Take The 5th

Have you been taking the Fifth Amendment? Has unfamiliarity with Volkswagen and Audi five cylinder engines prevented you from handling your customers' service questions about these engines on the grounds that your answers might incriminate you? You're not on trial here, so don't be afraid to answer yes if necessary.

To help make your next cross-examination a success, we've assembled an assortment of repair information for this unique engine that's more than a four, but not quite a six. But before we begin, some five cylinder engine history is in order.

Audi's first production use of their five cylinder engine goes back to the 1983 Audi 5000. Since then, the engine has powered a variety of Audi models, in several different displacements and in turbocharged and non-turbocharged versions. Volkswagen's first and only five cylinder model was the now discontinued Quantum.

The Audi 200 Turbo is the only current Audi or Volkswagen equipped with a five cylinder engine. Volkswagen plans to introduce a five cylinder version of their new Eurovan. Although Volkswagen and Audi's five cylinder engine production has declined in recent years, there will still be plenty of five cylinder models on the road that will need service in the years to come.

Engine Deposition

The following information supplements the information contained in our photo captions. We've also listed the part numbers for some of the updated parts that are available for five cylinder engines. Factory part numbers frequently change. Use the numbers listed for reference only and consult a Volkswagen or Audi parts department for current part numbers.

• **An improved rear crankshaft seal (P/N 068 103 051G) is available to correct oil leakage between the crankshaft and rear main seal on 1984-90 Audi four and five cylinder engines.** Before installing the updated crankshaft seal, check for distortion of the engine sealing flange in the area that mates to the crankshaft seal. This may be caused by improper installation of the previous seal. Also check for any burrs or flashing on the crankshaft sealing surface that mates with the inside diameter of the crankshaft seal. Remove any imperfections by lightly polishing the crankshaft surface with fine emery cloth.

• **An updated water pump design is available to correct water pump leakage problems on 1984-87 Audi 5000 models.** The water pump seal has been fitted with a ceramic sealing surface for improved sealing.

• **Some 1984-85 Audi 5000 and 1983-87 Volkswagen Quantum models may have an exhaust leak between the exhaust manifold and the cylinder head sealing surface.** This condition may be caused by exhaust manifold warpage, which causes the studs on or near the number 1 and 5 exhaust ports to break. Whenever the exhaust manifold is removed, always replace the studs at the number 1 and 5 exhaust ports with tempered studs. Also check the exhaust manifold for warpage. The manifold may be resurfaced and does not necessarily need to be replaced if it's warped.

Exhaust Manifold Studs and Components

Application	Part Number
Hardened Exhaust Stud	901 889 02
Hex Nut	902 002 01
Washer	900 955 01

• **Frequent engine starts and short duration trips may cause an insufficient oil cushion in the hydraulic valve lifters on some Volkswagen and Audi five cylinder engines.** A ticking noise from the hydraulic lifters may result. An updated hydraulic valve lifter, P/N 034 5109 309M, is available to correct this problem. Use the diagnostic procedure described in photo captions 13 and 14 before replacing any hydraulic lifters.

• **Some 1984-87 Volkswagen Quantum models with five cylinder engines may be hard to start when the engine coolant temperature is less than 95°F (35°C).** This condition may be caused by an incorrectly wired thermo time switch and/or a thermo time switch with the wrong temperature range.

The white wire with a green trace should be attached to the cold start valve "W" terminal. The red wire with a black tracer should be attached to the cold start valve "G" terminal. If the cold start valve is wired correctly, and the engine is still difficult to start, install an updated thermo time switch, P/N 043 906 163A.

Specialty Tools

Like many modern engines, you will have a hard time working on a five cylinder Audi or Volkswagen engine with a crescent wrench and a hammer. Some special tools are required to do the job properly, safely, and easily. If you are planning on doing any volume of work on these engines, buy the tools. You'll save yourself a lot of grief and probably some skin too. The following tool suppliers offer a range of Audi and Volkswagen tools and will gladly supply you with the tools you need.

