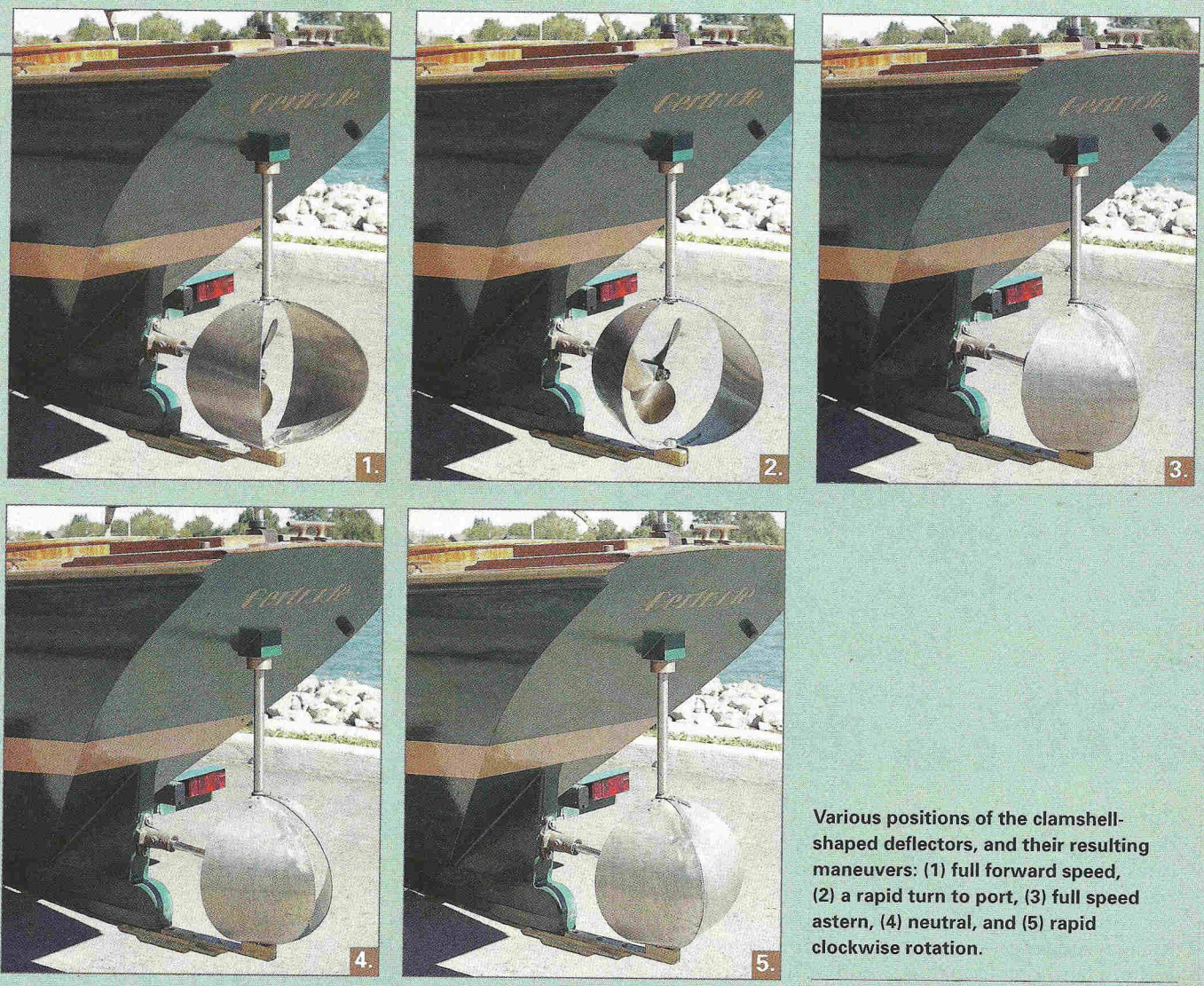
GERTRUDE
and Her Kitchen Rudder

A thrust reverser for a low-powered dory

by Barry Millar
Photographs by Michael Nangreaves

GERTRUDE is an adaptation of an 18′6″ Swampscott power dory—a boat presented in John Gardner's book *Classic Small Craft You Can Build.* She is powered by a 50-year-old engine and was launched in the summer of 2003 with a conventional rudder. This was replaced the following winter with a Kitchen rudder—so named for its inventor, John George Kitchen, of Lancaster, England. Kitchen, an Admiral of the British Navy, worked on the device with Isaac Henry Storey of Ambleside, England, and the pair patented their creation in the United States in 1916—and in Britain sometime before that. GERTRUDE's engine is a 3-horsepower, single-cylinder, two-cycle, hand-start antique built by the St. Lawrence Engine Company of Brockville, Canada; it is probably one of the last of the one-lungers built by that firm. This little power plant is directly connected to GERTRUDE's propeller shaft, with neither clutch nor reverse gear.

