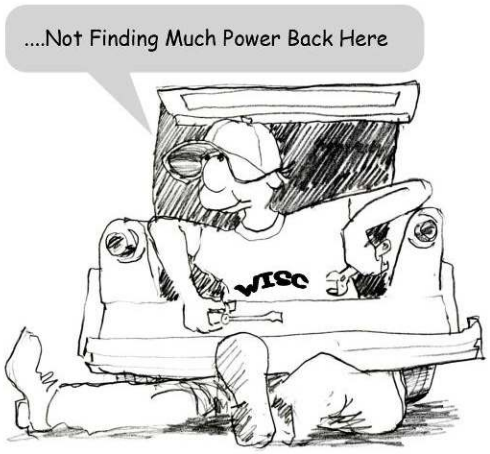


Probably the best of industrial engines of their day, Wisconsin's have stood the test of time and are well worth preserving. A well tuned example can still hold its own.

Section K Wisconsin

K-1 King Midget Power with Wisconsin Engines to 1965 *by Dave Stults*

This booklet contains information about Wisconsin engines sold to Midget Motors from April 14, 1947 to May 7, 1965. Included are engine build date and serial numbers, along with, specification numbers and engine type number.

Let's review an example. Look at the "DAILY MOTOR ASSEMBLY REPORT" dated Sept. 24, '56. On the ninth line from the bottom, it says, "Midget Motors." To the right it shows MODEL AEND, SPECIF. NUMBER 129552, AMOUNT 25, MOTOR NUMBERS 2666130 to 2666154. It shows Midget Motors customer number as 7153. Let's note some information that is here, but, not necessarily grabbing our attention. The model is AEND; the D indicates that the standard exhaust valve has been replaced with a stellite exhaust valve. The D in AENLD means the same thing.

The Specification number refers to a specification sheet numbered, in this case, 129552. Look for it among the specification sheets included in this booklet. The spec sheet starts with a basic AEN engine, as shown in the Wisconsin engine manual, then shows exceptions, such as, parts replacing standard parts, like the Stellite exhaust valve; parts added, like the Auto-Lite 6-volt starter; and those things to be omitted, listed by part number, as found in the engine manual.

The amount is the number of engines in this particular order, and, the number indicated corresponds to the motor numbers shown. One may observe that the motor (or serial) numbers don't follow in numerical order down the page of the ASSEMBLY REPORT. It would seem that an engine would have a motor number one greater than the engine made just before it, but, it isn't necessarily so. Motor numbers were stamped on the motor identification plates in a quantity equal to the order amount in advance of actual manufacture. The bundle of motor numbers was maintained intact for each order, but the orders weren't always manufactured in motor number order. So, at times, higher motor numbers were manufactured before lower motor numbers.

To find out about your engine, look at the Wisconsin Engine Assembly Information sheets. With your engine serial number, look down the Serial Numbers in Shipment

column until you find your number within the group of numbers. You'll be able to see how many engines were made in the group with your engine and the date on which they were manufactured. You will also find the specification number, so you may look at the specification number sheet to see how your engine differs from the standard engine.

DAILY MOTOR ASSEMBLY REPORT sheets are not available for all engines made; the only available one is this sample sheet.

One might add all the numbers in the Engines in Shipment column to obtain the total number of engines shown here, and say, "Ah, here's the number of King Midgets made in this time period." But that's a false assumption. There are engine build dates for all the serial numbers submitted, and, one other group of engines, of which, none are in the King Midget Registry. Therefore, there are likely other groups of engines made and installed in King Midgets that no one had knowledge of at the time this research was done. The files of information are massive; it would have been an enormous, and impossible, undertaking to search every record to determine all the Wisconsin engine purchases made by Midget Motors. There is confidence that most of the engines purchased by Midget Motors are documented here. The unknown number is believed to be relatively small.

Note: Dave sent this information to all Club members back in the nineties, in the form of a booklet containing a lot more detailed information. It's useful for helping determine when your KM was built. It is important to note though, that Midget Motors bought engines in batches and made no attempt to install them in sequence. The engine build date may well coincide with the year your car was built—but maybe not. Bob V.

Wisconsin Engine Assembly Information

Engine Build Date	Engines in Shipment	Serial Numbers in Shipment	Specification Number
4/14/47	8	includes 914202	47758
9/23/48	30	1169589 to 618	47603
9/20/51	30	1740227 to 241	77065
11/28/51	55	1786539 to 593	77065
2/ 4/52	30	1836656 to 685	77065
2/15/52	45	1845337 to 381	77065
4/29/52	30	1894607 to 636	88882
7/15/52	20	1944062 to 081	88401
7/15/52	20	1944082 to 101	89849
4/21/53	30	2113708 to 737	96250
5/21/53	30	2132856 to 885	96250
6/16/53	30	2153524 to 553	96250
7/13/53	30	2168862 to 891	96250
10/29/53	30	2212626 to 655	96250
11/25/53	30	2225690 to 719	96250
6/ 7/54	40	2308118 to 157	96250
6/16/55	30	2479957 to 986	112982
7/ 5/55	30	2497294 to 323	112982
2/ 7/56	30	2594800 to 829	112982
4/ 3/56	45	2628489 to 533	112982
9/24/56	25	2666130 to 154	129552
9/26/56	25	2667166 to 180	129552
9/27/56	20	2667455 to 474	129552
11/ 9/56	35	2684491 to 525	129552
12/ 4/56	35	2696676 to 710	129552
5/ 7/57	35	2772640 to 674	129552
9/12/57	16	2821844 to 859	146846
9/13/57	34	2821860 to 893	146846
10/15/57	35	2826886 to 920	146846
1/ 9/58	50	2852539 to 588	150157
1/21/58	50	2857035 to 084	150157
3/24/58	50	2883489 to 538	150157
5/21/58	50	2892357 to 406	150157
6/ 4/58	59	2914432 to 490	150157
7/10/58	16	2930727 to 742	150157
7/11/58	44	2930743 to 786	150157
10/17/58	40	2958153 to 192	150157
11/13/58	40	2968131 to 170	150157

Wisconsin Engine Assembly Information

Engine Build Date	Engines in Shipment	Serial Numbers in Shipment	Specification Number
1/ 2/59	1	2981908	150157
1/ 5/59	39	2981909 to 947	150157
5/24/59	50	3032228 to 277	167332
5/ 7/59	29	3042360 to 388	167332
5/ 8/59	21	3042389 to 409	167332
5/21/59	60	3047611 to 670	167332
6/22/49	60	3065912 to 971	167332
7/13/59	58	3077153 to 210	167332
11/30/59	4	3119331 to 334	167332
12/ 1/59	66	3119335 to 400	167332
3/ 3/60	59	3146727 to 785	167332
3/ 5/60	40	3154313 to 352	167332
6/ 8/60	62	3187943 to8004	182843
6/23/60	50	3190874 to 923	182843
1/26/61	50	3247775 to 824	182843
3/23/61	50	3270465 to 514	182843
6/16/61	17	3304997 to5013	182843
6/19/61	33	3305014 to 046	182843
7/17/61	40	3320053 to 092	182843
2/26/62	30	3387020 to 049	182843
4/11/62	50	3403315 to 364	182843
5/10/62	20	3419884 to 903	182843
5/11/62	20	3419904 to 923	182843
6/27/62	40	3439409 to 448	182843
1/ 2/63	30	3499456 to 485	182843
2/12/63	30	3520409 to 438	182843
4/19/63	50	3552171 to 220	182843
5/16/63	40	3565134 to 173	182843
6/12/63	40	3583070 to 109	182843
6/22/63	25	3598020 to 044	182843
4/27/64	40	3735612 to 651	182843
6/ 9/64	40	3760500 to 539	182843
10/15/64	40	3827216 to 255	182843
11/15/64	36	3851767 to 802	182843
2/19/65	12	3887744 to 755	182843
2/22/65	28	3887756 to 783	182843
5/ 7/65	40	3915098 to 137	182843

K-2 Next are 16 pages from the Wisconsin engine manual that came with Jolly McLean's King Midget. It's an AEN manual and is broadly applicable to all M2 and early M3 cars.

BOOK OF INSTRUCTIONS

WISCONSIN *Air-Cooled*

SINGLE CYLINDER ENGINE

MODEL AEN

3" Bore
3¼" Stroke
23 cu. in. Disp.

NOTE: The Model **AENS** was a high speed engine capable of operating at 3600 R.P.M. This high speed has been incorporated in the Model AEN engine and thus the Model AENS has been discontinued.

The AEN engine with **STELLITE** exhaust valve and seat insert has the letter **'D'** suffixed to the model designation and is referred to as the Model **AEND.**

Mclean

REPAIR PARTS LIST

READ THESE INSTRUCTIONS BEFORE ORDERING PARTS

THE MODEL, SPEC AND SERIAL NUMBER OF YOUR ENGINE, SHOWN ON THE NAME PLATE ATTACHED TO THE AIR SHROUD, MUST BE GIVEN WHEN ORDERING PARTS

FILL IN THE ABOVE INFORMATION ON THE PHOTO OF THE NAME AND INSTRUCTION PLATE SO THAT IT WILL BE AVAILABLE TO YOU WHEN ORDERING PARTS

193685C-1

TO INSURE PROMPT AND ACCURATE SERVICE, THE FOLLOWING INFORMATION MUST ALSO BE GIVEN

1. State exactly, quantity of each part and part number.
2. State definitely, whether parts are to be shipped by express, freight or parcel post.

