

# SHOP MANUAL

# ALLIS-CHAMBERS

## MODELS 170, 175

**Models 170 and 175 tractors are available in single wheel tricycle, dual wheel tricycle or adjustable front axle version. Model 170 and early 175 are equipped with either a 226 cubic inch non-diesel or 236 cubic inch diesel engine. Late Model 175 is equipped with either a 226 cubic inch non-diesel or a 248 cubic inch diesel engine.**

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## CONDENSED SERVICE DATA

### GENERAL

|                                     | Gasoline | Diesel  | Diesel  |
|-------------------------------------|----------|---------|---------|
| Engine Make . . . . .               | Own      | Perkins | Perkins |
| Cylinders . . . . .                 | 4        | 4       | 4       |
| Bore-Inches . . . . .               | 4        | 3.875   | 3.975   |
| Stroke-Inches . . . . .             | 4½       | 5       | 5       |
| Displacement-Cubic Inches . . . . . | 226      | 236     | 248     |
| Piston Removed From . . . . .       | Above    | Above   | Above   |
| Main Bearings, Number of. . . . .   | 3        | 5       | 5       |
| Main Bearings Adjustable? . . . . . | No       | No      | No      |
| Rod Bearings Adjustable? . . . . .  | No       | No      | No      |
| Cylinder Sleeves . . . . .          | Wet      | Dry     | Dry     |

### TUNE UP

|                        |             |         |         |
|------------------------|-------------|---------|---------|
| Firing Order . . . . . | 1-2-4-3     | 1-3-4-2 | 1-3-4-2 |
| Valve Tappet Gap (Hot) |             |         |         |
| Intake . . . . .       | 0.010-0.012 | 0.010   | 0.010   |
| Exhaust. . . . .       | 0.014-0.016 | 0.010   | 0.010   |

### TUNE-UP Cont.

|                                     |           |                  |         |
|-------------------------------------|-----------|------------------|---------|
| Valve Seat & Face                   |           |                  |         |
| Intake . . . . .                    | 30        | 45               | 45      |
| Exhaust. . . . .                    | 45        | 45               | 45      |
| Ignition Distributor Make . . . . . | D-R       | —                | —       |
| Mark Indicating:                    |           |                  |         |
| Retarding Timing. . . . .           | See       | —                | —       |
| Full Advanced Timing . . . . .      | Paragraph | —                | —       |
| Mark Location . . . . .             | 117       | —                | —       |
| Breaker Point Gap . . . . .         | 0.022     | —                | —       |
| Spark Plug Gap . . . . .            | 0.025     | —                | —       |
| Injection Pump Make . . . . .       | —         | CAV              | CAV     |
| Injection Pump Timing . . . . .     | —         | See Paragraph 98 |         |
| Compression Pressure                |           |                  |         |
| at Cranking Speed. . . . .          | 160       | 390-410          | 390-410 |
| Low Idle RPM . . . . .              | 525       | 600              | 600     |
| High Idle RPM . . . . .             | 2000      | 2000             | 2000    |
| Full Load RPM . . . . .             | 1800      | 1800             | 1800    |

# SINGLE WHEEL TRICYCLE

**1. WHEEL ASSEMBLY.** The single front wheel assembly may be removed after raising front of tractor and removing bolts (3—Fig. 1) at each end of front wheel spindle (1).

To renew bearing and/or seals, first remove wheel assembly; then, unbolt and remove bearing retainer (10—Fig. 2), seal (4), seal retainer (5) and shims (9). Drive or press on opposite end of spindle to remove spindle (8), bearing cones (7) and bearing cup from retainer side of hub. Then drive remaining seal and bearing cup out of hub. Remove bearing cones from spindle.

Soak new felt seals in oil prior to installation of seals and seal retainers. Drive bearing cup into hub until cup is firmly seated. Drive bearing cones tightly against shoulders on spindle. Pack bearings with No. 2 wheel bearing grease. Install spindle and bearings in hub and drive remaining bearing cup in against cone. When installing bearing retainer, vary the number of shims (9) to give free rolling fit of bearings with no end play.

Front wheel bearings should be repacked with No. 2 wheel bearing grease after each 500 hours of use.

**CAUTION:** If necessary to renew single front wheel hub or repair tire, completely deflate tire before unbolting tire retaining rings.

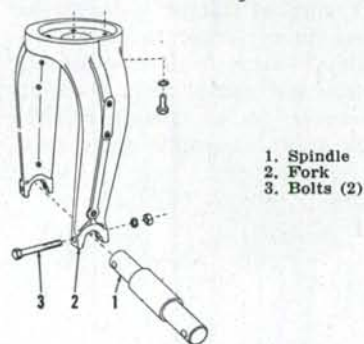


Fig. 1 — Exploded view of single front wheel fork and associated parts.

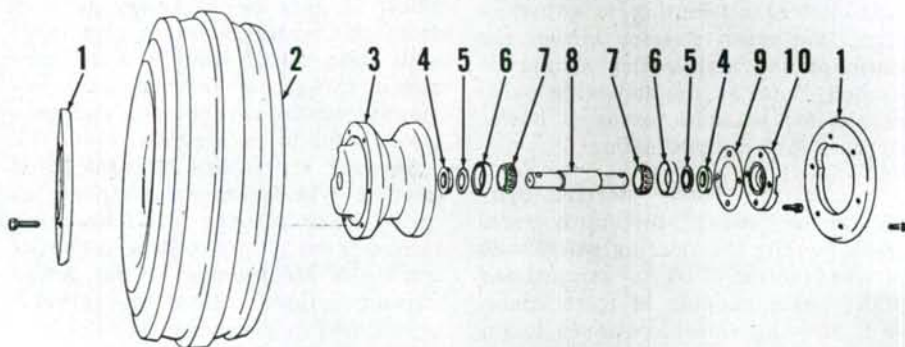


Fig. 2 — Exploded view of single front wheel assembly.

