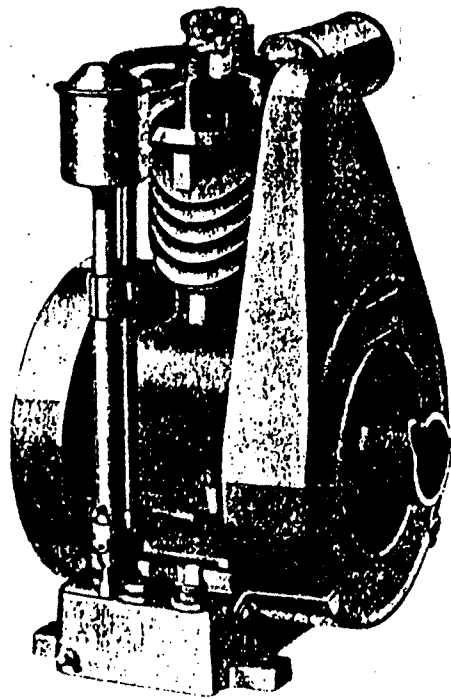


COURTESY OF
BRIGGS & STRATTON

INSTRUCTIONS

TYPE "FH"

Fullpower Briggs-Stratton Engine



BRIGGS & STRATTON CORP.

MILWAUKEE



WISCONSIN

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IMPORTANT SAFETY INFORMATION AND INSTRUCTIONS FOR ENGINE SELECTION ENGINE INSTALLATION ENGINE OPERATION

In the USA and Canada,
our 24 hour hotline is:

18002333723

Briggs & Stratton Corporation
Milwaukee, Wisconsin 53201

www.briggsandstratton.com

Keep these instructions for future reference.





Before installing and operating this engine read and observe all warnings, cautions and instructions on both sides of this sheet, on the engine, and in the operating & maintenance instructions.


NOTE: This sheet of instructions and safety information is not meant to cover all possible conditions and situations that may occur. Read entire Operating & Maintenance Instructions for this engine AND the instructions for the equipment this engine powers. Failure to follow instructions and safety information could result in serious injury or death.

The safety alert symbol () is used to identify safety information about hazards that can result in personal injury.

A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

 **DANGER** indicates a hazard which, if not avoided, will result in death or serious injury.

 **WARNING** indicates a hazard which, if not avoided, could result in death or serious injury.

 **CAUTION** indicates a hazard which, if not avoided, might result in minor or moderate injury.

CAUTION, when used **without** the alert symbol, indicates a situation that **could result in damage to the engine.**

HAZARD SYMBOLS AND MEANINGS



Fire



Explosion



Moving Parts



Toxic Fumes



Hot Surface



Shock



Kickback

(OVER)

FORM MS-6445-01/03

ENGINE SELECTION



 WARNING



Failure to select the correct engine could result in fire or explosion.



- Some engines are unique and designed for specific applications or types of equipment. If this engine will be used to build new equipment, contact Briggs & Stratton to ensure that the engine is appropriate for the intended use.
Note: For all Go-karts use only a model 136200 series engine, which offers improved safety and performance.
- Replacement engines should be the same model as the original engine, or be the Briggs & Stratton designated replacement engine. Refer to the Operation & Maintenance Instructions for engine identification information.
Note: For all Go-karts use only a model 136200 series engine, which offers improved safety and performance.
- Do not use Briggs & Stratton engines on 3-wheel All-Terrain Vehicles (ATVs), motor bikes, air craft products, or vehicles intended for use in competitive events. Briggs & Stratton does not approve of or authorize such uses.

ENGINE INSTALLATION



- [1] Do not attempt to install this engine if you do not have the appropriate tools and knowledge of small engine installation procedures. Use only Briggs & Stratton parts. Contact your Authorized Service Dealer for assistance.
- [2] Do not modify the engine in any way without Briggs & Stratton factory approval. Any such modification is at the owner's sole risk.
- [3] If the exhaust system on the old engine was supplied by the equipment manufacturer, you must transfer the exhaust system and related components (original muffler and related pipes, brackets, clamps, and shields) to the new engine. All components must be in good condition.
- [4]



 WARNING	Install muffler (and muffler deflector if used) so outlet points away from operator, fuel tank, and equipment, and so muffler heat will not damage or deform engine and components.
	
- [5]



 WARNING	Ensure all fuel lines and fittings are properly assembled and do not leak. Replacement parts must be the same model as the original.
	
- [6]



 WARNING	Ensure all wiring, including safety switches and engine shut-off components are completely installed and functioning properly.
	
- [7] Set engine speed to equipment manufacturer's specification. Refer to equipment manufacturer's manual. Do not tamper with governor springs, or other parts that will increase engine speed above specification.

- [8]

 WARNING	
When adding fuel:	
- [9]

 WARNING	
When starting engine:	
- [10]

 WARNING	
When operating equipment:	
- [11]

 WARNING	
When adding fuel:	







All engine parts, including fuel cap, spark plug, muffler, air cleaner, and covers and guards for drive components (gears, belts, shafts, couplings, etc.) must be in place before attempting to start engine.

If engine is installed on walk behind lawn mower, all mower components, including cutting blade, must be correctly installed before attempting to start engine.

When working on the engine or equipment, remove spark plug wire from spark plug. For electric start, remove negative wire from battery.

Do not check for spark with spark plug removed. Use Briggs & Stratton spark tester #19368.

ENGINE OPERATION

	 WARNING
	When adding fuel:
<p>Turn engine off and let engine cool at least 2 minutes before removing gas cap.</p> <p>Fill fuel tank outdoors or in well-ventilated area. Fill tank to about 1 inch below lowest portion of neck to allow for fuel expansion.</p> <p>Keep gasoline away from sparks, open flames, pilot lights, heat, and other ignition sources.</p>	
	 WARNING
	When starting engine:
<p>Remove all external equipment/engine loads.</p> <p>Wait until spilled fuel is evaporated. Start engine outdoors.</p> <p>Pull cord slowly until resistance is felt, then pull rapidly.</p> <p>If engine floods, set choke to OPEN/RUN, place throttle in FAST and crank until engine starts.</p>	
	 WARNING
	When operating equipment:
<p>Do not tip engine or equipment at angle which causes gasoline to spill.</p> <p>Run engine outdoors. Do not run in enclosed area, even if doors or windows are open.</p> <p>Do not choke carburetor to stop engine.</p>	

IMPORTANT--Please Read This Carefully

It is important that the instructions in this booklet be read and followed in order to insure satisfactory operation of the engine.

When desiring additional information, returning material or placing parts orders, address your letter to the attention of the Service Department. In replying to a letter from the company please mention the name of the individual and date of the letter but address the letter to the company and not to an individual.

WHEN ORDERING PARTS OR WRITING TO US ABOUT THIS ENGINE ALWAYS BE SURE TO GIVE THE NUMBER AND TYPE LETTER PRECEDING THE NUMBER. THIS NUMBER WILL BE FOUND ON THE NAME PLATE RIVETED TO THE BLOWER CASE.

Above all be sure to follow the instructions contained on the following pages, especially those concerning keeping the engine clean and replenishing of the oil supply.

Guarantee

The "Fullpower" Engine is guaranteed for one year against defects in material and workmanship. If within this time any part is found defective it should be returned to us, carrier charges prepaid, and if after our inspection, the part is found to be defective, no charge replacement will be made at once. Our guarantee is limited to replacement of parts and does not include any labor charges except in cases of new engines which are found not to operate satisfactorily from the start. In such cases write us, after having attempted to locate the trouble as outlined in this booklet and explain the difficulty as fully as possible. We will then advise you whether it will be necessary to return the entire engine to the factory for repairs.

