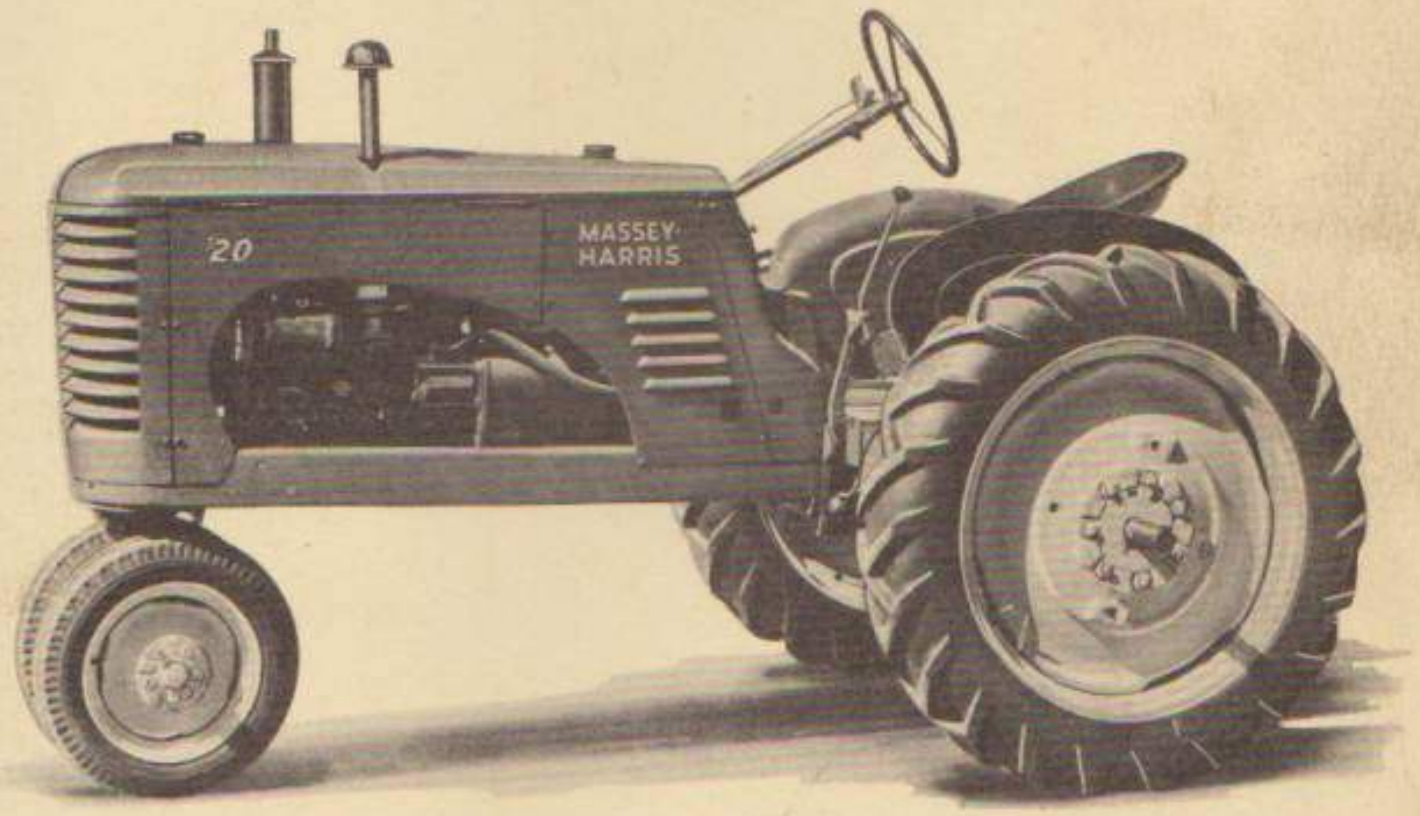
Form No. 694 018 M91

Operating Instructions and Service Manual

for

MASSEY-HARRIS
"20" TRACTORS "20K"



Manufactured by

THE MASSEY-HARRIS COMPANY
INCORPORATED

General Offices:
Racine, Wis.

Factories:
Racine, Wis.,
Batavia, N. Y.

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DATA

ACTOR SERIAL NO.: Located on plate mounted at rear of left frame member. Also stamped on top center of transmission housing.

MODELS	SERIAL NUMBER
Row Crop, Gasoline	20GR1001 and up
Row Crop, Low Grade Fuel	20KR1001 and up
Standard, Gasoline	20GS1001 and up
Standard, Low-Grade Fuel	20KS1001 and up

GINE

Cylinders	4
Bore	Gasoline 3" - Low Grade Fuel 3-3/16"
Stroke	4-3/8"
Speed R.P.M. Drawbar	1500
Speed R.P.M. Belt	1800
Displacement	Gasoline 124 - Low Grade Fuel 140 Cubic Inch
Compression ratio Gasoline 6.7:1 - Low Grade Fuel Models	5.0:1
Ignition	Battery
Spark Plug Gap (Auto-lite B7 18 MM)	.025"
Valve Clearance Int. and Ex	.014"

UTCH. . . Foot operated single plate dry disc

LT PULLEY

Diameter	9-1/2"
Face	6-1/4"
R.P.M	1020 at 1500 Engine Speed 1224 at 1800 Engine Speed
Belt Speed (Ft./Min.)	3040 at 1800 R.P.M. 2540 at 1500 R.P.M.

WER TAKE-OFF

Spline Size	1-3/8"
Speed 1500 Engine R.P.M	551 R.P.M.
Speed 1800 Engine R.P.M	661 R.P.M.
Height from Ground	25-1/2"
Left of Center	3-1/4"
Ahead of Drawbar Pin	14"

YT BRAKES

Disc Type Foot Operated. Individual action, or pedals interlocked.

TRANSMISSION (4 Speed)

1st	2.5 M.P.H.
2nd	3.6 M.P.H.
3rd	4.7 M.P.H.
4th (1800 R.P.M.)	16.0 M.P.H.
Reverse	3.0 M.P.H.

WHEELS AND TREAD

	R.C.	Std.
Front Wheels		
Tire Size	4.00 x 15	5.00 x 15
Rear Wheels		
Tire Size	8-32 9-32	8-32 9-32
Tread Rear	48-88	48"
Tread Front		45-3/4"

GENERAL DIMENSIONS	Over Tire	End of Drawbar
Length (Over-all)		
Std	113-3/8" +	5-1/8"
R.C	113-3/8" +	5-1/8"
Width (Over-all)		
Std	56-1/4"	
R.C	81-1/2" over end of Axles	
Height (Over-all)		
Std	67-3/8" over Steering Wheel	
R.C	66-1/8"	
Drawbar (Adjustable)		
Vertical	7-5/8"	
Lateral	9-3/16" to each side of center	
Ground Clearance		
R.C. and Std.	11-1/2" to Drawbar Pin	
Turning Radius		
Std	10 Ft.	
R.C. with Brakes	86-1/2" at 48" Tread	

CAPACITIES

Main Fuel Tank	12 Gal.
Auxiliary Fuel Tank (Low Grade Fuel Models)	1 Gal.

WATER COOLING SYSTEM

. . . . . 2-3/4 U.S. Gal. (2-1/3 Imp. Gal.)

ENGINE OIL PAN. . . .4 U.S. Qt. (.84 Imp. Gal.)

Belt Pulley Housing	3 Qt.
Transmission Case	2 Gal.
Differential Case	4 Gal.
Steering Gear Housing	1 Qt.

SECTION 1

RULES FOR SAFE TRACTOR OPERATION

1. Modern tractors travel fast and when operating tractors at high speed the same care must be exercised as is used in operating an automobile in order to avoid accident and injury.

2. Be sure gear shift lever is in neutral before starting engine.

3. Always engage clutch gently, especially when going up a hill or pulling out of a ditch.

4. When driving on highways, or to and from fields, be sure that both wheels are braked simultaneously when making an emergency stop.

5. When tractor is hitched to a stump or heavy loads, always hitch to drawbar and never take up slack of chain with a jerk.

6. Be extra careful when working on hillsides. Watch for holes or ditches into which a wheel may drop and cause tractor to overturn.

7. Always keep tractor in gear when going down hills or steep grades.

8. Always drive tractor at speeds slow enough to insure safety, especially over rough ground or near ditches.

9. Reduce speed before making a turn or applying brakes. The hazard of overturning the tractor increases four times when speed is doubled.

10. Always stop power take-off before dismounting from tractor.

11. Never dismount from a tractor when it is in motion. Wait until it stops.

12. Never permit persons other than the driver to ride on tractor when it is in operation.

13. Never stand between tractor and drawn implement when hitching. Use an iron hook, jack, or blocks to hold drawbar on drawn implement.

14. Do not put on or remove belt from belt pulley while the pulley is in motion.

15. NEVER remove cap from radiator while the water in the cooling system is boiling or when the motor is overheated. NEVER fill radiator if engine is hot.

16. Never refuel tractor while motor is running or extremely hot.

17. Do not stop engine immediately after it has been working hard. It may backfire and cause conflagration. Let the engine idle at a moderate speed for a few minutes before stopping.

18. Do not use clutch pedal as a foot rest.

19. Do not run engine if oil pressure gauge does not register.

20. When tractor is attached to a power take-off driven implement, be sure that all power line shielding is in place.

21. Never leave transmission in gear after engine has stopped.

SAFETY FIRST

Most farm accidents, like industrial, home and highway accidents, are caused by the failure of some individual to observe simple and fundamental safe rules or precautions. For this reason farm accidents, just as other types of accidents, can be prevented by recognizing the cause of accidents and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of farm equipment, there are many points that cannot be completely safeguarded without interfering with accessibility and efficient operation.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many thousand serious injuries each year. That rule is: "NEVER ATTEMPT TO CLEAN, OIL OR ADJUST A MACHINE WHILE IN MOTION".

--NATIONAL SAFETY COUNCIL--

SECTION 2

PREVIEW

It is not possible to have this Service Manual complete in every detail and yet have it brief enough so that one can commit to memory all the instructions enclosed herein; hence, this preview is written as a guide and reminder of the important and constant points on tractor care and operation. For detailed information on any part of the tractor, refer to the index

NEW TRACTOR:

Do not work the tractor under a heavy load for the first fifty hours.

Fill the engine oil pan with SAE #10 oil and drain after the first 30 hours -- refill again with SAE #10 oil and drain after 60 additional hours; then follow specifications as outlined on Lubrication Chart, Page **.

Use low gear while the engine is new.

The life of the tractor is affected by the manner in which it is handled during the breaking period.

CAUTION: DO NOT OPERATE TRACTOR ON DRAWBAR WORK WITH THE HAND THROTTLE LEVER ON SECOND SET OF NOTCHES ON THE RAISED PART AT THE LOWER END OF THE THROTTLE LEVER QUADRANT.

This raised position of the quadrant is for belt work and 4th speed only. For reasons see Page 7.

RADIATOR:

Fill the radiator with clean, pure water (preferably rain water). Drain-flush, and refill with fresh water at least twice yearly, oftener in summer.

STORAGE BATTERY:

There are two charging rates for the Storage Battery which are controlled by the Light Switch on the Instrument Panel. The first position of the Light Switch is Low Charging Rate. The second position of the Light Switch is High Charging Rate. The third position of the Light Switch is for turning on the Lights.

Keep the Light Switch on the Low Charging Rate unless the Storage Battery becomes low, partly, or completely discharged. This will prevent over charging the Battery and causing it injury.

Add distilled water to all three cells weekly. DO NOT LET SOLUTION GET BELOW TOP OF PLATES.

AIR CLEANER AND EJECTOR:

The air cleaner is put on this engine to prolong its life by preventing dirt and grit from getting into the engine.

Service the air cleaner DAILY, oftener in extremely dusty conditions.

SEE INSTRUCTION PLATE ATTACHED TO OIL CUP ON BOTTOM OF AIR CLEANER. See Page 21 for more complete details.

OIL FILTER:

The oil filter contains a replaceable cartridge which must be removed and replaced with a new cartridge at necessary intervals. If this is not done, the engine oil will become contaminated with grit and sludge and premature wear of the pistons, rings and bearings will be the result.

Under ordinary circumstances the cartridge should be changed every 200 hours when burning gasoline and every 120 hours when burning kerosene. Remove the bayonet gauge and inspect the oil on it. If the oil is darkened or discolored, it is time to change the cartridge. For changing cartridges, see Page 9.

OIL AND GREASE:

The outstanding feature of tractor care and operation is PROPER LUBRICATION. Keep all lubricants and their containers perfectly clean. Do not attempt to experiment or economize by using inferior quality or incorrect weight of oil. Any attempt to do so is like stopping the clock to save time. Refer to Page ** for oil specifications and to Lubrication Chart on Page **. See that the oil pressure gauge on instrument panel indicates 15 pounds at all times when the engine is running. Check this every time the engine is started, particularly in cold weather. If the pressure gauge fails to register when the engine is started or if the pressure drops below 10 pounds when the engine is running, stop the engine immediately. See Page 8.

FUELS:

There are two types of engines used in this tractor, each designed to burn a different grade of fuel. One for burning gasoline, the other for burning low grade fuel.

Tractors with serial numbers 20GR1001 or 20GS1001 are designed to burn gasoline of 70 Octane or better. Tractors with serial numbers 20KR1001 or 20KS1001 and up, are designed to burn low grade fuels of 30 Octane or better. The tractor serial number is located at the rear end of frame member, also stamped on top of transmission case.

When burning low grade fuel, adjust the damper on the exhaust manifold as outlined on Page **, and regulate radiator shutters to maintain a water temperature of approximately 190° F. The water temperature indicator is on the instrument panel.

For detailed information on carburetor setting, manifold setting and water temperature regulation, see Pages 19 and 20.

Clean the fuel strainer screen and tank outlets frequently to assure a constant, full flow of fuel to the carburetor.

GEAR CASES:

Check the level of lubricant in the three gear cases by removing the oil level plugs and maintain proper oil levels by adding if necessary.

For winter operation, drain the transmission oil from the transmission and differential cases and refill with a good quality SAE #90 Transmission Oil.

Change the oil in the gear cases twice each year.

TIRES:

The use of pneumatic tires on tractors has greatly improved power, fuel economy, operator's comfort and tractor life; also, has increased the range of tractor use. However, tractor tires must be given attention. Maintain proper air pressure and guard against tire injury. It is necessary to use some type of wheel weights for varying conditions. There can be either too much or too little wheel weights used. Refer to Page 37 for wheel weight analysis.

Obtain a low pressure Tire Gauge and check the tire pressure weekly. See Page 37.

SECTION 3

CONTROLS AND OPERATING

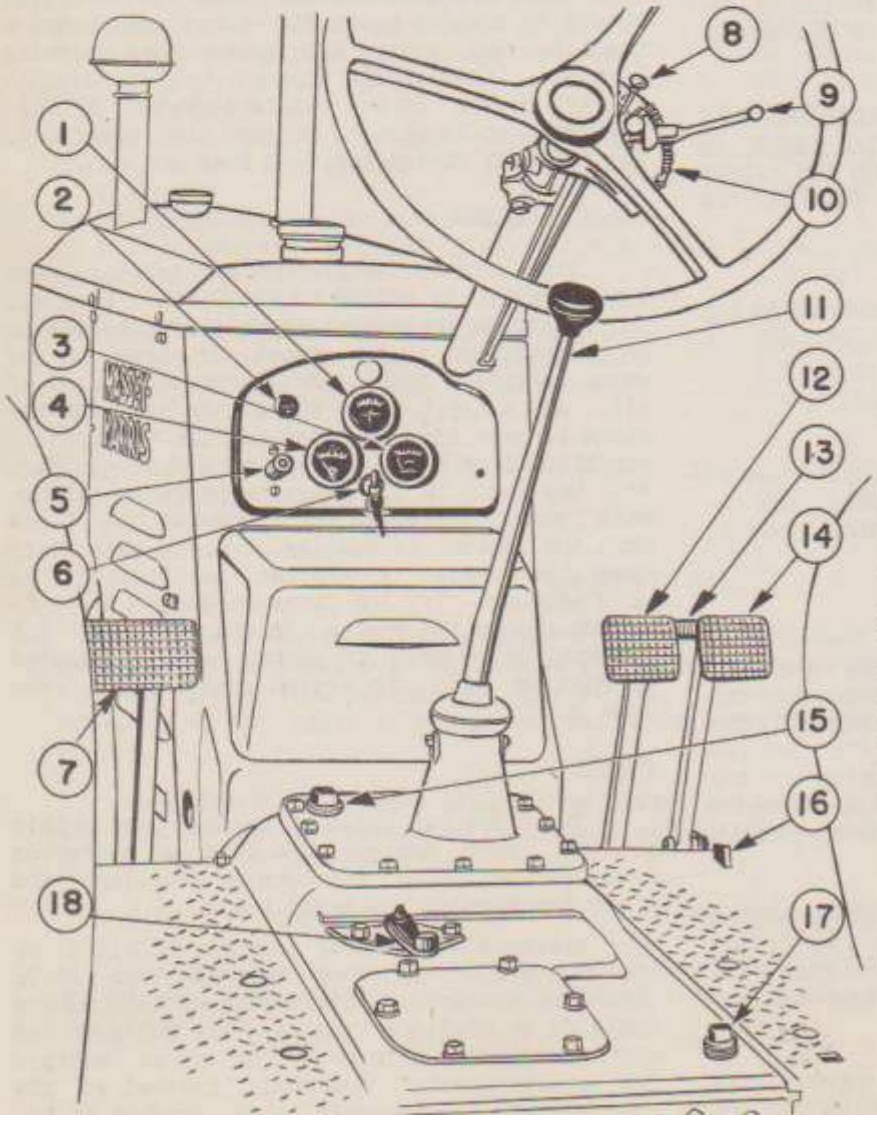


PLATE NO. 1 - CONTROLS

1. Ammeter.
2. Light Switch.
3. Water Temperature Gauge.
4. Oil Pressure Gauge.
5. Starter Button.
6. Ignition Switch.
7. Clutch Pedal.
8. Choke.
9. Hand Throttle Lever.
10. Raised Notches on Throttle Lever Quadrant.
11. Gear Shift Lever.
12. Left Foot Brake Pedal.
13. Brake Pedal Interlocking Plate.
14. Right Foot Brake Pedal.
15. Transmission Filler Plug.
16. Brake Pedal Ratchet.
17. Differential Filler Plug.
18. Power Take-Off Shift Lever.

START ENGINE, PROCEED AS FOLLOWS:

Check fuel shut-off valve under gas tank to be sure that it is open.

Be sure the gear shift lever is in neutral position. (Hand lever should be free to rock crosswise of tractor.)

Partially open throttle.

Choke engine if necessary. (Be careful in using the choke not to flood engine.)

Turn ignition switch to the "on" position.

Push in on starter button and hold it until engine starts.

Let engine run at half throttle for a minute or two in order to warm it up. Be sure oil pressure gauge is registering approximately 15 pounds pressure at normal operating speed.

If the tractor is a low grade fuel burning model, follow instructions for adjusting radiator shutter and fuel supply as described on Page 19.

It is advisable to use gasoline for fuel when breaking in a new tractor.

OVE TRACTOR, PROCEED AS FOLLOWS:

With engine running, place throttle control lever in idling position and disengage clutch by pressing clutch foot pedal forward as far as it will go.

Move shifting lever in position for desired speed. Numbers on the cover show the position of the shifting lever for various speeds. If the gears do not shift into mesh, engage clutch just enough to move the gears and then shift again. Do not clash or try to force gears into mesh.

Pull throttle lever down to raised position on quadrant (Number 10, Plate 1). This is the correct engine speed for drawbar or traction work. DO NOT OPERATE TRACTOR UNDER DRAWBAR OR TRACTION WORK WITH THE THROTTLE LEVER BEYOND THE RAISED POSITION ON THE THROTTLE LEVER QUADRANT.

4. Gradually engage the clutch until the slack is taken up between the tractor and the load, then let the clutch back in as far as it will come.

5. When starting a light load, either on drawbar or belt, open throttle about half open and engage clutch. Then bring load to full speed by opening throttle. This will add life to the clutch facing.

WARNING: DO NOT USE THE CLUTCH PEDAL AS A FOOT REST. USE IT ONLY TO START AND STOP THE TRACTOR AND WHEN SHIFTING GEARS.

TO STOP TRACTOR, PROCEED AS FOLLOWS:

1. Disengage clutch and move throttle into idling position.
2. Shift gear shift lever into neutral position.
3. Re-engage clutch.

WARNING: DO NOT LEAVE TRACTOR SEAT WITHOUT SHIFTING GEAR SHIFT LEVER INTO NEUTRAL POSITION.

TO OPERATE BELT PULLEY, PROCEED AS FOLLOWS:

1. With engine running, disengage clutch to stop pulley.
2. Re-engage clutch slowly to start pulley.
3. Bring engine up to operating speed by opening throttle control lever. When the tractor is doing belt work, the throttle control lever may be raised over the raised position on the hand throttle Lever Quadrant, and throttle control lever pulled all the way down to the bottom of the quadrant. This increases the engine speed to 1800 R.P.M.

SECTION 4

LUBRICATION

The purpose of lubricants is to establish iction reducing film between all rubbing aces, and in so doing performs several tions:

1. Reduces friction.
2. Prevents wear.
3. Keeps working parts cool by flushing.
4. Cushions power impulses on piston pins, bearings and gear thrust loads.
5. Forms a seal between piston rings and cylinder wall.

The molecules of oil might be compared to hard rubber balls, thus a film of oil between rubbing parts is comparable to a smooth running ball bearing. In a smooth running ball bearing, the balls must all be exactly the same size. In good quality oil, the molecules are all the same size and therefore spread in a perfectly smooth film surface.

To prevent wear, there must not be any grit, corrosive acid or glue like substances in the oil.

The oil must be light enough in viscosity to penetrate the close fitting parts quickly or it will neither prevent wear nor serve as a coolant.

It must not contain any non heat-resisting "filler" that will break down under heated working parts or there cannot be a "film seal" between the piston and cylinder, loaded gears or bearings.

When supplying lubricants for this tractor, be guided by these three prime factors:

First, select the grade or viscosity of oil that this book recommends and do not deviate from it. The grades or SAE rating of oils that are recommended for use by this book have been determined by exhaustive research engineering.

Second, use a quality of oil that is known by experience to be good. Do not use an oil unless you know it is good. Good oil maintains a constant viscosity at a fixed temperature, is uniformly refined and contains no foreign substance.

Third, KEEP IT CLEAN. No matter how good the oil is, if it contains dirt or grit, premature wear and expensive repair bills will be the result. Keep the containers clean and protected from dust and dirt while not in use. Wipe the dirt away from the filler cap or plug before removing them. Service the air cleaner and oil filter as prescribed and keep the tractor clean.

The lubrication of the various units of the tractor are individually dealt with in the following paragraphs:

ENGINE LUBRICATION:

The lubricating system is one of the most important features of the present day engine. Upon its proper functioning depends the successful operation of the engine which means continued operation of the machine. The oiling system of the engine is full pressure from a helical gear pump driven through spiral gears from the camshaft. Pressure is supplied directly through drilled oil ducts to the main, lower connecting rod and camshaft bearings and to the timing gears. The piston pins are lubricated by oil vapor. A bayonet type oil level gauge is employed on the left side of the crankcase and oil pressure relief adjustment is also provided. With the oil hot, the oil pressure of the engine should be approximately 15 lbs. at governed speed. Very little wear takes place in the oil pump during normal engine life and failures are rare. If a pump should require service, it is recommended that the entire oil pump assembly be replaced.

The engine oil pan holds four U.S. quarts or .84 Imperial gallons.

The first filling should be SAE #10 oil and drained after the first 30 hours run.

The second filling should be SAE #10 and drained after the next 60 hours run (30 hours if burning low grade fuel).

Change oil every 60 hours when burning gasoline or oftener in extremely dirty conditions and cold weather.

Change oil every 30 hours when burning low grade fuels, 40 hours in summer if dilution of oil is not excessive.

Check the oil level in the oil pan at least once daily with the bayonet oil gauge. This should be done when the engine is cold or several minutes after stopping. If the oil pan is half full or less, oil should be added to bring it to the full mark, but not above it. Wipe the dust away from the cap of the bayonet gauge before removing it for measuring the oil level, also the filler cap before removing it for adding oil or refilling.

Seasonal oil recommendations for both gasoline and low grade fuel models:

SAE #30 for summer or temperatures above 90° F.
SAE #20 for spring and fall or temperatures between 90° F. and 32° F.
SAE #10 for winter or temperatures between 32° F. and +10° F.
SAE #10W for temperatures below +10° F.

It is best to drain the oil when the engine is at normal operating temperature. The oil will drain more completely and flush out the oil pan better.

On the gasoline models, remove the oil pan once each season and wash the inside of the oil pan clean; also clean the screen on the bottom of the oil pump.

