



BUILD

By RAY BROCK



Approximately 60 horsepower is available in this modified VW engine getting the finishing touches by Joe Horvath. Visible are the special Denzel heads with intake system and dual Solex carburetors. The oil cooler is also a high-capacity type. Inside the engine, an EMPI stroker crank assembly gives 1300 cc displacement, more compression.

Many changes have taken place on the American automotive scene within recent years and the car that is credited with starting the revolution is Germany's Volkswagen. Until this small economy model with the face of a beetle reached the shores of the U.S. in the early 'fifties, foreign cars had not been too successful in their attempts to invade our 5 million-plus annual new car market. In the Volkswagen, Americans found a car that was simple, functional, relatively cheap to buy, easy to herd through traffic, could be parked in spots the larger models had to pass up and could be operated at a fraction of the cost required for large cars.

As the Volkswagen snowball started rolling downhill collecting customers, other European small cars were quick to see the market potential and started importing economy models to compete for the Yankee dollar. The result of all this foreign machinery tempting the American public was at first just a small slice of the automotive pie but the combined efforts of the imports cut the piece of pie bigger each successive year and the Detroit manufacturers were forced to change their way of thinking. The results of VW's American invasion less than ten years ago are today's U.S. compact cars.

VW sales have not waned the least despite the competition of other imports and don't figure to be bothered by the introduction of higher priced American compacts. This means that the several hundred thousand VW's presently in this country will be augmented by more thousands each month to come and also means the already high interest in VW's will continue to rise. Many VW owners bought their cars for economy, others for small size, still others because of the simple design without acres of chrome. Most of these owners are perfectly happy with their VW's and wouldn't change them for the world but there is always a certain percentage who invariably want

HOT ROD MAGAZINE

A "BEETLEBOMB"

The popular little Volkswagen, billed as the People's Car, now appeals to the horsepower-conscious as well as the economy-minded with a stroker kit and special racing heads

a little more than the product has to offer. Those who fall into this group have one common complaint, not enough horsepower. This brings us to the matter at hand. Just what can you do to the VW to give it better passing power on the open road or make it climb steep hills without dropping to a lower gear, or keep it from falling on its face at the higher altitudes? You've come to the right place, we have some answers.

First of all, normal hop-up procedures apply to the VW engine just as to any other engine. Increased compression, breathing, displacement, and the other modification procedures deliver improved performance. VW's being imported today have a 77 millimeter bore and a 64 mm stroke for a total of 1192 cubic centimeters. They are rated at 36 horsepower. Models imported prior to 1954 had a 75 mm bore, 1131 cc displacement and were rated 25 hp. Not too many of the 25 hp models are found nowadays since it was common practice to replace the early cylinders and pistons with the 77 mm size when the engine needed rebuilding and this brought the displacement up to 1192 cc.

Porsche engines prior to 1957 were basically nothing more than modified VW's. Early 1100 models had the same 1131 cc displacement but used different cylinder heads, more compression, dual carburetion and a different camshaft. The 1300 cc models had more displacement plus the heads, compression, carburetion and camshaft but were also glorified VW engines. All two-piece crankcases used for '56 and earlier Porsches are the same as those used by VW, so therefore a number of the Porsche parts could be fitted to VW's by those wanting more power. In 1957, Porsche started using a three-piece crankcase for their production engines and most of the parts' interchangeability was cancelled.

Although all of the 1192 cc VW engines are basically the same, a few

changes were made in 1958 models which perhaps make them slightly more desirable for modification. Most important was the change in crankcase patterns so that '58 and later cases have more strength around the main bearing webs.