Instructions For Use of Fullpower Engine Type FH

This engine has been carefully inspected and given a thorough running test before being shipped. It should, therefore, run satisfactorily now unless something has happened to it since it left the factory, provided it is properly supplied with gasoline and oil. It should be expected that it may still be slightly stiff the first few hours' running and the

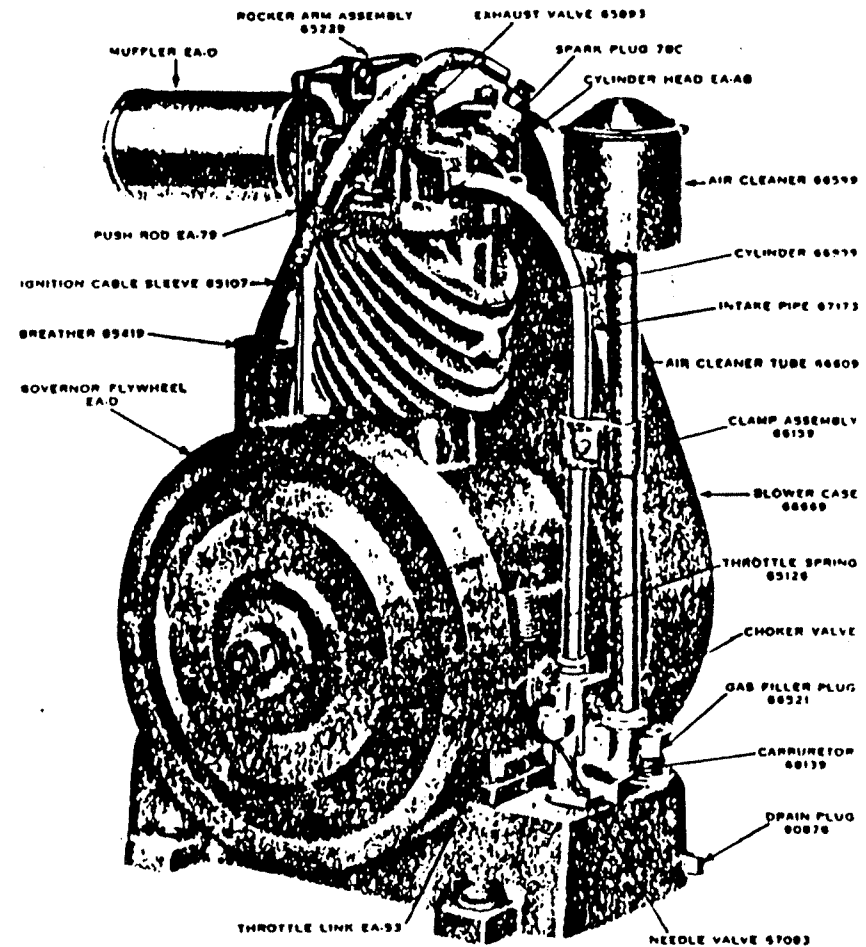


Figure 1—Model "FH" Engine

operation may be expected to improve after a few hours use. It would undoubtedly be a good idea to allow the engine to run without a load or with a light load for an hour or two before the full load is applied.

This little engine, although very simple and requiring very little care, nevertheless requires some attention and will give much better satisfaction if the instructions in this book are followed.

It is necessary to keep this engine as clean as possible. Wipe off any dirt or oil that accumulates on the engine and keep the engine covered when not in use.

We have developed for use outdoors or wherever there is much dirt or dust an air cleaner, which we recommend to anyone who is interested in keeping down future repair bills. This slips into the carburetor air opening and filters all the air used, preventing any particles of grit reaching the cylinder. This cleaner is not supplied with the engine unless ordered at an extra cost. You can easily determine by comparing your engine with the illustration in this booklet whether your engine is so equipped. This air cleaner can be purchased separately any time. Order 1-66599 Air Cleaner, 1-66609 Air Cleaner Tube, and 1-66159 Clamp Assembly for holding it in place.

Proper care in keeping the engine clean and following the instructions on the following pages will do much toward keeping down repair bills. We will try on the following pages to give sufficient information so that you should be able to take care of any simple troubles which may arise.

The Fullpower Engine operates on what is known as the four cycle or four-stroke principle, the same as practically all automobile and stationary engines. The four cycles can be explained as follows: It requires four strokes of the piston to produce one power stroke.

First Cycle or Suction Stroke: The piston moves down in the cylinder when exhaust valve is closed. The suction thus produced opens the intake valve and a charge of gasoline mixed with a proper proportion of air is drawn into the cylinder. This mixture quickly forms a gas when the engine is hot. When the piston reaches the bottom of the cylinder and there is no more suction the spring on the intake valve closes it.

Second Cycle or Compression Stroke: The piston now makes the up or compression stroke. Both valves being closed, you will readily

see that the charge of gas must be compressed into the small space in upper end of cylinder when the piston reaches the upper end of its stroke.

Third Cycle or Power Stroke: An instant before the piston reaches the end of its second stroke the timer breaks a contact in the ignition circuit, and this causes a spark to leap across the points of the spark plug. This ignites the compressed gas, which in burning expands so rapidly as to cause the term "explosion" to be used when describing this operation. It takes an instant for all the gas to ignite, and the spark is so timed that by the time all the gas is burning the piston has passed the upper end of the stroke and started down again. The rapid expansion of the burning gas pushes the piston down, forming the power stroke.

Fourth Cycle or Exhaust Stroke: When the piston reaches the bottom of the power stroke the exhaust valve is opened by the push rod and the piston in moving up forces all the burnt gases out of the cylinder. At the top of the exhaust stroke the exhaust valve closes and the first cycle or suction stroke takes place again, followed by the other strokes as described.

All the cycles or strokes take place more rapidly than they can be described, but we believe that this explanation of the operation of the engine will help you understand it better and thus enable you to keep it in perfect running order.

Inspection

Examine spark plug to see that it is screwed in place and is not cracked or broken. See that ignition cable terminal is securely fastened to spark plug.

Depress intake valve several times. It should snap up freely when released.

Revolve flywheel several times and watch exhaust valve stem, rocker arm and pushrod. These should work freely once every second revolution of flywheel. When exhaust valve is seated, or up, there should be a space between the exhaust valve stem and rocker arm of about double the thickness of a piece of newspaper.

If the space between the exhaust valve stem and rocker arm is not as outlined above, the adjustment is made on the rocker arm fork or

"yoke". Revolve flywheel until valve push rod and end of rocker arm are in lowest position. Loosen set screw holding rocker arm fork in place, raise rocker arm and fork and insert two thicknesses of newspaper between the valve stem and rocker arm. Lower rocker arm and fork gently until one end of rocker arm rests on paper on valve stem and other end of rocker arm is seated on valve push rod. Then securely tighten set screw holding rocker arm fork in place and your valve adjustment is properly made.

If rocker arm is removed entirely, care should be taken so that the small slug No. 65232, which is placed between the set screw and rocker arm fork, does not drop out. The purpose of this slug is to prevent the set screw from marring the rocker arm fork when same is drawn up tight.

Filling

Gasoline tank is in the base of the engine and is filled through openings in top of base after removing gasoline tank filler plug. Examine filler plug to see that small vent hole is clear and fill tank with a good grade of high test gasoline. Replace plug.

The oil filler opening is on either side of the engine, one side opposite the carburetor, the other below the breather pipe. With the engine setting level pour oil in this opening until it overflows. This is the maximum oil level. Replace filler plug. We recommend the use of Gargoyle Mobiloil A, which we have found by test to be of the proper characteristics for all conditions except outdoor use in winter weather when we recommend Gargoyle Mobiloil Arctic. These oils may be obtained almost anywhere.

Lubricating System

Lubrication of the Type FII Fullpower Engine is accomplished by the well known splash system. A positive action pump actuated by the cam shaft pumps the oil from the bottom of the oil pan into a dip trough, maintaining a constant level of oil in this trough, irrespective of the amount of oil supply in pan. Into this trough, the dipper on the lower end of the connecting rod dips on each stroke of the piston, distributing the oil in the form of a fine spray throughout the cylinder walls and crank case. By this means all moving parts are kept lubricated at all times.

IMPORTANT. Each day, before engine is started, a few drops of oil should be placed on the exhaust valve stem and rocker arm pin. This is very essential as same will prevent the exhaust valve from wearing into the cylinder head.

After filling the oil reservoir through the oil filler opening as directed under paragraph headed "Filling" no further attention is necessary except to examine the oil level as indicated by the height of the oil in the filler opening every five running hours. The first few times running a new engine it is advisable to check the oil level every two hours. The oil reservoir should be as nearly full as possible at all times.

ONCE EVERY FIFTY RUNNING HOURS DRAIN THE OLD OIL OUT OF THE ENGINE BY TIPPING IT AND POURING THE OIL OUT OF THE OIL FILLER OPENING. THE OIL SHOULD THEN BE REPLACED BY FRESH OIL. THIS SHOULD BE DONE WHILE THE ENGINE IS STILL HOT, AS WHEN THE ENGINE IS COLD IT IS IMPOSSIBLE TO GET ALL THE OLD OIL OUT.