SERVICE FACILITIES

Approved engine service stations, located throughout the U.S. and foreign countries, have been carefully selected by the WISCONSIN MOTOR CORPORATION in order to assure complete and efficient repair and inspection service to owners of Wisconsin Air Cooled Engines. These service stations, equipped and trained for complete engine repair, also stock parts to facilitate immediate delivery for all Wisconsin Air Cooled Engines.

A DIRECTORY OF SERVICE STATIONS CAN BE FOUND IN THE BACK OF THIS MANUAL

PARTS RETURNED FOR CREDIT

Before returning any parts, write a letter to the company from whom the parts were purchased, giving an exact list and description of the materials, why you wish to return them, whether for repairs, credit, or replacement, and also the model, specification and serial numbers of the engine from which the parts were taken. If authority is granted for their return, transportation charges must be prepaid and sender's name marked on the outside of the box or package.

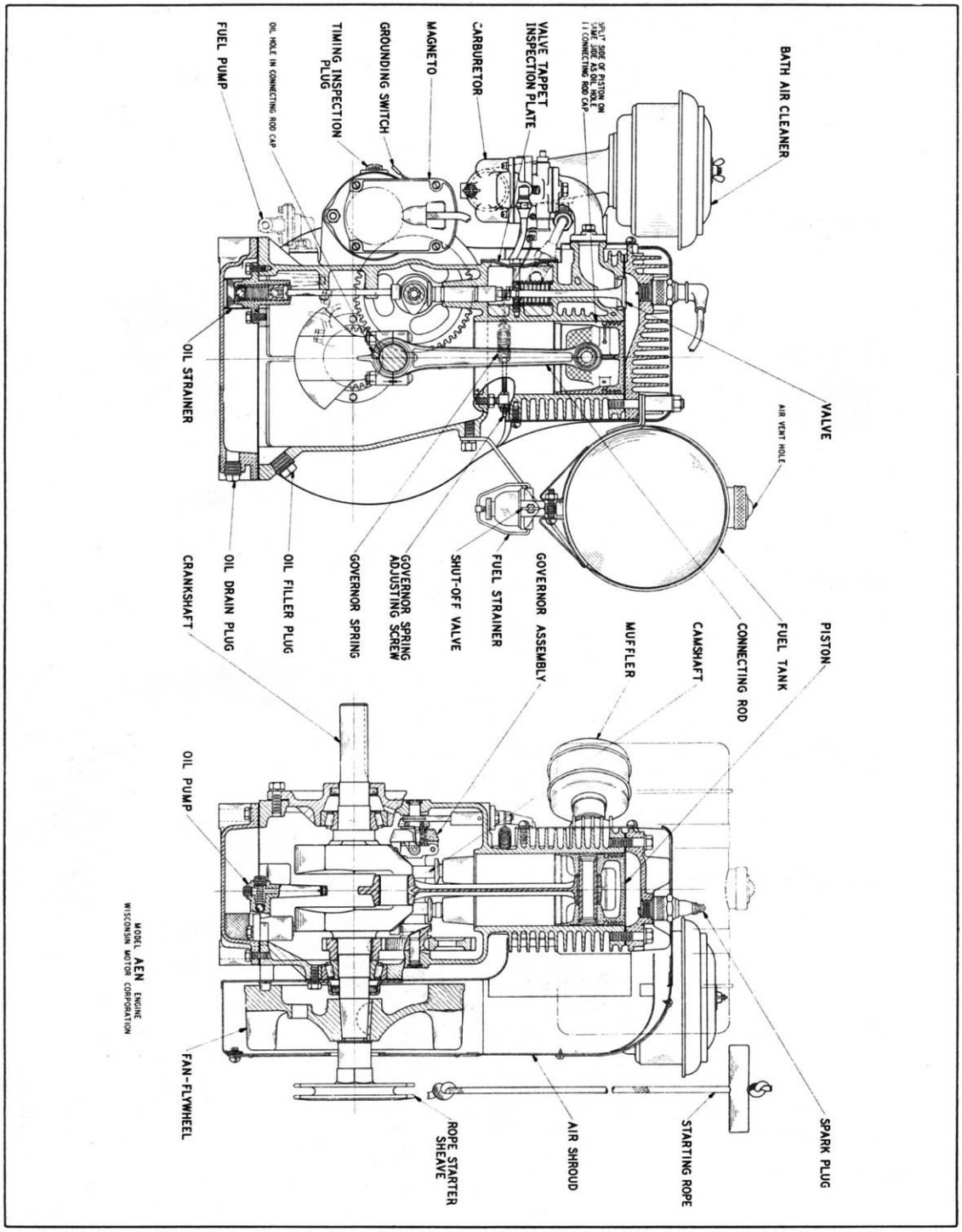


Fig. 3

SECTIONAL VIEWS OF MODEL AEN ENGINE

GENERAL DESIGN

Wisconsin engines are of the four cycle type, in which each of the four operations of suction, compression, expansion and exhaust requires a complete stroke. This gives one power stroke per cylinder for each two revolutions of the crankshaft.

COOLING

Cooling is accomplished by a flow of air, circulated over the cylinder and head of the engine, by a combination fan-flywheel encased in a sheet metal shroud. The air is divided and directed by ducts and baffle plates to insure uniform cooling of all parts.

Never operate an engine with any part of the shrouding removed, because this will retard the air cooling.

CARBURETOR

The proper combustible mixture of gasoline and air is furnished by a balanced carburetor, giving correct fuel to air ratios for all speeds and loads.

IGNITION

The spark for ignition of the fuel mixture is furnished by a high tension magneto driven off the timing gears at crankshaft speed. The magneto is fitted with an impulse coupling, which makes possible a powerful spark for easy starting. Also, the impulse coupling automatically retards the timing of the spark for starting, thus eliminating danger of a kick back from the engine when starting. When electric starter and generator are furnished, battery ignition is used. *See Page 12.*

LUBRICATION SYSTEM

A plunger type pump supplies oil to a spray nozzle which directs an oil stream against holes in the connecting rod. Part of the oil from the oil spray nozzle enters the rod bearings thru holes in the rod and the balance of the oil forms a spray or mist which lubricates the cylinder and all other internal parts of the engine. A relief valve in the oil pump plunger prevents the oil pressure from becoming momentarily too high when starting a cold engine. *See Fig. 4.*

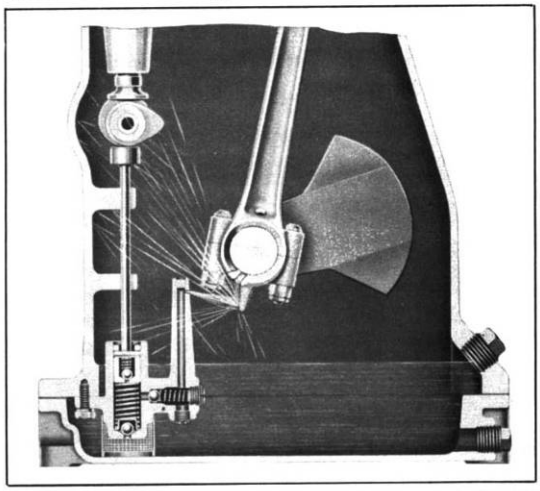


Fig. 4 141162C-1

GOVERNOR

A governor of the centrifugal flyball type, controls the engine speed by varying the throttle opening to suit the load imposed upon the engine.

ROTATION

The rotation of the crankshaft is clockwise when viewing the flywheel or starting end of the engine. This gives counter-clockwise rotation when viewing the power take-off end of the crankshaft.

HORSE POWER

R.P.M.	HORSE POWER
1600	4.5
1800	5.1
2000	5.8
2200	6.4
2400	7.0
2600	7.5
2800	7.9
3000	8.1
3200	8.2
3400	8.3
3600	8.2

The horse power given in the above chart is for an atmospheric temperature of 60° Fahrenheit, at sea level, and at a Barometric pressure of 29.92 inches of mercury.

For each inch lower Barometer reading deduct 3½% from above horsepower.

For each 10° higher temperature there will be a reduction in horsepower of 1%.

For each 1000 ft. altitude above sea level there will be a reduction in horsepower of 3½%.

The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but engines are guaranteed to develop at least 85 per cent of maximum power when shipped from the factory. The power will increase, as friction is reduced, during a few days of operation. The engine will develop at least 95% of power shown on chart when friction is reduced to a minimum.

For continuous operation allow 20% of horse power shown, as a safety factor.

INSTRUCTIONS FOR STARTING AND OPERATING

LUBRICATION

Before starting the engine, fill the base with good gas engine oil through the filler plug opening. *See*

Fig. 2. The oil should be filled to the level of the filler plug hole. Be sure the oil is clean, and also the funnels or measures used in filling.

