Operators' Instruction Book

for

CATERPILLAR

Reg. U. S. Pat. Off.

TRACTORS

TWENTY . . . { **LI & UP** / **PLI & UP** }

TWENTY-FIVE . 3CI & UP

TWENTY-EIGHT . 4FI & UP

CATERPILLAR TRACTOR CO.

PEORIA, ILLINOIS, U. S. A.

Track-Type Tractors . . . . Road Machinery

. . . . . Diesel Engines . . . . . .

THERE IS A «CATERPILLAR» DEALER NEAR YOU

Form 3686

NOTES

Foreword

"Caterpillar" products are a combination of advanced engineering, skilled manufacturing, and the finest materials metallurgical science can select. Thousands of satisfying, economical working hours are built into each machine.

Whether or not the owner derives the maximum of service from his machine depends largely on the care exercised in its operation and maintenance. This book is written to give the operator essential information regarding the day-to-day operation, lubrication and adjustment of the machine. Careful adherence to these instructions will result in assured economy.

A great many "Caterpillar" owners depend upon their dealer for service other than the care and adjustments described in this book. This practice is recommended because our dealers are equipped with factory-trained servicemen, tools designed and built by "Caterpillar", and stocks of genuine "Caterpillar" parts. Moreover, they are kept closely informed by the factory regarding advanced methods of servicing "Caterpillar" products — thus, in all ways, they are equipped to render the best of service.

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Lubricating Instructions

Detailed instructions regarding the lubrication of this machine are given on the folded LUBRICATION CHART on the following page. Careful attention to these instructions and the proper selection of the oil to be used will add much to performance, reliability, economy and long life of your machine.

It is important to use the type of oil that is best suited to your machine—taking into account the current outside temperature and the temperature range which is likely to be experienced before refilling again.

Practically all oil companies have adopted the S.A.E. (Society of Automotive Engineers) viscosity number system—which classifies oils in terms of viscosity or fluidity. The oils with the lower numbers are lighter, and flow more readily than do the oils with higher numbers. The S.A.E. number refers only to the viscosity of the oil, and has reference to no other characteristic or property.

In preparing to refill with fresh oil, any compartment should be drained while it is warm—it is best to drain after the machine has run for some time. Most of the sediment will then be in suspension, and therefore, will readily drain.

The following recommendations give the grades of oil best suited for use in your machine for the various operating temperatures.

Crankcase Lubricating Oil: Use S.A.E. 30 oil in the crankcase and air cleaner.

S.A.E. 30 oil will continue to be satisfactory for the crankcase when the temperature is below freezing (32° F. or 0° C.) where warm storage is provided for the machine. 20W should be used for extremely cold weather conditions, particularly when the machine must remain out of doors and is not operating for long periods of time. In such cases 20W is needed for cranking ability and the immediate establishment of oil circulation. Under the same conditions use 10W oil in the air cleaner.

Naturally, any precautions taken to house the machine or to cover it with a tarpaulin, or to warm it before starting will cause better immediate oil distribution and contribute to quicker starting. When the weather is excessively cold the cooling system liquid and crankcase lubricating oil may be drained at the end of the run. Heating them before starting will make starting easier and assure immediate distribution of oil. The engine should always be allowed to idle for a few minutes after starting to assure adequate lubrication before operating on normal load.

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Transmission Oil: A pure mineral oil will flow freely and will not channel at existing operating temperatures should be used. For temperatures above 32°F., (0°C.) use either S.A.E. 90 or 110 oil. In extremely cold weather an oil of lower viscosity than S.A.E. 90 may be required, and if it cannot be obtained the available oil should be diluted with kerosene.

Track Rollers, Track Carrier Rollers and Idlers: (Twenty-Five tractors after 3C451 and Twenty-Eight tractors)—For temperatures above 32°F., (0°C.) use S.A.E. 90 or S.A.E. 110 transmission lubricant. In hot summer weather it will be necessary to use transmission lubricants of higher viscosities, namely: S.A.E. 160 or S.A.E. 250. In extremely cold weather crankcase lubricating oil may be used in these assemblies.

DO NOT LUBRICATE THE TRACKS

Under no circumstances should the track be lubricated. The stiffness noted between the track links of a new machine is not caused by a lack of clearance between the track pins and bushings, and it will disappear as the tracks wear in.

All time intervals given in the lubrication chart are for hours of machine operation.

♦

Operating Instructions

FUELS

Gasoline is ordinarily used as a fuel, but in localities where it is unobtainable or where its price is unduly high in comparison with other locally obtainable fuels, kerosene, engine distillate, alcohol, etc., can be used. Information regarding attachments to burn these fuels will be furnished by the "Caterpillar" dealer on request.

PREPARING THE TRACTOR FOR USE

The first duty of anyone charged with the care and operation of a tractor is to give it a detailed inspection and to lubricate all parts as directed under the topic, LUBRICATING INSTRUCTIONS.

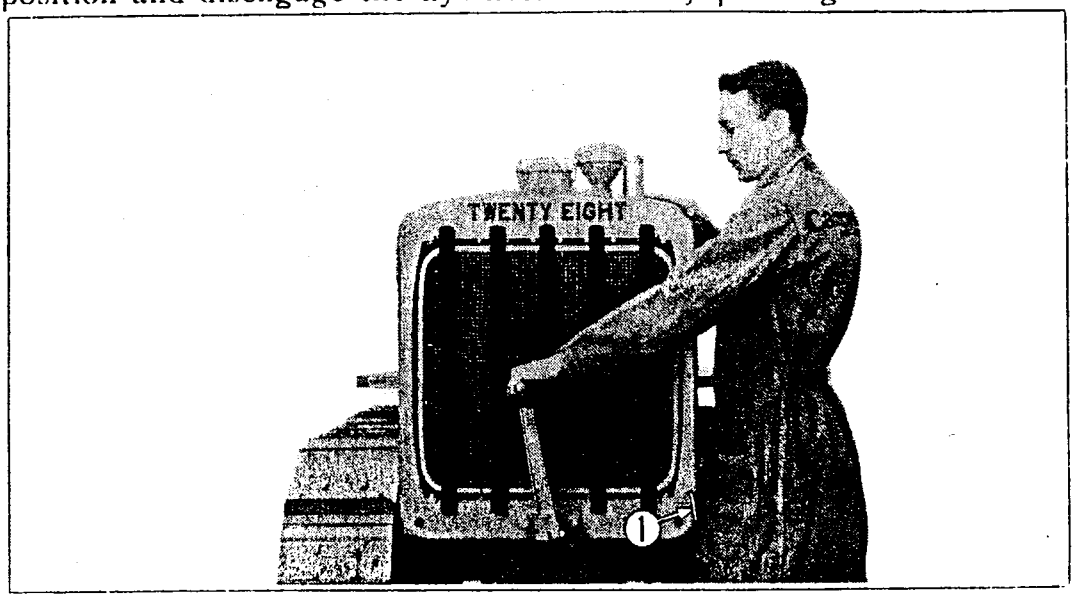
Fill the fuel tank, taking care that no dirt, water, or other foreign substances are admitted with the fuel. The auxiliary fuel tank on the Twenty-Eight Tractor should be filled with gasoline. This supply is used to start the engine when it is to be operated on "tractor-fuels." Give particular attention to the details of fuel handling as outlined under the topic, CARE OF THE FUEL SYSTEM.

Fill the cooling system with clear water, or with the correct anti-freeze solution if temperatures below freezing are likely to be encountered. Water used in the cooling system should be soft, or as free as possible from scale forming minerals. If it is impossible to obtain soft water, it is advisable to treat the available water with some commercial water "softener."

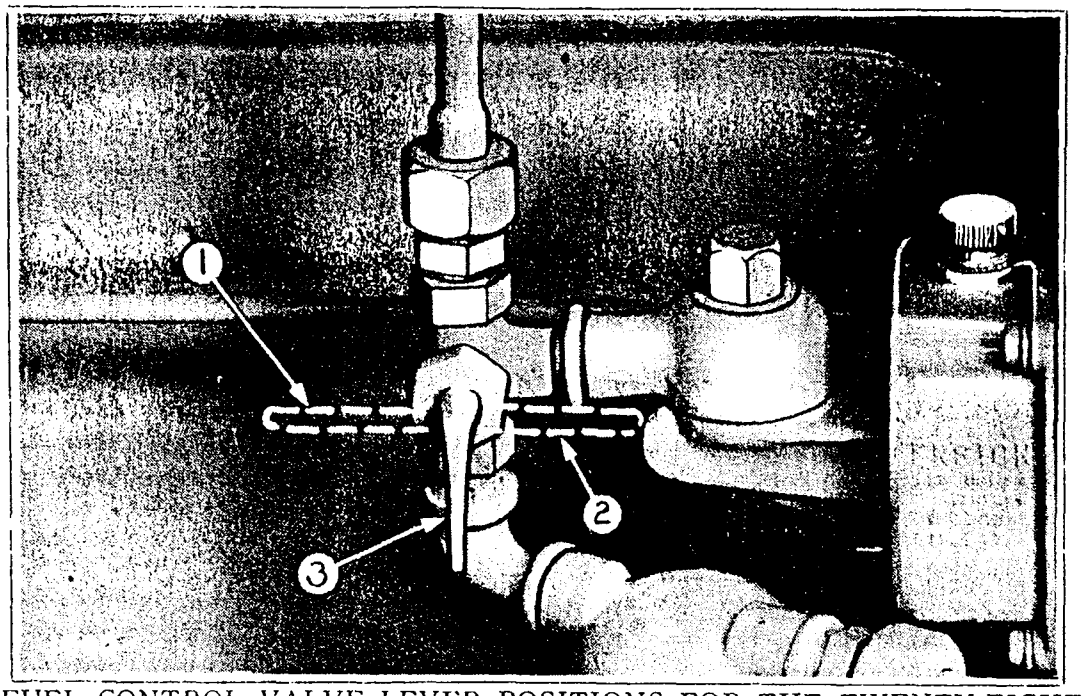
After the first few hours of operation, tighten all nuts, bolts, and cap screws holding together parts having asbestos-lined copper gaskets between them. This applies especially to cylinder head stud nuts. When the cylinder head studs nuts are tightened, the cylinder head gasket is squeezed together and the valve clearance is changed. After the cylinder head stud nuts are tightened, adjust the valve clearances as described in the topic, VALVE CLEARANCE ADJUSTMENT.

STARTING THE ENGINE

Open the fuel tank valve, Be sure the gear shift lever is in the neutral position and disengage the flywheel clutch by pressing forward on the



CRANKING THE TWENTY-EIGHT ENGINE
1—Choke rod.



FUEL CONTROL VALVE LEVER POSITIONS FOR THE TWENTY-EIGHT TRACTOR

1—Position for shutting off both the main fuel tank and the auxiliary tank. 2—Position for operating from main tank. 3—Position for operating from auxiliary tank.

control lever. Move the throttle control ratchet halfway back and place the manifold heat control ratchet in the "heat on" position. Turn the ignition switch key "on" and turn the choke control knob to the right to choke. The choke control rod on the Twenty-Eight tractor is pulled forward. Grasp the crank in the left hand and engage the jaw by pushing the crank in with the right hand. Stand with the right hand resting on the left side of the radiator and pull the crank over the top part of its circle. Repeat until the engine starts.

Do not spin the crank as this may cause the impulse starter to release and the engine to backfire. Temperature and altitude will change the length of time necessary to crank with the choke on. Actual experience in starting will determine this interval.

After the engine has started, engage the flywheel clutch and allow the engine to run until it warms up. Be sure that the oil gauge is registering the correct pressure and that the cooling system has been filled. The lubricating oil pressure should be approximately 25 pounds when the engine is warm.

The spark is retarded for starting by the action of the impulse starter in the magneto. After starting, the impulse starter releases and the engine operates with the spark set at the correct advanced position.

If the engine is cold, starting will be easier if the cylinders are primed. A tablespoonful of gasoline in each priming cock is ample. See the topic, OPERATING IN COLD WEATHER.

Avoid over-choking or over-priming. If the engine is flooded from either of these causes, crank the engine several revolutions with the choke "off" to dissipate the excess fuel.

If the engine does not start after cranking several revolutions, make an inspection at the various points where difficulty may arise. Be sure the carburetor contains gasoline. If in doubt, open the drain valve on the carburetor float bowl. If fuel is not reaching the carburetor, operate the fuel pump priming lever. If the glass bowl on the fuel pump is not full, inspect the fuel tank for shortage. If there is fuel in the tank, inspect

the fuel line and screens to see if they are clogged. See the topic, CARE OF THE FUEL SYSTEM. See that the magneto is functioning. Check as outlined under the topic, MAGNETO.

MANIFOLD HEAT CONTROL

A certain amount of heat applied to the inlet manifold is beneficial when starting a cold engine, or during operation in cold weather. This heat is derived from the exhaust gases, and the amount diverted around the inlet manifold is controlled by the position of the hot air valve, located in the hot air valve body between the two manifolds.

The manifold heat control ratchet is located on the inside of the left fender. When starting a cold engine, move the ratchet to the "heat on" position, or as far back as it will go. Allow it to remain in this position until the engine is thoroughly warmed up, then gradually move it toward the "heat off" position until the engine gives its best performance.

Too much heat on the manifold is indicated by a loss of power on full loads and by sluggish acceleration. Very little or no heat is required for operation in warm weather, especially with heavy loads. In cold weather, and especially with light or intermittent loads, some heat can be used advantageously all through the day's operation.