1. Nut
2. Washer
3. Bearing cone
4. Bearing cup
5. Wheel hub
6. Bearing cup
7. Bearing cone
8. Wear sleeve
9. Seal
10. Bearing spacer
11. Spacer shield
12. Spindle

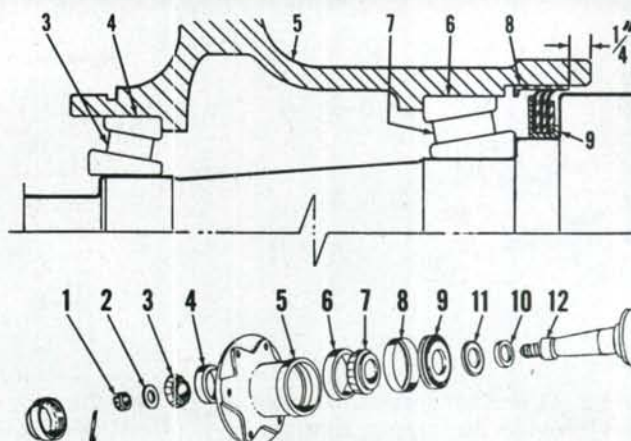


Fig. 3 — Views of front wheel hub assembly used on dual front wheel tricycle models. Wide front axle models are similar except spacer (10) and shield (11) are not used.

**2. R&R SINGLE FRONT WHEEL FORK.** Remove wheel assembly as outlined in paragraph 1. Then unbolt and remove fork (2—Fig. 1) from steering sector shaft (14—Fig. 14).

When reinstalling fork, tighten the retaining cap screws to a torque of 130-140 Ft.-Lbs.

# DUAL WHEEL TRICYCLE

**3. WHEEL ASSEMBLY.** Front wheel and bearing construction on dual wheel tricycle models is of conventional design. Stamped steel wheel disc is reversible on hub. Bearing adjustment is made by tightening retaining nut on spindle until bearings are firmly seated and then backing nut off one castellation and installing cotter pin. Bearings should be repacked with No. 2 wheel bearing grease after each 500 hours of use.

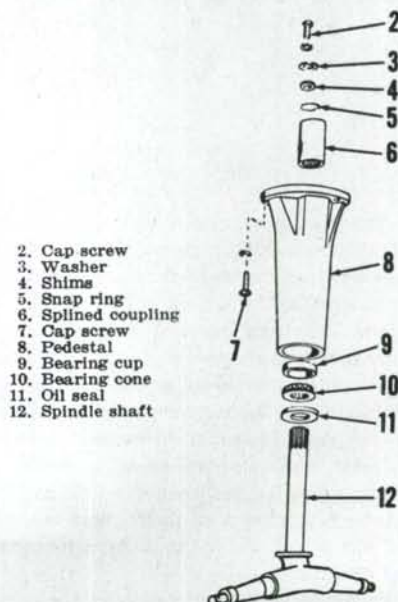
The three lips on outside diameter of seal (9—Fig. 3) contact steel wear sleeve (8) which is pressed into the front wheel hub. Install spacer shield (11) and spacer (10) on spindle. Install seal on spindle with large diameter metal flange (with name and number) out toward bearing (7). Pack

wheel bearings with No. 2 wheel bearing grease and install inner cone in cup. Drive wear sleeve into hub with crimped edge of wear sleeve towards bearing. Edge of wear sleeve should be 1/4-inch past flush with hub.

**4. R&R PEDESTAL.** Raise front of tractor, then remove cap screws retaining pedestal to front support casting. The splined coupling (6—Fig. 4) will be removed with the pedestal assembly.

When reinstalling pedestal, hold steering wheel in the center (straight ahead) position and install pedestal with wheels in straight ahead position (caster to rear).

**5. OVERHAUL.** To overhaul the removed unit, remove cap screw (2—Fig. 4), washer (3), shims (4) and coupling (6). NOTE: Make certain that



2. Cap screw
3. Washer
4. Shims
5. Snap ring
6. Splined coupling
7. Cap screw
8. Pedestal
9. Bearing cup
10. Bearing cone
11. Oil seal
12. Spindle shaft

Fig. 4—Exploded view of dual wheel tricycle pedestal and associated parts.

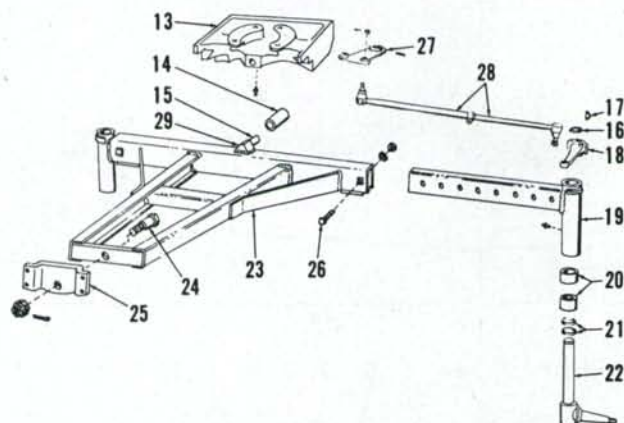


Fig. 5—Exploded view of typical adjustable axle and associated parts. Radius rod (23) is welded to axle main member (29).

- 13. Axle support
- 14. Bushing
- 15. Axle pivot
- 16. Snap ring
- 17. Woodruff key
- 18. Spindle arm
- 19. Spindle support
- 20. Bushings
- 21. Thrust washers
- 22. Front axle spindle
- 23. Radius rod
- 24. Radius rod pivot bolt
- 25. Pivot strap
- 26. Cap screw
- 27. Center steering arm
- 28. Tie rod
- 29. Axle main member

shims (4) are not lost or damaged as they provide the proper bearing adjustment. With splined coupling removed, spindle shaft can be withdrawn from pedestal. Pack bearing (10) with No. 2 wheel bearing grease. Oil seal (11) is of the lip type and should be installed with lip towards bearing. Coupling should be installed on spindle shaft with end of coupling nearest internal snap ring downward. When reassembling, vary the number of shims (4) to provide shaft with a free rolling fit and no end play.

#### ADJUSTABLE FRONT AXLE

**6. WHEEL ASSEMBLY.** Front wheel and bearing construction on wide front axle models is of conventional design. Stamped steel wheel disc is reversible on hub. Bearing adjustment is made by tightening retaining nut on spindle until bearings are firmly seated; then, backing nut off one castellation and installing cotter pin. Bearings should be repacked with No. 2 wheel bearing grease after each 500 hours of use.