Oil Sludge

Oil Sludge is dirty oil, emulsified with water (which is a product of the combustion in the engine) and beaten up into a gummy mass in the crank case. It clogs the screen, preventing the pump from getting enough oil to keep the dip trough full and in extreme cases cuts off the flow of oil entirely.

This sludge occurs largely in winter and is due to using cheap and improper lubricating oil and to neglect of draining the crank case regularly every 50 hours as directed above. As the formation of this sludge is very injurious to the engine, care should be taken in following our recommendations in regard to lubrication outlined above.

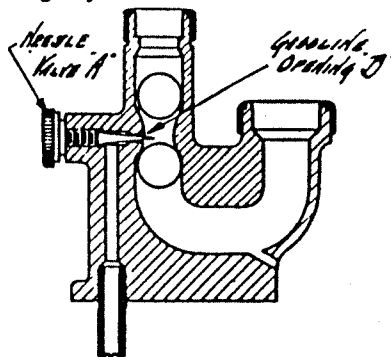
STARTING

First make sure that the oil level is correct as described above and also make sure that the gasoline tank is supplied with plenty of gasoline. Depress intake valve once or twice. (This need only be done on a cold engine.)

Then choke the carburetor by closing the valve at the lower end of the air cleaner (handle at right angle to pipe) if the engine is equipped

with an air cleaner. If engine is not equipped with air cleaner, a choker tube is provided with a shut-off valve that is to be used for choking the engine when starting. Choking the carburetor shuts off considerable of the air supply, giving a richer mixture, needed when starting a cold engine. This choker valve should be closed completely when first starting the engine and after the engine has fired a few times, it should be immediately opened slightly in order to give the engine more air, and as the engine warms up it can gradually be opened to its full opening. Under no conditions should the engine operate with this valve in any other position than wide open.

The small needle valve "A" shown on section cut below, regulates the amount of gasoline the engine uses. This valve has been properly set at the factory before the engine was shipped, but in case it has been moved, the proper setting is approximately one-half turn open. Screwing the valve "A" in cuts off the gasoline and screwing the valve "A" out opens up the gasoline. A very slight movement of this valve in either direction will have a decided effect on the operation of the engine. When this valve is properly set, it need not be moved or adjusted again, as the proper setting for a running condition is the proper setting for starting. In order to determine whether or not the gasoline mixture is correct, the exhaust pipe can be disconnected from the engine and the exhaust flame that shows through the exhaust opening should be blue in color when the engine is running. If this exhaust shows dark red it is an indication of too much gasoline and the valve should be cut down slightly.



Section Thru Carburetor

It is always necessary to close the choker valve before starting the engine, and even if the engine is hot, it is necessary to close this partially in order to get a good start.

If the engine is equipped with the foot starter it is only necessary to crank the engine over by stepping on this foot starter and pumping it as fast as possible with the foot in order to get as high a speed as possible on the engine. This starter is provided with an automatic clutch that releases as soon as the engine has started and there is absolutely no danger of the starter being jammed when the engine starts.

If the engine is equipped with the rope starter, the starter rope should be applied to the starting pulley by slipping the knot of the starter rope into the "V" of the starter pulley and wind all the cord on the pulley assembly, winding in a clockwise direction when facing the engine from the starter pulley side. Grasp the cord and give it a hard fast pull so as to spin the engine. The cord will become disengaged from the pulley at the end of the pull. If the engine is cold, it may be necessary to repeat this operation two or three times.

As soon as the engine starts to turn over under its own power, open the choke valve slightly and as the engine picks up, gradually open this valve until the engine is running full speed. In case the engine starts to slow down after opening this valve, close it again slightly to increase the suction of gasoline and as soon as the engine has warmed up completely, this valve should be left wide open. A little practice in the adjustment of this air valve will produce good results in starting at all times.

If Engine Fails To Start Properly

If the engine fails to start properly the following suggestions may be of value and should be followed one by one until trouble is found:

CAUSES

1. Intake valve may be stuck.
2. No gasoline in tank.
3. Water in gasoline.
4. No spark or poor spark.
5. Governor arm improperly adjusted.
6. Carburetor gas pipe plugged up.

REMEDIES

1. Depress valve several times, making sure same works freely. (Always do this when starting a cold engine.)
2. Fill tank with gasoline.
3. Drain tank (remove small plug near bottom of base) and refill.
4. Inspect and test spark plug and if not in good condition replace plug. Be sure cable is tight and breaker points are properly set. Refer to paragraph headed "Ignition" for detail ignition tests.
5. Loosen set screw, move governor arm to the right and tighten in place. See paragraph headed "Speed Regulation."
6. Loosen nut holding gas pipe to lower end of carburetor and unscrew gas pipe. Then blow out any obstructions in the small opening through the pipe. Do not clean out with pin or tool.

Troubles and Remedies

ENGINE LACKS POWER OR DOES NOT OPERATE SMOOTHLY

1. Leaky valves and engine badly carboned.
2. Compression leaks at other points.
3. Weak valve springs.
4. Clearance too great between exhaust valve and rocker arm.
5. Muffler clogged.
6. Dirty or cracked spark plug.
7. Engine overheating.
8. Worn piston rings.
9. Equipment operated by engine may be binding or otherwise working improperly.
10. Carburetor clogged up.

REMEDIES

1. Head should be removed (see paragraph on "Lack of Compression"). Carbon should be thoroughly cleaned out and exhaust valve ground to a seat.
2. Spark plug must be securely screwed into head. Be sure gasket is in place. Cylinder head gasket may leak. Test for air leak and

replace if necessary. Use only copper and asbestos gasket as supplied with engine.

3. Weak valve springs may be tested by inserting the point of a screwdriver into the coils and placing tension on the spring. If engine speeds up to normal, spring should be replaced. Head should be removed and valves removed as described in paragraph headed "Lack of Compression". Only valve springs as supplied by the factory for this purpose are to be used. The exhaust valve spring must be considerably stronger than the intake valve spring.

4. See third paragraph under "Inspection."
5. Make sure that small holes in muffler are not clogged.
6. Clean spark plug thoroughly and set points at .020" clearance. Replace plug if defective in any way. See paragraph headed "Ignition".
7. Caused by poor grade of oil or lack of oil or overloaded or tight bearings.
8. This condition will not occur until engine has had a great deal of use or has been run with poor or an insufficient quantity of oil. Replacement should be made by a reliable repair man or by the factory.
9. Disconnect engine and test equipment for freedom of movement or amount of friction. Be sure the equipment is kept well oiled and greased.
10. Same as No. 6 under "Engine fails to start properly."

Engine Knocks

1. Engine badly carboned.
2. Loose connecting rod.
3. Loose crankshaft bearing
4. Loose flywheel.
5. Lack of oil.

REMEDIES

1. Proceed to clean out. See paragraph "Lack of Compression".
2. and 3. Have repairs effected by a reliable repair man or return to factory. This condition is caused only by poor oiling or long service.
4. Be sure flywheel nuts and pulleys are properly tightened. Replace key on crankshaft if necessary.
5. Replenish oil supply.

Carburetor

The carburetor is adjusted properly at the factory for all conditions, and if this adjustment has not been changed, the engine should start and function correctly. In case this adjustment has been changed and it becomes necessary to regulate the carburetor, this can be done by a slight movement of the needle valve "A" located in the side of the carburetor body. This needle valve should be set at approximately one-half of a turn open and screwing the valve down reduces the amount of gasoline taken into the engine, and screwing the valve up increases the amount of gasoline taken into the engine. When the valve is set approximately one-half turn open, a very small movement of the valve in either direction will give the proper mixture. The proper mixture can be determined by the sound of the engine and also by the color of the exhaust coming from the exhaust opening. This should be a light blue color slightly tinged with red. A heavy black exhaust indicates too much gasoline and the needle valve should be screwed down slightly. An intermittent popping of the engine with no signs of red in the exhaust indicates too lean a mixture and the valve should be opened slightly to increase the amount of gasoline. Be sure that there is always sufficient gas supply in the tank and that the vent hole in the gasoline filler plug is not clogged up, preventing the gas to flow freely.

For use outdoors or where there is much dirt or dust we have developed an air cleaner which slips into the carburetor air opening. This is supplied only at an extra cost when ordered and is not standard equipment on the engine. We recommend its use, however, to keep the dust and dirt out of the cylinder, thus reducing wear. The air cleaner proper can be removed from the tube by merely pulling same off. EVERY DAY the air cleaner should be rinsed or cleaned in kerosene to remove all dirt which may accumulate. Then dip in old crank case oil and replace.

