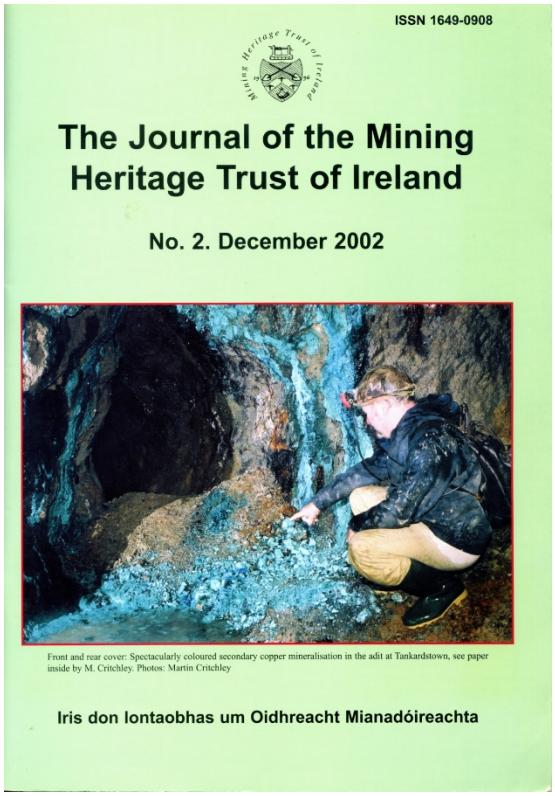

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A UNIQUE CORNISH ENGINE HOUSE - WILLIAMS' IN AVOCA

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Abstract: Because of its location and prominent position, Williams engine house is almost an icon for mining in Wicklow, although most people passing through the Vale of Avoca have no idea of its significance. Mining heritage people have hitherto assumed it to be a standard Cornish engine house but recent investigation has revealed unique features. It is an ingenious solution to various topographical and technological problems associated with Connorree/Tigroney mines. *Journal of the Mining Heritage Trust of Ireland*, **2, 2002, 21-24.**

THE STANDARD CORNISH ENGINE

This engine house is spectacularly visible from various points along the scenic Vale of Avoca drive. There are other less visible engine houses on both sides of the road, but Williams' on the townland of Tigroney with its slender chimney, is the one everybody notices. The arrangement of the Cornish pumping engine at William's shaft is possibly unique, and it is good news that conservation work on its house and stack is starting. But before describing the engine's unusual features, discernible from the empty house, it is worthwhile considering the form these engines normally took.

The basic layout and operation of a beam pumping engine were established by James Watt in the 1780's and had been derived in turn from the atmospheric engines of Thomas Newcomen. Watt's pumping engine comprised a rocking beam supported on the front wall of the house with the indoors end connected to the piston rod in an upright cylinder. The outdoors end was connected to a timber pump rod extending down the mine shaft to which a series of plunger pumps were attached. Live steam from a boiler housed in an annexe was applied to the top of the piston via throttle and admission valves, causing the pump rod and plungers to be raised. To allow the return stroke a third valve, the equilibrium valve, opened to allow the used steam above the piston to transfer via an external pipe to its underside. Thus free to descend under their own weight, the pump rod and plungers forced the water up the rising main in the shaft.

On the next steam stroke, descent of the piston and opening of an exhaust valve caused the used steam to pass into a Watt separate condenser, so creating a powerful vacuum and assisting the steam in drawing down the piston. The condenser was usually placed in the basement beneath the driver's feet. Scavenging it of air and water was done by a bucket pump - the air pump - fixed to the lower end of a long rod depending from the beam, and also used to work the valve gear at the driver's floor level above.

