

**KNOWLEDGE**

**MEANS**



**POWER**

**FARM EQUIPMENT**

**SERVICE MANUAL**

**ALLIS-CHALMERS**

TRACTOR GROUP MILWAUKEE, WIS.

**MODEL "G" TRACTOR**

**MODEL "B&C" TRACTOR**

**MODEL "CA" TRACTOR**

## FOREWORD

This book, covering the Service and Maintenance of the Model "G", "B & C", and "CA" Tractors manufactured by "Allis-Chalmers", contains material formerly incorporated in the loose leaf Farm Equipment Service Manual, "Knowledge Means Power".

It is material now seldom used, but never-the-less very valuable when needed. This is the last revision that will be made of these Sections, and you should retain this book for your permanent file.

For information listed under "General Section" in indexes, refer to "General Section" in loose leaf Farm Equipment Service Manual.

This book, like the material in loose leaf Farm Equipment Service Manual "Knowledge Means Power", is printed for the exclusive use of "Allis-Chalmers" Dealers in servicing and maintaining farm equipment manufactured by "Allis-Chalmers".

**G**

**B&C**

**CA**

PRICE \$1.00

ALLIS-CHALMERS MFG. CO.  
FARM EQUIPMENT DIVISION  
MILWAUKEE, WISCONSIN, U. S. A.

## SERVICE MANUAL FOR THE MODEL "G" TRACTOR

G

The engine for the model "G" tractor is mounted in the rear of the tractor. For purposes of identification, the engine will be referred to as crank end, flywheel end, manifold side and generator side. The No. 1 cylinder will be at the crank end of the engine.

The design of the model "G" tractor lends itself to a variety of procedure for following practical repair work. The following general procedure may be followed in removing major assemblies from the complete machine.

The complete engine may be removed as a unit. The engine must be removed to do any repair work on the clutch, throwout bearing, flywheel or oil pump.

The engine and clutch housing may be removed as a unit if the differential is to be removed or the transmission dismantled.

Removal of the complete engine assembly or of the clutch housing must be made if the belt pulley drive gear or engine intermediate gears need servicing.

The adjustment of the transmission shaft bearings and removal of the special low reduction gear may be accomplished if the torque tube is removed from tractor.

If the complete transmission and differential is to be repaired, the torque tube, the engine, clutch housing and the two wheel axle assemblies must be removed.

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MODEL "G" TRACTOR INDEX

<u>SUBJECT</u>	<u>G SECTION</u>	<u>SPECIFICATIONS</u>	<u>GENERAL SECTION</u>
AIR CLEANER	8	3	31
AMMETER	11		
BATTERY			40
BELT PULLEY	40	4	
BRAKES	29		
BRAKE PEDAL ADJUSTMENT	29		
CAMSHAFT	20	3	
CARBURETOR	12	3	22
CONNECTING ROD	22	3	
CLUTCH	25	4	
CLUTCH HOUSING	26		
CLUTCH HOUSING & ENGINE REMOVAL	17		
CLUTCH THROWOUT BEARING & FORK	26		
CRANKSHAFT	18	3	
CRANKSHAFT OIL SEALS	19		
CYLINDER HEAD	16		
DIAGNOSIS OF TRACTOR PROBLEMS			32
DIFFERENTIAL	31		
DISTRIBUTOR	14	3	
DRAWBAR	9		
ENGINE		3	
ENGINE OILING SYSTEM	24		
ENGINE REMOVAL	17		
ELECTRICAL SYSTEM	10	5	
FAN BELT	13		
FAN ASSEMBLY	7	5	
FLYWHEEL & RING GEAR	27		
FRONT AXLE & SPINDLE	36	5	
FRONT WHEELS	36		
FUEL			6
FUEL FILTER	30		
FUEL TANK	30	5	
GEAR SHIFT	34		
GENERATOR	11		
GOVERNOR	15	3	
GOVERNOR WEIGHT ASSEMBLY	16		
HOOD & HOOD SUPPORT	7		
HYDRAULIC PUMP	39		
IGNITION SWITCH	11		
INTERMEDIATE GEARS	26		
LIGHTS	11		
LIGHT SWITCH	10		
LOW GEAR (SPECIAL)	32		
MANIFOLD	36		
OIL SEALS, FRONT & REAR	17		
OIL PUMP	19	4	
OILING SYSTEM	24		
OIL PRESSURE RELIEF VALVE	21		
PISTONS & RINGS	22	4	
RING GEAR & FLYWHEEL	27		
RADIATOR	8	5	
REEL WHEEL & AXLE HOUSING	28		
SPECIFICATIONS	3		
STARTER	12		
STEERING GEAR	35		
SPARK PLUGS			17
SPECIAL LOW GEAR	32		
TIMING GEAR COVER	15		
TIMING ENGINE	14		
TRANSMISSION	32	5	
VALVES	21	4	19
WIRING DIAGRAM	10		



# SPECIFICATIONS

## ENGINE

### ENGINE

Type	L-Head 4 cycle
Cylinders	4
Bore	2-3/8"
Stroke	3-1/2"
Piston Displacement	62 Cu. In.
Engine Speed Full Load	1800 R.P.M.
Engine Speed High Idle	2100 R.P.M.
Engine Speed Low Idle	500 R.P.M.
Compression Ratio	
Prior to Eng. 23988	5-3/4 to 1
Eff. On Eng. 23988	5-5/8 to 1
Firing Order	1-3-4-2
Rotation	Clockwise
Compression Pressure (Starter Speed)	90 to 95 lbs.

### AIR CLEANER

Type	Oil Bath
Capacity	1/2 pint

### CAMSHAFT

Journal Size	
Front & Center	1-3/4"
Rear	1-1/4"
Clearance	.003" to .0045"
Replace-maximum	.007"
Thrust Plate	.147" to .149"
End Clearance	.005"
Replace at	.007"
Thrust Plate	
Capscrews	15 to 20 ft. lbs. torque

### CARBURETOR

Marvel Schebler	TSV - 13
Type	Updraft
Throttle Flange	5/8" SAE
Venturi	7/16"
Float Level	1/4" from nearest edge of float to top of bowl
Idle Needle Adj.	approx. 1-7/8 turn open

### CONNECTING ROD

Length	5-3/4"
Squirt Hole	1/16"
Piston Pin Oil Hole	5/32"
Capscrew & Shake Proof Lockwasher	5/16"
Side Play	.006" to .010"
Replace at	.014"
Shims	None used
Journal Size	1.499 to 1.500
Bearing Clearance	.0015" to .002"
Maximum-Replace	.004"
Undersize Bearings	.002" & .020"
Capscrew Torque	20 to 25 ft. lbs.

### CRANKSHAFT

Main Bearings	
Dia. Journal	1.999 to 2.000
Clearance	.0015" to .002"
Maximum - Replace	.004"
Replace shaft if out of round or taper	.003"
End Thrust	Adjustable
Shims	.002" & .008"
End Clearance	.003" to .007"
Main Nut Torque	75 to 85 ft. lbs.
Pal Nut Torque	5 to 10 ft. lbs.
Undersize Bearings	.002" & .020"

### CYLINDER BLOCK

Bore Size	
Top	2.376" - .001"
Bottom	2.3765" - .001"
Piston Clearance	.002"
Rebore at	.010" or more
Ridge - Remove if replacing Rings or bearings	

### DISTRIBUTOR

Gear Backlash	.0015" to .003"
Maximum	.008"
Cam Angle	32°
Point Gap	.020"
Condensor	.18 to .23 Microfarads
Type	Battery distributor
Drive	Clockwise
Crank Pulley Timing Mark Advance	3°
Advance - Automatic	12°
Running Advance	15°

### GOVERNOR

Needle Bearing	21 rolls
Pivot Ball	3/16"
Spring - free length	2-7/32"
Speed Range	500 to 2100 R.P.M.

### LUBRICATION

Type	Pressure
Pump	Gear type
Pressure	7 to 20 lbs.
Capacity	3-1/2 qts.
Filter	own-cotton waste
Oil	SAE 10W to SAE 30 (according to load & temperature)

ENGINE SPECIFICATIONS (Cont'd.)

OIL PUMP

Gear Backlash	.001" to .002"
Maximum Gear Backlash	.005"
Tooth Tip to Body	.004"
Gear end clearance	.004"
Drive Shaft Clearance in bushing	.002" to .0035"
Drive Shaft Clearance in bushing maximum	.006"
Driven Gear Shaft in body	.001" loose to .001" press
Driven Gear Shaft in block	.0005" to .0025" loose
Oil Pump to block gasket	Treated paper
Oil Pump cover to body gasket - lead	.007" thick
Capacity	7-1/2 qt. per min.
Pressure	
Minimum	7 lbs.
Maximum	20 lbs.
Spring (relief valve)	painted green
Length (free)	1-15/16"

PISTON

Cast Iron

Bosses relieved at End of pin	Relieved .002"
Tapers Out	1/2" above skirt end
Tapers Out	45° each side of pin
Piston	True Round
Sizes	.0035", .020", .040"
Dimensions	
Top	2.362" to 2.364"
Skirt	2.3735" to 2.3750"
Height	2-9/32"

Aluminum

Cam Ground Sizes	.0035", .020", .040"
Dimensions	
Top	2.362" to 2.364"
Skirt	2.3735" to 2.3750"
Height	2-9/32"

PISTON PIN

Diameter	.5433" to .5435"
Oversizes furnished	.003" and .005"
Fit in Piston	Light push fit
Fit in Rod	Very light push fit
Replace	.0003" loose or noisy

PISTON RINGS

Number used	3 per piston
Type - Production	
Compression (2)	Tapered
Pit Mark	Indicates top
Oil Control (1)	Ventilated

Standard Size Service

Top Compression	Chromium Plated
not tapered	
Second Compression	Expander used
tapered	
Oil Control	Expander used

Clearance

End Gap	.007" to .012"
Ring Land Clearance	.0015" to .0035"
Replace at	.0045"

Replace rings when gap increases above .012", plus three times the bore wear.

Oversize Rings	.020" & .040"
Not to be used until block is rebored	

SPARK PLUGS

A.C. 45 or autolite AN7

Size	14 M.M.
Point Gap	.025"

VALVES

Intake Tappet Clearance	.012" cold
Roto Exh. Tappet Clearance	.012" cold
Timing	Marked gear
Inlet Opens	T.D.C.
Inlet Closes	35° after B.D.C.
Exhaust opens	40° before B.D.C.
Exhaust closes	T.D.C.
Seat Angle	45°
Seat Diameter	57/64"
Maximum Seat Width	1/16"
Intake Stem to Guide Clearance	.0018"
Replace at	.005" Maximum
Exhaust Stem to Guide Clearance	.0035"
Replace at	.007" Maximum
Pilot Size	5/16"
Guide Length	1-21/32"
Location	25/32" from top of block to top of guide
Service Guides	factory reamed to size
Valve Springs	free length 1-13/16"
Replace if less than	1-3/4"

## CHASSIS SPECIFICATIONS

### BELT PULLEY

Location	Left Side
Speed	1950 at 1800 of engine
Ratio Pulley to Engine	1.08 to 1
High Idle	2275 R.P.M.
Size	6" dia, 4" face

### Optional Equipment

### GENERAL DIMENSIONS

Tires	
Front	4:00 x 12
Rear	6 x 30

### BRAKES

Diameter	7"
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### Internal expanding

### Tire Pressure

Front	15 lb.
Rear	12 lb.

### CLUTCH

Type	Dry Plate
Size	6-1/2" dia.
Springs - free length	1-9/16"

### Wheel Spacing

Front	36" to 64"
Rear	36" to 64"

### COOLING SYSTEM

Type	Thermo Syphon
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Wheel Base	68"
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Length - Overall	116"
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### CROP CLEARANCE

Under Rear Axle	17-3/8"
Under Drawbar	13"

Height - Top of Steering Wheel	56"
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### ELECTRICAL EQUIPMENT

Battery	6 volt 70 ampere hr.
Generator (Delco-Remy)	2 charging rates
High Rate	approximately 13 amp.
Low Rate	approximately 3 amp.
Starter (Delco-Remy)	6 volt

### POWER

Drawbar	8:00 H.P.
Belt	10.5 H.P.
Recommended Load	1 - 12" plow

### RADIATOR

Type	Pressure - Tubular
Operating Pressure	7 lbs.
Capacity	6-1/2 qt.

### FAN

Type	Suction
Size	12" dia.
Blades	4
Fan Speed at 1800 engine R.P.M.	2900 R.P.M.
Ratio-Crankshaft to fan pulley	1 to 1.616

### TRANSMISSION

Speeds	
Low (Special - Optional)	1.6 M.P.H.
First	2.26 M.P.H.
Second	3.57 M.P.H.
Third	6.91 M.P.H.
Reverse	1.96 M.P.H.

### FRONT AXLE

Castor	None
Camber	5 degrees
Steering	Semi-Reversible
Toe In	None

Lubricant Capacity	8 qt.
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### TURNING RADIUS

With Brake	6-1/2 ft.
Without Brake	8-1/2 ft.

### FUEL SYSTEM

Type feed	Gravity
Fuel	Gasoline only
Tank Capacity	5 gal.
Carburetor	Updraft
Float Level	1/4" from nearest edge of float to top of bowl
Fuel Filter	Felt & Bowl

### WEIGHT

Weight	1400 lbs.
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## ENGINE HOOD AND HOOD SUPPORT

### Removal

The hood and hood support may be removed together if the capscrews attaching the hood to the radiator are removed and the two short capscrews, spacers, the one long cap-screw and spacer are removed from the lower

portion of the hood support at the crank end of the engine. Remove the tail light from the hood support.

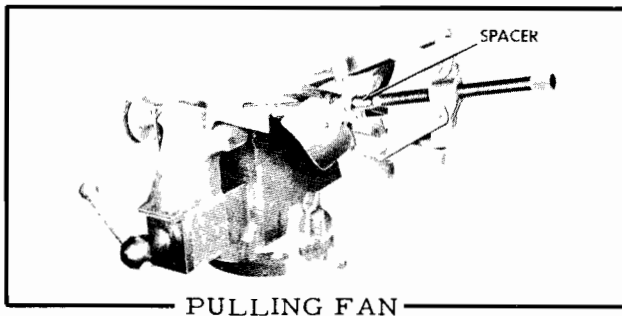
If the hood alone is to be removed, the bolts must be removed from the hood at the top of the hood support.

## FAN ASSEMBLY

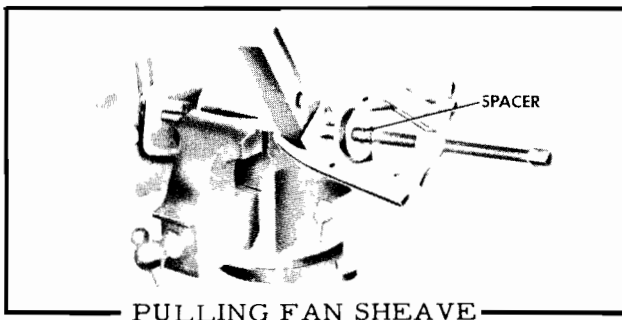
### Removal

Loosen the generator and move it toward engine in order to remove tension from the fan belt. Remove the air cleaner and the instrument box from the fan shaft bracket. Remove the carburetor air inlet pipe and bracket from the cylinder head. Remove the four nuts attaching the fan shaft brackets to the cylinder head.

without removing it from the engine. Check the bearings for wear and roughness. They should not be rough or worn more than .006". Check the fan belt sheave contact surface for wear caused by the fan belt. If the wear indicates that the surfaces are curved or that the belt bottoms in the sheave, the sheave should be replaced. The fan shaft should be straight. Check fan blades for loose rivets or cracks.



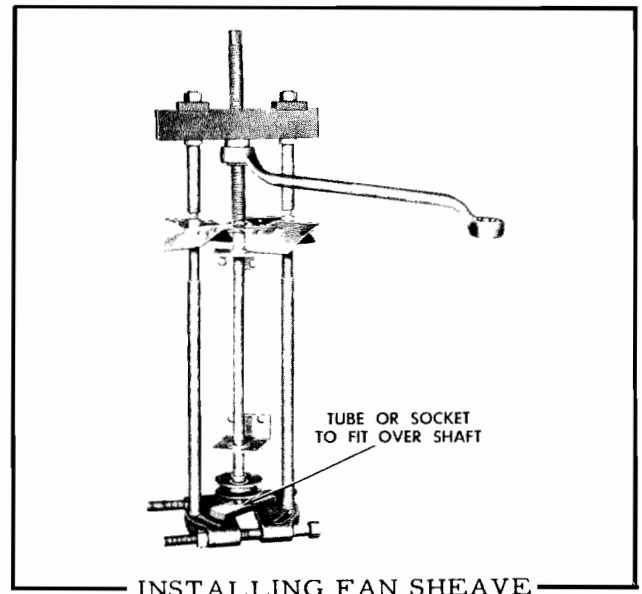
To remove the fan from the shaft, it is necessary to remove the fan bracket from the bearings and attach the OTC puller as shown using a 1/2" x 2" spacer equipped with a 60° center between the puller screw and the fan shaft.



The pulley may be removed from the shaft with the same tool. This work may be done more satisfactorily if a press is available.

### Inspection

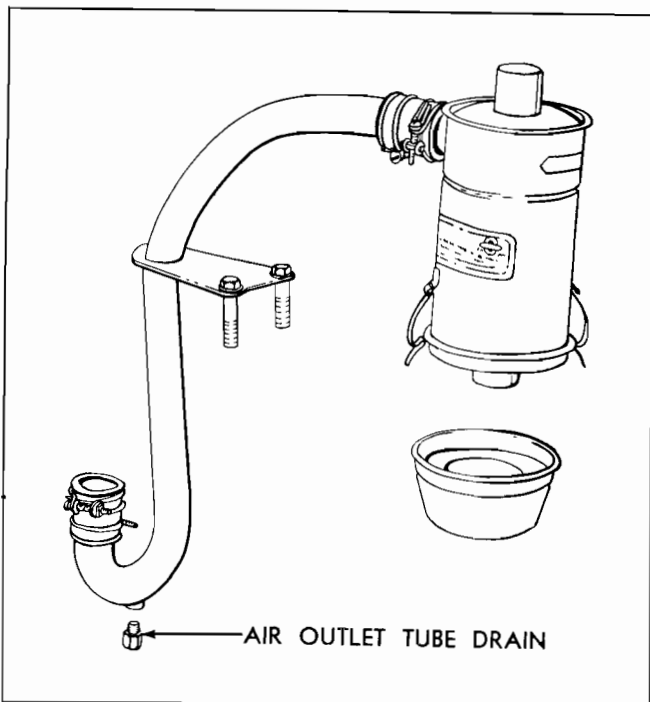
Inspection of the fan may be accomplished



### Assembly

Press the front bearing, bearing spacer and fan sheave on the shaft until the sheave is flush with the end of the shaft. Place the front fan shaft bracket on the bearing and install the snap ring. Press the rear bearings and brackets and fan blade assembly on the shaft until the bearing brackets measure exactly 11-1/4" center to center between the bearing bracket attaching holes. This method must be followed in order that the fan sheaves will line up with the generator and crankshaft sheaves and to make sure that the bearing bracket centers will fit the cylinder head studs of the engine.

## AIR CLEANER



### Removal

Loosen the hose connections at each end of the carburetor air inlet pipe and remove the two nuts attaching the air inlet pipe support to the cylinder head. Remove the bolts attaching the air cleaner body to the rear fan bracket.

### Inspection

Check the air inlet pipe, air outlet tube drain filter and air cleaner for leaks. Any leaks in air cleaner body or between body and carburetor will defeat the purpose of the air cleaner. Check the drain hole at the lower end of the carburetor air inlet pipe and make sure the strainer is in place. If missing or loose, it should be replaced. Backwash the filter element, making sure that all foreign material is removed from the element and the inlet side of the air cleaner body.

## RADIATOR

### Removal

Remove fuel tank and fenders as an assembly. Remove the engine hood and disconnect the two brake rod return springs from the lower side of radiator. Drain the radiator and remove the upper and lower hose from radiator inlet and outlet. Remove the two capscrews attaching the radiator to the clutch housing.

### Inspection

The cooling system is of the thermo-syphon type and to operate must have the cooling solution maintained above the lower edge of radiator inlet tube. The cooling solution temperature will vary with the prevailing weather temperature and will be hottest on the days when the outside temperature is hottest. This system is automatic and the speed of circulation varies with the difference between temperature of the radiator and the water jacket of the engine. The engine will operate at a temperature even in the coldest weather, which tends to prevent the formation of condensation in the crankcase. If the engine should overheat, check the fan belt for slippage. Check the radiator for leaks and accumulation of foreign material in

the radiator core. If hard or alkaline water has been used in the cooling system, check the inside of the radiator and cylinder block for an accumulation of scale deposit. Check the hose connections and hose for deterioration or collapsing. The spring loaded pressure cap retains approximately 7 lbs. of pressure in the cooling system and raises the boiling point to approximately 230° Fahrenheit. The pressure cap also incorporates a vacuum valve which is set at 1-1/2 ounces to relieve the system of vacuum when it is cooling off. When draining the cooling system, it is best to loosen the radiator cap so the system will not become air-bound, which might prevent draining. CAUTION: Do not remove the radiator cap if the engine is overheated. Remove cap after engine has cooled.

### Assembly

Install the radiator on the tractor using a sealing compound at the hose connections to prevent leaks. Due to the higher operating temperature of the thermo-syphon system, it is not advisable to use alcohol as an anti-freeze. Ethylene-Glycol or some similar solution should be used as an anti-freeze.

## DRAWBAR

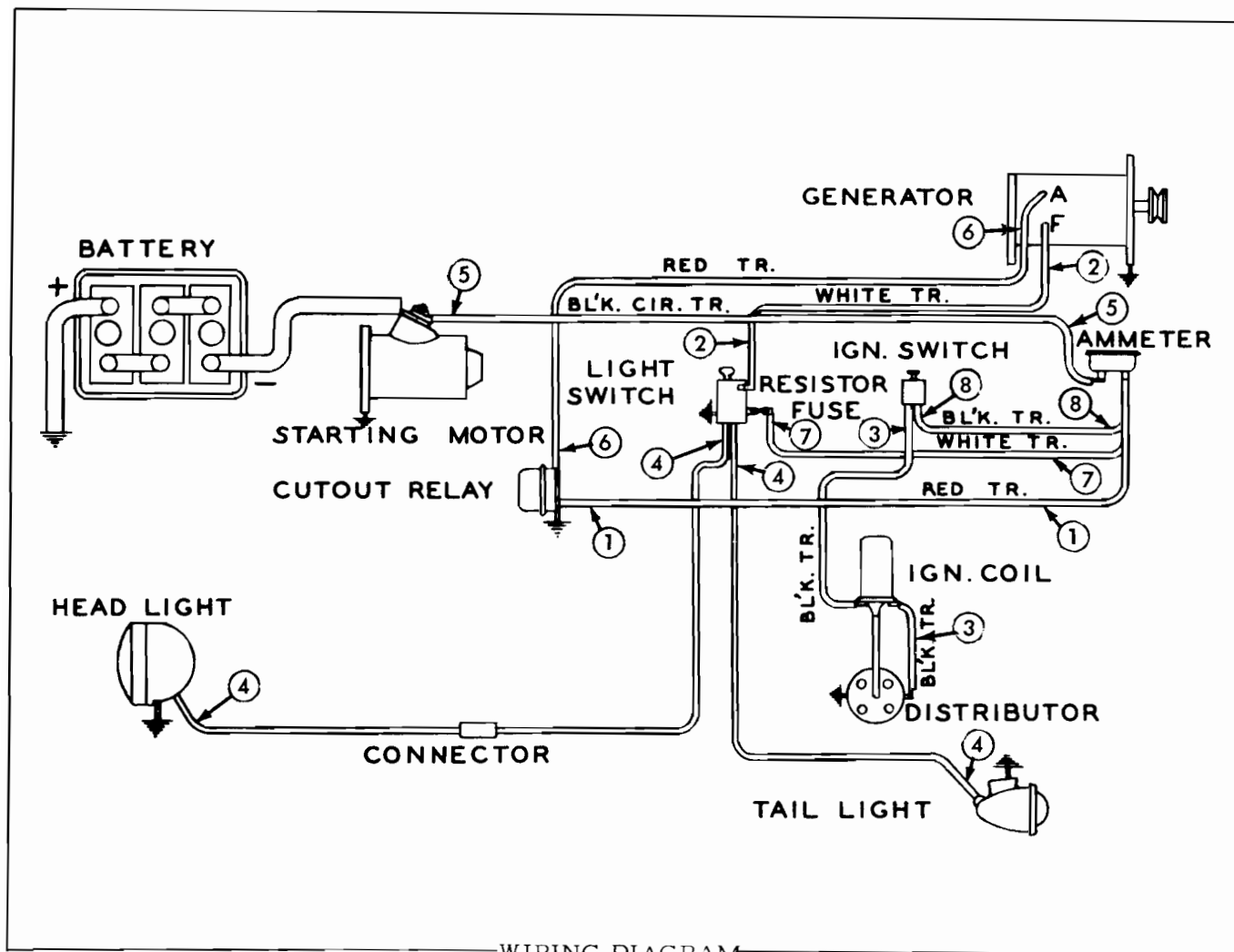
### Removal

Remove the four capscrews attaching the drawbar guide to the cylinder block and remove the guide. Remove the cotter pin and

nut from the drawbar pivot pin.

For engine removal, remove drawbar guide and swing drawbar to one side.

## ELECTRICAL SYSTEM



WIRING DIAGRAM

- #1 - Discharge side of ammeter to cutout.
- #2 - Resistor to generator field terminal.
- #3 - Ignition switch to coil to primary distributor lead.
- #4 - Light switch to headlight & tail light.
- #5 - Change side of ammeter to starter.
- #6 - Generator armature terminal to cutout relay.
- #7 - Discharge side of ammeter to fuse.
- #8 - Discharge side of ammeter to ignition switch.

When any service is to be performed on the electrical system, the battery ground strap should be removed. Removal of the battery ground strap will prevent shorting and damage to ammeter or any of the relative parts of the entire electrical system.

### LIGHT SWITCH

The light switch is mounted on the instrument panel which is located under the engine hood and is attached to the front fan bracket. The light switch incorporates the generator control, which is of the two step system, having a high and low charging rate. The fuse for the lighting system is also mounted on the light switch. A fuse of either a 10 or 15 amp. capacity can be used. The operation of the light switch is as follows: When the switch

is all the way in, the lights are off and the generator charge rate is at the low position. With the light switch pulled out to the first stop the lights are on and the charging rate is in the high position. With the light switch pulled all of the way out, the lights are off and the charging rate of the generator is in the maximum position. This manual control of the charging rate is accomplished by a resistance unit on the outside of the light switch



which is cut into or out of the circuit and limits the amount of electrical current allowed to pass through the field coils of the genera-

tor. The generator charging rate is approximately 3 amperes in low position and 13 amperes in high position.

### IGNITION SWITCH

The ignition switch is also mounted on the instrument panel and is used to complete the

ignition circuit.

### AMMETER

The ammeter is mounted on the instrument panel and indicates the rate of generator charge or battery discharge to the electrical system.

kept free of grease and dirt accumulation. All grommets should be in place and in good condition.

#### Inspection

Inspect all wires and make sure they are free from cracks, broken wires or terminals and free from deterioration. They should also be

#### Assembly

See the wiring diagram for the connections which must be made to complete the wiring system. Keep all connections clean, bright and tight.

### HEADLIGHT AND TAIL LIGHT

#### Removal

The headlight is mounted on the front frame of the tractor and may be removed if the headlight wire is disconnected at the front frame. If the wire is to be removed from the torque tube, it is advisable to place an extension on the wire that may be left in torque tube when the light wire is drawn out. With this extra extension it is possible to replace the head light wire without any difficulty.

Both lights use single contact 6 - 8 volt bulbs. The headlight is 32 candle power and the tail-light is 15 candle power. With the single contact bulbs, it is necessary to have all the lamps and tractor parts which are used to complete the circuit, clean, bright and tight. Dull reflectors cause inefficient lighting. The reflectors should be replaced if dull or polished by the use of lamp black or silver polish. In polishing the reflector, use a soft cloth that will not scratch the reflector. Always use a new gasket between the lamp and reflector to prevent any moisture from accumulating on the reflector surface.

The tail light is mounted on the hood support and the wire is connected directly to the light switch.

### GENERATOR

#### Removal

Remove the capscrew from the generator brace and the wires from the field terminal and ammeter or cutout terminals of the generator. Remove the two bolts from the lower pivot point or the two nuts attaching the generator mounting bracket to the cylinder block.

Manual for details on the generator. The generator should be repaired only by an authorized service station.

The generator is driven by the fan belt. To adjust tension, loosen clamp screw and move generator away from cylinder block. See "fan belt".

#### Inspection

Refer to the general section of the Service

## STARTER

### Removal

Disconnect the battery ground strap. Remove the starter pull rod, the starter cable and ammeter wire from the starter switch. Remove the two capscrews attaching the starter to the clutch housing.

### Inspection

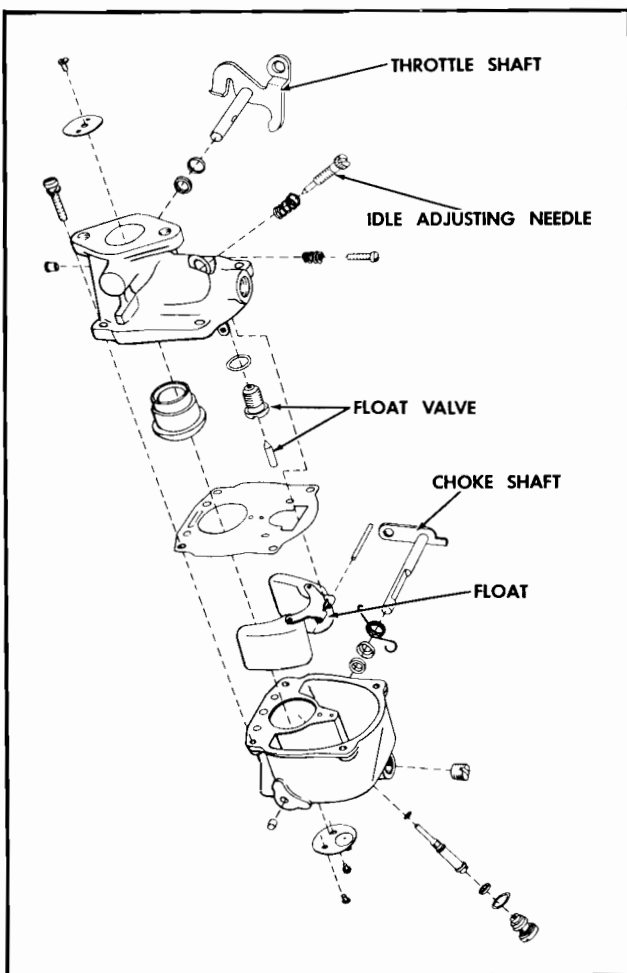
See the general section of the service manual for details on the starter. The starter should be repaired only by an authorized service station.

Check the battery terminals for cleanliness and tightness. All connections must be clean and tight.

In cold weather if the starter does not engage the flywheel promptly, the starter drive screw threads should be washed out with kerosene. Do not lubricate the starter drive threads but leave the kerosene as the only lubricant.

When reinstalling battery cable, place it under radiator and not around side of radiator.

## CARBURETOR



The carburetor is a Marvel-Schebler TSV-13. The jet sizes are not marked on the jets of this carburetor and reference must be made to part numbers to be sure the correct parts are obtained.

### Removal

Remove the carburetor air inlet pipe, the choke rod and the fuel line. Disconnect the carburetor link rod to the governor. Remove the two capscrews attaching the carburetor to the intake manifold.

### Inspection

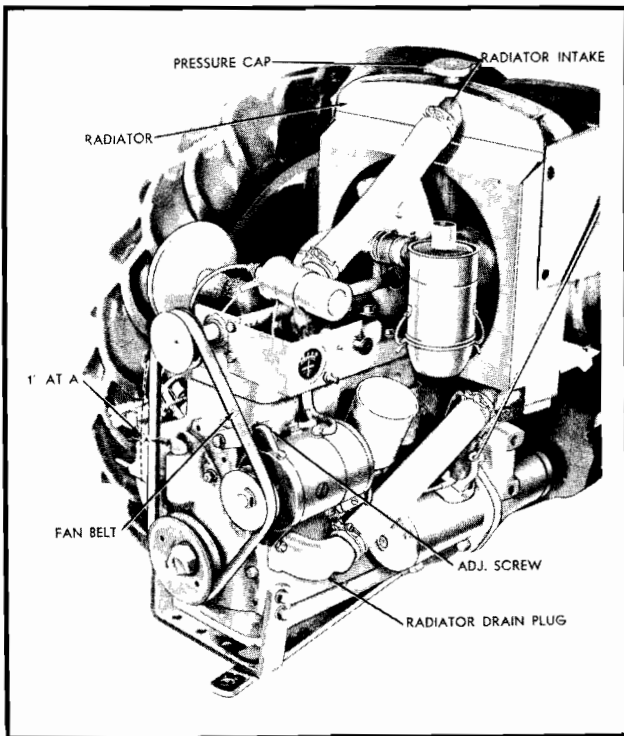
Inspect the choke shaft and throttle shaft for wear in the body. Any wear at these points will allow the entrance of dirt to the engine and cause uneven operation at low speeds. Check the float and the float valve for leakage. Check filter in intake pipe for loose felt through which dirt might enter.

### Assembly

The float level should be set with the float  $1/4$ " from the top edge of the bowl or  $1/4$ " between the bowl gasket and the nearest edge of the float. The idle needle is set approximately  $1-7/8$  turns open. The float may be set by bending very near the float axis, being sure not to cause the float to strike the edges of the bowl.

With the engine heated to normal operating temperature, the idle stop screws should be adjusted to permit the engine to operate at approximately 500 r.p.m. at low idle.

## FAN BELT



### Removal

Loosen the generator brace and move the generator closer to the cylinder block. Remove the upper right capscrew and spacer attaching the hood support to the cylinder block.

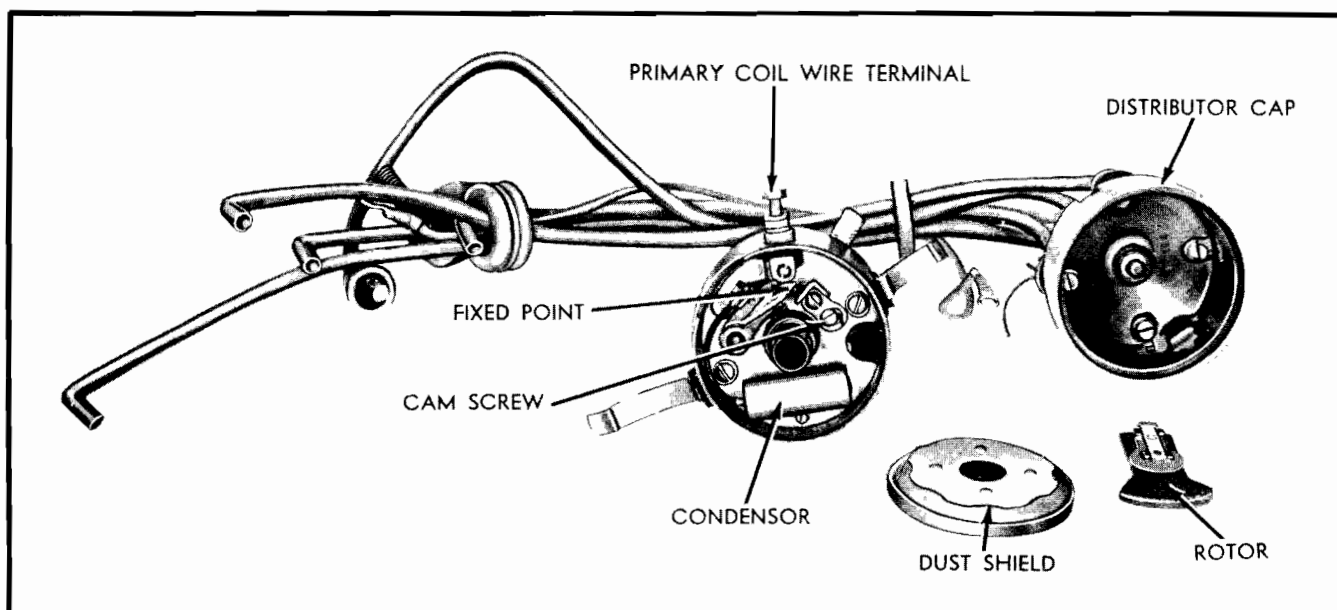
### Inspection

Check the belt and the condition of the sheaves. The sheave side should be flat and smooth and the belt should not bottom in the sheave. If the belt is grease-soaked, deteriorated or broken, it should be replaced.

### Assembly

Check the fan belt tension opposite the generator pulley on the straight side of the belt. The belt should move in or out approximately one-half inch from the straight line. Insufficient tension causes belt slippage or excessive tension places an overload on the front fan shaft bearing or the generator bearings.

## DISTRIBUTOR



### Removal

Remove the spark plug wires and coil wire from the top of the distributor. Disconnect the primary coil wire from the coil to the side of the distributor. Loosen the clamp screw at the base of the distributor and pull distributor up out of engine.

### Inspection

Check the breaker points for pitting or wear.

### Assembly

To set the breaker point gap the distributor rotor and the dust shield must be removed from the distributor. Turn the distributor until the points are separated to their widest position.

Loosen the lock screw on the fixed point and turn the cam screw until the points are separated .020". Tighten lock screw and recheck point adjustment.

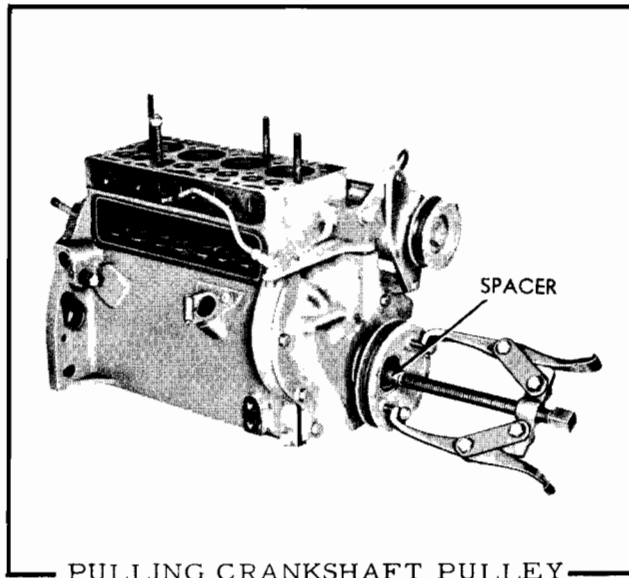
To time the engine, turn the engine until No. 1 cylinder is at top dead center on its compression stroke and the timing mark on the fan pulley is located in the center of the timing inspection opening directly below crank

support in the hood support. Hold the distributor with the coil wire terminal pointing toward #1 spark plug, and the rotor pointing towards the clip farthest from terminal. Enter the distributor into the engine block in this position. As the distributor enters the block and the gears mesh, the rotor will turn slightly in a counter clockwise direction. Clamp the distributor in place partially and turn the distributor body in a counter clockwise direction until the points just start to open. Clamp the distributor body securely in this position. This will place vent in dust shield down for proper drainage. Place No. 1 spark plug wire directly above the rotor and then proceed around the distributor in a clockwise direction placing 3, 4, 2 spark plug wires. Place the high tension coil wire in the center outlet of the distributor cap. Attach the battery lead wire from the coil terminal to the terminal on the side of the distributor body.

Use a good grade of rubber cement or shellac on the rubber nipples on the distributor to spark plug wires and high tension coil lead.

The distributor is a Delco-Remy model #1111708 and all repair parts and service should be obtained from United Motors Service.

## TIMING GEAR COVER



### Removal

Remove the hood and hood support. Disconnect the carburetor link rod and the governor spring. Remove crank jaw. Use two 3/8" capscrews and pull crankshaft pulley as shown. Do not run capscrew through against die cast cover or pry against cover as it may be easily damaged.

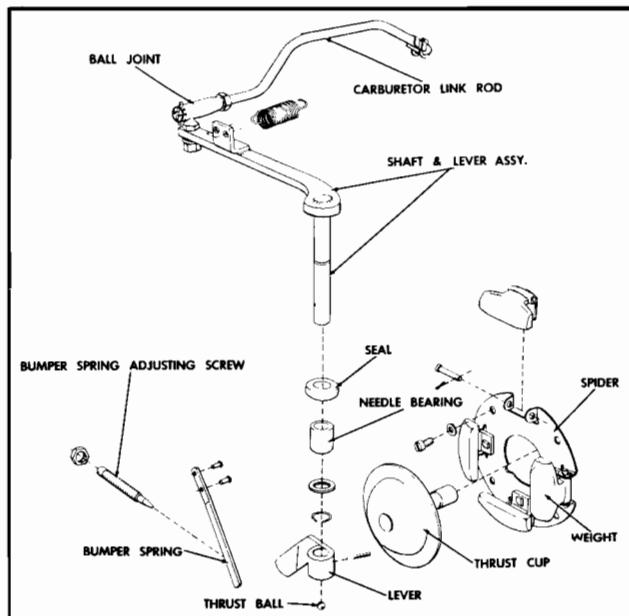
### Inspection

See "governor" and oil seals.

### Assembly

Tighten capscrews to 15 ft. lbs. torque.

## GOVERNOR & GOVERNOR WEIGHT ASSEMBLY



### Removal

Remove the hood and hood support and the fan belt. Pull the crankshaft fan drive sheave. Disconnect the carburetor throttle link rod from the carburetor and the governor spring from the governor arm. Remove the timing gear cover from the engine.

Remove the snap ring from the governor shaft and turn the shaft until the tapered groove pin can be driven out of the governor arm. The shaft and lever assembly can be pulled from the timing gear cover. A 3/16" thrust pivot

ball is used under shaft. The needle bearing may be driven from the cover.

### Assembly

If the needle bearing has been removed, it should be replaced with a new part and pressed into place. Install the lever and shaft assembly in the timing gear cover using a new dust seal. Be sure pivot ball is in position. At any time when the timing gear cover is removed a new crankshaft oil seal must be used. Tighten the timing gear cover capscrew to 15 ft. lbs. torque.

To adjust the governor, back out the governor bumper spring adjusting screw entirely. Place the throttle lever in the full speed position and hold the carburetor in the full speed position. Adjust the carburetor link rod until it just fits between the governor arm and the carburetor. Adjust the ball joint at the end of the carburetor throttle link rod until it is free of all slack but not tight. The throttle rod is provided with a stop to keep the engine from being over speeded. Make sure this cotter pin stop is in place. Be sure that the throttle rod has not been bent at the spring end which would cause interference with the spring.

The governor bumper spring adjusting screw is provided to eliminate surge from governor. It is usually not necessary to use this screw - however, if the engine does surge

the screw should be turned in slowly until surging is overcome. If the surge screw is turned in too deeply, it will increase the r.p.m. at which governor action takes place. This increase would be from low idle to a maximum of 700 r.p.m.

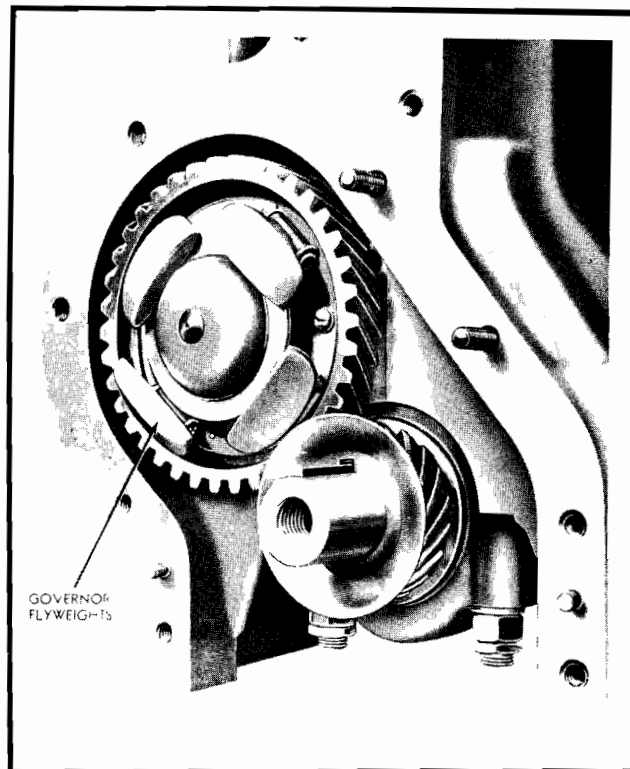
### Governor Weight Assembly

#### Removal

Remove the timing gear cover and the governor thrust cup assembly. Remove the governor spider and weight assembly from the timing gear.

#### Inspection

The governor thrust cup assembly fits the camshaft with from .002" to .004" clearance. It should be replaced if this clearance exceeds .008" or if the cup is worn at the weight riser contact surface. Check the vent hole in the camshaft behind the thrust cup shaft and be sure it is clean and free of any foreign material. If this hole becomes plugged, the governor will be inoperative due to the vacuum created behind the thrust cup shaft. Check the governor weight for wear on the riser and any wear at the hinge points. The assembly should be replaced if the hinge pins are worn more than .006"



### CYLINDER HEAD

#### Removal

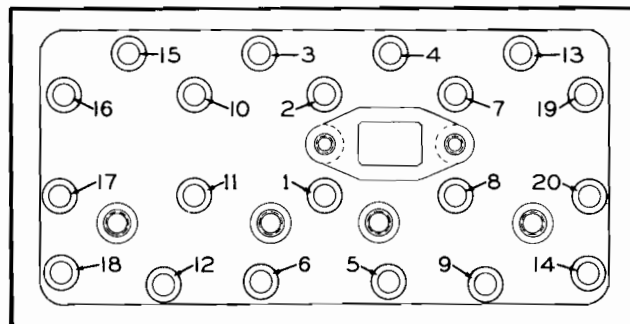
Remove the hood and hood support, carburetor air inlet tube, air cleaner, instrument panel, spark plug wire grommet holder and fan assembly. Drain the radiator and remove the upper hose. Remove the balance of the studs and nuts from the cylinder head.

#### Inspection

Clean the carbon from the cylinder head and check the head for leaks or cracks and scale accumulation.

#### Assembly

Install the head using a new gasket. Tighten the stud to 55' pounds torsion following the chart.



## OIL SUMP

### Removal

Remove the drawbar guide and swing the drawbar to one side. Drain the oil sump and remove the small cover over the lower portion of the clutch housing. Remove the capscrews attaching the oil sump to the cylinder block.

### Inspection

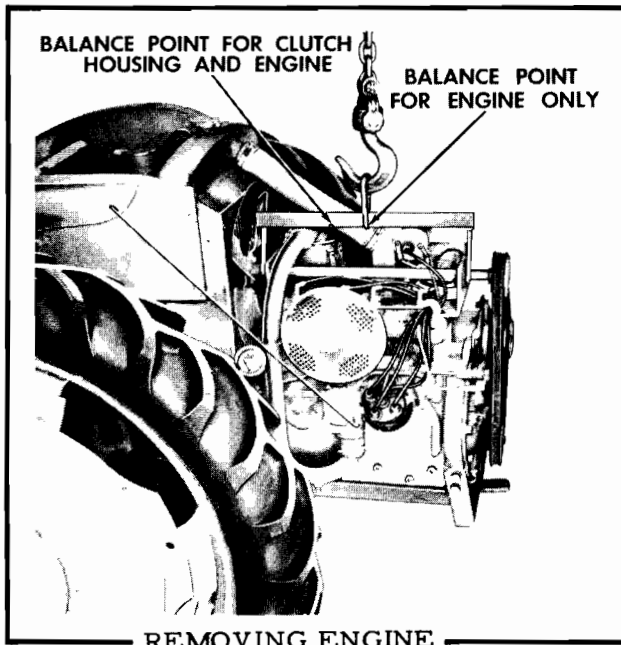
Clean the oil sump and pump screen thor-

oughly and inspect the screen for broken mesh

### Assembly

Use a sealer on the one side of the gasket surface only. Tighten the end capscrews which enter the die cast timing gear cover and rear oil seals to 15 foot pounds torque. To overtighten may strip threads from die casting. Refill sump with fresh oil.

## ENGINE REMOVAL



The complete engine may be removed as a unit as follows: Drain the cooling system and the oil sump and shut off the fuel supply. Remove the hood, hood support and radiator

hoses. Remove the drawbar guide. Remove the starter and choke rods and the battery cable at the starter - also disconnect the headlight wire. The engine may be supported from the fan shaft bearings, however, do not hook in such manner as to pull bearing brackets closer together or to place a strain on shaft. It is best to use a solid bar as shown or a spreader must be placed between the chain ends close to the fan shaft bearing bracket. Disconnect the fuel line, remove throttle rod, remove the bolts from the clutch housing and swing engine away from tractor.

### Clutch Housing and Engine Removal

The small housing and engine may be removed as a unit by following the engine removal procedure and removing the clutch pedal rod from the throwout bearing fork and unhooking the brake return springs at the bottom of the radiator support. The same lift arrangement can be used excepting the balance point for the engine and clutch housing is about 4" closer to the flywheel end of the engine. After attaching the engine to the chain hoist, remove the capscrews attaching the clutch housing to the transmission housing.

## MANIFOLD

### Removal

Remove the carburetor air inlet tube. Disconnect the fuel line and governor link rod and governor spring. Remove the throttle rod guide. Remove the nuts attaching the manifold to the cylinder block.

### Inspection

Check the manifold for carbon accumulation. A partially plugged manifold will cause rapid loss of power. Check the manifold for leaks or cracks. Always use new gaskets.

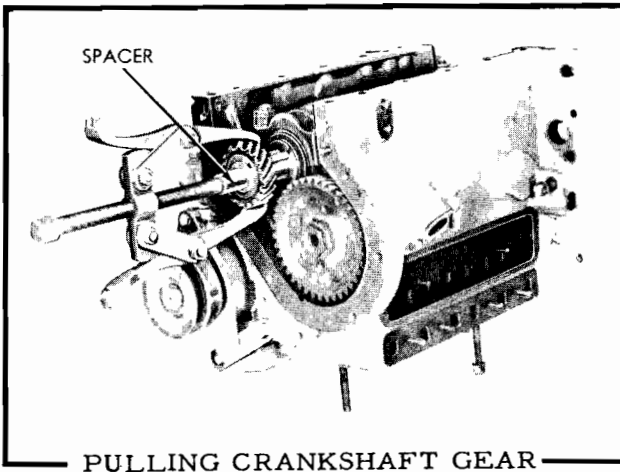
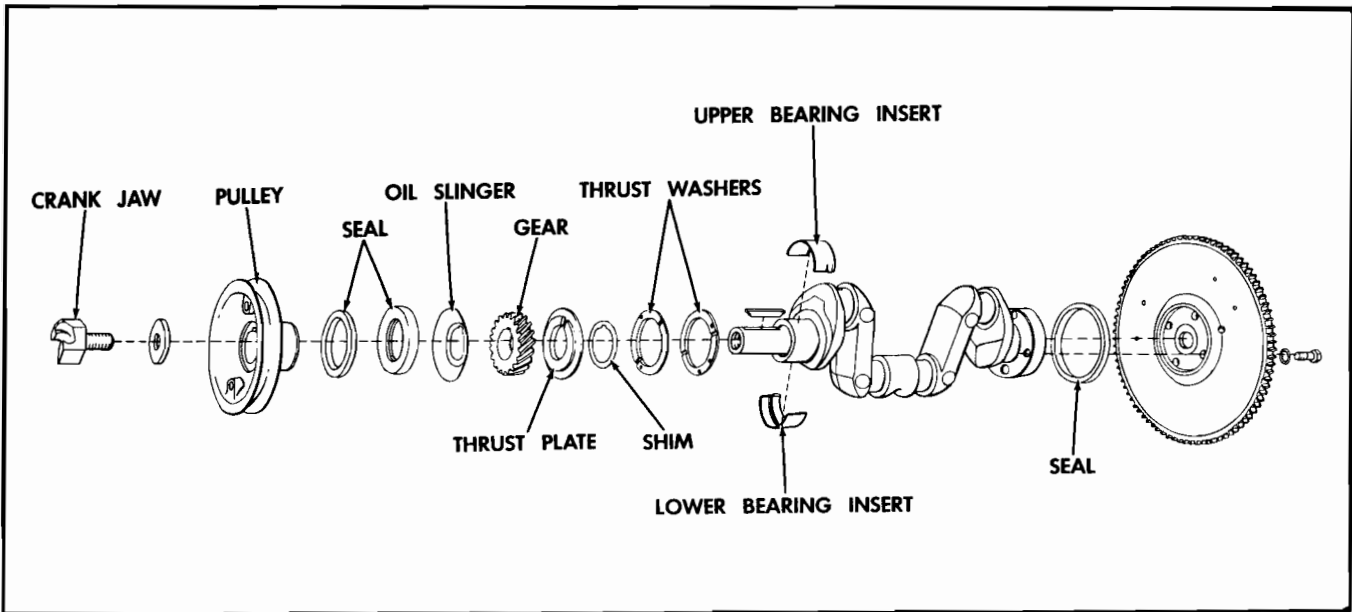
### Assembly

Install manifold and tighten nuts to 20 to 25 ft. lbs. torque.

Install the pin in the throttle rod ahead of the throttle rod guide. This pin prevents the engine from being oversped.

The intake manifold vacuum is 18 to 19 inches at low idle when the engine is in good mechanical condition and properly adjusted.

## CRANKSHAFT



### Removal

Remove the engine from the tractor. Remove the clutch and flywheel. Remove the crankshaft fan pulley and the timing gear cover. The crankshaft pulley may be removed by using two capscrews and the OTC puller with a 1" x 1-1/2" spacer with a 60° center. Do not pry on die cast gear cover or turn capscrews in against cover. Remove the oil sump and the main bearing cap. Remove the connecting rod bearing caps.

### Inspection

Check the crankshaft journals for wear, scoring and out-of-round. The shaft should be replaced if worn or out-of-round more than .003". .002" undersize bearing shells are provided for service. The bearings do not use shims, and if the shaft is worn under-

size the undersize bearings should be used for service. Check the end of the crankshaft at point contacted by oil seal and the crankshaft pulley at point contacted by oil seal. If worn excessively at either place, they should be replaced. The end clearance of the shaft should be maintained within .003" to .007". The clearance must be checked with all parts in place including the crank jaw which is used to retain the thrust washers in position. It is best to check end clearance before disassembly. It will not be necessary to dismantle the engine to adjust end clearance until such time as it is increased to .011". However, if the engine is down for any other reason the end clearance should be adjusted to the specified limit.

### Assembly

The main bearing inserts may be installed without removing crankshaft if a small pin is inserted in the crankshaft oil hole and the upper shell rotated out of place. The main bearing shell has an oil hole in the upper half and is solid on the lower half. The spurs on the shells to prevent turning in the block are diametrically opposite. The main bearing oil clearance should be from .0015" to .002" and should be adjusted if it reaches .004" or more. Do not file main bearing caps or inserts. Tighten the main bearing nuts to 70 to 80 foot pounds. Tighten pal nuts to 10 foot lbs.

Both thrust washers should be placed on the shaft with the bevel on the inside diameter towards the first crank throw of the shaft. The steel thrust plate goes against the bronze thrust washer with the large surface towards



the bronze washer, .002" and .008" shims are used between the steel thrust washer and the shoulder on the crankshaft to adjust the end clearance. Either the shaft must be removed to adjust end play or a special puller used to remove the crankshaft timing gear.

When installing the crankshaft, the crankshaft

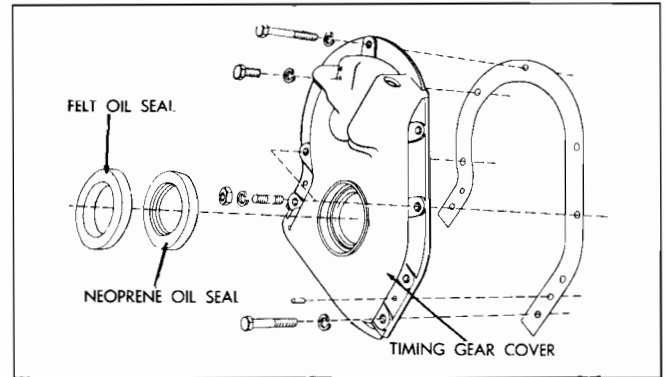
gear must be meshed with the camshaft gear according to the marks. There is one mark on the crank gear and two on the cam gear. Place the single mark between the double mark.

The main bearing caps are marked No. 1 and No. 2 and the block correspondingly and these marks should face the camshaft side of engine.

### CRANKSHAFT OIL SEALS

The crankshaft seals are Neoprene seals, spring loaded. They must be installed with the lips toward the oil supply in the oil sump. The seals must be replaced each time the crankshaft is removed or the timing gear cover removed. The front seal has a felt seal installed on the outside of the Neoprene seal. Shellac the felt seal to the face of the Neoprene seal. When replacing seals, be careful not to damage the die cast retainer.

If difficulty is encountered with the seals seeping or leaking oil, check the surface of the crankshaft at the flywheel end contacted by the oil seal and the surface of the crankshaft fan pulley contacted by the front seal. If these diameters are worn too small for the seal to make a firm contact, the parts should be replaced. Be sure



the regular oil sump capscrews are used in the center hole of the rear oil seal retainer. If an extra long capscrew is used on this position, it will force the seal away from the retainer.

### OIL PUMP

#### Removal

Remove the engine from the tractor and remove the clutch and flywheel. The pump is mounted at the rear of the engine block and is driven by the camshaft. The capscrews that attach the oil pump to the cylinder block also hold the pump assembly together.

#### Inspection

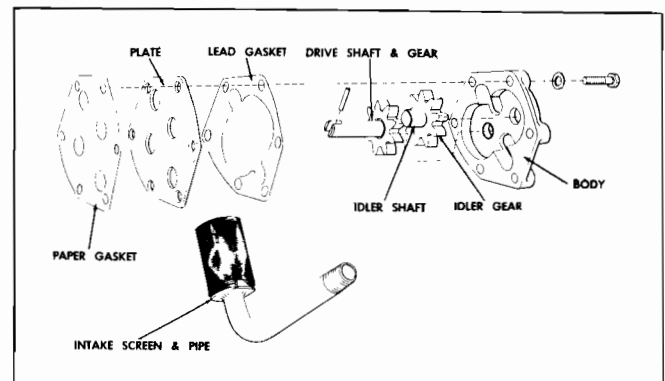
Check the pump for gear back lash, which should not be more than .005". The clearance between the tips of the teeth and the pump body should not exceed .004". The clearance between the gear and cover for the side clearance of gears should not exceed .004". The minimum permissible oil pressure is 7 pounds per sq. inch.

Later pumps have short idler shaft and no hold in plate.

The drive shaft clearance should not exceed .006". The desired clearance is from .002" to .003".

#### Assembly

A .007" thick lead gasket is placed between the



body and the cover and the treated paper gasket is placed between the pump and cylinder block.

If oil pump strikes clutch housing it will cause gears to cut into pump body, shearing drive pin.

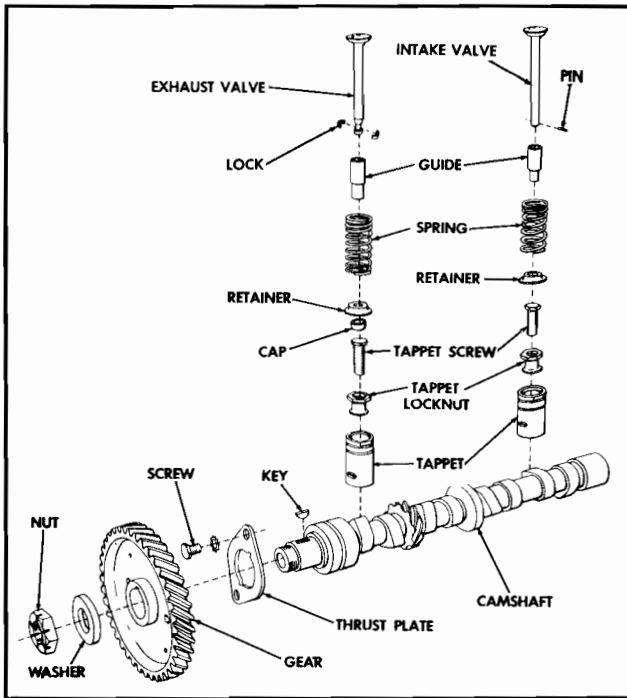
When repairing the pump, the oil screen and suction line to the pump should be checked and must be clear and free of leaks. The oil gallery in the cylinder block must be clean to 15 foot lbs. Use a sealer on paper gasket between body and block.

The desired oil pressure is 15 to 20 pounds

per square inch and can be obtained by adjustment of the oil pressure relief valve. Do not attempt to adjust low oil pressure by use

of the pressure relief valve until all other sources of low oil pressure are investigated.

### CAMSHAFT

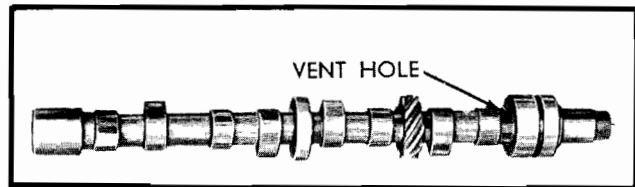


the governor spider assembly and pull the camshaft timing gear. Remove the camshaft thrust plate and pull the camshaft from the engine.

The cam followers or tappets may be removed from the valve compartment if the adjusting screws are removed.

#### Inspection

The maximum clearance between the camshaft journal and the cylinder block should not be more than .007". Check the camshaft vent opening into the governor thrust cap shaft. If this hole is plugged, it will be impossible to obtain good governor action.



#### Removal

Remove the hood and hood support. Drain the oil and remove the oil sump. Remove the cylinder head and the valves. Remove the crankshaft fan drive pulley and the timing gear cover. Remove the distributor. Remove

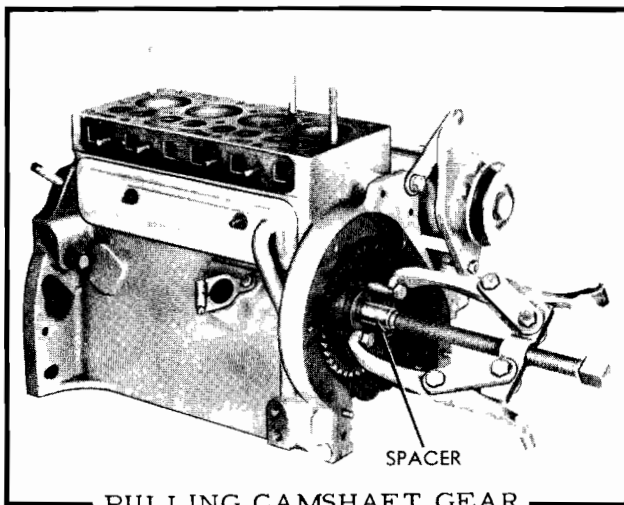
Check the opening between the center of the front cam journal and the oil hole leading to the thrust plate. Check the shaft journals, cam lobes and cam follower faces for wear or scoring. If scored, they should be replaced.

The back lash of the timing gear will not cause the engine to become inoperative, however, as clearance increases noise will also increase. Noise usually becomes objectionable as the back lash clearance approaches .020".

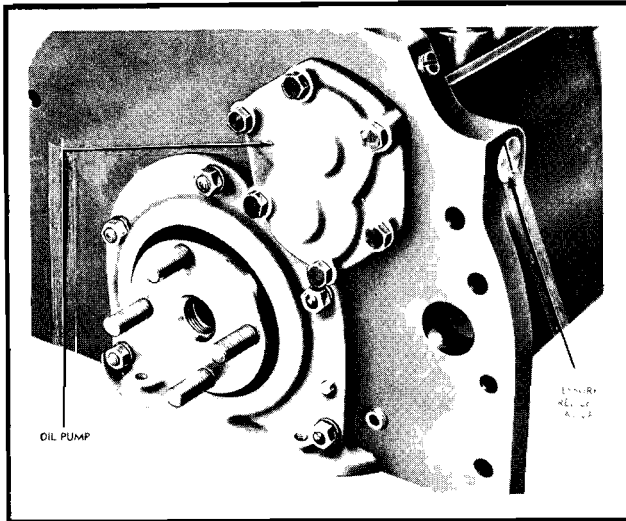
The end play of the camshaft should be approximately .005". If this clearance exceeds .007", a new thrust plate assembly should be used.

#### Assembly

When the camshaft is replaced or reinstalled, the valves must be timed. There is a single mark on the crankshaft gear and a double mark on the camshaft gear. The single mark must be placed between the double mark.



## OIL PRESSURE RELIEF VALVE



### Removal

The oil pressure relief valve is located on the flange of the cylinder block near the oil pump.

It may be removed by use of a heavy duty screw driver. Beneath the plug is the spring and plunger assembly.

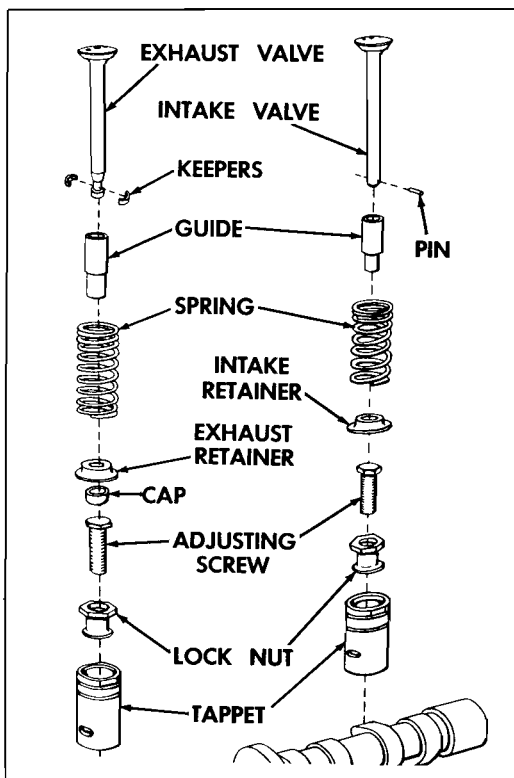
### Inspection

Check the relief valve spring for its free length, which should be 2". The spring is painted red for identification. A neoprene seal is used on the plug to prevent leakage.

### Assembly

The oil pressure relief valve should not be used to increase the pressure of the system until all other sources of low oil pressure are investigated. The minimum allowable oil pressure 7 pounds. The desired operating pressure 15 to 20 pounds. The gauge is not calibrated in pounds, but the center of the indicator needle travel on the gauge face is approximately 15 pounds. The pressure may be regulated by placing washers between the spring and the retaining plug.

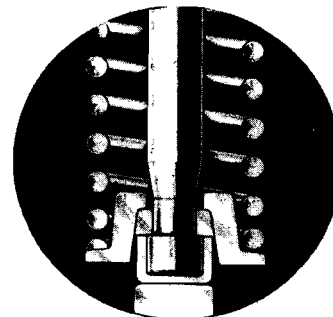
## VALVES



### Removal

Drain the cooling system and remove the cylin-

der head. Remove the distributor, the throttle rod and the carburetor and the valve cover. Use a valve lifter or spring compressor to remove the keepers from the valve stems. The valves may then be lifted out.



**ROTO VALVE**

The engine is equipped with roto caps on the exhaust valves. These caps provide a means of relieving the spring pressure from the valve when it is in the open position, allowing the valve to rotate on its seat. These caps increase valve life. Set exhaust valve clearance to .010" cold when equipped with roto caps.

The valve guides are removable and can be driven from the cylinder block if necessary. Always use a suitable driver.

driven from the cylinder block is necessary. Always use a suitable driver.

### Inspection

The valve face and seat angles are 45°. The seat width should be approximately 3/64" and not over 1/16". The intake valve stem clearance is .0018" and should be replaced if the combined clearance between the stem and guide exceeds .005". The exhaust valve stem clearance in the guide is .0035" and the maximum allowable clearance is .007" between the stem and the guide. Replace that part which is worn most or both, if necessary.

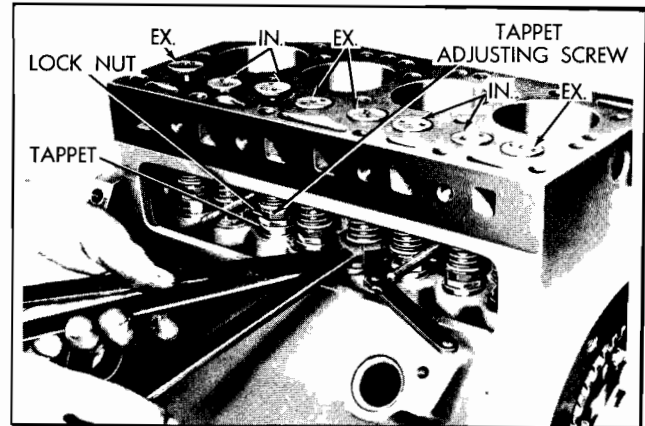
Service guides are reamed and ready for use and are all the same size. The difference in clearance between intake and exhaust valves is taken care of on the valve stem. A 5/16" diameter pilot is required for checking the guides. These pilots may be secured in .001" .002", .003" oversizes. The valve spring is cadmium plated and 1-13/16" long. The spring should be replaced if it is less than 1-3/4" long.

Install valve spring with closed end or 3 closed coils end towards cylinder block.

### Assembly

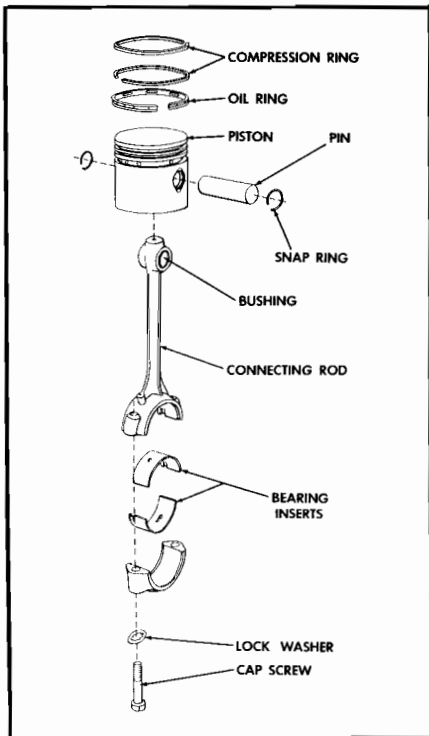
The valve guide is 1-21/32" long and should be driven into the cylinder block until it is exactly 25/32" from the top face of the block to the top of the guide. Use a special driver

in order to prevent distortion of the guide bore while driving in place. If the guide bore is collapsed, it will be necessary to ream the guide. After the guides are in place, use a 45° cutter to reseat the valve seat. Use 15° and 75° cutters to narrow the seat if it is too wide. Reface or replace the valves. Lap the valves to their seats with fine valve grinding compound. Valve clearance is set to .012" with the engine cold. Exhaust valves with roto caps are set .012" with engine cold. These valves must be free to rotate. The clearance between cap and stem is .004" to .006".



To set the tappets it is necessary to have a thin jawed 7/8" tappet wrench that will work between the adjacent tappets without interference, also thin tappet wrenches in 9/16" and 3/4" sizes.

## CONNECTING RODS, PISTONS & RINGS



### Removal

Drain and remove the oil sump. Remove the connecting rod caps and lift the rods from the crankshaft. Remove the connecting rod and piston assembly from the bottom of the engine opposite the camshaft side. The piston pin is a full floating type and may be removed after the retaining snap rings are removed, if it is desired to separate the pistons from the connecting rods.