The three lips on outside diameter of seal (9—Fig. 3) contact a steel wear sleeve (8) that is pressed into the wheel hub. Install the seal over spindle with large diameter metal flange (with name and number) out toward bearing (7). Pack wheel bearings with No. 2 wheel bearing grease and install inner cone in cup. Drive the wear sleeve into hub with crimped edge of sleeve towards bearing. Edge of wear sleeve should be 1/4-inch past flush with hub.

**7. ADJUSTMENTS.** Front wheel toe-in should be checked after each tread width adjustment on adjustable front axle models. All wide front axle models are provided with toe-in alignment marks; however, it is advisable to measure front wheel toe-in and adjust to 1/16-1/8-inch if necessary. Be sure that the tie rod clamps are securely tightened.

**8. REMOVE AND REINSTALL.** Support tractor, and disconnect tie rods from center steering arm (27—Fig. 5). Detach radius rod rear pivot from torque tube and lower rear of

radius rod. NOTE: Some rear pivots may be different from type shown in Fig. 5. Move front axle assembly rearward and roll axle assembly away from tractor. Axle support (13) can be removed from the front support after removing the attaching cap screws. Center steering arm is attached to steering shaft with a roll pin.

#### STEERING KNUCKLES (SPINDLES)

**9.** The procedure for removing the spindle is evident after an examination of the unit and reference to Fig. 5. Bushings (20) should be installed flush with spindle support (19). These bushings are pre-sized and if carefully installed will need no reaming. Tie-rod length should be varied to provide a toe-in of 1/16-1/8-inch.

#### FRONT SPLIT

Detaching (splitting) the front wheels and steering gear assembly from tractor is a partial job required in several other jobs such as removing the timing gear cover.

**10.** To detach (split) the front wheels and steering gear assembly from tractor, first remove the grille and hood. Drain coolant from radiator and disconnect upper and lower radiator hoses. Unbolt and remove the radiator and radiator shell as a unit. Disconnect tubes from the steering cylinder, support tractor under torque tube and unbolt front support from side rails. On wide front axle models, disconnect the radius rod from its pivot bracket. On all models, roll the complete front assembly away from tractor.

## STEERING SYSTEM

Tractors are equipped with a hydrostatic steering system that has no mechanical linkage between the steering wheel and tractor front wheels. The control valve unit (Fig. 8) contains a rotary metering motor, a commutator feed valve sleeve and a selector valve spool. In the event of engine or hydraulic power failure, the metering motor becomes a rotary pump to actuate the power steering cylinder when steering wheel is turned. A check valve in the control valve housing allows recirculation of fluid within the control valve and steering cylinder during manual operation.

Power for the steering system is supplied by a gear type pump mounted on right side of the torque tube.

#### TROUBLE SHOOTING

**11.** Before attempting to adjust or repair the power steering system, the cause of any malfunction should be located. Refer to the following paragraphs for possible causes of power steering system malfunction:

**Irregular or "Sticky" steering.** If irregular or "sticky" feeling is noted when turning the steering wheel with forward motion of tractor stopped and with engine running at rated speed, or if steering wheel continues to rotate after being turned and released, foreign material in the power steering fluid is the probable cause of trou-

ble. Renew the throw-away type oil filter. It may be necessary to also drain the hydraulic sump and refill with clean oil. If trouble is not corrected, the power steering valve assembly should be removed and serviced; refer to paragraphs 15 and 16.

**Steering Cylinder "Hesitates".** If steering cylinder appears to pause in travel when steering wheel is being turned steadily, probable cause of trouble is air trapped in the power steering cylinder. Bleed the cylinder as outlined in paragraph 12.

**Slow Steering.** Slow steering may be caused by low oil flow from pump. Check time required for full stroke

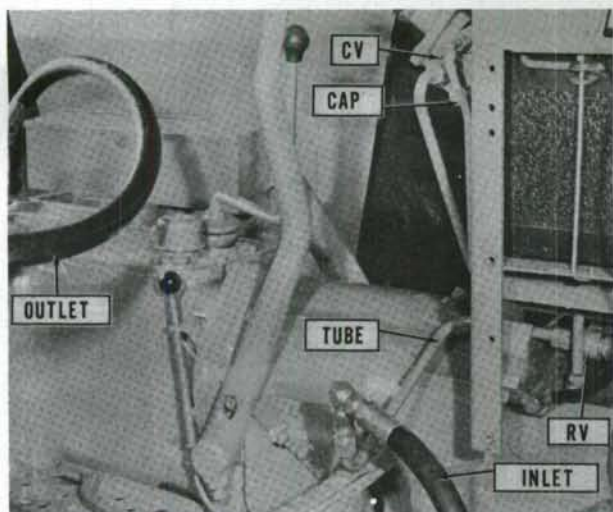


Fig. 6—View of connections for checking power steering system. Inlet port of the steering control valve (CV) must be capped before engine is started.

travel of power steering cylinder; first with tractor on the front wheels, then with front end of tractor supported by a jack. If time between the two checks varies considerably, overhaul the power steering pump as outlined in paragraph 186.

**Loss of Power.** Loss of steering power may be caused by system pressure too low. Check and adjust relief valve setting as outlined in paragraph 13.

#### LUBRICATION AND BLEEDING

12. The torque housing compartment is utilized as a reservoir for the hydraulic systems including power steering. Capacity is approximately 26 quarts and only "Allis-Chalmers Hydraulic Power Fluid 322" or automatic transmission oil type "A" suffix "A" should be used. The oil level can be checked at the filler plug which is located forward and to the left of gear shift lever. Make certain that lift arms are lowered and hydraulic cylinders are retracted.

The power steering system is usually self-bleeding. With engine running at high idle speed, cycle the system through several full strokes of the cylinder. In some cases, it may be necessary to loosen connections at cylinder to bleed trapped air.

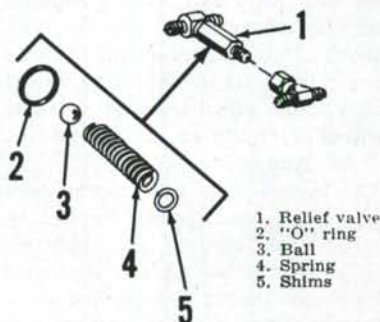


Fig. 7—Exploded view of the relief valve assembly. Refer to B—Fig. 10 for location.