Too much emphasis cannot be given to the matter of oil selection. High grade oil of the body suited to the requirements of your engine is the most important single item in the economical operation of the unit, yet it is the cheapest item of operating cost. Select your oil solely on quality and suitability—never on price—for no one thing is so sure to bring about unsatisfactory performance and unnecessary expense as incorrect lubrication.

High-grade, highly refined oils corresponding in body to the S.A.E. (Society of Automotive Engineers) Viscosity Numbers listed in the following chart will prove economical and assure long engine life.

GRADE OF OIL

SEASON OR TEMPERATURE	GRADE OF OIL	EXAMPLE
Spring, Summer or Autumn +120°F to +40°F	SAE 30	Mobiloil A
Winter +40°F to +5°F	SAE 20–20W	Mobiloil Arctic
Winter +5°F to −20°F	SAE 10W	Mobiloil 10W
Crankcase Capacity		3 Pts.

Important: S.A.E. Viscosity Numbers classify oils in terms of body only, without consideration of quality or character, therefore we list certain grades of ***Mobil oil*** as typical examples of lubricants possessing the qualities we believe desirable in oils for ***Wisconsin*** engines. We plainly state that these grades of ***Mobiloils*** are listed because of their recognized quality and world-wide distribution. ***There are other high quality oils on the market that are equally satisfactory for Wisconsin engines.***

Follow summer recommendations in winter if engine is housed in warm building.

Check oil level every 8 hours of operation.

The old oil should be drained and fresh oil added after every 50 hours of operation.

To drain oil, remove drain plug. *See Fig. 2.* Oil should be drained while engine is hot, as it will then flow more freely.

AIR CLEANER

The air cleaner is an essential accessory, filtering the air entering the carburetor, and thereby prolonging the life of the engine.

Unscrew wing nut and remove the cover and filtering element from the air cleaner. *See Fig. 5.* Fill bowl to oil level line with the same grade of oil as used in the crankcase.

Fig. 5 208064C

The air cleaners must be serviced frequently, depending on the dust conditions where the engines are operated. When the oil in the bowl becomes dirty it should be removed and replaced with new oil. The filtering element should be washed in solvent if it shows signs of collected dust. This servicing will vary from a few days of operation in comparatively clean conditions to twice a day in dusty conditions. Detailed instructions are printed on the Air Cleaner.

Operating the engine under dusty conditions without oil in the air cleaner or with dirty oil, may wear out cylinder, piston, rings and bearings in a few days time, and result in costly repairs.

Daily attention to the air cleaner is one of the most important considerations in prolonging engine life.

FUEL

The fuel tank should be filled with a ***good quality*** gasoline free from dirt and water. The capacity of the tank is 1½ gallons. Some of the poorer grades of gasoline contain gum which will deposit on valve stems, piston rings, and in the various small passages in the carburetor, causing serious trouble in operating, and in fact might prevent the engine from operating at all.

Use only reputable, well known brands of ***Regular*** gasoline. Fuels with the lowest possible lead content, but not below octane rating 74 (Research Method), are best. Fuel with a lower octane rating will cause detonation, and if operation is continued under this condition, severe damage will result: cylinder and piston will be scored, head gasket blown out, bearings will be damaged, etc.

Be sure to open the gasoline shut off valve below the fuel tank. *See Fig. 2.* Also be sure air vent hole in fuel tank cap is clear, otherwise gas cannot flow to carburetor.

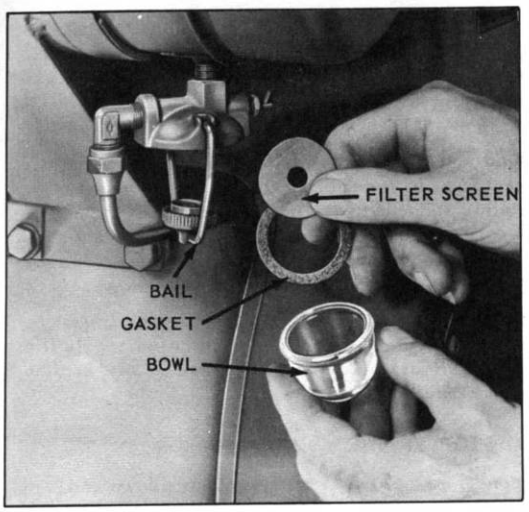


Fig. 6 208072C

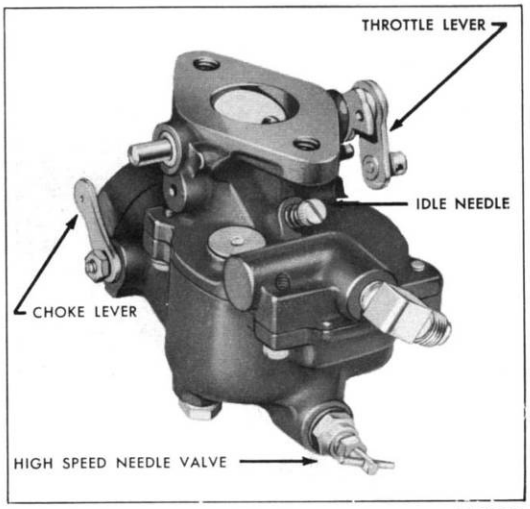


Fig. 7 140456C

GASOLINE STRAINER

The gasoline strainer on the bottom of the fuel tank is very necessary to prevent sediment, dirt, and water from entering the carburetor and causing trouble, or even complete stoppage of the engine. The glass strainer bowl should be inspected frequently and cleaned if dirt or water is present. To remove bowl, first shut off fuel valve, then loosen the knurled nut below the bowl and swing the wire bail to one side. After cleaning the bowl and screen, replace the parts, being sure that the gasket is in good condition, if not, use a new gasket. *See Fig. 6.*

CHOKE

Before starting a cold engine close the choke on the carburetor air inlet horn by pushing the choke lever upwards. *See Fig. 7.* The choke will remain closed until the engine starts, at which time it will open automatically. If the choke should accidentally snap open before the engine starts, close it again. Less choking is necessary in warm weather or when the engine is warm than when it is cold.

If after several unsuccessful attempts to start engine, gasoline begins to drip from carburetor, the choke should be opened, by pushing choke lever downward, otherwise the fuel mixture may become too rich to burn. The regular starting procedure should then continue as in paragraph on *Rope Starter, Page 9*, but with the choke open.

CARBURETOR ADJUSTMENT

The Model AEN engine is equipped with a Zenith Model 161-7 carburetor.

The high speed needle valve on this carburetor should be opened approximately ¾ to 1¼ turns. *See Fig. 7.*

After the engine is started and warmed up for several minutes, and running at normal operating speed, this needle valve should be readjusted for best operation. This adjustment need only be made the first time the engine is started.

After that the needle should be left in that position. In cold weather, starting may be facilitated by opening the needle valve slightly more, then readjusting to normal running position after engine is started. The idle needle should be adjusted for best low speed operation, while carburetor throttle is closed by hand.

For further information on carburetor see the Zenith instructions in back of this manual.

FUEL PUMP

Fuel pump is an optional accessory. Due to special machining of crankcase, fuel pump can be furnished only upon request, when engine is purchased from factory. Instructions for fuel pump maintenance and repair are located in the back of this manual.

IGNITION SWITCH

Magneto ignition is standard on these engines, with a lever type ground switch, on the side of the magneto, which is always in the **on** or running position, except when depressed for stopping the engine. *See Fig. 1.*

STARTING, ROPE STARTER

The engines are equipped with a rope starter. These have an advantage over starting cranks in that a pull on the rope will give two full revolutions of the crankshaft, with the resultant easier starting especially if direct connected loads are coupled to the engine, such as generators, compressors, or belted equipment, and when no clutch is used.

The rope should be wound on the starting sheave in a clockwise direction after the knot in the end of the rope has been inserted in the notch in the sheave.

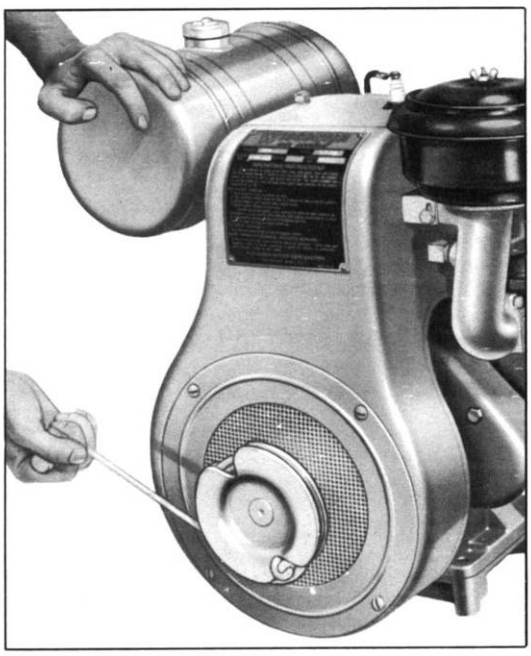


Fig. 8 140443C-1

See Fig. 8. Pull gently on the rope until increased resistance is felt on compression stroke. Now turn the sheave back one-half turn. Rewind the rope fully and pull briskly to turn the crankshaft over rapidly. If all conditions are right, engine will start promptly, after one or two applications of the rope. After engine starts, allow it to warm up a few minutes, before applying load.

