Servicemen's

REFERENCE BOOK

FOR

CATERPILLAR

REG. U.S. PAT. OFF.

R4 TRACTOR

★

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CATERPILLAR TRACTOR CO.
PEORIA, ILLINOIS • U. S. A.

FOREWORD

IT is the purpose of Caterpillar Tractor Co., to build into its products the capability for a long life of useful work. The records of tens of thousands of users testify to high success in the achievement of that purpose. It is natural, however, that length of life and cost of operation and maintenance will vary — top records are the reward of the owners and operators who are diligent and conscientious in the care, operation and maintenance of their machines.

The Operator's Instruction Book, a copy of which is supplied with each machine, tells what to do, and how and when to do it, with regard to the day-to-day lubrication, operation and maintenance of the machine. It is urged that these instructions be studied carefully and reread frequently until the operator is thoroughly familiar with them. By following the instructions, the operator is best assured of obtaining maximum life and performance from his machine and of minimizing the frequency, number and cost of repairs.

Even the best of care will not eliminate the necessity, in course of time, of making minor repairs or complete overhauls and of replacing some parts. Your "Caterpillar" dealer has exceptionally complete facilities for such work. He carries a stock of replacement parts and has in his employ competent factory trained servicemen. For work that cannot be done in the field, dealers have well equipped shops. Both the shop and the servicemen have many special tools, designed and developed by "Caterpillar", that make easier and quicker the disassembly and assembly operations.

Though most "Caterpillar" owners prefer to make use of the excellent service and shop facilities of their dealers, some are themselves skilled mechanics or have such mechanics in their employ. To those owners and to all mechanics of the United Nations — many of whom until recently were unfamiliar with construction machinery — this book, issued as a guide for servicemen, will be of equal value.

The special tools pictured in various operations throughout are among the many which can be purchased from dealers. These tools are illustrated and listed in the Service Tool Catalog, a copy of which is available on request.

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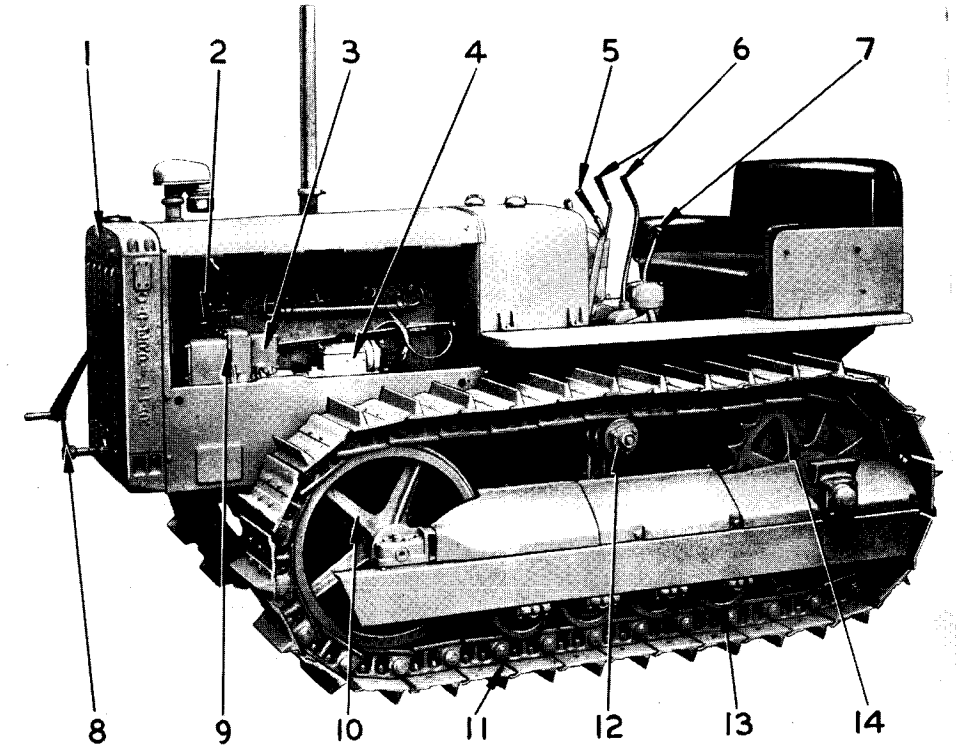
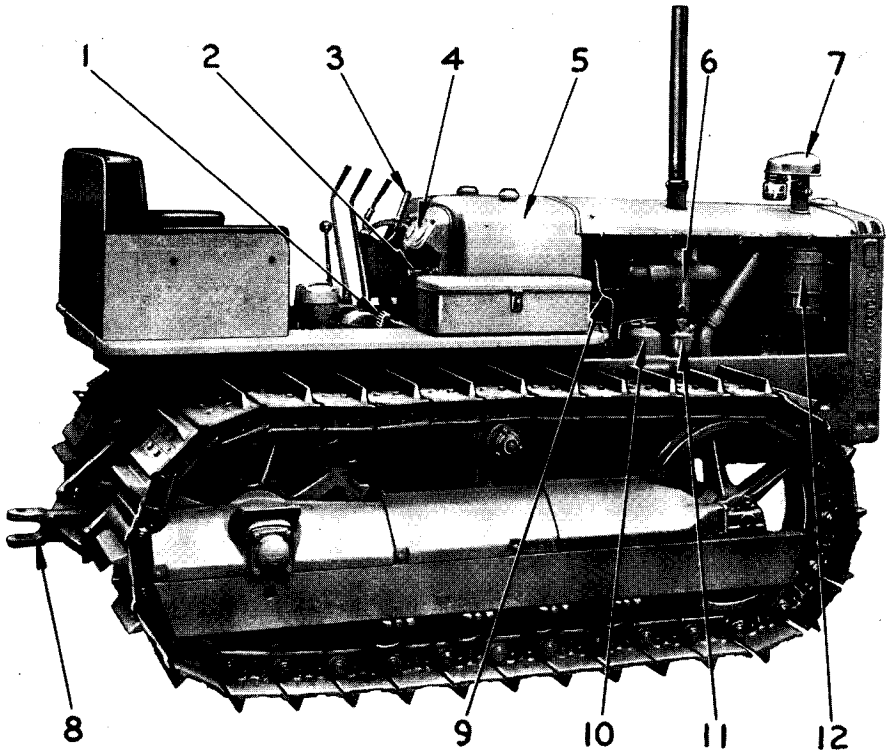


R4 TRACTOR — LEFT FRONT VIEW

1. Radiator
2. Water Pump
3. Governor Spring Housing
4. Magneto
5. Flywheel Clutch Lever
6. Steering Clutch Levers
7. Gear Shift Lever
8. Starting Crank
9. Timing Gear Housing
10. Front Idler
11. Track
12. Track Carrier Roller
13. Track Roller
14. Sprocket



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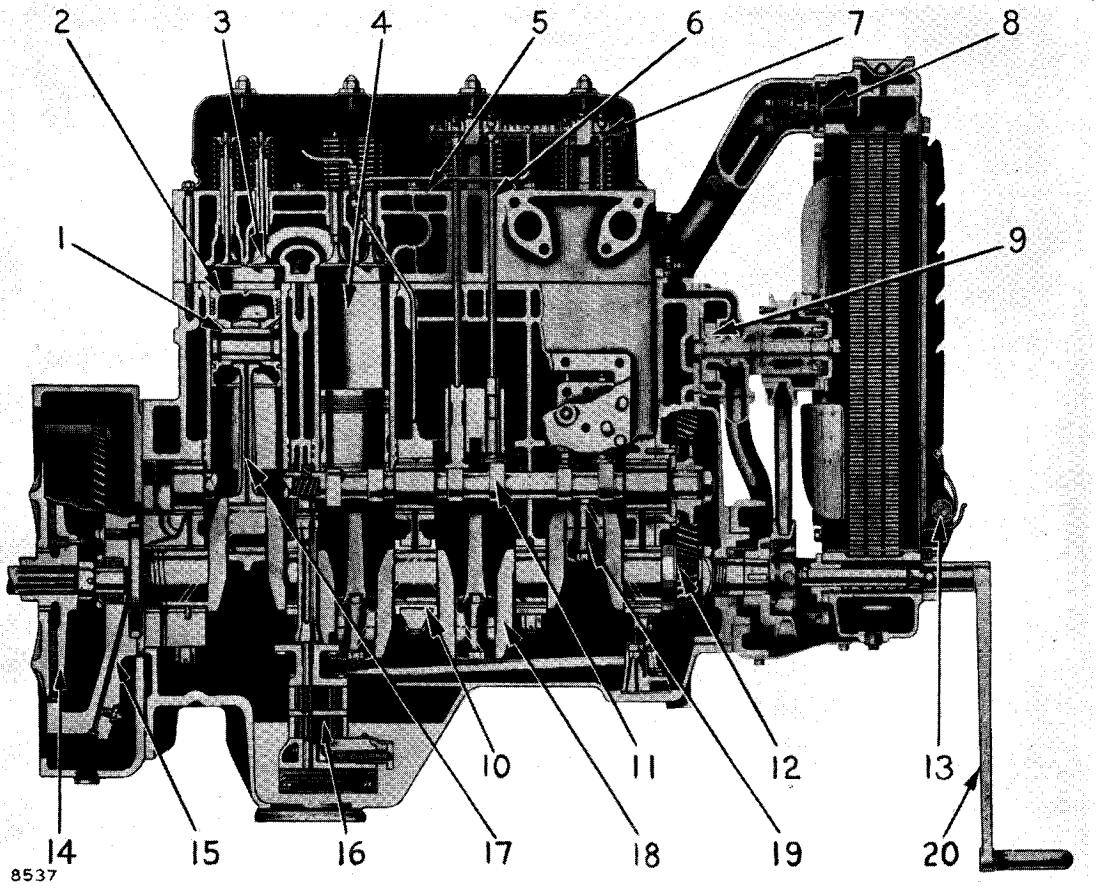
1. Brake Pedals
2. Manifold Heat Control
3. Throttle Control Lever
4. Gauges
5. Fuel Tank
6. Inlet Manifold
7. Air Pre-Cleaner
8. Drawbar
9. Auxiliary Fuel Tank Line
10. Lubricating Oil Filter
11. Carburetor
12. Air Cleaner

R4 TRACTOR — RIGHT REAR VIEW

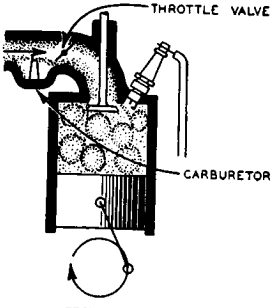


ENGINE CROSS-SECTION

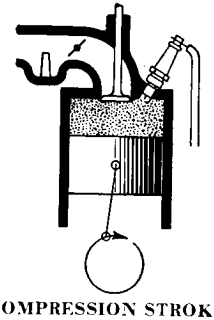
1. Piston Pin
2. Piston
3. Valve
4. Cylinder Liner
5. Cylinder Head
6. Valve Push Rod
7. Valve Rocker Arm Assembly
8. Temperature Regulator
9. Water Pump
10. Center Thrust Main Bearing
11. Camshaft
12. Timing Gears
13. Radiator Curtain
14. Flywheel Clutch
15. Flywheel
16. Lubricating Oil Pump
17. Connecting Rod
18. Crankshaft
19. Connecting Rod Bearing Cap
20. Crank

ENGINE

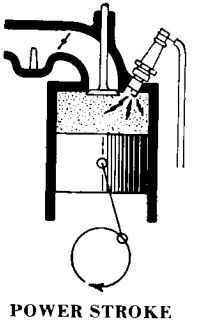
THE "Caterpillar" spark ignition engine is a relatively simple piece of machinery and is easy to maintain and service. Its simplicity is more evident if one understands thoroughly the principles underlying spark ignition engine operation.



INLET STROKE



COMPRESSION STROKE



POWER STROKE

THE WORKING PROCESS

The "Caterpillar" spark ignition engine operates on the 4-stroke cycle and burns gasoline or tractor fuel which is ignited by means of spark plugs.

In considering the working process of the engine the inlet stroke is a convenient point at which to begin.

STROKE ONE

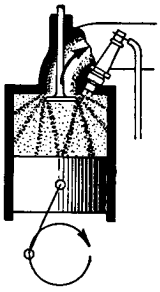
As the piston moves down on the inlet stroke, air is drawn through the air cleaner, carburetor and inlet valve opening, into the combustion chamber. The carburetor mixes air and fuel in the proper proportion before the mixture passes into the engine.

STROKE TWO

On the compression stroke, both the inlet and exhaust valves are closed. The piston moves up, crowding the air and fuel mixture into a small space. Near the end of the compression stroke, a spark passes between the electrodes of the spark plug and ignites the mixture.

STROKE THREE

As the ignited mixture burns and expands the piston is forced down by the pressure of the expanding gases. This downward force of the piston is transmitted through the connecting rod to the crankshaft which converts the reciprocating travel of the pistons into rotating or turning motion for operating the tractor.



EXHAUST STROKE

STROKE FOUR

As the piston moves up on the exhaust stroke, the exhaust valve opens and the burned gases are forced out through the exhaust pipe.

The exhaust stroke completes the spark ignition cycle; as the piston moves downward on its next stroke, the working process is started over again.

KEEP DIRT OUT!

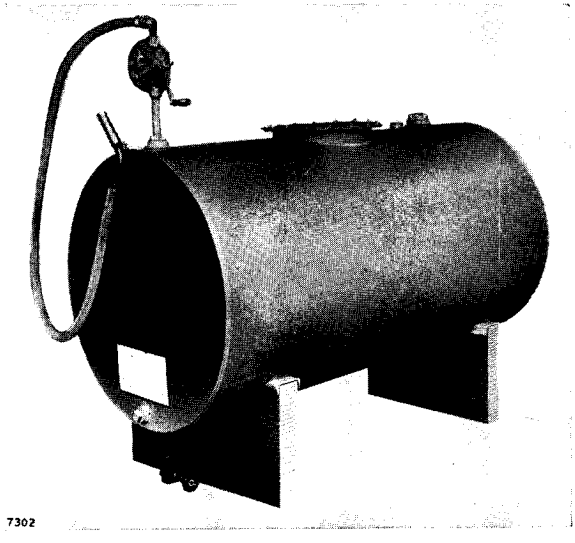
The "Caterpillar" spark ignition engine will give long uninterrupted service if it is given the care it deserves.

The most important single item in preserving the long life of an engine is to keep dirt out!

Caterpillar Tractor Co. has taken every precaution to safeguard against dirt entering the engine. Filters and cleaners have been supplied to keep the supply of air, fuel and lubricating oil clean.

Regardless of the original effectiveness of these cleaning units, it is highly important that they be kept clean; otherwise they will become ineffective. Unnecessary wear will result if dirt is allowed to work its way into the engine.

FUEL STORAGE



FUEL STORAGE TANK

Buy clean fuel from a responsible vendor and keep it clean.

Since natural settling is an effective method of cleaning fuel, allow the fuel to stand as long as possible after delivery before using.

A storage and settling tank of 500 gallon capacity or greater, similar to the one shown in the accompanying illustration, provides one of the most satisfactory methods of handling fuel. Such a tank allows continuous settling and even though some dirt might accidentally get into the fuel during its delivery, the fuel will be clarified considerably as the dirt settles out in the tank.

If other methods become necessary at times, use containers which are absolutely clean and reduce agitation to a minimum.

Always plan on transferring fuel directly from the storage tank to the fuel tank by means of a pump similar to the one shown in the illustration.

IMPROPER FUEL HANDLING

It is almost impossible to keep cans and funnels clean and their use should be discouraged. If a portable pump and 50 gallon drums are used, it is important that the exterior as well as the interior of the drums and pump be kept clean and free from dirt. Reputable refiners take every precaution to provide clean fuel but carelessness in handling it after delivery makes these clean fuels unsatisfactory.

Good fuel should be obtained and then kept free from dirt and water until it is burned.

Improper or careless handling of fuel is expensive.

Cylinder Head and Valve Mechanism

ON tractors prior to serial number 6G1588, the cylinder head gasket was used to seal the water passages between the cylinder block and head.

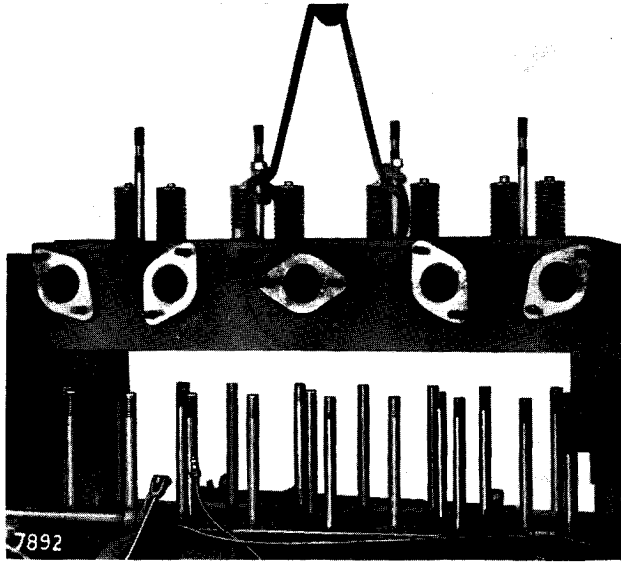
Effective with serial number 6G1588, the cylinder head is equipped with copper water directors to direct the flow of the coolant around the valve ports. Rubber seals and copper ferrules installed in the water passages between the cylinder head and block relieve the cylinder head gasket of any water sealing function.

REMOVING CYLINDER HEAD

Remove the hood and then the following items from the engine:

1. Manifolds and carburetor
   The inlet manifold, exhaust manifold and carburetor will come off as a unit after disconnecting the base of the carburetor from the air cleaner elbow and removing the nuts that hold the manifolds to the cylinder head.
2. Water outlet pipe between the cylinder head and radiator
3. Spark plugs and valve cover
4. Oil lines — from oil manifold to cylinder head and from cylinder head to valve rocker arm assemblies
5. Valve rocker assemblies, push rods and cylinder head nuts

Lift off the cylinder head as shown.



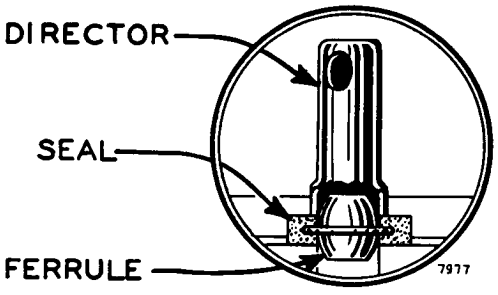
REMOVING CYLINDER HEAD

WATER DIRECTORS

Water directors are located on the manifold side of the head and should be replaced only if they are damaged.

Press the director into position in the head after aligning the notch on the director with the V mark on the head. The director should be pressed until the open end is flush with the counterbore in the cylinder head.

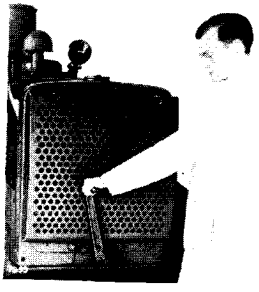
Care should be taken when installing the ferrules and seals to see that the ridge on the ferrule is in the central groove of the seal. Installation of the seal on the ferrule can be facilitated if the inner surface of the seal is first coated with soap.



WATER DIRECTOR

VALVES AND VALVE MECHANISM

Properly adjusted valves will operate many hours before they need to be serviced. Eventually, however, the valve faces and seats may become slightly pitted which ultimately allows compression pressure losses.



CHECKING COMPRESSION

It is well to check the valves occasionally for proper seating. This may be done by cranking the engine with the hand crank. If little or no resistance is noted, it is quite likely that the valves and valve seats should be refaced and reground. Valve leakage often may be heard distinctly in the manifolds.

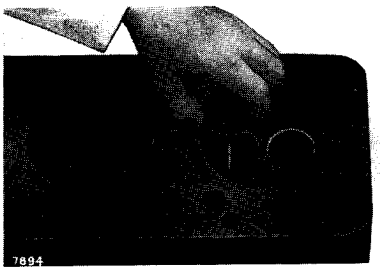
NOTE: Worn pistons and piston rings, improperly adjusted valves or a damaged cylinder head gasket may cause a loss of compression; therefore, these items should be checked before concluding that the valves are at fault. Worn pistons and piston rings can usually be detected without dismantling the engine as considerable oil vapor will come out of the breather while the engine is running. In addition, this condition will probably be accompanied by high oil consumption.

It is not always necessary to put on a new gasket when the cylinder head is removed since a cylinder head gasket can often be used several times. Damaged cylinder head gaskets can usually be determined by inspection. Gaskets showing blow-by marks or cracks should be replaced with new gaskets.

REMOVE ALL CARBON

After removing the cylinder head from the engine and the valve assemblies from the head, carefully scrape all carbon accumulations from the parts. Be sure to clean the valves thoroughly, as well as the valve stems, valve stem bushings and valve ports.

VALVE STEM BUSHINGS

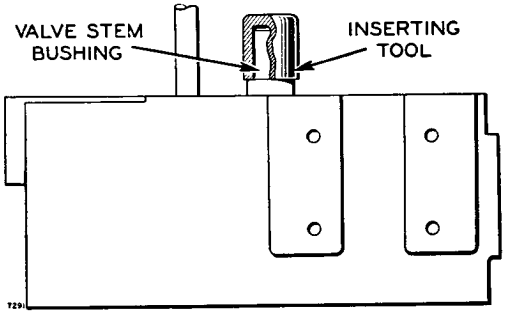


CHECKING VALVE STEM CLEARANCE

The valve stems operate in replaceable bushings. A valve stem bushing can be roughly checked for wear by cleaning the inside of the bushing and inserting a new valve. If the valve stem bushing is worn, an excessive amount of side play will be present, and the valve will not seat properly.

The valve stem bushing can be driven out from the inside of the head with a suitable drift.

The bushings should be *pressed* into position carefully with the type of inserting tool shown in the accompanying illustration to prevent damage to their ends.



Normal valve stem clearance in the valve stem bushing is from .005″ to .006″ for inlet valves and from .006″ to .007″ for exhaust valves.

VALVE INSPECTION AND RECONDITIONING

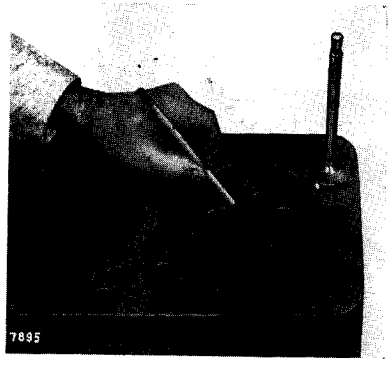
The valve faces should always be inspected and refaced if necessary. If they are badly pitted or warped, they should be replaced.

The valve seats should be carefully inspected. A reseating tool may be used to advantage but care should be exercised in its use as too much valuable material may be removed quickly and unknowingly.

Finish the valve seat by grinding with fine grinding compound. CAUTION: *Never turn valves one complete revolution while grinding as the compound is likely to create grooves in the valve seats.*

CHECKING VALVE SEAT

When a perfect seat and face are apparently obtained, remove the valve and clean it and the valve seat thoroughly. Make ten or twelve evenly spaced marks around the valve seat with a soft lead pencil. Replace the valve and rotate it lightly in its seat about $\frac{1}{8}$ turn. Remove the valve and examine the pencil marks. If each of the marks has been partially wiped out, the valve seat is all right. If not, continue to "lap in" the valve until a satisfactory seat is obtained.



VALVE INSTALLATION

When installing valves, care should be taken to see that the valves are installed in the same port from which they were removed. Exhaust valves, marked EX on the valve head, should be installed in the exhaust ports. Inlet valves, marked IN on the valve head, should be installed in the inlet ports.

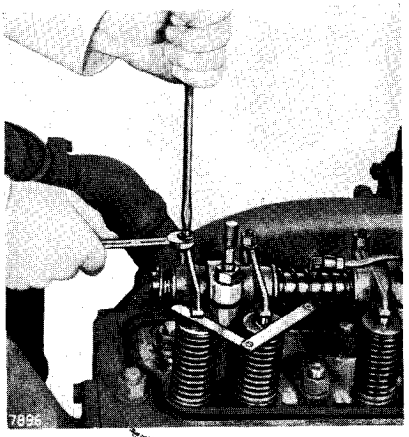
Installation of the valve locks will be facilitated if they are first coated with heavy grease.

VALVE CLEARANCE ADJUSTMENT

The valve clearance adjustment should be made while the engine is hot; that is, after the engine has been stopped ten minutes and before it has been stopped twenty minutes. If the adjustment is not completed during this ten minute interval, start the engine and allow it to warm up.

NOTE: Check the cylinder head nuts and rocker arm assembly hold-down nuts to see that they are tight before adjusting the valves.

Adjust the valves in the firing order of the engine (1-3-4-2). Crank the engine in the direction of normal rotation until the inlet valve closes on No. 1 cylinder, then give the engine one-half additional turn and adjust both valves on No. 1 cylinder at the same time.



SETTING VALVE CLEARANCE

Loosen the valve adjusting screw lock nut on the valve rocker arm. Insert the feeler gauge between the valve stem and the valve rocker arm. Turn the adjusting screw to obtain the correct clearance between the top of the valve stem and the end of the valve rocker arm.

Set the clearance at .010" for the exhaust and inlet valves. Recheck the adjustment after the adjusting screw lock nut is tightened.

Turn the engine another half turn and adjust the valves on the next cylinder in the firing order.

VALVE TIMING

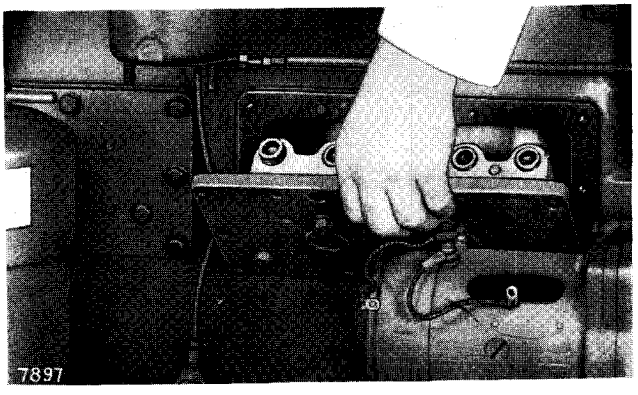
The valve timing is controlled by the setting of the timing gears. Corresponding marks on the crankshaft, camshaft, accessory shaft, and idler gears must be in line before installing the timing gear cover. Timing is discussed in the topic, TIMING GEAR ASSEMBLY.

VALVE LIFTER ASSEMBLIES

Two valve lifter assemblies are attached to each valve lifter cover. After loosening the valve rocker arm assemblies, remove the valve push rods. Remove the carburetor and air cleaner pipes as a unit.

To remove the front valve lifter assembly, disconnect the leads to the voltage regulator on top of the generator and remove the regulator.

To remove the rear valve lifter assembly, remove the breather and oil filler bracket. Remove the tube from the auxiliary tank to the fuel



REMOVING VALVE LIFTER COVER

pump and then remove the fuel pump. Take off the cover on the oil filter and remove the filter elements.

Drive the two dowel pins in each valve lifter cover in flush with the block and then remove the valve lifter assembly covers as shown after taking out the capscrews holding each cover in place. Drive the dowel pins on through the block, catching them as they come out inside the block.

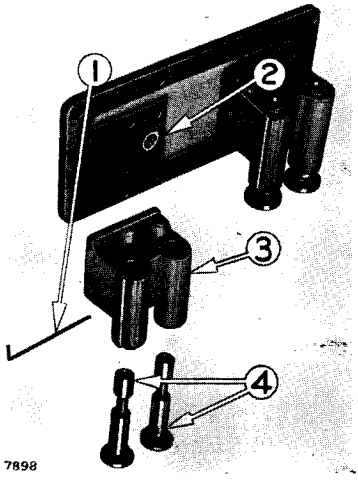
LIFTERS AND GUIDE ASSEMBLY

The lifters (4) may be removed after the wire lock (1) has been taken out. Worn lifters should be replaced.

The guide (3) should be replaced if the bores for the lifters are worn. This may be checked by inserting a new valve lifter in the bores of the guide.

The clearance between a new valve lifter and the bore of a new valve lifter guide is .0015" to .003".

If worn, remove the capscrews holding the guide to the cover (2) and install a new guide.



VALVE GUIDE ASSEMBLIES

Camshaft

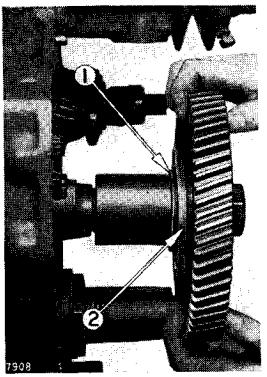
THE camshaft is driven by the camshaft gear which meshes with the crankshaft gear. The cams on the shaft actuate the inlet and exhaust valves. The gear which drives the lubricating oil pump is an integral part of the camshaft.

REMOVAL

Remove the valve lifter cover assemblies as outlined in the topic, VALVE LIFTER ASSEMBLIES.

Remove the timing gear cover as outlined in the topic, TIMING GEAR ASSEMBLY.

By working through the holes in the camshaft gear, remove the thrust plate capscrews and locks from the cylinder block. Slide out as a unit



REMOVING CAMSHAFT

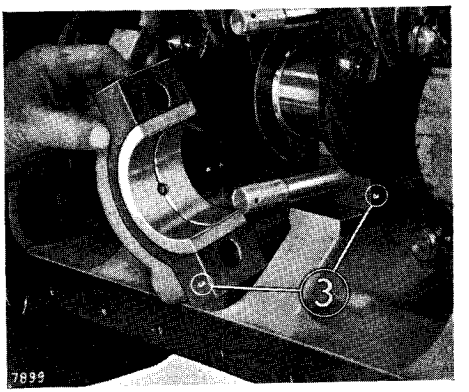
the camshaft gear, thrust plate (2), washer (1) and camshaft. Care should be taken when removing and installing the camshaft not to damage the camshaft bearing bores. After removing the nut and lock, the camshaft gear may be pressed off the camshaft or pulled with the cross arm and screw of the 8B7554 Bearing Cup Pulling Attachment and two ½"-20 capscrews 4½" long (1A3046). Use a 4B8267 Nut and 4B8268 Stud to replace the camshaft gear as described in the topic, TIMING GEAR ASSEMBLY. When installing the camshaft gear, do not drive it into place with the camshaft in the block as this will dislodge the plug in the camshaft rear bearing bore and allow oil to leak into the flywheel clutch compartment.

END-PLAY

If the end-play of the camshaft exceeds .025", the thrust washer (1) and thrust plate (2) should be replaced. Be sure the chamfered side of the thrust washer is toward the cylinder block.

Main Bearings

The main bearings are babbitt-lined shells located in the cylinder block. Dowel pins in the cylinder block and main bearing caps keep the shells from rotating. The inner diameter of the bearing shells is 3.003" - 3.0045" giving a new bearing clearance of .003" - .0055".



BEARING IDENTIFICATION NUMBERS

The bearing caps are numbered consecutively from the front of the engine on the left side.

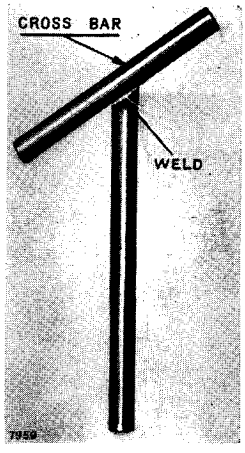
Effective with Serial No. 6G1237, the center main bearing takes the end thrust of the crankshaft. The upper shell of this thrust bearing is not held in place by a dowel in the cylinder block as are the remainder of the bearings. The lower shell of this bearing is held in position by a dowel in the bearing cap.

INSPECTION AND REPLACEMENT

The upper center main bearing on tractors beginning with Serial No. 6G1237, and this shell alone, may be removed from the cylinder block without removing the crankshaft. Insert a screw in the drilled oil passage of the crankshaft journal and rotate the crankshaft.

If the bearing offers appreciable resistance and the screw is likely to damage the bearing shell, a tool similar to the one shown can be made from ¼" drill rod to rotate the bearing shell out of the cylinder block.

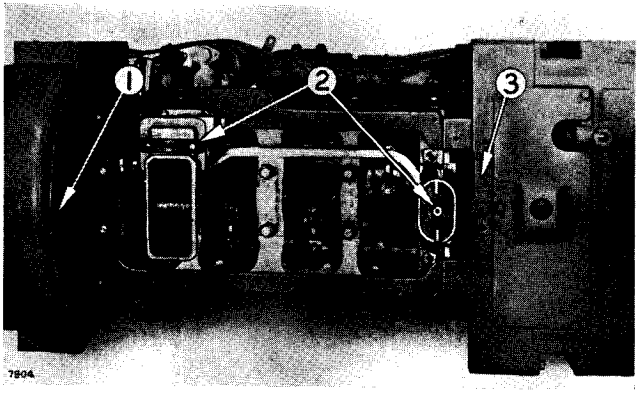
The cross bar will spread the force of removing across the contact area of the bearing shell. The angle of the cross bar can be determined by inserting the upright portion into the oil hole in the crankshaft.



REMOVING TOOL

It is necessary to take out the crankshaft when removing or replacing any of the other main bearings.

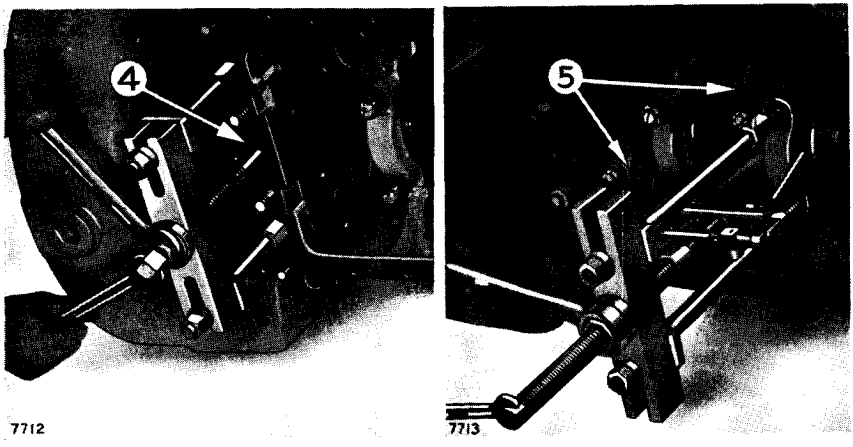
To remove all main bearings, first remove the engine as outlined in the topic, REMOVING ENGINE. Disconnect the water pipes between the radiator and the engine and remove the radiator as outlined in the topic, RADIATOR REMOVAL. Remove the timing gear cover (3) as described in the topic, TIMING GEAR ASSEMBLY.



Inspect the crankshaft oil seal in the timing gear cover. If it is worn or leaking, install a new seal with the wiping edge or lip out. This seal should be installed with a 7B7918 Crankshaft Oil Seal Driver.

Remove the flywheel and flywheel housing (1) and then the oil pan and oil pump and suction bell (2).

The rear main bearing cap (4) is drilled and tapped and may be pulled as shown using the bar of 8B7548 Push Puller, 8B7550 Legs, the screw from an 8B7546 Puller and a nut from 8B7551 Puller.



REMOVING MAIN BEARINGS

The remaining bearing caps have recesses to permit the use of a bar in their removal. These bearing caps can also be pulled as shown, with 8B7548 Push Puller, 8B7553 Reducing Adapter and 8B7554 Bearing Cup Pulling Attachment.

Remove the connecting rod bearing caps (5) and take out the crankshaft. On machines built prior to Serial No. 6G1237, remove the capscrews holding the crankshaft thrust plate to the cylinder block before taking out the crankshaft. Care should be taken to prevent scratching or marring the crankshaft bearing journals.

Before installing the bearings, wash the shells thoroughly and wipe the outer surfaces dry. Place the upper bearing shells in position and then the crankshaft. Install the lower bearing shells in the bearing caps. Place several thicknesses of paper between the lower shells and the crankshaft to eliminate all clearance and tighten the bearing caps to seat the upper shells. Remove the paper and then tighten the caps uniformly. The crankshaft should rotate freely.

The flywheel end of the rear main bearing is counterbored .003 - .005" larger for oil control; consequently, the crankshaft should not touch this part of the bearing.

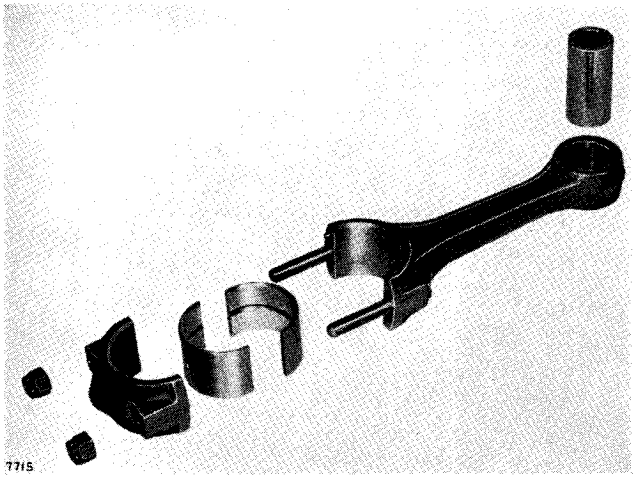
REPLACEMENT BEARINGS

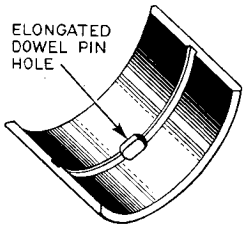
Precision main bearings are obtainable in complete sets and should be installed without fitting.

Single replacement bearings of this type can be obtained. If a single bearing is installed, care should be taken to see that the other bearings are not worn to any extent; otherwise, the new bearing will carry a large part of the normal load and may be damaged.

Connecting Rod

CONNECTING rod bearings are the precision type. Precision bearings should be installed without fitting, reaming or scraping the rod, cap or shells. These shells are designed for installation without removing the connecting rod from the engine. They may be removed, inspected and replaced through the inspection doors on the side of the cylinder block.





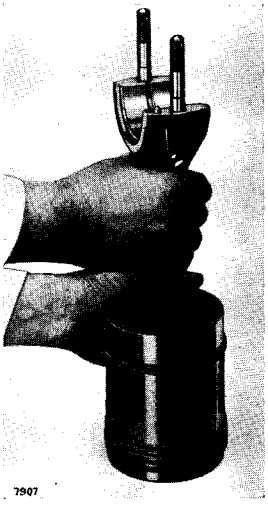
LOWER BEARING SHELL

The inner diameter of connecting rod bearing shells is 2.6285 - 2.630", giving a clearance of .0035 - .006" between the bearing and a new crankshaft. The dowel pin hole in the lower shell is oblong to assure proper alignment of the bearing in the connecting rod.

Do not attempt to align connecting rods by bending. Bent rods are not suitable for service and should be discarded.

PISTON PIN BUSHING

It is not always necessary to replace piston pin bushings whenever new precision bearing shells are installed in a connecting rod. In many cases, bushings may be serviceable even though the second replacement of bearing shells has been made.



CHECKING BUSHING

After the oil has been wiped from the piston pin and bushing, it is possible to feel the clearance between them. This normal oil clearance should not be mistaken for wear. A new bushing should be installed only when the clearance between the bushing and a new piston pin exceeds .005".

