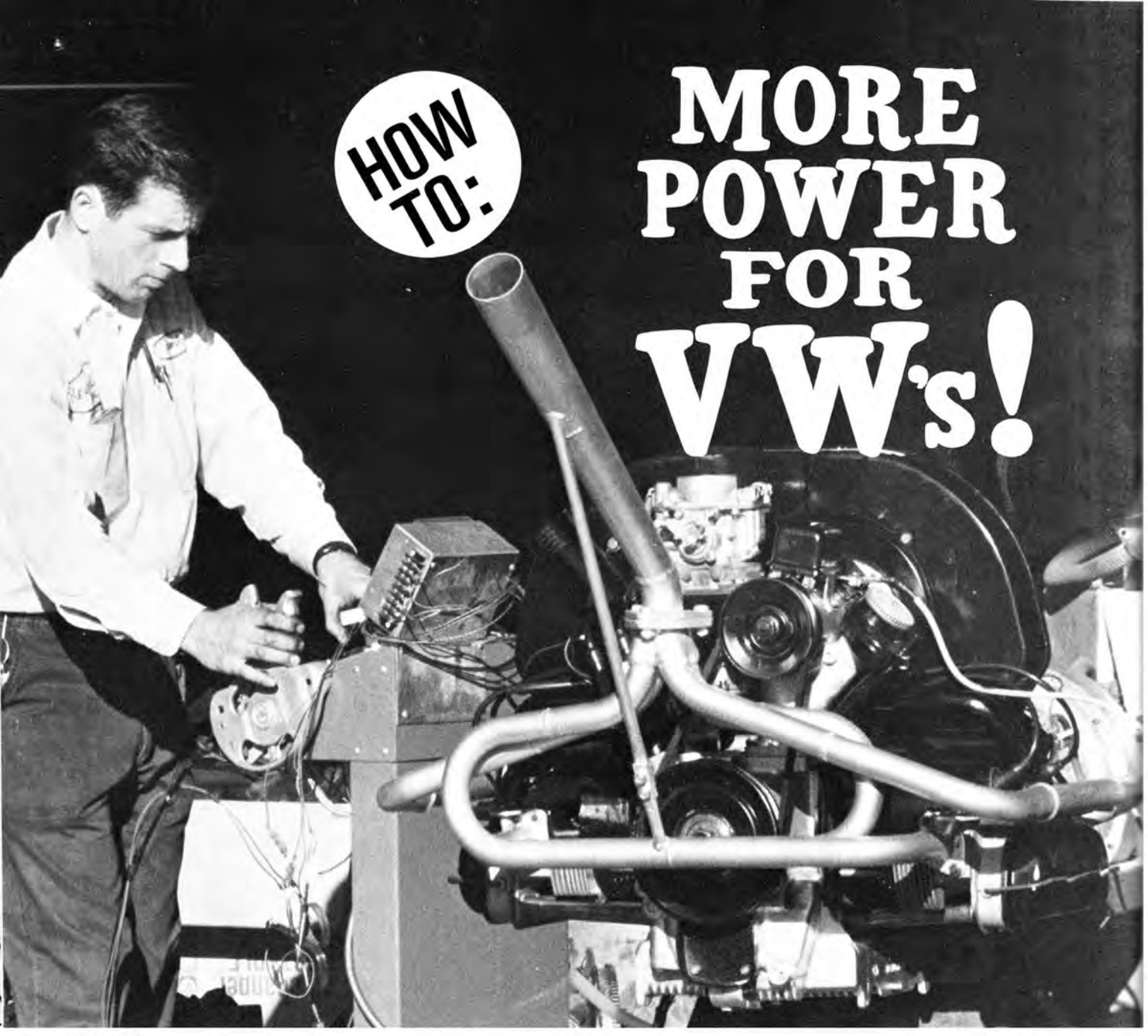


HOW TO: MORE POWER FOR VW's!

By Ed Orr

A stage two hop-up for the VW is generally considered the maximum amount of modification possible while remaining usable in a street machine. The 85 hp Revmaster "Spoiler" is a perfect example.

It is an interesting comment on both VW design and Revmaster's skill that modifications which double the stock horsepower are still considered stage two. Imagine for example a 700 hp 327 Chevy street machine! To learn just how to double a VW's horsepower we packed our notebooks and cameras out to Riverside, Calif., and followed each step of the two-day operation.

