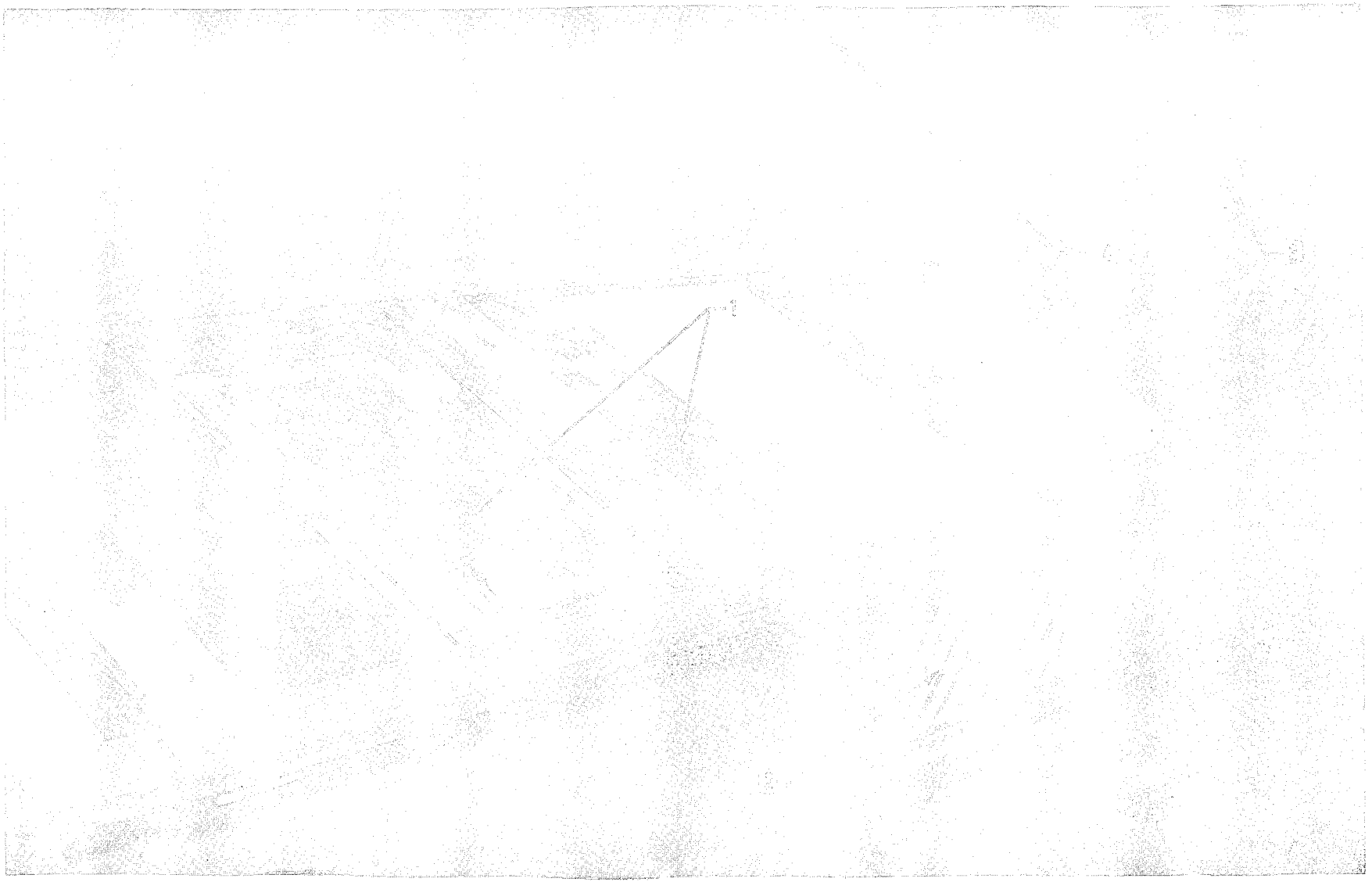
The "Positive" side of the batteries is grounded at the starter.

The starter is solenoid operated, with starter switch button located at the operator's position (see (15), page 8).

The standard generator with standard regulator, is 12 volt, 375 watt capacity. Also see proper engine Operator's Manual for further general instructions.

Extra heavy duty generator equipment is available where additional load is placed on the electrical system.

For accessory wiring diagrams, see separate pages in this manual.



23. BATTERY COMPARTMENT.

(1) Two 6 volt batteries.

(2) Two-stage water heater.

(3) Instrument Panel.

(4) Seat Cushion Frame with back rest. The back rest and seat cushion frame as a group can be moved forward or backward as required for operator comfort.

24. STORAGE BATTERIES.
(Located under Operator's Seat)

a. New storage batteries should be registered with the nearest battery service station.

b. The batteries store the current produced by the generator and energize the starting motor and the electrical controls that are part of the electrical system. See that the batteries are kept fully charged. In extreme cold weather, the terminal voltage of a battery drops as much as 30%, and it is sometimes advisable for quick starting to connect an additional six volt battery in series. The additional battery should be removed as soon as engine is started.

On initial start be sure to polarize generator. Check and keep tight all electrical connections located at the ammeter, starting motor, starting switch, generator, and voltage regulator.

Keep all battery terminals clean and tight. Loose connections cause the voltage regulator to chatter, which may result in early failure of the regulator. If terminals show a tendency to corrode, clean and apply a thin coat of vaseline. Keep the outside of the battery clean. Neutralize any electrolyte on the surfaces with a cloth saturated with ammonia or bicarbonate of soda (one pound of soda to one gallon of water), then wash off and dry.

c. Vent Holes. Keep vent holes in battery filler caps open.

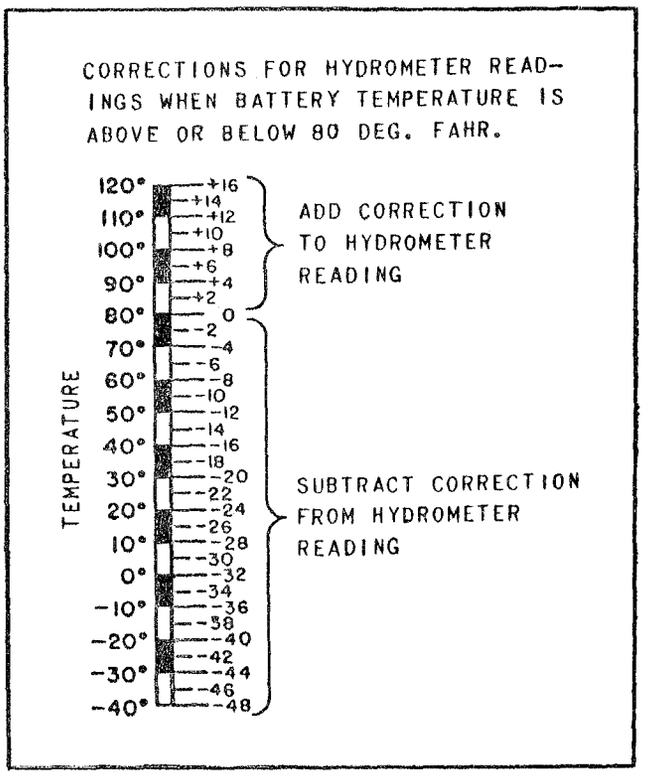
d. Electrolyte Level. The electrolyte in each cell should be 3/8" above the separators. Keep the electrolyte up to this level at all times to prevent battery failure. When the electrolyte falls below this level, pure distilled water should be added. Never use hydrant water or any water which has been in a metal receptacle. Keep pure distilled water in a glass jar on hand for battery use only. To put water in a cell, use a clean syringe. When adding water to the battery in temperature near the freezing point (32° F.), always operate the engine long enough to mix the water and the electrolyte, or damage to the battery from the water freezing will result.

CAUTION: Acid or electrolyte should never be added except by a skilled battery man. Under no circumstances add any special battery "dopes", solutions, or powders.

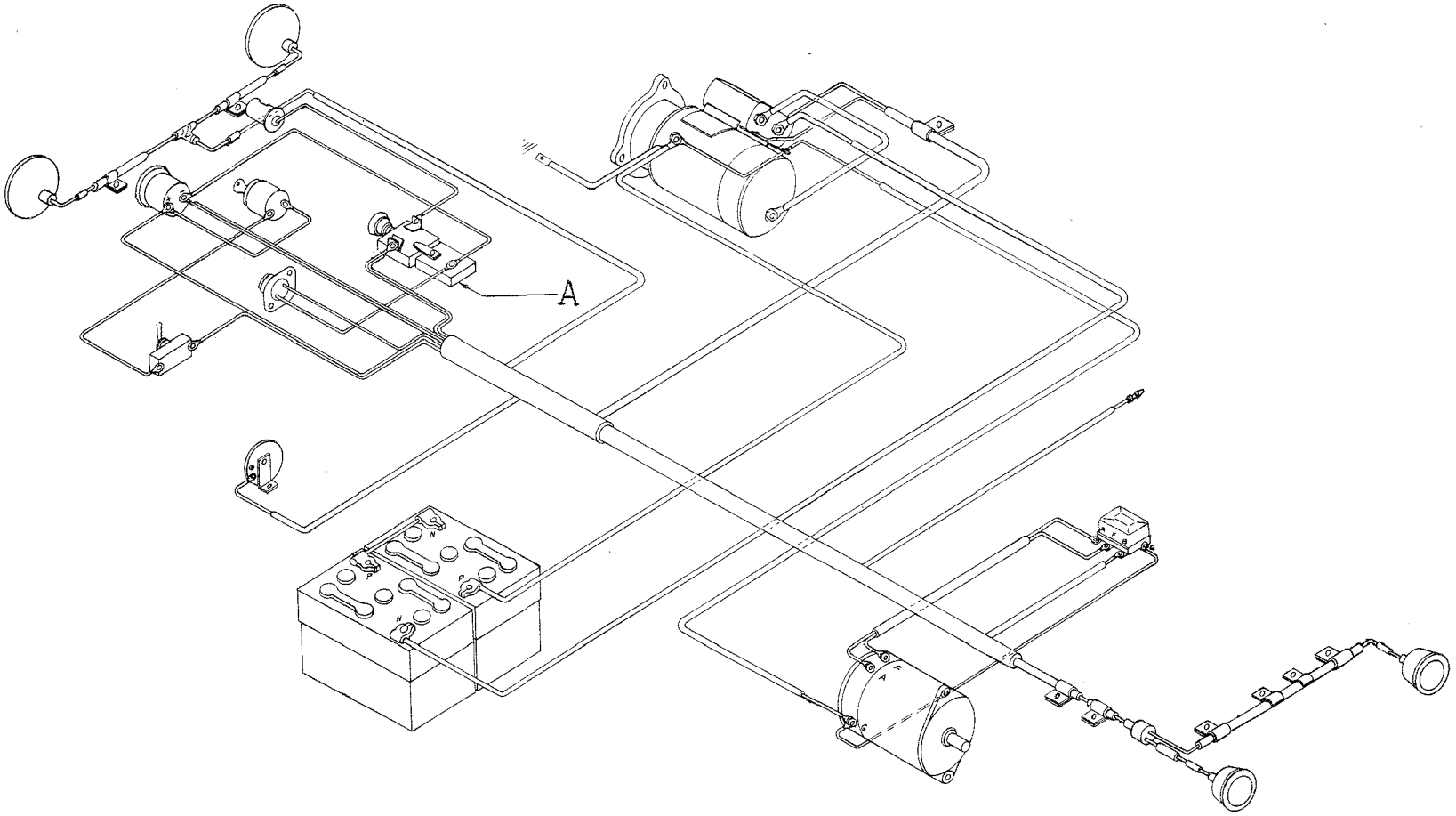
e. Specific Gravity of Electrolyte. The specific gravity of the electrolyte indicates the relative condition of the battery charge and warns when it may be necessary to increase the generator charging rate or to recharge the battery.

Inspect the battery once a week or more often to maintain correct specific gravity. Specific gravity reading of at least 1.250 corrected to 80° F. should be maintained (see chart).

If the specific gravity of the electrolyte is less than the required figure in the chart, the generator charging rate should be increased, or the battery should be recharged with standard auxiliary battery recharger.



Hydrometer Reading Correction Chart



25. WIRING DIAGRAM FOR GM-471 DIESEL ENGINE.

(See Repair Parts booklet for part number data.)

NOTE: Ref. (A) consists of a 30 AMP. circuit breaker or safety device.

26. GM DIESEL ENGINE FUEL LINES.
(Shown at right.)

1. Diesel fuel tank.

2. Fuel tank shut-off valve.
(Valve must be open to run the engine.)

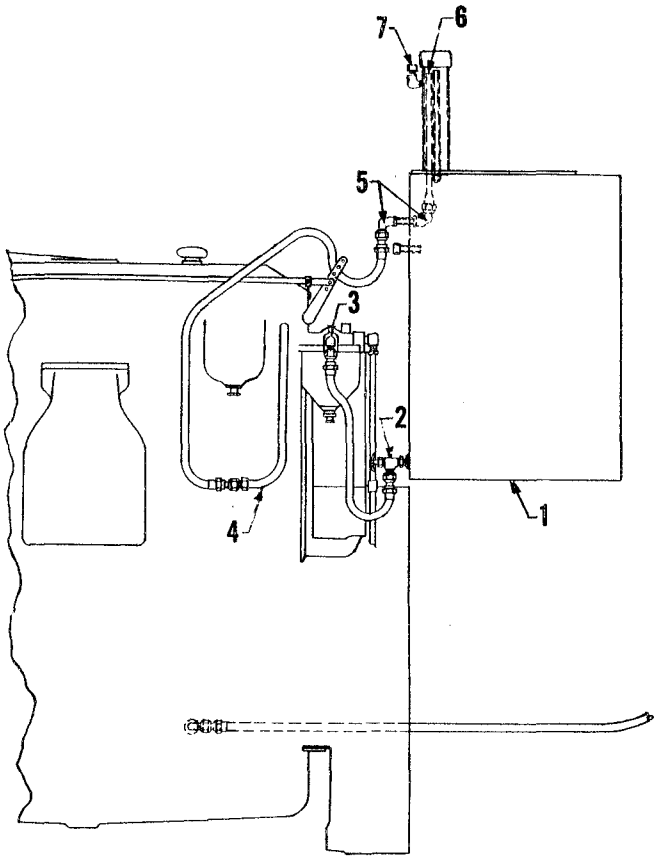
3. Fuel inlet to primary oil filter.

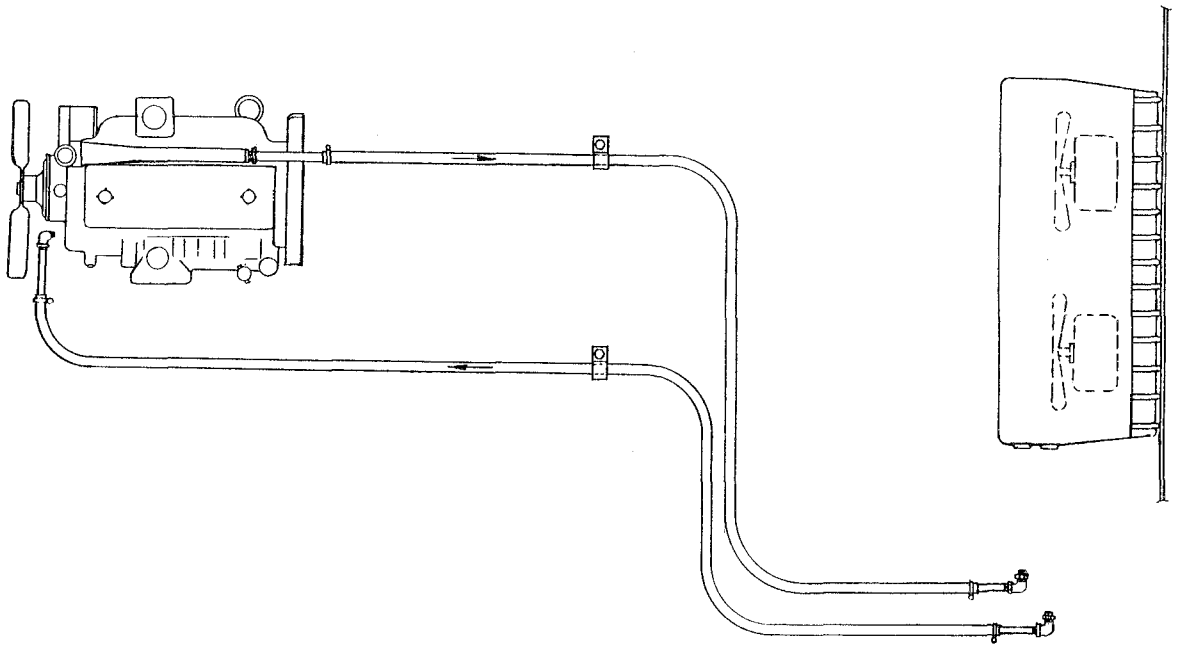
4. Fuel oil return line, (at engine block) to fuel tank (1).

5. Fuel oil return elbow near top of the fuel tank (1).

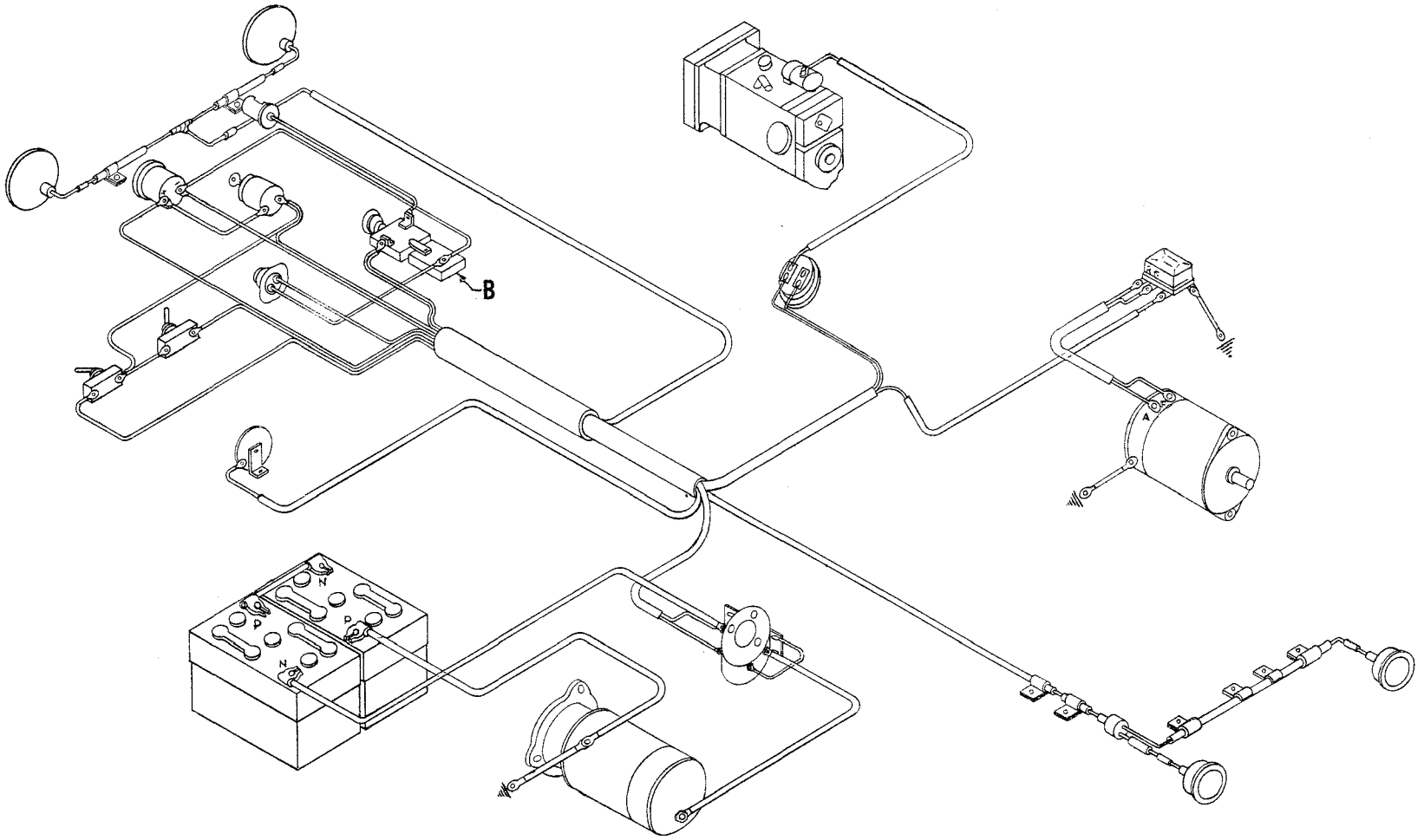
6. Return fuel oil is discharged at highest point in the fuel tank. The fuel drops down into the fuel tank.

7. The air being lighter is discharged outward at breather (7). Keep the breather open.





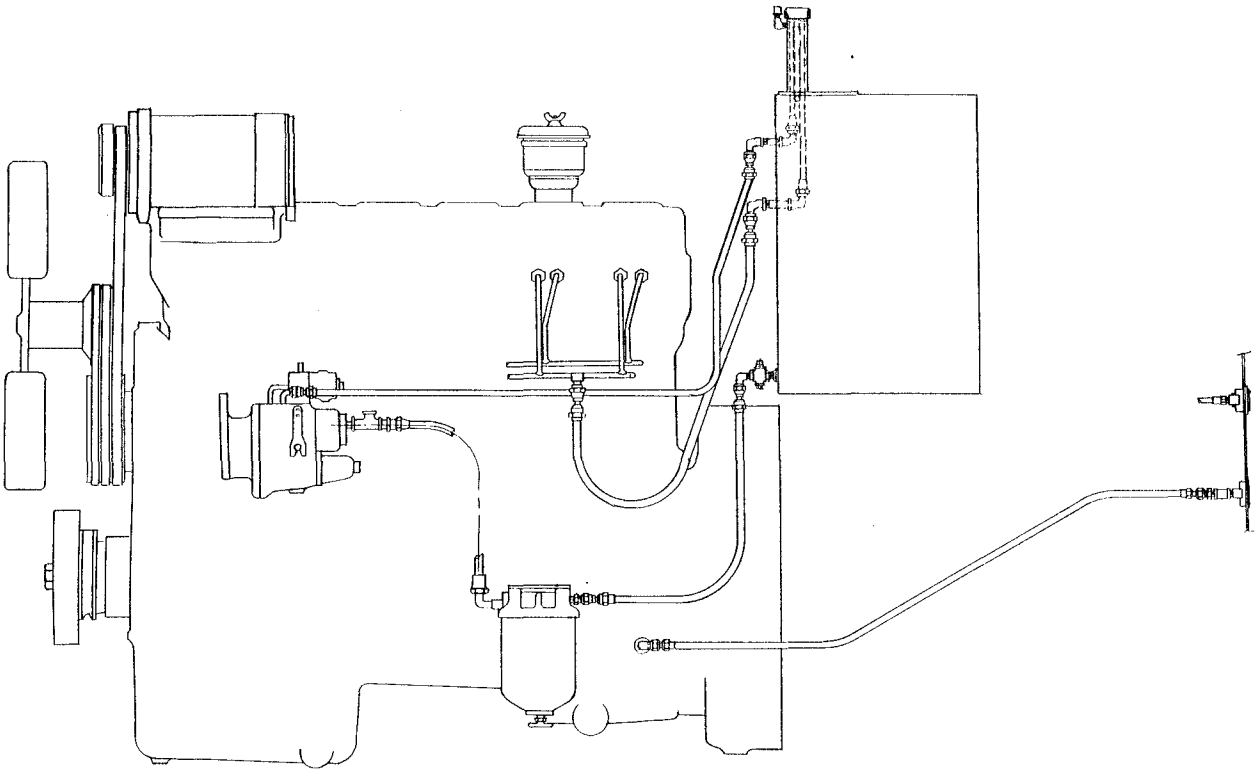
26A. WATER HEATER AND PIPING - GMC-471 ENGINE.
(See above and Repair Parts booklet for part number data.)



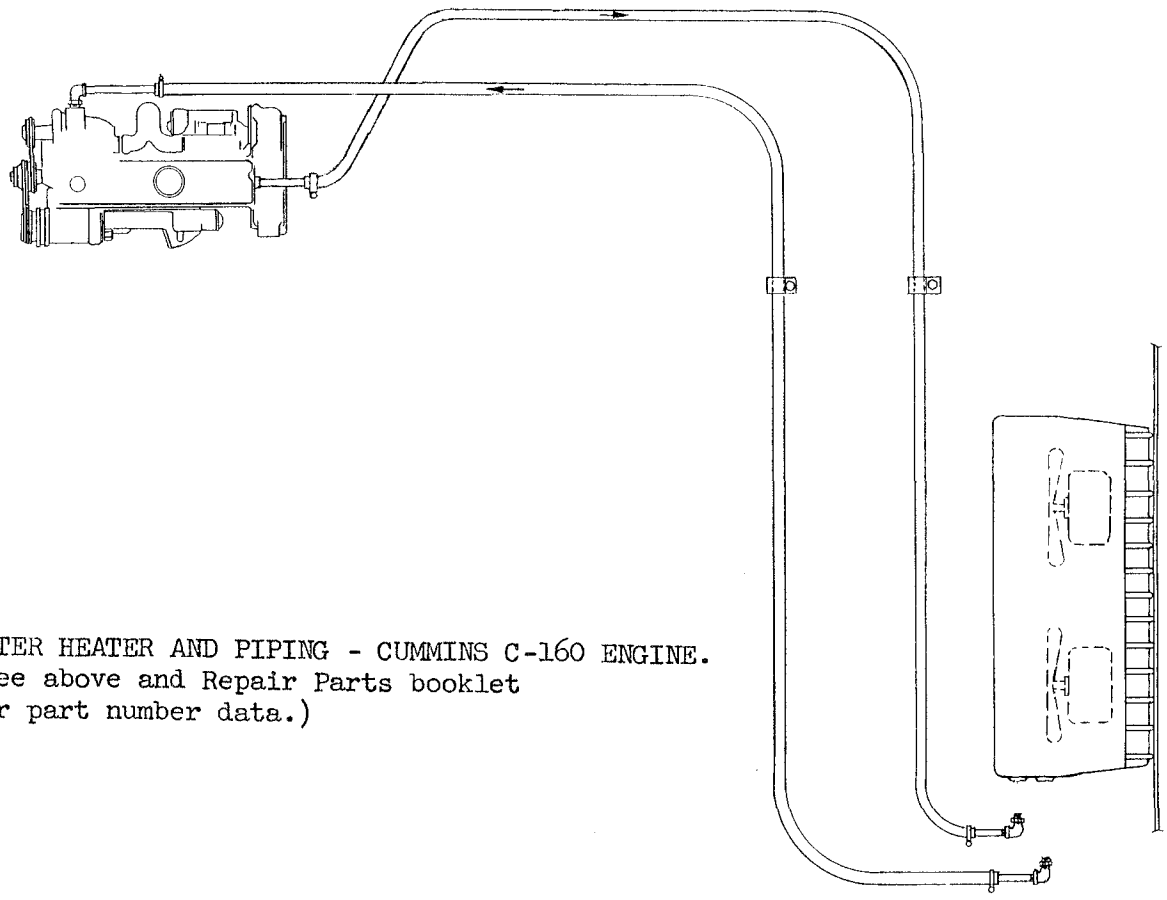
27. WIRING DIAGRAM FOR CUMMINS - C-160 DIESEL ENGINE.

(See Repair Parts booklet for part number data.)

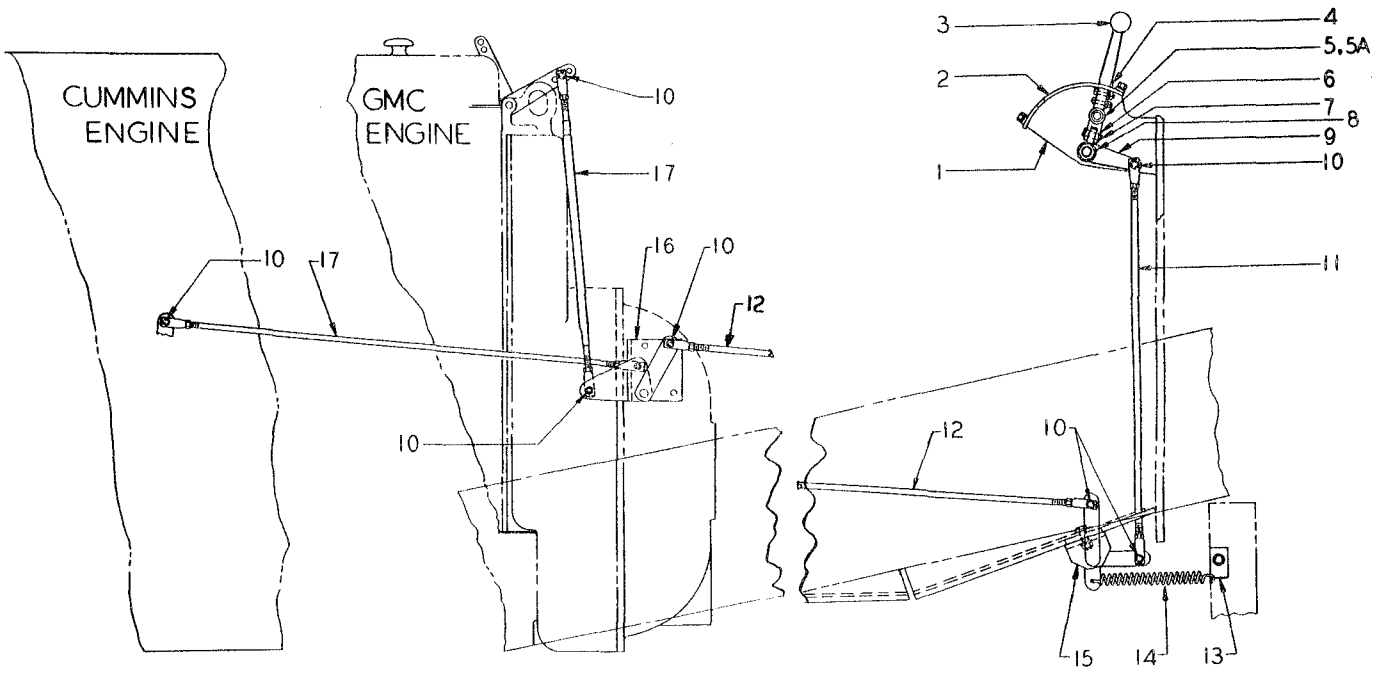
NOTE: Ref. (B) consists of a 30 AMP. circuit breaker or safety device.



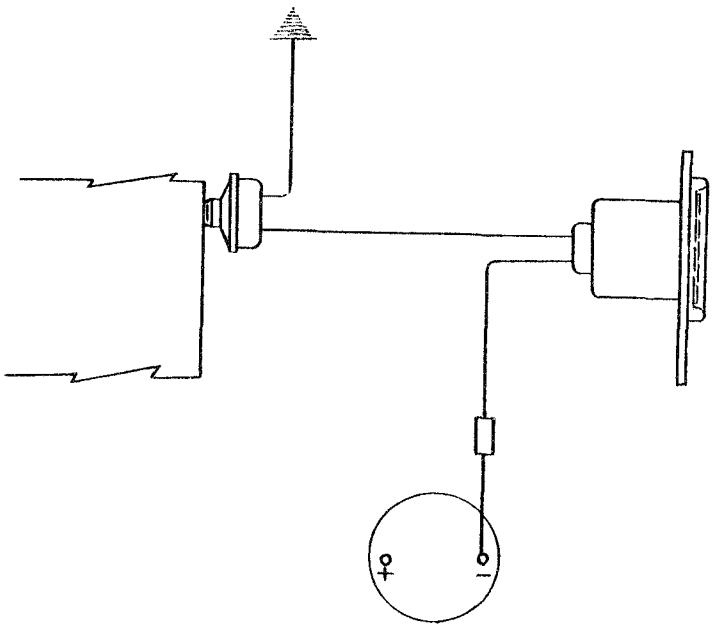
28. CUMMINS ENGINE
(Fuel Lines)



28A. WATER HEATER AND PIPING - CUMMINS C-160 ENGINE.
(See above and Repair Parts booklet
for part number data.)

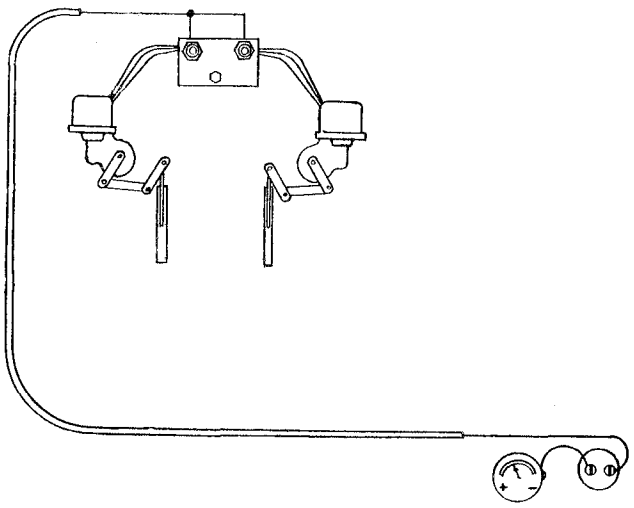


29. ENGINE GOVERNOR CONTROL LINKAGE. (Dry clutch shown above.) (See pages 132 and 133 for Converter Tail Shaft Governor data, and Repair Parts booklet for part number data.)

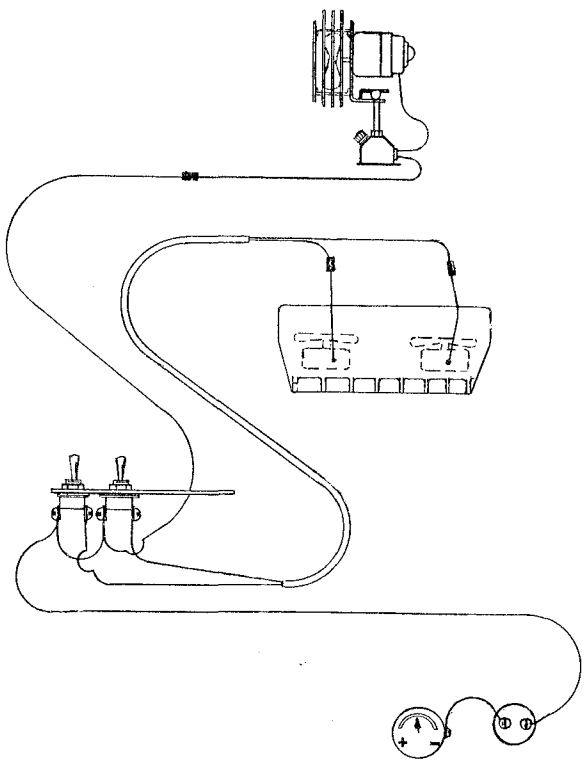


30. HOURMETER WIRING DIAGRAM.

(See Repair Parts booklet for part number data.)



31. WINDSHIELD WIPER WIRING DIAGRAM.
(See diagram above and Repair Parts booklet for part number data.)



32. WATER HEATER-FAN WIRING DIAGRAM.
(See diagram above and Repair Parts booklet for part number data.)

33. COOLING SYSTEM.

a. Operation.

The cooling system automatically maintains the most desirable engine temperature under normal operating conditions.

When the engine is started cold, a thermostat of the by-pass type prevents circulation of water to the radiator and allows the coolant to circulate only through the cylinder head and around the cylinders of the engine. When an efficient operating temperature has been reached, the thermostat is wide open and the by-pass is closed, allowing the coolant to circulate through the engine block, cylinder head, and radiator.

b. Rust Prevention.

Suitable treatment of the water for corrosion prevention will reduce rusting at least 95%. Rust inhibitors for the cooling system are inexpensive and simple to use and should be used in the proportions recommended by their manufacturers.

Starting with the system clean, fill it nearly full with fresh water and add the recommended dosage; then operate the engine until it reaches operating temperature, when the thermostat will open and establish circulation through the radiator and engine block for complete mixing.

Where anti-freeze has been used, drain the solution after freezing weather is past. Flush the system thoroughly and clean if necessary. Then install a fresh filling of summer rust inhibitor and water.

In a system that was clean originally, the appearance of rust in the radiator or in solution is an indication the inhibitor is weakened, in which case the solution should be drained, the system flushed, and a fresh filling installed. (See separate Engine Manual.)

c. Cleaning Out Dirt and Sludge.

Open the drain in the bottom of the radiator. Allow the system to drain. Close the drain. Fill the cooling system with a solution of two pounds of ordinary baking soda mixed with sufficient water to fill system.

Leave off the radiator filler cap and operate the engine until the water is hot. Then drain and flush with clean water.

d. Filling Cooling System.

Close the drain in the bottom of the radiator.

Filling the radiator with water to a level slightly below the bottom of the filler neck will allow for expansion of the coolant under normal operation conditions. Soft, or rain water is recommended as it does not contain minerals which form scale and eventually clob the passages.

e. Radiator Core.

Overheating is often caused by bent or clogged radiator fins. If the spaces between the fins become clogged, clean them with an air or water hose.

When straightening bent fins, be careful not to injure the tubes or break the bond between the fins and tubes.

34. EXTREME HEAT OPERATION.

The engine will operate satisfactorily in extreme hot temperatures without additional adjustments.

a. Lubrication.

Particular care should be given to the engine crankcase to see that it is kept to proper level with lubricants of correct grade. (See separate Engine Manual.)

b. Fuel System.

Keep the diesel fuel tank well filled to avoid condensation of moisture within the tanks.

Be sure the vent at the fuel tank is open and the filler cap is on tight.

c. Batteries.
(Located under Operator's Seat)

Inspect the batteries frequently to see that the electrolyte is at the correct level and of the correct specific gravity.

d. Cooling System.

Check the tension of the fan belt frequently.

Keep radiator filled with clean, soft, fresh water. Radiator fins must be kept free of accumulated dirt, leaves, insects, etc.

Remove the hood sides to assist in better ventilation at the radiator core fins.

e. Air Cleaner.

When operating in extreme dust conditions, check the air cleaner as often as necessary to insure against accumulation of dirt. Keep oil cup, upper elements, and upper tube clean.

(Please read complete instructions shown under "Air Cleaner". Pages 17 and 18, paragraph 21).

35. COLD WEATHER OPERATION.

If the engine is to be operated in temperatures of 22° F. or lower, observe the following precautions:

a. Lubrication.

Be sure to use the correct grade of oil in the engine crankcase. (See separate engine Manual.)

b. Fuel System.

(1) Fill the diesel fuel tank at the end of the day's operation to avoid condensation of moisture in the tank.

The fuel filters should be checked and elements replaced at start of winter season.

Suction lines from fuel tank to filter should be checked for air leaks.

Low pressure fuel lines should be checked. Replace parts if there are any signs of deterioration or cracks.

(2) Only highest grade fuel oil for winter operation should be specified when ordering, and a definite check should be made that the specified fuel oil is being delivered.

Fill the fuel tank at end of the day's operation, to prevent moisture from collecting in the tank. A quantity of fuel should be drained from the fuel supply tank and if there is any rust or corrosion, the tank should be drained completely and flushed.

Fuel storage tanks should be checked for possible rust or corrosion and if necessary, a filter installed on the outlet connection.

c. Batteries.
(Located under Operator's Seat)

Check the specific gravity of the electrolyte frequently to determine the charged condition of the batteries. It is important to keep the batteries fully charged in cold weather for two reasons: (1) to maintain the operating efficiency. (2) to avoid freezing. In extreme cold weather the terminal voltage of a battery drops as much as 30%. (It is sometimes advisable for quick starting to connect an additional six volt battery in series. The additional battery should be removed as soon as the engine is started.)

d. Cooling System.

(1) When operating temperature is 32° F., (0° C.) or lower, there is danger of the water freezing in the cooling system. To overcome this condition use one of the recommended anti-freeze solutions.

(2) Keep the radiator filled with a good anti-freeze mixture ("Ethylene Glycol"), or if the system is drained nightly, the introduction of warm water added slowly will facilitate starting.

Before filling the cooling system with anti-freeze, drain and clean the system as described on page 27, paragraph

33, subparagraphs C, B, D, and E. Refill system, and check the radiator, water pump, all gaskets, and hose connections.

If any leaks are found make repairs before filling with anti-freeze.

(3) Drain the cooling system by opening the drain at the bottom of the radiator and at the engine. Remove the radiator filler cap. See that the drain is not plugged and that the water drains out completely.

(4) Anti-Freeze solutions. Never mix anti-freeze solutions, as it will be difficult to determine how much protection against freezing the solution has. Never use honey, salt, kerosene, fuel oil, glucose or sugar, calcium chloride, or any alkaline solution as an anti-freeze.

WARNING: Do not use denatured alcohol as an anti-freeze if other materials are available, because it boils at 173° F.

If alcohol is used, check the solution frequently with the hydrometer to be sure you have adequate protection for the prevailing temperature. Replenish solution when necessary at your responsibility.)

(5) IF NO ANTI-FREEZE IS AVAILABLE drain the cooling system completely after operation.

Before refilling, cover the radiator front completely, start the engine, and fill the system immediately with water. This will prevent the radiator from freezing during the warm-up period.

36. OPERATING PRECAUTIONS.

a. SAFETY FIRST! Never fill the fuel tank when near an open flame or when the engine is operating. When pouring in the fuel keep the funnel and container in contact with the metal of the tank to avoid the possibility of an electric spark igniting the fuel. Never light matches near the tank vent, as the air within several feet is permeated with a highly explosive vapor.

b. Never operate the engine under load until it is thoroughly warmed up.

The engine speed control lever should be adjusted to suit the load to be handled. Refrain from slipping the tires. Failure to follow these suggestions will result in excessive tire tread wear and waste of fuel.

Never operate the engine at more than the no load engine speed. Excessive speeds are harmful.

Do not tamper with the fuel injection apparatus with the idea in mind to inject more fuel in the cylinders.

Operate a new engine with a light load for the first thirty to thirty-six hours at about three-quarter throttle.

c. The fuel tank is provided with an air vent. The vent should be kept open to assure a proper flow of the fuel, to the injection system.

d. Immediately after the engine starts, check the oil pressure indicator to see if it is registering the proper pressure. If it is not, stop the engine and inspect the oil system to find the cause of failure. (See separate engine Manual.)

e. Check the tension of the fan belt. Tension is correct when the belt can be depressed by your thumb 3/4" midway between the pulleys. If belt tension is not correct, adjust as required.

For the most efficient operation, the heat indicator needle should be between 160° and 180° F.

f. Be sure to clean the air cleaner and to replace the lubricating and fuel oil filter elements at regular intervals.

g. Never operate the starting motor more than five minutes at a time. Allow the starting motor to cool one minute and repeat the starting operation.

h. Never pour cold water into the radiator if the engine is very hot. Stop the engine for 30 minutes, then restart it and let it idle while slowly pouring the water into the radiator.

37. TIRE INFLATION CHART.	"Pacer" Only		"Pacer" Only		"Super" Only		"Super" Only	
TIRE SIZE	14.00 X 24, 12 ply		16.00 X 24, 12 ply		13.00 X 24 & 14.00 X 24 12 ply		16.00 X 24, 12 ply	
	Inflation		Inflation		Inflation		Inflation	
	Front	Rear	Front	Rear	Front	Rear	Front	Rear
With or without Scarifier.	30	40	20	25	40	25	40	20
With Bulldozer.....	40	40	20	25	45	25	40	20
With Snow Plow and Wing...	45	60	30	45	50	40	30	20
With rear Roller.....	25	55	20	40	—	—	—	—

Note, all tires listed above have 5° tapered bead seats, for use with inner tubes and flaps. Tubeless tires of sizes listed above having 5° taper bead seats may also be used.

The tire pressures shown in the above chart are ideal for maximum tire flotation and general construction.

38. TIRE MAINTENANCE.

A. Matching New Tires - New Grader. We recommend that all tires be matched to within 1/8" of the same rolling radius. Rolling radius is the distance (in inches) from the ground to the center of each wheel driving axle.

B. To match tires, proceed as follows: The grader should be on a level floor, carrying a correctly distributed rated capacity load. Example-See above chart for various attachments. Inflate the tires as shown.

Carefully measure the rolling radius at each tire as shown under paragraph A. Over inflation of 2 to 4 lbs. as required, will result in matched or uniform rolling radii at all tires.

C. The above is based on the assumption that all tires are of the same name brand, and same size, same number of plies, type of tread, and 5° Tapered Bead Seat.

D. Matched rolling radii will provide equal tire to ground traveling speed at all tires. This will result in higher tire mileage, satisfactory axle gear lubricant temperatures, and maximum work factor from the fuel as it is burned.

E. Matching Used Tires. Used Tires should also be held as shown under paragraphs A, B, and D. We recommend all used tires be of same size, same number of plies, bead seat, and nearly same type and height of lugs at the treads. When certain tire treads show a tendency to wear more than others, the worn tires (with wheels) should be removed and attached to the hubs at the opposite side of the grader. Rotation of tires is necessary in order to hold all tire treads to the same wear pattern and uniform height of all lugs. As tire treads wear it may be necessary to over-inflate certain tires as much as 5 lbs. in order to maintain uniform rolling radii within 1/8".

F. Retreaded tires should be installed in complete sets. (not singly-because retreaded tires generally are larger in diameter than new tires; therefore the establishment of uniform rolling radii becomes problematical.)

G. A-W Graders have differentials at the front axle; however, it is important that the same rolling radii be maintained at both right and left front tires. Failure to comply with this may result in the differential internal parts being subjected to unnecessary rotation and wear, when the grader is traveling in a forward or reverse direction.

H. The "Super", and "Pacer" graders do not have differentials at the rear axles. Excess tread skidding will be held to a minimum when the rear tires have equal rolling radius.

(continued)

I. Unequal rolling radius will develop waste of the following types. Excessive fuel waste. Excessive tire wear, and replacement there-of. Overworking of the drive units and unusually high axle lubricant temperatures-which may lead to costly axle, and drive services.

J. When operating A-W graders at excessive side tilt, approaching a 2 to 1 slope, the tire inflation in all tires may be increased 10 lbs. over the pressures on chart. This increase in tire pressure when operating at or near a 2 to 1 slope will stabilize the tires and prevent them from rolling slightly sidewise on the rims. Damage to the tire sidewalls will be reduced when the additional tire pressure is raised by about 10 lbs.

When the construction slope work approaches a 3 to 1 slope, the tire pressure in all tires should be lowered to values as shown on chart shown on page 30.

NOTE: Tandem graders - those without the "A-W Front Wheel Drive"- at best can only be effectively used in 3 to 1 slope construction work.

K. WATER WEIGHTS FOR FRONT AND REAR TIRES. Not recommended or required.

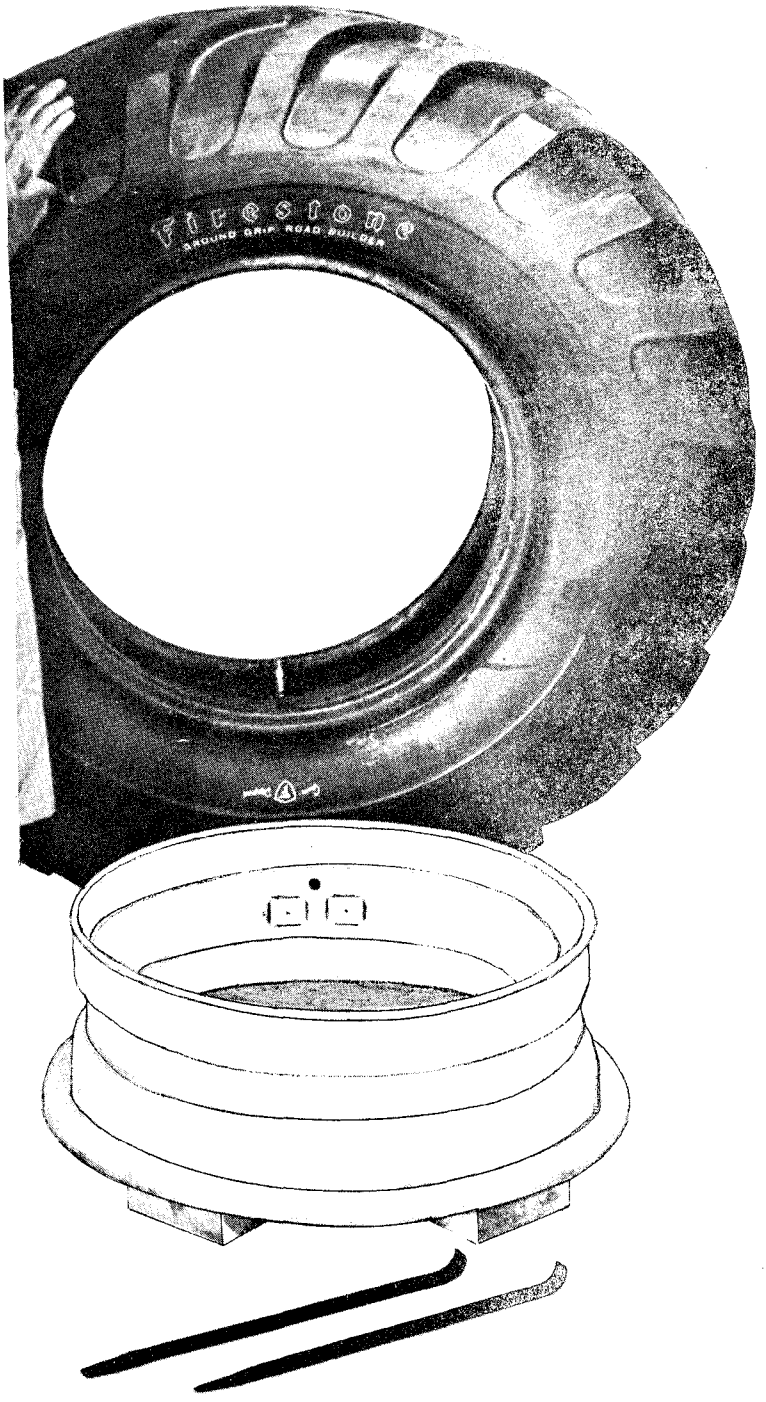
L. TIRE CHAINS.

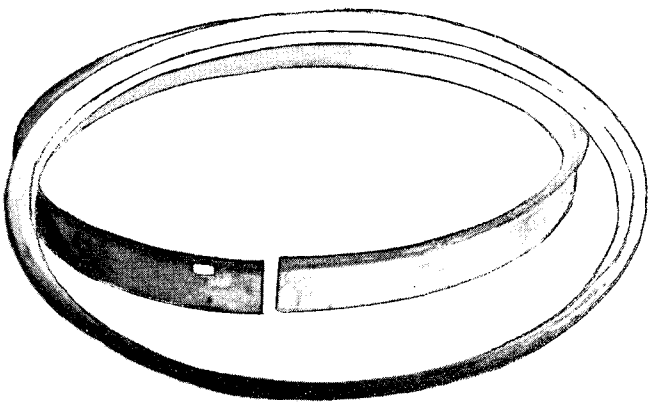
Tire chains may be used on all wheels in snow removal. (Exception - 16.00 x 24 tires.)

Tire chains must have cross chains every other side link. Never use tire chains having cross chains every two or three side links or more.

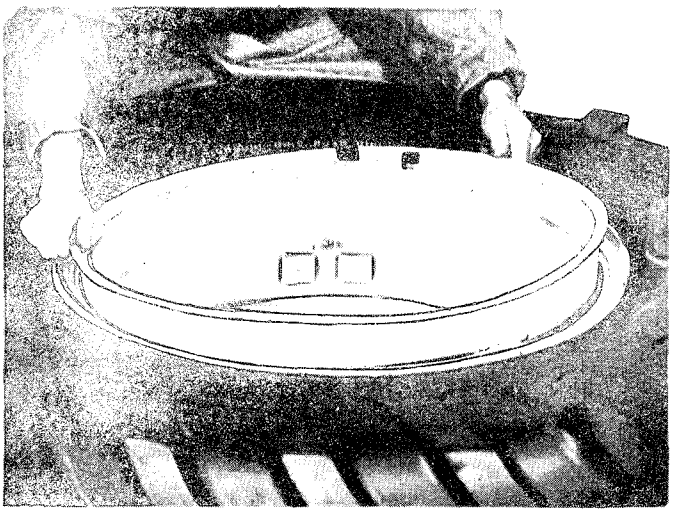
M. TIRE MOUNTING PROCEDURE.

1. Assemble parts in position as shown. Note rim base is placed on wood blocks to provide clearance for tires. Rim nut is removed from valve and valve is properly placed to fit offset valve hole in rim. The rims should be straightened, cleaned and painted to make mounting easier and to prevent rust damage. All oil or grease should be removed from the rims and tires.

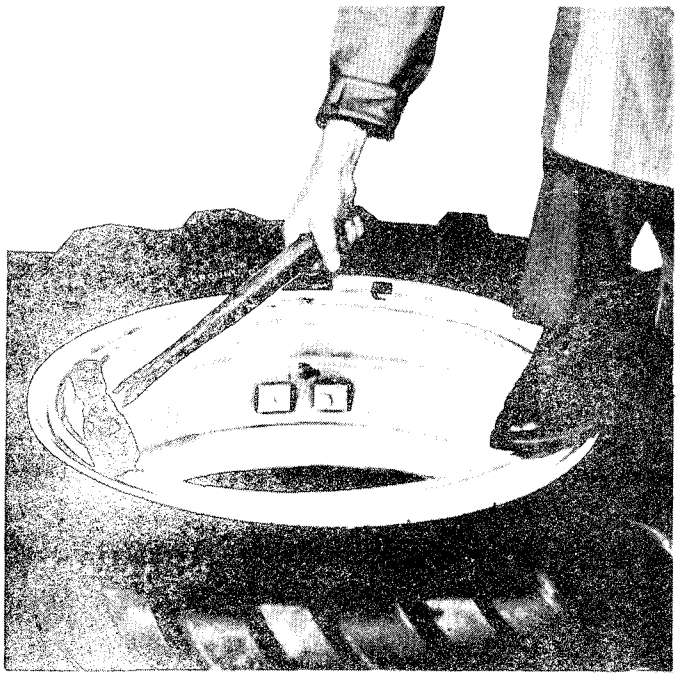




Lower tire onto rim base and apply rim nut to valve. Place the continuous side flange in position and then insert tapered toe of locking ring between side flange and tire bead as shown below.



Engage one end of the locking ring in the rim gutter and working progressively around the rim, hammer the ring in place, using a soft metal hammer as shown below.

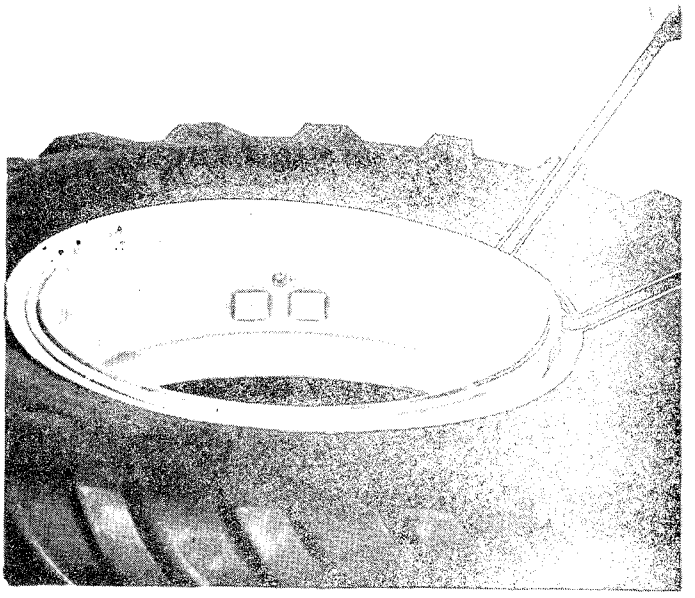


Carefully examine the assembly to make certain the locking ring is in place, then inflate to recommended pressure (see page 30) to seat the tire beads. Completely deflate to permit proper positioning of tube and again reinflate to recommended pressure for service.

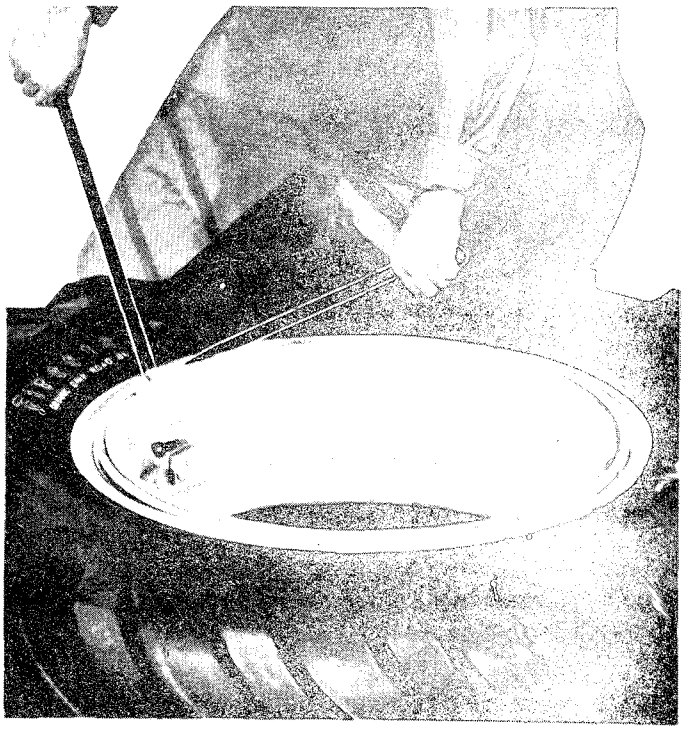
CAUTION: Do not use a heavy hammer to seat the lock ring because abuse of this kind may weaken the locking lip of the rim itself. Never stand over, or stand directly beside a tire or rim.

N. Demounting Procedure.

Completely deflate tire by removing valve core or using deflator cap. Use tire tools to free tire bead from the bead seat on removable flange side as shown below.



Insert tapered end of tire tool in notch located at split in locking ring to pry the ring out of the rim gutter at this point as shown below.



Use tire tools to progressively remove the locking ring, then remove the side flange ring as shown below.

Turn tire over and free tire bead on fixed flange side. Remove rim nut from valve and then force tire off the rim base.

39. FUNCTION OF THE "A-W" POWER GRADER.

The A-W Power Grader does heavy grading jobs because of its All-Wheel Drive, All-Wheel Steer, greater flexibility, and tremendous tractive effort.

The ability to at all times move the maximum amount of material and simultaneously overcome the side thrust caused by the load on the angled blade, is accomplished by All-Wheel Drive and All-Wheel Steer.

Largely because of these features, this grader:

1. Will move more material than other motor graders, and move it farther and faster.

2. Will work in rough ground where other motor graders cannot work at all.

3. Will work in sand and other soft and wet materials, where other motor graders cannot even travel with blade empty.

4. Will work on narrow trails, around corners, and in close places where other motor graders cannot work at all.

5. Will work on the faces of steeper slopes than other motor graders.

6. Will finish to closer tolerances in fine grading than other motor graders.

7. Will give a better year around, all season performance than any other motor grader.

Evidence of the truth of these statements will be found in the pages which follow.

40. SHIPMENT FROM FACTORY.

Before shipment from the factory, the A-W graders are assembled with the moldboard and controlling parts for right hand operation.

Due to its unique design, the following type of work may be done without the operator leaving his station. (It is not necessary for him to get up from his seat and reach around the windshield, to remove or change linkage pins, or step to the ground and procure suitable wrenches, hammers, bars, or jacks, plus a helper, to change the moldboard position on the circle supporting arms).

1. Regular maintenance.
2. Scarifying.
3. Ditch cut. (Right or left).
4. Flat bottom ditch. (Right hand).
5. Ditching or maintaining in reverse.
6. Wide reach or moving over ditch windrow.
7. Side shift circle.
8. Side shift moldboard on circle. (Right or left hand).
9. Cut low or medium ditch or bank. (Right or left hand).
10. Cut high bank or slopes. (Right hand).

NOTE: See page 48 for left hand high lift or bank cutting operation.

41. TRAVEL SPEEDS. Approximate, with various tire options. Speeds are based on 2000 R.P.M. engine (G.M.-4-71) speed, except for high speed which is based on 2120 R.P.M. overrun engine speed.

(A) Tire size 13.00 x 24, 12 Ply. Used with "Super" - Yes.(Used with "Pacer" - No.)

Dry Clutch or A-W Converter group requires an A-W Transmission with 3 Speeds Forward and 1 Reverse, while the Transfer Case has 2 speeds.	A-W Converter - Power Reverse is ahead of a 4 Speed A-W Transmission and a Single Speed A-W Transfer Case.	"Allison"Converter - Power Shift Transmission Group is ahead of a single speed A-W Transfer Case.
The traveling speeds are:	The traveling speeds are:	The traveling speeds are:
First 2.20	First 3.46	First 3.57
Second 3.59	Second 5.17	Second 7.02
Third 5.20	Third 11.11	Third 13.59
Fourth 7.59	High 19.10	High 20.03
Fifth 12.40	The Reverse Speeds are the same as forward speeds.	Low Rev. 3.13
High 19.09		High Rev. 4.64
Low Rev. 2.23		
High Rev. 8.20		

(B) Tire sizes 14.00 x 24, 10 and 12 ply. Used with "Super" and "Pacer".

Dry Clutch or A-W Converter with A-W Transmission and Transfer Cases, are the same as (A) above.	A-W Converter - Power Reverse and Transmission - Transfer Cases are the same as (A) above.	"Allison" Converter - Power Shift Transmission and A-W Transfer Cases are the same as (A) above.
The traveling speeds are:	The traveling speeds are:	The traveling speeds are:
First 2.27	First 3.57	First 3.67
Second 3.71	Second 5.34	Second 7.23
Third 5.37	Third 11.47	Third 14.03
Fourth 7.84	High 19.69	High 20.64
Fifth 12.81	The Reverse Speeds are the same as forward speeds.	Low Rev. 3.23
High 19.69		High Rev. 4.77
Low Rev. 2.31		
High Rev. 8.45		

(C) Tire sizes 16.00 x 24, 12 ply. Used with "Super" and "Pacer".

Dry Clutch or A-W Converter With A-W Transmission and Transfer Cases, are the same as (A) above.	A-W Converter - Power Reverse and Transmission - Transfer Cases are the same as (A) above.	"Allison" Converter - Power Shift Transmission and A-W Transfer Cases are the same as (A) above.
The traveling speeds are:	The traveling speeds are:	The traveling speeds are:
First 2.44	First 3.84	First 3.95
Second 3.98	Second 5.73	Second 7.78
Third 5.77	Third 12.31	Third 15.08
Fourth 8.42	High 21.12	High 22.15
Fifth 13.76	The Reverse Speeds are the same as forward speeds.	Low Rev. 3.47
High 21.12		High Rev. 5.11
Low Rev. 2.48		
High Rev. 9.04		

42. EARTH ROAD CONSTRUCTION.

The data on these pages show the "A-W" grading but one side of the road. The other side is handled in the same manner. For all operating purposes and intent, the photos and illustrations shown in this section will apply similarly to A-W graders fitted with either "Four or "Six Driving Wheels".

1. PREPARING GRADER FOR BLADE OPERATION.

After completely lubricating and fueling the grader, and learning the location and method of operation applying to the various controls (page 7) proceed as follows:

A. ADJUSTMENT OF BLADE TILTING LINKS.

Loosen the four vertical and the two horizontal bolts at the links (20), page 120. For all general grading, set both tilting links in the central position. When cutting hard pan, clay, or caliche, tilt the moldboard back to suit local conditions. Tilt moldboard ahead full distance for light maintenance. (Retighten the six attaching bolts).

B. Cleaning Paint Off Face of Moldboard.

Apply paint remover to paint. Let set for a few minutes and rub clean using old cloth or sack.

Always oil all moldboard faces at end of each day's work.

C. Moldboard Extension.

Extensions are available in 1 ft. or 2 ft. lengths. 1 ft. and 2 ft. extensions may be placed on both moldboard ends. One of either length may be put on either right or left moldboard end and none on the other moldboard end. The standard length moldboard is 13 ft. (Bits are 6 ft. and 7 ft.). The maximum length of moldboard, with extensions, is 17 ft.

NOTE: Always remove all extensions when doing heavy grading work.

2. OPERATING.

A. We recommend the operator first practice with the controls, slowly placing the moldboard in the various positions illustrated and explained in the following pages. By proceeding in this way he will learn all of the various operations much quicker.

B. The hydraulic "Finger Control Levers" at the operator's station, (when manipulated by the operator) control the amount of oil flow; namely, from the smallest perceptible amount to full or variable flow of oil.

C. The A-W power grader, with All-Wheel Steer, will turn around on a thirty foot road or less, and therefore it is very easy to quickly maneuver it into practical operating position for maximum loading of the work to be done. For similar reasons the A-W may be quickly and easily turned at the end of the section.

D. For many years the Austin-Western power graders have been satisfactorily operated with all tires driving on slopes of all types of specifications, running from 2 to 1 to level grade.

When operating an Austin-Western Power Grader on slope work, always "ride the bank" with the tires, in order that the grader may be placed in position to most effectively load the engine for maximum work. The reason for this is that All-Wheel Steer and All-Wheel Drive make it possible to effectively hold and load the grader. Follow these suggestions when grading with an A-W grader and the work will be accomplished and finished in the shortest possible time.

When grading less than 2 to 1 to vertical bank, or extremely high bank sloping jobs, see the recommendations on pages 41, 42 and 46 to 53 inclusive.

3. GRADING ON (3 to 1) SLOPE.

The front and rear wheels are steered in order to place the frame in offset position. (Maximum of 2 to 1 slope).

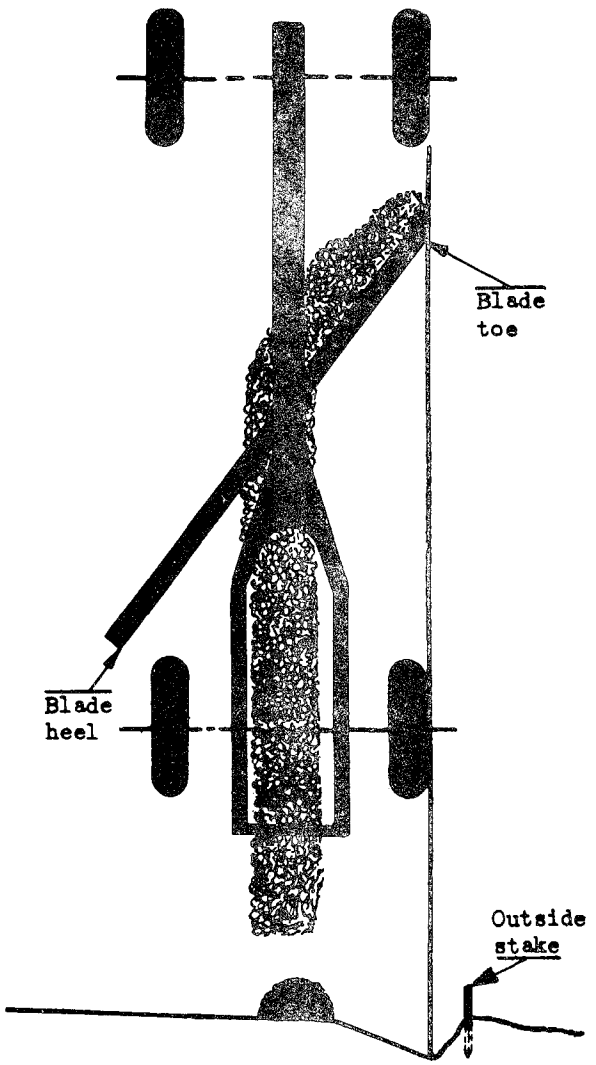
NOTE: Page 7 shows the locations of all control levers, such as (2), (4), and (3) listed there. Keep this in mind when reading the text as shown on the following pages.

4. STARTING A NEW DITCH.

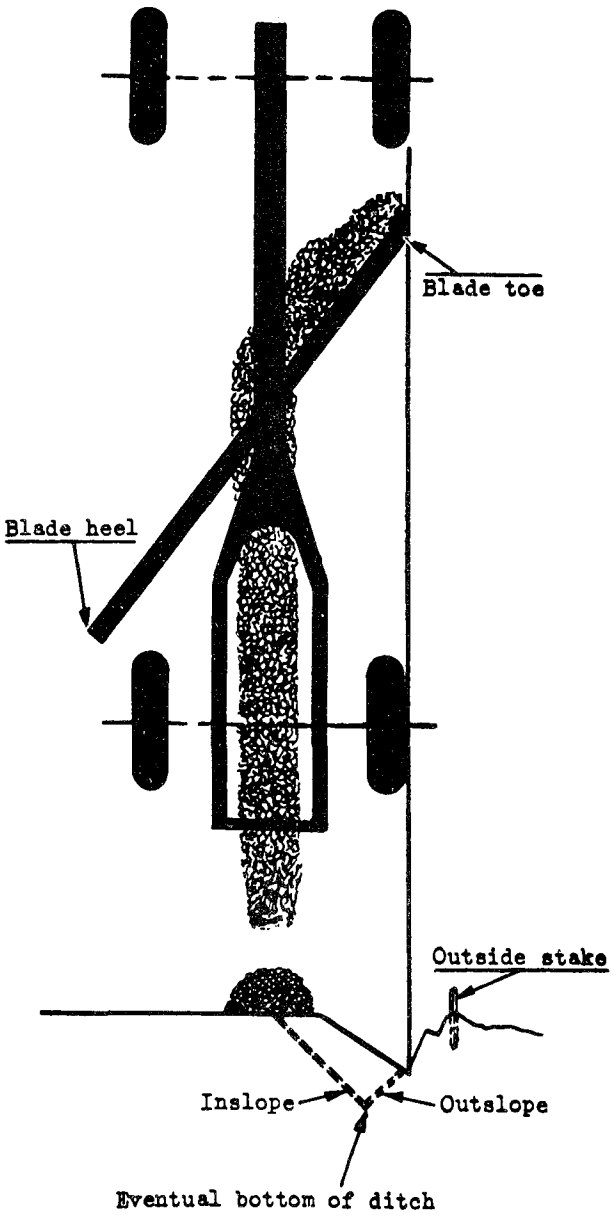
When starting a new ditch do not attempt to cut too deep the first time thru. Straight steering considered.

1 Rotate circle, lever (2). Side shift the moldboard, lever (4), setting the toe of the blade behind the front wheel.

2 Elevate heel of blade, lever (3), so material is delivered between the rear wheels as shown.



NOTE: When preparing the right of way to be graded, all rock, stumps, and trash should be buried or hauled away. If sods are to be used in the roadway, they should be stripped from the outslope stake to the shoulder line before the ditch line cut is started. Do not attempt to cut too wide a strip of sod. Use care to spread the sod evenly over the roadbed.



5. SECOND PASS.

1. Rotate the circle, lever (2). Side shift the moldboard, lever (4), setting the toe of the blade behind the front wheel, but not clear cut to outside edge of tire.

2. Lower heel of blade, lever (3), so material is delivered outside the rear wheels as shown.

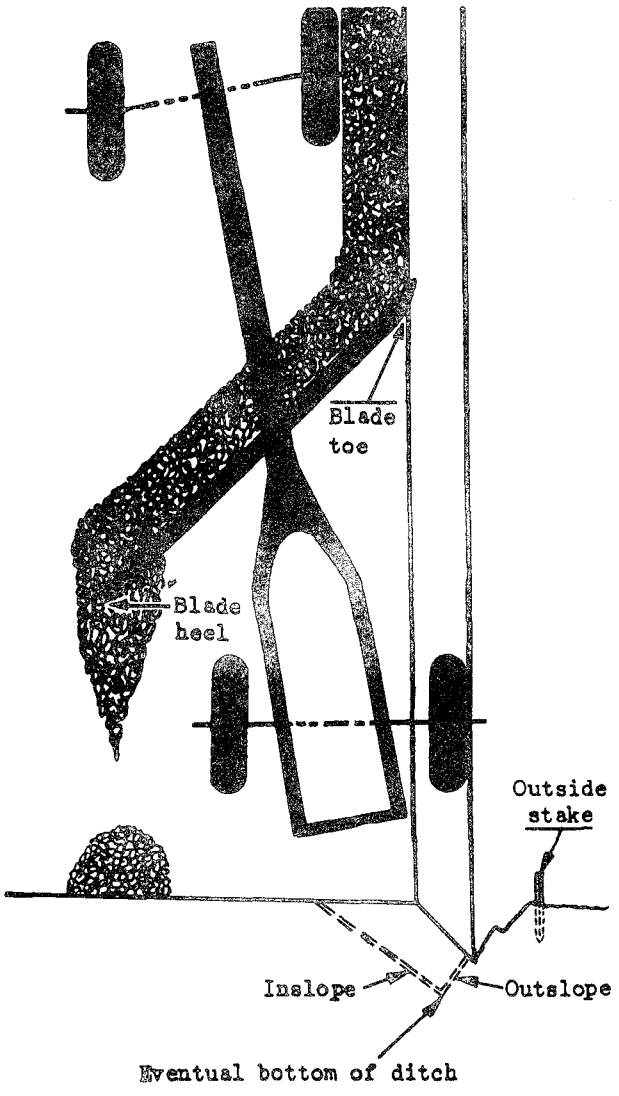
NOTE: All consecutive ditch cuts are made in the same fashion as shown. Remember, as ditch progresses deeper, the point of blade must follow the dotted line to eventual shape of the ditch slopes and bottom of ditch. This means that when another ditch cut is made, both front and rear wheels must be positioned a little further to the left in order that the toe of the blade can cut and follow the dotted line to the eventual bottom of the ditch.

6. CUTTING WET DITCH.

When there is water in the ditch, steer the grader with rear wheels offset, as shown in the above photo.

This places all rear wheels on solid footing and permits the use of full engine power and capacity of the grader on this type of ditch work. Also cleaning old ditches having overhanging rock ledges, trees, and etc.

Steering the grader as shown, positions the cab away from ledge or obstruction.



The third pass or windrow move-over is always the most difficult for any but the Austin-Western All-Wheel Drive and All-Wheel Steer power grader, due to the side load on the heel of the blade affecting the course of the wheels.

To perform this operation, proceed as follows:

1. Steer rear wheels, lever (7), to maximum, toward the blade toe.

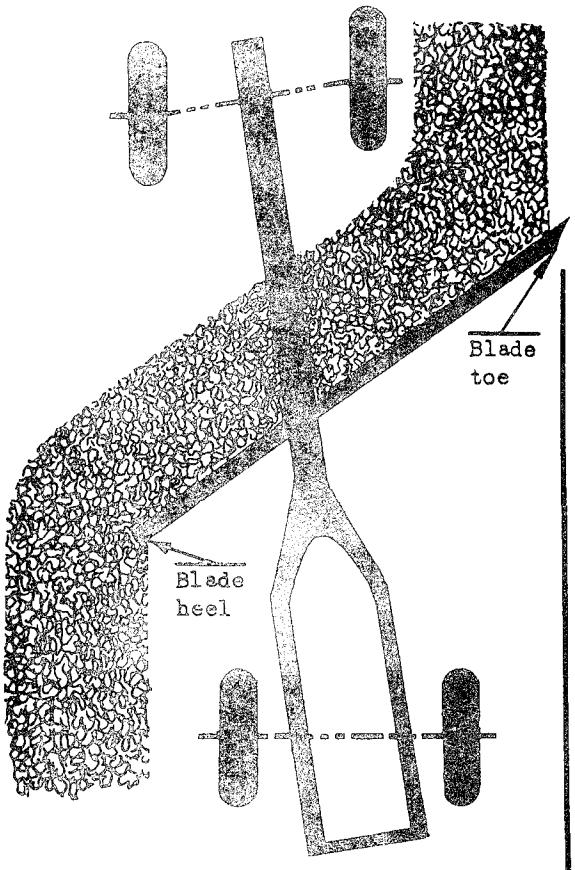
2. Rotate circle, lever (2), and shift the moldboard sideways, lever (4), sufficiently to reach the windrow.

3. Steer the grader offset, levers (6) and (7), as shown, with both front wheels missing the windrow.

4. All consecutive windrow move-over passes near the ditch or crown of the road are made in the same fashion; namely, both front wheels on one side of the windrow and all rear wheels on the other side. The job will be finished quicker if this is done because the full engine power is used effectively.

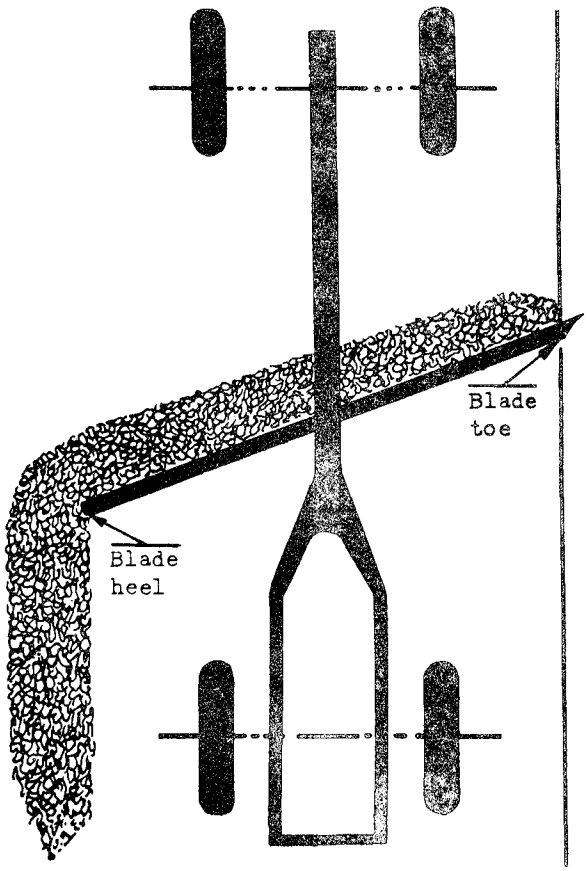
7. THIRD PASS, OR WINDROW MOVE-OVER.

8. WINDROW MOVE-OVER IN BLOW SAND.

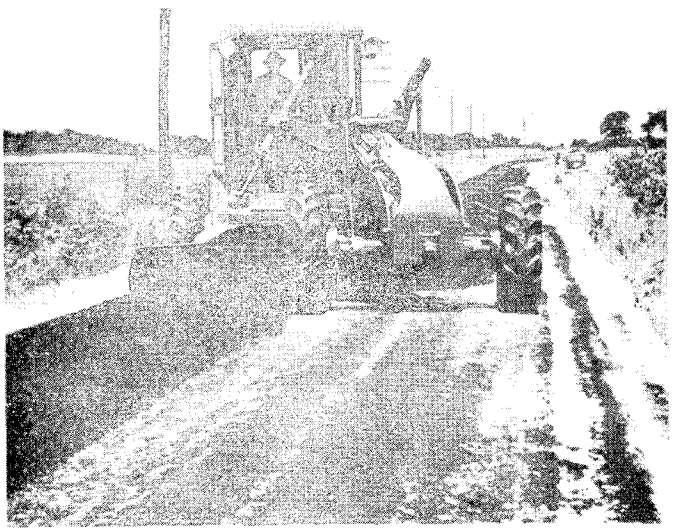


1. Steer rear wheels, lever (7), to extreme, toward blade toe.

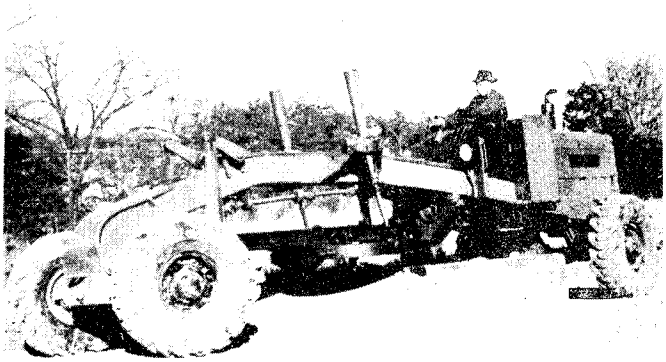
2. Rotate circle, lever (2), and side shift, lever (4), to suit conditions, approximately as shown. Guide grader with front steer, lever (6), missing windrow with both front and rear wheels.



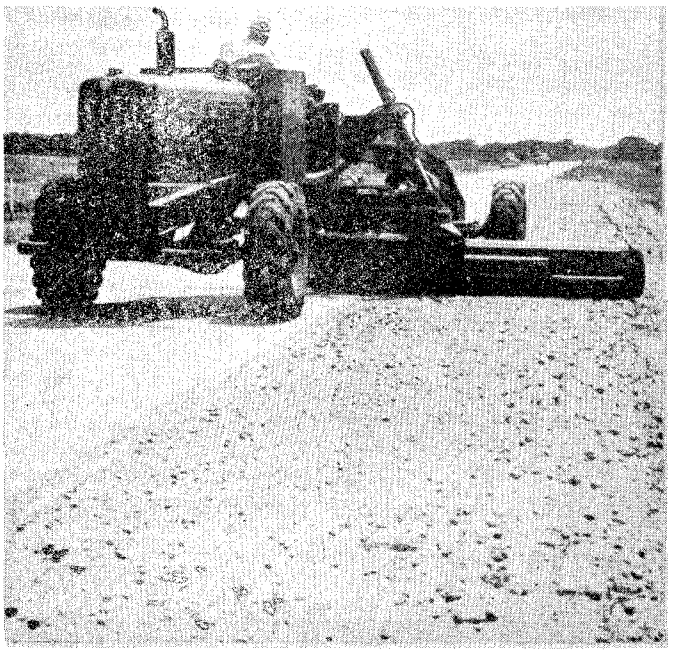
The above shows wheel and blade adjustment for conventional maintenance operation.

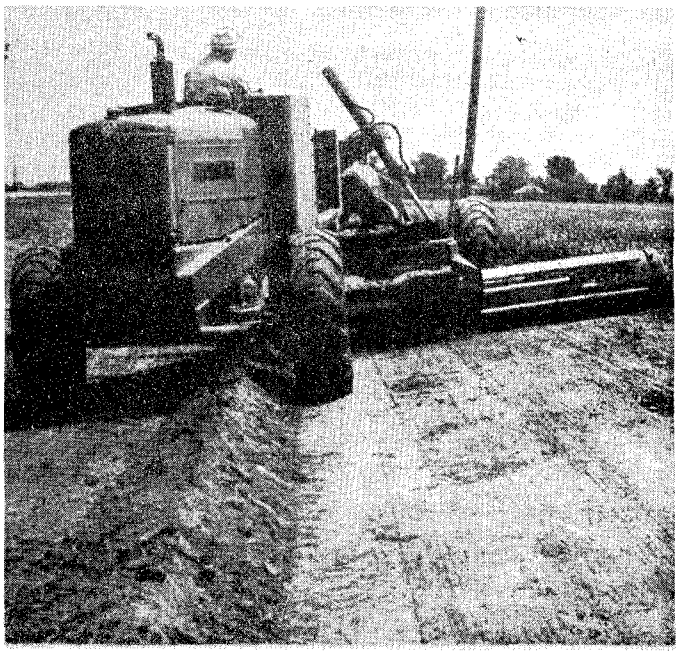


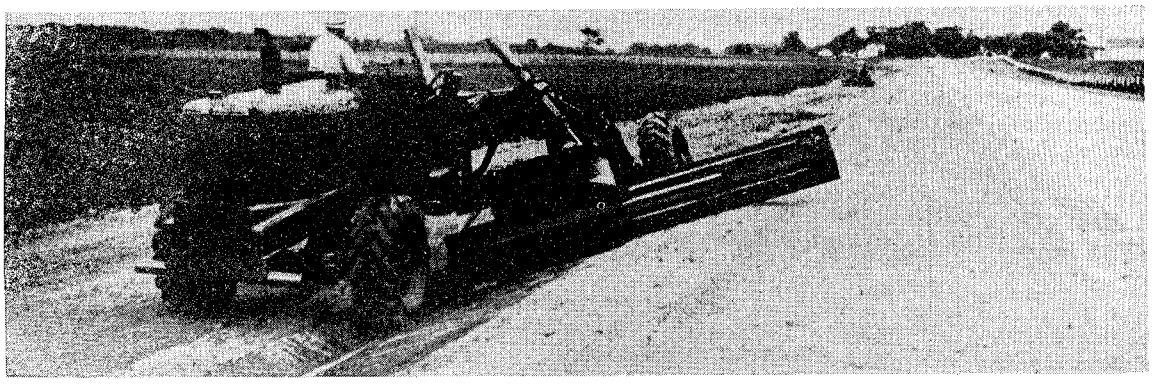
9. HANDLING OIL-MIX, OR HEAVY MAINTENANCE.



