REWORK YOUR CONNECTING RODS THE RIGHT WAY

There's more to connecting rods than meets the eye; all engine power is funneled through rods, bearings.

Cap and rod distort and stretch lengthwise under pounding in high speed engine operation. Parting faces, rod bores must be trued.

A CONNECTING rod seems like a very simple forging which would not require more than casual inspection before you reinstall it in an engine. However, there is more to it than meets the eye. All engine power is funneled through the rods and bearings, and these are generally the weak links of any engine. This calls for special attention to making them stay together. Leo Gonzalez, a successful engine builder from Taylor, Michigan, gave us a number of pointers on the *right* way to rework a rod for competition useage.

A connecting rod is generally fitted with two balance pads, one at each end. These pads compensate for variations in rod weight at either end due to forging inaccuracy, forging die wear, etc. During manufacture, automatic machinery weighs the ends of the rod and brings the weights to standard by cutting the required amount from each balance pad. Regardless of pad size, rod weight is held within narrow limits to ease balancing problems in production. Thus, when balance pads are big, it is a fair guess that the body of the rod is light. Since light rods are desirable for maximum revs, you can select rods with big pads, then grind down the pads.

On the other hand, in building an engine for use with a blower, you would be more interested in heavy, sturdy rods and a little extra reciprocating weight would not seem as important. You would then pick a rod with very small balance pads which would indicate thicker webs.

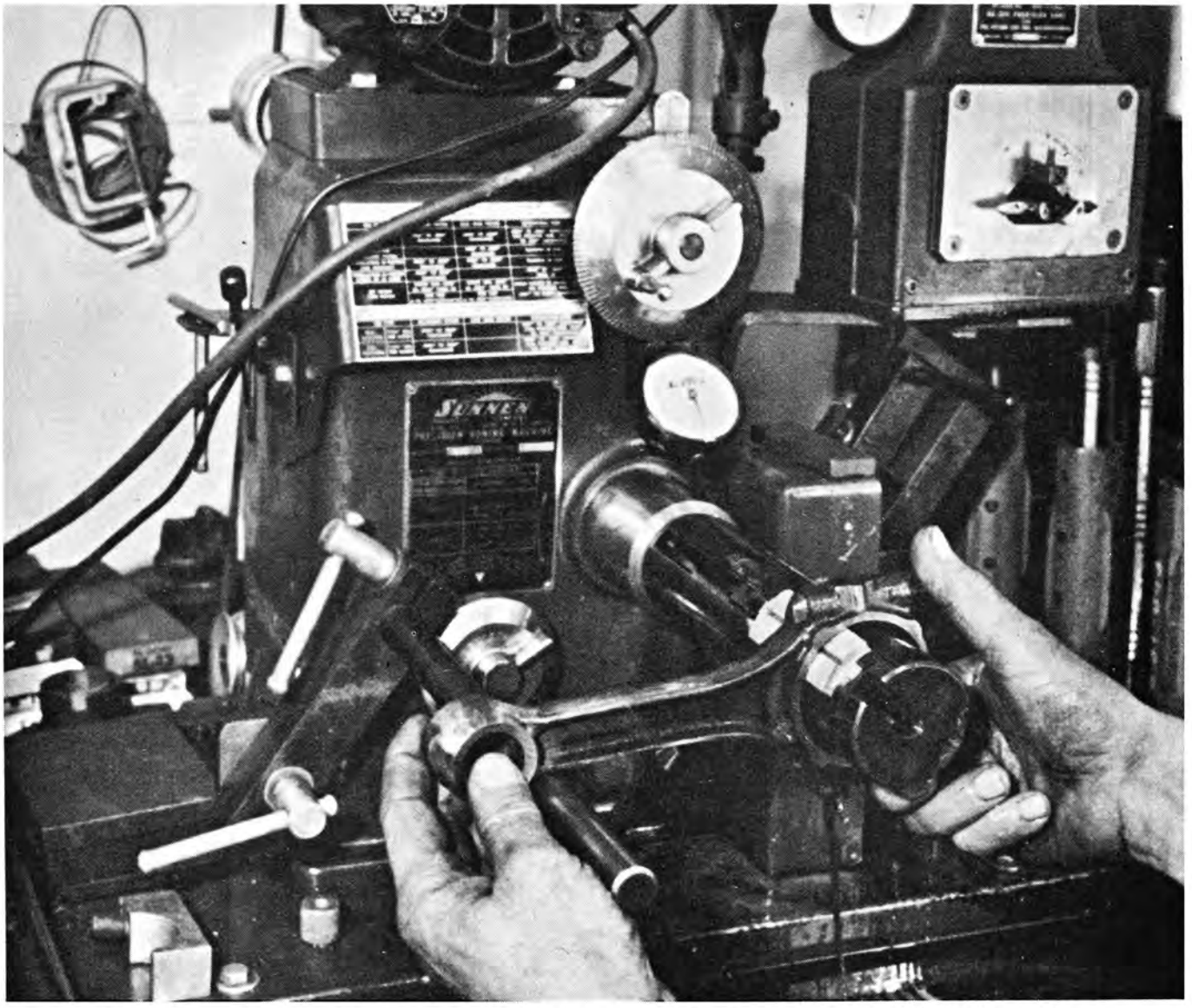
A rod should be inspected visually then sent out for Magna-fluxing, especially if you plan to pour a great deal of power through it. During the Magnaflux process the rod is placed within a magnetic field either by placing it between magnet poles or by passing a large current through it. Any minute crack, which is the starting point of a potential major failure, is then revealed as a color line silhouetted by either special magnetic powder or by a flourescent outline that can be seen under "black light" (ultraviolet). The Magnaflux step is cheap insurance against potential failure.