Ignition

If the engine fails to start, remove ignition cable from spark plug and remove spark plug. See that points are clean and about .020" apart. This will be a trifle greater than 1/64". Attach ignition cable firmly to spark plug and lay spark plug on top of engine so that steel part of plug is touching engine. Grasp ignition cable by the insulation and keep plug in place as above. Revolve flywheel smartly by hand several times.

At a point during each revolution a spark should jump across the gap in the spark plug providing spark plug is laid so that steel part is touching engine. If there is no spark the probabilities are that the spark plug is cracked or porous. Replace with a plug of reputable manufacture that you know has been tested and is O. K.

CAUTION: Never in any case try to test for spark by removing ignition cable from spark plug, trying to hold terminal of cable close to cylinder, revolving flywheel and watching for spark between ignition cable terminal and cylinder. You run an excellent chance of completely ruining your magneto if you test in this manner.

If there is still no spark remove pulley from end of crankshaft that holds magneto flywheel in place. Pulling outward on the flywheel, tap the end of the crankshaft gently with a piece of wood, brass or lead. Do not strike end of the crankshaft with hammer or other hard substance as you will ruin the thread. This gentle tapping will loosen flywheel from its taper seat and it will come off of the crankshaft. You will then have exposed to view the breaker arm 65489. You will note that the breaker arm is pivoted in the center, with one end riding on the crankshaft. On the other end is located a tungsten point with another located opposite it. You may find that there is oil or foreign substance between these points or they may be burned. (Note: The latter only after an engine has seen considerable service.) If found to be dirty, clean well with a piece of fine sand paper. If the points are rough scrape them with a sharp knife, but under no condition use emery cloth. When the points are separated the greatest, the gap should be about .020 of an inch.

Another important matter to watch is the proper fastening of the magneto cable which reaches from the connection on the coil to the spark plug. This cable should be securely fastened at both the coil and the spark plug. Fasten the cable to the coil connection with a pair of pliers. Under no circumstances is the cable to be soldered to the coil. This heat will damage the winding. To insure the cable not coming loose at the coil, secure with the clamp just to the left of the points. This will insure a good connection even though the cable is jerked. The insulation of the coil and cable must not be cracked or oil soaked. Replace flywheel carefully and try as before. If still no spark develops there is something wrong that you cannot remedy and the engine should be returned to the factory or to a competent ignition expert for further repairs.

When replacing flywheel be sure that the taper end of the crankshaft and the taper hole in flywheel are absolutely clean to insure proper fit of flywheel to the shaft. Insert a bar or rod through the two holes in the starter pulley (which acts as a nut to hold the flywheel in place) and tighten securely by hitting bar with hammer. **PULLEY MUST BE DRAWN UP TIGHT.**

The key, which holds the flywheel in place, is made of aluminum so that it will shear off if the pulley becomes loose, thereby not allowing any damage to be done to the keyways in the flywheel or crankshaft.

Lack Of Compression

The mixture of gasoline from the carburetor must be compressed on the up stroke of the piston and in this condition fired by the spark jumping across the gap in the spark plug. If this compression is faulty there will be either no explosion or insufficient explosion to develop full power by the engine. To determine if you have compression revolve flywheel at a moderate speed by hand. If compression is correct, there will be a point during every second revolution where resistance will be felt. It will feel as if pull were against a spring and if the flywheel is revolved, fairly fast, up to this point of resistance and let go, it will rebound rapidly in the opposite direction. If this action does not take place there is no compression and the cause must be looked for. There are four causes of poor compression which you can easily determine and remedy.

1. Cylinder head loose. Can be detected by air coming through between cylinder and cylinder head and by oil oozing out at same place. Turn screws down tightly and if this does not remedy condition, use a new copper and asbestos gasket.

2. Spark plug loose. Screw down and if necessary replace gasket.

3. Exhaust valve not seating properly. First examine the exhaust valve spring and make sure it is not broken. If not broken insert the point of a screwdriver between the coils and place tension on the spring. If this makes the engine run normally the spring is weak and should be replaced. If spring is not at fault the valve may be badly carboned and need regrinding. (The latter can only occur in engines which have been running for some time and will never happen on new engines) To replace spring or regrind valves see paragraph on "Cylinder Head and Valves" for method of removal from engine.

4. Intake valve not seating properly. Depress the valve by hand several times. It should snap up freely. Test the spring as outlined above for exhaust valve spring. It should very seldom be necessary to replace intake valves. See paragraph "Cylinder Head and Valves".

If none of the causes mentioned above seem to be responsible for the lack of compression see paragraph headed "Worn Rings and Scored Cylinders" for further suggestions.

Cylinder Head and Valves

To remove cylinder head, first remove ignition cable, from spark plug, and the upper blower case clamp. Then remove the four cylinder head screws. Cylinder head can now be lifted straight up, bringing tube from carburetor to cylinder head with it. Tube can then be pulled out of cylinder head.

To regrind the exhaust valve it should not be necessary to remove the valve from the cylinder, unless the valve is in very bad condition. It should very seldom be necessary to regrind the intake valve. Secure a small amount of valve grinding compound from any garage, auto supply or motorcycle supply store and cover the seat of the exhaust valve thinly with this compound, oscillating the valve rapidly in the seat. When clean metal shows all around on both the valve and seat, and there are no pits or black spots showing, the valve is properly ground. Wash valve and seat thoroughly with gasoline before assembling.

When necessary to remove exhaust valve to regrind or to replace exhaust valve spring, the following suggestions will be found helpful. The head should be laid on a bench with some means of supporting the exhaust valve from beneath, as a block of wood, etc. Using a tube, pipe or anything else that will bear down on the collar at the upper end of the exhaust valve stem without touching the split sleeve next to the stem, drive the collar or sleeve retainer down by several taps with a hammer. The split sleeve will then drop out, enabling the valve parts to be disassembled. If no other tool is available, the flywheel nut may be used to drive down the sleeve retainer or collar as described above. Always grind in, as described above, a new valve before assembling.

After assembling adjust the rocker arm. There should be a space about double the thickness of a piece of newspaper between the exhaust

valve stem and the rocker arm, when the exhaust valve is seated or up. This adjustment can be made as outlined in the first paragraph under the heading "Inspection" on page 7.

The intake valve is spun in place on the cylinder head and we do not recommend replacement except by a competent repair shop or the factory. There should be very little occasion to replace intake valves. In many cases when necessary to replace intake valves it may be advisable to replace entire cylinder head. If necessary to replace intake valve spring, the entire cylinder head may be returned to the factory to have spring replaced and valve seats reground at a cost of \$2.00 net. This includes new valves.

All Model FH Fullpower Engines are equipped with a cylinder head gasket composed of copper and asbestos. While it is possible to use this part a second time it is advisable to use a new gasket when available. Place intake tube in head and put head in proper position on cylinder, making sure that other end of tube is properly inserted in the carburetor. Insert screws, attaching magneto cable clip and upper blower clamp and draw to seat. Tighten all screws, a half turn at a time so as to bring head down evenly on the cylinder.

