Until Frank Foulke set to work, the engine was dismissed as having little potential for the 'smoke' paths. Here, for the first time, is his step-by-step method of

Obtaining 187 H P From The Plymouth

By ED NABB

MANY newspaper and magazine articles have detailed the boat racing exploits of Frank Foulke and his wife Mildred, so we'll pass that by with a brief mention that the couple has held some 38 world's records. Frank accounted for the competitive marks, and Millie—with much less weight—could get added speed over the measured mile. Today, Frank's 266-cubic-inch hydro Sagano with engine builder Joe Wolf driving, is "the boat to beat" in her class in the East.

It all started around an engine most of the speedboat boys passed up as having little potential; Frank had different ideas! A Plymouth-DeSoto dealer at Essex, Maryland; he had spent years around dirt track racing before becoming interested in boats and in hopping up a Plymouth to make the boats go. He and his boys were so successful they completely killed off competition (and the class) in D Racing Runabouts, and did just about the same with the 225-cubic-inch hydros, before Foulke decided to retire.

An engine in a racing boat must produce plenty of power but, unlike a car installation, it must produce its power above 5000 RPM to be successful. For example, if maximum output came at 4000 RPM and a propeller was installed to hold

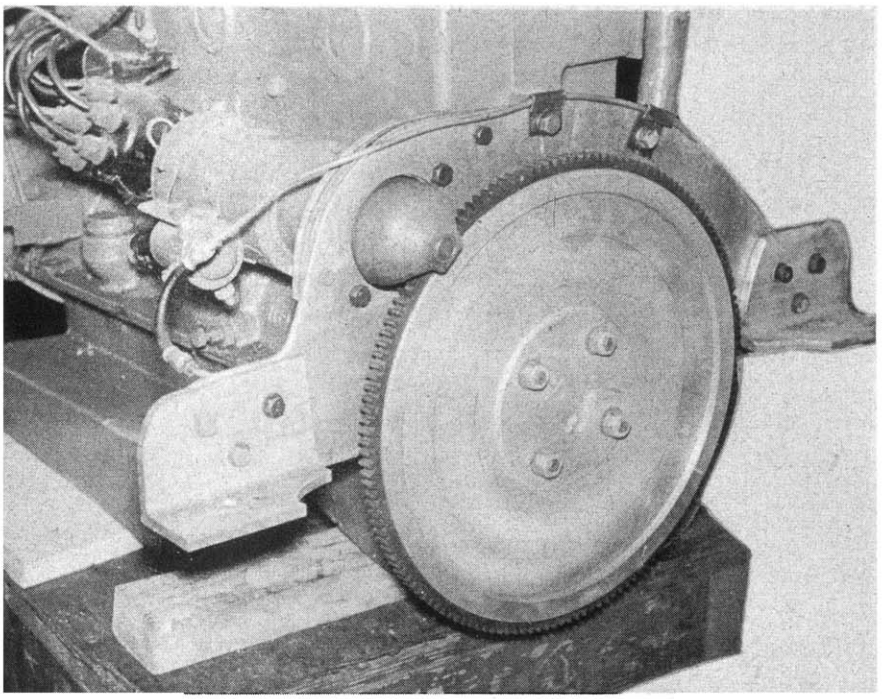
Frank Foulke and his wife with the Plymouth powered record breaker.

the engine to that speed the boat would 'torque out' so badly it would probably turn over in the straightaways. If this fault was corrected there still would be a shortage of performance, and the boat would be dead on the starting line and coming out of the turns. The only solution is a fast-turning engine with high output above 5000 RPM, or an expensive and impractical gear box.

Frank found his horses in the stock Plymouth engine, just asking to be discovered! After hundreds of hours of frustrating labor, dozens of crankshafts and bushels of connecting rods this is how his 'almost stock' Plymouth looked on the dynamometer—using Gulf, 91-octane, gasoline:

187 HP at 5200 RPM
164 HP at 6000 RPM
155 HP at 7000 RPM

Now, let's go through the step by step building of the hot Plymouth. Of course procuring the block assembly comes first and a junk yard is a happy hunting ground. Any 1946-53 block is suitable and don't worry if it's badly worn. Lots of iron will be ground away before the mill is complete. The initial cost need not be excessive—$20.00 to $25.00 for the block.