#### TESTS AND ADJUSTMENTS

13. A pressure and volume (flow) test of the power steering system will disclose whether the pump or relief valve is malfunctioning. To make such a test proceed as follows:

Remove hood right rear side panel and disconnect steering system inlet tube from the steering control valve and install a cap over inlet port of valve. Connect a pressure-volume tester inlet hose to steering system inlet tube as shown in Fig. 6. Connect the outlet hose from tester to sump return tube or transmission filler opening so that oil will be returned to the reservoir. Start the engine and adjust speed to 1800 RPM. Close valve on tester until pressure is 1000 PSI and allow oil temperature to reach 120-135 degrees F.

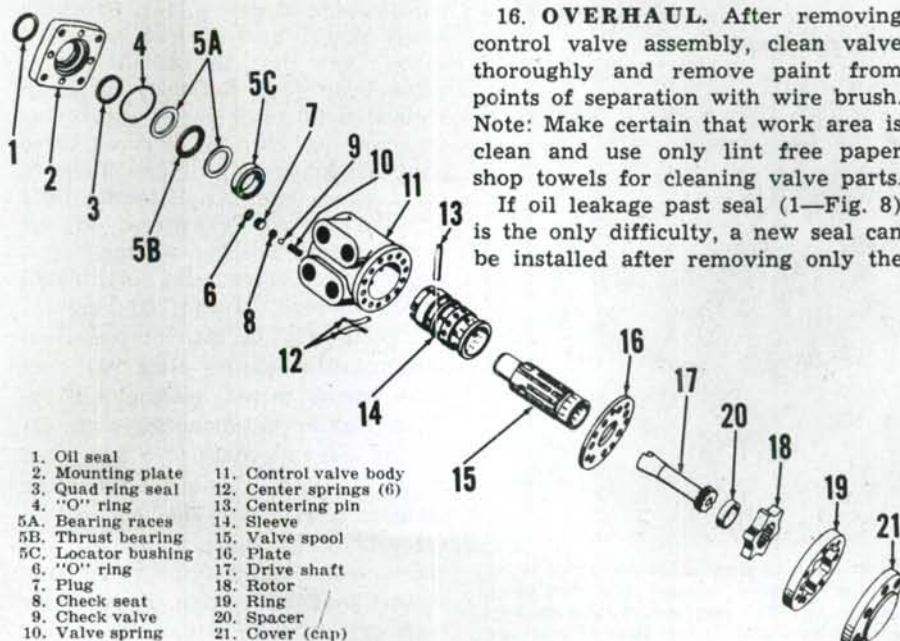


Fig. 8—Exploded view of steering control valve assembly. Centering springs (12) are installed in two groups of three springs with arch in each group back-to-back.

Close the valve on tester completely and check pressure gage. If relief pressure is not 1100-1200 PSI, disassemble relief valve (Fig. 7) and add or deduct shims (5) to set pressure.

The addition of one shim should raise the relief pressure approximately 50 PSI. Open the valve on tester slightly until pressure is 200 PSI below the relief pressure and observe volume of flow. With engine operating at 1800 RPM and pressure 200 PSI below relief pressure, volume should be 6 GPM. If volume of flow is too low, the pump should be serviced as outlined in paragraph 186.

#### POWER STEERING PUMP

14. A gear type pump located on right side of torque tube is used as the power source for the steering system. The power steering pump is an integral part of the hydraulic system pump and the "Traction Booster" pump. For service information on the three section pump, refer to paragraph 185.

#### CONTROL VALVE

##### 15. REMOVE AND REINSTALL.

Remove cover from below steering column and disconnect the four tubes from control valve. Unbolt and remove control valve assembly from the steering shaft housing.

Reinstall the control valve by reversing the removal procedure. Refer to Fig. 9 for proper hose locations. Install new "O" ring seals on the hose fittings before connecting hoses to control valve and tighten fittings securely. Bleed trapped air from the power steering cylinder as outlined in paragraph 12 after assembly is completed.

16. **OVERHAUL.** After removing control valve assembly, clean valve thoroughly and remove paint from points of separation with wire brush. Note: Make certain that work area is clean and use only lint free paper shop towels for cleaning valve parts.

If oil leakage past seal (1—Fig. 8) is the only difficulty, a new seal can be installed after removing only the

mounting plate (2). Remove plug (7) from valve body using a bent wire inserted through out port (Fig. 9). Install new "O" ring (6—Fig. 8) on plug, lubricate plug and "O" ring with oil and reinstall in valve body. Install new quad seal (3) and "O" ring (4) in mounting plate and tighten retaining cap screws equally to a torque of 250 inch-pounds.

To completely disassemble and overhaul the control valve, refer to exploded view in Fig. 8 and proceed as follows: Clamp valve in vise with end cap (21) up and remove end cap retaining screws. Remove end cap (21), gerotor set (18 & 19), plate (16) and drive shaft (17) from valve body as a unit. Remove valve from vise, place a clean wood block in vise throat and set valve assembly on block with mounting plate (2) end up. Lightly clamp vise against port face of valve body and remove mounting plate retaining screws. Hold spool assembly down against wood block while removing mounting plate. Remove valve body from vise and place on work bench with port face down. Carefully remove spool and sleeve assembly from 14-hole end of valve body. Use bent wire inserted through outlet port to remove check valve plug (7) and use  $\frac{1}{8}$ -inch Allen wrench to remove check valve seat (8). Then remove check valve  $\frac{1}{4}$ -inch steel ball (9) and spring (10) from valve body.

Remove centering pin (13) from spool and sleeve assembly, and push spool (splined end first) out of sleeve. Remove the six centering springs (12) from slot in spool.

Separate the end cap and plate from the gerotor set and remove the drive shaft, rotor and spacer.

Inspect all moving parts for scoring. Slightly scored parts can be cleaned by hand rubbing with 400 grit abrasive paper. To recondition gerotor section surfaces, place a sheet of 600 grit paper on plate glass, lapping plate or other absolutely flat surface. Stroke each surface of the gerotor section over the abrasive; any small bright areas indicate burrs that must be removed. Polish each part, rinse in clean solvent and air dry; keep these parts absolutely clean for reassembly.