10. CONVENTIONAL MAINTENANCE.







Extreme wide reach for finishing shoulders, slopes, etc., leaving no tire marks.

1. Moldboard is side shifted, lever (4), as far as it will go.

2. Circle side shift ram piston rod, lever (5), is retracted to position the circle to the extreme right side.

3. Rear Wheels are steered, lever (7), to extreme, toward heel of blade.

4. Drive machine by using front steer, lever (6).

5. Circle may be rotated, lever (2), to give desired cutting angle on moldboard, and also adjusted so windrow of material is deposited just inside of rear wheel as shown.

11. WIDE REACH, OR RESLOPING OF GRADE SHOULDERS.

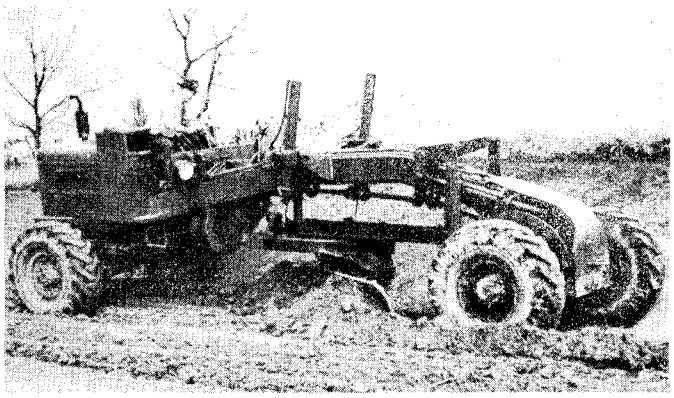
12. FLAT BOTTOM DITCH.

Circle side shift ram piston rod, lever (5), is almost fully retracted. Circle can be rotated, lever (2), to suit different width flat bottom ditches. Precaution must be taken not to foul moldboard into tires, transfer case, and guard.

13. GRADING IN REVERSE "BETWEEN FORMS."

The fully reversible blade and rear steer are an ideal and very practical combination when operating and steering the grader while blading in reverse. The reason for this is because the front wheels are not steered; instead, the operator steers the grader by using the rear steer control. Since he is looking back, it naturally follows he can steer the rear end of the grader much easier than by using the front steer control.

Both rough and finish grading between forms and grading dead end streets, is work which lends itself to the reverse grading feature of the A-W power grader.



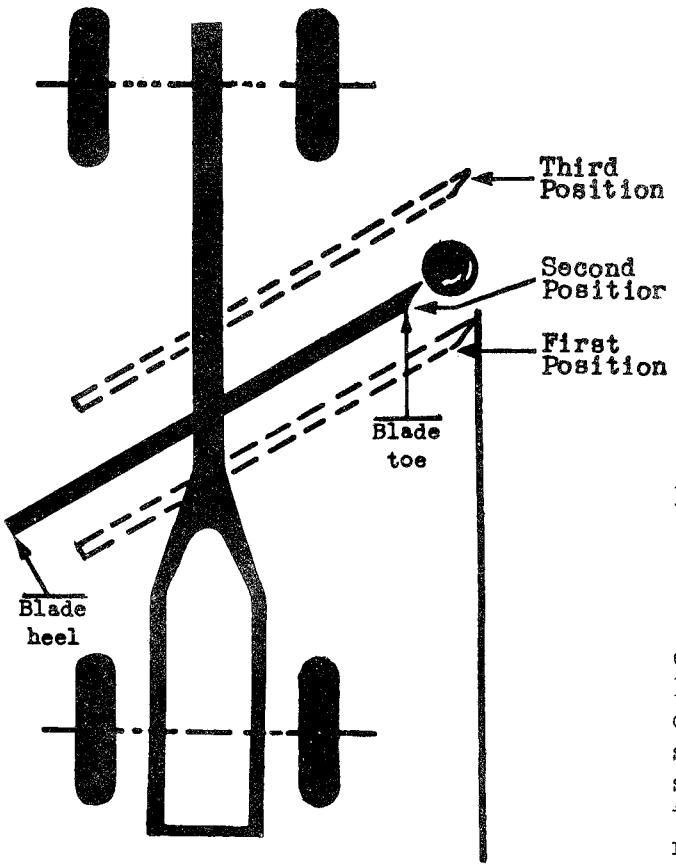
14. GRADING IN REVERSE.

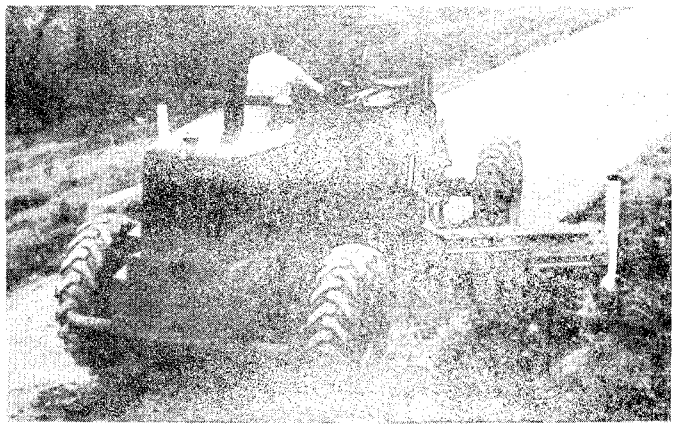
(Full Reversible Circle)

1. Moldboard may be reversed, lever (2), with scarifier on the machine, by rotating the circle clockwise when machine is set up for right side high lift. (Anti-clockwise when set up for left side high lift). The reverse procedure is used to get moldboard back into forward position again.

2. Moldboard is side shifted, lever (4), so end of it just clears back side of scarifier block. The circle should be on a level with the machine both fore and aft, as well as sideways, in which position cutting edge is clearing ground approximately 2 inches. Caution should be taken not to foul tires and transfer case guard.

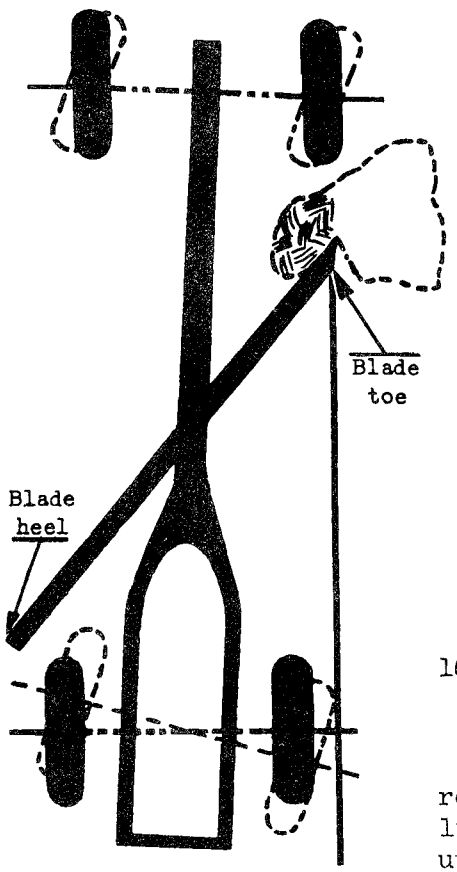
3. Use rear steer, lever (7), for guiding machine when grading in reverse.

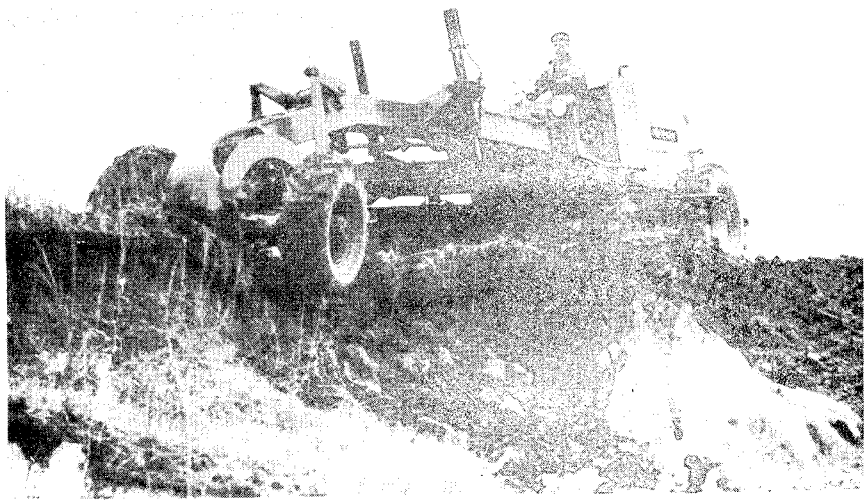




15. GRADING CLOSE TO AN IMMOVABLE OBJECT.
(See photo above and illustration to left)

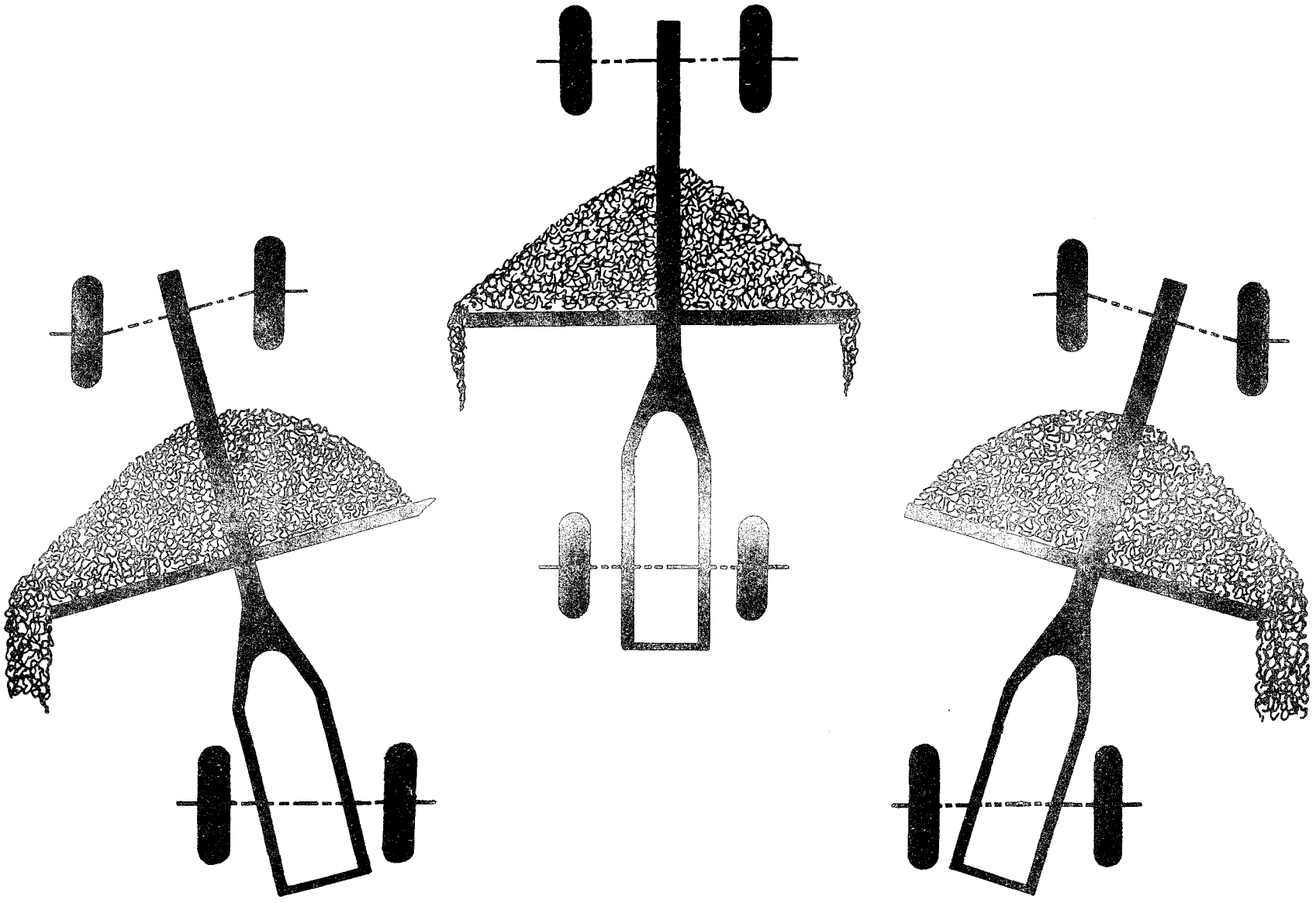
The moldboard can be either extended or retracted, side shift lever (4), without leaving the "floor", and "grade" maintained close to obstructions. Ditch lines can be straightened with ease. This operation saves hand labor finishing time because the blade can cut right up to the guard rail, post, or bridge abutment. The grader is momentarily stopped and blade shifted hydraulically sideways without the operator leaving his station. Grader is then moved forward and blade shifted outward at once to full grading width.





16. BACKING OUT.
(See photo above and illustration to left)

When obstructions are encountered, steer front and rear wheels, levers (6) and (7), as shown by dotted lines. Shift into reverse, lever (14), and slowly back up. The machine will move sidewise as it goes backwards away from obstruction or out of the ditch.



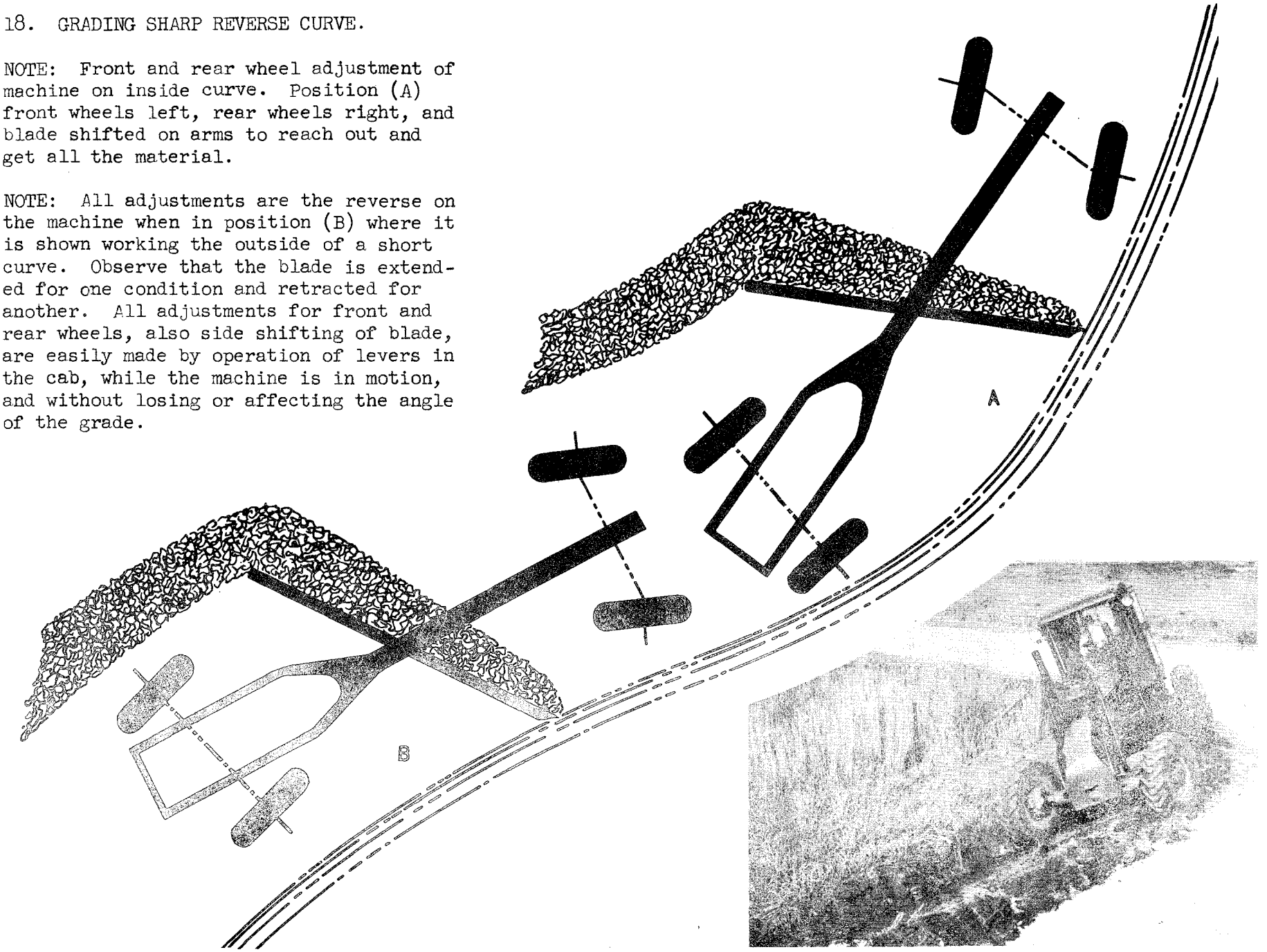
17. CUTTING HIGH AND FILLING LOW PLACES.

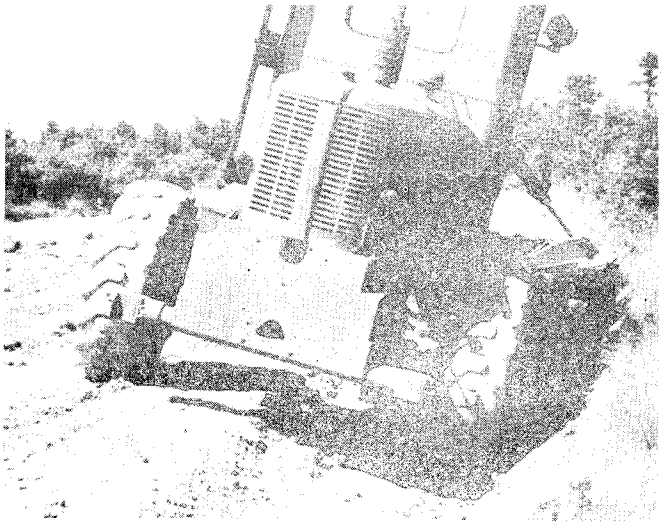
This operation is performed easiest by setting the blade square across the frame and controlling the "drifting" by adjusting the rear wheels to suit. The rear wheel adjustment responds to a valve in the cab. It is simple and easy.

18. GRADING SHARP REVERSE CURVE.

NOTE: Front and rear wheel adjustment of machine on inside curve. Position (A) front wheels left, rear wheels right, and blade shifted on arms to reach out and get all the material.

NOTE: All adjustments are the reverse on the machine when in position (B) where it is shown working the outside of a short curve. Observe that the blade is extended for one condition and retracted for another. All adjustments for front and rear wheels, also side shifting of blade, are easily made by operation of levers in the cab, while the machine is in motion, and without losing or affecting the angle of the grade.



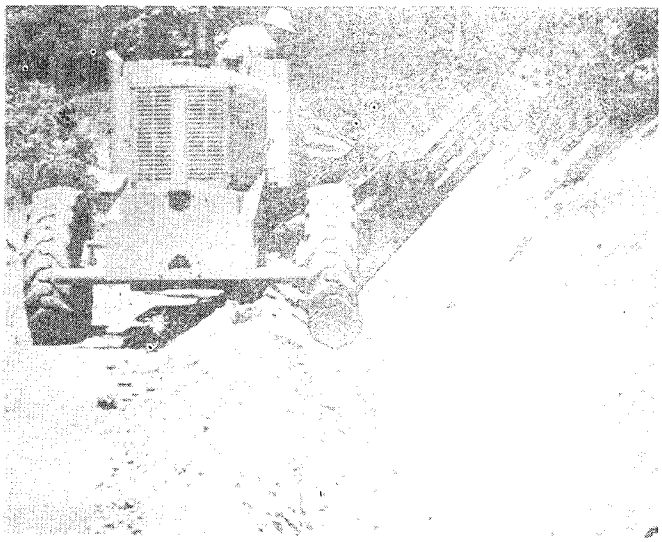


19. GRADING THE OUTSLOPE OF A LOW BANKED DITCH.

All-Wheel Steer makes it possible for all wheels to drive on smooth ground.

The rear drive wheels are steered to the right sufficiently to permit the right rear wheels to drive and ride the bank slightly. Most of the windrow passes to the left side of the right rear tires, and therefore the operator finds he can finish the complete outslope job quicker and better.

The front drive wheels are steered and drive on smooth ground also, as shown. The toe of the moldboard is turned down in order to grade near the fence line.



20. HEAVY GRADING OF HIGH BANK SLOPES.

a. As shown in the above photo, the right front wheel is riding the smooth bank in order to permit the grader and engine to do its most effective work when heavy or light grading work is to be done. The left front wheel is also driving on smooth ground.

b. The above photo shows the right rear wheels riding the bank slightly. It is driving on smooth ground because the windrow is delivered to the left of it. All wheels effectively travel on smooth ground, permitting the work to be finished in the shortest possible time.

c. The above photo shows the A-W grader sloping a bank. A tremendous cut has been taken off the bank. Heavy cuts of this type are easy work for the A-W grader, for the following reasons:

1. All wheels drive and steer on smooth ground.

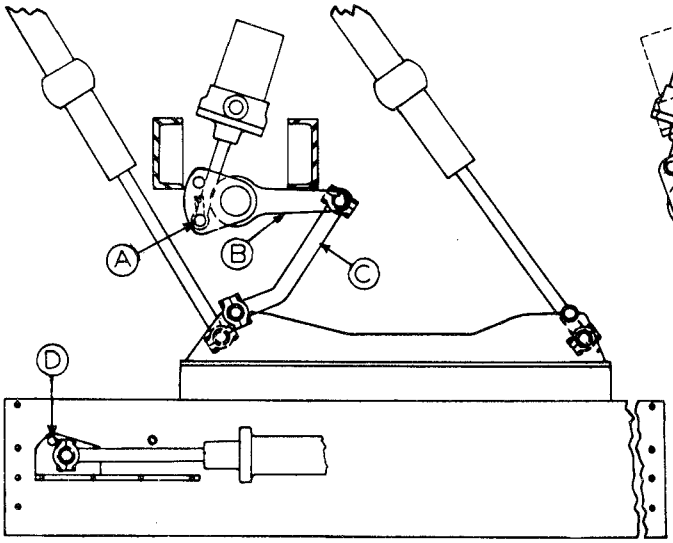
2. The right front wheel is located close to the bank ahead.

3. The grader is steered in the offset position by the All-Wheel Steer. The windrow passes to the right side of the right rear wheels. Hard or soft spots in the bank do not cause the moldboard to first suck into the bank, then push it out of the bank, because both front and rear wheels, together with moldboard, are held into the work by the All-Wheel Drive and All-Wheel Steer.

The surprising feature is that the operator can cut more or can cut less at the bank, as he wishes, by steering the rear wheels only.

NOTE: The front wheels and both right and left blade lift controls at the operator's station, are used but very little when taking heavy or light moldboard cuts from a bank of this kind.

Bank sloping work with an A-W power grader is easily performed and quickly finished.

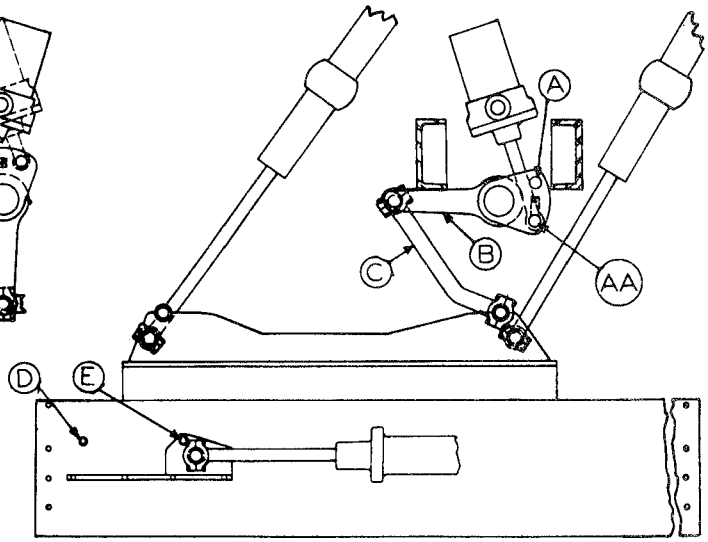


21. RIGHT HAND HIGH LIFT.

Before shipment from the factory, the A-W power graders are assembled with the moldboard and controlling linkage parts in position for right hand operation, as shown in drawing above.

As viewed from the operator's seat, the top of the circle side shift cylinder will be tilted toward the right. The removable pin (A) is located in the lower hole as shown.

Arm (B) is contacting the bottom side of the right frame rail (this is explained on page 51). Link (C), at its lower end, is connected to the trunnion ball located at the left side of the circle cross member (this is shown on page 53). The moldboard side shift bracket (D) is attached with one bolt in the location as shown above.

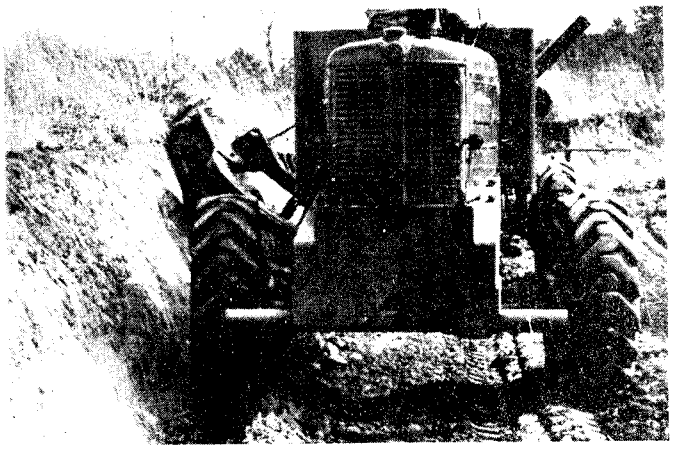


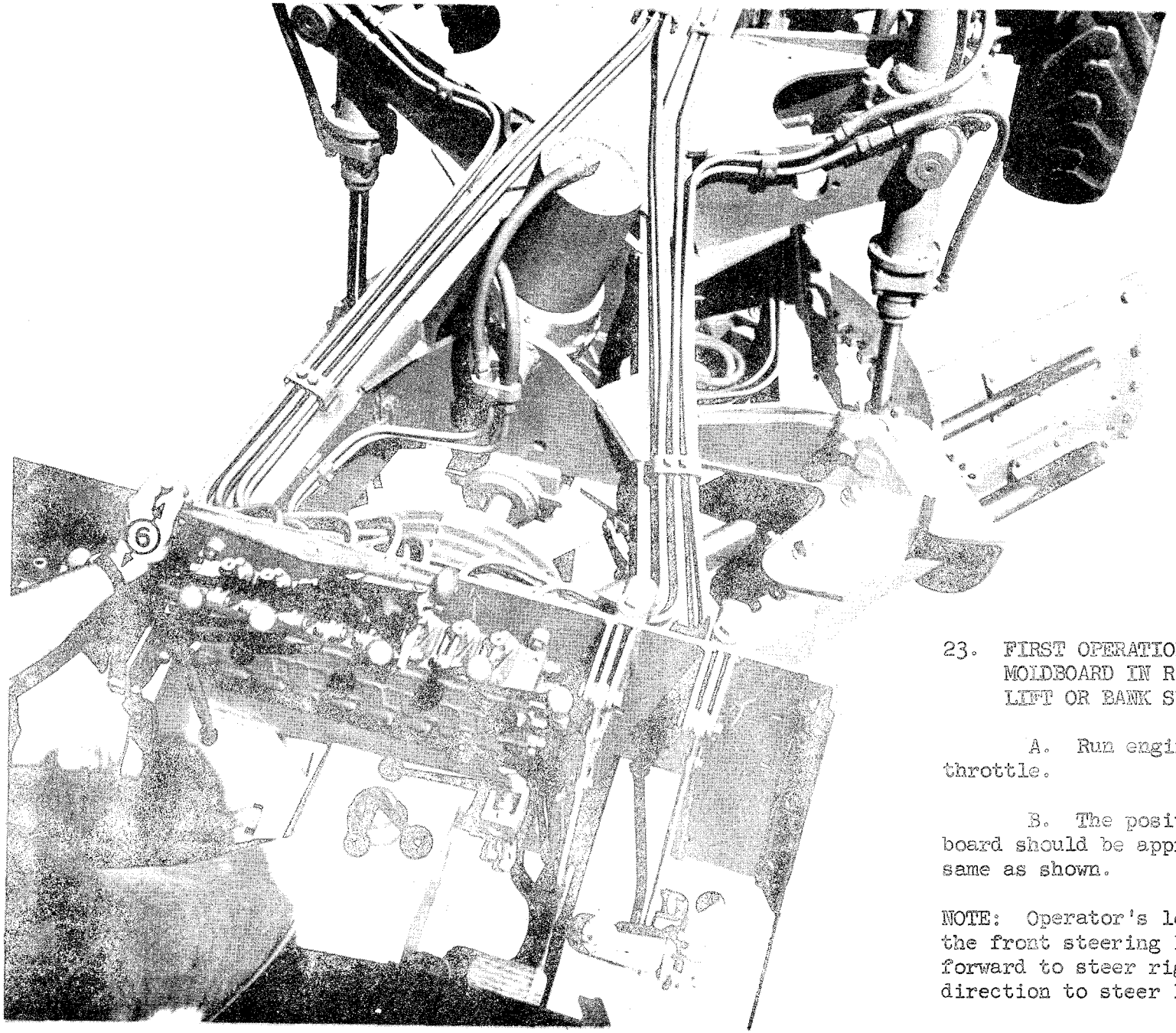
22. LEFT HAND HIGH LIFT.
(See photos below.)

To change from right to left hand high lift operation (drawing above), place the circle directly under the grader, and lower the moldboard to the ground.

Remove link (C) and pin (A). Then swing the piston rod to the right and reinstall the pin into the hole at (AA). Reinstall link (C) as shown, connecting its lower end to the right side of circle. Remove the bracket at (D). Use hydraulic power to side shift the bracket into position, and reinstall the one attaching bolt at (E).

The A-W grader is now mechanically changed over to provide maximum left hand operation, as shown in the two photos below. After some practice, the operator will be able to effectively operate the grader and do the same quality of work as shown in the preceding pages.



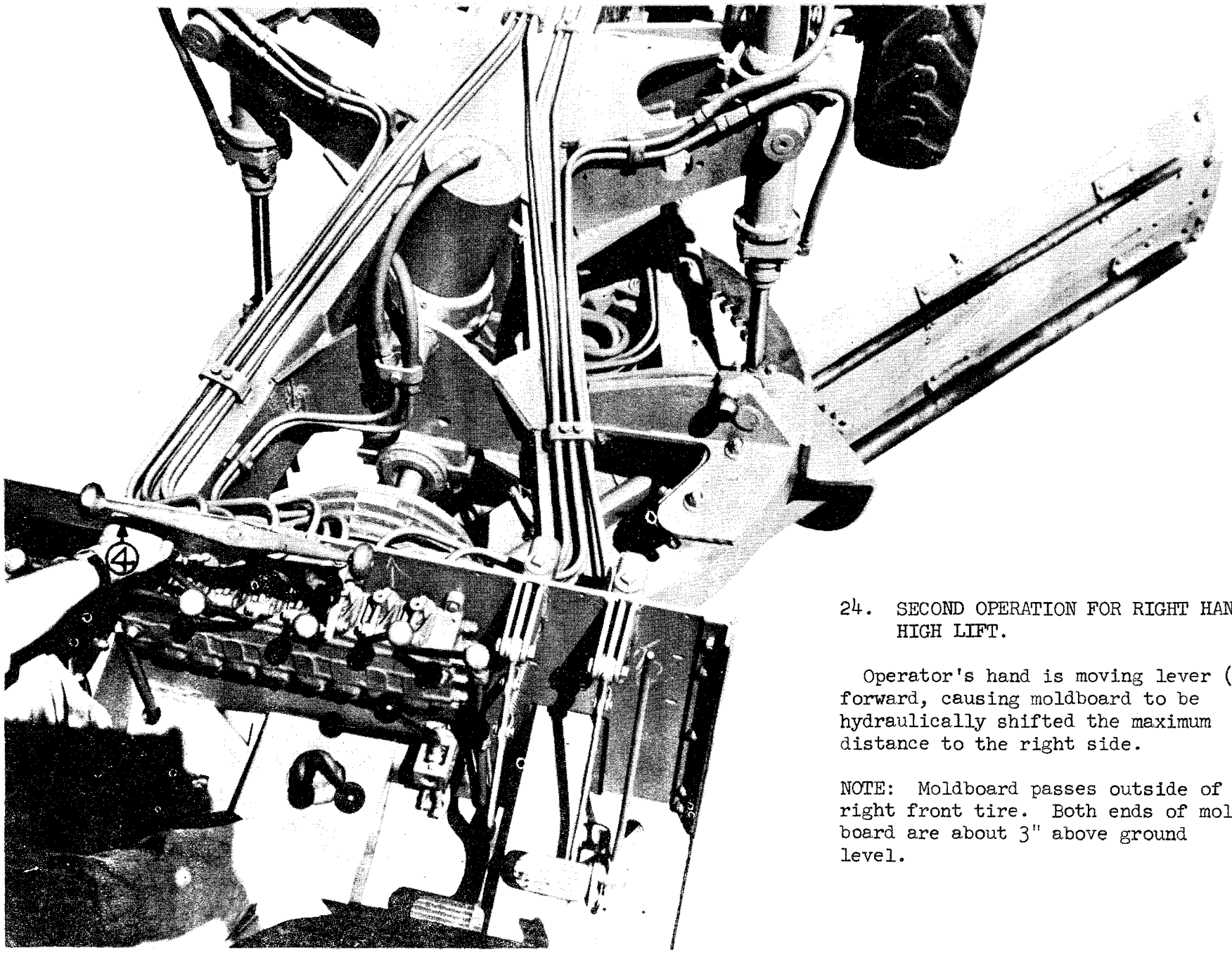


23. FIRST OPERATION FOR PLACING MOLDBOARD IN RIGHT HAND HIGH LIFT OR BANK SLOPING POSITION.

A. Run engine at wide open throttle.

B. The position of the moldboard should be approximately the same as shown.

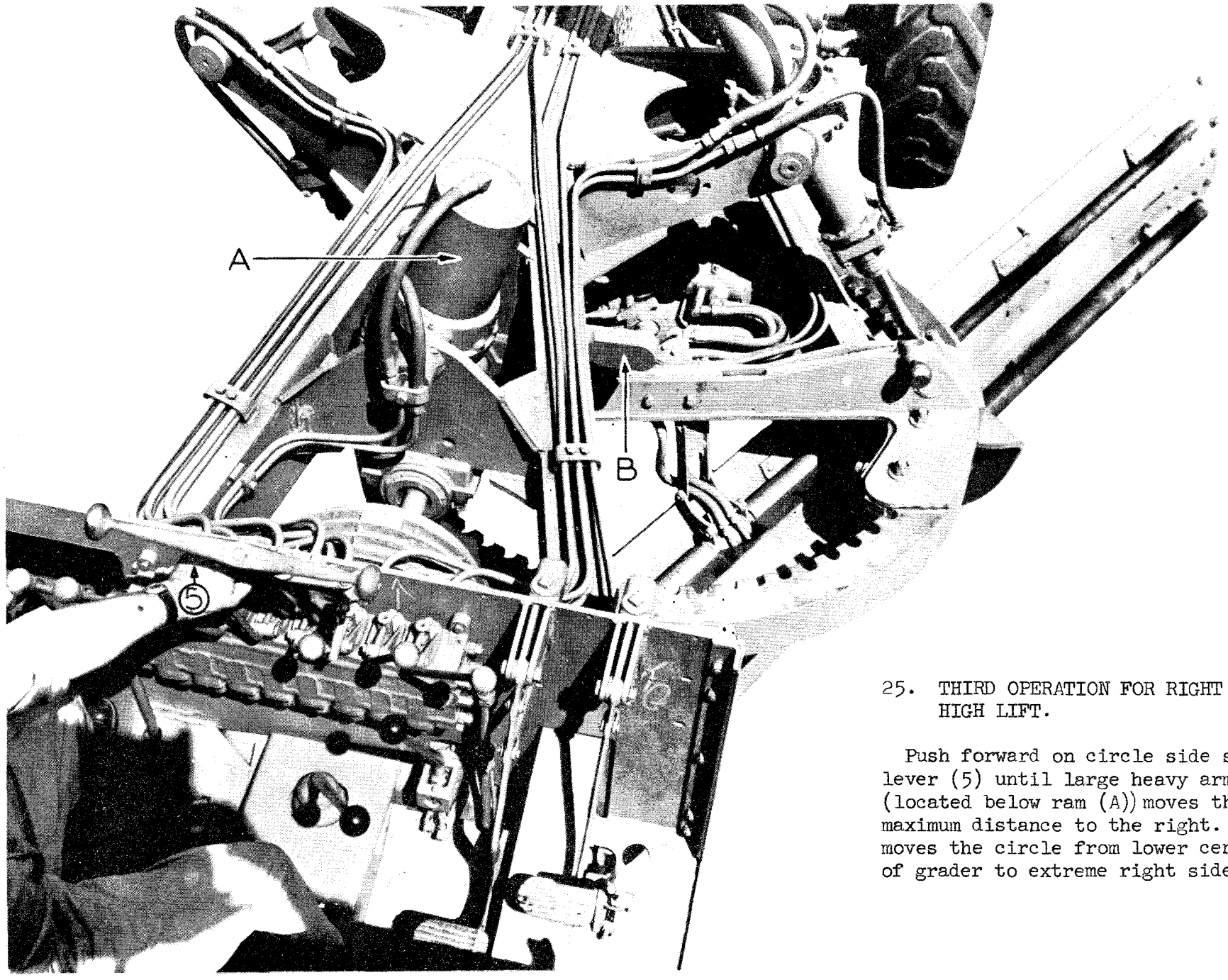
NOTE: Operator's left hand is on the front steering lever (6). (Push forward to steer right; opposite direction to steer left.)



24. SECOND OPERATION FOR RIGHT HAND HIGH LIFT.

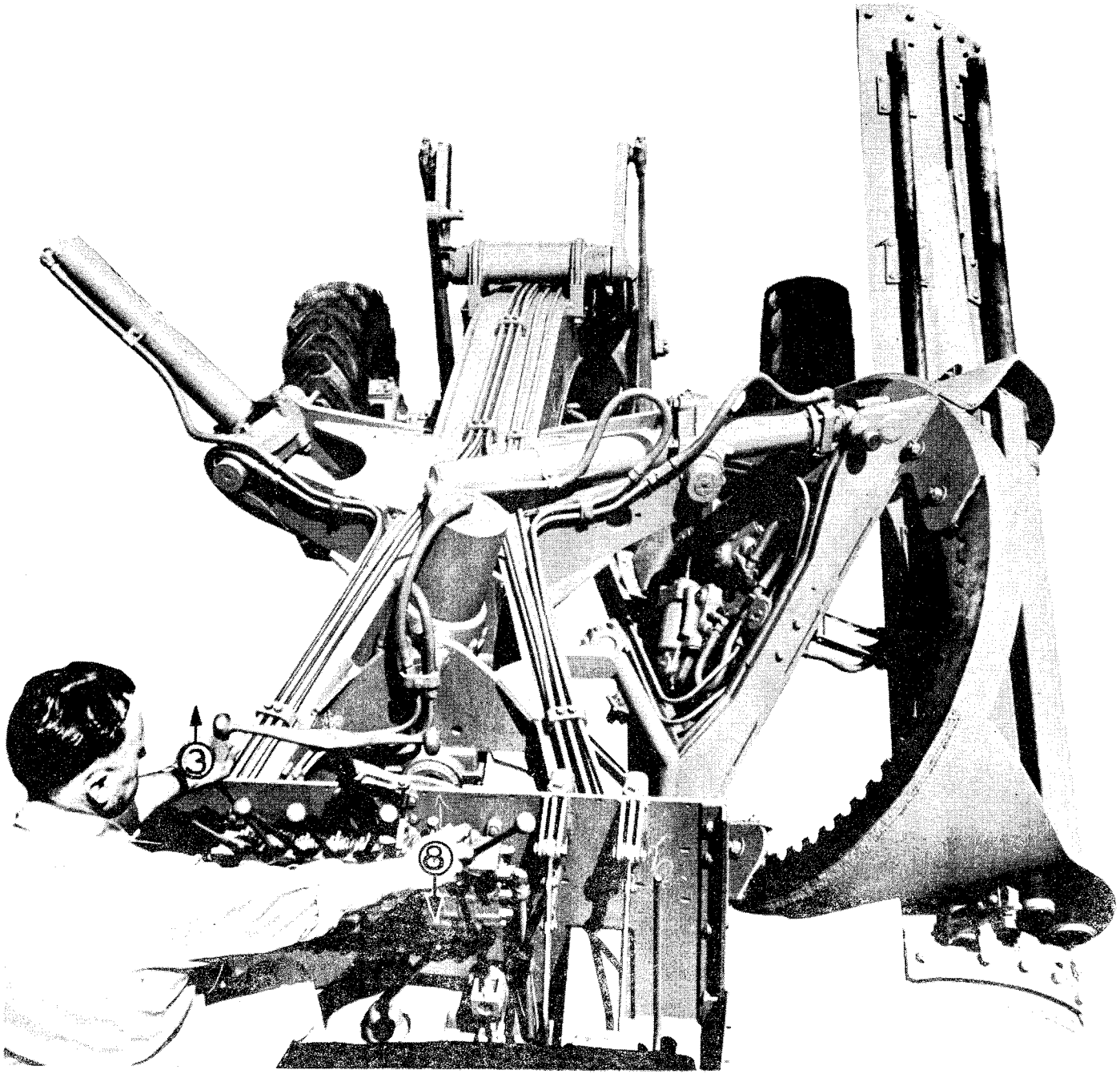
Operator's hand is moving lever (4) forward, causing moldboard to be hydraulically shifted the maximum distance to the right side.

NOTE: Moldboard passes outside of right front tire. Both ends of moldboard are about 3" above ground level.



25. THIRD OPERATION FOR RIGHT HAND HIGH LIFT.

Push forward on circle side shift lever (5) until large heavy arm (B) (located below ram (A)) moves the maximum distance to the right. This moves the circle from lower center of grader to extreme right side.

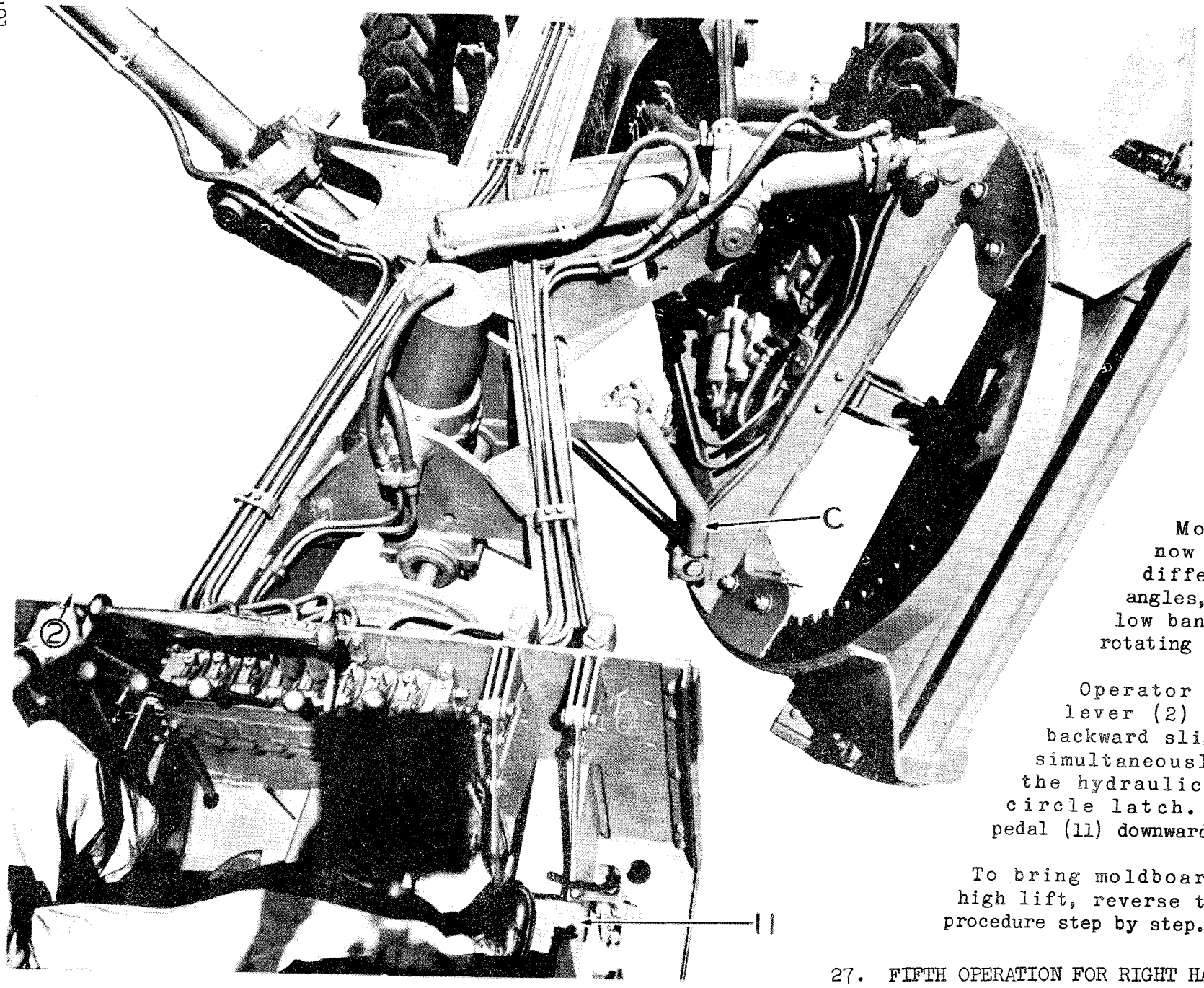


26. FOURTH OPERATION FOR RIGHT HAND HIGH LIFT.

A. Pull back on the right hand blade lift control lever (8).

B. Push forward on the left hand blade lift control lever (3).

This raises the right side of the circle and pushes the left side of the circle downward and outward simultaneously, into the position as shown.

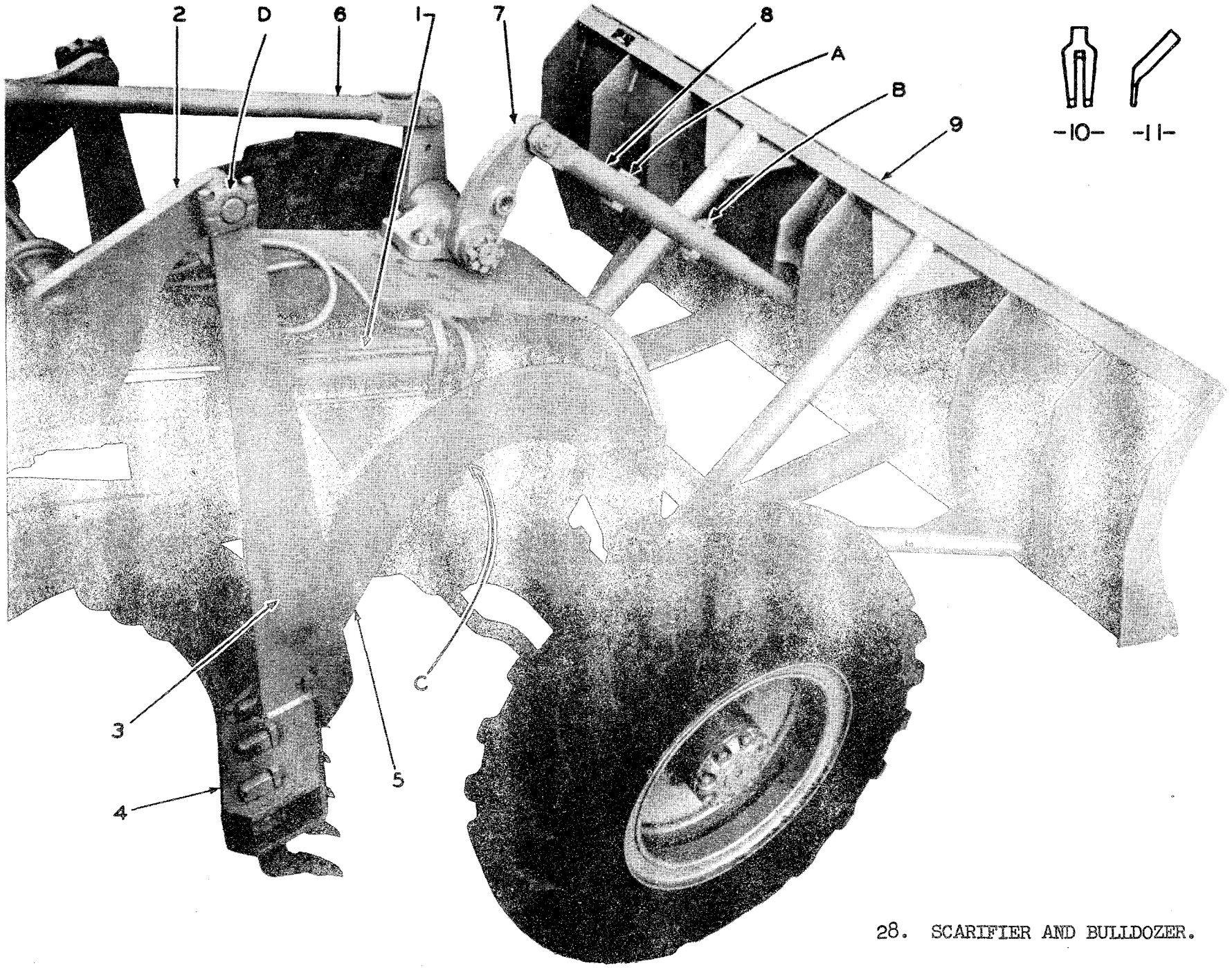


Moldboard may now be placed in different cutting angles, for high and low banks, etc., by rotating circle.

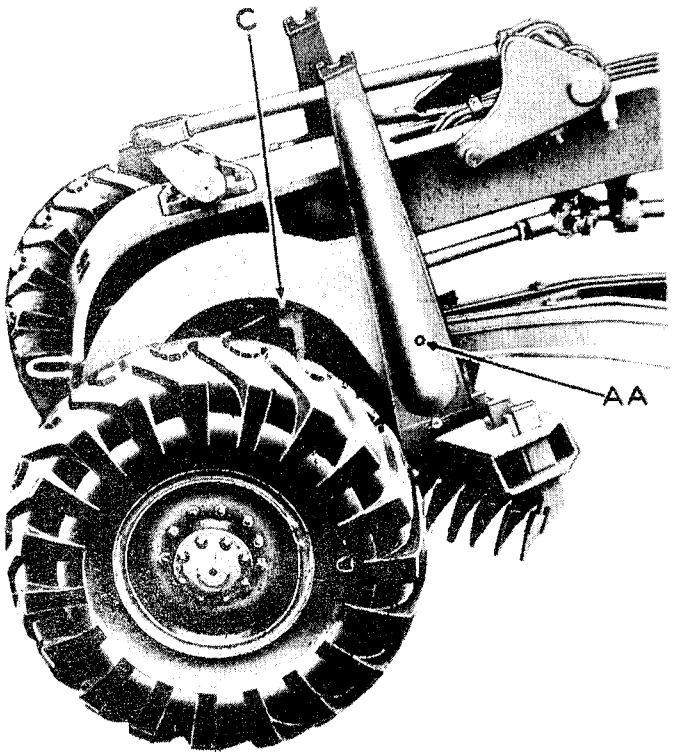
Operator should move lever (2) forward and backward slightly, while simultaneously unlocking the hydraulic controlled circle latch. Push foot pedal (11) downward.

To bring moldboard down from high lift, reverse the foregoing procedure step by step.

27. FIFTH OPERATION FOR RIGHT HAND HIGH LIFT.



28. SCARIFIER AND BULLDOZER.



28. SCARIFIER AND BULLDOZER.
(See page 54)

a. General.

This grader may be fitted simultaneously with both scarifier and bulldozer attachments, parts (1) to (9) inclusive, with hydraulic piping and connections.

NOTE: Lubricate all grease fittings with general-purpose pressure gun grease ("Lithium" type preferred); two strokes of lubricator every 50 hours of operation.

b. To Fit Grader With Scarifier Only.

Parts (1) to (5) inclusive shown on page 54 are required.

c. To Fit Grader With Bulldozer Only.

Parts (1), (2), (6), (7), (8) and (9) inclusive are required.

d. To Operate Scarifier.

The photo on page 54 shows the scarifier block (4) and bulldozer blade (9) in carrying position.

The scarifier tynes will be entered into the ground when the scarifier hydraulic control lever (9), page 7, at operator's station, is pushed ahead. The tynes are raised when the lever is pulled back. With pin (A) in upper hole of the telescopic tube (8), the bulldozer blade will not contact the ground.

Tynes may be raised or lowered in block (4), after first removing the wedges with driver (11). If engine cannot pull a full set of tynes, remove the necessary and same number of tynes from both sides of the scarifier block. (The remaining tynes should be centered in the block.) Keep on removing tynes until the engine can pull the load.

When not using scarifier, remove all tynes. Proceed as shown in the following paragraphs; (1), (2), (3) and (4).

If scarifier teeth become worn or broken they may be easily replaced without removing tyne. Tooth driver (10) is provided with each scarifier attachment.

e. To Operate Bulldozer.

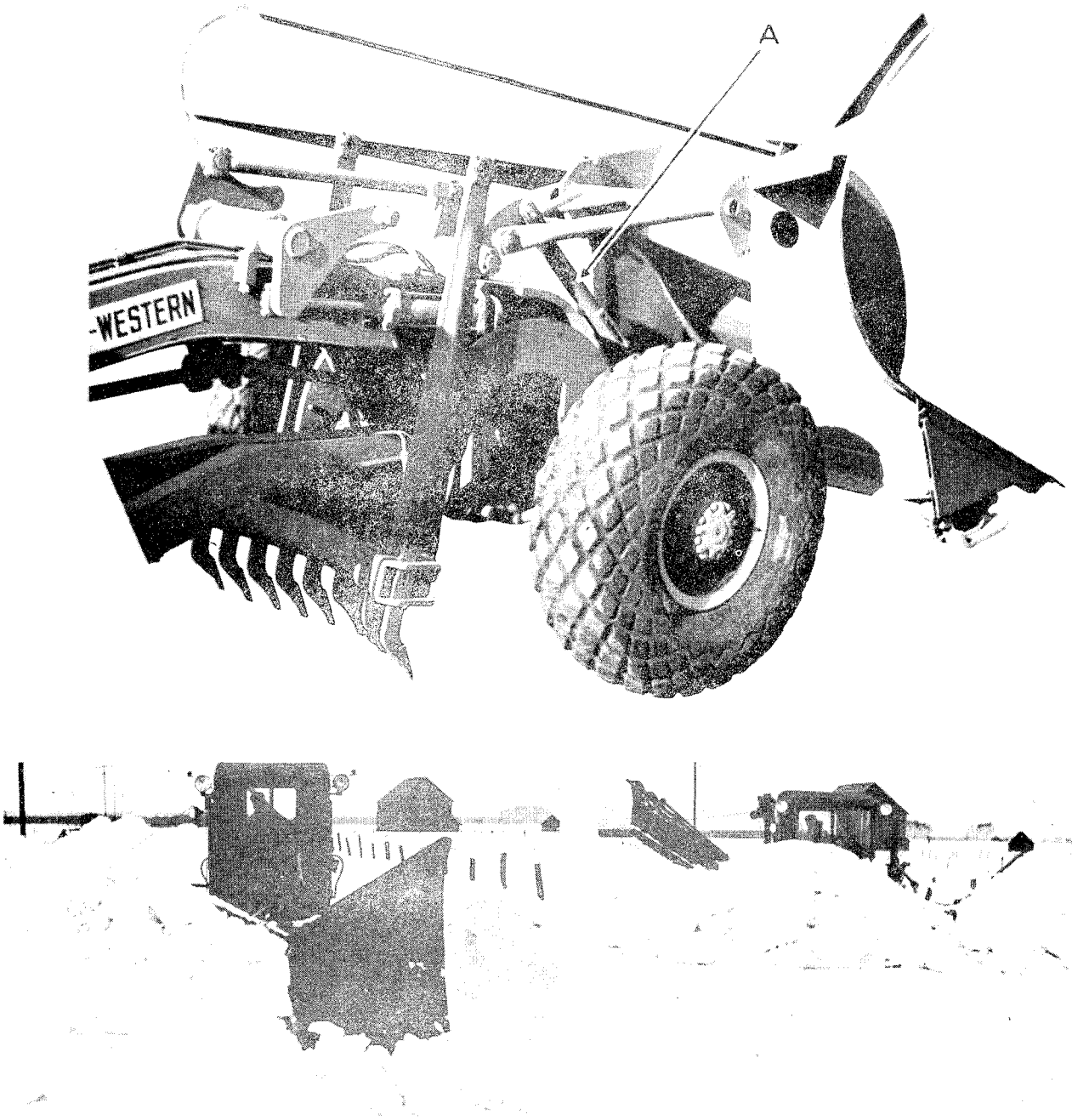
1. To change over from scarifier to bulldozer operation, turn outward both scarifier draft beam support levers (C), page 54. (One on each side of grader.)

2. Lower the scarifier draft beams against the levers (C).

3. Remove both right and left arm ball caps (D).

4. Raise the bulldozer blade (9). Swing the arms (3) ahead and lock them to the draft beams (5) by use of bolt as shown at (AA) above.

5. Lower the bulldozer blade (9), page 54. to the ground, then remove pin (A). With hydraulic control, move tube (8) back sufficiently to enter pin into hole position (B). The bulldozer blade (9) may now be used effectively.



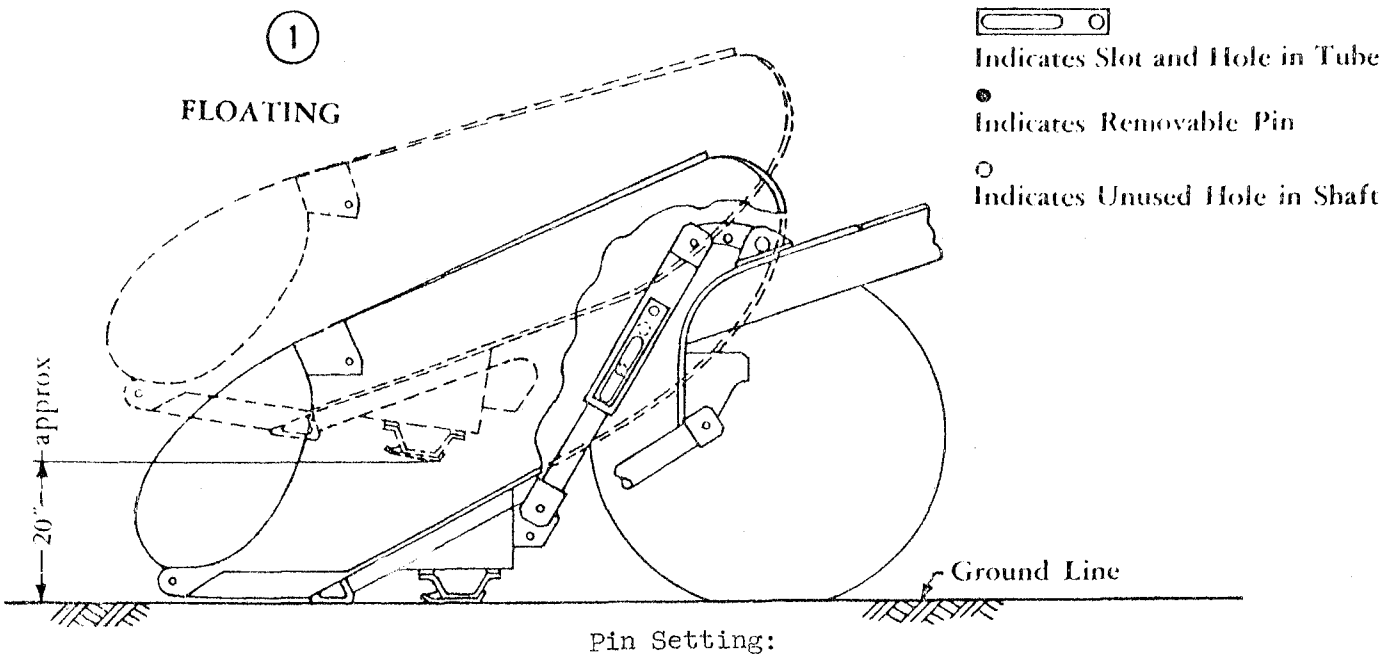
29. GIANT "V" SNOW PLOW.

The parts groups (1), (2), (6) and (7), page 54, must be on the grader in order to attach and operate the giant "V" plow attachment.

A pin through the slotted hole in the telescopic tube (A), shown above, is provided in order that the giant plow may float over rough ground.

The amount of float of the "V" plow is hydraulically controlled by the operator while in the cab. Actually he can operate the hydraulic controls to force the "V" plow cutting bit into the ground when plowing hard snow. This happens when the pin reaches the lowermost point of the slot in telescopic tube (A).

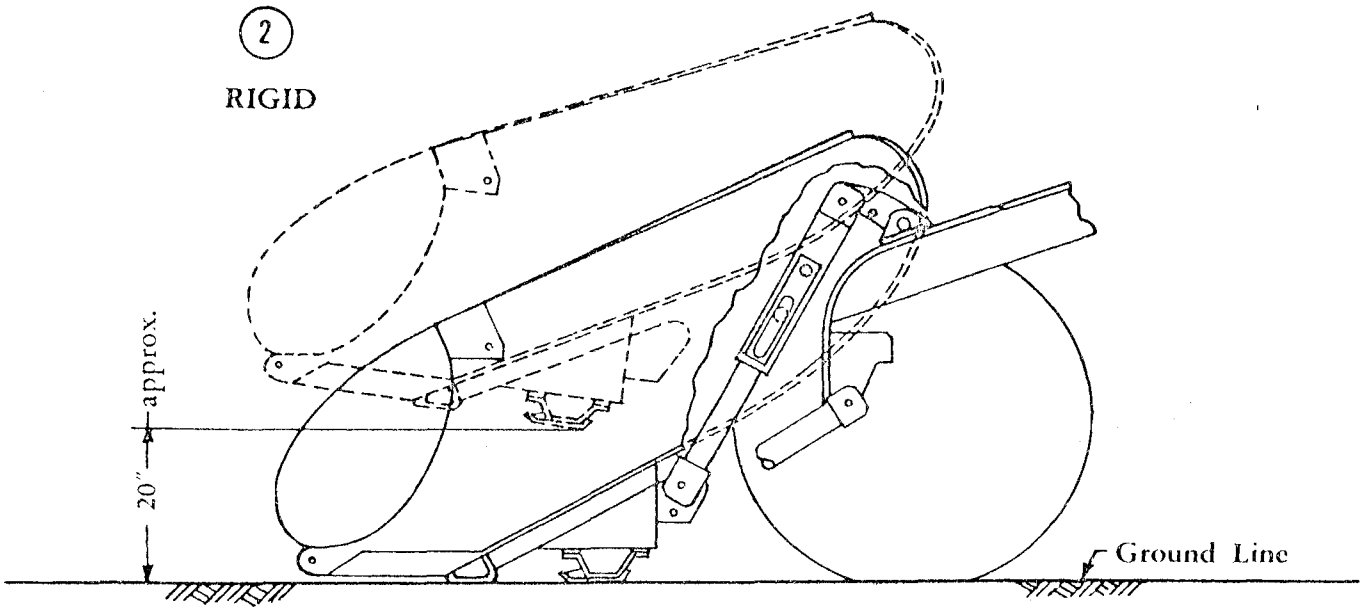
NOTE: Lubricate all grease fittings with multipurpose pressure gun grease ("Lithium" type); two strokes of lubricator every 50 hours of operation.



Pin Setting:

Pin is inserted thru tube slot and inner shaft hole.

This setting provides floating action in operating position. Ground clearance, with plow lifted, is approximately 20 inches. When ram is at end of stroke, with plow on ground, blade can float up 7 inches approximately and down 2 inches approximately.



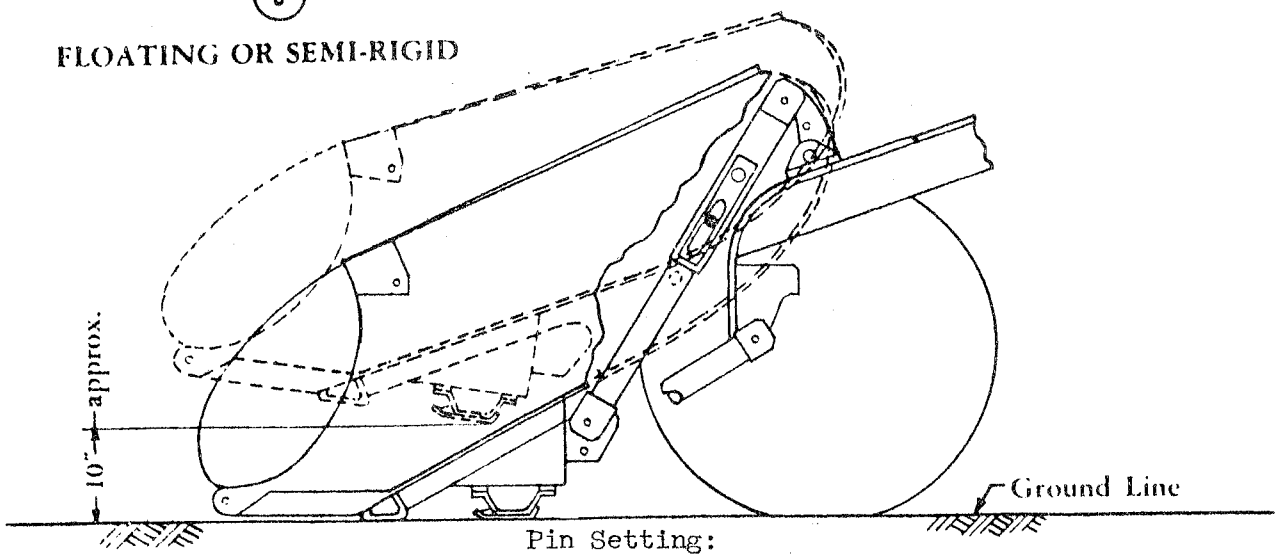
Pin Setting:

Pin is inserted thru tube hole and outer shaft hole.

This setting provides rigidity in operating position. Ground clearance, with plow lifted, is approximately 20 inches. Cut below grade is approximately 2 inches.

(3)

FLOATING OR SEMI-RIGID



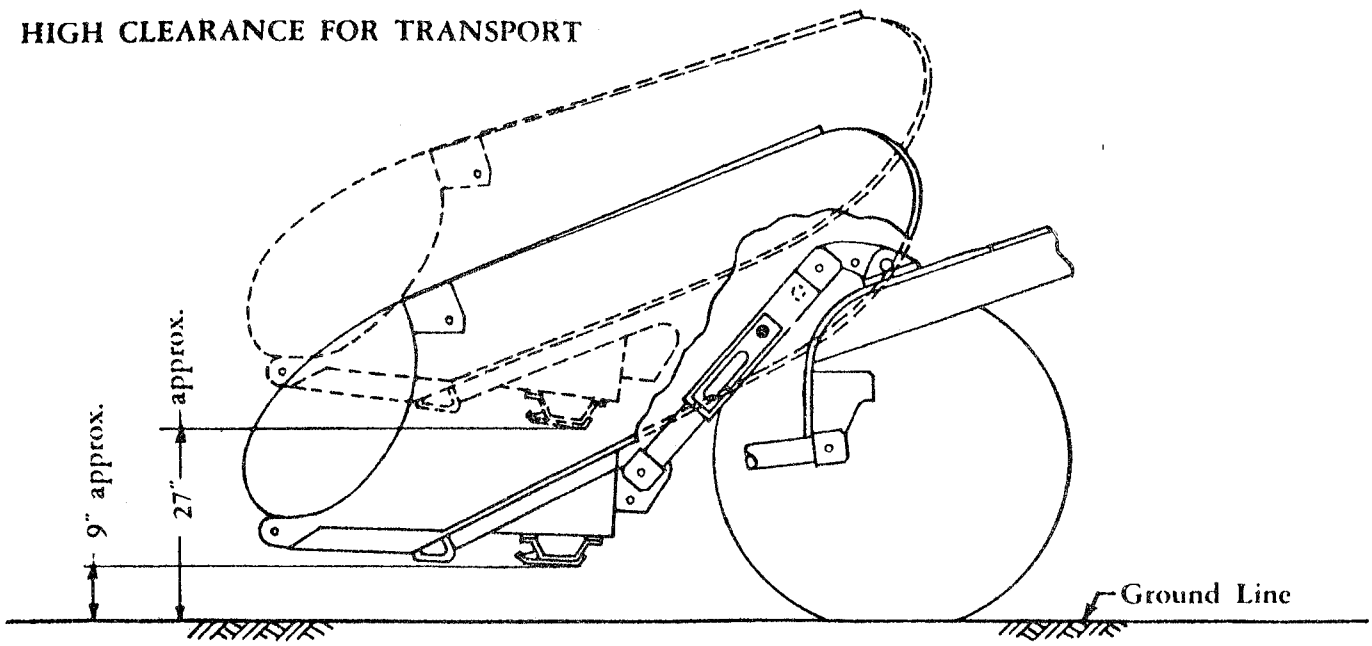
Pin Setting:

Pin is inserted thru tube slot and outer shaft hole.

This setting provides the same type of floating action as shown in #1 diagram. Sufficient ram stroke remains to hold the plow rigidly against the work, permitting downward float only. Ground clearance, with plow lifted, is approximately 10 inches.

(4)

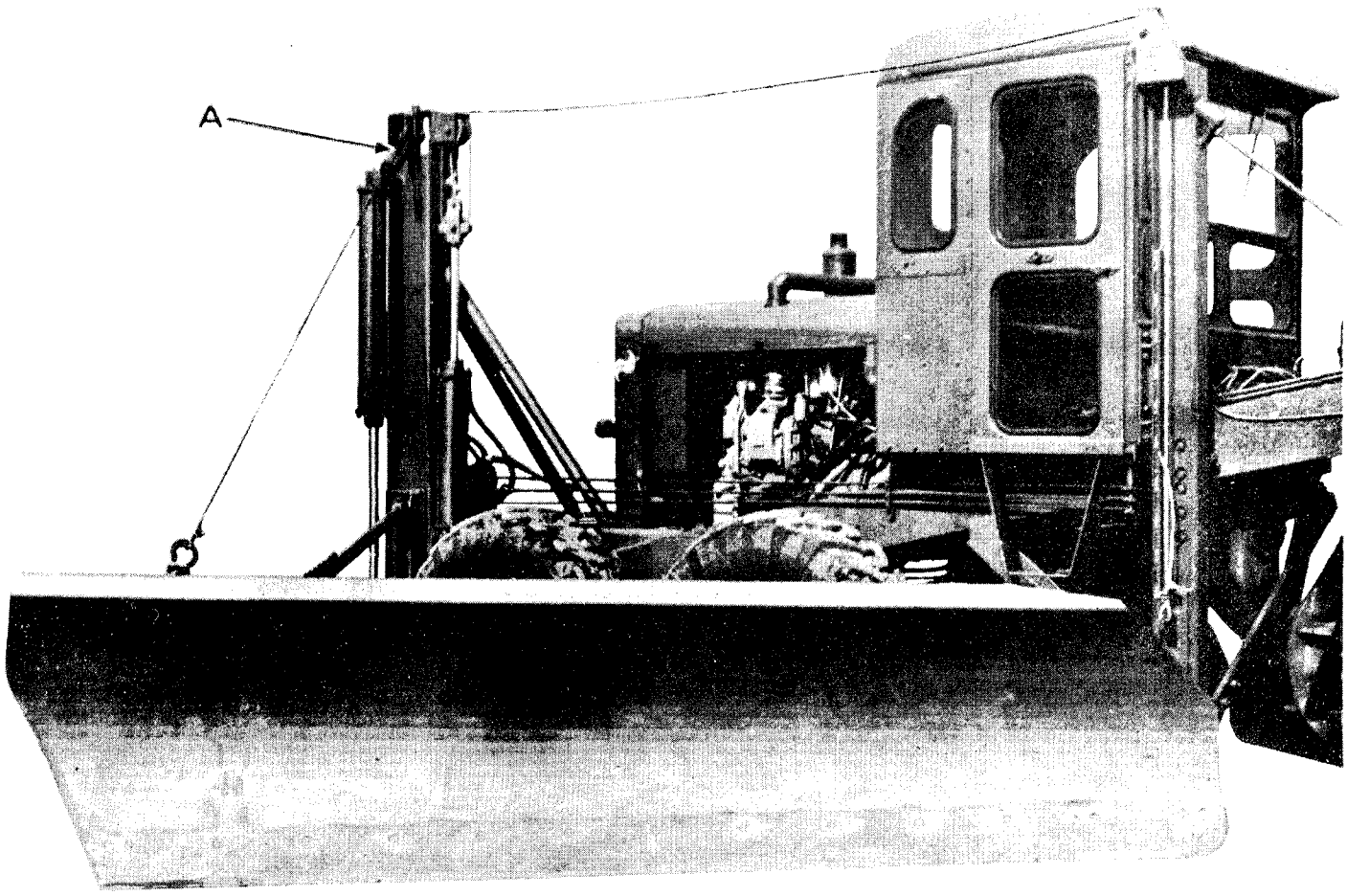
HIGH CLEARANCE FOR TRANSPORT



Pin Setting:

Pin is inserted thru tube hole and inner shaft hole.

This setting provides high clearance for transporting. It is necessary to block up plow to insert pin. Ground clearance, with plow lifted, is approximately 27 inches. Plow cannot be lowered to ground.



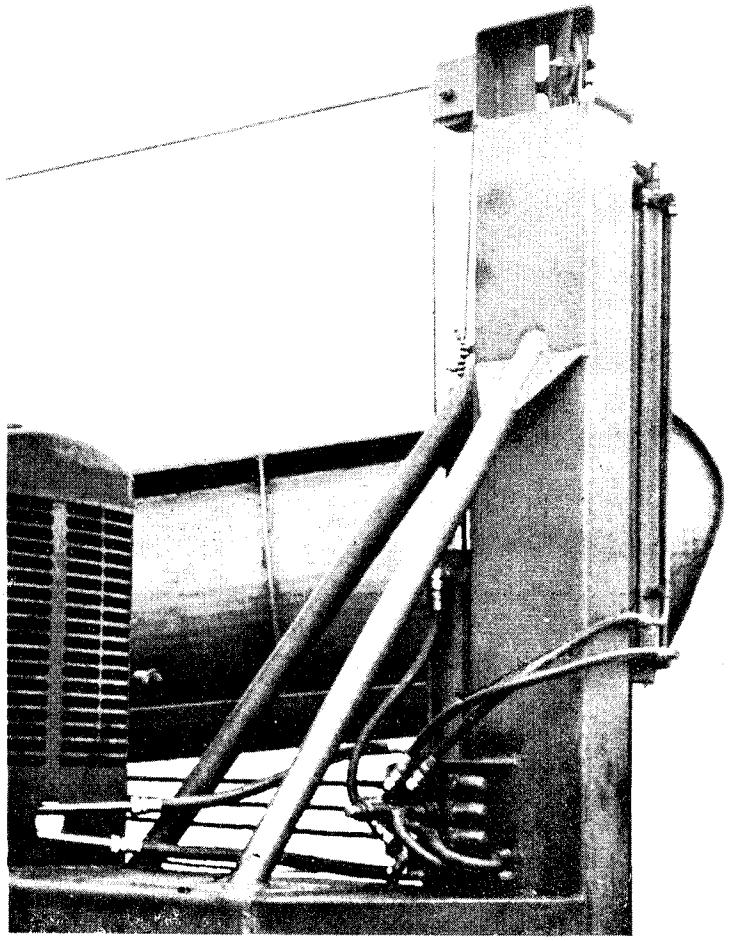
30. SNOW WING.

NOTE: For all operating purposes and intent, the photos, illustrations, and test in this section will apply similarly to either "Pacer" or "Super" graders.

The complete snow wing attachment consists of a rear mast, front bracing, brackets and slide, control mast and wing assembly, all of which can be assembled on the grader in a few hours with common tools. (Each wing assembly has installation instructions included with the unit.)

The snow wing hydraulic system is mounted on the rear mast and need never be removed except for replacement.

Simple hydraulic hose connections to the present grader system are made with equipment provided.



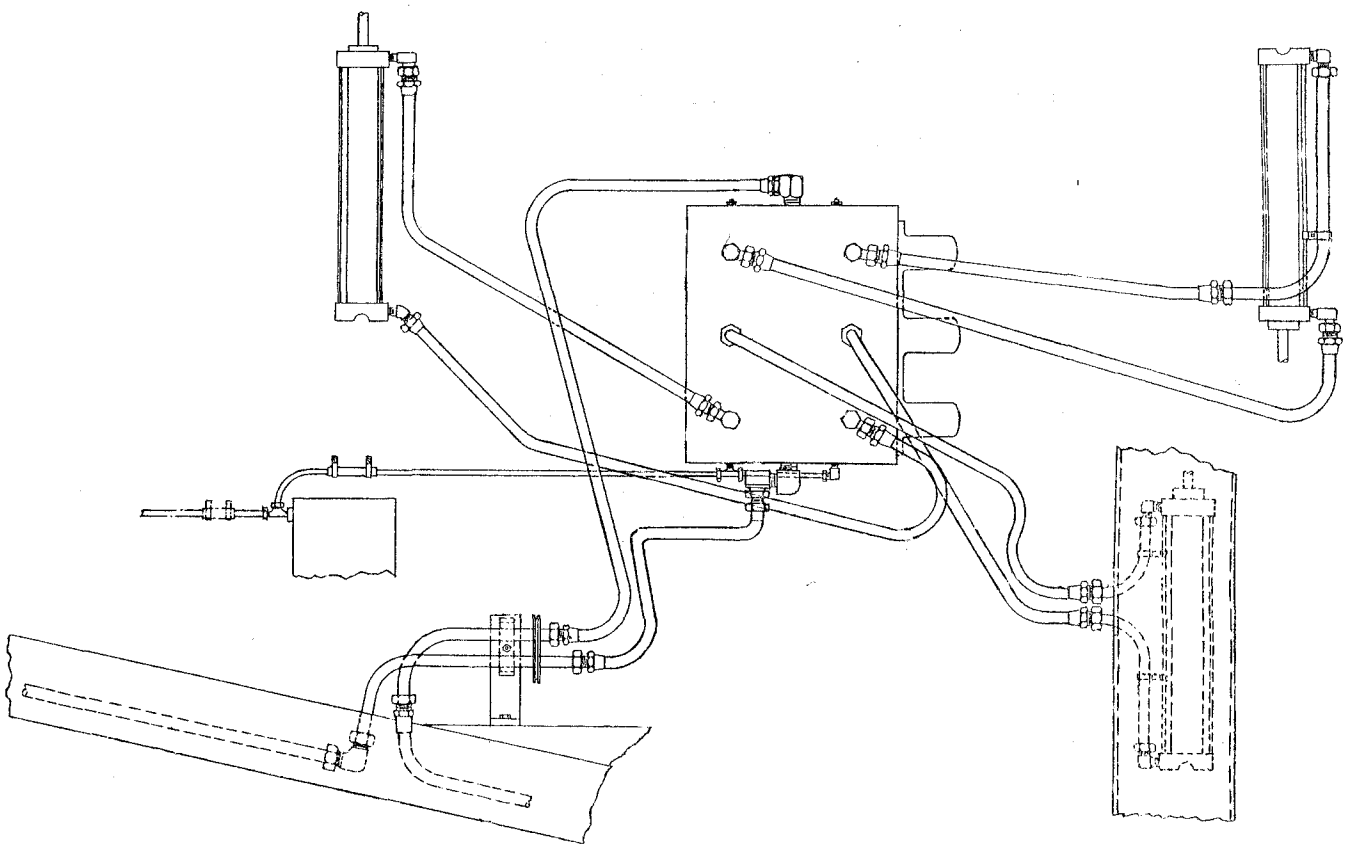
All wing movement is done with cable systems and hydraulic rams, one located inside the rear mast and one mounted on the outside of the rear mast. The base, or inside end, of the push rod assembly is raised and lowered by a hydraulic ram located on the rear mast.

All control handles are mounted on a mast in the right front corner of the cab. Control rods run back to the valve bank from the lower end of the control mast.

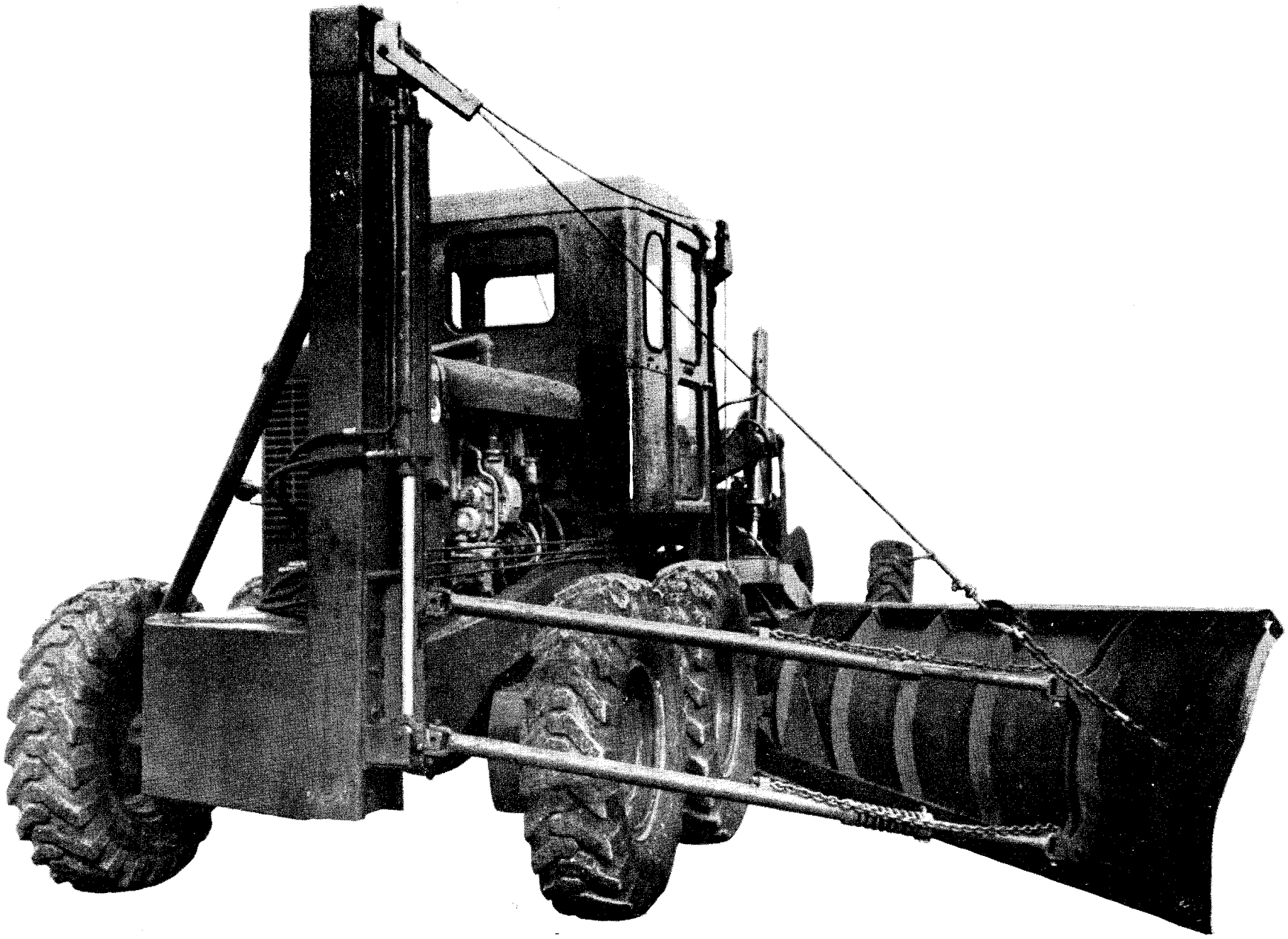
To raise any part of the wing, the control handle is pulled to the rear; and to lower, the control handle is pushed forward.