On low grade fuel models, clean the screen on the bottom of the oil pump every 60 hours. On these models there is a hand hole plate on the underneath side of the engine oil pan which can easily be removed and the screen on the oil pump taken out through this opening. When replacing the screen after it has been cleaned, note that there is a felt washer and two spacers between the top of the screen and the bottom of the pump. The felt washer fits over the inlet tube of the pump and the spacers each fit over the studs supporting the screen.

If this screen is not cleaned regularly, the oil will be shut off from the inlet or "suction" tube of the oil pump and consequently the pump cannot supply oil to the working parts of the engine. If the oil pressure gauge on the instrument panel does not show 15 pounds while the motor is running at operating speed and operating temperature, or if the pressure

is slow in rising when starting the engine when cold, it indicates that the screen on the oil pump is quite dirty. Clean it at once or the main and connecting rod bearing as well as piston and rings are liable to be injured from lack of sufficient oil.

The oil pressure is regulated by a "by-pass" valve, located on the right side of the engine and in line with the lower part of the carburetor. The valve may be removed for inspection by removing the adjusting plug and pressure spring, and inserting a stick into the hollow end of the valve (it being a piston type valve) and pulling it out.

The following are some of the causes of improper oil pressure:

1. Lack of oil.
2. Broken oil lines or tubes.
3. Leaky connections in oil lines or tubes.
4. Defective oil gauge.
5. Clogged oil pump or screen.
6. Loose main or connecting rod bearings.
7. Relief valve stuck.
8. Improper viscosity of oil.
9. Worn oil pump gears.
10. Oil lines on base of filter plugged.

OIL FILTER:

The sole purpose of the oil filter is to keep the engine oil clean. Practically all the oil in the engine passes through the filter every half hour of engine operation. The effectiveness of the filter depends on how regularly the filter cartridge is changed. The cartridge "strains" the grit, sludge and foreign particles from the oil as it passes through the filter. Since the filter is continually collecting this substance, the minute passages in the cartridge become clogged and the oil ceases to pass through the filter. The result is that the oil is not strained and these abrasive or grinding qualities remain in the oil and are fed to the bearings. The remedy is to change the filter cartridge frequently. Under average conditions, the cartridge should be changed every 200 hours when burning gasoline and every 120 hours when burning low grade fuel, oftener when operating in dusty conditions and in winter.

To replace the Cartridge, unscrew the nut holding the top on the filter, lift out the old cartridge; clean out bottom and wall of filter, place new cartridge in filter and replace cover. Do not change cartridge while engine is running. After cover is replaced, start the engine and check cover of filter for oil leaks.

GEAR CASE LUBRICANT:

There are four gear cases in the tractor, viz.: Belt pulley housing, main transmission case, differential housing and steering gear housing. Each case is filled to proper level as designated by the oil level plug for each case as shown on Plate 2, Page 10.

MAIN TRANSMISSION:

The main transmission case is contained in the front part of the rear housing of the tractor, a retaining wall separating it from the differential housing.

The main transmission case has a capacity of 2 gallons and is filled through filler plug at the front end of the housing on top. (See 15, Plate 1). An oil level plug is located on the left side of the housing, in about the center (See Lubrication Chart, Plate 2). Check the oil level in this case each 60 hours.

In winter, if the tractor is used when the temperature is below freezing, drain the oil from the transmission case and refill with a good grade of SAE #90 transmission oil.

Change the oil in the transmission case twice each year. It is just as necessary to change the oil in the gear cases as it is to change oil in the engine and for the same reason. The best time to change oil is in the spring. Drain out the old oil, fill the gear cases with kerosene and drive the tractor for a few minutes to thoroughly flush the inside of the case. Drain out the kerosene and refill with new SAE #140 transmission oil.

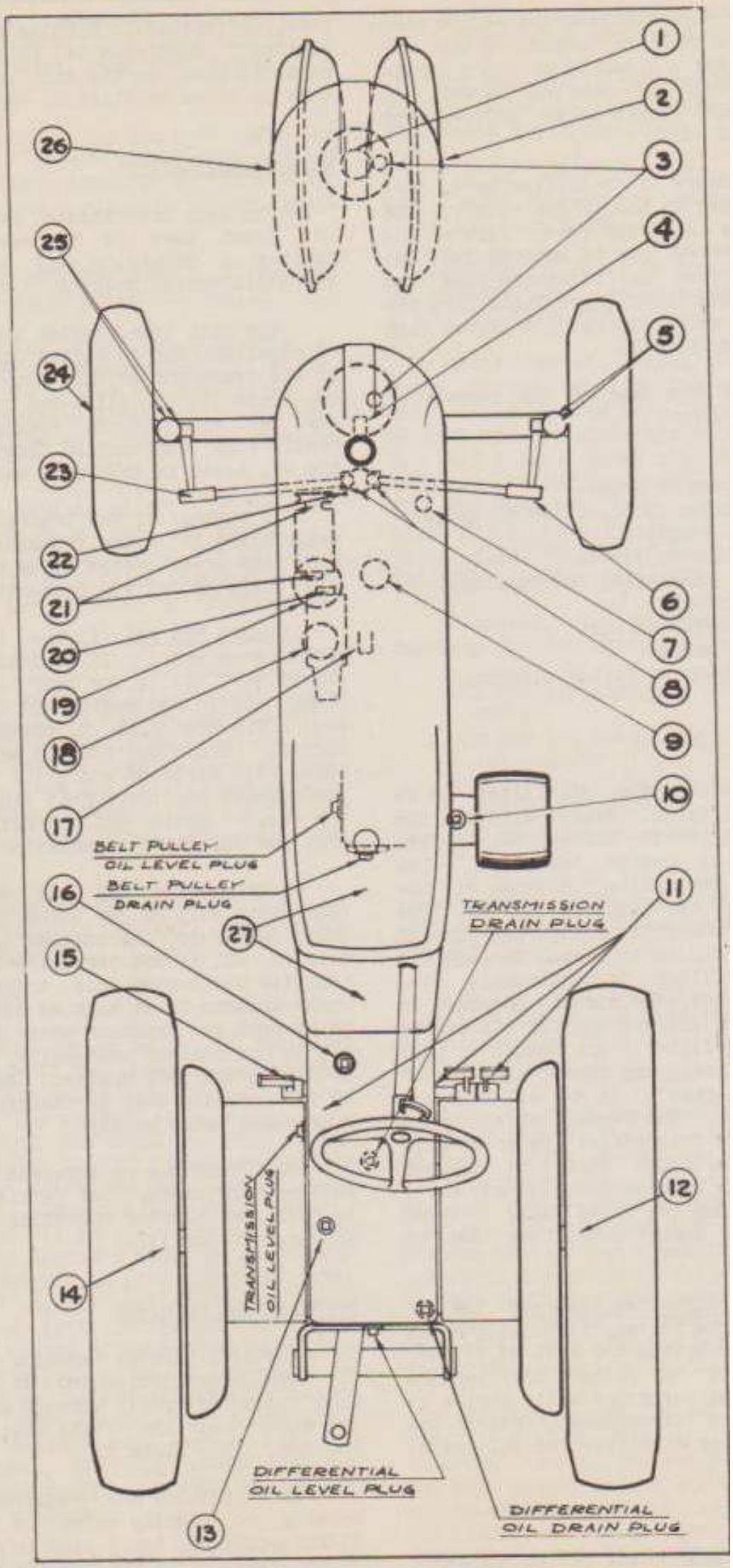
Transmission oil and chassis lubricant constitute only 3% of total tractor operating cost, therefore, the expense of changing transmission oil is not burdensome. In fact, exhaustive tests show that transmission maintenance amounts to as much as 6½% of total operating cost in tractors where the transmission oil is not drained seasonally, and was reduced to 1½% in tractors drained. Hence, a saving of 4% in operating cost by changing the oil in the gear cases twice yearly.

This text has no interest whatever in the sale of lubricants, but is vitally interested in reducing tractor operating costs and prolonging tractor life.

DIFFERENTIAL HOUSING:

The differential housing is just back of the main transmission and is filled with SAE #140 transmission oil through an opening on the top side, near the right rear corner of the housing. (17, Plate 1.)

Four gallons are required to fill this housing to capacity which is indicated by the differential oil level plug in about the center of the rear end of the housing (See Lubrication Chart, Plate 2). Check every 60 hours.



TEN HOUR LUBRICATION

CHART NO.	MODEL	
1	RC	King pin in Front End Support: 1 grease fitting.
4	S	Front Axle Pivot Pin: 1 grease fitting.
5-25	S	Steering Knuckles: 4 grease fittings, two on right and two on left knuckle.
6-8-23	S	Steering Tie Rod: 4 grease fittings, one on each end and two in center.
7	RC-S	Universal Joint on Steering Staff: 1 grease fitting.
11	RC-S	Brake Pedal and Arm: 3 grease fittings.
15	RC-S	Clutch Pedal: 1 fitting.
17	S	Pivot Pin at Rear End of Front Axle Brace: 1 grease fitting.
19	RC-S	Air Cleaner: Clean and refill. (See Air Cleaner Instructions, Page 21.)

SIXTY HOUR LUBRICATION

9	RC-S	Distributor: Several drops of light engine oil in soft oiler on base. Remove rotor and add a few drops of light oil to wick in top of distributor shaft. WIPE DISTRIBUTOR CAM WITH OILY FINGER -- USE CLEAN OIL.
10	RC-S	Belt Pulley Housing: Check oil level. Maintain proper level, drain, flush and refill once yearly. (See Transmission Lubrication, Page 9.)
12-14	RC-S	Rear Axle: 2 grease fittings, one at outer end of each axle housing.
13	RC-S	Differential Housing: Check oil level. Maintain proper level, drain, flush and refill twice yearly. (See Transmission Lubrication, Page 9.)
16	RC-S	Transmission Case: Check oil level. Maintain proper level, drain, flush and refill twice yearly. (See Transmission Lubrication, Page 9.)
18	RC-S	Oil Filter: Change filter cartridge as prescribed. (See Page 9.)
20	RC-S	Starter Motor: One soft oiler. Add few drops of light motor oil.
21	RC-S	Generator: Two soft oilers. Add 3 drops of light motor oil in each oiler.
22	RC-S	Water Pump: One grease fitting. Use wheel bearing grease.
27	RC-S	Universal Joint: Remove pipe plugs, put in grease fitting and pump one shot only of grease in each joint. Remove fitting and replace pipe plugs after each greasing.

PERIODICAL LUBRICATION

3	RC-S	Steering Gear Housing: One filler plug under radiator grille. Fill to top of worm. Check once each 300 hours. Use steering gear lubricant.
2-24-26	RC-S	Front Wheels: Remove wheels; wash out old grease and repack with front wheel lubricant each 300 hours.

In winter if the tractor is used when the temperature is below freezing, drain the oil from the differential case and refill with a good grade of SAE #90 transmission oil.

Drain and refill the differential housing twice each year in the same manner and at the same time as described for the main transmission. This is important as it is possible for the lubricant of these housings to pass from one to the other; however, the retaining wall between the two housings will maintain the proper respective oil levels.

BELT PULLEY HOUSING:

This gear case is cast integrally with the clutch housing, but is separated from the clutch compartment by a wall. (There is no lubricant in the clutch compartment.) The belt pulley housing is filled with SAE #90 transmission oil through a plug on top of belt pulley housing.

Three quarts are required to fill the belt pulley housing. An oil level plug is located on the left side of the case. (See Lubrication Chart, Plate 2.) Check the oil level in this case once each 60 hours.

When the belt pulley assembly is installed in this gear case the oil level will be changed. After the belt pulley assembly is installed, check the oil level in the gear case and refill to oil level plug (See Plate 2), through the belt pulley assembly (10, Plate 2).

Change the oil in this housing once yearly.

STEERING GEAR HOUSING:

The steering gear housing is located under a baffle plate over the front end of the tractor frame and is filled with one quart of steering gear lubricant.

As this housing is tightly sealed and not subjected to any amount of heat or load, very little attention to its lubricant is necessary. However, it is advisable to take out the filler plug in the top of the housing once each year and check the contents, and add lubricant if necessary. There is no level plug in this housing.

If, after a few years, the tractor is dismantled for a complete overhaul, it would be advisable to remove the housing, wash it out and refill with new lubricant.

CHASSIS LUBRICANT:

For chassis, generator, starting motor and distributor lubrication, see accompanying Lubrication Chart. Use a good grade of pressure gun grease in all fittings except the water pump. A good grade of wheel bearing grease should be used in the water pump. A special "relief type" grease fitting is used on the water pump to prevent over lubrication.

SECTION 5

ENGINE

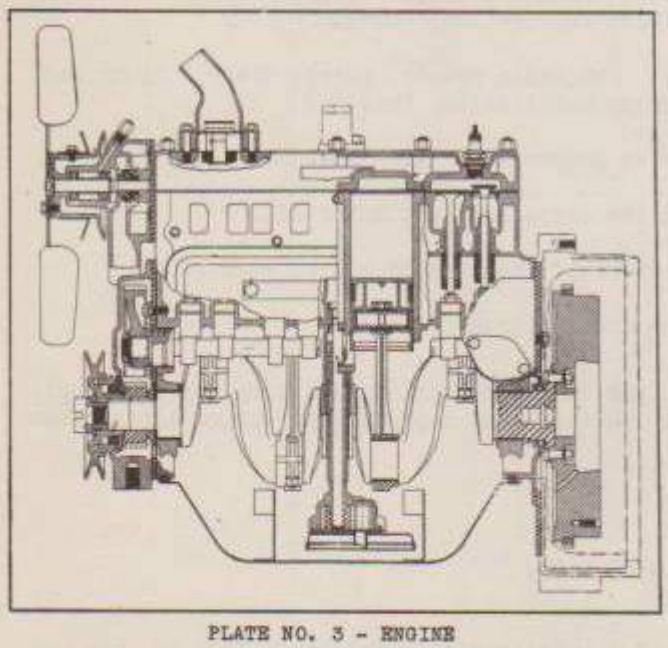


PLATE NO. 3 - ENGINE

The engine in this tractor is the latest design of modern engineering with a background of experience dating back to the very beginning of power equipment. It is a 4 cylinder, 4 cycle L head type engine. The gasoline burning engine's dimensions are: 3 inch bore, 4-3/8 inch stroke, 124 cubic inch displacement, with a compression ratio of 6.7 to 1. The low grade fuel engine's dimensions are: 3-3/16 inch bore, 4-3/8 inch stroke, displacement 140 cubic inches, with a compression ratio of 5 to 1.

The cylinder block and upper portion of the crankcase are cast integrally of close grained gray iron, horizontally and vertically ribbed to provide maximum rigidity with a minimum weight. Water jackets extend the full length of the cylinders to prevent distortion of the cylinders and consequent uneven cylinder wear.

The material of the cylinder walls is of sufficient density to provide hard mirror-like surfaces after the various machining and honing operations have been completed, but not too hard, which would cause scoring.

After a long period of use, natural wear enlarges the cylinders which widens the clearance between the cylinder and piston. When the clearance between the cylinder and piston is worn to .010 of an inch, the cylinders should

be rebored, honed and fitted with oversize pistons. There are a variety of sizes of oversize pistons available so that it is only necessary to bore out the cylinders just enough to straighten the walls.

Modern reboring and honing tools have been developed to produce a perfection of work equal to that of factory production, and are so designed that the modern Service Station or machine shop can produce that perfection of work at a nominal cost.

It is not advisable to attempt to fit new pistons in a block without reworking the cylinders.

The pistons are tin plated cast iron. Cast iron is used because of its greater wearing qualities. It is also easier lubricated and has a minimum of expansion when heated. The tin plating on the surface makes possible a closer fit without danger of scoring during the breaking-in period.

.0020 to .0035 of an inch is the correct clearance between the piston and the cylinder wall. This measure can be taken by thrusting a feeler gauge .002" thick by 1/2" wide between the piston and the cylinder wall the full length of the piston. The clearance is correct if this gauge can be pulled out with the gauge held between the thumb and two fingers (10 to 15 lbs. pull). This measure must be made on the thrust face of the piston skirt, that is, on a point half way between the piston pin holes. The piston pins are to be removed when fitting new pistons. This measure should be made at two or three places along the length of the cylinder and the piston pin holes parallel to the crankshaft. Mark each piston for the cylinder in which it is measured and assemble them in that order.

The piston rings are all above the piston pin and there are four on each piston. The three top rings are 1/8" Taper Face Compression rings. The bottom ring is a 3/16" Hi-F Super Drain-Oil control ring.

The purpose of the piston ring is to hold the fuel and compression above the piston and the lubricating oil below the piston and extreme care must be employed when fitting rings to a cylinder and piston so they will do this job.

Ring Gap Clearance: . . . . . .008" to .013"

Side Clearance in Groove:

Top Ring	.0015" to .0035"
2nd and 3rd.	.0010" to .0030"
4th.	.0010" to .0025"

The side clearances should be measured by actually applying a feeler gauge.

The ring gap end clearance must be made by pushing the ring down in the cylinder with a piston to be sure the ring is straight with the wall and gap clearance measured with a feeler gauge.

When installing new rings, do not use a ring that is over .010" too large for when it is filed down to get proper gap and then compressed to go into the cylinder, it bends into an egg shape and consequently does not fit against the cylinder wall all the way round.

Keep the ends filed square so that the ends fit together evenly when the ring is compressed until the ends touch.

When fitting new rings in a worn wall, always take the measure at the bottom of the ring travel in the cylinder.

Remove ridge at top of cylinder bore with a ridge remover.

Always install the rings in the cylinder for which they are measured and the compression rings with the side marked "top" up.

Remove all carbon from the ring grooves and drain holes in bottom groove carefully when installing new rings.

It is a known fact that when a piston is removed from a cylinder after the rings have worn to a fit, they will not fit properly when the piston is replaced no matter how much caution is used to replace the rings in the same position. It is therefore necessary to clean the grooves and install new rings whenever a piston is removed from the cylinder.

High oil consumption is ordinarily due to: (1) Excessive clearance on main, connecting rod or cam shaft bearings, also cracked or damaged lining in the bearings, permitting excessive oil flow from the ends of the bearings; (2) Pistons and cylinders worn beyond working clearance or worn, weak or sticking rings, also excessive wear in valve guides and stems.

The obvious remedy is to replace the worn parts. However, worn engine parts are by no means the sole cause of high oil consumption. Poor quality of oil, improper grade or weight of oil, dilution of oil with fuel and incorrect motor temperature have as much bearing on this subject as engine parts.

Inferior oil will quickly build up a carbon deposit in the ring grooves and prevent free action of the rings to seal the cylinder walls against leak. Also the slots in the oil control ring and the oil drain holes in the bottom piston groove become filled and can no longer carry the oil wiped from the cylinder wall back into the crankcase. In this case, it will be necessary to clean the pistons and replace the rings, but not the pistons if the clearance between piston and cylinder wall is satisfactory. It is advisable to burnish the

cylinder walls very lightly to aid in fitting the rings to the cylinder wall.

Oil of improper grade will not create a perfect seal between the cylinder walls and the pistons also does not protect bearing clearance, permitting excessive wear.

Dilution of the oil with fuel reduces the body of the oil until an excessive amount flows out the bearing ends, also breaks down the oil seal at the piston rings.

Occasionally, the thermostat in the radiator outlet elbow becomes defective and does not maintain proper water jacket temperature. The result is that the crankcase temperature is not high enough to evaporate the moisture therein and the resultant sludge formed by the water mixing with oil fills up the slots in the oil ring, ring grooves and oil drain holes.

Good oil, kept clean, and regularly changed is the best assurance of long engine life.

Refer to Page ** for correct seasonal oil grade and interval change.

PISTON PINS:

The piston pins are 55/64" in diameter. A bronze bushing provides the bearing in the upper end of the connecting rod and they are held in the piston by snap rings.

Piston Pin Fit:

In piston. . . . . .0001" tight
In connecting rod. . . . . .0002" loose

Before placing a serviced piston back in the cylinder bore make sure the snap rings are in place on the piston pin ends.

CYLINDER HEAD:

The cylinder head is of the conventional cast iron type.

The recommended method for removing the head in order that the head, cylinder block and cylinder head gasket will not be damaged is as follows:

1. Remove all cylinder head stud nuts.
2. Screw an eyebolt in the second or third spark plug hole and lift up on the eyebolt while tapping lightly around the edges of the cylinder head with a lead or raw hide mallet or hammer.

Never use a screw driver or chisel to pry the cylinder head loose from the cylinder block.

IMPORTANT:

When installing the cylinder head, tighten the cylinder head stud nuts in sequence as shown in Plate 4. Tighten nuts down evenly and repeat the operation until the nuts are tight. After the engine has been warmed up to the normal operating temperature, give the bolts a final tightening.

CRANKSHAFT AND CRANKSHAFT BEARINGS:

The high carbon steel crankshaft is carried on three large thin shell, steel backed, babbitt lined interchangeable bearings of 2-1/4" diameter. Each bearing is made up of two interchangeable shells. If replacement is ever necessary, they must be replaced without scraping or fitting. The bearings are furnished in upper and lower halves, and when installing, be sure the halves are in their respective positions.

The normal crankshaft end play:
.004" to .006"

The crankshaft end play should be adjusted immediately when it becomes noticeably excessive, to prevent damage to the front main bearing, the rear face of which is the thrust face for the crankshaft. The end thrust is adjusted by removing the desired number of shims from between the thrust collar just to the rear of the crankshaft timing gear and the shoulder on the front crankshaft bearing.

The normal crankshaft bearing clearance:
.0015" to .0020"

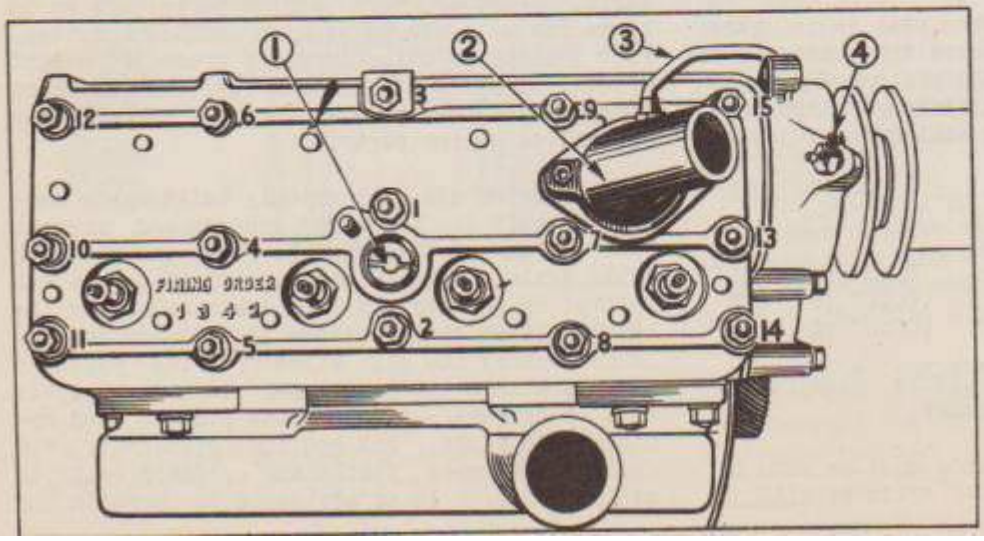


PLATE NO. 4 - SEQUENCE FOR TIGHTENING CYLINDER HEAD BOLTS

1. Distributor Shaft.
2. Thermostat Housing.
3. By-pass Tube.
4. Water Pump Grease Fitting.

If bearing shells become worn or defective for any reason, they should be discarded and replaced with new ones. Under no condition should fitting ever be attempted by scraping or filing of bearing caps. Such practice would permanently ruin the caps. Make sure there is no foreign matter between the shell and case boss or bearing cap when the bearing shells are replaced. When servicing a crankshaft or any parts in connection with the shaft, especially rod and main bearing shells, always make sure that all oil holes in the shaft are clean and open.

CAMSHAFT:

If for any reason, the timing gears have been removed, they should be installed so that the marks on the gears line up as shown in Plate 6. This is absolutely necessary to insure proper valve timing.

The normal camshaft end play is from .005" to .009". The end thrust is taken on the thrust plate, bolted to the engine block between the front face of No. 1 camshaft bearing and the rear face of the camshaft gear hub.

The timing gears and camshaft are lubricated direct from the pressure oiling system.

Camshaft bearing clearance:

No.1 and No.3 bearing	.002" to .004"
No. 2 bearing. . . .	.003" to .0045"

The camshaft gear can be assembled on the camshaft in only one position due to the key and keyway.

VALVES:

The valves are one piece forgings. Intakes are chrome nickel steel and exhausts are XCR steel.

The necessity for valve grinding is usually quickly detected by loss of power due to loss of compression. Before grinding valves, the valves should be removed and their heads and stems as well as the block parts cleaned of all carbon, and the holes in the guides cleaned out and oiled. It is important that each valve be replaced in the hole from which it was taken. No more metal should be removed from the valve than is necessary for a good seat.