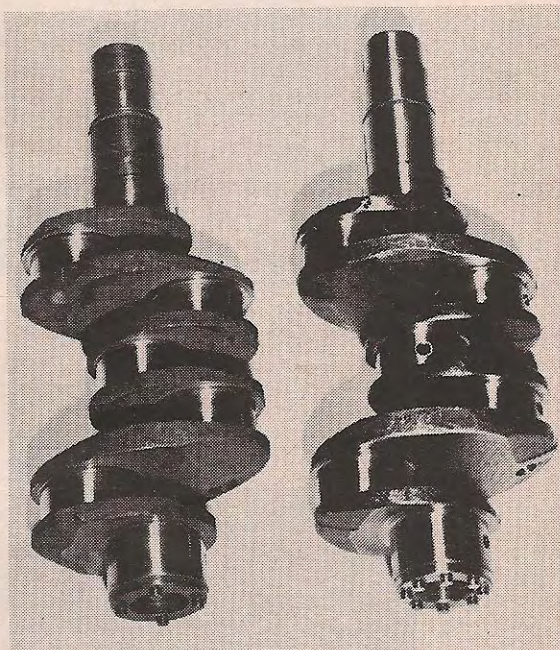
To get qualified information on VW hop-up procedures, we went to Revmaster Incorporated in Sunnymead, California, and European Motor Products Incorporated in Riverside, California. Revmaster specializes in stock VW engine rebuilding plus custom modified VW engines. EMPI imports specialized products for many European models and is the dealer for VW stroker kits and special cylinder heads made in Germany and Austria.

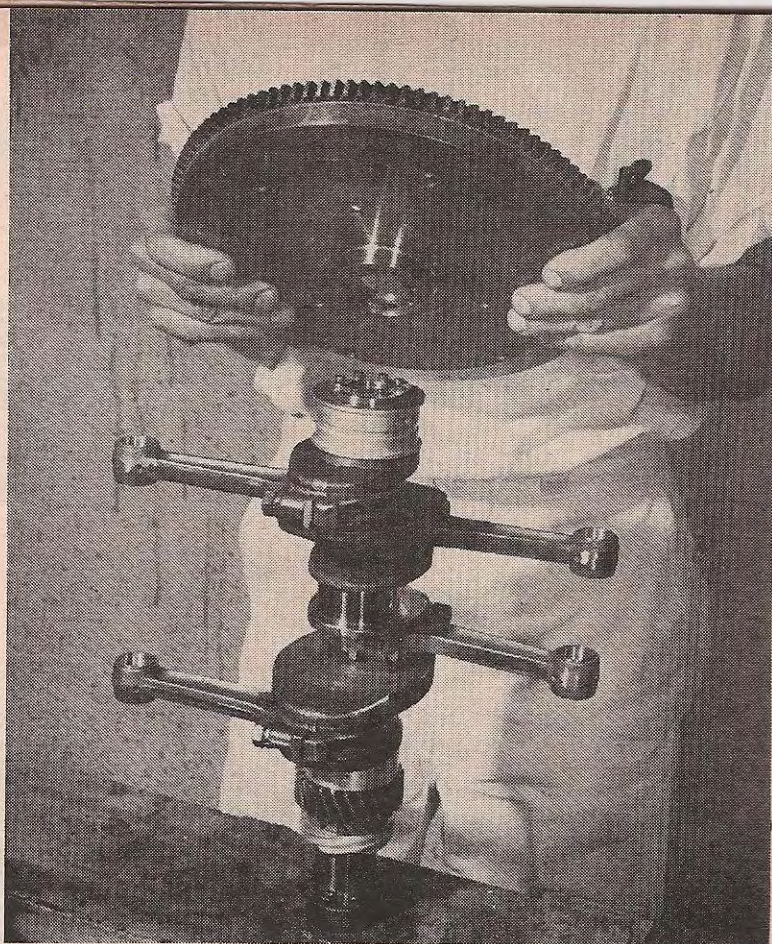
Discussing the VW engine with Joe Horvath of Revmaster, we learned which modifications were practical and which were impractical. We asked what the weak points were, if any, to be looked for before modifying the VW. Joe informed us that the engines are very durable but when they do have trouble, the most common failure in the stock engines is burned or dropped exhaust valves. This is brought about by lack of attention from the owner and too many miles between valve jobs. Another weak point, which usually doesn't appear unless the engine is modi-

