EARLY LIMESTONE RAILWAYS OF SOUTH-EAST WALES

being a Thesis submitted for the degree of

Doctor of Philosophy (PhD)

in the University of Hull

by

John van Laun M.Sc. (Cranfield)

October 1999

CONTAINS

PULLOUTS

CONTENTS

List of Maps		iv
List of Figures		v
List of Plates		x
Abbreviations		xii
Acknowledgements		xiii
Explanatory Notes		xiv
Introduction		1
Chapter 1.	The Industrial Background	5
Chapter 2.	Early Railways	29
Chapter 3.	Abersychan	76
Chapter 4.	Blaenavon area	87
Chapter 5.	South Clydach	128
Chapter 6.	Clydach	152
Chapter 7.	Disgwylfa	165
Chapter 8.	Llangattock	173
Chapter 9.	Trevil	228
Chapter 10.	Twynau Gwynion	275
Chapter 11.	Morlais (East)	311
Chapter 12.	Morlais (West)	313
Chapter 13.	Gurnos	334
Chapter 14.	Penderyn and Glyn Neath	342
Chapter 15.	Conclusions	360

Appendices

1. Summary of railroads and tramroads discussed 409

2. Railroads and tramroads built under canal acts
Railroads and tramroads built without acts 410

3. Castings at Ebbw Vale 1791-6 and Plymouth 1787-1801 411

4. Summary of finds 418

Bibliography 420

LIST OF MAPS

A.	The Abersychan Limestone Railway and its Connections	77
B.	Railroads, Tramroads and Quarries of the Blorenge	92
C.	Tyla Quarries and Gilwern Hill	100
D.	Pwll Du Quarry	114
E.	The Quarry Railroads and Tramroads of South Clydach	129
F.	Daren Ddu and the Clydach Railroad	159
G.	Disgwylfa Quarries and Tramroads	166
H.	Llangattock Quarries and Tramroads	174
J.	Craig y Gaer	226
K.	Communications to Trevil Quarries	229
L.	Trevil Quarries up to 1830	243
M.	Trevil Quarries c.1880	244
N.	Trevil Quarries c.1899	245
O.	The Brinore Tramroad	256
P.	Tramroads between Rhymney and Merthyr Tydfil	277
Q.	Approach Tramroads to Twynau Gwynion	278
R.	Twynau Gwynion to 1829 and to 1848	279
S.	Twynau Gwynion to c.1875 and to 1891	301
T.	Morlais Quarries (West)	328
U.	Tramroads from Penderyn to Aberdare	343
V.	Tramroads at Dinas	345

LIST OF FIGURES

1.	The South Wales Coalfield and its ironworks	2
2.	The Heads of the Valleys ironworks and their quarries	6
3.	Iron plates at Coalbrookdale	34
4.	The Dowlais rail, 1791	35
5.	Curr's dovetailed sleeper	39
6.	Curr's method of morticing	39
7.	Peak Forest Tramroad non-dovetailed chair	46
8.	Kington Railway dovetailed chair c.1818	47
9.	Wrought-iron rail compared with cast-iron, Bicslade branch of the Severn & Wye Railway	48
10.	Severn & Wye Railway, chair for plain wrought-iron plate	48
11.	Curr pointwork	50
12.	Plan of points, Tredegar, 1808	51
13.	Crossing with pointer, c.1819	51
13a.	Combined plate and edge rail (Guest rail) from South Duffryn	53
14.	Weighhouse at Goytre Wharf	63
15.	A large Shropshire waggon	64
16.	Brakes on the Caldon Low Railroad	66
17.	Method of assembling the wheels on Curr's corves	67
18.	Fish-belly rail and chairs from Abersychan Limestone Railway	80
19.	Stockton & Darlington Railway and Liverpool & Manchester Railway fish-belly rails	81
20.	T-rail chair from Abersychan Limestone Railway	84
21.	Clarence Railway chair	84
22.	Fragments of wheel from Abersychan Limestone Railway	85
23.	Stone blocks for bar rail on Tyla-Blaenavon railroad	88

24.	Stone block for bar rail on Tyla-Blaenavon railroad	89
25.	Saddle for bar rail from Tyla-Blaenavon railroad	90
26.	Conjectural arrangement with saddle	91
27.	Sill for wrought-iron plate from Tyla-Blaenavon tramroad with wrought-iron tie	96
28	Chair for flat-bottomed rail from Gilwern Hill railway	97
29.	Horned sill from Tyla (west)	103
30	Ribbed plate from Hill's Tramroad	111
31.	Reconstruction of dovetailed sill from Hill's Tramroad	112
32.	Dovetailed sill from Pwll du	113
33.	Plateway finds from the Blorenge Tramroad	121
34.	Underground horned sill from Clydach Dingle	122
35.	Horned sill from Blorenge Tramroad	123
36.	Plate for horned sill from Blorenge Tramroad	124
37.	Curved Outram plate from Craig yr Hafod Tramroad	126
38.	Horned sill and plate from Craig yr Hafod Tramroad	127
39.	Curved plate from Llam-march Tramroad	133
40.	The Llanelly inclines in 1869	136
41.	Situation of stone blocks at Pwll du	142
42.	Ribbed and low-flanged plate from near Blaenavon staith	143
43.	Dual-purpose curved plate from Clydach-Blaenavon tramroad	144
44.	The Cwm Quarry incline	149
45.	Reconstruction of Cwm Quarry incline brake engine	150
46.	Chair for flat-bottomed rail from Cwm Quarry	151
47.	Bar rail from the Clydach Railroad	153
48.	Bar rail sill from Clydach Dingle	156
49.	Area of 1800 lease	160
50.	Finds from Disgwylfa	167

51.	Reconstruction of Disgwylfa track from fragments	168
52.	Box plate from first Llangattock Tramroad	179
53.	Re-railing plate from behind brake engine, second Llangattock Tramroad	183
54.	Part of wheel from Llangattock Tramroad	187
55.	BBCo dovetailed sill from Chwar Mawr	190
56.	Turnout in Chwar Mawr	193
57.	Outram check rail from Chwar Mawr	194
58.	Boat Company dovetailed sill from Bick's Tramroad zigzag	194
59.	Sills at Daren (east): Rhymney and Baileys' types	195
60.	Heavy ribbed plate from Bick's Tramroad zigzag	196
61.	Wrought-iron plate lift from Bick's Tramroad zigzag	197
62.	Dovetailed sill from Bick's Tramroad	198
63.	Flange from Bick's Tramroad	200
64.	Plate with **CJB** from Daren (east)	200
65.	Plate with **BB** from Daren (east)	201
66.	Sill for wrought-iron plate from Daren (east)	202
67.	Chair for wrought-iron plate from Daren (east)	203
68.	Chair for wrought-iron plate from Baileys' Llangattock Tramroad	207
69.	Fragment of sill with keys from the Wern Watcyn incline	217
70.	Fragment of heavy plate from Wern Watcyn	217
71.	Fragment of sill from Baileys' Llangattock Tramroad	218
72.	Heavy ribbed and vandyked plate from Bick's Tramroad	219
73.	Bar rail from the Trevil Railroad	234
73a.	Changes at Trevil Machine	238
74.	Wrought-iron T-rail and sill from Trevil quarries	247
75.	Standard gauge chair for flat-bottomed rail from Trevil quarries	249

76.	Horned sill with lower rib from Tredegar-Trevil Tramroad	252
77.	Sill with upper rib from Tredegar-Trevil Tramroad	252
78.	Plate specifically made for the Brinore Tramroad	258
79.	Rhymney-type sill from Brinore Tramroad	258
80.	Outram-type plate from Brinore Tramroad	259
81.	Dual-purpose check plate from Brinore Tramroad	260
82.	Reconstruction of dual-purpose plate from Hall's Trevil Tramroad	261
83.	Plate rail chair from Trevil quarries	263
84.	Ribbed wrought-iron plate from Tredegar-Trevil Tramroad	264
85.	Ribbed wrought-iron plate from Tredegar-Trevil Tramroad	266
86.	Heavy chair for wrought-iron plate from Trevil quarries	271
87.	Chairs for wrought-iron plate with wrought-iron tie from Trevil quarries	272
88.	Sleeved or coned plate from Dowlais Line **1**	282
89.	Blocks on Dowlais Line **4** at Pengarnddu	286
90.	Blocks on Dowlais Line **4**	287
91.	Dual-purpose plate from Dowlais Line **4**	290
92.	Details of wear marks on Dowlais Line **4**	291
93.	1848 and 1857 lease maps combined	293
94.	Non-dovetailed sill from Rhymney Line **2**	295
95.	Dual-purpose vandyked plate from Rhymney Line **2**	297
96.	Sill from Bute Tramroad	299
97.	Point chair from Twynau Gwynion	303
98.	Chair for wrought-iron plate from the Rhymney Limestone Railway	304
99.	Broken outer cheeks of railway chairs from Twynau Gwynion	305
100.	Outer and inner cheeks of separate chairs, Twynau Gwynion	306

101.	The Penydarren rails	315
102.	Part of Outram plate from Morlais (west)	321
103.	Outram-type points from Morlais (west) and from Bicslade	322
104.	The Morlais Tram	324
105.	Axle arrangement with iron pin for free-running wheels	326
106.	Heavy chair for bullhead rail laid sideways, from Morlais (west)	327
107.	Non-dovetailed sill from Morlais (west)	329
108.	Plate rail chair from Morlais (west)	332
109.	Stone blocks with chair marks on the Gurnos Tramroad	336
110.	Reconstruction of the original Pont y Cafnau deck	338
111.	Wear mark of roller on block on Tappendens' Tramroad incline	350
112.	Wear mark of chair for wrought-iron plate, Penderyn Tramroad	355
113.	Method of fixing 'Homfray's Old dram Roads' in 1800	378
114.	Eared plate	379
115.	Horned sill from Clydach-Blaenavon tramroad	381
116.	Non-dovetailed Blaenavon Company sill reputedly from Garnyrerw	382
117.	Evolutionary tree of tramplates	392

LIST OF PLATES

1.	A 'traveller' on the restored incline at Vivian Quarry, Llanberis	59
2.	Remains of bridge leading into the Blaenavon Railroad	79
3.	Staith at Blaenavon	94
4.	*Llanfoist* at Gilwern Hill	98
5.	Quarrymen and locomotive at Gilwern Hill	98
6.	Tyla from Garnddyrys	101
7.	Tyla (west). Waste at **C8**	104
8.	Pwll du quarry from Garnddyrys	108
9.	Short tunnel on Hill's Tramroad	110
10.	Top of Pwll du water balance shaft	117
11.	The Lonely Shepherd	169
12.	Second Llangattock Tramroad. Forepart of brake engine showing wear marks from chain	181
13.	Curr's 'pointer plate' or re-railer	184
14.	Waste from Daren (west) over Bick's Tramroad	199
15.	Causeway on Baileys' Llangattock Tramroad at Nant yr Hafod	206
16.	Baileys' Llangattock Tramroad. Wear marks and chair	207
17.	*Cymro* at Wrexham, c.1892	212
18.	Pant y Rhiw incline. Wear marks from chains on pillows	215
19	Junction of the Wern Watcyn Incline with Bick's Tramroad	220
20.	Trevil Railroad. Wear marks on blocks at 1346 1213	232
21.	Simple lintel bridge on the Trevil Railroad	235
22.	New trackbed of Trevil Railway	235
23.	Trevil (south). Waste at **M8**	241
24.	Trevil: embankment built over **M17**	248
25.	Fletcher Jennings vertical boiler type used on the Tredegar Tramroad	267

26.	Locomotive on the Tredegar Tramroad 1911	267
27.	Trevil: organisation of waste at **N33**	272
28.	Twynau Gwynion. Workings into Line **1**	283
29.	Twynau Gwynion. The cut through **R4G**	284
30.	Twynau Gwynion. Staith onto the RLR	307
31.	Twynau Gwynion. A **b** quarry with an **a** quarry above	308
32.	The final quarries at Twynau Gwynion	309
33.	Morlais (west). Mixed plates in the Penydarren quarry	330
34.	Morlais (west). A northern quarry looking south	331
35.	Morlais (west). Wooden sleeper impressions in the northern quarries	333
36.	The replacement deck at Pont y Cafnau	339
37.	Tappendens' Tramroad: the Abernant part of the incline	348
38.	Tappendens' Tramroad: the top of the incline with the site of the engine	349
39.	Roller and bracket at Dinorwic Slate Quarries	349
40.	Cast-iron fishbelly rail from Duffryn Llynvi and Porthcawl Railway	396
41.	Chair *in situ* on the Duffryn Llynvi and Porthcawl Railway at Cefn Cribwr Ironworks	396
42.	Incline wheel at Dinorwic	402
43 .	Brake Engine at Afon Argoed Country Park	403

ABBREVIATIONS

B&A	Brecknock & Abergavenny Canal (Company)
BBCo	Brecknock Boat Company
BRL	Birmingham Reference Library
Glam RO	Glamorganshire Record Office
GRO	Gwent Record Office
H&WCRO	Hereford and Worcester County Record Office (now Herefordshire)
JRCHS	*Journal of Railway & Canal Historical Society*
MCC	Monmouthshire Canal Company
MPICE	*Minutes of Proceedings of the Institution of Civil Engineers*
NLW	National Library of Wales
PRO	Public Record Office
RCAHM	Royal Commission on Ancient and Historical Monuments in Wales
RCHS TGOP	*Railway & Canal Historical Society, Tramroad Group Occasional Papers*
TNS	*Transactions of the Newcomen Society*
WGlamRO	West Glamorganshire Record Office
WIMM	Welsh Industrial and Maritime Museum, Cardiff

ACKNOWLEDGEMENTS

This work is dedicated to the memory of the late Gordon Rattenbury, who in the 1960s introduced me to the subject.

Necessarily I owe debts to the many who have offered advice and provided information. These are far too many to thank individually by name, but the members of the Northamptonshire Industrial Archaeology Group have over the past 25 years sparked many questions which have led me to make this study. The staffs of record offices and libraries have afforded me every assistance, without which I would not have progressed far.

However, some individuals have been helpful beyond the call of friendship and scholarship. To Dr Michael Lewis, my supervisor, go my thanks for seeing me through a highly complex study. His assistance and discipline have, I hope, ensured a study which is worthy of his previous work in a similar field. To Michael Blackmore go my grateful thanks for his inspired illustrations, which I hope set a new precedent for industrial archaeological illustration. David Bick, my companion in field work, who with me first realised the need to record the subject, has been at my disposal with his keen eye and expertise with spade and trowel. John Evans of Blaenavon guided me to much helpful archival material. All four have provided a remarkably balanced team.

EXPLANATORY NOTES

The terminology of early railways is always problematic. In this thesis the word 'railway' is used mostly in a generic sense, and the reader will more frequently meet the terms 'railroad' and 'tramroad.' In the late eighteenth and early nineteenth centuries, 'railroad' was the South Wales equivalent of the waggonway of the north-east: an edge railway where the flange was on the wheel. The alternative, where the flange was on the rail and the wheel was plain, is nowadays often called a 'plateway,' but in South Wales was commonly known as 'tramroad' or 'dramroad.' Nonetheless, when edge railways began slowly to return to favour in South Wales from the 1830s, they were usually called 'railways.'

Almost all the national grid references given lie in the 100km square SO. This prefix has therefore been omitted, but the appropriate prefix is included for places outside this square. Ordnance Survey maps are referred to in the text and notes by their date of survey, but further details can be found in the Bibliography.

Historians, especially of technology, are constantly confronted with awkward questions of presentation to which a compromise is often the best, if unsatisfactory, answer. Thus the metric system is used for modern measurements, and the imperial system in the context of the railways when they were built and in use. The ton was not then standardised: a short ton had 20cwt of 112lb (2240lb, as now), while a long ton might have 20cwt of 120lb (2400lb) or 21cwt of 120lb (2520lb). The method of measuring gauge will be discussed in Chapter 2.

Welsh place names are mostly spelt in standard modern orthography, but a few anglicised versions were so entrenched in the literature of the day that, at the risk of offending the Welsh speaker, they have been retained. Examples are Blaenavon (Blaenafon), Trevil (Trefil) and Brinore (Brynoer).

The illustrations are arranged as follows. Area maps are lettered **A-V**, and sites on them are numbered for cross-reference; thus **H6** means site **6** on Map **H**. Figures, numbered in sequence, are mostly line drawings but include a few maps of details. Plates, separately numbered, are mostly photographs. In the Conclusions, for the convenience of the reader, many items of track have been redrawn to small scale, retaining the original figure numbers. Appendix 4 tabulates the specimens of trackwork discussed, and gives the figure number and the present location.

The ironworks, which were virtually the sole reason for the existence of the railways discussed in this thesis, are dealt with in order from east to west. As a result of amalgamations and take-overs they traded at different times under a variety of styles and titles. But what is of greater importance in understanding the history and the archaeology of the quarry railways is the geographical location of the ironworks they served. For this reason they are generally referred to by location rather than by owner. For example, the ironworks located at Ebbw Vale traded successively as J. Homfray & Watkins, Harford & Co, Darby & Co, Ebbw Vale Iron & Coal Co, Ebbw Vale Iron Co, Ebbw Vale Co Ltd, Ebbw Vale Steel, Iron & Coal Co Ltd, Richard Thomas & Co Ltd, Richard Thomas & Baldwins Ltd, and British Steel Corporation. The Harfords took over the Sirhowy works; and using the names of the works rather than of the owners will ensure that both Ebbw Vale and Sirhowy retain their own geographical identity.

INTRODUCTION

Although in one sense this is a study in regional or local history, its findings have much wider implications which are of national significance. Britain gave to the world the Industrial Revolution and, as a corollary, the railway. Evidence which throws new light on the evolution of railways is therefore of high importance to historians and archaeologists of industry. Such evidence, it is suggested, is presented in this thesis. It relates mainly to the evolution of that most essential component of any railway, its track, and to the industrial archaeology of what was the leading iron-producing region of its day.

From the 1790s into the 1840s South Wales and, in particular, the Heads of the Valleys was much the largest producer of iron in Britain. To feed the works with raw materials there was a major system of railroads and tramroads which, except perhaps for the North-eastern coalfield, was by far the most extensive in Britain and therefore in the world. Even the tramroads of Shropshire, though tight-packed, were much smaller in extent. As it turned out, the North-east had the greatest influence on the Railway Age, with South Wales not remaining in the vanguard of progress for long. However, it was in South Wales that the first all-iron edge rail was used, and South Wales developed the tramroad to its highest form. Here too, among the precursors of the Railway Age, elements of the public railway were forged.

There are three components to the South Wales network. First, the feeders which ran from the limestone quarries of the northern outcrop to the furnaces can be followed for about 100km in total. Although a fair proportion of this distance is now buried by tarmacced roads, within the

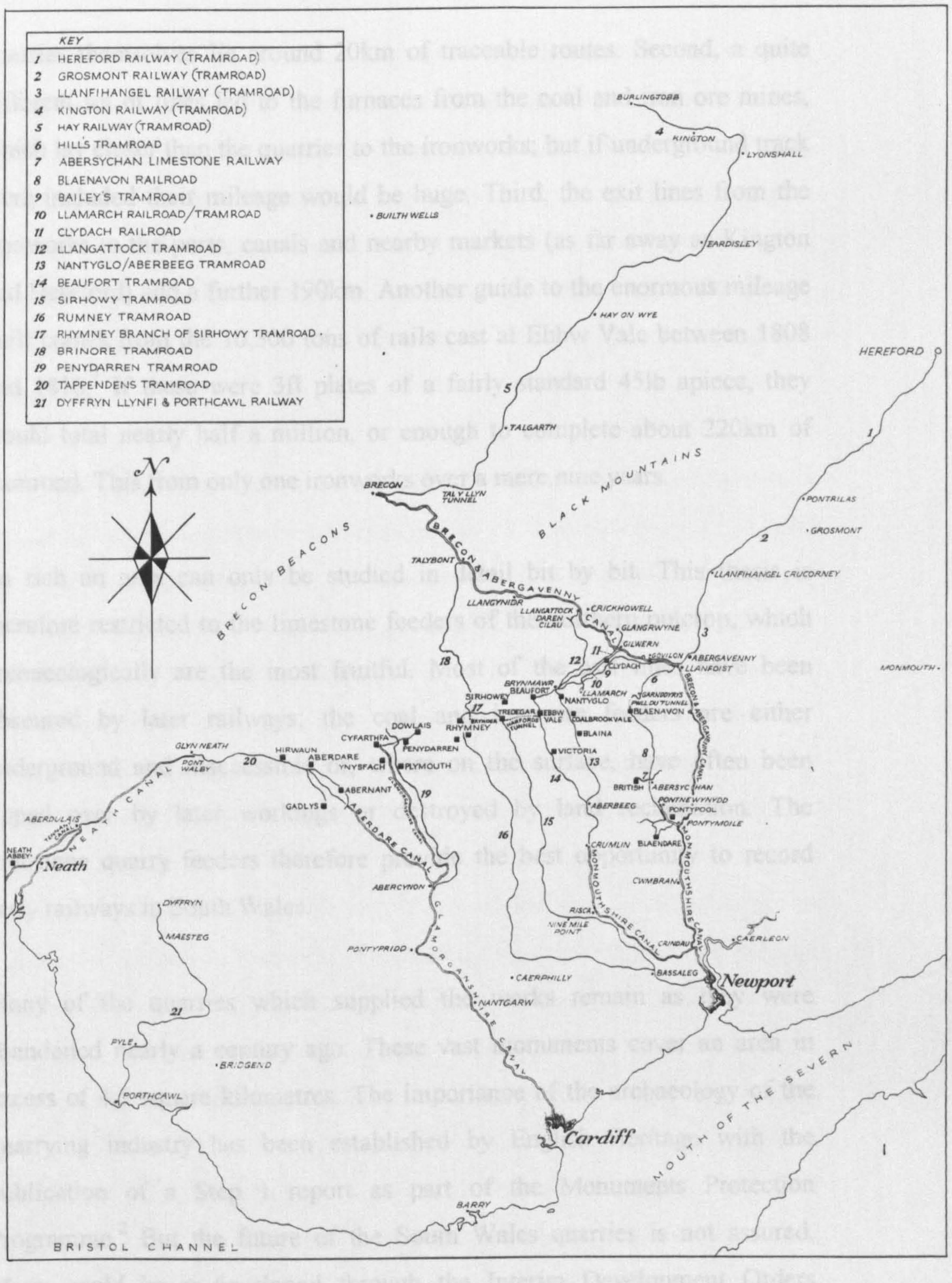


Fig. 1. The South Wales Coalfield and its ironworks

quarries themselves lie around 20km of traceable routes. Second, a quite different set of lines led to the furnaces from the coal and iron ore mines, which lay closer than the quarries to the ironworks; but if underground track were included their mileage would be huge. Third, the exit lines from the ironworks to the ports, canals and nearby markets (as far away as Kington and Hereford) add a further 190km. Another guide to the enormous mileage built comes from the 10,500 tons of rails cast at Ebbw Vale between 1808 and 1816.[1] If these were 3ft plates of a fairly standard 45lb apiece, they would total nearly half a million, or enough to complete about 220km of tramroad. This from only one ironworks over a mere nine years.

So rich an area can only be studied in detail bit by bit. This thesis is therefore restricted to the limestone feeders of the northern outcrop, which archaeologically are the most fruitful. Most of the exit lines have been obscured by later railways; the coal and iron ore feeders are either underground and inaccessible or, where on the surface, have often been tipped over by later workings or destroyed by land reclamation. The limestone quarry feeders therefore provide the best opportunity to record early railways in South Wales.

Many of the quarries which supplied the works remain as they were abandoned nearly a century ago. These vast monuments cover an area in excess of 4.5 square kilometres. The importance of the archaeology of the quarrying industry has been established by English Heritage with the publication of a Step 1 report as part of the Monuments Protection Programme.[2] But the future of the South Wales quarries is not assured. Many could be re-developed through the Interim Development Orders

---

[1] PRO C114/124 (part 1) f. 278-79
[2] Lancaster University 1996

granted in 1947, at a time when they were regarded as eyesores with no particular relevance to our past. Owners of largely unproductive areas of moorland are constantly looking for ways of increasing income. Quarrying for roadstone offers a lucrative return, and provides some jobs in largely rural communities which, theoretically, stimulate local economies. In the relevant counties output, mostly for roadstone, grew from 1,343,000 tons in 1895 to 15,515,000 in 1974.[3] It is this threat which in part prompted this study.

Although a great deal of attention has been devoted to the history of railways in South Wales (as in the rest of Britain) after 1830, relatively little has been given to their evolution. While previous studies have established the outline — notably Macdermot, Marshall, Lee, Barrie, Clinker, Baxter, Rattenbury and Hughes — these were mainly related to identifying the subject or concentrated on existing lines and documentary sources. Limestone railways have been largely ignored (with the partial exception of Rattenbury and Hughes), and little industrial archaeological survey has hitherto been done.

My work, then, breaks new ground. It is intended as a contribution not to business or economic history, but rather to industrial archaeology and the history of technology. As such it combines extensive fieldwork with a detailed study of the history of limestone feeders from documentary sources, some printed but mostly in the National Library of Wales, Gwent Record Office and similar repositories. The result throws a completely new light on the artefacts of early railways, and especially on their permanent way. This has allowed for the first time a provisional typology to be made, and improved our understanding of the influences at work.

---

[3] Williams 1985, 15

CHAPTER 1

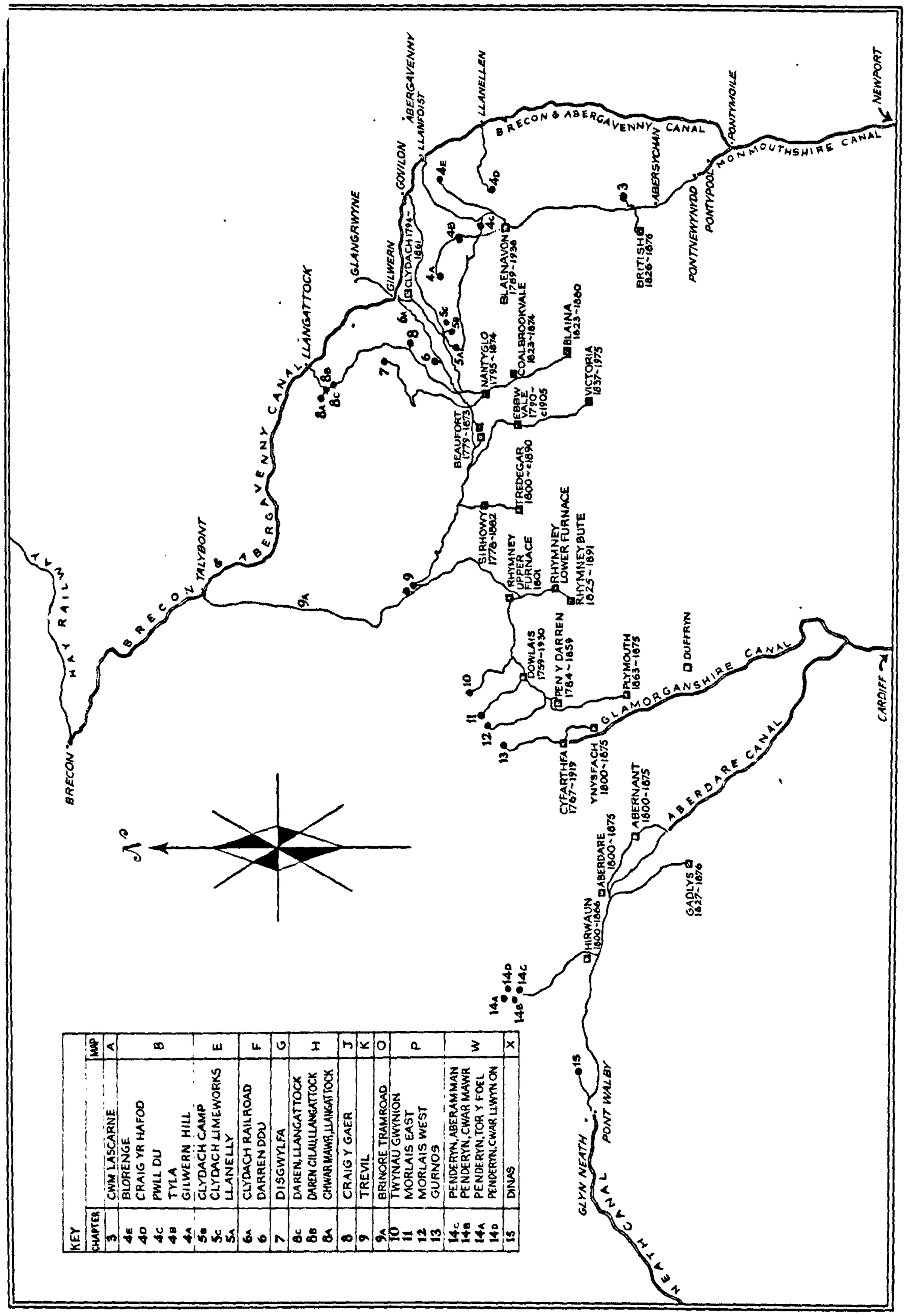
THE INDUSTRIAL BACKGROUND

South Wales Geology and Landform

The South Wales Coalfield is made up of a succession of rocks. The oldest, and therefore deepest, is the Carboniferous Limestone. Overlying this is Millstone Grit, then the Lower and Middle Coal Measures, and finally the Upper Coal Measures (which include Pennant Sandstone) at the top. Within the coal measures lie bands of clay ironstone and seat earth (used in making refractories). From the north the rocks dip downwards to form a basin where deep mining techniques are necessary; but at the northern edge the limestone and coal measures outcrop. It is not, therefore, surprising that the iron industry, based on coke, grew up on this northern fringe.

A number of river valleys, cutting into the Middle and Lower Coal Measures, run approximately south. These are (from east to west) the Llwyd, Ebbw Fach, Ebbw Fawr, Sirhowy, Rhymney and Taff. To the east the River Clydach runs eastwards to join the Usk; to the west the River Cynon flows south-eastwards to join the Taff; and further west again the Neath runs south-westward to Swansea.

The ironworks themselves did not develop actually on the outcrop, but slightly to the south at the valley heads. Drift mines for ore and coal could thus be driven up into the outcrop and thereby be self-draining. Although this shortened transport down the valleys to the ports, it distanced ironworks from their limestone sources. There were exceptions caused by the morphology of the local valley: thus Hirwaun lay between the limestone to



KEY		MAP	A	B	E	F	G	H	J	K	O	P	W	X
CHAPTER														
3	CWM LASCARNE													
4E	BLORENGE													
4D	CRAIG YR HAFOD													
4C	PWLL DU													
4B	TYLA													
4A	GILWERN HILL													
5B	CLYDACH CAMP													
5C	CLYDACH LIMEWORKS													
5A	LLANELLY													
6A	CLYDACH RAILROAD													
6	DARREN DDU													
7	DISGWYLFA													
8C	DAREN, LLANGATTOCK													
8B	DAREN CILAU, LLANGATTOCK													
8A	CWAR MAWR, LLANGATTOCK													
8	CRAIG Y GAER													
9	TREVIL													
9A	BRINORE TRAMROAD													
10	TWYNAU GWYNION													
11	MORLAIS EAST													
12	MORLAIS WEST													
13	GURNOS													
14C	PENDERYN, ABERAMMAN													
14B	PENDERYN, CWAR MAWR													
14A	PENDERYN, TOR Y FOEL													
14D	PENDERYN, CWAR LLWYNON													
15	DINAS													

Fig. 2. The Heads of the Valleys Ironworks and their quarries

the north and the coal measures to the south, and Clydach lay with both limestone and the coal measures to the south.

The South Wales Coke-iron Industry

At first charcoal was used as the fuel in iron making, but in 1709 Abraham Darby successfully smelted iron with coke at Coalbrookdale in Shropshire. By the mid-18th century an embryonic coke-iron industry was beginning to replace charcoal in South Wales, focused at first almost totally on Merthyr Tydfil.[1] One impetus was the low cost of raw materials, which was about two thirds of that in Shropshire.[2] Furthermore the American War of Independence (1776-85) stimulated demand for iron. Although raw materials were readily available, the hinterland situation of the 'top towns' involved high capital costs and a high risk element. For this reason partnerships were formed for initial development. But once an ironworks was under way, its capital value rose rapidly. With a starting capital of £4000, Dowlais had by 1782 grown in value to £20,000 and by 1798 to £61,000.[3] The need for capital encouraged investment from entrepreneurs who were normally outsiders and often new to the industry. Of twenty five in 1788, only fourteen had experience of the iron industry.[4] Nevertheless they brought with them expertise which was to have widespread implications for communications systems.

---

[1] Hyde 1977, 54
[2] Hyde 1977, 60
[3] Hyde 1977, 64
[4] Birch 1967, 282

In South Wales the growth was dramatic. In 1788, 11,300 tons of iron was produced (16.2% of the British total); by 1815 this had grown to 140,000 tons (35.4%).[5] The impact on the South Wales economy is further demonstrated by a tenfold increase in production between 1806 and 1845 from the works which exported through Newport and the Monmouthshire Canal (to 193,375 tons) and sevenfold from the four giants of Merthyr (to 195,828 tons).[6] Production rates for furnaces in South Wales was also dramatic. By 1812 the national average for a coke furnace was 1500 tons per year, but for South Wales it was 2035 tons.

The perfection of Henry Cort's wrought iron puddling process at Cyfarthfa in 1791 was a major impetus to the South Wales iron industry. The production of wrought iron was further encouraged by the rapidly increasing tariffs on imported iron which effectively drove Sweden and Russia out of the British market by the end of the Napoleonic War. Most of the South Wales ironworks had adopted the puddling process by 1817, when they produced roughly 60,000 tons of bar iron,[7] or perhaps 40% of the total British make. The end of the Napoleonic War saw a slump in the pig and bar iron market in South Wales, which did not fully recover until the advent of the wrought-iron rail in the late 1820s. However, between 1817 and 1823 nineteen new furnaces were built, possibly as many as nine of them replacing old furnaces. Between 1823 and 1827 three new ironworks were established, so that by 1830 South Wales produced 41% of the total British make.[8] Thereafter much of the iron went to build the burgeoning railway system, especially during the mania of the 1840s.

---

[5] Hyde 1977, 123
[6] Atkinson and Baber 1987, 10
[7] Hyde 1977, 106
[8] Atkinson and Baber 1987, 5

An important factor in the demise of the South Wales iron industry was the decline in demand for wrought iron following a strike in the early 1870s. It had depended too much on a single basic product, either bar iron or rails, and when demand diminished it could only eat into reserves. Investment in new plant to fulfil spasmodic orders also helped to sap the industry. The larger companies were able to diversify into steel: Dowlais in 1865, Ebbw Vale in 1869, Rhymney and Blaenavon in the late 1870s, Tredegar in 1882 and Cyfarthfa in 1884. But the large-scale importation of Spanish hematite ore from 1868-69 heralded the final demise of iron production in the top towns. By 1861 Hirwaun and Penydarren had closed and by the mid-1870s Beaufort, Nantyglo, Plymouth and Clydach had followed.

Year	Furnaces in blast	Tons
1788	15	11,300
1796	24	34,391
1806	36	75,601
1823	72	182,235
1827	90	272,000
1830	113	277,643
1839	122	453,880
1847	151	706,680
1857	164	970,727
1858	148	886,478
1865		845,035
1875		541,809

The growth and beginning of decline of the South Wales Iron Industry
(Source: Scrivenor 1854, Gruner and Lan June 1863, Atkinson and Baber 1987)

Luckily the expansion of the coal trade cushioned the depression in the iron trade. In the early days of coke smelting, leases were often obtained from landowners at very favourable rates and it was these fortunate works which

not only expanded fastest and survived longest. Dowlais, under the control of the Guests, ploughed back profits rather than paying dividends. It started pig iron production at East Moors, Cardiff in 1893, finally closing the Dowlais site in 1930. The Ebbw Vale works closed in 1929, but Richard Thomas & Co opened a new works there in 1938, the furnaces being finally put out of blast in 1975.

Ironmasters

Merthyr Tydfil was the largest of the South Wales iron towns. As a result it is not surprising that it spawned a number of ironmasters who came to dominate other works at the Heads of the Valleys. Of its four works (Dowlais, Cyfarthfa, Penydarren and Plymouth) the first two vied for supremacy. At Dowlais, John Guest (1722-1787) from Broseley in Shropshire, who became manager in 1767 and partner in 1782, founded a dynasty of ironmasters. He was succeeded by his grandson Josiah John Guest (1785-1852) under whom, along with William Taitt (1748-1801) his uncle by marriage, Dowlais came for a time to be the largest in Wales. Josiah John married Lady Charlotte Bertie (1812-1895) who carried on the works after his death with the innovative managers William Menelaus and E. P. Martin

At Cyfarthfa Richard Crawshay (1739-1810) founded another dynasty which was to run the works virtually until 1902. From 1786 to 1792 he was in partnership with James Cockshutt from Wortley near Sheffield, and from 1792 with Watkin George 'the mechanical genius,' who moved to Rhymney in 1803. Richard's son, William I (1764-1834) showed little interest in ironmaking but William I's son William II (1788-1867) ran Cyfarthfa from 1817 to 1839. Richard, being mindful of his nephews Joseph and Crawshay

Bailey (1789-1872) and son-in-law Benjamin Hall (1778-1817), helped establish them in ironmaking. Joseph ran Nantyglo from 1811 where he was joined by his brother in 1820. Here, in the Ebbw Fach valley, they ran one of the most successful ironworks until they sold out in the 1870s. William II's son, another William, was involved in Hirwaun where he tried out a Gurney locomotive in 1830. Another son was Robert Thompson Crawshay (1817-79) who ran Cyfarthfa from 1839 to 1875.

Another dynasty was that founded by Francis Homfray (1674-1737). The family hailed from the Midlands, had ironmaking interests in Shropshire, and brought railway innovation to South Wales. His grandson, also Francis (1757?-1809) was at Cyfarthfa from 1782 to 1786. Francis backed his sons Samuel (1762-1822) and Jeremiah (1759-1833) in starting the Penydarren Ironworks in 1784. Samuel remained at Penydarren until 1813, but after 1790 Jeremiah moved between Ebbw Vale, Abernant and Hirwaun, finally severing with Penydarren in 1796. From 1802 Jeremiah was allied with James Birch, the Penydarren manager, at Abernant in forming a partnership with the Tappendens. It was Samuel who, with Richard Trevithick, introduced the locomotive to South Wales. Samuel also had interests at Tredegar until 1813 and his son Samuel (1795-1882) introduced locomotives there in 1829.

At Plymouth, although hardly a dynasty, the Hills dominated from 1788 to 1862. Their involvement stemmed from Anthony Bacon, an influential early ironmaster, who married Richard Hill's sister. Richard was an innovator and played an important role in the introduction of railways to the area. After Richard's death in 1806 his sons John and Anthony ran the works together until 1826, after which Anthony continued until his own death in 1862.

Other ironmasters were of lesser stature, but mention should be made of the Harfords who ran Nantyglo from 1791 to 1811 and Ebbw Vale from 1792 to 1842, and of Thomas Hill who ruled Blaenavon for nearly fifty years from 1789.

Ironmaking

Since Tudor times, iron in Britain was mainly produced by the indirect method. The primary process involved the blast furnace which produced cast iron, rich in carbon which made it brittle. Pigs from the furnace would be re-melted at the foundry to make finished castings. The secondary process took place at the forge where, by re-heating the pig iron, the carbon was burnt away. The resulting bloom, when worked with hammer and (later) with rolls, became wrought iron which, being malleable, could be shaped and welded.

The blast furnace was generally built against a bank for ease of charging from the top. The raw materials were coke (later coal), iron ore and limestone. From the eighteenth century, coke was the fuel which, when fanned with a powerful blast of air, produced temperatures high enough to reduce the ore to iron. Limestone acted as a flux, encouraging the impurities to coalesce as slag; roughly one ton was needed to produce a ton of iron. The internal shape of the furnace, tapering in towards the hottest part, supported the raw materials (technically known as the burden); and here they melted, dripping down into the crucible at the bottom. The slag mixed with lime floated on top and, once it had been drawn off through a slag notch, the iron could be tapped into the sand pig beds. The nineteenth century saw many improvements to the furnace, which grew greatly in size

and efficiency. The most notable innovation was the hot blast, introduced in 1828 but only perfected when George Parry of Ebbw Vale invented the bell and cone which closed the previously open furnace top. The hot gases could now be piped down and re-used to heat the blast without the need for separate hot stoves. Iron smelting was a continuous process, a furnace remaining in blast for years on end and only being blown out when its lining needed replacing. Supplies of raw materials therefore had to be continuous too.

The fuel used at the forge was traditionally charcoal, but in 1784 Henry Cort patented a reverberatory furnace which allowed raw coal to be used by keeping it separate from the iron to prevent contamination with sulphur. This 'puddling process' reduced the cost of wrought iron considerably, and was perfected at Cyfarthfa by Peter Onions, who married John Guest's sister. Cort also patented the grooved roll which, rather like a mangle, rolled wrought iron into bars or rods of almost any profile. Once the material was available in quantity, wrought iron railway rails could easily be rolled, which from the 1820s hastened the demise of the brittle cast iron rail. The South Wales ironworks came early to specialise in rolled rails and in this sense dominated the first decades of the Railway Age.

The coming of mass-produced steel followed Henry Bessemer's patent of 1856. But its adoption was at first limited because the silica lining of his converters allowed only non-phosphoric ores to be used. This impediment was only removed in 1878 when Sydney Gilchrist Thomas (1850-1885), working at Blaenavon with his cousin P. C. Gilchrist, a chemist employed by the Blaenavon Company, discovered that phosphoric ores could be used

if the converter were lined with magnesia limestone. The two processes are known as the acid (silica lining) and basic processes.

Limestone Quarries

Limestone, in our area, had four uses. In its raw state it was used for roadstone and as the flux in ironmaking; when reduced it was used on the land as a manure, and for building purposes both as mortar and limewash. The quarries included in this study were mainly worked to provide a flux in ironmaking at the blast furnace. But although limestone was an essential ingredient, it was not a large one, being about 12 per cent of the charge. In 1885 it was stated that 'of limestone there is so small a weight used that its geographical position rarely, if ever, determines the location of the blast furnace.'[9] In the metallurgical sense a flux is 'any substance that is mixed with a metal to facilitate its fusion,' in other words to cause the impurities in the ore to melt readily and become fluid at furnace temperature. A flux must be of a chemical nature opposite to that of the material to be reduced. Silica in the ores is acid: the addition of lime, which is basic, reduces the ores. The fluxes used in ironmaking were, when possible, limestones rich in carbonate of lime. Magnesia is often found in combination in the same quarries and tends to cause infusibility in pig iron, but in small proportions it is not injurious.[10] Nevertheless, carbonate of lime together with a richer combination of magnesia (dolomite) has its uses in steel-making.

---

[9] Atkinson and Baber 1987
[10] Percy 1864, 507

All the quarries except Penderyn belonged to large landed proprietors, from whom leases had to be obtained. From east to west these were the Earl of Abergavenny, the Duke of Beaufort, the Marquis of Bute and the Earl of Plymouth. Limestone does not appear to have been a major charge on the ironworks. In 1778 the Trevil lease was as little as £5 per annum[11] but by 1870 Ebbw Vale were paying £500 per annum for up to 60,000 tons and 2d a ton thereafter.[12] The maximum paid was 3d a ton in 1854 at Tyla and Pwll du by the Blaenavon company,[13] but in 1885 the Duke of Beaufort charged them only 2d a ton for Gilwern Hill limestone. The charges for lime burning were more favourable, the Brecknock Boat Company paying only a 1d a ton at Llangattock.[14]

Limeburners

There was lime-burning in the lordship of Crickhowell as far back as 1589,[15] but until the canal era it appears to have been a local affair. In some places limestone was burnt with coal in open clamps, as at Clo Cadno in Llangynidr (Clo probably meaning coal, brought from about 5km away) and at Disgwylfa and Craig y Castell. The stone appears to have been quarried in piecemeal fashion in shallow workings as at Twynau Gwynion and Blaen Onneu.[16] In this pre-canal age some kilns were built adjacent to the quarries, as at Clydach Camp,[17] Disgwylfa and Craig yr Hafod.

---

[11] NLW Maybery I 232, 16 February 1778
[12] NLW Badminton 3837, 3839
[13] GRO D.591.112.71, 11 September 1854
[14] Rattenbury 1980, 91-92
[15] NLW Badminton II 7000
[16] 065 102 and 161 167
[17] 2288 1249, 2150 1468 and 2729 1031

With the arrival of canals, lime-burning became organised, canal-side kilns became the norm, and some traders formed themselves into groups to take out quarry leases. The most active of these, the Brecknock Boat Company, started trading in the late 1790s and from 1798 to 1817 built a succession of canal-side kilns between Abergavenny and Brecon. Other traders followed such as Dixon and Overton, whose kilns at Dyffryn Crawnon and later Talybont (c.1815) were supplied with limestone by the Brinore Tramroad and, lying closer to Brecon with access to Herefordshire markets via the Hay Railway, must have offered strong competition to the BBCo. The Cwm Llanellen Lime & Coal Company built a tramroad about 1812 to bring lime, limestone and coal from Craig yr Hafod to the canal at Llanellen. This concentration of lime-burning based on the B&A was secured on the basis of agricultural markets in eastern Gwent, Breconshire and Herefordshire. Elsewhere there was not so much. At the western end of the outcrop, Penderyn quarries were worked around 1793 by the embryonic Aberdare Canal Company. Later another lime burner was the Merthyr, Tredegar & Abergavenny Railway which built huge kilns at Cwm quarry in the Clydach to supply lime for the construction of its nearby tunnel and viaduct.

The working of the quarries

The story of the flux quarries is one of ever-increasing size and complexity. Although when working began there were no geological surveys, the location of limestone must, especially with the experience of limeburners, have been common knowledge. Nor were the early flux quarries large or complex. The needs of the furnaces were still limited, and a few thousand tons of limestone would go a long way. Even during the five years 1809-13, when growth was accelerating, Ebbw Vale removed only 21,000 long tons from Trevil.

At Trevil in 1797, Ebbw Vale agreed to pay five guineas[18]

> for opening the quarry, putting it in good order and a regular form for two waggons to load at any time and making and forming a road from the quarry to join the Sirhowy Company's road, stoning and gravelling the same in a fair and workmanlike manner to the satisfaction of the Ebbw Vale Co. or their servants, Five guineas when the job is completed.

Although we know that the Trevil Railroad was open by this time, there is no mention of laying a railed branch in the quarry. It was perhaps with the commoners in mind that the lessees were to leave the quarry after the expiration of the lease 'in a proper and workmanlike manner.' Tools were provided by the company for the two quarrymen — 4 iron bars, 2 sledges, 3 mandrels, 2 shovels, 2 wheelbarrows, 2 wedges and some planks. The overburden would be loosened with the mandrels or pick axes, removed with the shovels and dumped with the wheelbarrows running on the planks. The exposed rock could then be wedged and 'barred' off.

Similarly in 1793 Thomas John Llewellin was given 5 guineas to start quarrying at Penderyn (Tor y Foel) and loaned 'two planks and two wheelbarrows out of the [canal] company's stock;' six years later he was paid to construct a wooden rail road in the quarry.[19] This 'plank and barrow' method[20] involved working the exposed face down as far as practicable until the next section of overburden was reached. This was barrowed on planks bridging the newly-formed gorge and deposited one step further

---

[18] GRO D.2472.1, 6 April 1797

[19] Lloyd 1906, 168, reciting an agreement of 1794 for the raising of ore at Nantyglo, quotes 'planks ... for the purpose of wheeling over;' but this could equally mean the 'plank and barrow' method

[20] Described in Tonks 1988, 47-8

back. In this way the face advanced in a long strip, and the waste also advanced a step at a time, always roughly the same distance behind the face.

Judging from the hummock-like nature of early spoil tips, dumping was normally by barrow, and occasionally as at Trevil and Blaen Onneu the single grooves cut by wheelbarrows can still be found. The unevenness of the landscape thus created did limit the distance waste could be taken and, although planks would help make a level path, dumping tended to be over a more extensive area laterally. Waste was still being placed by barrow as late as 1811 when two Trevil quarrymen were paid 9d per ton for raising stone, which included 2½d for 'cutting and wheeling rubbish.'[21]

The early quarries were generally shallow, working up into the outcrop where the rock was much shattered and could readily be removed in small pieces by bar or pick. But by 1813[22] most of the workings were moving into the massive limestone, which with its fewer joints is not so easily separated. It could rarely be won by barring off, and the traditional plug and feathers would be laborious. But because stone for fluxing and burning did not need to be large or regular, black powder, which had been available for blasting for over a century, could be used. For instance, tucked up among the costs of building the toll house at Trevil is the sum of 6s 9d for 'Blasting tools,'[23] and in 1800 'the men [were] finding the powder & tools' at Gurnos.[24]

As time went on, the quarries were forced more and more into the massive limestone. Where the rock was bedded and jointed, as in parts of Twynau

---

[21] GRO D.2472.1, 11 April 1811
[22] OS 1813
[23] GRO D.2472.3
[24] BRL (Journal)

Gwynion, it could be freed by leverage, and large blocks could be loaded by derrick cranes. Being portable these could be quickly erected and dismantled: they were simple and efficient and consisted of a central mast supported by strong backstays and bearing a movable jib. By 1845 the stone could be lowered and the jib swung simultaneously, thus making it possible to place rock weighing up to 10 tons with accuracy.[25] We get an idea of how the massive was won in 1831 when at Cwmdu quarry 'there is 20 men working ... and all the tools they have to work with is 1 sledge, 1 wedge, 2 barrs and 5 picks. Twenty men ought to have had 6 sledges, 40 wedges, 12 bars and 20 picks.'[26]

By the 1810s the massive limestone was being seriously attacked. The quarries of the previous phase were already into it, and new quarries (apart from a little earlier random scratching for lime burning) were opened straight into it at Pwll du, Cwm and Disgwylfa. Between 1813 and 1820 Ebbw Vale won 41,000 long tons from Trevil, much of which must have been the closely grained massive and blasting with black powder became common. A single shot in a four foot hole, which might take a few hours to drill by hand, would dislodge as much rock as would take two men a week to break up with pick.[27] Although there was still working up into the drift, which involved steep gradients, much of the rock was now won along the line of strike which meant that trams could be run on the level. Railways, as well as those to the quarries, were now general within them.

First the overburden had to be cleared and placed in neat fingers radiating outwards by means of temporary tramroads, many of which reveal the use

---

[25] Greenwell and Elsden 1913, 329
[26] NLW Maybery I 340
[27] Greenwell and Elsden 1913, 129-30

of sills. Then the rock was blasted from the top of the quarry downwards. The first block was blown, leaving a platform from which the next hole could be drilled and blasted, and so on, making about four in each quarry elevation. The rock dropped nearly vertically, and the tramroads ran to within 3m of the face at a slightly oblique angle for ease of loading. Where the rock was freely quarried, it was removed in benches one running into the one above. In this way trams could be run along each bench and loaded from above. As quarrying advanced the track would have to be slewed sideways at regular intervals.[28] By around 1850, then, tracks ran almost to the face, either in parallel lines or, in circular quarries, branching radially from a single line. At Trevil, remnant stone was left as abutments for plankways across rail tracks, presumably for the dumping of waste as the face progressed using the 'plank and barrow' method.

As quarries became larger, stepped-longwall working was introduced. In this, each gang was allotted a face, each being about three months in advance of the next step back in order to avoid impeding the gang there. Galleries now became the norm, and the high faces they created were of concern to the commoners. In 1851 they presented the Trevil quarries for being unfenced and a danger to livestock.[29] Most of the quarries still retained plateways, either wholly or in part, but already by the 1850s some quarries had standard gauge track which was laid parallel to the quarry face. This was particularly useful where the rock had pronounced bedding planes and joints and the wholesale removal of blocks at waggon height could be adopted. A mobile crane could be run on the previous line, parallel to the current one, its jib extending over the waggon. The advantage lay in its

---

[28] Stanier 1995, 63
[29] NLW Badminton II 3837

mobility, in contrast to the derrick crane which had to set up and dismantled. Once a length of face had been removed, the track was laid along the cleared section ready for the next slice.

By the 1870s spoil tips became fewer but longer and higher. Some were worked by locomotive, using side-tipping waggons which left a V profile to the waste. It was often necessary to shore up earlier waste to stop it spilling onto working tracks. If the primary layout of quarries and their waste areas had been poorly planned, there could be a shortage of tipping space, and spoil might have to be taken elsewhere to fill abandoned quarries. .

High explosives became available from 1875 and reliable compressed air drills rather later. Blasts became ever larger. Shot holes could be up to 20ft deep with a bore of 2½in, charged with up to 50lb of gelignite. A whole face could be brought down by drilling parallel holes from the top downwards and firing them simultaneously. Alternatively, in the heading or chamber blast,[30] a chamber in the rock was created with dynamite and charged with black powder. The resulting blast liberated huge quantities of variably sized rock to be loaded by steam shovel. From the mid-nineteenth century some machinery was available for breaking stone: the Blake double-toggle jaw crusher was invented in 1858[31] and manufactured in Britain from 1860. From late in the century breaking began to take place at the quarry rather than furnace top.

The lifespan of the quarries was very variable. Some closed early: the Baileys forsook Disgwylfa in 1829 for the much superior Llangattock.

---

[30] Lancaster University 1996, 24; Greenwell and Elsden 1913
[31] Clews 1955

Penydarren's quarry at Morlais (west) was probably nearly worked out by 1848 when they took a lease on Twynau Gwynion. In the 1880s Blaenavon's Tyla quarry was suffering from geological problems, which spurred them to move to Gilwern Hill. But considerable quarrying continued at Gurnos until around 1920 and at Morlais (east) until 1930. Llanelly and Cwm Quarries were worked for roadstone into the 1960s, and Penderyn still is. Cwar yr Hendre supplied fluxing stone until 1975, and part of Trevil is now being reworked.

Limestone at the furnace

In South Wales as elsewhere, fluxing stone was a low cost factor in the production of pig iron, but because limestone lay further from the furnaces than iron ore and coal it was the most costly in terms of transport. Even in the most extreme case known, distance of transport does not appear to have been a deterrent. At Middlesborough in 1863 much of it came 65km from Stanhope and Allenhead,[32] accounting for 6 per cent of total costs compared with 3.6 per cent for South Wales at the same period. Nevertheless the percentage cost of limestone at the furnace was still highly variable. It was directly related to the percentage of limestone in the gross burden, which in turn depended on the quality both of ore and of fuel, and hence on the nature of the waste to be fluxed. The change from charcoal to coke greatly increased the amount of limestone needed; thereafter the proportion fell again with the introduction of hot blast and other improvements in furnace design. In 1843-74 it took 14-15 cwt of limestone to produce 1 ton of iron.

---

[32] Gruner and Lan Jan. 1863, 328, 330

	% of cost	% of burden
1750	1.3	
1795	9.2	26
1813	6.78	16
1843-74	c.2.5	8-11

South Wales, limestone as percentage of total costs and of burden
(sources: 1750: van Laun 1989b, 25-6, Percy 1864, 896-9; 1795: GRO D.2472.3; 1813: NLW Maybery I 3966; 1843: Truran 1855, 170; 1863: Gruner and Lan June 1863, 79-80; 1874: GRO D.397 1047)

At the furnace, the limestone had to be broken into quite small pieces, and in the absence of crushing machines by hand. A water-colour by G. Childs of 1840 shows three workers, one a woman, prising the limestone apart with long bars at the top of the Dowlais furnaces.[33] At Ebbw Vale[34] in the 1800s a limestone breaker and filler was paid 21 to 28s a week, compared to 14s (plus 4d a ton for the make) for a furnace keeper, 18s for a carpenter and 14s for the engineer of the blast engine. In an age when manual labour was so badly paid it is surprising that the unskilled job of breaking and filling was better paid than that of a carpenter.

Descriptions of breaking and filling in 1842 are given in the evidence to the Royal Commission on the Employment of Children.[35] At Dowlais 'Hannah Jenkins [aged 21] works by the ton, and gets 7s. or 8s. for herself and 5s. for her helper [aged 16]. They work about 12 hours a-day; they begin from six to eight o'clock in the morning, and leave off about six or eight o'clock in the evening. They break up three trams of stones (four tons) in a day; they must supply one furnace with stones.' At Penydarren all the limestone was broken by girls from 15 to 25 years old. Some chose to work alone, such as

---

[33] Reproduced in Rees 1969, pl. 41
[34] GRO D.2472.1, 4 August 1802 to 14 November 1806
[35] Children's Employment Commission 1842

Mary Richard who broke up about 14 trams a day of over one ton each. She was paid by the ton of iron made and took home £2 15s to £3 a month.

Transport

Before the quarry railways

At first the only means of moving raw materials and exporting the finished product was by packhorse or mule. A memorandum of about 1750[36] related to (probably) Hanbury's furnace at Llanelly, says that each horse carried 2¼ cwt of ore in small bags at an average of 5s per ton or 6d a trip. A writer of the same period mentions limestone being burnt at the quarry to reduce its weight and hence the cost of carriage to the furnace.[37] In 1795 Gilbert Gilpin[38] noted that carrying horses cost 1s 3d per day, their owners finding attendants and paying all expenses including turnpikes. A horse, he wrote elsewhere, would carry about two hundredweight 20 miles in an eight-hour day, though the Penydarren ponies carried three hundredweight.[39] In other cases, however, transport was included in the price of the stone: in the 1790s Ebbw Vale often paid for 'raising and carrying' from any convenient quarry.[40] Many ancient trackways linked quarries to the villages of South Wales and had long carried lime for agricultural purposes.[41]

Canals

---

[36] Percy 1864, 896-899
[37] NLW John Lloyd Collection, Vol.1 No.50
[38] Evans 1990. Gilpin was clerk to the Wilkinson brothers at Bersham who spent some time with Boulton and Watt.
[39] BRL (Gilpin) October 1795, June 1793
[40] GRO D.2472.3 and D.2462.3 passim (1792-5)
[41] In the Second World War limeburning was revived at Llangattock quarries and petrol shortages re-established the use of mules.

It was the ironmasters who introduced canals to South-east Wales, with the primary intention of providing cheap and reliable transport for finished products from the works to the ports on the Bristol Channel. Most of the ironmasters emanated from the Midlands or had associations with areas which already had canals, and it is therefore not surprising to find them behind the formation of both the Monmouthshire and the Glamorganshire canals. To build the canals, the ironmasters likewise brought in the engineers. Francis Homfray of Penydarren must have known Thomas Dadford senior who engineered the Staffordshire & Worcestershire Canal past his works at Stewponey; and, as a shareholder in the Glamorganshire Canal, it may very well have been his patronage which brought Dadford and his sons Thomas and John to South Wales. They built the Glamorganshire, Monmouthshire, Brecknock & Abergavenny and Neath Canals and many of the early railways which fed them.

A short note will suffice to place the canals within the context of the region, together with the personalities involved.[42] Canals linking the top towns with Newport were constructed in the eastern and western valleys of Monmouthshire (Llwyd and Ebbw), and the eastern of these was linked up the Usk valley to Brecon. A canal from Merthyr Tydfil was built down Taff Vale to Cardiff with a connecting branch down the Cynon valley from Aberdare. The Cynon valley ironworks also for a time sent out their produce westwards to Neath via the Neath Canal. But although the acts which authorised these canals also authorised most of the railways which were built to feed them and the ironworks, canals themselves played virtually no part in the transportation of limestone. The only exceptions were the B&A,

---

[42] For full histories see Hadfield 1967

with kilns at Goytre Wharf, and the Glamorganshire which possibly carried limestone for Plymouth Ironworks until about 1803.

The **Brecknock & Abergavenny Canal** was authorised in 1793 from Brecon to a junction with the Monmouthshire Canal near Pontypool. Within the act there was reference to specific railways to be built under it. The engineer was Thomas Dadford junior with some involvement of his brother John. The principal shareholders invested for a variety of motives. There were large landowners such as the Duke of Beaufort, Sir Charles Morgan and the Hanburys of Pontypool. Ironmasters, who stood to gain by ease of transport, included Samuel and Jeremiah Homfray at a time when Jeremiah had interests at Ebbw Vale. The canal was opened northwards to Brecon in 1800, but was not completed southwards to its junction with the Monmouthshire Canal at Pontymoile, and therefore did not acquire a through link to Newport, until 1812. It was used by the ironworks at Blaenavon, Clydach, Nantyglo, Beaufort, Tredegar and Rhymney. In 1865 the B&A was taken over by the Monmouthshire Railway & Canal Company, and in 1880 both concerns, including the railroads and tramroads built specifically under their acts, became the property of the Great Western Railway. What remains of the canal from Pontypool to Brecon is now styled the Monmouthshire & Brecon Canal.

The **Monmouthshire Canal** was authorised in 1792. The engineers were again Thomas Dadford junior and John. Surprisingly the principal shareholder was an outsider, Josiah Wedgwood; one can only assume that his dedication to canals was his motive. The Duke of Beaufort and Sir Charles Morgan took major shares, and there was a fair sprinkling of ironmasters such as Thomas Hill of Blaenavon and the Harfords of Ebbw

Vale. The canal ran to Newport down two branches: the eastern or Pontnewynydd branch was navigable by 1796 and was used by Blaenavon and Clydach ironworks; the western or Crumlin branch was completed in 1798 and was used by Nantyglo, Ebbw Vale and Beaufort. Sirhowy and Tredegar used the Sirhowy Tramroad to reach Newport.

The **Glamorganshire Canal** was authorised in 1792 and completed in 1794. The joint contractors were Thomas Dadford father and son and Thomas Sheasby, with the proprietors acting as the engineers themselves. Richard Crawshay was the principal promoter, but the other three Merthyr ironworks were involved. After Crawshay the Harfords at Melingriffith were the largest subscribers. The canal was used by the Merthyr ironworks of Dowlais, Penydarren, Plymouth, Cyfarthfa and Ynys Fach. Inevitably Crawshay and Taitt of Dowlais fell out, and a proposed branch canal to Dowlais (which would have been near impossible because of the height to be climbed) was dropped. Its place was taken by the Dowlais Railroad, to which the canal company made a contribution. The canal was handicapped by its fall of 543ft which required 51 locks over its 25 miles from Merthyr to Cardiff. This practical drawback, as well as commercial antagonisms, stimulated the construction of the Penydarren Tramroad from Merthyr to Abercynon, which bypassed some 9½ miles of canal.

The **Aberdare Canal** was authorised in 1793 but its building was long delayed, not being completed until 1812. A wide variety subscribed to it: a fair sprinkling of Birmingham men, local landowners, and the Homfrays of Penydarren, Richard Hill and John Partridge representing ironmasters' interests. Although canal construction was delayed for years, a railroad was built from Aberdare towards Penderyn, and the canal company went into the

lime burning business. The canal was finally engineered by Thomas Sheasby junior. It ran from Aberdare down the Cynon valley to join the Glamorganshire Canal at Abercynon, and was used by Hirwaun, Aberdare, Abernant and (once they were established) Gadlys and Aberamman.

The **Neath Canal**, authorised in 1791 and completed in 1799 from Glynneath to Neath, was engineered by Thomas Dadford junior. Its purpose was originally to carry coal for export, and iron ore and limestone to the Neath Abbey Ironworks, and though on the fringe of our area it encouraged the building of a section of Tappendens' Tramroad from Abernant to Hirwaun, was briefly used (until the opening of the Aberdare Canal) by the Cynon valley ironworks, and was the destination of Bevan's Tramroad.

There were no canals down the Sirhowy and Rhymney valleys.

Roads

The canal acts did not always specify that feeders built under their powers should be railways, but often permitted stone roads. In the initial period, these would have the advantage of speedy and cheap construction, and might offer the enticing option of a short sharp pull on a more direct route as opposed to a lengthy and costly railway on a gentle gradient. What is of interest is that so few stone roads were built (and only by the B&A), which suggests that sufficient capital was available to contemplate railways at the outset.

CHAPTER 2
EARLY RAILWAYS

Definitions

Lewis defines a railway in its most basic sense as 'a prepared track which so guides the vehicles running upon it that they cannot leave the track.'[1] These vehicles, in our period and area, could be guided in two very different ways. They might, as is now standard, have flanged wheels running on edge rails, the whole railway being known, especially in the North-east, as a waggonway or, much more commonly in South Wales, as a railroad. Alternatively the flange was on the L-shaped plate rail or tramplate and the wheel was plain. In this case the contemporary name was tramway or (as virtually universal in South Wales) tramroad; plateway is a term which, although there are occasional contemporary usages, has gained popularity in more recent times.

The history of British railways down to the opening of the Liverpool & Manchester Railway is broadly that of industrial railways, namely lines designed essentially for carrying goods in a localised industrial context. After 1830, for the most part, industrial railways and fully-fledged public passenger railways developed independently of each other. Robbins defines the modern public railway as a combination of (a) specialised track, (b) accommodation of public traffic, (c) conveyance of passengers (though he might better have said paying passengers), (d) mechanical traction, and (e) some measure of public control.[2] Our quarry railways qualify under some of these headings, but not all: they were inter-works lines for carrying industrial goods and did not approach the totality of Robbins' definition.

---

[1] Lewis 1970, 1
[2] Robbins 1962, 11- 17, following Lee 1943, 104

Public control and access

Nonetheless many of the quarry lines were built under Act of Parliament, and thereby occupied an interesting intermediate stage in the move towards accommodating public traffic and towards public control. Because of the high lockage involved, canals were impractical in hilly country such as the Heads of the Valleys in South Wales. It was for this reason that acts which empowered the construction of local canals also permitted the construction of railways, waggonways or stone roads.[3] Occasionally these were specifically described and authorised; otherwise they could be built for a maximum distance of four or eight miles (depending on the act in question) from the canal or from an authorised railway, provided that they served industrial works. This was interpreted to include lines not only to the canal from ironworks but also to the works from quarries within the permitted distance. Most of the early railways in South Wales were authorised by such clauses.

They could either be built by the canal companies or, if the companies did not wish to, privately. The point here is that in either case they were public roads subject to tolls and byelaws. The B&A Act emphasised that such roads were 'publick and open to all Persons.' This gave railway proprietors control of the specification for waggons on railroads, or for trams on tramroads. The gauge, for instance, and the maximum weight was often laid down and the tare weight recorded. One of the first actions of the B&A was to issue byelaws concerning the control of traffic on its railroad.[4]

---

[3] B&A Act (1793) specified 'a Rail or Waggon Way or Stone Road' for lines specifically constructed under the Act and 'Stone Roads or Rail Ways' for those built under the 8-mile clause. It did not mention tramroads.

[4] B&A General Assembly, 16.10.1794

From these simple byelaws grew public control. Some of the railway clauses in these canal acts gave such wide powers to proprietors of railways that they began to take control from the canal companies. This trend so worried the B&A Canal Company that it tried to have its 8-mile clause repealed in its own interests, as will be described in Chapter 9. Public control grew in another sense too. From the 1790s, parliamentary Standing Orders required an increasing amount of information to be submitted in support of bills.[5] It was no longer a matter of considering only the interests of local parties, but Government, on behalf of the public, began to play an active part in controlling the format of railways. Standing Orders of 1793 which required plans and books of reference to be deposited for canal bills were extended to railway bills in 1803. From 1813 Government started to show an interest in safety, and plans were now required of tunnels, bridges and archways.

These 4-mile or 8-mile clauses, whether empowering specified or unspecified lines, were no novelty, nor peculiar to South Wales. They can be traced back to at least 1776 (the Trent & Mersey, Dudley and Stourbridge Acts), although the distance limit could be as short as 1000 yards.[6] But it was in South Wales, over little more than a decade, that they reached their peak. One of the last was the second Monmouthshire Canal Act of 1802 which specifically authorised the Sirhowy Tramroad,[7] much longer than the existing 8-mile limit. But already in 1801 the act for the Surrey Iron Railway had been passed. This was the first purely railway act, as opposed to a canal act, to permit public traffic on rails; and it set the scene for the future.

---

[5] This section is based on Bond 1971
[6] Lewis 1970, 280-3
[7] 42 George III c.115

Track and its evolution

What follows under this heading is an introduction to the history of permanent way down to the mid-nineteenth century, as far as it is relevant to South Wales and as it has hitherto been understood. For the most part it ignores the new findings which result from the present study. We are for the moment concerned primarily with innovation, and it should not be forgotten that older types often survived in use long after new types were introduced.

EDGE RAILS

Wooden Railways

Huntingdon Beaumont is credited with the introduction of the wooden railway in the Nottingham coalfield, with a two-mile line at Wollaton built in 1603-4.[8] He soon turned his attention to Northumberland where he had built another line by 1608. Here on Tyneside the new waggonway spread rapidly, particularly after the Restoration, and for carrying coal from the pits to the river it soon superseded the traditional wain on overcrowded and nearly impassable roads. Only a year or two after Wollaton, the railway appeared at Broseley in the Severn Gorge where it also took root. By 1660 visibly different types of railway were evolving round Newcastle and in Shropshire. The wheels of both systems were flanged, which Lewis suggests was a British invention. In both system the rails were of squared wood fixed to transverse wooden sleepers. But the Newcastle waggonway had larger waggons on a broader gauge, while the Shropshire railway had a narrower gauge with generally smaller waggons which sometimes ran right to the

---

[8] Up to the coming of the all-iron rail, most of this section is based on Lewis 1970. For the all-iron rail there is no overall, authoritative and up-to-date account. Marshall 1938, Lee 1943, and Baxter 1966 still have their uses, but need to be used with caution in the light of more recent findings.

coalface, and sometimes its steep gradients demanded haulage by rope rather than horse.

Tyneside has rightly been called the 'native land of railways.' It was however the Shropshire type which spread southwards, appearing near Stourbridge from the 1660s and on Clee Hill on the Welsh border from 1733,[9] and until about 1800 it dominated South Wales. Here, where coal and iron ore outcropped and limestone lay fairly close by, the smaller Shropshire railroad was ideal. In 1697 Sir Humphry Mackworth built a railway 'after the manner used in Shrop-shire and New-castle' from the coalface down to the River Neath. During the eighteenth century a sprinkling of wooden railways followed, mostly in the Neath and Swansea area but including one built by the 1780s from Penderyn Quarries to Hirwaun.

Cast-iron railroads

Until 1767 rails were wholly of wood. In that year Coalbrookdale introduced flat cast-iron plates, laid on top of the wooden under-rails to protect them from wear and held by nails through projecting lugs (**Fig. 3**).[10] These were installed on many railroads in Shropshire and were to some degree imitated elsewhere, most notably on the Trent & Mersey Canal's limestone railway at Caldon Low in Staffordshire, opened in 1778, where the plates (at least towards the end of century) had male and female joints.[11] The length and weight of Shropshire-type plates was very variable, ranging from 3 to 7ft long and from 32 to 70½lb per yard; they were generally 1½in thick.[12] It is to this phase of development that we may date the introduction of railways to the Heads of the Valleys by, most likely, John Guest of Broseley in Shropshire and Francis Homfray who had ironworks at Broseley,

---

[9] van Laun 1989a
[10] Lewis 1970, 262; Clark 1993, fig. 76
[11] Lewis 1970, 284 shows that Farey is wrong in describing these plates as flanged
[12] The evidence is summarised in Conclusions

both of whom were influential ironmasters in Merthyr Tydfil by 1782. Further west, at Landore near Swansea, it will shortly be argued that Coalbrookdale-type plates had already been used in 1776.

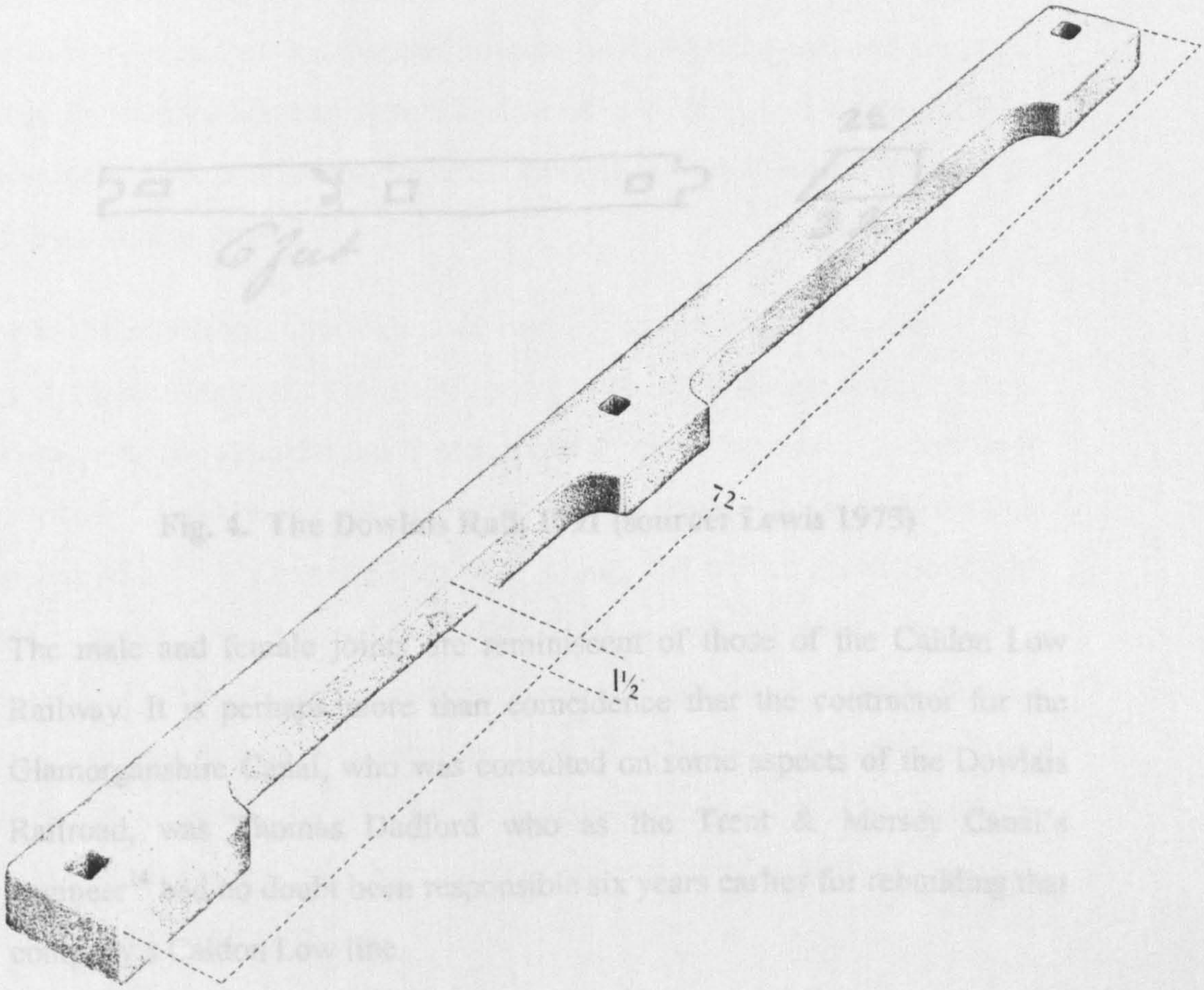


Fig. 3. Iron plates at Coalbrookdale

The Coalbrookdale plate represents a phase intermediate between the all-wood and the all-iron rail. The next step was to dispense completely with the wooden rail. The accepted date is 1791, when all-cast-iron rails, still fixed to transverse wooden sleepers, were made at Dowlais. These were described by William Taitt:[13]

---

[13] Elsas 1960, 171; Lewis 1975, 1

We are now making Rails for our Waggon way which weigh 44 li or 45 li [lb] per yard. The Rails are 6 feet long, 3 pin holes in them, mitred at the ends, 3 Inches broad at Bottom, 2½in. top & near 2 in. thick thus [**Fig. 4**].

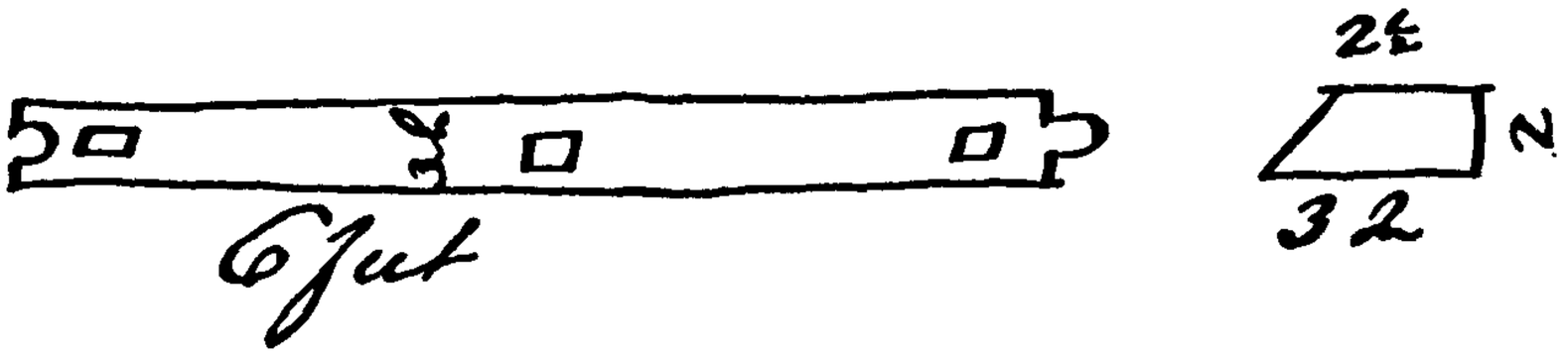


Fig. 4. The Dowlais Rail, 1791 (source: Lewis 1975)

The male and female joints are reminiscent of those of the Caldon Low Railway. It is perhaps more than coincidence that the contractor for the Glamorganshire Canal, who was consulted on some aspects of the Dowlais Railroad, was Thomas Dadford who as the Trent & Mersey Canal's engineer[14] had no doubt been responsible six years earlier for rebuilding that company's Caldon Low line.

This bar-shaped rail, with modifications, was rapidly adopted for railroads built for the Monmouthshire Canal Company (from 1792) and the Brecknock & Abergavenny (from 1793), with bulbous lugs to accommodate the spikes.[15] It became standard in the Heads of the Valleys for almost a decade, but was rarely imitated elsewhere. One instance is known at Cwm Clydach near Swansea (to be distinguished from the Clydach near Abergavenny) dating from probably 1796-8,[16] another on the Somerset Coal

---

[14] Hadfield 1966, 23, 43, 51
[15] Rattenbury 1980, 63
[16] *Hereford Journal*, 4 September 1799; Oeynhausen and Dechen 1971, 60; Hughes 1990, 113; Svedenstierna 1973, 45

Canal in 1795.[17] The Lake Lock Railroad near Wakefield of 1798-9 employed a rather similar but even more poorly designed bar rail[18] which might have been related. Despite the apparent weakness of the section (approximately a square), there is no evidence whatsoever that any of these bar rails were laid on longitudinal timbers, and plentiful evidence that they rested solely on transverse sleepers of wood or of iron, and increasingly on stone blocks. We first hear of the latter when they were mooted for the MCC railroads in September 1792.[19]

It was the inefficient distribution of iron in the rail which soon led to the search for a stronger section, culminating in the tall T-shape with a narrow vertical web for strength and a wide head to carry the wheel. It has been suggested, debatably, that this was used on the Loughborough & Nanpantan Railway of 1794.[20] Certainly rails of this kind, fish-bellied for strength and held in chairs, were adopted at Walker Colliery near Newcastle in 1798.[21] By 1815 William Jessop had added a bottom flange for extra strength, and the Stephenson and Losh patent design of 1816 brought the cast-iron fish-bellied rail to its final form.[22] But these developments are of little relevance to South Wales where only three instances of cast-iron fish-belly are known, none of them in our area.[23]

Wrought-iron railways

The wrought-iron rail proved a major break-through in permanent way. Much superior in strength to the brittle cast-iron rail, and with many fewer joints, it quite rapidly became standard and, most important, it opened the

---

[17] *Felix Farley's Journal* (Bath), 3 June 1795
[18] Goodchild 1977
[19] Rattenbury 1980, 61
[20] Hadfield and Skempton 1979, 168-72
[21] Skempton and Andrews 1976-77
[22] Hadfield and Skempton 1979, 172-3
[23] Cwm Clydach near Swansea (Oeynhausen and Dechen 1971, 55), Saundersfoot (Price 1964, 6), and the Duffryn Llynvi & Porthcawl Railway (recent finds; Chapman 1999 only discusses the gauge).

way for the full development of the locomotive. After a few small-scale but promising experiments, its story properly begins with the 1820 patent of John Birkenshaw of Bedlington ironworks. This simply covered rolled iron rails of T-section; the belly, created by an eccentric roll, was only later adopted at John Buddle's suggestion. The earliest non-bellied Birkenshaw rails were laid in 1820-1,[24] the first bellied ones were rolled for the Stockton & Darlington in 1822. This allowed for a reduction in weight from 48¾ to 28lb/yd.[25]

The fish-belly ruled the roost for a decade until in the 1830s parallel sections, in a multitude of slightly different shapes generically referred to as T-rails, began to take over. About 1840 a symmetrical dumb-bell section, the double-head rail, became more common, and this finally gave way to the long-lived bullhead rail where the head was larger than the base. The flat-bottom or Vignoles rail, American by origin, did not become frequent on industrial railways until well after the middle of the 19th century and on main lines very much later still. Another variant, the bridge rail, a brain-child of Brunel's, was widely adopted on industrial lines from the 1850s. Both these types were usually spiked direct to the sleepers, but other wrought-iron rails were held, like the later cast-iron rails, in chairs to which they were fixed at first by cross-pins, then by thin iron keys, and finally by chunky wooden keys.

PLATEWAYS

John Curr

Hughes claims that the first flanged iron plate rails were cast for John Morris of Landore near Swansea, who wrote:[26]

---

[24] Tomlinson 1914, 15-16
[25] Oeynhausen and Dechen 1971, 23 and 25
[26] Hughes 1990, 172; Lewis 1970, 320-1, thinks otherwise

Cast *Iron Tram* plates

In Nov.r 1776 I wrote to Mess.rs Darby & Co. at Coal Brook Dale that I had sent them a pattern in wood about 4ft. long & 5 in. wide, to cast Iron plates for wheeling Coal on in my Collieries, each plate to weigh ab.t 56 lb, that if they cou'd be supply'd at £8 p ton I shou'd want immediately 100 Tons & that the introduction of them wou'd occasion a vast consumption of Metal, *never before* us'd for such purpose

This Pattern was made early in the Summer of 1776.

Morris does not mention a flange, that vital difference between edge and plate rails; only two years before he had built for Landore colliery an ordinary wooden surface waggonway, of the same kind as others in the area;[27] and the weight of 56lb sounds at this date more like a plating for wooden under-rails for underground use. It therefore seems much more likely that Morris merely used Shropshire-style cast-iron plates on wood. The view taken here is the standard one, that it was John Curr (1756-1823), the viewer of the Duke of Norfolk's collieries, who translated pre-existing wooden flanged rails into iron tramplates and first used them underground at Sheffield in 1787.[28]

Curr's plateways were small in scale, designed essentially for carrying underground corves (his standard North-eastern term for trams).[29] For a smaller corf his rail gauge was 1ft 10½in, for a larger one 2ft. The basic plates which he advocated were 6ft long, 3in broad on the tread, and ½in thick. The flange stood 2in above the tread, was ½in thick at the base tapering towards the top, and was hogged for strength. They were nailed to wooden dovetailed sleepers **(Fig. 5)** or morticed into each other **(Fig. 6)**. He proposed quite sophisticated details for plates on sharp curves, which needed to be broader in the tread and superelevated on the outside.

---

[27] Lewis 1970, 251

[28] For evidence that the date was 1787, not the traditional 1776 which is still sometimes quoted, see Lewis 1970, 316-18

[29] Described in Curr 1797, 7-29

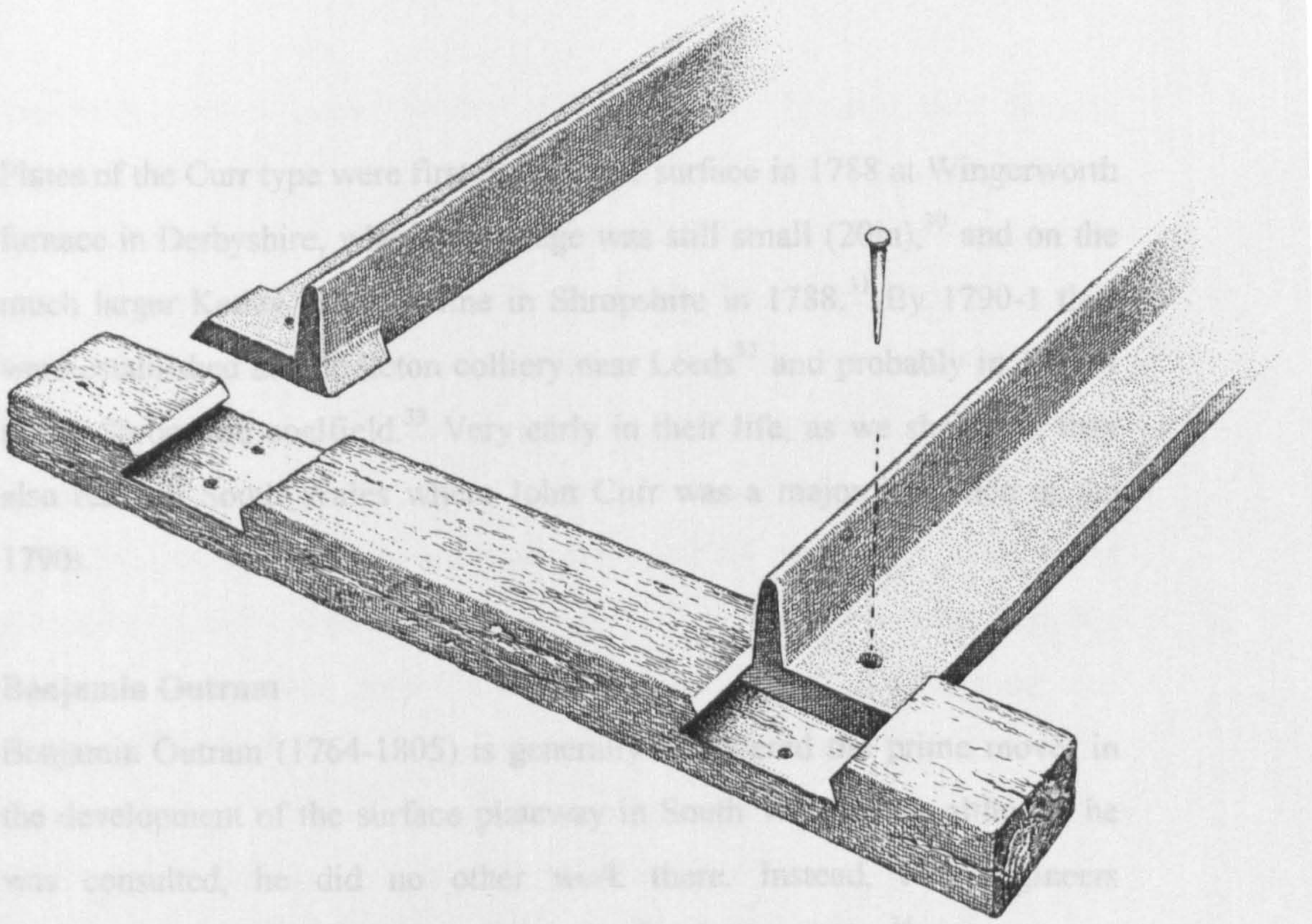


Fig. 5. Curr's dovetailed sleeper

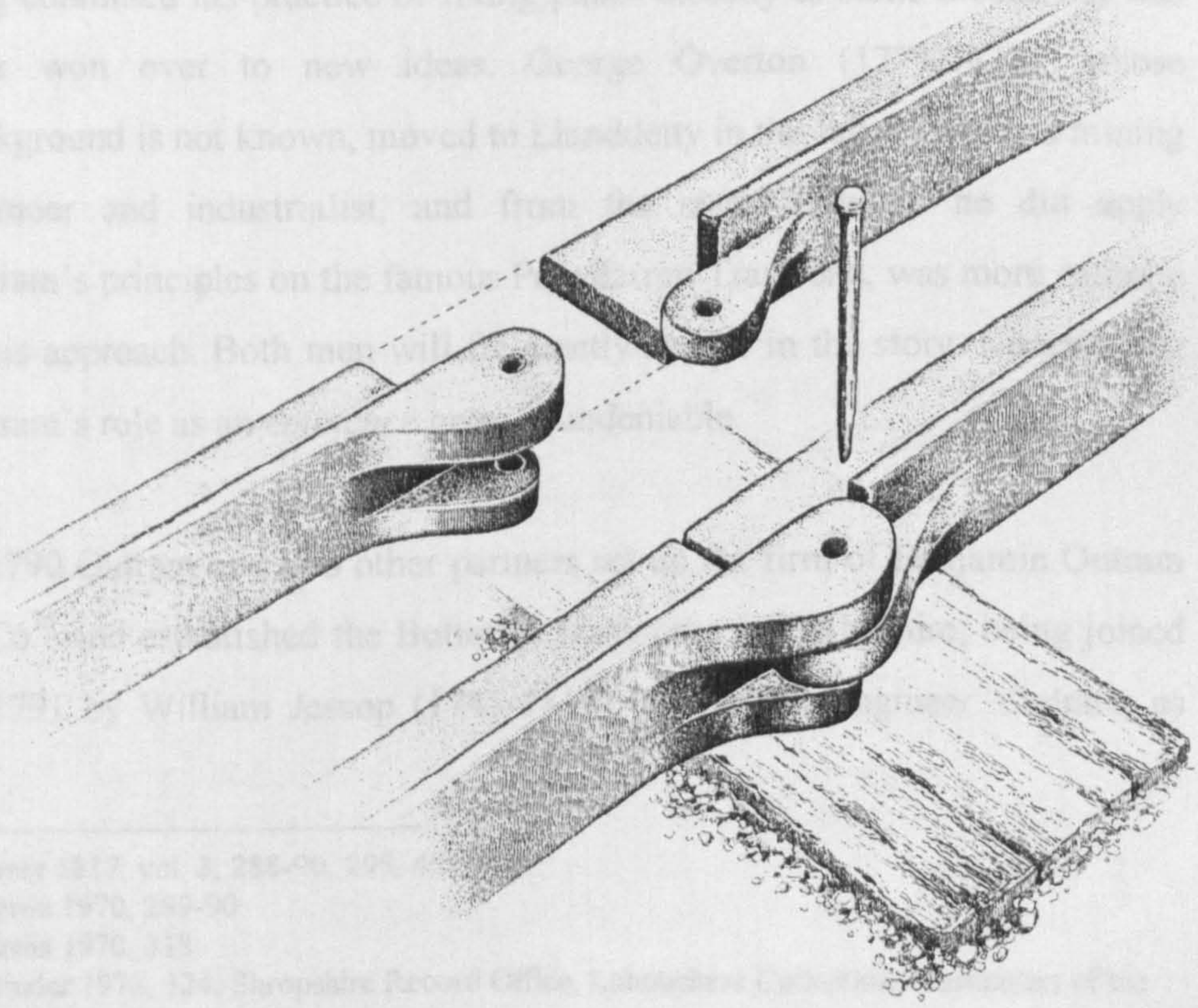


Fig. 6. Curr's method of morticing

Plates of the Curr type were first used on the surface in 1788 at Wingerworth furnace in Derbyshire, where the gauge was still small (20in),[30] and on the much larger Ketley canal incline in Shropshire in 1788.[31] By 1790-1 they were established at Middleton colliery near Leeds[32] and probably in 1793-4 in the Shropshire coalfield.[33] Very early in their life, as we shall see, they also reached South Wales where John Curr was a major influence in the 1790s.

Benjamin Outram

Benjamin Outram (1764-1805) is generally considered the prime mover in the development of the surface plateway in South Wales. But, although he was consulted, he did no other work there. Instead, two engineers dominated. John Hodgkinson (1779-1861), Outram's relative[34] and assistant, long continued his practice of fixing plates directly to stone blocks but was later won over to new ideas. George Overton (1774-1827), whose background is not known, moved to Llanddetty in the late 1790s as a mining engineer and industrialist, and from the start, although he did apply Outram's principles on the famous Penydarren Tramroad, was more catholic in his approach. Both men will frequently appear in the story. Nonetheless, Outram's role as an *éminence grise* is undeniable.

In 1790 Outram and two other partners set up the firm of Benjamin Outram & Co[35] and established the Butterley Ironworks in Derbyshire, being joined in 1791 by William Jessop (1745-1814) the famous engineer. Outram, as

---

[30] Farey 1817, vol. 3, 288-90, 295, 451
[31] Lewis 1970, 289-90
[32] Lewis 1970, 318
[33] Trinder 1973, 124; Shropshire Record Office, Labouchere Collection, 'Particulars of the Expence of a Corve,' 1794
[34] Outram was the son of Joseph Outram of Alfreton, Derbyshire, by his second wife Elizabeth née Hodgkinson
[35] This paragraph is based on Riden 1973, 30-52

managing partner, began to cast plate rails and became their leading exponent. It is not clear exactly what influences bore on him. Nearby, at Wingerworth, lay Joseph Butler's ironworks where Curr's L-shaped rails came to the surface in 1788, and which cast plates for Outram before Butterley was in blast. It is said that Outram's father Joseph (1732-1810) had cast plates at Alfreton for Curr. But in general Outram developed a type of his own, markedly heavier than Curr's for a larger gauge and for surface lines. The prime hallmarks are the tapered notch for the spike at each end of the plate,[36] and the lugs on the inner side of the rail to increase stability. Outram's plates were generally 3ft long, although 6ft lengths were not unknown.[37] One of their assets was that, if he cast and laid them himself, he guaranteed them for a period, which enhanced their reputation. He built no lines in South Wales, nor cast plates for them; but his insistence on careful preparation and track laying was inherited by his pupils. On some rails unearthed on the Hay Railway, engineered by Hodgkinson, it was only possible to find the rail join after the application of a wire brush.[38]

Outram's own 'Minutes to be observed in the construction of railways' have survived.[39]

> The ground for the whole must be formed and effectually drained. The breadth of bed for a single rail-way should be, in general, four yards; and for a double one six yards, exclusive of the fences, side drains, and ramparts.
>
> The bed of road so formed to the proper inclination, and the embankments and works thereof made firm, the surface must be covered with a bed of stones broken small; or good gravel, six inches in thickness or depth. On this bed must be laid the sleepers or blocks to fasten the rails upon. These should be of stone in all places where it can be obtained in sufficient size; they should be not less than 8, not more than 12 inches in thickness; and of such breadths (circular,

---

[36] Derbyshire RO D503, D103; drawing in Riden 1973, 97
[37] Riden 1973, 41
[38] van Laun 1977, 83
[39] Riden 1972

square or triangular) as shall make them 150lbs. or 200lbs. weight each. Their shape not material, so as they have a flat bottom to rest upon, and a small portion of their upper surface level, to form a firm bed for the end of the rails. In the centre of each block must be drilled a hole, one inch and a half diameter, and six inches in depth, to receive an octagonal plug of dry oak five inches in length; for it should not reach the bottom of the hole; nor should it be larger than so as to be put in easily and without much driving: for if too tight fitted it might, when wet, burst the stone. These plugs are each to receive an iron spike or large nail, with a flat point and long head, adapted to fit the counter-sunk notches in the end of the two rails, and thereby to fasten them down in the proper position.

The rails should be of the stoutest cast iron, one yard in length each, formed with a flanch on the inner edge about two inches and a half high at the ends, and three and a half in the centre; and shaped in the best manner to give strength to the rails, and keep the wheels in their track. The soles of the rails for general purposes should not be less than four inches broad; and the thickness proportioned to the work they are intended for. On rail-ways for heavy burdens, great use and long duration, the rails should be very stout, weighing 40lbs. or, in some cases, nearly half an hundred weight, each. For railways of less consequence less weight of metal will do; but it will not be prudent to use them of less than 30lbs. weight each, in any situation exposed to breakage above ground ...

In fixing the blocks and rails, great attention is required to make them firm. No earth or soft materials are to be used between blocks and the bed of small stones or gravel ...

The blocks and rails being fixed and spiked fast, nothing more remains to be done than to fill the horse path, or space between the blocks, with good gravel, or other proper materials; a little of which must also be put on the outsides of the blocks to keep them in their proper places. This gravel should always be kept below the surface of the rails on which the wheels are to run, to keep the tracks for the wheels free from dirt and obstructions.

John Hodgkinson's 1812 estimate for a five-mile tramroad from the Leominster Canal follows the Outram formula:[40]

> Covering the Bed of the Road formed, with Stone broken small or good Gravel 10 feet in width and 6 inches in thickness, providing Stone Blocks 168lbs in weight each, laying the same, filling between and backing the sides with small Stone or Gravel, Nails, Plugs and all kind of Workmanship, 8800 Yards @ 3s/-

Good salesmanship undoubtedly played a part in Outram's convincing clients of the worthiness of his method. In 1799, for instance, he persuaded the MCC and B&A committees, despite the cost, to convert most of their railroads to tramroads,[41] and, even more startling, he almost persuaded the B&A to abandon building their canal when it was well under way and substitute a tramroad.[42] The ball, once set rolling, continued to roll. In South Wales, for the next three decades and in many cases longer, virtually all new lines were tramroads, and few pre-existing railroads were not converted.

The other item indelibly associated with Outram's name is the stone block. He did not invent it: as we saw, on railroads it goes back to 1792. But if we ask when Outram first used blocks on a plateway, we are faced with the difficulty that although they survive on most of his early lines, there is no certainty that they are original. Thus the plates for his Derby Canal Tramroad (Little Eaton Gangway), ordered in 1793 from Butler rather than Butterley, were laid on wooden sleepers,[43] and stone blocks were substituted later. Possibly his first were on the Peak Forest Railway, where the contract for the track, the first large order for rails that Butterley received, was let in December 1794, although the canal company minutes are silent on the nature of the sleepers. Underground they remained rare, but on the surface they became almost universal. But not entirely, for they were not essential

---

[40] NLW Powis Castle 2502
[41] Quoted at length in Davies 1814, vol. 2, 383-9 and 398-9
[42] B&A Committee Minutes, 7.3.1799
[43] Hadfield and Skempton 1979, 173

with sills, which South Wales used aplenty both before and after Outram's reports of 1799.

The plateway, whatever its advocates claimed for it, can with hindsight be seen as a gross aberration of railway development. In particular its wide flat rails harboured the dirt kicked up by the horses to a far greater extent than narrower edge rails which stood proud of the ground, and greatly increased the friction on the wheels. To cut through this dirt, tram wheels were made narrower, which also cut through the plates. Other drawbacks are mentioned in the letter shortly to be quoted. One of the unanswered mysteries of early railway history is why so defective a system found such popularity. Of all the regions of Britain, it was only Tyneside and North-west Wales which remained largely faithful to the edge rail. Serious questions about the plateway only began to be asked on the eve of the Railway Age, when the form of track for the Stockton & Darlington Railway was being considered. George Overton, an ardent supporter of plate rails, was its current engineer.

In 1821 William Jessop junior of Butterley Ironworks wrote:[44]

> The flanged Rail Way or Tram Road is in common use in this neighbourhood, and is universal amongst the Collieries in this Country & ... we are fully aware of their merits & demerits ... We can pronounce without any hesitation or doubt, that the edge Rail Ways are very superior to the Tram Roads of this Country & Wales, and we should very gladly alter all our roads to that plan [if it] were not attend'd with so great an expence. The expences of Repairs are less, & they a[llow] of greater Weights being carried on them than Rails [of] the same weight on the Tram plate ... The advantages are so many as not to leave a doubt on the subject and all those who have experienced both will agree in that opinion.

Sills for cast-iron plates

Curr's wooden dovetailed sleeper was translated into a combination in iron of two chairs and a tie-bar, for which 'sill' is the most useful name. The

---

[44] Elsas 1960, 172

disadvantage of sills over stone blocks was that the track, although reasonably stabilised by the pins and male and female joints which located plates in the sills, could be displaced by heavy loads. Their advantage was that as well as maintaining the gauge they could be moved rapidly to new locations. They were therefore ideal for contractors' railways,[45] quarries and mines. In 1805-6 Nemnich saw 'rails and sleepers cast in one piece' at Wilkinson's ironworks at Bilston in the Black Country.[46] Dovetailed sills were reported in 1826-7[47] at Dudley and were possibly in use at Bickley Works near Bilston.[48] Sills were not to be found on any of the Swansea Valley tramroads, but were common in Shropshire, and in the Denbighshire coalfield examples survive in Bersham Museum of around 19in gauge.