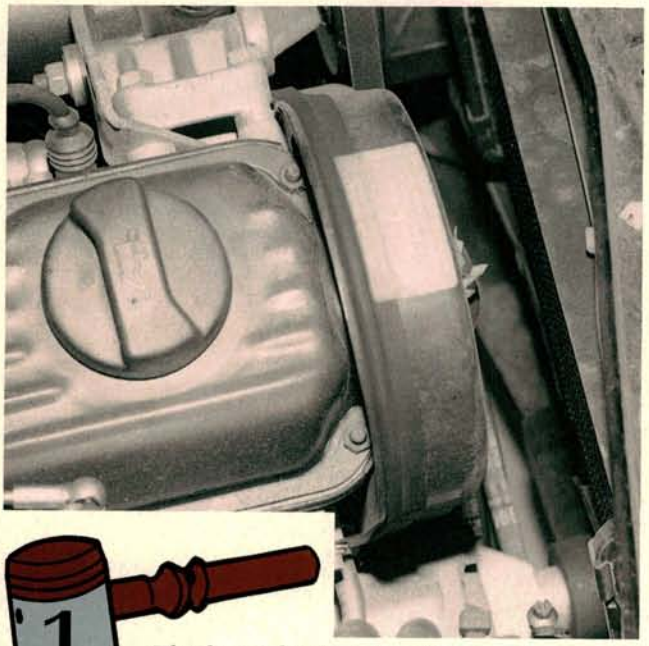
Assenmacher Tools
Circle No. 330

Baum Tools
Circle No. 331

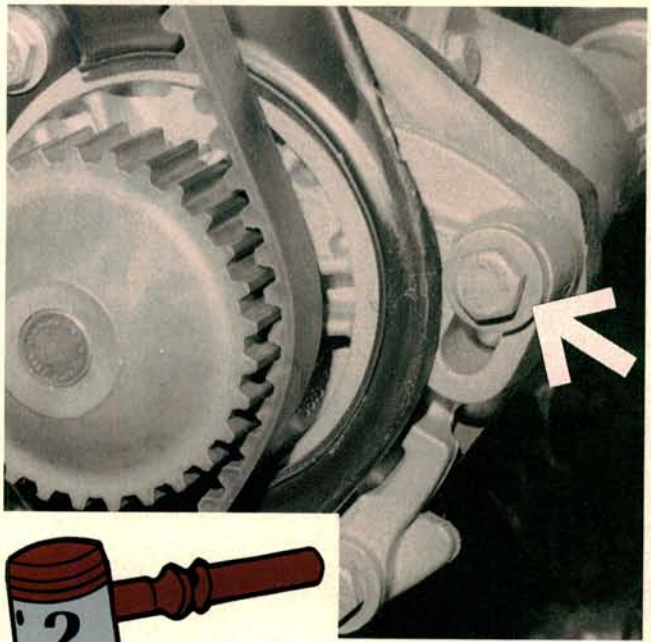
Schley Products
Circle No. 332

Zelenda Machine and Tools
Circle No. 333

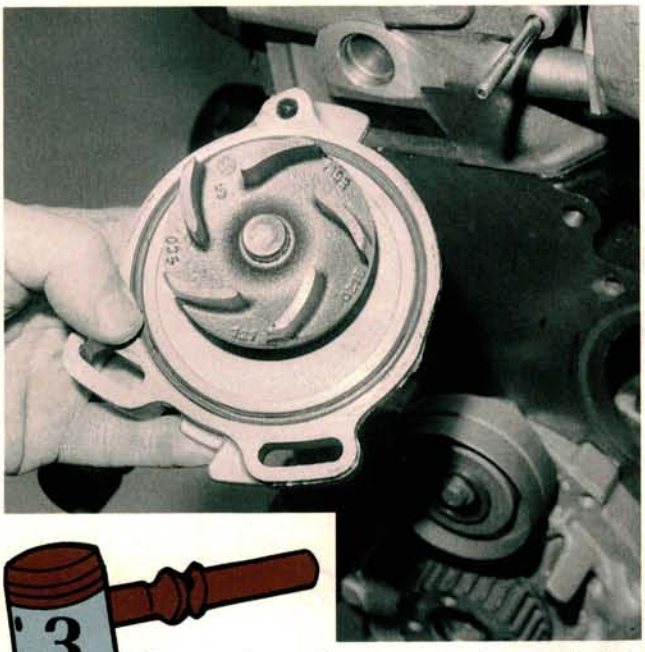
— By Karl Seyfert



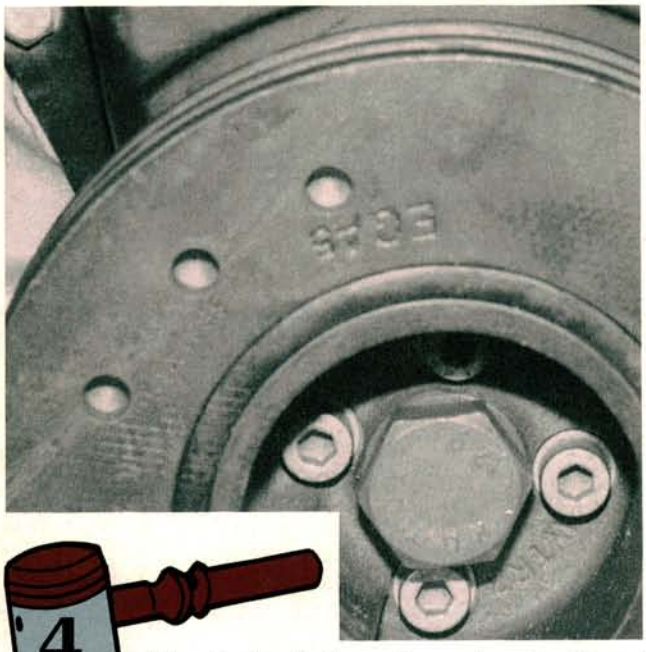
The five cylinder's lengthwise placement cuts down on your working room. This photo shows the cramped quarters at the front of an Audi engine compartment. The service procedures we'll describe can be done with the engine in the car. But for clarity, the remainder of our photos were taken with the engine on a stand.



