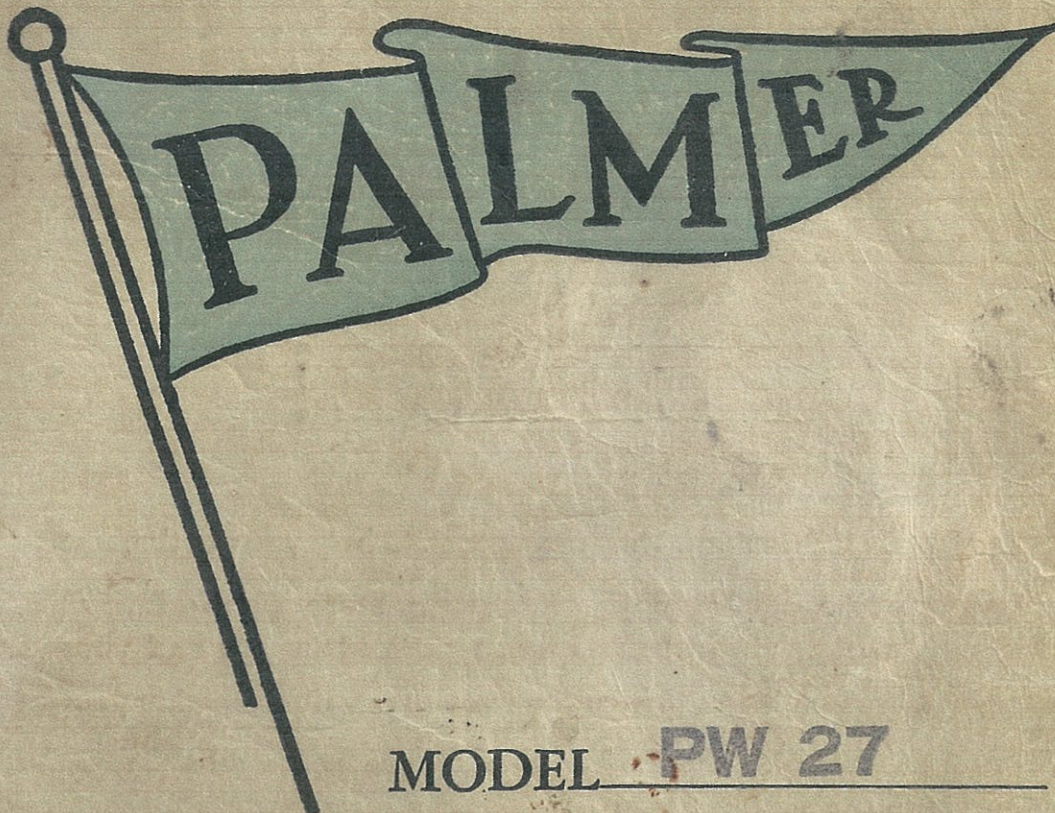


# OPERATING INSTRUCTIONS



MODEL PW 27

## IMPORTANT

OWNER'S RECORD CARD IS ENCLOSED. IF THIS  
CARD IS NOT MAILED TO THE FACTORY WITHIN  
10 DAYS AFTER ENGINE IS IN OPERATION,  
GUARANTEE WILL BE VOID.

THE PALMER ENGINE COMPANY

COS COB, CONNECTICUT

U. S. A.

Printed in U.S.A.

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## OPERATING INSTRUCTIONS

### PW-27

#### I. FOREWARD:

The following instructions are intended to give you an understanding of the engine for which you have paid your money. They may not be as long-worded as some you have seen for we intend them to be understandable to the wide range of people who use Palmer Engines in all parts of the world. It is hoped that you will make the slight effort necessary to read the following simple suggestions so that you will get the full long life and dependable service for which Palmers have always been known.

Your Palmer PW-27 is the smallest of the line but you will find that it has all the fine characteristics of its larger brothers - - if you treat it right.

#### II. INSTALLATION:

Many engines have been handicapped by faulty installation and then blamed by the owner when something went wrong. We offer the following notes on installation in the hope that some of this may be avoided.

##### a) Engine Bed:

Your engine is not designed to run at a pitch of over  $15^{\circ}$  (3-1/4" to the foot).

Any single-cylinder engine is subject to vibrations not found in the multiple-cylinder types. It is therefore necessary to provide a good solid bed. Use as heavy oak bed pieces as practical and be sure that supporting cross members go clear across the boat and are well fastened to the boat sides. Do not expect good results from a flimsy bed merely fastened to the bottom of the boat. Small boats are usually quite flexible, and this must be overcome by stiffness of the bed.

b) Alignment:

The coupling should be perfectly aligned at the split. The simplest means of doing this is to leave the bed a half inch low, prop the engine on wood wedges to the exact alignment, and then cut and fit two oak shims to take the place of the wedges. If the engine is not exactly aligned, you cannot expect the rear bearing to last any length of time.

When the engine is properly aligned, it should be possible to slide the propeller coupling onto its pilot without any pushing to one side, and the faces of the two couplings should match to within .003" when checked with a feeler gauge.

c) Exhaust Line:

The matter of exhaust pipe installation has given more trouble than any other one thing. In nine cases out of ten where the engine gets water in the cylinder or where the valves stick, it will be found that water is somehow coming back through the exhaust pipe. It will pay to make sure that the pipe drains away from the place where the water is put in to cool it and that water is not admitted to the pipe till it has dropped at least 4" from the exhaust pipe. As a safety feature in pipes which do not drain well, it is a fine idea to use only part of the overflow water in the exhaust line, and to place a valve in this small stream (5/16" copper tubing is large enough) so that you can shut off the water just before stopping the engine. This will dry the pipe and avoid the chance of any of the above troubles. If your exhaust line has any low spots where water can remain it will be absolutely necessary to use the above system, since you will sooner or later happen to have the engine backfire or turn the wrong way in the starting. When this happens, the exhaust valve is opened on the suction stroke and any water in the pipe will be immediately drawn into the cylinder. For the same reason, it is necessary to always avoid having the exhaust outlet under water. Keep it well up out of the water where loading of the boat will not tend to take it beneath the surface.

NOTE: Every PW-27 engine leaves the factory with a tag showing the recommended exhaust hook-up to prevent water being sucked back into the engine. Any deviation from this recommendation will void the guarantee against damage resulting from water in the engine. See duplicate diagram at back of this book.

c) Exhaust Line: (Con't)

In rowboats or small boats of other types, we have found that an excellent exhaust system can be made out of rubber hose. Run a straight length of hose from the end of the nipple at bottom of U-pipe to a 1" pipe tee under a seat of the boat and similar hose to hull fittings on each side of the boat. No muffler will be needed and with this system, water will always drain away regardless of the slant of the boat. A straight line of hose with a stern outlet can be used with success also but should be so clamped to the boat that it will drain.

d) Water Hook-up:

The water intake pipe to pump should be protected by a screen outside the hull to prevent large particles from jamming the pump impeller. A 1/2" O.D. Copper tube makes a good intake line but this tube should have ample bend or rubber section to absorb vibration. A complete suction line of stiff rubber hose is also acceptable.

e) Gasoline Line:

In piping up the gasoline line, it is a good idea to install a good filter just below the tank. The gas line should travel in one slant from tank to carburetor. For short runs 1/4" tubing is large enough. For long runs, use 5/16" tubing. A fuel pump can be supplied for the engine if desired.

f) Oiling:

When you receive your engine, it is safe to assume that all oil has been drained from it for shipping. Oil must be provided for the base and for the clutch (if with clutch), for these are oiled separately and do not connect. Use a good grade of S.A.E. #30 oil. The engine uses so little oil that it would be very poor sense to economize on the oil you buy. Get the best obtainable. The base should be filled to the mark of the dipstick and will take approximately a quart of oil, depending on the pitch of the engine. The clutch (if any) is filled by removing the hand hole plate and filling to 1" below the shaft at the rear of the clutch. This will take about one quart of the same grade of oil used in the engine.

f) Oiling: (Con't)

There are no points to hand oil on the PW engine. Oil may be drained from the engine through the plug located at the after side of the bottom base or may be pumped from it with a special hand pump which we can supply. This pump is used through the dip stick hole and is also useful in draining the clutch. Oil may be drained from the clutch through the plugged hole at the bottom of the housing.

g) Ventilation:

If your engine is placed in a tight box of any sort it will not get proper ventilation and will "sweat" with consequent damage to ignition and metal parts. Bore some 1" holes in opposite sides of the box for air circulation or in some way provide ventilation for the engine. You will save yourself a great deal of trouble by giving this your best attention.

h) Propeller:

Your PW-27 one cylinder engine is designed to handle a 10 x 6, three blade, Left Hand Wheel or something similar according to the shape of the boat. It is poor judgement to make any radical changes in wheel dimensions without expert advice. It is sometimes desirable to put a large wheel on the engine in order to hold the revolutions below the rated 2800 r.p.m. but you should take care that the full throttle revolutions are not pulled down below 1200 r.p.m. by the use of too heavy a wheel. Likewise, a wheel which allows more than 2800 r.p.m. may damage the engine. We suggest that you write us if you have any questions concerning the proper wheel to use.

**IMPORTANT: THIS ENGINE USES A LEFT HAND WHEEL**

i) Controls:

Plastic cable tube with stainless inner wire is recommended for throttle and choke controls. Care must be taken to avoid sharp bends which will bind the cable.

j) Magneto Ground:

The engine is stopped by grounding the magneto. This can be done by leading a wire from the ground screw to a grounded switch which can be closed to stop the engine.

### III STARTING:

Before trying to start the engine, be sure that gas has reached the carburetor, that there is oil in the base, that the seacock is turned on, and that a spark is delivered by the magnet when the engine is turned clockwise.

The high speed needle adjustment is located at the bottom of the after side of the carburetor. To adjust, turn needle valve gently to the right as far as it will go - - - gently. Then, back it out approximately 1-1/4 to 1-1/2 full turns, (two to three half-turns). Follow the same procedure with idling screw (screw with spring) but only back it out one-half turn or until engine runs smoothly.

For the first start, it may be well to prime the engine with a few drops of gasoline through the spark plug hole. Close the throttle valve (spring loaded screw against pin) then open about 1/8 of an inch. Close choke, then open slightly to allow some passage of air.

Now use the rope starter to turn the engine, giving it a spin clockwise against compression. The engine should start at once. You can regulate the throttle to hold it to an easy speed while warming up. If it hesitates or spits, close the choke for an instant. Open the choke as the engine warms up.

Make sure that the water pump has picked up and the water is coming out of the overboard pipe or through the exhaust.

In starting under ordinary conditions and after engine has been adjusted, simply close the choke. Turn engine one and two revolutions with rope starter, then open choke about 1/3. With throttle open just a little, rewind the rope and pull briskly. The engine should now start. If it does not start, repeat the operation. Never attempt to start the engine with throttle more than 1/3 open for you will have poor success.



#### IV. ADJUSTING:

##### a) Carburetor:

1. Idling Adjustment. After the engine is warmed up and choke is fully open, slow the speed down to normal idling speed (about 400 r.p.m.). If it does not run smoothly at this speed, turn the idling screw of the carburetor slowly one way and another until you find the spot at which the engine idles smoothly.

2. High Speed Adjustment. Take the boat away from the dock and while running at about 1000 r.p.m. adjust as follows: Turn high speed needle in bottom of carburetor to the right until engine begins to falter. Then turn needle out until engine runs smoothly.

##### b) Magneto:

Since the magneto is carefully timed and adjusted before leaving the factory, no provision is made to either advance or retard the timing.

#### V. CARE:

##### a) Oiling Care:

We would suggest changing the engine oil every 50 hours of operation. Clutch oil may be changed once a season since it is not subject to heat. It will be a good idea to flush both engine and clutch once a year with a good grade of solvent oil to make sure that small drilled passages and grooves do not become sludged up. When a flush of this sort is completed, the next fill of new oil should be run only a few hours and then changed for it will be diluted with solvent caught in the various pockets of the engine.

##### b) Water Pump Care:

A good grade of water proof grease should be used in the grease cup of the pump and should be given a half turn every four hours of operation. The packing nut of the water pump should be kept just sufficiently tight to avoid drippage - - do not overtighten. The intake of the pump should be protected with a screen on the boat hull. Avoid running the engine when the boat is grounded for mud or sand could ruin the pump and most certainly would cause mud sediment in the cylinder jacket. Be sure water pump is pumping when engine is started. To run engine with dry

b) Water Pump Care (Con't)

pump will ruin the pump impeller. Should the pump fail to pick up water and the engine become overheated, be very careful never to allow a gush of cold water to enter the jacket until the engine is thoroughly cooled. Otherwise cracked jackets are bound to result.

c) Winter Lay-Up:

When the engine is laid up for the winter, you will add many years to its life if you follow the instructions below:

1. Drain thoroughly
2. Plug water intake and fill jackets with alcohol. Never use oil or kerosene. Seal water outlet passage.
3. Put 1/2 cup of oil in the cylinder through spark plug hole.
4. Put extra oil in clutch compartment. Fill to level of shaft at rear of clutch.
5. Remove magneto for dry storage during winter. See VII for re-installing.
6. Turn engine every few weeks during the winter. Have clutch in go ahead position so drum will be revolved in oil. It may be necessary to remove spark plug to turn engine if there is too much oil in cylinder.
7. Grease any exposed metal parts.
8. If it is possible to do so, remove engine from boat for dry storage during winter. If not, disconnect propeller coupling so there will be no strain in case boat changes shape due to storage conditions. (See II-b, page 2, for re-alignment in the Spring.
9. Order any parts needed at the time of laying up. This is when you will best remember what is needed and you will avoid the Spring rush. Always give engine number in ordering parts.

d) Start of Season Check-Up:

When the engine is to be put in service for the season, it will pay to do the following things:

1. Remove the cylinder head, wipe out all oil, and scrape out carbon. Use new head gasket.
2. If Valve surfaces appear pitted, remove valves, reface and grind in with fine compound. Set clearances to .008 when cold.

- d) Start of Season Check-Up (Con't)
3. Remove carburetor and either send it to a carburetor man for cleaning or carefully disassemble it yourself and blow out all small jets etc.
  4. Wash out base and clutch as explained in V-a, "Oiling Care", page 6.
  5. Adjust clutch. (See clutch instructions)
  6. Re-align engine (as per II-b, page 2).
  7. Drain gas tank of all dead gas and sludge. Clean gas filter, if any.
  8. Scrape rust spots and repaint engine with special Palmer enamel.

