Photos by the Author

The runner planks of the new type of ice boat are rigid and all four runners are spring mounted

PROGRESS IN FOUR-RUNNER ICE BOATS

By J. JULIUS FANTA

EVIDENCE that the four-runner ice boat is the coming thing in ice yachting, and not a fly-by-night experiment, is presented in this article. Details of long standing difficulty have been worked out so thoroughly in the boat discussed here that she is the best concrete example of the type. Moreover, her design offers the best taking off point for further development in this particular type.

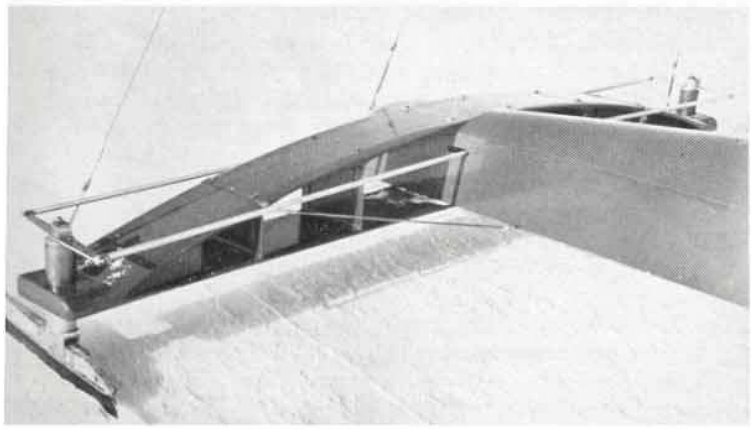
The Skeeter Ice Yacht Club of Williams Bay, on Lake Geneva, Wisconsin, is distinguished by having in its fleet the craft that has made the most significant contribution to the development of the four-runner type. This organization is on record for building up the largest Skeeter fleet as well as being the first to adopt the bow rudder, three-runner Skeeters. Henry Reynolds, of Chicago, is responsible for this distinction since it is his four-runner craft that did the trick. She is not only the product of his own brain and hand but also the result of solving numerous problems, the difficult nature of which had discouraged many from tackling them and adopting the four-runner design.

The four-runner type is far from new, but, since its inception, there is nearly a half century of stagnation. About fifty years ago, the idea was tried in the East but it was soon abandoned as a total failure. In subsequent years, various attempts have been made to make this design a working success. But not until four years ago, when various craft met with sufficient success to make further experiments worth while, did the type show real development.

First, a Skeeter was fitted with a second runner plank, with all four runners movable. The problem of adjustment and synchronization of the runners led to the use of two Ford front axles, which served as runner planks, with runners attached to automobile wheel spindles. If it did nothing else, such axles proved the "iceworthiness" of the four-runner design, since its weight was forbidding. Next was tried a craft with two fore and aft runner planks in an effort to provide a basis for synchronizing the runners. For steering gear, this craft had long double tillers, connected by a five-foot cross bar. Although the longitudinally planked craft proved her worth, subsequent boats reverted to the traversing runner planks, a special type of which Mr. Reynolds adapted for his craft.

The craft is 16 feet long and the length of each runner plank is 10 feet. The transverse distance between the cutting edges is 9 feet. The sail area is 75 square feet, which, of course, classifies the craft as a Skeeter. Weighing 290 pounds, as light as a front-steering Skeeter, the boat is a single-seater, designed primarily as a racing machine to develop every possibility for speed.

Unlike previous types, the mast of this four-runner craft is practically vertical, being only a few inches off the perpendicular. In the Hudson River, or stern-steering, type, raking the mast appreciably was not necessary because, while "hiking," these craft tilted the mast and sail aft. If raked at all, however, the mast on this type should have been raked forward to compensate for the backward shift of sail, while hiking. Naturally, this movement aft means throwing the center of effort considerably abaft its designed position.



because the mast does not shift. It remains practically vertical as the sail goes neither forward nor aft in a hike. Because the hull is supported on four runners, the design is stabilized to the point where the centers of sail, weight and balance are constant at all times. The four-runner craft neither throws the sail forward to pile up wind until the craft capsizes, nor drops the sail aft so that wind and speed are lost. (Sidewise movement of the mast in heeling is not to be confused with fore and aft shifting of the mast and sail. This sideward movement does not affect balance.)

In the four-runner boat, as designed and built by Mr. Reynolds, the center of sail effort and the center of gravity and balance coincide in the center of the hull. This worked out as well as expected, even though testing and tuning up the boat was limited by unfavorable ice conditions last winter. After many years of sailing a three-runner Skeeter, Skipper Reynolds found that this four-runner boat hiked less than three-runner craft in the same wind. With the weather runners just touching, the fastest sailing position for any ice boat, the quadrilateral design held steady in trials as against three-runner types that lifted and bobbed, teeter fashion.

Many novel features are found in the new craft. These are not only interesting but they contribute to sailing success and steering efficiency as well. It was the difficulty of synchronizing the steering runners and maintaining the synchronism that had delayed the progress of this design. Reynolds discarded all old theories about alignment and synchronization of the runners and approached the problem from an entirely different direction. One glance at the accompanying illustrations will make this clear. The truss-beam type runner planks serve a definite purpose.