In larger engines, Watt's wooden beam soon gave way to cast-iron, made in two halves spaced a short distance apart. Between the expiry of Watt's condenser patent in 1800 and about 1830,

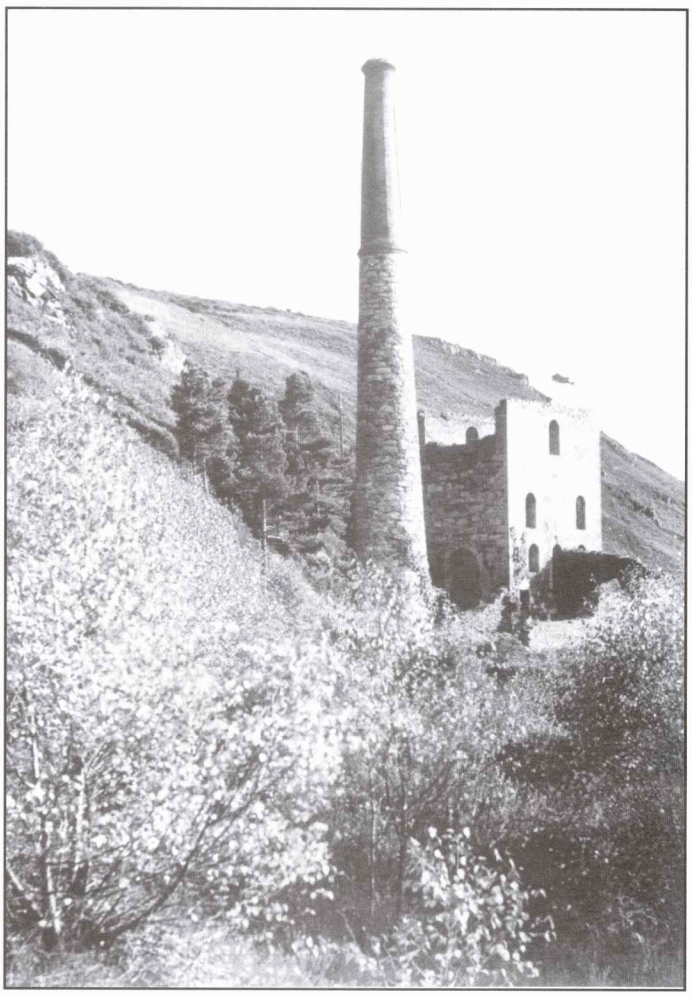

Figure 1. A 1958 view of the engine house from the hillside behind, before trees had grown up round it. Note the architectural feature in the stack brickwork (JC Ferguson).

