Boos - Herrel
Lincoln Zephyr & Continental Parts
1936 - 1948

9895 Hidden Hollow Trl
Broadview Heights OH 44147

boos.herrel@gmail.com

215-965-8296
215-310-9869 Fax

Water Pump Rebuilding

The water pump rebuild kit contains the following items:

8530 Bearing
8542 Felt washer
8507 Gasket
8557 Carbon seal
8524 Graphite rope packing
2 of 352503-S Tapered grooved pin

The above kit is identical to the factory offered kit, part # 86H-18515 (for early pumps with a 6 tab carbon seal) or part # 06H-18515 (later pumps with the 4 tab carbon seal) EXCEPT for the spring # 8560. The springs are usually serviceable and may need to be stretched out a bit. If replacement is needed, we do carry them.

8542 graphite rope packing needs to be coiled and inserted into the brass cup 8558 during the re-assembly.

A Water pump rebuild, in stock form, is pretty straight forward. The challenge is when the pins, pulley, impeller don't want to come off easily. Depending on how things come apart, you may get more involved then planned.

First, spray some WD40 on the pins and shaft ends of the pulley and impeller to help loosen things. The business end of the pump, the impeller, is going to be harder to remove than the pulley – usually, since it is constantly in water/antifreeze.

The pins are grooved and tapered if original or correct replacements were used over the years. Never use a split drift pin as they can come lose and fall out potentially causing some severe damage. To knock the pins out, use a drift punch. The pins are 3/16", and since tapered, should be pushed out from the end that is slightly recessed.

You need to remove the pulley as the parts on that side of the housing are locked in by clips 8539 on the shaft and 8537 on the housing. Removing the pulley is extremely critical as it can be easily broken/chipped (it can be welded) and new ones are not available. Some say you can use a 3-jaw puller; that will most surely break it. You can press out the shaft as the service literature specifies however with it will come the bushing. Read on. The need to remove the pulley would be to replace the felt packing 8542 and the bearing 8530. You need to remove the bearing retainer clip and bearing spacer 8536.

Here is where you can make a decision. If you can't remove the pulley or fear you may break it, and it seems the bearing may be OK, you can focus on the impeller end.

At this point with the impeller off, (and if you break it or its badly deteriorated, we do have them) you can replace the graphite packing 8524 with the rope material and you can replace the carbon seal 8557. Its this end where pumps are more likely to leak.

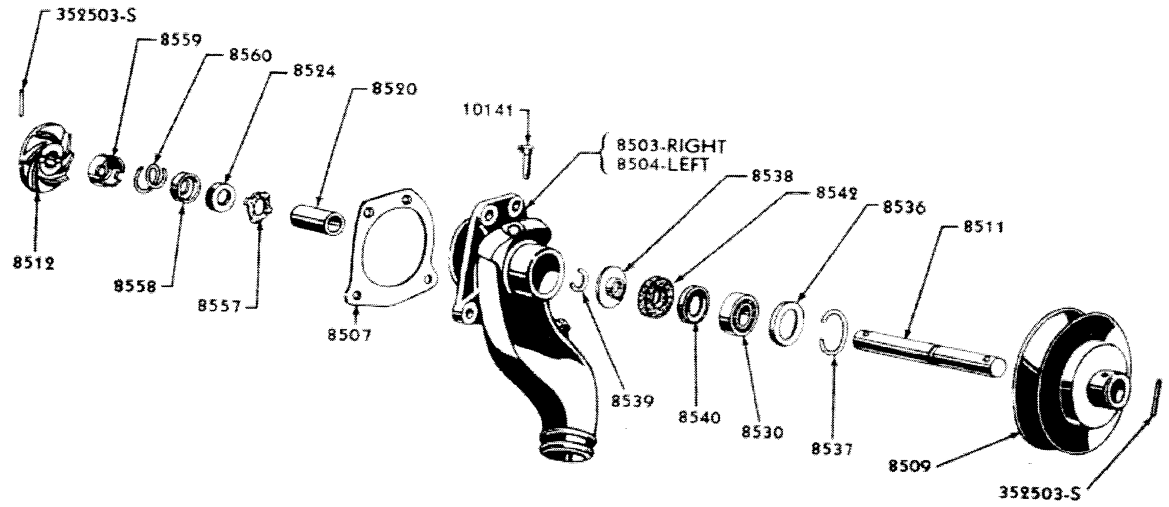
If you can get the pulley and the impeller off you may be able to press the shaft from the impeller end (after removing all the part on the shaft on that side of the housing) to push out the bearing, understanding that you have removed the retainer 8537 behind the pulley. Keep in mind that parts 8538 and 8540 are made of brass and may get crushed if too much force is required. The benefit with this approach is you don't have to disturb the bushing 8520.

If you can get the pully off or want to press the shaft through it from the front and cannot get the impeller off, you can also push the shaft form the pulley side of the housing. This will also press out the bushing mentioned above, due to the clip 8539 being inaccessible at this point. This is the procedure the Lincoln service literature describes. Once the bushing is out and the shaft pulled through you can more easily access the front-end parts to remove and replace.

Attached are several versions of the water pump rebuilding procedure for instructions. Please note the most important aspects is the bushing (8520) surface facing for the carbon seal to ride on. It needs to be smooth with the housing and square to the shaft. Therefore, if you don't have to disturb the bushing, the better off you may be, but inspect it carefully along with the housing. Any cracks in the bushing housing of the pump body (the typical weak point) and its non-rebuildable. If you press out and re-install the bushing, along with the importance of surfacing it as mentioned above, you should also ream it (per the service manual) with a 15mm reamer as it may get distorted with removal and installation. We do carry new bushings if needed.

If you need any other parts including an impeller, we have all of them in stock depending on the condition of your pump's parts. The only thing we do not have in supply is the pulley, so be careful as you remove that!

Read through all the instructions and procedures before you begin. If you have any questions, give us a call.



WATER PUMP

Fig. 1 illustrates the Lincoln-Zephyr Water Pump which is of the oil reservoir type. A ball bearing and porous type bushing are used for the pump shaft. The ball bearing is of the pre- ubricated type, and requires no lubrication in service. The pump shaft receives lubrication through the oiler and oil reservoir. The oil penetrates through the porous bushing to the shaft.

It is important that the oil reservoir (see Fig. 1) be kept filled with engine oil in order to adequately lubricate the shaft through the porous bronze bushing. The same viscosity engine oil is used as that which is recommended for the engine.

Starting 1940 production, the disc has been made thicker, has four lugs instead of six, and the material is carbon instead of fibre.

A new cage is used in conjunction with the new disc.

A new impeller having a shorter hub was used which allowed for the additional thickness of the disc.

A tapped hole was incorporated in the left water pump housing for the hot water heater connection.

Kit 86H-18515 is available for servicing water pumps on 1937,-38,-39, cars. Kit 06H-18515 is available for 1940 pumps.

The right and left pumps are not interchangeable. The part numbers of the pumps are 8501, right side and 8502, left side.

Special tools for servicing the Lincoln-Zephyr water pump are available. These tools are illustrated in Figs. 2 and 3.

The water pump bushing reamer shown in Fig. 2 is listed under catalogue No. 8503-C.

