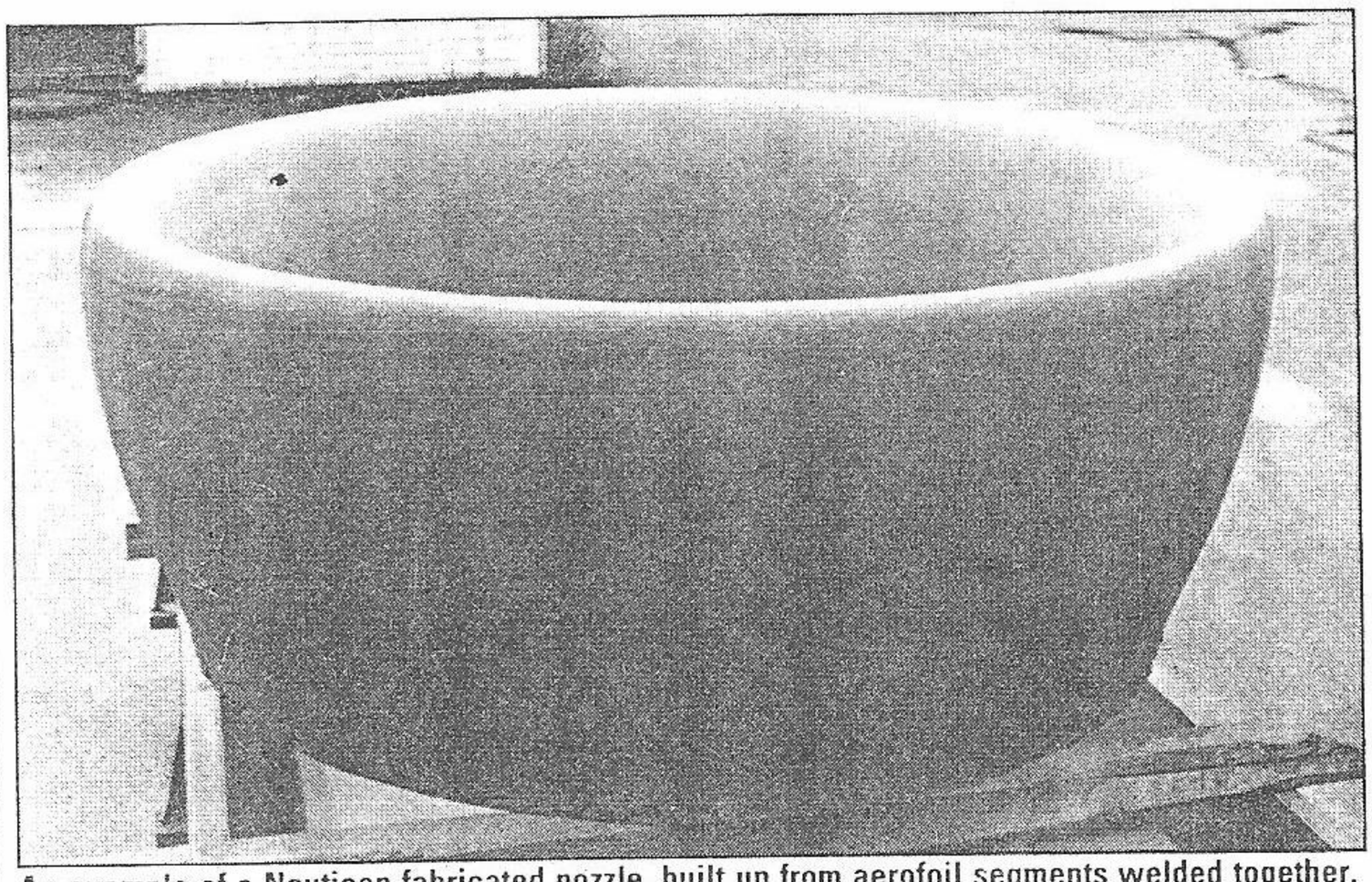
Nozzles for speed and pull

It is usually considered that adding a propeller nozzle to a vessel will increase its bollard pull or its ability to tow nets, but that there will be a sacrifice in top speed caused by the resistance of the nozzle itself.

A Canadian company claims that this is not necessarily so, and if their propeller nozzles of unusual cross-section are used both thrust and top speed can be improved. The firm, Nautican Enterprises Ltd of North Vancouver in Canada, have developed two main types of nozzle based on a highly efficient aerofoil section which owes much to recent research into the fundamentals of aerofoil design. They claim that their nozzle is far more efficient than the standard type 19A nozzle profile, tests at the Vienna ship model basin showing that there was no flow separation on the inside or the outside surface of a Nautican model, unlike the standard type, while the Nautican nozzle also showed an increased efficiency compared with an open water propeller at higher speeds.

The subtleties of the nozzle shape could be difficult to obtain with conventional fabricating techniques and Nautican have developed two methods of building nozzles, one by fabrication and one by casting. The fabricating technique builds the nozzle up from aerofoil shaped segments which are welded together to give a complete ring. Typically the entire inner surface is made of stainless steel. According to Nautican this construction gives excellent structural strength and integrity with freedom from weld cracking.