Worn Piston Rings or Scored Cylinders

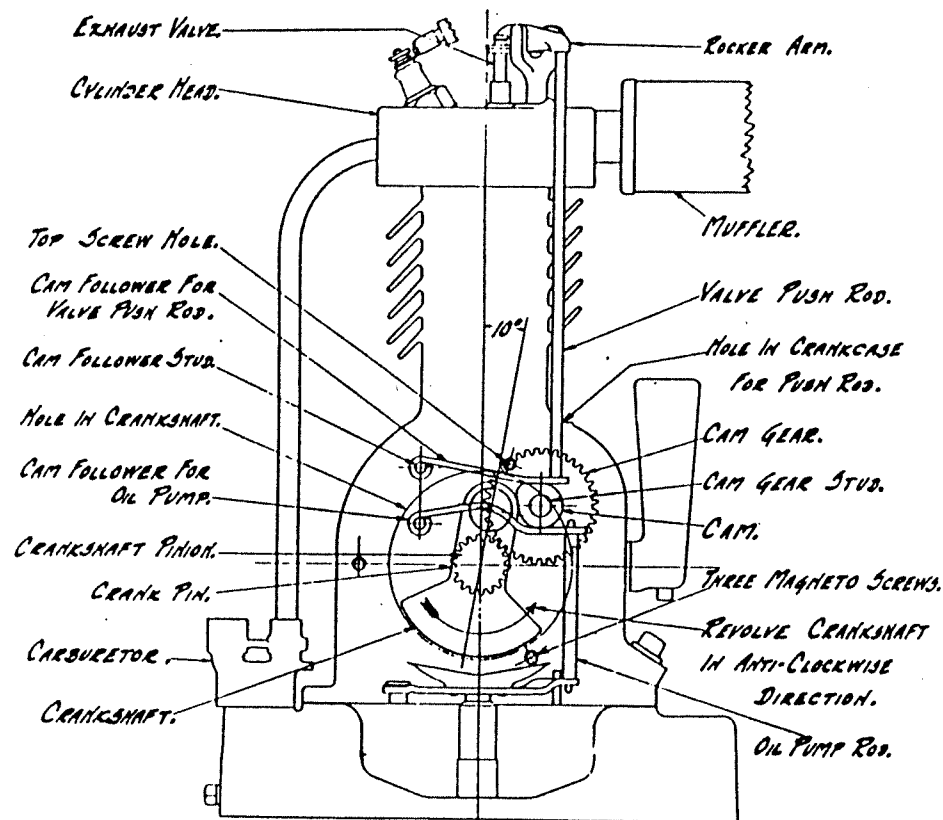
This condition can be identified by the sound of air rushing down into the crank case when point of compression is reached. This would only occur after long use of the engine unless the engine were run without sufficient oil, or with a poor grade or dirty oil or continuously overloaded.

In the condition, or whenever the engine does not perform satisfactorily and you have proper gasoline, ignition and compression at other points, we recommend that either a competent gas engine expert repair the engine, or it be returned to the factory for repairs.

If the engine is torn down, in no event use any gasket, except the copper and asbestos cylinder head gasket, a second time. Always use a new gasket.

Speed Regulation

The speed of the engine is set properly when leaving the factory, and there should be no need of adjustment unless the governing mechanism



VIEW LOOKING AT MAGNETO SIDE OF ENGINE.

Figure 2—Timing Diagram

ism has been disarranged in transit. If it is necessary to change speed, proceed as follows:

Immediately in rear of carburetor will be found a double arm lever attached to a small stem entering carburetor. From one of these arms a wire extends to the governor in the flywheel. From the other arm a coil spring extends to a small bracket fastened to the crankcase by a

screw. Loosen this screw and move bracket down to decrease speed, and up to increase the speed.

If the connecting rod has not been disassembled from the crank shaft, even though the engine has been otherwise disassembled, the timing gears will not be disengaged and the engine will not have to be retimed.

When taking the engine apart closely observe the relative position of the cam followers and other parts and how they are removed as this will be of great aid when again reassembling.

Timing

If the connecting rod has been disassembled from the crank shaft, the timing gears will have been disengaged, and when reassembling the engine the gears must be properly engaged, or the engine will not run. Referring to diagram, figure 2, will make timing instructions outlined in the following paragraphs, clearer.

After the connecting rod has been properly assembled to the piston by means of the piston pin, this pin being locked by the piston pin lock, the piston and connecting rod is inserted into the cylinder from the large opening in the crank case, from which the magneto was removed, meshing the pinion (small gear) on the crank shaft with the cam gear. This cam gear should be on its stud with the cam part of the gear toward the wall of the crank case. The cam followers should be on their studs, secured in place by cotter pins, with the free ends of the cam followers riding on the cam of the cam gear.

The cam follower for the valve push rod, or the shorter one of the two, is mounted on the upper stud. Care should be taken to mount same correctly. The free end should point upwards and rest on the upper side of the cam. The cam follower for the oil pump, or the long bent one, should be mounted on the lower stud and rest on the lower side of the cam.

Insert valve push rod through small hole in top of crank case, lower end of rod resting on cam follower. Revolve crank shaft to the left or anti-clockwise, at the same time holding push rod down on cam follower until the push rod just begins to rise. It will be best to do this several times so the exact spot may be determined. You will readily feel when the cam begins to push the cam follower and push rod up. If you have

the timing gears properly meshed, the crank pin of the crank shaft, or, in other words, the part of the crank shaft to which the connecting rod will be fastened, will be nearly in its topmost position. It will be to the right of its topmost position about 10° and will be pointing, nearly directly, towards the top one of the three screw holes in the crank case, in which the screws fit that fasten the magneto to the crank case.

If, when the push rod is just beginning to rise, the crank shaft is not in the correct position, pull it straight out toward you, disengaging the timing gears. Revolve it until it assumes the correct position described above, then push it straight in, engaging the timing gears. During this operation, be sure that the cam gear has not moved. If you should engage the gears incorrectly, even so little as one tooth, the position of the crank shaft, when the push rod begins to rise, will be so far wrong that it will be readily apparent.

After the gears have been meshed properly, assemble the connecting rod to the crank shaft, being sure that the screws holding the connecting rod cap in place are drawn down tightly and have lock-washers under each head.

Always use new gaskets when reassembling the engine.

To Stop Engine

Engine can be stopped in several ways. Intake valve can be held down, governor throttle can be moved to extreme left and when engine is equipped with a short circuiting switch the switch should be closed and held closed until the engine stops. Be sure short circuiting switch is open when attempting to start engine. It is very poor practice to stop the engine by choking the carburetor as this practice has a tendency to flood the engine with raw gasoline which washes the oil out of the pistons and rings tending to make hard starting.

Operation And Care

Always use a good grade of high test gasoline and be sure there is a sufficient amount in the tank. Use the very best grade of cylinder oil of medium weight. Be sure oil is up to proper level.

Inspect spark plug frequently and keep points free from carbon and set with a .020 gap.

KEEP YOUR ENGINE CLEAN. THIS PROLONGS LIFE OF ENGINE AND INSURES SATISFACTORY OPERATION AT ALL TIMES.

Repairs

We have attempted to describe in this booklet only those repair operations which might well be undertaken by the average man, with a slight mechanical skill. If it is necessary to undertake any serious repairs to the magneto, replace piston, piston rings, bearings or regrind cylinders, we recommend that the engine either be sent to a competent repair shop or to our factory for repairs. This should not be necessary until the engine has seen considerable service.

Ordering Parts

We are listing below a list of parts of the Type FH Fullpower Engine for your convenience in ordering parts.

In order to avoid delay and unnecessary correspondence, the INSTRUCTIONS BELOW MUST BE CAREFULLY OBSERVED IN ORDERING PARTS. Do not order parts in the same letter you write on any other subject. Be sure to write plainly and legibly.

Description Of Parts

Select the part numbers by referring to both the list of parts and the illustrations of parts. Always refer to both the description and the illustration to make sure the proper part number is selected. If unable to determine the proper number of the part wanted describe it as fully as possible. Do not depend on the numbers cast on parts as being correct as they may only cover part of what you want if it is an assembly.

ALWAYS USE BOTH PART NUMBER AND DESCRIPTION OF PARTS ORDERED, IF POSSIBLE. ALWAYS GIVE THE NUMBER OF THE ENGINE ON YOUR ORDER. Service orders cannot be filled unless these numbers are given. This number will be found on the name plate riveted to the Blower Case and is preceded by the type letter which should always be shown on the order.

Shipping Instructions

Always specify on the order whether shipment is desired by parcel post, express or freight. In absence of any instructions we will always ship the cheapest way.

Remittance

REMITTANCE SHOULD ACCOMPANY EACH ORDER. We will not ship any parts C. O. D. unless a deposit of more than twice the transportation charge has been made. Remittance must include sufficient to cover postage charge if to be shipped by mail as well as ten cents (\$0.10) to cover insurance. Any excess remittance will be refunded. **MINIMUM CHARGE FOR PARTS IS 25 CENTS PLUS POSTAGE AND INSURANCE.**

Remit either postoffice or express money order. Postage stamps will be accepted in amounts of less than one dollar (\$1.00) only.