Alignment is very important, for if a rod is bent it will force the piston and rings out of square with the cylinder walls, hence sizeable loss of oil control plus uneven piston wear. A twisted rod will cause the pistons to cock and weave in the cylinder. Rod alignment is checked on a fixture in which the rod is clamped by its large end. If the ends of the wrist pin are not resting squarely, with respect to flat-ground indicating surfaces, the rod is out of alignment. In normal shop practice, the rods are often realigned by bending them past the neutral line then bending them back to reset the metal in its permanent position. However, in heavy duty work the rod often returns to its initial warp after a short period of running in the engine. Leo advises against straightening a rod which is bent too badly, and *prefers* not to straighten rods at all. Instead, he rebores the rod on a special machine that can hold precise center-to-center rod dimensions as well as insure squareness.

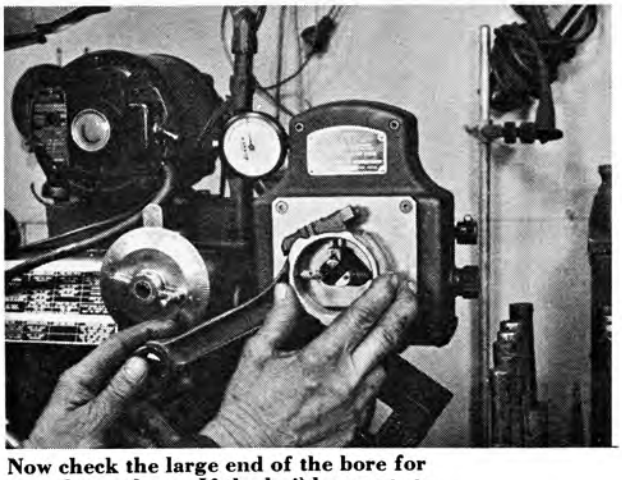
Each time the direction of the piston is reversed, the rod is subjected to considerable inertia loads. These loads, cycled over a period of time, tend to elongate or stretch out the rod bore. This has the dual effect of increasing the bearing clearance along the axis of the rod and pulling in the rod's sides. In fact, the new

Caps and rods are clamped in handle, swung back and forth past grinding wheel with very fine grit. Micrometer feed controls cut.

