OPERATOR'S

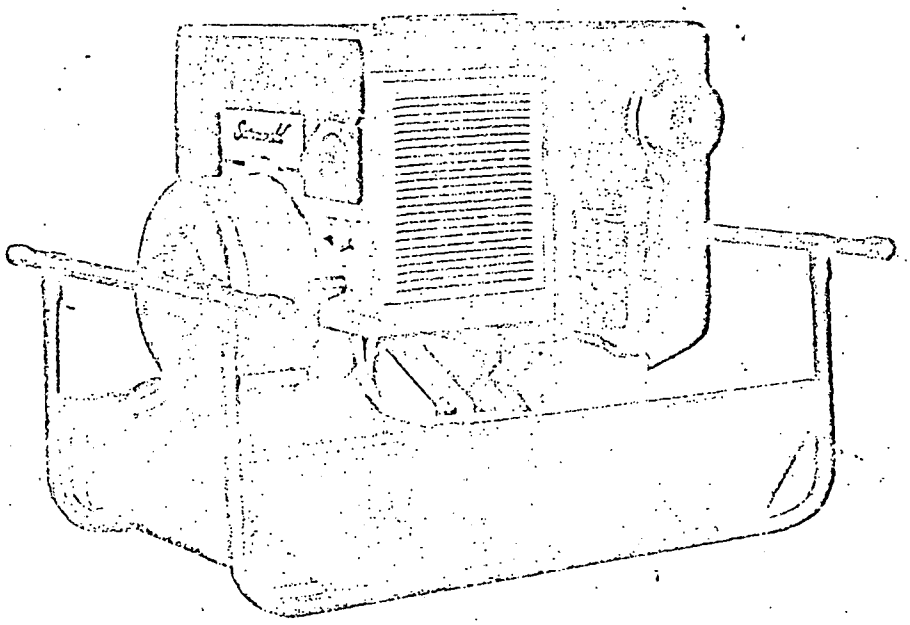
INSTRUCTION MANUAL AND PARTS CATALOG

Sureweld®

200 AMP. DC WELDERS

MODELS

SGW-201-MS1 SGW-201-ES1
SGW-201-MS2 SGW-201-ES2



April, 1967

NH-680

NCG®

NATIONAL CYLINDER GAS
DIVISION OF CHEMETRON CORPORATION
340 N. MICHIGAN AVE., CHICAGO, ILLINOIS 60611

327-1032

Printed in U.S.A.

INTRODUCTION

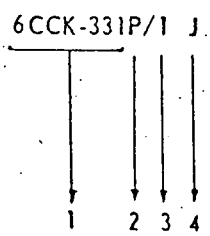
The welder is a complete engine-driven, direct-current arc welding machine. It consists of a gasoline engine directly connected to an electric generator which are mounted to a sturdy carrying frame.

The welder is rated 200-amperes, 30-volts direct current, 50% duty cycle. Auxiliary alternating current is available. AC output is 120 or 240-volt and is rated 3500-watts, 60-cycle; or 2500-watts, 50-cycle, single-phase, 100% duty cycle. AC output is available at any time the welding current is not being used, through a simple lever control. This ac output is convenient for emergency lighting, running power tools, etc., when working at locations away from ac power line sources. Models are available in either voltage with either electric or manual starting.

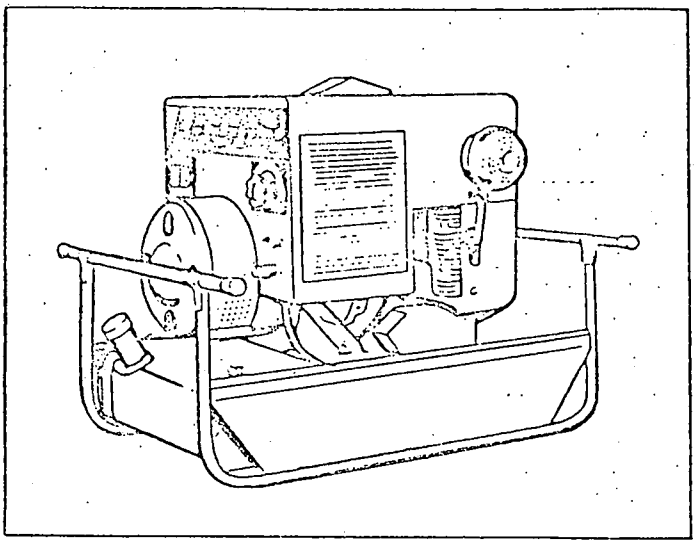
All 1/16" through 5/32" electrodes may be used. 3/16" positive and negative electrodes which do not exceed the welder capacity may be used.

When instructions in this manual refer to a specific model of welder, identify the model by referring to the MODEL AND SPECIFICATION NO. as shown on the unit nameplate.

How to interpret MODEL and SPEC. NO.



1. Factory code for general identification.
2. Specific Type:
   P - PORTABLE. Pull rope starting.
   E - ELECTRIC. Electric starting at welder.
3. Factory code for optional equipment.
4. Specification (Spec.) letter (advances when factory makes production modifications.



TYPICAL 200-AMPERE WELDER

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any cause.

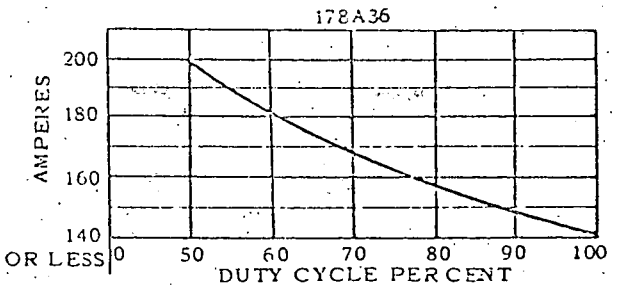
The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED AUGUST 1, 1963

SPECIFICATIONS

Nominal dimensions (inches)	
Height	
Width	
Length	
Number Cylinders	2
Displacement (cubic inches)	50
Cylinder bore	3-1/4
Piston Stroke	3
Horsepower (at 1800-rpm)	10.2
Compression ratio	5.5:1
Oil capacity	4 qts.
Fuel capacity	7-1/3 gal.

DUTY CYCLE CHART



Duty cycle equals one 10 minute period.

When interpreting the Duty Cycle Chart, note that at 200 amperes (rated load) not-welding time must be at least 1/2 (50%) of each 10-minute period. As welding load is reduced, longer welding time is permissable because less not-welding running time is required for the machine to cool down. Extreme ambient temperatures must also be taken into consideration. Continuous welding is permissable at 140-amperes or less.

For convenience in servicing, especially draining oil, it may be desirable to elevate the welder above the vehicle floor.

OIL DRAIN EXTENSION

A 3/8" oil drain plug is provided in the engine oil base with an extension pipe and coupling (Fig. 1-2) to promote oil draining convenience and cleanliness. Electric start models have an additional 45° elbow which is used for clearing the battery.

BATTERY (Electric Starting Models)

Connect battery cable marked POS. to the battery positive (+) terminal. Connect unmarked cable to the battery negative (–) terminal. Always keep cable connections tight and clean.

LPG FUEL CONNECTION (Liquid Withdrawal)

Welders equipped with a Zenith gas carburetor, or a Garretson secondary (demand) gas regulator and Zenith combined vaporizer and primary regulator assembly; connect the LPG (liquid petroleum gas) liquid withdrawal line to the vaporizer fuel inlet (1/4" pipe tapped hole). The combination vaporizer and primary regulator is factory set to reduce gas line pressure to 8±.1 psi. The secondary regulator is a Garretson Model SD which supplies gas to the carburetor upon demand. Incoming gas pressures to the Garretson regulator must not exceed 10 psi. Bleed air from the fuel line by depressing the primer button on the secondary regulator. Major components of the LPG system are illustrated in Fig. 1-3.

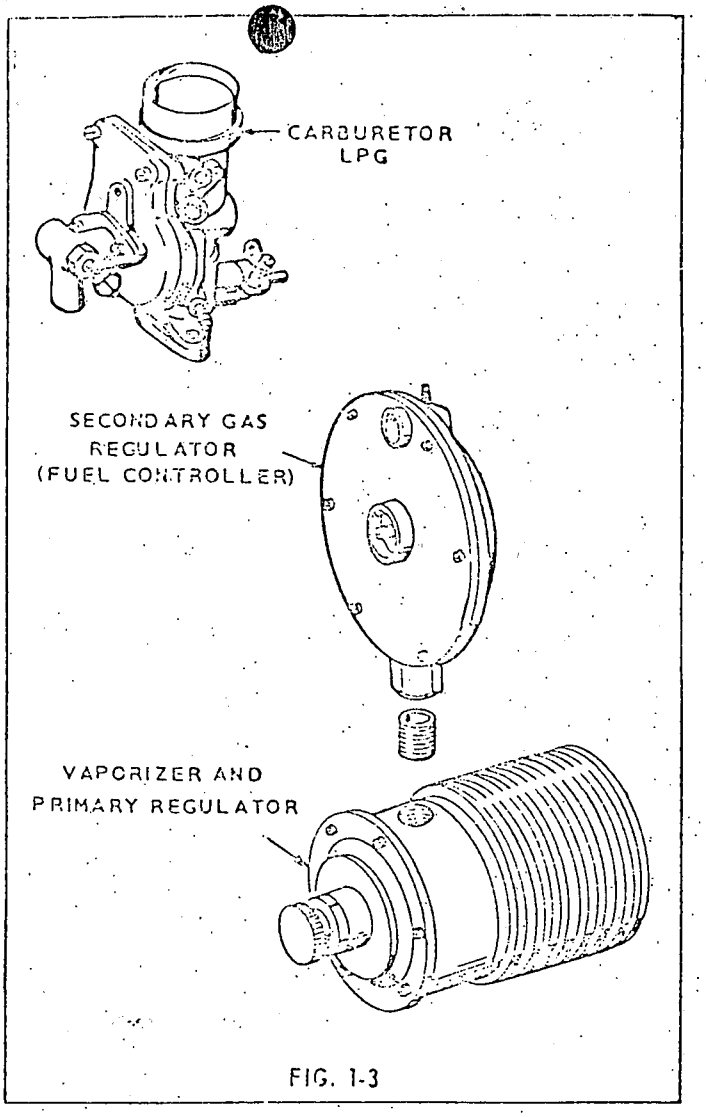


FIG. 1-3

OPERATION

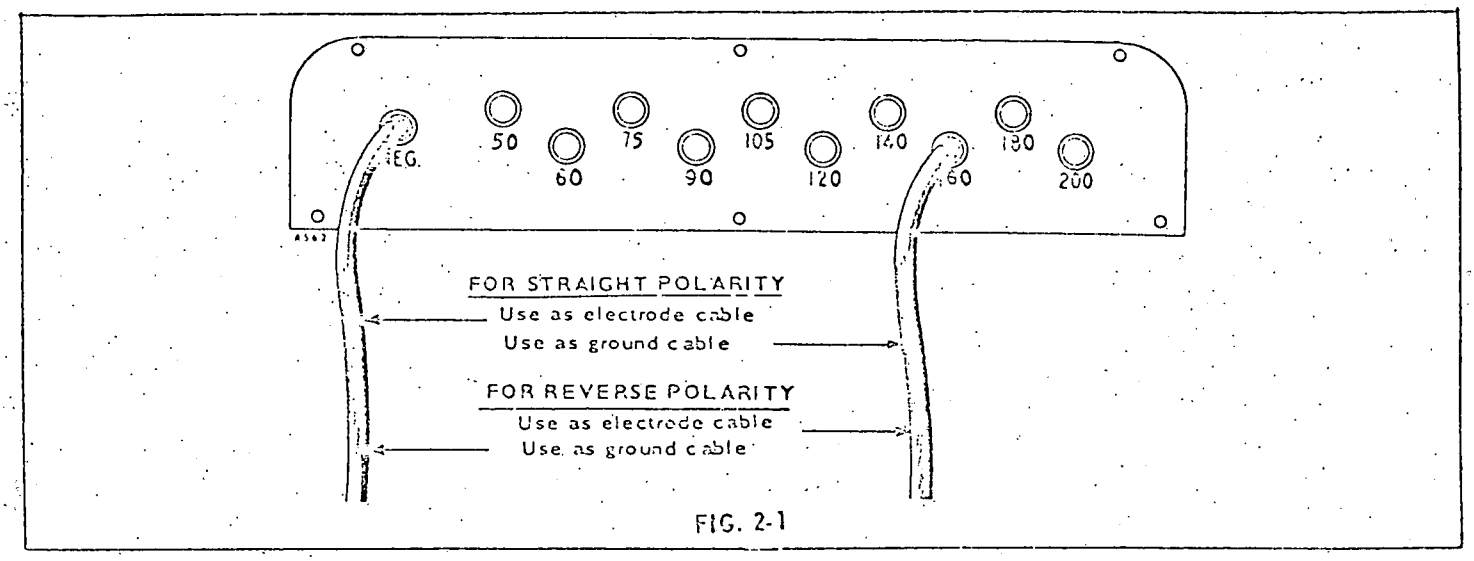


FIG. 2-1

WELDING CABLE CONNECTIONS

Insert welding cables into the main current amperage jack receptacles (Fig. 2-1) according to the welding requirements. Some welding jobs may require frequent polarity changing to permit using various types of welding rod.

Straight Polarity Welding: Connect the *electrode* cable to the negative (NEG.) jack receptacle. Connect the *ground* cable to the desired amperage jack receptacle.

Reverse Polarity Welding: Connect the *ground* cable to the negative (NEG.) jack receptacle. Connect the *electrode* cable to the desired amperage jack receptacle.

WELDERS IN PARALLEL

Two welders can be connected in parallel if the welding amperage requirements are greater than those provided by one welder. Larger welding cables must be used because of the higher amperage. Consult your dealer, if in doubt, as to the welding cable size required.

1. Determine welding amperage requirements. Select *identical amperage jack receptacles* on each welder which *total* the amperage requirement.
   EXAMPLE: If 300 amperes are required, select the 160-ampere jack receptacle on each welder (155-ampere jack receptacle prior to Spec H). It may be necessary

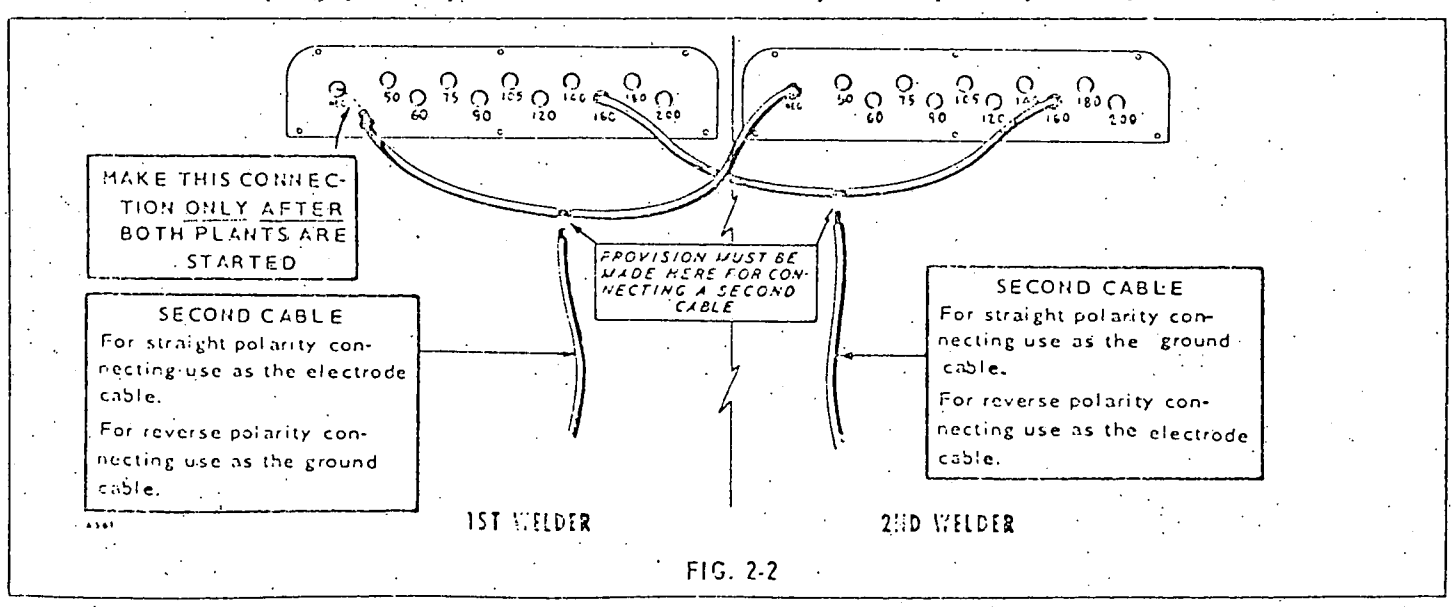


FIG. 2-2

to select amperages which total slightly higher than the welding requirements to obtain proper welding characteristics. This is due to voltage and current differences which occur when welders are connected in parallel. Proper current can then be obtained using the fine current control adjustment.

2. Connect a cable between the pre-selected *identical amperage jack receptacles* of the welders. This cable (Fig. 2-2) must have some means of attaching a second cable by splicing, clamping, etc. which will insure a tight connection.
3. Connect another cable (equal size and length) to the negative (NEG.) jack receptacle of only one welder. DO NOT complete connection to negative (NEG.) jack receptacle of second welder until both welders are running. Provisions for connecting a second cable must also be made as described in paragraph 2.

CAUTION: *DO NOT attempt to parallel the welder's AC output--serious control and welder damage will result.*

INITIAL START

Check engine to be sure it has been filled with oil and fuel. If engine fails to start at first attempt, inhibitor oil used at the factory may have fouled the spark plugs--remove, clean in gasoline, dry thoroughly and install. Heavy exhaust smoke, when engine is first started, is normal and is caused by the inhibitor oil.

Crankcase Oil: Use good-quality detergent oil meeting API (American Petroleum Institute) service designations MS, MS/DG. Recommended SAE oil numbers for expected ambient temperatures are as follows:

Above 90°F	SAE 50
30°F to 90°F	SAE 30
0°F to 30°F	SAE 10W
Below 0°F	SAE 5W (5W-20 if 5W is not available)

OIL CAPACITY - 4 QUARTS U.S. MEASURE

Do not use service DS oils. Do not mix brands or grades.

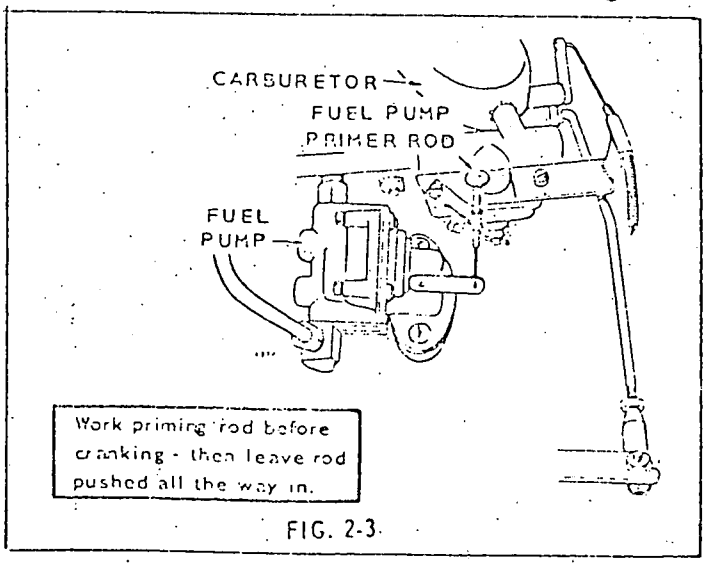


FIG. 2-3.

Recommended oil change periods and maintenance requirements are given in the Maintenance Section.

Recommended Fuel: Use clean, fresh automotive regular grade gasoline. Do not use highly leaded premium fuels.

Never fill the welder fuel tank when the engine is running. Always leave fuel expansion space in the fuel tank and wipe off any spilled fuel.

STARTING

Manual Start: Fuel system priming will be necessary if the welder has been idle long enough for gasoline to evaporate from the carburetor. To prime, remove the engine and control cover. Operate fuel pump primer rod (Fig. 2-3) approximately 15 complete strokes which should fill the carburetor. NOTE: *If engine camshaft pump lobe is up (fuel pump priming rod has little or no resistance), crank engine one revolution to permit hand priming. Be sure to return priming rod to its' downward position after priming. Replace the engine and control cover.*

If the welder has been standing idle in cold temperatures, full choking may be necessary when cranking to start. In hot weather, or if the welder is still warm from recent operation, little or no choking will be necessary. Pull choke control outward to choke the carburetor according to temperature conditions.

1. Welders Equipped with Optional Readi-Pull Starter. The starter rope is in the starting position and will automatically rewind to this position after the rope is pulled and released.

   Welders Not Equipped with the Optional Readi-Pull Starter. Wind starting rope on flywheel rope sheave in a clockwise direction to within approximately 6" of the starting rope handle.
2. Crank unit with a rapid, smooth pull on the starting rope. DO NOT JERK. If unit does not start readily, change choke setting. Avoid over-choking as this can cause oil dilution which can result in excessive wear of internal engine parts. NOTE: *Setting the throttle control lever at the POWER (1800 rpm) position, especially true in cold weather, aids starting.*
3. As soon as unit starts, adjust choke to best running position, gradually pushing choke control in as unit warms up.

Electric Start: On initial start (or if the unit has run out of fuel) it will be necessary to pump fuel to the carburetor. It usually takes about 30-revolutions to properly fill the carburetor.

1. Snap the ignition switch, located on the control panel, to its' ON position (battery must be connected).
2. Adjust choke according to temperature conditions. Adjust as explained for manual start models.
3. Push START switch firmly. If unit does not start within

a few seconds, release the START switch and wait a few seconds before re-attempting to start. If unit does not start after two attempts, open the choke and repeat starting sequence.

4. After unit starts, adjust choke to best running position. Gradually push choke control in as unit warms up.

LPG FUEL (Liquid Withdrawal):

Open tank fuel valve and check for fuel system leaks. Bleed air from system by temporarily pressing the primer button on the secondary regulator. NOTE: *If gas BTU rating differs* from that used during the factory test run, it will be necessary to make compensating carburetor adjustments.

Engine cranking normally draws fuel from the secondary (demand) regulator. It may be necessary to press the secondary regulator primer button for the initial start.

CAUTION: *If unit fails to start, return ignition switch to its' OFF position before leaving the unit. Battery will discharge if unit stops with ignition on.*

Should the charge condition of the battery become so low that it cannot furnish enough power for cranking, the unit can be started by manually cranking, using the starting rope.

OIL PRESSURE

Normal operating oil pressure is 20-35 pounds. Pressure will be higher until the engine warms up. CAUTION: *Long storage periods may cause the oil pump to lose its' prime. If this should occur (no oil pressure), stop the engine immediately, remove the oil pressure relief valve (Engine Assembly Section) and fill the pressure line. Replace relief valve and adjust.*

WELDING CURRENT ADJUSTMENT

Welders have an engine speed control lever and a fine current adjustment control (Fig. 2-4).

The engine speed control lever, when at the WELD (2500-rpm) position, cuts off ac output and welding current only is available. When the speed control lever is at the POWER (1800-rpm) position, welding current is by-passed and ac only is available.

The jack receptacle type main current control connects various resistance units into the welding circuit, limiting the amount of current at each jack receptacle. The fine current control provides for further adjustment between the jack receptacles of the main control.

CAUTION: *Considerable heat is generated by the resistance units inside the welder control box. Always keep the engine and control cover installed on the unit to properly direct cooling air to the control box. NEVER WELD WITH ENGINE AND CONTROL COVER REMOVED!*

1. Plug cables into proper jack receptacles to obtain the amperage recommended for the electrode used.
2. Set fine current control at its' approximate center position (midway between minimum and maximum). Try the welding characteristics, making fine current adjustments as necessary. NOTE: Fine current control range is greater than the current spread of the main current control jack receptacles. If perfect arc conditions are not obtained by normal procedure, try the next higher or lower jack receptacle connections and re-adjust the fine current control to compensate.
3. When operating welders in parallel, ALWAYS have both ends of the connecting cables plugged into IDENTICAL jack receptacles on each welder. If an amperage connection change is made on one welder, immediately change the other end of the connecting cable to the like jack receptacle of the second welder.
4. If welding current cannot be satisfactorily adjusted, poor electrical contact is indicated. Check welding cable connections at welder, ground clamp and clamp

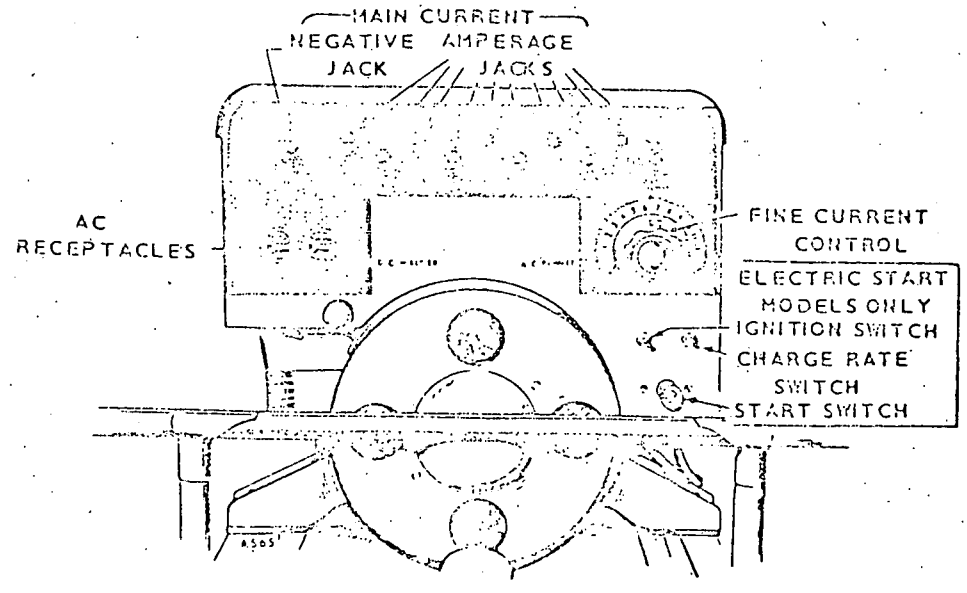


FIG. 2-4

connections at the work. Check electrode holder connections also. A poor connection at any of these points will affect welding current.

AC OUTPUT

Move speed control lever to POWER (1800-rpm on 60-cycle models or 1500-rpm on 50-cycle models) position. This cuts the welding current control off and supplies 120- (or 240) volt current to the output receptacles. Limit ac loads to not more than 3500-watts, 60-cycle or 2500-watts, 50-cycle.

MICRO SWITCH

The engine speed control lever controls micro switch operation. If the micro switch becomes stuck or inoperative, welder operation is vitally affected. Refer to wiring diagram.

1. If micro switch dc contacts remain closed when speed control lever is at WELD position, welder voltage at no-load increases from a normal 60-volts (approximate) to 80-volts. At heavy welding load, speed will drop excessively and welder will appear to lack power.
2. If micro switch dc contacts remain open when speed control lever is at POWER position, ac voltage will be low with similarily low power performance.
3. If micro switch ac contacts fail to close with speed lever at POWER position, there will be no available ac output.
4. If micro switch ac contacts remain closed with speed control lever at WELD position, ac output voltage will be excessively high, and any ac load left connected will be damaged.