WARM-UP PERIOD

When starting a gasoline engine for its days work, the engine should be allowed to warm up to operating temperature, before the load is applied. This requires only a few minutes of running of the engine at moderate speed.

Racing an engine or gunning it, to hurry the warm-up period, ***is very destructive*** to the polished wearing surfaces on piston, rings, cylinder, bearings, etc., as the proper oil film on these various surfaces cannot be established until the oil has warmed up and become sufficiently fluid. This is especially important on new engines and in cool weather.

Racing an engine by disconnecting the governor, or by doing anything to interfere with the governor control of the speed of the engine, ***is extremely dangerous.*** Quite naturally the operator of the engine desires to get all possible power out of an engine, and the engine manufacturer does his best to supply this want, but if all of this power is used merely to speed up the engine, without any load being imposed upon it, dangerously high speeds will result.

The governor is provided as a means for controlling the engine speed to suit the load applied, and also as a safety measure to guard against excessive speeds, which not only overstrain all working parts, but which might cause wrecking of the engine, and possible injury to bystanders.

All parts of the engine are designed to safely withstand any speeds which might normally be required, but it must be remembered that the stresses set up in rotating parts, increase with the square of the speed. That means that if the speed is doubled the stresses will be quadrupled, and if the speeds are trebled the stresses will be nine times as great.

Strict adherence to the above instructions cannot be too strongly urged, and greatly increased engine life will result as a reward for these easily applied recommendations.

TO STOP ENGINE

Depress magneto stop switch and hold down until engine stops. *See Fig. 1.* On engines with battery ignition, push in ignition switch on control panel.

If the engine has been running hard and is hot, do not stop it abruptly from full load, but remove the load and allow engine to run idle at 1000 to 1200 R.P.M. for three to five minutes, depending on how hot the engine has been. This will reduce the internal temperature of the engine much faster than stopping the engine, and of course the external temperature, including the manifold and carburetor will also reduce faster, due to the air circulation from the flywheel.

Two main troubles resulting from abrupt shutting off a hot engine are ***vapor lock*** and ***dieseling.*** Vapor lock will prevent the flow of fuel in the fuel lines and carburetor passages, which will result in hard starting of the engine. This can be overcome by choking the engine when cranking or waiting until the engine has cooled off sufficiently to overcome the vapor lock.

Dieseling, is caused by the carbon and lead deposits in the cylinder head being heated up to such an extent that they continue to fire the engine and keep it running after the ignition has been shut off. By idling the engine, as previously mentioned, the carbon and lead deposits cool off, break up and will blow out thru the exhaust. Have the carburetor throttle partially open when engine is shut off.

RESTORING COMPRESSION

On a new engine or on one which has been out of operation for some time, the oil may have drained off the cylinder so that compression will be weak. This may cause difficulty in starting. To remedy this condition, remove the spark plug and pour about a fluid ounce of crankcase oil through the spark plug hole into the cylinder.

Turn the engine over several times with the starting crank to distribute the oil over the cylinder wall. Then replace the spark plug and compression should be satisfactory.

When compression is proper, considerably more re-

sistance will be felt in cranking on one stroke of the piston, the compression stroke, than on the other three strokes.

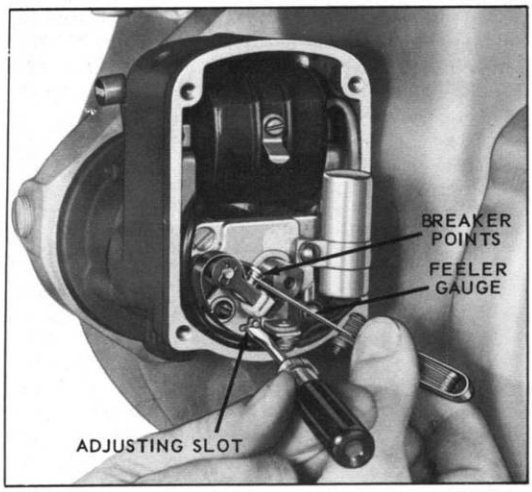
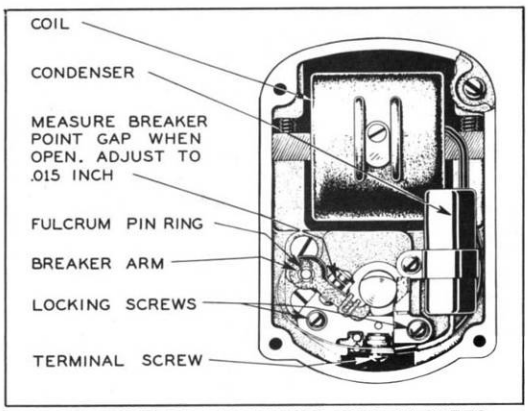


Fig. 9 208073C

MAGNETO BREAKER POINT ADJUSTMENT

Magnetos are properly adjusted and timed before leaving the factory. The breaker points on the Fairbanks-Morse magneto and Wico magneto should have an opening of .015 inch at full separation. If the spark becomes weak after continued operation, it may be necessary to readjust the breaker points. To do this first remove the end cover on the magneto. *See Fig. 9* and *10* which show the end cover removed and the breaker points of the magneto exposed. The following instructions are for the Fairbanks-Morse magneto, but can be applied to other magnetos used on this model of engine. The crankshaft should be rotated by turning the starting rope sheave by hand (this also rotates the magneto), until the breaker points are wide open. The opening or gap should then be measured with a feeler gauge and if necessary reset as shown in *Fig. 9*. To readjust points, first loosen the locking screws on the contact plate enough so that the plate can be moved. Insert the end of a small screw driver into the adjusting slot at the bottom of the contact plate and open or close the contacts by moving the plate until the proper opening is obtained. *See Fig's. 9* and *10*. After tightening the locking screws, recheck breaker point gap to make sure it has not changed. If it is found that the breaker points have become rough, they should be smoothed with a breaker point file before the above adjustments are made. Replace magneto end cover carefully so that it will seal properly. Do not force cover screws too tightly otherwise cover may crack. For further information see Fairbanks-Morse or Wico Magneto Maintenance Instructions in back of this manual.



END VIEW OF FAIRBANKS-MORSE MAGNETO
Fig. 10

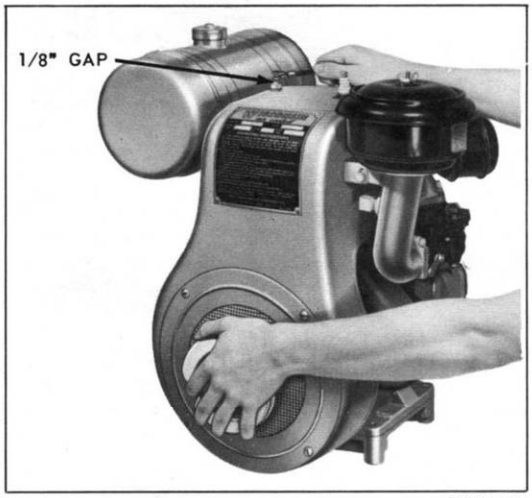


Fig. 11 140450C-1

MAGNETO IGNITION SPARK

If difficulty is experienced in starting the engine or if engine misses firing, the strength of the ignition spark may be tested by removing the ignition cable from the spark plug and holding the terminal 1/8 inch away from the cylinder head shroud stud, as shown in *Fig. 11*. Turn the engine over slowly by the starting crank as shown. When the impulse coupling on the magneto snaps, there should be a good spark at the ignition cable terminal. If there is a weak spark, or none at all, check breaker point opening as mentioned in preceding paragraph. If this does not remedy the trouble, it may be necessary to install a new condenser. See Magneto Manufacturer's Maintenance Instructions in back of this manual.

MAGNETO TIMING

The magneto is properly timed to the engine at the factory, but if for any reason it is necessary to retime the magneto, the following instructions will be helpful.

First remove the screen over the flywheel air intake opening by taking out the screws holding the screen in place. This will expose the ***timing marks*** on flywheel and shroud for timing magneto. *See Fig. 12.*

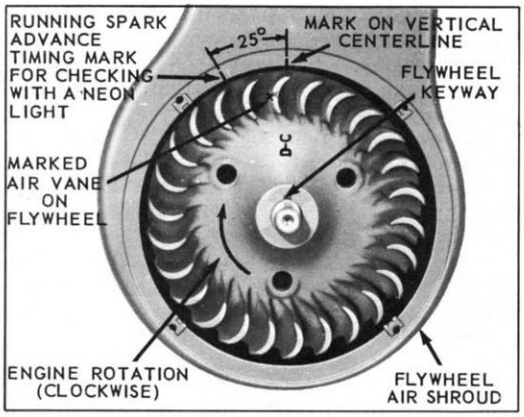


Fig. 12 208068C

Next, remove the spark plug to make cranking easier. Then turn engine over slowly with the starter sheave until the compression in the cylinder blows the air out thru the spark plug hole.