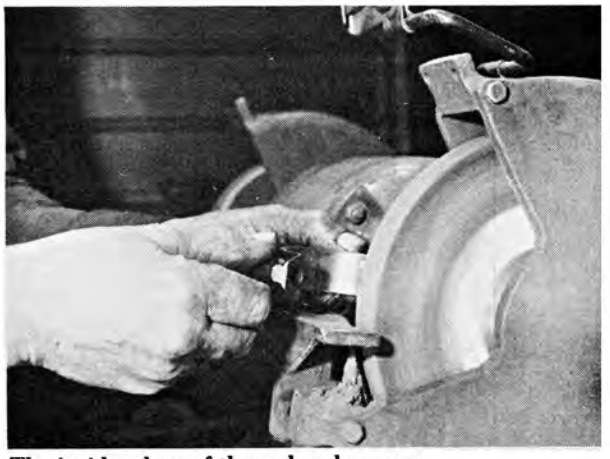
Clamp the rod flat at its big end and torque it accurately. Never clamp a rod at the web and twist. The rod will deflect in competition use.



Now rebore the bottom end of the rod on a hone. If the rod is twisted a little, it may be realigned by boring it in a fixture that will hold its true centers. This operation, if necessary, should be carried out with extreme care.



Now check the large end of the bore for out-of-roundness. If the builder wants to remove a lot of material from the balancing pad at the bottom of the rod, he should do it before reconditioning the bottom.



The inside edges of the rod and cap are bevelled off with touches of the grinder. This prevents a sharp edge from scraping metal from a bearing shell during the installation process.