HI-LO BATTERY CHARGE SWITCH

When the welder is used infrequently, keep Hi-Lo toggle switch at its' Hi position, which provides approximately a 2-ampere charge rate. The Lo position provides approximately a 1-1/4-ampere charge rate, which is usually sufficient for normal operation.

STOPPING

Before stopping, put engine speed control lever at its' POWER position and allow welder to run at the lower speed for at least 30-seconds. If engine speed control lever is left at WELD position when stopping, next starting may be difficult.

To stop a MANUAL START unit, press STOP button (located on engine blower housing) firmly until engine has come to a a complete stop. If STOP button is released too soon, engine will pick up speed again and continue to run.

To stop an ELECTRIC START unit, snap IGNITION SWITCH (located on control panel) to its' OFF position.

EXERCISE

Infrequent use results in hard starting. Operate welder one 30-minute each week. Run longer if battery (Electric Start models) needs charging.

BREAK-IN PROCEDURE

No matter how carefully engine parts are manufactured or expertly assembled, there are always microscopic variations in fit between metal parts such as pistons, rings, main and connecting rod bearings.

Break-in or ideal fitting of all internal moving metal parts can best be achieved by maintaining proper cooling and correct lubrication during the running-in period. *Break-in* can take as little as ten operating hours or it may take many hundreds of hours. Extended periods of very heavy engine loading (above rated horsepower or electrical output) during this initial service period can cause severe cylinder scoring or bearing galling. On the other hand extended periods of very light loading during initial break-in may cause cylinder wall glazing and/or poor piston ring seating. Engine parts damage can also be caused by using the wrong type and viscosity oil and high engine operating temperatures during break-in.

All engines use more oil than normal during the first hours of operation. As internal moving parts are run-in by controlled operation, oil consumption should gradually decrease until the rate of consumption is stabilized. It is extremely rare that oil consumption drops to zero. All engines use some oil even when in perfect condition and properly broken-in. Oil consumption varies according to engine design, engine (piston) speed, size of engine, type of oil, oil viscosity, length of operating periods, operating temperatures, engine loading, etc. As engine operation is continued, clearance between moving parts increase slightly due to normal wear of piston rings, cylinder walls, valve guides, oil seals, etc. These clearances increase until oil consumption is excessive and engine parts have to be replaced and/or refitted. This usually takes thousands of hours.

Each engine is *run-in* at the factory for a minimum of three hours. This is not enough running time to completely *break-in* the engine. Proper completion of the *break-in* period is up to the customer.

During *break-in* check oil level at least every eight (8) operational hours. Add oil if the level is at *low* on the dip-stick. Never over-fill. This may cause oil to foam and enter the breather system.

Drain the initial oil fill after 50-hours of operation while the engine is hot.

Controlled *break-in* with consistent use of proper oil from a reputable supplier and a conscientiously applied maintenance program will help assure satisfactory service for thousands of hours from your welder.

OUT-OF-SERVICE PROTECTION

Protect a plant that is to be out-of-service for more than 30 days as follows:

1. Run welder until thoroughly warm.
2. Turn off fuel supply and run until welder stops.

3. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove each spark plug. Pour 1 oz. (two tablespoons) of rust inhibitor (or SAE #50 oil) into each cylinder. Crank engine slowly (by hand) several times. Install spark plugs.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe generator brushes, slip rings, etc. Do not apply lubricant or preservative.
9. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
10. Provide a suitable cover for the entire unit.
11. If battery is used, disconnect and follow standard battery storage procedure.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the welder.
2. Keep cooling fins clean. Air housing should be properly installed and undamaged.
3. Keep ignition timing properly adjusted.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the welder to a warm location or apply heat externally until oil flows freely.
2. Use fresh (not *premium*) gasoline. Protect against moisture condensation. Below 0°F adjust carburetor main jet for slightly richer fuel mixture.
3. Keep ignition system clean, properly adjusted, and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid over-heating.

DUST AND DIRT

1. Keep welder clean. Keep cooling fins free of dirt, etc.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 50 operating hours.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.
6. Clean generator brushes, slip rings, and commutator.

HIGH ALTITUDE

For operation at altitudes of 2500-feet above sea level, close carburetor jet adjustment slightly to maintain proper air-to-fuel ratio (refer to the *Adjustments Section*). Maximum power will be reduced approximately 4% for each 1000-feet above sea level, after the first 1000-feet, thus at an altitude of 5000-feet, the welder will deliver approximately 160-amps., with proper carburetor adjustment.

ADJUSTMENTS

GENERAL

Satisfactory welder performance is largely dependent upon correct adjustments. However, adjustments cannot fully compensate for low engine power due to wear, etc. If trouble develops, follow an orderly procedure to determine the cause before making any adjustment. Refer to the Troubleshooting section for help in checking causes of troubles which may occur.

CARBURETOR ADJUSTMENT

Gasoline: The carburetor has an adjustable idling jet. Refer to Fig. 3-1. It is simple in construction and normally requires little attention other than a periodic cleaning. Make the adjustment while the engine is running at normal operating temperature and no-load.

When adjusting the idle jet needle, turn the idle adjusting needle in until the engine loses speed. Then turn it out until the engine runs smoothly. A hunting condition at no-load can sometimes be corrected by an idle adjustment.

The unit may be adjusted for maximum power by turning the main adjusting needle (early models only) out about two full turns. Then turn it slowly in until the engine begins to lose power and speed. Then turn it out very slowly until the engine runs smoothly at full power and speed.

If the engine develops a hunting condition (alternate increase and decrease of engine speed) try correcting by opening the main adjusting needle (early models only) a little more. Do not open more than 1/2-turn beyond the maximum point of power. If this does not correct the condition, follow the instructions for regulating the sensitivity of the governor under *Governor Adjustment.*

LPG Liquid Withdrawal Fuel: The carburetor has main and idle fuel adjustments. The main adjustment affects operation at a light or no-load condition. Under normal circumstances, factory carburetor adjustments should not be disturbed. Differences in altitude or fuel (BTU rating) will require a carburetor re-adjustment.

Allow the engine to thoroughly warm up. Adjust the idle adjustment (Fig. 3-2) with no load connected. Slowly turn the idle adjustment out until the engine loses speed. Then turn the needle in until speed returns to normal.

Adjust the main fuel adjustment with a full-load connected. Turn the main adjustment (Fig. 3-2) in until the speed drops below normal. Then turn the needle out until engine speed returns to normal. Proper carburetor adjustment cannot be assured unless the governor is also properly adjusted.

THROTTLE STOP SCREW

Set the throttle stop screw, on the throttle shaft lever, to clear the manifold surface by 1/32" when the engine is operating at 1800-rpm and with no electrical load connected (see Fig. 3-3).

GOVERNOR

The governor function is to keep engine speed nearly constand, regardless of the load it must carry. Nominal welding speed is 2500-rpm. When the engine speed control lever is at the POWER position for ac output, engine speed is ap-

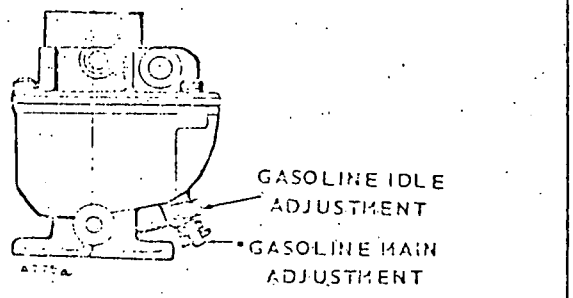


FIG. 3-1

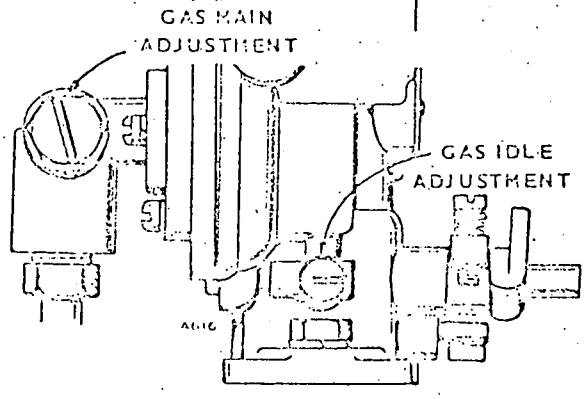


FIG. 3-2

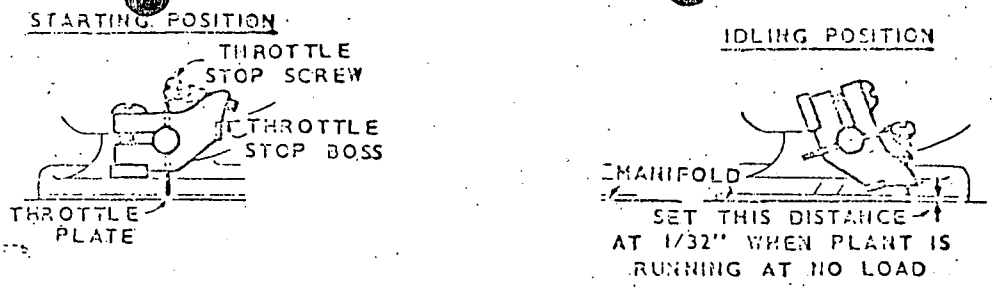


FIG. 3-3

proximately 1800 (60-cycle) or 1500-rpm (50-cycle) depending on the particular unit.

Before making any governor adjustment, see that the carburetor is first properly adjusted. Provide an accurate instrument (tachometer) for checking engine speed. Be sure welder is thoroughly warmed up.

1. Check the length of the linkage (A) which connects between the governor arm and the carburetor throttle arm. This linkage synchronizes the governor arm travel with the carburetor throttle. If the original factory adjustment has been disturbed, adjust the length so that with the engine stopped and tension on the governor spring, the carburetor throttle lever stop projection is just touching the bottom surface of the carburetor body, then turn the governor ball joint (B) approximately two more complete turns to shorten the linkage (A). Now, tighten the lock nut. (See Fig. 3-4).
2. Set engine speed control lever (C) at the POWER posi-

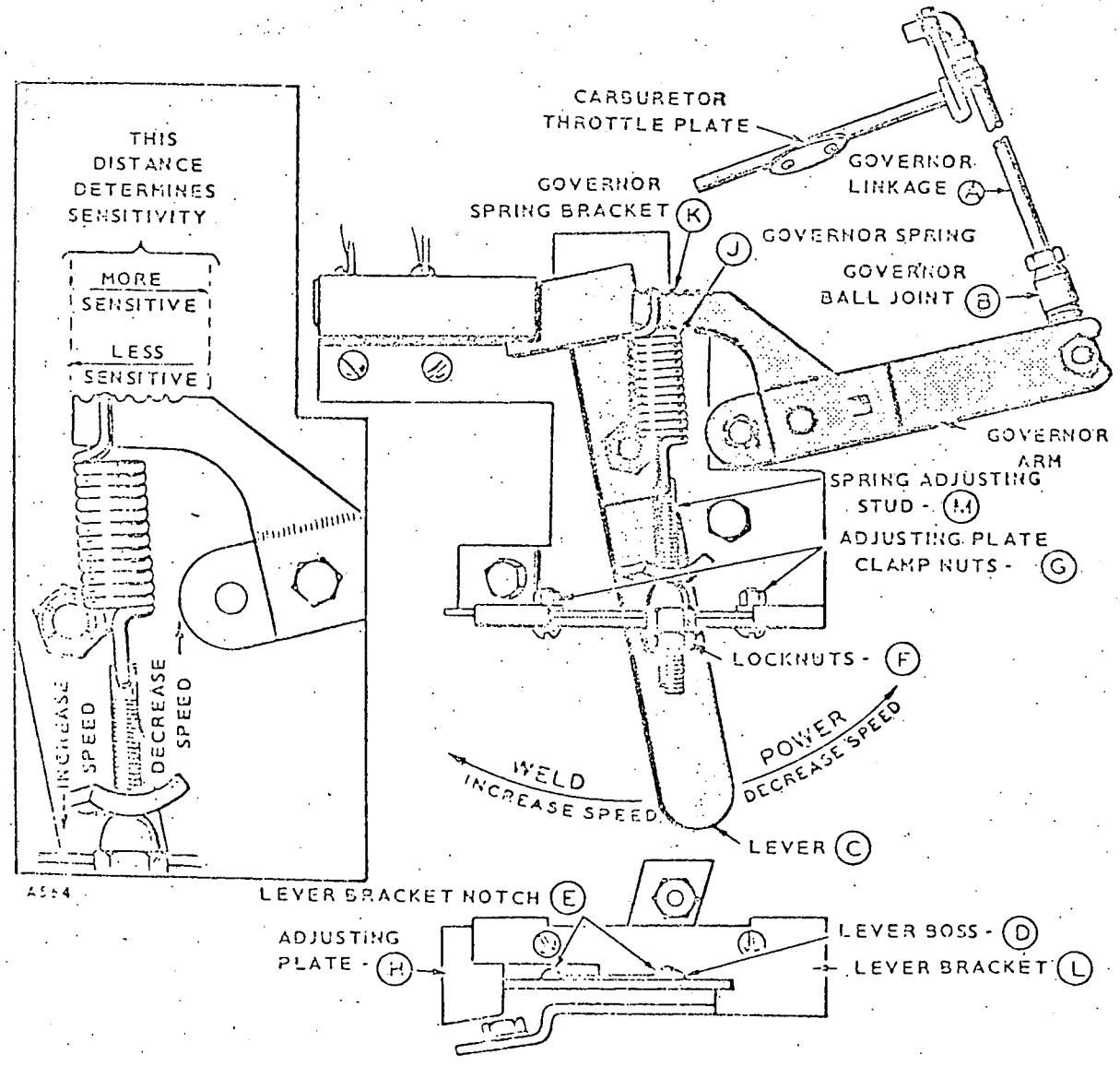


FIG. 3-4

tion, where the lever boss (D) engages with the notch (E) in the lever bracket (L).

3. Adjust the spring tension to produce engine speed of approximately 1850-rpm (1550-rpm on 50-cycle models) at no-load. Spring tension is adjusted by loosening the lock nuts (F) and turning the inner nut on spring adjusting stud (M). This will determine engine speed for ac operation.
4. Pull engine speed control lever to the WELD position. The speed should then be approximately 2700-rpm at no-load. If speed is not approximately 2700-rpm, loosen the two nuts (G) holding the adjusting plate (H), and slide the plate either in or out to gain the desired speed. Retighten nuts.
5. Check engine speed while welding at maximum current. Engine speed at full welding load should be approximately 200-rpm lower (about 2500-rpm) than no-load speed. If speed drop is excessive, move the governor spring (J) in (towards the governor arm) one or more notches on the spring bracket (K) until speed drop is approximately 200-rpm. This will require a new speed adjustment, repeating steps 2, 3, and 4.

   If the spring is moved in too far, the engine will "hunt" (alternately increase and decrease speed). If hunting develops before speed drop is reduced to 200-rpm, try correcting by enriching the carburetor adjustment slightly. Do not turn the carburetor main adjustment needle out more than 1/2-turn (early models only) past its' original full-power setting.

BREAKER POINTS

Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone.

Ignition breaker points (Fig. 3-5) must be correctly gapped (.020"). Crank engine to fully open breaker points (1/4-turn after top center). Loosen and move stationary contact to correct the gap at full point separation. Secure points and check gap with thickness gauge.

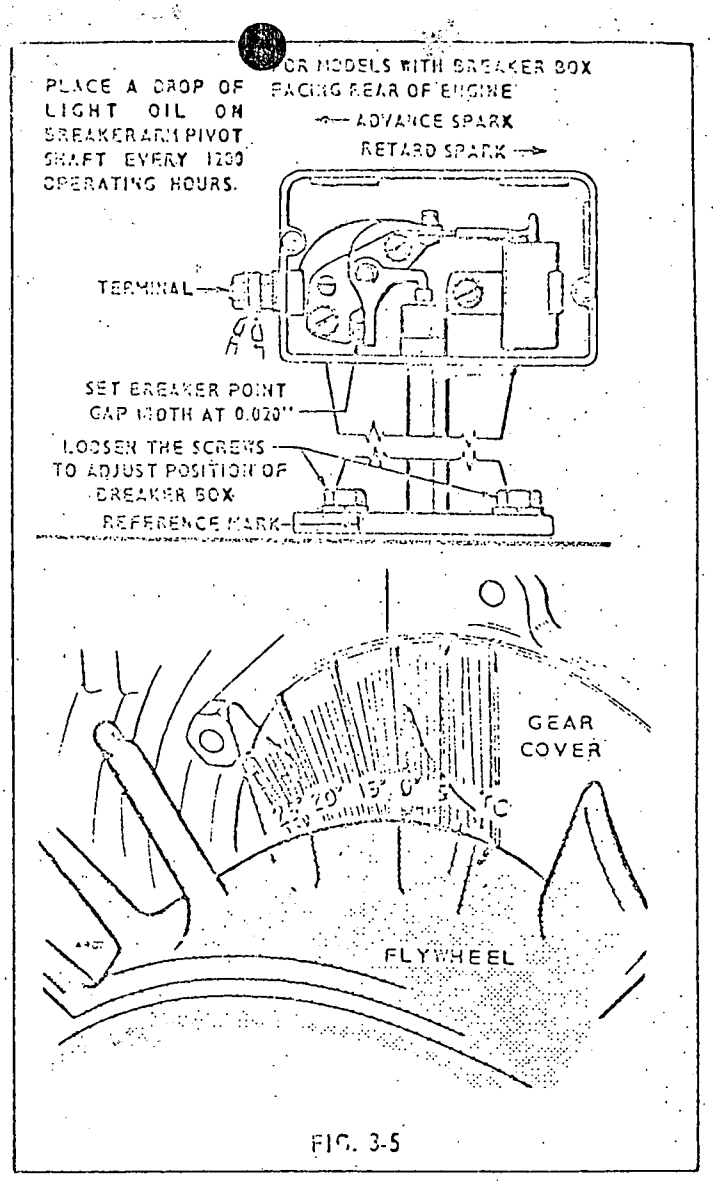
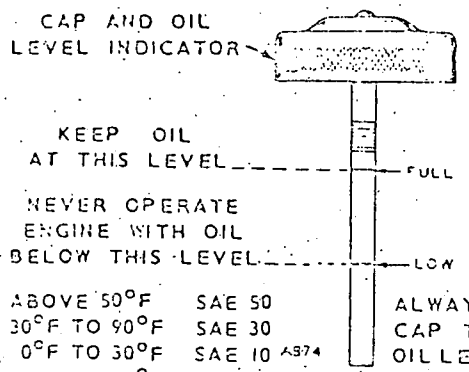


FIG. 3-5

Ignition points should break contact just when the timing mark aligns with the flywheel timing mark. Final timing is corrected by properly shifting the breaker point box on its mounting and using a timing light. If specified timing cannot be obtained by shifting the box position, check to be sure timing marks on gears are aligned. Timing procedures appear in Ignition System Section.

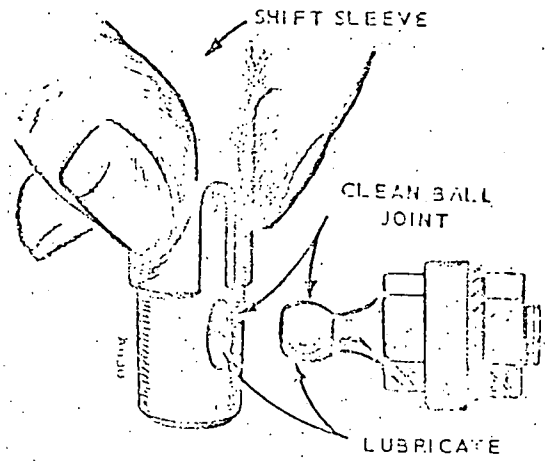
CRANKCASE OIL

Oil capacity (4-quarts). Fill to *full* mark on oil indicator. Use good quality detergent oil classified for service MS or DS DG. Do not use service DS oil at any time. Use single viscosity oil; oil consumption is usually higher with multi-viscosity *all weather* oil. Use proper SAE number of oil for expected temperature conditions. Do not mix brands or grades. Extremely dusty or low temperature conditions require oil change at 50 hrs.

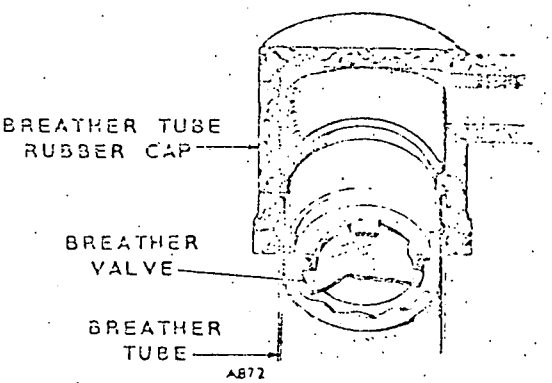


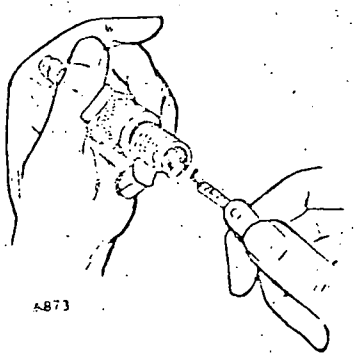
(SAE 5W-20 if 5W is not available)

GOVERNOR LINKAGE

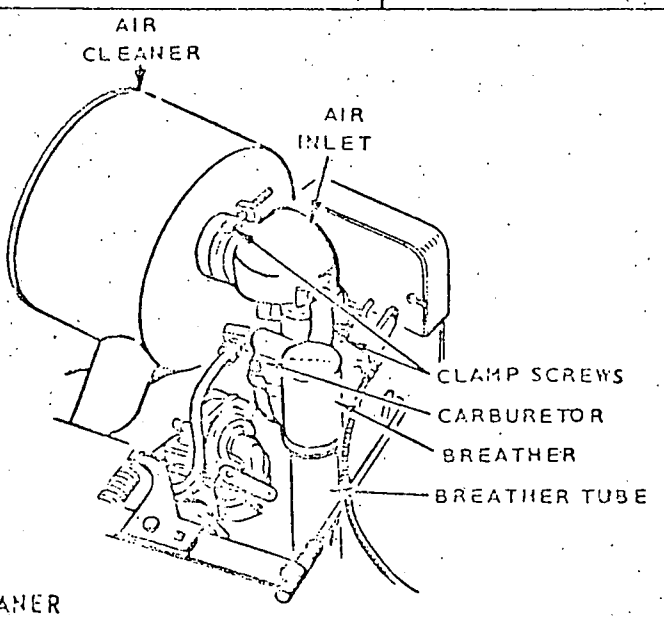


CRANKCASE BREATHER





SPARK PLUG GAP
0.025" GASOLINE
0.018" GAS FUEL



AIR CLEANER

FIG. 4-1

MAINTENANCE SCHEDULE

Use this factory recommended maintenance schedule (based on favorable operating conditions) to serve as a guide to get long and efficient welder life. Neglecting routine maintenance can result in failure or permanent damage to the welder. Maintenance is divided into two categories: (1) *operator maintenance* – performed by the operator and (2) *critical maintenance* performed by qualified service personnel.

OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200
Inspect Welder	x			
Check Fuel	x			
Check Oil Level	x			
Clean Air Cleaner*		x1		
Clean Governor Linkage		x1		
Check Spark Plugs			x	
Change Crankcase Oil			x1	
Clean Crankcase Breather				x
Clean Fuel System				x
Check Battery				x
Replace Oil Filter				x1
x1 - Perform more often in extremely dusty conditions.				

*Remove air filter cartridge and shake out accumulated dirt. Do not wash. Install new cartridge every 500 hours.

For any abnormalities in operation, unusual noises from engine or generator, loss of power, overheating, etc., contact your dealer.

CRITICAL MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	200	500	1000	5000
Check Breaker Points	x			
Clean Commutator and Collector Rings	x1			
Check Brushes	x2			
Remove Carbon & Lead		x3		
Check Valve Clearance		x		
Clean Carburetor		x		
Clean Generator			x	
Remove & Clean Oil Base			x	
Grind Valves (If required)			x	
General Overhaul (If required)				x

x1 - Perform more often in extremely dusty conditions.

x2 - Replace brushes when worn to 5/8" or less.

x3 - The frequency of necessary carbon or lead deposit removal will vary with operating conditions. Frequent short operating periods, consistently cool operation, use of highly leaded gasoline, etc. are some causes of more rapid formations of combustion deposits. Remove deposits as experience indicates the necessity. Always install new gaskets.

FUEL SEDIMENT

Empty carburetor and fuel filter (strainer) bowls of any accumulated sediment. Clean filter screen thoroughly. Assemble and check for leaks.

BOLT TORQUES

BOLT TORQUES	FT-LB
Spark Plugs	25-30
Cylinder Heads	29-31
Oil Base Mounting	43-48

CLEARANCES

Spark Plug Gap Gasoline - 0.025"
Gas - 0.018"

TAPPETS (Intake & Exhaust) 0.015" to 0.017"

Ignition Breaker Point Gap 0.020"

IGNITION TIMING

Prior to Spec H	25°BTC
Begin Spec H	
Running	25°BTC
Stopped or Cranking	5°BTC
Begin Spec L	20°BTC

TROUBLE SHOOTING

POSSIBLE CAUSE	REMEDY
ENGINE CRANKS TOO STIFFLY	
Too heavy oil in crankcase.	Drain. Refill with lighter oil.
ENGINE CRANKS TOO SLOWLY (Electric Start Models)	
Discharged or defective battery.	Recharge or replace.
Loose connections.	Tighten.
Corroded battery terminals.	Clean. Replace cables if necessary.
Brushes worn excessively making poor contact.	Replace brushes and/or clean commutator.
Short circuit in generator or load circuit.	Repair or replace parts necessary. Disconnect load.
ENGINE WILL NOT CRANK	
Engine Siezed.	Disassemble and repair.
Defective starting circuit.	Repair or replace as necessary.
Defective switch.	Replace.
ENGINE WILL NOT START WHEN CRANKED	
Faulty ignition. Breaker point plunger sticking.	Clean, adjust, or replace breaker points, spark plugs, condenser, plunger, etc. Time ignition.
Lack of fuel or faulty carburetion.	Fill tank. Check fuel system. Clean, adjust or replace parts necessary.
Clogged fuel filter.	Clean.
Cylinders flooded.	Ground spark plug cables. Crank engine with spark plugs removed.
Poor fuel.	Refill with good fuel.
Poor compression.	Tighten spark plugs and cylinder heads. If still not corrected, grind valves and replace piston rings if necessary.
Fuel vapor lock.	Always operate at 1800-rpm before stopping.