Renew all parts that are excessively worn, scored or otherwise damaged. Install new seal kit when reassembling.

To reassemble valve, proceed as follows: Install check valve spring (10) with small end out. Drop check valve ball (9) on spring and install valve seat (8) with counterbored side towards valve ball. Tighten seat to a torque of 150 inch-pounds. Lubricate valve spool and carefully insert spool (15) in valve sleeve (14) using a twisting motion. Stand the spool and sleeve assembly on end with spring slots up and aligned. Assemble centering springs (12) in two groups with extended edges of springs down. Place the two groups of springs back-to-back (arched sections together) and install the springs into the spring slots in sleeve and spool in this position. Use a small screwdriver to guide springs through slots in opposite side of assembly. Center the springs with edges flush with upper surface of sleeve. Insert centering pin (13) through spool and sleeve assembly so that both ends of pin are below flush with outside of sleeve (14). Carefully insert spool and sleeve assembly, splined end first, in 14-hole end of valve body (11). Set body on clean surface with 14-hole end down. Install new "O" ring (6) in check valve plug (7), lubricate plug and insert in check valve bore. Install locator (5C) in valve bore with chamfered side up. Install thrust bearing assembly (5A and 5B) over valve spool (15). Install new quad seal (3) and "O" ring (4) in mounting plate (2), lubricate seal and install mounting plate (2) over valve spool, thrust bearing and locator. Tighten the mounting plate retaining screws evenly to a torque of 250 inch-pounds. Clamp the mounting plate in a vise with 14-hole end of valve body up. Place plate (16) and gerotor outer ring (19) on valve body so that bolt holes align. Insert drive shaft (17) in gerotor inner rotor (18) so that slot in upper end of shaft is aligned with valleys in rotor and push

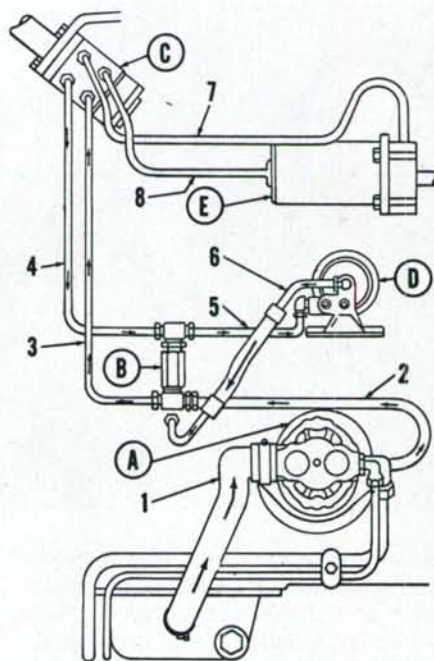


Fig. 10 — Drawing of the steering system components and tubes.

- A. Pump
- B. Relief valve
- C. Control valve
- D. Filter
- E. Steering cylinder
- 1. Suction tube
- 2. Pump pressure tube
- 3. Steering pressure tube
- 4. Outlet tube
- 5. Outlet tube
- 6. Return tube
- 7. Left turn tube
- 8. Right turn tube

shaft through rotor so that about  $\frac{1}{2}$  of length of the splines protrude. Holding the shaft and rotor in this position, insert them in valve housing so that notch in shaft engages centering pin in valve sleeve and spool. Install spacer (20) at end of drive shaft; if spacer does not drop down flush with rotor, shaft is not properly engaged with centering pin. Install end cap (21) and tighten the retaining screws equally to 150 inch-pounds torque.

## FRONT SUPPORT

**18. REMOVE AND REINSTALL.** Remove grille, hood, air cleaner and front support breather. Drain coolant from radiator, then disconnect radiator hoses. Unbolt radiator shell from front support and side rails, then remove the radiator and shell as a unit. Support front of torque tube and remove the single front wheel fork and wheel assembly, dual wheel tricycle pedestal and wheel assembly or the wide front axle and support assembly.

**NOTE:** On wide front axle models, drive the pin out of center steering arm and remove the center steering arm from the steering shaft. On all models, disconnect tubes from the steering cylinder and cover the openings. Attach hoist to the front support; then, unbolt and remove front support from side rails.

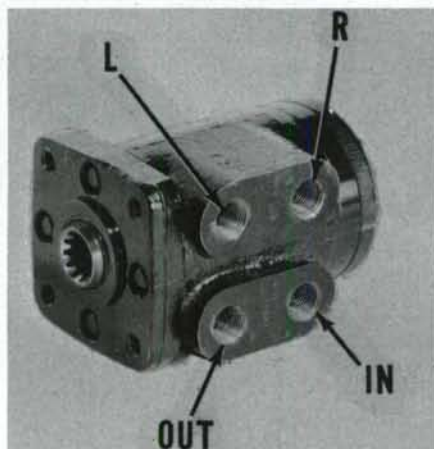
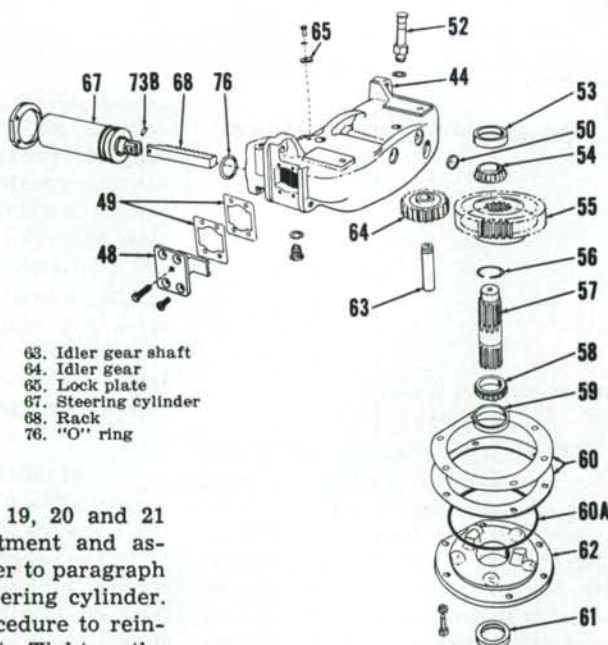


Fig. 9—View of steering control valve showing port locations. Pressure tube from pump connects to "IN" port; return tube to sump connects to "OUT" port; tube to rear end of cylinder connects to "L" (left turn) port, and tube to rod end of cylinder connects to "R" (right turn) port.