New connecting rods have the piston pin bushing bored in a special machine which maintains the proper center-to-center distance and parallelism of the connecting rod bearing and piston pin bore. Reconditioned rods should have the piston pin bushing machined in the same manner. A new connecting rod makes the best templet for center-to-center distance. After pressing a new bushing into place, it should be machined accurately from .0005" to .001" larger than the diameter of the new piston pin to be installed.

Crankshaft

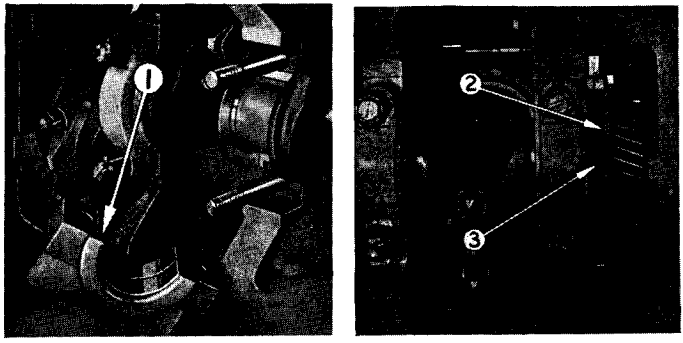
THE crankshaft main bearing journals are 2.999 - 3.000" in diameter and the connecting rod bearing journals are 2.624 - 2.625" in diameter.

A crankshaft should not be put in an engine if the wear on the main bearing or connecting rod bearing journals exceeds .007" or if the connecting rod bearing journals are more than .005" out of round.

CRANKSHAFT END-PLAY

When the engine leaves the factory, the crankshaft end-play is from .005" to .007".

On tractors built prior to 6G1237, the end-play of the crankshaft is taken by a thrust plate and washer at the front end of the crankshaft.

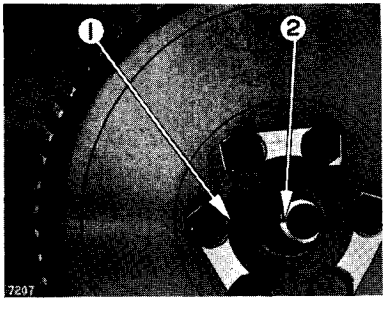


Effective with machine 6G1237 the end-play of the crankshaft is taken by the center main bearing.

If the end play of the crankshaft exceeds .020", replace the thrust plate (2) and washer (3), or the center main bearing (1).

Flywheel

IF the flywheel is removed from the crankshaft, the marks (1) and (2) should be aligned when the flywheel is replaced. This will insure that the timing marks on the flywheel will be in their correct location with respect to the crankshaft.



ALIGNING MARKS

When installing the flywheel, care should be taken to center the flange on the crankshaft in the counterbore of the flywheel before tightening the capscrews. The capscrews should be drawn down evenly and tightly before securing the locks.

RING GEAR

When starting an engine equipped with an electric starting motor, the pinion of the electric starting motor engages with a ring gear on the flywheel.

Before installing a new ring gear, carefully clean and remove all burrs from the contact surfaces of the ring gear and flywheel. Heat the ring gear in oil and slip it into position.

Drill four evenly spaced holes $1\frac{3}{64}$" in diameter $\frac{7}{8}$" deep at the front of the flywheel between the ring gear and flywheel and tap the holes with a $\frac{1}{4}$"- 20 tap.

Install the setscrews and stake them in place after they are tightened securely.

Cooling System

THE cooling system should be kept clean and free from scale deposits. The use of soft water in the cooling system will reduce the formation of scale deposits. If soft water is not available, clean rain water or hard water treated with water softener should be used. The fan belt tension should be adjusted as recommended in the Operator's Instruction Book.

CLEANING COOLING SYSTEM

If difficulty is experienced in cooling, the radiator should be checked and cleaned of any accumulation of debris between the fins and tubes. Such accumulations decrease the efficiency of the cooling system and may cause the engine to overheat. If enough coolant is boiled out of the system, the cylinder head may be cracked when cold water is added.

Some of these accumulations may be removed from the radiator core by flushing with water or compressed air from the engine side. It may be necessary eventually to remove the radiator guard to clean out effectively the accumulation. If it is necessary to use hard water in the cooling system, periodic checks should be made for lime deposits. Sediment and lime deposits will cause the engine to overheat.

If such deposits are present, the cooling system should be filled with a mixture consisting of five parts of commercial hydrochloric (muriatic) acid, one part of formaldehyde, and forty-eight parts of water. Mix the formaldehyde and water and then add the acid to the solution.

Operate the engine for three hours and then drain the cleaning solution. Thoroughly flush the system and refill with soft water.

WINTER CONDITIONING

The cooling system should be prepared for cold weather operation and a suitable anti-freeze used to prevent damage to the engine. Various anti-freeze mixtures such as ethylene glycol (Prestone, G.M., Permaguard, Zerex, etc.), denatured ethyl alcohol, methanol (synthetic wood or methyl alcohol) and glycerine are all suitable for use.

Because the boiling point of alcohol is low (approximately the same as the normal operating temperature of the engine), some of the alcohol is continually evaporating inasmuch as the cooling system is controlled by a water temperature regulator and held at a relatively high temperature. This loss by evaporation is objectionable *but the regulator should not be removed.* Removal of the regulator might lower the temperature of the coolant and save the alcohol but it would reduce the efficiency of the engine. It is essential, therefore, that the coolant be tested frequently to assure adequate protection.

Other anti-freeze compounds such as salt solutions of calcium chloride, magnesium chloride, sodium silicate, etc. may cause serious corrosion of the cooling system and, for this reason, are not recommended. Honey, glucose, and sugar solutions likewise are not satisfactory for use as an anti-freeze.

The use of light fluid oils, such as kerosene, Diesel fuel, saw oil, etc., should also be discouraged because their poor heat conducting qualities may cause overheating of the engine under certain conditions. Oil is also destructive to rubber seals and connections in the system.

SERVICING THE COOLING SYSTEM

Before adding anti-freeze, regardless of the type used, the cooling system should be inspected to be sure that it is clean, leak-proof, and in proper working order. If cleaning is necessary, refer to the topic, CLEANING COOLING SYSTEM.

After anti-freeze is added, the system should be inspected regularly to be sure that no leaks have developed. To avoid overflow loss of solution, care should be exercised not to over-fill the radiator. Make necessary additions only when the cooling system is warmed up to operating temperature so a correct coolant level is indicated.

The cylinder head should be tightened or the gasket replaced to avoid the possibility of solution leaking into the engine. Anti-freeze or water mixed with engine oil will form heavy sludge that may cause lubrication failure, gumming, and serious damage to the engine.

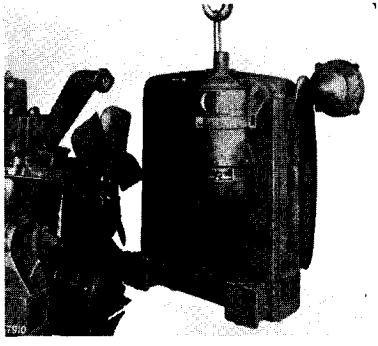
The water pump (also packing nut on tractors built prior to 6G1588) should be inspected for leaks, and corrections made if necessary, to avoid loss of coolant. This will also prevent air from being drawn into the cooling system which can cause foaming, rust, overheating, and similar difficulties.

Anti-freeze should be used in accordance with the instructions and in the proportions recommended by the anti-freeze manufacturer. It should be tested frequently (especially alcohol) to avoid the possibility of a freeze-up through undetected loss. A hydrometer, graduated for testing the kind of anti-freeze being used, can be obtained from almost any automotive supply house.

Proper sheltering is an aid to cold weather starting, insures longer engine life through immediate oil circulation, and helps to prevent freezing of the cooling system when unexpected temperature "drops" occur.

RADIATOR

Remove the engine hood and side plates. Then disconnect the upper and lower water pipes from the radiator and remove the carburetor choke rod which passes through the right hand side of the radiator assembly.



REMOVING RADIATOR

Take out the capscrews securing the radiator assembly to the support and remove the radiator assembly as shown.

On tractors built prior to serial number 6G1588, the radiator assembly is fastened to the timing gear cover. Effective with serial number 6G1588, the timing gear cover was redesigned to accommodate a separate radiator support bracket.

RADIATOR CORE

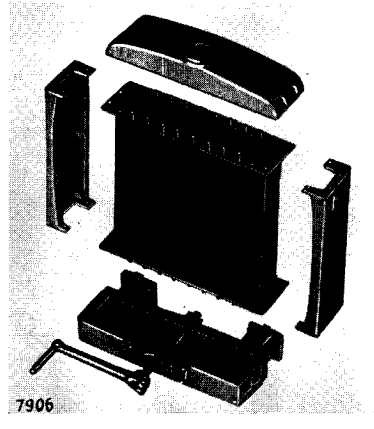
If difficulty is experienced in cooling, the radiator core should be cleaned of any accumulation of debris between the fins and tubes. Such accumulations decrease the efficiency of the cooling system and may cause the engine to overheat.

To remove the radiator core, remove the overflow tube and take off the top tank and side plates. Remove the capscrews holding the radiator core to the bottom tank and then remove the radiator core. The outer row of tubes on each side of the radiator core carry no coolant and serve only as supports.

The inside of the radiator core, bottom tank and top tank should be cleaned as recommended in the topic, CLEANING COOLING SYSTEM.

Care should be taken, when assembling the radiator, to see that a perfect seal exists between the top and bottom tanks and the radiator core.

Metal strips are used on the flanges of the radiator core to aid in securing a perfect seal between the radiator core and the bottom and top tanks. Narrow strips are used at the front of the core and wide strips on the engine side.



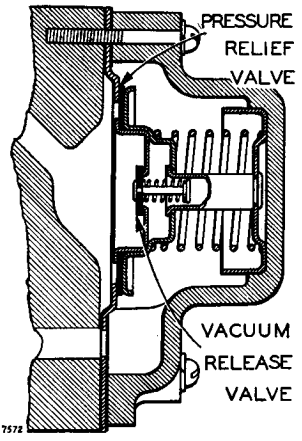
REMOVING RADIATOR CORE

SEALED PRESSURE OVERFLOW SEAL ASSEMBLY

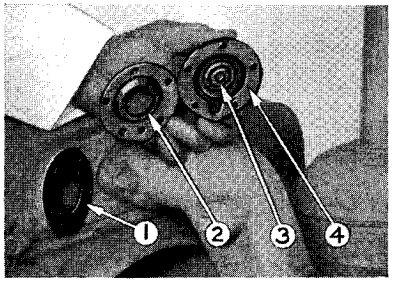
A sealed pressure overflow assembly became effective with serial number 6G1588 to prevent the loss of coolant through the radiator overflow tube when the tractor is operating at an angle.

If a pressure in excess of six pounds per square inch is created by a rising temperature and the resultant expansion of the coolant, the pressure relief valve will be forced away from its seat and the pressure will escape through the radiator overflow tube. As the pressure decreases to less than six pounds per square inch, the valve will close.

When a vacuum of one pound per square inch is present in the cooling system due to contraction of the coolant by a decreasing temperature, the vacuum release valve will open, permitting air to enter the cooling system until the vacuum becomes less than one pound per square inch.



SEALED PRESSURE OVERFLOW



REMOVING VALVE ASSEMBLY

The seal assembly (3) may be removed by taking out the screws holding the housing (4) in place and removing the housing and seal plate (2). The gaskets between the radiator tank (1) and seal plate, and between the seal plate and the housing should be replaced if leaking. To remove the seal assembly, pry under the opposite edges of the pressure relief valve.

To install a new seal assembly, place the seal assembly in position in the housing and press down evenly with the thumbs on the seal of the pressure relief valve. The edge of the cup on the end opposite the pressure relief valve should be firmly seated in the recess in the housing.

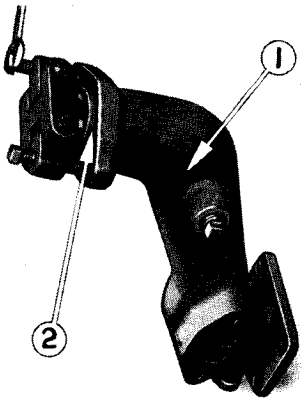
WATER TEMPERATURE REGULATOR

A water temperature regulator is used to restrict the flow of coolant through the radiator until the engine has warmed up. The regulator is adjustable on tractors burning tractor fuel. The regulator is not ad-

justable on tractors burning gasoline as a fuel. These regulators are so constructed that if the element should be punctured accidentally, they will open to a position of safety.

REMOVAL

Drain the cooling system until the coolant level is below the cylinder head. Remove the heat indicator element from the water outlet pipe (1) and remove the water outlet pipe. The regulator is located in the



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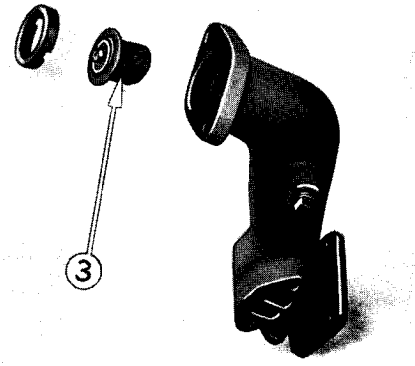
PULLING REGULATOR RETAINER



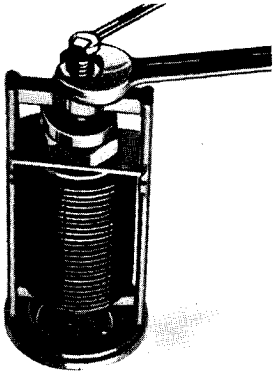
7751

REMOVING REGULATOR

upper end of the pipe. Use a 3B7184 Regulator Retainer Puller to remove the retainer (2). The hooks of the puller fit in the slots of the retainer. Lift out the regulator (3).

CHECKING REGULATOR

To check a water temperature regulator, suspend it in an open pan of water so that the regulator is completely covered. Gradually heat the water until the regulator reaches its "fully opened" position. Use an accurate thermometer to note the temperature. Stir the water to obtain a more accurate check.



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ADJUSTING REGULATOR

The regulator used on tractors burning gasoline should be fully open at 180° F. plus or minus 5°. This regulator is non-adjustable and if not properly calibrated, should be replaced.

The regulator used on tractor fuel tractors should start to open at 193° F. to 198° F. and be $\frac{1}{8}$" open at 205° F. Adjust the regulator using the nut on the end away from the valve as shown.

FAN AND WATER PUMP

The water pump circulates water through the cooling system. The fan and water pump impeller are mounted on opposite ends of the same shaft. The fan and water pump shaft is driven by the fan belt.

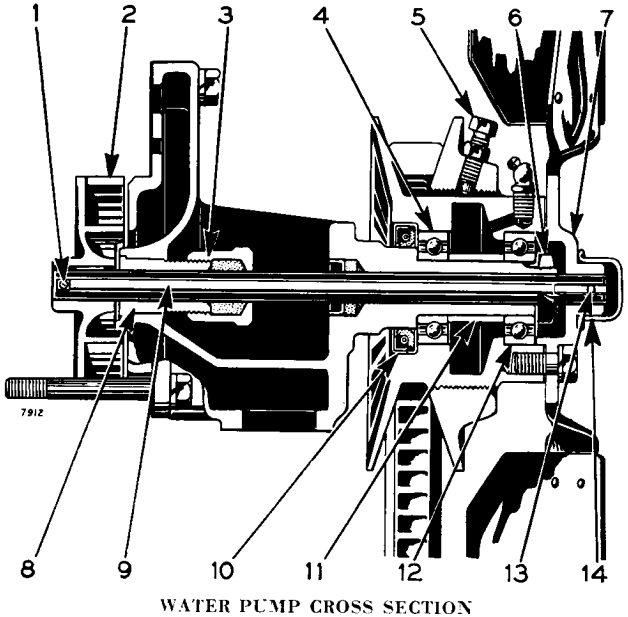
After the radiator is removed as described in the topic, RADIATOR REMOVAL, the fan and water pump may be removed from the front of the engine as a unit by disconnecting the water pump pipe and removing the nuts or capscrews holding the water pump housing to the timing gear housing.

On machines built prior to 6G1588, a packing type pump is used. Effective with serial number 6G1588, a non-adjustable seal type pump is used. With the use of a non-adjustable seal type pump, a different fan assembly is used.

With the radiator removed, all parts of the fan may be replaced without removing the water pump housing from the engine.

WATER PUMP—PACKING NUT TYPE

Care should be taken when tightening the packing nut not to bind the shaft by over-tightening. Too tight an adjustment prevents the coolant



WATER PUMP CROSS SECTION

from wetting and lubricating the pump packing and shaft, and often results in scoring the shaft. If the pump leaks when adjusted properly, new packing should be installed.

FAN HUB SEAL

To replace the seal (10) the following procedure is recommended. Loosen the fan belt adjustment. Pry off the cover (14) and remove the pin (13). Remove the fan spider (7) and fan blades by taking out the capscrews that pass through the fan spider and into the fan hub. Remove the nut (6) and lock from the water pump bracket. Remove the fan belt and slide the hub, bearings (4 and 12) and seal (10) off the shaft. Pry out the seal (10) and replace it if worn. Install the seal with the lip of the leather away from the bearing. If the bearings need replacing, press on the rear bearing (4) until the front bearing (12) is out. Remove the spacer (11). Then press the rear bearing (4) and seal out the rear of the hub.

Clean the hub and rim of any accumulations of dirt and grease. Such accumulations act as a grinding compound and cause excessive wear of the fan belt, hub and rim.

When adjusting the fan belt tension, be sure the screw (5) is seated in one of the grooves in the hub and the lock nut firmly tightened.

SHAFT AND BUSHING

Remove the cover (14), pin (13), fan spider (7) and the lock and nut (6). Remove the water pump by taking out the capscrews holding it to the cylinder block.

Loosen the packing nut (3) and slide out the impeller (2) and shaft (9). Press the impeller off the shaft after removing the tapered pin (1). If the pump shaft is badly worn or scored, it should be replaced. Remove the packing nut. Always renew the pump packing when installing a new shaft.

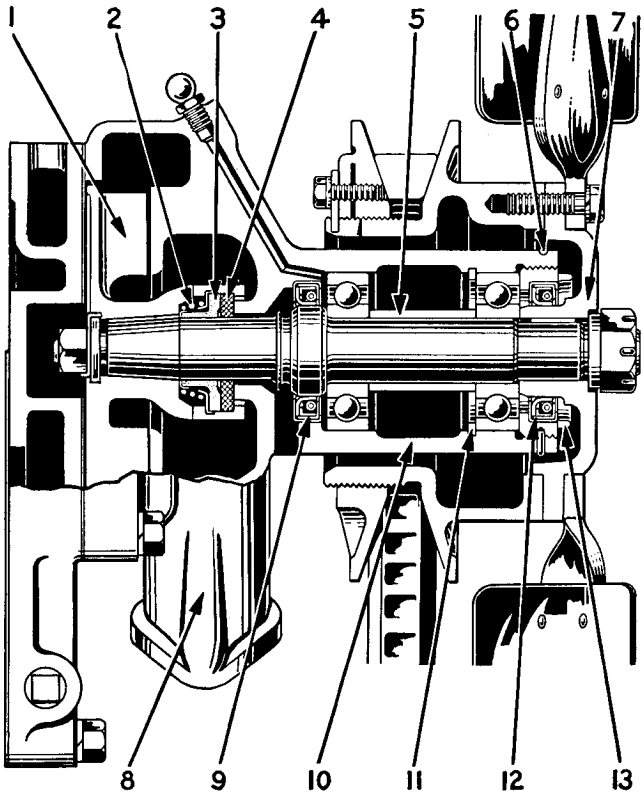
The bushing (8) should be pressed out and replaced if worn. A clearance of .001″ to .0025″ should exist between a new bushing and a new shaft.

WATER PUMP—SEAL TYPE

The seal assembly is self-adjusting thus eliminating the use of a packing nut.

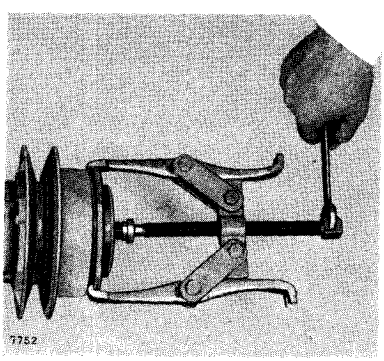
FAN HUB SEAL ASSEMBLY

To replace the seal (12), the following procedure is recommended. Loosen the fan belt adjustment. Remove the fan spider and fan blades



WATER PUMP CROSS SECTION

by taking out the capscrews that pass through the fan hub (7) and into the fan pulley hub (10). After the cotter pin, nut, and lock are removed, pull the fan hub (7) using an 8B7546 Puller as shown. Remove the snap ring (6) and screw out the retainer (13). After removing the seal, install a new one with the wiping edge toward the radiator.



PULLING FAN HUB

Clean the fan pulley hub and ring of any accumulations of dirt and grease. Such accumulations act as a grinding compound and cause excessive wear of the fan belt, hub, and ring.

When adjusting the fan belt tension, be sure the flat locks fit into the notches in the ring and hub and that the capscrews are securely tightened.

SEAL ASSEMBLY

If water is leaking from the drain opening on the underside of the pump, the seal assembly should be replaced. With the radiator removed, the water pump and fan can be taken off the engine. Removal of the fan will facilitate the disassembly of the water pump.

Pull the impeller (1) with the crossbar and screw from 8B7554 Bearing Cup Pulling Attachment and two ¼"-20 capscrews 3½" long (3B1798). Remove the key, coat the pump shaft with soap, and then remove the spring (2), seal (3), and washer (4).

The new seal assembly can be installed in the reverse order of disassembly. Check to see that the spring (2) is installed with the smaller end toward the impeller (1).

Slip the impeller onto the shaft and in mesh with the lugs of the carbon washer. Observe through the pump inlet port (8) the proper mesh of the impeller and washer. Then rotate the impeller on the shaft until the keyways line up and insert the straight key.

BEARING AND SHAFT ASSEMBLY

Before removing the bearing and shaft assembly, the impeller and seal assembly should be removed as previously recommended. Then, remove the nut from the front end of the shaft and the capscrews that hold the fan spider to the hub (7). Remove the fan spider assembly and pull the hub with an 8B7546 Puller.

Remove the lock ring (6) and then the retainer (13).

Press the shaft forward until the front bearing protrudes from the bearing housing. The bearing can be pulled with an 8B7547 Puller.

Remove the retainer ring (11). The spacer (5) and rear bearing can be removed with the shaft from the front of the pump body assembly.

Before reassembling any of the parts, the seals (9 and 12) should be inspected and replaced if necessary. It should be noted that each seal is installed with the wiping edge toward the fan spider assembly.

Fuel System

THE fuel pump supplies fuel from the fuel tank at the proper pressure to the carburetor.

The carburetor meters and mixes the fuel with the proper amount of air in accordance with the action of the governor on the air shutter to provide smooth operation of the engine at any speed.

The governor controls the speed of the engine in accordance with the setting of the hand throttle by controlling the amount of air entering the carburetor.

The manifold heat control on gasoline burning engines provides a means of heating the fuel mixture in the inlet manifold during the warm-up period to assure more complete combustion. The manifold heat control on engines burning tractor fuels provides sufficient heat at all times to permit the use of less volatile fuels.

FUEL TANK

The fuel tank is mounted above the flywheel housing just behind the engine. The tank is divided into a main fuel tank with a capacity of 31 gallons and an auxiliary gasoline tank of 1 gallon capacity.

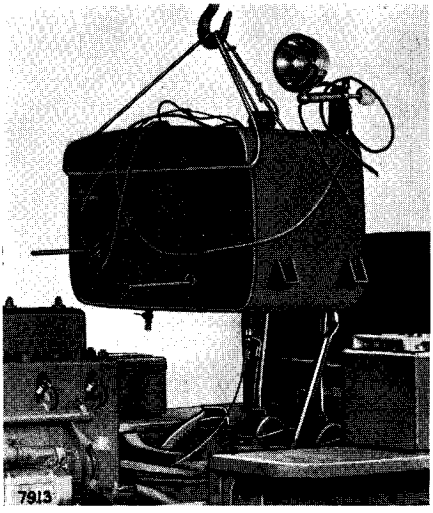
On machines burning tractor fuel, gasoline from the auxiliary tank is used when starting the engine. A three-way valve is used in the tractor fuel system to control the flow of fuel from the main or auxiliary tanks.

On machines burning gasoline, the line from the main tank is connected to the fuel pump and the line from the auxiliary tank enters the supply line to the carburetor just past the fuel pump.

REMOVING FUEL TANK

Shut off the fuel supply valves for the auxiliary fuel tank and main tank. The following procedure outlines the steps for removing the fuel tank. On engines without electrical equipment, disregard reference to electrical connections.

1. Disconnect the fuel line for the main fuel tank at the shut-off valve.
2. Remove the hood.
3. On engines so equipped, remove the choke control bracket from the hand throttle control bracket on the rear of the fuel tank.
4. Disconnect the fuel line for the auxiliary tank at the shut-off valve in front of the tank.
5. Disconnect the oil pressure gauge line at the elbow in front of the fuel tank.
6. Remove the head light lead clips on the fuel tank.
7. Remove the manifold heat control lever at the manifold and slide the rod out of the bracket on the engine block.
8. Disconnect the generator lead at the "BAT" terminal of the voltage regulator and remove the capscrews holding the lead clips to the cylinder block and fuel tank.



REMOVING FUEL TANK

9. Remove the heat indicator element from the engine water outlet pipe and the capscrews holding the heat indicator line clips to the block.

10. Remove the bolts holding the fuel tank to the fender assemblies.

11. Remove the battery box cover.

12. Disconnect the lead from the spotlight at the switch terminal inside the battery box and remove the capscrews through the clips of the spotlight lead.

13. Disconnect the lead from the generator at the ammeter terminal inside the battery box.

14. Disconnect the magneto lead at the top of the magneto.

15. Disconnect the hand throttle control rod in front of the fuel tank.

Lift off the fuel tank as shown.

FUEL PUMP

The fuel pump, located at the rear of the lubricating oil filter on the right-hand side of the engine block, delivers fuel to the carburetor. It is a diaphragm type pump actuated by a lever which contacts a separate cam on the engine camshaft.

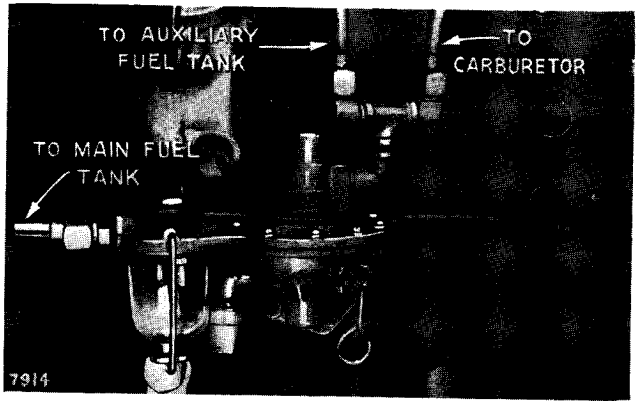
The pump is equipped with an externally mounted lever which may be operated by hand to fill the carburetor after the fuel tank has been emptied and then refilled.

Low fuel pressure or failure of the pump to deliver fuel to the carburetor may be caused by the following:

1. Clogged filter element in the fuel pump sediment bowl.

2. Leaking diaphragm.

3. Leaking check valves.



FUEL PUMP

4. Weak or broken diaphragm spring.

5. Broken rocker arm spring.

FILTER ELEMENTS

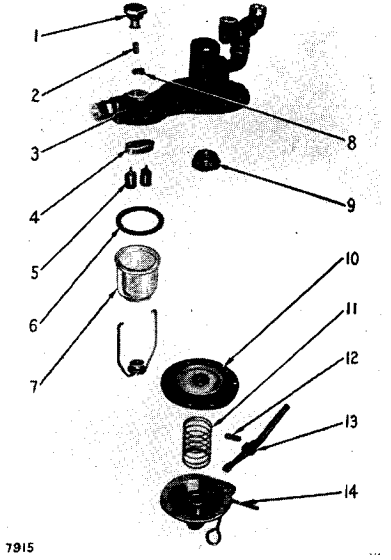
Remove the sediment bowl (7). The gasket (6) between the bowl and the cover (3) should be replaced if leaking. Unscrew the filter elements (5) from the head (4) and carefully wash them in non-inflammable washing fluid. Replace the elements.

ROCKER ARM SPRING

Disconnect the fuel lines at the pump and remove the pump by taking out the capscrews holding the pump to the engine block.

Remove the retaining ring from one end of the pin (14) and drive out the pin. Remove the rocker arm (13) and return spring (12). The return spring should be replaced if broken.

When installing the rocker arm, compress the diaphragm (10) and diaphragm spring (11) and install the short end of the rocker arm in the bracket of the diaphragm assembly. Then install the return spring and rocker arm pin.



FUEL PUMP ASSEMBLY

DIAPHRAGM

Remove the screws holding the body to the cover (3) and examine the diaphragm (10) for leaks. The diaphragm spring (11) should be replaced if broken or weak. The spring tension may be checked by comparing the spring with a new spring.

CHECK VALVES

The check valve above the sediment bowl prevents fuel from flowing back to the fuel tank when the diaphragm is on an upward or pressure stroke.

Remove the plug (1), spring (2), and valve (8). Check the condition of the valve and valve seat in the cover. Replace the valve if worn and smooth the seat if damaged.

The check valve above the diaphragm prevents fuel from flowing back from the carburetor when the diaphragm is on a downward or suction stroke.

Unscrew the valve assembly (9) and install a new assembly if worn or damaged.

CARBURETOR

A single venturi updraft Zenith carburetor with a 1¼" throat (Model K5A) is used on this tractor.

REMOVING CARBURETOR

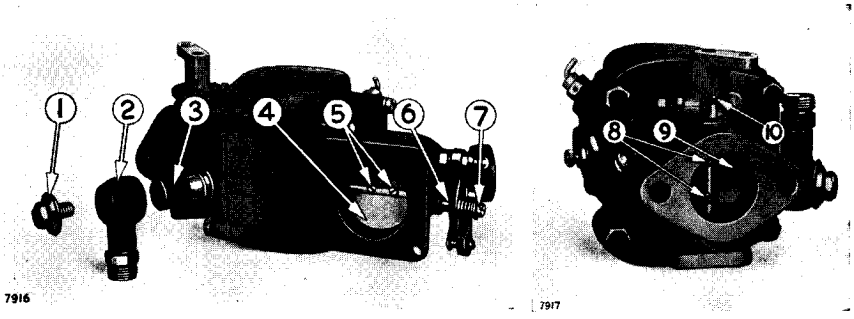
Disconnect the fuel line from the inlet body (2). Drain the bowl by opening the drain valve. Disconnect the throttle shutter control and both air shutter (choke) controls. Remove the capscrews holding the elbow for the air cleaner connection to the carburetor and the capscrews holding the carburetor to the inlet manifold. Remove the carburetor.

INLET BODY

Take out the stud (1) to remove the inlet body (2) and screen (3). Clean the screen and inspect the soldered joint to see that there are no cracks.

AIR SHUTTER OR CHOKE CONTROL

Take out the screws (5) and slip out the shutter (4). Remove the screw (7) and slide out the air shutter shaft and lever assembly (6). Replace the shaft bushing in the housing if worn.

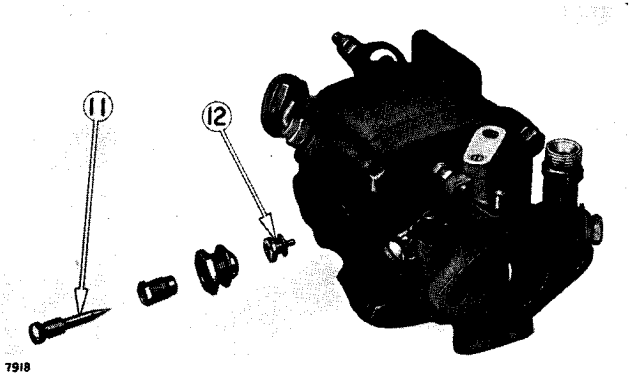


THROTTLE SHUTTER

Remove the screws (8), slide the shutter (9) out of the shaft and withdraw the shaft and lever assembly. If the shaft is worn, drive the tapered pin (10) out of the stop assembly and replace the shaft. The packing in the housing should be replaced after the shaft is installed.

MAIN OR HIGH SPEED JET

Remove the adjusting needle (11). If the needle is worn near the tip, replace it with a new one as this needle regulates the fuel flow at speeds above idling. Turn the screw clockwise to reduce the fuel flow.



To remove the main jet (12), remove the main jet adjusting assembly and screw out the main jet. This jet is non-adjustable. Carefully wash the main jet and clean with compressed air.

The size of the openings in the main jet (12) and the setting of the adjusting needle (11) determine the rate of fuel discharge when the engine is operating.

The compensating jet (13) which admits fuel to the idling jet and main jet may be removed with a screwdriver.

ECONOMIZER JET

Remove the economizer jet (17) by driving out the float axle, removing the float assembly and screwing out the jet with a screwdriver.

This jet is non-adjustable and is regulated automatically by the position of the throttle. This jet causes a partial suction on the fuel bowl except at the open throttle position. This provides a leaner mixture (less fuel due to the partial suction) under part load operation.

VENTURI

The venturi (16) can be removed by hand. The projection (14) on the diffuser bar (15) should register with the notch when installing the venturi.

IDLING SCREW AND JET

The idle adjusting screw (21) regulates the amount of air to be mixed with the fuel at the idling jet. The non-adjustable idling jet (18) controls the amount of fuel taken from the compensator well. The fuel and air pass through the priming plug located in the carburetor throat adjacent to the idling position of the throttle shutter. Remove the jet with a $\frac{9}{32}$" wrench. Carefully wash the jet and clean with compressed air.

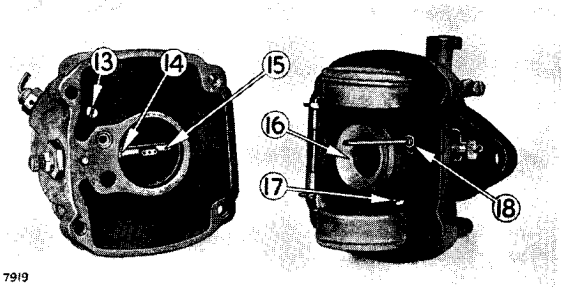
DIFFUSER BAR OR NOZZLE

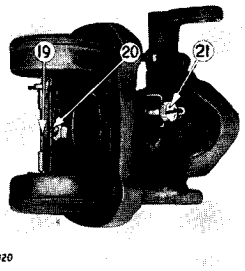
Remove the diffuser retaining screw with a screwdriver to take out the diffuser bar (15). Both the main jet and compensator jet feed into this bar which has three discharge openings to provide proper atomization.

FLOAT ASSEMBLY

If the fuel valve (20) leaks as evidenced by fuel leaking out of the filter on the air intake assembly, inspect the seat of the valve assembly after removing the float axle (19) and float assembly. Clean all foreign material from the seat or, if worn, replace the valve assembly.

The fuel level should be checked with a C4088 Level Test Gauge (available from Zenith Carburetor Division, Bendix Aviation Corporation, Detroit, Michigan). This gauge consists of an adapter (23), bolt (24) and gauge (22).



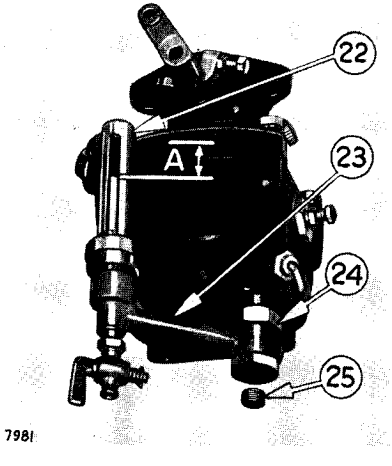


Disconnect the carburetor air intake assembly at the bottom air cleaner elbow and remove the air intake assembly from the bowl of the carburetor to expose a $\frac{1}{8}$" pipe plug (25) located in the underside of the bowl. Remove the pipe plug with a screwdriver and install the Gauge Adapter (23) which has a $\frac{1}{8}$" pipe thread. Then attach the gauge to the adapter moving the gauge around so the glass will be close to the bowl for easy reading.

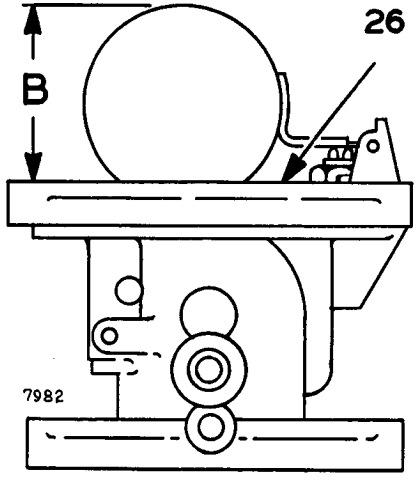
If the fuel valve connects the carburetor to the auxiliary tank, the carburetor bowl will be filled by gravity. If the fuel valve connects the carburetor to the main tank, operate the hand lever on the fuel pump until the fuel level in the gauge becomes constant. In both cases, be sure that the fuel level in the gauge becomes constant.

The distance (A) between the bottom of the concave surface (meniscus) of the fuel in the gauge and the top of the carburetor bowl should be $^{33}\!/_{64}$", not including the gasket.

If a fuel level test gauge is not available, the following check may be made. Instead of measuring the actual fuel level as accomplished with



CHECKING FUEL LEVEL



CHECKING FLOAT POSITION

the fuel level test gauge, an approximate level can be established by means of a mechanical measurement. This measurement as shown at (B) should be $1\frac{49}{64}$" plus or minus $\frac{1}{16}$". Note that this measurement is taken between the face (26) of the upper body assembly (without gasket) and the float assembly as shown.

Governor and Accessory Shaft

A horizontal type governor is used, with the governor weights and forward end of the accessory shaft located in the timing gear housing on the left-hand side of the engine. The accessory shaft, bearing assembly, and governor sleeve are pressure lubricated. The magneto is driven from the rear end of the accessory shaft by a tongue and groove connection inside the magneto coupling cover.

The forces of the governor weights and governor spring act upon the air shutter of the carburetor to govern the speed of the engine in accordance with the tension placed on the governor spring by the setting of the hand throttle control. As the governor weights vary in position with the speed of the accessory shaft and load on the engine, their travel is transmitted through the governor sleeve assembly, levers, and shafts to the carburetor air shutter.

GOVERNOR LINKAGE

The carburetor air shutter control rod on the right-hand side of the engine should be checked and adjusted for length to assure full opening and closing of the carburetor air shutter.

Set the hand throttle control in the fully advanced position, remove the governor cover on the timing gear cover, and pry the governor weights away from the accessory shaft as far as possible. With the governor weights in this position, the carburetor air shutter lever screw should be against the stop on the carburetor. Release the governor weights and check to see that the carburetor air shutter is in the fully opened position.

The hand throttle control rod on the left side of the engine should be checked and adjusted for length to assure that the high idle adjustment can contact its stop. Remove the connecting pin at either end of the throttle control rod. With the throttle in the fully advanced position, pull back against the force of the governor spring until the high idle adjustment strikes its stop. Then, adjust the throttle control rod so that the pin holes lack $\frac{1}{8}$" of lining up. Place the throttle control lever in the idle position and connect the throttle control rod.