Frank Sklaski is Revmaster's top engine man. He personally builds the mills that power the company's team race cars. To date not a single car has retired during a race due to engine trouble, and that has to be a record! Starting with a bare case Sklaski showed us step-by-step how he turns a mild-mannered Volkswagen into a super bug without the aid of a phone booth.

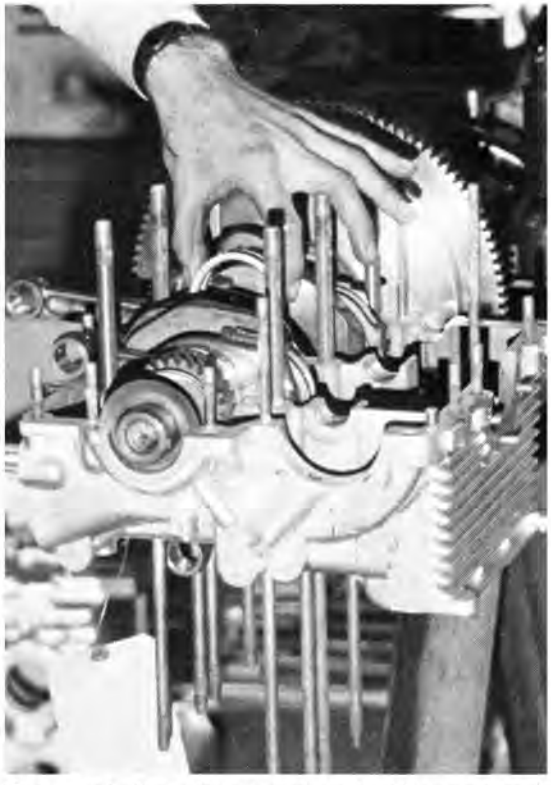
He starts by removing all the inside studs from the case and then grind lapping both case halves. This reduces the i.d. size of all the bearing bores. After this is done he replaces all the studs in the case and aligns the two halves with a dial indicator. The two halves must match within 0.01 mm. Once aligned the case halves are torqued together, with the 12 mm studs getting 25 ft.-lbs. and the eight mm's receiving 14 ft.-lbs.

The cam bearing bores are then reamed while being held exactly on center with a centering cone and then they're honed on a Sunnen honing machine. This gives an absolutely straight and very nearly perfectly round bore.

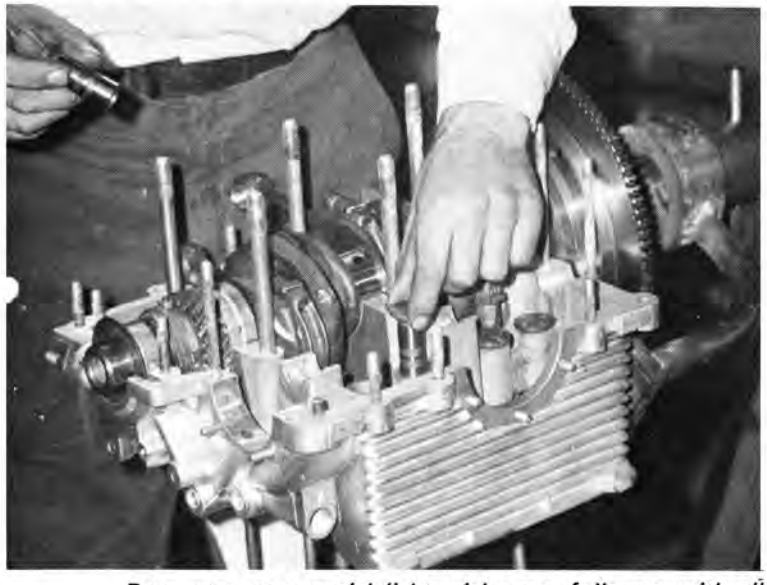
The method used for the remaining work depends on the type of case being machined. Volkswagen has used several styles over the years and the different configurations require different set up procedures. The first method used is to set up on center with the old bores using necessary jigs and fixtures and a boring bar of almost two inches in diameter. To this bar is attached a cutter or reamer to rebore the seal receptacle, main bearing bores and flange and pulley bore. The oil pump bore is done in the same manner described above but has its own centering devices and boring fixtures. This is necessary as this bore size has also been reduced by lapping the case

WANT MORE POWER FROM YOUR LITTLE BEETLE? HERE'S THE HOT SETUP ON HOW TO GET IT!