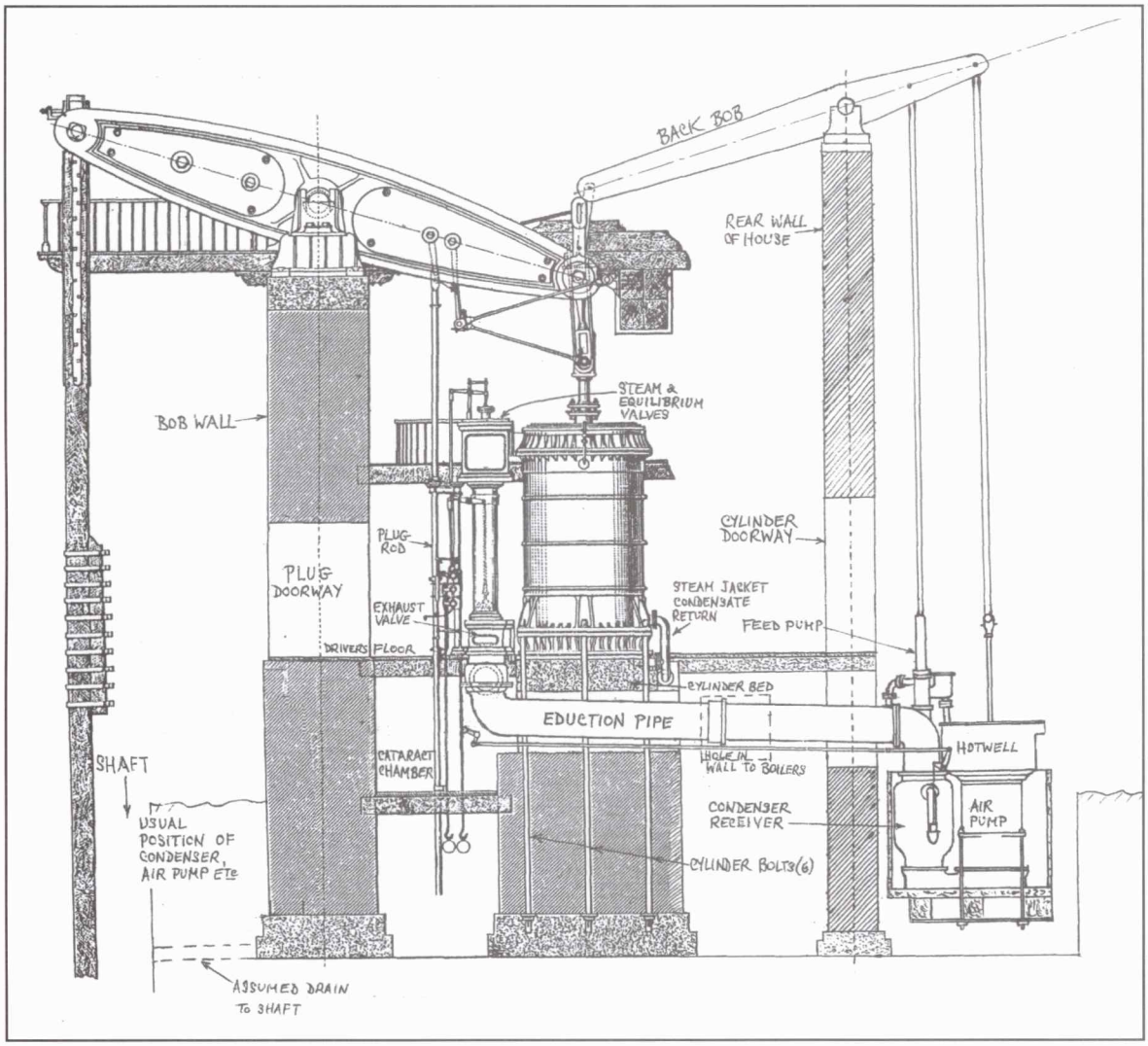

Figure 2. The deduced layout of Williams' engine showing the condenser assembly at the rear of the house instead of in front. It is approximately to scale but is based on an engine with a bigger cylinder.

Cornish engineers inspired by local inventor, Richard Trevithick, made dramatic improvements and raised coal efficiency threefold. However the engine's appearance remained unchanged except for moving the condenser from inside to outside the house and improving the design of the hotwell, with the air pump and feed pump now worked by separate rods from the beam.

It is doubtful whether the revamped condensing arrangements contributed much to the increased efficiency of the Cornish engine. This lay in other subtleties such as Trevithick's Cornish boiler with steam at higher pressure so that the engine could be worked expansively, that is cutting off steam admission early in the stroke; by thoroughly lagging the cylinder and steam pipes to conserve heat; and by the use of the patented, double beat valve which offered a large area for passing steam with minimum lift of the valve spindle.

In this final form the Cornish engine was manufactured and erected, virtually unchanged into the 20th century. A handful of engines continued at work into 1960's. Their supersession in deep mining was retarded for a while by serious problems with electric pumps due to acid water. Although alternative designs of steam pumps came on scene from 1880 onwards - engines which did not require such a massive house and which could even be placed underground when the situation demanded - they were not favoured in Cornwall.

OVERVIEW OF WILLIAMS' ENGINE HOUSE:

William's engine was built by the Perran Foundry in Cornwall about 1860 when Cornish engine building was at its peak. That the Perran Foundry was chosen was doubtless because Tigroney mine was worked by the Williams' family of Perran-ar-Worthal with an interest in the foundry. The engine had a 60 inch diameter cylinder (medium size) and drew water from a depth of 600 feet below the shaft collar. Documentary evidence of it is particularly scant but it probably worked at between six and eight strokes a minute.

