Struts: Playing a key supporting role on the power train

Just because struts are out of sight doesn't mean they don't affect your prop's performance.

By Dave Gerr

When a boat owner thinks about repowering or repropping, he may spend many hours researching the right prop and engine but frequently spends little time thinking about the strut. This hardly makes sense. After all, the strut not only supports your propeller but affects the water flowing to it, as well.

A poorly designed strut whips when put under a load and creates vibrations that are usually blamed on the prop. At the same time, a strut that's not well-faired causes whorls and eddies in the water flowing to the prop. Vibrations result from this turbulence, and the prop's efficiency is reduced.

The accompanying illustrations give the proper proportions for V and single-leg struts of cast silicon-bronze. These struts are strong enough to resist whip and will cause the minimum amount of turbulence. The [illegible] dimension is the "drop," or the vertical distance from the bottom of the hull to the shaft's centerline. This distance determines the bending moment on the strut and controls the area experiencing side forces in a turn or yaw. (Stainless steel strut legs and bases can be 85% of the thickness shown.)

Cutlass bearings come in varying dimensions for the same propeller-shaft diameter, so the bearing must be selected before determining the bearing-tube diameter. The bearing's tube-wall thickness should equal the shaft diameter divided by 5.34, as shown, but it should never be less than 3/16".

Fastening the Strut

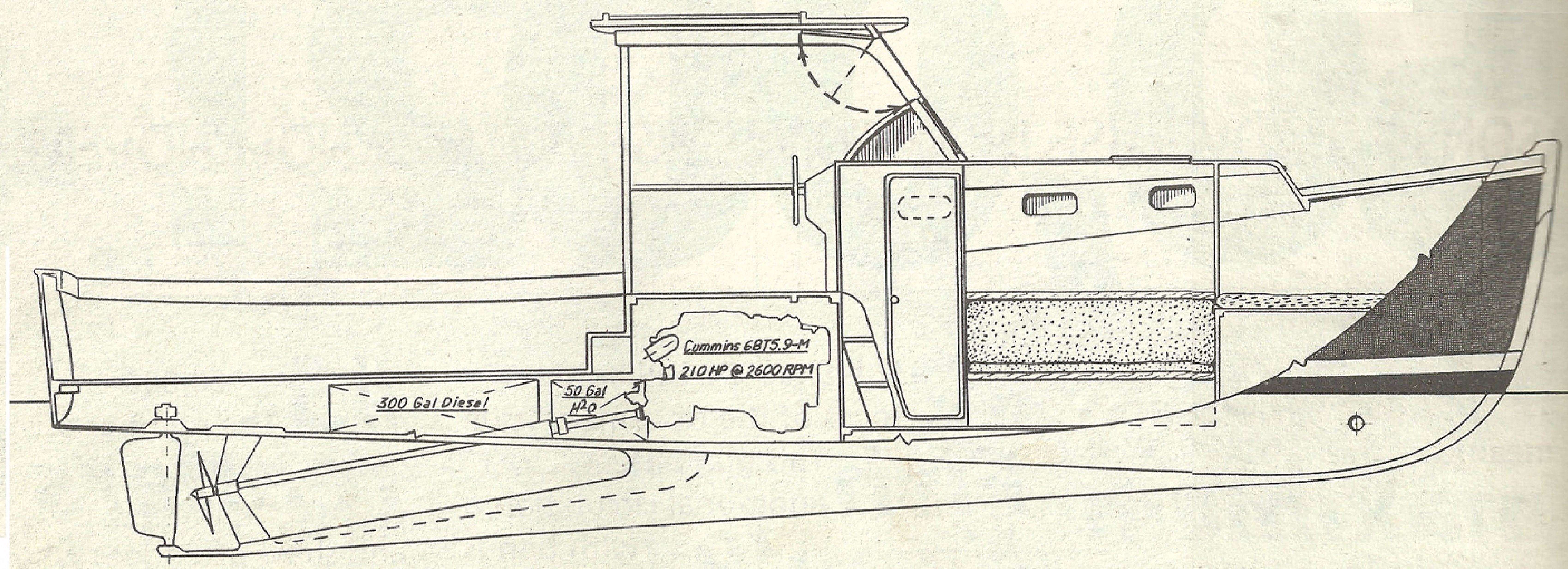
By itself, a sturdy strut does not necessarily make for a strong support. A strut is no stiffer or more reliable than its attachment. For instance, one fiberglass 50-footer I was called in to fix had severe vibration problems. Her V-struts were massive; the props were new and carefully balanced, and her shaft alignment had been checked and rechecked.