## VI. GENERAL FEATURES OF DESIGN

### a) Oiling System:

The PW engine is of the constant level splash type. A plunger pump maintains the proper oil level in a trough under the connecting rod. The connecting rod cap is made with a dipper projection. This projection dips into the oil trough at every revolution of the engine, splashing oil to the connecting rod and main bearings, gear train, camshaft and piston. Splashed oil returns to the base where it is again pumped to the constant level oil trough to complete the cycle.

### b) Cooling System:

The engine is cooled by a bronze pump of the rubber impeller type, driven at engine speed from the end of magneto drive shaft. The grease cup on the pump should be given half a turn every four hours of operation. The packing gland should be kept just tight enough to prevent drippage and should never be overtightened for undue wear will result. The pump shaft is made with a tang which fits into the slotted magneto drive shaft. This drive arrangement allows the pump to be removed by simply taking out the two bolts holding the pump to its base.

Water from the pump is delivered to the jackets through a copper tube. It flows first past the hottest part of the engine - - the valve ports, then around the cylinder and up through the head. The full stream of overboard water may be put into the exhaust pipe if it is certain that this pipe drains well. If there is any doubt about proper drainage, see II-c, page 2, Exhaust Line.

c) Ignition System:

See Magneto Pamphlet enclosed herewith.

VII DISCRIPTION OF INTERNAL PARTS

a) Crankshaft:

A counter-balanced steel forging carried in Timken roller bearings. There is practically no wear in these Timken bearings so that readjustment is seldom necessary after proper assembly. If necessary to adjust Timken bearings, remove rear bearing plate and take out one or two of the thin paper gaskets or shims, being sure not to get the end play in crankshaft to tight. The end play should be .002 to .004 inch when engine is cold.

Oil seals are located at each end of the crankshaft with drain-back passages located behind each oil seal.

If necessary to remove the crankshaft from the engine first remove the flywheel from front of engine. Next, remove clutch and clutch drive gear, if engine is equipped with clutch. Remove rear bearing plate, being sure to keep shims in place. The shims are used to give proper end play to the Timken main bearings. The end play should be .002 to .004 inch when engine is cold. The crankshaft will now drop down and can be pulled from the front bearing plate.

b) Connecting Rod:

I-section forging with integral poured babbit bearing. The connecting rod and cap have a number on one side of the bolt boss. The cap and rod must be assembled to the crankshaft so that these two numbers are on the same side (magneto side).

c) Piston:

Aluminum, split type - - split is toward port side of engine. Has two compression rings, one scraper ring and one oil control ring. To further facilitate installation, we have stamped the letter "P" for port, on the left side of the piston.

d) Camshaft:

Camshaft and camshaft gear are cast integral with two valve cams and an oil pump cam. The camshaft is supported and revolves on a stationary pin which is known as the camshaft support pin. To remove the camshaft the camshaft support pin must be driven out of the crankcase from the clutch or take-off end of the engine.

d) Camshaft (Con't)

Use a large drift punch or similar tool. When support pin is removed, the camshaft assembly together with valve tappets will drop out of case.

e) Timing Gears:

Spur-cut steel for crankshaft and magneto gears, cast iron camshaft gear. Crankshaft gear marked with one mark (-) meshed with camshaft gear marked with split mark (- -). Camshaft gear marked with one mark (-) meshed with magneto gear marked with one mark (-). If markings are lost set crank so piston is at top dead center, then turn camshaft in normal rotation (counter-clockwise) until exhaust valve is just about closed and intake valve is just beginning to open. Mesh gears at this point. Set magneto as per IX-b, page 12.

f) Valves:

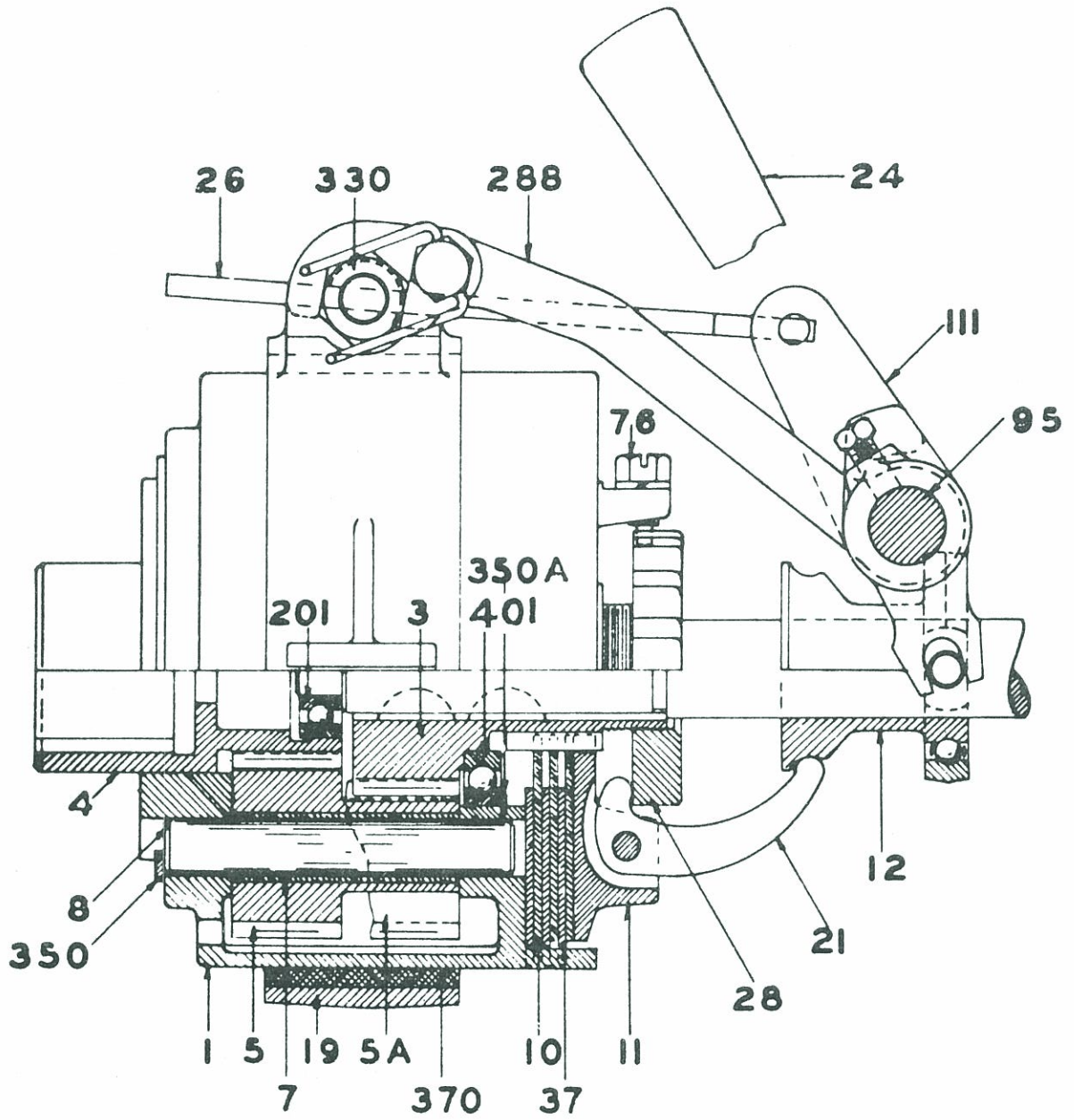
Valves have 45 degree angle. Exhaust and intake are similar. Valve springs are held by split keys. Valve tappets are adjustable. Both valve guides and valve tappet guides are made integral with the cylinder and crankcase. Valves with .004 oversize stems are available but must be so specified when ordered.

g) Magneto:

Impulse type, base mounted, (see Magneto Manual)

To time magneto after removal, the piston must be at top dead center on compression stroke. To accomplish this, loosen the spark plug and turn the engine in a clockwise direction (normal rotation) until you hear air escaping from the spark plug hole. Continue to turn engine until chisel mark on flywheel lines up with the chisel mark on top side of crankcase. Place coupling drive disc on lugs of magneto drive shaft of engine. The magneto should then be turned counter-clockwise until a point of resistance is met. This is the point at which the impulse is contacted. With magneto held in this position, the lugs on the magneto will line up with the slots in the coupling disc. Slide the magneto forward into the coupling disc and fasten to magneto pad lightly. Do Not pull screws tight until magneto is carefully lined up. Then tighten screws.

OXKB



VII-A REVERSE GEAR:

a) Description of Design:

The reverse gear used by the PW-27 engine is a Paragon model OXKE gear. The forward drive is obtained by means of a multiple disc clutch. The locking or clamping of these discs is brought about by the pressure produced by the outward movement of the fingers when the operating lever is thrown into the forward position. The ends of these fingers lock into the groove at the front end of the cone. On the forward drive the whole reverse gear is locked together as a solid coupling. Unless the pressure on these discs is great enough to lock the whole gear together under full load, the clutch will slip and heat and score and destroy the discs.

The reverse drive is obtained by clamping the brake band around the outside drum or case which carries the pinion gears. The reverse motion is obtained by driving through the gears. Unless this band is clamped tight enough to keep this gear cage from revolving, it will slip in the reverse position and score the contact surfaces of the drum and brake band.

In the neutral position, both the discs and the brake band are free and the gears run idle.

b) Adjustments:

1. Forward Drive. If the gear slips in the forward drive, back out the lock screw #76, until the end of it is clear of the notch in the adjusting collar, #28. Then turn the adjusting collar, #28, to the right until the lock screw, #76, is opposite one of the notches in the adjusting collar, #28.

Then tighten up the lock screw #76, and be sure that the end of the screw enters the notch in the adjusting collar, #28. Repeat this procedure until the reverse gear holds on the forward drive. An adjustment of one or two holes is usually sufficient.

2. Reverse Drive. Throw the lever into the reverse position.

Then tighten up the adjusting bolt, #330, until the brake band clamps or grips the case or gear Cage #1, and holds it from revolving. It is well to screw up this adjusting bolt, #330, a little

## 2. Reverse Drive (con't)

tighter than is necessary. This will compensate for any wear on the brake band. The lock wire holds the adjusting bolt nut and keeps it from loosening.

### c) Oiling & Care:

The proper oil level is maintained by keeping the oil within one inch (1") just below tailshaft at the rear of the clutch. The clutch drum should dip well into the oil but it is not advisable to keep too much oil in the clutch housing because this may cause overheating as well as leakage at the rear oil seal. Remove the hand hole plate and make certain that this is correct when you first install the engine and at intervals of two months thereafter.

Use a #30 oil in summer and a #20 oil in winter, and do not economize on the price of the oil you buy.

Oil should be pumped out for changing at least every six months of operation. REMEMBER that the clutch is oiled separately from the engine and therefore, you must look after it separately.

The worst damage to a clutch is done by allowing the adjustment to become loose and the plates or band to slip. Try the force necessary to engage your clutch when you get it new and always maintain this pressure by adjusting when necessary. (See ADJUSTMENT).



VIII A FEW DON'TS:

- a) Don't expect good results from a flimsy engine bed.
- b) Don't neglect proper ventilation in summer or in winter storage.
- c) Don't load the engine with a propeller so big it must struggle at less than 1200 r.p.m.
- d) Don't use such a light wheel that the engine turns more than 2800 r.p.m.
- e) Don't crank the engine the wrong way. It turns Clockwise.
- f) Don't flood it with gasoline by too much choking or priming.
- g) Don't try to start the engine with throttle more than 1/3 open.
- h) Don't run the engine with too much or too little base oil. Either practice is harmful.
- i) Don't ever pull the clutch out of gear until you have throttled the engine.
- j) Don't shift from forward to reverse or vice versa at more than 700 r.p.m.
- k) Don't clog the engine jackets by running in too shallow water.
- l) Don't use oil or kerosene in the jackets for winter storage - - - alcohol always.

IX. TROUBLE SHOOTING:

- a) If Engine Fails to Start:
  - 1. Check for gas in carburetor by removing plug at bottom of bowl.
  - 2. Check spark by cranking with spark plug grounded on outside of engine.
  - 3. Perhaps it is flooded. Let stand for 10 or 15 minutes or remove spark plug and revolve flywheel several times. Replace spark plug.
  - 4. Try priming. Remove spark plug and prime with a few drops of gasoline. If spark plug is dirty, clean or replace with new one.
  - 5. Perhaps the throttle is too far open.
  - 6. If compression is poor, remove spark plug and pour a spoonful or so of oil in spark plug hole, revolve engine several times, then prime with a few drops of gasoline. Replace spark plug.

a) If Engine Fails to Start (Con't)

7. There may be water in cylinder due to a backfire or too poor exhaust drainage. Remove spark plug, spin engine several times to remove water. Pour spoon full or so of oil in spark plug hole, revolve again. Then prime with a few drops of gasoline, clean and replace spark plug.
8. Are you turning engine in right direction? (CLOCK-WISE)

b) If Engine Runs Unevenly:

Have Magneto and spark plugs checked.

c) If Engine Won't Idle:

1. Carburetor may be dirty. Have cleaned by mechanic or disassemble and blow out with compressed air.
2. Valves may be leaky or piston rings may be bad. Check for loss of compression with gauge. Compression should be 90%.

d) If Engine Runs Hot:

1. Water inlet may be clogged. Disconnect at pump and blow through it.
2. Pump or impeller may be worn. Replace impeller or send pump to factory for rebuilding or replacement.
3. Jackets may be loaded with mud from traveling in too shallow water. Remove head and scrape water jackets with wire.
4. Oil may be low. Check level.
5. Spark may be too far retarded (see VII-g, page 10, for magneto timing).

e) If Engine Smokes at Exhaust:

1. There may be too much oil in the base. Check the dipstick.
2. Perhaps oil has been mixed in the gas by mistake. This engine does not use oil in the gas.
3. The piston rings may be worn. Check compression. It should be 90%.
4. Carburetor mixture may be too rich. Adjust as IV-a, page 6.
5. Choke may not open fully.

f) Clutch Trouble:

See Clutch Sheet

X. P.W. CLEARANCES		<u>Normal</u>	<u>Worn</u>
1.	Spark Plug .....	.030	.035
2.	Magneto Points .....	.015	.018
3.	Piston (Bottom Skirt) .....	.005	
4.	Piston Rings (End Clearances)		
	Compression .....	.013	.023
	Scraper .....	.013	.023
	Oil Control Ring .....	.013	.023
	Side Clearance .....	.002	.004
5.	Piston Pin (Connecting Rod Bushing)...	.0005	.002
	(Clearance In Piston) .....	PUSH fit	.001
		Heated	
6.	Cylinder Diameter .....	3.250	3.250
7.	Crankshaft (Timken Roller Bearings)		
	End Play .....	.002 to .004	- -
8.	Connecting Rod Bearing		
	Diametrical .....	.0007 to .002	.003
	Side Clearance .....	.004 to .010	.011
9.	Camshaft Support Pin .....	.001 to .0025	.003
10.	Valves: Tappet, Exhaust (cold) .....	.008	- -
	Tappet, Intake (cold) .....	.008	- -
	Stem Clearance .....	.004	.007
11.	Compression, Hand Cranked .....	90#	
12.	Magneto Drive Shaft Bushing .....	.002 to .0035	.004
13.	Oil Pump Plunger .....	.003 to .004	.005

TORQUE WRENCH TENSION

	<u>Foot-pounds</u>
Cylinder Head.....	32
Connecting Rod Nuts .....	18
Connecting Rod Pal Lock Nuts .....	1/4 turn beyond finger tight
Cylinder Block Mounting Screws.....	62 to 78
Main Bearing Plate Cap Screws .....	25 to 32
Spark Plugs .....	25 to 30
Manifold Mounting Studs .....	14 to 18
Engine Base Mounting Screws .....	28 to 32

INSTRUCTIONS FOR CHANGING GROUND POLARITY  
AND POLARIZING GENERATOR

All Palmer engines are shipped from the factory with negative ground electrical systems except when ordered special. To change to positive ground, interchange battery terminals as shown on the wiring diagram in the operators instruction book. Interchange the coil leads, since failure to do so will cause excessive spark leak at the plugs. Interchange the tachometer leads. (The electric fuel pump must also be changed for opposite polarity.)