The aluminum flywheel was built by Foulke.

BLOCK

The standard block has 3¼ inch bore and 4⅜ inch stroke for a displacement of 220 cubic inches. Porting comes next, clearing and enlarging intake and exhaust ports to the largest diameter which will still permit a good thin seat on the standard valves.

Next, bore the cylinders to .035 inch oversize and relieve the block from the valve area to the cylinder wall with a 3/16 inch relief. (If the engine is to be used in a boat, make sure that this practice is permitted in the class you'll be running. And the late model stock boys may take a dim view of this.)

OIL GALLEYS

This is the one most important refinement and deserves special mention. The Plymouth will not perform satisfactorily unless all parts run in a flood of oil. To insure this it is necessary to enlarge every oil passage by drilling all oil galleys in the block 3/32 inch larger than original. Also include passages to the camshaft bearings, main bearings and crankshaft.

VALVES

All experiments brought Foulke back to the stock MoPar valves. Exhaust valves should have a 45 degree seat, and intakes a 30 degree seat. Machine all excess metal from the valves, especially under the heads. This streamlining also reduces weight which would cause floating. Some experiments were tried with larger intake valves, but power was actually lost. This was probably due to the increased weight, but in any event the stock valves work to perfection.

VALVE SPRINGS

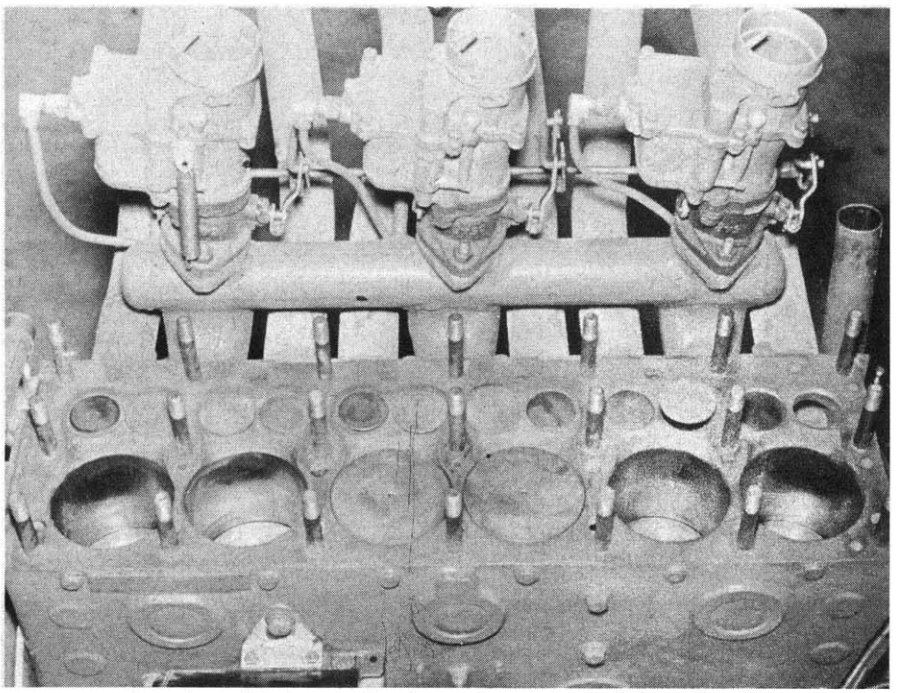
Double valve springs made by Ambler of Philadelphia, Pa., are used. These have 65 pounds pressure on the seat, 90 pounds open and a .375 inch lift. They have worked perfectly at the usual operating speed of 7000 RPM. If these or similar springs are not available (or are not permitted) the stock MoPar springs with a 1/16 inch washer under the upper part will work well.