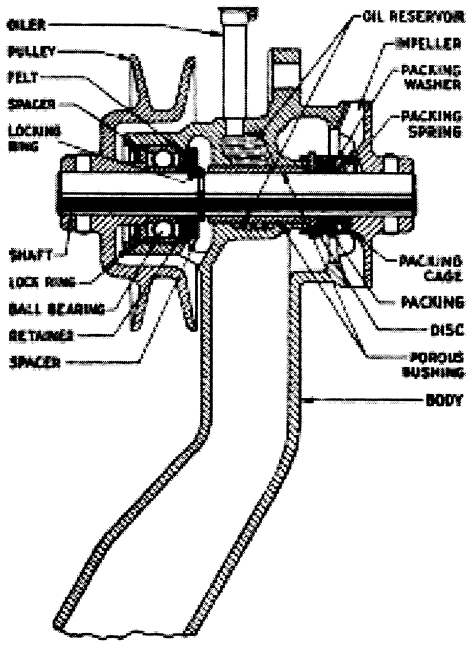


Fig. 1

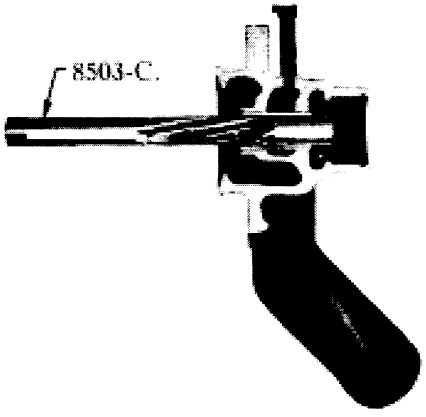


Fig. 2

EQUIPMENT USED

KRW—8503-B WATER PUMP FACING TOOL

KRW—8503-C REAMER

ABOVE APPLIES TO MODELS:

ALL

SERVICE BULLETIN

SUBJECT NO. 8501 PAGE NO. 62

The water pump bushing facing tool shown in Fig. 3 is listed under catalogue No. 8503-B.

These special water pump tools are available from K. R. Wilson, Buffalo, N. Y.

A squeaking noise is sometimes traced to the Lincoln-Zephyr water pump. This noise is usually heard when the engine is idling.

To eliminate this squeaking noise without disassembling the pump, it has been found that placing a piece of ordinary linseed oil automobile soap (about the size of a small egg) in the cooling system usually stops the noise in a few minutes.

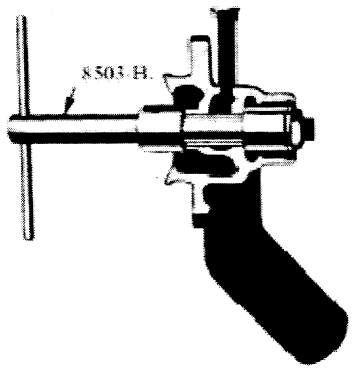


Fig. 3

The quality of service to a large degree depends on the dealer realizing the value of good service and its effect on future sales.

ABOVE APPLIES TO MODELS:	EQUIPMENT USED
ALL	KRW—8503-B WATER PUMP FACING TOOL KRW—8503-C REAMER

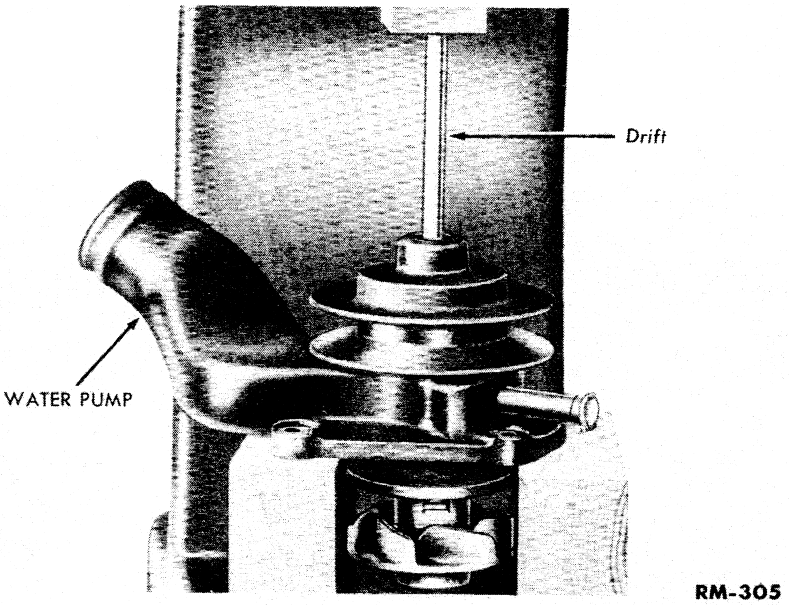


Figure 44—Pressing Impeller and Shaft Assembly Out of Pulley and Housing.

137. WATER PUMPS.

a. Disassembly. Drive the pin out of the pulley and shaft with a small punch. Press the shaft assembly out of the pulley and housing (fig. 44). Remove the lock ring from the water pump housing. Working from the inner side of the housing, remove the bearing outer spacer, bearing, felt retainer, felt packing, and bearing inner spacer (fig. 45) with a suitable driver. Drive the pin out of the impeller and shaft with a small punch. Press the shaft out of the impeller (fig. 46). Remove the water pump packing cage, spring, packing retainer, packing, packing disc, and bushing from the shaft.

b. Cleaning. Clean all parts thoroughly.

c. Inspection. Replace a water pump housing that is cracked or damaged in any way. Replace a water pump pulley if it is cracked or damaged. Replace an impeller that is cracked or has damaged or broken fins. Replace a bent pump shaft, or one on which the bearing surface is worn to less than 0.589 inch. Replace a water pump packing spring if it is corroded or rusted. Replace the ball bearing if the bearing has a tendency to stick when it is turned, or if it has excessive side or end play.

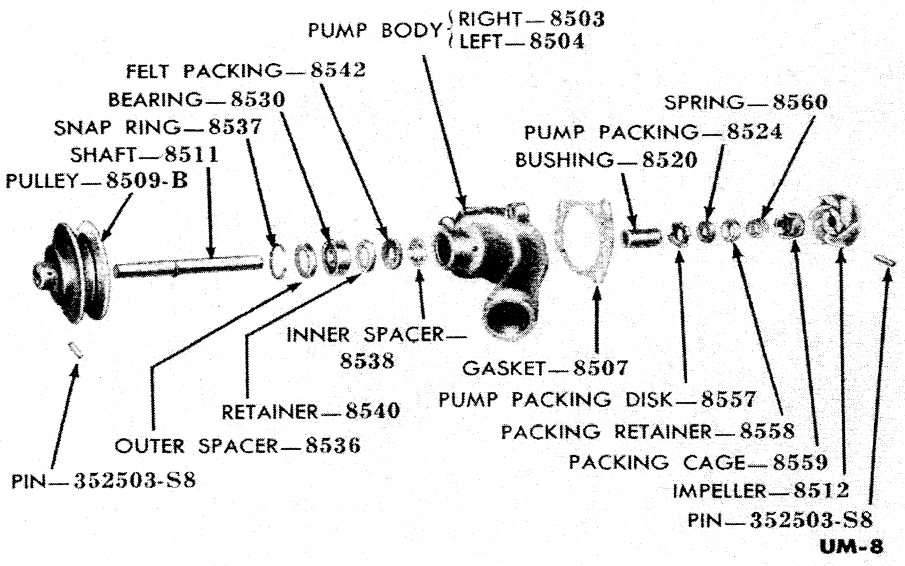


Figure 45—Water Pump, Disassembled.

d. Assembly. Install the bushing on the long end of the shaft.