On the IH-V345, IH-V549 and PW-27

With the regulator connected to the generator and battery, and before the engine is run, the generator should be polarized with the battery. Momentarily connect a jumper lead from the regulator armature "A" to the battery "B" terminals. CAUTION - DO NOT TOUCH THE FIELD TERMINAL.

On the IH-240, 264, SM-240, 264 and PH-134

Make all connections at the battery regulator and generator except the field lead at the regulator. Momentarily touch the field lead to the regulator battery "B" terminal. Then connect the field lead to the field "F" terminal.

READ CAREFULLY

PW-27 STARTER-GENERATOR INSTRUCTIONS

INSTALLING & OPERATING

Generator is polarized for negative ground.

Be sure wiring is correct per attached diagram - being especially sure that wire from ammeter to battery, if wired into starter switch, is on the "hot" side of switch; i.e., side of switch which goes directly to positive terminal of battery. Failure to wire properly will result in burned out regulator and/or generator.

BE SURE to use 14 gauge wire for primary cable.

Brushes are not adjustable. Charging rate is controlled by voltage regulator.

When charging, the ammeter needle may waver. This condition is normal. Charge rate will peak at about 15 amps.

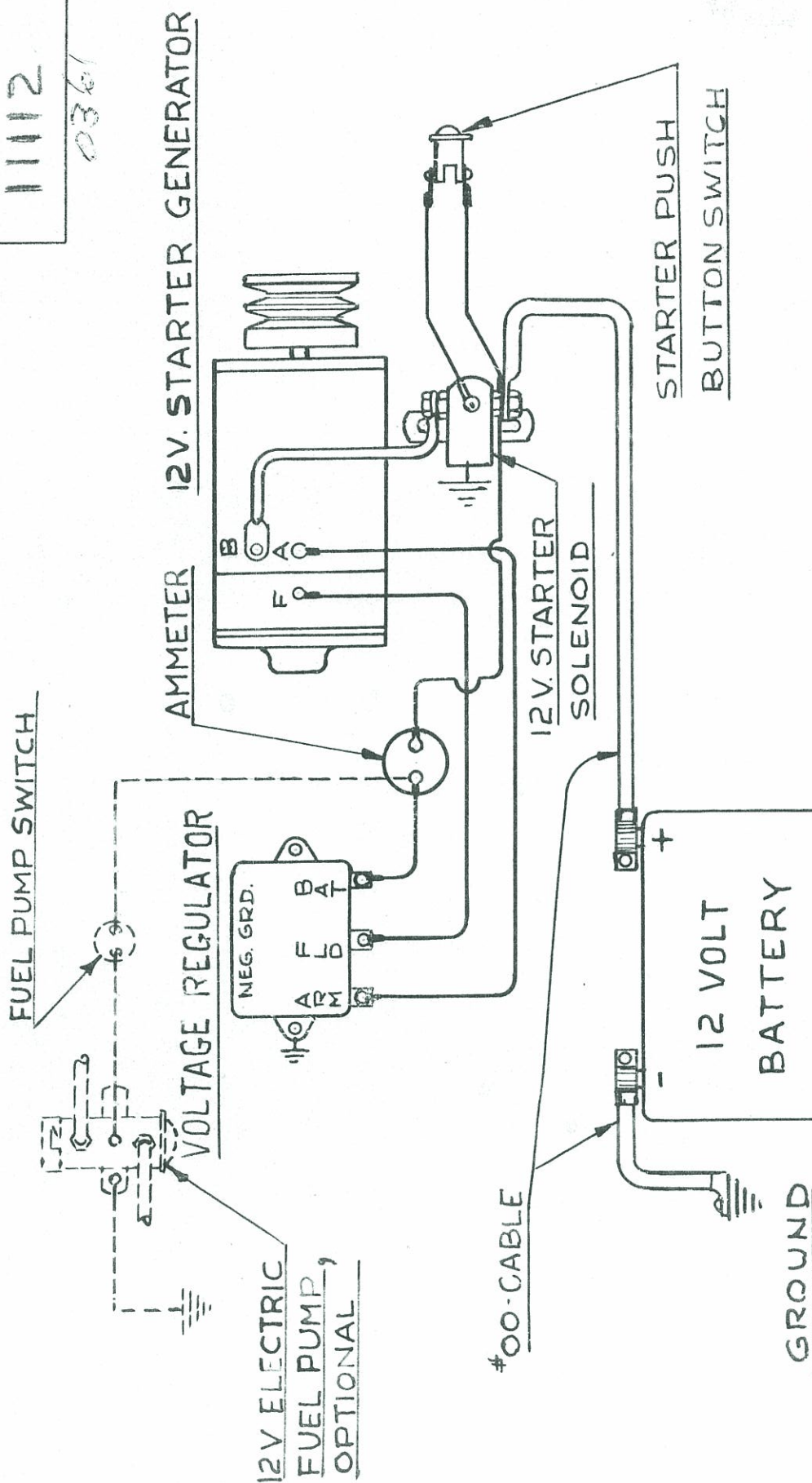
Generator will not charge at idle speed, but will cut in at about 1200 r.p.m. engine speed, and will cut back from full charge to a lower charge rate at about 1700 r.p.m. If battery is fully charged the charge rate will cut back automatically. DO NOT BE ALARMED IF AMMETER DOES NOT ALWAYS SHOW CHARGE.

Always check condition of battery when in doubt about proper operation of generator.

If regulator is removed from generator, be sure to replace armature and field wires to correct regulator terminals, as per diagram.

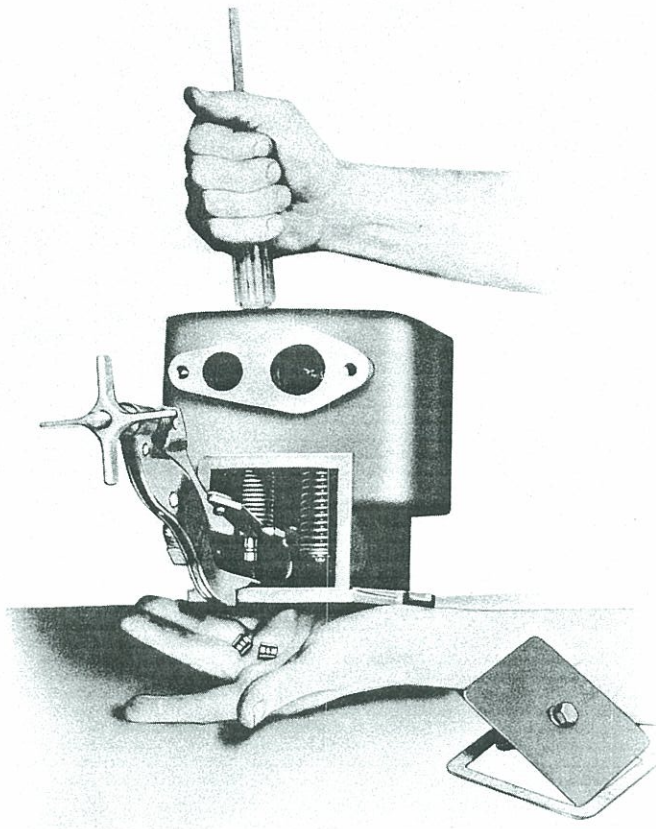
The starter-generator unit requires a few drops of engine oil every 25 to 50 hours.

PART NO.  
**11112**  
0361

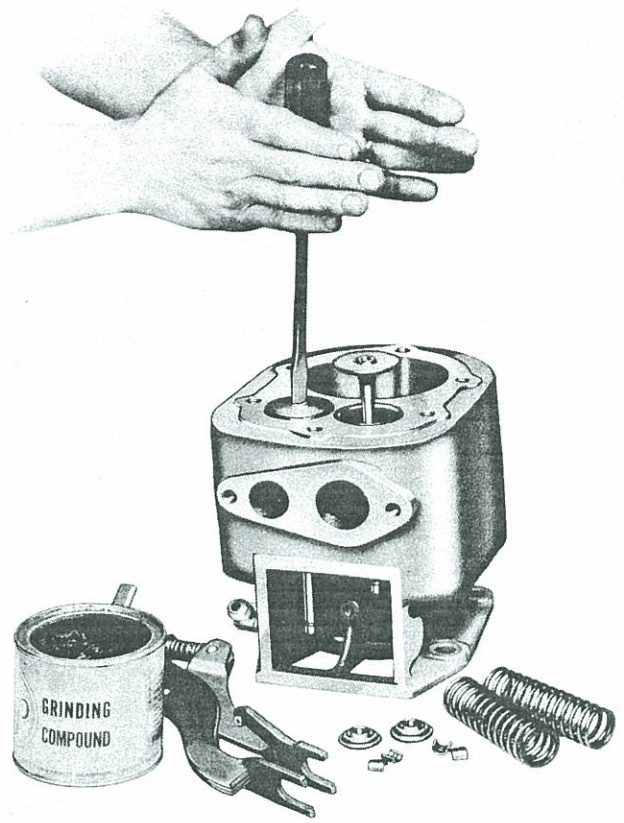


**THE PALMER ENGINE CO.**  
COS COB, CONN.

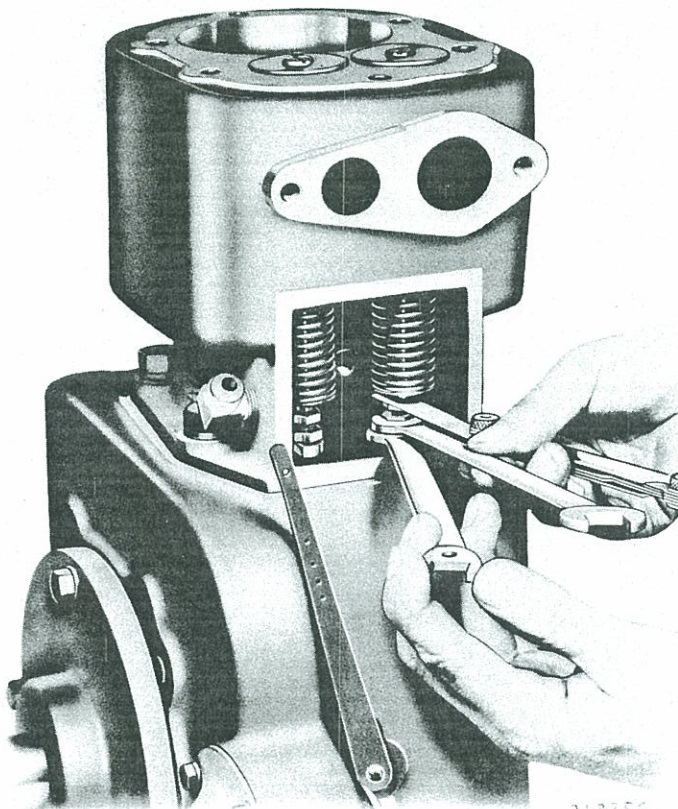
REV. LET.		REVISION		BY	CKD.	DATE	DRAWN	TRACED	CHECKED	APPROVED	PART NO.
							<b>AK</b>				<b>11112</b>
							<b>3-30-59</b>				
							PART NAME	MATL.	SPEC.	MODEL	
							<b>WIRING DIAGRAM</b>			<b>P.W. 27</b>	
							<b>12 V. STARTER - GEN.</b>				