LOW IDLE ADJUSTMENT

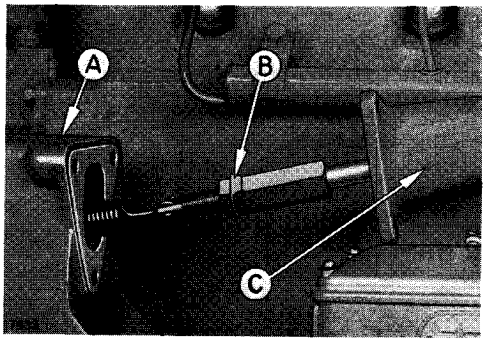
Start the engine and place the hand control throttle lever in the low idle speed position. Set the low idle speed at 300 R.P.M. by adjusting the setscrew on the carburetor air shutter lever. Check the engine speed by

CHECKING ENGINE SPEED

removing the metal cover on the rear of the magneto and using a speed indicator or tachometer, as shown, on the end of the magneto rotor drive shaft. The rotor drive shaft rotates at engine speed.

HIGH IDLE ADJUSTMENT

On tractors built prior to 6G1588, proceed as follows to set the high idle speed.



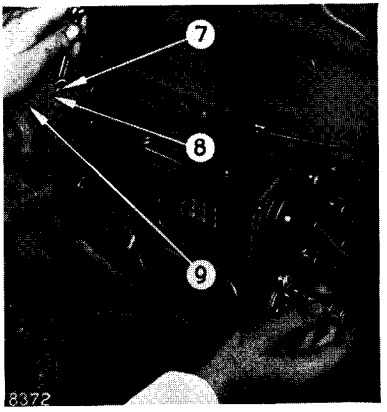
FULL LOAD SPEED ADJUSTMENT

Check the engine speed using a speed indicator or tachometer on the end of the magneto rotor drive shaft with the hand throttle in the fully advanced position. If this high idle speed is not 1550 R.P.M., stop the engine, disconnect the leather boot from the throttle control rod, and the housing (C) from the magneto bracket (A). Slide the housing back until the lock nut at (B) can be loosened and backed off several turns. The adjusting nut can then be turned toward the bracket (A) to increase the R.P.M., or away to decrease the R.P.M.

NOTE: *One complete turn of the adjusting nut changes the engine speed about 10 R.P.M.*

After tightening the lock nut at (B), bend the lock washer over the lock nut and adjusting nut. Reassemble the housing (C) to the bracket (A). Again check the engine speed and if necessary repeat the procedure.

On tractors effective with serial number 6G1588, use the following steps to set the high idle speed.

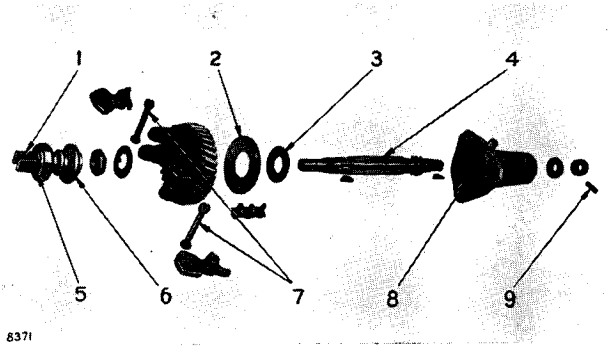


SETTING FULL LOAD SPEED

With the hand throttle in the fully advanced position, check the engine speed. If the speed is not 1550 R.P.M., stop the engine and substitute the cover on the rear of the governor spring lever housing (9) with a flat plate which will cover only the lower half of the opening. This will allow access to the adjusting screw (7) and at the same time stop the screw at the same location as the original cover. Loosen the lock nut on the screw (7) in the governor spring lever and adjust the screw so the engine speed is 1550 R.P.M. with the hand throttle in fully advanced position. Securely tighten the lock nut.

GOVERNOR SLEEVE ASSEMBLY

With the timing gear cover removed from the engine, slide the governor sleeve assembly off the end of the accessory shaft. If the bearing (5) or button (1) in the governor sleeve assembly is worn or damaged, they should be replaced. Press the bearing and button out of the sleeve with a ¾" diameter capscrew 3½" long. The button may then be pressed out of the bearing and replaced if worn. When pressing the bearing on the button, be sure that the bearing is against the face of the button. The thrust washer (6) should be replaced if worn or grooved.



GOVERNOR AND ACCESSORY SHAFT ASSEMBLY

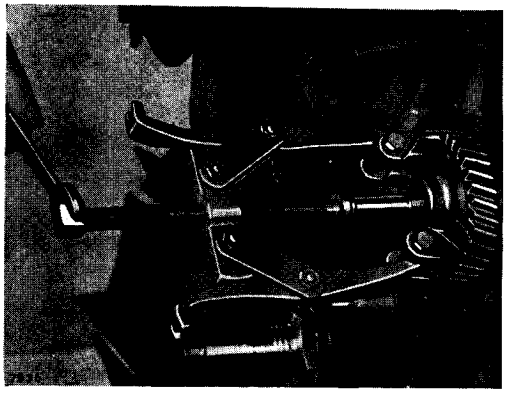
When assembled, check to be sure that the button rotates freely and that the sleeve rotates freely on the accessory shaft. Normal clearance between the sleeve and the accessory shaft is .001 - .003".

GOVERNOR WEIGHTS

Remove the cotter pin, nut and bolts (7) and then the governor weights. If the bolts or holes in the governor weights are worn or scored, they should be replaced. If the cams on the governor weights are scored or worn where they contact the sleeve assembly, replace the weights. Be sure that there is no binding of the governor weights when installed. Any of the above conditions may cause faulty or erratic governor action.

ACCESSORY SHAFT END-PLAY

Normal end-play of the accessory shaft is .005 to .010". Should the end-play exceed .020", the thrust plate (2) and washer (3) should be replaced. Remove the governor weights and the nut and lock from the front of the accessory shaft. Install two 3/8" capscrews in the holes for



ACCESSORY SHAFT GEAR REMOVAL

the governor weight bolts and pull the accessory shaft gear using an 8B7546 Puller as shown. Remove the capscrews and thrust plate (2). Pry the key out of the shaft and remove the thrust washer (3).

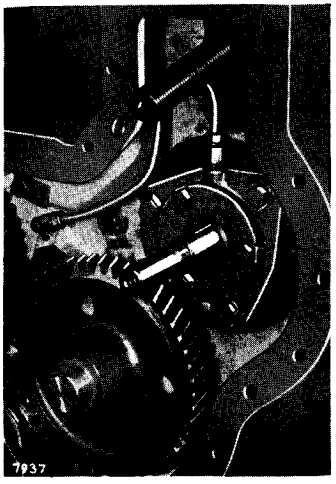
When replacing the gear, remove the magneto, block the rear end of the accessory shaft and carefully drive the gear into position.

ACCESSORY SHAFT BEARING

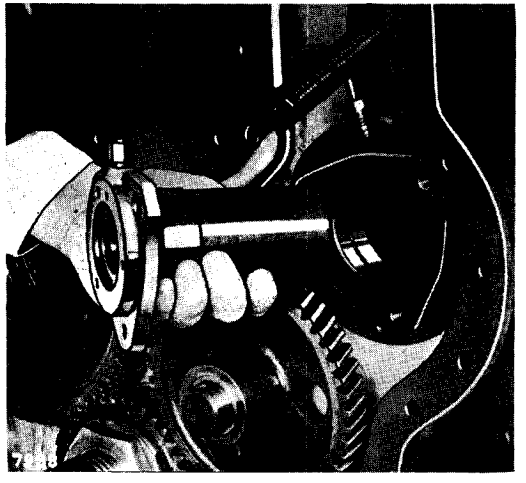
To remove the accessory shaft bearing assembly, remove the accessory shaft gear as previously outlined and also the hour meter if the engine is equipped with one.

On machines carrying serial numbers lower than 6G1588, loosen the magneto coupling cover and remove the magneto. Remove the drive hub clamp and drive out the taper pin (9). Remove the knurled shaft collar, key, friction hub and magneto coupling cover. See the topic, MAGNETO COUPLING.

On machines carrying serial number 6G1588 or higher, remove the magneto coupling cover and then the magneto. Remove the vernier drive hub, key, friction hub and magneto coupling cover. See the topic, MAGNETO COUPLING.



THRUST PLATE AND WASHER



ACCESSORY SHAFT BEARING

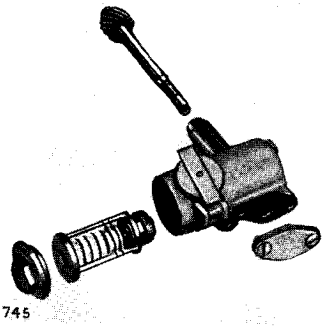
Remove the thrust plate and slide out the accessory shaft (4) and washer (3). Normal clearance between the shaft and bushings (8) in the bearing is .001″ - .0025″. If the bushings are worn, disconnect the oil line from the fitting on the bearing assembly flange and remove the bearing assembly. The bushings can then be pressed out and replaced. The seal in the end of the bearing should be replaced if leaking.

When installing the accessory shaft, protect the seal with shim stock to prevent the shoulder on the shaft from damaging the seal.

Hour Meter

AN hour meter is provided on tractors 6G1556 and above. The hour meter is located on the magneto bracket and is driven by the accessory shaft.

The drive shaft of the hour meter has the end grooved (6) so that a tachometer may be installed after the cover (7) has been removed. Engine speed may be obtained at this point by using a speed indicator. This drive shaft rotates at one-half engine speed.



HOUR METER ASSEMBLY

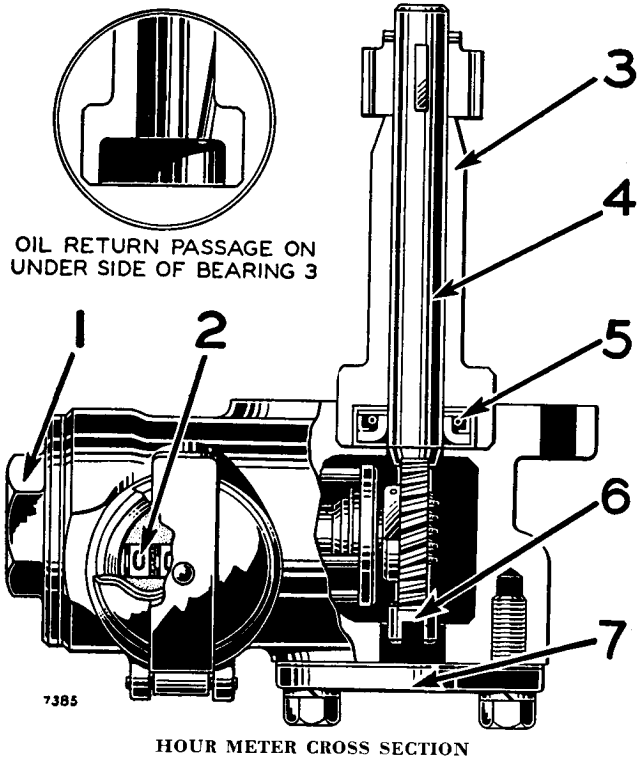
COUNTER ASSEMBLY

Replacement counter assemblies (2) are available and can be installed as follows: Remove the retainer assembly (1). The counter retaining spring will come out with the retainer. Remove the counter assembly.

DRIVE SHAFT

Slide out the drive shaft (4). After removing the pin, pull the gear with an 8B7547 Puller. Remove the bearing assembly (3).

BEARING ASSEMBLY



HOUR METER CROSS SECTION

An oil seal (5) keeps oil out of the hour meter assembly. If this seal is replaced, the wiping edge should be installed toward the bearing (3). The bearing should be replaced if the clearance exceeds .012". The bearing is lubricated through the holes in the bearing (3) and oil is returned through a drilled passage just behind the rawhide seal. This drilled passage should be on the bottom when the bearing is installed.

LUBRICATION

When reassembling, place high melting point grease on the counter assembly drive gear.

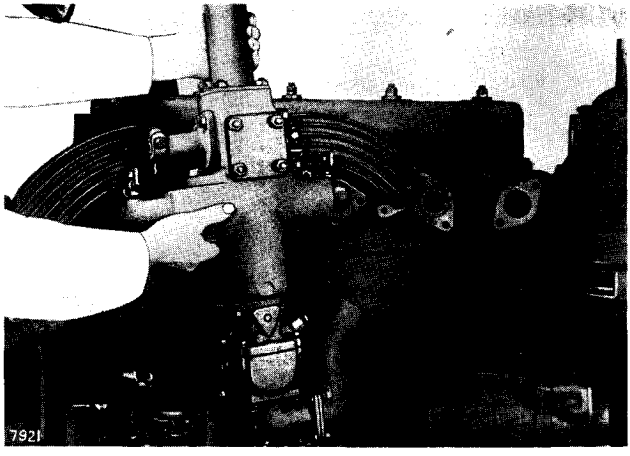
The drive gear and shaft are lubricated by oil in the governor housing.

Manifold and Heat Control

THE inlet manifold is heated by the exhaust gases of the engine.

GASOLINE MANIFOLDS

On machines equipped to burn gasoline, a manually controlled lever on the dash operates a valve in the body above the inlet manifold. The lever has seven different positions to vary the amount of exhaust gases diverted around the inlet manifold from practically none in the OFF position to all the exhaust gases from the four cylinders in the ON position.

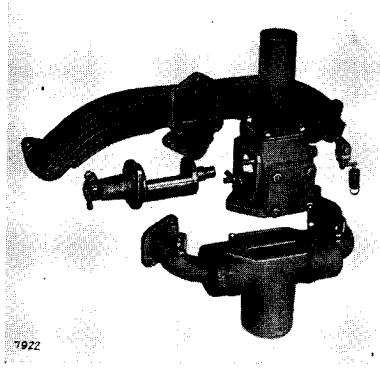


REMOVING MANIFOLD ASSEMBLY

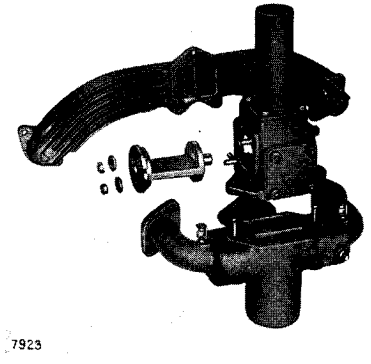
To remove the heat control valve, remove the bolts and nuts holding the base of the carburetor to the air cleaner elbow. Disconnect the carburetor air shutter rod, choke control rods, heat control rod, heat con-

trol spring, and fuel line. Remove the nuts holding the manifolds to the cylinder head and remove the manifolds and carburetor as a unit. Remove the exhaust manifold from the body above the inlet manifold by removing the nuts on the engine side of the exhaust manifold and then remove the control valve body from the inlet manifold.

Remove the spring lever at the front of the body. Then, from the rear of the body, remove the cover and valve as a unit. After the rear lever is removed, the valve will slide out of the cover. Clean out the carbon in the bores of the front and rear cover.



GASOLINE MANIFOLD ASSEMBLY



TRACTOR FUEL MANIFOLD ASSEMBLY

TRACTOR FUEL MANIFOLDS

On machines equipped to burn tractor fuel, the valve in the body above the inlet manifold is not manually controlled but may be rotated to the ON or OFF position after removing the retaining nuts at the rear of the valve body. In the ON position, the exhaust gases from the four cylinders are diverted around the inlet manifold. In the OFF position, all the exhaust gases from the two middle cylinders are diverted around the inlet manifold.

"Tractor Fuel" is the name commonly used to designate the group of spark ignition fuels that vaporize less readily than gasoline. Such fuels are often called kerosene, stove oil, lamp oil, distillate, etc. or by numerous trade names.

Ignition System

THE ignition system consists of the magneto, spark plug wires, and spark plugs.

The magneto generates and distributes the current through the spark plug wires to the spark plugs. The spark plugs provide a means for introducing the magneto current into the combustion chamber where it jumps a gap at the base of the spark plug thus igniting the fuel mixture in the cylinder.

MAGNETO

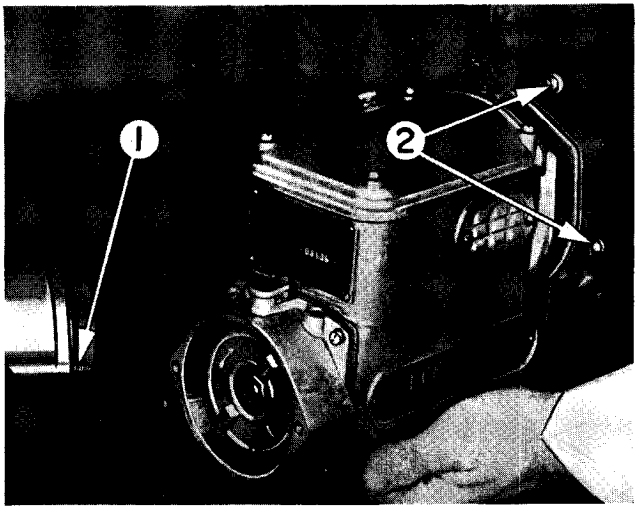
With exception of the 8B7547 Puller recommended for removing the induction rotor gear, all tool numbers in the Magneto Section refer to tools manufactured by and obtainable from the Eisemann Magneto Corp., 60 East 42nd Street, New York, New York.

An inductor type Eisemann Magneto Model CM-4 with an impulse starter and adjustable drive hub is used to generate current for the electric ignition of the fuel by the spark plugs.

The magneto is mounted on a bracket on the left-hand side of the tractor and is driven by the accessory shaft. Dowel pins in the mounting bracket insure proper location of the magneto.

REMOVING MAGNETO

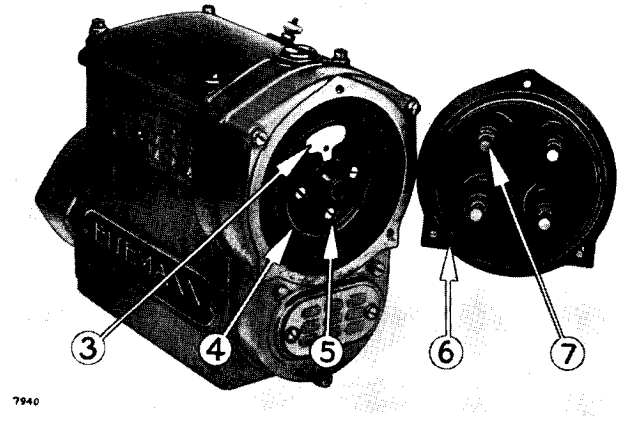
Pull the ignition wires out of the distributor plate, disconnect the wire on top of the magneto to the switch, and unscrew the coupling cover screws (1) at the front end of the magneto. Slide the coupling cover



away from the magneto, remove the capscrews from the bottom of the magneto bracket, and lift off the magneto as shown. Remove the floating disc.

DISTRIBUTOR PLATE

Remove the distributor plate by loosening the screws (2). Use a clean soft cloth *dampened* with gasoline to clean the inside of the plate of carbon dust. The gasket (6) should be replaced if damaged.



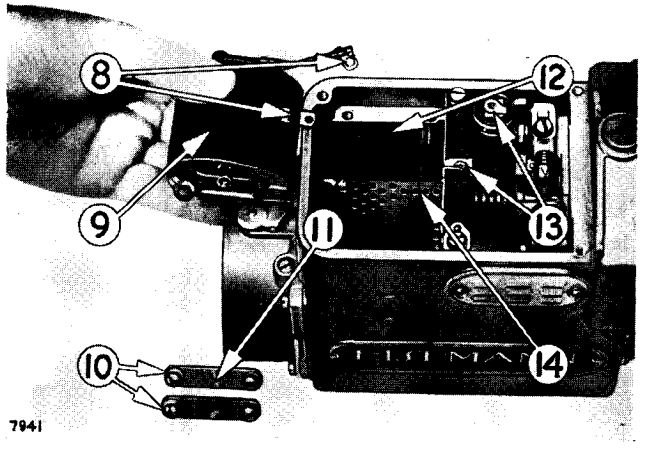
BRUSHES

The brushes (7) may be removed by pulling them out of their sockets. To install a new brush, place the small end of the coil spring on the brush, press the brush and spring straight into the socket and twist the brush a few turns clockwise. Again compress the spring by pressing the carbon brush into the socket. The brushes should move freely and protrude uniformly from their sockets.

ROTOR

Clean the face of the rotor (4). If the brass insert (3) is burned, the rotor or shaft cracked or the face grooved, remove the screws (5), slide out the rotor and install a new one.

WINDING OR COIL



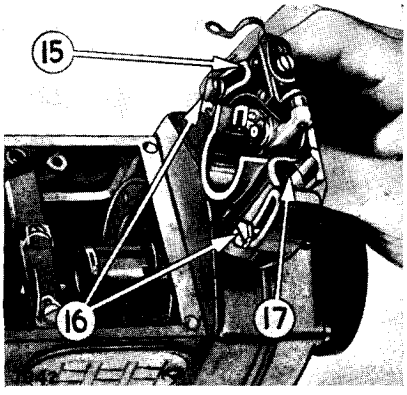
Remove the cover from the top of the magneto. Remove the winding (9) by disconnecting the leads (8) at the bridge and condenser (13). Remove the screws (10) holding the clamps (11) in place and slide out the winding. Check the winding (9) or coil on an Eisemann Winding Tester or other similar device.

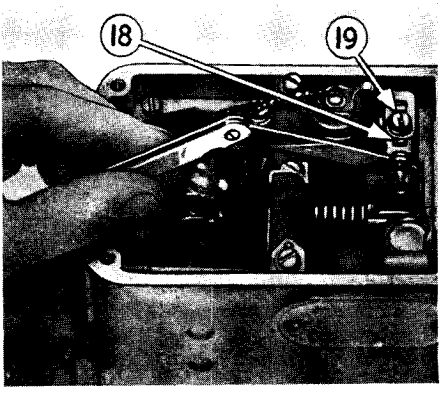
When replacing the winding, press firmly on the winding to seat the core ends in the tapered pole-shoes (12) before replacing the clamps.

The ventilator plate (14) may be removed after the screws holding it in place are taken out.

BREAKER ASSEMBLY

To remove the breaker assembly (15), remove the rotor and condenser. Take out the capscrews (16) and lift out the breaker assembly.





Remove the plug (17) and the oil wick underneath it. Impregnate the wick with a non-corrosive aluminum stearate No. 2 grade grease.

CONTACT POINTS

If the contact points wear unevenly or become pitted, a fine carborundum stone instead of a steel file should be used to smooth them.

ADJUSTMENT

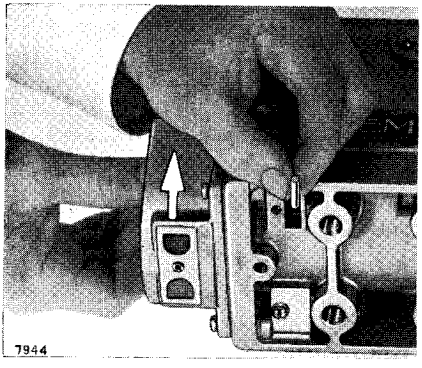
Insert a .020″ feeler gauge between the contact points after positioning the breaker lever bumper block on a high point of the cam. To adjust the gap, loosen the screw (19) and slide the adjustable contact bracket (18) to obtain .020″ gap. Tighten the screw and recheck the gap.

To replace the adjustable contact point, remove the screw (19) and replace the contact point and bracket. The other point may be replaced by removing the lock nut and then removing the point.

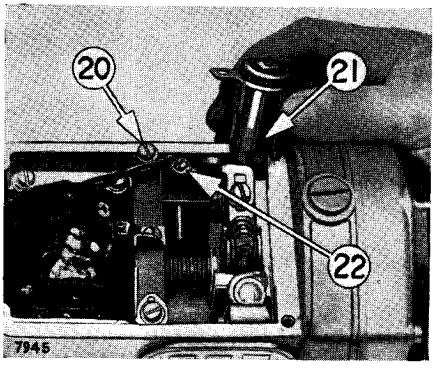
TIMING

To obtain maximum spark intensity when the breaker points separate and to insure proper timing, the rotor should be properly positioned with respect to the breaker plate and contact points.

Remove the coupling cover and then the plate and gasket covering the inspection hole on the underside of the magneto. With the magneto on its side so the top is toward the operator and the impulse starter is to the right, insert the shank of a No. 16 Drill (.177" diameter) through the upper hole. Turn the impulse starter the reverse of the normal operating direction as shown by the arrow until the drill is locked lightly between the induction rotor and the lower pole-shoe. Loosen the capscrews holding the breaker assembly to the housing and shift the breaker assembly until the contact points just start to separate. To check this, use a 6 volt "split lamp" circuit or pull on a piece of cigarette paper placed between the contact points. This is the maximum spark advance position. Tighten the capscrews holding the breaker assembly to the housing and recheck the timing.



ROTOR POSITIONING



REMOVING CONDENSER

In case the breaker assembly is removed and no facilities are available for timing, the original factory setting may be duplicated by aligning the arrow on the breaker assembly with the mark on the magneto housing. Then tighten the capscrews holding the breaker assembly in place.

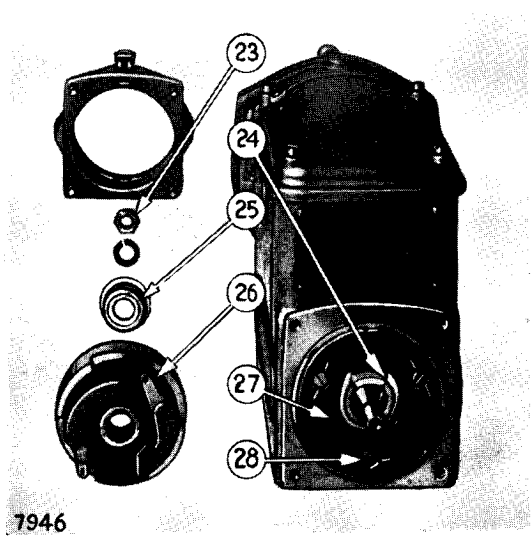
CONDENSER

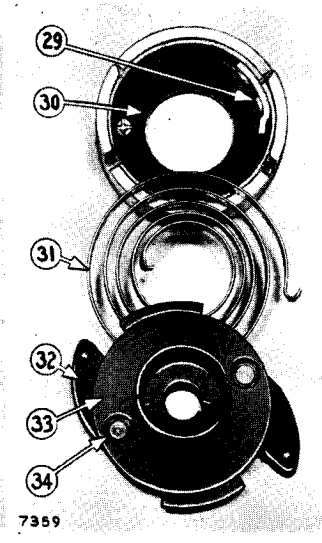
To replace the condenser (21), remove the screw (22) from the condenser for the winding lead and then remove from the bridge the screw (20) holding the condenser in place. Lift out the condenser. To check the condenser, install the screw from the winding lead. Use the screw as one terminal and the condenser case as the other terminal in series

with a lamp on a 110 volt circuit. If the lamp lights, the condenser is burned out and not serviceable. A 6 volt battery circuit may be used if a 110 volt circuit is not available.

IMPULSE STARTER

Remove the impulse starter (26) by taking off the nut (23) and prying with two screwdrivers between the catch plate (27) and flange. The catch plate can be removed by taking out the screws (28). It should be replaced if the pawl engagement edge (24) is rough or worn. When replacing the catch plate, stake the screws securely.





The compression spring (31) may be pried out of the flange (33) with a screwdriver. To replace the pawls (32), rest the edges of the flange across a vise and drive out the pawls with a center punch. Use the blunt end of a center punch to spread the snap ring (34) into place on the stud of a newly installed pawl. To install a new spring, grip the drive cup lugs in a vise, hook the outer end of the spring to the post (29), wind up the inner coil with pliers and seat the spring in the drive cup (30). Apply a light coat of fibrous type sodium-calcium base No. 3 grade grease to the compression spring before installing the flange. Hook the inner end of the spring to the slot in the hub of the flange and wind up approximately ½ to ¾ turn with the fingers at the same time lifting the flange to clear the high walls of the drive cup. Seat the flange in the drive cup and bearing hole.

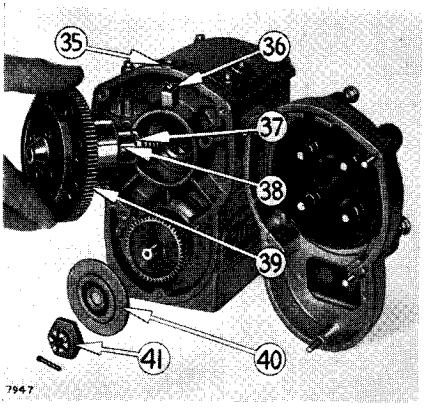
If the drive cup binds against the flange after assembly, install a spacing washer under the retaining cup (25) to prevent contact between the two parts.

DISTRIBUTOR GEAR AND SHAFT

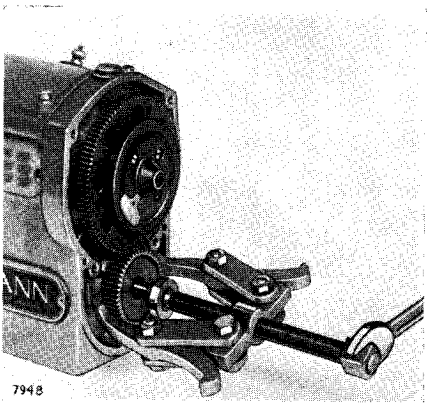
Remove the distributor plate and cover plate as a unit. Then remove the cotter pin, nut (41) and retaining disc (40). Loosen the set screw (36) by using a screwdriver through the timing hole (35). Remove the top cover and hold the points open when removing the distributor gear (39) and shaft.

If the surface of the breaker cam (38) becomes rough, replace the breaker cam. Remove the breaker cam nut (37) with wrench 22077. Use drift 22079 to install the breaker cam.

Pull the double row ball bearing using puller 22070 and replace the bearing if damaged. Pack the bearing with high melting point grease before installation.



REMOVING DISTRIBUTOR GEAR



REMOVING ROTOR GEAR

Be sure to align the timing marks on the distributor gear and induction rotor gear when installing the distributor gear and shaft.

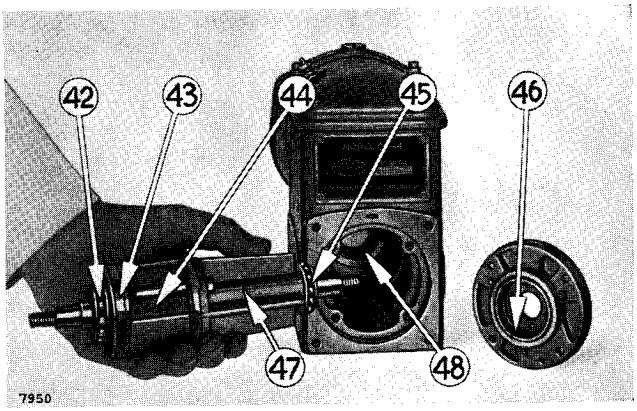
INDUCTION ROTOR AND GEAR

Remove the cotter pin, nut (41) and retaining disc (40) and then pull the gear using an 8B7547 Puller or 22070 Puller. From the other end of the magneto, remove the impulse starter cover, impulse starter and catch plate. Then take off the end plate by removing the screws holding it in place.

The bearing race (46) may be pulled from the end plate using outer race puller 17440. Use plunger 22078 to press this race into place. Pack this bearing with acid-free high-melting point grease.

The oil wick and felt washer in the end plate should be impregnated with pure mineral crankcase oil.

Slide out the induction rotor (47). The ball bearing (42) and race may be pulled using body 19970, adapter 19975, spring ring 19977, and chuck 19974. Use drift 22079 to install this bearing and race.



REMOVING ROTOR ASSEMBLY

The rotor gear bearing (45) may be pulled using the above puller tools with chuck 19973. Use drift 19985 to install this bearing and race.

The outer race (48) may be pulled with puller 19989. Use arbor 19987 to install this race.

The bearings should be packed with acid-free, high-melting point grease upon installation.

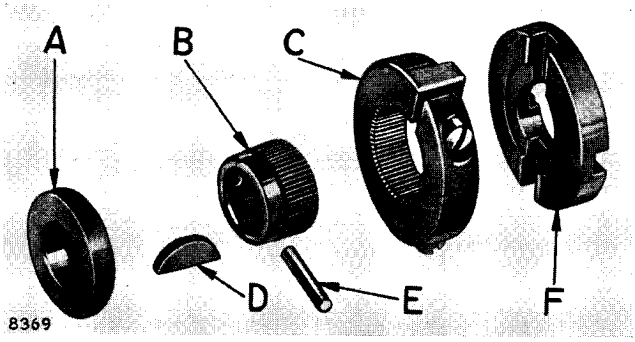
If any part of the rotor is damaged, remove the retaining screws and replace the damaged rotor end plate (43), magnet cage assembly (44) or rotor (47) as required.

MAGNETO COUPLING

Machines with serial numbers lower than 6G1588.

The drive connection between the magneto and accessory shaft consists of a split drive collar with serations on the inside that clamp to the serated drive collar on the accessory shaft and lugs on the face of the drive collar that mesh with a floating disc that drives the magneto.

The split drive collar when loosened allows the magneto shaft to be turned relative to the accessory shaft should this be required to time the magneto to the engine. When the magneto shaft and accessory shaft



SERRATED DRIVE COUPLING

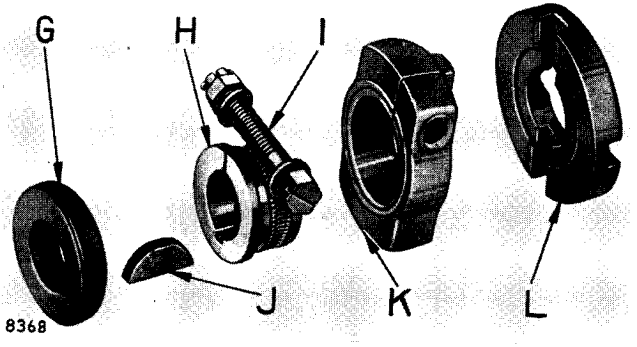
are in the correct relative position to one another for proper timing, the screws holding the two halves of the drive collar together should be tightened.

DISASSEMBLY

After the floating disc (F) has been taken off, loosen the two screws in the clamp (C) and slide the clamp off the serrated hub (B) on the end of the shaft. Then, drive out the pin (E) from the serrated hub (B) and remove the hub and key (D). The friction hub (A) can then be removed.

Machines with serial numbers 6G1588 and above.

A "vernier" adjustment consisting of the hub (H), adjusting screw (I), and split drive collar (K) is inserted between the accessory shaft and

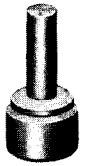


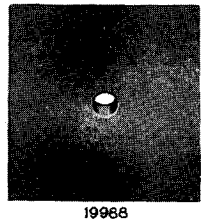
VERNIER DRIVE COUPLING

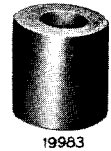
magneto drive shaft for the purpose of rotating the accessory shaft relative to the magneto shaft, should timing of the magneto to the engine be necessary.

EISEMANN MAGNETO SERVICE TOOLS

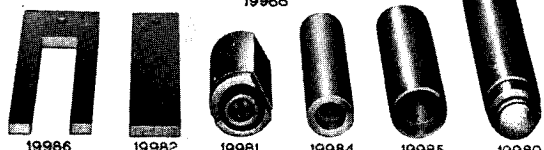
The tools shown on this page for servicing the magneto are available from the Eisemann Magneto Corporation, New York, N. Y.

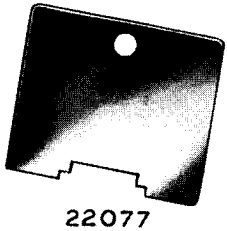

19987


19988


19983

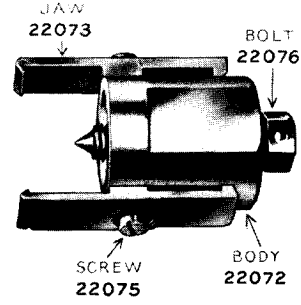

22079
COMBINATION DRIFT FOR BREAKER CAM AND 17 m/m BALL BEARING INNER RACE
8374

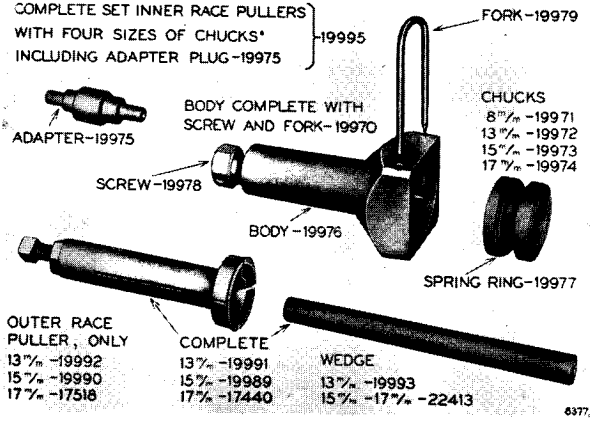

19986 19982 19981 19984 19985 19980
8373

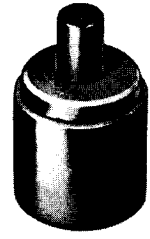

22077
SPECIAL WRENCH FOR BREAKER CAM HOLDING NUT
8375


REINFORCING PLATE **22071**
8376


BUSHING **22074**


JAW **22073**
BOLT **22076**
SCREW **22075**
BODY **22072**


COMPLETE SET INNER RACE PULLERS WITH FOUR SIZES OF CHUCKS* INCLUDING ADAPTER PLUG-19975 } 19995
FORK-19979
ADAPTER-19975
BODY COMPLETE WITH SCREW AND FORK-19970
CHUCKS
8 m/m -19971
13 m/m -19972
15 m/m -19973
17 m/m -19974
SCREW-19978
BODY-19976
SPRING RING-19977
OUTER RACE PULLER, ONLY
13 m/m -19992
15 m/m -19990
17 m/m -17518
COMPLETE
13 m/m -19991
15 m/m -19989
17 m/m -17440
WEDGE
13 m/m -19993
15 m/m -17 m/m -22413
6377

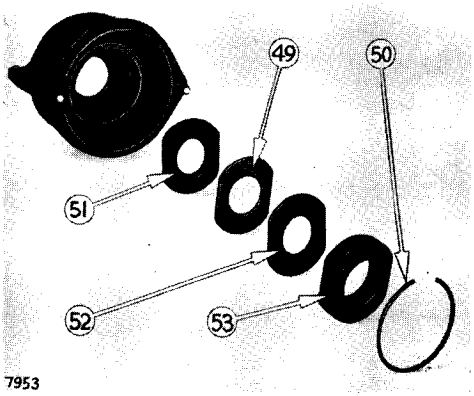

22078
PLUNGER FOR 17 m/m BALL BEARING OUTER RACE
8378

DISASSEMBLY

In order to remove this assembly from the accessory shaft after having removed the floating disc (L), loosen the adjusting screw (I) and then remove the split drive collar (K), the hub (H), the key (J) and the friction hub (G).