Instead of the conventional resilient, spring-type runner planks, rigid runner planks were used to give the rigidity necessary to avoid intermittent spreading of the runners. It is this spreading, caused by the spring action of the flexible runner planks, the designer discovered, that interferes with true alignment of the runners and the accurate synchronization of the rudders. Rigid planks eliminate these faults and keep the runners vertical, avoiding spreading and weaving. By comparison, the spring action of flexible runner planks tilts the runners outward at intervals when the boat is working on rough ice. The inefficiency of such planks on four-runner craft is obvious.

(Continued on page 74)

The newest four-runner boat and a close-up of the forward runner plank, showing the yokes and tie rods of the steering gear. Right, the center of effort of the traditional type of Hudson River ice boat moves aft when she hikes

The forward rudder craft of the three-runner type are distinguished by their raking masts, since they carry rakes ranging from three to five feet. The reason for this is obvious. In a hike, the single bow rudder type tips the mast and sail far forward, necessitating the tremendous rake. The rake is an effort to maintain the centers of sail in balance at the most precarious moments. While the forward rudder craft of the three-runner design tenaciously holds the wind, keeps "piling it up" and increases speed while hiking, the old Hudson River type does exactly the opposite. In tipping aft, she spills the wind to the point where the speed diminishes materially.

The Reynolds craft needs no rake to offset the shifting position of the mast while hiking

week-end and short vacation cruising; but, if I ever got the time really to go places and not have to be back Monday morning, I'd yank it out and put in something much smaller, either a heavy duty two-cylinder or a small four. The big motor would have all the usual superfluities: starter, generator and what not. But the small engine, for use offshore and in ports where there isn't a machine shop on every dock, would be as simple and independent as it could be made — no starter or generator, for instance, but an impulse magneto instead; no reduction gear or reverse. The way things look now, I'm not so sure I wouldn't put in the simpler unit in the first place. Except that, the way things look now, the perfect auxiliary will have to wait until 2141 A.D. to be built.

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(Continued from page 51)

Through the use of equalized compression springs, the designer has succeeded in giving the craft the riding comfort sacrificed by the hard-riding, rigid planks. (Note the cylindrical metal devices protruding above the ends of the planks.) The result is that the craft has spring action at all four corners, instead of only in the middle, thus providing more comfort than that derived from the spring action of the curved, non-rigid runner planks.

The operation of the compression springs is interesting. Each runner aft has two springs housed in telescoping tubes. The lower tube section of each housing is welded or brazed to the runner hobbler; the upper sections are fitted to the runner beam. A spring works between each set of tubes. While each runner aft has two springs to insure true alignment, each forward rudder has a single larger spring and spring housing around the rudder posts. Each pair of smaller springs aft was worked out to have the same compression as each single large spring forward. The result is that the springs have balanced compression throughout, each not varying more than five per cent from the other, a practically negligible amount. With balanced spring pressure, stability throughout is insured. With the efforts of sail and hull weight centered and balanced, all is stabilized because the balanced spring pressure allows each fore and aft runner to carry an equal burden on either tack.

There is a 12-inch diameter grooved wheel, which turns on a heavy rod set vertically between the sections of the runner plank, built inside the body forward. Bolted to this wheel, and working through the sides of the body, are rigid tie rods connected by clevises to the arms securely fixed atop the rudder posts. Around the grooved wheel just mentioned, and around a drum turning with the steering wheel, is a cable tautened by a turnbuckle. This allows remote control steering.

ADJUSTMENT of the steering runners is simply a matter of tightening or loosening the threaded clevises at the ends of the tie rods. Adjustment entails either increasing or decreasing the turning radius. This is about as mechanically perfect as steering on a four-runner ice boat can be. The same remote control steering principle has proved itself on the three-runner Skeeter for a decade and none better has yet been devised. In the four years of four-runner ice boat experimenting, at least a half dozen steering systems were tried and discarded. In all probability, this one will stay.

In sailing, this four-runner craft turned as fast or shorter than the bow-rudder craft of the three-runner design. The former was found to have considerably more control, because of the balanced pressure on the lee runners. However evenly distributed, the load on the lee rudder was sufficient for steering at all times. According to the skipper, the craft showed no tendency whatever to slide or slue while turning or in straight sailing. A surprising outcome is that the balance of the boat throughout enables her to steer herself, attention to the wheel being required only when changing course.

Foremost among the reactions of one who is sailing the four-runner design is the feeling of security which results from the knowledge that the craft will not pitch forward into a capsize while hiking. This is the bad trick of the bow-rudder, three-runner craft, although skippers of this type of boat maintain they can thwart that tendency by easing the sheet.

In the four-runner type, there is no inclination to pay off or come up into the wind, as with the single bow-rudder and Hudson River types. Equal pressure on the runners of four-runner craft is the reason for holding true, regardless of hiking. As for spinning tendency, the stability and balance of the hull preclude this danger. The four-runner ice boats will, of course, hike, but not as much as will three-runner craft in the same wind. Hence the chances of capsizing are substantially reduced. Needless to say, any ice boat will capsize in a gale.

It is the opinion of Mr. Reynolds that the four-runner design can, and will, be developed into the fastest of all ice boats — and the safest. The current season will see another long forward step taken in that direction.