NOTE: ***If assembling a new bushing, ream the bushing to . . inch.***

Install a new disc and packing on the shaft (fig. 45). Install the water pump rear packing retainer, spring cage, and impeller on the shaft. Secure the impeller on the shaft with the pin. Press the impeller and shaft assembly into the housing (fig. 47). Place a new felt washer on the inner spacer, and install the retainer on the felt washer. Install the spacer, felt washer, and retainer in the water pump housing with the retainer facing toward the front side of the housing. Pack the bearing with water pump grease, and install the bearing in the housing. Install the water pump bearing outer spacer and snap ring in the housing. Install the water pump pulley on the shaft, and secure it to the shaft with the pin.

138. OIL PAN.

a. Cleaning. Clean the oil pan thoroughly.

b. Inspection. Replace an oil pan that has stripped threads in the drain plug hole, or one which is badly dented or distorted.

139. INTAKE AND EXHAUST MANIFOLDS.

a. Cleaning. Scrape all the carbon and all parts of the old gaskets off the exhaust and intake manifolds. Clean the manifolds thoroughly.

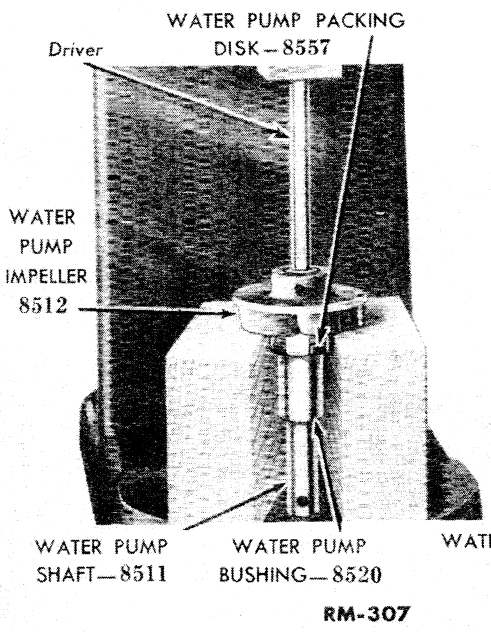


Figure 46—Pressing Shaft Out of Impeller

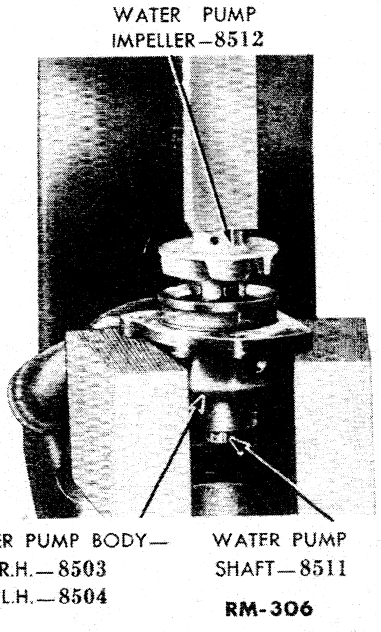


Figure 47—Pressing Impeller and Shaft Assembly into Housing.

b. Inspection and Repair. Replace an intake or exhaust manifold that is cracked or broken. Replace an intake manifold if the exhaust passage (commonly known as heat riser) is plugged or burned through into the intake passages. Repair or replace the intake manifold if the welch plugs on the under side of the manifold are loose. Replace broken or damaged manifold studs (par. 132 e).

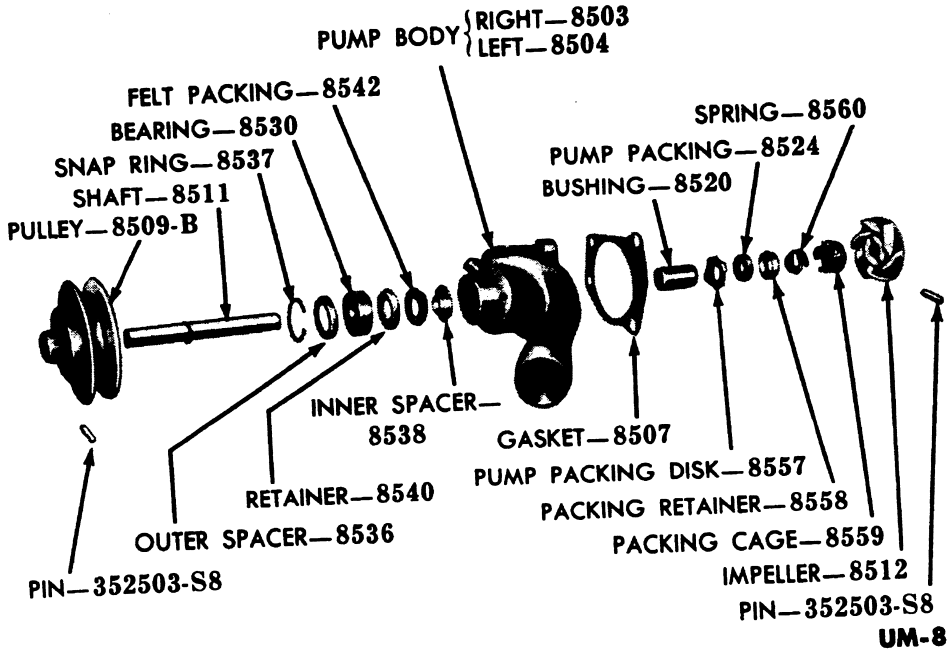


Figure 112—Water Pump, Disassembled (12-Cylinder).

Place the fiber thrust washer on the shaft. Press the pulley on the shaft until both ends of the shaft are flush with the outer surfaces of the pulley, and impeller hubs.

c. 12-Cylinder Engine (fig. 112).

(1) *REPLACEMENT.* Drain the cooling system. Remove the generator belt (sec. 365). Remove the hose running from the water pump to the radiator. Remove the four cap screws and lock washers that hold the water pump to the cylinder block. Remove the water pump. To install, use a new gasket and place the water pump in position on the cylinder block, securing it with the four lock washers and cap screws. Install the hose running from the radiator to the water pump. Install the generator belt (sec. 365). Fill the cooling system.

(2) *REPAIRS.*

(a) DISASSEMBLY (fig. 112). Press the pin out of the impeller, and press the impeller off the pump shaft. Remove the pump packing cage, spring, retainer, pump packing, and disk from the shaft. Press the pin out of the pump pulley, and press the pulley off the shaft. Press the bushing out of the water pump body with the pump shaft. Remove the lock ring from the pulley side of the pump body. Press the bearing spacer, bearing felt retainer, felt, and inner spacer, out of the pump body.

(b) INSPECTION. Replace the water pump if the housing is cracked or has other damage that may cause it to leak. Replace the shaft or bushing if excessive clearance exists.

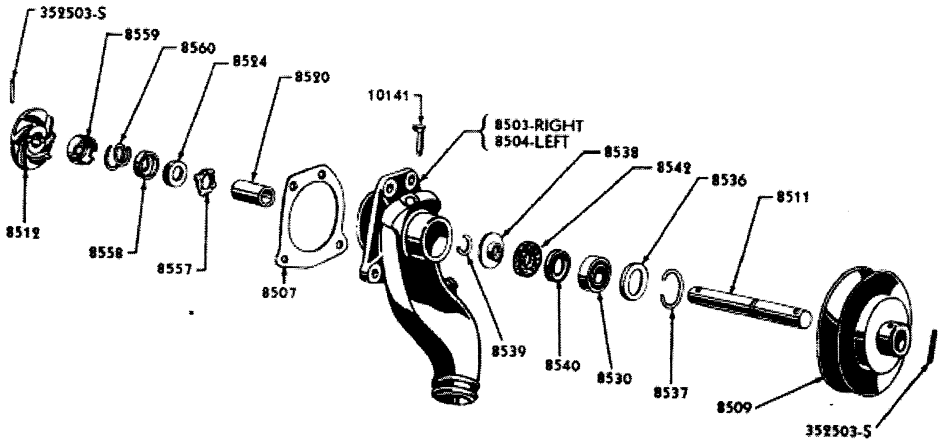
(c) ASSEMBLY (fig. 112). Place the inner spacer, felt, and felt retainer in position in the pump body. Place the bearing and bearing spacer in position on the pump body, and press them in place. Install the lock ring, pump shaft, and bushing. Install the disk, pump packing, retainer, spring, and pump packing cage on the shaft. Insert the shaft through the pump body, and install the bushing. Place the disk, pump packing, retainer, spring, and pump packing cage on the shaft. Press the impeller on the shaft, and aline the pin hole in the impeller with the hole in the shaft. Install the pin. Press the pulley on the other end of the shaft, and aline the hole in the pulley with the hole in the shaft. Install the pin.