Prices

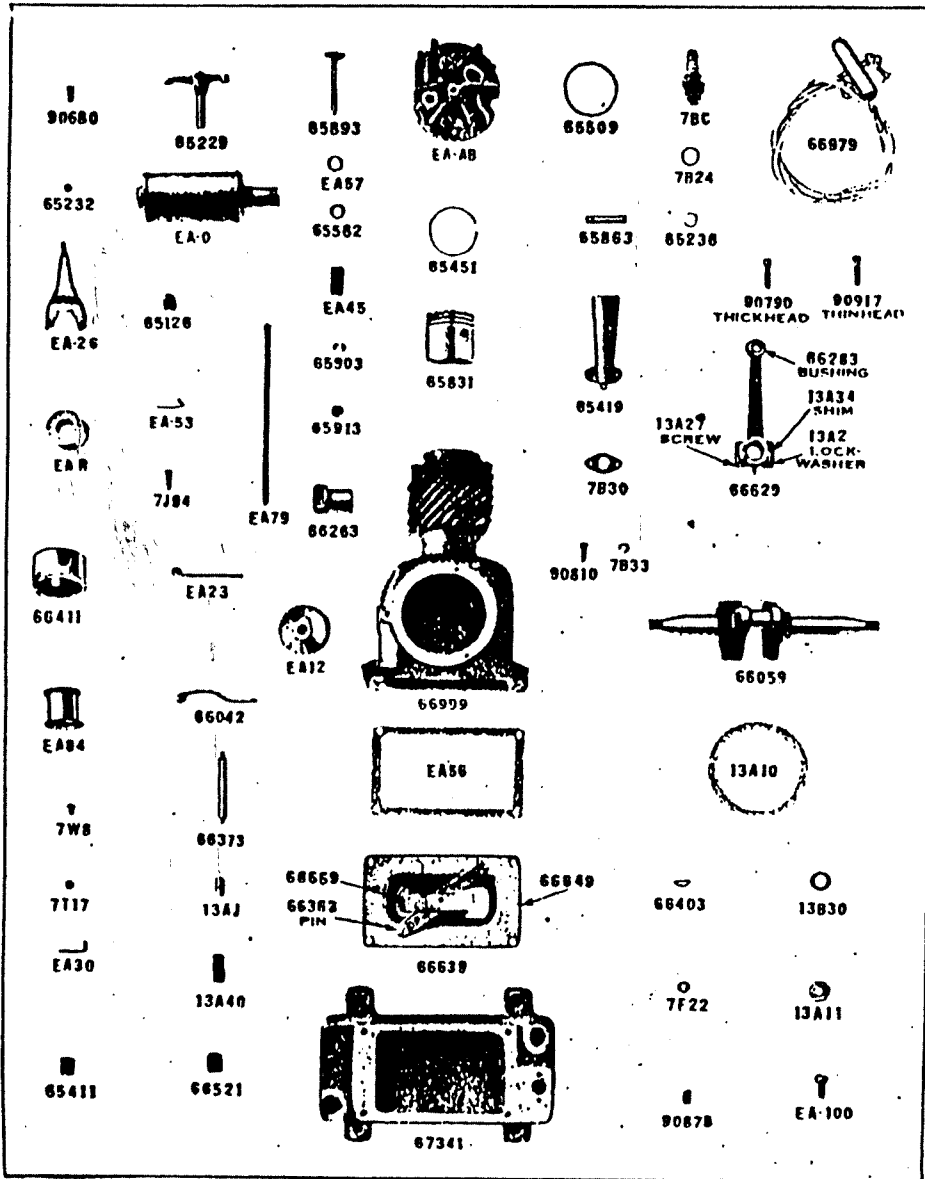
All prices in this book are subject to change without notice. In case of changes in price, orders will be filled at current prices. All prices shown are F. O. B. our factory in Milwaukee, Wis.

Instructions On Return Material

Never return material to us without writing us a letter explaining what parts are being returned, the engine number and the reason for return. Mark the shipment both outside and by tag on the parts with your name and address. Do not include any instructions in package, however. All instructions must be sent by mail to secure prompt attention. No return shipments will be accepted unless return transportation charges are prepaid.

Never return any material to the factory without first receiving permission from us to do so, except incorrect shipment of parts, defective material returned for replacement or material returned for repairs at your expense.

FIGURE 3—Type "FH" Engine Parts



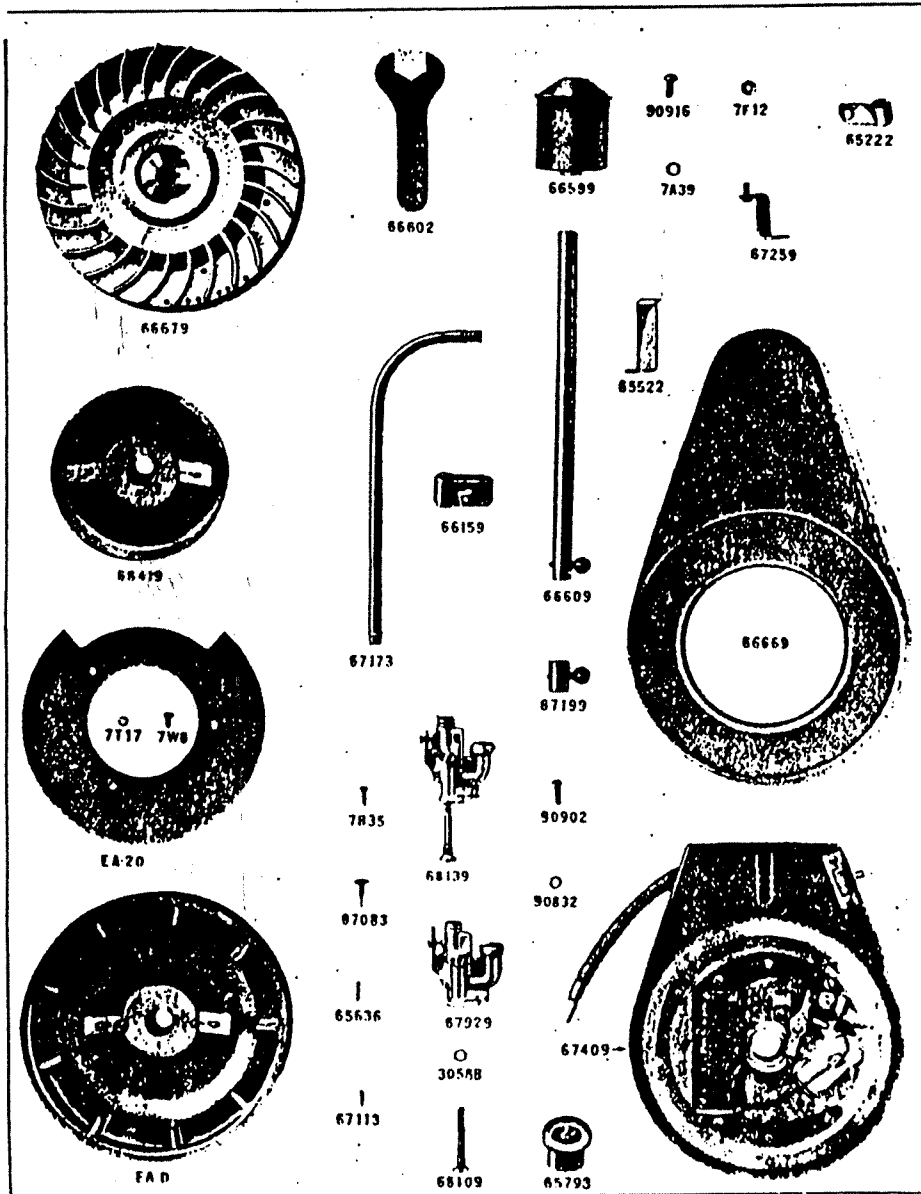
PARTS PRICE LIST

This list includes only parts used on standard Type FH Full-power Engines and should not be used to order parts for other Models. Always refer to the illustrations as well as this list.