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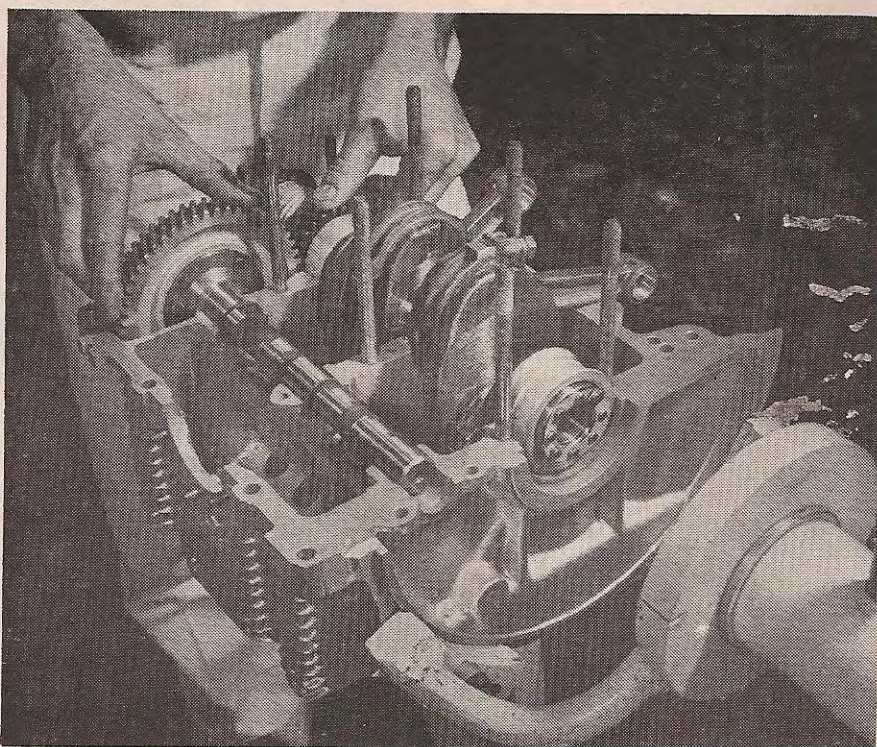
TOP—The stock crankshaft on the left and EMPI stroker on the right. EMPI crank is a new forging, not welded, and is stronger than the stocker. New crank has 6 mm more stroke, four extra drive dowels.

BOTTOM—Installing the stroker requires few modifications to the rest of the engine. Stock rods have ample beef but the corners of the rod caps must be ground off slightly, as shown, to clear the camshaft.





VW flywheel is held to the shaft in stock engines by a single large bolt and drive torque taken by four dowel pins. Dowels sometimes shear so extra strength is needed in modified engines. EMPI crank has extra dowels so extra holes must be drilled in the flywheel to match. Fit must be accurate.



Assembling a VW is easy but care should be taken to make sure the split cases mate perfectly. They can't be nicked or warped since gaskets are not used. Reground camshaft or early Porsche cam can be helpful but only if engine's breathing is increased too.

BUILD A "BEETLEBOMB"

continued

fied, is the crankshaft and the dowel pins that drive the flywheel. If a supercharger is bolted to a stock VW engine and the car then driven hard, a broken crankshaft will often be the end result. Or, the four dowel pins in the crank will not provide enough strength for the increased torque and they will loosen and shear off.

Increased compression is one way to gain power but the VW cylinder head construction is such that they cannot be milled, so new pistons must be used. Even with special pistons and a compression increase, there is very little noticeable power increase for the money spent. So, Joe doesn't recommend high compression pistons alone.

Hot cams can also be bought for the VW but most of these cams are fashioned to give increased timing and extra power at high rpm's. VW's single carburetor and small intake system does not lend itself toward good high rpm operation so a cam is not a good investment either. One possible exception is the stock 1300 and 1500 Porsche cam for the two-piece case up to 1956. This cam will give slightly better torque than the VW cam but hardly enough to warrant tearing the engine apart to install it.

Dual carburetion kits are also available. These carburetion kits supply the necessary pieces to mount a pair of stock carburetors on the engine and reportedly give as much as 20% more horsepower at higher rpms. Stock VW heads have small valves plus a small Siamese intake port in each head so actually cannot take full advantage of the increased breathing when it is available. The cost of dual intake systems varies from \$80 to \$110 depending on the make. Since the improvement is in the upper rpm range and low speed torque isn't boosted appreciably, carburetion kits to fit the stock engine don't appear to be the answer either.