Perhaps surprisingly it was offered for sale in June 1865 as nearly new along with two Cornish boilers and three waterwheels. However this can only have been a hiccup in the mine's operation because the engine remained in situ and is not heard of again until 1881. By this time the Perran Foundry had closed and we learn that Harvey & Co. of Hayle (who supplied a number of engines to Ireland - see Roz Cundick in this Journal) were in discussion with design engineers, Loam & Son of Liskeard, concerning joint purchase of the engine. These two

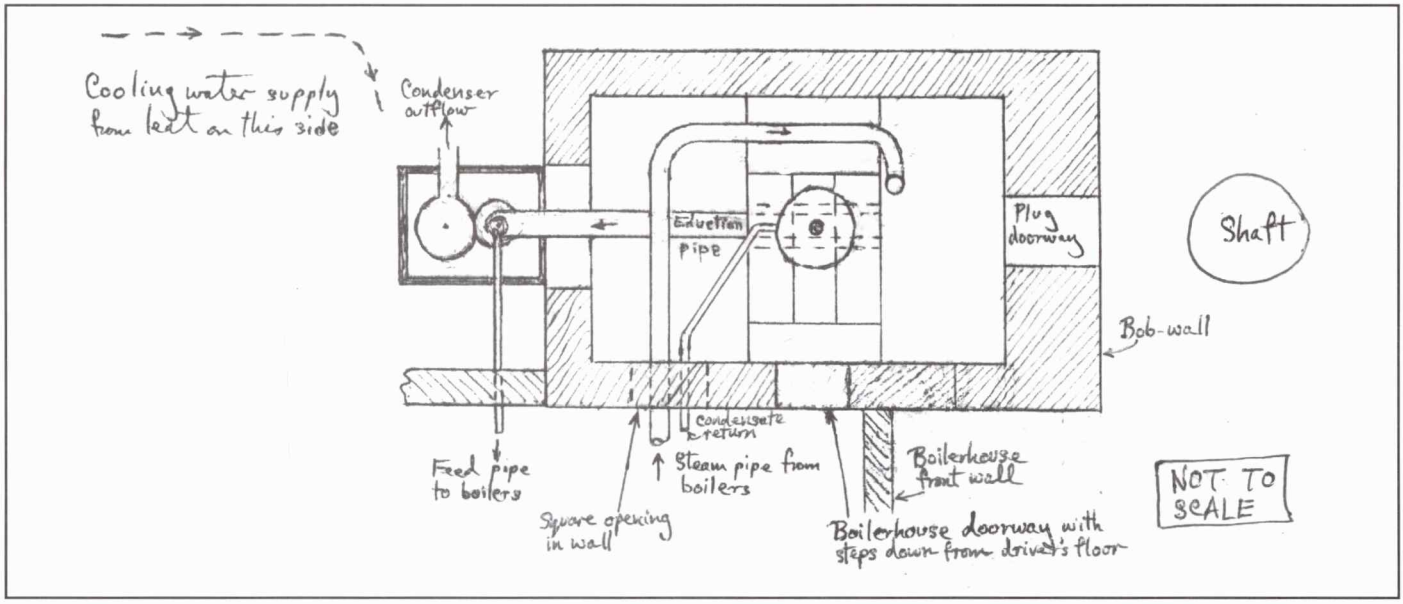

Figure 3. A rough plan of the house showing the low-level pipe runs.

Figure 4. The large square opening low down near the rear of the engine house which would have carried the main steam pipe from the boilers and the condenser return from the steam jacket. (Kenneth Brown).

firms bought a number of engines then standing idle in Cornwall with a view to overhaul and resale second-hand. We can therefore assume that it was intended to move William's engine for re-use elsewhere, but whether this was ever done seems unlikely. More probably, it was greased up and the engine house door boarded until being dismantled in 1884, probably for scrap.