145

LINCOLN

CHASSIS PARTS CATALOGUE

Water Pump



PL-37

Basic numbers only shown on illustration. Order by Part Numbers shown in list of parts.

PART NUMBER	FIG. INDEX	PART NAME	NO. REQ'D	MODEL	YEAR TO
	F	86H-18515 Kit (water pump repair)-consists of the following	1	90I,8B,86H,96H	35-39
		(1) H-8507 Gasket (1) H-8557 Disc			
		(1) H-8524-A Packing (1) HB-8558 Cage			
		(1) H-8542 Packing (1) H-8560 Spring			
		(2) 352503-S8 Pin			
	F	06H-18515 Kit (water pump repair)-consists of the following	1	06H,1AR,1S8H,26H,26BH,66H,76H,876H	40-48
		(1) H-8507 Gasket (1) 06H-8557 Disc			
		(1) H-8524-A Packing (1) HB-8558 Cage			
		(1) H-8542 Packing (1) H-8560 Spring			
		(2) 352503-S8 Pin			

Lincoln-Zephyr Water Pumps

Zephyr tech talks

by Dave Cole

PROLOGUE

HENRY FORD LIKED simplicity. He tried to avoid mechanical complexity in designing his automobiles wherever possible. If others used three bolts to hold parts together, Henry would strive to make do with two. If one bolt would suffice, so much the better! And when it came to pumps—to circulate motor oil, to push gasoline to the carburetor, or to make the water in the cooling system go through the radiator—Henry could figure a way to use none at all. Let others complicate their cars with those expensive troublesome doodads—Henry's famous Model T didn't need them!

An oil pump? What for? The spinning of the crankshaft in the crankcase splattered enough oil on the moving parts to take care of any lubrication needs. A fuel pump? No need for that! Just place the gas tank higher in the car than the carburetor and let gravity do the job. It never failed, unless a hill was so steep that the carburetor became higher than the tank, in which case you turned the car around and backed up the hill. Then the gravity flow system worked fine!

The Model T had no need for a water pump, either, and the *Ford Manual* explains why. The *Ford Manual*, published for owners and operators of the Model T to help them understand the operation of the car, was written as a series of questions and answers. In responding to the question about how the coolant is circulated in the Ford, Answer No. 36 says this:

> "The cooling apparatus of the Ford car is known as the Thermo-syphon system. It acts on the principle that hot water seeks a higher level than cold water—consequently when the water reaches a certain heat, approximately 180 degrees Fahrenheit, circulation commences and the water flows from the lower radiator outlet pipe up through the water jackets, into the upper radiator water tank, and down through the tubes to the lower tank, to repeat the process."

A law of physics made the water circulate, so no pump was needed.

But there were some disadvantages to relying on laws of physics, too. One was that a Model T was often low on water, as it evaporated or boiled away with the thermo-syphon system. In fact, the first question in the *Ford Manual* is, "What must be done before starting the car?" and Answer No. 1 says, in part, "fill the radiator . . . with clean fresh water." So important was this that Answer No. 1 elaborates on this theme for fourteen lines, or about a third of the page.

Eventually, after nineteen years on the market during which over fifteen million cars had been built, the Model T became obsolete and had to be replaced with a more modern car, the Model A. This was still a pretty simple car, but Henry Ford had been obliged to outfit it with two of the three pumps he had hitherto found unnecessary. The Model A still had no fuel pump, as the gasoline ran downhill from the tank in the cowl to the carburetor, but it had a gear-driven oil pump in the engine. It had to be so because the new engine put out twice the horsepower of the Model T: since it turned faster, the splash system just wasn't adequate any longer.

And certainly Ford owners who were sick and tired of checking the radiator every day before starting the car and filling it with clean fresh water—which was invariably necessary—rejoiced when they saw that old Henry had put a water pump on the new Model A. This would keep operating temperatures under the boiling point—most of the time, at least—and wisps of escaping steam would no longer trail a Ford. But Henry had not abandoned his principles entirely. This cooling system was described in the factory literature as being of the thermo-syphon type with a centrifugal pump to help circulate the coolant.

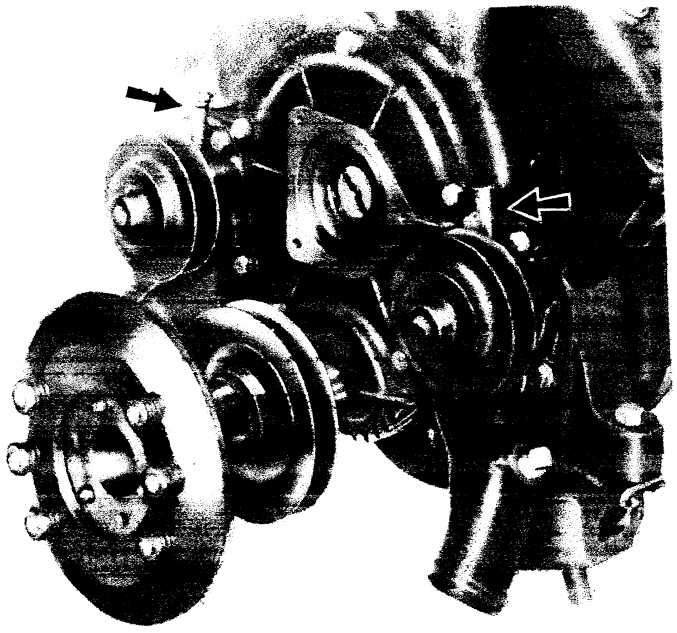
In 1932, four years and nearly five million cars after the introduction of the Model A, Henry Ford brought forth the first V-8 engine in the low-price field. It was revolutionary, abounding with clever details and solutions to mechanical problems: a marvel of fast, smooth travel with 65 horsepower—half again more than the Model A—but in designing it, Ford had had to compromise his penchant for simplicity even more. Unlike his beloved Model T, which had no pumps on it at all, or his Model A, which had two, this new V-8 had four pumps! In the interests of safety, the gas tank had been moved to the rear of the car, so now a fuel pump was necessary, and of course, an oil pump was needed in such a high-speed engine.

The other two pumps were *water* pumps! This was really surprising. Just five years earlier, Fords had used no water pumps at all, and here was the latest creation from the same manufacturer, who was so devoted to simplicity, and it needed two water pumps? Well, yes; one for each bank of four cylinders. Despite the fact that practically every other auto maker who ever set out to build a V-8 engine figured a way to make one pump draw water from both sides of the engine, Henry Ford did not. Every Ford V-8 engine built in his lifetime, and for several years after his death, had two water pumps. No one has ever explained satisfactorily how old Henry managed to miss this opportunity to simplify his V-8 engine.