The rear end of the wing may be swung inward over the rear wheels permitting passage through a space 11 feet high, 10 feet wide, with an over-all machine length of approximately 30 feet. To accomplish this, the wing is first lowered to the ground. Both pins are removed from the telescopic rods and the forward end of the wing is raised about 2 feet off the ground. The rear lift ram is retracted and when the wing is high enough to reach, the loose end of the lift chain is inserted into a slotted bracket located on the fairlead at (A), page 59.

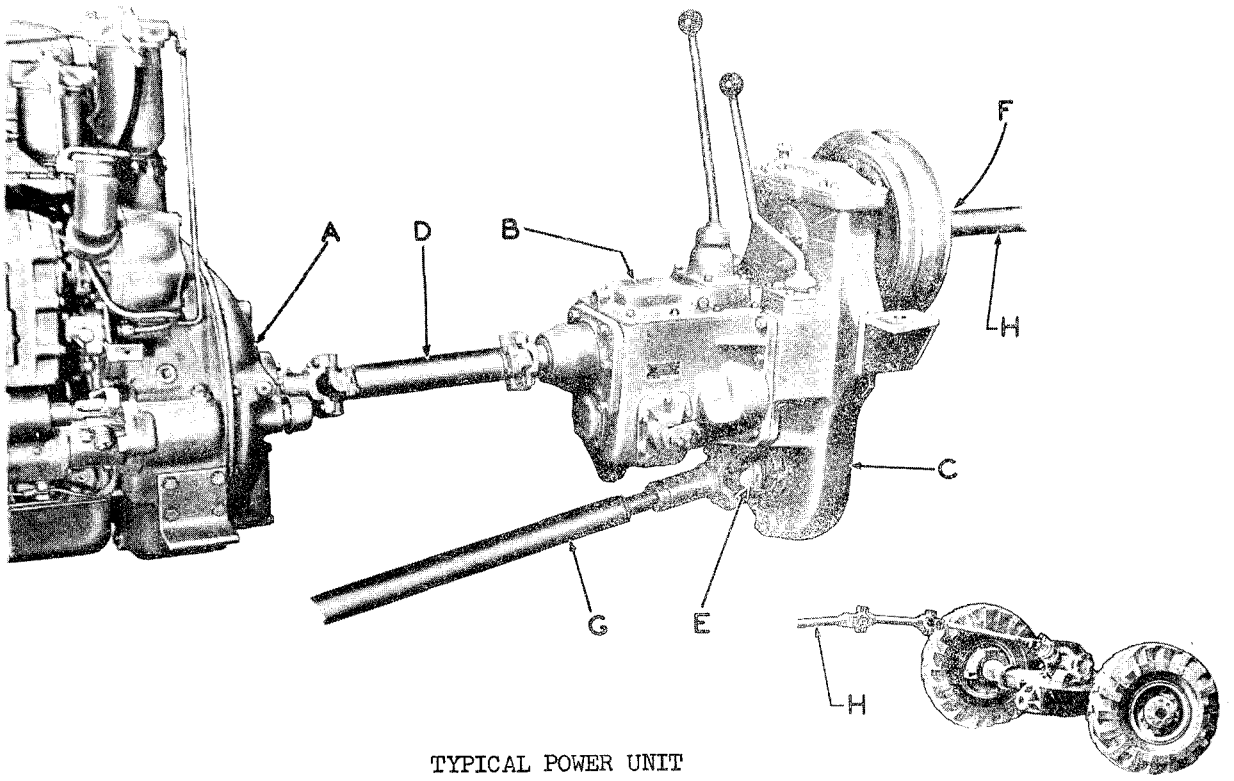
NOTE: Lubricate all grease fittings with multipurpose pressure gun grease ("Lithium" type); two strokes of lubricator every 50 hours of operation. Occasionally hand oil all moving parts not provided with grease fittings.



TYPICAL SNOW WING HYDRAULIC SYSTEM



Rear Mounted Snow Wing



TYPICAL POWER UNIT

43. POWER DISTRIBUTION - ENGINE TO WHEELS.

Every pound of the total weight of the machine is on a power driven wheel, and in this manner every ounce of engine power is transmitted to the front and rear axles.

The engine and clutch unit (A) is connected to the transmission (B) and transfer case (C) by means of a short propeller shaft (D).

The transfer case attached to the transmission extends above and below the centerline of the transmission and has two output shafts, the lower one (E) extending toward the rear, and the upper one (F) extending toward the front.

From the lower rearward shaft a propeller shaft (G) connects to the input pinion shaft of the rear axle. From the upper forward output shaft (F) of this power divider, as it might well be called, there is a propeller shaft (H) with several universal joints to carry the power down under the arched frame to the front axle.

Both front and rear axles have a double set of gears to further multiply the power on the axle shafts themselves, and eventually to the driving wheels with tires.

44. FRONT AND REAR STEER.

The front steering angle is 25 degrees each way, and the rear steering angle is 15 degrees each way. Steering is done hydraulically by simply moving a valve handle requiring very slight fingertip effort.

45. FRONT AXLE.

The front axle unit of the A-W power grader is of the double reduction type. The drive from the propeller shaft to the front axles is made first thru a spiral pinion and bevel gear, and then thru a pinion and spur gear fully enclosed, running in oil. It is equipped with dust proof oil seals and mounted on anti-friction bearings thruout.

A differential is incorporated between the two axle shafts.

In making repairs to parts located at either end of main axle housing, including replacing the drive shafts, it is unnecessary to remove the main axle housing from front end of the grader frame. However, should repairs be necessary to gear carrier or main axle housing itself, then axle assembly must be removed from frame. If possible, place the machine on a level place and block rear wheels securely.

If machine can be operated, it will be easier to wash out the main axle housing before disassembly is started. First remove the drain plug and allow all the oil to flow from gear case. Then refill the case with kerosene or diesel fuel.

CAUTION: Do not use gasoline as it is dangerous because it may explode and cause a fire. Run machine slowly with the kerosene or fuel oil in gear case for several minutes both forward and reverse, and drain gear case. If you wish to get it absolutely clean, refill case a second time with clean kerosene or diesel fuel and repeat washing operation.

46. WHEEL REMOVAL AND REASSEMBLY. (For illustration, see page 64 or 66)

All wheels are attached in the same manner, so the following will apply to either right or left hand wheel.

1. Remove the nuts (32) from the drive flange studs.

2. Remove the flange (1).

3. If the drive flange still sticks too tightly to be pulled off by hand, secure a couple of 1/2" hardened set screws to remove the flange. Lubricate the threads of hardened set screws well before inserting them in the threaded holes provided in the drive flange. Be sure to clean the threaded holes carefully and blow out all dirt present. The flange can then be forced off by screwing the set screws in thru the flange against the wheel face.

4. Unlock the bent over edge of lock washer (7) and remove the hub bearing lock nut (6).

5. Remove the lock washer (7), the drilled washer (8), and the adjusting nut (9) with pin (10).

Jack up on axle housing inside of wheel until wheel clears ground, and place a well greased metal plate under the tire. Lower jack until weight of wheel only rests on plate.

6. Slide the wheel off. Be sure to catch the bearing cone, forced off by wheel, so it does not fall on the ground and become dirty.

7. If the hub bearing felt (14) is worn or damaged, replace it by prying off the inner bearing and removing the washer (13) and felt (14).

8. Be sure to wash all the old grease from inside the wheel and from axle end and bearings. Repack the bearings with wheel bearing grease when reassembling. If bearings show any flat spots or chipping, replace both cone and cup.

9. In reassembly, after replacing the wheel and outer bearing replace the adjusting nut (9) (with pin (10) on outside). Tighten this nut up snugly. (Do not back it up for bearing clearance, as none is needed or desirable.)

10. Replace the drilled washer (8). Be sure one of the holes aligns with the pin protruding from the adjusting nut (9). If they fail to align, try taking the washer off and turning other side inward. If this fails to align the pin and a hole in washer, then the nut will have to be loosened slightly.

11. Replace the lock washer (7). Replace and securely tighten the lock nut (6). Bend one edge of the lock washer (7) so as to firmly fix the lock nut (6).

12. Replace the drive flange (1).

NOTE: Each drive flange (1) has a 1/8" pipe plug (X) recessed into the outside edge. When installing the flange, the plugged hole should mate a similar hole drilled sidewise into the wheel hub, and terminating into the compartment (A).

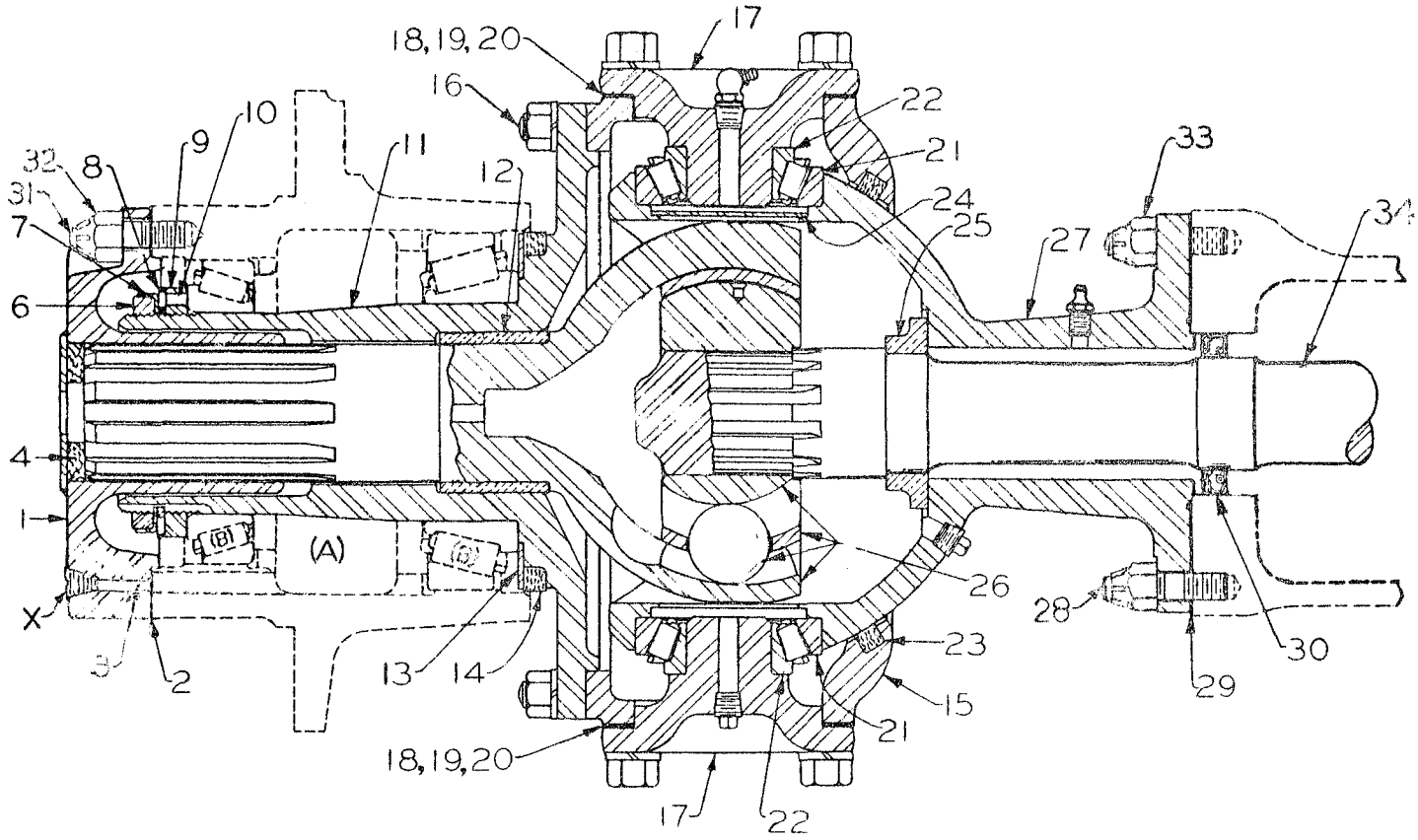
13. The two Timken bearings (B) are packed or completely charged with lubricant at time of assembly at the factory, therefore it should not be necessary to pump still more lubricant into the plugged port (X) when the grader is being used at temperatures above 22° F.

14. The purpose of the plug (X) in flange (1) is to make it possible (without removing the front wheels) to pump winterizing oil into compartment (A). When the temperature subsides to 22° F. and under, 1/4th pint of SAE-10W pumped into each wheel port (X) with winterize the wheel bearing grease at locations(B).

15. If an excess amount of lubricant is pumped through opening (X) into compartment (A) during temperatures above 22° F., the excess lubricant will flow past the wheel felt (14). This excess lubricant should be kept off the tires.

16. Replace lock washers and nuts on all studs.

17. Check all nuts and retighten, if necessary, after operating grader about an hour, and again after a day's operation.



The above shows the "Pacer" Grader type of Wheel Joint.
(Used in front and rear wheel drive)

47. UNIVERSAL JOINT WITH AXLE SHAFT REMOVAL.

a. Follow the instructions in paragraph covering "Wheel Removal", page 63.

b. Bushing (12) and thrust collar (25) page 64, should not have excess end wear, otherwise the total end clearance may exceed the permissible amount, namely .075". (Minimum .050")

c. Remove the nuts and lockwashers from studs (16). Loosen the capscrews located in caps (17). Remove the steering knuckle (11). Grasp the splined end of universal joint and carefully pull the joint, with axle shaft, out of housing. Be especially careful not to damage the oil seal (30).

d. Place the universal joint and axle assembly on a bench (or a box if bench is not available).

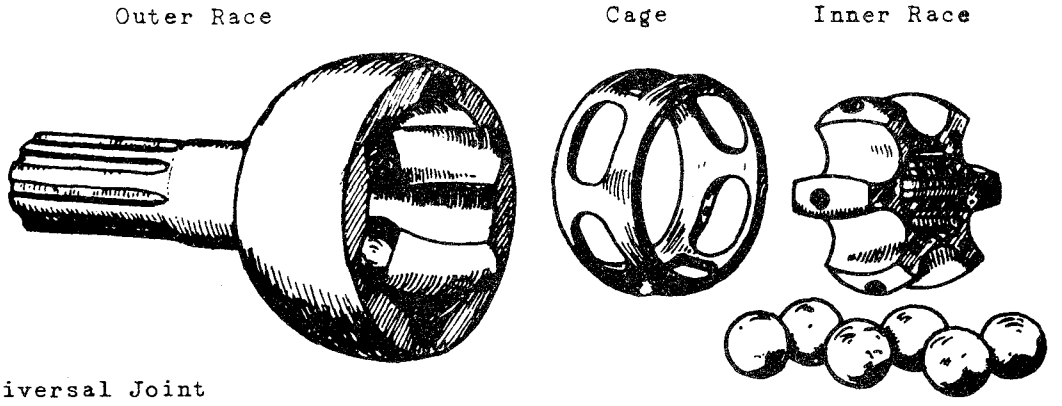
e. The universal joint group (26) can now be tapped off the end of axle shaft. (Use a bronze plug and hammer.)

f. Wash all parts carefully with kerosene and check them carefully before reassembly.

48. AXLE UNIVERSAL JOINT DISASSEMBLY. (For Cleaning and Inspection Purposes Only)

a. Whenever the joint is removed from its housing for any purpose, it is a good idea to wash it and inspect it. If it is desired to disassemble it, study Page 65 and follow the procedure outlined.

(continued)



Parts of Universal Joint

Universal Joint Assembly

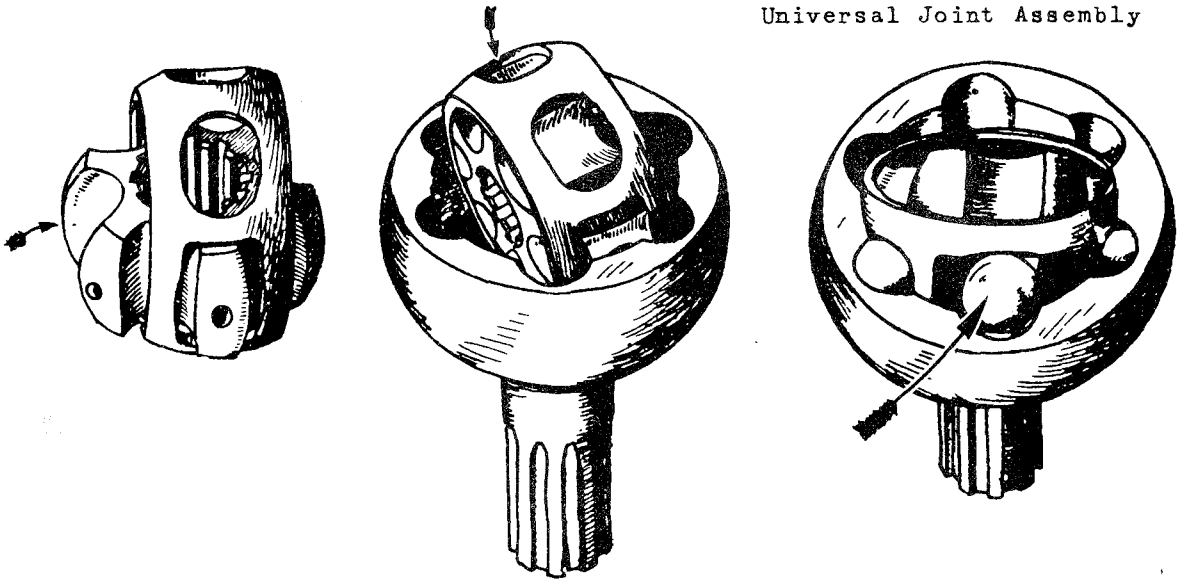


Illustration 1.

Removing or Inserting Inner Race Into Cage

Illustration 2.

Removing or Inserting Inner Race and Cage Into Outer Race

Illustration 3.

Removing or Inserting Balls

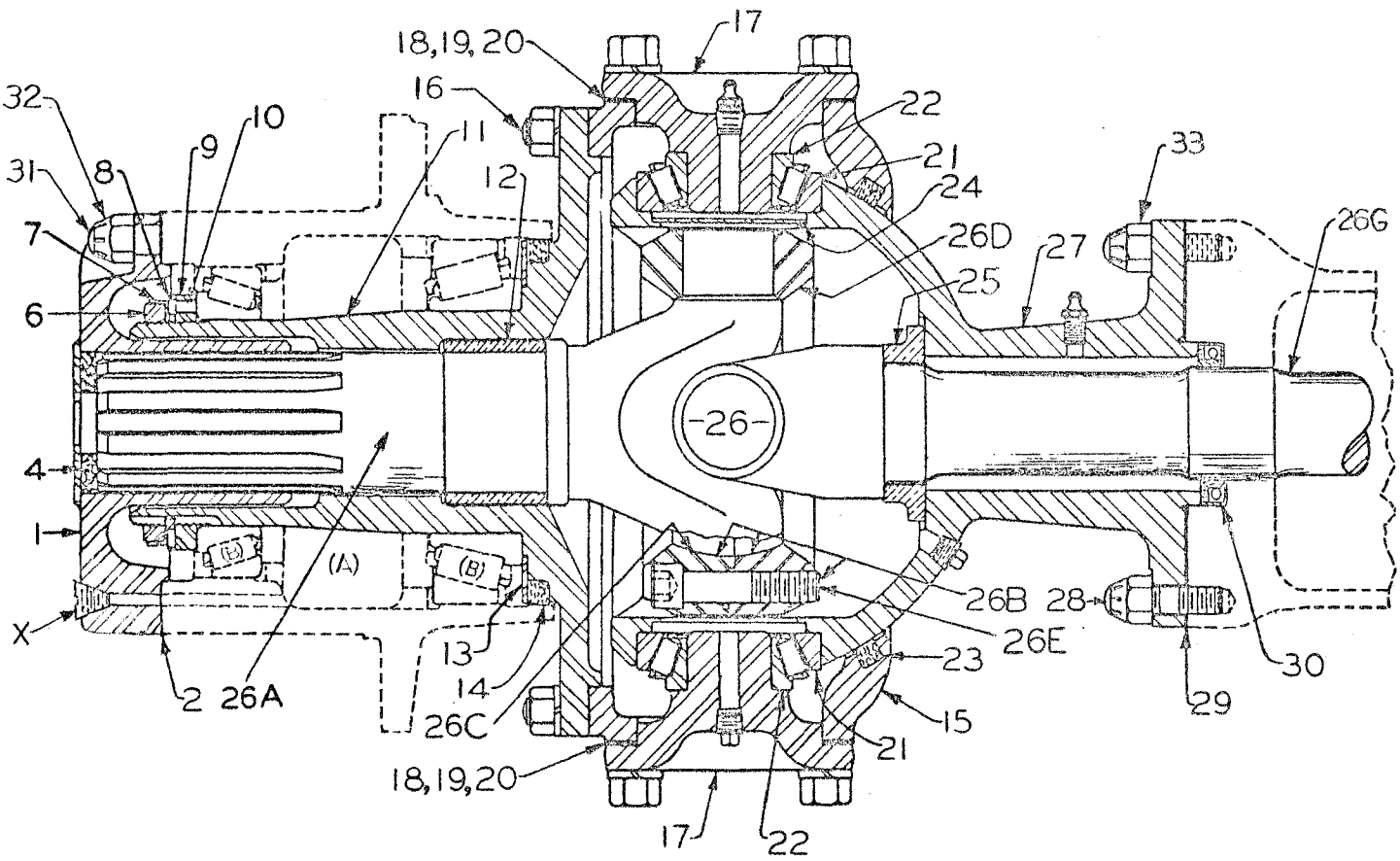
49. "PACER" GRADER UNIVERSAL JOINT.

b. By pushing down on one side of the inner race, the opposite side will automatically come up (Illustration 2), and one ball can then be removed. By pressing down at another point, another ball can be removed, and so on until all balls are removed.

c. Roll both the cage and inner race until they are standing on edge (Illustration 2). If the rectangular slots are not aligned with outer race, revolve the cage slightly to align. Then lift inner race and cage out.

d. Roll the inner race right angles to the cage so that one lug projects thru one rectangular slot in case. Remove inner race from cage (Illustration 1).

e. Clean and inspect all parts. If worn, chipped or cracked, procure a new drive joint group from your nearest Austin-Western distributor. It is not practical to replace any parts in a used joint with new parts. Therefore the entire joint group must be replaced as a unit.



The above shows the "Super" Grader "Cardan" type of front wheel joints.

50. UNIVERSAL JOINT WITH AXLE SHAFT REMOVAL. ("Super" Graders)

a. Follow the instructions in paragraph 46 covering "Wheel Removal", page 63, sub-paragraphs 1 to 8 inclusive.

b. Remove all the nuts and lockwashers from studs (16), see above.

c. Loosen all the capscrews located in caps (17).

d. Remove the steering knuckle (11).

e. Grasp the splined end of universal joint now exposed and carefully pull the joint, with axle shaft attached, out of housing. Be especially careful not to damage the oil seal (30).

f. Place the universal joint and axle assembly on a bench (or a box if bench is not available).

g. Wash all parts carefully with kerosene. Check and lubricate them carefully before reassembly.

51. AXLE UNIVERSAL JOINT DISASSEMBLY. (For Cleaning and Inspection Purposes Only)

a. Whenever the joint is removed from its housing for any purpose, it is a good idea to wash it and inspect it.

b. Clean and inspect all parts. If worn, chipped, or cracked, procure a new drive joint group, or parts, from your nearest parts depot.

Reassembly. The assembly and adjustments of these groups will be the same as shown in paragraphs 46, 52, 53 and 54.

52. WHEEL STEERING KNUCKLE DISASSEMBLY.

a. Follow instructions in paragraph 47, "Universal Joint with Axle Shaft Removal".

b. Remove fork bolts (1) page 69.

c. Remove the nuts from studs (28) page 64 or 66, at end of axle housing.

d. Pull the entire trunnion and knuckle flange off the studs. It may stick and require force to remove it. At this point check the seal (30), in end of trunnion socket. Replace if necessary. Be sure to oil it well before reassembling.

e. Remove the capscrews from top pivot bearing cap (17) and remove the cap and shims (18), (19) and (20). Keep the cap and shims together. (It will be well to tie them together if original parts are to be reassembled again.)

f. Now remove the lower pivot bearing cap (17), following the same procedure used to remove the upper bearing cap (17).

g. Slip the knuckle flange (15) off flanged end of trunnion socket (27).

h. The felt (23) can now be removed and replaced with a new one, if necessary.

i. For Reassembling, reverse the above procedure.

CAUTION: Before reassembling wash and inspect all parts carefully. Cleanliness is essential in preventing wear.

53. WHEEL PIVOT BEARING ADJUSTMENT. (With the Wheel Removed but Steering Knuckle still on the Power Grader.) (See page 64 or 66.)

a. Remove capscrews from top bearing cap (17) and cap and shims (18), (19) and (20). Keep cap and shims together. (It will be well to tie them together so they can be easily assembled in the original position.) Mark the cap (17) so it can be put back in the original position.

b. Carefully wash out the bearing cup (21) and its compartment. Remove all grit and chips present. Wash bearing cone and rollers carefully. If bearings show signs of chipping or flat spots, replace both cup and cone with new ones.

c. Remove the lower bearing cap (17) with shims (18), (19) and (20). Keep together for reassembly in original positions.

d. Wash the bearing cone and rollers and cup carefully. If there are any signs of chipping or flat spots, replace both the cup and the cone with new ones.

e. Pack bearings with grease. Reassemble caps with shims in original positions.

f. Tighten capscrews evenly on caps (17).

g. If there is any vertical end clearance in the bearings, adjust by removing equal amounts of shim thickness from both top and bottom. If too tight, add new shims of same thickness to both top and bottom.

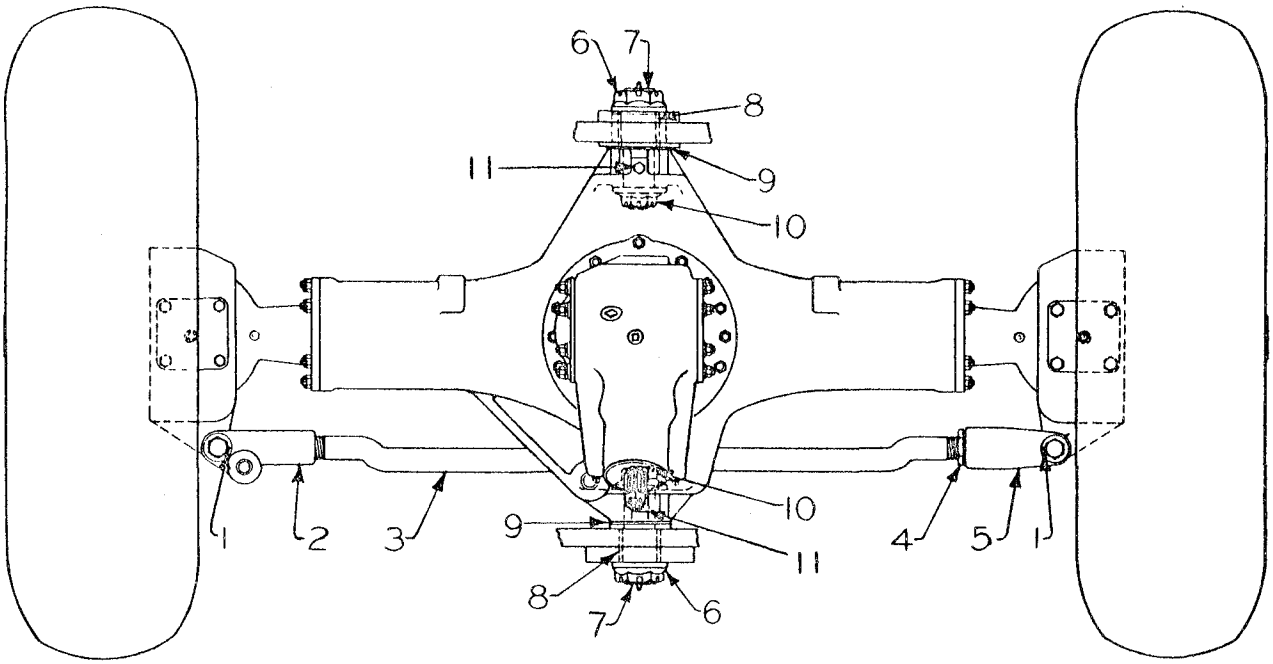
Continue this adjustment until the clearance is just out of bearings when screws are tight, then remove a thin shim (.005") from under both the top and the bottom bearing cap. This will bind the bearings slightly and is called "pre-loading". This is done to eliminate slight play from existing when these bearings are actually carrying the weight of machine while at work. The shims are of three thicknesses; .005", .007" and .020".

CAUTION: Capscrews holding top and bottom pivot caps (17) must be left loose until the axle and knuckle joint group are put in place and knuckle (11) is securely tightened by the nuts on studs (16). Otherwise, knuckle flange (15) will distort and the pre-loading effect be destroyed.

54. FRONT WHEEL TOE-IN ADJUSTMENT. (See Page 69)

a. The axle is equipped with a tie rod adjusting nut (4) with both right and left hand threads. Turn the nut so that front toe-in is 0". Measurements to be made at the side wall of tires as close to center line of axle as possible.

b. No toe-out should be tolerated as this causes excessive tire tread wear.



55. REMOVAL OF FRONT AXLE ASSEMBLY FROM FRAME (See above).

a. Place machine on level place.

b. Revolve blade until it is square across the lock circle latch.

c. Block both rear wheels securely to prevent possibility of machine rolling forward or backward.

d. Remove nuts (6) and (10) from pivot pins (7). Remove setscrews (11).

e. Disconnect steering ram hydraulic hoses at their union ends.

f. Unlock and remove the four capscrews from front propeller shaft universal joint fitting yoke.

g. Start the engine and raise blade as high as possible. Place blocking under each end of blade about a foot from the ends.

h. Force blade downward. This will lift the front end of frame upward. Lift it only enough so that axle pivot pins are free of excessive binding.

i. Remove the pivot pins (7).

j. Again push blade down to lift frame high enough to clear axle.

k. Roll axle out from under front end of frame.

l. Reverse above procedure for reinstalling.

56. FRONT AXLE GEAR CARRIER REMOVAL. (See page 76.)

a. Remove axle from frame. (See paragraph 55.) Remove bottom drain plug to drain oil from axle.

b. Block up under axle housing to hold it when wheels are removed.

c. Remove the nuts from studs (28), page 64 or 66, on both sides. Remove fork bolts at (1), see above.

d. Slide out, about 8", both the right and left wheel, with trunnion socket and axle still attached.

If the oil seals (30), page 64 or 66, are damaged or worn, be sure to replace them before reassembling.

e. Remove the nuts from studs (40), page 76.

f. Lift the gear carrier out of main axle housing.

57. HYDRAULIC BOOSTER STEERING - WHEEL CONTROL. (Special Order) (Field Installation)

a. Preliminary Check on Grader.

1. Check wheel alignment (no toe-in or out permissible).

2. Check steering ram adjustment so both wheels turn same to right or left.

3. Be sure to check the clamp bolts on ram rod end and tie rods, making sure they are tight.

b. Assembly Instructions.

1. Install steering wheel, shafts, and Ross steering gear unit.

2. Turn hand wheel (A), page 71, all the way to the right and to the left.

The hand wheel should turn freely, but if not, look for binding in support bearings (B), pages 71.

3. Count the revolutions of hand wheel to determine center position.

With hand wheel set at half the total revolutions, assemble steering arm (C), page 71, at axle as close to dimension (N) as possible.

4. Assemble booster valve, flow control regulator, hoses and tubing according to piping diagram shown on page 75.

5. Square head pipe plug is to be removed from top of gear carrier and replaced by socket head plug (H), page 71, to eliminate possible damage to hoses.

6. With booster valve in neutral and front wheels straight, assemble steering valve rod (K), page 71.

Next assemble linkage (C), by turning shaft (L) until dimension (M) is 27/32".

c. Steering Arm (C) Adjustment.

1. With set screws (J), page 71, out, steer wheels the maximum distance to right. Then screw in set screw against stop.

Turn wheel slightly to left and give set screw two extra full turns and lock into place.

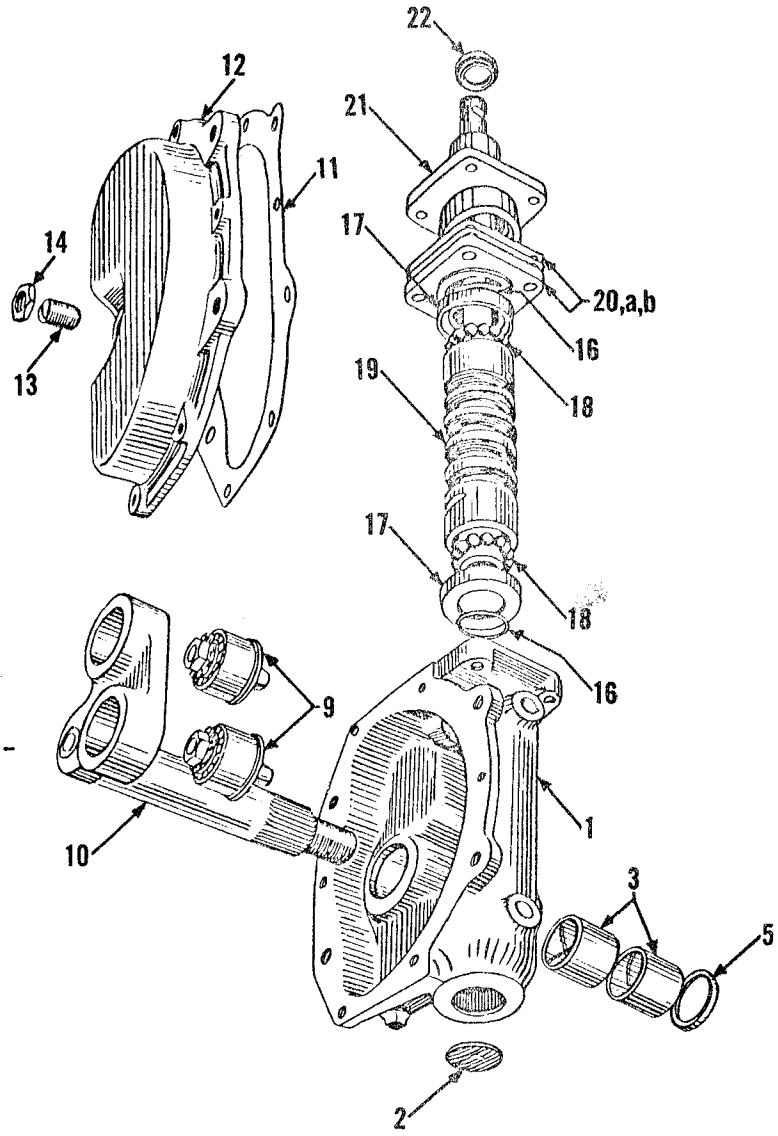
Follow the same procedure for steering to left.

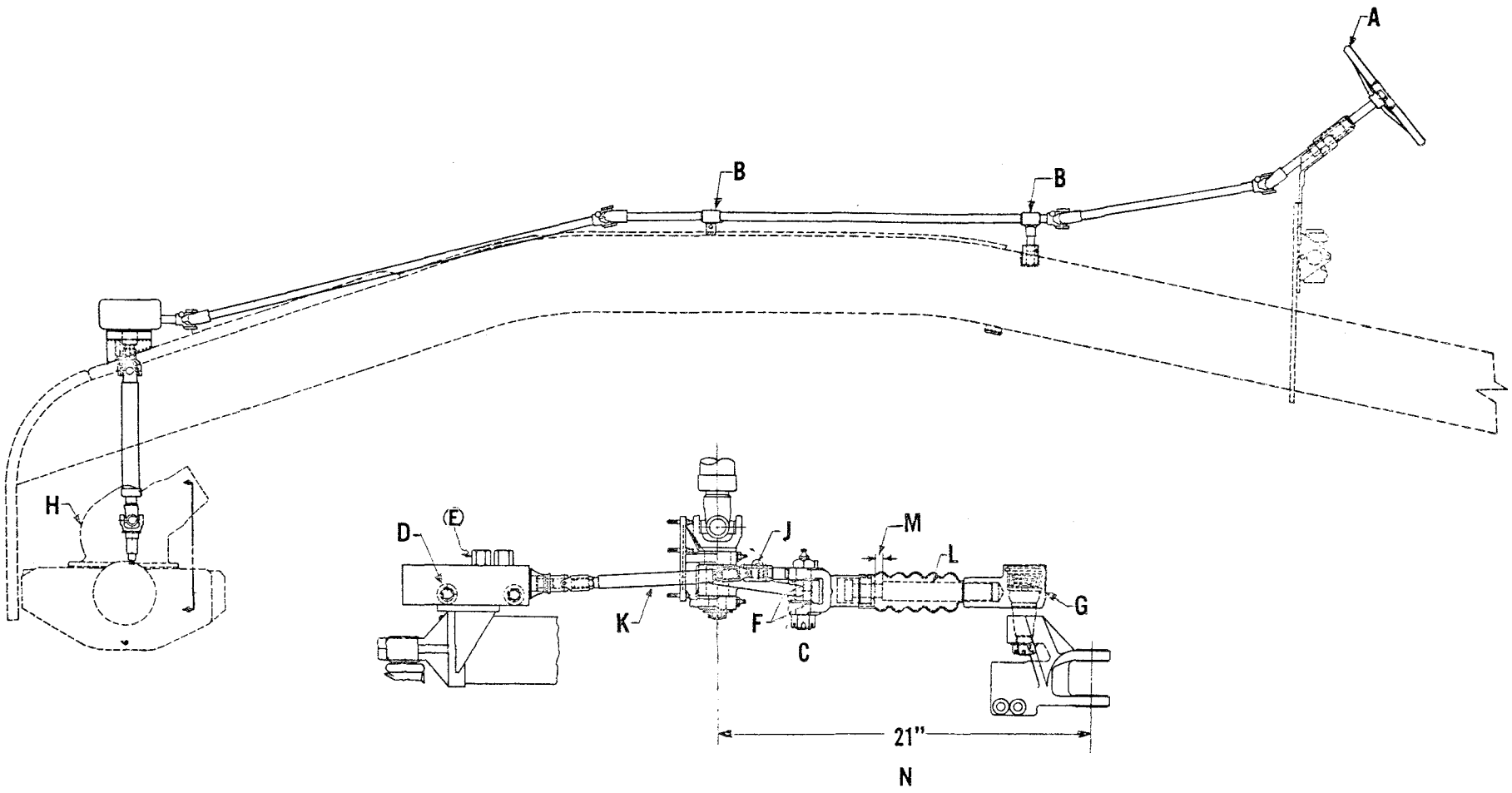
2. Shims (F), page 71, are provided for steering arm (C) to permit alignment with manual steering linkage (G).

d. Lubrication.

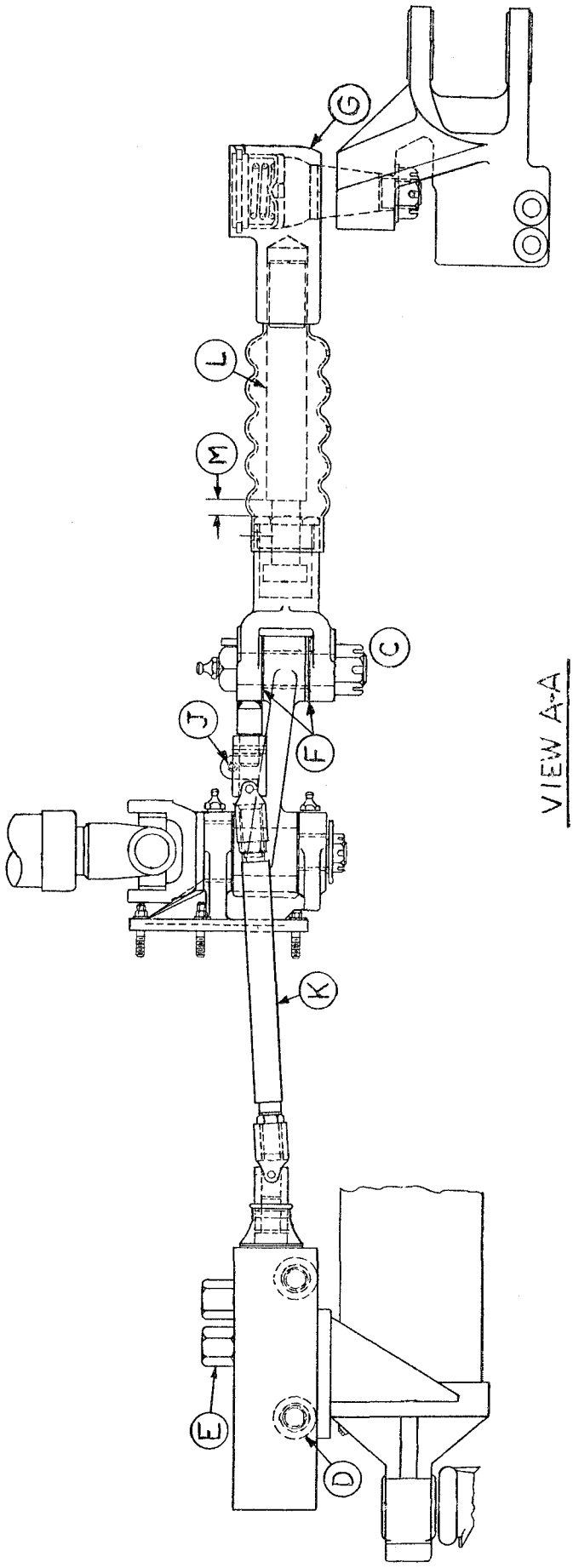
1. Lubricate each grease fitting with general-purpose pressure gun grease ("Lithium" type preferred); two strokes of lubricator every 50 hours of operation.

2. Add SAE-90 oil (for year around use) to Ross steering gear unit.



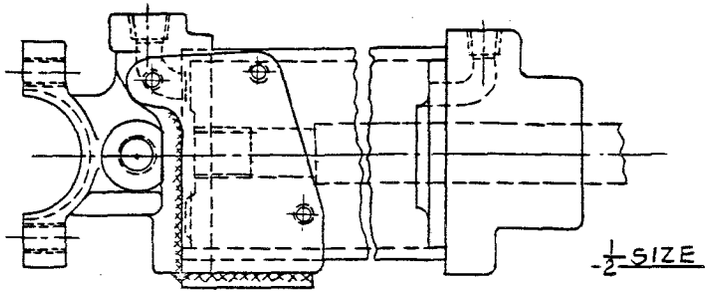


LINKAGE FOR BOOSTER STEERING
(See Repair Parts book for part numbers and data)

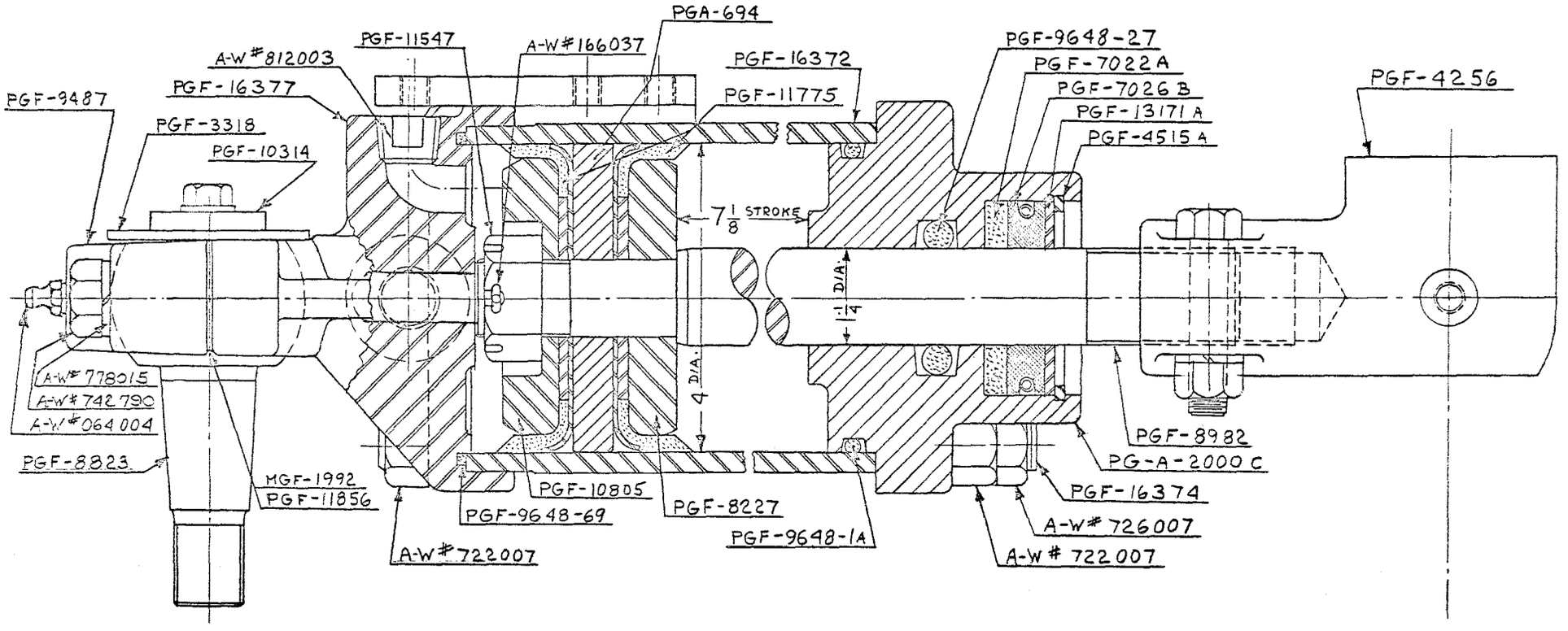


ENLARGED VIEW OF VALVE LINKAGE FOR BOOSTER STEERING

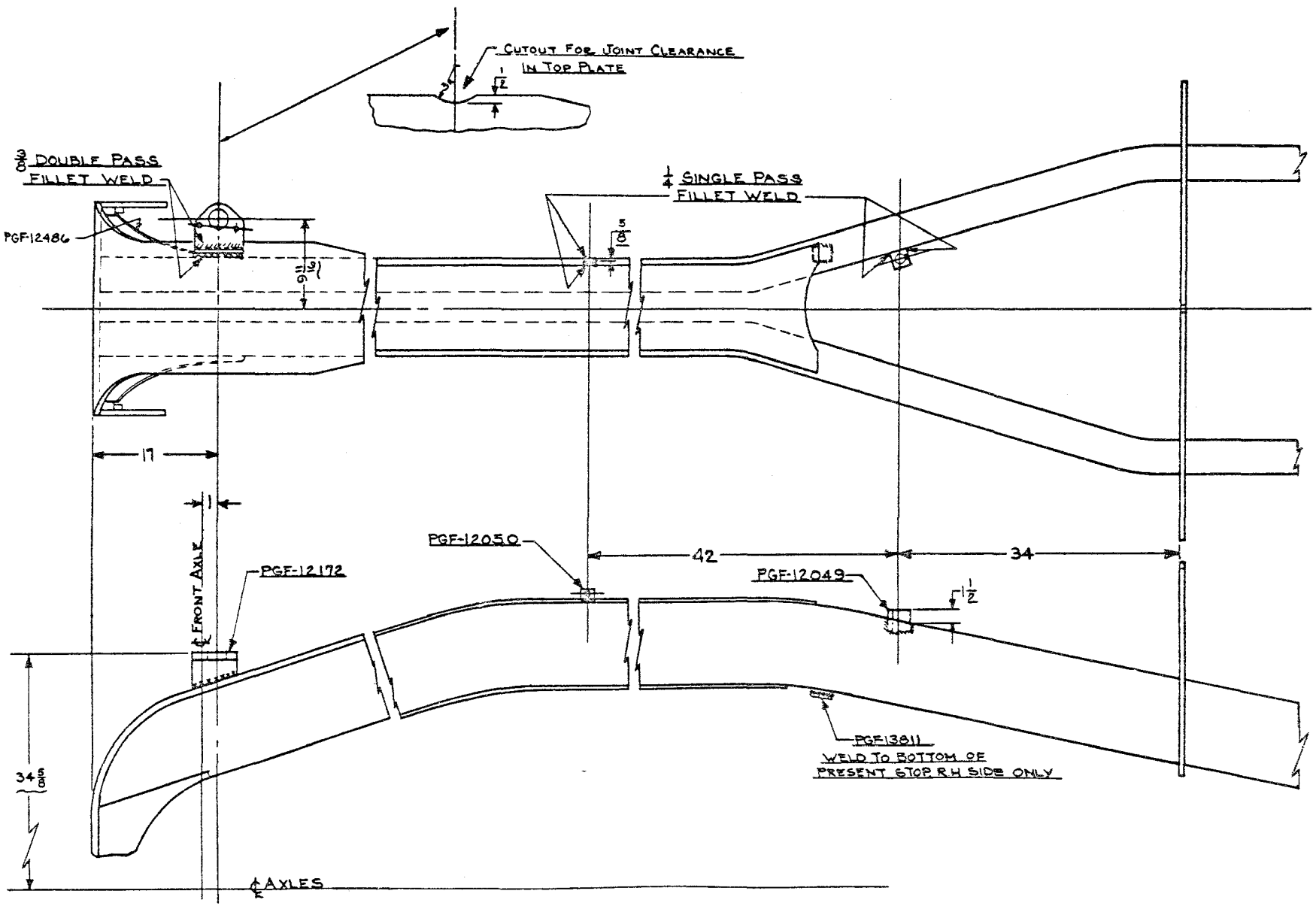
RAM TO BE ASSEMBLED WITH PORTS AS SHOWN.



$\frac{1}{2}$ SIZE

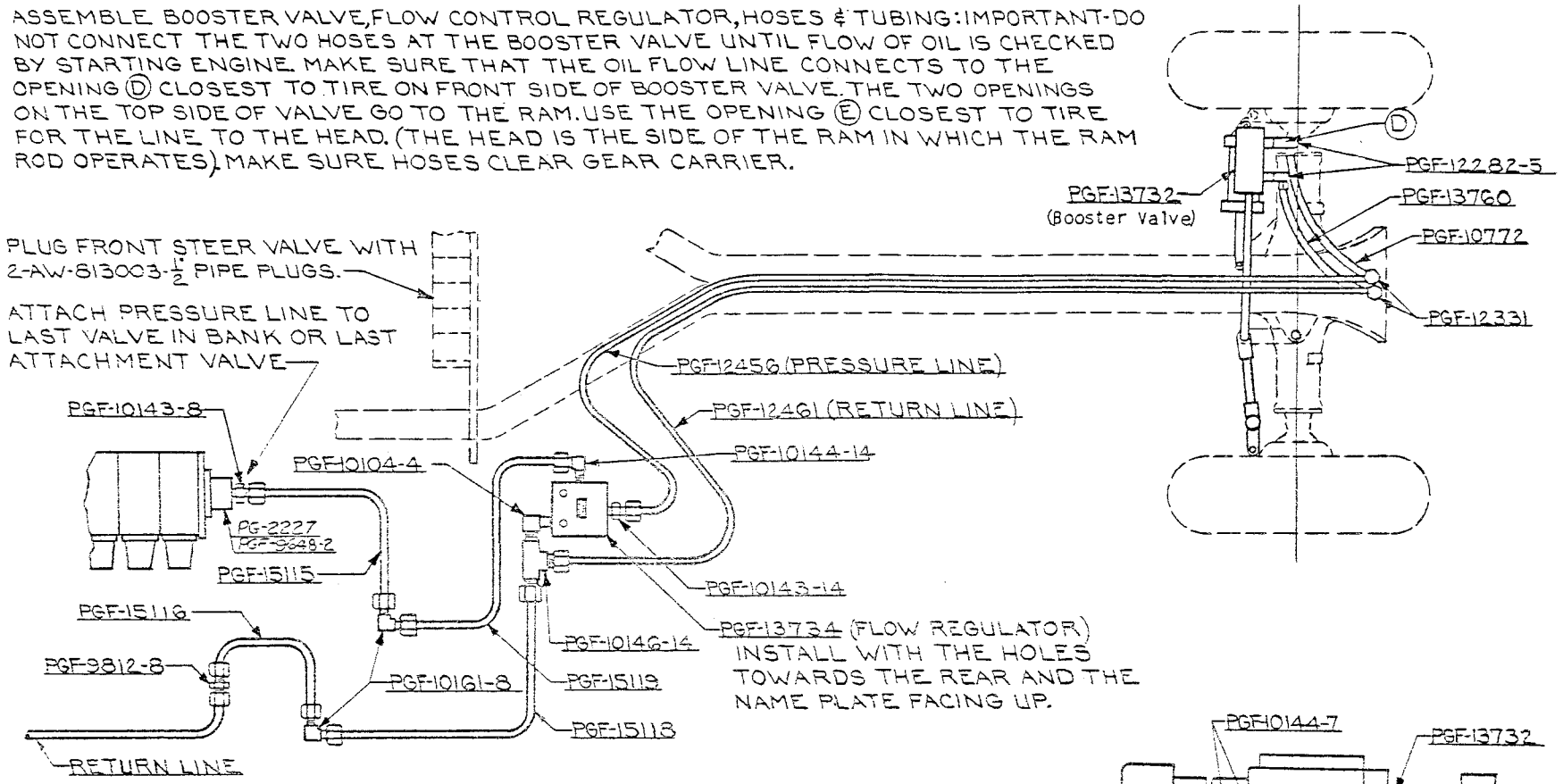


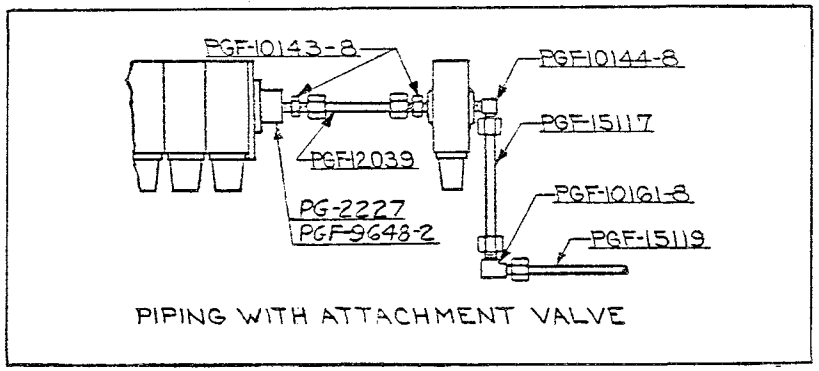
RAM FOR BOOSTER STEERING

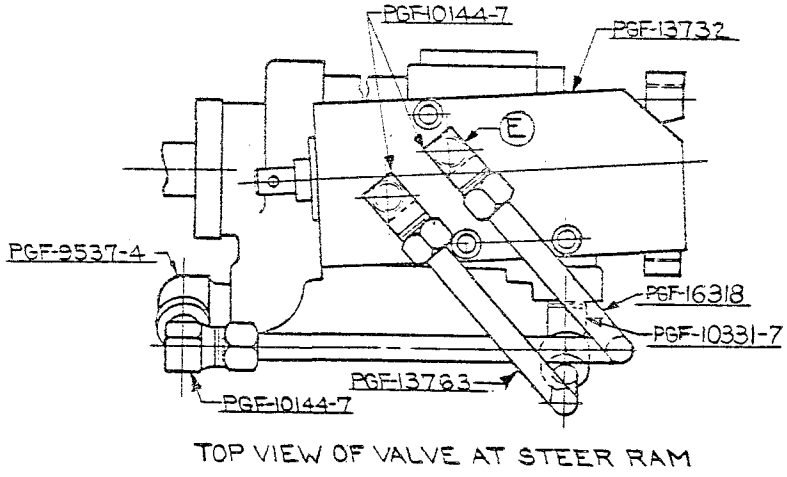


SUPPORTS FOR BOOSTER STEERING

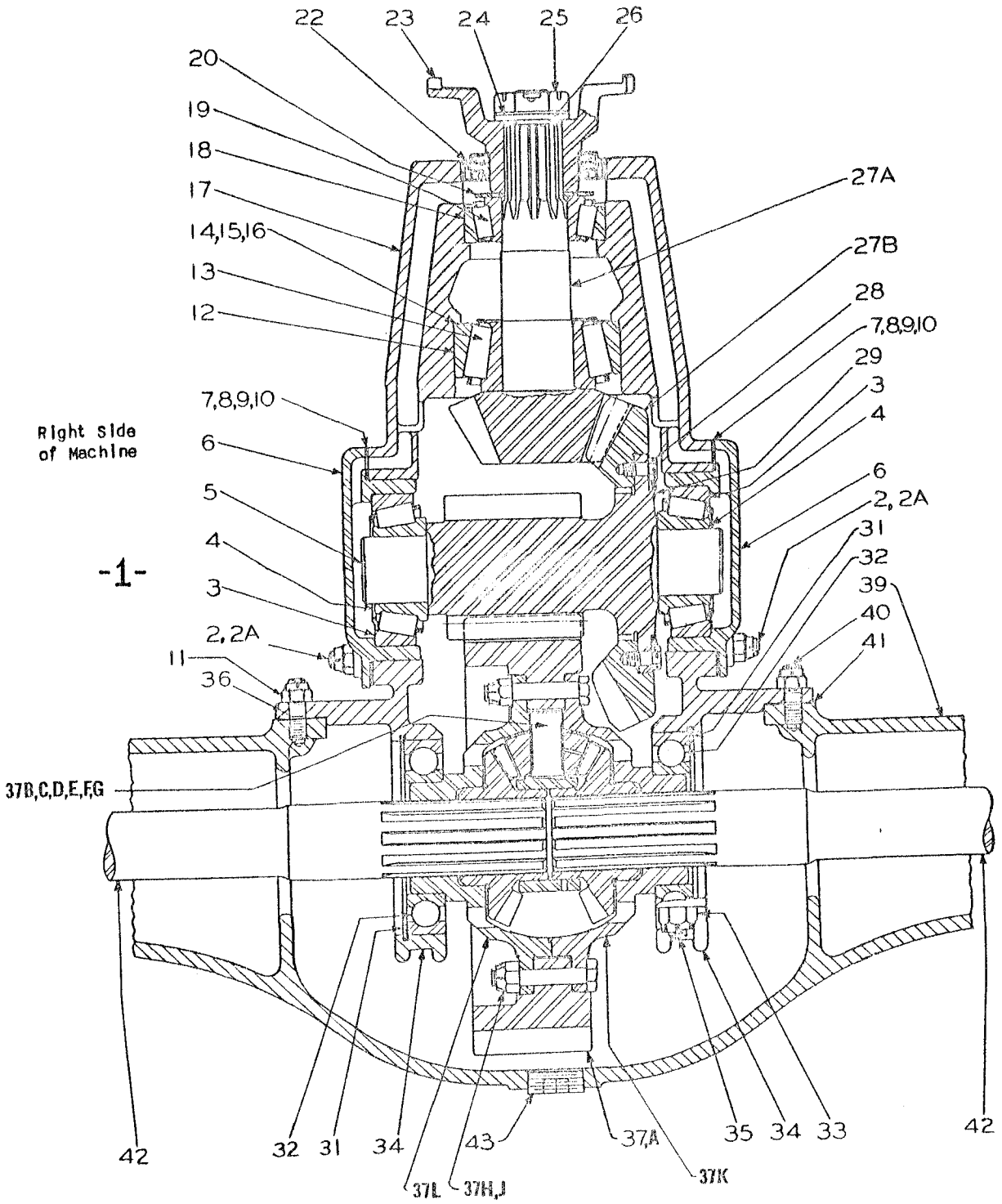
ASSEMBLE BOOSTER VALVE, FLOW CONTROL REGULATOR, HOSES & TUBING: IMPORTANT-DO NOT CONNECT THE TWO HOSES AT THE BOOSTER VALVE UNTIL FLOW OF OIL IS CHECKED BY STARTING ENGINE. MAKE SURE THAT THE OIL FLOW LINE CONNECTS TO THE OPENING Ⓓ CLOSEST TO TIRE ON FRONT SIDE OF BOOSTER VALVE. THE TWO OPENINGS ON THE TOP SIDE OF VALVE GO TO THE RAM. USE THE OPENING Ⓔ CLOSEST TO TIRE FOR THE LINE TO THE HEAD. (THE HEAD IS THE SIDE OF THE RAM IN WHICH THE RAM ROD OPERATES). MAKE SURE HOSES CLEAR GEAR CARRIER.







PIPING FOR BOOSTER STEERING



58. FRONT AXLE GEAR CARRIER DISASSEMBLY. (After Removing the Assembly from Axle Housing)

a. Remove the lock wires and nuts on the four studs (35).

b. Remove the two bearing caps (34). (If they are not already marked, mark them so they can be put back in exactly the same position in reassembly.)

c. Lift out the bull gear and differential group (37).

d. If ball bearings (32) on differential hub are worn, replace them with new ones.

e. To remove the one piece pinion and gear hub (5), proceed as follows:

1. Remove nuts and washers from studs (2).

2. Remove the left bearing cap (6). Save the gasket (7) and all shims (8), (9) and (10). Wire these to the cap so they will be replaced in original position.

3. Remove the right bearing cap (6), saving the gasket (7) and shims (8), (9) and (10). Wire to cap to prevent mix-up.

4. Remove the bearing cone and roller assembly (4) from ring gear end of shaft (5). If cone (4) cannot readily be driven from shaft, pour hot oil over bearing only, to expand for easier removal.

(When reassembling, polish both ends of shaft (5) using emery cloth so bearings will drive on and off easier.)

NOTE: Keep the shaft (5) cold.

5. Remove shaft (5) after removing capscrews (28) holding bevel gear (27B).

6. If inspection shows chipping or flat spots on either bearing, replace both the cone and cup of that bearing.

7. Clean and check all parts carefully before reassembly.

f. If you desire to remove the bevel pinion (27A) proceed as follows:

1. Remove the cotter and nut (25).

2. Remove washer (24) and universal joint fitting yoke (23).

3. Place a bronze drift on threaded end of pinion shaft, and drive it back through bearing (19).

4. Check oil seal (22) and replace it with new one if necessary.

5. If inspection shows any flat spots or chipping on bearings (12), (13), (18), or (19), replace both the bearing cone and the cup of damaged bearing.

59. FRONT AXLE GEAR CARRIER REASSEMBLY. (See page 76)

a. After all useable parts have been carefully cleaned, proceed as follows:

1. Assemble cup (12) with shims (14), (15) and (16), also cup (18), into the carrier casting (17).

2. Place cone (13) on shaft (27A) as shown.

Next insert shaft (27A) into location. ((27A) and (27B) are lapped together at the teeth and sold in matched sets only.)

Install cone (19), washer (20), seal (22), yoke (23), gasket (26), washer (24), and finally nut (25).

3. Tighten nut (25) sufficiently to remove all end clearance at bearings (13) and (19). Do not over-tighten nut (25) because the bearings (13) and (19) will be adjusted too tightly endwise.

Shaft (27A) should turn freely, except for the friction applied by the seal (22) around the yoke (23).

4. If you install too many shims (14), (15), or (16), the teeth of pinion (27A) will extend too far into the ring gear teeth near arrow (27B).

The teeth of both pinion (27A) and gear (27B) should be approximately flush with one another at the back side, or near arrow point (27B).

If you do not install a sufficient quantity of shims (14), (15), or (16), then the teeth of pinion (27A) will be outward from the teeth of gear (27B).

See pages 79 and 80 for proper tooth contact.

5. When installing a new bevel gear (27B), or a new pinion and gear hub (5), be sure to temporarily assemble the two together before putting them into the gear carrier. By doing this you will be sure they fit together properly.

The bevel gear is held firmly in place by capscrews (28) through the backing flange. It is therefore best to mark (with paint) the bevel gear and hub flange to make alignment easy. The bevel gear should be a snug fit on the hub (5).

Insert gear hub (5) (with gear (27B) slipped over end) into top of the gear carrier housing.

Align the bevel gear with flange and slip the gear into place tightly against the flange, as shown on page 76.

Be careful not to damage the gear teeth.

Insert and tighten the screws (28). Install lock wire (29).

If necessary (not recommended) heat the bearing cones (4) in hot oil (not over 300°F.) and tap them into place against the gear hub shoulders. (Always replace worn bearings.

Both ends of shaft (5) can be polished down by means of emery cloth in order that the bearing cones (4) can be more easily removed.

Align the oil holes and replace both of the bearing caps (6), together with the gasket (7) and the shims (8), (9) and (10), but first make sure the bearing cup (3) is in good condition. If otherwise, replace it and bearing cone.

Check the position of gasket (7) and shims (8), (9) and (10), and the bearing caps (6).

Oil ports in case and cap must align and the shims must be properly placed, or the flow of oil will be cut off, and the lubrication of the bearing will then be insufficient.

If end play exists in the one piece pinion and gear hub (after the caps (6) are tightened), it can be eliminated by removing shims (8), (9), or (10), as required. See pages 79 and 80 for diagrams on proper tooth contact.

Be sure the pinion and gear hub has only a slight drag when both caps (6) are tight.

If pinion (27A) needs to be adjusted for proper mesh with bevel gear, add or remove shims (14), (15), or (16) as required.

See pages 79 and 80 for diagrams on proper tooth contact.

6. Place the large spur gear and differential group (37) in position after installing the two hub bearings (32). (See Repair Parts book for loose internal repair parts (37B, C, D, E, F and G.)

The spur gear is offset to clear the bevel gear, so be sure you do not try to install it with the wrong side toward the bevel gears.

Replace the bearing caps (34) and tighten the nuts on studs (35) and wire them to prevent their loosening.

7. Install a new gasket (41).

Lower the now completely assembled gear carrier down into front axle housing (39).

8. Carefully push the axles and wheels back into axle housing and replace and tighten the nuts (33), page 64 or 66.

9. Check the toe-in adjustment. See page 68, paragraph 54, "Front Wheel Toe -In Adjustment."

10. Fill axle housing with recommended oil. (See lubrication charts, page 3 or 5.)

60. BEVEL GEAR AND PINION ADJUSTMENT.

a. General.

No other phase of axle maintenance is more important, yet less understood, than the adjustment of bevel drive gears and pinions in order to secure proper tooth contact.

It must be kept in mind that checking for tooth contact area and location is done with no load on the gear set.

When the area of tooth contact is toward either the heel or toe, the teeth will be overloaded at that end and chipping may occur.

When the area of contact is too high, then the load application is farther from the base of the teeth, thus increasing the bending load and possibly resulting in breaking teeth out at the base.

When the area of contact is less than specified, a higher localized load results in squeezing out the film of lubricant. A metal to metal contact such as this causes scoring, scuffing, or galling, which contributes to noisy operation and rapid wear.

Two other points to keep in mind are:

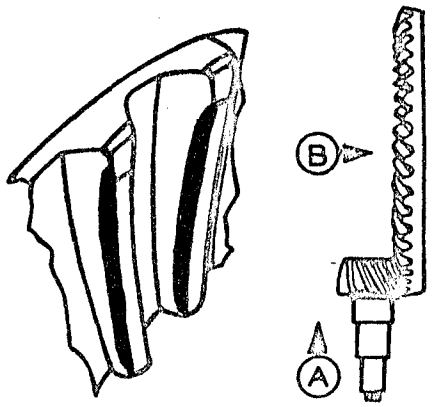
First: The factory adjustment of bevel drive gear and pinion sets is as correct as special equipment and years of experience in building thousands of axles can make it, and should not be disturbed except when absolutely necessary. For example, should it be necessary to dismantle and reassemble the gear carrier group to replace some part other than the gear and pinion, do not disturb the shim adjustment. Always replace worn bearings.

In addition to this, backlash should be checked and noted before disassembling the unit, in order that the gear may be adjusted to the original back lash when making final adjustments.

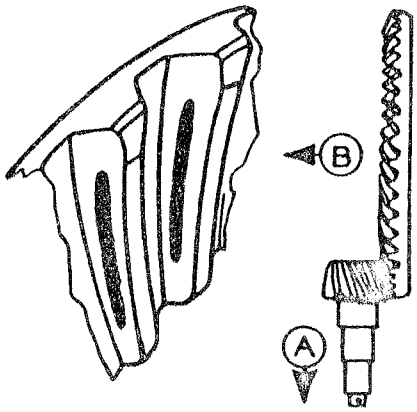
Second: Always bear in mind that gears and pinions are matched at the factory, and as far as possible should remain matched in service. Well matched sets operate quietly.

b. Checking Tooth Contact.

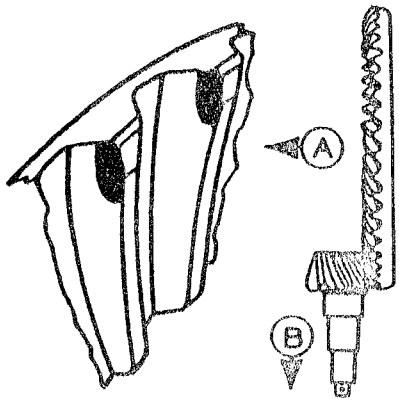
This is accomplished by means of oiled red lead applied lightly, or sparingly, to the drive side of the bevel gear teeth. When the pinion is rotated the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts. Sharper contact impressions can be obtained by applying a small amount of resistance to the gear when rotating the pinion. (Hold a block of wood against the gear and use a wrench to rotate the pinion.) When making adjustments always check the drive side of the bevel gear teeth. Coast side contact will be automatically correct when the drive side contact is correct. As a rule, coating about 12 gear teeth with red lead is sufficient for checking purposes.



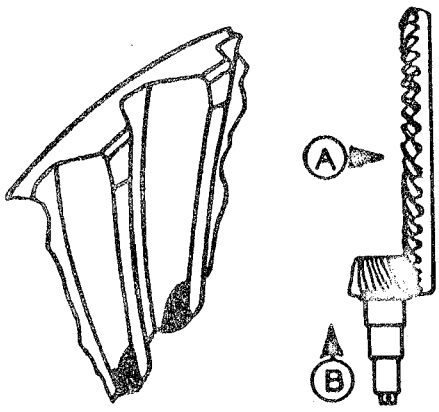
1. The above diagram shows a HIGH NARROW CONTACT, which is undesirable and will result in noisy operation, galling, and overloading of the teeth. To obtain correct contact, add shims to move the pinion (A) in toward the toe of the gear teeth (toward the center of the axle) to lower contact area to the proper location. This adjustment will decrease the backlash between the pinion and gear teeth, which can be corrected by moving the gear (B) away from the pinion. A backlash of (.008) is correct. Several adjustments of both pinion and gear may be necessary before correct contact and backlash are secured.



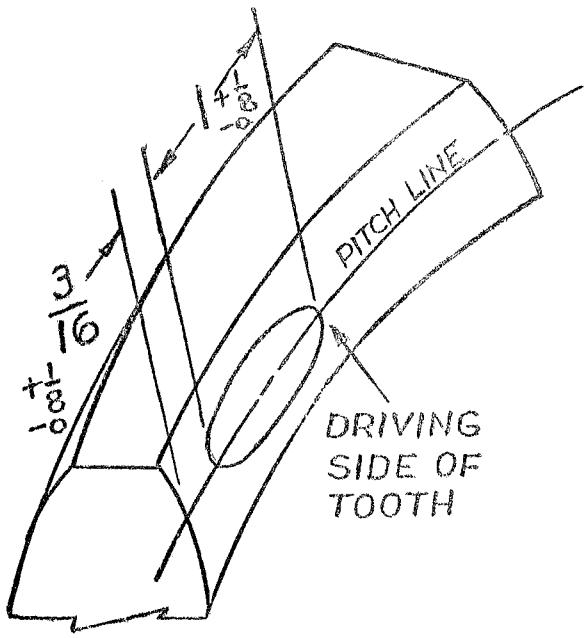
2. The above diagram shows a LOW NARROW CONTACT, which will result in galling, grooving of teeth, and noise. To secure correct contact, remove shims to move pinion (A) out from gear (away from center of axle) a sufficient amount to move the contact area to the proper location. To obtain correct backlash (.008) move the gear (B) in toward the pinion.



4. The above diagram shows a SHORT HEEL CONTACT, which produces approximately the same results as a short toe contact: noise, excessive gear tooth wear, and chipping of tooth edges. To correct this condition, the gear (A) must be moved in toward the pinion to increase the lengthwise contact and to move the contact toward the toe of the teeth. Correct backlash (.008) is obtained by moving the pinion (B) out toward the heel of the gear teeth (away from the center of the axle).



3. The above diagram shows a SHORT TOE CONTACT, which, because the contact area overlaps the toe of the bevel gear teeth, will result in chipping of tooth edges and excessive wear at this point if not corrected. To secure correct contact, move the gear (A) away from the pinion. This will increase the lengthwise contact and move the contact area toward the heel of the gear teeth. Correct backlash (.008) is obtained by moving the pinion (B) in toward the gear (toward the center of the axle).



5. The above diagram shows when ADJUSTMENTS HAVE BEEN PROPERLY MADE.

IMPORTANT - The tooth contact area shown in above diagram is to be held as close as possible to dimensions shown. Backlash to be no more than .008.

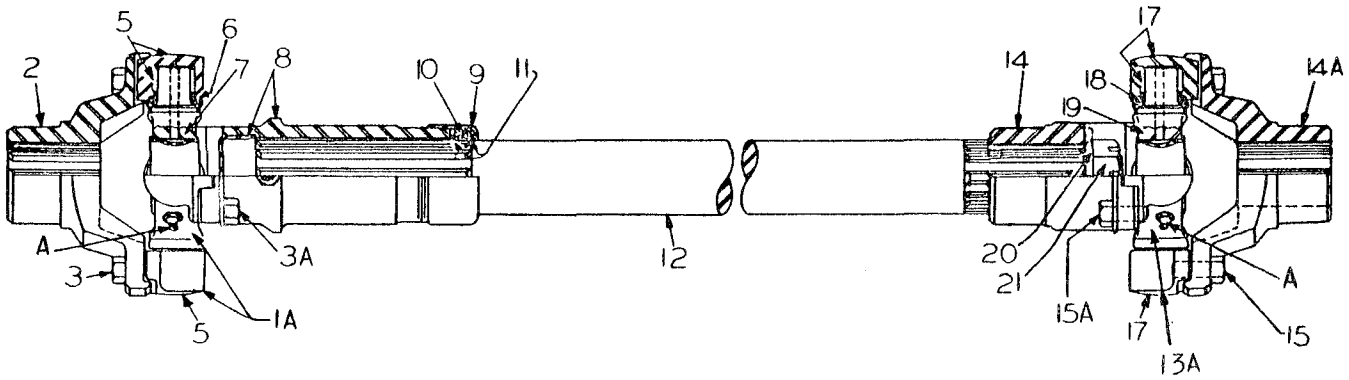
61. PROPELLER SHAFTS.

a. Lubrication.

The needle bearings are packed with lubricant at time of assembly. Grease fittings at (A), shown below, are provided in each bearing group.

The joints should be dismantled, cleaned, and inspected every 5000 hours of operation. Worn parts should be replaced at that time.

The needle bearings should be repacked with lubricant before assembly. (See lubrication chart, pages 3 or 5.)

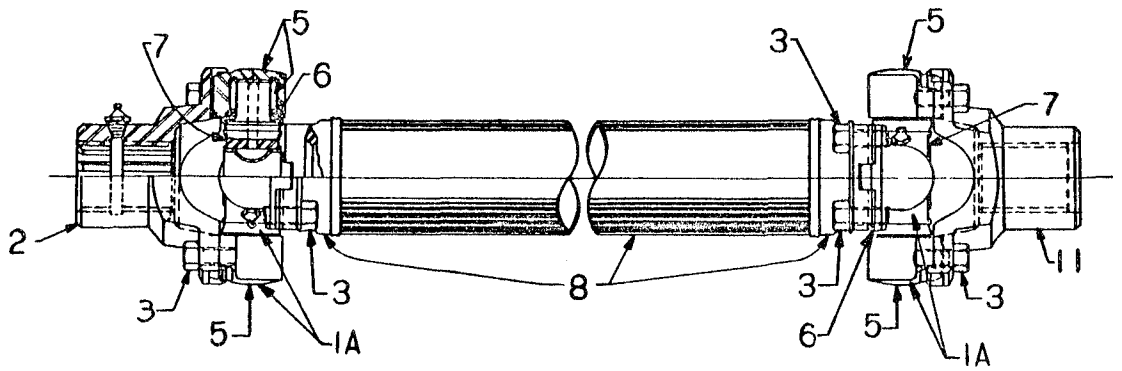


Front Axle End

Front Section of Front Propeller Shaft.

b. Front Section of Front Propeller Shaft.

The slip yoke (8) must be installed at the rear end (away from the front axle). When assembling slip yoke (8) to shaft (12) be sure to time the yokes (8) and (14) turned as shown.

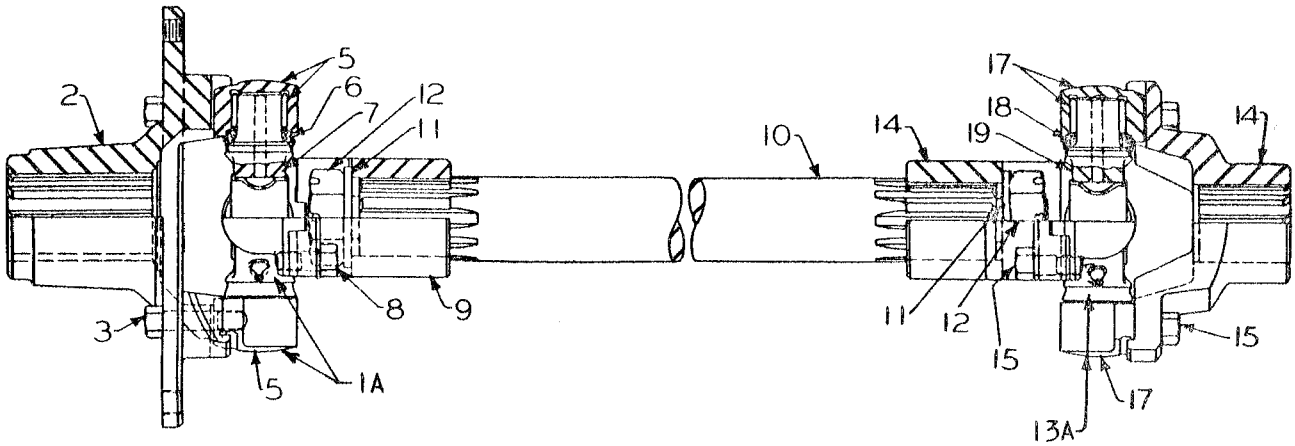


Clutch End

Clutch to Transmission Propeller Shaft.

c. Clutch to Transmission Propeller Shaft.

When making repairs to the main clutch group, (also converter, and power reverse) the tube group (8) may be removed after first removing the eight capscrews (3).



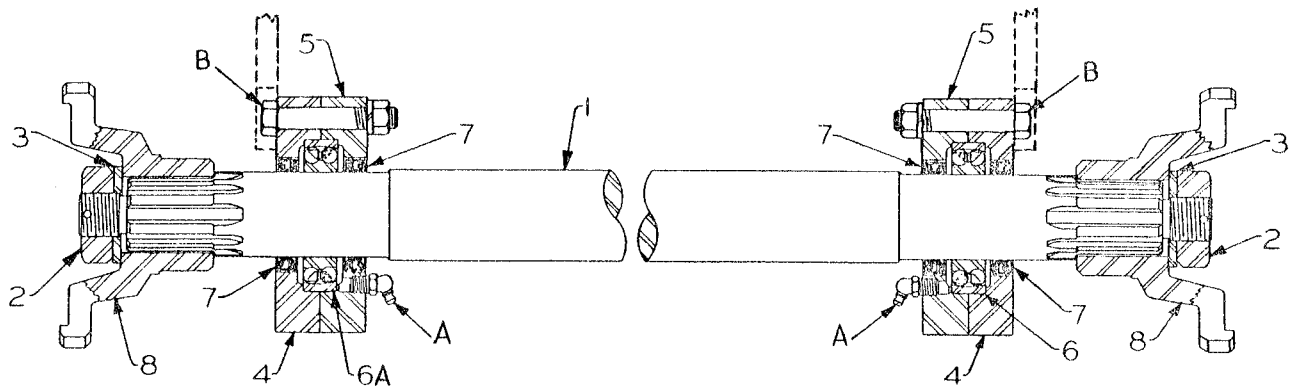
Transfer Case End

Rear Section of Front Propeller Shaft.

d. Rear Section of Front Propeller Shaft.

Capscrews (3), (8) and (15) must be tight and locked in place.

NOTE: Please notice that fitting yoke (9) is timed to the splined shaft (10) with the capscrews (8) to the side; also the fitting yoke (14), located at the right end of shaft (10), is shown correctly timed to the splined shaft (10). This procedure indicates the proper timing of these yokes to the propeller shaft "U" joints.



Center Section of Front Propeller Shaft.

e. Center Section of Front Propeller Shaft.

The center section is mounted in, and rotates on, two anti-friction bearings (6) and (6A). Adjustments are not required.

Each bearing housing (5) is fitted with grease fitting (A). See lubrication chart, pages 3 or 5.

The lips of the end seals (7) should be turned outward. Both nuts (2) should be tight and cottered.

NOTE: Please observe that both yokes (8) are correctly installed, or timed, on the splined shaft (1) with the flanges turned straight up and down.

62. HYDRAULIC BRAKE SYSTEM.

a. General.

The powerful hydraulic "Bendix Duo Servo" brake utilizes a standard hydraulic actuating system, having a compensating type master cylinder operated by a foot pedal, and a brake actuating cylinder at brake drum, together with the required piping, hose, and operating fluid. When a push is exerted on the foot pedal, pressure is created within the master cylinder, causing the column of fluid contained in the master cylinder, piping, etc., to move the drum cylinder pistons, which in turn forces the brake shoes into contact with the brake drum.

When the foot pedal is released, the brake shoe return springs retract the brake shoes and return the drum cylinder pistons to their normal or "off" position, thereby reversing the movement of the column of fluid within the system so that it flows back into the master cylinder.

b. Foot Pedal Adjustment.

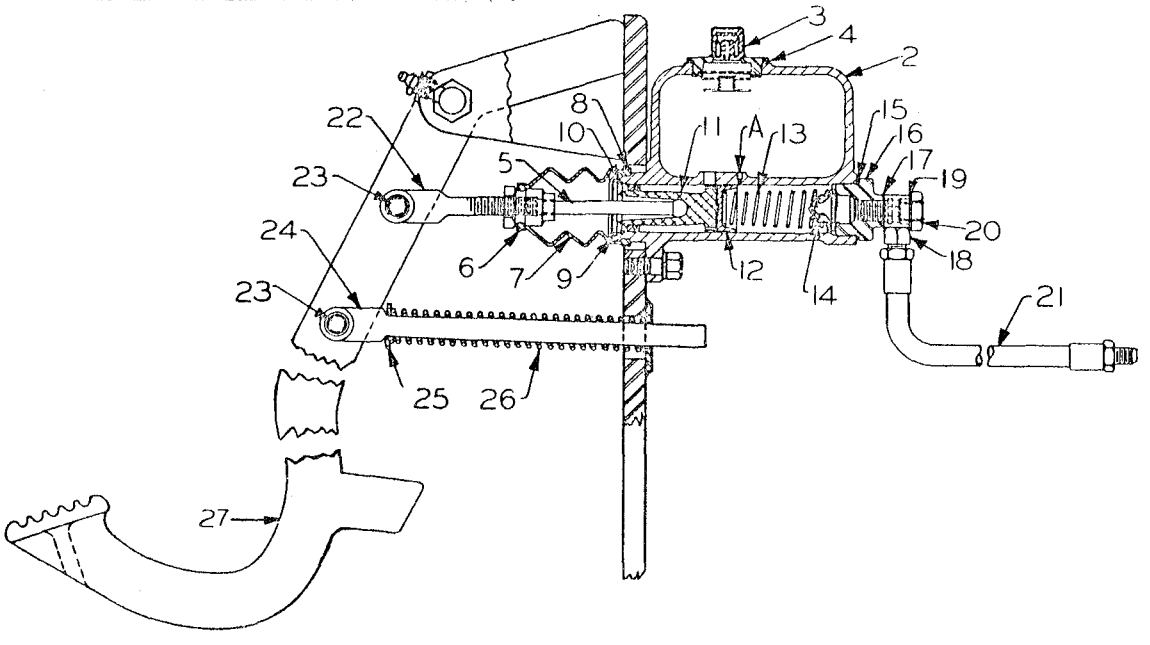
The foot pedal should be adjusted so that there is approximately 1" of free movement at the tread portion of the pedal before the pressure stroke begins. Should the master cylinder link be adjusted so that there is no backlash in the foot pedal, the master cylinder piston and cup may not return full distance to completely uncover the master cylinder compensating port (see (A) below), which may cause failure of the brake to fully release. If the brake does not fully release, the frictional drag will cause the fluid to further expand as its temperature is raised. This expansion of fluid will cause an increase in brake drag and may, in extreme cases, result in self-application of the brake to the point where the grader cannot be moved until the pressure is relieved, either by bleeding, or allowing the fluid to cool, or actually making the proper adjustment at yoke (22), see below.

c. Bleeding the Hydraulic Brake System.