### Inspection

The piston for the Model "G" is finished to a true radius. However, it does have a tapered relief over the end of the piston pin bosses. This relief varies from .002" to .007" deep, tapering out approximately 1/2" above the lower skirt end and 45° at each side of the pin center line. This appears as a discolored triangular shape after the engine has been in use a short time.

The skirt diameter is 2.375" approximately. The skirt diameter and piston weight will be

marked on the piston top.

The aluminum piston used N62-3872 and above is cam ground. When fitting cam ground pistons use a .002" feeler strip 1/2" wide between the cam or tight side of cylinder wall. With feeler strip in place at tightest point, you should be able to move the piston by a slight push with thumb. If recommended clearance can not be obtained hone or rebores for next larger size piston. Minimum clearance is .001" to .002" between piston and cylinder wall.

The pistons are serviced in standard size .0035", .020" and .040" oversizes to provide pistons when reboring or honing is necessary.

The piston pin is fitted with a very light push fit in the connecting rod and a light push fit in the piston. They should be replaced when .0003" loose or when noisy.

The piston pin is supplied in .003" and .005" oversizes for repairs. The standard pin size is .5435. The production cylinder block is machined slightly tapered, being .0005" smaller at the top than at the bottom. The bore size is 2.377". The piston is fit with approximately .002" clearance. The maximum allowable cylinder wear is approximately .010".

The production ring gap is from .007" to .012". The ring side clearance in the piston ring groove is .0015" to .0035". Standard rings may be used for service until reboring is necessary - then .020" or .040" oversizes are available and the engine should be rebored to these standard sizes. The piston rings should be replaced if the side clearance exceeds .0045" or the end clearance exceeds .050". The cylinder wall should be refinished if the standard ring, when new, has .046" or more clearance.

The connecting rod has removable bearing inserts which should be replaced if the clearance exceeds .004". The crankshaft should be replaced if out of round more than .003". The side play of the connecting rod is from .006" to .010" and should be replaced if it exceeds .014".

The bearings are not provided with shims. The rod or cap should never be filed to obtain bearing adjustment.

## Assembly

The compression rings of the tractors are tapered and have a small pit mark on the top side. The standard size service ring set will consist of a chromium plated top compression ring that will not be tapered and the second compression ring which will be tapered. All tapered rings will have a pit mark on the top side. The lower compression ring will be fitted with an expander. The oil control ring will also be supplied with an expander.

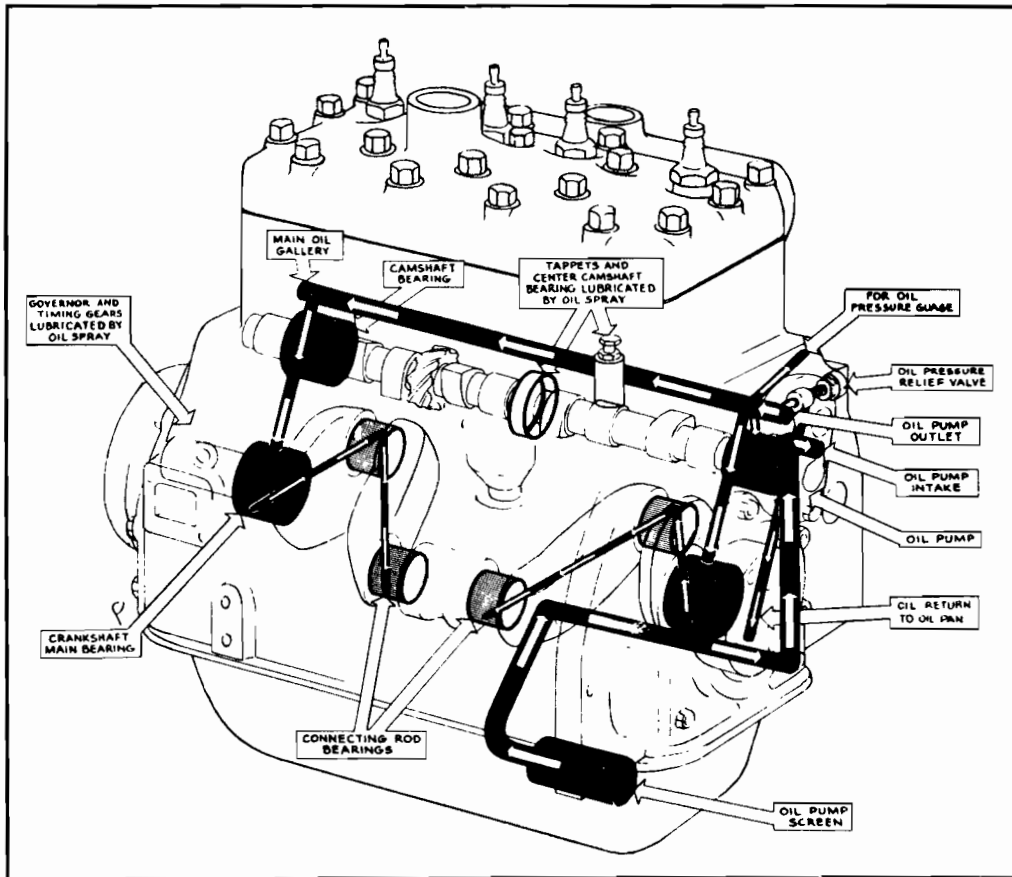
Fit each ring in the lower part of the cylinder block bore where piston ring travel stops or where the wear is the least. Try each ring in the groove on the piston in which it will be installed to make sure that it is free.

The lowest portion of the cylinder bore is chamfered 45° to permit installation of the rings without the need of a ring compressor. Pistons and rods must be installed from the bottom and on the side of the crankshaft opposite the camshaft.

When fitting standard or oversize piston pins use a spiral fluted expanding reamer or a hone. The bushing in the connecting rod is very thin and great care must be exercised when reaming. A very light cut must be used at all times. Be sure the oil hole in the bushing is in line with the oil hole in the top of the connecting rod. Clean the oil hole after reaming. The pin fits in the piston with a line to line fit and in the connecting rod with a .0003" loose fit. A good method of determining the type of fit is to use a light push fit in the piston and a very light push fit in the connecting rod.

The connecting rod as used in production is marked both on the rod and the cap on the camshaft side. If the standard bearing does not give the correct clearance on the crankshaft, .002" undersize bearings are available. The desired clearance on the connecting rod bearing is .0015" to .002". The spur on the bearing insert which prevents it from turning in the rod is on opposite sides of the crankshaft when the rod is correctly assembled. The oil spray hole in large end of connecting rod should face the camshaft side. Tighten the connecting rod capscrews to 20 to 25 foot lbs. torque. Do not file the connecting rod, cap or insert to obtain bearing fit.

## ENGINE OILING SYSTEM



The Model "G" engine uses regular grade lubricating oil of the following specifications:

For heavy duty service above 32°F use SAE 30.  
For normal duty operation above 32°F use SAE 20.

For temperatures between 0°F and 32°F use SAE 20.

Below 0°F use SAE 10W.

Heavy duty operation is any operation in which the engine is called upon to produce half or more of its rated horsepower. Normal duty operation is interpreted as an operation in which the engine is called upon to produce an average of less than half of its rated horsepower.

New or reconditioned engines should use SAE 20 oil for the first fifty hours of operation and should be operated on light to medium loads if possible.

The oil sump capacity is 3-1/2 quarts with oil filter. For oil changes when the filter is not changed, 3 quarts will fill the sump to the required level. The oil filter should be replaced at least each 200 hours of operation.

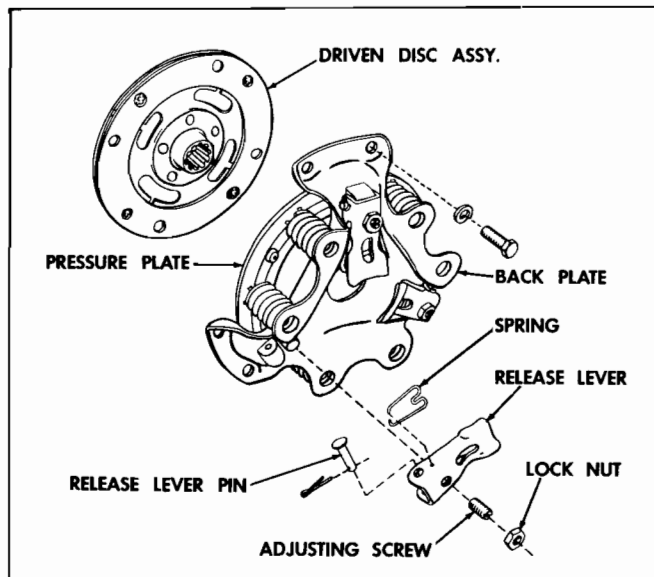
The oil is drawn from the oil sump through the intake screen and pipe to the oil pump which is mounted at the rear of the camshaft and is driven at camshaft speed. The oil from the pump is forced under pressure into the oil gallery which is located in the cylinder block between the camshaft and the crankshaft. The oil pressure relief valve is located at the rear end of this gallery. The oil pressure relief valve prevents excessive pressure from being developed in the oiling system. Drilled passages are provided to lead the oil from the oil gallery to the front main bearing and the rear main bearing, and the front camshaft bearing. The drilled passage to the front camshaft is smaller than those to the crankshaft. The rear camshaft bearing receives its oil from seepage from oil pump. The differences in sizes of the drilled passages assures an adequate supply of oil to the main bearings. The center camshaft bearing, cam followers or tappets are lubricated from spray. Two port holes are provided into the valve chamber and the valve springs and stems are lubricated from spray entering this compartment through these two port holes. The front cam journal has a groove cut around its outside circumference and a hole drilled from this groove to the front side of the

journal. This hole lines up with the two notches cut in the camshaft thrust plate allowing two spurts of oil from each revolution to reach the thrust plate, the timing gear and the governor mechanism. Oil from the front main bearing is fed through the drilled crankshaft to No. 1 connecting rod journal and from No. 1 through another drilled passage to No. 2 connecting rod journal. Oil from the rear main bearing

is fed to No. 4 connecting rod through a drilled passage and through a second drilled passage from No. 4 to No. 3 connecting rod.

Each connecting rod has a small squirt hole on the upper camshaft side of the large end which is used to increase the spray on the inside of the crankcase.

## CLUTCH

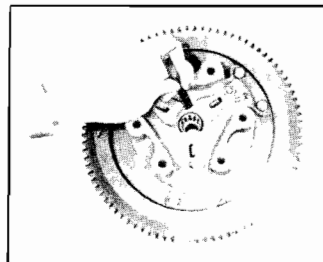


Check the face of the flywheel and the face of the pressure plate for flatness. These parts should not be warped.

Check the release lever for wear at the hinge pins and wear at the throwout bearing contact surface. Also check the adjusting screw and pivot or fulcrum points for wear.

### Assembly

Assemble the plate to the flywheel with the long hub of the plate away from the flywheel. Use a pilot to hold the plate in alignment as the pressure plate assembly is attached to the flywheel. Lubricate the clutch shaft pilot bearing in the flywheel with chassis lubricant.



### Removal

Separate the engine from the clutch housing and remove the six capscrews attaching the clutch to the flywheel. Remove these capscrews evenly so that the spring tension will not distort the back plate as it is loosened from the flywheel.

Compress the pressure plates against the back plate by the use of three "C" clamps or by use of a press. Remove the pins from the release levers and release "C" clamps or press.

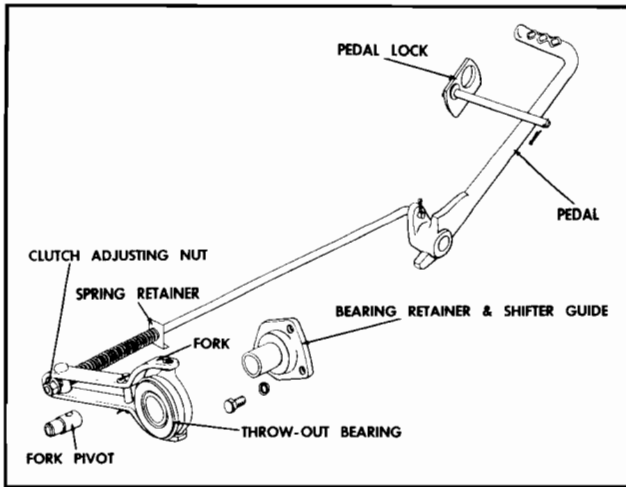
### Inspection

The clutch springs are 1-9/16" long and should be replaced if less than 1-1/2" long. It is preferable to replace clutch springs in full sets. Check the clutch lining for wear. It should be replaced if the lining thickness approaches the rivet heads. Check the lining and the hub for loose rivets. Check the hub for worn splines.

Adjust the clutch release levers until they are exactly 1-25/32" from the face of the flywheel, or 11/16" from the release lever contact surface to the back plate.

The throwout bearing should have 1/16" clearance between the bearing and the clutch release fingers. This measurement cannot be made when the tractor is assembled. This measurement can be related to clutch pedal travel, however, and is correct when the pedal has 1" of free travel. The clutch adjustment is made at the end of throwout fork by turning the nut on the end of the pedal rod. The pedal return spring is placed between the axle housing and the throwout fork. If a new clutch pedal is installed the upper stop should be filed until the pedal is approximately 4" below the seat attaching pad.

## CLUTCH THROWOUT BEARINGS & FORK



### Removal

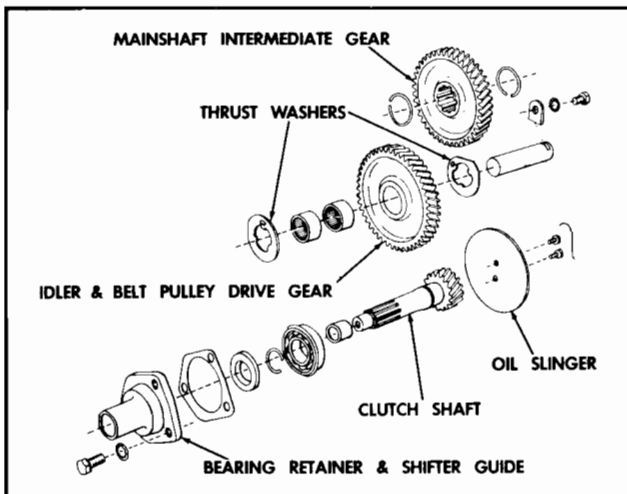
Separate the engine from the clutch housing and remove the pedal rod from the pedal. Remove the nut from the pedal rod and re-

move the rod and spring. Remove the hinge pin from the throwout fork. Remove the pin from the fork and remove the bearing assembly. The bearing may be pressed from the carrier.

### Inspection

Check the fork pivot pin and the pin ends of the bearing carrier and the holes in the fork. These points can stand considerable wear; however, if the wear is great enough to cause difficulty in securing the 1/16" clearance between the throwout bearing and the release levers, these parts should be replaced. Do not confuse the slotted hole in fork for wear. Check the bearings for roughness or sticking. If the bearing is rough or rolls with considerable effort it should be replaced. The bearing is a straight thrust bearing and can stand considerable side movement or wear until the point is reached when the retainer will strike the inner race.

## CLUTCH HOUSING



### Removal

Separate the engine from the clutch housing and the clutch housing from the transmission. Remove the lock from the idler gear shaft and pull shaft from clutch housing. Remove the oil slinger from the clutch shaft gear end. Remove the retainer from the clutch shaft bearing. The shaft may then be pulled toward the flywheel and removed from the case. The third gear in this assembly will remain on the main transmission shaft where it is

retained by two snap rings. The idler gear is mounted on two needle bearings and these may be pressed from the gear if necessary. Remove the snap ring from the clutch shaft and press the bearing from the clutch shaft.

### Inspection

Check the gear teeth and splines for wear. Check the needle bearings for wear and roughness. The maximum allowable wear is .007". Check the clutch shaft bearing for roughness or pitting. This bearing should be replaced if worn .006" or more. Check the clutch shaft, pilot bearing surface and the pilot bearing in the flywheel. The bearing or shaft, or both, should be replaced if the clearance exceeds .010". Use a new oil seal at the clutch shaft.

### Assembly

Place the oil seal in the retainer with the lip toward the oil supply. Place the clutch shaft bearing on the shaft with the snap ring toward the splined end of the shaft. Place the idler gear in the case with the two thrust washers between the case and the gear. The thrust washer on the front side of the gear or away from the flywheel has a turned-over lip which is used to prevent it from turning.



## FLYWHEEL AND STARTER RING GEAR

### Removal

Separate the engine from the clutch housing and remove the clutch. Remove the starter ring gear from the flywheel with a hammer and punch. Remove the four bolts from the flywheel.

### Inspection

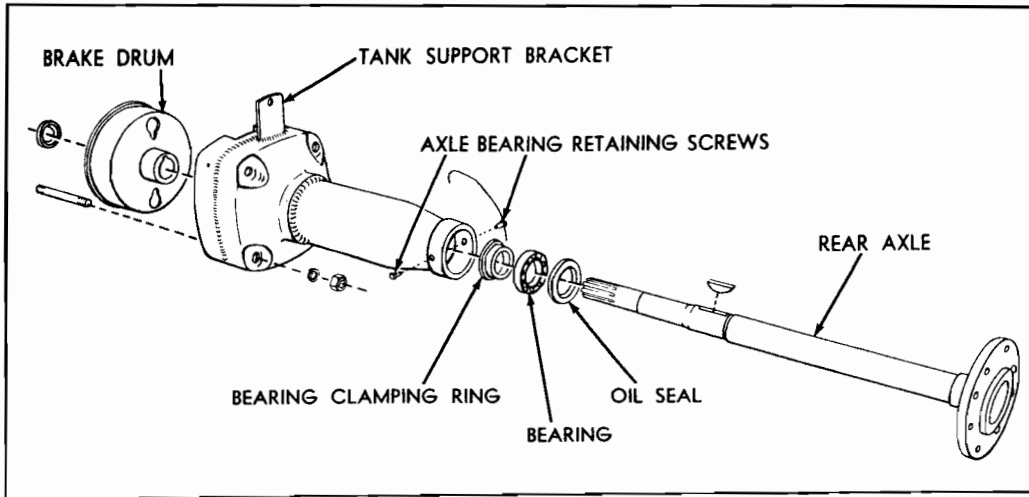
It will not be necessary to remove the flywheel ring gear from the flywheel unless the starter teeth are damaged. The flywheel is

balanced and no drilling or machining should be done to the flywheel. Check the clutch surface for flatness.

### Assembly

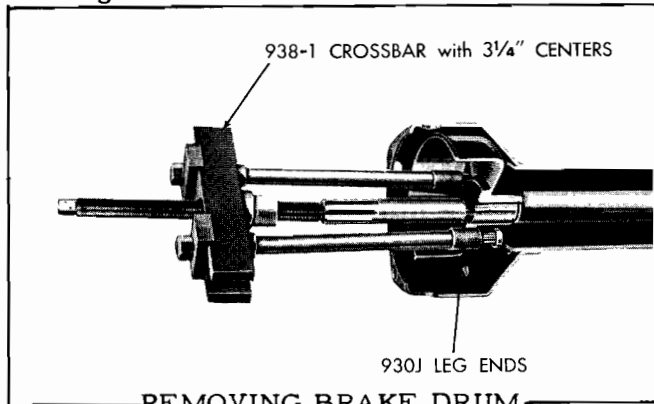
Heat the starter ring gear to 550°F and install on flywheel with the beveled end of the teeth toward the flywheel end of engine. The starter ring gear has 86 teeth and the starter pinion has 10 teeth. Tighten the flywheel cap-screws to 55 ft. pounds torque.

## REAR WHEEL & AXLE HOUSING



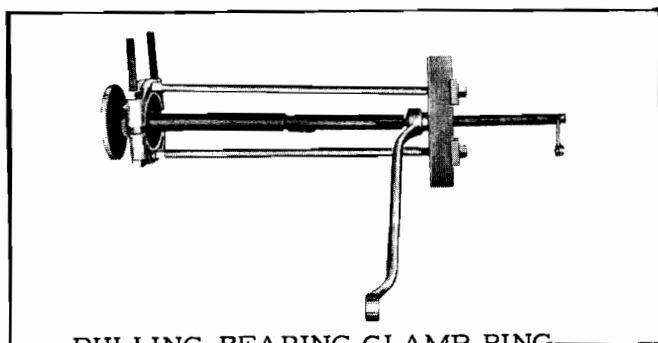
### Removal

Drain transmission to prevent oil from contacting brake bands. Remove the rear wheel to prevent damage to oil seals. When removing the left hand axle housing, the clutch pedal rod must be removed. Remove the bolt from the gas tank support and the four nuts attaching housing to transmission and differential case.



REMOVING BRAKE DRUM

Remove the two bearing clamp ring retaining screws from the outer end of axle and attach the OTC puller as shown and pull brake drum from shaft. To remove the cast drum use OTC 20M adaptor (5/8" male NC and 5/8" female NF) in place of the 930J leg ends. To replace oil seal or bearing, pull the bearing clamp ring from the axle shaft.



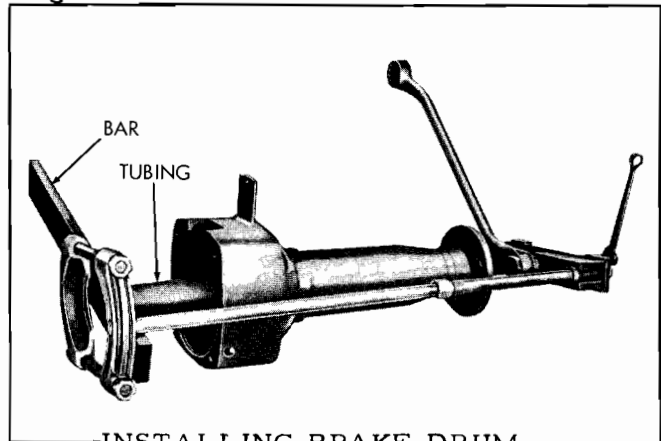
PULLING BEARING CLAMP RING

### Inspection

Always use a new oil seal. Check the brake drum for scoring.

### Assembly

Place the oil seal on the axle with the lip towards the bearing. Place bearing on the axle with the shielded side away from the seal. Pack the bearing with chassis lubricant. Install the bearing clamp ring with the small end towards the bearing. Always use a new clamp ring. The axle is retained by the press fit of the clamp ring.



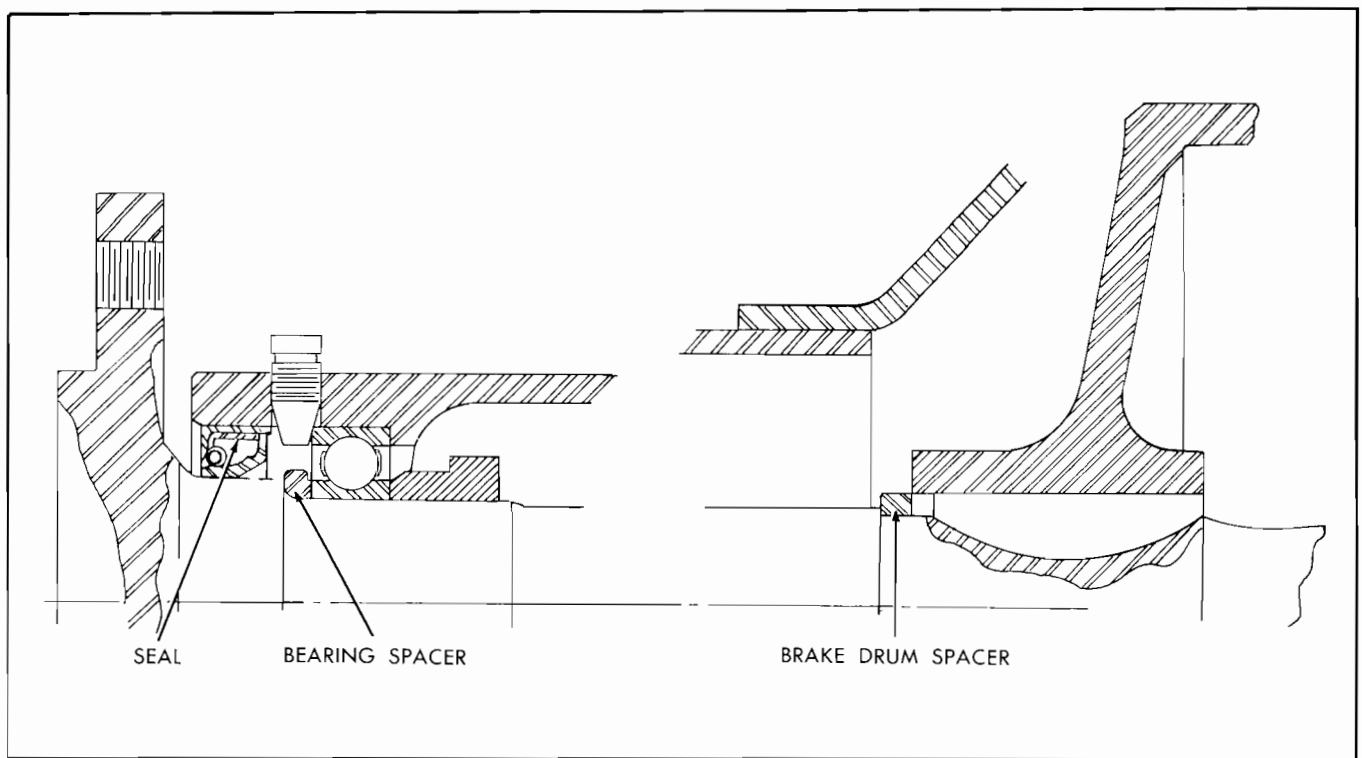
INSTALLING BRAKE DRUM

Install the axle in the housing. Tighten the bearing retaining screws to 10 ft. lbs. Lock with lacing wire.

Install the brake drum using a piece of 1-1/4" tubing 8" long and a heavy bar of iron in the OTC puller as shown.

A new Rear Axle Kit 800902 has been provided for service. It consists of the axle, a new oil

seal 800906, a bearing spacer 800904, and a brake drum spacer 800905.

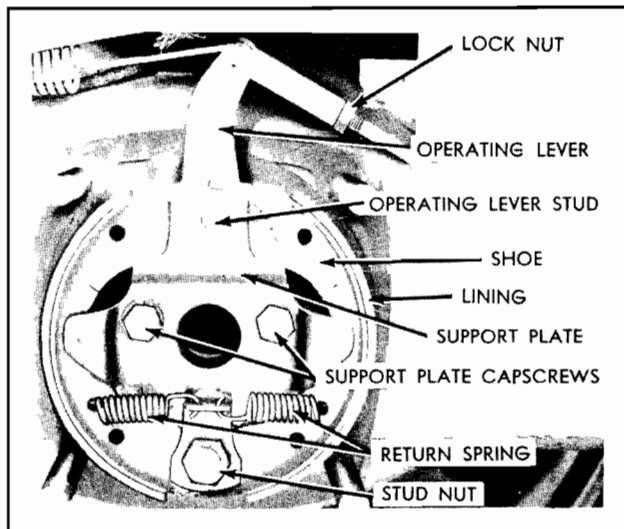


#### TO INSTALL

Place oil seal on axle with seal lip towards axle flange. Place the large diameter spacer on axle with the inner curved radius towards the seal. Install bearing and bearing retainer. Install the axle in the housing, being sure the

seal is pressed against the counterbore. If seal is not seated properly, the seal lip will ride up on flange radius damaging the seal. Place the smaller drum spacer on axle with square side towards drum. Heat drum and press into place.

## BRAKES



Check the lining for wear. It must be replaced when worn down to the rivet heads.

Check the brake lever cam for wear. If worn until adjusting brakes is difficult, either in the cam surface or hinge points the parts should be replaced.

### Assembly

Tighten the support plate capscrews to 55 ft. lbs. torque and the support stud nut to 100 ft. lbs. torque.

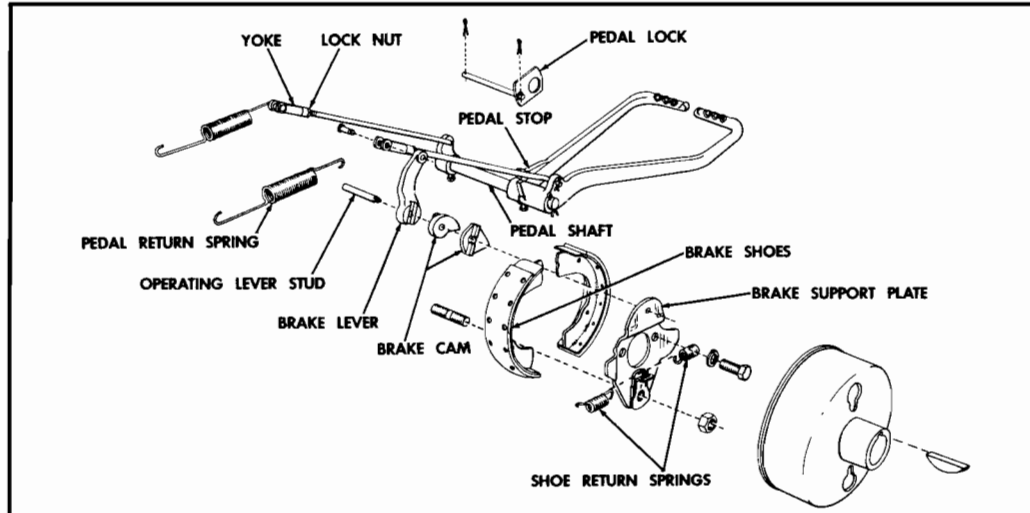
Rivet the lining to the shoe, placing the rivet head in the lining and upset with special punch on inner surface of the shoe.

The shoes are all alike and may be used in either front or back. However there is a top and bottom. The top of the shoe may be identified by the cutout section in the cam surface. The lining extends to the lower end of shoe. There are two holes in the lower end of shoe. One of these, the top, is used to attach the shoe return springs.

### Removal

Remove the wheel and axle housing assembly. Disconnect the brake pedal return spring and the brake shoe return springs. The shoes may now be lifted out. If the lever mechanism is to be removed, remove the brake support plate.

## BRAKE PEDAL ADJUSTMENT



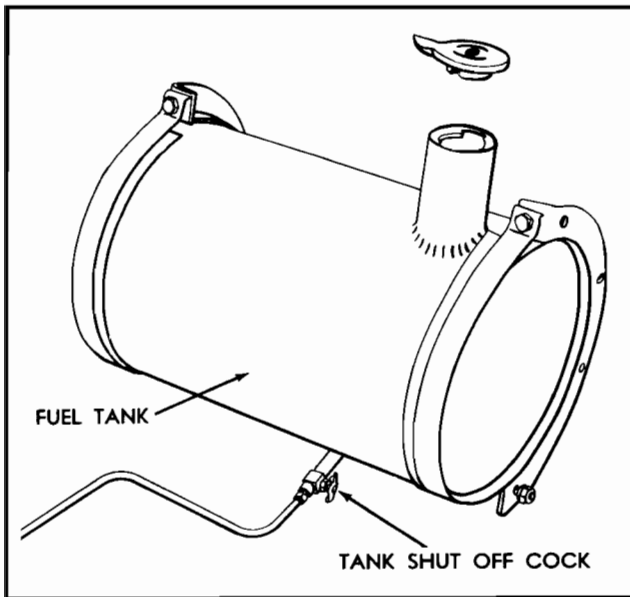
When new pedals are installed, the pedal stops must be filed to stop the pedal, approximately four inches below the seat attaching pad and to have the pedals level with each other.

Brake pedal parts should be replaced when wear makes adjusting brakes difficult.

The pedal lock is on the left hand brake only. The brakes may be adjusted by loosening the

lock nut on the yoke at the rear end of brake rod. Raise wheel from floor and remove rod from pedal and turn into yoke end to tighten brake. The pedal should have approximately 1-1/2" movement (by hand) before brake is applied, or a slight drag. Enter the rod in pedal from the left hand side. The threaded section of rod will provide enough adjustment to wear lining down to the rivet heads. Adjust left brake first. Adjust the right brake until pedals are level and have equal travel.

## FUEL TANK



### Removal

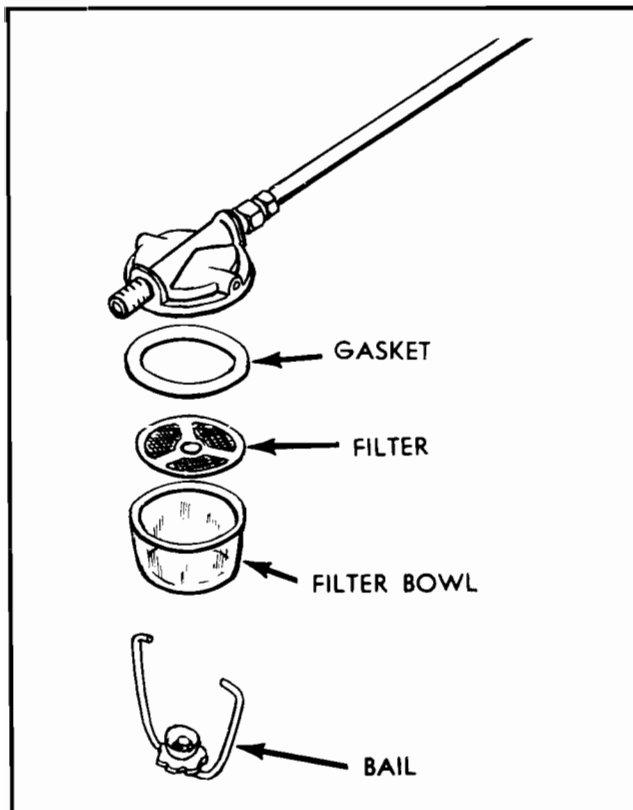
Remove the hood, fenders and seat. Shut off fuel valve under tank. Remove the seat and the fuel line. Remove the tank brackets from the axle housings.

### Inspection

Check the tank for leaking and accumulation of sediment. Clean if necessary. Check the tank cap for vent hole cleanliness. It must be open. Check cap gasket. It should seal tightly.

If fuel tanks are to be soldered, use extreme caution, or have it done by a competent mechanic who understands the hazards of such work and has the facilities to reduce the hazards to a minimum.

## FUEL FILTER

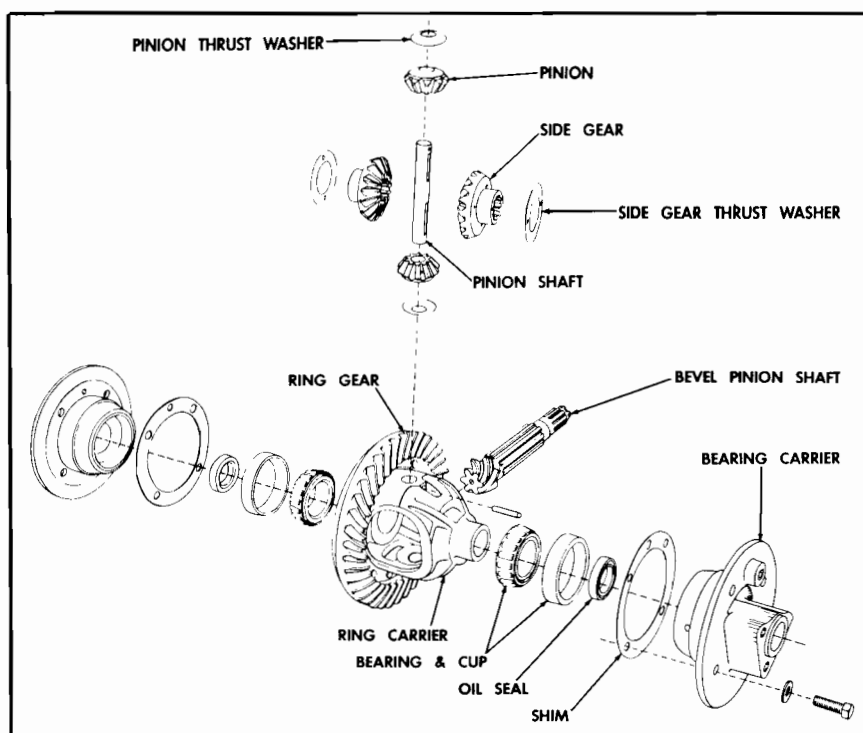


Shut off the fuel cock under tank and remove fuel line, carburetor and fuel filter.

Clean the filter thoroughly. The filter is a felt element and is very effective. If it plugs rapidly it indicates better methods of fuel handling should be employed.

Install the felt element with the web side up and above the gasket. However, if it has been installed upside down it is best to replace in same position, as dirt collected in felt will be washed out and enter carburetor if turned over. Dirt entering carburetor may cause float valve leakage.

## DIFFERENTIAL



### Removal

Drain the transmission, remove the clutch housing and engine assembly. Remove the wheel and axle housings. Remove the brakes and brake support plates. Remove the differential bearing carriers.

Pull the bearings from the carrier. Remove the pin from the pinion shaft and remove the shaft. The pinions, side gears and thrust washers may be moved around to open side of carrier and removed after the shaft is out.

### Inspection

Check the gear teeth and bearings for wear, roughness or pitting. Check the pinion and side gears for backlash clearance. They should be replaced if backlash is more than .015" and cannot be compensated by new thrust washers. Check face of pinions and side gears and thrust washers and thrust washer surface in carrier for scoring. Always use new oil seals.

### Assembly

If a new ring gear is riveted to the carrier it should be cold riveted. Place the side gears and pinions in carrier. Rivet the pinion shaft keeper pin by distorting end of hole. The gears should have about .005" backlash or turned or caused to revolve with a lever not more than one foot long.

Place the assembly in the case with the ring gear on the left hand side.

Adjust the bearings by use of the correct number of shims between the bearing carriers and transmission case. Adjust to a free rolling fit without end play or binding.

After the bearings are adjusted, the ring gear mesh may be adjusted by removing a shim from one side and installing it on the opposite side. The backlash clearance should be from .004" to .007". Use a nonsetting sealer between shims and between shims and case and carrier to prevent grease leakage.

## SPECIAL LOW GEAR

### Removal

Drain the transmission

Separate the torque tube from the front of the transmission case.

Remove the set screw from the shifter fork and remove fork and pinion. Remove the pinion shaft bearing adjusting nut to remove gear. The shifter rod and detent ball may be removed by removing the main shaft bearing retainer and pulling the assembly from the transmission case. Slide the shaft from retainer, placing the hand over detent ball and spring to prevent their loss.

### Inspection

Check the gear teeth and splines for wear or

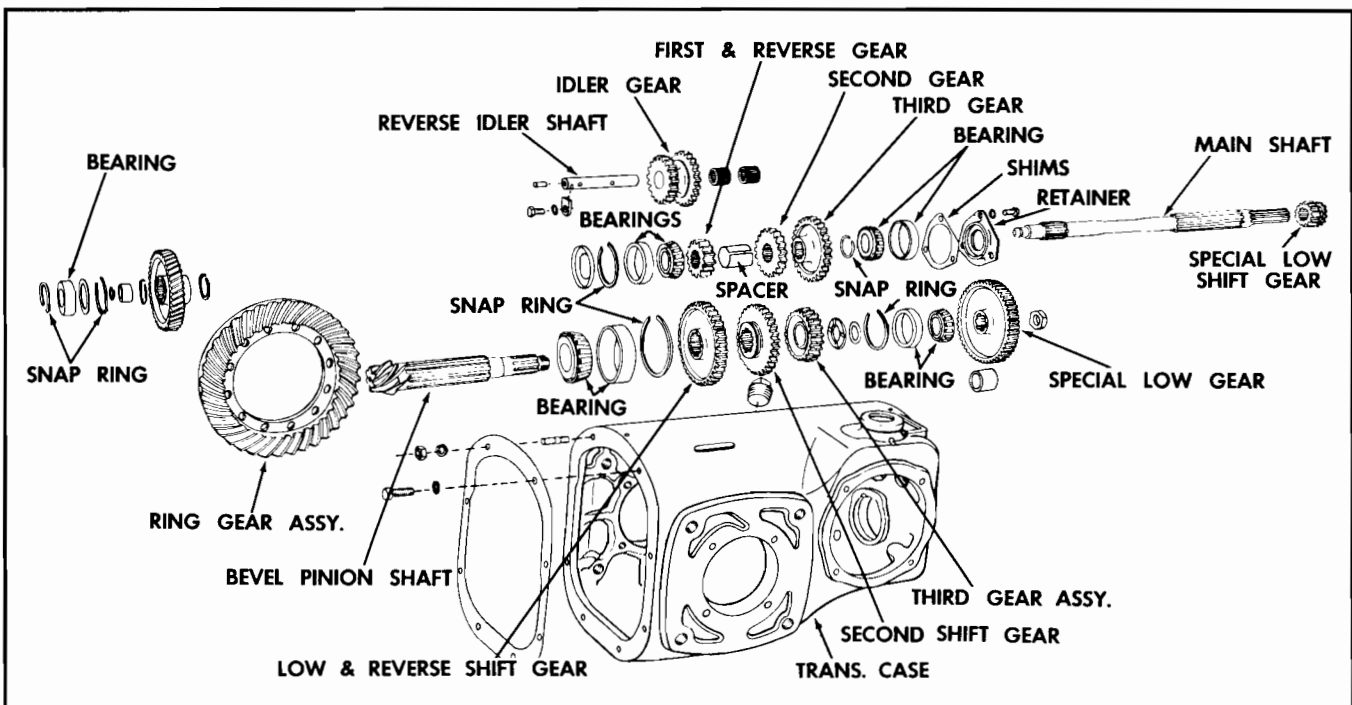
chipping. Check the shifter shaft for wear at the detent notches.

### Assembly

Install pinion gear with shift collar forward. Install gear with beveled ends of teeth forward. Adjust main shaft bearings to a free rolling fit without end play or binding. Adjust pinion shaft bearings to a slightly preloaded fit (8 ounce Ft.).

This amount is a noticeable drag, but must not be so tight that it feels as though the bearing runs over tight spots. Lock the adjusting nut by punching a portion of the thin section into the shaft keyway.

## TRANSMISSION



### Removal

Separate engine and clutch housing assembly from transmission case. Separate torque tube from transmission case. Remove the rear axle assemblies, brakes and brake support plates and differential. Remove the gear shifter mechanism.

Remove the main shaft bearing retainer at front of case and slide shaft forward, re-

moving gears from the shifter opening. Remove the adjusting nut and slide pinion from rear of case and gears from the shifter opening. Remove the lock from the reverse idler shaft and pull shaft to rear of case. This shaft is threaded for a puller if required.

### Inspection

Check the bearings for wear, chipping or rough cups and rollers. Check gears for

wear and chipped or rough teeth. Check the shafts for worn splines.

### Assembly

Place the reverse idle gear, bearings and shaft in the case first. Install the cork in the reverse idler shaft to prevent loss of oil.

Install the pinion shaft with the sliding gear, placing the shift collars towards each other. Install the loose third speed gear. Install the thrust washer with the grooved side next to the third speed gear. Place the spring washer next, then the bearing and retaining nut. Adjust the bearings to a slightly pre-

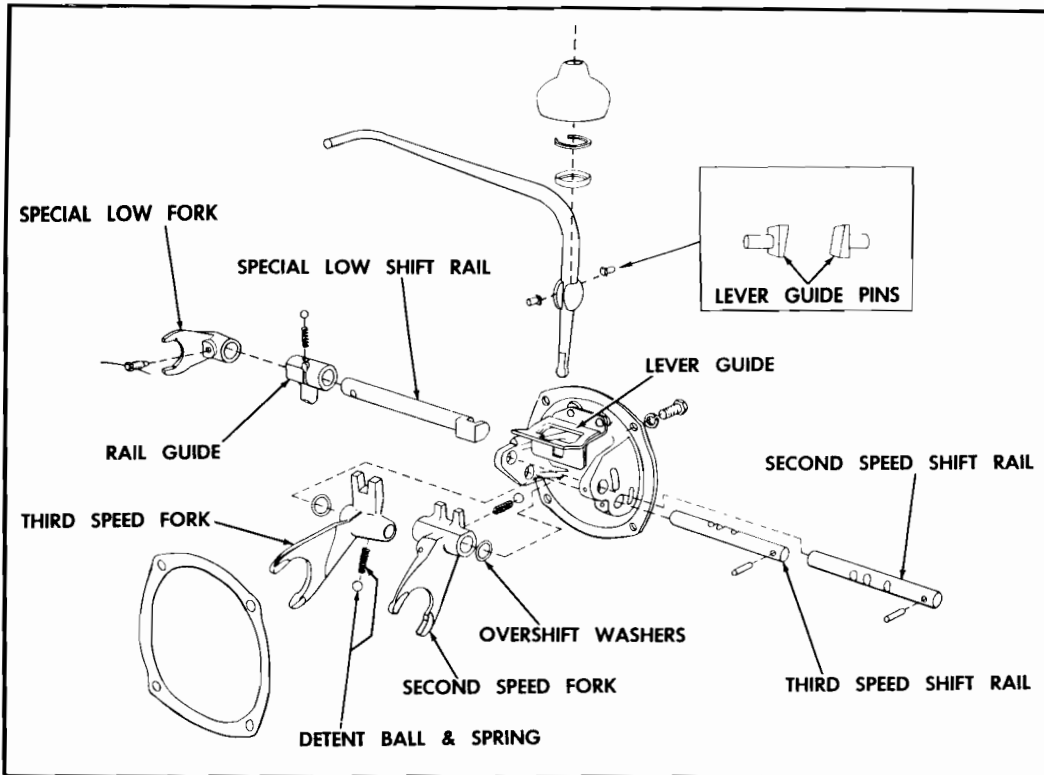
loaded fit, 8 ounce ft. Lock the nut by driving a portion of the thin section into the keyway of shaft.

Tractors without the special low gear will have a spacer to take the place of the gear.

The main shaft is installed from the front of case, placing the gears on shaft as it enters case. Install the rear bearing and the low speed pinion before installing gear spacer. Adjust bearings to a free rolling fit without end play or binding by use of shims between front bearing retainer and case. The oil dam for the rear main shaft bearing is installed behind the bearing.



## GEAR SHIFT MECHANISM



The gear shift is the same as used on the Model "B-C", except, the guide plate is notched for the special low gear and the lever is shaped differently and guide pins are used to control lever.

### Removal

Remove the seal boot from lever, and remove the snap ring from transmission case. The lever and retainer can be lifted from the case. After the lever is out, the two lever guide pins may be removed.

Remove the four screws attaching the shift mechanism to right side of transmission case.

Note the position of the overshift washers.

To remove shift rails pull the retaining pins from cover. If they cannot be pulled, drive them on through and cut off excess as it strikes cover.

### Inspection

Check shift rails for wear at detent notches. Check forks for wear at gear contact section and lever contact section.

The shift lever guide must be centered to line up with shifter slots in both forks. The edges of guide may not be worn excessively. If

either case exists the guide worn excessively or guide not lining up it may be possible to shift into two gears at once.

### Assembly

The third speed shift rail can be identified by the three notches. The two front notches are very close together. The notches are at right angles to the retaining pin hole. The third speed fork has the high shift lug. The fork is installed with the fork towards front of case and shaft in R.H. position.

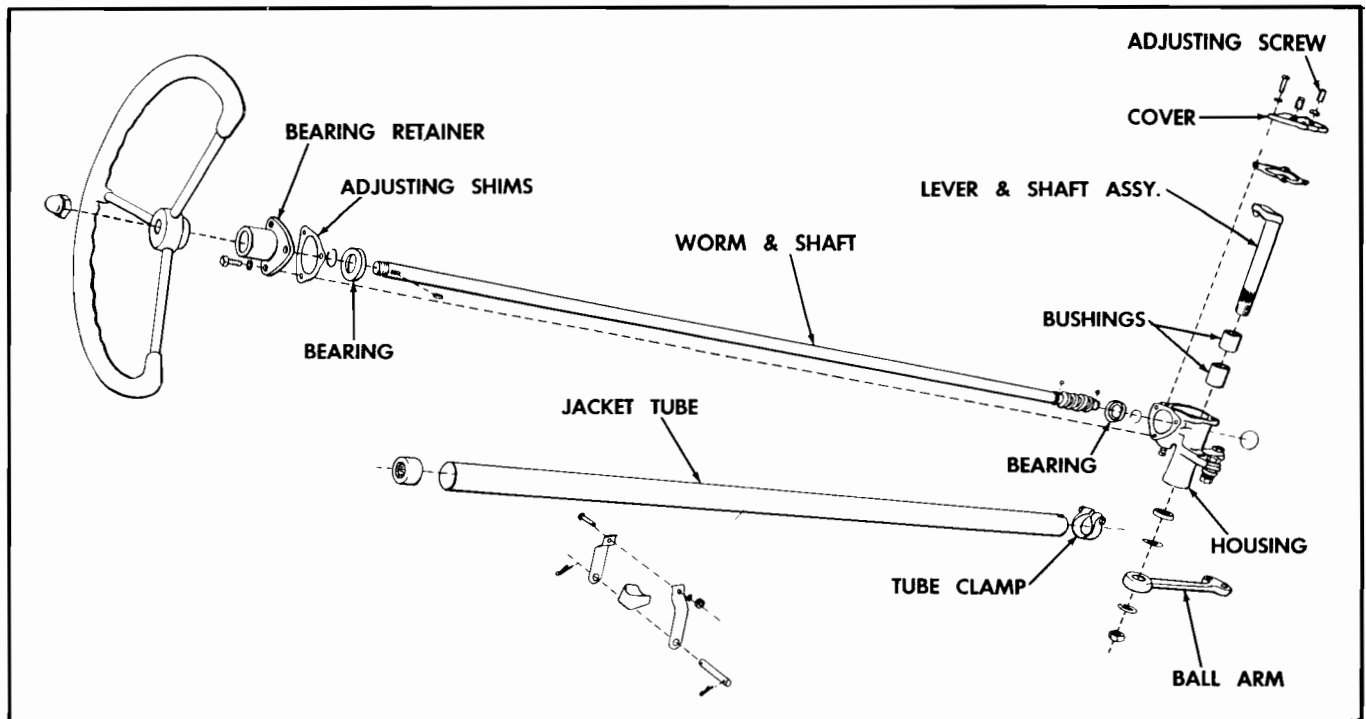
The low speed shift rail has three notches in line with the retaining pin hole.

The overshift washers should be replaced just as they are removed. They are used back of the third speed fork or in front of the low speed fork, as required, to prevent gears from rubbing when in the "in gear" position.

The gear shift lever guide pins are cut diagonally and must be installed correctly. The right hand pin is installed with the narrow side of the head up. The left hand pin is installed with the narrow side of head down.

If the tractor is not equipped with the special low gears, these pins may be turned over, and will prevent the shift lever from entering the slot in shift lever guide.

## STEERING GEAR



### Removal

Remove the steering gear ball arm and the two screws attaching steering gear to frame. Remove the four cover capscrews, cover and lever shaft. Remove the steering gear wheel and loosen jacket clamp. Slide jacket tube up and remove the four capscrews on bearing retainer.

### Inspection

Check bearings for wear and roughness. Check the cam and worm for wear and scoring. Check the lever shaft bearings for wear.

Steering gear parts must not be worn excessively or steering adjustment will be difficult.

### Assembly

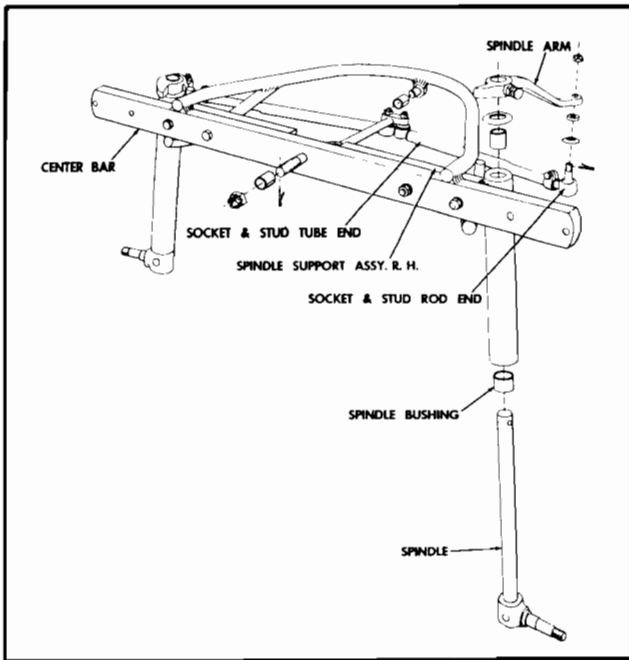
Install the worm shaft and adjust bearings to a free rolling fit without end play or binding by use of shims between bearing retainer

and housing. Install jacket tube with the notch in lower end "up" to prevent grease leakage. Adjust the length of tube to reach into recess of steering wheel. It must not touch wheel or it will cause binding.

Back out the lever shaft adjusting screw and install lever shaft and cover. Count the number of turns from full right to full left, then turn back half these turns to mid-position. At mid-position, adjust mesh between worm and lever shaft to .001" and secure lock nut.

When placed on the tractor the steering wheel should have the first spoke to left of cut-out section straight up or vertical. This places the cut-out section between the 12 o'clock and four o'clock position where greatest advantage in vision is obtained. This adjustment is made by lengthening one tie rod and shortening the other as required. Maintain the "toe-in" of 0" to 1/16" while making this adjustment. Lubricate the slip joints of socket and stud rod end to prevent rusting.

## FRONT AXLE AND SPINDLES



### Removal

Raise tractor and block securely. Remove the drag links from the steering arm. Remove the key and nut from the front of radius rod. Slide axle assembly back until free of tractor.

### Inspection

Check the spindle shafts and radius rod bushings for wear. If worn .020" or more, they should be replaced.

### Assembly

The radius rod bushings are .755" and are pre-fit. The spindle bushings are 1.126" and must be reamed after pressing into place.

The "toe-in" adjustment of front wheels must be made each time the axle is repaired or wheel spacing changed. The "toe-in" is 0" to 1/16".

## FRONT WHEELS

### Removal

Raise the front wheel from floor and block solidly. Remove the hub cap, key and nut from axle. Pull wheel. Pull inner bearing and oil seal. The bearing cups may be driven from hub.

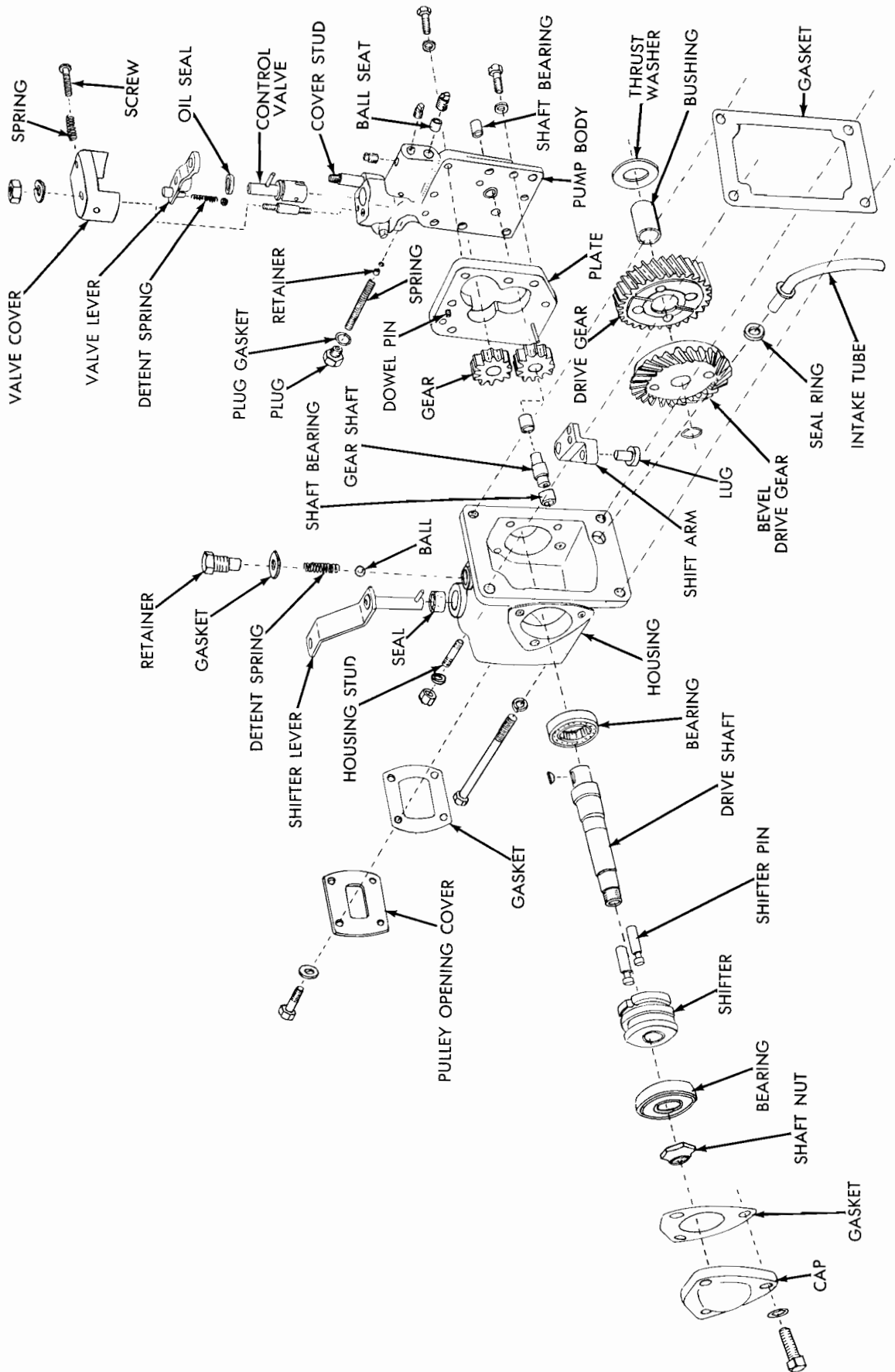
### Inspection

Check the bearings for wear, chipping and roughness.

### Assembly

Always use a new oil seal. Clean the parts thoroughly and dry the bearings of cleaning fluid. Pack with #2 wheel bearing grease. Adjust bearings to a free rolling fit without end play or binding.





HYDRAULIC PUMP

## MODEL "G" HYDRAULIC PUMP

### General

The Model "G" Hydraulic Pump is a gear type pump and develops approximately 900 P.S.I. It is driven from the belt pulley and is mounted on the side of the belt pulley assembly.

### Oil Circulation

Oil is drawn through the oil inlet tube which extends from the pump into the reduction gear section of clutch housing. Drilled passages from the tube through the belt pulley housing connects the inlet tube to the suction side of the gears.

Oil leaves the gears under pressure through drilled passages to the relief valve and control valve. Oil passes through the control valve through the drilled hole in valve which connects the pump pressure passage to ram.

When the ram is fully extended the pressure rises high enough (900) to cause the relief valve ball to leave its seat. At this time the oil passes the ball and returns to the sump through drilled passage at "B".

When the pump bypasses the control lever should be released immediately. The control lever spring will then return the control valve to the hold position. When in the hold position the valve is turned so the drilled hole does not line up with oil passages. This traps the oil in ram and holds rams extended. Also the wide notch in valve lines up with pump passage and oil passes into wide notch and to lower end of valve and back to sump through hole "B". When the pressure drops the relief valve closes.

When the control lever is pushed clear down the valve is rotated further until both the narrow and wide notches in valve lines up with the pump drilled passage. At this time the pump continues to force oil through wide notch and under valve back to sump through passage "B". Also at the same time oil from ram is released through the narrow notch and back to sump.

A screw is provided on the pump control lever to regulate rate of drop. Turning screw **in** slows rate of drop. The belt pulley and pump is of the clutch type. To shift, depress clutch pedal and move shift lever towards rear of tractor.

### Pump Removal

Disconnect the ram hose or hoses, remove control linkage, remove capscrews attaching belt pulley assembly to tractor.

### Pump Disassembly

Remove the pulley and pinion assembly. The surfaces of the pump body, gear plate and pulley housing are lap fits and mated together with dowel pins. No gaskets are used. Use great care when separating these parts to prevent damage to lapped surface.

The idler pump gear is pressed onto its shaft and the shaft is mounted in needle bearings. The pump drive gear is keyed to the shaft.

Remove the cover from the control lever. Drive the taper groove pin from the lever and valve and remove lever. The valve has an "O" ring seal and may be a little difficult but can be pulled from body.

Remove the pipe plugs from the relief valve bore and remove relief valve spring, ball seat and ball. Relief valve seat may be driven from body from spring side. (Enter punch in spring side).

To remove pump and pulley drive shaft, remove the detent spring and ball from shift lever. Remove the bearing cap from housing. Remove nut on end of shaft and remove the ball bearing.

Move shift collar towards bearing and remove shift pins. Move the shaft assembly towards cap side of housing until shaft is out of the roller bearing on the opposite end. Angle shaft and bring gears and shaft out through large opening in the pulley housing.

Press the bevel gear from shaft and idler gear and thrust washer may be removed.

Remove the taper pin from the shifter and shifter shaft and pull lever and shaft assembly from the housing.

### Inspection

Check the bearings for wear and roughness. Check gears for wear and roughness. Check the idler gear thrust washer for wear. Check the shifter collar and pins for wear.

Check the pump gears for wear and end play. The gear clearance should be .002" to .004". Measure the thickness of gear and gear plate to determine clearance. Gear backlash should not be excessive. If the relief valve is seating properly and not leaking the pump should develop approximately 900 lbs. pressure. If it does not the cause will be found in excessive gear backlash or end clearance.

The relief valve spring should measure 3-13/16" long - free length. If 3/16" short it should be replaced. Always use new oil seals and "O" rings.

### Assembly

Place the idler gear thrust washer on the shaft. Place idler gear next with shift pin holes with counterbored ends towards bevel gear. Install bevel gear key and press bevel gear on shaft. The idler gear should turn free without excessive end play. Place roller bearing in housing. Enter shaft assembly and place shifter and pins in position. Place ball bearing in position with long side of bearing from snap ring towards the gear. Tighten shaft nut securely and lock by depressing a portion of the thin section into shaft keyway. This bearing is a semi-thrust bearing and holds the end play of shaft. Install cover using sealer.

Install shift lever and seal in housing with lever pointed away from tractor and inside shift lever towards tractor with swivel in shifter collar groove. Drive taper pin into place. Install detent ball, spring and plug.

Place the pump drive gear key and drive gear on pump drive shaft. Install one needle bearing in drive housing and one in pump cover housing.

Use sealer on outside of needle bearing. Be sure this sealer does not enter bearing. Press pump idle gear on shaft, locating it in center of shaft.

Clean the lapped surfaces of pump body, gear section and housing thoroughly and place parts together on the 1/4" dowel pins. Late style pumps have 5/8" dowel pins. Bushings are provided for installing repair parts on pumps having 5/8" holes and 1/4" dowel pins. Start the capscrews and tighten evenly to 30 ft. lbs.

If lapped surfaces are scratched or marred or dirt on surface or capscrews tightened unevenly the pump will leak.

Seat the relief valve ball in its seat before assembly. Use a soft punch and use a solid blow. Drive seat into place in side of body closest to tractor. Drive to bottom. Enter ball, ball spring guide, spring and retaining plug from opposite side.

Install control valve with wide notch towards tractor side of pump. Install oil seal and control lever, detent ball and spring and cover assembly.

The screw & spring in control lever cover is used to secure slow rate of drop. Turning in on screw lowers rate of drop.

A valve is placed in the remote ram line to secure delayed lift of rear furrowing bar. Closing this valve partially, increases delay.

### BELT PULLEY (NEW STYLE)

Remove the four capscrews attaching the assembly to the belt pulley and pump housing. Remove sheave, shaft nut cover and nut. Pull the pulley drive flange. Press shaft from housing. Press bearing from shaft and drive bearing cups from housing. The snap rings may be left in place.

### Inspection

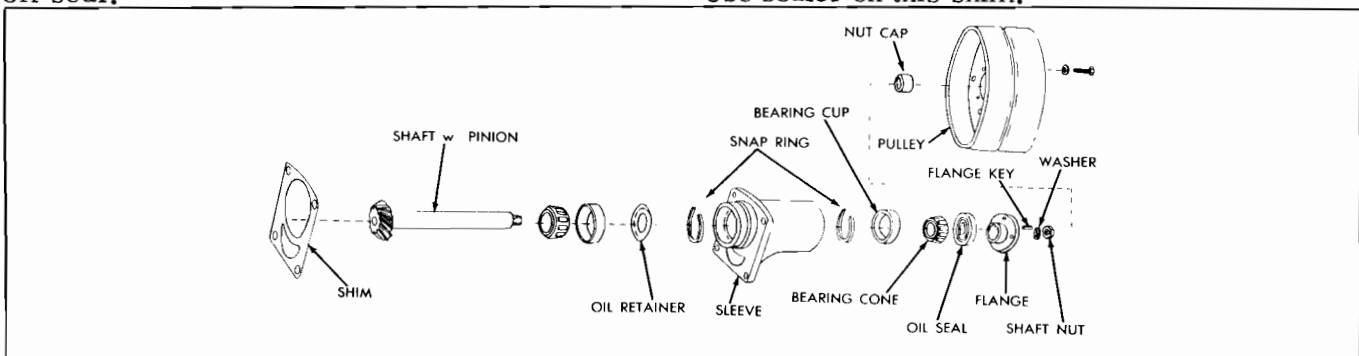
Inspect gear teeth for wear, and roughness. Check bearings for wear, roughness or scoring. Check oil seal surface on pulley hub. Replace oil seal.

### Assembly

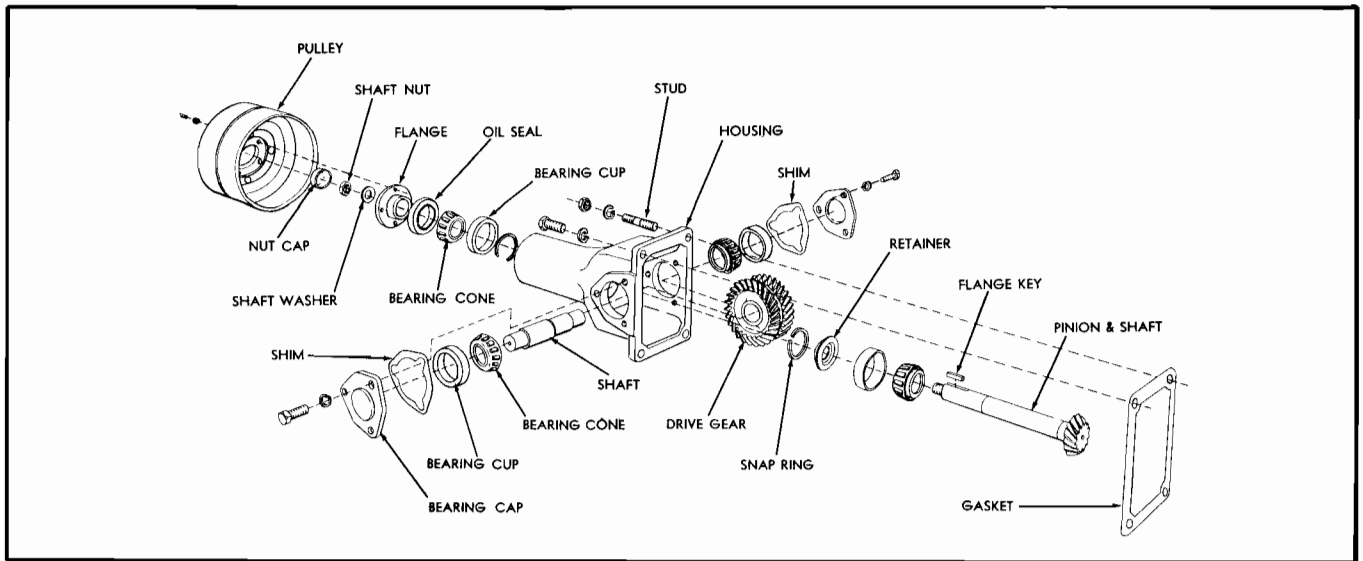
Assemble in reverse of above. Place the bearing shield washer with the concave side towards gear end of shaft and behind bearing cup. Install seal with lip towards bearing.

Adjust bearings to a free rolling fit without end play or binding. Lock nut by depressing a portion of the thin section into shaft keyway.

Adjust bevel pinion and gear mesh to .005" to .010" backlash by use of shims between housings. Use sealer on this shim.



## BELT PULLEY (OLD STYLE)



### Removal

Remove the four capscrews attaching the pulley assembly to the clutch housing. Remove the cap from pinion shaft and remove the bearing adjusting nut and pull pulley hub.

Remove the caps from the bevel gear shaft bearings. Move gear away from pinion as far as possible. Place two solid blocks between gear and case on pinion side of gear. Press shaft from gear. Pull pinion from case. Remove oil seal and bearing cups. It will not be necessary to remove the snap rings.

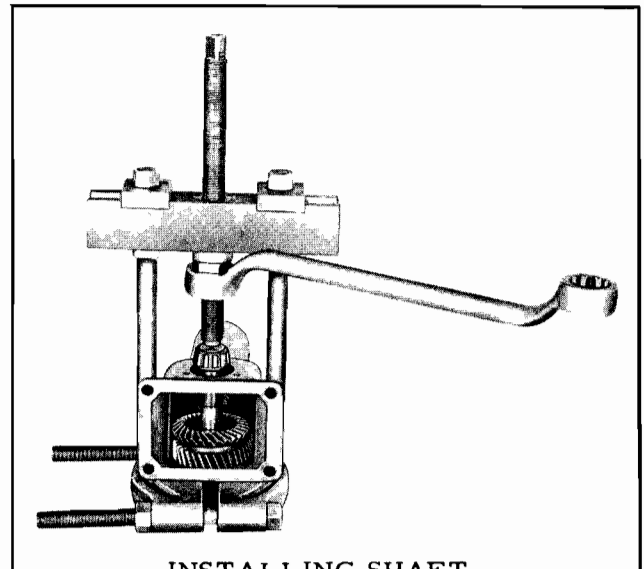
### Inspection

Check the bearings for wear, rough or chipped rollers. Check gear teeth for wear or chipping. Always use new oil seal.

### Assembly

Install the pinion in case and the oil seal with lip towards pinion end of shaft. Adjust bearings to a free rolling fit without end play or binding. Lock the bearing adjusting nut by punching a section of the thin flange into the shaft keyway. Install the seal cap over nut.

Place the bevel gear in case and press shaft in against shoulder. Install bearings and re-



tainers. Adjust bearings to a free rolling fit without end play or binding, by use of shims between retainers and case. Adjust gear backlash to .004" to .007" by removing shim from one retainer and installing under opposite retainer. This method will maintain correct bearing adjustment while securing correct backlash.

Use the gasket provided, which is hard paper .010" thick between pulley and clutch housing. If a single gasket does not give a gear backlash of .004" to .007" as required, use additional gaskets.



