



CONDENSED
SERVICE
DATA
FOR 7.6 CONVERTIBLE
TRACTOR

⚠ SAFETY MESSAGE ⚠

The product for which you have requested information or replacement parts is not a current product. The replacement models incorporate product designs, safety features, safety instructions or warnings which represent the latest "State Of The Art" developments. For your safety and those around you please contact your nearest Ariens/Gravely Dealer for a demonstration of the current product safety provisions and features.



A SUBSIDIARY OF STUDEBAKER-WORTHINGTON, INC.

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CONDENSED SERVICE DATA
GRAVELY MODEL C TRACTOR
ENGINE

The purpose of this booklet is to furnish the mechanic with the necessary information he needs to properly fit and service the Engine and Crankcase assembly of the Gravelly Model C Tractor. Detailed assembly and disassembly methods will not be discussed since the illustrations should give sufficient guidance to proper methods.

ENGINE AND MODEL DATA

<u>Model</u>	<u>Cylinders</u>	<u>Bore</u>
C	1	3- 1/4"

Key to Model Designations and Suffixes

CS -- "Slow Speed" (4 Thread Worm)
 CI -- "Intermediate Speed" (6 Thread Worm)
 C -- Standard "High Speed" (8 Thread Worm)
 C8 -- 8 - Speed -- (Swiftomatic Trans.)
 On the name plate serial number, M prefix means 100,000. For example, Tractor serial number "100105" would be shown as "M105".

MAINTENANCE

Spark Plug

Recommended: H 8

Electrode Gap .033

Carburetor

See separate instructions.

Magneto

See separate Magneto instructions.

Points .015 GA?

Stroke

3-1/2"

Displacement

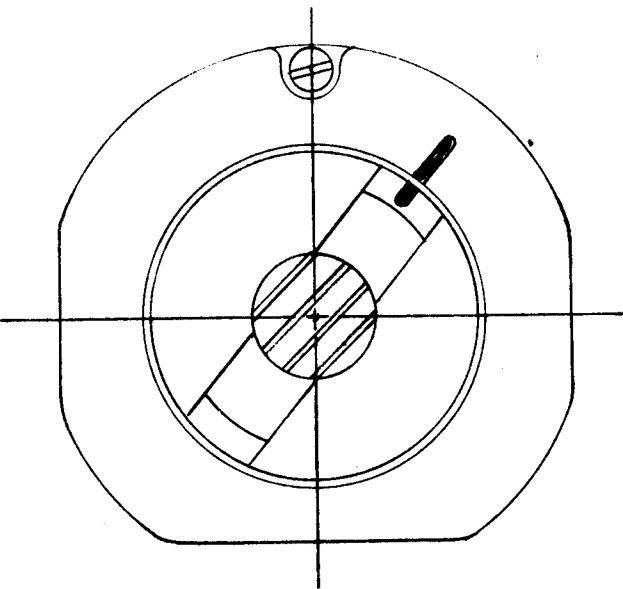
29.0 Cubic Inches

Timing Magneto to Engine

Before timing spark to engine, inspect face of Magneto and locate timing marks. If the timing marks are two lines, one on the Magneto face and one on the Coupling, proceed by Method 1. If the timing marks are a line and a dot on the Magneto face, and a line on the Coupling, proceed by Method 2.

TABLE OF ENGINE SPEEDS AND GROUND SPEEDS

<u>Slow Speed</u> <u>Tractor</u>	<u>Medium Speed</u> <u>Tractor</u>	<u>Regular Speed</u> <u>Tractor</u>	<u>Engine</u> <u>RPM</u>	<u>PTO</u> <u>RPM</u>
High Gear:				
1 mph	1-1/2 mph	2 mph	1364	682
1-1/2 mph	2-1/4 mph	3 mph	2046	1023
2 mph	3 mph	4 mph	2728	1364
Low Gear:				
1/2 mph	3/4 mph	1 mph	946	341
1 mph	1-1/2 mph	2 mph	1892	682
1-1/2 mph	2-1/4 mph	3 mph	2838	1023