Adjust the manifold heat control ratchet according to the atmospheric temperature and the nature of the work being done so that the engine pulls best, and accelerates quickly and smoothly to the opened throttle.

DRIVING THE TRACTOR

Operate a new tractor under a light load for the first sixty hours.

Move the throttle control ratchet to the idling position and disengage the flywheel clutch. Press the clutch control lever forward as far as it will go to apply the clutch brake and stop the rotation of the upper transmission shaft and the gears. Carefully move the gear shift lever into the position for the speed desired. The sliding gears in the transmission are held in place by locking plungers which must be released by moving the gear shift lever sideways before the shift can be made.

After the gears are in mesh, pull the throttle control ratchet all the way back. Carefully engage the clutch until the slack is taken up between the tractor and the load, and then pull the control lever all the way back until it snaps over center.

STEERING THE TRACTOR

The "Caterpillar" tractor is steered by hand levers that operate the steering clutches, and by pedals that control the steering clutch brakes. Release the steering clutch on the side toward which the turn is to be made by pulling back on the steering clutch lever. Apply the brake on the same side by pressing down on the pedal just hard enough to turn at the desired angle. Both controls should be handled smoothly so that the turn will be made evenly and not as a series of jerks. Just before the turn is accomplished release the brake. Then engage the steering clutch by releasing the control lever quickly but gently.

With a load behind the tractor it is seldom necessary to use the brakes except for sharp turns, since the load acts as a brake. The brakes may also be used to hold back the tractor when going down grade, and one pedal may be locked in position to hold the tractor on slopes or when doing stationary work.

Steering down grade: When going down grade with the tractor **pulling** the load, steer in the usual manner. If the load is **pushing** the tractor, the operation of the steering clutches and brakes is reversed. For example, to turn to the right under these conditions, release the steering clutch on the left, but do not apply the brake. This allows the left track to travel faster while the right hand track is held back by the engine which acts as a brake.

The pedals must be in the fully released position during normal operation of the tractor. Keep the feet off the pedals except when it is necessary to use the brakes.

OPERATING OVER AN OBSTRUCTION

The fact that the steering clutches are controlled by entirely separate levers may be used to advantage in running over an obstruction, such as a log, or a ditch bank. Both clutches may be released slightly until the tractor balances on top of the obstruction. One clutch may then be engaged gradually so that the tractor moves forward at an angle, over and down. If the tractor is being operated without a load it may be necessary to use the brakes.

OPERATING IN DEEP MUD OR WATER

If the tractor must be operated for any length of time in mud or deep water, see that the plugs are in place under the steering clutch compartments. Lubricate the track rollers and front idlers every 5 hours. Inspect the oil in the final drives frequently for indications of mud or water. Drain, wash, and refill the final drive cases as often as the oil shows the presence of any mud or water. See the topic, LUBRICATING INSTRUCTIONS.

STOPPING THE TRACTOR

To stop the tractor and allow the engine to run, disengage the flywheel clutch and move the throttle control ratchet to the idling position. Shift the transmission gears into neutral and engage the flywheel clutch. Never allow the tractor to idle with the flywheel clutch disengaged.

STOPPING THE ENGINE

Move the throttle control ratchet to the idling position and turn the ignition switch off. Close the fuel tank valve to prevent leakage of fuel and the attendant fire hazard.

If the tractor must stand without shelter for any considerable period of time, cover the exhaust pipe to exclude rain or snow. When the temperature is below freezing, or there is a possibility of freezing weather before the engine is started again, the cooling system must be drained or protected by suitable anti-freeze solution. See the topic, OPERATING IN COLD WEATHER.

DAILY CARE

A daily check of the tractor should be made to see if there are any loose nuts, bolts, cap screws, or parts worn to such an extent that they are no longer serviceable. If corrective steps are taken immediately upon discovery of loose or worn parts, fewer enforced stops and more economical operation will result.

Dirt should not be allowed to accumulate on the tractor. A few minutes spent daily in keeping it clean are well repaid in improved appearance, and greater ease and safety in repair operations.

Each day the cooling system should be checked, and, if necessary, additional water or anti-freeze added.

Lubricate parts as directed under the topic, LUBRICATING INSTRUCTIONS.

The fuel tank should be filled **full** at the end of the day's run. This will drive out air laden with moisture, which if allowed to remain, will not only condense and cause water to accumulate in the fuel system but may eventually cause the tank to rust. See the topic, CARE OF THE FUEL SYSTEM.

OPERATING IN COLD WEATHER

Crankcase: As the atmospheric temperature becomes lower, the crankcase lubricating oil must be of a lower viscosity in order to correctly lubricate the pistons, bearings, and the cylinder walls. See the topic, LUBRICATING INSTRUCTIONS.

Transmission and Final Drive: Like the crankcase, the transmission and final drives must be protected by oils adapted to the various atmospheric temperatures. See the topic, LUBRICATING INSTRUCTIONS.

Cooling System: The tractor may be operated with water in the cooling system when the atmospheric temperatures are as low as 20°F. (-7°C.) if the following precautions are taken:

When stopping for the night, drain the cooling system by removing the plug in the bottom of the radiator. This will drain the entire system if the tractor is standing level. After draining, crank the engine a few times to prevent water freezing in the water pump. The drain should be left open until the cooling system is filled.

When the engine is started, use a curtain over the radiator and allow the engine to run two minutes. Then fill the radiator quickly so that the water pump will function before the water can freeze in the lower part of the cooling system. Use a curtain as needed to keep the engine up to the normal operating temperature, by partially or entirely covering the radiator while working. The curtain is available from your dealer as an attachment.

When the temperature is below 20°F. (-7°C.) sufficient anti-freeze solution should be used in the cooling system to prevent freezing. Commercial solutions are available for this purpose or alcohol or glycerine may be used. Whatever liquid is used, it should be tested daily and kept up to the correct strength for the existing temperatures.

Starting the Engine: In extremely low temperatures, starting will be made easier if the tractor can be kept in warm storage, or by following these suggestions:

Under all circumstances, the engine should be cranked a few revolutions to loosen the oil on the bearings and the cylinder walls. If the engine seems locked when attempting to crank it, see if the water pump impeller is frozen tight. If it is frozen, warm the pump body to melt the ice.

Warming the crankcase lubricating oil, and the carburetor may be found necessary under the most extreme conditions. Drain the crankcase lubricating oil, heat and replace it. Warm the carburetor by wrapping it with a cloth and applying boiling water.

Sometimes moisture, or fuel which has not vaporized, collects on the spark plug electrodes. They may be dried by removing and pouring gasoline over them. Ignite the gasoline and allow it to burn.

The liquid in the cooling system may also be drained, heated, and replaced. When warming the anti-freeze solution, keep the flame away, as some of these solutions are inflammable. Avoid getting the solution hot and even a warm solution should be poured into the cold radiator and cylinder blocks very slowly to prevent any damage by expansion.

A priming mixture of 50% ether and 50% gasoline will materially assist starting, especially if the engine is allowed to stand several minutes so that the mixture can vaporize.

STORAGE

Engine: If the tractor is to be stored or left standing for a long period of time there is the probability that the lubricating oil will drain away from the cylinder walls and pistons, allowing them to rust or to become scored when the engine is started, during the interval before the lubricating oil reaches the surfaces. This condition will also cause poor compression and make starting difficult.

The oil film should be renewed periodically when the tractor is idle. This may be done by running the engine once every week for a few minutes, or until the oil is thoroughly warm. This will circulate the oil and prevent rusting from condensation. If it is not convenient to start the engine, remove the spark plugs once every month and pour ¼ pint (0.12 liter) of oil into each cylinder. Then crank the engine several revolutions to distribute the oil. Replace the spark plugs. Thereafter, crank the engine once a week, between the monthly oiling intervals, to maintain the oil film on the cylinder walls and pistons.

The oil film should also be renewed immediately before starting the engine when taking it out of storage.

Cooling system: If the temperature is likely to go below freezing, the cooling system should either be drained, or it should be filled with the correct amount of anti-freeze solution. If the cooling system is drained, a tag should be attached to the radiator cap to prevent the engine being started and run for any length of time without water in the cooling system.

Maintenance Instructions

The foregoing paragraphs have been devoted to instructions which are necessary for day to day operation of the tractor. The following topics give detailed instructions regarding the care and adjustment of the various assemblies.

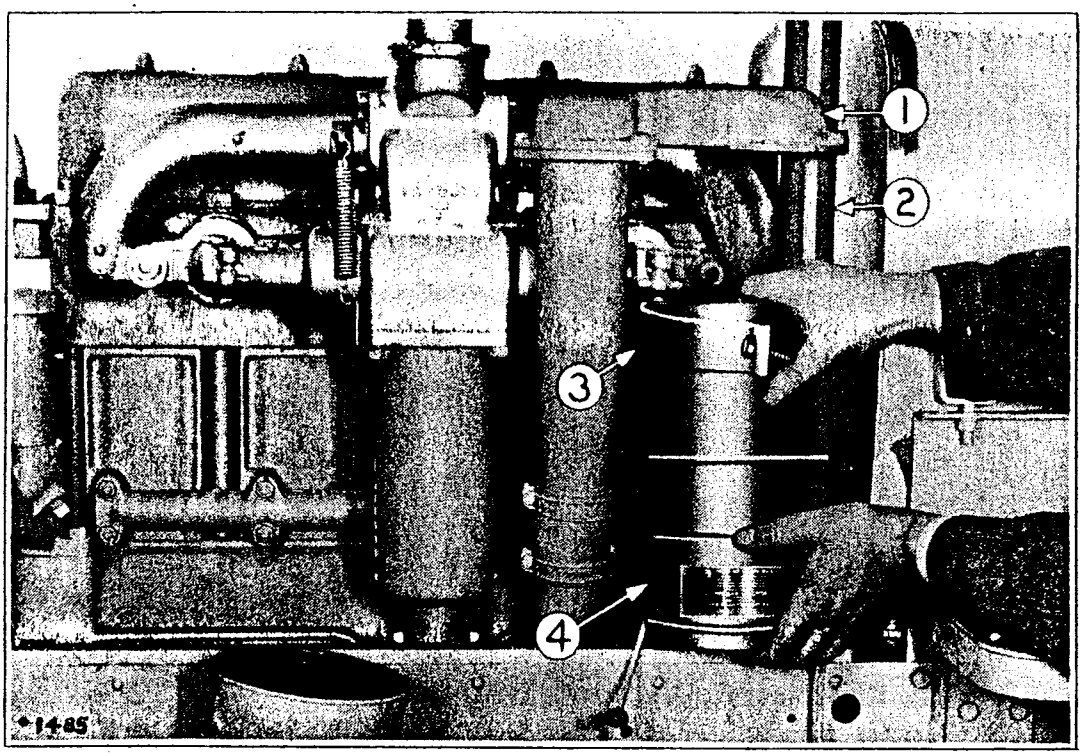
CARE OF THE AIR CLEANER

The air cleaner does its work efficiently as long as the oil in the cup is thin enough to spray into the filter section and wash back the dirt collecting there. For this reason, the air cleaner should be inspected frequently and serviced as often as necessary.

The interval between oil changes and cleaning will vary with the weather and working conditions. During the hot dusty months, and on jobs where dust conditions are severe, it may be necessary to service the air cleaner every 5 hours. In cold, damp weather, and on jobs where there is little or no dust, this operation may be necessary only every 60 hours.

To Wash Air Cleaner: Remove the hood, and the oil cup. Take out the cap screws that hold the air cleaner outlet elbow to the top of the air cleaner. Remove the small set screw that holds the lower end of the air inlet pipe to the elbow of the air cleaner body and pull the inlet pipe out of the elbow. Remove the cap screw that holds the air cleaner clamp band to the bracket. Lower the body of the cleaner until it is clear of the clamp band and remove it.

Shake the filter section in gasoline or kerosene. After washing, pour about ½ pint (0.24 liters) of oil through the filter. Wash the cup, refill to the circular oil level mark, and replace before the engine is started. Keep all connections between the air cleaner and carburetor air tight. Whenever the air cleaner is washed, clean all pipes through which the air flows.



REMOVING AIR CLEANER
1—Air cleaner outlet pipe. 2—Air inlet pipe. 3—Clamp band. 4—Air cleaner body.

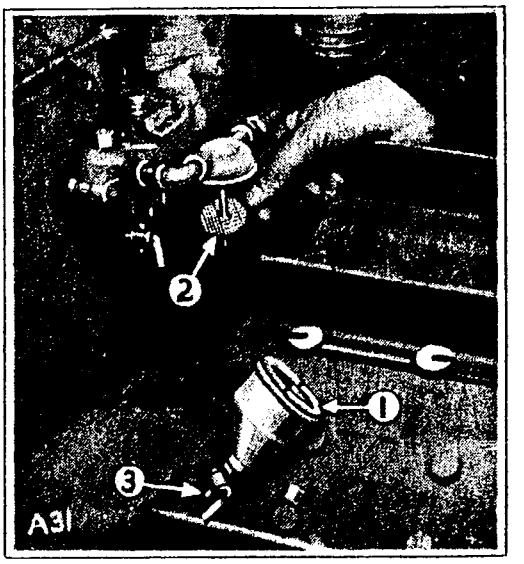
CARE OF THE FUEL SYSTEM

Use every precaution to keep the fuel clean. The best method is to use an underground storage tank. If this is not possible, see that the filling cans, funnels, pumps, hose and the storage barrels are clean before the refueling process is begun.