Chairs for cast-iron plates

Chairs or saddles, though generally associated with edge rails, were also used with plateways. Perhaps the earliest date to 1795, when a tramroad was laid on Trafford Moss near Manchester to assist with its reclamation, consisting of 6ft cast-iron plates, just like Curr's, held in very shallow dovetailed chairs pinned to wooden sleepers.[49] Outram's Peak Forest Railway which opened in 1797 had saddles formed of a flat base with vertical cheeks to locate the plate ends, which were held down by common pin through the two adjacent notches and the saddle **(Fig. 7)**; it is likely but not entirely certain that these were original. Another line which used saddles in a similar way was the Kilmarnock & Troon where they were introduced perhaps in 1817 for the trials of a locomotive.[50] In 1818 at the latest the

---

[45] Tramplates were used in 1811 by a canal contractor: B&A Committee Minutes 30.5.1811
[46] Nemnich 1807, 64
[47] Oeynhausen and Dechen, 67
[48] Elsas 1960, 175
[49] Holt 1795, 97
[50] Tredgold 1825, 35. Illustrated in *Edinburgh Encyclopaedia* 17 (1830), 307 and plate ccclxxvii

Kington Railway took up the idea with dovetailed 'shoes' **(Fig. 8)**, the rail ends being chamfered to fit the cheeks without, it seems, any key.[51]

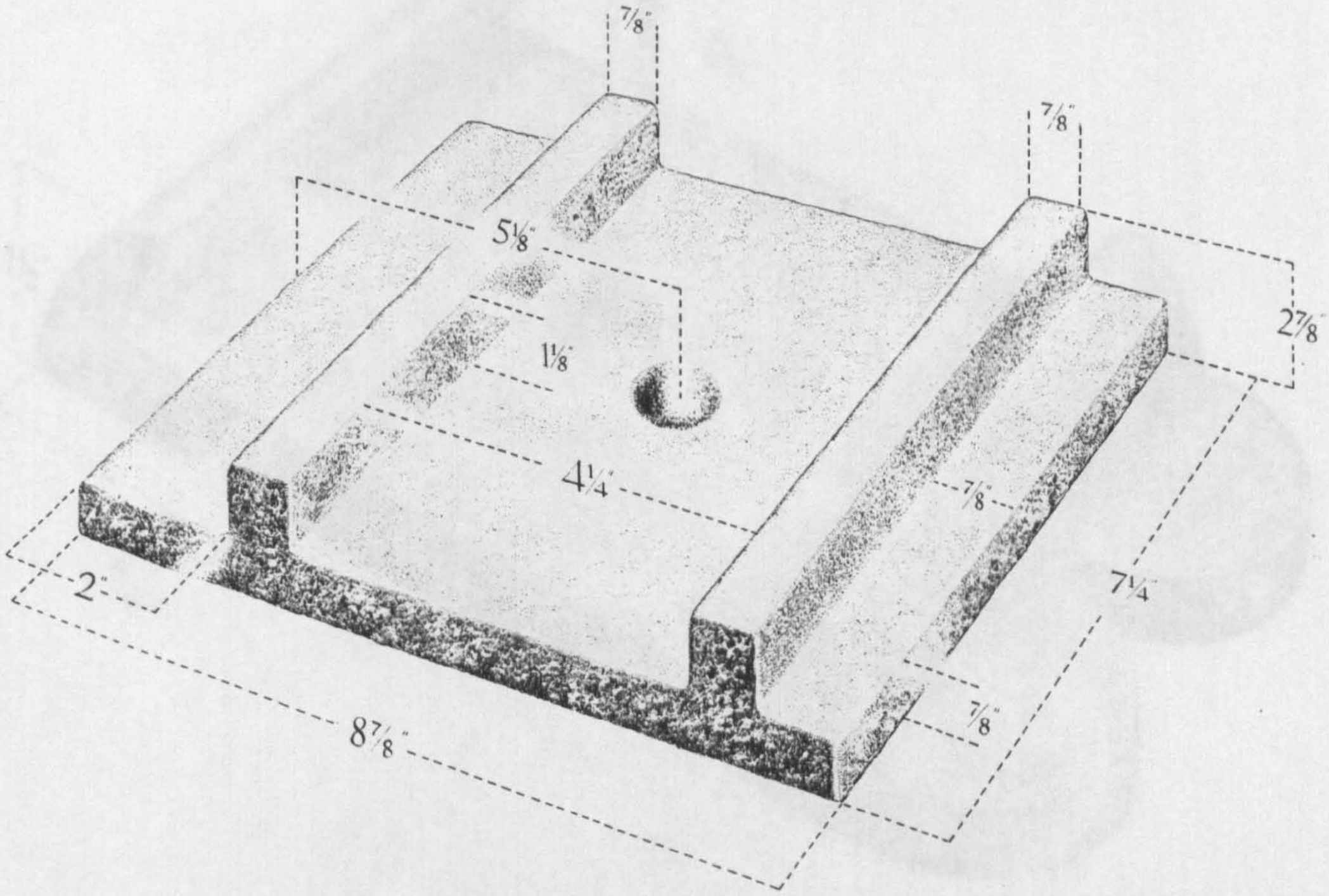


Fig. 7. Peak Forest Tramroad non-dovetailed chair

Wrought-iron plates with sills and individual chairs

As well as being stronger than cast iron in tension, wrought iron could be rolled to lengths of around 15ft. Such plates are first recorded about 1824,[52] but took at least a decade to catch on. None were reported by Oeynhausen and Dechen in 1826-7, but Dowlais had rolled some shortly before 1835,[53]

---

[51] Rattenbury and Cook 1996, 71 say they were conventional tramplates notched. From finds (John van Laun 1973 at Eardisley embankment) and Rattenbury and Cook 83 this is plainly not so: the chairs leave impressions on the blocks much like those of Outram plates

[52] Wood 1825, 48

[53] Elsas 1960, 94

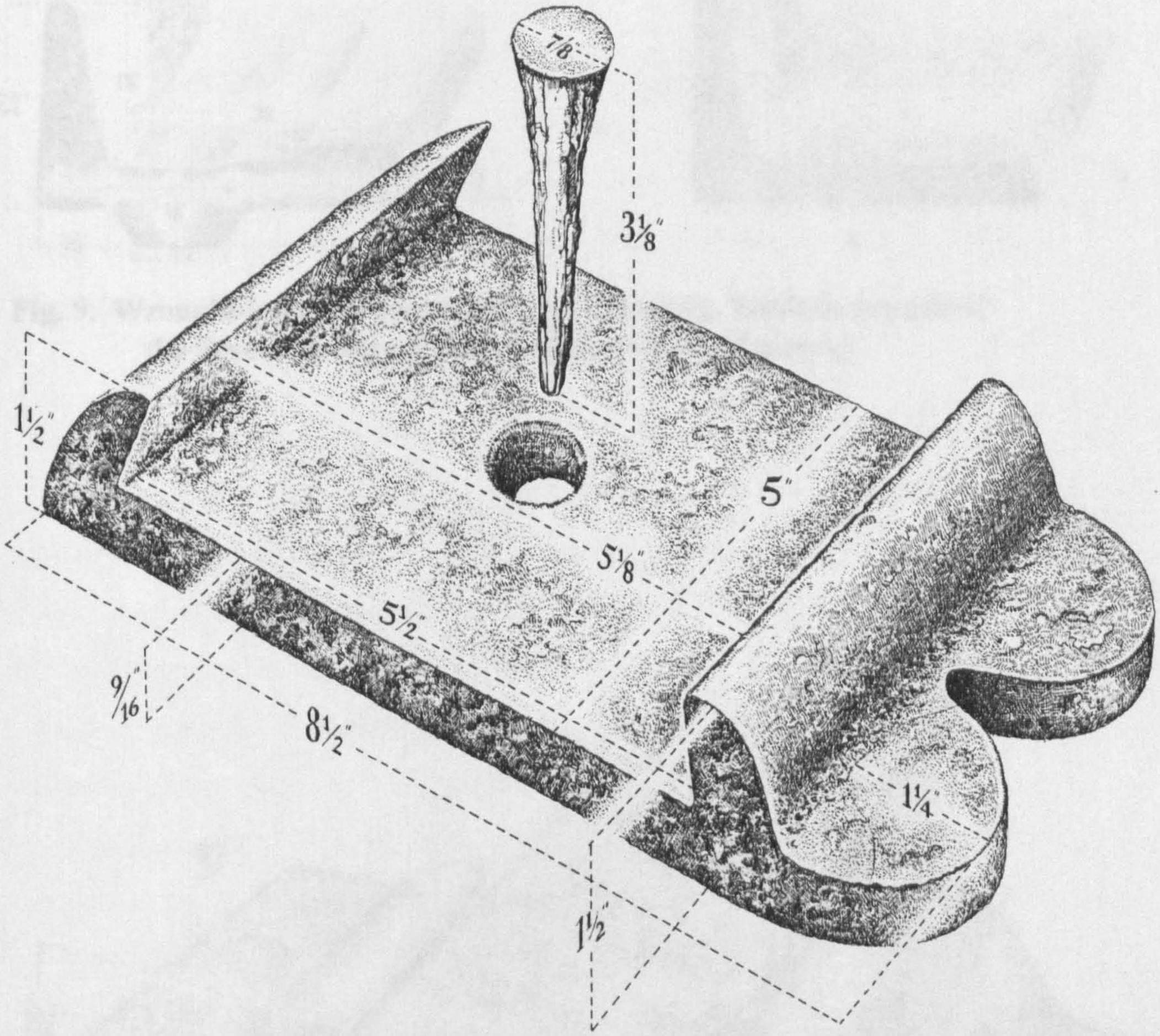


Fig. 8. Kington Railway dovetailed chair c.1818 (312 497)

and on the Lancaster Canal Tramroad they were in use by 1837.[54] The Severn & Wye Railway converted to rolled plates at intervals in 1848, 1853 and 1864 **(Fig. 9)**, the plates weighing 40lb a yard in probably 9ft lengths with chairs weighing 14lb.[55] These were at first of simple dovetail design, but later versions had two bosses dogged into the underside, with a hollowed

---

[54] Biddle1963, 96
[55] Paar 1973, 35, 37

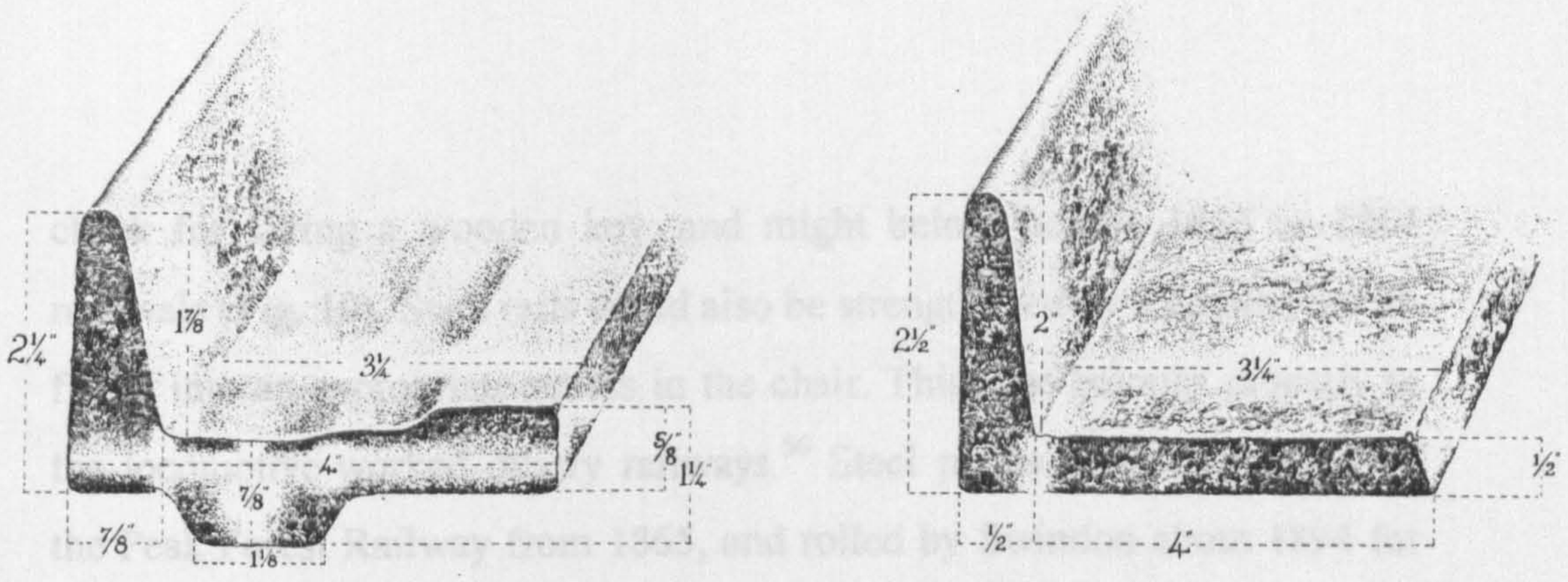


Fig. 9. Wrought-iron rail compared with cast-iron, Bicslade branch of the Severn & Wye Railway (Dean Forest Museum)

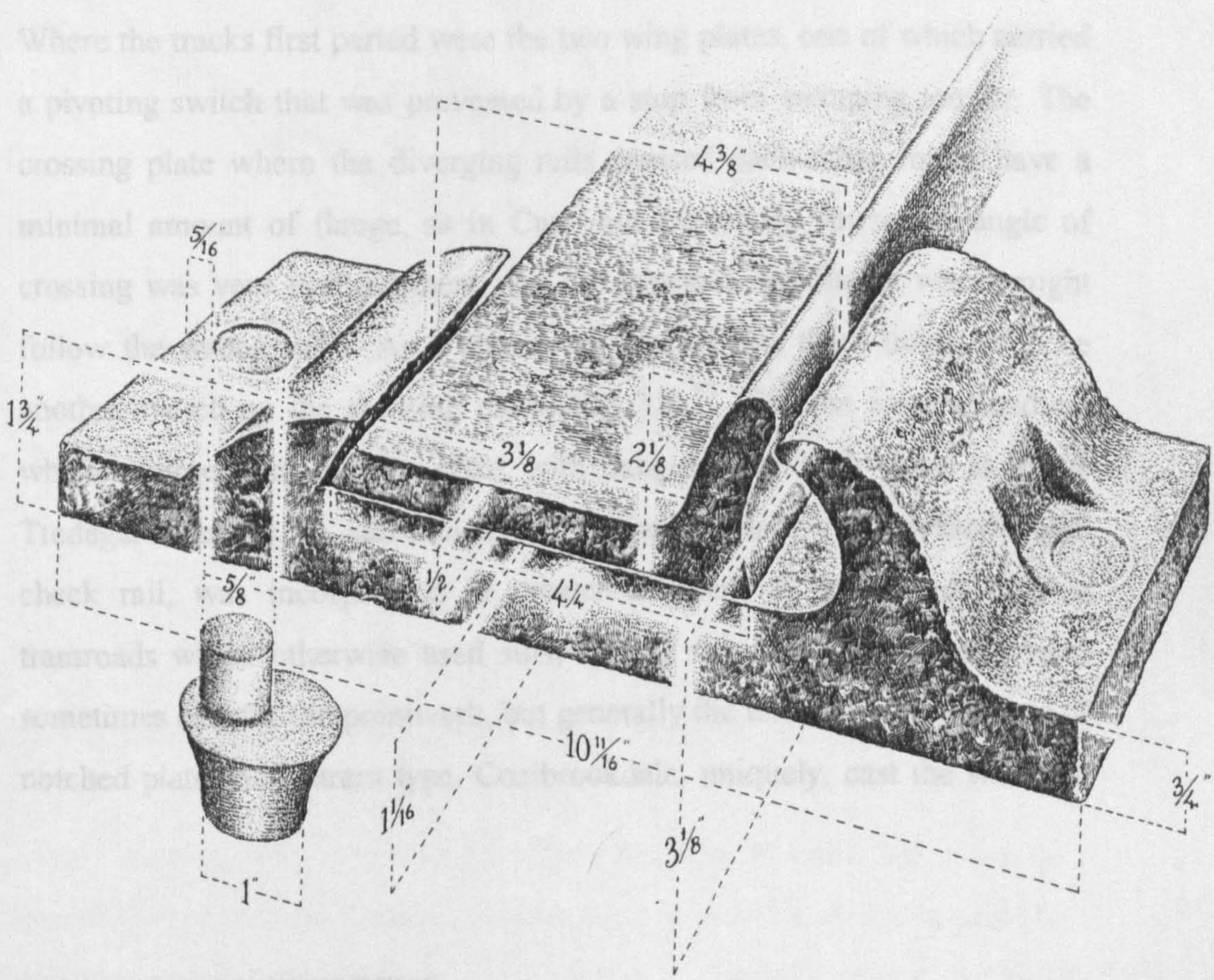


Fig. 10. Severn & Wye Railway, chair for plain wrought-iron plate (Dean Forest Museum)

cheek for taking a wooden key, and might belong to the 1853 or 1864 renewals **(Fig. 10)**. Such rails could also be strengthened by a continuous rib fitting into an appropriate recess in the chair. This type belongs properly to the locomotive-worked quarry railways.[56] Steel plates were introduced on the Peak Forest Railway from 1865, and rolled by Swindon about 1894 for the Severn & Wye.

Specialised trackwork

Pointwork may be illustrated by two examples, of which Curr's **(Fig. 11)** is not only earlier but simpler than that from Tredegar **(Fig. 12)**. The whole was normally built up from ordinary plates and three types of special plate. Where the tracks first parted were the two wing plates, one of which carried a pivoting switch that was prevented by a stop from swinging too far. The crossing plate where the diverging rails crossed each other might have a minimal amount of flange, as in Curr; but especially where the angle of crossing was very shallow there was the constant risk that a wheel might follow the wrong track. As a precaution against this there might even be another switch on the crossing plate **(Fig. 13)**.[57] But the usual expedient which emerged was the box plate, with flanges along both sides, as in the Tredegar example. In addition the third special plate, the double-flanged check rail, was incorporated in greater numbers as time went by. On tramroads which otherwise used sills, special sills to hold four rails were sometimes cast for the pointwork, but generally the turnouts were built up of notched plates of Outram type. Coalbrookdale, uniquely, cast the whole of

---

[56] Gilson and Quartley 1968, 140-161, on the Somerset Coal Canal Tramroads where the rib was $1^{5}/_{8}$in deep and the sections resemble those found in South Wales. But these rails, most unusually, merely rested on top of the chairs and were presumably fastened positively at infrequent intervals

[57] Dutens 1819; Baxter 1966, 55

the turnout in one.[58] Tramroads were virtually always single track, and passing places were therefore needed. Hodgkinson specified four to the mile, each 60 yards long, on a 3ft 6in gauge line and three to the mile on a 2ft gauge one.[59]

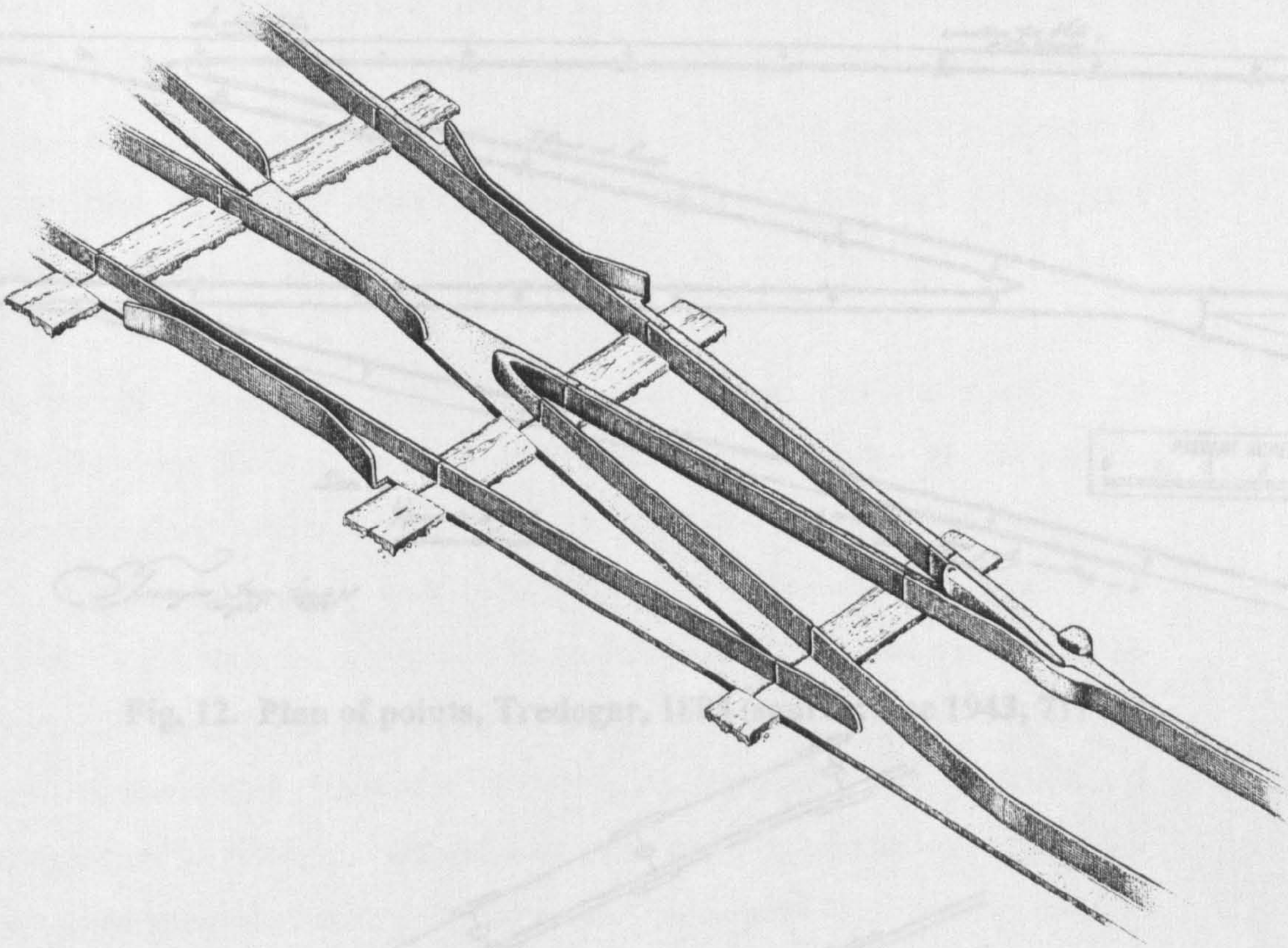


Fig. 11. Curr pointwork (re-drawn from Curr 1797, pl. fig. 12)

Curves, when gentle, were normally built up from straight plates, but on sharp ones special curved plates could be used. Wrought-iron plates could be bent to a curve, whether on sills or chairs.[60] Turnpike plates for level

---

[58] Example in Ironbridge Gorge Museum
[59] NLW Powis Castle 2502
[60] Baxter 1966, 132

crossings had the top of the flange scalloped or 'vandyked' (crenellated) both to give a grip to the wheels of road vehicles crossing at an acute angle, which otherwise might skid sideways, and perhaps to reduce breakage of the flange when they crossed the track at right angles. Sometimes they are single-flanged, sometimes (in an attempt to keep dirt off the tread) double-flanged; in the latter case the outside flange might be lower.

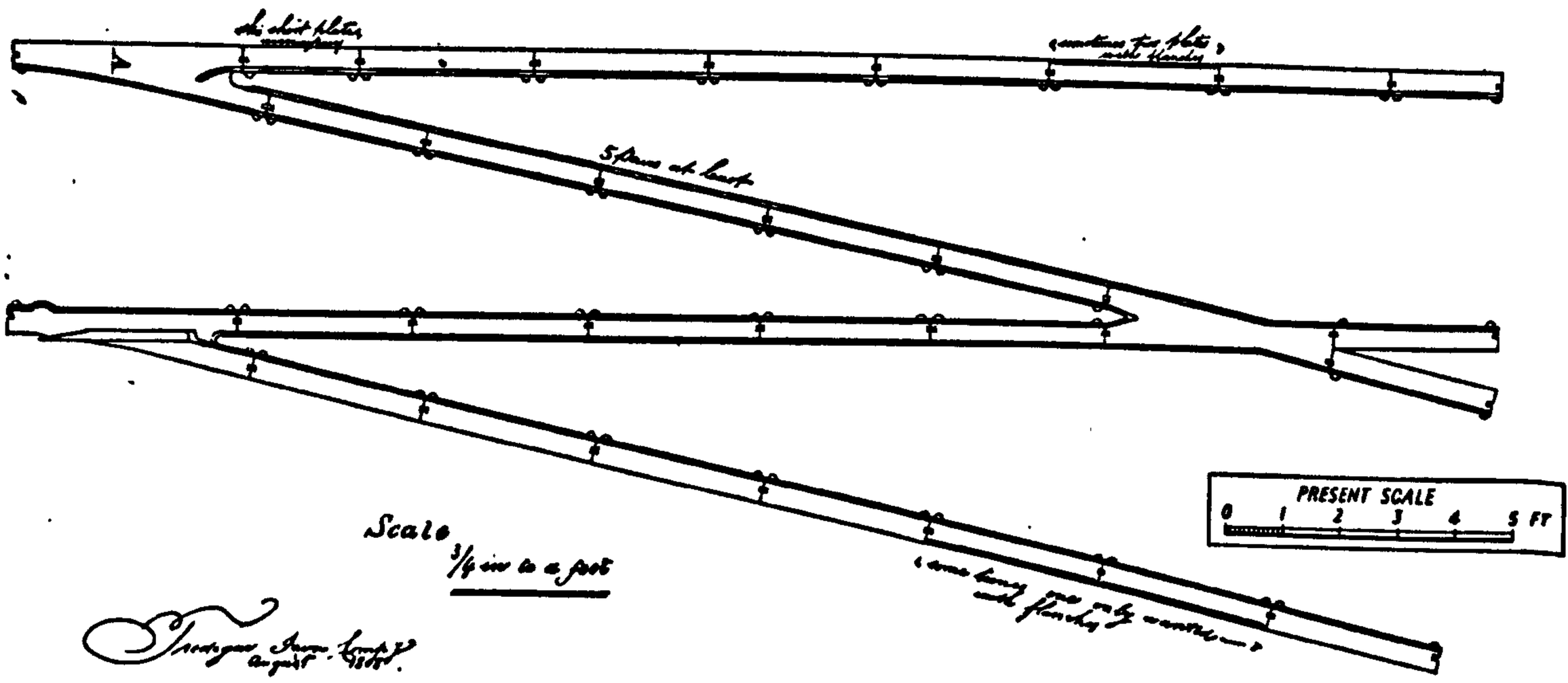


Fig. 12. Plan of points, Tredegar, 1808 (source: Lee 1943, 71)

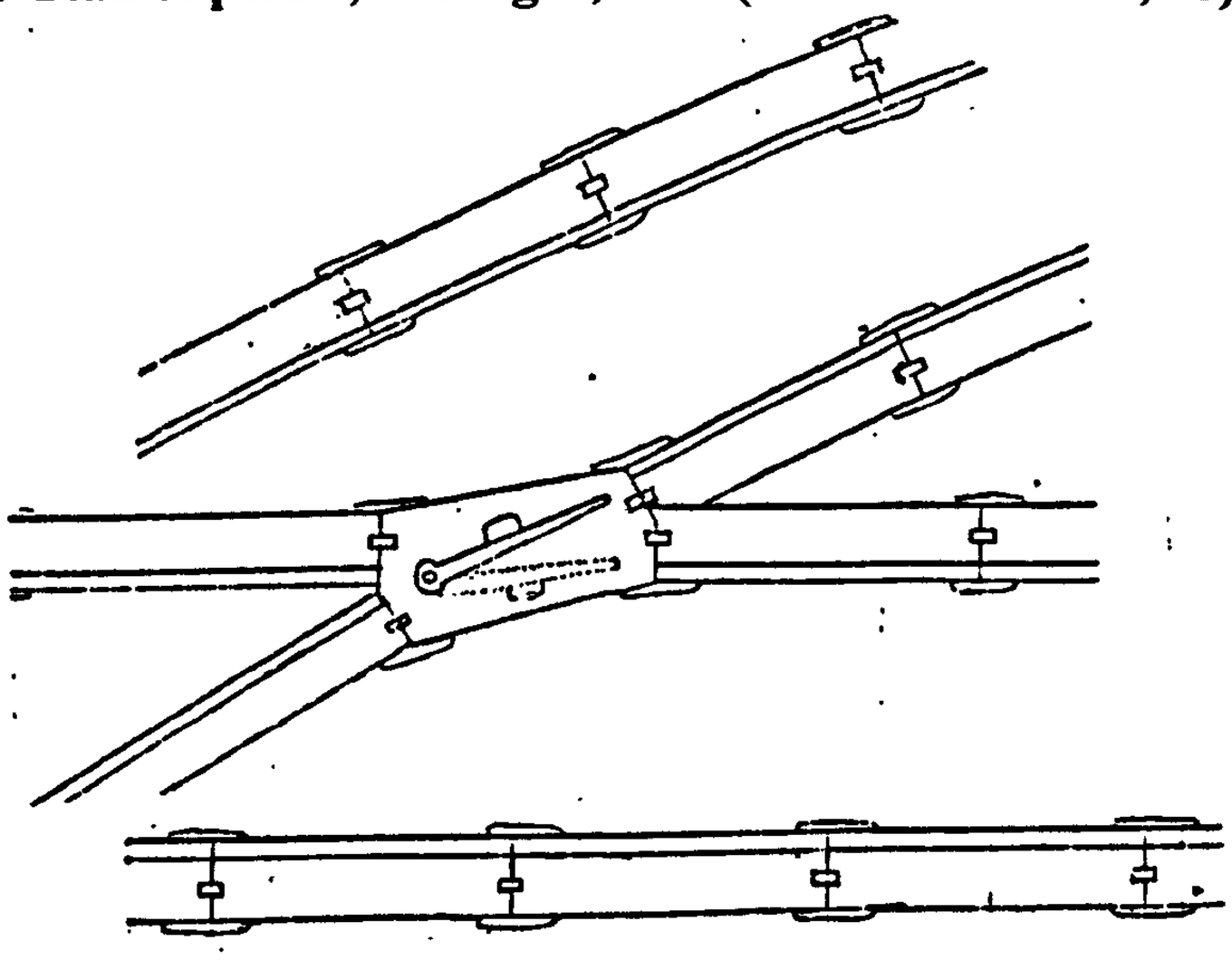


Fig. 13. Crossing with pointer c.1819 (source: Dutens 1819)

Wrought-iron combined plate/edge rail

As the 19th century wore on and the edge railway prevailed, tramroads became more and more of an anachronism. Sometimes they remained as tramroads to the bitter end, even well into the twentieth century. Sometimes, sooner or later, they were converted to edge railways in one fell swoop. But on occasion, although modernisation was inevitable, the cost and disruption of wholesale and simultaneous conversion was too great to contemplate. In such cases there were two options. One was to fit the waggons with special wheels which could run on either plate or edge rails; once this was done, the track could be relaid at comparative leisure. The other was to lay combined plate/edge rails which could carry either type of waggons; and the waggons could then be converted at leisure.

It has been suggested that the first use of combined rails was in 1836[61] on the Rumney Railway, but the first certain instance was at Ticknall in Leicestershire where a 'rim and tram rail' was introduced in 1839.[62] It resembled an extremely wide (6½in) plate rail with a massive flange 1¾in wide for the edge rail wheels to run on. In South Wales problems centred on the MCC lines to Newport and their connections, which totalled 103¼ miles of interconnected tramroads and carried extremely heavy traffic. A suggestion in 1840 that dual-purpose track and waggons be introduced fell on stony ground,[63] but in 1849 matters came to a head. The company tried to insist that the traders convert their 4,161 trams immediately to standard gauge, and the outrage was only mollified by a compromise agreement that dual track be introduced with a 4ft 2in tramroad gauge and a 4ft 8½in edge rail one.[64] The result was a wrought-iron plate rail, ribbed underneath and

---

[61] *Railway Magazine* Apl 1909, 272
[62] Hadfield and Clinker 1958, 62; specimen in Science Museum
[63] NLW Tredegar III 57/136, quoted by Kidner 1993
[64] Parliamentary Papers 1850 xxxi, 179-99

with a raised edge rail rather like bridge rail on the outside.[65] Dowlais also used a similar but unribbed version known as the Guest rail **(Fig. 13a)**.[66]

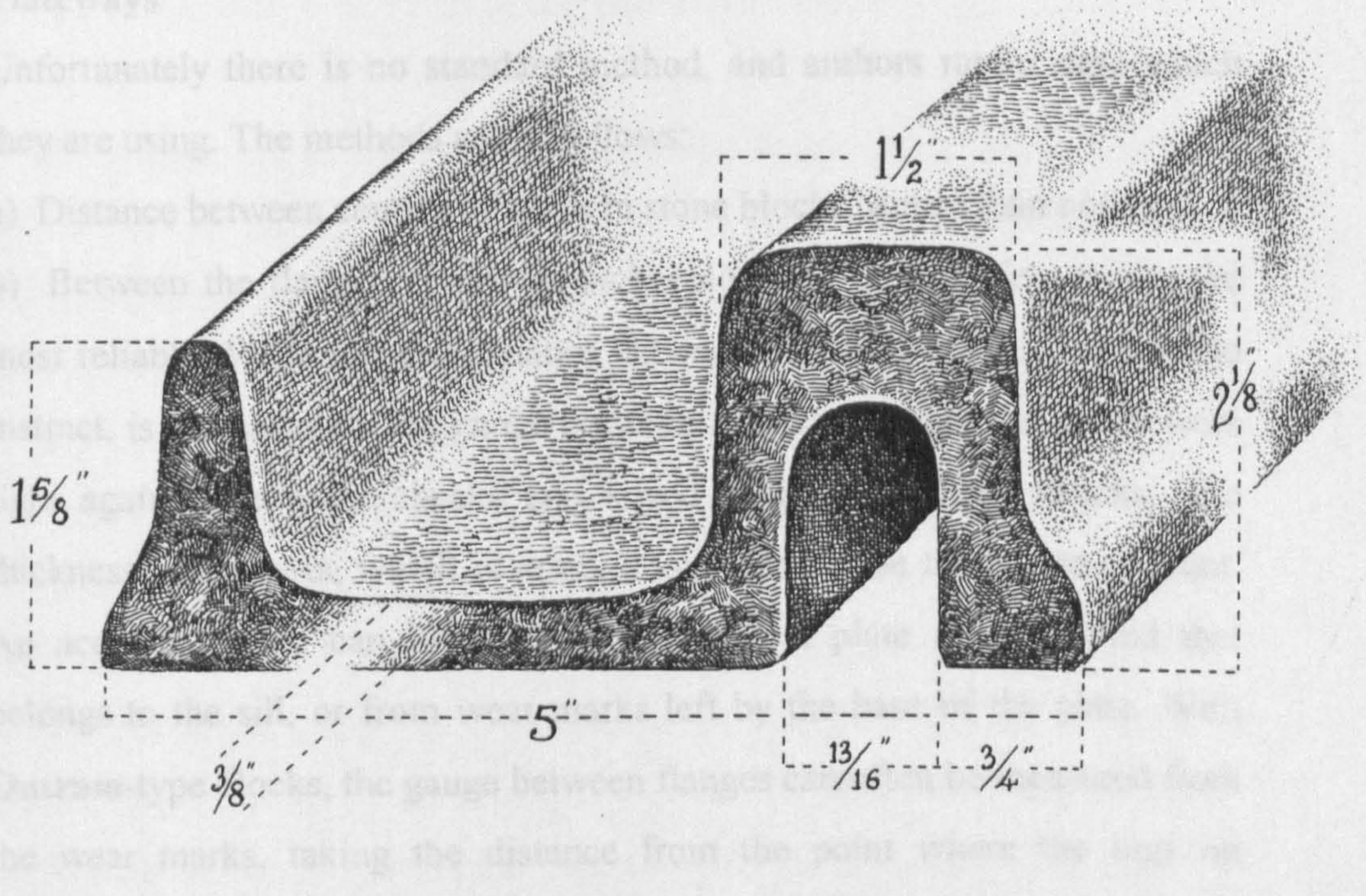


Fig. 13a. Combined plate and edge rail (Guest rail) from South Duffryn (070 031) (Lewis collection)

METHODS OF MEASURING GAUGE

Railroads and railways

a) Between the rails; the standard method.

b) Wheel gauge, measured over the wheel flanges; it will be somewhat less than (a).

---

[65] Macdermot 1931, vol. 2, 112
[66] Marshall 1938, pl. 73

c) Centre-to-centre gauge, measured between rail centres; this was not uncommon in early days in North Wales where wheels were double-flanged and floated on the axle.[67]

Plateways

Unfortunately there is no standard method, and authors rarely state which they are using. The methods are as follows:

a) Distance between centres of holes in stone blocks. Better than nothing.

b) Between the flanges. From the archaeological point of view this is the most reliable. With **sills** the distance between the inner cheeks, contrary to instinct, is not normally the gauge between flanges, because the plates were tight against the outer cheeks and keyed against the inner cheeks. The thickness of the keys, which is rarely known, has to be taken into account. An accurate figure can however be found if a plate is discovered that belongs to the sill, or from wear marks left by the base of the plate. With **Outram**-type blocks, the gauge between flanges can often be measured from the wear marks, taking the distance from the point where the lugs on adjacent rails meet. If wear marks are not available, a reasonable guess can be made by measuring between the holes and subtracting 3½ or 4in. But in both cases caution is needed, because stone blocks can shift.

c) Over the flanges. This is normally 1½ or 2in greater than (b), but smaller than the wheel gauge because there is usually a fillet in the angle of the flange and the tread to keep the wheel from rubbing against the flange. Outram in his 'Minutes' notes that a gauge of 4ft 2in between the flanges equates to a wheel gauge of 4ft 6in. Since the gauge over the flanges would be about 4ft 4in, this implies 1in play for the wheels on each side. But the play varied greatly. The Severn & Wye byelaws of 1811 specify a gauge between wheels of not more than 3ft 6in, which with no significant play just matches the 3ft 4½in between flanges. What is more, gauges could increase

---

[67] Lewis 1995

with time. On the Severn & Wye the wheel gauge, and the gauge over flanges, ended up at 3ft 8in.[68] Archaeological evidence from stone blocks needs careful consideration.

The archaeology of railroads and tramroads

Engineering features such as embankments and bridges are usually self-evident, unless hidden in dense undergrowth in valley bottoms; but most of the quarry lines are on open hillsides where vegetation is not a problem. It is often possible to determine the outline of a quarry's development, even from a date before large-scale Ordnance Survey maps are available, by relating the trackbeds to quarry faces and tips. By far the most revealing and rewarding target of fieldwork, however, is permanent way. Stone blocks, having no scrap value, survive in considerable numbers, mostly more or less *in situ* but occasionally built into nearby walls. A great deal of information can be gleaned from them, making allowance for the fact that they may have shifted somewhat. A longitudinal run will give the rail length, and blocks on both sides will give the gauge. They often bear marks which point to the track employed: depressions deliberately cut to accommodate the rail or chair, impressions worn by the track under traffic, rust marks left by the iron. From the shape and size of these marks much can be deduced. If there are no holes for spikes, the block was almost certainly occupied by a sill; single spike holes are a pointer (though not an infallible one) to notched plates of Outram type; and so forth.

Actual rails, sills and chairs are of course more useful still. They may occasionally be seen by eye, one corner exposed among the compressed ballast. But much more frequently they are buried, to be located only by metal detector. Surprisingly often they were overlooked when the line was

---

[68] Paar 1973, 38, 120

scrapped and survive intact; but equally often they are fragmentary, having broken in service and been cast aside. Even if the trackbed has been tarmacced it is still worth sweeping the banks or ditches to the side in search of such rejects. It is from fieldwork of this kind that much of the core material for this study has been assembled.

Engineering

In some aspects of early railway engineering our quarry railways incorporated little or nothing that was innovative or outstanding, and there seems little point in attempting to paint an outline of the national picture, as we did with track, if nothing new can be added to it. Overviews of the subject are readily available.[69] This section, therefore, while at least mentioning the different kinds of engineering works, will concentrate on those to which South Wales and especially the quarry railways did make a particular contribution.

Gradient and horse power

The first consideration was ease of gradient, which in general was maintained by following contours. Nonetheless there are some surprisingly steep tramroads, and railways in the quarries themselves, being of a more temporary nature, were not subject to the same careful engineering as the permanent lines leading to them. A few instances of ordinary practice must suffice. On the Sirhowy Tramroad the average gradient was about 1:288,[70] on which one horse drew 10 tons 2cwt downhill and brought the empty trams back, 'a performance which far surpasses that usual on the tramroads of South Wales.'[71] In 1818,

> upon a well made Tram road in Wales, four middle size draught horses value about £20 each draw regularly 24 tons

---

[69] Lewis 1970, 144-62; Baxter 1966, 59-73; for South Wales, Hughes 1990, 316-30
[70] Cumming 1824, quoted in Tasker 1992, 13
[71] Oeynhausen and Dechen 1971, 65

> 8 miles and back 8 miles empty on a declivity of about 1/3rd of an inch on a progressing yard [1:108] on waggons carrying 2¼ to 2½ tons each.[72]

The Blaenavon Railroad rose 610 feet in 5½ miles,[73] an average gradient of 1:48. In planning the Hay Railway, in 1810 William Crosley proposed a ruling gradient to the summit of 1:66, over which one horse would draw one ton. In 1811 Hodgkinson proposed a gradient of 1:158 which would allow one horse to draw three tons.[74] The Kington Railway, an extension of the Hay Railway completed in 1820, adopted the steeper gradient of 1:66 over its first 3¾ miles.[75] Although these examples are all drawn from South Wales, the range of roughly 1:50 to 1:300 seems typical of Britain as a whole.

Bridges and earthworks

Bridges were used almost exclusively to cross rivers and streams, not roads, and in general were not an important part of early railway engineering. The smallest are often only culverts through an earth bank, and ordinary bridges were few and undistinguished. The occasional exceptions like the two sizable spans carrying the Penydarren Tramroad across the Taff only prove the rule. There were a few impressive but low stone viaducts, such as that of 1826 at Basseleg on the Rumney Railway with four arches, and that of 1802-5 at Risca on the Sirhowy Tramroad with 32 arches, now demolished. Timber was perhaps the most common material, being used for example on a number of very large viaducts on Tyneside and quite extensively in South Wales where, on the tramroads of the Swansea valley, 22 out of 26 river bridges were of wood.[76] Iron bridges were fewer still, but the quarry railways

---

[72] Guy and Reynolds 1999
[73] Oeynhausen and Dechen 1971, 65
[74] H&WCRO, John Hodgkinson's Report 30 September 1811. When the line was built, neither proposal was adopted and the actual gradient was 1:117 (van Laun 1976)
[75] van Laun 1988
[76] Hughes 1990, 326-8

did generate some very important ones which will be dealt with in the appropriate places.

Among the best embankments in South Wales are those on the Llanvihangel, Grosmont and Hereford Railways dating to between 1812 to 1829, which were built with Hodgkinson's usual thoroughness; and his cutting on the Hereford at Howton (419 299) has a depth reminiscent of the Railway Age. Something of a speciality of the region was the causeway, in the sense of a stone-faced embankment, with impressive examples on the Brecon Forest Tramroads, at Ebbw Vale and at Hirwaun.

Tunnels

The earliest purpose-built railway tunnel, apart from underground workings, was a very short one at Landore near Swansea, driven in 1762 to give access to a quay on the river. Perhaps the next was the 100 yard one on Outram's Peak Forest line of 1796. This he followed with three on the Ticknall Tramroad of 1803. The first of significance, 1000 yards long, was on the 1809 Bullo Pill Tramroad in the Forest of Dean, engineered (like the 674 yard Talyllyn Tunnel of 1812 on the Hay Railway) by Hodgkinson.

Almost all the South Wales ironworks were well placed for reasonably level running to their quarries. The main exceptions were Blaenavon and Clydach. The difference in level at the latter was overcome by an incline. But at Blaenavon the early line from Tyla quarries, 4km long, climbed 82m before falling about 25m to a staith above the ironworks, and the advantages of a tunnel through the mountain must have been apparent from the time the quarries were opened. In the event, a pre-existing mine working was extended and completed for through running about 1817, which reduced the climb to only 18m and shortened the distance by around 1km. At 2.4km this was the longest tramroad tunnel ever built; but in 1832, to save a very

circuitous journey by surface railroad, the Harfords linked their works at Ebbw Vale and Sirhowy together by a 2km tunnel through Cefn Manmoel.

Inclines

Where the gradient was in favour of the load, a variety of inclines were used

Plate 1. A 'traveller' on the restored incline at Vivian Quarry, Llanberis

to overcome steep falls. In moderate cases they might be worked by horse or locomotive, but for steeper drops the balanced or self-acting incline was favoured, whereby the weight of full waggons descending on one side pulls up empties on the other. The two runs of vehicles were connected by rope or chain passing at the incline head round a braked sheave, which could be mounted either horizontally or vertically. The former arrangement seems to have been the more common.[77] Inclines were rare in the North-east, but more numerous in Shropshire; and there at Ketley in 1788 the first

---

[77] The literature on inclines is sadly limited. For typical North-eastern practice see Mountford 1966. For the vertical sheave or drum see Curr 1797, pl. 3 and Bick 1994, 2, 21

successful canal incline, for carrying boats on rails, was built by the local ironmaster William Reynolds.[78] Reynolds is also our best evidence for the first self-acting incline in South Wales, built at Cyfarthfa Ironworks in 1794. This had double track for two 'travellers' or cradles with level decks for the waggons, and a horizontal brakewheel with two guide sheaves for the chain in front.[79]

From this time, with the spread of railways, inclines began to proliferate. A single-track incline for coal to the furnaces, 900 yards long with a passing place halfway, was proposed at Aberdare in 1800.[80] In 1802-3 Svedenstierna gave a full description of a similar but double-track incline:[81]

> From one of these mines, barely half a mile from Pontneath Vaughan, coal was brought down on a railway, which crossed over the highway, and ended at a place where the waggons were sent down an inclined plane to the bank of the canal, with a very simple machine. This machinery consisted of a horizontal roller, around which a double rope was wound, and a double railway, a couple of hundred yards long and inclined at 40 degrees. When the loaded waggon, which held a chaldron of coal, or an equal weight in ironstone, came from the mine, it was hooked fast on one end of the rope, and brought on to the inclined railway and then not only itself ran down by its own weight, but also pulled the empty waggon, which was fastened to the other end of the rope, up again. In order to moderate the speed, the end of the roller was braked by an iron brake shoe, which could comfortably be done by one man.

There was an incline on the Blaenycwm Railroad in 1802 (266 006 to 268 004) which had teething problems. At first a chain was used, but its dead weight appears to have stopped the waggons running freely. Rollers were used, but the friction of the chain could only be overcome by greasing. Eventually a rope was recommended.[82] The continuous chain, with sheaves

---

[78] Tew 1984
[79] Hughes 1990, 108
[80] BRL (Journal)
[81] Svedenstierna 1973, 49
[82] Gordon Rattenbury unpublished MSS, quoting PRO RAIL 500/44

at bottom as well as top, was also to be found, as at Crumlin, probably on the short Phillips' Tramroad which carried coal from Trinant to MCC.[83] Trams ran over the brake engine, which was 10 yards behind the incline head, and the bottom sheave pit which was 5 yards from the foot. Rollers supported the chain at 14ft intervals with an extra one added at the incline brow. The gradient was only 1 in 13.[84] A good part of a horizontal rope-worked brake engine, set in a cast-iron frame below ground, survives from the 1840s at Hill Pits, Blaenavon, and details have been published elsewhere.[85]

The powered incline, where the gradient was against the load, was much less common. The first was built in 1791 on the Shropshire Tub-boat Canal at Wrockwardine, which was followed by several more in Shropshire.[86] In South Wales, perhaps the earliest steam-powered incline was installed in 1803 on Tappendens' Tramroad incline between the Neath Canal and Aberdare and powered by a Trevithick engine. A much later instance was the Ynysgedwyn incline in the Swansea Valley, built about 1832, which was strictly a balanced incline with a steam engine for raising the occasional load.[87] A rotary beam engine drove large sheaves for the ropes in much the same way as the Middleton engine on the Cromford & High Peak Railway. These examples may help to fill in the background to the inclines which will be met with in subsequent chapters.

Staiths

Staiths for transferring bulk materials between any transport systems were of two types, the 'stockpile' staith and the loading staith. The former was used for dropping materials from a higher to a lower level, where they were re-loaded; those at Blaenavon and Twynau Gwynion will be described in later

---

[83] 213 985 to 209 997
[84] Combes 1845, plate xxxiii
[85] van Laun et al 1979
[86] Lewis 1970, 289
[87] Hughes 1990, 109-111

chapters. The loading staith was for direct transhipment, like the typical and age-old Tyneside loading staith, a massive timber structure on the river side onto which waggons with bottom-opening doors were run at high level and emptied down a chute into the ship's hold.[88] Elsewhere, as at Landore,[89] there was a simpler wooden platform supported on stilts over the river. At the end was a gallows to which the back of the waggon was secured by two chains. A winch lifted the rear wheels off the rails and the coal was shot through a door in the front, down a chute and into the waiting barge.

Weighbridges and houses

Weighbridges were almost universal. The B&A company weighhouse at Goytre wharf, although for road vehicles, must have been typical of those to be found on tramroads **(Fig. 14)**. The two-storey building is in two parts, the living accommodation comprising one downstairs room with a bedroom over, and a further room over the 'office.' A single-storey wash-house adjoins. A door leads into the main accommodation with a separate door to the 'office.' A ticket window lay on the south, but the main viewing window looked onto the weigh-bridge. The arm of the mechanism passed through an arch under the viewing window into a cellar beneath the office. The weighing machine came from Whitmore & Son of Birmingham in 1812 at a cost of £103 2s 6d, and was probably capable of weighing 5 tons.[90] The size of its deck is not known, but on railroads and tramroads the deck was sometimes little wider than the total width of the track: on the Surrey Iron Railway it was around 6ft 6in long by 6ft wide,[91] and on the 2ft 3in gauge Banwen Railway of 1847-8 it was 3ft 3in by 3ft 4in.[92]

---

[88] Lewis 1970, 161
[89] In 1796, shown in Lewis 1970, pl. 55; a few years later Svedenstierna 1973, 44 reports waggons here with bottom doors
[90] B&A Committee Minutes 17 September 1812. For type see Minutes 21 September 1809
[91] Dutens 1819
[92] Hughes 1990, 183-4

Fig. 14. Weighhouse at Goytre Wharf (3131 0632)

A much larger deck, however, which survives at Govilon (2721 1366, almost certainly from the B&A-Llanvihangel Railway wharf) measures 6ft 0¾in by 7ft 1½in for a gauge of 3ft 3½in between flanges or 3ft 5½in over the flanges. The wheelbase of the trams would be around 3ft. Possibly this deck was made so much larger to weigh road as well as tramroad vehicles. An interesting feature is that on one end the rails curve slightly inwards to help locate the tram wheels. It is likely to be part of the machine installed in 1804.[93]

Waggons and trams

RAILROADS

In South Wales, railroad vehicles were normally referred to as waggons, as distinct from trams on plateways. Coxe noted in 1798 that the Blaenavon 'cars' 'from the solidity of their structure, and the quantity of iron used in the axle trees and wheels, when loaded weigh not less than three tons and a half; they are drawn by a single horse'.[94] At the same time Sir Richard Colt Hoare recorded that waggons on the Llam-march Railroad carried three tons.[95] But such loads proved too much. In 1813 the MCC committee heard

---

[93] B&A Committee Minutes 21 July 1804
[94] Coxe 1801, 231
[95] Thompson 1983, 97

that overloaded limestone waggons were passing from Trevil onto the Rassa Railroad: 'It appears that the enormous weight of three tons is carried on one set of wheels to the great injury of the Road. It is conceived that two tons and a half is as great a weight as should be carried in one Waggon.'[96] Seven years later the Trevil proprietors asked ironmasters to limit their loads to 2

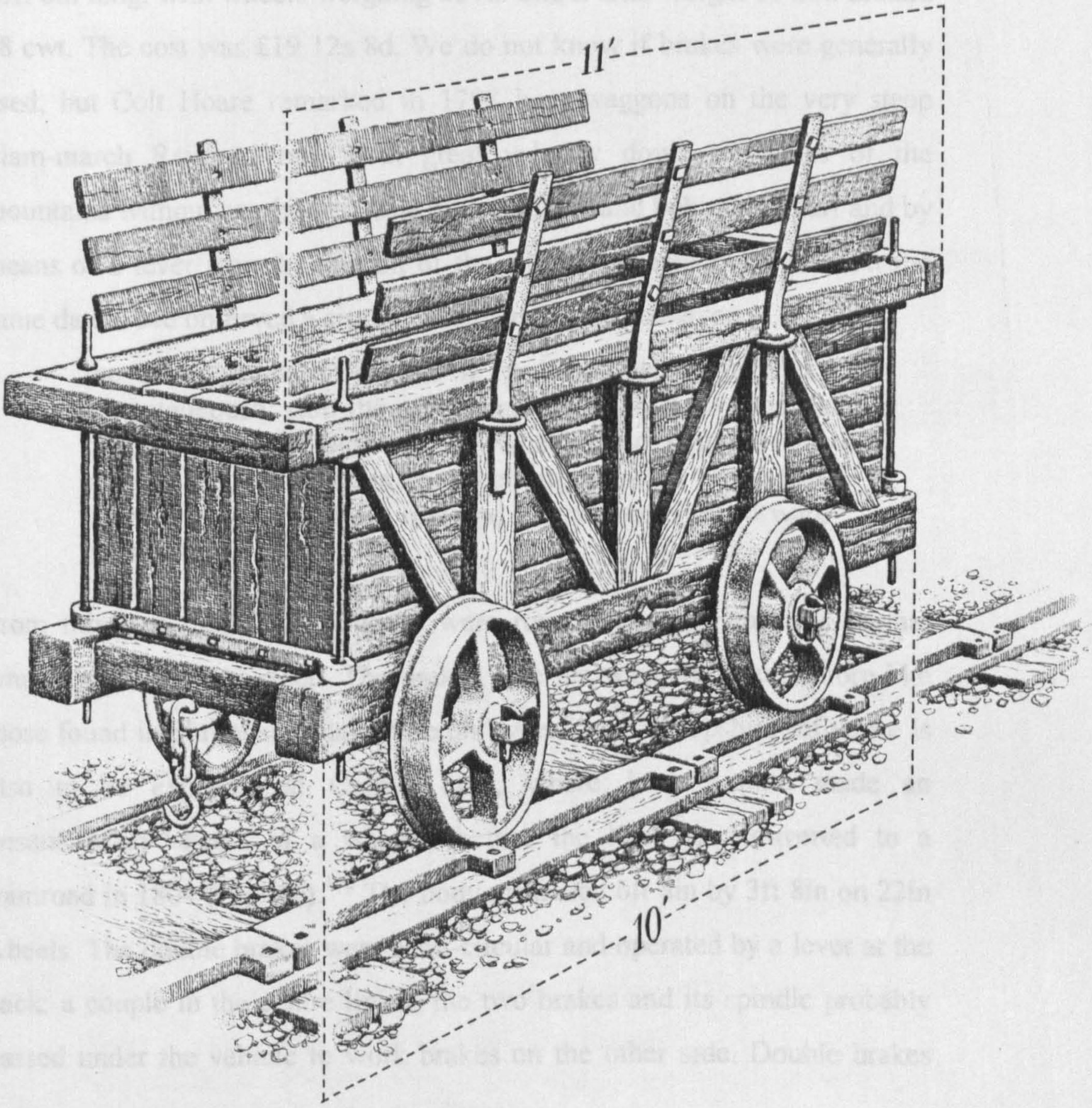


Fig. 15. A large Shropshire waggon, 1796 (re-drawn from Lewis 1970, fig. 46)

[96] MCC Committee Minutes 17 July 1813. See also GRO D1078.89

tons 18cwt. But more modest loadings are recorded earlier. In 1797 limestone was brought to the Ebbw Vale furnaces from Trevil in two journeys of four waggons carrying two tons each,[97] and in 1807 waggons were noted on the Clydach carrying about 2 tons 6 cwt.[98] The ancestor of these waggons may well be the large Shropshire type **(Fig. 15)**,[99] which was 10ft 6in long, with wheels weighing 337lb and a total weight of iron around 18 cwt. The cost was £19 12s 8d. We do not know if brakes were generally used, but Colt Hoare remarked in 1798 how waggons on the very steep Llam-march Railroad ran 'with great velocity down the sides of the mountains without any horses. One or two men stand behind the cart and by means of a lever stop the motion of the wheels instantaneously.'[100] At the same date Coxe observed a similar arrangement at Blaenavon:

> the driver stands on a kind of footboard behind, and can instantaneously stop the car by the means of a lever and a drop, which falls between the wheels, and suspends the motion. In places when the declivity is more rapid than usual, the horse is taken out, and the car impelled forward by its own weight.

From this it is clear that waggons were run down singly, as was normal where gradients were steep. The brakes, like the waggons, sound more like those found in Shropshire than those on Tyneside.[101] Shropshire influence is also to be expected at Caldon Low, where John Rennie made an unsatisfactory sketch of a waggon before the line was converted to a tramroad in 1804 **(Fig. 16)**.[102] The body measured 6ft 8in by 3ft 8in on 22in wheels. The double brakes were semi-circular and operated by a lever at the back; a couple in the centre linked the two brakes and its spindle probably passed under the vehicle to work brakes on the other side. Double brakes

---

[97] Gray-Jones 1992, 51
[98] NLW MS 784A, 79-90
[99] Lewis 1970, fig. 46, 'Particulars of the Expence in making a Railway Waggon 1796'
[100] Thompson 1983, 97
[101] Lewis 1970, 271-2
[102] Lead 1990, 70

specified for use on the Clydach Railroad in 1794[103] were presumably similar to those at Caldon Low.

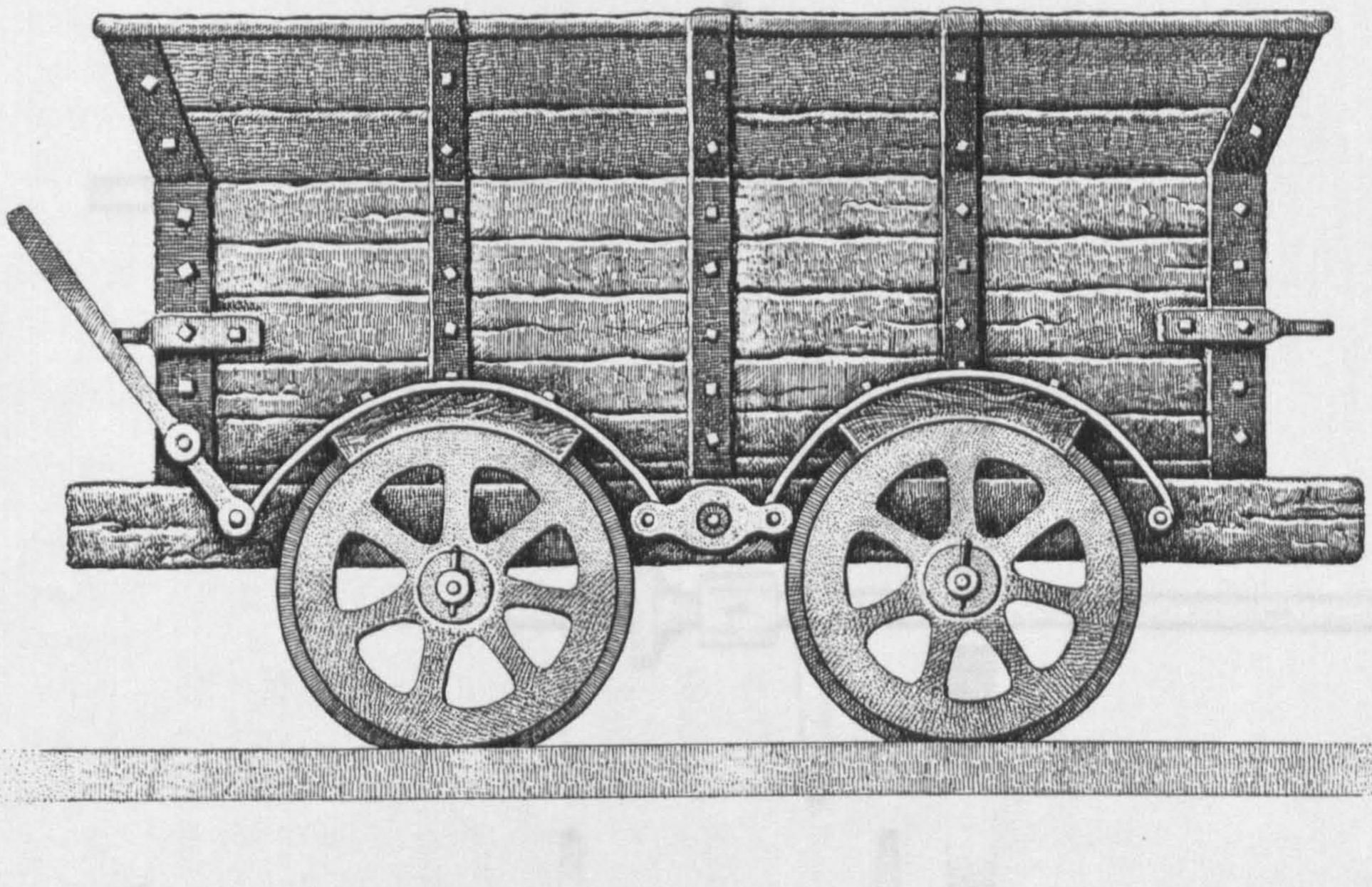


Fig. 16. Brakes on the Caldon Low Railroad (re-drawn from John Rennie's original, Lead 1990)

TRAMROADS

Curr's corves

The tram evolved from Curr's underground corves.[104] His were of two types:

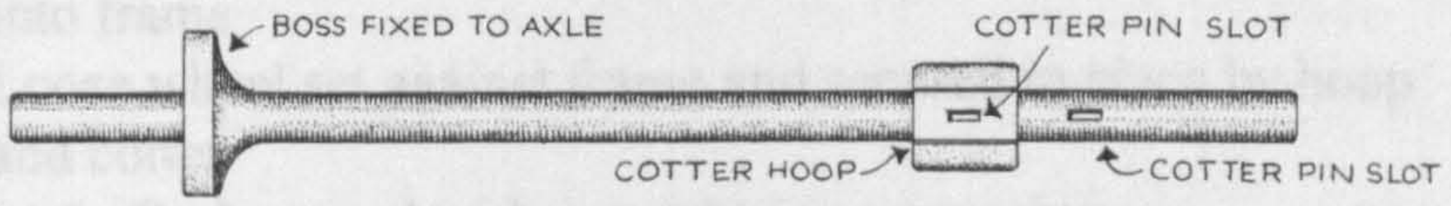
Type 1. Body: wood with wrought-iron strapping
Outside: length 40in, breadth 30in, height 21½in, height above rail 30in
Inside: length 38in, breadth 27½in
Wheels: cast iron, 13¼in diameter, weight 14lb 3oz, 8 spokes, outside frames
Axle: wrought iron, 2ft 7in long
Bushes: cast iron, rectangular, bored to take axle

---

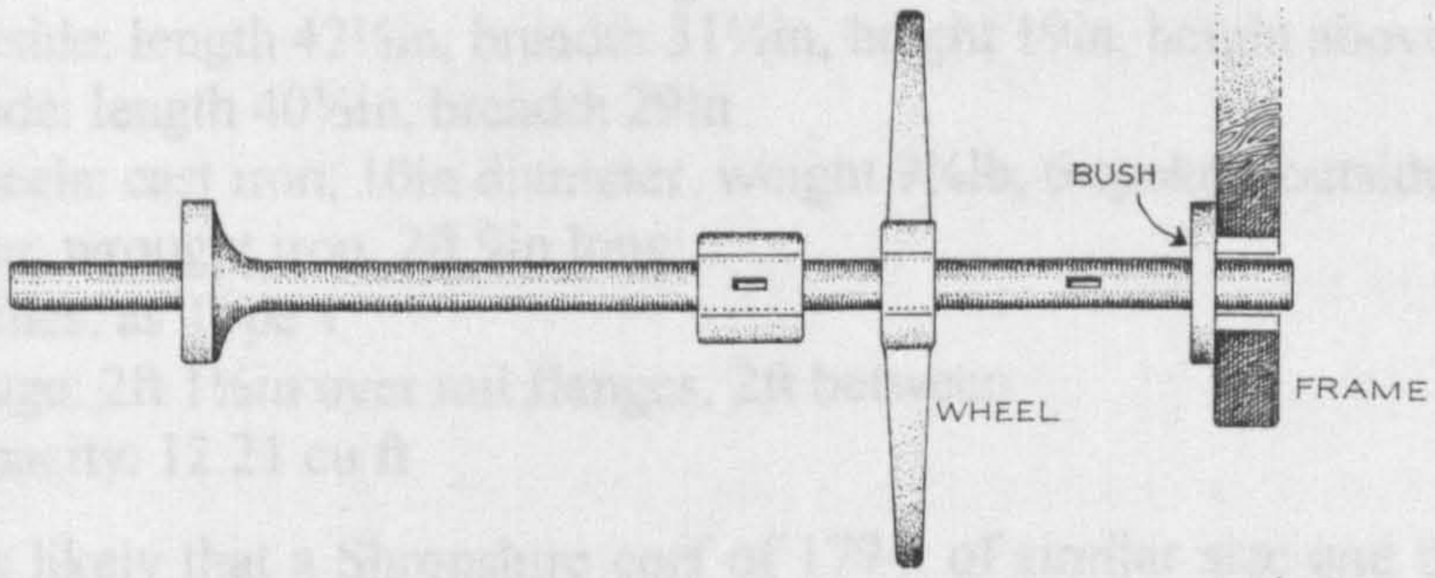
[103] Rattenbury 1980, 64
[104] Curr 1797

Gauge: 2ft over rail flanges, 1ft 10½in between
Capacity: 11.86 cu ft
Cost: £2 16s 6d

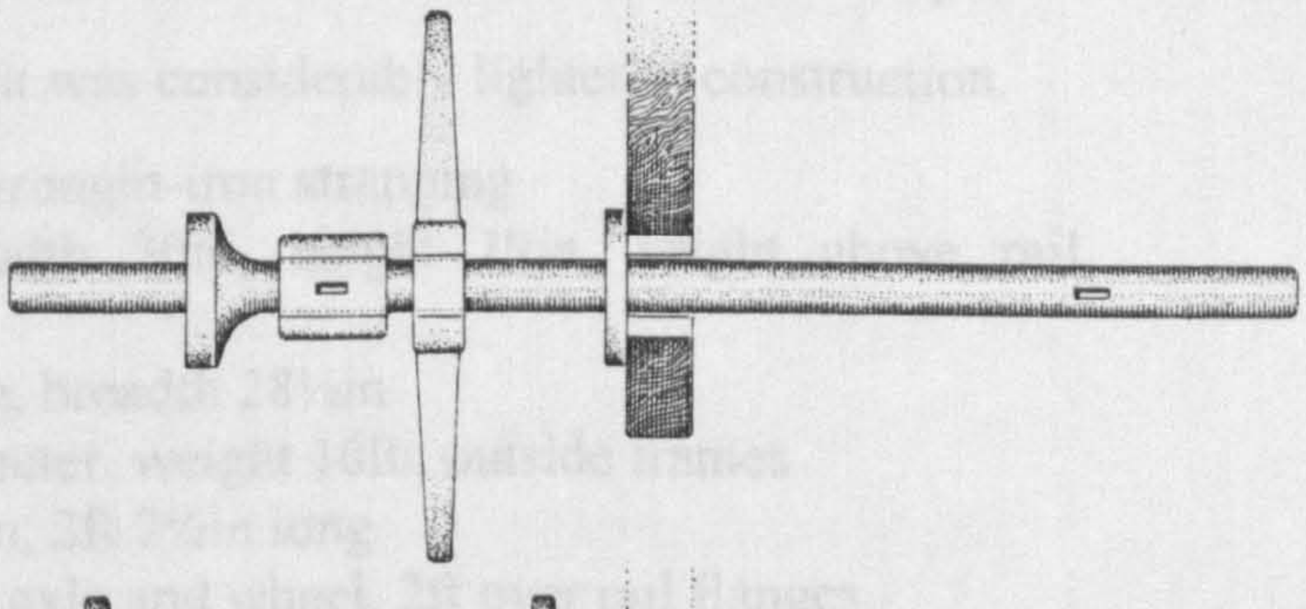
1



2

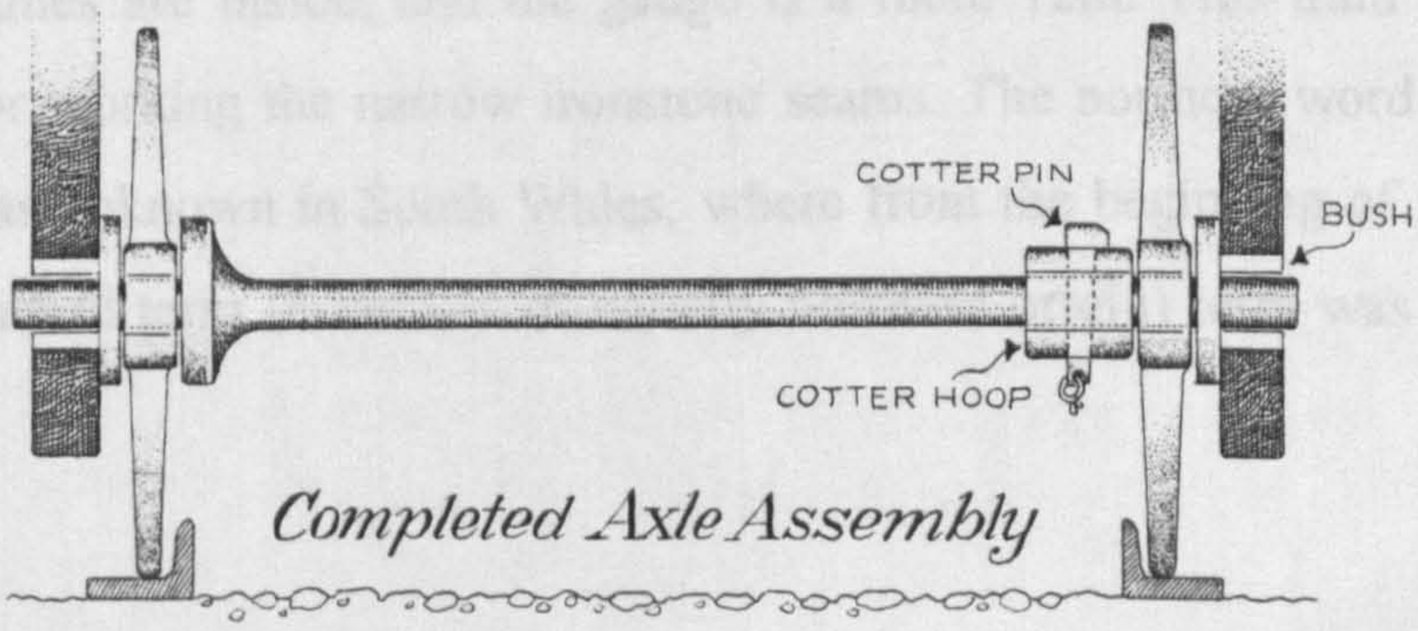


3



4

5



Completed Axle Assembly

Fig. 17. Method of assembling the wheels on Curr's corves

The inside wheels where fixed in a novel manner as follows **(Fig. 17)**:

1. Hoop run onto axle but not fixed by cotter
2. Wheels run onto axle, one sliding loose
3. Long end of axle run through bush to allow boss end to be let into frame
4. Loose wheel set against frame and secured in place by hoop and cotter

Type 2. Body: wood with wrought-iron strapping
Outside: length 42½in, breadth 31½in, height 19in, height above rail 26in
Inside: length 40½in, breadth 29in
Wheels: cast iron, 10in diameter, weight 9¾lb, 6 spokes, outside frames
Axle: wrought iron, 2ft 9in long
Bushes: as Type 1
Gauge: 2ft 1½in over rail flanges, 2ft between
Capacity: 12.21 cu ft

It seems likely that a Shropshire corf of 1794, of similar size and design,[105] was based on Curr's corves; but it was considerably lighter in construction.

Body: wood with minimal wrought-iron strapping
Outside: length 48in, breadth 30in, height 19in, height above rail unknown
Inside: probable length 46in, breadth 28½in
Wheels: cast iron, 10in diameter, weight 10lb, outside frames
Axle: probably wrought iron, 2ft 7½in long
Gauge: by calculation from axle and wheel, 2ft over rail flanges
Capacity: approx. 12.5 cu ft
Cost: £1 5s 2d

The closest parallel to a Curr corf found in South Wales is a tram recovered in 1966 from a Rhymney ironstone level.[106] This has a wooden body with wrought-iron strapping, 52in long, 16in wide and 22in high above the rails. The frames are inside, and the gauge is a mere 12in. This tram would be ideal for working the narrow ironstone seams. The northern word 'corf,' in fact, was unknown in South Wales, where from the beginning of plateways the standard term (curiously of equally northern origin) term was 'tram' or 'dram.'

---

[105] Shopshire Record Office, Labouchere Collection: 'Particulars of the Expence of a Corve'
[106] Rees 1969, fig. 10

The surface tram

Curr foresaw that his 'roads and corves ... might ... be extremely serviceable to sundry large lime works in Staffordshire and Shropshire.' His prophesy came true for South Wales as well, as this study sets out to show. Trams for limestone were different from those for coal, iron or slag. For instance an experimental slag waggon, built in 1800 at Neath, was made of fire-resistant iron rather than wood; because of its very low tare weight (4½cwt) it was limited to carrying 10 cwt.[107] In 1831 Thomas Brown of Blaina stated that 'the trams used for conveying our iron to the [B&A] Canal are not adapted to carry limestones, but return empty from the wharf ... We employ a distinct set of men, horses, and trams, to convey the limestones to those employed conveying iron.'[108] Iron pigs were probably carried on flat trams with uprights, and by 1821 the Sirhowy Tramroad carried rod and bar iron on long bogie waggons with eight or twelve wheels.[109] Trams for coal and ironstone, which have a lower density than limestone, would be larger than limestone trams; indeed trams from the Penderyn quarries tended to have lower sides.[110] But in terms of dimensions the most important consideration is that the wheelbase should be long enough for only one wheel to bear on a plate at any one time.

The original wooden construction gave way to iron. George Overton wrote:[111]

> Among such as are made of wood, designed for use both underground and above, I have found none equal to those which are constructed with sides one foot upright and nine inches upon that to bevel a little outwards ... I have ever since adhered to the same shape and form, but have substituted iron instead of wood, using gunnel iron for the sills (which gives strength not to be obtained by the use of common bars), flat iron for the straps of the same

---

[107] BRL Journal
[108] *Monmouthshire Merlin* 12 March 1831
[109] Reynolds 1996, Lewis 1996
[110] Hughes 1990, 176-80
[111] Overton 1825, 48 (quoted in Hughes 1990, 177-8)

> description as those used for the wooden ones, and plate iron, one eighth of an inch thick for the sides and bottom. Ten years ago [1815, the date of the Brinore Tramroad] the Penydarren Company made me two hundred trams of this sort in one lot; and although somewhat worn, they are still as good for every purpose of practical use as they were at first.

As well as Overton's plate-iron bodies, coal and limestone could be carried in openwork bodies built up of riveted wrought-iron strips which kept the tare weight down and were quite adequate for containing lumps.[112]

It appears that the capacity of trams was less than that of waggons, though it was very variable. Evidence given to the Royal Commission on the Employment of Children in 1842 suggests that trams carried just over one ton of limestone. Those which supplied Rhymney from Trevil in 1835 carried between 1 and 1½ tons.[113] Limestone trams on the Hay Railway in 1832 had a tare weight of around 11 cwt and carried loads of 28 cwt,[114] well within the total permitted load of 50 cwt. In 1821 the weight carried on the Brinore was limited to 30cwt but increased to 40 to 45 cwt in 1835 on improved track.[115] All these were on a gauge of 3ft 4in.

We know virtually nothing of how limestone trams were emptied at the furnace. But at the quarries most spoil tips grew lengthways and must have been created by rubbish trams with end doors, emptied perhaps by being run against a balk. There is however a photograph of 1905 of wooden side-tipping trams at Morlais (east).[116] A wrought-iron end door was recovered in 1970 from the Blaenavon company quarry at Pwll du, and at Daren Cilau an

---

[112] Visible in photographs at e.g. Pwll du (Francis Keen Blaenavon collection) and Trevil (WIMM). Such a strip was recovered from Pwll du quarry in 1971
[113] Rattenbury 1980, 121
[114] H&WCRO (Hereford) N44/5, selection of weigh tickets. A Hay tram found at Dolyhir limestone quarry is illustrated in Rattenbury and Cook 1996, 76
[115] Rattenbury 1980, 7, 10
[116] Owen 1978

angled hinge for the rear door of a tram with raked sides which can be dated to between 1815 and 1829.[117]

It was a general rule that tram wheels were free-running, mounted on fixed axles and held in place by linchpins. The sideways play was considerable: on a late tipping tram of the Severn & Wye it totals 3½in. This float, which helps a tram around sharp curves, was evidently deliberate and explains why plate rail treads are so wide. Nor should we expect the gauge of a tramroad, especially an elderly one laid with Outram plates, to be perfectly constant. But, astonishingly, one application to a tramroad (Fayle's at Purbeck in 1813) is known of John Collinge's precision-made axle and boxes, patented in 1811. This was intended for fast running and was similar to the axle which the General Post Office insisted on for mail coaches from 1795.[118]

It has often been argued that the advantage of trams was that, with their plain wheels, they could be run off the track. Outram never contemplated this; he specifically stated that at Abergavenny Wharf trams should be lifted off the track and placed on a separate set of road wheels. Trams were always designed as specifically railway vehicles, and ordinary road vehicles were never used. Rather, one of the main factors in adopting tramroads was that the wheels were considerably lighter than on edge rails.

Control and braking

Gradient, both up and downhill, was so important that experiments on traction and braking were conducted in the Midlands as early as 1799.[119] With trams, braking methods were more variable and crude than on railroads. When the horse, as was normal, was harnessed to the tram by chains kept apart with a spreader, it could not contribute to the braking, and

---

[117] At 1962 1588 (24.7.96 in care of David Bick)
[118] Farey 1817, vol. 3, 297
[119] *Repository of Arts and Manufactures,* 1st series, xiii (1800), 167

either a slipper[120] or a sprag was applied. In the 1799 trials it was found that on 'a declivity of 1¾ of an inch at a yard [1:21] it is necessary to slipper or lock the wheels, the horse not being able to resist the increased momentum of more than three or four tons.' This suggests the use of shafts with a 'breeching' attached, against which the horse would brace itself. Shafts were not, however, common on tramroads, though they were evidently intended on the Gloucester & Cheltenham Tramroad[121] and the committeec waggon on the Peak Forest had detachable shafts for pulling in either direction.[122] In South Wales spragging was evidently the norm, whereby a bar was inserted between the spokes and jammed against the tram body. The wheel therefore skidded and ultimately wore a 'flat,' which could break plates.[123] Both slippers and sprags were used on the Severn & Wye Railway branches.[124] To stop trams running backwards, the last tram could have a wooden dagger attached, which normally trailed behind but dug in if the trams ran backwards.[125]

Haulage

Horse

Before the partial introduction of locomotives, haulage was by horse, although oxen were not totally unknown on railroads.[126] The initial cost and the maintenance of a draught horse were both considerable. In 1805 one authority suggests a purchase price of £30, with keep at 8s a week and depreciation at £2 a year.[127] Mules were cheaper — one was bought for

---

[120] As on the Peak Forest Tramroad: Lamb 1999, 32
[121] Bick 1987: original draft for the company seal
[122] Lamb 1999, 33
[123] On the MCC lines, 'a system of spragging having been adopted, the wheels have as many sides as there are holes in the wheel, instead of being round:' Parliamentary Papers 1850 xxxi, 184
[124] Paar 1973, pl. 1, 2 and 4
[125] Gotheridge 1971, 478
[126] Lewis 1970, 205, 276
[127] Duncomb 1805, 127-31

carrying limestone by Ebbw Vale in 1791 for 6 guineas — but while adequate as pack animals were little use for draught. Between 1796 and 1801 Ebbw Vale paid hauliers on the railroad from Trevil quarry to the furnace between 1s 3d and 1s 5d per long ton; one man who contracted to carry 1250 tons over the summer would have earned £88 10s 10d.[128]

Easy gradients represented a great economy in the use of horses; but the converse was equally true. Joseph Needham complained in 1833 of the gradient of the Trevil Railroad (about 1:62) on which one horse could take three tons of limestone down to Beaufort ironworks but only one empty waggon back.[129] Tramroads made even less effective use of horse power. A photograph of about 1870 shows three horses pulling five loaded trams from Penderyn, and downhill at that.[130] Anyone familiar with the waggonways of Tyneside, even a century earlier, would have been appalled. Small wonder, with such high overheads and such low efficiency, that mechanical replacement of horses was sought.

Other haulage costs

Capital costs, including engineering and permanent way, will be touched on in the Conclusions. But it is worth mentioning here that transport costs (excluding haulage) were less when ironworks owned their own tramroads, in which case in 1863 they were generally between 1d and 1½d per ton mile.[131] It was when tonnage had to be paid for the use of other parties' lines that they escalated. In 1793, for instance, Sirhowy, Ebbw Vale and Beaufort agreed to pay 5d per ton mile for carrying limestone on the Trevil Rail Road.[132] This, although a private concern, was built under the MCC act and should, strictly, have adhered to the MCC tonnage of 1½d. In addition, for

---

[128] GRO D.2472.3
[129] GRO D.1078.89
[130] Jones 1972, 73
[131] Gruner and Lan June 1863
[132] Rattenbury 1989, 455

the use of the Rassa Railroad, Ebbw Vale had to pay tolls to its owner, the MCC: to the tune of £471 in the two years 1810-12.[133] These high charges greatly increased the cost of limestone at Ebbw Vale, and were not reduced until 1828 when the Trevil company agreed a reduction to 3½d and the following year to 3d. The Trevil Railroad seems also to have favoured some ironworks over others, in 1826 charging Sirhowy only 2½d per ton mile which was further reduced to 1½d. The explanation may lie in the circuitous route which Sirhowy had to follow to reach Trevil Quarries. Another consideration was perhaps the threat of competition from the Trevil extension of the Sirhowy Tramroad, which charged the same 2½d per ton/mile.[134]

Locomotives

The development of the locomotive depended on the successful and safe use of high-pressure steam. Richard Trevithick was its major exponent and was the first to run a locomotive on a railway. This momentous event occurred in South Wales on the Penydarren Tramroad in 1804. Locomotive development then moved north: the first commercially viable engines were John Blenkinsop's on the Middleton Railway at Leeds from 1812, and on Tyneside the prolonged work of Hedley, Chapman, Buddle, Stephenson and Hackworth brought the locomotive to its triumph of the late 1820s. In South Wales, after Trevithick, there was possibly a Blenkinsop rack locomotive supplied to Nantyglo in 1813, one by William Stewart working on the MCC tramroads in 1816, and a Stephenson one at Llansamlet in 1819. Otherwise, all is silent until 1829 when two locomotives by Robert Stephenson & Co arrived: *Britannia* at Tredegar and *Eclipse* at Penydarren. Thereafter a whole succession of idiosyncratic engines, designed for the local conditions of heavy loads on steeply-graded plateways, was produced by local builders, notably the Neath Abbey Ironworks. But most were employed on the exit

---

[133] PRO C.114/124 (part 1) f. 158, Michaelmas 1810 to Lady day 1812.
[134] NLW MS 772E

tramroads, and only rarely were they introduced to the quarry lines before the 1850s and 1860s, by which time a fair number of tramroads had been replaced by edge railways.

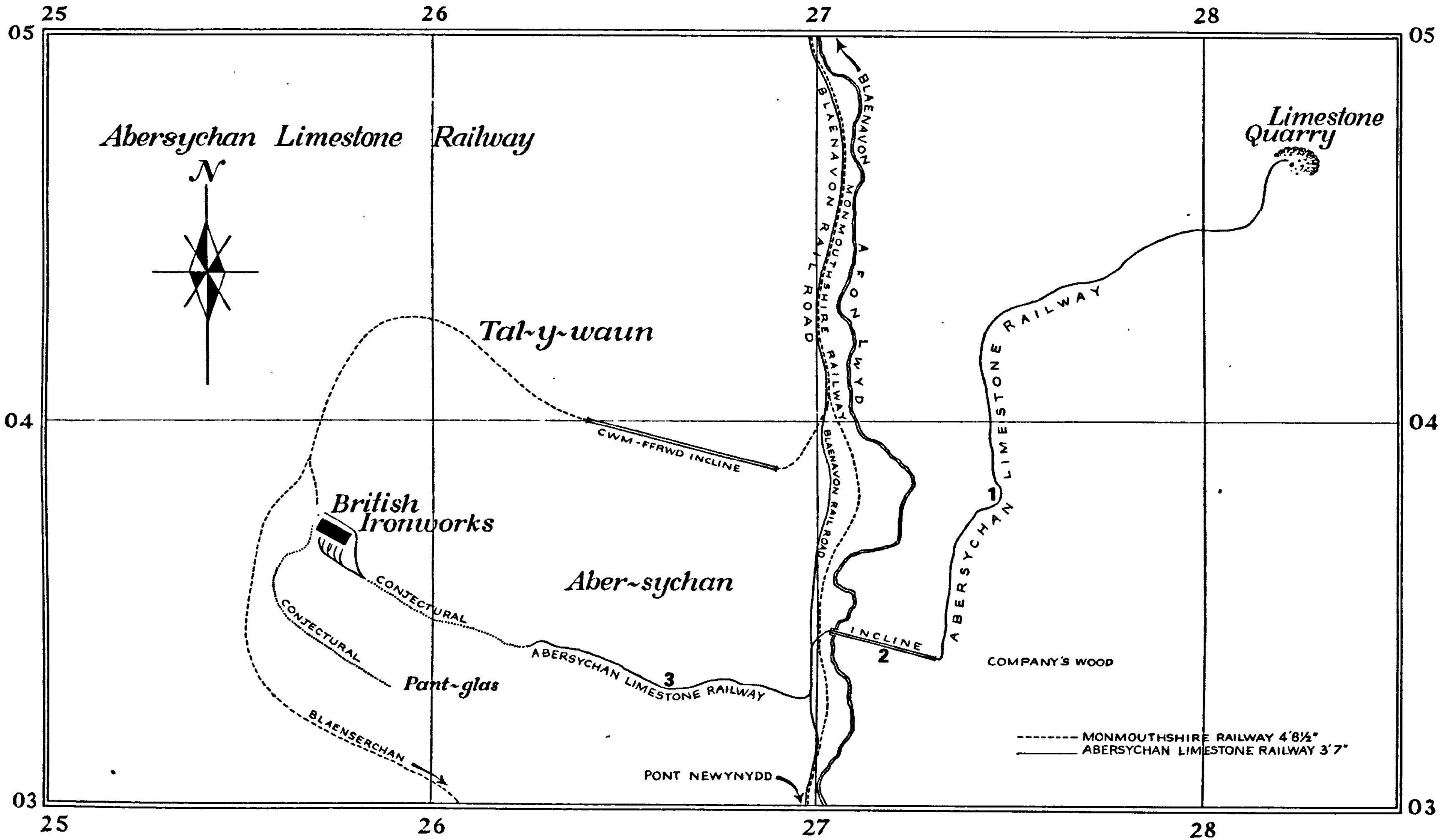
CHAPTER 3
ABERSYCHAN

About 1794 the Monmouthshire Canal Co built the Blaenavon Railroad from its eastern terminal at Pontnewynydd up the valley of the Afon Llwyd to the Blaenavon ironworks. Like all lines in South Wales at that time, it was an edge railway, the track consisting at least originally of the cast-iron bars[1] which Thomas Dadford was then developing. As time went by, the Blaenavon acquired a number of branches to adjacent ironworks and quarries. Hadfield (followed by Baxter) thought that it was converted to plate rail about 1829,[2] but the evidence is entirely to the contrary. The available sources consistently refer to the Blaenavon and its branches as railroads, specifically contrasted with the tramroads in most other places, right up to the time that it was converted to the standard gauge Monmouthshire Railway in 1854.[3] Furthermore, the MCC resolved to build a railroad from Pontnewynydd to Pontymoile in 1825 which would connect with the Blaenavon Railroad.[4] From Pontnewynydd up to Blaenavon, therefore, the valley remained plate-free territory.

In 1825 there arrived the speculative British Iron Co, which also had works in the Black Country, Denbighshire, Neath and the Swansea Valley. Up a side valley to the west of Abersychan it built furnaces which came into blast late in 1827,[5] and which were served by a branch off the Blaenavon Railroad whose route is now followed by the B4246. In 1852, however, the ironworks were sold to Ebbw Vale, which in 1858 replaced the original access by the new standard-gauge Twyn y Ffrwd incline. Although coal and iron ore were

---

[1] Wear marks on stone block at 2708 0371
[2] Hadfield 1967, 132; Baxter 1966, 198.
[3] Morris 1839; Parliamentary Papers 1850 xxxi, 186, 189.
[4] MCC Committee Minutes, 16 September 1825
[5] In 1827 the British sent out 113 tons of iron by the Monmouthshire Canal, in 1828 6478 tons (Scrivenor 1854, 127). For an outline of its history, see Colebrook 1983, 26.



MAP A. THE ABERSYCHAN LIMESTONE RAILWAY AND ITS CONNECTIONS

abundant nearby, there is no limestone to the west of the Afon Llwyd, and the British therefore had to obtain it from the east, where it opened the Abersychan limestone quarry in Cwm Lascarn and, to carry the stone down to the valley, built a railway of especial historical interest. Certainly in existence by 1830,[6] it is well-nigh certain that it was contemporary with the furnaces, which can hardly have had any other supply.

From the quarry the railway ran for rather more than a mile, falling over 200ft at an average grade of roughly 1:25, to a point high above Abersychan (**A1**). From here it dropped nearly 300ft in 300m down an incline (**A2**), now largely destroyed, to the valley floor. Of the river bridge a finely constructed stone abutment survives, reminiscent of cut-stone work at British itself, which curves round to join the route of the Blaenavon Railroad, now occupied by the A4043. Limestone traffic followed the railroad southwards for about 150m before branching west up the line to the ironworks (**A3**). By 1879-81 the quarry railway had disappeared,[7] and the latest date for its abandonment would be 1876 when British stopped producing pig iron. In fact it is difficult to see how it could have survived after 1854, when the conversion of the Blaenavon brought about a break of gauge at the junction. We know that the furnaces were idle during 1857-8 while the Twyn y Ffrwd incline was being built. It seems likely, therefore, that their limestone came in 1854-6 from stockpiles at the ironworks, and after 1858 from some more distant source via the new incline.[8]

Along the route of the Abersychan limestone railway, which is a public footpath through attractive woodland, a fair number of stone blocks still survive more or less *in situ*. From the holes and markings on them it has long been known that they carried neither plate rails nor cast-iron bars. Further

---

[6] Greenwood 1830, confirmed by Walker 1834
[7] OS 6in
[8] A possible candidate is the Graig quarry higher up the valley at 272 073, which had an incline to the railway

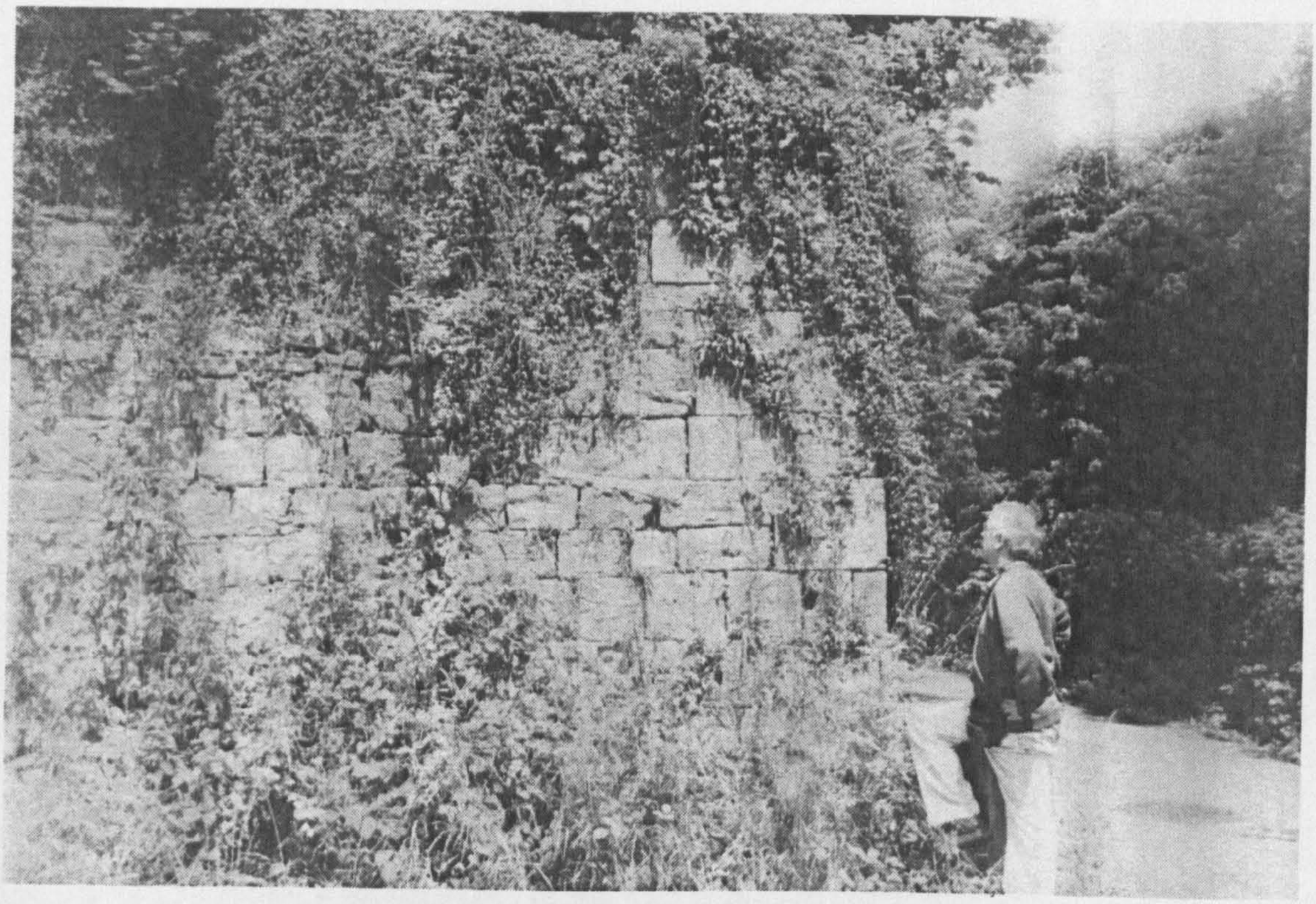


Plate 2. Remains of bridge leading into the Blaenavon Railroad

investigation has revealed that the track consisted, uniquely for South Wales, of wrought-iron fish-belly rails.[9] Three types of chair were recovered, and one length of rail **(Figs. 18, 20)**.

Type 1, with two specimens, both broken at one end. They are oval in plan and very light, and although the tops of the cheeks are broken off, the fractures took place where the cheeks were pierced by a transverse hole, of which the lower part remains visible.

Type 2, with one specimen, oblong in plan but with rounded ends. It was secured to wooden plugs in the stone block by wrought-iron pins 4¼in long. Again the cheeks are broken off, in this case along the line of two transverse holes.

---

[9] It is of course possible, even likely, that the line to British Ironworks itself had the same track, but nothing is known of its nature

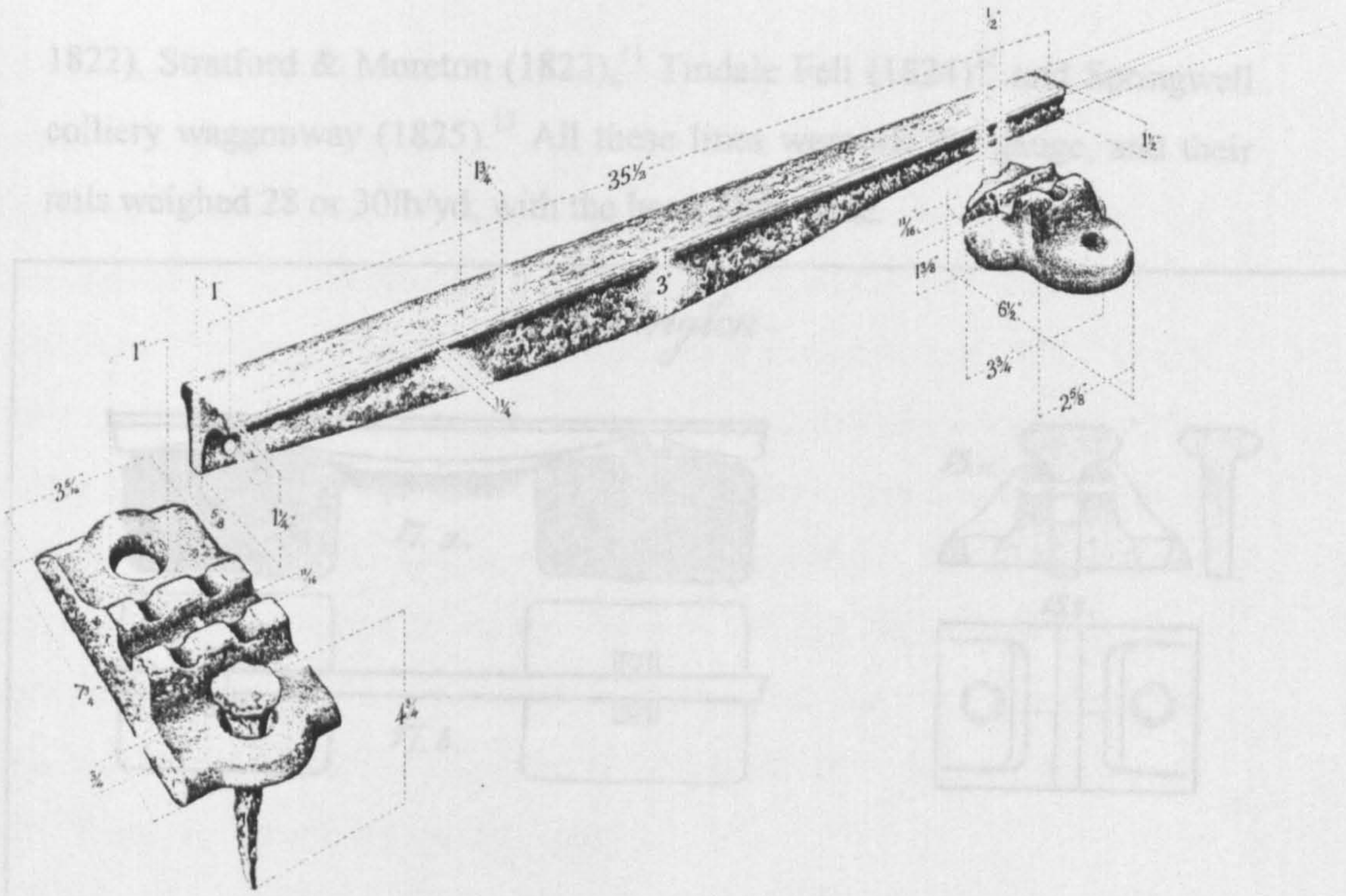


Fig. 18. Fish-belly rail and chairs from Abersychan Limestone Railway (279 045)

A number of blocks display narrow grooves, running longitudinally and deepening away from the chair marks, to accommodate wrought-iron fish-belly rail, of which a section nearly 3ft long was found. The distance between blocks for Type 1 chairs is consistently 32in, which is therefore the length of the belly. The rail was originally probably five or six bellies in length. It weighs 21lb/yd, and its head is 1¾in wide. One end has a hole through the web just short of the original butt end; at the other end the rail has broken at the next hole. It was held by cross pins which passed through the rail and both cheeks of the chair, one pin in ordinary chairs, two pins in the joint chairs which held the ends of adjacent rails.[10] Exactly the same arrangement applied on the Stockton & Darlington (**Fig. 19**, rails supplied

[10] Tomlinson 1914, 89, disproving the statement by Oeynhausen and Dechen 1971, 24, that there were two pins in the ordinary chairs as well as in the joint ones

1822), Stratford & Moreton (1823),[11] Tindale Fell (1824)[12] and Springwell colliery waggonway (1825).[13] All these lines were 4ft 8in gauge, and their rails weighed 28 or 30lb/yd, with the head 2¼in wide.