POSSIBLE CAUSE	REMEDY
ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP	
Poor brush contact.	See that brushes seat well on commutator and collector rings, are free in holders, are not worn shorter than 1/2", and have good spring tension.
Open circuit, short cir-	Refer to "Generator" Section.
GENERATOR OVERHEATING	
Operation of welder for long periods without welding.	Do not run engine for long periods of time unless welding, or using a output.
Improper brush rig position.	See "Brushes" in "Generator" Section.
ENGINE OVERHEATING	
Improper lubrication.	See Low Oil Pressure.
Poor ventilation.	Provide adequate ventilation at all times.
Dirty or oily cooling surfaces.	Keep the engine clean.
Retarded ignition timing.	Retime ignition.
Generator overloaded.	Reduce load.
UNSATISFACTORY WELDING AT HIGH AMPERAGE POSITION	
Engine lacks power.	See remedies under "Engine Operates at Reduced Load"
Poor compression.	Tighten cylinder heads and spark plugs. If still not corrected, grind valves and replace piston rings if necessary.
Faulty carburetion.	Check fuel system. Clean, adjust or repair as needed.
Micro switch dc contacts stuck closed.	Replace micro switch.
Choke partially closed.	Choke plate must be wide open after warm up.
Carbon in cylinders or in carburetor venturi.	Remove carbon.
Restricted exhaust lines.	Clean or increase the size.

POSSIBLE CAUSE	REMEDY
ENGINE MISFIRES AT LIGHT LOAD	
Carburetor idle jet clogged or improperly adjusted.	Clean.
Spark plug gaps too narrow.	Adjust to correct gap.
Intake air leak.	Tighten manifold and carburetor mounting screws. Replace gaskets if necessary.
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc.
Poor compression.	Tighten cylinder heads and spark plugs. If still not corrected, grind valves and replace piston rings if necessary.
ENGINE MISFIRES AT HEAVY LOADS	
Defective spark plug.	Replace.
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc. Retime ignition.
Clogged carburetor.	Clean carburetor.
Clogged fuel screen.	Clean.
Defective spark plug cable.	Replace.
ENGINE MISFIRES AT ALL LOADS	
Fouled spark plug.	Clean and adjust or replace.
Defective or wrong spark plugs.	Replace.
Leaking valves.	See "Valve Service".
Broken valve spring.	Replace.
Defective or improperly adjusted breaker points.	Adjust or replace breaker points.
Defective ignition wires.	Replace.
LOW OIL PRESSURE	
Oil too light.	Drain, refill with proper oil.
Oil badly diluted.	Drain, refill with proper oil. Check Fuel Pump Diaphragm for leak. Repair or replace pump.
Oil too low.	Add oil.
Oil relief valve not seating.	Remove and clean, or replace.
Badly worn bearings.	Replace.
Sludge on oil screen.	Remove and clean.
Badly worn oil pump.	Replace.
Defective oil pressure gage.	Replace.
HIGH OIL PRESSURE	
Oil too heavy.	Drain, refill with proper oil.
Clogged oil passage.	Clean all lines and passages.
Oil relief valve stuck.	Remove and clean.
Defective oil pressure gage.	Replace
ENGINE BACKFIRES AT CARBURETOR	
Lean fuel mixture.	Clean carburetor. Adjust jets.
Clogged fuel filter.	Clean.
Air leak at intake manifold or carburetor flange.	Tighten mounting screws. Replace gaskets if necessary.
Poor fuel.	Refill with good, fresh fuel.
Spark advanced too far.	Reset breaker points or retime ignition.
Intake valve leaking.	Reseat or replace.
EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKEY EXHAUST	
Poor compression. Usually due to worn pistons, rings, or cylinders.	Refinish cylinders. Install oversize pistons and rings.
Oil too light or diluted.	Drain. Refill with proper oil.
Too large bearing clearance.	Replace bearings necessary.
Too much oil.	Drain excess oil.
Crankcase breather valve sticking.	Free up disc. Replace valve if necessary.
Air leak at oil filler cap gasket.	See that cap fits tightly and that gasket is in good condition.
BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, FOULING OF SPARK PLUGS WITH BLACK SOOT. POSSIBLE LACK OF POWER UNDER HEAVY LOAD	
Fuel mixture too rich.	See that choke opens properly. Adjust jets properly. Adjust the float level.

POSSIBLE CAUSE	REMEDY
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc. Retime the ignition.
Choke not fully open.	See that choke opens properly.
Dirty air cleaner.	Clean.
LIGHT POUNDING KNOCK	
Loose connecting rod.	Replace bearing.
Low oil supply.	Add oil. Change if necessary.
Oil badly diluted.	Drain. Refill with proper oil.
Low oil pressure.	See "Low Oil Pressure" for remedies.
ENGINE STOPS UNEXPECTEDLY	
Empty fuel tank.	Refill.
Defective ignition system.	Check ignition system. Repair or replace as needed. See that the STOP lead is not grounded.
DULL METALLIC THUD, IF NOT BAD, MAY DISAPPEAR AFTER FEW MINUTES OPERATION. IF BAD, INCREASES WITH LOAD	
Loose crankshaft bearing.	Replace, unless one of the next two remedies permanently corrects the trouble.
SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED	
Low oil supply.	Add oil. Change if necessary.
Oil badly diluted.	Drain. Refill with proper oil. Check fuel pump diaphragm.
PINGING SOUND WHEN ENGINE IS RAPIDLY ACCELERATED OR WELDING AT HIGH AMPERAGE POSITION	
Carbon in cylinders.	Remove the carbon.
Spark advanced too far.	Reset breaker points or retime ignition.
Wrong spark plugs.	Install correct spark plugs.
Spark plugs burned or carboned.	Clean. Install new plugs if necessary.
Valves hot.	Adjust tappet clearance.
Fuel stale or low octane.	Use good, fresh fuel.
Lean fuel mixture.	Clean fuel system. Adjust carburetor jets properly.
TAPPING SOUND	
Valve clearance too great.	Adjust to proper clearance.
Broken valve spring.	Install new spring.
HOLLOW CLICKING SOUND WITH COOL ENGINE LOAD	
Loose piston.	If noise is only slight and disappears when engine warms up, no immediate attention needed. Otherwise replace parts necessary.
NOISY BRUSHES	
High mica between bars of commutator.	Undercut mica.
EXCESSIVE ARCING OF BRUSHES	
Rough commutator or rings.	Turn down.
Dirty commutator or rings.	Clean.
Brushes not seating properly.	Sand to a good seat or reduce load until worn in.
Open circuit in armature.	Install a new armature.
Brush rig out of position.	Line up properly.
NO AC OUTPUT AVAILABLE	
Micro switch ac contacts stuck open.	Replace micro switch.
AC OUTPUT WHEN WELDING	
Micro switch ac contacts stuck closed.	Replace micro switch.
AC OUTPUT VOLTAGE LOW	
Micro switch dc contacts stuck open.	Replace micro switch.

TABLE OF TORQUES AND CLEARANCES

Refer to the Trouble Shooting section for assistance in locating and correcting troubles which may occur. If a major repair or overhaul becomes necessary, the engine should be carefully checked and necessary repairs made by a competent mechanic. Major generator repairs should be made by a competent electrician. Maintain factory limits and clearances as shown below, replacing worn parts when necessary.

CLEARANCES

All clearances given at room temperature of 70°F.

	Minimum	Maximum
Tappets	0.015"	0.017"
Valve Stem In Guide – Intake	0.001"	0.0025"
Valve Stem in Guide – Exhaust	0.0025"	0.004"
Valve Seat Interference Width	1/32"	3/64"
Valve Face Angle	44°	
Valve Seat Angle	45°	
Valve Interference Angle	1°	
Crankshaft Main Bearing Clearance		
Aluminum Alloy, Flanged - Prior Spec H	0.0025"	0.[illegible]
Bronze Faced Begin Spec H	0.0025"	[illegible]35"
Crankshaft End Play	0.006"	[illegible]
Camshaft Bearing	0.0015"	0.[illegible]3"
Camshaft End Play	0.003"	
Rod Bearing (Aluminum Rod)	0.002"	0.003"
Rod Bearing (Forged Rod)	0.0005"	0.002"
Connecting Rod End Play (Aluminum Rod)	0.002"	0.016"
Connecting Rod End Play (Forged Rod)	0.012"	0.032"
Timing Gear Backlash	0.002"	0.003"
Oil Pump Gear Backlash	0.002"	0.005"
Piston to Cylinder, Conformatic Type (Measured at Bottom of Skirt 90° to pin)		
Interference	0.0005"	
Clearance		0.0015"
Piston Pin in Piston	Thumb Push Fit	
Piston Pin in Rod	0.0001"	0.0006"
Piston Ring Gap in Cylinder	0.010"	0.023"
Breaker Point Gap (Full Separation)	0.020"	
Spark Plug Gap – For Gaseous Fuel	0.018"	
Spark Plug Gap – For Gasoline Fuel	0.025"	
Crankshaft Main Bearing Journal – Std. Size	1.9995"	2.000"
Crankshaft Rod Bearing Journal – Std. Size	1.6255"	1.6260"
Cylinder Bore – Standard Size	3.249"	3.250"

TORQUES

Assembly torques as given here require the use of a torque wrench. These assembly torques will assure proper tightness without danger of stripping the threads. If a torque wrench is not available, you will have to estimate the degree of tightness necessary for the stud, nut or screw being installed and tighten accordingly. Be careful not to strip the threads. Check all studs, nuts and screws often. Tighten as needed to prevent them from working loose.

Bolt Torque	FT.-LB.
Cylinder Head Cap Screws	29-31
Rear Bearing Plate Nuts	20-25
Connecting Rod Screw - Aluminum Rod	24-26
Connecting Rod Bolt - Forged Steel Rod	27-29
Flywheel Cap Screw	35-40
Armature thru Stud and Nut	45-50
Other 5/16" Cylinder Block Studs and Nuts	10-12

FUEL SYSTEM

CARBURETOR

Carburetor maintenance should consist of regular cleaning. Some gasolines have a tendency toward formation of gum deposits inside the carburetor which can usually be removed by soaking in alcohol or acetone. A fine soft wire may be used to clean jets.

See that the float is not damaged. If necessary to reset the float level, use a small screwdriver to bend the lip of the float. With the carburetor casting inverted and the float resting lightly against the needle in its seat; there should be 5/16" (1/4" with styrafoam plastic float) clearance between the bowl cover gasket and the free end of the float (side opposite needle seat). See Fig. 5-1.

GASOLINE

The carburetor has an adjustable idling jet. It is simple in construction and normally requires little attention other than a periodic cleaning. If the engine runs unevenly at half or full load due to faulty carburetion, the main adjusting needle (early models only) needs adjusting. Make the adjustment while the engine is running at normal operating temperature and with almost a full-load connected to the engine.

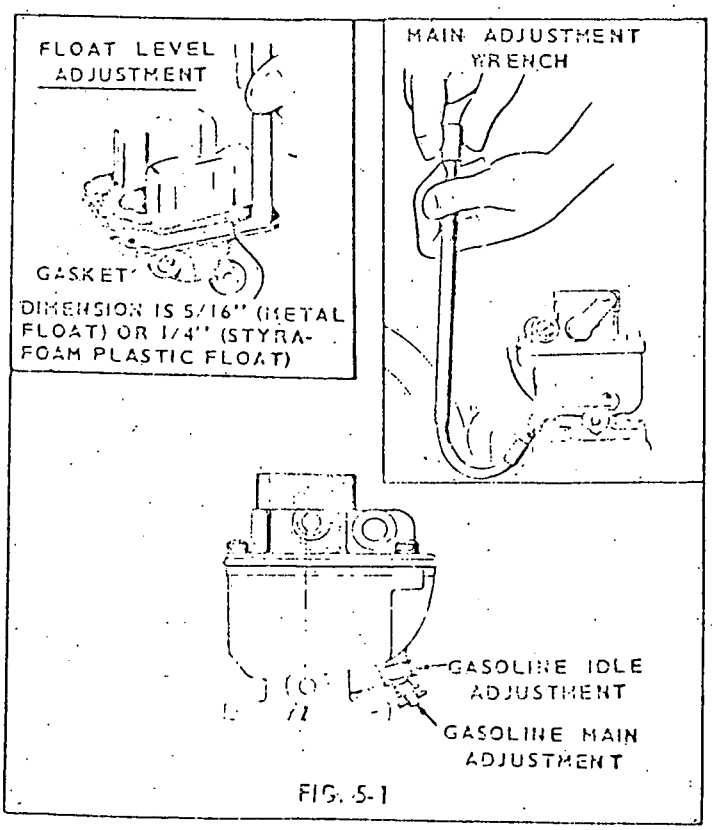


FIG. 5-1

Turn the main adjusting needle (early models only) out about two full turns. Then turn it slowly in until the engine begins to lose speed. Then turn it out very slowly until the engine runs smoothly at full power and speed. Carburetor wrench (4203169) can be purchased from your dealer for easier adjustment of the carburetor main adjusting needle.

When adjusting the idle jet needle, the engine should be running at normal operating temperature and without a load connected. Turn the idle adjusting needle in until the engine looses considerable speed. Then turn it out until the engine runs smoothly. A hunting condition at no-load can sometimes be corrected by an idle adjustment.

To adjust the carburetor float level, bend the float near the shaft as needed to obtain the correct level (Fig. 5-1).

If engine develops a hunting condition (alternate increase and decrease of engine speed) try correcting by opening the main adjusting needle (early models only) a little more. Do not open more than 1/2-turn beyond the maximum power point. If this does not correct the condition, the governor sensitivity adjustment should be adjusted.

FUEL PUMP

A diaphragm type fuel pump is used. If fuel does not reach the carburetor, check the fuel pump before dismantling it.

The pump can be checked by disconnecting the fuel line at the carburetor, cranking the engine slowly by hand, and observing whether fuel comes from the line at the carburetor. If there is enough fuel in the tank, and the line between the tank and the pump is open but the pump fails, repair or replace it. Failure of the pump is usually due to a leaking diaphragm, valve or valve gasket, a weak or broken spring, or wear in the drive linkage. If the operator chooses to repair the pump rather than install a new one, the use of a complete repair kit is recommended.

Always return the hand priming lever all-the-way inward so that the priming lever does not prevent normal pump operation.

Gasoline diluted oil may indicate a faulty fuel pump.

IGNITION SYSTEM

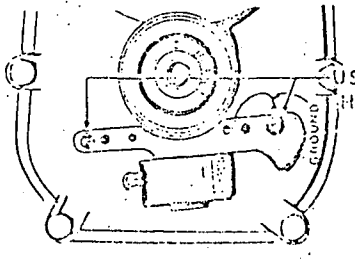
MAGNETO STATOR INSTALLATION

The magneto stator assembly is mounted on the gear cover. The flywheel must be removed to expose it. On engines *without* spark advance mechanism, the stator has two pairs of mounting holes. The outermost holes give 25° spark advance mechanism (welders prior to Spec. H). Connect the smaller (ground) coil lead to the stator mounting screw. Engines with spark advance mechanism (Begin Spec. H) and engines without spark advance (Begin Spec. L) have one set of mounting holes only. Connect the stator larger lead to the breaker box insulated terminal, which also connects to the ignition coil (welders prior to Spec H) and breaker points. Be sure the larger lead is held in place to prevent rubbing on the flywheel.

The stator coil, used on welders beginning Spec H, includes both the primary and secondary windings. There is no separate automotive type coil used.

IGNITION COIL INSTALLATION (Prior to Spec. H)

Coil connections differ between magneto ignition engines and battery ignition engines. Refer to the illustration which applies. The ignition coil is grounded on magneto ignition engines but not grounded with battery ignition.



If flywheel rubs on pole shoe loosen pole shoe mounting screws, tap pole shoe and retighten mounting screws.

FIG. 6-1

TIMING IGNITION (Prior to Spec. H, Begin Spec L)

Ignition timing procedure is the same for manual-start engines with magneto ignition as for electric start engines with 12-volt battery ignition.

Spark advance is 25° (Prior to Spec H) or 20° (Begin Spec L) before top center. The correct timing is stamped on the cylinder block near the breaker box.

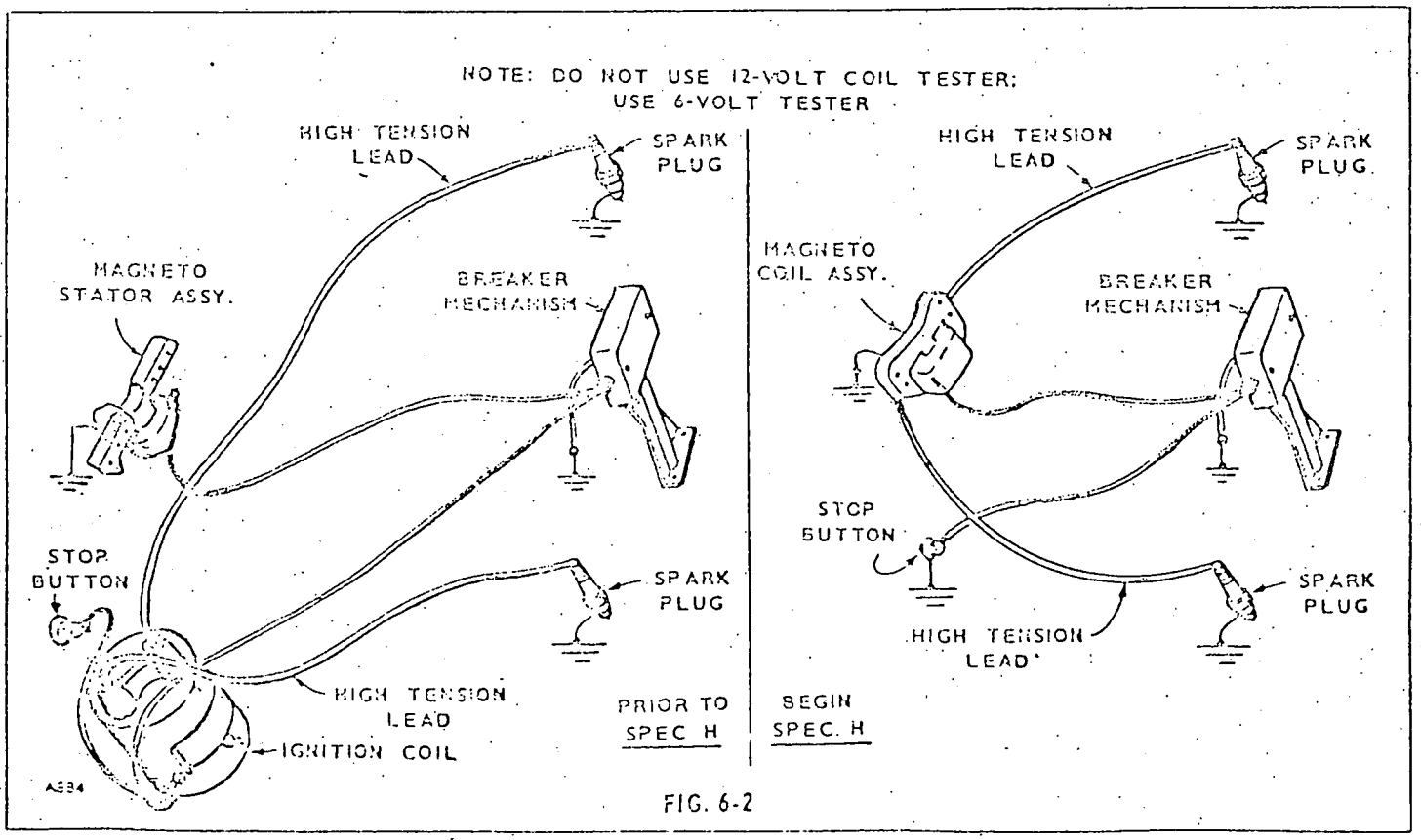


FIG. 6-2

1. Remove the cover from the breaker box. If the timing is very far off, attain an approximate setting by loosening the mounting screws and shifting the breaker box (and spacer if used) to align the witness marks on the cylinder block and breaker box (or spacer).
2. Crank the engine over slowly by hand in the direction of crankshaft rotation until the witness mark on the flywheel and the TC mark on the gear cover are exactly in line (Fig. 6-3).
3. Adjust the ignition breaker point gap width to .020" at full separation.
4. Turn the flywheel to the left, against crankshaft rotation, until the timing mark is about two inches past the 25° mark on the gear cover.
5. Turn the flywheel slowly to the right and note whether the ignition points just separate when the mark on the flywheel aligns with the correct degree mark (19° or 25°) on the gear cover. If the marks align as the points break, timing is correct. If they do not, loosen the breaker box mounting screws and shift the whole breaker box assembly slightly toward the #1-cylinder to retard the timing (points breaking too soon), or shift it slightly away from the #1-cylinder to advance the timing (points not breaking soon enough). Tighten the breaker box mounting screws securely after making an adjustment (Fig. 6-3).

To accurately check the time at which the spark occurs, an automotive type timing light may be used when the engine is running.

To accurately check the time at which the spark occurs when not running the engine, connect a continuity test lamp set across the ignition breaker points. Touch one test probe to the breaker box terminal (to which the lead to the coil is connected), and touch the other test probe to a good ground on the engine. Turn the crankshaft against rotation (backwards) until the points close. Then slowly turn the crankshaft with rotation. The lamp should go out just as the points break.

6. Reinstall the breaker box cover.

TIMING IGNITION (Begin Spec H, Prior to Spec L)

The correct timing (5° stopped or idle speed - 24° running at 1,100 rpm or over) is stamped on the crankcase near the breaker box. If the breaker points separate when the timing marks align (engine stopped) timing is correct. Timing adjusted using an automotive type timing light with engine running is preferred.

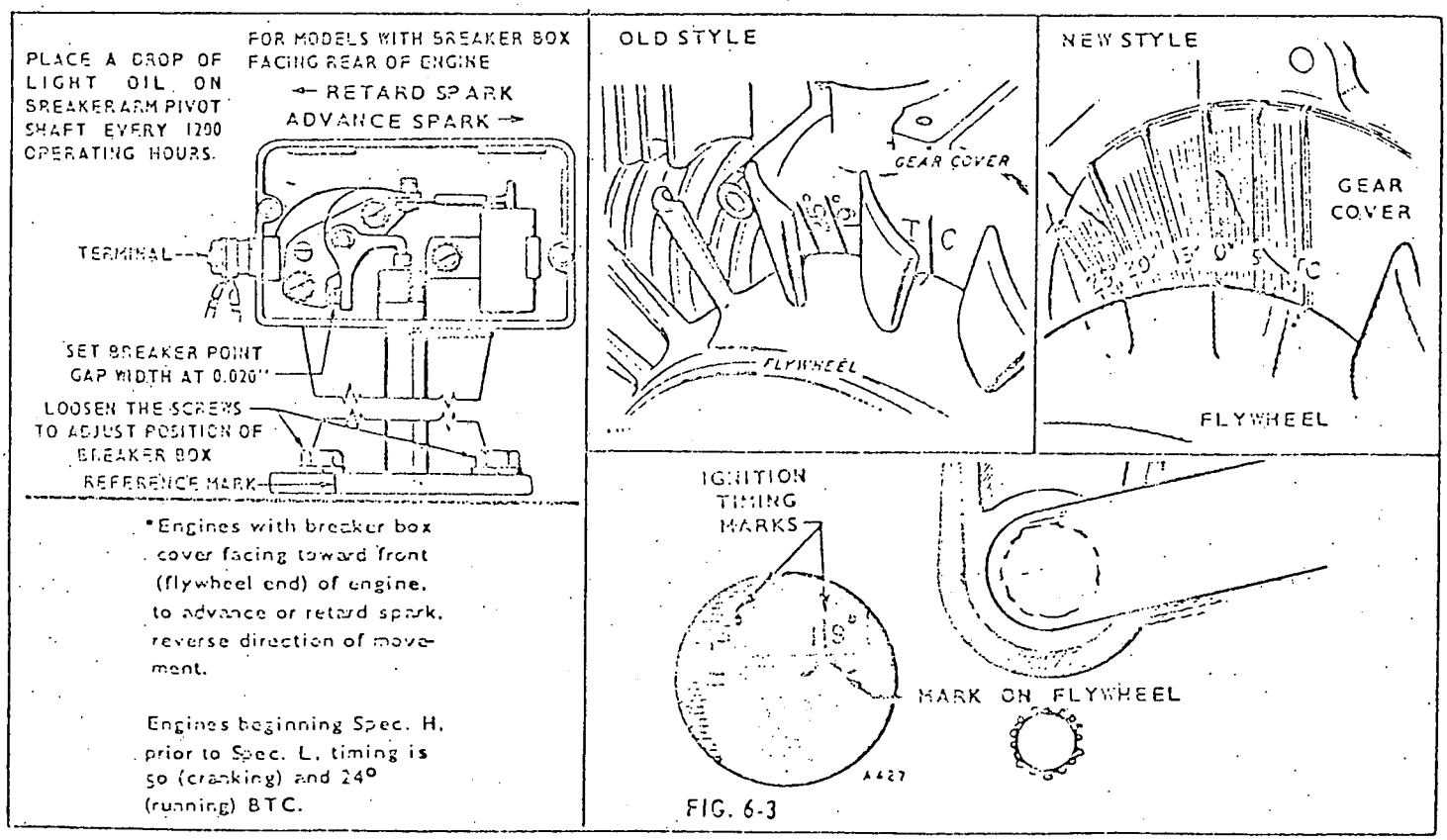
Timing Marks on Flywheel: Align the correct timing mark on the flywheel with the TC mark on the gear cover.

Timing Marks on Gear Cover: Align the correct timing mark on the gear cover with the TC mark on the flywheel.

Timing Marks on Both Gear Cover and Flywheel: Align either the TC flywheel mark with the correct timing mark on the gear cover or the correct timing mark on the flywheel with the TC mark on the gear cover.

NOTE: *Use only one TC mark and one set of timing marks.*

SPARK ADVANCE MECHANISM (Begin Spec H, Prior to Spec L). The spark advance mechanism, located on the rear end of the camshaft, is operated by centrifugal force. As engine speed is increased, weights push the cam, advancing the spark, or release the cam, retarding the spark as engine speed is decreased.



*Engines with breaker box cover facing toward front (flywheel end) of engine, to advance or retard spark, reverse direction of movement.

Engines beginning Spec. H, prior to Spec. L, timing is 5° (cranking) and 24° (running) BTC.

FIG. 6-3

If the spark advance mechanism should become dirty or gummy, causing the mechanism to stick closed (retarded), the engine will lack power. If the mechanism sticks open (advanced), the engine would possibly kick-back on cranking. The spark advance mechanism can be reached for cleaning by either removing the cup shaped cover in crankcase rear camshaft opening (exposing the mechanism) or by removing camshaft from engine. Do not indent the cup shaped cover as it will interfere with the weight mechanism. To check the operation of the spark advance mechanism, follow these these steps:

1. Connect a timing light (either plug).
2. Start the engine and run it at 1400 to 1600-rpm.
3. While watching timing marks with the timing light, slow the engine to below 800-rpm. If the TC mark on the flywheel disappears and then re-appears when the engine is brought back to speed, the spark advance mechanism is operating properly.
4. If the spark advance mechanism does not react as outlined in step 3, remove, clean and/or replace as necessary.

TESTING IGNITION COIL

A 6-volt tester must be used to test the ignition coil. To avoid burning out the coil, do not use a 12-volt tester and do not leave coil on tester over 15 or 20-minutes.

VALVE SYSTEM

Properly seated valves are essential to good engine performance. The aluminum cylinder head is removable for valve servicing. Do not use a pry to loosen the cylinder head, rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. A conventional type valve spring lifter may be used when removing the valve spring locks, which are of the split type. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

Worn valve stem guides may be replaced from inside the valve chamber. Valve locks are the split, tapered type, the smaller diameter of which must face toward the valve head. Tappets are also replaceable from the valve chamber, after first removing the valve assemblies.