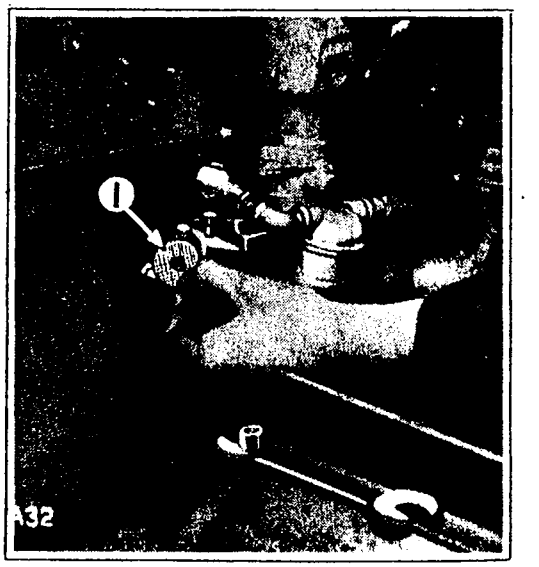
There are two screens in the fuel system which should be removed and cleaned occasionally; one is in the sediment bowl and the other in the carburetor.

Sediment Bowl and Screen: The sediment bowl collects water and sediment that may be in the fuel. To remove the collected water and sediment, shut off the main fuel tank valve and remove the bowl by unscrewing the nut that clamps it to the body of the fuel pump. The screen can then be removed and cleaned. When the bowl is replaced, see that the gasket is clean, is in the correct position, and is not broken.

Carburetor Screen: To remove the screen turn the fuel control valve lever off, and unscrew the nut that holds the carburetor strainer cage in place. Lift the cage off the float valve assembly. The screen can then be lifted off the float valve assembly and cleaned. When the carburetor screen body is replaced, see that the gasket is clean, is in the correct position, and is not broken.



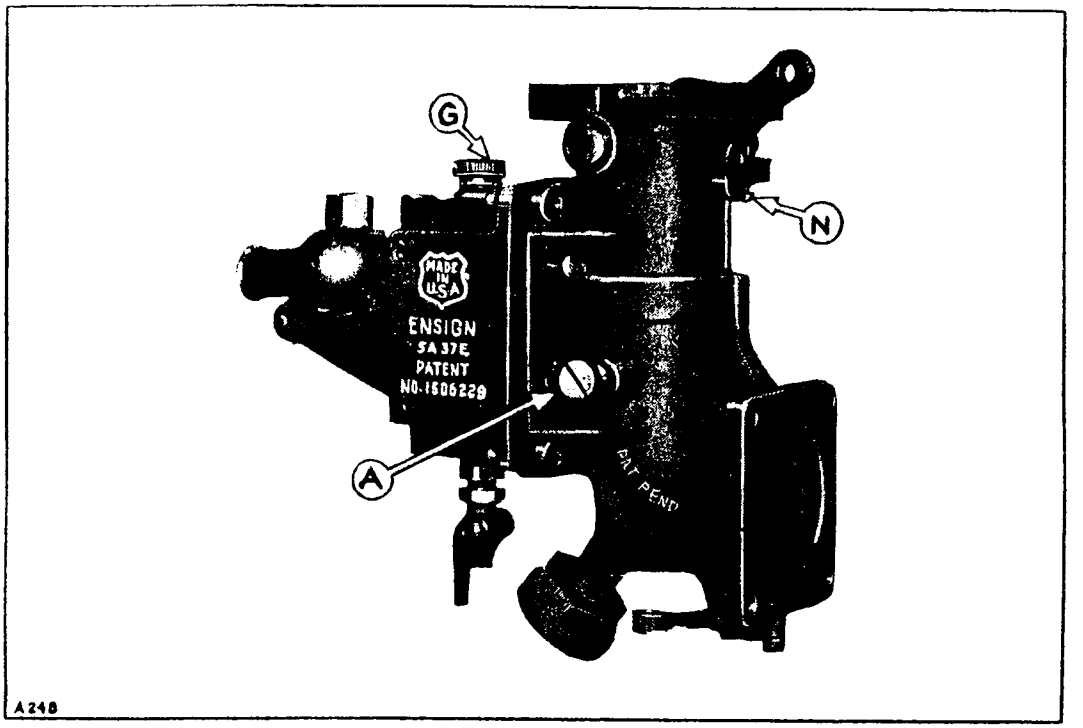
SEDIMENT TRAP SCREEN
1—Sediment trap bowl. 2—Sediment trap screen. 3—Petcock



CARBURETOR SCREEN
1—Screen

CARBURETOR ADJUSTMENT

To obtain an approximate adjustment for starting, turn the high-speed adjusting screw one and one-eighth turns from the closed position. Turn the idling speed screw one-half turn from the closed position. Start the engine and allow it to become thoroughly warm. Then obtain a more accurate adjustment with the tractor pulling a normal load.



CARBURETOR ADJUSTMENT

A—Idling adjustment. G—High speed or load adjustment. N—Idling speed control.

Turn the high speed adjusting screw out to make the mixture richer. This screw should be adjusted to give the lowest fuel consumption without loss of power.

Turn the idling adjusting screw in to make the mixture richer. This screw should be adjusted to the point where the engine will idle regularly at slow speed without emitting black smoke from the exhaust. Turn the idling speed control screw in to increase the idling speed or out to decrease it.

CARE OF THE COOLING SYSTEM

The cooling system should be drained occasionally to remove the dirt and sediment which accumulates. This should be done at the end of the day's run, when all the foreign material is in suspension and will easily drain with the liquid. Removing the plug in the bottom of the radiator will drain the entire system if the tractor is standing level.

The cooling system should be washed out occasionally. To do this run the engine until the liquid in the cooling system is at operating temperature and the loose foreign material is stirred up. Then stop the engine and drain as quickly as possible before the sediment has time to settle. Close the drain and pour in kerosene equal to one-tenth the capacity of the cooling system and fill the remainder with a solution of one-half pound (226.8 grams) of washing soda to each gallon (3.8 liters or .8 Imp. Gal.) of water. Run the engine for about one-half hour, and again drain and flush the system with clean water.

In more obstinate cases, if the above treatment does not prove effective, an acid solution may be used; but acid must be used with extreme care, and only after other methods have proven ineffective. **Immediately,**

after the system has been washed with the soda solution described above, fill the cooling system with a solution of one part hydrochloric (commercial muriatic) acid to ten parts of water and allow it to remain in the system for a few hours at operating temperatures. Drain immediately after stopping the engine and thoroughly flush the system with clean water to which has been added a handful of washing soda, which acts as a neutralizing agent.

After using the acid treatment, the cooling system should be drained and flushed again with clean water after the first day's operation.

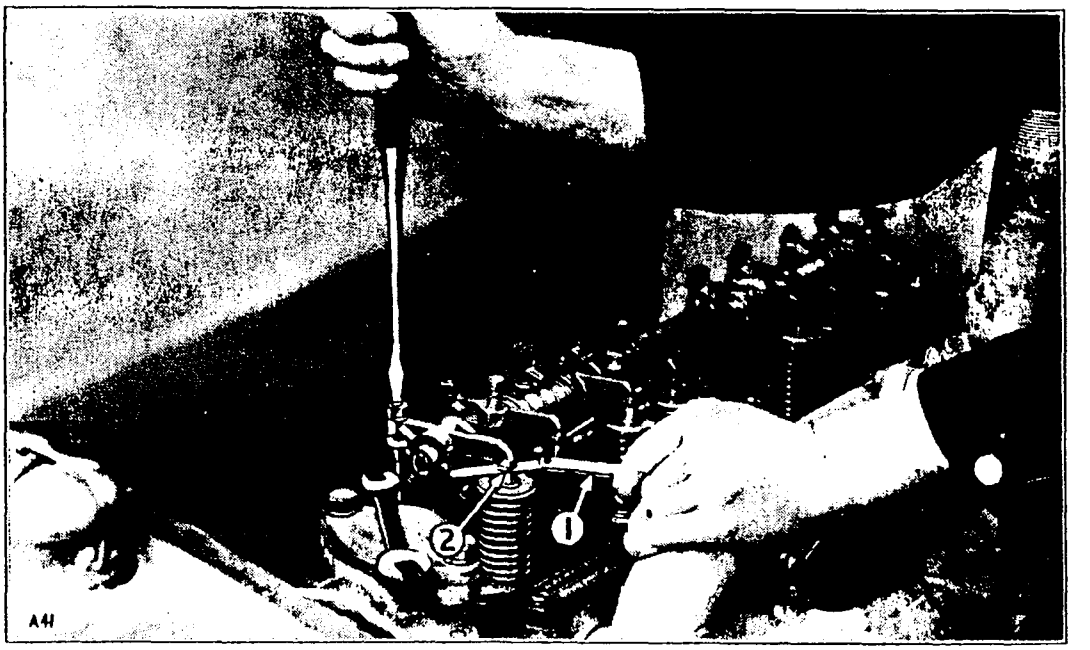
CAUTION: The acid solution is also a solvent of the metals of which radiators are made, therefore, great care must be exercised to avoid continuing the operation beyond the point where the scale is dissolved. It is highly important that no trace of the acid be left in the cooling system.

PACKING NUT ADJUSTMENT

Tighten the water pump packing nuts by turning them in the direction the shaft turns. They should be only tight enough to stop any leak, but not tight enough to bind on the shaft. Make this adjustment with the engine running. Tighten the packing nut on the accessory shaft bearing in the same manner.

VALVE CLEARANCE ADJUSTMENT

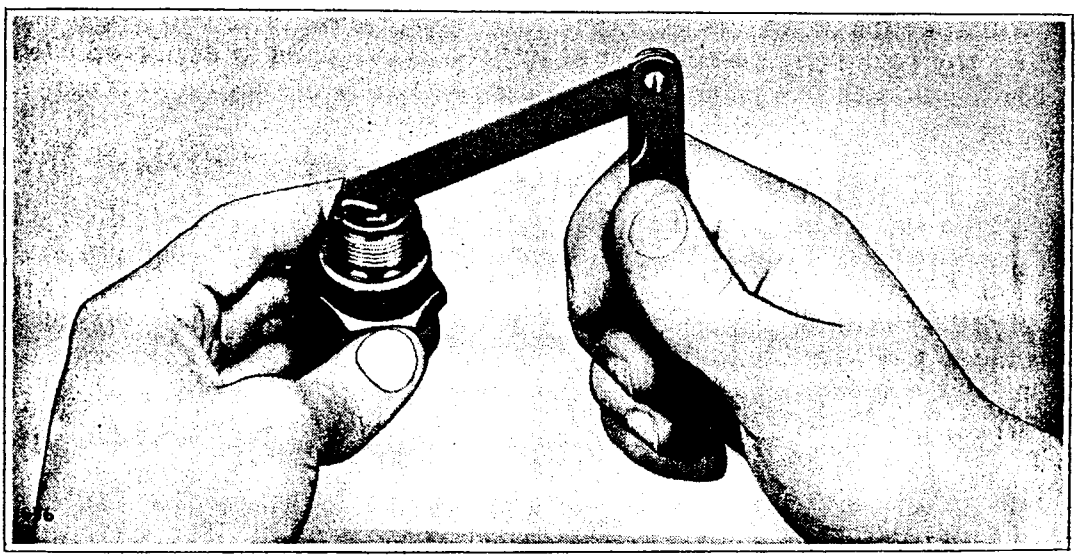
The inlet valves should be adjusted for a clearance of .005 inch (0.13 mm) and the exhaust valves .015 inch (0.38 mm). The adjustment should be made when the engine is hot. This means the temperature the engine will have attained 10 minutes after it has been stopped after having run for several hours. If the adjustment is not completed before the engine has been stopped 20 minutes, start the engine again to warm it.



VALVE CLEARANCE ADJUSTMENT
1—Valve clearance gauge. 2—Measure clearance at this point.

To adjust, crank the engine until the valve closes and the push-rod is at its lowest point. Loosen the adjusting screw nut on the valve-rocker. Turn the screw to obtain the correct clearance between the top of the valve stem and the end of the valve rocker. Measure this clearance with the thickness gauge supplied in the tool equipment. Recheck the adjustment after the adjusting screw nut is tightened. Check the clearance every 60 hours and adjust if necessary.

SPARK PLUG ADJUSTMENT



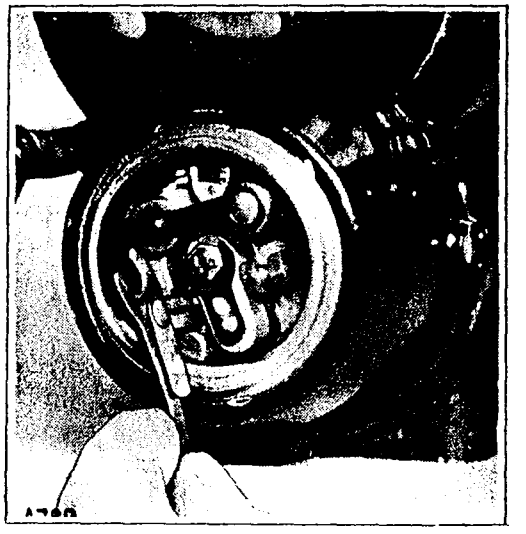
The spark plugs should be examined often enough so that the gaps may be kept at approximately .025 inch (0.64 mm.). To make this adjustment, bend the outer electrodes.