VALVE SEATS:

The inlet valve seats are cut in the cylinder block and may be refaced in the usual manner. The exhaust valve seats are hardened inserts, and if truing up is necessary, they must be reground with a special grinding stone in a high speed tool. Oversize inserts are available.

Angle of intake valve seat	30°
Angle of exhaust valve seat.	45°
Width of intake valve seat	5/64"
Width of exhaust valve seat.	1/16"

VALVE STEM GUIDES:

The valve stem guides are removable. New guides should be installed with the upper end 1-7/8" below the top face of the cylinder block. The lower end of the guide is countersunk. New guides must be reamed for the correct clearance in relation to the valve stem.

Inlet valve stem clearance:
.0008" - .0026"

Exhaust valve stem clearance:
.0027" - .0045"

VALVE SPRINGS:

The valve spring pressure; 31-37 lbs. to compress the length of the spring to 1-45/64". The exhaust and intake springs are interchangeable. When reassembling the springs, make sure the upper end of the spring fits around the lower end of the valve guide and in the counter bore in the block.

VALVE TAPPETS:

The barrel type tappets operate in a bath of oil delivered under full pressure from the engine oiling system and require little or no servicing. Tappet clearance is adjusted by turning the self-locking adjustment screw in or out until the desired clearance is obtained. Only two wrenches are needed for this operation.

Tappet clearance should be set with engine at operating temperature.

Inlet valve tappet clearance . . .	.014"
Exhaust valve tappet clearance . .	.014"

It is important that the proper tappet clearance be maintained at all times to insure good engine performance. The tappets and adjusting screw are mated and cannot be interchanged, although the tappets and adjusting screw assembly will fit any tappet bore.

To remove a tappet, remove the adjusting

VALVE TIMING:

The valves have been timed correctly at the factory and the timing gears marked (Plate 5). The relation of these gears must not be altered.

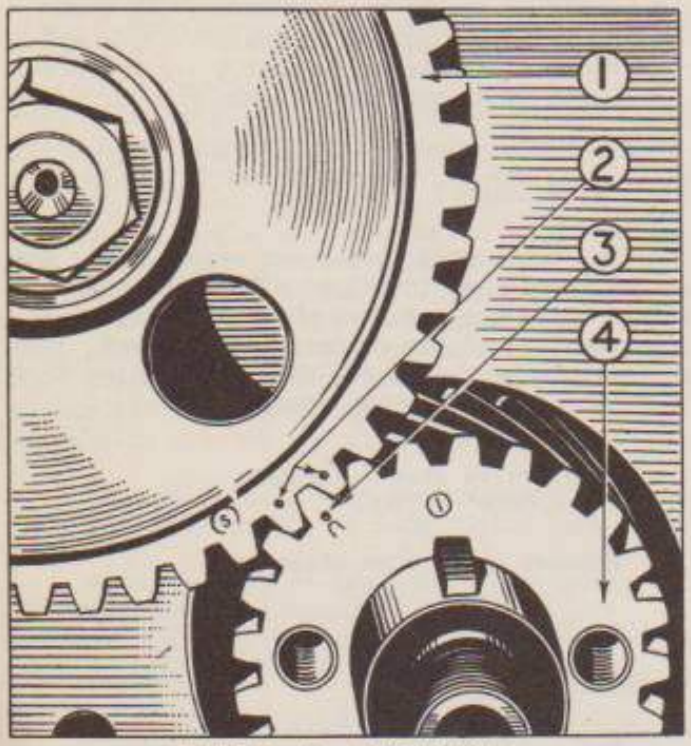


PLATE NO. 5 - TIMING GEARS

1. Camshaft Gear.
2. Timing Marks.
3. Timing Mark.
4. Crankshaft Gear.

Valves are timed with tappet clearance set at .014".

When the marking Ex.C on the flywheel is just beneath the flywheel pointer in the flywheel housing inspection hole, the 1 or 4 exhaust valve should just have closed. The intake valves open 0° early and close 215° after T.D.C. (Top Dead Center) on the intake stroke. The exhaust valves open 140° after T.D.C. on the power stroke and close 0° late.

The $\frac{\text{No. 1 T.D.C.}}{\text{Ex.C.}}$ mark located on the flywheel, when under the inspection hole pointer, indicates that No. 1 or No. 4 piston is at top dead center. See Plate 7.

WARNING:

When timing the valves, under no circumstances should the camshaft be retarded in order to effect proper meshing of timing gear teeth.

TIMING GEAR COVER:

The timing gear cover assembly has a spring retained leather oil seal which prevents oil leakage around the hub of the fan drive pulley. Care must be exercised in centering this seal around the fan hub when the cover is bolted into place. Install the fan pulley on the end of the crankshaft before bolts holding the cover to the engine block are inserted. After the pulley is in place, rock the cover back and forth slightly; this tends to center the oil seal around the pulley hub. Then bolt the cover in position.

CONNECTING RODS AND CONNECTING ROD BEARINGS

CONNECTING ROD:

The connecting rods are removed from the engine through the top of the block as they will not pass the crankshaft.

The rods are offset, No. 1 - 3 and No. 2 - 4 being interchangeable.

The piston pin bushing in the upper end of the connecting rod should not be replaced in the field unless the proper equipment is available to diamond bore it, otherwise, the complete rod assembly should be replaced.

The piston pin fit in the piston pin bushing in the upper end of the connecting rod is .0002" loose.

CONNECTING ROD BEARINGS:

Connecting rod bearings are of the same removable type as those used for the crankshaft, and require no scraping or fitting when they are replaced.

Bearing Clearance. . . .	.0015" to .0020"
Side Thrust Clearance. .	.006" to .010"

The lip on the bearing shell registers with a machined slot in the rod which prevents

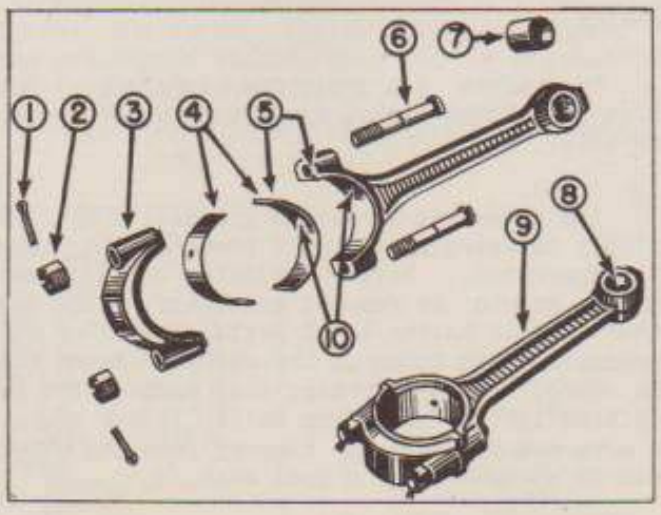


PLATE NO. 6 - CONNECTING ROD

1. Cap Bolt Nut Cotter Pin.
2. Cap Bolt Nut.
3. Cap.
4. Rod Bearings.
5. Tongue and Groove.
6. Cap Bolt.
7. Rod Bushing.
8. Oil Hole.
9. Rod Assembly.
10. Oil Holes.

any tendency of the bearing to revolve. The small bearing hole in the upper bearing shell must coincide with the metered oil hole in the connecting rod.

Install the rod so that the oil hole is on the camshaft side of engine. Do not file crankshaft or connecting rod bearing caps in order to reduce clearance. Always install new bearing shells. Filed caps produce out-of-round bearings, increase the escape of oil and result in decreased oil pressure, and may cause serious damage to the crankshaft.

FLYWHEEL:

The semi-steel flywheel is attached to the crankshaft flange with six bolts. One of these bolts is offset 1/16", consequently, the flywheel can be assembled in but one position.

When replacing the flywheel, be sure that all foreign material has been removed from flange on the crankshaft and the recess in the flywheel into which the flange fits. The rim of the flywheel should run within .004" of being true when secured tightly in place on the crankshaft. The flywheel bolts are provided with lock washers and the nuts should be set up very tightly against these at final assembly.

Flywheel markings:

IGN	Indicating ignition No. 1 or No. 4 Cylinder.
#1 T.D.C.	Indicates exhaust close and intake open - No. 1 or No. 4 Cylinder.
Ex.C.	

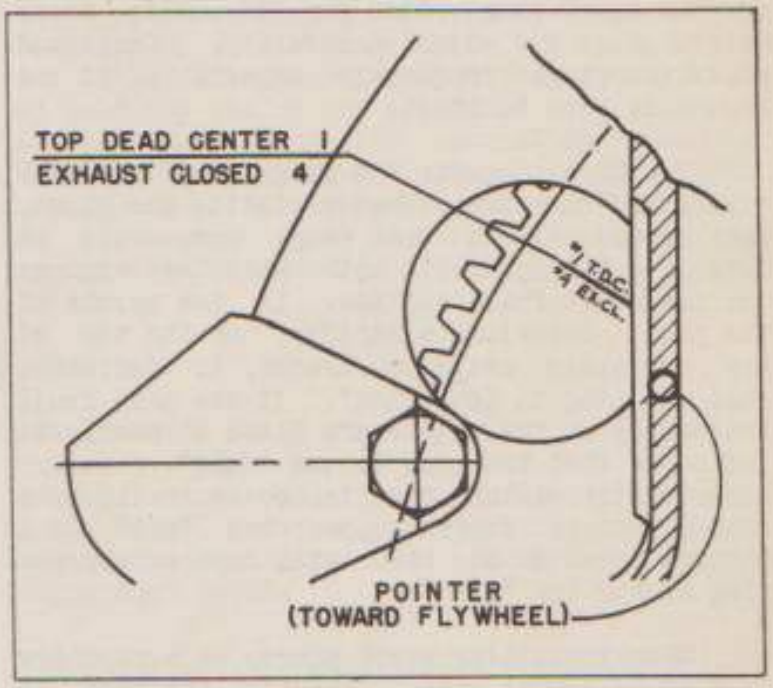


PLATE NO. 7 - FLYWHEEL TIMING MARKS

SECTION 6

IGNITION SYSTEM

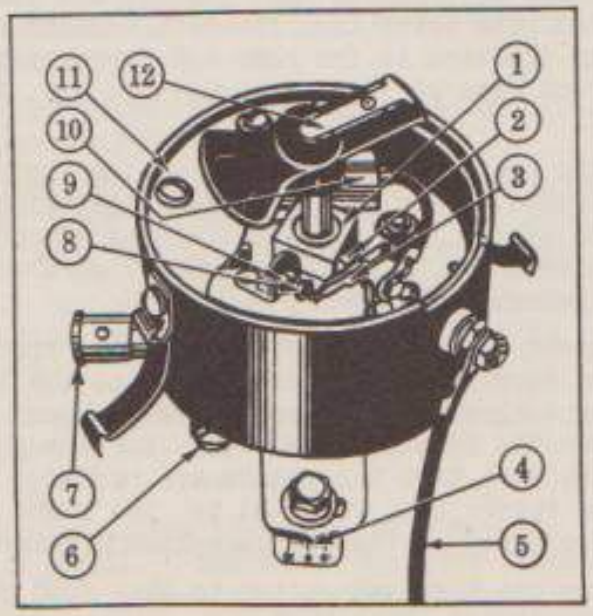


PLATE NO. 8 - DISTRIBUTOR

1. Cam.
2. Breaker Rubbing Block.
3. Breaker Arm.
4. Timing Adjustment.
5. Cable - Distributor to Coil.
6. Clamp or Adjusting Bolt.
7. Grease Cup.
8. Stationary Breaker Point.
9. Point Lock Nut.
10. Condenser.
11. Dust Proof Cover.
12. Rotor.

The ignition system on this tractor consists of either a Distributor Assembly and Induction Coil, or a Magneto, Spark Plugs, and Cables.

DISTRIBUTOR:

The distributor is driven from the upper end of the oil pump shaft. It requires lubrication each 60 hours. Use a good grade of fibre grease such as front wheel bearing grease in the grease cup (No. 7, Plate 8).

BREAKER POINTS; DISTRIBUTOR:

The Breaker Points must be clean and making proper contact before adjustment is made. Set breaker rubbing block on the high point of the cam. Loosen lock nut and turn the adjustable point until a .020" gap is obtained. Tighten lock nut and recheck point adjustment. Keep the points free from oil or grease and clean or polish the points every 200 hours. When points become pitted or rough, they must be ground or honed smooth. After points have been ground once, they should be replaced when becoming rough again. If the points get rough or pit quickly, it indicates that the condenser (No. 10, Plate 8) is defective or is not making good contact at its ground or wire connection. As the electric current through the condenser

is very low, the ground connection and wire connection must be very clean in order to carry this low current.

SPARK PLUGS:

The spark plug size is 18 M.M. The setting of the spark plug point gap is .025"; check with a gauge and adjust accurately. Check and clean the plugs frequently especially if the engine is hard to start.

The heat range of the plugs is of comparatively medium range. When replacing the plugs, they should have a heat range comparable to Auto-Lite B 7 plugs in both gasoline engines and low grade fuel engines. If the points of the plugs deteriorate rapidly, or the tip of the porcelain chips or cracks, it indicates that the plug is too "hot". If the plug fouls frequently or the points are black or sooty, it indicates that the plug is too "cold". However, a carburetor mixture that is too lean will make a plug that is correct appear too "hot" and a mixture that is too rich will make a correct plug appear too "cold".

When installing spark plugs, be sure there is a round copper gasket between the base of the plug and the cylinder head and that the plug is tight on the gasket, as this gasket carries the heat from the plug. If the gasket is pressed quite thin, use a new gasket. Replace the spark plugs every 250 hours, and the engine will use less fuel and have more power.

The proper Torque Wrench tension for the plug is 40 foot pounds.

CABLES:

Occasionally check the spark plug cables and the cable from the Distributor to the Coil. See that the cable terminals set snugly in the Distributor Cap sockets, and that there are no cracks in the insulation, also keep the top of the distributor cap and cables clean. When the insulation on the cables becomes hard and cracked, the cables should be replaced. The size of the cable is 7 M.M. or #1 Brown and Sharpe Gauge.

IGNITION TIMING:

Firing order, 1 - 3 - 4 - 2.

BE SURE BREAKER POINTS ARE CAREFULLY AND ACCURATELY ADJUSTED AND IN GOOD CONDITION. (Refer to Page 17.)

TIMING PROCEDURE FOR GASOLINE MODELS:

1. Remove distributor top.
2. Remove the inspection hole cover from flywheel housing opening (located to the rear of carburetor on front face of flywheel Housing) (18, Plate 12). Bring No. 4 Piston up on compression stroke until mark IGN on the flywheel lines up with the pointer in the flywheel housing. (Plate 7.)
3. Loosen clamp or adjusting bolt (6, Plate 8) and turn the distributor body to the left. (Anti-clockwise as you look down on it.) Turn the distributor body far enough to make sure that the points are closed. Turn the rotor (10, Plate No. 8) to the right (or clockwise) so that all back-lash is taken up.
4. Turn the ignition switch to the "ON" position (Plate 1).
5. Disconnect the ignition cable that leads from the center of the distributor cover to the spark coil. (Disconnect it at the distributor.) Hold the end of the cable very close to some metal part of the engine and at the same time turn the distributor clockwise until a spark occurs at the end of the cable just disconnected. Set the distributor at the exact point where the spark occurs by tightening the clamp screw (6, Plate 8).
6. Replace distributor cover and reconnect ignition cable.
7. Check the accuracy of the above setting by removing cables from No. 1 and No. 4 spark plugs and holding them very close to some metal part of the engine. With the ignition switch still "ON" turn the flywheel backward about 1/8 of a turn, then turn very slowly forward until a spark occurs at the end of either of the two disconnected cables. If the "IGN" mark is in line with the pointer when the spark occurs, the timing is correct.

TIMING PROCEDURE FOR LOW GRADE FUELS:

1. Remove distributor top. Remove the inspection hole cover from flywheel housing opening (located to the rear of carburetor on front face of flywheel housing). (18, Plate 12.)
2. Turn the flywheel so that timing pointer, located at the rear of the right side of the engine, is three sixteenths of an inch above No. 1, D.C. (Dead Center) mark on the flywheel. (Plate 7.)
3. Loosen clamp or adjusting bolt (6, Plate 8) and turn the distributor body to the left. (Anti-clockwise as you look down on it.) Turn the distributor body far enough to make sure that the points are closed. Turn the rotor (10, Plate 8) to the right (or clockwise) so that all back-lash is taken up.
4. Turn the ignition switch to the "ON" position (No. 6, Plate 1.)
5. Disconnect the ignition cable that leads from the center of the distributor cover to the spark coil. (Disconnect it at the distributor.) Hold the end of the cable very close to some metal part of the engine and at the same time turn the distributor clockwise until a spark occurs at the end of the cable just disconnected. Set the distributor at the exact point where the

spark occurs by tightening the clamp screw (6, Plate 8).

Replace distributor cover and reconnect ignition cable.

Check the accuracy of the above setting by removing cables from No. 1 and No. 4 spark plugs and holding them very close to some metal part of the engine. With the ignition switch still "ON", turn the flywheel backward about 1/8 of a turn, then turn very slowly forward until a spark occurs at the end of either of the two disconnected cables. If the D.C. mark is 1/8 to 3/16" above the pointer when the spark occurs, the timing is correct.

The timing may also be checked with the engine running at 1/3 to 1/2 speed, and moving the distributor forward and backward to advance and retard the spark. Correct timing is where the engine runs fastest and smoothest.

A "glow lamp" may be devised by adding an extension of insulated wire to number 4 spark plug cable (disconnected from the spark plug) and hold the end of the extension wire close to the flywheel through the opening as shown on Plate 7, then, with the engine running, the firing time will show in relation to marks on the flywheel, by the light created by spark jumping from the wire to the flywheel.

SECTION 7

CARBURETOR AND MANIFOLD

The carburetor is Marvel-Schebler make and ssified as a 1" size.

There are two types of carburetor and ifold systems. One for gasoline model ctors and the other for low grade fuel els.

In the gasoline models, use gasoline of 70 ane or better. Do not attempt to use third de or "white" gasoline.

In the low grade fuel model, use a fuel of octane or better.

Gasoline may be used in the low grade fuel el by keeping the heat control on the mani- d in the cold position and the shutters on radiator wide open.

Low grade fuels cannot be used in the soline models.

The carburetor is adapted with an automatic lance tube to compensate for any restriction used by a partially clogged air cleaner.

Do not experiment with different size jets her than regular equipment or any so called el saving "gadgets".

If the carburetor is dismantled for clean- g or repairs, be sure the bowl gasket is ght and free from leaks.

Do not clean the jets with a wire or any nd of metal. Use free air or a few blasts om a tire pump. The holes in the jets are ry critical and the jet (being of brass to revent rust and corrosion) would be damaged or ined if cleaned with a metal object.

The fuel level in the bowl is also very portant. The fuel level is adjusted by bend- ng the float arm, not the float. The float rm is to be adjusted so that the top edge of he float is 9/32" below the machined surface n the outer, underneath edge of the bowl cover hen the float valve is closed.

When it becomes necessary to replace the float, valve, seat or gasket, it is necessary to replace the entire float assembly to assure proper fuel level.

Do not tamper with carburetor unnecessarily.

Adjustment for Burning Gasoline:

The main needle valve provides a means of manually controlling the ratio of fuel and air. Close the main needle valve by turning it to the right until the needle is seated (never force it against seat), then open by turning it to the left for an approximate setting of 2 to 2-1/2 turns. Start engine and put tractor to work under a maximum load with the approximated needle valve setting. After the engine is thoroughly warmed up, turn the needle valve gradually to the right until the engine starts to lose power due to the lack of fuel. Then gradually turn in the opposite direction until the position is found where the engine speed will not increase with further increase in fuel. This adjustment should be carefully made to insure the best fuel economy.

The idling adjustment should be set from 2 to 3 turns open. If opened more than 3 turns, acceleration of the engine will be affected.

Adjust carburetor throttle stop screw to obtain proper idling speed with hand throttle in idling position. Always make the idling adjustment after the main needle valve adjustment and while engine is warm.

Adjustment for Burning Low Grade Fuels:

The low grade fuel model tractors are equipped with a main fuel tank and an auxiliary fuel tank, a heat regulator on the manifolds and adjustable shutters on the radiator. There is also a shield over the manifolds.

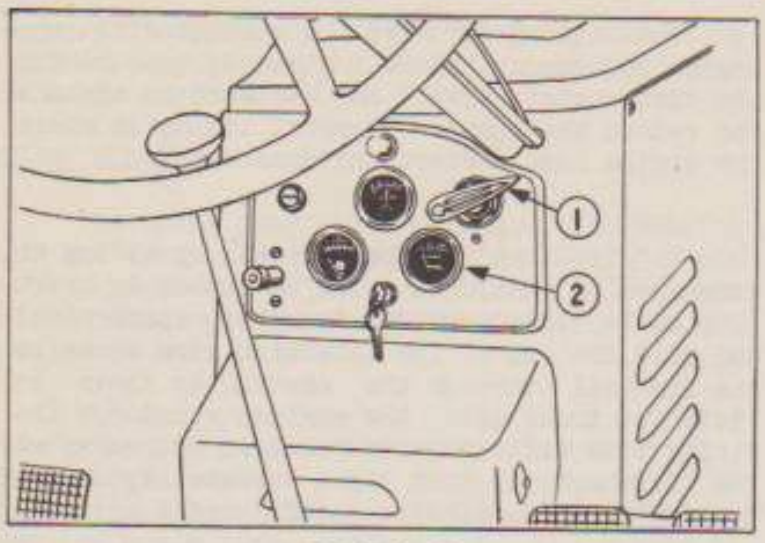


PLATE NO. 9

When burning low grace fuels, proceed as outlined in the following paragraphs:

1. Close fuel valves under both fuel tanks and fill main tank with fuel and auxiliary tank with gasoline. See Plate 10.

2. Drain the carburetor if it contains low grade fuel and open fuel valve under auxiliary tank.

3. Close radiator shutters by turning shutter control handle as indicated on the instrument panel (1, Plate 9) and start engine.

4. Keep radiator shutters closed and carburetor fed from gasoline tank until water temperature indicator on instrument panel (2, Plate 9) shows between 175 and 200. Then close gasoline tank valve (2, Plate 10), and open fuel tank valve (1, Plate 10). Never permit both fuel valves to be open at the same time or the fuels will flow from one tank to the other and become mixed.

5. While working or running the tractor, keep the water temperature indicator between 175 and 200 by opening or closing the radiator shutter. The ideal working position is 190.

6. There are four positions for manifold heat regulation as shown (Plate 10) to make adjustment for seasonal temperature changes. For summer or atmospheric temperature of 85 degrees and up, set the lever on the manifold heat control lever (Plate 10) on COLD. For spring and fall or atmospheric temperature ranging between 45 degrees and 85 degrees, set the manifold lever on the INTERMEDIATE positions (Plate 10). For winter or temperature below 45 degrees, set the manifold lever on HOT (Plate 10).

To adjust the carburetor, have the manifold heat regulator properly adjusted and the water temperature regulated as just outlined and proceed as outlined for carburetor adjustment on Page **.

If excessive dilution of the engine oil occurs, set heat regulator on manifold to hotter position or close needle valve on carburetor, also watch water temperature closely to maintain operating temperature at 190.

If the engine is to run idle for any length of time, close the radiator shutters enough to maintain normal water temperature.

If the engine is stopped while burning low grade fuel, close the fuel shutoff valve under the main tank and drain the carburetor so that the carburetor can be filled with pure gasoline when preparing to start the engine again.

Observe the water temperature gauge frequently and adjust the radiator shutters occasionally if necessary, to maintain water temperature of 190 degrees F.

SECTION 8

FUEL TANKS AND LINES

The capacity of the main tank on both gasoline and low grade fuel models is 12 gallons. The capacity of the auxiliary tank is 1 gallon.

It is a good practice to fill fuel tanks on the tractor in the evening after a days work. This expels the air from the tank which is naturally high in moisture content that otherwise would condense during the cool of night and collect in the bottom of the tank. This water constantly collecting in the fuel tank would eventually find its way into the fuel lines and cause trouble. It also promotes rust in the interior of the tank.

Clean the fuel strainer and fuel line passages frequently even though they may look OK. Much trouble from lack of power as well as burned and sticking valves is caused by a restricted flow of fuel through the fuel line passages to the carburetor bowl. There are vents in the caps for the fuel tanks. Keep these vents open.