And yet, Henry still had not thrown over all his principles. Believe it or not, the Ford V-8, when introduced and for several years thereafter, was still said to make use of the thermo-syphon cooling system! It says so, right there in the *Instruction Book*, or owner's manual, for the 1932 Ford V-8, on page 30, where in describing the cooling system, it says,

"The water is circulated by thermo-syphon action, the flow of water being accelerated by means of centrifugal water pumps located at the front of each cylinder head. These pumps draw the heated water from the engine into the upper radiator tank. . ."

The same design continued through 1936, with the water pumps bolted to the fronts of the cylinder heads, so they pulled the heated water out of the engine and sent it up to the top tank of the radiator, where it could trickle down through the tubes and let the wind whistling through the core cool it off enough to go back into the front of the engine, ready to pick up more excess engine heat.



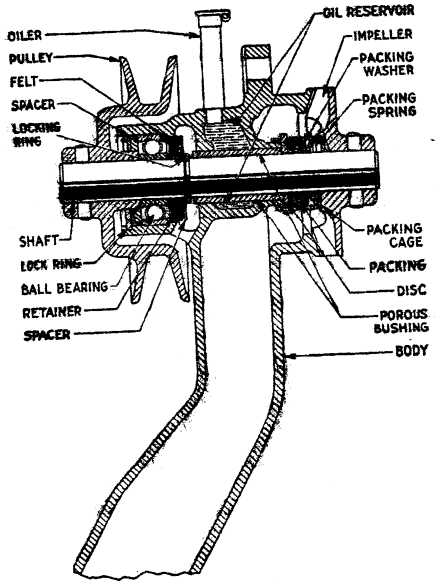
■ *Every Lincoln-Zephyr V-12 takes two water pumps. The housings or bodies are not interchangeable, being mirror images of one another, but the internal parts can be used on either one, left or right. If the Zephyr had been patterned after the big Lincoln Model K V-12 engine, it would have used one single water pump mounted low on the right side of the engine, behind the generator. Note the prominent H-10141 oilers here (arrows). When the fan belt is installed, the oilers are harder to see.*

THE LINCOLN-ZEPHYR

The next new engine to come from the Ford Motor Company (for domestic use, anyway*) was the Lincoln-Zephyr V-12, which was introduced as a new car for 1936. It was to be Ford's first entry in the medium-price field, a companion car to the big Model K Lincoln, which, like other big expensive cars of the time, was faltering owing to the continuing economic depression and the changing tastes of motorists. The Lincoln used an elegant 150-horsepower V-12 engine of very sophisticated design, and if the Zephyr was to be a suitable running mate for the big, classy Lincoln, then it would have to use a V-12 engine, too. But in the interests of keeping the costs of building such an engine low enough to put it in the medium-price class, Ford designed it after the current V-8. Only its V-12 configuration and the oil level float took their cues from current Lincoln practice (and in 1938, the hydraulic valve lifters); in all else, the Lincoln-Zephyr V-12 was little more than a Ford V-8-and-a-half.

Thus, it used two water pumps, one for each bank of cylinders, as did the Ford V-8. But there was one big difference: instead of having the pumps in the cylinder heads to draw hot water out of the engine, the Zephyr had the pumps mounted low in the front of the cylinder block, to draw cooled water from the radiator and force it through the water jackets. At long last, Ford had abandoned the thermo-syphon cooling system. Water continued to rise when heated, true enough, but Ford no longer sought to credit this phenomenon as the reason why water circulated in the Zephyr cooling system. The water pumps did it!

While the packing, seal and whatnot that kept the water from leaking out past the shaft in the Zephyr water pump was similar to what was used in the Ford V-8 pump, there were other features that were quite different. Whereas the shaft in the Ford pump turned on plain bronze bushings, the Zephyr pump also had a ball bearing at the forward end of the shaft, with the pulley offset so that the belt that drove it was directly in line with the ball bearing—a much more expensive design. The means of lubrication differed, too. While most Ford V-8 water pumps used regular pressure gun grease—the same stuff used to lubricate the king pins, drag link, brake shafts and wheel bearings—the Lincoln-Zephyr pumps used motor oil, of the same grade as used in the crankcase. Some water pumps for Fords had been designed with this arrangement but had been discontinued during 1935 production, yet when the Zephyr came out, it had water pumps that featured an oil reservoir, which surrounded a porous bronze bushing through which the oil would soak to lubricate the shaft, and an oiler with a spring-loaded cap on top by which to fill the reservoir. Despite a few modifications and refinements, all Lincoln-Zephyr V-12 water pumps were of this type right up to the end of the line in 1948.



■ *Lincoln-Zephyr Service Bulletin No. 8501, page 61, shows this cross-sectional view of a completely assembled Zephyr water pump.*

The mounting of the water pumps low in the front of the engine block was similar to what had been first seen in the Ford V-8 60-horsepower engine that had been developed for use in England and Germany, but not yet seen in the U.S. It must have shown its superiority, as for 1937, the 85-horsepow-

* The little 4-cylinder Model Y engine, designed in 1931, and the 60-horsepower V-8, designed in 1935, were made for use in foreign production.

er V-8 engine was redesigned along similar lines—the biggest change in its basic design to occur between its introduction in 1932 and its discontinuance in 1953. But the new Ford water pumps included a desirable feature that was never adapted to the Zephyr. To keep the oil reservoir filled, an oil gallery was provided in the Ford cylinder block, which lined up with a hole in the water pump housing, and if the mechanic who installed the pump didn't use too much sealer on the gasket surfaces so that the hole got plugged up, the running of the engine would keep the oil reservoir in the pump filled with engine oil, and no other servicing of the water pumps was ever needed.

The Zephyr pumps, however, continued with the primitive oiler on top of the pump, by which to fill the reservoir, if anyone ever thought to do it. A few improvements were made in the design, but even so, the pumps required servicing by someone who knew what he was doing, so they didn't run dry. The earliest Zephyr water pumps had the same little oiler as was used in the generator to keep the rear bushing lubricated, and in the distributor, to anoint the front end of the shaft inside it. In either case, only a couple of drops of oil were required. Not so with the water pumps, though: you were supposed to keep squirting oil into those reservoirs through the oilers until they were full! The problem was that the oiler was hidden down behind the pulley so you couldn't see what you were doing, and it was inconspicuous, so you probably wouldn't even think to oil a pump anyway. The owner's manual was not much help in this respect, noting only that you were to "use engine oil in the oilers located at the top of each water pump," but not telling how much to put in. These little oilers had first been used in the 1932 Model B Ford generator, so they used a '32 Ford part number, B-10141, even on a Lincoln-Zephyr water pump.