MAGNETO COUPLING COVER

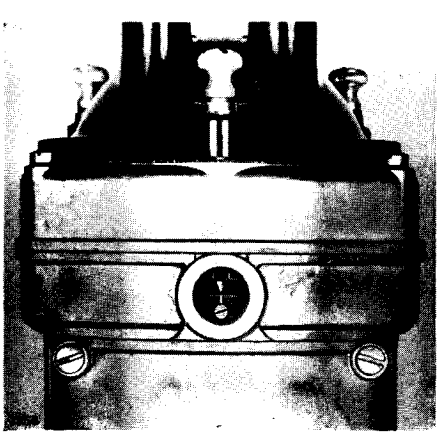
The cover that slides over the magneto coupling and attaches to the magneto has a seal assembly within it. In order to remove the seal assembly after having taken off the coupling connection, remove the snap ring (50) and withdraw the wooden disc (53), felt seal (52), cambric washer (49) and felt seal (51). These various parts should be inspected and replaced if necessary. The felt seal (51) is not lubricated while the felt seal (52) is lubricated. Lubricate the felt seal (52) with a few drops of pure mineral lubricating oil.

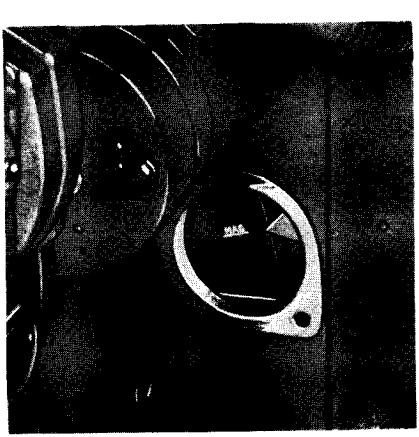


TIMING THE MAGNETO AND ENGINE

Remove the spark plug from No. 1 cylinder and the timing mark inspection cover below the cranking motor on the left hand side of the flywheel housing.

Holding a finger over the No. 1 cylinder spark plug opening, crank the engine slowly until a rush of air out the spark plug opening indicates





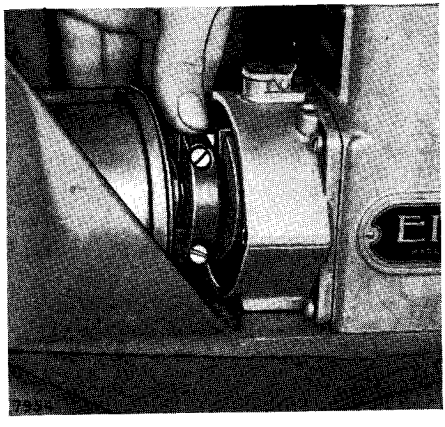
that No. 1 piston is coming up on the compression stroke. Continue to crank the engine slowly until the "MAG" mark on the flywheel is lined up with the pointer that is visible through the opening in the flywheel housing. The connecting rod bearing journal for No. 1 cylinder is now 30° ahead of top center on the compression stroke which is the correct point for the magneto points to separate.

Remove the inspection plug from the top of the magneto and turn the impulse starter counterclockwise until the pointer on the back of the distributor gear lines up with the stationary mark on the housing.

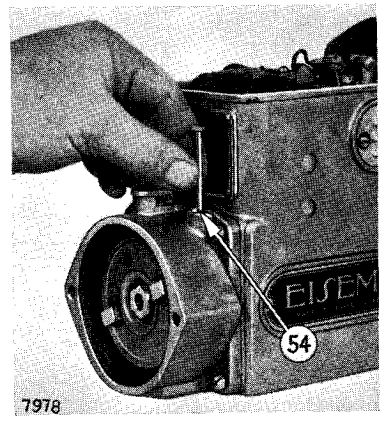
KNURLED DRIVE HUB

On tractors with serial numbers below 6G1588, place the two piece drive hub clamp and floating disc in place over the accessory shaft knurled collar.

Set the magneto in place on the magneto bracket dowel pins and install the capscrews through the base of the magneto bracket. Slide the two piece drive hub clamp toward the impulse starter until the grooves of



INSTALLING CLAMP ASSEMBLY



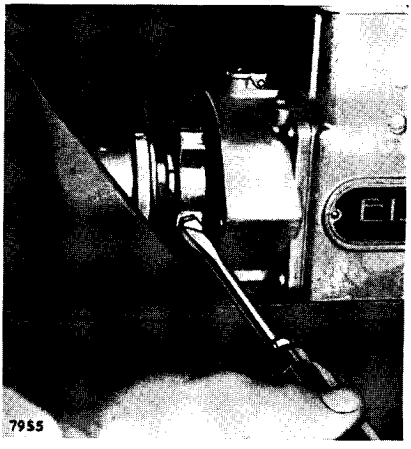
RELEASING IMPULSE STARTER PAWL

the floating disc fit over the lugs of the drive cup. Tighten the screws in the two piece clamp. Check to be sure the pointer on the back of the distributor gear is lined up with the mark on the magneto housing.

Turn the engine two complete revolutions and recheck the pointer and timing mark on the magneto housing after disengaging the impulse starter pawl by inserting a nail in the hole (54). Reset the two piece drive hub clamp if the pointer and mark are not lined up. Install the plug and the coupling cover.

VERNIER DRIVE HUB

On tractors with serial numbers 6G1588 and above, place the drive hub assembly and floating disc in place on the end of the accessory shaft. Turn the "vernier" screw until the grooves of the floating disc line up with the drive cup lugs. Install the magneto in place on the magneto bracket dowel pins and install and tighten the capscrews through the base of the magneto bracket.



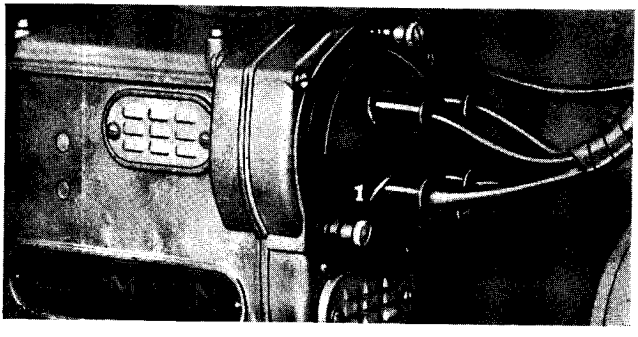
VERNIER ADJUSTMENT

Tighten the lock nut on the "vernier" screw and check the alignment of the pointer and mark in the housing.

Turn the crankshaft two complete revolutions and recheck the pointer and mark in the housing after disengaging the impulse starter pawl by inserting a nail in the hole (54). If the marks are not aligned, loosen the "vernier" screw lock nut and line up the pointer and mark using the "vernier" screw. Tighten the lock nut and install the plug and coupling cover.

INSTALLING IGNITION WIRES

Install the wire from the spark plug on No. 1 cylinder in the socket of the distributor plate mark "1". Then, facing the distributor plate and reading clockwise, install the wire from the spark plug on No. 3 cylinder



in the next socket, the wire from the No. 4 cylinder in the next socket and finally the wire from No. 2 cylinder in the remaining socket. The firing order of the engine is 1-3-4-2.

SPARK PLUGS

Current from the magneto is conducted to each spark plug which introduces a spark into the combustion chamber. In order to properly ignite the fuel within the combustion chamber, it is important that the path surrounding the conductor be insulated thoroughly and that the gap between the electrodes be set at the proper distance so as to obtain the correct spark.

INSPECTION

The spark plugs should be removed and inspected occasionally. A careful check should be made to see that there are no cracks in the insulator as this will permit a partial shorting out of the plug with a consequent reduction in spark intensity. The electrodes should be examined and if badly burned, the spark plug should be discarded. If considerable carbon has been accumulated, the plug should be cleaned.

CLEANING

The carbon accumulation should be cleaned from the inside of the spark plug by using an abrasive type cleaner. The electrodes should be cleaned with sand paper or a fine file. The porcelain part of the plug which is exposed should be thoroughly cleaned of any grease accumulation.

SPARK PLUG GAP

The gap between the electrodes of the spark plug should be set to .025". This should be done with a round wire gauge so as to obtain a gap of .025" between the end of the vertical electrode and horizontal electrode. As shown in the accompanying illustration, if a flat feeler gauge is used, a much larger gap will be obtained than when a round wire gauge is used.

When setting the gap, it is important that any variation in the gap be made by bending the side electrode. If the center electrode is bent, it is quite possible that the porcelain will be cracked.

INSTALLATION

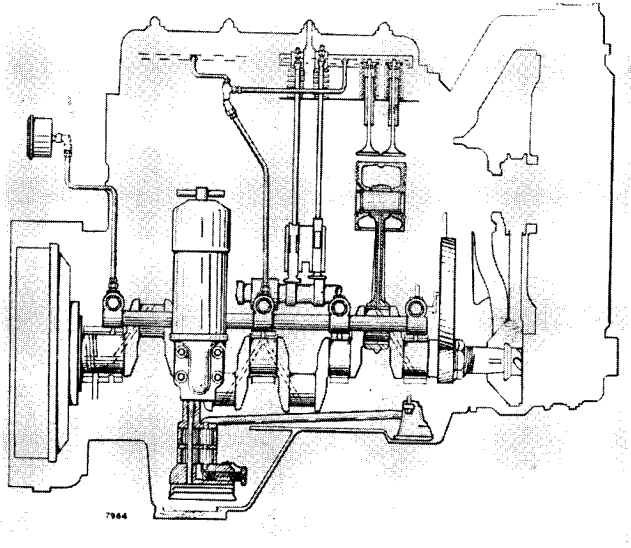
Care should be taken when installing a spark plug, to use the correct size wrench. Otherwise, damage may be done to the porcelain part of the plug.

Spark plugs should be tightened only sufficiently to prevent leakage between the cylinder head and spark plug.

If a new gasket is used, it is good practice to screw the plug in with the fingers until it is tight and then give it an additional ½ to ¾ of a turn with the wrench. If a previously used gasket is installed, tighten the plug with the fingers and then turn approximately ⅛ to a ¼ turn with a wrench.

Lubricating System

One of the most important items contributing to the long life of an engine is proper lubrication. The lubricating system has been designed



to meet all working conditions, but it should be inspected occasionally to see that everything is functioning properly.

OIL PRESSURE GAUGE

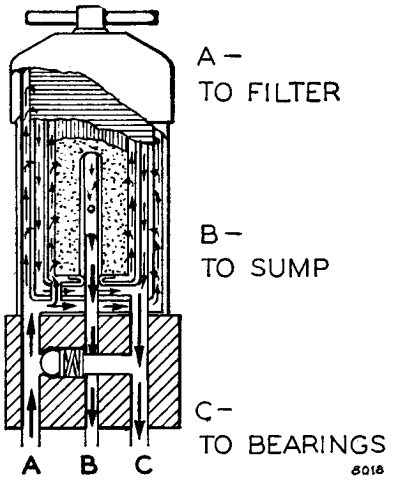
The oil pressure with the engine operating at normal load and operating temperature is about thirty pounds. At this pressure, the gauge needle registers approximately midway across the scale on the gauge dial. As long as the needle stays within the "operating range" under normal operating conditions, the oil pump may be assumed to be operating correctly.

OIL FILTER

The oil filter has an edge-type metal element surrounding an absorbent type element. As shown in the sketch, the oil filtered by the outer element goes to the bearings while the oil filtered by the inner element is returned through the metering hole in the oil filter stud to the oil pan.

If the outer element becomes clogged, a by-pass valve in the filter base opens to permit the oil to flow directly to the bearings without passing through the metal element. This by-pass valve should be checked to insure that it is functioning properly.

The outer element may be clogged internally even when the outside surface has been carefully cleaned. To check the internal condition, plug the holes in the bottom of the element in question and a new element, and then immerse both elements to the top rim in some non-inflammable fluid such as Diesel fuel, kerosene or distillate. Compare the rate at which the fluid level rises in each element. Discard the used element if its flow rate is less than three-fourths the flow rate of the new element. In other words, if the used element is not at least three-fourths full in the time required to fill a new element, the used element should be discarded.



OIL FLOW THROUGH FILTER

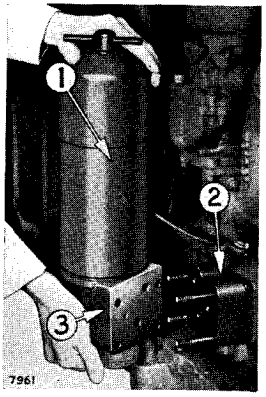
The oil filter housing (1) and base (3) can be removed from the side of the engine after taking off the nuts from the studs holding the base against the oil manifold (2).

Remove the oil manifold screws and the studs at (5). This will give clearance between the oil manifold and oil level gauge guide (4). The manifold can then be removed as shown.

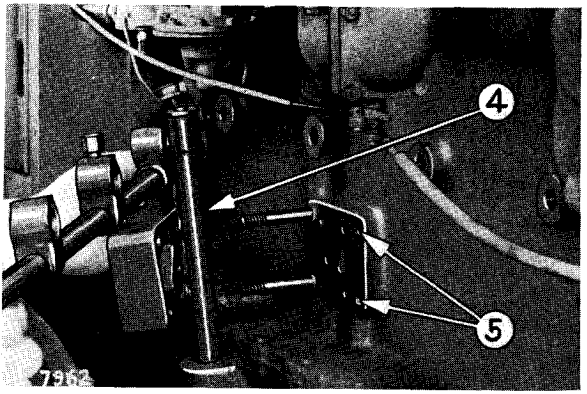
Clean the manifold carefully. When reassembling, care should be taken to install gaskets between the oil manifold and cylinder block, and between the oil manifold and fastening capscrews.

DISASSEMBLY

The accompanying photograph shows the filter housing and base completely disassembled.



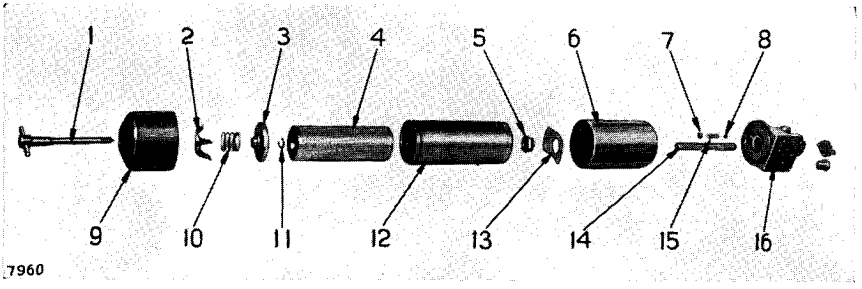
OIL FILTER



OIL MANIFOLD

The screw assembly (1), gasket, springs (2 and 10) and the plate assembly (3) in the top cover (9) that hold the filter elements (4 and 12) in position are held in place by a snap ring (11) that fits in a groove on the screw.

Socket wrench 8B2444 should be used to remove the nut (5) at the bottom of the filter stud (14). This nut holds the retainer (13) that secures the filter element case (6) to the base (16). Remove the filter stud with a pipe wrench taking care not to damage the metering hole in the stud.



OIL FILTER ASSEMBLY

Remove the plug (7) adjacent to the stud and take out the spring (15) and ball check (8). This ball check and spring permits oil to by-pass the outer element if the element is clogged. If the ball check and spring are corroded, replace them. Smooth the seat if rough.

Clean thoroughly the oil passages in the filter base (16) and stud (14).

OIL PUMP

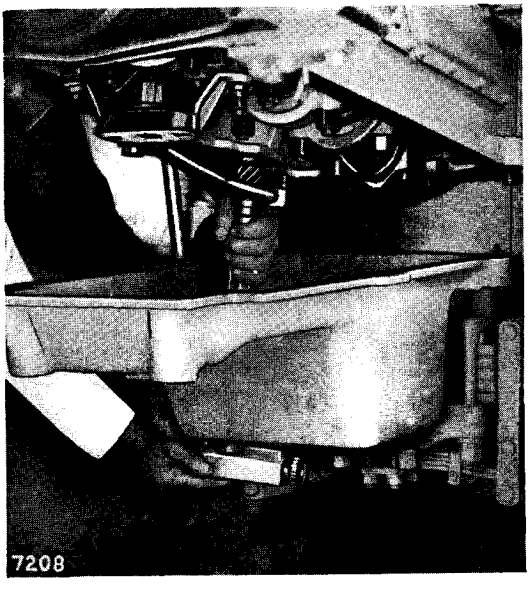
The oil pump is driven by a spiral gear on the camshaft through the vertically mounted drive shaft of the oil pump. It circulates oil under pressure to the oil filter and to the working parts of the engine. If the oil pressure gauge indicates a low pressure or no pressure at all, check for the following in order:

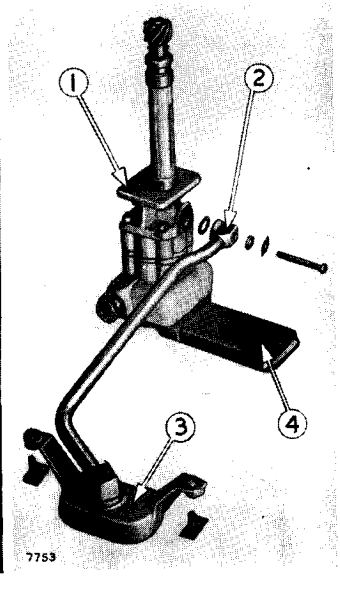
1. Clogged oil filter
2. Defective oil gauge or oil gauge line
3. Clogged oil pump screen
4. Sticking oil pump plunger
5. Leaking connections
6. Loose bearings
7. Worn oil pump gears
8. Improper adjustment of the oil pressure relief valve adjusting screw.

REMOVAL

The oil pump assembly can be removed by jacking up the front of the engine and dropping the oil pan as shown. Remove the oil pump suction bell (4) and the capscrew holding the auxiliary pump bell tube (2) to the oil pump. Remove the capscrews holding the oil pump (1) to the block and lower the oil pump through the bottom opening in the oil pan.

The oil pump assembly contains a pressure pump section which circulates the lubricant under pressure to the engine parts. It also has an auxiliary pump section connected to a screened suction bell (3) lo-



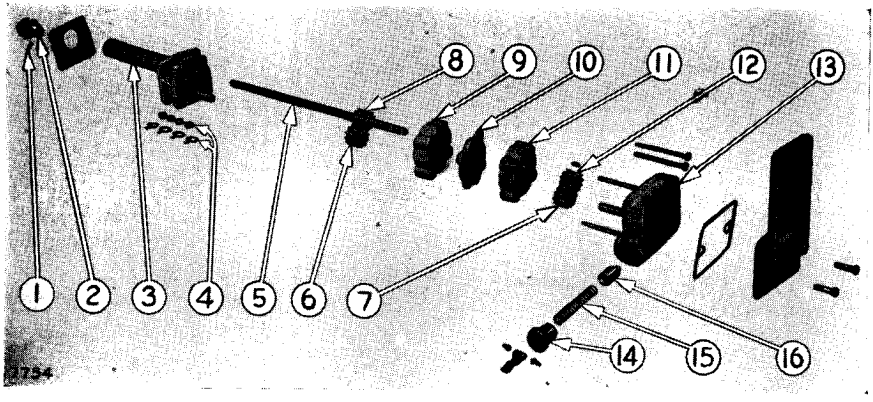


cated at the front end of the oil pan. On steep downhill operation, the auxiliary pump returns accumulated oil from the front end of the oil pan to the sump in which is located the pressure pump suction bell.

PUMP GEARS

Ordinarily, oil pump gears should not be replaced unless they have worn sufficiently to cause a considerable drop in oil pressure.

To check the pump gears, remove the nuts and locks (4) and then the lower case assembly (13). Remove the body (11). Slide off the idler gear (7). The drive gear (12) is keyed to the drive shaft and must be carefully pulled from the shaft. These two gears constitute the pressure pump section.



OIL PUMP ASSEMBLY

Remove the pin (1) that holds the driving gear (2) to the shaft (5). Pull the drive gear with an 8B7547 Puller. The separator (10), pump body (9) and auxiliary pump gears (6 and 8) and shaft (5) can now be withdrawn as a unit from the bracket (3). Remove the separator (10) and body (9). The idler gear (6) and the drive gear (8) constitute the auxiliary pump section.

To remove the drive gear (8) from the shaft, drill out the gear on both ends of the pin and drive out the pin. Press the gear off the shaft and remove the key. When installing a new gear, replace the key and press the gear on the shaft until the holes in the gear and shaft are in alignment. Using these holes as a guide, drill a $\frac{1}{8}$" hole through the shaft and the opposite side of the gear. Install a new pin and peen the gear over both ends of the pin. CAUTION: The ends of the pin should not protrude beyond the surface of the gear. Any roughness caused by drilling or peening should be removed from the gear teeth.

The clearances are small between the moving and stationary parts of the pump, and for this reason, ground joints instead of gaskets are used between the pump body sections.

SUCTION BELL

Remove the oil pump suction bell through the opening in the bottom of the oil pan. Wash and clean the bell assembly in kerosene or some non-inflammable washing fluid before replacing. The bell assembly should be cleaned at least twice a year or more frequently if necessary.

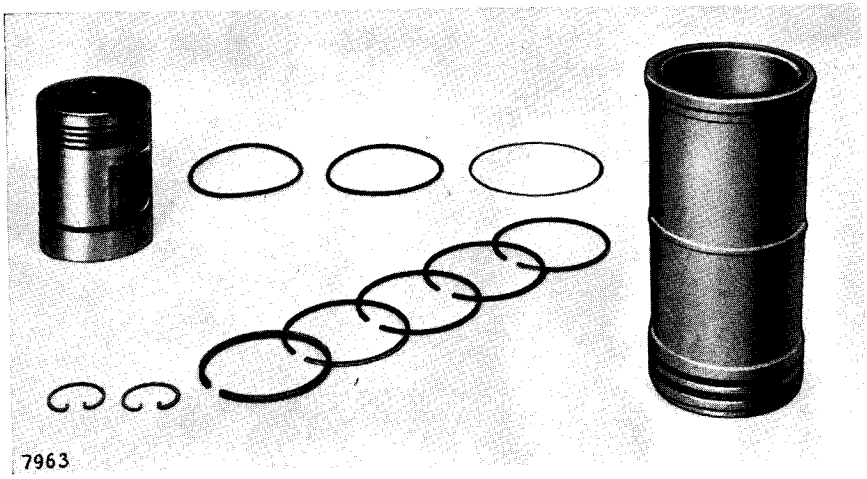
New gaskets should be installed between the bell assembly and case assembly when reassembling.

OIL PRESSURE RELIEF VALVE

The relief valve arrangement provides a means by which the oil pressure may be kept reasonably constant under normal operating conditions unless excessive wear takes place in the pump or engine parts. This valve, consisting of the plunger (16), spring (15), and adjusting screw (14), is accessible for adjustment, without draining the lubricating oil, by removing the rear inspection cover on the cylinder block. The oil pressure is increased by turning IN on the adjusting screw or decreased by turning OUT on the adjusting screw.

The plunger may fail to function properly if foreign material lodges between it and the seat. After cleaning the contact surfaces, check to see that the seat is smooth and flat, and that the sealing surface of the plunger is in good condition. If this plunger is functioning properly, the gauge needle should vary only slightly.

Pistons, Rings and Cylinder Liners

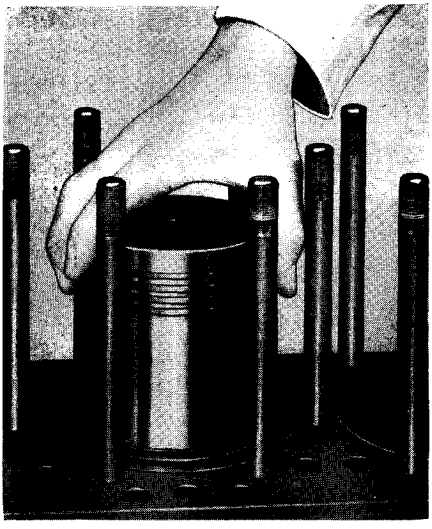


PISTON ring and cylinder liner wear usually results in loss of power, a smoky exhaust, loss of compression and excessive oil consumption.

REMOVING PISTONS

Drain the lubricating oil and remove the cylinder head and the cylinder block inspection covers or oil pan. Take off the connecting rod bearing caps.

The piston and connecting rod assembly should be removed from the top of the cylinder block.



REMOVING PISTON

CLEANING PISTONS

Pistons which are not excessively worn or badly scored should be cleaned and used again, providing the ring grooves are square and not damaged and the clearance between the ring and groove is not excessive. The side clearance between a new ring and the top ring groove should not exceed .008". Pistons with ring grooves worn beyond this limit should be replaced.

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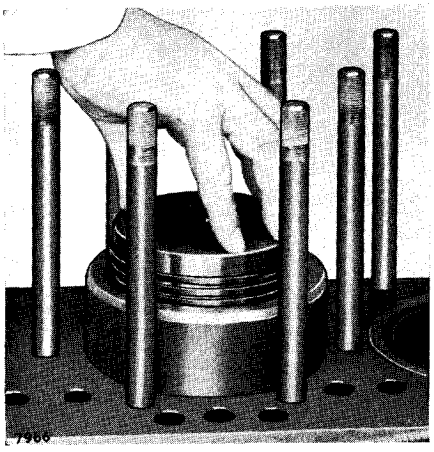
PISTON RING EXPANDING TOOL

To avoid damage to the rings, remove them with the piston ring expanding tool 7B7976 and clean the ring grooves. Pistons and rings are available from the factory in standard sizes only and require no fitting when they are installed.

REPLACING RINGS

Always install piston rings with the piston ring expanding tool. The ring expander is not only a time saver but will also prevent broken or distorted rings. Install the compression rings in the top grooves and the



PISTONS RING COMPRESSOR

slotted oil ring in the bottom groove of the piston.

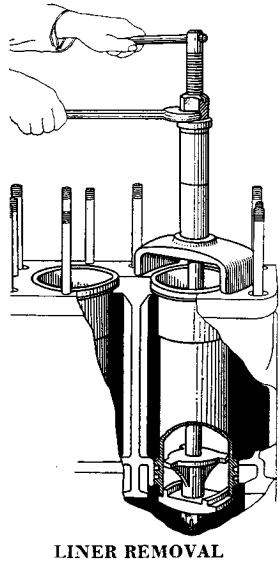
Piston rings control oil flow to the cylinder walls. If oil consumption is not a factor, pistons should not be removed and new rings installed if the engine is dismantled for some other reason.

When installing the piston and rings in the cylinder liner, use ring compressor 3B5241 to prevent damage to the rings.

CYLINDER LINERS

REMOVAL

Cylinder liner tools are available for removing and installing cylinder liners. Always protect the crankshaft and bearings with clean cloths when changing liners to prevent water jacket sediment from entering the oil passages and bearings.



LINER REMOVAL

SERVICE

Cylinder liners need to be replaced only when they are worn at the top of the ring travel more than .012″ or when they are scratched or scored.

Cylinder liner surfaces are machined, hardened, ground and finally honed to a mirror finish and chemically treated. The resultant surface is so hard that ordinary boring tools will not machine it. Also, cylinder liners and pistons are priced at the factory so that it is not economical to grind worn cylinder liners oversize.

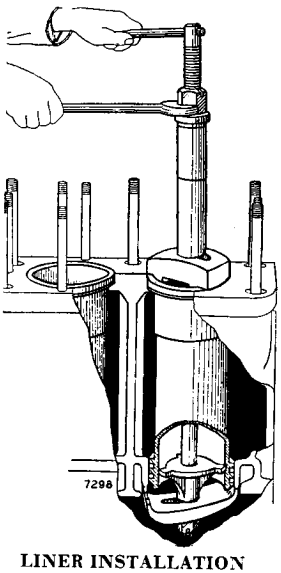
Liners, pistons, and rings are available from the factory in standard sizes only and require no fitting when they are installed.

Each liner installed should have a new copper gasket at the top between the flange on the liner and the cylinder block, and new rubber seals in the grooves at the bottom of the liner to prevent water leaks.

Thoroughly clean the upper and lower sealing surfaces of the block.

To avoid damaging the seals, coat the exposed portion of the rubber seals and the lower liner bore in the block with a mixture of soap stone and glycerine or soap and water.

Lower the liner carefully into the block and use the service tool to install the liner. The liner is a very light press fit and if resistance is felt, alternately apply and relieve the pressure until the rubber sealing rings slip into place.



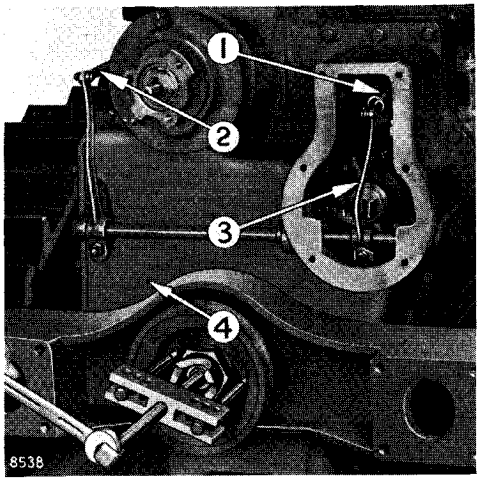
LINER INSTALLATION

Properly installed liners should extend slightly above the face of the cylinder block. This insures proper holding and sealing of the cylinder liner against the cylinder head gasket when the cylinder head is drawn down.

Liners may be slightly loose in the bore at the bottom, yet serve satisfactorily without water or anti-freeze leaking past the rubber seals.

Timing Gear Assembly

REMOVE the hood, radiator, fan spider, fan belt, water pump pipe, and cranking jaw. Pull the crankshaft pulley as shown with the



REMOVING CRANKSHAFT PULLEY
(With cranking jaw installed loosely.)

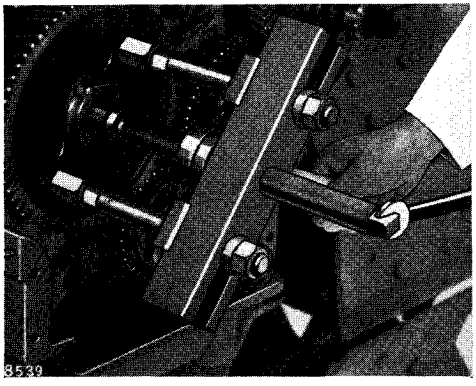
cross arm and screw of 8B7554 Bearing Cup Pulling Attachment and two 3/8"-16 capscrews 6" long (1D4706). Remove the governor cover and disconnect the governor lever (3), spring (1), and the carburetor air shutter rod (2).

NOTE: On tractors beginning with serial number 6G1588, remove the radiator bracket and the cover on the right hand side of the timing gear cover and housing.

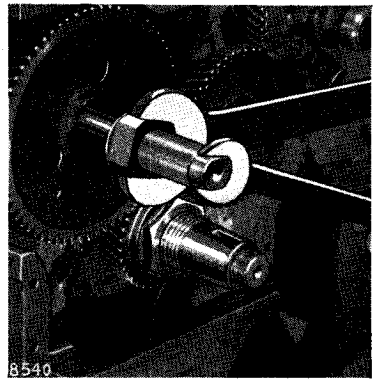
Remove the timing gear cover (4). The idler gear will slide off the stub shaft.

CAMSHAFT GEAR

Remove the nut and lock from the end of the camshaft and pull the camshaft gear as shown using 8B7548 Push Puller with 4½" Legs and two 8B7559 Adapters.



REMOVING



INSTALLING

Remove the thrust plate and then slip the thrust washer off the end of the camshaft. If the end-play of the camshaft exceeds .025", the thrust washer and thrust plate should be replaced. Be sure the chamfered side of the thrust washer is toward the cylinder block.

The camshaft gear can be installed with the camshaft in place using:

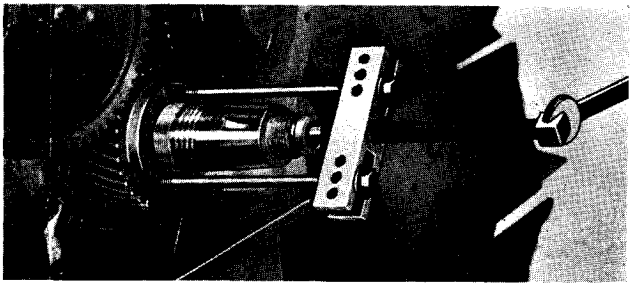
1 — 4B8267 Nut

1 — 4B8268 Stud

The stud screws on the end of the camshaft and the nut forces the gear into place.

CRANKSHAFT GEAR

To remove the crankshaft gear, first remove the nut with wrench T727 and then the lock. Pull the gear with the cross arm and screw of 8B7554 Bearing Cup Pulling Attachment and two $\frac{3}{8}$"-24 capscrews



REMOVING CRANKSHAFT GEAR

$8\frac{1}{2}$" long (1B1284). The crankshaft gear can be easily reinstalled after heating it in oil.

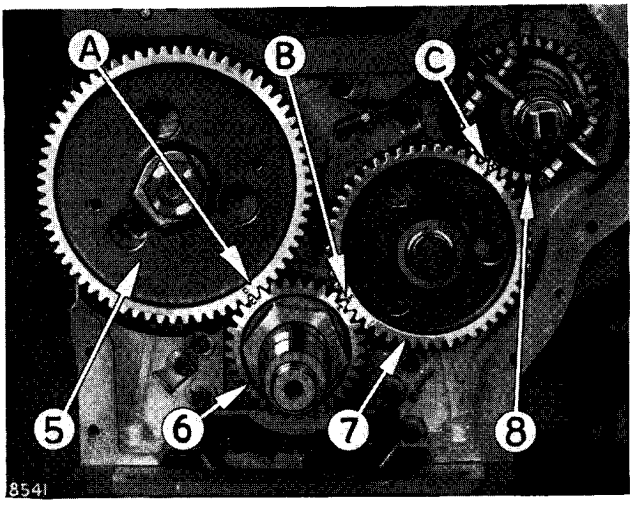
On tractors with serial numbers lower than 6G1588, the end-play of the crankshaft is taken by a thrust plate and washer. If the end-play of the crankshaft exceeds .020", remove the thrust plate and washer and replace them. Be sure the chamfered side of the thrust washer is toward the cylinder block when installed.

Effective with serial number 6G1588, the end-play of the crankshaft is controlled by the center main bearing which should be replaced if the end-play exceeds .020".

TIMING GEAR TRAIN

The timing gear train is as shown. The crankshaft gear (6) is timed to the camshaft gear (5) at (A). The idler gear (7) is timed to the crankshaft gear at (B). The accessory shaft gear (8) is timed to the idler gear at (C).

Since the idler gear (7) has an odd number of teeth, the timing marks will line up only periodically. To line up the timing marks, time the



TIMING GEARS

crankshaft and camshaft gears, and then rotate the accessory shaft gear until the marks line up when the idler gear is slipped into position.

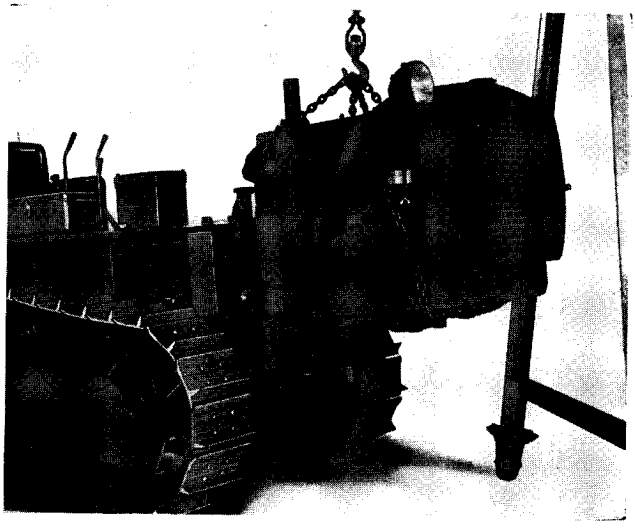
Removing Engine

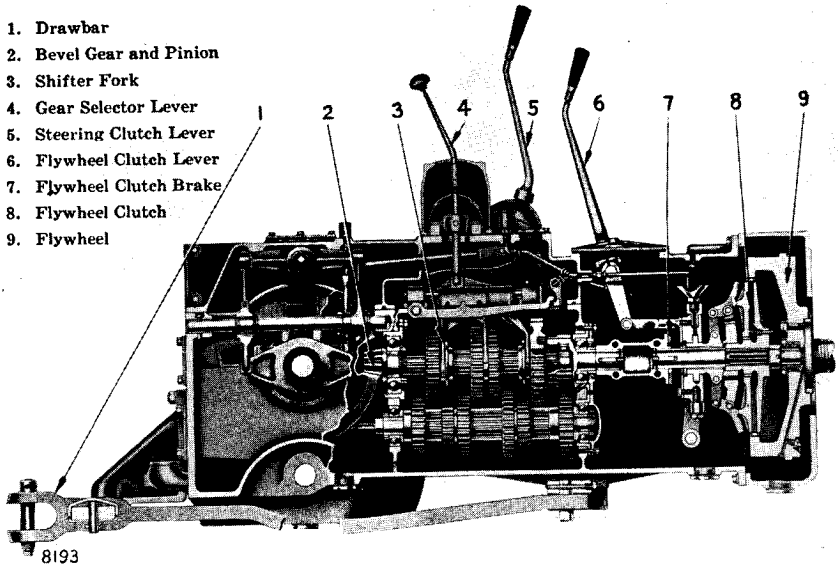
DRAIN the cooling system and lubricating system and shut off the fuel supply valves on the auxiliary and main fuel tanks. Engage the flywheel clutch so the driving disc will remain in place.

Then, remove the following from the engine:

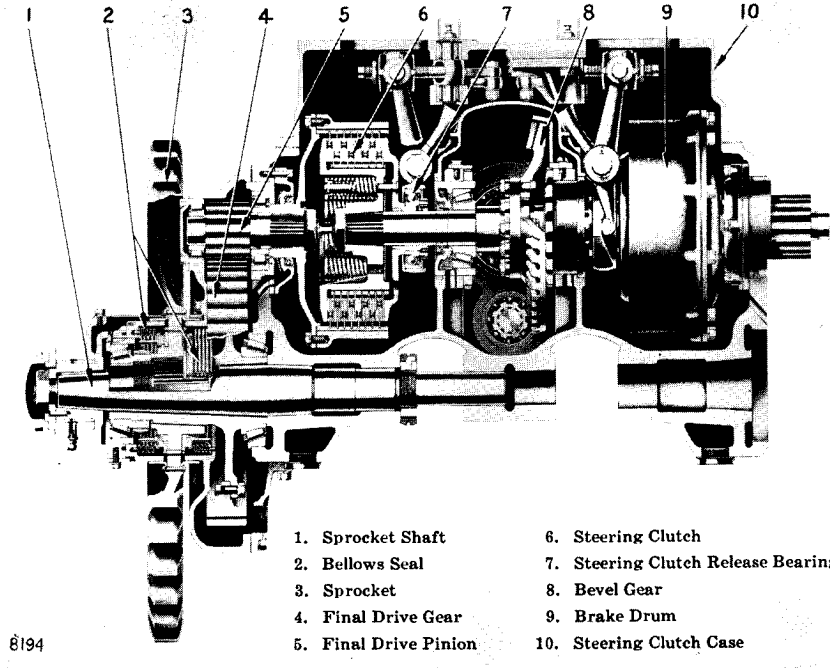
1. Hood and side plates
2. Fuel lines to fuel pump
3. Choke control (leading from the dash) at carburetor
4. Throttle control rod
5. Carburetor heat control rod lever from forward end of shaft
6. Heat indicator line
7. Connection for oil pressure gauge at fuel tank
8. Electrical leads to headlight, cranking motor and generator, if so equipped
9. Fuel tank
10. Capscrews fastening the front end of the fenders to the flywheel housing
11. Connections between equalizer spring and engine
12. Raise the engine to clear the equalizer spring and block under the front end of the transmission case
13. Capscrews holding the engine to the transmission case.