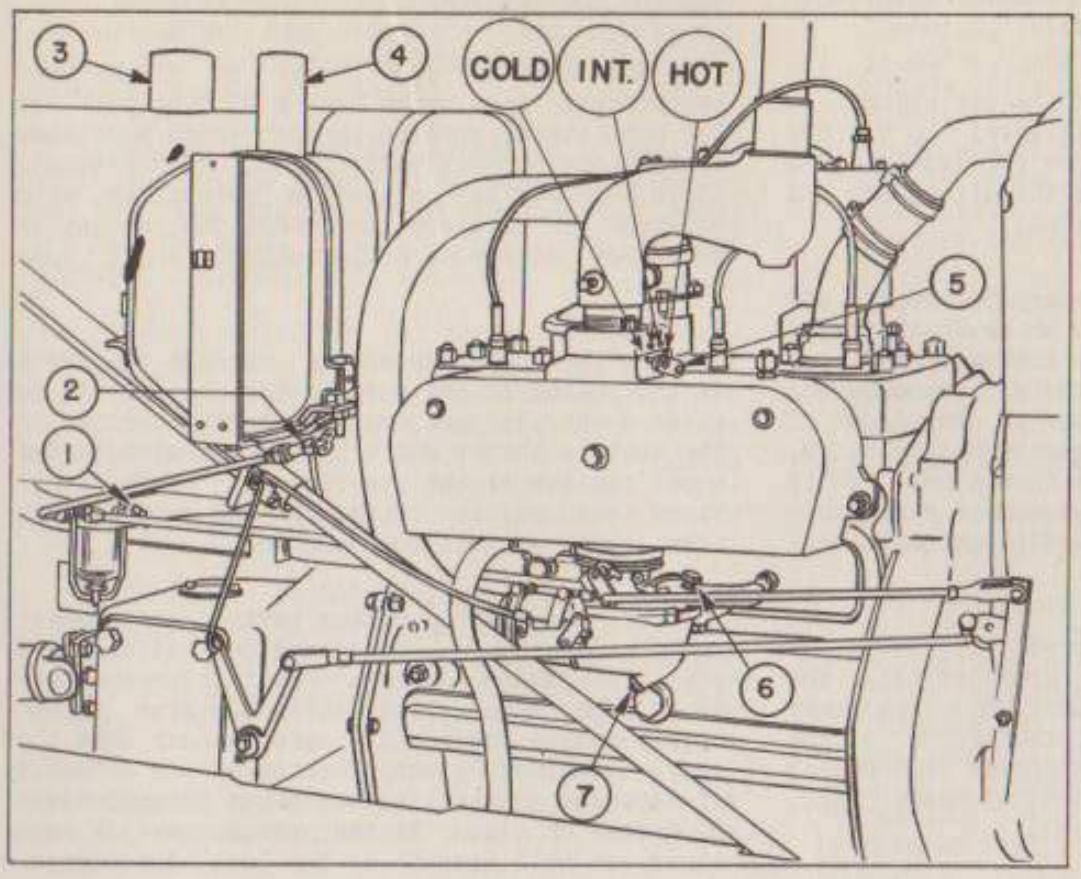


PLATE NO. 10 - MANIFOLD

1. Main or Fuel Tank Valve.
2. Auxiliary or Gasoline Tank Valve.
3. Main Fuel Tank.
4. Auxiliary or Gasoline Tank.
5. Manifold Heat Control Lever
6. Main Jet Adjustment.
7. Carburetor Drain Cock.

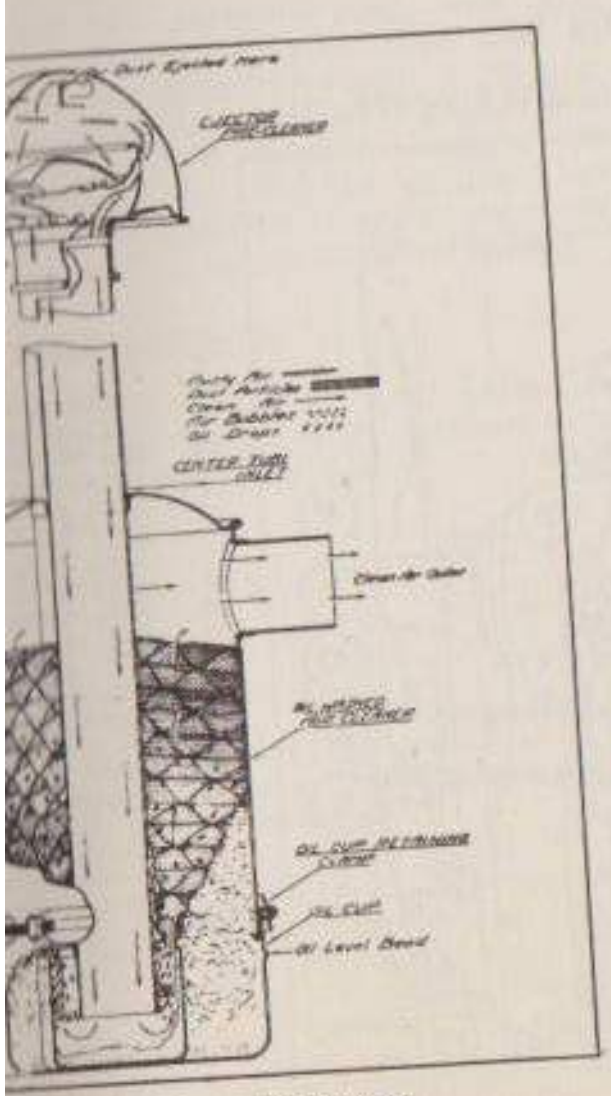


PLATE NO. 11 - AIR CLEANER

When the engine is running at its rated speed under full load, approximately 3215 cubic feet of air pass through the air cleaner and carburetor into the cylinders each hour that the tractor is running. Without an air cleaner on a dry, dusty day as much as a tablespoon of dirt can be drawn into the engine each working hour. Because of the abrasiveness of dust, this amount is very comparable to a like amount of valve grinding compound which would be drawn into the engine and ruin it if it were not for the air cleaner.

The air cleaner is put on the tractor engine to prolong its life and performance by preventing dirt and grit from getting into the engine, causing excessive wear on all operating parts. HOWEVER, THE TRACTOR OPERATOR IS OF NECESSITY CHARGED WITH THE RESPONSIBILITY OF GIVING THE AIR CLEANER EQUIPMENT REGULAR AND CONSTANT ATTENTION IN ACCORDANCE WITH THE INSTRUCTIONS.

SERVICE AIR CLEANER DAILY. Remove oil cup, empty oil, scrape out dirt. Fill to oil level bead with engine oil. Replace oil cup securely. NEVER REMOVE OIL CUP WHILE ENGINE IS RUNNING.

The oil cup should be kept filled as near as possible to the level indicated by the bead with FRESH OIL the same as is used in the

crankcase. Never use oil heavier than that used in the engine crankcase.

The best performance of the air cleaner is obtained by keeping the oil level up to the bead on the cup. Raising the oil level above this point DOES NOT increase the efficiency and this practice should be avoided.

It is absolutely necessary to change oil and thoroughly clean the cup whenever the level of dirt accumulated in the bottom of the cup reaches one-half inch, or the oil appears too thick or heavy to spray properly. The depth of dirt at the bottom can be measured with a stick, screw driver, or whatever is convenient. DAILY INSPECTION is necessary, to enable the operator to see when any of these conditions have been reached.

Ordinarily, if the correct oil level is maintained with the proper grade of oil, the wire screen filtering element will need very little attention. However, the bottom of the screen should be inspected whenever the cup is removed and any accumulation of heavy lint, chaff, leaves or straw removed.

All connections between the air cleaner and carburetor should be inspected at frequent intervals and must be kept tight. SEE INSTRUCTION PLATE ATTACHED TO OIL CUP.

EJECTOR PRE-CLEANER:

The ejector pre-cleaner is of the dry centrifugal type which has a slot or port in the dome shaped portion through which particles of dust are automatically thrown out or ejected. It is intended to be used in connection with oil-type air cleaners to lessen the amount of dust that otherwise would collect in oil type cleaners.

As the dusty air enters through the fins in the bottom of the ejector pre-cleaner, it is given a whirling motion and a large portion of the dust is thrown out through the slot in the upper portion of the pre-cleaner. This operation is automatic in nature and requires no care on the part of the operator.

The fins in the bottom part of the ejector pre-cleaner should be examined periodically and any accumulation of dust or oil or grease removed from them. It is advisable also to entirely remove the ejector pre-cleaner from the stack occasionally and immerse it in a bucket of kerosene or gasoline to remove accumulations of grease or oil. If the pre-cleaner is kept clean, it will operate to the best advantage.

With the ejector pre-cleaner removed, clean out the tube that goes down through the center of the air cleaner body.

SECTION 10

GOVERNOR AND THROTTLE CONTROL

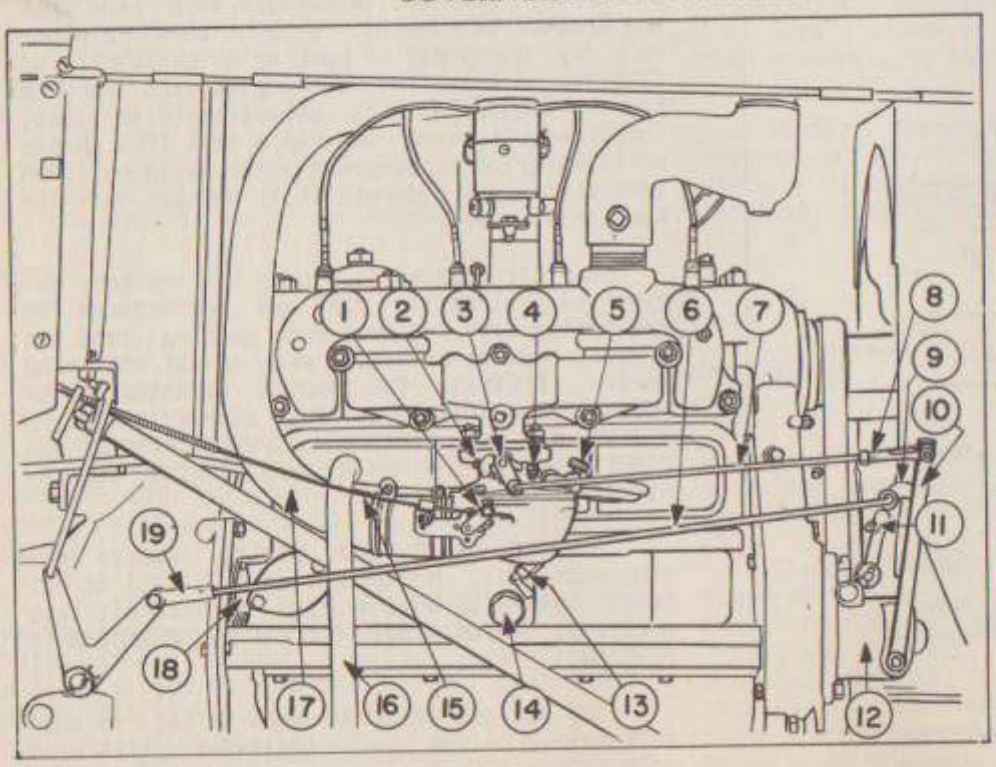


PLATE NO. 12

1. Choke Lever.
2. Idling Speed Adj. Screw.
3. Arm on Butterfly Shaft.
4. Idler Jet Adj.
5. Main Jet Adj.
6. Hand Throttle Rod.
7. Link Gov. to Carb'.
8. Link Adj. Clevis.
9. Gov. Lever.
10. Gov. Arm.
11. Gov. Speed Adj. Screw.
12. Governor.
13. Carburetor Drain Plug.
14. Oil Pressure Adj. Plug.
15. Choke Wire.
16. Crankcase Ventilator.
17. Air Intake Tube Air Cleaner to Carb.
18. Timing Mark on Flywheel Inspection Hole Cover.
19. Hand Throttle Rod Adj. Clevis.

The governor is a variable speed type and is gear driven from the center gear on the cam shaft. It is lubricated from a bath of oil fed from the engine oil pan.

The engine speed is controlled by the governor and engine speed can be varied by moving the hand throttle lever on the steering post. Moving the hand throttle lever down on its quadrant increases engine speed.

There are two sets of notches on the quadrant for the hand throttle lever. The first or upper set of notches regulates the engine speed from idle to 1500 R.P.M. The second or lower set of notches (10, Plate 1), on the raised part of the hand throttle lever quadrant regulates the engine speed from 1500 R.P.M. to 1800 R.P.M.

CAUTION: Do not operate the tractor on drawbar work with the hand throttle lever on the second or lower set of notches on the raised part of the quadrant except in fourth speed. The weight of the tractor, gear train in the transmission, and size of the drive wheels are not designed to operate safely, economically or at practical ground speeds with the engine running faster than 1500 R.P.M. or beyond the first set of notches.

The purpose of the second set of notches is to obtain greater power and higher belt pulley speed for belt work only.

Adjustment:

The governor to carburetor link, and hand throttle rod are properly adjusted when leaving the factory, also the governor speed adjusting screw is sealed to maintain proper engine speed and will need no further attention unless it becomes necessary to replace the governor or carburetor. Then the governor control rods and adjusting screws will have to be adjusted.

To Make Governor Adjustments:

1. Set hand throttle lever on last notch on the first set of notches or against the raised part at the lower end of the quadrant (10, Plate 1).
2. Swing the arm on the butterfly shaft (3, Plate 12) clear back to the "wide open" position, and screw the link adjusting clevis (8, Plate 12) until the holes in the clevis line perfectly with the hole in the upper end of the governor arm and put the pin in place. Tighten the lock nut against the clevis. This adjustment is very important and must not be altered.
3. Close the throttle with the hand throttle lever and adjust engine idling speed by screwing in or out on idling adjusting screw (2, Plate 12).

To Obtain Correct Engine Speed for Drawbar Work:

1. Start engine and let it run until it is at operating temperature.
2. Set hand throttle lever on the lowest notch of the first set of notches (against the raised part at the lower end of the quadrant) and screw the clevis on the hand throttle rod (19, Plate 12) in or out until the belt pulley is running 1115 R.P.M. NO LOAD. Tighten the lock nut against the clevis. This is correct engine speed for drawbar work.
3. Lift hand throttle lever up on second set of notches and pull it down as far as it will go.
4. Screw in or out on governor speed adjusting screw (11, Plate 12) until belt pulley is running 1292 NO LOAD. This is the correct engine speed for belt work. Seal the governor adjusting screw in this position.

Governor Gear Adjustment:

The mesh of the governor drive gear with the timing gear is adjusted by means of a slotted hole in the timing gear cover at the point where the lower bolt in the governor mounting flange fastens. The gears should be adjusted to provide for noticeable back lash or tooth play by pivoting the governor housing around the upper bolt in the governor mounting flange.

SECTION 11

COOLING SYSTEM

The capacity of the cooling system is 2.75 U.S. or 2.3 Imperial gallons. Always use clean water, preferably soft rain water.

The cooling of the water is accomplished by water circulating through the cooling system and air drawn through the radiator core. The water is circulated by a water pump driven by a "V" belt from the engine crankshaft. A suction fan is secured on the front end of the pump shaft to draw air through the radiator core.

On low grade fuel tractors, the temperature of the water is regulated with adjustable shutters in front of the radiator. The shutters are adjusted to meet the varying atmospheric temperatures of the day and season to maintain a temperature of 180° F. constantly. The temperature of the water is shown by a temperature gauge on the instrument panel.

For Cold Weather Operation: Completely drain the system when the tractor is not in

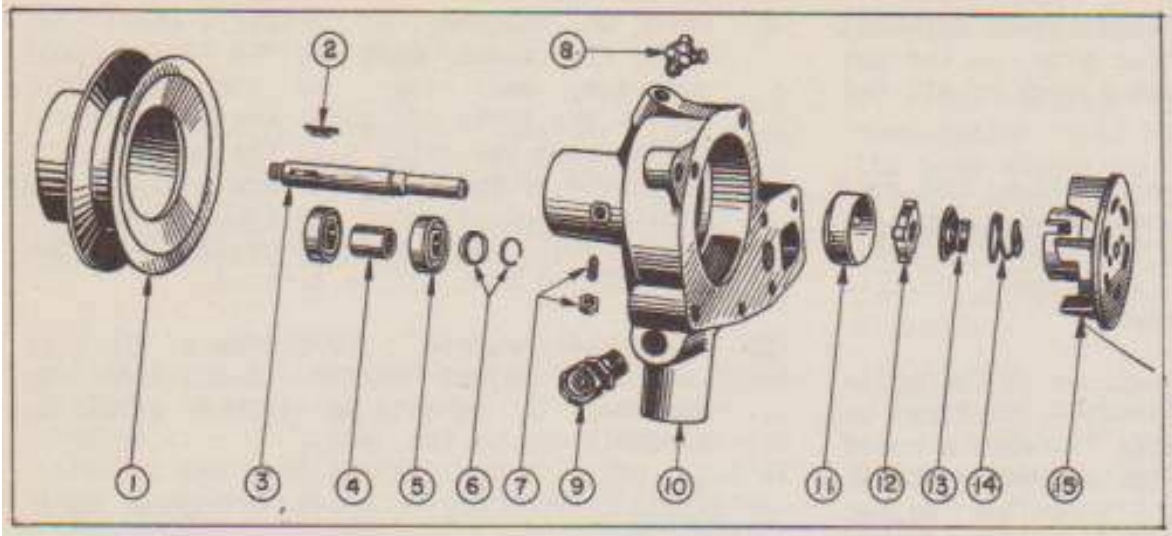


PLATE NO. 13 - WATER PUMP

1. Fan Hub.
2. Mortons Hi-Pro Key.
3. Water Pump Shaft.
4. Spacer Between Bearings.
5. Ball Bearing.
6. Snap Ring and Retainer.
7. Bearing Locking Screw and Nut.
8. Pressure Grease Fitting.
9. Water By-Pass Elbow.
10. Water Pump Body.
11. Brass Cup Over Seals.
12. Carbon Disk Seal.
13. Neoprene Seal.
14. Seal Spring.
15. Impeller.

actual use or else employ a good anti-freeze solution. See Page 41. Alcohol is not recommended because of its low boiling point.

RADIATOR:

Clean radiator screen occasionally. Never allow chaff, leaves, etc. to accumulate on screen in sufficient quantities to affect cooling.

Drain Cooling System:

To completely drain cooling system open drain cock in radiator outlet tube under radiator and also drain cock on the left side of the engine by the starting motor. In cold weather, unless anti-freeze solution is used, the operator should not leave the tractor until it is completely drained. Every ninety days, remove both drain cocks and flush out the cooling system with clean water until all accumulated sediment is washed out.

WATER PUMP:

To dismantle the pump the following procedure should be followed:

1. Remove radiator and fan belt.
2. Remove fan blades from fan pulley hub.
3. Remove the cap screws holding the water pump body to the front end of the cylinder block and the pump can be removed as an assembly.
4. Remove the nut holding the fan pulley hub on the pump shaft and remove the fan pulley. Do not pound or drive on pulley hub, as the carbon seal inside the pump is liable to be damaged by the shock. Pull or press the hub off the shaft.
5. Remove the three screws holding the rear cover plate to rear of water pump body and remove the plate.
6. Pull the impeller and seal assembly off of the rear end of the shaft.
7. Loosen the lock nut and remove the set screw (No. 7, Plate 13) and press the shaft and bearing assembly out of front, or the small end of pump body.

To reassemble, reverse the foregoing procedure. Pack the space between the ball bearings with a good quality fibre grease such as front wheel bearing grease.

The seal assembly for preventing water leak is contained in the hub of the impeller and is held in place by the brass cup which is pressed over the impeller hub. If a water leak develops, it is more than likely that the seal has become damaged or worn and should be replaced. This can be done by removing the rear cover of the pump body and impeller without removing the shaft and bearings.

When installing a new seal assembly, wet the shaft and rubber seal with soapy water before pushing rubber seal on shaft to prevent damaging the rubber seal.

When replacing the bearings on the water pump shaft be sure the shielded side of the bearings are toward the outer side of the assembly so the grease can work into the ball race.

A good fibre grease should be used in the grease fitting. This fitting has a pressure release valve to prevent damage to the bearing seals by over greasing.

Fan Belt:

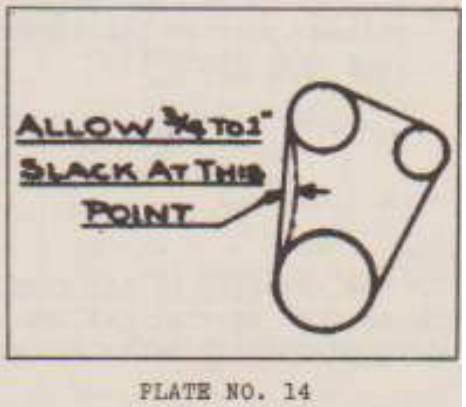


PLATE NO. 14

Loosen generator adjusting bolts and pull out on the generator with hand until fan belt is snug. Tighten adjusting bolt to hold generator in new position. Under no circumstances should the fan belt be tightened by moving the generator with a pry bar.

The fan belt is to be adjusted just tight enough so that it can be deflected about three-quarters to one inch as shown in Plate No. 14.

SECTION 12

ELECTRICAL SYSTEM

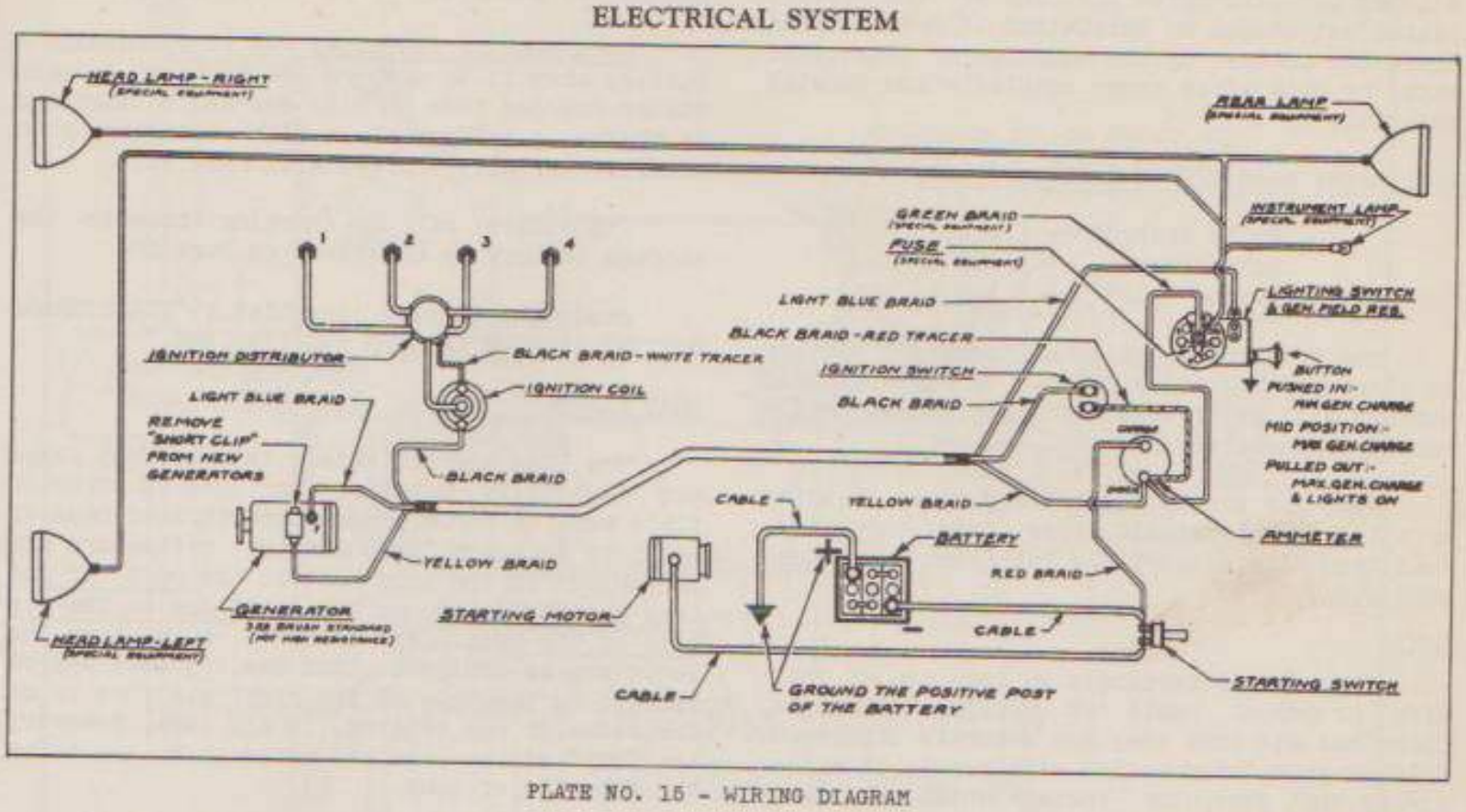


PLATE NO. 15 - WIRING DIAGRAM

The Electrical System (except head lamps) is standard equipment on all model tractors, and consists of the following units - generator, starting motor, storage battery, ignition system (see Section 6). Wiring system and head lamps are extra equipment.