The engine-starting process begins with the operator kneeling facing the flywheel, looking aft. Various valves and switches are turned on, levers positioned, carburetor adjusted, priming completed, and finally the flywheel is gripped with both hands and rotated, forcing the piston over top dead center. Then, if the ignition system is properly adjusted, a spark occurs, and this, if the engine is in good spirits, causes the fuel-air mixture within the cylinder to explode. The engine then rotates the propeller at about 400 rpm, moving GERTRUDE forward at a speed close to 5′ each second. The procedure with the conventional rudder was followed by a frantic leap to the steering station to avoid collision or grounding. During my first summer with the boat, launching and retrieval always required judicious and awkward use of a paddle at the ramp. For the sake of dignity, a miraculous intervention was required.



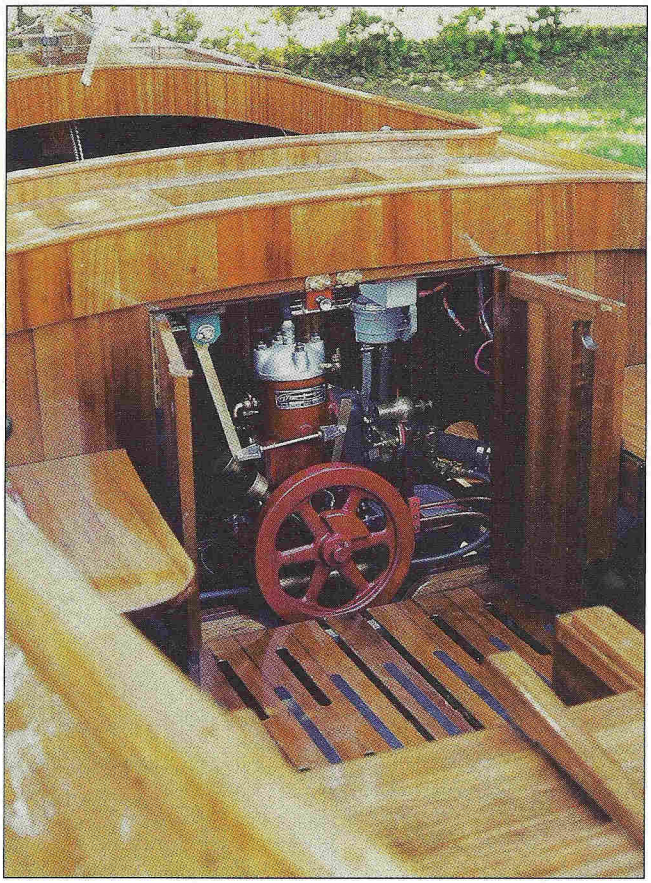
Various positions of the clamshell-shaped deflectors, and their resulting maneuvers: (1) full forward speed, (2) a rapid turn to port, (3) full speed astern, (4) neutral, and (5) rapid clockwise rotation.