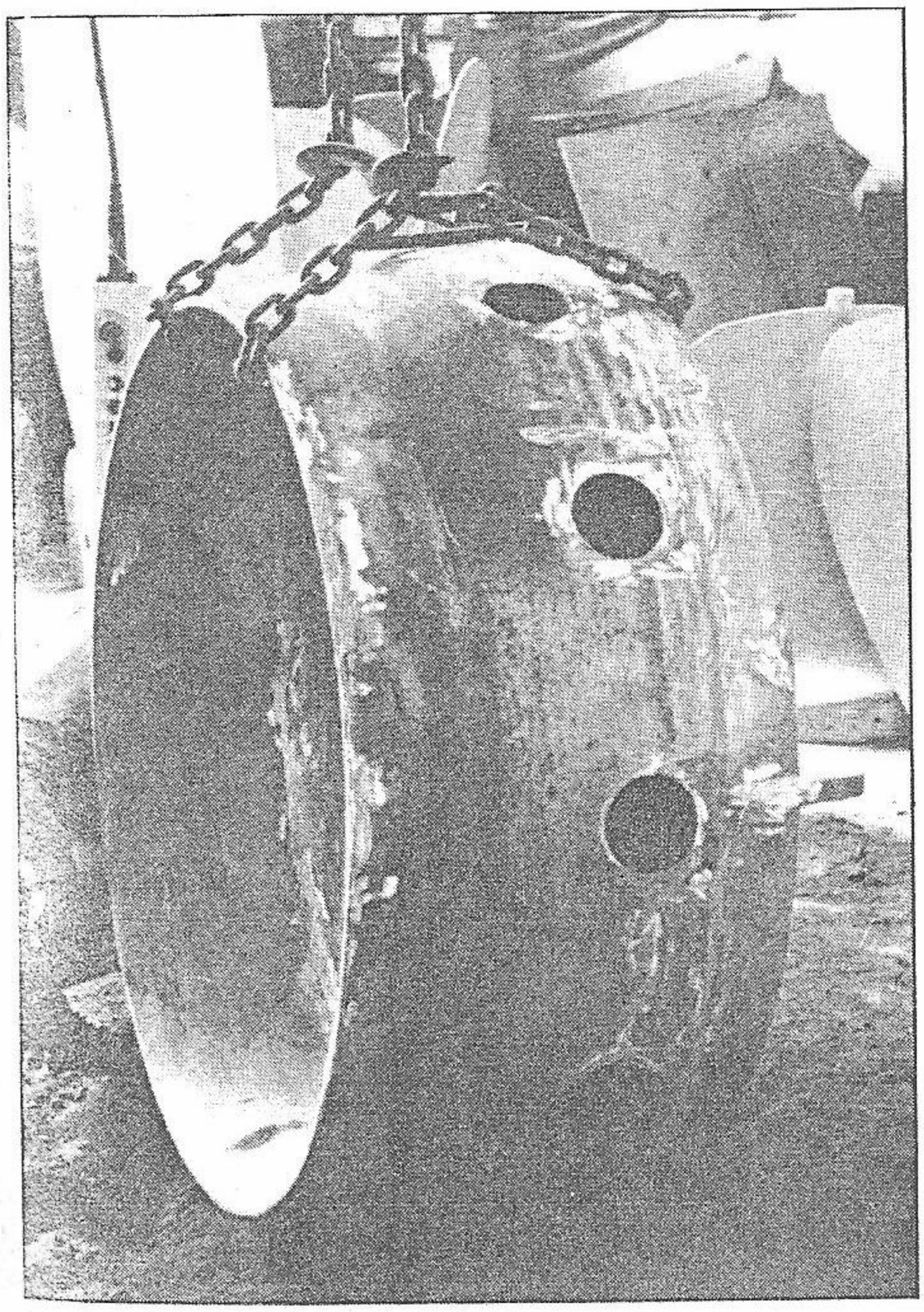


An example of a Nautican fabricated nozzle, built up from aerofoil segments welded together. Section chosen is claimed to improve thrust without sacrifice of speed.

Nozzles are sometimes used for engine cooling purposes, since coolant can be circulated within the structure of the nozzle giving excellent heat transfer. In principle this is a good solution but there have been a number of failures where weld cracking has led to leaks and contamination. This, claim Nautican, is eliminated with their techniques.

A totally different approach is to cast nozzles in one piece and a number of Nautican nozzles have been made by this method using either stainless steel or high tensile bronze. Casting enables an extremely accurate and strong nozzle to be produced. Where the nozzle is to be fitted to a new vessel other propulsion elements can be included in the nozzle casting, for example a stator which helps to recover rotational losses in the propeller wake and the tail shaft bearing which gives improved concentricity between nozzle and propeller. The section of the nozzle ring is hollow, the space being produced by coring at the casting stage. To obtain consistent thin walls for strength with lightness is no easy matter and Nautican are currently working on computer generated self cores to replace wooden pattern boxes.

To date some eight tugs and 12 fishing vessels have been fitted with fabricated Nautican nozzles, either to new construction or as retrofits, in one or two cases replacing existing nozzles. Cast nozzles have been fitted to a series of five US Navy torpedo recovery vessels and to the *GSI Explorer*.



A cast nozzle during manufacture. The holes are for core removal and are subsequently covered. Material is bronze or stainless steel depending on application.