BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G96.010.1
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AT&TCo Standard

GASOLINE AIR-COOLED ENGINES
BRIGGS & STRATTON 4-CYCLE

Contents **Page**

1. GENERAL

1.01 This section covers the general operation and maintenance of Briggs & Stratton 4-Cycle Gasoline Engines used principally to drive manhole pumps, blowers, generators, etc, used in outside plant construction and maintenance work.

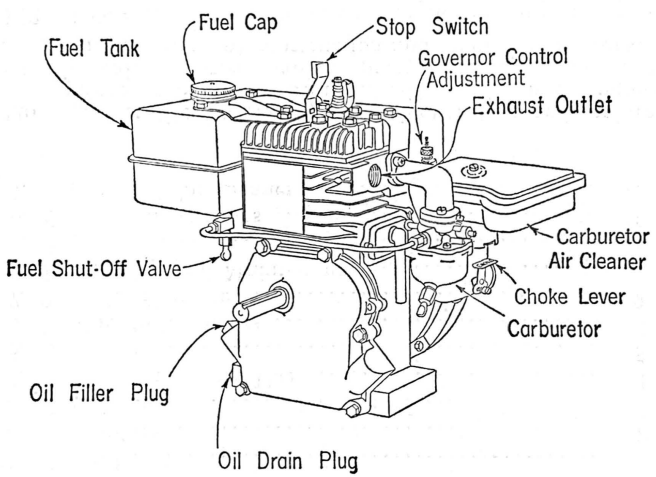
1.02 This section has been reissued to include information on the oil-foam air cleaner and revise the engine maintenance intervals.

1.03 Information pertaining to the operation and maintenance of the equipment utilizing **4-cycle** engines is covered in other sections of the Practices.

1.04 As far as practicable, engine adjustments and trouble shooting are covered in this section; however, reference should be made to the manufacturer's operation and maintenance manuals supplied with the equipment for specific information relating to the make and model of engine used.

2. DESCRIPTION

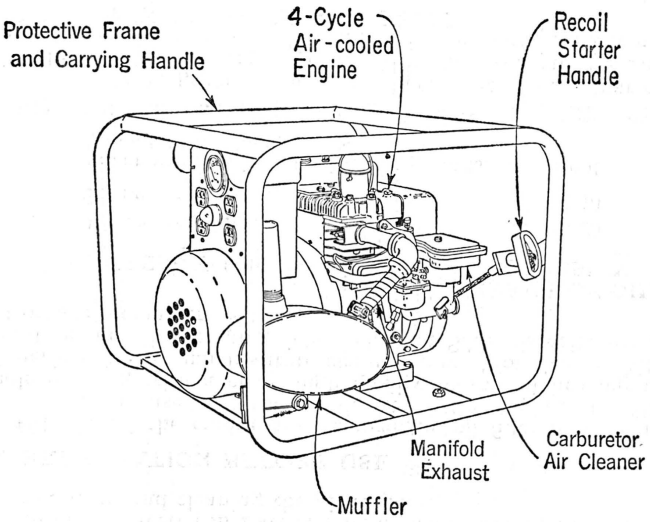
2.01 The gasoline engines covered in this section are small air-cooled, single-cylinder, 4-cycle type. Lubrication of the crankshaft, connecting rod, bearings, etc, is provided by means of a splash system in the engine crankcase. The spark for ignition of the air-fuel mixture in the cylinder is supplied by a flywheel-type high-tension magneto. Rope starters, either rewind or non-rewind, are used to crank the engines for starting. Fig. 1 illustrates a typical Briggs & Stratton engine and indicates the principal parts referred to in this Practice.



4 CYCLE GASOLINE ENGINE

Fig. 1

2.02 Fig. 2 illustrates a complete engine-driven generator.



ENGINE DRIVEN GENERATOR

Fig. 2

3. PRECAUTIONS

3.01 Before pulling the starting rope, observe that there are no objects in the immediate vicinity which will interfere with free movement.

3.02 Never fill the fuel tank when the engine is hot or running. Avoid spilling gasoline, particularly on the engine, because of the fire hazard. If gasoline is spilled, wipe the affected area dry and permit the vapors to dissipate before starting the engine. Only approved safety cans should be used for transportation or storage of gasoline.

3.03 When filling the fuel tank or engine crankcase, precautions should be taken to avoid entrance of foreign matter because it will result in wear and damage to the engine.