'B" AND "C" TRACTOR

**B&C**

MODEL "B" & "C" TRACTOR INDEX

<u>SUBJECT</u>	<u>B &amp; C</u>	<u>SPECIFICATIONS</u>	<u>GENERAL</u>
	<u>SECTION</u>		<u>SECTION</u>
	<u>PAGE</u>	<u>PAGE</u>	<u>PAGE</u>
Air Cleaner	31	4	31
Ammeter and Light Switch	33		
Battery	31	6	40
Battery Ignition Units	32		
Belt Pulley & Power Take Off	42	5	
Brakes	36	5	
Camshaft Bushings	17	4	
Camshaft & Valve Tappets	17	5	
Carburetor	26	4	22
Clutch	29	5	
Clutch Driven Disc	29		
Clutch Release Bearing	30		
Clutch Shaft & Torque Tube	38		
Connecting Rods & Pistons	18	4	21
Control Levers, Hydraulic Pump	49		
Crankshaft	19	4	
Crankshaft & Main Bearings	19		21
Crankshaft Oil Seals	20		
Crankshaft Wick	28		
Cylinder Head & Valves	22		
Cylinder Liner	21	4	
Diagram Wiring	52		
Differential	39	5	
Drawbar	41	5	
Electrical System	52		16A
Engine		4	
Engine Oiling System	53		
Engine Diagnosis			32
Fan Belt	13		
Fan & Water Pump	14		
Filter Oil	15		
Filter Fuel	34		
Flywheel & Starter Ring Gear	28		
Final Drive	37		
Front Axle		5	
Front Support	8		
Front Support Single Wheel	9		
Front Support Wide Axle	9		
Front Support Single and Adj.	10		
Front Wheel	12	5	
Front Wheel (Single)	13		
Front & Rear Crankshaft Oil Seals	20		
Fuels			6
Fuel Tank & Fuel Filter	34		
Gauge Oil	15		
Gemmer Steering Gear	50		
Generator	32	6	
Governor	24	4	
Hood	7		
Hydraulic Pump	43		
Hydraulic Pump in Action	46		
Hydraulic Pump Control Levers	49		
Hydraulic Ram	49		
Intake & Exhaust Manifold Assy.	25	5	
Ignition Units, Battery	32		
Light Switch & Ammeter	33		

MODEL "B" & "C" TRACTOR INDEX (Cont'd)

<u>SUBJECT</u>	<u>B &amp; C</u> <u>SECTION</u>	<u>SPECIFICATIONS</u>	<u>GENERAL</u> <u>SECTION</u>
	<u>PAGE</u>	<u>PAGE</u>	<u>PAGE</u>
Lights	41	6	
Liners, Cylinder	21		
Lubrication		4	
Lubricating Oil			6
Magneto		4	14
Manifold	25	5	
Oil Filter	15		
Oil Gauge	15		
Oil Pump	16	5	
Pedestal	11		
Piston	18	5	
Piston Rings	18	5	
Plugs Spark		5	17
Power Take Off & Belt Pulley	42		
Pump Hydraulic	43		
Pump Hydraulic Control Levers	49		
Pump Oil	16		
Pump Water	14		
Push Rods & Rocker Arms	23		
Radiator	7		
Radiator Shutter	8		
Ram Hydraulic	49		
Rear Crankshaft Oil Seal	20		
Rear Wheels		5	
Ring Gear, Starter & Flywheel	28		
Rocker Arms & Push Rods	23		
Ross Steering Gear	51		
Seat Frame, Fenders & Fender Angles	40		
Shutter Radiator	8		
Single Front Wheel	13		
Starter	40	6	
Starter Ring Gear & Flywheel	28		
Steering Gear, Gemmer	50		
Steering Gear, Ross	51		
Spark Plugs	27	5	17
Specifications		4	
Support Front	8		
Support Front Wide Front Axle	9		
Support Front Single Wheel	9		
Support Front Single & Adj.	10		
Thermostat & Housing	15		
Three Way Valve	49		
Tires			42
Torque Tube & Clutch Shaft	38		
Transmission	34	6	
Valves	22	5	19
Valves & Cylinder Head	22		
Valve Tappets & Camshaft	17		
Wiring Diagram	52		

MODEL B - C SPECIFICATIONS

ENGINE

Engine (CE)	
Number of Cylinders	4
Bore	3-3/8"
Stroke	3-1/2"
Displacement	125 Cu. In.
Gasoline Engine	
Compression Ratio	5.75 to 1
Compression Pressure	115 lbs.
Low Octane Fuel Engine	
Compression Ratio	4.75 to 1
Compression Pressure	99 lbs.
Engine (BE)	
Bore	3-1/4"
Compression Ratio	4.92 to 1
(Gasoline)	
Compression Pressure	94 lbs.
(Gasoline)	
Low Octane Fuel	
Compression Ratio	4.67 to 1
Compression Pressure	84 lbs.
RPM	
CE Engine	1500
BE Engine	1400
High Idle	1850
Low Idle	400 to 500
Firing Order	1-2-4-3

AIR CLEANER

Type	Oil bath
Oil Capacity	1/2 pint U.S.

CAMSHAFT

Drive	gear
Valve Timing	marked gear
Journal Diameter	1.749 to 1.750
Bearing Diameter	1.752 to 1.753
Bearing Clearance	.002 to .004"

CONNECTING ROD

Type	Offset
Bearing Length	1.219" to 1.229"
Journal Length	1.436" to 1.439"
Bearing Diameter	1.938"
Journal Diameter	1.9365" to 1.9375
Bearing Clearance	.001" to .002"
Rod Width	1.432"
Adjustment	by shims
Bearing Insert	Removable
Nut Tension	35 Ft. lbs.

CRANKSHAFT

Bearing Length	
Front Lower	1.623" to 1.625"
Front Upper, center & rear	1.500
Journal Length	
Front	1.626" to 1.628"
Center and Rear	1.750"

Bearing Diameter	2.251"
Journal Diameter	2.249" to 2.250"
Clearance	.001" to .002"
End Thrust Clearance	.001" to .005"

COOLING SYSTEM

Capacity	8 Qt. U.S.
Cooling	pump and fan
Drive	V belt
Belt Adjustment	By generator or adjustable sheave
Pump	Vane type
Pump Lubrication	Sealed and packed
Pump Bearing	ball
Water Seal Adjustment	automatic
Fan	4 blade 14-1/2" dia.

FUEL SYSTEM

Fuel Tank	13 gal. U.S.
Filter	felt strainer & bowl

CARBURETOR

Size	61 AJ 7 7/8"
Type	Updraft
Adjustment	main jet-fixed
Adjustment	Idle jet-adjustable.
Venturi	Size 13
Main Jet	Size 19
Main Discharge Jet	Size 45-2
Idle Jet	Size 15
Float Level	7/16" from top of fuel to top of bowl. 1-5/32" from bottom of float to top of bowl.

CARBURETOR

	161 J 7
Venturi	Size 13
Main Jet	Size 18-1
Main Discharge Jet	Size 45
Idling Jet	Size 15
Fuel Level same as	61 AJ 7

GOVERNOR

Type	Variable Speed
Speed	Controlled by operator

LINERS CYLINDER

Size CE Engine	3.375"
Size BE Engine	3.250"

LUBRICATION ENGINE

Capacity	4 qts. U.S.
Pressure	by pump
Filter	own
Filter Element	removable

MAGNETO

Fairbanks Morse	FM and FMJ
Type	High tension
Rotation	Clockwise
Impulse	Automatic

MAGNETO (Cont'd)

Lag Angle	30°
Advance	30°
Point Gap	.020"
Lubrication	packed and sealed

SPARK PLUGS

Size	14 MM
Point Gap	.030" to .040"
Heat Range	Gasoline-autolite AN 7 or AC 45 Low octane fuel autolite A 9 or AC 47

MANIFOLD

Two distinct kinds used. One for gasoline and one for low octane fuel.

OIL PUMP

Pressure	15 lbs.
Pump	Vane type
Location	Rear end of camshaft
Rotor end clearance	.002"
Rotor side clearance	not more than .004"

PISTON RINGS

End Gap	.007" to .017"
Ring Width	
Scraper	1/8"
Compression	1/8"
Oil Control	3/16"
Land Clearance	.0015"

PISTON

Material	Grey cast iron
Type	Cam ground

PISTON PIN

Type	Clamped in rod
Pin Diameter	.813" to .8133"
Bushing Diameter	.814" to .8142"
Clearance	.0007" to .0012"

VALVES

Exhaust Diameter	1-5/16"
Intake Diameter	1-7/16"
Stem Diameter	.3407" to .3417"
Seat Angle	45°
Margin	3/64"
Seat Width	1/16"
Guide Inside Diameter	.344" to .345"
Stem Clearance	.0023" to .0043"
Spring - Full Length	2-5/16"
Exhaust Seat Ring	Outer Dia. 1.4415"
Intake Seat Ring	Outer Dia. 1.540"
Tappet Clearance	.010 hot

VALVE TIMING

Intake valve opens top D.C., closes 40° past bottom center.  
Exhaust opens 40° B.B.D.C. and closes 10° after TOP D.C.

BELT PULLEY

Diameter	8"
Face Width	5-1/2"
RPM - Full Load	1125 at engine speed of 1500
RPM - High Idle	1350 at engine speed of 1800
Rotation	Anti-clockwise
Height	27"

P.T.O. SHAFT

Size	1-1/8"
Splines	6 B.
RPM	560 at engine speed of 1400

BRAKES

Type	Enclosed, contracting, foot operated
Adjustment	By nut. By screw on B52714 and C 15714 & up

CLUTCH

Diameter	8-1/2"
Early Engines	9" (B only)
Facings	Full circle, molded.
Springs	6
Full Length	2-1/4"
Throwout Bearing	Ball
Throwout Bearing Adjustment	1/4" between bearing and levers

DIFFERENTIAL

Ring Gear to Pinion Backlash	.004" to .009"
Lubricant	6 qt.

DRAWBAR

Height	10-1/4" to 18-3/4"
"B" 7" Tires	Six positions
"BC" 9" Tires	12-1/4" to 20-3/4"
	Six positions
Horizontal	3 positions each side of center, four inch spacing

FRONT AXLE

Toe in	1/8" plus or minus 1/16"
Spindle Diameter	1.247"
Spindle Bushing Dia.	1.249" to 1.251"
Axle Clearance (B)	23"
Wheel Tread (B)	42"
Turning Radius (B)	7-3/4'
Turning Radius (C)	7'

FRONT WHEELS

Tire Size	4:00 x 15
Steel	4" x 22"
Steel Skid Band	1-1/2" x 1-1/2"
Tire Air Pressure	28 lbs.

REAR WHEELS

Tire Size	9 x 24
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REAR WHEELS (Cont'd)

Air Pressure	12 lbs.
Steel Wheels Size	6 x 36
Lugs	18 per wheel 3-1/2"
Wheel Tread "B"	40" to 52"
Wheel Tread "C"	52" to 80"

TRANSMISSION

Lubricant - Capacity	6 Qt.
	7 qt. with P.T.O.

ELECTRICAL EQUIPMENT

BATTERY

6 Volt	95 ampere hour
Size	13 plate
Control Panel	
Ammeter	
Magneto Ground Switch	
Light Switch	Controls generator charge rate

GENERATOR

Type	Third Brush
Lubrication	Oilers - front and rear
Capacity	3 to 13 amperes

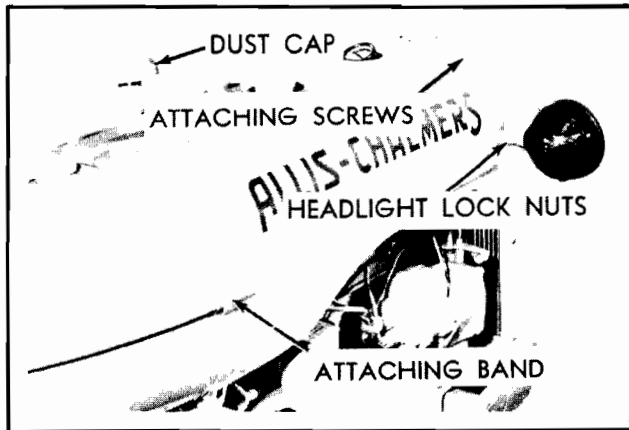
STARTER

Switch	Manual control
Drive	Bendix
Lubrication	Oiler on rear end

LIGHTS

Bulbs	Single contact
Capacity	6-8 volt 32 C.P.
Tail	6-8 volt 15 C.P.

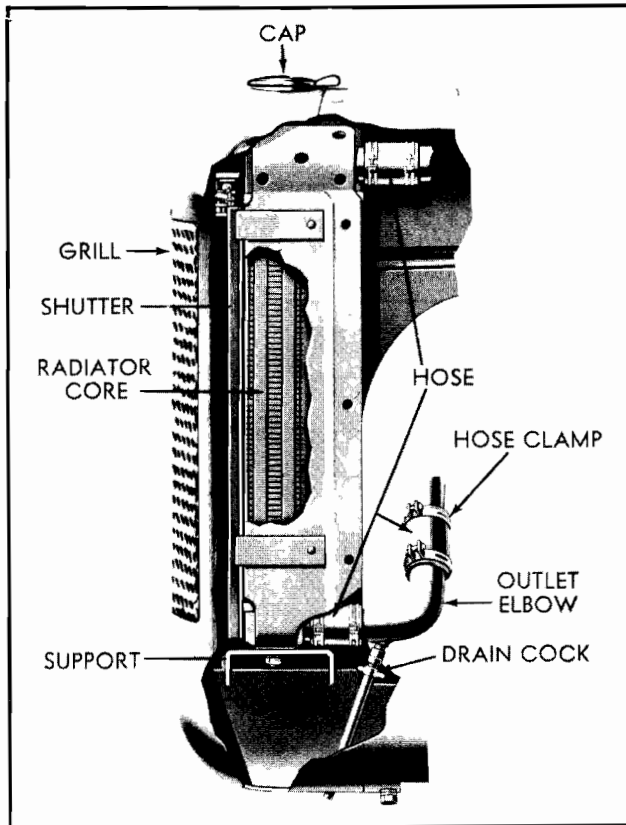
## HOOD



### Removal

Remove the dust cap from air cleaner intake pipe. Remove the band attaching hood and tank to tank support. Remove the screws and bolts attaching hood to radiator shell. Loosen headlight locknuts. Lift hood from tractor. On tractors equipped to burn low grade fuel, shut off the fuel cock under both tanks and remove fuel line to small tank.

## RADIATOR



### Removal

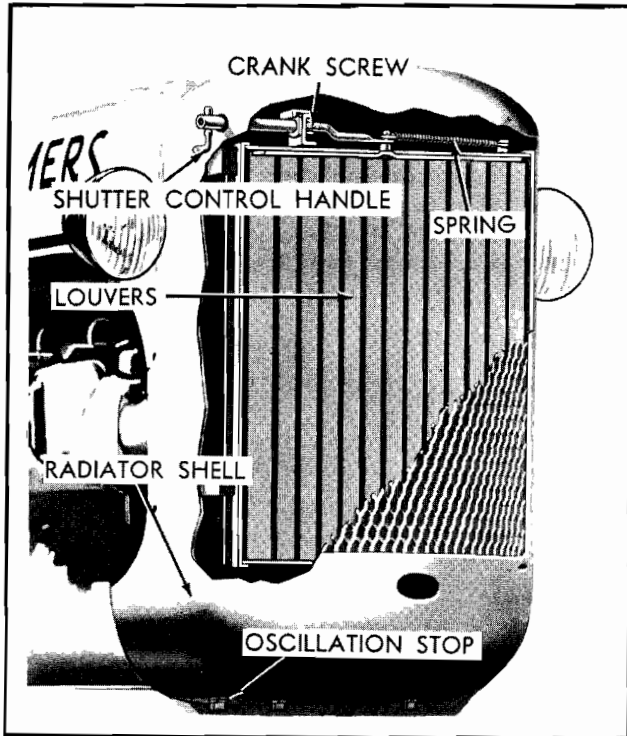
Drain radiator and remove hood. Remove the screws from the front support and side of shell. On the Model "B" tractor the two 1/2" capscrews attaching lower part of shell to front support are each equipped with two lockwashers. These capscrews act as the oscillation stop of front axle. Remove the shutter adjusting crank. Remove the radiator cap. Lift grill from radiator. Remove the two nuts retaining radiator to front support. Loosen hose clamps on radiator, inlet and outlet and lift radiator from engine.

### Inspection

Check radiator for clogging, both inside and outside. Check for bent fins, broken shrouds and leaking. Check hose for deterioration and collapsing. Check pressure radiator cap gasket, and the valve seat. It must not be bent or deformed.

If the engine loses excessive quantities of water check the baffle plate and overflow tube. The overflow tube must be soldered all around. On pressure radiator the baffle plate must not have holes in it. The pressure radiator operates at approximately 7 lbs. pressure and will not boil until a temperature of 230° F. is reached.

## RADIATOR SHUTTER

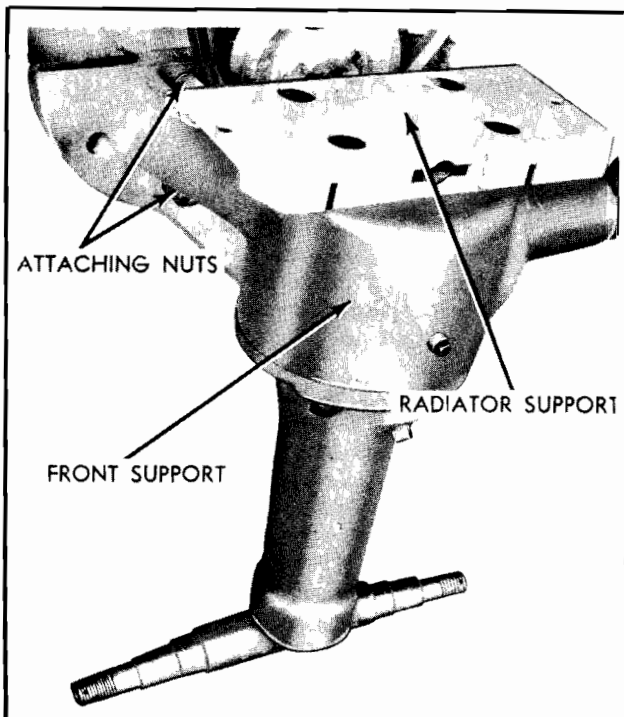


Remove hood and radiator shell (see radiator).  
Remove the four attaching screws from radiator and lift shutter from radiator.

### Inspection

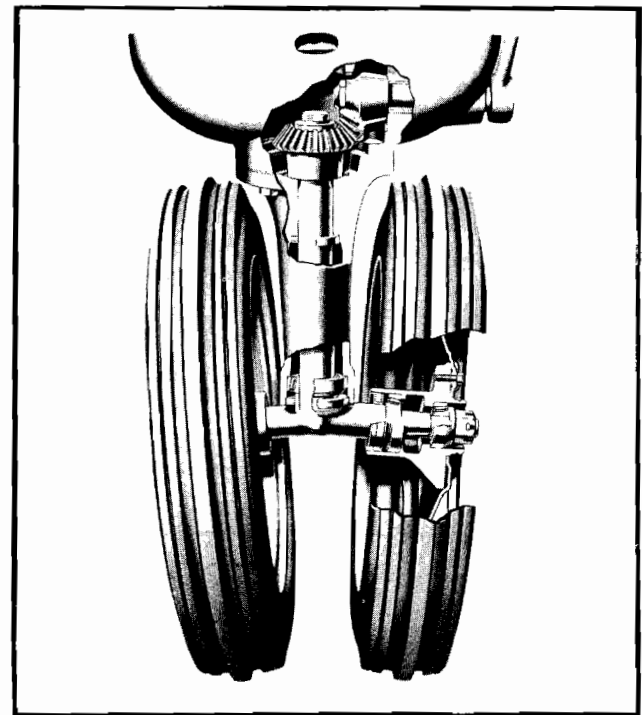
Inspect adjusting crank screw threads and return spring. Check louvers for cracks and worn or broken hinge pins and holes.

## FRONT SUPPORT



### Removal

Remove the hood, radiator, radiator support and pedestal or front axle on Model "B".



Disconnect the drag link. Remove the four nuts attaching front support to engine block.



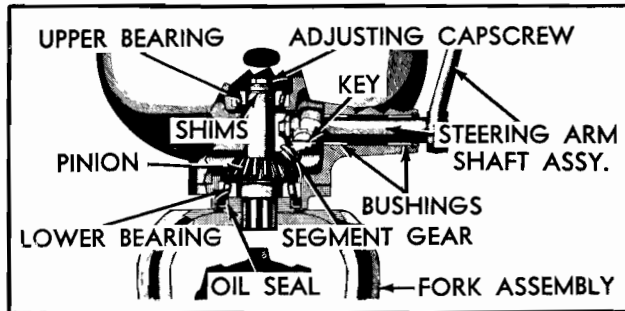
### Disassembly (Model "C")

Remove the nut or set screw, retaining segment gear to steering arm shaft assembly, pull shaft from front support. Oil seal and bushings may be driven from front support.

### Inspection

Bushings and shaft should be replaced if wear exceeds .006". Always replace oil seal. Inspect segment gear for worn or broken teeth.

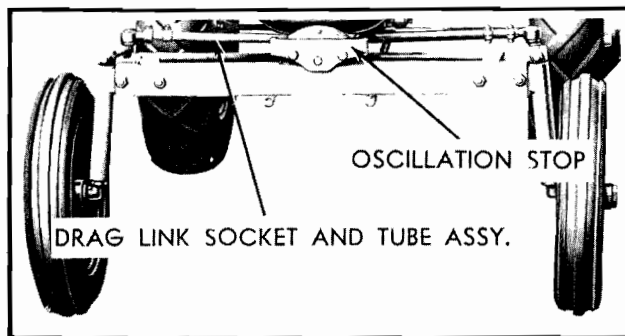
### FRONT SUPPORT (Single Wheel)



Removal: Same as above.

Disassembly: Remove front wheel, remove capscrew from top of fork assembly. Drive fork assembly from support. Pull pinion gear and seal from fork assembly.

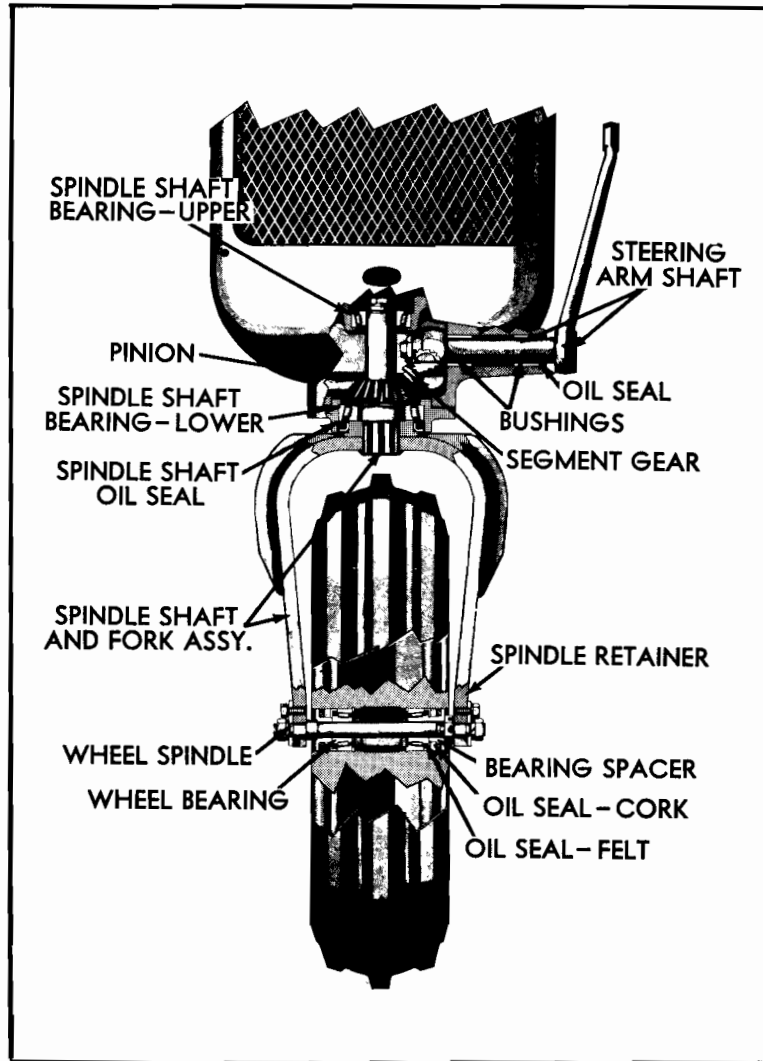
### FRONT SUPPORT (Wide front axle)



Removal:

Remove the pin from front support and nut from radius rod, and two drag link tube ends from center steering bar. Proceed as under front support (single front wheel).

## FRONT SUPPORT (Single & Adj.)



### Inspection

Check the bearings for cracked, chipped or rough balls and races. Check pinion and segment gear teeth for wear. Check pinion for looseness on splines. Check segment gear for looseness on taper of shaft. Check steering arm shaft and bushings for wear. Replace bushings and/or shaft if worn .006" or more. Always use new oil seals.

### Assembly:

Place the oil seal, bearing and pinion on the steering spindle. Use an approximate number of alternate paper and steel shims between the front axle support and front support. Bolt in place and install upper bearing.

Adjust bearings to a slightly preloaded fit by use of the .005" and .010" shims placed between the retaining washer and end of steering spindle. Remove the assembly and install the steering arm shaft and segment gear. Mesh the pinion and segment gears to a minimum backlash clearance. To do this remove or add one shim at a time from between the axle support and front support and remove or add one to the bearing adjustment. This method will maintain the proper bearing adjustment while obtaining the correct backlash. The bearing adjusting shims are .005" and .010" thick. The support shims are .005" thick. Lubricate the upper bearing with #2 wheel bearing grease on assembly.

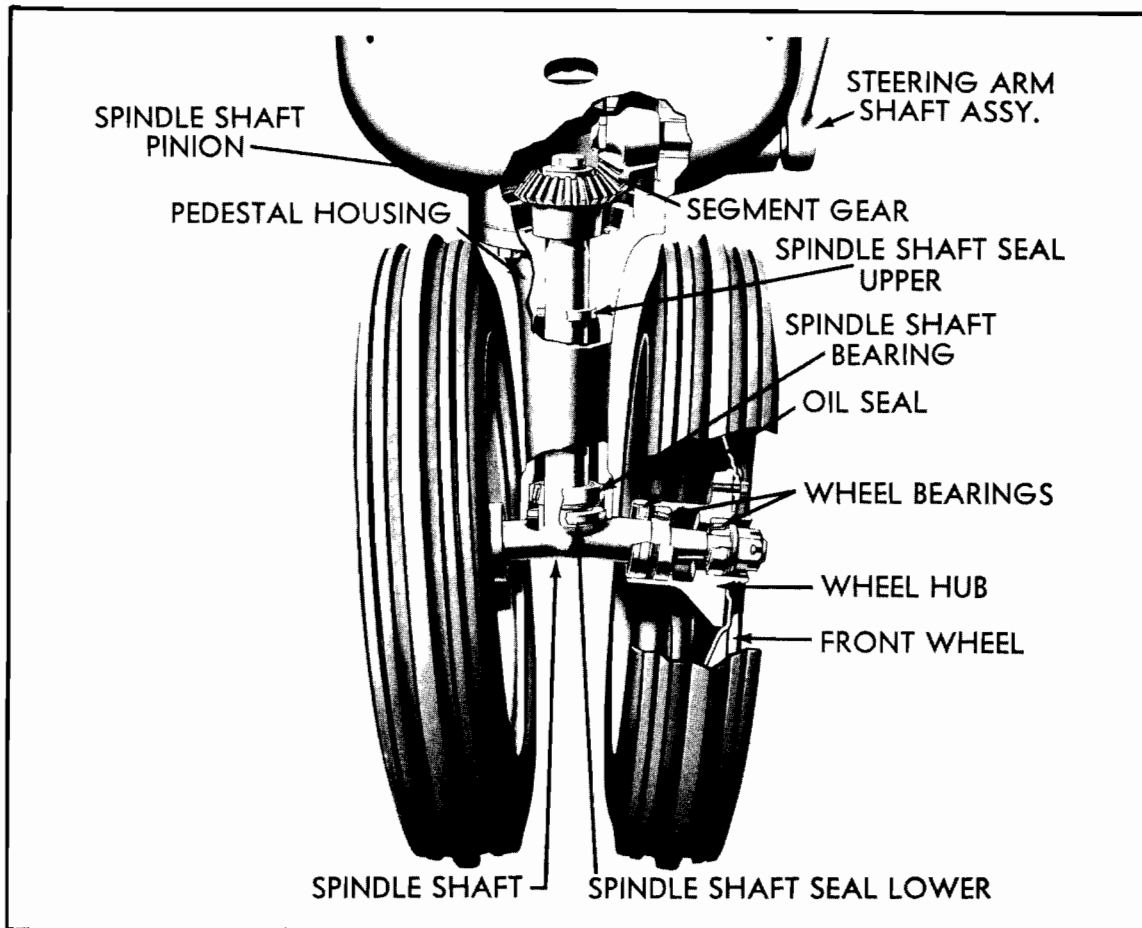
The pinion must mesh with the proper teeth of the segment gear. To do this, center the steering wheel by counting the number of turns from right to left and then turn back half this amount.

Hold the steering spindle assembly with the

arm straight back or the single wheel fork with the wheel in the straight ahead position and mesh gears.

Tighten front support stud nuts to 85 ft. lbs.

### PEDESTAL



Raise front end of tractor from floor and block securely.

Remove front wheels and the four capscrews attaching pedestal to front support.

#### Disassembly:

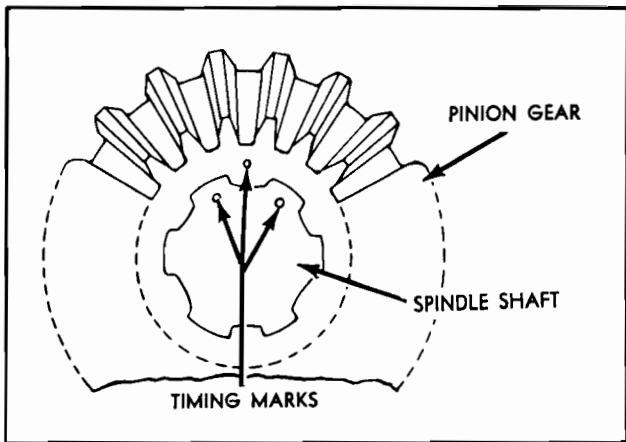
Remove the capscrew, washer and shims retaining pinion gear to spindle shaft. Use suitable puller and remove pinion. Do not force puller screw into capscrew hole threads. Remove upper oil seal from pedestal. Pull bearing and lower oil seal

from shaft. The bearing cup may be driven or pulled from pedestal.

#### Inspection:

Inspect pinion gear for worn or broken teeth. Inspect pinion gear and spindle shaft splines for wear. If gear can be turned slightly indicating looseness in splines the pinion of shaft should be replaced.

Check the bearing cup and cone for wear, roughness and broken rollers. Always replace oil seals.



### Assembly

When installing the pinion gear on spindle shaft the splines must be timed.

There are marks on the pinion gear and spindle shaft and these marks must match as shown. If they do not the tractor will turn shorter in one direction. To adjust spindle shaft bearing, place pinion gear on spindle.

Place an excess of shims in position with thinner shims on top. Press down and slide excess from top of pinion, add one extra shim and install retaining washer and cap-screw. The bearing should have a slightly

preloaded fit, without end play or heavy binding.

Lower spindle bearing must be packed with #2 wheel bearing grease when assembling.

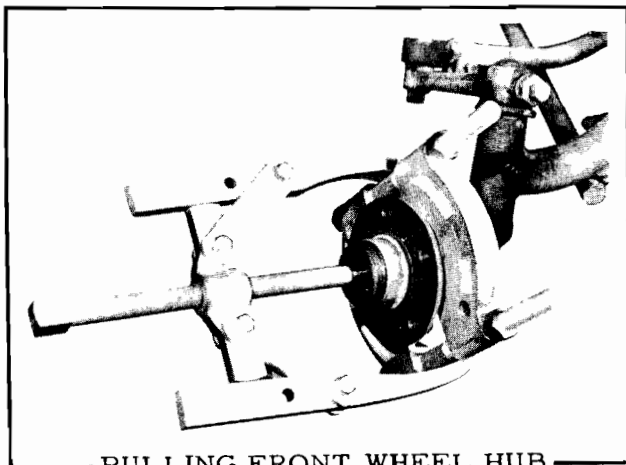
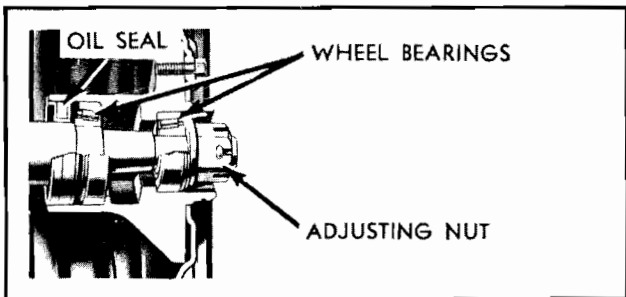
### Installation

When installing the pedestal to front support have the steering gear in the center or straight ahead position. This may be determined by counting the number of revolutions of steering wheel from extreme right to extreme left and then turning back half the number of turns to mid position. Place the front wheels in the straight ahead position and mate segment gear and pinion gear together.

Shims are used between the pedestal and front support housing. Use alternate steel and paper shims to prevent grease leakage. Always use paper gasket against cast housings.

These shims provide the adjustment between the pinion gear and segment gear. Use as required. The pinion gear and segment gear back lash should be as tight as possible and still have clearance; that is adjust back lash to the least amount possible.

## FRONT WHEELS



PULLING FRONT WHEEL HUB

### Removal:

Raise front wheel from ground and block solidly. Remove the 5 capscrews attaching wheel to hub.

Remove hub cap, and the cotter pin from the bearing retainer nut. Remove nut and pull hub from spindle. Use the O.T.C. 952 bearing puller attachment and remove the inside bearing and oil seal.

The bearing cups may be driven from hub.

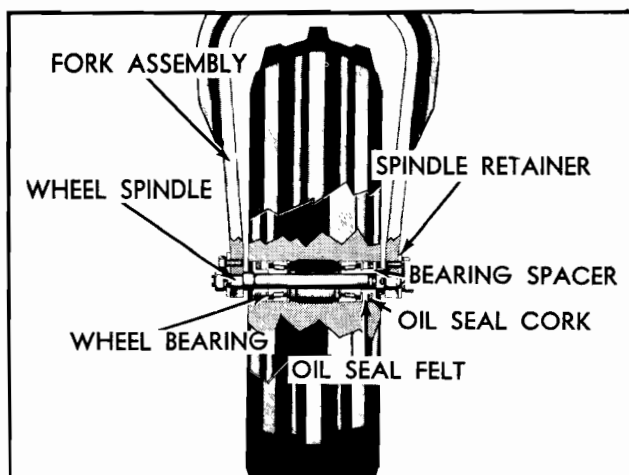
### Inspection

Inspect the bearings and cups for wear and roughness. Always replace oil seals. The bearings should fit spindle tightly.

### Assembly

Locate oil seal with inner side flush with shoulder of spindle. Install inside bearing, place hub and outside bearing in position. Tighten adjusting nut until bearings have a free rolling fit without end play or binding.

## SINGLE FRONT WHEEL



### Removal

Raise and block front end of tractor securely. Remove the capscrew from the right and left spindle retainers. Remove axle from fork assembly.

### Disassembly

Remove cotter pin from bearing adjusting nut and nut from spindle. Drive spindle from wheel. Bearing cups may be driven from wheel.

### Inspection

Inspect bearings for wear or roughness. Check fork for spreading.

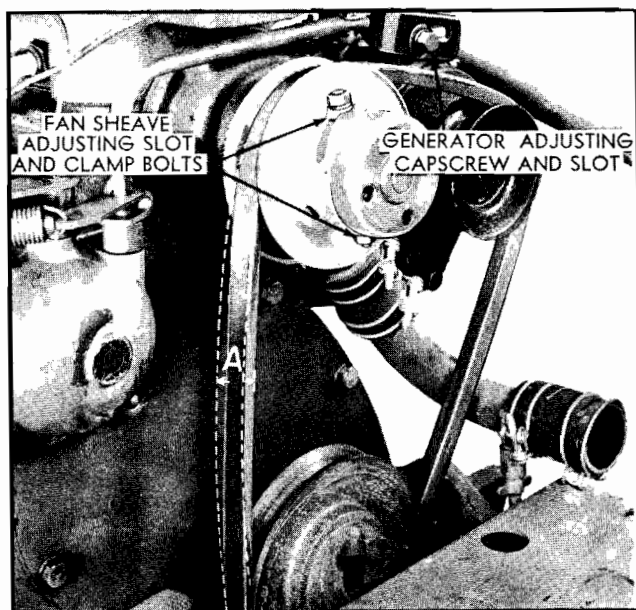
### Assembly

Assemble seal retainer to spindle and place the cork washer and then felt washer on spindle. Now put bearing on spindle and place in wheel, install opposite bearing felt seal and cork washer and seal retainer.

Adjust bearings to a free rolling fit without binding or end play.

On older models, two half rings are used to locate the right hand seal retainer.

## FAN BELT



The fan belt drives the water pump and fan and also the generator on tractors so equipped.

To tighten belt on tractors equipped with generators, loosen the generator clamp screw at front of generator and move generator away from engine.

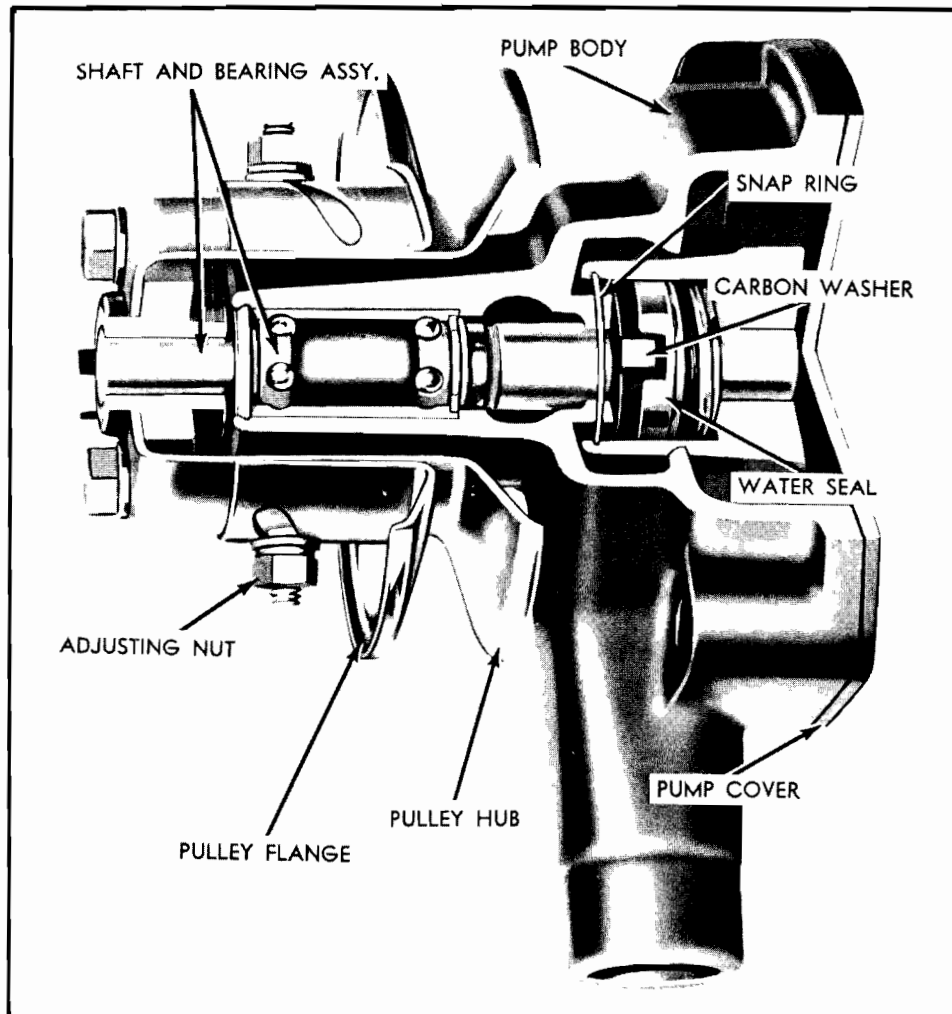
On tractors without generators loosen the two nuts on pump sheave and turn front section clockwise when viewed from the front. If the slotted diagonal holes do not provide sufficient adjustment, remove the two bolts and reinstall in the two extra holes provided for this purpose.

Adjust the belt until a movement of 1" is obtained midway between the two sheaves at "A".

The belt should be replaced if it is worn or broken or if it bottoms in any of the sheaves. Bottoming will cause slippage.

On tractors equipped with generators the fan sheave should be adjusted until the fan turns 15 revolutions to 11 revolutions of the crankshaft.

## WATER PUMP AND FAN



### Removal

Remove hood and radiator or if desired, remove hood and fan blade. Drain radiator and engine block and loosen hose clamps. Remove the three capscrews attaching pump to cylinder block.

### Disassembly

Remove the fan pulley from the fan hub and pull hub from shaft. Remove the cover from rear of pump. Two tapped holes are provided in impeller for attaching puller for removing impeller. It may be necessary to tap these holes to remove the scale accumulation. Remove the snap ring at front of pump body and drive the pump shaft assembly from pump body.

The shaft and bearing are an assembly and must be replaced as a unit if replacement is necessary.

### Inspection

Inspect the bearing for looseness and roughness, replace if worn. Check the carbon seal washer and the rubber sealing ring. In most cases the carbon washer, sealing ring and spring should be replaced. Check the pump body at carbon seal surface. It should be flat. If curved or uneven it should be resurfaced. This can be done with valve seat insert tools if a special adaptor is provided.

### Assembly

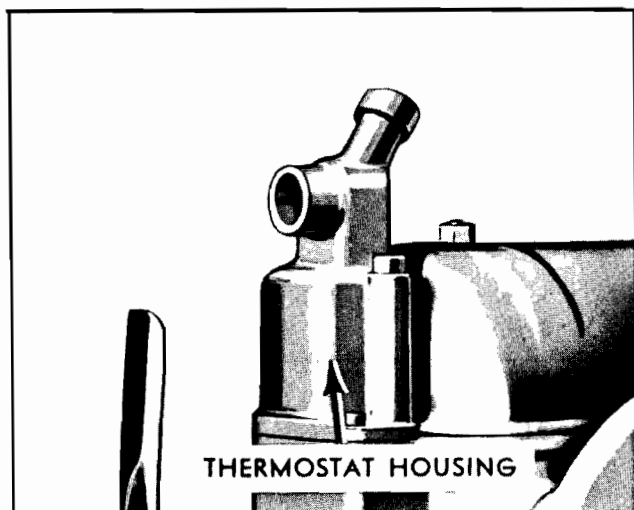
Install shaft and bearing assembly in pump body and install retaining snap ring. Press fan hub onto shaft until flush with end of shaft.

Install rubber seal ring retainer, rubber seal, spring, carbon washer retainer and carbon washer in impeller. Press on carbon seal

washer until the spring is compressed far enough to allow entry of retaining snap ring. Press impeller assembly on shaft with seal towards pump body until nearly flush with

end of shaft. Impeller must be located so it neither touches pump body or cover. Install pump body cover using shellack on gasket and tightening securely.

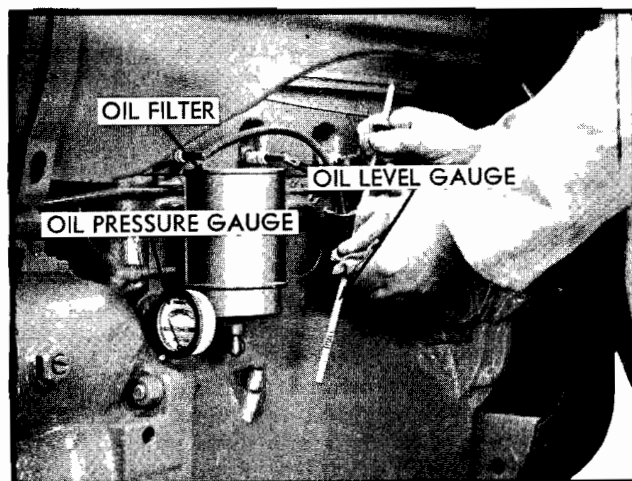
#### THERMOSTAT AND HOUSING



When the tractor is equipped with the Dole thermostat two or more gaskets must be used between thermostat and housing to prevent valve from striking housing. The thermostat must be turned so the valve opens towards the deepest part of housing. If the valve strikes the housing, it cannot open fully and may cause overheating. The Bishop and Babcock thermostat does not cause any interference.

Thermostats used with gasoline burning engines open at 135°F. Thermostats used with low octane fuel engines open at 165°F.

#### OIL FILTER



The oil filter is removable by turning to the left and raising it off the feed pipe. No attempt should be made to repack this filter as the filtering yarn is made especially for this purpose and is machine packed to a specific density. Any change in density may change oil pressure, volume of oil passing

through filter or may not filter the oil passing through if an opening is left in filter material.

The oil is fed to filter from oil pump and the restriction of filter determines the amount of oil filtered. This is about 1/6 the pump volume. The oil after passing through the filter material, enters the base of filter and flows back to crankcase through the push rod compartment.

To install filter, remove any pieces of loose or straggling yarn. Place a small amount of oil in filter. Make sure there are no burrs around drilled hole in end of feed pipe.

Start filter on feed pipe and press down and turn at the same time. Always use a new gasket. A slight decrease in oil pressure is generally noted when a new filter is installed. The filter feed pipe, if pressed into filter base too far will cause gauge to fail to register pressure. If too long will dent top of filter can.

#### OIL GAUGE

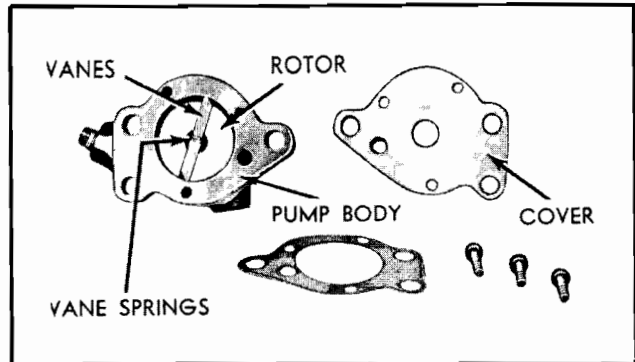
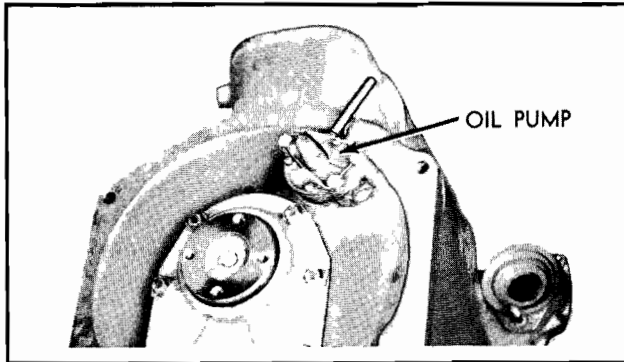
The oil gauge registers the pressure supplied by the oil pump to the oil filter and rocker arms. The pump by pass is set at 15 lbs.

This usually is very near the ORM in the word normal on gauge.

The threaded end of gauge is equipped with a metering pin to prevent fluctuation of indicator needle. Always make sure the

gauge is clean before installing. Any dirt or heavy grease forced into metering pin will cause gauge failure.

## OIL PUMP



### Removal

Separate the engine from the torque tube. Remove clutch and fly wheel. Remove the lock wire and the three capscrews attaching pump to engine block.

### Inspection

Inspect the drive pin in camshaft. This pin must not be worn or loose. The end clearance of pump should not exceed .002". The side clearance between rotor and body at tight side should not exceed .004". The vanes should fit the rotor snugly and yet free enough to slide readily. The vanes should be exactly flush with surface of rotor when rotor and vanes are in place. The vane springs must not be kinked.

Make sure there are no air leaks in the suction pipe or the cylinder block between the suction pipe and pump.

### Assembly

Assemble the relief ball and spring in pump and insert the retaining pin. The small end of spring must be turned against ball.

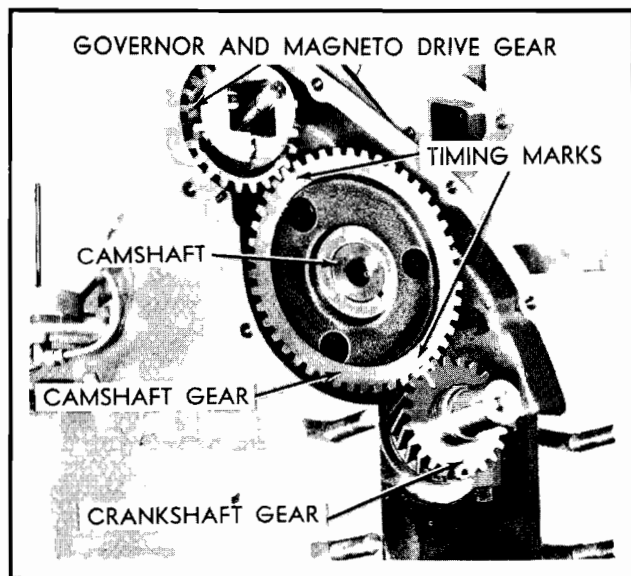
Assemble rotor to body and install cover. The end clearance of pump rotor is adjusted by use of gaskets between cover and body. However, one gasket must always be used to prevent oil leaks. If the clearance is too great with one gasket, dress the face of body with valve grinding compound placed on a piece of glass or face block.

Vanes must be installed with long tapered side towards direction of rotation. Rotation is clockwise when viewed with cover removed. Tighten the capscrews to 15 ft. lbs.

The pump draws oil from the sump through the inlet screen and suction pipe to the pump rotor, here it is pressurized and forced through an opening in pump cover to center of rotor. The rotor has two drilled holes which match up with two holes in the pump body as the rotor turns. Oil from these holes enter the camshaft, where it is distributed to the various engine bearings etc. Oil is also fed by the pump through a separate outlet to the oil filter, oil gauge, rocker arm and governor. When the pressure within the pump exceeds 15 lbs. the relief valve opens. This extra quantity of oil is also fed to center of camshaft.



## CAMSHAFT AND VALVE TAPPETS



### Removal

Remove hood, radiator and front support. Remove crankshaft fan drive pulley, oil sump and timing gear cover, valve cover and push rods. If bushings are to be replaced, separate engine from torque tube. Remove clutch, flywheel and oil pump. The cam gear may be pressed or pulled from shaft if necessary.

### Inspection

Check the shaft journal size and the condition



of the cam lobes. They must not be scuffed or rough. Check the shaft bore for cleanliness and make sure the four connecting rod metering holes are open. Check the end play plunger and spring. Check timing gear backlash. Backlash should not exceed .008".

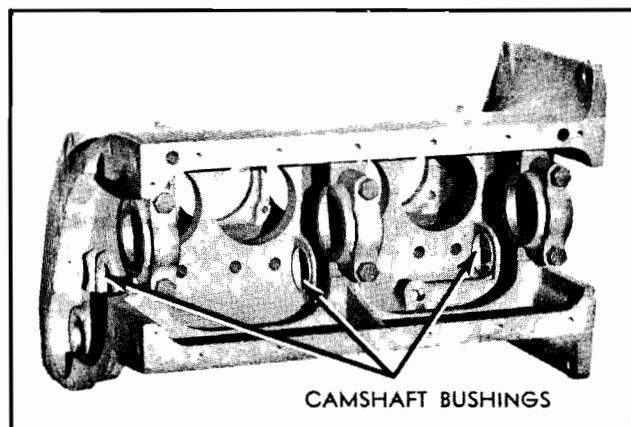
Check the tappets for wear in guides. They should be replaced if worn excessively or noisy. Check the cam contact surface for wear or scuffing.

### Assembly

Reverse the above procedure. The camshaft must be timed with the crankshaft and magneto when reinstalled. Mesh the straight mark with crankshaft and the oval mark with magneto.

On older engines where all of the timing marks are straight lines, mesh the mark opposite the camshaft gear keyway with crankshaft gear.

## CAMSHAFT BUSHINGS



### Removal

Separate engine from torque tube, remove camshaft, clutch, flywheel and oil pump. Drive bushings from engine block with suitable driver.

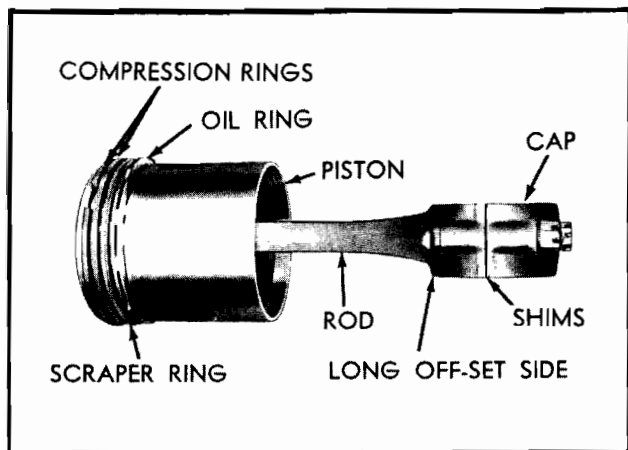
### Inspection

The camshaft bushings should be replaced if worn or scuffed. The clearance between shaft and bushing is .002" to .004". They should be replaced if worn to exceed .006".

### Assembly

Install the rear bushing, driving it in from the front until it is 1/4" from rear of block which will allow installation of oil pump. The center bushing is 1/8" longer than the web in block. Center bushing in web allowing approximately 1/16" to extend on each side. Drive front bushing in flush with front of block. Line up the oil holes in bushings with the drilled passage in engine block between cam shaft and main bearings.

## CONNECTING RODS AND PISTONS



### Removal

Remove hood, valve cover, rocker arms and push rods. Drain block and remove upper hose connection. Disconnect fuel lines. Disconnect oil line from oil pump to cylinder head. Remove cylinder head. Drain and remove oil sump. Scrape the carbon from cylinder liner above the pistons. Number each rod and cap on the camshaft side by center punching. Number each rod starting at the front. Remove the cotter keys, connecting rod bolt nuts and cap. Push connecting rod and piston assembly upward from engine.

To remove piston from connecting rod, place a punch in vise and tighten securely. Place piston pin over punch and loosen connecting rod clamp capscrew. Slide piston pin from rod and piston. Do not clamp connecting rod or piston in vise.

### Inspection

Check fit of piston pin in bushing. If any noticeable looseness, replace. Clearance permissible is .0007" to .002". However, the engine will not operate quietly if tolerance approaches or exceeds .002".

Check piston for wear. The ring should fit the groove with not more than .0025" side clearance. The pistons are cam ground and measure .0025" greater diameter at right angles to piston pin.

Check the connecting rod alignment in a fixture made for this purpose. Check bearings for scuffing or broken babbitt. Replace if damaged.

### Installation

Assemble rod to piston. Centralize piston

pin and clamp securely. Make sure the piston ring grooves are clean and ring fits groove freely. Roll each ring around the groove in which it is to be installed checking for tight spots. Try each ring in the cylinder liners. File ring gaps if necessary until each ring has .007" to .017" end gap. Install rings on piston using a suitable ring spreader. The compression ring is tapered and one side is marked "top". This side must be assembled towards top of piston.

The connecting rod is off set and must be installed with the long side of off set turned away from the nearest main bearing.

The bearing shell has a small lip on the side. This lip must enter the depression in the connecting rod or cap. This lip prevents insert from turning in rod.

Shims are provided for bearing adjustment. Each shim is .002" thick. The bearing must be adjusted to .002" diametrical clearance. This can be determined by placing a piece of .002" shim stock inside of bearing and adjusting until a slight drag is felt. Remove the shim stock and tighten bolts and lock with the proper size cotter keys. Use keys of proper length and lock tightly so they will not become loose. A loose cotter pin will wear and fall out. Tighten the connecting rod bolt nuts to 35 foot pounds tension. If proper bearing adjustment cannot be secured with the old bearings, new undersize bearings must be installed.

**CAUTION:** The bearing insert stands out above the bearing cap and rod .0015" with four shims in place on each side of the rod. This standout is provided to insure the bearing making good contact with the rod, in order to transfer heat from the bearing to rod where it will be dissipated more readily.

As shims are removed to secure adjustment the ends of the bearing shell must crush in order for the cap and rod to meet tightly. It has been found that two of the four shims on each side may be removed for adjustment without causing interference between the two halves of bearing. If adjustment desired has not been secured by the removal of two shims on each side, the bearing should be replaced with either a standard or undersize, depending on amount of wear present on crankshaft.

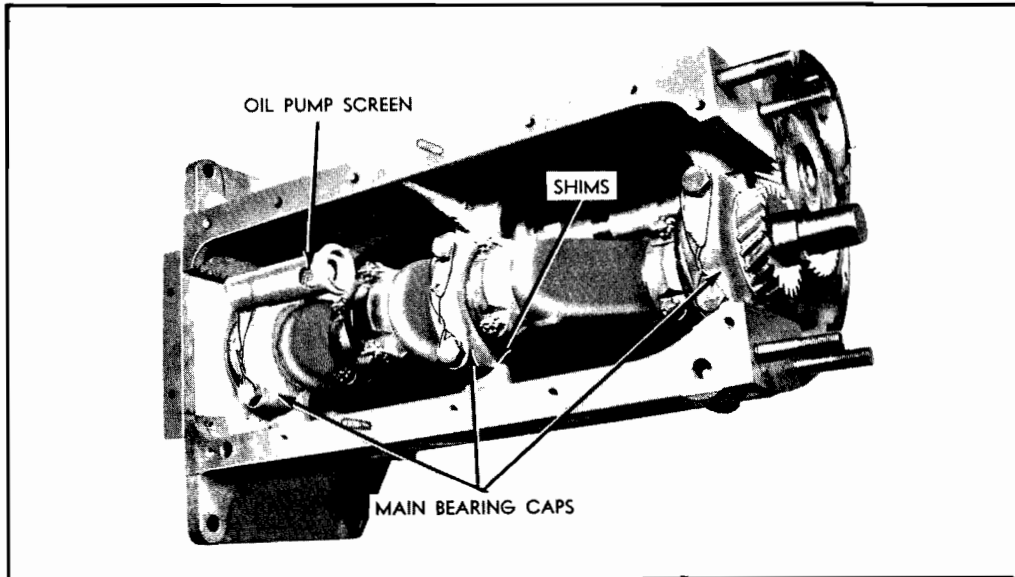
If new parts are not available, additional shims may be removed if the ends of the

bearing inserts are filed away.

File .002" from the ends of bearing for each shim removed. This can be measured by placing the bearing on a face plate and measuring its height with a dial indicator.

After filing remeasure. Great care must be exercised in removal of material. Removal of excess material will allow bearing to be loose in rod. Do not file the rod or its cap.

### CRANKSHAFT AND MAIN BEARINGS



#### Removal

Remove radiator and front support. Separate engine from the torque tube. Remove clutch and flywheel. Remove oil sump, rear oil seal, retainer, governor and timing gear cover. Remove connecting rod caps. Remove lock wires from main bearing cap screws and remove capscrews. Lift shaft from block. Caution: Never clamp shaft in vise.

#### Inspection

Check the shaft for wear. The shaft should be replaced if it is out of round more than .004" or tapered more than .004". Measure the shaft and subtract the smallest measurement from the larger. Measure the shaft at several points such as center and ends of journals also at several points on diameter at each position. The shaft will prove serviceable at .003" out of round or tapered but will tend to be noisy as the wear approaches .004".

Excessive crankshaft wear indicates negligence to change oil, oil filter or service air cleaner as often as required.

If the shaft is worn undersize .0025" or more, undersize bearing inserts should be used.

The journals must be free from scratches and scoring. Check fit of crank pulley on shaft. If loose, replace pulley or shaft or both as necessary.

Check the oil return grooves on the front and rear ends of crankshaft. They should not be worn or nicked. Clean these grooves thoroughly.

The bearing shells should be replaced if scored or scratched or have babbitt flaked out.

#### Assembly

See "Camshaft" for timing. See "Connecting rod" for bearing adjustment.

Always turn the rounded side of shim toward the crankshaft. Make sure the shims are not placed between bearing shells.

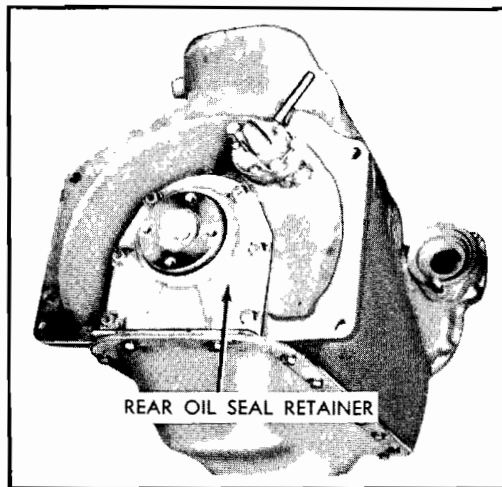
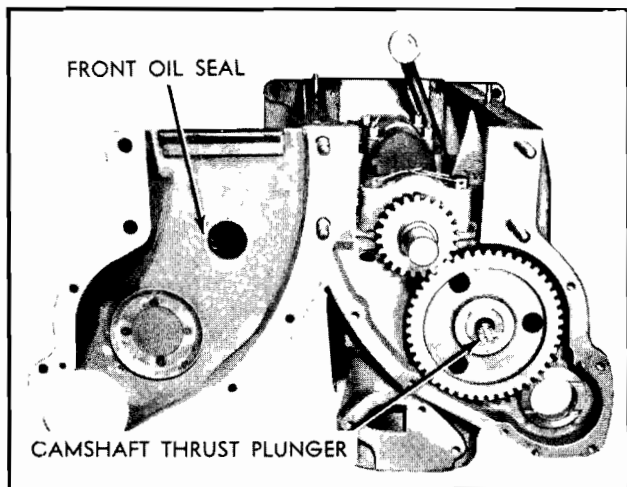
Adjust each bearing separately and after securing proper adjustment, proceed to the next bearing. When all three bearings have been adjusted separately, tighten capscrews securely. The shaft should turn as free with all bearings tightened as with one. If not check alignment of shaft. The bearing caps must be installed in their original

position. This should be marked before dis-assembly.

When replacing the lock wires in capscrews,

cross the wire and lace in such manner as to keep the capscrew from turning. The main bearing retaining capscrews should be tightened to 80 foot lbs. torsion.

### FRONT AND REAR CRANKSHAFT OIL SEALS



Removal: See Crankshaft

#### Inspection

Replace seals whenever they are removed from engine.

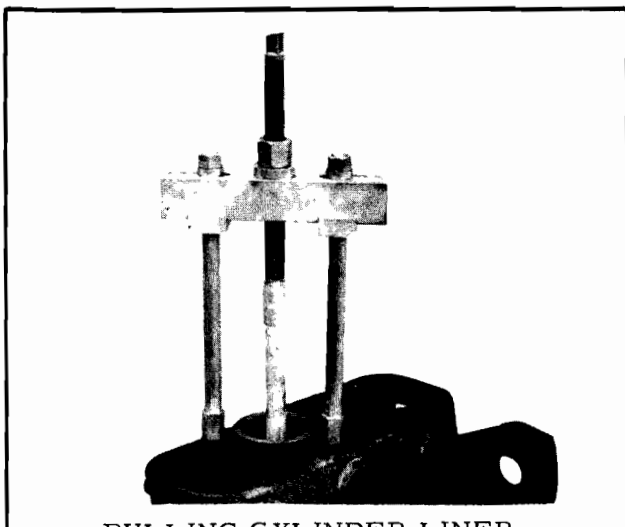
#### Assembly

Clean the rear oil seal groove and dry thoroughly. Shellack groove and press cork in place. Use great care as cork may be broken if applied carelessly. Press cork into groove firmly. Lubricate face of seal and place seal assembly on shaft. Shellack rear gasket and place in position. Allow seal to center the retainer and hold in this

position until capscrews are tightened. Use the flat metal locks under capscrews. These locks are dual purpose preventing oil leakage and by bending over retainer and raising one corner against capscrew head prevents capscrew from loosening. These locks can be used to replace the asbestos wicking or copper washers formerly used.

The front seal is furnished as an assembly and is pressed into timing gear cover until the projections on its outer diameter contacts cover. It is advisable to use a sealer on outside of retainer. Lubricate cork surface and center the timing gear cover on the crankshaft.

## CYLINDER LINER



PULLING CYLINDER LINER

### Removal

Remove hood, valve cover, rocker arm shaft assembly, water manifold, oil line and cylinder head capscrews. Remove oil sump, pistons and connecting rods.

Use suitable puller to remove cylinder liners.

### Inspection

Cylinder liners should be inspected before removal. The greatest wear on the cylinder liner occurs near the top. When this wear is .011" or more the liner should be replaced.

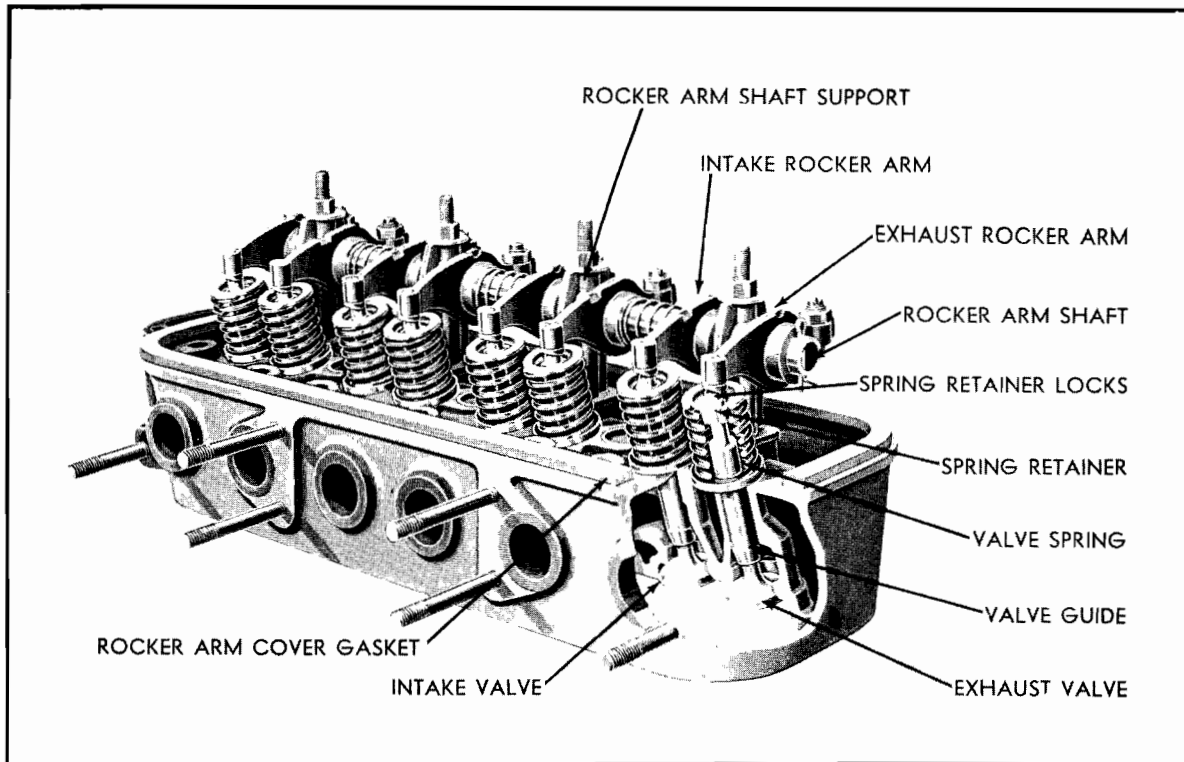
The wear at the bottom of liner will be very slight. This causes a tapering bore. This taper causes the ring to contract and expand as it moves up and down causing excessive strain and wear on piston rings which makes it difficult for them to satisfactorily control oil consumption.

### Installation

Clean the cylinder block at lower web and in groove for top of liner. Try cylinder liner in block before installing rubber rings. Clean the liner and install the two rubber seal rings. Keep these rings free of twists. Install a coat of thin white lead on seals to aid installation. Place the liner in block until seals touch lower web. Place both thumbs on top of liner and push firmly and turn at same time. Liner should go into place. If not use a wood block and drive into place. Make sure that nothing enters under flange of liner which will hold it up out of place. The liner should stand out from .002" to .005" above face of block. If the stand out is more, check for foreign material under liner flange. Excessive stand out will induce water seepage at outside edge of head gasket.

When fitting piston rings to worn liners try ring for size at bottom of liner where wear is least. They must have the necessary end gap at this point.

## CYLINDER HEAD AND VALVES



### Removal

Remove hood, valve cover, rocker arm assembly, water manifold, exhaust and intake manifold assembly and oil line to cylinder head. Remove capscrews.

### Inspection

The clearance between valve stem and guide should not exceed .008". Replace part with greatest wear or both if necessary. Valves can be refaced on a valve lathe, however if the margin of valve is ground to a sharp edge, the valve should be replaced.

Check the valve seats for width and wear, if seat is wide it should be narrowed or if valve is flush with surface of cylinder head, seat rings should be installed. If the valve has worn into the seat it affects the valve spring length which weakens the valve spring action.

The valve spring should have 2-5/16" free length. If it is 2-1/4" or less it should be replaced. Make sure the retainers and locks are not worn.

### Assembly

Clean all carbon from valves and stems. Reface in a valve lathe. Reseat the valve seats. If wide they must be narrowed to 1/16" by use of 15° and 75° cutters or stones.

If the seat is worn into head, replacement valve seats are available, however, special tool equipment is necessary for their installation. The manufacturer of this tool equipment furnishes the instruction for proper use.

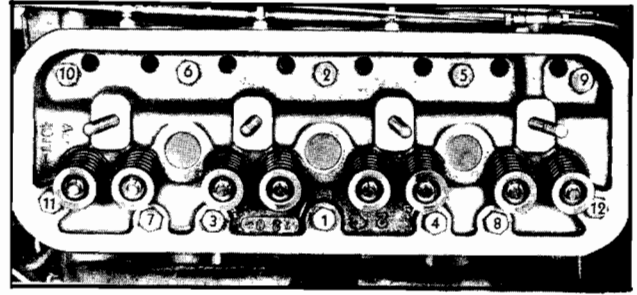
If new seats are to be installed it is necessary to replace the valve guides, otherwise the pilot will not allow proper alignment of the cutting tool.

The valve guides have a scribe line around their outer circumference. The guide is pressed into the head until this line is flush with top of head. Older engines were equipped with a shoulder on guide for locating depth. These guides must not be driven down solidly or they will distort. The guides should be pressed into place or a special driver used to prevent distortion of bore.

If bore is distorted it will be necessary to ream guide to secure proper fit of valve stem.

Lap the valves to their seats using fine valve grinding compound. Thoroughly clean all compound from valves and head and oil the valve stems and seats. Install safety wires, spring seats, springs, retainers and locks.

Use a non setting type of gasket cement on the cylinder head gasket. Tighten cylinder head capscrews evenly starting at center and working towards ends, as numbered on chart.



Do not attempt to tighten one entirely, before proceeding to the next. Go over them several times. Tighten to 60 ft. lbs. torsion.

### ROCKER ARMS AND PUSH RODS

#### Removal

Remove hood and valve cover. Remove the four nuts retaining rocker arm shaft supports to cylinder head. Lift assembly from head. The push rods may now be lifted from their positions.

Remove the cotter pin or hairpin retainer from end of shaft. Rocker arms and supports may now be removed from shaft.

#### Inspection

Check shaft and rocker arm bushing for wear. If the combined tolerance is more than .010" they should be replaced.

Check the rocker arm contact face for wear. If this face is worn flat, undue side thrust is placed on valve stem and will cause excessive wear on valve stem and guide. Replace if necessary. The oil for the shaft and valves is fed from the pump to the rear support stud which has a groove in its side. From this stud, oil enters the hollow rocker arm shaft. From the shaft the oil passes to the rocker arm supports. The supports and rocker arms are flat on the mating sides and the oil flows to rocker arms with very little leakage at this point. From the rocker arm the oil passes out the hole on top side and flows to push rod and valve stem. It is possible to over oil the intake valves causing

excessive oil consumption. For this reason the intake rocker arm has a shed built into the upper surface between shaft and valve. This shed is from 1/32" to 1/16" wide on its top surface. Examine assemblies and determine if the proper amount of oil is being fed to valve stems. Check the supports for length. They must all be equal.