GENERATOR:

The generator is driven by a "V" belt from the crankshaft and is mounted upon a pivoted bracket for belt adjustment. The amount of current delivered by the generator is manually controlled by the light switch (2, Plate 1). The manually controlled resistance switch is connected directly with the generator to control the charge rate, thereby protecting the battery from over or undercharging.

HOWEVER, THE TRACTOR OPERATOR IS OF NECESSITY RESPONSIBLE FOR THE CORRECT USE OF THE SWITCH IN ACCORDANCE WITH THE FOLLOWING INSTRUCTIONS. REMEMBER THAT OVERCHARGING WILL SERIOUSLY DAMAGE THE BATTERY.

The light switch has three positions for various operating conditions:

Position No. 1:

Place the switch button in its farthest forward position for use under normal operating conditions. With the switch in this position, the generator should deliver from 3 to 4 amperes, which is sufficient to maintain the battery at full charge. Always regulate the generator charge rate with the switch in No. 1 position.

Position No. 2:

Place the switch button in the middle position for recharging a low battery and use for this purpose only.

Position No. 3:

Place the switch button in the farthest back position for use under normal operating conditions with lights.

Three drops of oil should be applied each 60 Hours to the armature shaft bearings through the oil cups provided at each end of generator.

STARTER:

The starter requires little attention except for oiling. A few drops of clean engine oil should be applied to the oil cup at the front of the starter at the same time the generator is being lubricated.

NOTE:

After considerable service, the starter and generator should be removed from the engine for examination and test by an electrical expert, preferably at a service station maintained by the makers of the equipment.

STORAGE BATTERY:

The storage battery is in a compartment just below the instrument panel and covered by a removable cover which can be lifted off to inspect and service the storage battery.

The battery water level should not be allowed to fall below the tops of the battery plates but should be maintained at 3/8" to 1/2" above the plates by the addition of distilled water or water free from chemicals and foreign material.

Hydrometer readings of battery fluid:

Fully charged -- 1.275
Half charged -- 1.225
Danger - Low -- 1.150

The freezing point of a discharged battery is about 5° F. above zero. A full charged battery will not freeze at temperatures ordinarily encountered.

Keep the top of the battery clean. After scraping the terminals free from corrosion, coat them with a non-fluid lubricant to retard corrosion.

NOTE:

Inspect the terminals at each end of positive or ground cable at regular intervals, clean and see that they are securely tightened. A loose ground connection will result in excessively high generator voltage which is likely to pit and burn ignition breaker points and damage the generator and electrical equipment.

Care must be exercised not to overcharge a battery when it is new. A new battery is much easier charged than an old one and to continue to charge a battery at a high charging rate after it is fully charged will ruin it.

The control of the charging rate to the storage battery is described on Page 25.

Study the battery pamphlet, "THE STORAGE BATTERY IN YOUR TRACTOR AND ITS CARE."

HEAD LAMPS:

The lens and reflectors in the head lamps are especially designed for use in tractor field work to throw a wide concentrated beam of light if both the lens and the reflectors are assembled in the lamp so that the part of the lens and reflectors marked "TOP" are on the top side of the lamp. The brackets supporting the lamps are so designed that the brackets may be mounted on the rear of the right platform or on the sides of the tractor. In any case, however, the "TOP" of the lens and reflectors are to be the top side of lamp.

SECTION 13

CLUTCH AND BELT PULLEY GEAR CASE

CLUTCH HOUSING:

The clutch assembly is bolted to the face of the engine flywheel and is enclosed in a bell housing. The clutch housing is bolted to the rear end of the engine.

In the rear of the clutch housing is a separate compartment which contains the gear for driving the belt pulley.

CLUTCH:

The single plate dry disc clutch has ample capacity for transmitting the power of the engine.

As the facings wear, the release levers in the clutch assembly move outward toward the release bearing. In time the working clearance between the release bearing and the release levers would disappear as the release bearing is held in its position by the clutch pedal (7, Plate 1), and create a condition called "Clutch Riding" which would cause slippage and damage to the clutch facings.

ADJUSTMENT:

To prevent "clutch riding", or to make clutch pedal adjustment, adjust the link rod connecting the lower end of the clutch pedal to the arm on the clutch throw-out shaft so that the pedal is not less than 1/2 to 3/4 of an inch away from the platform before it starts to release the clutch or when it is felt to put pressure on the release bearing.

Do not attempt to adjust the pressure on the release levers in the clutch assembly without a special tool to calibrate and equalize the pressure on all levers alike.

The clutch release bearing in the clutch assembly will require no lubrication by the operator, it being a permanently lubricated type, packed in special lubricant at the time of assembly.

CAUTION: Never use the clutch pedal as a foot rest.

BELT PULLEY ASSEMBLY:

The belt pulley assembly is supplied as extra equipment and can be installed on any model tractor at any time.

The belt pulley gear case contains 3 quarts of SAE #90 oil. Once yearly drain out the old oil, flush out the gear case and refill with fresh oil. This should be done in the spring and when the oil is warmed up by tractor operation.

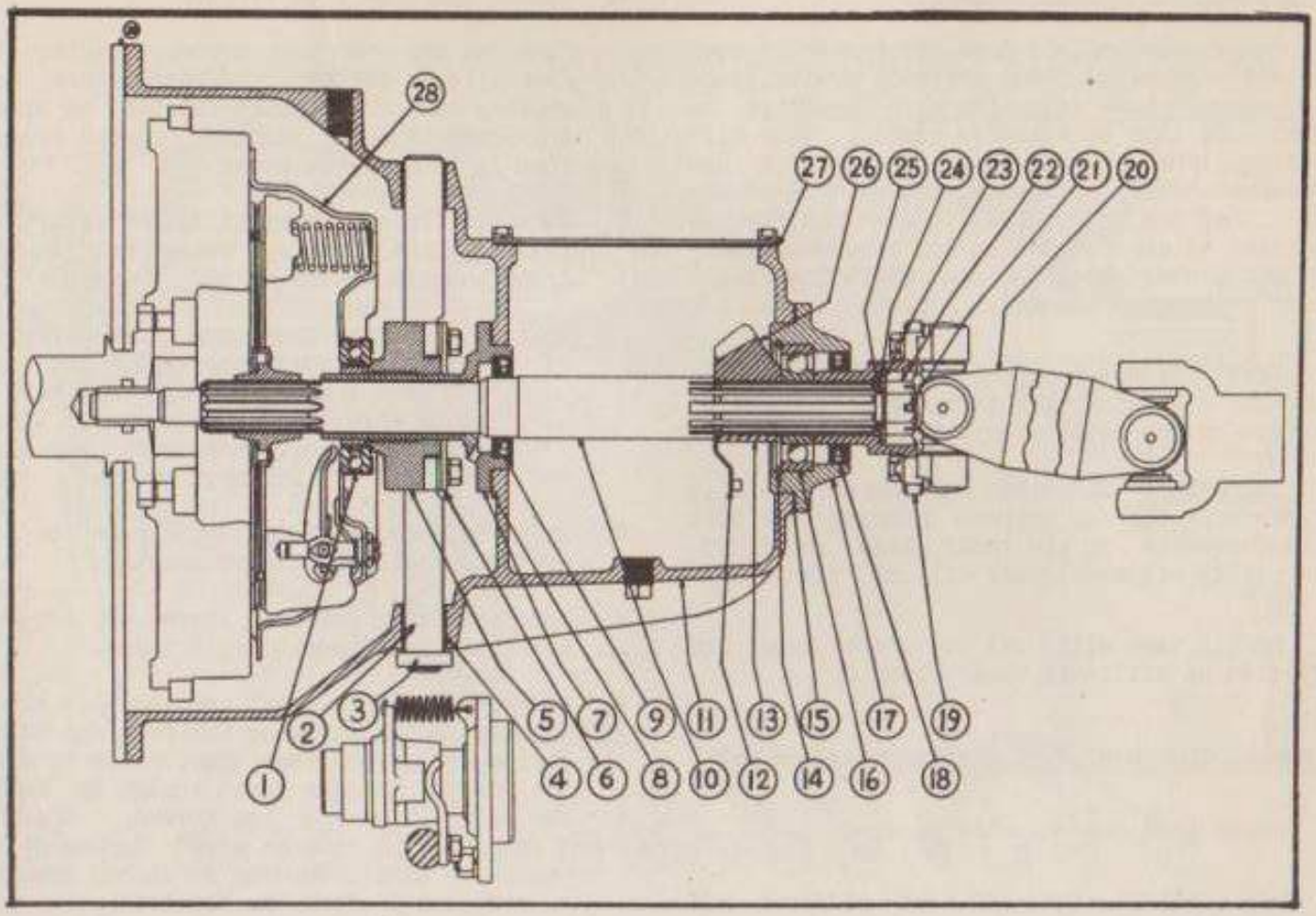


PLATE NO. 16 - CLUTCH AND BELT PULLEY GEAR HOUSING

1. Clutch Release Bearing.
2. Clutch Release Shaft.
3. Clutch Release Shaft Lever.
4. Clutch Release Shaft Bushing.
5. Clutch Throw-Out Bearing Sleeve.
6. Clutch Throw-Out Yoke.
7. Clutch Throw-Out Bearing Guide.
8. Clutch Throw-Out Bearing Guide Gasket.
9. Clutch Throw-Out Bearing Guide Oil Seal.
10. Clutch Shaft.
11. Clutch and Belt Pulley Drive Housing.
12. Clutch Shaft Oil Paddle.
13. Clutch Shaft Spacer.
14. Clutch Shaft Bearing Snap Ring.
15. Clutch Shaft Bearing Cap Gasket.
16. Clutch Shaft Bearing.
17. Clutch Shaft Bearing Cap.
18. Clutch Shaft Bearing Oil Seal.
19. Universal Joint Knuckle.
20. Universal Joint Assembly.
21. Clutch Shaft Joint Nut Cotter Pin.
22. Clutch Shaft Joint Nut.
23. Clutch Shaft Joint Nut Washer.
24. Clutch Shaft Joint Nut Gasket-Vellum.
25. Clutch Shaft Joint Nut Gasket-Cork.
26. Belt Pulley Drive Gear.
27. Belt Pulley Housing Shims.
28. Clutch Assembly.
29. Rear Engine Plate.

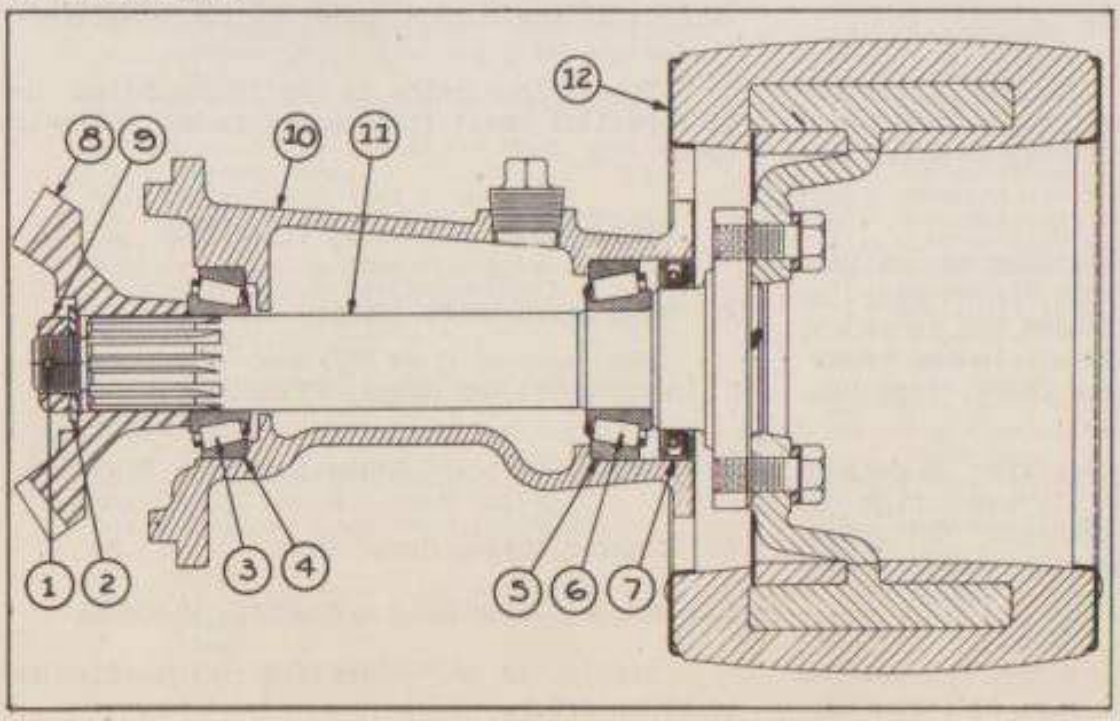


PLATE NO. 17 - BELT PULLEY HOUSING

1. Belt Pulley Drive Gear Nut Cotter Pin.
2. Belt Pulley Drive Gear Washer.
3. Belt Pulley Shaft Bearing Cone Inner.
4. Belt Pulley Shaft Bearing Cup Inner.
5. Belt Pulley Shaft Bearing Cup Outer.
6. Belt Pulley Shaft Bearing Cone Outer.
7. Belt Pulley Shaft Oil Seal.
8. Belt Pulley Drive Gear
9. Belt Pulley Drive Gear Nut.
10. Belt Pulley Housing.
11. Belt Pulley Shaft.
12. Belt Pulley.

TO INSTALL BELT PULLEY ASSEMBLY:

Remove steel plate from right side of gear case and bolt belt pulley assembly in its place using enough shims (supplied with assembly) to obtain .006 inch backlash in gears. This will be accomplished if the backlash permits the face of the belt pulley to travel 3/64 of an inch. Turn the belt pulley to 4 or 5 different positions of one revolution and make the adjustment measurement at the point where the least amount of backlash occurs.

This can be measured by measuring the travel of a scratch mark (not a pencil mark) on the face of the belt pulley.

IMPORTANT: Make this adjustment carefully and be sure the cap screws holding the belt pulley assembly on the gear case are TIGHT. Incorrectly adjusted gears will not last long.

Refill case with oil to proper level as indicated by oil level plug, Plate 2.

TO REMOVE CLUTCH HOUSING AND GEAR CASE:

1. Remove hood top and side panels.
2. Take gasoline line off fuel strainer and carburetor.
3. Disconnect the throttle control rods from bell crank on clutch housing.
4. Remove gas tank from tractor.
5. Take out the two cap screws holding the front tank support bracket to the bell housing and turn support bracket on steering column enough to clear clutch housing when it is moved backward.
6. Take the front universal joint apart by removing the four cap screws holding the front knuckle on the joint.

CAUTION: Do not let the cups come off the universal joint spider or let dirt get into them. The cups are held in place with a wire tied around them. Slide the universal joint and shaft assembly off the rear shaft.

7. Block up under engine just enough to take the weight off the clutch housing.
8. Remove locking wire and loosen cap screw in front engine support 3 or 4 turns.
9. Remove the cap screws holding the clutch housing to the plate on the rear end of the engine and at the same time, block up under the rear of engine just enough to remove the weight from the cap screws. Then the clutch housing can be moved backward far enough to permit working on clutch assembly or removing it from the flywheel.

To reassemble, reverse the above procedure. Do not forget to secure bolt in front end support of engine.

SECTION 14

TRANSMISSION AND DIFFERENTIAL

TRANSMISSION AND DIFFERENTIAL:

The rear case contains both the transmission and differential assemblies. The transmission and differential assembly housings are divided by a wall in the case.

The transmission case contains two gallons of SAE #140 lubricant. An oil level plug on the left side of the case toward the front end determines the proper oil level in the transmission case. (See Lubrication Chart, Page 10).

The differential case contains 4 gallons of SAE #140 lubricant. An oil level plug on the rear end of the case determines the proper oil level in the differential case. (See Page 10).

See Section 4, Page 10 for Lubrication Service for the transmission and differential.

TO DISASSEMBLE TRANSMISSION AND DIFFERENTIAL:

The various units in the transmission and differential cases disassemble in the following order:

1. Differential Assembly, Plate 20.
2. Main Drive Shaft (front) Plate 21.
3. Main Shaft and Gears, Plate 21.
4. Pinion Shaft and Reduction Gear, Plate 22.
5. Counter Shaft, Plate 23.
6. Reverse Idler Gear and Shaft, Plate 24.

The units are assembled in exactly the opposite order.

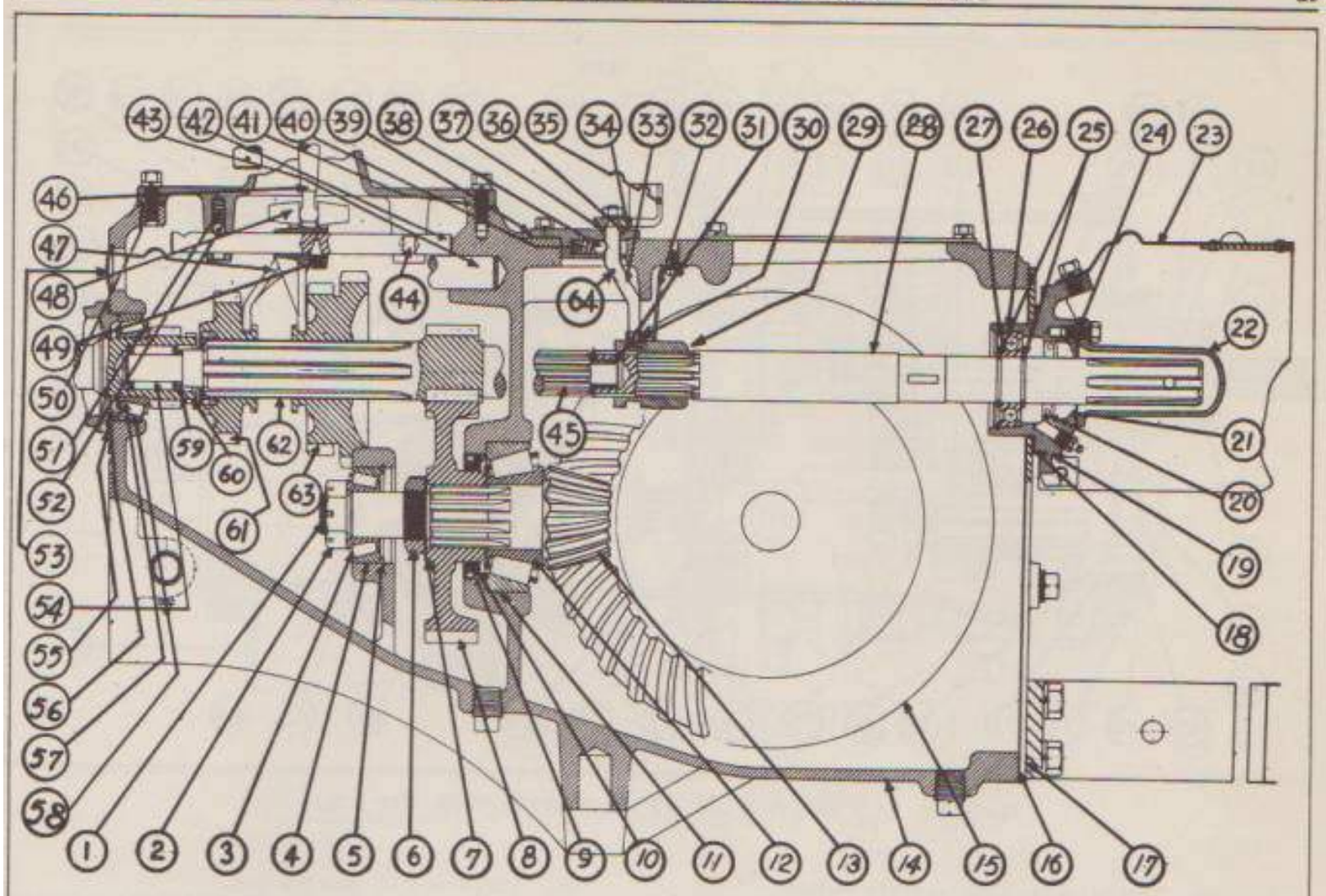


PLATE NO. 18 - TRANSMISSION AND DIFFERENTIAL CASE, SIDE VIEW

1. Differential Pinion and Shaft Nut Cotter Pin.
2. Differential Pinion and Shaft Nut.
3. Differential Pinion and Shaft Front Bearing Cone.
4. Differential Pinion and Shaft Front Bearing Cup.
5. Differential Pinion and Shaft Snap Ring.
6. Differential Pinion and Shaft Nut.
7. Differential Pinion and Shaft Washer.
8. Reduction Gear.
9. Differential Pinion and Shaft Oil Seal.
10. Differential Pinion and Shaft Bearing Spacer.
11. Differential Pinion and Shaft Rear Bearing Cup.
12. Differential Pinion and Shaft Rear Bearing Cone.
13. Differential Pinion and Shaft.
14. Transmission and Differential Case.
15. Drive Gear.
16. Transmission Case Rear Cover Gasket.
17. Transmission Case Rear Cover.
18. P.T.O. and Lift Shaft Bearing Cage Gasket.
19. P.T.O. and Lift Shaft Bearing Cage.
20. P.T.O. and Lift Shaft Bearing Cage Oil Seal.
21. P.T.O. and Lift Shaft Bearing Cage Felt.
22. P.T.O. and Lift Shaft Cap.
23. P.T.O. and Lift Shaft Guard.
24. P.T.O. and Lift Shaft Cap Gasket.
25. P.T.O. and Lift Shaft Bearing Snap Ring.
26. P.T.O. and Lift Shaft Bearing.
27. P.T.O. and Lift Shaft Bearing Snap Ring.
28. P.T.O. and Lift Shaft.
29. P.T.O. Clutch Collar.
30. P.T.O. Shift Crank Block.
31. P.T.O. Drive Shaft Pilot Bushing.
32. Oil Scraper.
33. P.T.O. Shift Crank
34. P.T.O. Shift Cover.
35. P.T.O. Shift Lever.
36. P.T.O. Shift Crank Felt.
37. P.T.O. Shift Crank Washer.
38. P.T.O. Shift Crank Ball.
39. P.T.O. Shift Cover Gasket.
40. P.T.O. Shift Crank Ball Spring.
41. Transmission Case Cover Gasket.
42. Transmission Shifter Rails.
43. Reverse Idler Shaft.
44. Shifter Rail Interlocking Ball.
45. Countershaft.
46. Transmission Shifter Lever.
47. Transmission Shifter Fork.
48. Transmission Shifter Fork.
49. Transmission Shifter Fork Lock Screw.
50. Transmission Case Cover.
51. Shifter Rail Lock Spring.
52. Shifter Rail Lock Spring Ball.
53. Reverse Idler Shaft Plug.
54. Transmission Main Shaft Bearing - Front.
55. Transmission Main Shaft Bearing - Cap Shims.
56. Main Drive Shaft Bearing Cage.
57. Transmission Main Drive Shaft Bearing Cone Rear.
58. Transmission Main Drive Shaft Bearing Cup Rear.
59. Transmission Main Shaft Bearing Spacer.
60. Transmission Main Drive Gear and Shaft.
61. 3rd and High Sliding Gear.
62. Main Shaft.
63. Low and Second Sliding Gear.
64. P.T.O. Shift Crank Pin.