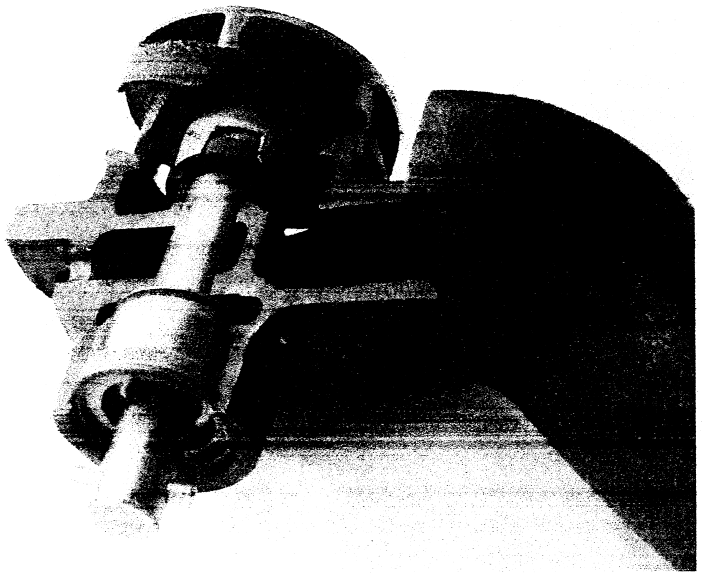
It was soon apparent that the water pumps were being neglected in the Lincoln-Zephyrs, and by January of 1936, the B-10141 oilers had been supplanted by a newly-designed oiler made just for the Zephyr water pumps. These were big and tall, about 7/16" in diameter and standing about 1½" above the top of the pump housing, and they fit into a 3/8" hole instead of the 1/4" hole used by the B-10141 oiler. Certainly anyone servicing the engine would notice them, as they all but cried out, "Oil me!" to anyone with any mechanical aptitude whatsoever.

These big tall oilers were never used on anything other than Lincoln-Zephyr water pumps, and as such, they should have been given a part number in the 8500-series, along with all other water pump parts. But that did not happen. Instead, the new oiler was numbered H-10141, as if it belonged in the generator group of parts. Few Ford or Zephyr parts were ever given numbers outside their proper group, but this is one that was, and you may have to look in the generator section of your parts book in order to find it.

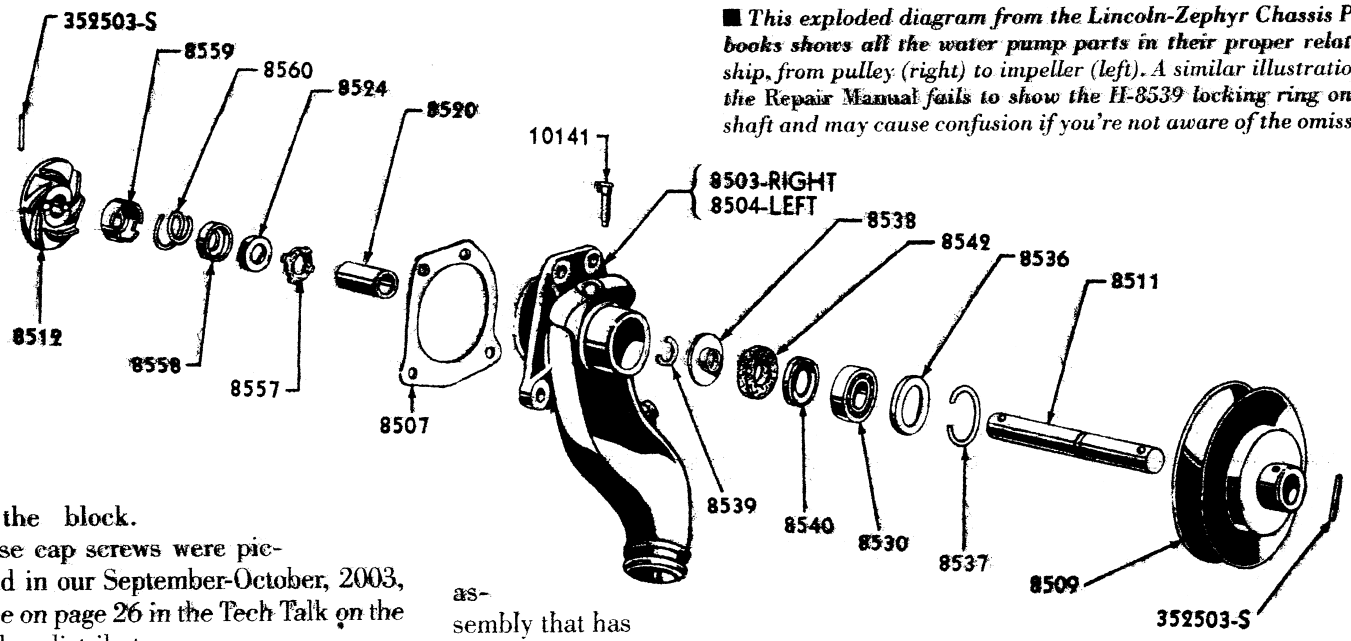
It appears that even with the big tall H-10141 oilers in the pumps, some Zephyrs were not being serviced properly, and water pumps were failing due to neglect. So for 1938 and later production, the oil reservoir at the top of the pump housing was increased in size so it would hold about twice as much oil. The 1936-'37 water pump bodies can be distinguished by their rounded tops, about 2¼" in diameter, with the hole for the oiler at the top. Most of them will have the part number prominently cast into the side, too—H-8505-B for the right-hand pump and H-8506-B for the left. These numbers apparently apply just to the body itself, and are not listed in parts books. But press an H-8520-B bushing in those bodies and they become H-8503-B (right) and H-8504-B (left) assemblies, and add all the rest of the internals and they become H-8501-B (right) and H-8502-B (left) water pump assemblies. Ford did funny things with part numbers!

The 1938 and later bodies are much more common, and can be distinguished by their almost flat tops, nearly 3 inches wide, with the 3/8" hole for the oiler in the middle. In 1940, the left water pump was given a 3/8" pipe fitting in a boss cast into the side of the body to accommodate a pipe nipple for the return of water from the hot water heater that was newly introduced that year. From then on, all left-hand pumps had this fitting, and if no hot water heater was installed in the car, the hole was plugged with a 3/8" pipe plug.

All Lincoln-Zephyr water pumps use the same GASKET, H-8507, but the pattern of the four bolts used to secure the pump is not bisymmetrical, so you have to flip the gasket one way or the other to make it fit. Technically, you're supposed to use special cap screws, with part number 48-12148, as specified for installing a Zephyr distributor, for the water pumps, too. They look like a regular 5/16"-18 x 1" hex head screw, except that the upper portion of the shank is unthreaded and held to close tolerances, .316 to .320 inch diameter, in order to position the pump accurately



■ *Zephyrist Bob Lenz cut a water pump in two, then put all the parts in one side of it except for the oiler and the pulley, to show how it should look. Note that the oil reservoir completely surrounds the bushing for about half an inch. Oil permeates the porous bronze bushing to lubricate the shaft.*



■ *This exploded diagram from the Lincoln-Zephyr Chassis Parts books shows all the water pump parts in their proper relationship, from pulley (right) to impeller (left). A similar illustration in the Repair Manual fails to show the H-8539 locking ring on the shaft and may cause confusion if you're not aware of the omission.*

in the block. These cap screws were pictured in our September-October, 2003, issue on page 26 in the Tech Talk on the Zephyr distributor.

Through the body of the pump runs the **SHAFT**, basic part number 8511. Early pumps, from 1936 until early in the 1940 model year (actually mid-December, 1939), use an H-8511-B Shaft that is 4 27/32" long. Beginning with engine number H-91345, an improved impeller was used, which had vanes that were much wider and threw more water. This necessitated a deeper recess in the engine block, and a longer shaft in the water pump. It was made 5" long, renumbered 06H-8511, and remained in use to the end of production.

Both shafts have the unusual distinction of measuring 15 millimeters in diameter. Is there any other part of the car, except the spark plugs, that have metric specifications? One wonders why it was necessary here. Contemporary Ford V-8 water pumps used shafts that were 1/2" in diameter, or .500", but the Zephyr shafts were 15 mm., or .59055", which is normally rounded off to .591". Still, it's an inconvenience having to deal with such an odd measurement, but there it is.