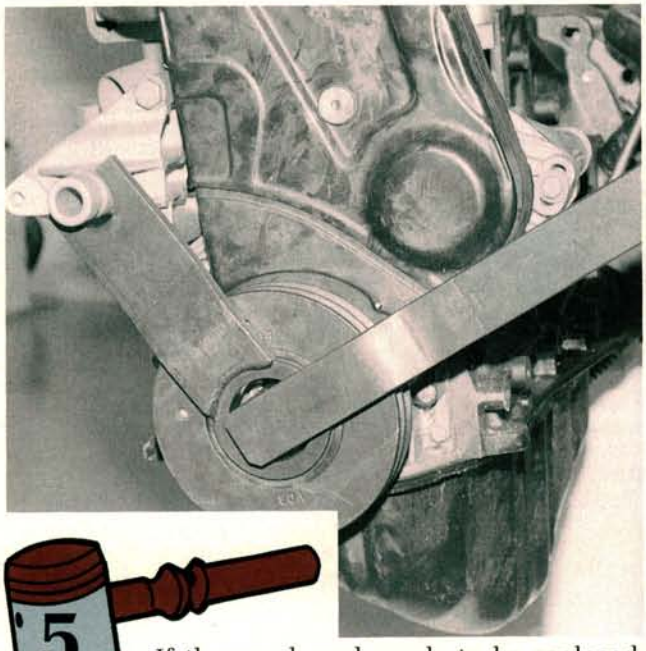
We'll start with the timing belt. The water pump pivots to adjust timing belt tension. There's no intermediate shaft or adjustable idler pulley. Inspect the water pump when replacing or adjusting the timing belt. Always replace the pump o-ring to prevent coolant leaks, even if you're not replacing the pump.



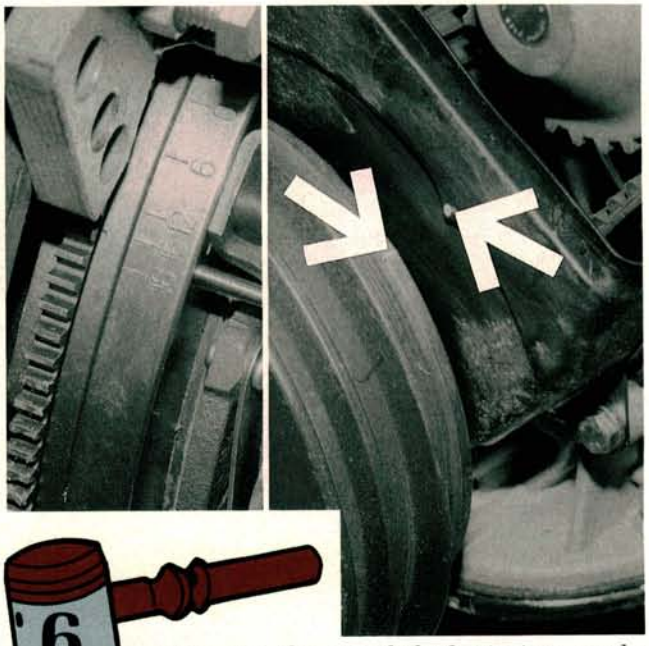
Inspect the sealing groove when replacing the water pump. The grooves on some remanufactured water pumps have been machined to accept a larger 5 mm o-ring. The stock 4 mm o-ring will not seal properly on these pumps. Pumps with modified grooves can be identified by a number 5 stamped on the pump fastening flange area.