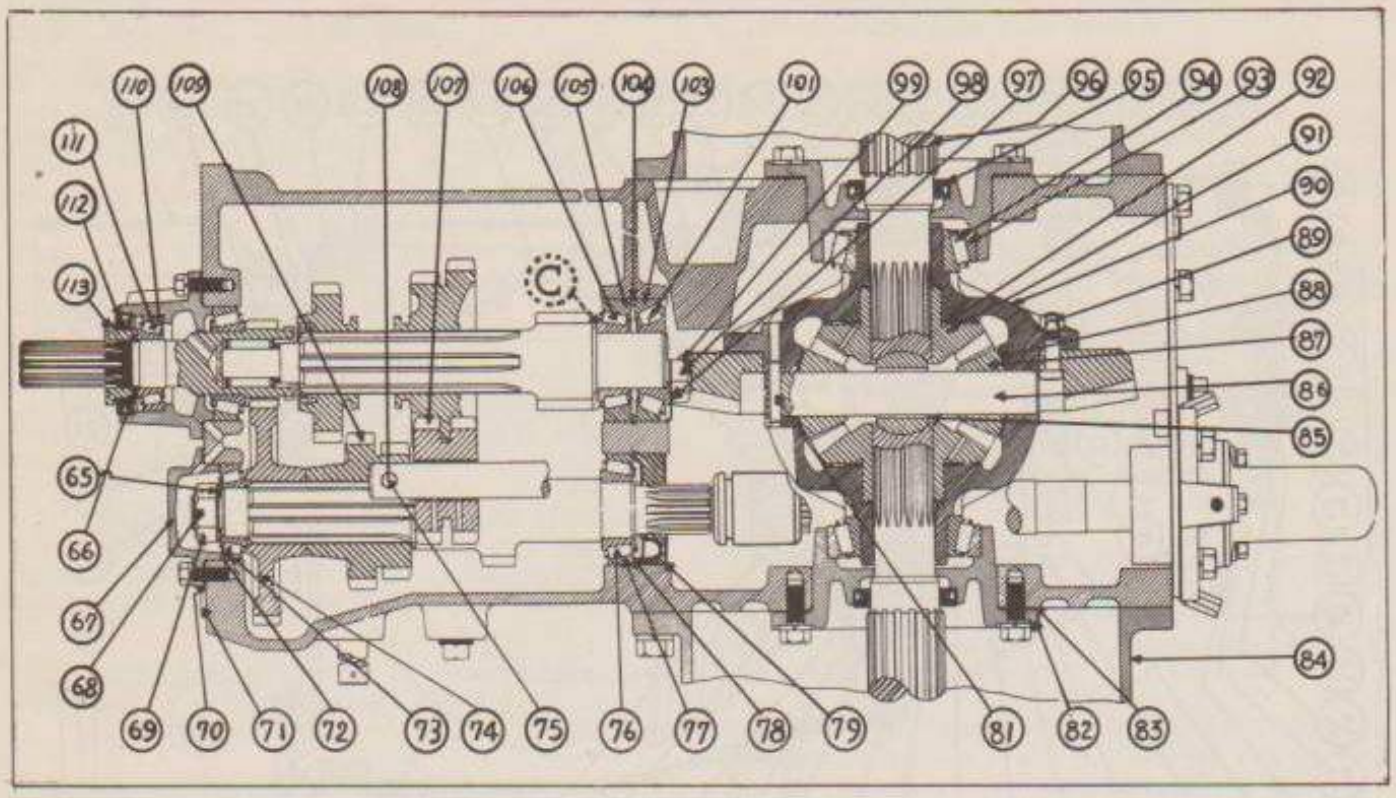


PLATE NO. 19 - TRANSMISSION AND DIFFERENTIAL CASE, TOP VIEW

65. Transmission Countershaft Washer.
66. Drive Gear Oil Seal Collar.
67. Transmission Countershaft Bearing Cap.
68. Transmission Countershaft Nut Cotter Pin.
69. Transmission Countershaft Nut.
70. Transmission Countershaft Bearing Cap Shims.
71. Transmission Case Cork.
72. Transmission Countershaft Bearing Cone Front.
73. Transmission Countershaft Bearing Cup Front.
74. Main Countershaft Gear.
75. Reverse Idler Gear Shaft Screw.
76. Transmission Countershaft Bearing Cone Rear.
77. Transmission Countershaft Bearing Cup Rear.
78. Transmission Countershaft Rear Bearing Snap Ring.
79. Transmission Countershaft Rear Bearing Baffle.
81. Differential Pinion Shaft Pin.
82. Differential Bearing Retainer.
83. Differential Bearing Retainer Shims.
84. Rear Axle Sleeve.
85. Differential Thrust Ball.
86. Differential Pinion Shaft.
87. Differential Pinion.
88. Differential Pinion Thrust Washer.
89. Differential Ring Gear Screw Lock.
90. Differential Case.
91. Differential Side Gear.
92. Differential Side Gear Thrust Washer.
93. Differential Bearing Cup.
94. Differential Bearing Cone.
95. Differential Bearing Retainer Oil Seal.
96. Rear Axle Shaft.
97. Transmission Main Shaft Rear Bearing Diaphragm.
98. Transmission Main Shaft Nut.
99. Transmission Main Shaft Nut Cotter Pin.
100. Differential Thrust Shoe Adjusting Screw Nut.
101. Transmission Main Shaft Bearing Cone Rear-Rear Bearing.
102. Differential Thrust Shoe Adjusting Screw.
103. Transmission Main Shaft Bearing Cup Rear-Rear Bearing.
104. Transmission Main Shaft Bearing Snap Ring.
105. Transmission Main Shaft Bearing Cup Rear-Front Bearing.
106. Transmission Main Shaft Bearing Cone Rear-Front Bearing.
107. Reverse Idler Gear.
108. Reverse Idler Gear Shaft Screw Wire.
109. Transmission Counter Shaft 2nd and 3rd Gear.
110. Transmission Main Drive Shaft Bearing Cup Front.
111. Transmission Main Drive Shaft Bearing Cone Front.
112. Transmission Main Drive Shaft Oil Seal.
113. Transmission Main Drive Shaft Bearing Nut.
114. Differential Thrust Shoe.

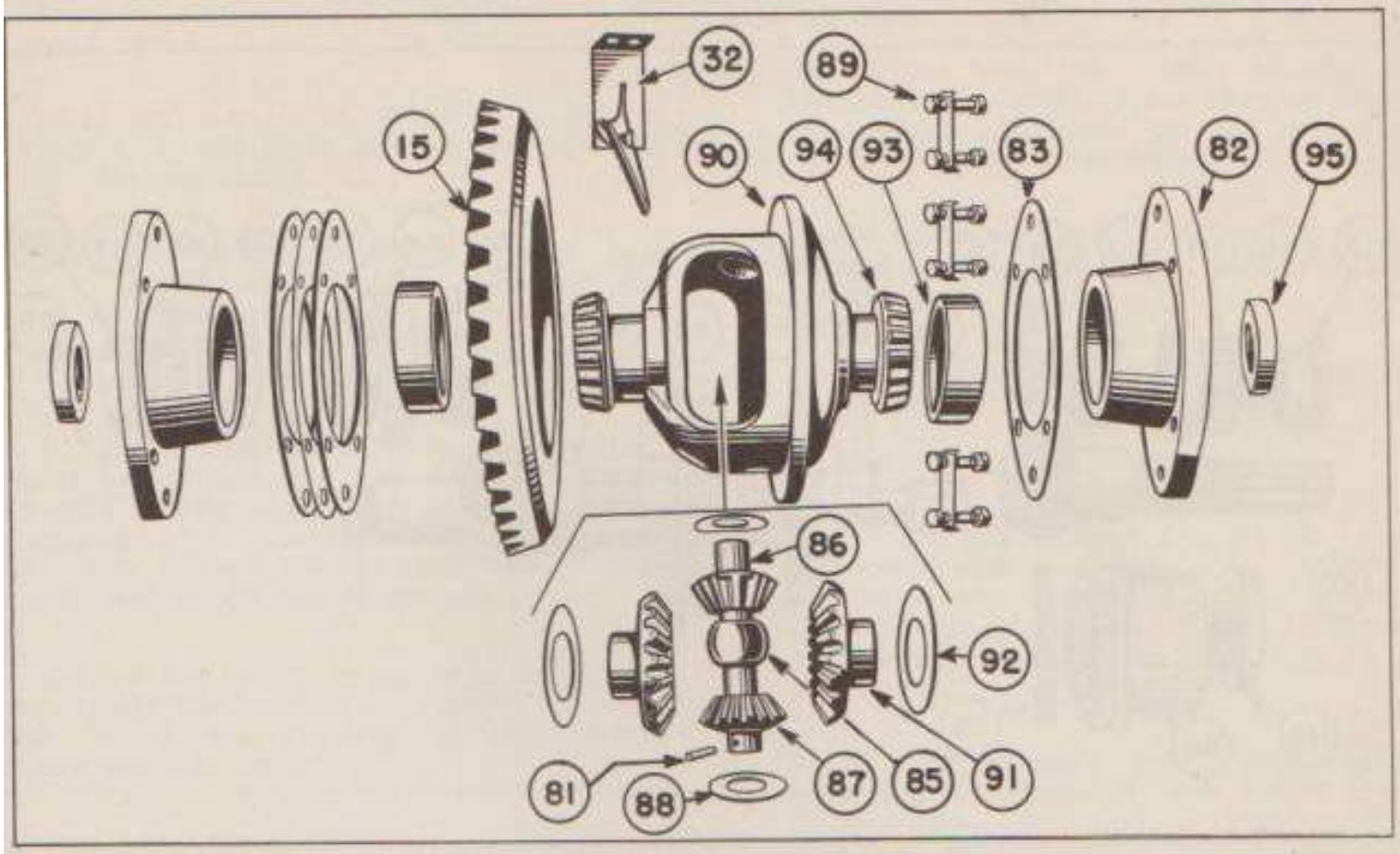


PLATE NO. 20 - DIFFERENTIAL ASSEMBLY
(These numbers are identical with numbers on Plates 18 and 19)

fferential Assembly:

. Block up rear end of tractor securely so that it will not tip or fall, also block front wheels.

. Remove rear wheels.

. Remove fenders and platforms.

. Disconnect brake pull rods and remove rear axle, and sleeve assembly (see Page **).

. If power take-off is in tractor, remove power take-off assembly (see Page 34).

. Remove large plate on rear of differential case.

. Remove both differential bearing housings bolted to each side of case.

. Loosen differential thrust shoe adjusting screw, 102, Plate 19 and differential assembly will come out. CAUTION: Be careful not to distort oil scraper which is side of differential gear (32, Plate 20).

. Remove ring gear 15, Plate 20.

. Drive locking pin 81, Plate 20 out of differential pinion shaft, 86, Plate 20 and shaft will slide out.

. Thrust ball 85, Plate 20 has to be turned sidewise and it will come out.

CAUTION: DO NOT pit or mar this thrust ball Spider Gears (87, Plate 20) and Thrus Washer (86, Plate 20) will now com out.

When reassembling, rivet the hole fo locking pin 81, Plate 20, so that it will no come out.

The full width of the oil scraper troug 32 must just clear the side of the ring gea .020".

Adjust backlash of ring gear and pinion t .007" to .012" by shifting shims between bear ing housing and case from side to side.

Set differential thrust shoe so it clear the side of the differential gear .010 of a inch.

TO DISASSEMBLE TRANSMISSION:

MAIN DRIVE SHAFT FRONT AND REAR:

1. Take front universal joint apart by re moving the 4 cap screws holding the fron knuckle on the joint. CAUTION: Do not le cups come off universal joint spider or le dirt get into them. The cups are held place with a wire tied around them. Slid universal joint assembly off rear shaft.

2. Remove the four cap screws holding th bearing housing 56, Plate 21 and the fron shaft assembly can be taken out.

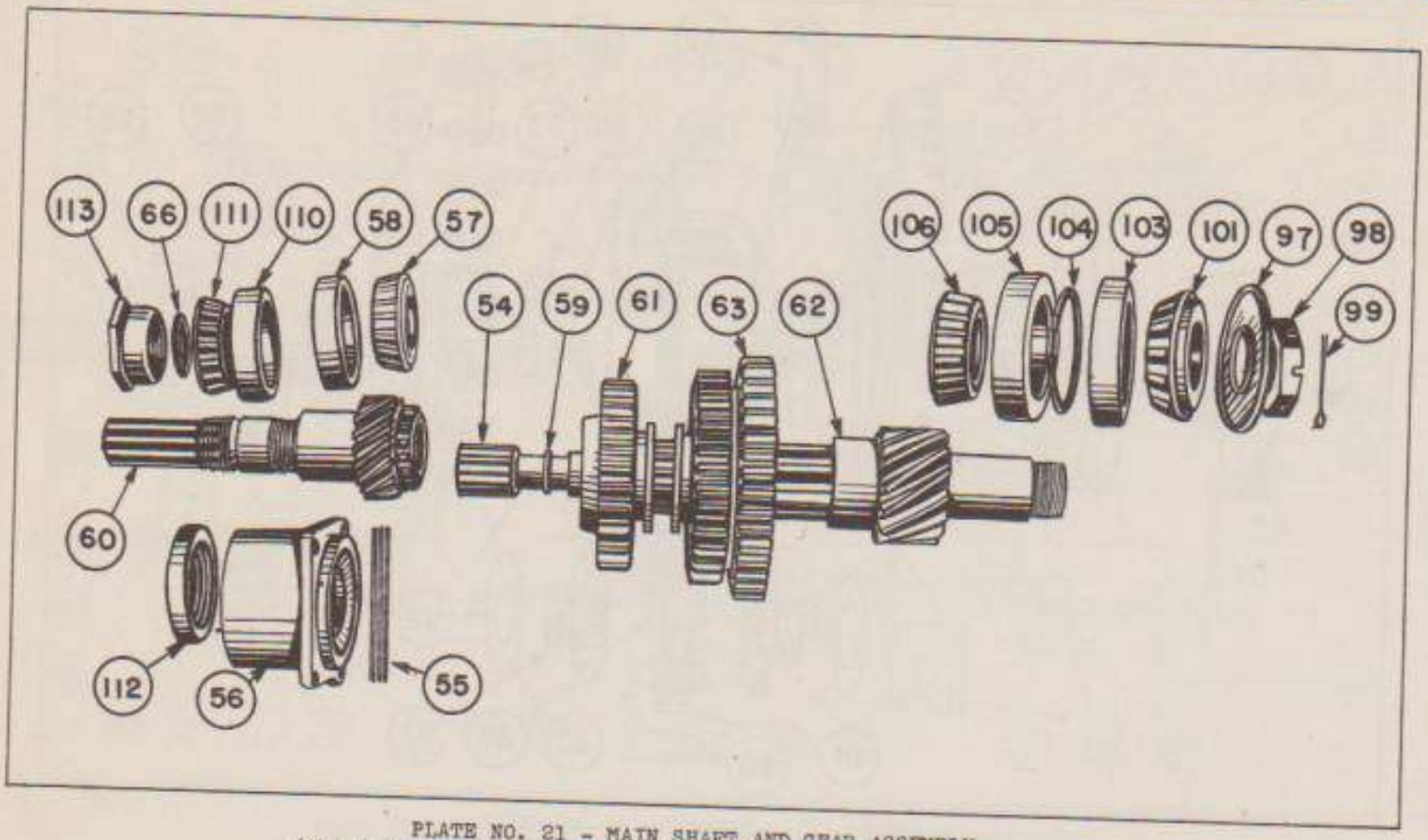


PLATE NO. 21 - MAIN SHAFT AND GEAR ASSEMBLY
(These numbers are identical with numbers on Plates 18 and 19)

3. Remove gear shift lever and cover assembly.

4. Remove cotter key and nut 98, Plate 21 from rear end of rear main shaft 62, Plate 21.

5. Secure a washer with 2 inches inside diameter, 3 inches outside diameter and approximately 1/8 inch thick. Cut a section out of the washer to make it "C" shaped (See Plate A) so that it can be slipped over the rear end of the shaft between the rear of the pinion ("C", Plate 19), and the case. Turn the washer one quarter turn and hold it from falling off and drift the shaft out from the rear. This washer is purchasable as part No. 17532.

The purpose of this washer is to protect the bearing on the rear end of the shaft from striking the hard teeth of the reduction gear just below the shaft which is too large in diameter to let the bearing pass by it. Without this washer in place as described above, the teeth on the reduction gear would damage the bearing when the shaft is driven forward, since the bearing will follow the shaft unless it is held back. The washer holds the bearing from following the shaft and the same time, protects the bearing from coming in contact with the hard, sharp teeth on the reduction gear.

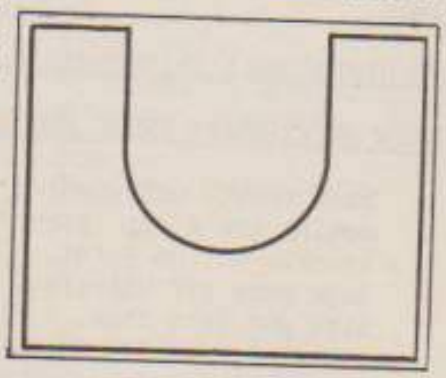


PLATE A

Re-Assembly:

If front main drive shaft assembly is taken apart, the rubber packing washer (66, Plate 21), should be replaced with a new one. This washer is to be placed in the groove in the jam nut. If for any reason the jam nut is backed off, it will be necessary to remove it entirely and replace the rubber washer back into the groove of the jam nut.

Tighten jam nut (113, Plate 21), just enough to have a very slight drag on bearings. Lock the nut by driving the lip on the inner edge of the nut into a spline in the shaft with a blunt punch.

To reassemble the rear main shaft, lay front bearing (106, Plate 21), in place and drive shaft into bearing as far as it will go. Drive rear bearing onto shaft from the rear and adjust bearing by taking up on nut on rear end of shaft. In making this bearing adjustment, use care not to tighten the bearings too tight, but they are to be just tight enough so there is no "up and down play" on front end of shaft. The shaft should have a very slight drag when turned in the bearings.

REDUCTION GEAR AND PINION SHAFT ASSEMBLY:

1. Remove nut and cotter key (1 and 2, Plate 22) from front end of shaft.

2. Remove nut (6, Plate 22), holding gear on shaft, and drift out to the rear.

3. The reduction gear (8, Plate 22), can be removed by moving it forward to clear the oil seal and lifted out.

CAUTION: When reassembling the reduction gear in the housing, do not get the edge of the leather oil seal damaged or turned under, when the hub of the gear is placed in the seal.

The nut 6, Plate 22 is to be set as tight as possible against the gear and locked with the square locking washer (7, Plate 22). Use new corners of the locking washer and fold one corner over the nut and the other corner over the flat spot on the hub of the gear.

The nut and cotter on the front end of the shaft adjusts the bearings. Tighten this nut enough to put a slight drag on the bearings when the shaft is turned.

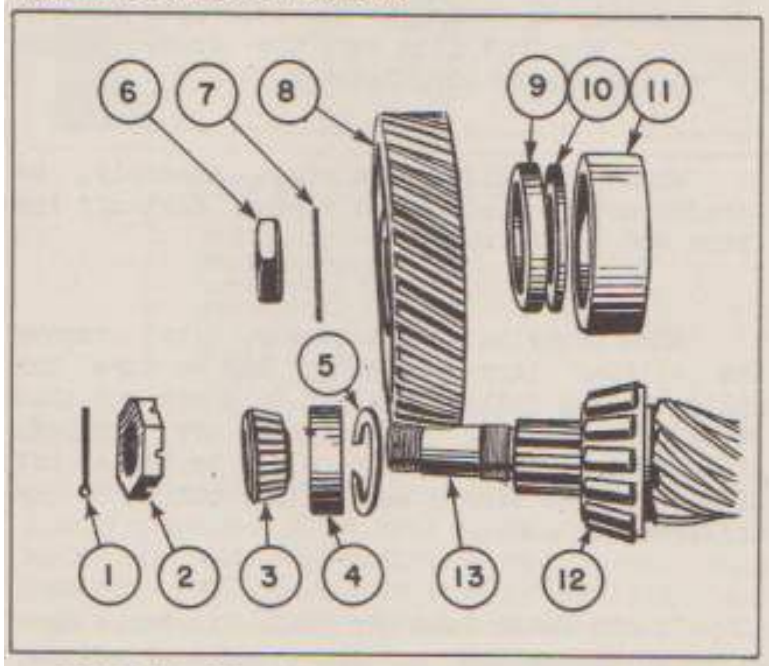


PLATE NO. 22 - REDUCTION GEAR & PINION SHAFT
(These numbers are identical with the numbers on Plates 18 and 19)

Countershaft:

1. Remove the four cap screws holding the front bearing cap 67, Plate 23 on the transmission case and remove the cap, noting the number of spacer shims on it.

2. Remove cotter pin and nut 68 and 69, Plate 23 from front end of shaft, and drift shaft forward about 1/4 inch.

3. Remove rear oil baffle cup 79, Plate 23. There are 2 holes in the rear of this baffle cup to use for pulling it out of the housing.

4. Drift outer cup of rear bearing 77, Plate 23 forward with a suitable sleeve that will fit inside snap ring 78, Plate 19 and make contact with outer race. Drive it forward just enough so snap ring 78, Plate 19 can be removed.

5. Drive shaft backward until rear bearing outer cup 77, Plate 23 comes out of transmission case. Then shaft will slide to the rear out of the gears and transmission case.

When reassembling, the nut, 69, Plate 23, on the front end of the shaft is to be drawn and keyed tight. Then drive rear bearing cup into case far enough past snap ring groove to insert snap ring. After snap ring is inserted and securely seated in its groove, drive cup back tight against snap ring.

The bearings are adjusted by adding or removing the shims, 70, Plate 23, between the cup and transmission case. If it is necessary to add shims, the outer cup of the front bearing must be drifted forward to determine amount of change of adjustment. Then when the cap screws are tightened on the cap, the outer cup will be pushed in with the cap as it tightens against the shims.

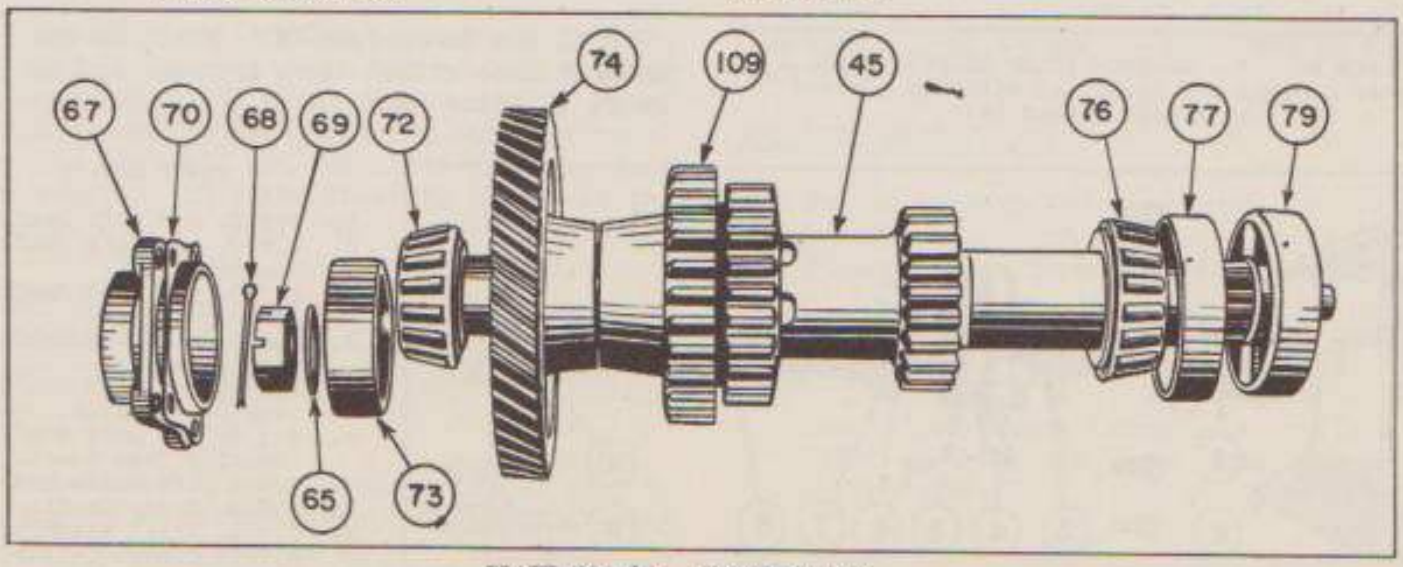


PLATE NO. 23 - COUNTERSHAFT
(These numbers are identical with the numbers on Plates 18 and 19)

Remember also, the oil baffle cup, 79, Plate 23, must press against snap ring (78, Plate 19). When installing this baffle into case, do not drive on inner part of baffle cup, but on the outer edge of the baffle cup because this baffle cup must be tight in the case to prevent oil from leaking back into differential case at this point. Also the small hole in the outer face of the cup must line with the upper part of the slot in the hole in the case, or in other words, have the 2 holes in the back side of the cup straight up and down.

REVERSE IDLER SHAFT AND GEAR:

This assembly can be removed only when countershaft and gear are out.

1. Remove retaining wire and set screw 75 and 108, Plate 24.

2. Slide shaft to the front far enough to remove gear.

3. If shaft has to be removed, slide it out to the front, pushing out the expansion plug with it.

When reassembling, a new expansion plug should be used.

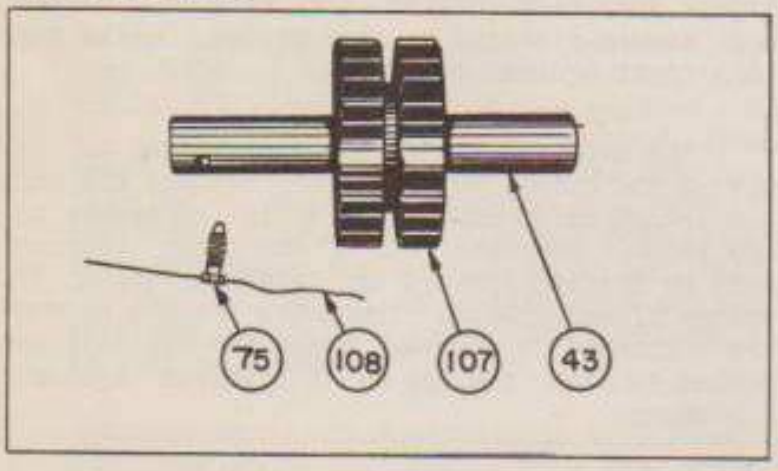


PLATE NO. 24 - REVERSE IDLER SHAFT & GEAR
(These numbers are identical with the numbers on Plates 18 and 19)

POWER TAKE-OFF INSTALLATION

1. Remove cover for Power Take-Off opening located at upper left hand corner of rear cover for differential case.

2. Drive the two dowel pins into the two parallel holes in the differential rear cover plate.

3. Put the splined sleeve, 10, Plate 25, on the front (spline) end of the Power Take-Off Shaft, 8, Plate 25, also the gasket in front of the bearing 5, Plate 25, and slide the shaft in place through the opening in the rear.