Next, we come to increased displacement. This can of course be done by increasing the bore size, lengthening the stroke, or both. Increasing the bore can be done by installing certain model Porsche barrels (cylinders) but the price for new Porsche barrels and pistons is pretty high. So, dropping the extra bore idea, we get to the stroking method and this, according to Joe Horvath is the most practical means of making the VW perk up its ears. EMPI imports forged steel stroker crankshafts from Germany which increase the stroke from 64 mm stock to 70 mm. The extra 6 mm is slightly less than 1/4-inch and raises the displacement from 1192 to 1300 cc. Con-

verted to inches, 72.8 inches stock and 79.4 inches with the stroker kit. Compression is raised from 6.6:1 to 7.4:1. Don't snicker just because it is only 6.6 cubic inches more with the stroker kit, tests show 18% more torque and 4 more horsepower. The big advantage is not readily seen in just the figures, however, the increased torque in the low speed range makes it possible for the VW to fly over hills in fourth gear that formerly required a downshift to third.

The 7.4:1 compression ratio is with the flat-top pistons supplied in the EMPI kit (kit price, \$137.50) and still permits the use of regular grade gasoline. New pistons are supplied because in most cases, these stroker kits are installed in engines that have had a certain amount of piston wear. Either standard or over-size pistons are available in the kit. For engines that are relatively new and therefore have no piston wear, it is possible to machine the top of the stock piston as shown in the photograph on this page, so that they can be used with the stroker crank and even more compression gained. Caution: The slightest ring ridge in the barrel must also be removed. This will give 8.15:1 compression ratio but necessitates the use of premium grade fuel. EMPI gives an allowance if pistons aren't ordered and this will make the stroker kit cost even more reasonable.

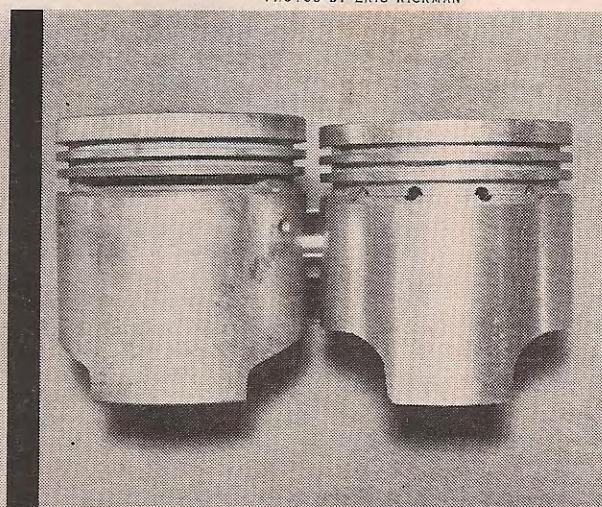
To install the EMPI stroker, the corners of the rods must be ground down slightly to clear the camshaft, the bottoms of the barrels notched or turned down on pre-'58 engines and the four extra dowel holes drilled in the flywheel. The extra dowel holes are needed to hold increased torque.

(Continued on following page)



Horvath fits the two VW magnesium crankcase halves together. VW cases and bearings have proven quite capable of absorbing added load of a modified engine without giving any problems but Joe installs heavy-duty steel-backed main bearings to be safe.