MAGNETO FACE PLATE

To accomplish by Method 1. (Two Lines)

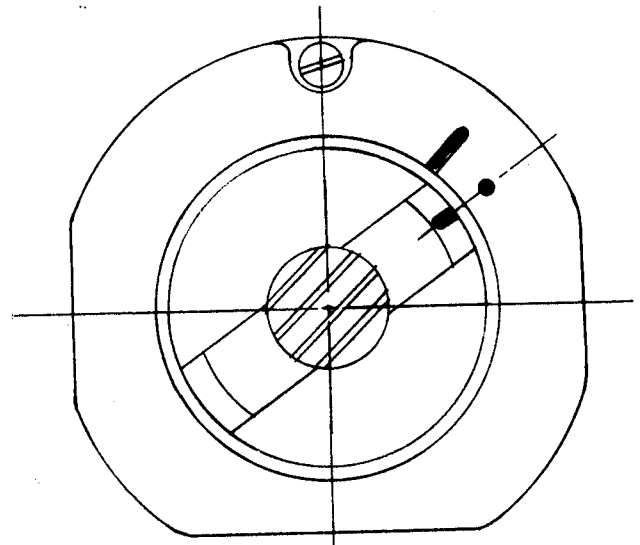
1. Remove Air Cleaner, Air Cleaner Bracket.
2. Loosen Magneto Coupling Nut until it slips on the Camshaft. It may be necessary to tap coupling gently.
3. Remove Cylinder Head.
4. Bring Piston to Top Dead Center on the compression stroke (both valves closed). Measure, accurately, the distance from top of Piston to top of Cylinder Wall. Record this measurement, then add 5/16 of an inch.
5. Turn the Starter Pulley counter clockwise until the Piston goes down the cylinder approximately an inch. Then bring Piston back up Cylinder slowly until it is the distance calculated in step four. (5/16" plus distance from top of Cylinder Wall to Piston at Top Dead Center). This procedure takes up any back-lash in the gears.
6. Hold the Magneto Shaft Extension with Vise-Grip Pliers so it will not move. Rotate the Magneto Impulse (inoperative) until the timing marks line up.

7. Be sure that there is at least 1/64" end play in the Magneto coupling so it will not cramp the impulse. Use a 1/64" (.015) Feeler Gauge between the Fiber Block and the Coupling Flange before tightening nut. Tighten nut while holding timing marks together.

8. Check your settings by backing the Piston not more than two inches down the cylinder barrel (to avoid picking up Magneto impulse) and review the procedure.

9. When timing is correct, lock Magneto Coupling Nut.

10. NOTE: Timing Marks will not line up when piston is at Top Dead Center.



MAGNETO FACE PLATE

To accomplish by Method 2. (Lines and dot for Wico). Two yellow lines for Fairbanks Morse.

1. Remove Air Cleaner, Air Cleaner Bracket.
2. Loosen Magneto Coupling bolt until coupling moves on the Camshaft. It may be necessary to tap the coupling gently.
3. Crank Starter Pulley until you feel the beginning of the Compression Stroke. Remove Spark Plug, observe by eye or, more accurately, measure to piston surface until Piston is exactly at Top Dead Center.

4. Hold the Magneto Shaft Extension with Vise-Grip Pliers so it will not move. Rotate the Magneto Impulse (inoperative) until timing marks (line on Coupling and dot on Magneto) line up for Wico. Two yellow lines for Fairbanks Morse magneto.

5. Reassemble Magneto Coupling, use 1/64th (.015) Feeler, between Fiber Block and The Coupling Flange before tightening bolt, so you will not cramp the impulse. Be sure timing marks are together while tightening bolt.

6. Lock Magneto Coupling bolt. Replace Air Cleaner and Bracket.

7. NOTE: Timing line on Coupling and dot on Magneto line up at Top Dead Center.

LUBRICATION

Capacity is 5 PINTS. Engine and Chassis are lubricated by the same oil. Use only Motor Oils, do NOT use transmission oils or greases.