When I clambered into the vessel's afterbilges, I found that her struts were through bolted to the fiberglass bottom with nothing more than backing plates of the same dimensions (footprint) as the V-strut's bases below them. The construction gave the illusion of being strong, but it wasn't. (Certainly it fooled the boat's builder, who had otherwise done an excellent job.)

Even though the solid-fiberglass bottom was a bit over 7/8" thick, there wasn't sufficient reinforcing. The hull itself was flexing at the strut attachments — flexing severely enough to generate prominent hairline cracks after only a few hundred hours of operation.

Fiberglass is moderately strong for its weight in terms of pure tension, but it's quite weak under bending stresses. All fiberglass hulls need well-thought-out stiffening, with a lot of attention to spreading the loads and avoiding hard spots. It was a simple matter to fix the 50' boat's problem. Inside the hull, the bottom was built up with another 1/4" to 3/8" of fiberglass for about 2

The author designed the Jackpot, a 36' lobster boat, with a strut assemblembly instead of deadwood just before the prop. Behind the strut is a 28" wheel with 18% ti% tip clearance. He says this type of keel configuration allows ample prop diameter and and clean water flowing to the wheel and provides good directional control and and grounding protection. The boat cruises at 20 knots, with a 24-knot top speed.



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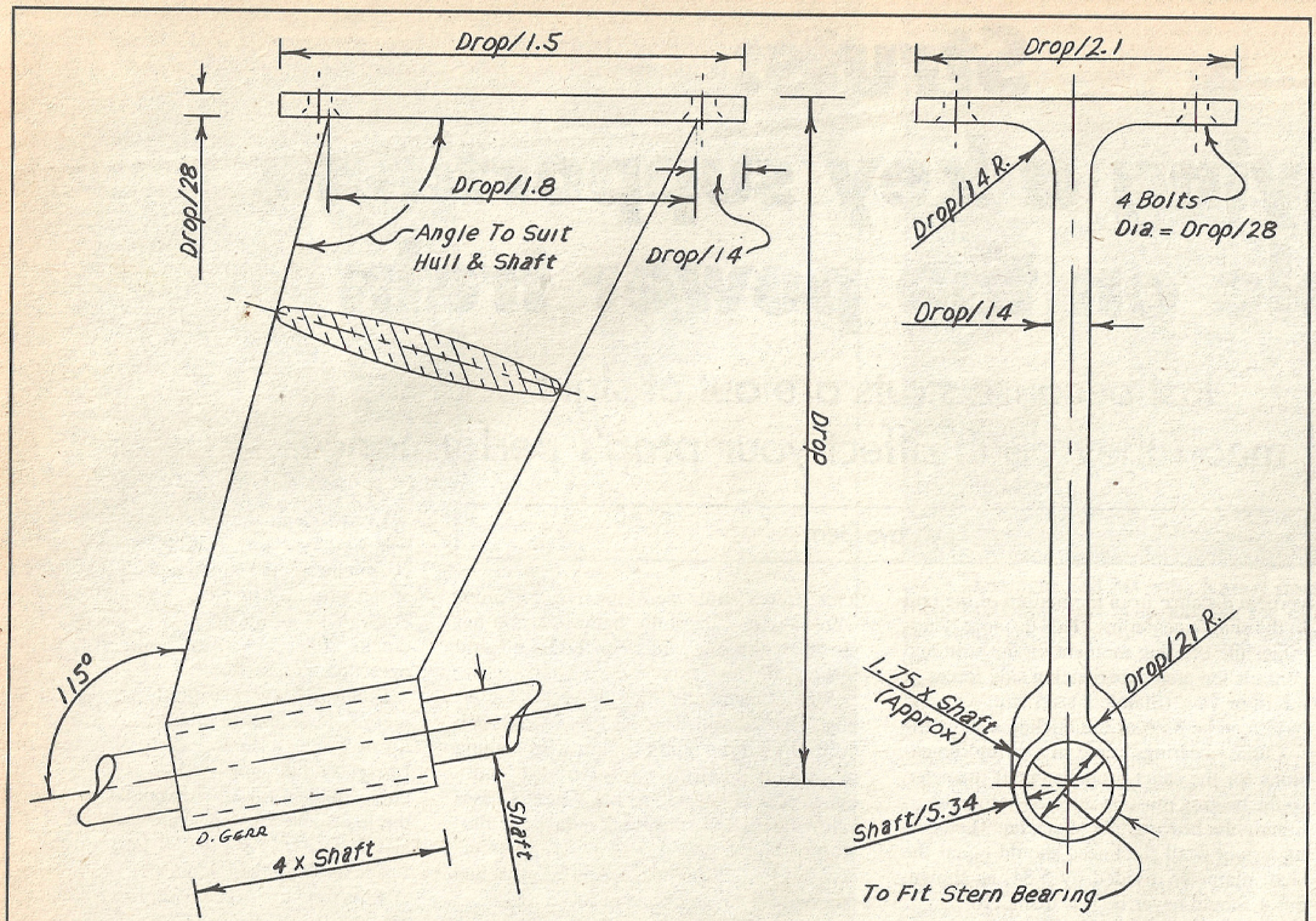