Whenever the hydraulic line is disconnected from the master cylinder, it is usually necessary (after reconnecting the line) to bleed the entire hydraulic system at drum cylinder, to expel any air that may have been taken into the system. Fill the master cylinder reservoir with genuine Lockheed or Delco brake fluid before bleeding the line. Keep the reservoir at least half full of fluid at all times.

To bleed the line, unscrew the hex shouldered portion of bleeder screw three-quarters of a turn to the left and push pedal down slowly. This produces a pumping action which forces fluid through the tubing and drum cylinder, carrying with it any air that may be present in the line.

When air bubbles cease to appear, and the fluid stream is a solid mass, hold the brake pedal down and have a mechanic close the bleeder screw.



Fluid drained out of the system during the bleeding operations should not be used again as it may contain dirt or foreign matter which may be injurious to the system. After drum cylinder is bled the supply of fluid in the reservoir should be replenished.

> CAUTION: Be sure to keep the reservoir half full of brake fluid when bleeding the brake system. Should the reservoir be drained during the bleeding operations, air will again enter the system and rebleeding will be necessary.

d. Brake Adjustment.

Do not adjust brake when drum is hot. If brake is adjusted when drum is hot and expanded, the shoes may drag when the drum cools and contracts.

There are two points for adjustment in a brake system of this type to compensate for normal brake lining wear. These points are the adjusting screw (6) and the anchor pin (15), page 85. The adjusting screw takes up the clearance between the brake lining and the brake drum. The anchor pin serves to centralize the shoes.

e. To adjust Brakes to Compensate for Wear. (See page 85)

1. Jack up rear wheels and one front wheel clear of the floor.

2. Remove the four 3/8" pipe plugs (54) from brake drum (46), page 88.

3. Release brake. Revolve wheels, causing brake to rotate until arrow that is cast into the brake drum (46), page 88, points down.

4. Thru lower right hand 3/8" pipe plug hole in brake drum, insert a pry between the lining of the shoe (2) and the brake drum, and move the shoe assembly until the other shoe (2), page 85, is against the drum.

5. Insert a .015" feeler gauge between the lining and the drum at lower end of shoe (2). Turn the adjusting screw (6) with a screw driver, which causes the adjusting screw to force the brake shoes against the drum, until .015" clearance between lining and drum is obtained. Remove the feeler gauge and centralize the shoes (2).

6. In the event clearance is not found at the upper ends of linings (2), it will be necessary to move the anchor pin to the correct position.

7. To adjust the anchor pin, loosen the anchor pin nut (16), page 85, enough to permit turning the anchor pin with a screw driver (inserted through adjusting hole in upper face of the drum). To decrease clearance between the drum and lining at the anchor pin end of the shoe (2), turn the screw driver to the right. With lower shoe (2) against the drum, turn the adjusting screw (6) and anchor pin (15), in the necessary direction to obtain .015" lining to drum clearance at the lower end of the other shoe (2).

8. Tighten anchor pin nut securely with a wrench while holding the anchor pin with a screw driver. Again check the shoe clearance to be certain the anchor pin has not moved. The lining clearance at lower ends will be about .008" for each shoe. The upper clearance will be about .004" at each end of linings.

9. Install the four 3/8" pipe plugs into brake drum.

f. Precautions.

Use only alcohol to clean rubber parts and the inside of master and drum cylinders. Kerosene or gasoline may cause damage to, or failure of, the hydraulic system.

Do not allow grease, oil, paint, brake fluid, or foreign matter to come in contact with the brake lining.

If brake shoes are not properly lined, poor braking will result. It is better to install new brake shoe and lining groups when linings are badly worn.

63. HAND BRAKE.

The hand brake lever and interconnecting cable actuates lever (25). See below.

Periodic mechanical adjustments are not required to the hand brake mechanism.

Lubricate daily the hand lever pins and internal cable, using SAE-10W oil.

64. HYDRAULIC FOOT BRAKE MASTER CYLINDER.

The master cylinder and interconnecting parts require no periodic adjustment.

Do not allow the master cylinder reservoir to become less than one-half full of brake fluid at any time.

Keep filler cap (3), page 83, clean on master cylinder to prevent air vent being plugged with dirt.

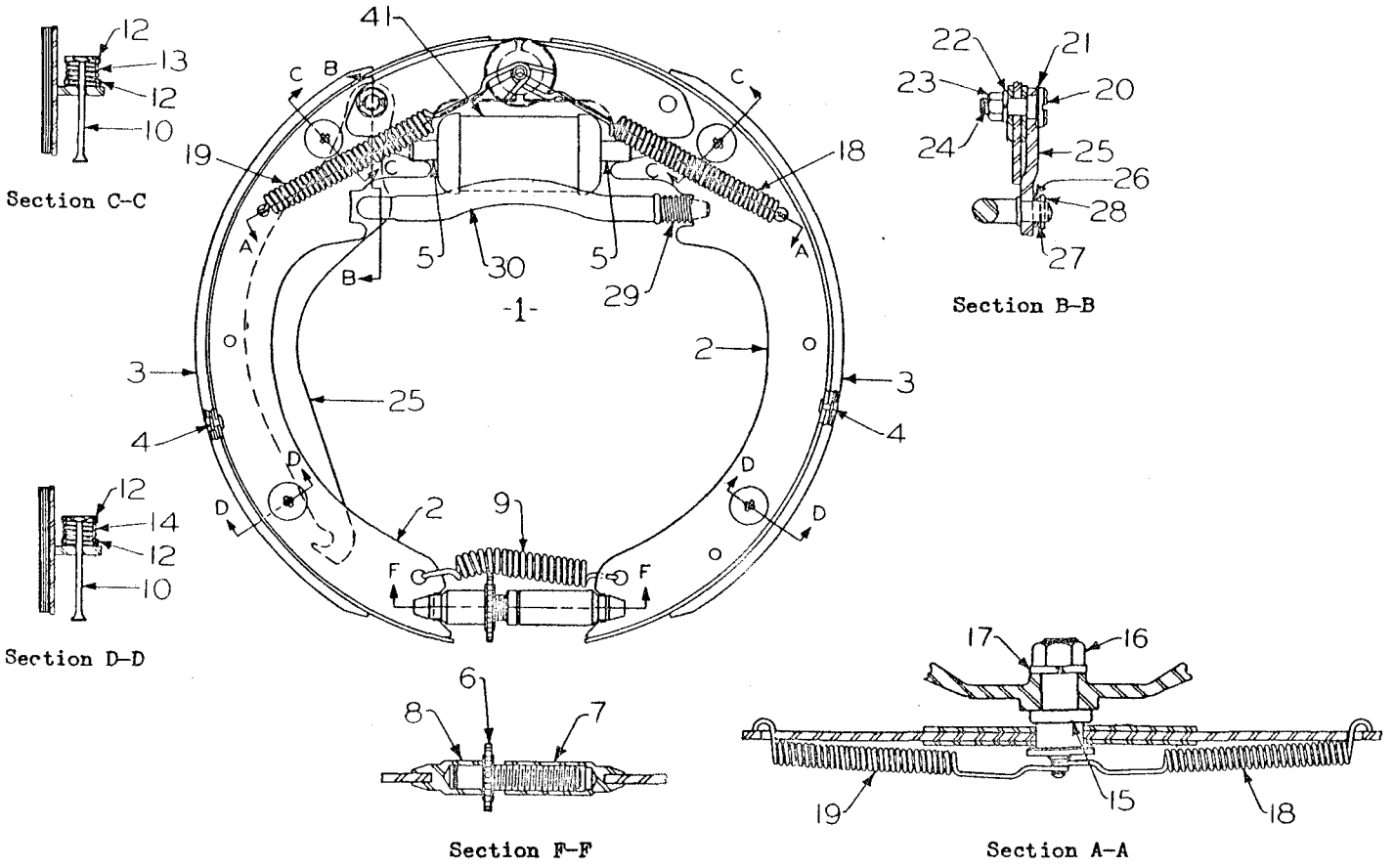
Use only genuine Lockheed or Delco brake fluids. Substitutes may do considerable damage to the hydraulic system.

CAUTION: Be sure to keep the reservoir half full of brake fluid when bleeding the brake system. Should the reservoir be drained during the bleeding operations, air will again enter the system and rebleeding will be necessary.

65. AUXILIARY BRAKE. (Special Order) (Original Equipment Only)

The auxiliary brake used on A-W graders is installed on a flange which is part of the rear gear carrier. The brake assembly is of the same basic type used for the primary brake. Hydraulic lines for the two brakes are in parallel and are actuated at the same time with one brake pedal. There is no emergency brake unit on the auxiliary brake.

All instructions pertaining to adjustment and maintenance (page 83) apply to the auxiliary brake and must be performed at any time the primary brake is adjusted.



66. TRANSMISSION AND TRANSFER CASE REMOVAL. Used with Dry Clutch and A-W "Torcon" Converter only on "Super" and "Pacer" 400 Graders.

a. General.

If internal repairs are to be made, then the assembled transmission and transfer case should be removed as a group from the grader frame.

Before dismantling, if the machine is in operating condition, it is best to drain the gear oil from the transmission and transfer cases and refill them with flushing oil (kerosene or diesel fuel) and run the machine slowly backward and forward for several minutes.

It is best to drain this first washout; refill with clean flushing oil, and repeat. In this way the second washing will usually get everything clean and free of oil.

CAUTION: Do not use gasoline, as there is danger of explosion and fire.

b. Transmission and Transfer Case Group Removal.

The engine, radiator, and engine accessories, need not be disturbed. This likewise applies to the operator's seat, battery box, and dash.

Certain equipment, such as a cable hoist of not less than 1/2 ton capacity, and the necessary wood blocking, etc., is needed before starting the operation.

Follow the procedure outlined as follows:

1. Remove the four capscrews at the following yokes: (28), page 91; (50) and (11), page 88. The center section of front propeller shaft, page 82, may now be removed, after removing the bearing housing to frame bolts (B).

NOTE: Shaft (1), may have to be shifted forward slightly within the bore of bearing (6).

2. Remove shift lever group with cover, after removing the nuts at (26), page 90. Also remove the two sheet metal covers near the top of the transmission.

3. Remove pin (7). Then remove rod group, after removing the cotter pin near (9), page 96.

4. Remove brake cable at hand lever.

5. Remove hydraulic brake hose at master cylinder and (20), page 83.

6. Remove socket (89), with shift lever (77), page 89. Also remove guard under the transfer case.

7. Remove the two bolts (94) and (102), page 89.

8. Place suitable blocking under transmission.

9. Use one cable hoist and attach lifting end over the front two studs (26), page 90. (Balance of hydraulic piping need not be removed.)

10. Transmission and transfer case may now be shifted forward about four inches, and carefully lowered to the ground by means of the hoist.

(Remove blocking progressively as transmission and transfer case is being lowered to the ground.)

Reassembly is the reversal of the above procedure.

67. TRANSFER CASE DISASSEMBLY. (See page 88)

To remove the transfer case from the transmission, it is necessary to first follow the procedure outlined in paragraph 66.

The 2-speed transfer case is attached to the machined rear face of the transmission in the power division gear case and contains six gears. This case pilots over the outer race of the end bearings at the top transmission shaft.

Eight large studs (16) and (26A) hold the transmission and transfer cases together with an oil tight gasket in between.

After these two units are out of the power grader, proceed as follows:

1. Remove cover (37) and oil guards (38), page 88.

2. Remove nut (52) on upper drive shaft (51), also drum (46). Remove the nuts from the studs (35) and (53). Bearing cap (34) may now be pulled out, after which the shaft (51) can be driven toward the brake end of the shaft. (Use light hammer and bronze drift on the opposite end when driving it out.) The brake plate (45), shims (41), with Timken bearing and cup, will come out with the shaft. Keep the shims wired to plate (45) while in dismantled state.

The upper gear (39) may now be lifted upward and out of the case, together with the rear Timken cone (4A).

3. Remove the nuts from studs at bearing support (67). Next pull out the bearing housing (67). The nut and washer (57A) should now be removed. The gear (31) may now be pulled off shaft (24), together with the ball bearings (58), roller bearing (58A), thick spacer (59), and thin spacer (60).

4. The two lock screws (81), with lock wires (82), page 89, may be removed, permitting the removal of shifter shafts (83) and (91). Also remove two springs (85) and two balls (84). Slip the shifter (30), page 88, off the shaft. (Lift out forks (80) and (90), page 89, when dismantling. Insert these forks into slot in shifters when reassembling.) Then expand the snap ring (29), page 88, and slip it, with gear (28), off the shaft.

5. The transfer case (1) may now be removed from the transmission case, after all nuts have been removed from the studs (16) and (26A).

6. Remove shaft group (22).

7. Remove cap (71), with shims (72), (73) and (75). Keep the shims wired to cap (71).

8. Next remove the nut (13) and yoke (11) from shaft (12). Use a medium weight hammer and drive against a bronze drift on the left or yoke end of the shaft, driving it out toward the right. The Timken cup and cone (4) at right side will come out with the shaft. The gear (2) and other cone may now be lifted up and out of the case.

68. TRANSFER CASE REASSEMBLY.

a. For reassembling, reverse the above procedure.

b. Before reassembling shaft (12), clean, inspect, and replace (if necessary) all parts, such as seals, gaskets, Timken and ball bearings, and spacers (21), (48), (59) and (60), page 88.

c. Clean the complete transfer case and parts carefully, inside and out.

d. Place Timken cone (5) (taper outward) over the right end of the shaft, and pass the yoke end of shaft (12) through the right lower hole in the case: then through parts as follows: gear (2), Timken cone (4), with taper outward. Tighten cap (8) solidly to the case (1), after being sure Timken (4) and (5) are in place. Install seal (10). Then assemble and tighten solidly the yoke (11), using washer and gasket with nut (13).

e. Next install the right cup (5) with taper inward, then a new gasket (72), together with shims (73), (74), (75), as required and cap (71). Shaft (12) should not have any end clearance. Lubricate both Timken bearings (4) with SAE-30 oil.

f. When a new gasket (26) is installed between the transfer and transmission cases, care must be used in evenly and alternately tightening the nuts on studs (16), and (26A), otherwise the transfer case may be tipped slightly, later presenting difficulty in entering the last or outer bearing (58A), nearest to cap (61).

We strongly recommend the use of a dial indicator attached to the right end of shaft (24) and indicating in the bore of the transfer case at the point where the outer roller bearing (58A) is located.

The indicator reading must not exceed .002" eccentricity. If it is greater than .002", then loosen the nuts on studs (16) and (26A) and retighten them alternately until all are tight, then dial indicate the bearing bore again for final alignment. (Both faces of the transmission case and transfer case must be clean and smooth. A new gasket (26) should always be installed.)

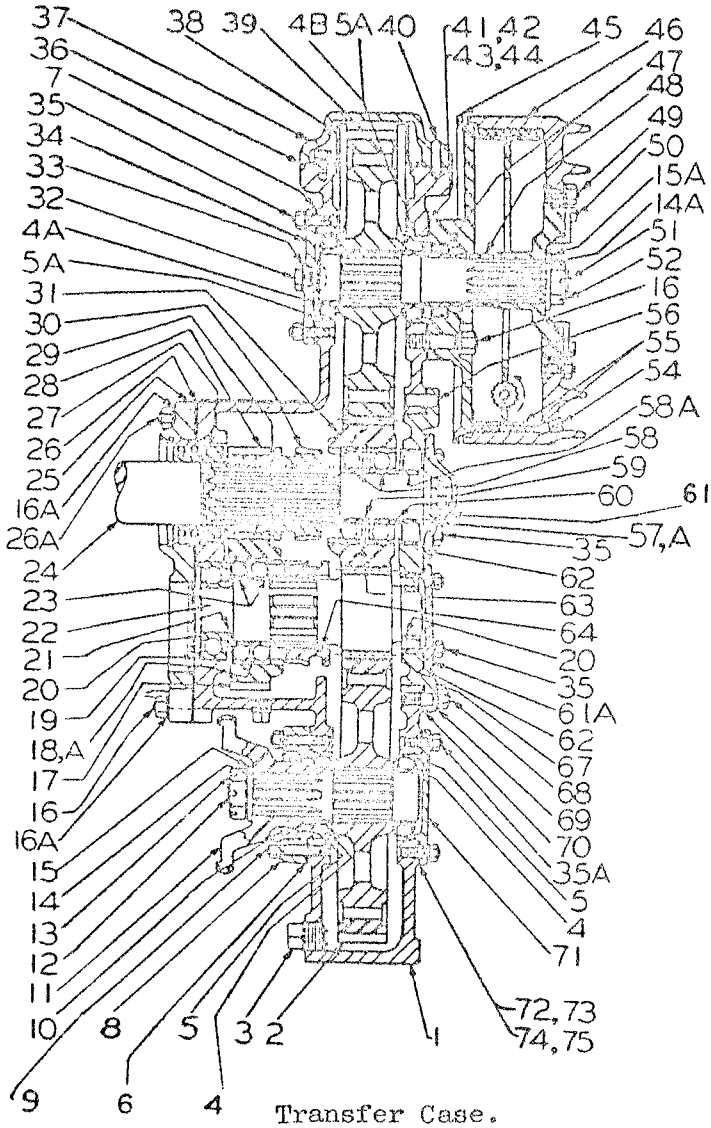
NOTE: Nut (27) must be on the shaft with the small diameter toward the right.

g. Slip gear (28) over shaft (24). Be sure the snap ring (29) is locked in the shaft groove. The shifter fork slot in shifter (30) should be nearest to gear (28). (Insert the fork (90), page 89, into the shifter slot before moving the shifter onto the spline of shaft (24).)

Assemble the shift clutch (64) on the countershaft (22), with the fork groove toward arrow (64). Install bearing (23) into the bore of idler gear (17) Then install snap ring (18). Then lubricate the bearing with SAE-30 oil and lightly drive the gear with bearing over the shaft (22). Next slip the spacer (21) and drive the lubricated single row ball bearing (20) over the shaft. Then install the assembled shaft (22) into the transfer case bore. Lightly drive the lubricated (right) bearing (23) onto the stub end of shaft (22).

h. Reinstall shift fork (80), page 89, together with shifter shafts (83) and (91), locking the two setscrews (81) by means of lock wires (82), as shown. Replace the balls (84), springs (85), tube (86), and bracket (89).

Install the rear ball bearing (58), (see above), and the snap ring (63) in gear (31), and slip it over shaft (24). Next slip the following parts on the shaft in order shown: namely, spacer (59), bearing (58), spacer (60), bearing (58A), then securely attach the washer and nut (57A). Lubricate the ball bearings and roller bearing (58A).



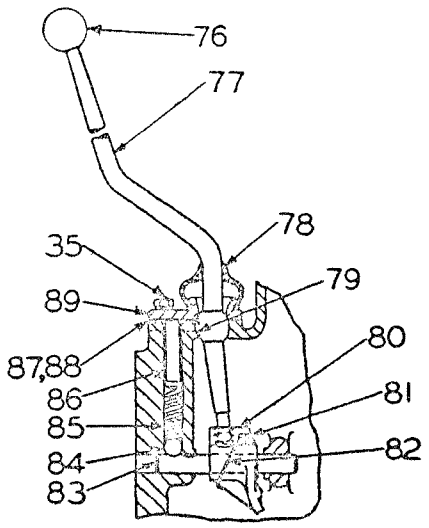
Transfer Case.

NOTE: The location and end clearance of all gears, bearings, and spacers are controlled by the snap rings (29) (63), and (18).

All snap rings should be concentric, and the circular tension should solidly lock the rings in the snap ring grooves.

Next install bearing support (67), caps (61A) and (61), (new gaskets), by means of studs and lock washers and nuts provided. When shifters (30) and (64) are in neutral position, the gears (31), (22), (2) and (39) should rotate freely, except for friction developed by the seals (46) and (47).

i. Lower the upper gear (39) into position, after installing the left cone (4A) (taper outward) with cup (5A), together with cap (34) and gasket.



Section B-B

Next insert shaft (51) and right cone (taper outward), with cup (5A). Then brake plate (45) (seal lip turned inward) with all shims (41). Add or remove shims as required in order that the shaft (51) will not have any end clearance. (The Timken bearings should not be preloaded or binding.) Next install spacer (48) and flange (50), with brake drum (46). Securely tighten and cotter the nut (52).

j. Install the oil collectors (38).

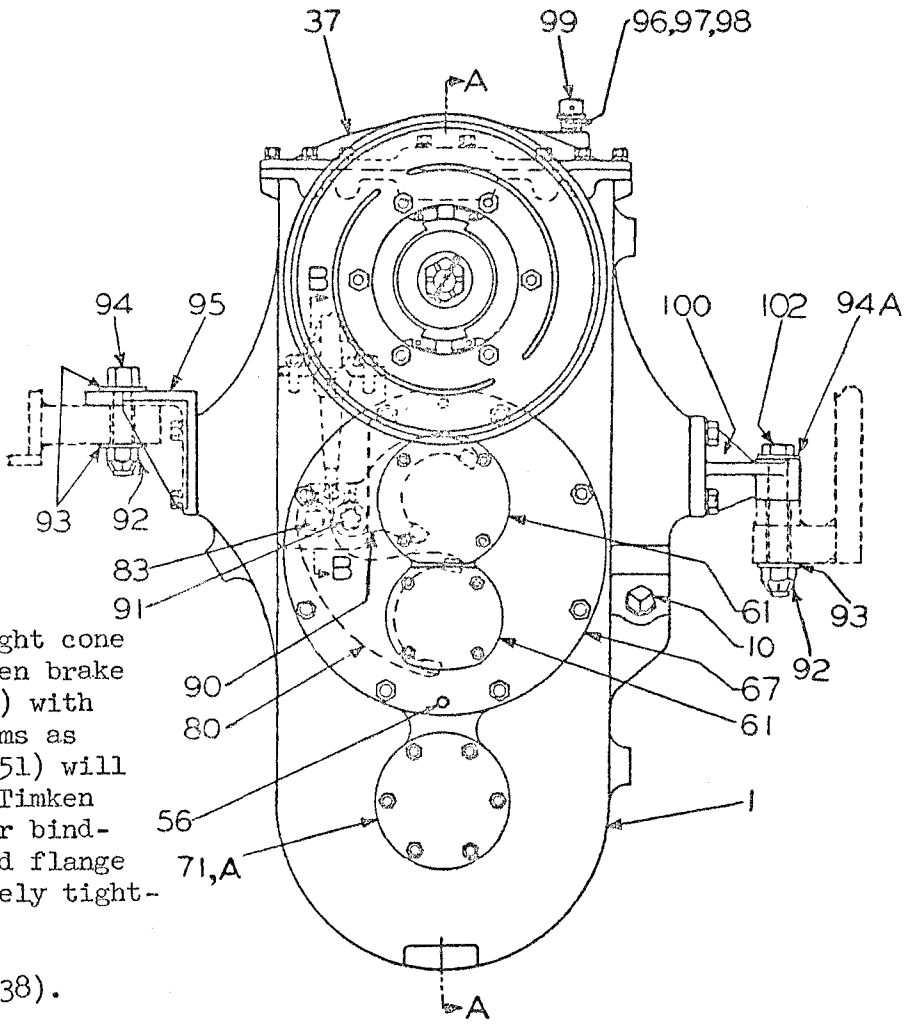
k. Reinstall cover (37), this page. Cap (99) has a drilled vent for ventilation purposes. Tube (96) extends downward into the transfer case about 2-1/2". Its lower end is cut on a 45° bias and the long side of the tube should be turned toward gear (39), page 88.

Never attempt to dismantle or make repairs to the transfer case without thoroughly studying the cross section diagram shown on page 88.

69. TRANSMISSION SHIFT COVER.

a. It is not necessary to remove the transmission or seat box to inspect the shift rails (15) and (11), page 90. It is only necessary to remove the nuts at studs (26) and lift off the shift lever group.

b. Then remove the nuts at studs (26A), after which the rail case cover may be lifted upward and turned over on its back, and removed from the right side of the grader. (Mechanic stands on the ground to do this.)



Transfer Case

c. Remove the expansion plugs from the cover, also the three wired setscrews from the shift rod ends.

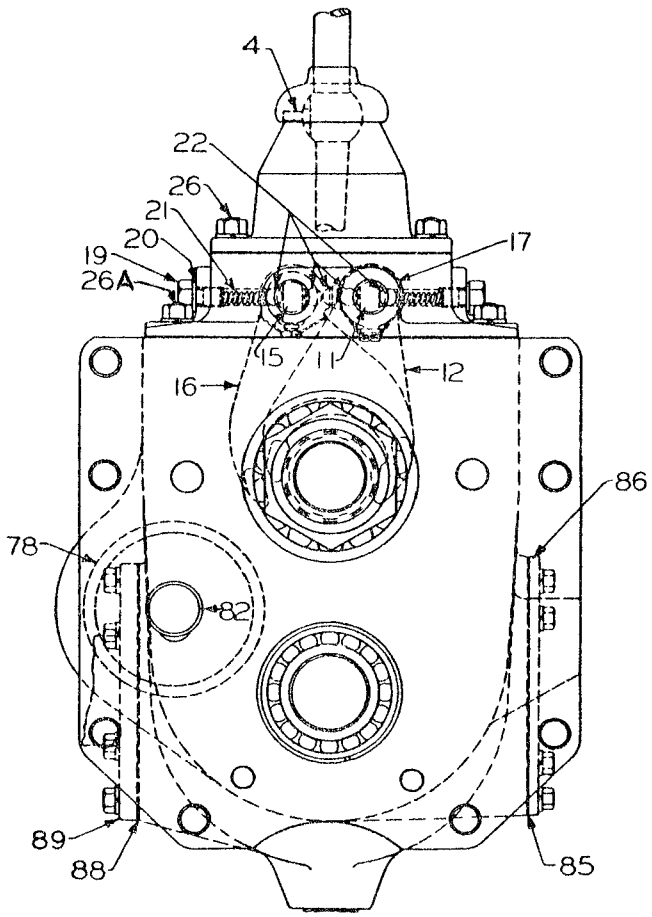
d. Remove the two capscrews (19) with washers (20). The two outer springs (21) and balls (22) will now come out.

e. Shift both rails into neutral, then either rail may be slid out of the cover hole. The three center balls will now fall out. Remove the other rail.

f. Reassembly is reversal of the above procedure.

g. The tension of springs (21) should not be too tight, otherwise hard shifting will be the result.

h. When installing the cover to the transmission, be sure the lower ends of both shift forks (12) and (16) slide into the shift grooves of shifters (38) and (49), page 91.



70. TRANSMISSION DISASSEMBLY.

In order to disassemble any part of the transmission, follow the instructions under "Transmission and Transfer Case Removal", paragraph 66, which will permit the transfer case and transmission to be removed from the grader.

Now remove transfer case from transmission by following the instructions given under "Transfer Case Disassembly", paragraph 67. Disassemble the transmission as shown on page 91 as follows:

a. Move both shifters (38) and (49) into mesh. Remove cotter and loosen nut (27).

b. Remove nuts from studs (32) and pull housing (31) with shaft (34) away from the transmission case. Remove nut (27) and yoke (28). Shaft (34) may now be tapped out of bearing (30). (Examine bearing (30), and if it requires replacing, be sure to do so. Also install a new seal (29).)

c. Examine bearing (36). It may be pressed off the shaft (34) after removing nut (35). The end thrust on shaft (34) is taken by bearing (36). Snap ring on its outside diameter is held between the face of transmission case (77) and face of housing (31). The bearing (30) floats on its outside diameter within the bore of housing (31). The inner diameters of both bearings (30) and (36) are held to the shaft shoulders by the nuts (35) and (27).

d. Oil pocket (A) delivers oil through ducts at (B) and (C) to the forward side of bearing (30). In view of this, the gasket (33) and housing (31) must be reassembled with the oil ducts turned up as shown.

e. Oil flows through bearing (30), after which it flows through bearing (36) and back into the transmission case.

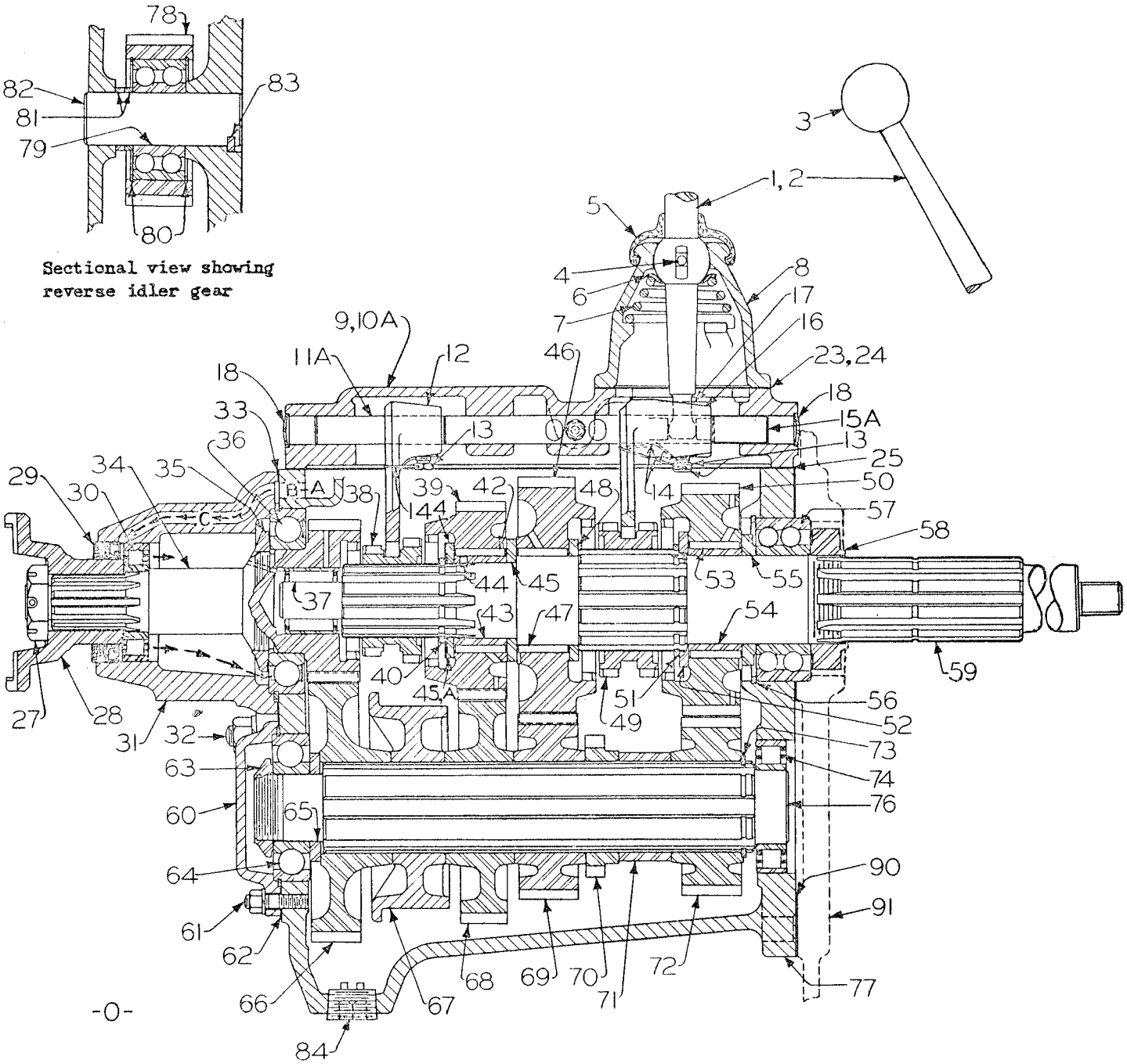
f. Slip the low and reverse shifter gear (49) to the left, and pry the snap ring (51) out of its groove. Slip both of these to left as far as they will go. Screw off the nut (58). Drive the main shaft (59) to the right until bearing (57) may be pulled off the shaft.

g. Lift up on clutch end of main shaft (59) and moving it toward the left, lift it out of case with gears mounted on it.

h. Washer (55) and reverse gear (50) may be slipped off the shaft, also forty-eight rollers (53), sleeve (54), thrust washer (52), snap ring (51), and low and reverse shifter gear (49).

i. Expand and slip the snap ring (40) off the shaft. Next slip the following parts off the shaft; washer (41), 2nd speed gear (39), forty-two rollers (42), and sleeve (43).

> CAUTION: There is a small pin (44) inside of this sleeve (43). Do not lose this pin as it must be used in reassembly.



Sectional view showing reverse idler gear

"SUPER" AND "PACER" 400 GRADERS, A-W TRANSMISSION.
USED WITH DRY CLUTCH OR A-W TORCON CONVERTER ONLY.

j. Next remove the thrust washer (45) and low speed gear (46), together with forty-two rollers (47) and finally thrust washer (48).

NOTE: All end clearances of bearings are controlled by the location of the snap ring grooves cut in the main shaft (59). The three gears (39), (46), and (50) are mounted on roller bearings, and each must have not less than .006" total end lubrication clearance between the supporting thrust washers and the ends of the gear hubs.

k. Remove countershaft bearing cap (60), and nut (63), also snap ring (75). Countershaft (76) may now be pressed or driven out, toward the transfer case end.

l. All countershaft gears may now be removed from the case for cleaning and inspection.

m. The reverse idler gear (78) and reverse gear parts may be removed, after removing shaft (82), with key (83).

71. TRANSMISSION REASSEMBLY.

a. Clean and inspect all parts carefully. Always install new gaskets. Carefully check snap rings for concentricity and tension before using again.

b. Be sure to reassemble shafts and gears as shown on pages 89, 90 and 91.

c. Install a new adjusting nut (63), page 91, on clutch end of countershaft.

d. Reassembly is the reverse of the above procedure.

72. TIRE PUMP. (Special Order)
(Part No. PGF-13961, model 127-12V)

a. Specifications.

AIRSEAL: Specially processed heavy neoprene, reinforced with nylon, takes the place of ordinary piston rings.

LUBRICATION: Grease-packed sealed bearings. No other lubrication required.

PISTON: High strength aluminum.

OIL-FREE AIR: Absolutely oil-free air at all times. No oil filters or collectors needed in the air line.

RELIEF VALVE: None needed due to patented design, which is why no "All-purpose" compressor can ever explode.

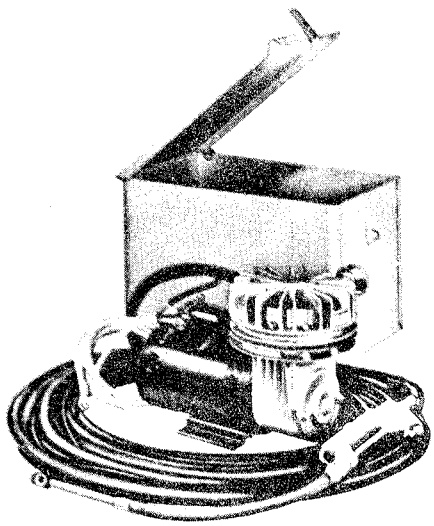
b. Operating Instructions.

The compressor supplies air only on demand by firmly squeezing the lever on the tire chuck. Releasing this lever will automatically register the tire pressure on the gauge. To deflate the tire, depress the handle to an intermediate position.

Conserve battery power by running the grader engine at a fast idling speed to permit the generator to charge the battery while the compressor is in use.

c. Service Instructions.

If the compressor runs but delivers only a small amount of air, trouble may be due to broken valve, air seal, or clogged filter. Keep filter clean at all times.



"All-Purpose" Air Compressor

To examine valves or air seal, remove bolts around top of finned head. Remove screws which hold retainer plate and air seal to top of piston. Inlet Valve (Part No. D-10158) is on underside of Compression Plate. Outlet Valve (Part No. D-10775) is on top. These valves may be changed by removing the two screws which fasten them to the Compression Plate.

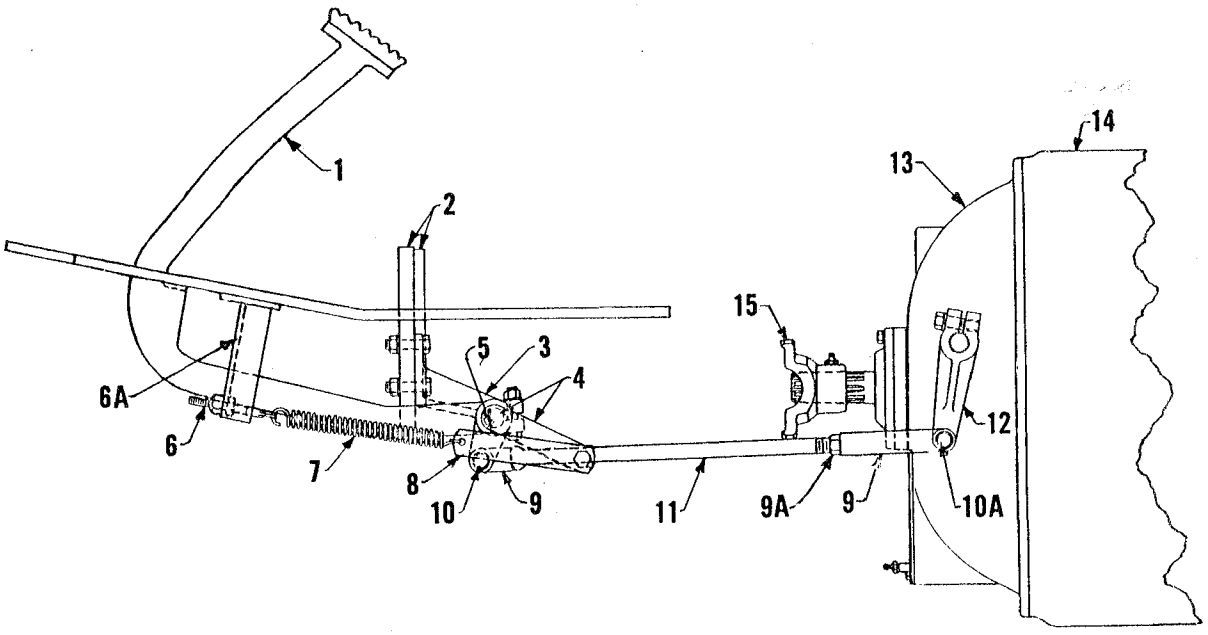
> CAUTION: Always use new head gasket. Be sure all screws and bolts are tightened securely to prevent air leaks.

d. Guarantee.

The Johnson Service Company guarantees its Air Compressors unconditionally for a period of 90 days. All units are thoroughly tested and inspected. However, any part proving defective within one year of date of purchase will be replaced without charge.

This guarantee applies to defective material or workmanship. Ordinary wear, accident, mis-use or misapplication are expressly excepted. All repairs and parts under this guarantee are F.O.B., Johnson Service Company, Milwaukee, Wisconsin. No local service or repair charges will be allowed unless permission is granted by the Johnson Service Company.

NOTE: The Electric Motor is manufactured by the Electric Auto-Lite Company of Toledo, Ohio. Service and Parts can be obtained from any Auto-Lite dealer.



73. MAIN CLUTCH ADJUSTMENT.

a. General.

1. First inspect the clutch pedal linkage. (See above drawing.)

2. Spring (7) must have sufficient tension of its own to lift the pedal (1) clear up to the floorboard without pulling it up with your hand. If you can lift the foot pedal (1) upward against the floorboard with your hand, then the tension of the spring (7) should be made tighter, or the linkage parts (3), (4), (5), (9), and (10) may be binding, and require oiling to loosen them up.

3. Make certain this return action is positive even with a slow foot action.

4. Be sure the clutch lever (12) is located on the shaft so it does not strike the transmission bell housing either in released or full engaged position of clutch. The pin end of lever (12) slants toward the foot pedal (1) when the pedal is in highest position. This is shown above, with the pedal (1) in the raised and released position.

5. The clutch itself, however, is in fully engaged position and there is ample clearance between the clutch throwout bearing (22), page 95, and the clutch fingers, to permit the clutch to operate satisfactorily, unless abused.

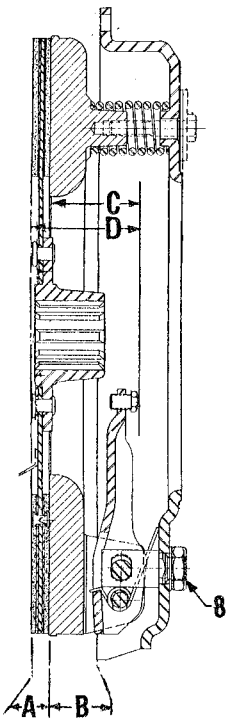
b. Clutch Adjustment.

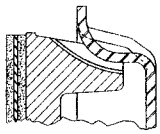
1. To adjust clutch, first loosen lock nut (9A), (see above drawing), remove pin (10A), screw forked yoke onto the rod (11) about two turns, and reinstall pin (10A). Do not reinstall the cotter pin through pin (10A) or tighten the lock nut (9A) at this time. Instead depress foot pedal (1) and observe if the first free easy movement is from 2-1/2" to 3". If it is correctly adjusted, then replace the cotter pin and tighten lock nut (9A).

2. If the first free easy movement is more than 3-1/4", then you have shortened the rod (11) too much and the clutch will not disengage properly. This will result in gear clashing.

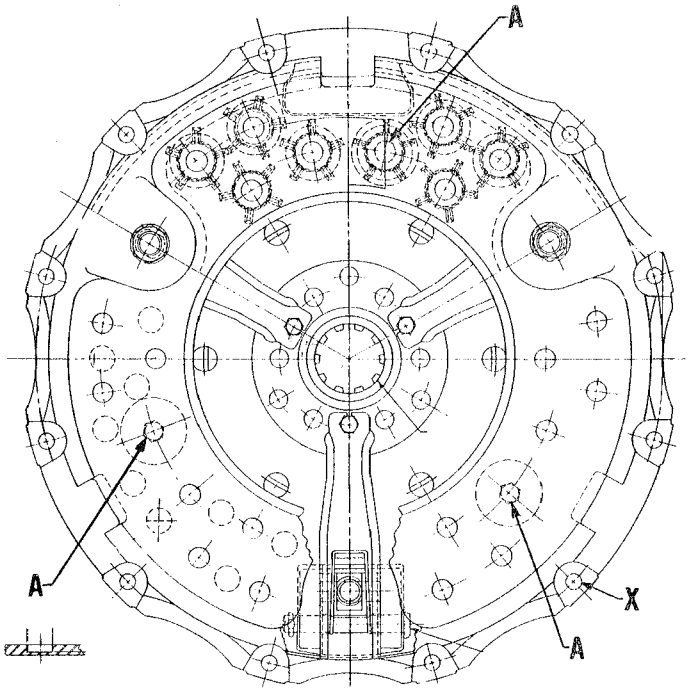
3. To ascertain if the clutch is disengaging properly, stop the engine, have someone depress the clutch pedal to within 3" of floorboard. Then try to turn the propeller shaft yoke (15) with your hands. If it turns freely you can consider the clutch linkage is adjusted correctly and that the clutch is properly disengaging.

NOTE: When the clutch pedal is fully depressed to the floorboard, you cannot turn the yoke (15) easily, because the transmission clutch brake is applied. Raising the clutch pedal about 3" will release the transmission clutch brake. (See page 96 for clutch brake.)





DIMENSIONS:
(A) - .471 ± .011
(B) - 1.279 Important
(C) - 2.276 ± .015
(D) - 2-3/4 ± 1/16
With drive member in position, approximate only.



15" Clutch (Sectional View) 15" Clutch (Rear View)
Used with "400 and 500 Series" Graders with Dry Clutch or A-W "Torcon" Converter.

c. Clutch Adjustment Warning.

Do not disturb the factory setting of the three nuts (8), shown above, inside the clutch housing, as these have been properly set on a fixture at the factory, and without special tools it is impossible to obtain perfect alignment and adjustment. The only field adjustment necessary is in the outside linkage (rod and fork (11) and (9), page 93.) Never make any adjustment of the three nuts (8).

d. Clutch Abuse.

Abuse consists of slipping the clutch such as trying to move the grader in high reverse speed or any forward speed which the engine cannot pull. In such cases, shift the transmission gears to a lower speed which the engine can pull.

Do not slip the clutch unnecessarily, lest you be burdened with costly repairs and the grader not available for work.

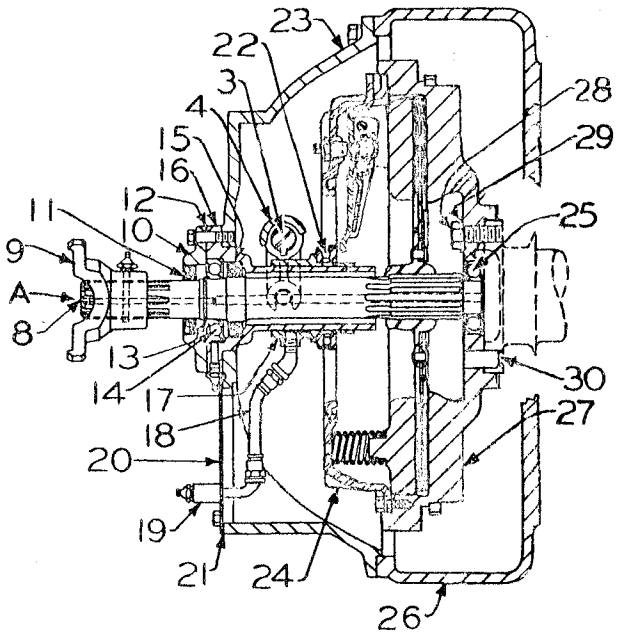
Riding the clutch pedal with your foot, or over-lubrication of the clutch release and pilot bearings, constitute other forms of abuse.

e. Clutch Lubrication.

1. Clutch throw-out bearing (22), page 95, is lubricated through the exposed high pressure fitting (19), extending through the plate (20). Do not over-lubricate this clutch throw-out bearing. Usually it only takes one, and not more than two strokes of pressure gun, to replenish grease. (Every 50 hours of operation).

2. The Clutch pilot bearing (25) is lubricated through a grease fitting screwed into the rifle drilled hole (A) of the clutch shaft (8). Consult lubrication chart, page 3 or 5, for frequency of servicing operation.

3. Warped and cracked pressure plates, and prematurely worn facings, indicate excessive heat, and are generally caused by excessive clutch slippage, or over-greasing. In cases where too much lubricant has been applied accidentally, causing temporary slippage, wash the entire clutch compartment with kerosene to remove all traces of grease.



Clutch Compartment

f. Clutch Removal.

1. General:

The clutch may be easily removed from the A-W power grader in approximately 20 minutes. The engine or transmission will not be removed or disturbed in any way. This likewise applies to the cab, seat box, fuel tank, dash, hood, air cleaner, and battery box.

Ordinary hand tools, such as socket wrenches, are all that is required. One man can do the job easily.

2. To Remove Clutch: (See above)

a. Remove the eight capscrews at both yokes (9). Next remove the clutch to transmission propeller shaft group.

b. Remove the cotter and pin at the lower end of lever (12), page 93.

c. Remove the inspection door (20) (see above). Remove nipple (19) from hose (18). Unscrew hose (18) from shifter yoke (17).

d. Remove the capscrews from bearing cover (10). The shaft (8), with (10), (16) and (17), may be pulled straight out toward the transmission.

e. Remove the capscrews from cover (23) and lower it to the ground.

f. Use 3/8" x 2-1/2" N.C. capscrews with plain washers, and these should now be screwed into the three holes located in the pressure plate at (A), page 94. These screws will compress the clutch springs and keep the clutch group assembled during clutch removal.

g. The capscrews at (X), page 94, may now be removed, after which the clutch drive member group may be lifted out of the bell housing.

g. Clutch Installation.

1. General:

If a new driven disc is needed, the outside diameter of the disc should run true with the splined hole at hub. To check this, proceed as follows:

a. Mount the driven disc on the splines of shaft (8). Place the shaft on lathe centers. Rotate the shaft by hand and with dial indicator determine the amount of facing runout.

b. When the shaft (8) is rotated by hand, the outside face of the lining should run true; that is, within .030" dial indicator reading. Install a new straight disc if necessary.

2. To Install Clutch:

a. Replace clutch pilot bearing (25), (above) if worn. Assemble the bearing seal away from the crankshaft flange. Before assembly use a grease gun to fill the rifle drilled hole at point A. Pack the bearing with lubricant.

b. Clean out the flywheel of all dust and lining material.

c. Install the driven disc into the flywheel, with the short end of the splined hub toward the crankshaft.

d. Install the clutch (24), leaving the capscrews (X) page 94 loose. Insert the shaft (8) thru the driven disc hub and clutch pilot bearing. Then tighten the clutch solidly to the flywheel (X) page 94. Remove shaft (8) page 95.

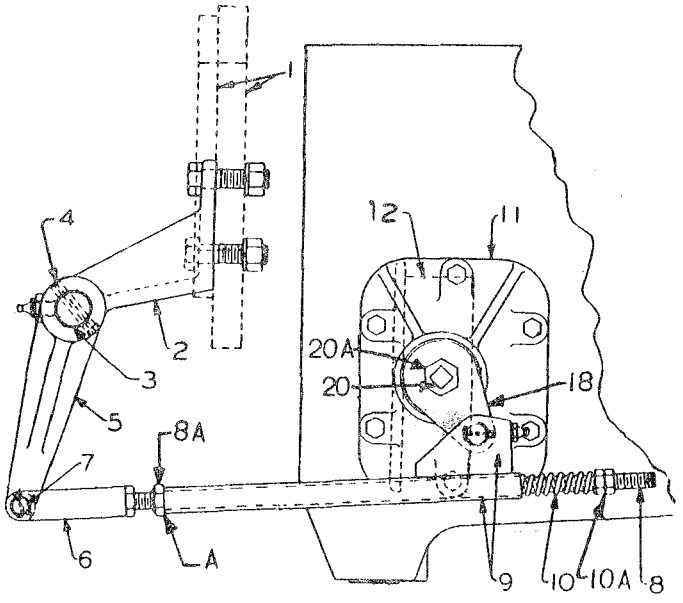
e. Install and tighten the bell housing (23) to the housing.

f. Assemble shaft (8) to sleeve (16). (Replace seals (11) and (15), keeping seal lips turned as shown. Replace bearing (14) if worn or damaged; then install snap ring (13).)

g. Enter shaft (8) with sleeve (16) into bell housing. Slip cap (10) over shaft (8), turn seal lip towards Ref. (11), and install capscrews in cap (10). Remove the capscrews (A), page 94. Reinstall parts (18), (19) and (20), page 95, and the propeller shaft.

h. Lubricate all bearings (14), (22) and (25).

i. Re-adjust clutch linkage, page 93, paragraph b.



74. CLUTCH BRAKE. (See Above)

a. Function of Clutch Brake.

1. The powerful Austin-Western clutch brake provides a speed retarding effort to the clutch driven member and transmission gears, when shifting gears.

2. The internal brake consists of an internal drum (12), 5" in diameter, which is spline driven. A lined brake shoe and internal screw arrangement, together with external linkage, is interconnected to the clutch foot pedal (1), page 93. When the foot pedal is pressed to the floorboard, the linkage moves lever (18),(below) to the left, and the threaded screw moves the lined shoe against the internal drum.

3. When the engine is running full throttle and brake properly adjusted, and foot pedal is depressed to the floorboard, the transmission gears will come to a rolling stop in about three seconds.

b. Clutch Brake Adjustment.

NOTE: Levers (5) and (18), (below) and interconnecting linkage are shown in released brake position.

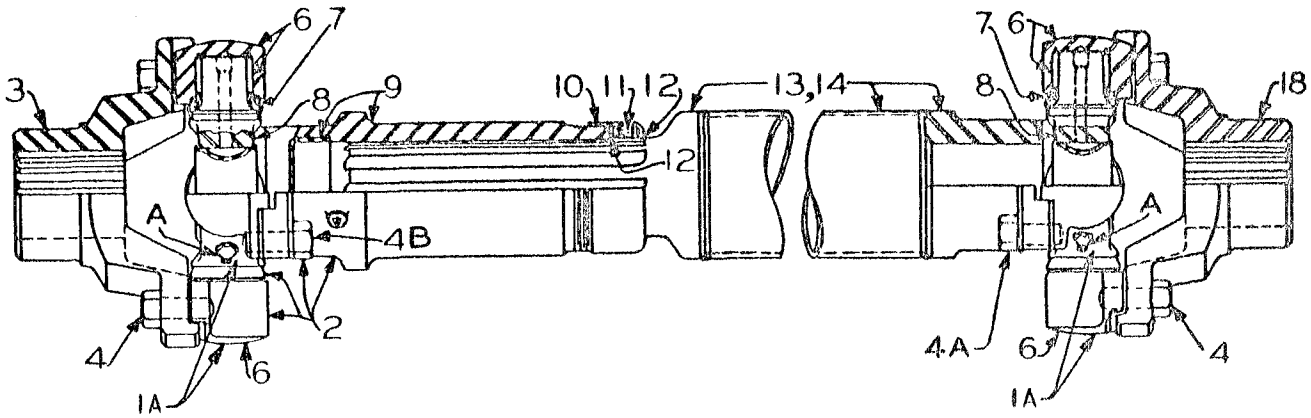
1. First adjust the main clutch, page 93, paragraph b.

2. With clutch pedal in fully raised position (engine stopped), the overall length of spring (10), (below), should be adjusted to about 1-3/4". Then lock the two nuts (10A) together as shown.

3. Run engine at wide open throttle. Then have an assistant depress and hold the foot pedal to the floorboard.

4. Loosen lock nut (20A), (see illustration at left) and adjust the screw (20) in order to establish about 1/16" space between the end of tube (9) and nut (8A). (Nut (8A) is welded to rod (8) and will move to the left about 1/16" when adjusting screw (20) is properly set and lock nut (20A) tightened.) Move the clutch pedal upward and downward full distance several times and observe at (A) for proper 1/16" spacing.

NOTE: The main clutch must be adjusted as shown on page 93, paragraph b, before the above adjustments are made.



Rear Axle End

75. REAR AXLE PROPELLER SHAFT.

The slip yoke group (9) must be installed nearest to transfer case.

When installing the slip yoke (9) on the male spline shaft (13) be sure the capscrew holes, at (4A) and (4B) on both ends of the shaft, are in line with one another.

76. REAR AXLE. "PACER" GRADER.

The rear axle unit of the A-W power grader is of the double reduction type. The drive from the propeller shaft to the rear axles is made first thru a spiral pinion and bevel gear, and then thru a pinion and spur gear, fully enclosed, running in oil. It is equipped with dust-proof oil seals and mounted on anti-friction bearings thruout.

The oil level is the 1" pipe threaded hole with square head pipe plug. It is located on the center line of axle on left hand side of grader, a few inches below the gear carrier (see "A", page 98).

Keep this filled with oil as recommended in the lubrication instructions, pages 3 or 5.

In making repairs to parts located at either end of the main axle housing, page 98, including replacing of the drive shafts, it is unnecessary to remove the main axle housing from the rear end of power grader frame.

If the machine is in operating condition it is best to drain the gear oil from the rear axle and refill it with kerosene or diesel fuel, and run the machine slowly, backward and forward several minutes. It is best to drain this first wash-out and refill with clean kerosene or diesel fuel, and repeat. In this way, a second washing will usually get everything clean and free of oil.

> CAUTION: Do not use gasoline as there is danger of explosion and fire.

77. REAR WHEEL REMOVAL.

Both wheels are attached in the same manner, so the following will apply to either right or left hand wheel.

Follow the procedure shown on page 63, paragraph 46, "Wheel Removal and Reassembly".

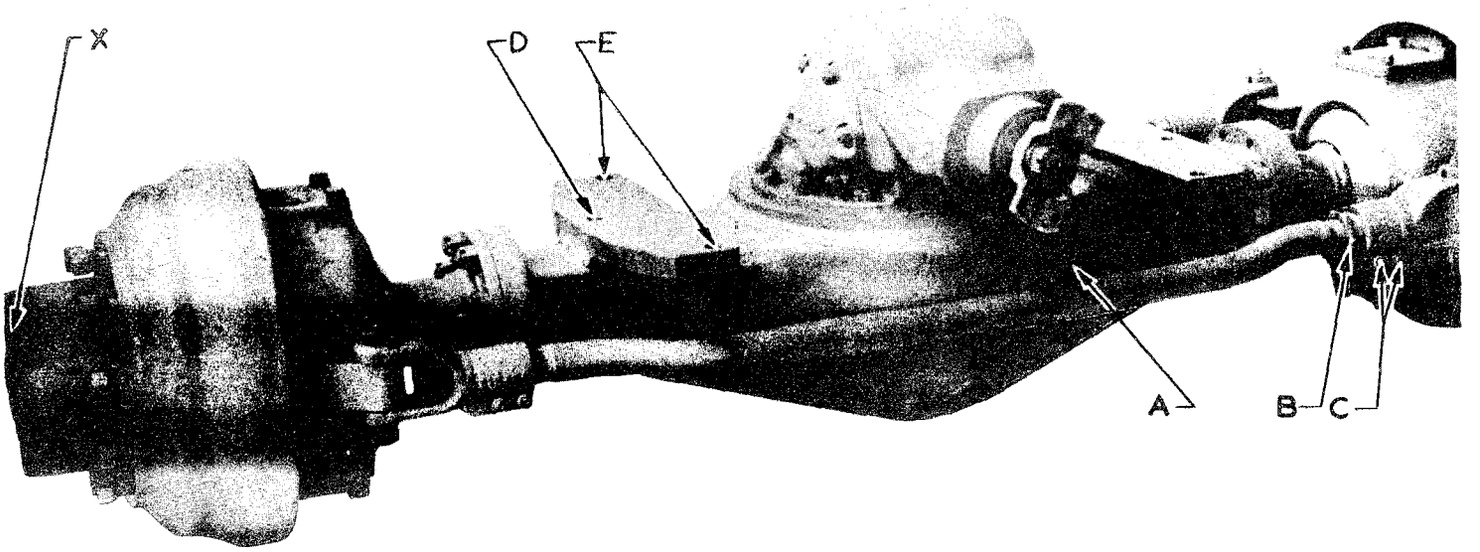
78. UNIVERSAL JOINT WITH AXLE SHAFT REMOVAL.

Follow the instructions as shown on page 63, paragraph 46, covering "Wheel Removal and Reassembly.

Follow the instructions shown on page 64, paragraph 47.

79. AXLE UNIVERSAL JOINT DISASSEMBLY. (For Cleaning and Inspection Purposes Only)

Follow the instructions as shown on page 64, paragraph 48.



"PACER" 400 GRADER REAR AXLE

80. REAR WHEEL STEERING KNUCKLE DISASSEMBLY.

Follow the instructions as shown in paragraphs 46 and 47.

Follow the instructions as shown on page 68, paragraph 52.

81. REAR WHEEL PIVOT BEARING ADJUSTMENT. (With the Wheel Removed but Steering Knuckle still on the Power Grader)

Follow the instructions as shown on page 68, paragraph 53.

82. REAR WHEEL TOE-IN ADJUSTMENT.

The A-W power grader is equipped with tie rod adjusting nut (B), (above) (which has both right and left hand threads). Loosen the clamping bolts (C) and adjust so there is no toe-in or toe-out. Check this monthly, and after overhauling axle. Measurements to be made at side wall of tires as close to the height of center line as possible.

83. REMOVAL OF REAR AXLE ASSEMBLY FROM FRAME. (See above)

It is not essential to roll the rear axle from under grader to remove the gear carrier, but it is preferable to do so.

1. Place machine on level place.

2. Revolve blade until it is square across and lock circle latch. Place blocking under each end of blade about a foot from the ends.

3. Block both front wheels securely to prevent possibility of machine rolling forward or backward.

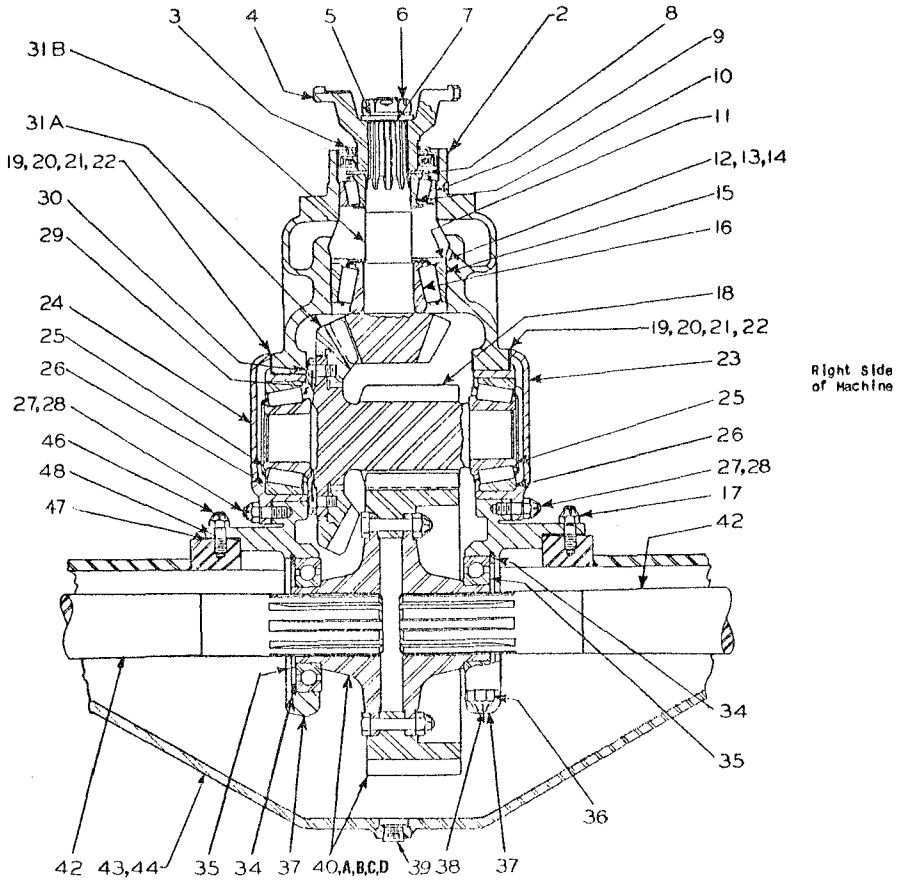
4. Move blade downward onto blocking to stabilize machine. Do not take any weight off grader with blade.

5. Remove capscrews from each axle mount (D) and capscrews and nuts (E) from each axle mount.

6. Force blade downward, lifting the front end. It will still be necessary to jack up under the rear bumper plate to lift the frame off the rear axle, but by lifting the front end first, it makes the lifting easier and keeps the power grader from tipping.

7. Roll rear axle back toward the rear and block under the axle bracket on frame.

8. Remove the jack from under bumper plate.



84. "PACER" 400 GRADER REAR AXLE GEAR CARRIER. (Viewed from rear of machine toward front)

Gear and hub group (40) consists of solid drive on the rear axle of this machine, instead of a differential (37) used on the front axle as shown on page 76. The bevel gear (31A), shown above, locates on the left side of the housing.

85. REAR AXLE GEAR CARRIER REMOVAL.

a. Block up both ends of the axle housing, then remove both axle shafts (34), page 64, by following instructions found in paragraph 52, (B), (C) and (D) page 68.

b. Remove the nuts from studs (46), see above.

c. Lift out the gear carrier assembly as a group.

d. In reassembly, reverse the above procedure and use a new gasket (47).

86. REAR AXLE GEAR CARRIER DISASSEMBLY AND REASSEMBLY.

a. Remove the nuts on studs (38), caps (37), and washers (34).

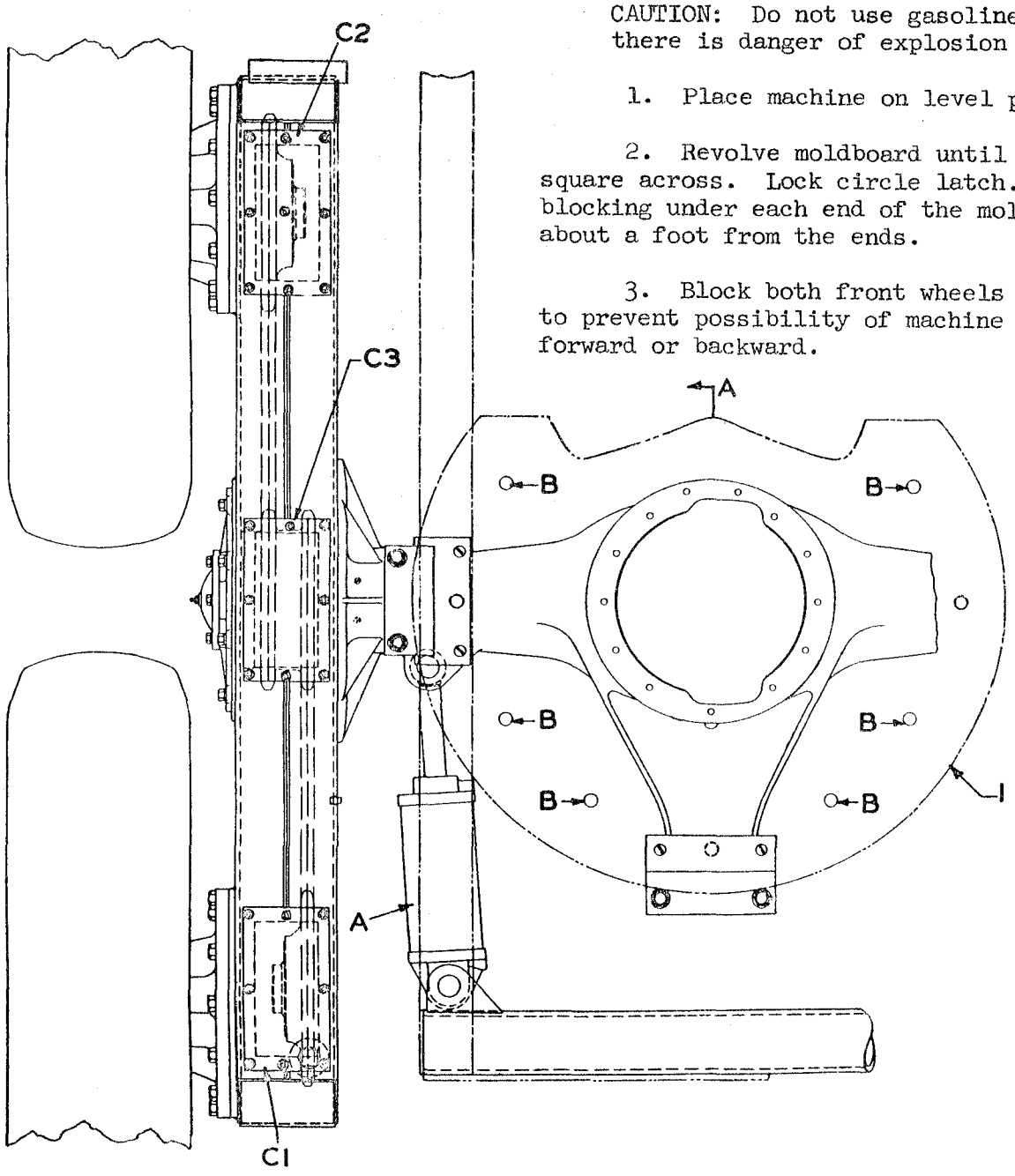
NOTE: The written text as shown in the following list of paragraphs may be followed in further dismantling, cleaning, checking and reassembling the rear gear carrier, including proper bevel gear and pinion tooth contact:

1. Paragraph 58, pages 76 and 77.

2. Paragraph 59, pages 77 and 78, except sub-paragraph (8).

3. Paragraph 60, pages 79 and 80.

Always replace worn bearings with new ones. Always keep worn but useable Timken cups and cones mated or wired together during disassembly.



"SUPER"400 GRADER REAR AXLE TANDEM DRIVE ASSEMBLY.

87. REMOVAL OF REAR AXLE AND TANDEM ASSEMBLY FROM FRAME.

If the machine is in operating condition, it is best to drain the gear oil from the rear axle and refill it with kerosene or diesel fuel, and run the machine slowly, backwards and forward for several minutes. It is best to drain this first wash-out and refill with clean kerosene or diesel fuel, and repeat. In this way a second washing will usually get everything clean and free of oil. (See caution at top of next column).

CAUTION: Do not use gasoline as there is danger of explosion and fire.

1. Place machine on level place.

2. Revolve moldboard until it is square across. Lock circle latch. Place blocking under each end of the moldboard, about a foot from the ends.

3. Block both front wheels securely to prevent possibility of machine rolling forward or backward.

4. Remove the six capscrews (B), shown above, which attach the support plate (1) to the main frame itself.

5. Remove the four capscrews at yoke (4), page 99.

6. Remove pins with keepers and disconnect the rear steering rams from the rear axle housing. (See above)

7. Start the engine and operate (push forward) blade lift ram levers (3) and (8), page 7. Operating these levers slowly and intermittently will raise the rear end of the main frame sufficiently to permit the rear axle, with wheels and tires, to roll away from the frame. (Place a jack under the rear bumper plate as a safety measure to stabilize and hold up the rear end of the grader frame.)

8. The support plate (1), shown on page 102, may be removed from the axle housing, after removing the six nuts from studs (19) and (10). The guides (9) and (16) should be marked in order that they will later be reinstalled in the same position.

The shims (12),(13), (17) and (18), should be wired to each guide during the dismantling operation. (Hold the vertical shim clearance to about .010).

The support plate bushing (2) should be inspected and replaced if damaged or worn. Spread lubricant by hand to the lower side near the guides (9) and (16).

If steering rams are removed from unit, make certain during reassembly to install the piston rod ends to the axle housing. (See (A) page 100.)

88. REAR WHEEL DRIVE CHAIN ADJUSTMENT.

To test the chain tension, remove the inspection covers (C1) and(C2), page 100.

Jack up the housing at the left rear wheel and turn the top of the wheel toward the front of the grader and hold it there. With a short bar through hole, test the upper chain tightness. You should be able to lift the chain about 3/4 inch.

When the sag in the chain is in excess of approximately 2", the chain tension should be re-adjusted as follows:

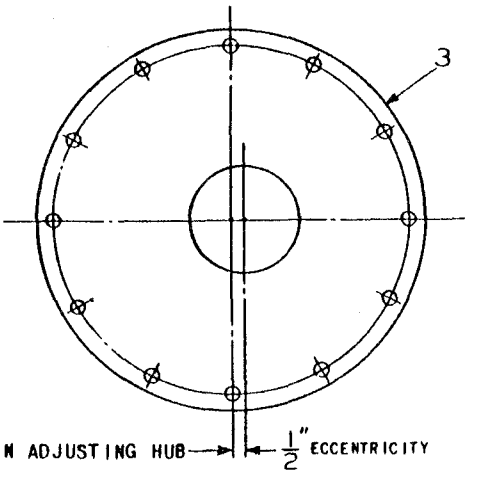
Remove all capscrews (10); see photo at right. To tighten the chain rotate the eccentric spindle hub (3) in correct direction. Install the capscrews (10).

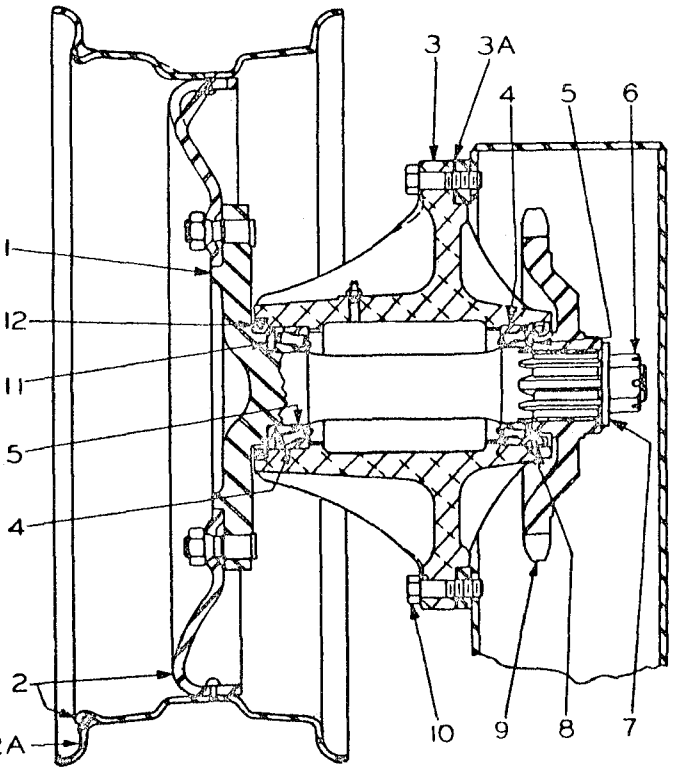
NOTE: It will be best to remove the wheel (2) from axle flange (1) before making this adjustment, in order to see the gasket (3A) and get the capscrew holes in the proper location.

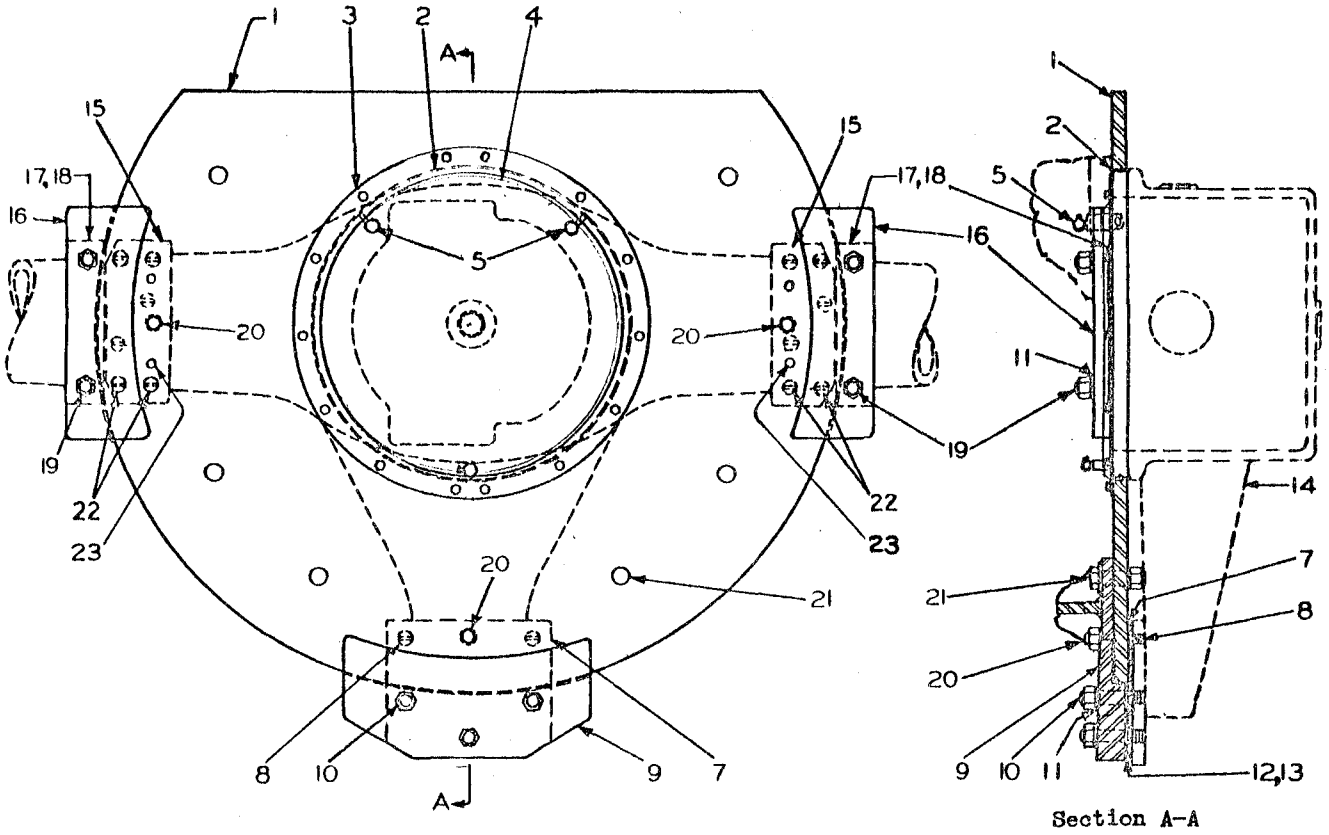
Since all four rear wheels are driven by an enclosed roller chain, each wheel axle group has an eccentric hub (3), by means of which the chain tension can be adjusted as required. Each wheel, therefore,will have to be raised and chain adjustment procedure followed as directed, except that the front tandem wheels have to be held rearward at the top of the tire when testing the chain tension.

The two Timken bearings (4) and (5) at right and left side of axle (1), should have no end clearance. Carefully adjust nut (6) to accomplish this adjustment, then insert a strong cotter pin into place to lock the nut (6).

Seals No. 12 and 8 should be installed with lips toward tire.







"SUPER" 400 GRADER REAR AXLE CIRCLE AND SUPPORT PLATE GROUP.

89. REAR AXLE PIVOT CASE. (See page 103)

a. General.

Power from the rear axle is transmitted from drive axle (4) (shown on page 103) to drive sprocket (9). Chain (25) drives the front tandem wheel, while chain (8) drives the left rear wheel. Inspection cover (C3), page 100, may be removed to expose the sprocket (9) together with chains (25) and (8). Inspection covers (C1) and (C2) may also be removed as required. Chains (25) and (8) have a master link, from which two cotter pins may be removed, together with link itself, after which both chains can be removed from the pivot case.

The illustration (page 103) shows the left hand pivot case, but the right hand pivot case is assembled similarly, and the instructions in the above and following paragraphs will apply to it also.

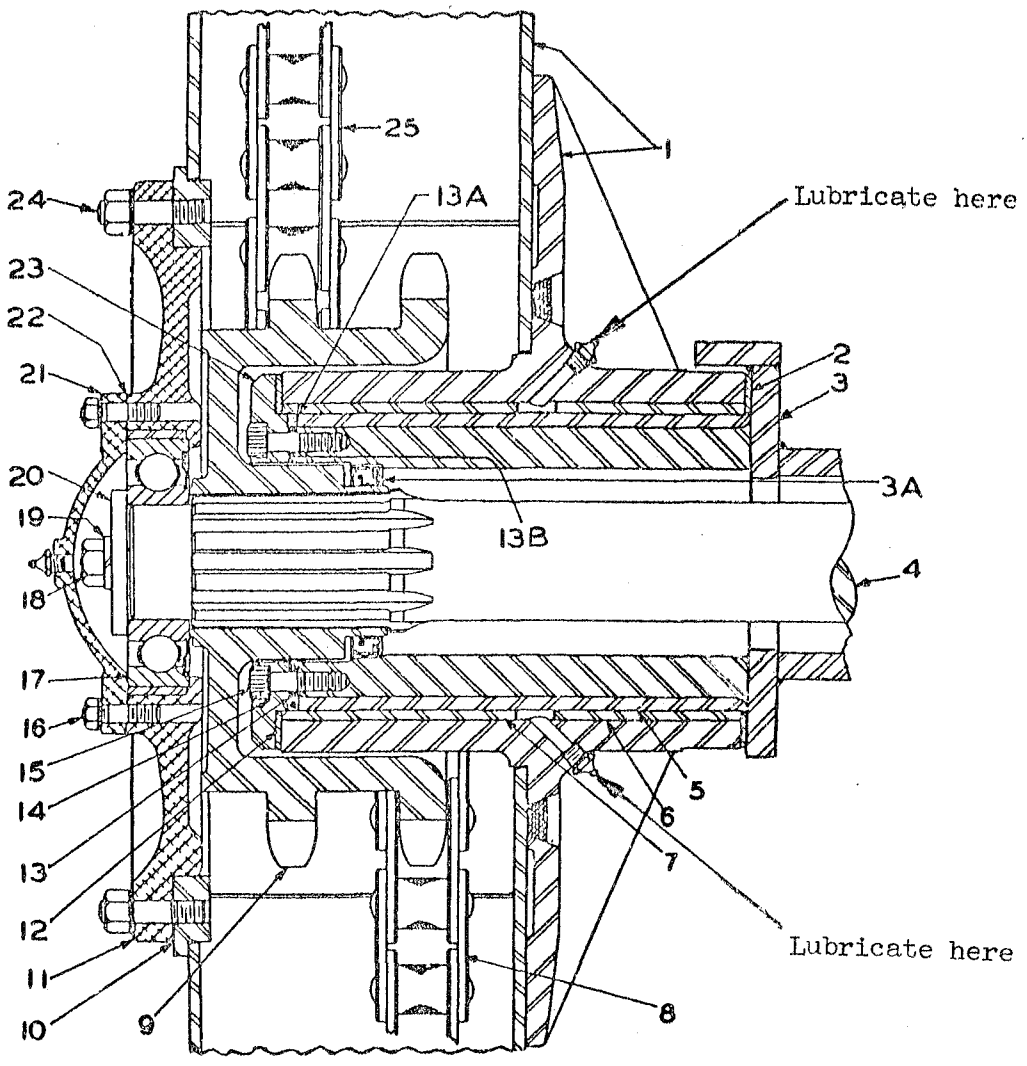
b. Drive Axle Removal. (See page 103)

Disconnect both drive chains (25) and (8) at a point near sprocket (9).

Remove cover (21) after removing nuts (with lock washers) at (16). Remove capscrew (18) and washers (19) and (20). Remove bearing support (11) after removing nuts, with lock washers, at (24). The sprocket (9) with shaft (4) may now be drawn out of the axle housing bore (3). Inspect bearing (17) before reassembly. If seal (3A) is worn or damaged, it should be replaced, making sure it is assembled with the lip turned outward.

c. Pivot Case From Axle Housing Removal. (See page 103)

To remove pivot case (1) from axle housing (3), proceed as outlined in paragraph b. Then place a supporting jack under the center of axle housing (3).



90. "SUPER" 400 REAR AXLE PIVOT CASE DRIVE SHAFT GROUP.

(Continued from page 102)

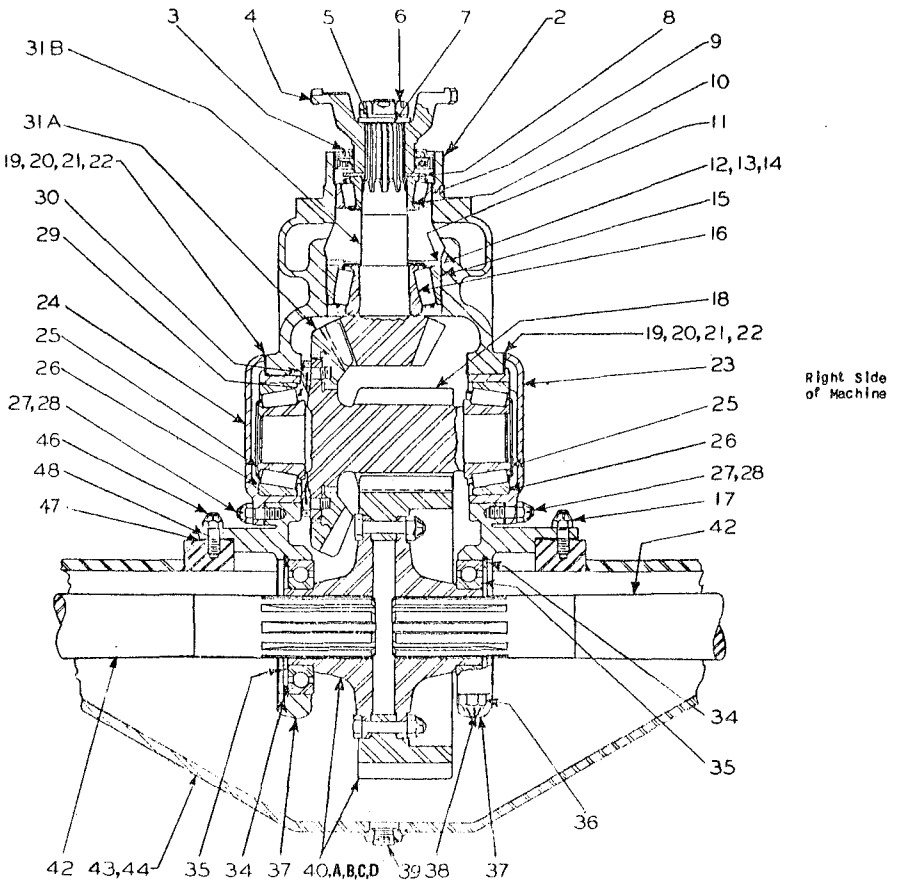
Remove all screws with lock washers at (15). Remove thrust plate (23) with shims (13), "O" ring (13A), and spacer (13B). (The end clearance between plates (2) and (12) should be approximately .010", and this is accomplished by adding or subtracting shims (13). Pull the pivot case (1) off of axle housing (3).