The valve *face* angle is 44°. The valve *seat* angle is 45°. This 1° interference angle results in a sharp seating surface between the valve and the top of the valve seat. The interference angle method of grinding valves minimizes face deposits and lengthens valve life.

The valves should not be hand lapped, if at all avoidable, since the sharp contact may be destroyed. This is especially important where hard alloy faced valves and seats are used. Valve faces should be finished in a machine to 44°. Valve seats should be ground with a 45° stone, and the width of the seat band should be 1/32 to 3/64 of an inch wide. Grind only enough to assure proper seating.

Remove all grinding dust from engine parts and install each valve in its proper location. Check each valve for a tight

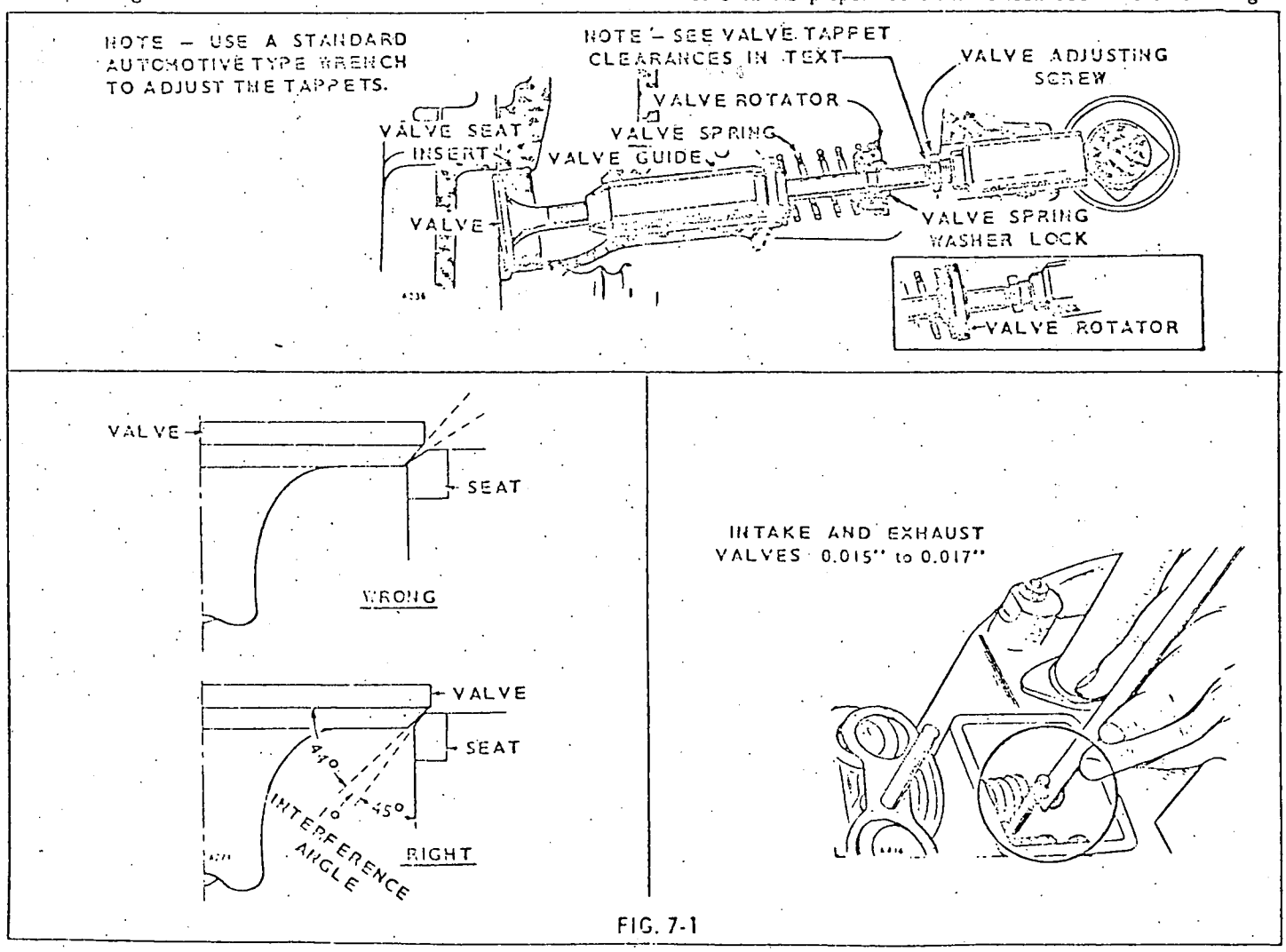


FIG. 7-1

seat, using an air pressure type testing tool. If such a tool is not available, make pencil marks at intervals across the valve face and observe if the marks rub off uniformly when the valve is rotated part of a turn against the seat.

Lightly oil the valve stems and assemble all parts removed. Adjust the valve clearance.

The positive type valve rotocaps serve to prolong valve life and need for valve service. When functioning properly, the valve is rotated a fraction of a turn each time it opens. While at open position, the valve can be rotated freely but in only one direction. If rotocaps are faulty, install new rotocaps.

TAPPET ADJUSTMENT

These plants are equipped with adjustable tappets. To make a valve adjustment, remove the valve covers. Crank the engine over slowly by hand until the left hand intake valve, when facing the flywheel, opens and closes. Continue about 1/4 turn until the mark on the flywheel and the TC mark on the gear cover are in line. This should place the left hand piston at the top of its compression stroke, the position it must be in to get proper valve adjustment for the left hand cylinder. Clearances are shown in the Table of Clearances. For each valve, the thinner gage (minimum) should pass freely between the valve stem and valve tappet but the thicker gage (maximum) should not. Refer to the illustration, Fig. 7-1.

To correct the valve clearance, simply turn the adjusting screw as needed to obtain the right clearance. The screw is self-locking and will stay where set.

To adjust the valves on the right hand cylinder, crank the engine over one complete revolution and again line up the mark on the flywheel and the TC mark on the gear cover. Then follow the adjustment given for the valves of the left hand cylinder.

FLYWHEEL

To remove flywheel turn flywheel mounting screw outward about two turns. Use a screwdriver behind the flywheel to take up the crankshaft end play. Strike a sharp endwise blow on the head of the cap screw with a heavy soft faced hammer to loosen. A suitable puller (with claws or with bolts to agree with flywheel) is recommended to pull the flywheel. Do not drop the flywheel. A broken fin will destroy the balance. Always use a steel key for mounting the flywheel.

A magneto flywheel which has lost its' magnetism can be remagnetized. The spark should jump a 3/16" gap with ease as tested by holding the spark plug wire away from a clean metal part of the engine while cranking.

GEAR COVER

After removing mounting screws, tap gear cover gently with a soft faced hammer to loosen it.

When installing the gear cover, make sure that the pin in the gear cover engages the metal lined (smooth) hole in the governor cup. Turn the governor cup so that the metal lined hole is at the three o'clock position. The smooth side of the governor yoke must ride against the governor cup. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal. Adjust roll (stop) pin to protrude 3/4" from the covers mounting surface (Fig. 8-1).

GOVERNOR CUP

With gear cover removed, the governor cup can be taken off after removing the snap ring from the camshaft center pin. Catch the flyballs while sliding the cup off.

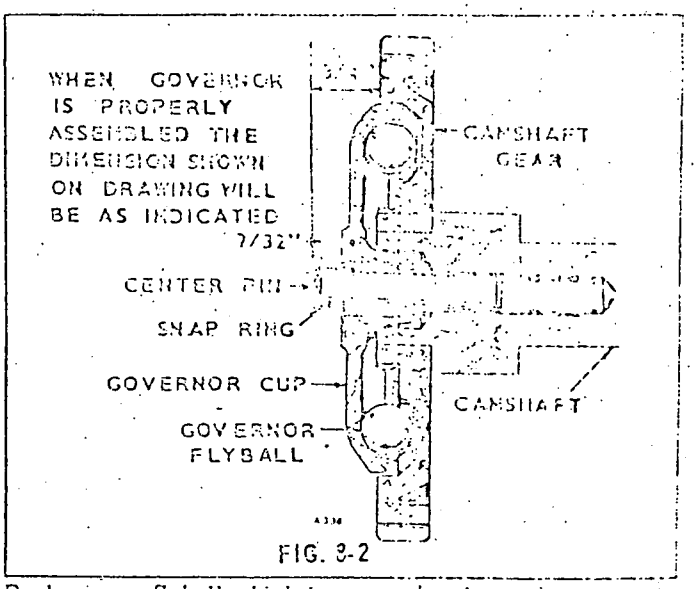


FIG. 8-2

Replace any flyball which is grooved or has a flat spot; the ball spacer if its' arms are worn or otherwise damaged; and the governor cup if the race surface is grooved or rough. The governor cup must be a free spinning fit on the camshaft center pin, but without any excessive play.

When installing the governor cup, tilt engine so the timing gears are up, put the flyballs in place (equally spaced), and install the cup and snap ring on the center pin.

The camshaft center pin extends out 3/4" from the end of the camshaft. This distance provides a 7/32" in and out travel distance for the governor cup (Fig. 8-2). Hold the cup against the flyballs when measuring. If the distance is less (the engine will race, especially at no-load) remove the center

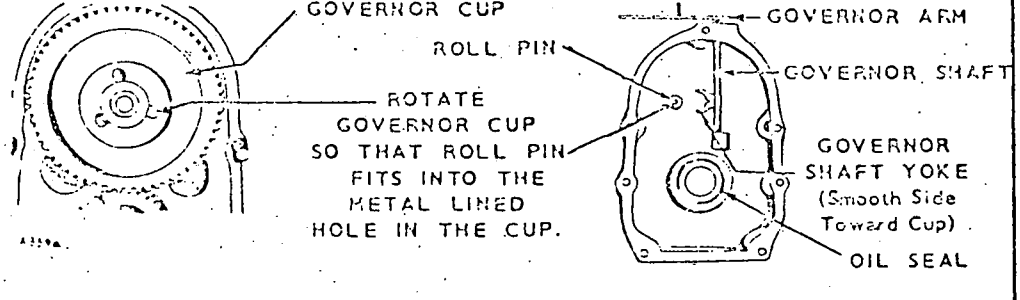
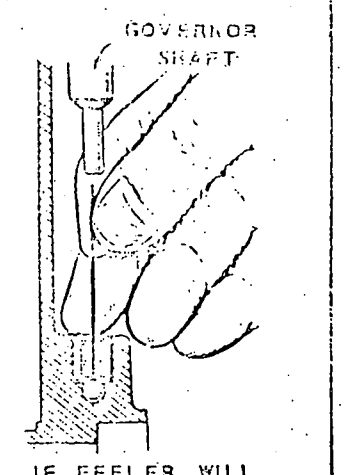


FIG. 8-1



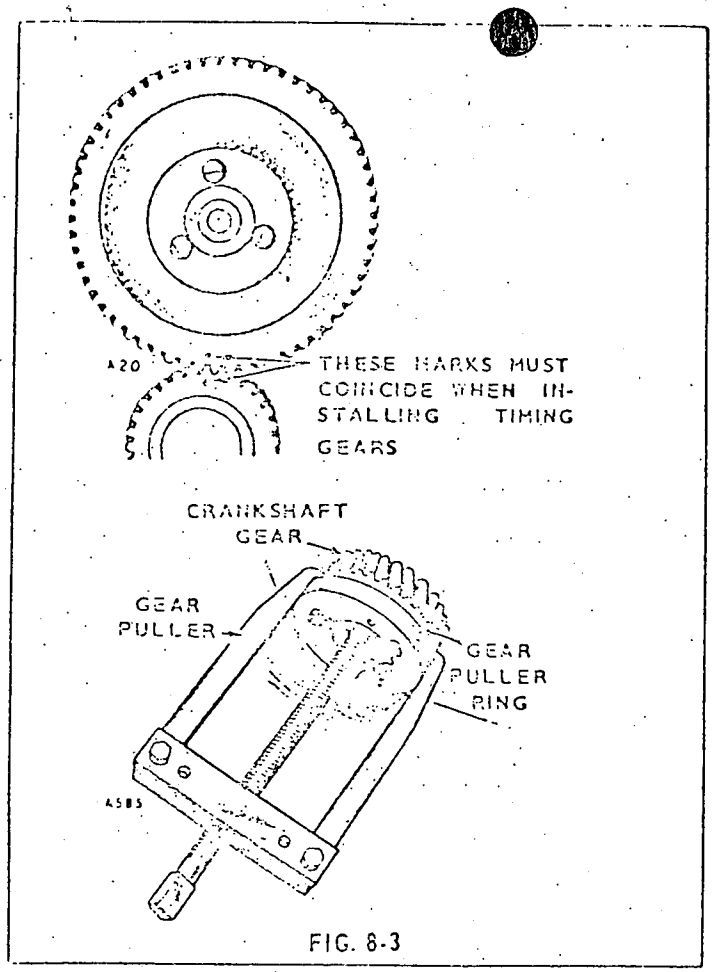


FIG. 8-3

pin and press in a new pin or grind off the cup hub as required. The camshaft center pin cannot be pulled outward or removed without damage. If the center pin extends out too far, the cup will not hold the flyballs properly.

TIMING GEARS

If either crankshaft or camshaft gear replacement becomes necessary, always install both gears new.

To remove the crankshaft gear, first remove the snap ring, then attach the gear pulling ring (*Onan* tool no. 420A248) using two #10-32 screws. Tighten screws alternately until both are tight. Attach gear puller to the puller ring and proceed to remove the gear.

The camshaft gear is pressed on and keyed to the camshaft. The camshaft and gear must be removed as an assembly, after first removing the crankshaft gear lock ring and washer. Before removing the camshaft and gear assembly, remove the cylinder head and valve assemblies, the operating plunger for the breaker points and the fuel pump and tappets. After removing the governor cup assembly from the gear, the camshaft may be pressed out of the gear by using a hollow tool or pipe which will fit over the camshaft center pin. Do not press on the center pin or damage it in any way. The governor ball spacer is press fit to the camshaft gear.

When pressing a gear onto the camshaft, be sure it is started *straight and the key is properly in place. NOTE: When replacing the cam gear on units having automatic spark ad-*

vance mechanism, remove the spark advance mechanism and put blocks beside the pins to avoid damage when pressing on cam gear. Install the governor cup assembly before installing the camshaft and gear.

Each timing gear is stamped with an "O" near the edge. The gear teeth must mesh so that these "O" marks coincide exactly when the gears are installed in the engine. When installing the camshaft gear and shaft assembly, be sure that the thrust washer is properly in place behind the camshaft gear. Then install the crankshaft retaining washer and lock ring.

PISTONS AND RINGS

Piston and connecting rod assemblies are removed from the top of the cylinder. Pistons are fitted with two compression rings and one oil control ring with an expander. Inspect each piston. Piston ring grooves should be cleaned of any carbon deposits, and the lower groove oil return slots must be open.

If pistons are badly scored, very loose in the cylinder, have badly worn ring grooves, or otherwise are not in good condition, install new pistons. If pistons are so loose on the piston pins that a 0.002" oversize pin will not correct it install new pistons. Handle pistons carefully to avoid nicking the walls. Any raised surface of this type must be dressed down carefully.

Before installing new rings, check the ring gap by placing each ring squarely in its' cylinder at a position corresponding to the bottom of its' travel (Fig. 8-4). Piston ring end-gap should be as given in the Table of Clearances. Slightly oversize rings may be filed as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on .005" oversize pistons. 010", .020", .030" and .040" oversize rings are to be used on the corresponding size piston. Tapered rings are usually marked *top* on one side, or identified in some other manner. These rings must be installed with this mark toward the piston head. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove should be fitted with an expander and an oil control ring and the two upper grooves with compression rings. A chrome faced

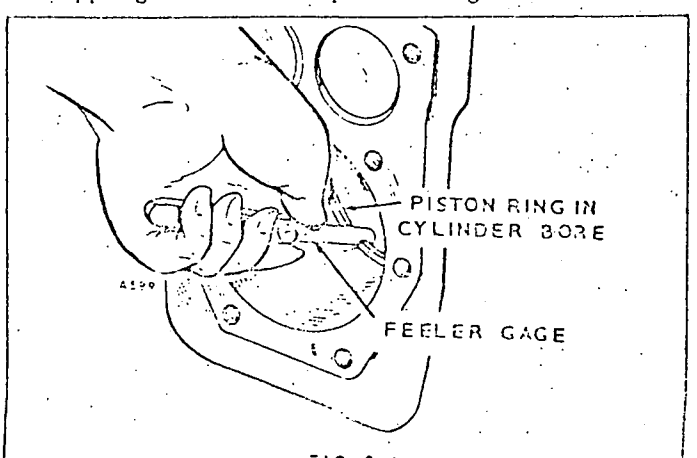


FIG. 8-4

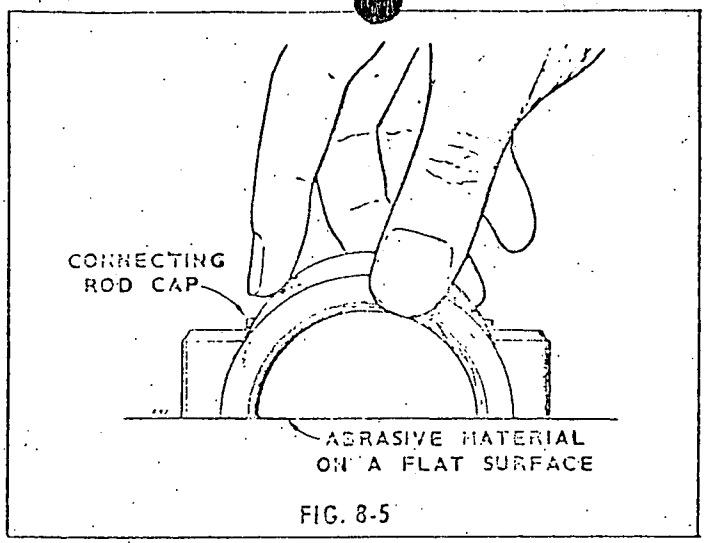


FIG. 8-5

ring (when used) will be in the top groove. The oil control ring is selected for best performance in regard to correct unit pressure characteristics.

The piston is fitted with a full floating piston pin. The pin is kept in place by two lock rings, one at each side. Be sure these lock rings are properly positioned in their groove before installing the piston and connecting rod in the engine. Correct piston-to-cylinder clearance appears in the Table of Clearance.

CONNECTING RODS

Connecting rods should be serviced at the same time the pistons or piston rings are serviced. Rods must be removed with the piston. Two materials have been used. Prior to Spec H models, rods are aluminum alloy with bearings integral. Beginning with Spec H models, rods are forged steel with replaceable bushings and bearings. Rods are available in standard or .010", .020" or .030" undersize. Bearings are available in standard or .002", .010", .020" or .030" undersize.

Aluminum Alloy Rods: Proper clearance for rod to crankshaft is obtained by carefully dressing the ends of the connecting rod cap. Use a sheet of (320 grit or finer) abrasive on a smooth flat surface. Place the ends of the connecting rod cap on the abrasive material and carefully dress the ends down as needed (Fig. 8-5). Be sure the cap is held perfectly straight. Remove all abrasive material from the cap before installing it.

Forged Steel Rods: Proper clearance is obtained by replacing the pin bushing and the bearings. Rod bearings are precision size and require no reaming.

The connecting rod and piston assembly must be properly aligned before assembly to the engine. Aligning should be done on an accurate aligning gage by a competent operator. Misalignment may cause rapid wear of piston, pin, cylinder and connecting rod.

Install connecting rods and caps with raised lines (witness

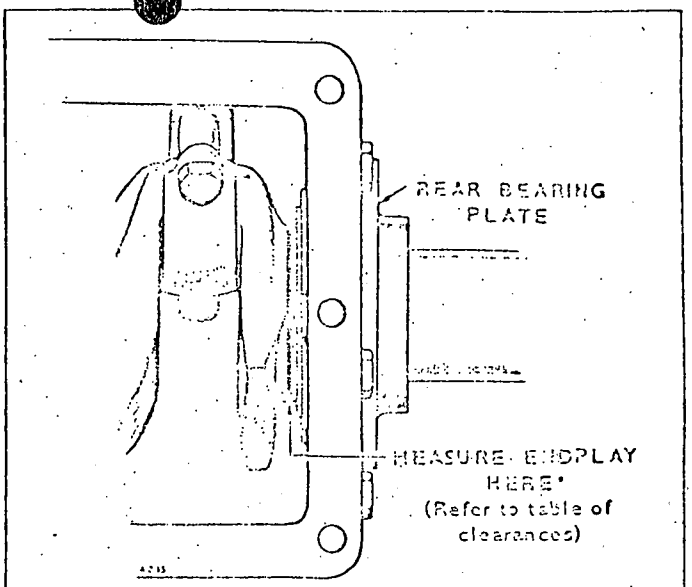


FIG. 8-6

marks) aligned, and with the caps facing toward the oil base. Rod and cap numbered two fits on the crankshaft journal nearer the bearing plate. Coat the crankshaft journal bearing surfaces with oil before installing the rods. Crank the engine by hand to see that rods are free. If necessary, rap the connecting rod cap screws sharply with a soft faced hammer to set the rod square on the journal.

CRANKSHAFT

Inspect bearing journals. If they are scored and cannot be smoothed out by dressing down, the bearing journals should be refinished to use nearest available undersize bearings or a new crankshaft should be installed. If a worn main bearing journal cannot be fitted with an available precision type undersize bearing, then refinish it to the next undersize. If a worn rod journal cannot be fitted by dressing down the rod cap (Aluminum Rod) or by installing new bearing inserts (Forged Rod), then refinish it to take the corresponding undersize rod or bearing insert available.

NOTE: *Whenever making major repairs on the engine, always inspect the drilled passages of the crankshaft. Clean them to remove any foreign material and to assure proper lubrication of the connecting rods. Use gaskets as necessary behind the bearing plate to obtain proper crankshaft end play (Fig. 8-6).*

BEARINGS

Camshaft or crankshaft bearing removal requires complete engine disassembly. Use a press or suitable drive plug to remove the bearings. Support the casting to avoid distortion and avoid damaging the bearing bore during removal and installation. Use oil on the bearings to reduce friction when installing and again lubricate with oil after installing.

Crankshaft main bearings are precision type which *do not* require line reaming or boring after installation. They are available in standard size, .002", .010", .020" or .030" undersize. Expand the bearing bore by placing the casting in hot water or in an oven heated to 200°F. Warning: *If a*

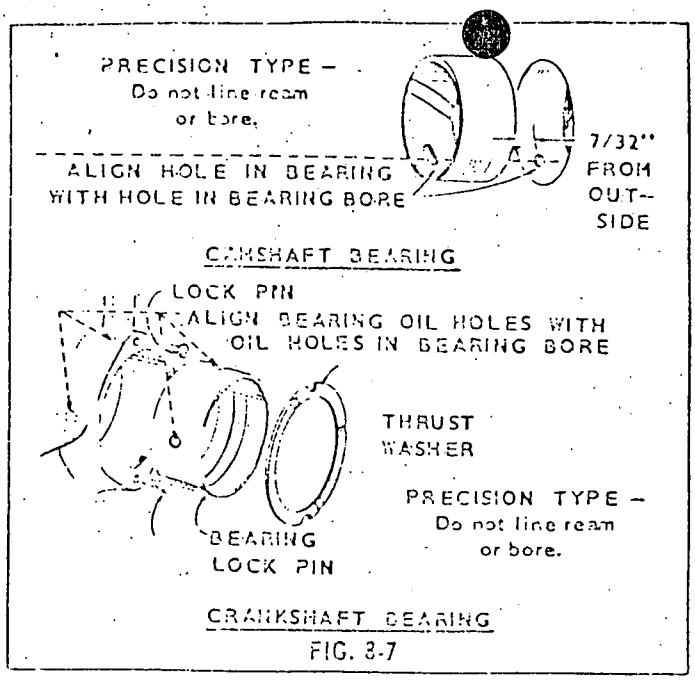


FIG. 8-7

torch is used, apply only a little heat. If practical, cool the precision bearing to shrink it. Crankshaft bearings must be installed from the inside of the cylinder block. Align the oil hole(s) in the bearing with the oil hole(s) in the bearing bore (Fig. 8-7). The oil passage holes must be at least 1/2-open. The cold oiled precision bearing should require only light taps to position it. If head of lock pin is damaged, use side cutters or Easy Out tool to remove and install new pin. Apply oil to thrust washer (one used with each bearing) to hold it in place while installing the crankshaft. Oil grooves in thrust washers must face the crankshaft, washers must be flat (not bent) and washers two notches must fit over two lock pins to prevent riding on crankshaft. Crankshafts with H stamped on the counter weight have induction hardened main bearing journals and should use steel backed aluminum bearings.

Camshaft bearings (Fig. 8-7) are precision type which *do not* require line reaming or boring after installation. Coat the bearing with lubricating oil to reduce friction. Place the bearing on the crank[illegible]e over the bearing bore with the elongated hole in proper position and narrow section facing out (except bores without oil holes install with bearing groove at the top). Be sure to start the bearing straight. Press the front bearing in flush with the outside end of the bearing bore. Press the rear bearing in flush with the bottom of counterbore which receives the expansion plug.

OIL SEALS

The bearing plate must be removed to replace the oil seal. Drive the oil seal out from the inside.

Before installing the seals, fill the space between lips with a fiberous grease or stiff cup grease (Fig. 8-8). This will improve sealing.

When installing the bearing plate oil seal, tap the seal into the bearing plate bore to bottom against the shoulder in the plate bore. Use a seal expander (Omni Part #420A181) or place a piece of shim stock around the end of the crankshaft when replacing the bearing plate to avoid damaging the seal. Remove shim stock as soon as plate is in place.

OIL PUMP

To remove the oil pump, it is necessary to detach the intake cup assembly (Fig. 8-9).

Check the oil pump thoroughly for worn parts. Oil the pump to prime it before reinstalling. Except for gaskets and suction cup, the component parts of the pump are not available individually. Install a new pump assembly if required.