PISTONS AND CLEARANCES

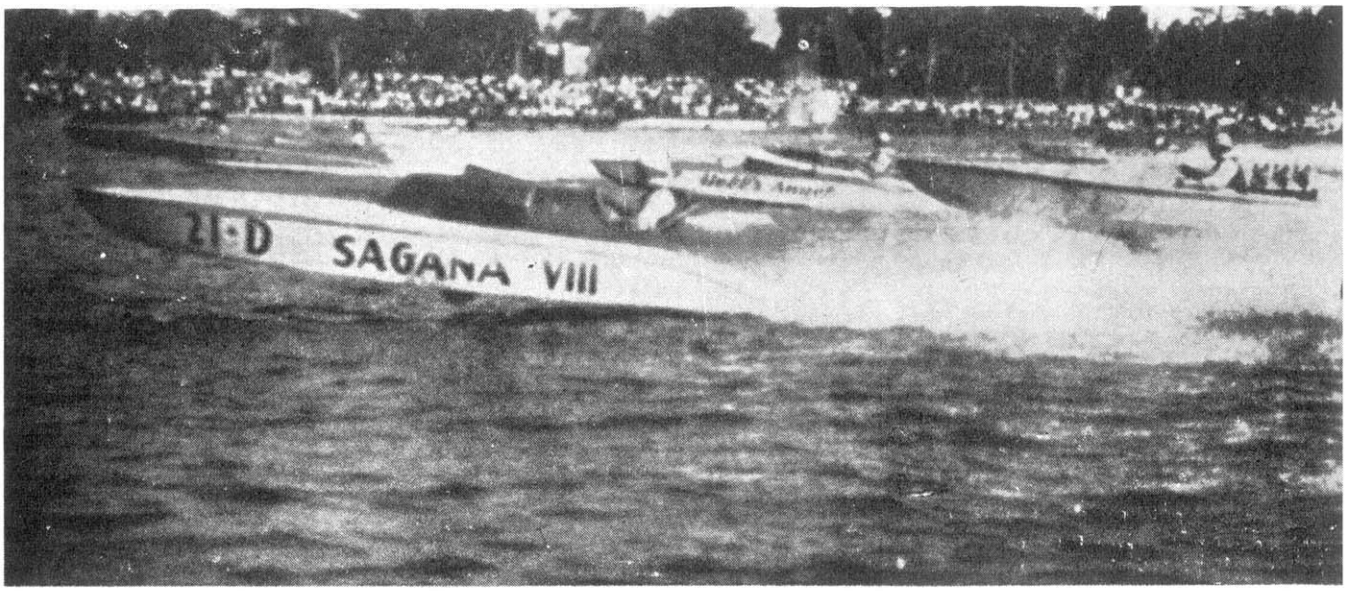
Use MoPar factory replacement pistons, stock number 9543808, .030 inch oversize. If you have followed instructions carefully and bored the cylinders .035 inch oversize, these pistons will give a clearance of approximately .007 inch. Experiments with racing pistons were very disappointing, but one set of stock replacements ran for three hard seasons of racing without mishap. One word of warning. If a spark plug wire is left off and the engine is run at full throttle for any length of time that piston is sure to break thru.

PISTON PINS

Fit the pins with .001 of an inch clearance in the rod bushings only. The pins fit into the pistons with standard clearance, which is a good tight 'thumb push' fit. The .001 of an inch clearance insures the pin turning in the rod bushing rather than in the piston. If the rod ends turn blue after a little running, it's an indica-



Log-type intake manifold was made from thin-wall tubing.



Sagana VIII speeds down course at St. Petersburg, Fla.

tion the pins have been improperly fitted.

PISTON RINGS

Frank uses Perfect Circle rings. two 5/32-inch oil rings and two 3/32-inch compression rings. The bottom one is standard 3¼-inch bore and the others are .030 of an inch oversize. The extra .005 of an inch oversize in cylinder boring gives proper clearance to the rings. Expanders are not used. and end gap is about .005 of an inch.