Use a 2-ton hoist and lift out the engine. Care should be taken that the lifting chains or cables are located so that any point of bearing will be against a solid part of the engine. Pull the engine straight forward until the flywheel clutch shaft is clear of the pilot bearing in the flywheel. Securely tighten all capscrews when replacing the engine.





TRANSMISSION AND FLYWHEEL CLUTCH CROSS-SECTION

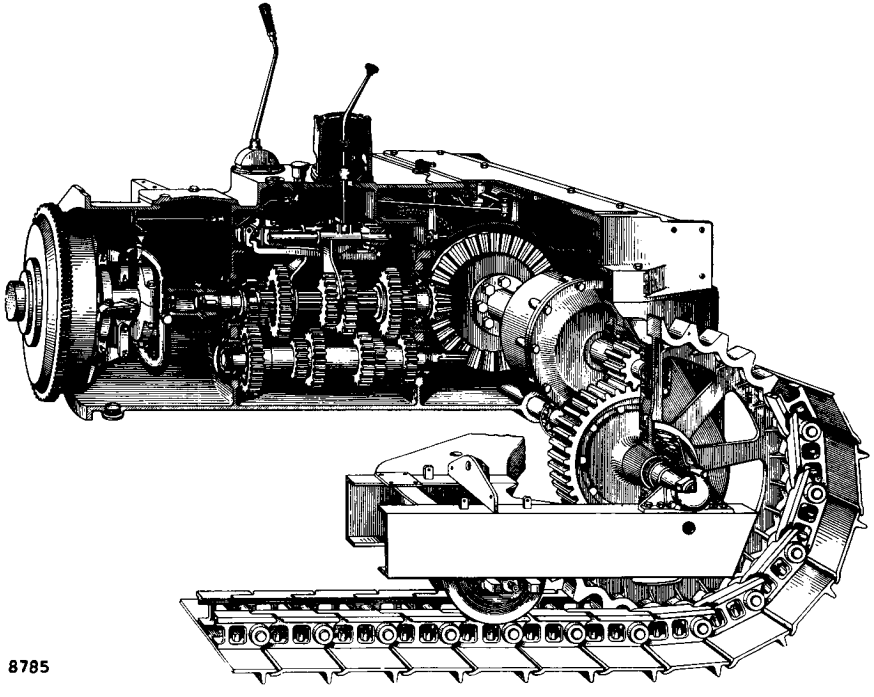


1. Sprocket Shaft
2. Bellows Seal
3. Sprocket
4. Final Drive Gear
5. Final Drive Pinion
6. Steering Clutch
7. Steering Clutch Release Bearing
8. Bevel Gear
9. Brake Drum
10. Steering Clutch Case

FINAL DRIVE AND STEERING CLUTCH CROSS-SECTION

POWER TRANSMISSION UNITS

THE power transmitting units consist of the flywheel clutch, transmission, gearshift and interlock mechanism, steering clutch assembly, and final drive.



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The transmission case is divided into five compartments. The forward compartment contains the flywheel clutch. The middle compartment contains the transmission. The rear compartment is divided in two outer compartments, each containing a steering clutch, and the middle compartment containing the bevel gear and bevel gear shaft bearings. The transmission and bevel gear compartments have an opening between them which allows lubricant to flow from one to the other. The final drive gears are located outside the transmission case in the final drive cases.

Flywheel Clutch

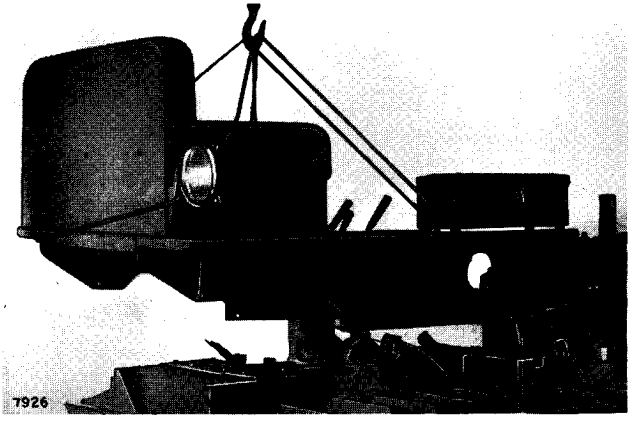
The flywheel clutch and flywheel are enclosed in a separate compartment in the front end of the transmission case. This compartment together with the other compartments is covered by the transmission case cover. It is necessary to remove the fuel tank, seat, fenders and transmission case cover to remove the flywheel clutch.

SEAT AND FENDER REMOVAL

The seat frame alone may be removed from the tractor by taking out the bolts holding it to the fenders. In most cases, however, removal of the seat and fenders as a unit will be desirable.

To do this, remove the fuel tank as outlined in that topic and proceed as follows:

1. Remove the battery
2. Disconnect the starting motor cable at the switch outside the battery box



REMOVING SEAT AND FENDERS

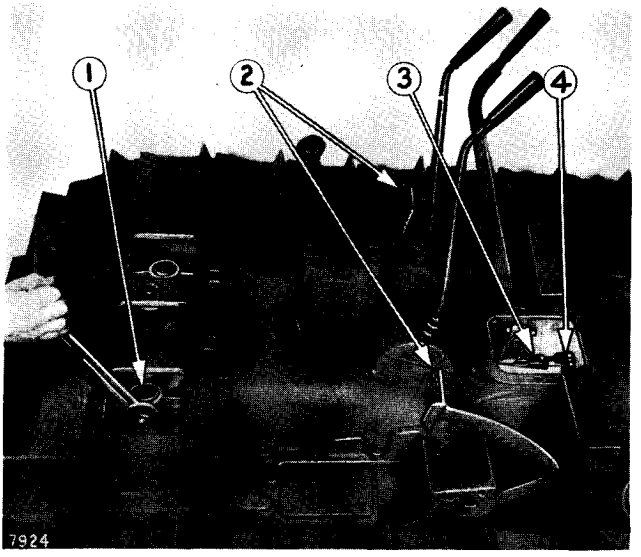
3. Disconnect the rear headlight at the switch in the battery box and at the headlight. Remove the lead from the fenders.
4. Remove the hand lock on the right hand brake
5. Remove the floor plates
6. Remove the capscrews holding the fenders to the tractor and lift off the seat and fenders as shown.

When installing the seat and fenders, place the floor plates in position and lower the seat and fenders into place simultaneously tilting the floor plates so they will clear the lugs on the fenders.

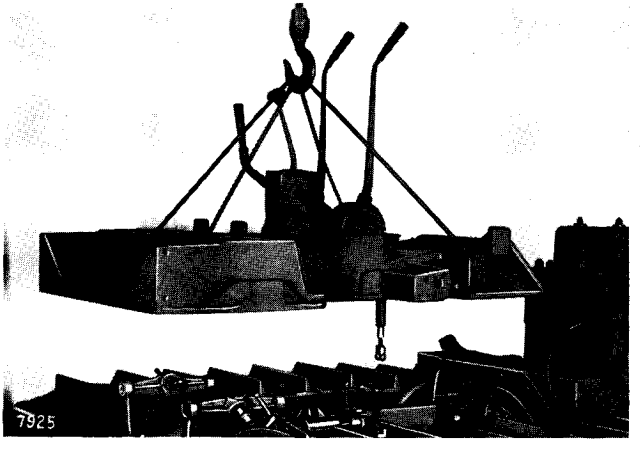
TRANSMISSION CASE COVER REMOVAL

Remove the fuel tank and seat and fenders as described in the topics, FUEL TANK and SEAT AND FENDERS.

Disconnect the flywheel clutch linkage (3) at the top of the lever (4) inside the flywheel clutch compartment after removing the inspection cover. Remove the inspection plate at the rear of the transmission case



cover and loosen the steering clutch adjustment as shown until the adjusting screw is free of the socket in the steering crank (1). Remove the brake pedals (2) or loosen the brake adjustment and swing the pedals forward.



REMOVING TRANSMISSION CASE COVER

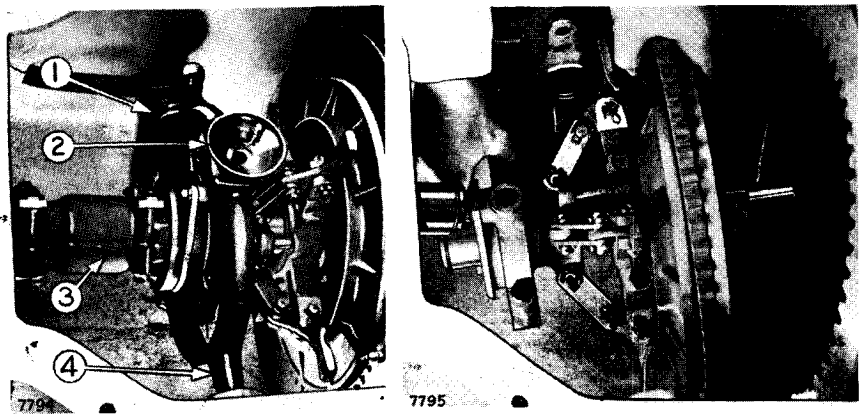
With the flywheel clutch lever forward, lift off the transmission case cover as shown.

When installing the transmission case cover, place the flywheel clutch lever in the forward or disengaged position to prevent the cams on the flywheel clutch lever shaft in the transmission case cover from damaging the gearshift interlock assemblies.

When installing a brake pedal, remove the small cover over the brake lever compartment, using a heavy wire pull the brake lever to the rear until the brake pedal shaft rotates forward enough to install the brake pedal.

CLUTCH REMOVAL

Remove the coupling assembly (3) and take out the screw and funnel assembly (2) and the screw at the bottom of the yoke (4). Shift the yoke to the right until it is free of the lever (1). Then slip the yoke

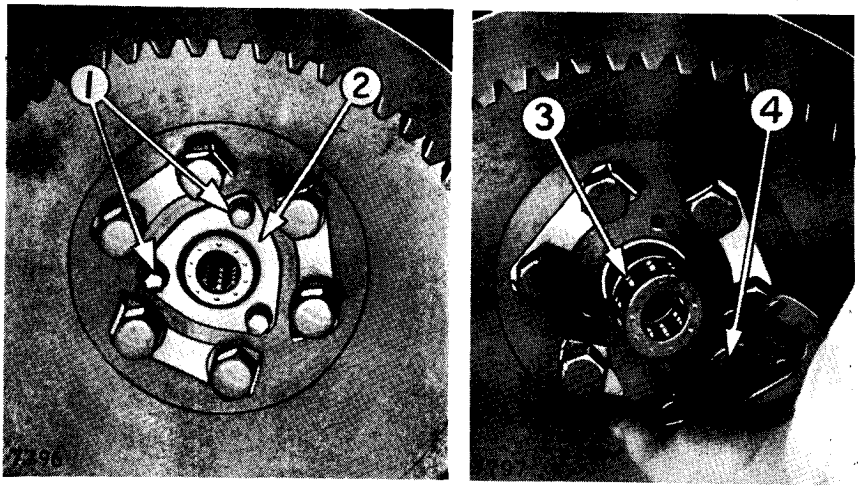


REMOVING CLUTCH ASSEMBLY

out of the socket in the transmission case, over the rear end of the flywheel clutch, and out of the case between the front end of the transmission shaft and the rear end of the flywheel clutch shaft. Move the clutch away from the flywheel until the front end of the clutch shaft is out of the pilot bearing in the flywheel. Then remove the flywheel clutch as shown.

CLUTCH PILOT BEARING

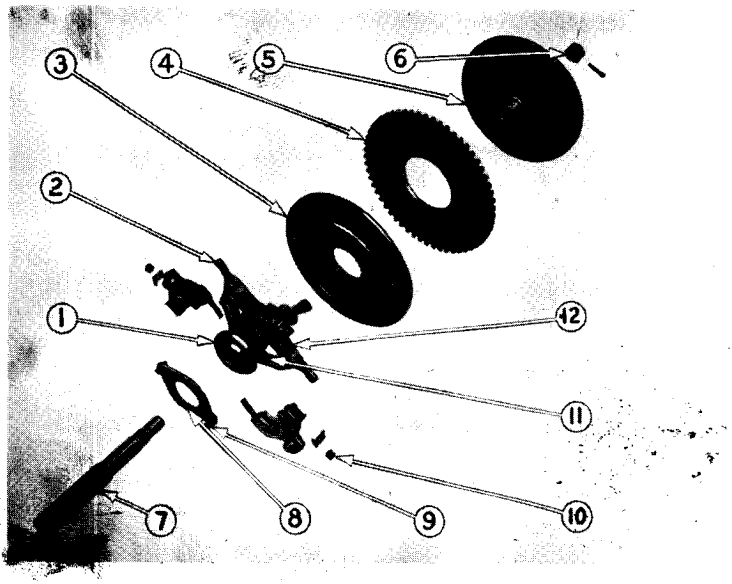
To remove the pilot bearing (3) in the flywheel, take out the capscrews (1), remove the inner and outer retainer (2) and felt washer (4) as a unit. The washer should be replaced if worn and leaking. The bearing (3) will slide out of the flywheel. The inner and outer races should be replaced if worn.



CLUTCH PILOT BEARING

CLUTCH DISASSEMBLY

Unscrew the adjusting collar (12) from the front pressure plate (5). Remove the cotter pin and nut (6). Slide out the clutch shaft (7). Remove the front pressure plate (5), driving disc (4) and rear pressure plate (3) individually. If the contact surfaces of these parts are worn, scored or excessively cracked, they should be replaced. Care should be taken to prevent any lubricant or similar substance from getting on the contact surfaces of the clutch plates and driving disc as this will cause glazing of the surfaces.



CLUTCH ASSEMBLY

The pins and springs in the front pressure plate keep the pressure plates separated when the flywheel clutch is disengaged. If the plates do not separate when the flywheel clutch is disengaged, these springs may need to be replaced. Drive the pins through the front pressure plate toward the driving disc. Install new springs and pins. Place the washer in position on the end of the pin and peen over the end of the pin.

The flywheel clutch brake plate (8) may be removed by taking out the capscrews (9). The plate should be replaced if worn or scored. The clutch brake facings, attached to the coupling between the flywheel clutch and transmission, should be replaced if worn flush with the counter sunk machine screws.

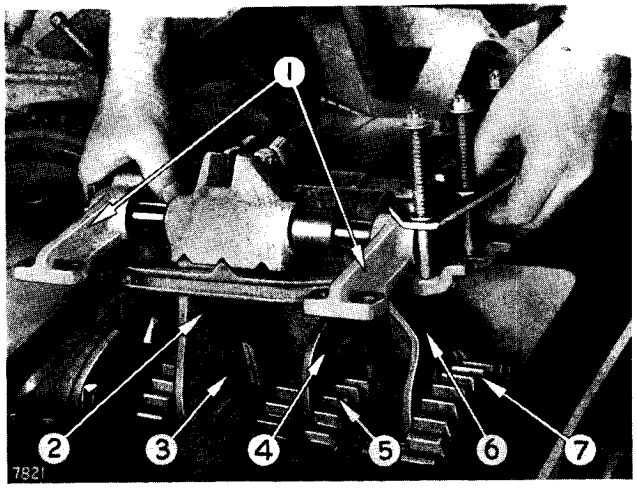
To remove the bronze collar assembly, take off the nuts (10) and locks and pull each half off the collar (1). Replace the worn parts of the collar assembly or collar.

If the cams (2), pin holes in the links (11) or pins are worn, they should be replaced.

Gear Shift and Interlock Mechanism

TO remove the gear shift and interlock mechanism, first remove the transmission case cover as described in the topic, FLYWHEEL CLUTCH.

The gear shift and interlock mechanism is mounted directly on top of the middle compartment of the transmission case.

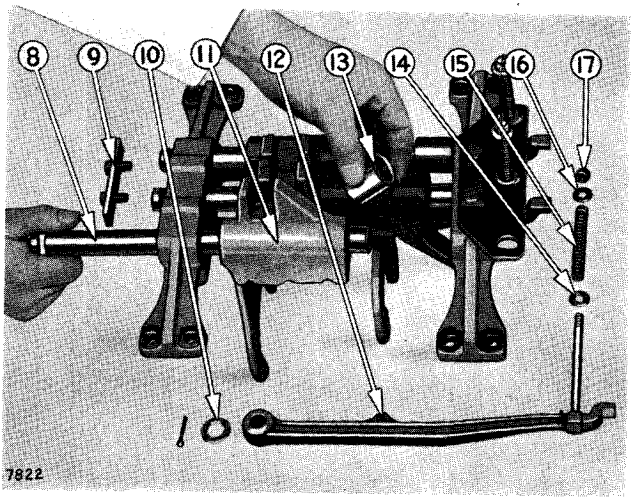


REMOVING GEAR SHIFT AND INTERLOCK MECHANISM

Remove the capscrews holding the brackets (1) to the transmission case and lift off the entire mechanism as shown.

The forward fork (6) shifts the gear (7) forward for fifth gear and to the rear for first gear. The middle fork (4) shifts the gear (5) forward for fourth and to the rear for third gear. The rear fork (2) shifts the gear (3) forward to engage the reverse idler gear for reverse and to the rear for second gear.

To remove a gear shifter fork, remove the cotter pin, nut (17), washer (16), spring (15) and washer (14) at the front end of the lock assembly (12). Remove the cotter pin and washer (10) and drive out the pin at the rear end of the lock assembly. Remove the capscrews securing the shaft plate lock (9) and remove the lock. Slide out the gear



GEAR SHIFT AND INTERLOCK MECHANISM

shifter shaft (8), removing first the spacer (13) and then the fork (11). The outside shifter fork shafts have a spacer in front of the fork; a spacer is not used on the center shifter fork shaft. Remove the lock assembly (12) and replace if worn or damaged.

GEAR SHIFT INTERLOCK

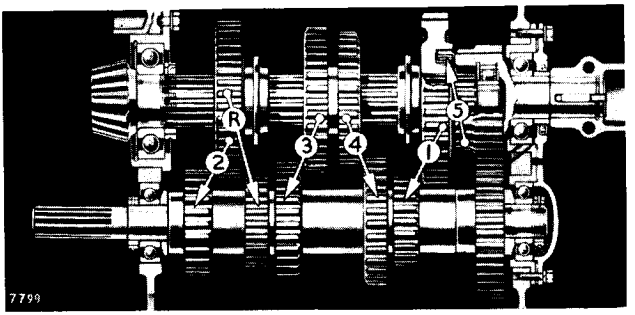
The gear shift interlock mechanism consists of the three lock assemblies and a shaft with three cams mounted in the transmission case cover. This shaft is connected by linkage to the flywheel clutch lever. This mechanism serves to lock the gears in position when the tractor is op-

erating and the flywheel clutch is engaged. It also prevents the gears from being shifted unless the flywheel clutch is disengaged.

When installing the transmission case cover, place the flywheel clutch lever in the forward or disengaged position to prevent the cams on the shaft in the transmission case cover from damaging the lock assemblies.

Transmission

THE transmission (speed change compartment) is located in the middle compartment of the transmission case. All of the gears required for obtaining the five forward and one reverse speeds are mounted in this compartment.



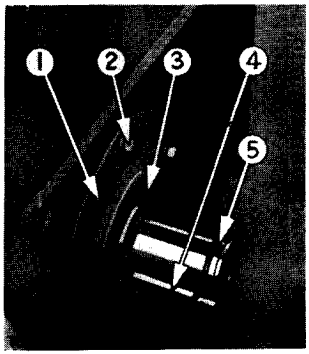
The gears that mesh in each speed are shown in the accompanying illustration. When the gearshift lever is placed in the reverse position, the rear gear on the upper shaft is shifted into mesh with the idler gear which reverses the rotational direction of the bevel pinion.

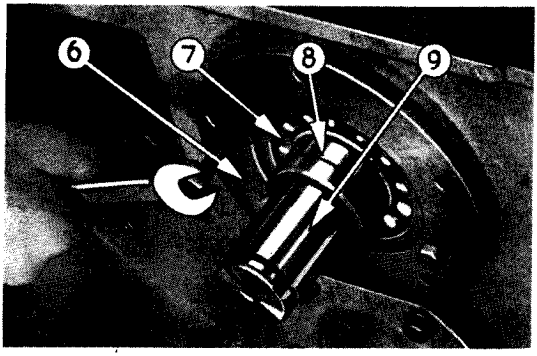
The bevel pinion does not extend the length of the transmission case but is piloted at its front end in the transmission drive pinion. By shifting the front gear forward, the internal teeth of this gear are meshed with the external teeth on the drive pinion to obtain a direct drive for fifth gear.

Remove the transmission case cover, flywheel clutch and the gearshift and interlock mechanism as described in the topics, FLYWHEEL CLUTCH and GEARSHIFT AND INTERLOCK MECHANISM, before attempting to remove any of the transmission.

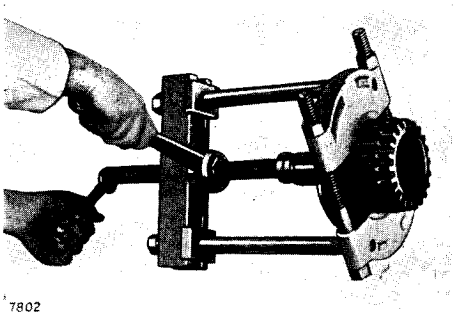
TRANSMISSION DRIVE PINION

Remove the snap ring (5) and key (4) and then the capscrews (2) around the cover (1). Remove the cover. The seal (3) in the cover should be replaced if leaking. Using the capscrews from the cover, pull the bearing cage (6), bearing (7) and pinion (9) as a unit.

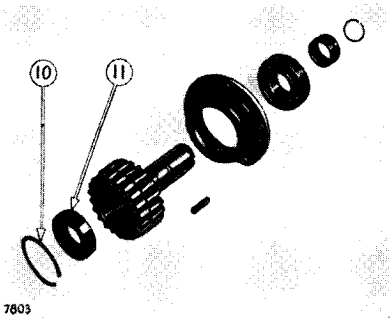




Pull the cage and bearing from the transmission drive pinion as shown, using the 8B7551 Bearing Pulling Attachment and 8B7548 Push Puller. The spacer (8) will come off with the bearing and cage. Press the bearing (7) out of the cage. The pilot bearing (11) in the drive pinion will slip out after the snap ring (10) is removed.



PULLING PINION BEARING

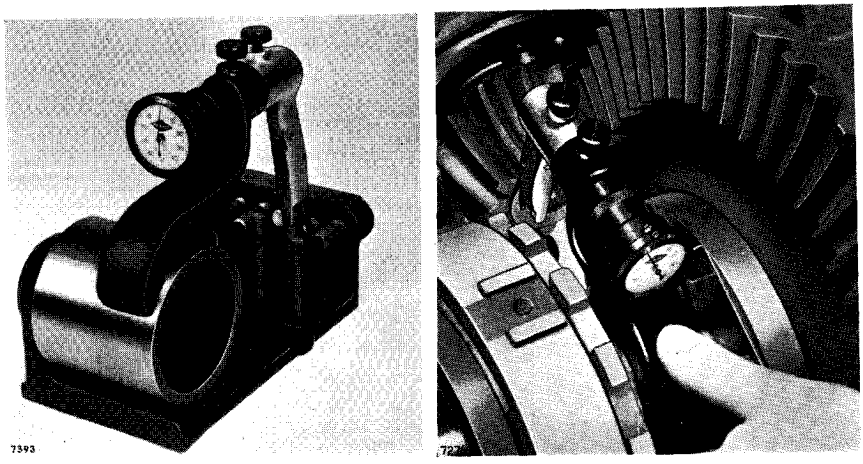


DRIVE PINION ASSEMBLY

BEVEL PINION SETTING

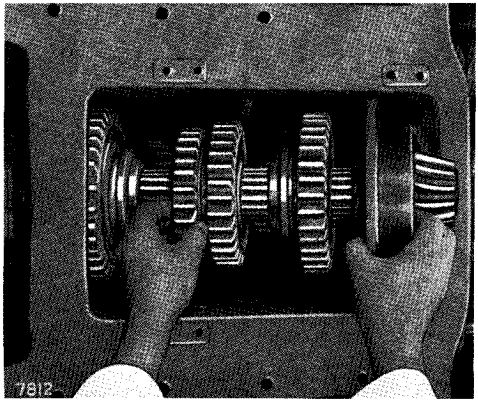
Remove the capscrews and locks around the bearing cage at the rear end of the bevel pinion shaft. Using two capscrews from the cover of the transmission drive pinion, pull the bearing cage. The shims (12) are used to properly position the teeth of the bevel pinion with the bevel gear. They are half-moon shaped and may be easily removed.

When replacing a bevel pinion, use the pinion setting gauge 8B5598 and indicator 8B722 both of which are available from the Parts Department. Complete instructions accompany the tool. With suitable attachments, the dial indicator can also be used for numerous other jobs requiring readings in thousandths of an inch.

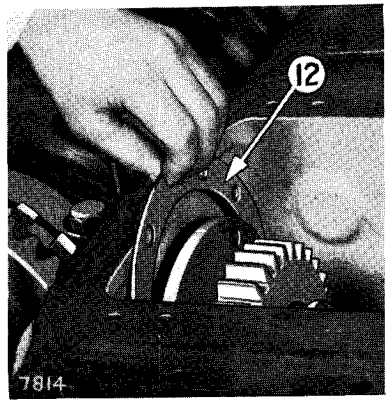


BEVEL PINION SETTING GAUGE

Lift out the bevel pinion and gears as shown after moving them forward enough for the rear end of the pinion to clear the rear wall of the transmission compartment. The gears will slide off the shaft.



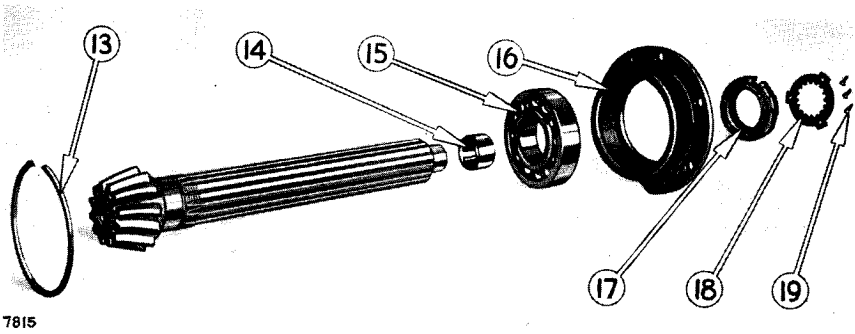
BEVEL PINION REMOVAL



PINION ADJUSTMENT

Remove the screws (19), lock (18) and nut (17) with 3B5964 Wrench. After the snap ring (13) is removed, cage (16) will slip off the bearing (15). Press the bearing off the shaft. When replacing the lock (18), be sure to stake the screws securely in position with a center punch.

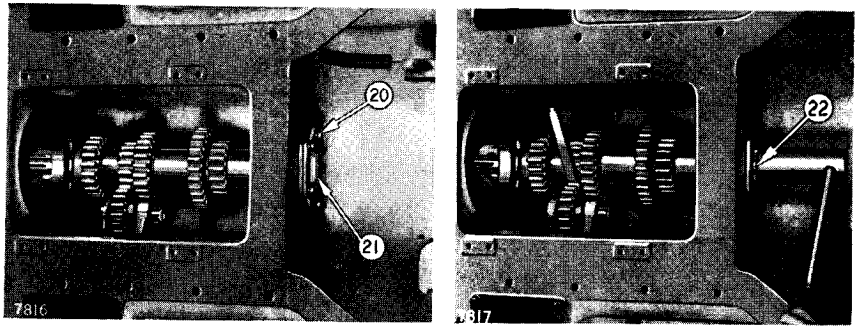
The pilot bearing inner race (14) on the front end of the pinion shaft may be pulled using 8B7551 Bearing Pulling Attachment and 8B7545 Puller.



BEVEL PINION SHAFT AND BEARING ASSEMBLY

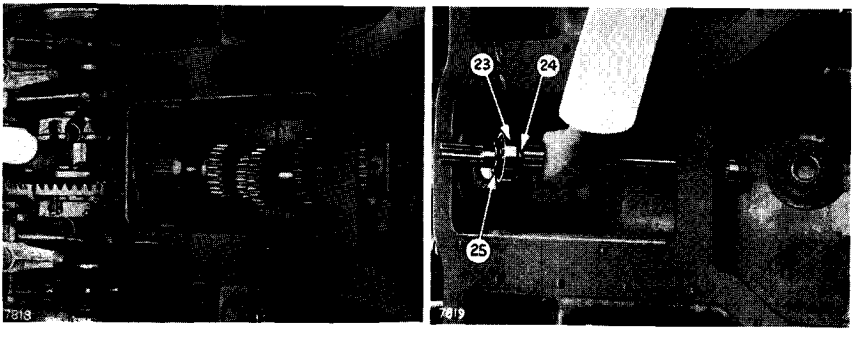
TRANSMISSION SHAFT

Remove the capscrews (20) and cover (21) and then the snap ring on the lock nut. Remove the nut (22) with wrench 3B6780. Pull the bearing and cage off the shaft with two of the capscrews from the cover.



TRANSMISSION SHAFT BEARING REMOVAL

Press the bearing out of the cage for replacement. Slide the transmission shaft into the rear compartment of the transmission case as shown, and remove the spacers and gears. Slide the transmission shaft forward

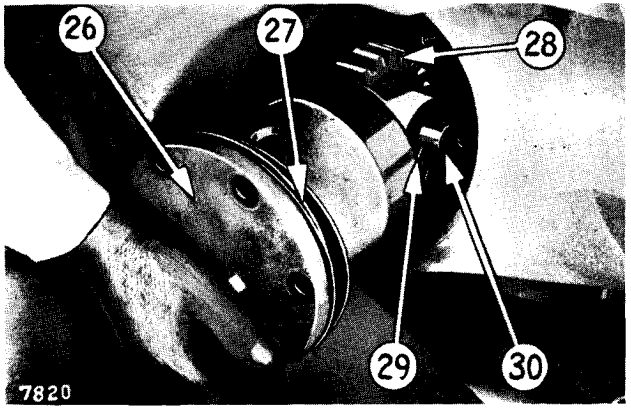


TRANSMISSION SHAFT, GEAR, AND BEARING ASSEMBLY

until it can be removed as shown. Remove the snap ring and then the lock nut (25) with wrench 3B6780. The bearing (23) and spacer (24) may be pressed off in a press by installing a gear in front of the spacer and pressing down on the shaft.

REVERSE IDLER GEAR

Remove the reverse idler gear (28) and bracket (26) from the right-hand side of the transmission case. The shims (27) between the bracket and transmission case control the backlash of the idler gear with the bevel pinion and transmission shaft gears. The backlash for the idler gear should be .006-.008" at the tightest point with the gear on the transmission shaft.



REVERSE IDLER GEAR ASSEMBLY

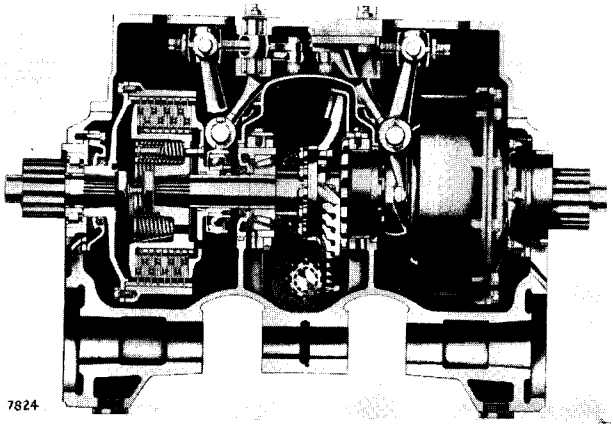
To replace the idler gear bearings, remove the capscrew and lock (29) and press out the shaft (30). The hardened thrust washers between the gear and the inside faces of the bracket should be replaced if worn or scored.

When assembling and installing the reverse idler gear, be sure that the chamfered edge of the idler gear teeth are toward the rear of the tractor to facilitate shifting.

Steering Clutch Assembly

IT is necessary to remove the steering clutches and bevel gear as a unit to work on the steering clutches. To do this, remove the transmission case cover as described in the topic, FLYWHEEL CLUTCH.

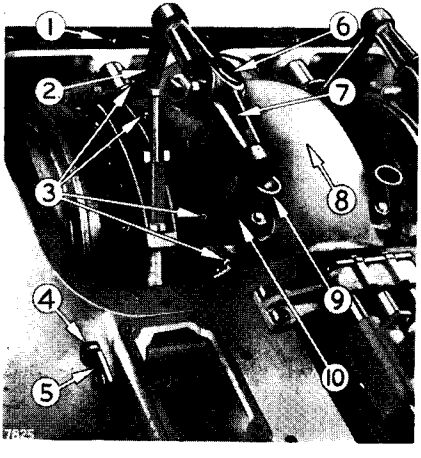
Remove the brake lever shaft (4) from the outside of the transmission case after removing the capscrew and flat lock (5) by inserting the capscrew in the tapped hole in the end of the shaft and pulling the

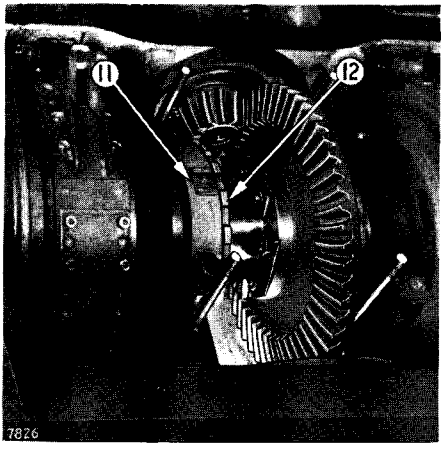


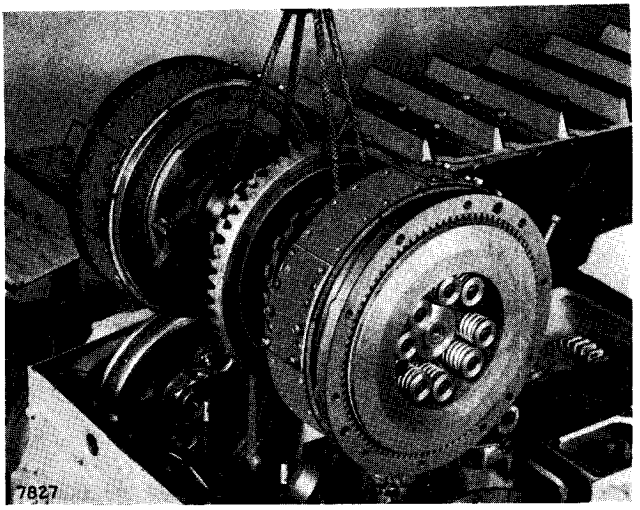
shaft. Disconnect the brake linkage. Remove the cotter pins (3) and slide the arm (2) to the rear and remove the trunnion (7). Remove the rivet (1) from the shaft and slide the shaft out the rear of the transmission case, removing at the same time the arms (2 and 10) and tube assembly (9). The bearings in the arms should be replaced if worn.

When installing the trunnion, be sure that the flat top of the pin (6) is up and the adjustment screws are in position toward the bevel gear guard (8) as shown.

Remove the bevel gear guard (8). Remove the bearing cage caps (11) and loosen the bevel gear shaft adjusting nut (12). Mark the caps to insure replacement on proper side when reinstalling. Remove the cap-



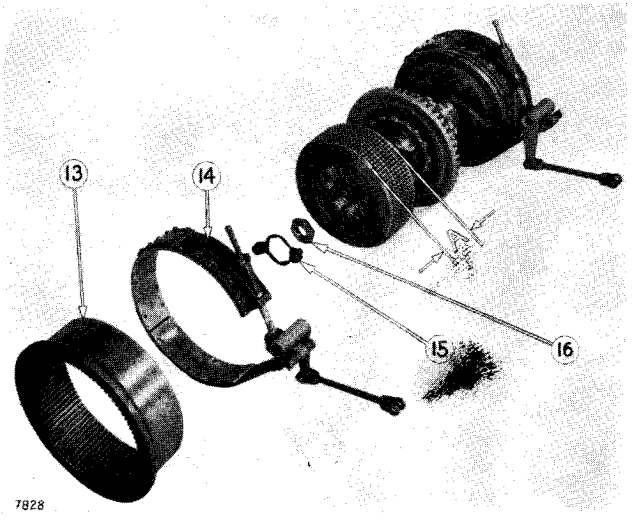




REMOVING BEVEL GEAR AND STEERING CLUTCH ASSEMBLY

screws from the outer drums of the clutches and slide the drums toward the center of the machine so that they clear the ridge on each steering clutch flange. Lift out the steering clutches and bevel gear as shown.

Remove the outer clutch drums (13) and brake bands (14). If the splines of the outer clutch drums are worn excessively, the final drive pinion bearings should be inspected for wear. Remove the pinion as outlined in the topic, FINAL DRIVE ASSEMBLY.



BEVEL GEAR AND STEERING CLUTCH ASSEMBLY

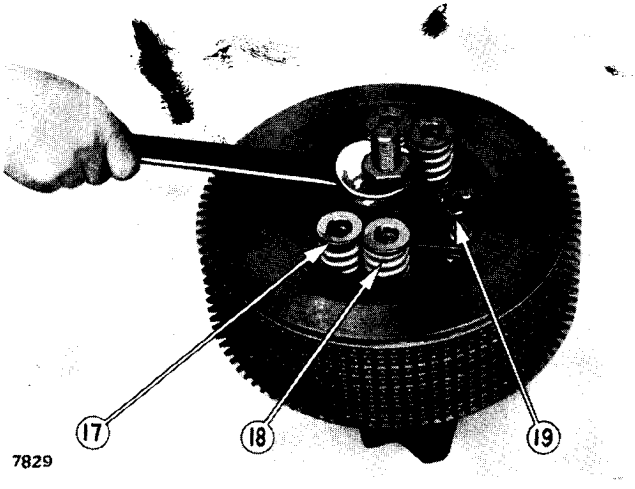
If the distance (A) between the face of the inner drum and the face of the pressure plate is less than 3⅛", the steering clutch discs should be relined.

Remove the capscrews, lock (15) and nut (16) on the bevel gear shaft and pull the steering clutches using 8B7548 Push Puller with two 8B7550 Legs and two 8B7556 Adapters.