Fig. 13 — Partially exploded view of the power steering front support. For exploded views of the control valve unit and ram refer to Figs. 8 and 15.

- 44. Front support
- 48. Rack adjusting block
- 49. Rack adjusting shims (0.003 & 0.005)
- 50. Plug
- 52. Breather
- 53. Bearing cup
- 54. Bearing cone
- 55. Sector gear
- 56. Snap ring
- 57. Steering shaft
- 58. Bearing cone
- 59. Bearing cup
- 60. Shims (0.005 & 0.010)
- 61. Oil seal
- 62. Bearing support



Refer to paragraphs 19, 20 and 21 for disassembly, adjustment and assembly procedures. Refer to paragraph 22 for servicing the steering cylinder.

Reverse removal procedure to reinstall the front support. Tighten the screws attaching front support to side rails to 310-320 Ft.-Lbs. torque. Refill front support with "Allis-Chalmers Special Gear Lube". Capacity is approximately  $3\frac{1}{4}$  quarts and oil should be maintained at  $\frac{1}{8}$ -inch above gears.

**19. DISASSEMBLY.** With the front support removed as outlined in paragraph 18, proceed as follows: Unbolt bearing support (62—Fig. 13 or 9—Fig. 14), then withdraw steering shaft and sector gear from front support casting. **CAUTION:** Do not lose or damage shims (60—Fig. 13) on dual wheel tricycle or wide front axle models. On all models, unbolt and remove rack adjusting block (48) and steering cylinder (67). **CAUTION:** Do not lose or damage shims (49). Remove idler shaft lock (65), then pull idler shaft (63) out top of front support casting. **NOTE:** Top end of idler shaft is threaded for using a puller screw. Withdraw idler gear through bottom opening. Further disassembly will be evident after examining Figs. 13 and 14.

Thoroughly clean the front support casting and inspect all gears, bearings and shafts. Any excessive play between steering unit gears or looseness of sector gear on steering shaft may cause shimmy of front wheels. Refer to paragraph 22 for servicing the steering cylinder.

**20. ADJUSTMENT.** Rack mesh position and steering shaft end play are adjustable. Each adjustment must be accomplished with only a minimum of parts installed in the front support casting.

On models with single front wheel, adjust steering shaft bearings as follows: Install both bearing cups (7 & 11—Fig. 14) in bearing support (9)

until firmly seated. Pack the lower bearing cone (12) with No. 2 wheel bearing grease and position cone in the lower cup (11). Use sealer on outside diameter of seal (13) and drive seal into support (9) with lip toward bearing (11 & 12). Install new "O" ring (10) in groove on steering shaft (14). Insert steering shaft through seal and lower bearing cone until shoulder on shaft is seated against bearing cone (12). Install the upper bearing cone (6) on shaft. Install sector gear (5) on shaft splines with mark on top of gear hub aligned with the marked spline of shaft. Install cap screw (1), lock washer (2), flat washer (3) and shims (4). Vary the thickness of shims (4) to provide a slight pre-load on bearings when screw (1) is tight. It is not necessary to install the steering shaft, support and bearings assembly in the front support casting to assemble or adjust. The unit should not be installed until correct rack mesh position is adjusted.

On dual wheel tricycle and wide front axle models, adjust the steering shaft bearings as follows: Drive the lower bearing cup (59—Fig. 13) into bearing support (62) and upper bearing cup (53) into the front support casting until cups are firmly seated against shoulders in bores. Apply sealer to outside diameter of seal (61) and install seal in bearing support with lip towards bearing cup (59). Install snap ring (56) in groove on steering shaft (57) and drive the lower bearing cone (58) tight against snap ring. Install sector gear (55) on steering shaft with protruding hub down (against snap ring) and timing mark on top of gear hub aligned with

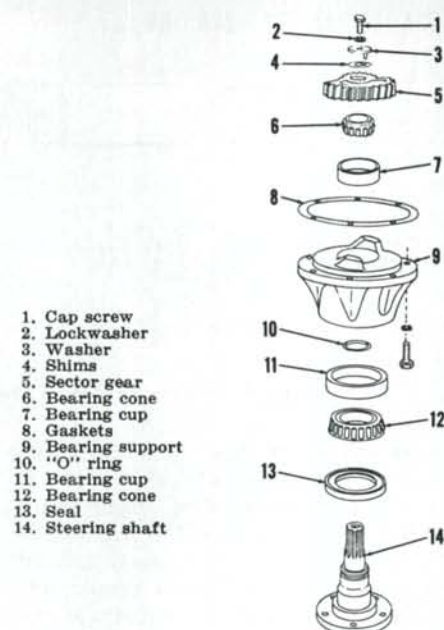


Fig. 14 — On single front wheel tricycle models, above parts are used in steering gear instead of items 53 through 62 shown in Fig. 13. Mark on hub of sector gear (5) must be aligned with punch mark on top of sector shaft (14).

mark on steering shaft. **NOTE:** Mark on shaft is located in the undercut area of bearing surface above the splines. Be sure that hub of gear is tight against snap ring (56) and install the upper bearing cone (54) tightly, against sector gear. Install the steering shaft, gear and bearing support assembly (parts 54 thru 62 except "O" ring (60A) using shims (60) that were removed. Tighten the two bearing support retaining screws to 90-100 Ft.-Lbs. torque and check steering shaft for looseness or binding. Vary the number and thickness of shims (60) to provide a free rolling fit with no end play. After the correct number and thickness of shims (60) is determined, remove the steering shaft assembly and adjust the rack mesh position. **NOTE:** Make certain that the correct shims are not lost or damaged. The steering sector gear must be removed when checking rack mesh position.