PHOTOS BY ERIC RICKMAN

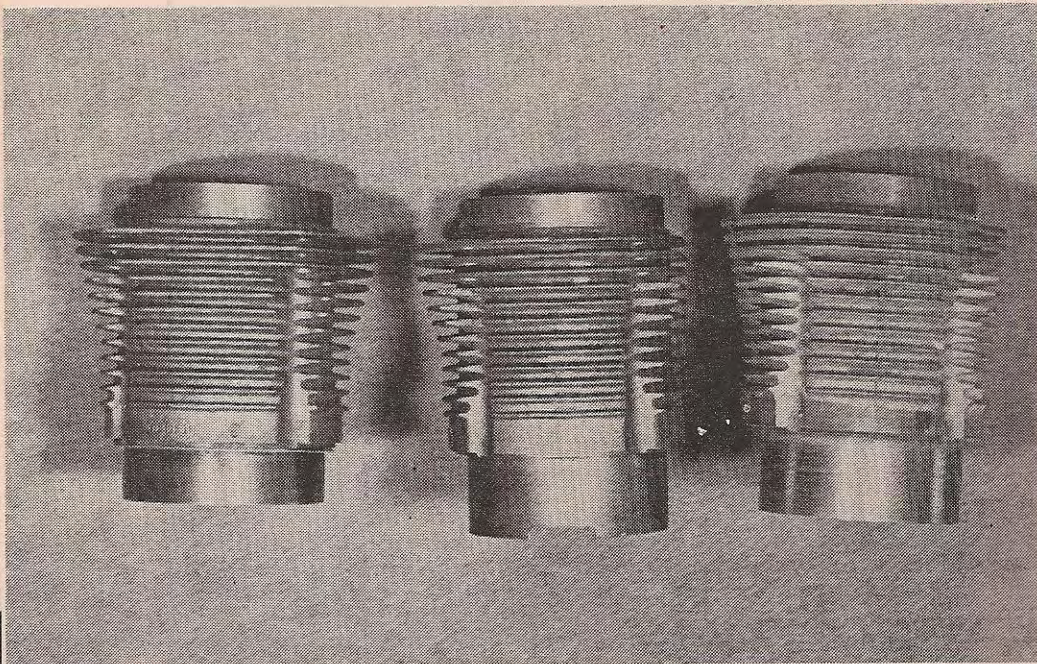


Stock VW pistons can be reworked to go with the stroker crankshaft. Head must be trimmed 3 mm around the outer edge as shown and skirt relief cut deeper to clear crankshaft throw. Compression is 8.15.

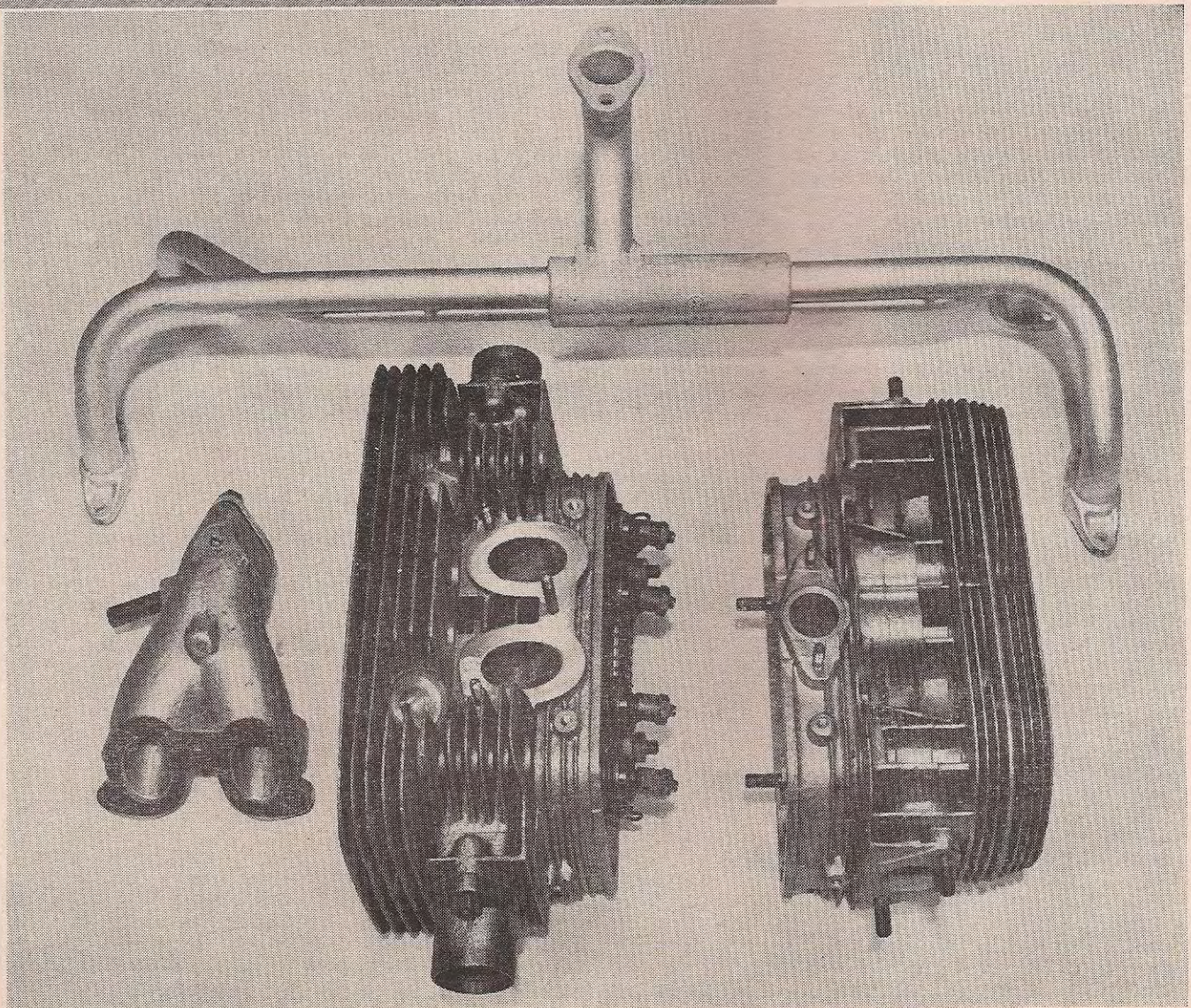
Comparison of stock VW piston and the German-made pistons supplied with EMPI kit. With pin holes aligned, special piston on right shows the lower crown as well as skirt relief. Compression ratio is 7.4:1.