MAGNETO (EISEMANN MODEL GV-4)

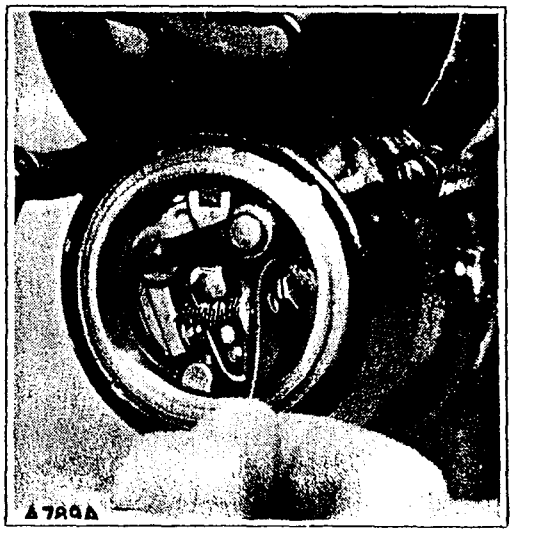
Cleaning: Approximately every 600 hours of operation, remove the distributor plate. Avoid striking the brushes against the edge of the housing. Wipe the carbon dust off the distributor plate, disc, and the collector ring, with a clean cloth moistened with gasoline. Wipe dry before operating the magneto. See that the carbon brushes are clean and slide freely in their sockets.

Keep the magneto and the bracket clean so that the slotted ventilator openings at the base of each end of the magneto housing may provide the necessary air circulation.

Checking and Adjusting Contact Points: Check the condition of the contact points approximately every 600 hours of operation. Keep the surfaces smooth and true in order to maintain the correct gap. This should be .012 inch (0.30 mm.) to .014 inch (0.36 mm.) when the bumper block is on the highest elevation of the cam.



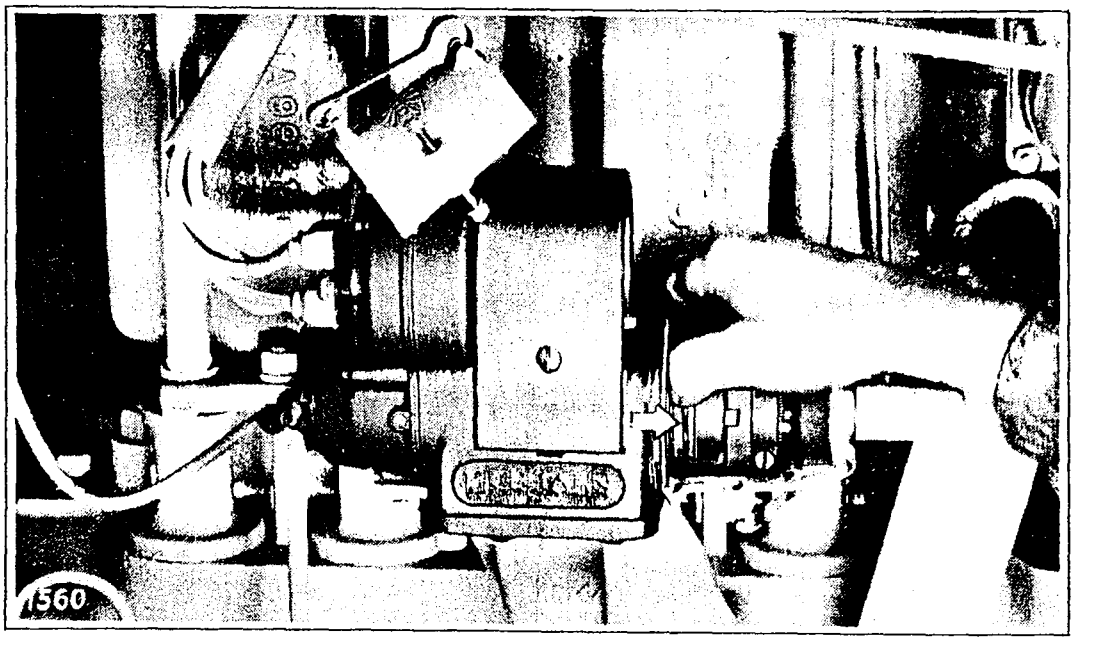
CHECKING OPENING OF MAGNETO CONTACT POINTS



ADJUSTING MAGNETO CONTACT POINTS

To adjust the gap, remove the cables from the spark plugs, take off the removable half of the impulse starter cover. Remove the breaker box cover. Crank the engine slowly until the impulse starter pawl engages, and then release the pawl by depressing the exposed end. Crank the engine until the bumper block of the movable contact point is on the highest elevation of the cam. Loosen the lock nut holding the breaker screw, insert the leaf gauge and adjust the clearance; then tighten the lock nut. Always check the clearance on both cams. A combination wrench-gauge is supplied in the tool equipment.

If the magneto has been idle for some time, the tungsten contact points must be cleaned to remove a film of oxide which will cause "hard starting." Use a fine grained carborundum stone which is available in thin strips especially for this purpose. Make sure that all the particles of metal and abrasive material are wiped from the points and from the breaker box.



RELEASING IMPULSE STARTER PAWL

Testing: A magneto may be tested when coupled to the engine by removing a cable from a spark plug and holding the terminal ⅛ inch (3.2 mm.) away from the hex part of the plug while the engine is being cranked. If no spark passes from the cable to the plug body when the ignition switch is in "ON" position, remove the magneto and take it to the nearest Eisemann Service Station for testing. See the list accompanying the tool equipment, or consult your dealer. The complete magneto including the cables and the spark plugs should be given to the Eisemann Station to insure a complete check. Do not disconnect the cables from the magneto, but remove as a whole by following the directions in the next paragraph.

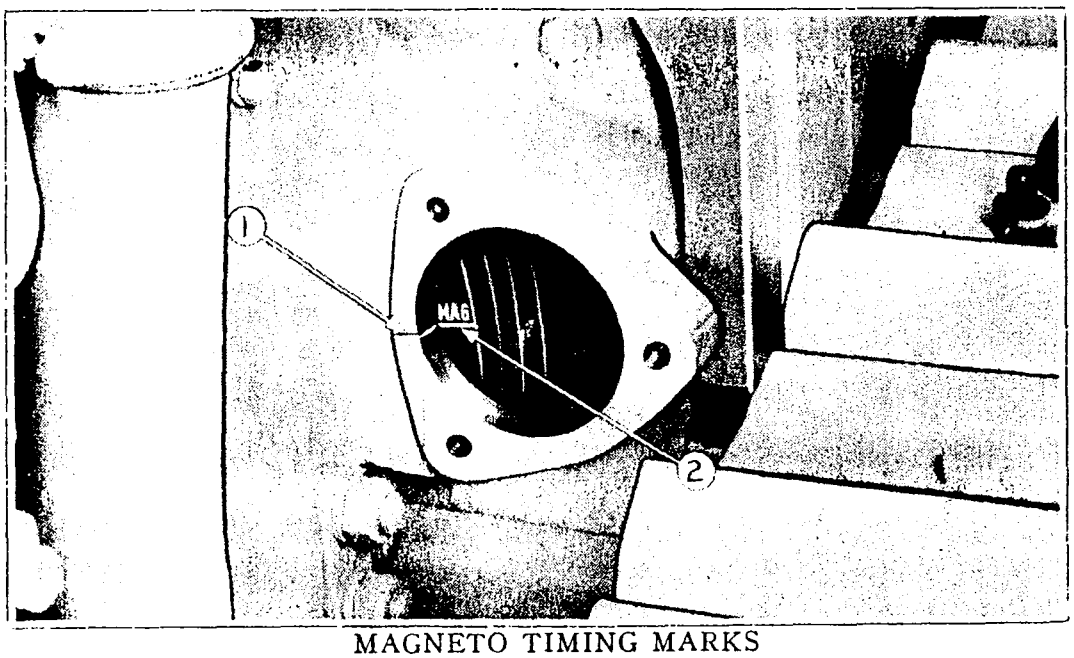
Removing: Pry out the clamp springs on the impulse starter cover. Remove the two long screws which hold the halves together and remove one half by tapping lightly. Disconnect the ground wire from the breaker box cover. Disconnect the cables from the spark plugs and remove the ignition cable conduit. Remove the magneto by taking out the cap screws holding it to the support bracket.

Timing: First check the opening of the contact points as described under the heading, CHECKING AND ADJUSTING CONTACT POINTS.

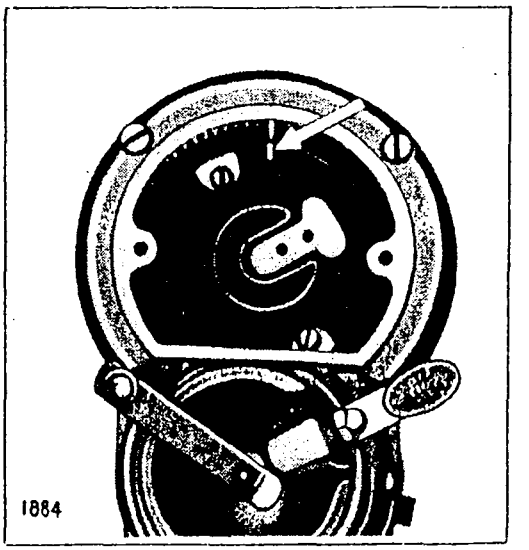
Remove the spark plug from No. 1 cylinder. Hold a finger over the spark plug opening and turn the crank slowly, until a rush of air is noted coming from the cylinder. The rush of air indicates that the piston is coming up on the compression stroke.

Remove the inspection cover from the left side of the engine on the forward side of the flywheel, and continue to turn the crank until the mark "MAG" is directly opposite the mark on the edge of the opening. The crank of No. 1 cylinder will now be 30° ahead of top center on the compression stroke, which is the correct firing point of the magneto.

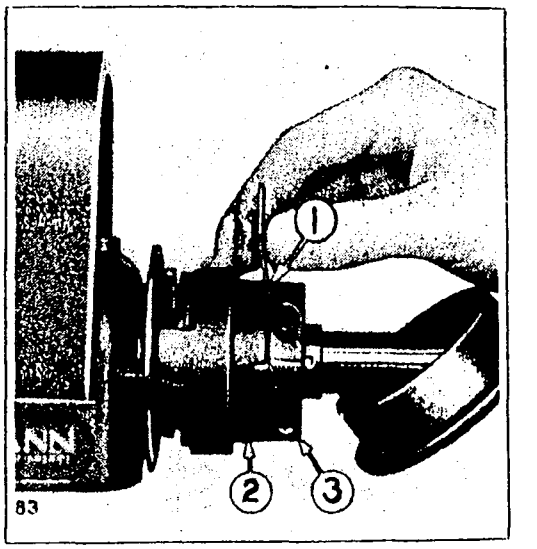
Remove the distributor plate. If the magneto timing is correct, the white mark on the distributor disc will be in line with the pointed screw on the upper inside surface of the housing.



MAGNETO TIMING MARKS
1—Mark on edge of opening. 2—Mark on flywheel.



MAGNETO TIMING MARKS



CHECKING DRIVE HUB
1—Check clearance here. 2—Floating disc. 3—Adjustable drive hub.

This setting indicates that the distributor disc conducting segment is in line with the brush that is connected by a cable to the spark plug of No. 1 cylinder, and that the contact points are just barely separated.

If the timing is not correct, remove the two screws that hold the coupling cover in position. With a screw driver, loosen the two screws in the adjustable drive hub sufficiently to permit the armature of the magneto to be turned. Release the impulse starter pawl and turn the armature until the white mark on the distributor disc is in line with the pointed screw on the top inside surface of the housing.

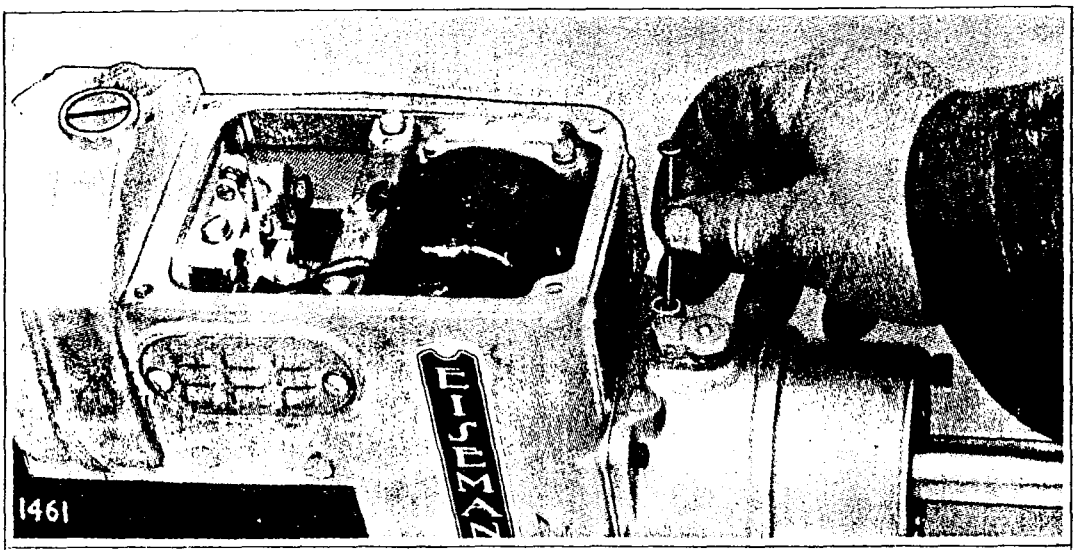
After the magneto is timed, replace the adjustable drive hub with care to avoid changing the magneto timing. Replace the hub in such a position that there is .015 inch (0.38 mm.) clearance between it and the floating disc. Use the thickness gauge supplied in the tool equipment to check this clearance. When tightening the adjustable drive hub, pull down evenly on both screws so that the notches fit correctly.