Sklaski torques the matched rods to the Revmaster "B" 74 mm crankshaft. Extra care goes into the assembly of the engines slated for racing.



When installing the crankshaft in the case the fit can be checked with the remaining half of the number two bearing as shown here. If the crank is down on the dowel pins the bearing half will fit with little or no play.



Revmaster uses special lightweight cam followers with all their cam kits. All cams are turned from new billets to insure top quality.

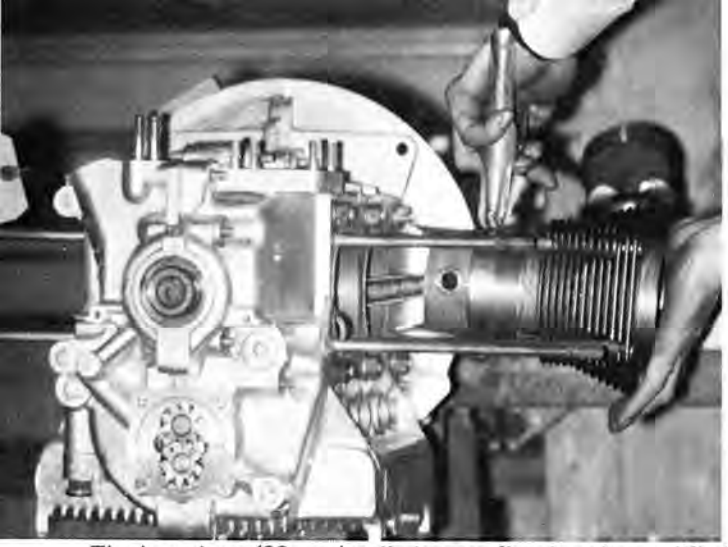
halves and must be brought back to its stock size of 70 mm.

The second method used is an automatic boring machine. This machine was designed and built by Revmaster as there were none on the market that could meet their requirements of accuracy and output. It is the only one of its kind in existence.

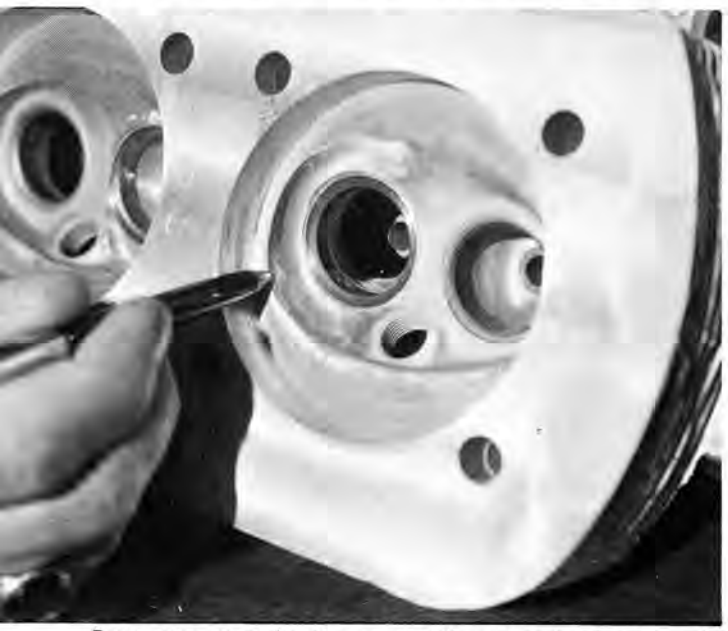
When using this machine a mandrel is placed through the already finished cam bores and by the use of eccentric sleeves the main bearing bores are lined up with a high speed boring bar. This bar has three micro-bore cutters recessed in it. These cutters are adjusted to bore precision holes of whatever size is needed. While all sizes rate about the same for strength, standard is preferred where possible as there are a wider variety of bearing sizes available. As with the first method the oil pump bore must be done separately. With either method, the cases are always bored to the smallest of three sizes possible. The sizes are standard, plus-.010-inch, and plus-.020-inch. Through all work perfect alignment and size, well under new parts tolerances, are maintained.