Inspect, and if scored or worn, replace bushing (6), short (inner), and long (outer) bushing (7). These bushings should be pressed in until they are flush at the outside ends.

Reassembly.

Reassembly is the reverse of the above. Be sure that all bearing surfaces are well lubricated at time of assembly. The annular bearing (17) has a sealed side which must be turned inward.

NOTE: See pages 3 or 5 for lubrication of the enclosed chain or pivot case compartment.



91. "SUPER" 400 GRADER REAR AXLE GEAR CARRIER. (Viewed from rear of machine toward front)

Gear and hub group (40) consists of solid drive on the rear axle of this machine, instead of a differential (37) used on the front axle as shown on page 76. The ring gear (31A), shown above, locates on the left side of the housing.

92. REAR AXLE GEAR CARRIER REMOVAL.

a. Block up both ends of the axle housing, then remove both axle shafts (4), page 103, by following instructions found in paragraph 87, subparagraphs 1 to 8 inclusive and paragraph 89, subparagraphs (a) and (b).

b. Remove the nuts from studs (46), see above.

c. Lift out the gear carrier assembly as a group.

d. In reassembly, reverse the above procedure and use a new gasket (47). Replace seals (3A), page 103.

93. REAR AXLE GEAR CARRIER DISASSEMBLY AND REASSEMBLY. (See above.)

a. Remove the nuts on studs (38), caps (37), and washers (34).

NOTE: The written text as shown in the following list of paragraphs may be followed in further dismantling, cleaning, checking and reassembling the rear gear carrier, including proper bevel gear and pinion tooth contact:

1. Paragraph 58, pages 76 and 77.

2. Paragraph 59, pages 77 and 78, except sub-paragraph (8) and (9).

3. Paragraph 60, pages 79 and 80.

Always replace worn bearings with new ones. Always keep worn but useable Timken cups and cones mated or wired together during disassembly.

94. HYDRAULIC SYSTEM.

a. General.

The hydraulic system on A-W power graders is sealed in its entirety, except for the breather filler cap.

It consists of an anti-foam reservoir, filters, pump, control valves, rams, and necessary piping.

It requires periodic attention, and this can be summed up as shown in the following paragraphs.

c. Hydraulic Oil.

1. The oil in the hydraulic system can be contaminated by dust of a gritty nature that is finer than the openings in the screen of the hydraulic oil strainer. By maintaining the quality of the oil in the hydraulic system, you increase the life of the pump, valves, and rams, and you also keep your machine at a high degree of efficiency. Change the hydraulic oil at least twice a year, flushing out the supply tank thoroughly, using clean hydraulic oil only. Keep oil supply free from dust. Use clean cans when changing oil.

2. The kind of oil to use in the hydraulic system is SAE-10W for temperatures above 32° F. For temperatures below 32° F. use SAE-5W. Using a heavier oil than the above will cause air bubbles and foaming. Either a paraffin or asphalt base oil will be acceptable.

c. Reservoir. (See page 106)

1. Consists of an extended filler tube with cap at the top. A cleanable screen is provided at the inner end of the filler tube.

2. Removable clean out cover.

3. Vent.

4. Keep oil level between the two cocks.

5. This is the high pressure oil line which goes to the left end of the valve bank, at the operator's position.

6. Oil flows from the reservoir to the suction side of the hydraulic pump.

7. Drain plug location.

8. This is a vertical internal baffle plate, which is welded in place. Its purpose is to force all returned oil to raise upward and then flow over to the internal suction pipe opening (6).

9. When the relief valve discharges oil into the reservoir the oil is diverted downward through an internal tube. The oil then flows upward; see arrows showing the direction of oil flow to the oil suction pipe (6).

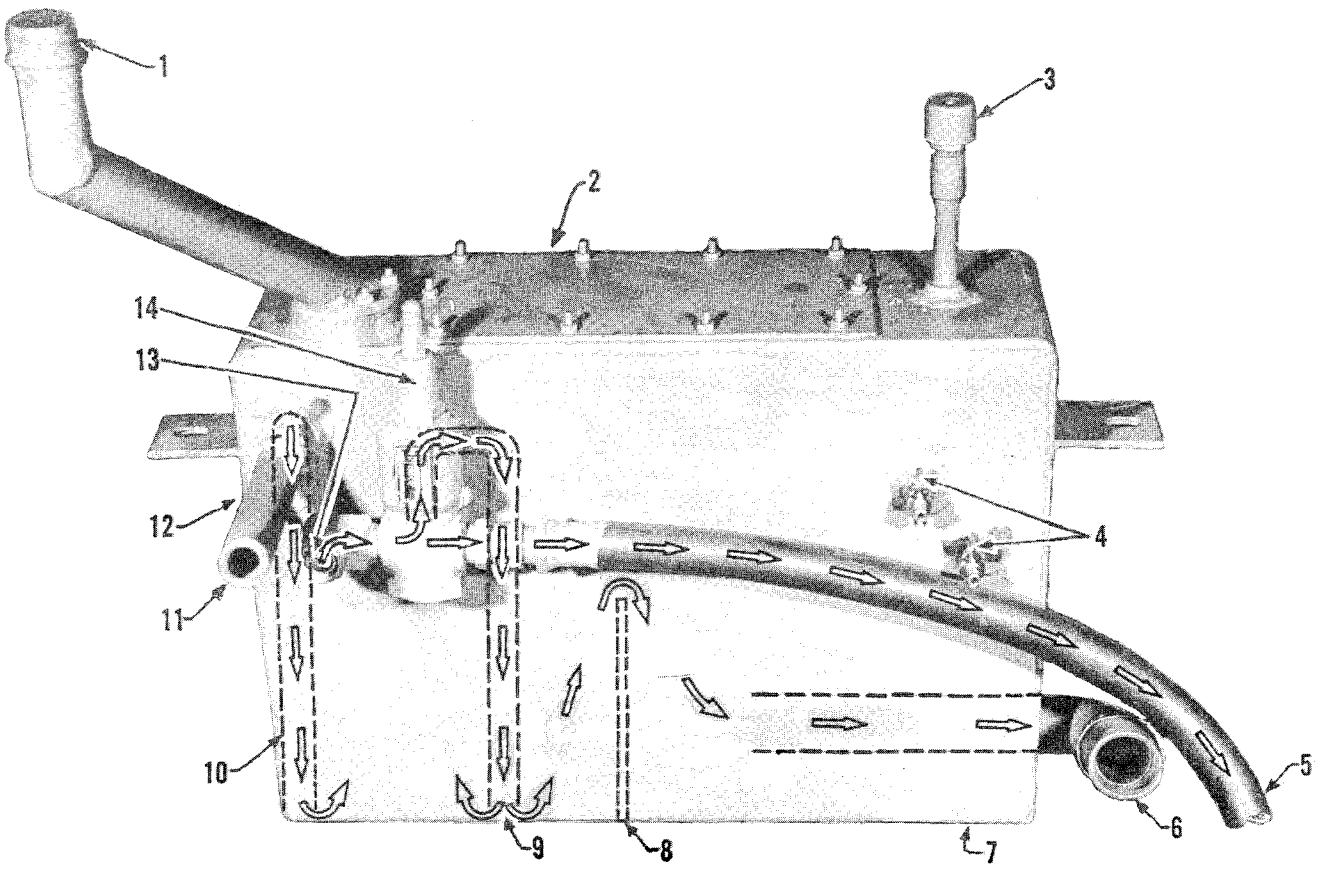
10. Low pressure oil returned to the reservoir from the right end of the hydraulic bank eventually returns through piping and a hose (11), then flows downward through an internal pipe.

12. Slight oil seepage at the hydraulic valve bank is returned via piping to the reservoir at a port near ref. (12).

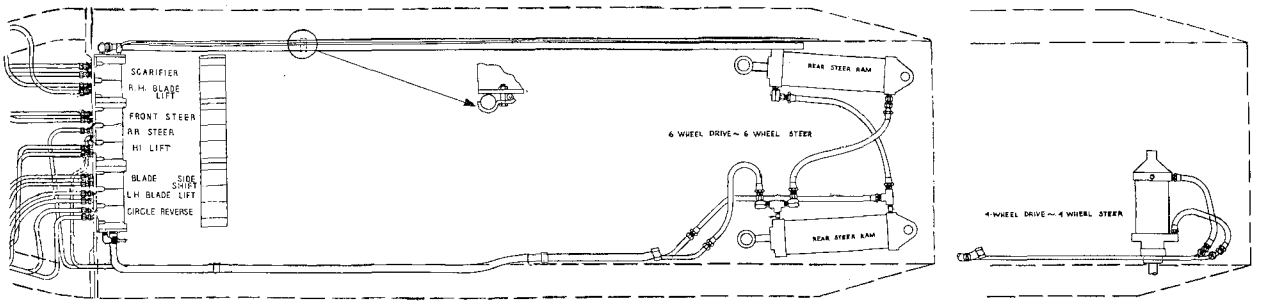
13. This is the high pressure oil fitting which receives the oil from the high pressure side of the hydraulic pump.

14. The spring loaded relief valve is set to unload at 1500 PSI.

Never attempt to set relief valve without using a pressure gauge, as too high a relief valve setting will materially shorten the life of hydraulic working parts.



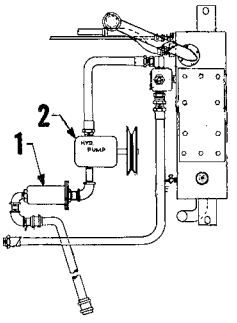
95. THE ABOVE PHOTO SHOWS THE HYDRAULIC OIL RESERVOIR.



(Continued from page 105.)

d. Pump Strainer.

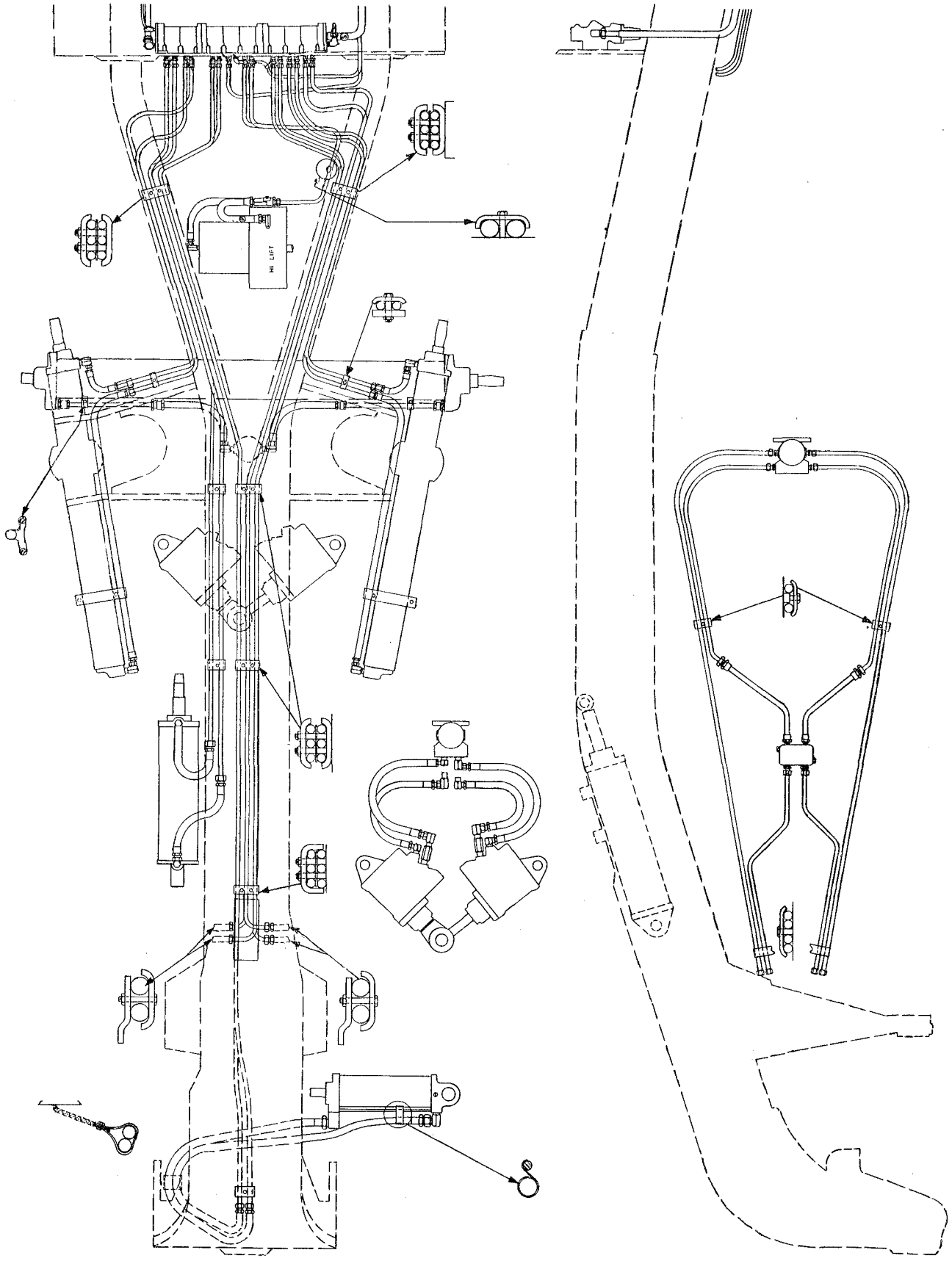
1. The strainer (1) shown at right, is located in the suction supply line between the reservoir and the hydraulic pump (2).



This strainer will probably need more attention than any other item and should be your first thought in case of sluggish operation or failure of the oil to properly move the rams.

2. To clean the strainer, unbolt the body (1) from the head. Remove the screen, and wash it out thoroly with air and kerosene, and reinstall.

Should loss of power occur (slow action in rams or a howling noise in the pump), your trouble is most likely due to a clogged screen in the hydraulic oil strainer, or to the quality of oil used.



96. PIPING DIAGRAM FOR "PACER" AND "SUPER" GRADERS. TILLER BAR STEER.

97. HYDRAULIC PIPE FITTINGS, HOSE AND PIPING.

a. Hydraulic Pipe Fittings.

CAUTION: In reassembly, pull nut up finger tight and then give one-fourth turn only with a wrench. This is important and must be observed when disconnecting and reconnecting established lines.

To install a new pipe or fittings proceed as follows:

Step 1. Cut Tubing Square.

Use a tube cutter with a rotating cutting wheel, or cut with a saw. Then file or grind end reasonably square. Remove burrs.

Step 2. Assemble Nut and Ring to Tube.

Make sure head of sleeve (A) is toward nut.

Step 3. Insert Tube into Fitting.

Make sure tube rests squarely on shoulder point (B).

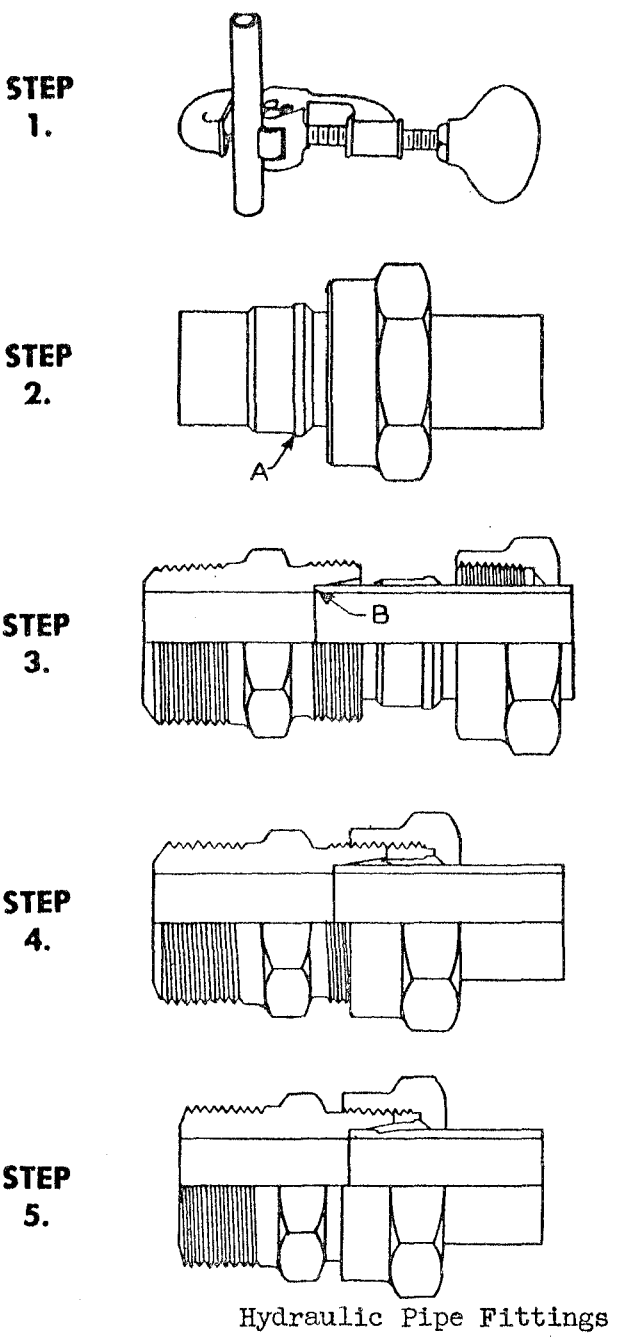
Step 4. Tighten Finger Tight.

Bring nut down on sleeve and make finger tight, as shown in illustration Step 4.

Step 5. Tighten with Wrench.

Give nut one and one-half turns only with wrench to bring up as tight as shown in illustration Step 5.

CAUTION: Never tighten over two turns as this will distort the sleeve and tubing, thereby preventing a leak-proof seal.



Hydraulic Pipe Fittings

b. Hydraulic Hose.

The connecting hose is amply strong to stand the pressures encountered. Constant vibration may tend to loosen some of the fittings and they should be inspected occasionally and tightened with special wrenches provided.

c. Hydraulic Piping.

Always procure replacement piping from the nearest Austin-Western distributor.

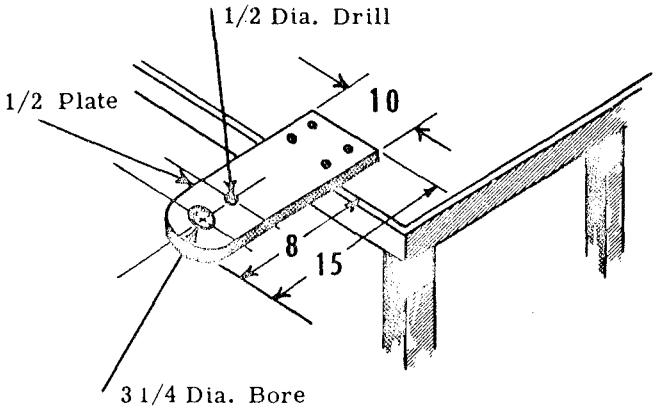
98. HYDRAULIC PUMP WITH DRIVE PULLEY.
For Pacer and Super Dry Clutch Graders.

A. General.

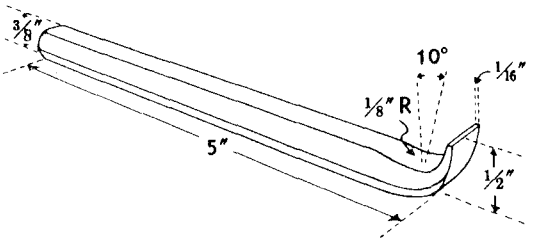
The hydraulic pump is a small, important unit and should be handled with care. Loss of volume will more than likely be due to loose connections or to a clogged screen in the hydraulic oil strainer. We strongly recommend leaving the pump alone. Should anything occur that would lead you to believe the pump might be in need of repair, procure another pump, or repairs, from your nearest Austin-Western distributor.

To adjust pump belt see page 16, item (14). Loosen front capscrews. Loosen check nut at (14) and tighten adjuster screw until belt doesn't slip when the pump relief valve unloads at 1500 P.S.I. Retighten lock nut and capscrews.

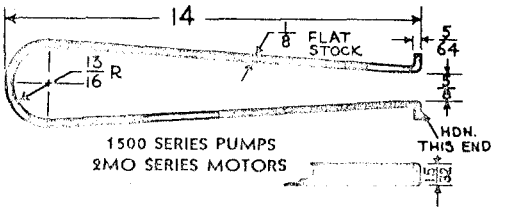
Special Tools for Pump Repair.
(Not furnished. Can easily be made locally.)



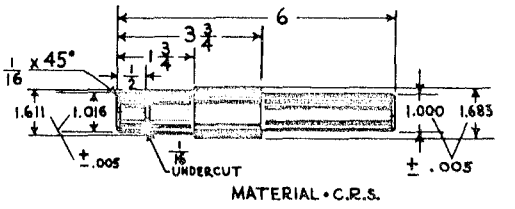
Bench Mount



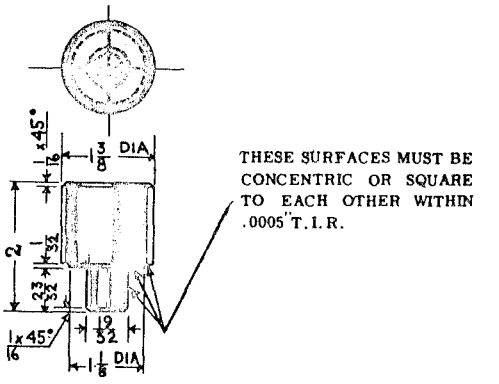
Bearing Pry Bar



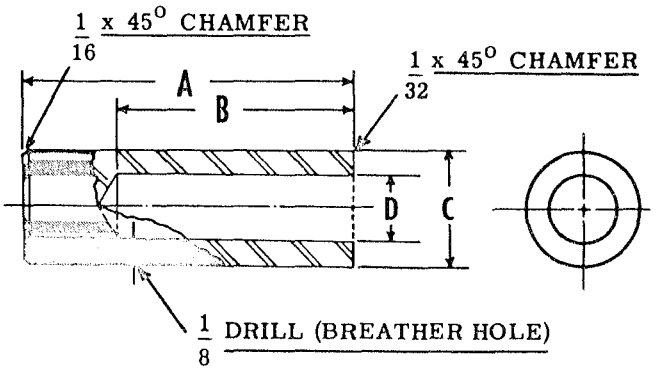
Bearing Puller



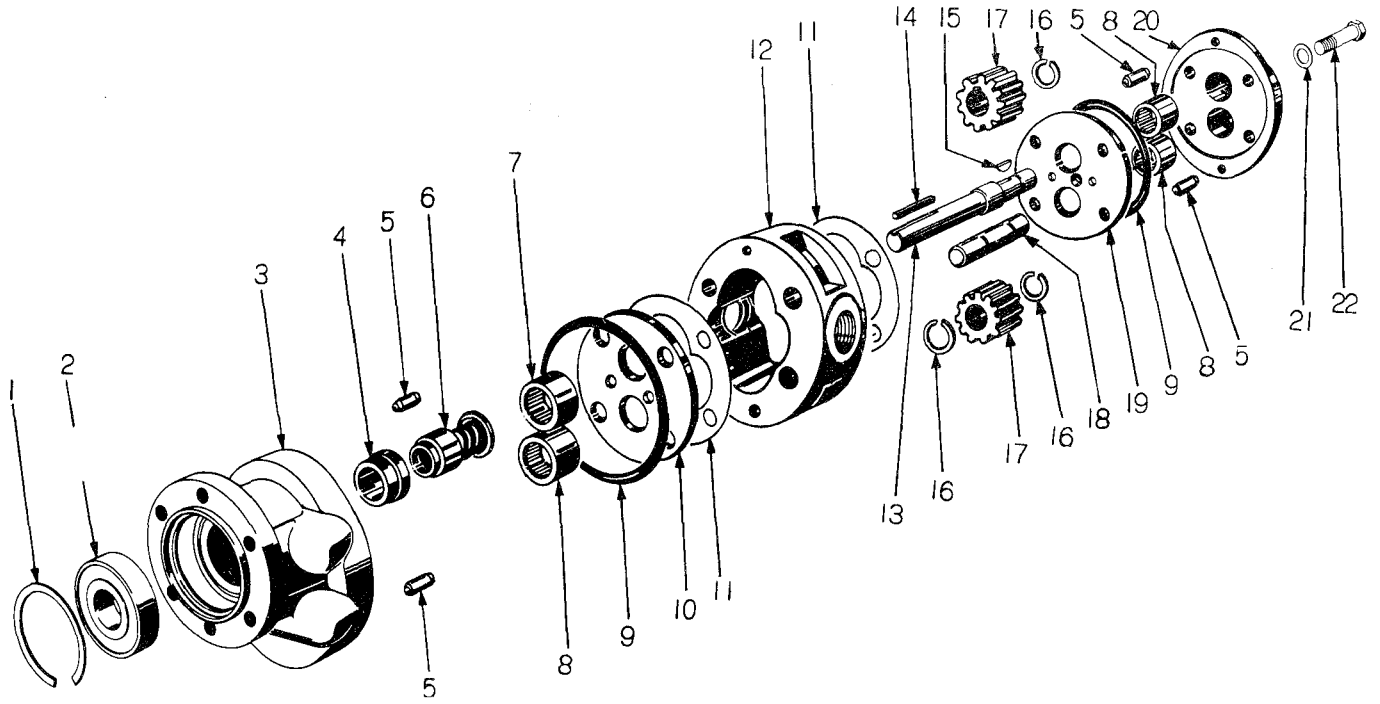
Seal Driver



Roller Bearing Driver



Outboard Bearing Driver



B. Hydraulic Pump Dismantling. (Hydreco Pump)

1. Clean outside of the pump with an oil solvent, fuel oil or gasoline, and dry thoroughly. With file or oil stone remove sharp edges or burrs from shaft splines, drill point, keyway or shaft end before proceeding with disassembly. Mark sections of pump with prick punch for proper reassembly.

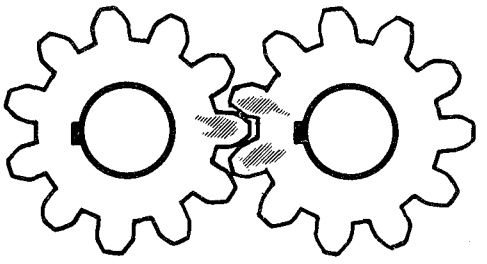
NOTE: Servicing is facilitated by bolting the adapter to a special bench mounted assembly plate. (See page 109.)

2. Remove the four cover capscrews (22) (see above). Remove the cover (20) which may come off separately or with the housing (12).

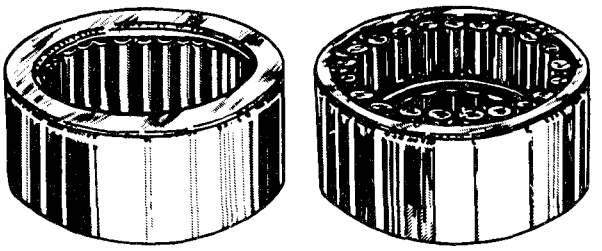
To prevent possibility of leakage, avoid scoring or nicking machine surfaces of pump sections. DO NOT USE A SCREW DRIVER to pry the sections apart. Tap with fibre hammer, if necessary, to loosen.

Note position of relief pocket and drilled holes in the wear plate (10) and (19) for proper reassembly. Mark the drive and driven gears (17) with an India stone, (see right, above) for proper reassembly.

Note the location and number of gaskets when disassembling.



Remove driver shaft (13) and gear (17). Unbolt adapter end from bench plate. By pressing on keyed end of shaft, press out the bearing (7). Remove seal assembly (4) and (6) and snap ring (16), freeing shaft (13) and wear plate (10). This pump is equipped with an outboard ball bearing. Be sure to coat end of shaft with white lead and remove any burrs before pressing out to prevent the



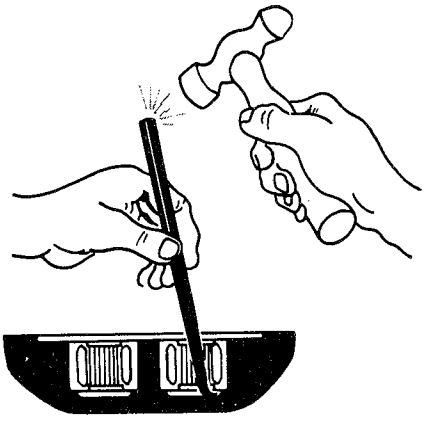
Type "A" Bearing. Type "B" Bearing.

bearing from being scored. Remove dowel pins (5) from adapter (3) and cover end (20), with pliers or a lever jaw wrench.

3. Type "A" Roller Bearings. (See page 110)

Check bearings for freeness of rollers and pitted, broken or excessively worn rollers. Replace bearing if it is possible to insert a feeler of .020" thickness between rollers.

More gap indicates rollers are worn excessively. Remove roller bearings by starting them with a tool shown on page 109. Insert tool under the bearing and into the cored hole between the bearing bores (see below). Complete removal of bearing using puller (see page 109)and tap out with heavy bar shown below.



3A. Type "B" Roller Bearings. (See page 110)

Remove retaining ring and all rollers. Start bearing shell out with tool, page 109. Complete removal with puller, page 109. Tap out with heavy bar as shown at right.

4. Ball Bearing. (Outboard bearing)

a. Remove outboard bearing retaining snap ring (1) with ring pliers.

b. Reach down through the drive shaft bearing bore with a brass drift and tap out the outboard bearing (2). Tap opposite sides alternately.

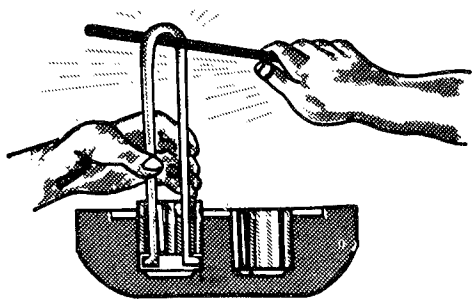
CAUTION: Replace roller or ball bearings only if necessary, and then only with the SAME MAKE AND TYPE as originally installed.

5. Seal Seat.

The seal seat (4) should not be removed unless the seal face is excessively worn or damaged. To remove the seal seat, invert the adapter (3) and drive out the seat (4) with a wooden block. If a new seat (4) is required, press into adapter, using a seal seat driver, page 109.

6. Gears.

If gears or shafts must be replaced, remove snap rings (16) and press off gears on an arbor press. (Some models may be furnished with shaft and gear made in one piece). To reassemble, coat gear bore with white lead, and after installing one snap ring, press onto shaft until the gear covers approximately one quarter of the key slot. Hold key in place and press gear onto shaft until it contacts snap ring. Install second snap ring. The same procedure is used for driven shaft except no key is required.



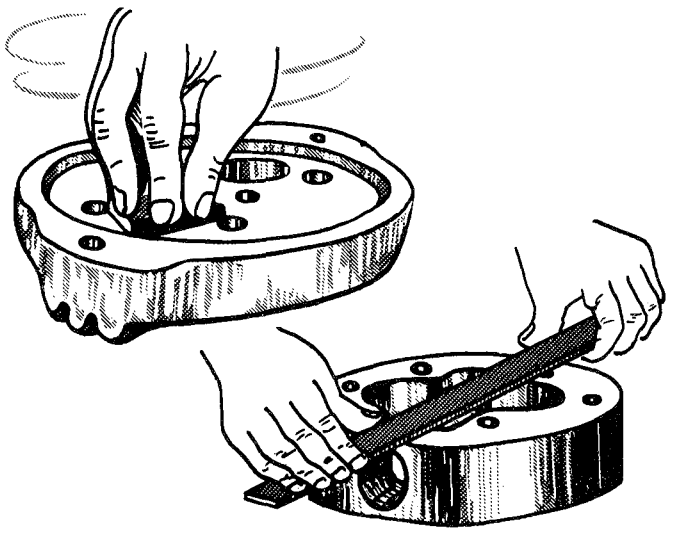
CAUTION: To prevent bending of drive shaft, push (drive or keyed end of shaft) through the gear and press on straight end of shaft.

C. Inspection and Check of Pump Parts For Wear.

1. Wash all parts in oil solvent, or fuel oil. Dry thoroughly with clean cloths or dry compressed air.

2. Inspect all parts of the pump.

3. With a small piece of flat file remove nicks and burrs from around the bearing bores and drilled holes of adapter (3) and cover (20) (see top of page 112). Clean up burrs and nicks on the machined mating surfaces of housing (12), cover (20) and adapter (3) (see top of page 112) with India stone and a fine mill file. Rewash before assembly.

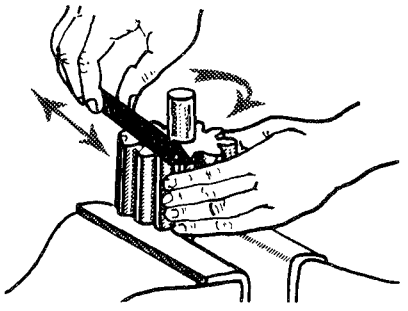


4. Shafts.

Inspect at bearing points and seal areas for rough surfaces and excessive wear.

5. Gears.

Inspect edge of teeth and gear face for scoring. Stone face of gears (see below) and edge of teeth before reassembly.



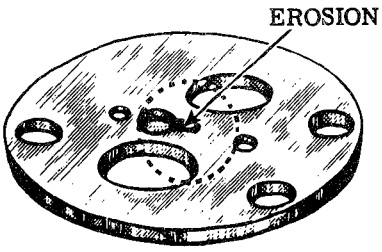
6. Gaskets.

Always replace housing gaskets (11) if damaged. Replace all seal rings (9).

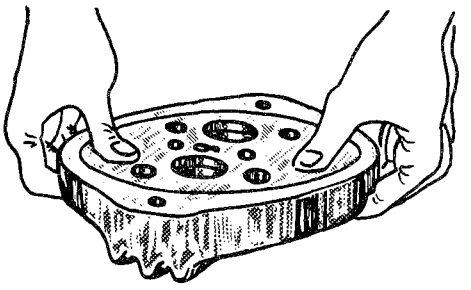
7. Wear Plates.

Replace if found scored or excessively worn.

NOTE: Do not turn wear plate (10) and (19) as counterbored relief pocket is on gear side only. If wear plate is steel backed, bronze side should be next to gears. Even though slight wear is shown on gear pattern, check for erosion path in vicinity of relief pocket, (see right, above) and replace if in evidence.



8. Check for proper seating of wear plate in adapter or cover, (below). A rocking motion indicates either a burr on face of adapter or cover.



9. Recommended Wear Tolerances.

a. Discard any housing (12) whose gear bores measure greater than 3.259" through the dowel pin hole centerline.

b. Replace both gears (17) if the differential between the housing width and the gears, with no gaskets in the pump, is in excess of .0035".

c. Assembled, the total end clearance between the gear faces and the housing width should be .0025" minimum and .0035" maximum.

d. Replace shafts(13) and (18) if wear at the roller pattern exceeds .001" from that of the major diameter.

e. Replace wear plates (10) and (19) that have severe score marks or show erosion marks in the vicinity of the counterboard relief pocket.

f. If the pump shafts have been replaced because wear at the roller patterns exceeded .001", also replace the bearings.

g. Replacement of seal assembly (6) and seat (4) is recommended if drive shaft is replaced.

D. Pump Assembly.

1. Type "A" Roller Bearings.

Lubricate rollers (7) and (8) with light grease. Coat I.D. of bearing bore with white lead. Press bearing assembly into bearing bore of adapter and cover with tool. (See page 109).

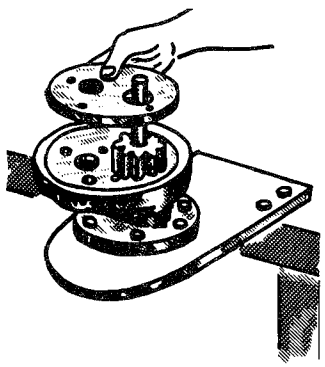
1A. Type "B" Roller Bearings.

Coat rollers with light grease, bearing bore with white lead and press bearing into bearing bore of adapter and cover.

2. Final Housing and Cover Assembly.

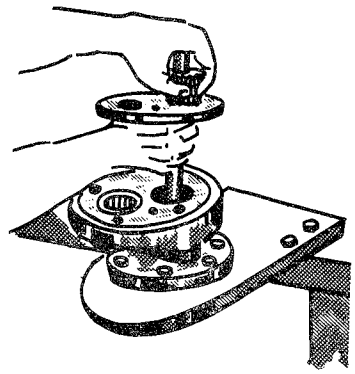
a. Install dowel pins (5) in adapter (3).

b. To assemble the wear plate (10), bearing and seal assembly (4) and (6), use the adapter end (3) bolted to the bench plate as a support. (See below). Insert the drive shaft (13) in the adapter end with the long end UP in the side that has a bearing driven in. Put the wear plate over drive shaft making sure the counterbored relief pocket is FACING the gear.



Place the bearing on the drive shaft. Now assemble the oil seal parts in the following order: Back up washer, coil spring, synthetic rubber ring. (Lubricate this ring with a light grease or oil) and the seal cup with lapped surface UP. Make certain the rubber ring (9) is not cut when placing it on the shaft and when passing it over the key slot or spline. Press the entire seat assembly down against the spring and compress it. When released, the spring should return the cup to the position held before compressing. If it sticks on shaft, replace the oil seal assembly.

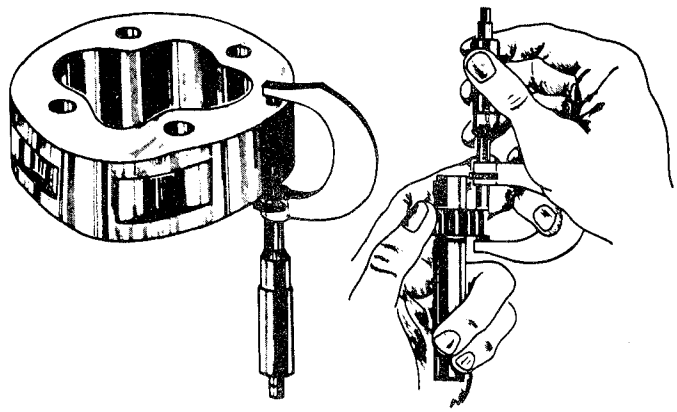
c. Wipe off any foreign matter from seal seat. Lubricate the lapped surfaces of the seal seat and seal cup with light oil. Turn the entire drive shaft assembly over and install in adapter end as shown below. Use a composition hammer to drive entire assembly down, driving bearing into bearing bore. Place "O" ring seal around wear plate. Lubricate with light oil the section of the wear plate that comes into contact with the gear face.



d. Pumps with Outboard Bearings.

With an India stone polish out any scratches on drive shaft that were made when shaft was driven out through the bearing.

e. Clearance between gear face and wear plate is provided by the plastic shim gasket between housing, adapter and cover. With micrometer, measure housing width and width of gears. (See below).



f. Insert driver assembled gear (17) and shaft (13) into adapter end. Line up marks previously made on gear faces if original gears are reinstalled.

(Page 110). If new gears are used keep keyways 180° apart. Note that on some models shaft and gear are made in one piece. Lubricate face of gears with light oil.

g. Place proper gasket as selected by chart (below), over gears and on face of wear plate (10). If it is not practical to use micrometers to measure gears and housing use a gasket that measures .002" thickness.

h. Line up punch marks and place pump housing (12) over gears and gasket. Tap down with fibre hammer.

i. Select another gasket from chart or if no measurement (para. 2e) is available, use a gasket of .002" thickness. Place gasket on housing face. Lubricate gear face with clean oil.

j. After selecting proper gasket from the chart, and putting it in place on the housing face, install the wear plate, making sure that the 1/16" deep counterbored relief pocket is in its original position facing the gears and is rotated 180° from the pocket of the adapter wear plate. Place seal ring (9) around the wear plate and position on wear plate with an equal air gap around each shaft. Put cover (20) in place and tap down, being careful not to pinch "O" ring seal (9).

Chart below indicates color, number and location of shim gaskets to be used to provide proper clearance between gear face and wear plate.

CLEARANCE CHART			
	Gear Width Greater (+) or less (-) THAN HOUSING WIDTH	NOTE: Only plastic shim gaskets are used on 1500 Series Pumps ADAPTER SIDE	COVER SIDE
1500 SERIES PUMPS	+.002	.002	.002
	+.001	.001	.002
	.001	.001	.001
	-.001	--	.001
	-.002	--	--
COLOR CODE:	.001 - Amber	.002 - Red	.0015 - Purple

If gears are so worn that housing width becomes more than .0035" greater than gear width, both gears (17) should be replaced.

k. Install dowel pins (5) in cover. Line up punch marks previously made on housing and cover and put in place. Tap cover down on dowel pins with fibre hammer until cover bottoms on housing. Be careful not to pinch "O" ring seal around wear plate.

Install four capscrews. Pump may be furnished with either hollow head capscrews or hex head type. If hex head, be sure that proper washer (21) is in place before installing. If for any reason replacement of capscrews is required, always use same type as originally furnished. If hollow head capscrews are used, the shoulder of the screw must ride against the spot face of the cover and both surfaces should be free of burrs to prevent leaks.

Tighten gradually opposite capscrews, using torque wrench set at 60 ft. pounds torque. After assembly, turn shaft with a 6" Crescent wrench. If shaft will turn with a slight drag and not too freely, proper clearances are assured between gears and wear plate. If shaft is too tight or too free, add or remove .001" or .002" gaskets as necessary for proper clearance.

3. Assembly of Outboard Bearings.

a. Coat I.D. of bearing bore with white lead.

b. Lubricate the bearing (2) with light grease.

c. Drive outboard bearing (2) down over drive shaft with special tool, until it bottoms. (See page 109.)

d. Insert snap ring (1) in bearing bore.

e. Remove grease plug and repack outboard bearing bore with good quality bearing grease. Use fingers for repacking. A grease gun will force grease into the oil seal and cause it to leak.

E. Break-In of Repaired Pumps.

1. If shop test stand is available on which the pump can be mounted and operated against full pressure and at maximum speed, the following procedure is recommended for break-in and test:

a. Start pump and run for 2 minutes at zero pressure. Be sure that test stand reservoir is filled and that all inlet and outlet lines are open.

b. By restricting pump discharge line with needle valve, raise discharge pressure to 500 PSI for 10 seconds and lower to zero pressure for 10 seconds. Continue this procedure for 5 minutes.

CAUTION: Do not apply pressure for more than 10 second intervals.

c. Stop pump and rotate drive shaft coupling by hand to determine if drive shaft is free. If it cannot be turned freely, remove and rebuild pump.

d. Resume test and apply 1000 PSI for 10 seconds intermittently for 5 minutes.

CAUTION: Do not apply pressure for more than 10 second intervals.

e. Stop pump and check freeness as in para. c. Check for possible leaks at mating surfaces of adapter, housing and cover and around seal assembly and the four assembly capscrews.

f. Be sure oil level is up to normal in oil reservoir. Start pump and run pressure to 1100 PSI and run flow test by whatever means is available on the test stand.

2. If a shop test stand is not available, the following alternate break-in and test procedure may be used:

a. Mount repaired pump in place on equipment and run pump at one quarter engine speed for 5 minutes at zero pressure.

b. Operate control valve until relief pressure is attained, then hold in this position for 10 seconds and release for 10 seconds. Follow this procedure for 10 minutes.

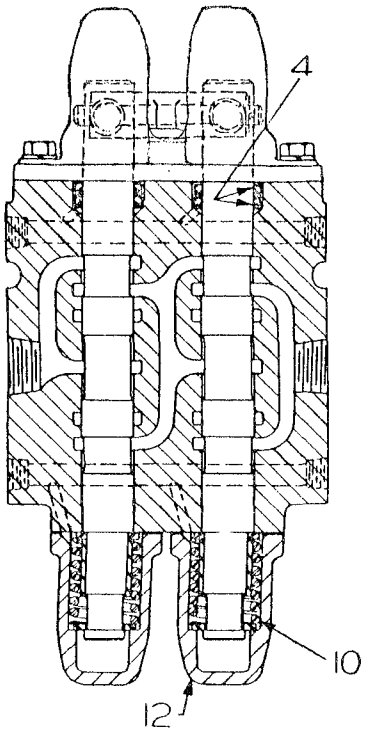
c. Increase engine speed to one-half throttle, and repeat step para. b for 10 minutes.

d. Increase engine speed to full throttle, and repeat step para. b for 5 minutes.

e. Idle engine and check pump for possible leaks at mating surfaces of housing, adapter end cover, shaft seal area, and any of the capscrews.

TROUBLE SHOOTING

POSSIBLE PUMP TROUBLES	CAUSES	REMEDIES
I. Cavitation, pump unusually noisy.	a) Low oil supply. b) Heavy oil. c) Dirty oil filter. d) Restriction in suction line.	a) Fill to proper level. b) Change to proper oil. c) Clean and replace filter. d) Remove.
II. Pump takes too long to respond or fails to respond.	a) Low oil supply. b) Insufficient relief valve pressure. c) Pump worn or damaged.	a) Fill to proper level. b) Reset to correct pressure setting using gauge. c) Inspect, repair or replace.
III. Oil heating up.	a) Foreign matter lodged between the relief valve plunger and relief valve seat. b) Using very light oil in a hot climate. c) Dirty oil. d) Oil level too low. e) Insufficient relief valve pressure. f) Relief valve pressure too high. g) Pump worn (slippage).	a) Inspect and remove foreign matter. b) Drain and refill with proper oil. c) Drain, flush and refill with clean oil. d) Fill to proper level. e) Set to correct pressure. f) Same as "e". g) Replace or repair.
IV. Oil foaming.	a) Air leaking into suction line from tank to pump. b) Wrong kind of oil. c) Oil level too low.	a) Tighten all connections. b) Drain and refill with a non-foaming type of hydraulic oil. c) Fill to proper level.



99. HYDRAULIC CONTROL VALVES.
(See above and Repair Parts Book.)

A separate trouble-free movable valve is used to control each operating ram, and all the valve bodies are bolted together to form a single unit. Each movable valve is held in a neutral position by the use of one spring (10). The spring (10) and parts within cap (12), do not require adjustment or cleaning whatsoever, from one season to another, and this likewise applies to the seals (4).

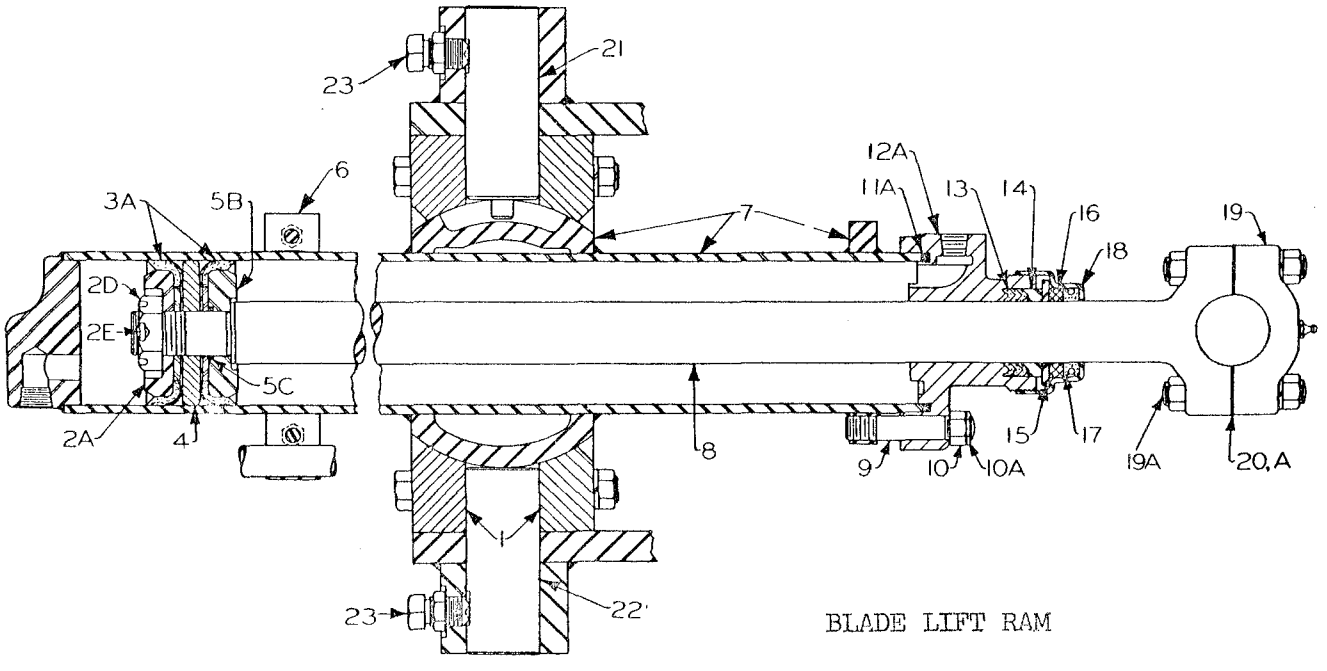
Should you believe the control valve group requires attention, contact your nearest Austin-Western distributor for service assistance.

100. HYDRAULIC RAM CYLINDERS.
(See below)

a. General.

The ram cylinders should require little or no attention through many years of trouble-free service. The honed cylinder walls are of special annealed quality steel, and pistons are of special construction to eliminate scoring, by the use of special molded cups and spacer shoes. The piston rods are chrome plated. Shims are provided at the ball sockets to permit easy adjustment after long hard wear. The piston rod glands contain a special packing ring assembly.

In making cylinder cup replacements do not replace with leather or other questionable material, as the special moulded steel back cups (3A), supplied as original equipment, are the only type recommended. Each cylinder has a special wiper ring (17) and felt (16) in the gland to prevent the entry of dirt in the packing chamber.



BLADE LIFT RAM

101. BLADE LIFT RAM.
(See page 116)

To dismantle and reassemble proceed as follows:

1. Lower the moldboard to the ground and with engine shut off, disconnect the two hose connections at the top and bottom of the ram.

2. Remove nuts off the studs (19A) and swing the rod (8) out sideways.

3. Remove nuts (10A) and (10). The head (12A) with rod (8), may now be pulled out of the cylinder (7) exposing the cups (3A).

4. To remove the cups (3A) together with the piston (4) and outer spreader (2A) and inner spreader (5B) from the rod (8), clamp the socket end of rod in a vise. By means of a suitable long wrench remove nut (2D). After removing the nut (2D) the cups and parts may be slipped off the rod (8). Loosen cap (18) and remove the head (12A) with seal parts.

5. Assembly is reversal of the above procedure.

6. Coat the inner bore of cups (3A) with quick setting compound, such as Perma-Tex #3, before placing them on the rod.

7. When retightening the nut (2D) use a socket wrench with 3 foot handle. Then drive against the end face of nut, using a bronze plug and hammer. Then retighten the nut still further. This is necessary in order to securely clamp the cups (3A) to the rod (8).

8. Before inserting the cups and rod (8) into the lower end of cylinder (7), be sure to install a new "O" ring (11A) into the recess of the head (12A). Piston ring squeezer or fine wire tightened over the end of the cup will have to be used in order to compress the cup for easy entry into the exposed bore of cylinder (7). Retighten the cap (18) with your hands.

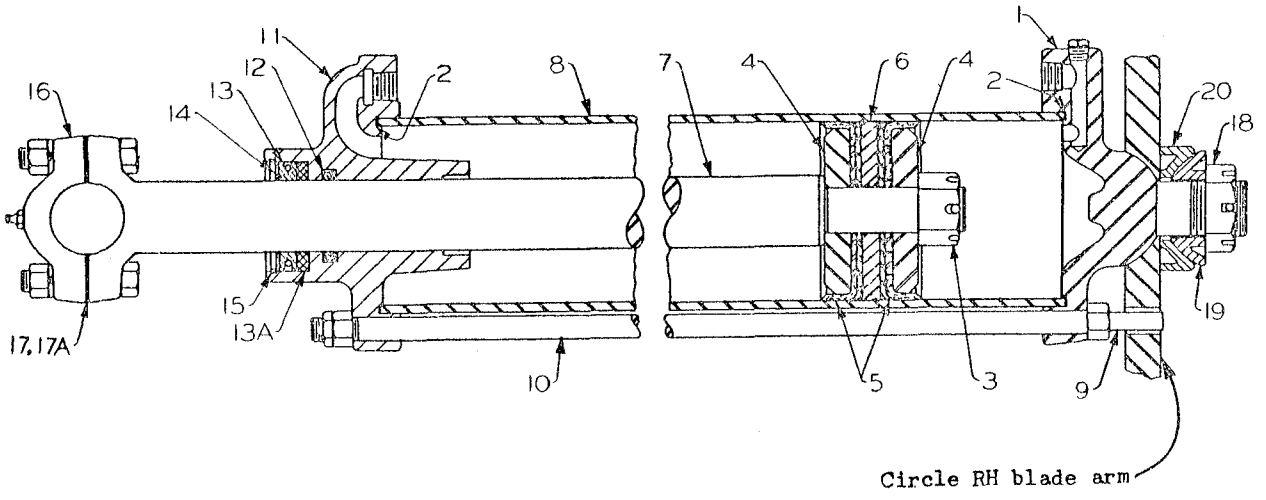
9. To remove the complete blade lift ram group from the machine, lower the moldboard to the ground and detach the two hydraulic hoses. Detach the ball socket (19). Remove the two setscrews (23) and pull out the two pins (21) and (22).

102. BLADE SIDE SHIFT RAM.
(See below)

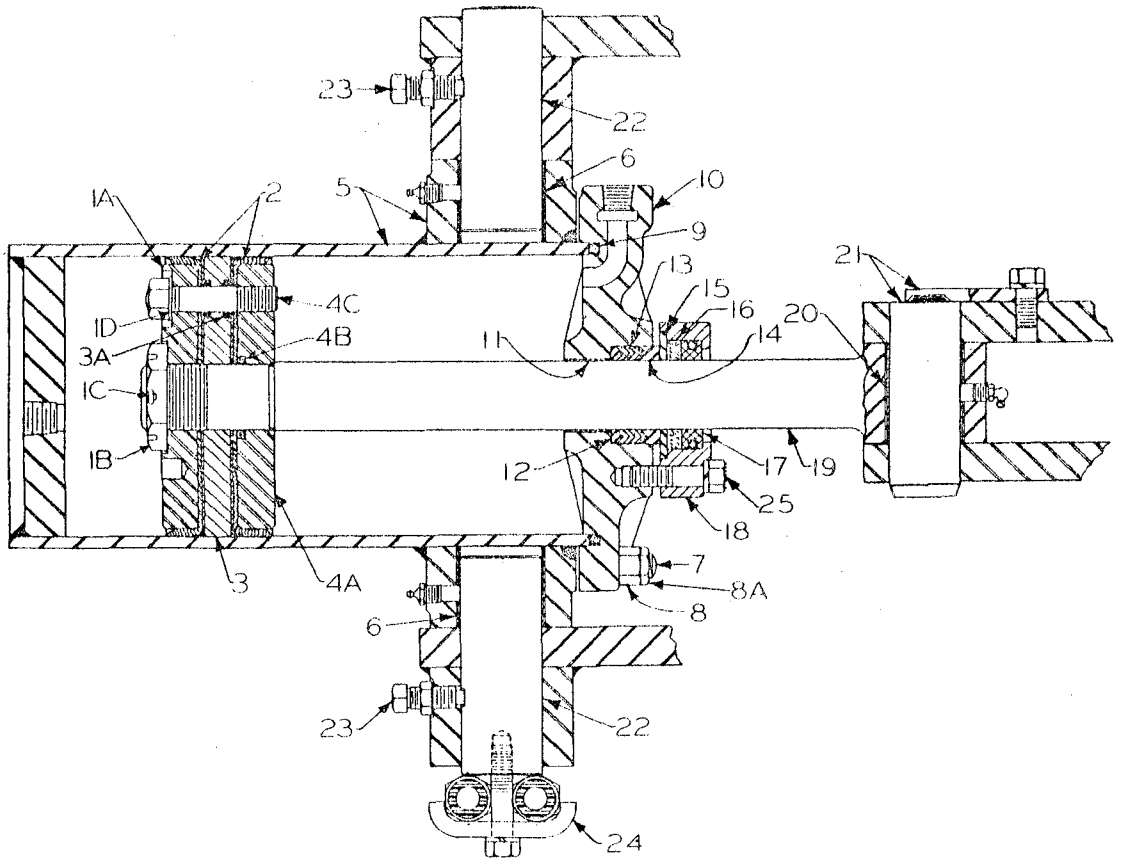
a. To remove the complete ram group, disconnect the ball socket (16), the two hydraulic hoses, the nut (18) and parts (19) and (20).

b. To dismantle and expose the ram cups (5), proceed as shown in paragraph 101, subpara. 3 to 8 inclusive. When assembling the cups, drive against spreader (4) in order to seat the cups (5).

c. When assembling, always install two new gaskets (2) and "O" ring (12). Nut (18) should only be tightened slightly, then cottered.



BLADE SIDE SHIFT RAM

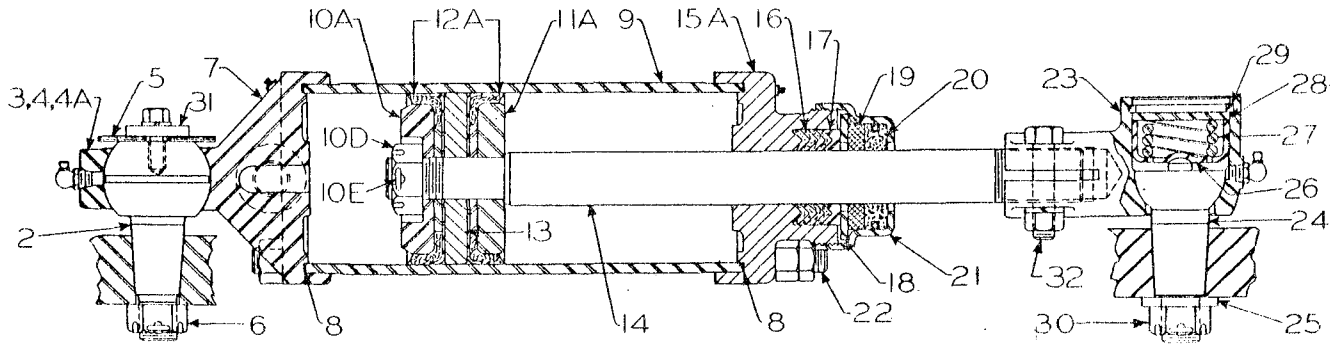


103. HIGH LIFT RAM.
(See above)

To remove the complete ram group, lower the moldboard to the ground and disconnect the two hydraulic hoses.

Remove pin (21). Then remove the two setscrews (23) in order to remove the two shafts (22).

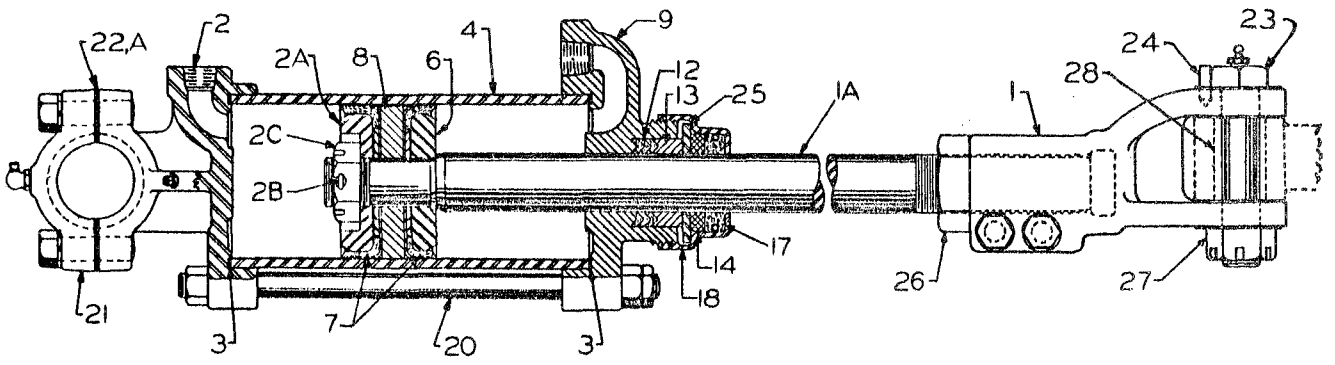
To dismantle and expose the ram cups (2) proceed as shown in paragraph 101, sub-paragraphs 3 to 8 inclusive.



104. FRONT STEER RAM.
(See above)

Remove cap (3), also disconnect the two hydraulic hoses. Remove nut (30), and then drive ball stud (24) upward to remove the complete ram.

To dismantle and expose the ram cups (12A) proceed as shown in paragraph 101, sub-paragraphs 3 to 8 inclusive.



105. REAR STEER RAM. "PACER" GRADER. (See above)

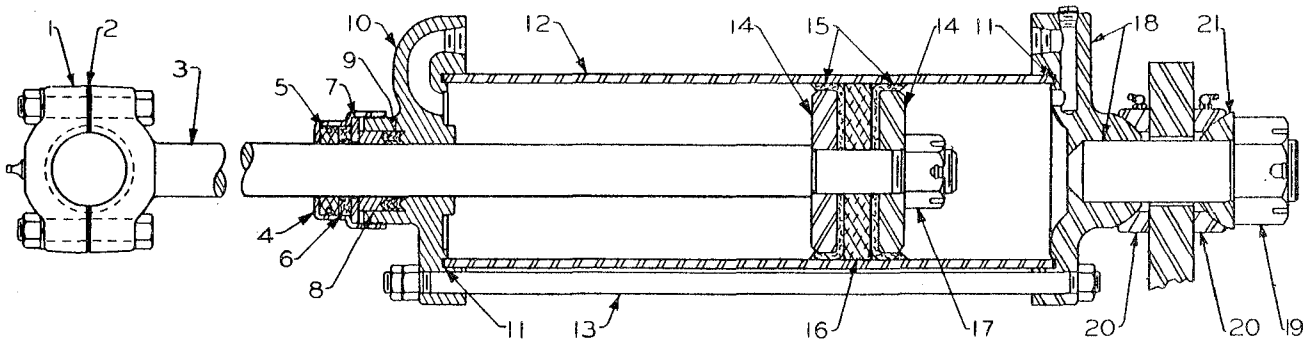
To remove the complete ram, remove the nut (27), bolt (23), cap (21), and disconnect the two hydraulic hoses.

To dismantle and expose the ram cups, (7) proceed as shown in paragraph 101, sub-paragraphs 3 to 8 inclusive.

When assembling the cups, drive against the spreader (6) in order to seat the cups (7).

Always install new gaskets (3).

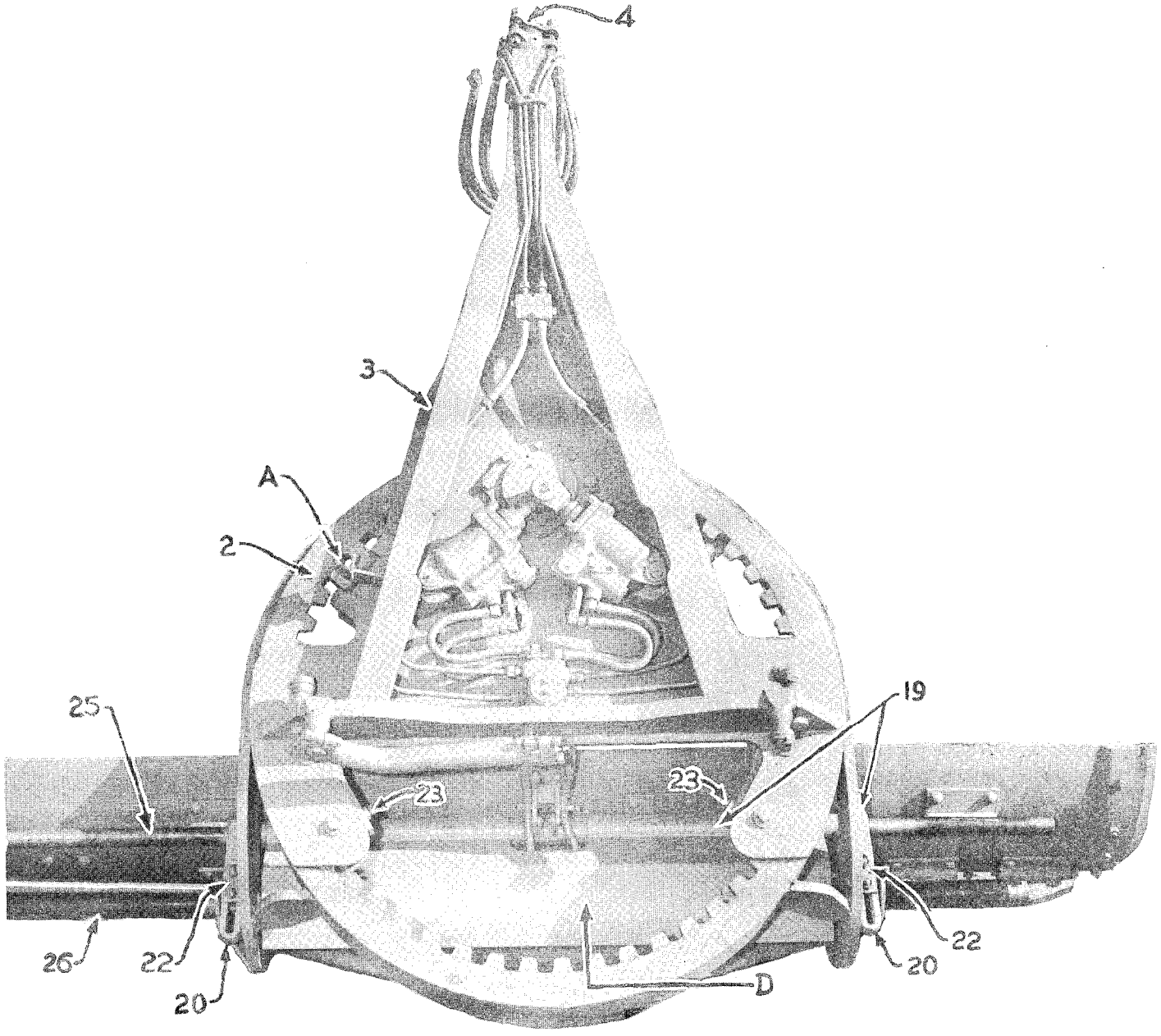
105A. REAR STEER RAM "SUPER" GRADER. See page 100 for removal from frame. See Repair Parts Book for illustration of internal parts. Removal of internal parts will be similar to data on page 117, paragraph 102.



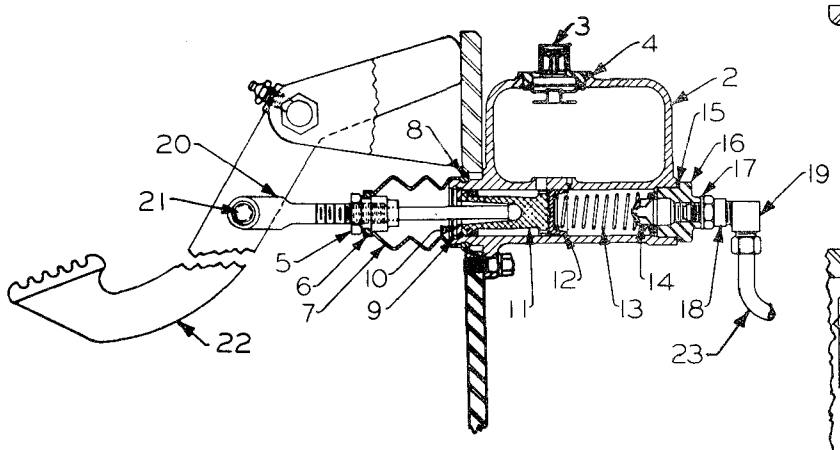
106. SCARIFIER RAM. (See above) (Also used with Bulldozer and front Snow Plows)

To remove the complete ram, lower the scarifier to the ground. Remove nut (19), also cap (1) and two hydraulic hoses.

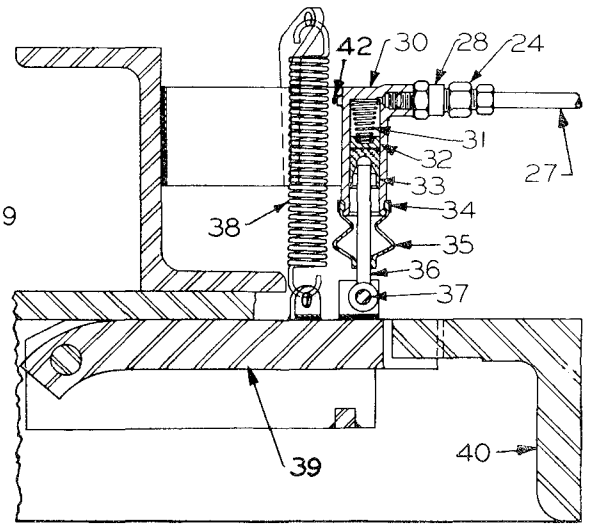
To dismantle and expose the ram cups (15) proceed as shown in paragraph 101, sub-paragraphs 3 to 8 inclusive.



107. CIRCLE AND DRAW BAR GROUP.



CIRCLE LATCH MASTER CYLINDER



CIRCLE LATCH AND CYLINDER

108. CIRCLE AND DRAW BAR.
(See Page 120)

a. General.

The strong all welded circle (2) supports the moldboard and tilting arrangement, (19) to (22) inclusive, and hydraulically operated side shift cylinder (D).

When blade is out of the ground, the combined circle and moldboard may be revolved 360° without discomfort to the operator. Without leaving his seat, the operator may side shift (either right or left) the full stroke of the ram, while the blade is in the ground and while the grader is moving.

The hydraulic "finger controls" at the operator's station, when manipulated, control the flow of oil. The operator controls the amount of oil flow; namely, from the smallest perceptable amount, to full flow of oil.

Do not lubricate the top side of the circle. The circle should be rotated at least half way every day, in order that high pressure grease may be evenly spread by hand, over the inside bore and the bottom flange of the circle.

b. Draw Bar.

The strong all-welded draw bar (3) has a ball and socket pulling arrangement (4) at the forward end.

Wear adjusting shims are provided, and after many years of hard, trouble-free service, the original clearance at the ball sockets may be reestablished.

Four adjusting screws (23) are provided for horizontal wear take-up. Shims may be removed to compensate for vertical wear.

c. Tilting Links.

To change the leaning position of the moldboard, proceed as follows:

1. Start engine and place moldboard bit straight across and on the ground.

2. Loosen the two vertical bolts which pass thru the slots of link (20) (two on each side).

3. Move hydraulic blade lift control levers at operator's station to tilt the moldboard as required, then retighten all bolts referred to above.

d. Moldboard.

The hydraulic controls at the operator's station should always be used when reversing the moldboard. The moldboard should be raised out of the ground when this operation is performed.

Both moldboard ends are forged with an offset which strengthens it and which makes it possible to bolt in renewable flush type end boots.

A good operator uses caution when operating the grader. He does not abuse it. He stops the grader and backs away from objects that should first be removed (dynamited), such as stumps and rocks. Be careful when operating the grader around street manholes or bridge abutments.

When the machine is being operated under muddy conditions during freezing weather, always apply a coating of anti-rust or water resistant grease to upper shaft (25) and lower shaft (26) for easy side shifting of blade.

The moldboard should be side shifted full stroke to the right and left sides, at termination of each days work. This is necessary in order to clean off the debris from both upper and lower shafts (25) and (26). Water resistant grease should then be applied by hand over the entire exposed length of both shafts.

When the machine is not being used, coat the shafts and moldboard with anti-rust or water resistant grease to keep them from rusting.

When operating under dry or dusty conditions, do not grease upper and lower side shift shafts.

e. Blade Extensions.

Blade extensions are provided to enlarge the usefulness of your machine for light work only.

109. HYDRAULIC BLADE CIRCLE LATCH.
(See page 120)

To unlock the circle it is necessary to stop the grader, then depress the foot pedal (22) which is conveniently located at the operator's station. The hydraulic piston (11) is thereby moved inward, forcing oil thru lines to the cylinder (30). The piston (33) being interconnected with the latch (39), forces the latch downward, thus unlocking it. The latch cannot be unlocked and the circle rotated while the moldboard is moving material. The circle reverse control lever at the operator's station may be manipulated slightly in order to free the latch for effortless disengagement.

To bleed the interconnecting lines of air, loosen screw (42) located at side of cylinder (30) and depress lever (22) several times. Then hold it downward and relock screw (42). Keep filler cap (3) clean on master cylinder to prevent air vent from being plugged with dirt. Use only genuine "Lockheed" or "Delco" brake fluids. Be sure to keep the reservoir half full of fluid when bleeding the system of air. Should the reservoir be drained during the bleeding operation, air will again enter the system, and rebleeding will be necessary. When cleaning cylinder parts such as (2), (11), (33) and others, use alcohol.

NOTE: When reversing the circle proceed as follows: Use the hydraulic controls, levers (3) and (8), page 7, and lift the moldboard and bit out of the ground. Release the blade circle latch. (Use foot pedal (11), page 7.) Always rotate the circle as required by using hydraulic power; lever (2), page 7. Never reverse the circle by placing one end of the moldboard in the ground and moving the grader either forward or backward.

109A. ELECTRIC SOLENOID BLADE CIRCLE LATCH.

A. The following parts are not used with the Electric Solenoid Latch, namely; all items shown in the lower left and lower right of page 120, under the subject of Circle Latch Master Cylinder and Circle Latch and Cylinder. The foot pedal group (11) shown on page 7 is also not used.

B. Circle Rotation Lever (2) shown on page 7 will have an electric switch attached to it at the top.

To unlock the Circle it is necessary to stop the grader. Squeezing upward with the finger tips at the switch will result in the electric current energizing the Solenoid, which in turn will unlock the latch. While depressing the switch button the operator may find it necessary to slightly move lever(2) forward or backward in order for the solenoid to unlock the latch at the circle.

Latch (39) page 120 is replaced with a similar latch having a lever at the bottom which in turn is actuated by an enclosed Solenoid group.

There is a sketch in the Repair Parts Book, identifying the items involving this Electric Latch.

110. CIRCLE REVERSE HYDRAULIC MOTOR.
(See page 123)

The hydraulic oil motor has been adjusted and timed properly at the factory and should not be tampered with unless it becomes necessary to disassemble for the purpose of making repairs or replacements. To time valves properly, proceed as follows:

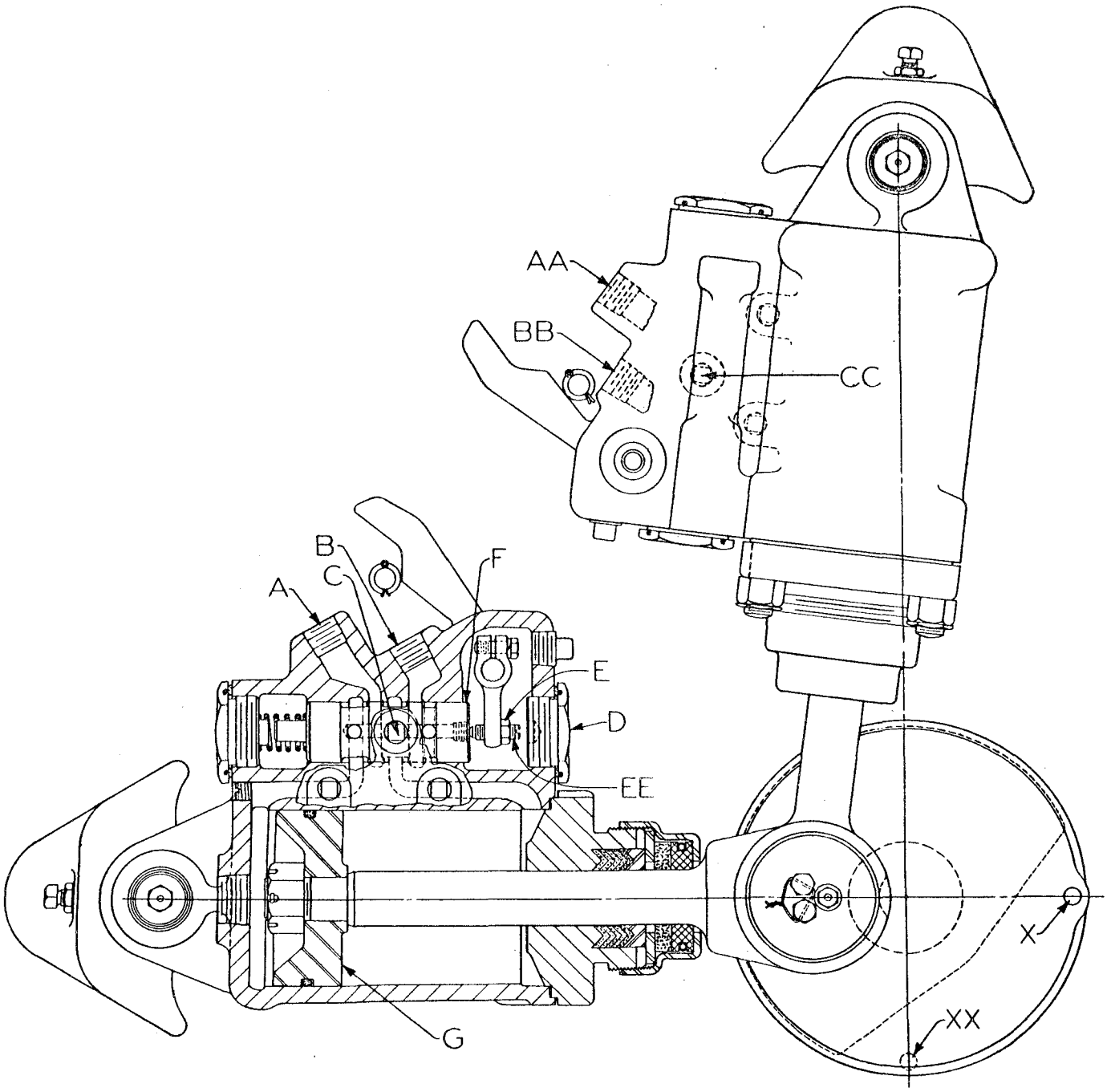
1. Rotate circle with power (as slowly as possible) to centering pin hole which has been provided on outer rim of crank pin flange located at (X). A 3/8" diameter cold rolled pin should be used. Final centering of pin hole must be done by manual movement of circle to avoid shearing of pin.

2. Disconnect the two hydraulic hoses at (A) and (B) from the cylinder and valve body which is to be timed. Remove one pipe plug (C) located on top of the body and nearest to openings (A) and (B). Attach air test hose to unplugged pipe plug hole (C). Remove valve end hex plug (D) at cam lever end. Loosen jam nut (E) on cam adjusting screw (EE). Adjust air pressure as low as possible. (Blowing on end of test hose with mouth pressure is O. K. as an alternate test.)

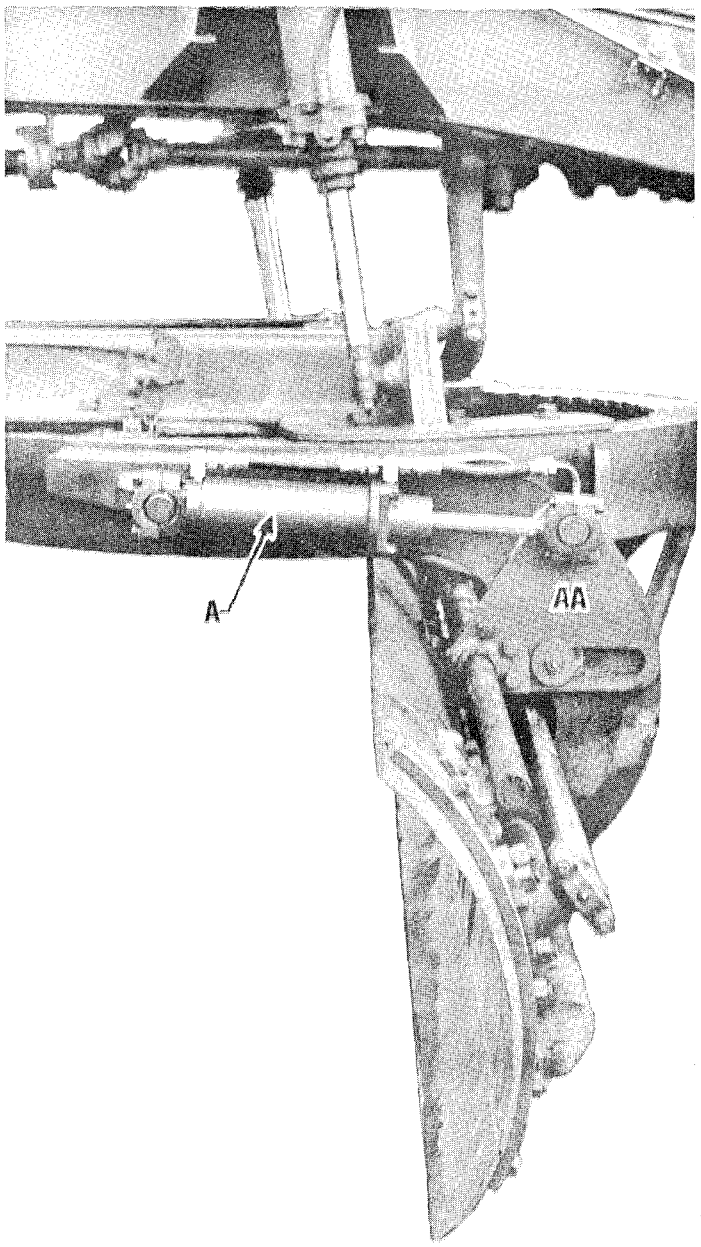
3. Proceed to adjust slotted cam screw (EE) in the end of the cam lever until the amount of air blown out of the two open ports (A) and (B) is equal. This means that the piston valve (F) is in dead neutral position, while the main 4" cylinder piston (G) is on dead center.