The flywheel is marked with the letters **'DC'** near one of the air circulating vanes. This vane is further identified by an **'X'** mark cast on the end. *See Fig. 12.* When the air blows out of the spark plug hole, continue turning the starter sheave until the edge of the ***marked vane*** on flywheel is on line with the ***mark*** on the ***vertical centerline*** of the shroud as shown on *Fig. 12.* Then leave flywheel in this position. At this point the ***keyway*** for mounting the flywheel is also on top.

The magneto should then be fitted to the engine so that the **'X'** marked tooth on the magneto gear is visible through the opening in timing gear housing as shown in *Fig. 13.*

When the magneto is properly timed the impulse coupling will snap when the **'DC'** and **'X'** marked vane of the flywheel, lines up with the ***mark*** on the flywheel shroud which indicate the ***vertical centerline*** of the cylinder. This can be checked by turning crankshaft over slowly by hand.

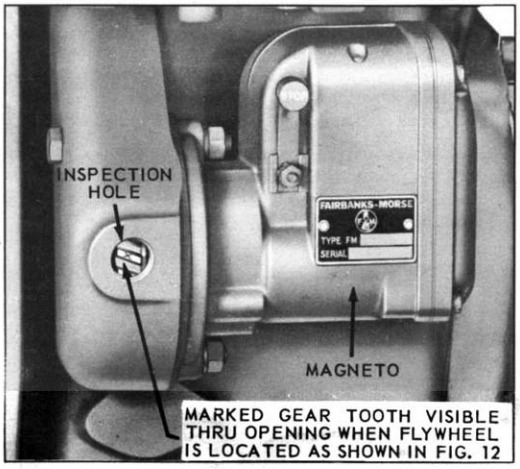


Fig. 13 208069C

The proper spark advance is 25°. For checking timing with a ***neon light,*** the running spark advance is indicated by a ***mark*** on the flywheel shroud, 25° before ***vertical centerline*** of the cylinder. *See Fig. 12.* The end of the **'X'** marked vane should be whitened with chalk or paint for this operation.

BATTERY IGNITION TIMING

These engines are properly timed at the factory, but the following instructions are given as a help in retiming, if this becomes necessary.

Remove the screen over the flywheel air intake opening by taking out the screws holding the screen in place. This will expose the timing marks on the flywheel shroud, also the **Vane** on flywheel, marked by an **'X'** and the letters **'DC'**. *See Fig. 16.* Next, remove the spark plug from cylinder and turn the engine over slowly by the rope starting sheave, at the same time holding a finger over the spark plug hole, so that the compression stroke can be determined by the air blowing out of the hole.

Upon reaching the compression stroke, continue turning the rope starting sheave until the leading edge of the ***marked vane*** on the flywheel is in line with the ***centerline mark*** on the flywheel shroud. The piston is on top dead center. *See Fig. 16.* Keep flywheel in this position.

Assuming that the timer assembly is removed from the engine, turn the ***cam,*** by means of the ***drive gear,*** in a counter-clockwise direction until the ***breaker points*** are just beginning to open. Mount timer assembly to engine, being sure that the ***oil return hole*** in the adapter is in the downward position. *See Fig. 14* which also shows the position of the timer on the engine.

The running spark advance is 25° of crankshaft or timer rotation. The timer has an automatic advance of 15°, thus requiring an initial advance setting of 10°.

With the timer assembly mounted securely in place, loosen the ***clamp lever screw.*** To get the initial 10° advance required; with the ***breaker points*** just beginning to open, turn the ***timer body*** in a clockwise direction through an angle of 10°, which is equal to 7/32 inch on the outside circumference of the timer body. Tighten ***clamp lever screw.***

If care is exercised in the above operations, the spark timing should be accurate enough for satisfactory operation, however checking spark advance with a neon lamp, as described in *'Neon Lamp Timing'*, is recommended.

The breaker point gap should be .020 inch. This opening must be checked before the timer body is set, otherwise any adjustment made to the breaker point opening will change the ignition advance adjustment. To readjust the breaker point gap, turn the engine

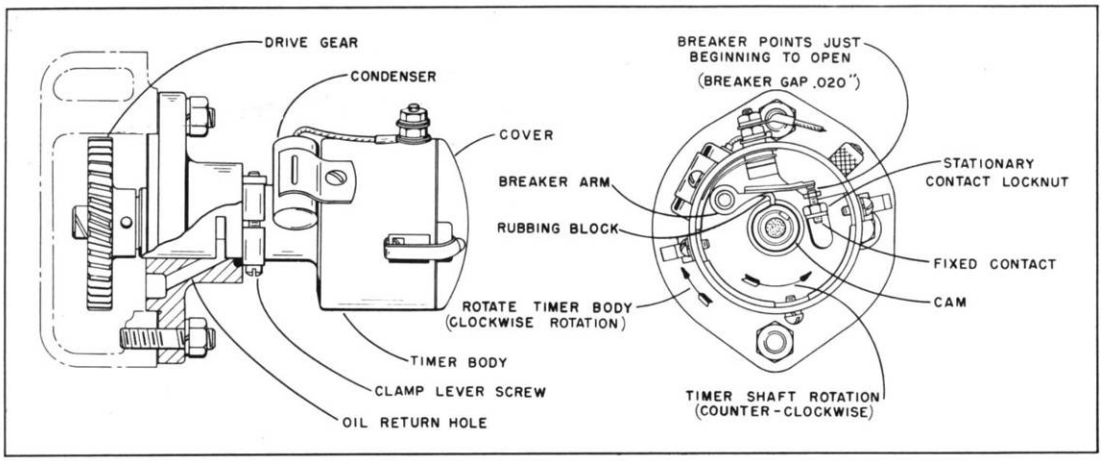


Fig. 14
IGNITION TIMER

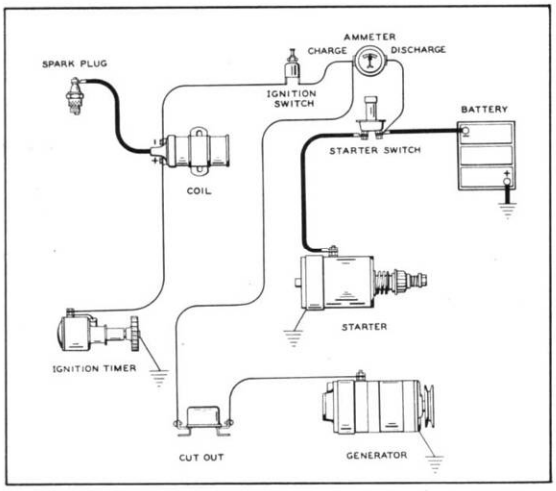


Fig. 15
WIRING DIAGRAM

over by means of the rope starter sheave so that the ignition timer breaker arm ***rubbing block*** is on a high point of the ***cam***. Loosen the ***stationary contact locknut*** and screw ***fixed contact***, in or out, until correct gap of .020 inch is obtained. Tighten locknut and recheck gap. *See Fig. 14.*

NEON LAMP TIMING FOR TIMER IGNITION

The timing should be checked with a neon lamp connected in series with the spark plug. Chalk or paint the end of the **'X'** marked vane on the flywheel, white. Then with the engine operating at 1800 R.P.M. or over, allow the flash from the neon lamp to illuminate the whitened vane. At the time of the flash, the leading edge of the vane should line up with the ***running spark advance timing mark*** on the flywheel shroud. *See Fig. 16.* If it does not, the ***clamp lever screw*** should be loosened and the timer body turned slightly clockwise or counter-clockwise, as required, until the ***advance timing mark*** and the ***white vane*** coincide.

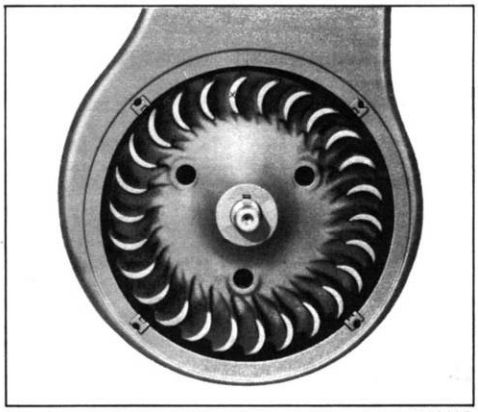


Fig. 16 208068C

Be sure ***clamp lever screw*** is then carefully tightened. If the engine is running below 1800 R.P.M. when timing, the automatic advance in the ignition timer will not be fully advanced and the timing would not be accurate.

SPARK PLUG

The spark plug gap should be thirty thousandths (.030) of an inch, and plugs should be kept clean both inside and out. *See Fig. 17.* If the porcelain insulator is cracked replace with a new plug of correct heat range, like Champion No. 8 Commercial–64K or AC No. 86S Commercial or equal. The spark thread is 18 millimeter. Be sure to use a good gasket under the spark plug. Tighten spark plugs to 24 to 26 foot pounds torque.