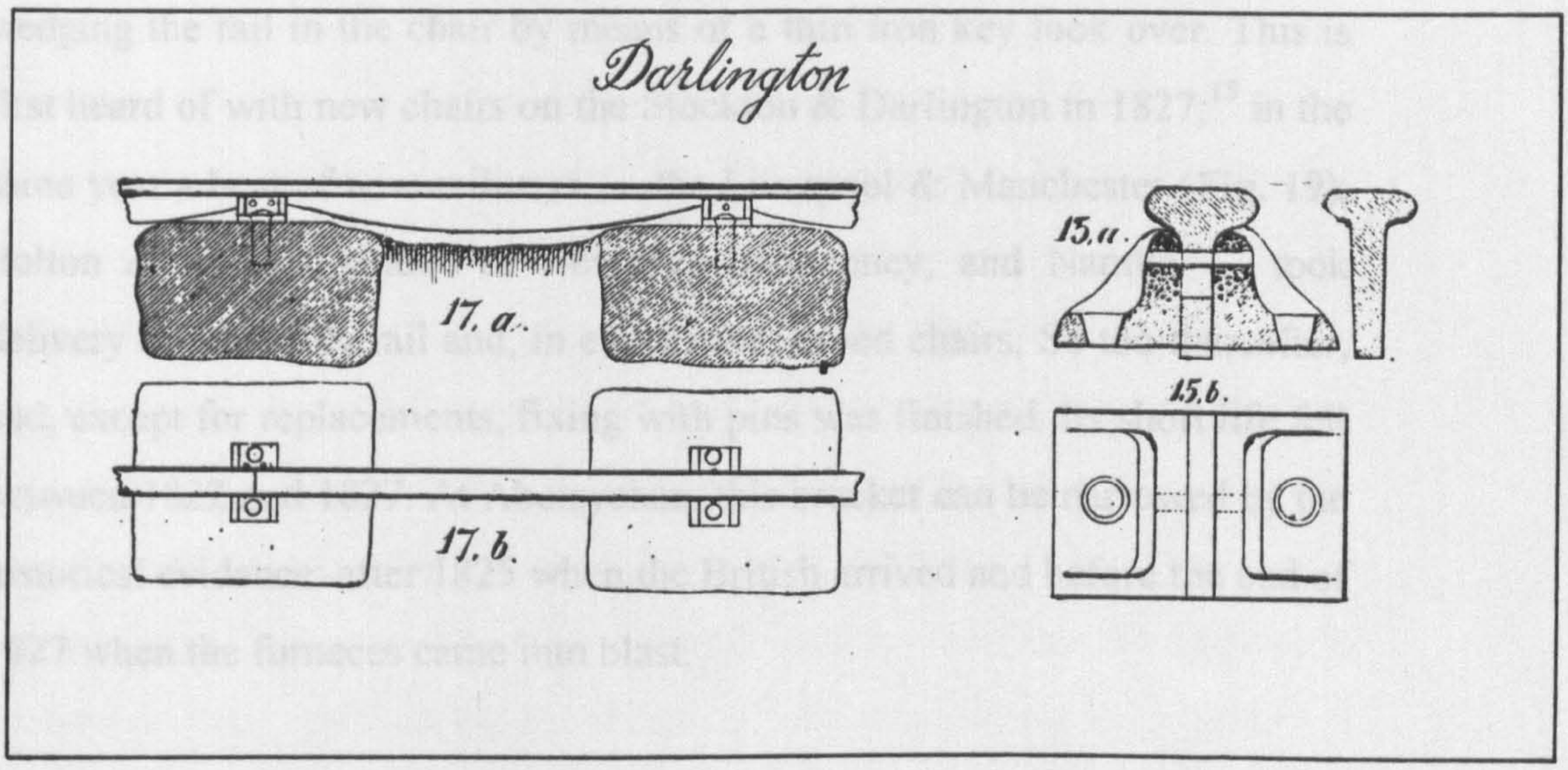


Fig. 19. Stockton & Darlington Railway and Liverpool & Manchester Railway fish-belly rails (source: Minard 1836)

---

[11] Norris 1987, 17 and fig. 7. Here they used split pins, not nails with ends hammered over as on the Stockton & Darlington

[12] Specimens in Science Museum

[13] Science Museum, E. A. Forward's notebook of extracts from Robert Stephenson & Co's ledger (R.647)

Cross pins quickly proved unsatisfactory because wear and corrosion reduced their diameter, and the rail became loose and could not be tightened.[14] They were therefore abandoned and an improved method of wedging the rail in the chair by means of a thin iron key took over. This is first heard of with new chairs on the Stockton & Darlington in 1827;[15] in the same year a host of new railways — the Liverpool & Manchester (**Fig. 19**), Bolton & Leigh, Dundee & Newtyle, Ballochney, and Nantlle — took delivery of fish-belly rail and, in every case, keyed chairs. So too thereafter, and, except for replacements, fixing with pins was finished. Its short life fell between 1822 and 1827. At Abersychan, this bracket can be narrowed by the historical evidence: after 1825 when the British arrived and before the end of 1827 when the furnaces came into blast.

The reason for the adoption of wrought-iron fish-belly here is not far to seek. In its early days the British Iron Co, which had no great reputation for efficiency, was ruled by directors whose expertise lay in metalliferous mining rather than in ironmaking. They included the great mining engineer John Taylor (1779-1863), who as lessee of the phenomenally successful Consolidated Mines in Cornwall had very recently promoted and become manager of the Redruth & Chasewater Railway, authorised in 1824 and opened in January 1826.[16] Its rails too were wrought-iron fish-belly, and although no details are on record, they must have been supplied in 1825 if not 1824, and therefore in the era of fixing by cross pin. It was surely Taylor who brought the idea of this track to South Wales.

On most railways, the original wrought-iron fish-belly proved to be too light and had soon to be replaced. So too here. The Abersychan limestone railway

---

[14] Norris 1987,17; Oeynhausen and Dechen, 24
[15] Oeynhausen and Dechen, 24
[16] Barton 1966, 17-24

was later re-laid with heavier and parallel rails of T or single-head section. At the top end, from the quarry to 2802 0452, there is no trace of the earlier permanent way; lower down, where blocks of the old type do survive apparently *in situ*, it was possibly a matter of patching up rather than wholesale relaying. One chair of this type 3 was found, together with its thin and tapering iron key, which smacks of the 1830s or 1840s **(Fig. 20)**. The profile of the cheek on one side shows that the rail foot was bulbous, and the off-vertical face on the other shows how the key was made to bear down against the top of the bulb and hold it in its seating. Amid the plethora of rail and chair types experimented with at this time, only one is a particularly close match to the rail section and the principle of keying seen at Abersychan. This was designed by Edward Steel for the Clarence Railway in County Durham, and was used in increasing weights (32 to 45lb/yd) from its opening in 1833 until well into the 1840s, as well as on the Brandling Junction and Newcastle & Carlisle Railways from 1839 **(Fig. 21)**.[17] The only significant difference is that the Clarence chair had a key shaped to fit the bulb. The Abersychan chair, being only marginally smaller, probably carried rail of much the same size and weight, about 4in high, 2in wide on the head, and roughly 35lb per yard. Its date may be put at somewhere around 1840. Towards the top end of the railway, in association with fragments of type 3 chairs, sizable fragments of a heavy flanged wheel of 20 or 21in diameter were also found **(Fig. 22)**. At just over 4in, the tread is much wider than the rail head, but guards against derailments if the track gauge spreads. A similar chair was dredged out of the canal at Llanfoist, but this is of the pattern advocated by Losh for use with an L-shaped key.[18]

---

[17] Wood 1838, 47 and pl. III fig. 1; Whishaw 1842, 45, 60, pl. 3 figs. 8, 10; Day 1848, 142-3

[18] Day 1848, 142

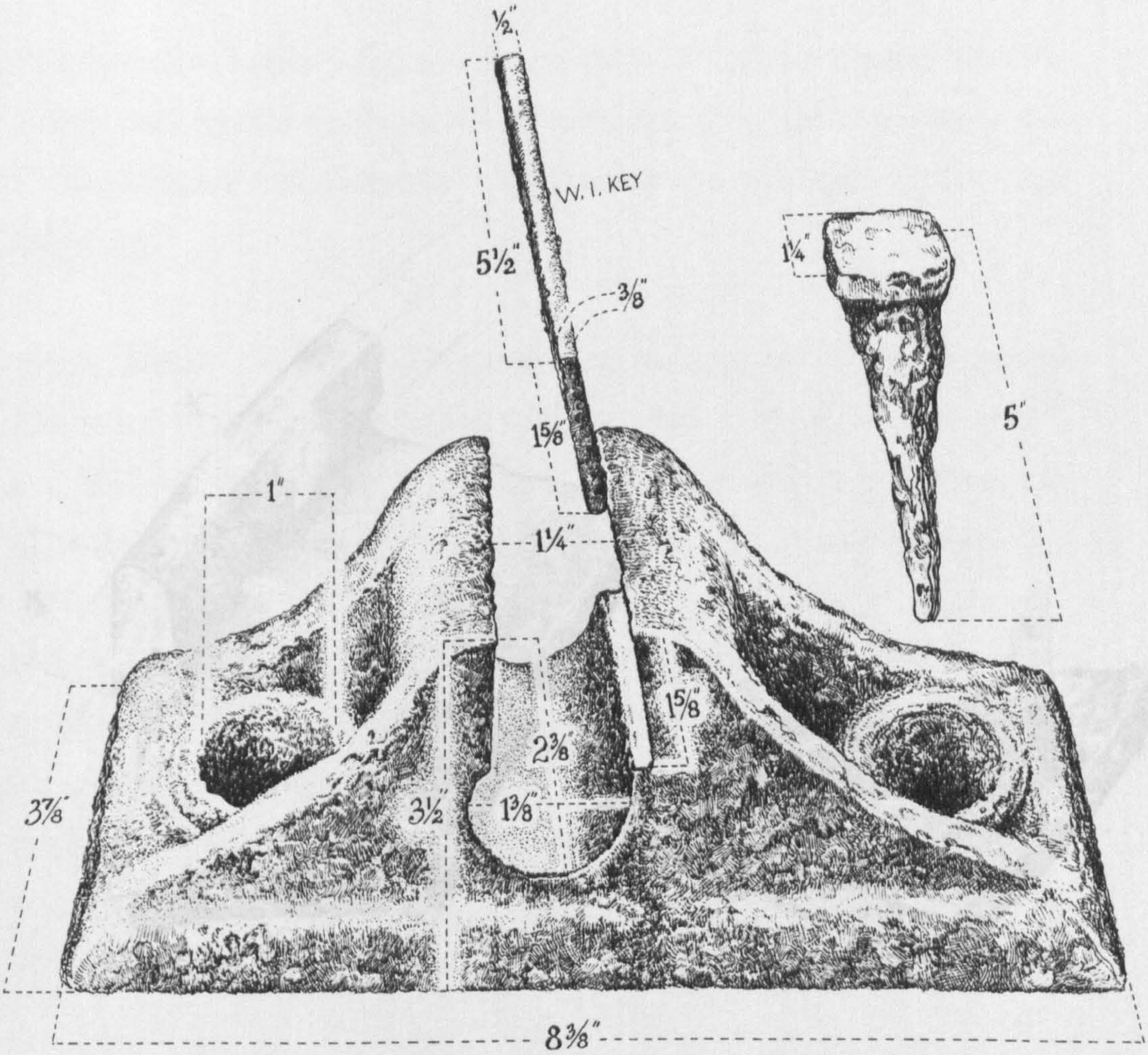


Fig. 20. T-rail chair from Abersychan Limestone Railway (279 045)

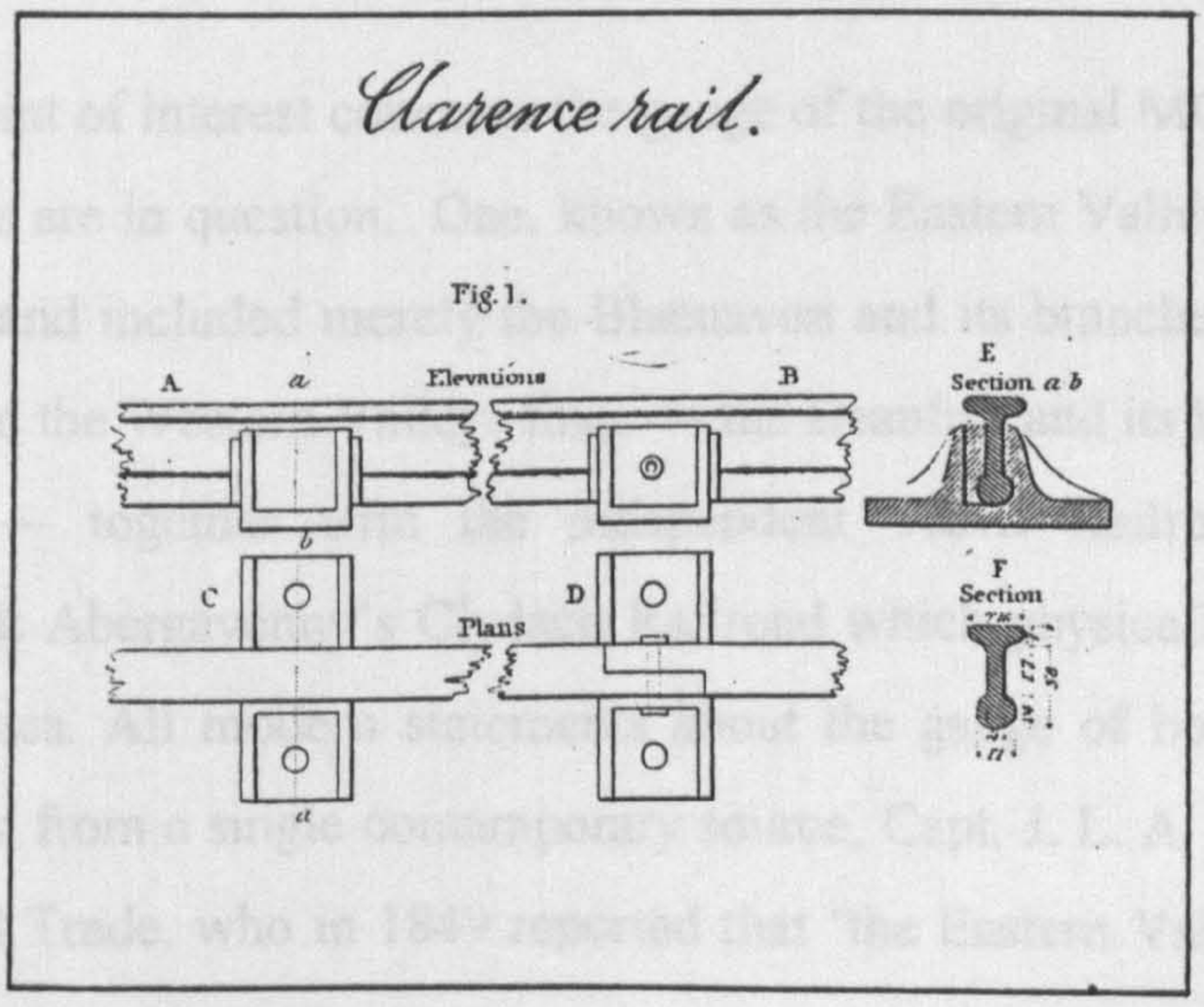


Fig. 21. Clarence Railway chair (source: Wood 1838)

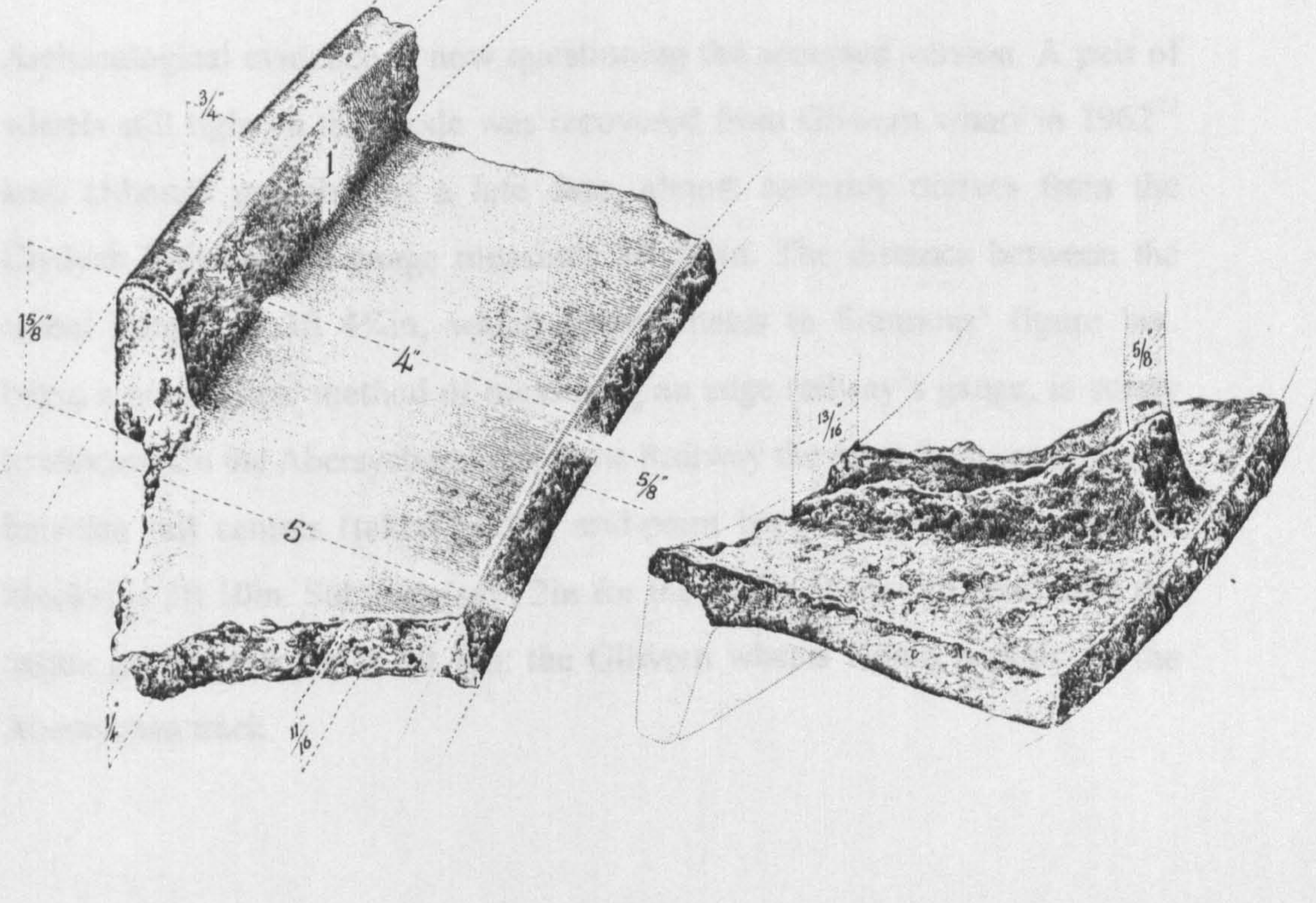


Fig. 22. Fragments of wheel from Abersychan Limestone Railway

The final point of interest concerns the gauge of the original MCC railroads. Two systems are in question. One, known as the Eastern Valleys lines, was the simpler and included merely the Blaenavon and its branches. The other encompassed the Western Valleys lines — the Beaufort and its branches and the Rassa — together with the independent Trevil Railroad and the Brecknock & Abergavenny's Clydach Railroad which physically connected with the Rassa. All modern statements about the gauge of both systems[19] seem to stem from a single contemporary source, Capt. J. L. A. Simmons of the Board of Trade, who in 1849 reported that 'the Eastern Valleys lines ...

[19] For example Macdermot 1931, vol. ii, 104; Hadfield 1967, 130; Baxter 1966, 198-201.

are constructed with a gauge of 3 feet 4 inches.'[20] By this time the Western Valleys lines (except the Rassa and its connections) had long been converted to plateways, and there seems to be no contemporary statement of their edge rail gauge.[21]

Archaeological evidence is now questioning the accepted version. A pair of wheels still tight on their axle was recovered from Gilwern wharf in 1962[22] and, although probably of a late date, almost certainly derives from the Clydach Railroad. Its gauge measures 3ft 7½in. The distance between the wheel flanges is 3ft 4¾in, which approximates to Simmons' figure but, being a nonsensical method of measuring an edge railway's gauge, is surely irrelevant. On the Abersychan Limestone Railway the most frequent distance between rail centres (taken as the mid-point between chair holes on the blocks) is 3ft 10in. Subtract (say) 2in for the width of the rail head, and the inside gauge emerges as 3ft 8in: the Gilwern wheels would happily fit the Abersychan track.

---

[20] Parliamentary Papers 1850 xxxi, 192
[21] Gordon Rattenbury found no reference to the gauge in the minutes of either canal company
[22] WIMM accession no. 62.387/1

CHAPTER 4
BLAENAVON AREA

TYLA QUARRIES (247 125 to 244 129)

The Blaenavon furnaces were supplied throughout their life, except for a short period at the turn of the eighteenth and nineteenth centuries, by the Tyla quarries. These covered a lease area of rather over 154 acres and stretch for 2km from north of the abandoned settlement of Pwll du round to Gilwern Hill. They may have been initially served by road, as a well established track ran from Blaenavon via Pwll du village over Gilwern Hill to the Usk Valley. On the way it picked up quarries close to Gilwern Hill[1] which could have been worked by the Blaenavon company with mules, but the fact that the track was known as 'the white road' from the Usk upwards suggests that lime burning was the first industry.

Railroad, Phase 1

Before Blaenavon opened the Blorenge Tramroad (see below) about 1796, the furnaces can only have been supplied from Tyla. This supposition is confirmed by the location towards Tyla of two blocks *in situ*, each with two holes for bar rails **(Fig. 23)**. All four holes are perfectly aligned, but the 3ft interval gives an unusually short length for bar rails. Another anomaly is that wear marks on one block show that the rails did not have the usual mortised male and female ends. About 700m beyond lies a single block, which site and map evidence[2] suggests is *in situ*, with wear marks showing even more clearly that the rail ends were not mortised and were no more than 2¾in

---

[1] 2417 1307
[2] GRO D.1583.188, Plan No XXX

wide **(Fig. 24)**. A cast-iron saddle found near Pwll du **(Fig. 25)**[3] helps to explain the apparent 3ft length. Although broken down the centre, the trough

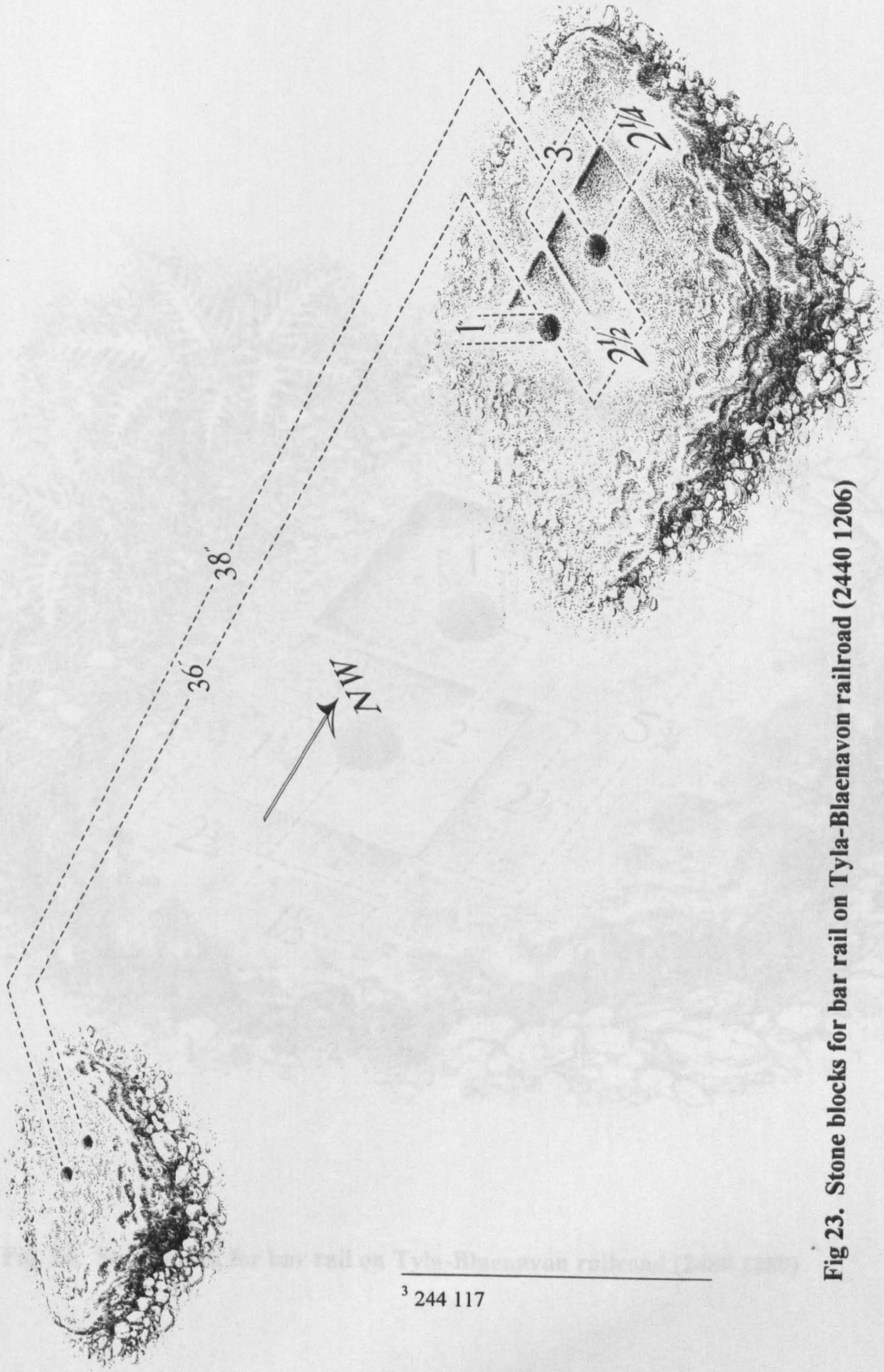


Fig 23. Stone blocks for bar rail on Tyla-Blaenavon railroad (2440 1206)

[3] 244 117

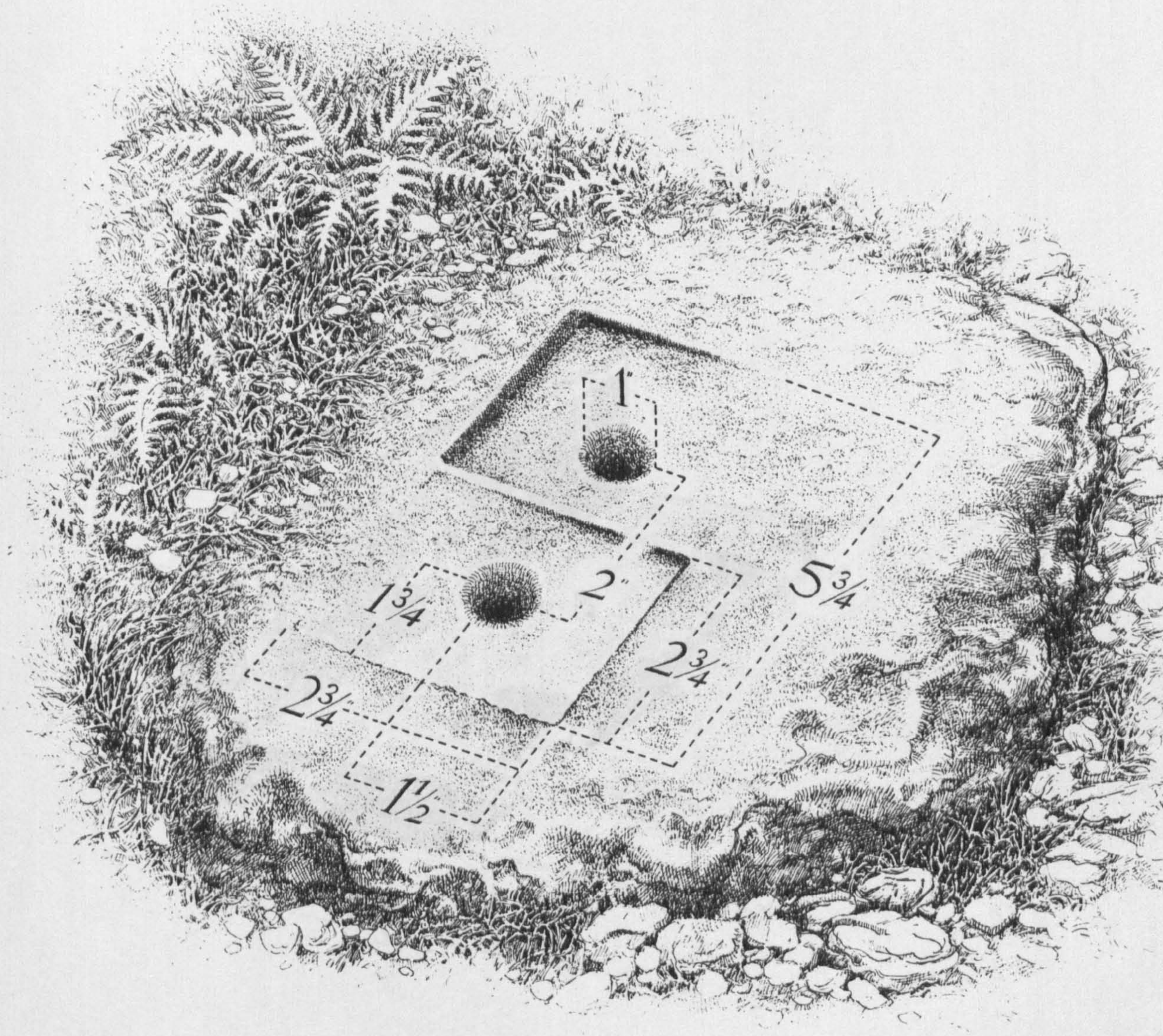


Fig. 24. Stone block for bar rail on Tyla-Blaenavon railroad (2480 1289)

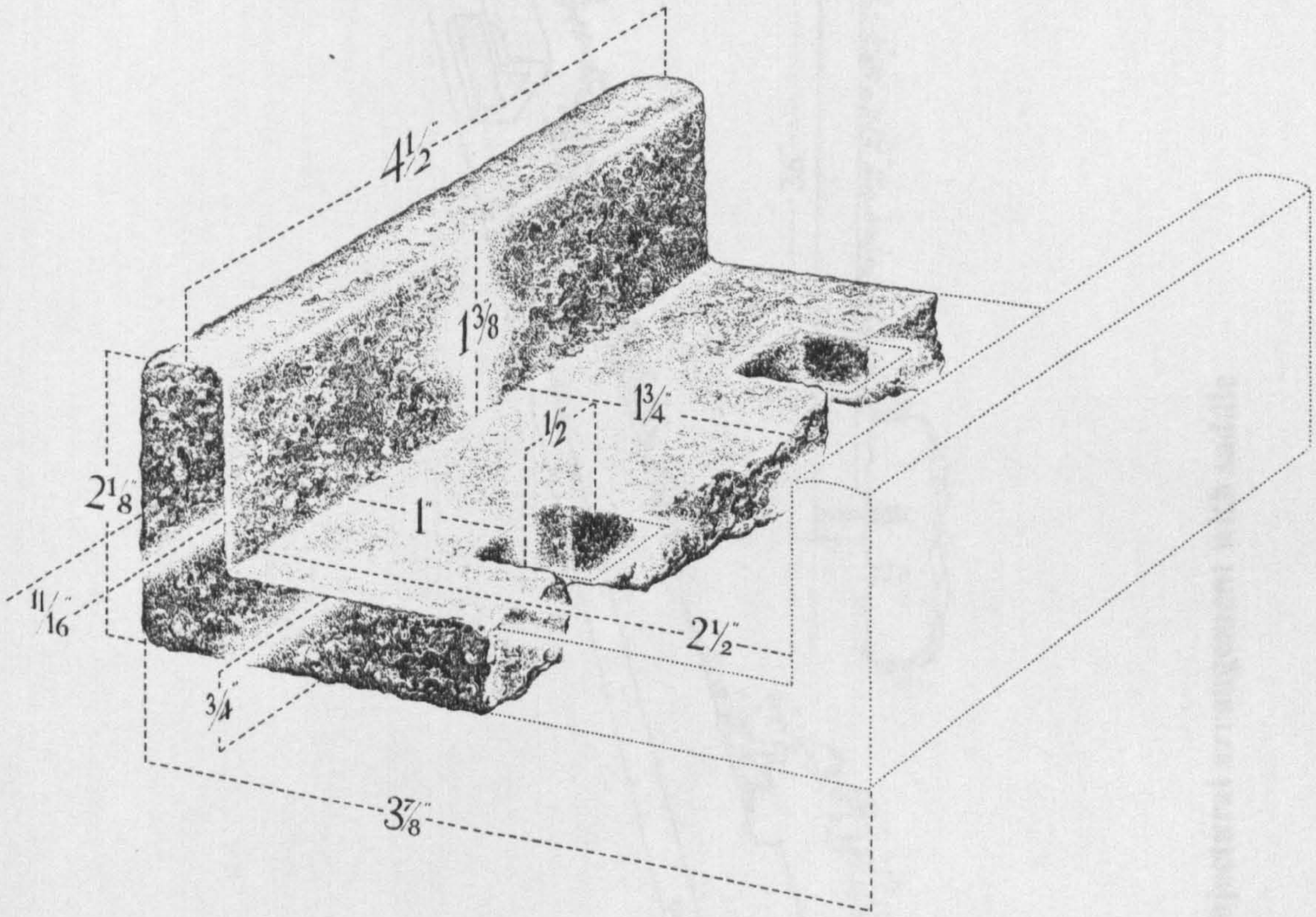


Fig. 25. Saddle for bar rail from Tyla-Blaenavon railroad (244 117)

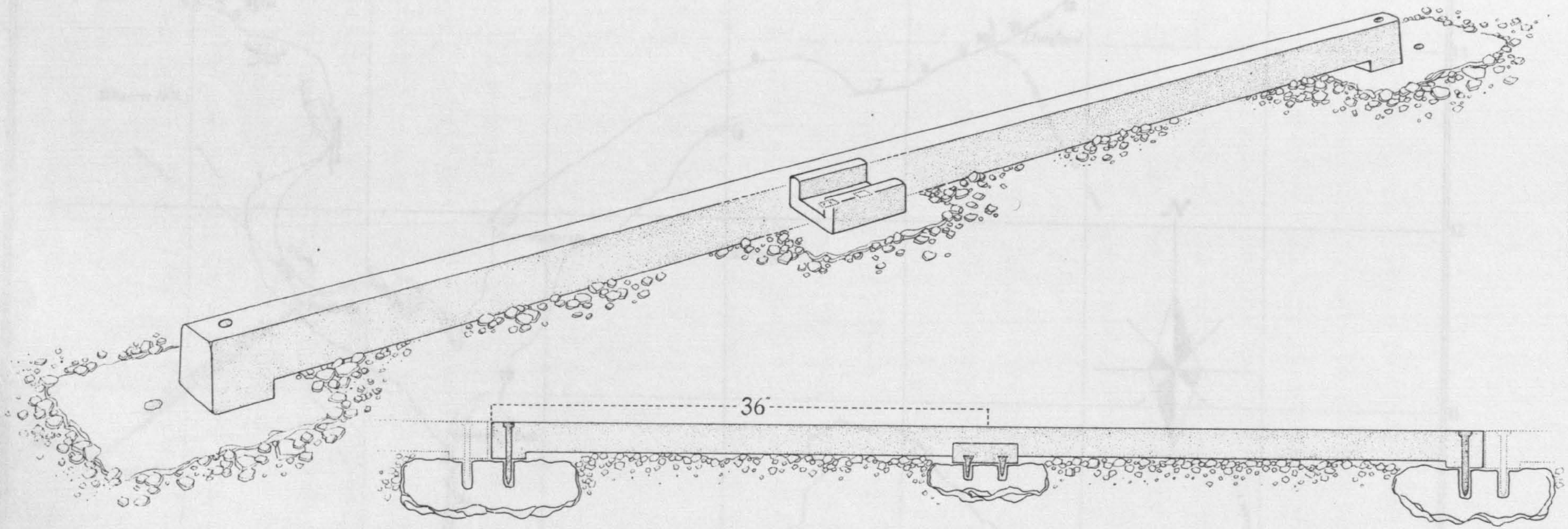
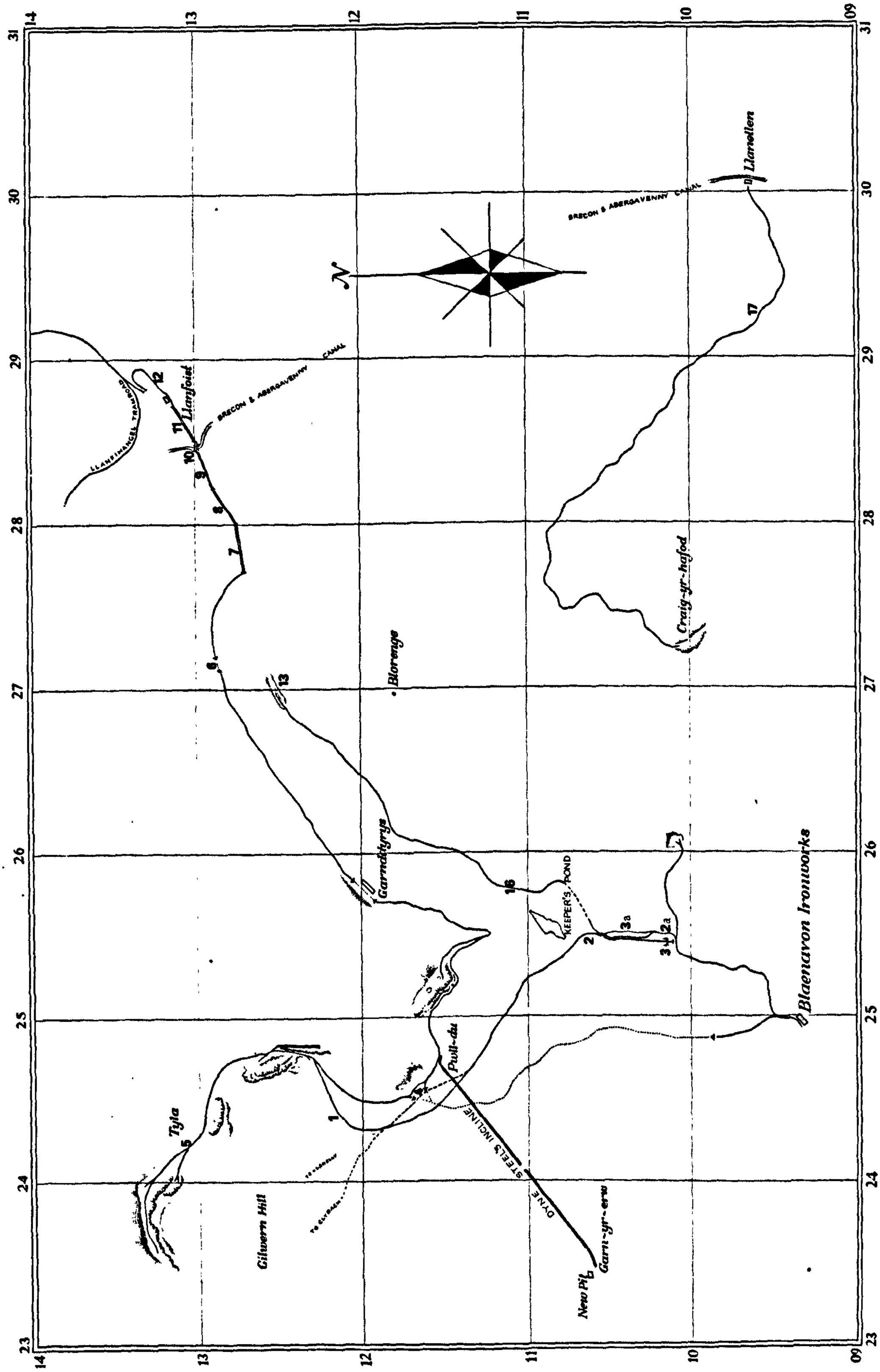


Fig. 26. Conjectural arrangement with saddle



MAP B. RAILROADS, TRAMROADS AND QUARRIES OF THE BLORENGE

M of the saddle would admit a rail 2½in wide on the base. The holes for the tapered nails are at 2in centres. The wear marks on the single block **(Fig. 24)** show that the rail end had a foot 4¼in wide. On one of the pair of blocks **(Fig. 23)** the wear mark is indistinct and could well represent a saddle rather than two rail ends. With 6ft rails, the centre would be supported by the saddle, which would also reduce lateral movement **(Fig 26)**. The possible date of these rails will be discussed in the Conclusions.

From Tyla (west) the original route follows a track round a field **(B1)** to cross the road 100m north-west of **B4** and run parallel to it on the south. At about this point, from 1798, iron coming probably by road from Clydach was transferred to the Blaenavon railroad (see Chapter 5). Around 100m beyond Dyne Steel's incline (see below) it joined the road, which now follows its course to cross the B4246 near Keeper's Pond. It then curves round to head south **(B2)**, finally following a gully **(B3a)** to pass the foot of the later staith **(B3)** and join a line to the ironworks.

Tramroad, Phase 2

The railroad was replaced with a tramroad of Outram type. Holes in stone blocks[4] show that the plates were 3ft or sometimes 47in long, with a gauge of 2ft (29in between holes).[5] This change probably resulted from Outram's 1799 report to the MCC, and (as we shall see in a later section) in 1800 Blaenavon was expecting to give up its Blorenge line for a new one. A date soon after 1800 seems likely. For most of the way the route followed the course of the original railroad. Blocks with holes at 47in centres longitudinally confirm that en route it served some drift mines (see Map D), and on one of their tips near Pwll du, assumed to be pre-1817 (see below),

---

[4] 2439 1182. There is good ballasting here

[5] The gauge is confirmed by a sill recovered from 2471 1275. Two further ones are at the 'Lamb and Fox,' Pwll du

part of a sill was found very similar to those from the Blorenge. A little beyond, by Keeper's Cottage (close to **B2**), there was an 'old weighing machine' in 1819.[6] Proceeding southwards, the formation is first raised then sunken, and a single Outram block (with nail still in place) lies between **B2** and **B2a**. From here the line runs onto a promontory to finish at a staith **(B3)** which existed by 1814;[7] but in 1813[8] there was a steep deviation **(B2a)** to the

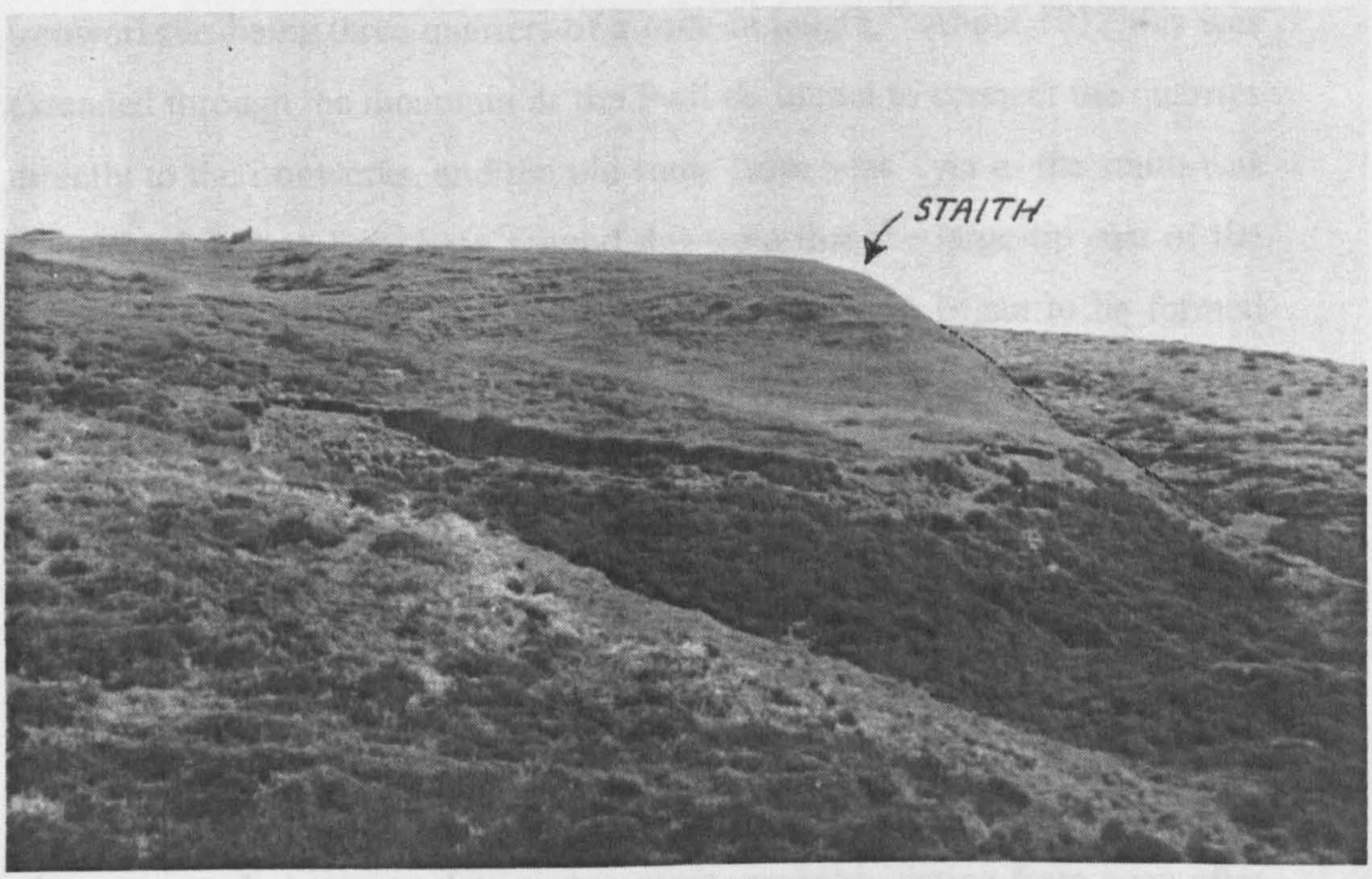


Plate 3. Staith at Blaenavon

east[9] which can be followed as a footpath with a clear metalled formation but no stone blocks. On the staith promontory, transverse impressions at 4ft intervals suggest that sills were used here to hold the gauge. The promontory is retained by a 4m-high wall, and trams were probably tipped by running them against a timber baulk stop. At the base lie lumps of limestone. Here the stone was re-loaded onto a pre-1812 tramroad which served coal levels,

---

[6] GRO MAN/A/2-273. Cottage at 2549 1047. The 'Keeper' may have been the weighmaster
[7] GRO 1814
[8] OS 1813
[9] A little east of the principal line (2551 1034) is a shallow cutting which may be another line

and transported to the ironworks as needed. By 1819 the whole route was shown as 'Old Limestone Road to the Quarry.'[10] A plan of 1821[11] shows it as 'Old Tramroad,' and also marks the 'Limestone Tip,' but probably only as a landmark.

Tramroad, Phase 3

In 1798 Archdeacon Coxe referred to a coal level running north from the ironworks as being three-quarters of a mile in length.[12] About 1817 this was extended through the mountain as the Pwll du tunnel to connect the quarries directly to the ironworks, and the old route from near Tyla to the staith was abandoned. It may have been around this time that the large tip east of the tunnel portals, on which the Welfare Hall now stands, began to be formed (see **Map D**). On the quarry side, the route ran from the tunnel **(B4)** through a field on a broad formation (now a footpath) which is slightly raised and pierced by two culverts. Towards the junction with the phase 1 and 2 route there was double track. Sills recovered from here and close to the tunnel portal[13] give a 2ft gauge between flanges **(Fig. 27)**. Although they rested on stone blocks, they are of unusual construction, with chairs cast onto a wrought-iron tie-bar, and they clearly held long lengths of wrought-iron plates. As such they are a late replacement, probably dating from soon after the installation of Dyne Steel's incline in the 1850s (see below).

---

[10] GRO MAN/A/2-273
[11] GRO 1583.188 Plan XXX
[12] Coxe 1801, 228; GRO 1812
[13] Recovered by Northants Industrial Archaeology Group 31.3.96, now at Nene College Northampton

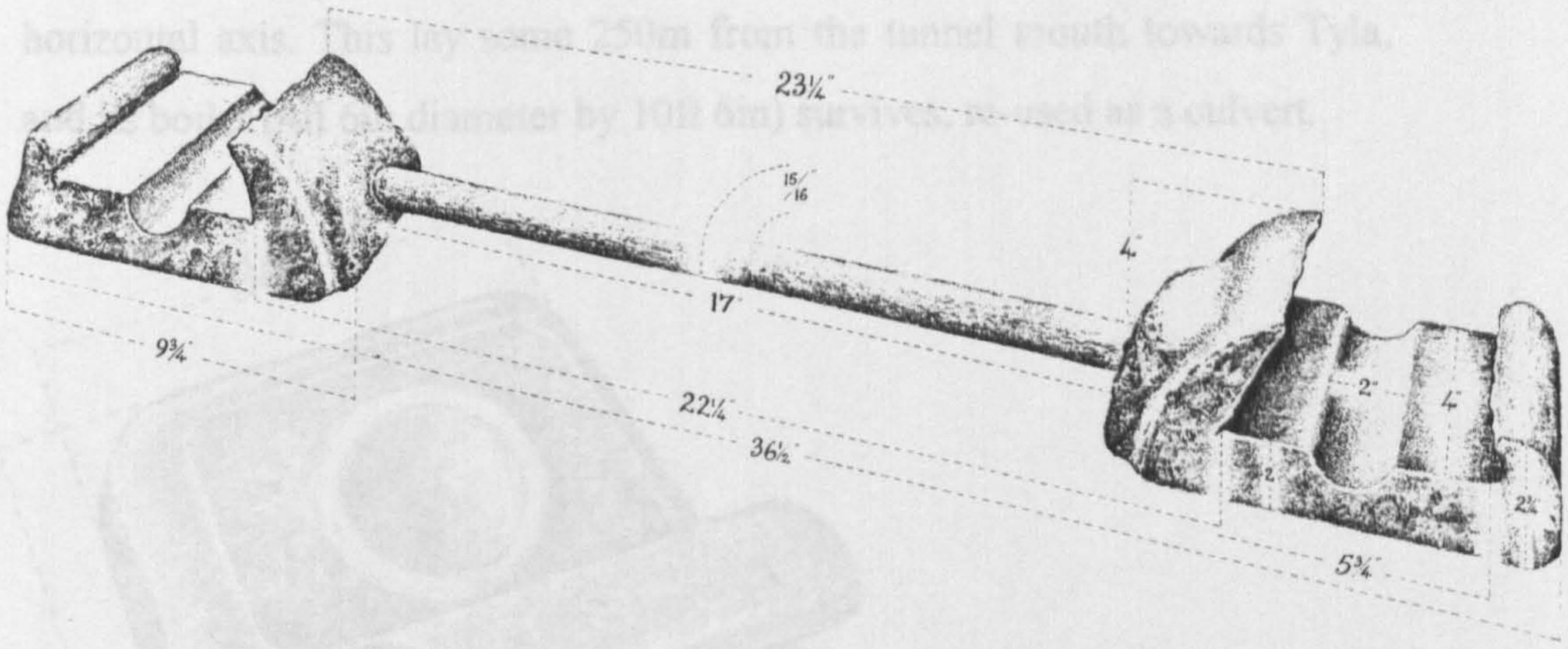


Fig. 27. Sill for wrought-iron plates from Tyla-Blaenavon tramroad with wrought-iron tie (2461 1220)

By 1836[14] there were two tunnel portals, the southern one carrying traffic to Llanfoist via Garnddyrus (see under Pwll du below), the northern one serving the quarries; possibly a third side to the triangle gave a direct link from Tyla to Llanfoist. Between the lines to the portals lay a stable. The portal measures 8ft across, which would allow for two trams side by side on the 2ft gauge; indeed by 1879/80 an 80m length of double track emerged from the northern portal.[15] Although disused at this time, the southern portal had a short run of single track.

Railway, Phase 4

In 1885, when Blaenavon leased Gilwern Hill quarry, the 2ft plateway on sills was re-laid and extended **(B5)** as a 3ft gauge edge railway for locomotive working from the tunnel. The rails were flat-bottomed and spiked to wooden sleepers, although chairs were at least occasionally used **(Fig. 28)**. The Pwll du tunnel was still available for use in the 1940s and was worked by rope by a post-1899 stationary engine[16] with a drum on a

---

[14] GRO MAN/A/2/279
[15] OS 25in
[16] 2447 1187. Culvert at 243 119

horizontal axis. This lay some 250m from the tunnel mouth towards Tyla, and its boiler (4ft 6in diameter by 10ft 6in) survives, re-used as a culvert.

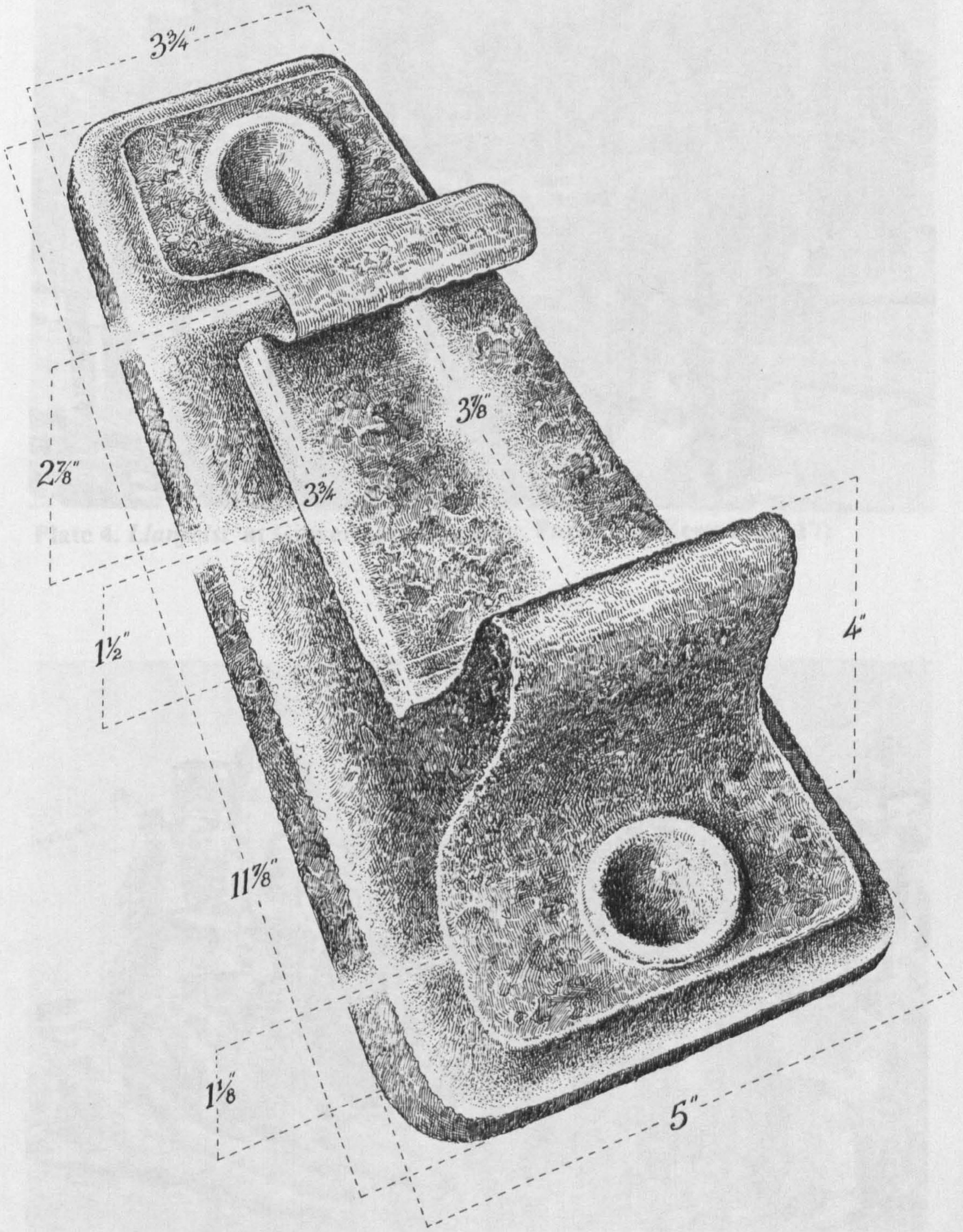


Fig. 28. Chair for flat-bottomed rail from Gilwern Hill (246 128)

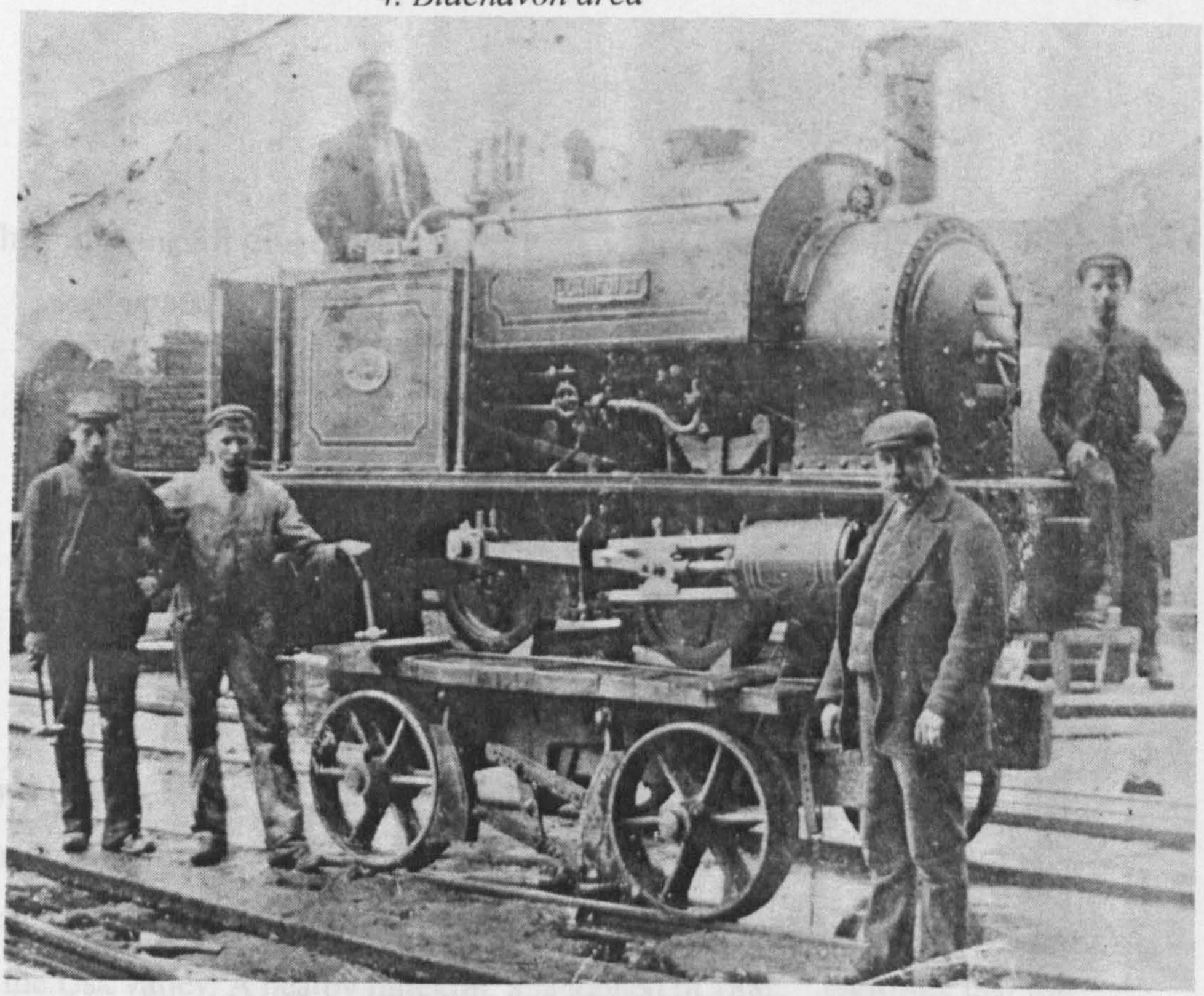


Plate 4. *Llanfoist* at Gilwern Hill (Source: Parry and Keen 1986, 17)

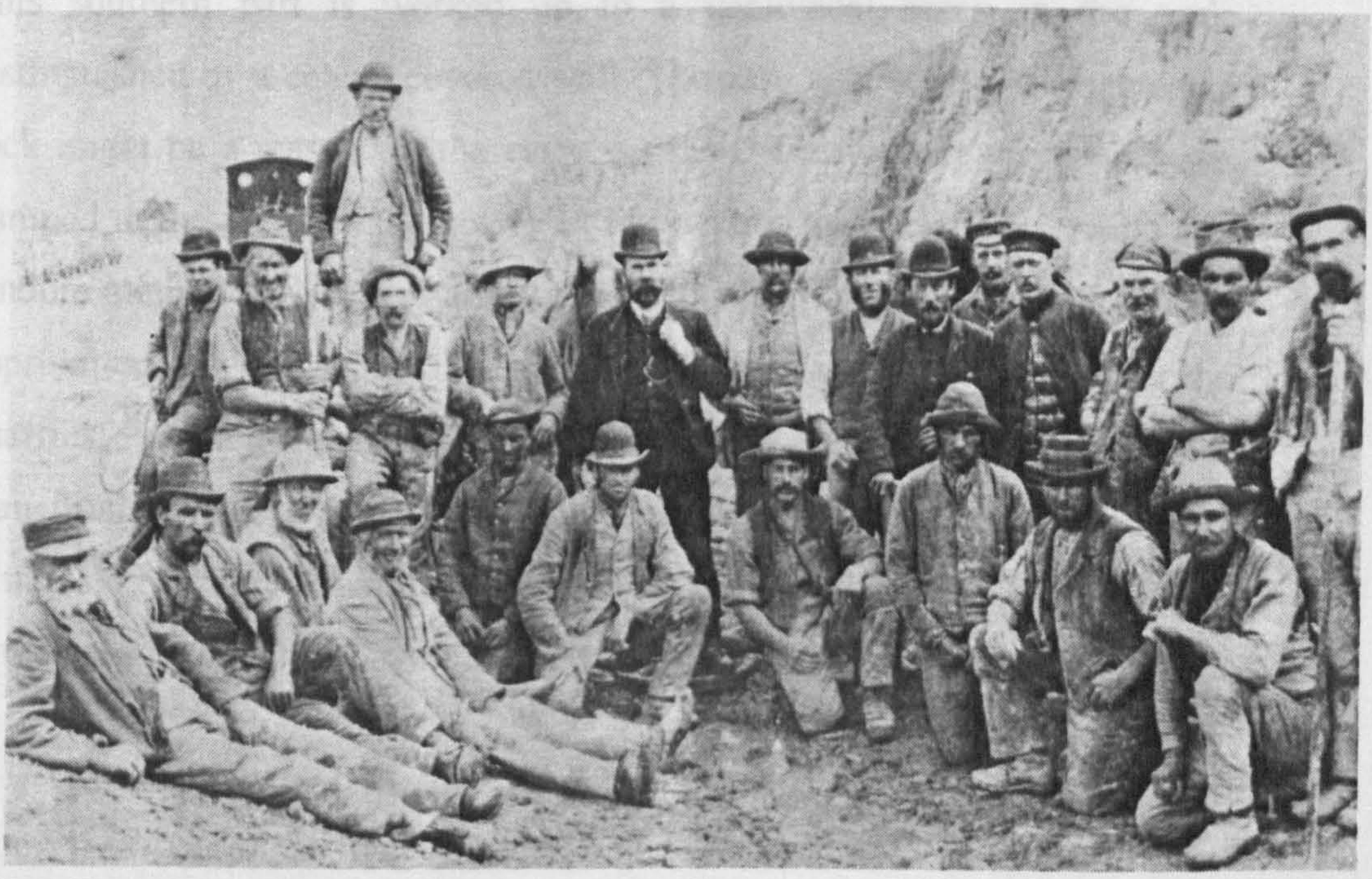


Plate 5. Quarrymen and locomotive at Gilwern Hill (Source: Parry and Keen 1986, 18)

The following 3ft gauge locomotives worked to Gilwern Hill:[17]

Llanfoist	0-4-0ST	Blaenavon	1897
No 13	0-4-0ST	John Fowler	reb. 1906
Kilmarnock	0-4-0ST	Andrew Barclay	reb. 1913
No 3	0-4-0ST	Black, Hawthorn	1888
Llanover	0-4-0ST	Blaenavon	c.1900
Aberystruth	0-4-0ST	Blaenavon	c.1900
Trevethin	0-4-0ST	Blaenavon	c.1900
No 12	0-6-0ST	John Fowler	1886

Tyla (east) (2453 1212 to 2479 1258)

There are two parts to the quarry. The southern part **(C1)** was reached by a long established track known as Rhiw galchen (limestone hill) from Govilon in the Usk valley. A nearby limekiln, abandoned in 1880,[18] confirms that this part of the quarry was limited to limeburning.

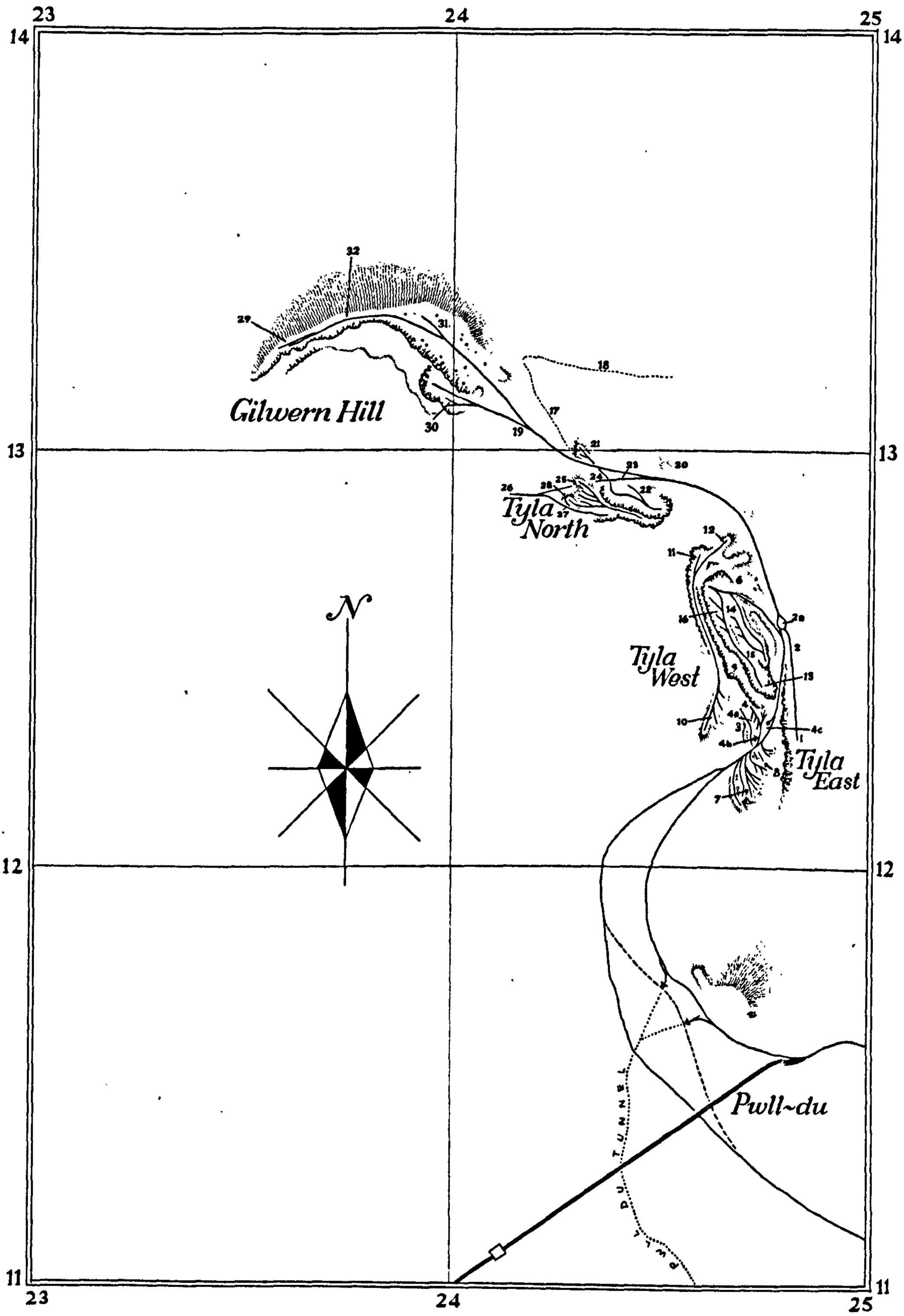
This southern part is worked up to a geological break in the rock, distinguished by a calcite covered wall. The easy availability of fragmented rock might be a reason for the early working. The very limited waste was dumped in the apron of the quarry in three strips approximately 5m long, a random method suggesting barrow runs with sledgeways between. This area approximates to that shown in a plan of 1819 as 'Lime stone worked for the quarries,'[19] which implies that the rock was used for some purpose other than fluxing. This plan shows the tramroad extending beyond Tyla (west) with a slightly curved incline **(C2)** running back down to **C1**. The incline is now overgrown, but the Outram-type stone blocks lying loose along it and

---

[17] I am grateful to Geoffrey Hill for information on all the Gwent quarry locomotives; this is now published in Hill and Green 1999, 56

[18] 2480 1220. OS 25in 1879/80

[19] GRO MAN/A/2-273



MAP C. TYLA QUARRIES AND GILWERN HILL

part of a plate recovered near the top show that it belonged to Phase 2 and predated the tunnel. Although the gradient is 1:15, the slight bend suggests that it was horse worked. Debris from the tramroad above has obscured the quarries except for a longwall with blasting holes. The area is shown in 1821[20] as approximately 400m by 20m; it does not appear on the 1829 map,[21] and by 1881 was clearly abandoned.

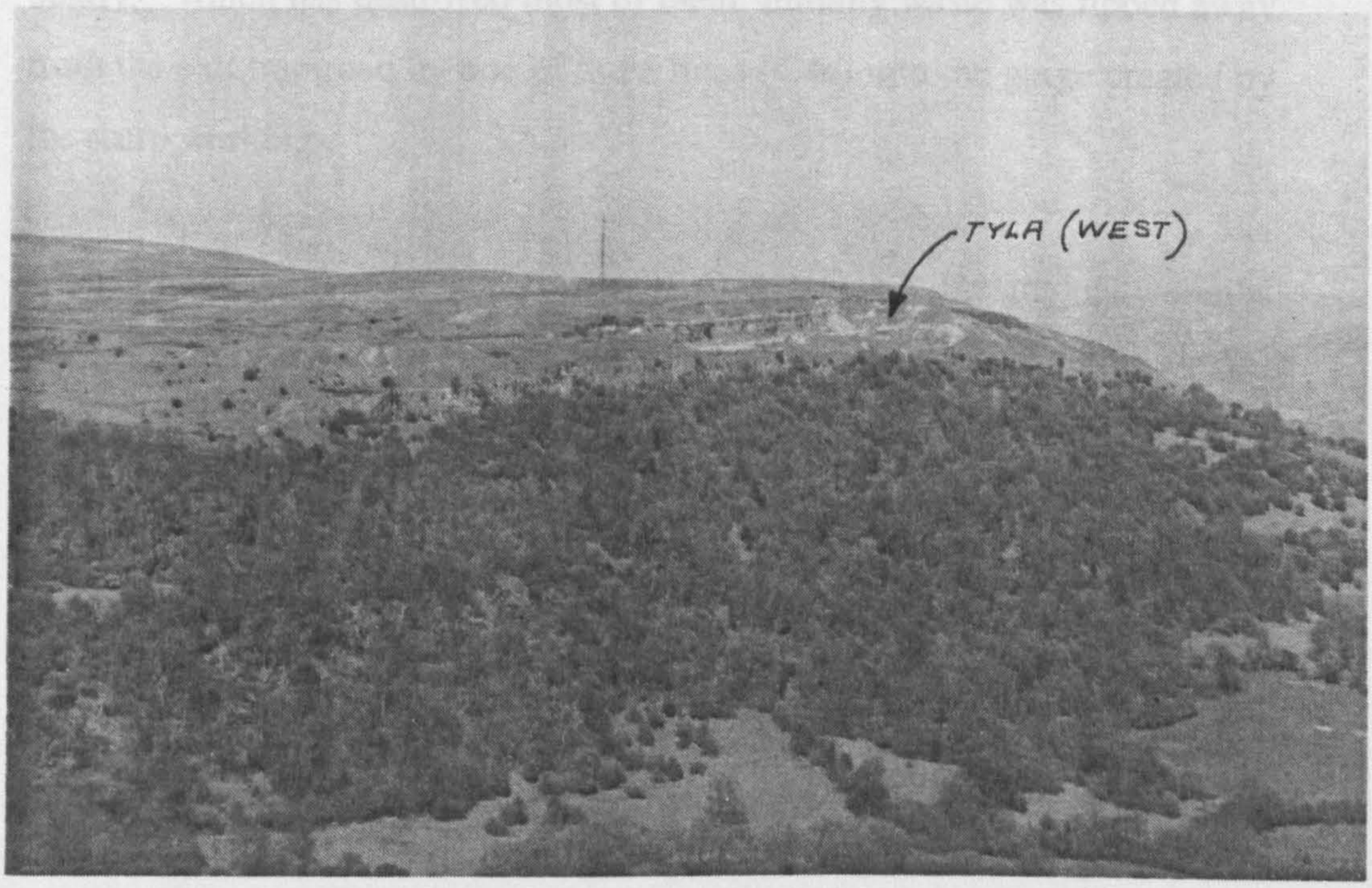


Plate 6. Tyla from Garnddyrys. Tyla (east) is the lower of the two quarries

Tyla (west) (2472 1230 to 2468 1277)

This quarry was one of the principal sources of limestone for Blaenavon Ironworks for much of the nineteenth century. At a lower level than the access tramroad there runs northwards a moderate scarp face **(C3)**, the earliest fluxing quarry at Tyla. The Phase 1 railroad drops slightly to give access to it, although the central section is covered in spoil which raised the

[20] GRO D.1583.188 Plan XXX
[21] OS 1829

later tramroad for access to **C2**. At the northern end of **C3** a revetted trackway, which terminates in a possible stone mine,[22] is about 2.7m wide, more consistent with a railroad than with 2ft-gauge plateways. About 20m to the east, between 1813 and 1821,[23] there developed a 'Limestone Quarry' 240m long **(C4)** which follows the dip upwards and northwards with shallow faces, and whose spoil blocked off **C3**. These workings originally extended northwards at the high level for almost the full length of the later quarry,[24] which has destroyed most of them. Initially waste was tipped away from the exit tramroad by one of three lines **(C4a)** into the gorge created by the scarp workings.

A little to the north of the main quarry **(C6)**, to which a line gradually climbs from the main tramroad, a sill for a 2ft gauge plateway was found *in situ* resting on ballast **(Fig. 29)**. Cast in an open mould, it marks only a slight advance on those of about 1796 on the Blorenge Tramroad and dates perhaps to Phase 3 and the opening of the tunnel. Alternatively, it is possible that it is contemporary with the Phase 2 Outram-type line to **C2** and that sills were used within quarries where less permanent way was adequate. Certainly the method of casting looks early. Both in 1821 and back in bar-rail days there was a sharp curve in the tramroad **(C2a)** which might be a vestige of a line from **C6**.

The main quarry was then deepened, the waste and overburden being dumped in three phases. The first dump **(C7)** was probably formed before 1829[25] by stripping the upper overburden from the southern quarry by

---

[22] 2469 1243
[23] OS 1813; GRO, D.1583.188 Plan XXX
[24] GRO 1829; Greenwood 1828 and 1830
[25] GRO 1829

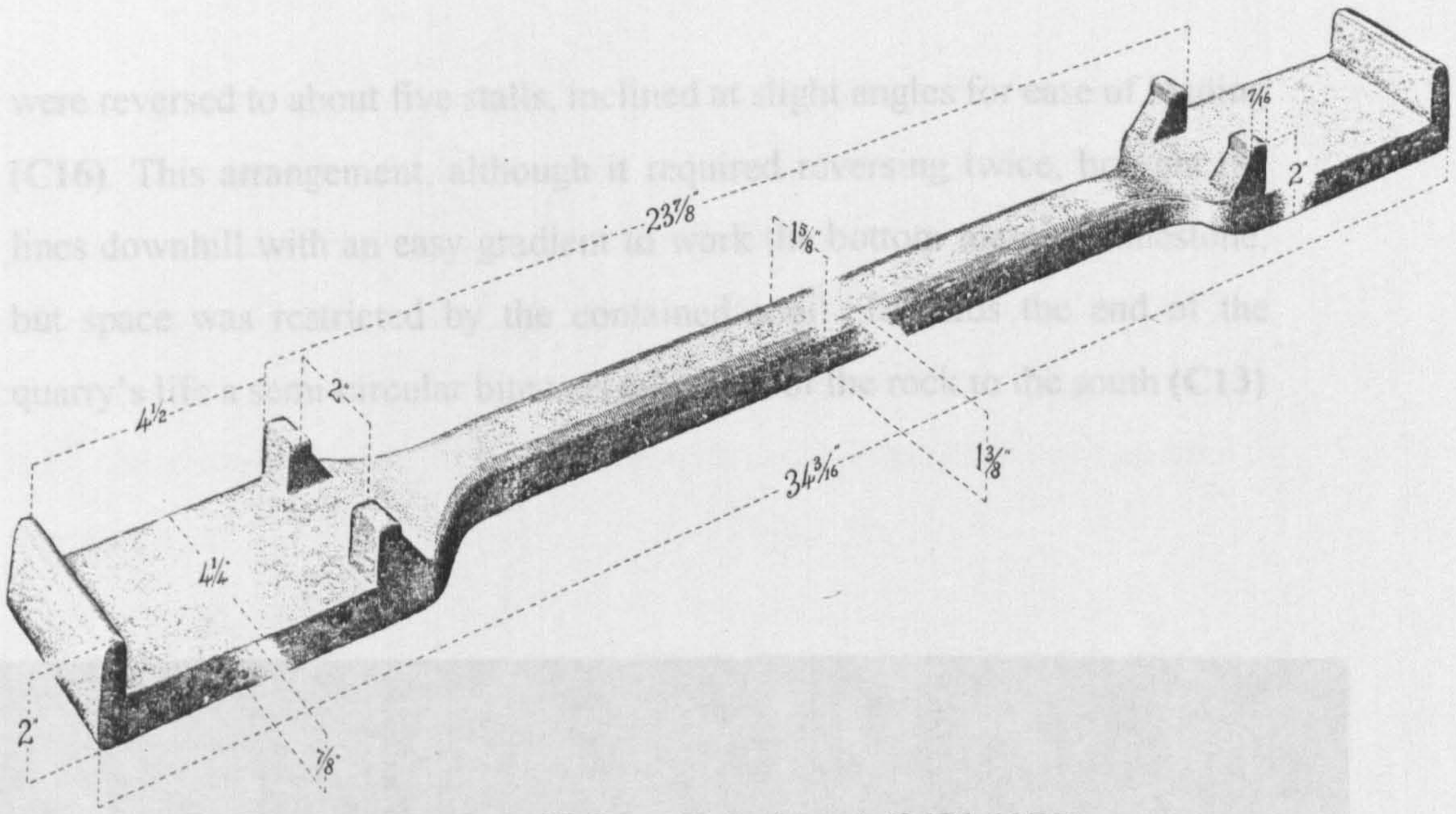


Fig. 29. Horned sill from Tyla (west) (2471 1275)

tramroads **C4b** and **C4c**. The second phase, before 1878,[26] involved waste from a small quarry **(C11)** to the north being tipped into the old quarry **(C6).** In 1878 the main quarry was no longer in use, but was shortly re-opened in the third phase, which is unlikely to have continued after the opening of the 3ft gauge railway to Gilwern Hill. Overburden from **C11** was first dumped in three extended fingers **(C10)** well above the main quarry, and then via a cutting to a single spoil tip **(C12)**, while **C8** was formed with overburden removed from **C9** via the main tramroad; its fingers are well organised and regular, and blocks show the use of tramplates with sills. But by 1881 the quarry was obviously suffering geological problems and consideration was given to moving elsewhere,[27] an event which finally took place in 1885.

Observation and aerial photographs[28] show that the main quarry was worked at two levels. The top one was mainly for the removal of overburden to **C7, C8, C10** and **C12**. To reach the lower level and the main west face, a line was run almost two thirds the length of the quarry **(C15)**, from which trams

---

[26] OS 6in 1878/79 and 1899
[27] GRO D.480.1
[28] Welsh Office, CPE UK 2079, 19 May 1947, 4013

were reversed to about five stalls, inclined at slight angles for ease of loading **(C16)**. This arrangement, although it required reversing twice, brought the lines downhill with an easy gradient to work the bottom massive limestone, but space was restricted by the contained spoil. Towards the end of the quarry's life a semi-circular bite was taken out of the rock to the south **(C13)**

Plate 7. Tyla (west). Waste at C8

and more waste was dumped to the east over the abandoned east face **(C14)**. Further spoil, tipped at a third level from a branch off the 3ft gauge railway, must have come from elsewhere after the quarry's closure. This waste fills roughly half the quarry and reflects the problem of disposal.

Tyla (north) (2452 1289 to 2428 1300)

An almost continuous shallow rock face nearly 500m long follows the 350m contour just above the cultivation level. The area is known as Wenallt (white uplands), no doubt from the colour of lime, and a wide and ancient track leads directly up from the Usk Valley. By 1792[29] a double limekiln **(C17)** with access from the track **(C18)** shows there was already quarrying here. By 1821[30] there were two long trenches approximately 20m apart worked from a common track.

By 1821 the tramroad extension beyond Tyla (west) was only 50m short of the quarry. By 1829[31] quarries extended as far as Carreg Pen Rhiwyne **(C19)**, which marks the boundary between Beaufort and Abergavenny lands as well as the county boundary, but they were still modest in scale, perhaps because the company was then concentrating on Tyla (west).

The name of the main quarry, 'Coronation,' suggests that its full development began in either 1830 or 1837. By 1878[32] it was wholly worked out and the track removed. It was worked at two levels. The northern, lower, one consists of barrow spoil and probably represents the earliest preparation of the quarry **(C22)**. The clearing of limestone here gave space for a branch **(C23)** which ran westwards and slightly uphill from the summit of the main tramroad **(C20)**, but was cut through at a later date by the final working of the lower part of the quarry **(C24)**. A little beyond here the tramroad is covered by waste from the top workings **(C25)** but emerges the other side to end in a holding line **(C26)** 300m from the summit. From this point it reverses **(C27)**, climbing slowly into the upper quarry. Thus the whole forms a zigzag, which was laid with sills and plates approximately 4ft long. In the

---

[29] NLW Badminton 16666
[30] GRO D.1583.188 Plan XXX
[31] OS 1829
[32] OS 6in 1878/79

upper quarry it cuts and winds through old clearings, and waste was removed to a tip near the summit **(C20)**.

When the zigzag was abandoned, clearing of the upper level continued in two phases. The first and lower waste tip covered part of the tramroad **(C25)**. The next phase covered part of this tip **(C28)** and was worked by a 2ft gauge tramroad with sills, from which a broken plate was recovered. As the old tramroad became buried the lines working on the tips must have been isolated from the common system. This clearing of overburden prepared the face for the working of the lower quarry in the massive limestone. All that was necessary was to cut through the line to the upper quarry and work the exposed stone back **(C24)**. Spoil was dumped to the north-west where the tip is laid out in four well organised fingers **(C21)**.

Gilwern Hill (240 131 to 235 131)

Some small workings on the northern side of the railway,[33] perhaps of the early 1860s, are now filled with spoil; two rectangular foundations lie close by. The major workings derive from a lease from the Duke of Beaufort of 31 December 1885 for 63 years.[34] An annual rent of £200 was payable with a royalty of 2d a ton for converting to lime for the furnaces[35] and 3d for other purposes. The area leased starts from a line approximately 200m west of the county boundary stone (Carreg Pen Rhiwyne) and and continues west for 400m, covering 25 acres with an extra 24 acres allowed for tipping. As we have seen, the reason for the move here was the difficulties of working Tyla (west). With this fresh start, Blaenavon decided to totally reorganise their transport, and the Gilwern Hill Railway resulted, following the earlier tramroad although probably not exactly on the old formation.

---

[33] 2400 1333; there were leases to Blaenavon in 1863-65 of 'limestone and bastard stone upon part of Gilwern Mountain:' NLW Badminton II 3833-3835
[34] NLW Badminton II 6093: see also Badminton II 6079
[35] GRO D.751-155. This suggests the use of caustic lime and therefore hot blast.

This extensive quarry was worked in two parts separated by a large knoll of unusable rock **(C29)**. But in the period up to 1900 only the east part was worked, and that only at the upper level **(C30)**. This was entered from a branch from what was, in the 20th century, to become the principal line. Where the line left the quarry there was a separate branch for dumping waste **(C31)**, By 1899 a line ran the full length of the later quarry **(C32)**. Its function was to clear the overburden, and it had already generated a fan-shaped tip.

To the west of the main group, a quarry 100m long, 5m wide and 8m high has been worked up along the dip of the massive limestone. The 1885 lease to Blaenavon specifically excludes this quarry, which was 'leased to Hoskins and others.' It is possible that this was the intended destination of an embryonic tramroad which approaches the area from the south-west. For about 600m from the small settlement at Cwm Dyar (236123) the formation has been well prepared and, in places, sizable lumps of millstone grit have been carefully removed to the side; but some 400m short of Gilwern Hill quarry the engineering peters out.

PWLL DU (251 115)

Hills's Tramroad

The reason for opening quarries at Pwll du lies in the establishment of Garnddyrys Forge by the Blaenavon company in 1817. Although Garnddyrys lay on the north side of the Blorenge, divided from Blaenavon by a ridge, it could be linked to the furnaces by a branch, to run on the east side of Cwm Llanwenarth, off the newly-opened tunnel line to Tyla quarries. Such a tramroad had added attractions. The junction between the Monmouthshire and Brecknock & Abergavenny canals was made in 1812, and ironmasters

began to direct their attention to forming links with the B&A. The reason is not far to seek. The B&A Act contained a clause which stipulated that goods originating on the B&A would be carried through to Newport by the Monmouthshire at B&A rates which, in March 1817, the company were considering lowering from 3d to 2d per ton/mile on iron.[36] A tramroad from furnaces to forge could easily be extended to the canal at Llanfoist to take advantage of the lower tolls on the B&A. Yet another attraction lay in the Llanvihangel Tramroad, opened in 1814 from Llanfoist to Abergavenny and beyond,[37] which offered new markets for coal and for the lime burnt in the Llanfoist kilns.

Plate 8. Pwll du quarry from Garnddyrys

The result was Hill's Tramroad, named after Thomas Hill, the principal partner at Blaenavon. It has been well covered by Gordon Rattenbury,[38] and

---

[36] B&A Committee Minutes 4.3.1817
[37] Hadfield 1967, 176
[38] Rattenbury 1980, 33-45

only matters relevant to limestone will be dealt with here, drawing partly on material not used by him. As completed, from the Pwll du tunnel to the Llanvihangel, Hill's Tramroad was 5½km long. It embodies most kinds of engineering features — transhipment points, inclines, cuttings, embankments, tunnels, and a water balance.

Despite an early plan of 1795 to build a railroad to Llanfoist (see later, under Blorenge Mountain), it was only in August 1817[39] that the Blaenavon company leased a piece of ground belonging to the canal company at Llanfoist. The tramroad was 'marked out' in February 1818 and in place by November when it is referred to as 'recent.'[40] At this time it emerged from the sole (northern) tunnel portal **(B4)** at Pwll du; the southern portal was added for Hill's between 1821 and 1836.[41] The line crossed a field belonging to William Hiley **(D1)** and after a short stretch on the common ran round an enclosure **(D3)** leased to Walter Lewis, with whom Thomas Hill had to make an agreement.[42] From here on most of the tramroad lies on the Abergavenny estate. It continues as footpath and bridleway for most of its course, and it will be sufficient to mention only features of interest.

Near the quarry the tramroad follows a precipitous and winding course **(D4),** and wrought-iron posts and rails were installed to restrain runaways. Cut on a shelf on the steep hillside, it runs up into Cwm Llanwenarth before turning very sharply north-east over a square culvert **(D5).** It passed Garnddyrys in a cut-and-cover tunnel **(D6)** to protect it from forge waste. It crossed the B4246, continued north-east for 1.7km to a 40m tunnel **(B6,** portal 2.2m

---

[39] B&ACommittee Minutes 13.8.1817

[40] GRO D.751.328 (7 Feb. 1818); CRBTT2.M1, Abergavenny Turnpike Trust Minute Book p.424 (23 Nov. 1818)

[41] GRO D.1583.188 (1821) and MAN/A/2-279 (1836). In 1821 Hill's Tramroad swung sharply into the single portal. There was possibly through running from Tyla to Llanfoist, is hinted at by the OS 1in of 1832 and the Tithe Plan (Llanwenarth) of 1845. This area is now covered with coal waste

[42] GRO D.751.328

wide) built to avoid encroaching on enclosed land, and a final 500m brought it to the head of the three inclines **(B7-9)** which took it to the canal. This it crossed by what is possibly the sixth oldest railway bridge in South Wales **(B10),**[43] constructed of three cast-iron T-section girders supporting the original cast-iron deck. A final incline **(B11)** ran down to the Llanfoist kilns **(B12)** and a transhipment point to the Llanvihangel Tramroad. The four inclines dropped 280m over about 1km.

Plate 9. Short tunnel on Hill's Tramroad

Along the route lie many holed blocks which have been turned through 90 degrees and must have originated elsewhere: probably the redundant Blaenavon-Tyla line. Field evidence and finds[44] show that the tramroad actually used sills, except that turnouts and inclines were laid with Outram plates. Some original plates were 4ft long with rib, hogged flange, feet and

---

[43] Hughes 1990, 328 implies that the date was 1822
[44] Lewis collection, plates P6, 7 and sills P38, 39

mortised ends **(Fig. 30)**; from the distance between wear marks on blocks others appear to have varied from 3ft to around 3ft 3ins long. Wear marks on blocks show the overall length of sills was about 3ft, and wear marks on sills show that the inside of the plate was 5¼in from the sill end. This gives a gauge of rather over 2ft, the Blaenavon gauge. The sill reconstructed here **(Fig. 31)** is very similar to others recovered in the vicinity of Pwll du **(Fig. 32)**.[45] A feature of the inner cheek is that it is slightly elliptical in plan, which would help in driving the two wooden holding keys. Part of a wheel originally 26in in diameter was recovered.

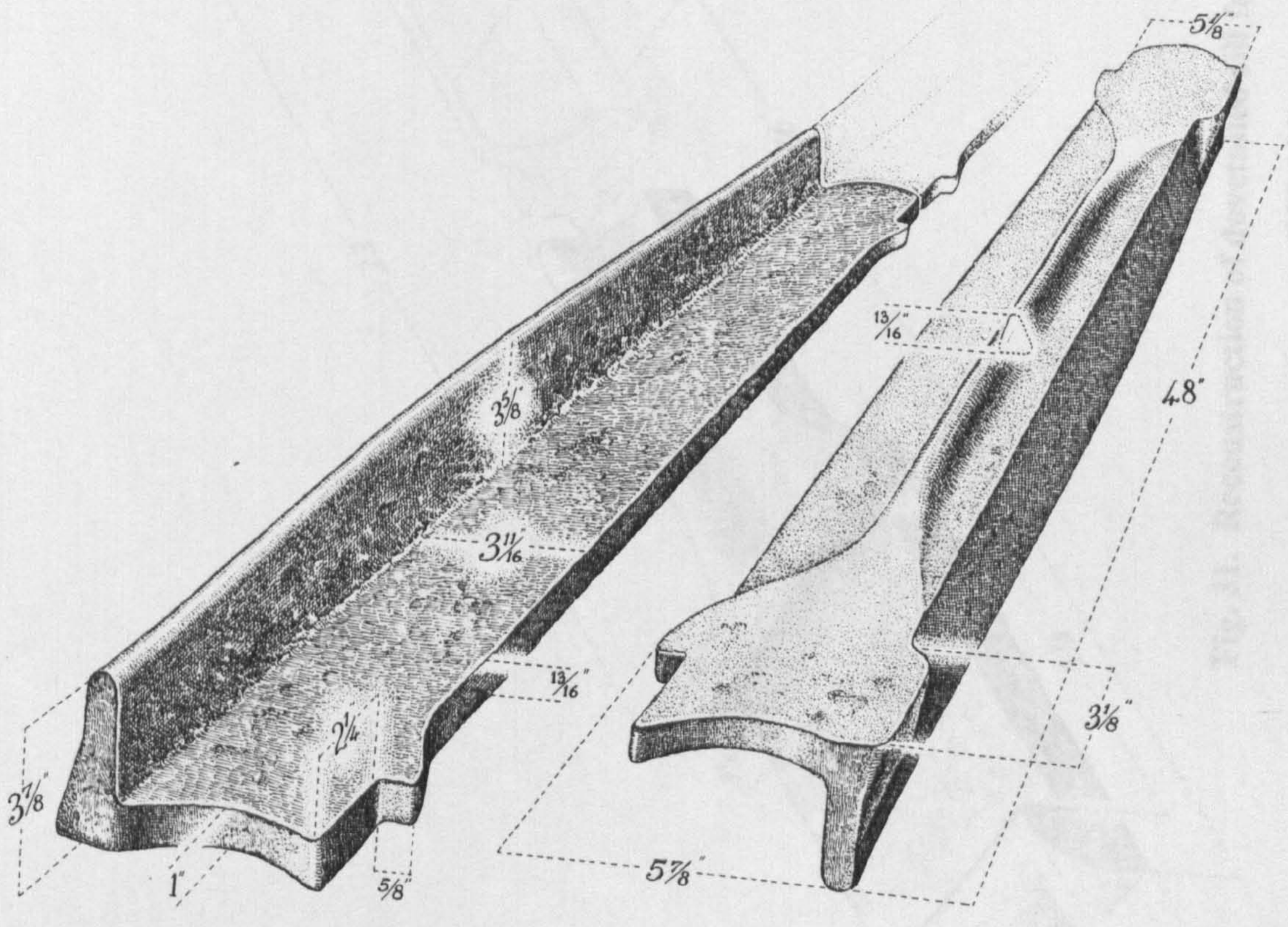


Fig. 30. Ribbed plate from Hill's Tramroad (258 120)

[45] Now at the 'Lamb and Fox'

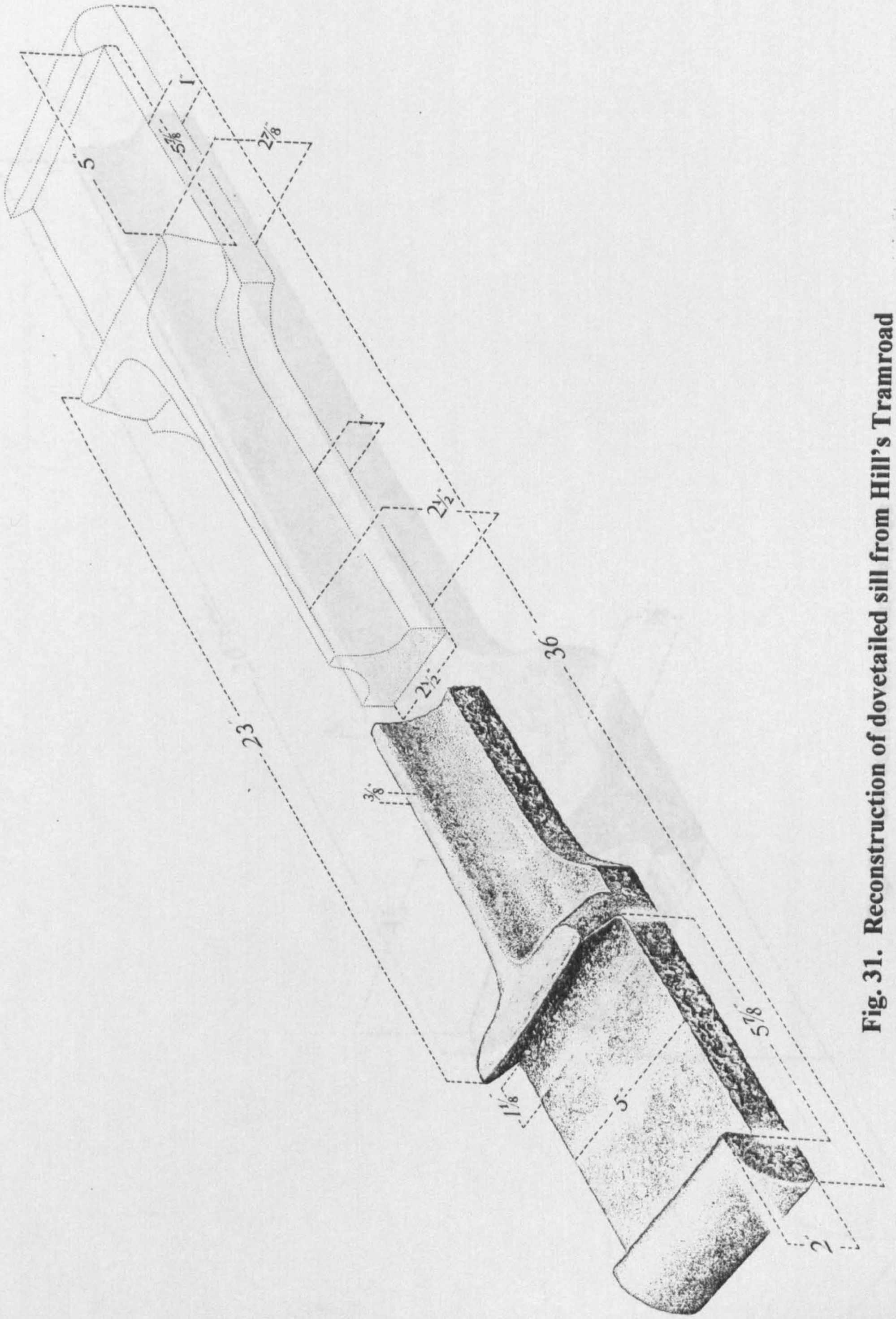


Fig. 31. Reconstruction of dovetailed sill from Hill's Tramroad (258 120)

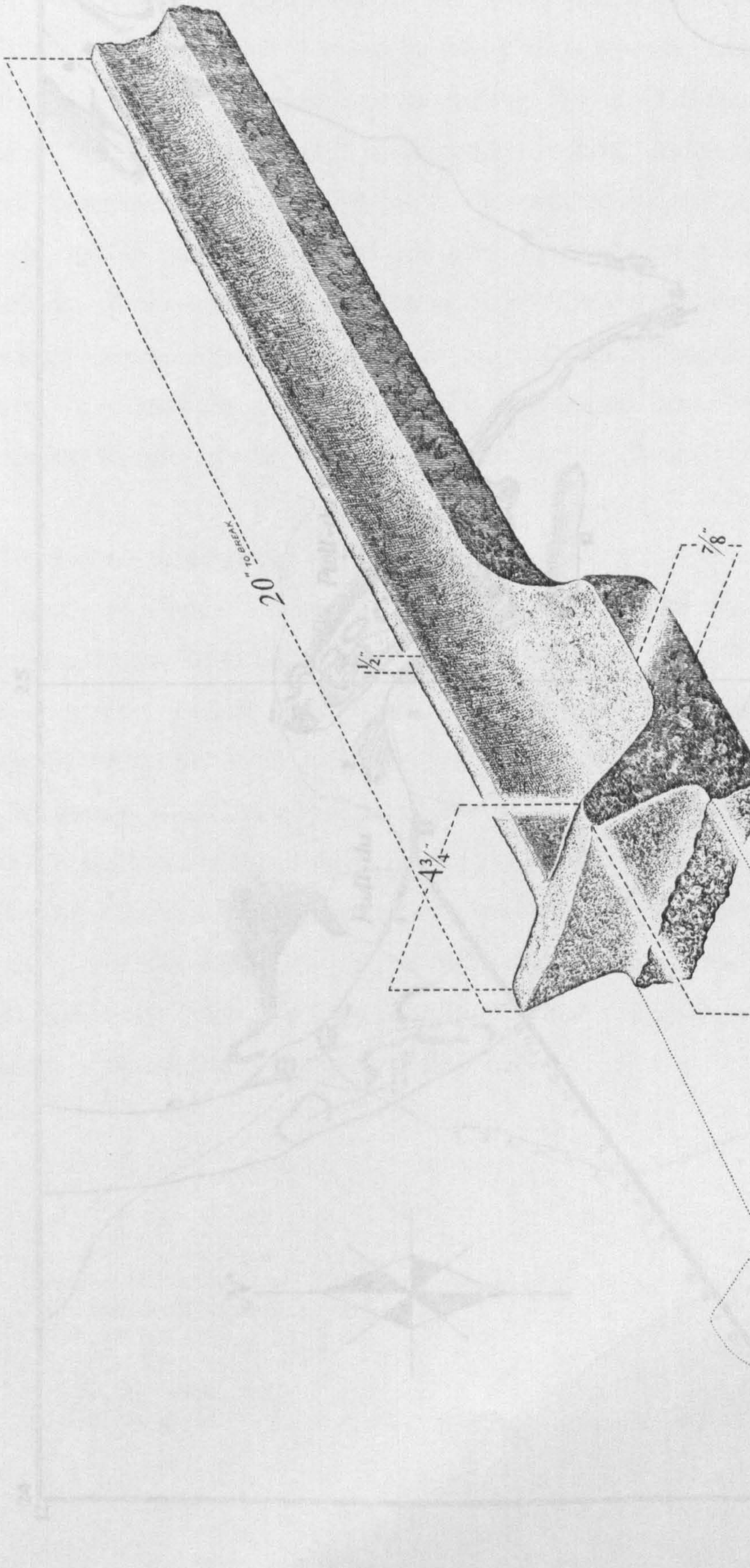
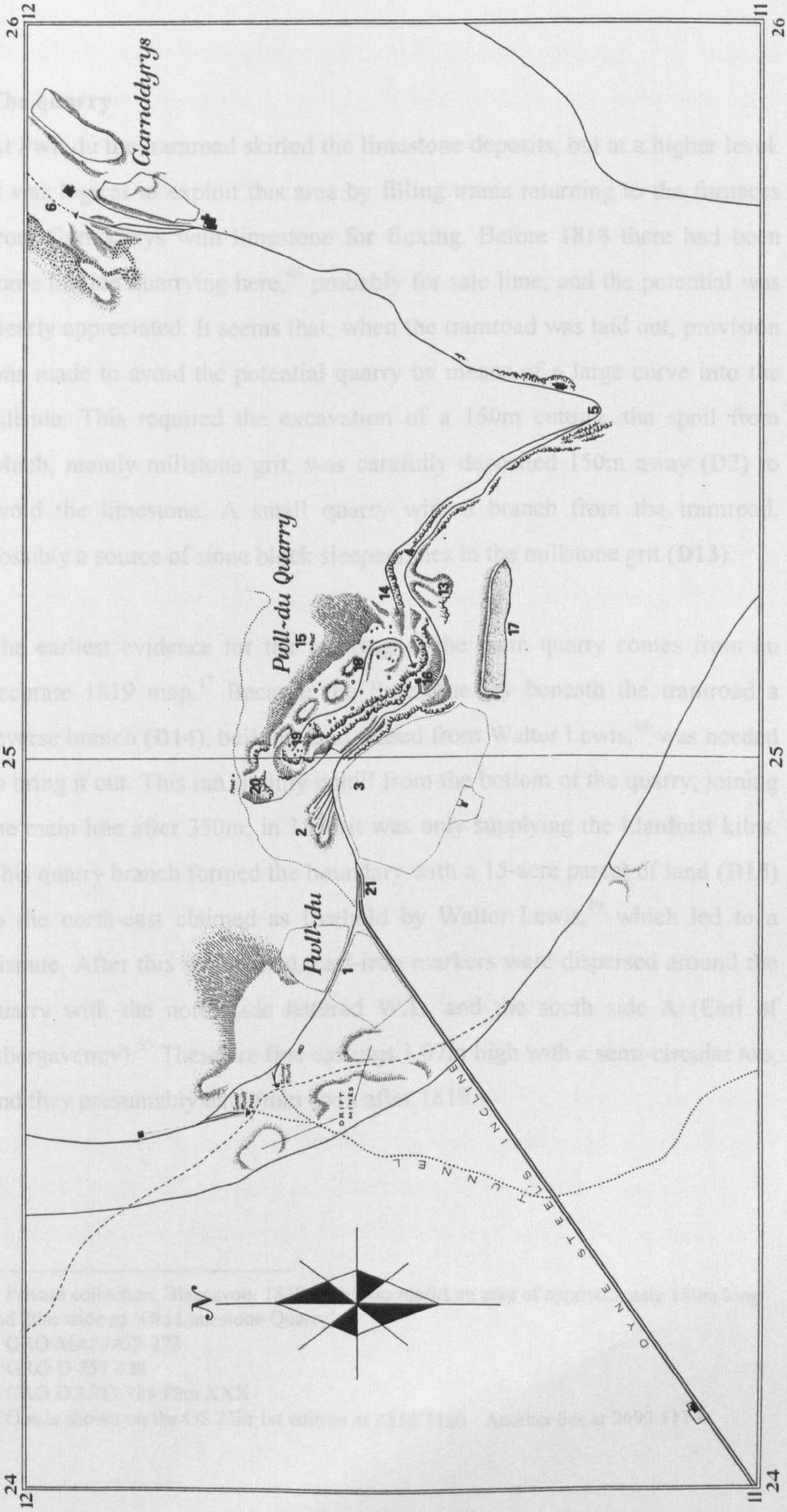


Fig. 32. Dovetailed sill from Pwll du



MAP D. PWLL DU QUARRY

The quarry

At Pwll du the tramroad skirted the limestone deposits, but at a higher level. It was logical to exploit this area by filling trams returning to the furnaces from Garnddyrys with limestone for fluxing. Before 1818 there had been some limited quarrying here,[46] probably for sale lime, and the potential was clearly appreciated. It seems that, when the tramroad was laid out, provision was made to avoid the potential quarry by means of a large curve into the hillside. This required the excavation of a 150m cutting, the spoil from which, mainly millstone grit, was carefully deposited 150m away **(D2)** to avoid the limestone. A small quarry with a branch from the tramroad, possibly a source of stone block sleepers, lies in the millstone grit **(D13)**.