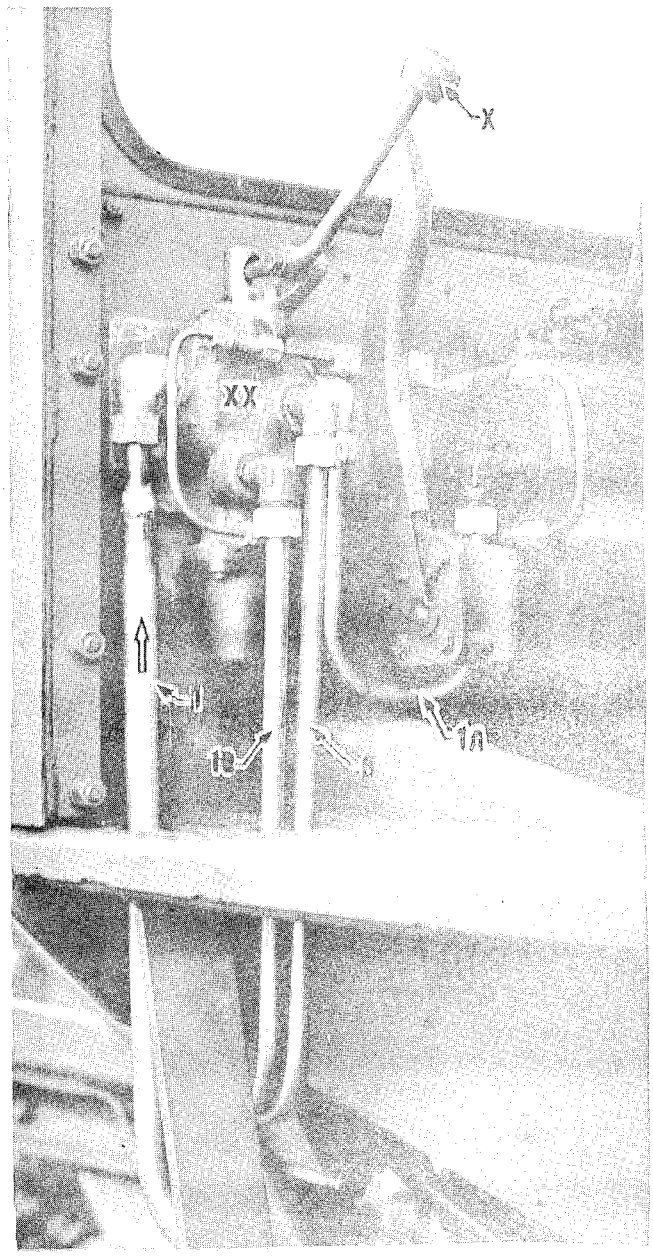
Tighten lock nut (E) and cam adjusting screw, making sure that position of screw (EE) does not change when tightening lock nut. Recheck air test after locking nut (E). Remove centering pin at (X). Screw in valve end hex plug (D) and air timing pipe plug (C). Connect hoses.

4. Rotate circle to opposite dead center hole location at (XX). Proceed to time other valve after removing the two hoses at (AA) and (BB), and the one pipe plug (CC) located under the body



Timing Hydraulic Oil Motor

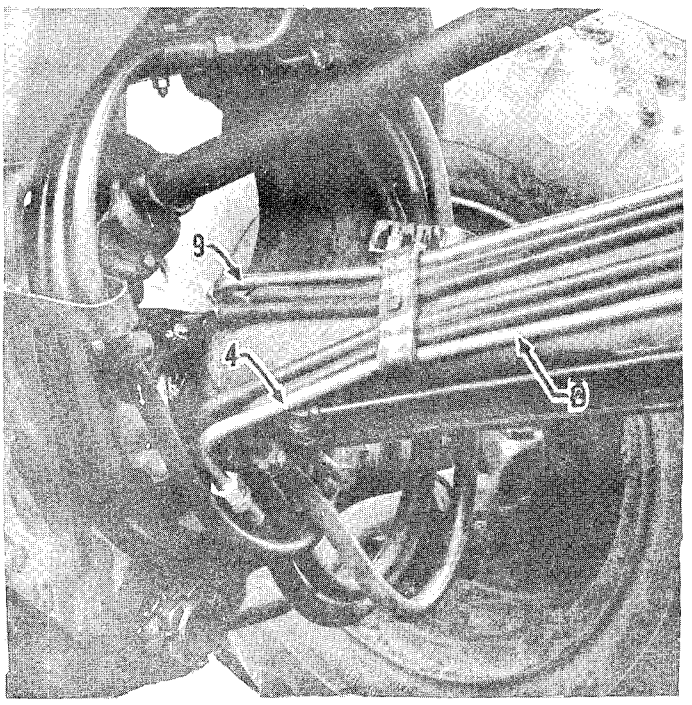




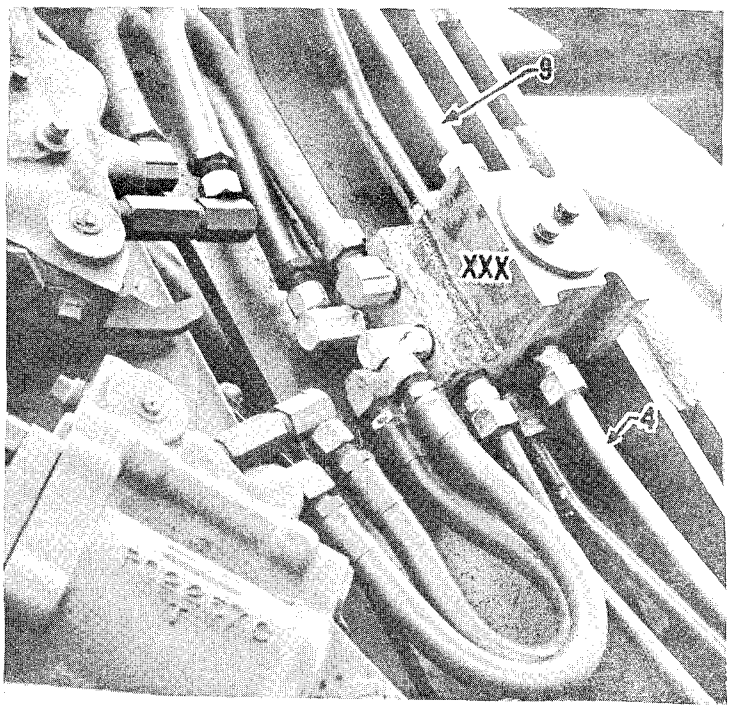
111. A-W POWER TILT MOLDBOARD.
(Optional Attachment).

This attachment permits the operator to take full advantage of the various degrees of blade pitch without making manual changes to the tilt links. This is obtained by finger-tip control of the hydraulic lever (X), see upper right photo. Pitch change can be made at any time, with or without a load and with the blade in any working position. This eliminates guesswork when it comes to proper pitch. One angle is used for cleaning ditches, another for cutting sod, perhaps still another for grading. The same applies to oil mix operations. One angle is desired for mixing, one for spreading and perhaps another for the finish pass. For snow removal, the moldboard is tilted back to obtain the proper pitch for rolling or throwing snow. When ice is encountered, the pitch can be changed by tilting the moldboard forward, giving a desirably sharp cutting edge.

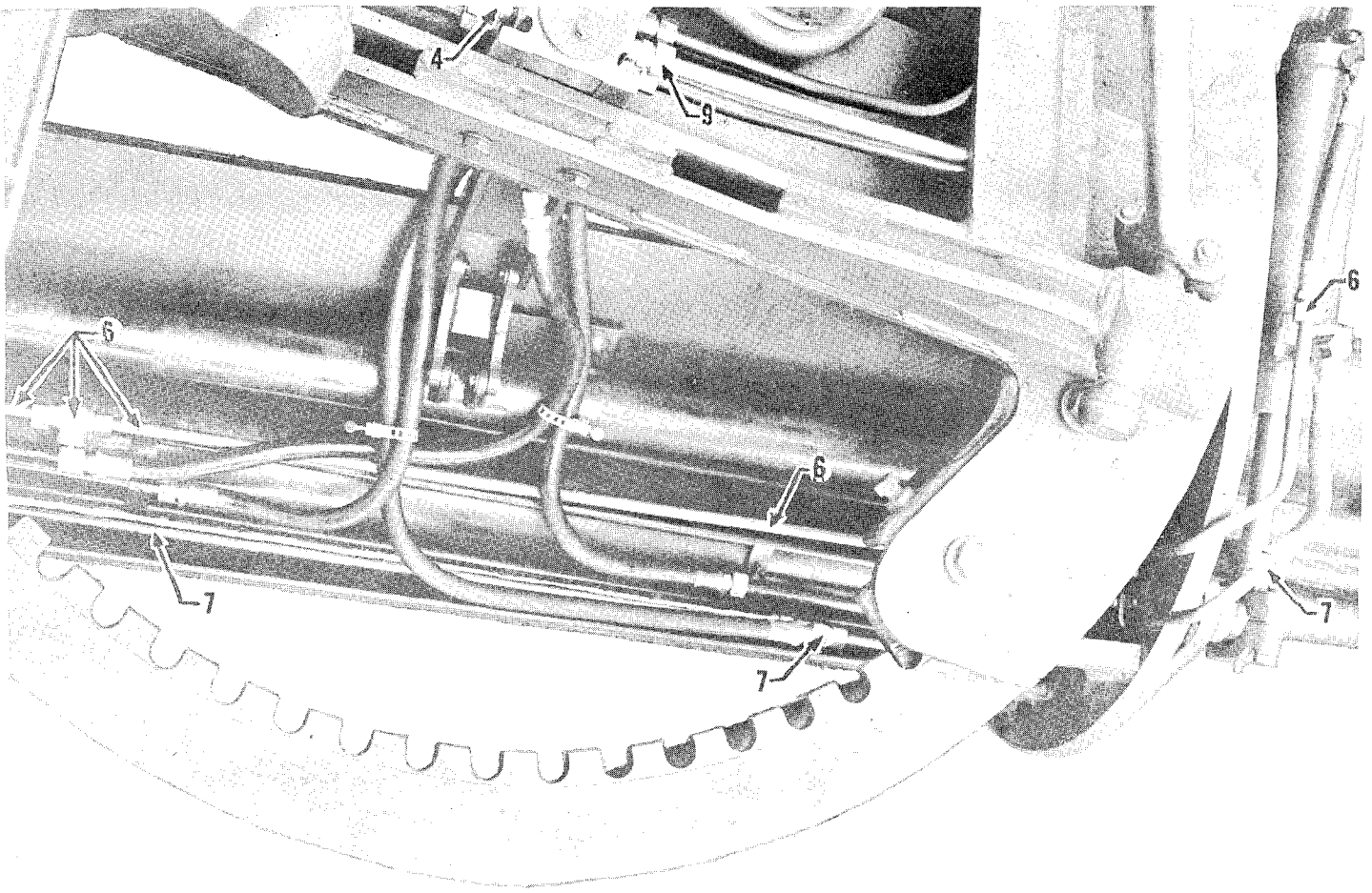
The left photo shows the hydraulic cylinder (A) and linkage (AA) attached to the left side of the circle assembly. (There is a similar group attached to the other side of the circle). The photo shows the moldboard leaned back full distance.



The upper left photo shows lines(4) and(9)attached to the draw bar.

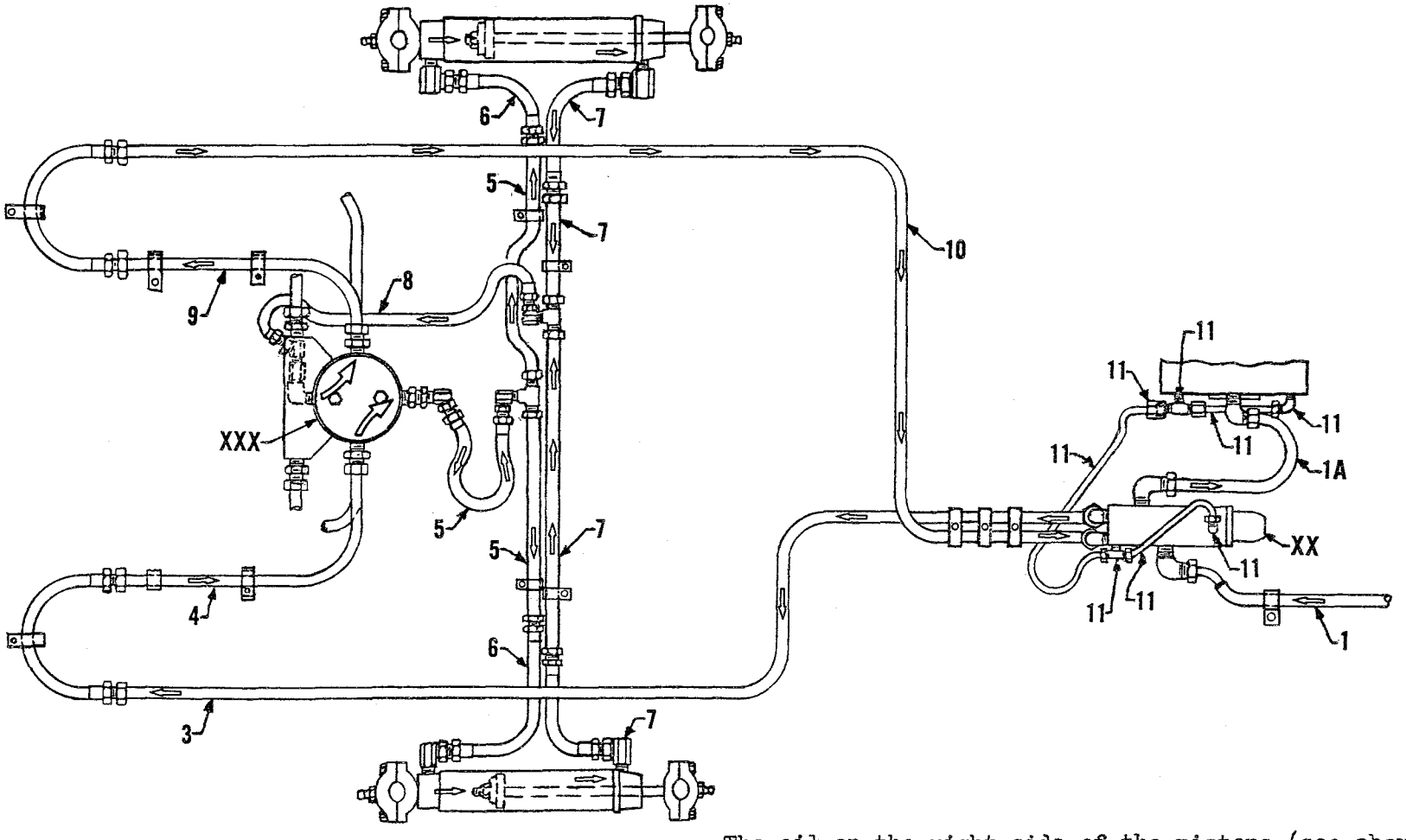


The upper right photo shows the new swivel valve (XXX) that must be installed.



The upper photo shows the hydraulic lines (6), and (7).

112. A-W POWER TILT PIPING DIAGRAM.



The attachment consists of 2 hydraulic rams, 1 valve bank (XX), 1 swivel valve (XXX) plus hose, and piping items shown on the upper diagram.

With the engine running and when the control handle (X) (page 124), is in the released (neutral) position the hydraulic oil will flow up pipe (1) (see above) then across the valve (XX) then down pipe (1A) and over to the main "Hydraulic Valve Group".

When the control handle (X) (page 124) is pulled clear back the oil will flow as shown in the above diagram. That is-from pipe (1) through the valve (XX) then through the piping as follows: Lines 3, 4, 5, and 6.

The oil on the right side of the pistons (see above), is pushed out of the cylinder and travels back to the valve (XX) through lines as follows: 7, 8, 9, and 10.

To lean the moldboard forward, push lever (X) (page 124) clear forward. In this case the oil will flow in reverse direction from the valve bank (XX) namely through lines as follows: 10, 9, 8, 7, 6, 5, 4, 3.

All of the small lines and fittings (11) drain all of the seepage oil through the main valve bank and eventually back into the oil reservoir.

113. DUOMATIC STEER.
(Optional Attachment)

A. This device provides slow and fast steer, utilizing a steering wheel. (Shown at the right).

(1) and (2) "X" mark is the point where the shoulder on the spool (19) engages the plungers (6) thereby increasing steering effort.

The counter weight (3A) is located at the left side of the steering shaft. The ball stud (3) faces to the rear.

Add four drops of engine oil (50 hours of operation) at the spring top oilers (4).

Lock nuts (5) hold the spring tensioners locked in place. Decreased spring tension on plungers (6) lessens the hand wheel effort. Increased spring tension creates more hand wheel effort. The ball stud (7) is located on the left side of the lever.

The ports (8) and (11) drain slight oil seepage back to the oil reservoir.

When the steering wheel is turned right from center towards "X" (2) and the oil metering slot (9) approaches port (16) oil slowly flows to the steering ram.

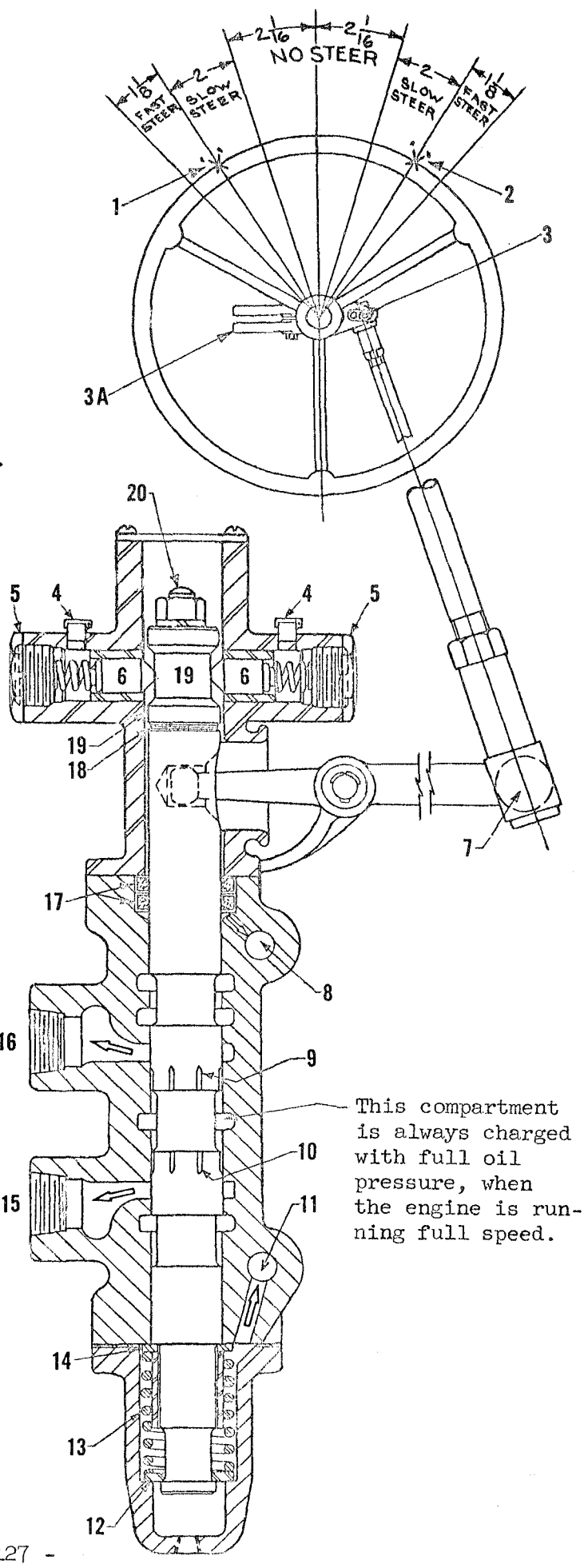
When the wheel is turned left from center towards "X" (1) and the oil metering slot (10) approaches port (15), the oil will flow slowly, thereby steering the front wheels slowly.

When the steering wheel is turned to the left or right of "X" the full flow of oil is delivered to ports (15) and (16), thereby steering the front wheels faster.

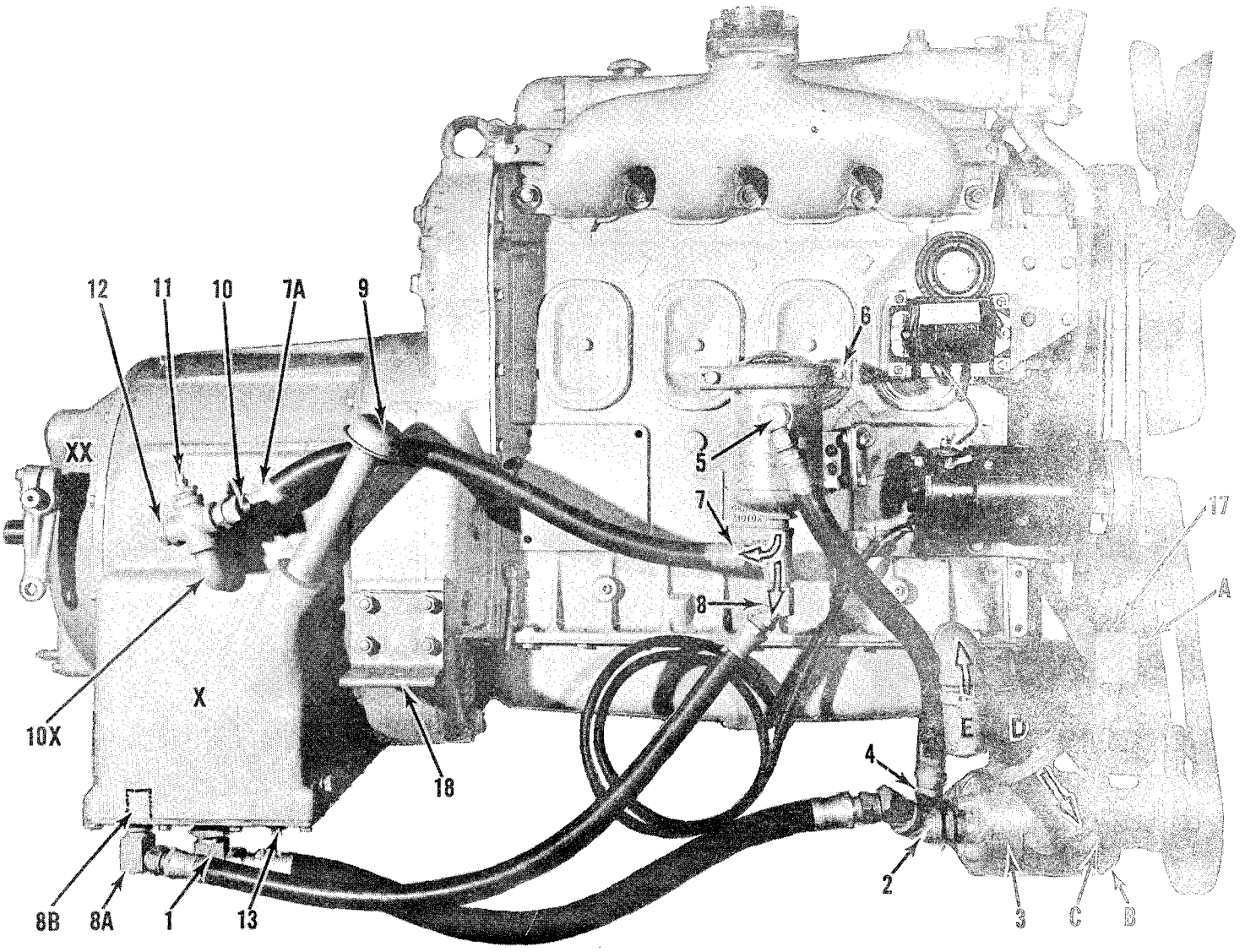
Washers (12) and (14) move from their seats as the movable plug group (20) is raised or lowered.

Seals (17) are installed with their lips turned down.

Two thin shims, (.010") and one thick shim (.020") Ref. (18), are installed at the factory to center the spool (19). Nut (20) should be tightened securely.



This compartment is always charged with full oil pressure, when the engine is running full speed.



114. A-W TORCON CONVERTER. Optional, for use with GM-471 or Cummins C-160 Diesel engine. Used with Transmission, and Transfer Case group shown on pages 86 to 92 inclusive.

A. Converter (X) is of A-W design; however, the 14" internal Turbine is made by Clark Equipment Company, group #CT-374-1. Hydraulic Transmission Fluid, Type A, is used in the oil reservoir. The maximum hot oil pressure at wide open throttle (grader stopped) is 40-50 PSI. For most efficient operation, the converter oil temperature should be kept between 200° F. and 240° F.
CAUTION: Never let the converter temperature exceed 250° F. Downshift first.

B. The above photo shows the left side of the GM-471 Engine, the Converter (X) with dry clutch (XX) attached, also the two stage Hydraulic Pump reference (3).

C. The pump (3) has two separate internal pumping compartments.

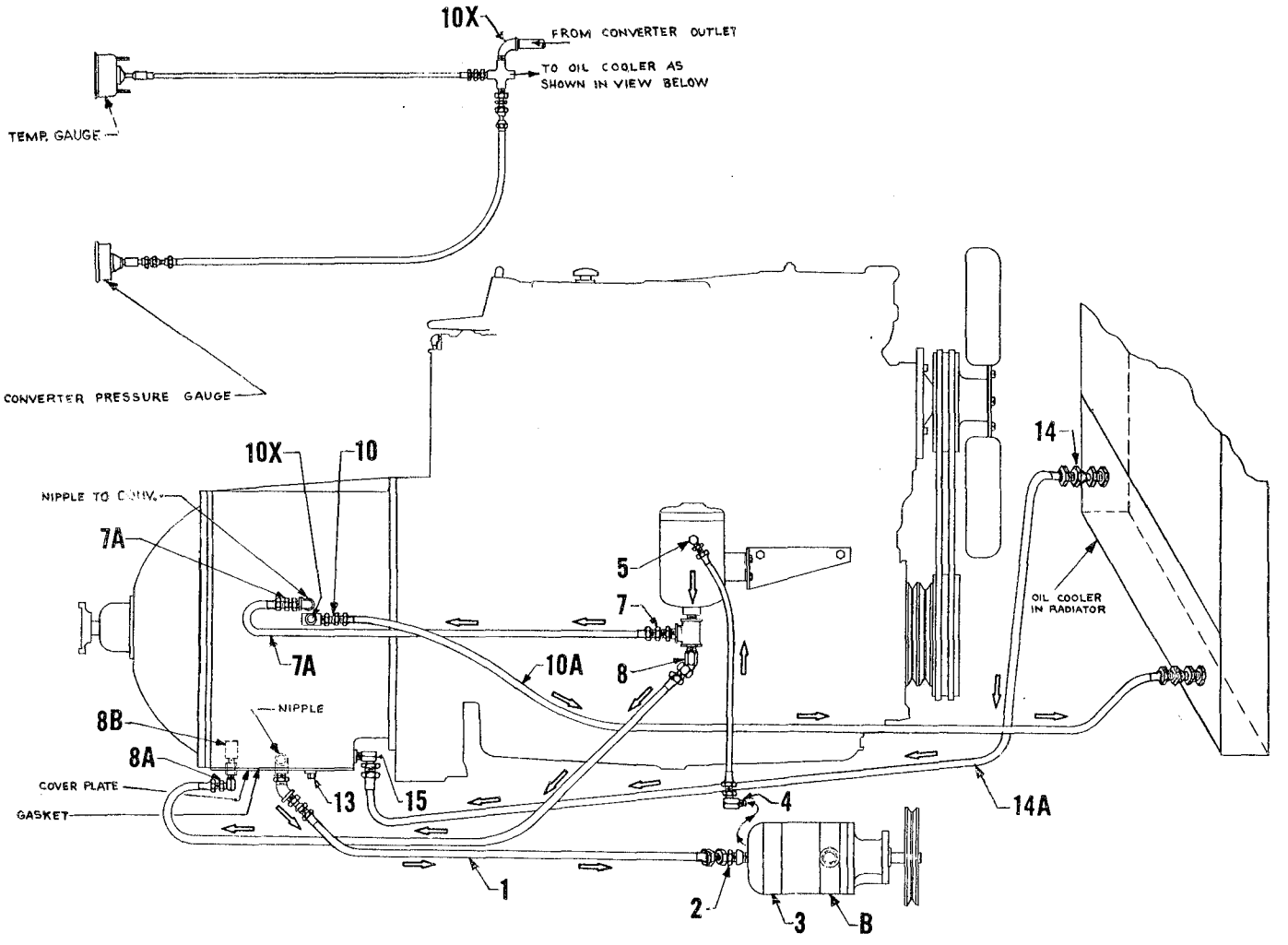
First Compartment. For power steering and grader controls.

Arrow (B) points to the end which pumps SAE-10W oil, required for steering the grader and moldboard controls. It draws oil from the oil reservoir hose Ref. (6) page 106. The oil flows up the suction hose (E), (see above), then down through the cleanable oil strainer (D), then down into the suction side of the pump (C).

Second compartment. For Converter operation.

CAUTION: There is an internal seal group which separates compartment (B) from compartment (3).

Arrow (3) points to the end which pumps type (A) fluid from the Converter oil circuit. The oil flows as follows: From the bottom of the reservoir through



The above shows the A-W Torcon Converter piping diagram. (Continued from page 128).

line (1) to Ref. (2), (see above diagram), then through the suction side of the pump, then out at fitting (4) and up to the filter inlet port (5). After the oil is cleaned by the internal filter element, the oil flows downward through the hose (7) and (7A), thereafter it flows inward to the converter as shown in the above diagram.

On a cold start when the oil does not flow readily through line (7), the oil may momemtarily flow downward through line (8) and (8A), then upward through the internal relief valve (8B) inside the reservoir. (see above)

The hot return oil flows from the converter through the following lines: From fitting (10) through piping (10A) to the oil cooler located in the bottom of the radiator core. After the oil is cooled it flows through line (14A) to the bottom of the reservoir return fitting (15).

D. CONVERTER FLUID.

Use Hydraulic transmission Fluid, Type A. See pages D or F for reference.

1. The reservoir oil level bayonet gauge and filler cap is item (9) page 128. Check the oil level every 8 hours of operation, with engine idling. Keep the level to the full mark on the gauge. Cleanliness is important.

2. The reservoir lower drain plug is Ref. (13). The converter oil temperature bulb is attached at the threaded port (12). The converter oil pressure gauge tubing is attached at fitting (11).

E. CONVERTER OIL FILTER. See group (6) page 128.

1. Removal of clamp ring (6) and the cap will expose the inner removable non-cleanable element. Cleanliness is important, therefore do not remove the cap until it has first been washed and dried.

2. Never try to wash or clean or reuse the old element. Carefully lift the old element out of the housing. Proceed at once to install a new clean unused element and be sure to replace the cap group with new gasket as soon as possible, so that contamination will not find its way into the converter oil circuit. Cleanliness is important. .

3. The part number of the filter element is Purolator Products Inc. 33316-13. The Purolator part number of the gasket is 62866.

NOTE: The Purolator part number of the filter group (all assembled) is 63148-3 The AW part number of the group is PGF-17270, one filter required per grader.

F. CONVERTER MAINTENANCE SCHEDULE.

1. At first 50 hours of operation.

The element and "O" ring should be replaced after the first 50 hours of operation. Add fluid as required. Cleanliness is important. Use clean dispensing containers. Do not use flushing oil for internal cleansing purposes. Entrapped flushing oil will contaminate the refill.

2. At first 100 hours of operation.

Remove the oil drain plug Ref. (13) page 128, to drain the fluid from the reservoir. Do not use flushing oil.

To refill the reservoir proceed as follows:

Cleanliness is important. Reinstall drain plug (13). Remove breather cap (9) and pour quantity of unused, clean Hydraulic Transmission Fluid, Type A, into the reservoir at filler tube (9).

Repeat filter element installation as shown under Paragraph E, sub-paragraphs 1, 2, and 3.

Start and idle the engine at slow speed, and continue to fill until the fluid remains at the full mark on level bayonet gauge.

Converter fluid level is always measured with the converter in operation, and at engine idle speed.

3. After schedule number 2, and every 500 hours of operation thereafter, repeat filter element installation as shown under paragraph E, sub-paragraphs 1, 2, and 3.

4. Every 1000 hours of operation (cold or hot weather operation). Repeat fluid and filter changes as shown under paragraph F, sub-paragraph 2.

G. STARTING THE A-W TORCON CONVERTER.

The initial warm up period is the most important part of converter operation. After the engine has been started, the throttle should be left in idle position until the engine water and converter oil temperatures have reached the minimum operating temperature.

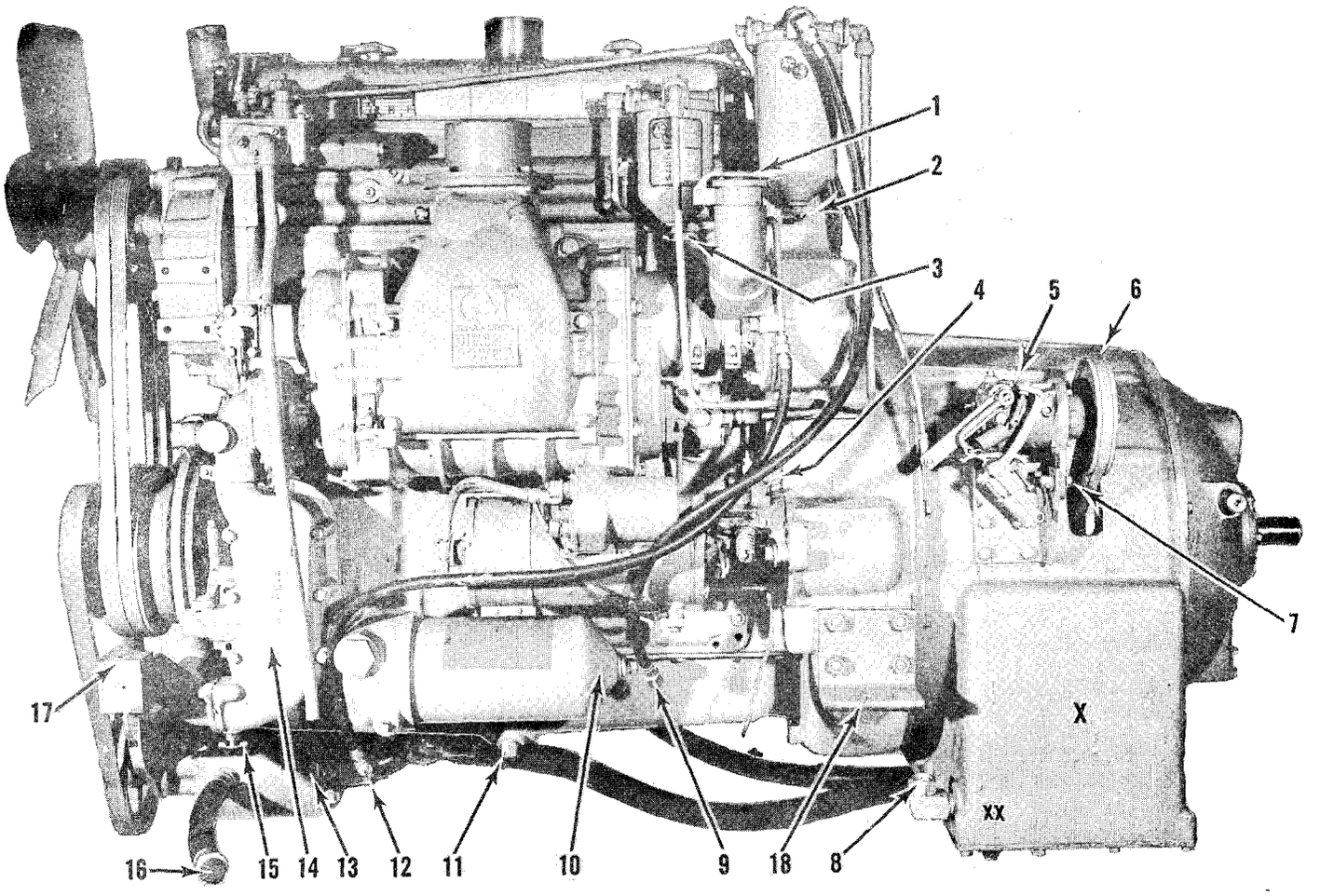
This method of starting will allow the viscosity of the oil in the converter to thin down enough so it will flow freely throughout the converter's working parts.

The grader can be put to work at partial throttle and light loads, after the minimum warm up period has been completed.

Under no condition should the grader be put to heavy work, immediately after starting the engine. Always allow the engine ample time to warm up at low throttle setting.

H. Always consult the Lubrication and Preventive Maintenance section, as shown in the General Motors or Cummins Diesel Engine Operator's Manual, packed in the tool box and shipped with the grader.

I. The A-W Torcon serial number will be stamped into a name plate attached to the lower right side of the reservoir. (See XX page 131). The Turbine serial number will be stamped below the A-W serial number. The Turbine itself will have the same number stamped into the Turbine group.



115. A-W TORCON CONVERTER. Right side of GM-471 Diesel Engine.

A. The above photo shows the converter with belt driven tail shaft governor attached. (See separate GM Engine Manual for all engine services.)

(1) GM-471 engine oil filler cap.

(2) and (3) Water and debris drain cocks under primary and secondary fuel oil filters.

(4) GM-471 Engine crank case oil bayonet gauge.

(5) Belt-driven tail shaft governor.

(6) Governor drive belt and pulley.

(7) Two attaching bolts at slotted bracket for governor drive belt tension adjustment.

(8) This is the cooled oil return elbow from the oil cooler. (See Ref. (15) page 129.

(9) Fuel line from main fuel tank shut-off valve. See page 22 Ref. (2) of paragraph 26.

(10) Full-flow engine oil filter.

(11) GM-471 engine crank case pan oil drain plug.

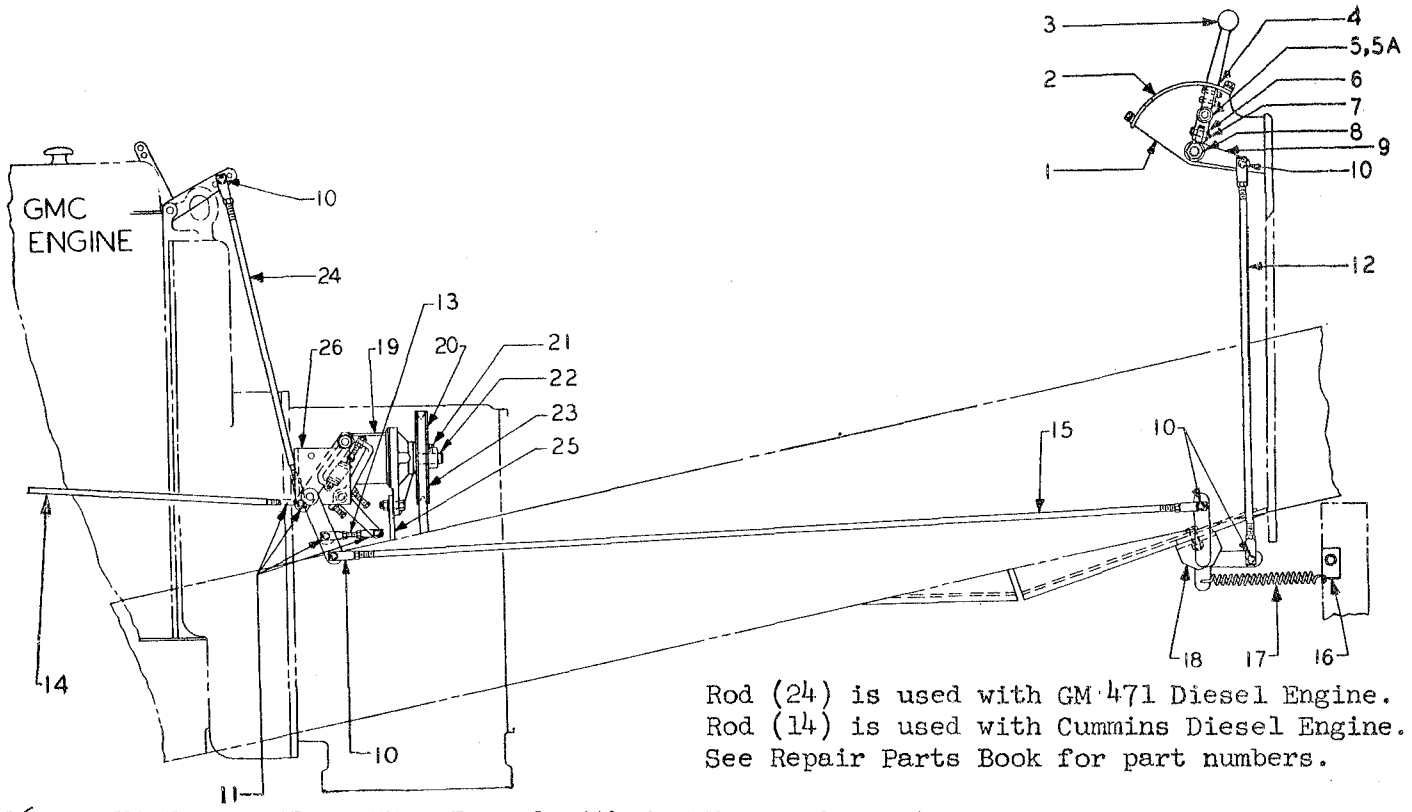
(12) Fuel oil return line from GM-471 engine to main fuel tank. See page 22 Ref. (4) and (5) of paragraph 26.

(13) Two stage Hydraulic Pump.

(14) Engine oil water cooled by internal element. See separate GM-471 Instruction Manual for complete service data.

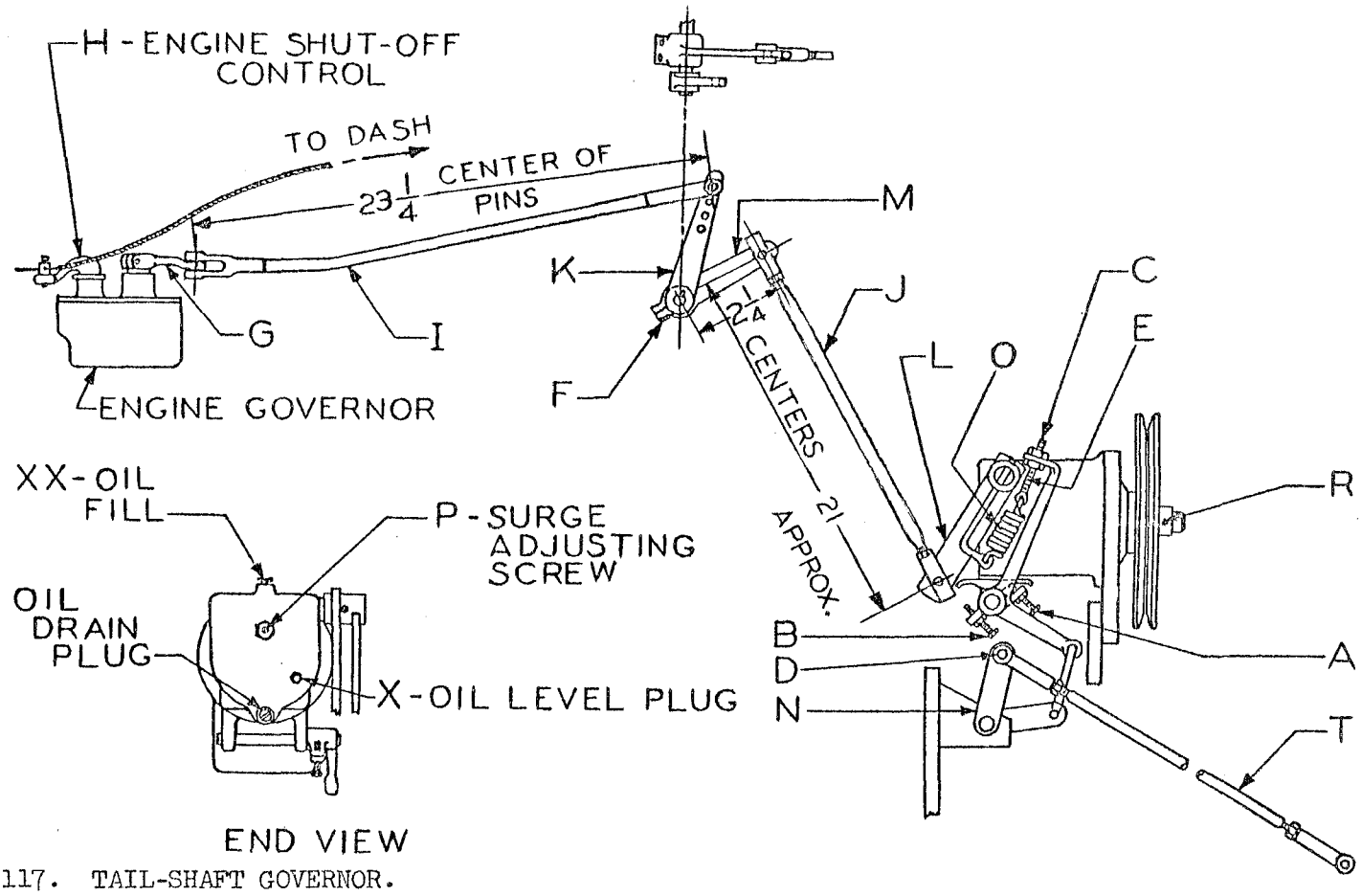
(15) Water drain cock for oil cooler (14).

(16) This is the high pressure hydraulic oil hose which comes from the first compartment (B), of the hydraulic oil pump, page 128, paragraph C.



Rod (24) is used with GM 471 Diesel Engine.
Rod (14) is used with Cummins Diesel Engine.
See Repair Parts Book for part numbers.

116. GOVERNOR CONTROL LINKAGE used with A-W Torcon Converter group.



117. TAIL-SHAFT GOVERNOR.

The above illustration shows "Converter" tail-shaft governor linkage adjustment and other data. (Continued on next page).

a. If engine surges it can be corrected by adjusting surge screw (P) in or out, as the condition might require. Be sure to tighten jam nut after adjustment has been made.

b. Be sure socket head set screw (R) on governor pulley is securely tightened to eliminate any change of pulley becoming misaligned causing premature belt failure.

c. Be sure to fill tail-shaft governor with engine oil at (XX) until it shows the proper level at oil level plug (X).

1. Disconnect control rod (I) at engine governor control and operate governor by hand. Check engine RPM at (G) by holding governor arm open to determine if engine develops approximately 2200 RPM. Stop engine.

2. Check belt on governor drive for proper tension and alignment of pulley to be sure the belt does not contact the opening in the converter housing.

3. Attach rod (I) to engine governor arm at (G) and to the top hole in arm (K). This arm is keyed to the cross shaft at the rear of engine block. Control rod (I) is approximately 23-1/4" between pin centers.

4. Disconnect engine throttle control rod (T) at pin (D).

5. Adjust eyebolt (C) to obtain about 1/4" gap at point indicated by (E). This distance may vary plus or minus 1/4", depending on variation in connecting linkage. It may be necessary to adjust idling screw (A) to obtain this adjustment. At this time, spring (O) must be free so it can be moved easily, but not a loose adjustment.

6. Adjust control rod (J) to approximately 21" from ball studs and connect arm (M) at cross shaft on rear of engine block and lever (L) on tail-shaft governor.

7. Loosen lock bolt (F) on arm (M).

8. Move lever (N) toward wide open throttle position. This will bring adjusting screw (B) against bumper plate. (This adjustment (B) is for full RPM and the threaded portion should extend through the lever arm about 3/8".)

9. Move arm (K) to bring engine governor to wide open position. (This is toward rear of engine block.)

10. With lever (N) and arm (K) held in wide open position, tighten lock bolt (F) on arm (M) securely. This insures the tail-shaft governor having full travel on the engine governor.

11. With governor linkage completely assembled, check travel of arm (K) to be positive of full travel on engine governor. At this time, if more travel is required, it can be obtained by backing full RPM adjustment screw (B) away from the stop.

12. Attach engine throttle control rod (T) at pin (D).

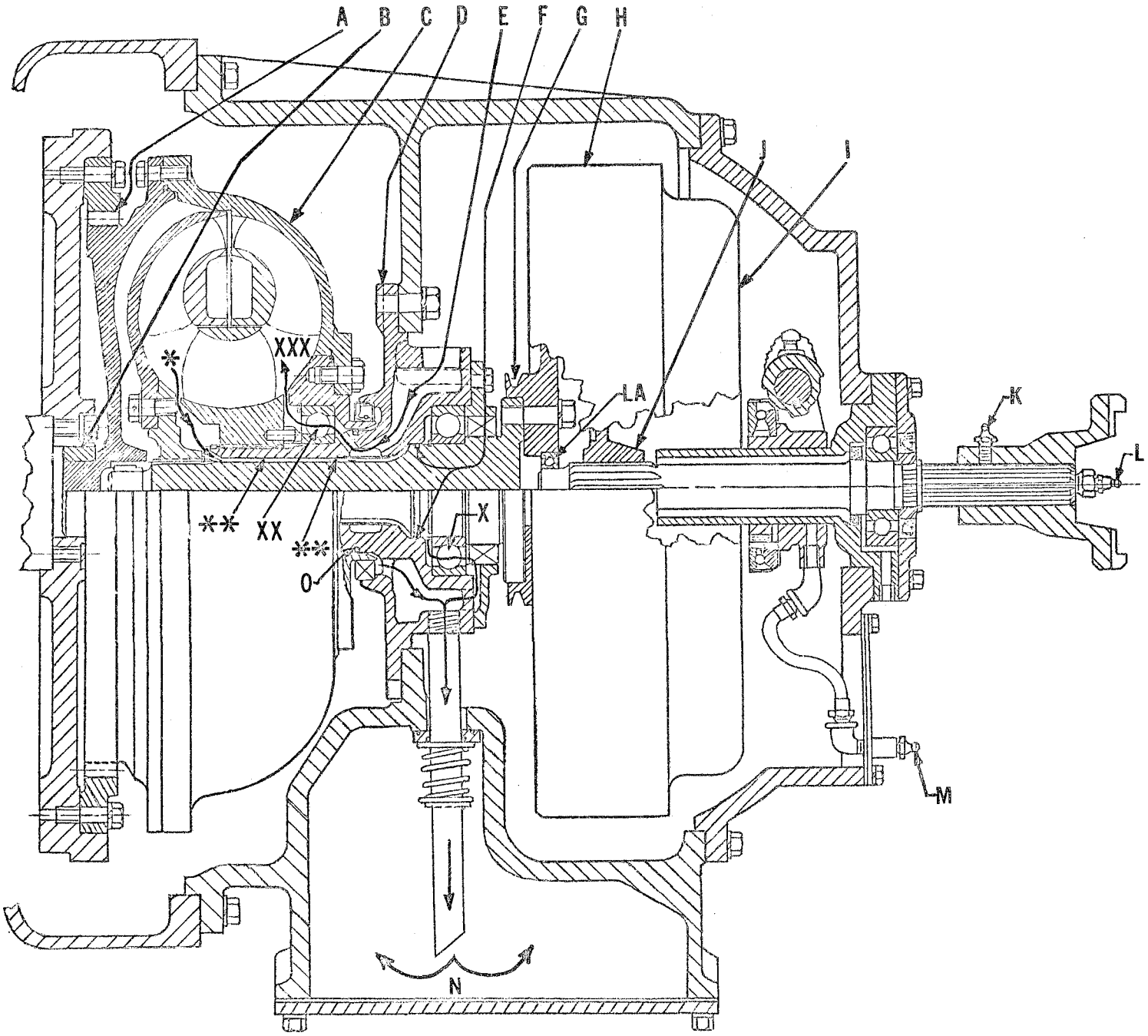
13. Start engine. Test tail-shaft governor action. To check the governor action, place transmission in 3rd gear and low range, set hand brake, and step on foot brake pedal. Open throttle to about the 4th notch on the throttle quadrant, or approximately 1/4 open position. Engage clutch. Governor will now respond under these simulated load conditions.

14. Check engine governor to be sure it has full travel at (G). Use tachometer and check RPM of engine, which should be about 1650 RPM under these conditions.

15. Idle engine, and check RPM at idle speed. The engine should idle at approximately 900 RPM. If this idle cannot be obtained, it may be necessary to change eyebolt adjustment (C).

16. Engine shut-off control (H) is the only means provided for shutting off engines equipped with tail-shaft governor.

Install endless belt on tail-shaft governor drive. (Use genuine A-W part.) To install this belt it is necessary to remove the propeller shaft (clutch to transmission), the clutch and clutch shaft, and the clutch cover from the unit.



118. CONVERTER. OIL FLOW.

(A) Flywheel to Converter ring drive. This ring bolts to the flywheel.

(B) Flywheel to Converter stub bearing.

(C) Converter together with Stator support (D).

(E) Cooled Fluid is pumped into this port after which it flows through the spaces between the balls of the Impeller Hub Bearing (XX), and finally to the Reaction Member Area (XXX).

After the Fluid has performed it's function at the Turbine Elements, the heated Fluid flows from area (*) towards the bore of the Stator support (D). The Fluid continues and flows around the driven Turbine Shaft (**) and eventually it is discharged through a cored port and pipe nipple (10) page 136, from which the Fluid flows via line (10) page 129, to the Fluid cooler (10A) located at the radiator.

(F) This is a Piston Ring Seal. See above. It prevents excessive leakage of heated fluid towards bearing (X).

(G) "V" groove for Governor belt.

(H) Flywheel for clutch.

(I) Bolted on clutch cover.

(J) Long end of clutch driven disc hub turned away from the engine.

(K) Driving Yoke. Has grease fitting so yoke will slide on the shaft splines.

(L) Grease fitting in rifle-drilled shaft. Provides lubricant for clutch flywheel pilot bearing (LA). (See pages 3 or 5 for schedule.)

(M) Grease fitting. Provides lubricant for clutch release sleeve and throw out bearing. (see pages 3 or 5 for schedule.)

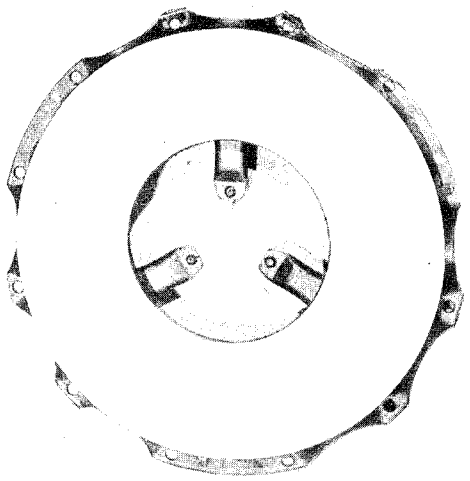
(N) This tube drains seepage Fluid back into the Reservoir.

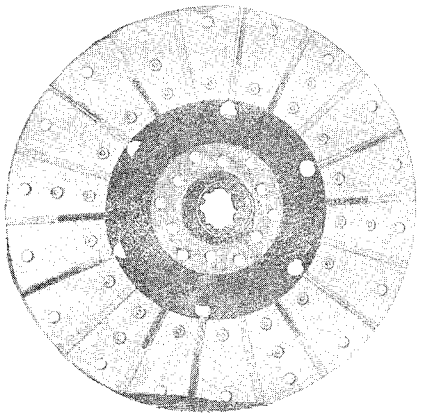
For lubrication purposes, slight Fluid seepage flows toward the right at the two Piston Ring Seals (F) and (O). All seepage to the right of (F) and (O) is drained via ports down into the reservoir at (N).

(O) This Piston Ring Seal also aids in maintaining Fluid pressure at the Reaction Member area (XXX).

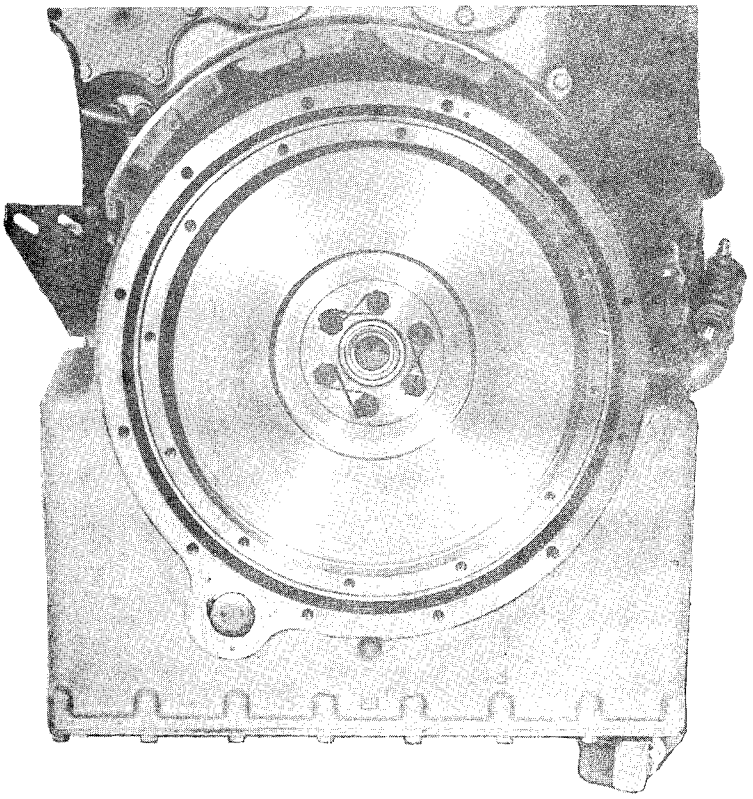
119. CONVERTER CLUTCH AREA.

A. The clutch and clutch transmission brake servicing data shown on pages 93 to 96 inclusive should be followed in complete detail.

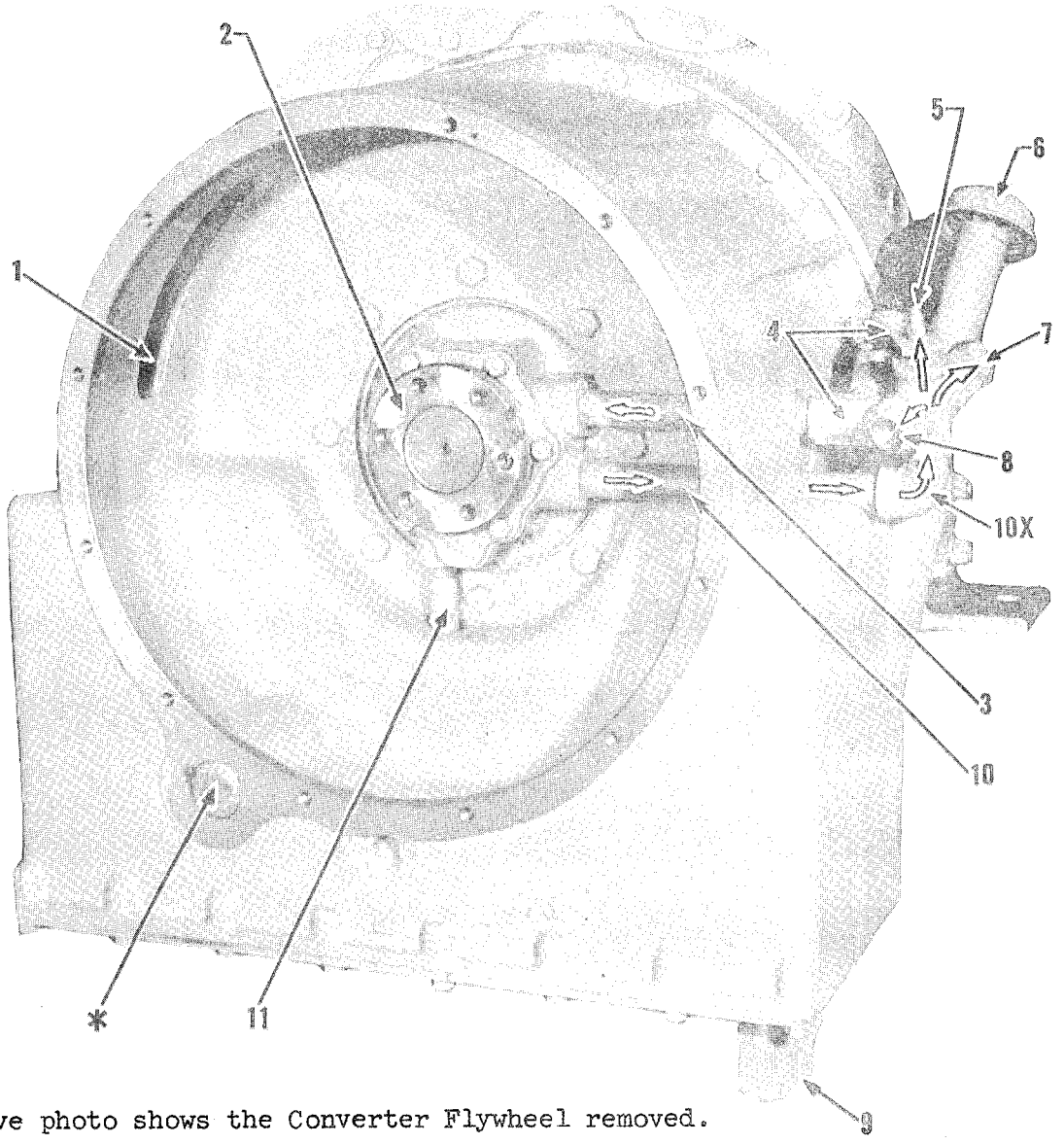




B. The lower left photo shows the machined face of the pressure plate. The upper photo shows the one side of the driven disc, with riveted-on facing.



C. This photo shows the exposed Flywheel (for dry clutch) as attached to the Converter turbine shaft.



120. The above photo shows the Converter Flywheel removed.

A. The clutch and flywheel group operate in a dry compartment. A lip type seal confines the Fluid to the Converter Unit and reservoir.

(1) Governor belt slot in housing.

(2) Turbine shaft flange for clutch flywheel drive.

(3) and (4) consist of high pressure Converter oil piping from Hydraulic pump. (see line (4) and (7) page 129.)

(5) Converter oil pressure gauge tubing is attached at this point.

(6) Reservoir Breather with oil level gauge. Check the oil level every 8 hours of operation, with engine at idle speed. Keep level up to full mark.

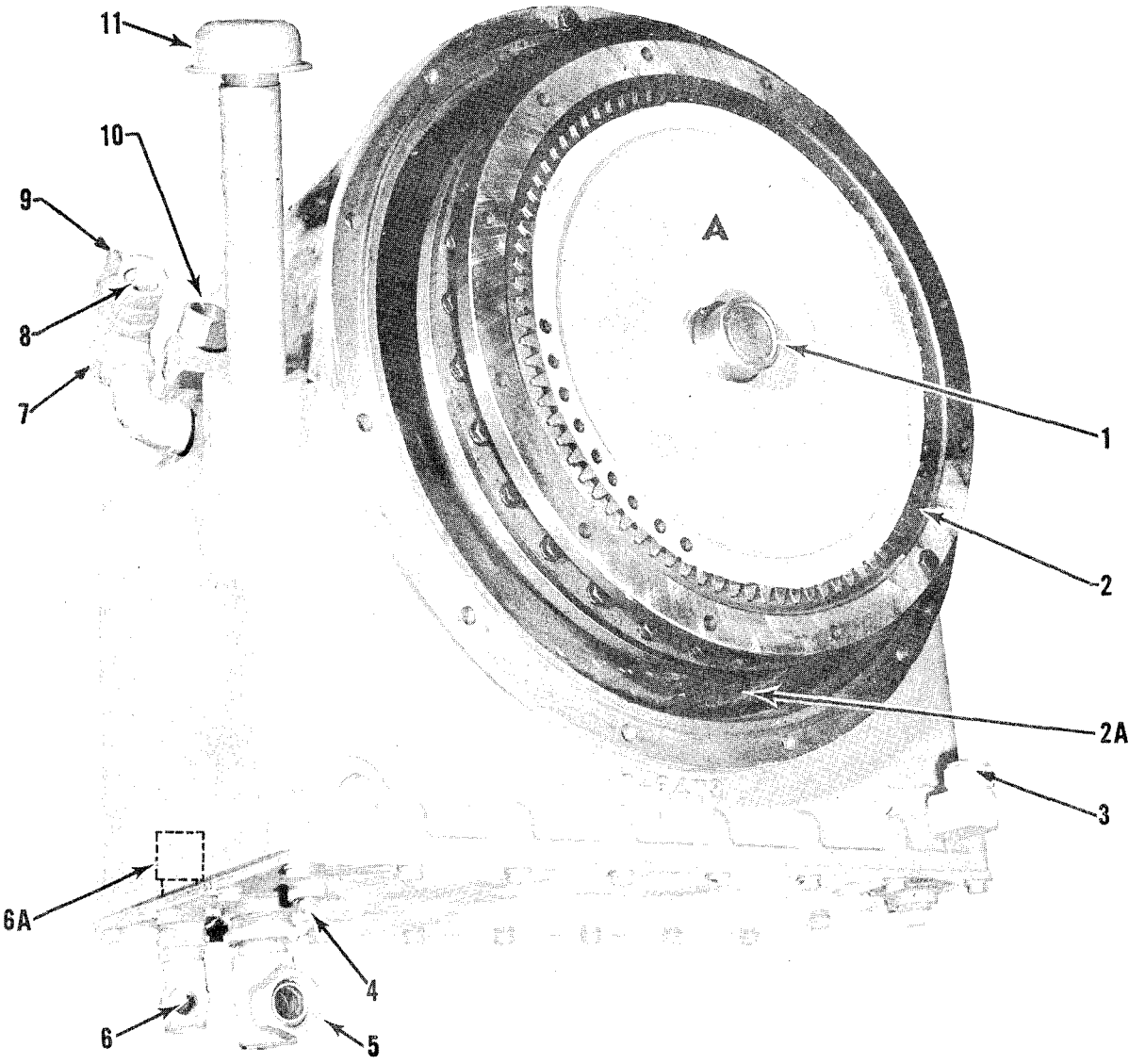
(7) The low pressure hot return oil, flows from the Converter through this port and line (10) (page 129), then, to the oil cooler located at the lower part of the radiator core.

(8) The Converter oil temperature bulb is attached at this port.

(9) This is elbow (8A) page 129. Also see Ref. 6, page 137.

(10), (10X), and (7) shown in the above photo carry the return oil from the Converter to the oil cooler located at the bottom of the radiator core.

(11) This pipe nipple is the upper end of drain tube (N). See the diagram on page 134.



121. The above photo shows the Converter group removed from the Engine.

A. The Converter Unit, Ref. (A) above, rotates within a dry compartment; see (2A). A lip type seal confines the Fluid inside the Converter unit and reservoir.

(1) Steel sleeve (1) pilots in the bore of the Engine flywheel.

(2) This is the Converter coupling gear. It bolts to the Engine Flywheel.

(3) Cooled oil is returned to the reservoir through this elbow.

(4) Oil reservoir drain plug.

(5) Pump for Converter, draws its oil supply through this elbow.

(6) On a cold start some of the Converter Fluid may flow through elbow (6), then upward to the internal relief valve (6A).

(7) The Converter oil temperature bulb is attached at this port.

(8) The low pressure hot return oil flows out this port, then flows to the oil cooler.

(9) Converter oil pressure gauge tubing is attached at the point.

(10) Converter Fluid flows from the hydraulic pump to this elbow, then to the internal area of the Converter; see piping (4) and (3) page 136.

(11) Reservoir oil filler Cap.

122. Removal of Clutch from Converter.

To remove and reassemble the clutch, follow all the instructions shown on pages 95 and 96.

123. Removal of GM-471 Engine with A-W Torcon Converter and clutch from grader.

1. Remove the Converter to transmission propeller shaft. Remove drain plug and drain the Fluid from the Converter reservoir. Disconnect oil lines at 10, 11, and 12, page 128. (plug all ports.) Also remove governor linkage from the Converter group. Remove the muffler, air cleaner tubing, hood, fuel lines at fuel tank, Clutch lever rod at bell housing. Remove the battery ground wire, also wire at the generator, and electric starter.

2. After removing the front and rear engine-to-frame bolts, (17) and (18) page 128 and 131, the Engine and Converter group can easily be hoisted upward and away from the grader main frame.

After removal of the group, all open ports should be plugged, and the entire group thoroughly cleaned with a suitable cleaning fluid.

124. Removal of Converter group from engine and overhaul.

A. After completing work as shown under paragraph 123 above, proceed as follows:

1. Remove all Engine bell housing-to-converter capscrews Ref. (2) shown in the sectional drawing page 139. Support the Converter by means of a suitable hoist and move the Converter housing to the right, thus separating the Converter from the bell housing. The Converter (A) page 137, will now be exposed to view as shown except that the coupling ring gear (2) will remain attached to the flywheel itself. (It bolts to the engine flywheel.)

2. See page 131. Remove bolts (7) and the throttle rod, so the governor (5) can be detached from the Converter Housing.

3. See page 128. Remove hose couplings at Ref. (1), (8A), and (7A). Be sure to plug all exposed hose and fitting openings so that debris cannot find its way into the Converter oil circuits.

4. Remove the clutch group (9) page 139. Follow the disassembly instruction shown on page 95 paragraph F.

5. Remove the lock wires and remove the six flywheel capscrews (8) page 139. The flywheel may now be lifted away from the Turbine shaft flange.

6. Remove the twenty capscrews (14) and remove the lower reservoir cover and gasket, for clean-out purposes. The relief valve attached inside is preset to unload at 50 to 60 PSI.

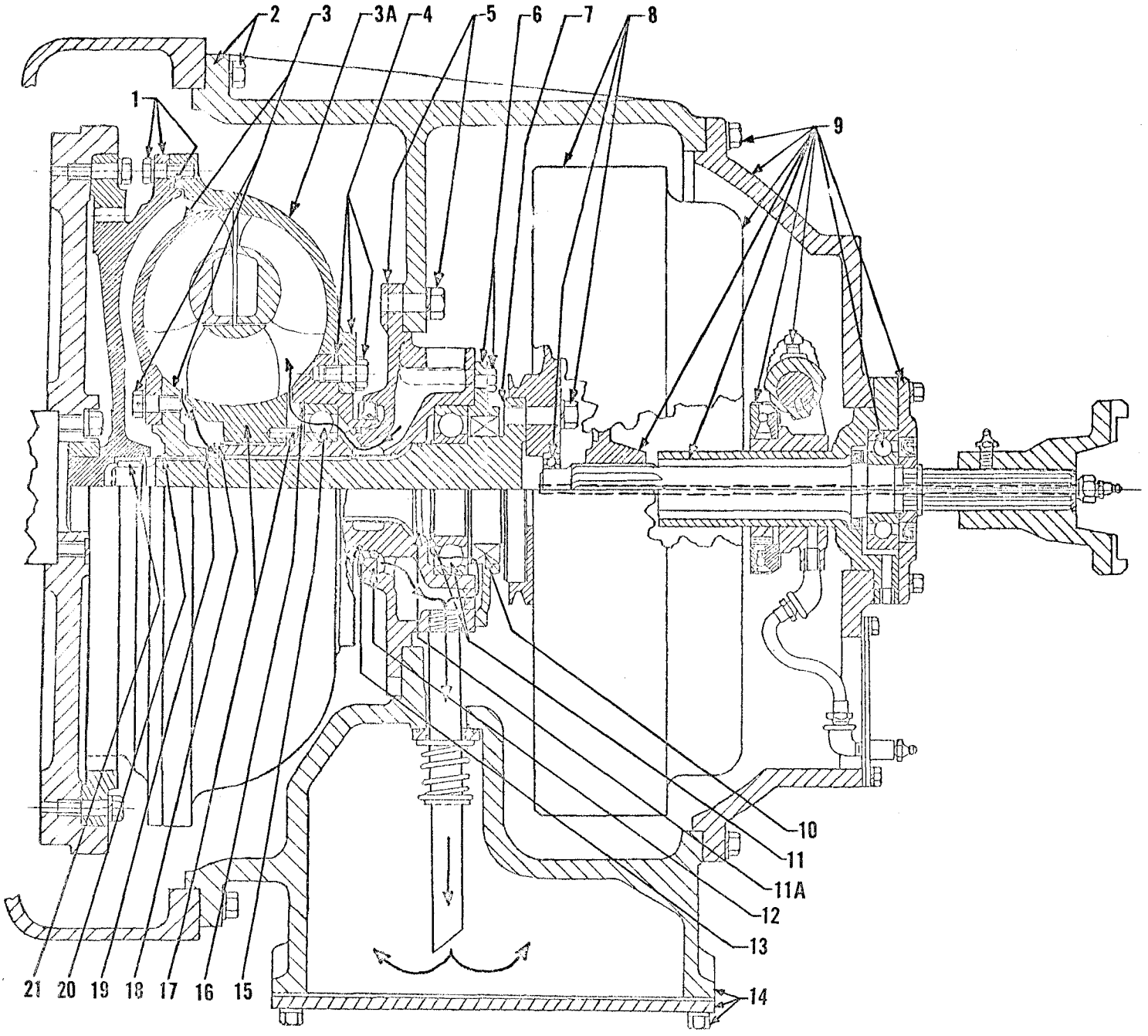
7. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism. Use clean tools and work bench facilities.

Cleanliness of the respective parts is absolutely necessary in reassembling. Dirt in its many forms can and will cause trouble. Therefore, before reassembling the torque converter or any of its parts, be sure all parts have been thoroughly cleaned with a suitable cleaning fluid. After cleaning, all parts should be thoroughly dried with moisture free compressed air. Keep parts covered during disassembly.

A thorough visual examination of all parts should be made before reassembly. Any parts which show excessive wear or damage should be replaced. Small nicks or burrs may be removed with a hone or crocus cloth. Lay cleaned parts on clean paper. It is recommended that all gaskets, oil seals, piston rings, and internal lockwashers be replaced.

Be sure to wash and dry each part before assembly. Do not wash new bearings; leave them in their original clean boxes until assembly time. Wash and clean all hoses and lines internally and externally before assembly.

The use of grease is recommended when positioning new gaskets in their respective location. Piston rings and rails should be coated with grease to facilitate assembly.



The above shows a sectional view of the Converter group.

125. DISASSEMBLY OF CONVERTER WHEEL ASSEMBLY. Refer to above view.

1. Remove bolts Ref. (1) and lockwashers. Then separate impeller cover (1) from impeller (3A). "O" ring at Ref. (1) may now be removed from impeller (3A).

2. Remove front turbine hub retainer ring (20). Turbine hub (3), the turbine hub bolts and turbine, may be removed as a group from turbine shaft. Remove rear turbine shaft retainer ring (19).

3. Remove reaction member hub to reaction member sleeve retainer ring (18).

4. Remove reaction member (17) and hub assembly from reaction member sleeve (5). If assembly will not slide from the sleeve, tapped holes in the reaction member hub are provided and a suitable puller may be used.

5. Impeller (3A) will slide from the reaction member sleeve (5) as an assembly.

126. DISASSEMBLY OF VARIOUS SUB-ASSEMBLIES. TURBINE SHAFTS:

1. Remove capscrews and cap (6).

2. Press turbine shaft (7) and bearing (11) from the reaction member (5).

3. Remove turbine shaft piston ring (11A) and bearing to turbine shaft retainer ring at (11). Press bearing (11) from turbine shaft (7).

REACTION MEMBER SLEEVE ASSEMBLY:

Remove reaction member sleeve piston ring (13) from sleeve (5).

IMPELLER ASSEMBLY:

1. Remove oil seal (12) from impeller hub (5). NOTE: This should be done only if oil seal is to be replaced.

2. Remove impeller hub bolts at (4). Separate the impeller hub with bearing (15) from impeller (3A). The "O" ring at (4) may now be removed from impeller (3A).

3. Remove impeller hub bearing retainer ring (16) from impeller hub at (4). Press bearing (15) from impeller hub near (4).

TURBINE & HUB ASSEMBLY:

Remove turbine to turbine hub bolts (3). Separate turbine (3) from turbine hub.

TURBINE COVER HUB:

1. Remove turbine shaft pilot bearing retainer ring; see (21).

2. Using an off-set screw driver, remove pilot bearing (21) from the hub.

127. ASSEMBLY OF VARIOUS SUB-ASSEMBLIES. IMPELLER COVER:

Press bearing (21) in hub (1) and secure with retainer ring.

TURBINE AND HUB ASSEMBLY:

Align holes in turbine hub (3) with holes in turbine and install turbine to hub, bolt lockplates and bolts. Tighten securely and bend corners of lockplates against head of bolts at (3).

IMPELLER ASSEMBLY:

1. Press bearing (15) into impeller hub (4) and secure with retainer ring (16). Install new "O" ring (4) on impeller hub. Align holes in impeller with hole in the impeller hub at (4). Install impeller to impeller hub, bolt lockplate and bolts at (4), tighten securely and bend corners of lockplates against head of bolts.

2. Press new oil seal (12) into place at the bore of (5) with lip of oil seal turned towards ball bearing (11). Use CAUTION not to damage oil seal.

REACTION MEMBER SLEEVE ASSEMBLY:

1. Press bearing (11) on turbine shaft (7) and secure with bearing retainer ring at (11). Install turbine shaft piston ring (11A) on turbine shaft (7). (Apply grease to ring.) Install turbine shaft (7) and bearing (11) in the reaction member sleeve (5).

2. Install reaction member sleeve piston ring (13).

ASSEMBLY OF CONVERTER WHEELS:

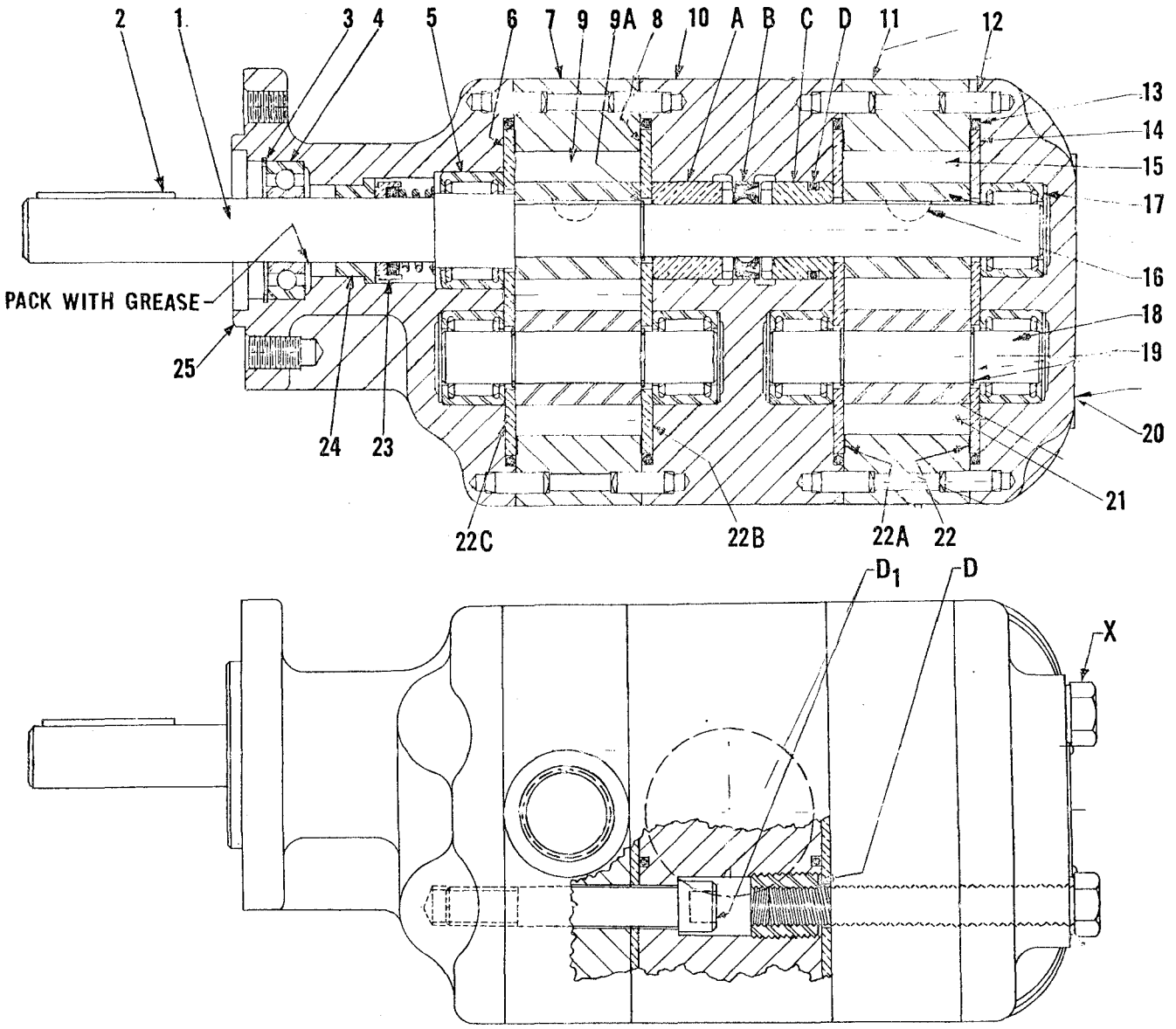
Install impeller (3A) on reaction member sleeve. Use CAUTION not to damage piston ring (13). (apply grease at ring.)

Install reaction member (17) and hub on splines of reaction member sleeve (5). NOTE: Heavy edges of blades on reaction member must be outward. Install reaction member sleeve retainer ring (18).

Install rear turbine hub retainer ring (19) on turbine shaft (7). Install turbine (3) with hub assembly on turbine shaft. Install front turbine hub retainer ring (20).

Install new "O" ring at (1) on impeller (3A). Install impeller cover (1). Install bolts at (1) and lockwashers and tighten securely.

Reassembly to grader will be the reverse of paragraphs 123 and 124, page 138.



128. HYDRAULIC DUAL PUMP for A-W Torcon Converter (also A-W Power Reverse Transmission).

A. The rotation is clockwise, as viewed from the pulley end of the drive shaft.

B. The end gear section (11) as shown above, contains the pump gear group that supplies the oil for operation of the A-W Torcon Converter. The oil circuit is protected by a relief valve; see (6A) page 137. This valve screws into a coupling which is welded into the lower coverplate of the oil reservoir. The valve is preset to unload at 50 - 65 PSI.

C. Section (7) as shown above, contains the gear group that supplies the oil for operation of the Grader steering and hydraulic ram controls. This oil circuit is protected by a relief valve; see par. 14 page 105. The valve is preset to unload at 1500 PSI.

D. The center section (10) separates oil compartment (11) from oil compartment (7).

Section (10) consists of an assembled group as follows: One outer body (10), one bushing (A), one seal (B) with lip turned away from the pulley end, and one bushing (C) with "O" ring (D).

129. HYDRAULIC DUAL PUMP OVERHAUL.(HYDRECO)

A. See page 109 for tools.

B. Hydraulic Pump Dismantling.

1. Clean outside of the pump with an oil solvent, fuel oil, or gasoline, and dry thoroughly. With file or oil stone remove sharp edges or burrs from shaft splines, drill point, keyway or shaft end before proceeding with disassembly. Mark section of pump with prick punch for proper reassembly.

NOTE: Servicing is facilitated by bolting the adapter to a special bench mounted assembly plate. (see page 109.)

2. Remove the four cover capscrews (X) (see page 141). Remove the cover (20) which may come off separately or with the housing (11). (see upper illustration).

To prevent possibility of leakage, avoid scoring or nicking machine surfaces of pump sections. DO NOT USE A SCREW DRIVER to pry the section apart. Tap with fibre hammer, if necessary, to loosen.

Note position of relief pocket and drilled holes in the wear plate (22) for proper reassembly.

Mark the drive and driven gears (15) and (21) with an India stone, for proper reassembly. Illustration on page 110.

Note the location and number of gaskets when disassembling.

Remove shaft with gear (18) also gear (15) and key (16). Remove the plates (22) and (22A) with "O" rings.

3. See page 141 lower illustration. Remove the four threaded inserts (D). These can be removed with a wide bladed tool.

(When re-installing them, bottom the inserts in the threads. They must be flush with the surface, or preferably below the surface).

Remove the four Allen head capscrews (DI). (Remove the sharp edge of the keyway (16) with an oil stone).

The center section (10) can now be loosened and slipped off of the shaft (1).

Check the condition of the internal bores of bushings (A) and (C).

Upon reassembly, be sure the inner seal (B) is in good order. Be sure the keyway at (16) is honed down with an oil stone because the sharp edge of the keyway can cut and ruin the lip of the seal (B). The lip of the seal (B) should be turned away from the pulley end of the shaft (1). Oil the bores of bushings (A) and (C) during assembly.

Loosen and remove wear plate (8) and "O" ring, with housing (7) and the lower gear with shaft. Remove snap ring (9A) and gear (9). Remove wear plate (6) and "O" ring.

Unbolt the adapter end from the bench plate.