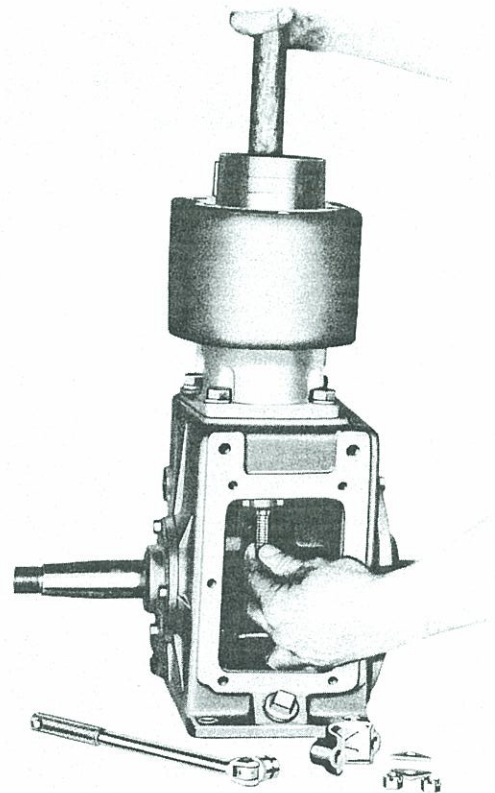
REMOVING THE VALVES



GRINDING THE VALVES

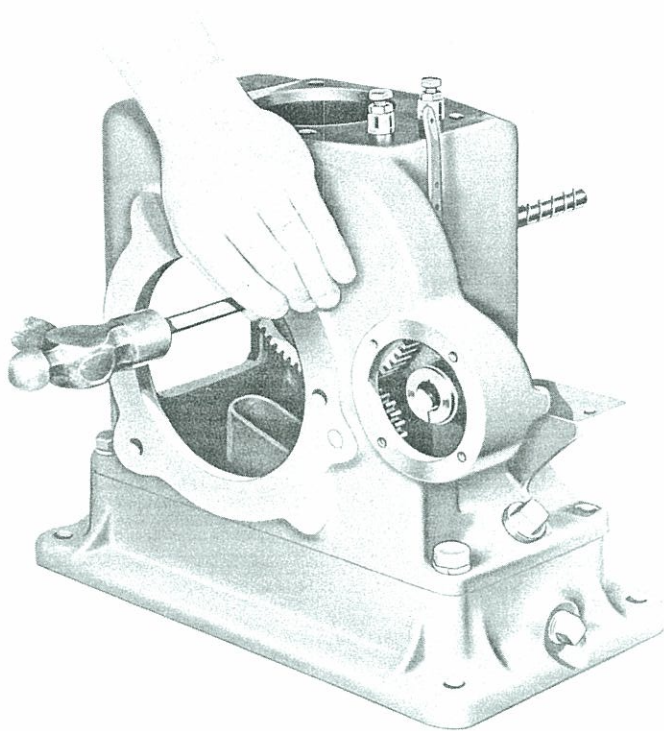


ADJUSTING THE VALVES

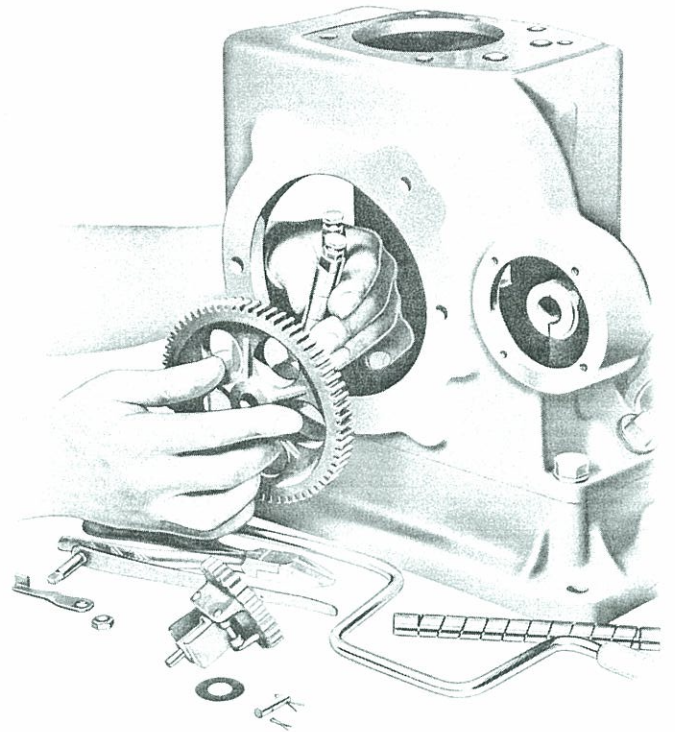


INSTALLING PISTON RINGS

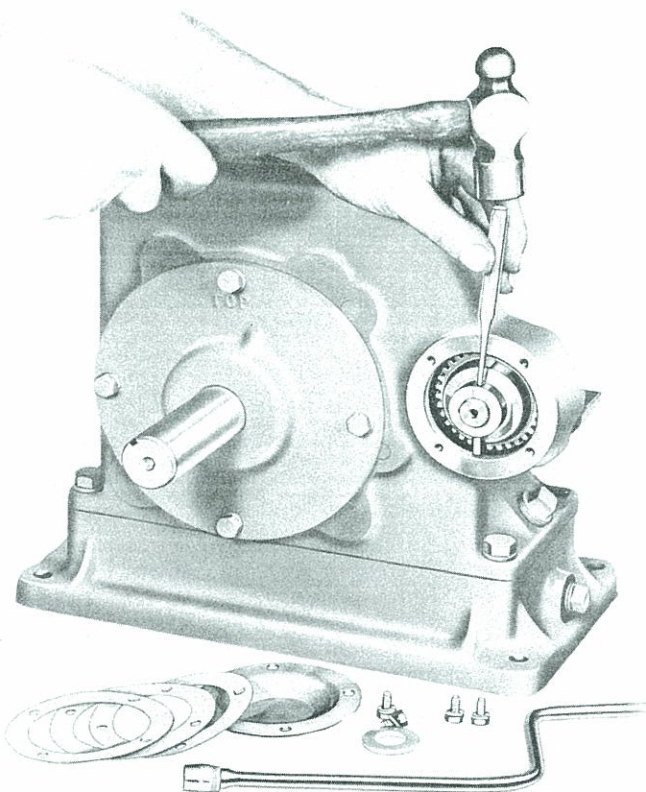




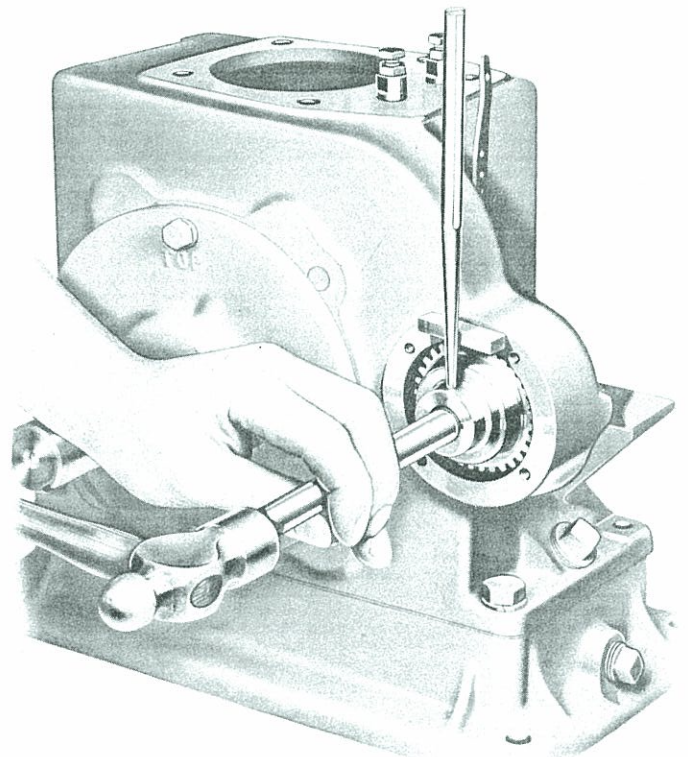
Removing Camshaft Support Pin



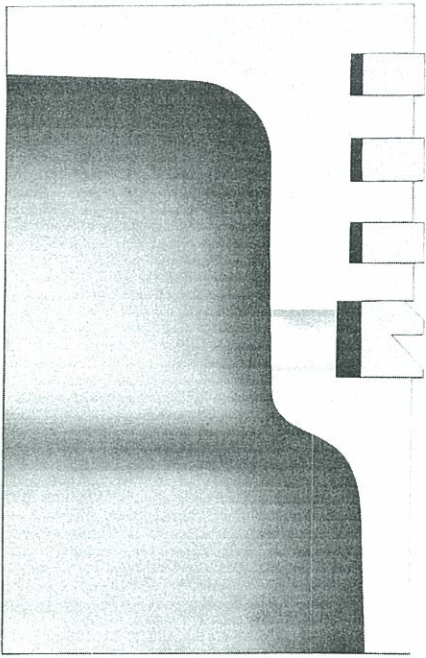
Removing Camshaft and Valve Tappet



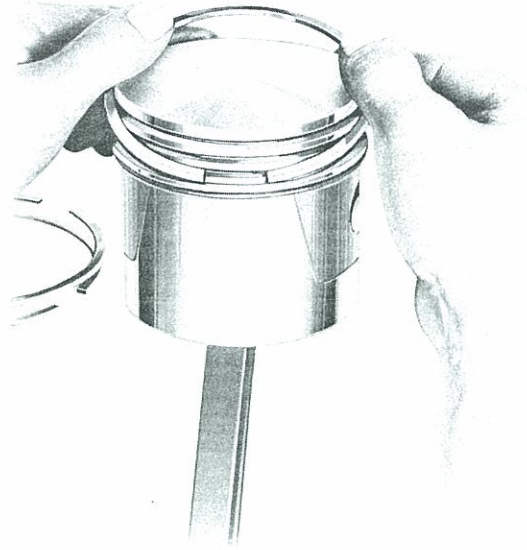
Driving Out Magneto Drive Gear Retaining Pin



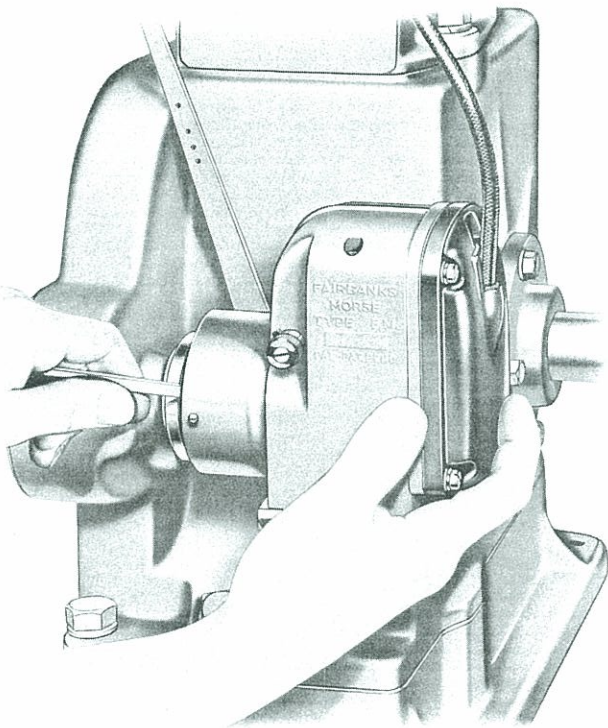
Removing Magneto Drive Gear



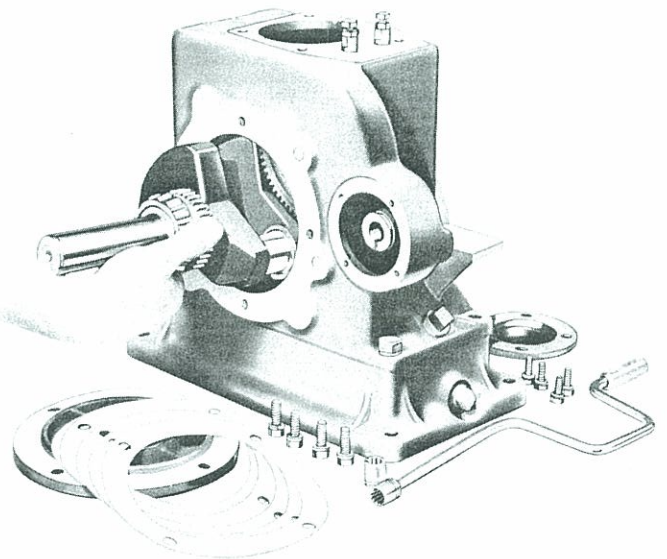
Compression, Scraper and  
Oil Ring Assembly