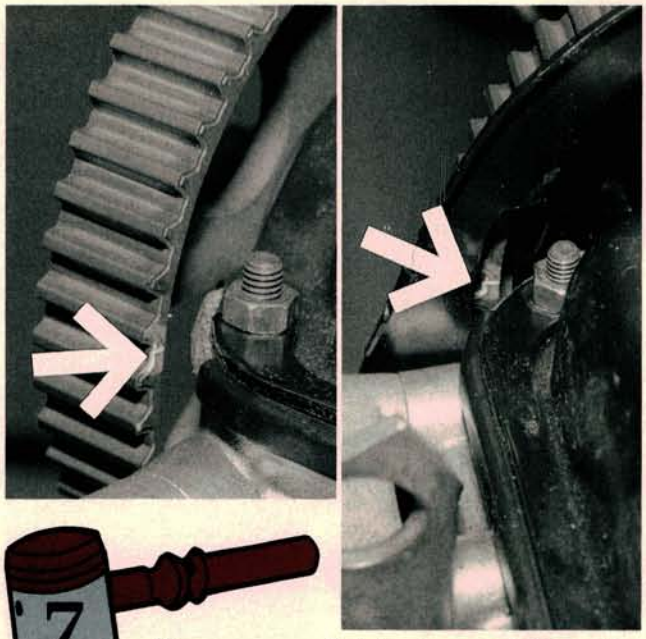
The timing belt can be replaced without removing the crankshaft sprocket bolt. Remove the four Allen bolts that attach the vibration damper to the crankshaft timing sprocket. The sprocket bolt is torqued to 350 Nm (252 ft-lb) at the factory. Add thread locker and you have all the ingredients for a hernia.



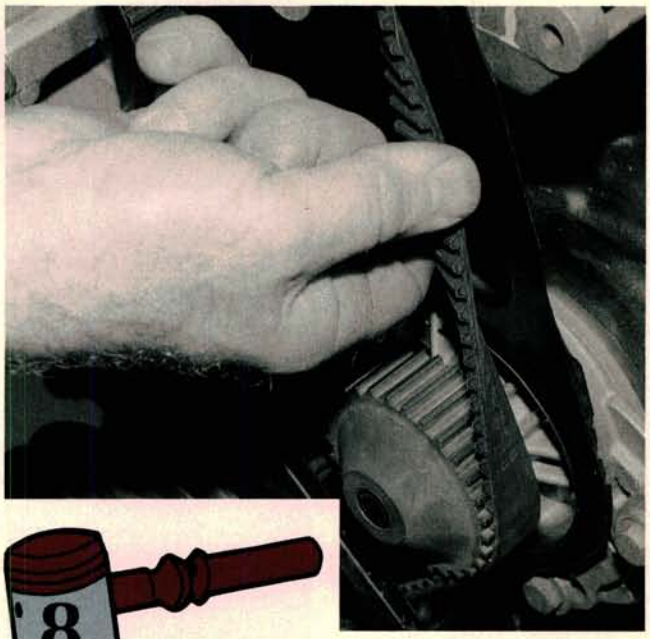
If the crank seal needs to be replaced, leave the vibration damper in place. The tool on the left engages the damper to lock the crankshaft. The tool on the right gives the leverage needed to loosen the crank bolt. If the engine is in the car, brace the damper tool above the motor mount while loosening, and below while tightening.



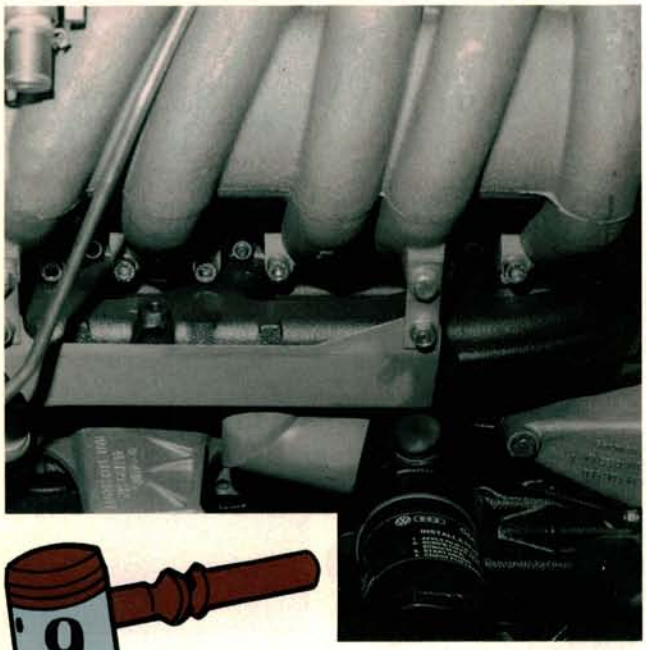
Line up the crankshaft timing marks before installing the new timing belt. If the engine is in the car, use the access window in the bell housing and the marks on the crankshaft (left photo). If the engine is out of the car, use the raised mark on the timing belt cover and the notch on the crank pulley (right photo).



The cam sprocket timing mark is on the back side of the pulley. Line up the mark with the top edge of the cylinder head. The mark is very easy to see with the belt shield removed (left photo). An access window in the belt shield (right photo) allows a glimpse of the timing mark when the shield is installed.