OIL PRESSURE RELIEF VALVE ADJUSTMENT

Engine oil pressure is easily adjusted by means of the slotted stud and locknut located near the breather tube. See Fig. 8-10. Oil pressure readings when the engine is thoroughly warmed up should be between 20 and 35-lbs. To increase oil pressure, loosen the locknut and turn the stud

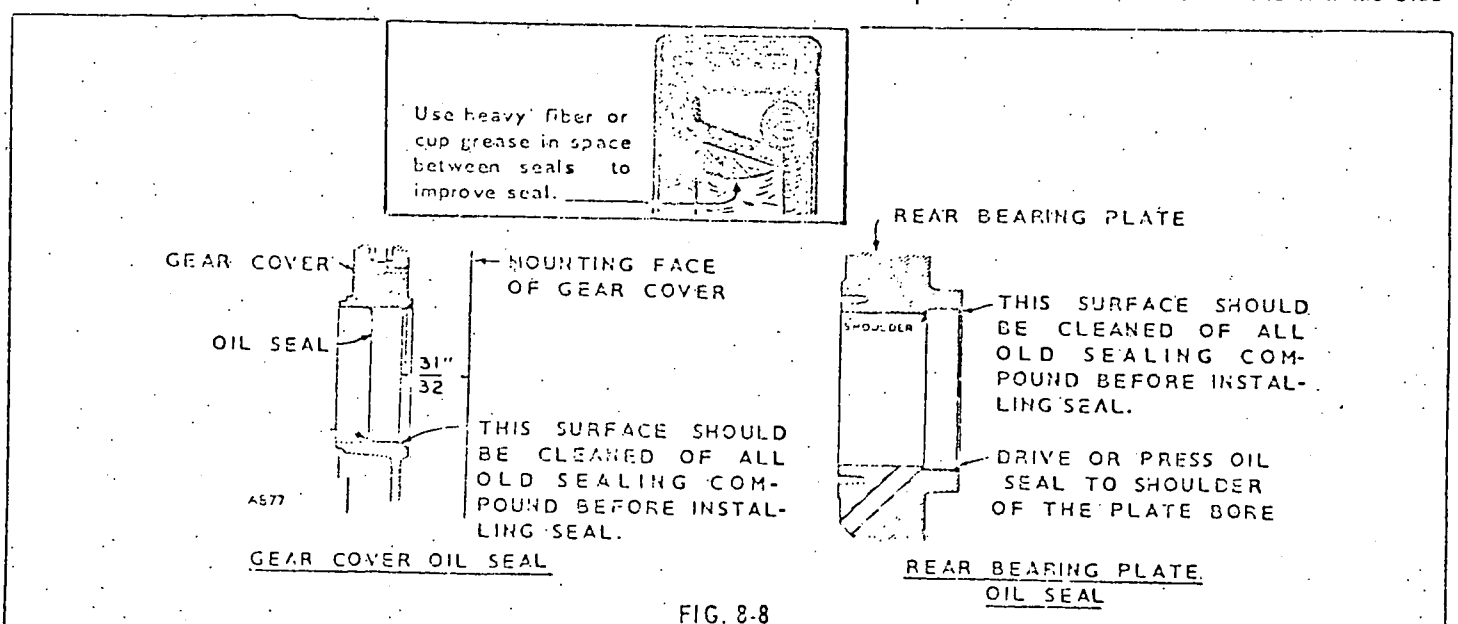


FIG. 8-8

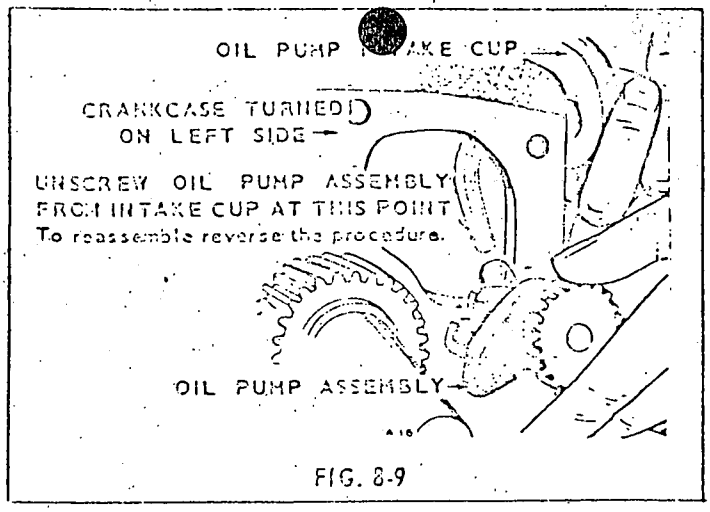


FIG. 8-9

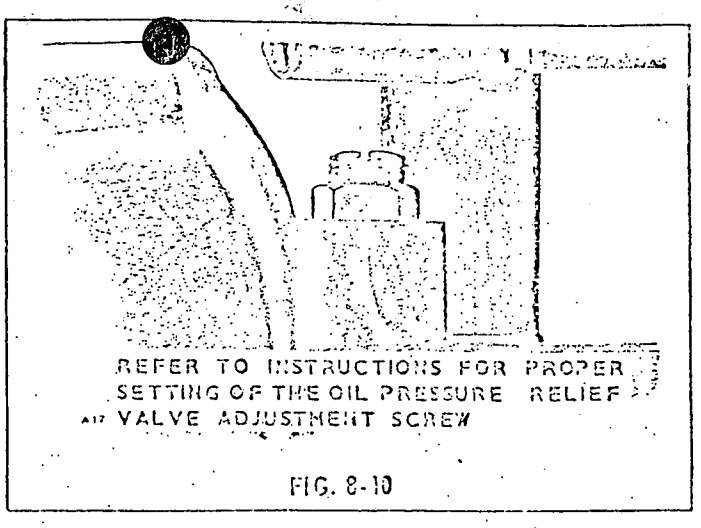


FIG. 8-10

inward. To decrease oil pressure, loosen the locknut and turn the stud outward. Be sure to tighten the locknut securely after making an adjustment. The spring and plunger can easily be removed and cleaned.

Low oil pressure may point to worn main or connecting rod bearings, improper clearance at these points, a weak or broken by-pass spring, an improperly adjusted by-pass or a defective gage. Check the oil pressure gage before making any other test, it may be defective.

CYLINDER

The cylinder wears very little in normal service. If, through improper lubrication or accident, the cylinder wall should become scored or worn badly, the cylinder may be rebored and honed to accomodate a new piston and rings of one of the available oversizes. Pistons are available in .010", .020", .030" and .040" oversize. Piston rings are available in .010", .020", .030" and .040" oversize. Use standard size rings on a .005" oversize piston. If the cylinder is not being reconditioned, but new piston rings are being installed, remove any ridge which may have become formed at the top of piston ring travel in the cylinder bore. Engine might be fitted at the factory with a .005" oversize piston and are so indicated by a letter E following the engine serial number stamped on the cylinder block and on the unit nameplate. The standard cylinder bore size appears in the Table of Clearances.

CYLINDER HEADS

The cylinder head bolts should be tightened evenly and to the torque specified at the time the engine is assembled or the cylinder head replaced. Both heads must be of the same compression. This should be at room temperature. At some later time, after the engine has been operated so it reached normal hot temperature *and allowed to cool to room temperature*, the cylinder head bolts should be re-torqued to the original specified torque. This re-tightening should be done before the engine has been run a total of fifty operating hours.

GENERATOR

Generators normally require little care other than a periodic check of the brushes, commutator and collector rings. If a major generator repair should become necessary, have the equipment checked and repaired by a competent electrician who is thoroughly familiar with electric generating equipment. Continuity tests can be performed without disassembling the generator.

GENERATOR DISASSEMBLY

The disassembly procedure (Fig. 9-4) is largely self evident and follows a natural sequence. Remove the cover band and the end bell cover. Remove all brush springs and lift all brushes out of their guides.

Remove nuts from generator frame through studs. Tap end bell back until it is free of the armature bearing, then lift it off.

Provide blocking under the rear of the engine for support. Slots in engine-to-generator adapter provide for prying the generator frame loose. Pull the generator frame straight back over the armature, using care not to let it catch or drag on the armature.

Turn the armature nut out to the end of the armature through stud. While pulling outward with one hand under the armature, strike a sharp endwise blow on the nut to loosen the armature. Remove the armature and blower as an assembly. The blower is keyed and pressed fit on the armature shaft, and is keyed and tapered fit to the engine crankshaft.

If the armature does not come loose, place a heavy brass rod on the armature shaft near the ball bearing and strike a sharp endwise blow on the nut to loosen the armature. Remove the armature and blower as an assembly. The blower is keyed and pressed fit on the armature shaft, and is keyed and tapered fit to the engine crankshaft.

If the armature does not come loose, place a heavy brass rod on the armature shaft near the ball bearing and strike a sharp downward blow on the rod with a hammer. Rotate the armature 1/2-turn before repeating. Do not strike the commutator, collector rings, or bearing.

BRUSHES AND SPRINGS

Inspect brushes periodically. Brushes worn to 1/2" should be replaced. Replace springs if damaged or if proper tension is questionable. Rapid brush wear may be caused from high mica between commutator bars, rough commutator or collector rings, or from a deviation from "neutral" position in the adjustment of the brush rig. NEVER bend the constant-pressure-type spring over the edge of its support.

BRUSH RIG POSITION

Check the reference mark on the edge of the brush rig and if necessary align it with the boss in the end bell (Fig. 9-1). If the brush rig is adjusted so that there is arcing of the brushes, brush wear will be rapid, voltage and current will not hold steady, and the generator may over-heat.

Whenever a new brush rig or armature is installed, the brush rig must be adjusted to the point where the brushes do not arc, regardless of where the witness mark falls. This is commonly known as the "neutral" brush position.

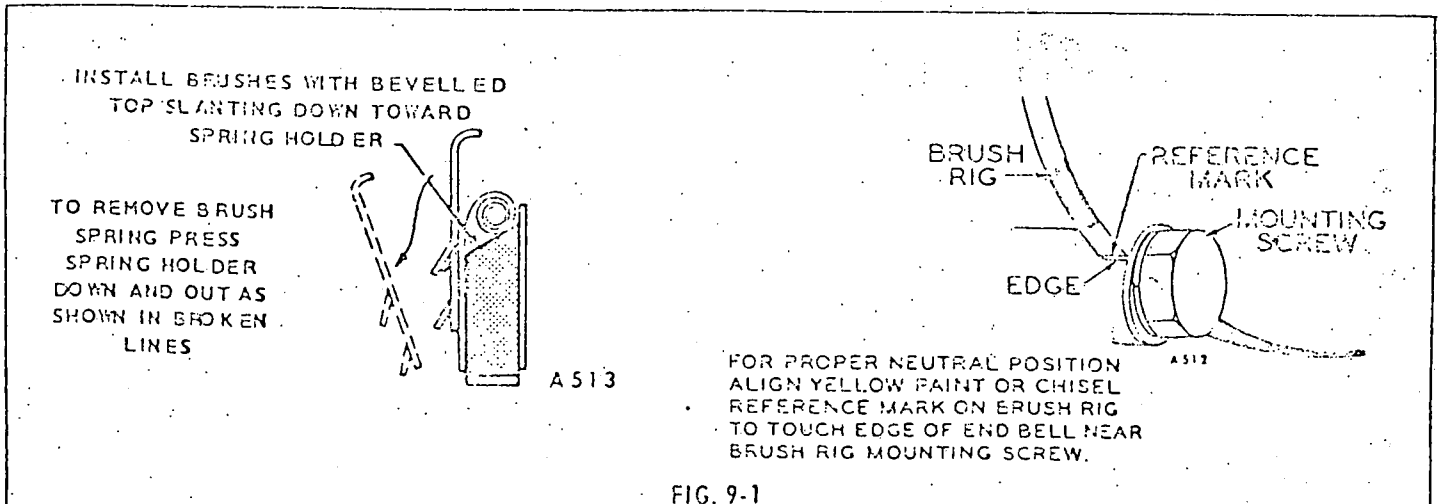


FIG. 9-1

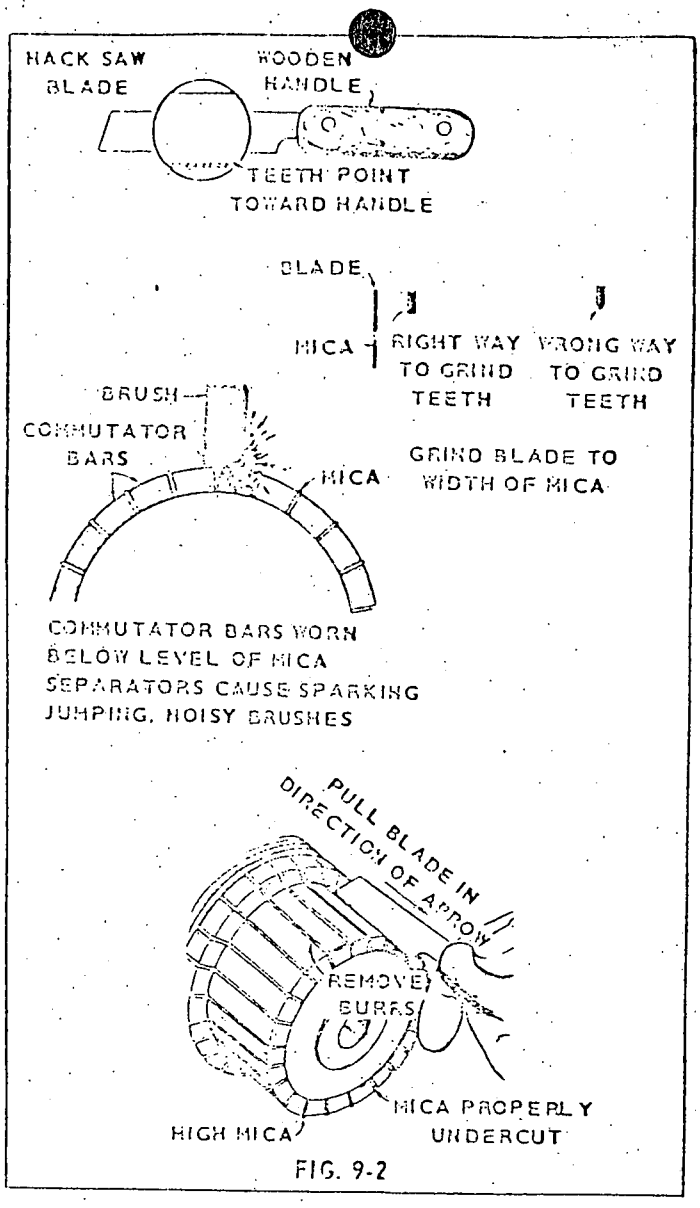


FIG. 9-2

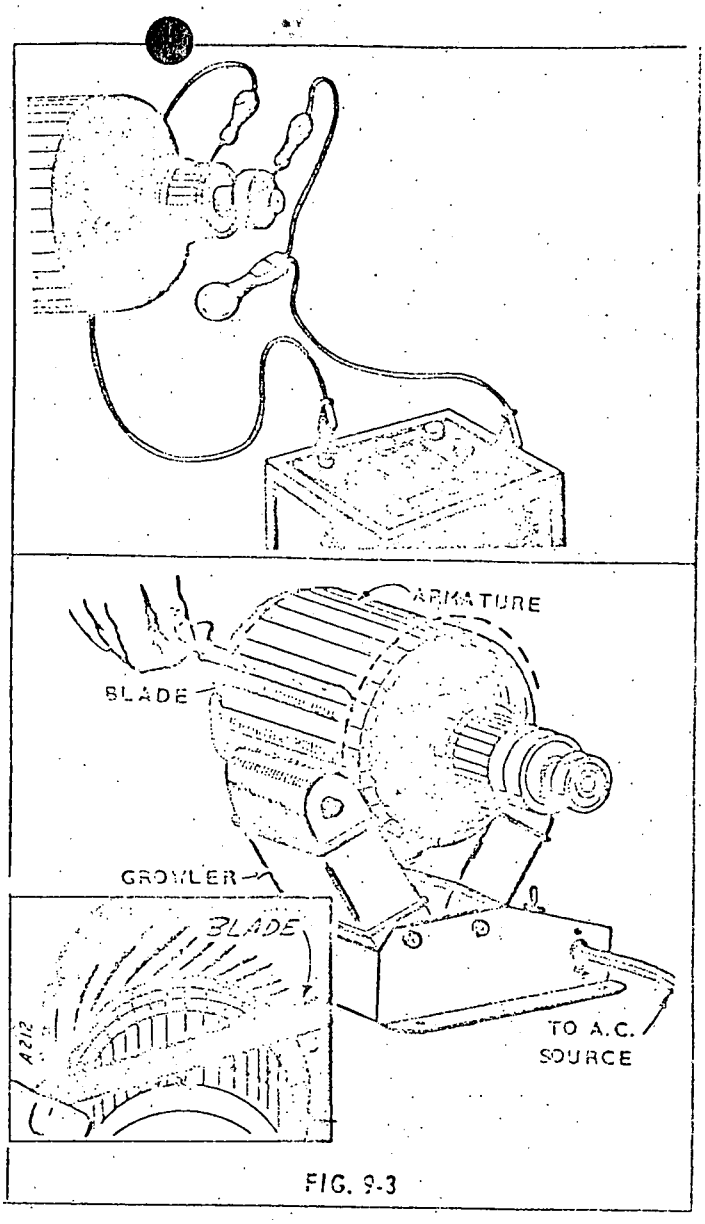


FIG. 9-3

COLLECTOR RINGS

If collector rings become grooved or out of round, or the brush contact surface becomes pitted or rough so that good brush seating cannot be maintained, remove the armature and refinish the collector rings in a lathe. If the commutator appears to be rough or scored refinish it at the same time. Remove or adequately shield the ball bearing during refinishing.

COMMUTATOR

Commutator bars wear down with usage so that the mica between them must be undercut. This should be done as soon as the mica on any part of the commutator touches the brushes. Most service shops have equipment for undercutting mica. An emergency undercutting tool (Fig. 9-2) can be made from a hack saw blade. Avoid injury to the surfaces of the copper bars. Leave no burrs along the edges of the bars. The mica must also be undercut whenever the commutator is refinished.

TESTING WINDINGS

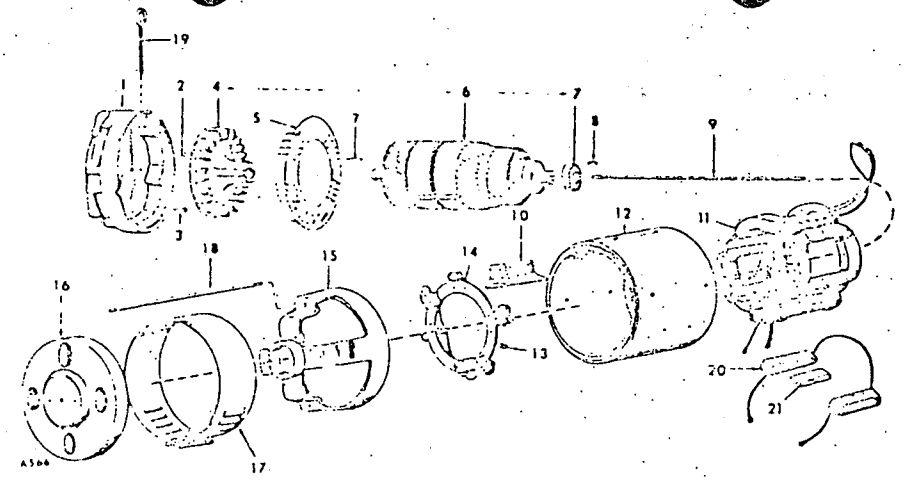
A test lamp set and an armature growler are required for the various tests. Before making any tests, lift all brushes in their holders and disconnect the load circuit wires from the plant. If the armature tests defective, the practical repair is to replace it. If a field coil tests defective, replace the entire coil assembly unless the trouble is in one of the external leads. Then it can be repaired as the nature of the trouble requires.

ARMATURE GROUND TEST

To test the armature for a grounded condition, lift or remove the brushes so that none contact the commutator or collector rings. Use a continuity test lamp set. Place one test prod on the commutator, and the other test prod on a bare, clean part of the armature shaft (Fig. 9-3). The test prods must make good electrical contact. The test lamp should not glow. If the test lamp does glow, the dc winding or the commutator is grounded. To test the ac winding, place one test prod on one of the collector rings and the other test prod on the armature shaft. If the test lamp glows, the ac winding or a collector ring is grounded. Replace a grounded armature with a new one.

ARMATURE OPEN CIRCUIT TEST

Armature ac windings may be tested for an open circuit without armature removal. Testing dc windings requires removal and the use of an armature growler.



1- ADAPTER
2- KEY
3- SCREW
4- BLOWER
5- PLATE
6- ARMATURE ASSEMBLY
7- BEARING
8- CLIP
9- STUD
10- SHOE
11- COIL ASSEMBLY, FIELD
12- FRAME
13- CLIP
14- RIG ASSEMBLY
15- BELL
16- COVER
17- BAND
18- STUD
19- EYE
20- COIL SET, INTERPOLE
21- INTERPOLE

FIG. 9-4

To test the ac winding, be sure all brushes are lifted or removed. Use a test lamp set. Place on test prod on each of the collector rings. If the test lamp does not glow, the ac winding is open circuited.

To test the dc winding, place the armature in a growler. With the growler current on, pass a smooth steel strip across the commutator segments (Fig. 9-3). Repeat all around the commutator. At some point around the commutator, a spark should occur as the strip contacts two adjacent segments. Rotate the armature slightly and repeat the test. Continue until a spark is obtained between all adjacent segments. If no spark is obtained at some point, an open circuit is indicated. (NOTE: A short circuit in the winding might prevent sparking. This condition may be indicated by the short circuit test described in the next paragraph.) Replace an open circuited armature with a new one.

ARMATURE SHORT CIRCUIT TEST

To test for a short circuit, place the armature in a growler. With the growler current on, hold a steel strip about 1/2" above the armature laminations (Fig. 9-3). Pass the strip back and forth over the laminations. Cover as much of the lamination area as possible. If the strip is magnetically attracted to the armature at any point, a short circuit is indicated. After testing in one position, rotate the armature slightly in the growler and repeat the test. Continue until a complete revolution of the armature in the growler has been made. Replace a short circuited armature with a new one.

TESTING FIELD WINDINGS FOR GROUNDS

To test a coil assembly for a ground, disconnect its external leads and touch one test prod to the terminal of one of its leads and the other test prod to the generator frame. If the lamp lights, the coil assembly being tested is grounded. The ground may be in a coil, coil connection, or coil lead. Repair or replace as required.

TESTING FIELD WINDINGS FOR OPEN CIRCUIT

To test a coil assembly for an open circuit, disconnect its external leads and touch one test prod to the terminal of one coil winding lead and the other test prod to each of the other leads of that coil winding in turn. If the lamp does not light, the circuit being tested is open. If the fault lies in connection between coils or in a coil lead, the trouble can be repaired. If it is inside the coil proper, replace the entire coil assembly.

BALL BEARING

If armature ball bearing replacement becomes necessary, pull the bearing from the shaft with a suitable bearing puller. Be careful not to damage the armature shaft because it must remain true to serve as a turning center when refinishing the commutator or collector rings. Drive the bearing on to the shoulder of the shaft. Use a double-sealed pre-lubricated ball bearing.

GENERATOR ASSEMBLY

When assembling the generator (Fig. 9-4), see that there are no nicks or dirt on the armature blower tapered surface. These conditions may cause an excessive run-out (wobble) at the bearing end. Run-out should be within 0.002". Tighten the armature through stud nut securely.

CONTROL

If any control equipment fails to function properly, replace the defective part with a new part rather than try to repair the old part. Check all electrical connections and contacts whenever servicing control equipment.

When disassembling controls, tag each lead that is to be removed and mark the lead connection point on the tag to assure correct connections when assembling.

Always disconnect the battery (electric start units) whenever servicing controls to avoid accidentally starting the unit.

READI-PULL STARTER

SERVICING THE STARTER

Refer to Fig. 10-1 showing the optional Readi-Pull manual starter disassembled.

Caution: The recoil spring may unwind and cause injury if let fly wildly when starter is disassembled or assembled.

The sheave hub bearing (16) has a recess which was packed full of grease at the factory. Normally, no additional lubrication is required. However, if the starter is disassembled for some other reason, add grease to the bearing and to the spring pawls (11) where they contact the ratchet arm (13).

To install a new rope or internal parts, remove the starter from its mounting ring by removing the four clamping screws.

To install a new rope, rotate the sheave (10) with crankshaft rotation direction to fully tighten the spring (8), back up only as necessary to align the hole in the sheave with the slot in the cover (5), clamp the rope to the sheave, then when released, the rope will wind on the sheave.

To install a new recoil spring, remove the sheave from the cover. Wind the spring, with its rivet heads outward, forming a coil small enough to be inserted in the recess of the starter cover. It may be necessary to tie the spring with a piece of wire to prevent its unwinding during installation unless other help is available. Place the spring in the cover recess in crankshaft rotation direction. Remove the tying wire if used. While holding the spring to prevent its unwinding, install the inside end of the spring on the roll pin (7) in the cover. With the pull rope removed, install the sheave assembly in the cover so that the tab on the sheave enters the outside end loop of the recoil spring. Be sure the thrust washer (9) is in place. Then install the pull rope.

Spring breakage is much less common than spring fatigue due to long usage. In either case, the spring should be replaced. Cleaning and lubricating the pawls, and ratchet arms in the rope sheave will improve a sluggish acting recoil. To temporarily extend the life of a fatigued spring, try rewinding it *inside out* (rivets heads inward).

To install a ratchet arm (13) in the sheave, the pawl (11) must first be removed. The ratchet arm will fit in only the correct position. The spring pawl must be installed with its flat edge against the ratchet arm.

The anti-back lash cogwheel (6) is an easy press fit on the starter cover.