If the spark plug cables have been removed from the distributor plate, be sure they are replaced in the correct sockets. The socket at the lower left hand corner of the plate is marked "1" and the cable leading to No. 1 spark plug should be placed there. Place No. 3 cable in the upper left socket, No. 4 cable in the upper right socket, and No. 2 cable in the lower right socket.

MAGNETO (EISEMANN MODEL CT-4)

Cleaning : Approximately every 1200 hours of operation, remove the distributor plate. Avoid striking the brushes against the edge of the housing. Wipe the carbon dust off the distributor plate and disc, with a clean cloth moistened with gasoline. Wipe dry before operating the magneto. See that the carbon brushes are clean and slide freely in their sockets.

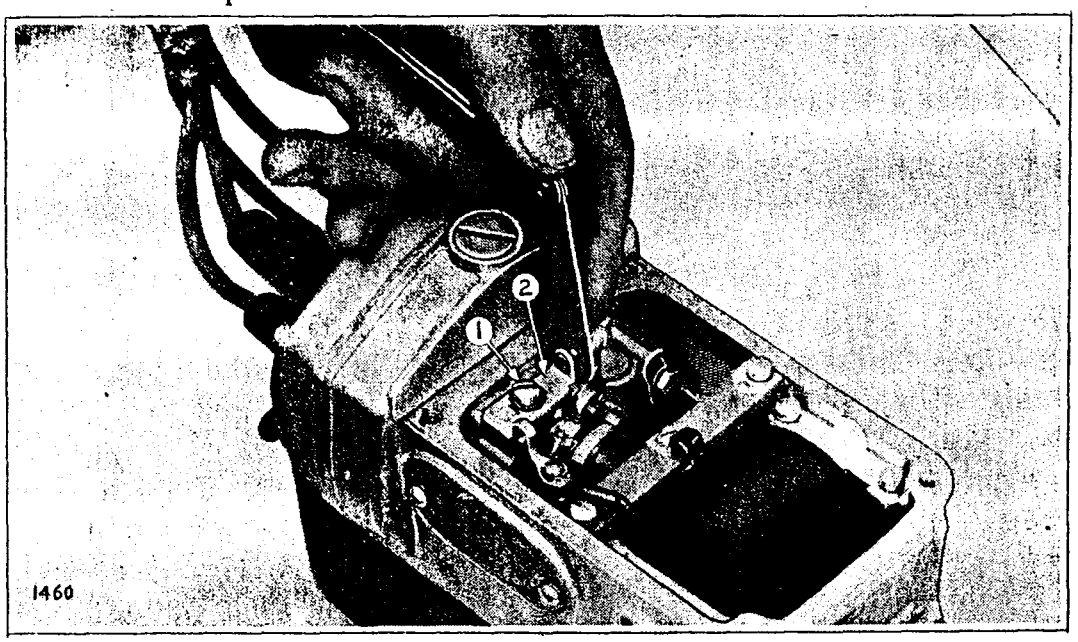
Once a year flush out impulse starter with kerosene to remove gummy oil. To do this remove the four screws which fasten the coupling cover to the magneto housing. Slide the cover away from the magneto. Pour the kerosene on the catch plate and pawls. Avoid drenching the body



RELEASING IMPULSE STARTER PAWL

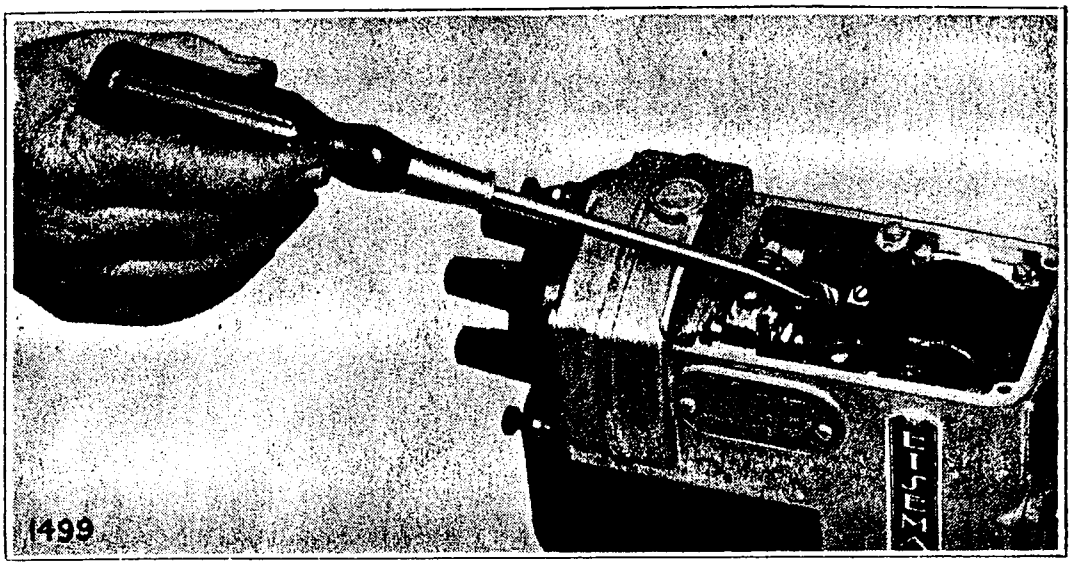
of the impulse starter, as the compression spring on the inside is packed with grease and kerosene might wash out the grease. After flushing, install the cover and fill the oil well with fresh crankcase lubricating oil. Keep the louvers clean in the ventilator plates to permit the necessary air circulation. There are three of these plates, one on each side of the magneto housing and one in the bottom of the gear cover plate.

Checking and Adjusting Contact Points: Every 1200 hours remove the top cover and check the contact point opening. This should be .020 inch (0.51 mm.) when the bumper block is on the highest elevation of the cam. To check the adjustment it is necessary to release the impulse starter pawl. This is done by removing the plug screw in the coupling cover and inserting a nail or stiff wire in the hole as the engine is cranked slowly. The nail depresses the short end of the pawl and releases it from the catch plate.



CHECKING CONTACT POINTS
1—Fastening screw. 2—Adjustable contact points.

To adjust the contact points, remove the cables from the spark plugs and loosen the screw which secures the adjustable contact point. Insert the thickness gauge supplied in the tool equipment. Adjust the clearance to .020 inch (0.51 mm.) when the bumper block is on the highest elevation of the cam. Tighten the fastening screw and recheck the clearance.

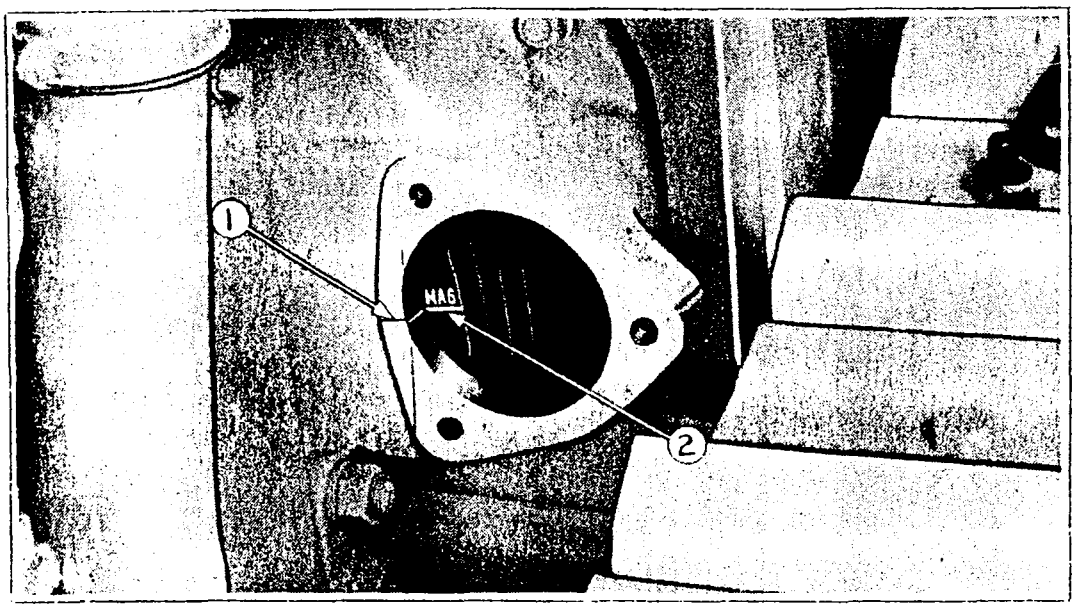


TESTING MAGNETO

Testing: A magneto may be tested when coupled to the engine by removing a cable from a spark plug and holding the terminal 1/8 inch (3.2 mm.) away from the hex part of the plug while the engine is being cranked. If no spark passes from the cable to the plug body when the ignition switch is in "ON" position, and the engine has been cranked two revolutions repeat the test with another cable. Then if no spark occurs, remove the distributor plate and examine the brushes. Clean the distributor plate and disc as described under the heading, CLEANING. Check contact point opening as described under the heading, CHECKING AND ADJUSTING CONTACT POINTS. Install the distributor plate and repeat the test. If the difficulty is not overcome, remove the magneto and take it to the nearest Eisemann Service Station for testing. See the list of Eisemann Service Stations accompanying the tool equipment, or consult your dealer. The complete magneto including the cables and the spark plugs should be given to the Service Station to insure a complete check. Do not disconnect the cables from the magneto but remove as a whole by following the directions in the next paragraph.

Removing: Take out the two screws that hold two-piece coupling cover together. Disconnect the ground wire from the top cover. Remove the spark plug cover and disconnect the cables from the spark plugs and remove the ignition wire conduit. Remove the magneto by taking out the cap screws holding it to the support bracket.

Timing: First it is necessary to check the opening of the contact points as described under the heading, CHECKING AND ADJUSTING CONTACT POINTS.

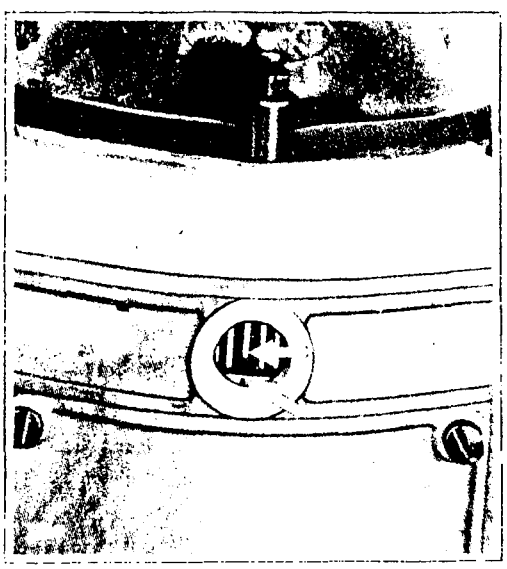


MAGNETO TIMING MARKS
1—Mark on edge of opening. 2—Mark on flywheel.

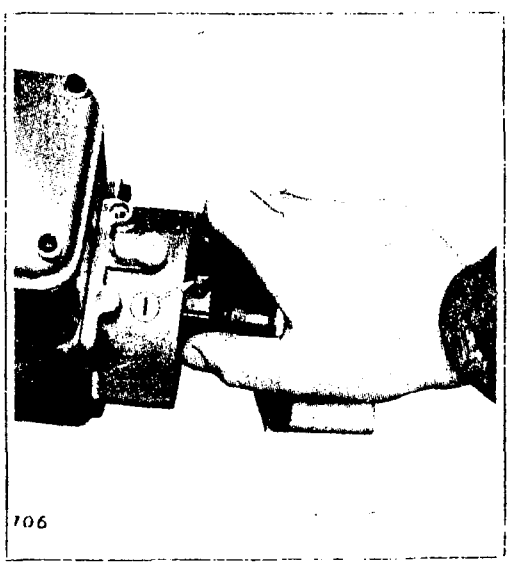
Remove the spark plug from No. 1 cylinder. Hold a finger over the spark plug opening and turn the crank slowly, until a rush of air is noted coming from the cylinder. The rush of air indicates that the piston is coming up on the compression stroke.

Remove the inspection cover from the left side of the engine on the forward side of the flywheel, and continue to turn the crank until the mark "MAG" is directly opposite the mark on the edge of the opening. The crank of No. 1 cylinder will be 30° ahead of top center on the compression stroke which is the correct firing point of the magneto.