THE UNIQUE FEATURES OF WILLIAM'S ENGINE HOUSE

The peculiar back-to-front arrangement of the condenser only became apparent when I began examining the engine house on visits to Avoca. Figure 2 is a diagram, not to scale, which when taken with Figure 3, shows the condenser at the rear instead of the front, and with an auxiliary beam, or back bob to work the air and feed pumps. (My interpretation of the site is first revealed in *MHTI Newsletter* No 6). The back bob was probably of lightweight construction using twin wrought iron plates with the rod connections in between.

The full significance was not apparent at first inspection. Then I noted the enlarged cylinder bed with six hold-down bolts [four is normal for a sixty inch engine] and a pipe tunnel passing underneath, plus the lack of an opening low down in the bob-wall for the exhaust pipe. Evidence of the back bob was so heavily obscured by ivy that the rear wall could have had a conventional gable end which had collapsed: a view reinforced by a heap of stone at the base. My initial surmise was therefore that the condenser had been inside the house at the rear.

However reflection on this made me uneasy. Cornish engineers always made a point of having the condenser outside, keeping steamy vapour out of the house. On my third visit I was fortunate to be able to scale a ladder and prove beyond doubt that the top of the rear wall finished at a level which can only be explained by having carried a back bob.

The site of the condenser pit outside the rear wall was, and still is, filled with loose stone that obscures any evidence there.

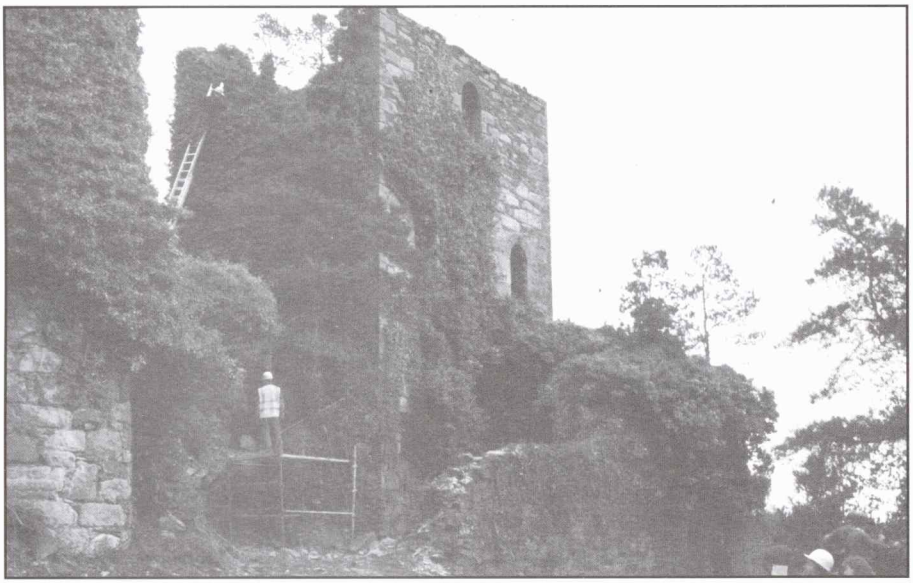

Figure 4. General view of the house and stack from the north. The rear bob opening is obscured by ivy. The author at the top of a ladder checking out the location of the back bob amidst the ivy, October 1997. (Roz Cundick)

der bed in the house is believed to be for the main steam pipe [see plan, figure 3]. This appears to have entered the house via an oversize square opening low down towards the rear, see figure. 4. A small opening in the boiler house wall further to the rear is assumed to be for the feed water pipe from the condenser hotwell to the boiler.