3.04 Care should be exercised to avoid burns from contact with heated parts, particularly the muffler and exhaust pipe.

3.05 The engine should be kept as level as possible during operation in order that the crankshaft, connecting rod, bearings, etc, receive proper lubrication.

3.06 **Do not operate an engine in an enclosure unless there is adequate ventilation and never operate or store it in a manhole. When operating an engine in the vicinity of a manhole, locate it so that the exhaust fumes will not blow into the manhole opening.**

3.07 Check the oil level in the crankcase before starting the engine and after every five hours of operation.

Caution: More engines are damaged by failure to maintain the proper oil level in the crankcase than by any other cause.

3.08 **Change oil in the crankcase and service the oil-foam air cleaner once a month or every 100 hours, whichever comes first.** Drain oil while the engine is warm and replace with clean oil as covered in Part 8. Part 8 also describes the method of removing and cleaning the air cleaner.

4. PREPARATION BEFORE USE

4.01 Level the engine and remove the oil filler plug on the crankcase. Fill the crankcase to the top of the filler hole opening with a clean high quality motor oil bearing the American Petroleum Institute classification, "For Service MS." Replace the oil filler plug. The following SAE viscosity grades of oil are recommended:

TEMPERATURE	GRADE OF OIL VISCOSITY
Above Freezing	SAE 30
Below Freezing	SAE 10

Never use special additive compounds or oils not labeled, "For Service MS."

4.02 Fill the fuel tank with a **REGULAR (NOT PREMIUM)** grade of clean gasoline. Check to see that the vent hole in the fuel cap is open and replace the cap. Be careful not to spill gasoline on the engine; if necessary, use a funnel. **DO NOT MIX OIL WITH THE GASOLINE.**

5. OPERATION

5.01 To start the engine proceed as follows:

(1) **Make certain there is a sufficient amount of clean oil in the crankcase.**

(2) Be certain the **stop switch** is away from the spark plug.

(3) Open the fuel shut-off valve.

(4) Completely close the carburetor choke (see Fig. 4).

(5) Pull the rope on the rewind starter slowly until the starter clutch engages, then pull until the resistance of compression is felt. Continue to pull slowly about 2 or 3 inches until compression ceases. Allow the starter rope to recoil and again pull out slowly until the starter clutch engages as illustrated in Fig. 3. Pull with a quick steady motion to start the engine.

Caution: When starting the engine, do not hold unit by placing foot on air cleaner, spark plug, etc.

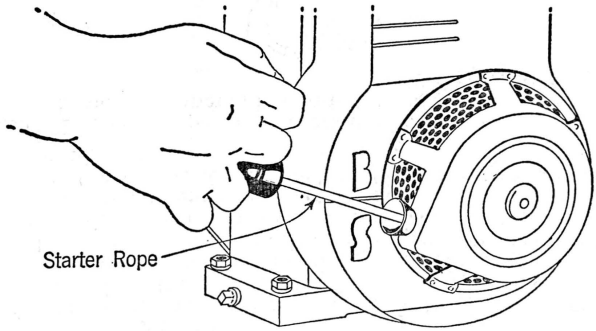


Fig. 3

(6) Should the engine fail to start on the first pull, repeat the cranking operation with the choke slightly open.

5.02 If the engine fails to start after being cranked four or five times, see Part 6 of this section on Engine Adjustments and Part 7 on Trouble Shooting.

5.03 After the engine is running, slowly open the choke until it runs smoothly with the choke wide open.

5.04 Permit the engine to run until it warms up before operating it at full speed or placing it under load.

5.05 To stop the engine, press the stop switch on the cylinder head against the spark plug. The stop switch on some engines may be contained in the spark plug shield or mounted on

the side of the external magneto. Do not place your hand on an open spark plug.

6. ENGINE ADJUSTMENTS

6.01 Engine speed and carburetor adjustments are regulated by the manufacturer for most efficient operation of the associated engine-driven equipment and under normal work conditions require no field adjustments. However, due to engine repair, previous adjustment attempts by an inexperienced operator, etc, it may be necessary to make certain engine adjustments.

6.02 The engines are equipped with a governor which performs two important functions:

(1) Prevents overspeeding or running away under varying load conditions.

(2) Maintains automatically, under varying loads, the speed at which the governor is set.

In the case of installations provided with remote hand throttle control, the governor maintains the speed selected by the operator. Engine speed adjustments should conform to the manufacturer's recommendations. In general, the desired speed setting is the lowest RPM which will satisfactorily operate the driven equipment.