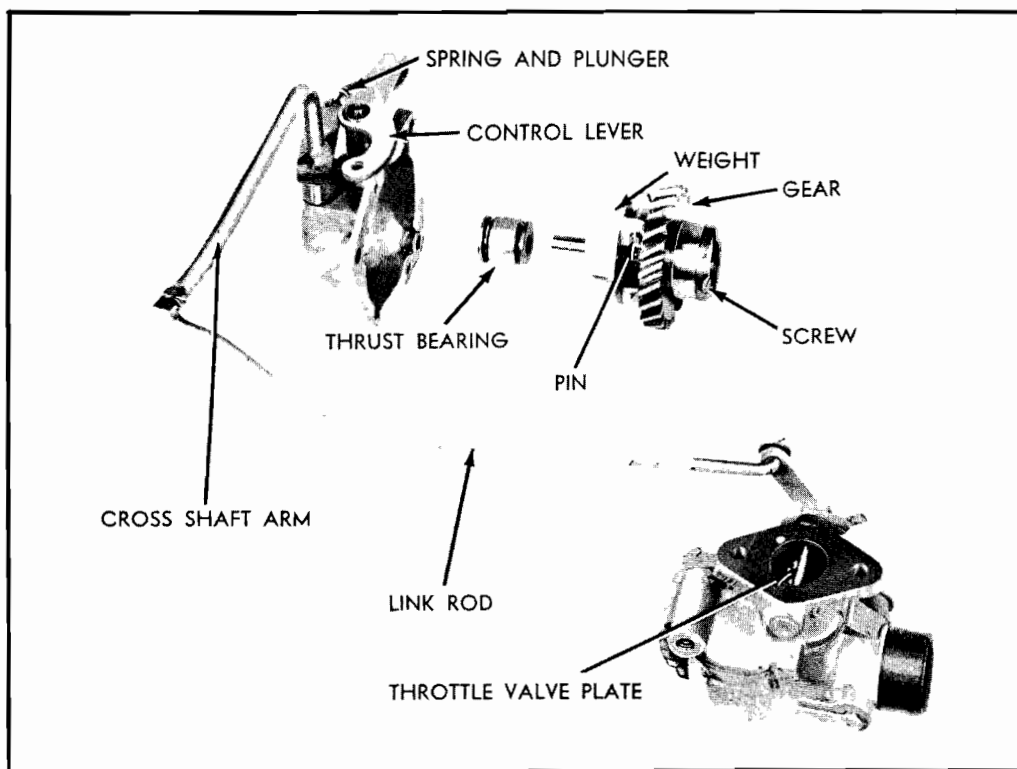
#### Assembly

The rocker arms are placed on the shaft starting with the exhaust arm, then a support, intake arm, spring, intake arm, support and exhaust arm etc.

Use long corks in the ends of all rocker arm shafts using hairpin retainers and short corks in shafts using cotter pins. On shafts that are drilled for oil to rocker arms turn the shaft so oil holes are towards head or at the bottom.

Use a flat washer between support and retaining nut. On 60 All Crop engine this washer is only 1/32" in thickness. Thicker washers will cause interference between nuts and valve cover, because of the oil trough placed under supports. Make sure the support is turned with the split side of bushing towards push rods. Adjust valve clearance to .010" with engine hot and push rod at its lowest position.

## GOVERNOR



The governor is placed on the engine for the purpose of controlling the carburetor throttle valve setting, in order to maintain a constant R.P.M. under varying load conditions. Without a governor the engine speed would decrease if the load increases and increase if the load decreases for any particular throttle position. The action of the governor is to open the throttle valve wider giving the engine more fuel as increased load slows the engine down or closes the throttle valve as a decrease in load allows engine to run faster. Thus the engine speed can be regulated within a very small fluctuation in R.P.M.

The governor consists of a pair of hinged weights which act against a thrust bearing and linkage to which a spring is attached. The linkage in turn is attached to the carburetor butterfly valve. The governor weights are acted upon by centrifugal force which tends to move them away from their axis when they are revolved. This force is transmitted through the thrust bearing and linkage to the governor spring. The force of the spring is in exactly the opposite direction of the weights and tends to keep the weights from moving away from their axis. These two forces always balance each other for any given speed and load. The force of weights is always trying to close carburetor

and the spring is always trying to open carburetor.

If we consider the engine to be operating at the desired speed with the weights about 1/2 open and the carburetor throttle valve about 1/2 open and the load decreases allowing engine to speed up, the weights due to the increased speed and centrifugal force move further from their axis. This movement forces the thrust bearing forward placing greater tension on the governor spring until the spring tension again balances the force of weights and at the same time decreases the throttle valve opening, thus preventing the engine from running too fast. Oppositely, if the load increases, the engine slows down decreasing the centrifugal force of the weights. Now the force of the spring is greatest and the fork and thrust bearing are moved back forcing the weights closer to their axis and at the same time opening the carburetor throttle valve allowing more fuel to enter engine.

The facts to be remembered are that the two forces - spring tension and centrifugal force work against each other and must balance, (otherwise there will be movement of the linkage) also that the position of the carburetor throttle valve is in direct re-



lation to the distance the governor weights are moved from their axis.

The speed of engine is selected by the operator and is determined by the amount of tension placed on the governor spring. After this original setting the governor will control the engine speed within the small margin needed for governor action.

#### Removal

Disconnect the throttle lever rod and carburetor link rod. Remove oil line. Remove the three capscrews and one nut attaching housing assembly to engine. Remove magneto and the screw from coupling end of magneto and governor drive gear. Pull gear and weight assembly from front of engine.

#### Inspection

Check the fork and the shaft bearing for wear. If these parts are worn the assembly should be replaced. Check the gear for backlash. If the gear has .008" backlash or more it will cause engine to be noisy. Check shaft for wear at point contacted by thrust bearing. If worn or scored replace shaft. Check shaft and front bushing in cover assembly. If wear exceeds .006" replace shaft or bushing or both. Check the governor gear bushing in cylinder block. If clearance exceeds .006" replace bushing.

Check the thrust bearing for wear and corrosion. Replace if worn or if it does not roll free. Check weight hinge pin for wear and weight hinges for wear or cracks. Check the risers for wear or looseness. The hinge pin and weight should not exceed

.005" clearance. Check the spring anchor levers for wear and replace if loose on pivot or worn at spring eye hole assembly.

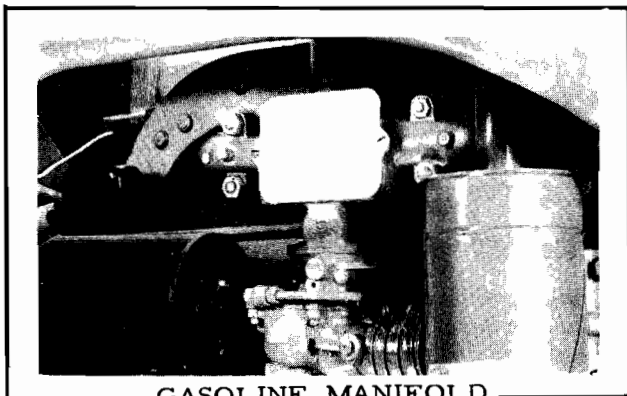
When assembling the governor parts make sure they are perfectly free of binding. Even the slightest binding will cause poor governor action. Check the carburetor throttle valve shaft for wear when checking for binding.

When installing the magneto and governor drive gear bushing, the notches for oil must be aligned with notches in block. Install the gear matching the oval timing mark with the oval mark on camshaft gear. The end play of the governor gear shaft is adjusted by pressing the shaft in or out of gear. The end play of this shaft should be .002" to .007".

Place the thrust bearing on the shaft with the smaller race towards the front. The bearing should turn with the shaft. When the assembly is in place adjust the cross shaft by bending until the carburetor link rod is 1/32" to 1/16" too short when the carburetor is wide open and the throttle lever placed in the wide open position. Adjust the spring anchor by bending in or out until a very small amount of tension is placed on spring when throttle lever is in the idling position. If the spring is loose in this position it may require several notches on quadrant to change engine speed.

The 212092 governor cover assembly can be used for service on all engines if the throttle valve control shaft arm is the proper length of 1-1/2".

### INTAKE AND EXHAUST MANIFOLD ASSY.



GASOLINE MANIFOLD

#### Removal

Shut off gas supply and remove fuel line and



TWO FUEL MANIFOLD

air cleaner hose. Disconnect carburetor link rod and choke rod. Remove nuts retaining manifold to cylinder head.

### Inspection

Check the manifold for carbon accumulation and clean if necessary. Check manifold for cracks and gaskets for leaking. The vacuum gauge reading is 19-1/2 inches for a properly adjusted engine in good mechanical condition operated at idling speed.

### Assembly

Always use new gaskets and retainers. Tighten manifold nuts evenly to 20 ft. lbs.

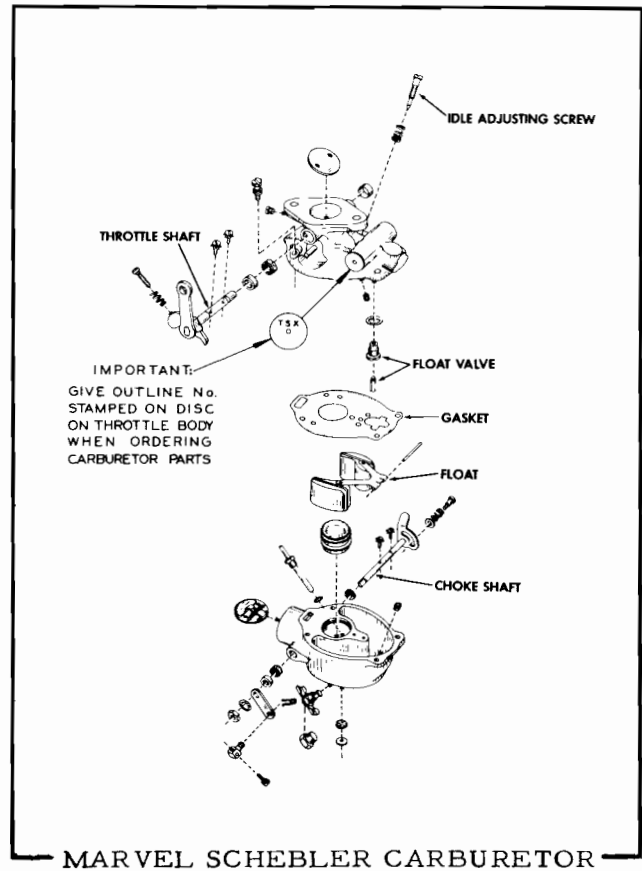
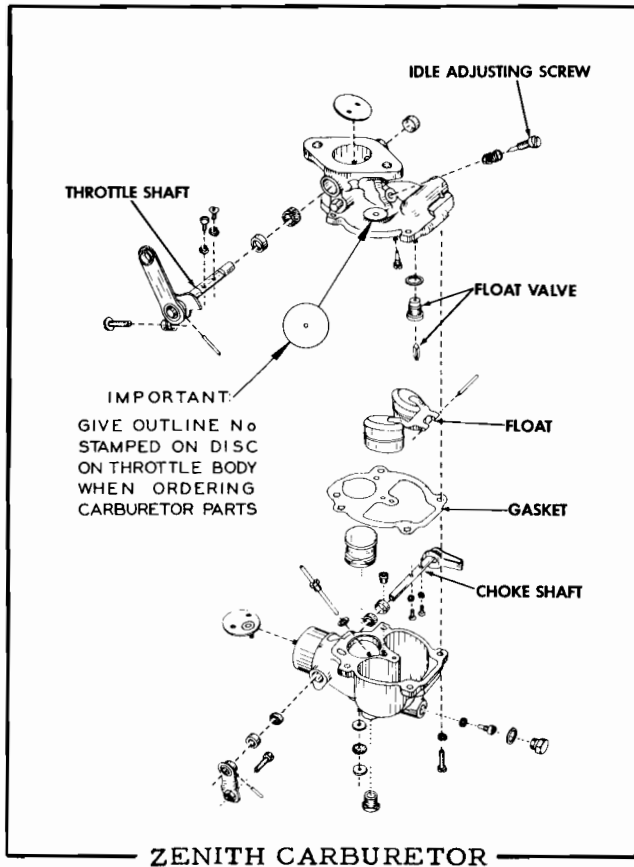
Two distinct types of manifolds are used. One for burning low octane fuel and gasoline. This is commonly referred to as two fuel

manifolds. The other is for burning gasoline only.

The two fuel manifold is cast with an opening around the riser tube of intake manifold and is provided with a shield which partially covers the intake and exhaust manifolds. The straight gasoline manifold is cast solid around the riser tube.

A large pet cock is provided for use on all 60 All Crop engines and also for other engines where hand cranking is necessary. This cock is installed in the intake manifold directly above carburetor. By opening this cock and allowing entry of fresh air into intake manifold the tendency of engine to flood when hot is reduced. Do not operate engine with cock open.

## CARBURETOR



### Removal

Shut off fuel supply. Disconnect fuel line, carburetor link rod and choke lever. Loosen air cleaner hose and remove the nuts attaching carburetor to manifold.

### Inspection

Check carburetor throttle and choke shafts for wear. If worn until air may leak past they should be replaced.

Check float for leaks. Check float valve for leakage. Check jets for wear.

### Assembly

Clean all parts and passages of carburetor thoroughly. Always use new gaskets and seals.

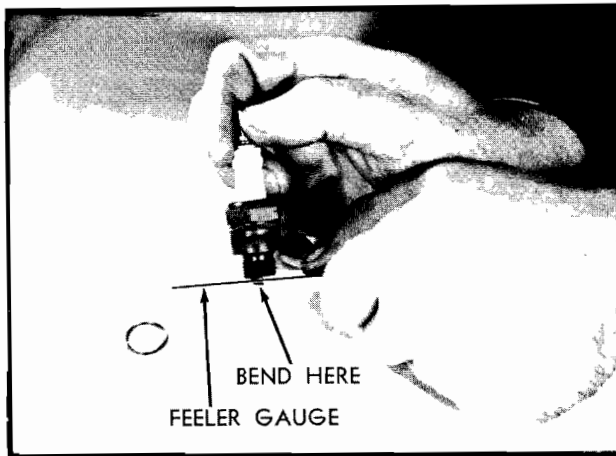
Set the float level by installing thicker or thinner gaskets under float valve. Do not bend float to change level. Make sure float does not touch sides of bowl. The float level for Zenith carburetors should measure  $1\text{-}5/32$ " from bottom of float to top of bowl, or  $7/16$ " from top of fuel to top of bowl by use of glass level test gauge. On Marvel Schebler carburetors the float level is  $9/32$ " measured from top of body to nearest edge of float or  $7/16$ " from top of fuel to top of bowl by use of glass level test gauge.

When installing the throttle valve to shaft

make sure it is turned so beveled edges contact barrel at the correct angle. Make sure the valve does not cause carburetor shaft to stick or it will cause the governor to act slowly.

The idling speed of engine is set by turning the screw in throttle valve arm in or out against its stop. The engine should be adjusted to idle at approximately 400 R.P.M. The idle speed fuel air ratio is adjusted by the screw located on front top of body. This adjustment controls the amount of air allowed to enter. Turning out allows more air to enter and makes mixture leaner. These adjustments should be made with the engine hot. The main jet is fixed at a predetermined size to provide maximum economy and efficiency and is not adjustable. If difficulty is encountered in securing proper carburetor adjustment check the air cleaner and make certain it is not plugged or leaking.

### SPARK PLUGS

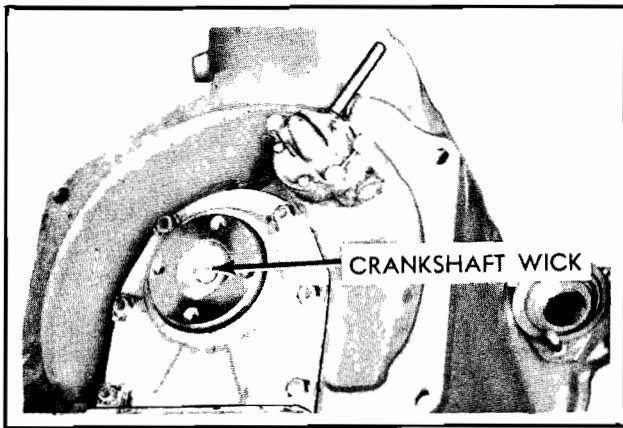


The spark plugs should be removed and the points respaced every 200 hours of operation. The points are spaced  $.030$ " to  $.040$ ". Space the points by bending outside electrode.

Use Autolite AN-7 or AC-45 for gasoline. Use Autolite A-9 or AC-47 for low octane fuels.

Check the plug for cracked porcelain and carbon deposits. When the end of porcelain exposed to combustion becomes porous looking or loses its glaze the plug will become inefficient. Tighten the plug in cylinder head to 25 foot lbs.

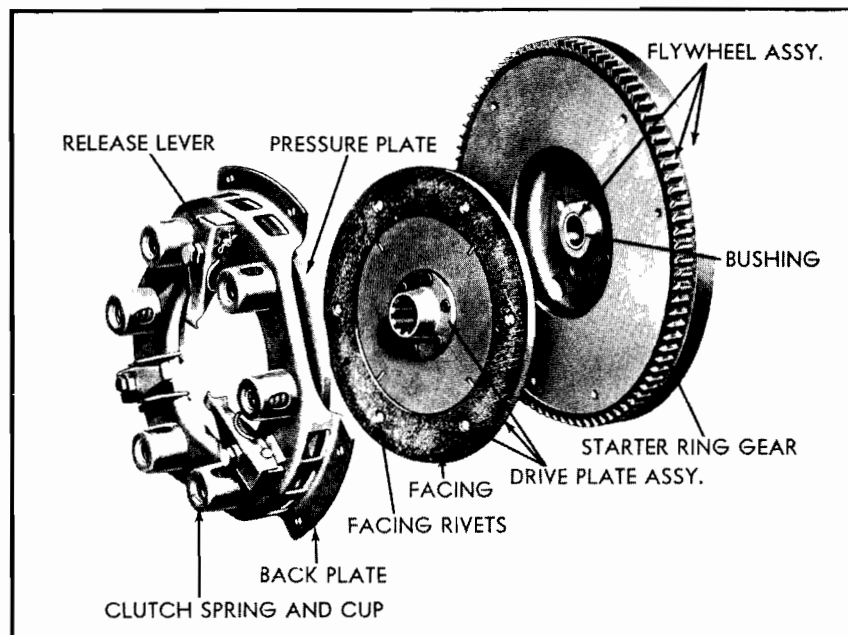
## CRANKSHAFT WICK



The wick furnishes oil to the clutch shaft pilot bearing and must be adjusted to furnish the proper amount.

The wick should be pushed into the crankshaft from the rear. Never pull into place. The wick should be flush with front end of wick hole. It should extend towards the clutch shaft 1/8". This is to make sure it touches clutch shaft. If too much wick extends to rear it will cause pressure between clutch shaft and crankshaft causing excessive pressure on crankshaft bearing thrust flange, and may also cause clutch to drag.

## FLYWHEEL AND STARTER RING GEAR



### Removal

Separate engine from the torque tube and remove clutch assembly and driven plate.

Remove lacing wire and the four capscrews attaching flywheel to the crankshaft.

### Inspection

Check the clutch pilot bushing for wear. If worn .006" or more it should be replaced. Check the starter ring gear teeth and replace if damaged. Check the oil drain passage on front of flywheel that provides the drain from the recess just forward of clutch lining. This

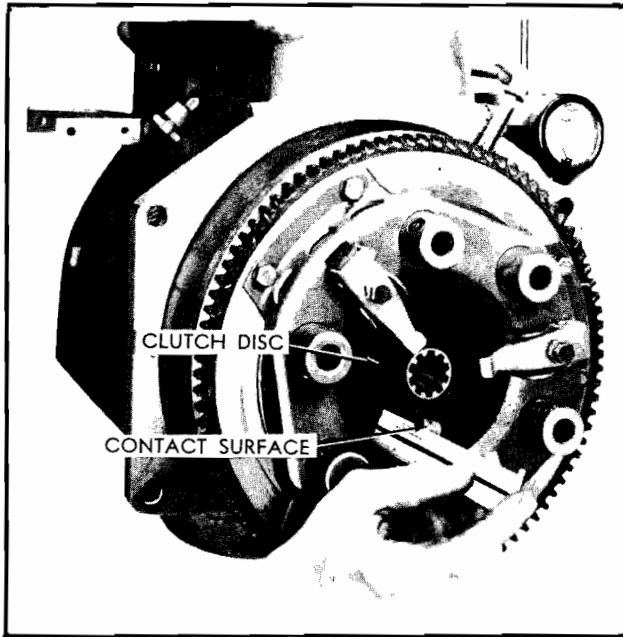
passage should touch the bottom of recess in order to drain thoroughly.

### Assembly

Press the pilot bushing into flywheel until flush with front side of flywheel. If distorted in pressing into place, it must be reamed to .879". To install the ring gear to flywheel, heat the gear to about 400° F. Drive onto flywheel with beveled ends of teeth towards clutch, while hot. The flywheel can only be installed on the crankshaft in one position, due to the offset holes.

Tighten flywheel capscrews to 50 ft. lbs. Lace in pairs with wire, crossing the wire in such manner the capscrews cannot loosen.

## CLUTCH



### Removal

Separate the engine from the torque tube. Remove the six capscrews attaching the clutch to the flywheel. Remove evenly turning each screw a small amount each time, until they are removed. This will prevent distortion of the pressure plate and eliminate the danger of cracking the pressure plate.

The clutch can be disassembled by compressing the pressure plate against the back plate. Use three "C" clamps. Loosen the finger or clutch lever adjusting screw and remove the return spring and hinge pin.

### CLUTCH DRIVEN DISC

Check plate for loose rivets and worn or oil soaked lining. Check for cracks and bent plate. A bent plate may cause clutch to drag.

Install rivets with heads in the thin lining and rivet with a special punch made for this purpose. Install thin lining on front side of

### Inspection

Check the pressure plate for warping with a straight edge. Check for scoring or cracks.

If warped .010" or more or scored the plate should be replaced. Check the release levers at release bearing contact surface and if worn flat they should be replaced.

Check the pressure springs and if more than 1/16" short they should be replaced. It is advisable to replace springs in full sets.

Check the release lever adjusting screw and screw pivot. If worn the proper adjustment cannot be obtained.

### Installation

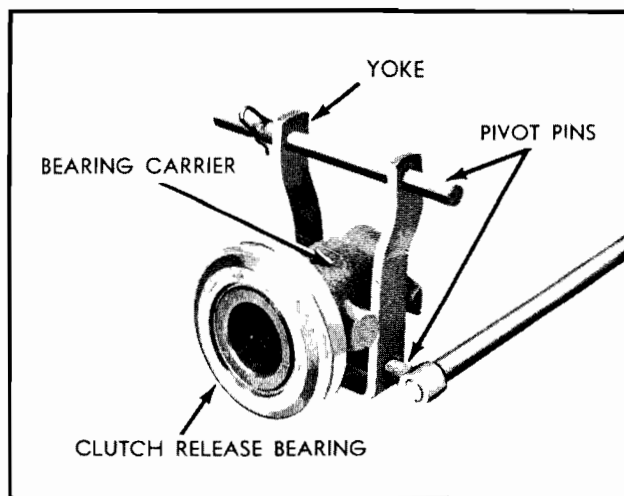
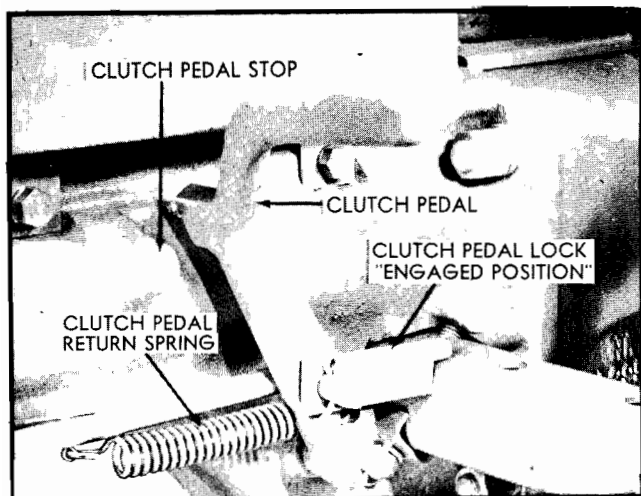
Use a piece of old clutch shaft or some suitable tool to align the clutch plate with the flywheel. Install plate with the stiffener or grease slinger towards the flywheel.

Adjust the clutch fingers or release levers until they are 1-13/16" from the clutch disc to the surface contacted by the release bearing. Place a small amount of oil on pilot bearing.

If the crankshaft wick is too long or the pilot bushing tight, the clutch shaft will tend to rotate, causing difficulty in shifting gears.

plate. Install plate on flywheel with the oil slinger towards flywheel. If the plate is turned with the long section of hub towards flywheel, proper adjustment cannot be secured as the lining will be held away from the flywheel.

## CLUTCH RELEASE BEARING



### Removal

Separate engine from torque tube. Disconnect the clutch pedal return spring and pedal rod from pedal. Turn the rod to the left and remove from yoke. Remove the hair pin from yoke fulcrum pin and remove pin, yoke and bearing carrier assembly. Press the release bearing from bearing carrier.

### Inspection

Check the pivot points and if worn excessively they should be replaced. Check the carrier and carrier tube. If the carrier or tube are worn or the tube loose in torque tube they should be replaced.

Check the bearing for wear. Replace if worn excessively or if balls or races are cracked, chipped or rough. The release bearing is a straight thrust bearing and can stand some side movement, however, if the side movement allows the retainers to touch, the bearing should be replaced.

### Assembly

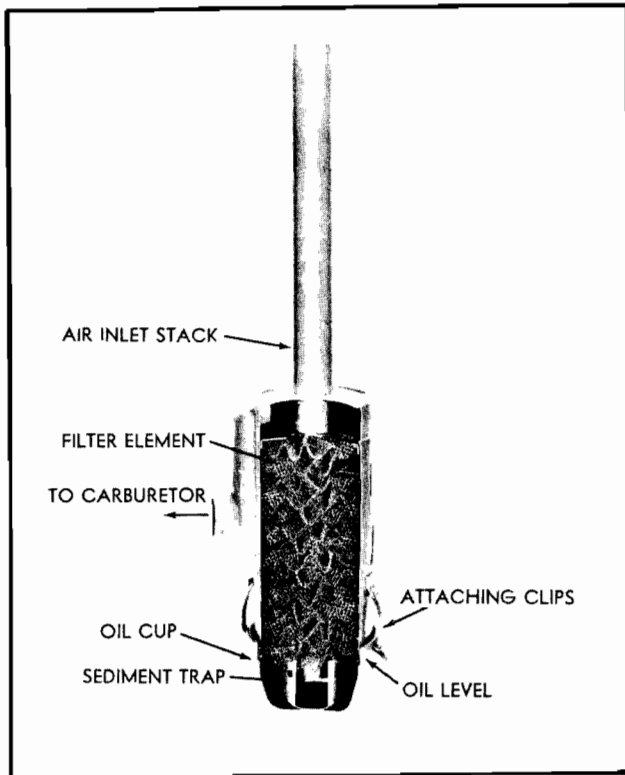
Press bearing on the carrier with the free face forward or in such a manner that the retainer does not turn.

Install bearing and carrier with the grease fitting down on model "B" tractors. On the model "C" the bearing is prelubricated and installation of carrier may be either up or down.

Adjust the clutch pedal rod until there is 1/4" clearance between the release bearing and the release levers on clutch, providing the release levers are adjusted as outlined under "clutch".

Usually one or two threads extend through the yoke screw when properly adjusted. Make sure the clutch pedal strikes stop on side of torque tube.

## AIR CLEANER



### Assembly

Be sure the hose connection is in good condition and shellack in place.

The entrance of a small amount of dirt into engine will cause rapid wear. In checking the air cleaner, note the condition of the throttle shaft and choke shaft in carburetor.

Even with a good air cleaner, its purpose will be defeated if dirt is allowed to enter engine around carburetor shafts.

Maintaining the proper oil level in oil cup and oil of correct viscosity cannot be overstressed.

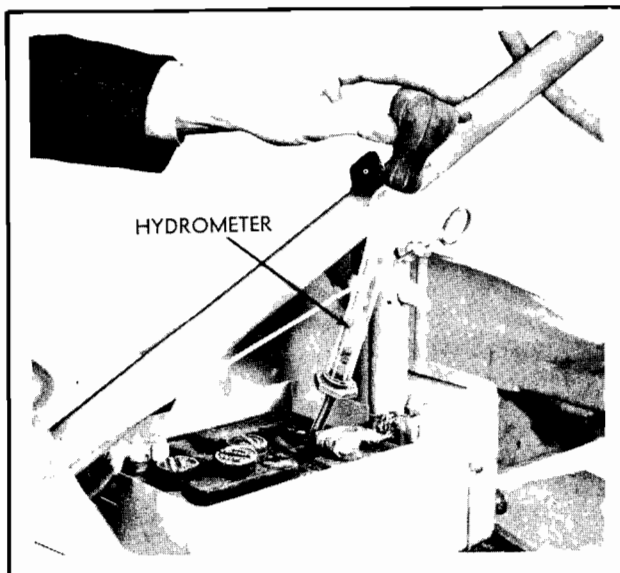
### Removal

Remove the air cleaner stack cap. Loosen the hose connection between carburetor and air cleaner. Remove the two capscrews attaching cleaner body to cylinder block.

### Inspection

Check cleaner for plugging with dirt or trash. Check for air leaks. Clean the center tube and cup. Backwash the filter element thoroughly.

## BATTERY



### Removal

Remove the battery cover and disconnect the battery cables. Remove the four capscrews attaching battery box to the torque tube. Tip battery and box to the side and lift from the torque tube. The second type battery box has a removable side. The battery can be removed without removing the complete box,

### Inspection

Inspect battery case for cracks or leaks. Inspect sealing compound over top of battery. It should not be broken loose from case. Check terminals for looseness. Terminals are sometimes broken loose from the plates in removing the cables. Check the terminal post seal and nut for looseness. This is sometimes noticeable by leaking and excess corrosion.

Take hydrometer readings of the individual battery cells. The gravity of a fully charged cell is 1.280. With a voltmeter take voltage readings of each individual cell. The voltage should be approximately 2 volts.

When the battery is placed on a battery charger for several hours and fails to test as above, it indicates the battery is defective and should be replaced.

### BATTERY IGNITION UNITS

Two types of battery ignition units have been used on model "B" and "C" tractors. Both of these were manufactured by the Fairbanks-Morse Company. The first had a single battery terminal. The second style had two battery terminals and was used with a reversing type switch. This type of switch was used to reverse the polarity of current across the contact points. This lessens the tendency of contact points (Breaker) to pit and pyramid. High battery voltage caused by overcharging battery or poor connections increase this tendency. The contact point setting is .020" at full separation in both models.

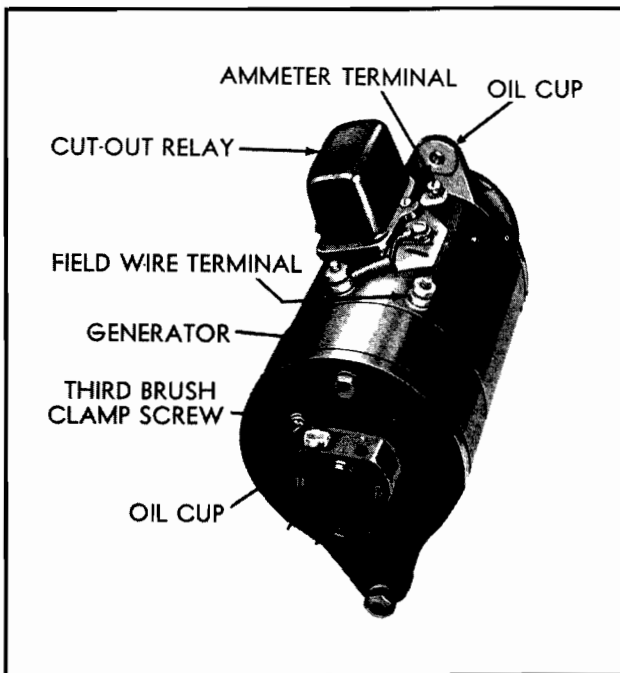
It is not practical to attempt repairs to the internal parts of battery unless complete lead burning and mold facilities are available.

Ignition and lighting systems in which the positive battery post is grounded are usually preferred. This tends to prevent corrosion at the point where ground cable attaches to tractor.

#### Timing Battery Ignition Units

The battery ignition unit unlike the magneto is always in the retarded position when at rest. It must be timed to engine with the points just opening .001" when the mark "Dead Center" on the flywheel is in the center of the inspection opening of clutch housing. However, if the timing is checked with a timing light, ignition takes place at 30° B.T.C. or on the fire mark, when the engine is 900 or more. At this speed the ignition unit is fully advanced.

### GENERATOR



#### Removal

When working on the electrical system always disconnect the battery ground cable.

Disconnect the ammeter lead from the cutout and the field wire from the generator frame. Remove the capscrew from the generator brace and the bolts from both ends of the mounting bracket.

Repair of the generator should be handled by an authorized service station.

The generator is of the three brush type. The third brush is adjustable and is used to regulate the charging rate of the generator. To regulate, the Delco Remy generator, loosen the screw in rear end of generator. Auto-lite generators are equipped with a spring controlled third brush and have no clamp screw.

To regulate simply move brush holder in desired directions.

The charging rate should be regulated to



three amperes with light switch in the low charge position and 10 amperes in the high charge position. Moving the brush in the direction of armature travel increases the charging rate. Adjust charging rate at high idle speed.

The cutout relay provides an automatic switch which prevents the battery from discharging through the generator circuit when the generator is at rest.

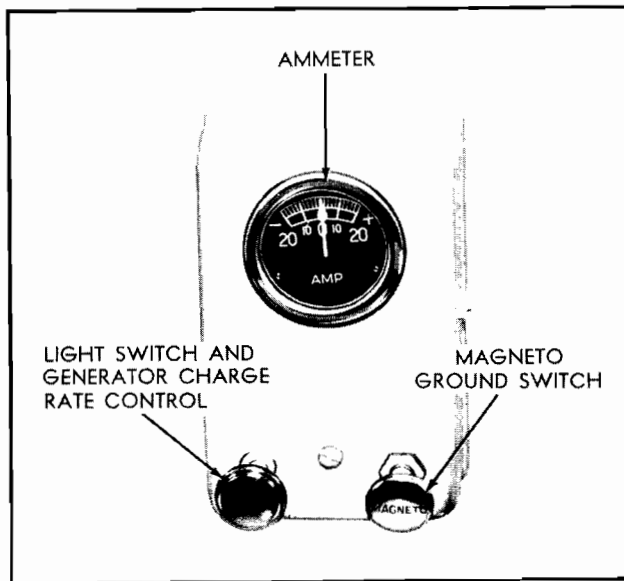
The cutout consists of an electro magnet wound with a coil of fine wire and a coil of heavy wire and a set of points. As voltage builds up in the generator the current passes through the fine winding to the ground. This causes the magnet to pull the movable point towards the fixed point closing the circuit between the generator and battery. (The large number of turns in the fine wire coil prevent any large volume of electricity to

flow through this coil. This amount is always lost.) With the points closed the coil of large wire is cut into circuit and its force is used to hold the points in firm contact. When the generator comes to rest, the current in battery will flow to generator, reversing the polarity of the electro magnet which will force the points apart, breaking the battery circuit and preventing its discharge.

If the cutout proves defective it is best to replace the unit rather than attempt repairs, in an emergency the points may be filed smooth. If the point adjustment is changed by filing, the cutout must be readjusted.

Providing the generator is in good condition, decreasing the air gap of relay armature will cause the cutout to close easier and quicker. The light spring on armature needs only enough tension to hold points apart when generator is idle.

### LIGHT SWITCH AND AMMETER



#### Removal

Always disconnect battery ground cable. Remove the two screws attaching the front half of instrument box to the rear half. Remove the leads from the ammeter terminals and

magneto switch terminal.

#### Inspection

The light switch should be checked before removal and in relation to the ammeter and generator.

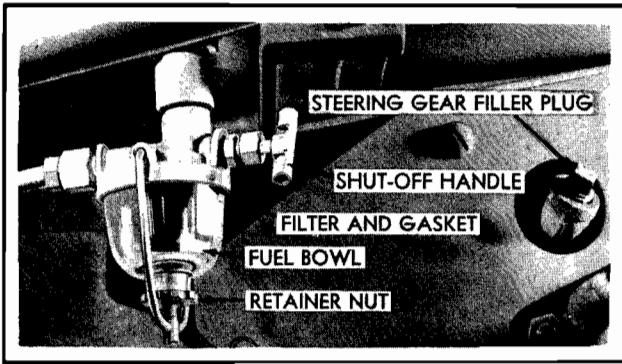
The light switch must be replaced if found defective due to poor contact points. The resistance unit provides the means of reducing the charging rate of generator by limiting the amount of electricity allowed to flow through field coils of generator.

If the generator is in good condition and the high charge rate cannot be obtained, it indicates the resistance unit contact points do not open. If the low rate cannot be obtained it indicates the resistance unit points fail to close, are dirty or the winding is burnt out or broken.

#### Assembly

For assembly see wiring diagram.

## FUEL TANK AND FUEL FILTER



### Inspection

Inspect the tank for leaks. Check inside of tank for rust, dirt and fuel gum. Check filter element for dirt and holes or breaking away from retainer. Clean or replace element. Check shutoff handle for leakage. Repack if necessary. Turning handle to left as far as possible prevents leakage when valve is open. Always use a new bowl gasket.

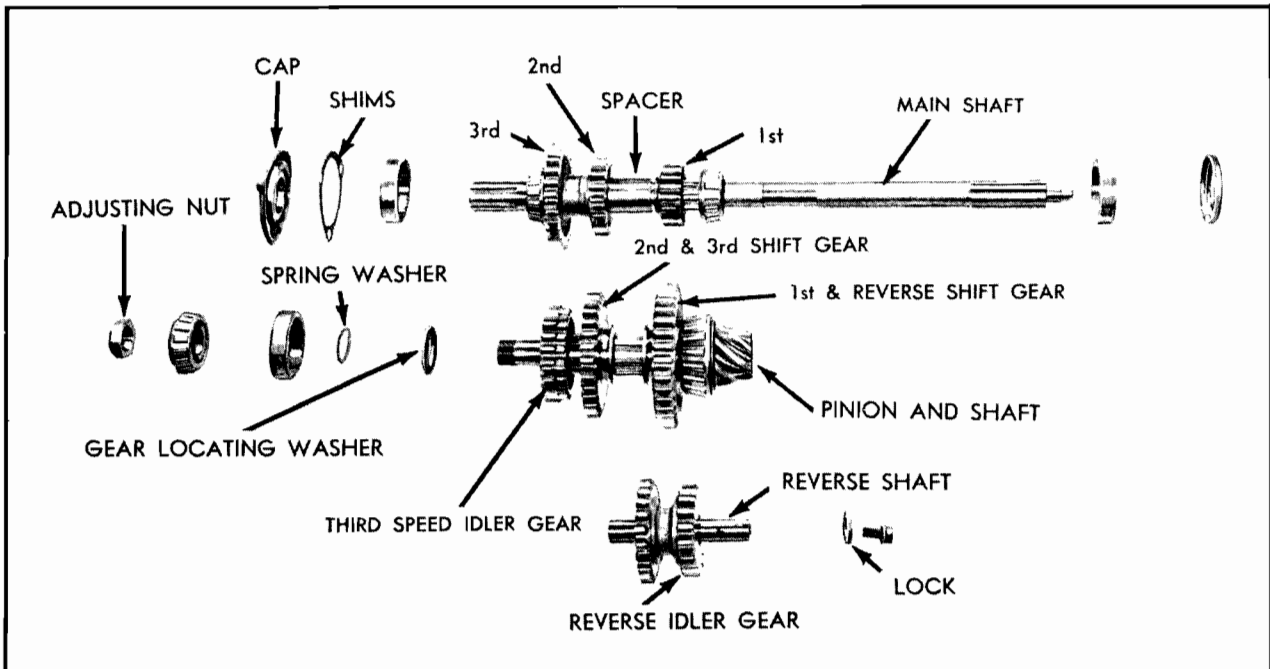
### Assembly

Install the filter element above the bowl gasket. The felt retainer has a reinforcing web on its top side. When installing new elements, place with web side up. On old element, reinstall in same position as it was before removal.

### Removal

Remove the hood and the screw at rear end of tank. Disconnect fuel line from fuel filter.

## TRANSMISSION



### Removal

Remove the drawbar, the seat frame and final drives. Drain the transmission oil and separate transmission from torque tube. Remove the differential assembly.

### Main Shaft

Remove the shifter mechanism, the clutch

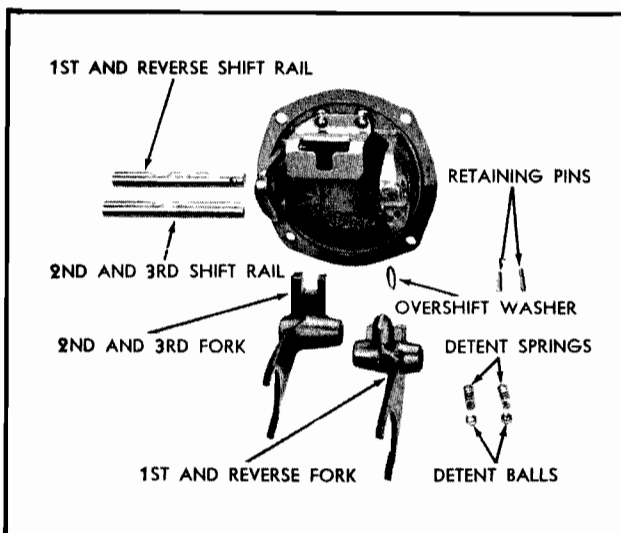
shaft and the front bearing retainer and oil seal. Slide the shaft forward and remove the gears and bearings through the shifter mechanism opening. The bearing cups may be driven out of transmission case. The bearing cup retainer snap rings need not be removed unless a new case is to be installed.

### Pinion Shaft

Remove the cover over front bearing and remove the nut on pinion shaft. Drive shaft towards rear of case. The bearing cups can be driven from case. The snap ring need not be removed unless new case is to be installed.

### Reverse Shaft

Remove the capscrews and retainer from rear end of shaft. The shaft is drilled in order to furnish oil to the reverse gear bearing and the rear end is threaded, 5/16" N.F. This threaded section is corked to prevent loss of oil. Remove cork and install a long bolt to pull reverse shaft if necessary.



### Shifter Mechanism

Remove the three capscrews and the one flat head screw attaching the shifter mechanism to transmission case. To remove the shifter forks, pull the pins that retain shifter rails and slide rails out. Be sure to catch balls and springs. If the pins are tight and cannot be pulled out drive them through and cut off the inner end as the pin strikes cover.

### Gear Shift Lever

Remove the dust cover from shift lever and remove the snap ring from transmission case. Lift lever and retainer from case.

### Inspection

Check bearings for chipped or cracked balls, rollers and races. Check gears for worn or chipped teeth and fit of splines on shaft. Check shafts for alignment and worn splines.

Check fit of bearings on shafts. They must be tight or at least a snug fit. Check the shifter rails for grooves worn by detent balls. Always replace all gaskets and oil seals.

## ASSEMBLY

### Reverse Idler

Install the reverse idler as shown and install lock and tighten securely. Reinstall cork in rear end of shaft.

### Pinion Shaft

Install bevel pinion shaft and install the low and reverse sliding gear with the shifter collar forward. Install the second and third speed gear with the shifter collar towards rear. Install the third speed idler gear with the short teeth towards the rear. Install the bevel washer with the oil grooves towards third speed idler gear. Install the spring washer, bearing cup and bearing cone. Install adjusting nut and tighten until bearings have a free rolling fit without end play. The nut may now be finely adjusted until a very light force is required to turn shaft. The bearing must never be adjusted tight enough to make the bearing feel as though it rolls over high spots, becoming harder and easier to turn. Lock the nut by punching a portion of the thin section down into the keyway of shaft.

### Main Shaft

Start the main shaft from the front with the front bearing and snap ring on the shaft. Place the third speed gear in case with the long shoulder towards the rear and the second speed gear with the long shoulder towards the front. Install the spacer. Next install the rear bearing and then place the low gear between spacer and bearing and enter shaft. Install front bearing cup and retainer. The oil seal must be installed in retainer with the lip towards the rear. Use shims and gaskets as required to adjust bearings to a free rolling fit without end play or binding.

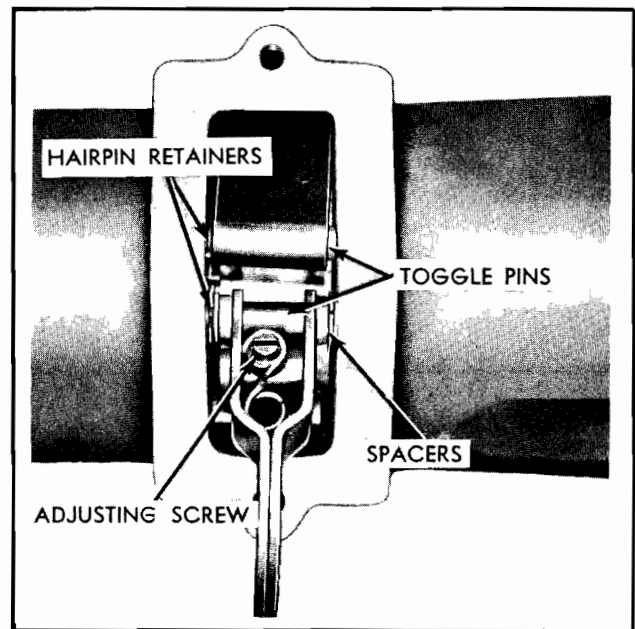
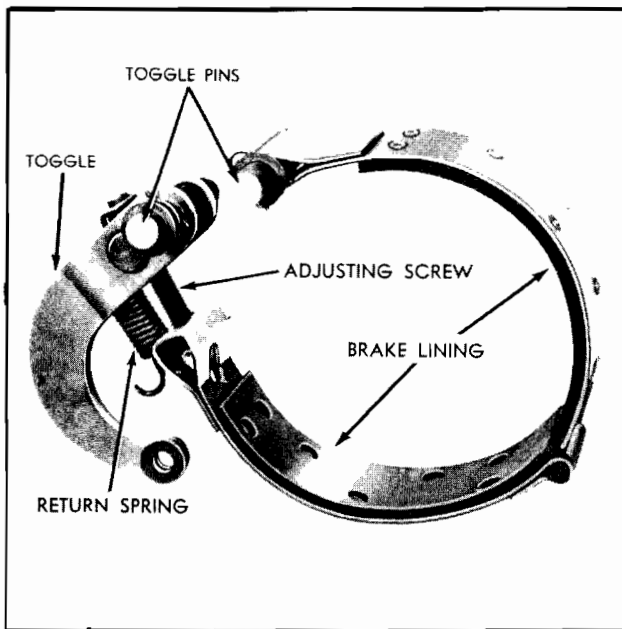
The washer or oil reservoir goes behind the rear bearing and provides a reservoir to supply oil to rear bearing.

The shifter assembly is made up of the cover, rails and forks. The third and second speed shifter rail can be identified by the detent notches. The neutral and third speed notches are on the opposite end of rail from retaining pin hole and are the closest together of any of the notches. The third speed shifter rail is installed in the right hand position. If

the shifter is equipped with the overshift washer, it must be installed on the rear side of the third speed fork, or the front

side of the reverse fork or as removed from the shifter. These washers prevent overshifting.

## BRAKES



### Removal

Remove the seat frame, fender and fender angle. Disconnect the brake lever foot pedal linkage. Remove the hair pin retainers from the toggle pins and remove pins. Remove the brake adjusting screw. The band can be removed by pulling on the front end of band, up and back. If the band fails to slide out easily, place a jack under the tractor and raise the wheel from the floor. Turn wheel forward and band will be rolled out.

### Inspection

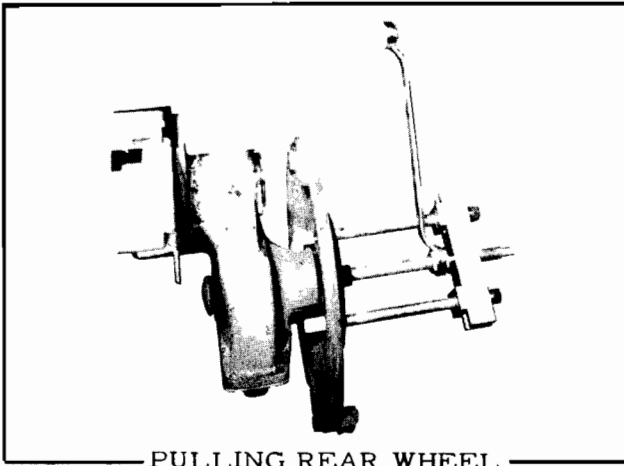
Check band for wear and loose rivets.

### Installation

If replacing a bolt end band assembly with a screw end band assembly on tractors below Serial Number B-64501 and C-20723 the final drive housing must be chipped out to allow band to pass around brake drum.

Adjust the brakes until the brake lock can be engaged and hold the brake tightly in the engaged position. If adjusted too tight it will not be possible to engage lock. Oil the pins and linkage, but do not allow oil to contact lining.

## FINAL DRIVE



PULLING REAR WHEEL

### Removal

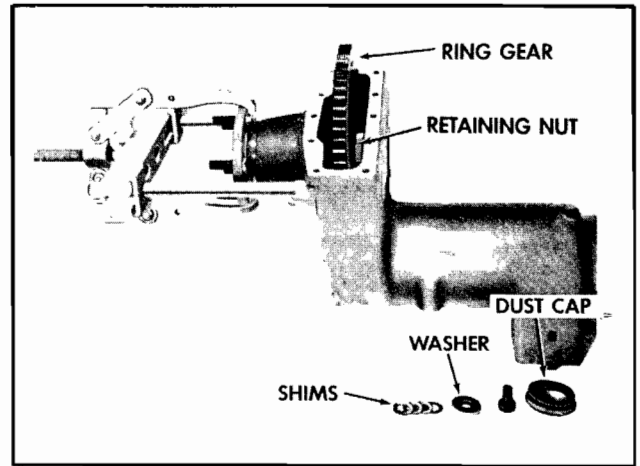
Remove seat frame and fender angle. Remove wheel. Remove the four nuts attaching final drive to differential case. Use a chain hoist and attach to housing in such manner that the housing will balance and slide away from tractor. (The final drive ring gear can be removed from final drive without removing final drive housing from tractor).

### Disassembly

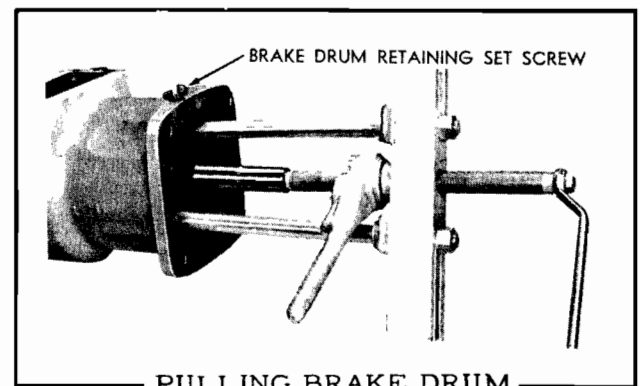
Remove the dust cap from inner side of final drive case that covers inner bearing. Remove capscrew, washer and shims. Remove oil pan from bottom of case and loosen ring gear retaining nut as far as possible. Attach puller as shown.

Pull the shaft partially and finish removing retaining nut.

Remove lock wire and brake drum retaining jam nut and set screw. Attach puller as shown and remove brake drum. Remove brake drum key. Remove the pinion bearing



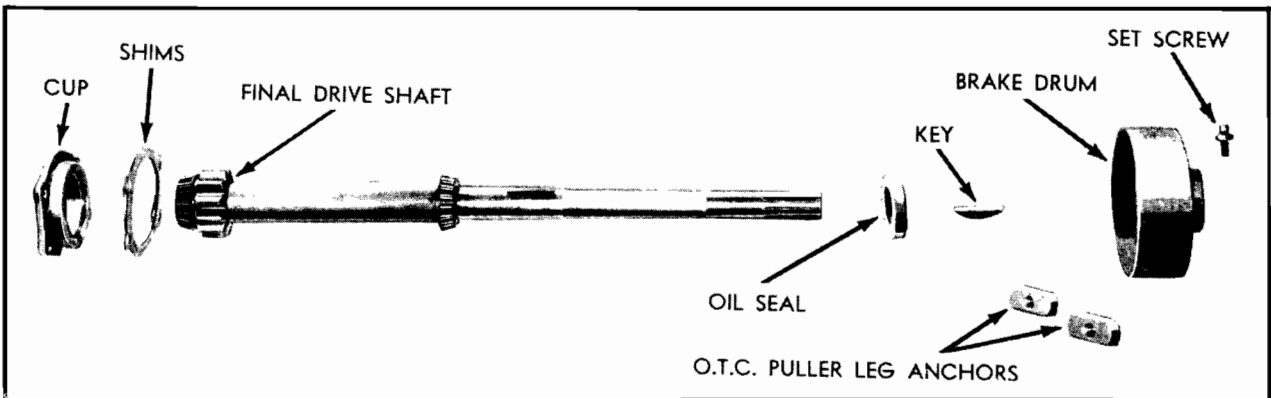
retaining cover and shims. The pinion shaft may now be removed. Bearing cups may be pulled or driven from case. It is not necessary to remove the bearing cup snap rings unless a new final drive case is to be installed. Bearings may be pulled or pressed from shafts.

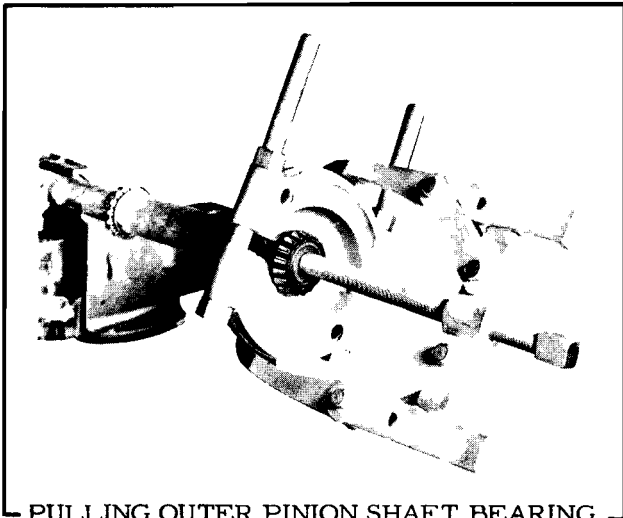


PULLING BRAKE DRUM

### Inspection

Check bearings and cups for wear, chipping and cracks. Check gear teeth for wear or chipping. Check brake drum for scoring on lining contact surface. Check the splines on





PULLING OUTER PINION SHAFT BEARING

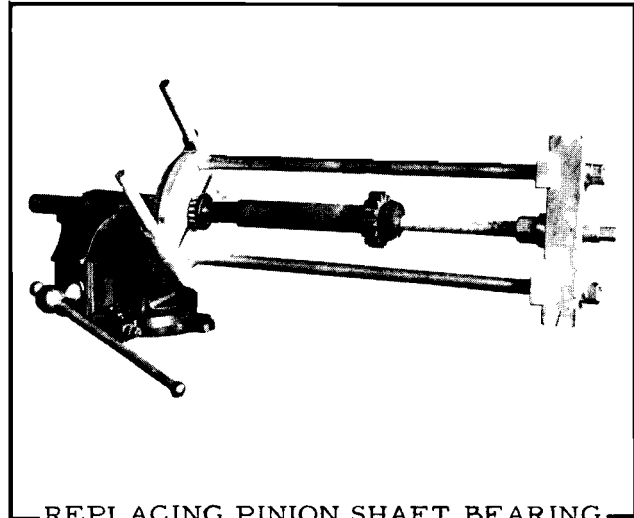
shaft and gear hub. On the model "B" check the spline in wheel. Always use the narrow bearing spacer (1/2 inch) between wheel and bearing on the Model "B". Use new oil seals.

#### Assembly

Install bearings on pinion shaft and install in case. Install bearing retainer and adjust bearings to a free rolling fit without end play or binding by use of the proper number of shims and gaskets placed between bearing retainer and final drive case. Use alternate metal shims and paper gaskets to prevent grease leakage. Install brake drum, centering drum in upper opening.

#### Axle Shaft

On the Model "C" assemble oil seal on final



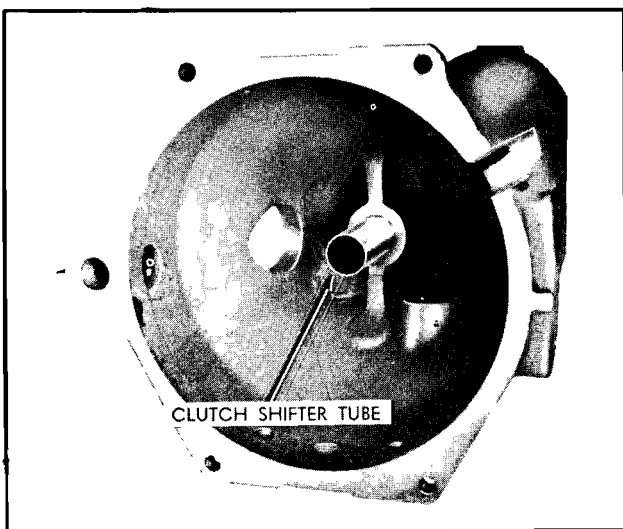
REPLACING PINION SHAFT BEARING

drive gear shaft with lip of seal turned towards the inner end of shaft. Start shaft into place and enter shaft into gear, placing lock-washer and nut on shaft. Push shaft through and start nut. Oil seal must now be started and driven in as nut is tightened. If a special split oil seal driver is available the shaft and seal may be driven in. Remove seal driver before installing inside bearing.

The oil seal for the model "B" may be installed after the shaft is in place and before the wheel is installed.

Adjust the bearings to a free rolling fit without end play or binding by use of shims between the heavy inner washer and the end of shaft. Use a sealer compound on edges of inside dust cap to prevent oil leakage.

### TORQUE TUBE AND CLUTCH SHAFT



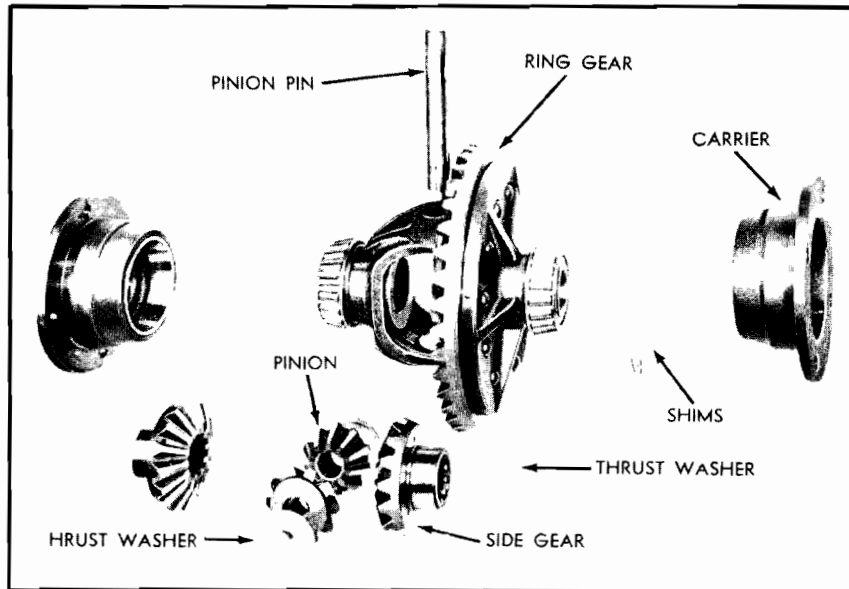
CLUTCH SHIFTER TUBE

The clutch shaft may be removed only if the transmission is removed. Check shaft for alignment and wear of splines. Check size of pilot bearing. If worn more than .006" it should be replaced. Be sure to replace cotter pin in coupling.

The torque tube may be removed by removing the engine, transmission, fuel tank etc. and steering gear.

Check the clutch shifter tube. It must be tight in the torque tube. On the model "B" tractor the bushing for radius rod should be replaced if worn more than .010". Length of shifter tube is 5-1/2" from end of tube to housing.

## DIFFERENTIAL



### Removal

Remove the seat frame, fenders and final drive assemblies. Remove the right and left hand bearing retainers. Keep these parts identified and keep the shims separate and with their particular bearing retainer. If no new parts are used they may be reinstalled as removed and the bearing adjustment simplified.

The rear cover or PTO must be removed. Remove the lock pin from the pinion gear shaft. Remove shaft, pinions, pinion thrust washers and side gears. If necessary to remove ring gear the rivets must be cut and driven out.

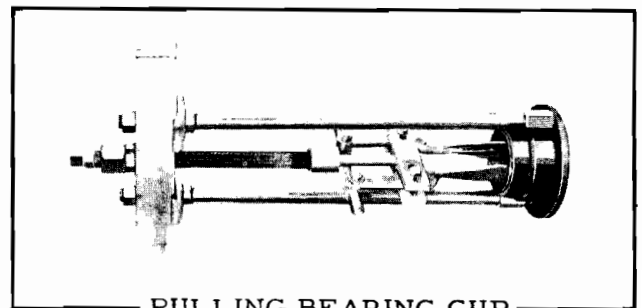
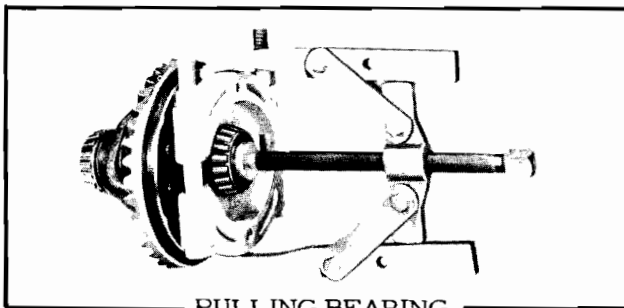
### Inspection

Check bearings and cups for wear chipping and cracks. Check gear teeth for wear and chipping, check thrust washers, the backs of pinion gears and thrust washer surface in carrier for wear and scoring. Check the

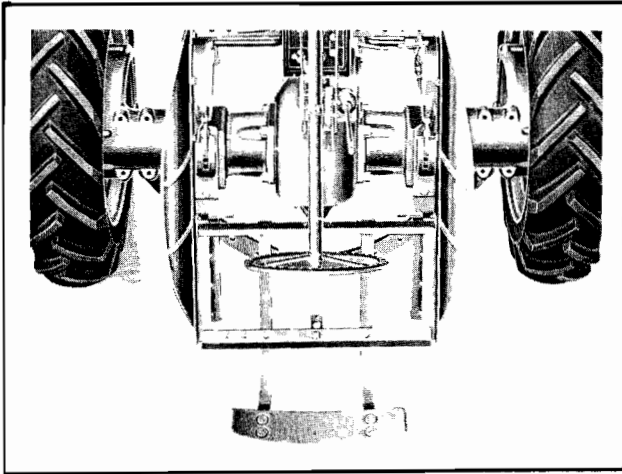
pinion gear shaft for wear. If worn more than .008" it should be replaced. Use new oil seals in bearing cages.

### Assembly

If the ring gear is to be assembled to the carrier, it should be cold riveted. Assemble side gears, pinions and thrust washers in carrier and enter pinion shaft. Rivet over pinion shaft retaining pin to hold it in place. The ring gear is driven from the lower transmission shaft and must be placed in the case with gear on left side of tractor. Enter bearing cages and adjust bearings to a free rolling fit without end play or binding. After securing the proper bearing adjustment the backlash between ring gear and drive pinion may be set to .004" to .005". To adjust, remove the proper thickness shim from the side towards which the ring gear is to be moved and install on the opposite side. In this manner the bearing adjustment will not be affected.



## SEAT FRAME, FENDERS AND FENDER ANGLES

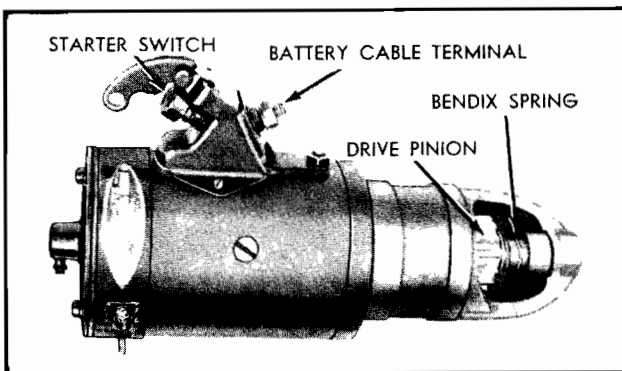


### Removal

Remove the four bolts attaching seat frame to fender angles. If equipped with three way valve and hydraulic ram, these parts must be removed. Remove the bolt at front of fender angle, the brake linkage or brake band lever and the two capscrews holding brake cover to final drive. On foot operated brakes the fender must be tipped forward and down to remove from brake operating lever.

The fender must be removed if foot brake pedal shaft is to be removed. Replace worn parts if necessary.

## STARTER



### Removal

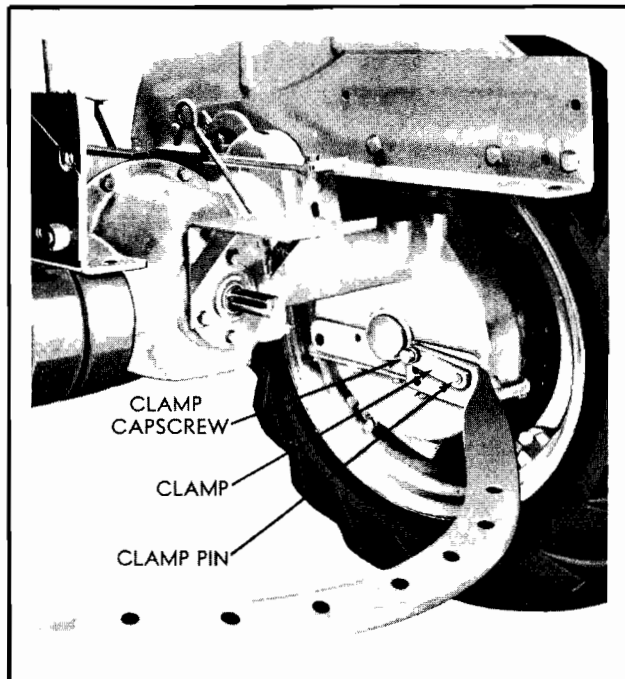
Disconnect the battery ground cable. Remove the starter cable from the starter switch. Disconnect the starter pedal rod. Loosen the jam nut and remove the starter retaining set screw. Rotate starter back and forth and pull from the torque tube.

### Inspection

Check the starter switch contact points. File square and smooth to remove pits if necessary. Clean commutator with grade 00 sand paper. Take the starter to an authorized repair station for repair, unless the shop is thoroughly equipped for such work.



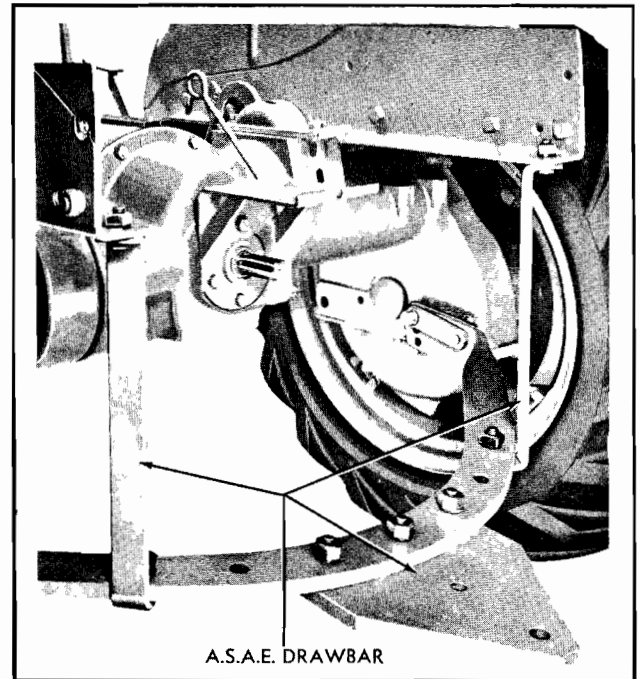
## DRAWBAR



### Removal

Remove the capscrews from the pivot pin clamps. Remove pivot pin clamp and pin assembly. Slide drawbar from tractor.

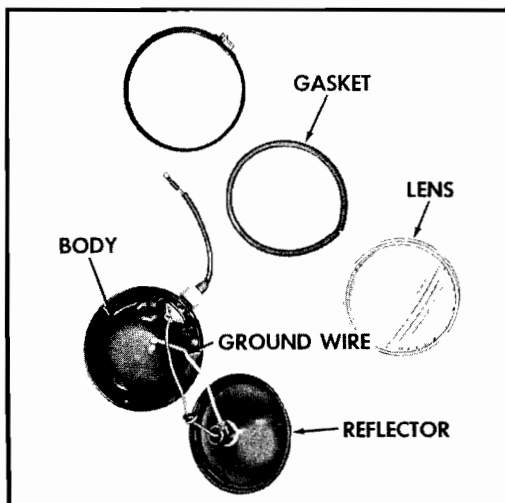
On A.S.A.E. drawbars the drawbar brace's between drawbar and fender angles must be removed.



### Assembly

The drawbar should fit tight between the two final drive cases. To install, place drawbar between final drives with the rear end touching the floor. Start between pads of final drive cases near pivot pin holes. Tap with hammer to line up pivot pin holes and enter pivot pins. Raise rear of drawbar until the desired capscrew hole lines up.

## LIGHTS



### Removal of Head Lights

Disconnect the wires from the terminal block on rear of radiator shroud. Loosen the lamp lock nut and turn entire lamp to the left until removed.

### Removal of Tail Light

Separate the two halves of instrument box and remove the tail light wire from the light switch. Remove the shield from the top of transmission case. Remove the two nuts retaining the tail light to tail light mounting bracket.

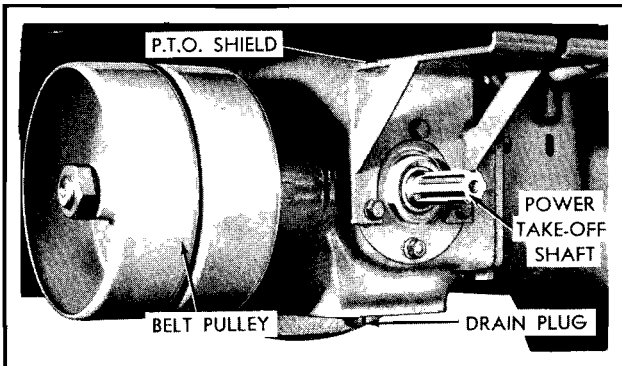
## Inspection

Check the polish of reflector. Dull reflectors will cause ineffective lighting. The reflectors can be polished with silver polish or lamp black. Check the filament of bulb. Replace if burned out. Use new gaskets between lens and reflector. Make sure the ground screw on reflector touches outside shell, or the ground wire has good contact.

