SILENT PROPULSION 1917–1919

BY

D. K. BROWN, M.ENG., C.ENG., F.R.I.N.A., R.C.N.C.
(*Sea Systems Controllerate*)

During World War I the only method available to detect a submerged submarine was the hydrophone and it was soon discovered that the ship's own noise limited the chance of detection. By 1918 the Engineer-in-Chief (Vice-Admiral Sir George Goodwin) and the Director of Experiment and Research (C. H. Merz) were exploring two promising ways of reducing self noise: air bubble screening and pump jet propulsion.

The use of air bubble screens seems to have been proposed by James Brown of Scotts' Shipbuilding Co about 1917 but the old files are incomplete and there are indications of parallel development elsewhere. Brown's first tests were with a 5 inch model propeller in a tank 6 ft × 3 ft × 1½ ft deep, though later he used a bigger tank. He was able to show that a bubble screen reduced the radiated noise levels from the propeller and from machinery in the hull. The bubbles were carried with the stream and did not rise too rapidly.

There were some further early tests in 1917 by J. H. Gibson of Cammell Laird with a 30 ft launch of 40 bhp using 6 air bottles at 1800 lb/in^2 released at 5–10 lb/in^2. Trials were unsuccessful in reducing noise but measurements were obtained of the rate of rise of bubbles—2 ft/sec. Early in 1918, another launch, the *Amey*, was tried off Harwich with equal lack of success. She had one air pipe on the stem and one either side alongside the propeller.

Based on the model tests at Scotts it was decided to go ahead with a larger and properly engineered trial. The first tests were with *ML 497* which was fitted with three air emitting belts, one just forward of amidships, one on the quarter, and one surrounding the propeller. The air holes were 1/64 inch diameter and air was supplied by the main engine air compressor via a reservoir kept at 100 lb/in^2. There was some reduction in noise but it was thought that the air supply was insufficient.

The next step, in May 1918, was to fit screens to *PC43*, a twin screw turbine anti-submarine vessel. Not surprisingly, the first problem was to find a suitable air compressor. Available units of 30 to 40 horse power weighed about 4 to 5 tons each and delivered 100–120 cu ft/min at 300 lb/in^2 compared with the requirement for 15 000 cu ft/min at 20 lb/in^2. A reservoir of 30 large air bottles was considered but rejected in light of its weight of 60 tons. A new design would take too long to develop. The eventual solution was to use two 90 hp Weir centrifugal water pumps delivering through an aerator. It was said that there was about 1% air in the water at the outlets.

The first belt in *PC43* was fitted at the forward end of the boiler room, with a second belt at the forward end of the engine room. Each belt had 36 nozzles perpendicular to the hull; there were also discharges forward of the propellers and near the bow. The system functioned correctly with the ship stationary, the stream of bubbles travelling out some 30 feet from the ship's sides. The bubbles were small, about 1/32 inch in diameter and rose slowly. When underway at 6 knots the wake of bubbles extended some 200 yards astern. From observations made using a water telescope it seems that the screen was fairly complete. The jets themselves were noisy. Trials using listening gear on *ML 494* showed the equipment as installed to be useless, as

PC43 was noisier with the screen working than without, and the noise was particularly conspicuous when turned on and off.

The air/water mix was discharged at 113 lb/in^2 forward and 75 lb/in^2 aft with about 40 cu ft/min of air from each belt. Messrs Scotts returned to the drawing board to design quieter discharge nozzles, and a means of discharging very much larger quantities of air was sought. The apparatus was left in *PC43* for further trials but it would seem that these never took place.