For Summer:

API MS SAE 30

For Winter:

Temperature range from 32° to 0°F
Use SAE 10 - W 30° and below 0, 5 W 20.

Oil is checked by having tractor level.

REPAIRS

Crankpin

Crankpin diameter is 1.497/1.498, and the Connecting Rod big end Bushing must be reamed to 1.500. The Crankpin diameter has been changed. We suggest you accurately "mike" the Crankpin. If less than 1.497, ream the Bushing to give .002/.003 clearance.

Connecting Rod has bronze Bushing, pressed into Rod. Crankpin into Flywheel is a .001 to .003 interference fit. An interference fit means that the Crankpin is actually .001 to .003 larger than the hole in the Flywheel. The Crankpin must be a very tight fit to keep it from turning. Therefore the Crankpin is pressed into the Flywheel. (Note that Flywheel must be pressed tightly to shoulder on Crankpin.)

Piston, Pin, Rings

Piston is equipped with three rings.

1 Chrome Compression Ring
(Ring Gap: .012 to .020)

1 Steel Compression Ring:
(Ring Gap: .008 to .016)

1 Oil Scraper Ring:

Old Style Iron Ring, (Gap:
.008 to .016) or New Style

Three Piece Chrome Oil

Ring: Ring (Gap .015 to .055)

We have put into production a chrome-plated steel, three piece oil ring. Both our laboratory test and field test show this ring much superior to the old style cast iron ring. Therefore, even though it is more expensive, we are using it now in all production, and the rings are available on repair orders.

The rings will be furnished in standard, .010, .020, and .030 oversizes.

The standard size can be used up to .009 oversize, the .020 up to .029 oversize, and the .030 up to .039 oversize.

We recommend the use of the ring especially when "smoking" occurs in the equipment, and yet the compression rings are still in good shape. Quite often, the simple expedient of changing the old cast iron ring to the new style will stop the "smoking" completely.

Of course, it is better to refinish the cylinder bore, and use the proper size of oversize pistons and rings. The new three-piece oil ring, should have from .015 to .055 end gap for the two flat segments. In contrast, the old style cast iron oil ring should have .008 to .016 end gap. The top chrome compression ring should have .012 to .020 end gap. Measure the end gap with a feeler gauge, with the ring removed from the piston and held in the cylinder bore.

Installation of the new ring, though not difficult, must be carried out with care, following the instructions given below carefully and accurately.

INSTRUCTIONS FOR INSTALLING THREE-PIECE OIL RING

1. Place stainless steel expander spacer in groove with ends butted.

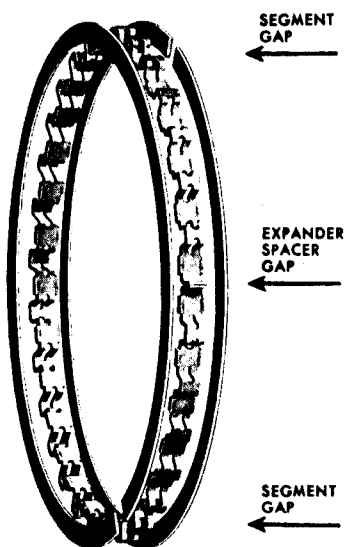
2. Install steel segment on top side of expander spacer with gap of segment approximately 90° beyond gap of stainless steel expander spacer, making certain that the expander spacer is still in a butted position.

3. Install second segment on bottom side of the expander spacer with segment gap approximately 90° from the expander spacer gap in opposite direction from which the top segment has been installed.

4. Recheck assembly - rings should be free to move in the groove, however, a slight drag will be evident because of the side sealing action of the ring assembly. **BE SURE EXPANDER SPACER REMAINS IN BUTTED POSITION.**

5. When pistons are ready for installation in the cylinders, compress rings carefully, and slip the cylinder down over piston and rings. Since the Cylinder is chamfered, a slight twisting motion will allow this process to be carried out easily, without forcing.

If any difficulty is encountered, the rings should be checked for correct installation in the groove.



Piston Pin (Wrist Pin) is .859 diameter. Small end of Connecting Rod holds Bronze Bushing which should be reamed to .860/.861.