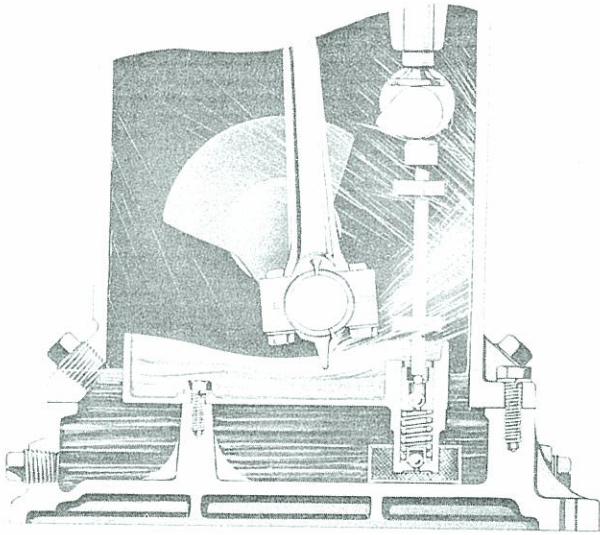
Piston Ring Assembly



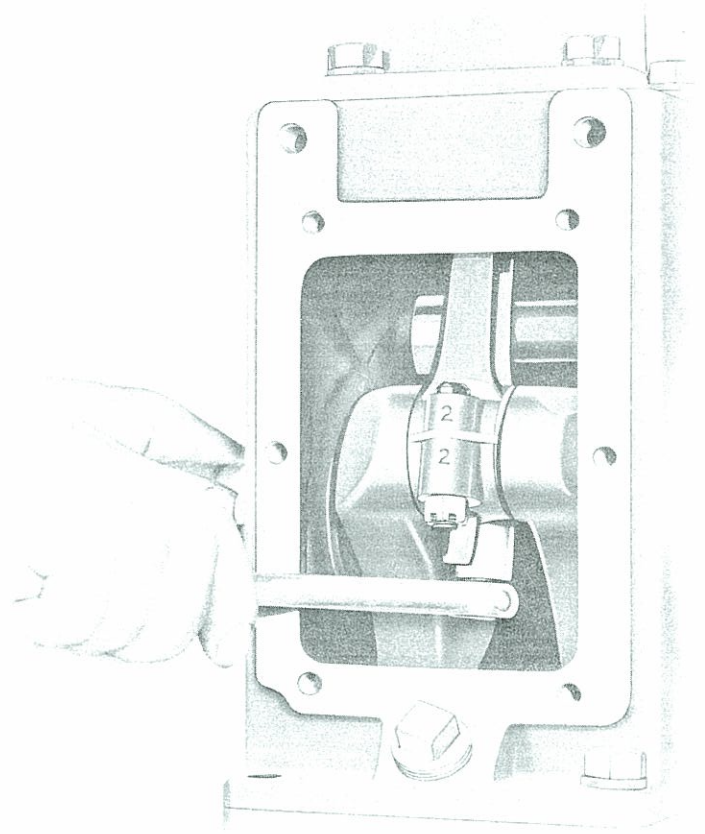
Magneto Alignment



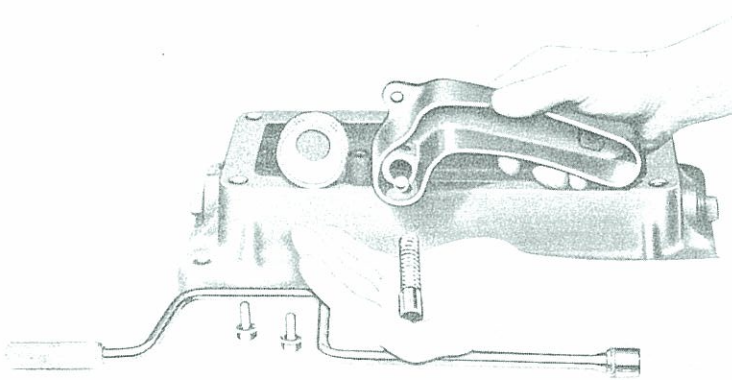
Crankshaft, Removed



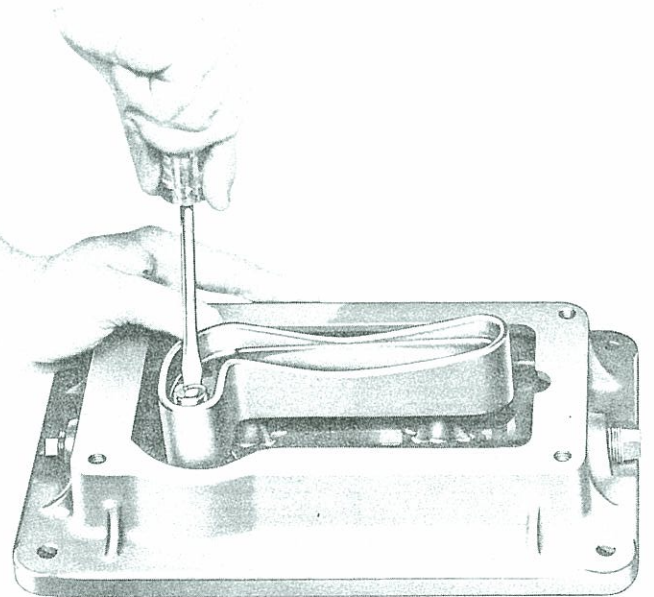
Splash Oiling System



Connecting Rod Assembly



Oil Pump Assembly



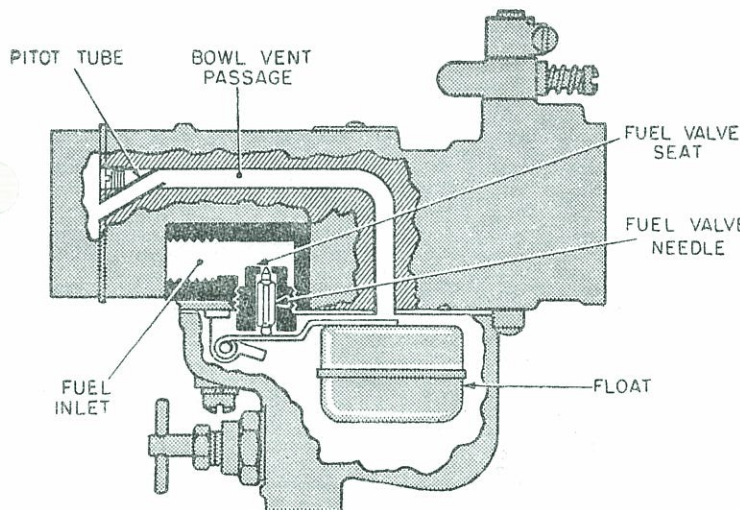
Oil Pump Manual Operation

# ZENITH 87-SERIES CARBURETORS

The Zenith 87-Series is a horizontal carburetor with a concentric fuel bowl. It is a "balanced" carburetor, because all air for fuel chamber and metering well ventilation and idling must come through the air cleaner. Air cleaner restrictions have a minimum influence on the fuel-air ratio when a carburetor is thus "balanced".

The main jet and discharge jet are centrally located. The metering well which completely surrounds the discharge jet is in the center of the fuel bowl assembly. This construction permits extremely high angle operation in any direction.

The venturi, which is part of the throttle body casting, measures the volume of air that passes through the carburetor. In selecting the venturi size, the smallest size that will permit full power development should be used.

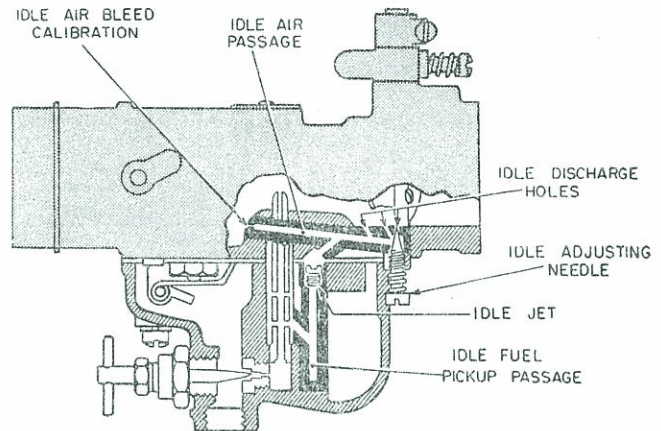


FUEL SUPPLY SYSTEM

**FUEL SUPPLY SYSTEM.** Fuel under normal pressure entering the float chamber through the fuel valve seat is controlled by the twin float which, moving on its axle, closes the needle valve when the fuel reaches the proper level in the bowl.

**IDLING SYSTEM.** At idling speeds the throttle plate is almost closed, thus a very high suction exists at the edge of the throttle plate. At this point the idle discharge orifices are located. All fuel for idling and part throttle operation is supplied through the main jet. Fuel from the float chamber flows through the main jet into the metering well. Fuel for idling is drawn from this well through the calibration, or metering orifice, in the center of the idling jet. As the fuel reaches the idling channel it is mixed with air which is admitted through a calibrated orifice in

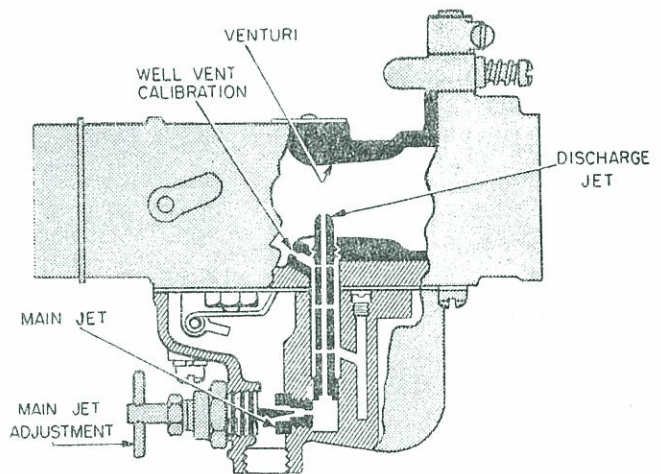
the channel from the inside of the air intake to form an emulsion. This emulsion is discharged into the air stream, to form the idling mixture, through two holes, one of which is controlled by the Idle adjusting



IDLE SYSTEM

needle. Turning the adjusting needle counter-clockwise (out) permits more of the emulsion to reach the air stream and make the idling mixture richer while turning the needle in (clockwise) cuts off the amount of the emulsion reaching the air stream and makes the mixture leaner.

**HIGH SPEED SYSTEM:** As the throttle is opened, the suction on the idling system diminishes, but the increased volume of air entering the engine through the venturi creates sufficient vacuum (suction) on



HIGH SPEED SYSTEM

the discharge jet to draw an emulsion of fuel and air from the metering well which receives its fuel from the main jet and its air from the well vent. The flow characteristics of the discharge jet are influenced by the size, location, and number of holes in the sides

## E. DISASSEMBLE THROTTLE BODY

- (a) Remove the float axle (26) by pressing against the end with the blade of a screwdriver.
- (b) Remove the float (27).
- (c) Remove the fuel valve needle (25), using the fingers.
- (d) Remove the fuel bowl to throttle body gasket (28).
- (e) Remove the main discharge jet (23), using a small screwdriver.
- (f) Remove the fuel valve seat (25) and fibre washer (24), using Zenith Tool No. C161-85.
- (g) Remove the idle adjusting needle (11) and spring (10).

## CLEAN AND INSPECT PARTS

### A. CLEAN PARTS

- (a) Clean all metal parts thoroughly with cleaning solution and rinse in solvent.
- (b) Blow out all passages in the air intake assembly, fuel bowl assembly and throttle body. **NOTE:** Be sure all carbon deposits have been removed from throttle bore and idle Discharge holes. It is advisable to reverse flow of compressed air in all passages to insure all dirt has been removed. Never use a wire or drill to clean out jets.

### B. INSPECT PARTS

- (a) **Float Assembly.** Replace float assembly if loaded with gasoline, damaged, or if float axle bearing is worn excessively. Inspect top side of float lever for wear where it contacts fuel valve needle.
- (b) **Float Axle.** Replace if any wear can be visually detected on the bearing surface.
- (c) **Fuel Valve Seat & Needle Assembly.** Replace fuel valve seat and needle because both parts wear and may cause improper float level.
- (d) **Idling Adjusting Needle and Spring.** Inspect point of needle. This must be smooth and free of ridges.
- (e) **Gaskets and Fibre Washers.** Replace all gaskets and fibre washers every time the carburetor is disassembled.
- (f) **Check Specifications.** Verify the correctness of the following parts. Numbers will be found on the parts. **Venturi; Main Jet; Idling Jet; and Fuel Valve Seat.**

## REASSEMBLY

### A. REASSEMBLE THROTTLE BODY.

- (a) Install the fuel valve seat (25) and fibre washer (24), using Zenith Tool No. C161-85.

- (b) Install the main discharge jet (23), using a small screwdriver.
- (c) Install fuel valve needle (25) in seat (25), followed by float (27) and float axle (26). **NOTE:** Insert tapered end of float axle (26) into float bracket on side opposite slot and push through the other side. Press float axle (26) into slotted side until the axle is centered in bracket.
- (d) **Fuel Level.** Check position of float assembly (27) for correct measurement to obtain proper fuel level using a depth gage. **NOTE:** Do not bend, twist, or apply pressure on the float body (27).
- (e) With bowl cover assembly (9) in an inverted position, viewed from free end of float (27), the float body must be centered and at right angles to the machined surface. The float setting is measured from the machined surface (no gasket) of float bowl cover (9) to top side of float body (27) at highest point. This measurement should be  $3\frac{1}{32}$ ", plus or minus  $\frac{1}{32}$ ".
- (f) **Bending Float Lever.** To increase or decrease distance between float body (27) and machined surface (9) use long nosed pliers and bend lever close to float body. **NOTE:** Replace with new float if position is off more than  $\frac{1}{16}$ ".
- (g) Install throttle body to fuel bowl assembly gasket (29) on machined surface of throttle body (9).
- (h) Install the idle adjusting needle (11) and spring (10).

### B. REASSEMBLE FUEL BOWL

- (a) Install the main jet (32) and fibre washer (31), using Zenith Tool No. C161-83 main jet wrench.
- (b) Install the main jet adjustment (34) and fibre washer (33), using a  $\frac{3}{16}$ " open end wrench.
- (c) Install the idle jet (29), using a small screwdriver.
- (d) Install the bowl drain plug (35).

### C. REASSEMBLE CARBURETOR BODIES

- (a) Install the three bowl assembly screws (33) and lock-washers (36) through the fuel bowl and into the throttle body and draw down firmly and evenly.

## SPECIAL TOOLS

The special tools recommended for the 87-Series carburetors are:

1. C161-83 Main Jet Wrench.
2. C161-85 Fuel Valve Seat Wrench.

ZENITH CARBURETOR DIVISION OF  
696 Hart Avenue, Detroit 14, Michigan

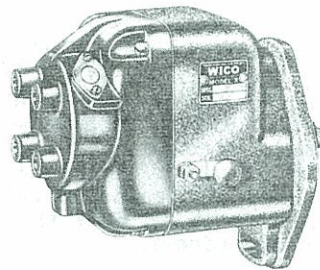
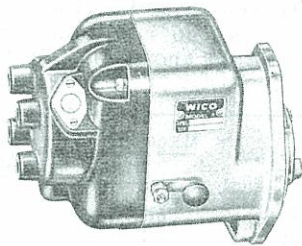


Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

# SERVICE INSTRUCTIONS & PARTS LIST

## WICO MAGNETO MODELS

### XH & XHD



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File in XH Parts Section of your Service Manual

**SERVICE INSTRUCTIONS**

**MODEL XH AND XHD WICO MAGNETOS**

DISTRIBUTOR CAP OR COVER

To remove the cap or cover loosen the screws 5622 which hold it in place. It is not necessary to completely remove these screws. When replacing the cap or cover make sure the gasket is in place. Check to make certain the distributor arm does not hit the inserts in the cap.

DISTRIBUTOR ARM

After the distributor cap has been removed the distributor arm may be pulled off the shaft or bridge. When replacing the geared type arm make sure the timing marks on the arm and pinion gear are in line.

BREAKER POINTS

The breaker points should be adjusted to .015" when fully opened. To adjust the contacts, loosen the two clamp screws 5900 enough so that the contact plate can be moved. Insert the end of a small screw driver in the adjusting slot and open or close the contacts by moving the plate until the opening is .015" measuring with a feeler gauge of that thickness, tighten the two clamp screws.

To replace the contacts remove the breaker spring clamp screw 5431, the breaker arm lock and washer 4210 and 3219, then lift the breaker arm from its pivot. Remove the aligning washer 5717 and the two fixed contact clamp screws 5900. The breaker plate can then be removed.

If the contacts need replacing, it is recommended that both the fixed contact and the breaker arm be replaced at the same time, using a replacement breaker contact set.

After assembly the contacts should be adjusted as described above. The contacts should be kept clean at all times. Lacquer thinner is an ideal cleaner for this purpose. Use WICO tool S-5449 to adjust the alignment of the contacts so that the surfaces meet squarely.

CONDENSER

To remove the condenser, first disconnect the condenser lead by removing the breaker arm spring screw 5431, then remove the two condenser clamp screws 5411, and the condenser clamp. When replacing the condenser, make sure it is properly placed and that the clamp screws are securely tightened.

Condenser Capacities		
Condenser	Magneto	Capacity Reading in Microfarads
X5614	XH	.16-.20
X6916	XHD	.30-.34

from the breaker arm spring terminal by removing screw 5431, take out the two coil core clamp screws 5411, and remove the clamps 5633. The coil and core can then be pulled from the housing. When replacing this group, make sure that the bare primary wire is connected under the core clamp screw and that the insulated wire is connected to the breaker arm spring terminal.