## Assembly

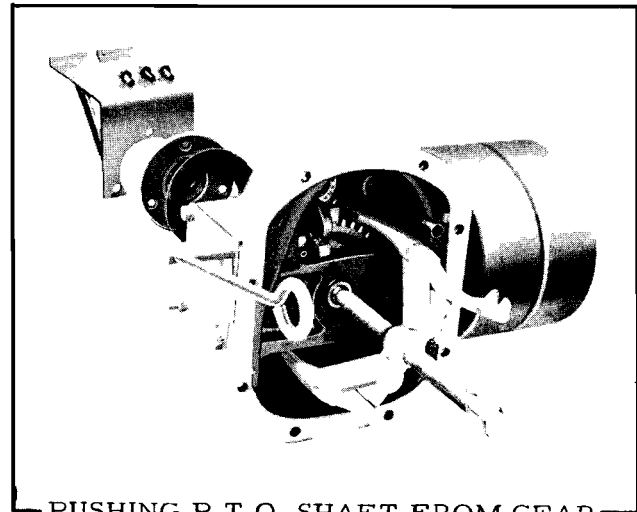
The system uses single contact bulbs; therefore it is necessary to have clean and tight connections between lights and tractor. The tail light may be used in the right hand, left hand or center position on seat to avoid interference with any particular mounted implement.

## POWER TAKE OFF AND BELT PULLEY



## Removal

Drain oil from the transmission and belt pulley case. (Two drain plugs.) Remove the capscrews and nut retaining assembly to transmission case. Remove the three capscrews from P.T.O. shield and rear bearing retainer. Use a suitable puller and push the P.T.O. shaft from the drive gear.



spring so they will not be lost. Slide shifter control lever from case.

The drive gear and inner bearing race on main transmission case may be removed by removing the retaining snap rings.

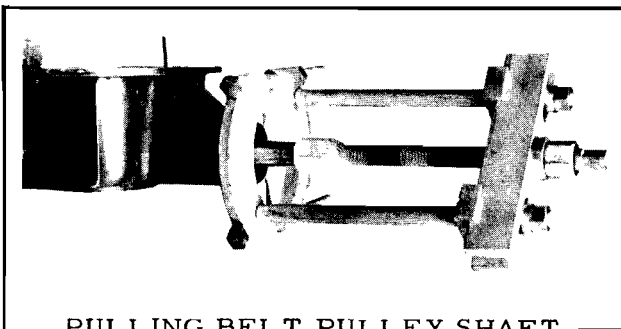
It is not necessary to remove the oil tube for the bearing which supports rear end of transmission main shaft. The bearing itself is retained with a snap ring.

## Inspection

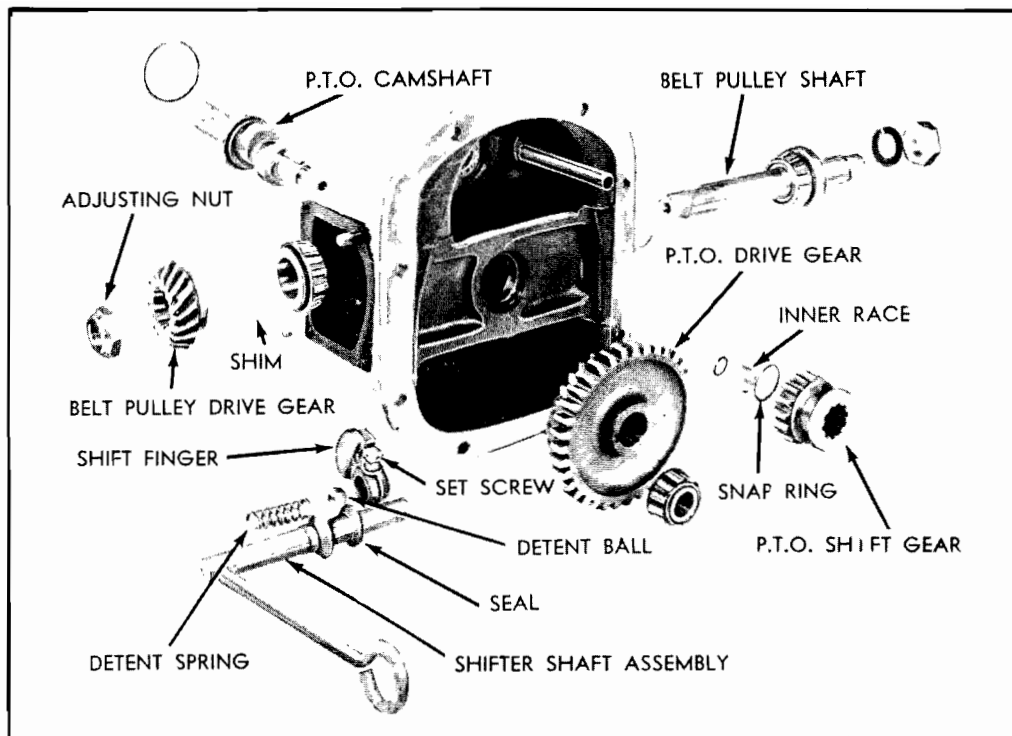
Check bearings for wear, cracks or chipping, check gears for wear, chipping or broken teeth. Check the splines and keys for wear. Use new oil seals and new cork seal for shifter lever. Check the hydraulic pump drive cams for wear or scuffing.

## Assembly

The belt pulley shaft bearings are adjusted by tightening the nut on the inner end of shaft, until the bearings have a free rolling fit without end play or binding. The nut is locked in place by driving a portion of the thin section down into the keyway of shaft.



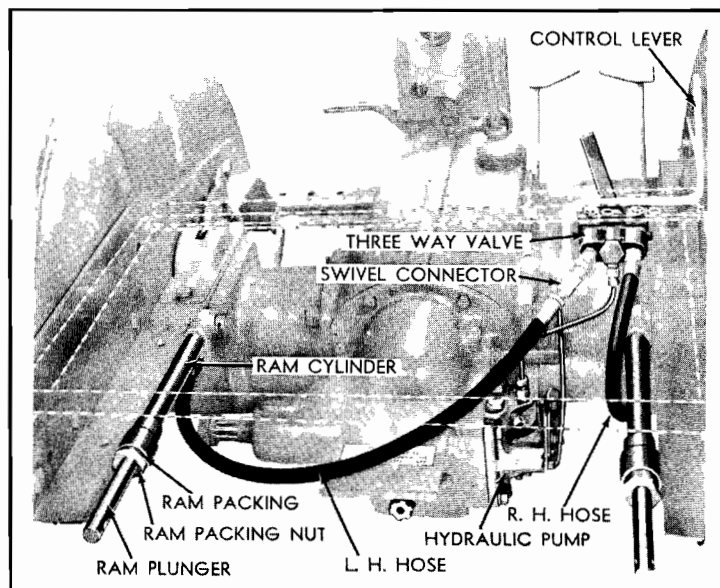
Remove the nut from the inner end of belt pulley shaft and drive or pull from case. Remove the nut, retaining belt pulley to belt pulley shaft and pull belt pulley from shaft. Press the bearing and oil seal from shaft. Remove the lock wire and set screw from the shift lever shifter. Remove the shifter, keeping the hand over the ball and



The bearings of the P.T.O. shaft are adjusted in the same manner by the use of alternate steel shims and paper shims placed between the rear bearing retainer and case. Install oil seals with the lip towards the oil supply.

The backlash between the belt pulley drive and driven gear should be  $.004''$  to  $.005''$ . This is adjusted by the use of shims between the belt pulley driven gear and the belt pulley shaft inner bearing.

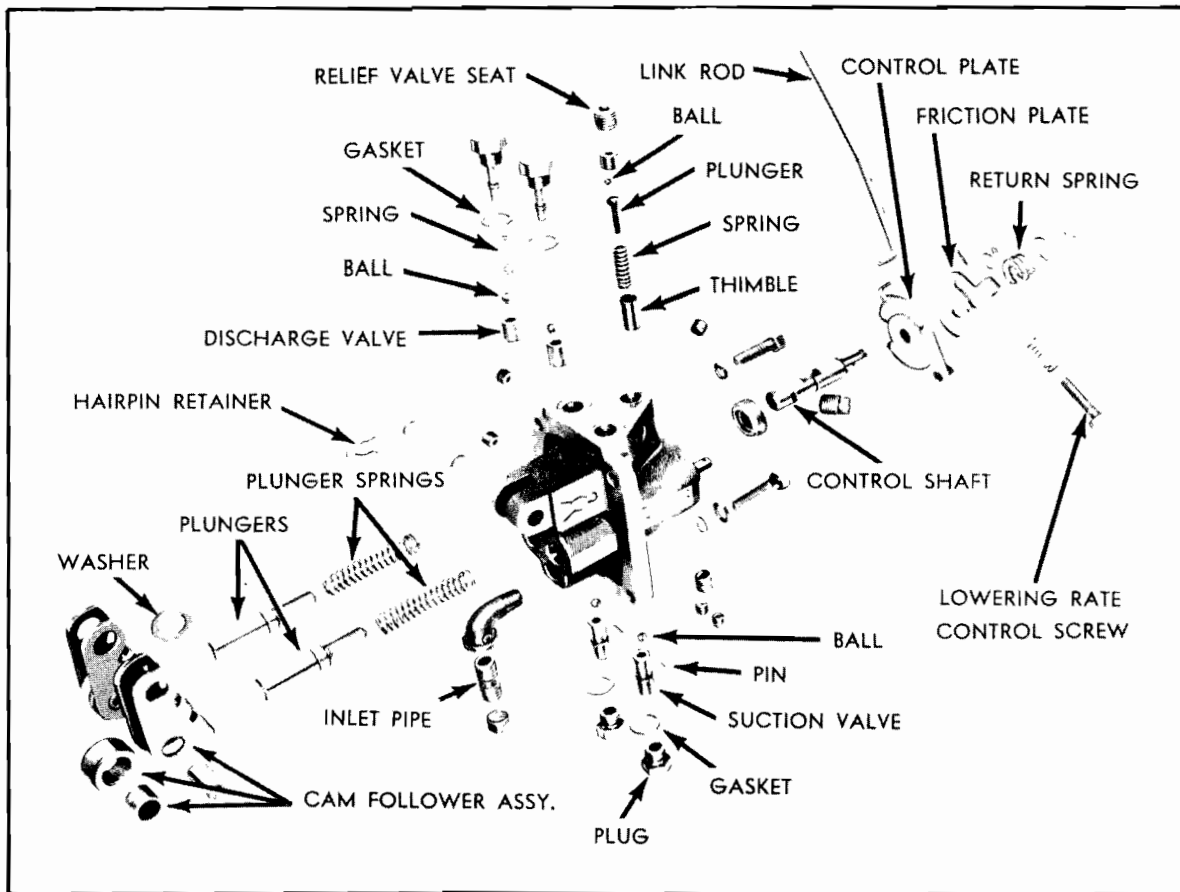
### HYDRAULIC PUMP



#### Removal

Disconnect the ram hose or three way valve.

Remove the control lever. Drain the P.T.O. housing. Remove the two capscrews and two nuts retaining the pump to P.T.O. housing.



### Suction Valves

Remove the two plugs over valves on lower side of pump. Use puller and remove the suction valves.

On older pumps using the short suction valve the pump plungers must be removed, the ball driven from the suction valve and the valves drilled and threaded to adapt puller. Use a 7/32" drill and a 1/4" N.F. tap.

### Cam Followers and Plungers

Remove one of the hairpin retainers from the cam follower hinge pin and drive hinge pin out. Pull plungers and plunger springs from pump body.

### Discharge Valves

Remove the suction valves. Remove the two plugs over discharge valves, valve springs and balls. Enter a long slender 1/4" punch through suction valve openings and drive discharge valve seat from pump body.

### Control Shaft

Remove the cotter pins and the return spring from the control friction plate retaining pins. Turn the control shaft to the lift position and

pull from body. It cannot be removed when in the lowering position.

### Relief Valve

Remove the pipe plugs immediately above and below the relief valve. Remove the control shaft. The thimble, spring, relief valve plunger and ball will fall out at bottom. Use a large punch and drive relief valve seat up out of pump body.

### Inspection

Inspect the parts for wear. The pump can best be tested by use of a hand operated test stand equipped with a pressure gauge. This test will show any difficulty present in pump.

It is difficult to visually check the different valves in pump and for this reason new valves should be used whenever a pump is dismantled.

### Assembly

#### Discharge Valves

Use a punch that just fits the bore of pump body. This punch must be square on the end so valves will not be damaged. Drive valves to bottom of bore. Seat the balls, using a very soft punch, driving ball against seat. Install ball springs and retaining plugs.

## Suction Valves

Place balls in valves and seat, the same as discharge valves. Place ball retaining pins in place and start valve assembly in housing. Drive in until at least three threads of retaining plug can be started. Place a few drops of oil on the retaining plug threads and use plug to press seat into place. Try the pump plungers and plunger springs in the plunger bore. Note: If the plunger or spring strikes the suction valve. If it touches, the suction valve must be pulled back slightly. If the suction valve was striking the plunger spring it will be necessary to use two copper gaskets under the suction valve retaining plugs.

## Plungers and Camfollowers

Install the plunger springs and plungers in body. Hold them partly compressed and install the cam followers with the thin washer between them. Install hinge pin and hairpin retainers.

## Control Shaft

The control shaft oil seal is installed with the lip of seal towards cam followers. Pin the control plate on the control shaft with the lever link hole towards the rear of the flat spot on control shaft. Enter control shaft into body entering control plate onto the retaining pins with the flat spot on shaft up or towards the relief valve seat. Place the friction plate in position and install the return spring. Wind this spring approximately one-half turn. Place a washer on retaining pin and hook end of spring into retaining pin. Install the remaining small flat washer and cotter pin on the opposite retaining pin. Install the large flat washer and cotter pin on end of control shaft to retain the control shaft return spring.

## Relief Valve

The control shaft must be in place and turned to the lowering position, so that the flat spot on shaft is turned directly towards the relief valve. Drop the relief valve thimble into body against control shaft with the cup up. Drop spring into cup and plunger into spring with the large end up. Seat relief valve ball into relief valve, using a soft punch and driving into seat lightly. Drop ball onto ball seat of plunger. Start relief valve with ball seat face down. This is the curved face. Drive into body until it measures 9/16" from the face of pump body where pump serial number appears, to the top of relief valve seat.

The pump should deliver 3200 lbs. pressure. If not, drive relief valve seat down a small amount. Do not under any circumstances

drive below 5/8" as this will cause slow lowering rate. Tighten all plugs securely.

## Testing Pump

The leakage of only one drop of oil past any of the pipe plugs will cause a rapid drop in pressure of test fixture gauge.

Turn pump upside down and place a small quantity of oil in inlet of pump. Work plungers by hand to prime pump. Add more oil as required. When pump is primed oil will appear at ram hose outlet. Mount pump in test fixture. Place enough oil in base of fixture to well cover suction inlet nipple. Install pressure gauge. Turn control valve to the lift position. Grasp and operate handle of test fixtures.

This handle may be placed in the central position to operate both plungers at the same time, until pressure increase makes pumping difficult. At this time move handle to the right or left and operate one plunger only. Both plungers must be checked separately.

If gauge shows pressure increase, but falls back to zero or nearly zero it indicates suction valves and discharge valve are both leaking. If relief valve leaks, oil will appear in drilled passage between and behind cam follower arms. If only the discharge valve leaks, gauge will show increase in pressure on the down stroke of operating lever and decrease on upward stroke. If the suction valve leaks the pressure will not raise high enough to cause relief valve to open. Drive relief valve into pump 9/16" measuring from the surface on which serial number is stamped to top of valve. Drive slowly a few thousandths of an inch at a time to increase pressure. If driven too deeply, pump will have to be disassembled to remove.

The relief valve governs the maximum pressure developed. When relief valve opens, it will be accompanied by a slight chattering or squealing noise and oil will appear behind cam follower arms with great force.

The relief valve should be driven into pump body deep enough to produce 3200 lbs. gauge pressure. This should only be done after all valves are checked.

When pressure is increased to 3100 lbs. on a properly functioning pump (pressure below point relief valve opens) there will be a slow dropping of pressure which will decrease in rate as the pressure decreases. The gauge must become stationary at 1500 lbs. or above, showing that all valves are seating satisfactorily. Do not expect the pump to hold the



implement in the raised position overnight.

After testing with control lever in the raising position, turn control to the "hold" position when pressure is near the maximum. It should in this position, maintain pressure as above. With pressure as before, and lowering control rate adjusting screw turned clear out, turn control arm to the lowering position. The pressure should immediately drop to 100 lbs. or less. If it does not, it indicates relief valve has been driven into pump too deeply.

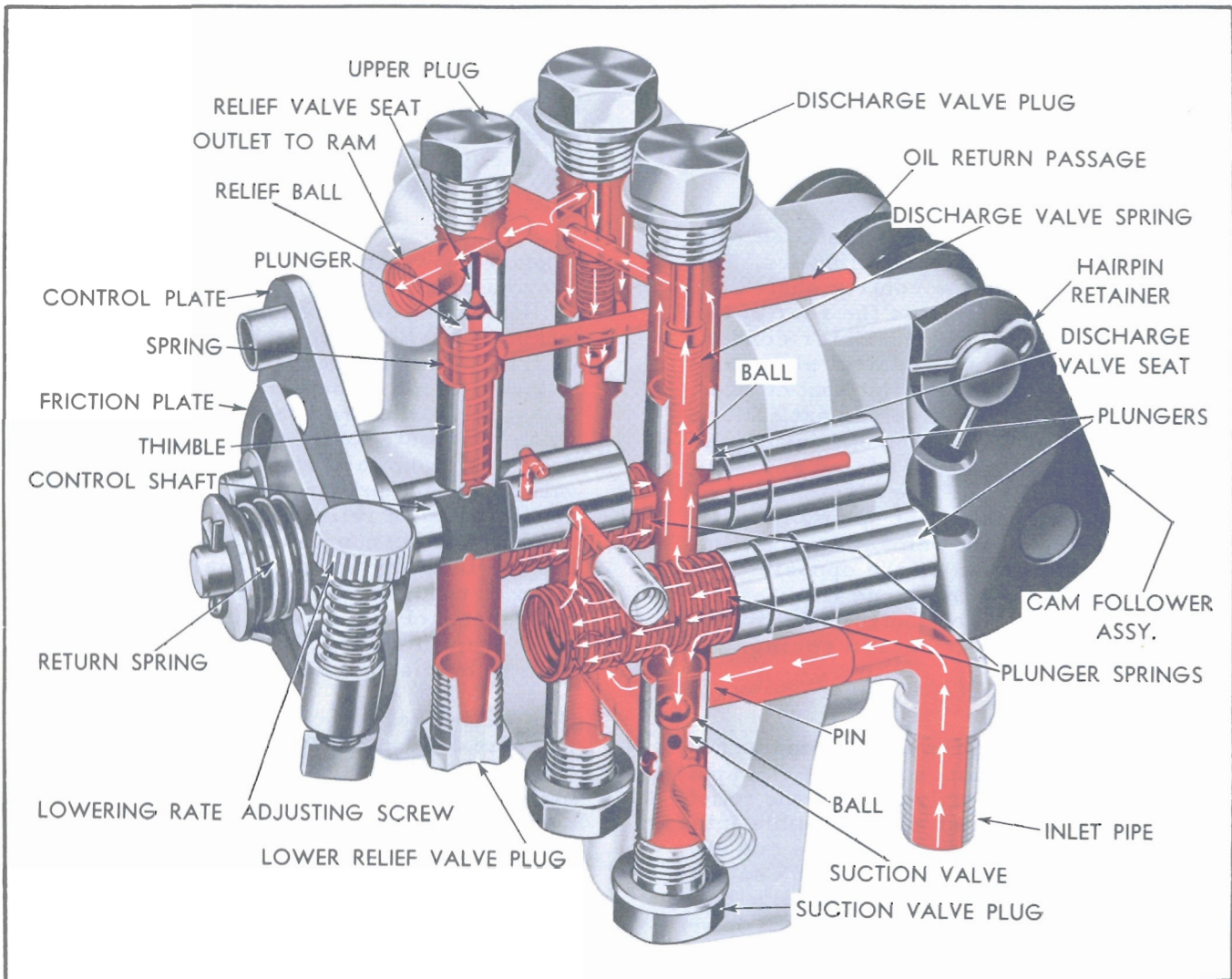
### Lowering Rate

The lowering rate is controlled by adjusting the screw in the control friction plate against the stop on the control plate.

### Hydraulic Pump Installation

Remove the protecting cap from the suction inlet pipe of pump. Clean the contact surface of pump body and P.T.O. housing. Use a sealer compound on gasket. Use the copper washer on the long capscrew and install at lower front of pump

## HYDRAULIC PUMP IN ACTION



**Lubrication** - The oil supply in the transmission case is used for the operation of this unit, therefore, maintain this oil level to transmission filler plug level with S.A.E.

20 W motor oil.

**Important:** Oil must be kept clean to avoid dirt from entering check valves in hydraulic unit.

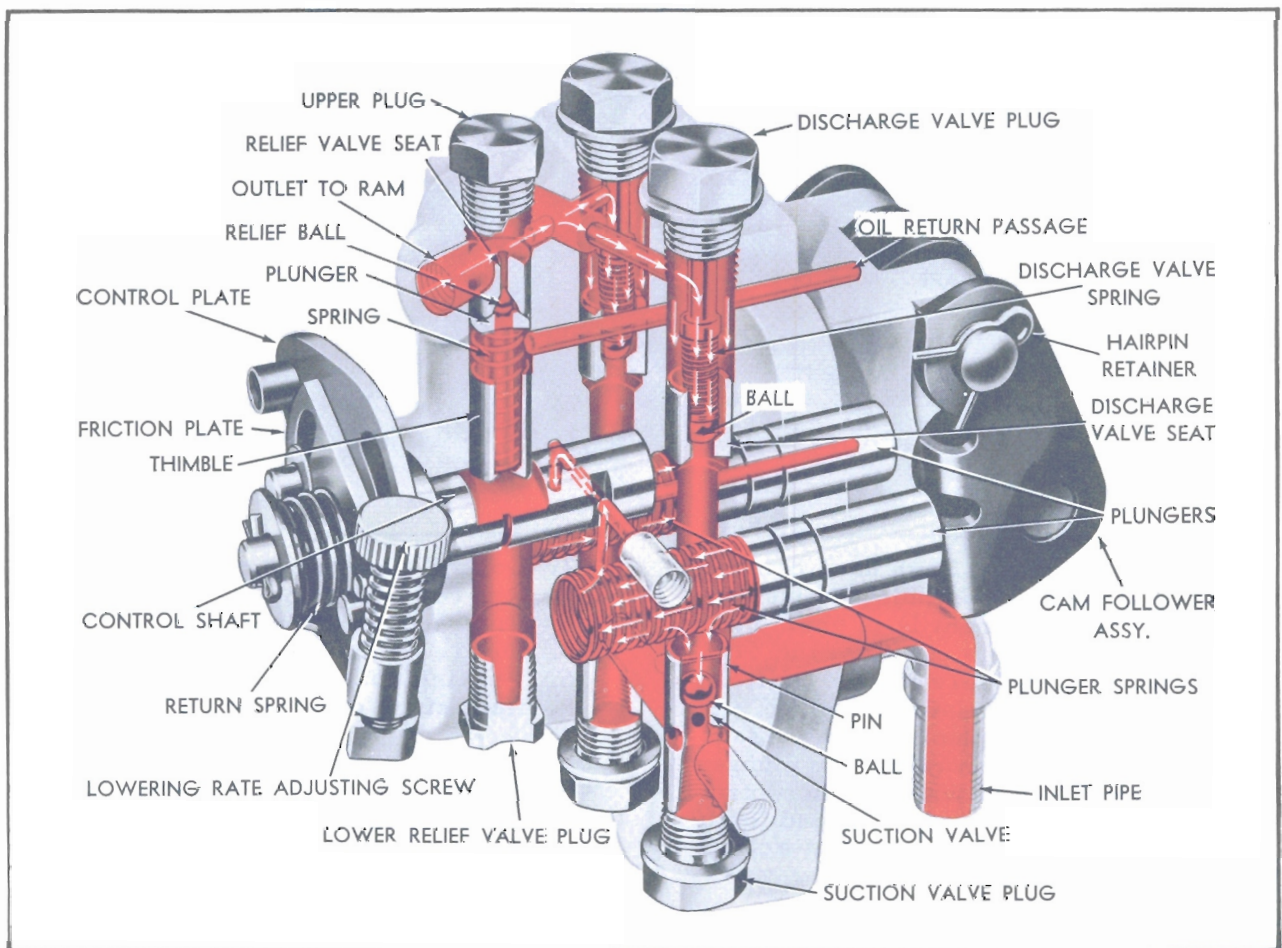
Operation - To operate unit, start tractor engine and engage power take off in the usual manner. There are three positions for the hydraulic lift control lever.

The Raising Position - Lift the control lever up as far as possible and hold it in this position until the implement is raised to the desired height. In this position the hole in the control shaft which connects the chamber is not in line with plunger chambers. The plunger coming forward forces the oil which was previously trapped in the plunger chamber past the discharge valve. The intake valve seats keep oil from flowing back to transmission. The adjacent plunger being forced back by plunger spring draws oil into the chamber through the intake valve. The suction of plunger allows discharge ball spring to seat and hold oil above ball in ram. The alternating action of the plunger in this manner keeps a steady flow of oil under pressure to the ram. If the pressure on the ram exceeds maximum pressure the relief valve spring will

release ball so oil will flow through oil return passage.

If the lift fails to operate in this position:

1. Tractor PTO not engaged
2. Oil level in transmission low
3. Viscosity of oil too heavy
4. Implement improperly assembled
5. Air in hydraulic system
6. Intake valve leaking
7. Discharge valve leaking
8. Broken plunger spring
9. Broken cam arm assembly
10. Relief valve leaking
11. Relief valve not in proper position
12. Control handle bent, not allowing control shaft to turn to lift position
13. Dirt in hydraulic system
14. Restriction in suction pipe
15. Restriction in intake valve plug
16. Ram plunger scored and stuck
17. Packing nut on ram too tight
18. Ram leaking
19. Hose or hose connection leaking



Hold Position. - Release hand control lever from lift position and it will automatically spring back to the hold position. In this

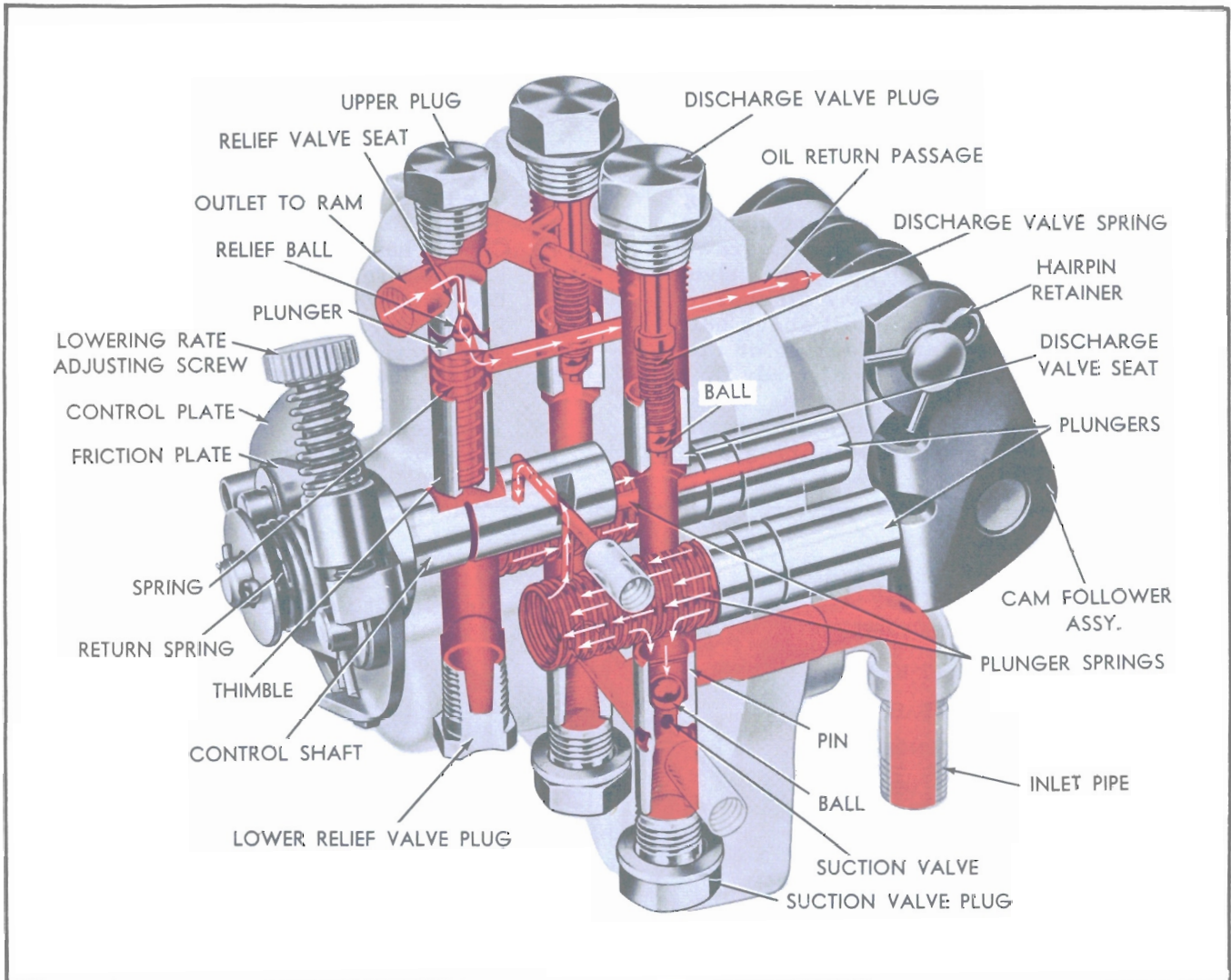
position the shaft is turned so the relief ball is held on its seat but the hole in the control shaft lines up the two plunger



chambers, and the oil is pumped back and forth between the two chambers. The pressure on the ram seats the discharge balls and hold the implement in this position. If lift fails to operate in this position:

1. Relief valve leaking

2. Relief valve not in proper position
3. Discharge valve leaking
4. Control shaft assembled off 180°
5. Ram leaking
6. Hose or hose connections leaking



**To Lower Implement -** Push hand control lever down as far as possible and leave it down while the implement is in use. With the control shaft in this position the implement can float freely as the shaft is turned as shown, the relief valve opens and allows oil to pass through oil return passage relieving all pressure on ram. The plunger chambers being lined up with hole in control shaft the plungers pump oil back and forth between chambers as alternating action takes place.

If the lift fails to operate in this position

1. Implement improperly assembled

2. Control shaft assembled off 180°
3. Relief valve not in proper position
4. Viscosity of oil too heavy
5. Relief valve thimble stuck
6. Packing nut on ram too tight
7. Ram stuck or scored

**Lowering Rate -** The lowering rate is controlled by the adjusting screw. Turning this in prevents the control shaft from being turned to the full lowering position, limiting the amount of oil allowed to flow past relief valve.

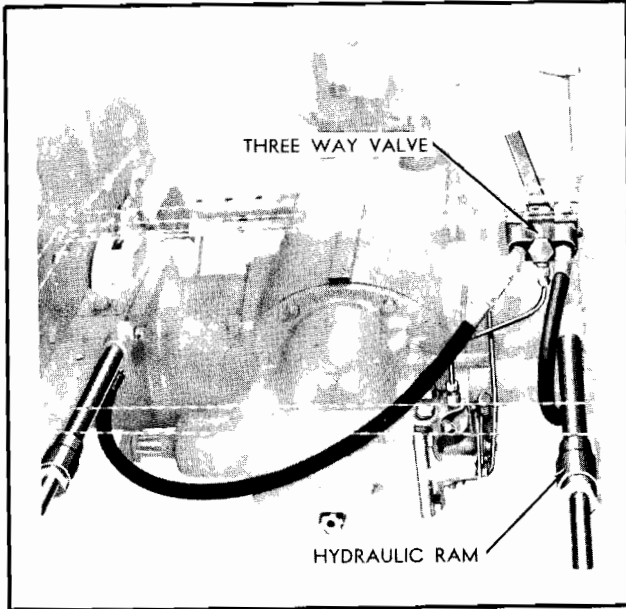


## HYDRAULIC PUMP CONTROL LEVERS

The control lever is mounted at right hand end of front seat frame angle. Adjust the retaining clips until they form a good bearing and tighten the bolts. Install the cotter pins

through control lever on the outside of bearing clips to keep the lever located properly. Attach the link rod between lever and control plate on pump.

## THREE WAY VALVE



### Removal

Remove the control lever and disconnect the ram hose swivel connectors. Disconnect the line between the three way valve and pump.

### Inspection

If the valve leaks, replace the packing. If the opposite implement in the raised position settles to the ground replace the body or shaft or both.

### Assembly

The three way valve is mounted on the front seat frame angle. Start the oil line in both pump and body of valve but do not tighten. Place control lever clips between three way valve and seat angle with control lever in position. Enter capscrews and tighten.

## HYDRAULIC RAMS

### Removal

Disconnect the swivel connector between ram hose and pump or three way valve. Remove cotter pin from the ram anchor pin and slide ram from pin.

### Inspection

Check the plunger and plunger guide for scoring and wear. Scoring on plunger will make it difficult to hold packing tight. Check the brass plunger guide for wear. Replace if necessary.

### Installation

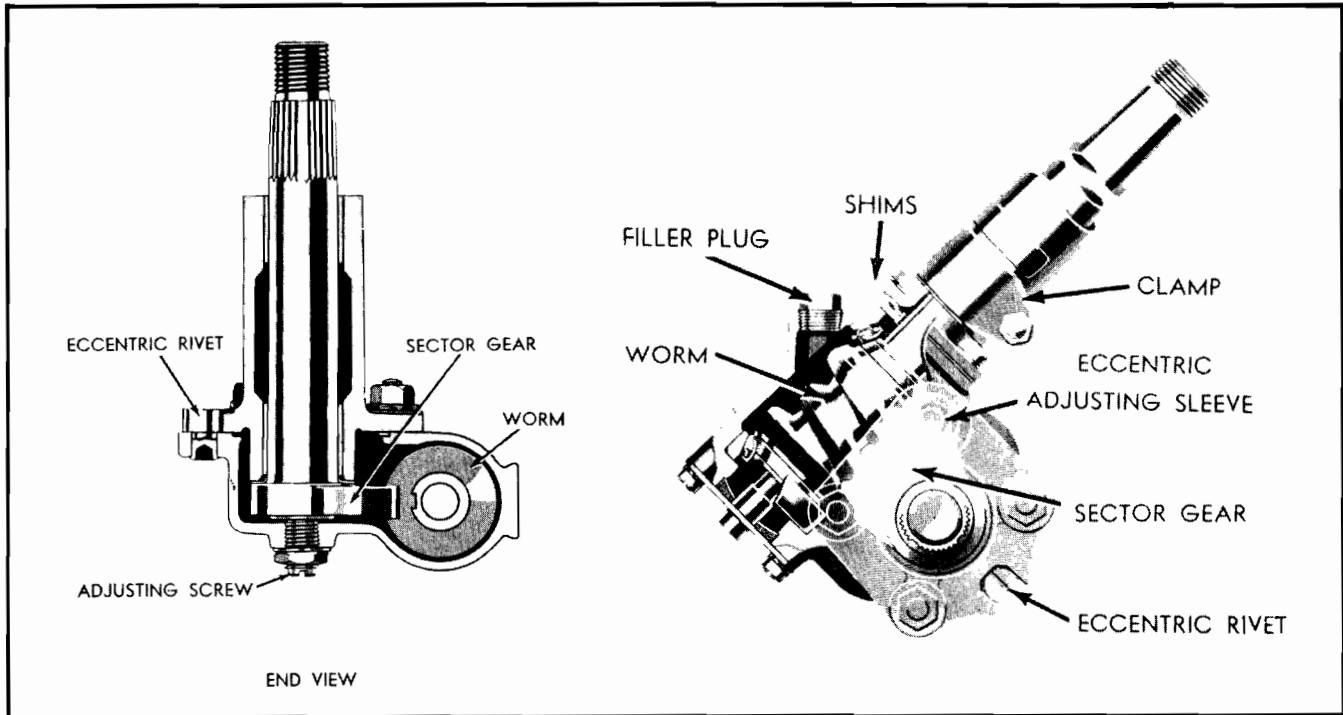
Install the chevron type packing on the ram

plunger with the open end of "V" towards the oil supply. Tighten the packing nut only enough to prevent leakage.

Install ram hose on pump and fill hose with oil. Connect ram to hose with plunger clear in, keeping the hose full of oil. Connect the ram to the anchor bracket. Start engine and engage P.T.O., operate pump until the ram is fully extended. Loosen the packing nut until oil is forced past the packing. This operation will bleed all air from pump, hose and ram. Install ram on tractor with the hose inlet towards the ground.

Installation of left hand ram. Follow the same procedure as for the right hand ram. Install the 45° street elbow between hose and three way valve.

## GEMMER STEERING GEAR



Turn the hand wheel through its full range of travel. If tight spots are encountered readjust as above.

The worm is graduated in such manner that close mesh of the sector teeth is provided at the mid position or the straight ahead position and giving increased backlash clearance as the gear is turned to either right or left. Since normal wear is most pronounced at mid position this allows for subsequent adjustment without fear of binding.

When the sector teeth are properly meshed in relation to worm there should be an equal amount of backlash clearance at  $1/3$  turn of the wheel to right and left from the mid position.

By use of the eccentric rivet the backlash of gear can be set so that clearance is equal to the right or left of mid position. Starting with the gear in mid position turn wheel  $1/3$  turn to left and try backlash. Next turn wheel  $2/3$  turn to the right or in reality  $1/3$  turn to right of mid position and check backlash. If there is more clearance at the left, turn eccentric rivet in a clockwise direction. After making this adjustment, recheck the worm to sector adjustment at mid position. Tighten all nuts securely (35 ft. lbs.)

The worm of the Model "C" steering gear is cut right hand and cannot be used to replace worms used for the model "B".

The ball arm must be attached to gear with the steering gear in mid position and the front wheels in the straight ahead position in order for tractor to steer equally short to right or left.

Used on Model "C"

### Removal

Remove the steering wheel, battery and box, hood, fuel tank, upper tube support and the tool box. Remove the drag link and the torque tube brace. Remove the two nuts attaching the steering gear to the torque tube.

Loosen the jacket tube clamp and pull tube from gear. Remove the drag link arm and separate the housing and housing cover. Slide the sector shaft from cover. Remove the capscrews from worm shaft bearing retainer and pull worm assembly from housing.

### Inspection

Check the bearings for wear, cracks and chipping. Check worm and sector teeth for wear and scoring. The sector shaft bushings should be replaced if wear exceeds .007".

### Adjustment

Assemble gear. Adjust the worm shaft

bearings by using the proper number of shims between the bearing retainer and housing. Adjust bearings to a free rolling fit without end play or binding. The shims may be removed by loosening jacket tube clamp and moving tube up.

Adjust sector shaft end play by turning adjusting screw in tightly and then backing out 1/3 turn and locking jam nut.

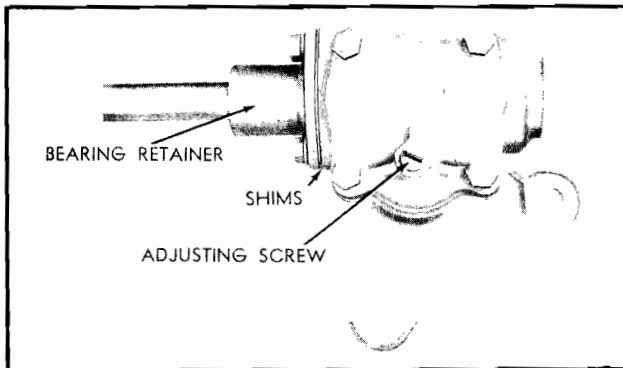
The mesh of the segment and worm is controlled by the eccentric adjusting sleeve and the eccentric rivet.

Turn hand wheel to its mid position of

complete travel or turning radius. Shake the ball arm to determine amount of lost motion. Loosen housing cover nuts about 1/2 turn. Turn the eccentric adjusting sleeve clockwise gradually, testing at each movement the amount of lost motion remaining in ball arm.

Adjust to the point where backlash can just be felt at end of ball arm. It is very important that the adjustment of the eccentric sleeve be finished in a clockwise direction. If the adjustment is too tight turn the eccentric rivet counter-clockwise and readjust as above, carefully.

### ROSS STEERING GEAR MODEL "B" & "C"



Removal - Same as Model "C"  
Inspection - Same as Model "C"

#### Assembly and Adjustment

The worm shaft bearings may be adjusted by loosening the jacket tube clamp and

moving the tube up as far as possible. Remove capscrews from worm shaft bearing retainer and remove enough shims to secure a free rolling fit of bearings without end play or binding.

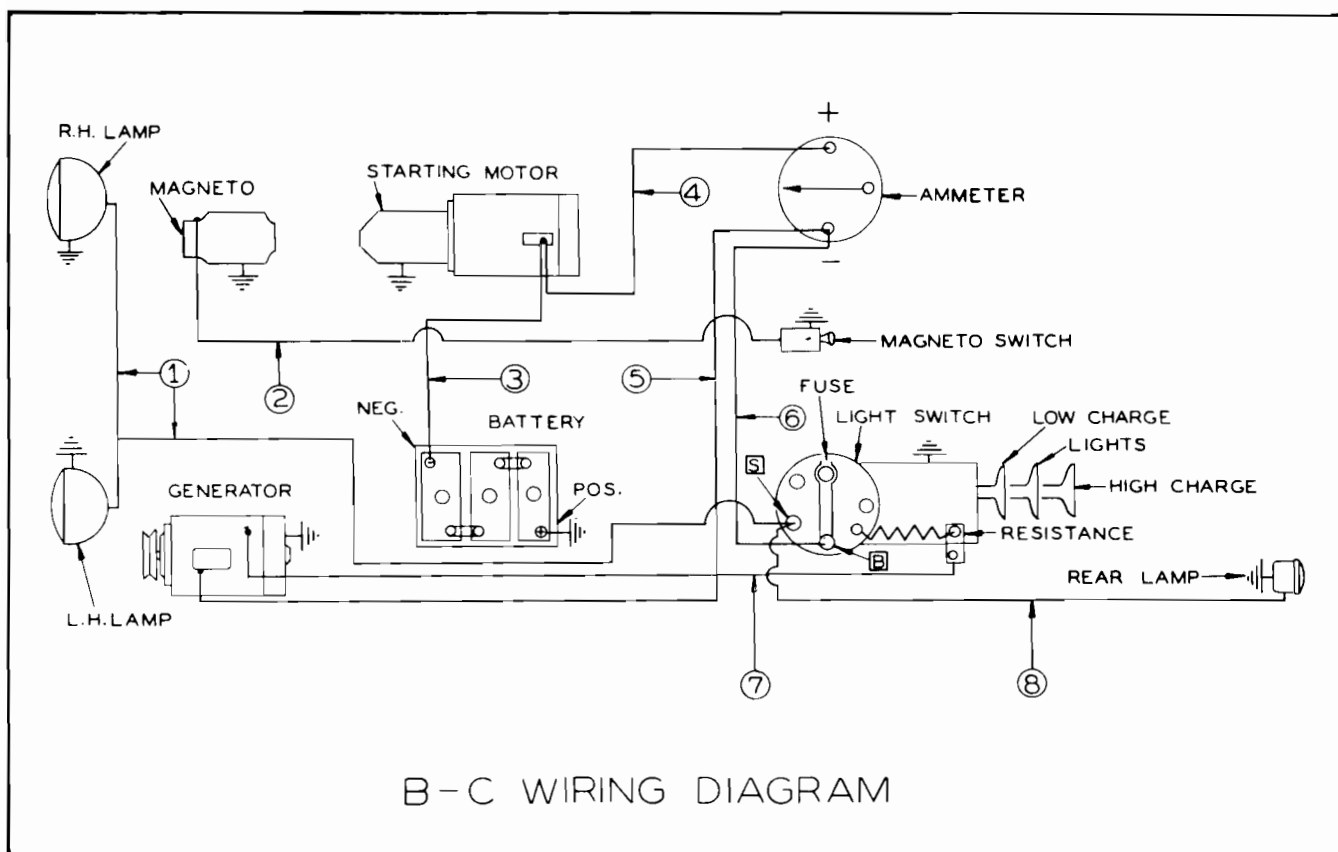
Adjust jacket tube as high as possible without having it rub or bind on wheel. This prevents entry of dirt or water into tube.

The mesh of worm and lever is secured by controlling end play of lever shaft assembly. Adjust screw until the least amount of backlash is obtained without binding.

Install ball arm on gear with wheels in straight ahead position and the steering gear in mid position.

The model "C" and "B" worm shaft assemblies are not interchangeable. The model "B" worm is cut left hand and the model C worm is cut right hand.

## WIRING DIAGRAM



B - C WIRING DIAGRAM

By following diagram, the wires may be successfully installed. Wire number (1) is the light wire, has a green circuit tracer, and attaches to terminal marked "S" on light switch and to junction between the two headlight wires which are plain black. Wire number (2) is the magneto ground wire with black and red circuit tracer connected to magneto ground post and magneto ground switch. Wire number (3) is the battery cable connecting negative post of battery to starting motor switch. Wire number (4) has black circuit tracer and connects to starting motor switch terminal and positive or charge side of ammeter. Wire number (5) has red circuit tracer and disconnects generator cutout to "minus" or "discharge" side of ammeter. Wire number (6) also has red circuit tracer. This wire may be distinguished from generator wire because it is very short and is not enclosed in loom. It connects from "minus" or "discharge" side of ammeter to light switch terminal marked "B". This terminal is in fuse holding bar. Wire number (7) has black and white circuit tracer and connects field terminal on generator case to light switch resistance unit. This resistance unit controls the

charging rate of generator by controlling the amount of current flowing through field coils of generator. The full flow of current is allowed to pass through field coils when light switch is in "lights on" and "high charge" positions. When in "low charge" position, current must pass through resistance unit which limits amount of current which can flow through field coils in generator. Wire number (8) is plain black, not enclosed in loom. It attaches to terminal marked "S" on light switch and to tail lamp. Note: In making installation all wires and connections must be clean, bright and securely tightened.

Complete the system excepting battery ground strap. When ground strap is connected, have switch in "off" position and if spark is noted at battery post when connection is made, it indicates a short circuit at some point.

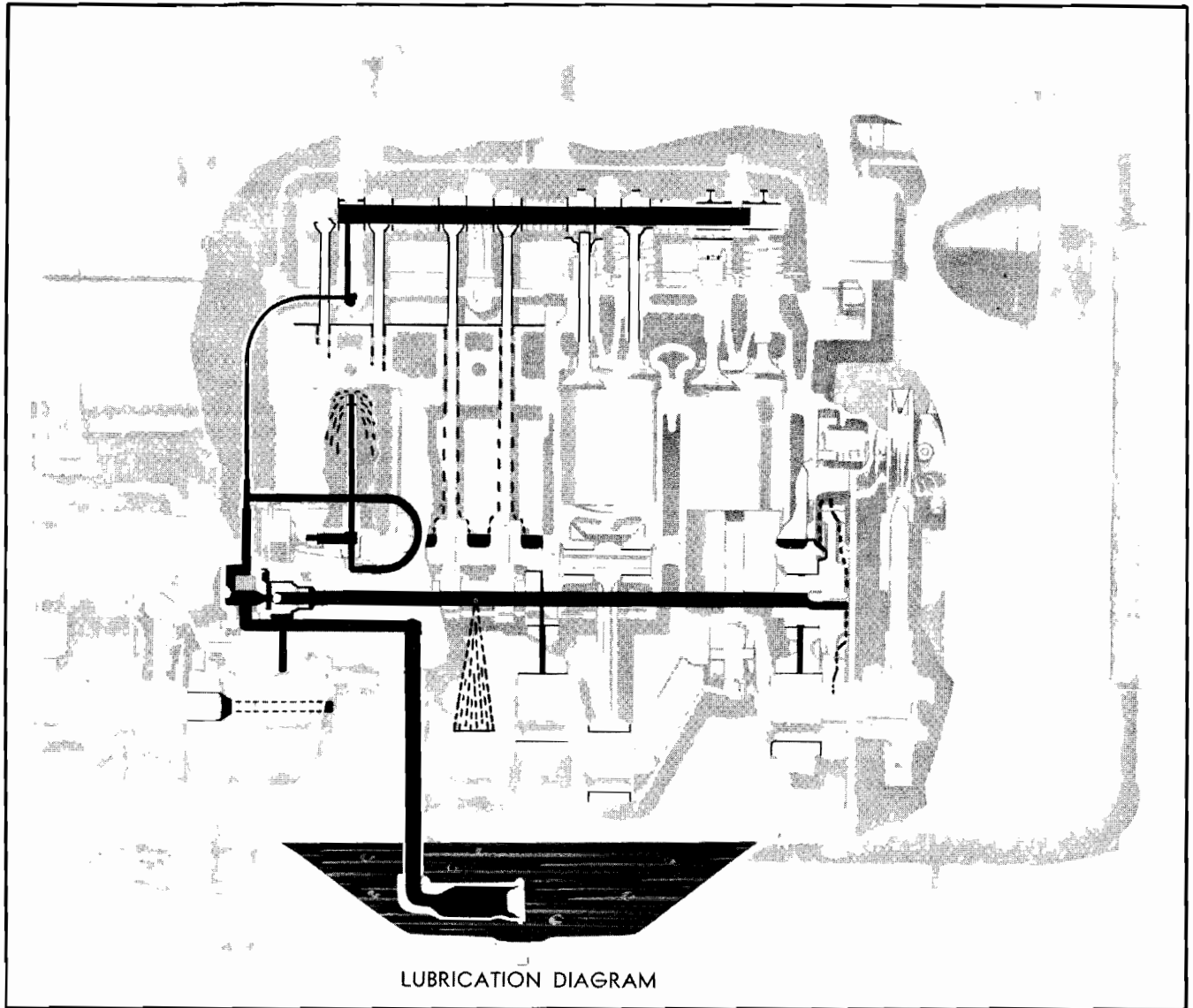
After battery is connected, with positive post grounded, turn lights on; if ammeter shows charge, reverse the leads on ammeter. Next, start engine and note ammeter; if ammeter should show discharge it indicates polarity of generator is reversed. To overcome this, remove cover from cutout and close points momentarily. (Engine must be stopped to do this). If cutout points vibrate

or open and close rapidly it indicates battery is installed with negative post grounded. Reverse battery to correct. Next, try with lights on. Charging rate should remain practically the same as at low charge.

Next, place switch in "high charge" position.

Charging rate should increase to 10 or 12 amperes. If it does not, check resistance unit by grounding field terminal directly to generator frame. If this does not increase charging rate, check third brush setting of generator and adjust until desired charging rate is secured.

### THE ENGINE OILING SYSTEM MODEL "B-C"



The supply of oil for the engine is carried in the oil sump. This supply must be maintained at the correct level. If the supply is too low the temperature of the remaining oil will increase because it is pumped through system more often and may cause damage to engine. If the level is too high the connecting rods may dip and create an over-

oiled condition of pistons and rings causing excessive oil consumption.

The oil is drawn from the oil sump through the oil inlet screen and intake pipe to the oil pump.

In the pump the oil is forced from the ends

of rotor blades through a passage in pump body and cover to the center of rotor, which is hollow. At the forward end of rotor two holes drilled clear through the rotor. As the rotor turns these holes line up with two holes in the pump body. Each time these holes match, oil is discharged into the camshaft.

The forward end of the rotor is equipped with a spring loaded bypass valve. This valve will not open until a pressure of 15 lbs. is reached. When it is open the extra oil passing the valve is discharged into the camshaft and augments the supply through the metering holes. Under normal operation the bypass valve is nearly always open as the pump is capable of creating more than 15 lbs. pressure.

Another separate line from the pump leads to the oil filter, governor and cylinder head. The oil passing through this line is determined by the resistance of the lines, filter and rocker arms. As long as the resistance is below 15 lbs., oil will flow. Normally about 1/6 of the oil handled by the pump passes through the filter. However, if the filter is allowed to become dirty and clogged it is possible no oil will pass through the filter until a new element is installed.

The clean oil passing through the filter returns to the oil sump through the base of filter. The oil gauge is attached to the filter base and is actuated by the oil entering filter and lines to head and governor.

The oil line to the governor housing supplies oil to the governor linkage, governor weights and timing gears.

The oil line to the cylinder head enters the side of the head and through a drilled passage reaches the rear rocker arm shaft support stud, which has a groove in its side allowing oil to enter the hollow rocker arm shaft. The rocker arm shaft ends are plugged with cork so that pressure can be maintained in the shaft.

The oil is distributed the full length of shaft and is allowed to enter the four rocker arm supports. Each support has a rocker arm on either side. The rocker arm and support are ground squarely so their mating sides are in perfect contact. The oil from the support passes to the rocker arm bushing with a

small amount of leakage. The oil is led to the top of the rocker arm through a drilled hole in arm and bushing. This oil flows to either end of the rocker arm lubricating the ball ends of push rod and adjusting screws and the valve stems and guides. The intake rocker arm has a shed ground on its top side between the shaft and valve. The width of the shed determines the amount of oil fed to the intake valves. It is through this metering device that proper lubrication of the valves is assured. The excess oil delivered to rocker arms returns to sump by passing down the push rods, lubricating the valve lifters or cam followers. Excess oil from this compartment flows to front of engine and is discharged on the camshaft gear.

Oil in the camshaft is maintained by a fluted end thrust plunger. Oil passing the plunger enters the timing gear compartment. The camshaft being hollow its entire length is used to distribute oil to the three main bearings.

The oil passes through holes drilled into shaft to a groove in the shaft bearing. This oil lubricates the camshaft bearings. The groove around the camshaft journal allows constant pressure on the main bearings through holes drilled in the cylinder block between the camshaft and main bearing.

The camshaft has four holes drilled in it directly in line with one each of the connecting rods. The connecting rod has a hole which is funnel-shaped drilled in the upper part of bearing. Oil is sprayed through the centrifugal force of the rotating camshaft and the pressure maintained in shaft into the crankcase. This stream of oil is met by the connecting rod and the impact forces oil into the rod oil holes and into the groove of bearing insert.

The excess oil and splash in crankcase lubricates the cylinder walls, pistons, rings and piston pins.

Oil is supplied to the wick which leads through the rear main bearing journal to the clutch shaft pilot bearing. The amount of oil this wick supplies to bearing is determined by the tightness and amount of wick extending into the crankcase. The looser or more wick extending into crankcase the more oil will be supplied to bearing.

"CA" TRACTOR

CA

MODEL CA SPECIFICATIONS INDEX

<u>SUBJECT</u>	CA	SPECIFICATIONS	GENERAL
	SECTION		SECTION
	<u>Page</u>	<u>Page</u>	<u>Page</u>
AIR CLEANER	31	4	31
AMMETER & LIGHT SWITCH	33		
BATTERY	32	6	40
BELT PULLEY & P.T.O.	45	5	
BRAKES	34	6	
CAMSHAFT BUSHINGS	19	4	
CAMSHAFT	18	4	
CARBURETOR	28	4	22
CLUTCH, ENGINE	30	6	
CLUTCH, HAND	36	6	
CLUTCH SHAFT & TORQUE TUBE	37		
CONNECTING RODS & PISTONS	19	4	21
CRANKSHAFT & MAIN BEARINGS	20	4	21
CRANKSHAFT OIL SEALS	21		
CYLINDER HEAD & VALVES	23	5	
CYLINDER LINER	22	5	
DIAGRAM WIRING	54		
DIFFERENTIAL	38	5	
DISTRIBUTOR ASSEMBLY		5	16A
DISTRIBUTOR DRIVE	53		
DRAWBAR	48		
ENGINE	17	4	
ENGINE DIAGNOSIS			32
FAN BELT	14	4	
FAN & WATER PUMP	15	4	
FILTER OIL	16	4	
FILTER FUEL	34	4	
FLYWHEEL & STARTER RING GEAR	30		
FINAL DRIVE	35		
FRONT SUPPORT (Dual Front Wheels)	8		
FRONT SUPPORT (Single Wheel & Adjustable Axle)	13		
FRONT WHEEL (Dual Front & Adjustable Axle)	10	6	
FRONT WHEEL SINGLE	11		
FRONT & REAR CRANKSHAFT OIL SEALS	21		
FUELS			6
FUEL TANK & FILTER	34	4	
GAUGE OIL	16		
GENERATOR	32	6	
GOVERNOR	25	4	
HOOD	7		
HYDRAULIC RAM & LIFT SHAFT	51		
HYDRAULIC SYSTEM	50		
IGNITION DISTRIBUTOR TIMING		5	16B
INTAKE & EXHAUST MANIFOLD	27	5	
LIGHT SWITCH & AMMETER	33		
LIGHTS		6	
LINERS CYLINDER	22	5	
MAGNETO		4	
MANIFOLD	27	5	
OIL FILTER	16		
OIL GAGE	16		
OIL PUMP	17	5	
PEDESTAL (Dual Front Wheels)	9		
PISTON	19	5	
PISTON RINGS	19	5	



MODEL CA SPECIFICATIONS INDEX (Cont'd.)

	CA SECTION	SPECIFICATIONS	GENERAL SECTION
<u>SUBJECT</u>	<u>Page</u>	<u>Page</u>	<u>Page</u>
PLATFORM	44		
P.T.O. & BELT PULLEY	45	5	
PUMP OIL	17	5	
PUSH RODS & ROCKER ARMS	24		
RADIATOR	7	4	
RADIATOR SHUTTER	8		
REAR CRANKSHAFT OIL SEAL	21		
REAR WHEELS	42		
RING GEAR & STARTER	30		
ROCKER ARMS & PUSH RODS	24		
STEERING GEAR	46		
SEAT	43		
SHIFTER ASSEMBLY	41		
SHUTTER RADIATORS	8		
SINGLE FRONT WHEEL	11		
STARTER	33	6	
STARTER RING GEAR	30		
SPARK PLUGS	29	5	17
SPECIFICATIONS	4	4	
SUPPORT-FRONT (Dual Front Wheels)	8		
SUPPORT FRONT (Single Wheel & Adjustable Axle)	13		
THERMOSTAT & HOUSING	16		
TIRES		6	42
TORQUE TUBE & CLUTCH SHAFT	37		
TRANSMISSION	39		
VALVES	23	5	
VALVES & CYLINDER HEAD	23		
VALVE TAPPETS	18	5	
WHEEL GUARD	44		
WIRING DIAGRAM	54		

## MODEL CA SPECIFICATIONS

### ENGINE

Number of Cylinders	4
Bore	3-3/8"
Stroke	3-1/2"
Displacement	125 Cu. In.
Gasoline Engine	
Compression Ratio	5.75 to 1
Compression Pressure	115 lbs.
Low Octane Fuel Engine	
Compression Ratio	4.75 to 1
Compression Pressure	99 lbs.
R.P.M. Full Load	1650
R.P.M. High Idle	1950 to 2075
R.P.M. Low Idle	400 to 500
Firing Order	1-2-4-3

### AIR CLEANER

Type	Oil Bath
Oil Capacity	1/2 Pt. U.S.

### CAMSHAFT

Drive	Gear
Valve Timing	Marked Gear
Journal Dia.	1.749"-1.750"
Bearing Dia.	1.752"-1.753"
Bearing Clearance	.002"-.004"

### CONNECTING ROD

Type	Offset
Bearing Length	1.219"-1.229"
Journal Length	1.436"-1.439"
Bearing Dia.	1.938"
Journal Dia.	1.9365"-1.9375"
Bearing Clearance	.001"-.002"
Rod Width	1.432"
Adjustment	Shims
Bearing Insert	Removable
Nut Tension	35 ft. lbs.

### CRANKSHAFT

Bearing Length	
Front Lower	1-623"-1.625"
Front Upper, Center and Rear	1.005"
Journal Length	
Front	1.626"-1.628"
Center and Rear	1.750"
Bearing Dia.	2.251"
Journal Dia.	2.249"-2.253"
Clearance	.001"-.002"
End Thrust Clearance	.001"-.005"

### COOLING SYSTEM

Capacity	9 qt. U.S.
Cooling	Pump and Fan
Fan Drive	V Belt
Belt Adjustment	By Generator or Adjustable Sheave
Pump	Vane Type
Pump Lubrication	Packed and Sealed
Pump Bearing	Double Ball
Water Seal Adjustment	Automatic
Fan	4 blade - 14-1/2" dia.

### FUEL SYSTEM

Fuel Tank	13 U.S. Gallon
Filter	Felt Strainer and Bowl

### CARBURETOR

Zenith	161 J7
Size	7/8"
Type	Updraft
Adjustment	Main Jet Fixed
Adjustment	Idle Jet-In for Richer
Well Vent	Size 13
Venturi	Size 16
Main Jet	Size 21
Main Discharge Nozzle	Size 45
Idling Jet	Size 12
Float Level	7/16" From top of bowl To top of fuel or 1-5/32" from top of bowl to bottom of float.
Marvel-Shebler	TS x 486
Adjustment	Main Jet Fixed
Adjustment	Idle Jet-In for Richer
Main Jet	Fixed
Idle Jet	in for richer
Well Vent	12- # 65 Drill
Venturi	5/8" dia.
Main Jet	150 c.c. Flow
Main Discharge	
Nozzle	#39 dia. Drill (.0995")
Idler Jet	101 CC. Flow (.071")
Economizer Jet	.0775" dia drill
Float Valve Seat	.070" Dia Drill
Float level	7/16" from top of bowl to top of fuel, or 9/32" from top of bowl to nearest edge of float.

### GOVERNOR

Type	Variable Speed
Speed	Controlled by operator

MODEL CA SPECIFICATIONS (Cont'd.)

LINERS CYLINDER

Size 3.375"

LUBRICATION

Capacity 4 U.S. Qt.  
 Pressure By Pump  
 Filter Own  
 Filter Element Removable

MAGNETO

Fairbanks Morse F.M.J.  
 Type High Tension  
 Rotation Clockwise  
 Impulse 30° Automatic  
 Point Gap .020"  
 Lubrication Packed and Sealed

DISTRIBUTOR

Make Delco-Remy  
 Type Automotive  
 Rotor Rotation Clockwise  
 Spark Advance 30° Automatic  
 Point Gap .018" to .022"

SPARK PLUGS

Size 14 MM.  
 Point Gap .028" to .032"  
 Heat Range AC45  
 Gasoline Autolite A-7  
 Champion J-8  
 Autolite A-9  
 Low Octane Fuel AC47  
 Champion J-11  
 Autolite A-11

MANIFOLD

Two distinct kinds - one for gasoline and one for low octane fuel.

OIL PUMP

Pressure 15 lbs.  
 Pump Vane Type  
 Location Rear End of Camshaft  
 Rotor End Clearance .002"  
 Rotor Side Clearance .002" to .004"

PISTONS

Type Cam Ground  
 Material Aluminum  
 Cam .009"  
 Diameter (Large) 3.373"

PISTON PIN

Type Clamped in rod  
 Pin Diameter .813" to .8133"  
 Piston Pin Bore .814" to .8142"  
 Pin Clearance .0007" to .0012"

PISTON RINGS

End Gap .007" to .017"  
 Ring Width  
 Scraper 1/8"  
 Compression 1/8"  
 Oil Control 3/16"  
 Land Clearance .0015"

VALVES

Exhaust Dia. 1-5/16"  
 Intake Dia. 1-7/16"  
 Stem Dia. .3407 to .3417"  
 Seat Angle 45°  
 Margin 3/64"  
 Seat Width 1/16"  
 Guide Dia. Inside .344" to .345"  
 Stem Clearance .0023" to .0043"  
 Spring Length 2-5/16"  
 Exhaust Seat Ring Dia. 1.4415"  
 Intake Seat Ring Dia. 1.540"  
 Tapet Clearance (Hot) .012"

VALVE TIMING

Intake Valve  
 Opens 7°30 past top dead center  
 Intake Valve  
 Closes 37°30 past bottom center  
 Exhaust Valve  
 Opens 32°30 Before bottom center  
 Exhaust Valve  
 Closes 7°30 past top dead center

BELT PULLEY

Diameter 8"  
 Face Width 5-1/2"  
 R.P.M. Full Load 1220  
 R.P.M. High Idle 1440 to 1533  
 Belt Speed F.P.M. Full Load 2556  
 Rotation Anti-clockwise  
 Height 27"

P.T.O. SHAFT

Size 1-3/8"  
 Splines 6B  
 R.P.M. Full Load 538 at 1650 of Engine  
 R.P.M. High Idle 636

MODEL CA SPECIFICATIONS (Cont'd.)

BRAKES

Type Enclosed Contracting, foot operated.  
Adjustment Adjusting Screw

BATTERY

6 Volt  
Size 95 Ampere Hour  
15 Plate

CLUTCH

Diameter 8-1/2"  
Facings Full Circle, Molded  
Springs 6  
Free Length 2-5/32"  
Throwout Bearing Ball Thrust, Packed  
Throwout Bearing  
Adjustment 1/4" between release levers  
and bearing.

LIGHTS

Bulbs Single Contact  
Head Light (Capacity) 6 - 8 V. 32 C.P.  
Tail Light 6 - 8 V. 15 C.P.

DIFFERENTIAL

Backlash, ring gear to pinion .004" to .018"  
Lubricant Capacity 8 qt. (U.S.)

GENERATOR

Type Third Brush  
Lubrication Oilers, Front and Rear  
Capacity 3 to 13 Amperes  
Charging Rate Controlled by Light Switch

FRONT AXLE

Wide Axle Toe In. 1/8" Plus or minus 1/16"  
Spindle Dia. 1.247"  
Spindle Bushing Dia. 1.249" to 1.251"

STARTER

Switch Manual Control  
Drive Bendix  
Lubrication Oiler At Rear Bearing

TIRES

Front 5.00 x 15  
Rear 10 x 24  
Air Pressure  
Front 28 Lbs.  
Rear 12 Lbs.

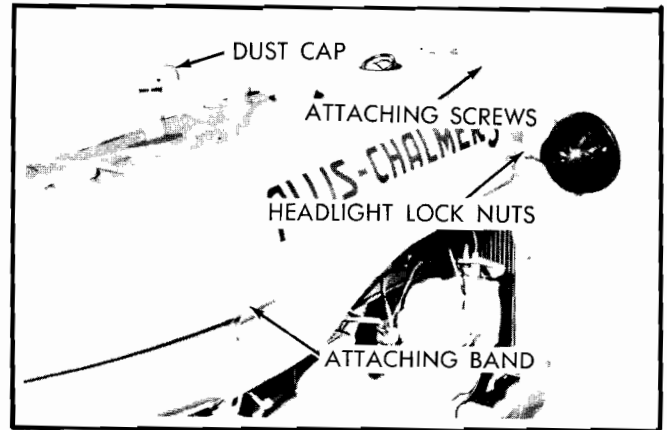
HAND CLUTCH

Type Dry Disc, Self Energized  
Size 5" Dia.  
Springs Free Length 1-1/4"  
Release Bearing Clearance .055"

## HOOD

### REMOVAL

Remove the dust cap from air cleaner intake stack. Remove the band attaching hood and fuel tank to tank support. Remove the screws and bolts attaching hood to radiator shell. Loosen head light lock nuts. On tractors equipped to burn low grade fuel, shut off fuel valves at both tanks, and remove fuel line from auxiliary fuel tank. Lift hood from tractor, raising high enough to clear muffler.



## RADIATOR

### REMOVAL

Drain radiator and engine block and remove hood. Remove the screws at sides and bottom of radiator shell. Remove radiator shutter adjusting crank. Disconnect headlight wires at radiator fan shroud and remove headlights. Remove radiator cap, and lift shell assembly from radiator. Loosen upper and lower radiator hose clamps and hoses. Remove the two nuts attaching radiator to radiator support, and lift radiator from engine.

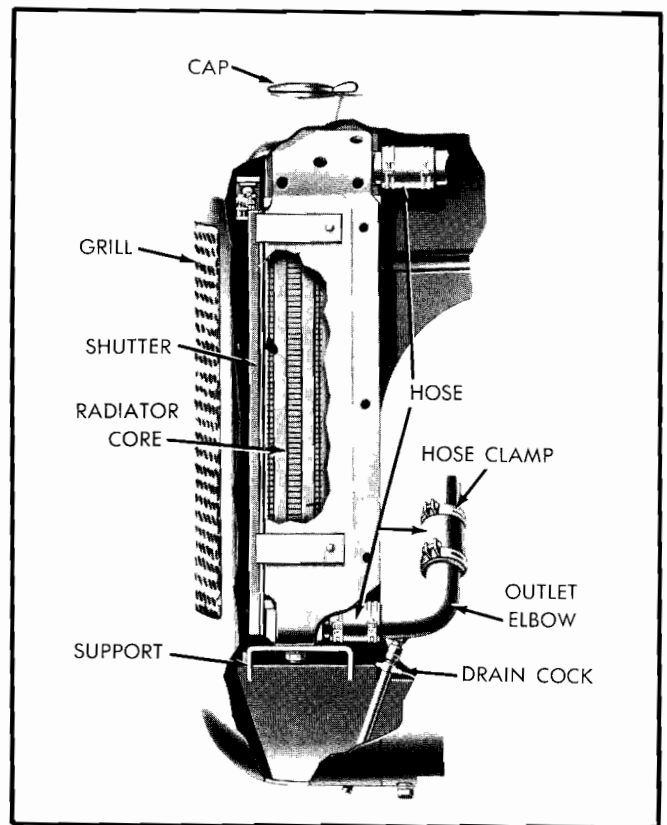
### INSPECTION

Check the radiator for clogging, both inside and outside. Check for bent or damaged fins, broken or cracked shrouds, leaking or damaged tubes and over flow pipe. Check pressure radiator cap gasket and the seal surface in neck of radiator. This surface must be smooth in order to form a good seal.

If radiator loses water rapidly check the baffle plate in upper tank and overflow tube. The baffle plate must not be loose or have holes in it. The pressure radiator operates at approximately 7 lbs. pressure, which increases the boiling point of water to approximately 230°F.

### ASSEMBLY

Reverse the above removal instructions.



## RADIATOR SHUTTER

### REMOVAL

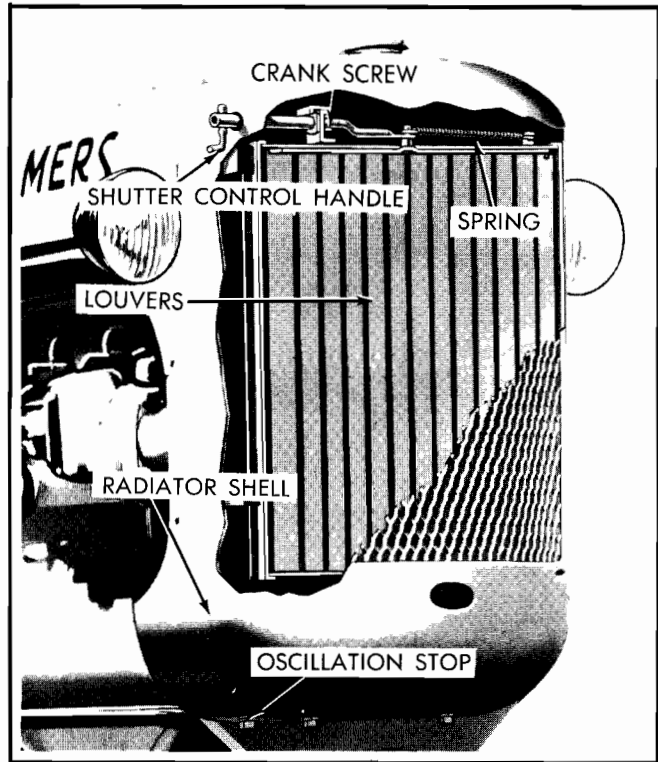
Remove hood and radiator shell as outlined under radiator removal. Remove the four screws attaching shutter to radiator, and remove shutter.