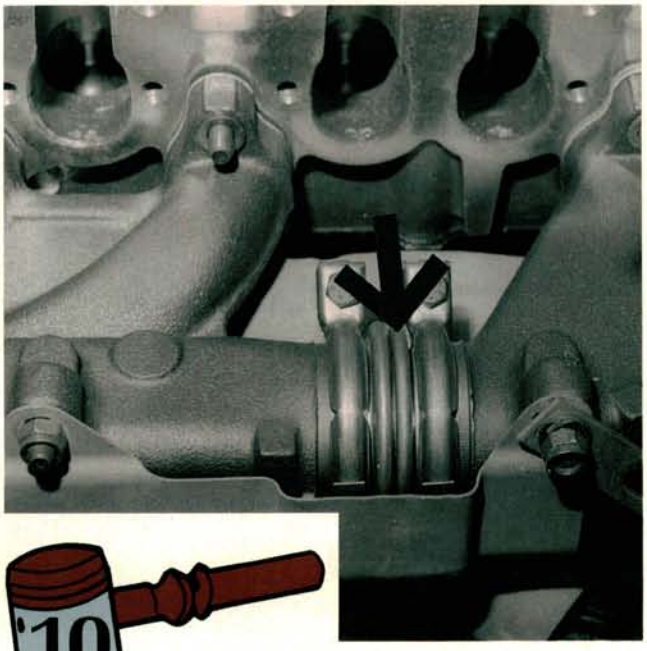


A belt tension gauge isn't needed to set the timing belt tension. Adjust the belt tension by pivoting the water pump counterclockwise. The belt is properly adjusted when it can be twisted about 90 degrees at the midpoint between the camshaft and water pump sprockets. Tighten the water pump bolts to 20 Nm (15 ft-lb).



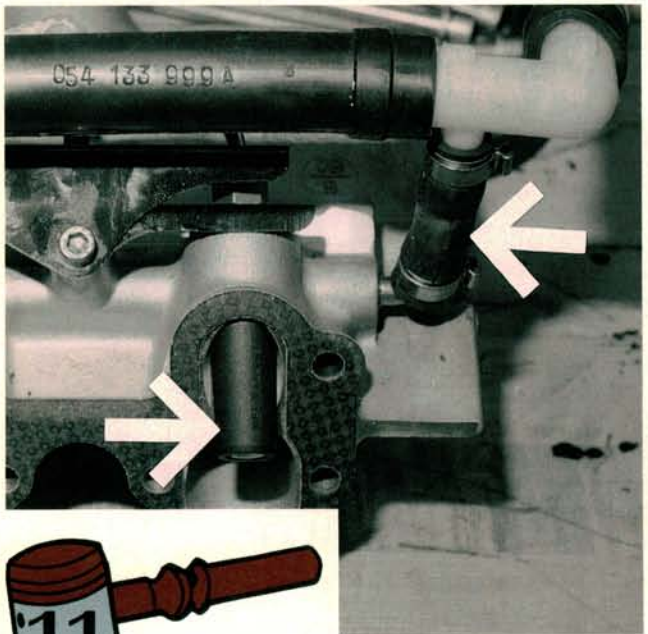
9

Uneven flexing of the cast iron exhaust manifold may cause exhaust manifold stud breakage at the number 1 and 5 exhaust ports. This Quantum manifold is cast in one piece. Check the manifold's mounting surfaces for flatness. The manifold can be machined to restore flatness and need not be replaced if it becomes slightly warped.



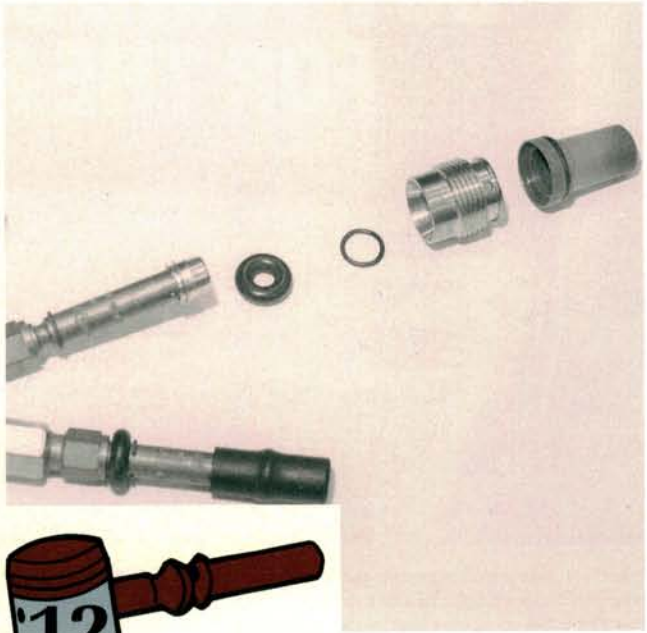
10

Specially tempered exhaust studs are available for the ports, and should be installed if the original studs break or whenever the exhaust manifold is removed. Replace the self-locking manifold nuts too. This later Audi manifold is jointed between the number 2 and 3 exhaust ports to prevent stud breakage problems.