COIL TESTING

When using an Eisemann coil tester, connect the ground lead of the tester to the bare ground wire of the coil; connect the breaker lead of the tester to the insulated primary wire of the coil, connect the spark lead of the tester to the high tension terminal on the coil. The coil must be replaced if it requires more than the value shown in the following table.

Coil	Magneto	Test Readings in Amperes on Core
X7744	XH	1.50
X5700	XH	1.50
X6762	XH-1	2.00
Wico (Green)	XH-1 (Replaced by X5700)	1.50
X7886	XH-1	2.00
X8545	XH-1	1.80
X6664	XH-2D (Ground one lead)	2.10
X8964	XH-2D (Ground one lead)	2.10
X6936	XHD	1.55
X7585	XHD-1	2.10

When using a Weidenhoff D-358 Coil Tester, test the coils according to the information in the following table.

Coil Part No.	Test Connections			Spark Output Primary Index No.	Insulating Test Method	
	Continuity Fig.No.	Spark Discharge Fig.No.	Fig.No.		Fig.No.	Index
X5700	5	9	13	14	13	
X6664	6	10	10	14	10	
X6762	5	9	6	14	6	
X6936	5	9	11	14	11	
X7585	5	9	9	14	9	
X7744	5	9	13	14	13	
X7886	5	9	6	14	6	
X8545	5	9	7	14	7	
X8964	6	10	11	14	11	
Wico (Green)	5	9	12	14	12	

Spark output tests on all the above coils will be made with the spark gap set at 5MM

All the above specifications are for coils NOT mounted in magnetos. Laminated steel cores MUST be in coils while making ALL tests. Marginal leak tests on all the above coils will be made with the secondary terminals DISCONNECTED from test leads.

## REMOVAL OF COIL FROM CORE

The coil is held tight on the core X5524 by a spring wedge. It will be necessary to press against the coil core with considerable force to remove it from the coil. The coil should be supported in such a way that there is no danger of the primary of the coil being pushed out of the secondary.

## STOP DEVICES

There are three different types of stop devices for XH and XHD magnetos, all of which serve the same fundamental purpose, that of rendering the magneto inoperative by short circuiting the primary circuit and thus stopping the engine. The illustration on page 7 shows these three different types of stop devices and distinctly illustrates the manner in which they are assembled to the housing. In all cases the two small fibre washers, M34X, are inserted into the hole in the side of the main housing. All parts below the two M34X washers are assembled on the inside of the magneto. All parts above the M34X washers are assembled on the outside of the magneto. Each of these stop devices is available as a replacement kit. Each kit contains all of the parts necessary for completely replacing the stop device of the type. If the stop device is on the left side of the magneto, as viewed from the drive end, use ground connector 5635; if the stop device is on the right side, use ground lead group X5747.

## MAGNETIC ROTOR ASSEMBLY

To remove the magnetic rotor assembly first remove the distributor cap and distributor arm or pinion gear. The pinion gear may be pulled from rotor shaft after screw 6466 is removed. Next remove the four impulse stop clamp screws 6465, after which the magnetic rotor assembly may be pulled from the main housing by holding the main housing in one hand and pulling on the drive cup with the other.

When replacing the magnetic rotor assembly, make sure that the inside of the housing and rotor are free from dirt and chips, also that the impulse stops are on the correct side, and the top witness mark is in the correct position before tightening the four impulse stop clamp screws.

## IMPULSE COUPLING (Impulse Coupling Lock)

The impulse lock nut is best removed by placing the magnetic rotor in a vise (use brass jaws) and tighten them lightly against the flat sides of the magnetic rotor. After securing the rotor, remove nut with a 3/4" socket WICO tool number S-4704, if the nut has a hex-head. On gear driven magnetos, remove snap ring 6424 and thrust washer 6425, then after removing the drive cup, the impulse coupling lock nut, 6412 and 6414, may be removed with a spanner wrench, WICO tool number S-9961. If it is desired to remove the impulse lock nut without removing the magnetic rotor assembly from the housing, insert an impulse holding tool, WICO tool No. S-10204, between the ear on the driven flange and an impulse stop clamp screw, and proceed as above.

There are two other types of impulse lock nuts. They are 6230, which has a fine thread (3/8-24) and 16-491C, which has a coarse thread (3/8-16). One or the other of these nuts are used on all XH and XHD type magnetos that are not gear driven.

## DRIVE CUP AND DRIVE SPRING

To remove the drive cup, after having removed the impulse lock nut, in the case of magnetos that are not gear driven, as explained above, or remove the snap ring 6424 and the thrust washer 6425 on gear driven magnetos, turn the drive cup in the direction of the proper magneto rotation until the trip arm latches against the impulse stop. Continue to turn the cup until the projections on the cup have cleared the projections on the driven flange. Without the friction of these parts against each other the cup can be pulled out far enough to allow it to unwind. A firm grip should be taken on the cup to prevent possible injury to the hand. Then, pull the cup, with the spring still in it, off the shaft.

To remove the spring from the cup, it is merely necessary to work the spring out of the cup with a screw driver.

In replacing the drive spring, locate the spring over the cup so that the outer eye of the spring is over the slot provided on the inside wall of the cup. For a clockwise magneto the spring should be installed so that the turns spiral in toward the inner eye in a clockwise direction. For a magneto of counter-clockwise direction, it should spiral inwards in a counter-clockwise direction. Next insert the outer eye of the spring as far as possible into the proper slot. Next, take the drive cup spacer 16-583 which contains the slot for the inner eye, insert a large screw driver in the center hole so it will bind, and the drive cup spacer can be turned with the screw driver acting as a handle. Insert the inner eye of the spring in the drive cup spacer slot and wind the spring around the spacer until the spirals close sufficiently to allow the spring to slide inside the drive cup. This method of winding the spring eliminates any possibility of distorting or scratching the spring surface. The spring may be more easily inserted if the lugs of the drive cup are securely held in a vise.

The model XH and XHD drive cups can be used interchangeably on magnetos of clockwise or counter-clockwise rotation.

To reassemble the drive cup and spring to the XH magneto, proceed as follows: The impulse lock nut has to be replaced first on gear driven magnetos only. Then make certain that all parts are clean and there is grease between the turns of the impulse drive spring. Next, pull the inner eye with one turn of the spring out of the cup a little way. Place the drive cup over the end of the magnetic rotor shaft, making sure the inner eye of the spring is in the notch provided in the drive cup spacer washer. Press the parts together, hold the



impulse cup out far enough so that the projections on the drive cup clear the flange, and then give the cup a full turn as follows: make a half turn and allow the cup projections to lock against the driven flange, then, with a fresh hold on the drive cup, make the other half turn. On XHD magnetos using 7908 and 7909 drive cup spacing washers it is necessary to wind the cup an extra half turn. When the cup is wound, press it firmly into place and apply a small amount of grease to the bearing surface of the impulse lock nut.

XHD magnetos before serial number 646915 were built with 16-583 and 1VA-583 drive cup spacing washers (diameter 1 inch) which only allowed one full turn of impulse spring windup. Magnetos built after serial number 646914 have 7908 and 7909 spacing washers (diameter 7/8 inch) which allow one and a half turns of windup which eliminates impulse flutter when the magneto is run at slow speeds just out of impulse. Therefore, it is recommended that on early magnetos the spacing washers be replaced with 7908 and 7909 washers, and then install drive cup as outlined below.

## ADJUSTABLE DRIVE CUP

Model XH base mounted specifications XH-19, XH-20, XH-22, XH-23, and XH-169 have an adjustable drive cup, X2084, which enables the lug angle on the drive cup to be set at any degree when the magneto is at advanced spark. The adjustment is made by removing the two coupling adjuster nuts and setting the lug plate in the desired position.

Several specifications of the model XH and XHD flange mounted magnetos have our new style adjustable drive cup (see illustration page 9. To adjust the lug angle loosen the two number 10 set screws, and loosen the lock nut two complete turns using Wico tool No. S-10164. It may be necessary to hold the magneto rotor shaft from turning by inserting tool No. S10204 between the driven flange and a stop plate clamp screw. Push the lock nut down until the lug plate can be turned. The lug plates are marked for easy setting. Line up the correct setting with the line on the cup flange, tighten the lock nut as tight as possible and tighten the set screws. It is recommended that the set screws be staked. It is not necessary to loosen the impulse lock nut to make the above adjustment.

Occasionally these adjustable cups can be used on magnetos of other specifications to adapt standard specifications to fit unusual engine applications.

## DRIVEN FLANGE GROUP & TRIP ARMS

After having removed the impulse lock nut, drive cup, drive spring and various spacing washers the driven flange group may be removed. If the driven flange does not pull off easily, remove the magnetic rotor assembly from the housing, and press the flange off with an arbor press. To support the flange while pressing the shaft out, it is best to use a steel ring under the impulse stop group. If

this method is used it will be necessary to install a new oil slinger 6204 when reassembling the magneto.

There are four different drive flange groups, two for each rotation. They are easily identified in the following manner. Hold the driven flange group with the trip arm pins facing you and turn it so that the two ears are horizontal. If a trip arm pin is now in the upper right-hand quadrant the driven flange is clockwise, but if a trip arm pin is in the upper left-hand quadrant, the driven flange is counter-clockwise. Driven flanges used on magnetos with spring loaded trip arms have trip arm pivots which are slotted.

Driven flange groups are furnished without the trip arms. When replacing the driven flange group, make certain that it is pressed on to the shaft as far as it will go. When pressing the driven flange on to the magnetic rotor assembly, always support the rotor by placing a block etc., under the cam.

## TRIP ARM

To remove the trip arms, clamp the driven flange in a vise, push the point of a knife between the snap ring, A243X, and the trip arm pivot, near the opening of the snap ring. This will spring the snap ring out a little, and then by inserting a knife between the snap ring and pivot as far from the opening as possible, the ring may be pulled off. Now the trip arm, X179X may be removed. It is recommended that a new snap ring be used if the old one becomes damaged in the process of removal.

Magnetos equipped with trip arm springs do not have snap rings, and it is merely necessary to unhook the spring from the trip arm and lift it off the end of the pivot.

An easy method for putting on a new snap ring is to take a socket wrench, or similar device, of a size slightly larger than the pivot, put the ring on the pivot and press down on the ring with the open end of the socket wrench.

## IMPULSE STOP GROUP

The impulse stop group serves not only to hold the driven flange group and rotor stationary while the impulse is winding up, but also contains an oil seal which prevents the lubricating oil, used in the engine, and other foreign matter from entering the magneto. The impulse stop groups can be used on magnetos of either rotation. For counter-clockwise magnetos, the impulse stop lug should be on the left-hand side of the magneto, and conversely when used on magnetos of clockwise rotation, the impulse stop lug should be on the right-hand side of the magneto as viewed from the drive end.

The standard X5549 impulse stop group is used on most magnetos. The X5550 group with two stop lugs is used on four cylinder magnetos in which the distributor arm is not geared, such

as XH-1343. The X6578 group is used where a short lug is necessary due to lack of clearance on the engine as on XH-936 and XH-1059. The bearing retaining group X6603 is used on magnetos which do not incorporate an impulse coupling unit.

If a new oil seal is desired for the impulse stop group, it must be ordered separately by number 6199. A spring finger type oil seal will be found on some magnetos, but when replacing them a regular oil seal 6199 should be used.

## LAG ANGLE ADJUSTMENT

After the complete magnetic rotor assembly has been reassembled in the housing, it is necessary to adjust the impulse lag angle, which provides retarded spark for starting. On one, two, and four cylinder magnetos, any impulse range from  $5^{\circ}$  to  $42^{\circ}$  may be obtained and on 6 cylinder magnetos, from  $5^{\circ}$  to  $52\frac{1}{2}^{\circ}$ . The position of the impulse stop group determines the lag angle of the magnetos.

To set the lag angle loosen the four impulse stop clamp screws at the outer edge of the stop group and set as follows: The impulse stop plate has stamped on its face, two witness marks  $180^{\circ}$  apart, one of which is used for clockwise and the other for counter-clockwise magnetos. These marks serve to register against corresponding marks,  $5^{\circ}$  apart, on the main housing, acting as a guide to the amount of rotation of the stop plate during the adjustment of the lag angle. When either the clockwise or counter-clockwise witness mark on the impulse stop group is even with the center mark on the main housing an impulse range of  $13^{\circ}$  is obtained, with the following exception - on 6 cylinder magnetos the range will be  $33^{\circ}$ , and on XH-1042 magnetos with a 6274 drive cup it will be  $30^{\circ}$ . The rotation of the stop plate in the same direction as the rotation of the magneto increases the impulse range by the amount of its rotation. Thus, since the marks on the main housing are  $5^{\circ}$  apart, turning the stop plate one mark in the direction of the magneto rotation from the center mark will increase the range  $5^{\circ}$ . Turning the stop plate one mark in the opposite direction to the magneto rotation will decrease the range  $5^{\circ}$ . These variances of range are only approximate and the magneto should be tested on a rotary gap test stand and readjusted to accurately give range desired. After adjustment has been made be certain to tighten the impulse stop group clamp screws 6465.

The above instructions for setting lag angle applies to all model magnetos with the exception of specification XH-1343 used by Wisconsin Motors Corporation. To set the lag angle on the XH-1343 magneto, with the impulse stop lugs to your right, line up the witness mark on the impulse stop group with the timing mark on the housing - that is, second from the top of the magneto - on a counter-clockwise direction. This will give approximately  $30^{\circ}$  impulse lag.

The proper lag angle for each specification magneto may be found in the table of variable parts. It is important that the lag angle be correctly adjusted to the value given in these tables to insure the most efficient performance of the engine for which the magneto is intended.

## LUBRICATION

Model XH and XHD magnetos do not require oiling. The drive end of the magnetic rotor is supported by a double shielded bearing, part 5517; it may also be ordered with the bearing cage and snap ring by part number X5521. The cam end of the magnetic rotor is supported by a porous bronze bushing that is oil impregnated, 5610.

On flange mounted models, it is important to seal the impulse spacer to the magnetic rotor shaft to keep engine oil from entering the magneto. Use Perfect Seal #4 for best results.

## ROTORS

The ability of magnet steel to retain its magnetism is known as its coercive property. The magnet steel used in the model XH and XHD rotors has such extremely high coercive value that it is practically impossible for these rotors to lose any appreciable amount of magnetism under any condition. It is therefore not necessary to recharge these rotors.

The table of variable parts shows the correct rotor for each specification magneto. The correct part number of each rotor is also stamped on the rotor at the factory, therefore, making identification very easy.