STEERING CLUTCH DISCS

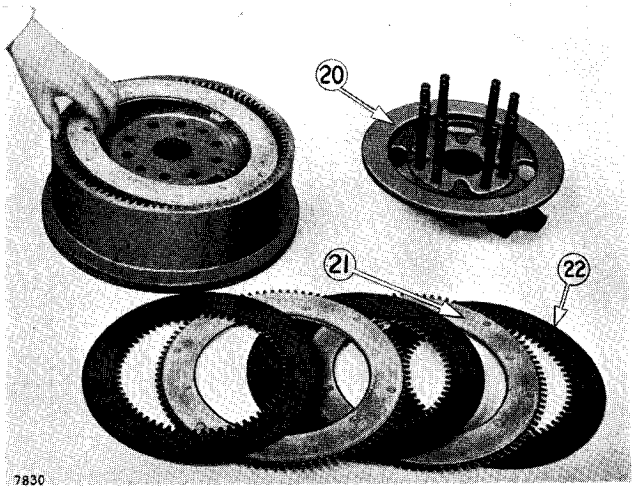
The steering clutch springs can be compressed and the locks (19) removed by using:

1—3456-A Plate
1—S2364 Bolt
1—1B4332 Nut
1—3B6779 Yoke



REMOVING STEERING CLUTCH SPRINGS

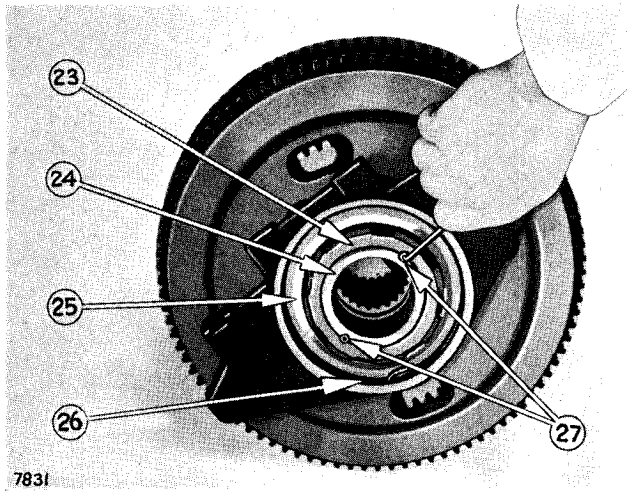
Release the springs and remove the retainer (17) and springs (18). Turn over the clutch assembly and lift off the pressure plate (20). Remove the discs (21 and 22). The rivets can be punched out of the lined discs (21) and the linings replaced. When installing the alternate lined discs (21) and steel discs (22) in the inner and outer drum as shown be sure that a steel disc will be against the pressure plate (20). The outer drum assures proper alignment of the teeth of the lined discs. Do not remove the outer drum until the steering clutch springs have been assembled in position.



STEERING CLUTCH DISC INSTALLATION

STEERING CLUTCH RELEASE BEARING

Remove the hollow head set screws (27) with wrench 4B9820 as shown and then the nut (23). The thrust bearing and cage will slide off the pressure plate hub (24). After the snap ring (26) and washer (25) are removed, press or drive the bearing out of the cage using a punch in the two holes in the back of the bearing cage and applying pressure first through one hole and then the other. If the bearing is damaged, install a new one. Be sure the side of the bearing marked THRUST HERE on the outer race will be toward the pressure plate when assembled in the cage.

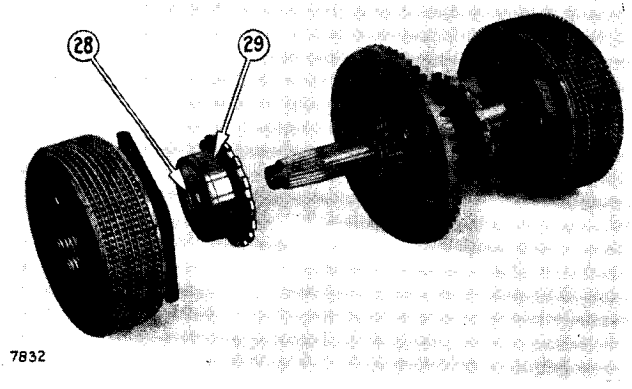


STEERING CLUTCH RELEASE BEARING

BEVEL GEAR SHAFT SEALS

Oil leakage from the bevel gear and transmission compartment into the steering clutch compartments would be evidenced by loss of oil from the transmission and bevel gear compartments and the appearance of oil in the steering clutch compartments. Such leakage can be corrected by replacing the seals in the bevel gear bearing cages.

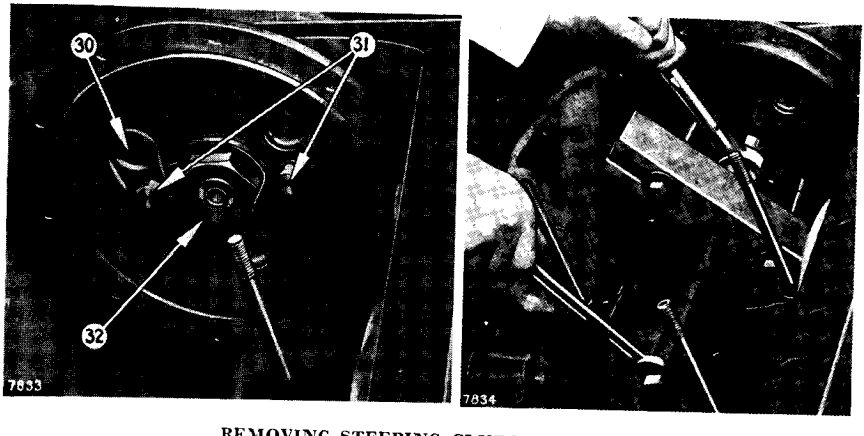
After pulling the steering clutches from the shaft, the cage (29) containing the bevel gear bearing race and seal will slide off the shaft. Remove the seal (28) and replace it with a new one which has been soaked in warm lubricating oil for thirty minutes. Install the seal with



BEVEL GEAR SHAFT SEAL ASSEMBLY

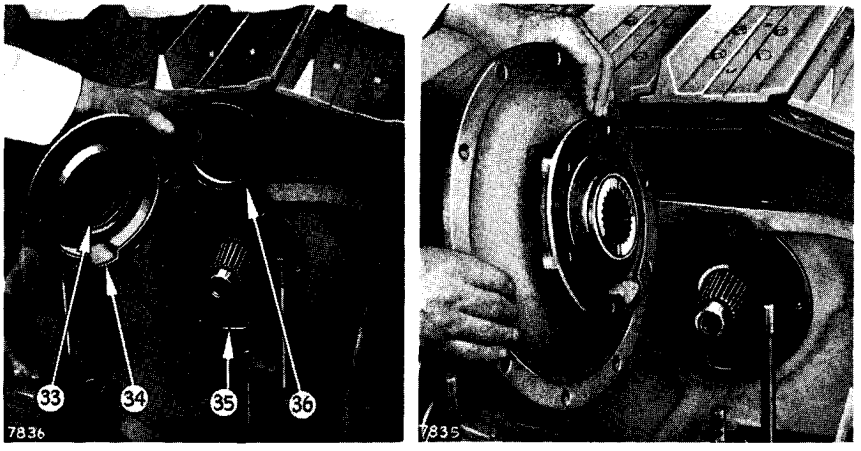
the wiping edge toward the bevel gear. When replacing the cage and seal, care should be taken not to turn the rawhide lip of the seal inside out when slipping the seal and cage into position. Be sure that the cage is installed with the oil return hole at the bottom.

STEERING CLUTCH FLANGE SEALS



REMOVING STEERING CLUTCH FLANGE

If inspection of the steering clutch compartment and back of the flange indicates an oil leak, check the lubricant level in the bevel gear compartment. If this is correct, the steering clutch flange seal should be inspected. Remove the capscrews (31), cover stop (30) and nut (32)



FLANGE AND SEAL

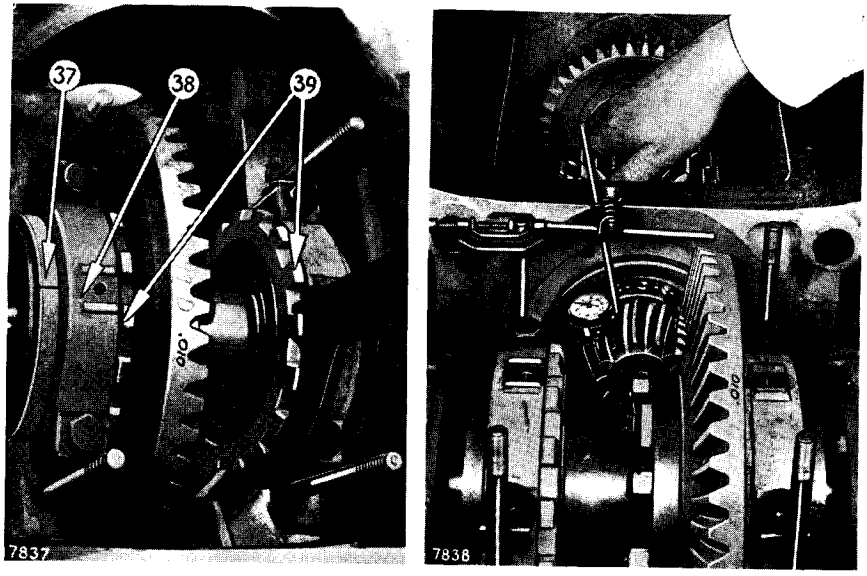
with a 3B6352 Wrench. Pull the flange using an 8B7548 Push Puller with two 5/8"—11 capscrews 6" long (1D4595). Remove the capscrews in the cover and take off the cover (34) and oil thrower (36). The seal (33) in the cover should be replaced if worn or leaking. When reinstalling, place the seal and cover on the hub of the flange. Drive the oil thrower on the hub with the lip of the thrower flush with the end of the hub as shown. Install the assembly on the pinion shaft using a guide stud to hold the cover in position. Tighten the nut on the pinion shaft securely and install the capscrews for the cover through the opening in the flange. Be sure the oil return groove (34) and hole (35) are aligned when installing the assembly.

BEVEL GEAR GUARD SEALS

When installing the steering clutches, bevel gear and bevel gear shaft, be sure to install new cork seals (37) in the supporting web for the bevel gear bearing cages and new felt seals for the bevel gear guard. Bevel the edges of the cork seals after installation of steering clutch assembly to insure an oil tight seal around the bearing cage.

BEVEL GEAR AND PINION BACKLASH ADJUSTMENT

When installing the steering clutch assembly, care should be taken to adjust the pre-load on the bevel gear bearings and the backlash of the bevel gear.



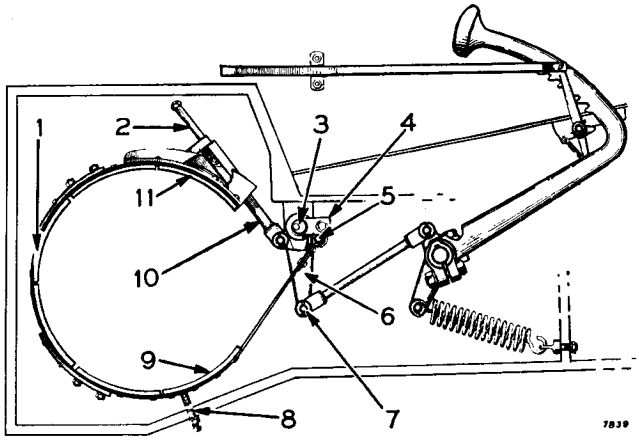
BEVEL GEAR AND PINION BACKLASH ADJUSTMENT

With the steering clutch assembly in place, install the bearing caps (38) and tighten the capscrews enough to seat the bearing caps on the bevel gear bearing cages but not enough to cause the bearing cage to bind. Using wrench 1A334 as shown, tighten the adjusting nuts (39) on each bearing cage until tight. Back off the nut until the nearest notch is in alignment with the lock, and install the lock. This procedure properly pre-loads the bearings. Adjust the bevel gear backlash by loosening one adjusting nut and tightening the other nut the same amount until the correct backlash reading is obtained on the dial indicator. The correct backlash is marked on the outer edge of the bevel gear and the backlash at the tightest point should not be less than the amount given on the edge of the bevel gear. After completing and checking the adjustment, tighten the bearing caps down tightly. Lock the capscrews and install the flat lock and deflector that locks the bevel gear bearing nuts.

BRAKES

Separate foot brakes are used to supplement the action of the steering clutches or to stop the tractor. Each pedal operates a self-energizing brake band on the steering clutch outer drum.

The right-hand brake has a hand-operated lock as shown to set the brake.

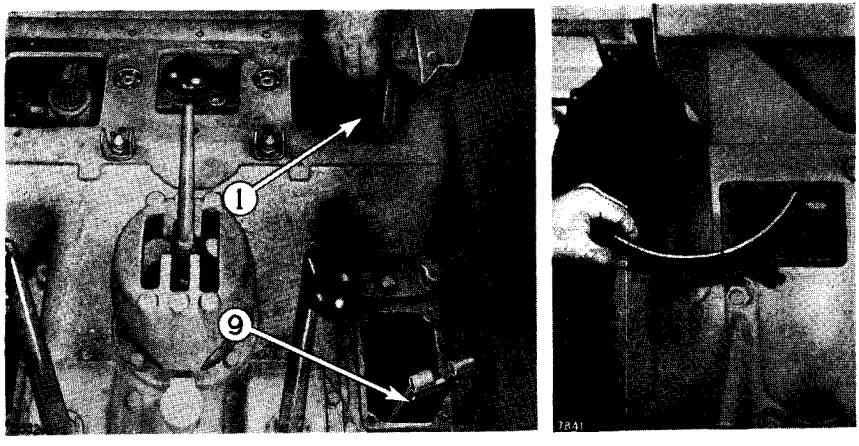


BRAKE LINING REPLACEMENT

Remove the seat cushion, floor plates, small covers on each side of the gear shift lever, covers on the top of the steering clutch compartment, and the cover on the rear of the steering clutch compartment.

Remove the steering clutch trunnion (see STEERING CLUTCH ASSEMBLY) by taking out the rear cotter pin in the steering clutch arm shaft and sliding the lever arm to the rear. Unscrew and remove the brake adjusting nut (2). Remove the cotter pin and pin (7) through the small hole in the top of the transmission case. Remove the lock (4) and pin (3) by inserting a $\frac{3}{8}$"—16 capscrew in the tapped hole in the end of the pin and pulling the pin. Remove the brake lever (6) and fork (10). Remove the set screw (8).

Remove the nuts and lock holding the top section (11) and rear section (1) of the brake band together. Rotate the brake band until the



REMOVING BRAKE BAND SECTIONS

nuts and locks holding the rear section (1) and bottom section (9) of the brake band together can be removed through the rear hole in the transmission case. Remove the bottom section (9) through the hole in the top of the transmission case, the top section through the rear hole of the transmission case, and the rear section through the transmission cover as shown.

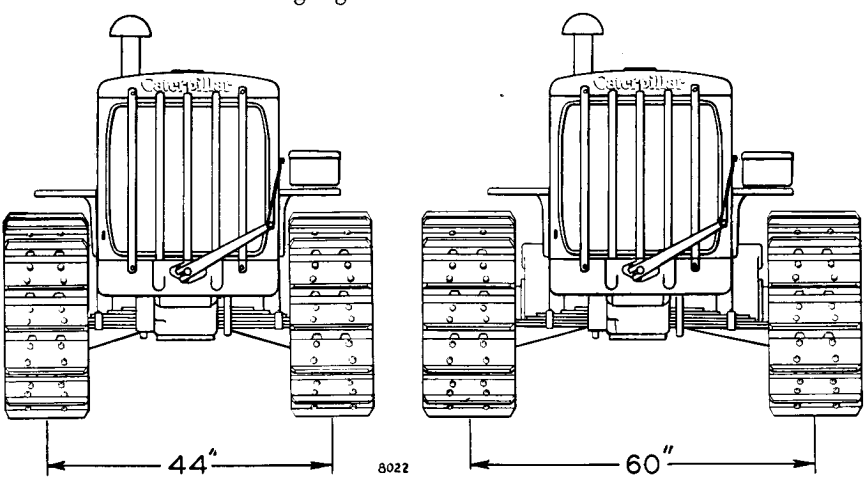
The rivets can be punched out and the linings replaced. Care should be taken when installing the bands to tighten fully the nuts which hold the three sections together.

When installing the trunnion, be sure that the flat top of the pin is up and that the steering clutch adjusting screw is in the normal position.

If the tractor has rear mounted equipment, it will be necessary to remove either the equipment or the transmission top cover to remove the brake band assemblies.

Final Drive Assembly

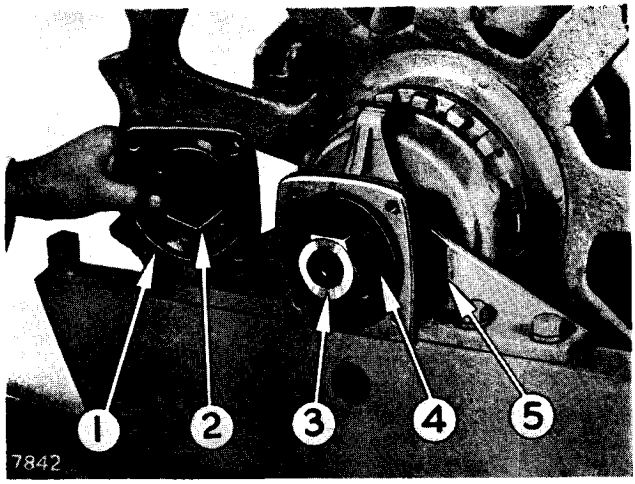
THE final drive assembly will differ slightly in a 44" gauge in comparison to a 60" gauge machine. The 60" gauge machine has a longer sprocket shaft and a spacer extension between the final drive case and the sprocket. A longer equalizer spring and a wider diagonal brace are also used on the 60" gauge machine.



TRACTOR GAUGES

Wide gauge tractors (60" gauge) are identified by a "W" following the serial number.

When removing the final drives, separate the track and lay it out flat, remove the capscrews from the outer frame bearing, the lubricant fitting through the hole in the side of the track frame and the bearing cap on the diagonal brace. Remove the pin and sleeve on the bracket for the equalizer spring.



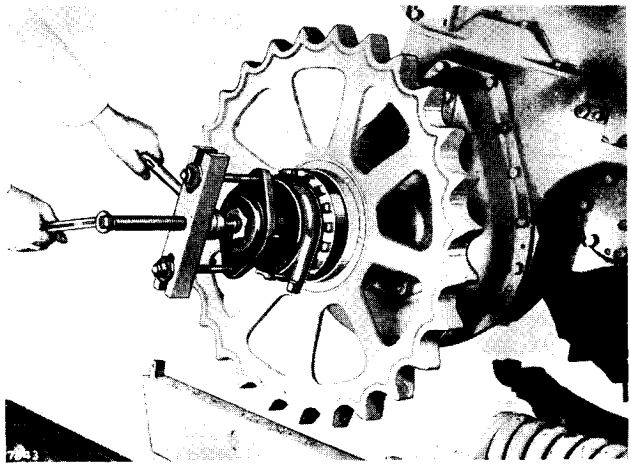
BEARING CAP ASSEMBLY

Remove the cap (1), lock (2), nut (3) with wrench L-1418 and washer (4). The shims behind the washer (4) are for alignment of the track rollers on the track frame with the sprocket. When properly adjusted, the track rollers will be centered with the sprocket.

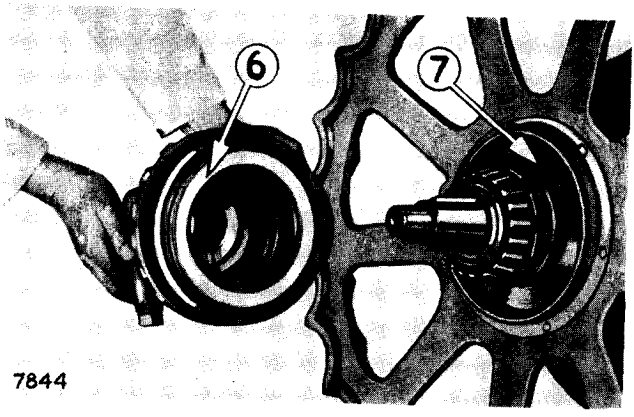
Raise the rear of the tractor until the sprocket is clear of the track frame. CAUTION: Block under the equalizer spring on the side that the final drive is to be disassembled to insure that the front end of the tractor will not fall and damage the engine if the equalizer spring should slip out of the bracket on the track frame.

Remove the outer frame bearing (5). Replace the bronze bushing in the bearing if damaged or if worn until a .025" feeler gauge can be inserted between the bushing and bearing cage holder assembly.

BEARING CAGE HOLDER ASSEMBLY



PULLING BEARING CAGE HOLDER ASSEMBLY



BEARING CAGE HOLDER AND SEAL ASSEMBLY

Replace the sprocket shaft nut (3) and use the following tools to pull the sprocket hub bearing cage holder as shown:

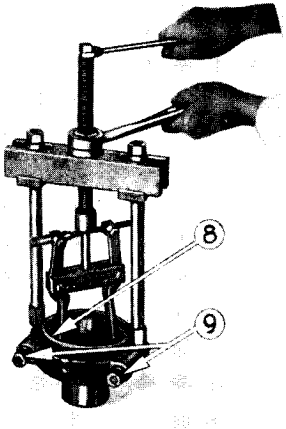
1—1B4643 Yoke	2—L1772 Stud
1—1B4655 Bushing	2—1D4720 Nut
2—3B5991 Shoulder Bolt	1—8B7561 Step Plate

Either the 8B7548 Puller or No. 2 Puller can be used with the above tools. The sprocket shaft nut will prevent the holder and puller arrangement from "jumping" off the end of the shaft.

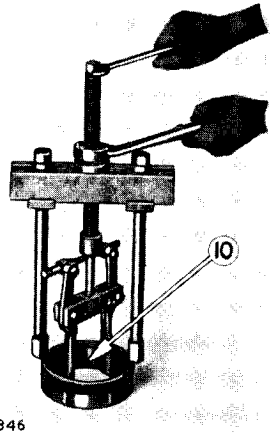
Replace the copper bellows seal (6) in the adjusting nut if damaged or worn.

The chromium plated washer (7) on the final drive gear hub may be turned over when necessary to provide a new wearing surface. It should be replaced if both sides are worn or damaged.

BEARING CAGE



PULLING CAGE

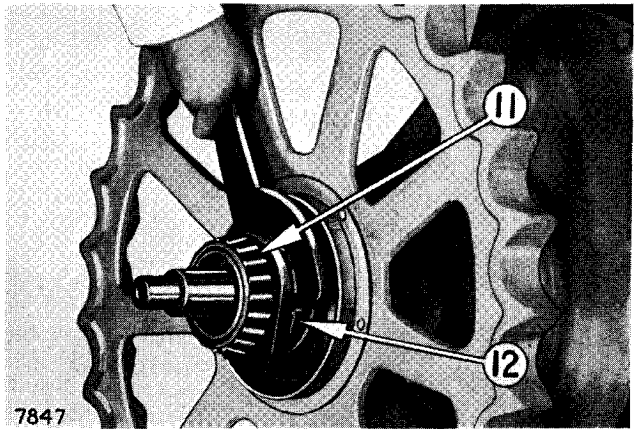


PULLING BEARING CUP

Remove the capscrew and flat lock and unscrew the final drive adjusting nut from the cage holder. Loosen the nuts (9) on the bolts in the bearing cage holder. Pull the cage (8) from the holder using the 8B7548 and 8B7554 Pullers as shown. The same pullers will pull the bearing cup (10) from the cage.

OUTER BEARING

Force off the bearing and inner race (11) by loosening the sprocket retaining nut (12) with wrench 1B1563. Due to insufficient threading on the final drive gear hub to force the bearing completely off the hub, use a 4B6090 Yoke as a spacer between the nut and bearing after the nut has forced the bearing off half-way.

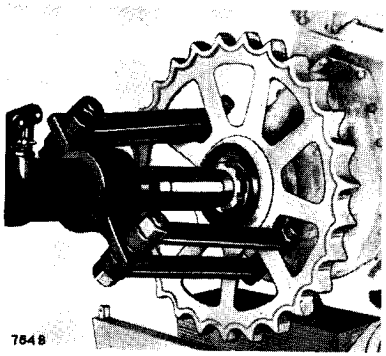


REMOVING OUTER BEARING

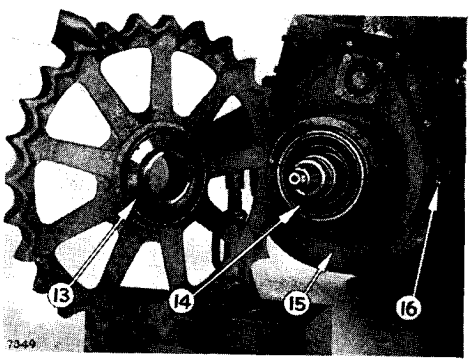
SPROCKET REMOVAL

Replace the sprocket retaining nut (12) on the final drive gear hub leaving some space between it and the sprocket. This will prevent the sprocket from "jumping" off the shaft when it comes loose. Attach the sprocket puller arrangement as shown and pull the sprocket. The following tools are used with the 1881-AA Hydraulic Press:

1—1B999 Head	1—3B5993 Sleeve
2—1B1287 Tie Bolt	1—1B4664 Plug
2—1B7413 Nut	2—1B1286 Tie Bolt
4—1B1267 Arm	2—1B4209 Nut
1—1B4663 Spacer	1—4B3636 Set Screw



PULLING SPROCKET



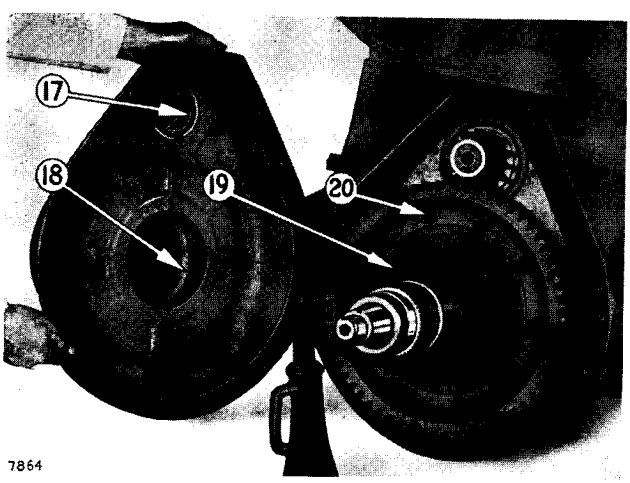
SPROCKET AND SEAL ASSEMBLY

The chromium plated washer (13) on the back of the sprocket may be turned over when necessary to provide a new wearing surface. It should be replaced if both sides are worn or damaged. Securely stake the new washer in place.

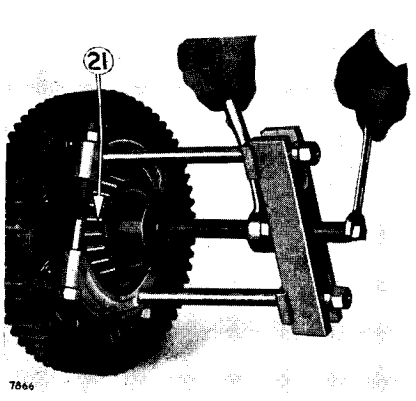
Pull out and replace the copper bellows seal (14) in the final drive case if worn or damaged.

FINAL DRIVE AND INNER BEARING

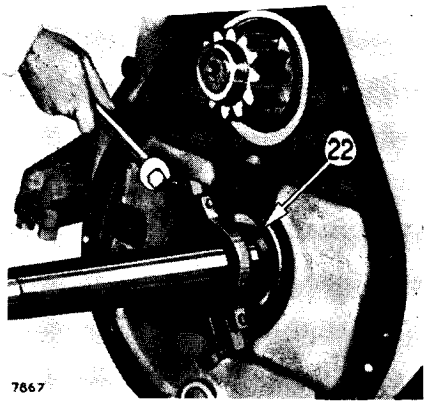
Pull the final drive case (15) using two $\frac{3}{8}$"—16 capscrews (S-1591) in the hole (16) and the hole directly opposite. The spacer extension (18) is used only on wide gauge machines. The pinion bearing (17) in the case can be removed after the cover on the outside of the case is taken off. Tap on the outer race to remove the bearing.



FINAL DRIVE GEAR AND CASE ASSEMBLY



PULLING BEARING



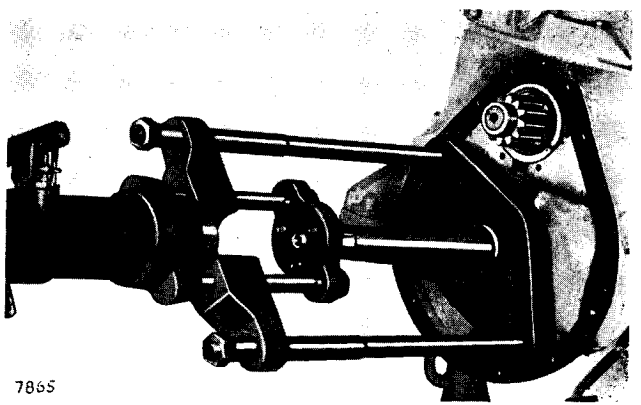
PULLING CUP

Slide the final drive gear and hub (19) from the sprocket shaft. Remove the bolts (20) and nuts to take off the final drive gear. When installing a new final drive gear, warming the gear may facilitate installation. The inner bearing and race (21) on the final drive gear hub may be removed using 8B7551 Bearing Pulling Attachment, 8B7548 Push Puller and a 3¾" diameter spacer as shown after the four bolts and nuts through the gear are removed. Pull the bearing cup (22) using 3B7084 Puller and two 3B7080 Screws as shown.

SPROCKET SHAFT

Remove the snap ring and pin, and unscrew the nut adjacent to the diagonal brace bearing with 1B1223 Wrench. Attach the sprocket shaft pulling arrangement as shown and pull the shaft. The following tools are used with the 1881-AA Hydraulic Press:

1—1B4644 Plate
2—3B7019 Stud
1—1B4648 Yoke
1—3B5243 Yoke
1—3B5992 Sleeve
1—1B4660 Spacer
4—1B4334 Nut
2—1899-A Stud



PULLING SPROCKET SHAFT

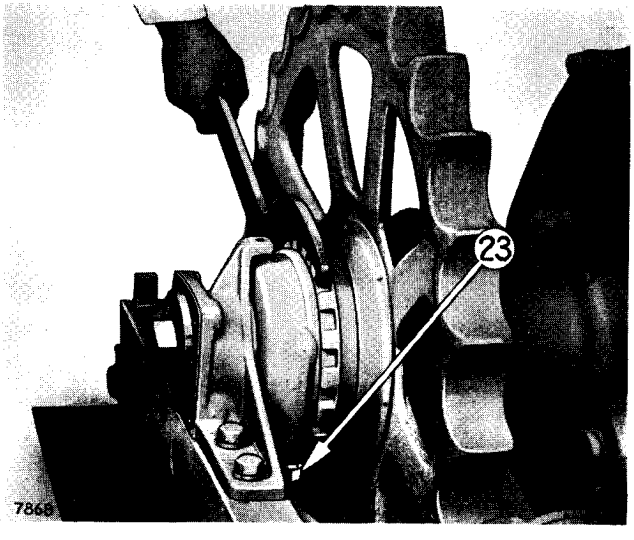
When installing a new shaft, drive the shaft into position using 3B7239 Nut on the end of the shaft. Chilling the shaft will facilitate installation. Securely tighten the nut adjacent to the diagonal brace bearing. Drill a 5/16" diameter hole through the nut 1 1/8" deep from the face of the hole in the nut and install the lock pin and snap ring.

SPROCKET INSTALLATION

Before installing the sprocket, make sure the tapered splines are clean and free from burrs. While tightening the retaining nut, drive with a sledge hammer against the sprocket until a "tight wedged" fit is obtained.

BEARING ADJUSTMENT

When assembling, the final drive tapered bearings should be pre-loaded by tightening the adjusting nut tight and then backing off one notch.



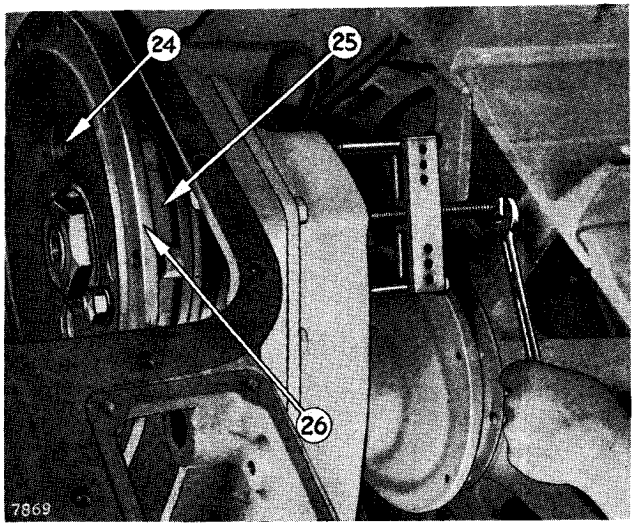
FINAL DRIVE BEARING ADJUSTMENT

Wrench S-1055 will fit the adjusting nut. An extension on the wrench handle will insure complete tightening of the nut. Be sure the bearing cage nuts (23) are loose when adjusting the bearings as shown.

FINAL DRIVE PINION

If only the final drive pinion and bearings are to be removed, it is not necessary to disassemble the final drive.

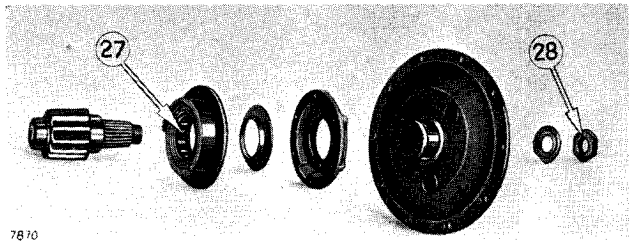
Remove the steering clutch assembly as outlined in the topic, STEERING CLUTCH ASSEMBLY, and take off the final drive pinion cover.



REMOVING FINAL DRIVE PINION

Remove the capscrews from the cover (25) through the hole (24) from which the stop is removed. Using the cross arm from an 8B7554 Bearing Cup Pulling Attachment and the screw from an 8B7546 Puller with two ½"—13 capscrews 5" long (1A8628), press the flange (26), cover (25), and pinion into the steering clutch compartment.

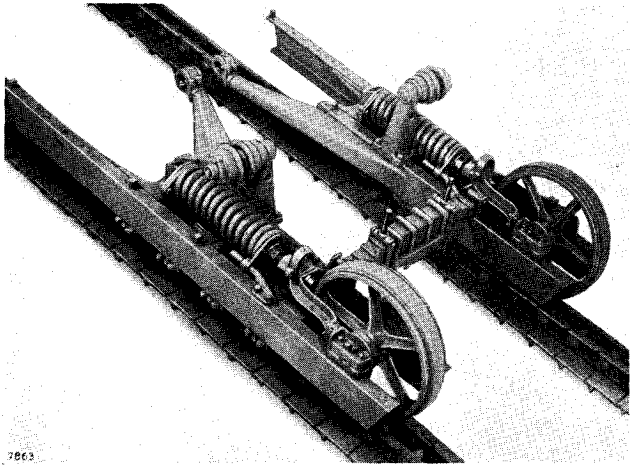
Remove the nut (28) and lock and press the pinion out of the flange. The bearing (27) in the cage may be removed and replaced if necessary. The bearing in the final drive cover may be tapped out and replaced if necessary.



FINAL DRIVE PINION ASSEMBLY

TRACK FRAME ASSEMBLY

THE track roller frame assembly provides a mounting for the track rollers, track carrier rollers, front idlers, recoil springs and equalizer spring. The weight of the tractor is carried through the frame to the rollers. The diagonal brace, welded to the inside of the frame, maintains correct track roller frame alignment. This construction allows each track frame to operate independently and to move up and down relative to one another by pivoting at the sprocket shaft.



Equalizer Spring

THE equalizer spring supports the front end of the tractor and transfers this load to the track frames. The auxiliary spring holds the equalizer spring in the equalizer spring saddle of the oil pan and permits the equalizer spring to oscillate when the track frames pivot at the sprocket shaft.

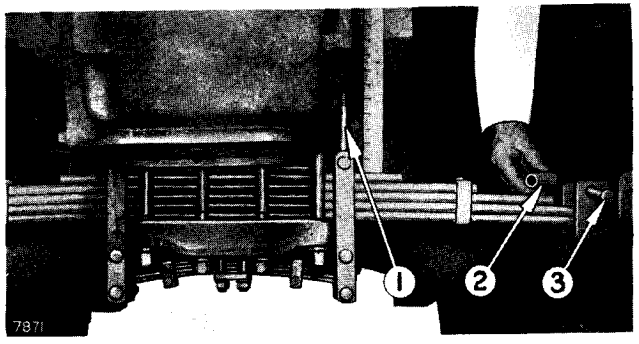
AUXILIARY SPRING REMOVAL

To remove the auxiliary spring, remove either engine side plate and loosen the nut on the shackle bolt until the shackle rests on the top of

the equalizer spring. Remove the cotter pins and shackle pins holding the equalizer spring to the shackles and remove the auxiliary spring.

EQUALIZER SPRING REMOVAL

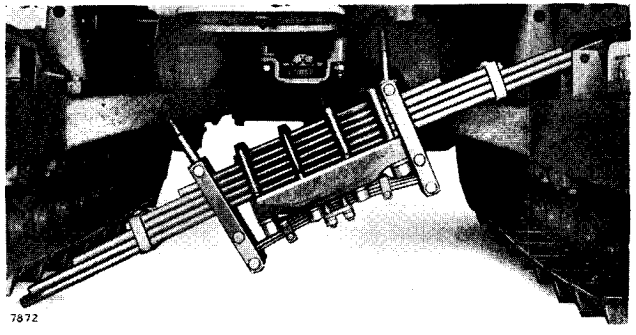
The equalizer spring and auxiliary spring can be removed as a unit. As a safety precaution, set the brakes to prevent the tractor from moving.



Remove the engine side plates and the nuts from the shackle bolts (1). Remove either front idler yoke guard and remove the cotter pin, pin (3) and sleeve (2) holding the equalizer spring in the bracket of the track frame.

Raise the front of the tractor until there is 10″ clearance between the top of the equalizer spring and the lower edge of the engine block.

Slide the equalizer and auxiliary springs to the side until the end of the spring is clear of the bracket on the other track frame and remove it from under the tractor.



Replacement of any leaf of the springs may be made after the nuts and clips are removed.

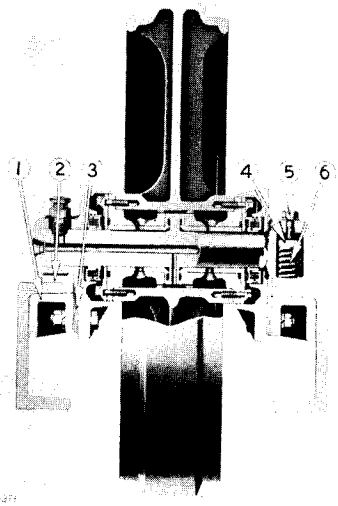
When installing the spring, care should be taken to see that the equalizer spring is centered in the saddle of the oil pan and that the auxiliary spring is centered in the plate of the equalizer spring.

It is important that the clip nuts on the springs be tightened periodically as a preventive against spring breakage.

Front Idler Assembly

THE front idler guides the track into position in front of the track rollers.

FRONT IDLER REMOVAL



CROSS-SECTION

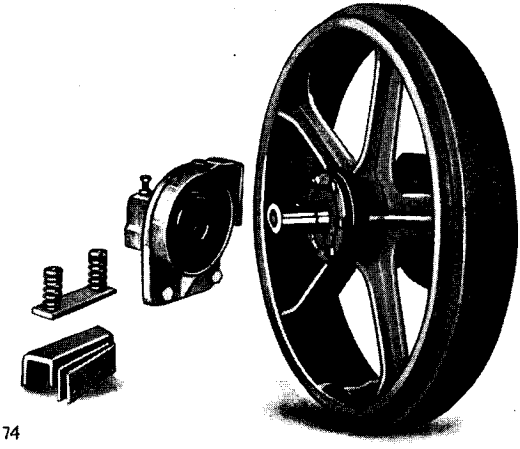
With the track separated and laid out flat, the front idler can be removed by taking out the capscrews connecting the yoke arms to the idler bearings. Loosen the capscrews (5) which keep the springs (6) in compression. Slide the idler assembly off the track frame taking care not to lose the wear plates (2), springs (6) or plates (4).