Piston Pin (Wrist Pin) is a solid fit in the Piston. It is a light push fit in a hot Piston.

Clearance

Piston skirt clearance is .003/.005, measured with a Feeler Gauge at right angles to the Piston Pin.

To determine if cylinder needs reboring:

1. Use any Piston Ring, inserting it in the cylinder 1/2 inch from the bottom of the bore, using the piston to square it with the sides. Measure the Gap with Feeler Gauge.

2. Use the same ring, 1/2 inch from the top of the Cylinder, seated true with piston, measure the gap.

3. Subtract smaller reading from larger reading, then divide by 3.

4. If result is more than .006, we recommend the cylinder be rebored to the next .010 over size. Pistons and Rings are furnished in oversizes: .005, .010, .015, .020, .025, .030. Diameter of Standard Cylinder is 3.2545/3.2535.

Bore

Crankshaft

Drive Pinion Shaft Bushing should be reamed to 1.0005/0.9995. The Drive Pinion Shaft is factory toleranced to .9975/.9965, which gives an overall clearance of .002/.004. (Drive Pinion Shaft Bushing is furnished in .005, .025 O. D. Oversize).

(Drive Pinion Shaft Bushing is fitted into hot crankcase.)

The timing Pinion Shaft is fitted into the Ball Bearing at manufactured tolerance.

Camshafts

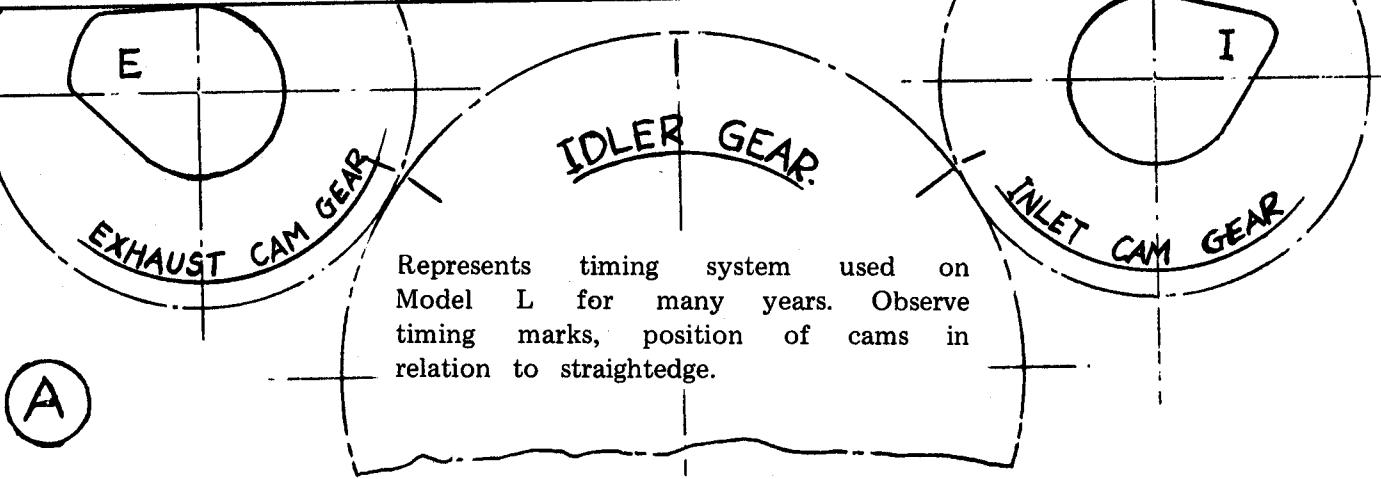
Camshafts must be timed very accurately to engine for best results. See timing diagram.

On Tractors manufactured before September 1955, the appearance of the Cam profiles in relation to a straightedge will vary as shown in the same Timing Diagram. On all models, when checking Timing, carefully observe the Cam profile and position. If not as shown in sketch C, replace Camshafts.