Next Sklaski takes a specially prepared and finished Revmaster "B" 74 mm stroke crankshaft and assembles to it four connecting rods of matching weight and end-for-end balance. This means that not only are the rods the same weight but all the wrist pin ends weigh the same as do the large ends. The rods have further been checked to make sure they are the same length within .005-inch. They have slightly larger (.0005-inch) dimensions both for side clearance and rod bearing clearance. This is a step in clearancing the engine that allows it to turn more freely. Wrist pin size remains stock.

The rods are installed on the crankshaft much in the same fashion as with stock components, the only exception being that more attention is paid to rod alignment at each journal. If this is not done the bearings will burn very quickly when the engine is put in operation. Sklaski uses a feeler guage between the rod and the rod journal boss to find the clearance. This must not be less than .007-inch. Then with a hammer and punch he brings the cap into alignment with the rod, rotating the rod from time to time to check.



The large bore (82 mm) cylinders are fitted to the modified pistons. Part of the skirt has been cut away to clear the crankshaft and the piston crown height has been reduced.



Revmaster reworks the combustion area to improve the engine's breathing capacity. In the process the chamber is shaped to avoid detonation which can be a problem with high compression VW engines.

Rocker arms from the 1500 series engines are identified by the two marks on the end shown here. The 1500 arms have a ratio of 1.1-to-1 which is a 10 per cent increase in cam lift over those from the 40 hp series.

Next the crankshaft gear and brass distributor drive gear are heated in an oil bath to 180 degrees F. This increases the diameter and allows them to be slipped on the shaft with spacers and a snap ring after number three main bearing is installed.

Sklaski states the next step is very important. It involves setting the crankshaft end play. This is done by standing the crank on the pulley end and installing the number one main bearing, three spacer shims and the flywheel gasket. Next the chopped and balanced flywheel is placed on the crank and torqued. He then checks the space between the flywheel flange and the shim with a feeler guage. The distance should be between .004 and .006-inch. If it is not satisfactory an adjustment of shim thickness is made until the desired measurement is attained. As a safety measure (after the case is assembled completely) the end play is checked by attaching a dial indicator to the flywheel and reading the amount of end play by moving the crank back and forth. The reading should be between .004 and .006-inch.

The crank assembly is then ready to install in the case. One half of the center main bearing (number two) is installed in the proper position. The crank is installed paying particular attention to getting main bearings one, three and four down on the dowel pins. When this is done it can be checked by placing the remaining half of number two main bearing down on the crank to see that it fits with little or no play. If the crank is properly seated, the number two bearing is placed in the other case half.

Next a factory-new REV-22 cam is installed in the case allowing a minimum amount of backlash between the crank gear and the cam gear. It should be pointed out that these camshafts are not regrinds. Each is turned from a new billet at the Revmaster factory. They use special lightweight cam followers with all their cam kits which are manufactured to extremely rigid specifications.

After installing the flywheel main seal and cam plug a moderate coat of glue is applied to the case and it is ready to close up except for fitting a new 1500 oil pump (or possibly an oil control tray) inside the case. The case is then torqued to factory specifications and the sump screen, cover and oil pump cover are installed. The flywheel is installed and a Revmaster high tensile hardened glan nut is used and torqued to 350 ft.-lbs. The factory glan nut specifications are 217 to 262 ft.-lbs. Revmaster has found that with the increased horsepower this additional method is needed to keep the flywheel tight.

The next step is the fitting of the 82 mm pistons which have been modified by Revmaster by cutting away part of the piston skirt to clear the crankshaft. The piston crown height has been reduced so as not to strike the cylinder head combustion area at top dead center. In addition to the piston modification a spacer is fitted between the case and the cylinders which allows the clearance required when using the stroker crankshaft. If Sklaski knows in advance the type of use to which the engine will be subjected, he can increase the piston clearance to an acceptable amount which reduces friction and helps the engine run cooler.

The cylinder heads have long since been prepared and are waiting on the shelf. The cylinder head bores are the same as stock but the internal modifications have been extensive. Again, depending upon the use to which the engine is being put, the compression ratios may vary. These run from 9.5-to-1 to 10.5-to-1.

The combustion area itself is completely reworked,

shaped and contoured to remove the shrouding restrictions around the intake valves and to remove restrictions and major obstacles from the intake ports. Revmaster does not pretend to have ported these heads but merely remove the restrictions. The combustion chamber is shaped to avoid detonation which is likely to occur in this engine with high compression heads. After the cylinder heads have been selected and installed on the case studs, the push rod tubes and seals are installed and the heads are torqued.