## MAIN HOUSING

**CAUTION:** Under no condition should the four screws holding the laminated cores in the main housing be removed. These cores are put on at the factory and finished to very close tolerance to maintain the proper air gap between the cores and the rotor. Do NOT try to replace the distributor arm bridge on geared distributor housings. It is necessary to bore the distributor arm pivot hole after the bridge is assembled to the housing to maintain close tolerance between the distributor arm gear and the pinion gear. Therefore, when it becomes necessary to replace the distributor arm bridge, the complete main housing must be replaced or returned to Wico to be rebuilt. Used main housings may be returned to the factory for rebuilding, transportation both ways to be paid for by the account. A new distributor arm bridge and pivot, new breaker arm pivot, and new bushing will be installed for a charge of \$4.50 list with regular discounts applying. No main housings will be reworked if the aluminum casting, mounting hole threads, or cores, are worn or damaged, and housings received in the above condition will be scrapped. The Wico Factory should be advised by the account at the time of shipment. The table of variable parts lists the correct main housing for each specification magneto.

## REPLACEMENT OF ROTOR BUSHING

In order to replace the bushing in the housing, it is necessary to use Wico re-bushing tool S-10035 to properly locate bushing with respect to the face of the breaker plate.

## REPLACEMENT OF BREAKER ARM PIVOT PIN

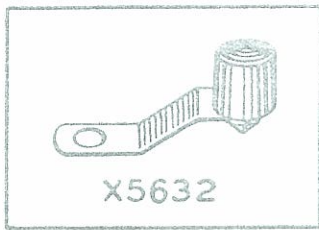
In order to replace the breaker arm pivot pin it is necessary to use Wico insertion tool number S-11824. Take care not to enlarge the hole in the breaker plate when removing the old pin, and make sure that the new pin is perpendicular when pressing it in.

## DUST COVER

If the magneto is equipped with a dust cover, it may be removed by removing the screw 5411. If the cork gasket 6693 shows signs of wear, it should be replaced.

## WARNING

Under NO condition should a battery be connected in any way to a WICO magneto. In several magneto failures the trouble was found to be that someone had tried to boost the spark output by connecting a battery to the ground stud. If this is done it causes a direct short every time the points close, and this burns the temper out of the breaker arm spring and pits the points. When the points are open it overloads the primary of the coil and causes coil failure. Also by overloading the primary, it makes an electromagnet out of the coil and coil core and this discharges the magnetic rotor.



3230



M-55XA



IXA-256



3230



M-55XA



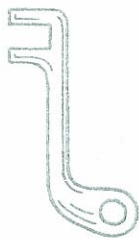
M-35X



M-34X



3539



5635



X5757



3945

Standard Ground Connection  
Kit K-6448



M-95X



1992B



A-170X



16-369



1991



M-33X



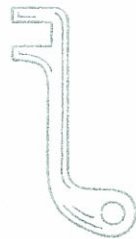
M-35X



M-34X



3539



5635



X5757



4631

Wisconsin Type Ground  
Connection Kit K-6449

STOP DEVICES  
FOR MODEL XH

Number at bottom of each line  
is number of replacement kit  
which includes all of the parts  
shown in the line above.



3230



IXA-256



3230



M-55XA



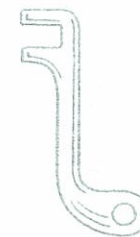
M-35X



M-34X



3539



5635

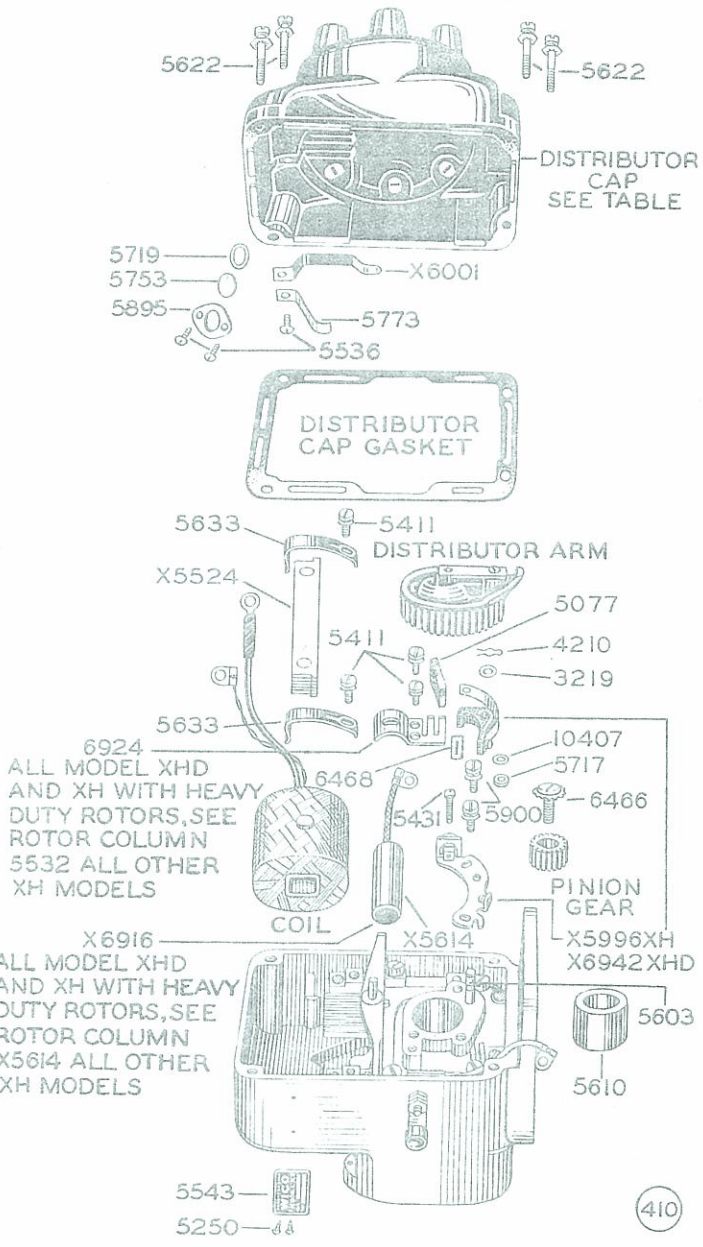


X5757

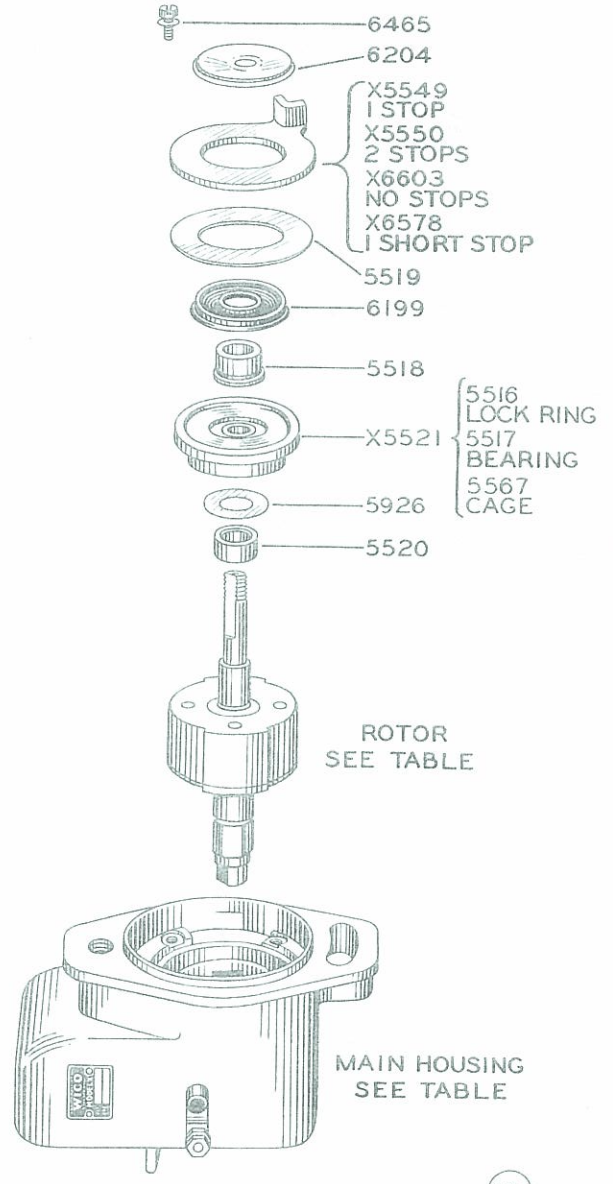


6074

Le Roi Type Ground  
Connection Kit K-6450



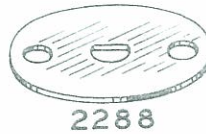
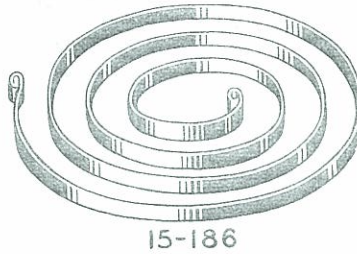
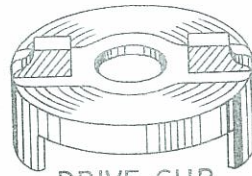
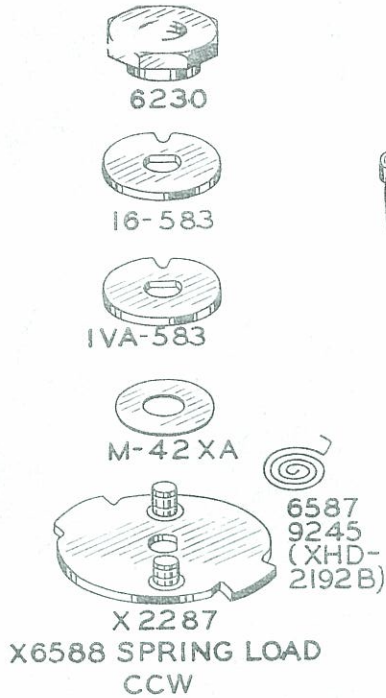
EXPLODED VIEW — DISTRIBUTOR END



EXPLODED VIEW — IMPULSE END

IMPULSE PARTS

For magnetos without drive gear



For gear driven magnetos



\* XH 2286 & XH2392



218

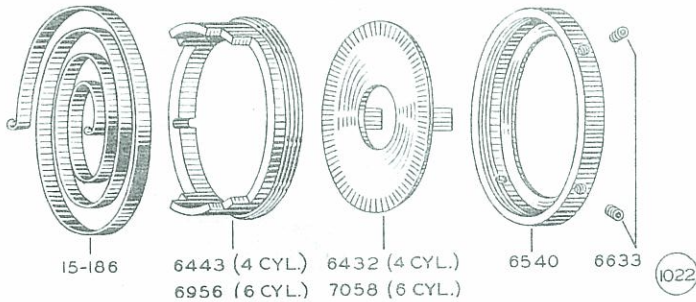
ADJUSTABLE DRIVE CUP

For flange mounted magnetos

Complete Drive Cup Unit

XH-4 and XHD-4 CW-X6634, CCW-X6635

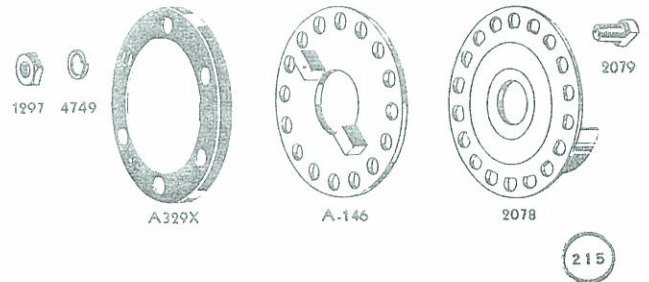
XH-6 and XHD-6 CW-X6954, CCW-X6955



ADJUSTABLE DRIVE CUP

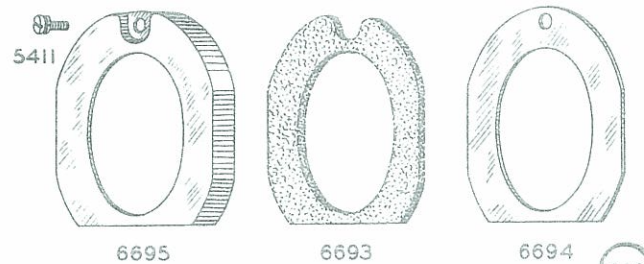
For base mounted magnetos

Complete Drive Cup Unit X2084

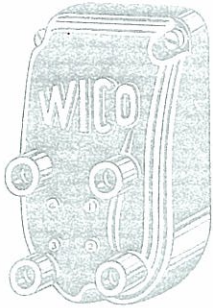


DUST COVER UNIT

X6768



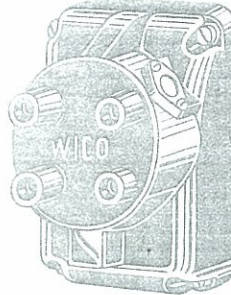
COVERS AND DISTRIBUTOR CAP UNITS



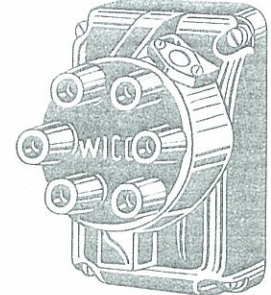
X5653



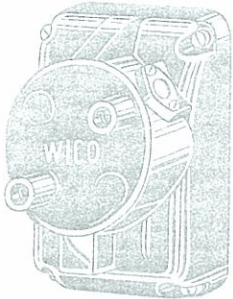
X7064



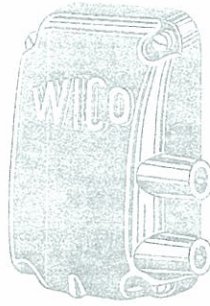
X5777



X5897  
X9172 (XHD-2358)



X5776-X9532  
(XHD-2263 & XHD-2289) X5770



X5651



X7114  
(XH-1295Y ONLY)



X5704



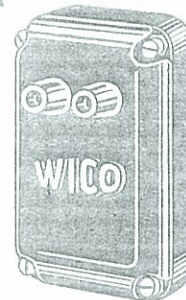
6081



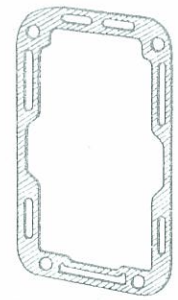
X6333  
X9213 (XHD-2192B)



X6326  
X9348 (XH-2302)

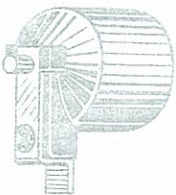


X7123



X5618

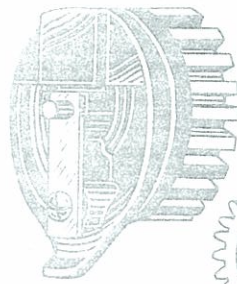
DISTRIBUTOR ARMS AND PINION GEARS



X5531 (XH-2 & 4)  
X6549 (XH-2017B  
& XH 2108)



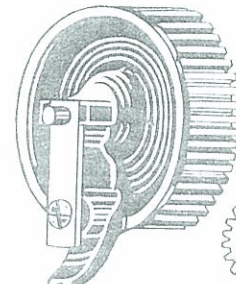
X5617  
XH2 (J. DEERE)



\* X9584 (HG-2&4)  
X9344 (XH-2302) \* 6865



5775



X5787  
XHG6

\*When replacing the distributor arm or gear on XHG 2 & 4 magnetos under serial #913897, use Kit K9619.