The earliest evidence for the working of the main quarry comes from an accurate 1819 map.[47] Because the limestone lay beneath the tramroad a reverse branch **(D14)**, built on land leased from Walter Lewis,[48] was needed to bring it out. This ran slightly uphill from the bottom of the quarry, joining the main line after 350m; in 1829 it was only supplying the Llanfoist kilns. This quarry branch formed the boundary with a 15-acre parcel of land **(D15)** to the north-east claimed as freehold by Walter Lewis,[49] which led to a dispute. After this was settled, cast-iron markers were dispersed around the quarry with the north side lettered **W.L.** and the south side **A** (Earl of Abergavenny).[50] These are fine castings 1.07m high with a semi-circular top, and they presumably date from soon after 1819.

---

[46] Private collection, Blaenavon, 1818. The map marks an area of approximately 180m long and 20m wide as 'Old Limestone Quarry'
[47] GRO MAN/A/2-273
[48] GRO D.751.328
[49] GRO D.1583.188 Plan XXX
[50] One is shown on the OS 25in 1st edition at 2512 1160. Another lies at 2499 1174.

By 1836 the quarry extended along its final length.[51] Although it is shown as far as the boundary north of Hiley's holding **(D1)**, this point was never reached. Working was still shallow, probably no more than 3m deep. Between then and 1878,[52] but probably considerably earlier as the quarry had closed by then, radical progress was made. The face was advanced approximately 75m south-west, increasing its height to about 30m. This was done in two galleries.

As the quarry expanded, a thick band of massive limestone ('Blue Lime Stone') became available. Raising the rock to tunnel level by the tramroad with its lengthy reversing neck was inconvenient, and a water balance **(D16)** was therefore installed to lift loaded trams from the developing quarry floor directly to the upper tramroad. This was possibly promoted after 1839 by James Ashwell (1799-1881),[53] the extravagant Blaenavon company manager, based on the principle applied by him at the ironworks themselves, and was certainly in place before 1845.[54] From the 1820s water balance shafts were a common feature of the South Wales mining scene. The principle, which can still be seen at Penrhyn slate quarry in North Wales, was simple but efficient. Two buckets, each with rails on top, were connected by a chain passing over a braked sheave set in a cast-iron frame above. A loaded tram was run onto one bucket at the bottom, and the bucket at the top, carrying an empty tram, was filled with water. It was allowed to fall, controlled by the brake, and raised the loaded tram to the top. The water at Pwll du came from a pond **(D17)** cut into the hillside and contained by an earth dam with a stone lining. The top part of the balance shaft ran through shale, where it was lined with ashlar blocks reminiscent of James Ashwell's quality work; the rest was blasted through solid rock. It was approximately 20m back from

---

[51] GRO MAN/A/2/0279
[52] OS 25in 1878/79
[53] *MPICE* lxvi (1880-1), 372-5
[54] Tithe Plan for Llanwenarth

the final quarry face, and in 1863 its depth was 40m.[55] The access tunnel to its foot is now largely buried.

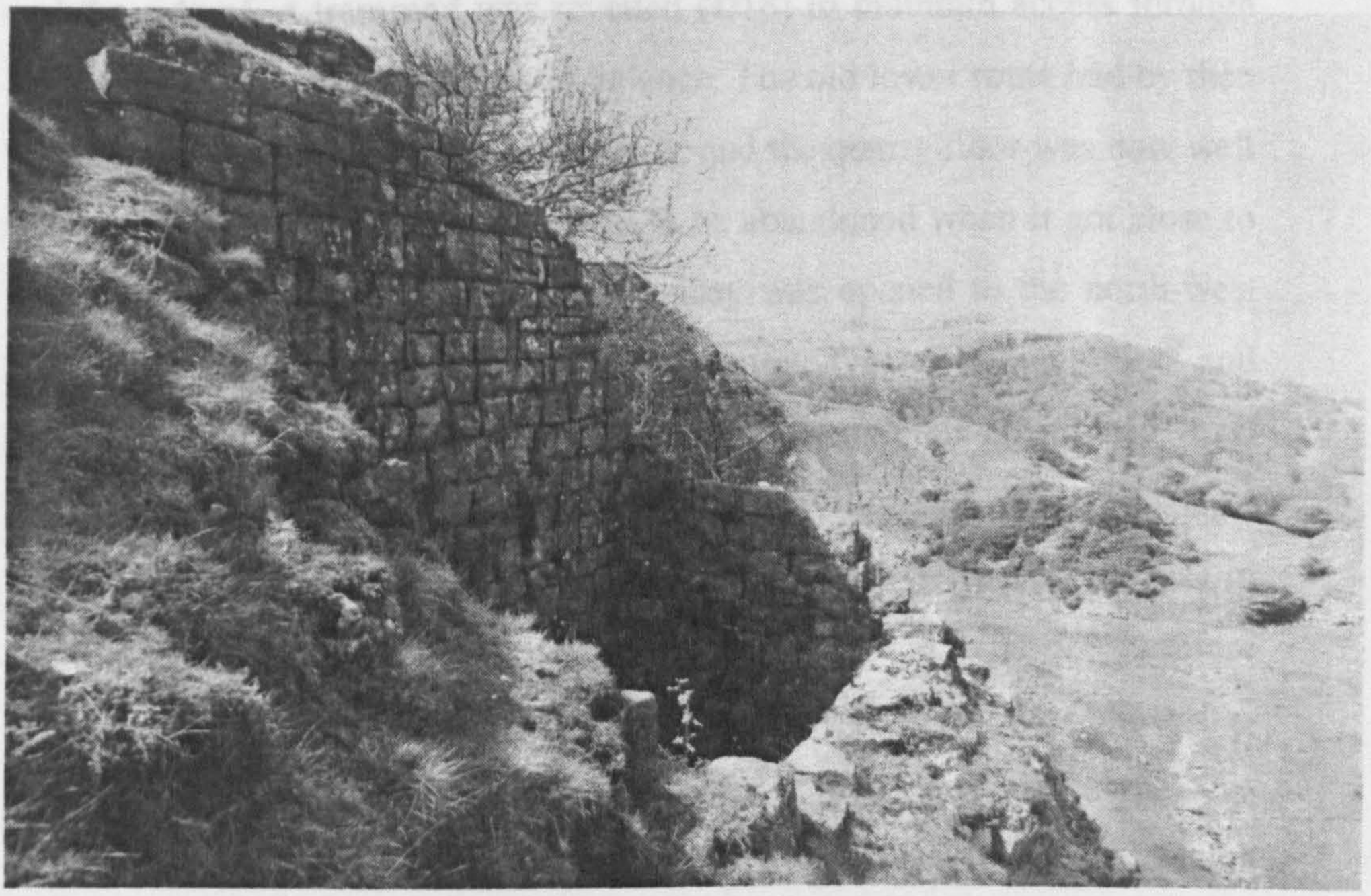


Plate 10. Top of Pwll du water balance shaft

We cannot be sure that the bottom tramroad **(D14)** continued in use for transporting limestone to the Llanfoist kilns, but it is likely that the water balance was used solely for fluxing stone. Output of sale limestone fell from 1845 to 1854 but then picked up again.[56] It was sold at Llanfoist by the Blaenavon company,[57] and must have arrived via Hill's Tramroad; but some or all may have come not from Pwll du but from Tyla.

---

[55] Private collection, Blaenavon, 1863

[56] GRO D.480.1, Blaenavon Company Minute Book. The potential for sale lime was high: in 1837 over 37,000 tons was sold at Llanfoist (GRO D.751.356).

[57] Weigh ticket: 'Llanfoist, March 1856. Bought of The Blaenavon Iron Company. Feb 20, To 8 Bls [bolls] Lime [@] 11d, 7s 4d. March 3, To 8 [bolls] 7s 4d.' (John van Laun collection).

Walter Lewis's freehold to the north was a constant waste management problem. Attempts were made to dispose of spoil within the quarry itself. Some of the high level waste was thrown behind the face as it progressed, and the side of a tramroad was revetted **(D18)** to maintain access through another pile to the foot of the water balance. The old lower route had by then been abandoned as spoil encroached on it, and the quarry floor was now well beneath its level. The main quarry had to be abandoned when it got close to severing Hill's Tramroad, and a new quarry was opened to the north-west **(D19).** In 1863 the quarry is shown as 'Limestone Quarry Balance Pit'[58] and may still have been working, but by 1880 it was completely abandoned[59] and the purpose of the balance shaft, now marked as 'Old Shaft (ironstone),' had been forgotten. It is concluded that the quarry probably went out of use in the late 1850s, around the time Garnddyrys forge closed.[60] Its life therefore spanned forty years. A further massive limestone quarry **(D20)** to the north-west of the main quarry, accessible only by a track, lies within the area claimed by the Earl[61] and may have been exploited early on for fluxing stone.

From the 1850s, a very short section of Hill's Tramroad continued in use for carrying coal from New Pit (see Map **B**) via a steam-powered double incline of which a 200m stretch can be followed on the Pwll du side. Built by Thomas Dyne Steel (1822-1898), the Blaenavon company's engineer,[62] it was standard gauge, each waggon carrying four trams.[63] At the end of their journey, where the incline curves round to run parallel to the tramroad **(D21)**, these were off-loaded onto Hill's for their journey through the tunnel.

---

[58] Private collection, Blaenavon, 1863
[59] OS 25in 1878/79
[60] Part of the incline to the canal was washed away in 1860 and there are no further recorded sales of limestone (Rattenbury 1980, 41)
[61] Cast iron marker at 2499 1172
[62] *MPICE* lxxxiii (1897-8), 406-8
[63] Steel 1968

The incline was abandoned by 1880,[64] there was no further use for Hill's Tramroad, and the land was returned to the Earl of Abergavenny in 1891.[65]

BLORENGE MOUNTAIN (270 125)

There was limestone burning on the Blorenge in or before 1585/6.[66] On the north side of the mountain, overlooking the Usk Valley, lies a shallow flat-floored quarry about 200m long **(B13)**. This area is part of the 1040 acre Blaenavon company lease of 1821,[67] but the quarry pre-dates this. Here the rock dips south and the quarry was formed by working directly up into the dip. Within the area are a number of trials and, by the time the quarry was abandoned, working was probably becoming difficult at the north-east end where the outcrop begins to turn east and then south-east along the contours. To continue working would involve driving down into the outcrop, removing substantial overburden and probably facing drainage problems.

From the quarry, the most obvious part of the Blorenge Tramroad can be followed as a bridleway and a track for around 2km. Even where the route would have had to make only minor detours to maintain the grade there are cuttings and stone embankments **(B16)**, and there is some cut and fill. At **B2** it ran close to the Tyla line, but then swung some 150m east to continue to the foot of the staith **(B3)** where **B2a** finished. Rails and sills similar to **Figs. 35-6** (see discussion below) at Blaenavon Ironworks itself, although not *in situ*, show that the Blorenge Tramroad continued to the works.

The origins of this tramroad may lie in an application from the Blaenavon Company in April 1795 for the B&A to build a railroad from Gwaith

---

[64] OS 25in 1878/79
[65] Rattenbury 1980, 41
[66] NLW Abergavenny/Manorial/A/1: Terrier, 15 January 1585/6
[67] GRO D.1583.188 Plan XXX

Newydd (new work: a colliery) in the parish of Llanfoist to near Llanfoist church.[68] But in October, armed with a favourable report by Hugh Henshall,[69] Blaenavon decided to give formal notice to the canal company and to build a rather different line itself.[70] It may be that it had decided on a tramroad rather than a railroad; the latter would have been the canal company style. The 'new work' may be Pwll Mawdy,[71] just in Llanfoist parish and north-east of **B2**. The top incline of Hill's Tramroad as built about 1817 **(B7)** lies only 600m from the end of the Blorenge Tramroad.

Initial searches found three small fragments of permanent way which enabled a conjectural reconstruction to be made **(Fig. 33)**. Their location, however, only confirmed that the tramroad had been completed to a point a little north-east of Keeper's Pond.

A further search was therefore organised and a complete sill of the suspected pattern, giving a gauge of 2ft 0½in, was found *in situ* only 400m from the quarry **(Fig. 35)**. To understand the origin of its design involves a digression. Ten sills recovered from near a drift mine at 1918 1289[72] in the Clydach valley have locating horns instead of the usual dovetails **(Fig. 34)**. Their weight, about 14lb, compares with the 15lb weight of some cast in 1794 at Ebbw Vale for Hill, Harford & Co at Nantyglo **(App. 3.4.E)**. The area where they were found was worked by Nantyglo around 1794 when preparations were afoot to put their furnace in blast. When the miners were discharged soon afterwards,[73] the ten sills were probably brought out of the drift and neatly stacked. Close by was found (but not kept) a 4ft plate which fitted the

---

[68] B&A General Assembly 13.4.1795
[69] B&A Committee Minutes 15.10.1795
[70] B&A Committee Minutes 17.12.1795
[71] 2582 1060
[72] John van Laun, BABT Report - SITE 120 Context 3
[73] Lloyd 1906, 167

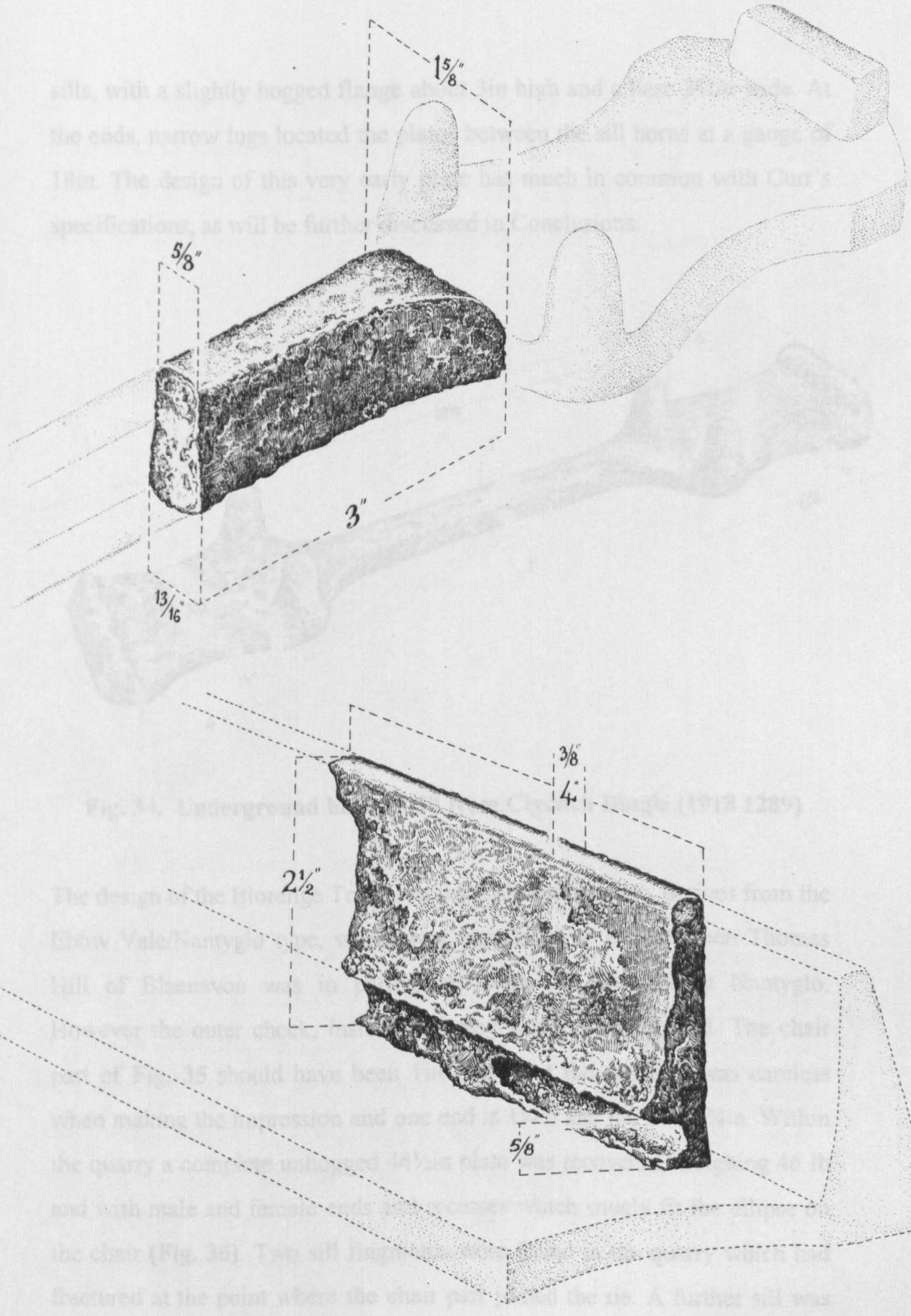


Fig. 33. Plateway finds from the Blorenge Tramroad (2587 1128)

sills, with a slightly hogged flange about 3in high and a base 3¾in wide. At the ends, narrow lugs located the plates between the sill horns at a gauge of 18in. The design of this very early plate has much in common with Curr's specifications, as will be further discussed in Conclusions.

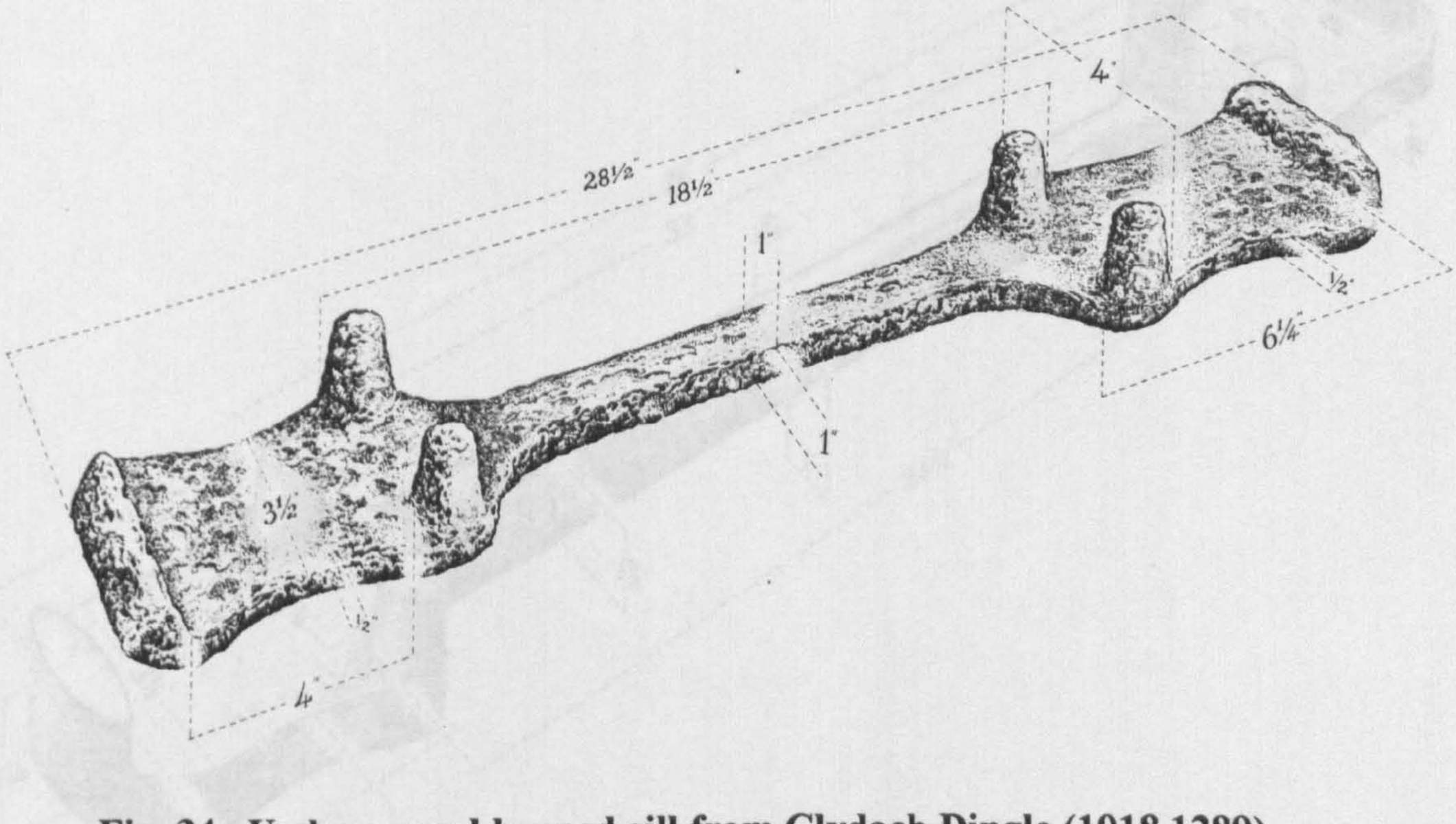


Fig. 34. Underground horned sill from Clydach Dingle (1918 1289)

The design of the Blorenge Tramroad track almost certainly derives from the Ebbw Vale/Nantyglo type, which was introduced at a time when Thomas Hill of Blaenavon was in partnership with the Harfords at Nantyglo. However the outer cheek, instead of being straight, is elliptical. The chair part of **Fig. 35** should have been 1in thick, but the moulder was careless when making the impression and one end is 1¼in and the other ¾in. Within the quarry a complete unhogged 44½in plate was recovered, weighing 46 lb and with male and female ends and recesses which snugly fit the ellipse on the chair **(Fig. 36)**. Two sill fragments were found in the quarry which had fractured at the point where the chair part joined the tie. A further sill was found *in situ* resting on stone blocks only 4in square and 1in thick. A lack of wear marks suggests limited use, and the design suggests a date close to that

of the Clydach finds, possibly about 1796 and soon after the railroad proposal was abandoned. The Blorenge plates are slightly shorter and probably 10lb heavier than the Clydach ones, a difference which may be attributed to the wider gauge and consequently greater weights carried.

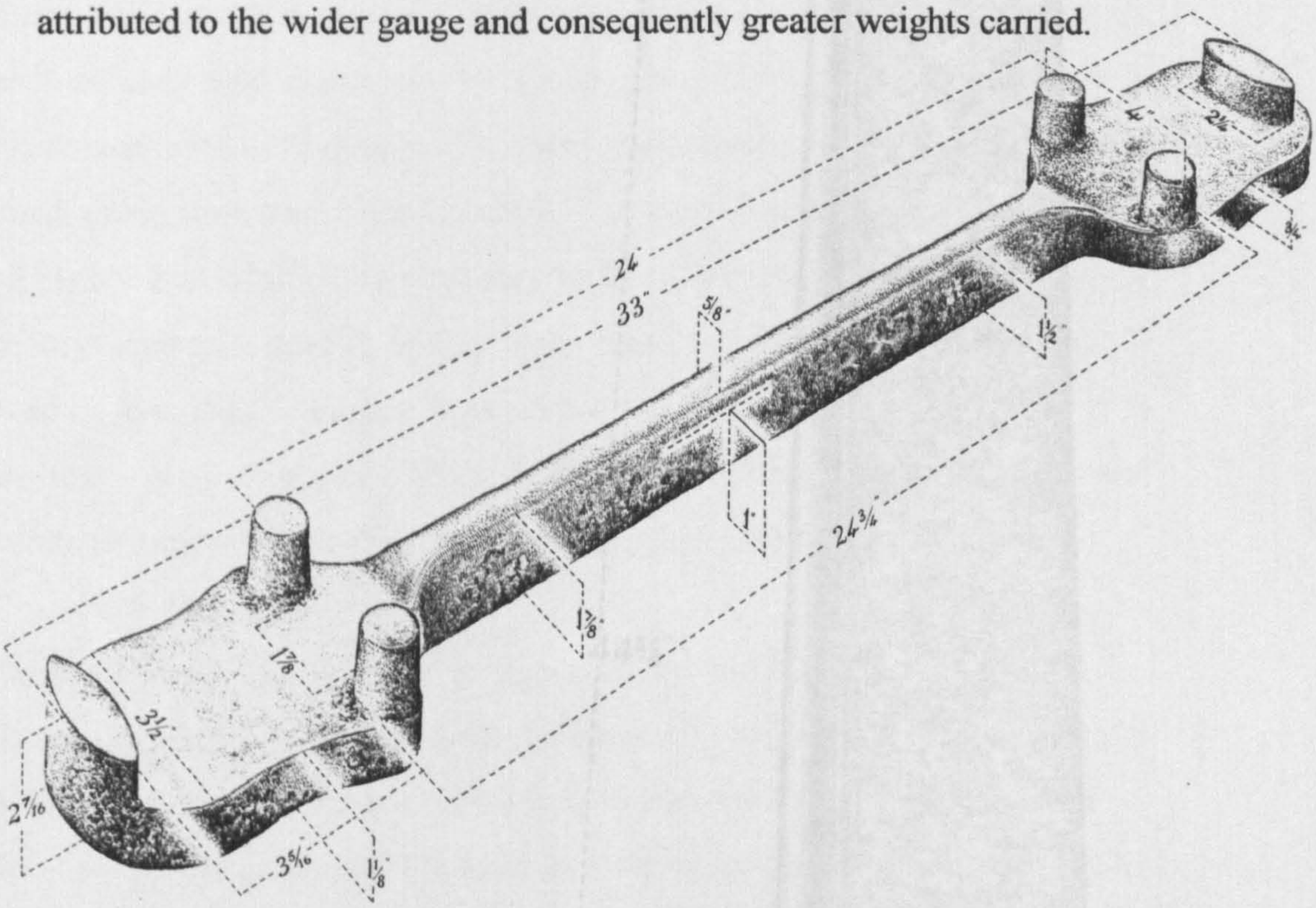


Fig. 35. Horned sill from Blorenge Tramroad (2664 1212)

The quarry was probably abandoned soon after 1800 when Blaenavon switched back to Tyla. James Watt junior was probably referring to it when he wrote in 1800 that Blaenavon received their limestone from '2 or 3 Miles from the Works to the North ... but expect to get it by a new dram road' which would reduce the cost from 3s 6d to 3s.[74] By 1813 the track had been lifted,[75] but memory of it survived: it is still marked as 'Old Tramway' in 1878. Perhaps limited quarrying continued for domestic purposes, the trackbed offering a convenient cartroad.

---

[74] BRL (Journal)

[75] Not marked on OS 1813, nor on subsequent maps which do however show a cartroad along the route

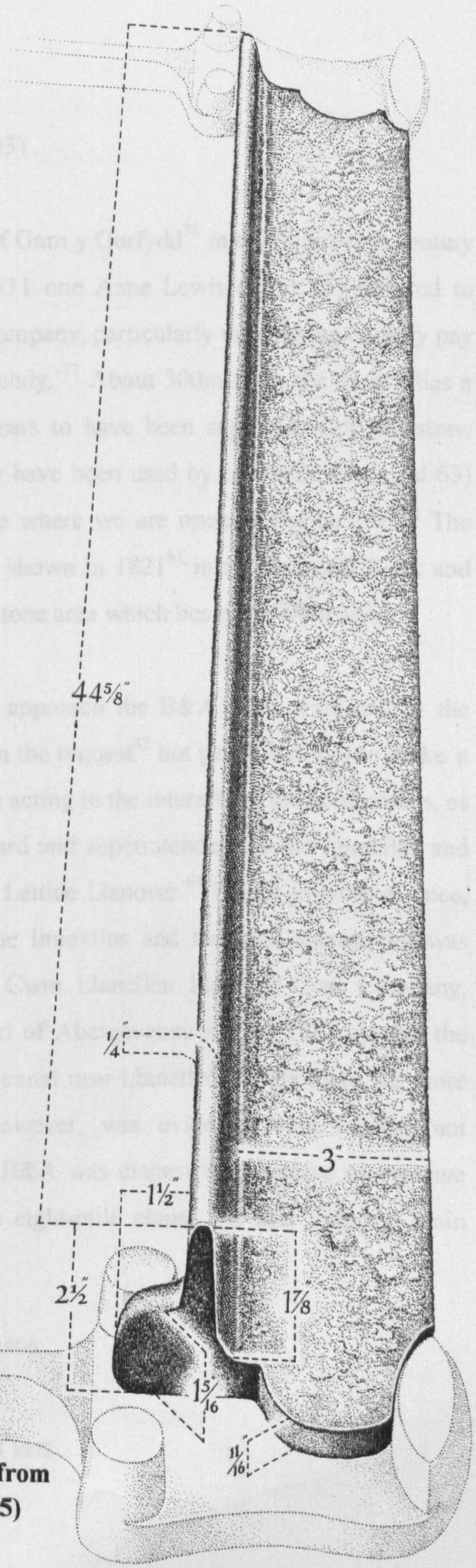


Fig. 36. Plate for horned sill from Blorenge tramroad (2691 1245)

CRAIG YR HAFOD (2730 1003)

Lime was burnt in the vicinity of Garn y Gorfydd[76] in the eighteenth century and possibly well before. In 1811 one Anne Lewis (aged 85) referred to 'encroachments of Blaenavon Company, particularly making the country pay for burning lime near Garn Clochdy.'[77] About 300m from the quarry lies a primitive limekiln[78] which appears to have been supplied with limestone from workings around it. It may have been used by Lewis Lewis (aged 63) who before 1811[79] 'burned lime where we are opening the quarry.'[80] The nearest source of coal is a level shown in 1821[81] in the Farewell Rock and orientated east towards the limestone area which lies only 900m away.

Walter Osland was the first to approach the B&A for a tramroad to the quarry. In 1810 they turned down the request[82] but permitted him to make it himself. He appears to have been acting in the interests of the commoners, as in 1811 he was appointed hayward and superintendent of the limekilns and coalworks of the manor of Park Lettice Llanover.[83] He set to work at once, busily investigating the rock, the limekilns and the coal seams, but was thwarted by the newly-formed Cwm Llanellen Lime & Coal Company, which took a lease from the Earl of Abergavenny and in 1812 opened the Craig yr Hafod Tramroad to the canal near Llanellen, where there are more substantial kilns. The lime, however, was evidently sold locally, not transferred to the canal, for the B&A was disgusted to receive no revenue from a tramroad built under its eight-mile clause. At this time the main

---

[76] 274 111 to 276 117
[77] GRO D.1210/1426/7; and see Evans 1996
[78] 2729 1031
[79] NLW Maybery 1/897 and 973
[80] GRO D.1210/1426/7; Evans 1996
[81] GRO D.1583.188 Plan XXX. At 2638 1072
[82] Rattenbury 1980, 28
[83] GRO 1210/1426/4

quarry, aligned north-south, was opened on the eastern slope near the top of Mynydd y Garn-fawr. When abandoned it was around 100m long.

The tramroad is of rudimentary construction with steep gradients and little wear. We have no date for its abandonment, but it was still marked on maps of 1821 and 1829.[84] A fragment of a heavy plate, with strengthening under the outer edge and **L** (for Llanellen?) cast on the underside, was recovered from near the top of the tramroad. A 28in curved notched plate in Abergavenny Museum **(Fig. 37)** gives a radius of 9½ft, or 12½ft on the outer rail which would be 3ft long.

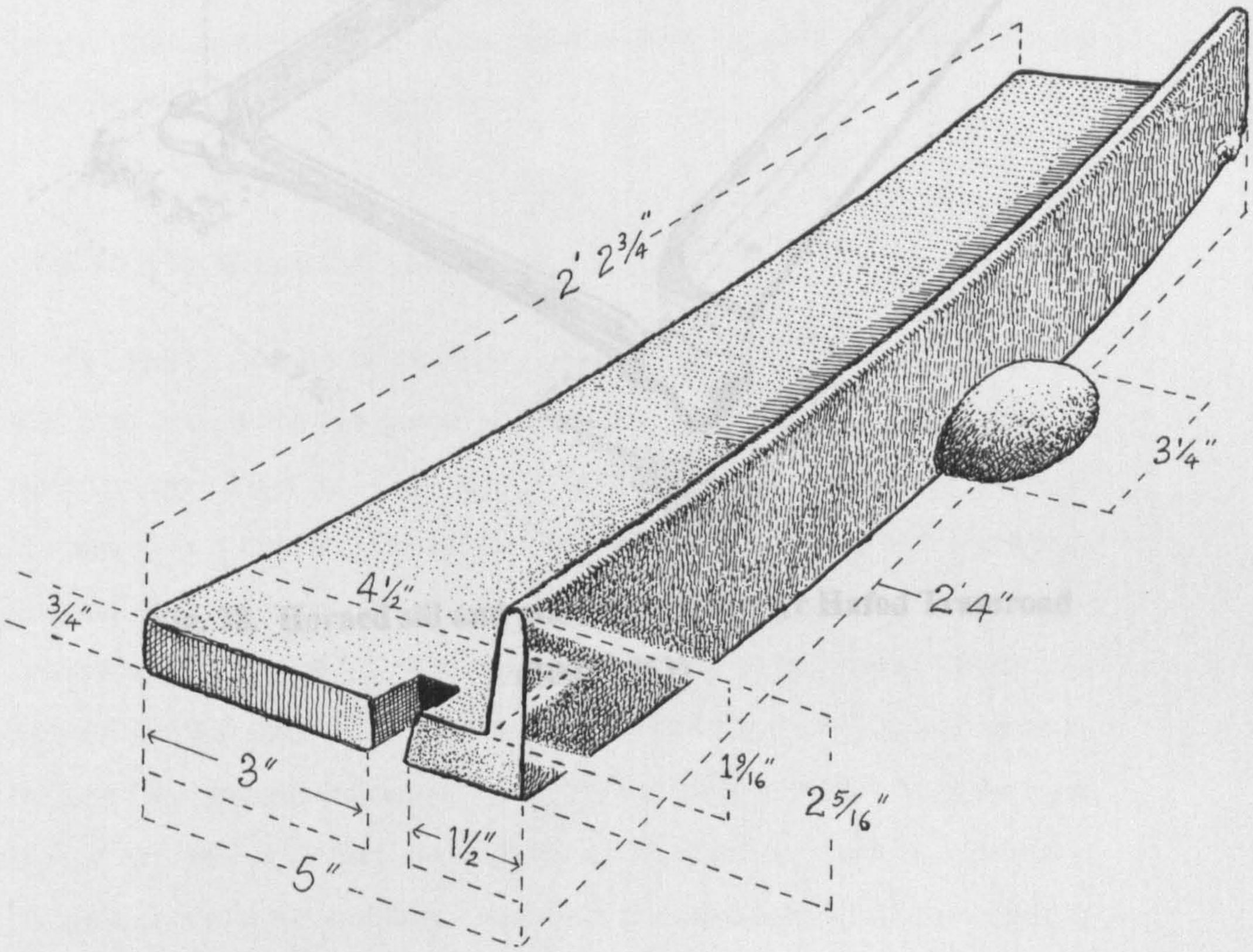


Fig. 37. Curved Outram plate from Craig yr Hafod Tramroad (Abergavenny Museum)

[84] GRO D.1583.188 Plan XXX; OS 1829

Measurement of blocks at Coed y Prior **(B17)** shows that the length of ordinary plates varied from 36 to 38in. The gauge is fixed as 2ft 10½in by a sill, similar to those on the 1804 Tredegar Tramroad **(Fig. 77)**, recovered from a kiln near the canal together with four 4ft 6in plates that fit it **(Fig. 38)**.[85]

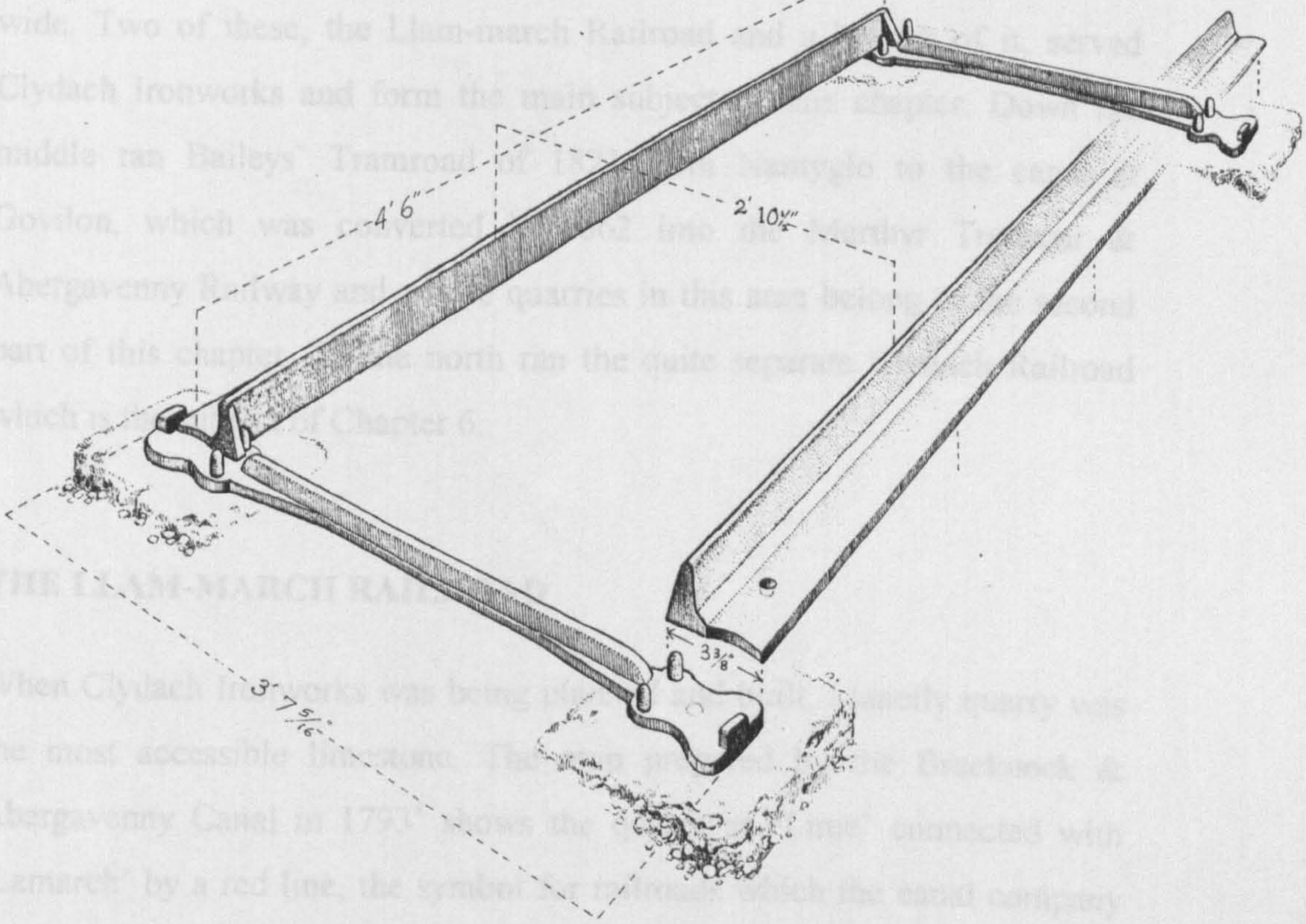


Fig. 38. Horned sill and plate from Craig yr Hafod Tramroad (3002 0963)

[85] The 2ft 9in given by Rattenbury 1980, 31 was based on less substantial evidence

CHAPTER 5
SOUTH CLYDACH

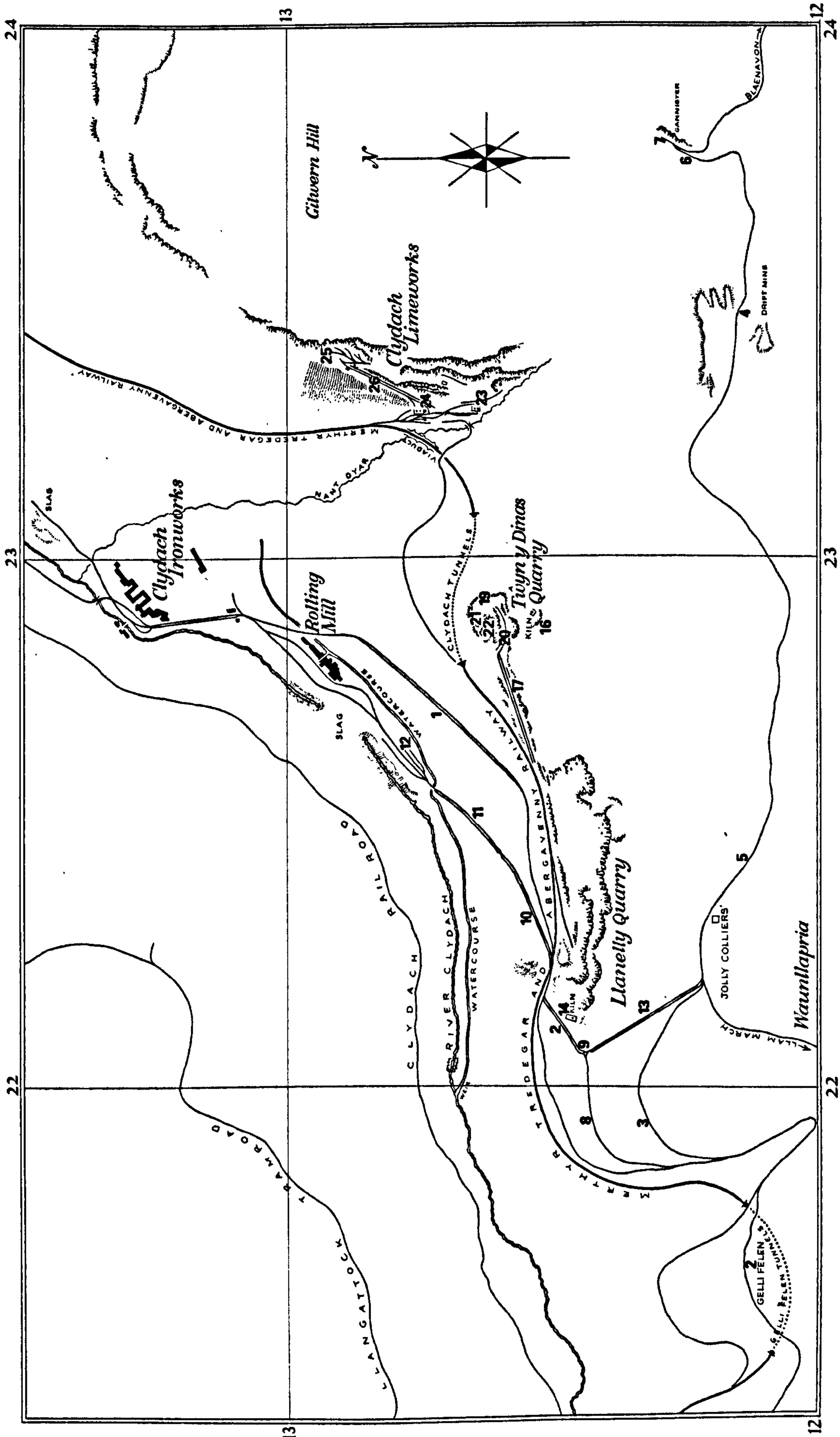
The Clydach valley is a complicated area. At one point no less than four railroads or tramroads ran roughly parallel within a band half a kilometre wide. Two of these, the Llam-march Railroad and a branch of it, served Clydach Ironworks and form the main subject of this chapter. Down the middle ran Baileys' Tramroad of 1821 from Nantyglo to the canal at Govilon, which was converted in 1862 into the Merthyr Tredegar & Abergavenny Railway and whose quarries in this area belong to the second part of this chapter. To the north ran the quite separate Clydach Railroad which is the subject of Chapter 6.

THE LLAM-MARCH RAILROAD

When Clydach Ironworks was being planned and built, Llanelly quarry was the most accessible limestone. The map prepared by the Brecknock & Abergavenny Canal in 1793[1] shows the quarry as 'Lime' connected with 'Lamarch' by a red line, the symbol for railroads which the canal company planned to build under their Act. The Llam-march Railroad[2] was indeed constructed by the B&A, although at the request of Frere, Cooke and Kendall of Clydach Ironworks, who paid a rental for its use. It was surveyed by John Dadford and opened by 1795 and was built, probably, with the same type of bar rails as he used on the Clydach Railroad, but cast in this case at Blaendare.[3] From the ironworks the route climbs steeply **(E1)** past Llanelly quarry for 1.5km (now a minor road), but at **E2** levels out to continue for

---

[1] T. Dadford Junr, 'Plan,' author's collection
[2] For its history see Rattenbury 1980, 83-4
[3] B&A Committee Minutes 12.2.1795 and 29.4.1795. David Tanner was paid a total of nearly £800 for rails



MAP E. THE QUARRY RAILROADS AND TRAMROADS OF SOUTH CLYDACH

another 750m to Gelli felen coal and ore works. The branch to Waun Llapria (**E3**), probably put in after 1797, ran east and then south to Llam-march iron mines, and later threw off another long branch (**E4**) east to Blaenavon.

THE LLANELLY INCLINES

In 1798[4] the Clydach company were given permission to alter the Llam-march to a double tramroad at their own expense. This formed part of a route spelt out by Outram in a printed report of 1799,[5] which proposed a complete tranfer of the Clydach Railroad from the north of the valley to the south. Outram is not entirely clear about the nature of the track; at one point he implies reuse of the Clydach rails, but his preamble is clearly discussing tramroads. His alternative would have run from the top of the existing Clydach Railroad, falling down the south side of the valley on a gradient of about 1 in 100 to Gelli felen

> at about fifty Feet below the Level of the present Coal Works, and continue the same Fall accross *Lamerch* Valley, and along the Side of the Hill for about Half a Mile, Eastward thereof; from thence a Fall of about one Hundred and forty Yards perpendicular, by an inclined Plane of about four Hundred Yards in Length, to near the Side of the Brook in the Bottom of the Vale; from the Foot of this inclined Plane, the Descent should be nearly two thirds of an Inch at a Yard, by which the Railway would be carried on the South Side of the Coke Hearths at *Clydach* Furnace ... it should be made double from the Lamerch Valley to Clydach Furnace, to avoid Interuptions from the Meeting of Waggons.

From the ironworks the line proposed would continue to the canal at Gilwern. This southerly route would broadly have followed that of the Baileys' Govilon Tramroad, but only as far at Llanelly Quarry. Below this point, Outram suggested replacing the steep section of **E1** with a single incline 400 yards long on the route later taken by **E10** and **E11**.

---

[4] B&A Committee Minutes 17.10.1798
[5] NLW Maybery 383

> The loaded Waggons descending the Plane, would bring up one third of their Weight of Loading in the ascending Waggons. The inclined Plane should be constructed on the rotative Principle, with an endless Chain to which the Waggons might be hooked, so that two, four, six, or more ... might be passing down, whilst equal Numbers were passed up, keeping up the Succession by hooking on, and casting off the Waggons at equal Distances on the Chain, so as to pass a Trade of any Extent; and unless the Upgate Trade should considerably exceed one third of the Downgate, no Power but the Weight of the Downgate Loading would be required to draw the Upgate Loading up the inclined Plane: but if in any extraordinary Case, more Power should be required, it might readily be applied to the Machine at the Head of the Plane.

The upward traffic would be iron en route from Clydach to Blaenavon, as will be discussed in the next section.

Outram's proposal for a complete remodelling of the Clydach was not adopted, and only relatively minor changes were made to the Llam-march. Work began in 1802 and was completed in 1804.[6] In the event, the rebuilt line did not deviate from the old but, instead of Outram's proposed single incline, the steep section of **E1** was converted into perhaps four inclines whose exact positions are not clear. At this time the cost of raising limestone at Llanelly quarry was given as:[7]

Raising per ton	10½d
Loading per ton	1½d
Unloading per ton	1½d
Jenny men	2½d
Ropes	2d

Cost of 21cw. LW [2520lb] at the furnaces 1s 6d.

The cost of running the inclines, at 25 per cent of the total, was high. The jenny men and ropes imply balanced inclines using ropes rather than chains.

---

[6] Rattenbury 1980, 85 says it is not known when it was finally completed. However by September 1804 Clydach were ready to deliver 30 tons of 'Bristol tramplates' (NLW Maybery II 3200)

[7] NLW John Lloyd Collection (vol.1) 145, March 1804

The ropes may have been flat hemp ropes after Curr's patent of 1798[8] and the brake engine itself a Curr type (for further discussion see Conclusions). A heavy and primitive Outram-type curved plate with additional lugs for spiking down was recovered from near the lower Llam-march Tramroad built in 1809 from the ironworks to the canal **(Fig. 39)**. However the lugs may be related to the heavy work one would expect on inclines, and it may have originated on the upper line and been reused.[9]

In April 1806[10] it was reported that

> the Lamerch Jinny Tram Road is not equal to the whole of their [Clydach Ironworks'] business, and having proposed to alter the same by making a deviation or a new branch at or near the place where their Gelli Felin Road joins the Lamerch Road by continuing the said Gelli Felin Branch with a proper fall to the place on the fudlon [Ffyddlwn] Farm above the fourth Roller and descending from thence by one or more Inclined Plane or Planes to a convenient spot near the upper water course and from thence to be continued to their works at the proper fall.

This new line, completed in October 1811,[11] adopted Outram's proposed route but incorporated three inclines instead of the one which he had suggested. **E1** was abandoned. A new level stretch **(E8)** was followed by a new incline **(E9)** through Ffyddlwn Farm: the 'fourth roller' mentioned was no doubt the sheave or drum on the highest **E1** incline of 1804. After crossing the old **E1**, the new line dropped down two more inclines **(E10** and **E11).** At its foot **E11** crossed a culverted stream near the leat which supplied the rolling mills. The stone bridge (see Chapter 6) still extant at this

---

[8] Curr 1797 (repr. 1970, introduction, 3): patent no. 2270, 17 Nov. 1798
[9] 2379 1409. Weight 40lb
[10] B&A General Assembly 16.10.1806
[11] Rattenbury 1980, 86

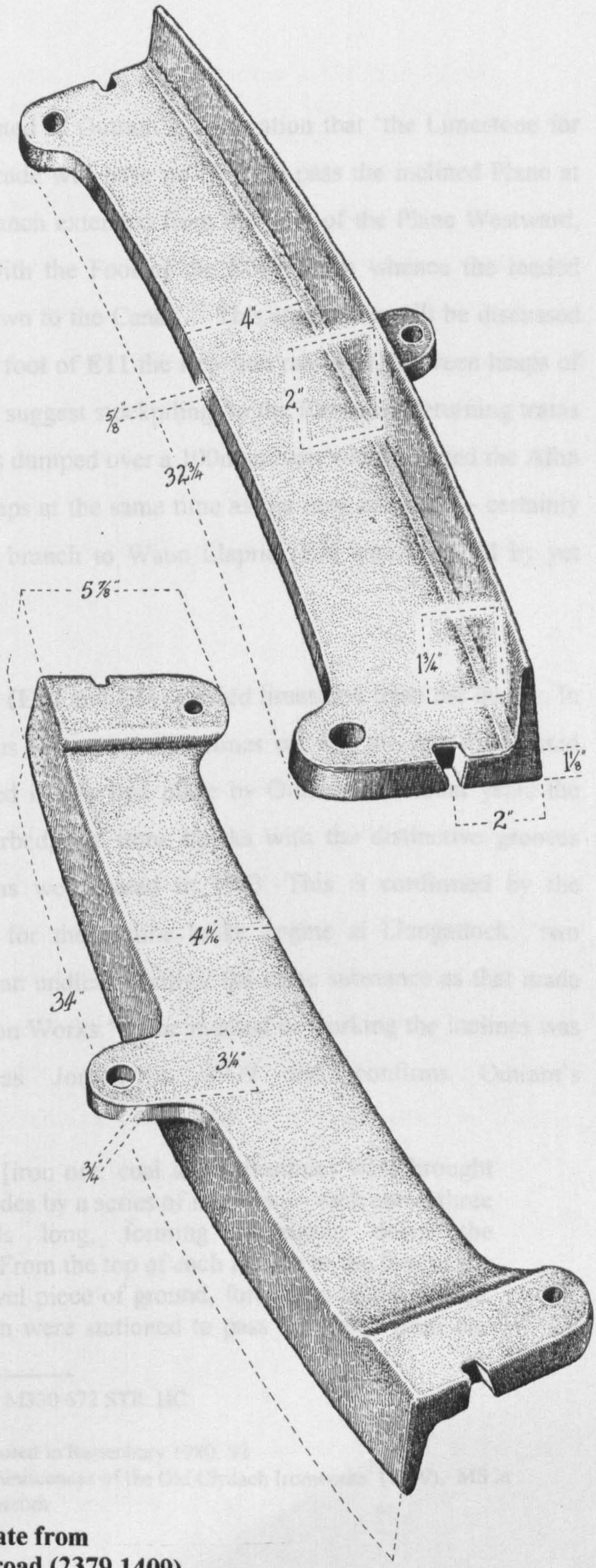


Fig. 39. Curved plate from Llam-march Tramroad (2379 1409)

point[12] is probably related to Outram's observation that 'the Limestone for Supply of the Canal Trade will have no Need to pass the inclined Plane at all, for a very short Branch extended from the Foot of the Plane Westward, would communicate with the Foot of the Rock, from whence the loaded Waggons would be drawn to the Canal'.[13] This suggestion will be discussed in Chapter 6. From the foot of **E11** the new line ran level, between heaps of limestone **(E12)** which suggest stockpiling, to the furnaces. Returning trams brought slag which was dumped over a 100m culvert which carried the Afon Clydach beneath. Perhaps at the same time as the new inclines — certainly not before — the old branch to Waun Llapria **(E3)** was replaced by yet another incline **(E13)**.

The two lower inclines **(E10** and **E11)** carried limestone from the quarry. In contrast to the previous rope-worked inclines on **E1**, the new ones used chains as recommended in the first place by Outram. In recent years the ground has been disturbed, but stone blocks with the distinctive grooves worn by incline chains were noted in 1973. This is confirmed by the specification of 1814 for the incline brake engine at Llangattock: 'two horizontal wheels and an endless chain of the same substance as that made use of ... at Clydach Iron Works.'[14] The method of working the inclines was described by Thomas Jordan in 1909 and confirms Outram's recommendations.[15]

> The materials [iron ore, coal and limestone] were brought down the hillsides by a series of inclines — each about three hundred yards long, forming a zigzag down the mountainside. From the top of each incline to the foot of the next, was a level piece of ground, forming a landing place, where two men were stationed to pass the trams from one

---

[12] Newport Ref. Library, px M330 672 STR. HC
[13] NLW Maybery 383
[14] NLW Maybery 964-5, quoted in Rattenbury 1980, 92
[15] Thomas Jordan, 'My Reminiscences of the Old Clydach Ironworks' (1909), MS in Abergavenny & District Museum

> incline to the other. The inclines were self-acting, having the weight of the full trams going down drawing the empty ones up, and were controlled and regulated in their motion by a brake on a wheel over which an endless chain worked, and to which the trams were attached.

In the quarry, little remains which can be attributed to ironmaking, for most of it belongs to the railway age. Just within the quarry lies a set of kilns **(E14)** similar to those at Cwm, which could have supplied mortar, via Baileys' Govilon Tramroad, for the Gelli-felen tunnels on the Merthyr Tredegar & Abergavenny Railway about 650m to the west. The two bores were opened in 1862 (386yds) and 1877 (252yds).[16] The route of Baileys' Tramroad **(E15)** sweeps round the hill pierced by the tunnels and passes the eastern portals at the same level.

In 1863 Llanelly quarry was leased by John Jayne, who in 1867 also acquired the Clydach Ironworks, which were already in terminal decline. The final changes to the inclines were doubtless his work. A plan of 1869[17] shows that they were laid with a mixture of standard gauge track and plateway to serve both the MT&A Railway and the tramroads of the Clydach Ironworks.[18] This arrangement probably originated in the desire to run coal onto the MT&A without the need for transhipment at the railway end. Coal would come by tramroad to point A (see **Fig. 40**) either from Gelli felen or from the drift at **E4** beyond the Jolly Colliers via **E13** (H to A), which was a double incline laid with plate rails only, and which also carried ore from the mines around the Miners' Arms at Llam-march.[19] At A, the coal destined for the MT&A was presumably transferred from tramroad to standard gauge

---

[16] Barrie 1980, 75
[17] GRO D.591.19.409
[18] In 1879 there was an unfulfilled plan to build a railway down the inclines to Gilwern and posibly beyond (Newport Ref. Library, px M 330 672 STR HC)
[19] The distinction between miners and colliers is made clear in these pub names

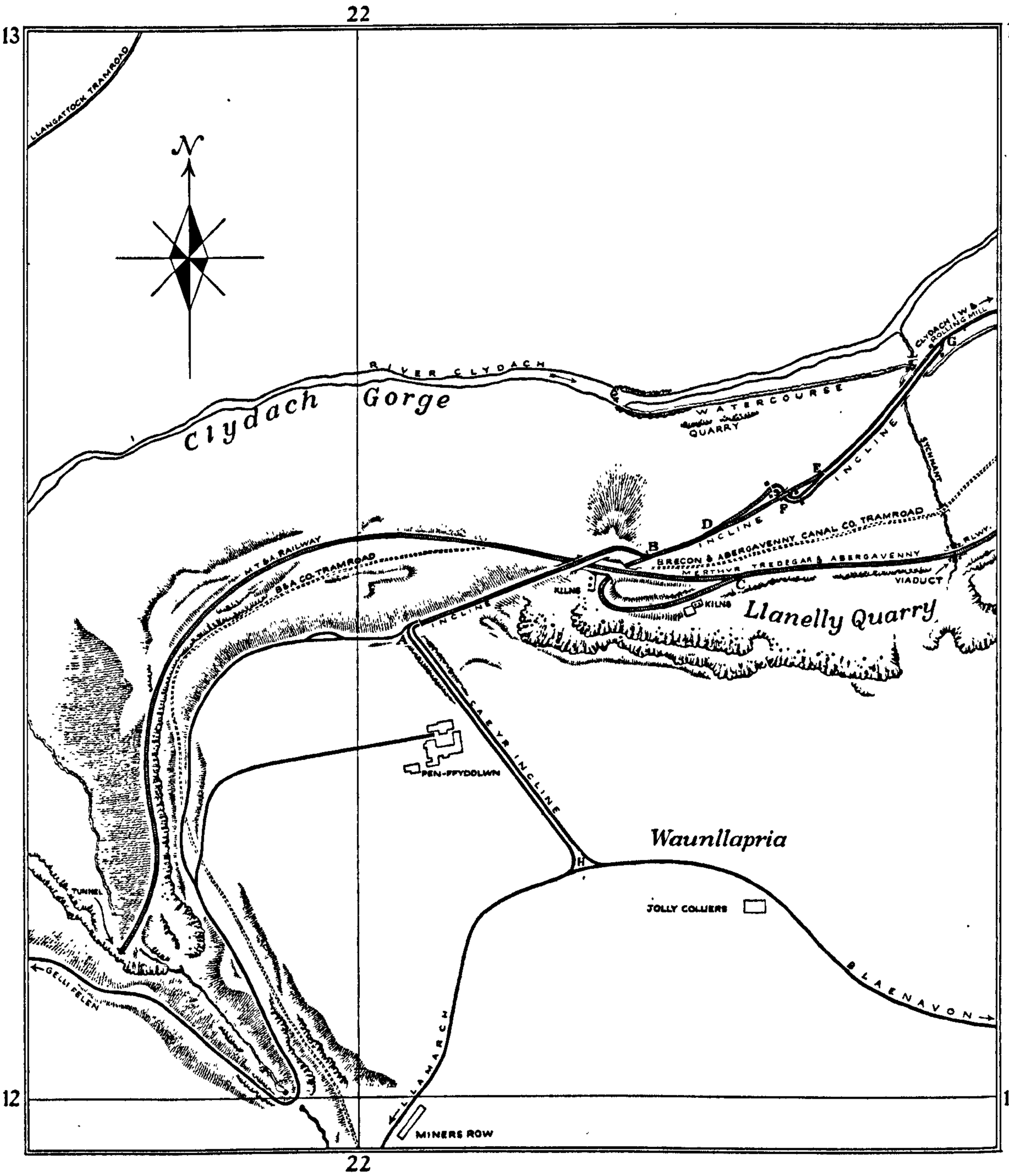


Fig. 40. The Llanelly inclines in 1869

waggons. Incline **E9** had single track of combined edge rail and plateway. If the plateway gauge was about 4ft 5½in over the flanges (as will be argued later) there would be a gap of about 1½in each side, just adequate to accommodate a tramroad wheel inside the edge rail. This incline crossed the MT&A on a skew bridge, the masonry of whose abutments is of obvious railway vintage, down to railway level at B whence a siding curved sharply back into the quarry to join the MT&A at C.[20] Incline **E10** had single mixed track from B to D, from where the standard gauge rails continued direct to E on incline **E11** after passing over F. From D to F and F to E was plateway only, with a landing and rollers to guide the rope onto **E11**. From E to G this consisted of double track with one track laid with combined edge and plate rails. The purpose of this complicated system was evidently to allow coal to be run straight onto the MT&A as well as maintaining suppies of iron ore and coal for Clydach Ironworks. But although inclines **E9, E10** and **E11** are the same length and were presumably worked together, it is very far from clear how they were operated.

CLYDACH-BLAENAVON TRAMROAD

Until 1812 when the B&A was finally joined to the Monmouthshire Canal, Clydach Ironworks had no handy canal outlet for its produce, and was forced to look south to the Monmouthshire. In 1797 Edward Frere requested permission from the MCC to construct a 'stone road' from Waun Llapria to Blaenavon,[21] from where he would use the Blaenavon Railroad to the canal head at Pontnewynydd. In November this request was granted, and the road was built before October 1799 when the MCC asked Frere & Cooke how much they had spent on 'the common road leading from their works to

---

[20] By 1879/80 (OS 6in, 1st edition) the accommodation bridge under the MT&A carried only a tramroad to a spoil tip.
[21] MCC Committee Minutes 21.11.1797

Blaenavon.'[22] Indeed Outram's report quoted earlier shows that traffic, presumably iron from Clydach, was already moving up the Llanelly inclines by July 1799.

Some uncertainty surrounds this road. There is a faint possibility that it was actually a railroad, on the same route as the later tramroad which served the same purpose. The Llam-march and the Blaenavon, and presumably the original Blaenavon-Tyla line, shared a common gauge, and if Clydach's road were a railroad joining the Tyla line at Pwll du, 'common road' could mean a shared or joint railroad. Certainly railroads were frequently referred to at the time as roads. Much more likely, however, it was an ordinary cart road, as the phrases 'stone road' and 'common road' naturally imply. There is, however, a strong suggestion that it ran not as far as the head of the Blaenavon Railroad, but only to Pwll du where iron could be transferred from road to the Tyla-Blaenavon line. In May 1798, a few months after permission was given to build this road, the MCC ordered Dadford to prepare 'a plan and estimate for an extension of the Blaenavon Railroad to the top of the Blaenavon furnaces.'[23] Hitherto the sidings off the Blaenavon Railroad ran only to the foot of the furnaces, while the line from Tyla ran only to their top. It is difficult to see any purpose for this new link other than to allow Clydach's traffic to run through from Pwll du to the Blaenavon Railroad.[24]

It was probably this link which Coxe saw under construction on 27 August 1798.[25]

> In the vicinity of Blaenavon we observed the process of making a rail road, so called because it is formed by a kind

---

[22] MCC Committee Minutes 30.10.1799
[23] MCC Committee Minutes 30.5.1798
[24] Thomas Deakin's map of 1819 shows that transhipment then took place between Hill's Tramroad (via the tunnel) and the Blaenavon Railroad at the foot of the furnaces
[25] Coxe 1801, vol.2, 230. The date is provided by the journals of his companion Sir Richard Colt Hoare (Thompson 1983, 98)

> of frame with iron rails, or bars, laid lengthways, and fastened or cramped by means of cross bars. The ground being excavated, about six feet in breadth, and two in depth, is strewed over with broken pieces of stone, and the frame laid down; it is composed of rails, sleepers, or cross bars, and under sleepers. The rail is a bar of cast iron, four feet in length, three inches thick, and one and a half broad; its extremities are respectively concave and convex, or in other words are morticed and tenanted into each other, and fastened at the ends by two wooden pegs to a cross bar called the sleeper. The sleeper was originally of iron, but experience having shown that iron was liable to snap or bend, is now made of wood, which is considerably cheaper, and requires less repair. Under each extremity of the sleeper is a square piece of wood, called the under sleeper, to which it is attached by a peg ... At the junction of two roads, and to facilitate the passage of two cars in opposite directions, movable rails, called turn rails, are occasionally used, which are fastened with screws instead of pegs, and may be pushed sideways ... The road, sometimes conveyed in a strait line, sometimes winding round the side of precipices, is a picturesque object, and the cars filled with coals or iron, and gliding along occasionally without horses, impress the traveller, who is unaccustomed to such spectacles, with pleasing astonishment.

If the interpretation of the link past the furnaces is correct, Clydach presumably continued to use the Tyla railroad even after Blaenavon had switched to the Blorenge Tramroad.

The archaeological evidence is quite clear that at some stage a tramroad of about 4ft 4in gauge was laid from Waun Llapria to Blaenavon. Beyond the Jolly Colliers **(E5)** it ran more or less level for 1.5km before crossing Cwm Dyar by a substantial causeway **(E6)**. From here it climbed gently to cross a minor road where, to gain height, there was a reversing spur **(E7)** 60ft long, where the formation is supported against sideways collapse by some careful kerbing. Between **E4** and **E6** is a substantial run of blocks at 3ft intervals and with single holes for Outram plates. The gauge between holes is generally 4ft 10in, and from wear marks the gauge between flanges is about

4ft 4in. At **E7** a run of 19 blocks at 3ft intervals has been lifted but the depressions again suggest a gauge of very roughly 4ft 6in. From here almost to Pwll du any evidence is covered by a tarmacced minor road, but at the summit of the road near Pwll du (see **Fig. 41**), just short of the Blaenavon-Tyla line, are more blocks with a gauge of 4ft 10in between holes.

Before looking at the evidence between Pwll du and Blaenavon, it is worth discussing the date of this line. A gauge of 4ft 4in between flanges compares with the 4ft 8in between holes on blocks at the foot of incline **E11** at the Clydach end.[26] This match is close enough, especially if plates of different design were used on these sections. It also ties in with the maximum possible gauge of 4ft 5½in over the flanges where standard gauge rails were later added to the inclines. There is thus no reason to doubt that we are dealing with a Clydach Ironworks line. The tramroad must pre-date 1812 when the B&A and the Monmouthshire were joined and the reason for Clydach exporting its iron via Blaenavon thereby vanished. Indeed Clydach would surely not lay out substantial capital after 1809 when construction of the canal link was begun and its completion was foreseeable, and when the Llam-march was extended from the ironworks down to the B&A at Gilwern in readiness for that event.[27]

It is therefore likely that the tramroad was laid, no doubt along the existing road, in 1802-4 when the Llam-march itself was being converted from edge to plate rails. It was moreover at about this time, though as we have seen the date cannot be pinpointed, that Blaenavon abandoned its Blorenge Tramroad and replaced the Tyla Railroad with a 2ft gauge tramroad. The 4ft 4in gauge of the new line from Clydach would therefore have to continue all the way to the Blaenavon Railroad, onto which Clydach iron would have to be

---

[26] John van Laun field notes 16.2.73
[27] Rattenbury 1980, 16, 85

transhipped. The decision to build this tramroad is probably marked by the MCC's order in November 1802 that 'a turnout [be put] on the Blaenavon Road to accommodate Messrs Frere & Cooke as soon as possible:' a siding, in other words, for transhipment. In 1804[28] the MCC also allowed Frere & Cooke £150 for repairs provided they continued using the Blaenavon Railroad until the B&A joined the Monmouthshire.

On the stretch between Pwll du and Blaenavon, now shared by the Clydach 4ft 4in and the Blaenavon 2ft gauge, it might be supposed that a third rail would be laid. But the archaeological evidence is to the contrary, and demands separate lines side by side. **Fig. 41** shows the evidence for the apparent arrangement at Pwll du, superimposed on the 25in map. First, there are two parallel lines of ballast, roughly 4ft 8in and 2ft wide. Second, in the narrow line of ballast lies a holed block which is characteristic of those on the Blaenavon-Tyla tramroad. Third, in line with the broad ballast, are three blocks, two on one side of the track and one on the other. They are not opposite each other but somewhat staggered, and the gauge between holes when measured slightly diagonally is 5ft 1in, which would give something like 4ft 10in if measured at right angles. The plate length, however, differs from that to the west in being 47in. South of this point there are no more blocks on the broader gauge. From **B2** onwards there are strong indications, parallel to the Blaenavon-Tyla Tramroad, of a second line which ultimately ran past the foot of the staith **(B3).**

The nature of its rails is uncertain. Possibly they were different from the Blaenavon pattern, for a low flanged plate strengthened by ribbing under the outer edge of the tread was found at **B2a (Fig. 42)**. But, given the choice of tramroads to which it could belong, there can be no certainty about its

[28] MCC Committee Minutes, 2.5.1804

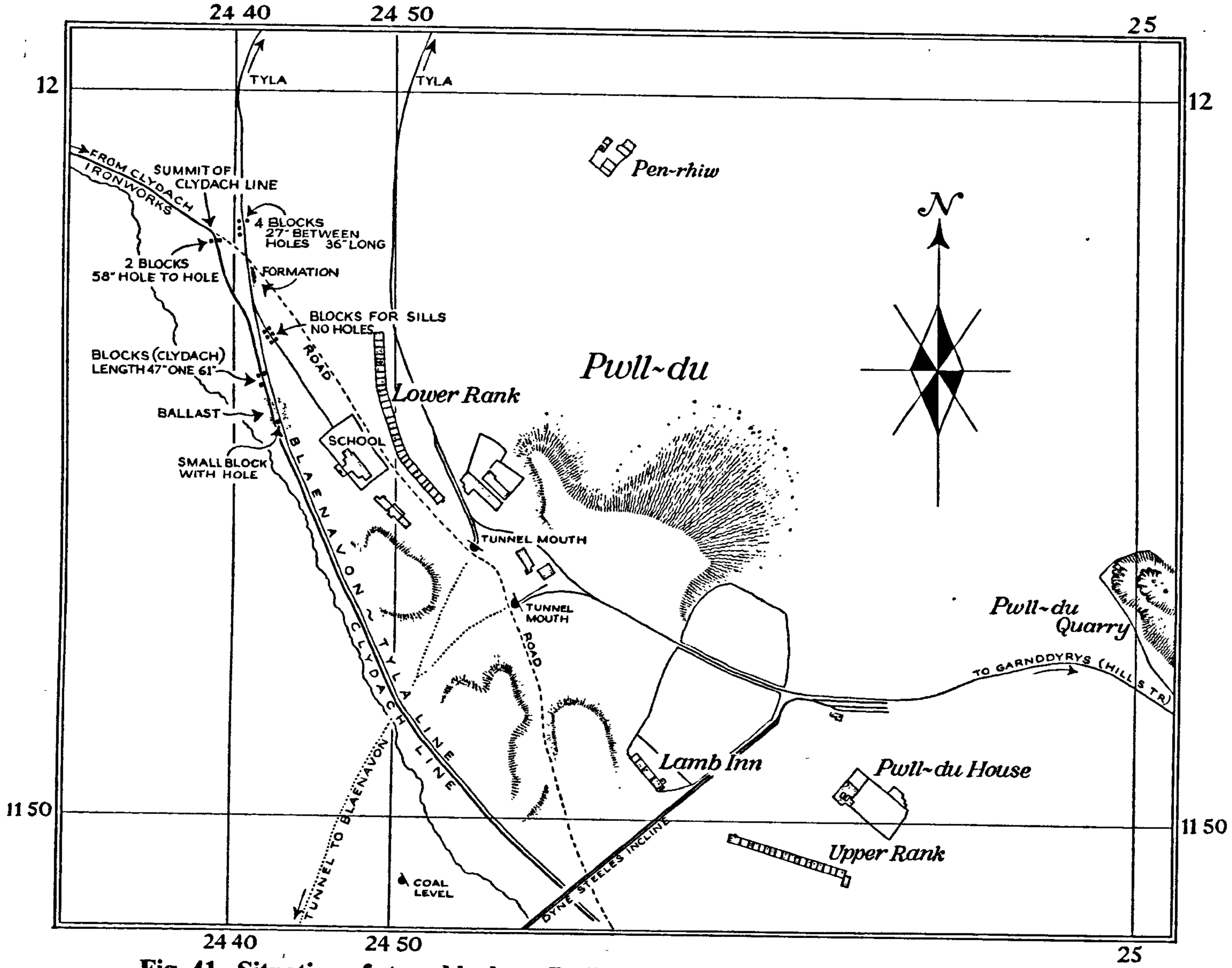


Fig. 41. Situation of stone blocks at Pwll du (re-drawn from 1st edition 25in map)

ownership. A more likely possibility is raised by a curved plate recovered near Pwll du **(Fig. 43)** which has similarities to that from Clydach **(Fig. 39)**, although in this case it could either be held in horned sills or fixed in the Outram fashion. With its weight of 55lb it can only be for surface use; and its length of 39½in equates to a length of 47in for the corresponding outer rail on the curve, the same as that measured elsewhere on the Clydach-Blaenavon line. It fits very well into two sill fragments, similar to **Fig. 29** but designed for a heavier plate. One was found just south of **B2a (Fig. 115)**, the other, almost identical, on a Coal Board track about 200m from the Clydach-Blaenavon line[29] from where it could easily have been swept when the track was bulldozed. Probably, therefore, the Clydach-Blaenavon line was in part laid with horned sills, and the use of Outram-style rails only for turnouts would explain the absence of blocks further along the line.

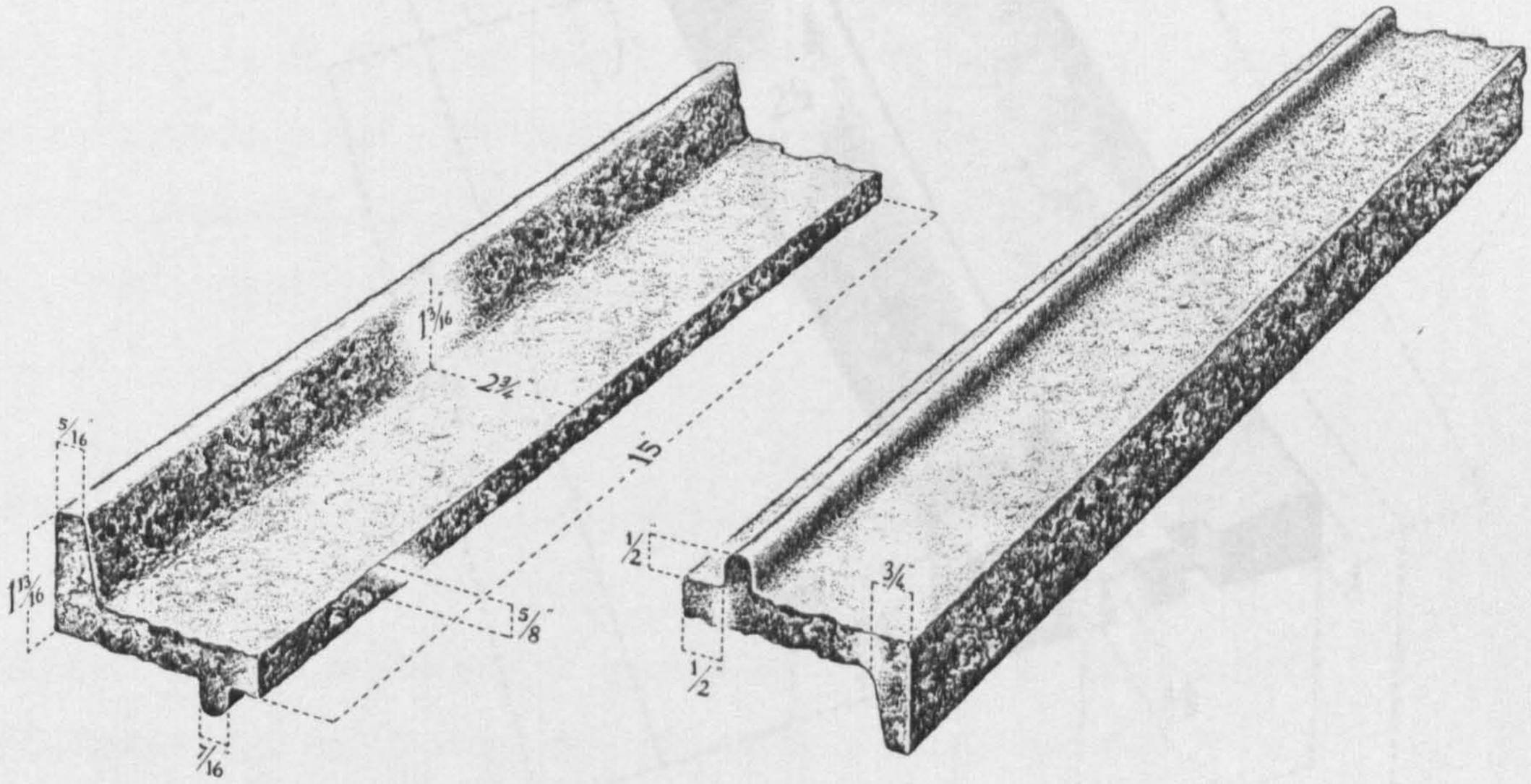


Fig. 42. Ribbed and low-flanged plate from near Blaenavon staith (2546 1018)

[29] 2372 1203

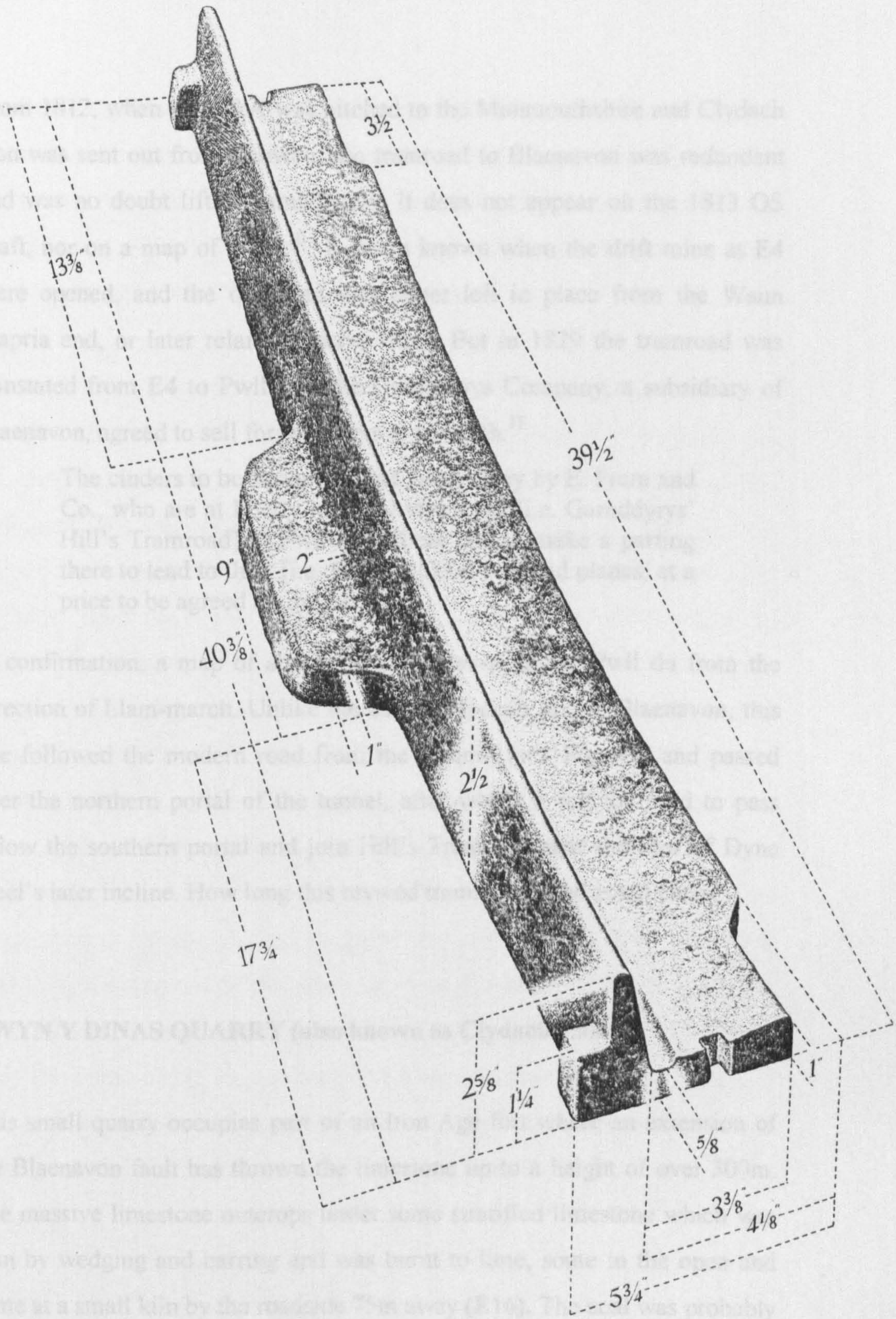


Fig. 43. Dual-purpose curved plate from Clydach-Blaenavon tramroad (2456 1159)

From 1812, when the B&A was hitched to the Monmouthshire and Clydach iron was sent out from Gilwern, the tramroad to Blaenavon was redundant and was no doubt lifted immediately. It does not appear on the 1813 OS draft, nor on a map of 1819.[30] It is not known when the drift mine at **E4** were opened, and the tramroad was either left in place from the Waun Llapria end, or later relaid, to serve them. But in 1829 the tramroad was reinstated from **E4** to Pwll du. The Garnddyrys Company, a subsidiary of Blaenavon, agreed to sell forge cinders to Clydach:[31]

> The cinders to be sorted out and taken away by E. Frere and Co., who are at liberty to travel their road [i.e. Garnddyrys' Hill's Tramroad] to Pwlldu Colliery and to make a parting there to lead to their [i.e. Frere & Co's] inclined planes, at a price to be agreed on inspection

In confirmation, a map of about 1836[32] shows a line to Pwll du from the direction of Llam-march. Unlike the earlier Clydach line to Blaenavon, this one followed the modern road from the summit (see **Fig. 41**) and passed over the northern portal of the tunnel, after which it left the road to pass below the southern portal and join Hill's Tramroad near the foot of Dyne Steel's later incline. How long this revived tramroad lasted is not clear.

TWYN Y DINAS QUARRY (also known as Clydach Camp)

This small quarry occupies part of an Iron Age fort where an extension of the Blaenavon fault has thrown the limestone up to a height of over 300m. The massive limestone outcrops under some stratified limestone which was won by wedging and barring and was burnt to lime, some in the open and some at a small kiln by the roadside 75m away **(E16).** The coal was probably brought from Gelli felen from where a level footpath runs to the quarry.

---

[30] GRO MAN/A/2-273
[31] NLW John Lloyd 167, 18.11.1829
[32] Copy in author's possession. Not found at GRO. Copy also held by RCAHM

Nantyglo began working the massive apparently about 1830. In 1829 an incline had been built for about a third of its final length of 300m towards the quarry from Bailey's Govilon Tramroad,[33] and it had evidently been completed by 1831 when it was claimed that Nantyglo did not use trams returning from Govilon Wharf to carry limestone.[34]

The main quarry is a cleared area of 50m x 46m **(E19)**, averaging 5m deep. On the north side a wall of limestone **(E21)**, 3.5m high and 3m thick, was left, possibly to protect the quarrymen from the inclement weather at this high level. The clearing was done by about six parallel lines, starting from the north-east and leaving low longitudinal piles of waste between them. But the most desirable stone was the massive, and instead of working the available stratified limestone, the quarrymen blasted and 'trawled' an east-west trench 40m by 3m and 2m deep **(E22)** through the massive towards a break in the backwall. The stone was brought out slightly uphill to join the existing tramroads. Where this trench has been abandoned at its west end, two or three rock steps clearly show the size of the blocks (about 1 cubic metre or 2 tons) removed by blasting from the top downwards. This raises the question of whether the whole quarry was worked by trenches. The lines joined into a single one **(E20)** which led through a short cutting to a ledge at the incline head, where the foundations of the brakesman's shelter can be seen. The brake wheel was vertical. The double incline **(E17)** can be traced from here down to where it was cut by the MT&A. On the north side is a substantial retaining wall. Some Outram-type blocks lie along its course.

---

[33] OS 1829. Rattenbury 1980, 87 wrongly links Twyn y Dinas to the Llam-march Railroad. The quarry with its incline was sketched c.1830 by Peter Richard Hoare (1772-1849) (National Museum of Wales case XLVI/1577)

[34] *Monmouthshire Merlin* 12 March 1831

THE CWM QUARRY INCLINE, CLYDACH LIMEWORKS

A small quarry known as Cwmdu was at work here in 1831,[35] but the greater part of Cwm quarry, also known as Cuckoo quarry, belongs to the railway age. The MT&A was opened in 1862 and doubled by 1877. Close to the quarry, on the single line, are a 386yd tunnel and a 150yd viaduct which, like the Gelli-felen tunnels, would have needed large quantities of lime for mortar. Before the railway arrived, Baileys' 4ft 4in Govilon Tramroad of 1821 ran conveniently into Cwm Dyar, crossing it by a small bridge which is partly extant. Close by is a set of double kilns **(E23)** which, it is suggested, provided lime for building the 1862 tunnel and viaduct. We may presume that Crawshay Bailey, as chairman of the MT&A, favoured the carriage of lime by his Govilon Tramroad, which was probably being used by the MT&A for constructional purposes by August 1860.[36] Once the single line was open, a siding off the MT&A into the quarry was possible,[37] on which was built a new large double kiln **(E24)**, each part having two draw-arches. The quality of work is reminiscent of railway construction, and it was most likely built for the doubling of the line, mandatory under the MT&A Act of 1863,[38] which necessitated a second tunnel of 352yds and widening of the viaduct.

High above the railway to the north-east lies a quarry **(E25)** which by 1879/80[39] was linked to the kilns by an incline **(E26)**, with a branch to a transhipment staith. At this time only a third of the final quarry area was being worked; by 1903[40] the shape of the quarry was complete but the incline was still in existence, since secondary working was perhaps taking

---

[35] NLW Maybery I 340
[36] Tasker 1986, 16
[37] Cuckoo's Nest Siding (Airey 1876)
[38] Barrie 1980, 75
[39] OS 25in
[40] OS 25in

place. From maps and from archaeological evidence it is possible to reconstruct this balance-worked incline **(Figs. 44-5)**.

The brake engine was contained within a pit built of good cut stone 17ft 4in by 13ft and 4ft 3in deep. The brake wheel itself occupied an inner pit, 11ft 6in by 6ft 3in and of unknown depth. Judging from its pit and from half of a brake strap (6ft 1in diameter, to which the missing half was hinged), the brake wheel was vertical and a little under 6ft in diameter. Its 12ft axle turned in bearings set in the outer pit,[41] and carried three cast-iron wheels (only traces remained) keyed with wooden wedges. Six holding-down bolts outside the inner pit presumably secured the frame which supported the wheel. In front lie the ruins of the brakesman's shelter which commands a view of the incline. From it the wrought-iron brake rod runs into the outer pit, and opposite, aligned with a channel running into the outer pit, is a narrow stone-lined pit which evidently held a counterweight similar to those used in railway signalling to balance the dead weight of the rods. The two cable paths are clear, the north-west one being the shallower and therefore for winding onto the top of the drum. Opposite the brakeman's shelter are remains of the weigh-house and weigh-pit, which was originally perhaps 6ft square.[42] The slot for the lever arm is clearly visible.

From the contemporary map[43] it is possible to see how the system worked. A single line emerged from the quarry over the weigh-pit to a reversing point behind the brake engine. From here the loaded tram or trams were run forward over the pit and hitched to the cable. The eastern line on the incline

---

[41] John van Laun field notes 21.11.78. These bearings could not be found in Sept. 1996
[42] Hughes 1990, 182-184 shows the weighing mechanism of c.1847 at Banwen Ironworks, where the pit was about 3ft 6in square
[43] OS 25in1881

was isolated and carried a counterbalance waggon, while running of empty and loaded trams was confined to the western line over the brake engine.[44]

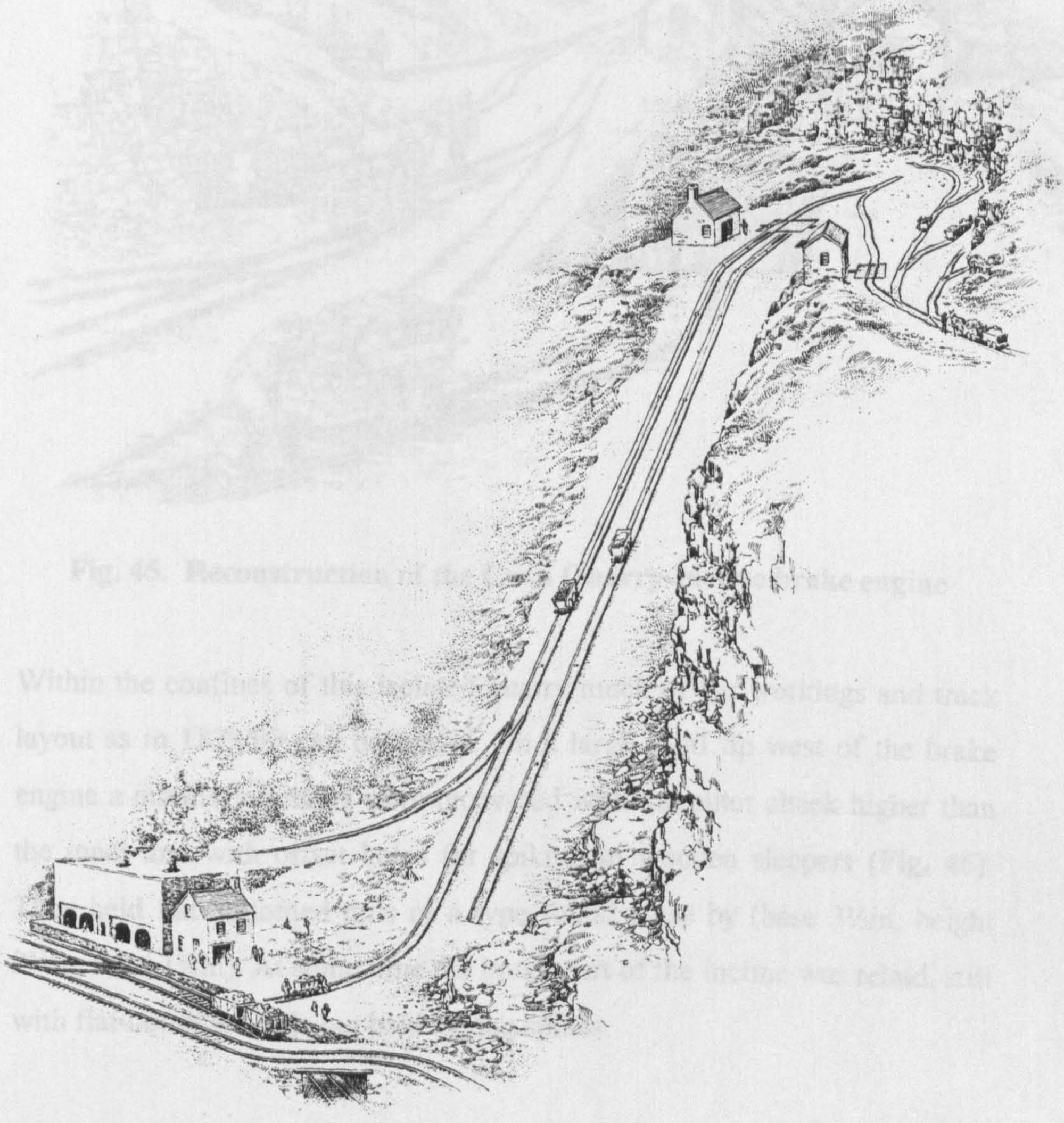


Fig. 44. The Cwm Quarry Incline

---

[44] The type of incline is shown in Jamieson 1905, vol. I, 212. The brake engine is set half in a pit. Two separate drums act for the up and down lines with a brake between the two. A sheave for each cable is set well in front of each drum and slightly to the outside. This ensures that the cable is wound on evenly. One drum winds onto the top, the other onto the bottom.