6.03 The float-type carburetors used on the engines have the basic adjustments illustrated in Fig. 4.

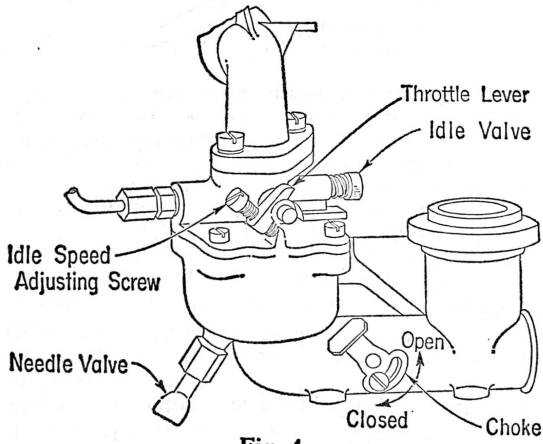


Fig. 4

6.04 If the engine is not operating properly and it appears that the carburetor is out of adjustment, stop the engine and proceed as follows **WITH NO LOAD ON THE EQUIPMENT:**

Note: Do not force any of the valve screws when making adjustments. Forcing the screws may score the valve seats.

INITIAL ADJUSTMENT

(1) Close the needle valve, (turn clockwise) carefully to avoid damaging the valve or seat.

(2) Close the idle valve, (turn clockwise) carefully to avoid damaging the valve or seat.

(3) Open the needle valve 1-1/2 turns (counterclockwise).

(4) Open the idle valve 3/4 turn (counterclockwise).

This initial adjustment is intended only to enable the engine to be started and run for several minutes to provide a warmup period before making the final adjustments.

FINAL ADJUSTMENT

After the engine is warmed up and is still running **(with the choke wide open)** proceed as follows:

(1) Turn the needle valve in, (clockwise) until the engine misses **(lean mixture)**, then turn the needle valve out (counterclockwise) until the engine runs unevenly **(rich mixture).** Now turn the needle valve to the midpoint between rich and lean so the engine runs smoothly.

(2) Close the throttle against the action of the governor and hold it in a closed position. The throttle lever is illustrated in Fig. 4.

(3) Set the idle speed adjusting screw to a position where it will provide a fast idle.

(4) Turn the idle valve (clockwise) until the engine misses (lean mixture), and then turn the idle valve (counterclockwise) until the engine runs smoothly.

(5) Readjust the idle speed adjusting screw if necessary for proper idle speed.

(6) Release the throttle. The engine should accelerate smoothly and quickly to the governed speed. It may be necessary to readjust the needle valve slightly for smoothest engine operation when the unit is operated under a load.

6.05 An air vane governor is supplied on the engines used for driving pumps, heater-ventilator units and blowers. This type of governor is illustrated in Fig. 5.

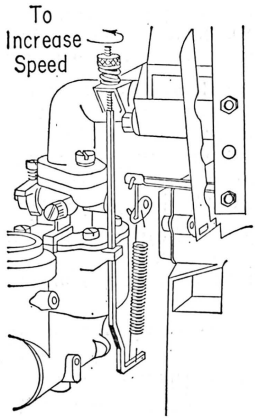


Fig. 5

6.06 A mechanical governor is supplied on the engines used on the portable generators. This type of governor is illustrated in Fig. 6.

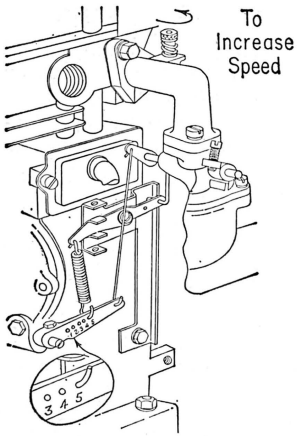


Fig. 6

7. TROUBLE SHOOTING

7.01 The most common causes of failure of the engine to start are lack of fuel, improper choking and/or lack of spark.

7.02 **Lack of Fuel** — If there is gasoline in the fuel tank and it appears that the carburetor is not getting fuel, open the fuel line at the carburetor. Gasoline should run out of the line at the point of detachment. Make sure that the fuel shut-off valve is open and that the air vent hole in the fuel tank cap is open and not clogged with dirt.