BUILD A "BEETLEBOMB"

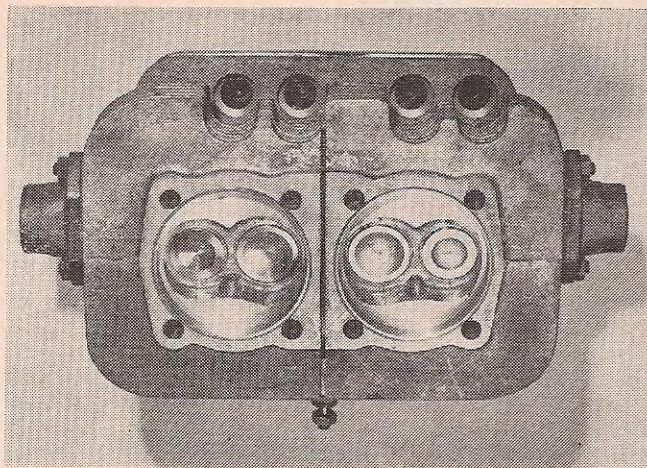
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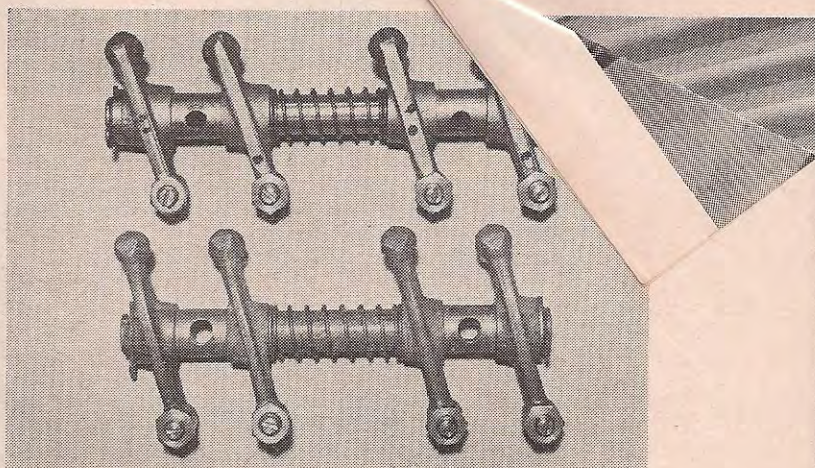
Cast-iron cylinder barrels on '58 and later engines, left, are shorter than early models barrels, right, so do not have to be altered for use with stroker crankshaft. Early barrels must either be notched $\frac{1}{4}$ -inch, center, or shortened to late size. Spacers between the barrels and case have been used occasionally but pushrods and shrouds must also be altered to match, so best method is to notch or trim barrels.