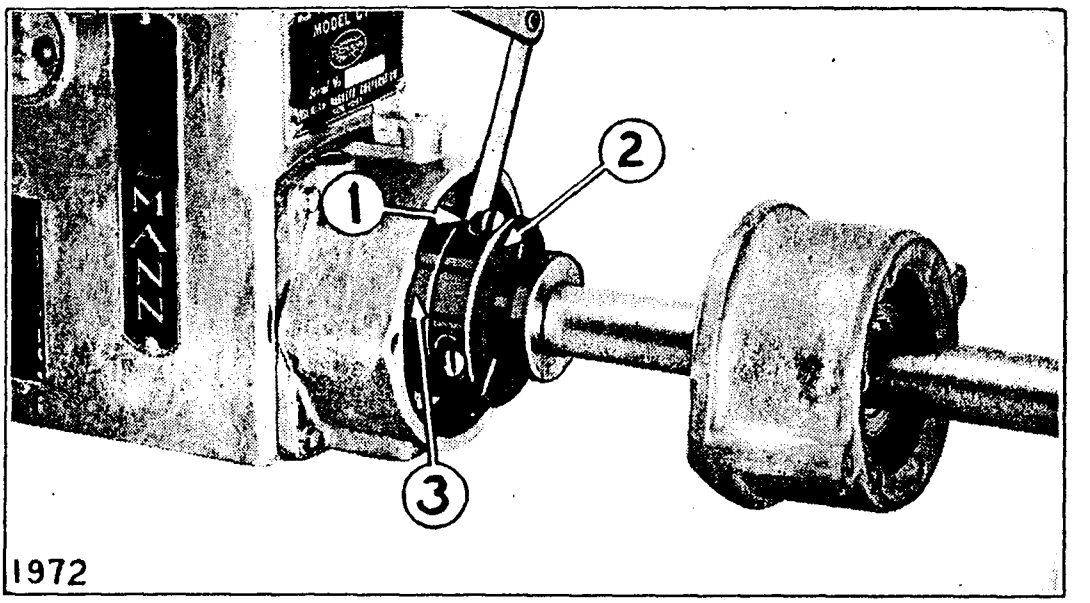
With a screw driver, remove the inspection plug from the top of the magneto housing. This will expose part of the distributor gear. If the timing is correct, the short tooth on the gear will be exactly opposite a vertical mark that is cast in the housing. This setting indicates that the distributor disc conducting segment is in line with the brush that is



INSPECTION PLUG REMOVED FROM TOP OF MAGNETO TO SHOW SHORT TOOTH AND STATIONARY MARK



TURNING MAGNETO ROTOR
1—Adjustable drive hub clamp screws.



1—THIS CLEARANCE SHOULD BE .015 INCH (0.38 MM.).
2—ADJUSTABLE DRIVE HUB. 3—FLOATING DISC.

connected by a cable to the spark plug of No. 1 cylinder, and also, that the contact points are just barely separated.

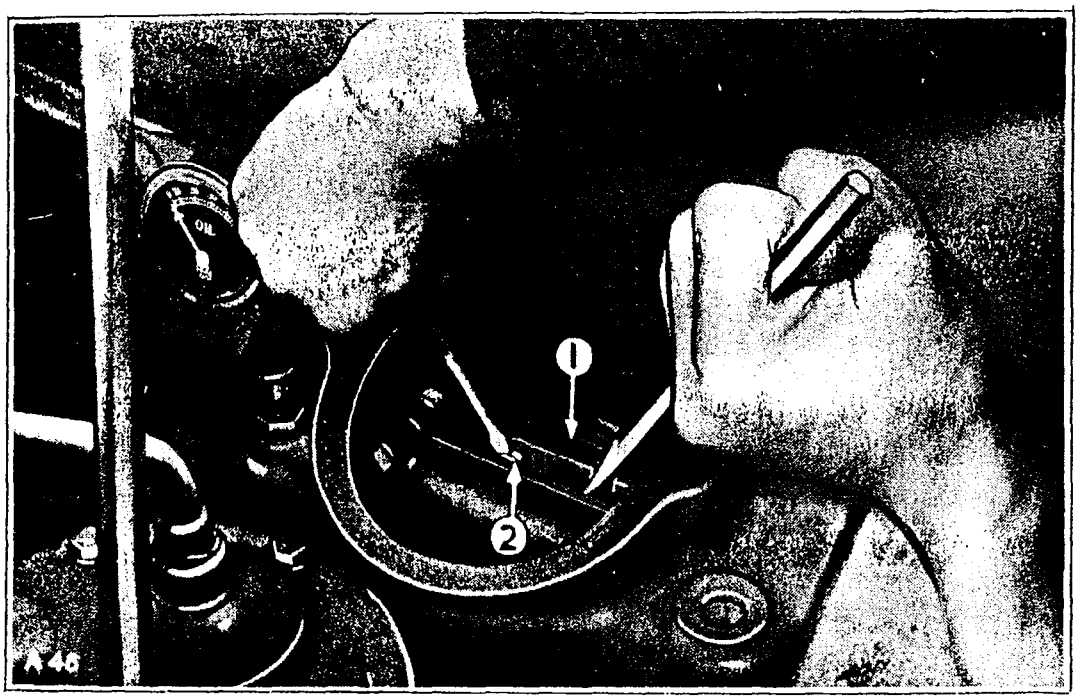
If the timing is not correct, proceed as follows: Remove the two screws that hold the coupling cover in position. With a screw driver loosen the two screws in the adjustable drive hub sufficiently to permit the rotor of magneto to be turned. Release the impulse starter pawl and turn the rotor until the short tooth on the distributor gear is directly opposite the cast mark in the housing or pointer lines up with stationary mark.

After the magneto is timed replace the adjustable drive hub with care to avoid changing the magneto timing. Replace the hub in such a position that there is .015 inch (0.38 mm.) clearance between it and floating disc. Use the thickness gauge supplied in the tool equipment to check this clearance. When tightening the adjustable drive hub, pull down evenly on both screws, so that the notches fit correctly.

If the spark plug cables have been removed from the distributor plate, be sure they are replaced in the correct sockets. The socket at the lower left hand corner of the plate is marked "1" and the cable leading to No. 1 cylinder should be placed there. Place No. 3 cable in the upper left socket, No. 4 cable in the upper right socket, and No. 2 cable in the lower right socket.

FLYWHEEL CLUTCH ADJUSTMENT

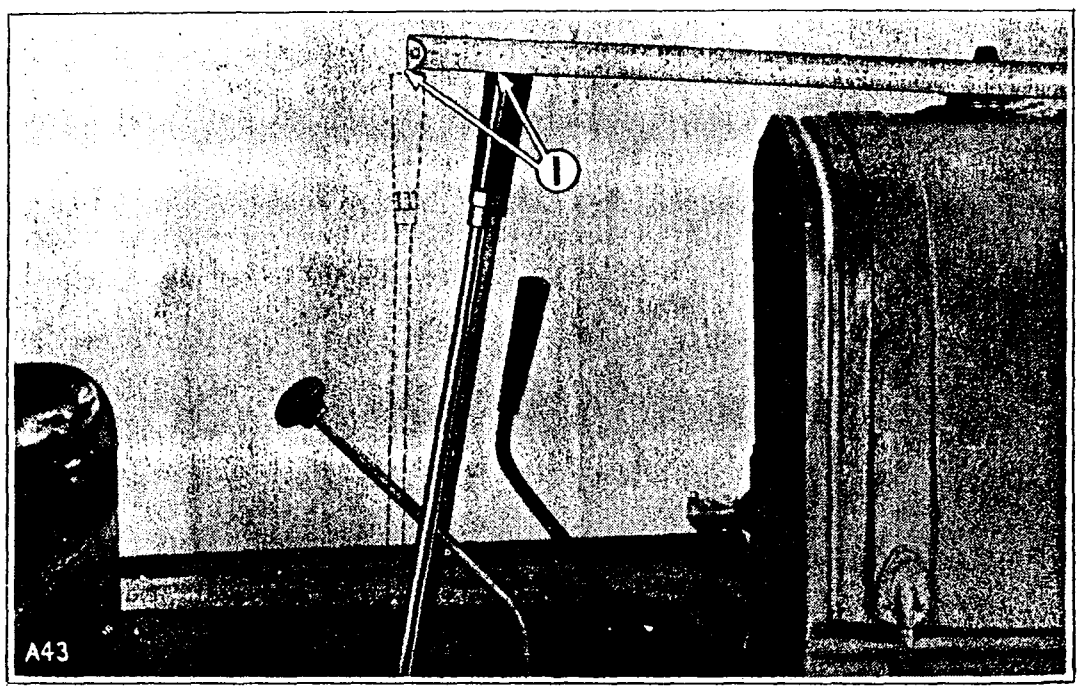
To test the adjustment, pull the clutch lever to the engaged position. The lever should go into position with a distinct snap, and should require a reasonably hard pull. To adjust, remove the inspection cover from the flywheel clutch compartment. Turn the crank until the lock pin in the adjusting plate can be reached. Disengage the clutch. Pull or pry out the lock pin and turn the adjusting plate with a pinch bar in a clockwise direction until the lock pin will engage the next retaining hole in the pressure plate. Test the adjustment. Replace the inspection cover. The adjustment may sometimes be made more easily by holding the adjusting plate with a pinch bar while an assistant turns the crank or fan until the lock pin engages the desired hole.



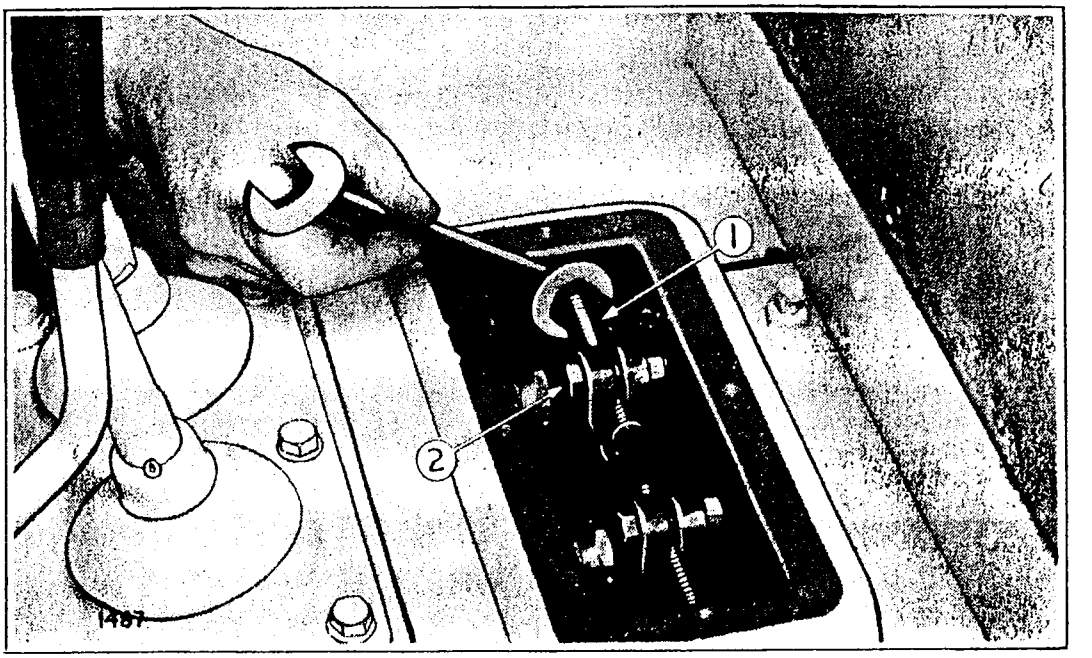
FLYWHEEL CLUTCH ADJUSTMENT
1—Pressure plate. 2—Lock pin.

STEERING CLUTCH CONTROL ADJUSTMENT

The adjustment is correct when it allows 3 inches (7.6 cm.) free motion at the top of the steering clutch levers. To adjust, remove the inspection plate from the transmission top cover. Loosen the lock nut on the clamp bolt and turn the adjusting screw in the steering clutch release yoke in, or toward the center of the tractor, to increase the clearance. The normal wear of the clutch discs tends to close up this clearance.



CHECKING ADJUSTMENT OF STEERING CLUTCH CONTROLS
1—There should be at least 3 inches (7.6 cm.) free motion at this point.

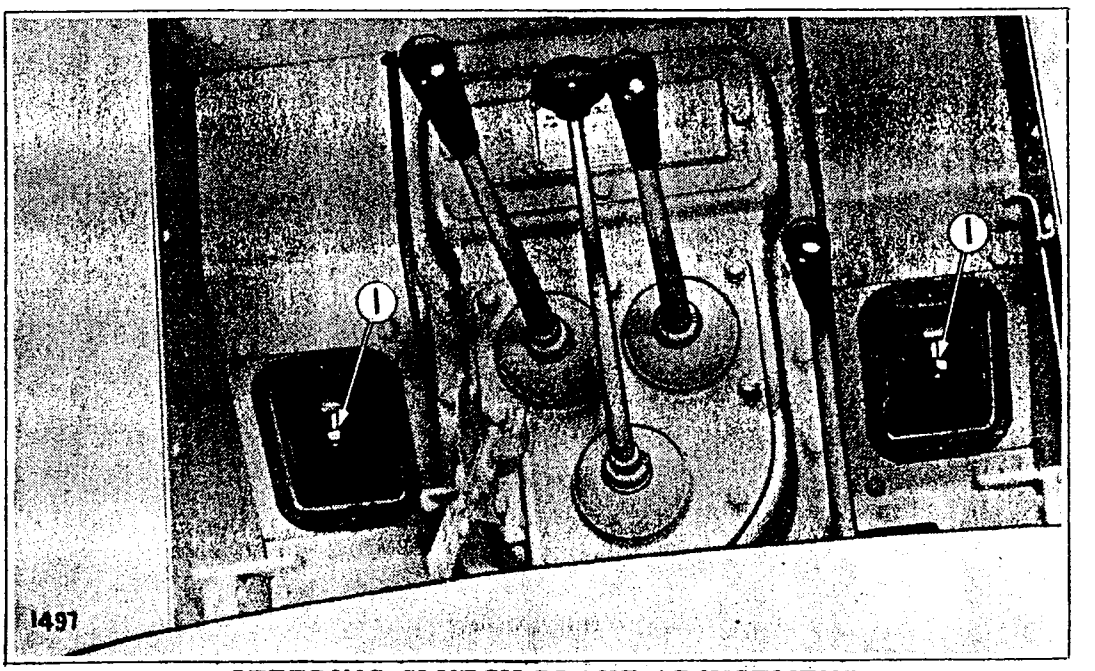


STEERING CLUTCH CONTROL ADJUSTMENT
1—Adjusting screw. 2—Clamp bolt.