Sklaski also installs special rocker arm assemblies made from 1500 VW rocker arms. The early 40 hp rocker arms had a ratio of 1-to-1. The 1500 arms have a ratio of 1.1-to-1. This provides an increase in cam lift of 10 per cent.

At this point Sklaski has built the basic engine. It can either be sold as a 75 hp or 85 hp Spoiler depending upon the carburetion.

Before selecting the carb, the shrouding is cleaned and painted. The generator, regulator, distributor, fuel pump, carburetor and coil assemblies are either new or completely rebuilt and tested. The distributor is set up to give full advance at 2500 rpm. A total of 38 degrees advance is used with 10 degrees on the crank and 28 degrees in the distributor.

Now to the carbs. On the 75 hp engine a stock manifold with a modified 28 PCI Solex carbuetor is installed. Modifications on this carburetor consist of changing the air correction jet and boring the venturi to a larger size.

The 85 hp version is equipped with a ram style intake manifold and fitted with a new Zenith 32 NDIX carburetor. In some instances Rochestor and Stromberg carbs have been used. However, the reduction in cost does not make up for the performance lost. Each engine is run on the test bench. Different jets and timing are used depending on the type of exhaust manifold and the use to which the engine will be subjected.

The final step is the addition of a 180 mm clutch assembly. The clutch can either be a Luk or a Hausermann as there is very little difference between them. The Hausermann has easier to read code numbers which designate the rating of the clutch. The disc is a standard "B" style VW type. Special lining is required that exceeds factory hardness.

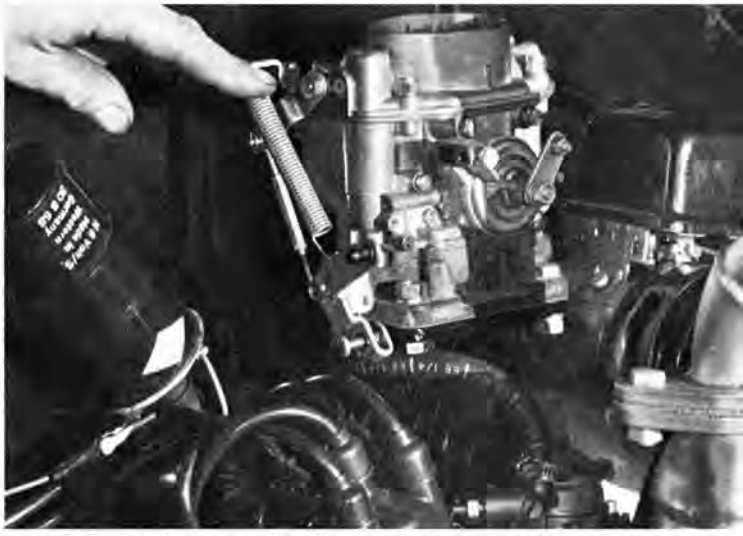
While the above covers the major steps taken in the engine's assembly, Sklaski checks a myriad of other minor details almost unconsciously as work progresses. The engines are assembled very carefully and to close tolerances but should not be considered as 100 per cent race ready until each screw, bolt, nut, fitting and connection has been double checked, sealed and locked in some manner. Revmaster recommends this work be performed by the customer as no two have the same requirements.

Since no two engines will run exactly the same, Revmaster will dyno-tune any engine upon customer request. Normally only every fourth engine is dyno-tested for quality control.

The engine is now ready to slide into a bug or buggy, and the performance is unreal! The blocks seem suddenly shorter and hills that formally pulled you down to 45 mph in third disappear.

As stated this is only a stage two hop-up. The fantastic little VW has still more potential which we will be looking into later. Would you believe 175 to 200 hp? It can happen, especially with today's modern hot rodding techniques. Stay tuned for further developments.

A centrifugal advance distributor takes the place of the stock vacuum actuated item. Sklaski sets them up to reach full advance at 2500 rpm. A total of 38 degrees of advance is used with 10 degrees on the crank and 28 degrees in the distributor.



Recommended carburetion for the 85 hp engine is a Zenith 32 NDIX. Rochestor and Stromberg carbs have been tried but on the dyno the Zenith was found to be superior.

To harness the horses Revmaster recommends a 180 mm clutch assembly. This can be either a Luk or Hausermann. Here the assembly is compared with a stock unit on the left.