ELECTRIC STARTER AND GENERATOR

The electric starter is an optional accessory, furnish-

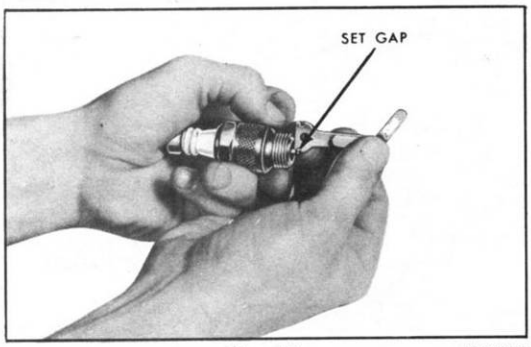


Fig. 17 104713C

ed only upon request when engine is purchased. The starter and generator cannot be mounted in the field unless provisions were made when engine was purchased. The starter and generator are products of the Electric Auto-Lite Company, Toledo, Ohio, and it is recommended that all repairs for this accessory be done through their authorized Service Stations. For wiring diagram, *see Fig. 15.* Battery is not furnished by engine manufacturer.

HIGH TEMPERATURE SAFETY SWITCH

As a safety precaution, some engines have a high temperature safety switch mounted on the cylinder head, that will automatically stop the engine when head temperatures rise beyond a safe degree.

This switch is set by the manufacturer to operate at the correct temperature. Consequently, the adjusting screw on the top of the switch should not be tampered with. If the cylinder head temperature at the spark plug reaches 505°F., the switch will automatically short out the magneto, or distributor, and stop the engine. A waiting period of about 10 minutes will be required before the switch has cooled off sufficiently to re-start the engine. An overheated engine will score the cylinder walls, burn out connecting rod and crankshaft bearings, also warp piston and valves. The cause of the overheating condition will have to be remedied before the engine is re-started. *See* **Engine Overheats** *paragraph in Troubles, Causes and Remedies section.*

SAFETY PRECAUTIONS

Never fill fuel tank while engine is in operation or hot, as danger from fire would be incurred.

Never operate engine in a closed building unless the exhaust is piped outside. This exhaust contains carbon monoxide, a poisonous, odorless and invisible gas, which if breathed into the lungs would cause serious illness and possible death.

Never make adjustments on machinery while it is connected to the engine, without first removing the ignition cables from the spark plug. Turning over the machinery by hand during adjusting or cleaning might start the engine, and machinery with it, causing serious injury to the operator.

Always keep all parts of the engine clean. This will prolong engine life, and give more satisfactory operation.

Every 4 to 8 hours depending on dust conditions, check air cleaner and change oil. *See Page 8.*

Every 8 hours check crankcase oil level. Keep filled to level of oil filler hole. *See Fig. 2.*

Every 50 hours drain crankcase and refill with fresh oil. *See Lubrication, Page 7.*

TROUBLES CAUSES AND REMEDIES

Three prime requisites are essential to starting and maintaining satisfactory operation of gasoline engines. They are:

1. ***A proper fuel mixture*** in the cylinder.
2. ***Good compression*** in the cylinder.
3. ***Good spark, properly timed,*** to ignite the mixture.

If all three of these conditions do not exist the engine cannot be started. There are other factors which will contribute to hard starting; such as, too heavy a load for the engine to turn over at a low starting speed, a long exhaust pipe with high back pressure, etc. These conditions may affect the starting, but do not necessarily mean that the engine is improperly adjusted.

As a guide to locating any difficulties which might arise the following causes are listed under the three headings: ***Fuel Mixture, Compression,*** and ***Ignition.***

In each case the causes of trouble are given in the order in which they are most apt to occur. In many cases the remedy is apparent, and in such cases no further remedies are suggested.

STARTING DIFFICULTIES

FUEL MIXTURE

No fuel in tank or fuel shut-off valve closed.

Fuel pump diaphragm worn out, so pump does not supply carburetor with fuel.

Carburetor not choked sufficiently, especially if engine is cold. *See 'Choke', Page 9.*

Water, dirt, or gum in gasoline interfering with free flow of fuel to carburetor.

Poor grade or stale gasoline that will not vaporize sufficiently to form the proper fuel mixture.

Carburetor flooded, caused by too much choking especially if engine is hot. *See 'Choke', Page 9.*

Dirt or gum holding float needle valve in carburetor open. This condition would be indicated if fuel continues to drip from carburetor with engine standing idle. Often tapping the float chamber of the carburetor very lightly with the wood handle of a screw driver or similar instrument will remedy this trouble.

Do not strike carburetor with any metal tools, it may be damaged. Also if the mixture in the cylinder, due to flooding, is not too rich to start the engine, starting should be tried, as it will usually correct the trouble. In this case the choke should be left open.

If, due to flooding, too much fuel should have entered the cylinder in attempting to start the engine, the mixture will most likely be too rich to burn. In that case the spark plug should be removed from the cylinder and the engine then turned over several times with the starting sheave, so the rich mixture will be blown out through the spark plug hole. The choke on the carburetor should of course be left open during this procedure. The plug should then be replaced and starting tried again.

To test for clogged fuel line, loosen fuel line nut at carburetor slightly. If line is open, fuel should drip out at loosened nut.

COMPRESSION

If the engine has proper compression, considerable resistance will be encountered in the pull on the starting sheave. If this resistance is not encountered, compression is faulty. Following are some reasons for poor compression:

Cylinder dry due to engine having been out of use for some time. *See 'Restoring Compression', Page 10.*

Loose spark plug or broken spark plug. In this case a hissing noise will be heard in cranking engine due to escaping gas mixture on compression stroke.

Damaged cylinder head gasket or loose cylinder head. This will likewise cause hissing noise on compression stroke.

Valve stuck open due to carbon or gum on valve stem. To clean valve stems, *see 'Valves', Page 18.*

Valve tappets adjusted with insufficient clearance under valve stems. *See 'Valve Tappets', Page 18.*

Piston rings stuck in piston due to carbon accumulation. If rings are stuck very tight this will necessitate removing piston and connecting rod assembly and cleaning parts. *See 'Piston and Connecting Rod', Page 19.*

Scored cylinder. This will require reboring of the cylinder and fitting with new piston and rings. If scored too severely an entirely new cylinder crankcase may be necessary.

IGNITION

See 'Magneto Ignition Spark', Page 11 or 'Battery Ignition Timing', Page 12. No spark may also be attributed to the following:

Ignition cable disconnected from magneto, timer, coil or spark plug.

Broken ignition cables, causing short circuits.

Ignition cable wet or oil soaked.

Spark plug insulator broken.

Spark plug wet or dirty.

Spark plug point gap wrong. *See Page 13.*

Condensation on spark plug electrodes.

Magneto or Timer breaker points pitted or fused.

Magneto or Timer breaker arm sticking.

Magneto or Timer condenser leaking or grounded.

Spark timing wrong. *See 'Magneto Timing', Page 11,* or *'Battery Ignition Timing', Page 12.*

ENGINE MISSES

Spark plug gap incorrect. *See Page 13.*

Worn and leaking ignition cable.

Weak spark. *See 'Magneto Ignition Spark', Page 11,* or *'Battery Ignition Timing', Page 12.*

Loose connections at ignition cable.

Magneto or Timer breaker points pitted or worn.

Water in gasoline.

Poor compression. *See 'Compression', Page 15.*

ENGINE SURGES OR GALLOPS

Carburetor flooding.

Governor spring hooked into wrong hole in lever, or governor rod incorrectly adjusted. *See 'Governor Adjustment', Page 21.*

ENGINE STOPS

Fuel tank empty.

Water, dirt or gum in gasoline.

Gasoline vaporized in fuel lines due to excessive heat around engine (Vapor Lock). *See 'Stopping Engine', Page 10.*

Vapor lock in fuel lines or carburetor due to using winter gas (too volatile) in hot weather.

Air vent hole in fuel tank cap plugged. Engine scored or stuck due to lack of oil.

Ignition troubles. *See 'Ignition', Page 15.*

ENGINE OVERHEATS

Crankcase oil supply low. Replenish immediately.

Ignition spark timed wrong. *See 'Magneto Timing', Page 11,* or *'Battery Ignition Timing', Page 12.*

Low grade of gasoline.

Engine overloaded.

Restricted cooling air circulation.

Part of air shroud removed from engine.

Dirt between cooling fins on cylinder head.

Engine operated in confined space where cooling air is continually recirculated, consequently becoming too hot.

Carbon in engine.

Dirty or incorrect grade of crankcase oil.

Restricted exhaust.

Engine operated while detonating due to low octane gasoline or heavy load at low speed.

ENGINE KNOCKS

Poor grade of gasoline or of low octane rating. *See 'Fuel', Page 8.*

Engine operating under heavy load at low speed.

Carbon or lead deposits in cylinder head.

Spark advanced too far. *See 'Magneto Timing', Page 11,* or *'Battery Ignition Timing', Page 12.*

Loose or burnt out connecting rod bearing.

Engine overheated due to causes under previous heading.

Worn or loose piston pin.

ENGINE BACKFIRES THROUGH CARBURETOR

Water or dirt in gasoline.

Engine cold.

Poor grade of gasoline.

Sticky inlet valve. *See 'Valves', Page 18.*

Overheated valves.

Spark plug too hot. *See 'Spark Plug', Page 13.*

Hot carbon particles in engine.