INSTALLING THE STARTER

See the engine blower housing is in good condition. If the mounting holes are worn or if the blower housing is otherwise

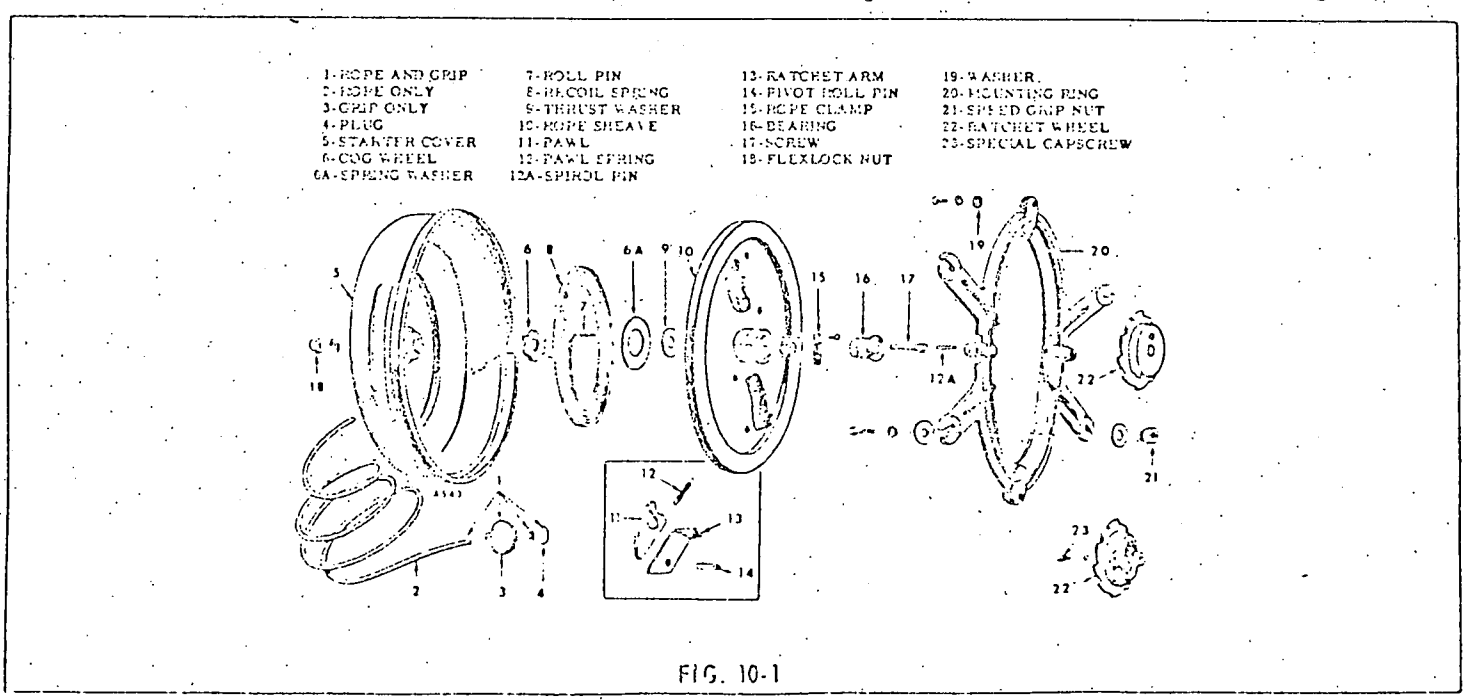


FIG. 10-1

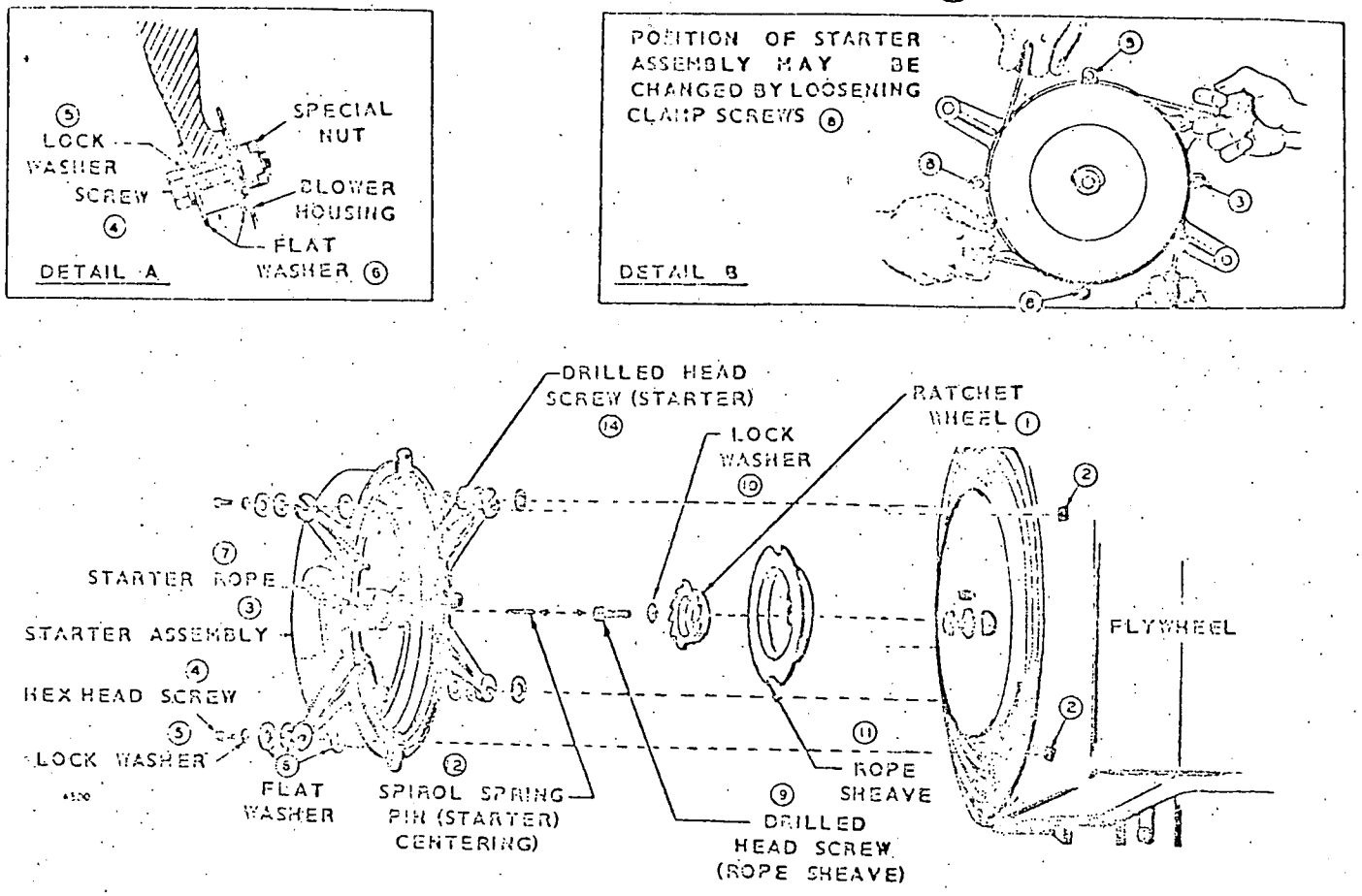


FIG. 10-2

damaged, replace it with a new one. Refer to Fig. 10-2.

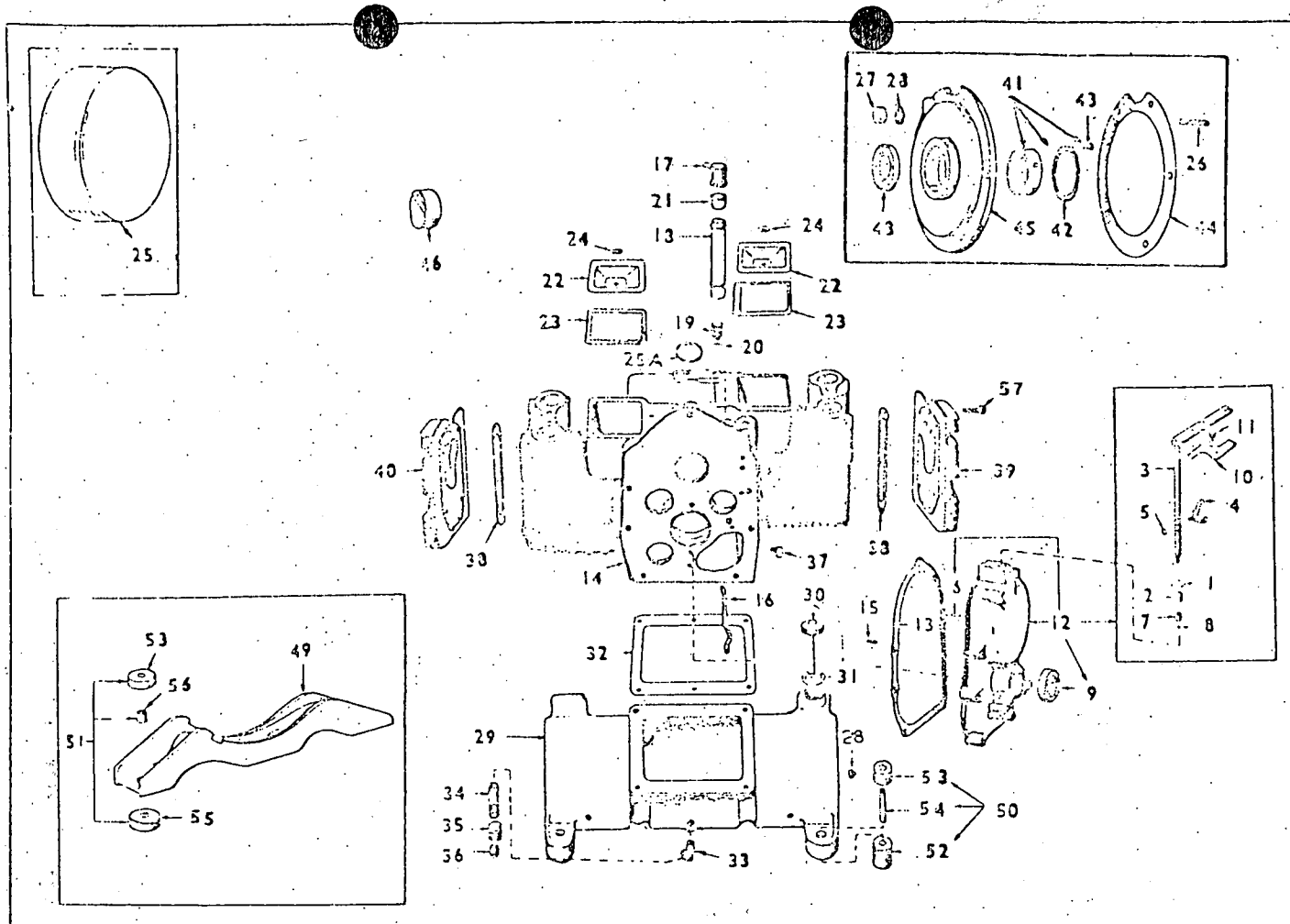
1. Install the new ratchet wheel (1) against rope sheave (11) using lock washer (10) and flywheel mounting screw (9). Discard the large flat washer from engines so equipped. Engage drive hole with flywheel boss.
2. Four special nuts are supplied for mounting the starter to the blower housing. If the blower housing is not already fitted with similar nuts, remove the blower housing and install the nuts as shown in detail A. Reinstall the blower housing, tightening securely in place.
3. Install centering pin (12) in starter center screw (14) allowing 3/8" to protrude. For re-installations, adjust pin depth.
4. Center the starter assembly over the ratchet wheel with the centering pin engaging the center hole of the flywheel mounting screw. While holding in position, mount the starter, using a hex head screw, lock washer, and two flat washers at each mounting arm as shown in detail A. Tighten the mounting screws securely.
5. The direction of pull on the starter rope is adjustable to fit the requirements of the individual installation. See detail B. To change the direction of pull, loosen the four clamp screws (8) and turn the starter in its mounting ring to the desired position. Tighten the four clamp screws securely. Try the starter several times, making sure that the pull rope will not rub against one of clamping screws.

This catalog applies to the standard 200 ampere welder as listed in the Model Identification Table inside the front cover, also listed below. Each illustrated part is identified by a reference number corresponding to the same reference number below the illustration. Parts illustrations are typical. Using the MODEL or SPEC NO. from the plant nameplate, select the parts Key No. (1, 2, etc. in the last column) that applies to your plant Model and Spec No. This Parts Key No. represents parts that differ between models. Unless otherwise mentioned in the description, parts are interchangeable between models. Right and left plant sides are determined by FACING the engine end (front) of the plant.

PLANT DATA TABLE

SPEC or MODEL or SERIAL	ELECTRICAL DATA						TYPE OF STARTING	USE PARTS KEY No.
	DC OUTPUT (For Welding)			AC OUTPUT, 1-Phase 2 Wire (Available continuously when not welding)				
	Amps	Volts	Duty Cycle	Watts	Volts	Cycles		
6CCK-331P/1	200	30	50%	3500	120	60	Manual	1
6CCK-332P/1	200	30	50%	3500	240	60	Manual	1
6CCK-5331P/1*	200	30	50%	2500	120	50	Manual	1
6CCK-5332P/1	200	30	50%	2500	240	50	Manual	1
6CCK-331E/1	200	30	50%	3500	120	60	Electric	2
6CCK-332E/1	200	30	50%	3500	240	60	Electric	2
6CCK-5331E/1*	200	30	50%	2500	120	50	Electric	2
6CCK-5332E/1	200	30	50%	2500	240	50	Electric	2

*-The Specification Letter which completes the specification on the nameplate (Example: 6CCK-331P/1L), advances (A to B, B to C, etc.) with manufacturing changes. Welders with the suffix numbers 4323, 4324, 4325, or 4443 (following the diagonal line) are the same as number 1, except the paint color.



CYLINDER BLOCK, OIL BASE AND GEAR COVER GROUP

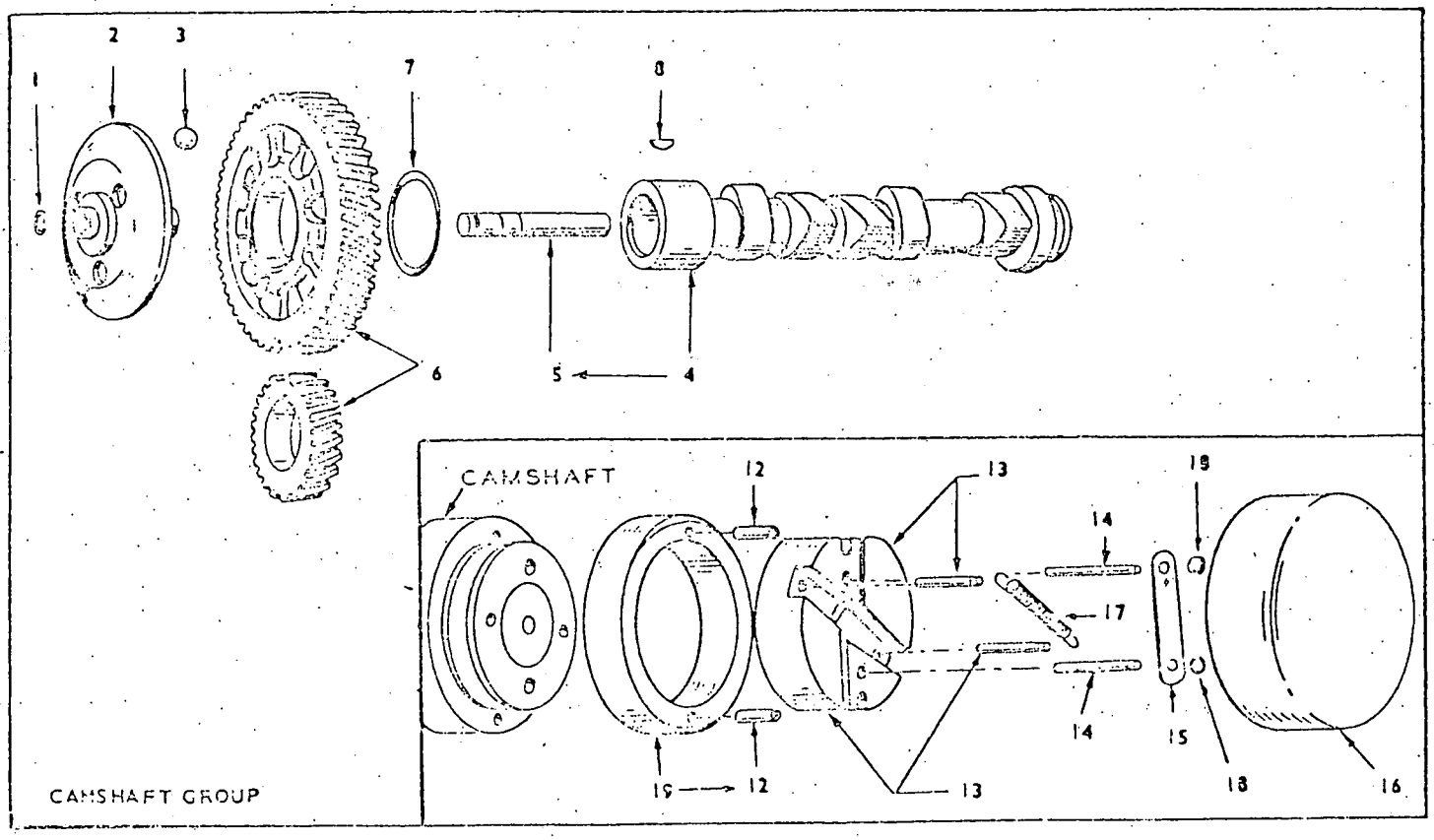
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	509-8	1	Seal, Governor Shaft
2	510-13	1	Bearing, Gov. Shaft Upper.
3	150A377	1	Shaft and Arm, Gov.
4	150A620	1	Yoke, Governor Shaft
5	518-129	1	Ring, Yoke Retainer
6	516-130	1	Pin, Roll - Gov. Cup Stop
7	510-8	1	Bearing, Gov. Shaft - Lower
8	510-14	1	Ball, Brg. - Gov. Shaft
9	509-40	1	Seal, Oil - Gr Cover
10	150B1000	1	Extension, Gov. Arm - Fastens to Gov. Arm
11	815-181	1	Screw, Self Tapping - Brkt. Fastening - 10-32 x 1/2"
12	103C163	1	Cover Assy. Gear - Incl. Cover plus items 1 through 11
13	103B11	1	Gasket, Gear Cover
14	BLOCK ASSY. CYL. INCLUDES PARTS MARKED*		
	110A915	1	To Spec H
	110A1419	1	Spec H and J
	110A1468	1	Begin Spec L
15	516A11	2	*Pin, Gr. Cover - 5/16 x 1-1/8"
16	120A386	1	*Tube, Oil - Crankcase Internal, to rear main bearing
17	123B293	1	Cap, Breather Tube Rubber
18	123A129	1	Tube, Breather - Less Valve & Baffle
19	123-591	1	Baffle, Breather Tube (only on early Spec H models)
20	123A643	1	Ring, Retainer - Internal (only on early Spec H models)
21	123A104	1	Valve, Breather Tube
22	110A666	2	Cover, Valve Compartment
23	110A667	2	Gasket, Valve Comp. Cover
24	526-63	2	Washer, Copper - Valve Comp. Cover
25	110A1283	1	*Cover, Timing Cont. - Spec H and J
25A	517-48	1	*Plug, Camshaft Expansion Spec. F and Begin Spec L
26	520A114	5	*Stud, Rear Br. Plate Mtg. - 5/16 x 1-5/16"
27	110A445	5	*Nut, Rear Brg. Plate
28	851-5	5	*Washer, Lock - 5/16 x Special Width - Rr. Brg. Plate
29	102A418	1	Base, Oil
30	123A489	1	Cap, Oil Fill - Incl. Cap Gasket & Oil Level Ind.
31	123A191	1	Gasket, Oil Fill Cap
32	102B158	1	Gasket, Oil Base Mtg.
33	505-232	1	Elbow, Oil Drain (45°) - Key 2 only
34	505-240	1	Nipple, Oil Drain - 3/8" x 3-1/2"
35	505-28	1	Coupling, Oil Drain - 3/8"
36	505-110	1	Plug, Oil Drain - 3/8"
37	502-20	1	Elbow, St. - Oil Line to Blk.
38	110A892	2	Gasket Cyl. Hd.

* - Parts Included in Cylinder Block Assembly

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
39	HEAD, CYLINDER - R H		
	110D890	1	To Spec H
	110D884	1	Begin Spec H - Hi-Compression
40	HEAD, CYL. - L H		
	110D891	1	To Spec H
	110D883	1	Begin Spec H - Hi-Compression
41	101K389	2	*Bearing Kit, Crkshft. - Prec. - Frt. or Rr. - Specify: Std. .002", .010" .020", or .030" Under. (Incl. Brg. Thrust washer & Lock Pins)
42	104A575	2	Washer, Crankshaft Brg. Thrust - Incl. in Brg. Kit
43	516A72	4	Pin, Crankshaft Thrust Washer Lock - Incl. in Brg. Kit
44	101K115	1	*Gasket Kit, Rear Brg. Plate
45	101C316	1	*Plate, Rear Brg. (LESS Brg.)
46	101A367	2	*Bearing, Cam. Frt. & Rear
48	509A41	1	Seal, Oil - Rear Brg. Plate
49	232D1358	1	Support, Generator

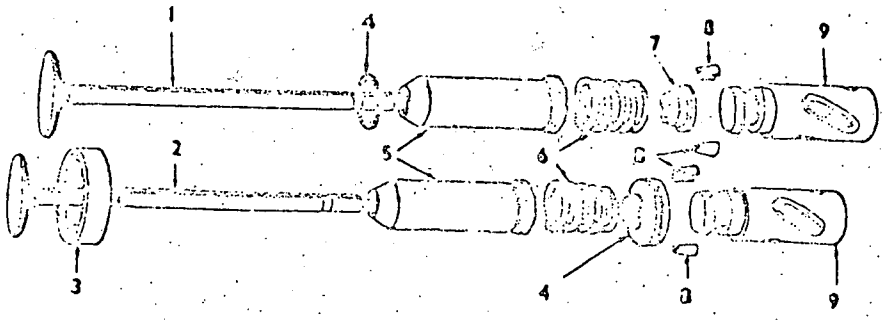
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
	CUSHION ASSY., PLANT MTG.		
50	402A226	2	Engine End
51	402A223	2	Generator End
52	402A38	2	Cushion, Mtg. (Lower) Eng. End.
53	402A131	4	Cushion, Mtg. (Upper) Eng. End (2), Gen. End (2)
54	402A137	2	Bushing, Spacer - Eng. End
55	402A192	2	Cushion, Mtg. (Lower) Gen. End
56	402A193	2	Bushing (Sleeve), Mtg. - Gen. End
57	SCREW, CAP - HEX HEAD		
	800-11	2	1/4-20 x 2" - Valve Comp. Cover Mtg.
	110A879	8	5/16-18 x 1-1/4" Cyl. Head Mtg.
	114A22	14	5/16-18 x 1-3/4" Cyl. Hd. Mtg. & Gr Cover Mtg.
	800-34	1	5/16-18 x 2-1/4" - Gr Cover Mtg.
	800-50	4	3/8-16 x 1" - Gen. Adapter Mtg.
	102A455	4	3/8-16 x 1-1/4" - Oil Base Mtg.
	800-54	2	3/8-16 x 2" - Int. Man. Mtg.

* - Parts Included in Cylinder Block Assembly No. 110A1516.



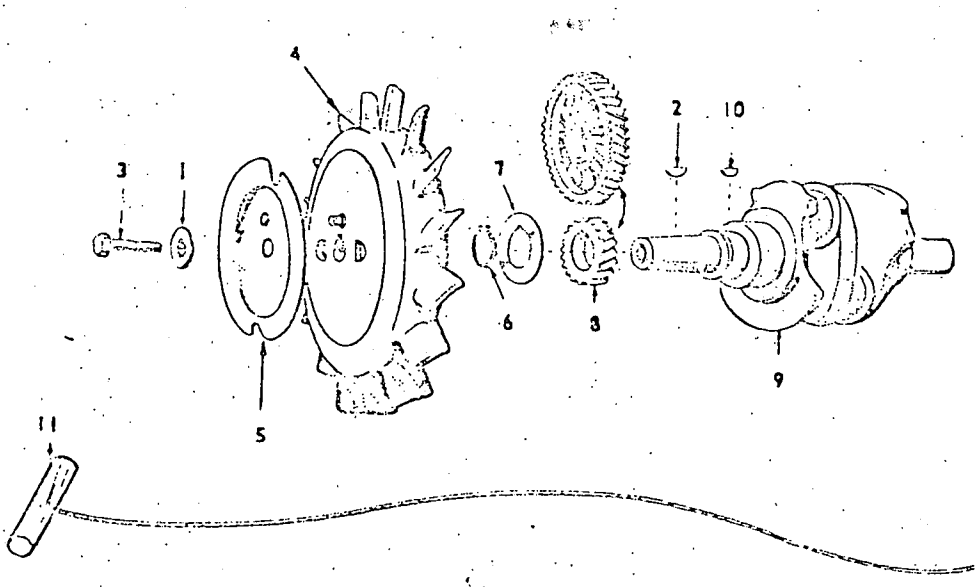
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	150A78	1	Ring, Camshaft Center Pin Snap
2	150A612	1	Cup, Governor
3	510-15	5	Ball, Governor Fly.
4	CAMSHAFT		
	105-140	1	Spec F - Incl. Center Pin
	105B234	1	Spec H and J - Incl. Center Pin & Spark Adv. Mech. Pins
	105A238	1	Begin Spec L - Incl. Center Pin
5	150A75	1	Pin, Camshaft Center
6	105-192	1	Gear Set, Timing - Incl. Crank Gr. & Cam Gr with Flyball Spacer & Plate (also in Crankshaft & Flywheel Grp).