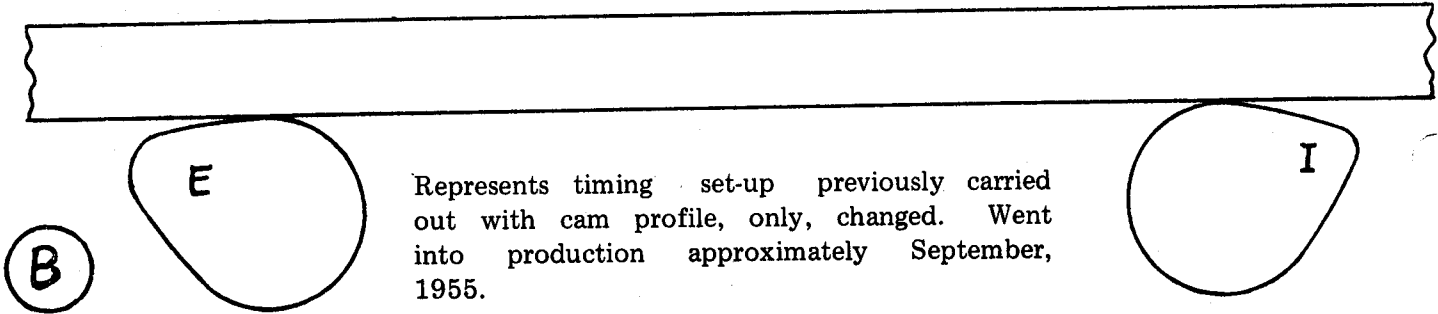
Camshaft Bushings are reamed with a .750 reamer. Camshaft diameters are precision ground to .7480/.7490. Clearance should be .001 to .003.

NOTE: Bushings should be line reamed, in place in bolted-together Crankcases. Crankcases must be replaced, when necessary, in Pairs.

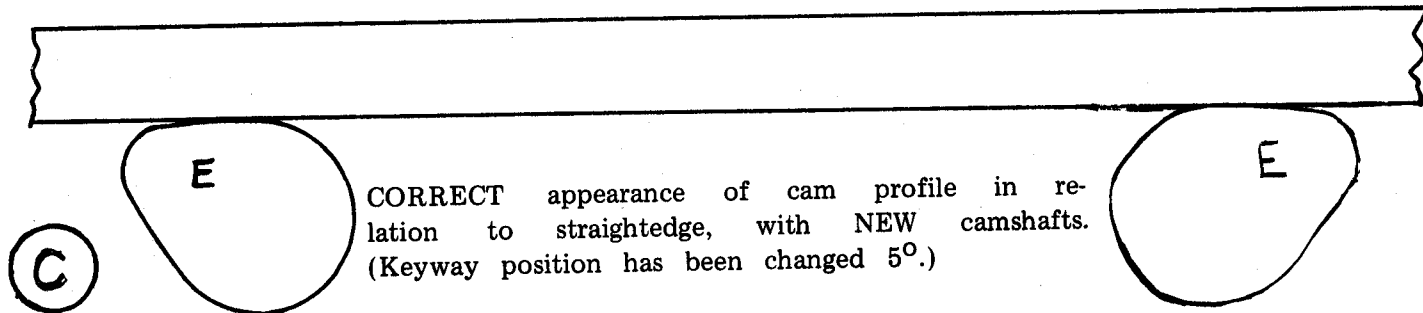
STRAIGHT EDGE.



Represents timing system used on Model L for many years. Observe timing marks, position of cams in relation to straightedge.



Represents timing set-up previously carried out with cam profile, only, changed. Went into production approximately September, 1955.