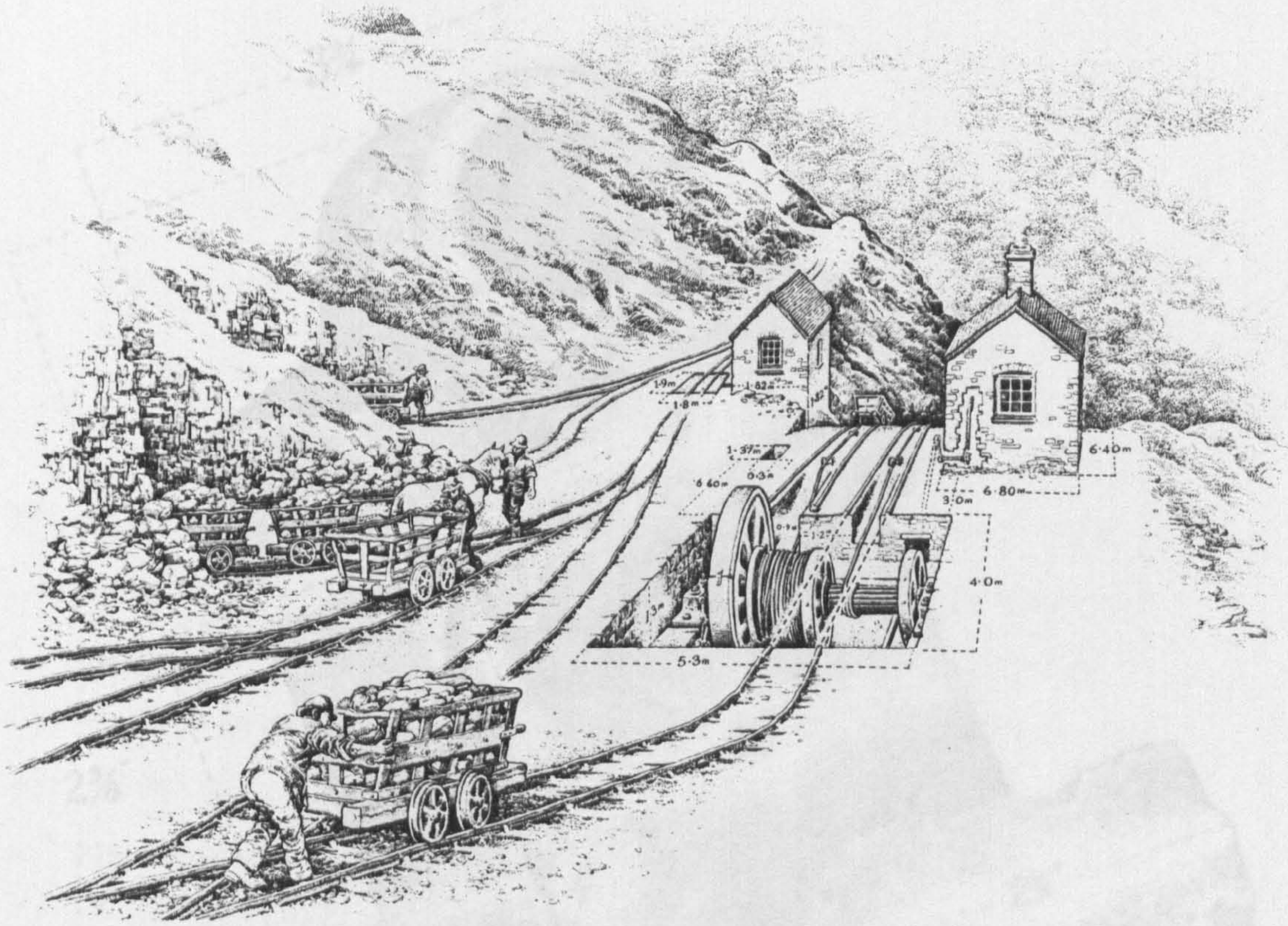


Fig. 45. Reconstruction of the Cwm Quarry Incline brake engine

Within the confines of this isolated quarry much of the workings and track layout as in 1879/80 can be traced. On a large spoil tip west of the brake engine a number of chairs were recovered with the outer cheek higher than the inner and with offset holes for spiking to wooden sleepers **(Fig. 46)**. They held flat-bottomed rails of a type found close by (base 3½in, height 2¾in, head 1¾in). At some time the lower part of the incline was relaid, still with flat-bottomed rails but held by dog spikes.

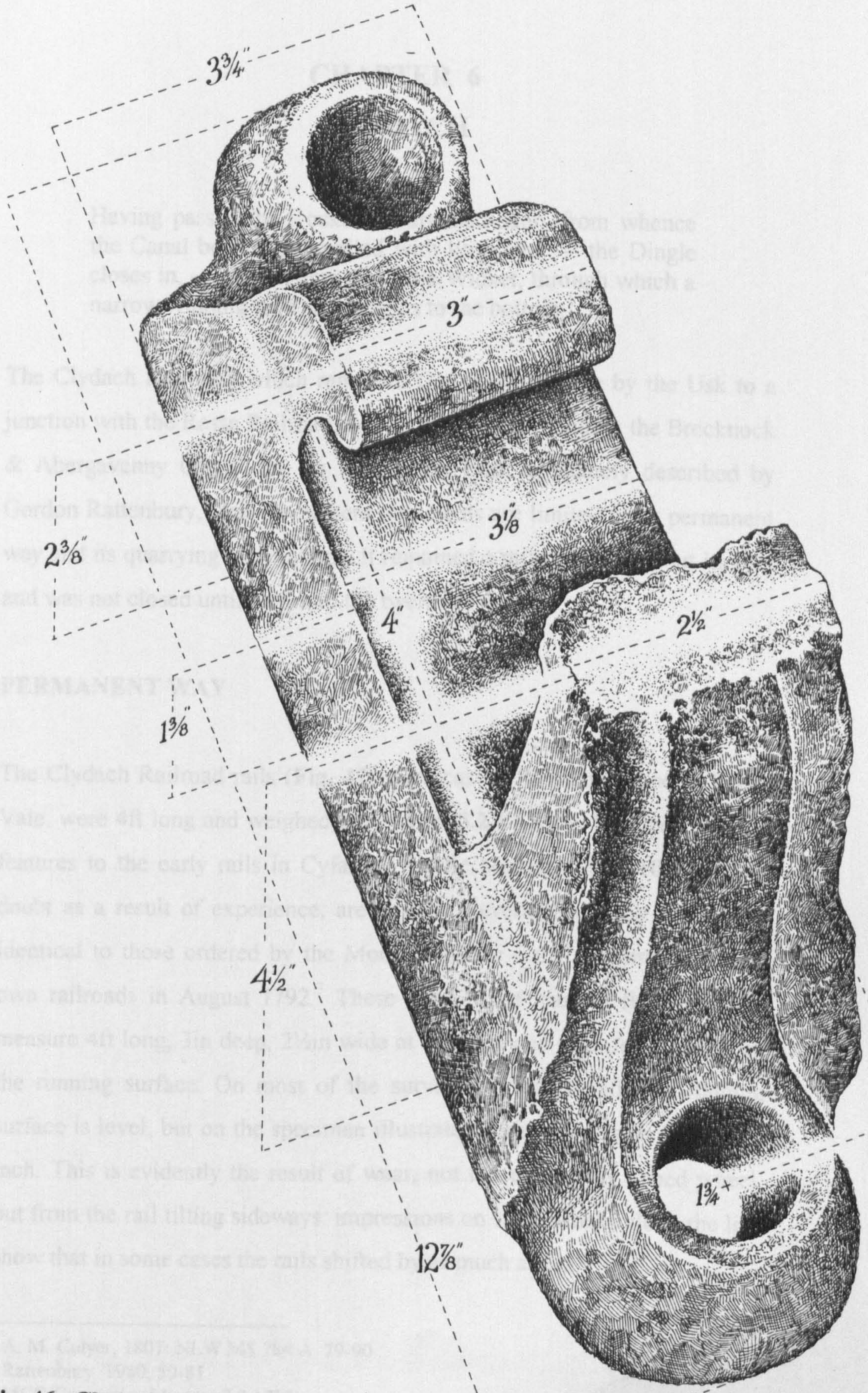


Fig. 46. Chair for flat-bottomed rail from Cwm Quarry (2340 1295)

CHAPTER 6

CLYDACH

Having passed the Rocks of Tarennau-duon, from whence the Canal boats are supplied with limestone — the Dingle closes in, — & we come to a little Wicket, through which a narrow winding path conducts us to the bottom.[1]

The Clydach Railroad, which ran from Glangrwyne Forge by the Usk to a junction with the Rassa Railroad, was built specifically under the Brecknock & Abergavenny Canal Act. Its history has been adequately described by Gordon Rattenbury,[2] and the present comments are limited to its permanent way and its quarrying associations. It remained a railroad throughout its life, and was not closed until well into the twentieth century.

PERMANENT WAY

The Clydach Railroad rails **(Fig. 47)** were cast at Penydarren and at Ebbw Vale, were 4ft long and weighed 84lb **(App. 3.2.E)**. They have very similar features to the early rails in Cyfarthfa Castle Museum **(Fig. 101)** but, no doubt as a result of experience, are deeper. Nevertheless, they are almost identical to those ordered by the Monmouthshire Canal Committee for its own railroads in August 1792.[3] These were to be 'cast in flasks' and to measure 4ft long, 3in deep, 2½in wide at the base and chamfered to 2in on the running surface. On most of the surviving Clydach rails the running surface is level, but on the specimen illustrated it slopes inwards by half an inch. This is evidently the result of wear, not from a heavily coned wheel, but from the rail tilting sideways: impressions on stone blocks along the line show that in some cases the rails shifted by as much as 3in.

---

[1] A. M. Culyer, 1807: NLW MS 784 A, 79-90
[2] Rattenbury 1980, 59-81
[3] MCC Committee Minutes 7.8.1792

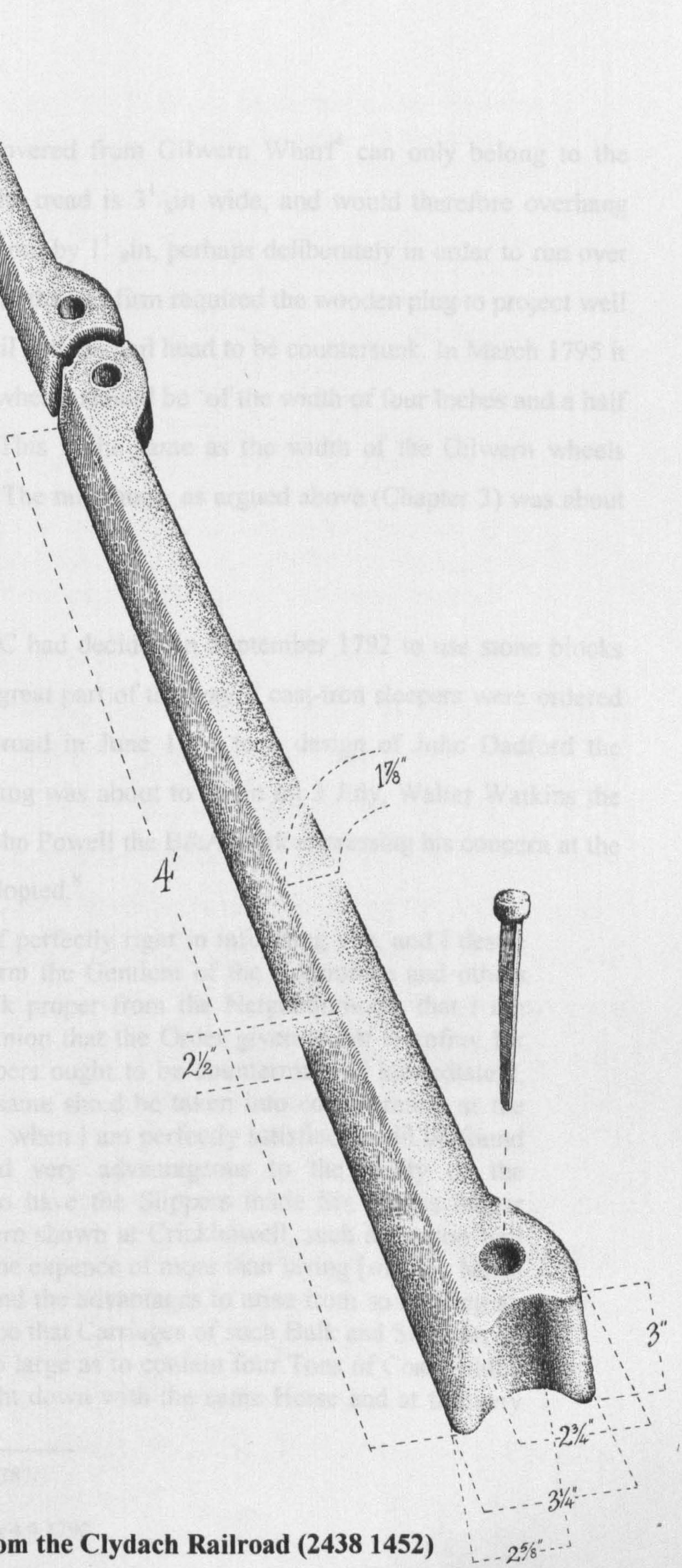


Fig. 47. Bar rail from the Clydach Railroad (2438 1452)

A set of wheels recovered from Gilwern Wharf[4] can only belong to the Clydach Railroad. The tread is $3^{1}/_{8}$in wide, and would therefore overhang the outer edge of the rail by $1^{1}/_{8}$in, perhaps deliberately in order to run over the fixing nail. To hold the rail firm required the wooden plug to project well into the hole in the rail and the nail head to be countersunk. In March 1795 it was ordered that the wheels should be 'of the width of four Inches and a half within the Crest.'[5] This is the same as the width of the Gilwern wheels including the flange. The rail gauge, as argued above (Chapter 3) was about 3ft 8in.

Even though the MCC had decided in September 1792 to use stone blocks instead of sills on a 'great part of the way,'[6] cast-iron sleepers were ordered for the Clydach Railroad in June 1793 to a design of John Dadford the engineer.[7] When casting was about to begin on 3 July, Walter Watkins the contractor wrote to John Powell the B&A clerk expressing his concern at the narrow gauge to be adopted.[8]

> I think myself perfectly right in informing you, and I desire you will inform the Gentlem of the Committee and others you may think proper from the Neighbourhood, that I am clearly of opinion that the Order given to Mr Homfray for the Iron Slippers ought to be countermanded immediately, and that the same sho.d be taken into consideration at the next Meeting, when I am perfectly satisfied it will be found necessary and very advantageous to the utility of the undertaking to have the Slippers made Six Inches longer than the Pattern shown at Crickhowell, such alteration will not increase the expence of more than laying [*sic*] Six Miles of Railway, and the advantages to arise from so triffling an expence will be that Carriages of such Bulk and Size can be constructed so large as to contain four Tons of Coals which will be brought down with the same Horse and at the very

---

[4] WIMM, accession no 62.387/1
[5] NLW Maybery 527
[6] MCC Committee Minutes 4.9.1792
[7] Rattenbury 1980, 60-64
[8] NLW Maybery 487

same expence as Two Tons can be carried on the Railway so Narrow as proposed, which is the same Demensions as the Monmouthshire, and that is constructed for the Carriage of Iron only, and not for the Carriaging of Coal or Lime. I need not observe to you that four Tons of Iron will take much less Stowage or Room than half that weight of Coal or Lime; as Coal and Lime takes More room, the Carriages Must be built so much larger and must have a wider Road to Travel upon, and such Road will be equally as good for the Carriage of Iron, and in Many instances much better; particularly for the conveyancing of Large Castings, some of which will frequently pass on this Road. The alteration proposed, will not in the smallest degree protract the Business, nor will it be any hindrance to Mr Homfray as he May go on with Casting the Rails, and if he has Made any of the Slippers, those may be altered at a very small expence.

There was a fair amount of cross-fertilisation between the MCC and the B&A. For instance, the day before Watkins' letter to Powell, the MCC adopted a 'pattern of sleeper ... produced by Mr Jere[miah] Homfray ... in preference to that now used;'[9] possibly Thomas Dadford for the MCC railroads had consulted with his brother John. But Watkins' suggestion of enlarging the 3ft 8in gauge to 4ft 2in, which would entail a break of gauge between the MCC and B&A railroads, was tacitly ignored.[10] By September 1793, 5396 sleepers (sills), enough for four miles with 4ft rails, had been delivered from the Penydarren works, and the final total of 6792 sills delivered would have been enough for over 5 miles.[11]

No drawing or description of these sleepers has survived, and no specimen was known until an unusual sill was recovered from Clydach Dingle (**Fig. 48**). The weight is 40lb, and unlike a plateway sill the outer cheek is the higher. It does not belong to the Clydach Railroad, for the gauge is 2ft 9in; but the middle part of the Clydach bar rail fits it accurately without a key. In 1798 Sir Richard Colt Hoare noted that '[the Clydach Railroad] is formed by

---

[9] MCC Committee Minutes 2.7.1793
[10] Rattenbury 1980, 61
[11] Rattenbury 1980, 61

long bars of iron cramped together, and strengthened by others fixed crossways.'[12] There is no evidence or likelihood that these cross members

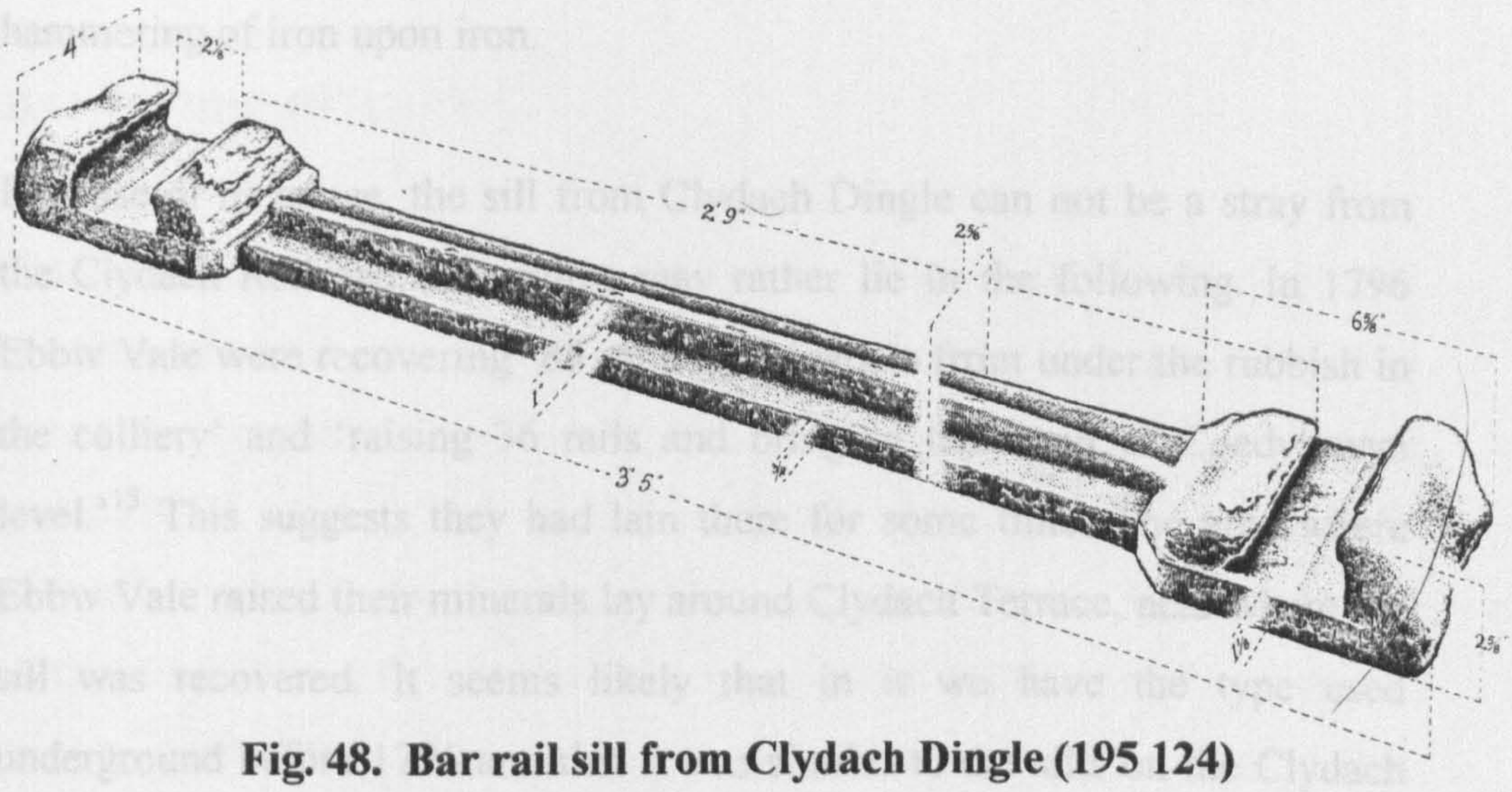


Fig. 48. Bar rail sill from Clydach Dingle (195 124)

were sills supporting the rail ends, whose bulbous shape would be difficult to hold and which were spiked directly to stone blocks. But if, as is suggested here, they were sills holding the middle of the rail (see vignette on **Map K**), then they themselves would need a supporting platform. This sheds much light on Rattenbury's unexplained reference of 1794 to '2 miles 586 yards, being flat paving stones to lay under the sleepers ... £34 4s 4d.'[13] A number of blocks have been found with only a single hole, yet with wear marks from the ends of both rails. In these cases one rail end was held in place only by the mortise; but this would hardly have worked without an intermediate sleeper as a tie. The evolution of intermediate sills will be discussed in the Conclusions.

On the Clydach, sills damaged by October 1794[14] were ordered to be mended. How this was done with cast iron we do not know; but Watkins presumed the 'slippers' could be lengthened without too much difficulty.

---

[12] Thompson 1983, 97
[13] Rattenbury 1980, 64
[14] B&A Committee Minutes 15.10.1794

However further breakages were to be avoided by 'Ledges made of sound heart of Oak to be laid upon the Sleepers,' presumably to reduce the hammering of iron upon iron.

Because of its gauge, the sill from Clydach Dingle can not be a stray from the Clydach Railroad. Its origins may rather lie in the following. In 1796 Ebbw Vale were recovering '85 rails and sleepers from under the rubbish in the colliery' and 'raising 36 rails and bringing them out of Coedymwyn level.'[15] This suggests they had lain there for some time. The area where Ebbw Vale raised their minerals lay around Clydach Terrace, near where the sill was recovered. It seems likely that in it we have the type used underground before 1796 and that it was similar to the sills on the Clydach and MCC railroads.

As work progressed, however, the B&A had second thoughts about stone blocks and iron sills, and ordered 1000 wooden sleepers each from two Brecon suppliers for delivery in April 1794 and a further 1000 each in May. Those for the MCC railroads were of oak, 4½ft long, 8in wide and 3in thick, and those for the Clydach were 4ft 8in by 9in by 2½in.[16] They supported and held to gauge only the ends, not the middle, of the rails. Nevertheless a fair part of the Clydach was laid with stone blocks. Calculated from the figures of components delivered, 5 miles 1 furlong 36 yards used iron sills and 3 miles 53 yards used wooden sleepers. This accounts for 8 miles 1 furlong 89 yards plus an unspecified length of turnouts, compared with the 8 miles 2 furlongs of the two principal lines. It must therefore be concluded that only two methods of supporting the rails were used: either stone blocks and iron sills, or wood sleepers. In 1836[17] it was decided to substitute stone blocks

---

[15] GRO D.2472.1: 22 April 1796; 30 June 1796; also 13 May 1796
[16] NLW Maybery 1067
[17] B&A Committee Minutes 20.10.1836

throughout instead of sleepers, both wood and iron. If these were the originals they had survived well.

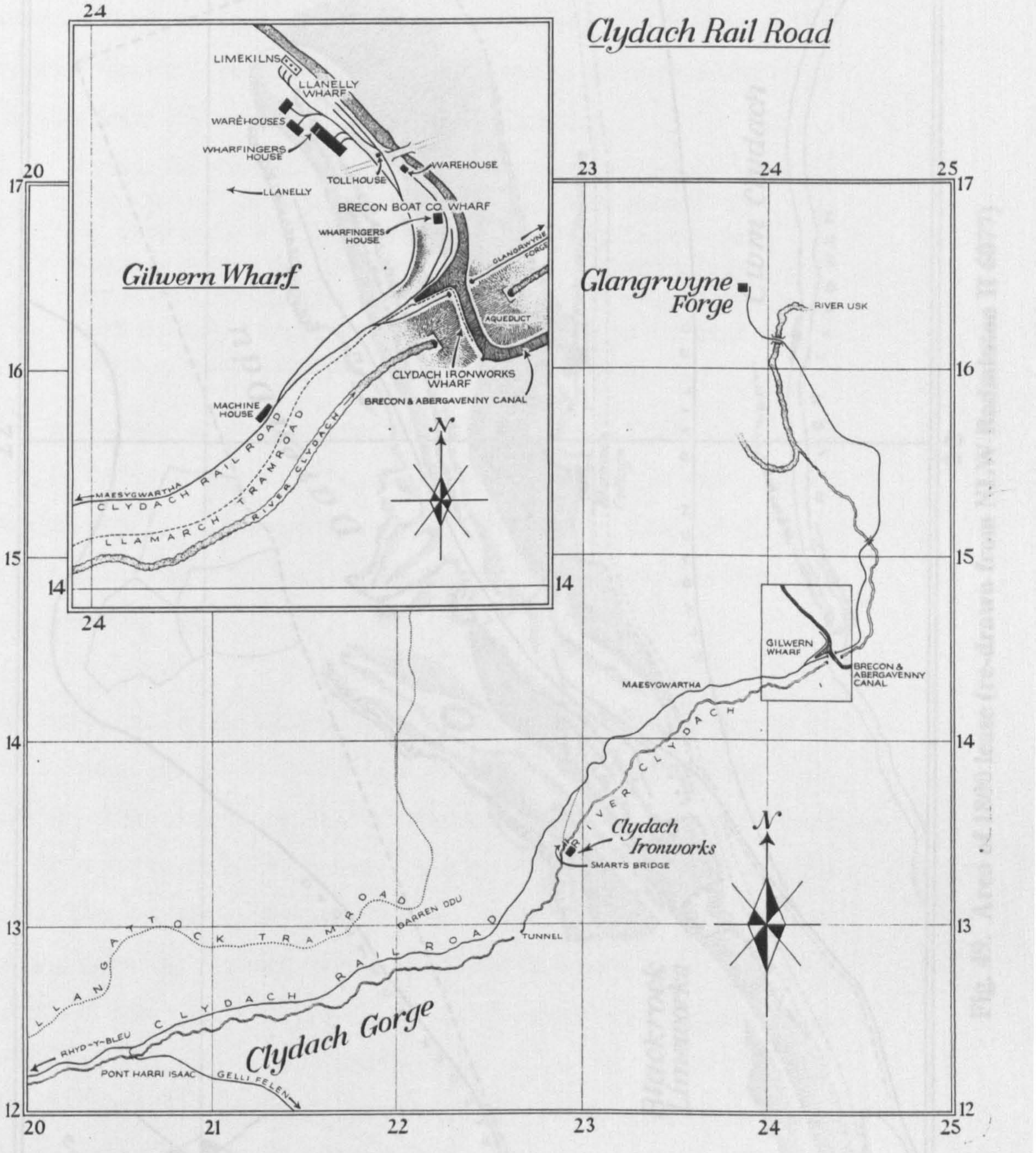
DAREN DDU QUARRY

The evidence for early working at Daren ddu ('Black rock') for fluxing stone is circumstantial, but it would have been the nearest source for the seventeenth-century Llanelly charcoal furnace[18] which was using 'limestone and sand' in 1704.[19] With its closure about 1795 it would be logical to maintain the existing source for the new Clydach furnace. In 1795, at the quarry, there was a 110yd spur from the Clydach Railroad just beyond the present kilns.[20] It appears the quarry served three separate kilns dotted around it; one can be identified on the OS 1920 25in map but the others have vanished. The 1795 map shows a building at the top of the spur: the possibility of an early balance incline with a brake wheel to control it should not be ruled out.

The quarry was let in 1800[21] to the proprietors of the Brecknock Boat Company, along with a cottage and piece of land occupied by Edward Frere, a partner in the Clydach ironworks (now 'Rock and Fountain,' 2303 1279). The map accompanying the lease **(Fig. 49)** shows the 38 acres let, starting just north of the Clydach Railroad from Hafod (where there was a separate quarry area called Havod y Pwll which had its own limekiln) and extending

---

[18] Riden 1993, 23
[19] Pontypool Park Estate, 'Observations on the making of Cast Iron at Lanelthy Furnace'
[20] 'Plan of the Brecon and Abergavenny Railroad ... to Rhyd-y-blew ... 1795' (tracing by Robin Stiles)
[21] NLW Badminton II 6077-8



MAP F. DAREN DDU AND THE CLYDACH RAILROAD

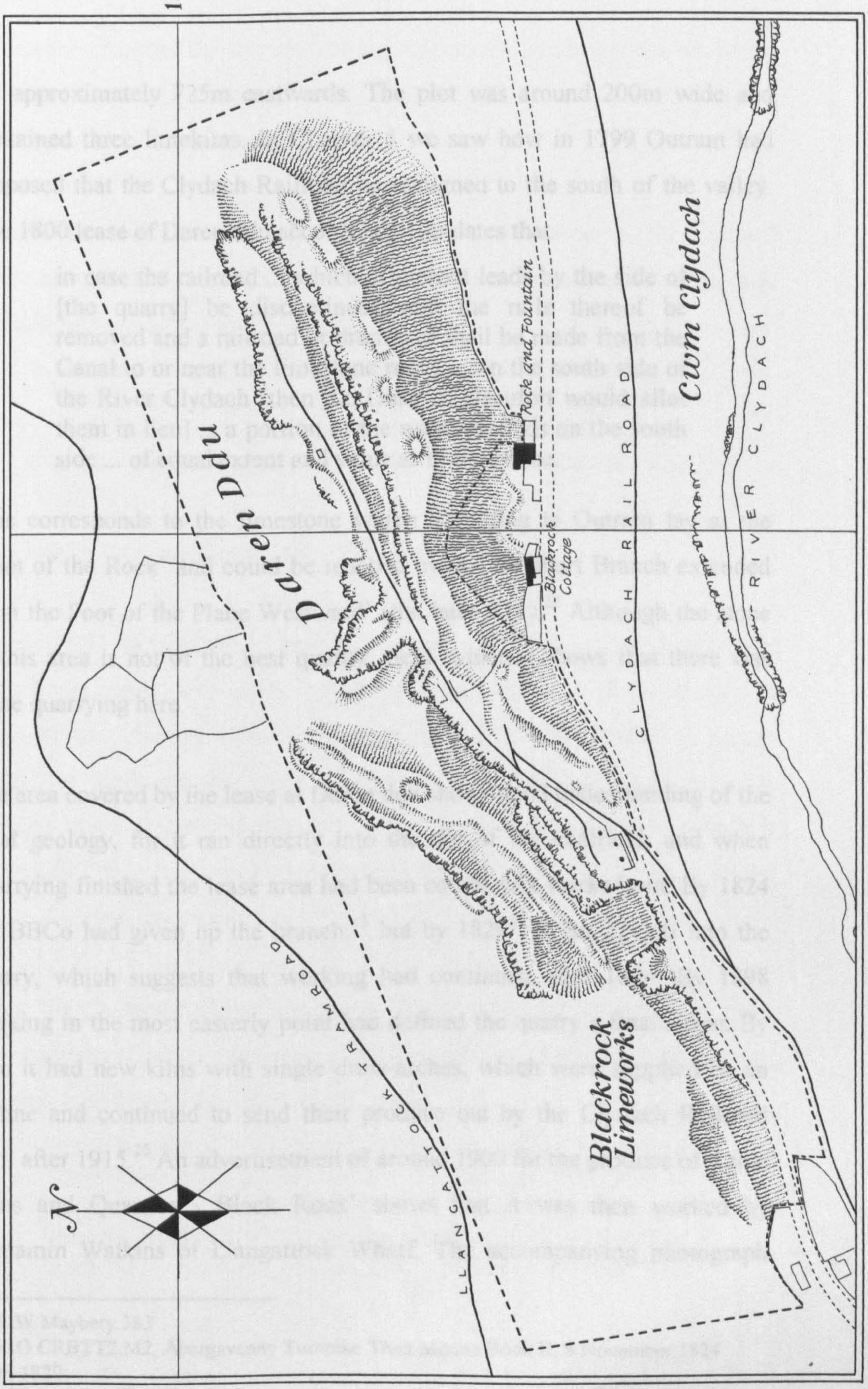


Fig. 49. Area of 1800 lease (re-drawn from NLW Badminton II 6077)

for approximately 725m eastwards. The plot was around 200m wide and contained three limekilns. In Chapter 5 we saw how in 1799 Outram had proposed that the Clydach Railroad be realigned to the south of the valley. The 1800 lease of Daren ddu accordingly stipulates that

> in case the railroad ... which at present leads by the side of [the quarry] be discontinued and the rails thereof be removed and a railroad or dramroad shall be made from the Canal to or near the limestone rocks ... on the south side of the River Clydach [then the Duke of Beaufort would allot them in lieu] ... a portion of the waste grounds on the south side ... of equal extent and value as to limestone.

This corresponds to the limestone which according to Outram lay at the 'Foot of the Rock' and could be reached by 'a very short Branch extended from the Foot of the Plane Westward' (the later **E11**).[22] Although the stone in this area is not of the best quality, field evidence shows that there was some quarrying here.

The area covered by the lease at Daren ddu shows good understanding of the local geology, for it ran directly into the dip of the coalfield, and when quarrying finished the lease area had been completely worked out. By 1824 the BBCo had given up the branch;[23] but by 1829[24] it ran 220yds into the quarry, which suggests that working had continued after 1824. By 1898 working in the most easterly point had defined the quarry's final shape. By then it had new kilns with single draw-arches, which were supplied by an incline and continued to send their produce out by the Clydach Railroad until after 1915.[25] An advertisement of around 1900 for the produce of 'Lime Kilns and Quarries - Black Rock' shows that it was then worked by Benjamin Watkins of Llangattock Wharf. The accompanying photograph

---

[22] NLW Maybery 383
[23] GRO CRBTT2.M2, Abergavenny Turnpike Trust Minute Book II, 8 November 1824
[24] OS 1829
[25] OS 25in 1920. The original railroad quarry branch is shown on a photograph of c.1900 (Jones and Rowson 1981, pl.18)

shows the kilns and the branch with a single storey building close by, which was possibly a weigh-house. Watkins most likely used the Clydach Railroad to Gilwern and the canal to Llangattock..

For a time Nantyglo used Daren ddu limestone carried by the Clydach Railroad. In 1812,[26] at a time when they were getting under way, they applied for permission to use

> rails now lying on the Llwyd Coed Branch ... for the purpose of making a Branch of Road out of the present Rail Way of this Company [B&A] near the Mountain Toll for the purpose of unloading Limestone Halled upon the said Rail Way.

Presumably they bought the limestone from the BBCo.

Until 1817[27] all lime would have been burnt at the quarry, but thereafter a branch was available to Llanelly wharf and the kilns there. This branch was served by a 'Machine House' for weighing and a 'Toll House.' In March 1798[28] the B&A ordered 'that the Engineer get a Tripper or Shoot made for loading the boats at the Clydach Wharf,' presumably off the Clydach Railroad. Though at a much lower level than at Landore,[29] it seems likely that a similar system was used.

When the Clydach Railroad was opened about 1794, the potential link from the quarry to Clydach ironworks was interrupted by a gap of 300m. If this gap was ever filled it was after 1817[30] when

> the Proprietors of Clydach Iron Works [applied] to make a Rail Way or Stone Road from this Company's Rail Way ... from a point on the said Rail Way nearly opposite and twenty yards below the dwelling house of Wm. Walbeoff to join the Tram Road now in their occupation leading from

---

[26] B&A Committee Minutes 11.12.1812
[27] Rattenbury 1980, 72
[28] B&A Committee Minutes 5.3.1798
[29] Illustration of 1796 in Lewis 1970, pl.55
[30] B&A General Assembly 16.10.1817

> Lamarch Coal & Lime Works to their Furnaces and that a Bridge should be built for carrying the said Rail Ways over the River Clydach nearly opposite and Twenty five Yards higher up the stream of the said River than the Weighing Machine.

Had this been built as a rail link, whether tramroad or railroad, there would have been transhipment problems at one or other end. In fact an old road already existed,[31] crossing the Afon Clydach by the bridge which lies around 100m east of the ironworks and crossing the railroad en route to Llanelly Church. But by 1817 this bridge was occupied by the Llam-march Tramroad, and if the ironworks were to make their permitted road they needed an alternative crossing. So in 1824, closer to the works, they installed an iron bridge (Smart's Bridge) on which the date is cast. This has been assumed to be a tramroad bridge. Longitudinal channels in the deck, however, give a gauge of around 4ft 8in, which is most unlikely for a tramroad but reasonable for road vehicles, and there are no wear marks or means of fixing plates.[32] The bridge was therefore most likely for road waggons and part of the stone road to the Clydach Railroad. Rattenbury thinks the purpose of the road was to ease the transport of iron between Clydach and other ironworks further west;[33] but the fact that the BBCo gave up Daren ddu at the same time as the bridge was built rather suggests that Clydach Ironworks took over the quarry and built the road to supply their furnaces.

At the easternmost end of the Clydach Railroad, beyond the Usk, lay Glangrwyne Forge where, beside the upper of the two wharfs, there was a limekiln fed from the railroad.[34] The rails crossed the Usk by a bridge of timber held in cast-iron sockets of the river bed; fifteen pedestals and seven

---

[31] 'Plan of the Brecon and Abergavenny Railroad ... to Rhyd-y-blew ... 1795' (tracing by Robin Stiles)
[32] Description and drawing in Wilson 1988, 29-31
[33] Rattenbury 1980, 86
[34] David Davies 1796, author's collection

pillars totalling 18½ tons were supplied by Ebbw Vale in September 1793.[35] But in February 1795, after barely a year's service, it was swept away, after which the railroad within the wharfs remained isolated. It was lifted in 1838,[36] but until then it continued to be used by Sirhowy Ironworks for coal and lime which was ferried across the river at 3d a ton.[37] This lime had had a varied journey of over ten miles, leaving Trevil via the Trevil Railroad, transferring at Trevil Machine to the Rassa Railroad and at Rhyd y Blew to the Clydach Railroad.

---

[35] GRO D. 2472.3. See also Rattenbury 1980, 60.
[36] B&A Committee Minutes 25.1.1838
[37] Rattenbury 1980, 65

CHAPTER 7
DISGWYLFA

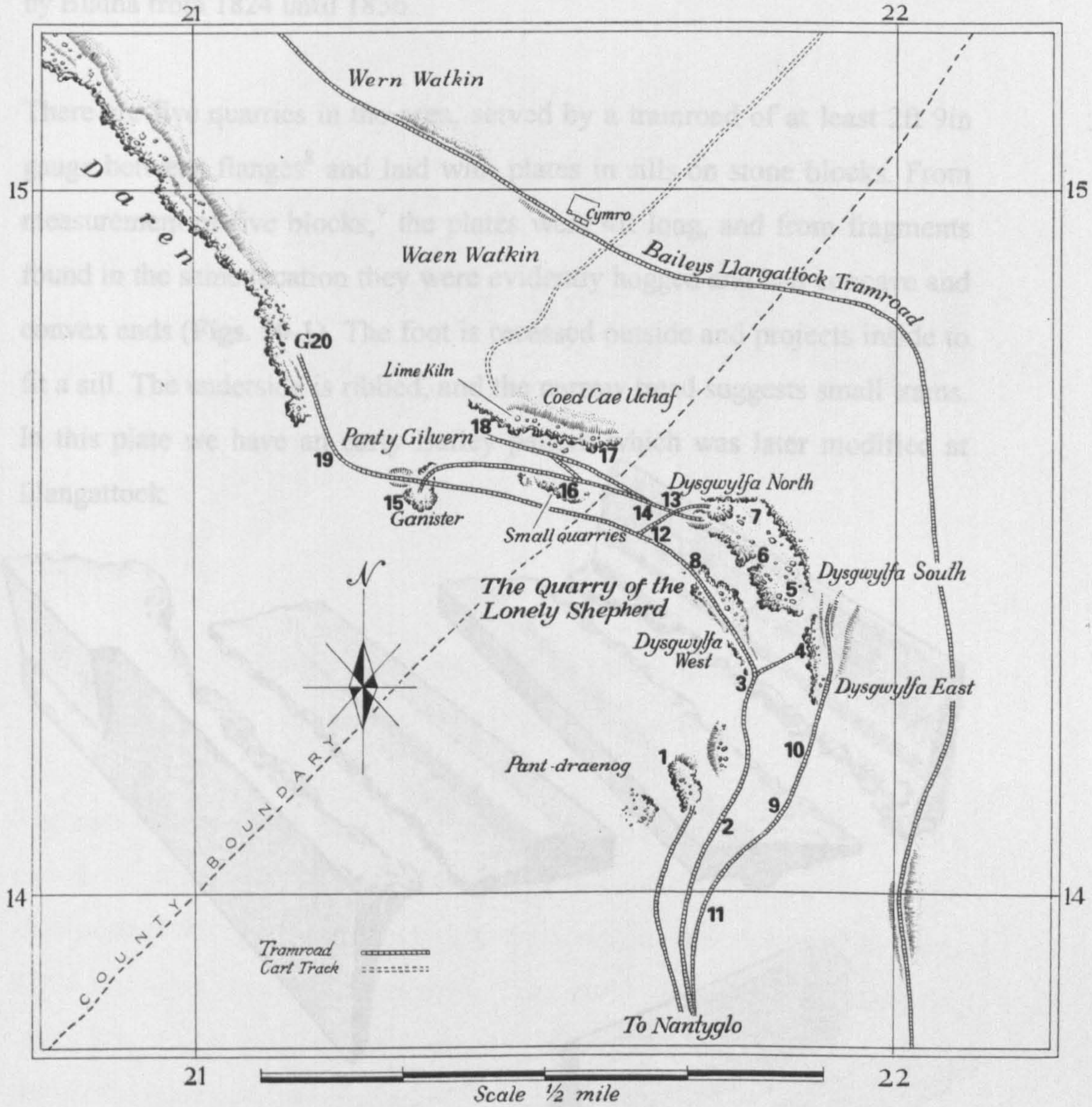
Between 400 and 440m OD on Mynydd Llangatwg lie the quarries called Disgwylfa, the 'Place of Waiting.' The name possibly derives from a remnant piece of limestone known as the 'Lonely Shepherd' which stands about 4m high and can be seen for some miles.[1] Here the Gilwern Oolite outcrops over a band approximately 150m wide, dipping sharply to the south-west. Working was generally along the strike, the dip making it impossible to work to any great depth to the west, although on the east it was possible to work out all the oolite. The quarries were abandoned in the 1830s.

Coed Cae Uchaf

There was lime burning in the lordship of Crickhowell as far back as 1589[2] when Richard Vaughan leased 'mines or pits of smythes coals and lyme coals and lyme stones.' In 1733 four limekilns and the right to dig for limestone were let to William Watkins, limeburner,[3] and Coed Cae Uchaf, which lies north-west of the Disgwylfa group, may be one of the areas exploited. It has never had any railroad or tramroad connection, and was served by an apparently old trackway running from Cymro. A limekiln which is shown in 1829[4] lies at the north-west end. Although a large quarry, the lack of rail communications and the tipping of waste by barrow suggests that it was worked for agricultural purposes.

---

[1] 2190 1438. See Bick 1994, 46-50 for an explanation of a similar remnant called 'The Devil's Chimney'
[2] NLW Badminton II 7000
[3] NLW Badminton II 7217
[4] OS 1829



MAP G. DISGWYLFA QUARRIES AND TRAMROADS

The fluxing quarries

The main quarries were worked by Nantyglo Ironworks. They were certainly in use by 1818[5] and maybe a little before, as iron output slightly increased in

[5] Lease of land 'bounded on the North by the Tram Road leading from Nanty Glo Works to the Disgwylfa Rocks:' GRO D.591/7.233, quoted in Rattenbury 1980, 54

1816-19. There is no sign of them in 1813.[6] They may also have been used by Blaina from 1824 until 1836.[7]

There are five quarries in the area, served by a tramroad of at least 2ft 9in gauge between flanges[8] and laid with plates in sills on stone blocks. From measurement of five blocks,[9] the plates were 4ft long, and from fragments found in the same location they were evidently hogged and had concave and convex ends **(Figs. 50-1)**. The foot is recessed outside and projects inside to fit a sill. The underside is ribbed, and the narrow tread suggests small trams. In this plate we have an early Bailey pattern which was later modified at Llangattock.

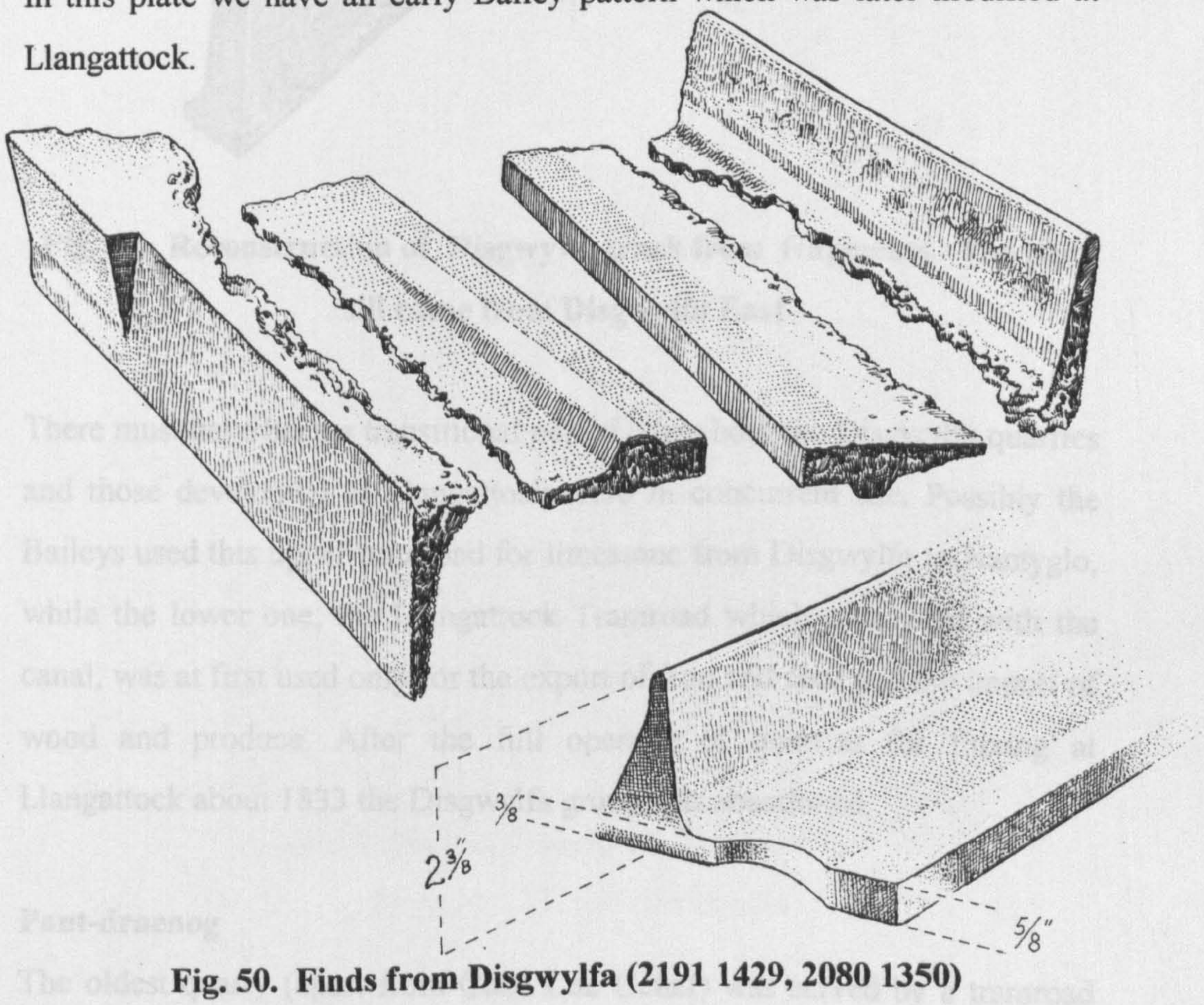


Fig. 50. Finds from Disgwylfa (2191 1429, 2080 1350)

---

[6] OS 1813

[7] NLW Maybery I 253. 23 March 1836, notice from Duke of Beaufort's agent to George Jones of Blainey Iron Works to deliver up possession of limestone quarries in the parishes of Llangattock and Llanelly

[8] Rattenbury 1980, 54 says 2ft 4in. Watkins 1997 gives 2ft 8in measured from a photograph.

[9] 2079 1350

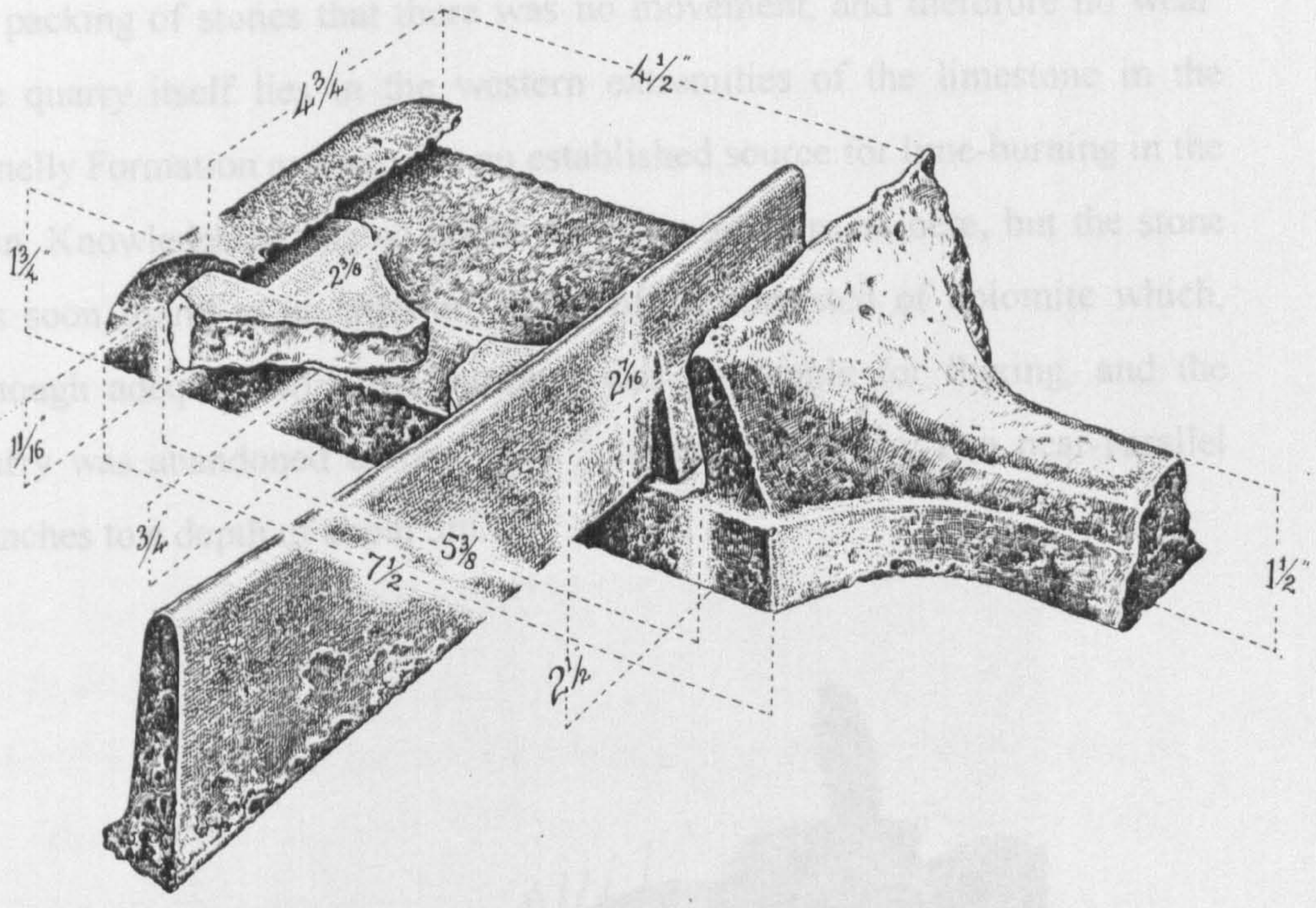


Fig. 51. Reconstruction of Disgwylfa track from fragments. The part sill came from Disgwylfa East

There must have been a transitional period when both the Disgwylfa quarries and those developing at Llangattock were in concurrent use. Possibly the Baileys used this upper tramroad for limestone from Disgwylfa to Nantyglo, while the lower one, the Llangattock Tramroad which connected with the canal, was at first used only for the export of iron and coal and the import of wood and produce. After the full opening of quarries for fluxing at Llangattock about 1833 the Disgwylfa group was abandoned.

Pant-draenog

The oldest quarry (apart from Coed Cae Uchaf) was served by a tramroad branch **(G1)** from the main line. Like other lines in the group it is well ballasted and graded, with a short rudimentary causeway. The lack of wear marks on the blocks might suggest little use; but this anomaly is general and is paralleled at Llangattock, where sills found *in situ* were so well fixed by

the packing of stones that there was no movement, and therefore no wear. The quarry itself lies in the western extremities of the limestone in the Llanelly Formation and appears an established source for lime-burning in the open. Knowledge of this no doubt drew the ironmasters here, but the stone was soon found to be inferior. Much of it consisted of dolomite which, although adequate for lime burning, was unsuitable for fluxing, and the quarry was abandoned before 1829.[10] It was worked by two near-parallel branches to a depth of about 3m.

Plate 11. The Lonely Shepherd

The Quarries of the Lonely Shepherd

The main tramroad **(G2)** continues for 600m beyond the Pant-draenog branch as a footpath, sprouting at **G3** a further branch to Disgwylfa West.

---

[10] OS 1829

After a further 75m it terminates at **G4** in a sheer drop where the later Disgwylfa East has cut into it. The line originally continued into the Quarries of the Lonely Shepherd to serve its earlier southern half **(G5)**, where deeper quarrying necessitated a causeway for the tramroad to cross the hollow. The line then circumvented a ridge of unworked rock **(G6)** into the later northern half of the quarry, and ultimately broke through the backwall to continue on to the small quarries at Pant y Gilwern described below.

Disgwylfa West

For 200m short of **G3** the common tramroad is doubled, suggesting that this and the Quarries of the Lonely Shepherd were worked concurrently. The quarry is entered by a narrow break. Within it are four trials on the east side with the waste thrown westwards into the centre of the quarry. The main face lies on the west, where the limestone was worked along the bedding plane, creating a variable face of about 6m high. It was abandoned when it broke into the Llanelly Formation. At the north the quarry terminates with a break in the backwall similar to that in the Lonely Shepherd. The tramroad continues beyond **(G8)**, but at a slightly higher level than its easterly neighbour, to the early workings at Daren which were in use by 1829.[11]

Disgwylfa East

This quarry lies approximately 10m beneath the Quarries of the Lonely Shepherd and was reached by a 550m branch off the main line which fell at 1:55 **(G9)**. Near the junction an 80m stretch of double track **(G11)** suggests a siding for storing trams, whether full or empty. An early trial was made at **G10**; but in 1829[12] the main quarry, which was worked on a longwall, was biting into the southern end of the Lonely Shepherd. By careful working it avoided the oolite on its eastern limits, but it did extract some of the

---

[11] OS 1829
[12] OS 1829

Pantydarren Bed which, being shales, proved unsuitable. The end of a sill was recovered from here **(Fig. 51)**.

Disgwylfa North

In a desperate attempt to find more workable stone, a tramroad branch **(G12)** was run back from the extension beyond Disgwylfa West. This quarry, probably abandoned by 1829, is about 10m deep into the massive limestone.

Extensions beyond Disgwylfa

North-west of Disgwylfa, we now know that the oolite runs into drift and a little beyond Pant y Gilwern back into limestone. However, the quarrymen of the period could only speculate on the geology in their quest for suitable rock. The tramroads which were extended beyond Disgwylfa by 1829 reflect this search. Nevertheless, they were fortunate in discovering ganister for making refractories in the drift.[13]

From the backwall of the Quarries of the Lonely Shepherd a rudimentary tramroad **(G13)** heads west-north-west to Pant y Gilwern. After 50m it was cut by the line running to Disgwylfa North described above. Beyond to the west are small trials. Near the county boundary **(G14)** there is a good run of blocks with ballast but no wear marks, and at this point the route splits, the southerly line running to a ganister quarry. This area appears to have been worked before the arrival of the tramroad, because a causeway **(G15)** was needed to level its course. From the junction a short exploratory branch **(G16)** ran downhill to some trials, and when the existence of limestone was established, another branch **(G17)** was built as a substitute as far as **G18** where it disappears among ganister.

---

[13] For a fuller discussion of ganister, see the beginning of Chapter 10

The last of the three extensions, better engineered and with a more permanent appearance, was the continuation of tramroad **G8** beyond Disgwylfa West. It runs for 650m and its real purpose was to serve the developing group at (shown here as **G20**) Daren which is discussed in Chapter 8. Although the formation is complete there is again an absence of wear marks on blocks. Measurement over blocks at three places shows it was laid with 4ft plates at around 3ft gauge. Where it crosses the branch serving the ganister quarries, a slight causeway suggests the ganister was no longer being worked. A little north-west a shallow cutting leads on to a 150m embankment **(G19).**

Certainly by 1833 quarrying had moved to the Llangattock group with access from Bailey's Llangattock Tramroad. The Disgwylfa workings therefore had a maximum lifespan of 17 years. A chronology can be postulated as follows:

Pant-draenog	1816-1818
Quarries of the Lonely Shepherd	1818-1829
Disgwylfa West	1818-1829
Disgwylfa East	1828-1833
Disgwylfa North	1828-1829

CHAPTER 8
LLANGATTOCK

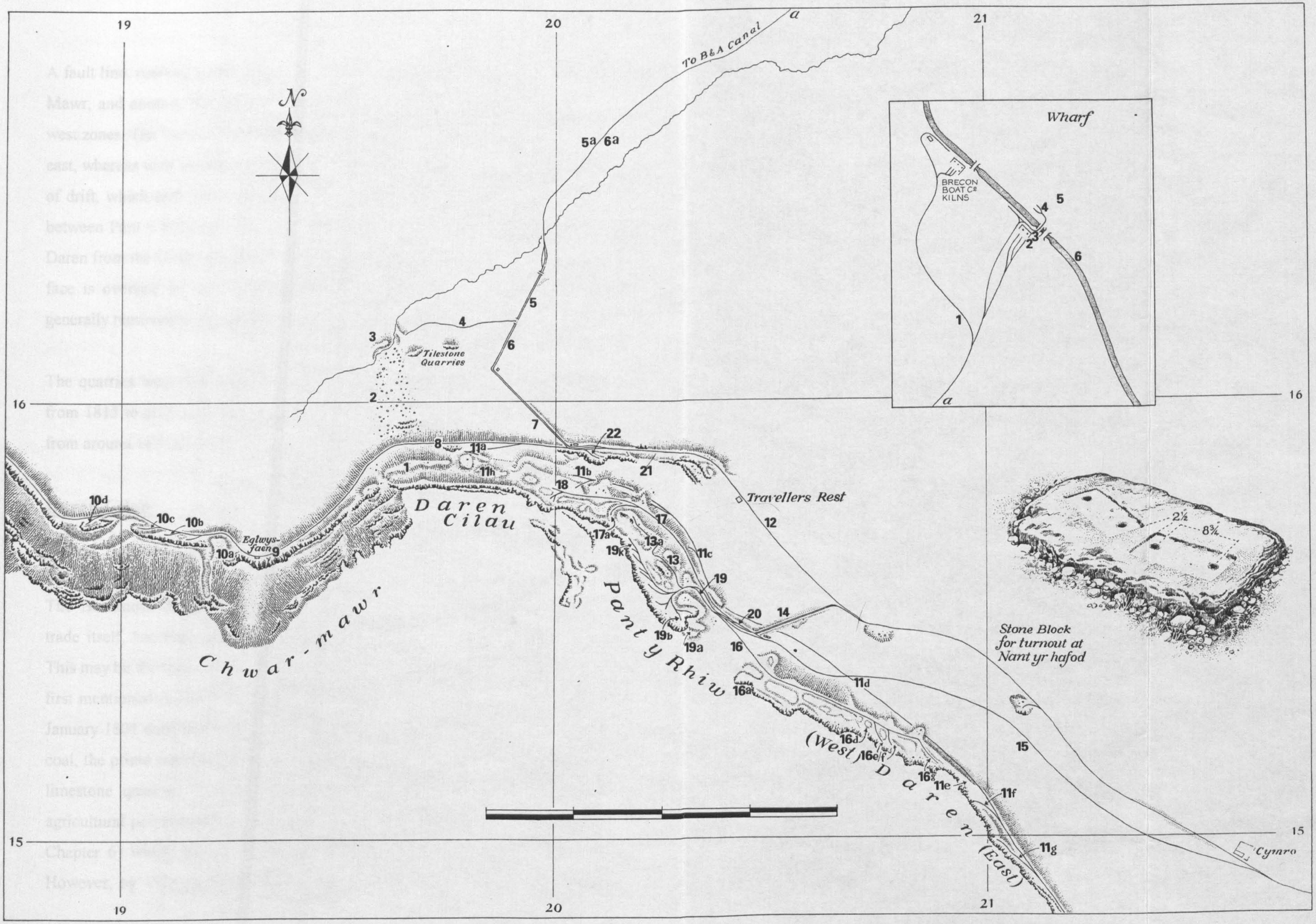
Llangattock Quarries have a history of winning limestone going back almost 220 years. As late as the mid-1920s 'a little of the white Canina Oolite [was] still being burnt for lime,'[1] and pack mules delivering it were a common sight along the Abergavenny-Brecon road until the Second World War.

Unlike many of the other quarries they offer some access to the general public, and their situation high above the Usk valley provides fine views across to the Black Mountains. They can be approached either from the canal using public footpaths or, less energetically, by car along the Hafod Road out of Brynmawr. The quarries have been used for climbing and caving for many years since quarrying revealed suitable features. 'Original route,' the first climb put up at Llangattock, lies in Chwar Pant y Rhiw, and the caves Agen Allwedd and Eglwys Faen ('stone church') lie in Chwar Mawr. The latter is shown on the 1813 OS draft and was presumably known before quarrying began. Both must have been used by quarrymen for shelter, and Agen Allwedd has a number of graffiti of the 1850s.

In this group of quarries the Dowlais Limestone appears as one band throughout, between 100 and 250m wide; but according to the geological map it was the underlying Gilwern Oolite which was worked. There are four clear divisions in the group — Daren, Pant y Rhiw, Daren Cilau and Chwar Mawr. Pant y Rhiw and Chwar Mawr are jointly referred to on OS maps as Daren Cilau. There is no Interim Development Order on the quarries and they are likely to remain as abandoned over a century ago, except that a little lime was burnt here during the last war.

---

[1] Strahan and Gibson 1927



MAP H. LLANGATTOCK QUARRIES AND TRAMROADS

A fault line, running north-west to south-east, cuts Daren Cilau from Chwar Mawr, and another through the middle of Daren dividing it into east and west zones. The Daren Cilau fault has thrown the rock upwards to the north-east, whereas with the Daren fault it is downwards to the south-east. An area of drift, which prevents working, interrupts the continuity of the limestone between Pant y Rhiw and Daren, and another separates the eastern end of Daren from the Disgwylfa group. The strata dip to the south-west. The scarp face is overlaid by the Llanelly Formation, which appears to have been generally removed as overburden.

The quarries were first worked seriously by the Brecknock Boat Company from 1815 to after 1844 and by the Bailey brothers (Joseph and Crawshay) from around 1829 to 1875.

Daren Cilau

The Brecknock Boat Company

The Brecknock & Abergavenny Canal Company was not encouraged to trade itself, but there was nothing to stop individual proprietors doing so. This may be the reason for the rise of the Brecknock Boat Company which is first mentioned in 1796.[2] A formal deed of partnership was drawn up on 1 January 1805 with four partners and a capital of £9400. Initially it traded in coal, the prime purpose for the construction of the canal, but it soon owned limestone quarries, maintained limekilns and supplied lime mainly for agricultural purposes. Its early activity was based in the Clydach Valley (see Chapter 6) which had the only feeder railway in operation at that time. However, by 1815 its activities had spread to Daren Cilau. It maintained

---

[2] Rattenbury 1986, 379; at first called simply the 'Boat Company,' by March 1798 Brecknock Boat Company was its usual title

wharves at Gilwern, Brecon, Llangynidr and ultimately Llangattock. It ceased trading in 1865.

The BBCo quarry

There are extensive isolated high face workings over a length of 150m. Here the face is covered with calcite and includes an extensive cave system, the result of faulting. These are the Daren Cilau quarries, first leased by the Duke of Beaufort to the B&A at 1d a ton, and sub-let to the BBCo in 1815.[3] The leased area measured 400 yards east 'from the top of the inclined tipping place of the said tramroad' (see under Llangattock Tramroad below) and 60 yards wide.[4] Here the Oolite is heavily overlaid by the Llanelly Formation. As a result extensive spoil lies to the north and the quarry may have extended eastwards, but was later cut through by the Baileys when working the west end of Pant y Rhiw. The spoil appears partly barrowed and partly neatly arranged by tramroad. It is clear that the quarry was originally worked by 'plank and barrow,' the face running about 50m north of the final one. At the western end are the earliest workings, broken off in steps. Working stops at the fault, where Chwar Mawr begins lower down. A short stretch of tramroad ran out from the quarry, ending at **H1** in a steep drop. This was the beginning of the 'shoot' or chute **(H2)** down which stones were rolled to the first Llangattock Tramroad. The hinge for a tailgate recovered from near the chute suggests that trams were run up to a timber stop and tipped. There is considerable quarried material directly below it as far as the stream, which the OS 1in of 1829 shows as a considerable scar.

The evidence points to the life of this quarry falling wholly before the installation of the upper incline about 1829. The tramroad **(H8)** from its head to Chwar Mawr passes through the chute which, if still in use, would

---

[3] NLW Badminton 6292, quoted in Rattenbury 1986, 382
[4] GRO D.591-11-61, for 21 years from September 1815

soon have destroyed it. As Chwar Mawr was initially worked by the BBCo from 1827, it must have abandoned Daren Cilau soon afterwards.

The Llangattock Tramroad

The First Llangattock Tramroad

The main tramroad was built under the eight-mile clause of the B&A Act. On 17 January 1814[5] John Hodgkinson presented his estimate for 'making of a Tram Road to the Darren y killey Lime Rock near Llangattock' at a cost not exceeding £2000.[6] It was under construction by October 1814 when Joseph Bailey of Nantyglo was seeking compensation for 2 acres of which he was a lessee.[7] In December 1815[8] it was leased to the BBCo (who in fact built it) for 21 years at 5 per cent of the cost.

The blocks (not less than 168lb) and plates (one yard long, 50lb) specified in the estimate are of typical Hodgkinson weight and length.[9] The lease of 1815 clearly describes this first Llangattock Tramroad, which was shorter than its successor:[10]

> All that spot of ground adjoining the Brecknock and Abergavenny Canal near Llangattock village together with all those three limekilns then lately erected on part thereof. Also all that line of railway or tramroad with the inclined plane, weighing house and weighing machine on the same leading from the said canal and limekilns to the bottom of the shoot or tipping place called Derwen y Killy Rocks

Stone from the Daren Cilau quarry slid down the 'shoot' to the 'basin' or collecting point near Nant Onneu (**H3**), where it was loaded onto a 300m

---

[5] Rattenbury 1980, 91-97
[6] B&A Committee Minutes 7.2.1814; also a proposal on 28.4.1814 to borrow £2000 and £500 more if necessary
[7] NLW Maybery I 961
[8] B&A Committee Minutes 22.1.1816 ratifying the lease
[9] Bick 1987, 42-43; Rattenbury and Cook 1996, 17
[10] GRO D.591-11-61

tramroad **(H4)**. This led to a 100m incline **(H5)**. Field evidence shows the tramroad and incline had plates secured directly to stone sleeper blocks. Close to the incline head the tramroad formation widens as if for an assembly area, and here a complete box plate was found, though not *in situ* **(Fig. 52)**. Each arm of the scissors is 36in long; one tread is 5½in wide, the other 6in. One arm is slightly curved, an interesting indication of careful design. The location and method of fixing suggest this plate dates from between 1815 and 1829.

10m west of this find, part of a tram wheel rim was discovered, 2¾in wide, 1in thick on the tread, and around 24in in diameter. Wheels on this 1815 line were distinctly smaller and lighter than those used later.

The 'shoot', short incline and connecting tramroad caused much inconvenience, and it is easy to see why. For instance in 1819 Thomas Ellwood, the BBCo's agent, reported that 'the slip at Llangattock certainly threw us back in getting a regular supply of Lime Stone.'[11] He was probably referring to the tramroad, which by 1877[12] was already reduced to a narrow footpath and is now almost eroded away. The incline brake sheave, locally known as an 'engine,' also gave trouble. The specification described it as 'two horizontal wheels and an endless chain of the same substance as that made use of ... at Clydach Iron Works,'[13] probably referring to the inclines **(E10-11)** of 1811 between Llanelly quarry and Clydach Ironworks. When the engine was tried in 1815, Ellwood reported:[14] 'I am sorry to have to say that we went of[f] ill[;] defects in the machienery chains &c. caused a breakige of some of the trams but at present it begins to work well.' In 1818 he had

---

[11] NLW Maybery 1106
[12] OS 6in 1877. All the 6in references are confirmed by OS 25in 1877 or 1879
[13] NLW Maybery 964-5 quoted in Rattenbury 1980, 92
[14] Brecknock Museum Maybery Collection Vol 2 ff. 111, 3.6.1815, quoted by Rattenbury 1986, 383

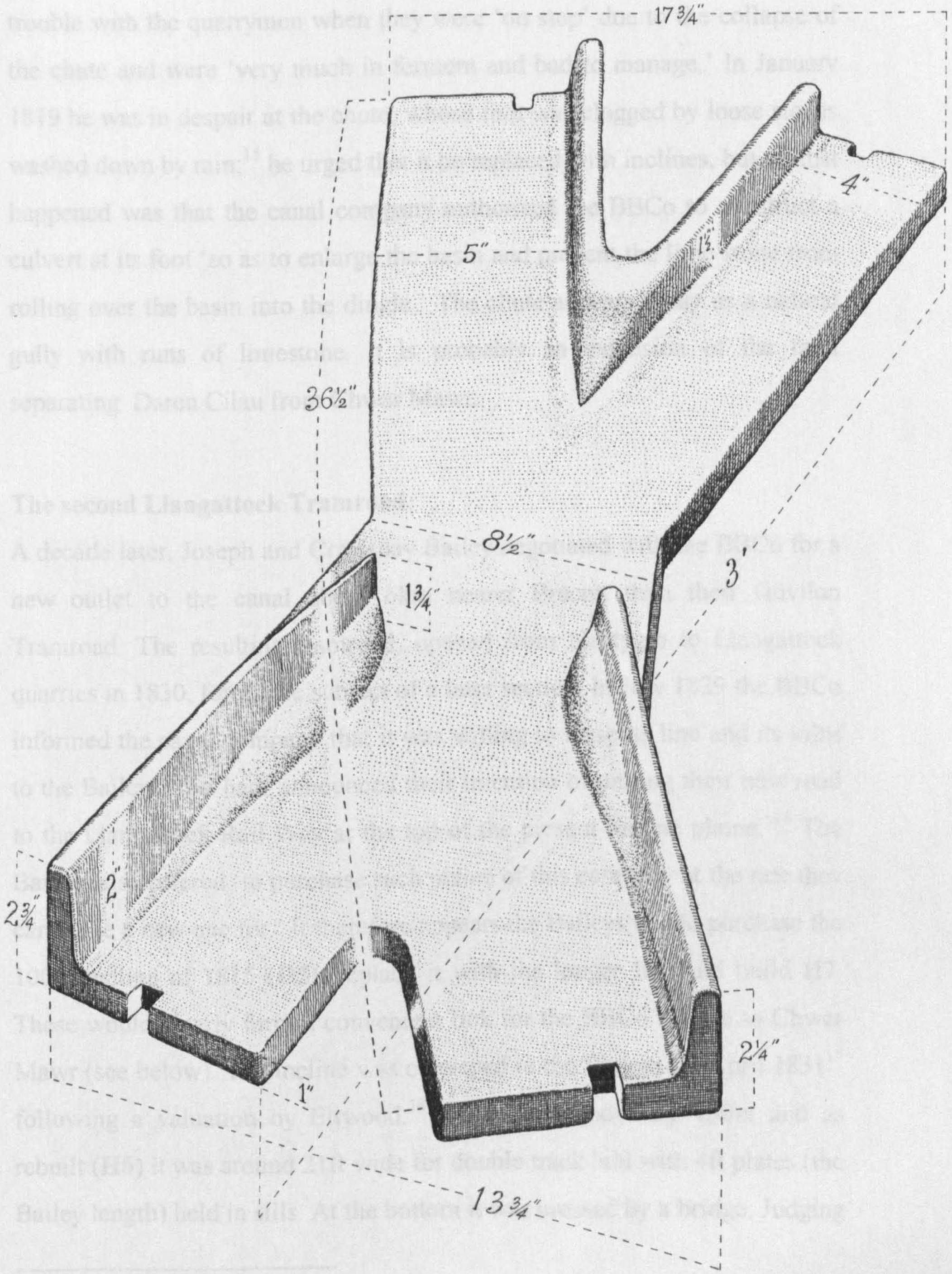


Fig. 52. Box plate from first Llangattock Tramroad (1990 1622)

trouble with the quarrymen when they were 'on stop' due to the collapse of the chute and were 'very much in ferment and bad to manage.' In January 1819 he was in despair at the chute, whose foot was clogged by loose stones washed down by rain;[15] he urged that it be replaced with inclines, but all that happened was that the canal company authorised the BBCo to construct a culvert at its foot 'so as to enlarge the basin and prevent the lime stone from rolling over the basin into the dingle.' The chute appears today as a natural gully with runs of limestone. It is probably an extension of the fault separating Daren Cilau from Chwar Mawr.

The second Llangattock Tramroad

A decade later, Joseph and Crawshay Bailey negotiated with the BBCo for a new outlet to the canal about 6km nearer Brecon than their Govilon Tramroad. The resulting tramroad, opened from Nantyglo to Llangattock quarries in 1830, forms the subject of a later section. In July 1829 the BBCo informed the canal company that it was willing to lease its line and its kilns to the Baileys who had 'announced their intention of uniting their new road to the Llangattock Rail Way at the top of the present incline plaine.'[16] The Baileys also offered 'to purchase such plaine of this company at the rate they can make a new one for.' It therefore appears the Baileys would purchase the 100m incline of 1815 **(H5)**, replace it with the longer **H6**, and build **H7**. These would clearly form a convenient link for the BBCo's route to Chwar Mawr (see below). The incline was conveyed to the Baileys 28 April 1831[17] following a valuation by Ellwood.[18] **H5** was extended by 150m and as rebuilt **(H6)** it was around 21ft wide for double track laid with 4ft plates (the Bailey length) held in sills. At the bottom it was crossed by a bridge. Judging

---

[15] Rattenbury 1980, 93

[16] B&A Committee Minutes 23.7.1829, quoted in Rattenbury 1980, 94-5. Rattenbury (1980, 93) assumed the whole of the incline **(H5-H6)** was that of 1815

[17] B&A General Assembly 28.4.1831

[18] B&A Committee Minutes 26.1.1831

from waste along its course, there appears to have been a fair trade in coal. Like all the Llangattock inclines it was worked on the balance principle: laden trams hauled up empties, and plenty of coal seems to have been dropped in the process. Some GWR boundary markers of the 1900s were once, but are no longer, to be seen. The gradient is 1 in 5. At the top was the brake engine, possibly transferred here from the 1815 incline, of which there remains only the pit (8.5m long by 6m wide overall) and the sill, which carries a cruciform groove cut by a 5in winding chain. A shelter for the incline workers lies 10m to the south-east.

Plate 12. Second Llangattock Tramroad. Forepart of brake engine showing wear marks from chain. c.1830

At Hills Pits, Blaenavon, a pit and cast-iron frame survive for a brake engine of the late 1830s, a sophisticated design which held all the working parts within the frame. It also had guide sheaves, whereas at Llangattock there was only a stone sill to guide the chain. However, the Llangattock engines are all horizontal, as at Hill Pits, so we can assume that trams were run over the top. The chains were 8ft apart and the wheel was therefore of that diameter, but possibly the brake-wheel was bigger. The bearing was in the centre, where excavation revealed a high concentration of oil. At the side are narrow steps leading into the pit, possibly for access for greasing. Because the weights on the incline would have been great, not only from the trams but from the dead weight of the chain, a heavy stone abutment anchored the pit at the front. The wear-marks from the chain on the sill slope slightly back towards the chain wheel, from which it is possible to deduce its height in the pit.

A plate with a straight flange and a widening tread, broken off at the broad end, was recovered behind the brake engine **(Fig. 53)**. This does not seem to be part of a turnout, but is reminiscent of Curr's 'pointer plate' to ease corves onto the rails from the wooden platform at the pithead. It raises the question whether at some stage there was a crude 'turntable' here: a smooth iron sheet without flanges on which trams were skidded through nearly a right angle to align them with the incline above.

In the same level area behind the brake engine a single-holed block was found which suggests Outram-type plates in this assembly area. These appear to have been replaced with chairs, similar to those used on Baileys' Llangattock Tramroad, set on wooden sleepers. The angle at which they lie

to each other agrees with the layout in 1903, which suggests replacement after 1877.[19]

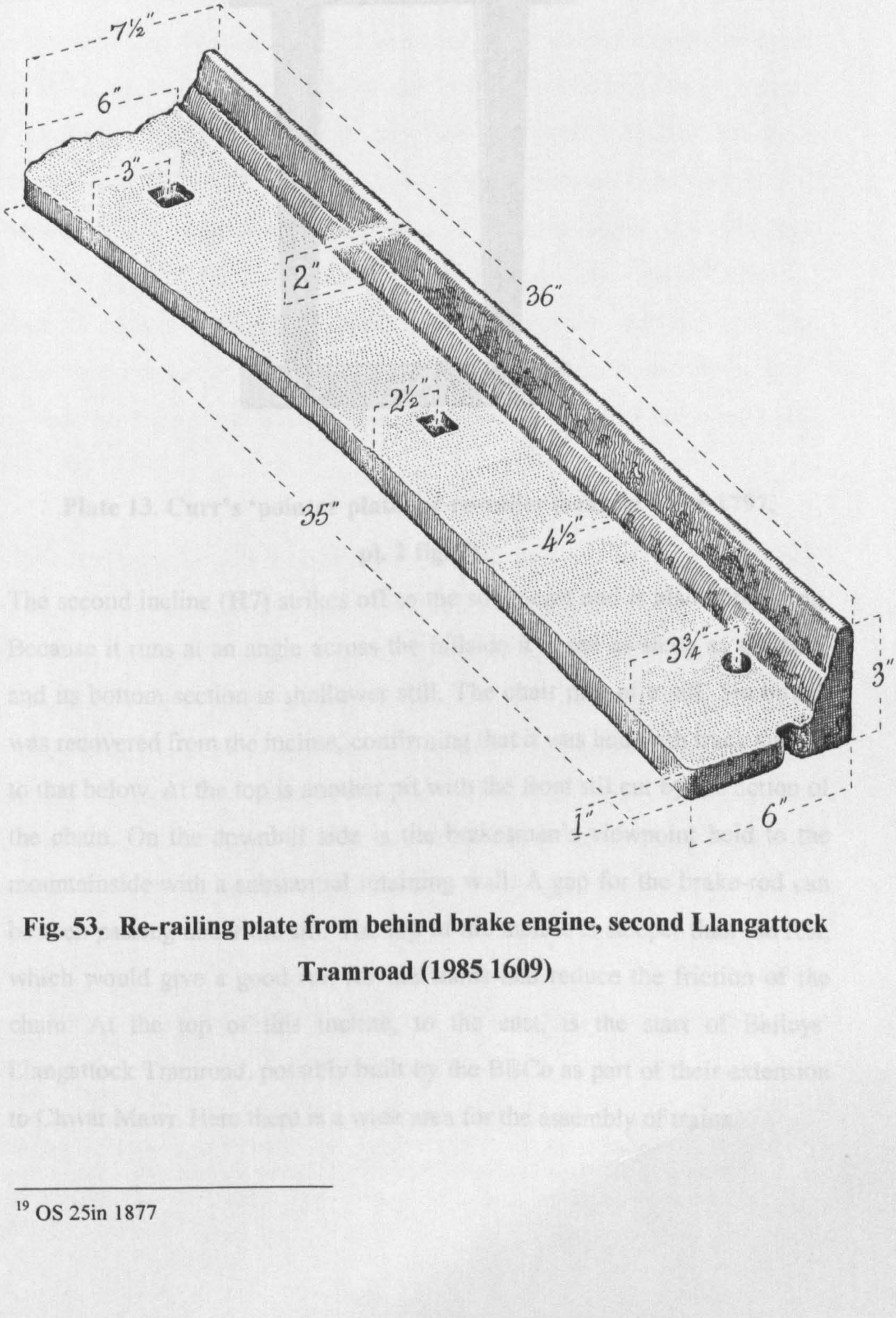


Fig. 53. Re-railing plate from behind brake engine, second Llangattock Tramroad (1985 1609)

[19] OS 25in 1877

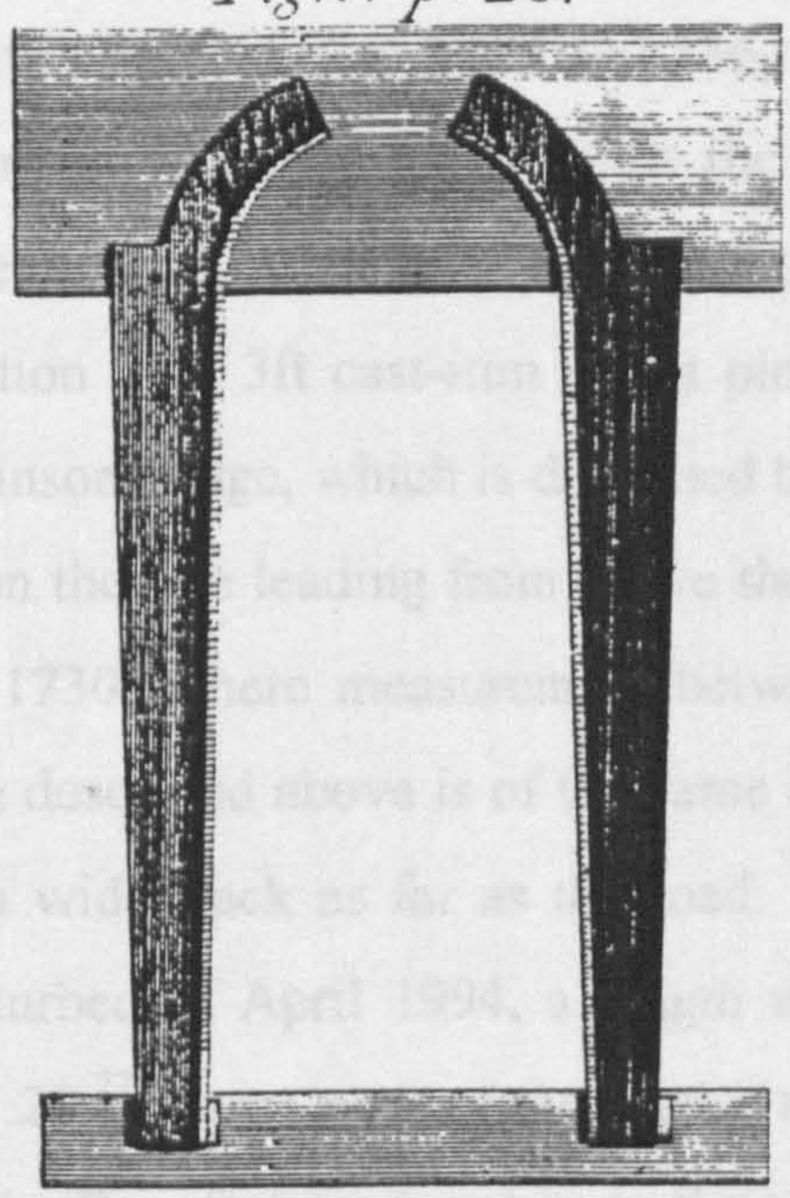


Plate 13. Curr's 'pointer plate' or re-railer (source: Curr 1797, pl. 2 fig. 7)

The second incline **(H7)** strikes off to the south-east and is also 250m long. Because it runs at an angle across the hillside it is not as steep as the first, and its bottom section is shallower still. The chair part of a sill, 5in broad, was recovered from the incline, confirming that it was laid with track similar to that below. At the top is another pit with the front sill cut by the action of the chain. On the downhill side is the brakesman's viewpoint held to the mountainside with a substantial retaining wall. A gap for the brake-rod can be seen passing under the sill. The top of the incline is steeper than the rest, which would give a good run for the trams and reduce the friction of the chain. At the top of this incline, to the east, is the start of Baileys' Llangattock Tramroad, possibly built by the BBCo as part of their extension to Chwar Mawr. Here there is a wide area for the assembly of trains.

The level part to the canal (H5a and H6a)

From the foot of the incline the course of the tramroad was used both by the BBCo from 1815 and the Baileys from 1829. In 1836, when the BBCo lease expired, the canal company leased the line below the inclines for £105 per annum directly to the Baileys. When first laid **(H5a)** it was to the usual Hodgkinson specification with 3ft cast-iron plates pinned directly to stone blocks[20] at the Hodgkinson gauge, which is discussed below. The only piece of original track lies on the line leading from above the 1815 BBCo kilns to the canal side (2059 1730) where measurement between holes is still 3ft. The original box plate described above is of the same length. The rails kept to the north-west of a wide track as far as the road. Near here,[21] where a passing loop was disturbed in April 1994, a length was surveyed and the gradient recorded as 1:20.[22] From west of the road it ran round the back of the wharves to cross the Beaufort road and so to the tops of the three 1815 kilns (2060 1761).[23]

After 1829, but perhaps not until 1836 when the Baileys took over the lease, the permanent way was changed to the Bailey arrangement of 4ft plates in sills **(H6a)**. The old blocks were generally turned through 90° to give a level base where the old plates had worn them. What happened to the surplus blocks we do not know, but possibly they were used around the canal-side wharves. Marks on the blocks correspond exactly with sills found on the tramroad to Chwar Mawr (see below), which were 4ft 4in long. Taken in conjunction with fragments found on the line to the canal, this gives the

---

[20] Authorised as 3ft plates and stone blocks of 168lb: NLW Maybery 964-965, quoted in Rattenbury 1980, 92-3

[21] 2050 1690

[22] Gibson 1994

[23] GRO D595-11-61: the 1815 lease refers to 'all those three limekilns then lately erected.' These are the south-easterly kilns recently restored (1995) with the date stone '1815.' The others, which adjoin them, were built after 1844. The BBCo stopped trading in 1865; nonetheless the post-1844 kilns were re-leased in 1861, though at a greatly reduced rate (Rattenbury 1980, 95-6)

inside gauge as about 3ft 4in.[24] It is likely that the Baileys conformed to Hodgkinson's gauge which is generally given as 3ft 6in between the flanges. This evidence suggests it should be over the flanges as built, or near the wheel gauge.

By 1903[25] the Llangattock Tramroad is shown only from the top of the bottom incline to the canal, and may have served a tilestone and lintel quarry which, with its products neatly stacked, is in itself of interest and subject to possible scheduling. The last toll was taken in March 1911 but the brake engine is remembered as in use in 1913. It seems probable that the quarry was working until the outbreak of the 1914-18 War and that it was abandoned in a working condition as quarrymen went off to the war.

Some tram wheels have been recovered from the route **(Fig. 54)**. One found on the stretch from the basin to the 1815 incline would have been 2ft in diameter with a rim 2¾in wide, and a tread 1in thick, similar to that from the head of **H5** (see above). It is suggested this would have been for a 3ft plate length and a wheelbase of 38in. A segment of 3ft wheel from the incline has a rim 3¼in wide with **TW** cast in it and a tread of 1½in.[26] On the common line to the canal[27] was found a slightly heavier wheel of similar size (34¾in by measurement of a chord, possibly worn down from 36in). These 3ft wheels were probably for the 4ft plates, with a wheelbase of 50in.

---

[24] 4ft 4in less two plate widths (2 x 4¾in) less two outer claws (2 x 1⅛in) = 3ft 4¼in between the flanges

[25] OS 6in 1903

[26] Kept at cottage at Llangattock kilns. About 1980 a similar complete wheel was found on the section below the incline and taken to the Brecon Beacons National Park Study Centre, Danywenault

[27] 2029 1678. Now at Michael Blackmore, 20 Belmont Close, Abergavenny

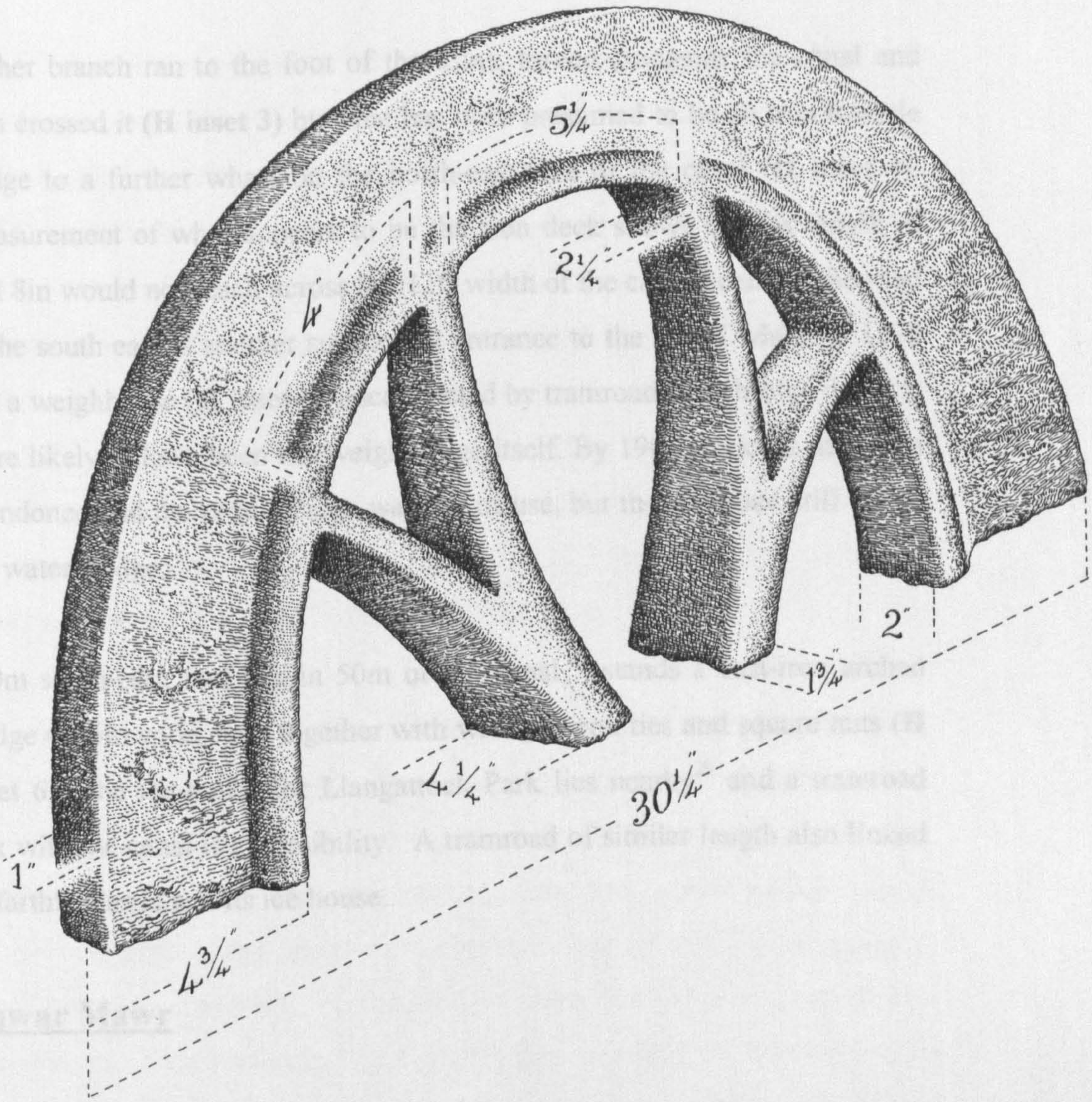


Fig. 54. Part of wheel from Llangattock Tramroad (2032 1678)

Baileys' wharf (207 172)

At the canal end of the Llangattock Tramroad lay J. & C. Bailey's wharf which played an important part in the history of the quarries. Permission was given for its construction in 1828. The original way in was by the blocked entrance where the tramroad passes behind the wharf. The one slightly east became the established entrance: the original iron gate and piers survives (**H inset 1**). Within the wharf are two limekilns **(H inset 2),** served by two branches of tramroad, showing that the Baileys must have burnt limestone. A

further branch ran to the foot of the kilns, turned alongside the canal and then crossed it **(H inset 3)** by what has been presumed to be an iron bascule bridge to a further wharf on the north-east side of the canal **(H inset 4)**. Measurement of what appears to be the iron deck shows that its length of 10ft 8in would not reach across the 12ft width of the canal here. On the road to the south east is another substantial entrance to the wharf which in 1879 had a weighhouse **(H inset 5)** unconnected by tramroad; the 'bridge deck' is more likely to have been the weighbridge itself. By 1903 the kilns had been abandoned and the canal bridge was out of use, but the tramroad still ran to the water's edge.

300m south-east, and within 50m of the canal,[28] stands a cast-iron arched bridge 4ft 6in wide, held together with wrought-iron ties and square nuts **(H inset 6).** The ice house for Llangattock Park lies nearby[29] and a tramroad link with the canal is a possibility. A tramroad of similar length also linked Cyfarthfa Castle and its ice house.

Chwar Mawr

Because of the fault which separates Daren Cilau from Chwar Mawr, the latter lies at a level about 30m lower, which coincides with the top of the upper incline **(H7)**. In January 1827 the BBCo applied to the B&A to extend their 'rail way' to 'Darendyon Limestone Rocks.'[30] Darendyon should ostensibly mean Daren ddu and the 'rail way' the BBCo's branch of the Clydach Railroad (see Chapter 6). But this cannot be: the BBCo had surrendered their lease of Daren ddu three years earlier. Nor need the term 'rail way' be taken at face value, for the clerk was not punctilious with his terminology—two years later he called the Llangattock Tramroad a 'Rail

---

[28] 2097 1697
[29] 2081 1712
[30] B&A Committee Minutes 25.1.1827

Way.'[31] It is therefore likely that Darendyon (which means simply Black Rocks) was some otherwise unrecorded section of Chwar Mawr, and that the BBCo began quarrying there in 1827.[32] In confirmation, part of a sill with **BBCO** cast on the base was recovered from Chwar Mawr **(Fig. 55)**. It cannot derive from the first Llangattock Tramroad which was laid exclusively with Outram-type notched plates, and must therefore date from after the arrival of Baileys' Llangattock Tramroad which used very similar sills. Furthermore, as we have seen, even after 1836 when the Baileys leased the Llangattock Tramroad directly from the B&A, the BBCo continued to use the 1815 kilns and even extended them. They therefore continued quarrying, and Chwar Mawr is the only possible site.

In working out the level of their Llangattock Tramroad from Nantyglo, the Baileys must have seen the advantages of continuing it beyond the incline top **(H7)**. The BBCo tramroad runs westwards for 700m from **H7** to **H9**, crossing the line of the chute where the ground was greatly weakened and has now collapsed. The plates were approximately 3ft 3in long (measured over 15 blocks), and marks on the blocks[33] show that the sills were 4ft 4in long. We can therefore conclude that this part was laid, as everywhere at Llangattock, to a gauge of 3ft 4in between the flanges, but instead of Bailey 4ft plates it used 3ft 3in ones.

The quarries

The BBCo quarries (H9)

The first quarry is that worked by the BBCo for the kilns towards the time that the Baileys arrived, and is about 250m long. It is a continuous face and stops at the overlying unusable rock. Presumably the overburden had been

---

[31] B&A Committee Minutes 23.7.1829
[32] This is also the interpretation of Rattenbury 1980, 94
[33] At 1996 1592

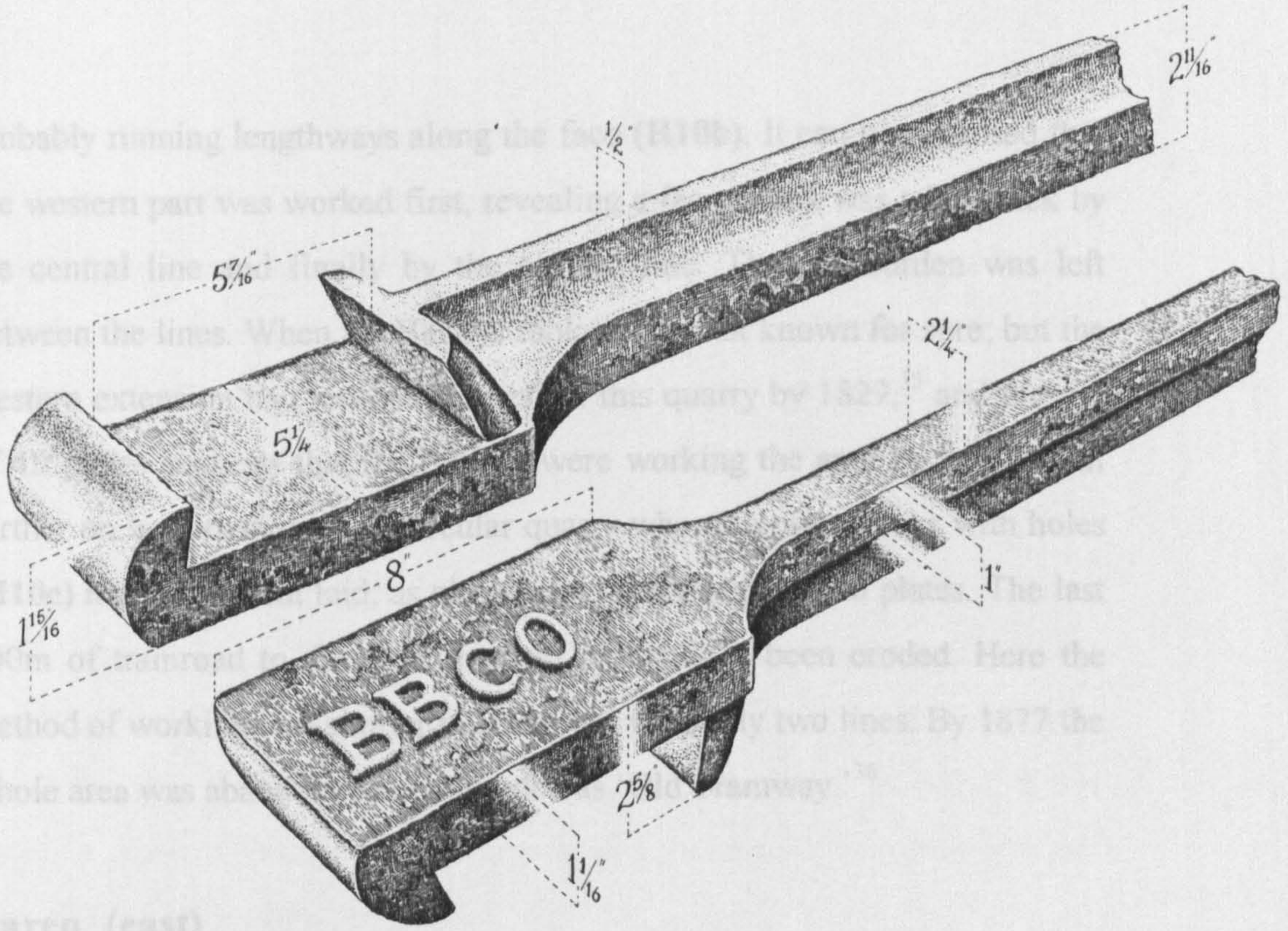


Fig. 55. BBCo dovetailed sill from Chwar Mawr (193 158)

cleared to this point and it was not thought worth clearing more. At the base is scree which has covered any sign of the track. On the east side of Eglwys Faen lies a circular quarry approximately 20m across.

Baileys' quarries (H10)

Set within this circular quarry are the foundations of a building 2.9m x 4.2m with ash around it. This may well have been a weigh-house at the junction of the BBCo's and the Baileys' quarries, as the blocks from here on are laid at 4ft intervals,[34] the Bailey plate length. This suggests that from this point westwards for around 600m the quarries were used for fluxing. The first one, close to the main entrance to Eglwys Faen, has left a slight promontory which contains the major part of the cave. Much of this working is obscured by scree but it was probably circular **(H10a)**. The next quarry to the west, approximately 180m long, was worked by at least three near-parallel lines

[34] Measured at 1912 1572 over 10 blocks

probably running lengthways along the face **(H10b)**. It can be surmised that the western part was worked first, revealing a face which was taken back by the central line and finally by the eastern line. The overburden was left between the lines. When the Baileys took over is not known for sure; but the western extension had reached the end of this quarry by 1829,[35] and the use of 4ft plates suggests that the Baileys were working the area by then. 100m further on lies another small circular quarry where sleeper blocks with holes **(H10c)** mark a turnout laid, as elsewhere, with Outram-style plates. The last 200m of tramroad to the final quarry **(H10d)** have been eroded. Here the method of working was similar to **H10b** but with only two lines. By 1877 the whole area was abandoned and recorded as 'Old Tramway.'[36]

Daren (east)

Before 1829[37] there was lime burning at three kilns at the eastern end, but by that date the Baileys had arrived at Daren at a high level by an extension from Disgwylfa (see Chapter 7). Trials in the area of Pant y Gilwern found that the bedded limestone was unsuitable, so the quarrymen extended the tramroad some 100m north in search of the massive, proved it, and opened a quarry approximately 120m long. This, the first quarry on Daren (east), was therefore worked from Disgwylfa in 1829 **(G20)**.