7.03 **Improper Choking** — Engines require considerable choking in cold weather. Keep the choke closed until the engine attempts to start and then open the choke slightly. The engine should start on the next spin. Very little choking may be required to start the engine when it is warm. If it appears that the engine is flooded, leave the choke fully open and crank the engine several times to clear it of excess fuel.

7.04 **Lack of Spark** — Check the strength of the electric spark and condition of the spark plug as follows:

(1) Remove the ignition cable from the spark plug.

(2) Grasp the ignition cable well back from the metal cable terminal to avoid shock and hold the tip about 1/8 inch from the cylinder head as illustrated in Fig. 7.

(3) Crank the engine and if a good spark jumps the 1/8-inch gap, the ignition system up to the spark plug is in good condition. If a good spark is not observed, proceed with Step (4).

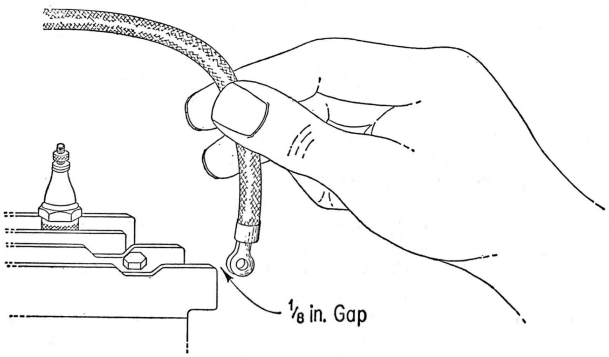


Fig. 7

(4) Check the spark plug for proper gap (.025") and clean if necessary. If the porcelain insulator is cracked, replace the plug with a Champion No. XJ8, or equivalent. (The XJ8 is a resistor-type spark plug.)

Note: Do not clean spark plugs on an abrasive blast cleaning machine. The abrasive used is highly injurious to the cylinder wall if it gets in the engine. Spark plugs should be cleaned only with solvents, by scraping, or wire brushing. Regap a spark plug after cleaning. It is a good practice to clean the spark plug and reset the gap at .025" after every 100 hours of operation.

(5) If a good spark is still not obtained, return the unit for repairs in accordance with local instructions.

7.05 Engine power is reduced when the muffler becomes clogged with carbon. This condition can be checked by removing the muffler and noting whether the engine develops more power. Some mufflers can be cleaned; others may be so badly clogged that replacement is necessary.

7.06 Ignition cable with cracked or otherwise damaged insulation will interfere with good ignition. Defective ignition cable should be replaced.

8. LUBRICATION AND MAINTENANCE

8.01 On a new engine the oil should be changed after the first five hours of operation. Thereafter, check the crankcase oil level regularly after every five hours of operation. Add oil as required (see Par. 4.01).

8.02 Once a month or every 100 hours, whichever comes first, service the unit as follows:

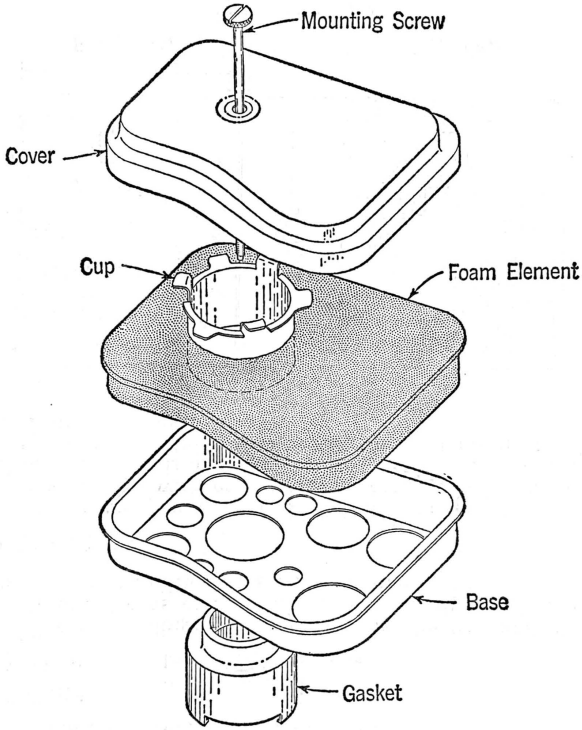
CRANKCASE

(1) Remove the oil drain plug and completely drain the crankcase. This should preferably be done while the engine is still warm to permit the maximum amount of old oil, sludge, and dirt to drain out. Replace the oil drain plug. Remove the oil filler plug and refill the crankcase with the proper grade of fresh motor oil (see Par. 4.01). Replace the oil filler plug and make sure both plugs are properly seated to avoid losing oil.