### INSPECTION

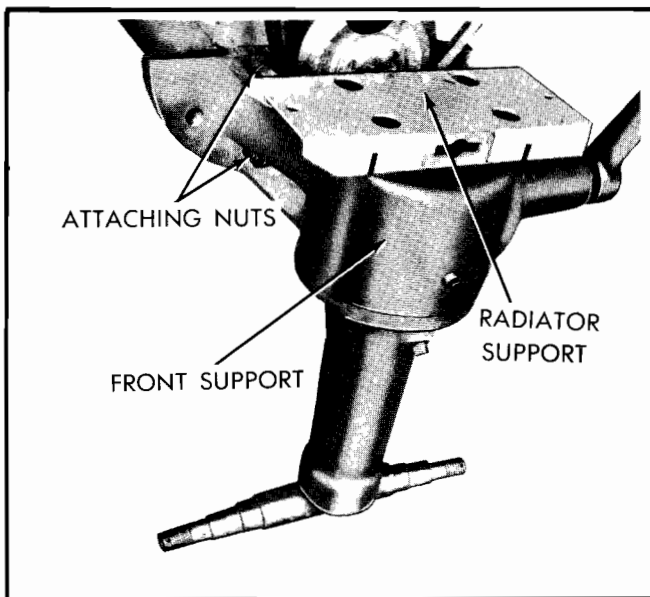
Check the adjusting crank and threaded rod for damaged or rusted threads. Check the return spring and spring anchors. Check the louvers for cracked, worn, or broken pivot pins and holes.

### ASSEMBLY

Reverse the above removal instructions.

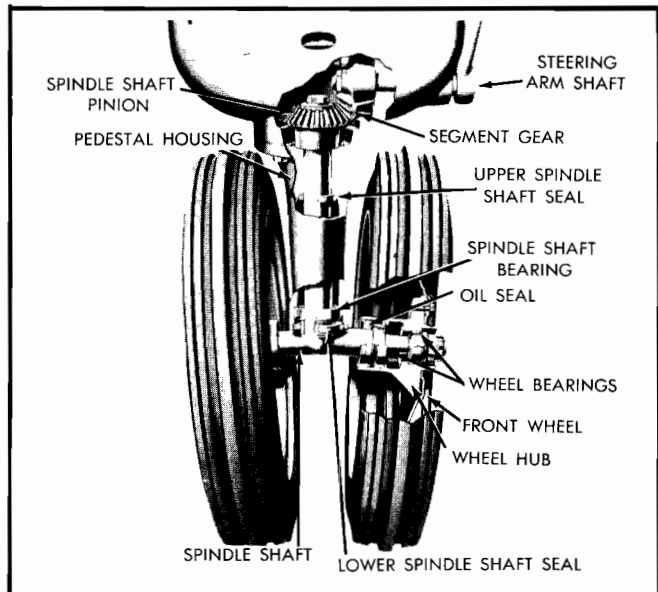


## FRONT SUPPORT (Dual Front Wheels)



### REMOVAL

Support tractor, two adjustable angle iron legs bolted to each side of clutch housing will support tractor suitable for front support or engine removal. Remove hood, radiator and radiator support. Remove front wheels. Remove the four capscrews attaching pedestal assembly to front support and remove pedestal, noting the number of shims and gaskets between pedestal and front support, this will aid in assembling. Remove the drag link from steering arm and shaft assembly. Remove the four nuts attaching



front support to engine block and lift front support from front of engine. Remove the segment gear retaining nut from end of the steering arm shaft assembly, remove gear and pull shaft assembly from front support. The oil seal and bushings may be driven from front support, bushings or shaft must be replaced as necessary if the combined wear exceeds .006". Always replace the oil seal, check segment gear for wear or chipped teeth.

### ASSEMBLY

Reverse the above removal instructions.

## PEDESTAL (Dual Front Wheels)

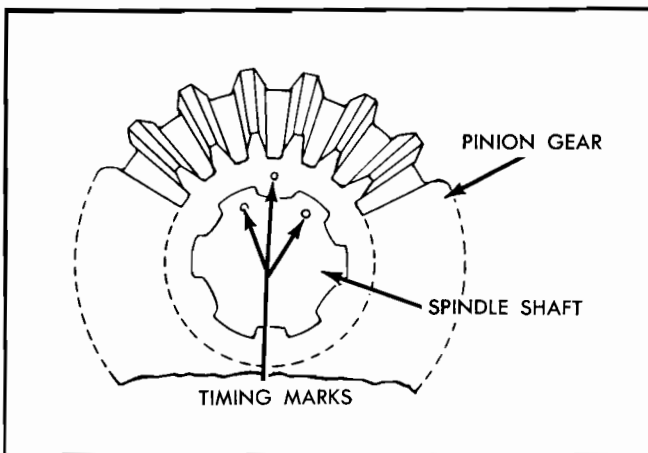
### REMOVAL

Support tractor and remove front wheels. Remove the four capscrews attaching pedestal to front support and remove pedestal from tractor, noting the number of shims and gaskets between pedestal and front support, this will aid in assembly.

Remove the capscrew, washer and shims retaining the pinion gear to spindle shaft, noting the number of shims, this will aid in obtaining bearing adjustment at assembly. Remove the pinion gear from splined shaft, if necessary to use puller, use a center cap between puller screw and end of spindle shaft to eliminate damage to threads. Remove spindle shaft from pedestal, pull bearing and oil seal from shaft, remove upper seal and seal retainer from pedestal, drive or pull bearing cup from pedestal.

### INSPECTION

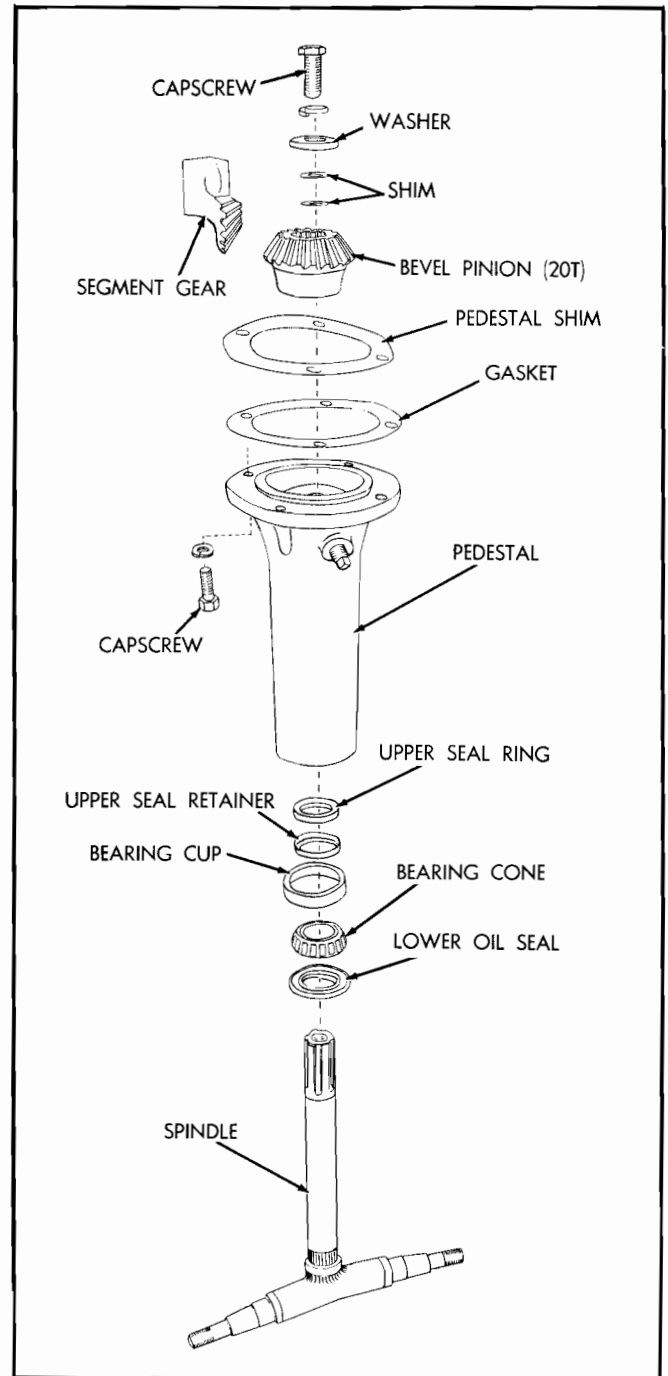
Check pinion gear for worn or damaged teeth. Check pinion gear and spindle shaft splines for wear, if gear is loose on splined shaft, gear or shaft must be replaced as necessary. Check the bearing cup and cone for wear, roughness or chipped rollers. Always replace oil seals.



### ASSEMBLY

The pinion gear for dual front wheel tractors has six splines and when installing gear to splined shaft the splines must be timed. There are timing marks on the pinion gear and spindle shaft and these marks must match as shown, (see sketch) If the marks are not lined up in this manner, the tractor will turn shorter in one direction than the other.

Install lower bearing cup, upper oil seal and retainer into pedestal. Install lower oil seal and bearing cone in place on spindle shaft, seating bearing firmly on shaft. Always replace oil seals. Pack bearing cone with #2 wheel



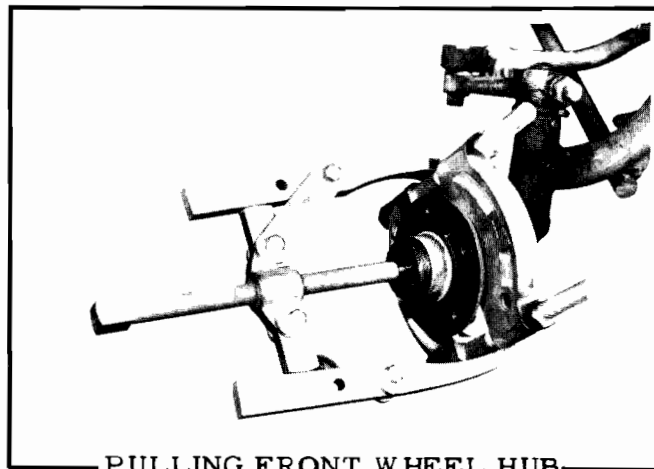
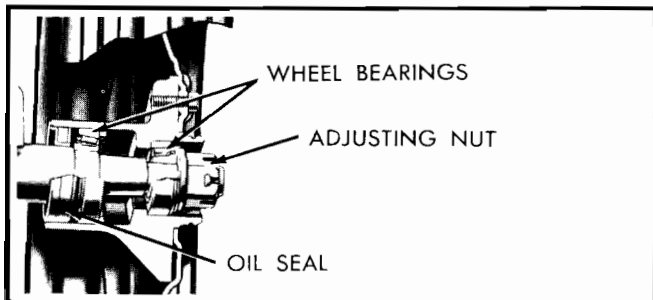
bearing grease before assembling. Enter shaft assembly through pedestal and install pinion gear as outlined, drive gear on shaft to remove all end play. Place an excess amount of shims in position on end of shaft, (approximately the number removed) with the thinner shim on top, press down and slide excess shims from top of pinion gear. Add one extra shim and install retaining washer, lockwasher and capscrew and tighten securely. If bearings are too loose, remove shims, if too tight, add shims. The bearing should have a slight preload fit, without end play or binding. The shims are furnished in .005" and .010" thicknesses.

## INSTALLATION

When installing pedestal to front support have steering gear in the center of straight ahead position. This may be determined by counting the number of revolutions of steering wheel from extreme left, to extreme right and then turning back half the number of turns to mid position. Install the wheels and place pedestal to front support with wheels in a straight ahead position and with caster to the rear. Place a number of paper and steel shims on pedestal

flange, (approximately the same number removed) using paper shims next to cast housings (top and bottom) and alternating with steel shims, this will eliminate grease leakage. The shims are .005" thickness. Mate pinion gear and segment gear together, install and tighten capscrews, at the same time noting backlash of gears by moving steering arms. If the gears mesh too tight add shims, if gears mesh too loose remove shims. The proper adjustment would be correct when gear backlash is as tight as possible and still have clearance.

### FRONT WHEELS (Dual Front and Adjustable Axle)



## REMOVAL

Support tractor with front wheels off the floor. Remove the five capscrews attaching wheel to hub. Remove hub cap, cotter pin and bearing retaining nut. Pull hub from spindle. Use the O.T.C. 952 bearing puller attachment and remove inside bearing and oil seal from spindle. The bearing cups may be driven from hub. Clean both inside and outside of hub thoroughly.

## INSPECTION

Inspect bearing cones and cups for wear and roughness. The oil seal and bearing cone should fit tight on spindle. Always replace oil seals. If bearings or hub are being used again wash clean of all grease and grit.

## ASSEMBLY

Locate oil seal on spindle with inside of seal flush with shoulder on shaft. A special driver is available for installing this seal. Always replace

oil seals. Install inside bearing cone driving it tight against shoulder on spindle. Pack bearings with #2 wheel bearing grease before installing. Place bearing cups in hub and drive in place. Install hub over spindle, placing some grease on outer diameter of seal and in end of wheel hub, this will aid sliding hub over seal and improve the effectiveness of the seal against moisture and dirt.

With bearing packed, place outer bearing in place over spindle. Install spindle washer and adjusting nut. Tighten nut until tight, this will force the cones and cups in place, then back off on adjusting nut one or two castellations, or until bearings have a free rolling fit without binding or end play. Install cotter pin when proper adjustment is obtained. The hub will not spin freely due to a slight drag from the oil seal.



## FRONT WHEEL (Single)

### REMOVAL

Remove capscrews from spindle retainer at each side of wheel fork. Remove retaining nuts at each end of wheel spindles. Use hoist and raise tractor just enough for wheel fork to clear wheel spindle and roll front wheel from tractor.

### DISASSEMBLY

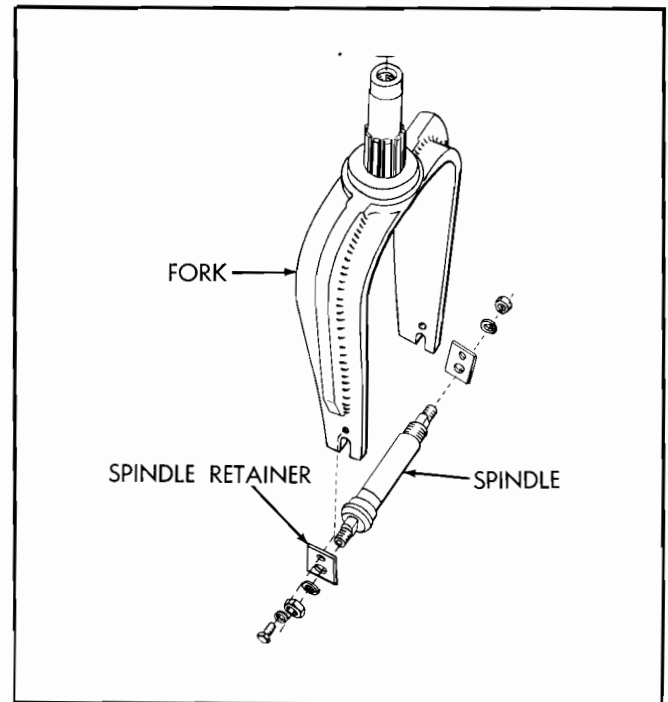
Remove cotter pin and bearing adjusting nut from spindle and push spindle from wheel. Pull or press bearing cone from spindle. Bearing cups may be driven from wheels.

### INSPECTION

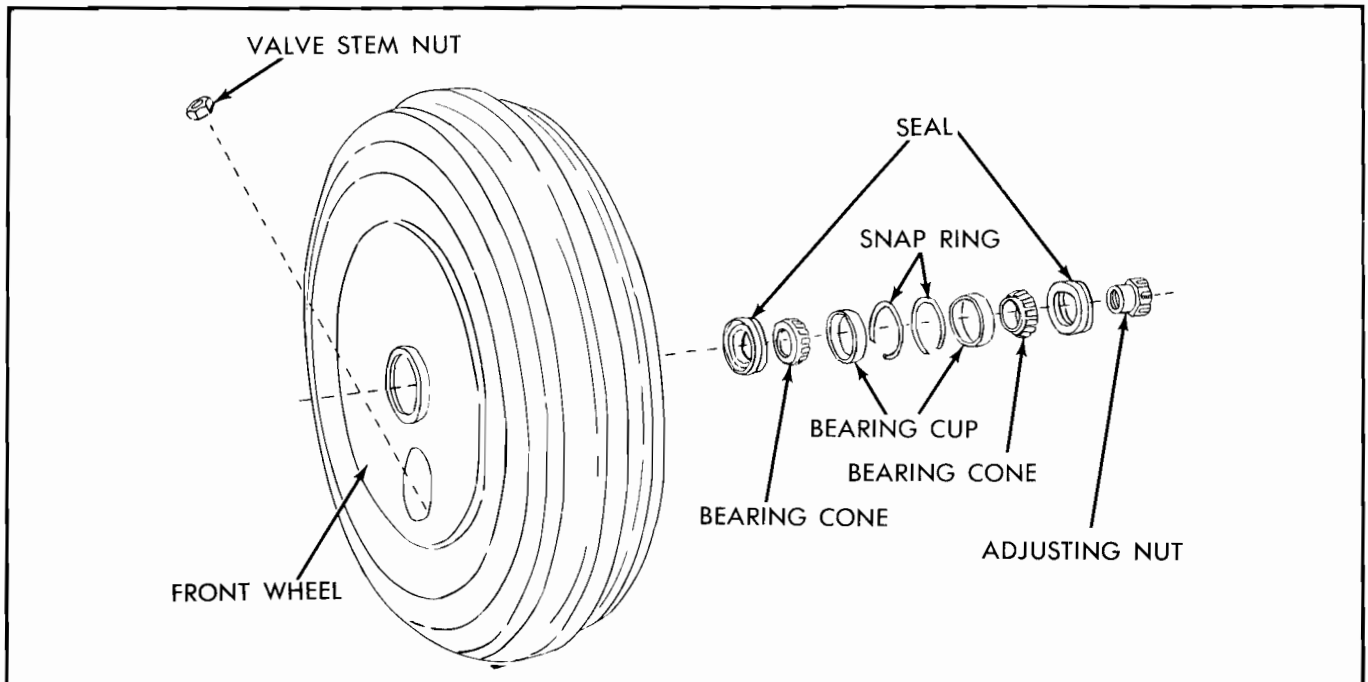
Check bearing cups and cones for wear or roughness. Check spindle for wear at bearing and seal surfaces. Check spindle to fork for wear. Check fork for spreading.

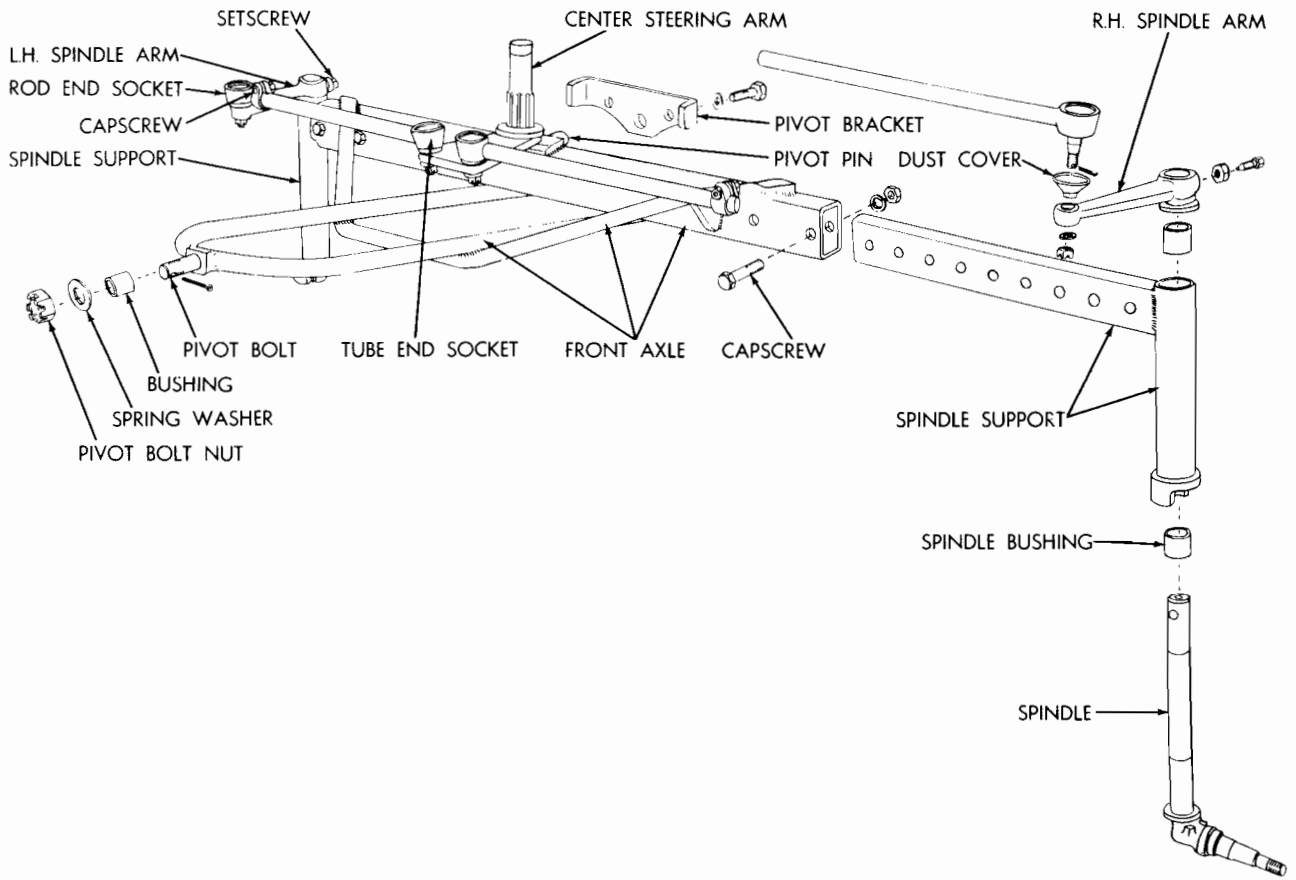
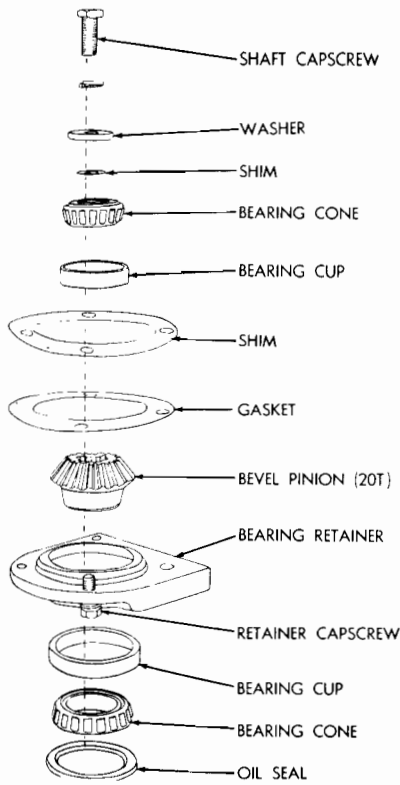
### ASSEMBLY

Install the seal assembly to spindle, first the seal retainer, cork washer and felt washer. Pack bearings with No. 2 wheel bearing grease and place inner bearing in place on spindle. Install bearing cups in wheel, enter spindle into wheel and install the opposite bearing cone, felt washer, cork washer and seal retainer. Adjust



bearing to a free rolling fit without binding or end play. Enter wheel into position in wheel fork with spindle in position to engage slots in fork. Lower hoist slowly until fork rests on spindle. Install the spindle retainers and capscrews. Install and tighten nuts at both ends of spindle.





FRONT AXLE ADJUSTABLE

## FRONT SUPPORT (Single Wheel and Adjustable Axle)

### REMOVAL

Remove hood, radiator and radiator support. Support tractor with the weight off the front wheel.

On single front wheel tractors, remove the front wheel.

On adjustable axle tractors remove the axle assembly as follows, remove axle pivot pin bracket from front support and nut from radius rod, remove both tie rods from the center steering arm assembly and remove axle assembly from tractor. Remove drag link from steering arm and shaft assembly. Remove the four nuts attaching front support to front of engine.

To remove wheel fork or center steering arm assembly proceed as follows. Remove the four capscrews attaching the lower bearing retainer to front support. Remove capscrew, washer and shims at top of shaft, (noting the number of shims, this will aid in assembling) and push shaft from front support. The bevel pinion, bearing retainer, lower bearing cone, cup and oil seal will be removed with shaft assembly. Note the number of shims and gaskets between bearing retainer and front support as this will aid in assembly. The shims and gaskets are used alternately to obtain the proper gear backlash. Pull bevel gear from shaft. Pull bearing retainer, bearing and oil seal, drive bearing cup from bearing retainer.

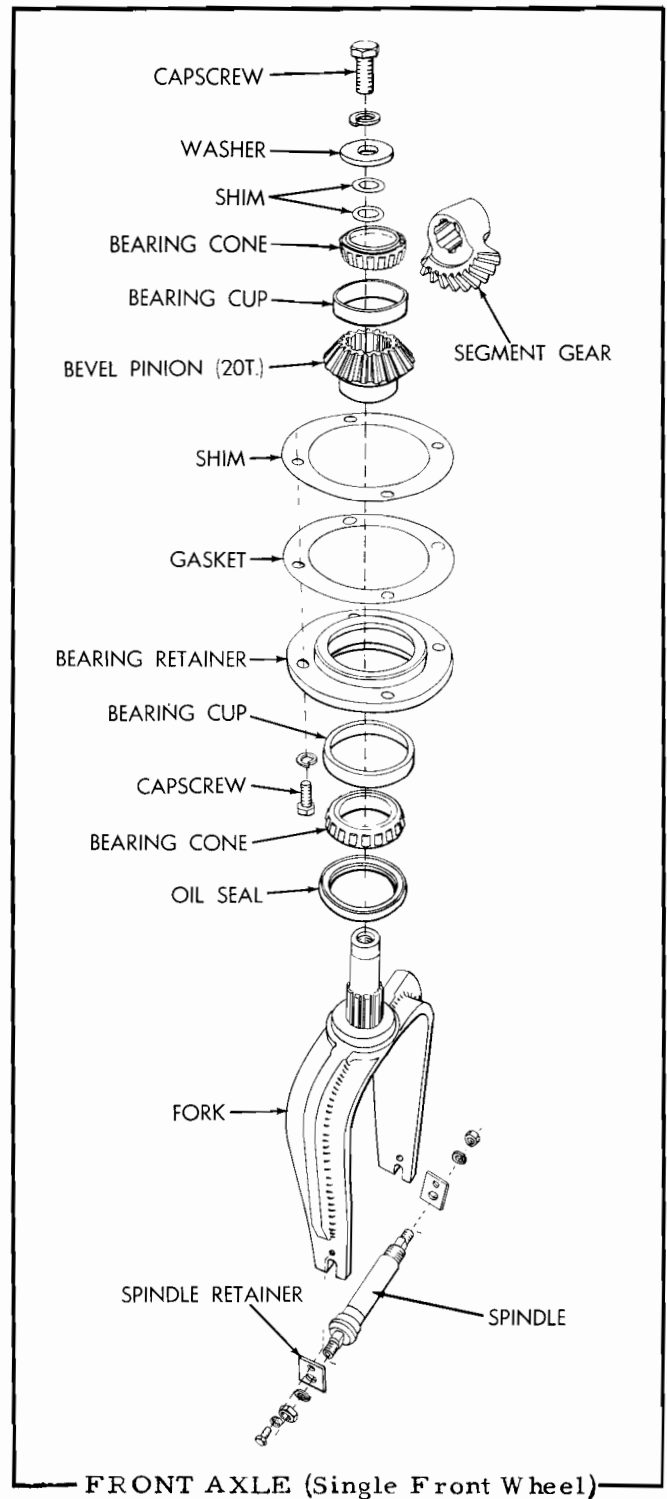
Remove segment gear retaining nut from end of steering arm shaft. Remove gear and pull shaft assembly from front support.

### INSPECTION

Check bearing cups and cones for wear, chipping or roughness. Check pinion and segment gear for worn or damaged teeth. Check pinion and segment gear for looseness on splined shafts. Check steering arm shaft and bushings for wear. Replace bushings or shaft as necessary if wear exceeds .006" or more. Always replace oil seals. Replace gears if teeth are worn or gears are loose at splines. Replace shaft assembly if splines are worn.

### ASSEMBLY

Install steering arm shaft bushings in front support using a bushing driver so bushings will not be damaged. Locate inner bushing flush with inside of support. Locate outer bushing past flush with outside of support leaving room for oil seal. Install oil seal using sealer at outside diameter. Always replace oil seals. Enter steering arm shaft through oil seal and bushings noting that shaft turns freely in bushings. Install



segment gear to shaft with steering arm in the straight up position and gear teeth centered in the straight down position.

Install lower bearing cup in place in bearing retainer. Place bearing cone in cup and install oil seal in bearing retainer with the seal lip upward using sealer on outside diameter of seal. Press bearing retainer assembly in place on

shaft being sure bearing is seated on shaft. Place bevel gear over splines on shaft.

The bevel gear used with the single front wheel or adjustable axle has 20 teeth and 10 splines. No timing of gear to shaft is necessary.

To install this assembly to front support, attach support to front of engine over studs and tighten stud nuts to 85 ft. lbs. Connect drag link to steering arm.

The segment gear must be centered, to do this turn steering wheel from extreme right to extreme left counting the number of turns of steering wheel, and turning back half this amount. Place gaskets and shims on bearing retainer. Use shims alternately in approximately the amount that was removed placing paper gasket next to cast housing. These gaskets and shims provide the proper backlash between pinion and segment gear and are furnished in .005" thickness (both paper or steel).

Place steering arm assembly in front support, holding steering arm in the straight back posi-

tion, or the single wheel in the straight forward position and mesh gears. Install capscrews in lower bearing retainer. Pack upper bearing with #2 wheel bearing grease and place on upper end of shaft (being sure bearing cup is in place). Place a number of shims on top of shaft, approximately the same amount that were removed and install retaining washer and capscrew. The shims at top of shaft are for obtaining proper bearing adjustment. Shims are furnished in .005" and .010" thickness. Tighten capscrew in end of shaft and at the same time note gear backlash. This may be done by removing drag link from steering arm and moving arm by hand. Also feel out the bearing adjustment, if too tight add shims, if too loose remove shims one at a time until proper bearing adjustment is obtained with the proper backlash at gear teeth. If backlash is excessive remove one shim at a time from between bearing retainer and front support. For each .005" shim removed, remove one .005" shim from top of shaft. Mesh pinion and segment gear to minimum backlash or clearance to eliminate excessive play in the steering gear.

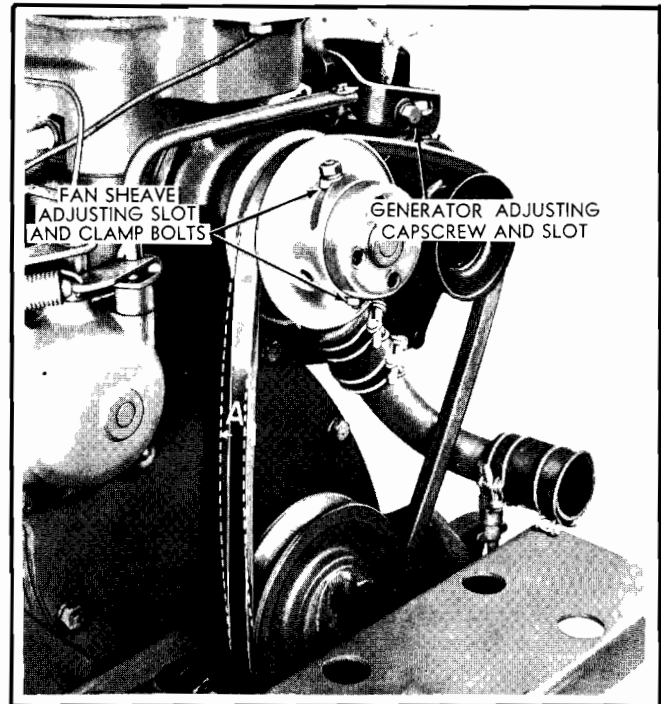
### FAN BELT

The fan belt is driven from crankshaft and drives the fan, water pump and generator.

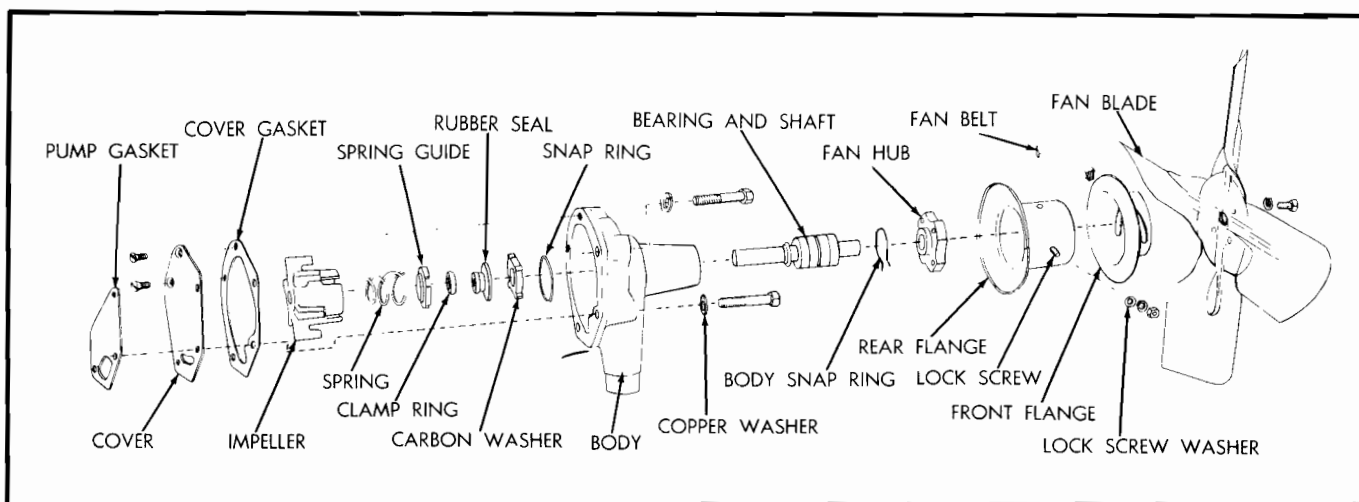
To adjust or tighten belt, loosen generator clamp screw at front of generator, move generator away from engine to tighten belt. Adjust belt with 1" deflection midway between the drive and driven sheaves at "A" and tighten clamp screw at generator.

If belt is operating too low in fan sheave, loosen belt, loosen clamp bolts in fan sheave and turn front flange of sheave clockwise when viewed from the front and tighten clamp screws in sheave and readjust fan belt. This will place sheave flanges closer together and allow the belt to ride higher in sheave. (This is necessary only to prevent belt from bottoming in sheave.)

If belt shows wear or small crack and breaks, the belt should be replaced.



## WATER PUMP AND FAN



### REMOVAL

Drain radiator and engine block. Remove hood and radiator. Loosen clamp and remove hose from water pump. Loosen fan belt and remove from fan pulley. Remove fan blades. Remove the three capscrews attaching pump to cylinder block.

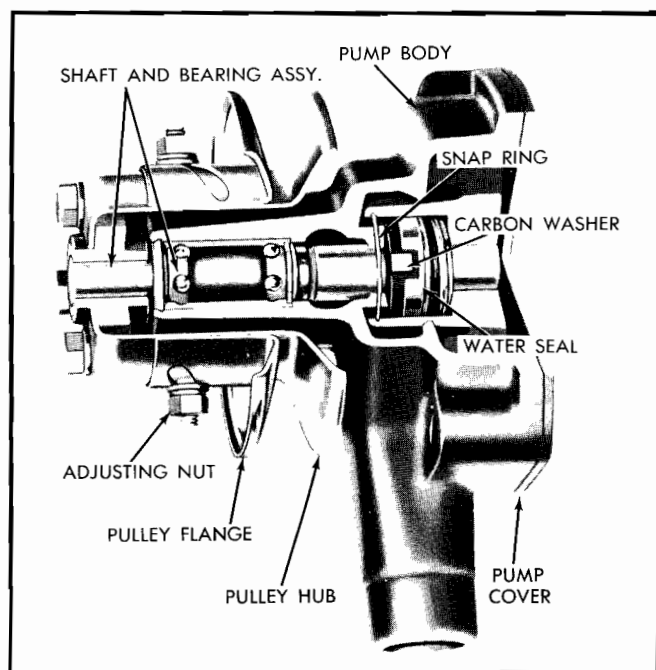
### DISASSEMBLY

Remove fan pulley from fan hub and pull hub from shaft. Remove the cover from rear of pump. Two tapped holes are provided in impeller for attaching puller to remove impeller from shaft. It may be necessary to tap these holes to remove any scale or dirt accumulation. Remove snap ring at front of pump body and press shaft and bearing assembly from pump body.

The shaft and bearing are an assembly and must be replaced as a unit if replacement is necessary.

### INSPECTION

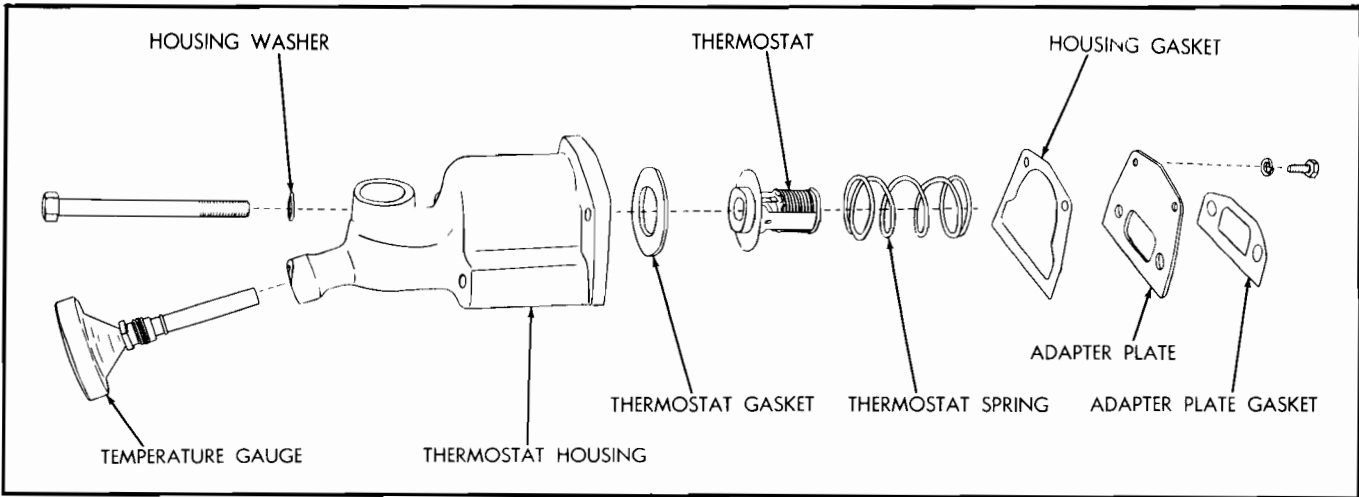
Inspect bearing for looseness or roughness, replace if worn. Check shaft surface where the rubber seal fits to shaft, if rough or pitted replace. Check carbon washer and rubber sealing ring. In most cases the carbon washer, rubber sealing ring and spring should be replaced. A pump parts kit is provided and includes all parts necessary to rebuild the pump with exception of the impeller and shaft assembly which are not commonly replaced. Check the pump body at carbon seal surface. This surface must be flat and smooth. If grooved, curved or uneven it should be resurfaced. This can be done with valve seal insert tools if a special adapter is provided. If no tools are available then replace pump body.



### ASSEMBLY

Install shaft and bearing assembly into pump body and install retaining snap ring. Press fan hub on to shaft until flush with end of shaft. Clean all corrosion from impeller and place on table front side upward. Place spring in impeller. Place clamp ring on rubber seal and place seal in retaining guide. Place carbon washer next to rubber seal. Place this assembly in impeller centering it on spring. Push down on carbon washer, compressing spring and install the retaining snap ring. Press impeller assembly on shaft until approximately flush with end of shaft or until impeller is approximately 1/32" past flush with pump body. Shellac gasket on both sides and install cover plate. Turn shaft by hand to check pump assembly, this will indicate if impeller is centered properly in pump body.

## THERMOSTAT AND HOUSING



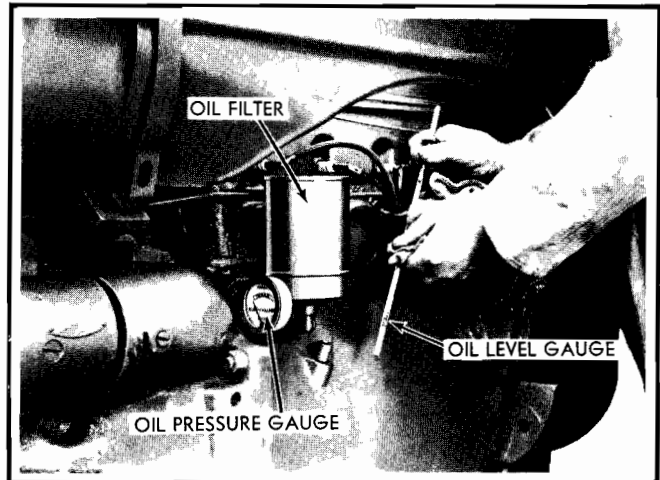
When the tractor is equipped with the Dole thermostat two or more gaskets must be used between thermostat and housing to prevent the valve from striking housing. The thermostat must be turned so valve opens towards the deepest part of housing. If valve strikes the

housing, it cannot open fully and may cause over heating of engine. The Bishop and Babcock thermostat does not cause any interference. Thermostats used with the gasoline burning engines opens at 135°F. Thermostats used with low octane fuel engines opens at 165°F.

## OIL FILTER

The oil filter is a replaceable type and should be replaced every 100 hours of engine operation. No attempt should be made to repack this filter as the filtering yarn is made especially for this purpose and is machine packed to a specific density. Any change in density may change oil pressure, volume of oil passing through filter or may not filter the oil passing through if an opening is left in filter material. A new filter will show some what less oil pressure until it becomes thoroughly saturated with oil.

When installing a new filter, remove any pieces of loose or straggling yarn and check the feed tube for plugging, roughness or burrs. If plugged, remove oil line at bottom of filter base, and clean with a wire or air pressure. If tube is rough, rusty or burred, polish smooth with emery cloth, placing a cloth around tube at bottom to prevent dirt or emery from entering base of filter. The filter feed pipe, if pressed into filter base too far will cause gauge to fail to register pressure. Check the filter base to be sure oil return is open.



Check all oil lines for plugging, making sure oil is reaching the valve mechanism and governor housing. When a new filter has been installed it should be retightened after engine has been operated for a period of time.

## OIL GAUGE

The oil gauge registers the pressure supplied by the oil pump to the oil filter and rocker arm shaft. The pump by-pass valve is set at 12 to 15 lbs. This is usually very near the O R M in the word normal on gauge. The gauge may

sometimes fail to register properly due to dirt entering the small metering hole in threaded end of gauge. This hole may be cleaned with solvent and compressed air. The purpose of this metering hole is to prevent fluctuation of the indicator needle.

## ENGINE

### REMOVAL

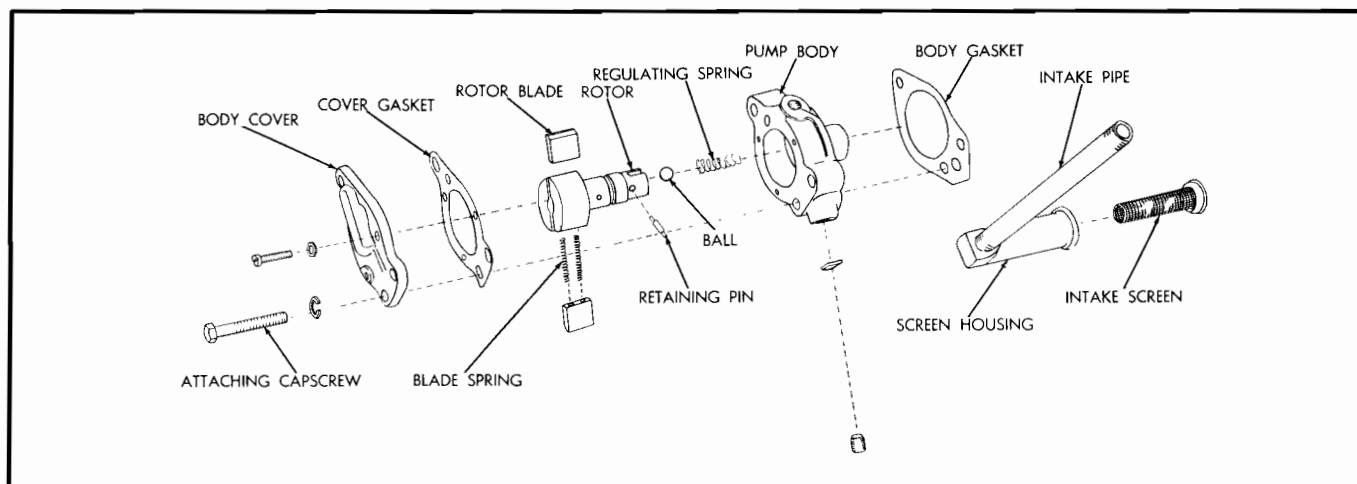
Remove hood, radiator and radiator support. Support tractor at clutch housing with the weight removed from front wheels. Adjustable angle iron legs bolted to each side of clutch housing will make a substantial means of supporting tractor while removing front support or engine. Remove front support. Disconnect governor control rod. Disconnect magneto ground wire from magneto. In case of distributor, disconnect

wire at ignition coil. Disconnect wires at generator cut out and field terminal and remove clip at generator support bracket. Remove air cleaner. Attach hoist to valve rocker arm studs and take up slack in hoist. Remove the four bolts attaching engine to clutch housing. Engine may now be removed from tractor.

### INSTALLATION

Reverse the above removal instructions.

## OIL PUMP



### REMOVAL

Separate and remove engine from torque tube housing. Remove clutch and flywheel. Remove lock wire and the three capscrews attaching oil pump to engine block. Remove cover from rear of pump.

### INSPECTION

Inspect the drive pin in end of camshaft. This pin must fit tight, if worn or loose it should be replaced. The end clearance of pump rotor shaft should not exceed .002". The side clearance between rotor and body at tight side should not exceed .004". The blades should fit the rotor snugly and yet free enough to slide readily. The blades should be exactly flush with rear surface of rotor when rotor and blades are in place. The rotor blade springs must not be kinked.

Make sure there are no air leaks in suction pipe on the cylinder block between suction pipe and oil pump. Check relief ball and spring.

### ASSEMBLY

Assemble the relief ball and spring in rotor shaft and insert retaining pin. The small end of spring must be turned toward ball. Place springs and rotor blades in position in rotor with tapered edge of blades leading in direction of rotation, then place this assembly in position in pump body holding the blades in position with thumb and forefinger. The end clearance of the pump rotor is adjusted by the use of one or more gaskets between cover and pump body, however, one gasket must always be used to prevent oil leakage. If the clearance is too great with one gasket, dress the face of body with valve grinding compound, or emery cloth placed on a piece of glass or face block. Install pump to engine block lining up slot in end of rotor shaft with drive pin in end of camshaft. Tighten capscrews to 15 ft. lbs.

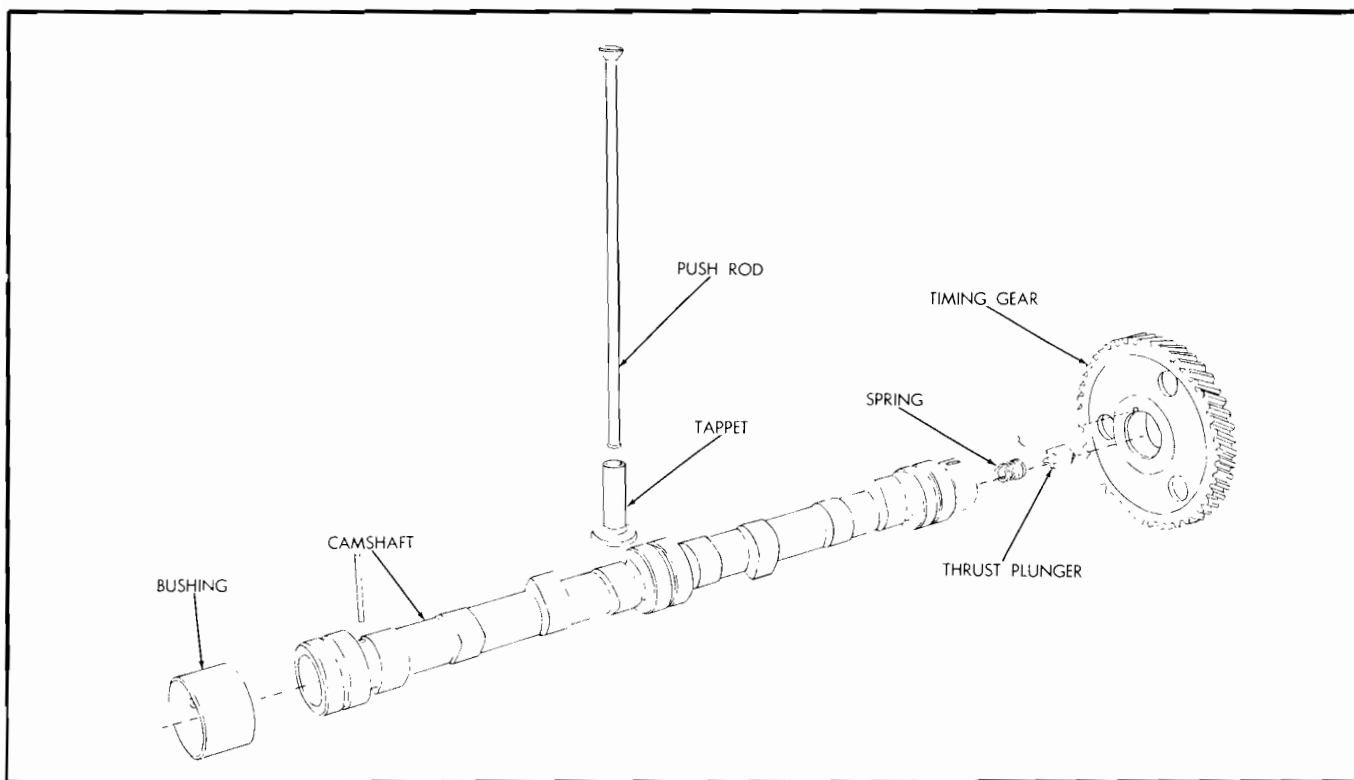
The pump draws oil from the sump through the inlet screen and suction pipe to pump rotor, here it is pressurized and forced through an opening in pump cover to center of rotor. The

rotor has two drilled holes which match up with two holes in pump body as the rotor turns. Oil from these holes enters the camshaft, where it is distributed to lubricate various parts of the engine. Oil is also fed by the pump through a separate outlet to the oil filter, oil gauge, rocker arm shaft and governor housing. When the

pressure within the pump exceeds 15 lbs. the relief valve opens. This extra quantity of oil is also fed to the center of camshaft.

Effective with Engine CE 190257 the oil intake pipe and screen was changed to a floating type oil intake screen.

### CAMSHAFT AND VALVE TAPPETS



#### REMOVAL

Remove engine, (refer to engine removal). Remove engine clutch, flywheel and oil pump. Remove fan drive pulley, water pump, oil sump and timing gear cover, valve cover, rocker arm shaft and push rods. Remove camshaft from engine block. The gear may be pressed from shaft if replacement is necessary. Remove the tappets from cylinder block.

#### INSPECTION

Check camshaft journal size for wear and condition of cam lobes for wear or scuffing. Check the shaft bore for cleanliness and make sure the four connecting rod metering holes are open. Check the end play plunger and spring. Check the camshaft in bushings for looseness, if bushings are worn and have to be replaced, (refer to camshaft bushings). Check timing gear backlash. If back-lash exceeds .008", replace

timing gears.

Check tappets for wear or looseness in guides. They should be replaced if worn excessively or noisy. Check cam contact surface for wear or scuffing, replace if loose in guides or worn at cam surface.

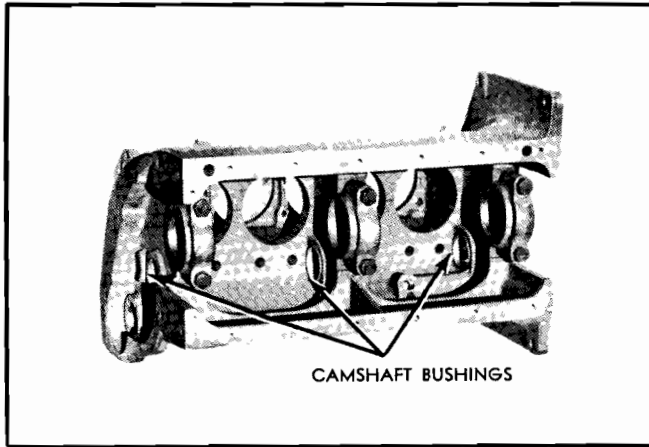
#### ASSEMBLY

Reverse the above removal instructions. The camshaft gear must be timed with the crank shaft gear when assembling. The marks for camshaft to crankshaft are straight marks.

In case of magneto ignition the magneto drive gear is also timed to the camshaft gear, these are oval timing marks. In case of battery ignition, the distributor drive gear is not marked for it is not necessary to time the distributor drive gear to the camshaft gear. (See distributor timing general section.)



## CAMSHAFT BUSHINGS



### REMOVAL

Remove engine, clutch, flywheel and oil pump, fan drive pulley, oil sump and timing gear cover, valve cover, rocker arm shaft and push rods. Remove camshaft and drive bushings from engine block. A special driver is available for removing these bushings.

### INSPECTION

The camshaft bushings should be replaced if worn or scuffed. The clearance between shaft and bushing is .002" to .004". They should be replaced if wear exceeds .006". Undersize bushings are available in .0025" in case the shaft journals are worn undersize.

### ASSEMBLY

Install the rear bushing, with oil hole in bushing aligned with oil passage in engine block. Drive bushing in from the front until it is 1/4" from the rear surface of block, this will allow installation of oil pump. Line up oil hole and drive center bushing in until it is centered in web of engine block. This bushing is 1/8" longer than web so approximately 1/16" of bushing will extend on each side of web. Line up oil hole and drive the front bushing in flush with block. Install camshaft and check that it turns freely in bushings.

## CONNECTING RODS AND PISTONS

### REMOVAL

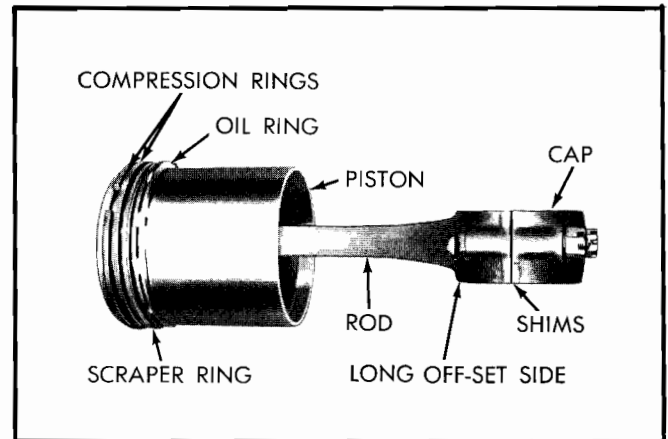
Remove hood, valve cover, rocker arm and push rods. Drain block and remove upper hose connection. Disconnect fuel lines. Disconnect oil lines at cylinder head. Remove cylinder head. Drain and remove oil sump. Scrape carbon from top of cylinder liner above the pistons. Number each rod and cap on the camshaft side with a center punch starting at the front with number one. Remove the connecting rod bolt nuts and cap, push connecting rod upward from engine.

To remove piston from connecting rod, place a punch in a vise and tighten securely. Place piston pin over end of punch and loosen connecting rod clamp screw, then slide piston pin from rod and piston. Do not clamp connecting rod or piston in vise.

### INSPECTION

Check fit of piston pin in piston. The clearance is .0007" to .0012". If any noticeable looseness they should be replaced, otherwise the engine would not operate quietly.

Check piston and ring lands for wear. The ring land clearance is .0015" and piston should be replaced if clearance exceeds .0025". The pistons are cam ground and should measure .009" greater diameter at right angles to piston pin.



Check connecting rod for alignment in a fixture provided for this purpose. Check bearing inserts for scuffing or broken babbitt. Replace if damaged.

### ASSEMBLY

The connecting rod is offset and the piston bosses are of equal length. To assemble connecting rod to piston, centralize the rod between piston bosses and the pin in piston and clamp securely. To assemble piston and rod to engine, the long offset side of rod must be turned away from the nearest main bearing.

Be sure the piston ring grooves are clean, and free of nicks and ring fits groove freely. Roll ring around groove in which it is to be installed.

checking for tight spots. Try each ring in cylinder liners to check end gap clearance. File ring gaps if necessary until each ring has .007" to .017" end gap. On used cylinder liners the rings should be fit at the bottom of ring travel. The compression rings are tapered and one side is marked "top". This side must be assembled towards top of piston.

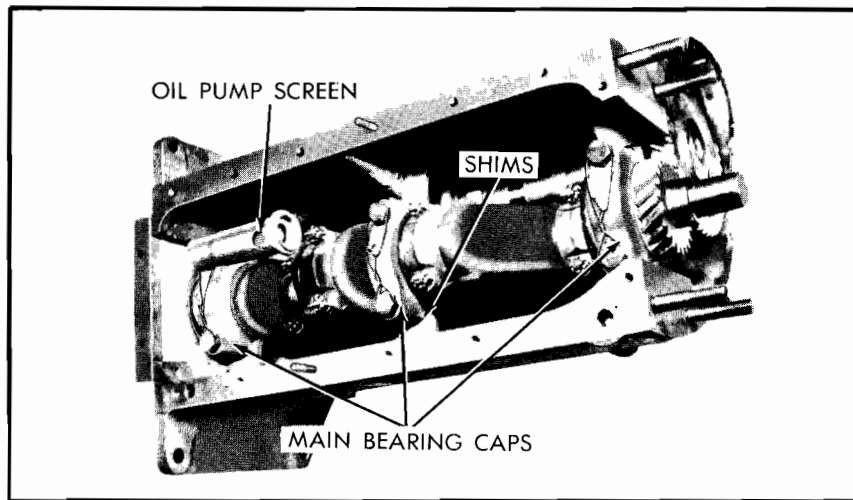
Install bearing shells, being sure lip on shell enters the depression in rod and cap. Thoroughly clean the insert contact surface of rod and cap.

**CAUTION:** The rod bearing uses four shims on each side and the bearing inserts stand out .0015" at each side of insert with the shims in place. This stand out is known as crush, and is

provided to insure the insert making good contact to the rod and cap in order to transfer heat from the insert to the rod, where it will be dissipated more readily.

The bearings must be adjusted from .001" to .003" diametrical clearance, this may be determined by a length of Plastigauge placed in bearing shell of cap and torquing rods nuts to the recommended 35 ft. lbs. Remove and measure width of Plastigauge with scale on envelope. When shims are removed to obtain bearing adjustment this same amount should be removed from the ends of the bearing insert. When proper adjustment cannot be obtained new standard or undersize inserts should be installed. Never file the bearing caps.

### CRANKSHAFT AND MAIN BEARINGS



#### REMOVAL

Remove engine, clutch and flywheel. Remove oil sump, and rear oil seal retainer. Remove fan drive pulley and timing gear cover. Remove connecting rod caps. Remove main bearing caps and lift shaft from engine.

**CAUTION:** Never clamp shaft in vise.

#### INSPECTION

Check shaft for wear or roughness. If journals are out of round or tapered .004" or more, shaft should be replaced.

Excessive shaft wear indicates negligence to change oil, oil filter or service air cleaner as often as required.

If crankshaft is worn .0025" or more undersize and is still round and not tapered, undersize bearing inserts should be installed. Bearing inserts should always be replaced if scored or have babbitt flaked or chipped out. Check the thrust surface for wear or roughness, replace shaft if necessary.

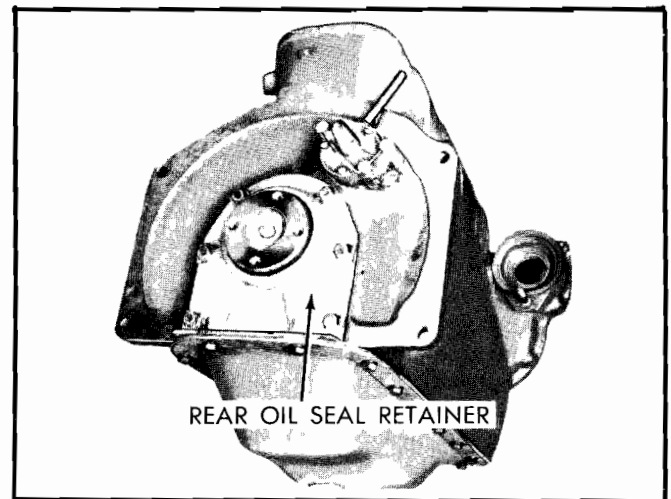
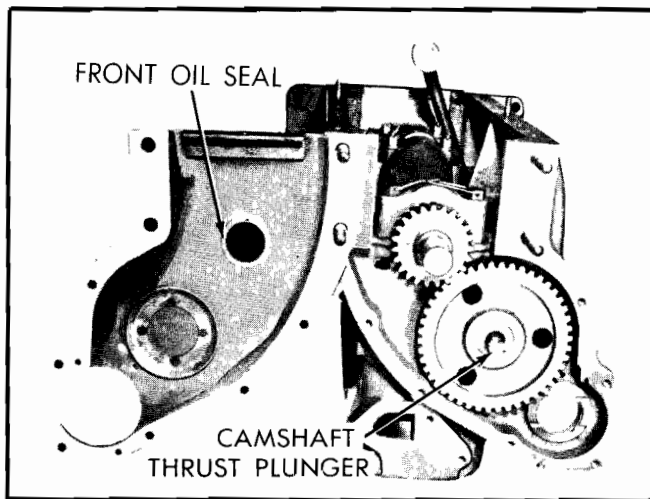
#### ASSEMBLY

Place crank shaft into position in block with the timing mark on crankshaft gear lined up with mark on camshaft gear.

If new inserts are being installed, thoroughly clean the contact surface of block and bearing caps. Adjust each bearing separately. When all three bearings have been adjusted separately, tighten all capscrews securely to 80 ft. lbs. torsion. The shaft should turn freely with all bearings tightened as with one. If not check shaft alignment. The front main bearing cap and lower half of the bearing shell carries the end thrust of the crankshaft, and should have from .001" to .005" end thrust clearance. The main bearing caps must be installed in their original position. This should be marked before disassembly. The center and rear caps are similar and have a long (or offset) side which should be placed forward. Both sides of the front cap are very nearly equal, but if installed wrong would not fit properly.

See "Connecting Rod" for bearing adjustment.

## FRONT AND REAR CRANKSHAFT OIL SEALS



### REMOVAL

Remove engine. Remove oil sump, crank shaft pulley and timing gear cover. Drive front oil seal from timing gear cover. Remove clutch, flywheel and rear oil seal retainer. Remove seal from retainer.

### INSPECTION

Check shaft oil seal surface for wear or roughness. Always replace oil seals whenever they are removed from shaft. Incorrectly adjusted main bearings cause excess seal leakage.

### ASSEMBLY

Clean the rear oil seal groove in seal retainer thoroughly. Shellac groove and outer diameter of seal and press seal into place in groove. Prior to Engine CE 161090 this was a cork seal and care should be taken when installing seal in retainer to eliminate breaking the seal. The seal used since CE 161090 is a felt ring with a Neoprene strip through the center of the felt to eliminate oil wicking through the felt. This seal

is more flexible and easy to install. This seal may be used on all older engines in place of the cork seal. With seal in place in retainer lubricate face of seal and shaft, shellac both sides of retainer gasket and place on engine block. Center seal over shaft and place against gasket. Start all capscrews and tighten. In later engines the tapped holes for the oil seal retainer capscrews are blind and do not enter crank case of engine, this eliminates oil seepage at capscrews.

The front seal is furnished as an assembly and is pressed into the timing gear cover, a sealer must be used on the outer diameter of seal. Prior to Engine CE 161090 the front seal was of a cork type, then changed to a Neoprene type. The oil grooves were also removed at the front of shaft. Effective with engine CE 178516 a new timing gear cover was used, this cover has oil deflectors to eliminate excessive amount of oil from contacting seal to help eliminate seal leakage. The hole in cover for installing seal is somewhat larger than in the previous gear covers and a new seal was used. This is the same seal as was used previously on the W engine.

## CYLINDER LINERS

### REMOVAL

Remove hood. Remove valve cover and rocker arm shaft assembly. Drain cooling system and remove cylinder head. Drain oil and remove oil sump, connecting rods and pistons. Carbon must be removed at top of liners before piston can be removed.

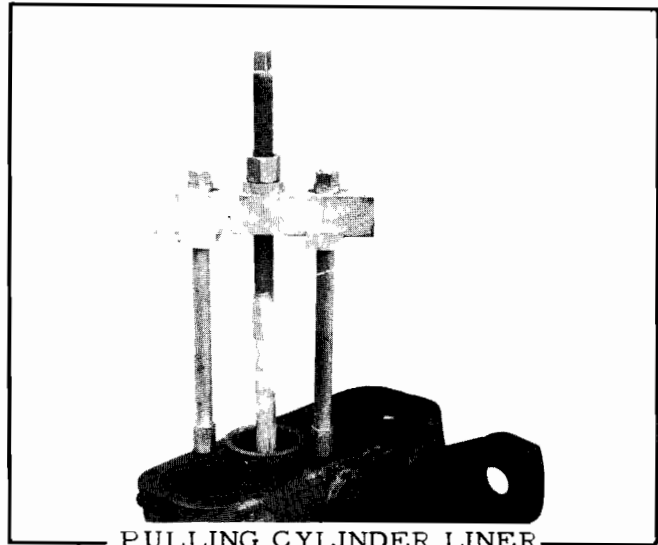
Use suitable puller to remove cylinder liners. When removing liner with engine still attached to tractor, care should be taken to eliminate dirt rust and scale from around liners falling on crankshaft and around main bearings. This can be done by placing wiping cloths on crankshaft around main bearings.

### INSPECTION

Check liners for wear before removing from cylinder block. The greatest wear occurs at the top of ring travel. When this wear is .011" or more, the liner should be replaced. The wear at the bottom of the liner will be very slight. This causes a tapered bore, and the taper causes the piston rings to contract and expand as the piston moves up and down, resulting in excessive wear on the piston rings and ring grooves, making it difficult for the rings to control oil consumption.

### ASSEMBLY

Clean the inside of cylinder block thoroughly of rust and scale. Use emery cloth to smooth the surfaces where liner contacts block at both top and bottom. Clean the liners and try for fit in cylinder block without the packing rings. Liners must turn freely in block. Remove liner and install the rubber packing rings. Keep these

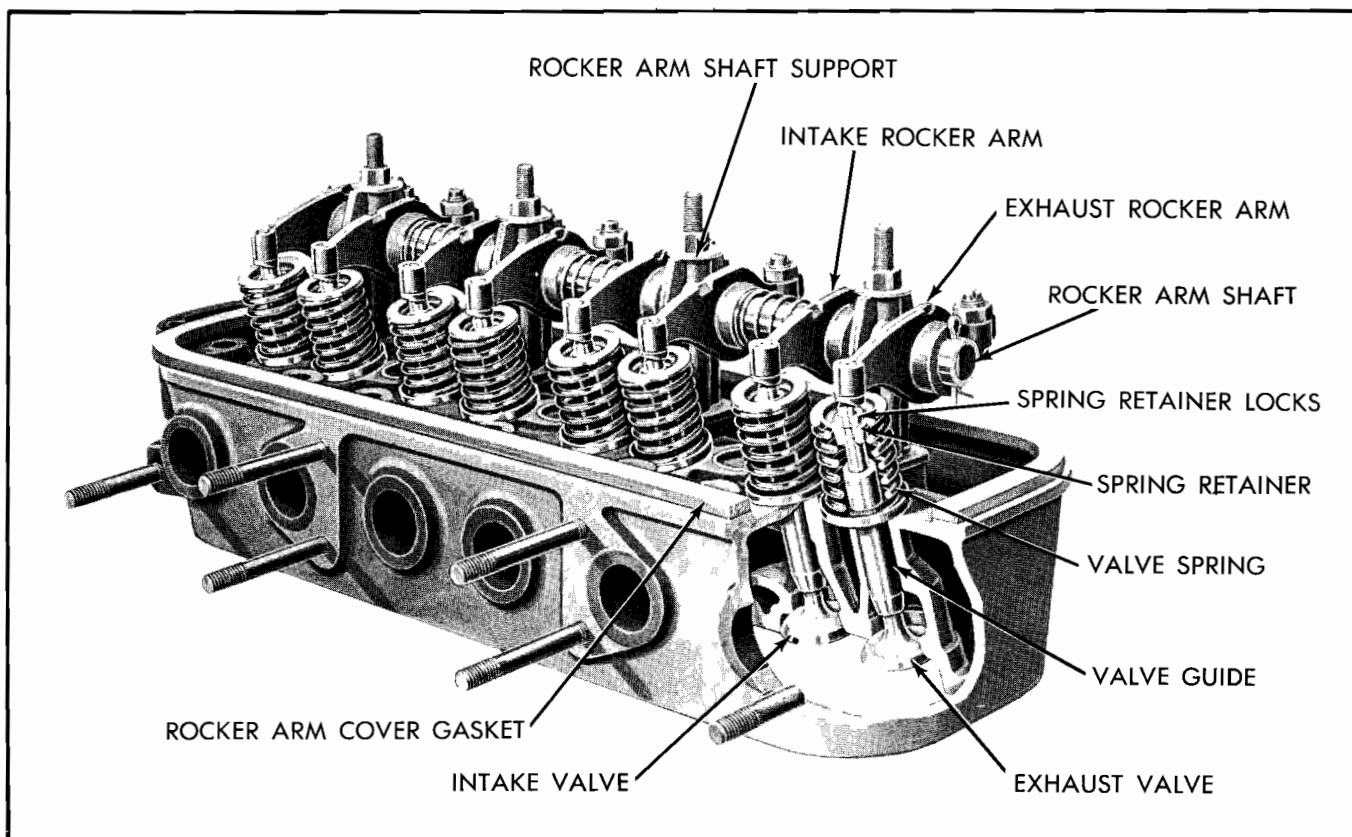


PULLING CYLINDER LINER

rings free of twists. Install a coat of white lead on seal rings and at bottom web of block as this will aid in installation. Place the liner in block until packing rings rest on the bottom web of block. With both hands on top of liner push down firmly and turn at same time. Make sure that nothing enters under flange of liner which will hold it up out of place. After the liner is in place, slide a piston up and down liner, checking for tight spots. With liner in place and firmly held tight to block the liner should stand out above surface of block .002" to .005". If stand-out is more, check for foreign material under flange of liner. Excessive stand-out will induce water seepage at outer edge of head gasket.

When fitting piston rings to worn cylinder liners always check the rings at bottom of liner where the wear is the least. They must have from .007" to .017" end gap at this point.

## CYLINDER HEAD AND VALVES



### REMOVAL

Drain cooling system. Remove hood, valve cover and rocker arm shaft assembly. Remove water manifold, exhaust and intake manifold and oil lines to cylinder head. Remove cylinder head, valve spring retaining locks and valves.