Skewered on the shaft, rather like a metallic shish kebab, are sixteen individual parts that do the pumping of water, and, with careful assembly and good luck, prevent the water from coming out the wrong place and the oil from mixing with it. From front to back, the parts involved are:

• The **PULLEY**, H-8509-B, made of cast iron or steel and driven by the fan belt. This is one of the few parts in the assembly that has its number cast into it. It is secured to the shaft by a

• **GROOVE PIN**, 352503-S8, measuring 3/16" in diameter and 1" long. We reviewed the necessity of using the correct part in the January-February, 2003, issue, in connection with a story about what happens if the wrong pin is used.

• The **LOCK RING**, H-8537, is a spring steel snap ring that fits into a groove in the bore in the pump body and holds in all the parts behind it.

• The **OUTER SPACER**, H-8536, is stamped of steel and flanged to make it about 1/8" wide.

• The **BALL BEARING**, H-8530, of the pre-lubricated type, needing no further attention.

• The **FELT RETAINER**, H-8540, of brass, into which fits

• The **FELT PACKING**, H-8542, which has on the other side of it,

• The **INNER SPACER**, H-8538, also of brass. The two brass parts are formed to hold the felt packing between them.

• The **SHAFT LOCKING RING**, H-8539, fits into a groove in the shaft itself. As may be seen in the cross-sectional view, this ring makes a barrier, so that all the parts between it and the pulley are held in proper alignment.

• The **BUSHING**, H-8520-B, is a porous bronze part. The oil in the reservoir surrounding it permeates the bronze just enough to lubricate the shaft so it will turn freely, but the bushing must not turn in the pump body; it must be a press fit.

The parts up to this point are all the same from 1936 through 1948, but from here on back, there are some differences.

• The **PACKING DISC**, either H-8557, with six tabs or prongs by which it is driven, used from 1936 to '39, or 06H-8557, with four tabs or prongs, used from 1940 onward, is the part that gets the most wear in the pump. It spins with the shaft and the cage and impeller behind it, but also bears against the back of the bushing and that part of the body surrounding it, which remain stationary. Thus, the disc must be made of very hard, long-wearing material, but it won't last forever. In fact, the usual reason you have to rebuild a pump is that the disc is so badly worn that it won't hold against the water. The early H-8557 six-prong disc is made of some sort of fibrous material that looks like Formica, and the later 06H-8557 is made of hard carbon. Bearing directly on the back side of the packing disc is

• The **PACKING**, H-8524-A, made of graphite but looking more like a glorified garden hose washer, which fits into

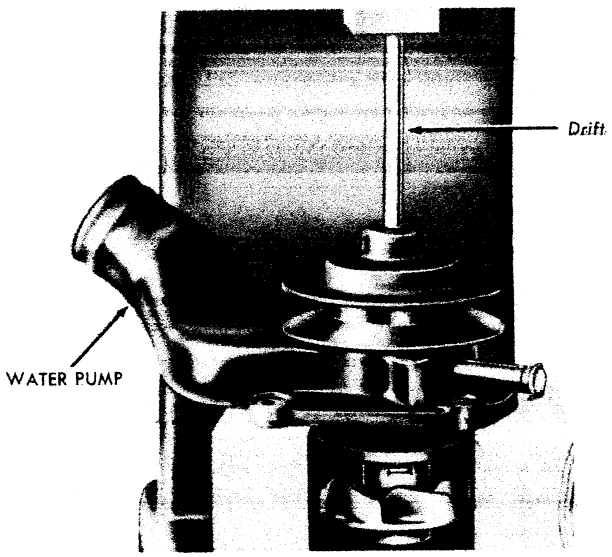
• The **PACKING RETAINER**, HB-8558, another brass part. Against the back of the retainer,

• The **PACKING SPRING**, H-8560, bears, to hold the packing and the disc

against the back of the bushing. It's not much of a spring—just short of two turns of steel wire and only about half an inch long, but it does the job. The last four parts named all fit within

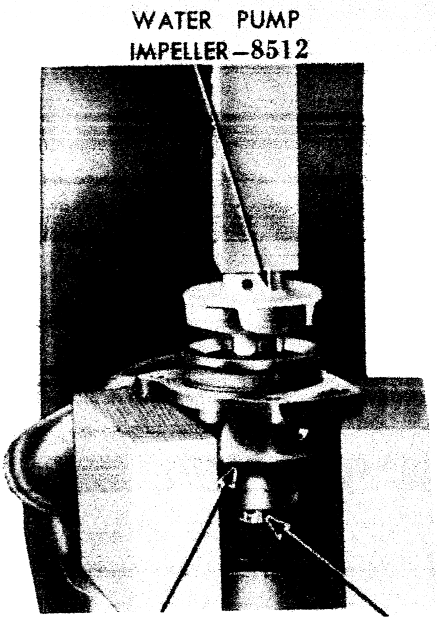
• The **PACKING CAGE**, either H-8559, with six slots for the tabs of the H-8557 Disc, used from 1936 to '39, or 06H-8559, with four slots for the prongs of the 06H-8557 Disc, used from 1940 onward. Either of the cages is made of brass and has ribs stamped into the back that fit into grooves in the impeller so that the cage and all the parts in it turn with the impeller and the shaft. Last on the shaft is

• The **IMPELLER**, the whirling of which circulates the coolant in the engine, and is the whole point of having the water pump. Four different ones were used over the years, and they are thoroughly discussed in the July-August, 1999, issue of this magazine, on pages 24 and 25. They were the 8-vane H-8512-B Impeller used in 1936 and '37, the 6-vane 86H-8512 used in 1938 and '39, the rare 06H-8512-A type used on only the first 5,704 Zephyrs built in the 1940 model year, and the much wider 06H-8512-B impeller, used from early 1940 to the end of production. Whatever the impeller, it is secured to the end of the shaft with another **GROOVE PIN**, 352503-S8, the same bit of hardware that holds the pulley on the front of the shaft.



RM-305

Figure 44—Pressing Impeller and Shaft Assembly Out of Pulley and Housing.



■ *This illustration (left) from the* Repair Manual *shows the pressing of the shaft assembly out of the pump housing and pulley, although it does not show the press itself. The pump is sitting on two pieces of 2x4, between which the impeller and the shaft are being pushed down by means of the drift on the end of the shaft, but the bushing will come out, too, and you may regret disturbing it. Reassembling the water pump (right), as depicted in the* Repair Manual, *also requires the use of a press. Here the impeller and shaft assembly is being pushed into the housing, but little of the press is seen.*