DISASSEMBLING AND REASSEMBLING ENGINE

Engine repairs should be made only by a mechanic who has had experience in such work. When disassembling the engine it is advisable to have several boxes available so that parts belonging to certain groups can be kept together, such as, for instance, the cylinder head screws, etc. Capscrews of various lengths are used in the engine, therefore great care must be exercised in reassembly so the right screw will be used in the various places, otherwise damage may result.

Tighten the cap screws and nuts of the manifold, cylinder head, engine base, connecting rod, main bearing plate and the spark plug to the specified torque readings indicated in the following paragraphs of reassembly.

While the engine is partly or fully dismantled, all of the parts should be thoroughly cleaned. Remove all accumulated dirt between the fins.

If it is desired to disassemble the engine, the following order should be substantially adhered to. As disassembly progresses, the order may be altered somewhat if desired, as will be self-evident to the mechanic. Reassembly of the engine should be made in the reverse order.

ACCESSORIES

Electrical equipment and other special accessories should be removed first.

FUEL TANK

To remove the fuel tank with bracket and strainer, disconnect fuel line at strainer, remove air shroud cover and the two capscrews holding bracket to crankcase, *see Fig. 18.*

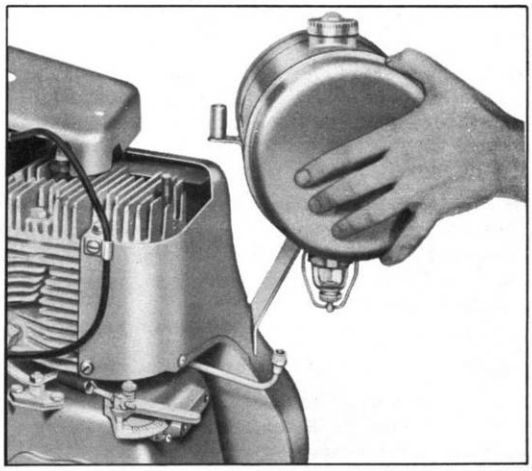


Fig. 18 140436C-1

STARTING SHEAVE AND FLYWHEEL SCREEN

Remove starting rope sheave from crankshaft by unscrewing sheave with a wrench applied to hexagon hub of sheave, *see Fig. 19.* Also remove the flywheel screen, *Fig. 20.*

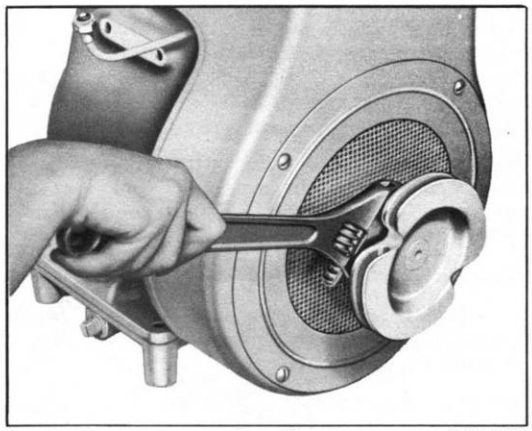


Fig. 19 140445C-1

FLYWHEEL

The flywheel is mounted to a taper on the crankshaft. Take a firm hold on the flywheel fins, pull outward

ZENITH 161 SERIES CARBURETORS

FOR WISCONSIN MOTOR CORPORATION

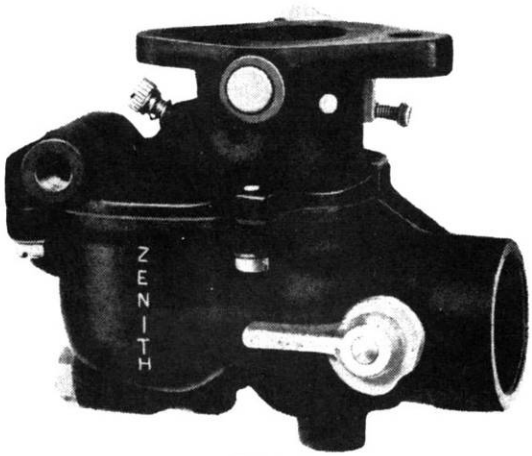


Figure 1

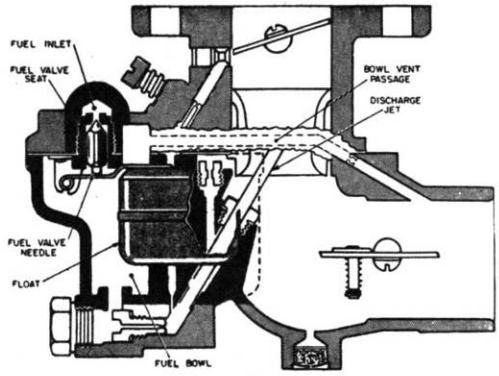
The Zenith 61 and 161 Series carburetors are of updraft single venturi design. They are made in 5/8" and 7/8" S.A.E. barrel sizes; with 5/8", 7/8", 1" and 1¼" S.A.E. flange sizes available. They are made with selective fuel inlet, with or without a back suction economizer and a main jet adjustment.

They are "balanced" and "sealed", and the semi-concentric fuel bowl allows operation to quite extreme angles without flooding or starving. This design makes them particularly adaptable to smaller farm tractors and a great variety of agricultural machines and industrial units.

FUEL SUPPLY SYSTEM

The fuel supply system is made up of the threaded fuel inlet, the fuel valve seat, fuel valve, float and fuel bowl.

The fuel supply line is connected to the threaded inlet. The fuel travels through the fuel valve seat and passes around the fuel valve and into the fuel bowl. The level of the fuel in the fuel chamber is regulated by the float through its control of the fuel valve. The fuel valve does not open and close alternately but assumes an opening, regulated by the float, sufficient to maintain



FUEL SUPPLY SYSTEM

Figure 2

a proper level in the fuel chamber equal to the demand of the engine according to its speed and load.

The inside bowl vent as illustrated by the passage originating in the air intake and continuing through to the fuel bowl, is a method of venting the fuel bowl to maintain proper air fuel mixtures even though the air cleaner may become restricted. This balancing is frequently referred to as an "inside bowl vent."

IDLE SYSTEM

The idle system consists of the idle discharge port, idle air passage, idle adjusting needle, idle jet, and fuel passage.

The fuel for idle is supplied through the main jet to a well directly below the main discharge jet. The pick-up passage is connected to this well by a restricted drilling at the bottom of this passage. The fuel travels through this channel to the idle jet calibration. The air for the idle mixture originates back of (or from behind) the main venturi. The position of the idle adjusting needle in this passage controls the suction on the idle jet and thereby the idle mixture. Turning the needle in closer to its seat results in a greater suction with a smaller amount of air and therefore a richer mixture. Turning the needle out away from its seat increases the amount of air and reduces the suction, and a leaner mixture is delivered. The fuel is atomized and mixed with

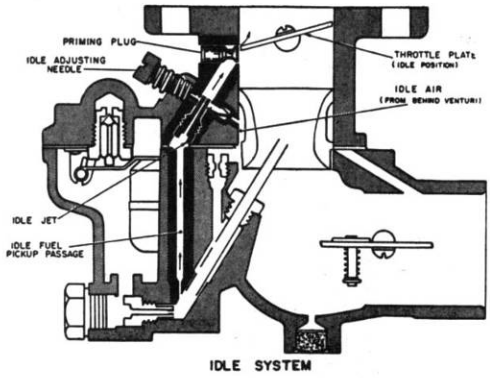


Figure 3

the air in the passage leading to the discharge port (or priming plug) and enters the air stream at this point.

HIGH SPEED SYSTEM

The high speed system controls the fuel mixture at part throttle speeds and at wide open throttle. This system consists of a **venturi,** controlling the maximum volume of air admitted into the engine; the **main jet,** which regulates the flow of fuel from the float chamber to the main discharge jet; the **well vent,** which maintains uniform mixture ratio under changing suction

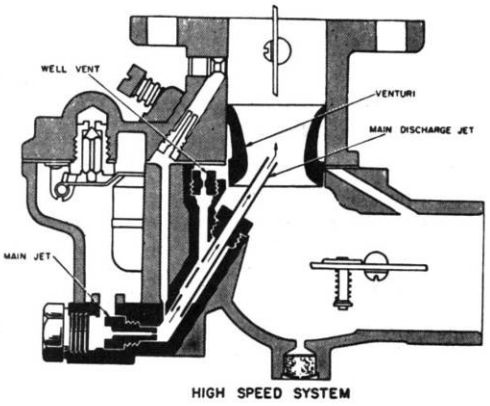


Figure 4

and engine speeds; and a **main discharge jet,** which delivers the fuel into the air stream.

The main jet controls the fuel delivery during the part throttle range from about one-quarter to full throttle opening. To maintain a proper mixture ratio a small amount of air is admitted through the well vent into the discharge jet through the air bleed holes in the discharge jet at a point below the level of fuel in the metering well.

The passage of fuel through the high speed system is not a complicated process. The fuel flows from the fuel chamber through the main jet and into the main discharge jet where it is mixed with air admitted by the well vent, and the air-fuel mixture is then discharged into the air stream of the carburetor.