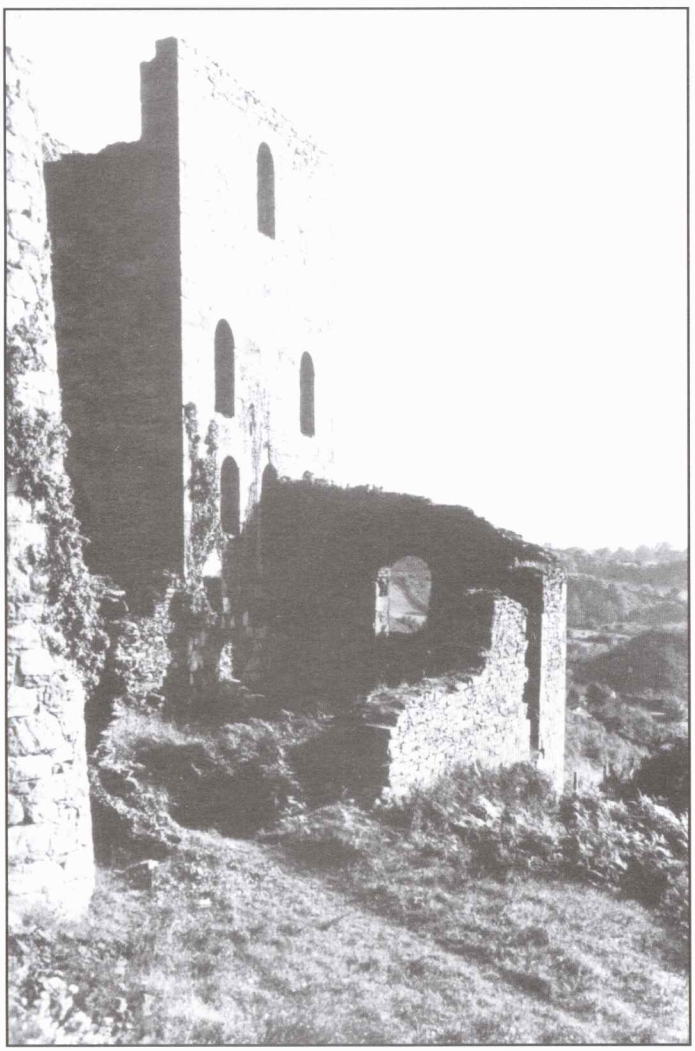

Figure 6. A 1958 view from the rear showing the ledge in the rear wall on which the back bob rested. The missing rear corner of the boiler house would be where the boilers were dragged out for cutting up. The square opening is visible beneath the nearest window. (JC Ferguson).

Indeed one has to climb over the stone to enter the house by the rear doorway. A second pipe trench running alongside the cylin-

The operation of the engine should have been unaffected by its unusual geometry. The excessive length of the exhaust (or eduction) pipe might, however, have made it take longer to raise the vacuum at starting, but then a mine engine was not often stopped. Why adopt such a peculiar arangement which must have added to the engine's cost? One or more waterwheels also stood on the steep valley slope to the north and traces of a contour leat coming in from that direction can be seen at several points. The engine stands at the southern termination of the leat which appears to have passed behind the chimney stack at exactly the right height to supply the condenser cistern. Nevertheless, having the condenser at the rear saved a lot of difficult excavation to take the leat to the front of the house.

Could the engine have faced the opposite way still keeping the condenser in front? Again it seems not, because the shaft from which the engine pumped is only yards from a hedge marking the mine's boundary, certainly not enough room for a pumping engine without leasing or purchasing more land. This explanation is, of course, pure conjecture and I would be grateful for the views of local members with more knowledge of mining there than I have.

In conclusion, the Williams' engine site is one of the finest anywhere in the world. The splendid ultra-tall stack appears to be in excellent condition but cries out for a lightning conductor. Too many mine stacks in Cornwall, not to mention the crusher engine stack at Cappagh in Co. Cork, have been lost in recent years through lightning strikes. The boiler house walls at Williams' are also remarkably complete, enclosing a rectangular area consistent with a pair of Cornish boilers. On the hillside below, a large mass of cinder shows evidence of the boiler fires have been cleaned-out over a period of years. Even a distant view of the tree-covered hillside with the engine house and stack from the main road is impressive. Is it too much to hope that one day they will be floodlit?