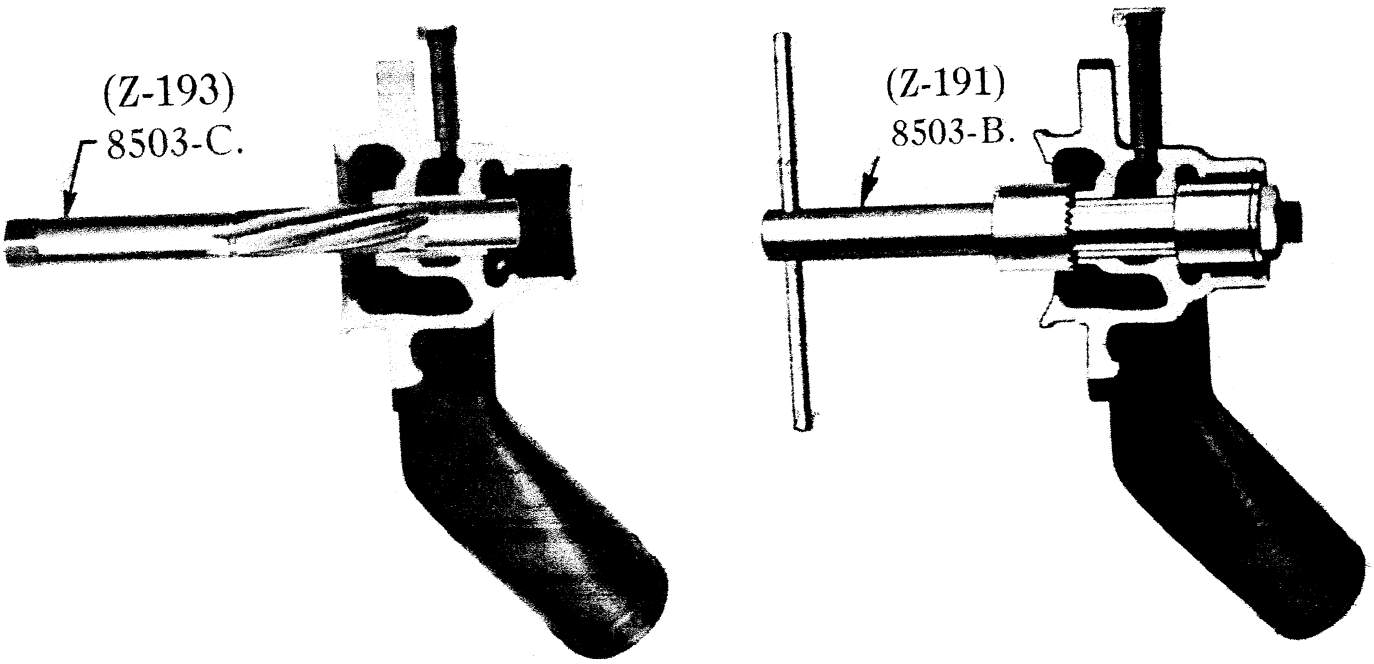
INSTRUCTIONS

Even with the new kit of parts from L.M.C.S. and perhaps some other new components, you will need something else before undertaking the rebuilding of a Zephyr water pump: instructions. Fortunately, they are easy to find. The kit comes with three pages of instructions, marked in red with the admonishment to *read them thoroughly before beginning.* You probably already have a copy of the *Repair Manual* for *Lincoln V-12 Engines,* Form 3693, in which pages 46 to 48 are devoted to the rebuilding of water pumps. You may also have the *Ford, Lincoln & Mercury Service Manual* of 1946, Form 3606-46, in which the rebuilding of Lincoln V-12 water pumps is detailed on pages 172 and 173. Finally, there is a *Service Bulletin* in the big seven-ring binder, Subject No. 8501, pages 61 and 62, that has good information on rebuilding Zephyr water pumps.

Unfortunately, these four sources of rebuilding information do not agree on how to take the pump apart and put it back together. The instructions from L.M.C.S. have you begin by removing the pulley with a three-jaw puller after driving out the retaining pin; the *Repair Manual* advises you to press the shaft assembly out of the pulley and housing with an arbor press; and the *Service Manual* has you begin at the other end by removing the impeller and other stuff just in front of it first. The *Service Bulletin* shows some special tools that help to ensure that your job will be done correctly, if used properly, but the other sources have little or nothing to say about them. It would be a good idea to read all these instructions and resolve the differences among them in your own mind before disassembling the pump.

One of the most important matters to determine is how you're going to get the pulley off. Should you press the shaft out of the pulley and housing as the *Repair Manual* advises, or should you draw the pulley off with a three-jaw puller, in accordance with the instructions that come with your kit? Alas, no matter which way you do it, you're likely to screw up something! If you press out the shaft, as pictured in the *Repair Manual,* that little H-8539 locking ring, which fits into the annular groove in the shaft, is sure to shove the H-8520 bushing right out of the body along with the other stuff on the shaft, and you may regret disturbing the set of that bushing in the housing. The bushing may still be usable as it is: not worn beyond tolerances, still a press fit in the housing, with the rear end of it flush with the machined bore in the housing, all true and square so that a new disc bearing against it will effect a good seal. You won't know, at this point, since you cannot inspect it until you get the pump apart, but there's a good chance that the bushing is all right, and you'd be well advised not to disturb it.

But if you follow the directions that come with your kit and use a three-jaw puller to take the pulley off, you risk breaking a chunk out of it. The metal is very thin and brittle on the edges of the pulley and can easily be broken. The instructions caution you not to apply excessive pressure, and to use heat on the hub along with pressure on the puller, if the pulley is stubborn and reluctant to come off, but all too often the way you learn how much pressure is too much is to break a few. How many extra pulleys do you have, anyway?



■ *The Lincoln-Zephyr water pump bushing reamer, Z-193 or 8503-C, as pictured in the* Service Bulletin *(left), would assure you of having a smooth bore in the bushing of the proper size . . . but who has one of these things? Right: The Z-191 or 8503-B water pump bushing facing tool is the ideal thing for truing the end of the bushing and housing interface, but nobody has one, that we know of.*

TOOLS YOU'LL NEED

In reading all the instructions, you will see the verb "press" used frequently. This alludes to the use of an arbor press or something of that nature. The pulley and the impeller are pressed on or off, the bushing is pressed into the housing, and so on. Study the chapter on "Fits and Tolerances" on page 58 of the *Repair Manual* if you're not familiar with the definitions of the various fits. You'll see you need a press and the ability to use it in order to rebuild a water pump. It isn't a job you do with a screwdriver and a pair of pliers!

Something else you'll need if your bushing has to be replaced will be the tools pictured in the *Service Bulletin*, or some other tools that will do the same job. After the bushing has been pressed into the housing, it should be reamed to make sure it has not been distorted during the reassembly, and that it still has the correct inside diameter. The tool specified in the *Bulletin* is a special one, a No. 8503-C reamer, formerly called Z-193, made by the K.R. Wilson Company, makers of Ford shop tools. This matter is so important that the *Repair Manual* admonishes the rebuilder with a NOTE in italics that says:

> *If assembling a new bushing, ream the bushing to . . inch.*

Uh . . . what's that measurement? Well, it isn't given! Apparently the tech writer lacked the necessary figure and forgot about it; the book went to press and was published without the all-important measurement. Undoubtedly, the 8503-B, or Z-193, reamer was the right size, but no one seems to have such a reamer any more, so we do not know its size. Presumably, it was on the order of 0.592 or 0.593", as there should be between 0.0005 and 0.0010" clearance all around the shaft, according to George Trickett.

It is essential that the clearance here be correct. If it is too tight, the shaft may seize in the bushing and stop the pump from turning, or it may cause the bushing to turn in the housing, which ruins both the bushing and the pump body. If it is too loose, the pump will leak water, or oil, or both.

The other K.R. Wilson tool you need (and probably don't have) is a bushing facing tool, which originally was numbered Z-191, but was renumbered 8503-B in 1940, when some shop tools were redesignated with the numbers that described the parts on which they were used. As may be seen in the illustration above, taken from the *Service Bulletin*, the cutter of the Z-191 or 8503-B tool would grind smooth and flat the end of the bushing and the bore in the housing so they were square and even, when the mechanic turned the handle. This would let the carbon disc form the proper seal. George Trickett describes this as the single most important step you can make to ensure a reliable leak-proof pump. Fortunately, you can do it with a face cutter or a lathe if you don't have the factory tools shown here.

There are other important matters to be considered in rebuilding your Lincoln-Zephyr water pumps, but those discussed here are the main ones. At least now that George Trickett and his Lincoln Motor Car Supply have made available a kit of parts needed in doing the job, you need not be hung up for the items that are most likely to be required.