To adjust the rack mesh position on all models, position idler gear (64—Fig. 13) through hole in bottom of the front support casting with oil hole in gear toward top. Install idler shaft (63) and retain in position with plate (65). **CAUTION:** Do not damage the threads when installing the idler shaft. Insert rack (68); then, install adjusting block (48) using the shims (49) that were removed. **NOTE:** When checking rack mesh position, rack (68) must be detached from the steering cylinder piston rod. The rack should

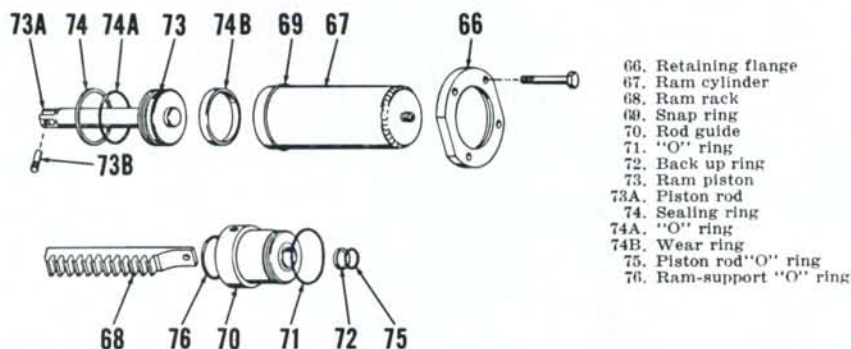


Fig. 15 — Exploded view of the power steering ram (cylinder).

move freely without any backlash. Vary the number of shims (49) if rack is loose or binding. Paper shims (0.005 thick) and steel shims (0.003 thick) should be alternately placed for proper sealing. When proper adjustment is obtained, withdraw the rack (68), leaving the adjusting block (48) and the correct shims (49) installed. Attach rack (68) to the piston rod (73A—Fig. 15) with pin (73B). Head of pin (73B) must be on toothed side of rack (68). Rivet the pin securely in position taking care not to draw ears of piston rod together.

**21. ASSEMBLY.** When assembling, refer to paragraph 20 for adjustment and assembly of the steering cylinder rack, idler gear and sector assembly. The steering cylinder and steering shaft must be correctly timed (centered) for correct operation as follows:

Pull the rack (68—Fig. 15) out of the steering cylinder (67) as far as possible, then mark the rack  $2 \frac{1}{16}$ - $2 \frac{3}{32}$  (2.08) inches from front edge of piston rod guide (70). Push the rack back into cylinder until the mark

is aligned with edge of piston rod guide. Loosen the screws attaching the rack adjusting block (48—Fig. 13) and install the steering cylinder using new "O" ring (76). **CAUTION:** With the previously affixed mark aligned with front edge of rod guide, the steering piston is correctly centered and must not be moved until after the sector gear is installed.

On models with single front wheel, install the steering shaft assembly (Fig. 14) with mark on edge of steering shaft flange in straight forward (centered) position. **CAUTION:** Make certain that idler gear and rack are not moved while installing steering shaft assembly. Make certain that installation is correct by turning steering shaft (14) in both directions and observing the mark on flange. Tighten the support retaining  $\frac{1}{2}$ -inch screws to 90-100 Ft.-Lbs. torque and the  $\frac{5}{8}$ -inch screws to 130-140 Ft.-Lbs. torque.

When installing the steering shaft assembly on dual wheel tricycle and wide front axle models, use the previously selected shims (60—Fig. 13) and new "O" ring (60A). Position the

steering shaft with marks on sector gear (55) and shaft away from rack (68) and retaining pin hole for the center steering arm (27—Fig. 5) exactly across (left to right) the front support casting. Check operation by turning steering shaft (57—Fig. 13) in both directions. Tighten the two  $\frac{1}{2}$ -inch support retaining screws to 90-100 Ft.-Lbs. torque.

After assembling the front support, refill with approximately  $3\frac{1}{4}$  quarts of "Allis-Chalmers Special Gear Lube". Oil should be maintained  $\frac{1}{8}$ -inch above gears.

## STEERING CYLINDER

**22. R&R AND OVERHAUL.** To remove the steering cylinder (Fig. 15), it is necessary to remove the front support as outlined in paragraph 18, then disassemble the complete front support as in paragraph 19. With cylinder removed, remove rack attaching pin (73B), then withdraw rod guide (70) and piston (73) from cylinder.

Examine all parts and renew any that are scored or show excessive wear. Lubricate all parts prior to assembly and renew all seals. Before assembling rack (68) to piston rod (73A), the rack mesh position should be adjusted as outlined in paragraph 20.

After rack mesh position is adjusted, attach rack to piston rod with head of pin (73B) toward toothed side of rack (68). Rivet the pin securely in position taking care not to draw ears of piston rod together. When assembling the front support, steering cylinder and steering shaft must be correctly timed. Refer to paragraph 21 for assembly and timing procedure.

# ENGINE AND COMPONENTS

## R&R ENGINE WITH CLUTCH Non-Diesel

**25.** To remove the engine and clutch as a unit, first drain cooling system and, if engine is to be disassembled, drain oil pan. Perform a front split as outlined in paragraph 10 and proceed as follows: Disconnect the ground strap from battery; then, disconnect wiring from alternator and ignition coil. Remove the muffler, hood side sheets and air cleaner tube. Disconnect oil pressure gage wire, fuel line, choke cable, speed control cable and temperature gage wire from engine. Unbolt and remove both engine side rails. Support engine in hoist, remove the cap screws retaining engine adapter

plate to torque housing, separate the engine from torque housing and move the engine to a stand or work bench.

Reinstall engine and clutch unit by reversing removal procedures.

## Diesel

**26.** To remove the diesel engine and clutch as a unit, first drain the cooling system and, if engine is to be disassembled, drain the oil pan. Perform a front split as outlined in paragraph 10 and proceed as follows:

Disconnect ground strap from batteries; then, disconnect wiring from alternator. Disconnect tubes from air cleaner.

Remove the main fuel line running to the primary filter and the fuel leak-off line from fuel tank to engine. Remove the muffler and hood side sheets. Disconnect throttle and fuel shut-off cables. Disconnect the oil pressure gage wire and the temperature wire from engine. Unbolt and remove both engine side rails. Support engine in hoist, remove the cap screws retaining engine adapter plate to torque housing, separate engine from torque housing and move the engine to a stand or bench.

Reinstall engine and clutch unit in reverse of removal procedure. Bleed the fuel system as outlined in paragraph 86.