CHOKE SYSTEM

The choke system consists of a valve mounted on a shaft located in the air entrance and operated externally by a lever mounted on the shaft. The choke valve is used to restrict the air entering the carburetor. This increases the suction on the jets when starting the engine. The choke valve is of a "semi-automatic" type, having a poppet valve incorporated in its design, which is controlled by a spring.

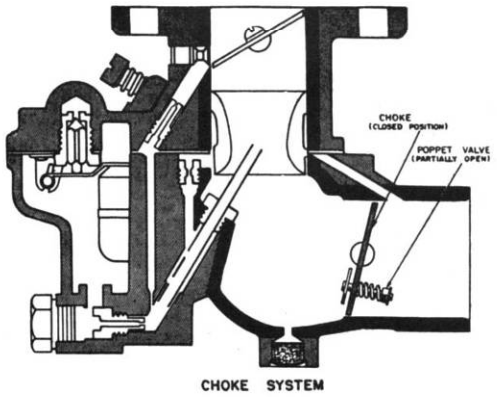
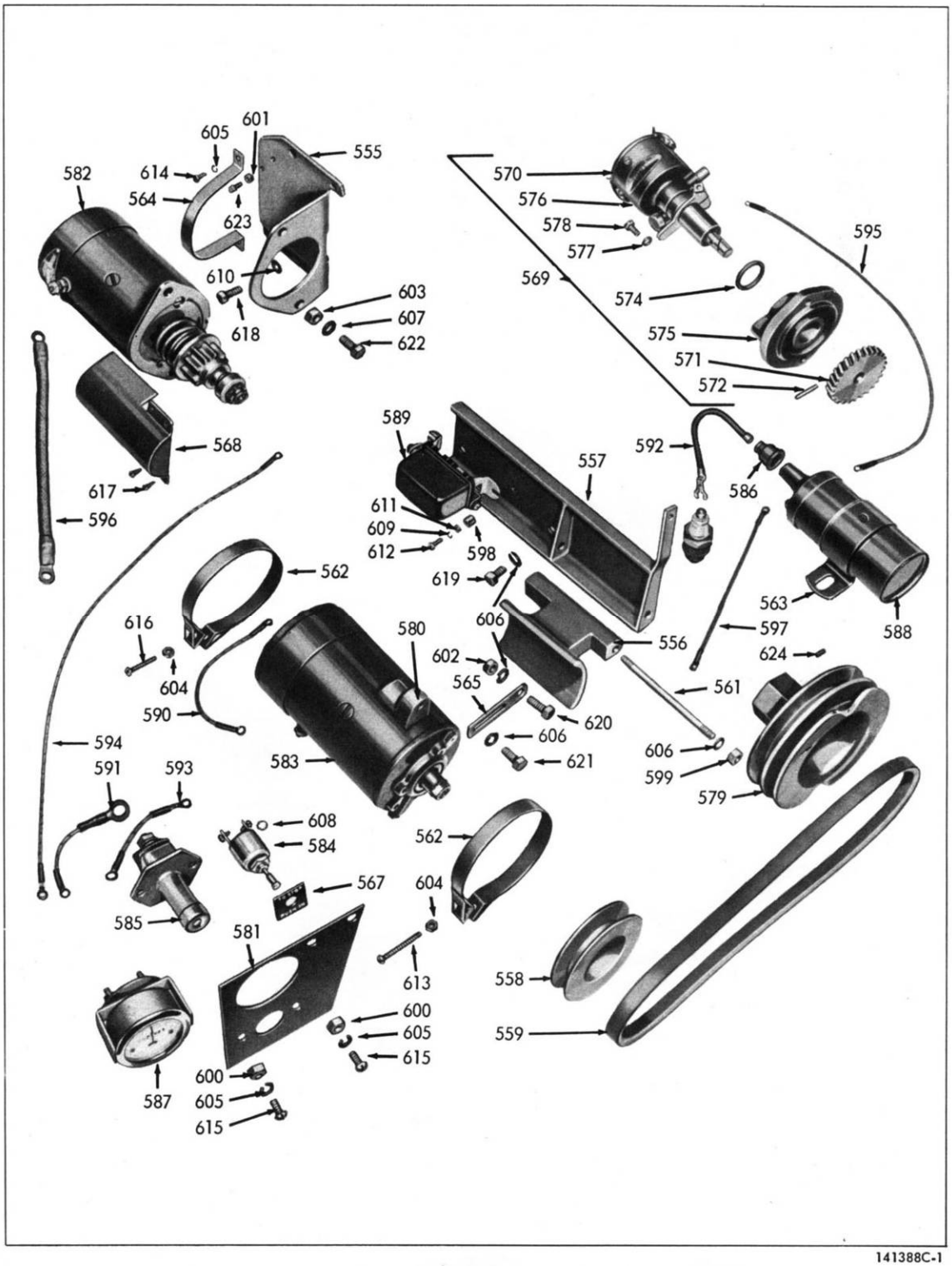


Figure 5

The poppet valve opens automatically when the engine starts and admits air to avoid **over-choking** or **flooding** of the engine. The mixture required for starting is considerably richer than that needed to develop power at normal temperatures. As the engine fires and speed and suction are increased, the mixture ratio must be rapidly reduced. This change is accomplished through adjustment of the choke valve and the automatic opening of the poppet valve to admit more air when the engine fires.

ELECTRIC STARTER AND GENERATOR WITH TIMER IGNITION
FOR MODEL AEN ENGINE



141388C-1

Parts are identified by reference number. See parts list for correct part number.

K-3 LETTERS: Engine Cover Removal

I am cleaning my engine for paint prep. I would like to remove the freewheeling pulley that does not hook up to anything on the passenger side (opposite side of the clutches) of the engine. I would then remove the screen between this pulley and the engine, straighten the screen out and clean it up, paint it and put the pulley and screen back on. Is this pulley removable? And if so how? Thanks! **Ian Grout**

I think that you are describing the starting sheave. It is for a rope starter. According to the Wisconsin shop book it should unscrew if turned counter-clockwise. There is a hex on the inside of the sheave for a wrench. You will have to find a way of holding the shaft so it doesn't turn. I got my shop manual on eBay. Put "AENL" in the search box. Good luck, ***Don Balmer*** □

K-4 LETTERS: Wisconsin & Oil

Hi, I have had engine problems with my Wisconsin overheating and losing power. Then it started to knock. When I tore it down the piston pin had apparently seized in the rod and or piston. The cylinder is messed up to the point I took it in to get it sleeved. The mechanic questioned whether the cam was different for cars and stationary engines. Does anyone know if there are different cams for different uses on Wisconsin engines? **Don Balmer**

The governor is removed from King Midget engines. You were probably a victim of sludge/lack of oil flow. These engines were designed to be run on a straight-weight oil. Be sure to use an air-cooled motorcycle type oil. They ARE different. Make sure nothing is inhibiting the air flow from the flywheel across the cylinder and head. ANY air cooled engine needs proper air flow. **Skip**

Hey Y'all. I was wondering if it would be a good idea [to use] a high-end Harley synthetic or its equal? Is there an advantage to synthetic? **Alan Day**

I've been using synthetic oils for many years and swear by them. 200,000 mile engines still have the hone marks in the cylinders. They claim to lubricate up their flash point, about 575 degrees. **Lou**

Hi, The shop which is putting a sleeve in my Wisconsin AENL is suggesting that I have the cam reground so that "the engine won't have to work as hard." It seems to me that if there was something to gain from this the manufacturer would have done it when they built it. **Don Balmer**

Your cam was ground for a stationary engine or some piece of construction equipment. That means it gets max hp at about 2500 rpm. I would not regrind the cam for more rpm because the rod, crank and flywheel weigh a ton. You get that much weight moving too fast it will come apart. On the oil issue, I like to use straight 30-weight in air cooled splash oil system engines, but multiviscosity in engines with pressure lube. That's because there is a filter to help cool the oil on most pressure systems and the oil is pumped thru passages close to the outside of the engine to help cool the oil. **Paul Gerhardt** □

K-5 Wisconsin Parts and Plugs

According to Scott Olene's parts man, the following are the parts you *can't* buy new; the oil pump, the crankshaft, the block, possibly the air cleaner neck, and the timer body. The rest of the parts are available from the factory (at inflated prices; has to do with the EPA).

Al Good asked the Yahoo Group about proper spark plugs for his Wisconsin. Don Balmer replied, the "… shop manual says Champion D-16 or AC C86 with a .030 gap. The Wisconsin AENL shop manual is available on line. Go to the Wisconsin Engine web site and it is there. All of the parts are still available." □

K-6 New Data Plates *By Bob V.*

Back before I'd seen the data plate copy in the Wisconsin manual, a KM fan asked if anything could be done to restore his engine's data plate. The photo at left below is his original. The one at right is a reconstruction using PhotoShop. Close inspection will reveal many small variations in type, spacing the like, but probably no one would notice. The original is in color and could be adapted to different serial numbers.

How to translate this to a metal plate that would stand up is unclear. Perhaps if printed by color laser printer to an adhesive film that could be bonded to an aluminum plate? □

K-7 Seeping Wisconsins *by John White II*

In rebuilding Wisconsin engines, brush some sealer (Permatex #2) on the threads of any bolt that goes through the block to the inside. If not, they'll seep oil around the bolts. □