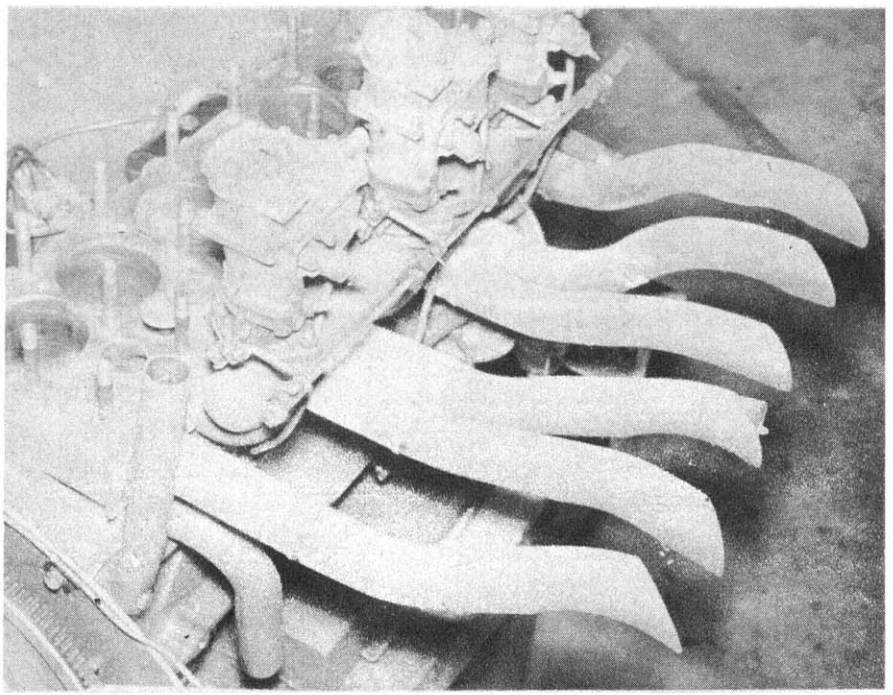
CRANKSHAFT

Some of the most important work in any engine is around the crankshaft. Drill out all the crankshaft oil holes 3/32 of an inch larger than stock. then funnel the end of each hole where it meets a bearing by running a countersink about ⅛ of an inch into the hole. This funnel shaped opening greatly aids proper lubrication.

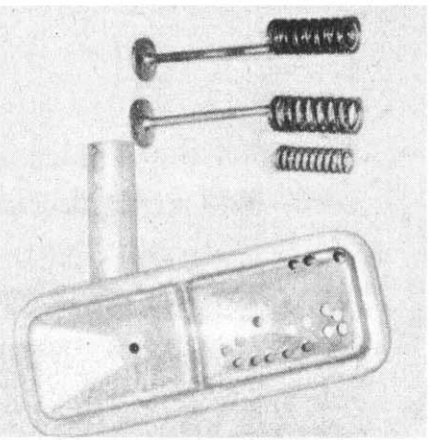
The most important clearances have to do with grinding the cranks. The main bearing journals should be .012 of an inch undersize (use .010 of an inch undersize bearings). and the rod throws should be ground .013 of an inch undersize (using .010 of an inch undersize rod bearings). If carefully carried out, this will give proper clearances for high output operation. Cranks could probably be chromed, but Foulke never did it.

BEARINGS

At this writing we have no knowledge of any available cadmium-silver bearings for the Plymouth engine. Stock MoPar Superfinish Micro factory replacements



Long exhaust stacks added 300 RPM.



Valves, springs and breather.

have been used in all of Foulkes engines. Use .010 of an inch undersize main and rod bearings and have a good machine shop enlarge the center groove in the mains to ¼ of an inch wide by .050 of an inch deep to allow more oil to flow to the rod inserts. Cut a groove in the center of the rod bearings 3/32 of an inch wide and .050 of an inch deep to match up with the oil holes in the rod journal. This allows full time oil pressure to the rod bearings.