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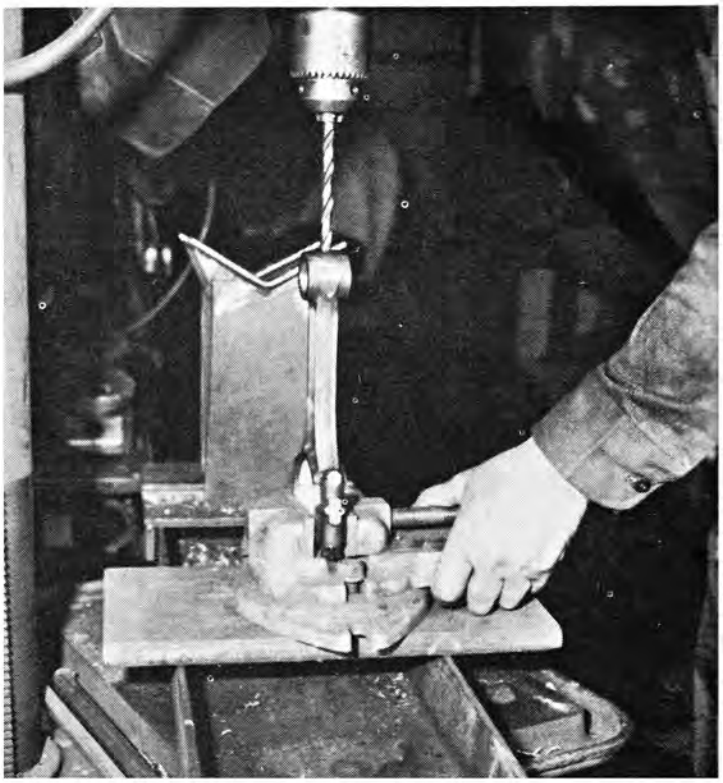
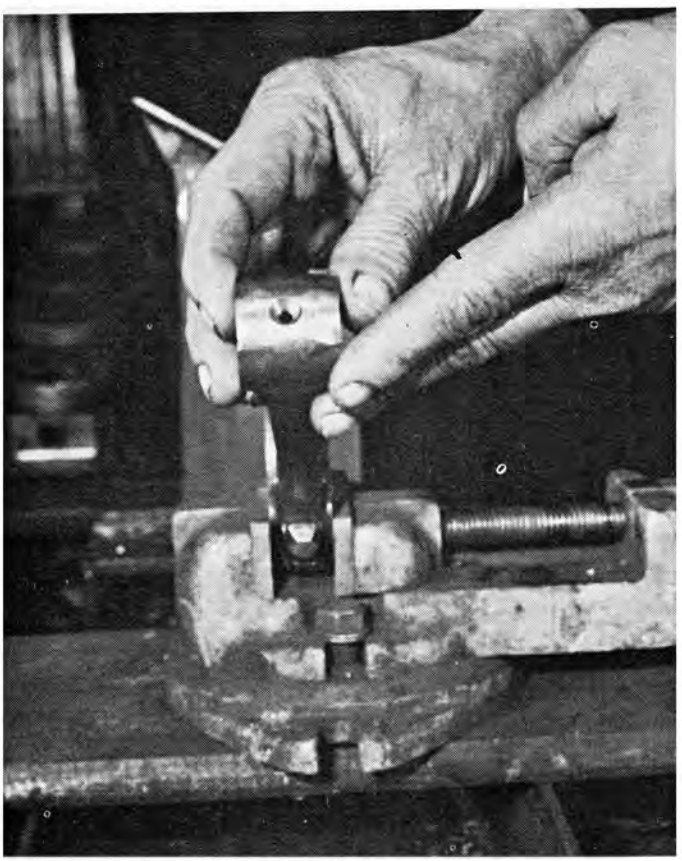
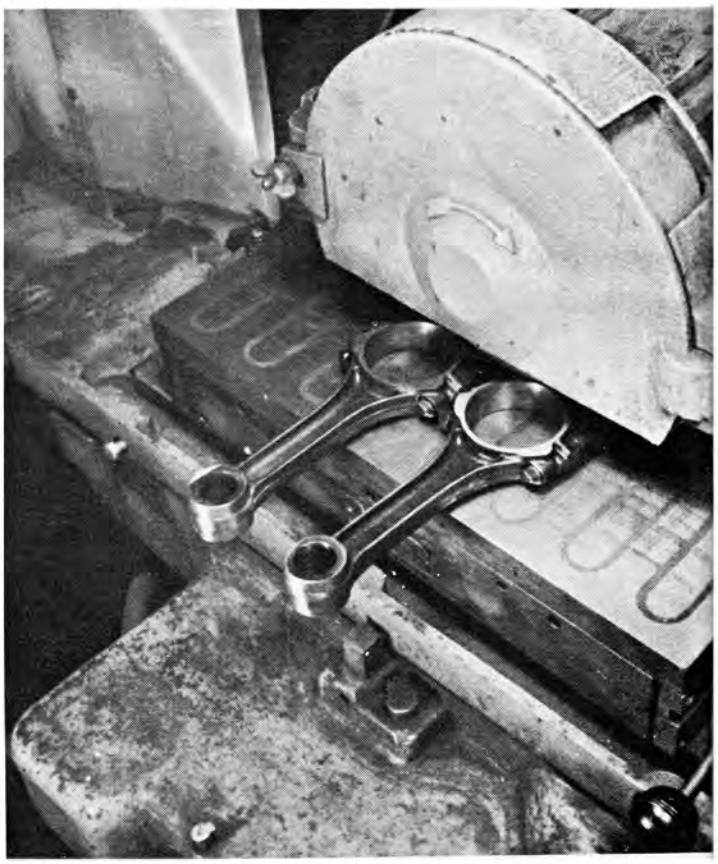
To convert a press fit pin installation to a full-floating rod, hone the small end to a larger size. Either run it that way with a chromed pin or bore for a bushing.



Now carefully drill the top of the rod to insure proper wrist pin lubrication. This is made necessary by the switch to a pin of the full-floating type.



A countersunk drill will widen your oil passages. If a bushing is pressed in, drill a hole right through the bushing.



Often, rod side clearance is increased for greater oil flow through the bearing as well as for reduced friction.