Single-Leg Shaft Strut

sq. ft. above each strut, and then large backing blocks and backing plates were installed.

Backing Blocks and Plates

All hulls, fiberglass or otherwise, require large backing blocks and plates behind the strut bolts. The block's thickness should be at least two times the strut-bolt diameter, and the block's footprint should be 1.5 times the footprint dimensions of the strut base below it — more doesn't hurt. With V-struts, the backing block should ideally span the width between the two bases.

The plate, which goes on top of the block, should have about 10% more footprint than the strut base. Don't forget to taper the block's edges on fiberglass boats. Cutting them off vertically and square leaves hard spots that aggravate hull stresses.

Easing the Flow

A common cost-cutting measure on off-the-shelf struts is to make the strut legs square in section. In fact, square-sectioned strut legs create only slightly more drag than oval sections. This fools people into believing that the compromise between price and efficiency is small and acceptable.

However, the problem isn't the drag but its effect on the propeller; the square corners create turbulence ahead of the prop. Theoretically, true airfoil-section strut legs produce the least interference with water flow to the prop. In practice, the symmetrical flat-oval section is very nearly as good and is simpler to build.

Square-sectional strut legs create more turbulence ahead of the prop than oval sections. The most important dimension for strut legs is the "drop," the vertical distance from the bottom of the hull to the shaft's centerline. Once that number is determined, it is used to calculate the leg's proportions. For instance, the thickness of a single-leg strut is found by dividing the drop by 14; dividing the drop by 28 determines the diameter of the bolts holding the struts in place. These figures work for the silicon-bronze single-leg strut (left) and the V- strut on page 41. The thickness of stainless steel struts can be 85% that of bronze.

Prop Apertures and Speed

The faster your boat, the more important it is to concentrate on obtaining unobstructed flow to the propeller. Perhaps the vessels that most frequently run into problems here are traditional down-east Maine lobster boats that have been powered to run at 20 knots and faster.

Modern semi-displacement hulls lobster boat hulls are generally constructed with long straight keels and a vertical deadwood just ahead of the prop. The stern bearing projects through the deadwood, and often this deadwood is not cut back or faired away ahead of the propeller.

Frequently, the trailing edge of the deadwood (ahead of the prop) doesn't even have its edges rounded off. At 8 knots to 12 knots, you can get by with such a setup (though still less than ideal). But when you try to drive such hulls faster, their propeller will be starved for water in the shadow of the heavy, blunt deadwood and keel just ahead.

As long as a lobster boat's run is fairly broad and flat in the after sections, it can be made to go 20 knots or more — given the power — but you have to provide her prop with room to breath. The traditional full keel should be cut away for 20% to 25% of the waterline length or more ahead of the prop, and the upper trailing edge of the remaining keel or skeg should have a pronounced rounded taper to reduce turbulence.