AIR CLEANER

(1) Remove the air cleaner from the engine by turning the mounting screw counterclockwise. Lift the air cleaner off the carburetor and separate the cover from the base of

the air cleaner. Do not remove the gasket from the carburetor. An exploded view of the oil-foam air cleaner is illustrated in Fig. 8.



OIL-FOAM AIR CLEANER

Fig. 8

(2) Lift the support cup out of the foam element and remove the foam element.

(3) Wash all parts in soap and water, kerosene, or an equivalent solvent. Wipe all metal parts dry with a clean cloth.

(4) Squeeze the foam element dry, and reoil with approximately 3 tablespoons of engine oil (see Par. 4.01). Squeeze gently to spread the oil through the foam element.

(5) Place the foam element in the base of the air cleaner, insert the cup in the foam element, affix the cover to the base, and mount the air cleaner on the carburetor using the mounting screw.

Note: An air cleaner may require service more frequently than recommended if the engine is operated under extremely dusty conditions.

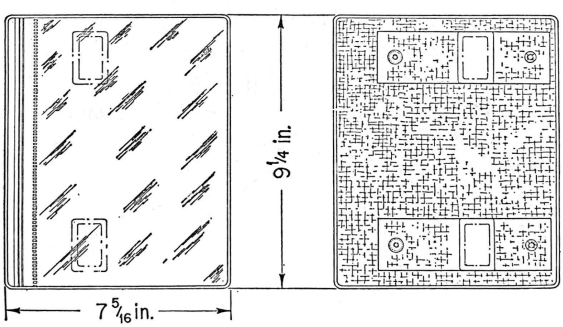
GENERAL

(1) Tighten any loose bolts or parts.

8.03 The air-cooling system should be checked and cleaned frequently as clogged air passages will result in overheating with possibilities of serious engine damage.

9. ENGINE LOG

9.01 An engine log (Form E-4637 or equivalent) should be maintained with each portable tool. A B log holder (a special plastic case) is available to hold the engine log and can be secured to the portable tool by the plastic flaps on the back of the plastic envelope.



B LOG HOLDER

Fig. 9

9.02 The log provides valuable information to the mechanic assigned to repair the engine as well as serving to remind the operator of the more essential service functions.

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FORM E-4637 (1-61)

LOG FOR AIR COOLED ENGINES

TOOL No. 34
CARD No. 1

LOCATION Milwaukee TOOL Generator SERIAL No. 118382
ENGINE Briggs & Stratton TYPE 943067 MODEL 80432 FUEL Gasoline

Check crankcase oil level before starting engine and at least every 5 hours.
Change oil once a month or every 100 hours, whichever comes first.
Clean and reoil air cleaner once a month or every 100 hours, whichever comes first.

DATE	OPERATOR	HOURS USED	CUMULATIVE HOURS	OIL Crankcase Add	OIL Crankcase Changed	OIL Air Cleaner Serviced	REMARKS
1-16-1	DD	8	60	✓			
1-17-1	DD	7	67	✓			
1-24-1	DD	5	72	✓			
1-27-1	KL	8	80	✓			
1-31-1	KL	7	87	✓			
2-1-1	DD	6	93	✓	✓	✓	
2-2-1	KL	8	101	✓			Won't start
2-6-1	KL	5	106	✓			

Notes:
① Indicates oil changed and air filter serviced after one months use.
② Indicates oil level checked and oil added as required.
③ The remarks column is for special information.

Fig. 10

9.03 Instructions for keeping the engine log. (See Fig. 10.) Fill in the first two columns and check the oil **PRIOR** to starting the engine.

(1) **DATE** — Fill in the month, day and year — for example, January 16, 1961 would be marked 1/16/1.

(2) **OPERATOR** — Enter the operator's initials.

(3) **HOURS USED** — Fill in the number of hours (to the nearest half hour) that the engine is run.

(4) **CUMULATIVE HOURS** — Add the number of hours that the engine is used on a particular day to the previous total. For example, on 1/17/1 the engine was run 7 hours, added to 60 (previous total) equals 67.

(5) **CRANKCASE — ADD** — Place a check (√) mark in this column indicating the crankcase oil level was checked and oil added as required. The amount added is not important, unless a relatively large amount is required (see Remarks column).