CAMSHAFT

The stock Plymouth cam has a lot more revs built into it than the production line engine gets out but, for boat racing, a special cam is a must.

Foulke experimented with Pop Green and Ambler grinds, but the most successful was a Clay Smith 270. The timing on the 270 is:

Intake opens 25 degrees before top dead center and closes 65 degrees after bottom dead center.

Exhaust opens 65 degrees before bottom dead center and closes 25 degrees after top dead center.

The lift is .375 of an inch. It probably will be necessary to move the cam in order to acquire proper timing. The easiest method is to slot the three holes in the cam gear then when the timing is properly set, drill a ⅛-inch hole through

the hub and gear and lock them with a metal dowel.

OIL PAN

Frank built a special oil pan which increases capacity to eight quarts. A boat lacks the rush of cooling air under the pan, so increased capacity and an oil cooler are necessary. It may be desirable to lower the oil level in an automotive application but be sure the sump is well supplied.

BREATHER

Plug the regular factory breather hole, and build one similar to that shown in the valve and spring photo. This is made by using two valve cover plates; turn one backward and weld together. Bore several ¼-inch holes in the upper part of the inside, as it sits on the engine.

IGNITION

The hot job uses a 12-volt aircraft battery, Mallory DSM coil, large DSM condenser and a stock distributor. Remove the vacuum control from the distributor, and silver solder the distributor plate in full advance position. Install double springs in the breaker arm and set the clearance of the points at .015 of an inch. Set the ignition timing at 28 degrees before top dead center, using a timing light and running the engine at about 3000 RPM which will allow the governor weights to open. The full 12 volts is run through this system successfully.

STARTER

Use the standard 6-volt starter, taking the 12-volt charge from the 36 amp battery.

OIL PUMP

The stock Plymouth rotor type oil pump has always worked perfectly on the Foulke engines. In most installations a full flow oil filter is invaluable, and Frank uses a Cuno. Even in the cleanest engines a lot of foreign matter collects, and a good filter prevents trouble. Frank has always used No. 40 Gulfpride Marine oil.

SPARK PLUGS

Drill and tap the head to 18MM, and use Champion R7 plugs. Autolite stainless 7-strand ignition wire is used.

FLYWHEEL

The flywheel is homemade and is constructed of ¼-inch 75ST aluminum, which is used also for engine mounts.

CARBURETION

The racing engine uses three 1½-inch Tillotson UR3A pots, with variable venturas. Three 1½-inch Zeniths with No. 28 venturas, large needle and seat, and large adjustable main jets also have been used successfully. For late model stock use, the stock manifold and Dodge truck carb make a good combination.

MANIFOLD

Foulke built a 'log type' manifold of thin-wall tubing or exhaust pipe, with an inside measurement of 1⅞ inches. The overall length is 19⅛ inches.

The three lower tubes which lead to the ports are made by splitting the pipe and inserting a flat middle section. The wedge shape has a cramming effect to the intake. The round ends of the log deserve special mention. A similar manifold with flat ends didn't produce nearly the power it should. When the round ends (made from inner dust hub caps) were added the power picked up immediately.

CYLINDER HEAD

The cylinder head is a MoPar stock 'export' head, made of aluminum and going under the part number 868456. It has a compression ratio of 8.5 to 1, and has a beautifully designed ramp to divert the mixture down into the cylinder. It requires no reworking or chopping. If your dealer can't supply one there is no reason why any good racing head of the desired ratio wouldn't work.

BALANCING

The Plymouth with its long stroke requires a very good balancing job. All reciprocating parts such as pistons, pins, rods, and bearings should be statically balanced and all rotating parts dynamically balanced. The answer to the problem is to turn the job over to one of the hundreds of good balancing shops all over the country. Vibrations Specialty, in Philadelphia balanced the Foulke Plymouth.

TIMING CHAIN LUBRICATION

Timing chain lubrication can be a bug-a-boo in the fast turning Plymouth, unless the oiling system is reworked. In its stock state the timing chain gets a small squirt of oil on each revolution of the camshaft. Machining a small groove around the cam, at the oil hole, assures full time lubrication. Enlarge the small hole which leads to the timing chain to double its stock size.