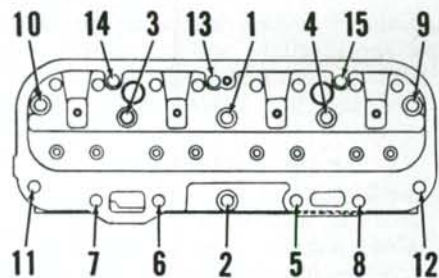


Fig. 20 — Tighten non-diesel cylinder head cap screws and stud nuts in sequence shown. Refer to text for torque specifications.

### CYLINDER HEAD

#### Non-Diesel

**27. REMOVE AND REINSTALL.** To remove the cylinder head, first drain the cooling system, shut off fuel and remove hood. Remove the air cleaner tube and disconnect the carburetor link, fuel line and choke cable from carburetor. Unbolt and remove manifolds, carburetor and muffler as a unit. Disconnect the temperature gage wire and remove the four nuts from cylinder head studs that extend through the water manifold (thermostat housing) and core hole cover. Disconnect upper hose from radiator and by-pass hose from water pump; then, remove the thermostat housing and hoses as a unit. Disconnect spark plug wires and oil line to cylinder head. Remove the rocker arm cover, rocker arm assembly and push rods. Remove cylinder head retaining cap screws and lift head from engine.

When reinstalling cylinder head, reverse removal procedures and tighten the head retaining cap screws and stud nuts in order shown in Fig. 20. Tighten the  $\frac{1}{2}$ -inch cap screws and the four stud nuts to a torque of 90-

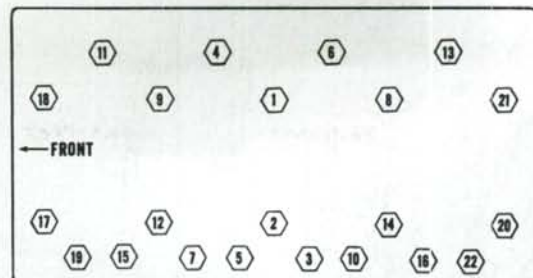


Fig. 22—On diesel models, tighten cylinder head stud nuts to a torque of 85 Ft.-Lbs. using the sequence shown.

95 Ft.-Lbs. and the  $\frac{1}{8}$ -inch cap screws to a torque of 70-75 Ft.-Lbs. Recheck torque after engine has reached operating temperature.

#### Diesel

**28. REMOVE AND REINSTALL.** To remove the cylinder head, first drain cooling system, remove hood and shut off the fuel. Disconnect upper radiator hose and heat indicator sending unit wire from side of head. Remove manifolds, injector lines and injectors. Remove rocker arm cover, rocker arms and push rods; then unbolt and remove the cylinder head. NOTE: Tips of injectors protrude through cylinder head and may be damaged if not removed.

The cylinder block, head and head gasket are internally ported to provide pressure lubrication to rocker arms (see Arrow—Fig. 21). Make sure passages are open and aligned when head is reinstalled. Cylinder head may be milled to remove surface defects provided no more than 0.012 of metal is removed or total head thickness is not reduced below 4.0355. If head is resurfaced, valve height must be checked as outlined in paragraph 30.

Head gasket is marked "TOP FRONT" for proper installation. Gasket is treated and must be installed dry. Tighten cylinder head stud nuts to a torque of 85 Ft.-Lbs. using the sequence shown in Fig. 22. Adjust valve tappet gap as outlined in paragraph 31. Head should be re-torqued and tappet gap readjusted after engine has been warmed to operating temperature.

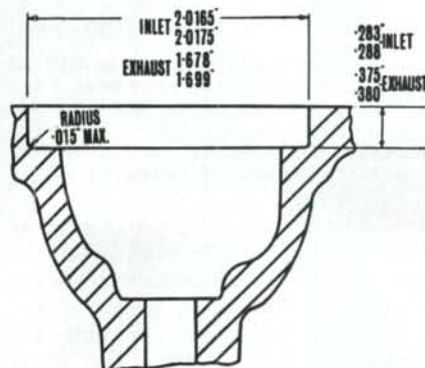


Fig. 24—Machining dimensions for installation of service valve seat inserts on diesel models.

### VALVES, SEATS AND ROTATORS

#### Non-Diesel

**29. Inlet valve** for non-diesel engines have a face and seat angle of 30 degrees. The seat width can be narrowed by using 15 and 70 degree stones to obtain the desired seat width of  $\frac{1}{8}$ -inch. Valve stem diameter is 0.3723-0.3730.

The exhaust valves for all non-diesel engines have a face and seat angle of 45 degrees. The seat width can be narrowed by using 30 and 60 degree stones to obtain the desired seat width of  $\frac{1}{8}$  to 5/64-inch. The exhaust valves seat in renewable ring type inserts which are available for service in standard size and one oversize. Exhaust valve stem diameter is 0.3713.

The positive type exhaust valve rotators require no maintenance, but the valve should be observed while engine is running to be sure that it rotates slightly. Renew the rotator on any exhaust valve that fails to turn.

Refer to paragraph 31 for setting tappet gap.

#### Diesel

**30. Intake and exhaust valves** seat directly in the cylinder head. Valve heads and seat locations are numbered consecutively from front to rear. Intake and exhaust valves have a face and seat angle of 45 degrees and a desired seat width of  $\frac{1}{8}$  to  $\frac{3}{32}$ -inch. Refer to paragraph 33 for valve stem and guide data.

Valve heads should be recessed a specified amount into the cylinder head. Clearance can be measured us-

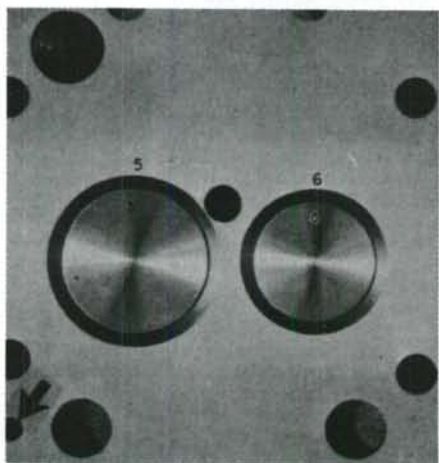


Fig. 21 — View of diesel cylinder head showing valves and valve numbers. Arrow indicates oil pressure passage to rocker arms.



Fig. 23 — Use a straight edge and feeler gage to check valve head height. Refer to paragraph 30.

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