Additionally, the keel or skeg on these boats usually must be dropped about 6" at the after end to make room for a larger-diameter prop than is normally fitted to traditional lobster boats. Larger engines need additional blade area to transmit their power, and greater diameter is the only efficient way to accomplish this. (see NF Feb. '91, p. 55). ❑

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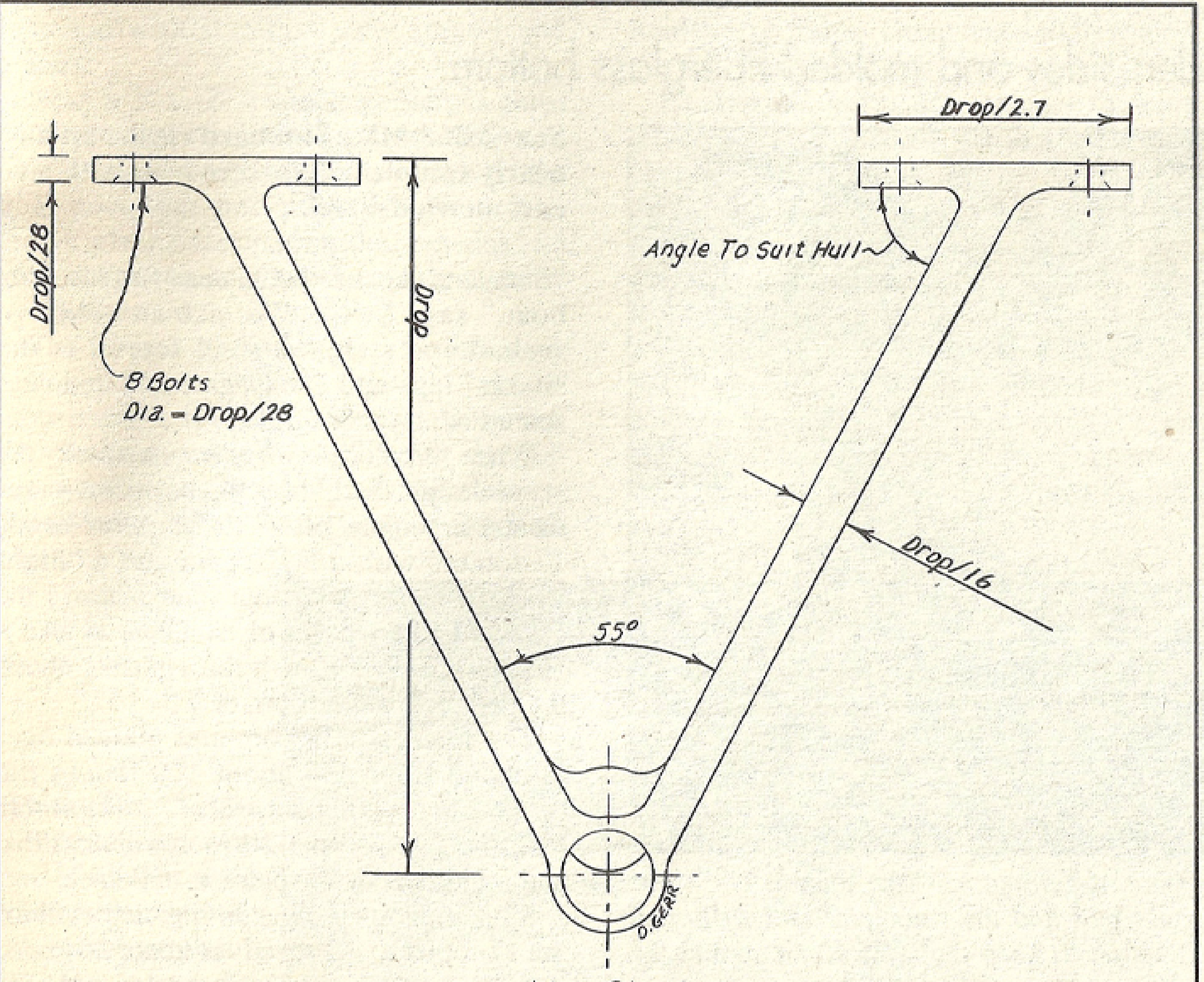

Vee Strut