The Daren (east) Tramroad (Bick's[38])

The level course of Baileys' Llangattock Tramroad **(H12)** to the upper incline **(H7)** and beyond came to extend nearly 2km west of the Daren limestone. But at an early stage the Baileys built a 1½km-long tramroad back from near the head of the top incline in a broadly south-easterly

---

[35] OS 1829
[36] OS 25in 1877
[37] At 2113 1488. OS 1829
[38] Named after David Bick who discovered it

direction **(H11)**. Since its purpose must have been to connect with the canal, the Baileys probably built it to supply the BBCo kilns which they leased in 1829.[39] As we have seen, these returned to the BBCo as soon as the Baileys built their own kilns on their wharf. The fact that the Baileys were forced to construct this lengthy line further confirms that the BBCo, having arrived first, had the best pickings.

Just west of the incline head, a branch runs uphill off the BBCo's Chwar Mawr extension towards Daren Cilau **(H11a)**. The turnout is marked by a row of blocks; one is displaced by about 6in, but the rest are reasonably in line **(Fig. 56)**. The pointwork here is of the Outram pattern with 3ft 7in plates. A plate of this type with a check was recovered from near here but this is 2ft 7¼in long **(Fig. 57)**.

Immediately before and after the pointwork the track reverted to sills, and one was found of a Rhymney type as used by Overton on the Brinore Tramroad **(Fig. 59)**. On the first part, beyond the turnout blocks, blocks lay at 4ft 6in centres and part of a 4ft 6in plate was found. In the same area a sill end was recovered with **[COM]PANY** cast into the base **(Fig. 58)**. Probably the lost end was marked **BOAT** and the sill was re-used here by the Baileys.

Beyond, after 100m, the line zigzags to the east, now heading towards Daren (east). Again the pointwork is of a similar pattern but only one hole remains. In this area a number of finds were made. A plate of typical Bailey design with heavy under-bellying shows deep wear marks, to the extent that it had almost worn through before breaking **(Fig. 60)**. The line here is steep and the wear marks are probably due to spragged wheels sliding on the plate; the under-bellying may have been to counteract this effect.

---

[39] Rattenbury 1980, 94-95

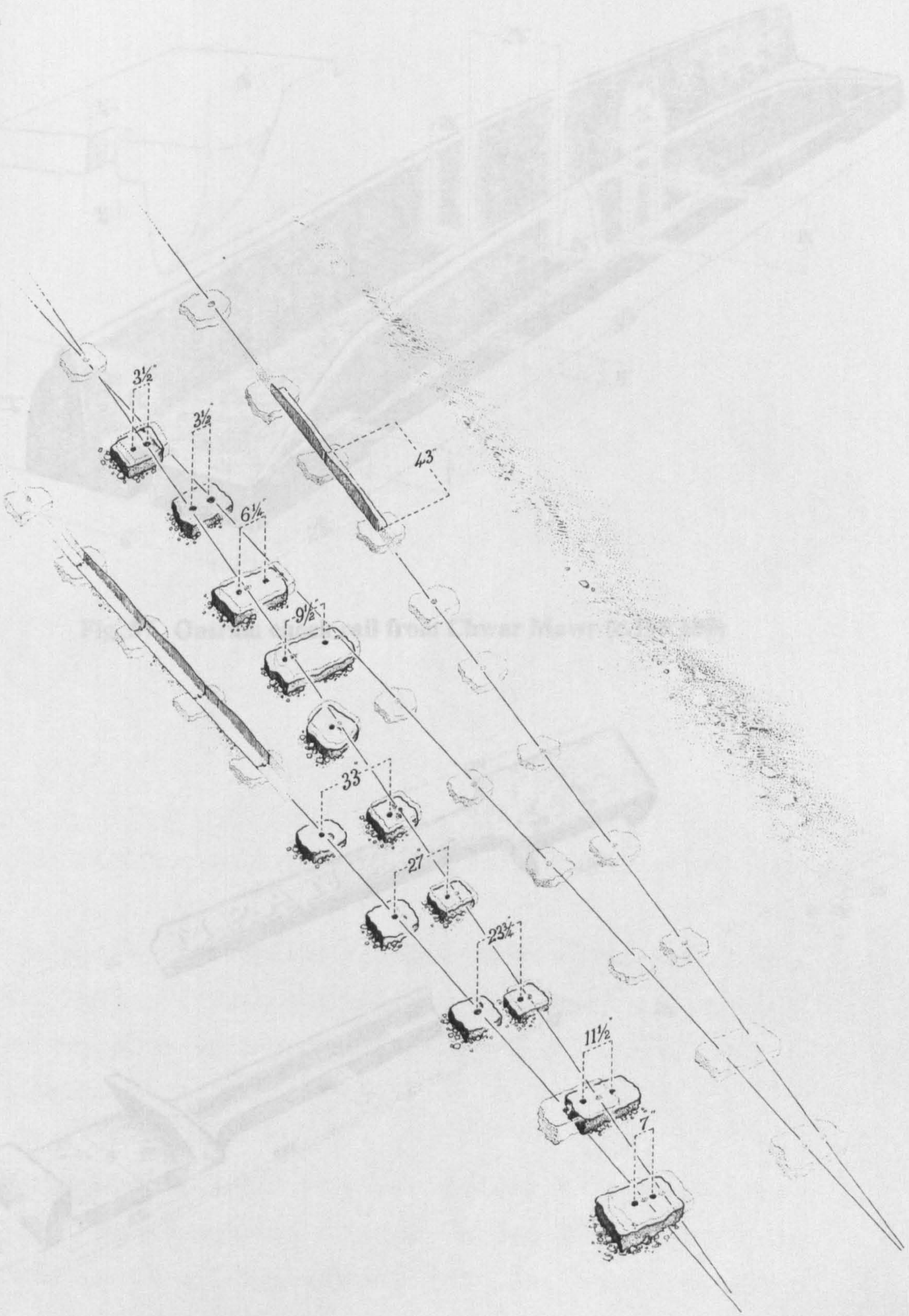


Fig. 56. Turnout at Chwar Mawr (1989 1595)

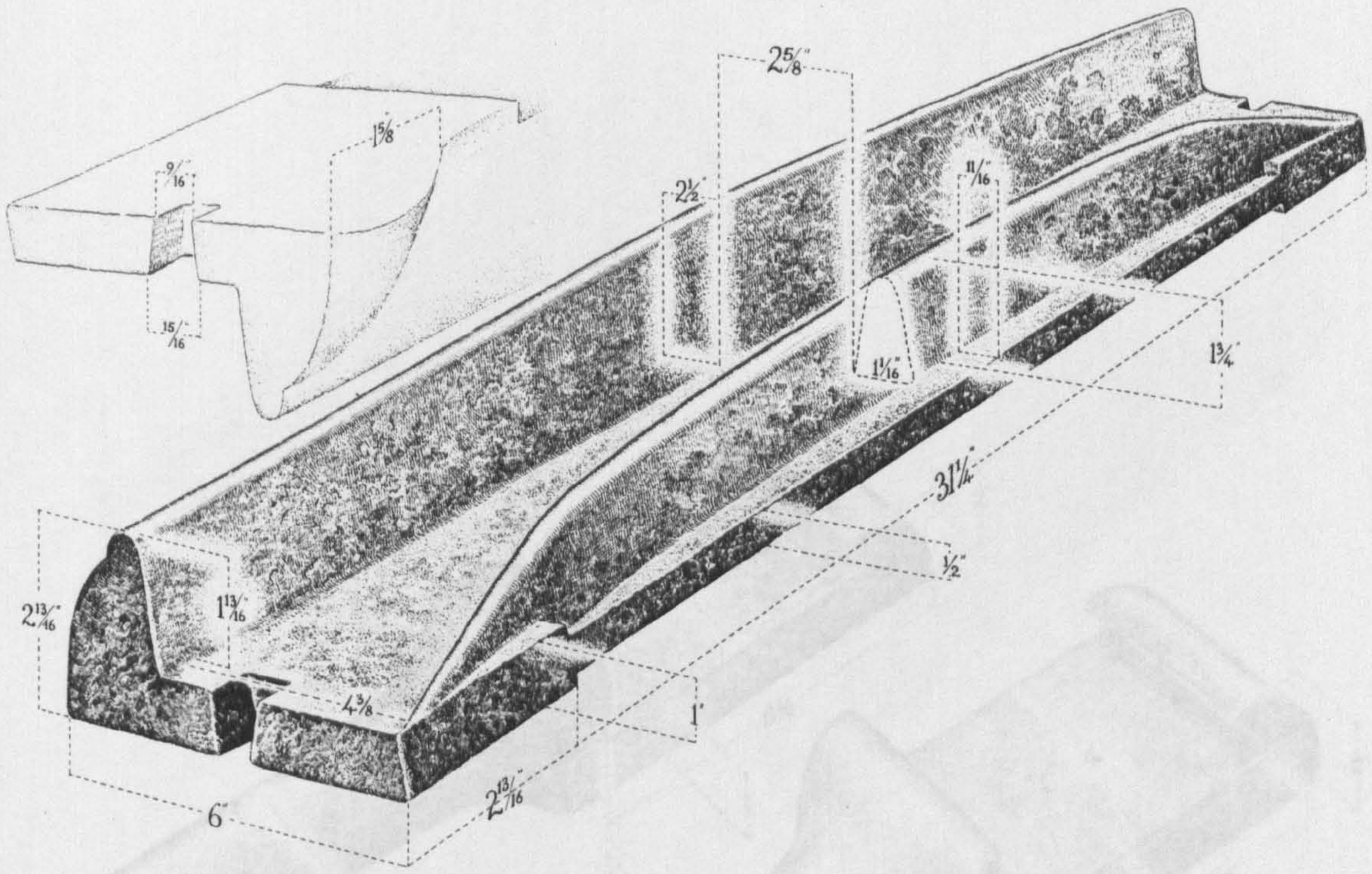


Fig. 57. Outram check rail from Chwar Mawr (c.199 ~~159~~)

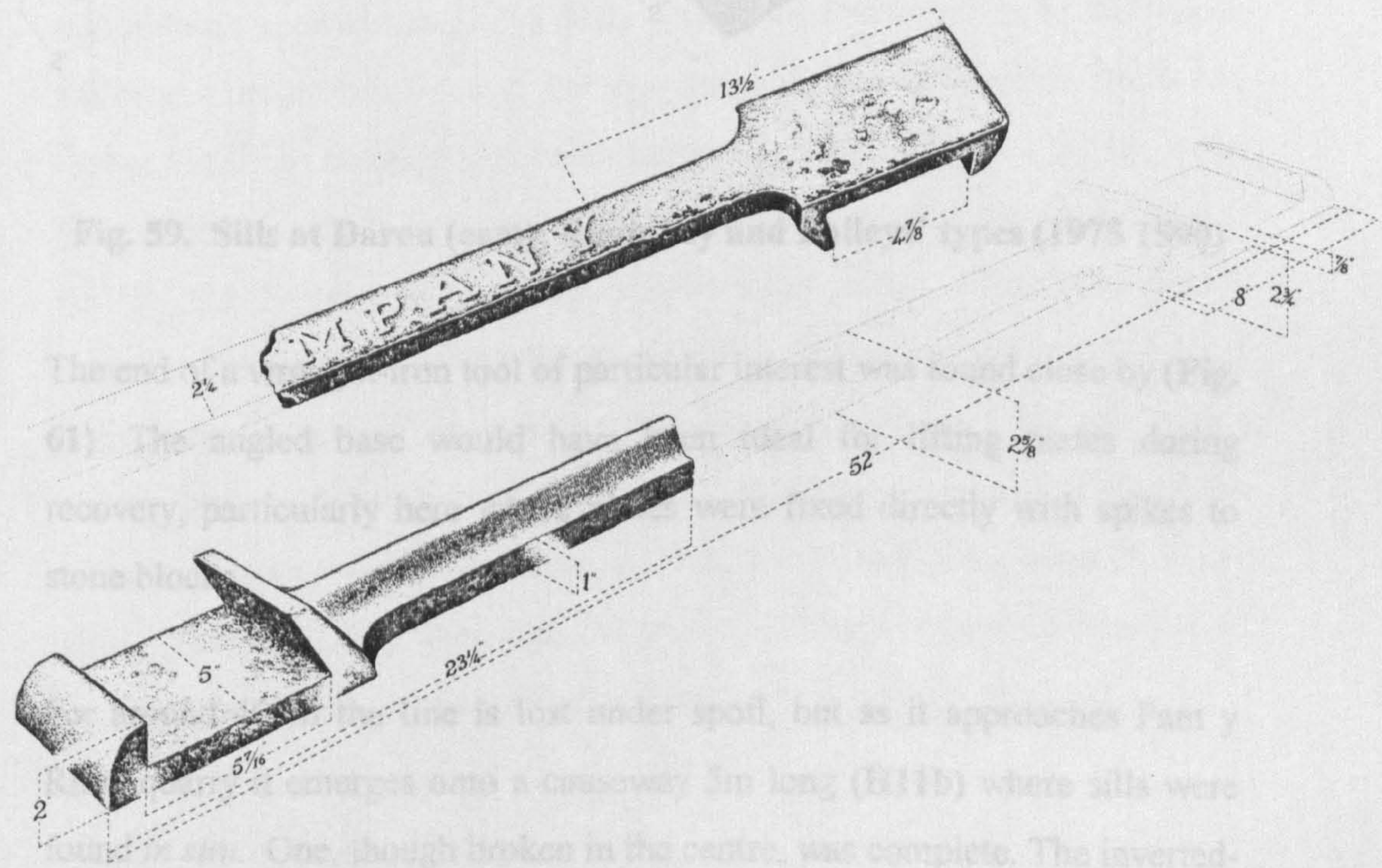


Fig. 58. Boat Company dovetailed sill from Bick's Tramroad zigzag (1978 1591)

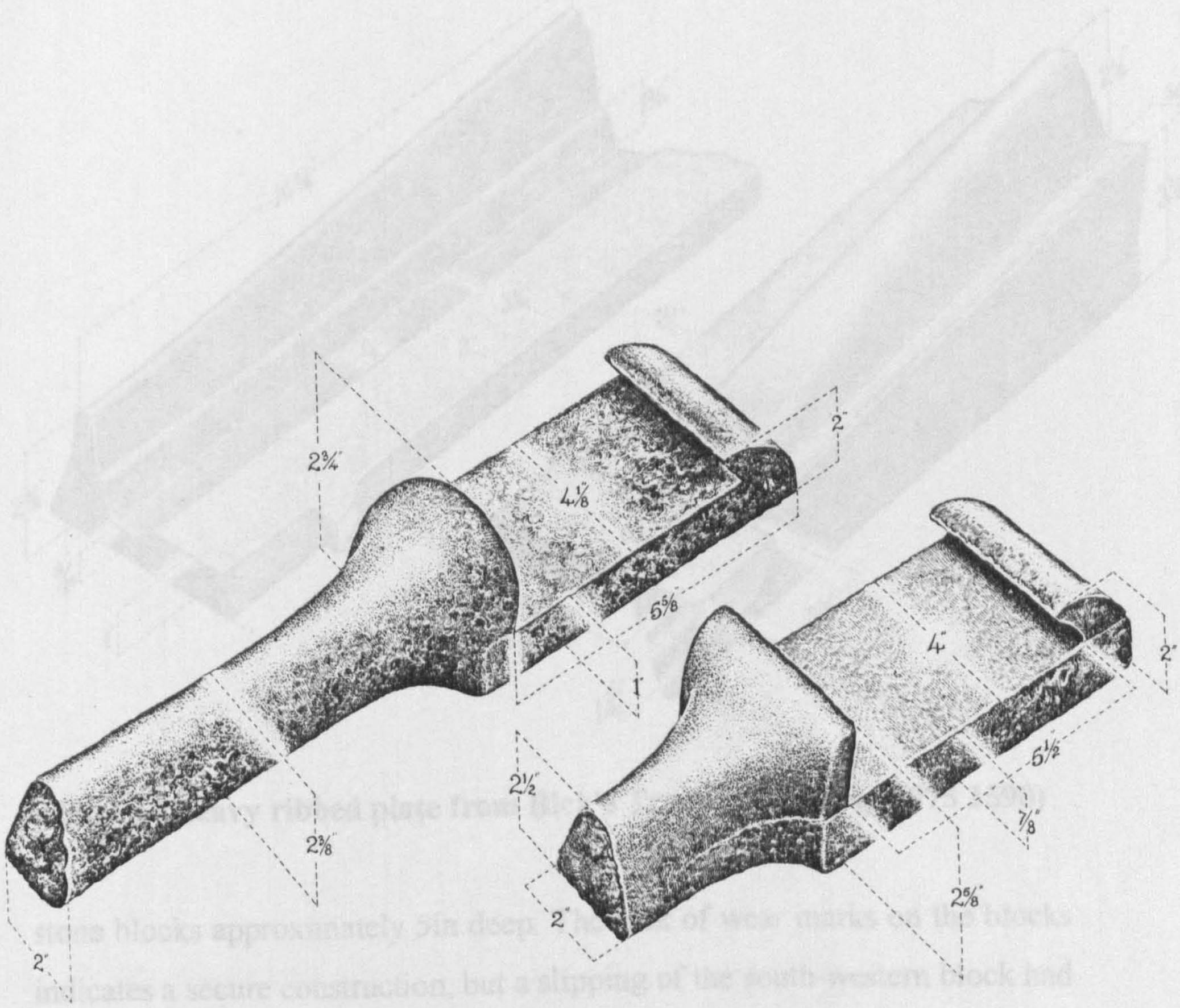


Fig. 59. Sills at Daren (east): Rhymney and Baileys' types (1975 1590)

The end of a wrought-iron tool of particular interest was found close by **(Fig. 61)**. The angled base would have been ideal for lifting plates during recovery, particularly here where plates were fixed directly with spikes to stone blocks.

For around 400m the line is lost under spoil, but as it approaches Pant y Rhiw quarry it emerges onto a causeway 5m long **(H11b)** where sills were found *in situ*. One, though broken in the centre, was complete. The inverted-T section on the tie-bar part would allow stones around 8in long and 2in deep to be wedged against it, the voids being filled by ballast of decreasing size to form a rounded horse track on top. The whole was laid on lime with

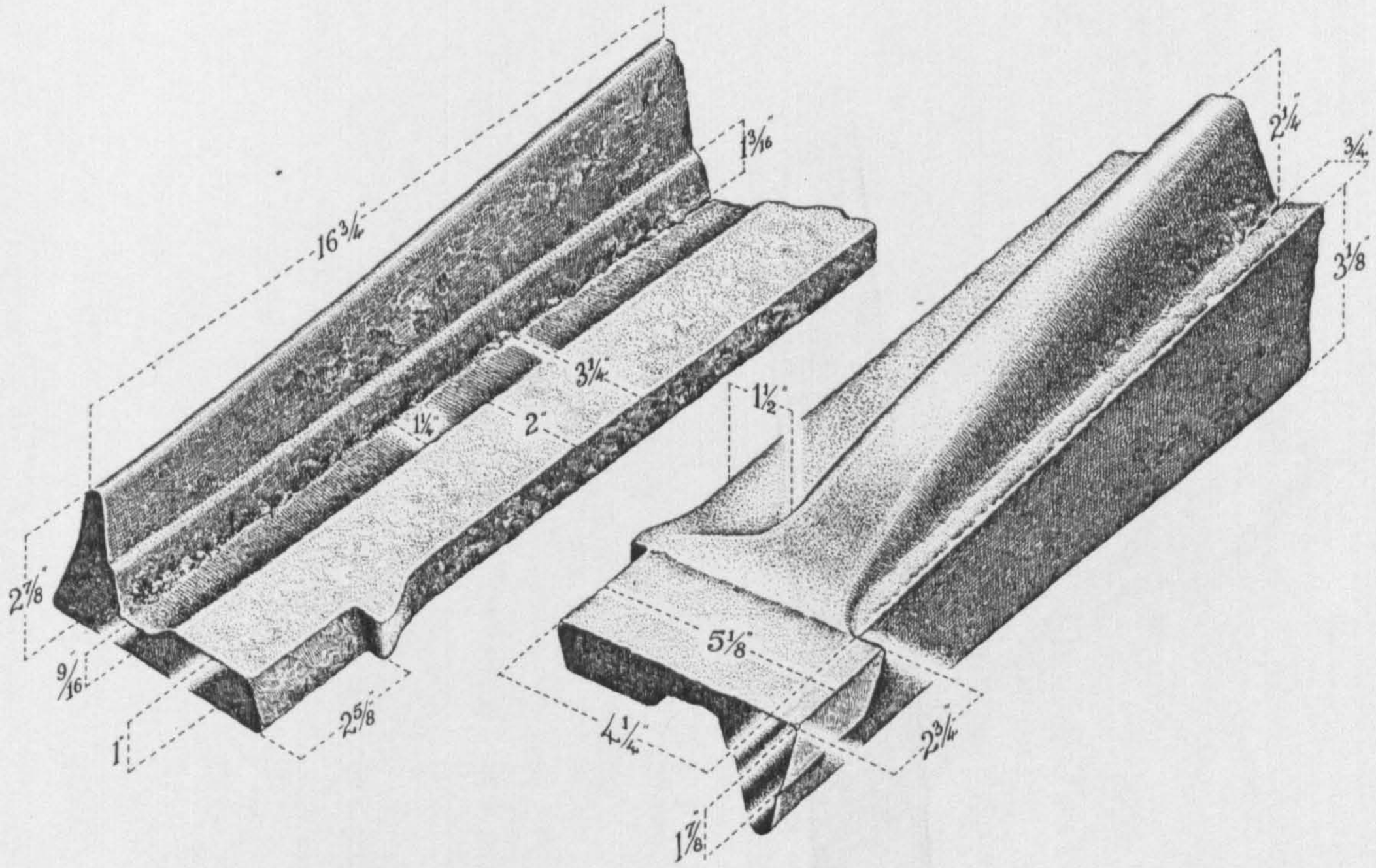


Fig 60. Heavy ribbed plate from Bick's Tramroad zigzag (1975 1590)

stone blocks approximately 5in deep. The lack of wear marks on the blocks indicates a secure construction, but a slipping of the south-western block had caused the tie to break in use. Measurement to another broken sill gives the plate length as 4ft. It therefore confirms that this part of the tramroad was laid by the Baileys to the same specification as the lower Llangattock Tramroad. An important feature of the sill is the wear marks on the tread which gives a gauge between the flanges of 3ft 4in. A little east was a reverse branch, showing that at one time the outcrop was worked near here. 300m east again was another reverse branch to Pant y Rhiw **(H11c)**, which after 100m disappears under spoil. Here more stone blocks were found at 4ft intervals and a sill identical to that at **H11b** was recovered **(Fig. 62)**.

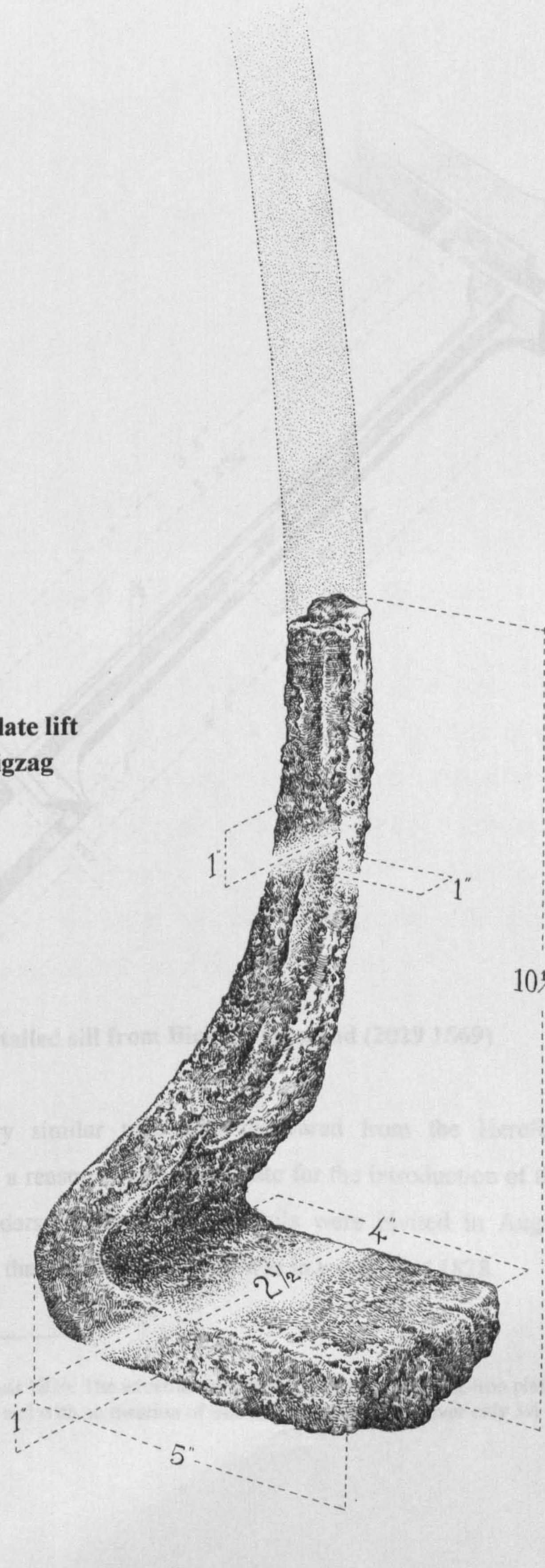


Fig. 61. Wrought-iron plate lift from Bick's Tramroad zigzag

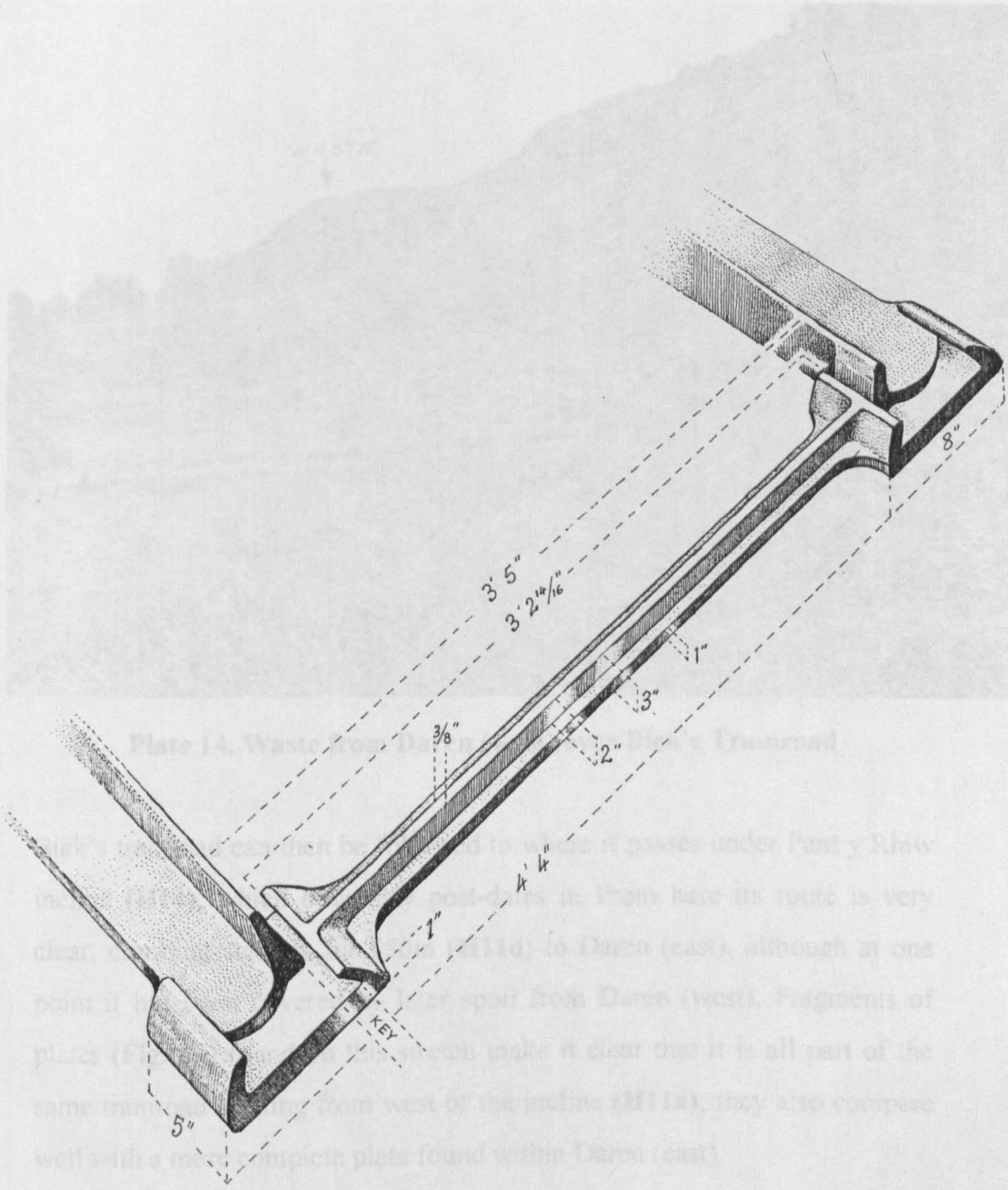


Fig. 62. Dovetailed sill from Bick's Tramroad (2029 1569)

Further afield, a very similar type was recovered from the Hereford Railway[40] which gives a reasonably accurate date for the introduction of this pattern. Although tenders for the Hereford rails were invited in August 1826,[41] it seems likely that the Bailey pattern was in use around 1828.

---

[40] Morris 1939, 100

[41] *Hereford Journal* 9 August 1826. The advertisement is for 250 tons of 3ft cast-iron plates of 40 to 50lb each (not 4ft, and with no mention of iron sills). These would cover only 3½

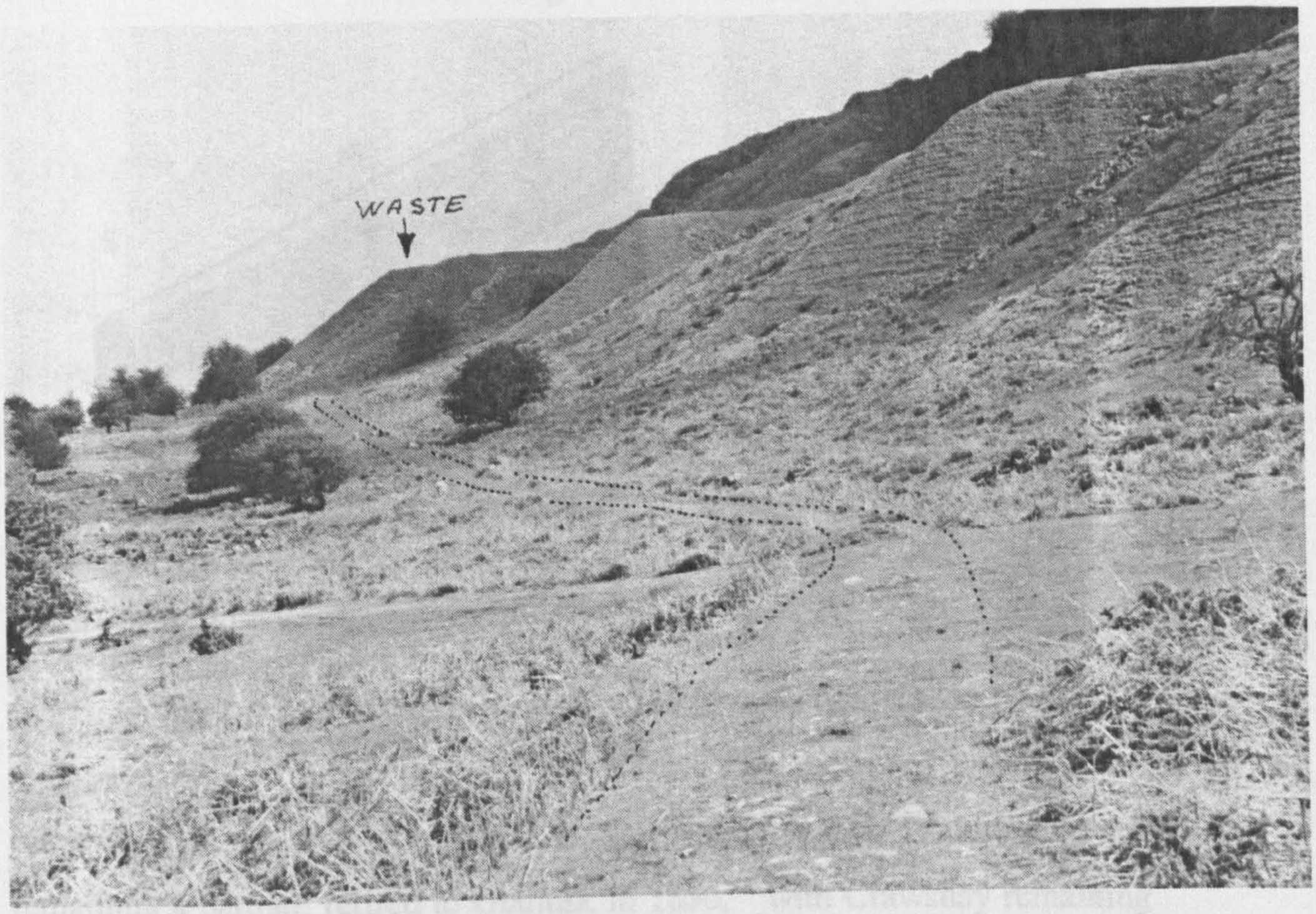


Plate 14. Waste from Daren (west) over Bick's Tramroad

Bick's tramroad can then be followed to where it passes under Pant y Rhiw incline **(H14)**, which obviously post-dates it. From here its route is very clear, climbing steadily for 550m **(H11d)** to Daren (east), although at one point it has been covered by later spoil from Daren (west). Fragments of plates **(Fig. 63)** found on this stretch make it clear that it is all part of the same tramroad running from west of the incline **(H11a)**; they also compare well with a more complete plate found within Daren (east).

The quarry area

At the quarry the tramroad levels out **(H11e)**. Around 100m further on, a plate for a sill was recovered which fits into the general Bailey system **(Fig. 64)**. On the tread is embossed **CJB**. Although from 1820 to 1843, and

---

miles of the 12-mile line. Possibly it was when tenders were submitted that Hodgkinson changed his mind, the first part of the line being laid with his normal notched pattern, and Joseph Bailey, who was a shareholder, instigating the new type for the rest. Plates and sills could have been easily delivered from Nantyglo via Baileys' Govilon Tramroad, the Llanvihangel Tramroad and Grosmont Tramroad

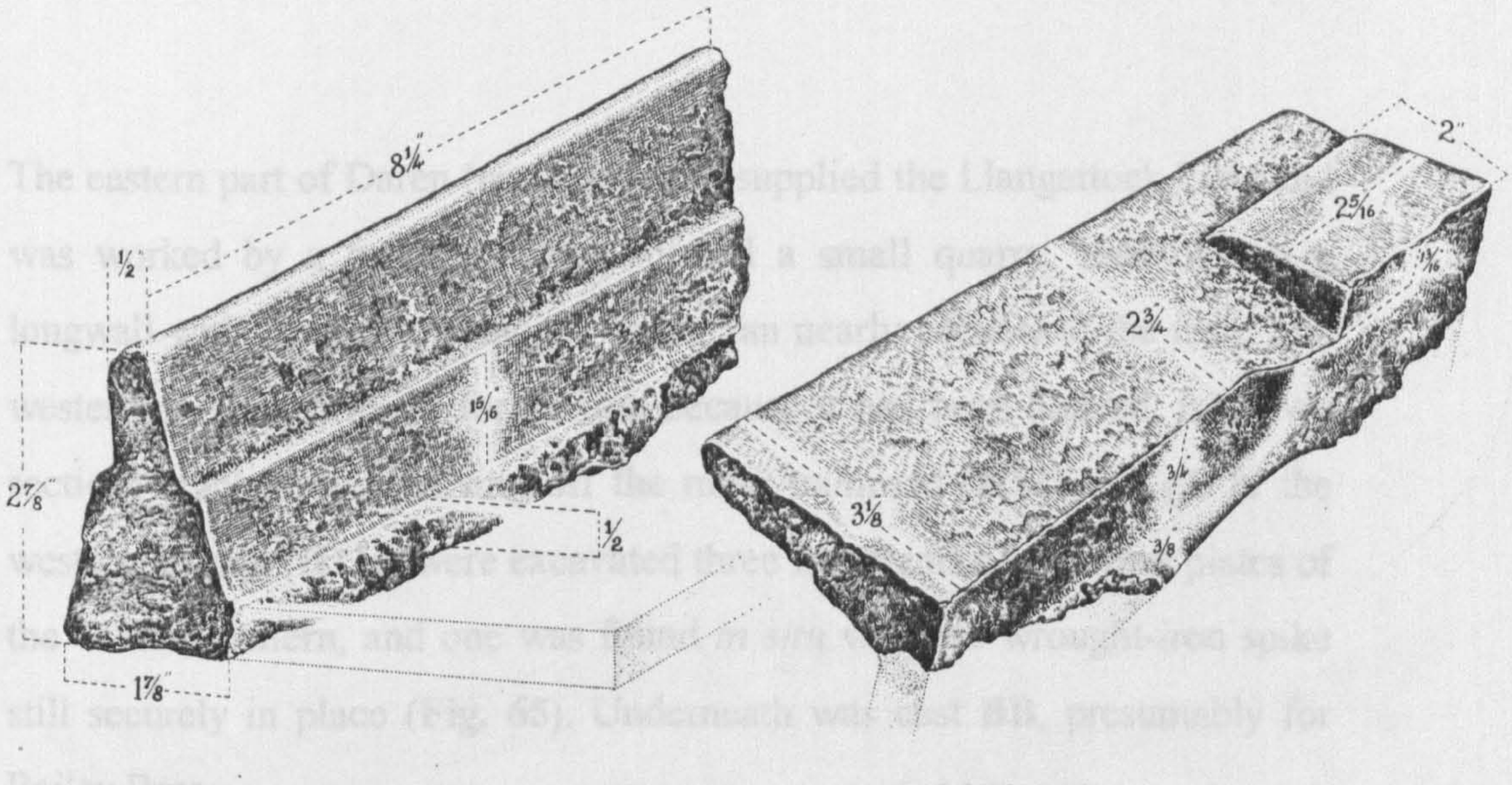


Fig. 63. Flange from Bick's Tramroad (2072 1531)

possibly later, the firm was styled Bailey Bros,[42] Joseph Bailey, although remaining a partner, retired to Glanusk in 1830,[43] with Crawshay remaining the working partner. It would understandable for a pattern maker to put Crawshay's initial first.

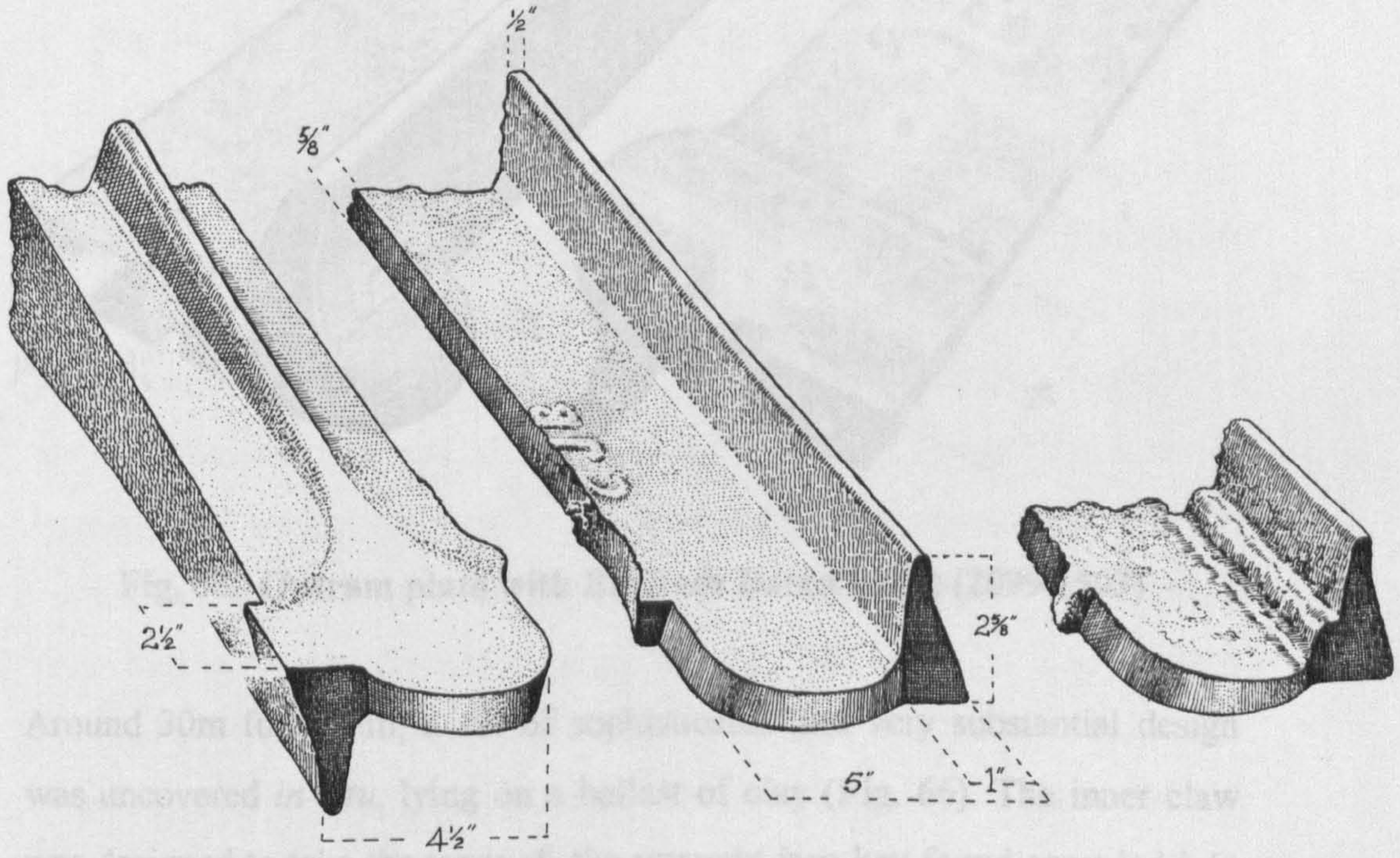


Fig. 64. Plate with CJB from Daren (east) (2099 1503)

---

[42] Riden and Owen 1995, 20
[43] Lloyd 1906, 174

The eastern part of Daren (east) probably supplied the Llangattock kilns and was worked by a heading which formed a small quarry. East of this a longwall with up to four principal tracks ran nearly parallel to the face. The western part, most likely for fluxing because it has been blasted, is in two sections reached by reversing off the main tramroad **(H11f** and **g)**. In the western section **(H11f)** were excavated three fragments of cast-iron plates of the Outram pattern, and one was found *in situ* with the wrought-iron spike still securely in place **(Fig. 65)**. Underneath was cast **BB**, presumably for Bailey Bros.

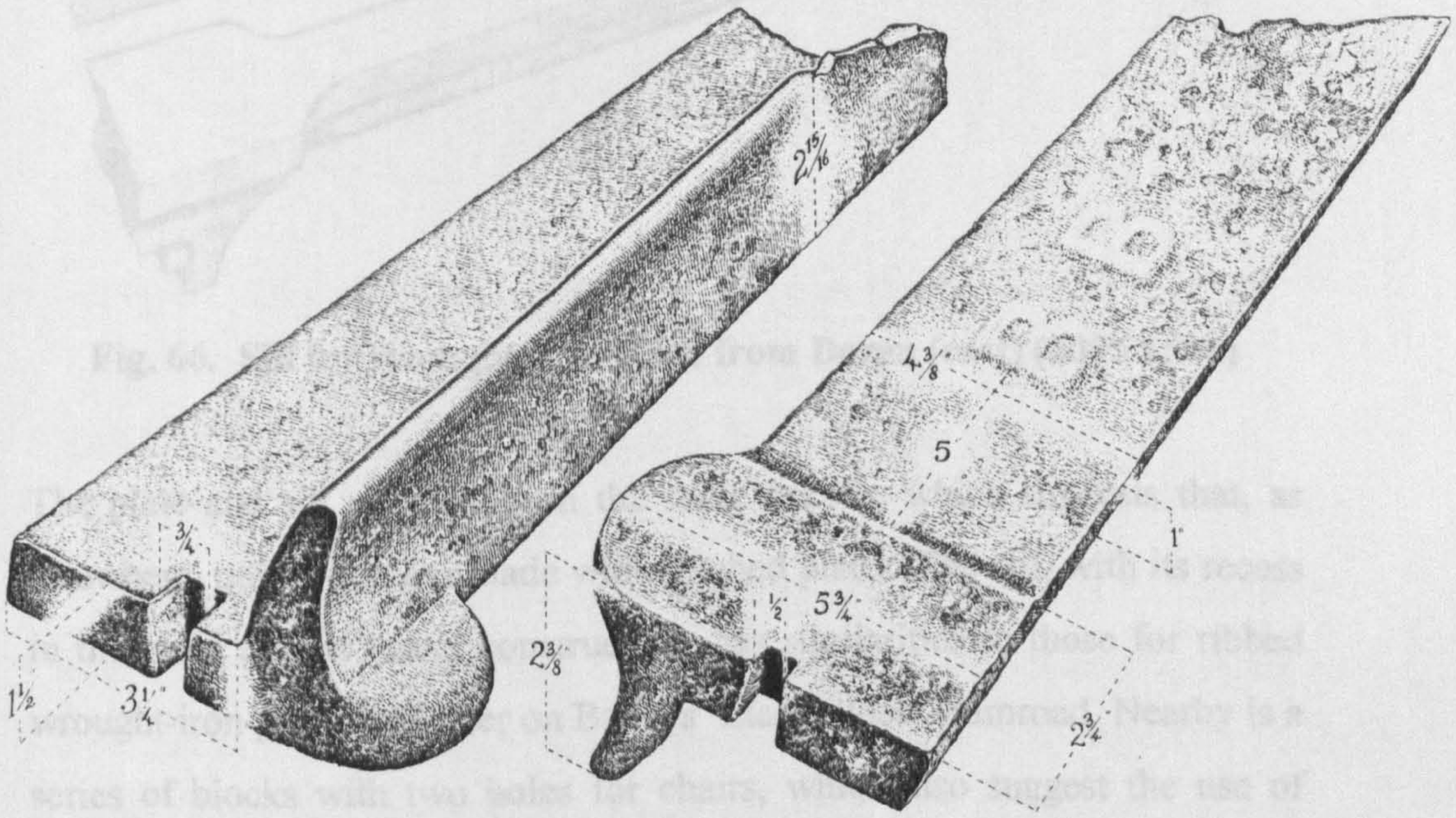


Fig. 65. Outram plate with BB from Daren (east) (2099 1503)

Around 30m further in, a sill of sophisticated and very substantial design was uncovered *in situ*, lying on a ballast of clay **(Fig. 66)**. The inner claw was designed to take the taper of the wrought-iron key found corroded into it. The gauge, at 3ft 5in between flanges, was slightly more than the Bailey standard.

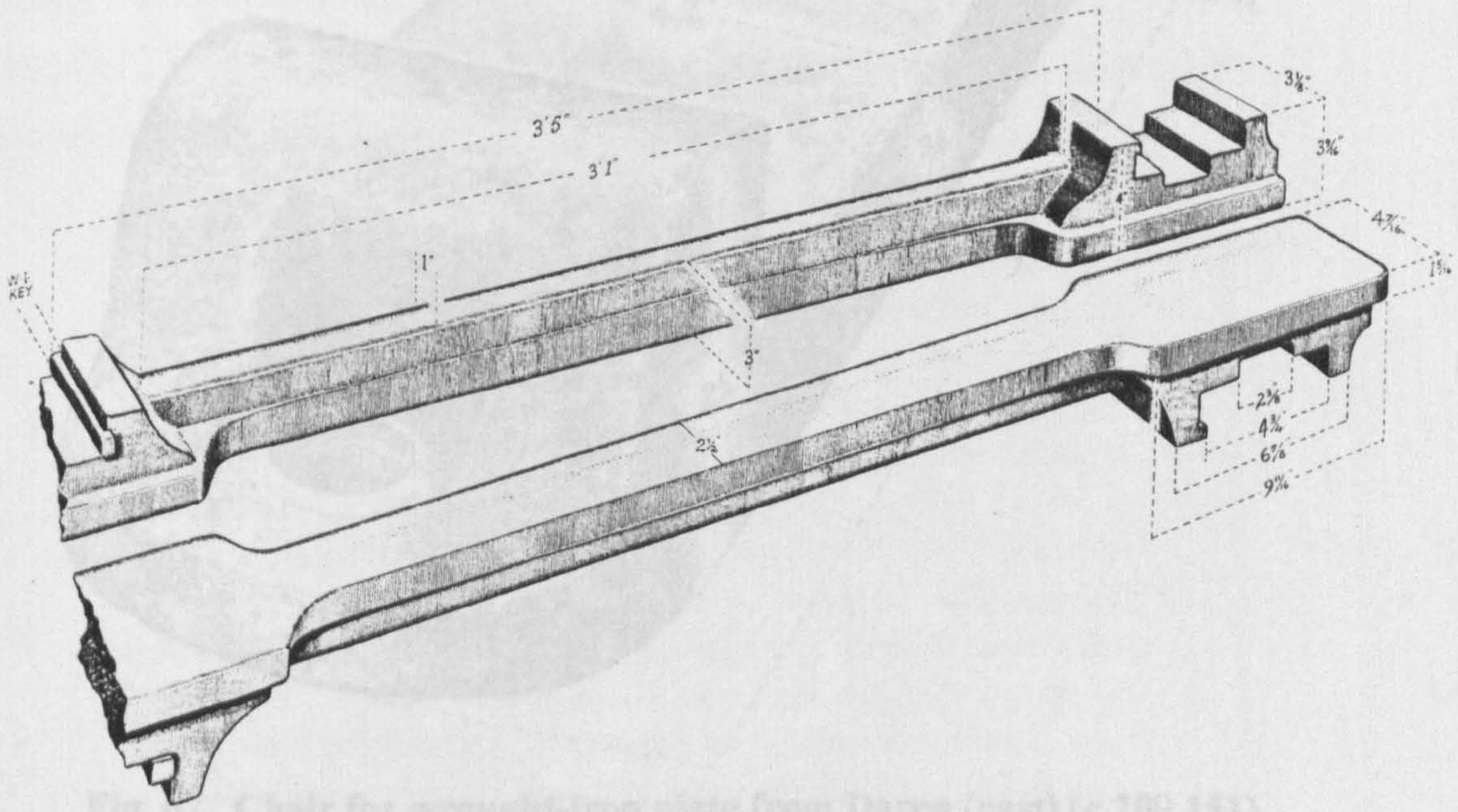


Fig. 66. Sill for wrought-iron plate from Daren (east) (2095 1508)

The plate and sill were used on the same branch, which suggests that, as elsewhere, pointwork was made with notched plates. The sill, with its recess in the tread and its heavy construction, has similarities to those for ribbed wrought-iron plates laid later on Baileys' Llangattock Tramroad. Nearby is a series of blocks with two holes for chairs, which also suggest the use of wrought-iron plates.[44] A chair for unribbed wrought-iron plates **(Fig. 67)** was recovered from here which fits the general pattern though not the marks on these blocks. These advanced designs point to a date after the installation of the Pant y Rhiw incline, which we know post-dates Bick's Tramroad. There is an apparent contradiction between this late permanent way and the line which had long been cut off. The explanation is that when the incline was built, Bick's Tramroad was not permanently abandoned, but its eastern end was later revived. This will be examined below (Wern Watcyn incline).

---

[44] 2096 1513. Rectangular indentations 12in by 4in with holes at 9, 9½ and 10in centres

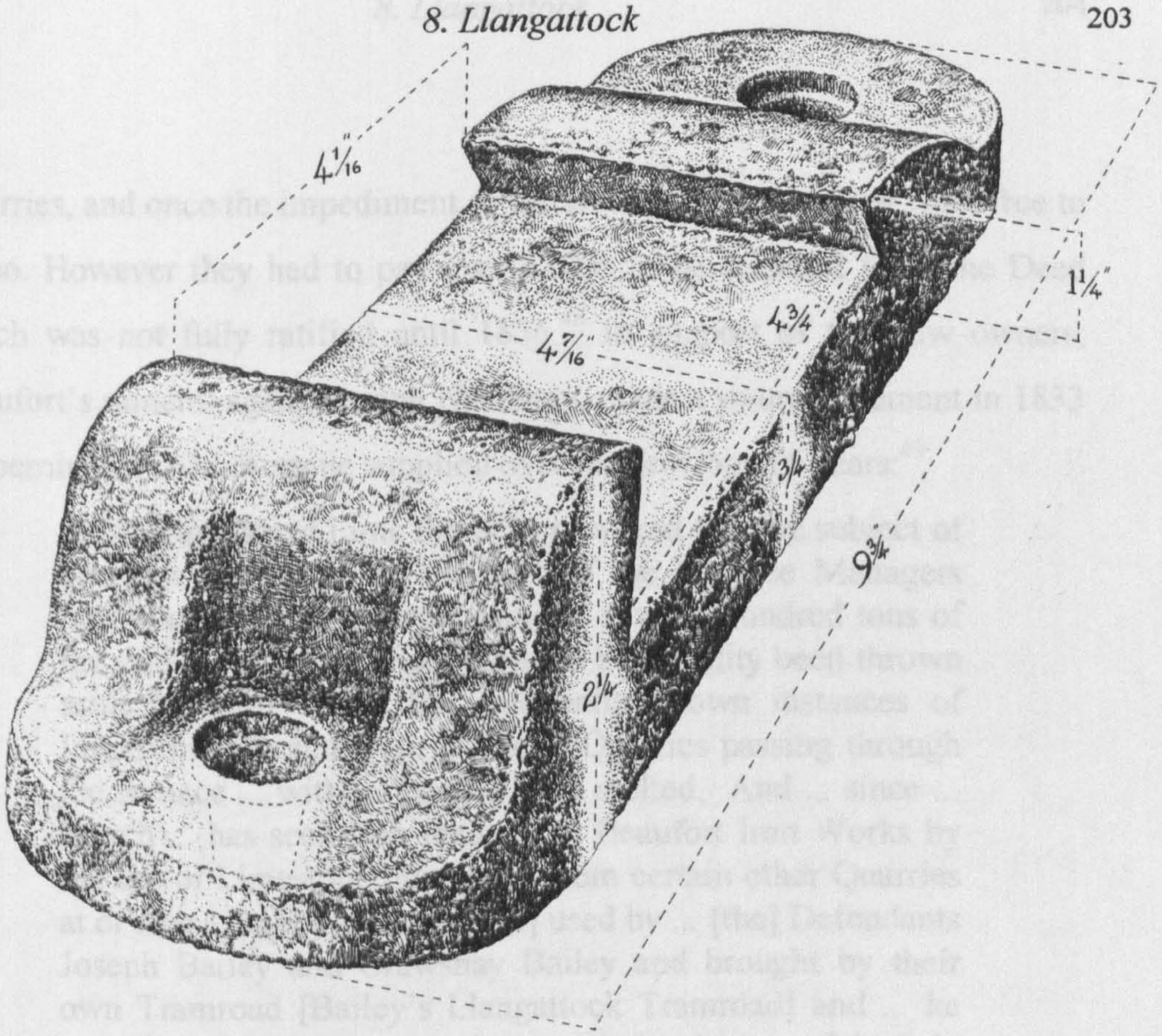


Fig. 67. Chair for wrought-iron plate from Daren (east) (c.209 151)

Baileys' Tramroad to Llangattock Quarries (H12)

On 24 April 1828 the Baileys applied to the canal company for a tramroad from Nantyglo to Llangattock. On 24 July the B&A declined to build it themselves, but authorised the Baileys to do so.[45] Fully opened on 7 December 1829,[46] it not only provided an outlet for Nantyglo several miles nearer Brecon, but also gave access to a new source of limestone. From 1833, with the taking over of Beaufort Ironworks, this was particularly pressing. Beaufort had previously used Trevil quarries under a Deed of Settlement with the Trevil Railroad, but apart from this had since 1779 had the right to take from the Duke of Beaufort's land in Llangattock.[47] The Baileys found it convenient and cheaper to use their own Llangattock

---

[45] B&A General Assembly 24 July 1828

[46] *The Cambrian* 18 December 1829 reports that the Nantyglo and Llangattock Railway had just been completed by Messrs J. and C. Bailey at enormous expense and opened 'Tuesday sennight.' I am grateful to Dr Michael Lewis for this reference

[47] GRO D.397.1664

Quarries, and once the impediment of the Deed had been settled were free to do so. However they had to pay over £2000 to be released from the Deed which was not fully ratified until 1836.[48] In support of the new owners, Beaufort's mineral agent, Joseph Needham, made a sworn statement in 1833 concerning Trevil limestone supplied over the previous 15 years:[49]

> the bad quality of Lime Stone so procured was the subject of constant complaint on the part of the Furnace Managers [and] large quantities amounting to several hundred tons of the said Limestone ... have from its bad quality been thrown aside as unfit ... He has frequently known instances of Limestone brought from ... Trevil Quarries passing through the furnace ... without having been melted. And ... since ... March ... has seen Iron made at ... Beaufort Iron Works by the use of Limestone brought ... from certain other Quarries at or near Llanelly [Llangattock] used by ... [the] Defendants Joseph Bailey and Crawshay Bailey and brought by their own Tramroad [Bailey's Llangattock Tramroad] and ... he considers the quality of the Iron made by the use of the said ... Limestone to have been very much better than the quality of the Iron made from the same Ore [with] Limestone brought ... from ... Trevil Quarries.

Ebbw Vale may also have intended to try to escape the stranglehold of the Trevil Railroad. A 500m incline and tramroad[50] connecting Beaufort to Baileys' Llangattock Tramroad was in use by January 1834.[51] Walker's map of 1834 also shows an 'Int.d Rail.d' running from Ebbw Vale to join Baileys' Llangattock Tramroad.[52]

The route, over 7km long, can be easily followed from Nantyglo, mainly by road. It ran from the furnace tops, via Limestone Road across the back of the

---

[48] Rattenbury 1989, 460-61. See also *Monmouthshire Merlin* 1 February 1834 on the removal of an injunction to restrain Bailey from using other tramroads to convey limestone
[49] GRO D.1078.89
[50] Incline from 1741 1149 to 1700 1121
[51] B&A Committee Minutes 31.1.1834. Report of James Peirce: 'the only crossing made without the consent of the Brecknock & Abergavenny Canal Co has been made by Messrs. J. &C. Bailey over the Rail Road near to the Incline leading down to Beaufort Iron Works'
[52] Rattenbury 1989, 461 refers a meeting between Charles Harford of Ebbw Vale and W. H. Bevan of the Trevil Rail Road Company on 30 September 1833 to have the tonnages reduced

Market Hall at Brynmawr, and along Lower Bailey Street. Here there are a number of limestone-built houses with round-headed doorways similar to one at Pant y Rhiw. On the corner is a building which might have been a weigh-house. From this point the line now comprises a well-graded tarred road to the Traveller's Rest, with causeways at Hafod and a 500m one from near the foot of the Wern Watcyn incline towards the Traveller's Rest.[53]

From here the final 500m, partly on causeway, leads to the incline head, where it joined the second Llangattock Tramroad with access to the canal at Llangattock. The type of track on this stretch was confirmed by a machine-dug trench[54] which showed the tramroad material to be generally 0.5m thick, of small stones in a mixed dark grey and orange sandy clay loam matrix. Stone blocks around 8in square, with the characteristic spade impression of sills, were noted at 3ft 3in intervals.[55] A sill 4ft 2in long with chair parts 4¼in wide matched them: with a tight fit it could give the 3ft 4in gauge. The length of plates is not the usual Bailey 4ft, but is the same as on the BBCo tramroad west of the incline head. Possibly the 500m east of the incline were also built by, or for, the BBCo. Indeed, a boundary stone found face down in a wall close to the Traveller's Rest[56] is carefully inscribed **BCC 1852**, which might be expanded as 'Brecknock Canal Company.' At the incline head are three parallel lines associated with the working of the incline, the two northerly ones forming a marshalling yard. The southerly one has 4ft spacings and must have been put in for through running from Chwar Mawr when the Baileys took over there. By 1877 this line was incorporated into the incline system.[57]

---

[53] Hafod Farm (2055 1285) belonged to the BBCo and was mentioned Ellwood in August 1828 when the Baileys were building the 'new Road' through their land (NLW Maybery 3615). The Traveller's Rest is at 2049 1562

[54] 2044 1583 to 2038 1584

[55] Hankinson 1996

[56] Now at Philip Thomas, Hillside; found at 2048 1562

[57] OS 25in 1877

Plate 15. Causeway on Baileys' Llangattock Tramroad at Nant yr Hafod

Further back, although the course is mainly tarred over, there are three places where the plate length can be measured.[58] Wear marks on blocks show 4ft lengths in sills, the chair part being 5in by 8in. At some stage the line was slightly re-routed in places, and at the same time the sills were replaced by heavy individual chairs, but only as far as the Traveller's Rest. One such chair has been recovered **(Fig. 68)**,[59] and blocks with marks which correspond to it are well dispersed along the line,[60] though none has been found *in situ*. The re-engineering was undertaken by Thomas Dyne Steel about 1859.[61]

---

[58] 2088 1280, 2063 1288, 2208 1310

[59] From 206 170

[60] 2061 1559, 2150 11499 and twelve at 2075 1289 The general size of the blocks is approximately 21 by 16in and 10in thick

[61] *MPICE* lxxxiii (1897-98), 406-8: he 'converted the Llangattock Tramway from Brynmawr to Llangattock into a locomotive road.' In 1859 he became agent to Crawshay Bailey

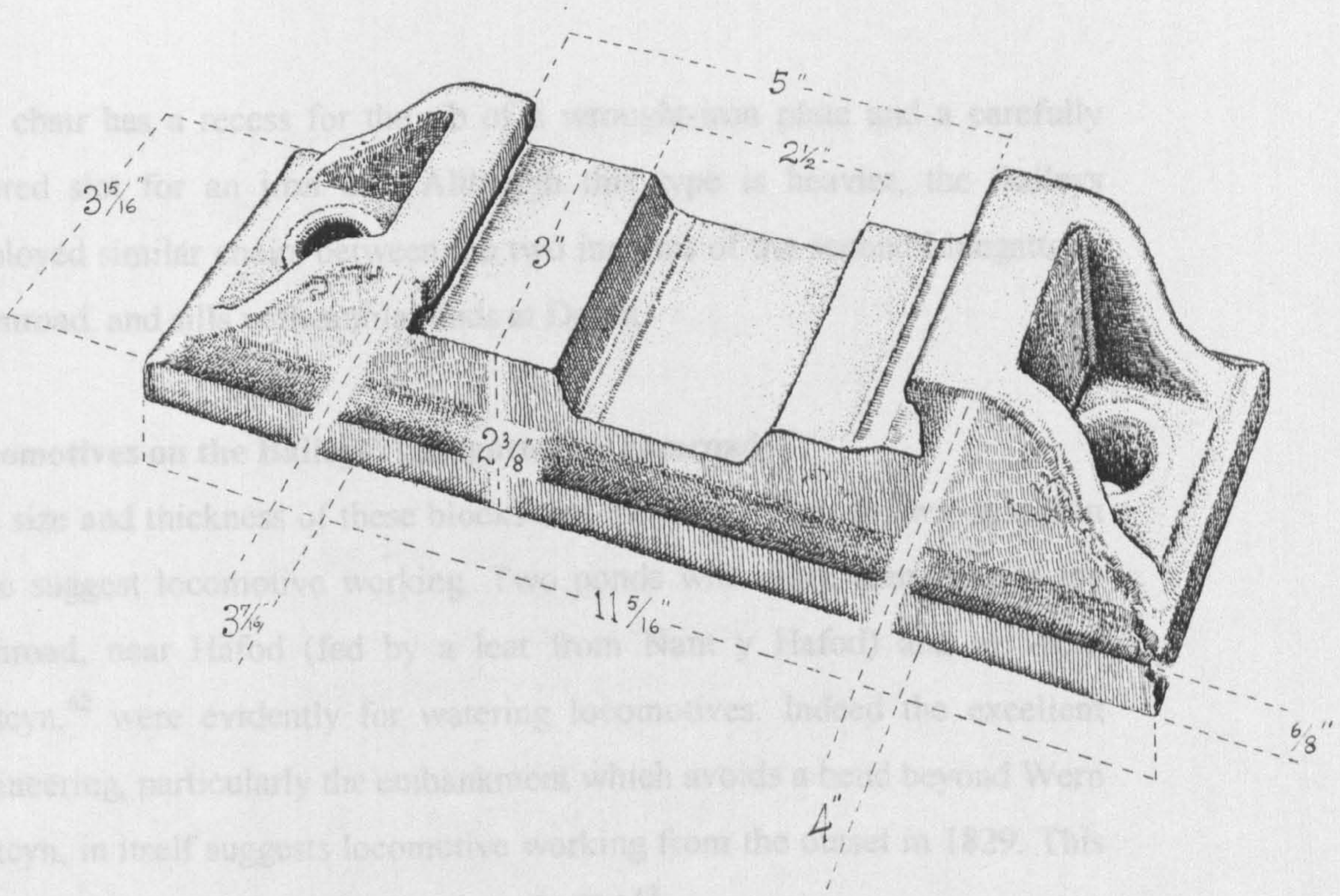


Fig. 68. Chair for wrought-iron plate from Baileys'Llangattock Tramroad (206 170, but moved from original site)

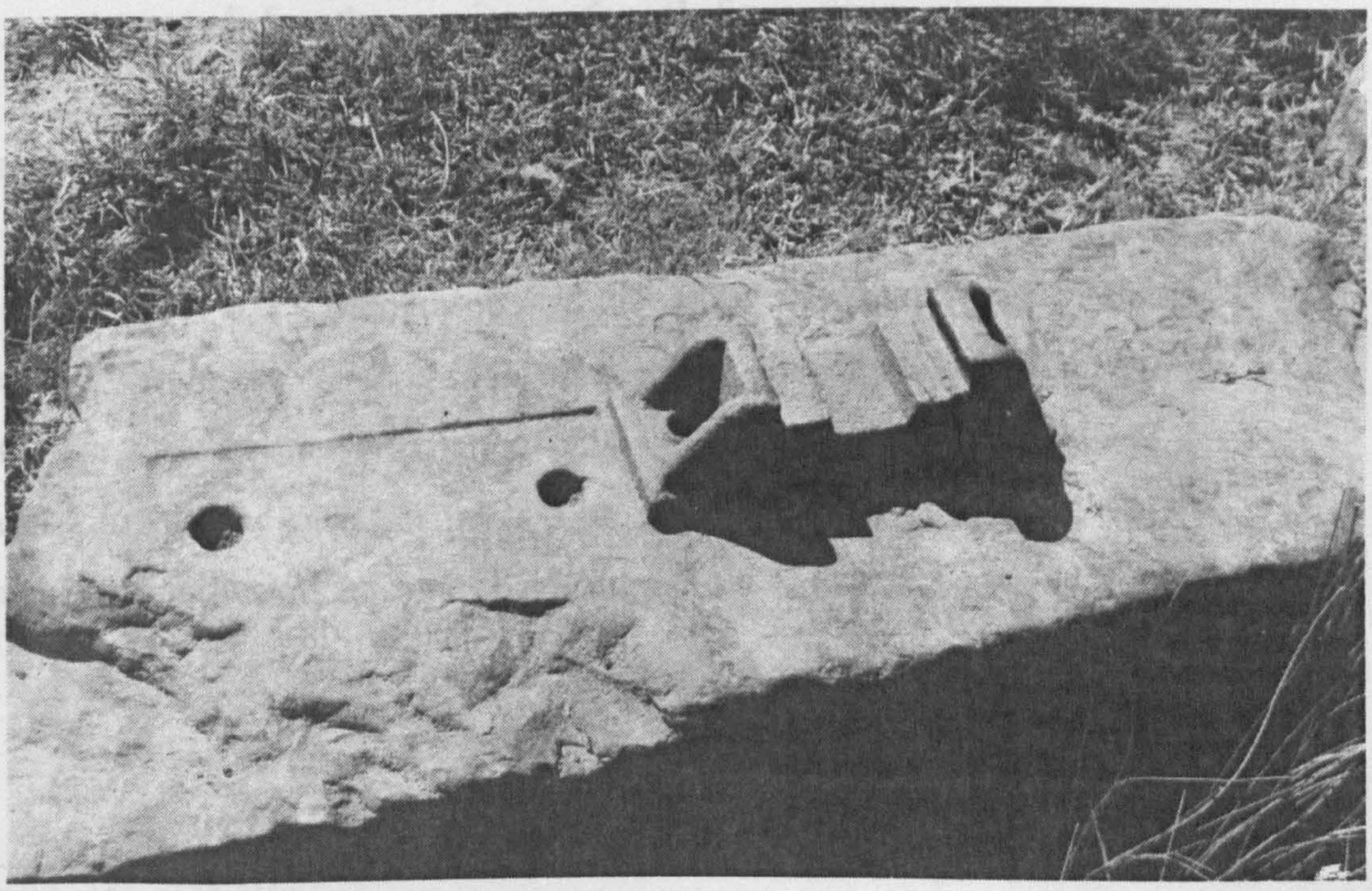


Plate 16. Baileys' Llangattock Tramroad. Wear marks and chair

The chair has a recess for the rib of a wrought-iron plate and a carefully tapered slot for an iron key. Although this type is heavier, the Baileys employed similar chairs between the two inclines of the second Llangattock Tramroad, and sills with similar ends at Daren.

Locomotives on the Baileys' Llangattock Tramroad

The size and thickness of these blocks and the heavy chair for wrought-iron plate suggest locomotive working. Two ponds with earth dams beside the tramroad, near Hafod (fed by a leat from Nant y Hafod) and at Wern Watcyn,[62] were evidently for watering locomotives. Indeed the excellent engineering, particularly the embankment which avoids a bend beyond Wern Watcyn, in itself suggests locomotive working from the outset in 1829. This is confirmed by the following extract of 1834.[63]

> There is also a tramroad and inclined plane for conveying limestone from the Darren rocks to the canal; and Messrs Bailey have recently established a steam-carriage and tramroad for the carriage of coal from their mines in Monmouthshire to the wharf near the village of Llangattock.

Was this Crawshay Bailey's[64] engine famed in song? We are in the realm of myth, but some facts are suggestive. It has been stated that Crawshay Bailey's engine was a Blenkinsop rack locomotive and that Crawshay Bailey lost £10,000 in the venture soon after joining his brother at Nantyglo.[65] Although their partnership started only in 1820, it is likely that there is confusion with the rack engine said to have been supplied around 1813[66] which apparently worked some coal or iron ore tramroad to Nantyglo.

---

[62] 2080 1290, 2149 1500
[63] Lewis 1834 under Llangattock
[64] Incorrectly 'Cosher Bailey:' see Watkin 1996
[65] Pers. comm. Keith Thomas of Ebbw Vale, from reported speeches of Crawshay Bailey in 1830
[66] Marshall 1953, 54

There is a manuscript version of the song in a contemporary hand,[67] entitled a 'Comic Song written when the Engine introduced by Mr Crawshay Bailey was objected to.' The first three verses run:

Oh my name is Edward Morgan
I do live down in Glamorgan
At a place they call Neath
Where the people curl their teeth

Crawshay Bailey's got an engine
Its a-puffin & a-blowing
And it is such great horse power
It goes fourteen mile an hour

He had got another engine
But he found it would'nt go
So he pulled her by a rope
All the way to Nantyglo

In these there is the kernel of two locomotives. The renderings of 'Crawshay Bailey's Engine' have given the engine a personality of sorts; but what was it like? And why should the composer of the song, Edward Morgan of Neath, be interested in locomotives in Monmouthshire? He appears more favourably disposed towards the first engine mentioned, which raises the possibility that, like most Welsh locomotives of early date, it was built by Neath Abbey Ironworks. The Neath Abbey records are notoriously incomplete, but one drawing survives, undated but almost certainly of the 1830s, of a tender for a plateway locomotive on a gauge of 3ft 6in between the wheels.[68] Part of the drawing, which perhaps included the engine itself, is missing, and the surviving superscription merely says that the tender was for an engine with 10½in cylinders (a favourite Neath Abbey size) and that it was built (or intended) for 'Mr Bailey.' The tramroad to Llangattock is the only Bailey one, and the only known one connecting with Nantyglo, for this

---

[67] Kindly supplied by Arthur Price, Frocester Court, Stonehouse. Fourteen verses excluding Chorus

[68] WGlamRO D/D NAI L/2/3. The drawing is unscaled but the gauge measures 3½in; the normal Neath Abbey scale for general arrangements was 1in to 1ft

wheel gauge. There is therefore a very real possibility that Crawshay Bailey's engine hailed from Neath Abbey.

The song, however, disparagingly mentions a second locomotive. And in 1832 R. Jones of Birmingham[69] submitted a quotation to the Dowlais company:[70]

> I will supply you with a Locomotive Engine ... working upon 4 wheels & Springs with Metalick pistons and fitted in a superior style of Workmanship, deliver'd at Bristol and put to work for the sum of 350 pounds. I would advise you to have one 4½ Tons, including the water in the Boiler and the cistern to carry water to suply the Boiler. I am now making one for Mr. Bailey of Nantyglo to the above weight.

This strongly implies that the engine was a reality, not just a project; and although no gauge is stated the Baileys are not known to had locomotives on any other of their tramroads. The Llangattock line, therefore, certainly had one locomotive by 1834, and probably two.

They may not have had a long life, but a generation later there was yet another, the *Cymro*. In 1864 George William Keeling of the Severn & Wye Railway saw at Brynmawr, on a gauge similar to the Blaenavon coal mines tramroad (3ft 3in), a locomotive similar to a four-wheeled one at Blaenavon which had been built fifteen years before by the Usk Side Iron Co at Newport with 3ft 6in wheels at 4ft 5in centres and a weight of nearly 8 tons.[71] This must be the engine as purchased by Blaenavon on 26 April 1850 for £825.[72] It was designed by Thomas Dyne Steel, who in 1853 became a partner in the Uskside works, who, as we saw, became Crawshay Bailey's agent, and who re-engineered the Baileys' Llangattock Tramroad with heavy-duty track fit for locomotive working. It therefore seems highly likely

---

[69] Probably Robert Jones of Deritend Foundry, who is not otherwise known to have built locomotives. For his background see Griffiths 1967, 279
[70] Elsas 1960,182; also Lewis 1975, 23
[71] 'Dean Forester' 1963, 59
[72] GRO D.751.356

that the *Cymro* was built at Newport around 1860 on the lines of a Blaenavon locomotive of 1850.

John Bainton, a native of Brynmawr, remembered the engine, suitably whitewashed, taking nonconformist Sunday School trips out to Llangattock quarries, whence they descended the inclines to enjoy a trip on the Canal. Mr Bainton, who died in 1973 aged 98, recalled at the age of 8 (in 1883[73]) taking a lift on the back of the 'engine and drams or trams' from just beyond the Hafod Farm. The engine would stop to take on water near the Hafod Farm gateway and, whilst the driver's attention was directed elsewhere, he would hitch a ride.[74] This tale refers to the pond at Hafod mentioned above.

A gravestone in Llanelly Churchyard bears the following inscription:

IN MEMORY OF
JOSHUA
SON OF
CHARLES AND MARY MORGAN
OF BRYNMAWR
WHO DIED OF INJURIES CAUSED
BY THE CYMRO ENGINE
OCT 20TH 1871, AGED 20 [26] YEARS

It emerged at the inquest that Joshua Morgan, the stoker and 'latchman,' fell whilst attempting to jump on the buffer of the engine after turning a point on the 'limestone railway.' The engine passed over his left leg which was later amputated. He fell down the bank and was not found until the following morning. At the inquest it was recommended that there should be a lamp for the latchman and one for the engine.[75] The location of this incident was at the same pond where John Bainton hitched a ride, where uprooted blocks testify to a former turnout.[76] A building named Cymro at the foot of the

---

[73] In fact the quarries closed well before then, but coal was presumably still being exported via the Baileys' Llangattock Wharf
[74] Bainton 1972
[75] *Star of Gwent and South Wales Times* 21.10.1871; *Monmouthshire Merlin and South Wales Advertiser* 20.10.1871 and 27.10.1871
[76] 2080 1285, extending for 30 metres eastwards (OS 25in 1877)

Wern Watcyn incline was possibly the shed for this engine, but it has been at least partially rebuilt as sheep pens, whose walls incorporate a crude date-stone of 1879 re-used upside down.

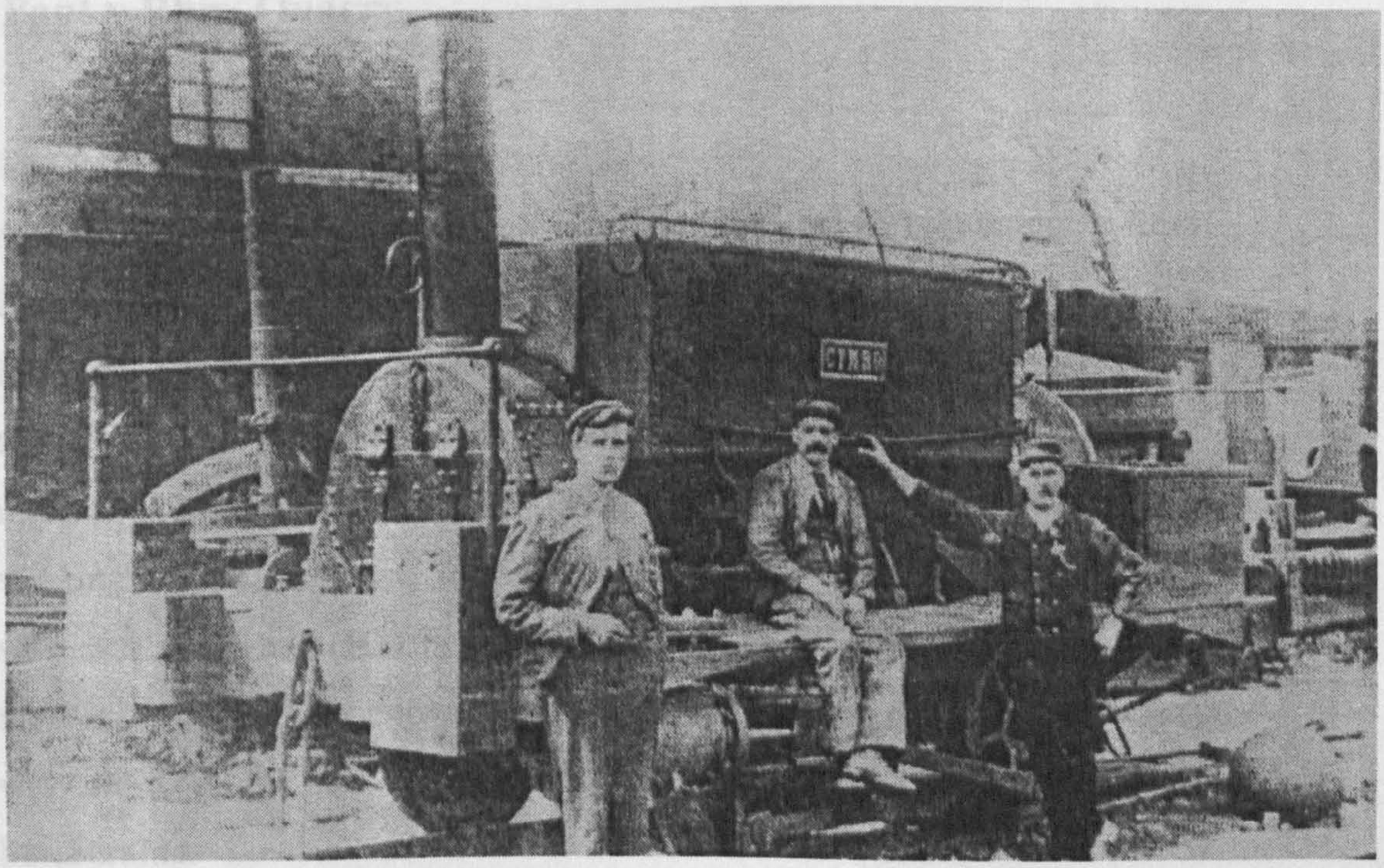


Plate 17. *Cymro* at Wrexham (source: Bradley 1992)

Towards the end of the century a standard gauge 0-4-0 saddle tank locomotive named *Cymro*, with outside cylinders 10in by 14in, appeared in the hands of Cudworth & Johnson, machinery dealers of Wrexham. Some say that it was assembled by the firm from assorted components, others that it was aquired from Greens Foundry in Aberystwyth. What can be seen in the photograph of the core of the engine fits a date of about 1860. It was sold in 1892 to Davies Bros, the contractors building the Wrexham-Ellesmere railway, and on completion of the contract was auctioned and reputedly departed for either Shoreham or Littlehampton under its own steam. It has been traced no further.[77] It is not impossible that the Llangattock *Cymro*, sold off in the 1880s, was converted to standard gauge (at Aberystwyth or anywhere else) and re-emerged briefly into history at Wrexham in the 1890s. But in the absence of photographs of other Uskside products we can only guess.

Pant y Rhiw Quarry

The first workings

Although there was some limited working of this area by two branches from Bick's Tramroad (**H11b** and **H11c**), it was not worked extensively until the installation of the Pant y Rhiw incline **(H14)**, which cut Bick's Tramroad in two. Some quarrying probably continued from Bick's, but it retreated increasingly westwards as spoil built up from the new workings. Eventually working was only possible from the zigzag, where the tramroad, still using sills, was re-aligned **(H11h)** through waste from the Daren Cilau quarry of the BBCo to work at the lower western end. This phase could be concurrent with the workings now to be described, but the product was still used for limeburning.

---

[77] Bradley 1992, 34, 151

The quarries of this phase ran from south-east to north-west, starting 200m west of the Pant y Rhiw incline head, continuing for around 300m, and served at first by a tramroad **(H13)** from the incline. The first two quarries swung into faces which have now been quarried away by the final phase of working. The last 150m is a gorge robbed from either side **(H13a)**. The three branches from which working took place now lie suspended above the later quarried area.

Pant y Rhiw incline (H14)

This balanced incline, 200m long, joined Baileys' Llangattock Tramroad 200m short of the Traveller's Rest. Evidence for its date is only circumstantial. When it was built, Bick's Tramroad (which it cut) was clearly out of use. Since the finds at Daren (east) are mostly late, it is likely that early working there was limited and that the initial phase of Bick's Tramroad which served it was short. Furthermore, there are strong similarities with the inclines on the second Llangattock Tramroad of about 1827: all three inclines used chains, not wire ropes, and Pant y Rhiw used stone pillows as guides along the whole course of the incline. For these reasons it is unlikely to post-date the other inclines by a great deal. A date of about 1836 is suggested, when Beaufort was finally free to take limestone from Llangattock. It is likely to have been abandoned when the alternative and more efficient Wern Watcyn incline was opened.

Its remains are noteworthy. It was double throughout, 6m wide and revetted and embanked in part, particularly the top third although some robbing may have taken place here. The stone pillows for supporting the chain are at 2.4m centres, with cruciform grooves cut by the continuous chain whose links were about 3in across. The pit at the foot measures around 3.5m wide by 5m long and slopes down from the incline to a maximum depth of around 1.5m.

The nearest pillow lies some 20m from it, and the final guide was no doubt below ground level. A drain lies to the north. Trams crossed the pit on a framework, as elsewhere at Llangattock. As no blocks have been found on the incline, one concludes that sills were used throughout.

Below the incline foot the track was laid with sills at a variety of intervals.[78] It turns sharply right, roughly parallel to Baileys' Llangattock Tramroad, before joining it after about 100m, an arrangement very similar to that employed by Thomas Dyne Steel in the 1850s at the point where his incline joins Hill's Tramroad near Blaenavon **(D21)**.

Pant y Rhiw incline is instructive for our understanding of incline working. The assembly points at the top vary at Llangattock, but the obtuse angle at Pant y Rhiw would have been ideal for the quick running of trams onto the incline. At the top and slightly east lie the remains of two buildings which may possibly be stabling for the horses working the assembly area.

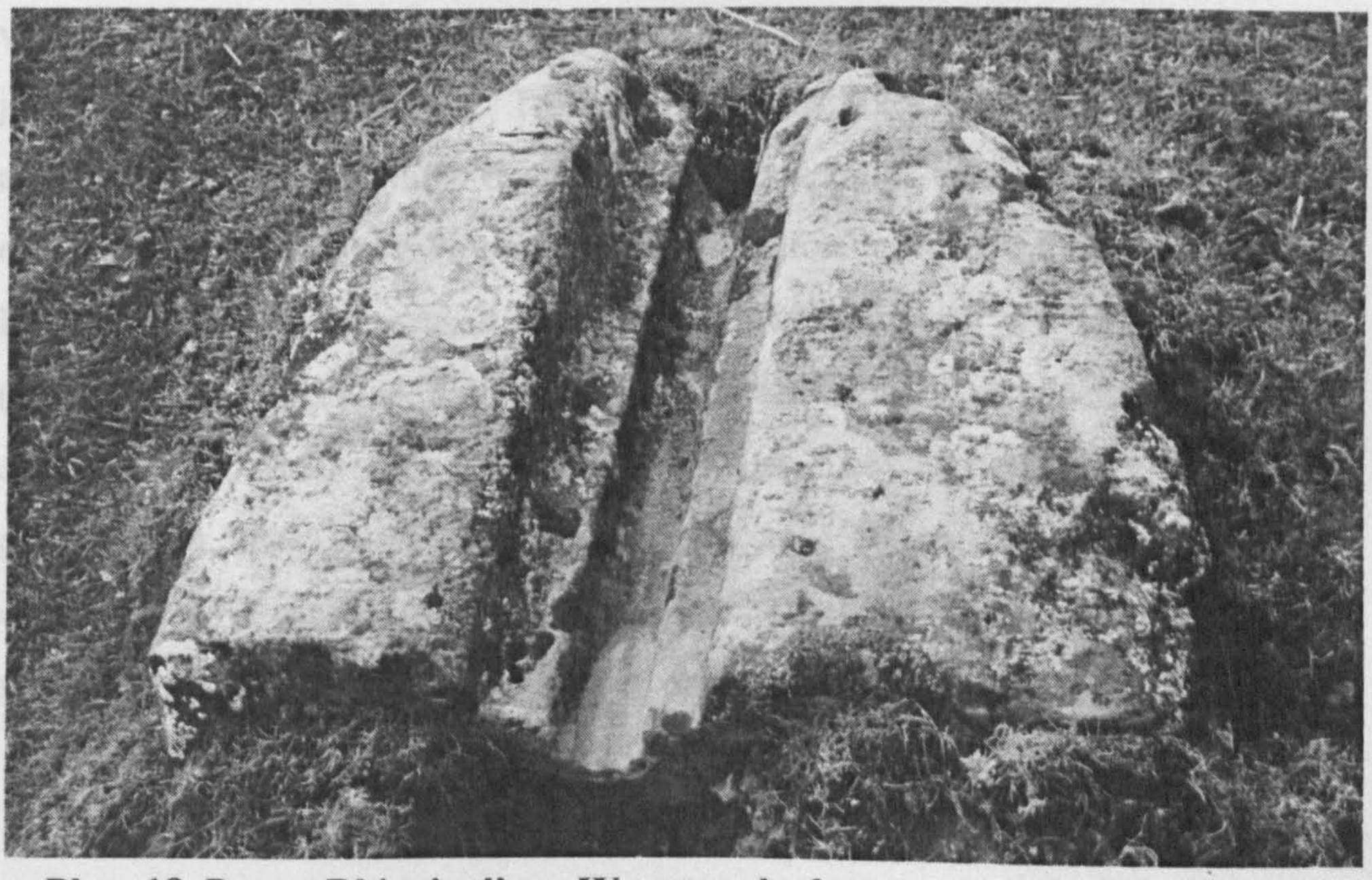


Plate 18. Pant y Rhiw incline. Wear marks from chains on pillows

[78] From the incline eastwards 48, 42, 42, 48, 34, 42, 48, 42, 48, 38, 37, 53in. This variation, if genuine, is difficult to explain; but the measurements, made from depressions in the ground which were assumed to correspond to sills, may be inaccurate

The Wern Watcyn incline (H15)

The final phases of development of Llangattock came with the arrival of the Wern Watcyn incline, which despite its name was not chain- or rope-worked. By leaving Baileys' Llangattock Tramroad over 1km closer to Nantyglo and heading straight for the quarries, it climbed on a gentle gradient to the same height as the Pant y Rhiw incline, which it superseded. Nevertheless, Baileys' Llangattock Tramroad was retained to the west for export purposes via the canal, which was probably its original function. In fact it remained in use, as we have noted, after the quarries closed.

The Wern Watcyn ran for over 1km from the Cymro to a junction with Bick's Tramroad (the main part of **H11d**) and beyond to Pant y Rhiw quarry. A reverse branch ran eastwards to Daren (west). There are indications that this line was worked by locomotive. It was laid with plates of a heavy design and only 2ft 6in long;[79] and traffic would have been heavy as the line worked both Pant y Rhiw and Daren (west) in the 1870s. Near where it joined Baileys' Llangattock Tramroad, double track at 8ft centres to accommodate waiting trams extended for 100m: trains of this length could only have been worked by locomotive. Excavation confirmed that sills 52in long and 5in wide were used as elsewhere; six fragments were excavated **(Fig. 69)**, all broken at the inner cheek by movement of blocks on the downhill side, which shows a design weakness. They carried heavy ribbed plates (1¼in thick) secured with iron male and female keys driven in at opposite ends **(Fig. 70)**. A combination of wear marks on blocks and the part sills gives a slightly modified gauge between flanges of 3ft 3in.

---

[79] Measurement over random group of 6 humps at 2120 1511. Two Outram-type stone blocks with plates secured directly have also been found (2058 1541), probably for a turnout

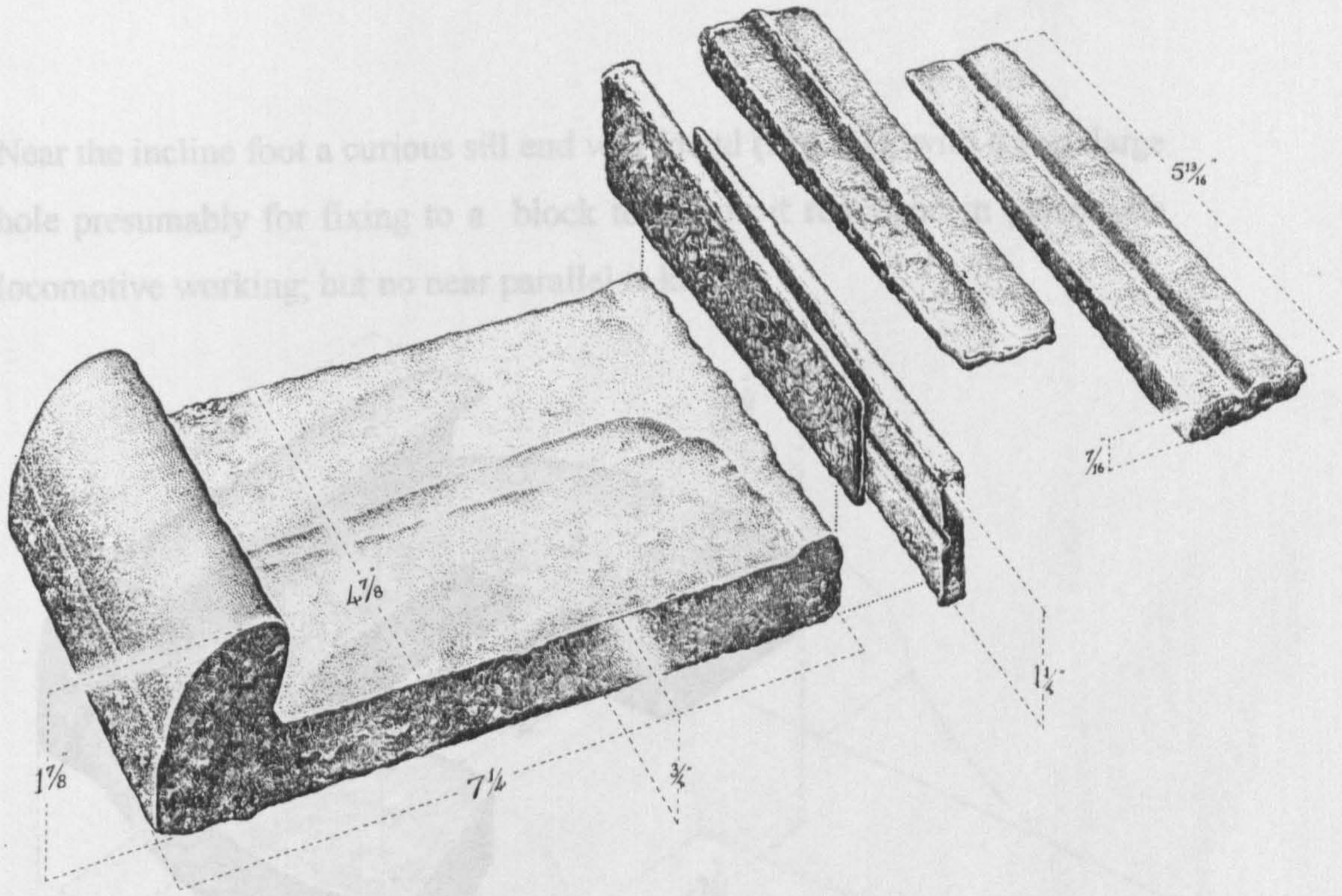


Fig. 69. Fragment of sill with keys from the Wern Watcyn incline (between 2131 1502 and 2111 1521)

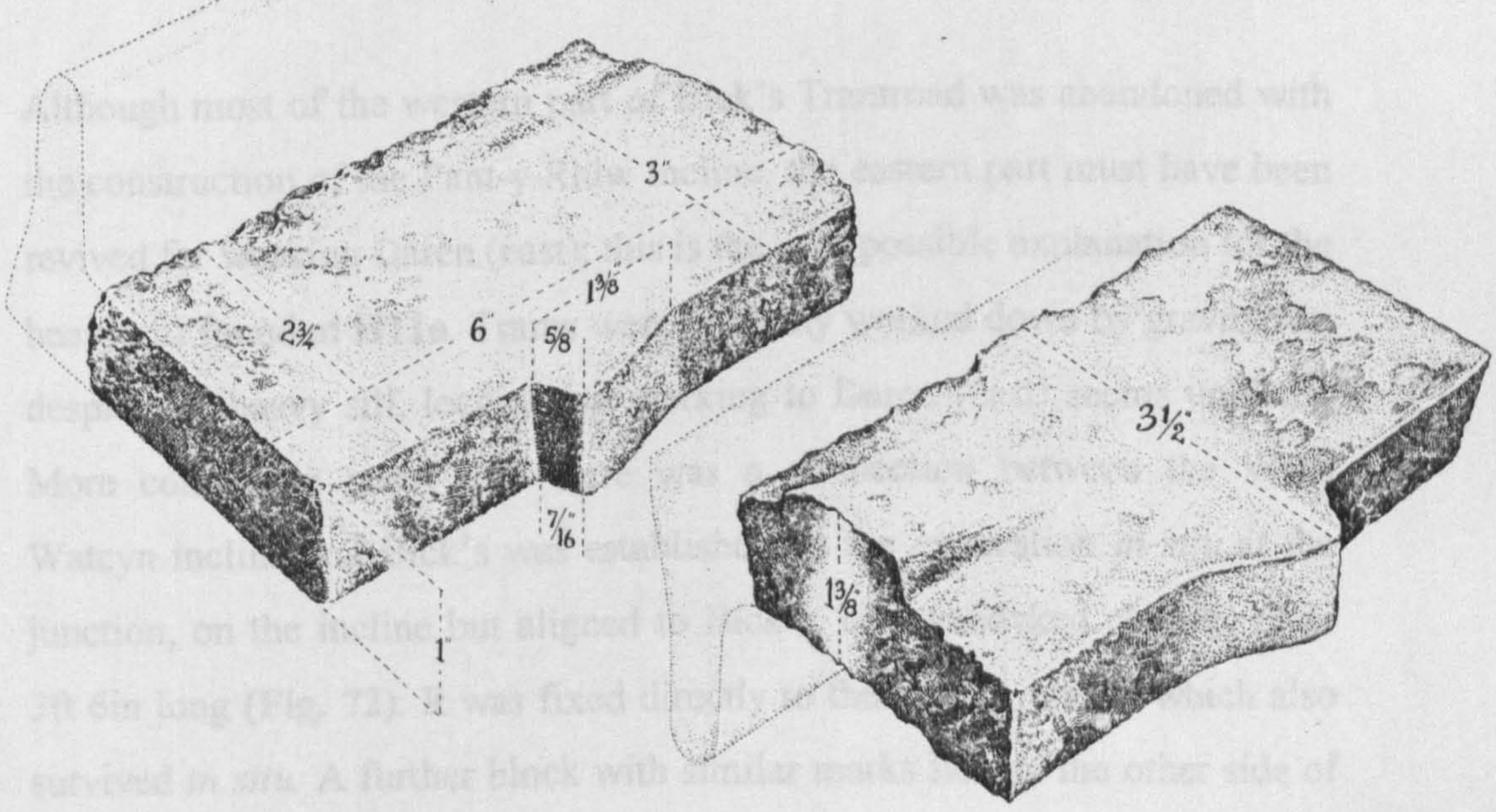


Fig. 70. Fragment of heavy plate from Wern Watcyn (212 151)

Near the incline foot a curious sill end was found **(Fig. 71)**, with a very large hole presumably for fixing to a block to ensure it remained in place with locomotive working; but no near parallel is known.