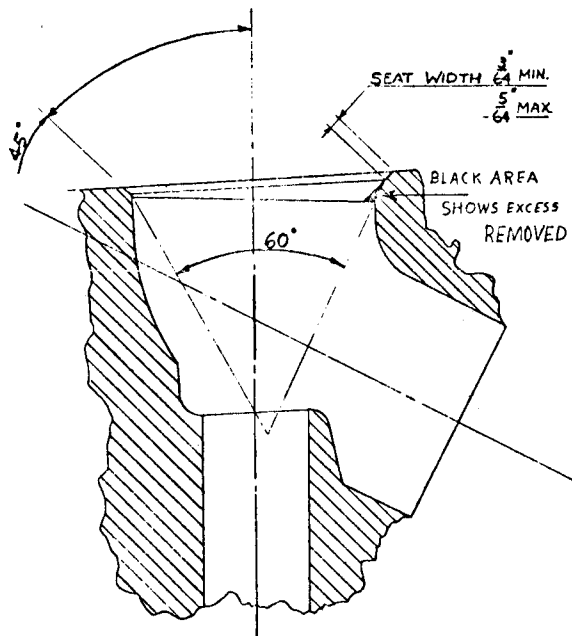
CORRECT appearance of cam profile in relation to straightedge, with NEW camshafts. (Keyway position has been changed 5°.)

When repairing older tractors, use new Camshafts, which will give the appearance shown in (C). To check if Valve Timing is correct, (Engine cold) set Valve Tappet at .0015 (Cigarette paper). Cylinder head off. Intake valve should just start to open at the Top Dead Center of Exhaust stroke. After piston passes Top Dead Center going down on the Intake stroke the exhaust valve should just close at 5/32" from Top Dead Center. After checking, re-adjust tappets to proper clearance before running engine.

Valve System

Grind Valve Seat Angle 45 degrees. Seat must be square with Valve Guide bore. Seat width dimensions are $\frac{3}{64}$ " to $\frac{5}{64}$ ". Finish with Valve Grinding Compound to insure good seat and compression. Rough: Government Grit grade 120 (E); Finish: grade 280 (A).

If Valve Seat exceeds $\frac{5}{64}$ " on one side, use a 60° Valve Seat Reamer, to remove excess valve seat width.



Timing of Valves is accomplished by Camshaft timing. See "Camshaft".

Valve Tappet clearance, engine COLD, is .012, exhaust, .012 intake, obtained by adjusting Valve Tappet.

Valve Clearance in Exhaust Valve Guide is factory toleranced. Intake Valve clearance is .002/.004.

Valve Plunger is .7485/.7495. Valve Plunger Guide is reamed to .750/.751. Clearance should be .0005 to .0025. (Tight slip fit.) (To prevent oil leakage around valve plunger, maintain this clearance.)

Valve Sleeve Gasket should be permatexed or shellacked.

Replace Valve Springs if you can squeeze together with one hand.

Oil Pump

Oil Pump is a precision gear pump. Fits and tolerances must be held closely to insure good oil supply at essential lubrication points.

Oil Pump Bushing should be reamed to $\frac{7}{16}$ " (.4373/.4388). The Oil Pump Master Gear Shaft is toleranced at .4363/.4368, which means clearances must be held to .0005 to .0025.

Oil Pump Gears must be a snug fit in the Oil Pump Cap.

To Accomplish:

1. Press Idler Gear Pin into place by starting it in the Crankcase, placing the Idler Gear over it, and pressing it until it is flush with the top surface of the Idler Gear.
2. Place Dowel Pin in Crankcase. Assemble Oil Pump Gears and Oil Seal in Cap. Check that the Gears are flush with surface of Oil Pump Cap with the Gasket in place.
3. Assemble to Crankcase, using a $\frac{9}{16}$ " socket and speed handle on the Oil Pump Idler Gear Pinion Shaft Nut.
4. After cap is seated, wash out and check by putting oil in large opening and turning speed handle to check pumping action and wash out pump.

Note that the Idler Gear Stud must be checked carefully to see that it is the same height as the gears. Also, be sure to check Oil Pump Gears to be sure they are the same thickness and that they are free of burrs. Never put new gears in an old Cap.

Tolerances of Oil Pump Gears are:
Diameter (O.D.) .746/.747 Thickness, .384/.385.