4. Set the rear bearing assembly on the dowel pins just inserted in the rear cover plate and put in the four cap screws holding the rear bearing assembly in place.

5. Install the Power Take-Off shifter lever assembly as shown at No. 18, Plate 1. Be sure the fork fits over the groove in the spline sleeve 10, Plate 25.

When installing the shaft assembly, be careful not to let spline sleeve fall off the front end of the shaft.

When removing the assembly, first remove the shifter lever assembly and be sure the spline sleeve follows the P.T.O. shaft and that it is not lost off. If it falls off, the top differential cover will have to be taken off and the sleeve fished out of the bottom of the differential case.

If the Power Take-Off Shaft is to be used at once, attach the universal joint shield (2, Plate 25).

If the Power Take-Off shaft is not to be used at once attach cover for rear end of P.T.O. shaft 1, Plate 25.

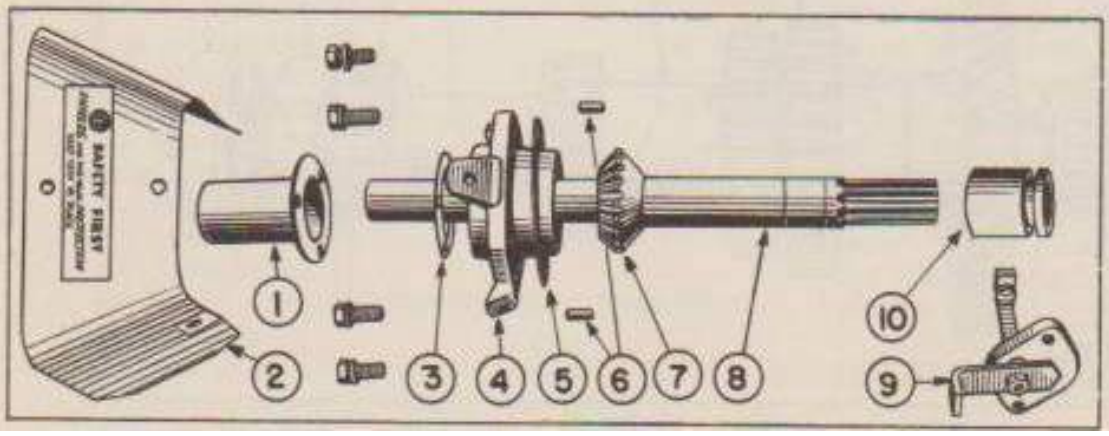


PLATE NO. 25

1. P.T.O. and Lift Shaft Cap.
2. P.T.O. and Lift Shaft Guard Assembly
3. P.T.O. and Lift Shaft Cap Shim.
4. P.T.O. and Lift Shaft Bearing Cage.
5. P.T.O. and Lift Shaft Bearing Cage Gasket.
6. P.T.O. and Lift Shaft Cap Bearing Cage Dowel.
7. Power Lift Drive Gear.
8. P.T.O. Drive Shaft.
9. P.T.O. Shift Assembly.
10. P.T.O. Clutch Collar.

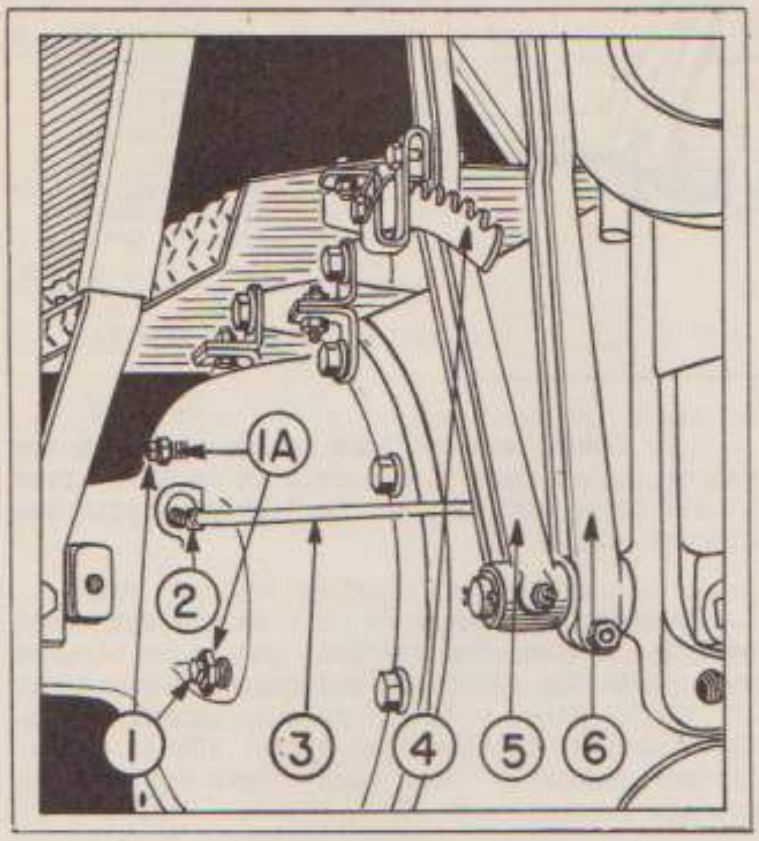


PLATE NO. 26 - BRAKE CONTROLS

1. Brake Adjusting Lock Bolt.
1A. Brake Adjusting Bolt.
2. Brake Pull Rod Adjusting Clevis.
3. Brake Pull Rod.
4. Brake Pedal Ratchet.
5. Right Brake Pedal.
6. Left Brake Pedal.

Brakes:

This tractor is equipped with two mechanically operated disc type brakes, mounted on each rear axle and enclosed in the rear axle housing. They are operated by the right and left brake pedals individually or the pedals may be locked together with the interlocking Plate 13, Plate 1 and the brakes will operate in unison.

To operate the brakes as turning brakes, lift the interlocking plate out of the locking position so that the brake pedals can be operated individually, and press on the left pedal to turn to the left and the right pedal to turn to the right. Turn the steering wheel at the same time.

For quick stops when traveling straight ahead, press on BOTH pedals. When traveling on roads or running in high gear, lock pedals together.

To lock the tractor in place for belt work, place the interlocking plate in place and press the pedals down, lock the pedals down with the brake pedal ratchet 16, Plate 1.

Adjustments:

The brake discs are adjusted by the adjusting screws in the axle housing, 1 and 1A, Plate 26.

To make correct brake adjustments:

1. Jack up one rear wheel at a time.
2. Loosen the 3 outer hex. head lock bolts (1, Plate 26).
3. Turn rear wheel with one hand and turn the adjusting screw in until there is a slight drag on the brake. Then back up adjusting screw until there is no drag on brake. Do this to all three adjusting screws. Then turn each adjusting screw 1/4 turn out.
4. Tighten hex. head locking nuts, being careful not to let the adjusting screw turn as the locking nuts are being tightened.
5. Make this same adjustment on both right and left sides.
6. Check travel of brake pedals to be sure they both travel the same distance. If one travels further than the other, disconnect the pull rod on the pedal that has the shortest travel and lengthen out the pull rod until both pedals travel same distance or are "equalized".

IMPORTANT: It is VERY DANGEROUS to operate a tractor without the brake pedals equalized, for, if the pedals are locked together with the interlocking plate and emergency stop is made, the tractor will swerve if the brake pedals are not equalized. If the brakes are applied severely under this condition, the tractor might turn short enough to upset it if it is traveling at a good rate of speed.

Lubricate fittings at outer end of axles sparingly. One stroke of gun every 60 hours is sufficient.

RELINING BRAKE DISCS:

1. Remove fenders and platforms.
2. Disconnect pull rods from brake pedal arm.
3. Raise rear wheels off the ground and block up under transmission case solidly.
4. Remove rear wheel from axle. (If a chain hoist is available, the wheel may be left on the axle.
5. Remove cap screws holding axle housing to transmission case.

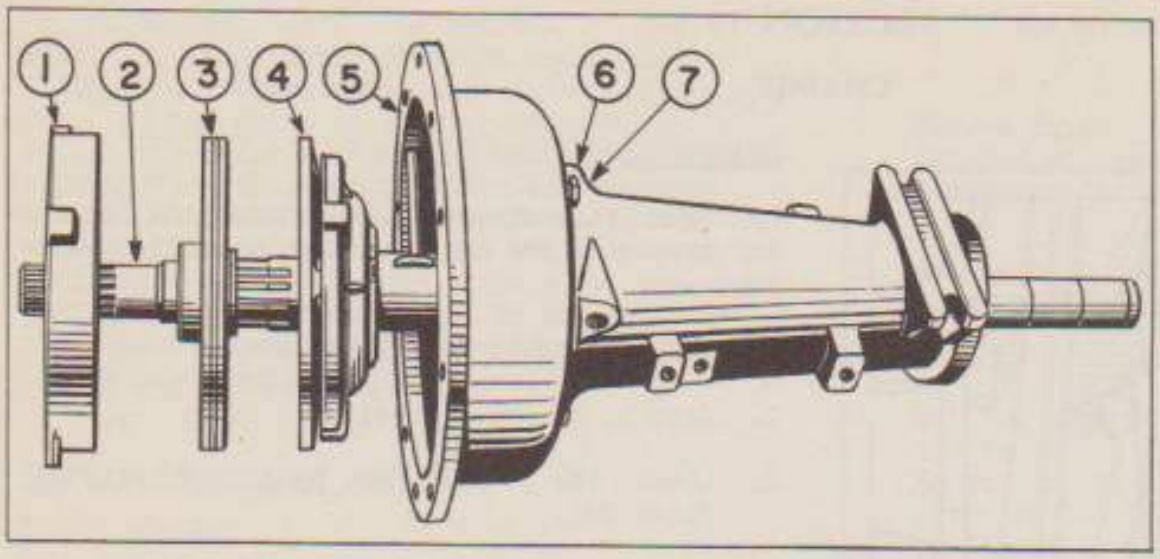


PLATE NO. 27 - BRAKE ASSEMBLY

1. Secondary Disc.
2. Rear Axle Shaft.
3. Middle Ring.
4. Primary Disc.
5. Rear Axle Sleeve.
6. Brake Adjusting Screw.
7. Brake Adjusting Locking Screw.

CAUTION: As the cap screws are removed, be very careful not to let the axle housing and axle tip sidewise or sag down as this will place a strain on the leather oil seal in the transmission case and may damage it. If the wheels have been taken off the axle, and a "saw horse" or other support of the right height is available, it would be well to support the outer end of the axle with it when the cap screws are taken out. The housing assembly must be moved straight outward.

6. Remove rear axle housing, axle and brake assembly from tractor as a unit (Plate 27).

7. The secondary disc 1, Plate 27, will remain on the transmission case.

8. Remove the middle ring with lining attached and replace it with a new assembly.

9. Reassemble axle and housing on tractor.

10. Adjust brakes and brake pedals as outlined on Page 35.

CAUTION: Do not damage leather oil seal in transmission case for inner end of axle when removing or replacing the assembly, also the sharp edges of the splines may cut the feather edge of the seal if the axle tips or sags as the axle passes through the seal. Grease or oil on the brake disc lining will impair brake performance; if the leather oil seal is damaged, grease will leak from the transmission case onto the brakes, also too much grease applied to the outer bearing in the axle housing will find its way to the brakes.

RUBBER TIRES:

Tires should be inflated to recommended pressures at all times. The pressure should be checked and the tires inflated once each week.

To insure against loss of air through the valves, valve caps should be kept on the valves at all times and should be tightened with the fingers only.

When the tractor is not in use for long periods of time, the tractor should be blocked up so that the tires do not support the weight of the machine. If it is not practical to block up the tractor, the tires should be inflated regularly once each month during the storage period.

Tires should be kept free from contact with oil and gasoline. They should not stand on oily floors nor be stored in sunlight or near electrical discharges.

The tires on tractors used on spraying and dusting operations, especially when Paris Green and Bordeaux mixtures which contain copper are used, should be thoroughly cleaned after the dusting and spraying season is over. A thorough cleaning with clear water will remove the harmful chemicals from the tires.

The paint and metal parts of tractors used in alkaline soils deteriorate rapidly due to oxidation. Although the salts and acids in the soil do not have any harmful effects upon the tires, it is suggested that the wheels and tires be washed with clear water to prevent the wheels and rims from becoming rusted.

Air Pressure in Tires:

When tractors are in transit the air pressure in the tires is very high to prevent excessive bouncing, and must be reduced to the rates given below before the tractor is put in field work.

FRONT TIRES - ALL SIZES:

1. 4 PLY TIRES . . . . . 28 LBS.
2. 6 PLY TIRES . . . . . 36 LBS.

REAR TIRES - ALL SIZES:

1. MINIMUM AIR PRESSURE. . . . . 12 LBS.
2. WHEN PLOWING, INCREASE AIR PRESSURE IN FURROW WHEEL TIRE. . . . . 4 LBS.
3. WHEN SPECIAL HEAVY WHEELS ARE USED OR HEAVY LOADS ARE CARRIED ON THE TRACTORS, THE AIR PRESSURE MUST BE INCREASED IN A RATIO OF ONE LB. OF AIR TO EACH 100 LBS. OF WEIGHT ADDED PER WHEEL.

REAR - 4 PLY - ALL SIZES:

1. MAXIMUM INFLATION PRESSURE. . . . . 16 LBS.

Excessive inflation pressures may cause so called "weather checking" of the rubber, imperfect cleaning of the tread, undue slippage and hard riding.

Insufficient inflation pressures may cause rim bruising, sidewall snagging, breaks in sidewall on shoulder area, difficult steering on front wheels, and fast tread wear when operating on hard surfaces.

Tread Wear:

The tread lugs or bars on tractor tires wear evenly at proper air pressure and with a correct amount of wheel weight.

Generally speaking, there are two distinct types of irregular tread wear, which are described as follows:

1. EXCESSIVE SLIPPAGE brings about an irregular angular wear on the front or leading edge of the traction bars as shown in Plate 28. This type of wear is caused by one or more of these causes:

   (a) Insufficient wheel weight.
   (b) Over inflation.
   (c) A too heavy draft load.
   (d) Quick starting by running motor at top speed as the clutch is engaged.

PLATE NO. 28

PLATE NO. 29

2. EXCESSIVE DEFORMATION of the rubber due to excessive bulge or flattening out of the tire will cause irregular and angular wear on the rear edge of the traction bars as shown on Plate 29.

This type of excessive wear is caused by one or more of these causes:

   (a) Excessive wheel weight or load.
   (b) Under-inflation.
   (c) Highway or other hard surface operations, especially in conjunction with excessive weight load and under-inflation.

Wheel Weights:

It is impossible to give any set rule as to the correct wheel weight necessary for all soils and operating conditions. The greater the weight on the tire, the more pulling power it can exert without slippage. Extra wheel weights do not increase ground pressure per square inch, but do give added traction by increasing the number of square inches of ground contact.

The following table may be of assistance in estimating the amount of wheel weight to use:

150 Lb. Weights on Rear Wheels	Pounds Drawbar Pull	
	Plowed Ground	On Sod
None.	1600	3000
1 Weight per wheel. .	1725	3200
2 Weights per wheel .	1850	3400
3 Weights per wheel .	1975	3600

Needed weight may be added by filling the tires with water and, since this method is inexpensive and does not add to the over-all rear axle width, it is very popular in many conditions.

When water is used for wheel weights on tractors operating in cold weather, the solution must be protected against freezing. Calcium Chloride is the most commonly used anti-freeze agent for solution in tractor tires.

CAUTION: When mixing the solution, do NOT pour the water onto the calcium chloride but add the calcium chloride to the water. THIS IS IMPORTANT.

The following table shows the amount and weight of solution required to fill each of the 3 sizes of tires used, also the proper amount of calcium chloride to use to protect against freezing.

TIRE SIZE	LIQUID CAP. WITH VALVE AT TOP		MIXTURE FOR ZERO		
	GALS.	LBS.	GALS. WATER	LBBS. OF CALCIUM CHL.	TOTAL WEIGHT
7-32	11	90	10½	13	102
8-32	15½	130	14½	18	148
9-32	20	170	19	24	185
			MIXTURE FOR -20°		
7-32			10	20	102
8-32			14½	29	148
9-32			18	36	185

The solution may be pumped into the tire with a hand water pump; forced in from a pressure tank or line; or run in by gravity from a container held at least five feet above the top side of the tire.

Employing anyone of these three methods, proceed as follows:

1. Jack the wheel off the ground and turn the tire valve to the top of the wheel.
2. Remove the valve core and allow all the air to escape.
3. Obtain a water adapter and screw the small end on the tire valve and attach the water line to the other.
4. Turn on water and allow pressure to build up in tire, occasionally allowing air to escape by pressing on small deflator.
5. When water begins to flow continuously from the deflator, the tire has been filled.
6. Turn off water. Remove adapter from tire valve. Let excess water run out of valve.
7. Replace valve core and inflate tire to 12 to 16 pounds (See Page 36).

Metal containers in which calcium chloride has been mixed should be cleaned immediately after using.

Anti-freeze must be added to the water that remains in tires after draining if it was not treated when put in as all the water in the tube cannot be drained out and sharp cornered pieces of ice will form in the tube and will damage the tire and tube.

Do not use a calcium chloride solution for anti-freeze in the radiator as calcium chloride will erode the metal parts of the radiator and engine.

REAR AXLE AND BEARING:

Plate 30 shows in detail the bearing assembly on the outer end of the rear axle. The inner end of the axle is supported by the bearing in the differential assembly.

The bearing is adjusted by adding or removing shims between the bearing cap and axle sleeve.

Do not pump too much grease into the bearing as it is only wasted and serves no purpose. About one stroke of the pump every 60 hours is sufficient.

REMOVAL AND INSTALLATION:

1. Block up under tractor securely so that it will not tip sidewise. Chock front wheels.

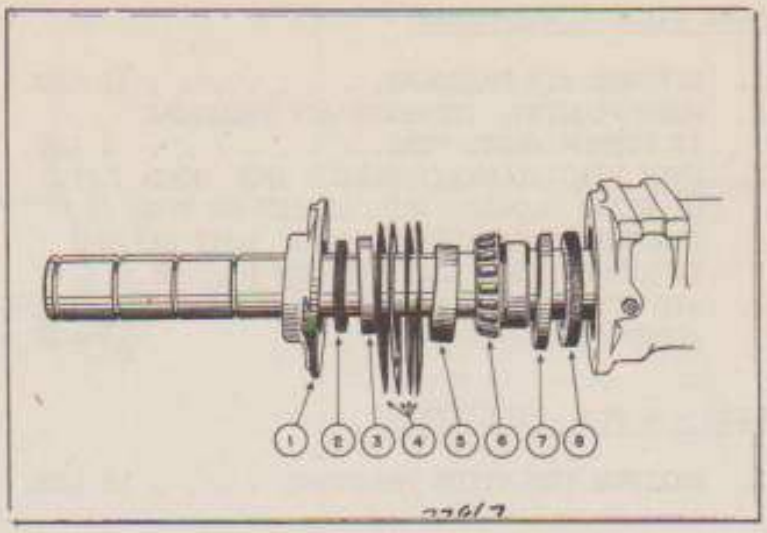


PLATE NO. 30 - REAR AXLE AND BEARING

1. Rear Axle Shaft Outer Bearing Cap.
2. Rear Axle Shaft Outer Bearing Collar Felt.
3. Rear Axle Shaft Outer Bearing Oil Seal.
4. Rear Axle Shaft Outer Bearing Cap Shims.
5. Rear Axle Shaft Outer Bearing Cup.
6. Rear Axle Shaft Outer Bearing Cone.
7. Rear Axle Shaft Outer Bearing Felt Retainer.
8. Rear Axle Shaft Outer Bearing Felt.

2. Remove wheels, fenders and platforms.
3. Disconnect Brake Pull Rods.
4. Remove bolts holding axle housing to transmission and pull axle and housing straight out. Do not let outer end of axle sag down or tip sidewise or let weight of assembly hang on the case after the bolts are all out. If it does, the seal on the side of the case may be damaged.
5. Remove bearing cap; 1, Plate 30, and axle and bearings will slide out of axle housing.

When reassembling, use the same care not to damage the oil seals in the side of the transmission case as when disassembling.

IMPORTANT: When adjusting the rear axle bearings; 6, Plate 30, use the same number of shims (4, Plate 30) on both right and left axle bearings, and adjust both sides together as the inner end of the axles thrust against a hollow ball in the differential assembly.

STEERING GEAR:

A worm and sector type steering gear is used. All working parts are enclosed and operate in a bath of oil. Oil level may be checked by removing the plug (No. 12, Plate 31), on the top of the worm gear housing. This should be filled so that the worm gear is covered with a good steering gear lubricant not heavier than a SAE #140. Do not use ordinary grease or any lubricant that will tend to "channel" or harden in cold weather. If the tractor steers too hard in winter, change to a lighter weight lubricant, or thin the lubricant by adding 1/4 pint of kerosene. At least a seasonal check should be made as to the amount of lubricant in the housing and its quality. If, in any event, dirt or other foreign matter has gotten into and mixed with the lubricant, remove all old lubricant, wash out housing and refill with new lubricant.

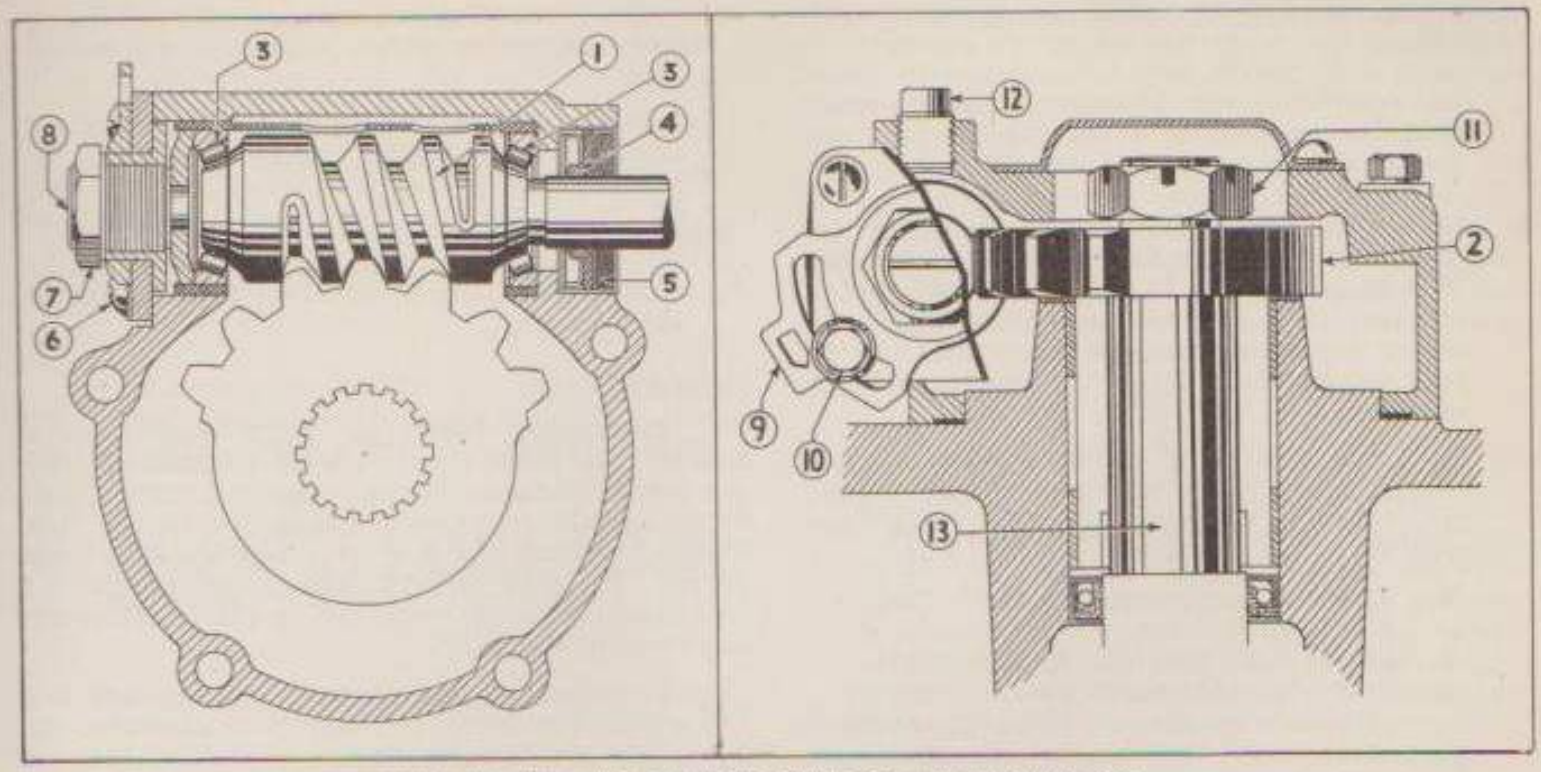


PLATE NO. 31 - TOP AND FRONT VIEWS OF THE STEERING GEAR

1. Steering Worm Gear and Shaft.
2. Steering Sector Gear.
3. Worm Gear Bearings.
4. Worm Gear Leather Seal.
5. Worm Gear Felt Seal.
6. End Cover Bolts.
7. Adjusting Screw Locknut.
8. Worm Gear, Adjusting Screw.
9. Lash Adjuster.
10. Lash Adjuster Lock Nut.
11. Sector Gear Retaining Nut (Row Crop Model Only).
12. Lubricant Filler Plug.
13. Steering Gear Pedestal Shaft.