Comparison between the stock VW head, intake system and the Denzel head and intake is well illustrated. Stock head at right has a single, small Siamese intake port and small diameter intake manifold, top, that feeds all four cylinders through a single Solex carburetor. Denzel head has large, individual intake ports and a cast manifold for carburetor on each head.



To take advantage of larger ports in Denzel heads, valves are much larger than stock VW size. Combustion chamber shape is smaller for more compression, 7.5:1 with stock displacement.



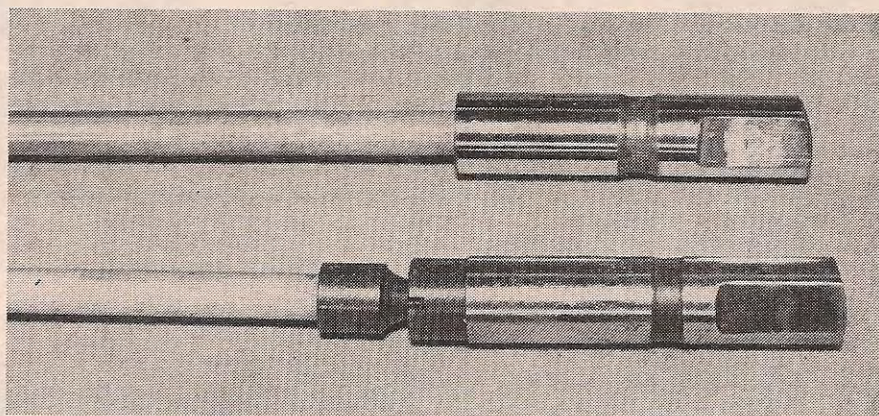
Rocker arms at the top are Denzel, those at the bottom, stock. Denzel heads have valves angled slightly so shorter rocker arms are required. Ratio between cam and valve is same as stock.

For those who want more extra punch than the stroker kit supplies, EMPI also imports a special cylinder head kit from Austria. These heads are made by Wolfgang Denzel and feature large individual intake ports to each cylinder, large exhaust ports, larger valves, dual valve springs with increased pressure for high rpm's, intake manifolds, articulated pushrods, large bore carburetors, a full-flow oil filter, and miscellaneous related pieces. When bolted to a stock displacement engine, the compression ratio is raised to 7.5:1 and the horsepower jumps from the stock 36 to 54 hp. Used with the EMPI 1300 stroker kit, the compression is 8.5:1 and the power jumps up to 60. The EMPI crankshaft is a good item to have with the Denzel heads not only for the extra inches but also since a substantial horsepower increase can often overstress the stock crankshaft. The EMPI pistons must be used with Denzel heads due to combustion chamber shape. 1300 cc VW's with Denzel heads, increased compression, long duration camshaft and larger carburetors have reportedly produced as much as 85 horsepower.