TROUBLESHOOTING

Tractor Engine Fails to Start

Probable causes are, in order of their frequency:

1. Out of Fuel
2. Fuel shut off at sediment bowl
3. Stuck valve
4. Fouled or out of adjustment Spark plug.
5. Magneto failure
6. Timing failure

Tools needed for this service work: Feeler Gauge, Screwdriver, light Ball Peen Hammer, $\frac{1}{2}$ " 6 pt Socket and Wrench, $\frac{15}{16}$ " Spark Plug Wrench, can of penetrating oil (may substitute $\frac{1}{2}$ and $\frac{1}{2}$ No. 10 Oil and Kerosene).

TO CORRECT:

1. Check Gas Tank, fill if empty.
2. Check Shut Off Valve at Sediment Bowl, to make sure it is open wide.

3. Turn engine over slowly by HAND, to see if engine has compression. If engine HAS COMPRESSION,

4. Remove Spark Plug, check for fouling, burning, wetness. Remove carbon, dry if necessary, reset at .033. If Spark Plug appears to need replacement, replace with Autolite TT-10.

5. If you DO NOT have COMPRESSION, you usually will have a valve stuck open. The primary symptom is a sudden (usually overnight) loss of compression. Lack of compression due to Ring Trouble is a gradual loss, getting progressively worse, and characterized by oily smoke from the exhaust for some period before actual complete compression loss.

6. Remove cylinder head. (Observe Gasket. Replace if necessary).

7. Check to see if there is any bit of carbon on the Valve seat which might be preventing the Valve from completely closing. If so, remove and grind Valve to a good seat if necessary.

8. If no carbon bits are present, flood the Valve and stem with penetrating oil. Let "soak" a few minutes, flood again. Using a screwdriver in the slot on top of the Valve, begin working the Valve by attempting to rotate the valve. If this is unsuccessful, flood again with penetrating oil, (IMPORTANT: Turn engine over until impulse clicks — to be sure you don't break Cams.) Then tap the Valve lightly with the hammer. Again use the Screwdriver. The Valve will usually break loose in a very short time. Continue to work until it is perfectly free, and rises and falls with the turning over of the engine.

Chronic cases of Valve sticking can be eliminated by one of the Bronze Valve Guides.

9. Observe the seating and the action of the Valves. If a Valve Grinding Job is indicated, recommend it to the customer at that time. If Valves need replacement, recommend it.

10. Occasionally a Valve is stuck closed. This is rare, however. The symptoms will show up immediately when you attempt to turn the engine over by HAND. The Engine will "stop dead" at a certain point. Reversing the direction of turn, the

Engine will stop again at the same point in the firing cycle. The procedure is exactly the same as for releasing a Valve that is stuck open. WARNING: Never attempt to test for a stuck valve by turning the engine over in any manner except by HAND. Turning an Engine over with a strap, or by forcing, when a Valve is stuck closed will result in fracture of the Crankcase, necessitating replacement.

11. If the Engine has compression, the Spark Plug is in good order, etc., test the spark.

12. The Spark should jump at least 3/16" when tested by putting the end of the Magneto Cable connection this distance from a metal object. (Usually the Cylinder Head).

13. If the Spark is weak, it is usually caused by condensation within the Magneto. Remove the Cap, dry out the Magneto. (You can observe the wetness when the Cap is removed.)

14. Normally, if the Magneto is not firing correctly, routinely replace Coil, Condenser, and points.

15. If it is impractical, or undesirable, to replace all of these parts, observe the Points first, to make sure they are breaking, and are not burned or dirty.

16. If the Points are dirty or wet, clean by using a piece of hard paper. (A piece of paper from a "slick" magazine works well.) Spread the Points by hand, release on the paper, and pull the paper through.

17. Adjust the Points. On Wico Magnetos, the setting is .015: on Bendix-Scintilla, .018.

18. To adjust, release the adjusting screw by turning the locking screw slightly. Make the adjustment by turning the adjusting screw, then lock in place with the lock screw. See separate Magneto instructions. If you replace, remember to lubricate the felt washer on the Wico Magneto. BE SURE TIMING MARKS ARE LINED UP when you make this adjustment!

19. If the Spark you get is very red, instead of blue or yellow-white, it is probably the condenser. A bad condenser will usually allow the Engine to start, but the Engine will backfire and spit, and quit. If

there is no spark at all, it is usually the Coil.