STEERING CLUTCH BRAKE ADJUSTMENT

Keep the brakes adjusted just tight enough so that the tractor will turn correctly when the steering clutch is released and the brake pedal is depressed about three-fourths of the way to the floor. The band should be entirely free from the drum when the pedal is in the released position.

To adjust, turn the adjusting nut in a clockwise direction to tighten the brakes. Turn the nut sufficiently to allow the notches on the nut to seat firmly on the brake lever pin. A compression spring mounted on

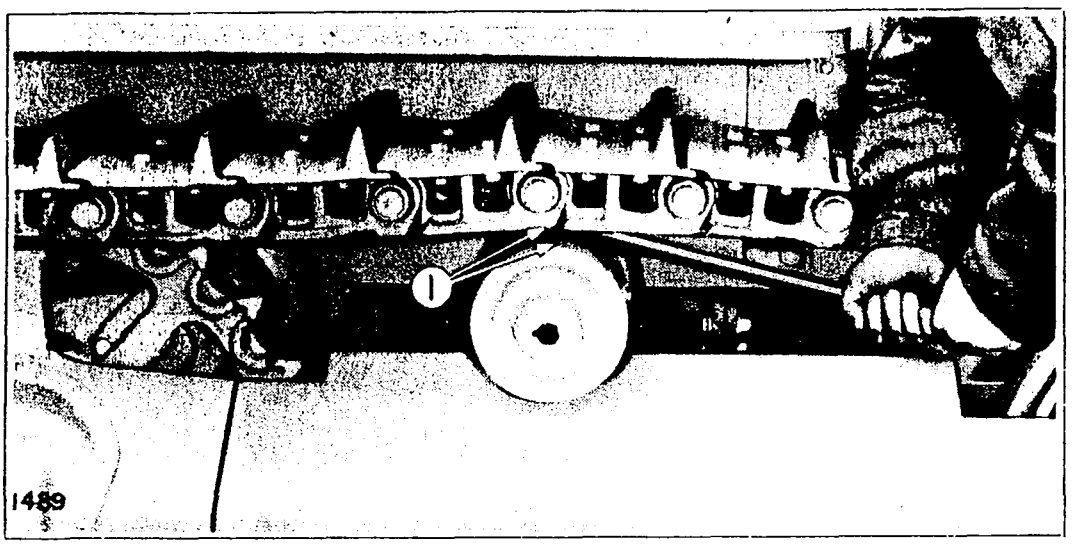


STEERING CLUTCH BRAKE ADJUSTMENT
1—Adjusting nuts.

the tang of the brake band keeps the nut from jarring out of engagement with the pin. The notches on the nut engage the pin at each half-turn.

Loosen the lock nut on the support screw on the under side of the case below the brake drum. Apply the brake to draw the brake band tightly around the drum. Turn the support screw up tight and then back off 1½ turns and tighten the lock nut. This screw supports the brake band and maintains the correct clearance between the lining and the drum.

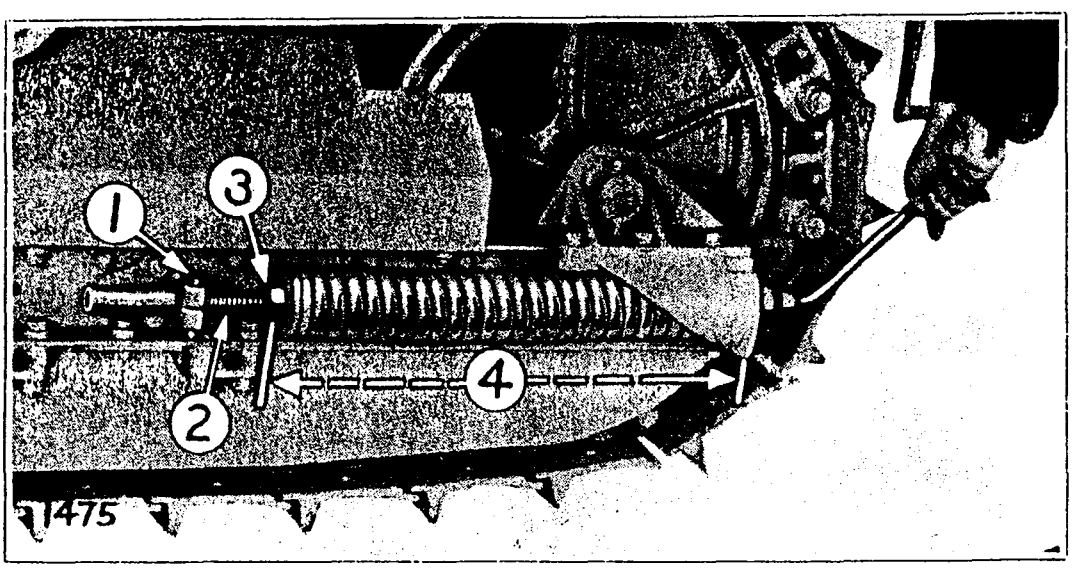
TRACK ADJUSTMENT



CHECKING TENSION OF TRACKS

1—It should be possible to raise track 1½ to 2 inches (3.8 to 5.1 cm.) at this point.

The track adjustment is correct when the track can be raised from 1½ inches to 2 inches (3.8 to 5.1 cm.) above the track carrier roller. To adjust the track, loosen the bolt on the clamp bracket and screw the adjusting bolts in or out as required to obtain the correct tension.



ADJUSTING TENSION OF TRACK

1—Clamp bracket bolt. 2—Adjusting bolt. 3—Adjusting nut. 4—Length of recoil springs should be 23 1/16 inches (58.6 cm.).

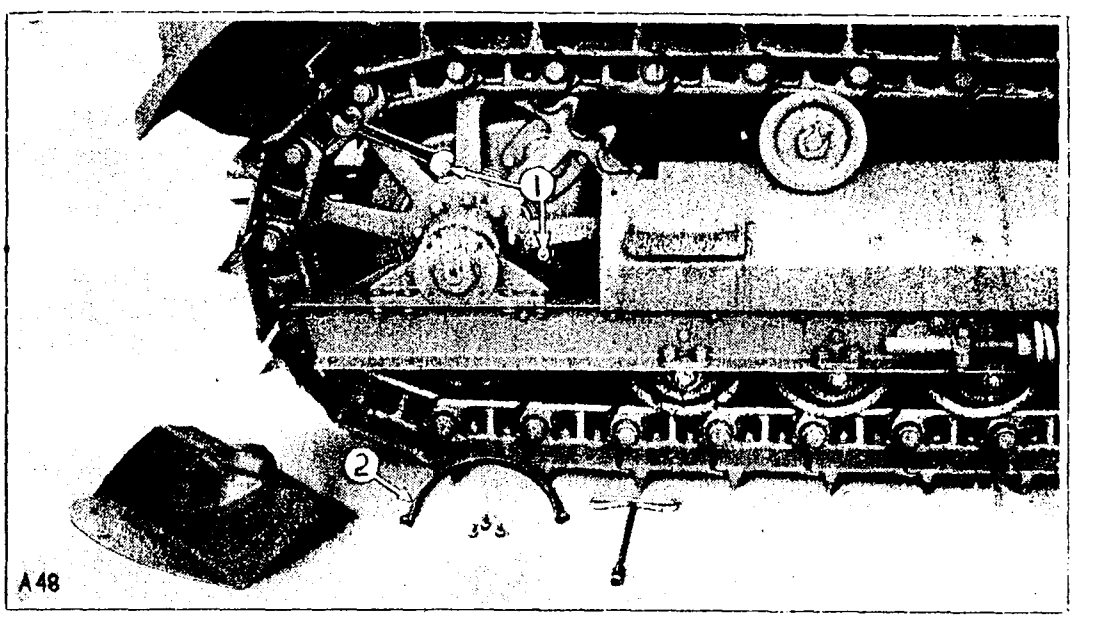
Turning the bolts clockwise decreases the tension: anti-clock wise, increases the tension. The length of each front idler spring should be 23 1/16 inches (58.6 cm.). Adjust the length of the springs by turning the large nuts at the rear of each spring.

Check the position of the front idlers to be sure that they are in line with the tracks. There should be an equal amount of clearance between the inner edges of the track rails, and the sides of the crown on the idler rim. This can be determined by observing how the track feeds into the idler when the tractor is being operated slowly on level ground. The clearance may be equalized by turning one of the recoil spring bolts in or out as required.

SPROCKET HUB PACKING GLAND ADJUSTMENT (TWENTY TRACTORS)

This adjustment is unnecessary on tractors below L-919 and PL-708. Tighten this gland only enough to prevent loss of large quantities of oil. A slight seepage around the sprocket hub is beneficial, rather than harmful, as it keeps the packing lubricated and the dirt from working in.

Adjustment is made through nuts on three studs protruding through final drive gear case around the sprocket hub. Remove sprocket guard, and final drive pinion outer bearing cover. Remove three cap screws holding sprocket hub dust guard to final drive case and lift out guard. Loosen lock nuts, take up on adjusting nuts, each the same amount, and tighten lock nuts. Replace guards.



SPROCKET HUB PACKING GLAND ADJUSTMENT
1—Adjusting nuts. (Remaining nut concealed by sprocket spoke)
2—Sprocket hub dust guard

WASHING CRANKCASE

It will be found advantageous occasionally to wash or flush out the crankcase to remove the foreign substances that have a tendency to accumulate there.

To Wash: At some scheduled oil change, replace the drain plug after the old oil has drained and pour one gallon (3.8 liters or .8 Imp. Gal.) of flushing oil into the crankcase. Run the engine for three minutes, noting that the oil gauge shows pressure. Then drain off the flushing oil. **If sludge is noticeable when draining the crankcase, the oil pump screen should be inspected and cleaned if necessary.** This screen can be removed by taking off the left rear crankcase side cover and removing the cap screw that holds the screen to the lower part of the oil pump.

Flushing oil may be used again if the foreign matter is allowed to settle and then removed.

WASHING TRANSMISSION

Remove the drain plug from the transmission case, after a run, when the oil is warm. This drains both the change speed gear compartment and the bevel gear compartment. Replace the plug and fill to the usual level with gasoline or kerosene. Drive the tractor back and forth for five minutes if it is convenient. Otherwise, start the engine, put the gears in the highest speed, tie back the steering clutches and engage the flywheel clutch. Allow the gears to run five minutes. Then shift the gears back to neutral. Stop the engine, remove the drain plug and allow the compartment to drain thoroughly. Replace the plug and fill to the correct level with transmission oil Drain the steering clutch compartments of any gasoline or kerosene that may have seeped into them.

WASHING FINAL DRIVE CASES

Remove the drain plugs from both the cases after a run when the oil is warm and allow the old oil to drain. Replace the plugs and fill the cases to the level of the filler hole with gasoline or kerosene. Drive the tractor back and forth for five minutes. After the cases have drained thoroughly, replace the plugs and fill with fresh oil to the correct levels. Drain the steering clutch compartments of any liquid that may have seeped into them.

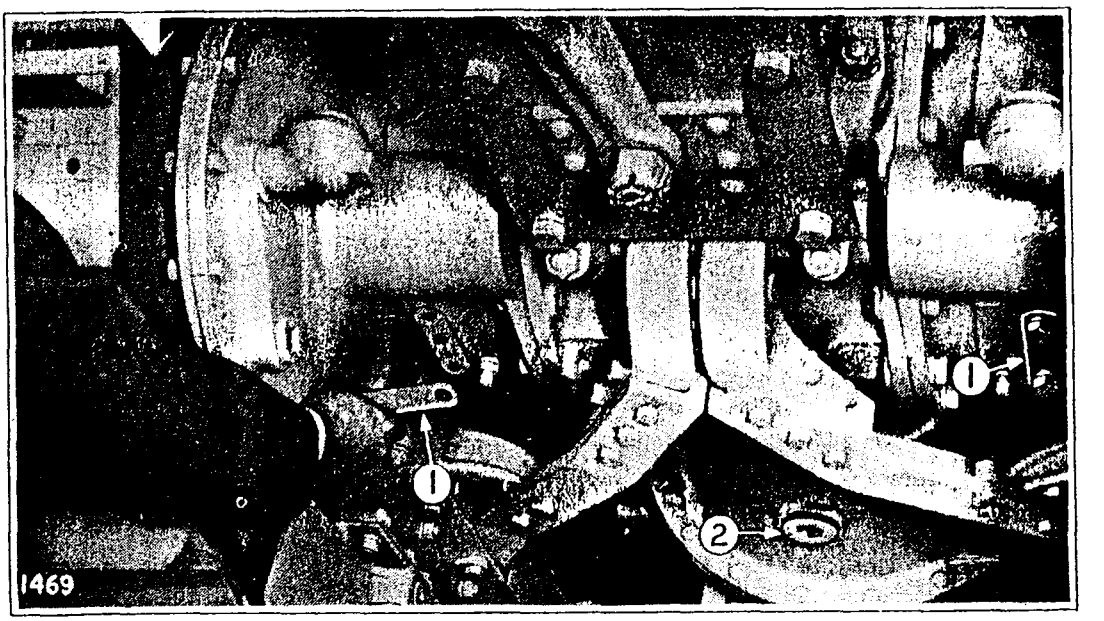
WASHING FLYWHEEL CLUTCH

The clutch plates are designed to operate dry. Oil is used only for the clutch shift collar and the driven plate bearing. The driven plate bearing is packed with a high melting point lubricant which need not be renewed except when the clutch is disassembled. The plug on the bottom of the transmission case directly under the flywheel clutch should be removed every 60 hours to drain any oil that may have seeped into the compartment from the engine, transmission or shift collar. If the clutch plates become sticky and cause difficult operation of the clutch they should be washed.