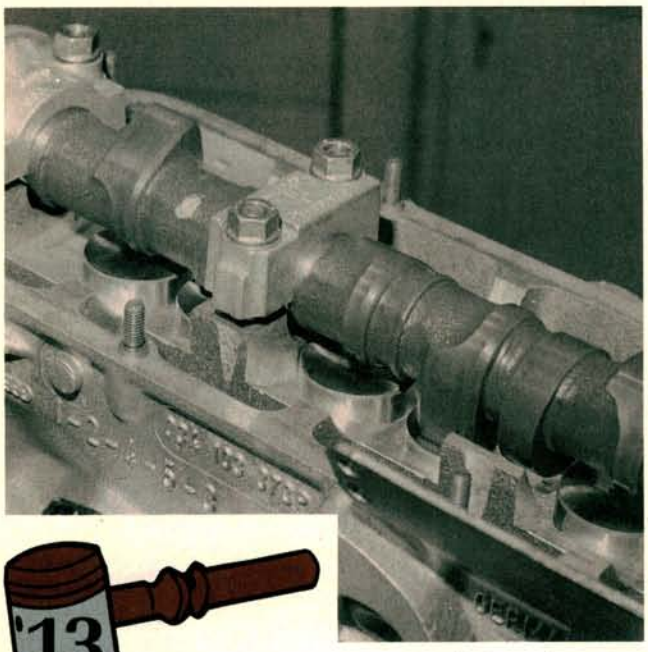
11

Leaking seals at the air shrouded fuel injectors may cause driveability problems. Metered air is normally diverted from the intake system (right arrow) and routed to sleeves (left arrow) that surround the injectors. The extra air mixes with the injector fuel spray for better atomization.

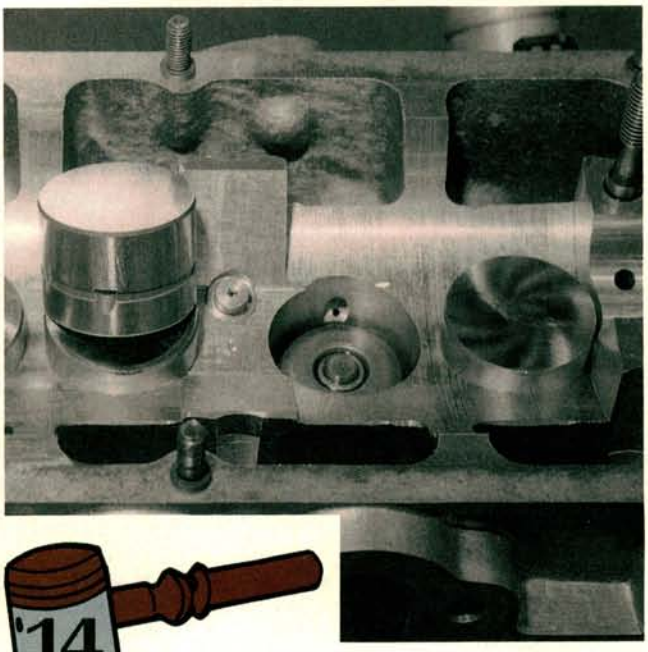


12

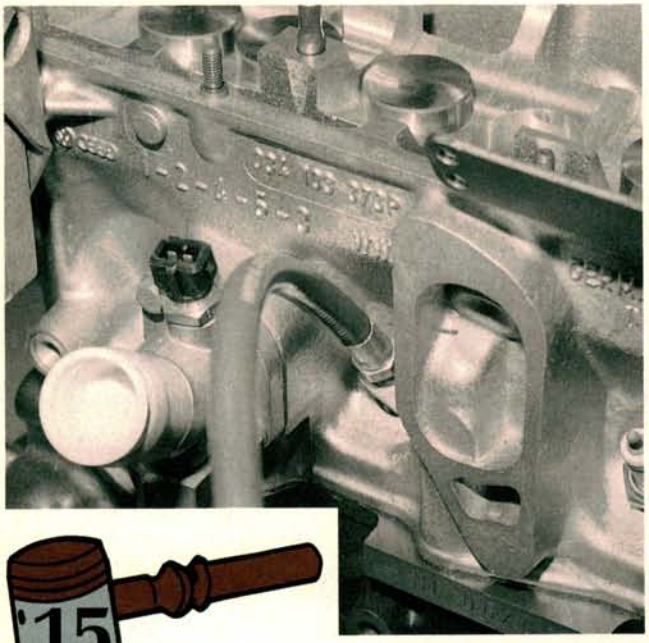
The seals shown are used in one version of the air shroud injector system. The large o-ring seals the top of the injector to the insert to prevent vacuum leaks. The smaller o-ring seals the tip of the injector. Air enters through the sleeve and must pass through the tip of the injector, rather than around it.