TACHOMETER DRIVE

If you prefer a mechanical tach, a simple drive can be made by welding the fitting onto the front of the timing chain cover and drilling and slotting the end of the camshaft to take the drive cable shank. A speedometer cable fitting from the transmission case is the part for this.

ASSEMBLY

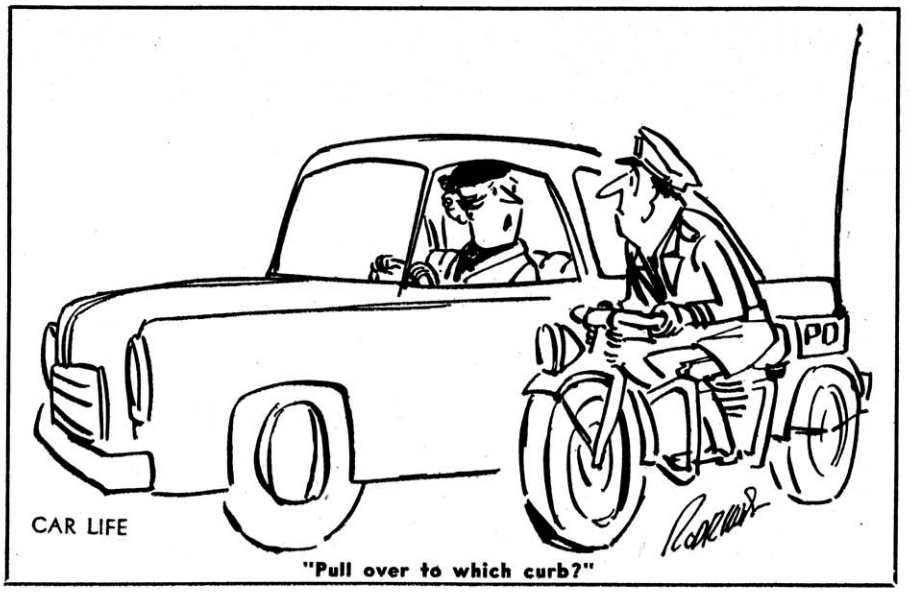
A few last minute odds and ends deserve mention before setting up the engine. First run a 180 grit stone lightly through the cylinders—just enough to scratch a few little oil holding grooves. It takes about two hours of careful steaming and solvent cleaning with a blow gun before any attempt should be made to assemble. The work should be done in a clean dust free shop—not in a busy garage, or under the apple tree.

In balancing and setting the cam, work only with the two valves in No. 1 cylinder. All other valves should be removed from the engine. When you are satisfied with the degreeing, install the other valves and set the clearances according to the cam grinder's specifications. The cam was ground without stress or twist, and should be set the same way. If the cam is properly ground, the grinder's specifications will give satisfactory performance and, if improperly ground, you don't want it in your engine at any cost.

Set up the rod bearings with 40 foot pounds torque, and the mains with 80 pounds. The aluminum head should set at about 60 pounds, and the cylinder pressure at cranking speed should be about 100 pounds.

For the boat enthusiast—this engine has turned a 10½ by 16½-inch Stannus wheel at 6800 to 7000 RPMS, and a Johnson 12 by 20-inch wheel 6000 RPMS. The engine is dependable, will perform with anything in its class and gives the owner a 50 to 60-pound weight advantage. Foulke has used only 91 octane gasoline, as this was restricted by class rules, but the engine can be further developed to burn alky or nitro.

The full house engine lends itself to the sprint car field and of course the Plymouth has been a contender in the late model stocks for years. Regardless of how you intend to use it, the clearances are applicable. Experiment where you may, but remember that the recommended clearances came about after years of trial and error and many dollars worth of ruined parts. Keep them free and running in a flood of oil and the Plymouth will scream like a swarm of bees! ☆ ☆



"Pull over to which curb?"