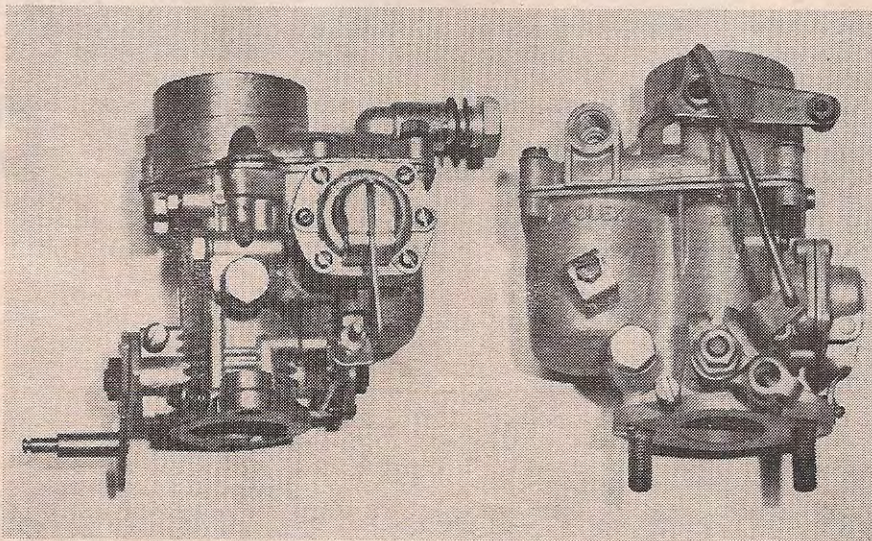
The cast aluminum Denzel heads have 38 mm diameter intake valves, 32 mm exhaust valves. Stock VW valves sizes are 30 mm intake, 28 mm exhaust. The individual intake ports and their sizes compared to the Siamese stock intake port is best shown in the accompanying photograph. Dual valve springs, machined steel retainers, and lightweight valves permit much higher rpm's than the stock valve train will run. Denzel equipped engines have run well over 5500 rpm without showing any valve float. VW bearing design is such that no problems are experienced in this department at the high rpm's either.

Stock heads have the valve perpendicu-

(Continued on page 102)



VW lifters have radiused end with flat side to hold alignment to cam lobe. Aluminum pushrods press into lifter. Top lifter is stock, the bottom lifter used with Denzel heads. Denzel lifter is articulated with U-joint which lets pushrod angle change.



Solex carburetors are used with the Denzel heads. 32 PBIC model at left is used for each bank of two cylinders and has much larger venturi area than the stock 28 PCI Solex at right. Costly Solex's could possibly be replaced with Corvair Rochester's.

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continued from page 39

lar to the top of the piston but the Denzel heads have valves angled about 5° to permit smoother port design. This necessitates the use of shorter rocker arms which in turn necessitates a change in pushrod-lifter. Both rocker arms and pushrod-lifters are furnished in the Denzel kit. Short intake risers bolt to each head with a Solex 32 PBIC carburetor for each pair of cylinders. These carburetors are expensive items and list for approximately \$40 apiece in this country.

The complete Denzel head kit is priced at \$379.50 so if the two special Solex carburetors could be eliminated from the kit, the price would be closer to \$300. One way to help cut cost would be to buy a second stock VW carburetor (Solex 28 PCI), bore the venturii out slightly and then rejet them. This would save about \$40. An even better idea for an enterprising hot rodder might be to buy a pair of Corvair Rochester carburetors and adapt them to the Denzel intake risers. Rochester carburetors are much easier to rejet than Solex plus they are much cheaper. They are about the same in venturi size as the special 32 PBIC Solex and should operate very well even without jet changes.

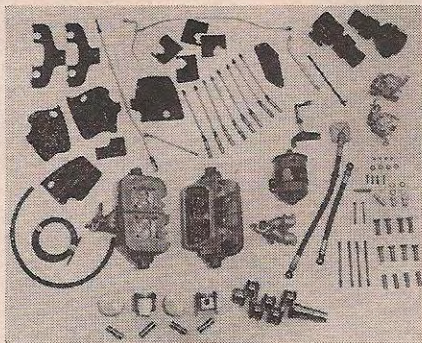
With the increased breathing ability of the Denzel heads, dual carburetion and the stroker kit, now is the time to consider a hot cam and a modified exhaust system. The Denzel kit features oversize exhaust flanges and EMPI also markets a free flowing exhaust system to match. With only 1600 pounds curb weight, a potential of 60-plus honest horsepower and a four-speed transmission, it is not impossible to predict a well-modified Volkswagen would "get the drop" on many higher powered Detroit cars at the stop light. They might also "head them off at the pass" when going through the hills.

Even with all the engine modifications, mileage is better than anything Detroit has to offer. We have heard reports of Denzel-equipped VW's running in excess of 100 mph so they will hold their own out on the open road too. They say that you can't have your cake and eat it, too, but with some help the little machine responsible for the great American automobile revolution appears to have the answer for that.



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