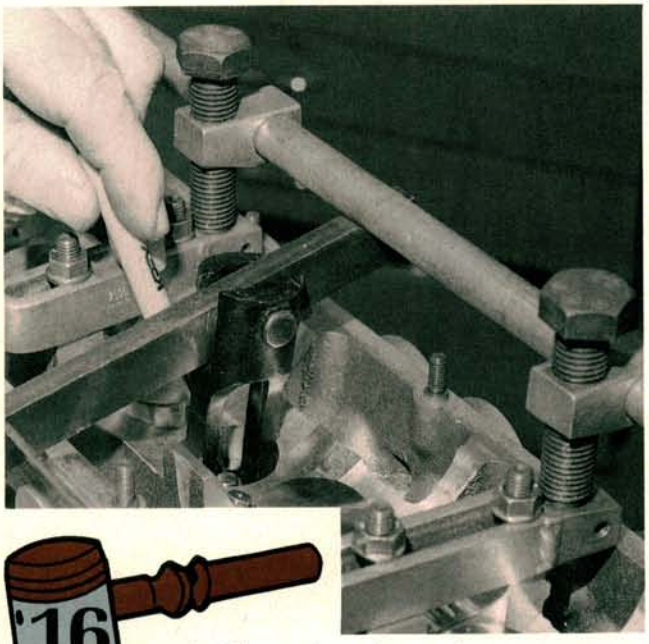
Frequent engine starts and short duration trips may cause hydraulic valve lifter noises. To test the lifters, run the engine until the radiator fan comes on at least once, then raise the engine speed to 2500 RPM. If any lifter noise is still present after two minutes, the noisy lifter should be replaced.



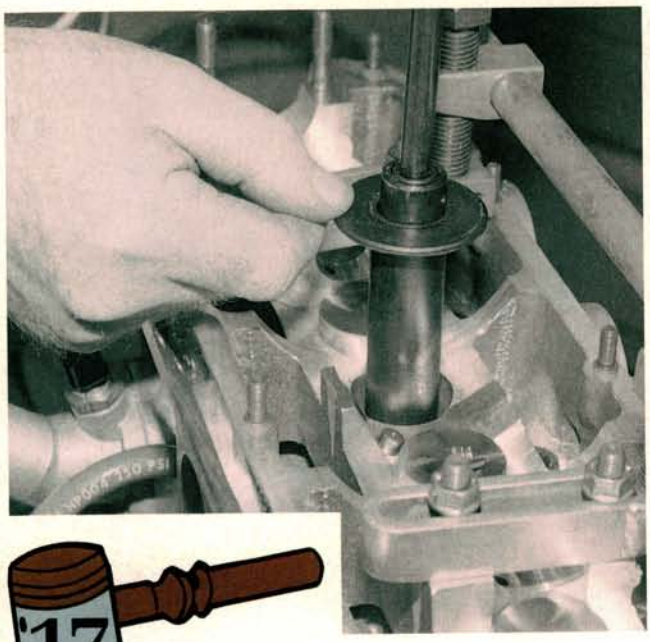
Test the lifters by pushing down on each with a wooden stick, with the valve closed. Replace any lifter that can be depressed. Always store new or used lifters with their cam contact surfaces facing down. Lifters may take 30 minutes to leak down after installation. Don't start the engine during this period.



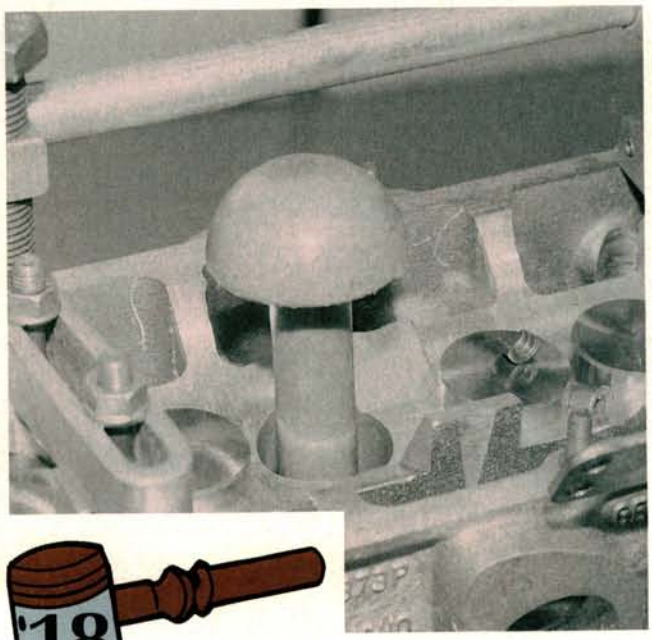
Four cylinder fans will recognize this routine. To replace a valve seal, remove the spark plug and install an air hold to keep the valve from dropping into the cylinder after the valve keepers are removed. Position the piston at BDC to keep the crankshaft from turning when the air is applied.