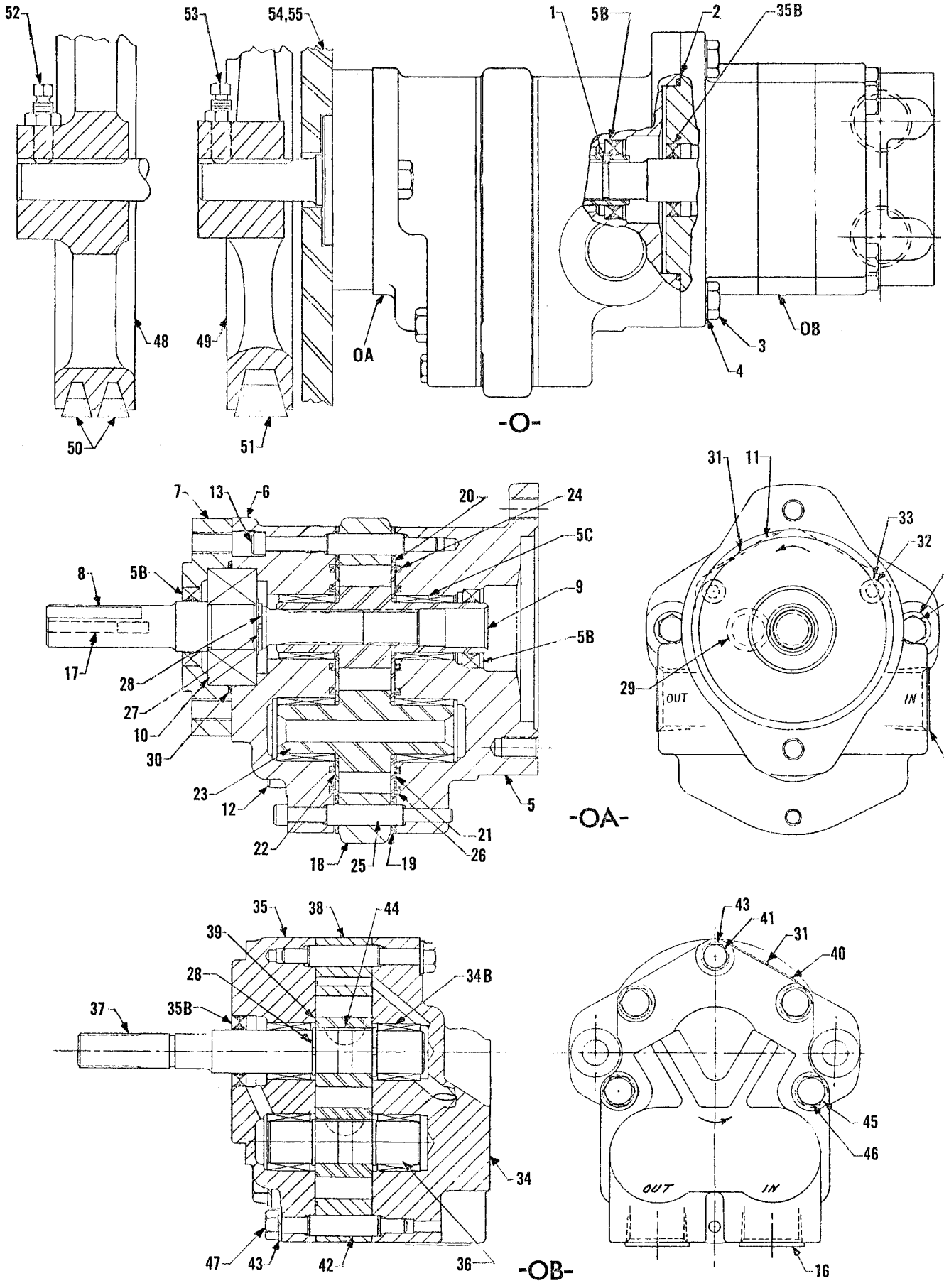
This pump is equipped with an outboard ball bearing (4). Be sure to coat end of shaft with white lead and remove any burrs before pressing out, to prevent the bearing from being scored.

Remove the driven shaft (1) and parts by pressing on the keyed end of the shaft. Remove the bearing (5) and the seal group (23) and (24) from shaft (1).

Remove dowel pins (12) from adapter (25) and cover ends, with pliers or a lever jaw wrench.

Reassembly of the items up to this point, will be performed in reverse sequence. Cleanliness is important.

4. The balance of pump rebuilding instructions will be the same, beginning with paragraph 3, page 111, Type A roller bearings, to page 115, all inclusive.



HYDRAULIC DUAL PUMP AND PULLEY.

129A HYDRAULIC DUAL PUMP OVERHAUL
(Webster-Electric)

A. Hydraulic pump dismantling.

1. Clean outside of pump with an oil solvent, fuel oil, or gasoline, and dry thoroughly. With file or oil stone, remove sharp edges or burrs from shaft splines, drill point, keyways or shaft end before proceeding with disassembly. Mark sections of pump with prick punch for proper reassembly.

NOTE: Servicing is facilitated by bolting the adapter to a special bench mounted plate.

2. Remove the two capscrews (3) and separate the two pump sections.

B. Disassembly - (Front Section.)

1. Remove the two capscrews (3) attaching the adapter assembly (7) to the pump body (5). Lift the adapter from the pump carefully to avoid damage to the seal (5-B) (Splines and key seats should be masked with tape by starting at seal seat and lapping each turn 1/16" over the last and progress outward.)

2. Inspect seal for wear and cuts and if found to be defective, press seal out of adapter and press in a new one.

3. Remove drive shaft (8) and ball bearing (10) CAUTION: Do not damage shaft. If necessary shaft can be left in pump until the stack has been separated and then removed by lightly tapping it out of the body.

4. Remove the eight capscrews. Two (13) thru the dowel pin holes and six (25) external.

5. With soft hammer, gently tap the stack apart until the pump can be disassembled by hand. CAUTION: Never pry any parts apart since this will raise a burr and possibly prevent satisfactory reassembly of the pump.

C. Assembly (Front Section)

1. Stone all mating surfaces to remove any burrs that may be present.

2. Wash all parts until clean in a solvent and air dry.

3. Install wear plate (21) (22) with flat surface down in both body and cover.

4. Install back-up ring (26) in body and cover.

5. Install O-ring (29) in recesses inside of wear plate grooves of cover and body.

6. Install wear plate retaining plate (19) on cover.

7. Install sealing ring (26) inside of retaining plate (19) with lip toward cover.

8. Install wear plate (21) with entrapment relief grooves in cover (5). Pressure loading ports (1/8") toward loading ring and bronze toward gear.

9. Install dowel pins (25) in gear plate (18).

10. Install gear plate (18) on cover (5)

11. Install gears and turn them to insure there is no interference with the gear plate. Lubricate gears with SAE No. 20 oil or system hydraulic fluid.

12. Install wear plate (22) without entrapment relief for body side (6).

13. Install wear plate retaining plate (20).

14. Install sealing ring (24) between wear plate (22) and retaining plate with lip toward body.

15. Install body (6) on pump.

16. Install eight capscrews. Two (13) through dowel pin holes and torque 18-22 ft. lbs. Six (25) external and torque 32-37 ft. lbs.

17. Press ball bearing (10) on shaft (8) with arbor press. Install washer (27) and snap ring (28) to secure bearing on shaft.

18. Install bearing and drive shaft assembly in pump.

19. Install adapter assembly.

20. Rotate drive shaft to insure no interference with rotating parts. A smooth heavy drag indicates a good pump. A jerky drag or frozen pump indicates an improperly assembled pump.

D. General

1. Alignment

The tolerances and allowances on all parts of this pump are held very close making alignment very important. All machining references are made from the dowel pin holes. The dowel pin fit should be a heavy wringing fit to a loose slip fit and the dowel pin should extend equidistant into the body and cover on reassembly of the pump. Since your pump has operated a considerable number of hours before rebuilding, it can be assumed that the bearing bores are in proper alignment.

2. Bearings

a. Needle bearings (5C) close visual inspection will generally indicate the condition of the bearing. The needles or shell should not be spalled or have case failure. The shaft and bearing shell should not contact and the needles should be held in securely by the shell. If a faulty bearing is found the assembly containing it should be replaced.

b. Ball bearings (10). This bearing should also be checked for spalling and case failure. This outer race should not turn in the housing bore.

c. All bearing components must be checked for cleanliness before rebuilding the pump. All bearing components must turn smoothly when assembled. If the components turn erratically after all possible foreign matter has been removed, the bearing must be considered defective and replaced.

3. Shaft Seals.

The lip of synthetic seals (5-B) should be checked to insure there are no cuts or nicks. The rubbing surfaces of mechanical seals must be smooth and free from nicks, scratches, and ridges. If a ridge can be felt with a finger nail on any rubbing surfaces of a seal it must be considered defective. All rubber sealing components of seals must be pliable and free from cuts and excessive wear. A defective seal will sometimes be indicated by air bubbles in the reservoir.

4. Drive Shafts.

If the wear of the seal can be felt with the finger nail the shaft (8) should be polished or replaced. As an expedient a seal seat with a smooth groove no more than a few thousandths deep will probably function without the shaft being altered. If wear has roughened the seat it is possible to polish with crocus cloth to a satisfactory finish if wear is not too deep. If the drive gear spline shows a considerable amount of wear it should be replaced.

5. Gears.

Gears (9) (23) that are to be used over should be free from burrs, scores, gouges, and pickup. The tooth tips should be lightly stoned to remove any burrs or pickup. The face of the gear should be sharp and square with the gear teeth. This edge should be free from burrs but never rounded. The bearing surfaces should be free from scores, pits, and spalling.

6. Gear and Gear Plates in general.

Always insure that there is no interference between the gears and gear plate before tightening a pump up. They should always be replaced in sets, never in components unless the other components can be restored to a like new condition. The damage done by the original components in seating themselves is generally so severe that it cannot be tolerated by new parts. Always try for the median clearance between the gears and gear plate of .0005 in thickness and .0015 on the diameter. Always insure that the drive shaft fits freely in the drive gear since end loading of the drive gear will upset the balanced loading of the pump.

7. Wear Plates.

Wear plates (21) (22) should be flat parallel and free from scores and gouges. If a wear plate is cleaned up by honing or grinding its clearance with the retaining plate should be .005. Never remove more than .010 from a wear plate.

8. Retaining Plates.

Retaining plates (19) should be flat parallel and free from burrs.

9. Sealing Rings.

Sealing rings should remain close to their original shape, heat will cause them to take a set. They should also be free from cuts and abrasion.

10. Loading Rings.

Loading rings should be free from cuts, nicks, and erosion. This ring can be easily removed by directing a compressed air stream at it.

11. Back-up Rings.

Back-up rings should be free from breaks, cuts, nicks and extrusion. Extrusion is caused by excess heat.

12. Body and Cover.

The pump side of the body and cover should be free from nicks, scratches, and cracks. The ball bearing bore should be smooth and free from wear caused by turning of the outer race of a defective ball bearing.

13. Adapter Assembly and Mounting Flange.

The Adapter Assembly and Mounting Flange should be free from burrs or anything that would tend to affect alignment with its power source.

14. General.

Cleanliness is of the utmost importance when working on any hydraulic equipment. A supply of cleaning solvent for cleaning is required with power cleaning equipment preferred. In general, all parts should be free from burrs, nicks, scratches, cuts, abrasions and sharp cutting edges. This is important in areas where seals, O-rings and alignment are concerned. Any part in contact with an O-ring and seal should have a surface finish of 40 RMS or better.

The reworking of parts in a machine shop should be done with caution. The removal of .010 from any part to clean it up probably would not affect the part

strengthwise, but the interference caused by its removal could lead to early failures of the pump. It is suggested new parts be used rather than attempt any extensive rework.

In reassembling the pump there should be no interference between the loading ring and sealing ring. Any extrusion from the flange or the sealing ring should be removed. O rings and seals that can become dislocated during assembly should be secured with a temporary adhesive (heavy grease for example).

Before tightening a pump after assembly always turn the gears a sufficient amount to assure removal of any foreign particles from between the gears and wear plates, and also that there is no interference between any of the parts. This is necessary because when the pump is tightened the rubber parts will not be properly seated and the pump will in all probability turn with difficulty making it impossible to tell whether it is normal or a malfunction.

Always torque all bolts evenly to avoid any distortion of the parts; this is important on the body and cover.

Lubricate the pump well before starting it; break it in slowly and apply about 200 PSI. of pressure to force the wear plates away from the gears for initial lubrication.

E. Disassembly (Rear Section)

1. Wash exterior of pump and scribe a line or center punch the cover, gear plate and body to indicate proper arrangement for reassembly.

2. Remove the eight capscrews (41,46 and 47) and the pump can be disassembled. Be careful not to damage the oil seal (35-B) in body assembly. Any sharp corners, grooves, shoulders and keyways will damage a new seal, therefore the outer end of the shaft should be wrapped with a layer of transparent scotch tape, starting at the seal seat, lapping each turn perhaps 1/16" over the last, progressing outward.

3. Inspect seal (35-B) for wear and replace if damaged. Note position of the seal case relative to the outer surface of the front body assembly (35) and press old seal out. The replacement seal should be inserted with the principal lip facing inward. Care should be exercised in pressing the seal squarely into the body (35).

4. The drive shaft (37) should be inspected for wear on the seal seat.

F. Reassembly (Rear Section)

1. Stone all mating surfaces to remove any burrs that may be present.

2. Wash all parts in a solvent and air dry.

3. Set body (35) with ground face up, the shaft extending downward.

4. Insert idler gear and shaft assembly and mesh with drive gear.

5. Stone sides of gear plate to remove any burrs. Using very diluted white shellac, (water like consistency), paint thin coat on body side of gear plate (38) staying 1/8" away from gear pockets where possible. Place over gear set observing the scribed witness marks on it and the body (35) and push firmly against body.

6. Shellac exposed gear plate surface.

7. Lubricate gears with clean SAE No. 10 oil.

8. Stone ground surface of cover (34) and lower onto shaft ends and dowels. Tap firmly into place, checking scribe marks.

9. Insert and tighten cover screws securely, then reverse pump and insert and tighten body screws.

When above procedure has been properly done, pump can be turned freely by hand. Any tightness is likely due to burrs or dirt, or lack of square machining where salvage work was performed. A momentary tightness can be due to surplus shellac hardening on the ends of the gears, but if so will break in brittle fashion after a degree or less of rotation. Any persistent or periodic tightness requires disassembly and correction.

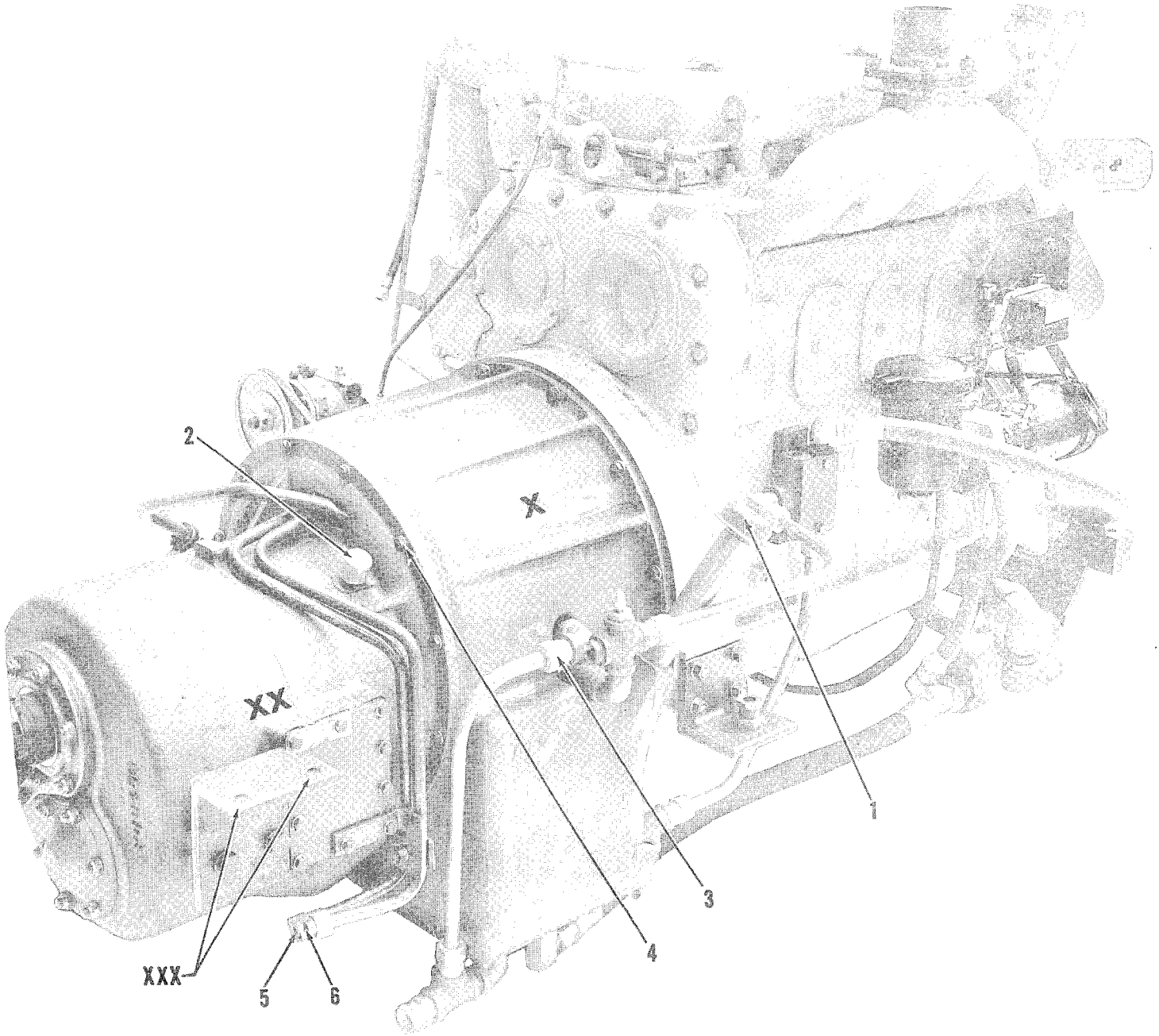
10. Install "O" ring (1) in groove on shaft (37) and coat with vaseline prior to mounting the front and rear sections together.

G. General

If cover (34) and body (35) surfaces are worn where gears bear, they should be resurfaced on a surface grinder, first stoning the back surface lightly with a flat hone to remove any burrs or nicks which might destroy paralellism.

It is almost certain to be necessary to replace gears if cover, and body require resurfacing. Always replace gears in sets. Normally the shafts do not require replacement unless abusive shock loads and over pressure operation have caused a keyway failure in the drive shaft.

If the wear of the seal can be felt with the finger nail on shaft (37) it should be polished or replaced. As an expedient a seal seat with a smooth groove no more than a few thousandths deep will probably function without the shaft being altered. If wear has roughened the seat it is possible to polish with crocus cloth to a satisfactory finish if wear is not too deep.



130. The above photo shows the A-W Converter (X) with A-W Power Reverse Clutch (XX) groups.

A. This is optional, for use with a GM-471 or C-160 Cummins Diesel Engine, and requires a 4-speed Transmission and a Single speed transfer case.

This combination will provide 4 speeds forward and 4 speeds in reverse.

The speeds are shown in the center column of the speed chart on page 35.

B. The shift chart and operating controls (A) and (C) with instructions are shown in paragraph 10 , pages 9 and 10.

C. The Converter section (X) as shown in the above photo is the same as covered in pages 128 to 140 involving text covering the Converter itself, but with the exception of following differences:

1. Page 128, paragraph 114.

Sub-paragraph A. The Power Reverse oil pressure gauge, is approximately 60-70 PSI. See item 18, page 8.

Sub-paragraph B. Omit entirely.

Sub-paragraph C. Page 128 and 129. The text is substantially correct, except follow the oil flow chart shown on page 145, and pump overhaul instructions shown in paragraphs 128 and 129, pages 141 and 142, except that the relief valve unloading pressure is 60-70 PSI.

2. Page 134, paragraph 118.

Disregard clutch items (H), (I), (J), (K), (L), and (M) on pages 134 and 135. Also clutch items on page 135, paragraph 119.

3. Page 138, paragraph 123.

The removal of engine with Converter and Power Reverse Clutch assembled will be substantially the same as shown in the text, except several additional oil lines will have to be disconnected at the Power Reverse Clutch group, also the removal of 2 additional frame to case bolts, Ref. (XXX). See page 143.

4. Page 138, paragraph 124.

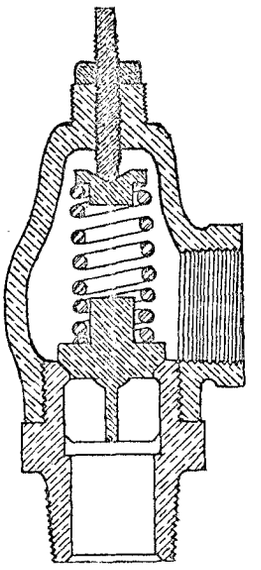
Disregard sub-paragraph (4) and (5) clutch details, also clutch item (9) on the illustration page 139.

D. The upper right illustration shows the Relief Valve which is used to control and protect the oil circuit of the combination AW Converter and AW Power Reverse Clutch assembly.

1. This valve is shown on page 145, as item (9A). It screws into a nipple welded into the lower coverplate of the converter reservoir. When used with the A-W Power Reverse-Converter combination, it is pre-set at time of assembly to unload at 60-70 PSI.

2. CAUTION: When a grader has an A-W Converter only, then the factory pre-sets the relief valve unloading pressure at approximately 50 PSI; see page 141, paragraph 128, sub-paragraph B.

E. The Converter-Power Reverse Clutch



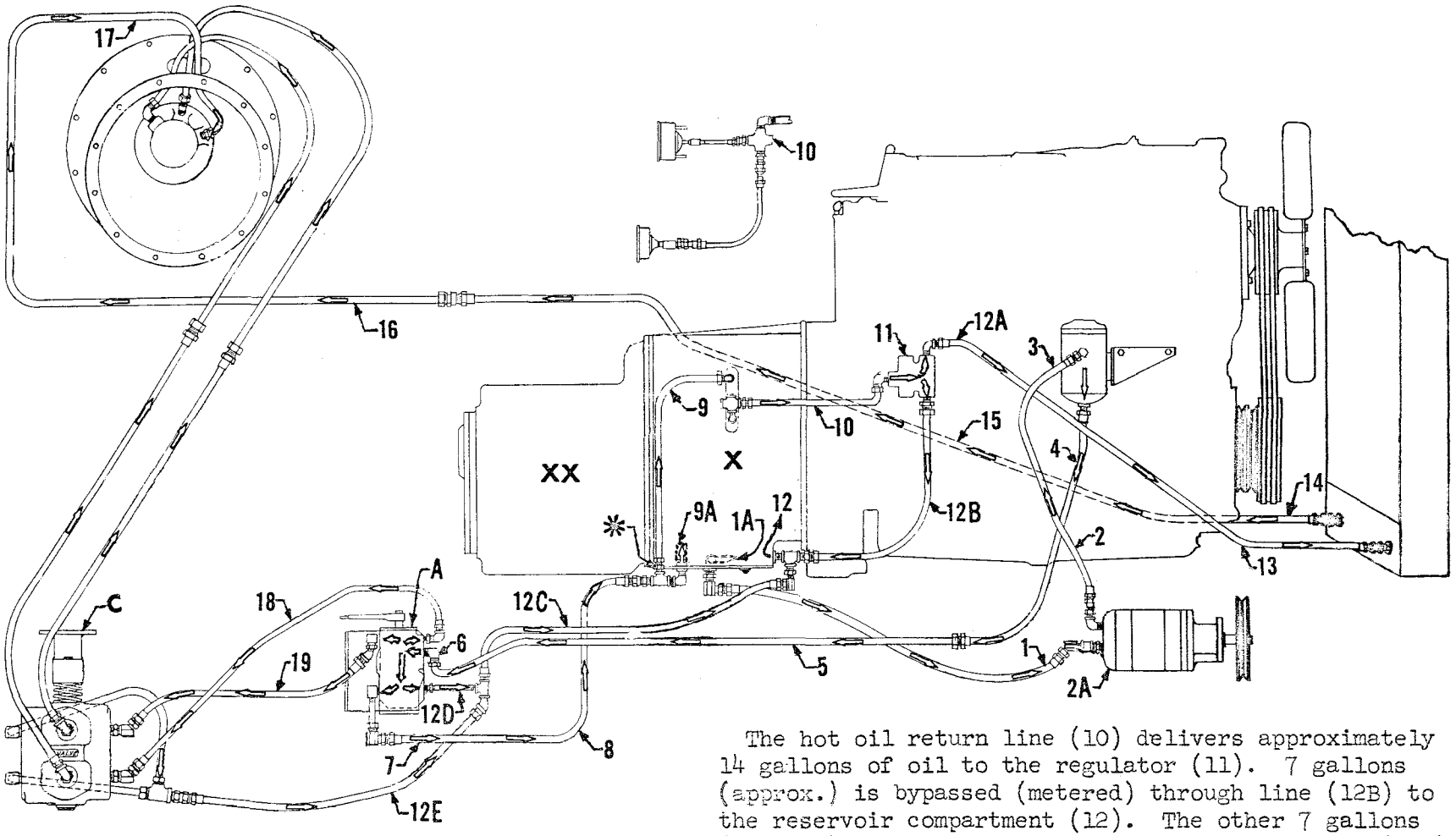
reservoir breather and oil level gauge is Cap (1), page 143. The vent for the Power Reverse Compartment (XX) is Cap (2).

The Converter (X) oil reservoir page 143, and the Power Reverse (XX) oil reservoir, are interconnected at the bottom through cored holes in the housings. The return oil flows from the Power Reverse to the Converter reservoir.

The oil return hole (*) for the Power Reverse Case, also the seal "O" ring (30), are shown on the illustration page 146.

The cored hole (*) for the Converter reservoir is shown in the photo on page 136. The expansion plug shown in the photo is used only when the grader has a Converter with Dry Clutch combination.

When the grader has a Converter-Power Reverse Combination, the expansion plug (*) page 136, must be removed, so that the oil can return to the Converter reservoir near point marked (*); see page 145.



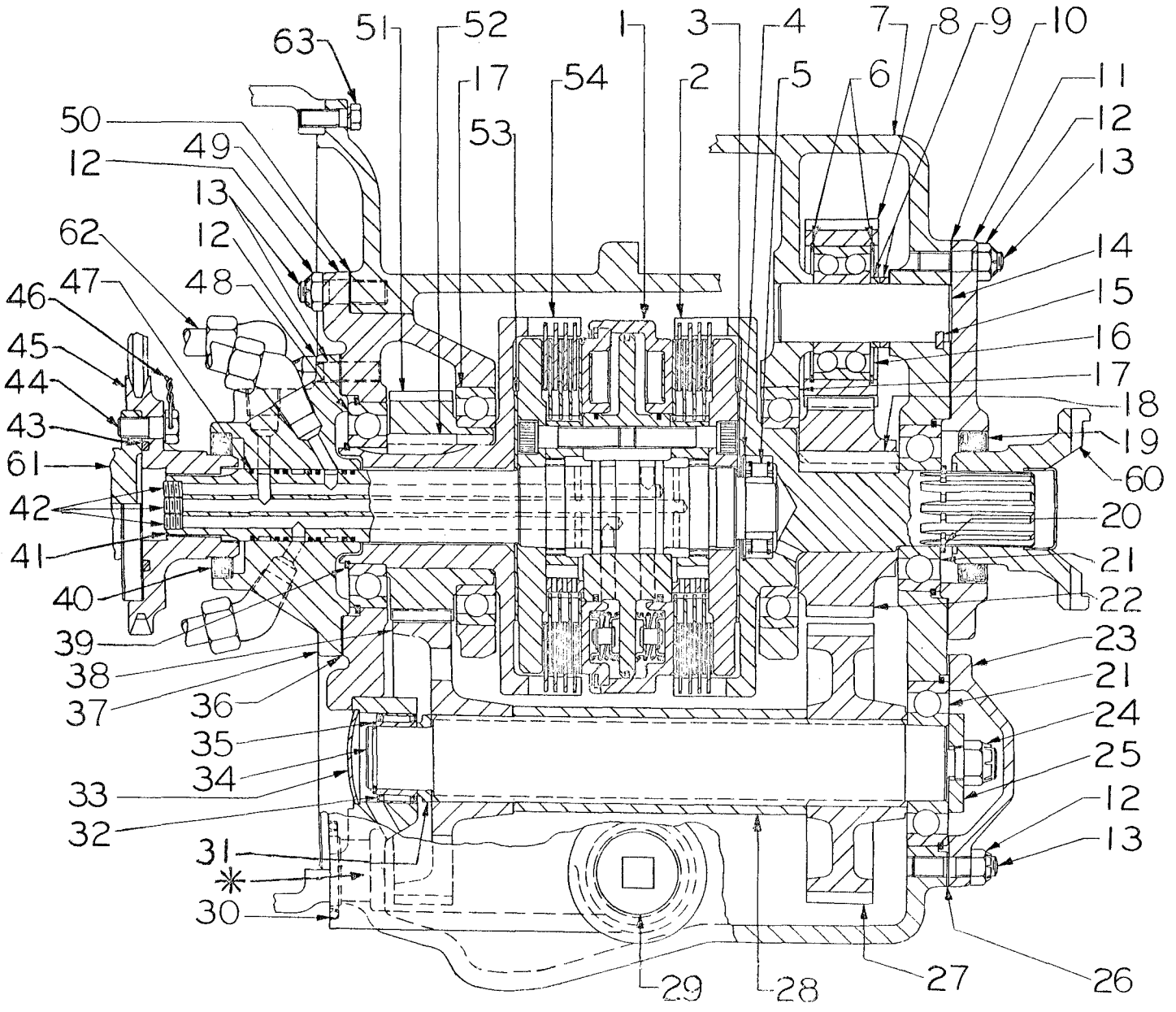
131. THE ABOVE SHOWS THE POWER REVERSE CLUTCH OIL FLOW DIAGRAM. The oil flows as follows:

From Suction line (1) to pump (2A).

Pressure lines (2), (3), (4), (5) and (6), to Selector Valve (A). Pressure lines (7), (8) and (9), to converter (X). Relief valve (9A) will bypass some oil back to the reservoir (12), if the pressure exceeds 60-70 P.S.I.

The hot oil return line (10) delivers approximately 14 gallons of oil to the regulator (11). 7 gallons (approx.) is bypassed (metered) through line (12B) to the reservoir compartment (12). The other 7 gallons (approx.) of oil, constantly flows through lines (12A) and (13). After the oil is cooled, it flows via lines (14), (15), (16) and (17) where it then passes through the main shaft (center plugged port) (42), page 146. Its function is to keep the internal clutch discs cool, whenever the engine is running, and grader standing or moving.

When the selector valve (A) (see page 9 paragraph (A)) is in neutral, or if the foot operated float valve (C) is depressed, the pressurized oil at point (6) (see above) is bypassed through lines (12E) or (12D) to (12C), and the oil is then returned to the reservoir oil compartment (12).



132. REMOVAL OF GM-471 ENGINE WITH A-W TORCON CONVERTER AND POWER REVERSE TRANSMISSION.

A. The quickest way to expose the Converter or Power Reverse Clutch Group for internal inspection is to remove same as an assembled unit exactly as shown in the photo on page 143.

B. Perform removal as shown on page 138, paragraph 123, sub-paragraphs 1 and 2.(also remove 2 bolts at (XXX) page 143.)

C. To work on the internal parts of the Converter, proceed as follows:

1. Remove the 12 capscrews Ref. (63), (see above) while supporting the Power Reverse with a suitable hoist.

By shifting the Power Reverse group to the right, the spline of the main shaft (41) will slip out of the drive flange (45). Lower the unit to the ground.

2. Proceed to remove Converter from Engine, see page 138, paragraph 124, sub-paragraphs (1), (2), (3), (6) and (7). Perform work as shown on pages 139 and 140.

D. To work on the internal parts of the Power Reverse Clutch Group, proceed as follows:

1. Remove all lines 62 (see page 146). Remove the side cover from the case (7).

Remove nuts (12) and cap (23). Loosen nut (24). Remove expansion plug (33) and snap ring (35). Pull the shaft (34) with bearing (21) out towards the right. Gears (38), (27), spacers (31), and (28), will drop down in the case and out of the way.

2. Remove nuts (12) with bearing support (49). The following items will come out with the support and in the following order, namely items (36), (37), (39), (40), (41), (42), (47), (48), (12), (13), (12), (50), (51), (52), (17), (53), (54), and (1) with discs attached, also washer (3).

3. Remove yoke (60), snap ring (20); then pushing in the left direction remove the output spider (2) with bearing (17) and gear (22).

4. Remove nuts (12), cap (11), bearing (21), and seal (19). Remove reverse idler pin (14) with key (15), and gear (8). Lift out gears (38), (27) and spacers (31) and (28). Remove bearing (32).

5. Carefully wash and dry the case inside and outside. Use clean rags for wiping purposes. Inspect parts at assembly time replacing items as required. Always install new gaskets, piston rings, and snap rings. With oil stone remove sharp edges or burrs from shaft splines, keyway, or shaft diameters before proceeding with assembly. Oil shaft diameters and bearing bores at time of assembly. Cleanliness, and use of good tools are important.

6. Place reverse idler (8) and the two spacers (9) into place and install the shaft (14) with key (15).

Install bearing (17) on the spider (2). Slip the key (18) into the slot of the shaft. Enter the shaft from left side, through the bore of the gear (22), lightly driving it into place. Install bearing (21) and snap ring (20). Install new seal (19), (lip turned in) into cap (11).

Install new gasket (10) and bolt cap (11) into place.

7. Lay gears (38), (27), and spacer (28) into proper position at the bottom of case (7).

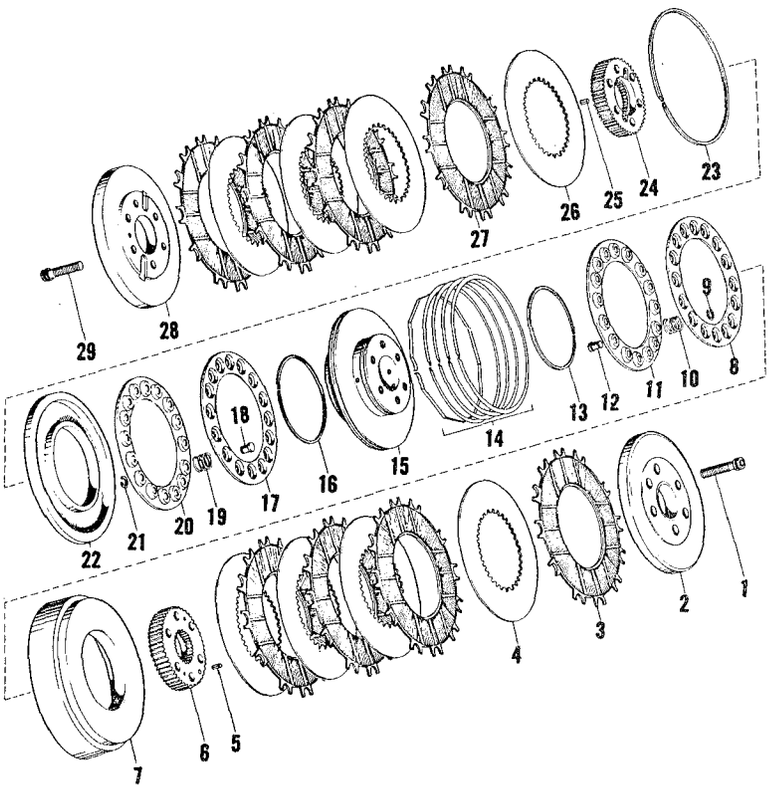
8. Carefully pull the main shaft (41) out of the spider and hub group (54). This will expose the seven piston rings (47) as assembled to the seven grooves in the main shaft itself. Carefully expand and remove the seven piston rings (47). Do not damage the piston ring grooves. Find washer (53).

Remove nuts (12), then loosen and slip the oil distributor (37) off of the support (49). Remove seal (40). Remove snap ring (39). Push on the left end of the hub of spider (54), to remove it from the support (49). The pinion (51) can be pushed off the hub bringing the bearing (17) with it. Key (52) can now be removed.

9. To disassemble the dual clutch group (1) from the main shaft (41) proceed as follows: The exploded view of the clutch (see page 148) requires the following explanation: The repair parts book shows the quantities and same view; however, certain items are exactly the same, for example: (1), and (29) are the same. (2) and (28) are same. (3) and (27) are same. (4) and (26) are same. (5) and (25) are same. (6) internal spline turned to the right and (24) internal spline turned to the left, are same parts. (7) and (22) are single items; also (23). (8), (11), (17) and (20) are same. (9) and (21) are same. (10) and (19) are same. (12) and (18) are same. (13) and (16) are same. (14) consists of 5 pieces, which make a piston ring group, and which is assembled to the outer diameter of the partition-plate near Ref. (15).

10. Remove the six Allen screws (1) page 148, from the right end of the main shaft (41). Slip the following items off the end of the shaft, namely, plate (2), four each alternately assembled sintered plates (3) and (4). Next remove hub (6) with pin (5).

11. Repeat the above paragraph as applied to similar parts located on the long end of the shaft.



12. Slip the external piston group (7) off the shaft. (See above)

Lay item (7) under a suitable press, and slightly compress the internal piston (22) in order to remove the snap ring (23). Raise the press, and lift out internal piston (22). Slip the external piston (7) off of the partition plate (15). This will expose the five element piston ring group (14), which may be removed at this time.

Remove the right and left spring retainer groups off of the partition plate (15).

NOTE: One spring retainer group consists of sixteen springs (10) or (19), sixteen pins (12) or (18), sixteen snap rings (9) or (21), and two retainers (8) and (11), or two (17) and (20). Use gasoline and air pressure to wash out the oil ports of main shaft (41).

13. To assemble the dual clutch group to the shaft (41) proceed in reverse sequence to that shown in paragraphs 12, 11, and 10. Carefully install new piston rings (13), (14) and (16).

14. To assemble the main shaft (41) (see page 146) to the support (49) and oil distributor (37) proceed as follows:

Assemble bearing (17) to pinion (51). Install key (52) and slip pinion (51) over the hub of (54). Insert group (54) through the bore of (49), and install bearing (48) with snap ring (39).

Press in a new oil seal (40), install a new gasket (36), then place oil distributor (37) on (49), then tighten nuts (12).

Oil and slip washer (53) over the main shaft, then oil the grooves and carefully expand and install five new piston rings (47). Oil the rings and be sure they are free to expand and compress in the grooves. Oil thrust washer (53), then carefully pass the spline end of main shaft (41) through the (oiled) bore of spider hub (54) and the (oiled) bore of oil distributor (37). Oil in the bores is required in order that the piston rings (47) will not be scuffed or damaged during assembly. (Rotate the clutch discs as required during assembly.)

15. To install main shaft, support and clutch to the case, proceed as follows:

Install a new gasket (50). Be sure

roller bearing (5) and snap ring (4) are in place and oiled. Oil and install the thrust washer (3) over the stub end of the main shaft.

Enter the clutch end (1) through the bore of the case, rotating the oiled clutch discs as required for entry into the spider (2). Attach the support (49) by means of nuts (12).

16. To install the lower counter shaft (34), arrange gears (38) and (27) so the long end of the hub points toward bearing (21).

Enter shaft (34) through the bore of gear (27), then spacer (28) then gear (38).

Install spacer (31) over the shaft end, then press oiled bearing assembly (32) into position. Install the snap ring (35).

Install oiled bearing (21), washer (25) and securely tighten nut (24). Install gasket (26) cap (23) and nuts (12). Install expansion plug (33).

17. Spray clean oil over the assembled parts. Re-install the side cover with new gasket. Re-attach oil lines near (62).

18. To install the Power Reverse clutch to the converter proceed as follows:

Install a new "O" ring (30). Install a new governor drive belt at flange (45). Raise the Power Reverse group into position so the spline end of shaft (41) can be entered into the drive flange (45), then securely tighten the twelve capscrews (63).

133. TRANSFER CASE DISASSEMBLY.
(For A-W Power Reverse Transmission.)

To remove the transfer case from the transmission, it is necessary to first follow the procedure outlined in paragraph 66, page 86.

The transfer case, page 150, is attached to the machined rear face of the transmission in the power division gear case and contains four gears.

Eight large studs (16) with nuts hold the transmission and transfer cases together with an oil tight gasket in between.

After these two units are out of the power grader, proceed as follows:

1. Remove cover (37) and oil guards (38), page 150.

2. Remove nut (52) on upper drive shaft (51), also universal joint brake flange (50). Remove the nuts from the studs (35) and (16). Bearing cap (34) may now be pulled out, after which the shaft (51) can be driven toward the splined end of the shaft. (Use light hammer and bronze drift on the opposite end when driving it out.) The brake plate (45), shims (41), with Timken bearing and cup, will come out with the shaft. Keep the shims wired to plate (45) while in dismantled state. (Turn seal lip in.)

The upper gear (39) may now be lifted upward and out of the case, together with the rear Timken cone (17).

3. Remove the nuts (68) and pull out the bearing housing (67). Remove cap (61), nut (58) and washer (57). The gear (28) may now be pulled off shaft (24).

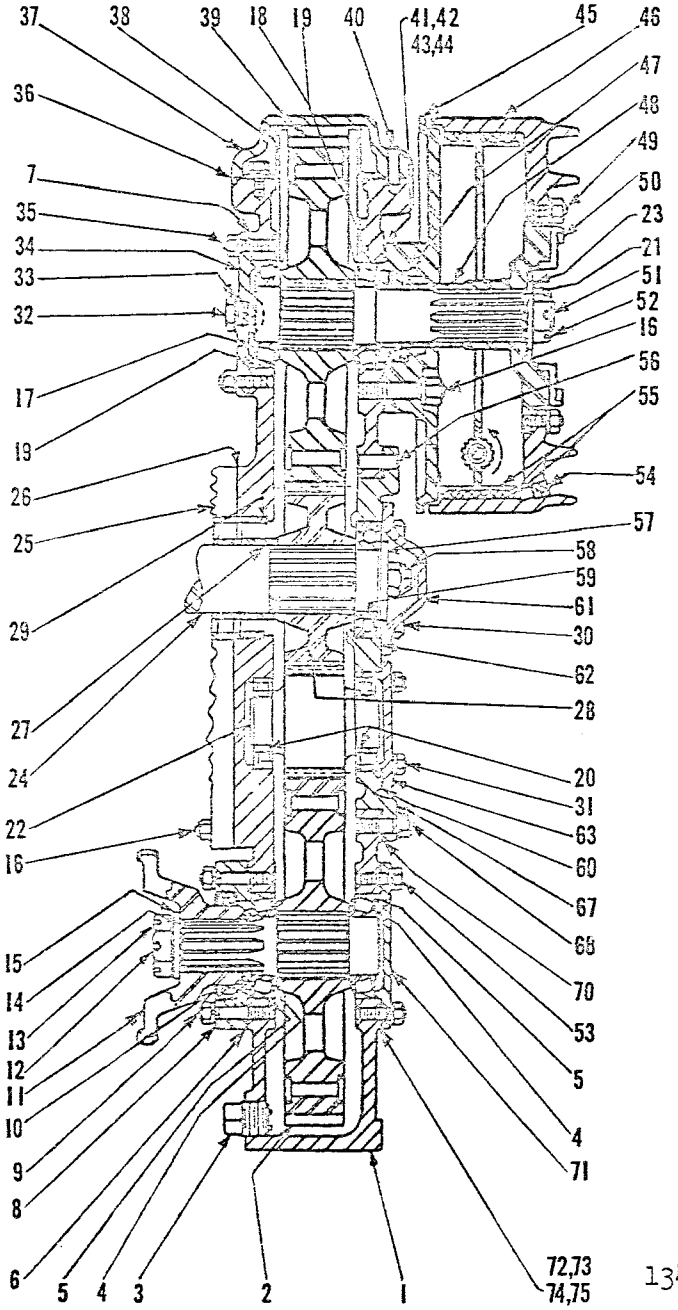
4. The transfer case (1) may now be removed from the transmission case, after all nuts have been removed from the studs(16).

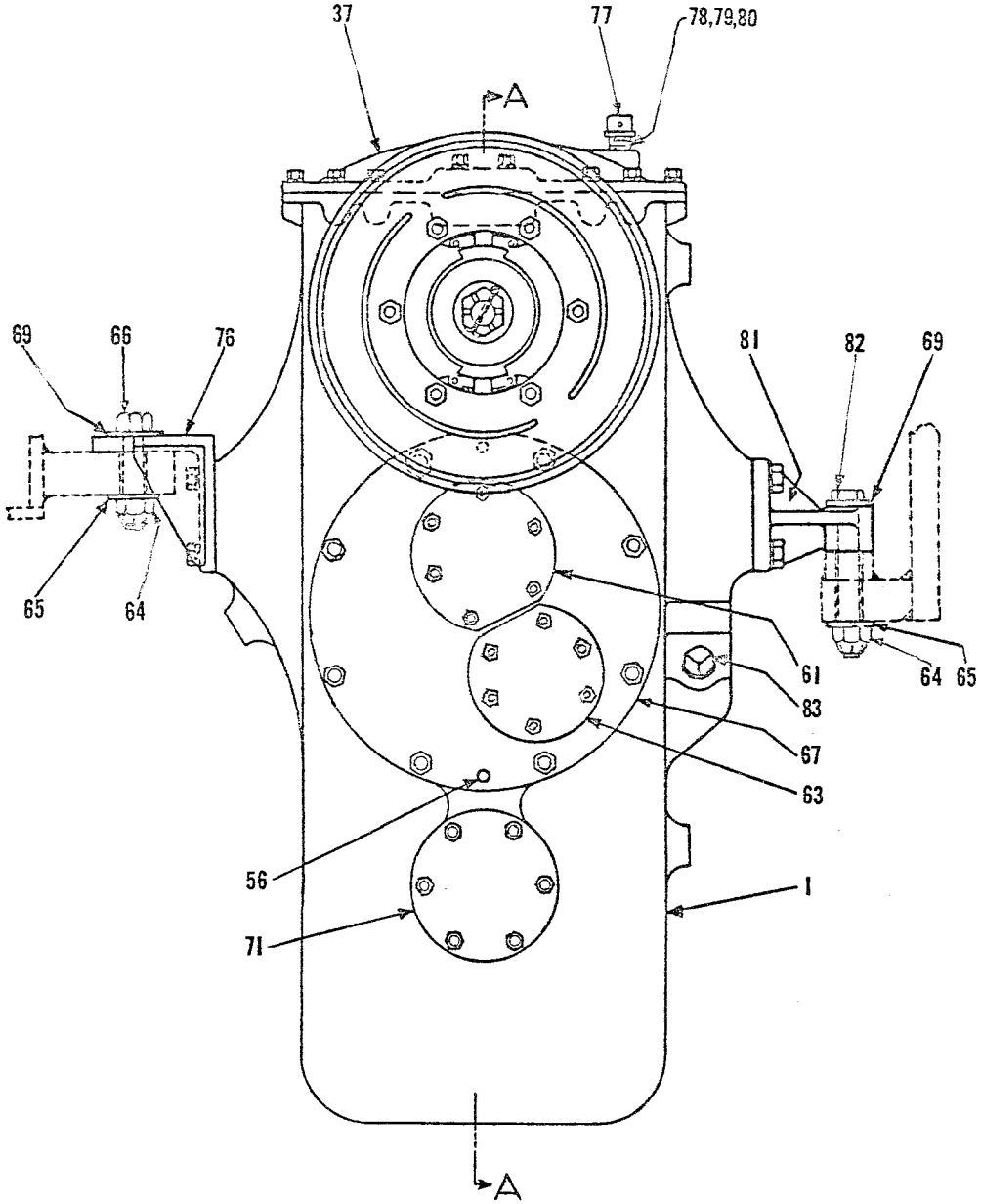
5. Remove cap (71), with shims (72), (73) and (75). Keep the shims wired to cap (71).

6. Next remove the nut (13) and yoke (11), from shaft (12). Use a medium weight hammer and drive against a bronze drift on the left or yoke end of the shaft, driving it out toward the right. The Timken cup and cone (4) at right side will come out with the shaft.

7. Remove shaft group (22). The gear (2) and other cone may now be lifted up and out of the case.

(continued on page 151)





134. SINGLE SPEED TRANSFER CASE ON PACER 447 AND SUPER 467. Used with 4-Speed Manual Shift Transmission (see page 153) and separate Power Reverse (see page 143).

135. TRANSFER CASE REASSEMBLY.
(Power Reverse)

a. For reassembling, reverse the above procedure.

b. Before reassembling shaft (12), clean, inspect, and replace (if necessary) all parts, such as seals, gaskets, Timken and ball bearings.

c. Clean the complete transfer case and parts carefully, inside and out.

d. Place Timken cone (4) (taper outward) over the stud end of the shaft, and pass the yoke end of shaft (12) through the right lower hole in the case; then through parts as follows: gear (2), Timken cone (4), with taper outward. Turn seal lip in and tighten cap (8) solidly to the case (1), after being sure Timken cup (5) is in place. Then assemble and tighten solidly the yoke (11), using washer and gasket with nut (13).

e. Next install cup (5) with taper inward, then a new gasket (72), together with shims (73), (74), (75), as required, and cap (71). Shaft (12) should not have any end clearance. Lubricate both Timken bearings (4) with SAE-30 oil.

f. When a new gasket (26) is installed between the transfer and transmission cases, care must be used in evenly and alternately tightening the nuts on studs (16), otherwise the transfer case may be tipped slightly, later presenting difficulty in entering the outer ball bearing (59).

We strongly recommend the use of a dial indicator attached to the right end of shaft (24) and indicating in the bore of the transfer case at the point where the outer bearing (59) is located.

The indicator reading must not exceed .002" eccentricity. If it is greater than .002", then loosen the nuts on studs (16) and retighten them alternately until all are tight, then dial indicate the bearing bore again for final alignment. (Both faces of the transmission case and transfer case must be clean and smooth. A new gasket (26) should always be installed.)

g. Slip spacer (27) and gear (28) over shaft (24). Install bearings (20) with gear (22). Install support (67), bearing (59), washer (57), nut (58), and cap (61).

WARNING:
WHEN REPLACING BEARINGS (20) ON (22), THE INNER RACE AND ROLLER ASSEMBLY SHOULD BE INSTALLED FIRST ON GEAR HUB WITH THE RADIUS TOWARD THE GEAR. THE OUTER RACE MUST BE INSTALLED WITH THE SHOULDER TO THE OUTSIDE OR AWAY FROM THE GEAR.

h. Lower the gear (39) in position, after installing the left cone (17) (taper outward) with cup (19), together with cap (34) and gasket (7). (Turn seal lip inward.)

Next insert shaft (51) and right cone (taper outward), with cup (47). Then brake plate (45) (seal lip turned inward) with all shims (41). Add or remove shims as required in order that the shaft (51) will not have any end clearance. (The Timken bearings should not be preloaded or binding.) Next install spacer (48) and flange (50), with brake drum (46). Securely tighten and cotter the nut (52).

i. Install the oil collectors (38).

j. Reinstall cover (37). Cap (77) has a drilled vent for ventilation purposes. Tube (78) extends downward into the transfer case about $2\frac{1}{2}$". Its lower end is cut on a 45° bias and the long side of the tube should be turned toward gear (39).

k. Never attempt to dismantle or make repairs to the transfer case without thoroughly studying the cross section diagram shown on page 150.

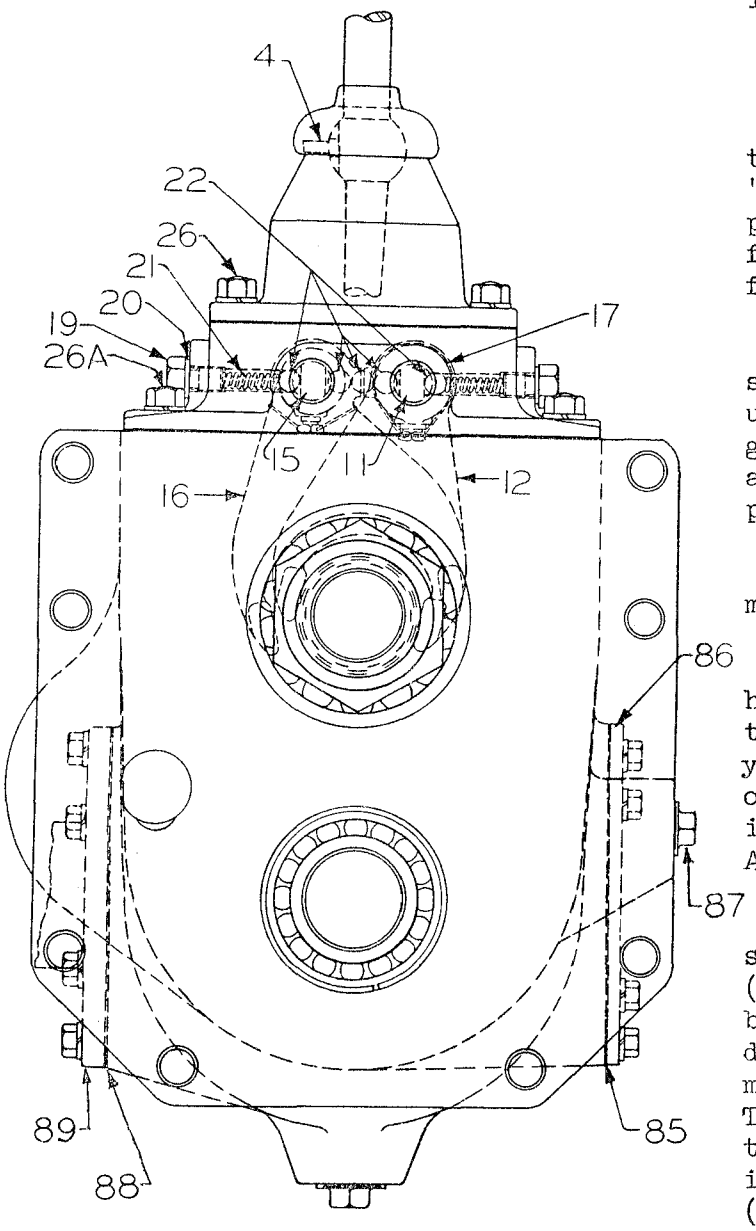
136. POWER REVERSE TRANSMISSION SHIFT COVER.
(See page 152.)

a. It is not necessary to remove the transmission or seat box to inspect the shift rails (15) and (11). It is only necessary to remove the nuts at studs (26) and lift off the shift lever group.

b. Then remove the nuts at studs (26A), after which the rail case cover may be lifted upward and turned over on its back, and removed from the right side of the grader. (Mechanic stands on the ground to do this.)

c. Remove the expansion plugs from the cover, also the three wired setscrews from the shift rod ends.

d. Remove the two capscrews (19) with washers (20). The two outer springs (21) and balls (22) will now come out.



e. Shift both rails into neutral, then either rail may be slid out of the cover hole. The three center balls will now fall out. Remove the other rail.

f. Reassembly is reversal of the above procedure.

g. The tension of springs (21) should not be too tight, otherwise hard shifting will be the result.

h. When installing the cover to the transmission, be sure the lower ends of both shift forks (12) and (16) slide into the shift grooves of shifters (38) and (49), page 153.

137. TRANSMISSION DISASSEMBLY.
(For single speed transfer case, see page 150.)

In order to disassemble any part of the transmission, follow the instructions under "Transmission and Transfer Case Removal", paragraph 66, which will permit the transfer case and transmission to be removed from the grader.

Now remove transfer case from transmission by following the instructions given under "Transfer Case Disassembly", paragraph 133, page 149. You may now disassemble the transmission (as shown on page 153)as follows:

a. Move both shifters (38) and (49) into mesh. Remove cotter and loosen nut (27).

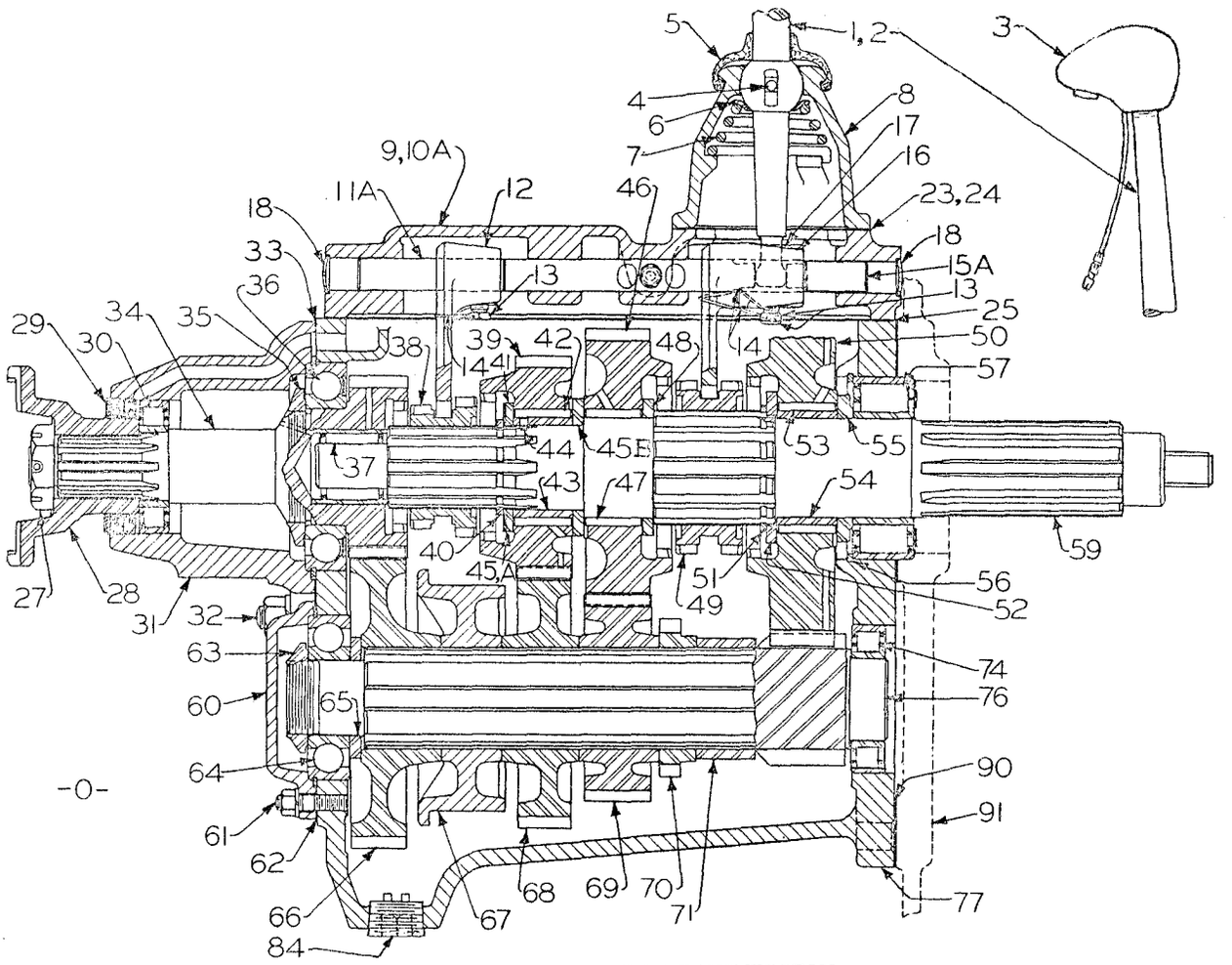
b. Remove nuts from studs (32) and pull housing (31) with shaft (34) away from the transmission case. Remove nut (27) and yoke (28). Shaft (34) may now be tapped out of bearing (30). (Examine bearing (30), and if it requires replacing, be sure to do so. Also install a new seal (29).)

c. Examine bearing (36). It may be pressed off the shaft (34) after removing nut (35). The end thrust on shaft (34) is taken by bearing (36). Snap ring on its outside diameter is held between the face of transmission case (77) and face of housing (31). The bearing (30) floats on its outside diameter within the bore of housing (31). The inner diameters of both bearings (30) and (36) are held to the shaft shoulders by the nuts (35) and (27).

d. Oil pockets deliver oil through ducts to the forward side of bearing (30). In view of this, the gasket (33) and housing (31) must be reassembled with the oil ducts turned up as shown.

e. Oil flows through bearing (30), after which it flows through bearing (36) and back into the transmission case.

f. Slip the low-second shifter gear (49) to the left, and pry the snap ring (51) out of its groove. Slip both of these to left as far as they will go. Drive the main shaft (59) to the right until bearing (57) may be pulled off the shaft.



FOUR SPEED MANUAL SHIFT TRANSMISSION
Used with Single Speed Transfer Case (Page 150) and separate Power Reverse On Pacer 447 and Super 467.

-0-

g. Lift up on clutch end of main shaft (59) and moving it toward the left, lift it out of case with gears mounted on it.

h. Washer (55) and low gear (50) may be slipped off the shaft, also forty-eight rollers (53), sleeve (54), thrust washer (52), snap ring (51), and low and reverse shifter gear (49).

i. Expand and slip the snap ring (40) off the shaft. Next slip the following parts off the shaft: washer (41), 3rd speed gear (39), forty-two rollers (42), and sleeve (43).

CAUTION: There is a small pin (44) inside of this sleeve (43). Do not lose this pin as it must be used in reassembly.

j. Next remove the thrust washer (45B) and second speed gear (46), together with forty-two rollers (47) and finally, washer (48).

NOTE: All end clearances of bearings are controlled by the location of the snap ring grooves cut in the main shaft (59). The three gears (39), (46), and (50) are mounted on roller bearings, and each must have not less than .006" total end lubrication clearance between the supporting thrust washers and ends of gear hubs.

k. Remove countershaft bearing cap (60), and nut (63). Countershaft (76) may now be pressed out toward the transfer case end.

l. All countershaft gears may be removed from case for cleaning and inspection.

138. POWER REVERSE TRANSMISSION REASSEMBLY.

a. Clean and inspect all parts carefully. Always install new gaskets. Carefully check all snap rings for concentricity and tension before using them again. Turn all seal lips inward.

b. Reassemble the counter-shaft gears.

c. Install a new adjusting nut (63), page 153, on the clutch end of the shaft.

d. Reassembly is the reverse of the above procedure.

139. ALLISON "TORQMATIC" CT-3340-4 Power Shift Transmission Maintenance.

a. The GM-471 Diesel Engine PGF-17238 (70 MM Injectors), is used with the PGF-16270 Allison "Torqmatic" Power Shift Transmission.

b. The Cummins C-160 Diesel Engine PGF-16554 is used with the PGF-16549 Allison "Torqmatic" Power Shift Transmission.

c. Page 11, paragraph b, sub-paragraphs 1, 1A, 2 and 2A, show engine speed data.

d. The shift chart for this transmission is shown on pages 11 and 12, together with full operating instructions as applied to A-W 400 series graders.

e. Page 12, paragraph g, shows full Hydraulic Fluid specifications for use with this particular transmission.

f. When a grader is equipped with an Allison "Torqmatic" Transmission, one copy of the Allison Service Manual number SA-1096 is packed in the tool box at our factory and included with the grader at time of shipment.

g. Section 1, pages 2, 3, and 6 of the Allison Manual SA-1096, shows right and left views of the CT-3340-4 Transmission used in the A-W 400 series grader. Manual SA-1096 consists of ten sections covering all phases of maintenance information applying to the CT-3340-4 Transmission.

h. The tail shaft governor is driven by a power take-off (PGF-16343) which bolts directly against a side part of the Allison Transmission itself. The internal gears and bearings are splash-lubricated from the interior of the Allison Unit. The tail shaft governor is driven by a "V" belt from a pulley driven by the take-off assembly.

The setting of the governor will be practically the same as shown on page 132 except that the rod lengths change.

i. The Torqmatic Transmission is directly attached to the engine crank shaft and engine bell housing. The drive yoke at the output end of this unit is interconnected by means of the propeller shaft to a one speed transfer case; see cross section and brake drum end view of same on page 155.

j. The one speed transfer case is mounted on a three point suspension, namely: trunnion supports (9) and (7). One capscrew (85), washers, and huglock nut. One capscrew (77), with washers and huglock nut. The propeller shaft pilots through the bore of trunnion (9).

k. Transfer case disassembly. Remove the propeller shafts. Remove the capscrews (85), and (77). Suspend the case with suitable hoist, and lower it to the ground.

See page 149 paragraph 133, and complete the following work: Sub-paragraphs 1, and 2.

See the cross section drawing on page 155. Remove the nuts (68), remove support (67) and pull out gear (22). Loosen nut (23) and pull off the washer and yoke (30). Pull out gear (28).

l. See page 149, paragraph 133, and complete the following work: Sub-paragraphs 5, 6, and 7.

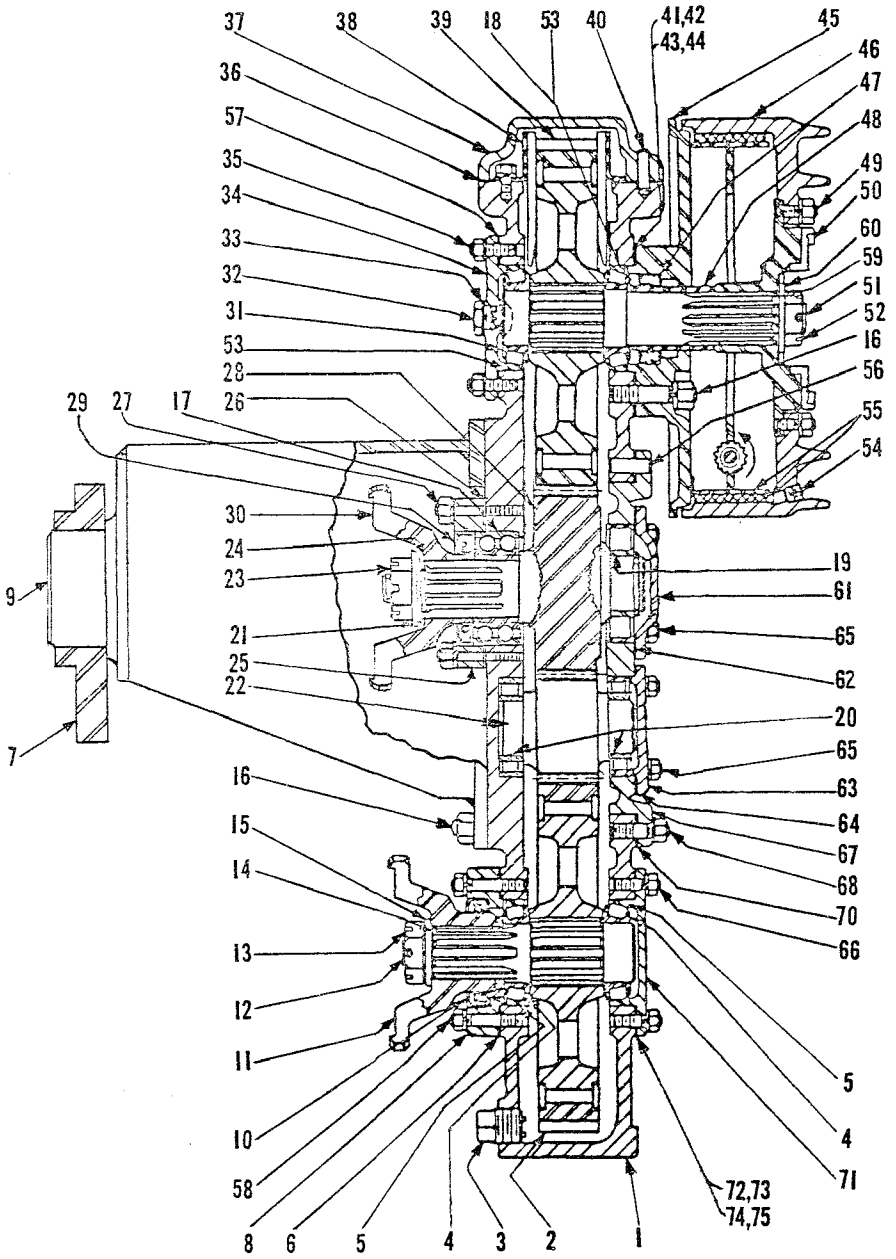
m. TRANSFER CASE REASSEMBLY. See page 151, paragraph 135, sub-paragraph A. Complete the following work: sub-paragraphs B, C, D, and E.

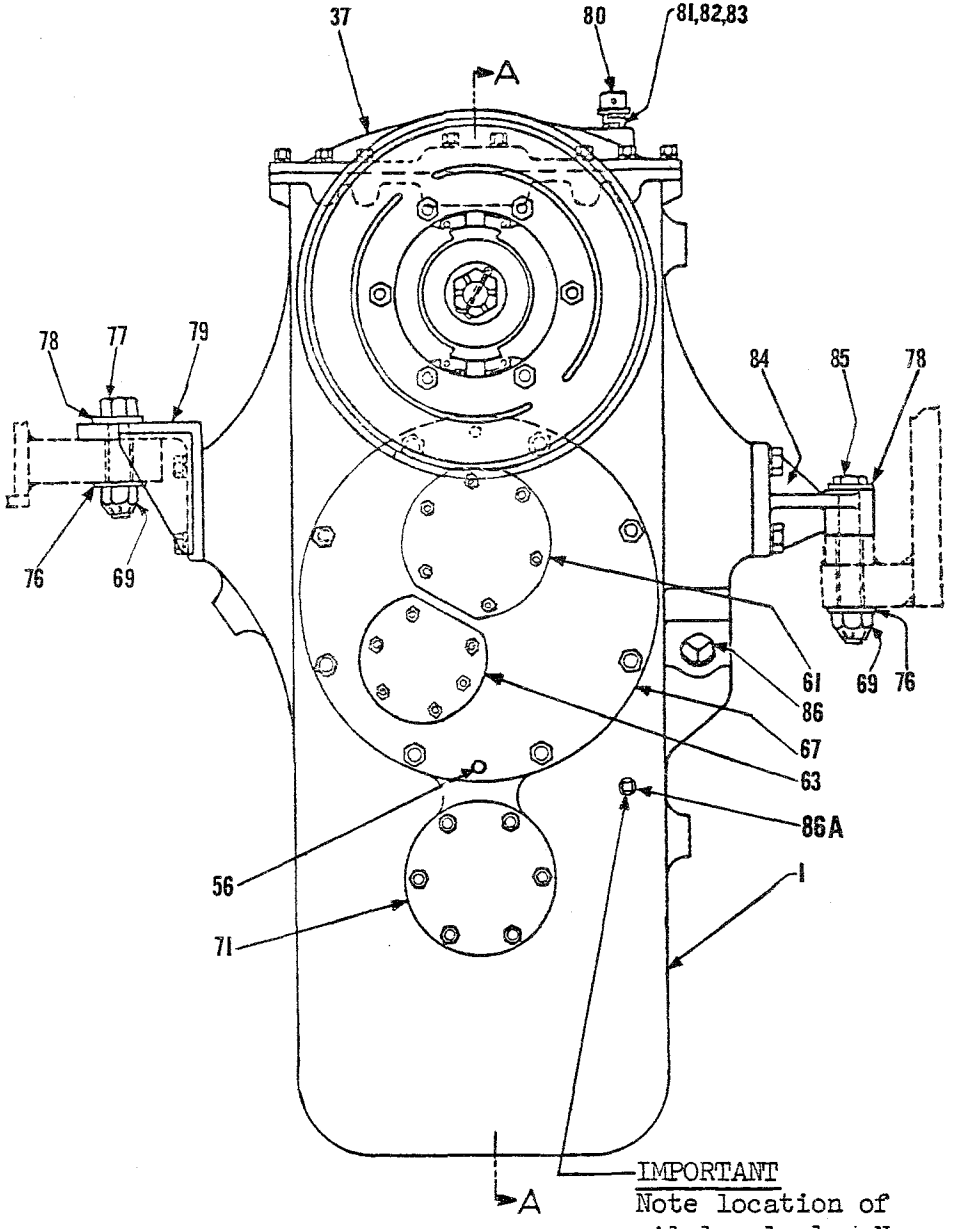
n. See page 155; replace bearings (20) and (17) if required. Replace seal (29); turn lip in. Install gears (22) and (28). Install support (67), bearing (19) with snap ring, and cap (61), bearing (20),and cap (63).

WARNING:
WHEN REPLACING BEARINGS (19) AND (20), THE INNER RACE AND ROLLER ASSEMBLY SHOULD BE INSTALLED FIRST ON GEAR HUB WITH THE RADIUS TOWARD THE GEAR. THE OUTER RACE MUST BE INSTALLED WITH THE SHOULDER TO THE OUTSIDE OR AWAY FROM THE GEAR.

See page 151, paragraph 135. Complete the following work: sub-paragraphs H, I, J, and K.

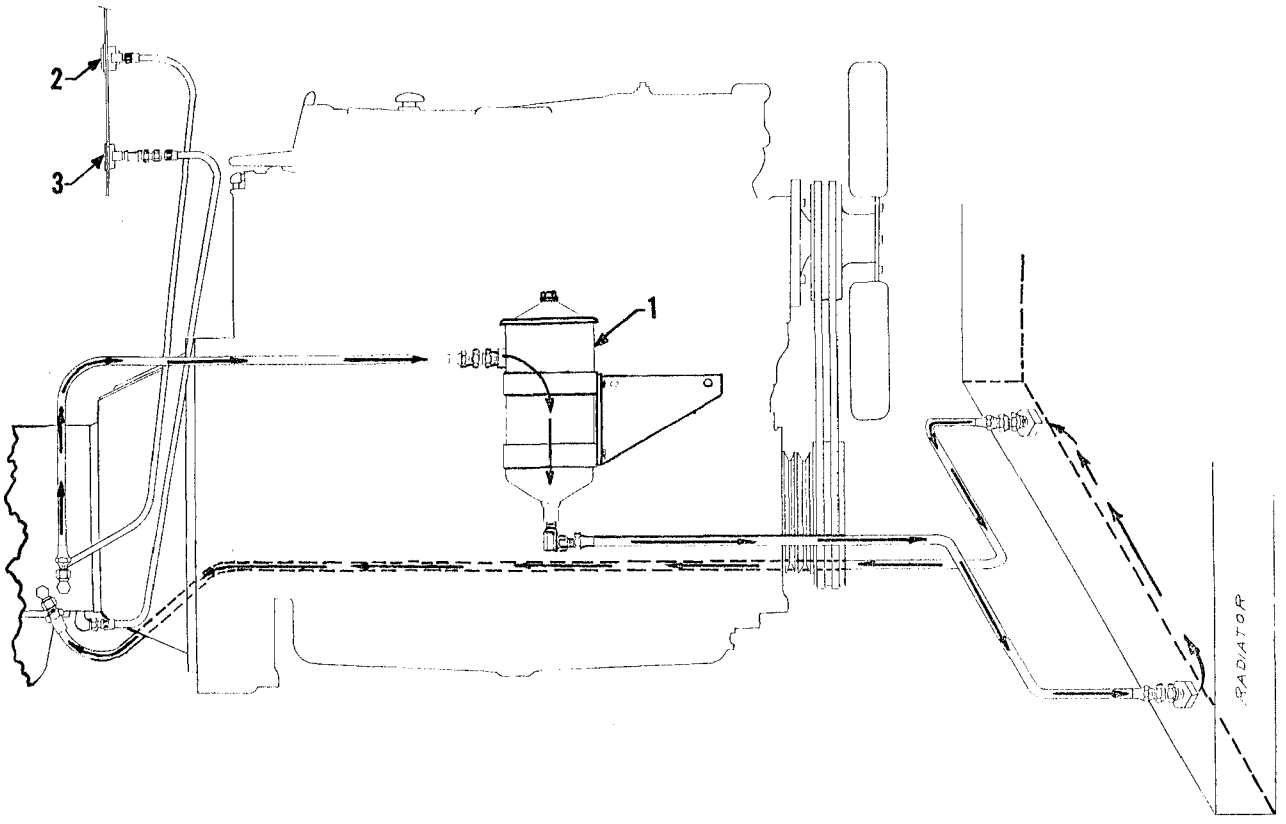
Reinstall the transfer case into the main frame, connect the propeller shafts, and fill the case with lubricant; see pages 3 and 4, or 5 and 6, for lubricant specifications.





IMPORTANT
Note location of oil level plug No. 86A. Plug No. 86 is filler plug only.

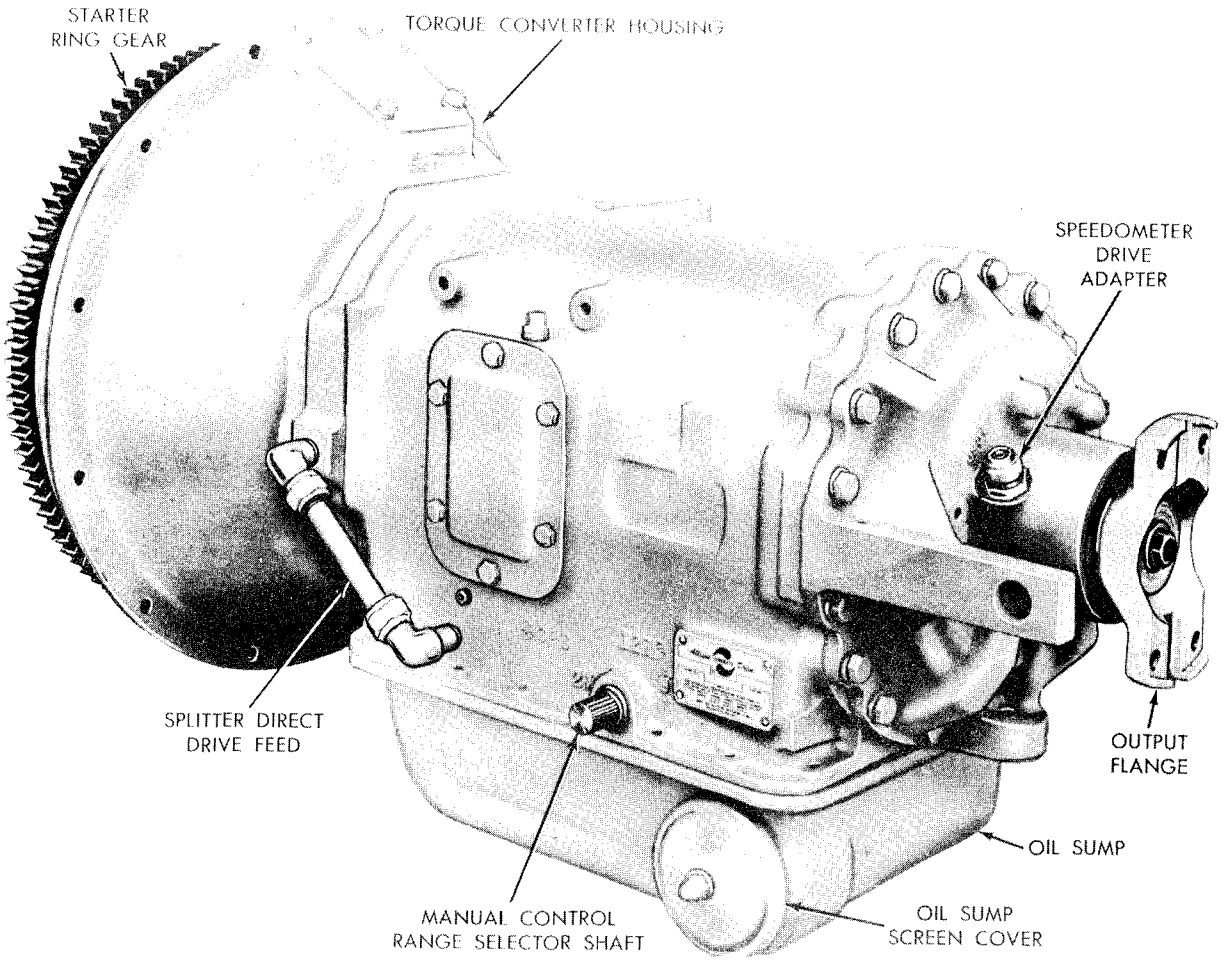
SINGLE SPEED TRANSFER CASE
on Pacer 448 and Super 468
(Used with 4-Speed Allison Power Shift Transmission)



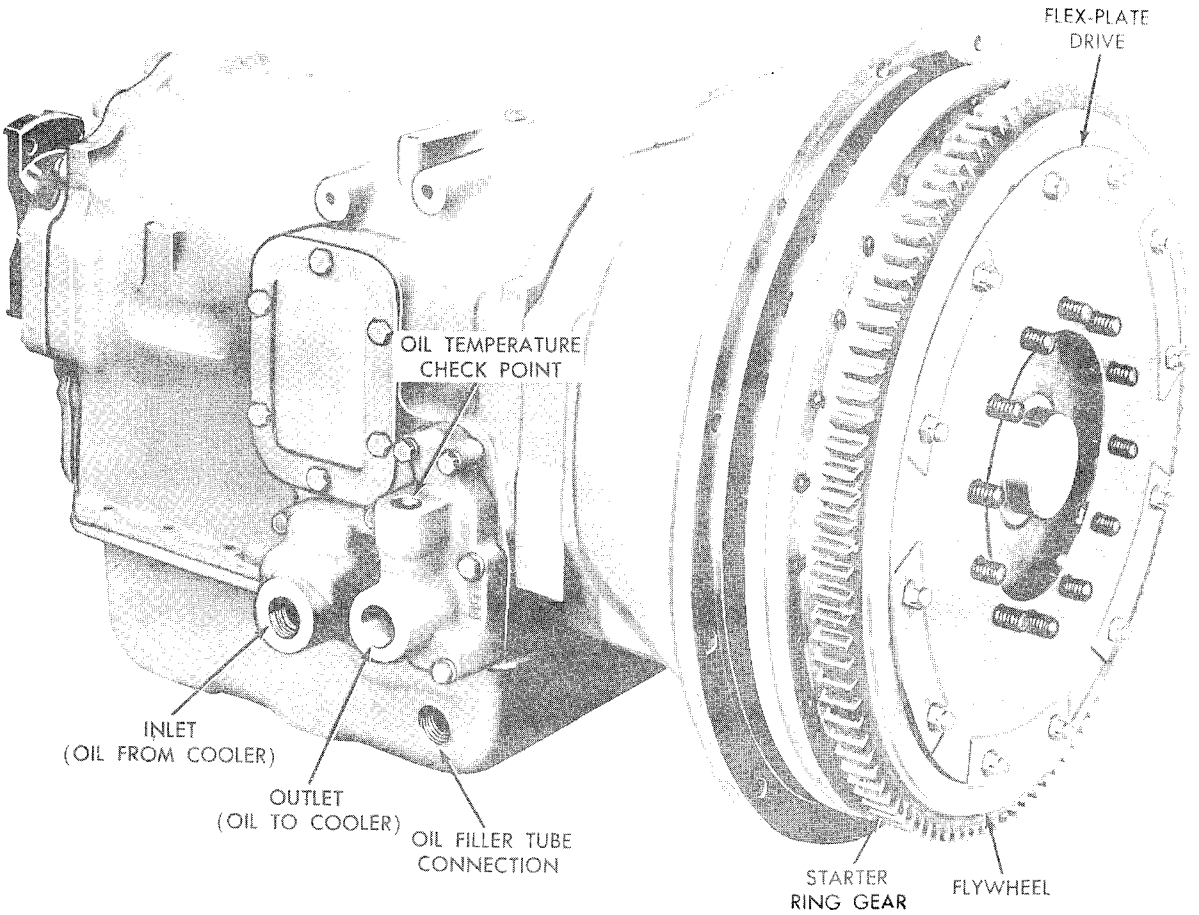
0. The Allison "Torqmatic" requires facilities for cooling the heated oil, and the oil flow diagram and cooler for this is shown above.

Item (1) consists of an oil filter, A-W group number PGF-15898. The Fram Corporation group number is FH-33-PLOE. The replaceable cartridge number is 9094. The cover assembly number is 8735 and the cover gasket number is 104503. The service instructions shown on page 130, paragraphs E, F, and G will apply with this filter, except the following: paragraph E, delete sub-paragraph 3; paragraph F, sub-paragraphs 1, 2, 3 and 4. Consult Allison Manual SA-1096 for drain and filling points. Page 12, paragraph G, shows full Hydraulic Fluid specifications.