During GERTRUDE's first summer afloat, my friend Murray Miner reminisced about his World War II service at Shearwater, Nova Scotia; in the process he spoke of "Kitchen gear." By then, I'd learned of the Kitchen rudder—one that reverses the thrust of a propeller—from Weston Farmer's book, *From My Old Boat Shop*, in which he describes the Kitchen rudder with great enthusiasm. It is obvious from the rest of this classic book that he did not have time for wildly impractical ideas. However, Farmer was exceedingly complimentary of the Kitchen rudder, embracing it without qualification—without having himself ever used one. He wrote, "And yet here and there in marine thinking over the past hundred years, there have been men who, well grounded in marine practices at designing or building, have come up with something of real merit. One of these was the Kitchen reversing rudder."

The Kitchen rudder uses semicircular clamshell-like "deflectors"; moving these, in unison, together or apart provides variable-speed forward or reverse. A mechanism to control the deflectors was mentioned in the patent as necessary, but not described in a level of detail useful for a small boat like GERTRUDE.

Improvement patents were granted both to Admiral Kitchen and to others after the original 1916 U.S. patent issue. These focused on two broad areas: one to improve reversing efficiency, and the other to provide the means of operating the clamshells. However, in all cases the means of operation was intended for a helmsperson in a wheelhouse rather than for a coxswain in an open boat. Murray Miner, when recalling the Kitchen gear of his war years, said the coxswain manipulated the tiller and rudder as a single unit. Weston Farmer likewise described and sketched a hand-cranked mechanism operated from the end of a tiller. This was the device I chose for operating GERTRUDE's Kitchen rudder, and it is without question the best choice for an open boat as it affords the helmsperson seamless control of his boat.

The Kitchen system allows the engine to operate at a constant speed and constant load when maneuvering.



GERTRUDE's 3-hp, single-cylinder engine is started by gripping the 12"-diameter flywheel with both hands and turning the piston past top dead center.

Conventional reverse gearing requires that the engine be unloaded before shifting gears. Then the engine speed is increased gradually to move the boat; often this cycle must be carried out several times during a single maneuver, with actions that are individual and disjointed. The Kitchen rudder provides a unique advantage with its seamless and harmonious manipulation. (This seamless maneuverability was probably not contemplated by the inventors, who appeared to be seeking only a way to move a boat in reverse.)

I stopped the conversation in mid-sentence to ask Murray to elaborate on his "Kitchen gear" experience. Here, possibly, were the only two people on the planet engaged at that moment in a conversation about this near-dormant bit of technology; one had a 60-year-old direct experience, the other a current need.

Murray recalled that there were two open boats at Shearwater—both equipped with Kitchen gear, both highly maneuverable. Weston Farmer had described how well a British-built Vosper gig equipped with a Kitchen rudder could be maneuvered. That was, perhaps, the reason for the Canadian Navy's use of similar craft.

The rudder's patent notes that the device's creators "have invented certain new and useful Improvements in Means for Reversing Screw Propelled Boats...without reducing the speed of or reversing the propellers." It is interesting to note that the original invention was limited to providing reverse, while subsequent patents described devices that improve maneuverability, too. GERTRUDE's Kitchen rudder likewise demonstrates superior maneuverability when compared to the reverse gearing commonly used today.

Excerpts from an article published in *The Rudder* in January 1921 provide a comparable testimonial:

> The first boat to be equipped in this country is the power cruiser, Violet, of Bridgeport. This boat is 38 feet long and 10 feet in breadth, with a draught of 3 feet 4 inches. The engine is an Automatic tractor machine of 22 h.p. directly connected to the propeller shaft. As soon as the engine is started the shaft and wheel begin to turn and the entire manoeuvring of the boat, ahead, astern, or from side to side, is done with the rudder....
>
> The tests were made in the East River off the New York Navy Yard on November 18th....
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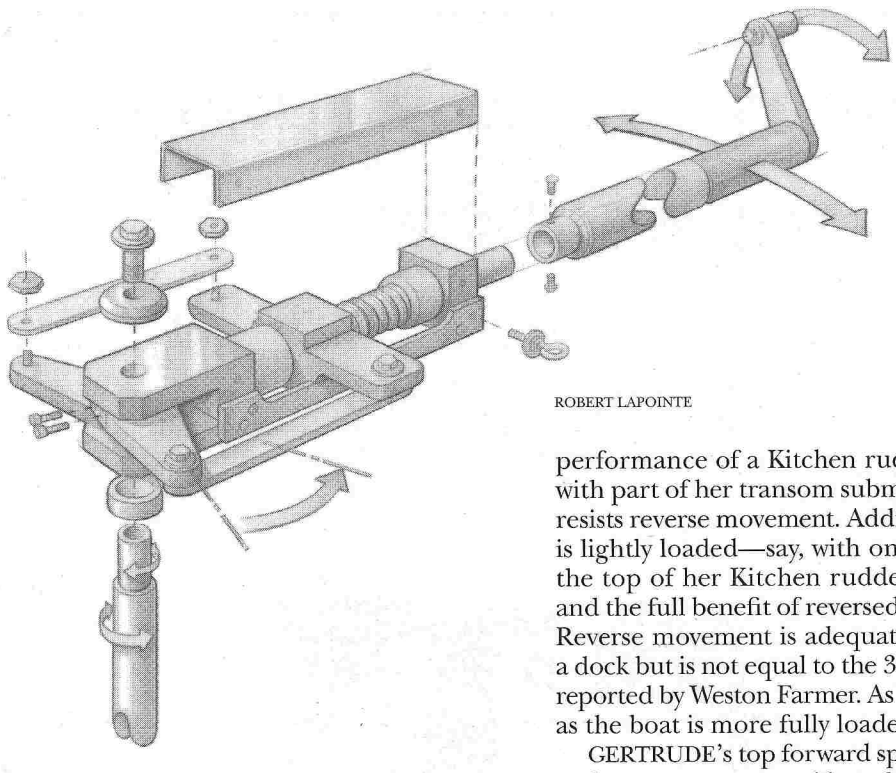
> The boat was started at full speed; about 12 miles an hour, and when she had full headway the rudders were brought together and the boat stopped in less than her own length. During the stoppage of the boat there was no apparent strain or vibration. With the engine running full speed the boat was stopped in the current and held stationary by obtaining the proper amount of opening in the blades. It was also demonstrated that the boat, when standing still, could be made to turn about on her own axis very rapidly....
>
> The average astern speed taken from trials...was 4 ½ miles an hour.
>
> By varying the opening of the blades the boat manoeuvred at speeds of only a fraction of a knot.

The patent, now expired, was a rich source of information to me when I prepared detailed drawings for all the parts required for construction of a Kitchen rudder. Joe Crowe, who lives close by, is a machinist of extraordinary skill. Joe's friend and associate, Scotty Dickie, is an artist when forming and welding stainless-steel sheet material. During the winter months, this team designed, manufactured, and installed GERTRUDE's Kitchen rudder for the 2004 summer season.