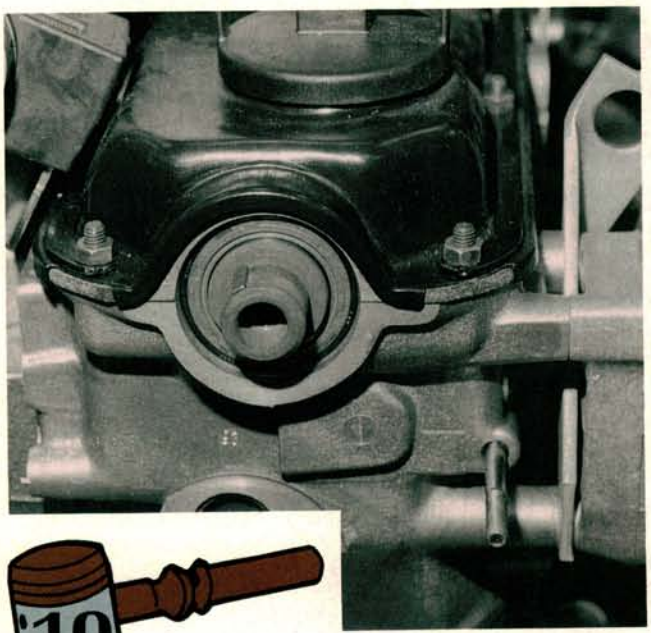
A bridge style valve spring compressor will reach the recessed valve springs and valve seals while the head is installed on the block. The hollow bucket below the tool's lever arm reaches into the well to compress the recessed valve spring. Depress the spring, then remove the keepers with a pocket magnet.



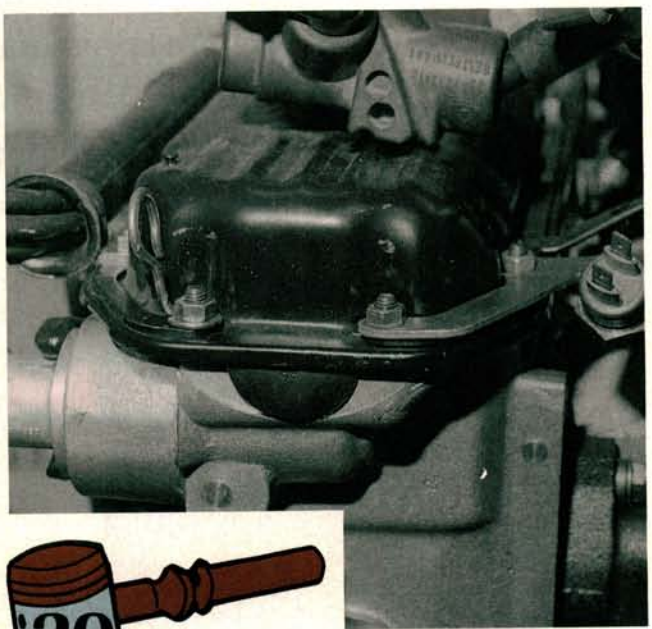
Reaching the valve seal is another challenge. The split collar on this slide hammer tool slips over the outside of the valve seal. Depressing the tool ring tightens the collar around the seal. A quick slap of the slide hammer weight removes the valve seal. Special gripping pliers are also available to do the same job.



Installing the new valve seal requires one last special tool. This mushroom shaped tool slips over the valve stem and installs the valve seal using hand pressure. Use the small plastic sleeve that's packaged with the valve seals to avoid damaging the new seal as it passes over the valve keeper grooves.



The camshaft seal can be replaced with the cam and valve cover in place, if you have the VW/Audi special tool or are particularly good with a hook style seal puller. It's much safer to remove the valve cover and front cam bearing cap. The seal will slide right out of its groove in the bearing cap.



One last word about valve covers and seals. Updated valve cover gaskets using a new rubber gasket material are available to replace earlier cork gaskets which may become brittle and deformed. To prevent oil leaks at the rear of the engine, replace the half moon seal whenever the valve cover is removed.