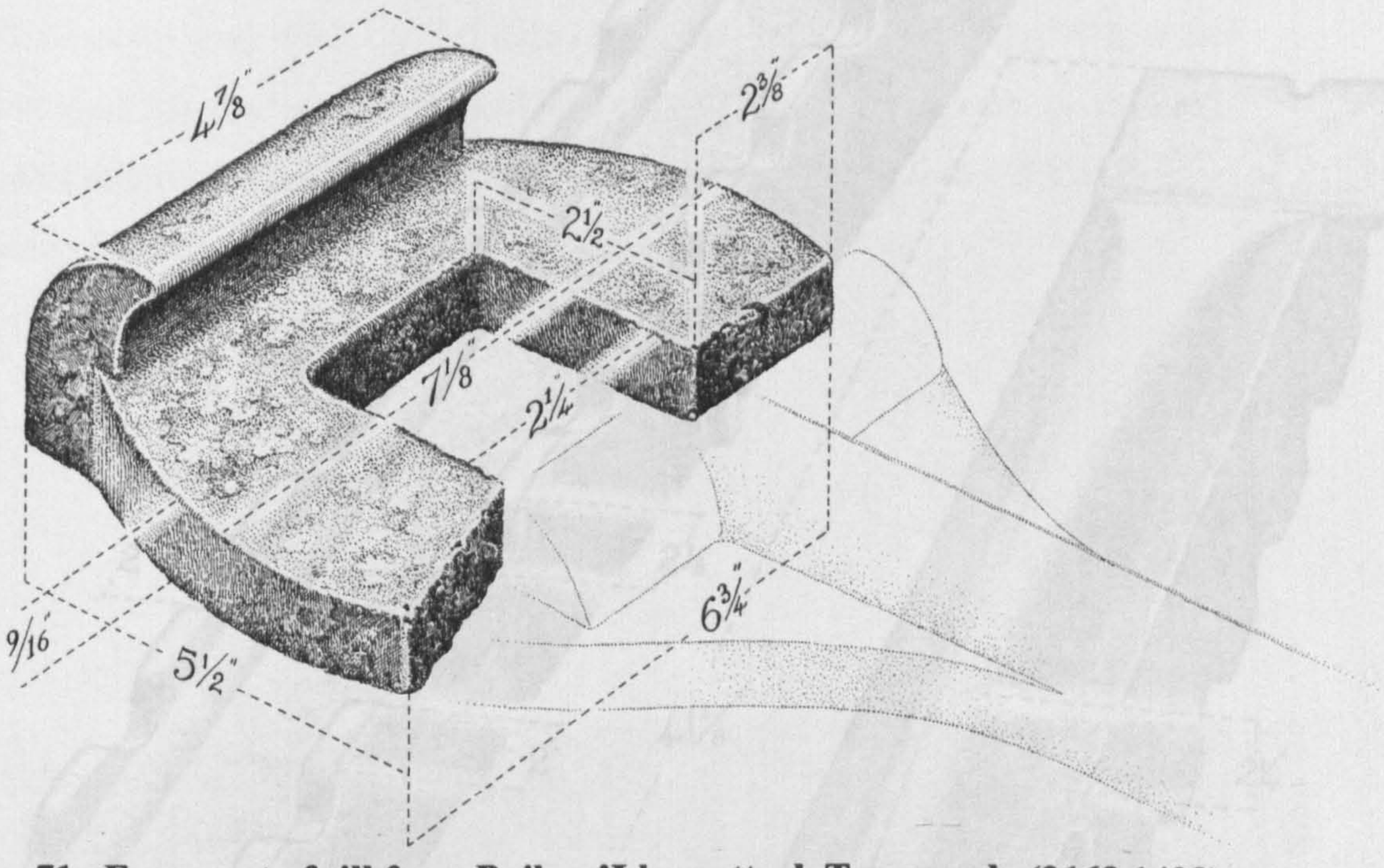


Fig. 71. Fragment of sill from Baileys'Llangattock Tramroad (2168 1488)

Although most of the western part of Bick's Tramroad was abandoned with the construction of the Pant-y-Rhiw incline, the eastern part must have been revived for working Daren (east); this is the only possible explanation for the heavy sill found at **H11e**. Trams were probably worked down by gravity for, despite the heavy sill, locomotive working to Daren (east) seems unlikely. More conclusive proof that there was a connection between the Wern Watcyn incline and Bick's was established by the excavation *in situ* at the junction, on the incline but aligned to Bick's, of a vandyked channel plate 3ft 6in long **(Fig. 72)**. It was fixed directly to the blocks, one of which also survived *in situ.* A further block with similar marks lies on the other side of the track.

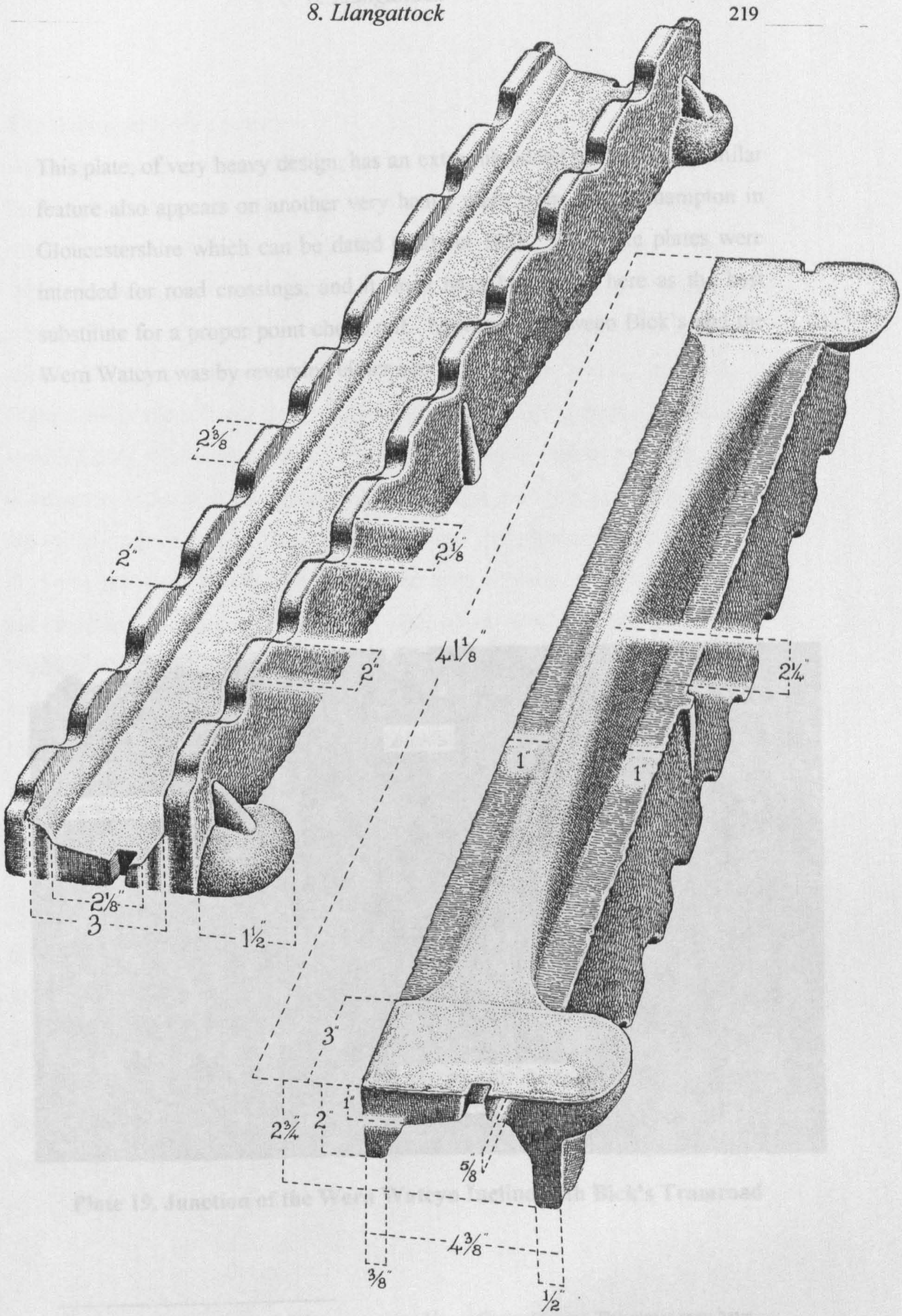


Fig. 72. Heavy ribbed and vandyked plate from Bick's Tramroad

(2068 1539)

This plate, of very heavy design, has an extra nib added to the lug; a similar feature also appears on another very heavy plate from Minchinhampton in Gloucestershire which can be dated to about 1825.[80] Vandyke plates were intended for road crossings, and it must have been used here as the best substitute for a proper point check rail. Movement between Bick's and the Wern Watcyn was by reversing either way.

Plate 19. Junction of the Wern Watcyn Incline with Bick's Tramroad

---

[80] Information from Arthur J. Price concerning Upper Green Quarry. The plates may have been intended for a tramroad planned from the Severn to Stroud in 1824 but rejected by Parliament (Household 1969, 131-2; Gloucester RO D1180 5/35)

The Baileys at Daren (west)

Because of faulting, the desirable rock at Daren (west) lies higher than at Daren (east). A combination of archaeological and cartographic evidence[81] make it clear how Daren (west) was worked and in what order. These quarries were only opened up after the arrival of the Wern Watcyn. Working started at the west end, but by the time the quarry closed there was a face around 500m long. A tramroad ran the length of the quarry, joining the Wern Watcyn near where it ran into Pant y Rhiw quarry, and reversing onto the incline **(H16)**. The oolite is thin here and the Llanelly Formation forms an overburden. Individual lines branched off through short gorges made in the unwanted rock to reach the oolite, making six separate quarry faces (between **H16a** and **H16f**). At the faces the lines turned parallel to them for easy loading. The final (eastern) quarry **(H16g)** was worked to the fault line where it met the Llanelly Formation head on and quarrying stopped at the spur. At some stage a search was made beyond by a pincer of two arms into the Llanelly Formation. In 1879 there was track as far as this, possibly to explore this area again but without success. By 1877[82] the track had been removed from the western four quarries **(H16a to d)**.

The majority of the spoil was taken across the lateral tramroad and tipped to the north-east by means of tracks with sills. When the quarry closed, 50m of spoil lay over Bick's Tramroad, showing that working of Daren (east) would have become impossible two-thirds of the way into the life of Daren (west). As quarrying progressed south-eastwards it was necessary for the principal line to cut through the abandoned tracks leading to the waste tips of the western quarries, which had been worked first.

---

[81] OS 25in 1877
[82] OS 25in 1877

Pant y Rhiw in its final stage

A line was continued for 550m from the Wern Watcyn incline outside the quarry to enter it at the western end **(H17)**. Measurement in three places shows that it was laid with sills at 2ft 6in intervals; it was therefore an integral part of the Wern Watcyn incline and likely to have been locomotive-worked. At some stage the loop **(H17a)** into the western end of Pant y Rhiw was extended 150m towards Daren Cilau **(H18)**. As this was in place in 1877,[83] and the loop abandoned by then, it may post-date the loop. Branches off the loop were laid sometimes with 3ft 6in plates and sometimes with 4ft, which suggests that they were horse-worked.

The main and final working at Pant y Rhiw was inside the quarry, south of the workings which had taken place from Pant y Rhiw incline **(H14)**. Before intensive working of the main quarry could begin, there was clearing of the top at the south-east corner **(H19a)**. The spoil was dumped at high level in three fingers by tramroad laid with 4ft plates on stone blocks with sills.

Once the top was cleared, a new branch was put in at the east end **(H19)**. Whilst the new quarry was being prepared, working continued from the 150m extension beyond the loop **(H18)**. Overburden from the new quarry was taken over the outer line **(H17)** to be dumped. Once prepared, the western end was possibly abandoned. Within the new quarry there was track for 200m. Some robbing was directed to the north side in the quarries which belonged to the era of the Pant y Rhiw incline, but the main working in the final days was from track with ten branches, seven of which slewed to the faces **(H19b to H19k)**, probably removing the rock in a series of benches. Where the quarry lines joined the Wern Watcyn there was a complicated system of sidings and crossings **(H20)**.

---

[83] OS 25in 1877

Beaufort ceased production in 1874 and Nantyglo the following year, and there was no further quarrying; but the track was left, maybe in anticipation of renewed activity. The Blaina and Coalbrook Vale Ironworks had amalgamated with Nantyglo and Beaufort in 1871, and Blaina continued in operation on its own until 1910. As there was no quarrying at Llangattock after 1875, it might be assumed that it obtained its limestone from elsewhere; however Percy[84] mentions that 'some years ago when the supply of limestone was suddenly cut off on account of a dispute with the owners of quarries from which it had always before been obtained' Blaina used blast-furnace slag as a substitute for limestone and it 'answered perfectly.' Perhaps it continued to do so.

Summary of phases at Llangattock Quarries 1815 to 1875

Phase 1. Daren Cilau opened in 1815 by BBCo. First Llangattock Tramroad. A short line in the quarry **(H1)** discharged onto the 'shoot' **(H2)** to the basin **(H3)**, tramroad **(H4)** from there to incline **(H5),** from incline foot tramroad to the kilns **(H5a)**.

Phase 2a. Working at Chwar Mawr from 1827 by BBCo **(H9)** with tramroad from top of future inclines **(H8)**.

Phase 2b. Second Llangattock Tramroad **(H6a)** with inclines **(H6, H7)** constructed by 1829.

Phase 2c. Baileys opened Daren (east) **(H11e-g),** served by Bick's Tramroad **(H11a, 11d)** from near head of incline **(H7)**. Some working at west end of Pant y Rhiw by short branches **(H11b-c)**.

Phase 3. Baileys' Llangattock Tramroad link to inclines opened 1830 **(H12).**

---

[84] Percy 1864, 520

Phase 4a. c.1836 Pant y Rhiw quarry (**H13** and **H13a**) opened out and linked to Baileys' Llangattock Tramroad via Pant y Rhiw incline (**H14**). Western part of Bick's Tramroad retracted with some working at western end possibly in conjunction with phase 4b **(H11h)**.

Phase 4b. Baileys take over western end of Chwar Mawr **(H10a-d)**.

Phase 5. Wern Watcyn incline opened **(H15)** as far as Bick's Tramroad **(H11d)**. Daren (east) re-worked by Baileys using track with heavy sills **(H11e)**.

Phase 6. Wern Watcyn incline reaches Pant y Rhiw quarry and Daren (west) **(H16a-g)**. Pant y Rhiw incline abandoned.

Phase 7. Concurrent working of Daren (west) **(H16a-g)** and Pant y Rhiw, at latter by tramroad **H17** and extension towards Daren Cilau **(H18)**.

Phase 8. Final working of Daren. Spoil covers Bick's Tramroad.

Phase 9. Pant y Rhiw worked from eastern end **(H19b-k)**. Working ceases 1875.

Phase 10. Top incline closed but bottom remains open.

Phase 11. Lower incline and tramroad closed 1911.

Miscellaneous quarries along Baileys' Llangattock Tramroad

A number of small limestone quarries beside the tramroad merit only summary treatment. None is visible on the OS first edition 1in map surveyed in 1829, but all appear on the first edition 25in surveyed in 1877.

In the main Llangattock complex, **H21** is orientated towards the incline **(H7)** and its waste is cut through by Baileys' Llangattock Tramroad, implying a date in the late 1820s. 'Old Quarry' in 1878-9.

H22 lies almost at the incline head, worked in 1877 from a branch off the southerly line there. The sleeper spacings are approximately 4ft.

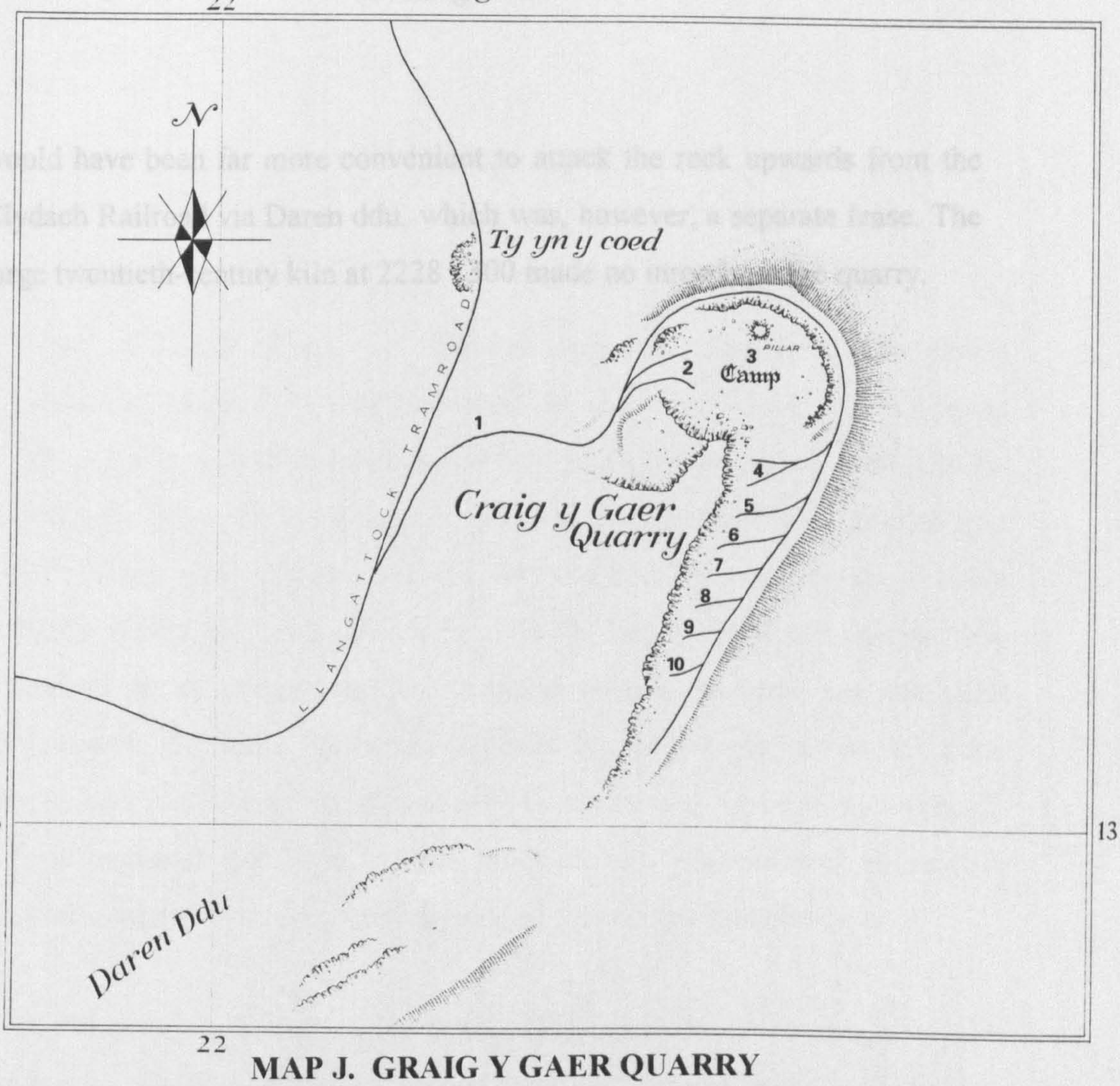
Two small quarries about 500m east of the Wern Watcyn incline, both 'Old Quarry' in 1877 though both still with tramroad branches. Their stone would be ideal for tramroad blocks.

Coed Pantydarren (2200 1369 to 2198 1397). The southerly quarry was worked for 75m by tramroad at two levels, into the overburden and into the massive, up to a change in rock type. Waste was dumped in terraces between the face and Baileys' Llangattock Tramroad. The northerly quarry begins where the massive resumes, with a 200m longwall. Abandoned by 1877.

Small quarry at 2212 1343. 'Old Quarry' in 1877.

Ty yn y coed, small quarry (2212 1331). 'Old Quarry' in 1877.

Pant Mawr Quarry (2193 1306 to 2206 1313). In 1877 apparently abandoned but still with a short tramroad spur.



MAP J. GRAIG Y GAER QUARRY

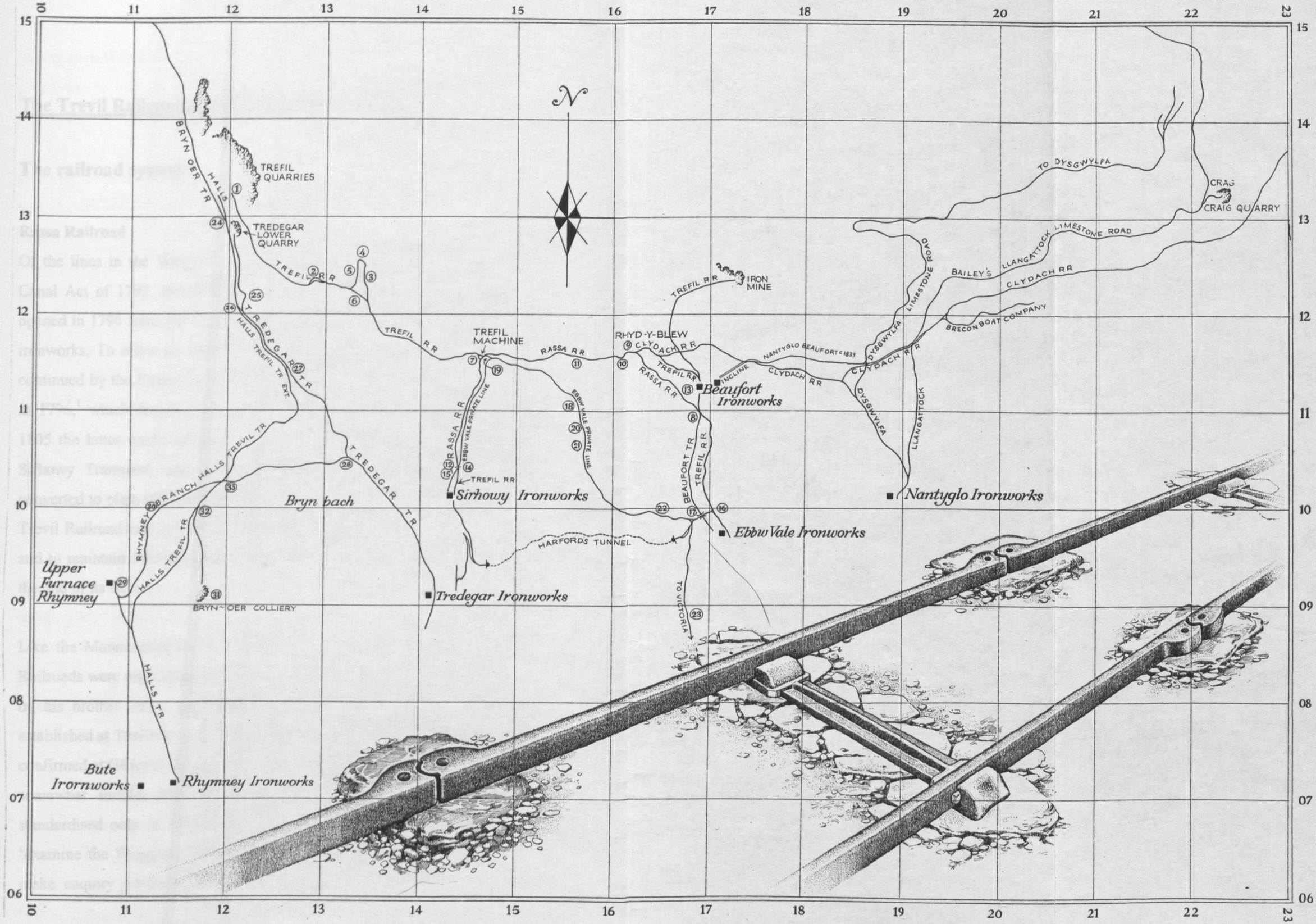
Graig y Gaer Quarry (2210 1311), much the largest of these outlying Bailey quarries, was served by a branch **(J1)** dropping steeply down from the main line. Being laid with sills and not re-laid with heavy chairs for locomotives, this either remained horse-worked or was abandoned before the 'Cymro' arrived. It was certainly out of use by 1877. Even the earliest exploratory workings at the top of the quarry were reached by tramroad. The workings on the north of the 225m outcrop are indicated by two spurs **(J2)** off the branch with a lime kiln nearby **(J3)**. The main quarry was reached by a circular tramroad which swept round on an incline of 1:15 towards Daren ddu. At around 20m intervals it threw off seven short branches **(J4-10)** working the face downwards by benches, not upwards as was usual. This was dictated by the quarry's location 60m below the main tramroad; it

would have been far more convenient to attack the rock upwards from the Clydach Railroad via Daren ddu, which was, however, a separate lease. The large twentieth-century kiln at 2228 1300 made no inroads on the quarry.

CHAPTER 9
TREVIL

North of Trevil village (120 126) a tongue of Dowlais Carboniferous Limestone, flanked to east and west by the Ebbw Fawr and Rhymney valleys, projects southwards towards the Sirhowy valley. It dips gently to the south. To the north, the limestone narrows to a point and is interrupted by a fault where quarrying stopped. On the west it is bounded by the Gilwern Oolite. At the south-west it is overlaid with drift material and was partially worked in an attempt to find suitable fluxing material and for sand (ganister). The most substantial deposits lay on the east where the main quarries stand at between 400m and 500m OD and cover an area roughly 2km long and ½km wide. Starting from the south-eastern end, where they became worked out, they were developed progressively northwards.

The limestone at Trevil, on the Duke of Beaufort's land, lay closer than any other to the five ironworks which grew up near the heads of the three valleys. Most of the workings are solely the result of quarrying for fluxing stone. The history and interactions of the railroads and tramroads which linked the quarries with the ironworks are complex. The Trevil Railroad served **Beaufort, Sirhowy** and **Ebbw Vale** with **Victoria.** It ran east of Nant Trefil, approximately 30m above the level of the Tredegar Tramroad which served **Tredegar** and Hall's Trevil Tramroad which served **Rhymney**. Towards the quarries these two last broadly follow the course of the modern road. Hall's Trevil Tramroad sent off an 8-mile extension, the Brinore Tramroad, to the Brecknock & Abergavenny Canal at Talybont-on-Usk. The routes of these lines can mostly be traced, although recent opencasting has caused some destruction.



MAP K. COMMUNICATIONS TO TREVIL QUARRIES

The Trevil Railroad and the quarries worked from it

The railroad system

Rassa Railroad

Of the lines in the Western Valleys authorised under the Monmouthshire Canal Act of 1792, the first to be completed was the Beaufort Railroad, opened in 1796 from the canal head at Crumlin to Beaufort and Ebbw Vale ironworks. To allow an outlet for the produce of Sirhowy furnaces it was continued by the Rassa Railroad, also authorised by the Act and completed in 1796,[1] which described a semicircle from Beaufort to Sirhowy. About 1805 the latter works achieved a direct link to Newport by means of the Sirhowy Tramroad, and at the same time the Beaufort Railroad was converted to plate rail. But by this time the Rassa had been connected to the Trevil Railroad and its three branches and to the B&A's Clydach Railroad, and to maintain through running with them it remained an edge railway to the end of its days.

Like the Monmouthshire Canal, the Beaufort, Rassa and probably Trevil Railroads were engineered by Thomas Dadford junior, the Clydach Railroad by his brother John. The track gauge common to all four railroads is established at Trevil by a sill and rail, shortly to be discussed, as 3ft 8in, and confirmed at Gilwern, as noted in Chapter 3, by the wheel gauge (necessarily somewhat smaller than the track gauge) of 3ft 7½in. But this was standardised only in 1797 when Thomas Dadford's assistant was told to 'examine the Waggons belonging to Sirhowy, Beaufort & Ebbw Vale and make enquiry which of these Waggons travell best upon the Road, and

---

[1] It became part of the Monmouthshire Railways & Canal Co and was ultimately (in 1880) inherited by the GWR

having ascertained the best Gage for the Wheels' to instruct the respective proprietors to 'use the same Gage and Flaunches.'[2] Presumably the users of the Clydach followed suit.

From the Beaufort Railroad the Rassa runs north-west as a footpath **(K8)**, turning west at Rhyd y Blew **(K9)**. A small bridge, rebuilt in 1806,[3] takes the line across a stream **(K10)**. In 1973 blocks were observed close by which confirmed that the Rassa was laid with 4ft bar rails. From here the line **(K11)** passes under the Heads of the Valleys Road to reach Trevil Machine **(K7)**. The route south from here to Penmarc **(K12)** is now lost.

Trevil Rail Road[4]

The Monmouthshire Canal Act, while providing for railroad outlets for the ironworks, made no mention of railroads to bring limestone to them. When the MCC refused to build any 'extension of Rail Roads' under the eight-mile clause until all those authorised under the Act were completed, the interested ironmasters took matters into their own hands in 1793 by forming the Trevil Rail Road Company. By March 1794 there had been three calls on shares, showing that construction of the line was well under way. By April Hill, Harford & Co of Ebbw Vale had made 3349 rails weighing 79lb each **(App. 3.2.E)** at a cost of £7 a ton (6s each) and delivered 3225 at a cost of 3s a ton. Opened in 1796, the line was laid on land leased for 2000 years from the Duke of Beaufort by Thomas Dadford junior. By the Deed of Settlement the three ironmasters agreed to pay 5d per ton/mile for fluxing stone, the maximum allowed under the MCC Act. Although this gave high returns to the railroad company, it was a stranglehold on the ironmasters, who held only £1600 of the total £5500 shares. As a result Beaufort, after being taken

---

[2] MCC Committee Minutes 17.10.1797.
[3] Hughes 1990, 312
[4] For its history see Hadfield 1967, 159; Rattenbury 1989, 454-469

over by the Baileys of Nantyglo in 1833, moved to Llangattock quarries instead. Likewise in 1851 Ebbw Vale[5] tried to free itself of the restraints of Trevil limestone and the railroad by acquiring its own quarries and its own outlet to the B&A; but its application for two tramroads or railways, from near Sirhowy to Llangynidr and from Trevil Machine to the limestone rocks at Cwm Crawnon, came to nothing.

Plate 20. Trevil Railroad. Wear marks on blocks at 1346 1213

From Trevil Machine the Rassa formed an intermediate link to the three ironworks, each of which had its own Trevil Railroad branch from the Rassa. These were maintained by the respective ironworks, an allowance being made for this by the Railroad Company. The total length of the TRR, including all these branches as well as one from Beaufort to its iron mines, was just over 6¼ miles. Wear marks on stone blocks[6] and a matching fragment dredged from Gilwern basin (**Fig. 73**: compare with **Fig. 47**) show that the bar rail used, 4ft long and weighing 79lb, was very similar to that on

---

[5] B&A Committee Minutes 26.4.1852 and General Assembly 25.4.1853
[6] At 1346 1213 and near Trevil Machine, which also confirm 4ft rail lengths

the Clydach Railroad but with raised ends.[7] The blocks were around a third heavier than those used on tramroads.

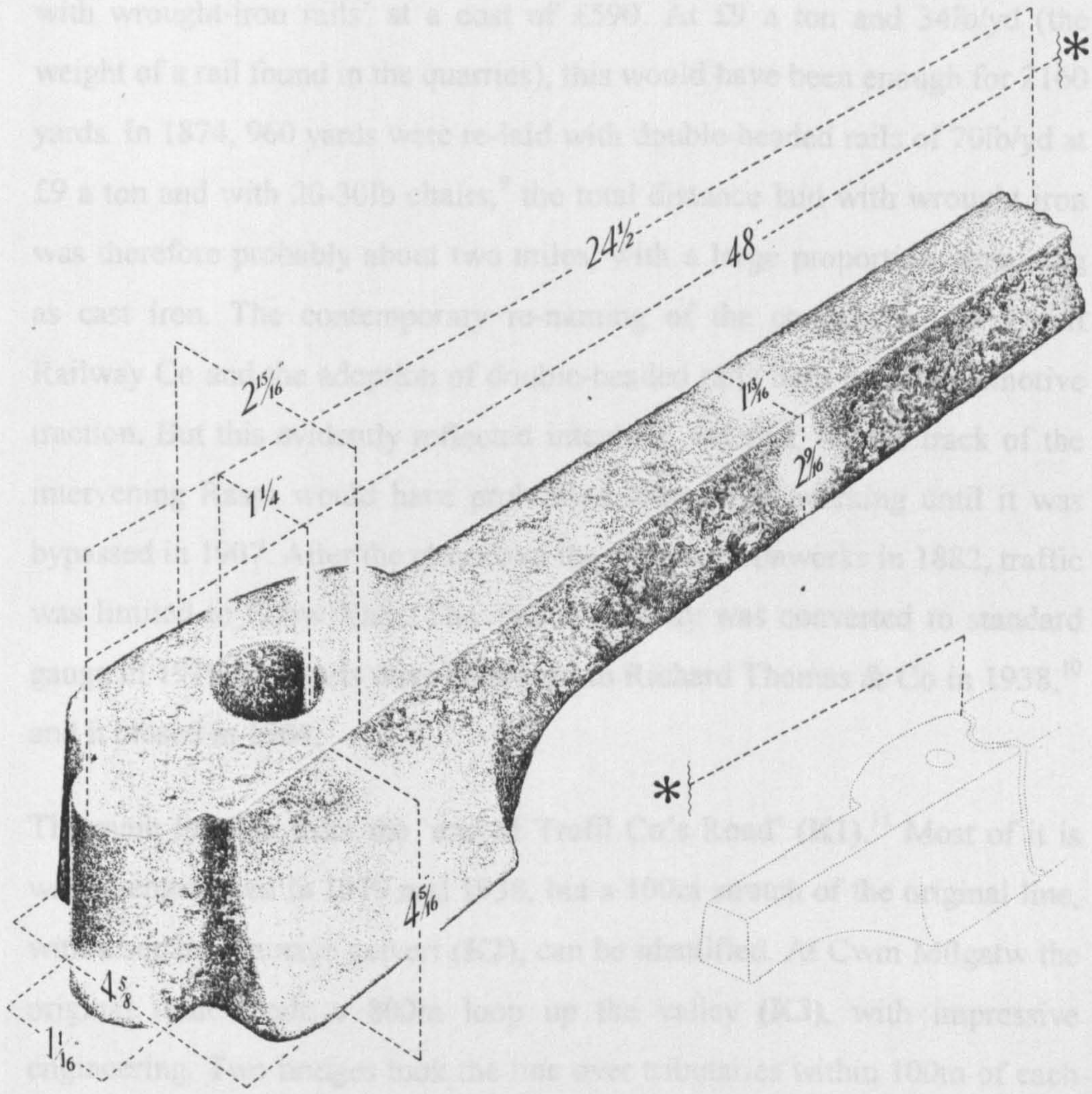


Fig. 73. Bar rail from the Trevil Railroad, found in Gilwern canal basin

Bar rails were still the norm in 1859 when 452 pairs (602 yards) and the equivalent number of blocks were supplied. In 1840 another 129 pairs (172 yards) were supplied and not more than half a mile was ordered to be laid with wrought-iron rails in chairs. By 1841, 534 yards of this distance had

---

[7] An almost identical type was used on a feeder line to the Somerset Coal Canal at Paulton (Gerald Quartley, pers. comm. to M. J. T. Lewis 28.2.67); tenders for these rails were invited in *Felix Farley's Journal* (Bath) 3 June 1795

been laid with wrought iron but, the TRR not yet being fully committed to change, another 300 yards with cast iron.[8] In 1847 there was 'new laying with wrought-iron rails' at a cost of £590. At £9 a ton and 34lb/yd (the weight of a rail found in the quarries), this would have been enough for 2160 yards. In 1874, 960 yards were re-laid with double-headed rails of 70lb/yd at £9 a ton and with 20-30lb chairs;[9] the total distance laid with wrought iron was therefore probably about two miles, with a large proportion remaining as cast iron. The contemporary re-naming of the concern as the Trevil Railway Co and the adoption of double-headed rails both imply locomotive traction. But this evidently reflected intention, not fact, for the track of the intervening Rassa would have prohibited locomotive working until it was bypassed in 1907. After the closure of the Sirhowy ironworks in 1882, traffic was limited to Ebbw Vale. The Trevil Railway was converted to standard gauge in 1919, its assets were conveyed to Richard Thomas & Co in 1938,[10] and it closed in 1964.

The main line ran from the 'end of Trefil Co's Road' **(K1)**.[11] Most of it is was re-engineered in 1919 and 1938, but a 100m stretch of the original line, with a square drainage culvert **(K2)**, can be identified. At Cwm Milgatw the original route made a 800m loop up the valley **(K3)**, with impressive engineering. Two bridges took the line over tributaries within 100m of each other **(K4)**, and 200m are substantially revetted **(K5)**. Despite very tight bends at the bridges, wooden sleeper indentations suggest the line was subsequently steam worked, although over much of this stretch the steam railway follows an independent course close to the original railroad. A post-1919 embankment was built as a cut-off **(K6)**. The main line continues to Trevil Machine **(K7)**.

---

[8] Rattenbury 1989, 463
[9] Rattenbury 1989, 466. A 50lb chair of crude design with heavy base plate was found on the Trevil Railway
[10] *Railway Magazine* 1941, 255
[11] NLW Badminton II 3859

Plate 21. Simple lintel bridge on the Trevil Railroad

Plate 22. New trackbed of Trevil Railway on left; the figure stands on the original line

A toll house here was ordered on 5 December 1795[12] and completed by 30 September 1796 at a cost of £35 8s 9d.[13] In 1797 weighing was still done 'at the scales on the yard at Ebbw Vale,' but by 1800 the tollhouse had its 'Machine,'[14] the weigh ticket serving as a means of compounding tolls and as a check for the quarrymen. The junction with the Rassa comprised two curves which allowed direct working either westwards to Sirhowy or eastwards to Ebbw Vale and Beaufort, the Machine lying on the Rassa to weigh traffic in either direction (see **Fig. 73a**). For the later history of the junction, see below.

Trevil Rail Road branches off the Rassa

The Beaufort branch was 7 furlongs 1 chain long[15] from the junction with the Rassa at Rhyd y Blew **(K9)** to the ironworks **(K13)** and, although it was abandoned when Beaufort switched to Llangattock, compensation was sought for the encroachment of the LNWR in 1866. From the eastern end of the Rassa **(K8)** through running was possible onto the Beaufort Railroad until around 1805 when the latter was changed to plateway.

The Sirhowy branch **(K14)** ran only 1 furlong 3 chains[16] to the works from its junction with the Rassa at Penmarc **(K12)**. It was re-laid in 1872 by the Ebbw Vale Company with new sleepers charged to the Railroad Company. (possibly at **K15**). Sirhowy closed in 1882.

---

[12] Rattenbury 1989, 455
[13] GRO D. 2472.3. The cost was divided between Ebbw Vale, Sirhowy and Beaufort
[14] Rattenbury 1989, 457
[15] This and subsequent lengths of branches are from Private collection, 1837
[16] Rattenbury 1989, 468 wrongly gives 6 furlongs 8 chains, confusing it with the Ebbw Vale branch

Ebbw Vale had a branch **(K16)** 6 furlongs 8 chains long, re-laid in 1870, running south from the end of the Rassa **(K8)** to the furnace tops. The parallel Beaufort Railroad served only the bottom of the furnaces.

Private railroads

In 1800 Ebbw Vale took an 18-year lease of Sirhowy[17] and the two works were linked by a private line[18] which, though begun or at least proposed in 1800,[19] was probably completed in 1813 when the dated viaduct was built **(K17)** over the MCC's Beaufort Tramroad. From near Trevil Machine **(K7)** (but not connected to it) it ran parallel to the Rassa southwards to Sirhowy and, more directly than the Rassa, south-eastwards to Ebbw Vale. Understandably, the MCC objected to the private line as it stood to lose potential traffic between the two works, and even more so from 1818 when Ebbw Vale bought out Sirhowy. From 1832[20] a 2km tunnel offered a shorter and better-graded route through the mountain between the Ebbw Fawr and Sirhowy valleys, and by 1857 the private line was truncated to run from Ebbw Vale only to Balance Pit No 1 by Gwaun y Pound **(K18)**.

From 1859 the new Victoria Ironworks, 2km south of Ebbw Vale, received Trevil limestone,[21] presumably brought as far as Newtown **(K16)** since Victoria was not connected to the Trevil system until after 1843.[22] A later link from the Ebbw Vale branch crossed the 1813 viaduct **(K17)** which gave access to Harford's tunnel to Sirhowy, and turned south down the west side of the Ebbw Fawr to Victoria. For this purpose the viaduct was heightened to the level of the Ebbw Vale branch. The combination of earth and relieving

---

[17] Lloyd 1906, 148-9
[18] Rattenbury 1989, 457
[19] Rattenbury 1989, 462
[20] The date on the portal (Jones 1975, 56). Portals at 1607 1018 and 1472 0980 (OS 6in 1872-85), confirmed by Morris 1859 and Prujean 1843
[21] Rattenbury 1989, 462-63
[22] Prujean 1843

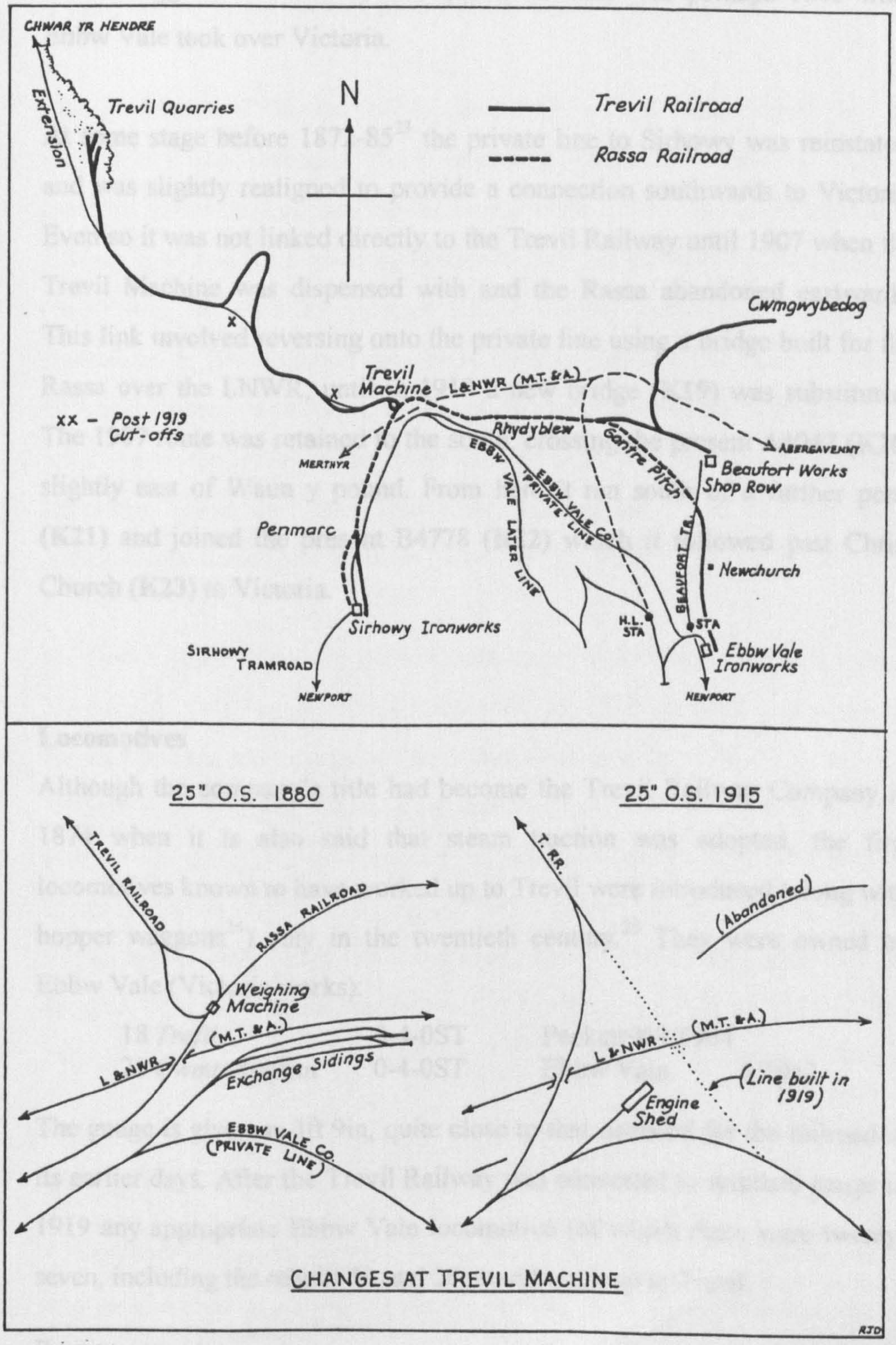


Fig. 73a. Changes at Trevil Machine (source: Rattenbury 1989, 456)

arches suggests mid-century work, and the date was perhaps 1848 when Ebbw Vale took over Victoria.

At some stage before 1872-85[23] the private line to Sirhowy was reinstated, and was slightly realigned to provide a connection southwards to Victoria. Even so it was not linked directly to the Trevil Railway until 1907 when the Trevil Machine was dispensed with and the Rassa abandoned eastwards. This link involved reversing onto the private line using a bridge built for the Rassa over the LNWR, until in 1919 a new bridge **(K19)** was substituted. The 1907 route was retained to the south, crossing the present A4047 **(K20)** slightly east of Waun y pound. From here it ran south of a further pond **(K21)** and joined the present B4778 **(K22)** which it followed past Christ Church **(K23)** to Victoria.

Locomotives

Although the company's title had become the Trevil Railway Company in 1874 when it is also said that steam traction was adopted, the first locomotives known to have worked up to Trevil were introduced (along with hopper waggons[24]) only in the twentieth century.[25] They were owned by Ebbw Vale (Victoria works):

18 *Trefil*	0-4-0ST	Peckett969/1904	
26 *Cwmtaffechan*	0-4-0ST	Ebbw Vale	6/1912

The gauge is given as 3ft 9in, quite close to that deduced for the railroad in its earlier days. After the Trevil Railway was converted to standard gauge in 1919 any appropriate Ebbw Vale locomotive (of which there were twenty-seven, including the rebuilt 18 and 26) could work up to Trevil.

---

[23] OS 6in 1872-85

[24] Rattenbury 1989, 467. Hill & Green 1999, 93 insist that locomotives were introduced in 1874

[25] Williams 1993, no pagination

The Sirhowy, Beaufort and Ebbw Vale Quarries

On 23 March 1793 the MCC, evidently having been asked by the ironmasters for railroads from limestone quarries, instructed Thomas Dadford junior to make an 'ocular survey from Ebbw Vale and Beaufort to Blaenonney' and from Sirhowy to Trevil. One can surmise that two separate lines were in mind to quarries which already supplied the respective ironworks. At Blaen Onneu there were kilns and at least five quarries around 157 167, some 7½km north of Beaufort and conveniently linked to it by what is now the B4560. Ebbw Vale records imply that this was the source of limestone before the Trevil Rail Road was opened,[26] and certainly Ebbw Vale retained an interest at Blaen Onneu until 1856.[27]

Dadford's ocular survey to Blaen Onneu came to nothing,[28] and in the event Trevil was to serve all three ironworks. In 1794 Edward and Jonathan Kendall of Beaufort opened a 'Limestone Quarry, at the Trevill' for £10 10s on behalf of Sirhowy, Ebbw Vale and themselves, each contributing one third of the cost.[29] On 16 August 1795 Beaufort undertook to obtain all its limestone from Trevil.[30] In June 1796[31] Lewis George agreed to haul limestones to Ebbw Vale from 'the place where David Davis gets them for his kiln' at Trevil 'when the railroad is ready to the furnace.' Ebbw Vale began working Trevil on 25 March 1797,[32] by which time the railroad must

---

[26] GRO D.2472.3
[27] NLW Maybery I 253
[28] It is nevertheless conceivable that a 500m track from the quarry at 159 162 to the summit of the road at 162 159 was a railroad. It has a rudimentary causeway and indentations that might be interpreted as sleeper marks; but its gentle undulations are not railroad-like, and it was more probably a stone road
[29] GRO D.2472.3
[30] Rattenbury 1989, 454-5
[31] GRO D.2472.3
[32] GRO D.2472.1

have been completed since Beaufort and Sirhowy were already paying tonnage.

By the OS draft of 1813 there were four distinct quarries working from four branches of the railroad. Unfortunately this source is not entirely accurate but, with additional information from the 1in survey of 1829, it is possible to trace where they might have been in 1813, and their limited growth in the intervening years.

The southern quarries

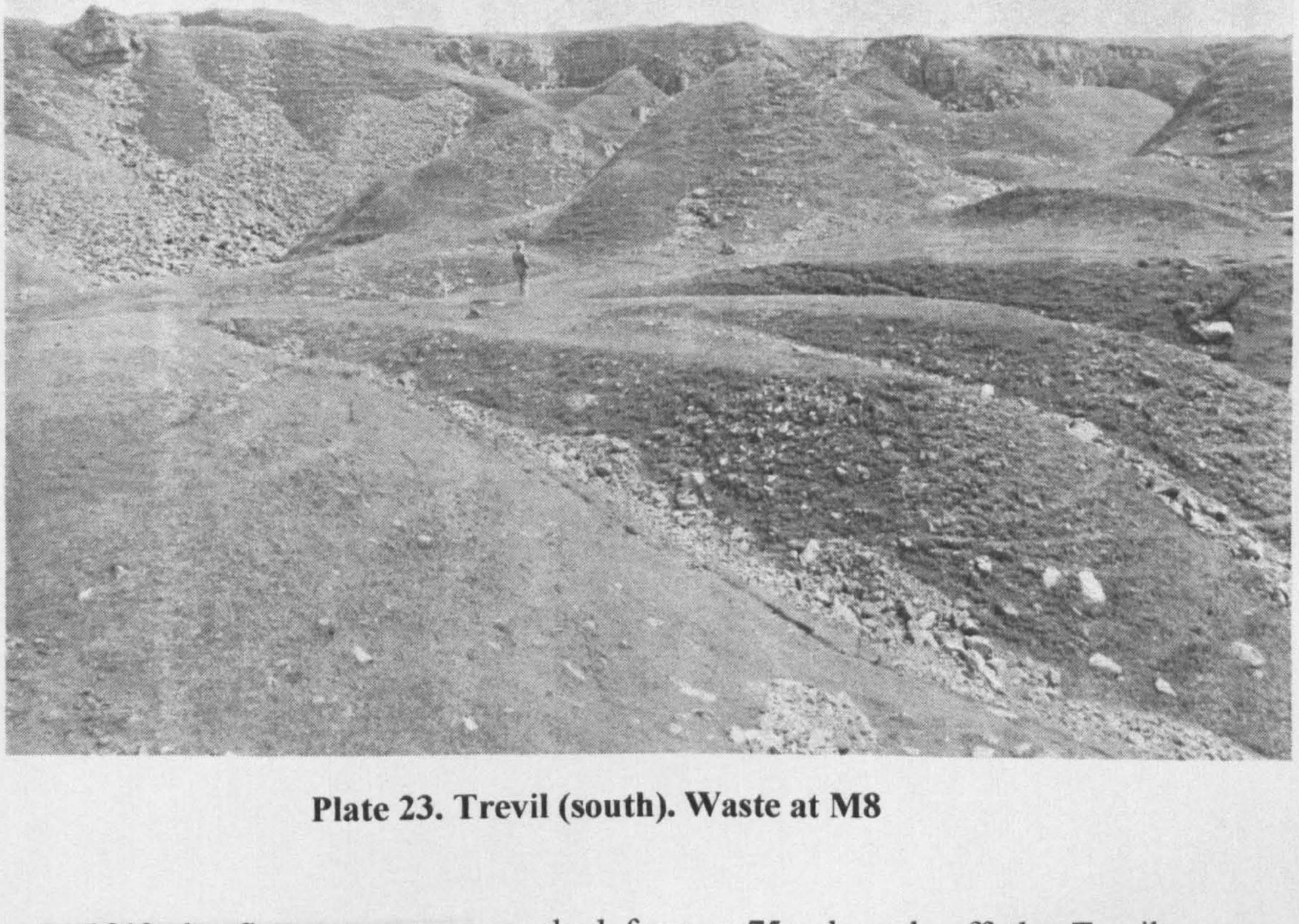


Plate 23. Trevil (south). Waste at M8

In 1813 the first quarry was worked from a 75m branch off the Trevil Railroad (**L1**). The site, now obscured by spoil, lay near the narrow cutting

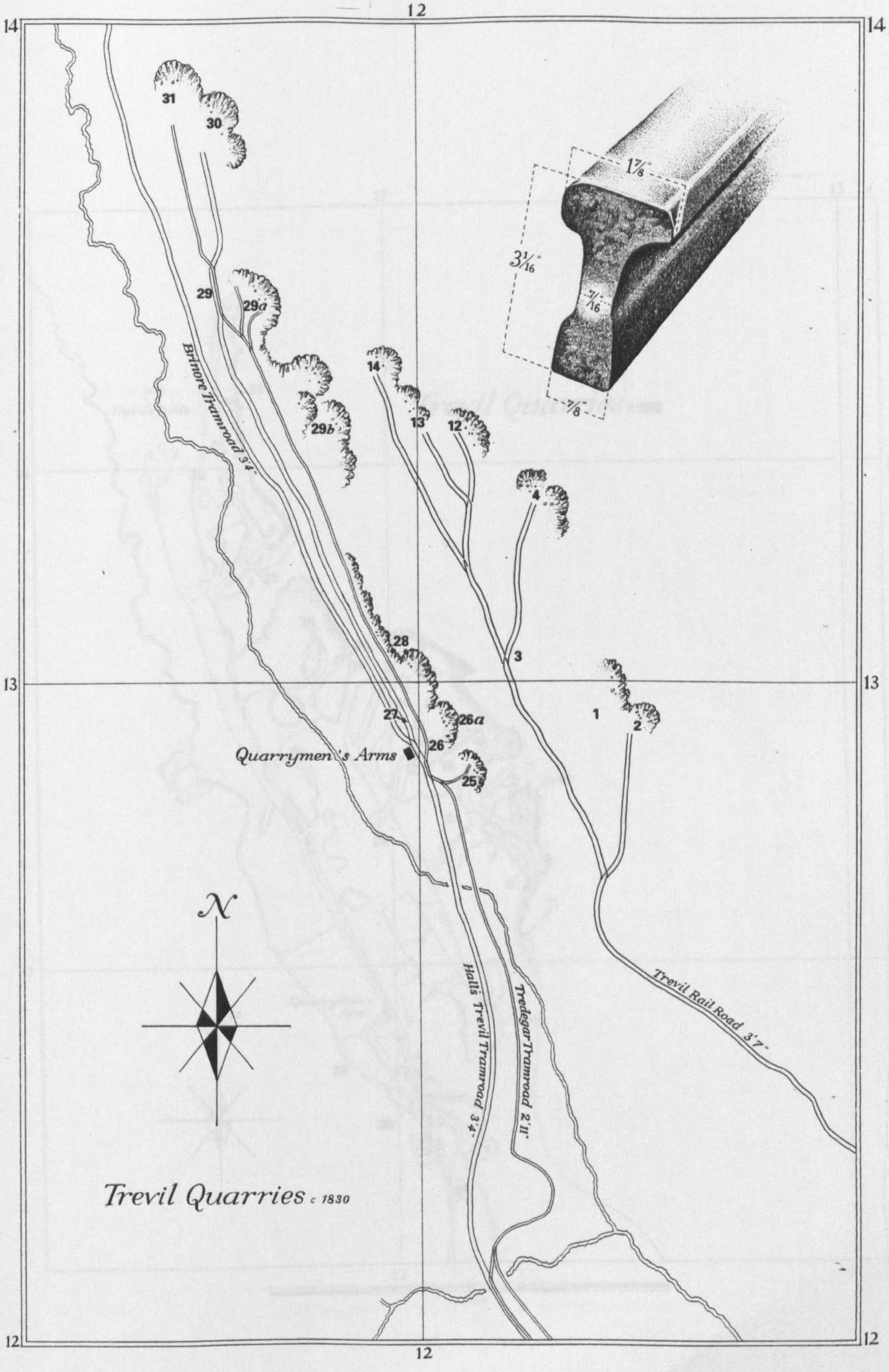
which leads into this group. By 1829 the branch started some 150m south, giving a better graded approach, and the quarry had advanced a little further **(L2)**. The second quarry in 1813 was about 275m beyond, its site possibly marked nowadays by a small knoll **(L3)**. The gradient here is steep and the area was abandoned by 1829 for a new quarry **(L4)**, with better graded access, which survives beyond a later deposit of spoil **(M8)**.[33]

After 1829 the principal working was a development beyond **L2** using a single railroad **(M5)**. Between 1829 and 1872-85[34] a gorge **(M6)** was developed by cutting suitable stone, with intermittent robbing at waggon height along the sides, and was replaced by a parallel gorge 10m north-east **(M7)**. Access to the old quarry at **(L4)** was blocked by an embankment of waste **(M8)** leading to a further cutting and quarry **(M9)** beyond. After 1872-1885 a face was developing at **M10** which by 1890[35] had been pushed northwards through the remaining deposits **(N11)**.

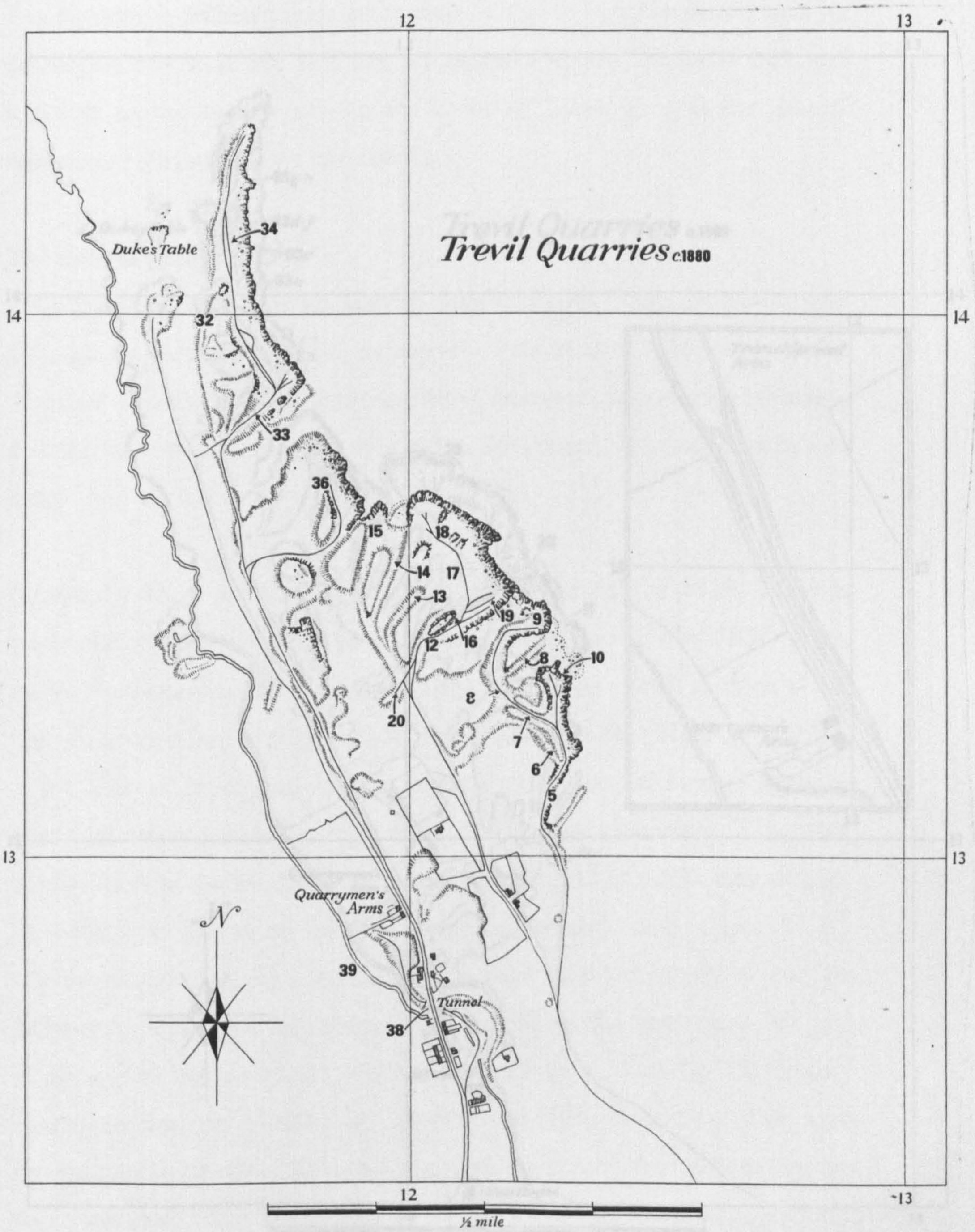
In 1912 the area was part of a lease to the Ebbw Vale Company[36] but the accompanying plan shows that by January 1890, except for a little working from the central quarries to the north, the quarry was not worked again. It is not certain which ironworks used these southern quarries, but it was probably Sirhowy, which closed in 1882. Furthermore, because (as we will see) Sirhowy started working Trevil before Ebbw Vale, they would be likely to take the first limestone available.

---

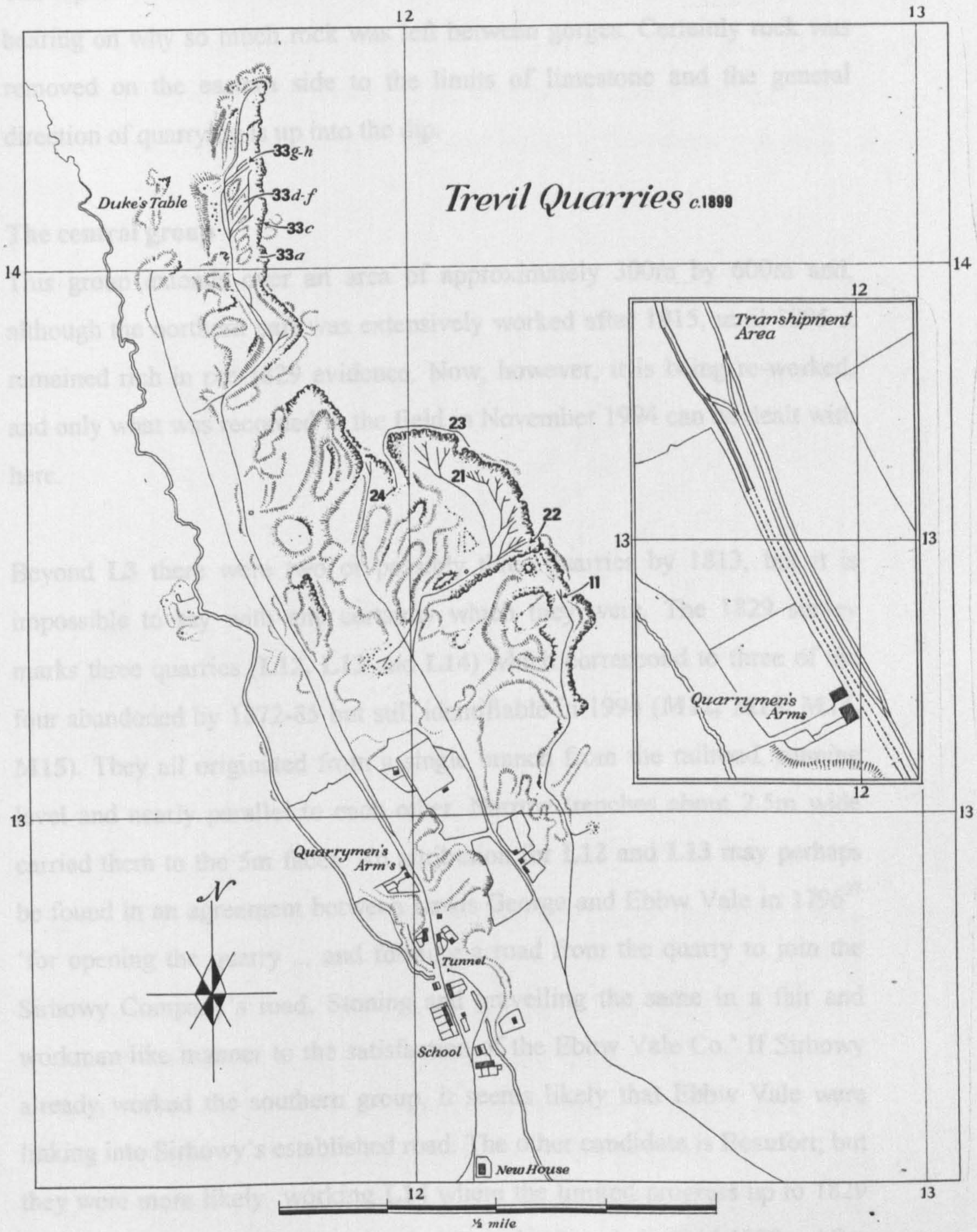
[33] The same numbering series applies to Maps L, M and N
[34] OS 6in 1872-85
[35] NLW Badminton II 3841
[36] NLW Badminton II 3841



MAP L. TREVIL QUARRIES UP TO 1850



MAP M. TREVIL QUARRIES c.1880



MAP N. TREVIL QUARRIES c.1899

The working methods of this quarry are unusual. The gorges wander about as if searching for suitable rock, possibly because of dolomite intrusions. The dip here is different from other parts of Trevil, but this should have no bearing on why so much rock was left between gorges. Certainly rock was removed on the eastern side to the limits of limestone and the general direction of quarrying is up into the dip.

The central group

This group extends over an area of approximately 300m by 600m and, although the northern part was extensively worked after 1915, until 1995 it remained rich in pre-1829 evidence. Now, however, it is being re-worked, and only what was recorded in the field in November 1994 can be dealt with here.

Beyond **L3** there were two or possibly three quarries by 1813, but it is impossible to say with any certainty which they were. The 1829 survey marks three quarries (**L12, L13** and **L14**) which correspond to three of the four abandoned by 1872-85 but still identifiable in 1994 (**M12, M13, M14, M15**). They all originated from a single branch from the railroad, running level and nearly parallel to each other. Narrow trenches about 2.5m wide carried them to the 5m faces. An attribution for **L12** and **L13** may perhaps be found in an agreement between Lewis George and Ebbw Vale in 1796[37] 'for opening the quarry ... and forming a road from the quarry to join the Sirhowy Company's road. Stoning and gravelling the same in a fair and workman like manner to the satisfaction of the Ebbw Vale Co.' If Sirhowy already worked the southern group, it seems likely that Ebbw Vale were linking into Sirhowy's established road. The other candidate is Beaufort; but they were more likely working **L14** where the limited progress up to 1829 accords with their limited output between 1813 and the mid-1830s. After

---

[37] GRO D.2472.1

then they moved to Llangattock. Possibly Ebbw Vale then took over **L14** and began developing **M15**. This would agree with a two-holed stone block found by the line to **L14**, which very likely carried a chair cognate to a sill recently discovered nearby for wrought-iron T-rail weighing 34 lb/yd **(Fig 74)**. The gauge is 3ft 8in, which fits the evidence discussed above for other railroads, and it probably dates to the 'new laying with wrought-iron rails' in 1847.

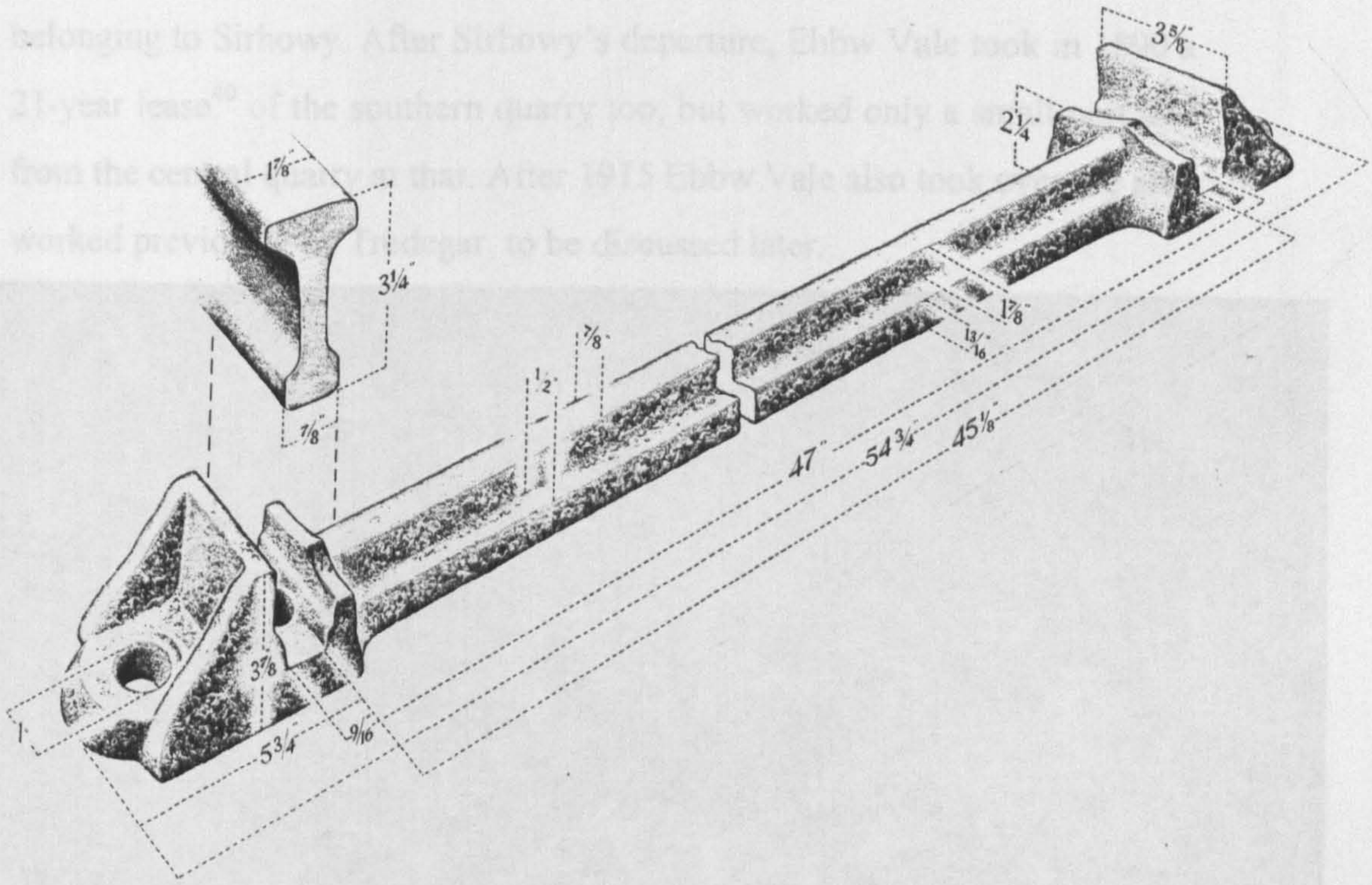


Fig. 74. Wrought-iron T-rail and sill from Trevil quarries (1219 1357)

Following a lease of 1870[38] to Ebbw Vale, the quarry was completely re-organised. Instead of working northwards into the outcrop, a line was run north-east beside **M12** to a new area **(M16)** where it turned north-west **(M18)**. This was the line in place by 1872-85, but an earlier parallel line **(M17)** to the west shows that the face was progressively pushed eastwards. **M17** and **M18** run at a gradient of 1:32, the same as the dip.[39] These lines

[38] NLW Badminton II 3857
[39] Pinpoint Land Survey, Drawing PP9141/3, June 1992, 1:1000, contour interval 2m

were bridged by planks supported on outcrops left on either side (and at one point **M17** was spanned by an embankment) which carried barrow-runs bringing waste from the face to tips in the abandoned **M13**. When this was full, the spoil was dumped the other side of the entrance **(M20)**. In 1872-85 the southern part of the quarry **(M19)** was worked by three parallel lines, were possibly stepped in benches of waggon height, along the line of strike. By this stage the quarry had reached the limits of the lease, the area south belonging to Sirhowy. After Sirhowy's departure, Ebbw Vale took in 1890 a 21-year lease[40] of the southern quarry too, but worked only a small part and from the central quarry at that. After 1915 Ebbw Vale also took over the area worked previously by Tredegar, to be discussed later.

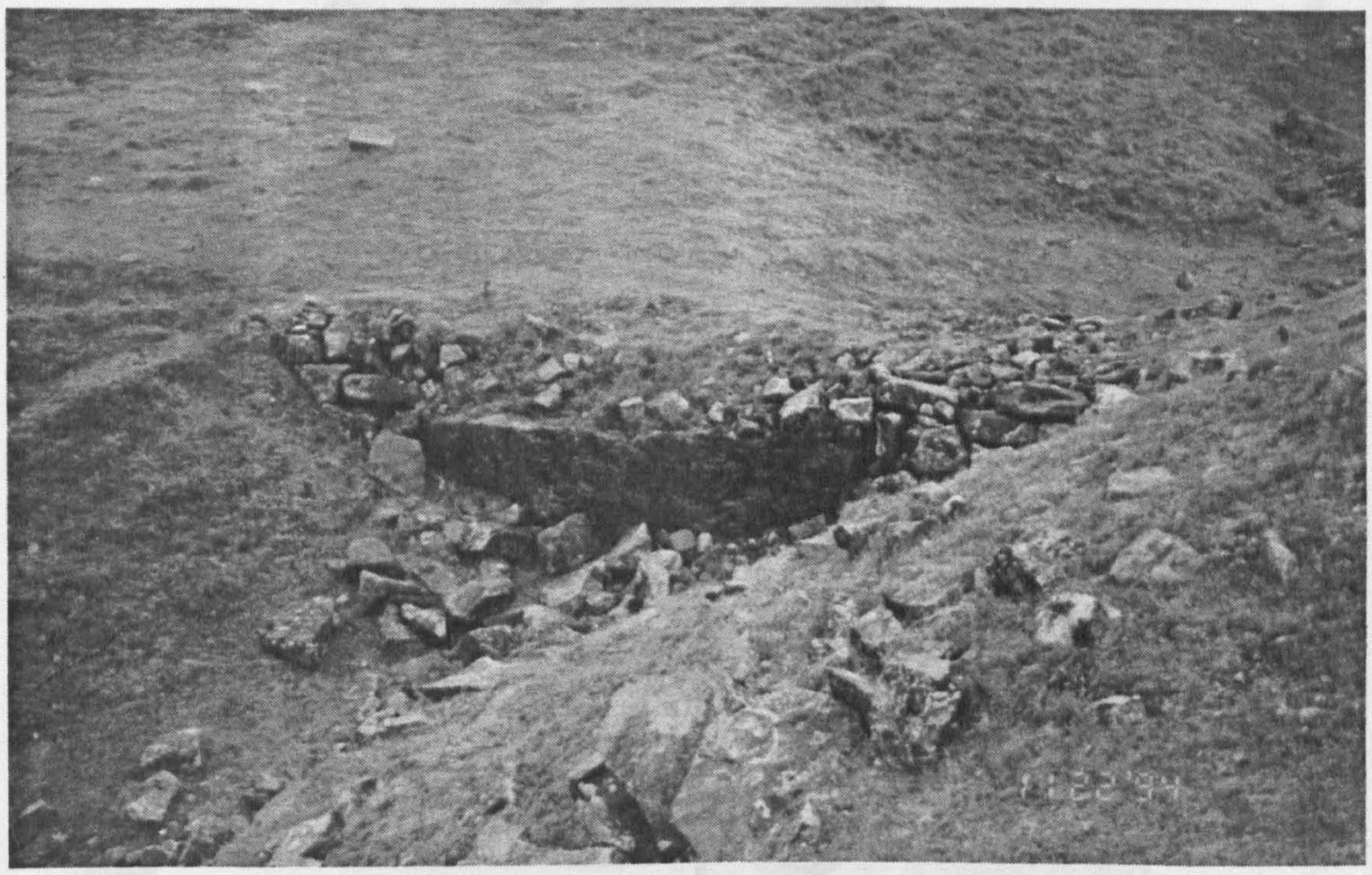


Plate 24. Trevil: embankment built over M17

By 1899, the quarry was being developed by fans of lines radiating from **M18** and **M19 (N21, N22)**. We know from finds that after 1919 these used some standard gauge track **(Fig. 75)** with both flat-bottomed and bridge rails.

---

[40] NLW Badminton II 3859

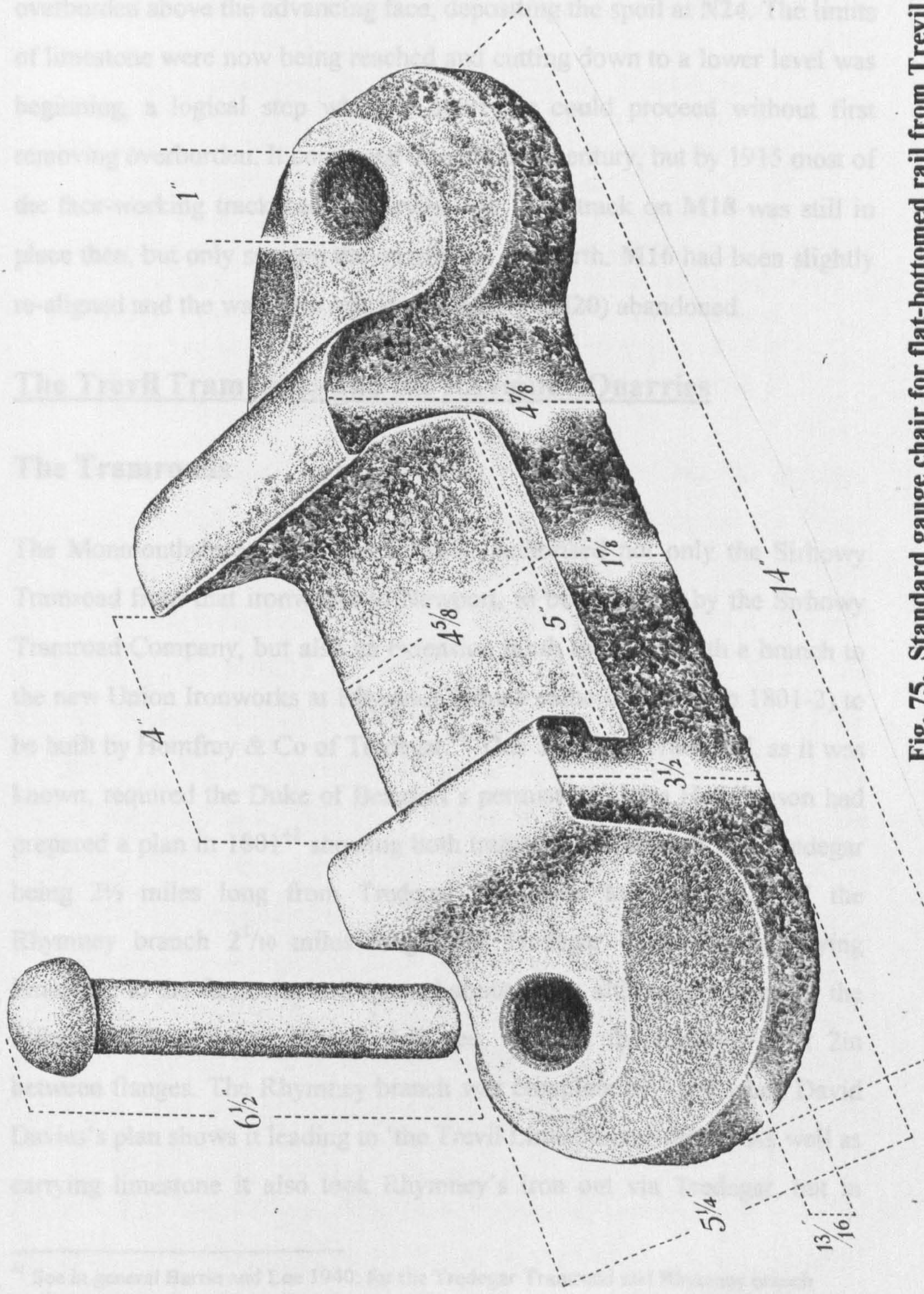


Fig. 75. Standard gauge chair for flat-bottomed rail from Trevil quarries (1219 1357)

Round the top of **N21** a totally isolated high level tramway **(N23)** removed overburden above the advancing face, depositing the spoil at **N24**. The limits of limestone were now being reached and cutting down to a lower level was beginning, a logical step whereby quarrying could proceed without first removing overburden. It continued into the new century, but by 1915 most of the face-working track had been removed. The track on **M18** was still in place then, but only serving the quarries to the north. **M16** had been slightly re-aligned and the waste tip outside the quarry **(M20)** abandoned.

The Trevil Tramroads and the Rhymney Quarries

The Tramroads

The Monmouthshire Canal Act of 1802 authorised not only the Sirhowy Tramroad from that ironworks to Newport, to be managed by the Sirhowy Tramroad Company, but also an extension north to Trevil with a branch to the new Union Ironworks at Rhymney (which came into blast in 1801-2) to be built by Homfray & Co of Tredegar.[41] This Tredegar Tramroad, as it was known, required the Duke of Beaufort's permission. John Hodgkinson had prepared a plan in 1801[42] showing both tramroad and branch, the Tredegar being 2½ miles long from Tredegar Ironworks to 'Trevil Lime,' the Rhymney branch 2 1/10 miles long. The Tredegar Tramroad, supplying limestone to the furnaces, was opened about 1804; although built under the Sirhowy Act its gauge, as we shall see, was not the Sirhowy's 4ft 2in between flanges. The Rhymney branch was complete by 1806 when David Davies's plan shows it leading to 'the Trevil Lime Stone Rock.'[43] As well as carrying limestone it also took Rhymney's iron out via Tredegar, but in

---

[41] See in general Barrie and Lee 1940; for the Tredegar Tramroad and Rhymney branch NLW MS 772E, Oeynhausen and Dechen 1971, 65 and Cumming 1824 quoted in Tasker 1992, 13

[42] GRO D.179.003

[43] NLW Badminton II 6282

1815 it was made redundant by the Brinore and Hall's Trevil Tramroads. Although surveyed by Hodgkinson, it was probably laid with sills of the type used on the Brinore Tramroad about 1814. George Overton wrote in 1822:[44]

> When I was laying the Brin ore road, say 8 years ago, I recollect some of the Men who were then laying plates for me saying ours were exactly the same as some they had seen at Ebw Vale & Rumny, which were also Dovetail'd. I have made no further enquiries since, conceiving they copied mine at Dowlais, but it has since occurred to me that Mr. [John] Llewellin [agent to Benjamin Hall at Rhymney], when I gave orders for the first Sleepers for Brin ore, said they had some seven years before at Rumny [i.e. on the Rhymney Branch?], in fact I think he said he found a Pattern when first he went there.

From its northern end near the Quarrymen's Arms **(K24)** the Tredegar Tramroad ran slightly east of the present road. Just after leaving the village the route can be found as a shallow embankment, and below New House it describes a long curve **(K25)** following the 380m contour, rejoining the road by the cattle grid **(K26)**. It continues along the road to Penrhyn **(K27)** and diverges slightly east in a shallow cutting, rejoining the road by the Mountain Air. It passes under the Heads of the Valleys Road around 150m east of the roundabout, and 100m further south it crossed a bridge. The minor road which joins here from the west **(K28)** was the Rhymney branch. The Tredegar Tramroad continues down a minor road to the furnace tops. The Rhymney branch started from the top of the single furnace **(K29)**, crossing the Nant Melin to the weighing machine and following a footpath north-eastwards as far as Princetown **(K30)**, whence it can be followed a little south of the Merthyr-Abergavenny Turnpike (former A465) to **K28.**

Between **K25** and **K26** an excavation uncovered two pieces of sill. The design of one is very similar to that found on the Craig yr Hafod Tramroad

---

[44] Elsas 1960, 175 (1 August 1822); also 174: 'Mr Llewellin has for the last 8 years [since 1814] been making that description of Plate & Sleeper for me' (30 July 1822)

(Fig 38), but has a strengthening underbelly extending almost to the stone blocks, thus limiting their dimensions to 8in square **(Fig. 76)**. Apparently to avoid this problem, the Craig yr Hafod and later Tredegar sills were strengthened above rather than below **(Fig. 77)**. From further finds, such as a dovetailed sill from Penrhyn which measured 2ft 8½in over the inner claws, it is possible to state the gauge of the Tredegar and the Rhymney branch as 2ft 9½in (allowing for keys) between or 2ft 11in over the flanges, with plates 4ft 6in long.

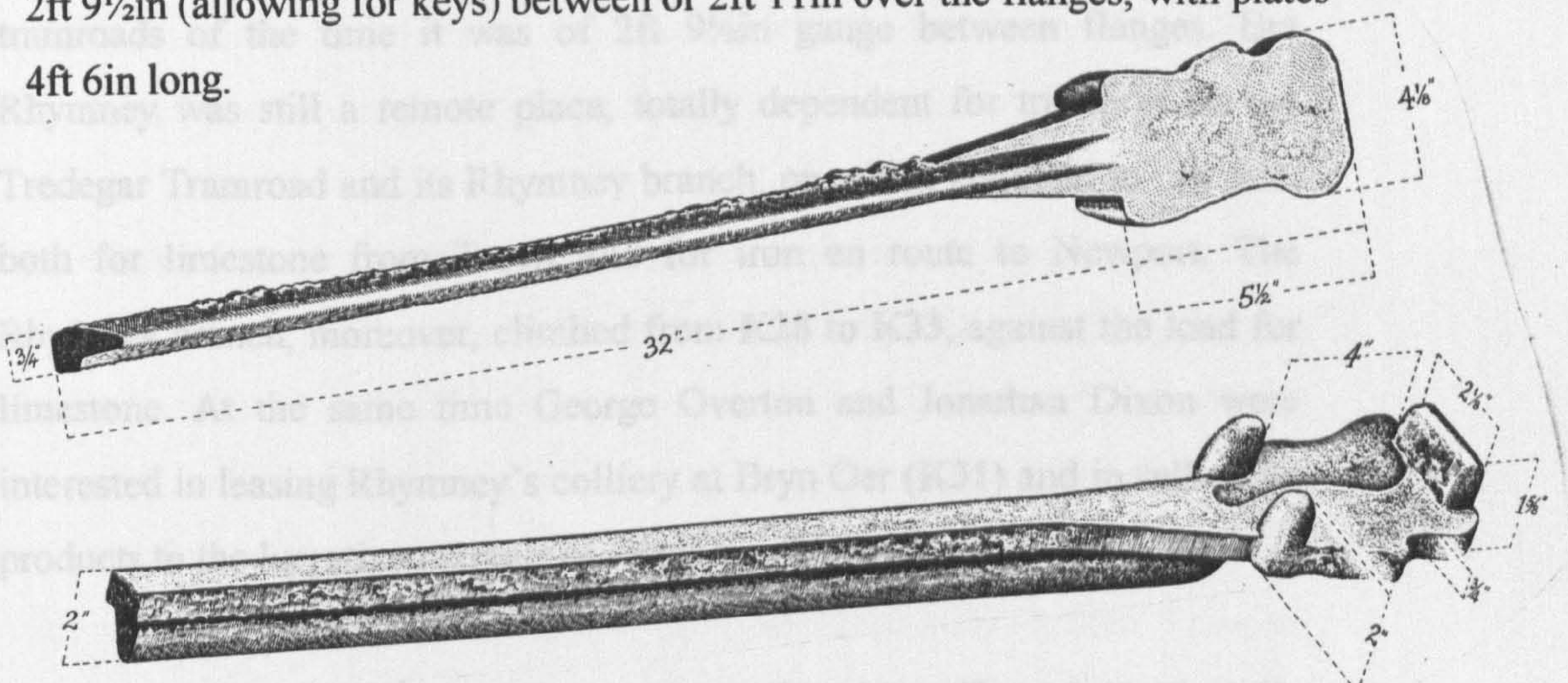


Fig. 76. Horned sill with lower rib from Tredegar-Trevil Tramroad (1217 1210)

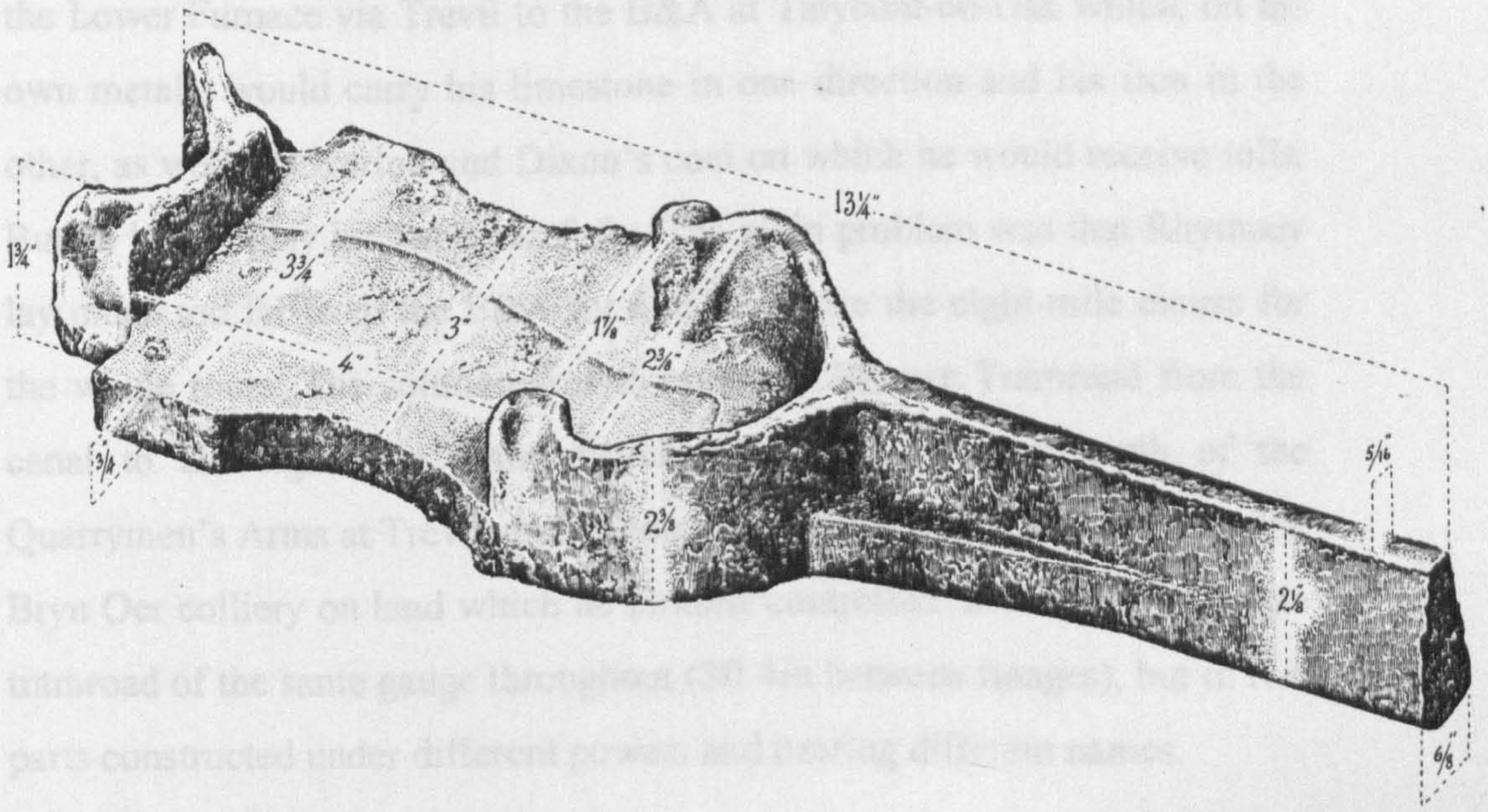


Fig. 77. Sill with upper rib from Tredegar-Trevil Tramroad (1217 1210)

The Brinore and Hall's Trevil Tramroads[45] to c.1814

In 1810 Benjamin Hall became the sole owner of the Union Ironworks which from 1804 had included the new Lower Furnace (**K** Rhymney Ironworks) 2km down the Rhymney Valley. At first the latter was supplied with limestone by a tramroad from the Upper Furnace. Like all the Rhymney tramroads of the time it was of 2ft 9½in gauge between flanges. But Rhymney was still a remote place, totally dependent for transport on the Tredegar Tramroad and its Rhymney branch, on which Hall had to pay tolls both for limestone from Trevil and for iron en route to Newport. The Rhymney branch, moreover, climbed from **K28** to **K33**, against the load for limestone. At the same time George Overton and Jonathan Dixon were interested in leasing Rhymney's colliery at Bryn Oer **(K31)** and in selling its products to the lucrative markets of Brecon and its hinterland.

Hall therefore devised a grand scheme to free himself (and incidentally Overton and Dixon) from bondage to Tredegar: a brand-new tramroad from the Lower Furnace via Trevil to the B&A at Talybont-on-Usk which, on his own metals, would carry his limestone in one direction and his iron in the other, as well as Overton and Dixon's coal on which he would receive tolls. But he had to play his hand carefully. The main problem was that Rhymney lay much too far from the B&A for him to invoke the eight-mile clause for the whole route. The solution was to build the Brinore Tramroad from the canal to the eight-mile point, which by chance fell just north of the Quarrymen's Arms at Trevil, and to complete the line to Rhymney and to the Bryn Oer colliery on land which he himself controlled. It was to be a single tramroad of the same gauge throughout (3ft 4in between flanges), but in two parts constructed under different powers and bearing different names.

---

[45] Not to be confused with the Hall's Tramroad built under the MCC Act towards Crumlin (Rattenbury 1988, 170-173)

Overton and John Llewellin, Hall's agent, made at least two surveys,[46] and on 13 October 1812 Hall applied to the B&A for the tramroad from Trevil to the canal.[47] Not surprisingly the canal company was alarmed at the prospect of loss of revenue. The proposed tramroad would meet the canal twelve miles nearer Brecon than their own Clydach Railroad, which hitherto had supplied the Brecon area with much of its coal. The Brinore might also bypass the seven canal miles between Talybont and Brecon by linking directly to the newly-authorised Hay Railway.

The B&A proprietors panicked, and at a special assembly on 11 December 1812 decided to seek annulment of the eight-mile clause. They sought Counsel's opinion[48] whether the tramroad could be built under the powers of the canal act (section 96), complaining that Hall would 'secure to the Romney Estate the whole supply of Coal to Brecon & into Herefordshire.' They implied that Hall was cheating and that their own Clydach Railroad was accessible to Rhymney, without stating that part of this route (Rhymney to Sirhowy via Tredegar) was tramroad on two different gauges and part (Sirhowy to Gilwern) railroad. They hinted that works like Rhymney which had been established since the act was passed should not qualify under the eight-mile clause. But the real concern was that they would be deprived of twelve miles of tonnage on coal to Brecon; they overlooked the twelve miles of tonnage on Rhymney's iron that they would gain. Trevil was admittedly within the permitted eight miles, but the limestone there was held from the Duke of Beaufort 'without any power of Sale:' in other words, they suggested, the quarry was not a 'works' within the terms of the act.

Counsel, in reply, offered little comfort:

---

[46] One survives: NLW Ashburnham II 243

[47] Rattenbury 1980, 99-127 deals with the history of the Brinore proper, but does not discuss Hall's Tramroad in any depth

[48] 26 Feb 1813, author's collection. See also Bill for amending the B & A Canal Act, NLW Maybery I 402

> The powers given by this Act are so large and invest any individual with such powers over his Neighbours Property that I scarcely think the Legislature would have given such powers had its attention been drawn to it or at least would have put them under more strict limitations.

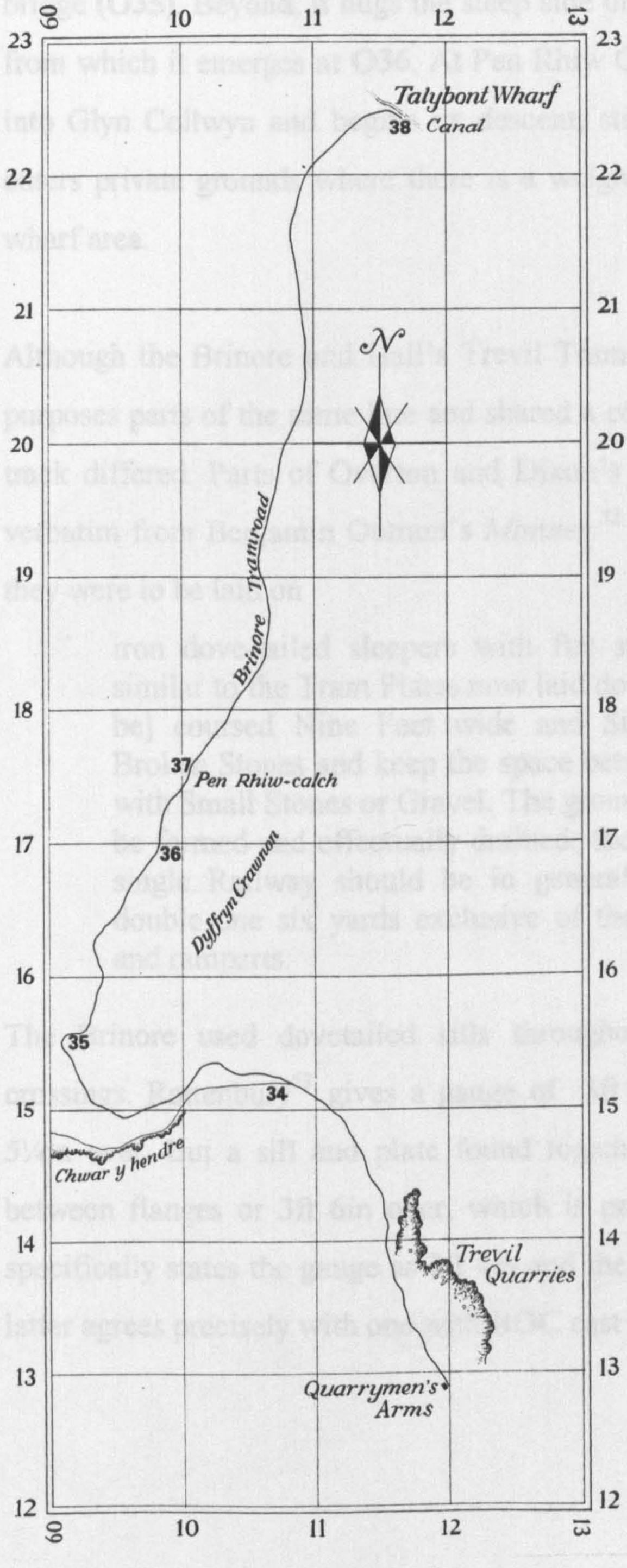
He was in effect blaming the canal company for admitting such wide powers in its bill in the first place. In the event the new bill to have section 96 repealed was defeated in March 1813 and, the B&A still refusing to build the line itself, the Brinore Tram Road Company was set up to do so. The major shareholders were Dixon and Hall, Overton being in financial difficulties; Dixon and Overton won the contract for construction which took place in 1814-15, and they also leased Bryn Oer colliery from Hall.

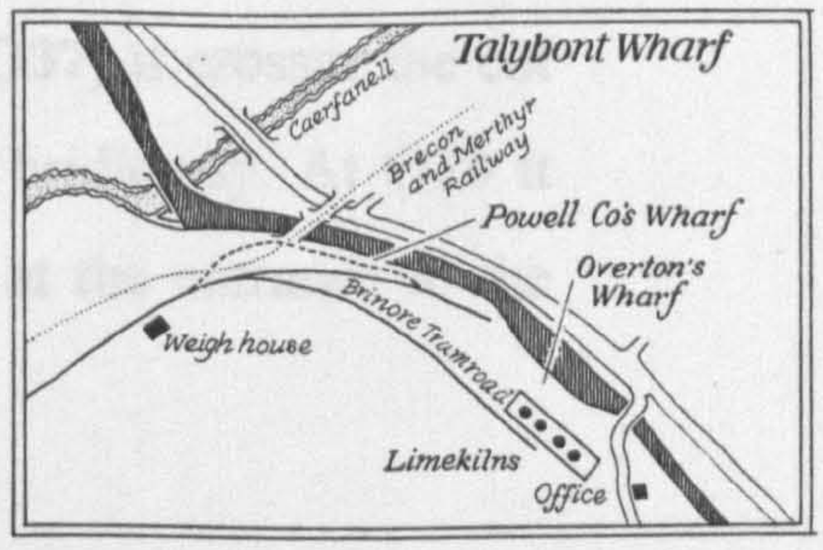
Meanwhile Hall was building his part of the overall line. From the Lower Rhymney works it ran north and north-east across land now opencasted, picking up at **K32** the 1km branch from Bryn Oer colliery **(K31)**, to cross the Rhymney branch at **K33** near the overbridge on the Heads of the Valleys road. At Penrhyn **(K27)** it came alongside the Tredegar Tramroad. This was as far as construction had proceeded in 1813 when the draft OS map was surveyed,[49] but by 1815 it had been completed, alongside the Tredegar Tramroad, to the Quarrymen's Arms **(K24)**. Here its dual purpose was realised, to enter the quarries and to join the Brinore Tramroad. In April 1815 the latter was almost completed to its eight-mile terminal point, and only 220 yards remained to be made by Hall. The junction was effected in May, when Dixon and Overton leased the Brinore, undertaking to maintain the road and keep it open to public toll-payers. Little needs to be added to Rattenbury's description of the route.[50] It follows the present road to **O34**, and then bridleway which crosses Cwm Crawnon by the remnants of a

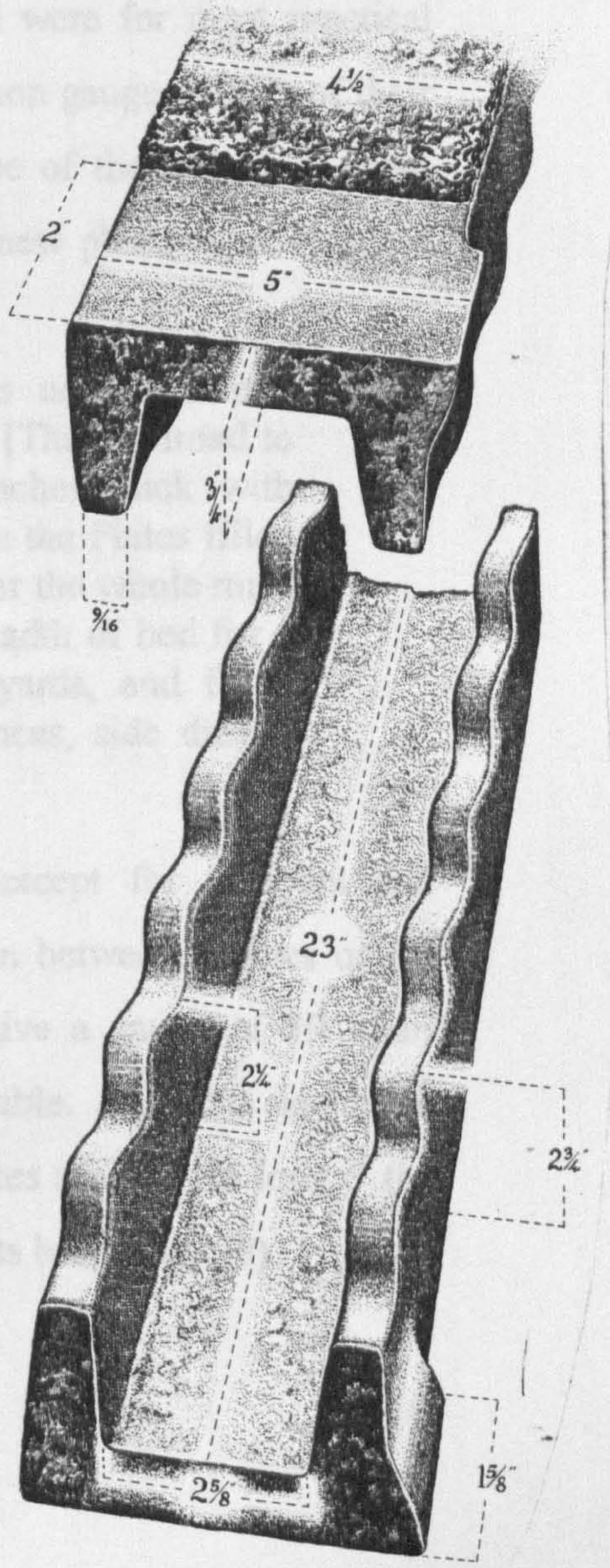
---

[49] The map appears to show a physical connection with the Tredegar Tramroad; but the gauges were different, and excavations along the latter revealed no trace whatever of a dual-gauge tramroad

[50] Rattenbury 1980, 123-126







MAP O. THE BRINORE TRAMROAD

bridge **(O35)**. Beyond, it hugs the steep side of the valley through woodland from which it emerges at **O36**. At Pen Rhiw Calch **(O37)** it crosses the col into Glyn Collwyn and begins its descent, still as a bridleway. At **O38** it enters private grounds where there is a weigh-house at the entrance to the wharf area.