Part No.	DESCRIPTION	Price
EAAB	†Cylinder Head Assembly, consisting of EA2 Cylinder Head, EA15 Intake Valve, EA40 Intake Valve Spring, EA60 Intake Valve Collar, EA45 Exhaust Valve Spring, EA57 Valve Spring Gasket, 65502 Valve Spring Washer, 65803 Exhaust Valve, 65003 Exhaust Valve Sleeve, 65013 Exhaust Valve Sleeve Retainer.....	\$ 0.00
65290	Cylinder Head Assembly, consisting of EAAB Cylinder Head, 65229 Rocker Arm, 65232 Slug, 90080 Set Screw.....	0.00
EAD	Governor Flywheel Assembly, consisting of EA4 Governor Flywheel, EA24 Weights, EA27 Washer, 90831 Escutcheon Pins.....	4.00
EAO	Muffler Assembly	2.50
EAR	Governor Spool Assembly .....	.70
EA12	Cam Gear	1.50
EA20	Air Deflector .....	.20
EA23	Cam Follower for Valve Push Rod.....	.45
EA26	Governor Arm .....	.12
EA30	Throttle Spring Clip .....	.10
EA45	Exhaust Valve Spring .....	.16
EA53	Throttle Link .....	.10
EA56	Diaphragm Gasket .....	.05
EA57	Valve Spring Gasket .....	.05
EA79	Push Rod .....	.10
EA84	Drive Pulley (Furnished only when specified).....	1.00
EA100	Cylinder Screw 5/16"—18 U. S. F. Thread x 1" lg. Hexagon Head Cap Screw .....	.05
EA117	Gasoline Filler Pipe Plug, 3/8" .....	.10
7A30	Blower Case Clamp Lockwasher .....	.01
7BC	Spark Plug with 7B24 Gasket.....	.75
7B24	Spark Plug Gasket .....	.03
7B30	Breather Tube Gasket .....	.10
7B33	Lockwasher for 90810 Breather Tube Screw.....	.01
7B35	F.H. Head Cap Screw No. 10-32 U. S. F. Thread x 1/2" lg. for Carburetor .....	.01

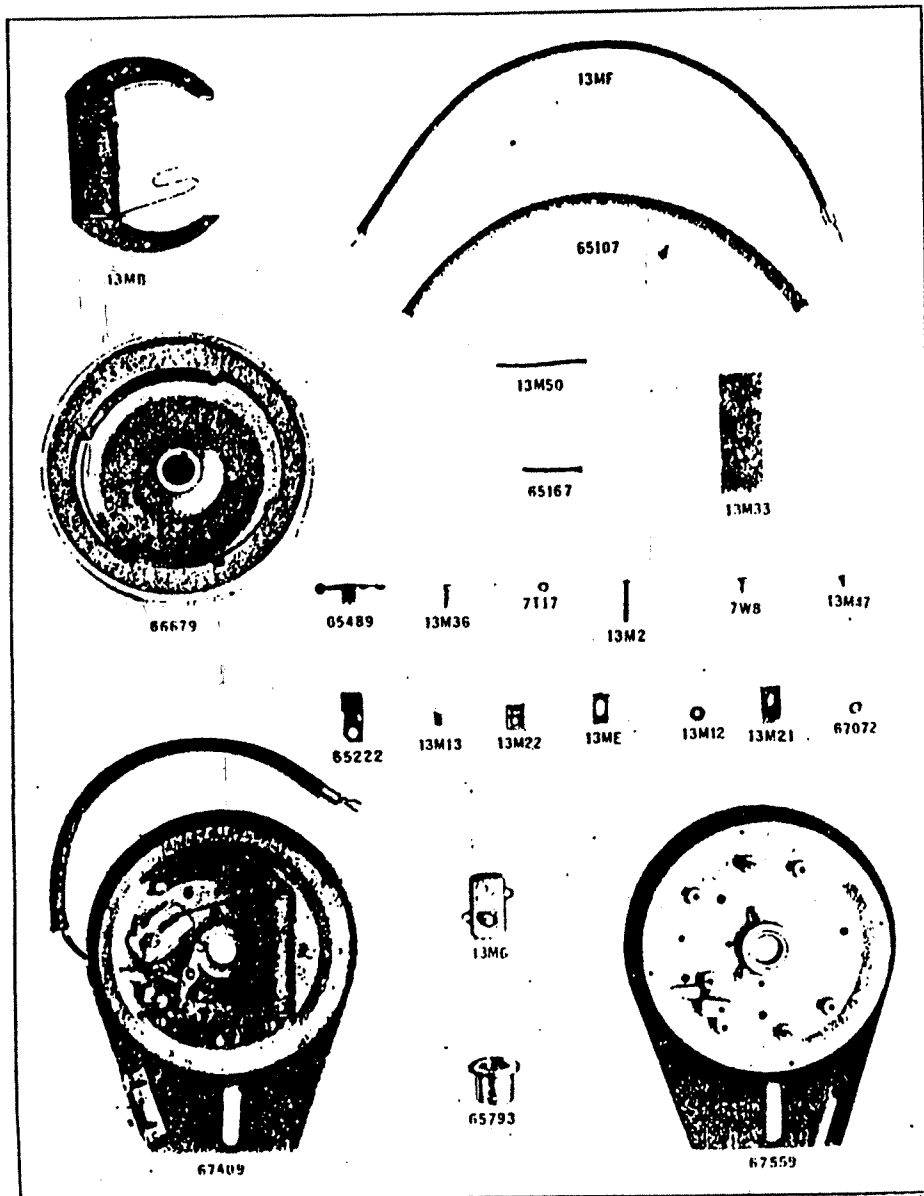
†Cylinder Head only furnished complete with both valves. Intake Valve should not be ordered separately unless customer has facilities for spinning or riveting same to head. If valves are ordered separately they must be ground in the head before being used. See paragraph headed "Cylinder Head and Valves".

FIGURE 4—Type "FH" Engine Parts



Part No.	DESCRIPTION	Price
7F12	Nut for upper Blower Case Bracket— $\frac{1}{4}$ "—20 Hex. Nut.....	.05
7F22	Cylinder Lockwasher, $\frac{5}{16}$ " Hole .....	.01
7J94	Cotter Pin for Cam Follower .....	.01
7T17	Lockwasher, $\frac{3}{16}$ " for Air Deflector and Throttle Spring Clip.....	.01
7W8	Fil. Head Machine Screw No. 10-32 U. S. Thread x $\frac{3}{8}$ " lg. for Air Deflector and Throttle Spring Clip .....	.03
13AJ	Pump Plunger .....	.30
13A2	Connecting Rod Lockwasher .....	.01
13A10	Crank Case Cover Gasket .....	.12
13A11	Flywheel Nut $\frac{9}{16}$ "—18 Thread Hexagon Nut .....	.21
13A27	Connecting Rod Screw .....	.05
13A34	Connecting Rod Shim .....	.10
13A40	Pump Spring .....	.07
13B30	Lockwasher for Governor Flywheel— $\frac{9}{16}$ " Hole .....	.03
13MB	Armature	6.00
13ME	Contact Bracket with Point .....	.52
13MF	Ignition Cable .....	.50
13MG	Condenser	1.50
13M2	Armature Core Screw .....	.05
13M12	Bracket Bushing .....	.06
13M13	Breaker Arm Spring .....	.05
13M21	Bracket Shim .....	.05
13M22	Ignition Cable Clamp .....	.07
13ME3	Coil Insulator .....	.10
13M36	Fil. Head Screw No. 10-32 U. S. F. Thread x $\frac{5}{8}$ " lg. for 13ME Contact Bracket .....	.02
13M47	Condenser Screw .....	.03
13M50	Armature Lead Insulator 3" lg.....	.05
30584	Gasoline Pipe Nut .....	.05
65107	Ignition Cable Sleeve .....	.10
65120	Throttle Spring .....	.15
65167	Condenser Lead Insulator $1\frac{3}{4}$ " lg.....	.05
65222	Ignition Cable Clamp .....	.15
65229	Rocker Arm Assembly consisting of 65281 Rocker Arm, 65281 Rocker Arm Fork, 65303 Rocker Arm Pin.....	1.50
65232	Slug for 00680 Set Screw.....	.02
65236	Piston Pin Lock Ring .....	.05
65251	Rocker Arm Fork .....	.90
65303	Rocker Arm Pin .....	.10
65307	Felt Washer .....	.01
65411	Oil Filler Pipe Plug $\frac{3}{8}$ ".....	.10
65419	Breather Tube	1.90
65451	Piston Ring .....	.55
65489	Breaker Arm with Point and Fibre Bushing.....	.75
65500	Cylinder Head Gasket .....	.08