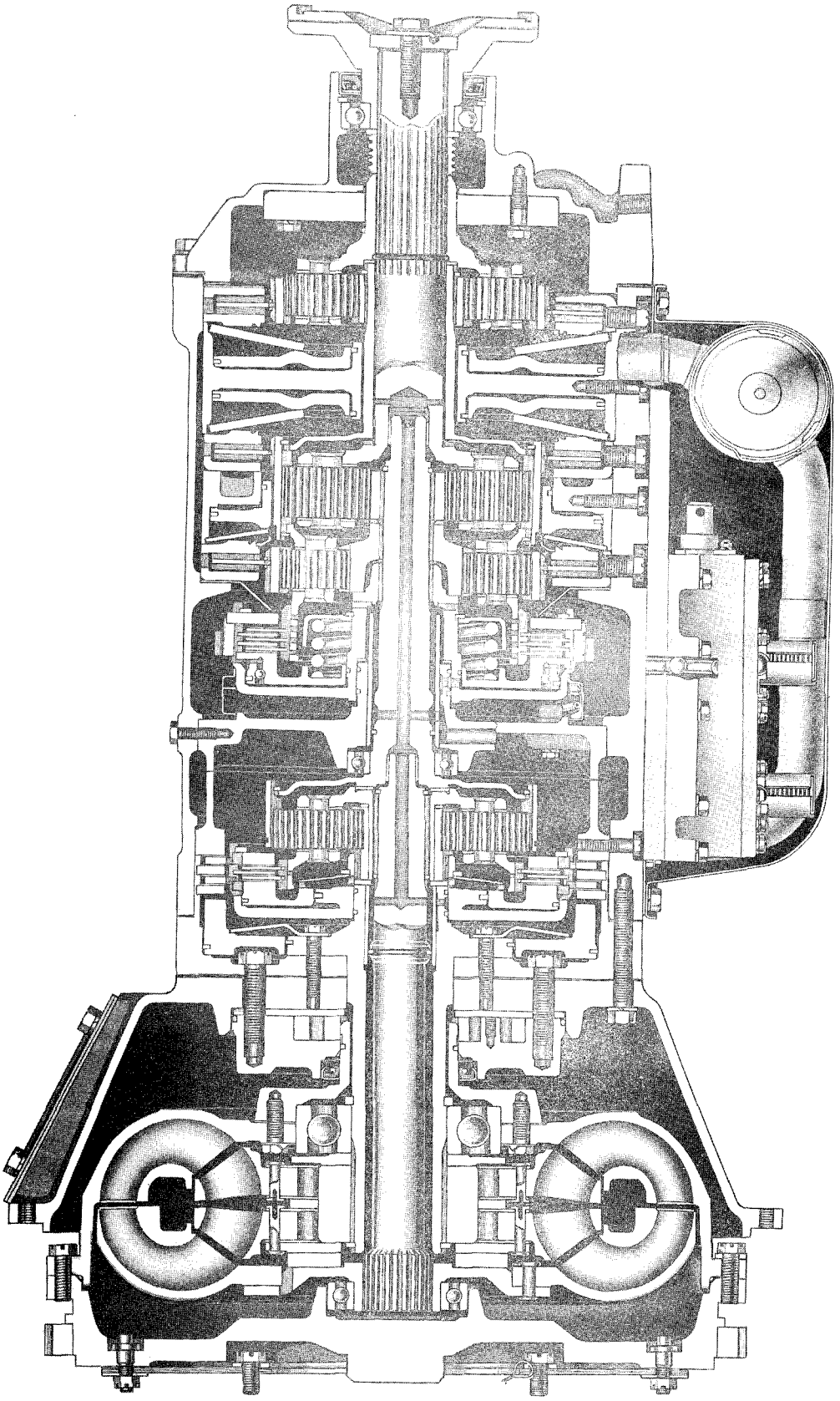
Item (2) is an oil temperature gauge. Item (3) is 200 PSI oil pressure gauge.



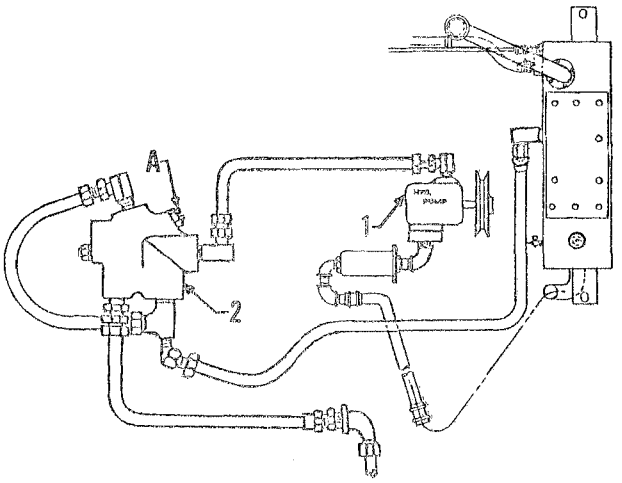
ALLISON MODEL CT-3340-4 TORQMATIC TRANSMISSION - RIGHT VIEW



ALLISON MODEL CT-3340-4 TORQMATIC TRANSMISSION - LEFT VIEW



ALLISON MODEL CT-3340-4 TORQMATIC TRANSMISSION - CROSS SECTION



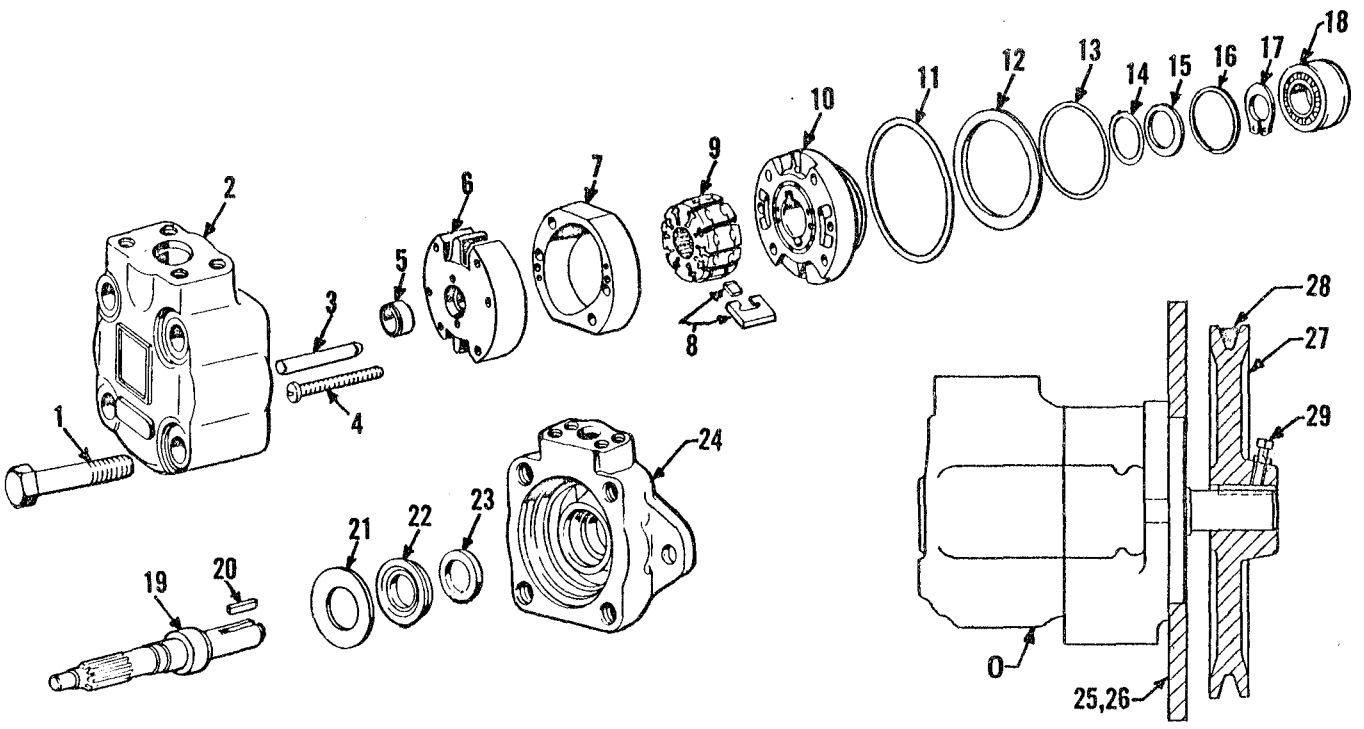
139-A Hydraulic Pump and Flow Regulator. (As used with Power Shift Transmission.)

A. Hydraulic Pump.

1. Description.

A high capacity hydraulic pump (1) with a combination flow regulator and pressure relief valve (2) is used with machines equipped with Power Shift Transmissions. The functions of these are outlined under sub-paragraph 3, page 11.

When the brake is applied and the engine is at low idle speed, this high capacity (26 GPM) pump permits a greater volume of hydraulic oil to be delivered thru the system thereby allowing the controls to be operated at near the normal speed. When the engine is being operated at higher speeds, the flow regulator dumps over any oil in excess of 15 GPM. therefore, the controls are always fed a near constant volume of oil and the speed of the controls also remains constant.



2. DISASSEMBLE, INSPECTION AND REPAIR.

a. Clean outside of pump with an oil solvent, fuel oil or gasoline and dry thoroughly. With file or oil stone remove sharp edges or burrs from shaft and keyway before proceeding to disassemble. Mark pump with prick punch for proper assembly.

Do not disassemble a pump further than is necessary to correct a malfunction. During Disassembly, special attention should be given to identification of parts for proper reassembly. This is especially important in installing cartridge parts to their proper relationship in rotation. Place all disassembled parts on a clean, lint-free surface for inspection. Carefully remove any burrs by light stoning with a medium India stone. Clean all parts except "O" ring seals in a clean mineral oil solvent. After drying thoroughly, lay the parts on a clean, lint-free surface. All internal oil passages in the cover, rotor, pressure plate and body must be thoroughly cleaned.

CAUTION

Never use an air hose on or near the exposed parts because of the presence of water and dust in the air system.

All "O" rings, back-up rings and the shaft seal should be replaced for reassembly. All seals should be soaked in hydraulic fluid before being used. Refer to above and proceed with disassembly.

3. COVER END

a. Place pump in a machinist's vise, being certain to use protective jaws. Clamp vise on flats of mounting bracket to prevent damage to body.

b. Remove four cover bolts (1) that secure to cover (2) to the body (24) Remove the cover (2). Note position of inlet port of the cover with reference to outlet port of the body before removal so that the cover may be returned to its original position at reassembly.

c. Firmly grasp pump cartridge (7 and 9) and while turning it slightly, pull outward on the unit to remove it from drive shaft (19). Loosening of pump cartridge may be accomplished by prying under the flats of the ring with two screw drivers. Lay the cartridge aside on a clean smooth surface for disassembly and inspection. Remove large "O" ring from recess in body.

4. PUMP CARTRIDGE

a. Remove "O" rings (11 and 13) and back-up rings (12) from hub and outside diameter of pressure plate (10).

b. Remove two screws (4) from face of wear plate (6). Lift wear plate from locating pins (3) and remove pins. Remove ring (7) from around rotor (9). Remove vanes and inserts (8) from rotor (9) and remove rotor from pressure plate (10).

c. Wash and dry all cartridge parts. inspect surfaces of wear plate (6), pressure plate (10), ring (7) and rotor (9) for scoring and excessive wear. Light scoring may be removed by lapping. Replace parts if heavily scored. Check edges of vanes (8) for wear. Vanes must not have excessive play in rotor slots or burrs on edges. Replace if necessary. Check each rotor slot for sticky vane fit or wear. Vanes (8) should drop in rotor slots by their own weight when both the slots and vanes are dry. If wear plate (6) is found to be satisfactory, inspect inside diameter of bushing (5) for wear or scoring. Remove bushing if wear or scoring is evident. If wear plate (6) is to be replaced, do not remove bushing since a new plate will incorporate a new bushing.

5. SHAFT END

a. Lift out shaft key (20) from its seat in shaft (19). Remove bearing retaining ring (17) and shaft snap ring (16) from inside of body (24). Carefully remove drive shaft (19) and bearing from body (24) by gently tapping the keyed end of shaft (19) with a soft tipped hammer.

b. Test the bearing (18) for wear before removing it from the shaft (19). Rotate bearing (18), applying a little pressure to outer race, to determine whether the balls or races have become pitted, worn or cracked. Check for looseness. If in doubt, remove bearing (18) from shaft (19). Inspect outside diameter of drive shaft at the point of contact with bushing and sealing lip of shaft oil seal. If excessive scoring or wear is noted, replace shaft.

c. Remove washer (21) from around shaft bore in body. Using a suitable hooked tool or a drift, remove shaft oil seal (22) and felt seal (23) from body (24).

6. REASSEMBLY

NOTE

Immerse all parts in clean hydraulic oil to facilitate reassembly and provide initial lubrication.

7. SHAFT END

a. Install a new felt seal (23) and shaft oil seal (22) in counterbore and body (24). Soak both seals thoroughly in hydraulic oil before installing. Make certain that lipped edge of seal is toward inside of body. Use shaft oil seal driver to prevent damage to seal during installation. Lubricate the shaft oil seal diameter with petroleum jelly or grease.

b. Position shaft bearing (18) in place on drive shaft (19), being careful not to cock the bearing. Using an arbor press and supporting the inner race of the bearing, press bearing against shoulder of shaft. Lubricate the chamfered edge of the shaft. With tape around end of shaft to protect seal, install shaft and bearing into body until bearing is fully seated. If necessary, gently tap the shaft with a plastic headed hammer. Install shaft snap ring and bearing retaining ring, making certain both parts are firmly seated in place.

c. Shaft key (20) may be installed at this time or after pump has been completely reassembled.

8. PUMP CARTRIDGE

a. Install an "O" ring (14) and back-up ring in groove on hub diameter of pressure plate (10). Install a back-up ring (12) and "O" ring (18) around large step diameter of pressure

plate. Make certain that smooth sides of back-up rings face the sealing rings.

NOTE

Back-up rings are always installed away from pressure chamber.

b. Position large "O" ring (11) in diameter recess of body (24). Petroleum jelly or similar grease should be used to hold the ring in position during assembly of pump cartridge.

NOTE

Direction of rotation is designated as viewed from shaft end of pump. Right hand rotation is clockwise, left hand rotation is counter-clockwise.

c. Place rotor (9) on pressure plate (10) with arrow pointing in desired direction of rotation. Install insert in vane (8) and position both parts in rotor slot. The sharp edge of the vane must be toward direction of rotation.

d. Install locating pins (3) in pressure plate (10). Install ring (7) on locating pins with arrow facing direction of rotation. Lubricate rotor and ring with clean hydraulic oil.

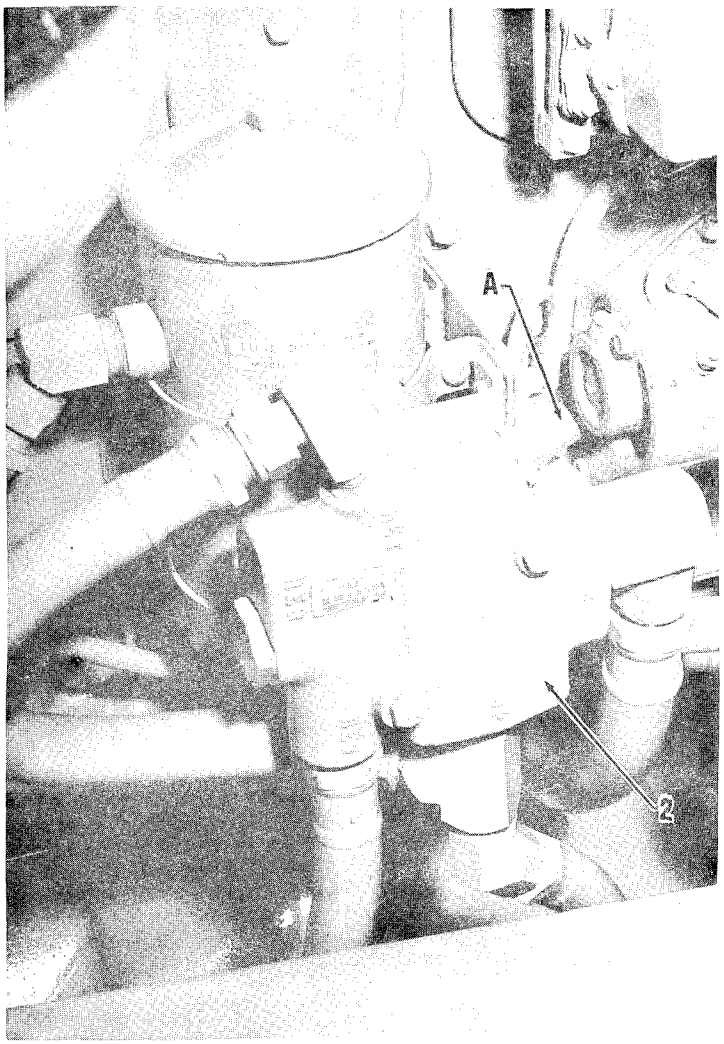
c. Press a new bushing (5) into bore of wear plate (6), if removed. Install plate on ring. Install two screws (4) and tighten until snug.

9. COVER END

a. Carefully install pump cartridge on drive shaft (19) and seat it firmly in place in body (24).

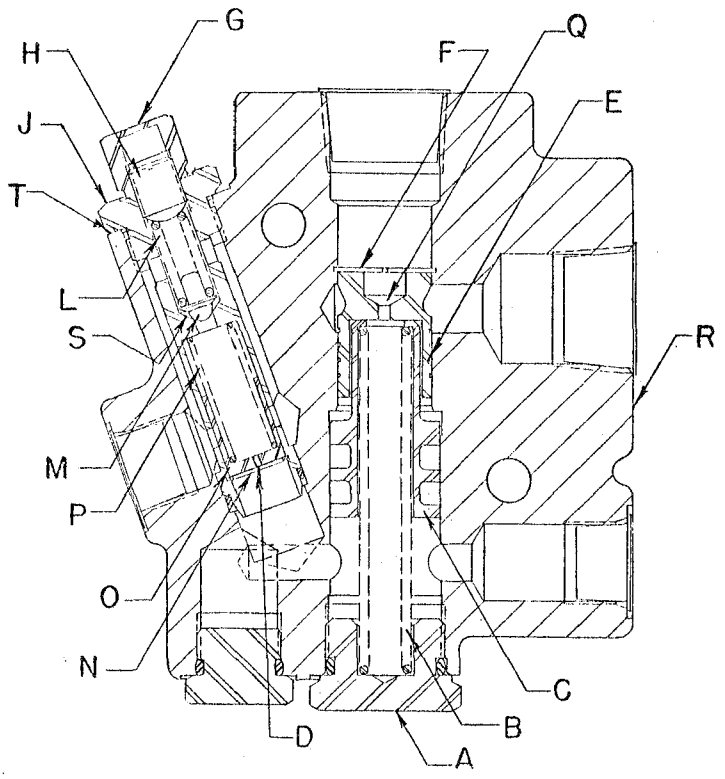
b. Install cover (2) making certain that the two locating pins (3) fit into the holes inside the cover (2). Seat cover firmly and secure in place with four cover bolts (1). The threads of the bolts should be oiled lightly and tightened to a torque of 55 ± 5 ft. pounds.

c. After the unit has been completely reassembled, pour a small quantity of clean hydraulic oil into the cover inlet port. Rotate drive shaft several turns by hand to check for free rotation and to insure complete lubrication of the cartridge parts. Cap the pump inlet and outlet ports to prevent entrance of foreign materials into the cover or body.



B. FLOW REGULATOR AND RELIEF VALVE (flow-divider)

1. The above photo shows the flow divider (2) as installed on the machine. Pressure relief setting 1500 PSI is adjusted at "A" above.
To adjust, remove lock nut (G) (see sketch on Page 158 E) and adjust screw (H) to obtain proper setting. Adjust with full engine RPM.



2. DISASSEMBLY AND INSPECTION

If for any reason the flow divide fails to function properly, it should be disassembled, inspected, cleaned and reassembled.

a. DISASSEMBLY PROCEDURE

Remove plug (A), spring (B), pistons (C and E). Remove relief valve cartridge (J). Remove nut (G), adjusting screw (H), spring (L) and poppet (M). Remove retaining ring (N), piston (O) and spring (P).

b. INSPECTION

Examine pistons (C and E) making sure orifice (Q) is clean. The outside diameters of pistons should be smooth, clean and free from scratches. If scratches are present, examine bore in body (R). When scratches are present, replace parts.

Examine relief valve piston (O) and sleeve (J) for scratches. Make sure orifice (D) is open. Also make sure poppet (M) and seat (S) are smooth and free from scratches. If any of these parts are scored, replace cartridge.

c. RE-ASSEMBLY PROCEDURE

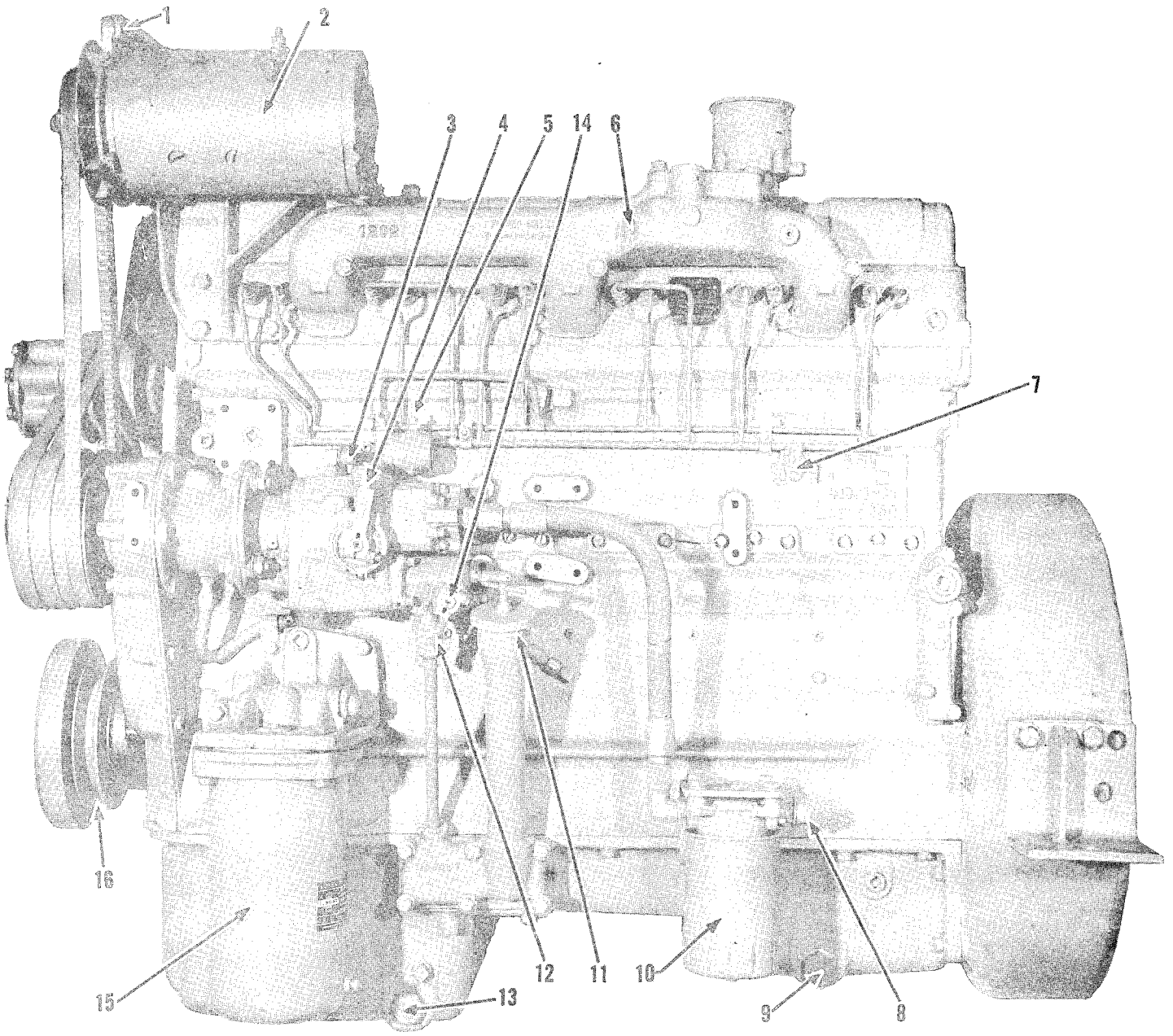
Clean all parts and passages. Replace all "O" ring seals, and reverse procedure as outlined for disassembly. Make sure all pistons slide freely in bores without binding or sticking.

d. TEST PROCEDURE

Subject valve to a source of oil equivalent to that which will be used in the application. With no load on either outlet port, check volume of oil from "controlled" port.

Apply load of 400 PSI to "controlled" port and check volume. Apply load of 800 PSI to "excess" port and check volume. Volume should remain within 20% of "no load" conditions.

Block discharge of oil from "controlled" port and read input oil pressure. This is relief valve setting. Adjust screw (H) (clockwise to raise pressure) to desired setting. Lock with nut (G).



140. The above photo shows a right view of the Cummins C-160 Diesel Engine. (See separate Cummins Operation and Maintenance Manual.)

A. The engine shown in this photo is for dry clutch operation and has a variable speed governor built into the fuel pump.

1. Generator belt tension adjuster.

2. Generator.

3. Fuel return outlet from pump to fuel tank.

4. Engine shut-off lever. (Operated by pull-out handle; see page 8, item 4).

5. When the engine is stopped, this electric shut down valve stops the flow of Diesel fuel from the fuel tank to the fuel pump.

To start the Cummins engine proceed as follows:

A. See page 8. Turn ignition key (16) to "on" position.

B. Push electric starter toggle switch (15) to the left and simultaneously push and hold toggle switch (14) to the left. When engine starts, release toggle switch

(continued)

(15), but hold toggle switch (14) to the left until the engine oil pressure gauge shows approximately 25 PSI.

6. The Ether starting nozzle is attached here. (see page 159.)

7. Diesel oil return connection from injector to fuel tank. (see page 159.)

8. Diesel oil connection from fuel tank to Diesel oil filter. (See page 159.)

9. Crank case oil drain plug.

10. Diesel oil filter (throw away type). To remove, unscrew in counterclockwise direction. Install a new cartridge with seal, procured from your nearest Cummins Authorized Servicing Dealer.

11. Add engine oil here.

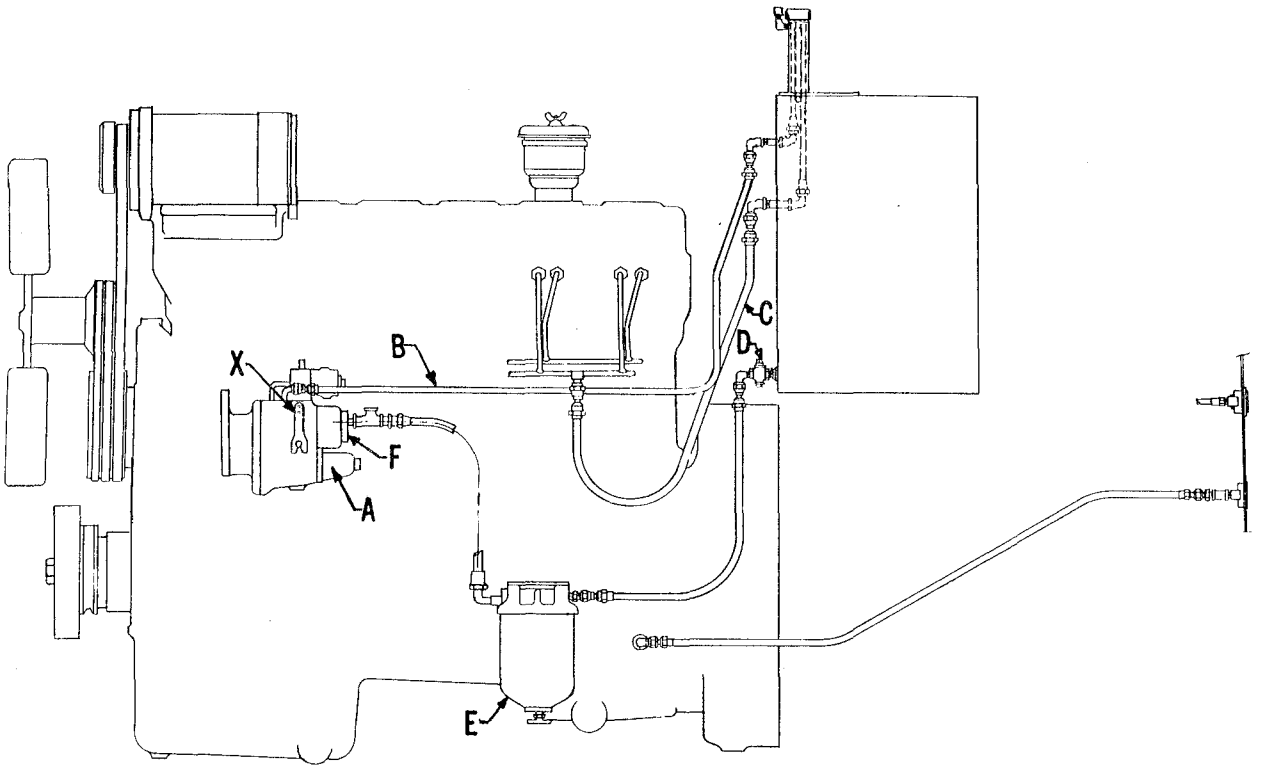
12. Engine crank case oil dip stick gauge. Keep oil level near the high mark.

13. Crank case oil drain plug.

14. Hand throttle lever;(page 7, item (10), connects to this lever).

15. Full flow engine oil filter.

16. Pulley for hydraulic pump "V" belt drive. (see separate manual for all engine maintenance.)



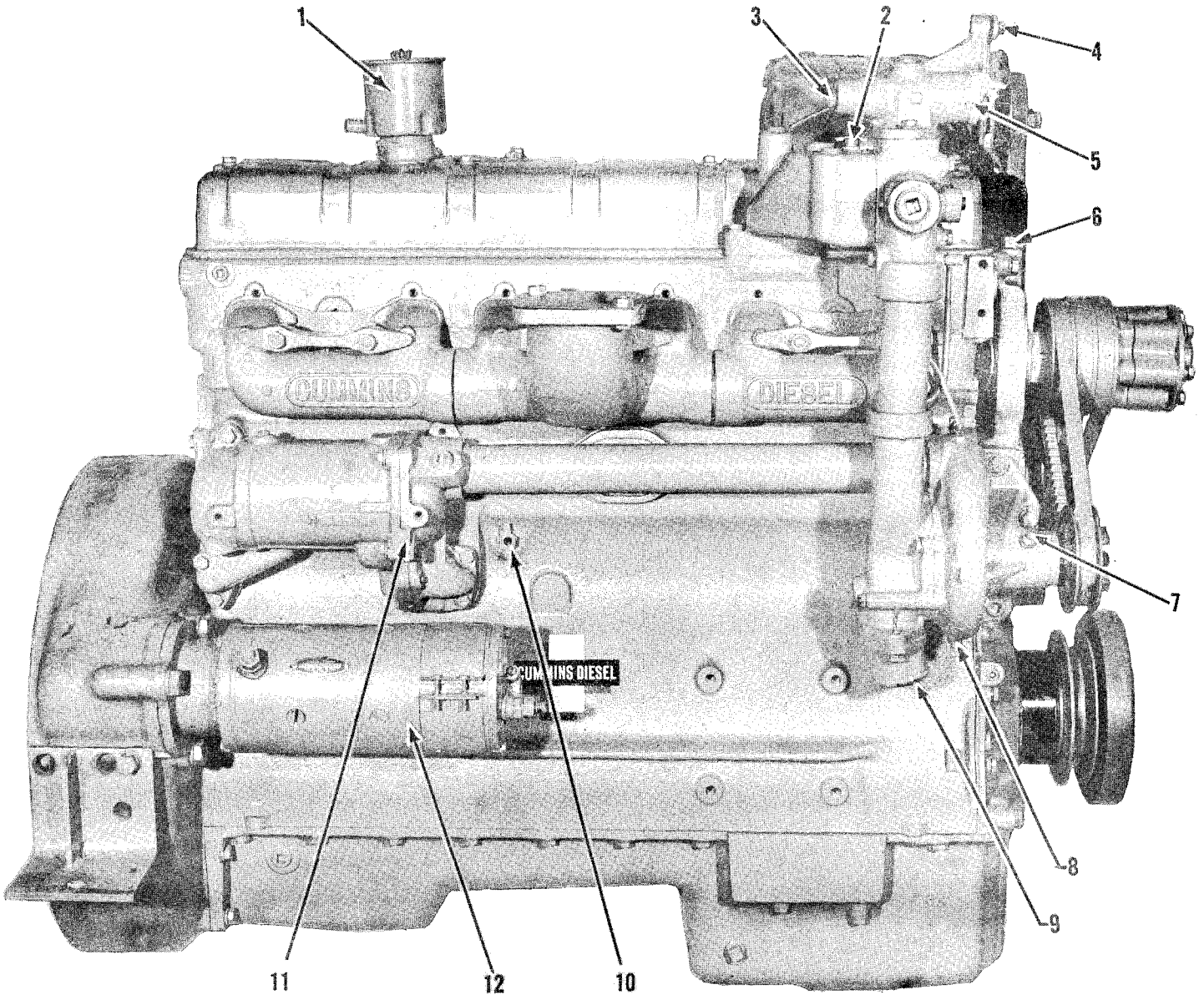
141. Fuel system diagram for Cummins C-160 Diesel Engine, for use with A-W "Torcon", "Power Reverse" and Allison Torqmatic" Transmission.

A. The fuel pump has a "High Speed Governor". Only one throttle arm (X) is used and the engine control is under the A-W type of "Tail Shaft Governor" shown on pages 132 and 133, except that the wire shut-off (H) is not used.

B. Pump fuel return to fuel tank.

C. Injector fuel return to fuel tank.

D. Open valve (D) to supply fuel to filter (E) and fuel pump (F).



142. The above photo shows a left view of the Cummins C-160 Diesel Engine. (See separate Cummins Operation and Maintenance Manual).

A. The engine shown in this photo is for dry clutch operation.

1. Crankcase Breather is oil bath type. (See engine manual for service instructions.)

2. To fill the cooling system proceed as follows: Close drain cocks (10) and (8). Open air bleed cock (2). Fill the radiator and when water dribbles out of cock (2), close it. Then continue to fill the radiator to within one inch under the neck of radiator. Start the engine on idle for a few minutes, then refill radiator to limit shown above.

3. Engine water temperature bulb is attached here.

4. Adjusting link for generator.

5. Water outlet to radiator.

6. Belt adjusting screw.

7. Water pump grease fitting.

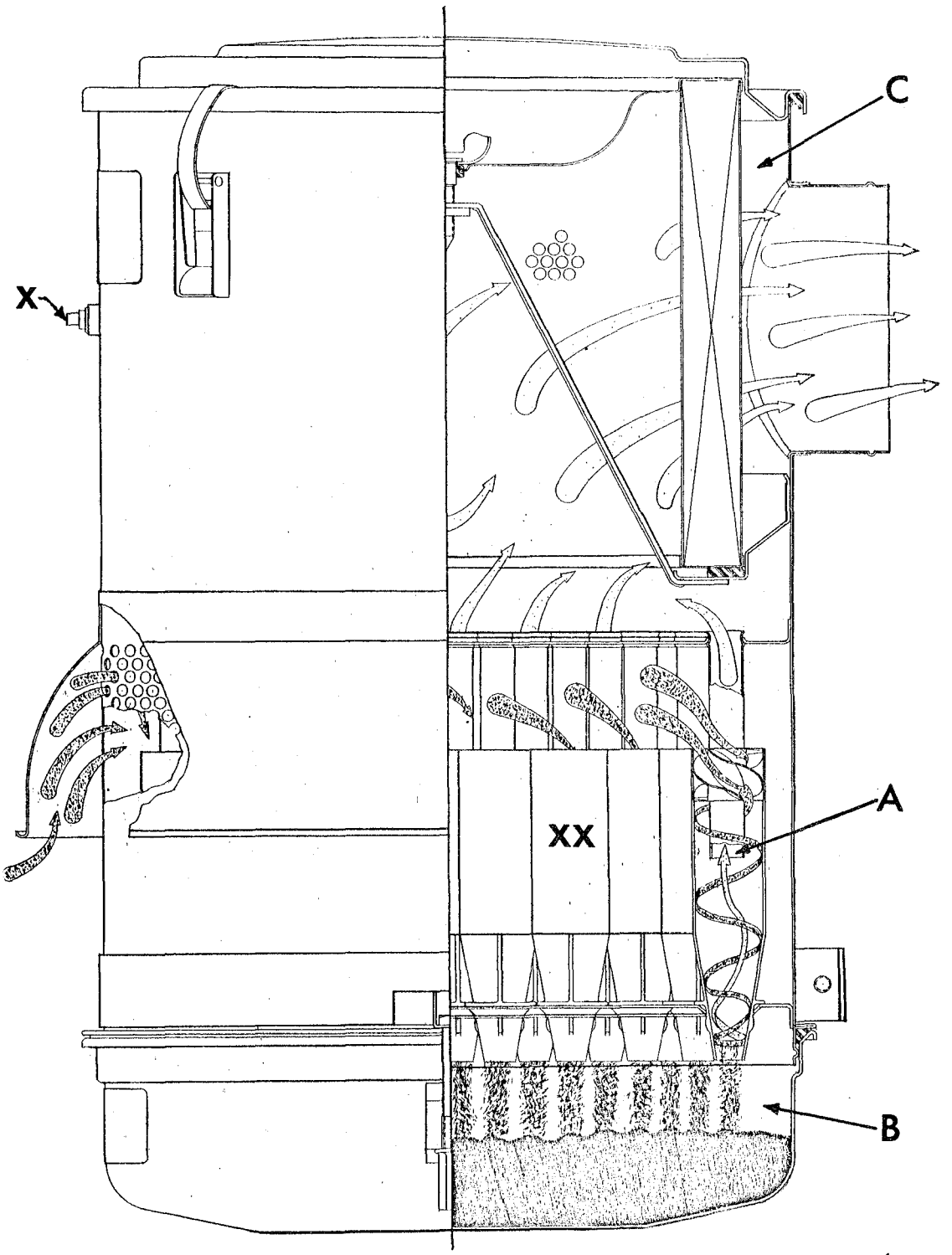
8. Water pump drain plug.

9. Water inlet to engine.

10. Engine block water drain plug.

11. Oil cooler.

12. Electric starter.



143. The above photo shows the Donaldson Donaclone Duo-Dry Air Cleaner. (This is available for the 400 Series Graders as on option and on special order).

a. This is a dry cleaner and <u>oil is not to be placed in the lower dust cup (B).</u>

The Donaclone's primary lower section (A) centrifugal stage alone, which hurls dust particles out of the airstream into the dust cup (B), takes out up to 98% of all foreign particles. The remaining particles are caught by the filter cartridge (C), giving the engine utmost protection against dust.

AMAZINGLY SIMPLE TO SERVICE.

Because practically all dust goes into the dust cup (B), it is only necessary to empty the dust cup daily (or more frequently if operating conditions warrant).

b. HOW TO SERVICE LOWER CUP.
(See right photo).

Stop engine. Loosen clamps (11) and drop dust cup (10) away from the cleaner. Dump out the dust and wipe the gasket (9) and joint surfaces. Replace gasket (9) if it shows signs of wear, damage, or leaks. Wipe the inside of the cup; also the outside. Do not use oil, gasoline or oily waste for cleaning purposes.

c. DAILY OPERATION.

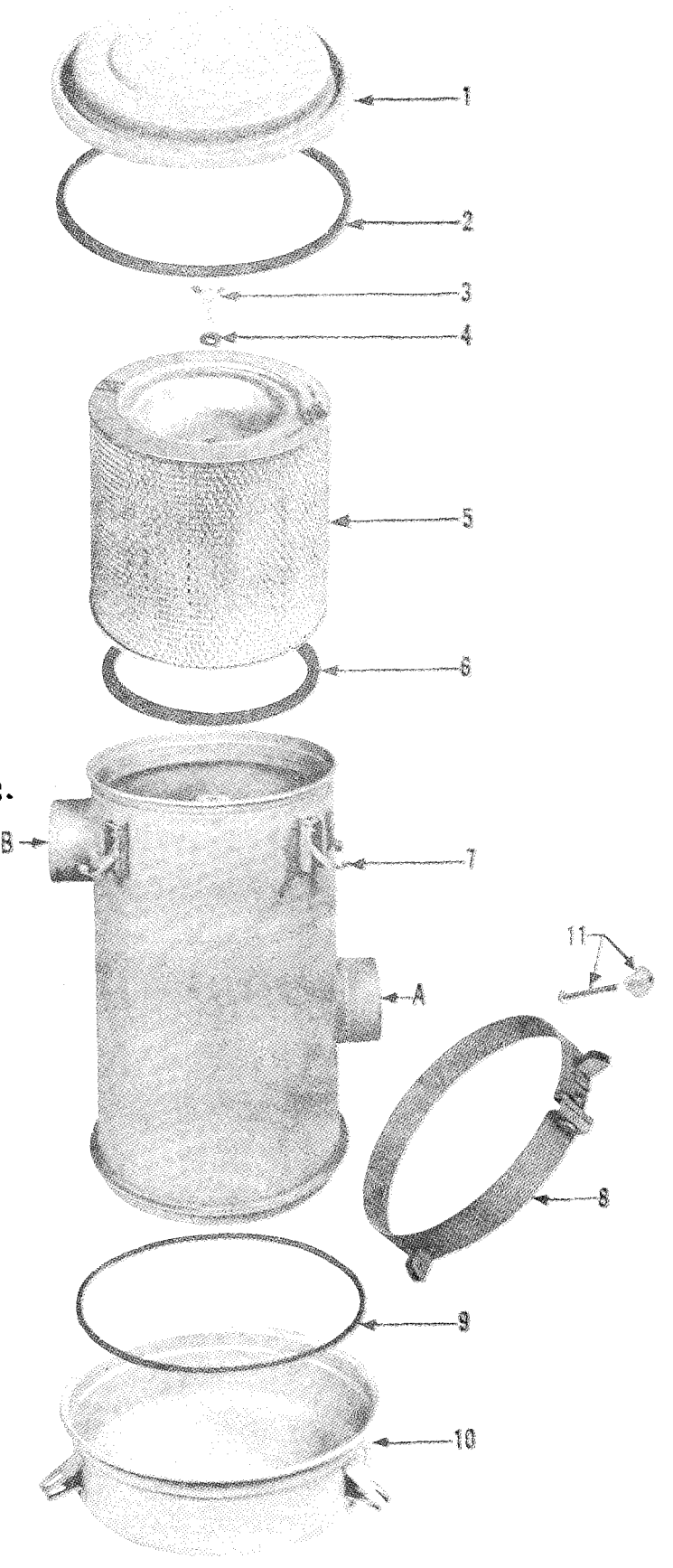
DUST CUP: Frequency of service can range from every 4 to 120 hours. Daily inspection is recommended and more often if dust conditions warrant. Important: The DONACLONE Air Cleaner will not function properly if dust deposits build up past a 2" level in the dust cup (10). A tight positive seal (9) must be made between dust cup and cleanser after every servicing. Leakage at this point will increase dust loading and make it necessary to service the filter cartridge (5) more often. Because of the frequency of dust cup servicing and the possibility of gasket damage, it is recommended that several replacement gaskets (9), (6), (4), and (2) be kept in stock at all times.

d. CHECKING THE DURALIFE UPPER CARTRIDGE.
(250-1200 Hours)

Excessive exhaust smoke and/or loss of power may indicate the need for service at the upper filter cartridge (5). If equipment is available, measure the air restriction of the Cleaner with a vacuum gauge or water manometer at the restriction tap (X), top left of the diagram; see page 162. Service is required when air restriction has increased to 20" of water at high idle for Diesels. After measuring, replace tap plug securely.

e. HOW TO SERVICE THE UPPER CARTRIDGE.

Stop engine. Wipe off cover (1) and upper portion of Air Cleaner. Loosen clamps (7) and remove cover. Unscrew wing bolt (3) which holds washer (4) and cartridge (5) in position, and lift it from cleaner. Considerable dust can be dislodged by slapping the side of bottom rim of the cartridge (5) with the palm of the hand. Do not bang the bottom rim of the cartridge (5) against any hard surface. This may damage the rim and



(continued on page 164.)

affect the seal (6) when unit is reassembled. If compressed air is available, blow out the cartridge (5) from the clean air side. An even, bright pattern of light through the cartridge when a light is held inside, means the cartridge is clean. Having spare cartridges (5) and gaskets on hand will minimize down-time.

f. ASSEMBLY.

Before replacing cartridge (5), wipe out any loose dust which may be at the bottom of the cartridge chamber. Lower cartridge into position and secure with wing bolt (3) so that unit cannot be rotated. Be sure that the rubber-metal washer (4) is in place under the wing nut, and that it is in good condition. Inspect cover gasket (2) for damage. Cover (1) should fit into position smoothly, without forcing. If it does not, check to be sure the cartridge (5) is installed properly.

g. WASHING FILTER CARTRIDGE.

In addition to tapping and blowing, it is practical to wash the filter cartridge (5) with any good, non-sudsing household detergent. Warm water (120-140 degrees F.) is recommended but is not essential. Flush unit with a gentle water stream until drain water is clear. Air dry cartridge thoroughly before using. Inspect after every cleaning for damage or rupture.

h. CLEANING DONACLONE TUBES.

With filter cartridge (5) and dust cap (1) removed, inspect the tubes (XX) see page 162, by looking through them at a bright light. Dust deposits can be removed with a stiff fiber brush.

i. GENERAL INSPECTION.

Check all connections as described in the "Causes of Short Service Life" schedule at bottom of this page.

j. FILTER CARTRIDGE LIFE.

For safety's sake, replace your DURALIFE Filter (5) after 1,000 hours of use. While the cartridge may function safely for longer than this, the small savings involved do not justify the risk.

k. PROBABLE CAUSES OF SHORT SERVICE LIFE.

EXCESSIVE OIL AND CARBON FUMES:

The Air Cleaner inlet (A), page 163, should be located away from exhaust and crankcase ventilator discharge points. Oil leaks in the vicinity of the inlet may also affect life. Inspect and insure leakproof connections at (B).

l. GASKET SEALS:

All gaskets must fit tightly. If dust cap gasket leaks, excessive dust is carried to the filter cartridge, shortening its service life. Leakage of cartridge gasket or rubber-metal washer under the wing bolt which secures the cartridge, will permit dust to enter the engine.

m. CHECK POINTS:

If short service life is still evident after the preceding recommendations have been complied with, check the following points for leakage or damage: FILTER CARTRIDGE (5), TOP COVER GASKET (2), RUBBER-METAL WASHER (4) under wing bolt securing filter cartridge, FILTER CARTRIDGE GASKET (6), RESTRICTION TAP PLUG (X), page 162.

n. WARNING.

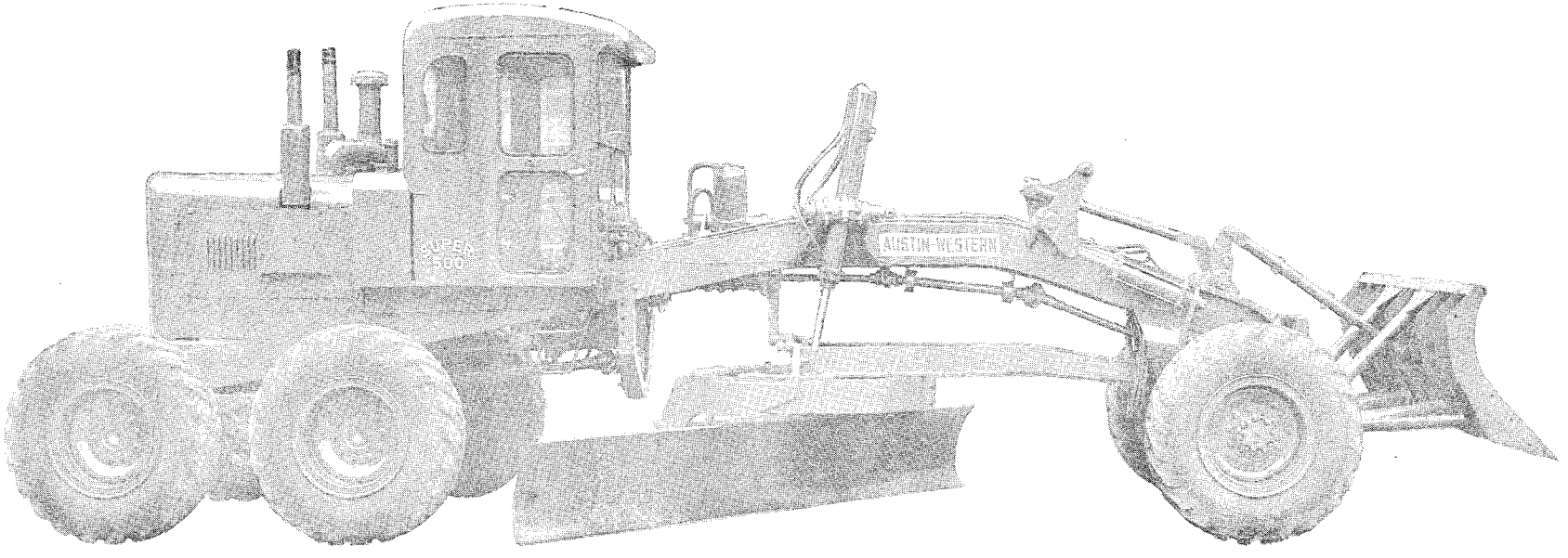
Use only genuine DURALIFE Filter Cartridges (5) in your DONACLONE Air Cleaner. "Will Fit" Elements are detrimental to the performance of your DONACLONE Air Cleaner and the unit cannot maintain its high efficiency when substitute parts are used.

DURALIFE Filter Cartridges (5) are protected by perforated steel cylinders, both inside and out. This rigid construction minimizes the danger of damage through rough handling. They cannot rupture or collapse, even under high engine vacuum.

The chemically treated filter is cured to combine structural rigidity with high resistance to oil and water. It is embossed and pleated to provide dependability and long life.

o. The photos shown in this Air Cleaner section cover the 14" DONACLONE loose repair parts with the following item numbers:

1. Top Cover P-16971
2. Gasket P-16972
3. Thumb Screw P-16984
4. Washer P-18462
5. Durolife Filter Element P-16973
6. Filter Gasket P-18029
7. Cover Clip P-17617
8. Band Assembly P-18028
9. Cup Gasket P-17335
10. Cup P-18026
11. Bolt Assembly P-17834



144. The above photo shows the right side view of the A-W Super 500 Grader with GMC 6V-71 Engine. (The Bulldozer is a special attachment.) The 14 inch Dry Clutch or the A-W Torcon 15 inch Converter can be supplied as an option. In either case the basic 500 Grader frame, cab, front and rear axle groups, hydraulic rams with controls, will be the same as the A-W 400 Grader. Follow the separate GMC 6V-71 Engine Manual for lubrication, operation, and maintenance. Omit pages D, F, 3 and 4 of this A-W manual. To lubricate the grader, follow the data shown on page 2, 5 and 6 of this manual. The Transmission and Transfer Case shift chart is shown on page 9, paragraph 9. Omit balance of page 9, also pages 10 to 17 inclusive. Pages 17 and 18, paragraph 21, show air cleaner instructions. Omit pages 21,22,23,24 and 25. Page 66, paragraph 50, shows instructions relative to the front wheel "Cardan" joints. Omit data on page 98, paragraph 105 page 119, and pages 141 to 164 inclusive.

145. SUPER 500 POWER GRADER SPECIFICATIONS.

STANDARD EQUIPMENT.- All-wheel drive and steer; dry clutch transmission; hydraulic control throughout, including steering; Diesel motor with electric starter, battery and generating unit; adjustable upholstered seat; 13-foot moldboard; hydraulic foot-operated service brake and hand-operated mechanical parking brake on drive shaft. Single 13.00 x 24, 12-ply tires. (See tire options below). No cab or hood sides for engine are included as standard equipment.

ENGINE (DIESEL)	
Make	GMC 6V71
Number of cylinders	6
Bore and stroke	4.25x5
Gov. speed	2100
H.P. at gov. speed (sea level 60°)	176
Cu. in. displacement	425.6
Fuel tank capacity	75 g.
Cooling system (gallons)	12½g.
Electric system	12V
Electric starter	Yes
Ignition	Comp.
Crank case oil capacity	5 g.
Crank case oil filter capacity	2 Qts.
Air cleaner oil capacity	5 Qts.
Type Crank Case oil & Fuel oil	See separate engine instruction books.
Oil pressure-hot engine (full throttle)	50 P.S.I.
OPERATING WEIGHTS	
NO SCARIFIER: Total weight	27,915
WITH SCARIFIER: Total weight	29,115
ADD 450 LBS. TO TOTAL WEIGHT FOR SHIPPING	

DIMENSIONS:

Wheelbase	19'-8¼"
Overall length	26'-5"
Overall height, no cab	9'-9¾"
Overall height, with cab	10'-3½"
Overall width	8'-0"
Turning radius	35'-5"

BLADE:

Length, standard	13'-0"
Width (curved height, moldboard and bit)	28"
Thickness, moldboard	3/4"
Cut below ground	18⅛"
Lift above ground	16⅜"
Blade base	108½"
Blade side shift (precision)	50"
Circle side shift	21¾"
Total side shift (by power)	71¾"
Added side shift (manual)	26"
Total side shift (power and manual)	97¾"
Max. blade reach beyond tire(frame straight)	90¾"
High lift	up to 90°

DRIVES:

Front with differential.
Full floating axles.
Type of universal wheel joints.....Cardan
Rear is rigid; no differential.
Semi-floating axles.
Type rear steer..5th wheel

CONTROLS:

Hydraulic, operated from the cab.
Steer front & rear wheels.
Raise and lower blade, including high lift.
Side shift blade.
Reverse blade circle.
Side shift circle frame.
Operate scarifier, bulldozer, snow plows and snow wing.
Kind of oil... SAE No.-10W
Oil capacity-entire system, initial fill..96 Qts.
Pressure relief valve unloads at 1500 P.S.I. (Grader stopped, wide open throttle.)

LUBRICATION - High Pressure.

BRAKES: Foot operated service brake, hydraulic expanding; and hand operating mechanical expanding parking brake.

OPTIONAL EQUIPMENT

TRANSMISSIONS:

Torque Converter:
Make.....Austin-Western
Element.....Torcon
Type.....Single Stage, three element.
Multiplication...2.80:1
For converter use type A Hydraulic Transmission Fluid.
Capacity initial fill.. ..... 28 Qts.
Maximum hot oil pressure at wide open throttle...(No load) 50 P.S.I.
Sustained-maximum Converter oil temperature.. ... not more than 240° F. (See page 128).
Speeds.....6 forward
2 reverse
Power Reversing Clutch:
Type.....Hydraulically actuated, oil cooled.
Use type A Fluid. When Converter and Power Reversing Clutch are used in combination, the oil initial fill will be .. ..32 Qts.
Speeds.....4 forward
4 reverse
Power Shift:
Type....CT3340 Allison
See separate Allison CT-3340 instruction book for complete oil specifications, at various operating temperatures.
Speeds..... 4 forward
2 reverse

SCARIFIER ("V" Type)"

Hydraulic Control.
Weight, approx. shipping, lbs..... **1,300
Number of teeth..... 11
Spacing, center to center..... 4½"
Total swath..... 46"
All teeth are hooked; have removable points; measure 1"x3", and are made of hardened alloy steel.

SNOW PLOW:

Hydraulic Control.
Giant "V" Type.
Plowing width.....9'-2"
Height.....7'-2"
Overall width....12'-7"
Weight, approx. shipping, lbs..... *3,200
**3,500

SNOW WING:
Hydraulic Control.

BULLDOZER:

Hydraulic Control.
Weight, approx. shipping, lbs..... *1,650
**1,950
Length..... 9'-0"
Height..... 40"
Lift above grade.... 16"
Drop below grade.... 17"

POWER TILT MOLDBOARD:
Hydraulic Control.

TIRES:
14:00 x 24 10-ply
16:00 x 24 12-ply
14:00 x 24 12-ply

CAB:

Headroom.....6'-4"
(Approx. shipping weight, lbs.):
Open Type..... 270
Cab enclosure..... 455
Enclosed type..... 725
Windshield wiper standard with cab.

HOOD SIDES FOR ENGINE:
Weight, lbs.....31

ELECTRIC LIGHTS:

Head, tail, stop, directional, cab mounted flasher, back-up, spot, identification, dome, clearance, moldboard.

TIRE PUMP:

Single cylinder, self contained; electric driven.
Weight.....53 lbs.

BLADE EXTENSION:

1' or 2' for either right or left side.
Weight..60 lbs. per foot.

ODOMETER:
Located in cab.

AUXILIARY BRAKE.

BOOSTER STEER.

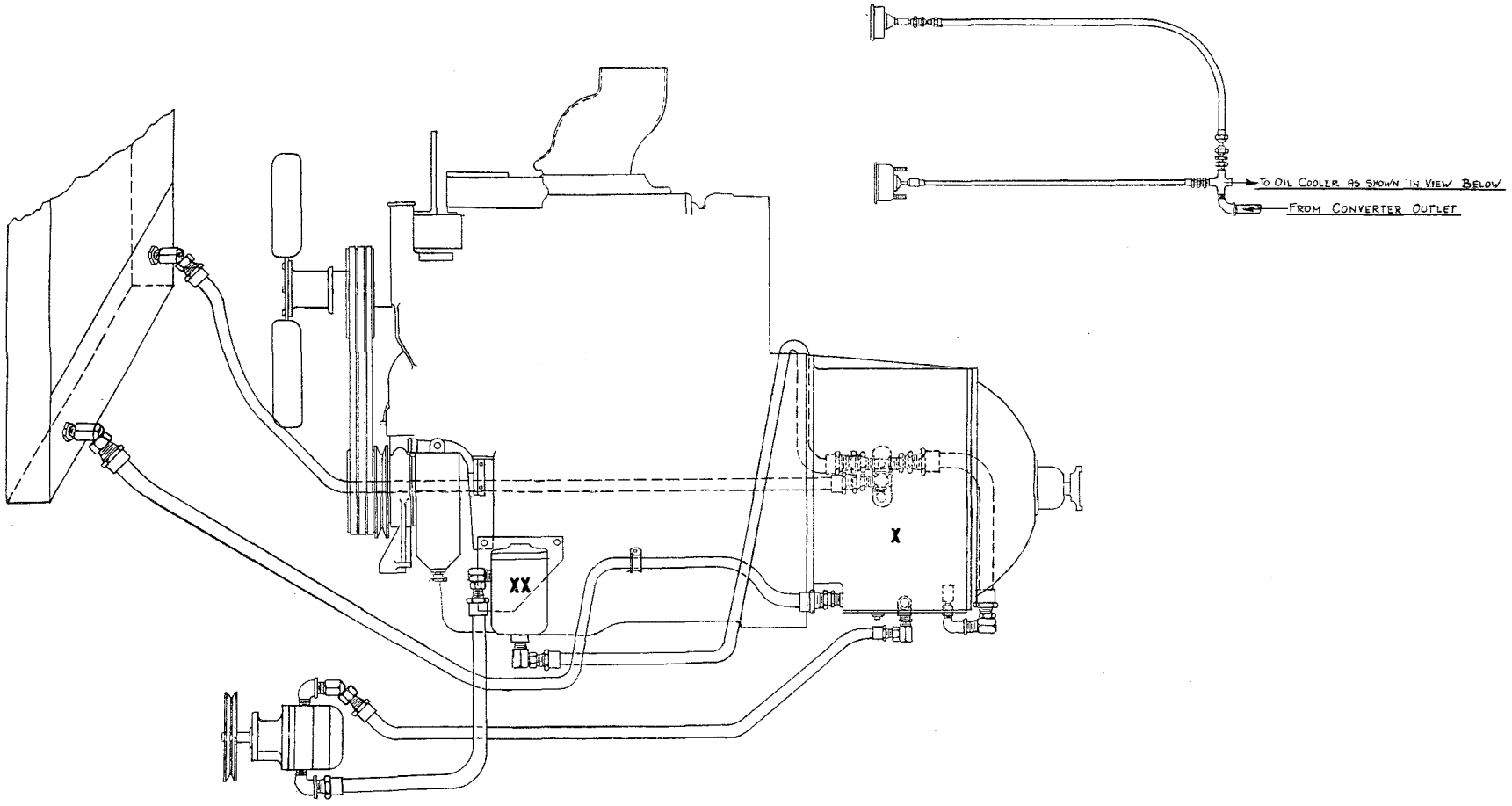
DUO-MATIC STEER:
2 speed, hydraulic, with wheel.

HEATER (TWIN FAN):
Type.....Hot Water

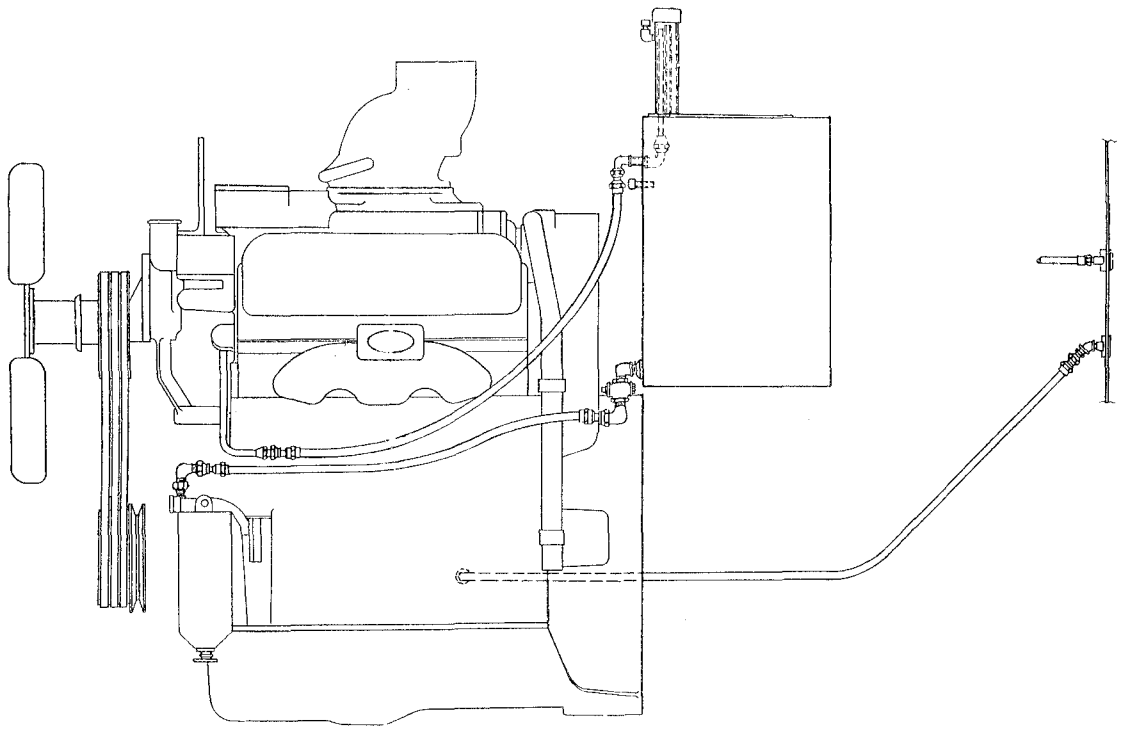
WINDSHIELD DEFROSTER:
Type.....Fan

HOUR METER.

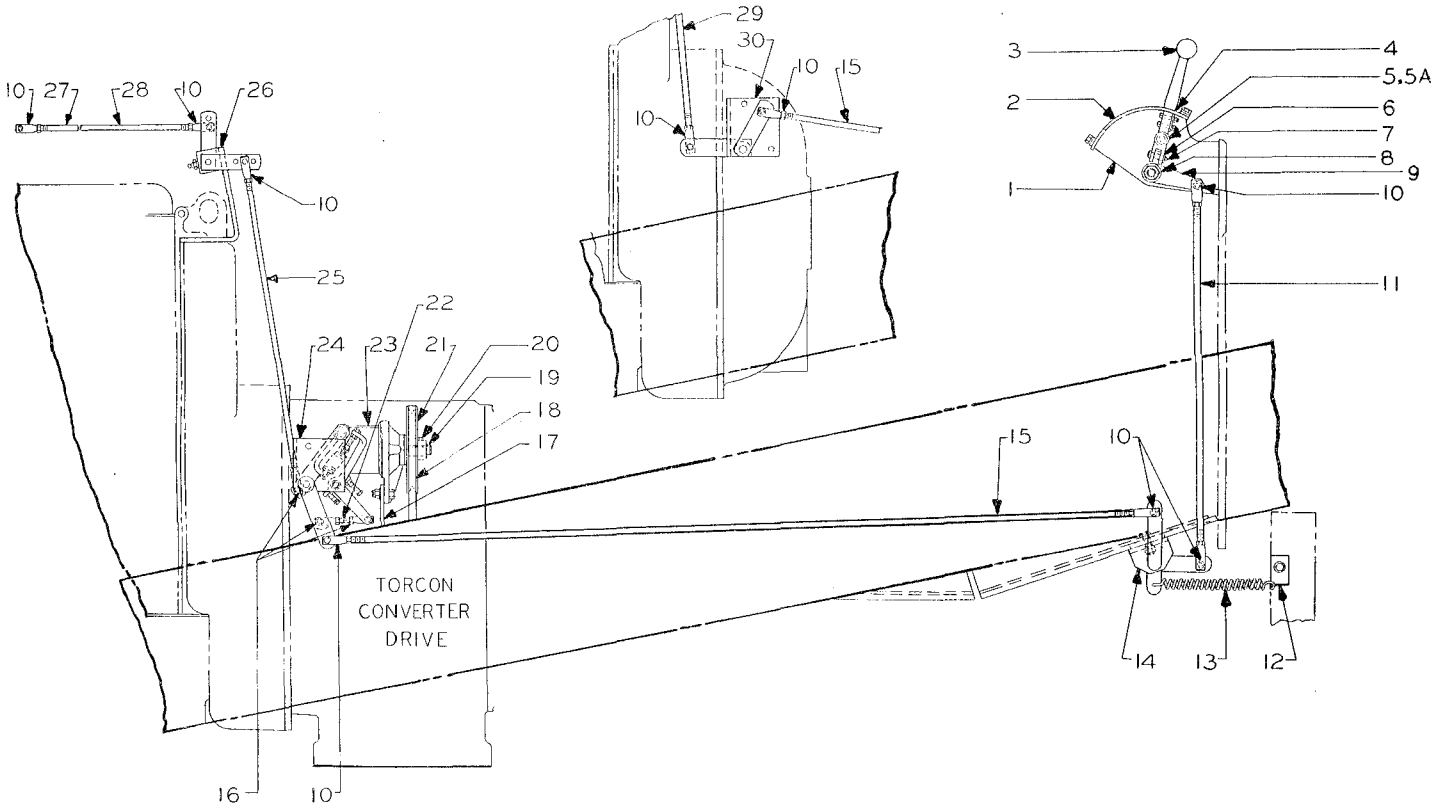
* Weight of attachment that will use the operating parts already mounted on grader.
** Weight of attachment complete, including all necessary operating parts.
All fluid capacities are approximate.



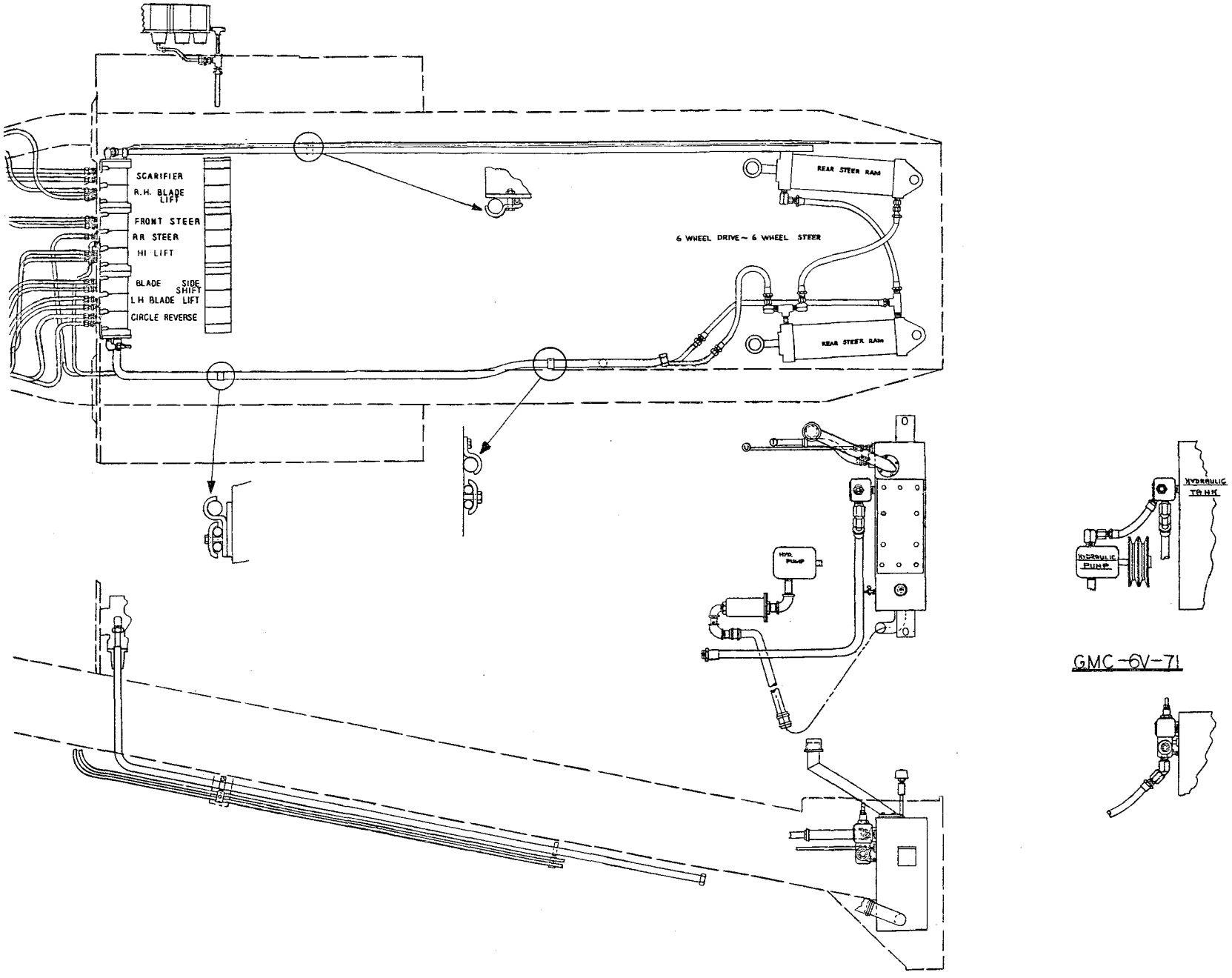
149. The above shows the A-W Torcon Converter Piping Diagram. The maintenance to the Converter (X) and the filter group (XX) (see above) will be the same as shown on page 128, except that the Converter Turbine is 15" instead of 14". Omit paragraphs B and C, page 128, except the last paragraph. The instruction data on pages 129, 130, 132 and 133 is satisfactory except that the governor rod linkage is changed. Pages 134 and 140 may be used for overhaul of the Converter. The 6V-71 Engine has a long spacer and a 3 grooved pulley at the exposed end of the Crank Shaft. The outer V belt drives one Hydreco pump which supplies type "A" oil to the Converter at approximately 50 P.S.I. The other two V belts drive another Hydreco pump which supplies SAE-10 oil to the Grader hydraulic controls at 1500 P.S.I. Follow the pump overhaul instructions shown on pages 109 to 115 inclusive.



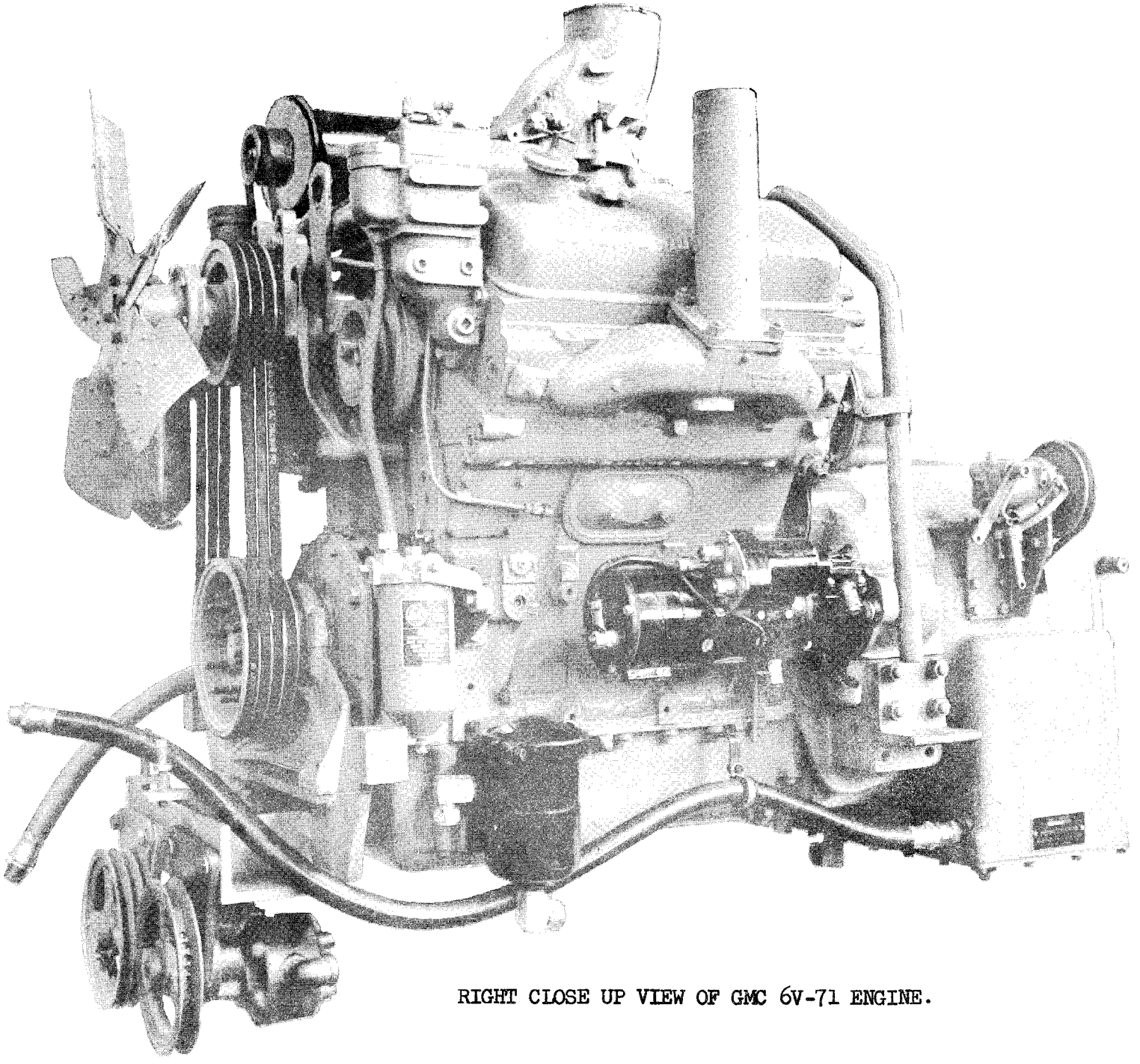
146. THE ABOVE SHOWS THE GMC 6V-71 ENGINE FUEL PIPING DIAGRAM.



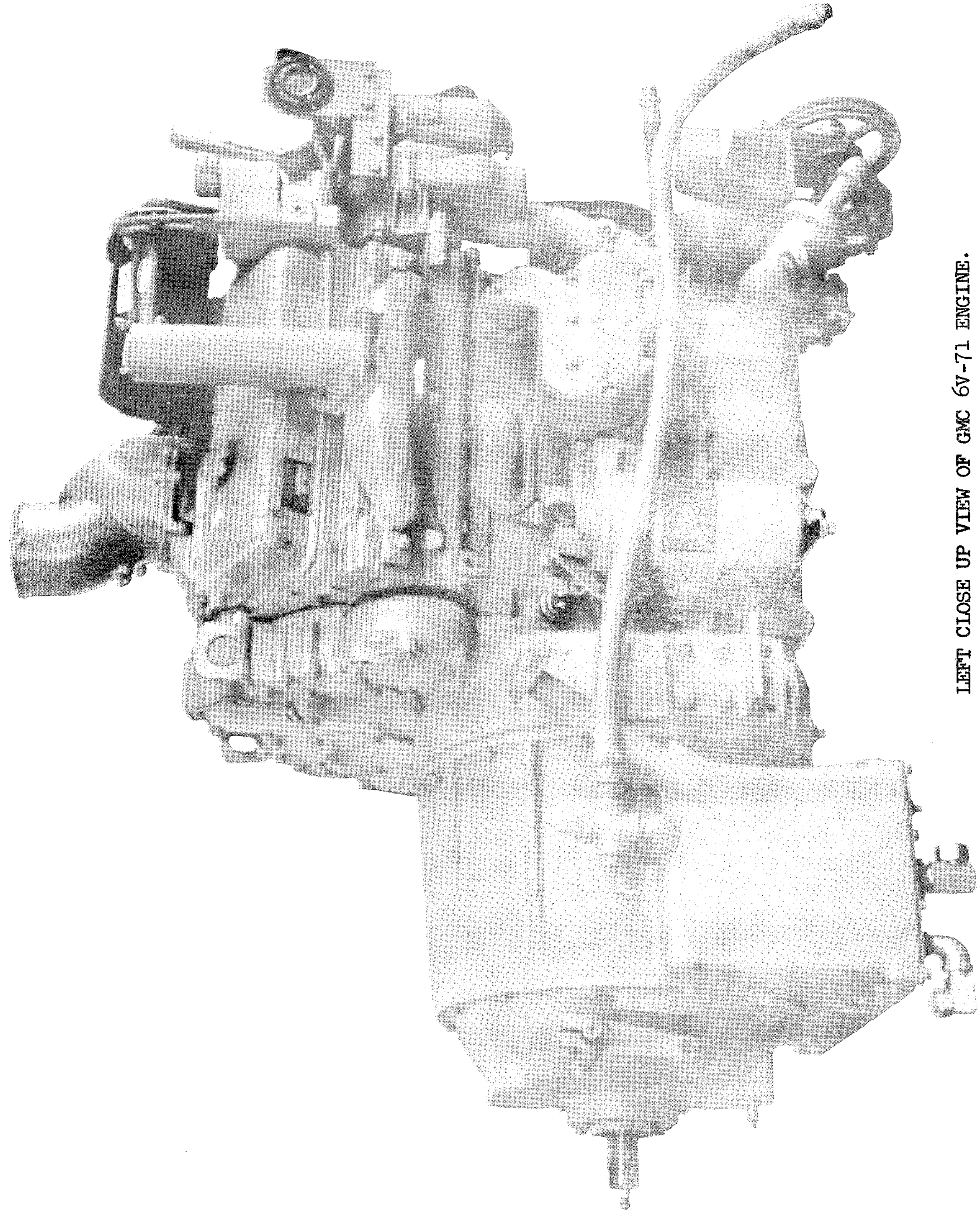
147. THE ABOVE SHOWS THE GMC 6V-71 ENGINE HAND THROTTLE AND GOVERNOR CONTROLS.



148. THE ABOVE DIAGRAM SHOWS THE GRADER HYDRAULIC PIPING AS APPLIED TO THE GMC 6V-71 ENGINE.



RIGHT CLOSE UP VIEW OF GMC 6V-71 ENGINE.



LEFT CLOSE UP VIEW OF GMC 6V-71 ENGINE.

150. STORAGE INSTRUCTIONS.

A. Preparing Engine for Storage.

When the grader is to be idle for a long period of time it should be stored in a dry and protected place.

1. The crankshaft must be turned several revolutions every 30 days.

2. The following procedure should be followed when the engine is placed in storage for sixty days or more.

Lubrication instructions should be repeated every six months after storage starts. If these precautions are not taken, there is great danger that the engine, pump, and nozzle parts will be seriously damaged by corrosion and gumming. Such damage can be very expensive and far outweigh the expense of the protection measures advocated.

After disconnecting the battery ground wire and protecting electrical parts, wash, steam, or otherwise thoroughly clean away all dirt and grease.

Drain the engine crankcase and oil filters and refill to proper level with specified clean lubricating oil. Drain the fuel tank and fuel filters.

3. Secure a clean one gallon can having screw top attached. Into the bottom of the can solder a suitable shut-off valve and connection. The Primary filter suction hose is to be attached to the bottom fitting of the can. Fill the can with a high quality rust preventing flushing oil.

The properties of flushing oils which render them useful for this type of application are: Good Aging Stability. High resistance to gumming, oxidation, and polymerization. Low Pour Point and Viscosity. Freedom from acids, asphalts, resins, tar, and water.

Open the shut-off valve at the fuel can. (Remove cap from can.) Fill the fuel oil filters, bleeding air from same. Start and run the engine (at about 1/4th throttle) on the oil in the gallon can. Running the engine in this way will clean the pump together with lines and nozzles of diesel fuel oil. Whatever oil isn't burned by the engine will be by-passed into the main fuel tank and may later be drained. Stop the engine just before the gallon can is empty. This is necessary in order that the fuel pump, together with fuel filter and lines, will be full of the clean oil while the engine is in storage.

4. Drain and flush entire cooling system. Loosen belt tension and wrap in paper. Partially disengage clutch and block the foot lever so clutch cannot accidentally be engaged. Remove battery and store in a warm dry place. Coat every exposed or polished metal surface with a generous amount of grease or other rust preventive. Seal every entrance to engine carefully to prevent entrance of moisture.

B. Removing Engine from Storage.

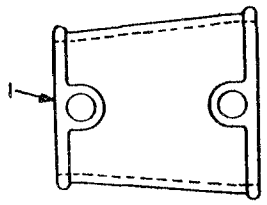
1. Remove the protecting covers and seals covering all entrances to the engine (exhaust pipe, air filter). Fill the fuel tank with clean fuel of the proper specifications, making sure the fuel filters are filled and bled of all air. Remove the paper from between the belts and pulleys and adjust the tension. Drain the crankcase and refill with oil of the proper viscosity. (See separate Engine Manual.)

2. Loosen air intake at top of the Intake manifold and pour about two tablespoons of lubricating oil into the manifold. Install fully charged batteries. Be sure the proper connections are made.

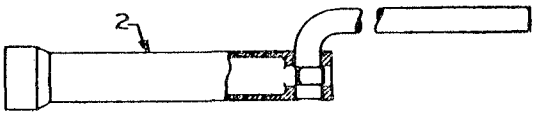
3. Start the engine and let it run slowly. CAUTION: Do not accelerate the engine rapidly or operate at high speed immediately after starting. Follow the instructions outlined in the separate Engine Manual.

151. TOOLS.

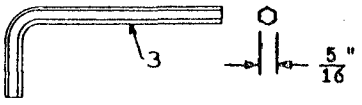
a. Standard Tools.



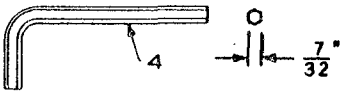
Front and Rear Wheel Bearing Wrench."Pacer" grader. (also for "Super" grader front wheels.)



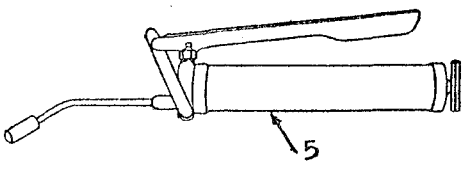
Wheel Stud Wrench.
"Pacer" and "Super" graders.



Front Axle Universal Joint Bearing Ring Cap Screw Wrench. "Super" grader only.

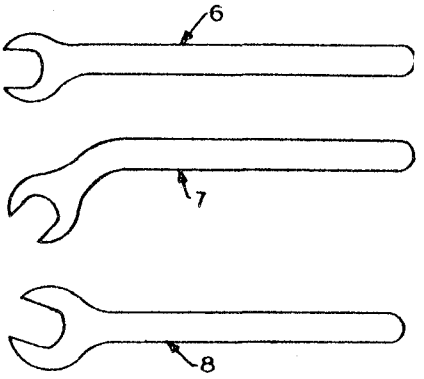


Hydraulic Control Valve Cap Screw Wrench For "Pacer" and "Super" graders.

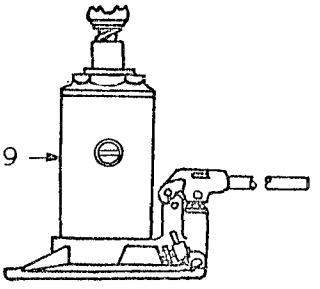


Grease Gun

b. Tools Furnished on Special Order Only.



Wrenches (6), (7), and (8) are for the hydraulic hose couplings. "Pacer" and "Super" graders.



Hydraulic Jack

NOTE: See Power Grader Repair Parts Catalog for part numbers of above tools (1) to (9) inclusive.

"PACER" AND "SUPER" GRADER TOOLS.