20. To replace the Coil, Condenser, or do any other work on the Magneto, it is best to remove the Magneto from the Tractor.

21. To remove, turn the Engine over by hand until the Timing Marks are lined up. **DO NOT MOVE THE ENGINE UNTIL YOU HAVE REPLACED THE MAGNETO.** When you are ready to replace the Magneto, line the Timing Marks on the Magneto and replace it. The engine will be Timed the same as it was when you removed the magneto.

22. Loosen the Bolts from the bottom mounting, and remove the magneto, pulling straight back (away from engine) so as to not disturb the Timing.

23. If the Magneto is furnishing a strong Spark, and all other factors mentioned are correct, then the difficulty is probably in the timing. See "Timing Model L Engine".

UNUSUAL FAILURES

24. Clogged Gas Line: You can usually spot this by observing the carburetor.

25. Air pocket in the Gas line: Occasionally, when a User runs completely out of gas and refills the tank, a "pocket" of air is trapped in the system. If the Engine is not getting gas, observe the Sediment Bowl. If it is full, there is no air pocket. If the Sediment Bowl gas level is down slightly, the air pocket is present. To correct, unscrew the nut that holds the glass bowl enough to break the vacuum in the system. The Bowl will fill, and you have corrected the condition.

26. A build-up of mud or dirt on the Magneto Stop Button, or a bending of the Button which keeps it in contact with the Magneto. This, of course, shorts out the Magneto and allows no sparks to reach the Engine.

27. Very rarely a User forgets to replace the cap on the Magneto connection to the

Spark Plug, and coincidentally the hood will be bent down. This will short the Magneto out also.

28. Carburetor adjustment may cause hard starting, but rarely causes a tractor not to start at all. Usually the tractor will run, even if adjustment is off. See "Carburetor Instructions".

ALIGNING FLYWHEELS:

Method 1

Aligning Flywheels by eye as closely as possible, and press in place.

2. Using a machinest Depth Gauge and Square, place it on the flywheels so that the "square" part of the depth gauge is on the machined flat face of the flywheel, and the Gauge part is lying along the outside diameter of the Flywheels, parallel to the centerline of the bore in the flywheel.

3. By inspection, determine if the flywheels are aligned. If not, move by some convenient method the flywheels until this measurement shows that the flywheels are aligned. This method is close enough for all practical purposes.

Method 2

If you have a Reel Mower Grinder, most models have centering spindles.

Place the Drive Pinion Shaft and the Timing Pinion Shaft in the centering spindles.

Clamp or otherwise attach a piece of flat steel to the Grinder frame, in such a manner as to allow you to place an "Indicator Dial" on the steel. An Indicator Dial is one that will show out-of-roundness in thousandths.

Then, by putting the pointer of the Indicator in contact with the OD of the Flywheel, and rotating the flywheel assembly slowly in the Centers, you can determine quickly if the flywheels are out of alignment or out of balance.

C Engine

Gravely Recommended Torque Specs.

Cylinder Head Bolts -- 25 ft. lb.

Oil Pump 1/4 20 Cap Screws -- 80 in. lb.

Timing & Drive Pinion Shaft Nut -- 90 ft. lb.

Spreader Bolt Nut -- 45 ft. lb.

Crankcase 5/16" Bolts -- 18 ft. lb.

Transmission Recommended Torque

Advance Casting to Chassis Bolts -- 15 ft. lb.

Axle Housing to Chassis Bolts -- 45 ft. lb.

Hi & Lo Planetary 3/8" x 1 13/16 Bolts --
30 ft. lb.

Forward & Reverse Plane. 3/8" x 1 15/16--
30 ft. lb.

Pin Plate to Quill 1/4" x 1/2" Bolts -- 85 in. lb.

Axle Bearing Cap 5/16"x 3/4" -- 15 ft. lb.

Swiftomatic Torque Specs.

5/16 x 3/4 long Bolts (180077) -- 20 ft. lb.

Stationary Clutch Bolt -- 45 ft. lb.