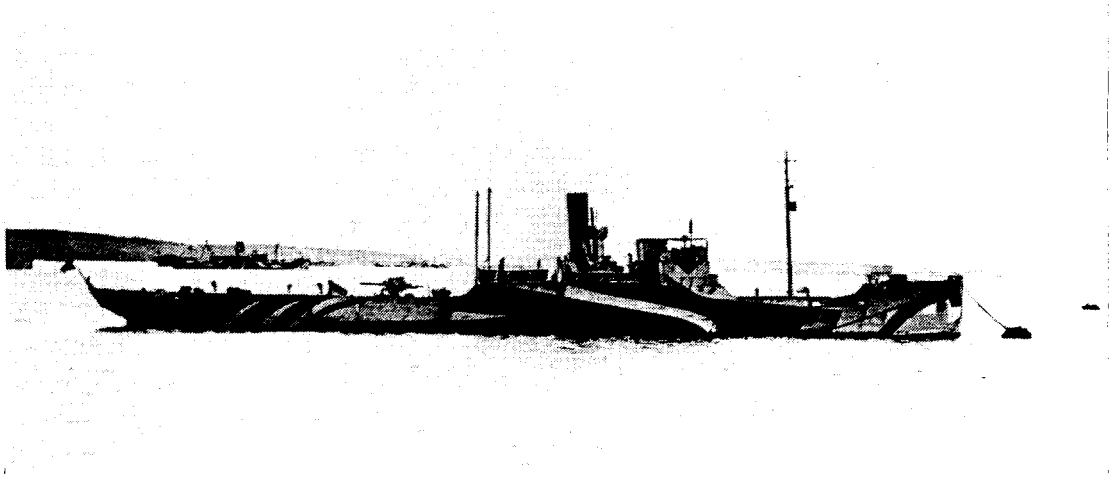

FIG. 1—PC69. THE PC VESSELS WERE MODIFIED DURING BUILDING FROM PATROL VESSELS OF THE P CLASS TO MAKE THEM LOOK LIKE SMALL MERCHANT SHIPS. THEY WERE ALL DIFFERENT BUT PC43 WOULD HAVE BEEN OF GENERALLY SIMILAR APPEARANCE.

The other style of 'silent propulsion' sprang from a suggestion by Barnaby of Thornycroft's. In 1883 they had completed torpedo boat *TB 98* with jet propulsion. With 170 horse power it achieved 12·6 knots, close to the predicted value, but far less than the 17·3 knots of a propeller-driven sister[1]. However, Barnaby did note that *TB 98* was quiet and during the 1914–18 war he suggested that the principles should be adopted for anti-submarine vessels. At about the same time an Admiralty scientist, on holiday in Liverpool, Bay observed that the local lifeboat (which was jet propelled) was unusually quiet.

As a result it was decided to convert two of the STRATH Class anti-submarine trawlers which were under construction. The *George Ireland* (later *Teviot*) and *Henry Jennings* (later *Ure*) were given jet propulsion engines designed by Major Gill and were tried against a screw-propelled sister (*Thomas Ansell*).

TABLE I—*Coal consumption comparison between water jet and screw propelled trawlers in 1919*

Ship	*Propulsion*	*Coal Consumption* cwt/hr	*Speed* knots
Henry Jennings	jet	5·25	7·91
*Thomas Ansell**	screw	5·0	10·3

*includes consumption of auxiliaries

It was reported that the jets were much quieter in the ratio of 1:6·7, but units and scale were not given. On the other hand, the jet units were very inefficient as shown by their coal consumption (TABLE I).

At 8 knots the jet needed 395 i.h.p., while the screw ship needed 165 i.h.p. for the same speed. Overall efficiency of 0·218 was worse even than *TB 98*'s 0·254. Astern thrust was provided by a 'reversing bucket' which could be lowered over the jet outlet. So used, *Jennings* failed to develop any astern speed at all.

At about the same time as these trials took place active ASDIC was being developed, and within a year of these trawler trials it was minuted that there was no longer a requirement for silent propulsion.

This article is based on examination of old Engineer-in-Chief's files, which will be classed as 'public records' and probably housed at the National Maritime Museum.

Reference

1. Brown, D. K.: Jet propulsion in the Royal Navy; *Marine Propulsion* March 1980, pp. 48–49, 51.