Ford 406 engine as well as several other mills specifies rod bearings with tapering shells that thin out toward the rod-parting faces, specifically to counteract the reduced clearance due to "hoop" action at the rods' larger ends.

Reconditioning a rod begins with taking it apart, pulling out the bolts and refacing the flats at the parting faces. This is essential, since the faces will get out of shape when the rod is pounded out. The rod is clamped, and swung back and forth in front of a rotating, cup-shaped grinding wheel. A micrometer feed controls the amount of stock removed with each pass. A similar operation is also performed on the cap.

Reboring the rod without first torquing the rod bolts to their correct values is an invitation to trouble. Also, you should always use new bolts when reconditioning a rod. When you do reassemble a rod, clamp the large end into the fixture of a vise with parallel and well-protected jaws. Attempting to clamp the rod by the web while applying leverage with a torque wrench will cause it to twist. The large end can now be bored or honed out to size, then checked for accuracy with a dial indicator.

Check for bends and twists. Straightening a rod is bad; it will always return to shape after running. Alignment boring is the only proper cure.

Forged aluminum rods offer considerable weight saving. Leave ample shoulders at the journals' sides.

It is always possible that metal will distort or that internal stresses will be relieved when a substantial chunk of metal is ground away. Therefore, if you plan considerable grinding at the balance pads, you should do much of it before the rod is reconditioned. Weighing the rod at frequent intervals during grinding will avoid your going below the desired weight on the lightest rod. Also, you should leave a little meat for subsequent balancing operations.

Sharp edges at the parting face of either the rod or the cap can result in some metal being scraped off the bearing shell. The chips then lodge between the parting faces, affecting the fit. Your best bet is to use file, grinder or stone on the edges to round them or provide a small chamfer.

If a special stroker crank is being made up for you, you may want to specify very generous fillets at the rod journals. Fillets add strength and prevent stress concentrations. However, too large a fillet may interfere with the side of a rod. The remedy is simple; small chamfers on the outside of each rod. If you plan to run aluminum rods and a stroker crank, you must specify that you want tall shoulders all around the crank pins to avoid a continuous chewing action on the sides of the aluminum rods. The extra weight makes the crank a little more difficult to balance, but it's a small penalty to pay for saving rods.

Most engines use wrist pins that are press fit into the rods for ease of assembly line production. A number of builders, on the other hand, prefer full floating pins as an extra means of saving pistons in the event of pin seizure.

Obviously, in very cold weather the piston contracts more than the pin, reducing the clearance. When the engine is shut off the piston cools off more rapidly than the pin, which receives a continuous input of heat that's been stored in the crank and rods. Thus, on warm restart, the press-fitted pin is more likely to jam than the full-floating unit. To transform a press-fit pin into a full-floating one the small end of the rod must be bored out. You have a choice of using a chrome plated pin directly on the rod or of boring out sufficiently to press in a bushing. The bushing is the better solution from a life and wear point of view, but it often calls for boring out too much metal. This can perceptibly weaken the rod. For instance, on a Chevy rod you can use a Lincoln bushing, but you could also get by in a very satisfactory way with hard chrome pins (Elgin, or similar design).

Full-floating pins call for some means of retaining the pin in the piston. Of these, a wire circlip is certainly the simplest, cheapest, and most likely to fail. The pin batters the wire and can sometimes push it out with disastrous effects on cylinder bore. A much better bet is to cut deep grooves in the piston so it will accept True Arc rings. Two-thrids of the ring is seated in the groove, and one-third of it protrudes to retain the pin. Aluminum buttons inserted into the wrist pin bore on either side of the pin are good, if cut to the same arc as the cylinder bore. More on this in the section on stroker pistons.

Rod side clearance is another important item. It is checked with a feeler gauge inserted between the crank and two assembled rods. To increase the clearance, the rods are ground two-at-a-time on a surface grinder to the required dimensions.

Of course, you can save yourself all of this work *by switching to a turbine . . .*