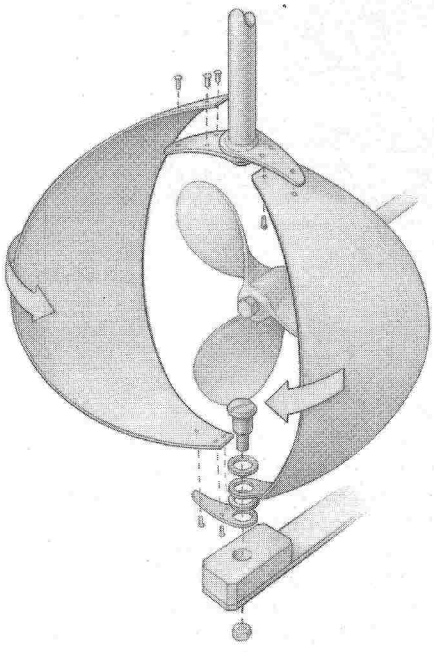
It requires practice to be able to manipulate the rudder effectively. GERTRUDE's Kitchen rudder is moved from full forward to full reverse by rotating the hand crank seven turns. Because of the precision built into the mechanism and the power provided by the screw, this can be accomplished within three seconds. The first five turns from full open results in a gradual decrease in forward boat speed. Tiller movement is normal—that is, moving the tiller to port results in the boat turning to starboard, etc. From about turn five to turn six, the boat's response to tiller movement is transitional, and requires skilled manipulation to hold course. At six turns, boat movement ceases. This is, effectively, "neutral gear"—and the correct position for starting the engine. The Kitchen rudder's control is very precise: When the boat is at a dock with the engine running and the Kitchen rudder at its neutral setting, the docklines are slack. Adjusting the rudder as little as a quarter turn in either direction results in tension on the docklines.

When the clamshells are fully closed at seven turns of the hand wheel, GERTRUDE moves slowly in reverse. The tiller becomes very sensitive and, as with a conventional



ROBERT LAPOINTE

The author devised a hand-crank mechanism to operate the Kitchen rudder's pair of deflectors. Spinning the crank on the end of the tiller results in counter-rotation of the concentric tubes that compose the rudderpost. The deflectors are fixed to these tubes.



rudder, operates in the opposite direction from when moving forward. Fifteen degrees of tiller movement with the clamshells closed causes the boat to pivot through 360 degrees in about 10 seconds. Rapid closure from full open to full closed causes an abrupt stop. Closing the rudder by five turns from full open results in very slow forward speed—less than 1 knot, compared to full-forward speed of 5½ knots. Sideways movement of the stern is possible, although it is not comparable to side thrusters.

The underwater shape of a boat would influence the performance of a Kitchen rudder. GERTRUDE is a dory with part of her transom submerged; to some extent this resists reverse movement. Additionally, when GERTRUDE is lightly loaded—say, with one or two people aboard—the top of her Kitchen rudder is at the water's surface and the full benefit of reversed water flow is not available. Reverse movement is adequate for powering away from a dock but is not equal to the 37 percent of forward speed reported by Weston Farmer. As expected, reverse improves as the boat is more fully loaded.

GERTRUDE's top forward speed is 5½ knots at 850 rpm and represents a speed-length ratio of 1.4 based on her LWL of 15½'. This is an acceptable speed for a displacement hull and suggests that increasing power would not significantly increase hull speed. Top speed is the same with conventional rudder or with Kitchen rudder. But the great speed benefit is at the low end: Using the conventional rudder, minimum speed is 3½ knots, whereas with her Kitchen rudder minimum speed is less than 1 knot.

Now, with full control over speed and direction, GERTRUDE's launching procedure at the local launch ramp is elegant—and accomplished without a paddle. It starts upon arrival with a gathering of locals who either stare in silence at the Kitchen rudder or perhaps suggest that they have not ever seen one of these. GERTRUDE is backed down the ramp, released, and tied to the jetty with both bow and stern lines. Valves and switches are set, rudder is adjusted at a three-quarters turn open, engine is primed and started in forward direction. Because the rudder is close to the water's surface, much frothing and splashing is evident and only serves to solicit concerned comment from the gallery. GERTRUDE, on the other hand, sits motionless at dockside. Her now-skilled coxswain quietly climbs onto the jetty and without haste unties both docklines, then climbs into the steering station and closes the clamshells. GERTRUDE moves backward until clear of the launch area, spins 180 degrees, and then gently moves forward. If, by chance, the spectator gallery is full, GERTRUDE then performs a 360-degree rotation on the spot, lifts her bow with pride, and powers out to sea at full 5½ knots.

Barry Millar lives in Canada in Port Colborne on the north shore of Lake Erie. He continues to research the Kitchen rudder and continues to improve his operating skills as a result of much practice.