### INSPECTION

Check the valve stems and guides for wear. If the total clearance exceeds .008" the guides and valves should be replaced. The valve guides may be checked by using the various oversize valve guide pilots used for valve seat refacing. If the valve margin is getting thin, the valve should be replaced. Thin valve margins result in short valve life.

Check the valve seat for width and wear. The seat should be 1/16" wide and if wider it should be narrowed by using 15 degree and 75 degree cutters or stones. If the seat is worn to the point where the valve is flush with the surface of head, seat inserts should be installed. Valve seat inserts are available for both exhaust and intake valves, and to install them the cylinder head must be counterbored.

If the valve has worn into the seat it effects the length of valve spring which weakens the valve spring action. The valve spring should have

2-5/16" free length. If it is 1/16" less, it should be replaced.

### ASSEMBLY

Replace guides, if necessary. The valve guides have a scribe line at outer diameter near the top. The guide must be driven or pressed into head until this scribe line is flush with top of head. If guide is driven down and guide becomes damaged it must be reamed to size.

Clean all carbon from valves and stems. Reface in a valve lathe. If the valve is warped or has a thin margin, replace valve. Reseat the valve seats. If wide, they must be narrowed to 1/16" by use of a 15 degree cutter or stone at top of seat and a 75 degree at the bottom of seat.

If the seats are worn into head, both intake and exhaust seat inserts for replacement are available, however, special tool equipment is necessary for their installation. The manufacturer of this tool equipment furnishes the instructions for proper use.

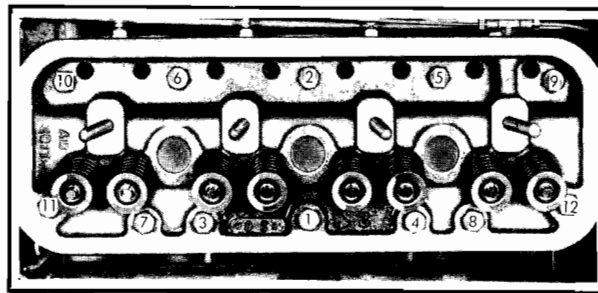
If new seat inserts are to be installed it will first be necessary to replace the valve guides otherwise the pilot will not allow proper alignment of the cutting tool.

Lap valves to their seats using a fine grinding

compound. Thoroughly clean all compound from valves and head and oil the valve stem and seats and place valves in position in cylinder head. Install springs seats, springs, retainers and locks.

Use a non setting type of gasket cement on cylinder head gasket. Tighten all capscrews evenly, starting at the center and working toward each end of head as numbered on chart.

Do not attempt to tighten one entirely before proceeding to the next. Go over them several



times and tighten all capscrews evenly to 60 ft. lbs. torsion.

### ROCKER ARMS AND PUSH RODS

#### REMOVAL

Remove hood and valve cover. Remove rocker arm shaft assembly. The push rods may be lifted from engine block.

Remove the cotter pins and washers from end of shaft. Remove rocker arms, supports and springs from shaft.

#### INSPECTION

Check shaft and rocker arms for wear. If the combined clearance is more than .010" the shaft and/or rocker arm should be replaced. Rocker arm bushings are not serviced and if worn excessively the rocker arm assembly should be installed.

Check the rocker arm contact face for wear. If the face is worn flat undue side thrust is placed on valve stem and will cause excessive wear on valve stem and guide. It may be re-faced on a valve lathe by the use of a special attachment provided for this purpose, or it may be replaced. The oil for the valve mechanism is fed from the pump through a line connected to rear of cylinder head. The oil enters a groove in the side of rear support stud. From this stud it enters the rocker arm shaft. The shaft is hollow and has a hole in line with each rocker arm. The oil enters the rocker arm and passes out of hole at top of rocker arm and lubricates the push rod and valve stems. The excess oil follows down the push rods and lubricates the cam followers or tappets. It is possible to over oil the intake valves causing excessive oil consumption. For this reason the intake rocker arm has an oil shed built into the upper part of rocker arm between the shaft and valve. This shed is from 1/32" to 1/16" wide on its top surface. The wider this surface, the more oil will pass over to the valve stem, the narrower

this surface the less oil will pass. Check the assemblies and control the oil flow accordingly. If the rocker arm assembly appeared to be dry, check for plugged oil line to cylinder head.

Check the supports for length. They must all be equal.

Check the corks at each end of shaft.

Effective with engine CE 18419 on CA tractor 30574, the rocker arm supports are made of cast iron instead of steel stamping.

Effective with engine CE 191558, the CA tractor is equipped with intake rocker arms in both the intake and exhaust position to control oil.

#### ASSEMBLY

With cotter pin in one end of shaft, place washer next to cotter pin, next install exhaust rocker arm, support, intake rocker arm, spring, intake rocker arm, support, exhaust rocker arm, spring, exhaust rocker arm, support, intake rocker arm, spring, intake rocker arm, support and exhaust rocker arm. Install washer and cotter pin.

NOTE: When installing pressed steel supports, place all supports with the split side of bushing away from the valve side. The cast supports can be installed in either position. Turn shaft so oil holes for rocker arm are in a downward position or toward cylinder head. Install push rods before installing shaft assembly. Place shaft assembly over support studs. Place flat washer at top of supports and tighten nuts. Check the corks in the ends of rocker arm shaft. Adjust valve lash at .012" with push rods at their lowest position. Readjust lash after engine is hot.

## GOVERNOR

The purpose of the governor is to provide a mechanical means of regulating the throttle in order to maintain a uniform speed under varying load conditions. Without a governor the engine speed would decrease if the load increases, and would increase if the load decreases for any particular throttle position. The governor has the ability to both open and close the throttle. The limits of the governor are from low idle to high idle, or the maximum horsepower at the rated speed.

The rated horsepower of an engine is the maximum load it can pull and still maintain rated speed. In this condition the throttle valve is wide open and the engine is receiving the maximum amount of air and fuel. From this it can be seen that the governor cannot provide more action or power once the engine reaches full load or the speed falls off due to an overload.

The governor consists of a pair of hinged weights which act against a thrust bearing and linkage to which a spring is attached. The linkage in turn is attached to the throttle valve of the carburetor. The governor operates on the well known laws of physics:

1. For every force there is an equal or opposing force acting in the opposite direction.
2. When two forces are equal, no movement takes place.

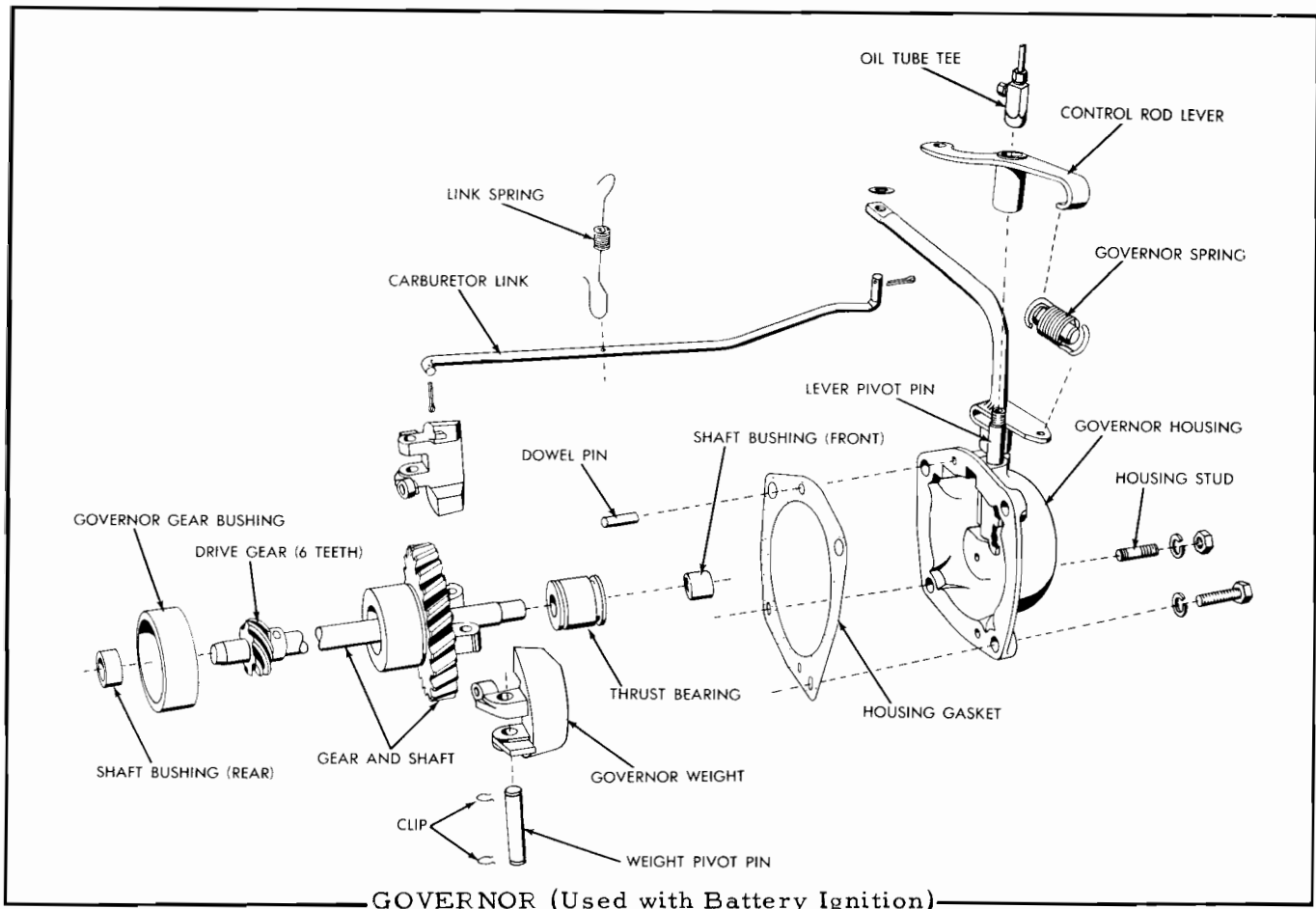
3. Centrifugal force. The force which tries to keep all objects moving outward from a center of rotation. The governor makes use of these facts by combining the centrifugal force of the revolving weights to act against the force of the governor spring. Movement of the governor is caused by increasing or decreasing the speed of the weights. The change of speed of the weights is caused by increasing or decreasing loads on the engine. The movement of the governor is always in the direction of the greater force towards the smaller force.

The throttle is held in position in direct relation to the position of the weights. The two forces acting on the throttle working in opposite directions are the weights which are always trying to close the throttle and the spring which is always trying to open the throttle.

The hand control lever simply places tension on the governor spring. The position of the throttle control lever and the amount of tension on governor spring is selected by the operator and determines the speed the governor will maintain.

The governor spring is fitted with a plunger which forces the governor weights to an idle position when throttle control lever is placed in the full closed position.





## REMOVAL

Remove throttle hand control rod, oil line and carburetor link rod. Remove the three cap-screws and nut attaching housing assembly to engine. Remove housing assembly and pull gear and governor assembly from front of engine.

Prior to Engine CE 149840, magneto ignition was used and the magneto drive is in conjunction with the governor drive gear.

Effective engine CE 149840 and since battery ignition system was used. To remove governor and distributor drive shaft assembly it may be necessary to remove radiator in order to provide clearance for the longer shaft.

## INSPECTION

Check the fork and shaft bearing for wear, or looseness in housing. If any of these parts are worn, the housing assembly must be replaced. Check the gear and shaft for wear, replace if gear backlash is .008" or more. Replace shaft if worn at surface where thrust bearing operates. The gear and shaft is furnished separately for magneto equipped tractors, but the shaft and gear for distributor equipped tractors are furnished only in an assembly. Check the thrust

bearing for wear. Replace if worn or bearing feels rough. Check the weights and hinge pins for wear. Check the riser pins on weights for wear or looseness. Check lever and pivot pin for wear if worn. Check all moving parts and linkage for binding, also check carburetor throttle shaft for wear or binding.

## INSTALLATION

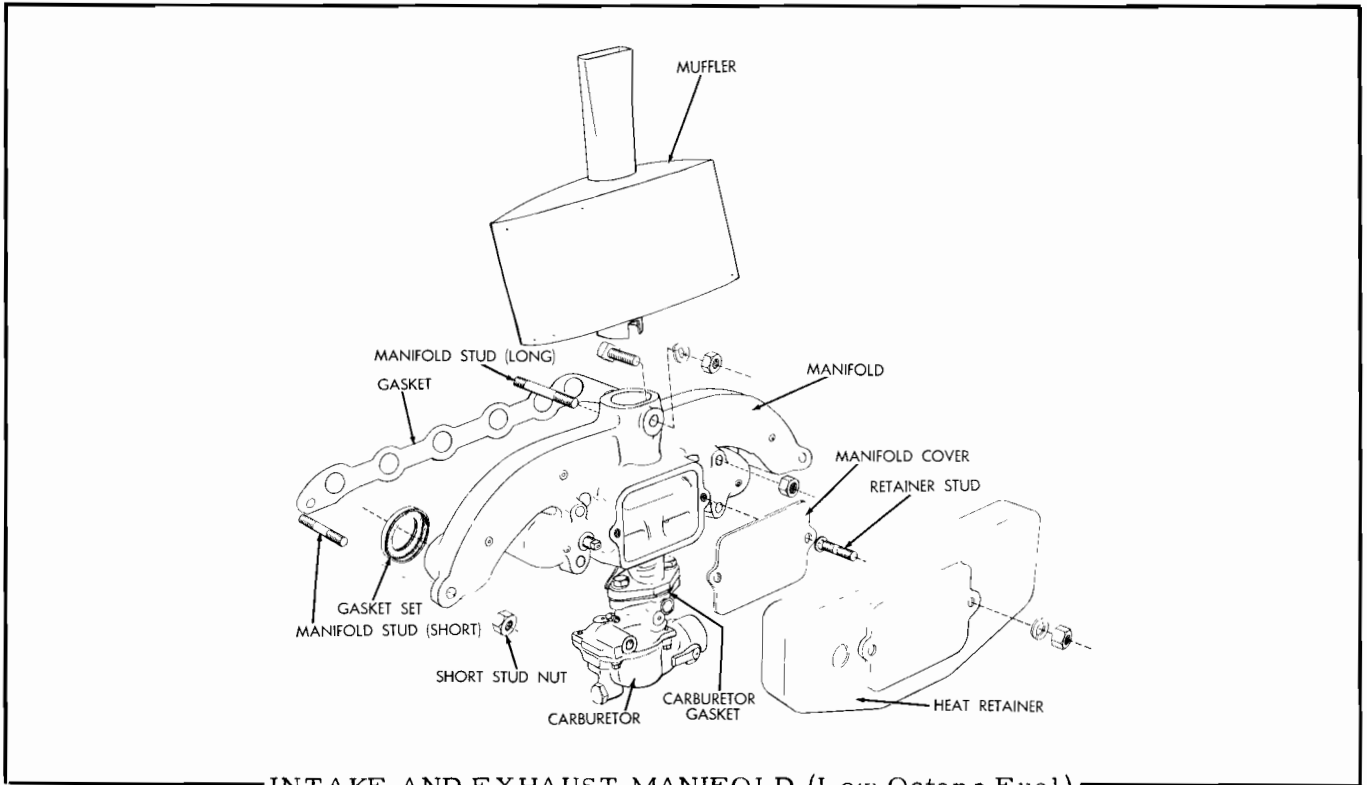
Installing the gear and governor assembly on magneto equipped engine. The oval mark on the magneto drive gear must mesh with the oval mark on the camshaft gear.

The gear and shaft assembly for the distributor equipped engines need not be timed to the engine camshaft. (No timing mark provided.)

Place thrust bearing on the shaft with the thrust surface forward. Install housing assembly and connect control rod and oil line. Then before connecting the carburetor link rod place throttle hand lever in the open position and adjust governor cross shaft by bending until the carburetor link rod is 1/16" too short when the carburetor throttle valve is held in the wide open position and connect link rod to cross shaft. Adjust the spring anchor by bending in or out until a slight amount of spring tension is present when the throttle lever is placed in the idle position.



## INTAKE AND EXHAUST MANIFOLD ASSEMBLY



INTAKE AND EXHAUST MANIFOLD (Low Octane Fuel)

### REMOVAL

Shut off fuel supply and remove fuel line. Loosen clamp at air cleaner hose. Disconnect choke and throttle link rod. Remove capscrews attaching carburetor to intake manifold. Remove nuts attaching manifold to cylinder head.

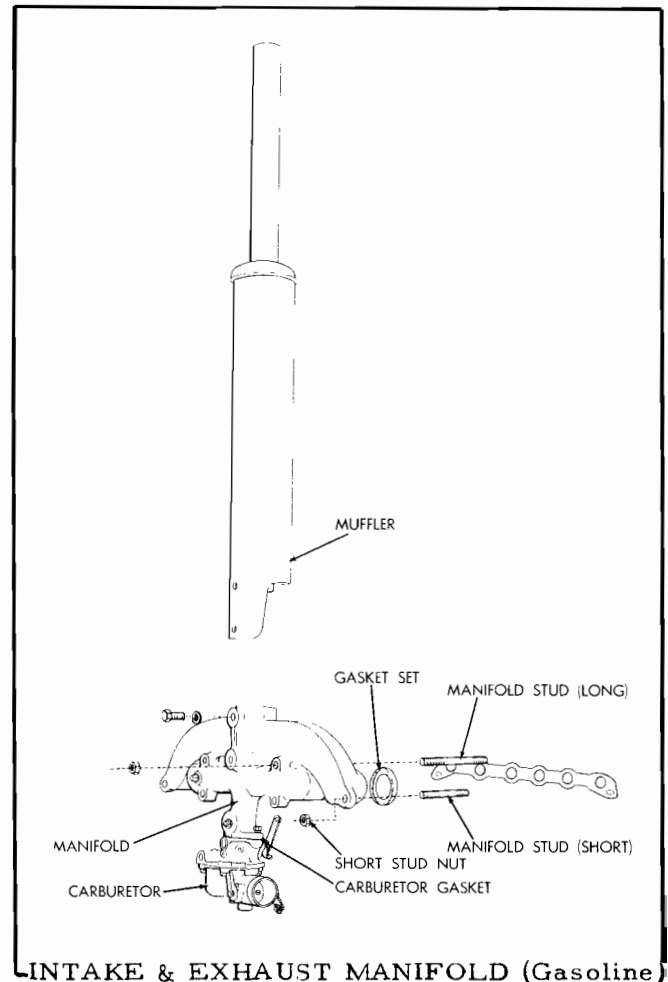
### INSPECTION

Check manifold for cracks or plugging. Check for carbon accumulation and clean if necessary. The vacuum gauge reading is 19 inches for a perfectly adjusted engine in good mechanical condition operating at idling speed.

### ASSEMBLY

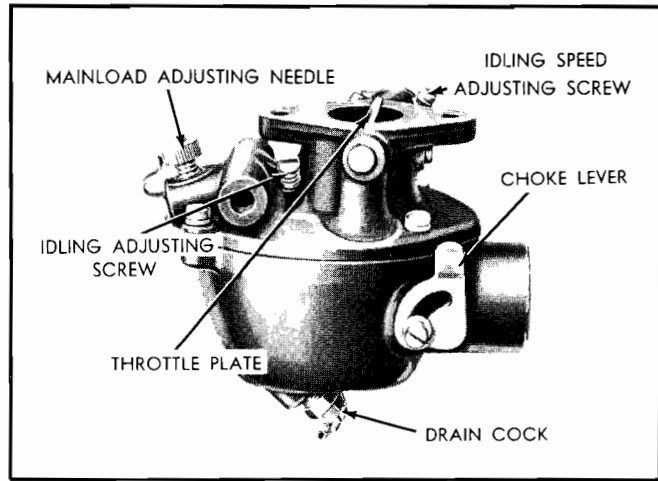
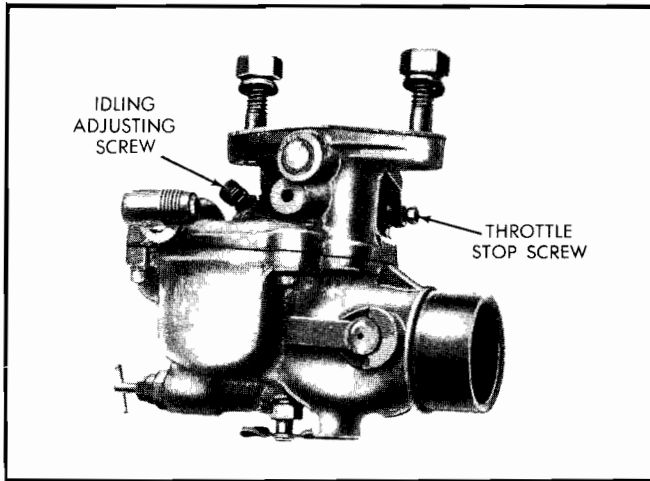
Always install new gaskets. Effective with Engine CE 171294 a one piece gasket was used. Tighten manifold nuts evenly to 20 ft. lbs.

Two distinct types of manifolds are used. One for gasoline and one for low grade fuel.



INTAKE & EXHAUST MANIFOLD (Gasoline)

## CARBURETOR



### REMOVAL

Shut off fuel valve. Disconnect fuel line, carburetor link rod and choke rod. Loosen air cleaner hose clamps and remove the capscrews attaching carburetor to manifold.

### INSPECTION

Check carburetor throttle and choke shafts for wear. If worn to the point where air and dust may enter they should be replaced. If a new shaft fits loosely in body assembly, the body assembly should also be replaced. Check float valve for leakage. Check float for leaks. If float is leaking it will have a small amount of fuel inside, causing it to be heavier and allowing too high a fuel level. Check and clean all jets and passages.

### ASSEMBLY

Clean all parts and passages of carburetor thoroughly. Always use new packing on throttle and choke shafts, use new gaskets. Set float level by using thicker or thinner gaskets under float valve seat. Do not bend float to change fuel level. Check float after assembly for freedom of movement and make sure it does not contact sides of bowl. The float level for Zenith carburetor should measure  $1\text{-}5/32$ " from bottom of float to top of bowl or  $7/16$ " from top

of fuel to top of bowl by use of glass level test gauge.

On Marvel-Schebler carburetors the float level is  $9/32$ " measured from top of bowl to nearest edge of float or  $7/16$ " from top of fuel to top of bowl by use of glass level test gauge.

When installing the throttle plate to shaft be sure it is positioned so that beveled edges contact barrel at the correct angle. Before tightening the screws in throttle plate, back out idle stop screw, close throttle plate in barrel of carburetor, pull outward on throttle shaft and tighten screws securely.

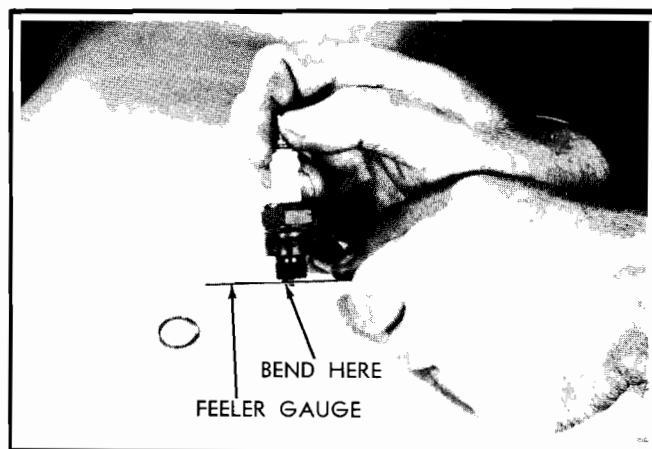
The idle speed stop screw must be adjusted by turning it in against its stop until the engine idles between 400 to 500 R.P.M. The adjusting screw at front top of body is for adjusting the fuel air ratio for idling. This adjustment controls the amount of air allowed to enter. Turning the screw in lessens the amount of air and causes the mixture to be richer, turning the screw out increases the amount of air and causes the mixture to be leaner. These adjustments should be made with engine hot. The main fuel jet is a fixed size and has no adjusting needle, it is a predetermined size to provide maximum economy and efficiency. If difficulty is encountered in securing proper carburetor adjustment check air cleaner and make certain it is not plugged or leaking.

## SPARK PLUGS

Fuels of today along with the higher compression engines, make it necessary to clean and regap plugs more frequently than in the past. Plugs should be removed, cleaned and points re-spaced from .028" to .032", every 100 to 150 hours depending on the type of operation. Space the points by bending outside electrode.

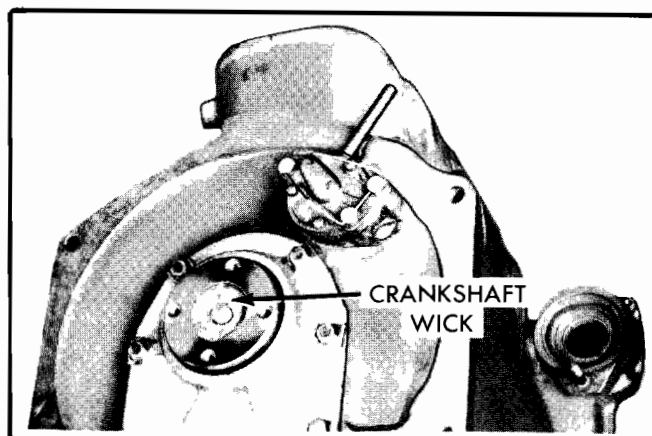
Tighten plugs in cylinder head to 25 foot lbs. To secure good plug life it is necessary that engine is properly timed, proper valve lash and carburetor adjusted.

The proper heat range for type of operation is very necessary. For heavy loads use a plug on the lower end of heat range, for light loads use a plug from the higher end of heat range.

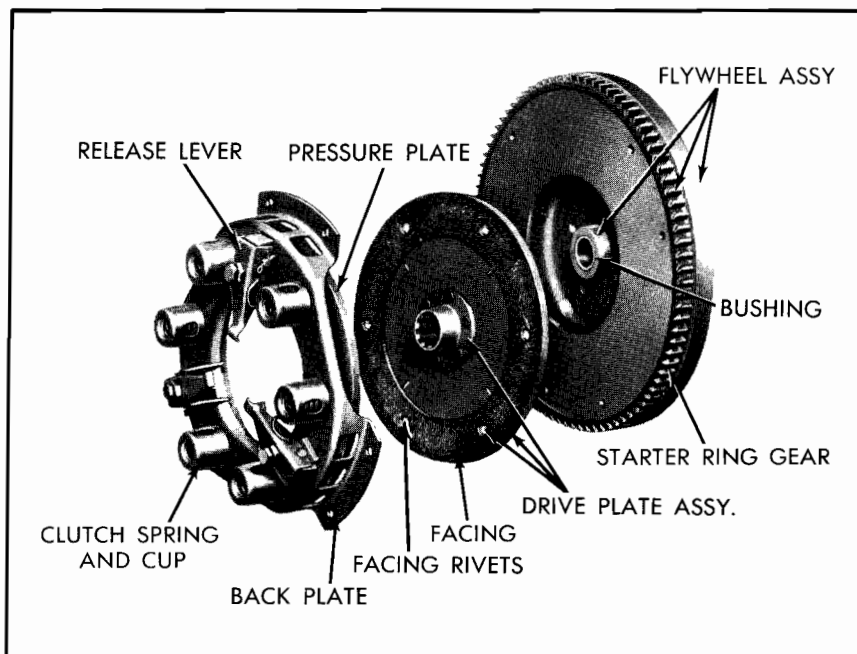


## CRANKSHAFT WICK

The oil wick lubricates the clutch shaft pilot bushing and must be adjusted to furnish the proper amount of oil. If excessive oil passes through wick, the wick must be packed tighter in crankshaft. To install a new wick in shaft it must be pushed into place from rear end of shaft. Never pull wick into place. The wick should be flush at front end of hole, and may protrude 1/8" at rear of shaft. If too much wick extends at rear of crankshaft it will cause pressure between clutch shaft and crankshaft and result in excessive wear of crankshaft bearing thrust flange, also will have a tendency to keep the clutch shaft turning with engine clutch released, making it difficult to shift gears.



## FLYWHEEL AND STARTER RING GEAR



### REMOVAL

Remove hood. Separate engine from torque tube and remove clutch assembly. Remove the four capscrews attaching flywheel to crankshaft.

### INSPECTION

Check pilot bushing for wear. If worn .006" or more it should be replaced. Check the starter ring gear teeth and replace if damaged. Check the flywheel clutch contact surface. If cracked or grooved it should be replaced. Check the oil drain passages at center of flywheel. This passage should contact at bottom of recess in order to drain thoroughly, if it does not,

use round file.

### ASSEMBLY

Press the clutch shaft pilot bushing into flywheel until flush with front side of flywheel. Check clutch shaft into bushing for proper fit. If bushing becomes distorted while pressing into flywheel it must be reamed to .879". Heat starter ring gear to approximately 400°F, and place into position on flywheel with the beveled ends of teeth toward clutch. Drive on to flywheel while hot until gear is seated all around. The flywheel can only be installed to the crankshaft in one position, due to offset holes. Tighten flywheel capscrews to 50 foot lbs. torque.

## CLUTCH

### REMOVAL

Remove hood and separate the engine from torque tube housing. Remove the six capscrews attaching the clutch to flywheel. Remove evenly turning each screw a small amount each time until they are removed. This will prevent distortion of the pressure plate and back plate.

The pressure plate assembly may be disassembled by compressing the pressure plate against the back plate by using three "C" clamps equally spaced. Loosen the release lever adjusting screws and remove the return spring and pivot pin. Remove the three "C" clamps turning each one an equal amount until loosened. The pressure springs and cups may now be removed. Press rivets from clutch disc and remove lining.

### INSPECTION

Check the pressure plate for cracks or warping. If warped .010" or more the plate should be replaced.

Check the clutch release levers for wear or flatness at clutch release bearing contact surface.

Check the clutch release bearing for wear or roughness and replace if necessary.

Check the release lever adjusting screw and seat for wear, replace if worn. Check the pressure springs for free length. If 1/16" or more shorter than a new spring they should be replaced. Replace in full sets.

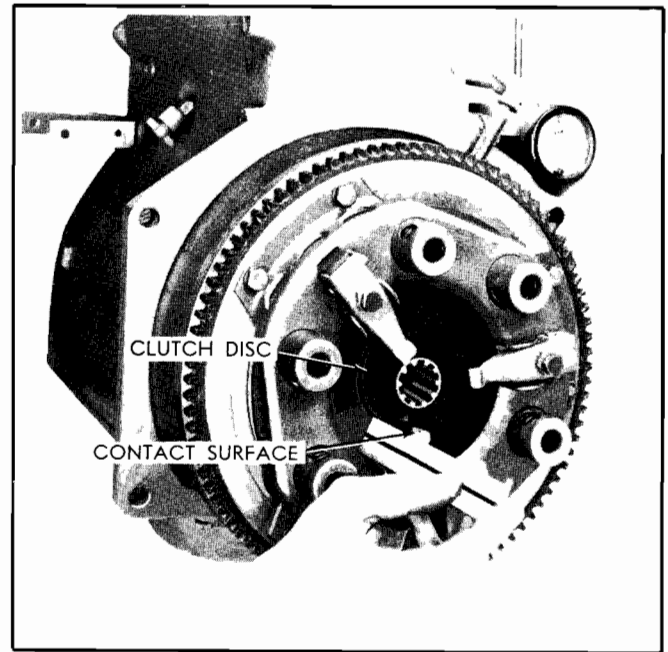
Check the clutch disc for loose rivets, worn or

oil soaked lining, broken dampener springs, cracked or bent clutch disc.

### ASSEMBLY

Before assembling clutch, place a small amount of oil on clutch pilot bushing in flywheel. Position clutch disc assembly in flywheel with the oil slinger toward flywheel. Use a piece of clutch shaft or clutch lining tool to align the clutch disc hub with pilot bushing in flywheel. Install pressure plate assembly, drawing the six capscrews up evenly.

Adjust clutch release levers until there is 1-1/2" from the dampener spring retainer to surface contacted by the release bearing. After engine is installed, adjust the clutch pedal rod until there is 1/4" clearance between the release bearing and release levers. Attach the clutch pedal return spring. With the clutch released or the pedal pushed forward, the pedal should strike the stop at the side of torque tube.



### AIR CLEANER

#### REMOVAL

Remove air cleaner stack cap. Loosen hose and clamps. Remove the two capscrews attaching cleaner body to engine block.

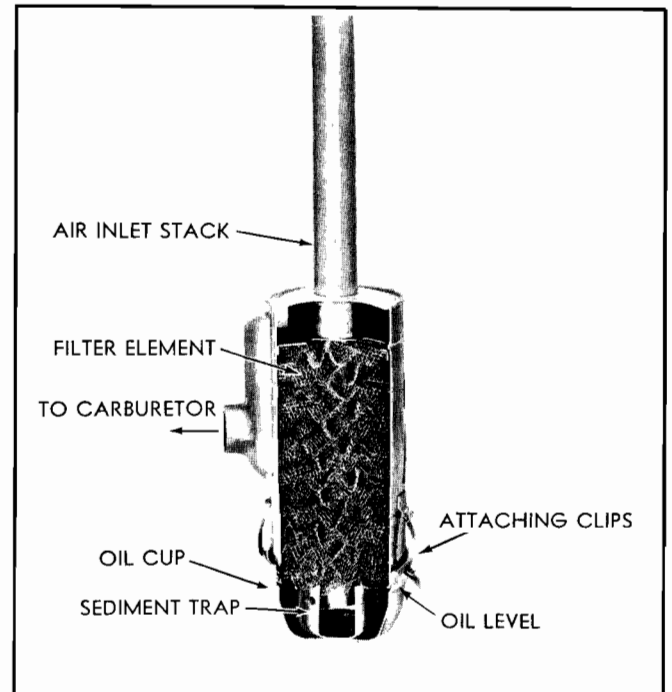
#### INSPECTION

Check cleaner for plugging with dirt or trash. Check for air leaks. Clean the center tube and cup. This should be done periodically. Back-wash the filter element thoroughly at least once a season, oftener if necessary. Check the hose and clamps, replace if damaged.

#### ASSEMBLY

Install air cleaner being sure hose connection is in good condition and shellaced in place.

The entrance of a small amount of dirt into engine will cause rapid wear. In checking the air cleaner, note the condition of the throttle shaft and choke shaft of carburetor. If shafts are loose in body, replace shafts with new packing. Dirt entering at worn throttle and choke shafts will defeat the purpose of the air cleaner.



Clean and refill oil cup daily. Oftener in extreme dusty conditions. Use the same viscosity oil in air cleaner cup as recommended for engine for the prevailing temperatures. Full cup to proper oil level.

## BATTERY

### REMOVAL

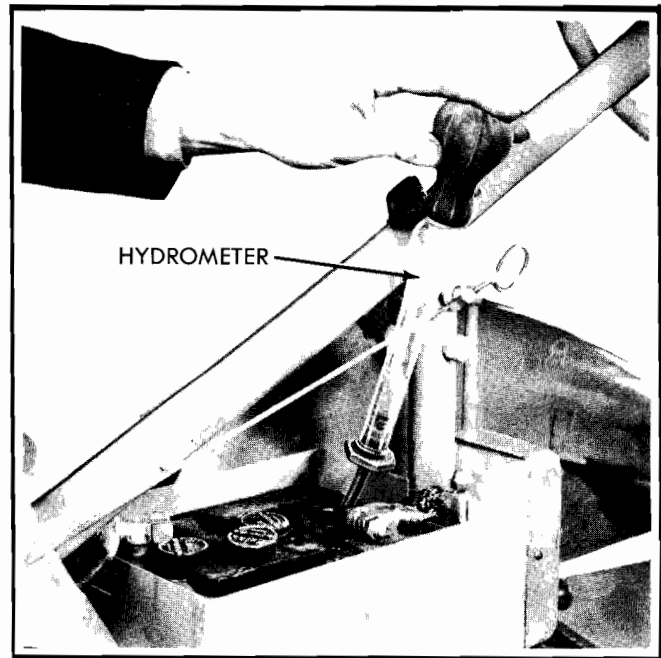
Remove the battery box cover and disconnect battery cables. The left hand side of battery box is also removable. Battery may now be removed from side of box.

To remove box, remove the four capscrews attaching battery box to torque tube.

The battery may be checked for gravity reading by the use of a battery hydrometer. A full charged battery should have a gravity reading of 1.270. When a battery is placed on a battery charger for several hours and fails to test as above, it indicates the battery is defective and should be replaced.

It is not practical to attempt to repair a battery, unless performed by a firm specializing in this business. Always install battery with the positive terminal to ground.

NOTE: Be sure that wood spacer is between top of battery and cover.



## GENERATOR

### REMOVAL

When working on the electrical system always disconnect battery ground strap.

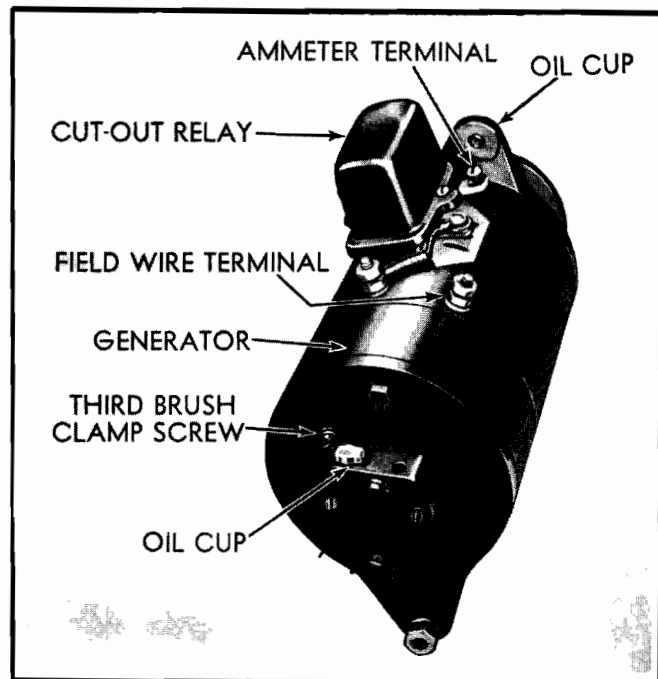
Disconnect wires from generator cutout and field terminal. Remove capscrew from generator brace and bolts attaching generator to mounting bracket.

Repairing of generator should be handled by an authorized service station.

Cleaning of the armature, or replacing worn brushes may be done by the average mechanic. Always clean armature with 00 sandpaper, never use emery cloth.

Check the operation of the generator before removing it from the tractor. If the generator fails to show charge at the ammeter, remove cover from cutout and run engine at high idle. If cutout points fail to close, force them together and notice if ammeter shows charge. If no charge is shown, replace cutout assembly. If cutout points fail to separate when the engine is stopped, replace cutout.

The generator is of the three brush type. The third brush is adjustable and is used to regulate the charging rate of the generator. Moving the brush in the direction of armature travel increases the charge rate. Movement in the opposite direction decreases the charging rate. The charge rate must always be adjusted with



engine at high idle speed.

The generator charge rate should be adjusted to three amperes with switch in the low charge position, and ten amperes in the full charge position. The Delco Remy generator has a clamp screw at rear of generator for locking the third brush in any desired position. This screw must be loosened when adjusting charge rate. The Auto-Lite generator has a spring controlled third brush and has no clamp screw.

## LIGHT SWITCH AND AMMETER

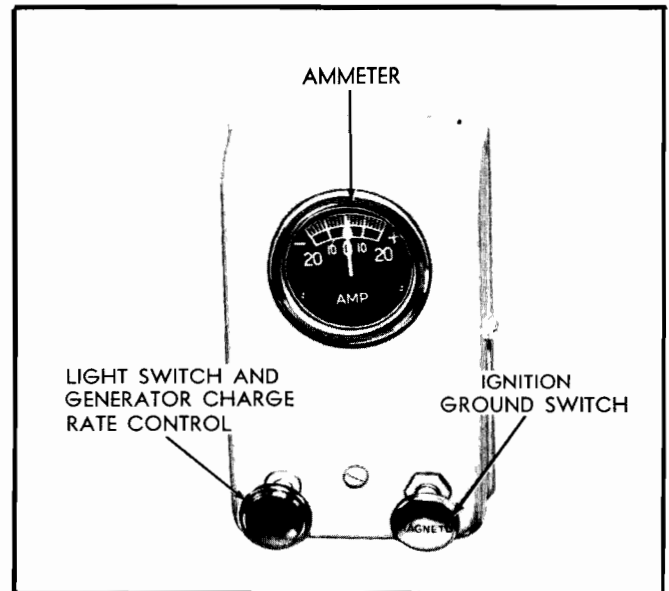
### REMOVAL

Always disconnect battery ground strap. Remove the two screws at sides of instrument box attaching the two halves together. Remove the wire cables from the ammeter terminals and from magneto ground switch or ignition switch terminal.

### INSPECTION

The light switch, ignition switch and ammeter are contained in the instrument box, and should be checked for any defects before removing. If the light circuit is found inoperative, check the fuse at light switch, also check for short circuit in light wiring. Replace light switch if found defective due to poor contact points. The light switch has a resistance unit which provides a means of reducing the charge rate of the generator by limiting the amount of electricity allowed to flow through the field coils of the generator.

If the generator is in good condition and the high charge rate cannot be obtained, it indicates the resistance unit contact points do not open. If the low charge rate cannot be obtained it



indicates the resistance unit contact points do not close or the winding is burnt out or broken.

### ASSEMBLY

For assembly see Wiring Diagram.

## STARTER

### REMOVAL

Disconnect the battery ground strap. Remove starter and ammeter cables from starter switch. Disconnect the starter rod from starter switch. Remove starter retaining setscrew and remove starter from torque tube. Remove starter switch from starting motor.

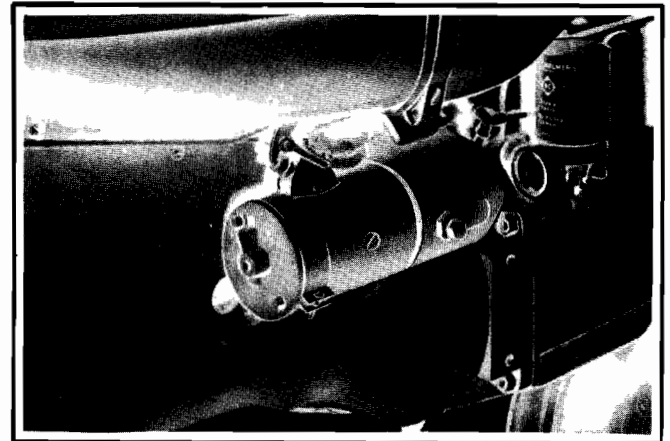
### INSPECTION

Check the starter switch contact points. Replace switch if necessary. The starting motor must be taken to an authorized repair station for repairing, unless the shop is thoroughly equipped for such work.

Check brushes for length, replace if worn short. Check armature bearings for wear. The front bushing can be replaced. To replace the rear bearing, replace rear cover plate. If bearings are worn excessively the armature will rub the pole pieces and these marks can be observed. Replace bendix drive spring if damaged or broken.

### ASSEMBLY

Wash out the screw threads on bendix drive with kerosene. Do not oil, but leave the kerosene as a lubricant.



If new brushes are installed, they should be fitted to commutator by placing a piece of "00" grade sand paper on commutator with the grit side towards brushes. Turn commutator until brushes acquire the same radius as commutator. Also clean commutator with the same grade sand paper when necessary. Do not use emery cloth as it will cause shorting of starter. Install the starting motor into torque tube housing and install retaining setscrew. Connect the starter cable and ammeter lead wire to the starter switch. Connect the starter switch control rod.

## FUEL TANK AND FUEL FILTER

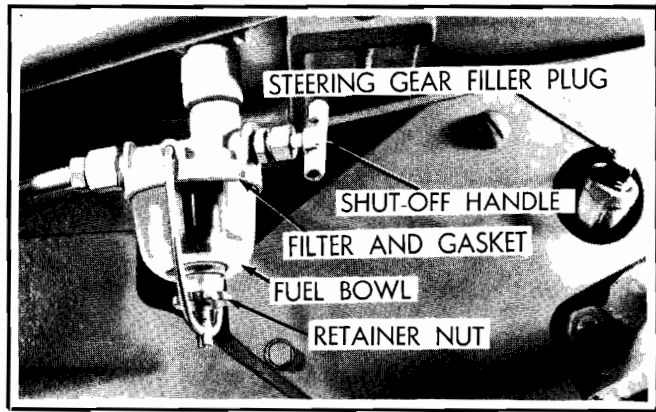
### REMOVAL

Shut off fuel and disconnect fuel line at filter. Remove the hood and bolt at rear of tank. Lift tank from tractor and drain fuel from tank. Remove filter assembly from fuel tank.

### INSPECTION

Check fuel tank for leaks. If tank leaks it should be replaced.

Soldering gasoline tanks is extremely dangerous and should only be attempted by one thoroughly familiar with this type of work and who can take the necessary precautionary measures to prevent an explosion. Check inside of tank for rust or sediment and clean if necessary. Check filter element, clean if dirty. Clean in warm soapy water using a small brush, let element thoroughly dry before using. It would be more convenient if customer has two elements, one to use while the other is being cleaned. If element has holes or is pulled away from retainer, it should be replaced. Check shut off valve for leakage and replace if necessary. Turning shut off valve out as far as possible, prevents leaking when valve is open. Check fuel tank cap gasket. If it does not seal properly



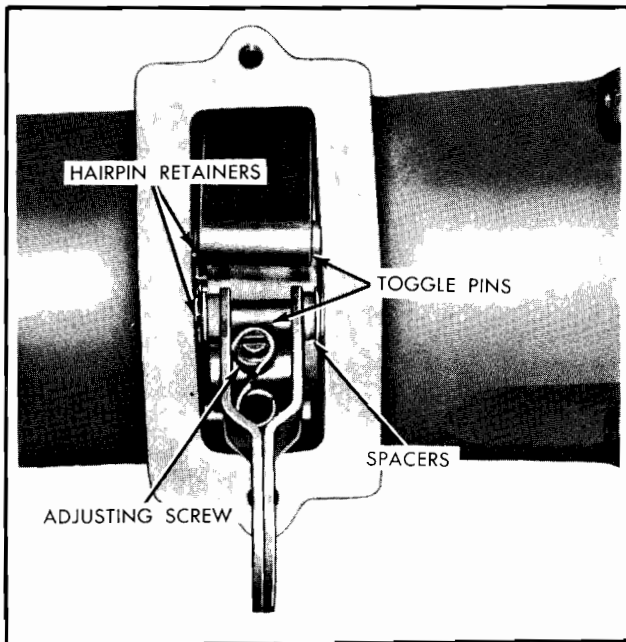
replace cap. The tank cap has a vent hole and it must be open.

### ASSEMBLY

Install filter element above the bowl gasket in filters with a short fuel inlet, and below the bowl gasket on filters with a long fuel inlet. Place the web side of element upward. Tighten filter into tank using sealer on threads.

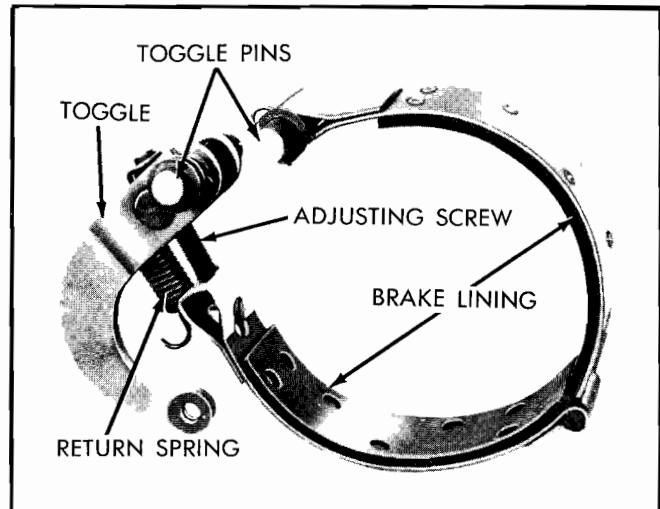
Place the packing strips under tank and between top of tank and hood. Install hood and tighten bolt at rear of tank. Connect fuel line to filter.

## BRAKES



### REMOVAL

Remove platform, wheel guards and support angles. Remove brake rods. Remove hair pin retainers from the toggle pins and remove pins. Remove the brake adjusting screw and toggle lever. The band can be removed by pulling on the front end of band, pulling up and



toward rear. If brake drum is to be replaced, remove final drive, remove setscrew from brake drum and pull drum from shaft.

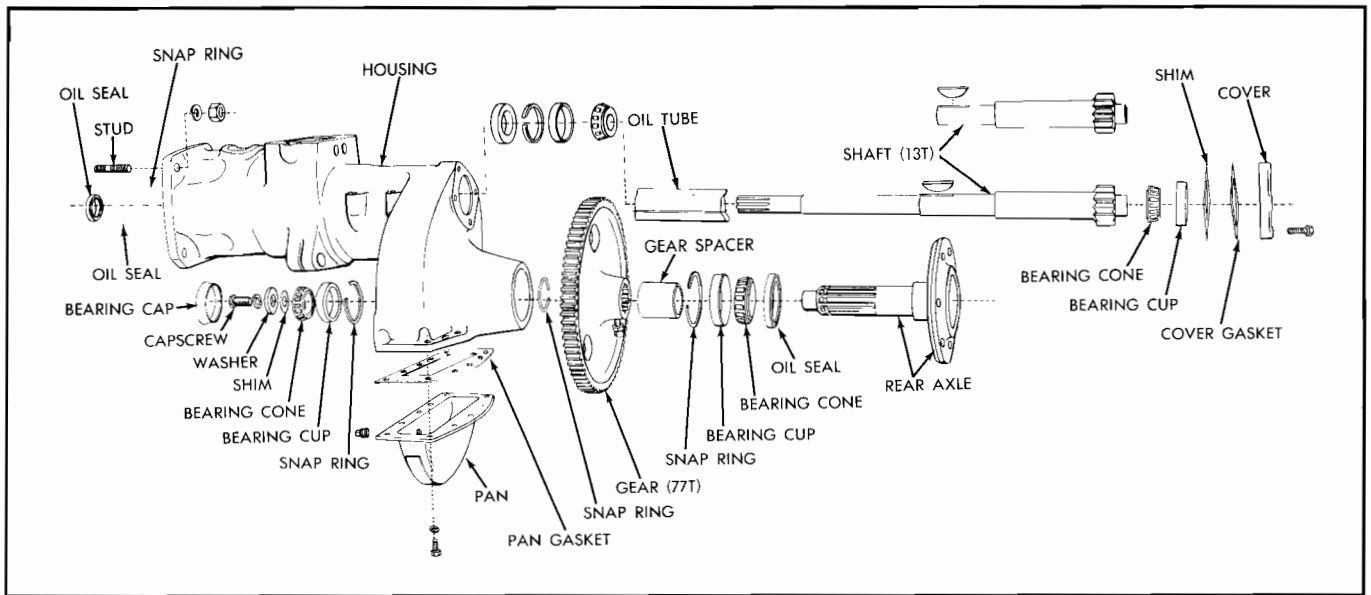
### ASSEMBLY

Install new lining or replace band assembly. Oil all pins and linkage but, do not allow oil to contact brake drum or lining.

Adjust brakes until the brake lock will just lock when the brake is applied. If adjusted too tight, it will not be possible to engage brake lock.



## FINAL DRIVE



### REMOVAL

Remove platform, wheel guards and support angles. Remove rear wheel. Remove the four nuts attaching final drive to differential housing. Use a chain hoist and attach to housing in such a manner that the housing will balance and slide away from tractor. The final drive ring gear can be removed from the housing without removing housing from tractor.

### DISASSEMBLY

Remove bearing cap from inner side of final drive housing. Remove capscrew, washer and shims from end of axle. Remove oil pan from bottom of housing. Remove snap ring from end of rear axle, and press or pull axle from housing. The ring gear can now be removed from housing.

Remove brake drum retaining setscrew and pull drum from shaft. Remove brake drum woodruff key. Remove pinion shaft outer bearing cover and shims. Pinion shaft may now be removed from outer end of housing by forcing shaft and bearing cup in that direction. The inner bearing cup may be pulled or driven from housing if replacement is necessary. It is not necessary to remove the bearing cup snap rings unless the housing is being replaced. Bearing cones may be pulled or pressed from shaft.

### INSPECTION

Check bearing cones and cups for wear or roughness. Check gear teeth for wear or chipping. Check brake drum for scoring or cracks. Check the splines on the shaft and gear hub. Replace all oil seals.

### ASSEMBLY

Install oil seal and bearing cup in housing. Install bearings on pinion shaft and enter shaft into place in housing, being careful not to damage oil seal. Install outer bearing cup and bearing retaining cover and adjust bearings to a free rolling fit without end play or binding by use of the proper number of shims and gaskets placed between bearing retaining cover and final drive housing. Use alternate metal shims and paper gaskets to prevent grease leakage. Paper gasket should be placed next to cover plate and housing. Use approximately the same number of shims and gaskets as were removed. If bearing adjustment is loose, remove shims. If adjustment is too tight, add shims.

Install brake drum key, brake drum and setscrew. Locate drum in center of opening at top of housing.

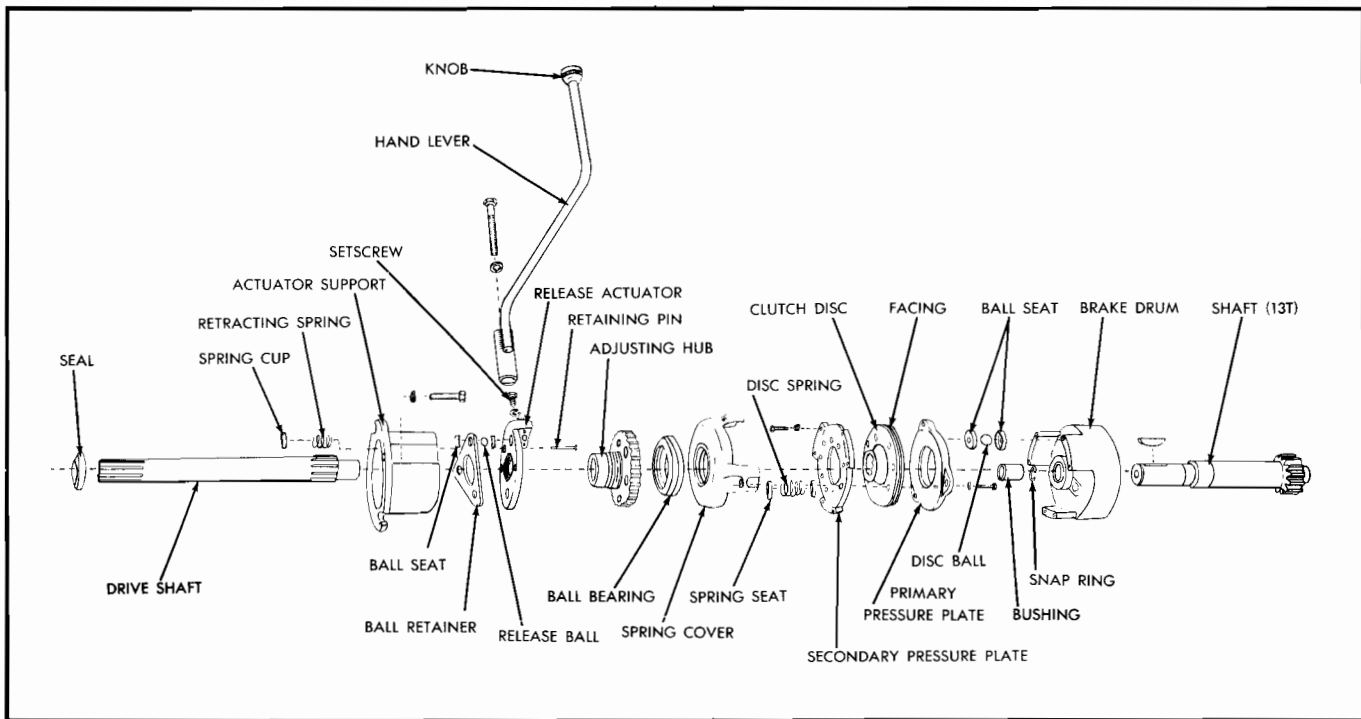
To assemble the axle shaft, install the outer bearing cup and bearing in housing and install oil seal using sealer at outer diameter of seal. Install seal with lip inward, or towards ring gear. Enter end of axle shaft into housing and install the gear spacer on shaft then place ring gear into housing with the long hub outward. Enter splines of shaft into gear hub. Install gear retaining snap ring on shaft. Push axle shaft into place and insert snap ring in place in groove on splines. Install the inner bearing cup and bearing, seating cup against snap ring. Install the proper number of shims to obtain the proper bearing adjustment. Add or remove shims until bearings have a free rolling fit without end play or binding. The capscrew must be tight.

Effective with tractor serial No. CA 17350 the

shim retaining washer is doweled to the end of the axle shaft to prevent loosening of the retaining capscrew. The axle oil seal and outer bearing may be installed on the axle shaft instead of housing by using a "U" shaped piece

of metal approximately 1/4" in thickness as a driver between seal and flange of axle, so when axle is pressed into place it will push oil seal in place in housing. As soon as the seal is flush with housing the driver must be removed.

### HAND CLUTCH



### REMOVAL

Remove platform, wheel guard, brake linkage and hand clutch lever. Remove final drive assembly. The clutch assembly will be removed with the final drive assembly and the clutch actuator and support will remain attached to the differential housing.

Remove the drive shaft from clutch and pull clutch from pinion shaft. The actuator and support may be removed from tractor by removing the two capscrews attaching it to the differential carrier.

### DISASSEMBLY

#### Release Actuator Assembly

Remove setscrew from release actuator. Turn the adjusting hub to the left until it is out of the actuator. The release bearing may be pulled from the adjusting hub. Hold the retaining pin tight in the actuator and press down on the spring cap and turn one fourth turn. Remove all three spring caps, springs and pins and the complete assembly may be separated, releasing the ball retainer, balls and seats.

### CLUTCH ASSEMBLY

Remove the three allen-head screws holding the two halves of the clutch together. Loosen evenly until the spring pressure is reduced. Remove the six remaining allen-head screws. After the two halves are separated, the pressure plate, springs, spring seats, balls and seats may be removed.

### INSPECTION

Check the self energizing balls and seats. Replace if worn, rusted or grooved. They should be replaced in sets. Check the acutator balls and seats in the same manner. If the balls and seats are uneven in dimensions it will cause uneven loading of clutch parts.

Check the pressure plate for warping. Check the clutch lining for wear. Replace if worn. Check the pressure springs for length, their free length is 1-1/4". Replace if 3/32" short or uneven. Check the splines for wear on the axle drive shaft and clutch disc hub. Replace if excessively loose. Check bushing in drum assembly for wear. This bushing pilots the axle drive shaft and must be replaced if wear exceeds .012" or more. This bushing is located by a snap ring in brake drum hub.

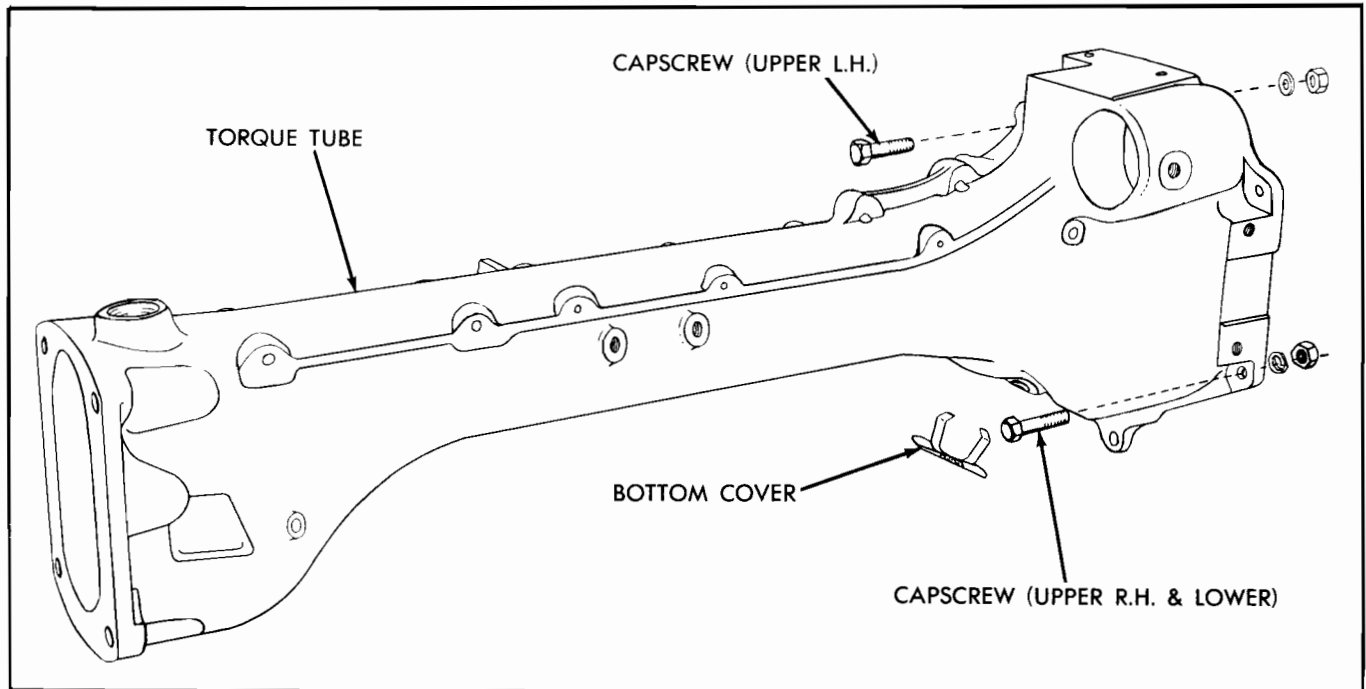
## ASSEMBLY

Assemble the clutch disc assembly with the long hub toward the differential. Assemble the clutch release mechanism so the lever position will be forward of the center line of axle shaft. This may be determined by the two notches in the release actuator support which must fit over the two capscrews in the differential bearing carrier. Turn hub of the release actuator in as far as possible to give the most possible release bearing clearance.

If clutch is partially compressed when assembled, it will be difficult to adjust clutch. Assemble clutch assembly in final drive and actuator assembly on differential bearing carrier and bolt final drive in place.

Attach release lever to actuator. Adjust the release bearing clearance by turning release actuator hub to the left until there is .055" clearance between release bearing and clutch cover and install the setscrew locking actuator in position.

## TORQUE TUBE AND CLUTCH SHAFT



## REMOVAL

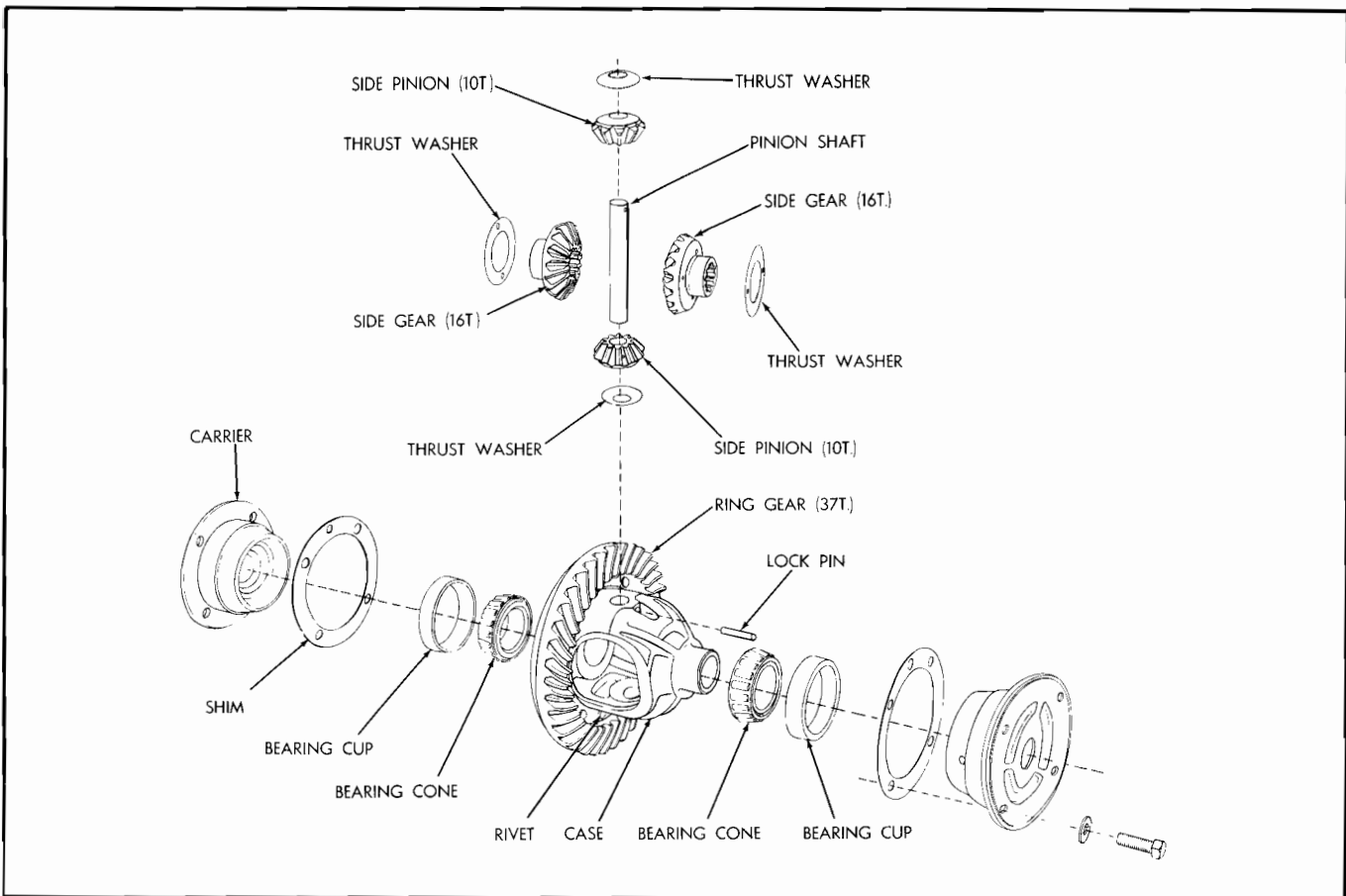
To remove torque tube assembly from tractor, remove engine, fuel tank and tank support, steering gear and battery box. Remove nuts attaching torque tube to transmission housing. To remove clutch shaft, remove cotter pin from shaft sleeve at front of transmission. Check clutch shaft for wear at splines at each end, and check shaft for alignment. When installing

shaft always replace cotter pin in coupling.

## INSPECTION

Check the clutch shifter tube. It must be tight in housing, and should measure 5-1/2" from end of tube to housing. Check the radius rod bushing on adjustable front axle equipped tractors for wear, replace if bushing is worn .010" or more.

## DIFFERENTIAL



### REMOVAL

Remove platform and power take off assembly. Support tractor and remove both final drive assemblies. Remove both bearing carriers from each side of housing keeping the shims with each carrier. Mark each carrier for identification as to right or left side as this will aid in bearing adjustment during assembly. Remove the differential assembly from rear of housing. Remove lock pin and drive the pinion pin from case. Drive the lock pin out from ring gear side of case using a 3/16" pin punch.

Roll pinions around and remove pinions and thrust washers from opening in case. The side gears and thrust washers may now be removed. Pull bearing cones from differential case. Remove oil seal and bearing cup from carrier.

If the ring gear has to be replaced the rivets must be cut off and driven out.

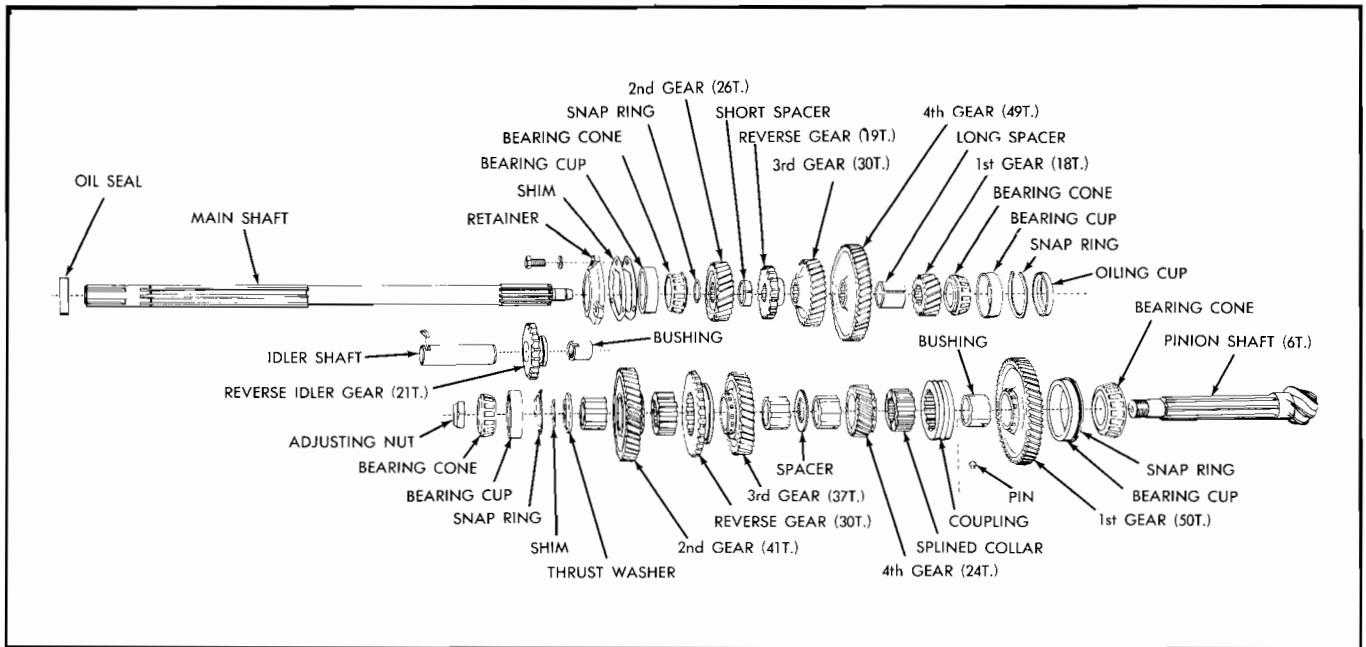
### INSPECTION

Inspect gear teeth for wear or chipping. Check the thrust surfaces for wear or scoring. Check thrust washers for wear or scoring. Check bearing cones and cups for wear, chipping or roughness. Check bevel pinions and shaft for wear or scoring. Use new oil seals.

### ASSEMBLY

Install ring gear to the case. Bolts have been made available for installing ring gear in the field. Install side gears and thrust washers in case. Install side pinions and thrust washers and roll them around until in line with the pinion shaft hole. Install pinion shaft and lock pin. Peen the edge of hole to retain lock pin. Install bearing cones and place the assembly into differential housing with the ring gear to the left hand side of tractor. With cups and new oil seals installed in the bearing carriers, install them in place on the same side from which they were removed, using the same shims. This will aid greatly in obtaining bearing and ring gear adjustment. Use sealer on shims to prevent grease leakage. Shims are furnished in .004" and .011" thicknesses. Adjust bearings by removing or adding shims until bearings have a free rolling fit without end play or binding. Adjust ring gear and pinion back lash from .004" to .018". This means checking the amount of backlash in several positions, and the closest position not less than .004" and at the widest position not more than .018" back lash. If back lash is too great, remove shim from the ring gear side and install it on the opposite side, if back lash is too tight remove shim from opposite ring gear side and install it on the ring gear side. This method will obtain proper back lash while maintaining the bearing adjustment.