GUIDES

The guides (1) attached to the bottom of the idler bearings by bolts and nuts should be replaced if they are worn to ¼" in thickness where they contact the track frame.

BUSHINGS AND SEALS

The bushings and seals can be removed as recommended for track rollers after the nuts on top of the bearing are removed, the wedge pins driven out and the bearings taken off.



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FRONT IDLER BEARING ASSEMBLY

ALIGNMENT

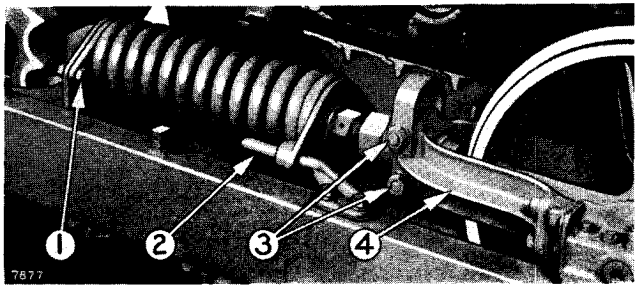
If unequal wear is observed on the sides of the raised center portion of the idler, the shims (3) should be shifted from between the bearing and guide on one side to between the bearing and guide on the other side to center the idler between the track links.

Recoil Spring

UNDER normal operating conditions, the track adjustment is controlled by the track adjusting nut. The recoil spring serves only to absorb shock loads transmitted to the track or to permit an object to pass between the front idler or sprocket and the track without damage to the parts.

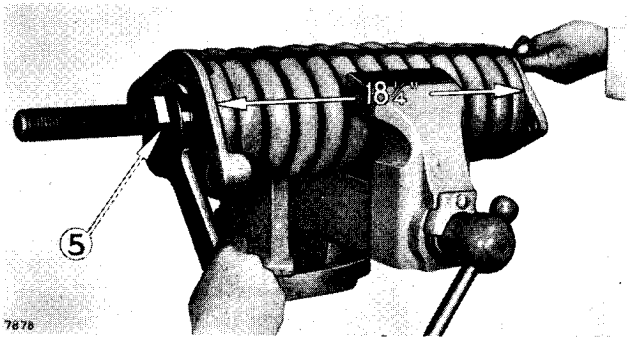
REMOVAL

Remove the recoil spring guards. Without separating the track, block between the rear of the front idler and the web of the track frame assembly. Loosen the track adjustment as much as possible. Remove the



RECOIL SPRING ASSEMBLY

nuts (3) and take off the outside yoke (4). Remove the recoil spring guides (2), the capscrews (1) through the seat and bracket, and lift out the recoil spring. Remove the adjusting nut.

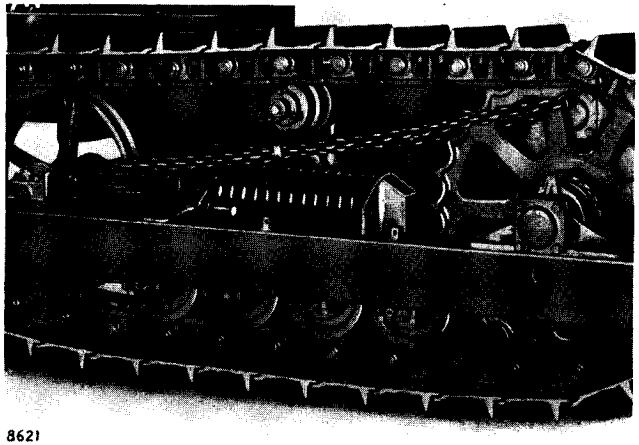


CHECKING LENGTH OF RECOIL SPRING

Remove the nut (5) to disassemble the spring. When assembling, tighten the nut as shown until the length of the recoil spring is 18¼" between the plate seats.

RECOIL SPRING BOLT

In the event a front idler recoil spring bolt is broken, all of the spring tension will be exerted against the track. To loosen the track enough to remove the master pin, place a heavy chain around the front idler and



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final drive sprocket as shown. Driving the tractor backward a few inches will pull the idler back so the track master pin can be removed. Then when the tractor is allowed to slowly move forward, the chain will gradually release the spring tension.

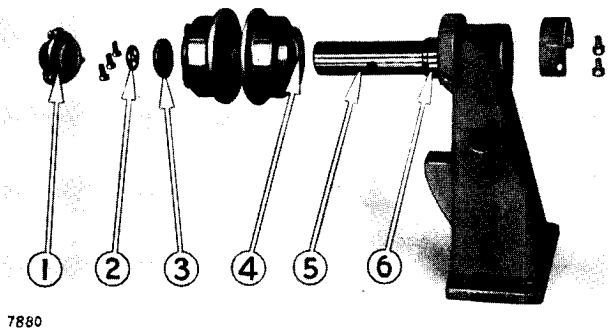
Track Carrier Rollers

THE track carrier rollers are of the cantilever type and are provided to support the weight of the track between the sprocket and the idler.

ROLLER REMOVAL

Insert a short piece of hardwood 2" by 4" or a 2" diameter pipe between the sprocket and track. Back up the tractor until the track clears the track carrier roller.

Remove the cap (1), capscrews, lock (2) and washer (3). Slide the roller off the shaft (5). A new seal can be installed after the snap ring (4) is removed. If the seal sleeve (6) is grooved, it can be cut with a chisel and removed. The new sleeve should be heated and slipped on the shaft.



TRACK CARRIER ROLLER ASSEMBLY

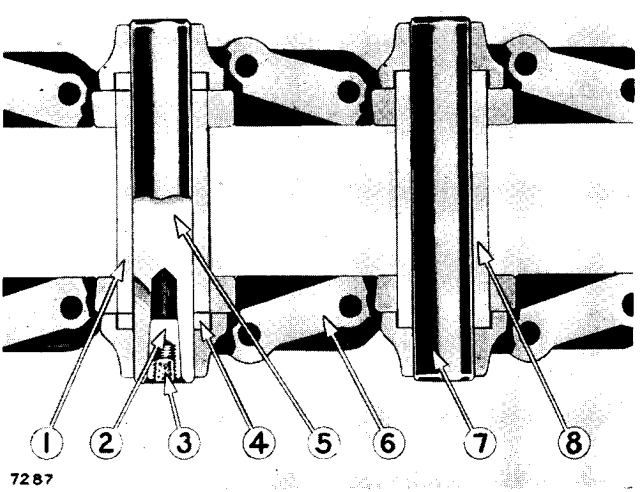
The shaft (5) may be pressed out of the bracket and a new one pressed in. When pressing in the new shaft, the distance between the end of the shaft and the face of the bracket must be $6\frac{7}{16}$".

BUSHINGS

The bushings can be pressed out of the roller by supporting the roller assembly and pressing on the bronze bushings.

Care should be taken not to damage the bushings when they are pressed in. White lead or kerosene should be used on the outside of a bushing when pressing it into position.

Track



CROSS-SECTION

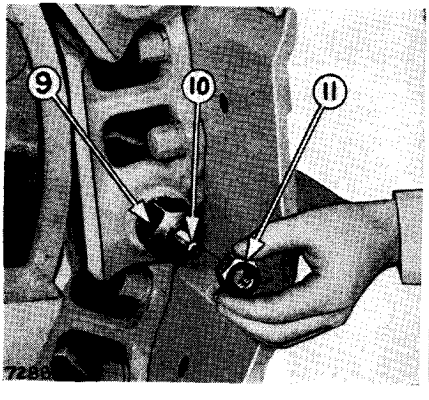
THE track link assembly consists of links, pins and bushings. As shown, each link (6) overlaps the preceding link thus forming a continuous chain. Each link is counterbored in the overlapped portion to provide a tight, well sealed joint and reduce the entrance of abrasives. The bushings (8) are all alike except the master bushing (1) which is shorter for assembly purposes. With the master bushing, collars (4) are inserted in the counterbored space. The pins (7) are alike except the master pin (5) which is taper reamed and split for 1¾" at each end. This construction permits the tapered plug (2) to be driven into the master pin to hold the pin in position in the links. The cork (3) protects the threads in the plug.

SEPARATING TRACK

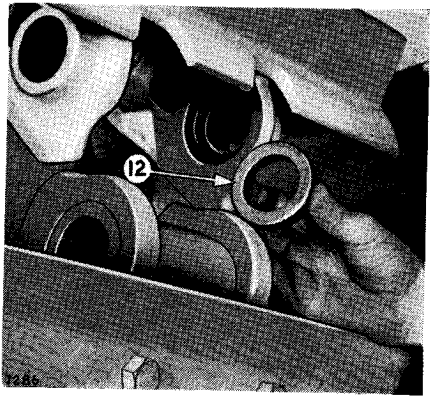
Loosen the track adjustment as much as possible. Place a block approximately 12" high in front of the track and drive the tractor forward so the track shoe below the master pin rides on the block and the slack is taken out of the bottom portion of the track. The master pin will then be in a position in front of the idler and approximately even with the top of the track roller frame. Set the brake so the slack in the track will remain in the top portion.

Remove the cork from the master pin plug and pull the plug on the outside of the track using 2B2108 Sleeve (9), 3B1027 Screw (10) and 3B1028 Nut (11). Drive out the master pin using a punch inserted in the plug hole of the master pin. Do not damage the tapered bore in the master pin. Remove the collars (12).

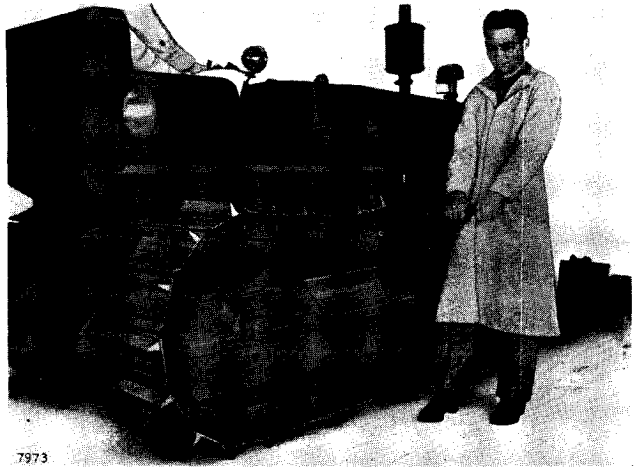
Using a bar as shown, slowly back up the tractor to lay out the track. In the interest of personal safety, always hold the bar from the side as shown whether removing or replacing the track.



REMOVING MASTER PIN PLUG



MASTER BUSHING COLLAR



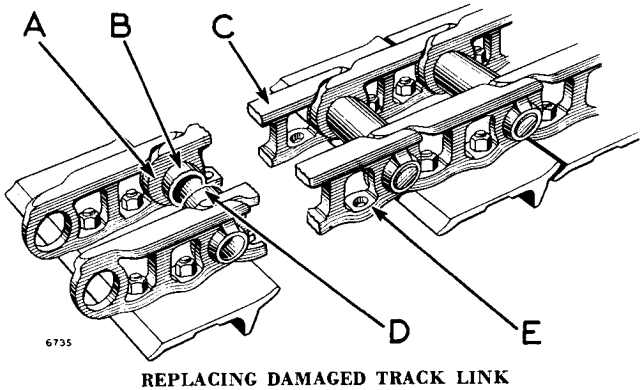
REMOVING TRACK ASSEMBLY

To replace the track, back the tractor until the sprocket is just ahead of the rear end of the track. With the bar in the track, aid the track to climb up and over the sprocket, carrier roller and idler as the tractor is driven slowly forward. With the block under the first track shoe, the track will come together. Be sure to install the collars. Drive the master pin in after the other master pin plug has been removed. Clean the tapered plugs and the mating surfaces in the master pin and dry thoroughly before driving the master pin plugs in place. Install the corks.

TRACK LINKS

A damaged track link not adjacent to the master pin can be replaced without disassembling the track.

Remove the shoe from the track links in question. Press out the track pins at both ends of the track link. It will not be necessary to cut both links as shown in the accompanying illustration. Cut in two the link



REPLACING DAMAGED TRACK LINK

to be replaced and a $\frac{5}{8}$" section out of the bushing with a torch. Remove the cut link (A) and bushing (B), the other portion of the cut link (C) and then the other link (E) and the remaining portion of the bushing (D).

Due to the possibility of uneven wear, press two new links on the track. Install a standard track pin in the overlapping portions of the new links and a master bushing at the opposite ends. Insert collars in the counterbore of the mating links and press in a master pin. Install master pin plugs and corks.

TRACK PINS AND BUSHINGS

To obtain maximum life of track pins and bushings, the wear on the outer diameter of the bushing should not exceed $\frac{1}{16}$" before turning. To turn pins and bushings, they should be pressed out, rotated 180° and reinstalled to obtain new contact surfaces.

REMOVAL

There are two types of presses for track reconditioning:

1. Heavy duty hand press
2. Portable power press

These illustrations show the use of a heavy duty power press.

Press out the track pins using a pin adapter and pushing pin (Fig. 1).

Press the bushing out of one link using the jaws and bushing pusher (Fig. 2). Turn the link around and then press the bushing out of the single link.

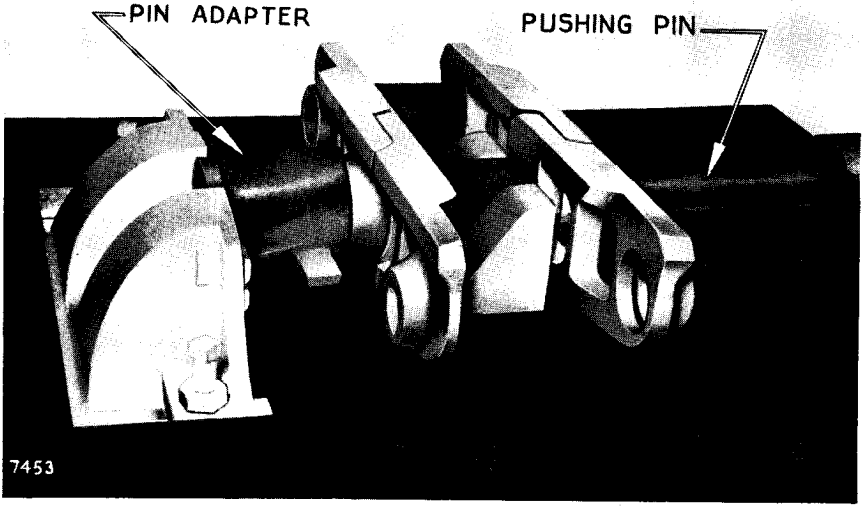


FIGURE 1

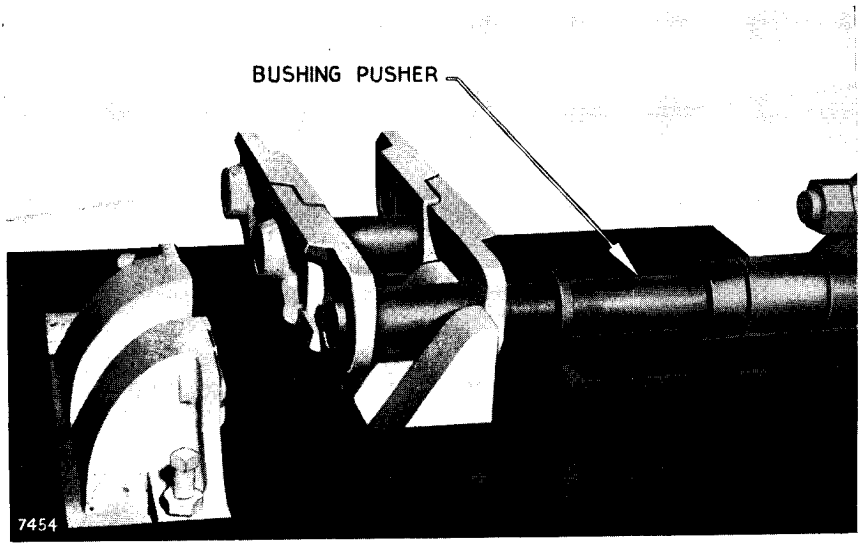


FIGURE II

Press the bushing in place using a bushing adapter, bushing assembly pin and bushing collar (Fig. 3).

Place one of the next links in position with the counterbored portion on the bushing previously installed. With the pilot pin in place, press the bushing in position using the bushing adapter, bushing assembly pin and bushing collar (Fig. 4).

After the bushings are pressed into position, press in the track pins.

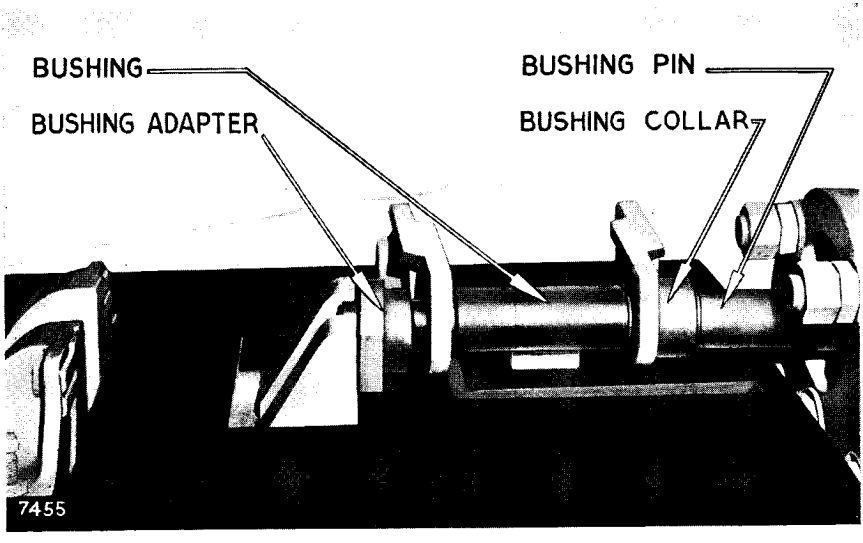


FIGURE III

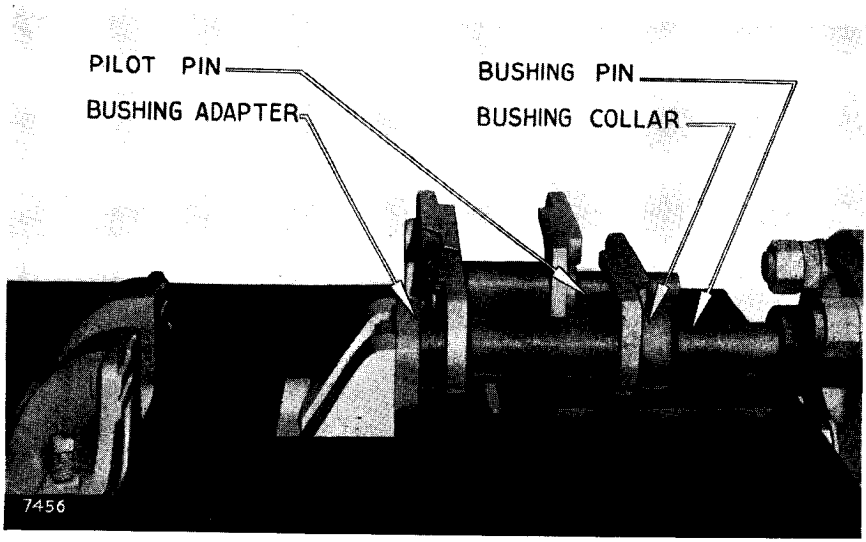
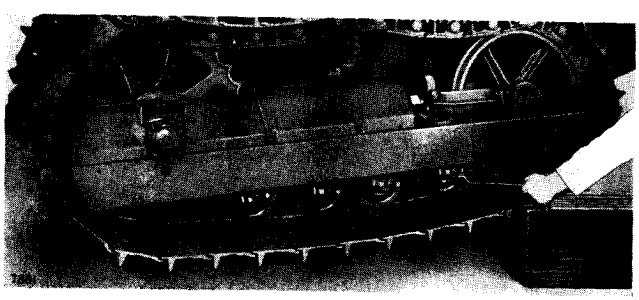


FIGURE IV

Track Rollers

TRACK rollers are used to guide the track and to distribute the weight of the tractor over a large ground area. Track roller frames having four track rollers are arranged with a single flange roller at the front and rear positions and two double flange rollers in the middle positions. Track roller frames having five track rollers, use a double flange roller at the front followed by a single flange roller, two double flange rollers and single flange roller. The track rollers are of the center thrust construction in which the flange at the center of the track roller shaft takes the side thrust of the roller and restricts the side movement of the roller assembly. The amount of side movement is controlled by the machining limits of the track roller bushings, track roller overall width and the shaft flange width.

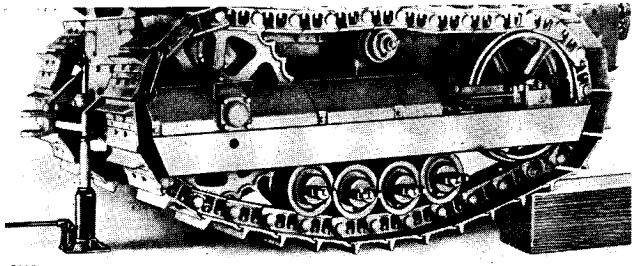
REMOVING ROLLER ASSEMBLIES



LOOSENING TRACK ROLLER END COLLARS

Remove the front idler yoke guard and loosen the track adjustment as much as possible. Place a block approximately 12″ high in front of the track and drive the tractor forward so the end of the block is under the idler as shown.

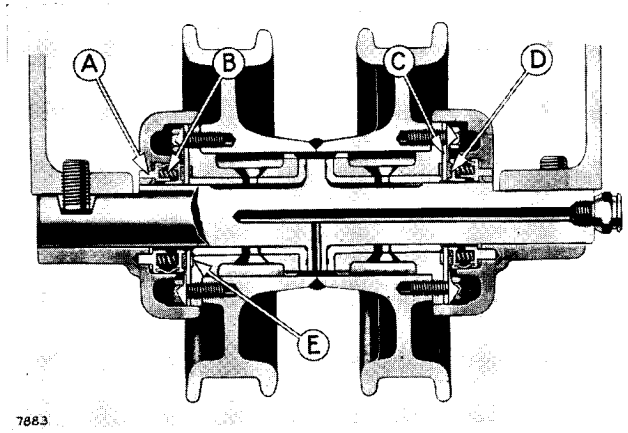
Remove the capscrews through the track roller end collars which hold the track roller to the track frame. Jack up the rear end of the tractor approximately 8″. Start the engine and disengage the steering clutch and engage the brake on the side of the tractor from which the rollers are *not* to be removed. Shift the tractor into reverse gear and remove the slack from the top of the track. The track rollers may then be lifted out.



REMOVING TRACK ROLLER ASSEMBLIES

In this manner, any of the rollers may be removed without disturbing the other track rollers.

With the track roller assemblies out of the machine, the end collars can be slid off the shaft and the capscrews that hold the chromium plated washers (C) and composite bushings in position can be taken out. The face-type bellows seals (B), which are held in position by four dowels (A) in the end collar, should be replaced if worn. New leather seals



(D) should be soaked in warm mineral oil for about ½ hour before installing. The chromium plated washer may be turned over when necessary to provide a new wearing surface. It should be replaced if both sides are rough or worn. Replace the cork gasket (E).

REMOVING BUSHINGS

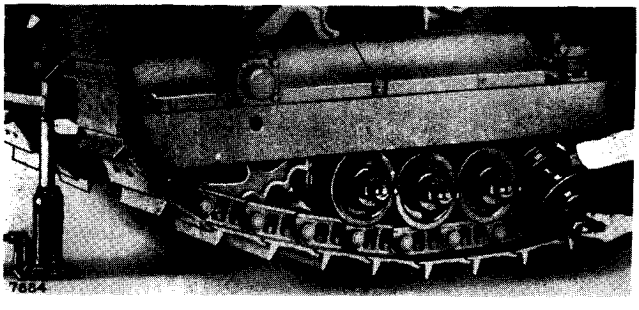
The composite bushings may be pressed out of the roller hub by supporting the roller assembly and pressing on the end of the track roller shaft. If the cast iron bushing is not damaged, replace only the bronze bushing.

INSTALLING BUSHINGS

Care should be taken when pressing the composite bushings in place to see that the capscrew holes in the flange of the bushing are held in alignment with the capscrew holes in the track roller assembly. This can be done by screwing studs (one on either side of the bore) in the roller hub to act as guides. White lead or kerosene should be used on the outside of the bushing assembly when pressing it into place.

INSTALLING ROLLER ASSEMBLIES

When installing rollers, care must be taken that the face-type bellows seals remain located in the end collars. Place the track rollers in their proper relative locations on the track. Start the engine, shift the tractor into first gear, disengage the steering clutch and engage the brake on the side of the tractor on which the track rollers are not to be replaced. Remove the slack from the bottom of the track. Then remove



INSTALLING TRACK ROLLER ASSEMBLIES

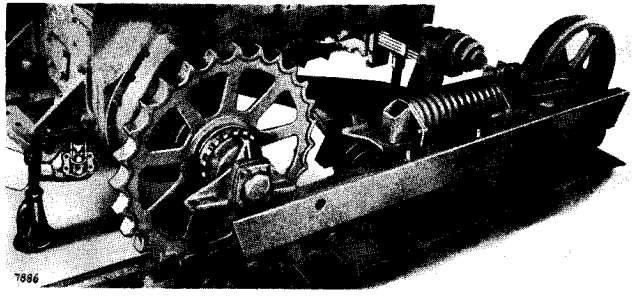
the jack from the rear of the tractor, at the same time guiding the track rollers into their proper positions. The track roller end collars will then be within ½" of the track frame and the capscrews for the end collars can be installed and tightened. This will lift the track rollers into position. With this method, it will not be necessary to lift the track roller at any time except when removing and replacing it on the track.

When the track rollers are installed, particular attention should be given that the notched end of the track roller shaft is clamped tightly by the end collar against the guide strip on the bottom of the track roller frame.

Track Roller Frame Assembly

THE track roller frame assembly can be removed as a unit for servicing any assemblies mounted on it. Separate the track and lay it out flat. Take off the diagonal brace bearing cap. If the diagonal brace bearing is damaged or worn, it should be replaced with a new bearing. Remove the capscrews holding the sprocket shaft outer bearing to the track frame assembly. Remove the lubricant fitting for the bearing through the opening in the side of the track frame. Check the clearance between the outer bushing and holder assembly as outlined in the topic, FINAL DRIVE ASSEMBLY and replace the bushing if damaged or if worn beyond the specified clearance.

Remove the cotter pin, pin and sleeve from the equalizer spring bracket on the track frame and jack up the equalizer spring enough to clear the track frame assembly. Securely block the equalizer spring so that it will not fall. Jack up the rear of the tractor until 3″ clearance exists



TRACK ROLLER FRAME REMOVAL

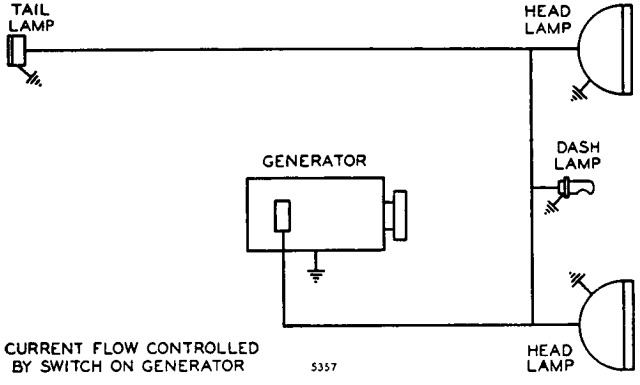
between the bottom of the sprocket shaft outer bearing and the track frame. Pry the front end of the track and track roller frame assembly out until the equalizer spring is free of its bracket on the track frame. The track frame assembly can now be rolled out and turned over if desired for further work.

ATTACHMENTS

Lighting Systems

LIGHTING systems may be divided into two groups—those without a battery and those with a battery.

In a lighting system without a battery, the amount of electrical load imposed on the generator should be watched carefully so that a generator will never have a total electrical load greater than its rated output.



WIRING DIAGRAM (WITHOUT BATTERY)

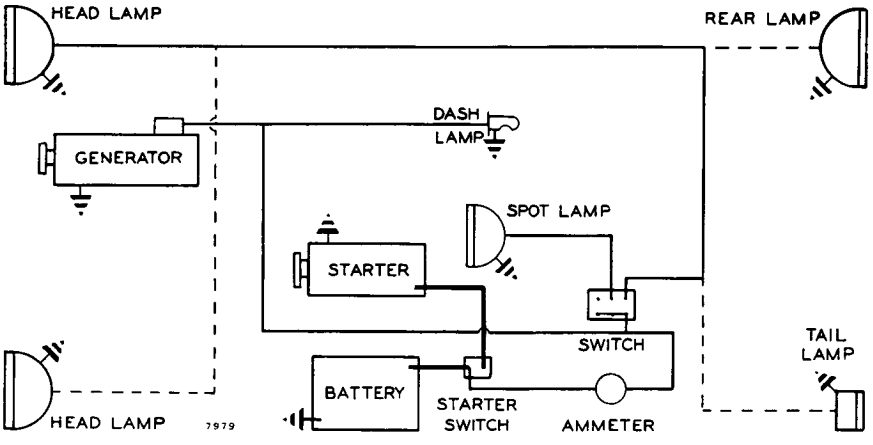
The electrical load can be estimated quite accurately in this manner: Mazda bulbs consume approximately 1 watt per candlepower. In connecting lights to a generator, without batteries, the candlepower of the lamp bulbs used should be calculated in terms of watts and the total maximum power demand kept within the rated capacity of the generator.

EXAMPLE

Lights Used	*Rating per Bulb*	*Total Watts*
2—Head Lamps	32 C.P.	64
1—Dash Light	3 C.P.	3
1—Tail Light	3 C.P.	3
		70

In this case, a 75 watt generator or larger should be used to carry the electrical load. If, however, an additional 32 candlepower light were used, the total load would then be increased to 102 candlepower. This would mean a consumption of approximately 100 watts, thus requiring a generator capacity in excess of the total load.

Lighting systems with a battery have a different type of generator. These generators are rated at 90 to 175 watts. They will take care of an overload for limited use, if run during the day to offset the excess current consumption at night.



WIRING DIAGRAM (WITH BATTERY)

Care should be taken to see that all connections are clean and tight. If the battery ground connection is broken in a lighting system with a battery, the generator voltage will rise rapidly, thus resulting in burned out bulbs and possible damage to the generator itself.

The 6 volt-90 watt generator, and 6 volt-175 watt generator are both used with a battery. These generators are of similar construction and will be discussed together. The 6 volt-130 watt generator is used without a battery and due to different type construction will be handled individually. These generators are all mounted on the right hand side of the engine and are driven by the camshaft gear.

LIGHTS

Prefocused, 32 candlepower, 6-8 volt light bulbs are used in the lamps. The light switch is located on the battery box.

Additional lamps when installed should be connected in the system past the ammeter so the current drawn will be indicated. For information regarding the requirements of the additional lamps and the capacity of the generator, refer to the topic, LIGHTING SYSTEMS.

A 3 candlepower, 6-8 volt light bulb is used in the dash lamp.

All wires should be checked periodically for worn spots on the insulation which might cause a short circuit. All connections should be kept clean and tight.

BATTERY

The electrolyte level in the battery should be checked every other day during the summer and at least once a week during the winter months. The electrolyte in the battery should be maintained at a level $\frac{3}{8}$" above the top of the plates by adding pure distilled water to each cell. Failure to maintain the proper electrolyte level will cause damage to the plates and reduce the capacity of the battery.

When distilled water is added to the battery during freezing weather, operate the generator for ten or fifteen minutes to mix thoroughly the distilled water with the electrolyte in the battery. This will eliminate the possibility of the water freezing and cracking the battery case.

CAUTION: *Never add acid, patent solutions or charging liquids to the battery electrolyte.*

The state of charge of a battery should be checked with a hydrometer every 60 hours. The following hydrometer readings indicate the charge condition:

Full charge	—1.275-1.290
Half charge	—1.225
Dangerously low	—1.150

In order to prevent freezing during cold weather, the hydrometer reading should be at least 1.250.

Keep the battery and its carrier and compartment clean and dry. Clean all accumulations of dust and dirt from the top of the battery. Such dust accumulations on a damp or rainy day may combine with moisture to form an electrical conductor and discharge the battery.

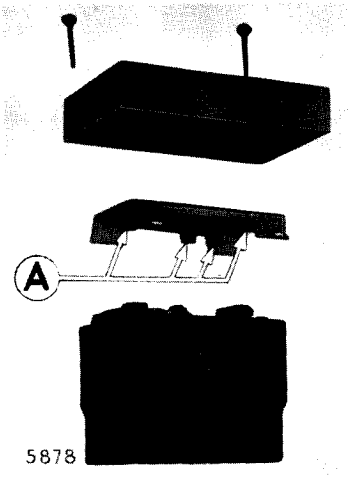
Keep the battery securely fastened in its compartment at all times.

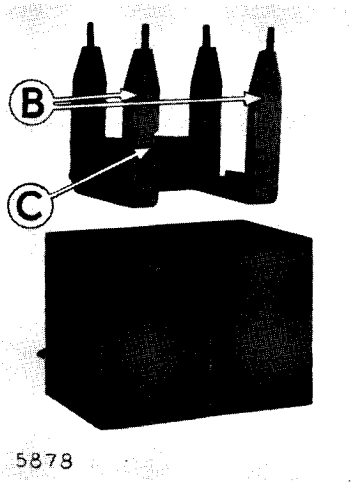
Keep the battery terminals and leads clean and tight. To clean corrosion from the battery terminals, scrub the terminals with a weak solution of bicarbonate of soda (baking soda) and water. Dry the battery thoroughly. Coat the terminals with petrolatum to prevent corrosion.

Disconnect, thoroughly clean and inspect the other terminals of the battery cables periodically to insure good connections. Securely tighten the terminals when finished.

BATTERY BOX

The battery box is mounted on the left hand fender within easy reach of the operator. The electric starting motor switch, ammeter and lighting switch are attached to the rear face of the box. Any of these may be removed by taking out the screws and nuts holding them in position.





The battery holder is constructed so as to "float" the battery on rubber.

The rubber bumper blocks (A) in the top of the battery support press against the terminals and battery posts to hold the battery firmly. Remove the nuts holding the top to the inner frame of the bottom battery support and lift off the top. Disconnect the battery cables and lift out the battery.

The rubber blocks (B) form the shock absorbing connecting links between the inner and outer support frames of the bottom battery support. These rubber blocks carry the weight of the battery and absorb vibration. The cross piece on the outer support frame has a capscrew (C) for attaching the battery ground cable. Remove the bolts and nuts holding the bottom support frame and battery box to the fender and lift out the bottom support frame.

Clean the battery box, battery support and battery of all accumulations of dust and dirt. Such accumulations, if present in sufficient quantities, may reduce the shock absorbing qualities of the battery support.

Generators

(90 AND 175 WATT)

THE recommended output of the 90 and 175 watt generators used with battery installations is shown in the following chart:

	Field Current at 6 Volts	HOT OUTPUT		
Generator	*(Amps.)*	*Amps.*	*Volts*	*Approx. R.P.M.*
90 Watt	4.0-6.1	11-14	7.5-7.85	1700-1800
175 Watt	1.53-1.67	21-23	7.0	1600

The generator output should be checked and adjusted at the voltage specified in the chart, since the generator output increases with generator voltage. Normally, if the generator is checked with an accurate ammeter and a fully charged battery, the proper voltage will be developed. If a fully charged battery is not available, it will be necessary to cut-in resistance until the proper voltage is obtained. This can be done by inserting into the charging circuit a ¼ ohm variable resistance of sufficient current carrying capacity to handle the load. See the topic, VOLTAGE REGULATOR. Connections for checking the output are shown in the sketch.

The generator output can be varied by moving the third brush as outlined in the topic BRUSHES. The output should never be set higher than recommended. If the battery continually overcharges and the regulator and generator are in proper operating condition, the charging rate should be decreased until a balance exists between the current requirements and the state of charge of the battery. Excessive output will result in an overcharged battery, light bulb failure and burned contact points and generator windings.

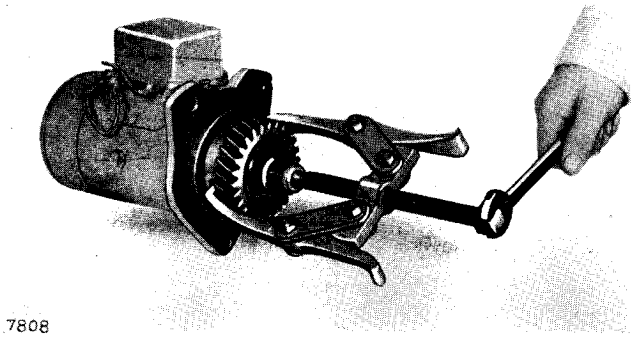
If the brushes are in good condition, the third brush properly adjusted and the regulator functioning as it should, and yet the generator output does not check with the specified current and voltage values, the unit should be disassembled and checked. If the bearings are worn, they should be replaced.

REMOVAL

Disconnect the generator lead, take out the capscrews holding the generator to the housing and remove the generator.

DRIVE GEAR

Remove the cotter pin and nut, and pull the drive gear with an 8B7546 Puller. Remove the key and shield.

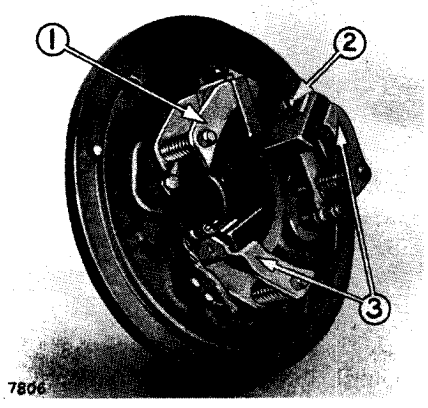


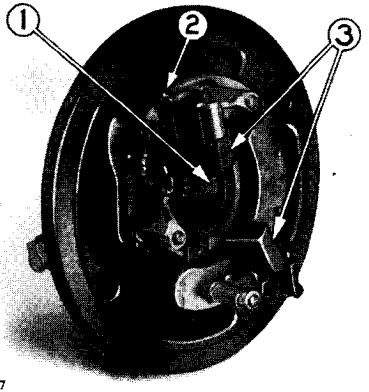
PULLING DRIVE GEAR

BRUSHES

ADJUSTMENT

These generators have an adjustable third brush (1) in addition to two fixed brushes (3). To vary the generator output, loosen the locking screw





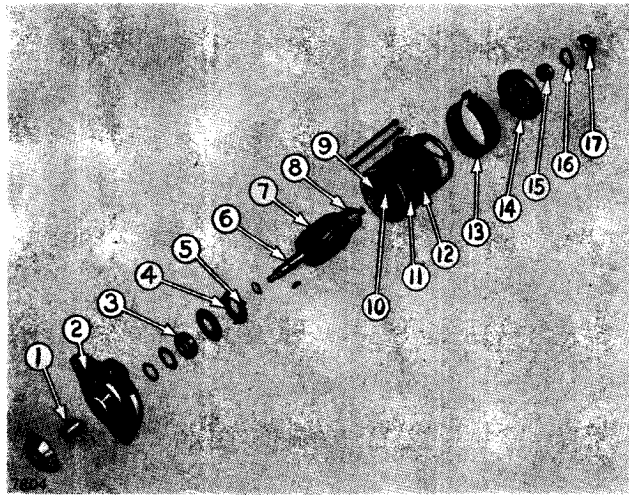
GENERATOR BRUSHES

on the rear cover of the generator and rotate the third brush in the direction of armature rotation to increase the ampere output of the generator or in the reverse direction to decrease the ampere output. Tighten the locking screw securely after making an adjustment.