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
7	105A4	1	Washer, Thrust, Cam Gear
8	515-1	1	Key, Camshaft Gr. Mtg.
12	516-144	4	Pin, Roll - 7/16" Timing Cont. Spec H & J
13	160A789	2	Weight Assy., Incl. Pins - Timing Cont. - Spec H & J
14	516A146	2	Pin, Groove - 1" - Timing Cont. Cam - Spec H & J
15	160A726	1	Retainer, Timing Cont. - Spec H & J
16	110A1283	1	Cover, Timing Cont. - Spec H & J
17	160A727	1	Spring, Timing Cont. - Spec H & J
18	518-185	2	Lock, Timing Cont. - Spec H & J
19	160A791	1	Cam, Timing Cont. - Spec H & J



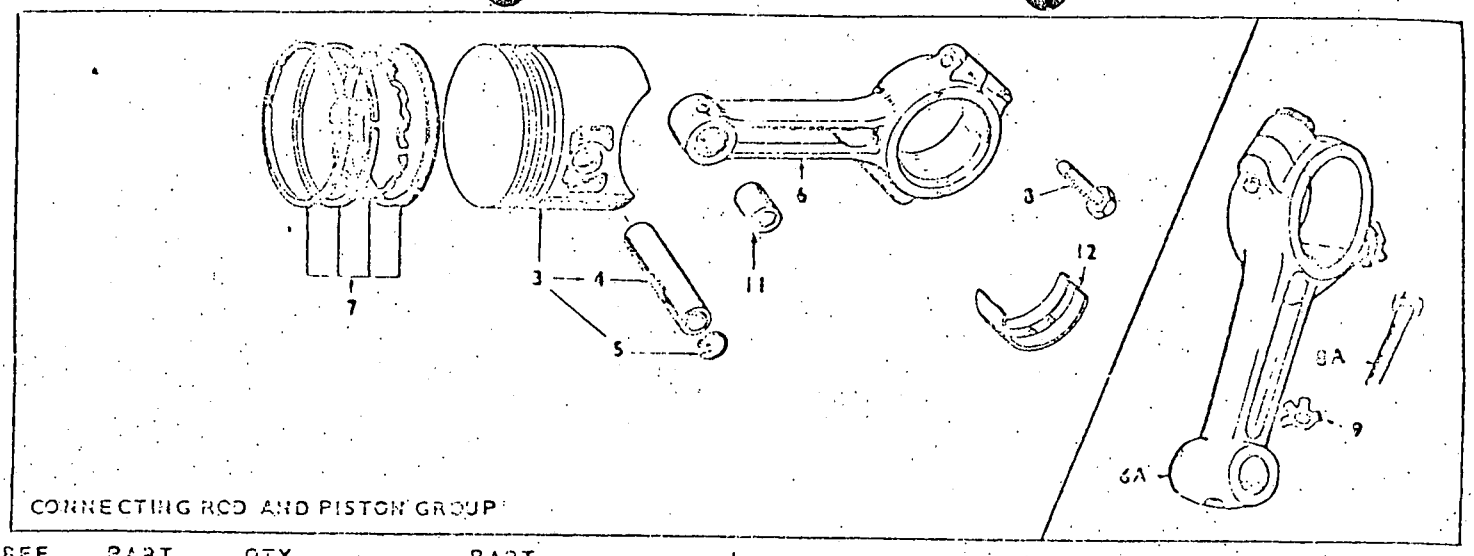
VALVE GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	110B381	2	Valve, Intake - Stellite
2	110B380	2	Valve, Exh. - Stellite
3	110A572	2	Insert, Valve Seat - Stellite - Exh.
4	110A904	2	Rotocap, Valve - Exhaust
5	110A902	4	Guide, Valve
6	110A539	4	Spring, Valve
7	110A093	2	Washer, Retainer - Intake
8	110A639	8	Lock, Rotocap or Spring Retainer Washer
9	115A6	4	Tappet, Valve



CRANKSHAFT AND FLYWHEEL GROUP

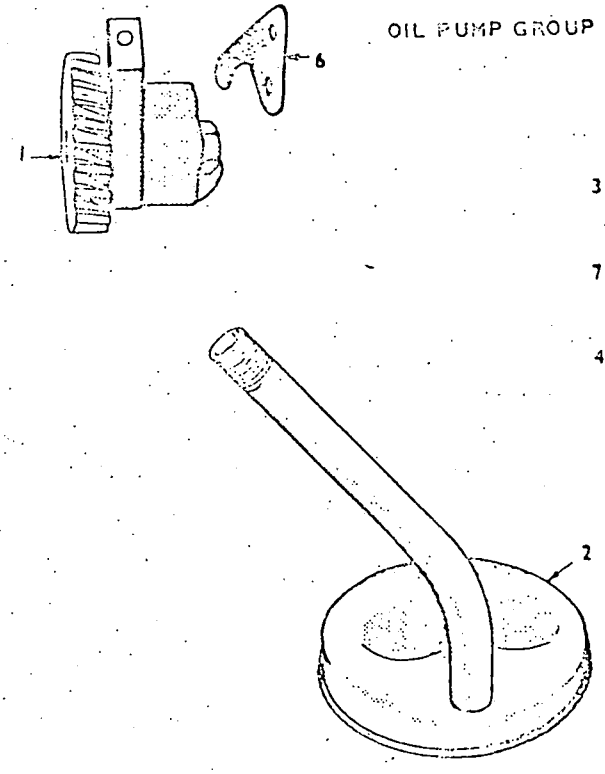
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	526A17	1	Washer, Flywheel Mtg.
2	515-2	1	Key, Flywheel Mtg. - Steel
3	104A170	1	Screw, Flywheel Mtg.
4	FLYWHEEL, MAGNETO - LESS ROPE SHEAVE		
	160D650	1	Spec F
	160B761	1	Spec H & J
	160B937	1	Begin Spec L
5	192B308	1	Sheave, Rope
6	518-14	1	Lock, Crankshaft Gear Washer
7	104A43	1	Washer, Crankshaft Gear Ret.
8	105-192	1	Gear Set, Timing - Incl. Crank Gr & Cam Gr with Flyball Spacer & Plate - (Also in Camshaft Grp)
9	104D256	1	Crankshaft
10	515-1	1	Key, Crank Gr Mtg.
11	192A83	1	Rope Starting



CONNECTING ROD AND PISTON GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
3	112-71	2	Piston & Pin Assy. - Incl. Ret. Rings - Specify: Std, .010", .020" .030", or .040" Over
4	112A69	2	Pin, Piston - Specify: Std, or .002" Over.
5	112A3	4	Ring, Piston Pin Ret.
6	114B28	2	Rod, Con. (Forged) Incl. Bushing & Place Bolts - (Begin Spec H)
6A	114C98	2	Rod, Con. (Alum.) - Specify Std, or .010", .020", .030" U/S.- Spec F only
7	113A88	2	Ring Set, Piston Specify: Std, .010", .020", .030", or .040" Over
8	805-10	4	Bolt, Place - Con. Rod Caps - Begin Spec H
8A	110A284	4	Screw, Con. Rod Cap. - Spec F Only
9	114A59	4	Washer, Con. Rod Cap - Spec F Only
11	114A36	2	Bushing, Piston Pin - Con. Rod - Begin Spec H
12	114B145	4	Bearing Half, Con. Rod - Specify: Std, .002", .010", .020" or .030 Under - Begin Spec H

OIL PUMP GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	120A491	1	Pump, Oil - Complete (Int. parts not sold separately).
2	120B400	1	Cup, Oil Pump Intake - Incl. Cup, Pipe & Screen
3	120A187	1	Stud Assy, By-Pass Adj. Incl. Stud & Nut
4	120A140	1	Spring, By-Pass Valve
5	120A398	1	Valve, By-Pass
6	120K161	1	Gasket Kit, Oil Pump - Incl. Mtg. & body gaskets
7	526-66	1	Washer, Copper - Oil Press. Relief Valve Adj. Screw

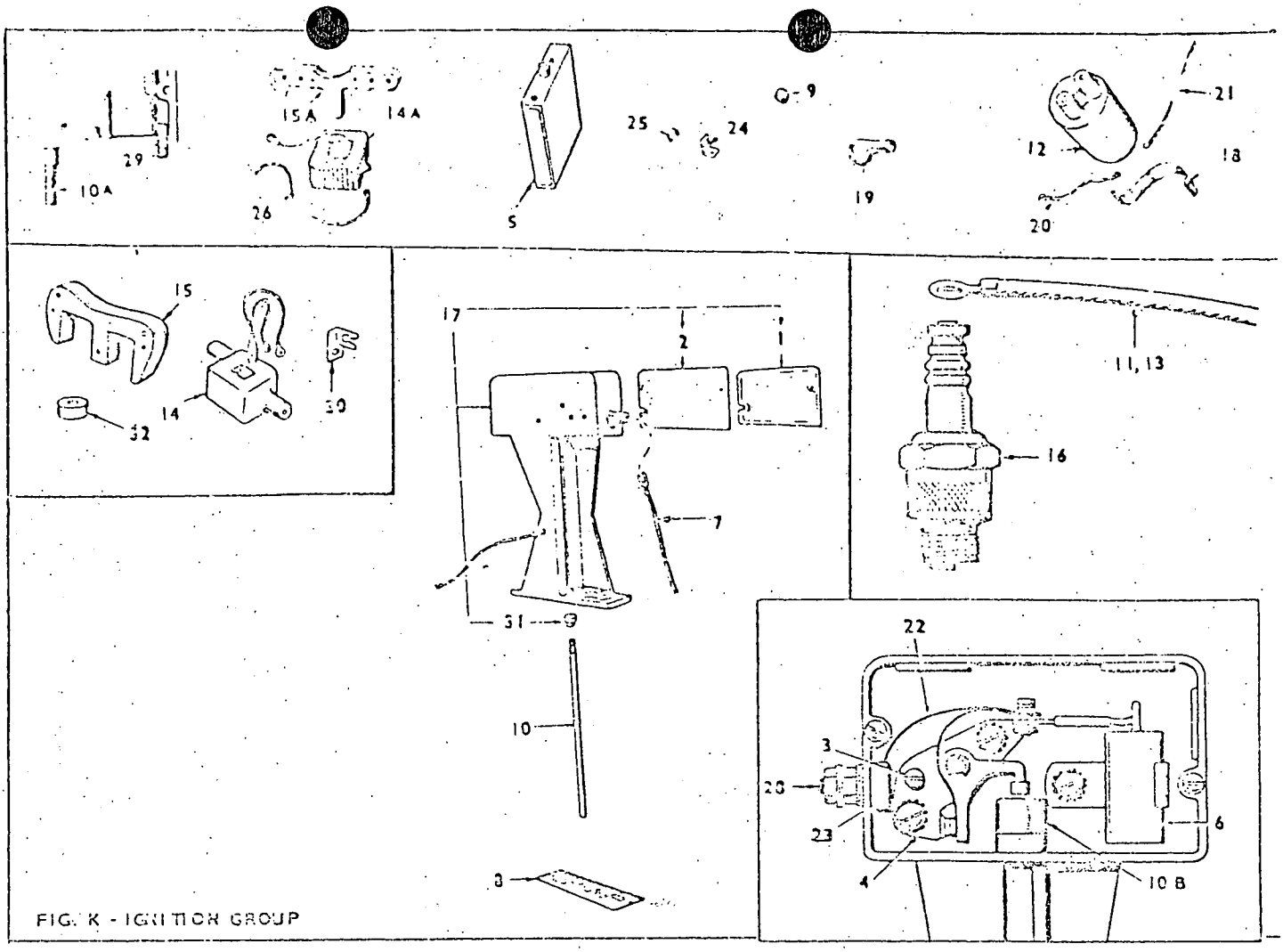
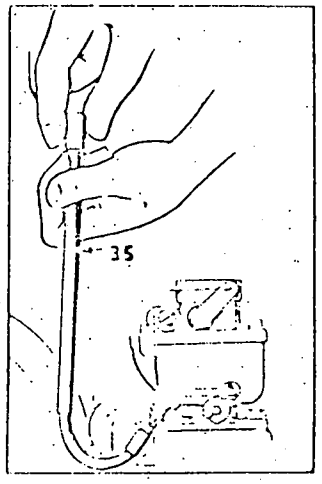
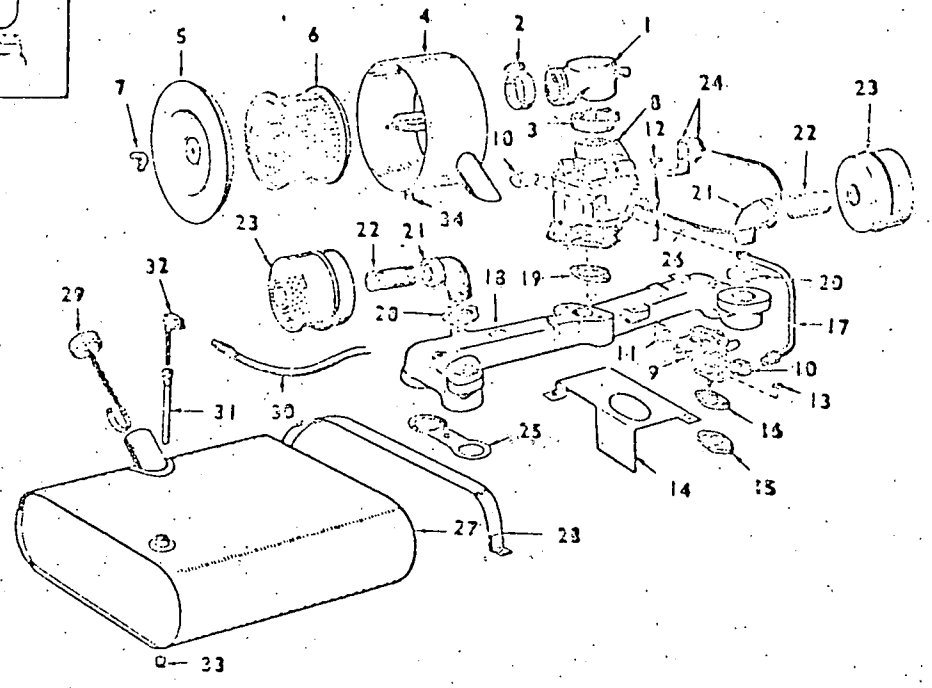


FIG. K - IGNITION GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	160A930	1	Cover, Breather Box
2	160A150	1	Gasket, Breaker Box Cover
3	160A75	1	Cam, Point Gap Adjusting
4	160A2	1	Point Set, Ignition Breaker
5	160B683	1	Spacer, Brkr. Box Mtg. - To Spec J
6	312A69	1	Condenser, Breaker Box - 0.3 Mfd.
7	336A1027	1	Lead, Breaker Box to Ign. Switch
8	160A43	1	Gasket, Breaker Box
9	508-5	2	Grommet, Spk. Plug Cables In Blwr. Hsg. - Spec F only
10	160A723	1	Plunger Only, Breaker - Begin Spec J
10A	160A636	1	Plunger Assy. Incl. Plgr., Diaph., Guide - To Spec J
10B	160A263	1	Diaphragm, Brkr. Plunger
11	CABLE, SPARK PLUG - R.H.		
	167A1308	1	9" Spec F only
	167A1404	1	10" Begin Spec H
12	160C792	1	Coil, Ignition - Spec F only
13	CABLE, SPARK PLUG - L.H.		
	167A1288	1	23" Spec F only
	167A1403	1	17-1/2" - Begin Spec H
14	160A750	1	Coil, Magneto Stator, Begin Spec H
14A	160A232	1	Coil Magneto Stator - Spec F Only
15	160A749	1	Pole Shoe, Magneto Stator - Begin Spec H

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
15A	160A281	1	Pole Shoe, Mag. Stator - Spec F Only
16	167-28	2	Plug, Spark
17	160A963	1	Box Assy., Ign. Brkr - Incl. Cover & Gasket
18	160A488	1	Clamp, Ign. Coil - Spec F only
19	160A558	2	Nipple, Ign Coil (Rubber) - Spec F only
20	336A530	1	Lead, Ign. Coil to Grd. (4") - Spec F only
21	336A219	1	Lead, Ign. Coil to Brkr. Box (20") - Spec F only
22	160A428	1	Strap, Point Set to Breaker Box Term Block
23	332A319	1	Block, Breaker Box Term.
24	332A273	1	Clip, Magneto Lead
25	508-2	1	Grommet, Magneto Lead Clip
26	336A1196	1	Lead, Mag. Stator to Brkr. Box (24")
28	332A284	1	Screw, Term. - Brkr. Box
29	160A261	1	Wick, Oil Drain - Brkr. Box To Spec J
30	167A188	4	Clip, Spk. Plug Cable - Begin Spec H
31	160A929	1	Bushing, Brkr. Box Plunger Begin Spec J
32	526-15	4	Washer, Poleshoe Mtg. (11/16" Thick) - Begin Spec H

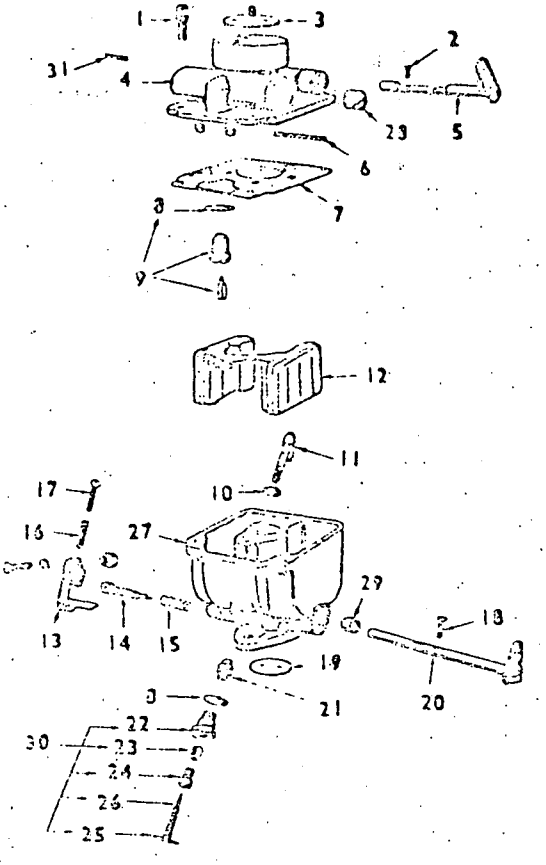




FUEL SYSTEM GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	145A94	1	Inlet, Carburetor Air
2	503-280	1	Clamp, Air Inlet to Air Cleaner
3	503-107	1	Clamp, Air Inlet to Carb.
4	140C537	1	Housing, Air Cleaner
5	140B538	1	Cover, Air Cleaner
6	140B495	1	Cartridge, Air Cleaner
7	518-56	1	Screw, Wing - Air Cleaner Cover Mtg.
8	CARBURETOR ASSEMBLY		
	142A386	1	Spec F only
	142A416	1	Begin Spec H
9	149D693	1	Pump Assembly, Fuel
10	502-2	2	Elbow, Inv. Male - (1) Fuel Pump Out (1) Carb. In.
11	502-20	1	Elbow, St. Fuel Pump In.
12	149A271	1	Rod, Fuel Pump Primer
13	526-63	2	Washer, Flat Copper - Fuel Pump Mtg.
14	134A981	1	Baffle, Fuel Pump Air
15	149A45	1	Spacer, Fuel Pump
16	149A3	2	Gasket, Fuel Pump & Spacer Mtg.
17	149A775	1	Line, Fuel Pump to Carb.

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
18	154D601	1	Manifold, Intake
19	141A78	1	Gasket, Carburetor Mtg.
20	331-53	2	Nut, Pipe - 1" - Exh. Out.
21	505-3	2	Elbow, Street - 1" - Exh. Out.
22	505-86	2	Nipple, Close - 1" x 2-1/2" - Exh. Out.
23	155B484	2	Muffler, Exhaust
24	143-263	1	Bracket & Clip, Manual Choke
25	134A13	2	Gasket, Intake Manifold
26	CHOKE, MANUAL		
	153B97	1	Key 1
	153B165	1	Key 2
27	159C690	1	Tank, Fuel
28	159A692	2	Strap, Fuel Tank Mounting
29	159B20	1	Cap, Fuel Tank
30	501A5	1	Line, Flex Fuel - Tank to Pump
31	159A695	1	Tube, Pick-Up - Fuel Tank Out.
32	149A773	1	Elbow & Screen, Fuel Tank
33	505-8	1	Plug, Slotted Pipe - Fuel Tank Drain
34	140A554	1	Spacer, Air Cleaner Mtg. Screw
35	420B169	1	Wrench, Carb. Adjusting



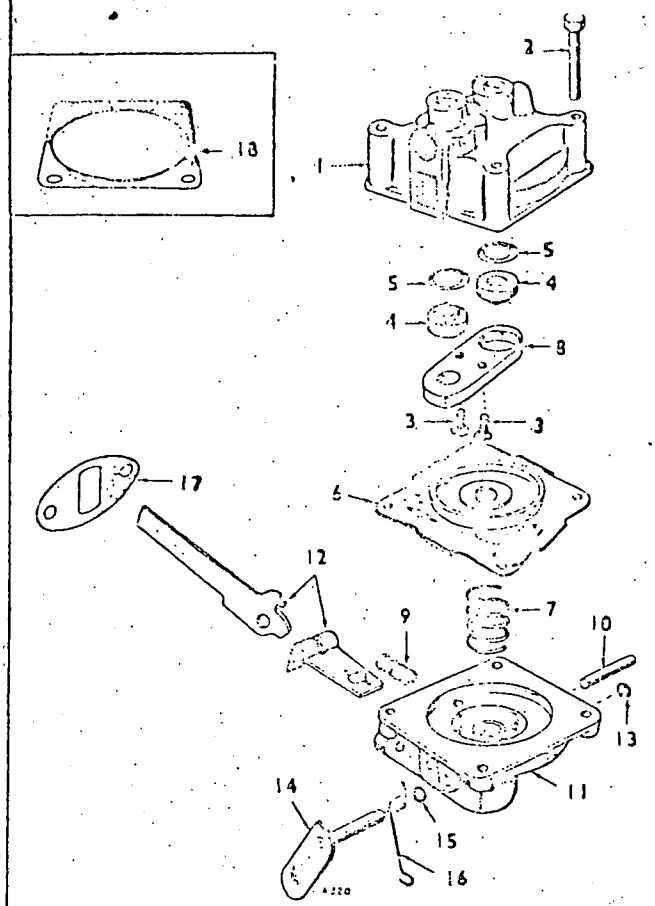
CARBURETOR PARTS GROUP

REF. NO.	PART NO.	QTY. USED	PARTS DESCRIPTION
	CARBURETOR ASSEMBLY		
	142A386	1	To Spec H
	142A416	1	Begin Spec H
1	SCREW, BOWL COVER		
	815-103	1	#10-24 x 1/2"
	815-109	2	#10-24 x 5/8"
2	815-91	2	*Screw, Choke Fly - #4-40 x 3/16"
3	142-55	1	Fly, Choke
4	142-205	1	Sleeve, Choke (Cover)
5	SHAFT ASSEMBLY, CHOKE		
	142-217	1	Spec F Only (142A386 Carb.)
	142-420	1	Begin Spec H (142A416 Carb.)
6	142-39	1	*Shaft, Float
7	142-31	1	Gasket, Body to Bowl
8	148A17	2	Gasket (1) Float Valve Seat, (1) Main Adj. Needle Ret.
9	142-356	1	*Valve Seat Assy, Float
10	142-32	1	Gasket, Nozzle
11	142-235	1	Nozzle Assembly
12	142-361	1	Float and Lever
13	145A8	1	Lever, Idle Stop
14	142-40	1	Needle, Idle Adjusting
15	142-282	1	Spring, Idle Needle Adj.
16	142A35	1	Spring, Throttle Stop Adj. Screw
17	812-63	1	Screw, Throttle Stop Adj. - #6-32 x 1 2"

REF. NO.	PART NO.	QTY. USED	PARTS DESCRIPTION
18	815-72	2	*Screw, Throttle Fly - #4-40 x 1/4"
19	142-369	1	Fly, Throttle
20	142-368	1	*Shaft Assembly, Throttle
21	142-370	1	Nut & Jet, Nozzle
22	142-46	1	Retainer, Main Adj. Needle
23	142-206	1	Packing, Main Adj. Needle
24	142-45	1	Retainer, Main Adj. Needle Packing
25	516A27	1	Pin, Main Adj. Needle
26	142-41	1	*Needle, Main Adjusting
27			Body Assembly (Not Sold Separately
28	505-53	1	Plug, Gas Inlet
29	142-343	2	Bushing, Throttle Shaft
30	142-42	1	Needle Assembly - Incl. Packing, Nut & Ret.
31	142-227	1	Pin, Choke Stop
	870-53	1	Nut, Throttle Stop
	813-102	1	Screw, Throttle Stop Clamp - 10-32 x 5/8"
	142-33	1	*Gasket Kit, Carburetor
	142K387	1	Repair Kit, Carburetor (Incl. parts marked *).

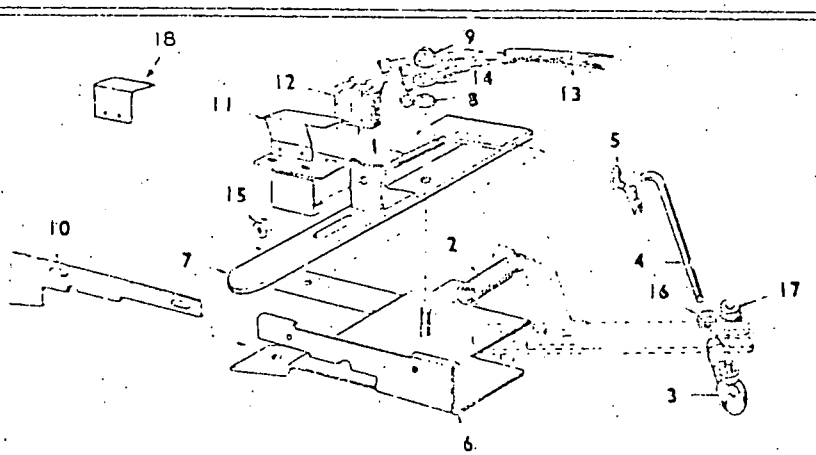
* - Contained in Repair Kit #142K387.

FUEL PUMP PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
	149D693	1	Pump Assembly, Fuel
	149K526	1	Repair Kit, Fuel Pump (Incl. parts marked **).
1		1	Body, Upper (Not Sold Sep.)
2	815-148	4	Screw, H. H. (8-32 x 7/8") Pump Assy.
3	815-147	2	Screw, Phillips Flat Hd (6-32 x 5/8") Valve Ret.
4	149-96	2	**Valve and Cage
5	149A95	2	**Gasket, Valve
6	149A582	1	**Diaphragm Assembly
7	149A672	1	**Spring, Diaphragm
8	149A539	1	Retainer, Valve Cage
9	149A675	1	**Spring, Rocker Arm
10	516A113	1	Pin, Rocker Arm
11		1	Body, Lower (Not Sold Sep.)
12	149-710	1	Arm & Link Set (Only as a set).
13	518-129	1	Ring, "E" Ret. - Priming Lever
14	149A551	1	Lever, Hand Primer
15	509-65	2	Seal, "O" Ring
16	149A404	1	Spring, Priming Lever
17	149A3	2	**Gasket, Fuel Pump & Spacer Mtg. (Also in Fuel System Grp).
18	149A858	1	**Gasket, Fuel Pump Diaph. (Pull Rod Side)

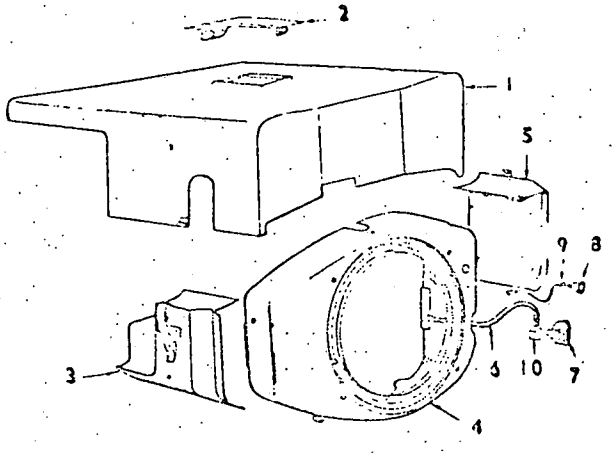
** - Contained in Repair Kit #149K526.



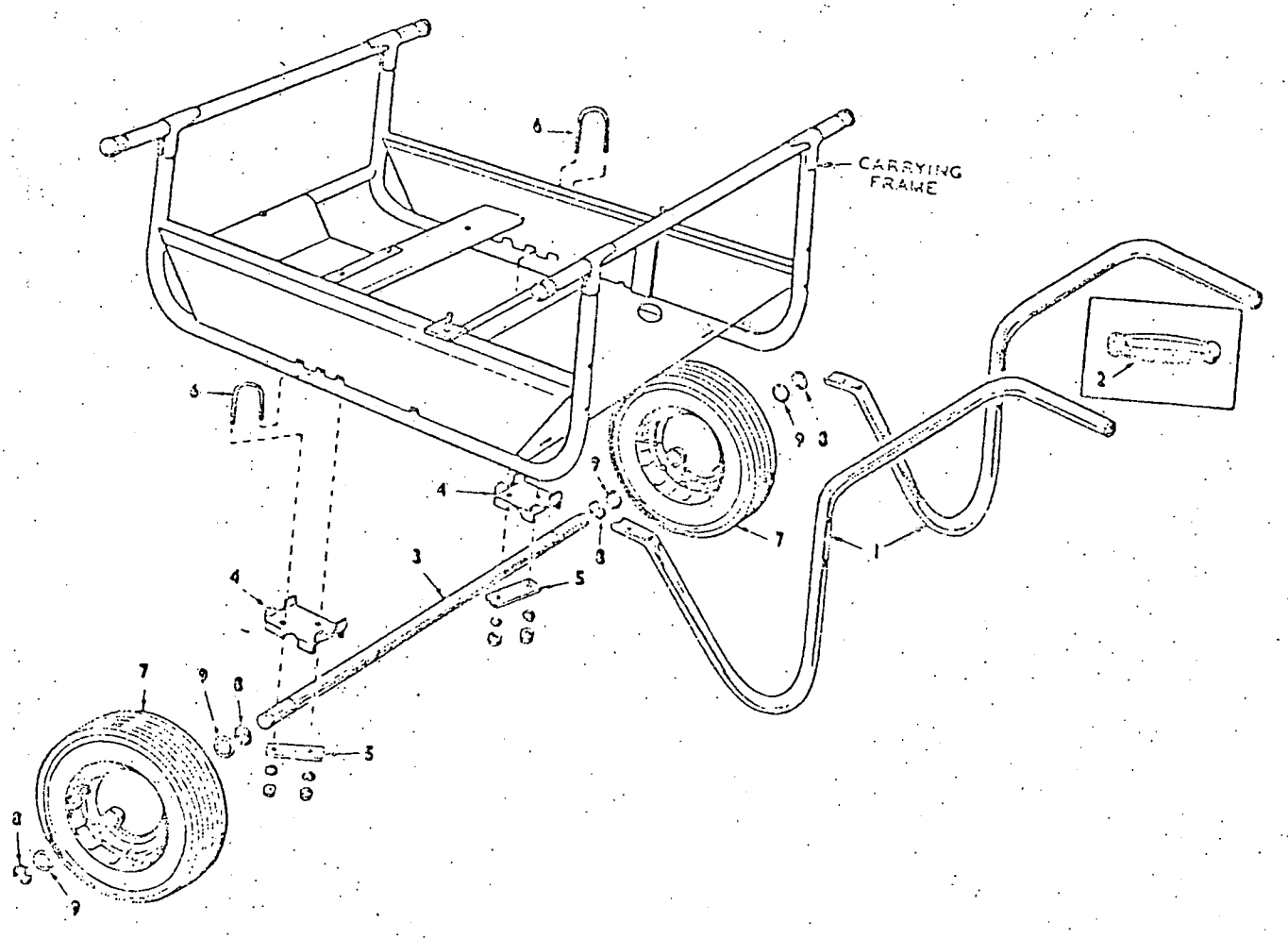
GOVERNOR AND THROTTLE GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	150A96	1	Stud, Governor Adjusting
2	150A98	1	Spring, Governor
3	150A639	1	Joint, Governor Link Ball
4	150A629	1	Link, Gov. Arm to Carb.
5	518-6	1	Clip, End - Link to Carb.
6	BRACKET, VAR. SPEED GOV.		
	152C109	1	Models with 60-Cycle AC Output
	152C130	1	Models with 50-Cycle AC Output
7	LEVER, SPEED ADJUSTING		
	152B111	1	Models with 60-Cycle AC Output
	152B129	1	Models with 50-Cycle AC Output
8	152A41	1	Washer, Tension - Speed Lever
9	870-65	1	Nut, Huglock - Speed Lever - 1/4 - 20
10	152A110	1	Plate, Adjusting - Speed Lever Travel
11	152A112	1	Bracket, Micro Switch Mtg.
12	308A151	1	Switch, Micro
13	333B228	1	Harness, Wiring Micro Switch
14	526-15	1	Washer, Flat - Speed Lever
15	870-53	1	Nut, Gov. Adjusting Stud
16	870-53	1	Nut, Hex - Gov. Ball Joint to Link
17	870-131	1	Nut, Keps - Gov. Ball Joint to Gov. Arm
18	152A119	1	Fibre, Insul. - Micro Switch Terminal.