## TRANSMISSION



### REMOVAL

Drain the oil from transmission and differential. Remove seat, platform and brake linkage. Remove rear wheels and final drives. Remove hydraulic pump hoses, belt pulley and P.T.O. assembly. Remove the four nuts attaching transmission to the torque tube housing and separate the transmission from torque tube.

### DISASSEMBLY

Remove cotter pin from clutch shaft coupling and remove clutch shaft from main transmission shaft. Remove differential carriers, keeping their original shims with each carrier and identify the carrier as to which side it was removed. This will simplify bearing and pinion adjustment during reassembly. Remove differential assembly from housing.

Remove gear shift lever dust cover, snap ring, and lever retaining washer, and pull lever from housing. Remove shifter cover assembly. Remove snap ring and belt pulley drive gear from rear end of main shaft. Remove bearing retainer from front of main shaft. Pull shaft from front of housing, and remove gears through the shifter assembly opening. Remove cover from the front pinion shaft bearing and remove nut from the pinion shaft. Push the shaft to the rear and remove gears through shifter assembly opening. Drive the reverse gear shaft toward front of housing and remove the reverse shift gear. The shaft is retained in the housing with a woodruff key.

### INSPECTION

Check bearings for wear and roughness. Check

gear teeth for wear and chipping. Check shafts for alignment. Check shaft and gear splines for wear or looseness. Check the spacer washers for wear or scoring. Check pinion shaft gear bushings for wear or scoring. Check the bushing retaining pins for wear or looseness.

### ASSEMBLY

(Pinion Shaft - Serial No. CA 13270 & Up)

The pinion shaft and gears on tractors prior to Serial No. CA 13270 is assembled in the same manner as outlined for later tractors with the exception that all four gear bushings and the two splined shift collars are alike, where in later transmissions they have different dimensions.

Assemble rear bearing cone on shaft with small end forward. Install bearing cup in transmission case using a snap ring of the same thickness as the one removed or use old snap ring. This snap ring controls the heel or toe lead of pinion in rear gear. Test with mechanics "blue", giving a very slight toe lead. Enter pinion shaft into rear of case and install low speed gear bushing (1-3/16" wide) with the retaining pin to front and entered into one of the splines. The pin may be retained to bushing by peening or swelling end of pin with center punch.

Install low speed gear (50 teeth) over bushing with clutch jaws forward. Place shifter collar (splined 7/8" wide) on shaft and shifter coupling (13/16" wide) over splined collar with shift fork groove towards the rear. Place the fourth speed gear bushing (1-3/16" wide) with pin on shaft. Place the fourth speed gear (24 teeth) over bushing with clutch jaws towards the rear.

Place splined spacer washer on shaft.

The low and fourth speed gears and bushings are 1-3/16" wide. The second and third speed gears and bushings are 1-1/8" wide. Place the third speed gear bushing (1-1/8" wide) with pin on shaft. Place third speed gear (37 teeth) over bushing with the clutch jaws forward. Place the splined shifter collar (1" wide) on shaft. Place the shifter gear (30 teeth) over shifter collar with the shift fork groove towards the rear.

Place the second speed gear (41 teeth) with its bushing (1-1/8" wide) and retaining pin in place with clutch jaws towards the rear and enter shaft through gear. Place the retaining washer on shaft with large diameter towards rear and place the proper amount of shims .003" and .005" on shaft. Install bearing, and retaining nut and tighten nut securely. This will cause the bushings, splined shifter collars and bearings to form a solid stack. If too many shims are used the bearings will be loose with the nut tight. If not enough shims are used, the bearings will be too tight or the bushings will be loose on shaft, with the nut tight. Never adjust bearings by loosening nut to obtain bearing adjustment. When proper adjustment is obtained by using the right amount of shims, the nut will be tight forming a solid stack on shaft and at the same time obtain a free rolling fit of bearings without end play or binding. When the proper adjustment is obtained lock nut securely.

#### MAIN SHAFT

Place the rear bearing cup in housing with the large end forward, making sure the cup is seated against the retaining snap ring. Drive the oil cup in place with the cupped side forward. Place snap ring on front end of main shaft and place the bearing cone on front end of shaft with the taper toward the front and press against snap ring. Two methods of installing gears and shaft are outlined below.

FIRST: Place the second speed gear (26 teeth) in housing with the flat side toward the rear, and

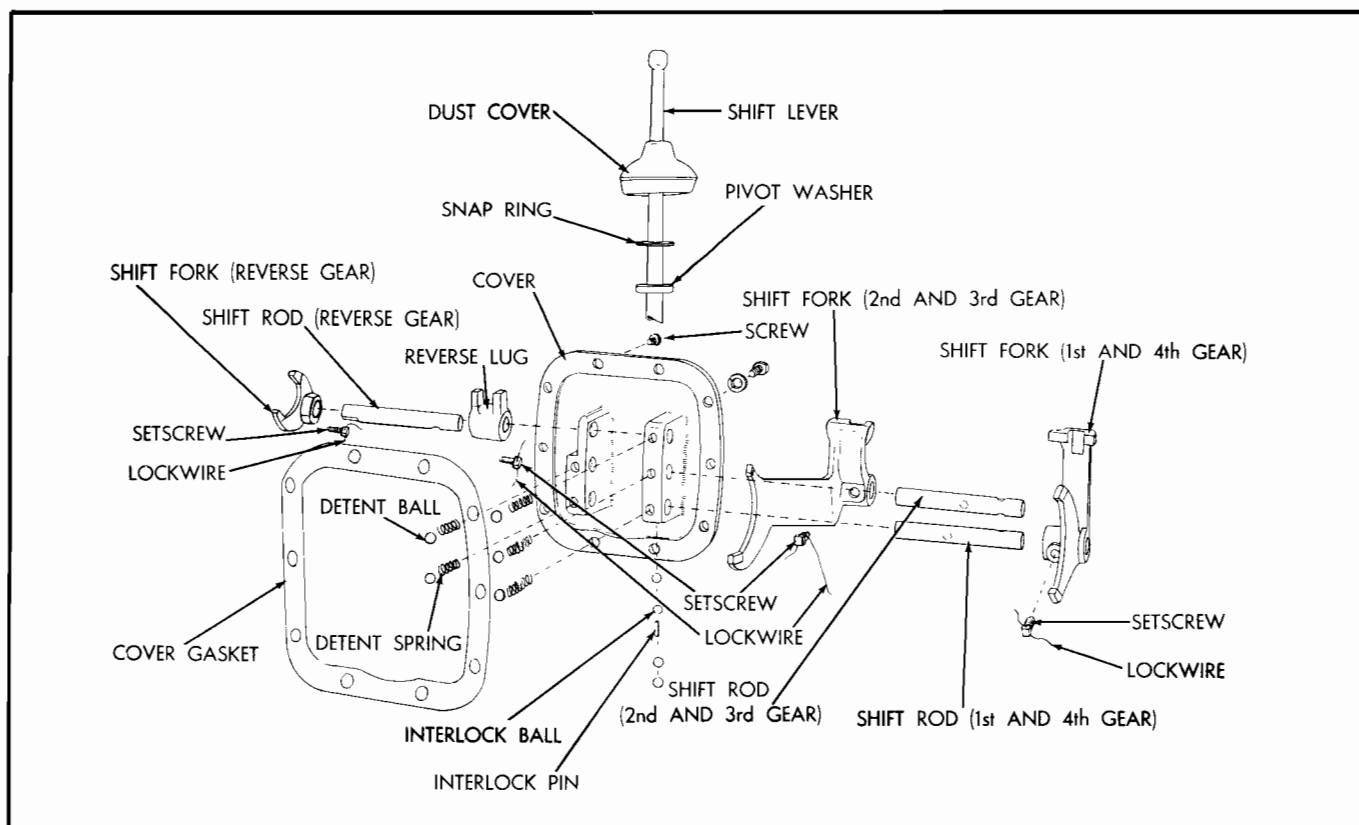
enter shaft from front of housing and place the short spacer on shaft. Place the reverse gear (19 teeth) on shaft with long side of hub towards the rear. Place the third speed gear (30 teeth) on shaft with the long hub forward. Place the fourth speed gear (49 teeth) on shaft with the long hub towards the rear.

Place the rear bearing cone in position in cup. Place the low speed gear (18 teeth) next to bearing cone. Place the long spacer between the low speed gear and fourth speed gear, and push the main shaft into position.

SECOND: With housing setting upright on table or bench (front of housing upward) stack the gears, bearings and spacers in housing in the following manner: Place rear bearing cone into bearing cup, stack first speed gear on top of bearing cone. Stack long spacer on top of first speed gear. Place fourth speed gear on top of spacer with long hub towards the rear (or downward) meshing teeth with mating gear. Place third speed gear on top of fourth speed gear with long hub forward, meshing teeth with mating gear. Place reverse gear on top of third speed gear with long hub towards the rear (or downward). Stack short spacer on top of reverse gear. Place second speed gear on top of short spacer with the flat side towards the rear (or downward). Enter shaft from front (or top) of housing and work shaft downward through the stack of gears, spacers (etc.) into position in the housing.

Install the front bearing retainer, using enough shims to obtain proper bearing adjustment with a free rolling fit without end play or binding. Install oil seal with lip toward housing. To protect seal lip from being cut by splines use a wrap of oiled paper over splined end of shaft. Install the P.T.O. sliding (or shifter) gear on the rear end of main shaft with the shifter collar forward. Install the gear retaining snap ring. Place the woodruff key in the reverse gear shaft, and press shaft into front of housing. The key must align with recess in housing. Place the reverse idler gear assembly on shaft with the shift fork groove towards the rear.

## SHIFTER ASSEMBLY



### REMOVAL

Remove gear shift lever dust cover. Remove snap ring and lever retaining washer and pull lever from transmission case. Remove screws attaching cover assembly to transmission housing and remove the shifter assembly. Remove the lock wires and setscrews from the shifter forks. Push shifter rails out of the forks. Be sure to catch the interlock balls, pin, detent balls and springs. There are four detent balls and five detent springs. There are four interlock balls and one interlock pin. The reverse shift rail has one detent ball and spring. The low and fourth shift rail, and the second and third shift rail have two detent balls and two springs for each rail. One located at each end of rail. There are two interlock balls between each of the two rails. The interlock pin enters through the center rail. Do not lose these parts when disassembling. Late style shift rails have a special shaped detent notch to prevent over shifting. To remove rail, rotate one fourth turn to dislocate detent notch with detent ball.

### INSPECTION

Check shift rails for wear at detent notches and notches for interlock balls. Check shift forks for wear. Check length of interlock pin. Pin should be .546" long. If pin is too short it may allow two rails to be shifted at the same time.

### ASSEMBLY

Install the reverse rail first in the top position. It may be identified by the detent ball notch which is on rear end of rail only.

Depress detent ball and spring with a small punch. (A special tool is available for this purpose.) Push shaft into place and remove punch at the same time. Install the shaft lug and fork in position on rail.

Turn the assembly upside down and drop two interlocking balls into place. Install the second and third shift rail, placing the interlock pin in hole in rail. Place the second and third shift fork on shift rail with the fork forward and the shift lever pocket upward.

The second and third shift rail and the low and fourth shift rail both have the same number of detent notches. The second and third rail has the hole for the interlock pin and is placed in the center position, using a detent ball and spring at each end of shaft.

Place two more interlock balls in position so they will lie between the second and third rail and the low and fourth shift rail. Install the low and fourth rail with a detent ball and spring at each end. Placing the low and fourth shift fork on rail with the fork toward the rear and

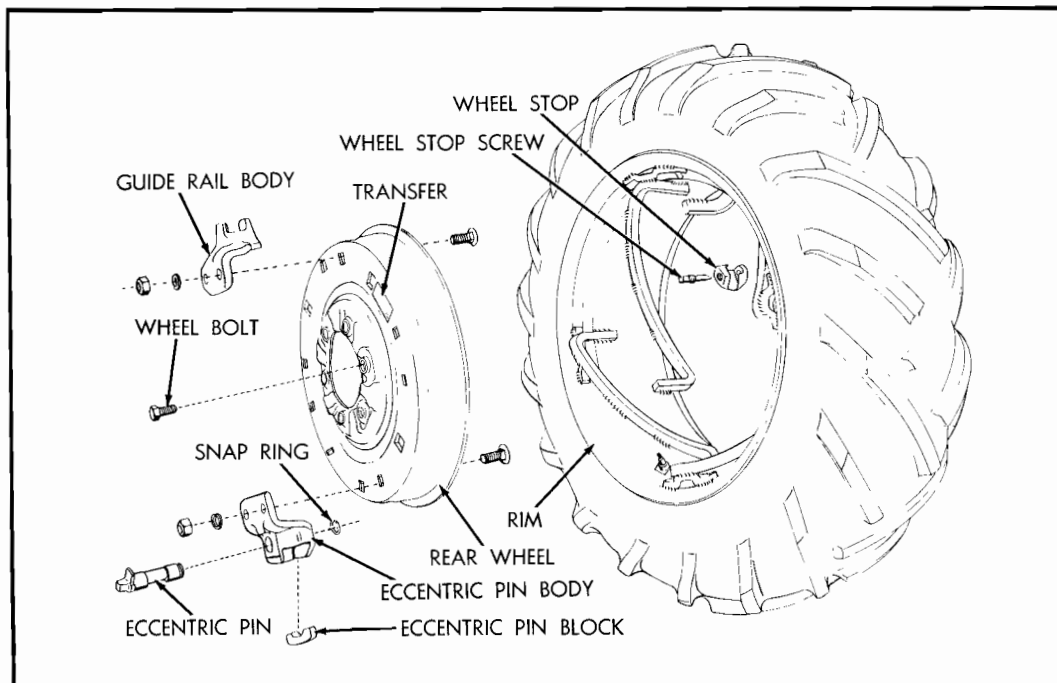
the shift lever pocket upward. Tighten all setscrews securely and lock with wire, tying wire in position so that it does not interfere with the shift mechanism.

To check the interlocking device, place any one of the rails in an "in gear" position. Bump one of the other forks sharply with the heel of the hand. If this rail remains in the neutral position

under normal force the interlock is functioning properly. When installing the assembly on the transmission be sure the shift forks enter the grooves in the shifter couplings.

When installing the latest type second and third shift fork on tractors prior to CA 13270 use one over-shift washer between fork and cover to prevent over shifting.

### REAR WHEEL



### REMOVAL

Raise tractor from floor and block securely, when using hoist attached to final drive housing. Remove the two wheel stops from one of the rim rails. Turn all eccentric pins to the left as far as possible. Turn the wheel until the rail guide bracket without the eccentric pin, is at the top. Remove bolts from the three remaining brackets and slide out along the rail. The tire and rim assembly may now be lifted from the remaining bracket. If hoist is attached, lower hoist slightly until the rail guide clears the rail and roll tire and rim away from tractor. Remove the capscrews from wheel hub and lift wheel from tractor.

### INSPECTION

Check eccentric pins and blocks for wear. They must be able to hold the rails firmly. Check rail guide brackets for wear at point contacted by rail. Brackets are about 1/16" wider than rail. Check rails for wear.

If the wheel wobbles or does not run true, check axle flange, wheel, rim assembly and tire for

run out to find which piece is in error. Tires sometimes have run out due to incorrect forming in the mold. Wobble can sometimes be corrected by adjusting wheels until they are tight against the stops so that rails are against the side of the slot in bracket. Three eights of an inch wobble is permissible.

### ASSEMBLY

Install wheel to axle flange and tighten capscrews evenly to 50 ft. lbs. torque. Install rail guide without the eccentric pin and turn to top of wheel. Place rim and tire in position with the rail and with stop lug holes at the top and locate rail to rail guide. Slide the other rail guides into place and tighten bolts securely.

Adjust wheel tread several times from one extreme to the other and install rail stops at the desired tread position. Turn the eccentrics to the right to lock wheel tightly to the rim. Tighten one at a time until as many as possible are tight. If they cannot be turned fully to the right, turn back to the left, they must be fully tightened or fully loosened to be self locking. They will not lock in the intermediate positions.



## SEAT

### REMOVAL

Remove bolt attaching seat bucket to seat bar. Remove bolt from the upper shock absorber anchor. Remove bolt from front end of seat bar. Remove P.T.O. shield. Remove bolt from lower shock absorber anchor. Depress shock spring retainer and turn one quarter turn to remove retainer and spring. The shock absorber is not repairable.

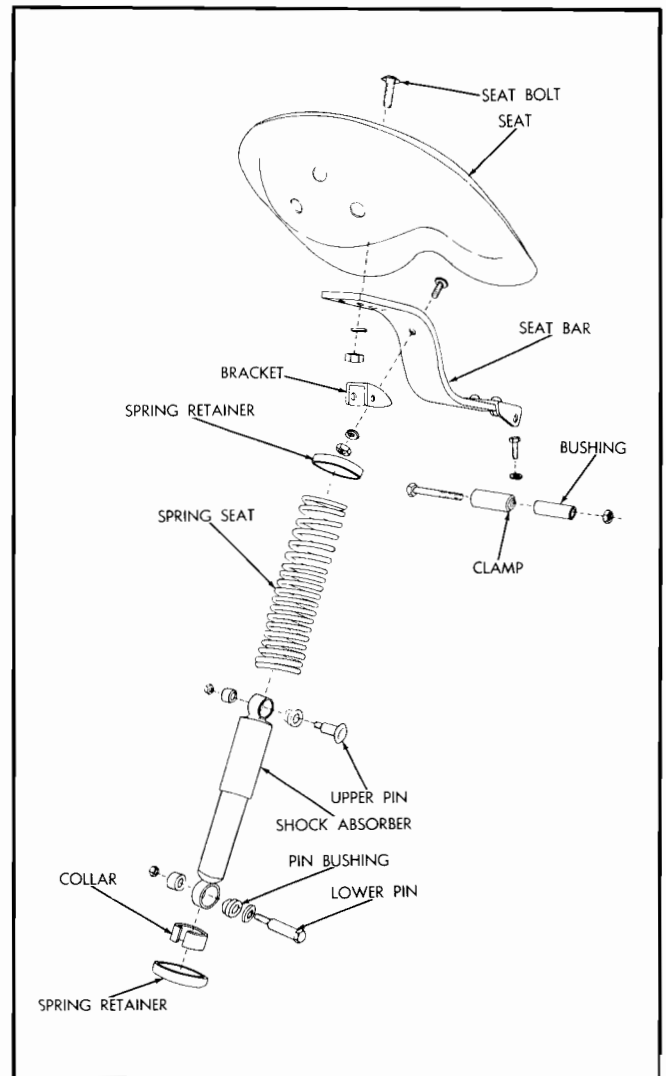
### INSPECTION

Check the rubber bushings in shock absorber and seat bar pivot for wear or deterioration. Replace if necessary. Replace shock absorber assembly if found ineffective.

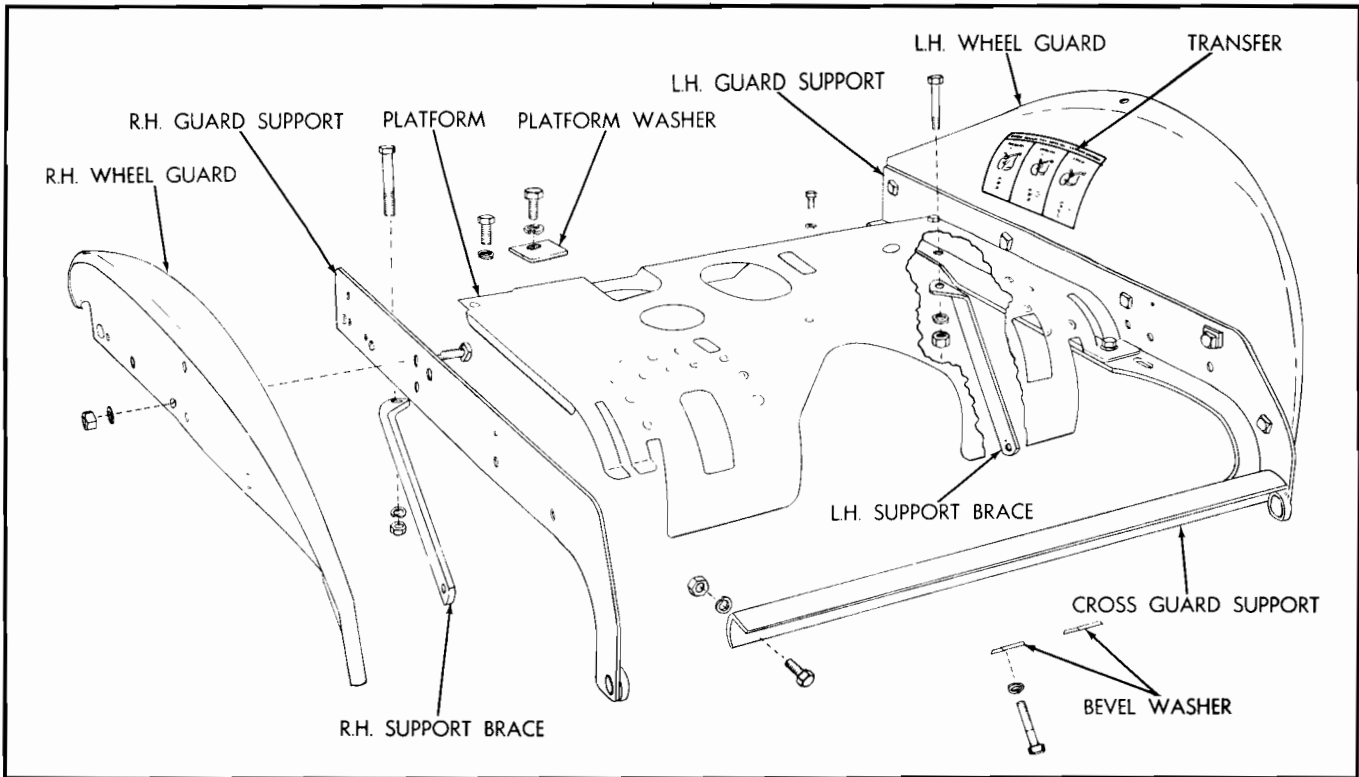
### ASSEMBLY

Assemble recoil spring to shock absorber and place in position on the P.T.O. housing with a rubber bushing on each side with the tapered ends inward. Install bolt and tighten nut. Install seat bar, bushing and clamp and bolt in position. Do not draw nut too tight as it will cause a bind in seat bar. Tighten just enough to remove looseness and side play.

Attach upper end of shock absorber to seat bar, using rubber bushings and bolt. Install seat bucket to seat bar and tighten bolt. It sometimes helps to use a heavy soap solution to lubricate bolts and rubber bushings for easy assembly. The seat bucket has three positions for adjusting to operator's comfort. The upper shock absorber anchor bracket may be turned towards the rear or towards the front. The front position gives the softest ride and is generally used by light weight operators. The rear position gives the stiffest ride and is generally used by the heavier operators.



## PLATFORM



### REMOVAL

Remove capscrews attaching remote ram line to platform. Remove bolts and capscrews attaching platform to the fender angles. The two nuts under the brake levers need only be

loosened, since platform is slotted at this point. Remove hydraulic pump control lever quadrant and bracket. Remove hand clutch lever. Remove the seat or at least remove the bolt from top of seat shock absorber. Move platform rearward until free from capscrews under brake levers then lift up and away from tractor.

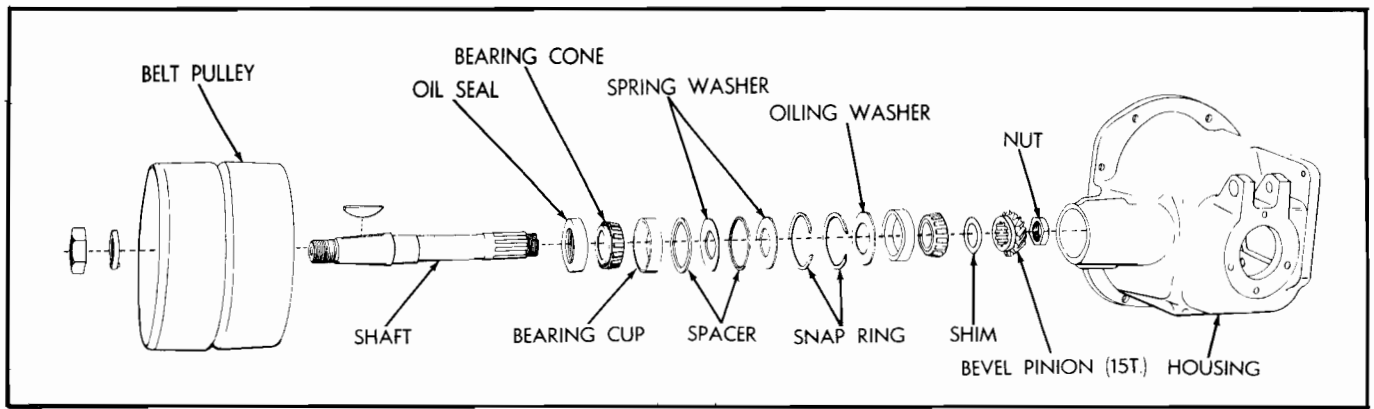
## WHEEL GUARDS

### REMOVAL

Remove platform, lift shaft support brackets and the brake link rods. Remove the capscrews attaching wheel guard angles to final drives.

Remove bolts from the front support angle, spread guard angles slightly and drop brake pedal shaft assembly out of brackets. Lift wheel guards from tractor.

## BELT PULLEY



### REMOVAL

Drain the oil from transmission and hydraulic pump compartment. Drain plugs are located at bottom of transmission housing, and power take-off housing. Remove the hand clutch lever. Remove hydraulic lever quadrant. Remove bolts from the lift shaft support brackets and remove lift shaft assembly. Remove seat and platform. Remove hydraulic line and hose from pump. Remove nuts and capscrews attaching hydraulic pump to P.T.O. housing. Remove nut and capscrews attaching P.T.O. and pulley assembly to differential case. Remove P.T.O. housing by moving rearward enough to clear stud at top of housing, then move housing to the right enough to disengage shifter from groove in sliding gear.

### DISASSEMBLY

Remove the four capscrews attaching the rear bearing retainer to P.T.O. housing. Use a suitable puller and push the P.T.O. shaft from the driven gear. The shaft bearings and gear may now be removed from the case. Remove the nut from the inner end of belt pulley shaft. Drive or pull shaft from housing.

Remove the belt pulley retaining nut from end of pulley shaft and pull or press pulley from shaft. The bearing cone and oil seal may be removed from shaft. Remove bearing cups from housing.

Remove the lockwire and setscrew from the shift finger, and remove shift finger from shift lever. Use caution not to loose the shift detent ball and spring while removing the shift finger. Remove shift lever assembly from case. The oil tube for oiling the drive shaft rear bearing need not be removed. The bearing assembly is retained in housing by use of snap ring.

### INSPECTION

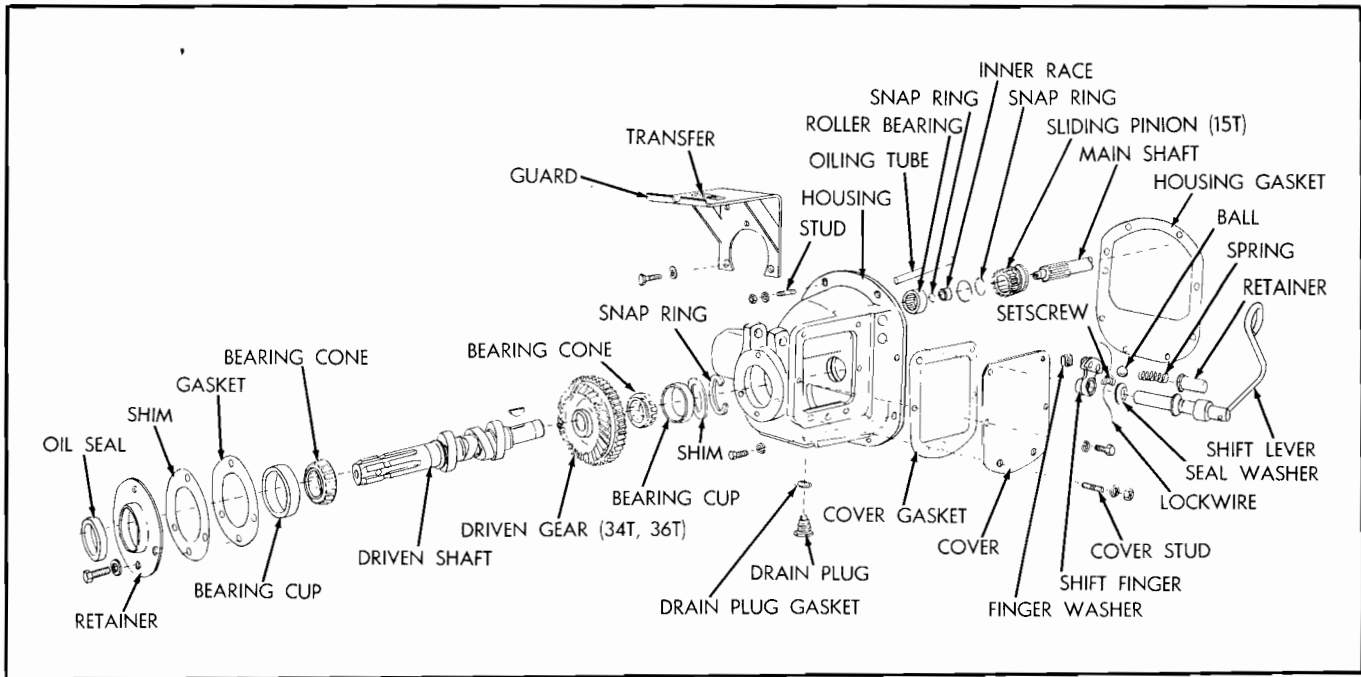
Check bearing for wear or roughness. Check gears for wear, chipped or broken teeth. Check the splines and gear for wear or looseness. Check woodruff key and keyway for wear or

looseness. Check shaft for wear or scuffing. Always use new oil seals when assembling.

### ASSEMBLY - Belt Pulley Shaft

The belt pulley shaft has two Belville spring washers and two special spacers to allow a drag on the shaft to prevent gear rattle. They are installed on shaft between the outer bearing cup and retaining snap ring. Later belt pulley assemblies do not contain the two special spacers and Belville spring washers and the outer bearing cup retaining snap ring has been relocated. All assemblies dismantled containing these special spacers and spring washers must have them reinstalled upon assembly. If a later assembly is dismantled that does not contain these special spacers and Belville spring washers they can not be installed. Install bearing retaining snap rings in housing. Install inner bearing cup placing washer between cup and retaining cup snap ring. Next to the outer bearing retaining snap ring, place a Belville spring washer with the cupped side toward snap ring. Next place one of the special spacers, and the second Belville spring washer with the cupped side in the opposite direction or the two convex sides together. Place the second special spacer in place, then install the outer bearing cup in place with the cupped side outward. Install the oil seal and outer bearing cone on shaft with the taper inward. Place shaft into housing and install the inner bearing cone, bevel pinion and adjusting nut. Shims are used between the bearing and pinion to obtain the proper gear teeth contact and back lash clearance.

To adjust the pulley shaft bearings, tighten adjusting nut tight then back off 1/20 of a turn. If adjusting nut is left too loose the pinion can pull into the drive gear and cause gear teeth failure, bearing failure, shaft failure or noise. If adjusted too tight will preload bearings too much. The preload on shaft with new parts should be 14 in. lbs. With old parts (polished bearings) 7 to 10 inch lbs. When proper adjustment is obtained lock nut securely.



### ASSEMBLY - P.T.O. Shaft

Install the inner bearing cup retaining snap ring and bearing cup. Shims are used between cup and snap ring to properly locate the driven gear in order to obtain tooth contact and back lash clearance with the pulley shaft pinion gear. These shims should be replaced in the same quantity as were removed when installing new bearings or gears. When replacing a new housing they should be used to secure a gear mesh with the contact of teeth as near the center of tooth as possible on both gears. Install the outer bearing cone on shaft with tapered end outward. Enter the shaft at rear of case with Woodruff key in shaft. Place the

driven gear in position in housing with the inner bearing cone in place, line up key in shaft with key way in gear and press shaft into place. Install outer bearing cup with the larger diameter toward bearing cone. Install oil seal in rear bearing retainer with lip toward oil supply. Install the bearing retainer using enough steel and paper shims alternately to obtain a bearing adjustment of a free rolling fit without end play or binding. Use shims in approximately the same number that was removed, then add or remove till proper bearing adjustment is obtained. The proper back lash between the belt pulley drive and driven gears should be .004" to .005".

### STEERING GEAR

#### REMOVAL

Remove hood, fuel tank and shroud assembly. Remove steering wheel and woodruff key from shaft. Remove clamp at upper end of steering column support and tube assembly. Remove steering arm retaining nut and pull arm from shaft. Remove the two capscrews from steering housing bracket and remove bracket. Remove the two bolts attaching steering housing to torque tube and lift assembly from tractor. Remove clamp from lower end of column tube and slide tube from steering shaft. Remove the four capscrews from the housing cover and remove cover. Slide lever shaft assembly from housing. Remove the capscrews attaching the upper cover to steering gear housing and slide cover over column shaft. Remove worm assembly and bearings from housing. Remove snap ring at each end of the worm gear and remove

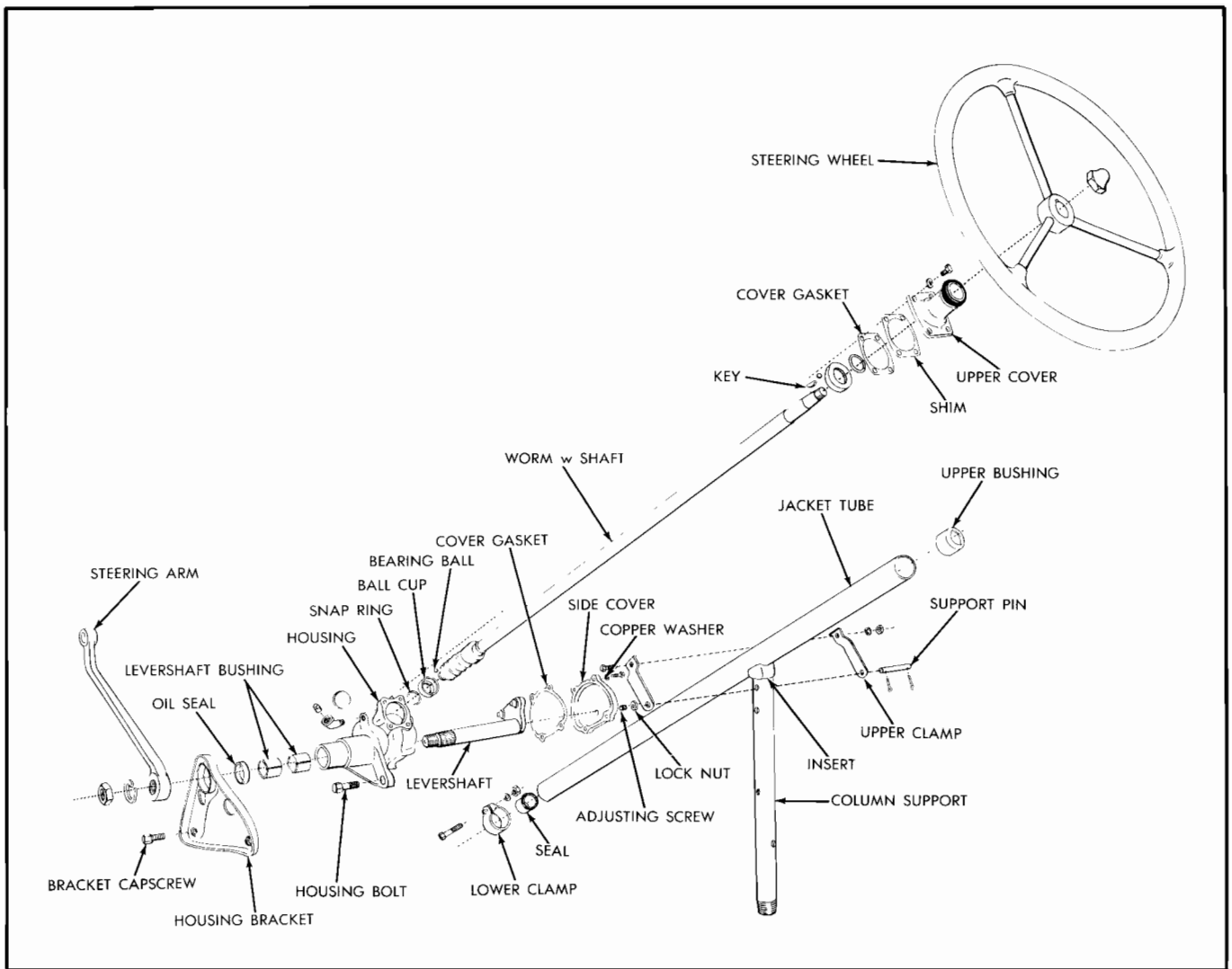
bearing cups, being careful not to loose ball bearings. The oil seal and bushings may be driven from housing.

#### INSPECTION

Check the worm gear for wear or chipping. Check the ball bearings for roughness or chipping. Check the pins of the lever shaft assembly for wear, roughness or breaking. Check the splines on shaft and in steering arm for wear or looseness. Check the lever shaft and bushings for wear. Replace bushings and shaft if total clearance exceeds .008".

#### ASSEMBLY

Install the ball bearings and cups on the worm assembly and install retaining snap rings. Enter worm and bearings into housing. Install



the upper cover assembly using the proper amount of shims and gaskets alternately to provide bearing adjustment of a free rolling fit without end play or binding. The steel shims are provided in .002", .003" and .010" thicknesses.

With lever shaft bushings installed in housing install the shaft and at same time meshing the pins on lever shaft with the worm gear. Install side cover and gasket using sealer on gasket. Back out lever shaft adjusting screw to prevent screw from contacting lever shaft while cover cap screws are being tightened. Then adjust screw until back lash is the least amount

possible without any noticeable bind or tight spots. Install oil seal in housing at outer end of lever shaft with lip toward housing. Install the column tube assembly and clamp in place. Fill the housing with grease and install on tractor bolting to torque tube housing. Install the column support clamp before tightening bolts at torque tube. Install the woodruff key, steering wheel and retaining nut. Install the bracket over end of housing and attach to torque tube with special cap screws. Install steering arm to lever shaft. There are blind splines to assist in locating the steering arm. With steering wheel in the center position, the steering arm must be in the straight up position. Install the shroud assembly, fuel tank and hood.

## DRAWBAR

The original drawbar as used on the "CA" tractor is shown at the right. It is used for all drawbar work in pulling trail type implements. The hydraulic lift arms are employed to form a portion of the drawbar bail.

The hitch point extends 14" beyond the P.T.O. shaft complying with A.S.A.E. recommendations for all P.T.O. driven machines.

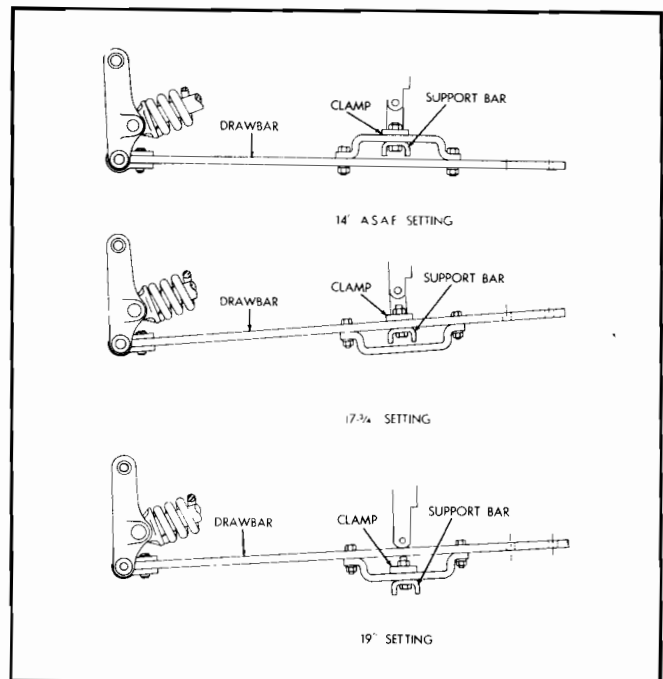
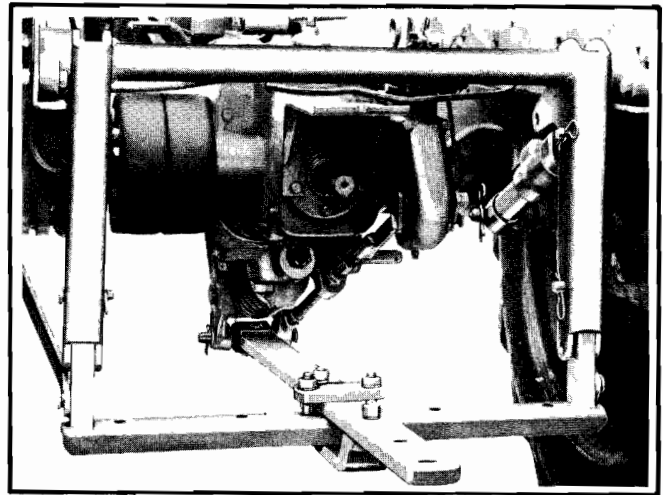
The drawbar is adjustable for different heights to meet the requirements of various pull type implements. (Refer to hitching in Implement Instruction Book.) The drawbar may also be allowed to swing by removing the drawbar clamp. This aids greatly in turning while pulling a trail type disc or any similar tool.

The sketch shows the various positions of drawbar to obtain the proper hitching heights for various implements.

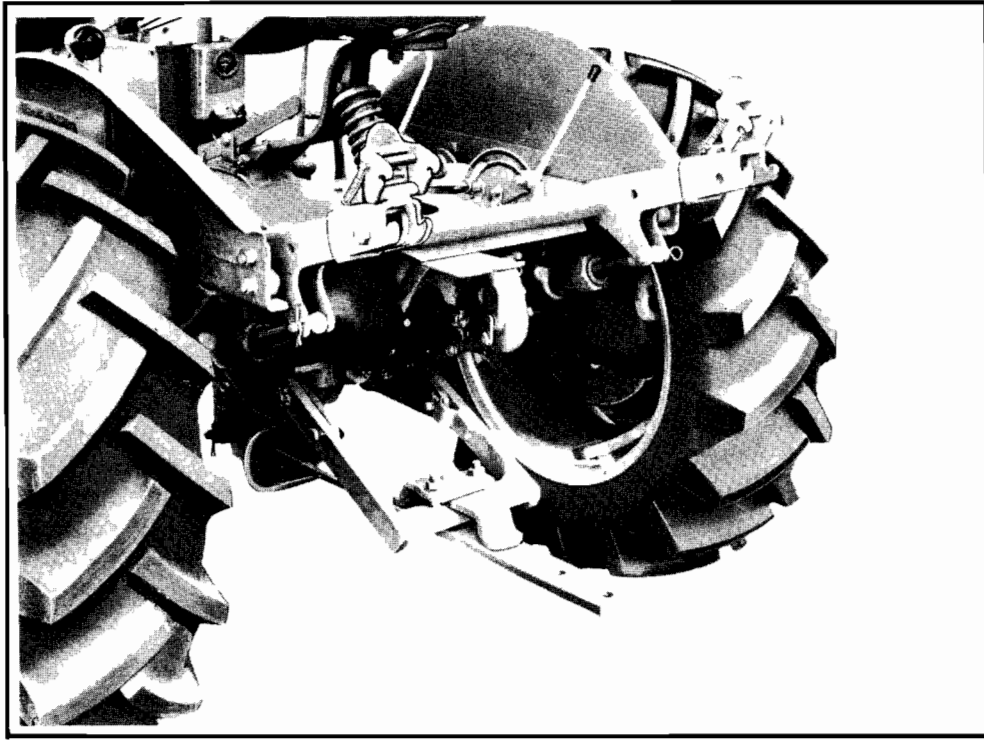
The drawbar may be used under drawbar bail, or on top of bail with the guide underneath. Additional heights may be obtained by placing both drawbar and guide above bail and installing clamp as shown.

To accommodate the use of mounted implements the drawbar must be removed as follows: Remove the two quick hitch pins from the lift arm pins. Remove the two quick hitch pins attaching the bail arm braces, and remove braces from pins. Grasp the drawbar with one hand and remove the two arm pins with the other. Lower drawbar to the ground and step around to front of rear wheel and remove the pin at front end of drawbar. The drawbar is now free of the tractor.

Before hitching a mounted type implement the lift rams must be relocated on the lift arms. Remove pins from lift arms where rams are attached. Raise lift arms until they are at a rearward position and re-attach rams to lift



arms. The tractor is now ready for the attaching of mounted implements.



The Snap Coupler Drawbar was introduced January 1954.

It is easily removed for the use of mounted equipment and quickly attached when needed. The use of the SNAP COUPLER type drawbar eliminates the necessity to change the ram location on the lift arms when removing or installing the drawbar.

To remove, merely remove two quick hitch pins from drawbar guide, depress trip latch, and

drawbar is free of tractor. This type of drawbar is also adjustable for heights by placing the drawbar above or below the drawbar guide.

The front end of the drawbar is equipped with an eye. A bell shaped coupler with a latch hook is attached to the tractor. To install drawbar, merely swing eye end of drawbar into bell of SNAP COUPLER, and the hook latches automatically. Lift drawbar until guide is in position with brackets and install the two quick hitch pins through guide.

## HYDRAULIC SYSTEM

### LUBRICATION

Check daily and keep filled to high mark on bayonet gauge (rams extended). Add oil through transmission filler cap. Use S.A.E. 20W for temperatures above 45°F, and S.A.E. 10W for temperatures below 45°F. A magnetic drain plug is located in the bottom of P.T.O. housing. This plug should be cleaned periodically.

When the pump drive housing is to be completely drained, it will be necessary to also drain the pump control housing, as oil trapped in pump control housing cannot be drained by removal of the magnetic plug. The transmission oil must also be drained, as this oil is used to operate pump.

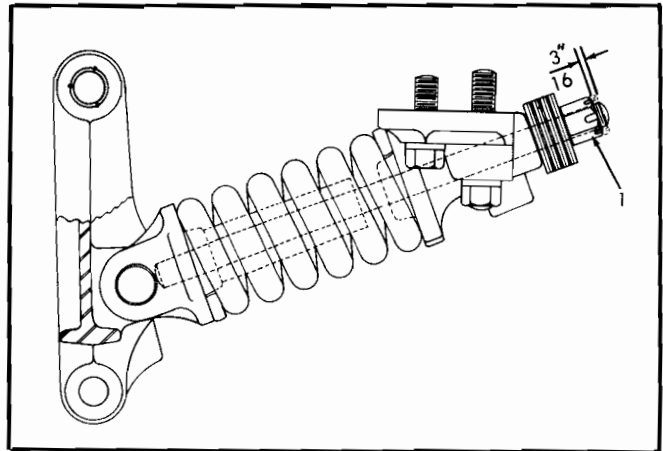
35 cu. in. of oil is required to fully extend CA Tractor Rams. If more than 60 cu. in. of oil is removed from the transmission it may create a dangerous condition, which will cause damage to the transmission gears and bearings.

### ADJUSTMENTS - Hydraulic pump linkage

NOTE: It is extremely important that this linkage be correctly adjusted, otherwise satisfactory operation cannot be obtained. (Once correctly set, this linkage needs no further adjustment unless disturbed.)

#### FIRST ADJUSTMENT - Spring Assembly

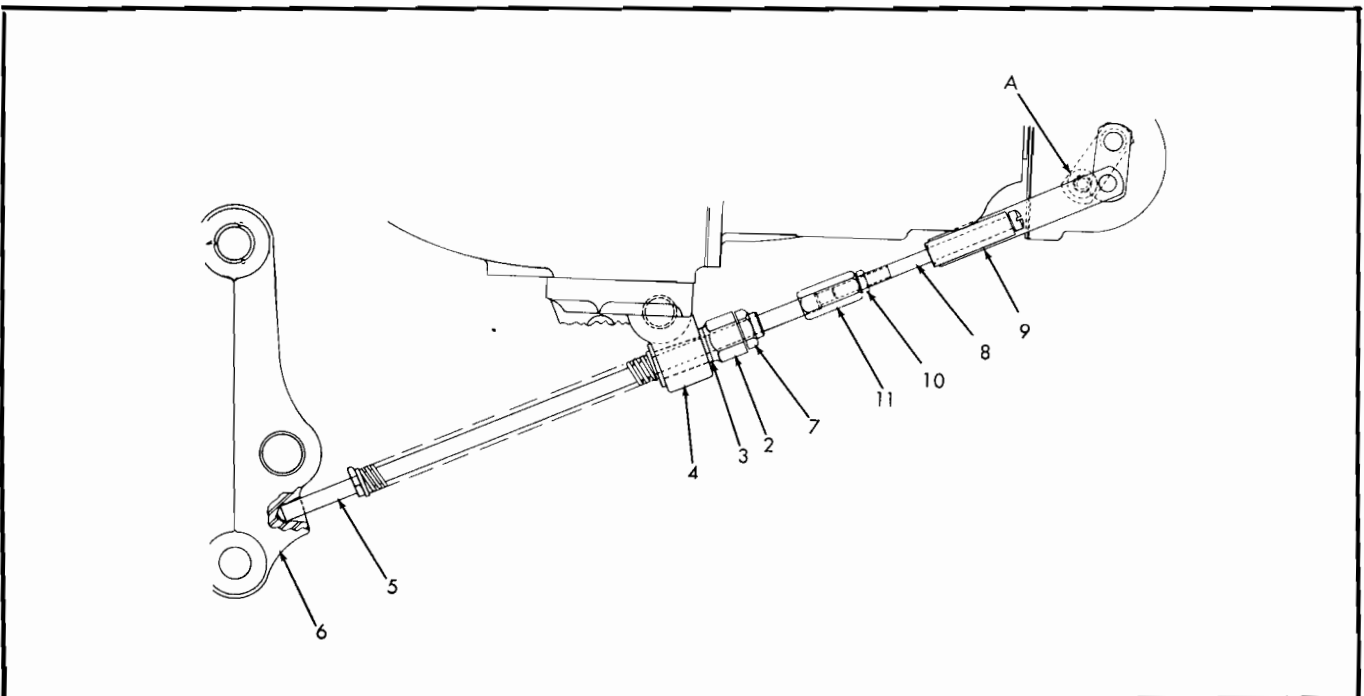
Assemble items with nut (1) tightened to eliminate all looseness. Pre-load assembly by tightening nut (1) three complete turns. (This



will pre-load assembly approximately 3/16".) Install cotter pin in next slot.

#### SECOND ADJUSTMENT - Linkage

1. Lock out drawbar control by tightening lock-out screw (A) in hole in control housing.
2. Loosen adjusting screw (8). Adjust large nut (2) to take up slack between washer (3) and bracket (4) when end of rod (5) is seated in bottom of hole in arm (6), arm in pre-loaded position; no drawbar load with drawbar clamp loose. Lock jam nut (7) against nut (2).
3. With hand control lever in raised position adjust screw (8) to give 1/32" clearance between shank of link assembly (9) and head of screw (8). Lock jam nut (10) against end (11).





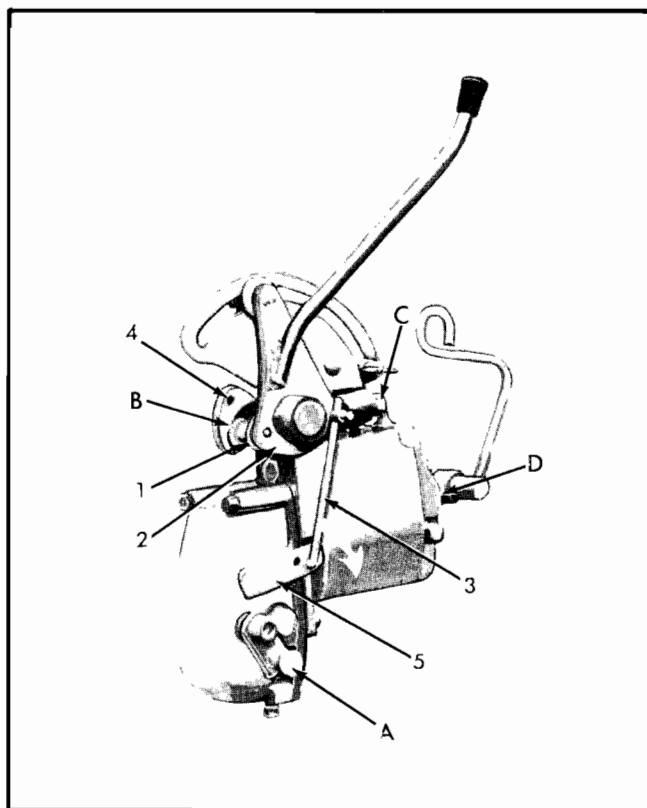
### THIRD ADJUSTMENT - Hand Lever

1. Turn screw "D" out until it contacts collar on shifter lever shaft.
2. Lock drawbar control arm by turning screw "A" into hole in control housing.
3. Lock plates (1) and (2) together with screw "B".
4. Loosen setscrew freeing link rod (3).
5. Place hand control lever in down position with point of screw "B" in line with upper edge of hole (4) in body.
6. Rotate lever (5) as far as possible in direction of arrow.
7. Tighten setscrew, fixing length of link rod (3).
8. Turn screw "C" out until it stops against plug.

NOTE: Misadjustment of these linkages will effect the operation of the system. If unit will not lift, lifts slowly or maximum load cannot be obtained, recheck linkage adjustment. Be sure drawbar is free to move forward or back without binding.

When pump is not in use keep hand control lever forward.

When tractor is used for drawbar work (other



than mounted tools or power take-off work) for prolonged periods of time, it is advisable to engage power take-off and operate tractor in this manner occasionally. This will keep the pump parts active and circulate oil through the pump system, which will help prevent moisture from corroding pump parts, and help to prevent sticking control valves.

### HYDRAULIC RAM AND LIFT SHAFT

#### REMOVAL - Lift Shaft

Remove the pins attaching rams to lift arms. Remove bolts attaching lift shaft supports to the rear of wheel guard support angles. The lift shaft assembly may now be removed from tractor. The bushings in lift shaft supports may be replaced if necessary. The lift shaft supports must be in perfect alignment to prevent binding of the lift shaft.

To install reverse the removal procedure.

#### REMOVAL - Tractor Rams

Disconnect ram hose and remove the quick hitch pins from each end of the ram.

Remove ram from tractor.

#### DIS-ASSEMBLY

Unscrew packing gland nut. Anchor bottom cap

end of ram in vise, (or clamp a pin in vise and anchor bottom cap end of ram over pin) and use a pipe wrench to unscrew the ram plunger guide, being careful not to damage guide.

Remove guide, remove snap ring from plunger and pull plunger from guide.

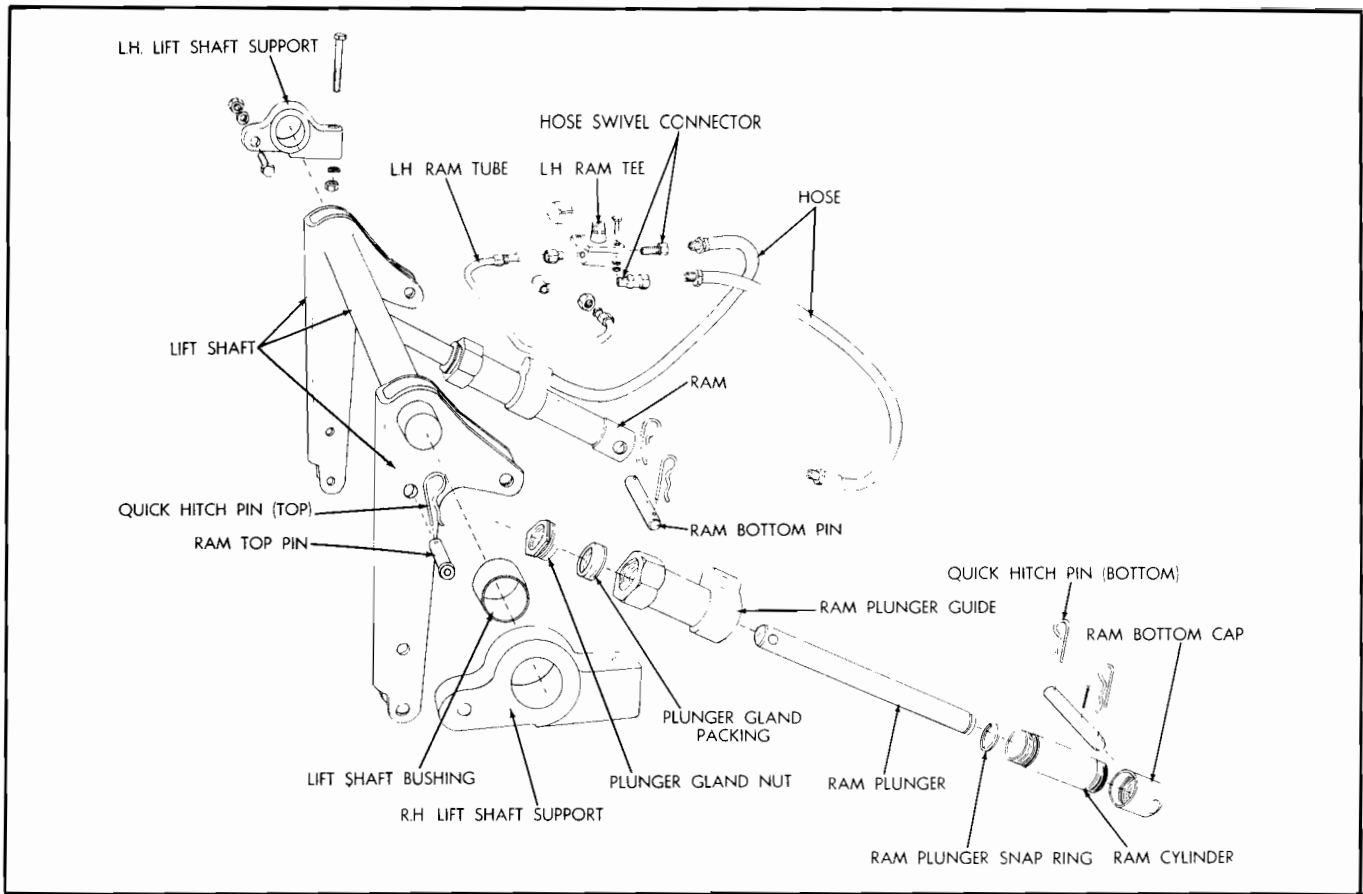
#### INSPECTION

Check the plunger and guide for wear or scoring. Scoring on plunger will make it difficult to hold packing tight to prevent leakage. Replace plunger or guide if worn or scored. Always use new chevron type packing.

#### ASSEMBLY

Install new chevron type packing in the plunger guide with open end of V towards oil supply. Insert ram plunger into guide and install snap ring.

To assemble "CA" tractor rams they must be



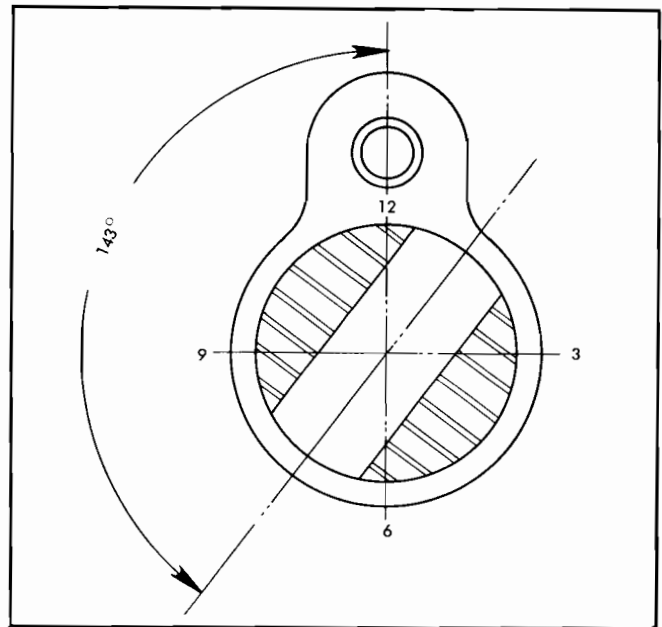
indexed with  $143^{\circ}$  between the mounting pin hole and hose outlet to prevent interference between hose and tractor. When assembling ram shim pack 225987 and copper washer 225988 must be used to secure the proper indexing and an oil tight joint at the same time.

The shim pack consists of 12, .002" shims. Use 9 of these shims and one copper washer under each end of ram cylinder.

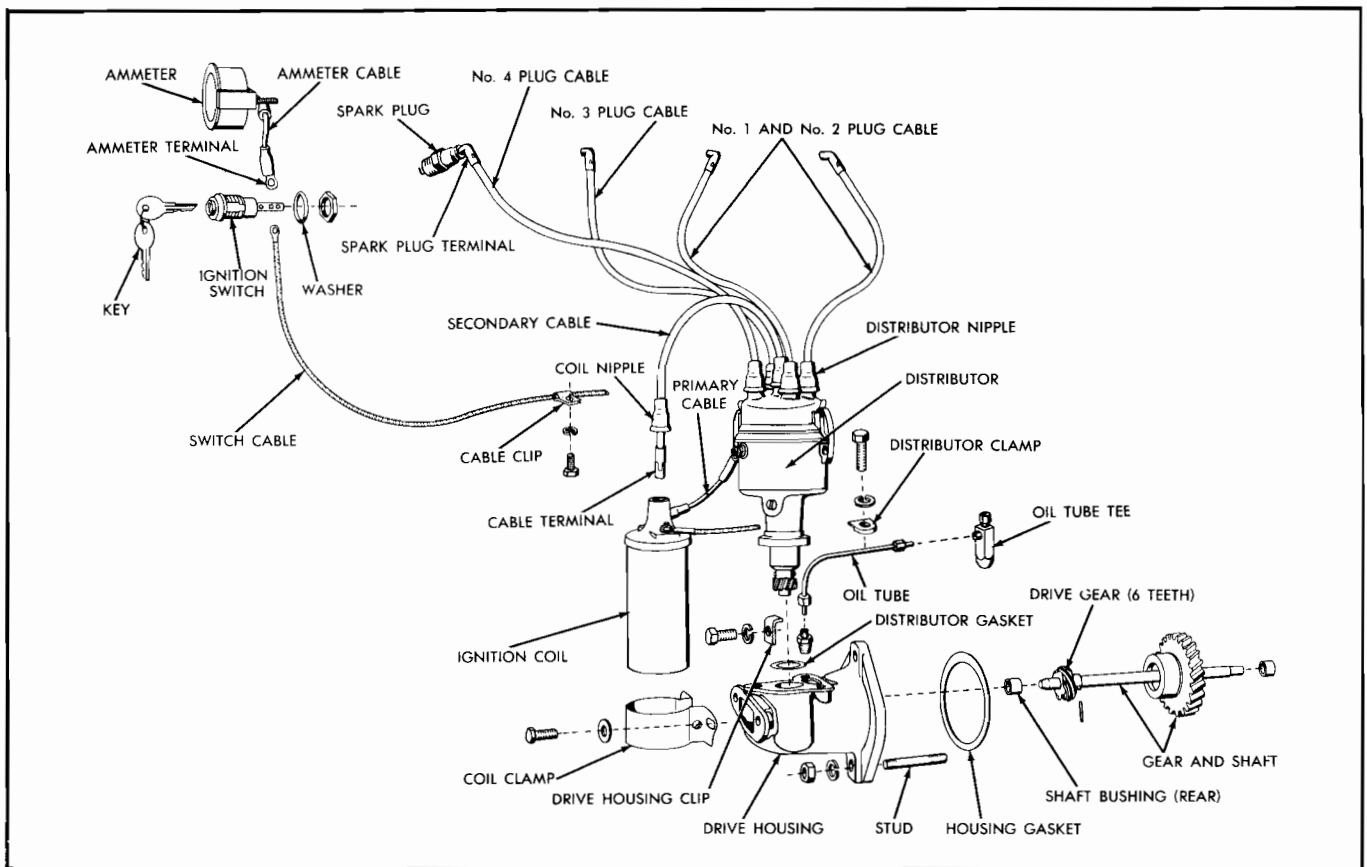
Tighten securely and until the proper indexing of  $143^{\circ}$  is obtained as shown in sketch. If necessary to dismantle again, use an extra .002" shim and a new copper washer. These shims should also be used on rams having  $112^{\circ}$  and  $135^{\circ}$  indexing to bring them up to the current indexing of  $143^{\circ}$ .

If a protractor is not available a watch may be used to gauge the angle. Set the watch at 6 minutes past seven. Hold the watch with numerals matching the ones on sketch. The anchor hole (dotted line) must line up with watch hands.

NOTE: Tighten packing gland nut only enough to prevent leakage.



## DISTRIBUTOR DRIVE



### REMOVAL

Remove the two capscrews and clamps holding the distributor assembly to drive housing, and lift assembly from housing. Remove oil line to drive housing. Remove the ignition coil from rear of housing.

Remove capscrew, clip, nut and washer holding drive housing to engine block, and remove housing.

The governor shaft assembly is mounted in engine block. To remove governor and shaft assembly, remove governor housing assembly at front of engine, and pull shaft assembly from front of engine. To remove distributor drive gear from shaft, support shaft and drive out pin holding gear to shaft, the gear can now be removed. The governor gear may also be pressed from shaft, although the shaft and gear are furnished as an assembly only. Remove pins and governor weights.

### INSPECTION

Check the governor housing assembly for wear at cross shaft bushings and fork. If worn excessive, replace assembly. Check front shaft bushing for wear. Check governor gear bushing for wear. Check rear shaft bushing for wear. Check shaft wear at thrust bearing surface.

Check governor weights and pins for wear. Check distributor drive and driven gear for wear.

### ASSEMBLY

Install distributor drive gear on shaft with the long hub forward, line holes and install pin, supporting shaft while riveting pin. Install governor weights and pins and insert clips to retain pins. Place thrust bearing on shaft, with thrust end forward. Replace governor gear bushing in block if wear exceeds .006". Install rear shaft bushing in drive housing. Install front shaft bushing in governor housing assembly. Install governor shaft assembly to engine block through opening at front, with the distributor drive gear toward the rear. There is no timing of gears necessary at this time. Install the front housing assembly, centering bushing over end of shaft, using a new gasket between housing and timing gear cover. Adjust and connect throttle and carburetor linkage. Install distributor drive housing over rear end of shaft, using new gasket between housing and engine block, being sure end of shaft is piloted in rear bushing. Connect oil line at governor housing and distributor drive housing.

To install distributor to the drive housing, both the engine and distributor must be timed. First the engine must be turned until No. 1

piston is at top dead center on compression stroke, and the center mark on flywheel is in center of inspection opening, this can be accomplished in the following manner:

**FIRST:** Remove spark plug from No. 1 cylinder, and place thumb in spark plug hole, crank engine slowly until air is forced past thumb, the center mark will then be close to inspection opening. Continue cranking until center mark is in center of inspection opening, (hole at right side of clutch housing). Fire mark or F on flywheel will show in opening first, do not use fire mark.

**SECOND:** Remove cap, rotor and dust cover from distributor assembly. Set the point gap from .018" to .022" at their widest position, or when breaker arm is at highest point on cam lobe. Replace rotor and turn shaft until rotor tip is pointing exactly opposite the primary lead terminal. Place gasket under distributor mounting flange and enter distributor into drive housing with primary lead terminal toward rear of engine. Rotate distributor body counterclockwise until points just break, and

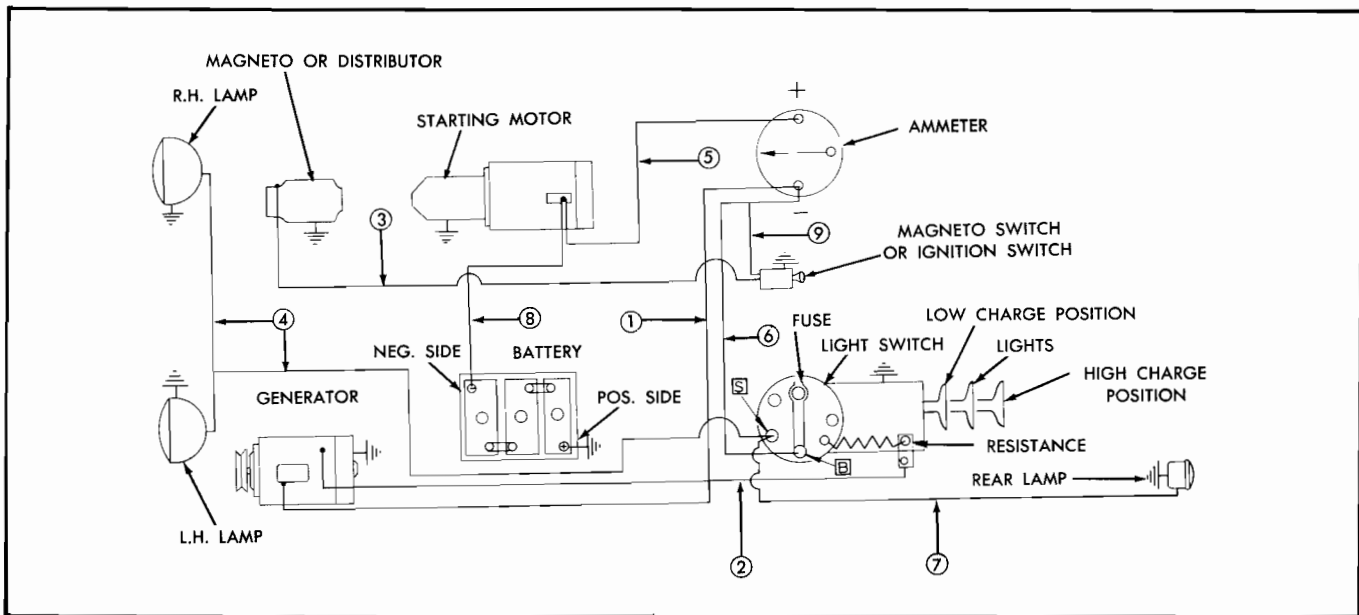
tighten clamps. Install ignition coil to rear of drive housing, and attach switch cable to coil and primary cable from coil to distributor.

Remove rotor, replace dust cover, rotor and distributor cap. Place No. 1 plug wire directly above rotor tip, and proceed around distributor clockwise No. 2-4-3 and place the coil wire in center.

The distributor has an automatic spark advance of 30° and when checked with a timing light the spark should occur when the fire mark is in center of inspection opening with the engine operating above 1000 R.P.M. Spark should occur at center mark on flywheel with engine operating below 400 R.P.M.

When replacing the distributor point set, always replace the point cam lubricator. The felt wick at upper end of breaker cam assembly, (under rotor) should be lubricated occasionally with a few drops of light oil, this lubricates the breaker cam assembly and the advance mechanism.

**WIRING DIAGRAM**



By following diagram the wires may be successfully installed.

No. 1 Discharge side of ammeter to cutout terminal. (Red circuit tracer.)

No. 2 Generator field terminal to resistor. (Black and white circuit tracer.)

No. 3 Magneto ground switch to magneto ground post or ignition switch to ignition coil. (Black with red circuit tracer.)

No. 4 Headlight junction to terminal marked "S" light switch. (Green circuit tracer.)

No. 5 Starting motor switch to positive side of ammeter. (Black circuit tracer.)

No. 6 Discharge side of ammeter to light switch at terminal "B". (Short wire, red tracer.)

No. 7 Tail light to light switch terminal "S". (Black)

No. 8 Negative side of battery to starting motor switch (Battery cable).

No. 9 Not used with magneto. Negative side of ammeter to battery ignition switch.