(6) **CRANKCASE — CHANGED** — Enter the cumulative hour total in this column whenever the oil is changed.

(7) **AIR CLEANER — SERVICED** — Enter a check (√) mark after servicing the air cleaner at the proper interval.

(8) **REMARKS** — For special information that will be of interest to the mechanic or to the next operator.

10. STORAGE INSTRUCTIONS

10.01 For short storage periods keep the fuel tank full.

10.02 If it is expected that the engine will not be used for 30 days or more, the fuel system should be completely drained as evaporation of gasoline usually leaves troublesome gum deposits. The following procedure should be adhered to:

(1) While the engine is still warm, drain the oil from the crankcase. Refill with fresh oil.

(2) Open the fuel shut-off valve. Remove the fuel tank drain plug and drain the tank completely.

(3) Operate the engine until it stops from exhaustion of the fuel. The carburetor need not be drained further.

(4) Leave the fuel shut-off valve open.

(5) Service air cleaner (see Part 8 or 11).

(6) Clean dirt and chaff from the cylinder and cylinder head fins, blower housing, etc.

(7) Remove the spark plug and pour about one ounce of clean motor oil into the cylinder. Crank the engine slowly to spread the oil, and replace the spark plug. A small

amount of oil on the threads of the spark plug will facilitate future removal of the plug.

10.03 Store the engine and associated equipment in a dry location.

11. SUPERSEDED AIR CEANER

11.01 The oil bath air cleaner, illustrated in Fig. 11, is a superseded type and has been replaced by the oil-foam air cleaner.

OIL BATH AIR CLEANER

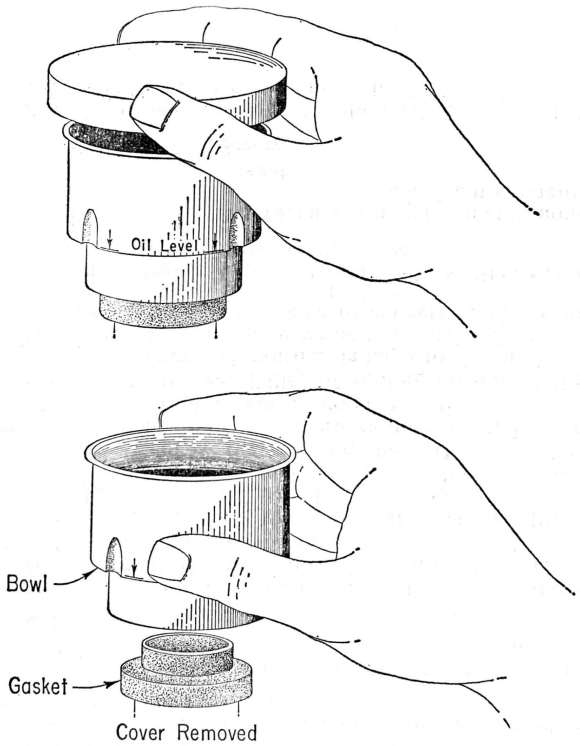

Fig. 11

11.02 Check the oil level in the oil bath air cleaner before starting the engine and after every five hours of operation. Use the same grade of oil in the air cleaner as is used in the engine crankcase (see Par. 4.01).

11.03 Service is required on the oil bath air cleaner once a month or every 25 hours, whichever comes first.

11.04 Service the oil bath air cleaner as follows:

(1) Remove the top of the air cleaner by turning the filter cover counterclockwise to unscrew. Lift off cover (filter element is attached) and bowl.

(2) Pour out the old oil. Wash the oil bowl and filter element in kerosene or an equivalent solvent and wipe dry. Pour oil in the small bottom part of the bowl to the "Oil Level" mark. Replace the bowl on the carburetor. Replace the filter element and turn clockwise until snug. Be certain the gaskets are in place and in good condition.

Note: Due to the possibility of spilling oil out of the oil bath air cleaner and causing damage to the engine (i.e., from running the engine without enough oil in the air cleaner), it may be desirable to convert to the oil-foam air cleaner which is simple to install. Procure the oil-foam air cleaner locally. The Briggs & Stratton part numbers for the parts required are:

296766	Air Cleaner (includes metal housing and foam element)
27994	Gasket
93323	Screw

Additional elements may be obtained as required. The Briggs & Stratton part number is 27987.