SERVICE ADJUSTMENTS:

Before making any final adjustments on the steering gear assembly, be sure that all parts that might bind or cause a drag have been lubricated properly. The front end of the tractor should be raised off of the ground, so as not to have any steering load on the steering gear. In the "Standard" model tractor, the steering drag-links may be disconnected while adjusting the steering gear.

To remove excessive play due to a wearing of the sector gear (No. 2) and the worm (No. 1):

1. Place front wheels in a "straight forward" steering position.

NOTE: THIS IS VERY IMPORTANT, AS IT IS ONLY IN THIS ONE POSITION THAT THERE SHOULD BE NO BACK-LASH BETWEEN THE SECTOR GEAR AND THE WORM.

2. Loosen lash adjuster lock nut (No. 10, Plate 31) ABOUT 1/2 turn.

3. With a soft hammer tap lightly on lash adjuster (No. 9, Plate 31) to turn it in the direction of the arrow. Adjuster should not be moved more than 1/16" at a time with relation to bolt 10. This adjustment must not be too tight or damage to gear will result. Preferably 1-1/2 to 2-1/2 lbs. of pull should turn steering gears when measured on the rim of the steering wheel.

CAUTION: Remove back-lash with wheels in the straight forward position only. There will be back-lash when wheels are turned in any other direction.

REMOVAL AND INSTALLATION OF THE STEERING GEAR ASSEMBLY.

The steering gear assembly can be removed from both the Standard and the Row Crop model as a unit.

1. Raise and support front end of tractor securely.

2. Drive pins out of lower universal joint on steering rod and drive towards the steering wheel end as far as it will go.

3. On the "Standard" model tractor, loosen drag links and drop axle by removing pivot pin. This will allow for sufficient room to take unit out downward. On the "Row Crop" model the entire pedestal can be removed.

4. Remove the six bolts holding steering gear housing to frame.

5. Remove steering gear by tilting it and removing it downward.

ASSEMBLING AND DISASSEMBLY OF THE STEERING GEAR MECHANISM:

1. The worm gear and housing can be removed from the assembly by loosening the four cap screws on the top of the assembly.

2. The sector gear is removed by loosening the retaining nut (No. 11, Plate 31) in the "Row Crop" model. In the "Standard" model tractor, this gear can be removed after removing the worm gear housing as outlined in step one above. After the steering arm is removed.

3. If, upon removal of the worm gear, or upon replacing any parts in the worm gear assembly, there is too much end play in the worm gear and shaft, remove it as follows:
   A. Tighten end cover bolts (No. 6, Plate 31).
   B. Loosen lock nut (No. 7, Plate 31).
   C. Turn adjusting screw (No. 8, Page 31), clockwise as far as possible without stiffening the action of the worm while turning through its entire range.
   D. Tighten lock nut securely (No. 7, Plate 31).

Plate 31).

4. In assembling the steering gear it is necessary to match the slightly heavier tooth on the sector gear with the worm, when the worm is in its central position. To do this follow the steps outlined below:
   A. Place sector gear in its center position as shown in Plate 32. This can be checked by installing the two housing bolts near the worm end. Then place a straight edge ruler so that it touches the worm gear side of the bolts. Then line up the sector gear as shown in Plate 32.

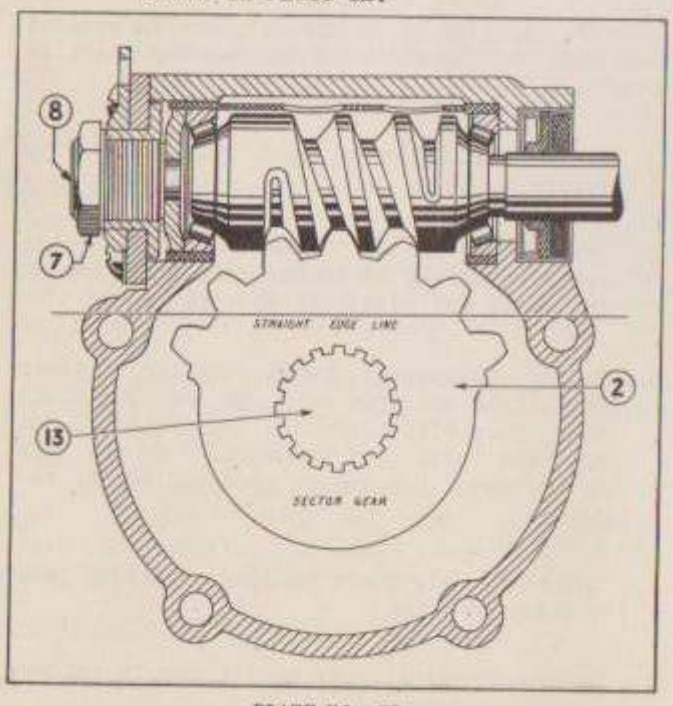


PLATE NO. 32

5. Without changing the sector gear position, mesh the center of the worm with the sector gear.

6. Bolt worm gear housing to the assembly and check steering range. When correctly installed there should be approximately 90° of travel from the center position in either direction.

7. Adjust back-lash as outlined under "Service Adjustments".

FRONT WHEELS:

Every 300 hours or twice each yearly season, the front wheels are to be removed, the old grease washed out and repacked with fresh front wheel lubricant. When replacing the wheels, replace the old felt washers with new felts. The felt washers, retaining washers and bearings are to be installed in the exact order as shown in Plate 33.

To adjust the bearings: Tighten the nut (7) until the wheel is very hard to turn or until the nut is drawn tight, and then back up the nut 1/4 turn and secure with a cotter key.

For the Standard models, the "toe-in" of front wheels should be about 3/8 inch, that is, the distance between the wheels when measured at the rear, should be 3/8 inch greater than at front. To make this adjustment, shorten or lengthen the tie-rods that connect the two front wheels.

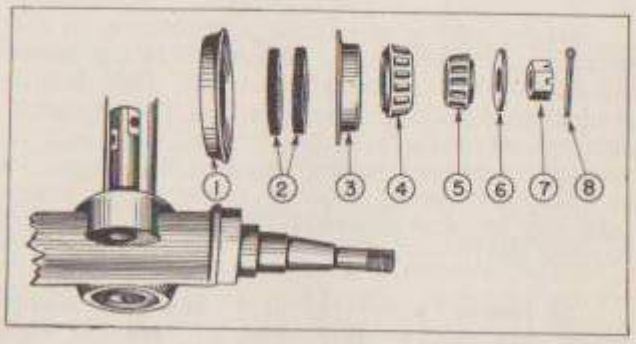


PLATE NO. 33 - FRONT WHEEL BEARING ASSEMBLY
1. Front Wheel Dirt Deflector.
2. Front Wheel Felt Washer.
3. Front Wheel Felt Retainer.
4. Front Wheel Bearing Cone Inner.
5. Front Wheel Bearing Cone Outer.
6. Front Wheel Spindle Nut Tongued Washer.
7. Front Wheel Spindle Nut.
8. Front Wheel Spindle Nut Cotter Pin.

REAR WHEELS:

The rear wheels on the RC model are adjustable to accommodate various row widths. When the rear wheels are placed on the axle with the clamp end of the hub to the outside, the wheels are adjustable from 52 to 64 inch tread. (Tread is the distance from center to center of wheel rims.)

When the wheels are reversed, the wheels are adjustable from 68 to 88 inch tread.

The maximum tread without reversing the wheels is 64 inches. With the wheels reversed, it is 88 inches.

To change rear wheel tread, jack up one side of tractor and loosen the clamp bolts in hub of wheel. Slide wheel to desired position and tighten the clamp bolts. Repeat operation on other side.

When reversing wheels on which chevron style tread pneumatic tires are mounted, place the left wheel on the right axle and vice versa.

After tractor is operated a few minutes after a tread change has been made, retighten hub clamp bolts.

The snap ring on the axle will accurately locate wheels.

The rear wheels on the Standard model tractors are fitted to the axles by means of a taper fit and key. The wheels are held in place by the axle nut.

1. Removing: A heavy duty puller is necessary to loosen the wheels from axle. If wheels are exceptionally tight, draw up on puller screw tightly and then tap the wheel hub with a hammer, or apply heat to the hub until the expansion loosens it.

2. Replacing: Slide the wheel onto axle as far as it will go and then line up keyways. Replace the key by driving it into the hub until outer end is flush with tapered end of axle. Replace the lip washer and axle nut. Draw up tightly on the axle nut and then drive on the end of the hub by means of a sledge hammer and block of wood. Continue this operation until the wheel is securely tight on axle.

SECTION 16

SUNDRIES

COLD WEATHER OPERATION

Cooling System:

In cold weather, completely drain the cooling system when the tractor is not in actual use or else employ a good anti-freeze solution.

When draining the cooling system, drain both the radiator and engine block and do not leave the tractor until the system has been completely drained. Leave the drain cocks open until tractor is to be used again.

The engine block drain cock is located on left side of block in front of starting motor. The radiator drain cock is located on the radiator outlet tube under fan belt.

Anti-Freeze Solutions:

For protection against freezing, alcohol or Prestone may be used. Solutions containing salt, calcium chloride, soda, sugar or mineral oils should never be used in the cooling system. The following table supplies the amount of alcohol or Prestone with water to make one U.S. gallon of anti-freeze proof against freezing at the Fahrenheit temperatures listed. The capacity of the cooling system is 2-3/4 U.S. gallons.

WATER PINTS	PRESTONE PINTS	ALCOHOL PINTS	FOR ONE GAL. ANTI-FREEZE TO PROTECT TO
6	2		+30° F.
5½	2½		0° F.
5	3		-10° F.
4½	3½		-20° F.
4	4		-30° F.
5½		2½	+30° F.
5		3	0° F.
4½		3½	-10° F.
4		4	-20° F.
3		5	-30° F.

With all anti-freeze solution, make sure that there are no leaky hose connections. Check the cooling system for leaks after the first few hours operation. Leaks of anti-freeze do not appear at once when system is filled but generally after the engine is at normal operating temperature.

OILING SYSTEM:

Engine:

Water has a tendency to condense in the crankcase of any engine and this tendency is greatly increased by cold weather. In the summer, the engine runs hot enough to vaporize the water and expel it through the crankcase breather system; while in the winter due to

relative short operating periods and cold outside temperature, the engine does not get hot enough to vaporize the moisture sufficiently to expel it from the crankcase.

Consequently, this moisture, which is mainly a by-product of fuel combustion (water and carbon dioxide) condenses soon after the engine is stopped and collects in the lowest parts of the oiling system, namely, the oil filter base and in the bottom of the crankcase.

This water in combination with the oil forms a sludge which may freeze and plug the screen on the oil pump and the oil ducts in the filter base resulting in broken pump parts and burned out bearings.

When the tractor is used in freezing weather, the following safe rules should be observed to prevent the engine from becoming damaged by condensed moisture freezing in the crankcase and oil filter.

1. Watch the oil pressure gauge for the first 15 to 20 minutes after the tractor is started. IF OIL PRESSURE DOESN'T REGISTER, STOP TRACTOR AND INVESTIGATE IMMEDIATELY.
2. Use light engine oil (SAE #10W).
3. Change engine oil oftener than in the summer.
4. Always drain engine when oil is hot. The oil will drain more completely and carry more dirt and sludge with it.
5. In extremely cold climates the oil should be drained from the engine when it is not being used, kept in a warm place and poured back into the engine before tractor is started.

TRANSMISSION:

In cold weather, drain the transmission oil and refill to proper level with a good grade of SAE #90 transmission oil.

LEATHER OIL SEALS

ASSEMBLING THE OIL SEAL:

Dip the oil seal in oil and let it soak a minute or two before installing.

The oil seal is pressed into position in every installation.

In cases where the oil seal is pressed to the bottom of a recess, it is important that an arbor be used that is not more than 1/32 inch smaller than the outside diameter of the oil seal. If the arbor is smaller than recommended, there is danger of collapsing the metal case and pinching the leather and consequently, the seal will not function.

Before passing the shaft thru an oil seal, examine it for sharp edges or corners or burrs. Bevel the sharp edges and remove the burrs before making the assembly. These instructions also apply when assembling the seal over the shaft.

Care should be taken when assembling seals over splines or keyways to prevent cutting into the leather.

When assembling an oil seal over a shaft that is undercut or grooved, shim stock should be wrapped around the shaft to completely cover the grooves. Then the seal should be rotated, in the direction of the overlapping shim stock, as it is moved along the shaft. This will eliminate the possibility of the shim stock cutting into the leather.

Make sure that the seal is assembled with the raw edge of leather facing the right way. Refer to the text or illustration for correct assembling instructions before pressing the seal in.

If a press is not available, seals may be tapped in with a hammer. When the seal is flush with the outer surface of recess, a block of wood or steel plate should be used to protext the seal from hammer blows.

Oil Leakage: If an oil leak occurs shortly after putting the seal into service, it is an indication that the seal was not treated properly before assembling or else the leather was cut or damaged when installing. In either case, the oil seal should be replaced immediately.

PERIODIC INSPECTION

Keep Tractor Clean. Anyone can judge an operator by one look at his machine.

Use every precaution to prevent dirt reaching working parts. Practically all wear is directly traceable to abrasives in the lubricant.

Rather than experiment with doubtful adjustments, call a competent repair man, the same as you would for your automobile.

Never overload the tractor. Any load which slows the engine below its normal operating speed is considered an overload.

Cold weather operation -- let the tractor run slowly without load until cold lubricants have warmed sufficiently. Use high grade lubricants of correct viscosity for cold weather operation.

Always use genuine Massey-Harris repair parts. Have a few gaskets and parts, that are subject to damage, on hand at all times.

ENGINE: Check all bearings for looseness. o not wait for a bearing to pound.

Grind valves and clean carbon from com- ustion chamber. Do not wait until the valves eak badly.

Keep tappets properly adjusted for clear- ances.

Clean and adjust spark plugs.

Give air cleaners proper attention.

Install a new oil filter element after each 200 hours operation.

Take the generator and starting motor to an authorized service station for a complete check in accordance with instructions.

Thoroughly clean out the entire fuel system of water and settlings, especially before freezing weather.

Check all bolts and nuts for tightness and examine cotter keys.

TRANSMISSION AND REAR END: Once each season drain out the transmission oil and flush out the case to thoroughly clean, and then refill with a good quality transmission lubricant of correct viscosity.

FRONT WHEELS: Once each season -- or every 300 hours -- jack up the front wheels, take the wheels off, and wash all the old grease out of wheel hub and off the bearings. Install new felt rings and gaskets in the dust seals. Repack with fresh front wheel lubricant.

REAR AXLE: Once each season check the bearings at the outer end of the axle sleeves. Wash bearings and repack with fresh cup grease. Renew the felt seal, located in each axle sleeve bearing cap.

AT THE END OF THE SEASON:

Get your TRACTOR ready to put away for the winter. Give it a thorough overhauling -- it will be money well spent.

Check it over carefully and replace any necessary parts, giving inside of engine and all working parts thorough cleaning. Replace bearings where they need it; grind the valves; see that piston pins, nuts and bolts are tight and in place.

Read the instructions again.

When you have finished overhauling, refill with new oil and let engine run idle for several hours, or a day, if possible, until the engine is thoroughly run-in, starting at low speed and increasing as the engine becomes free. Leave doors of building open while engine is running -- exhaust gas is dangerous under certain conditions.

If the tractor is not used during the winter months, completely drain the water from cooling system, leaving the drain cocks open and as an extra precaution, take out spark plugs, and squirt half pint of oil into each cylinder, then turn motor over once or twice by hand. Drain the fuel tank and carburetor.

TROUBLE CHART

FAILURE OF ENGINE TO START:

Ignition switch is off position.
Lack of fuel.
Water in fuel, or fuel lines to carburetor clogged.
Weak spark.
Spark plugs improperly adjusted or dirty.
Excessive choking of the carburetor.

ENGINE STOPS:

Lack of Fuel.
Failure of ignition system.

OVERHEATING:

Spark too late, or very weak.
Mixture too lean.
Lack of proper lubrication.
Insufficient cooling water.
Radiator water passages clogged.
Chaff or dirt in radiator fins.
Water pump not working properly
Loose fan belt.
Heavy carbon deposits in cylinder.

ENGINE USES TOO MUCH FUEL:

Spark too late.
Leaky valves.
Improper carburetor adjustment.

LOSS OF POWER:

Spark occurring too late.
Dirty spark plugs.
Poor connections; also dirty connections.
Breaker points worn, oily or out of adjustment.
Mixture too lean or too rich.
Flow of fuel to carburetor restricted.
Water in fuel.
Leaks around intake manifold.
Overheating in cylinder or bearings.
Gummy, inferior or insufficient oil.
Governor out of adjustment.
Sticky carburetor butterfly stem.
Lack of compression, which may be due t leaky valves or piston rings.
Leaky cylinder head gasket.

MISFIRING:

Poor connections.
Distributor dirty or broken or loose connections.
Breaker points pitted, dirty or poorly adjusted.
Dirty or cracked spark plugs; points of plugs not properly spaced.
Mixture too lean or too rich.
Fuel passages partly clogged.
Water in fuel.
Valves sticky or insufficient tappet clearance.

TO FIND SPEED OF DRIVEN SHAFT:

To determine speed of driven shaft when size of driven pulley is known:

Multiply diameter of driving pulley by number of revolutions per minute and divide by diameter of driven pulley.

Example:

13-1/2" pulley x 837 R.P.M. = 11299.5
11299.5 ÷ 8-1/2" pulley = 1329 R.P.M.

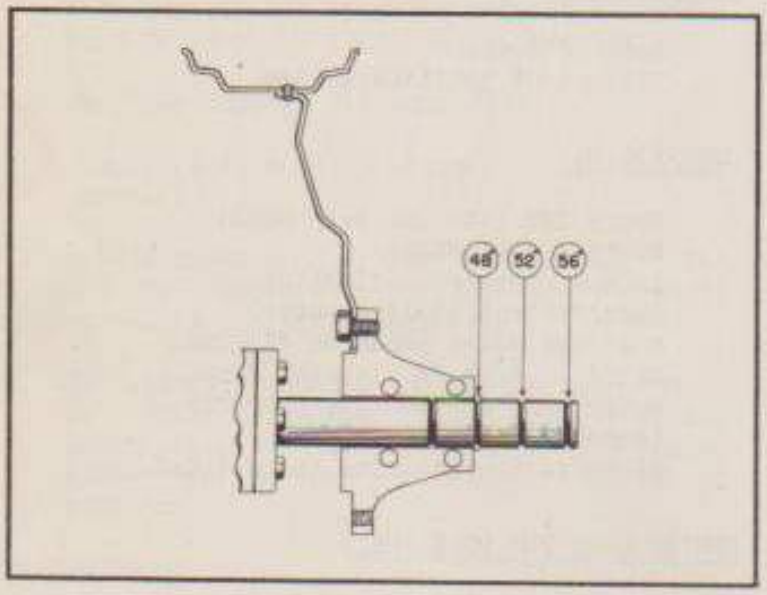
TO FIND SIZE OF PULLEY TO USE ON DRIVEN SHAFT:

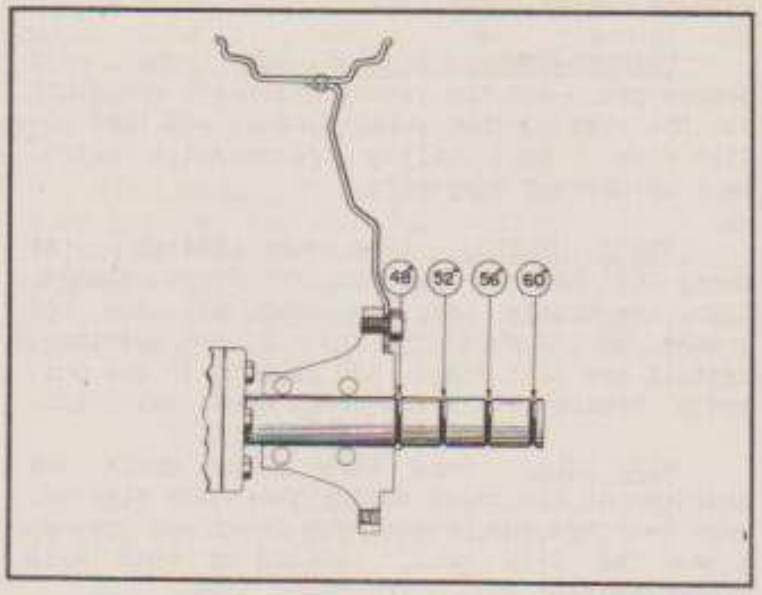
To determine size of driven pulley, to obtain a required speed of a driven shaft:

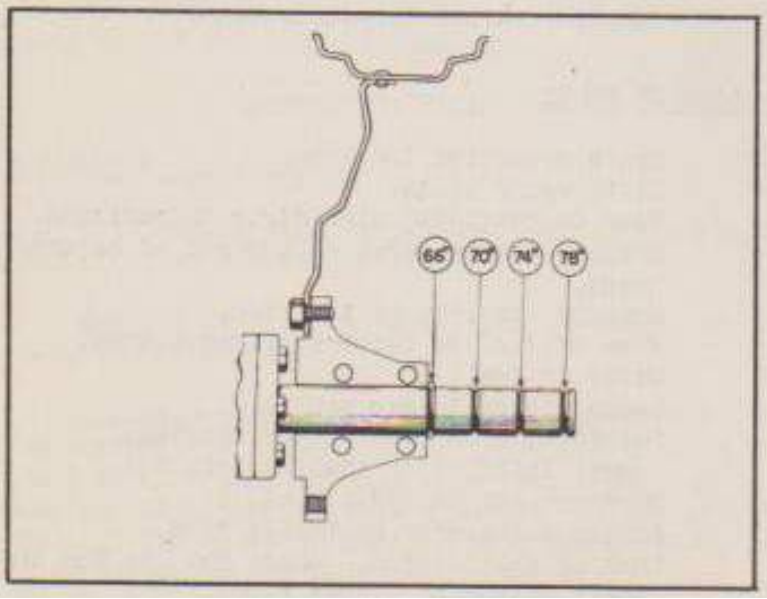
Multiply diameter of driving pulley by number of revolutions per minute and divide by desired speed of driven shaft.

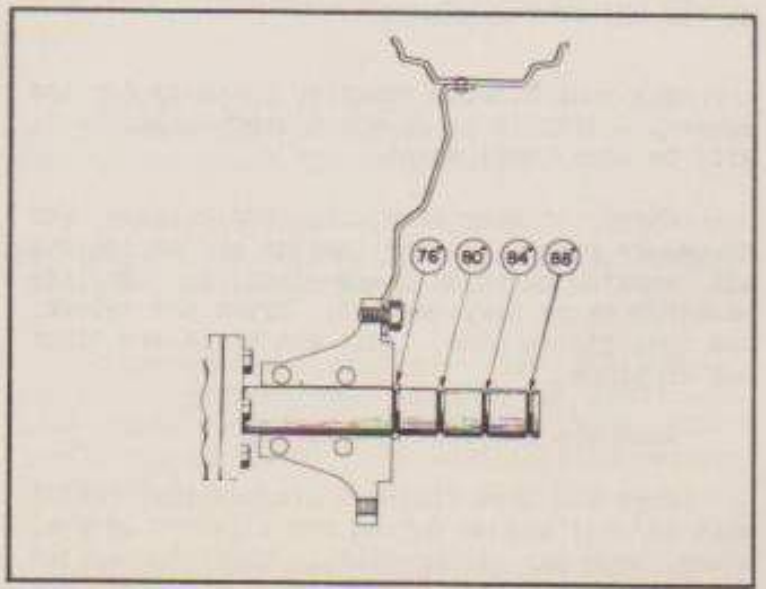
Example:

13-1/2" pulley x 837 R.P.M. = 11299.4
11299.4 ÷ 1329 Rev. = 8-1/2" Pulley









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