PARTS LIST

When ordering parts be sure to give your engine  
SERIAL NUMBER

4071461

J230

PALMER

MODEL

**PW 27**

ENGINE

THE PALMER ENGINE COMPANY  
COS COB, CONNECTICUT

Printed in U. S. A.



PW-27 PARTS LIST

March 1959

Part #	Part Name	Qty. Used
1200	Base . . . . .	1
1232	Ball Bearing, Water Pump Mtg.Bracket . . . . .	1
1261-asy	Bearing Retainer Plate, Front . . . . .	1
1220	Bracket, Engine Mounting . . . . .	2
1224	" Water Pump Mounting . . . . .	1
1273	Camshaft & Gear Asy. . . . .	1
1274	" Support Pin . . . . .	1
1135	Carburetor . . . . .	1
1136	" Back-fire Trap . . . . .	1
1267	" Fuel Valve (Spring Loaded) . . . . .	1
7142	" Hi-speed Needle . . . . .	1
7142-W	" Hi-speed Needle Washer . . . . .	1
1223	Collar, Engine Gear Spacer . . . . .	1
1242-asy	Connecting Rod Assembly . . . . .	1
1243-asy	" " Bolt Assembly . . . . .	2
1241	" " Inspection Plate . . . . .	1
1244	" " Shim . . . . .	2
6958	Coupling, Propeller Shaft 3/4" Bore . . . . .	1
6959	Coupling, Propeller Shaft 7/8" Bore . . . . .	1
1202	Crankcase Assembly . . . . .	1
1230	Crankshaft, Standard Engine . . . . .	1
1231	" Bob-tail or Standard Engine . . . . .	1
1239	" Gear . . . . .	1
1238-asy	" Main Bearing Assembly . . . . .	2
1238	" " " Cone, only . . . . .	2
8128-R	" " " Cup, only . . . . .	2
1201	Cylinder . . . . .	1
1205	Cylinder Head . . . . .	1
254	1/8 Drain Cock . . . . .	1
1220	Engine Mounting Bracket . . . . .	2
1223	Engine Gear Spacer Collar . . . . .	1
1207	Flywheel . . . . .	1
8065	Fuel Pump . . . . .	1
1288-asy	" " Assembly, Mechanical . . . . .	1
368	" " Electric, 12 Volt . . . . .	1
8145	" " Mounting Adaptor . . . . .	1
1265	" " Push Rod . . . . .	1
1266	" " " " Guide . . . . .	1
563	" " " " " Lock Nut . . . . .	1

Part #	Part Name	Qty. Used.
1200-G	Gasket, Base . . . . .	1
1201-G	" Cylinder to Crankcase . . . . .	1
1205-G	" Cylinder Head . . . . .	1
1201-G1	" Main Bearing Plate . . . . .	1
1201-G2	" " " " Spacer . . . . .	6-9
1206-CMG	" Clutch Mounting . . . . .	1
8065-G	" Fuel Pump Mounting . . . . .	2
1219-G	" Manifold . . . . .	1
1291-G	" Water Pump end Cover . . . . .	1
1299-S	" Set, Complete . . . . .	1
1209	Generator Belt Guard . . . . .	1
1208	" Mounting Bracket . . . . .	1
8158	" Regulator . . . . .	1
1266	Guide, Fuel Pump Push Rod . . . . .	1
8187	Lever, Clutch operating . . . . .	1
563	Lock-nut Fuel Pump Push Rod Guide . . . . .	1
1268	Magneto . . . . .	1
1271	" Coupling Disc . . . . .	1
1235	" Drive Shaft . . . . .	1
1236	" " " Bushing . . . . .	1
1269	" " Gear . . . . .	1
1270	" " Thrust Washer . . . . .	1
1224	" Coil . . . . .	1
1225	" Condenser . . . . .	1
1226	" Cover . . . . .	1
1227	" Point Set . . . . .	1
1206	Main Bearing Plate & Clutch Adaptor . . . . .	1
1229	" " " Rear, Bob-Tail . . . . .	1
1238-asy	" " Assembly, Complete Engine . . . . .	1
1238	" " Cone, only . . . . .	2
8128-C	" " Cup, only . . . . .	2
1219	Manifold . . . . .	1
1276	Oil Pump Body . . . . .	1
1278	" " Check Ball . . . . .	2
1279	" " " Retainer . . . . .	1
1284	" " Trough Cover . . . . .	1
1277-asy	" " Plunger Assembly . . . . .	1
1281	" " " Cap . . . . .	1
1283	" " " Spring . . . . .	1
1282	" " Push Rod . . . . .	1

<u>Part #</u>	<u>Part Name</u>	<u>Qty. Used</u>
1286	Oil Filler Cap & Dip Stick . . . . .	1
1285	Oil Screen . . . . .	1
1263	Oil Seal, Front Brg. Plate . . . . .	1
6502	" " Crankshaft, Rear . . . . .	1
1262	" " Retainer, Front Brg. Plate . . . . .	1
1206	Plate, Main Bearing & Clutch Adaptor . . . . .	1
1261-asy	" Front Bearing Retainer . . . . .	1
1241	" Connecting Rod Inspection . . . . .	1
1245	Piston, Standard Size . . . . .	1
1246	" .005 O.S. . . . .	1
1247	" .010 O.S. . . . .	1
1248	" .020 O.S. . . . .	1
1249	" .030 O.S. . . . .	1
1250-S	" Ring Set, Standard Size . . . . .	1
1252-S	" " .010 O.S. . . . .	1
1253-S	" " .020 O.S. . . . .	1
1254-S	" " .030 O.S. . . . .	1
1255	" Pin, Standard Size . . . . .	1
1256	" .005 O.S. . . . .	1
1257	" .010 O.S. . . . .	1
1258	" .020 O.S. . . . .	1
1259	" Retainer Ring . . . . .	2
1260	" Bushing . . . . .	1
1264	Rope Starter Sheave . . . . .	1
8079	" Handle . . . . .	1
8157	Starter-Generator . . . . .	1
899	Starter Solenoid . . . . .	1
406	" Push Button . . . . .	1
1221	" Generator Guard Mounting Bracker (upper)	1
1222	" " " " (lower)	1
1212	" Tension Bar . . . . .	1
1289	" " "V" Belt . . . . .	2
820	Spark Plug . . . . .	1
1210	Valve, Inlet & Exhaust similar . . . . .	2
1213	Valve Spring . . . . .	2
1214	" Seat . . . . .	2
1215	" " Lock . . . . .	2
1216	" Tappet w/Lock Screw . . . . .	2
1217	" Adjusting Screw . . . . .	2

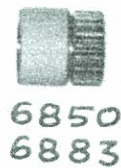
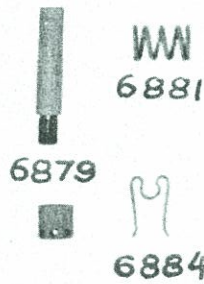
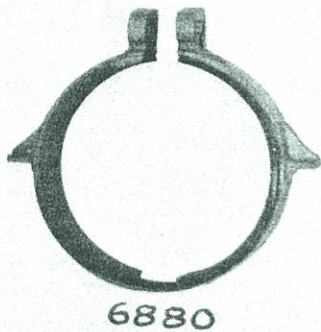
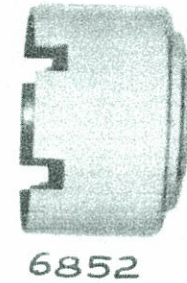
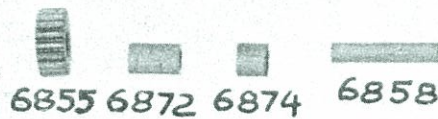
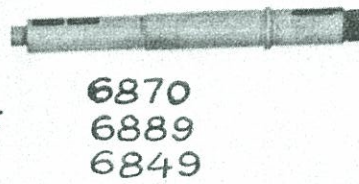
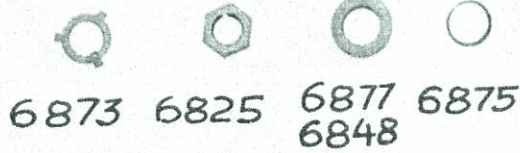
PW-27

-4-

March 1959

<u>Part #</u>	<u>Part Name</u>	<u>Qty</u> <u>Used</u>
1233	Water Pump . . . . .	1
1234	" " Mounting Bracket . . . . .	1
1232	" " Bracket Bearing . . . . .	1
1292	" " Body . . . . .	1
1296	" " Cam . . . . .	1
1296-S	" " Screw . . . . .	1
1293	" " Impeller. . . . .	1
1293-S	" " Screw . . . . .	1
1294	" " Shaft . . . . .	1
1295	" " Packing Nut . . . . .	1
1295-LN	" " " Lock-nut . . . . .	1
1297	" " . . . . .	1

# INDIVIDUAL PARTS—MODEL OXKB MANUAL CLUTCH



PARAGON REVERSE GEAR

Model OXKB

IH-60 Spec: 6678

BH-25 Spec. Y-5346

January, 1958

PART #	PART NAME	QTY, USED	
		IH-60	BH-25
6865	Adjusting Collar .....	1	1
8163	Bearing, Ball, Rear .....	1	1
6853	Bearing, Gear Cage Ball .....	1	1
6851	Bearing, Pilot Ball .....	1	1
8172	Bearing Retainer, Rear .....	1	1
6880	Brake Band Assembly .....	1	1
6882	Brake Band Brace .....	1	1
8173	Bracket, Reverse Gear Case Bed .....	2	-
6857	Bushing, Long Pinion .....	2	2
6872	Bushing, Short Pinion .....	2	2
6852	Cage, Gear or Drum .....	1	1
6871	Coupling, Gear Half .....	1	1
8171	Cover, Reverse Gear Case .....	1	1
6868	Cross Shaft .....	1	1
6863	Finger .....	3	3
8170-G	Gasket Reverse Gear Housing .....	1	1
8172-G	Gasket Rear Bearing Retainer .....	1	1
8171	Gasket Reverse Gear Case Cover .....	1	1
6850	Gear, Engine, used on all IH-60 engines .....	1	-
6883	Gear, Engine, used on all BH-25 engines .....	-	1
6856	Gear, Short Pinion .....	2	2
6855	Gear, Long Pinion .....	2	2
6860	Gear, Propeller .....	1	1
8170	Housing, Reverse Gear .....	1	1
6884	Lockspring, Brake Adjusting Bolt .....	1	1
6873	Lockwasher, Propeller Gear .....	1	1
6825	Nut, Propeller Shaft .....	1	1
8164	Oil Seal .....	1	1
6861	Plate Clutch (Bronze) .....	3	3
6862	Plate Clutch (Steel) .....	3	3
6864	Plate, Pressure .....	1	1
6878	Reverse Cam .....	1	1
6879	Reverse Cam Slide Assy .....	1	1
6876	Retainer, Oil Seal .....	1	1
6875	Ring, Tailshaft retaining .....	1	1
6854	Ring, Gear Cage Ball Bearing Retaining .....	1	1
6859	Ring, Gear Cage Snap .....	1	1
6866	Screw, Lock .....	1	1
6858	Shaft, Pinion Gear Stub .....	4	4
6867	Sleeve, Operating .....	1	1

Paragon Reverse Gear -2-  
 Model OXKB IH-60 Spec. 6678  
 BH-25 Spec. Y-5346

January 1958

PART #	PART NAME	QTY. USED	
		IH-60	BH-25
6874	Spacer, Short Pinion Gear.....	2	2
6881	Spring.....	1	1
6870	Tailshaft, Reverse Gear.....	1	1
6877	Washer, Thrust.....	1	1
6869	Yoke Assy.....	1	1

PARAGON REDUCTION GEAR  
 2:1 Ratio

Model RDAS BH25 and IH-60  
 Spec. Z-6110

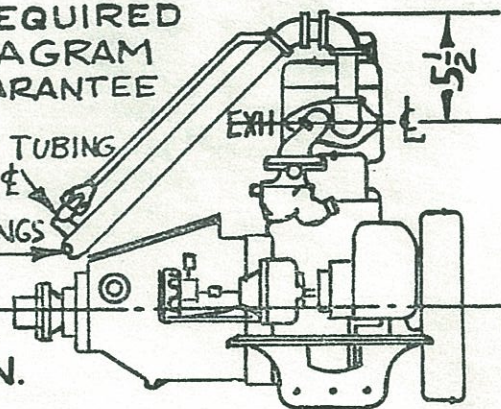
6886	Adaptor Plate.....	1	1
6887	Bearing, Ball, Front.....	1	1
6243	Bearing, Ball, Rear.....	1	1
6895	Bearing, Roller.....	1	1
6896	Bearing, Race, Roller.....	1	1
6891	Coupling, Reduction Gear Half.....	1	1
6886-G	Gasket, Adapter Plate.....	1	1
6892-G	Gasket, Oil Seal Retainer.....	1	1
6893	Housing, Reduction Gear.....	1	1
6242	Lockwasher, Tailshaft.....	1	1
6241	Nut, Tailshaft.....	1	1
6806	Oil Seal.....	1	1
6892	Oil Seal Retainer.....	1	1
6888	Ring, Adapter Plate Snap.....	1	1
6890	Ring, Tailshaft Retaining.....	1	1
6889	Tailshaft and Driving Gear, Integral.....	1	1

MOD. P.W.27 -REQUIRED  
EXH PIPING DIAGRAM  
(OTHERWISE GUARANTEE  
VOID.)

WATER INLET TUBING  
5" BELOW EXH  $\phi$

1" PIPE & FITTINGS  
FOR EXH.

THE PALMER ENG CO.  
COS COB, CONN.





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