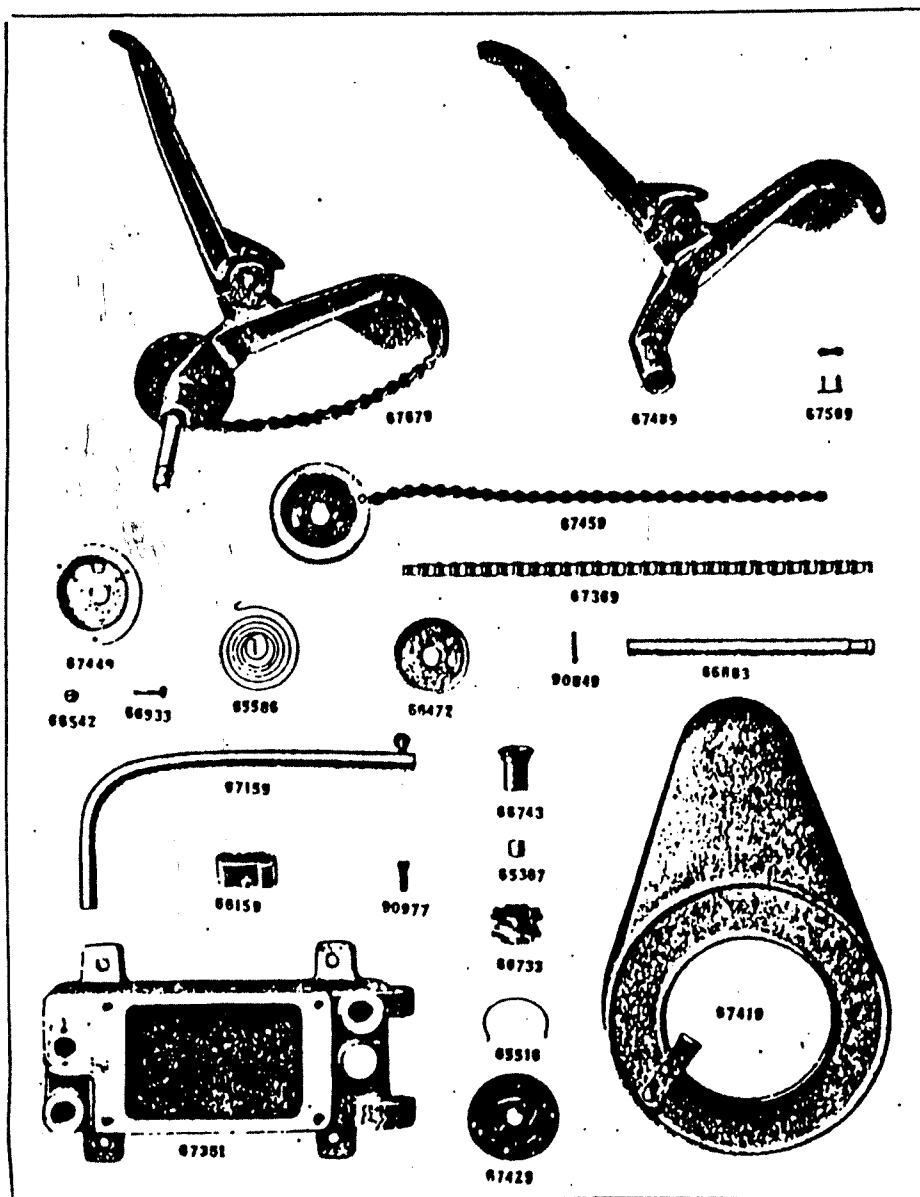
FIGURE 5—TYPE "FH" Magneto Parts



Part No.	DESCRIPTION	Price
65516	Spring for Pawl Assembly.....	.10
65522	Large Blower Case Clamp (Side).....	.15
65502	Valve Washer .....	.05
65586	Lever Return Spring .....	.35
65630	Stop Pin Spring .....	.05
65659	Magneto Assembly Complete with Air Guide (Without Stop Switch) ..	12.00
65689	Crank Case Cover, with Air Guide but less Stop Switch.....	4.00
65793	Magneto Crank Case Bushing.....	1.00
65831	Piston only	2.50
65861	Rocker Arm	1.00
65803	Piston Pin .....	.60
65893	Exhaust Valve	1.00
65903	Exhaust Valve Sleeve .....	.10
65913	Exhaust Valve Sleeve Retainer.....	.15
66042	Cam Follower for Oil Pump.....	.45
66059	Crank Shaft Assembly	8.00
66069	Piston Assembly consisting of 65831 Piston, 65451 Piston Rings.....	3.60
66159	Air Cleaner Clamp and Bolt Assembly or Choke Tube Clamp.....	.20
66263	Bushing for Cylinder.....	1.25
66283	Connecting Rod Bushing.....	.40
66363	*Retainer Stud for riveting Oil Trough and Pump Assemblies.....	.10
66373	*Oil Pump Rod .....	.10
66403	Woodruff Key for Flywheel.....	.15
66411	Starter Pulley	1.00
66472	Spring Case Cover .....	.10
66521	Gasoline Filler Plug-drilled, 1/2" pipe plug.....	.10
66542	Washer .....	.01
66599	Air Cleaner Assembly (Furnished only when specified).....	1.25
66602	Spark Plug Wrench .....	.20
66609	Air Cleaner Tube Assembly (Furnished only when specified).....	.75
66629	Connecting Rod Assembly consisting of 13A2 Lockwasher, 13A27 Screw, 13A34 Shim, 66283 Upper Bushing.....	3.75
66639	*Oil Pump Assembly complete, consisting of 66049 Oil Pan, 66059 Oil Trough, 66363 Retainer Stud	2.00
66640	*Oil Pan Assembly	1.65
66659	*Oil Trough Assembly .....	.35
66669	Blower Case	1.35
66670	Flywheel Assembly	9.20
66783	Ratchet .....	.60
66743	Ratchet Nut-Standard .....	.30

* Oil Pan Assembly 66640 and Oil Trough Assembly 66659 must be riveted together with Retainer Stud 66363 to form complete Oil Pump Assembly 66639.

FIGURE 6—Type "FH" Starter Parts



Part No.	Description	Price
60883	Starter Shaft	\$.35
60833	Chain Retainer Pin .....	.00
60070	Starter Rope .....	.30
66009	Cylinder Assembly, consisting of 06501 Cylinder, 06263 Bushing, EA02 Cam Follower Studs, EA03 Cam Gear Stud, EA118 Taper Pin, 07023 Bushing Retainer Pin	12.75
07072	Bracket Washer .....	.05
67083	Needle Valve .....	.25
07113	Stop Pin .....	.05
07150	Choker Tube—Standard	1.00
07173	Intake Pipe .....	.75
07100	Choke Tube used when Air Cleaner is not furnished .....	.05
07250	Upper Blower Case Bracket with Screw .....	.15
07341	Gasoline Base (Standard)	0.00
07351	Gasoline Base—Standard (For use with Kick Starter)	0.00
07300	Chain .....	.80
07400	Magneto Assembly, complete with Air Guide and Stop Switch	12.00
07410	Blower Case Assembly—Used with Kick Starter	1.10
07420	Pawl Assembly .....	.70
07440	Spring Case Assembly .....	.25
07450	Spring Case Assembly with Chain	1.30
07489	Pedal and Lever Assembly—Standard	1.75
07550	Crank Case Cover with Air Guide and Stop Switch	4.35
07560	Chain Connecting Link .....	.02
07070	Starter Unit Assembly—Standard	4.15
07020	Carburetor Sub-Assembly, consisting of Carburetor Body riveted together, 67083 Needle Valve, 07113 Stop Pin, 05030 Spring	2.00
08100	Gasoline Pipe—For use with 07341 Base .....	.45
08130	Carburetor for use with Standard 07341 Base, including 08100 Gasoline Pipe, 3058B Nut and 07020 Sub-Assembly	2.50
08410	Governor Flywheel Housing furnished on some engines in place of EA-D	1.25
08520	Sheave Assembly less Chain, consisting of 07440 Case, 05580 Spring and 00472 Cover .....	.75
00850	Rocker Arm Set Screw .....	.05
00700	Cylinder Head Screw 5/10"—U. S. F. Thread x 1 1/4" lg. Fill. Head (Thick Head) .....	.05
00610	Fill Head Machine Screw 1/4"—20 x 3/4" lg. for Breather Tube 05410 .....	.05
00832	Lockwasher for Magneto Crank Case Cover Plate .....	.01
00840	3/32" Dia. x 3/4" lg. Steel Cotter Pin .....	.01
00878	Drain Pipe Plug, 1/4" .....	.10
00002	Fill. Head Machine Screw, 1/4"—20 x 3/4" lg. for Crank Case Cover .....	.05
00010	Round Head Machine Screw, 1/4"—20 x 1/2" lg. for Blower Case Clamp .....	.05
00017	Cylinder Head Screw, 5/16"—18 U. S. F. Thread x 1 1/4" lg. Fill. Head Cap Screw (Thin Head) .....	.05
00077	5/16"—18 x 3/4" lg. Square Head Cup Point Set Screw .....	.05
01083	Gasoline Filler Plug—1/4" Pipe Plug .....	.10