TESTING: Remove all carbon dust from the brush holders and cover to insure that the brushes are not grounded. Check the lead from each carbon brush for a loose connection in the brush.

REPLACEMENT

If the brushes are worn or covered with oil, they should be replaced. Remove the tie bolts and take off the brush holder plate. Remove the screw (2) and install a new brush. New brushes may be installed through the openings under inspection cover (13).



90 WATT GENERATOR

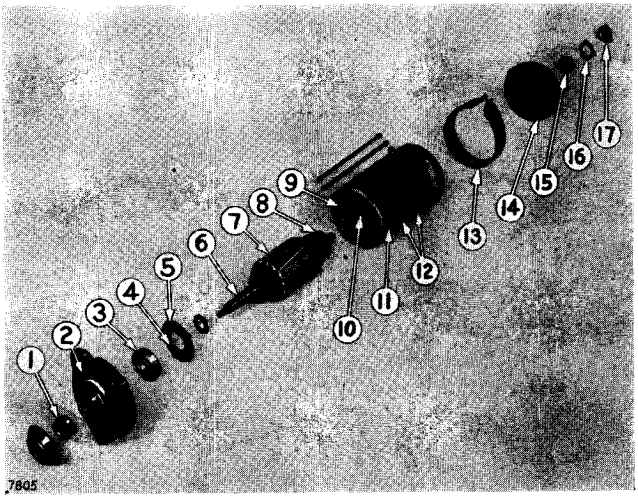
New brushes should not be sanded-in but should be seated using a bedding stone. With the engine operating at low idle speed, press the bedding stone firmly against the commutator and move it back and forth along the commutator to cover the area contacted by the brushes. The brushes should seat in a second or two. Clean the generator with air to remove all particles of abrasive. New brushes on the 90 watt generators may be seated with either "00" sandpaper or a bedding stone.

BRUSH HOLDER SPRINGS

If the brush holder springs have lost their tension, they should be replaced. On 90 watt generators, the spring tension should be 16 oz. while on 175 watt generators, the tension should be 25 oz. The third brush spring tension on both generators should be 17 oz.

BEARINGS

Remove the cover (17) and gasket (16). The bearing (15) will slip out of the end plate (14) and should be replaced if damaged.

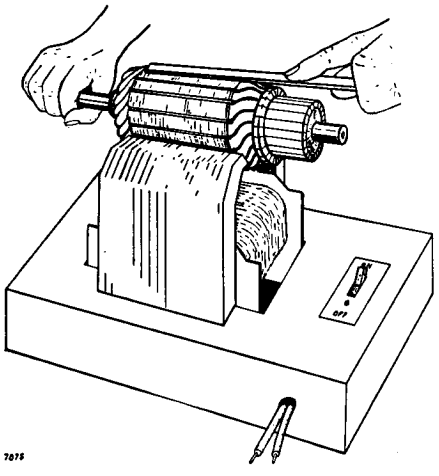


175 WATT GENERATOR

Remove the cover (2). Take out the locking wire through the screws (5), remove the screws (5), plate (4), and gasket. Slide out the bearing (3). A plate holds the felt washer in the cover (2) on 90 watt generators. This plate should be installed with the extended portion toward the drive end of the generator. The 175 watt generator has a felt washer in the cover (2). This washer is secured with a cup retainer pressed into the end cover. The spacer (1) locates the bearing (3) on the armature shaft (6). Pack the bearings with a high melting point grease before installing.

ARMATURE

Slide the armature (7) out of the stator (11). With a battery and 6 volt lamp connected in series, place one lead on the armature shaft and the other lead on each segment of the commutator (8) in succession. If the test lamp lights between any one segment and the shaft, the armature is grounded and should be replaced. If the test lamp does not light, the armature is not grounded.



CHECKING WITH GROWLER

To test the armature for a short, clean out between the commutator bars, place the armature on a growler with a hacksaw blade over the armature core and rotate the armature. If the blade does not vibrate, the armature is not shorted. If the blade vibrates, the armature is short circuited and should be replaced.

COMMUTATOR

Check the commutator (8) for roughness. If rough, it should be turned down in a lathe just enough to remove roughness and then sanded with "00" sandpaper. The commutator should check for concentricity. Undercut the mica between each segment $\frac{1}{32}$" with a hacksaw blade.

If the surface of the commutator is only glazed or darkened, polish with "00" sandpaper. Clean out the generator with air to remove abrasives.

FIELD WINDING OR STATOR

The field windings should be tested for a continuous circuit, ground and coil balance.

CONTINUOUS CIRCUIT: To test for a continuous circuit, connect a battery and a 6 volt lamp in series. Place the lead from the battery on the field (F) terminal of the generator and the lead from the lamp on the brush lead. If the lamp does not light, the field coils are open-circuited and should be replaced.

GROUND: To test for a ground, connect a battery and 6 volt lamp in series. Place the lead from the battery on the field (F) terminal of the generator and the lead from the lamp on the generator case. If the test lamp lights, the fields are grounded and should be replaced.

FIELD COIL BALANCING TEST: Connect a 6 volt battery and ammeter in series. Slide the insulation off the wire connection between the two fields. Connect the lead from the battery to this wire connection. First place the other lead on the field (F) terminal of the generator and note the ammeter reading. Second, place the same lead on the brush terminal of the windings and note the ammeter reading. If one field coil draws more current than the other, there is an internal short in that field coil and the coil should be replaced.

Removal: To replace the field coils (9) remove the screws (12) and pole shoes (10) and take out the coils. Use *rosin flux* in making all soldered connections. Check to make sure that the coils are installed in the same position as the coils which were taken out.

INSTALLATION

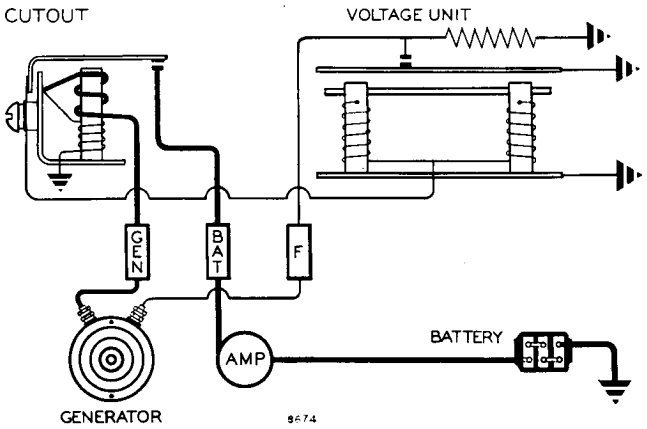
After the generator has been installed on the engine and reconnected, always connect momentarily with a jumper lead between the generator (GEN) terminal and battery (BAT) terminal of the regulator before

starting the engine. This allows a momentary surge of current to pass from the battery to the generator which will automatically give the generator the correct polarity with respect to the battery it is to charge.

Never operate the generator on an open circuit as this will allow the generator voltage to build up dangerously high and result in complete generator failure.

REGULATOR

The regulator for 90 and 175 watt generators consist of a cut-out relay and a voltage regulator.

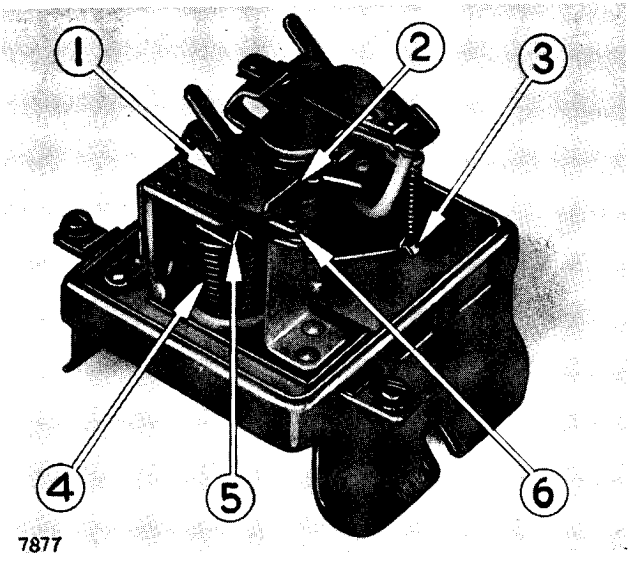


CUT-OUT RELAY

The cut-out relay automatically closes the circuit between the generator and the battery when the generator voltage is sufficient to charge the battery. The cut-out relay also automatically opens the circuit between the generator and battery when the generator voltage is not sufficient to charge the battery thus preventing the battery from discharging back through the generator windings.

TESTING: Disconnect the battery wire from the battery (BAT) terminal of the regulator. Connect an ammeter in series at this point with the positive lead of the ammeter on the battery terminal of the regulator and the negative lead on the battery wire. Connect the positive lead of a voltmeter to the generator (GEN) terminal of the regulator and ground the negative lead of the voltmeter. Start the engine, increase its speed and note the voltage at which the cut-out relay contact points (6) close. This should be 6.3 to 6.9 volts. Decrease the engine speed and note the amperage at which the contact points open. This should be 0 to 3 amperes.

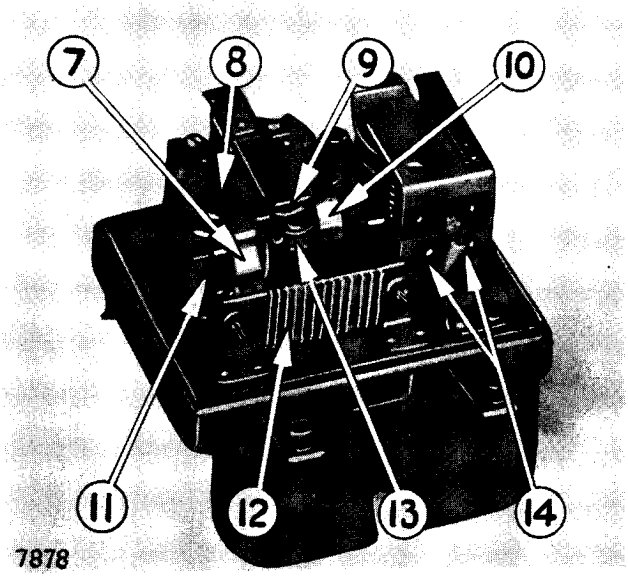
If necessary, adjust the closing voltage of the regulator by bending the spring post (5) up to increase the closing voltage and down to decrease the closing voltage.



Recheck the amperage to open the contact points. If the opening amperage is not between 0 to 3 amperes, check the air gap between the core (4) and the cut-out relay armature (1).

AIR GAP

Press the armature (1) down directly above the center of the core (4) until the points (6) just close. The air gap between the center of the core (4) and the armature (1) should be .020". Adjust the gap by loos-



ening the screws (14) on the back of the armature and raising or lowering the armature (1) as required. Tighten the screws (14) securely after adjustment.

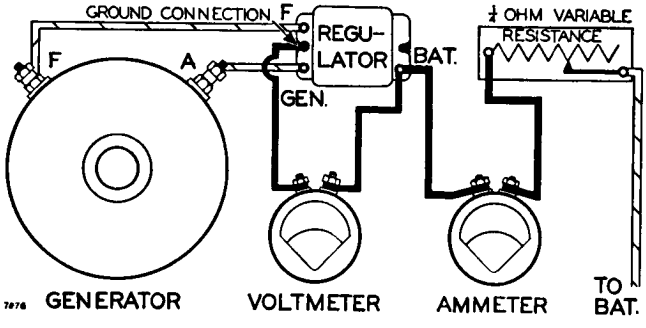
CUT-OUT RELAY POINT GAP: Adjust the contact point gap (6) to .020" by bending the upper armature stop (2) upward to increase the gap or downward to decrease the gap.

After adjusting the air gap and cut-out relay point gap, recheck and adjust if necessary the closing voltage and opening amperage of the cut-out relay as outlined under the topic, TESTING.

VOLTAGE REGULATOR

The voltage regulator functions to insert resistance into the generator field and thus reduce generator output when the battery becomes fully charged.

TESTING: Connect a voltmeter, ammeter, and variable resistance (1/4 ohm) as shown. Gradually increase the engine speed and note the voltage at which the voltage control contact points open. Decrease the speed and note the voltage at which the points close. NOTE: Readings should



be taken with the regulator at operating temperature and the cover in place. The contact points (9) should open between 7.75 and 8.2 volts. The points should close between 6.55 and 7.1 volts.

If the battery is in a low state of charge, the voltage will not be sufficient to operate the voltage control contacts. To obtain sufficient voltage, operate the generator at medium speed and slowly cut in resistance until the voltage control contact points open. Then cut out resistance until they close. Adjust the voltage setting by bending the spiral spring hanger (3) down to increase the voltage setting and up to decrease the voltage setting. Recheck the opening voltage of the contact points (9). If the opening voltage is not between a range of 7.75 to 8.2 volts, check the air gap above the cores and the contact point gap.

AIR GAP

Press the armature (8) down until it just contacts the lower stop (7). The air gap between the cores (11) and the armature (8) should measure .035". Adjust the gap by bending the lower stop (7) as required. The armature travel should be .035". The correct amount of travel may be obtained by bending the upper armature stop (10).

CONTACT POINT GAP

Press the armature down until it just rests on the stop (7). The gap between the contact points (9) should be .010". Adjust the gap by bending the stop (13) as required.

After adjusting the air gap and the contact point gap, recheck and adjust if necessary the closing and opening voltage of the voltage regulator contact points as outlined under the topic, TESTING.

CLEANING CONTACT POINTS

Properly cleaning the contact points of the voltage regulator is important. Dirty or oxidized contact points arc and burn and thus cause reduced generator output and run down batteries. If the points are properly cleaned, the regulator will be restored to normal operation. If improperly cleaned, *improvement in performance will be small and only temporary*. The points should be cleaned one at a time with a spoon or riffler file. Loosen the two contact mounting screws so the upper contact bracket can be swung to one side or the contact bracket removed entirely. A flat file cannot be used successfully to clean contact points, since it will not touch the center of the flat point, and will not clean out the slight cavity formed in the point surface during normal operation. Adjust the *air gap* after cleaning the contact points. *Never use sandpaper or emery cloth to clean the contact points.*

Generator

(American Bosch ARKF Series)

NOTE: The numbers given in the following paragraphs are reference numbers only and refer to Figure 1. They should never be used in ordering service parts. Tool numbers refer to special tools available from the American Bosch Corp., Springfield, Mass.

The Generator:

The generator is of the two-brush shunt-wound type with a voltage regulator (32), sealed in the housing (30), located on top of the generator.

The cylindrical generator frame (15) contains the pole shoes (16) and field coils (19). The armature (18) rotates in grease-packed ball bearings (4 and 26) mounted in their respective end plates (2 and 28). Brush holders (25), brushes (27) and brush springs (29) are contained in the

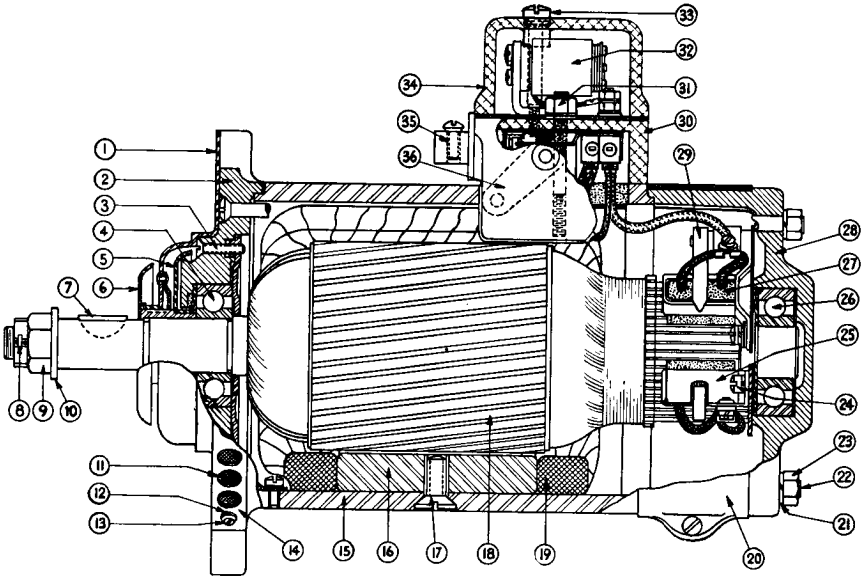


FIGURE 1

commutator end plate (28). A removable brush inspection garter band (20) protects these parts against the entrance of dust, dirt and foreign matter. A terminal block (35) secured to the saddle of the regulator assembly readily permits the attachment of an external load.

The switch mechanism, located in the hollow base (30) of the regulator is operated by the lever (36). The switch positions OFF and ON are engraved in the regulator saddle.

With the switch in the OFF position, only the generator field (19) is connected across the commutator; the external load remains disconnected.

With the switch in the ON position, both the generator field (19) and the external load are connected across the commutator.

DISASSEMBLY

To facilitate the reassembling of the generator and the regulator, it is suggested that the parts be laid on a clean bench or placed in a clean pan in the order in which they are disassembled.

Remove from the regulator the cover fastening screws (33), cover (34) and base holding screws or nuts (31). Loosen the cables in the base (30) and withdraw the complete regulator and base assembly.

1. Remove the cotter pin (8), hexagon nut (9), washer (10), woodruff key (7) and oil thrower (6) from the drive end of the armature.

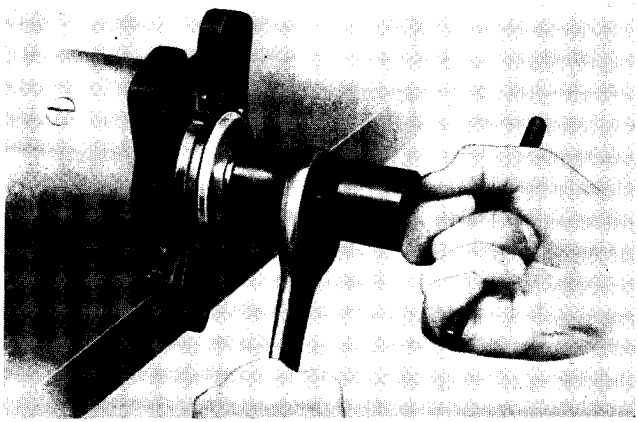


FIGURE 2

2. Withdraw the flange baffle plate fastening screws and remove the baffle plate (1).
3. Remove the oil slinger (5) using tool TSE 602—see Figure 2.
4. Withdraw the bearing retaining plate fastening screws (3).
5. Remove the garter band (20) and loosen the field coil leads from the brush holders.
6. Remove the through bolt hexagon nut (23), lock washer (21) and through bolt (22).
7. Tap end plates (2 and 28) with a mallet to remove them from the generator frame; withdraw armature (18).
8. Remove the bearings using Weidenhoff Puller Press No. 967 or equivalent. See Figure 3.

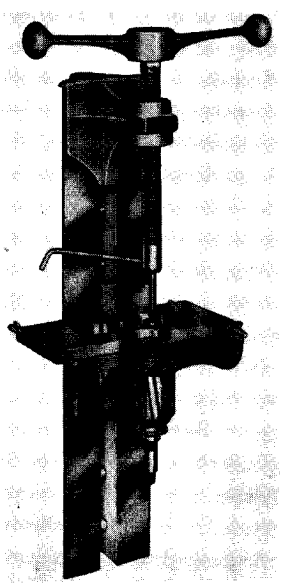


FIGURE 3

INSPECTION AFTER DISASSEMBLY

NOTE: All parts should be washed in *clean* gasoline and dried.

Check brushes (27) to ascertain if they move freely in the brush holders (25). Damaged or excessively worn brushes (27), damaged brush holders (25) and brush springs (29) must be replaced. Check insulation plate under insulated brush holder for possible damage due to heat.

Ball bearings (4 and 26) must be thoroughly cleaned in an approved solution and rough or worn bearings replaced. Repack bearings with high melting point grease.

Refer to the topic on GENERATORS (90 and 175 watt) for additional generator tests.

Visually inspect the armature for possible damage due to overheating; this would be caused by excessive load or speed. Check armature on a growler for ground, short or open circuit. If the commutator is rough, reface and undercut the mica between the commutator bars.

Remove ground connection of resistance B coil in generator frame and check continuity of field coils. A good field coil will show a current draw of 1.6 amperes at 6 volts. Replace coil if grounded or damaged due to overheating.

REASSEMBLY

Prior to positioning the bearings on the armature shaft (use tool TSE 76113 for this operation), insert them in the bore of their respective end plates to check the tolerance between the outer race and the bore. This must be a hand-push fit—under no condition should an arbor press be required.

If the outer race in the end plate is too tight, the bearing bore must be enlarged either by slight scraping or through the use of emery cloth, after which the end plate should be well cleaned.

The bearings must float in the end plates when the generator is completely assembled to allow for armature shaft expansion caused by operating temperature. If the bearings are restricted in this respect, a pressure is exerted on them with the result that they are damaged.

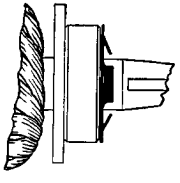


FIGURE 4

It is important that the correct retaining spring washers are properly installed in their respective end plates. Figures 4 and 5 show the right way to install the retaining spring washer at the drive end and the retaining spring washer at the commutator end.

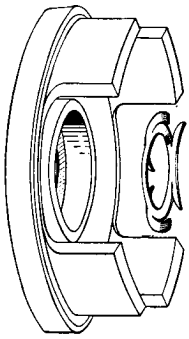


FIGURE 5

Complete the assembly of the generator following the opposite procedure to that outlined under Disassembly and check the end play.

The armature should have an end play of from .010"-.040". This can be checked by backing off about two turns on the bearing retaining plate fastening screws, see Figure 6. Pull the armature drive shaft toward you against the thrust of the spring washer. From this position it should be possible to push the armature toward the commutator end plate in accordance with the dimensions given above. Sufficient force must be exerted to overcome the pressure of the retaining spring washer.

If the unit has adequate end play, re-tighten retaining plate fastening screws. However, if the unit has insufficient end play recheck the assembly, making certain that bearings are properly positioned on the armature shaft. Reassemble the generator and recheck the end play.

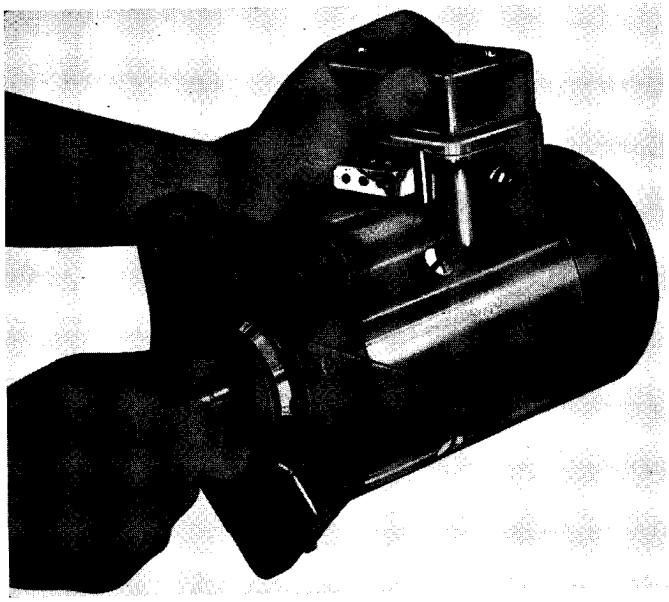


FIGURE 6

CHANGING THE GENERATOR ROTATION

The direction in which the generator must rotate is indicated by an arrow on the generator frame. Figure 7, illustrates the proper connections for anti-clockwise rotation of these units when viewed from the drive end.

To change the direction of rotation it is only necessary to reverse the two leads of the field coil, these can readily be identified since one is red and the other is blue or bluish green.

On SAE flange mounted generators it is also necessary to change the oil slinger (5). The threads on the hub of the oil slinger must correspond to the direction of rotation.

REGULATOR

The regulator unit (32) is of rugged construction, having a high contact pressure and powerful magnet which eliminates the influence of engine vibrations on its performance. The following is a general explanation of the functioning of the regulator, with the switch in the 'ON' position (see Figure 7).

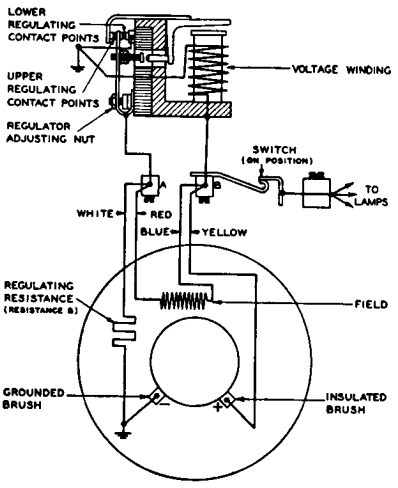


FIGURE 7

The armature (18) rotating in the magnetic field of the generator produces a voltage between the brushes (27), of which one is grounded. Current travels from the insulated positive (+) brush through the switch to the regulator yoke through the voltage coil returning to the negative (—) brush by way of ground.

At medium operating speeds, when the voltage tries to become excessive, the lower regulating contact points open, due to the increased current in the voltage coil, forcing the field current to flow from the terminal post 'A' through regulating resistance 'B' to ground.

At high operating speeds, when the armature (18) tries to develop an excessive voltage which, if not checked, would be detrimental to the current consumers and the generator, the upper regulator contact points close and open in rapid succession. This action, short circuits the generator field for brief intervals, reducing the field current to a comparatively low average value, thus stabilizing the generator voltage within permissible limits.

DISASSEMBLY

IMPORTANT! If the coil of the regulator is damaged due to overheating or the core is loose in the yoke, the unit is beyond field repair and must be replaced.

NOTE: The numbers given in the following paragraphs refer to Figure 8.

1. Withdraw the hold-down bracket fastening screw (3) and lock washer (4).

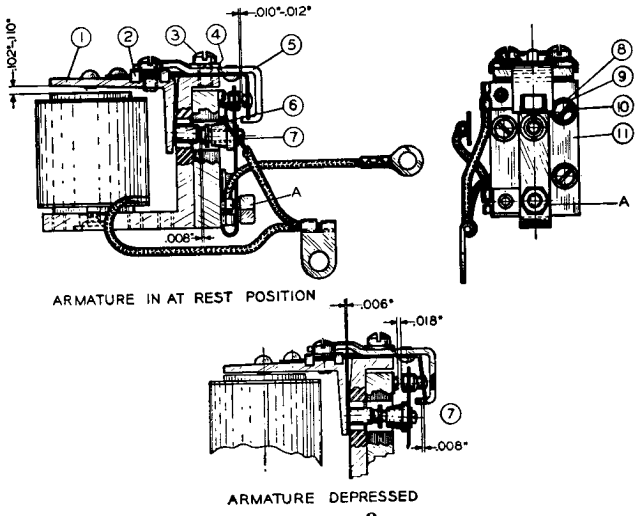


FIGURE 8

2. Remove the armature hold-down bracket (5) and armature assembly (1). Care must be exercised in the removal of the armature assembly (1) to prevent damage to the glass bead.
3. Withdraw the fastening screw (10), plain washer (8), lock washer (9) and contact terminal block (11).

INSPECTION AFTER DISASSEMBLY

1. Check the tension of the hold-down bracket contact point (this must not be less than 11 oz.) using the spring scale as shown in Figure 11.
2. Examine the contact points for signs of wear. Exercise care in dressing the points to assure a flat, square surface. Peaks or craters appearing on the contact surface must be removed. A fine stone is recommended for this operation. Crocus cloth should be used to obtain a mirror finish.
3. Check the riveting of glass bead (6) in the armature assembly (1). If this is loose, the armature must be replaced.

REASSEMBLING THE REGULATOR

1. The assembly must be clean and free from dust, dirt, chips, oil or solder flux. Check all solder joints and connections.

2. All contact point surfaces must be cleaned with carbon tetrachloride and wiped off with a *clean* chamois skin before reassembly.

IMPORTANT! Contact surfaces must not be touched with the hand after they are cleaned. Feeler gauges used to check air gaps and contact openings must be kept scrupulously clean.

3. Reassemble the contact terminal block (11) to the regulator yoke using screws (10), plain washer (8) and lock washer (9).

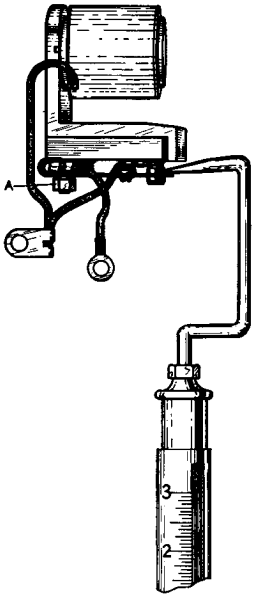


FIGURE 9

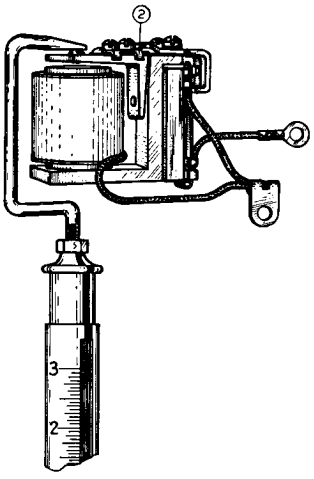


FIGURE 10

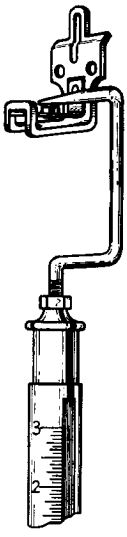


FIGURE 11

4. Adjust the tension of the terminal block movable contact springs —see Figure 9—this must be between 14 to 18 oz. Adjustment is made by tightening or loosening nut (A).
5. Loosely fasten the armature assembly (1) and hold-down bracket (5) to the regulator yoke using screw (3) and lock washer (4).
6. With the armature depressed, adjust the gap between the armature and yoke to .006″—see Figure 8—using a standard feeler gauge. Securely fasten the armature in place.
7. With the armature (1) in the "at rest" position, the gap between the front of the armature and core must be .102″-.110″; adjustment is made by bending the tongue end of the hold-down bracket (5) up or down as required.
8. Check the tension of the armature spring—see Figure 10—this must be between 23 oz.-32 oz. Adjustment is made by shifting the spring clamp (2).

9. The gap between the upper regulating points, in the "at rest" position, should be .010"-.012". Adjustment is made by bending the armature hold-down bracket as required. Recheck spring tension —see paragraph 1 under Inspection After Disassembly.

10. With the armature (1) fully depressed, the opening between the lower regulating contacts must be at least .018". This is adjusted by means of the reverse current screw (7). In this position the spring with the upper regulating contact must be raised at least .008" from its "at rest" position.

11. With armature (1) in the "at rest" position, a gap of not less than .008" must exist between reverse current screw (7) and the glass bead (6).

12. Securely set all fastening screws and reassemble the regulator to the generator.

ELECTRICAL ADJUSTMENT

1. Connect a low reading voltmeter (scale 0-10 volts) between the ground and the external terminal block of the regulator base.

2. Adjust the regulating voltage at 1000 generator R.P.M. to 6.0-6.3 volts by turning the nut (A) in or out as required. No external load should be connected during this adjustment.

3. Increase the generator speed to 2500 R.P.M. Adjust the regulating voltage to 6.3-6.6 volts, turning the reverse current screw (7) in or out as required.

4. Connect three 21 candle power lamps in parallel between the terminal block and ground, and recheck the regulating voltage as outlined.

Electric Starting System

THE electric starting motor is used to crank the engine, thus eliminating the use of the hand crank. It is located on the left side of the tractor just to the rear of the magneto. A push button type heavy duty switch is used to complete the electrical circuit between the battery and the cranking motor.

ELECTRIC STARTING MOTOR

A Bendix drive is used to mesh the pinion of the electric starting motor with the ring gear of the flywheel. The pinion of the Bendix drive is mounted on a threaded sleeve on the armature shaft. When the arma-

ture of the cranking motor revolves, the threaded sleeve turns within the pinion, moving it into mesh with the flywheel ring gear to crank the engine. A spring is used to absorb the shock of the pinion meshing with the flywheel ring gear. When the engine operates under its own power, the flywheel ring gear rotates the pinion at a higher speed than the threaded sleeve is revolving. The pinion then turns on the threaded sleeve and automatically disengages from the teeth of the flywheel ring gear. Once out of mesh, an anti-drift spring is used to keep the pinion disengaged.

If poor starting motor performance is experienced, be sure the battery, cables and starting switch are in good condition before disassembling the starting motor. Defective cables, loose or corroded connections or defective switch contacts will affect the operation of the starting motor.

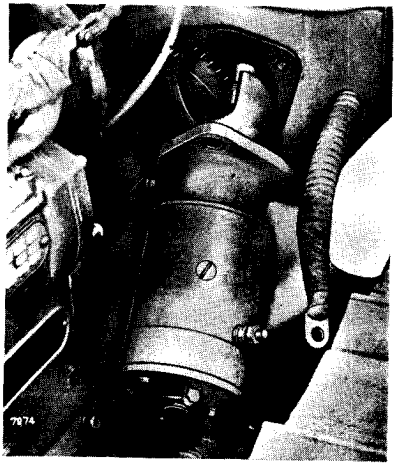
REMOVING STARTING MOTOR

Disconnect the cable at the terminal of the starting motor. Remove the capscrews holding the motor to the flywheel housing and remove the motor as shown.

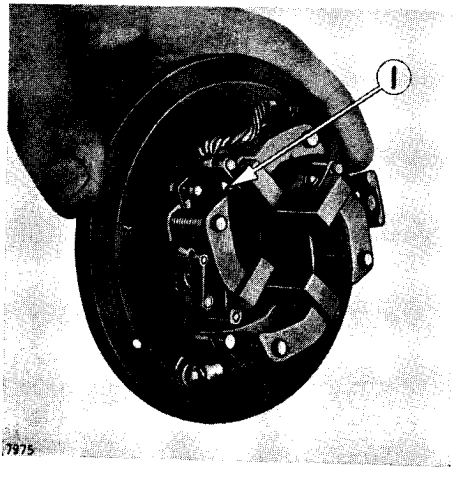
BRUSHES

Remove the cover band and blow out all carbon dust with compressed air. Check the brush leads for loose connections. Replace worn brushes. If brushes wear rapidly, check for roughness or high mica on the commutator or excessive brush spring tension.

Brush holder springs should be replaced if the tension is less than 24 oz. or more than 28 oz. To replace the springs, remove the tie bolts and take off the end plate to which the brush holders are attached.



STARTING MOTOR REMOVAL

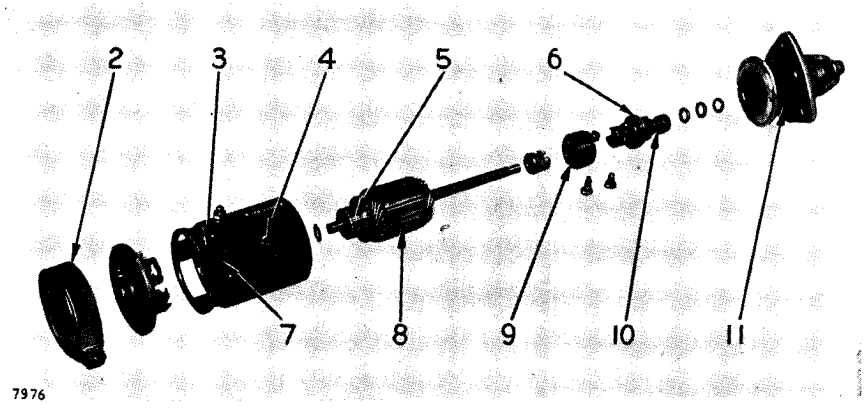


STARTING MOTOR BRUSHES

New brushes may be installed through the openings in the frame without removing the end plate. Remove the cover band and take out the screw (1). After installing a new brush, it should be seated to the commutator. This may be done by holding a brush seating stone against the commutator while rotating the armature or using "00" sandpaper between the brush and commutator with the abrasive side against the brush. Blow out all dust and abrasives.

BENDIX DRIVE

Remove the Bendix housing (11) and slide off the Bendix drive (6) and spring (9) after removing the screws. Wash and clean the spring and Bendix drive in some non-inflammable washing fluid. Clean the end of the armature shaft of any accumulations of dirt or grease. The spiral upon which the pinion operates should be kept free from grease and dirt. Wash the housing (11).



STARTING MOTOR ASSEMBLY

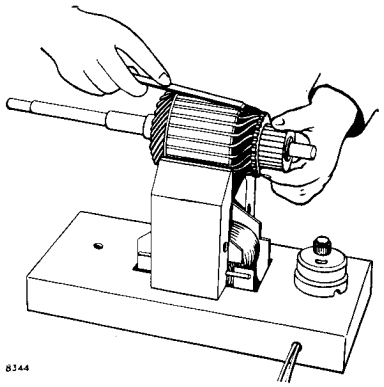
If the pinion teeth are chipped or damaged, replace the pinion. Check the anti-drift spring (10) as the pinion will tend to mesh with the flywheel ring gear if the spring is weak.

Before installing the drive, lubricate the threaded sleeve and the bushing in the housing with a few drops of light oil.

ARMATURE

Slide the armature (8) out of the frame.

With a battery and 6 volt lamp connected in series, place one lead on the armature shaft and the other lead on each segment of the commutator (5) in succession. If the test lamp lights between any one segment and the shaft, the armature is grounded and should be replaced. If the



GROWLER TEST

test lamp does not light, the armature is not grounded.

To test the armature for a short, place the armature on a growler with a hacksaw blade over the armature core and rotate the armature. If the blade does not vibrate, the armature is not shorted. If the blade vibrates, the armature is short circuited and should be replaced.

COMMUTATOR

If the commutator (5) is rough or out of round, it should be turned down in a lathe just enough to remove the roughness or eccentricity and then sanded with "00" sandpaper. Undercut the mica between the commutator bars $\frac{1}{32}$" with a hacksaw blade.

If the surface of the commutator is only glazed or darkened, polish with "00" sandpaper. Never use emery cloth. Clean out the cranking motor with an air blast to remove abrasives.

FIELD COILS

Field coils (3) should be replaced if they are grounded, shorted or open. To replace the field coils, remove the screw (4) and pole shoe (7) and take out the coil. Use Rosin Flux in making all soldered connections. Check to make sure the coil is installed in the same position as the coil which was taken out.

ELECTRIC STARTING MOTOR SWITCH

The switch is a self-contained unit. If the contacts become burned or pitted, the switch should be replaced.

To check for a burned out switch, remove the cranking motor cable and connect a test lamp with one lead on the cranking motor terminal of the switch and the other lead to ground. If the test lamp lights when the switch is closed, the switch is satisfactory for use. If the test lamp does not light, check the battery and the cable between the battery and the switch before assuming the switch is faulty.