To Wash: Drain the compartment, and then pour in sufficient gasoline or kerosene to fill the compartment about one-third full. Start the engine and allow it to run for one minute, engaging and disengaging the clutch. Excessive washing of the flywheel clutch will tend to remove the driven plate bearing lubricant, therefore the washing operation should be performed only when absolutely necessary.

Remove the drain hole plug and allow the compartment to drain. Replace the cover and lubricate the clutch shift collar and hub. Leave the clutch disengaged over night if possible to allow the plates to dry.

WASHING STEERING CLUTCHES



REMOVING STEERING CLUTCH COMPARTMENT DRAIN HOLE COVER

1—Steering clutch compartment drain hole covers.
2—Flywheel clutch compartment drain hole plug.

The steering clutches are designed to operate dry. Oil is used to lubricate only the release bearings. This oil, and any seepage from the adjoining compartments should be drained every sixty hours of operation by removing the drain hole covers from the bottom of the case. If oil works into the steering clutches sufficiently to cause slippage or hard steering, the clutches should be washed. The best time to wash them is after a day's run when the foreign material will wash away more readily.

To Wash: Drain the oil from the transmission and final drive cases. Remove the brake band inspection covers and pour approximately 2 gallons (7.6 liters or 1.7 Imp. Gal.) of gasoline or kerosene into each steering clutch compartment. Replace the inspection covers and operate the tractor back and forth for 5 minutes without releasing the steering clutches. This prevents the oil and dirt from the outside of the clutches and the inside of the clutch compartments from being washed in between the clutch discs. Drain the clutch compartments. Replace the drain hole covers and pour in the same amount of fresh cleaning fluid. Start the engine and tie back both of the steering clutch levers. Put the transmission gears in first speed and engage the flywheel clutch. Allow the gears to turn for five minutes to wash the clutch discs. Stop the engine and drain the compartments. Keep the steering clutch levers tied back

for several hours (over night if possible) to allow the discs to dry thoroughly.

Be sure that any cleaning fluid that may have seeped into the bevel gear compartment or final drive cases is drained. Replace the drain plugs and fill these cases with fresh oil. Lubricate the steering clutch release bearings.

OPERATING THE TWENTY-EIGHT ON TRACTOR FUEL

The Twenty-Eight tractor is designed to give very satisfactory performance on even the lower grades of gasoline. It may be equipped with special attachments which enable it to burn the better grades of "tractor fuels" very satisfactorily. Your "Caterpillar" dealer can give you full information concerning these special attachments.

The preceding instructions which govern the operation of the Twenty-Eight on gasoline, also apply to operation on "tractor fuels" with the following exceptions and additions:

FUELS

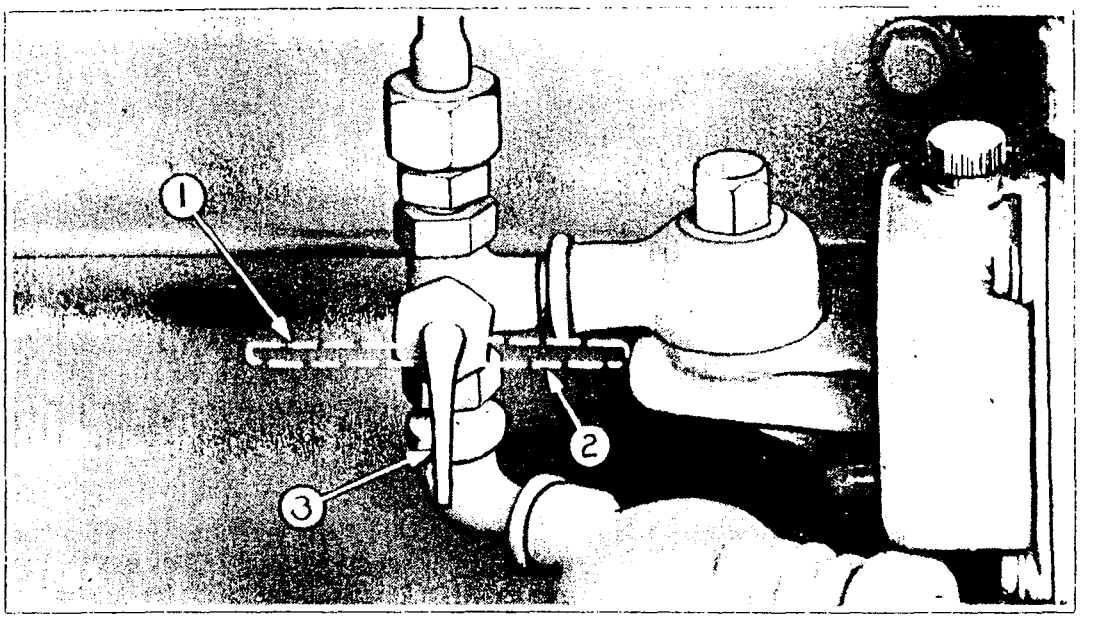
"Tractor Fuel" is the name commonly used to designate the group of spark ignition engine fuels that vaporize less readily than gasoline. Such fuels are often called kerosene, stove oil, lamp oil, distillate, etc., or by numerous trade names. They vary considerably in price, energy content, vaporizing ability, and the like, and short tests under actual operating conditions may be necessary to select the available fuel that gives the greatest economy and smoothness. Your "Caterpillar" dealer will gladly furnish you information concerning the fuels available in your territory and will help you to secure the most satisfactory performance from your Twenty-Eight tractor.

PREPARING THE TRACTOR FOR USE

Close the main fuel control valve and open the main fuel tank valve. Fill the tank with "tractor fuel", taking care that only clean fuel is admitted to the tank. If the presence of dirt, water, or other foreign substance is suspected, strain the fuel. Open the valve on the auxiliary tank and fill this tank with gasoline.

STARTING THE ENGINE

The ease with which the engine may be started depends upon the temperature of the atmosphere and the engine, and the vaporizing ability of the fuel. In warm weather, the engine may sometimes be started directly on "tractor fuel" especially if it has been stopped for only a brief period after having run long enough to become thoroughly warm. When using fuels not too far below gasoline in vaporizing ability, the engine can be started on "tractor fuel" after priming the cylinders with gasoline.



FUEL CONTROL VALVE LEVER POSITIONS

1—Position for shutting off both gasoline and "tractor fuel".
2—Position for starting with gasoline.
3—Position for running with "tractor fuel".

With fuels of still lower vaporizing ability it is necessary to start the engine as directed under the topic, STARTING THE ENGINE, for operation on gasoline. The difference being that the fuel control valve must be turned horizontally toward the rear of the tractor to admit gasoline to the carburetor from the auxiliary tank.

After the engine has started and has run long enough so that the manifold and the liquid in the cooling system have been warmed thoroughly, switch the fuel supply from the auxiliary tank to the manifold tank to burn "tractor fuel".

Note: The rate of crankcase lubricating oil dilution is excessive when burning "tractor fuel" in an engine that is not sufficiently warm. The operator should never be in a hurry to switch from gasoline to "tractor fuel". For the same reason, the engine should never be run at idling speeds for long periods on "tractor fuel".

MANIFOLD HEAT CONTROL

The engine will operate best when the temperature is above 190°F. (93.3°C.) and the heat control lever should be used to maintain this temperature. This heat on the manifold helps to compensate for the lower vaporizing qualities of the "tractor fuels" used.

When using fuels of lower vaporizing qualities it may be necessary to leave the heat control lever full "on" throughout the day. The nearer the fuel used approaches gasoline in vaporizing ability, the less heat will be needed. Actual experience will help the operator adjust the setting of the heat control to secure best results.

STOPPING THE ENGINE

When stopping the engine, move the throttle control lever to the idling position and turn the fuel control valve to the OFF position. Allow the engine to burn all the fuel in the carburetor. Then turn the ignition switch "OFF". This will make it unnecessary to drain the carburetor of "tractor fuel" when starting on gasoline.

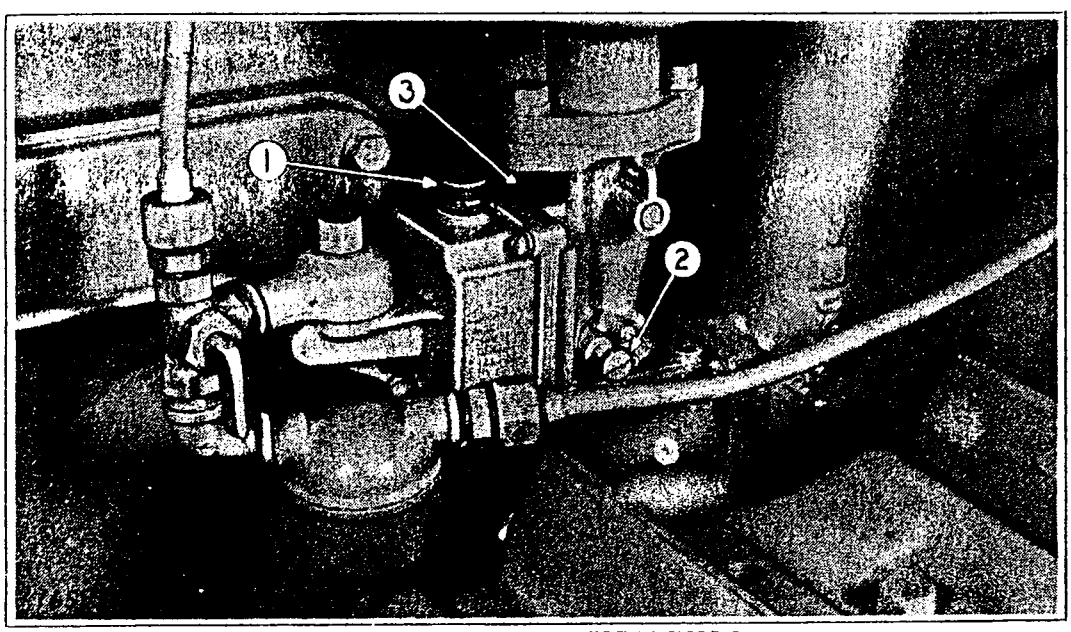
OPERATING IN COLD WEATHER

The special attachments for burning tractor fuels include a curtain that is adjustable to several different vertical positions. To adjust the curtain, loosen the wing nut on the lower right hand corner of the radiator (as viewed from the front) and turn the left wing nut enough to permit the curtain rod to be hooked into the desired slots. Tighten the right wing nut to maintain the tension on the curtain.

Use the radiator curtain to maintain an efficient operating temperature of approximately 190° to 200°F. (87.8° to 93.3°C.) In extremely cold weather, if it is difficult to maintain this temperature, it will be advisable to install hood side doors and perhaps cover the louvers in the doors with cardboard or some similar material. Side doors are available through your "Caterpillar" dealer as special attachments.

When the temperature is below 20°F. (—7°C.) sufficient anti-freeze solution should be used in the cooling system to prevent freezing. Commercial solutions are available for this purpose or glycerine may be used. **Alcohol cannot be used successfully in tractors operating on "tractor fuels" since it evaporates rapidly at the normal operating temperature of the engine.**

CARBURETOR ADJUSTMENT



CARBURETOR ADJUSTMENT

1—High speed or load adjustment. 2—Idling adjustment.
3—Idling speed control.

After obtaining an approximate adjustment for starting the tractor with gasoline, allow the tractor to warm up thoroughly. Then switch the fuel supply to "tractor fuel" and refine the adjustment by turning high speed adjusting screw "1" out to richen the mixture. Idling speed adjustment screw "2" should be turned in to make the mixture richer. The idling speed control screw "3" should be turned outward to increase the idling speed or in to decrease it.

Adjust until engine gives lowest fuel consumption without loss of power at high speed, and idles regularly without emitting black smoke from the exhaust. This adjustment will usually be found slightly rich for starting on gasoline, but for the brief warming up periods this may be disregarded.

CRANKCASE LUBRICATION

If the rate of crankcase lubricating oil dilution is rapid when operating on "tractor fuels", the oil should be drained while hot, and the crankcase refilled every 30 hours.

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FORM NO. SENR5079 (Replaces 3686)

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