Paddle steamer

- BOILERS

By W. Melville

Many readers will be interested in building a boiler for Edgar T. Westbury's workmanlike diagonal engines. Before we consider the model some remarks on full-size boilers may be of value.

Paddle propulsion, of course, forms the whole early history of marine engineering, but as that is too wide a field I shall limit myself to the boilers used in coastal passenger craft, which Mr Westbury obviously had in mind when he designed his engines.

In the very early days the flue boiler was universal, with side-lever jet condensing engines. As the pressures were around 5 p.s.i., the engineers of these days were not restricted to the circular shell, and designed their boilers in the most convenient shape to suit the space available. A flue boiler is shown in Fig. 1, but their shapes and internal arrangements were legion. They were still built as late as the 1880s for harbour craft. The feed water was salt and muddy and a surface condenser was considered an unnecessary luxury.

Increase in steam pressures brought a few locomotive boilers into service in light fast vessels, and tubular boilers of various types became common by the 1840s. The most popular variety resembled the modern Scotch return-tube boiler, except that they were square or rectangular in cross-section, with furnaces of similar shape, and were often dry-bottomed.

The haystack boiler, said to have been invented by David Napier, came into existence about this time and enjoyed a great vogue on the Clyde where it was usually associated with steeple, oscillating and single diagonal engines. The haystack boiler was built as late as the present century for pressures exceeding 100 p.s.i. in at least one case, though 50 p.s.i. was usual.

Its construction is shown in Fig. 2, which reveals that it was essentially a water-tube boiler, an arrangement made possible by the pure feed water obtained from the surface condenser. Its making must have been a feat even in these early days when the boilers were evidently undeterred by the most intricate plate work. They were built of considerable size, a fast steamer carrying two boilers, perhaps...
12ft 6in. dia. and 14ft 6in. high, one forward and one aft of the engine room.

The haystack boiler was well adapted to its work. The large grate area, effective tube heating surface and free draught made it very powerful for the space it occupied. The two boilers in McBrayne’s famous *Columba* made steam at 50 p.s.i. for a pair of oscillating engines indicating about 2,000 h.p., which drove her finely-modelled hull at nearly 20 knots. The latest haystack I have seen, and possibly the last ever built, was fitted in the small North British Railway steamer *Lucy Ashton*, and survived until the 1940s. It worked at over 100 p.s.i., and so far as I know was unique in driving compound diagonal engines.

Compound engines and higher pressures brought the need for more robust boilers, and Scotch and navy boilers appeared in the Clyde fleet in the 1880s, with one short-lived example of a watertube boiler, installed in the Caledonian Steam Packet Company’s *Caledonia*. The Scotch and navy boilers have persisted to the present day, and will never be superseded as the Clyde steamer has nearly run her course.

One feature which came in with the horizontal boiler was forced draught, which the limited grate area and high gas resistance of this type made necessary if it were to hold its own with the haystack; it had to do this, as speed paid a premium on the Clyde until the decline began in 1914. The closed stokehold system was universal. Some of the Scotch boilers were of enormous size. The *Juno*, owned by the Glasgow and South Western Railways, had a double-ended boiler nearly 20ft in diameter, with eight furnaces, and others were nearly as large.

As nearly all diagonal engines got their steam from Scotch or navy boilers, it seems that one or other of these types should be chosen for Mr Westbury’s engines. The Scotch boiler is the shorter and more compact, and is easily modified to make an efficient small generator. I have, therefore, selected it for the model. The engines have been designed as a small working set of diagonals, preserving the character of the original without being an exact model. I have tried to follow a similar course with the boiler.

**THE MODEL**

The full-size boilers were, of course, orthodox in type, generally double-ended. The model has one furnace, and the wet-back combustion chamber has been replaced by a system of watertubes which is just as efficient when fired with liquid fuel and is based on the full-size Howden-Johnson improved Scotch boiler.

It is designed to carry 60 p.s.i., and to provide ample superheated steam to drive the engines at 400 r.p.m. which should drive a 6 ft model at a scale speed of over 20 knots. It may appear small by normal model standards, but with a good workmanship in the engines and a suitable burner it will make steam to spare.

In the absence of a special burner, this type of boiler is best fired by a blowlamp, giving a short, fat, flame. A suitable burner, for paraffin, is produced by the makers of the “Monitor” blowlamp, and resembles a Primus roarer with a short barrel-shaped flame tube. A blower will be found necessary, as a compact and efficient model boiler lacks natural draught, but the merest wisp of steam through a No 70 jet will be ample when standing, and the engine ex-
haust will serve when under way.
Many model marine boilers would be improved by some attention to the draught, as the appalling roar made by a blowlamp does not necessarily indicate that the flame is receiving enough oxygen to burn efficiently.

The superheater area may have to be altered on trial; I cannot pretend that the surface is right, but it seems reasonable. The design allows any auxiliaries, such as the blower and possibly a steam pump, to be supplied with superheated steam, to the benefit of their thermal efficiency. But if a bilge ejector is fitted it will need saturated steam.

I have not shown any mountings except the main stop and safety valves, to which I have tried to give a marine flavour. LBSC has described so many thoroughly practical examples that the constructor should have no difficulty in providing his boiler with the full complement.

Construction is quite straightforward all the joints being silver soldered. It is essential that the combustion chamber baffle plate be thoroughly soldered to the water-tubes, as it does not only deflect the flame but acts as extended heating.

The securing of this plate should be the last soldering operation, for the joints where the tubes enter the backplate are obscured when it is fitted.

No method of fixing the boiler in the hull is shown, but it should sit on a pair of cradles and be secured by ties to the frames of the vessel. The ties are inconvenient in a model, and a better arrangement would be to strap the boiler to the cradles with brass bands.

I hope many model engineers are turning to the paddle steamer. The beautiful ships of the classical days have gone, but perhaps they will have little sisters to keep their memories green.