HOUSING, STOP BUTTON AND GAGE GROUP

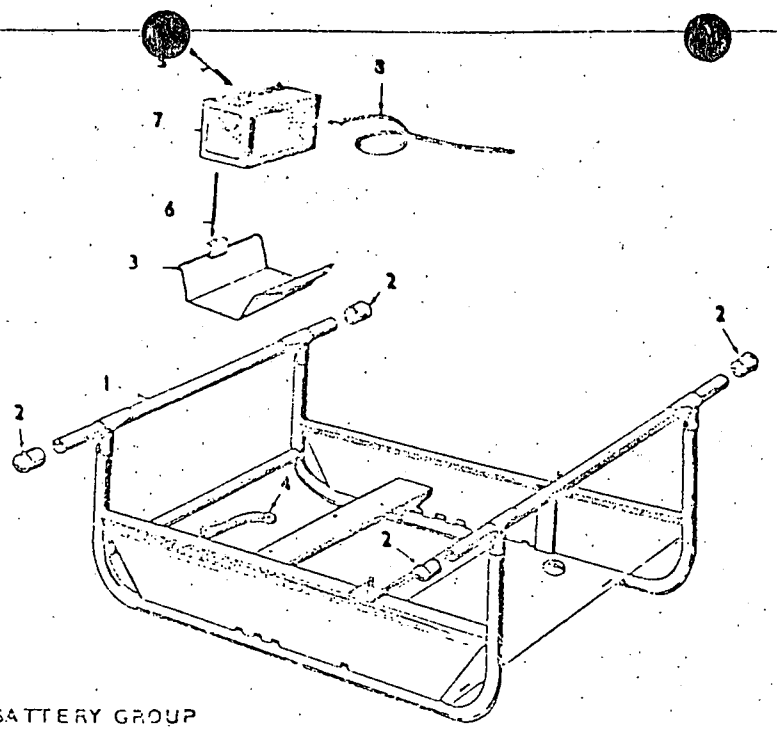


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	405D1184	1	Cover, Engine & Cont.
2	405B1187	1	Cover, Lifting Eye
3	134D930	1	Housing, Cyl. Air - L H (#1 Cyl.)
4	134D1579	1	Housing, Blower
5	134D979	1	Housing, Cyl. Air - R H (#2 Cyl.)
6	501A4	1	Line, Oil Gage - Flex.
7	193-5	1	Gauge, Oil Pressure
8	313-18	1	Button Stop - Key 1 - Spec F only
9	336A491	1	Lead, Stop Button - Key 1 - Spec F only
10	502-5	1	Elbow, Inv. Female - On Oil Gage



DOLLY GROUP (OPTIONAL EQUIPMENT)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	410K287	1	Dolly Assy. - Incl. entire grp plus hdwe (Does NOT include Carrying Frame).
1	410C285	2	Handle
2	403-205	2	Grip, Handle
3	410B233	1	Axle
4	410B283	2	Support, Axle
5	410A284	2	Plate, Axle Support.
6	410A148	2	Bolt, "U" - Axle Mounting
7	410P236	2	Wheel and Tire Assy. - Incl. Tube
8	518-130	4	Ring, "E" Ret. - Dolly Wheel to Axle
9	526A81	4	Washer, Flat - Wheel Mtg.

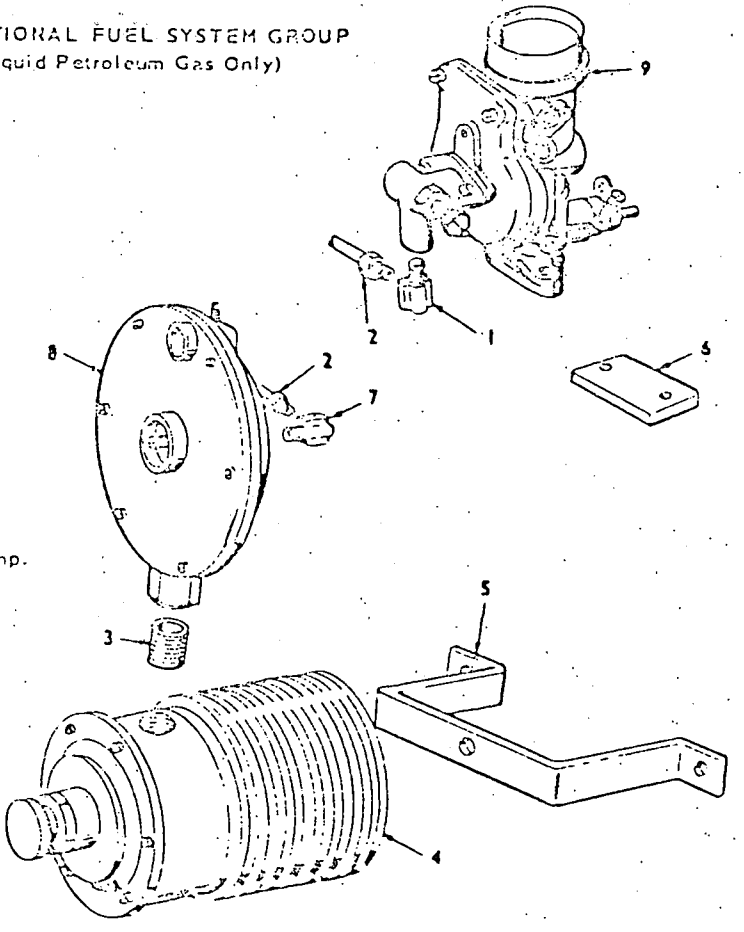


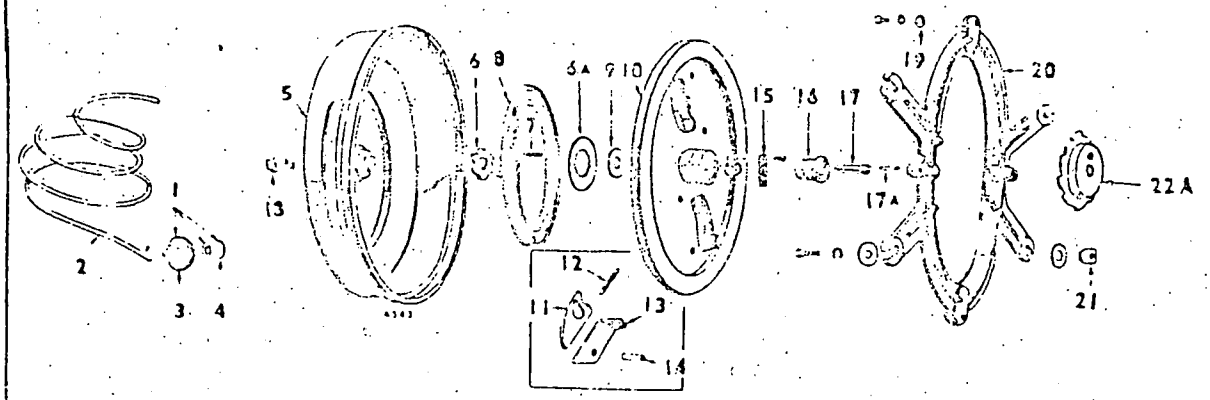
CARRYING FRAME AND BATTERY GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	403D586	1	Frame, Carrying
2	403P568	4	Tips, Rubber - Carrying Frame
3	416C452	1	Rack, Battery - Key 2
4	337A56	1	Strap, Grd - Carrying Frame to Blower Hsg.
5	416A453	1	Strap, Battery Hold-down - Key 2
6	416A454	2	Stud, Battery Hold-down - Key 2
7	416P451	1	Battery, Starting - 12 Volt - OPTIONAL Equip. - Key 2
8	LEAD, BATTERY TO CONTROL - KEY 2		
	336A1248	1	Positive Post to Start Switch (36")
	336A1249	1	Negative Post to Terminal Stud (50")

OPTIONAL FUEL SYSTEM GROUP
(Liquid Petroleum Gas Only)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	502-39	1	Elbow, Carburetor Inlet
2	159C745	1	Line, Fuel - Vaporizer to Carb.
3	505-99	1	Nipple, Vaporizer to Reg.
4	148A418	1	Vaporizer Assy.
5	148A423	1	Bracket, Vaporizer Mtg.
6	149A136	1	Cover, Crankcase, Fuel Pump Hole
7	502-39	1	Elbow, Regulator Outlet
8	148P465	1	Regulator, LPG - Secondary
9	141B647	1	Carburetor, Press. - LPG (Comb.) Carb. & Press. Reg.
	141K653	1	Repair Kit, Carburetor
	141K652	1	Gasket Kit, Carburetor
	141-651	2	Seal, Throttle Shaft (Comb. of Carb.)
	141-650	2	Retainer, Throttle Shaft Seal (Comp. of Carb.)





READI-PULL STARTER GROUP (Optional Equipment Key 1 only)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
	192K325	1	Starter Kit, Complete, Incl. Mtg. Ring & Ratchet Wheel
1	192A45	1	Rope & Grip Assy.
2	192-43	1	Rope (Less Grip) 83" Long
3	192A44	1	Grip, Starter Rope
4	517A25	1	Plug, Starter Rope Grip
5	192C152	1	Cover, Starter
6	192A153	1	Wheel, Cog, Anti-Backlash
6A	525A168	1	Washer, Sprg. Retainer (Used on Later Model Starters)
7	516-83	1	Pin, Roll, 3/16 x 5/8, Recoil Spring
8	192A39	1	Spring, Recoil
9	526A123	1	Washer, Thrust, Sheave Bushing to Cover
10	192B180	1	Sheave, Rope
11	192A172	2	Pawl
12	192A165	2	Spring, Pawl
13	192A168	2	Arm, Ratchet
14	516-110	4	Pin, Roll, 5/16 x 1/2", (2) Ratchet Arm, (2) Pawl
15	192A167	1	Clamp, Rope
16	192A163	1	Bearing, Sheave Hub, Bronze
17	192A323	1	Cap Screw, Socket Hd., 3/8-16 x 1-1/2", Sheave Bushing to Cover (Repl. 806-30)
17A	516-132	1	Pin, Spirol, Brass 1/3 x 5/8", Starter Locating,
18	870-138	1	Nut, Flexlock, Bushing to Cover Screw
19	526A21	4	Washer, Starter to Mtg. Ring
20	192C186	1	Ring, Mtg., Starter to Blower Hsg.
21	870-110	4	Nut, Speed Grip, Starter Ring to Blower Hsg.
22A	192B309	1	Wheel, Ratchet

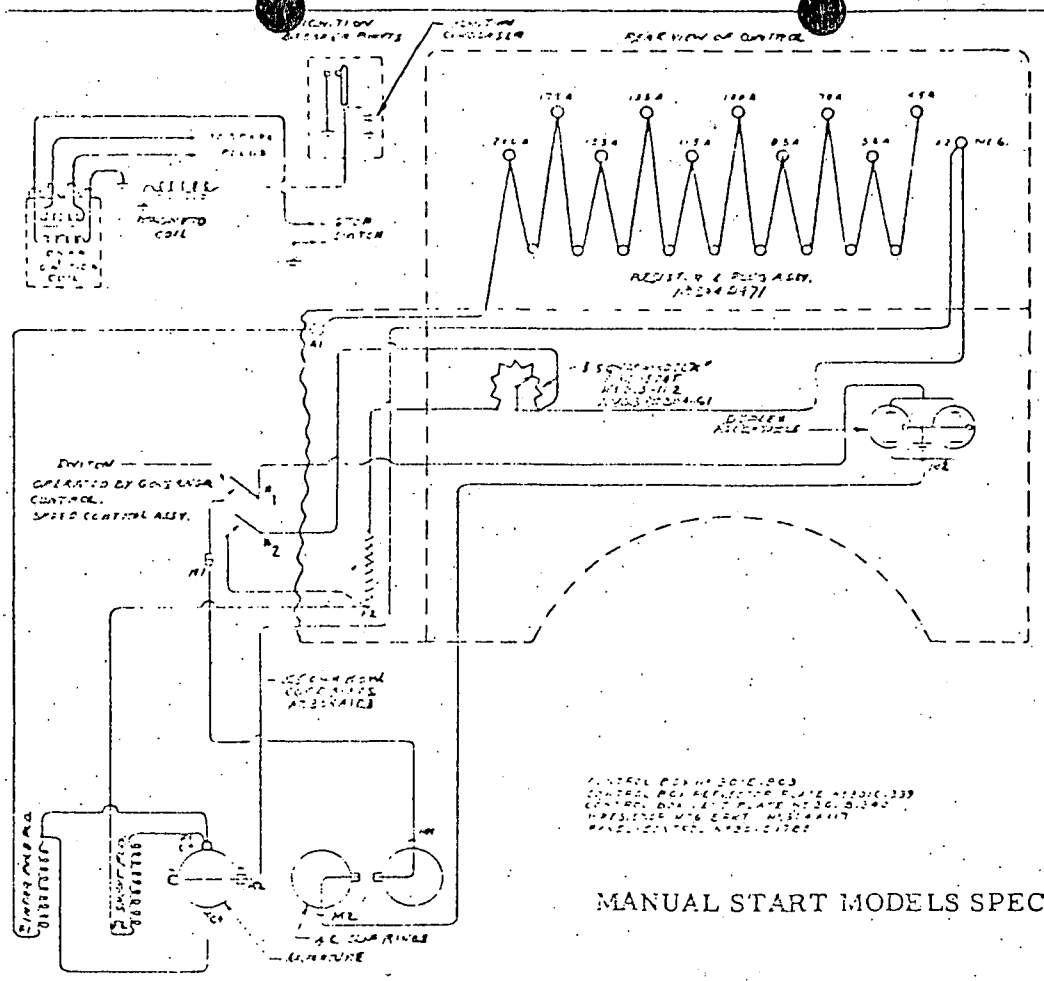
SERVICE KITS AND MISCELLANEOUS

NOTE: For other kits, refer to the group for the part in question.

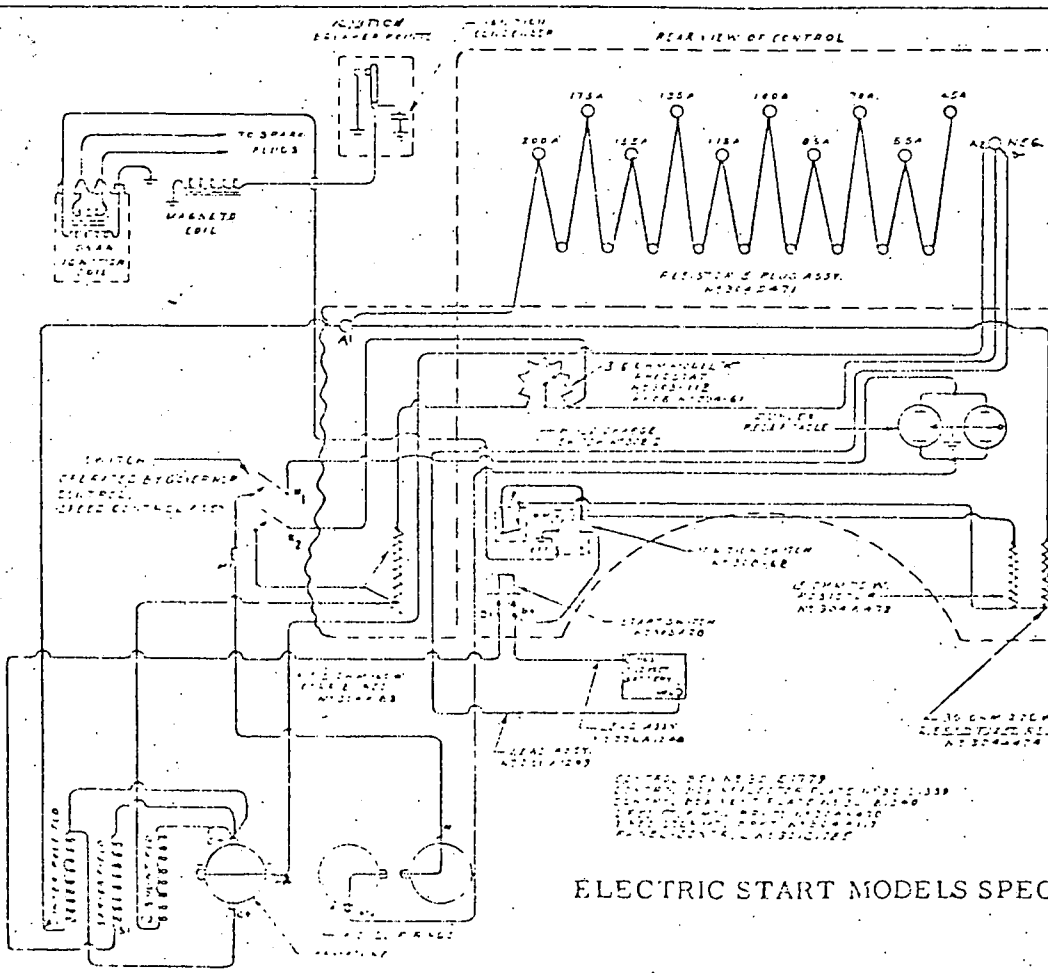
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
	168K103	1	Gasket Kit, Plant - Complete
	160K836	1	Kit, Ignition Tune-up
	168K95	1	Kit, Gasket - Carbon Removal (2 Manifold Gaskets Not Used).
	412C28	1	Cover, Canvas (optional)

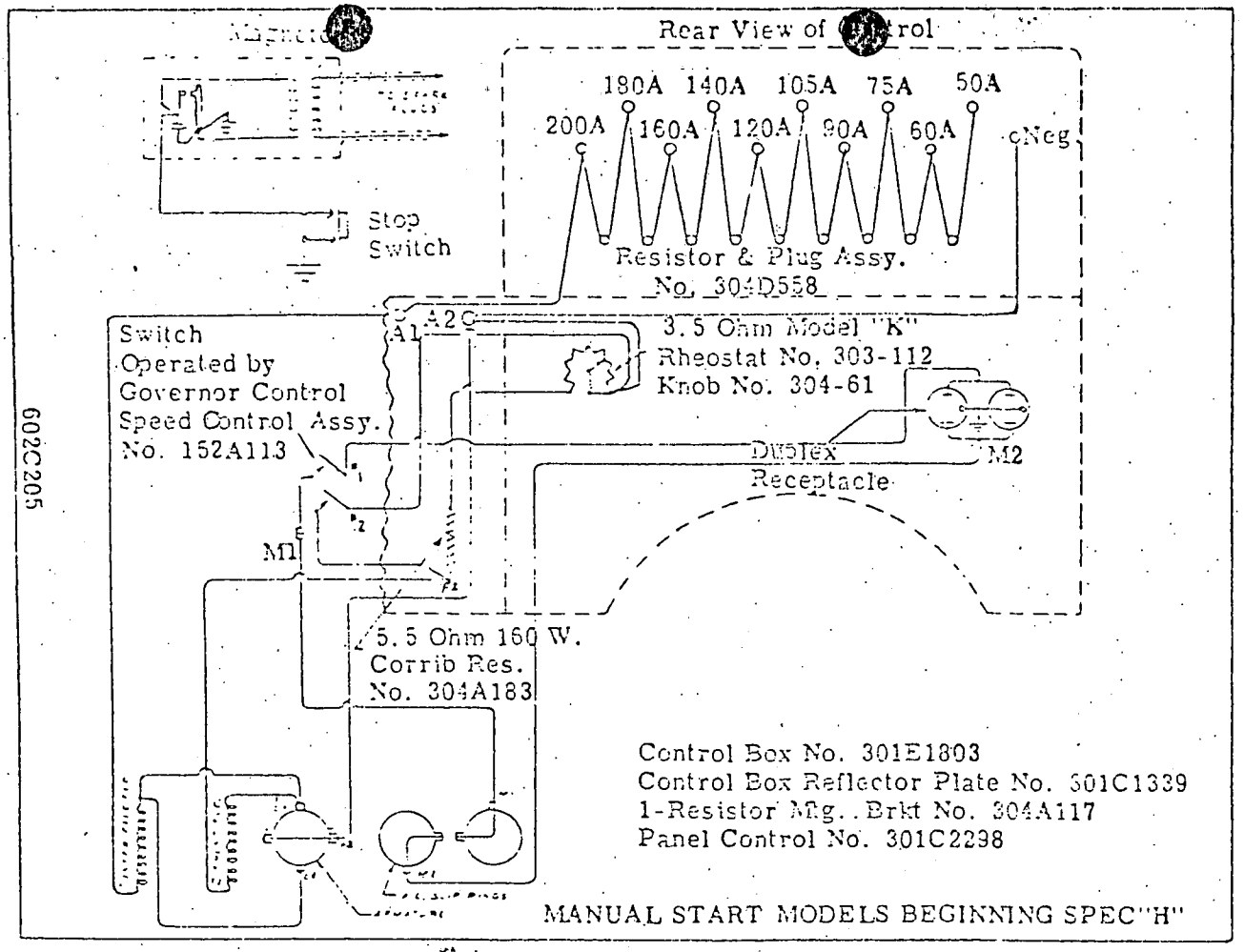
TYPICAL WIRING DIAGRAMS

602C179

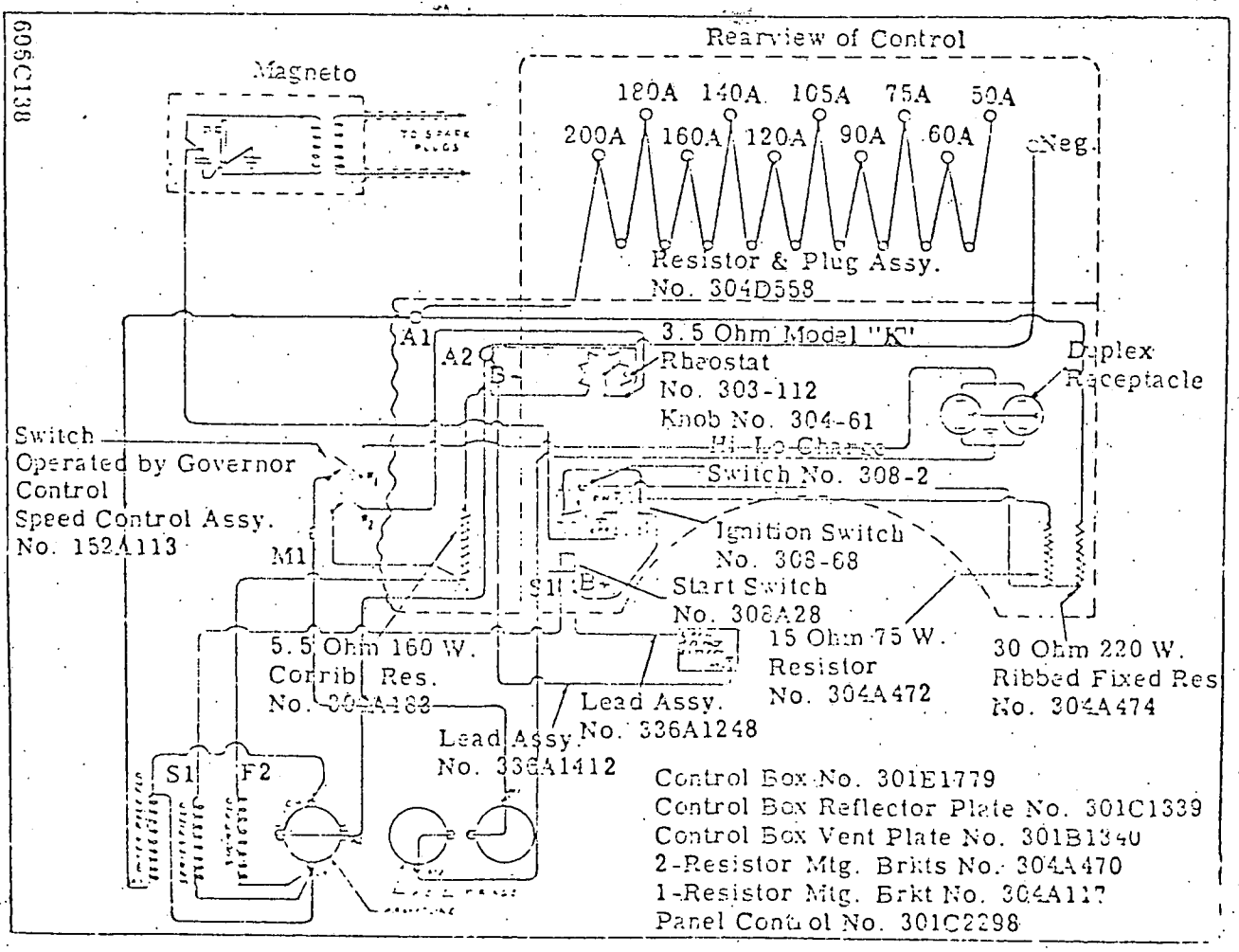


606C88





MANUAL START MODELS BEGINNING SPEC "H"



ELECTRIC START MODELS BEGINNING SPEC "H"