Although the Brinore and Hall's Trevil Tramroad were for most practical purposes parts of the same line and shared a common gauge, details of their track differed. Parts of Overton and Dixon's lease of the Brinore[51] quote verbatim from Benjamin Outram's *Minutes*.[52] As new plates were required they were to be laid on

> iron dove-tailed sleepers with flat stones under the end similar to the Tram Plates now laid down. [The tramroad to be] coursed Nine Feet wide and Six Inches thick with Broken Stones and keep the space between the Plates filled with Small Stones or Gravel. The ground for the whole must be formed and effectually drained; the breadth of bed for a single Railway should be in general 4 yards, and for a double one six yards exclusive of the fences, side drains, and ramparts.

The Brinore used dovetailed sills throughout except for turnouts and crossings. Rattenbury[53] gives a gauge of 3ft 3¼in between flanges or 3ft 5¼in over. But a sill and plate found together give a gauge of 3ft 4½in between flanges or 3ft 6in over, which is preferable. An 1850 document specifically states the gauge as 3ft 4in and the plates as 3ft 11in long;[54] the latter agrees precisely with one with **BOC** cast on its base **(Fig. 78)**.

---

[51] Rattenbury 1980, 103
[52] Riden 1972, 63
[53] Rattenbury 1980, 126
[54] GRO MAN/G/1/0006

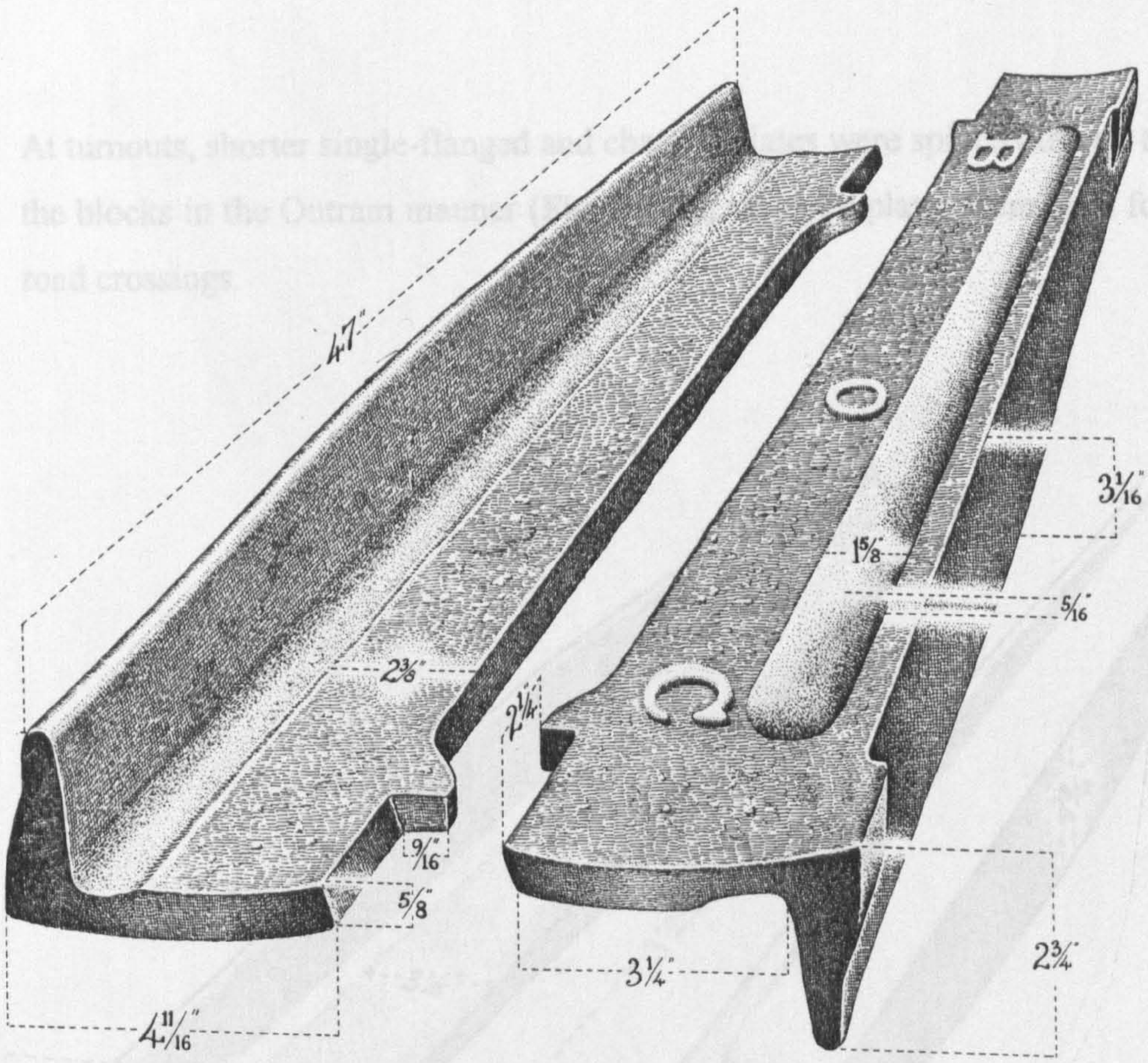


Fig. 78. Plate specifically made for the Brinore Tramroad (109 206)

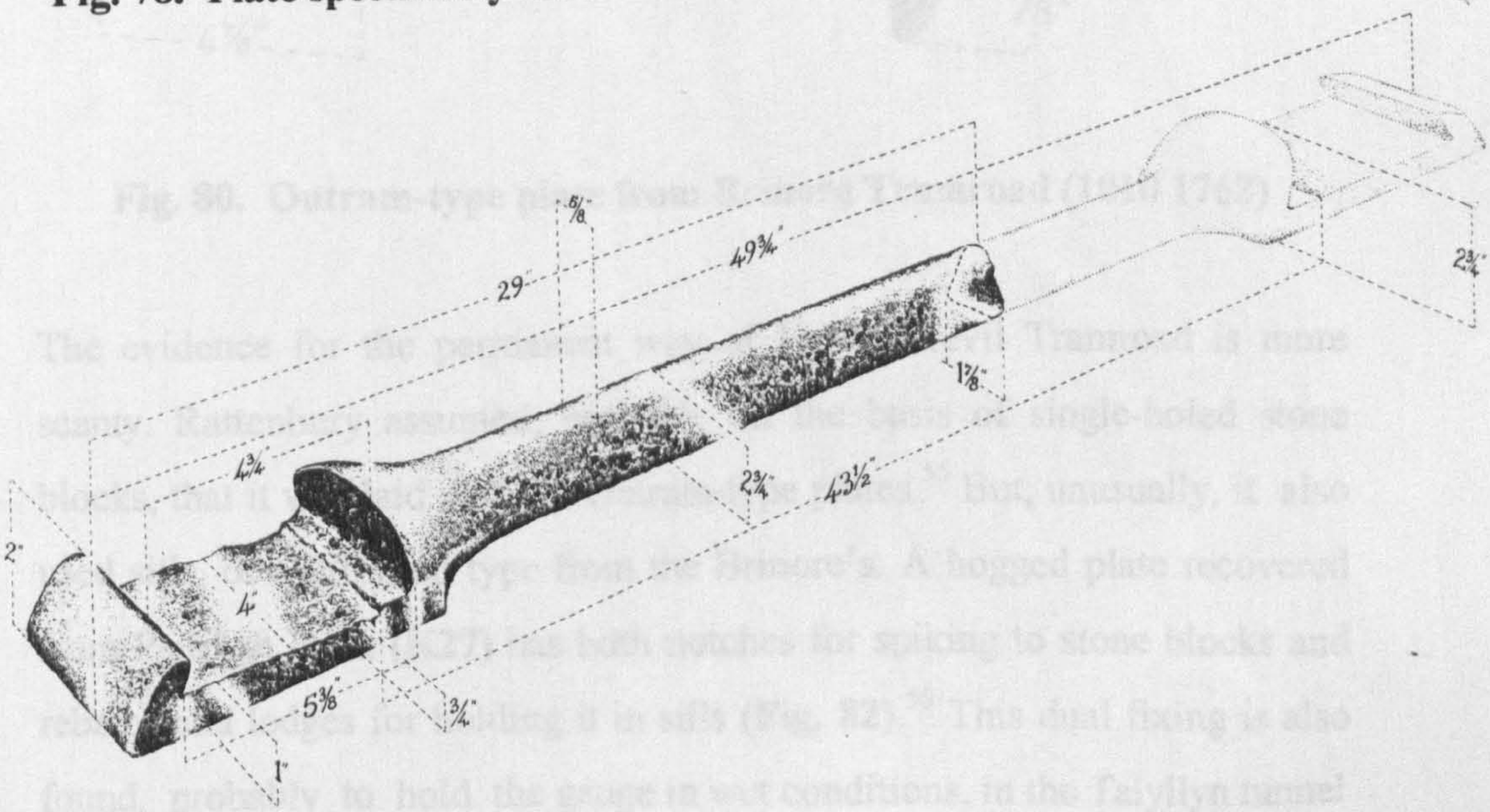


Fig. 79. Rhymney-type sill from Brinore Tramroad (1010 1762)

At turnouts, shorter single-flanged and channel plates were spiked directly to the blocks in the Outram manner **(Figs. 80-1)**; vandyke plates were used for road crossings.

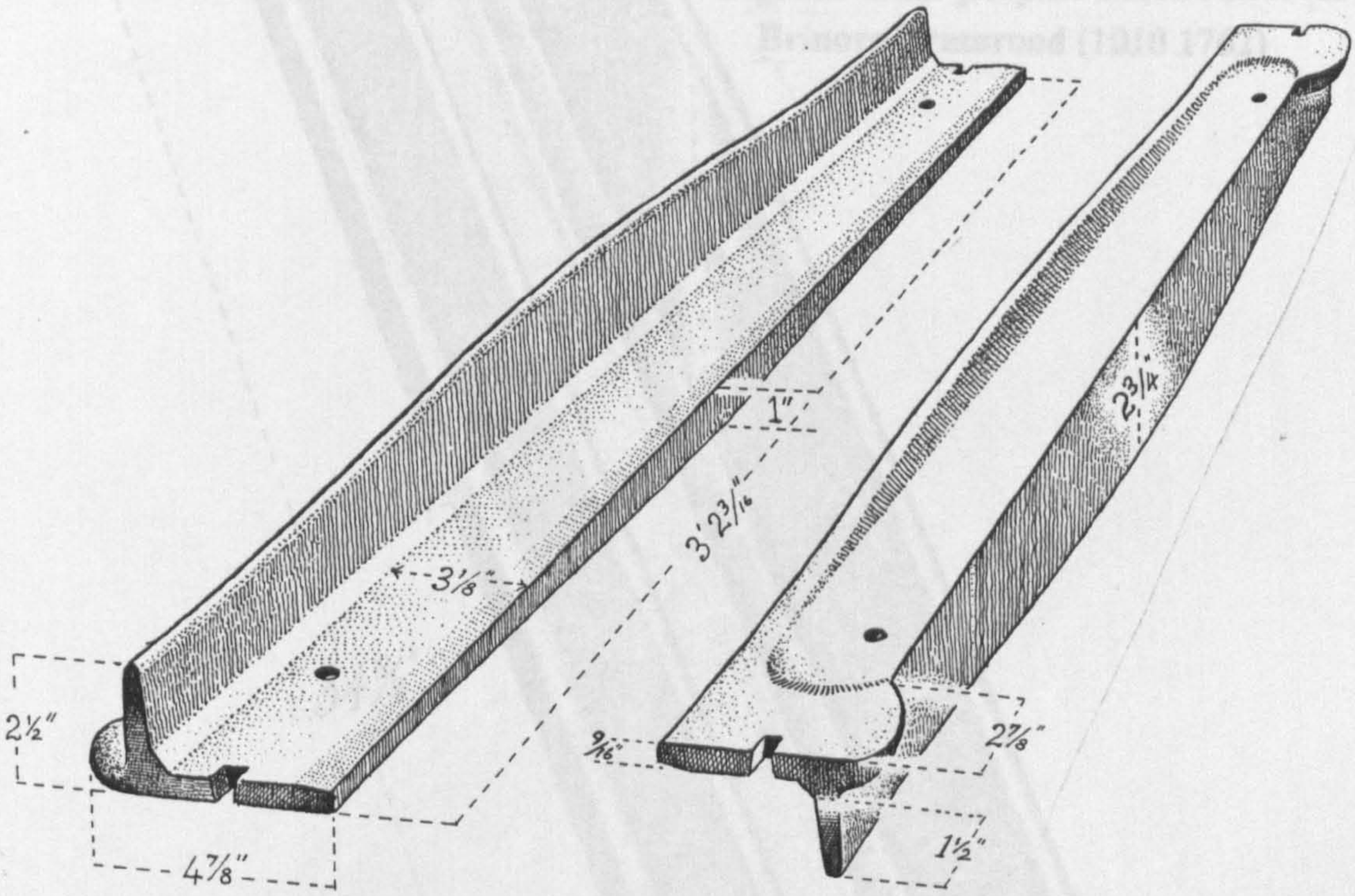


Fig. 80. Outram-type plate from Brinore Tramroad (1010 1762)

The evidence for the permanent way of Hall's Trevil Tramroad is more scanty. Rattenbury assumed, probably on the basis of single-holed stone blocks, that it was laid with 3ft Outram-type plates.[55] But, unusually, it also used sills, of a different type from the Brinore's. A hogged plate recovered from Penrhyn Farm **(K27)** has both notches for spiking to stone blocks and rebates and ledges for holding it in sills **(Fig. 82)**.[56] This dual fixing is also found, probably to hold the gauge in wet conditions, in the Talyllyn tunnel

---

[55] Rattenbury 1980, 126
[56] van Laun 1977, 85

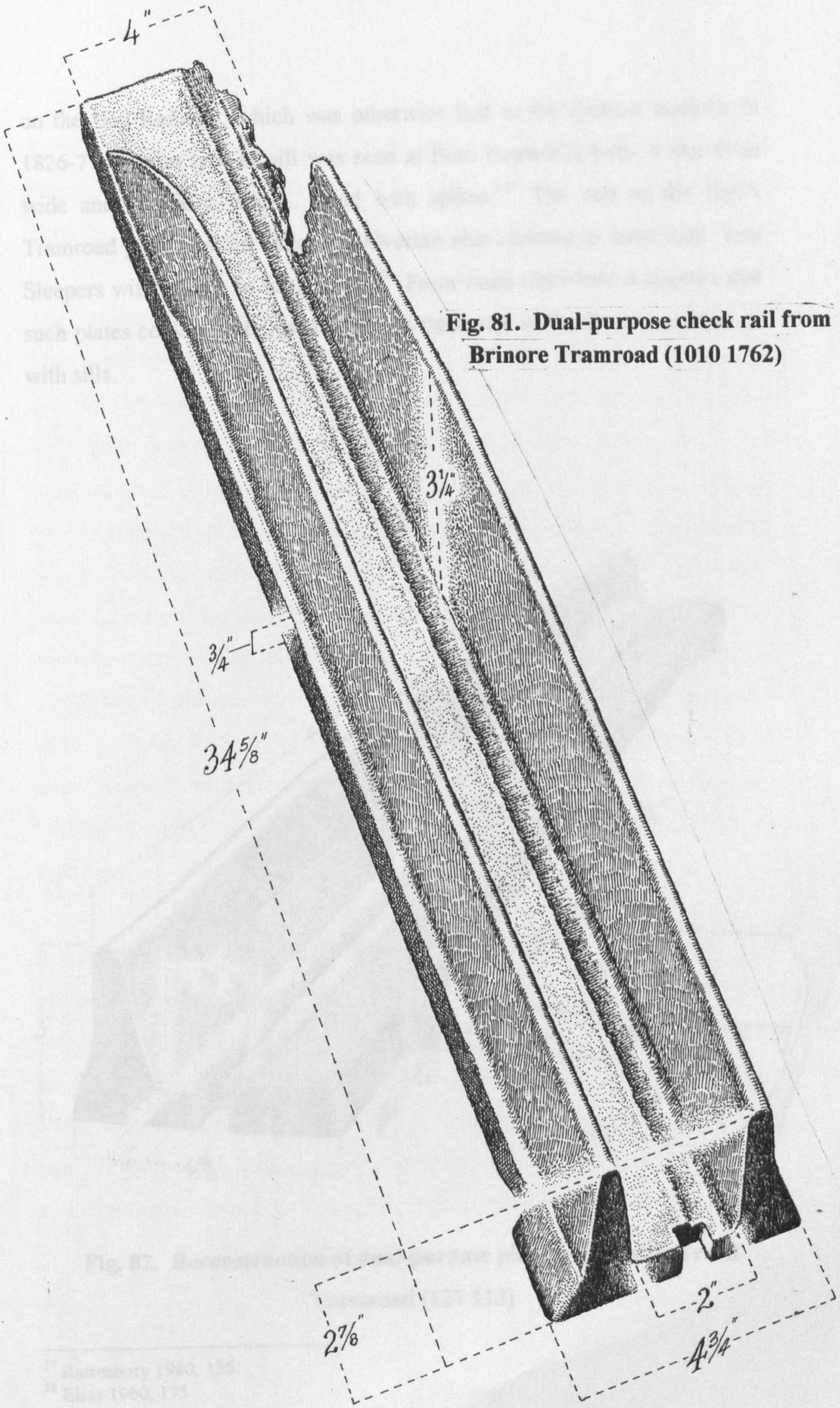


Fig. 81. Dual-purpose check rail from Brinore Tramroad (1010 1762)

on the Hay Railway, which was otherwise laid in the Outram manner. In 1826-7 a similar type of sill was seen at Bute ironworks with 'a slot 4¼in wide and 1in deep, and ... fixed with spikes.'[57] The end of the Hall's Tramroad plate is 4½in wide; and Overton also claimed to have used 'Iron Sleepers with a Hole in for a Plug.'[58] From finds elsewhere it appears that such plates could also be used either on their own in the Outram manner or with sills.

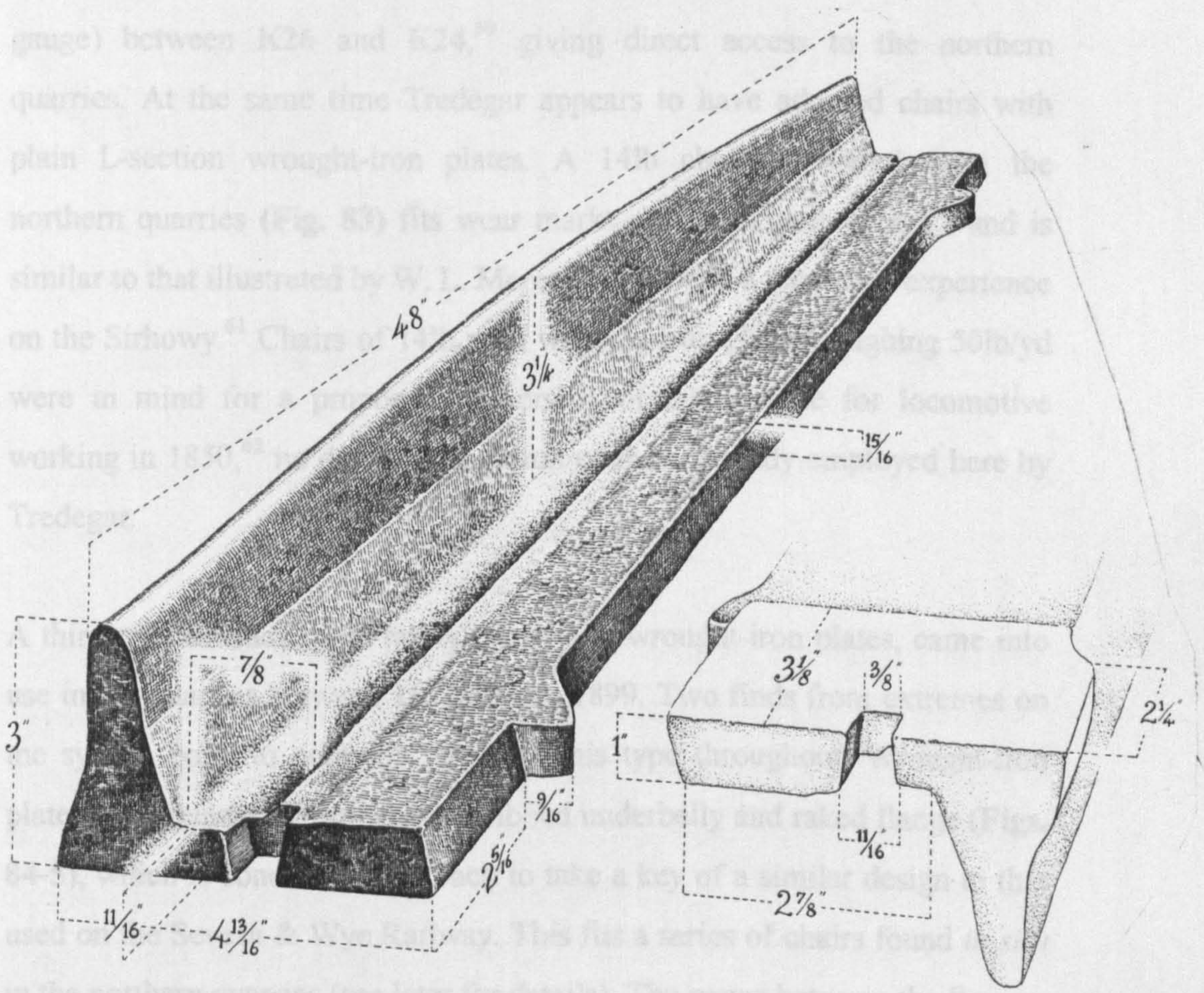


Fig. 82. Reconstruction of dual-purpose plate from Hall's Trevil Tramroad (127 113)

---

[57] Rattenbury 1980, 126
[58] Elsas 1960, 175

A channel vandyke plate for a road crossing, likewise recovered from Penrhyn, also has a ledge at the end for fixing within a sill (see vignette to **Map O**).

The Tramroads after 1852

Thus established, the three tramroads continued with relatively little change until 1852 when Rhymney abandoned Trevil. It seems likely that Tredegar had already moved its line from the curve at **K25** to a route parallel to but separate from Hall's Trevil Tramroad (which was of course of different gauge) between **K26** and **K24**,[59] giving direct access to the northern quarries. At the same time Tredegar appears to have adopted chairs with plain L-section wrought-iron plates. A 14lb chair recovered from the northern quarries **(Fig. 83)** fits wear marks seen in Trevil village[60] and is similar to that illustrated by W. L. Meredith, who had a lifetime's experience on the Sirhowy.[61] Chairs of 14lb with wrought-iron plates weighing 50lb/yd were in mind for a proposed conversion of the Brinore for locomotive working in 1850,[62] no doubt in imitation of those already employed here by Tredegar.

A third type of track, with heavy chairs and wrought-iron plates, came into use in the quarries between 1877/85 and 1899. Two finds from extremes on the system point to common usage of this type throughout. Wrought-iron plates from Penrhyn Farm[63] have a ribbed underbelly and raked flange **(Figs. 84-5)**, which is concave on the back to take a key of a similar design to that used on the Severn & Wye Railway. This fits a series of chairs found *in situ* in the northern quarries (see later for details). The gauge between the flanges

---

[59] OS 6in 1872-85
[60] Noted by M. J. T. Lewis
[61] NLW MS 772E
[62] GRO/MAN/G/1/0006
[63] Recorded by M. J. T. Lewis

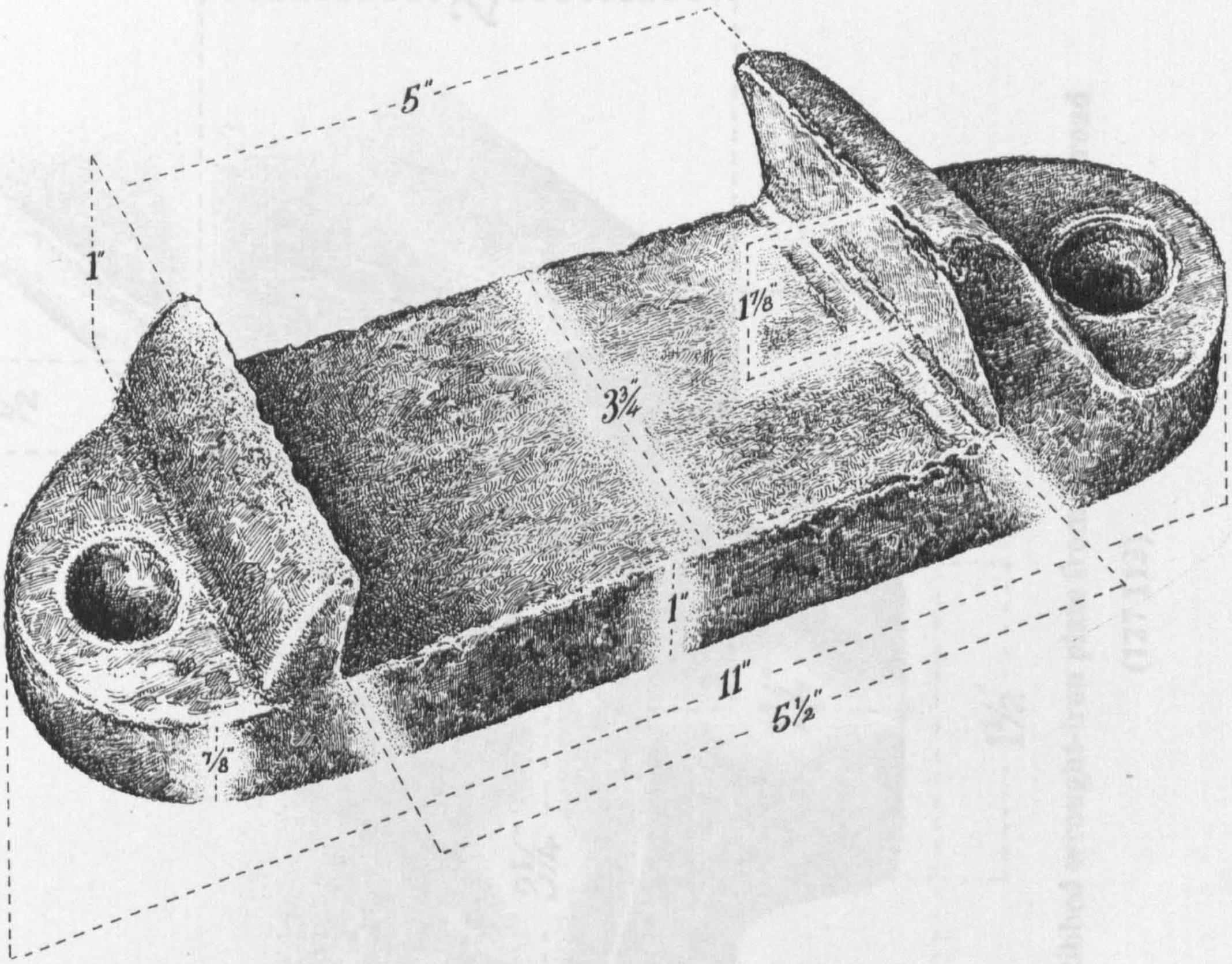


Fig. 83. Plate rail chair from Trevil quarries (1174 1386)

was about 2ft 9in and the wheel gauge 2ft 11in. The Tredegar Tramroad was still in place in 1915.[64]

Hall's Trevil Tramroad and the Rhymney Tramroad to Newport of 1826 between them rendered the western end of the Rhymney branch of the Tredegar Tramroad redundant, and by 1829 it had been lifted from **K29** to **K33**. The eastern half, however, from **K33** to **K28**, survived until 1904,[65] possibly because it served Tredegar collieries. By 1884, and probably well before, Hall's Trevil Tramroad itself had lost its *raison d'êtr*e and was out of use.[66] By the 1860s the Brinore was in trouble, and in 1863 reduced the tonnage rates in an attempt to encourage traffic, particularly coal and to a

---

[64] OS 6in 1915
[65] NLW MS 772E
[66] NLW Badminton II 3858, map showing Tredegar and Brinore Tramroads only

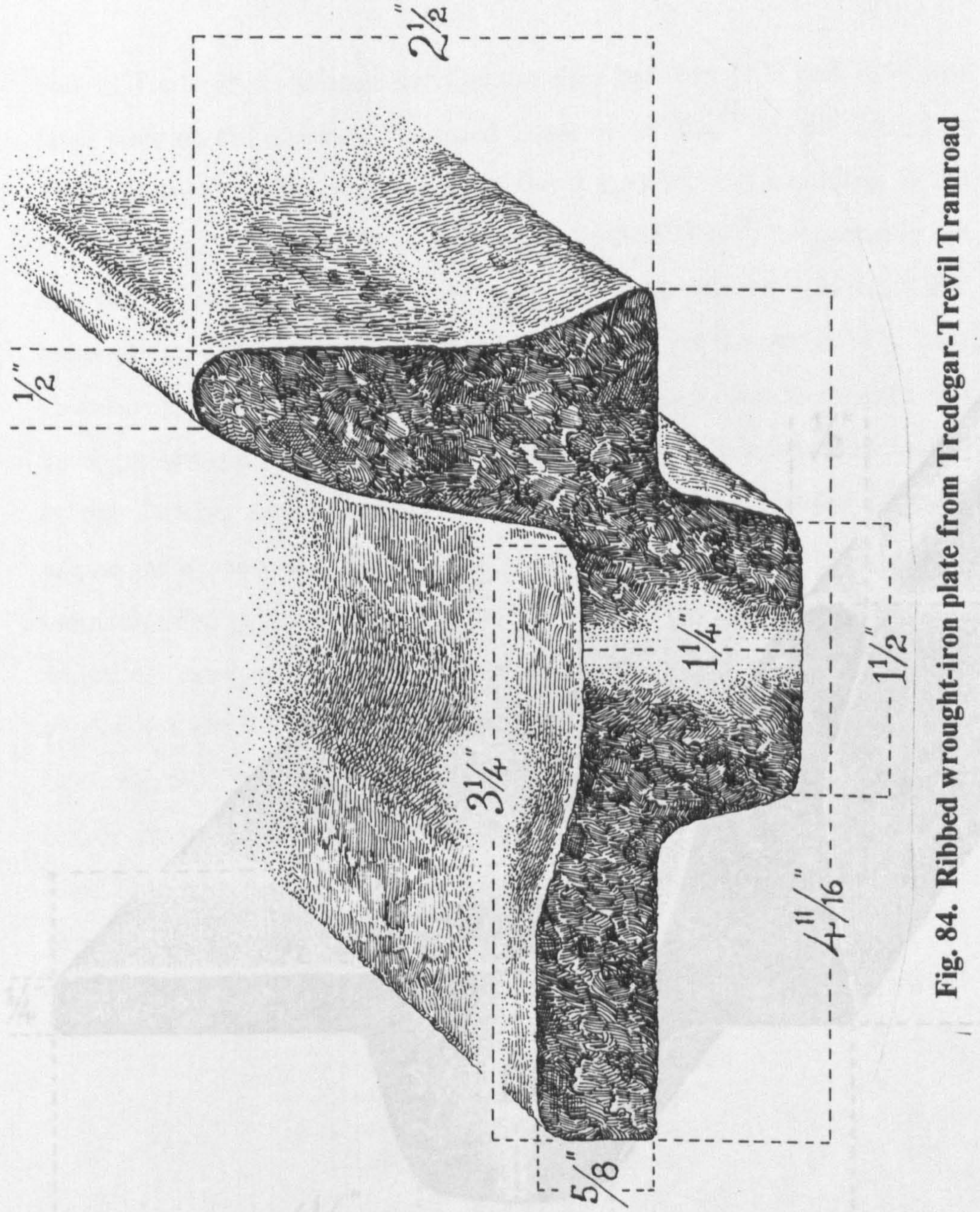


Fig. 84. Ribbed wrought-iron plate from Tredegar-Trevil Tramroad

(127 113)

lesser extent lime and limestone.[67] During the 1870s, if not the late 1860s, it quietly faded away. Before oblivion descended it had seen some use by Tredegar, perhaps for exporting coal from pits around **K33** via the eastern part of the Rhymney branch. At Trevil this of course entailed a change of gauge, overcome by parallel lines with mixed gauge and double track for transhipment[68] at the Quarrymen's Arms (see **Map N** inset).

---

[67] Poster noted in a Brecon second-hand book shop, 17.1.97

[68] NLW Badminton II 3858

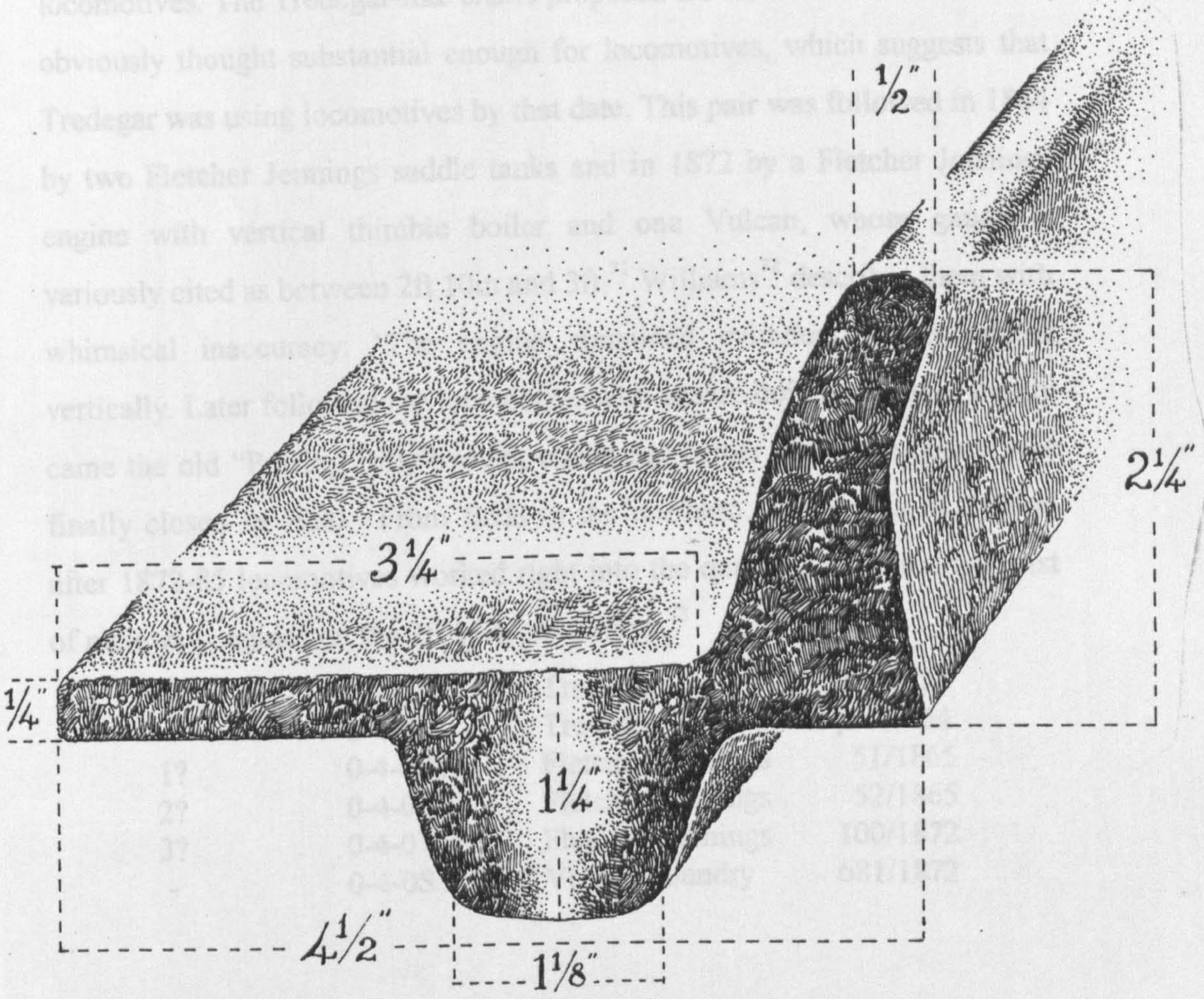


Fig. 85. Ribbed wrought-iron plate from Tredegar-Trevil Tramroad

(127 113)

Locomotives on the Tredegar Tramroad

Tredegar itself had a long acquaintance with the locomotive. Its first, the Stephenson 0-6-0 *Britannia* of 1829, was followed by a series of perhaps nine 0-6-0s based on *Britannia*'s design and by two 0-4-0 yard engines, all

built at Tredegar by its engineer Thomas Ellis between 1832 and 1854. All these were on the Sirhowy Tramroad gauge of 4ft 2in.[69] For the Tredegar-Trevil Tramroad, Ellis also built two 0-4-0 locomotives, according to the most authoritative source on a 3ft gauge and before 1854;[70] but probably not long before because, as we have seen, the early track was too light to support locomotives. The Tredegar-like chairs proposed for the Brinore in 1850 were obviously thought substantial enough for locomotives, which suggests that Tredegar was using locomotives by that date. This pair was followed in 1864 by two Fletcher Jennings saddle tanks and in 1872 by a Fletcher Jennings engine with vertical thimble boiler and one Vulcan, whose gauge is variously cited as between 2ft 10in and 3ft.[71] Williams[72] describes them with whimsical inaccuracy: 'The engine contained cylinders which rotated vertically. Later followed the locomotive with square boiler and tank; finally came the old "Puffing Billy" which ended her career when the quarry was finally closed in 1920.' From finds in the northern quarry it is likely that after 1872-85 locomotives worked right into the quarries. The summary list of plateway engines on the 2ft 11in gauge runs:[73]

-	0-4-0	Tredegar	pre-1854
-	0-4-0	Tredegar	pre-1854
1?	0-4-0ST	Fletcher Jennings	51/1865
2?	0-4-0ST	Fletcher Jennings	52/1865
3?	0-4-0VBT	Fletcher Jennings	100/1872
-	0-4-0ST	Vulcan Foundry	681/1872

---

[69] In 1849, Tredegar had 9 such locomotives; Rhymney had 6, Ebbw Vale 6: Parliamentary Papers 1850 xxxi, 198

[70] *Locomotive Mag.*, Dec 1915, 10. *Railway Mag.* Nov 1901, 422 gives the gauge, surely wrongly, as 2ft 6in. *Railway Mag.* July 1969, 408 has a photograph of one of these engines in a much-rebuilt and long-abandoned state

[71] 2ft 10in, four locomotives in Nov. 1869 (Geoffrey Hill, pers. comm.); 2ft 11¼in (Industrial Railway Soc. lists); 3ft (Industrial Locomotive Soc. lists); 2ft 11in, the most likely (Fletcher Jennings works list)

[72] Williams 1993, no pagination

[73] See also Hill & Green 1999, 156

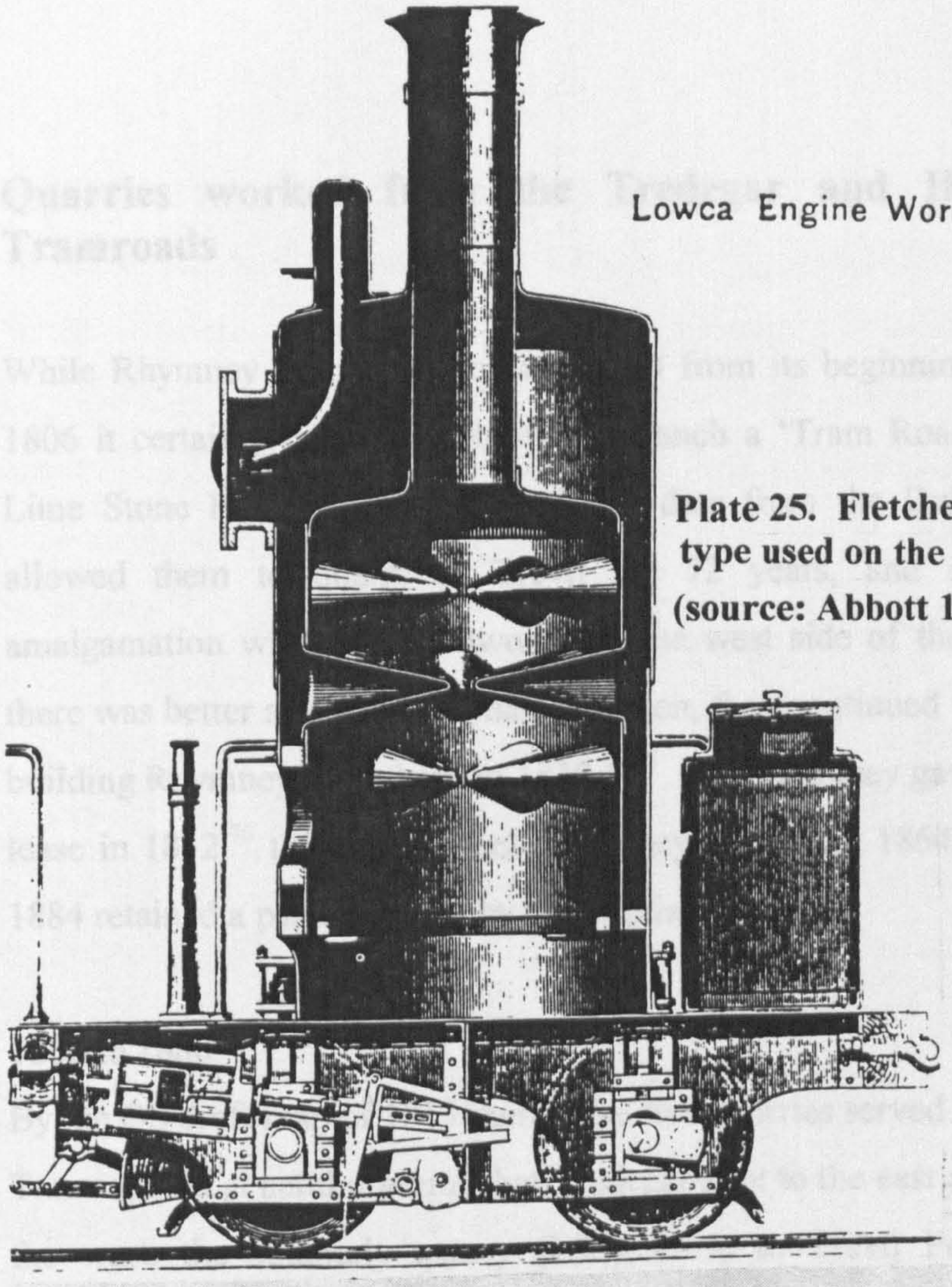


Plate 25. Fletcher Jennings vertical boiler type used on the Tredegar Tramroad (source: Abbott 1989, 58)

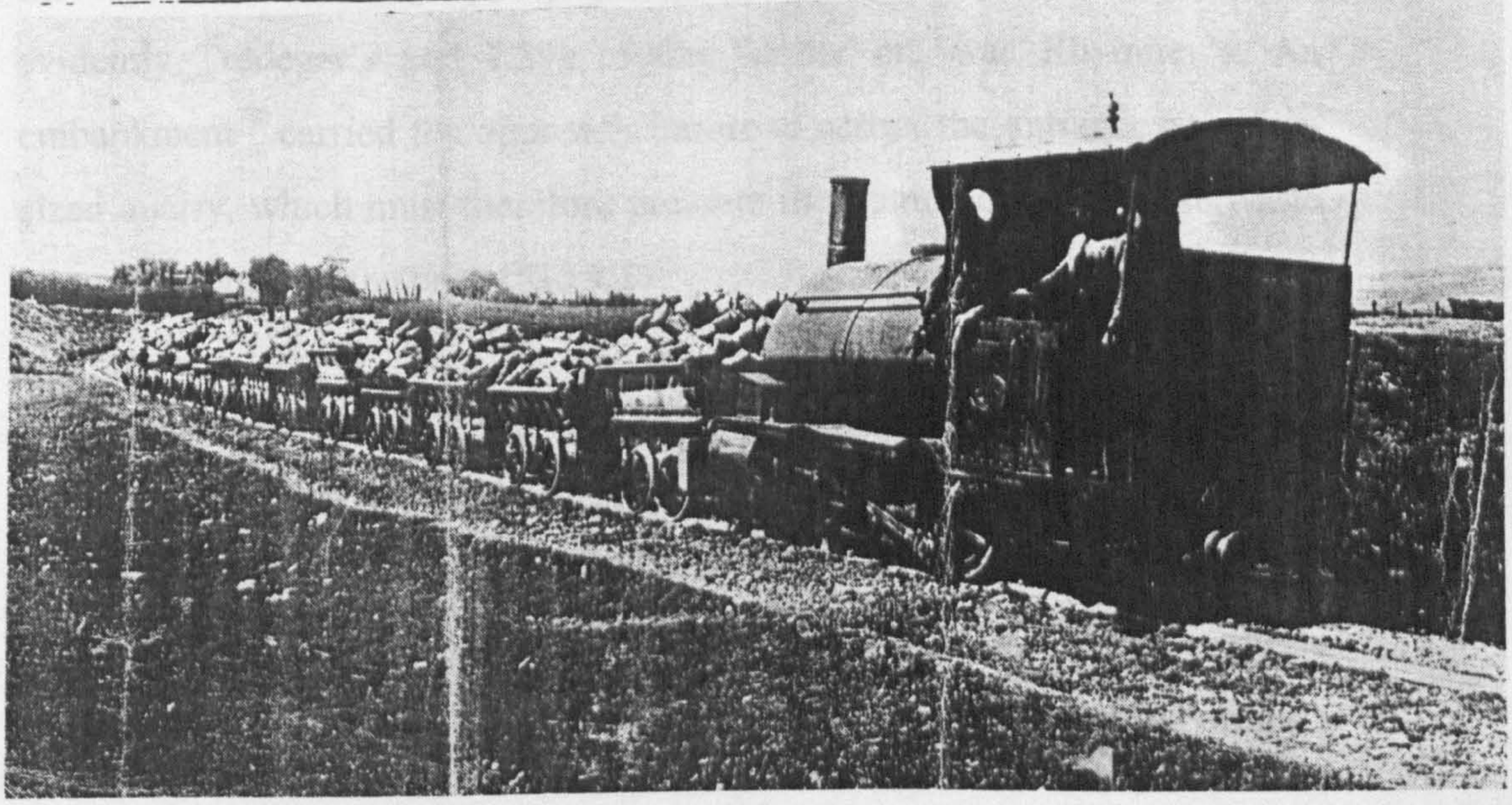


Plate 26. Locomotive on the Tredegar Tramroad 1911. The plate on the cab reads 'Rebuilt by the Tredegar Iron & Coal Co Ltd, 1905' (source: WIMM, GWR A1003)

Quarries worked from the Tredegar and Hall's Trevil Tramroads

While Rhymney may have worked Trevil from its beginnings in 1801, by 1806 it certainly had in the Rhymney branch a 'Tram Road to the Trevil Lime Stone Rock.'[74] The lease of that date from the Duke of Beaufort allowed them to quarry at Trevil for 72 years, and even after the amalgamation with Bute Ironworks on the west side of the valley, where there was better access to Twynau Gwynion, they continued working Trevil, building Rhymney Row there in 1837-8.[75] Although they gave up the Trevil lease in 1852,[76] they did not sell Rhymney Row until 1864, and as late as 1884 retained a parcel of land by the Baptist Chapel.[77]

1800 to 1850

By the OS draft map of 1813 there were two quarries served by the Tredegar Tramroad. In general it seems that Tredegar kept to the east and Rhymney to the west; the southerly quarry **(L25)**, close to Trevil Post Office, was evidently Tredegar's and **L29b**, 500m further on, was Rhymney's. An embankment[78] carried the approach tramroad across the entrance to a fair-sized quarry, which must therefore pre-date the tramroads and whose waste was cut through by the post-1813 **L27**.

The building of Hall's Trevil and Brinore Tramroads in 1813-15 brought about changes that are visible in the 1829 survey. Although Hall's Trevil Tramroad had only reached Penrhyn Farm by 1813 there was already a short spur beyond the Quarrymen's Arms as if poised ready to extend a westerly line parallel to Rhymney's **L26**. This was to form the nucleus of Rhymney's

---

[74] NLW Badminton II 6282, survey by David Davies
[75] 1203 1260
[76] NLW Badminton II 6092
[77] NLW Badminton II 3858
[78] 1188 1319

new 3ft 4in gauge western line **(L27)**, while Tredegar took over Rhymney's old **L26** (which of course had the Tredegar gauge) and from it developed a series of small quarries **(L26a** to **L28)**. It seems fair to assume that this happened in 1814-15. According to the 1829 survey Tredegar still maintained **L25** with a short tramroad spur into it. For a short distance from here to the Quarrymen's Arms only one line is shown, presumably with a third rail.

By 1829 the parallel Rhymney and Tredegar lines had reached the northern quarries, 1km beyond the Quarrymen's Arms. There was intermediate working at two quarries along the way **(L29a** and **Rhymney's L29b)** and, a little beyond, Rhymney's line crossed over Tredegar's **(L29)**. These two lines were to form the basis for the subsequent working of these northern quarries. Here the western limestone boundary, exposed by the downcutting of Nant Trefil, would have been easily worked (**L30** and **L31**). Tredegar's quarry **(L31)** was worked at a slightly higher level than Rhymney's **(L30)**. Part of a sill recovered in **L30** is of Rhymney and Brinore type.

1852 to 1872/85

When Rhymney moved to Twynau Gwynion, Tredegar were free to move westwards[79] onto the abandoned **L27** and re-lay it with chairs. After a little working from it across **L26**, now itself abandoned, they extended **L27** for 300m to enter the northern quarries at **M32**. It was laid with blocks at 3ft intervals with two holes for chairs (as in **Fig. 83**) at a gauge of about 2ft 11in.

At this northern end the limestone deposits narrow, so the western side was worked first before moving back south on the eastern side. By 1872-85

---

[79] NLW Badminton II 3858

(probably after 1879 when a new lease was concluded[80]) an extension of the old Rhymney quarry **L30** had been absorbed and **M32** had been replaced by **M33**, from which parallel east-west lines probably ran to the face. A loop was established at **M34.** The chair found here **(Fig. 83)** shows that its track was at first the same as on **M32**. Towards the end of the period there was a change of working practice in that waste had to be deposited within the narrow confines of the quarry as deepening took place. This was organised by dumping it in revetted tips 3m high between the tracks which brought rock out from the face. By 1899 three lines had been worked on this system and abandoned **(N33a to N33c)**.

1872/85 to 1899

The lease was renewed in 1898.[81] By 1899 there was no working at the southern end, but at the northern end the face had been considerably deepened by multiple branches **N33d-h** by the method described above using the loop **M34**, although **N33g-h** were able to dump waste at the gap where the earlier line **M32** entered the quarry. Following the 1879 lease[82] it seems that the permanent way was re-organised and locomotives worked into the northern quarries. Finds *in situ* in the quarry show it was laid with heavy chairs, some on wooden sleepers **(Fig. 86)** but some riveted to wrought-iron ties **(Fig. 87)** laid only on sand or loam. The latter must be the ultimate refinement in plateway design, and the wrought-iron plate shown in **Fig. 84** fits it well; the tie would bed very satisfactorily in the trackbed. The gauge is about 2ft 9in between flanges or 2ft 11in over them.

---

[80] NLW Badminton II 6100
[81] NLW Badminton II 6099
[82] NLW Badminton II 7056

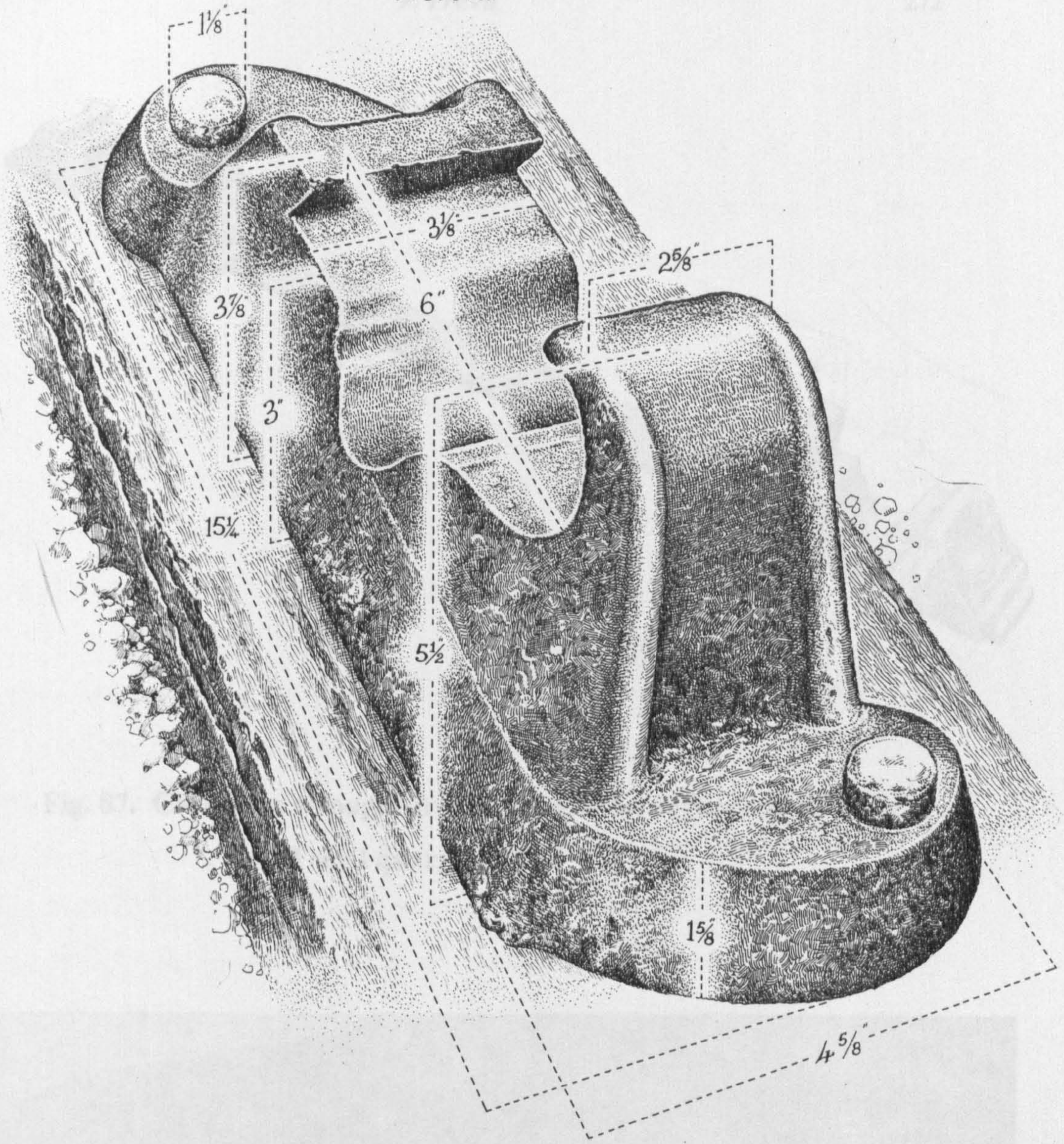


Fig. 86. Heavy chair for wrought-iron plate from Trevil quarries (1170 1411)

Up to 1915 and after

Some further working at the south-east end, taking the quarry near to the limits of limestone, can be dated precisely to between the survey of 1899, when Tredegar had two furnaces in blast,[83] and 1900 when they ceased production. It can not have been done by Ebbw Vale, as Tredegar surrendered their tramway only in 1915.[84] But at that point it seems clear that Ebbw Vale did take over and work the quarry throughout except for the

---

[83] Riden and Owen 1995, 28
[84] NLW Badminton II 7624

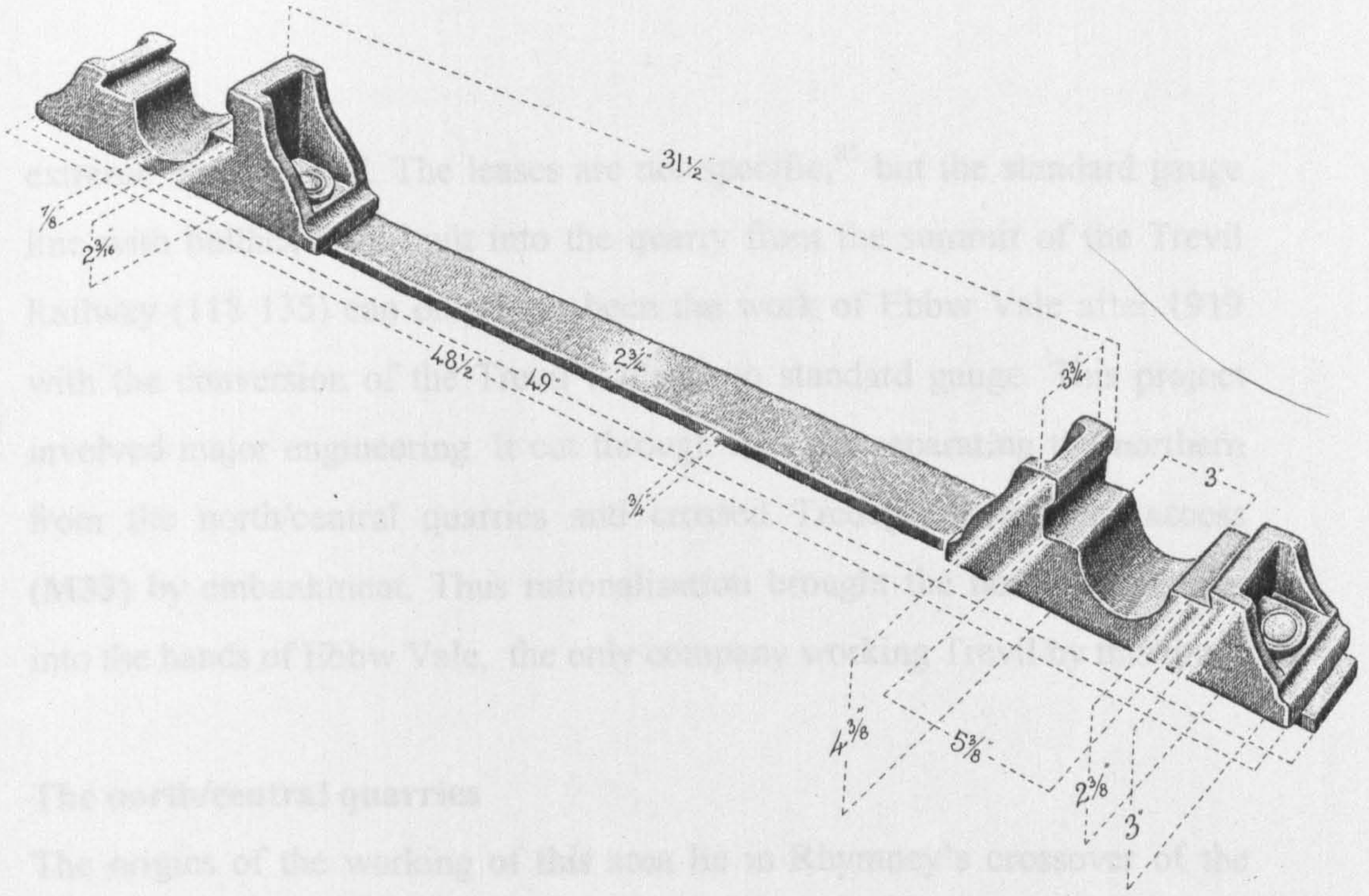


Fig. 87. Chairs for wrought-iron plate with wrought-iron tie from Trevil quarries (1170 1411)

Plate 27. Trevil: organisation of waste at N33

extreme northern end. The leases are not specific,[85] but the standard gauge line with bullhead rail built into the quarry from the summit of the Trevil Railway (118 135) can only have been the work of Ebbw Vale after 1919 with the conversion of the Trevil Railway to standard gauge. This project involved major engineering. It cut through the spur separating the northern from the north/central quarries and crossed Tredegar's southern access **(M33)** by embankment. Thus rationalisation brought the northern quarries into the hands of Ebbw Vale, the only company working Trevil by this time.

The north/central quarries

The origins of the working of this area lie in Rhymney's crossover of the Tredegar line at **L29**. Here, in 1829, there was a quarry with two branches **(L29a)**, the northern of which, now worked by Tredegar, had snaked by 1872-85 as far as **M36**. The 1879 lease[86] allowed Tredegar 60 acres which, being twice the area of the northern quarries, must include the north/central quarries. This lease also refers to Ebbw Vale takings which suggests that they might also have worked it. Following the 1890 Ebbw Vale lease[87] nothing was done here for a time, but by 1915 there was a little working from the Trevil Railway. Between then and closure, however, this was the main source of limestone, with more stone taken than in all the quarries in the previous 140 years. By this time the northward quest for limestone was nearing its limits. The railway to this quarry was to form the basis for the extension built by Richard Thomas & Company to Chwar yr Hendre to the north.[88]

Sand quarries

---

[85] NLW Badminton II 3841, 6099
[86] NLW Badminton II 7056
[87] NLW Badminton II 3859
[88] An embankment at the summit of this extension blocked the old Rhymney access to the quarries

A little south-west of the limestone lay sand deposits, worked in a small way by 1813 via the Tredegar Tramroad and probably used for refractory bricks. By 1872-85 working had switched to the west side of Nant Trefil, with a tramroad branch passing through a tunnel under the Tredegar Tramroad **(M38)**. In 1890 the area was leased to Ebbw Vale[89] and to keep the workings dry a leat **(M39)** was dug to divert Nant Trefil.[90] Another area at 1196 1228, leased to Tredegar from 1885,[91] was served by a branch of the Tredegar Tramroad. It was still in operation in 1898-99 but was abandoned by 1915.

---

[89] NLW Badminton II 3859
[90] 1171 1332 to 1201 1269
[91] NLW Badminton 3858

CHAPTER 10
TWYNAU GWYNION

At Twynau Gwynion the outcrop of the Dowlais Limestone is less than half a kilometre wide, but the quarries extend in a shallow crescent running from the south-east to the north-west for over a kilometre. The dip is to the south-east, which totally dictated the method of quarrying. The discovery of limestone here perhaps resulted from the need to find ganister to build Dowlais furnaces. Ganister is the term applied to a hard siliceous rock used normally for manufacturing refractory bricks. The most famous were the Dinas bricks from the Vale of Neath, where ganister was first discovered by Weston Young who mixed the siliceous sandstone with lime. Dowlais bricks, although not as renowned, were well known,[1] and much of the rock used came from Twynau Gwynion, where ganister occurred immediately west of the head of Nant Morlais.[2] Before the arrival of crushers it must be presumed that the rock was cut and shaped into bricks; the Ebbw Vale ledger refers in 1794[3] to 'dressed firebricks 15349 @ 35s [per 1000].'

The quarries lay on the Marquis of Bute's estate. The history of their development is very complex. To summarise, they were worked by Dowlais in a small way from the 1790s and on a larger scale from 1800, when they became its only source of limestone, until 1825 when it left for Morlais (east). From about 1800 Dowlais shared them with Rhymney; in 1825 Bute Ironworks took them over from Dowlais; and in 1835 Rhymney and Bute amalgamated. Twynau Gwynion was the sole source of limestone for Rhymney from 1852, when it gave up Trevil, until 1891 when it closed. But the history is not as clear-cut as one would like because the evidence

---

[1] Havard 1912, 30-40
[2] Throughout this chapter and its maps, reference numbers to ganister quarries are distinguished by the suffix **G**
[3] GRO D.2472.3

depends largely on archaeology and on maps, of which there is a dearth between 1830 and 1875.[4] All or parts of six lines can be traced to the quarries, and it may be easiest to deal with each of them and the quarries they served in turn.

Dowlais Quarries

The lease of 1763 from the Dowager Viscountess of Windsor[5] to the partners of the Dowlais works included all quarries on the commons or wastes of Merthyr and Gellygaer. By 1795, and probably by 1792, Dowlais had a tramroad running roughly north from the ironworks to coal and ironstone workings a little short of Pengarnddu[6] from where the possibility of extending to Twynau Gwynion would be apparent. In 1800 it was noted that 'The Dowlais Co. get their lime about 2 Miles to the Eastern end of Castle Morlais & have also a dram road to their Works,'[7] which can only mean Twynau Gwynion. This tramroad, as will become apparent, was engineered by George Overton in 1800, the same year that Dowlais finally gave up their quarry at Morlais (west). But there is evidence of a Dowlais presence at Twynau Gwynion even before then.

Line 1

All three of the tramroads from Dowlais to Twynau Gwynion shared a common route from the ironworks, which appears first on the OS draft map of 1813 and on a rough sketch map of about the same date which marks 'the

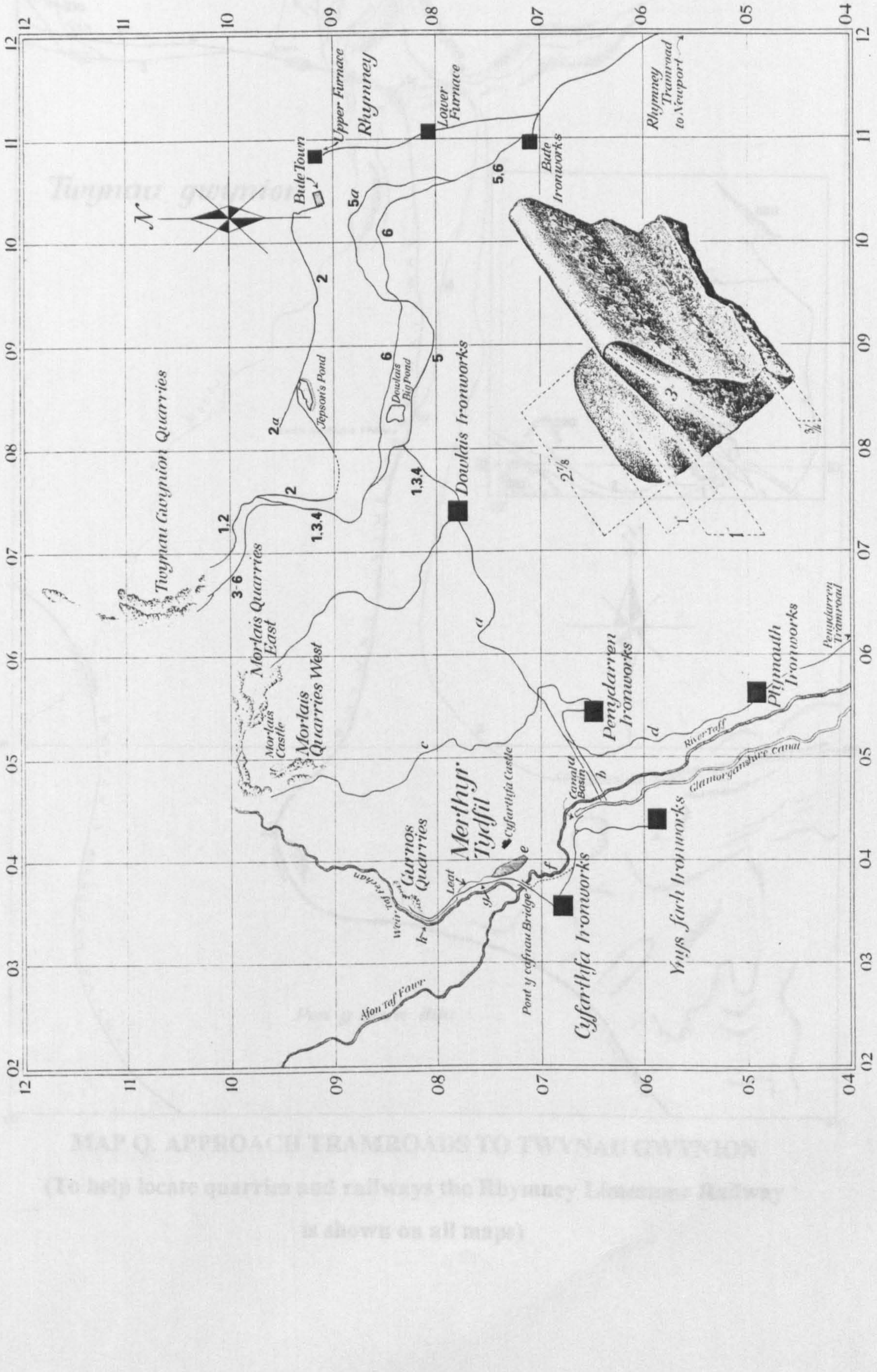
---

[4] OS 1830 and 1875

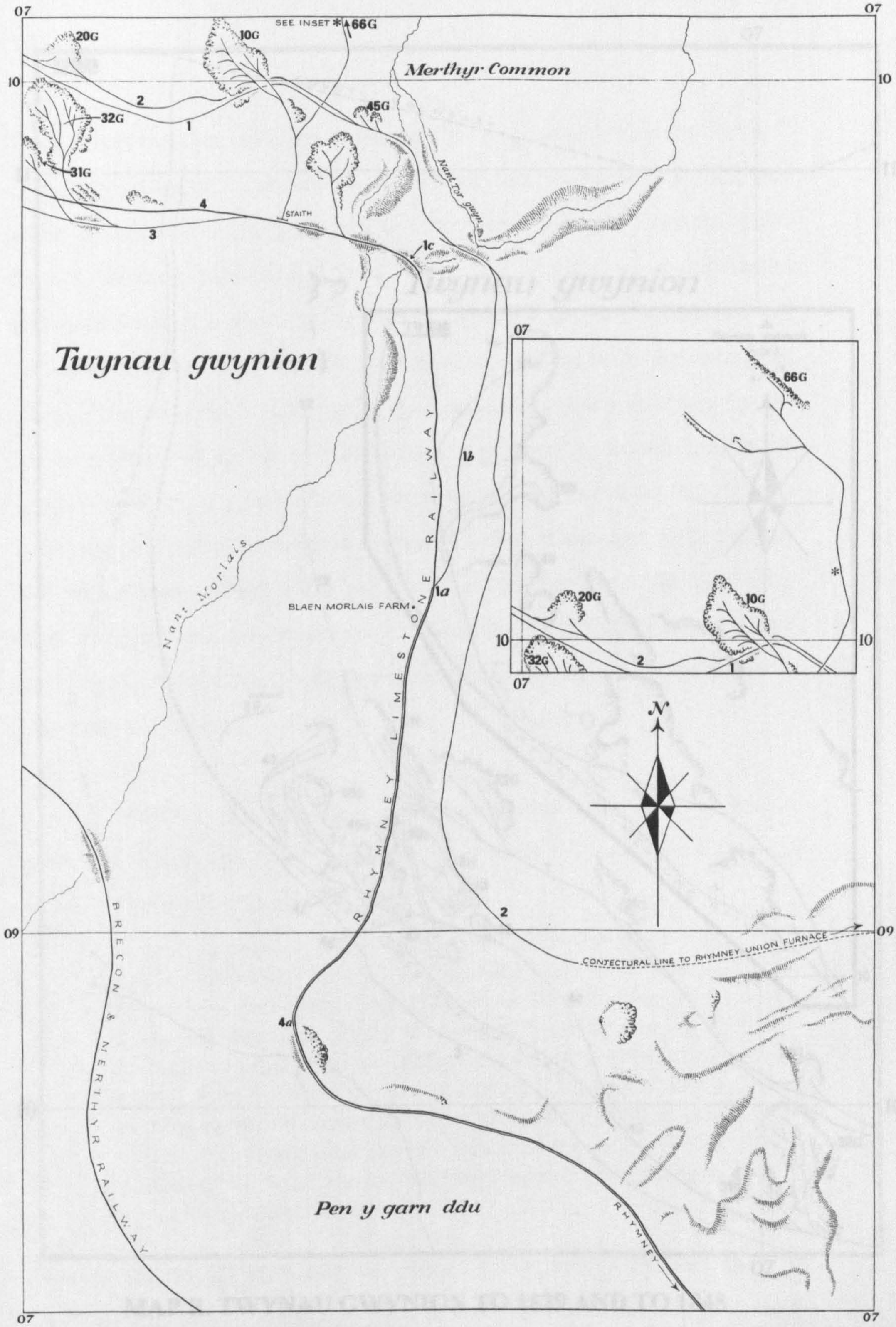
[5] She died in 1776, her son-in-law being Lord Mountstewart who became the first Marquis of Bute.

[6] 0769 0868. Plan in GlamRO cited by the late John Owen in pers. comm. (possibly that referred to in Owen 1977, 150), but not found in GlamRO

[7] BRL (Journal). The date of c.1820 for the opening of Twynau Gwynion given by Lewis 1975, 10 is much too late

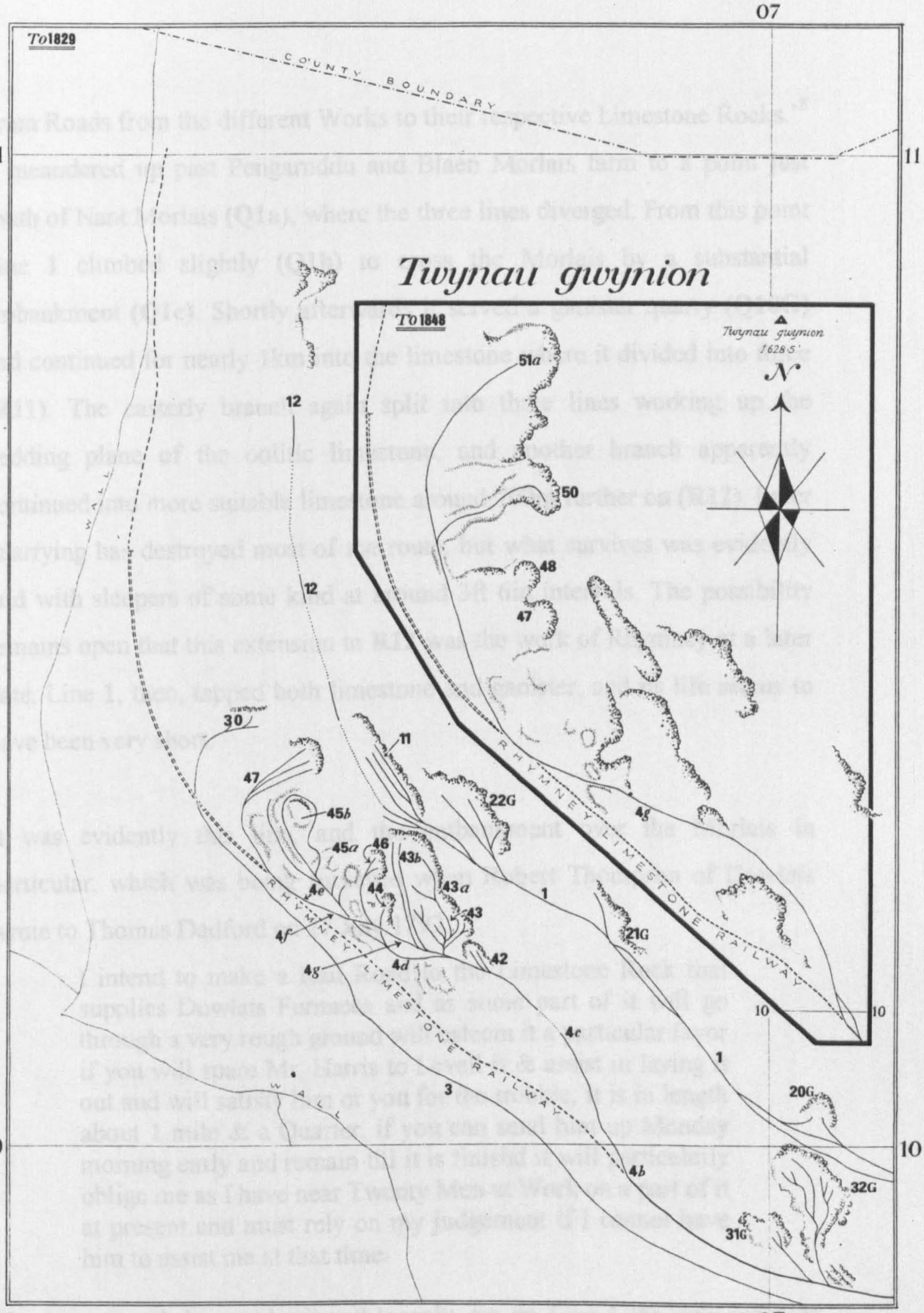


MAP P. TRAMROADS BETWEEN RHYMNEY AND MERTHYR TYDFIL



MAP Q. APPROACH TRAMROADS TO TWYNAU GWYNION

(To help locate quarries and railways the Rhymney Limestone Railway is shown on all maps)



MAP R. TWYNAU GWYNION TO 1829 AND TO 1848

(To help locate quarries and railways the Rhymney Limestone Railway is shown on all maps)

Tram Roads from the different Works to their respective Limestone Rocks.'[8] It meandered up past Pengarnddu and Blaen Morlais farm to a point just south of Nant Morlais **(Q1a)**, where the three lines diverged. From this point Line **1** climbed slightly **(Q1b)** to cross the Morlais by a substantial embankment **(Q1c)**. Shortly afterwards it served a ganister quarry **(Q10G)** and continued for nearly 1km into the limestone where it divided into three **(R11)**. The easterly branch again split into three lines working up the bedding plane of the oolitic limestone, and another branch apparently continued into more suitable limestone around 700m further on **(R12)**. Later quarrying has destroyed most of the route, but what survives was evidently laid with sleepers of some kind at around 3ft 6in intervals. The possibility remains open that this extension to **R12** was the work of Rhymney at a later date. Line 1, then, tapped both limestone and ganister, and its life seems to have been very short.

It was evidently this line, and the embankment over the Morlais in particular, which was being surveyed when Robert Thompson of Dowlais wrote to Thomas Dadford on 27 July 1792:[9]

> I intend to make a Rail Road to the Limestone Rock that supplies Dowlais Furnaces and as some part of it will go through a very rough ground will esteem it a particular favor if you will spare Mr. Harris to Levell it & assist in laying it out and will satisfy him or you for the trouble; it is in length about 1 mile & a Quarter, if you can send him up Monday morning early and remain till it is finishd it will particularly oblige me as I have near Twenty Men at Work on a part of it at present and must rely on my judgement if I cannot have him to assist me at that time

Thompson used the word railroad loosely, for on Line **1** the only piece of hardware found is a fragment of plate with semicircular end and downward-

---

[8] NLW Ashburnham II 243.
[9] GlamRO Dowlais Letter Book, 27 July 1792

projecting sleeve from near the turnout at **R11 (Fig. 88)**; the other end would have a matching concavity and perhaps another sleeve; and it would seem, from the sleeper marks noted above, that it was originally 3ft 6in long. At that length, the plate when complete would weigh about 35lb.

This introduces us to a fruitful and hitherto largely untapped source.[10] In 1800 James Watt and his son visited South Wales and showed a considerable interest in railroads and tramroads, fired perhaps by their casting in 1798-9 of fish-belly edge rails for Walker colliery near Newcastle.[11] When they were at Merthyr, James Watt junior's journal refers to 'Homfray's Old dram Roads' as being 'not of the description which is now thought most perfect' (that is, the Outram type):

> Rails 4ins broad overall, ½in thick & 3 ft 6in long, the feather 2½ins deep & about ⅜ thick. Distance between the rails outside 28½ ins. Form of the rail & joining as per Sketch & laid upon wooden sleepers **[Fig. 113]**.[12]

Although not identical to our specimen, this type is similar, as is the type from the Swansea area claimed by Hughes to date from 1776.[13] Whatever the case for or against that date, we have at Twynau Gwynion a plate weighing about 30lb/yd, clearly derived from the Curr type, and in use well before 1800. It is too early for Rhymney; Homfray of Penydarren had no access to Twynau Gwynion; and Dowlais and Thompson's limestone line of 1792 is therefore the only possible source.

---

[10] Only Gantee 1993 has, I think, used it

[11] Skempton and Andrews 1976-77

[12] BRL (Observations). He also sketched a similar type he saw at Neath Abbey (Journal). In 1826-7 Oeynhausen and Dechen (1971, 63) saw a lapped type of similar description at Landore Colliery: 'At one end of each rail there is a circular addition which projects 1⅛in., and in which there is a conical hole the larger diameter of which is 2¼ in. On the other end of each rail there is a conical piece on the underside which fits into the hole in the next following rail. Through these pieces there is a hole, through which a wooden peg is driven in order to fasten both rails to the wooden sleeper'

[13] Hughes 1990, 172 Fig. 92a

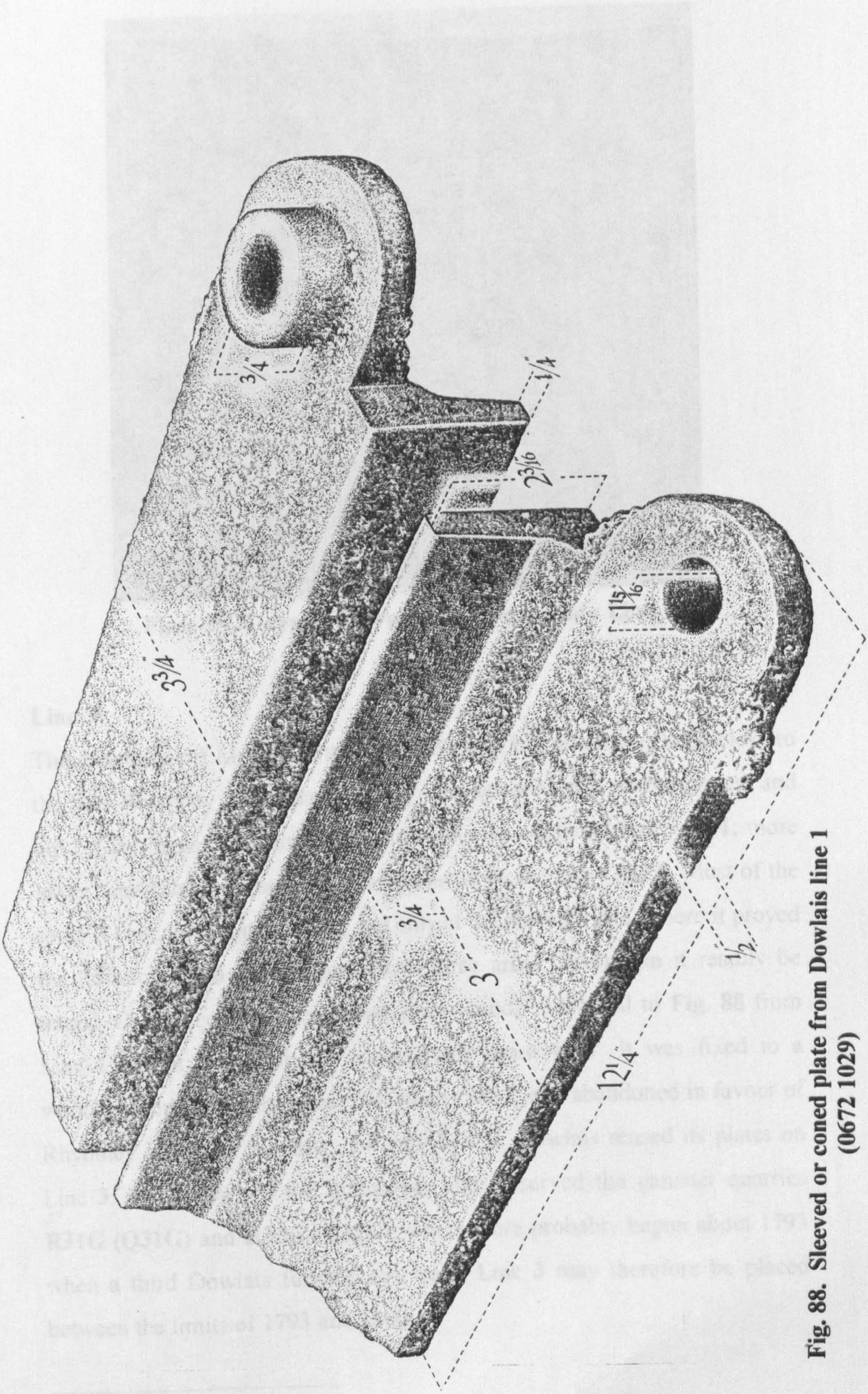


Fig. 88. Sleeved or coned plate from Dowlais line 1 (0672 1029)

Plate 28. Twynau Gwynion. Workings into Line 1

Line 3

This branched off Line **1** to run west and north but at a lower level close to the later Rhymney Limestone Railway. It is attested only on the ground and not by any maps or documents. Possibly it was contemporary with **1**; more likely Line **1**, after a short life, was replaced by the new Line **3**. Most of the route is covered by later works, and only at the northern end, where it proved the limestone in a small quarry with three arms **(R30)**, can it readily be traced. One piece of tramplate has been found,[14] identical to **Fig. 88** from Line **1** except that it shows considerably more wear. It was fixed to a wooden sleeper. It seems clear that when Line **1** was abandoned in favour of Rhymney (see Line **2** below), or even before, Dowlais reused its plates on Line **3**. On its way to the limestone, Line **3** served the ganister quarries **R31G (Q31G)** and **R32G (Q32G)**, which were probably begun about 1793 when a third Dowlais furnace was built. Line **3** may therefore be placed between the limits of 1793 and 1800.

---

[14] 0662 1011

Plate 29. Twynau Gwynion. The cut through 4 to 31G

Line 4

This is firmly dated by George Overton, writing in 1825:[15]

> About 25 years ago [1800] I made a tramroad ... not more than two feet and a half wide from the Dowlais Company's limestone quarries to their blast furnaces ... the total length being about 3 miles, and the fall about fifteen inches per chain. Upon this road each horse hauled regularly a weight of nine or ten tons, and took the empty carriages back. This continued to be the case for many years; in fact, until that road was diverted, and a new quarry opened.

This is borne out by Watt who was on the spot in 1800:[16]

> Mr Guest [of Dowlais] ... says that upon the present Dramroad, 2ft 6 wide with a slope of ¾ Inch in a Yard which they have laid part of the way to their Lime Works, 1 horse does as much as three upon the old [Dowlais] Railroad.

---

[15] Overton 1825, quoted by Marshall 1938, 87-88. The conclusion of Lewis 1975, 4-5 that Overton was referring to the line to Morlais cannot be sustained: that line was not altered, nor a new quarry opened, before 1825

[16] BRL (Journal)

The ¾ inch in a yard given by Guest is 1:48, the gradient quoted by Overton is 1:53, and both agree with that estimated from contoured maps. Overton's distance of three miles is correct. Overton's date for the closure of the line chimes with Dowlais' final departure for Morlais (east) in 1825, which will be discussed in Chapter 11. There can be no doubt that both Overton and Watt are talking of the tramroad to Twynau Gwynion.

Much of Line **4** lies under the Rhymney Limestone Railway. But, at the two extremities **(Q4a** and **R4b),** similar Outram-type blocks survive *in situ* **(Figs. 89-90)** with holes 3ft apart transversely, which agrees reasonably both with the gauge used on the Dowlais coal and ironstone lines of 2ft 8in or 2ft 8½in over the flanges,[17] and with Overton's figure of 2ft 6in between flanges.[18] Although the longitudinal spacing of the holes varies, the length of plates was almost certainly 43½ and 47in.[19]

In 1813 there were three limestone quarries served by a loop **(R4c,** abandoned by Rhymney after 1848) starting from **R4b** where the stone blocks were excavated. After a 150m stretch where they have been lifted they resume *in situ.* The first quarry **(R42)** follows the bedding plane north-westwards from **R4c** by parallel lines terminating at shallow faces in the oolitic limestone, which was not a good flux. The second quarry **(R43)** is more sophisticated, with branches swinging into the line of strike and then turning alongside the face for easy loading. The most northerly branch up into the bedding plane **(R43a)** even nibbled slightly into the abandoned Line **1.** Quarrying then began slightly west by two more parallel branches **(R43b)**

---

[17] Drawings in GlamRO D/D G Plans 128 and 134 give the gauge of Dowlais coal trams between the wheels as 2ft 9in or 2ft 9½in. The rail gauge over the flanges would be about an inch less

[18] Overton gives the Penydarren Tramroad gauge as 4ft 2in, which is correct between the flanges. Presumably he measured the Twynau Gwynion gauge in the same way, giving 2ft 8in over the flanges

[19] The gap of 11ft 8in would neatly take two 47in plates and one 43½in

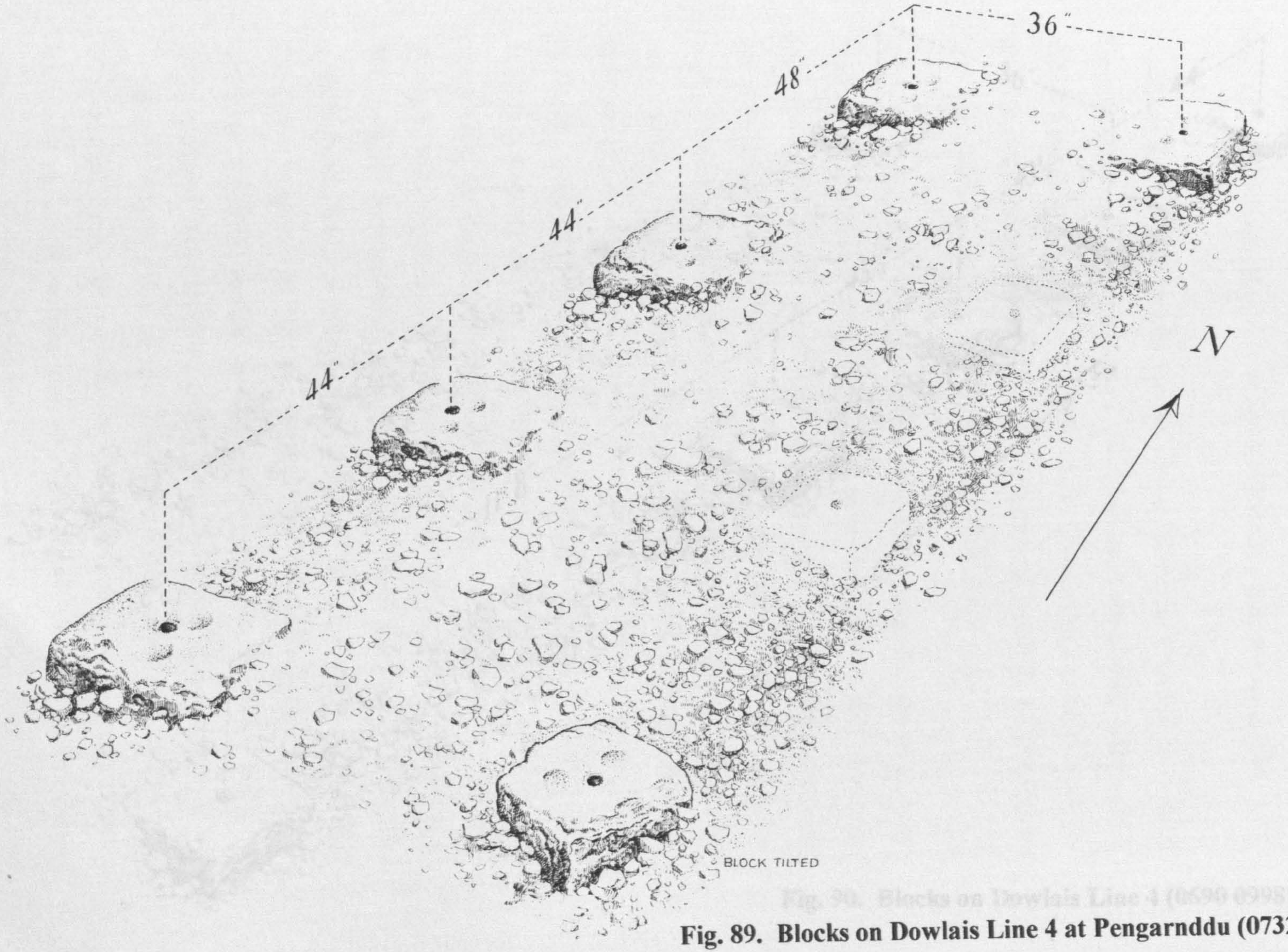


Fig. 89. Blocks on Dowlais Line 4 at Pengarnddu (0732 0892)

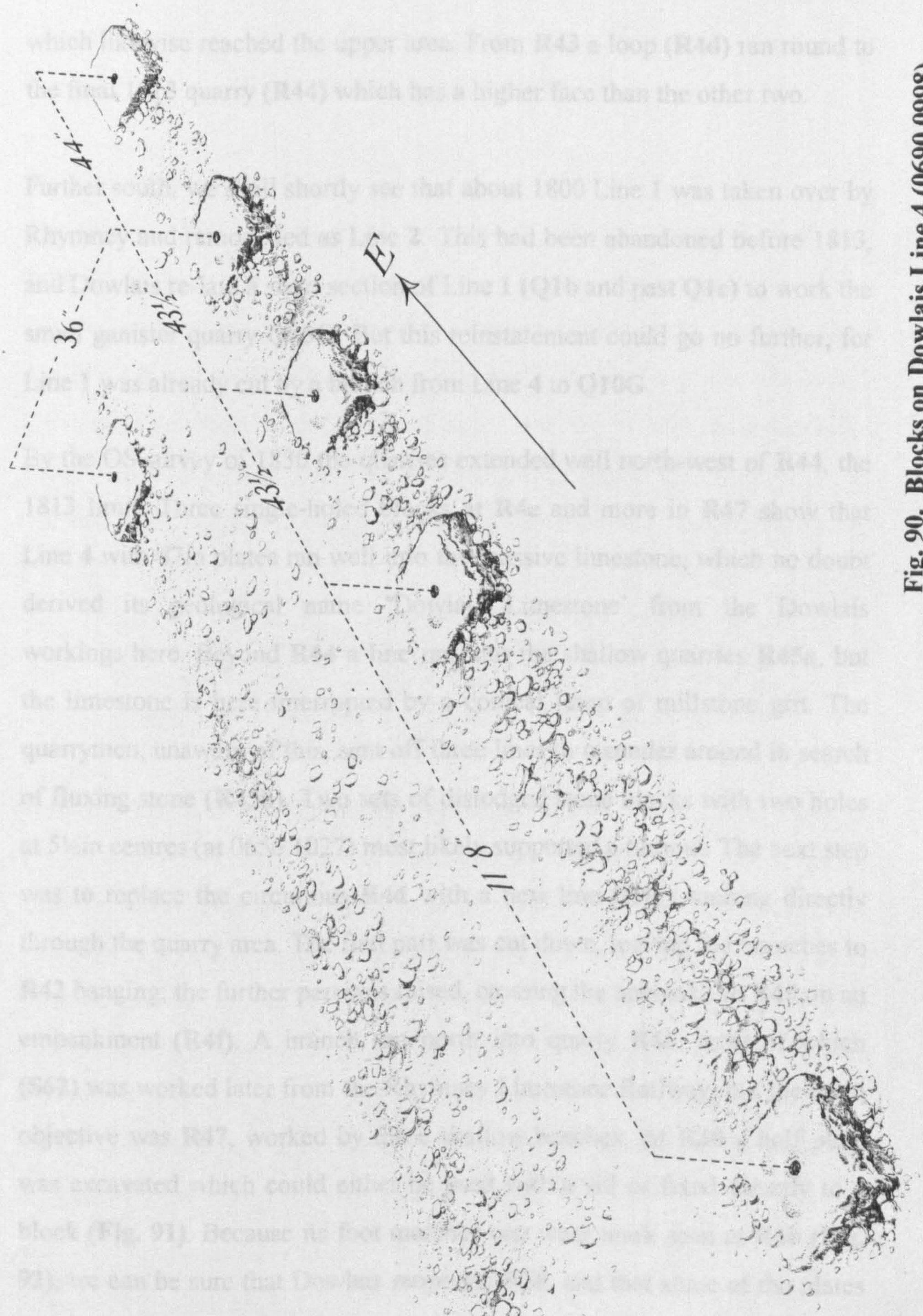


Fig. 90. Blocks on Dowlais Line 4 (0690 0998)

which likewise reached the upper area. From **R43** a loop **(R4d)** ran round to the final 1813 quarry **(R44)** which has a higher face than the other two.

Further south, we shall shortly see that about 1800 Line **1** was taken over by Rhymney and remodelled as Line **2**. This had been abandoned before 1813, and Dowlais re-laid a short section of Line **1 (Q1b** and past **Q1c)** to work the small ganister quarry **Q45G**. But this reinstatement could go no further, for Line **1** was already cut by a branch from Line **4** to **Q10G**.

By the OS survey of 1830 the quarries extended well north-west of **R44**, the 1813 limit. Three single-holed blocks at **R4e** and more in **R47** show that Line **4** with 47in plates ran well into the massive limestone, which no doubt derived its geological name 'Dowlais Limestone' from the Dowlais workings here. Beyond **R44** a line ran into the shallow quarries **R45a**, but the limestone is here interrupted by a conical lump of millstone grit. The quarrymen, unaware of this, sent off three lines to meander around in search of fluxing stone **(R45b).** Two sets of dislodged stone blocks with two holes at 5½in centres (at 0656 1027) most likely supported a turnout. The next step was to replace the circuitous **R4d** with a new line **(R4g)** running directly through the quarry area. The first part was cut down, leaving the branches to **R42** hanging; the further part was raised, crossing the approach to **R45** on an embankment **(R4f)**. A branch ran north into quarry **R46**, most of which **(S62)** was worked later from the Rhymney Limestone Railway, but the main objective was **R47**, worked by three shallow benches. At **R30** a half plate was excavated which could either be used with a sill or fixed directly to a block **(Fig. 91)**. Because its foot matches one wear mark seen at **R4b (Fig. 92)**, we can be sure that Dowlais reopened **R30**, and that some of the plates on Line **4** were dual-purpose ones. A full-length 4ft plate of a similar design, with a massive rib and weighing an extraordinary 100lb (see **App. 4**), was

found close by. In the letter quoted in Chapter 9, Overton mentions his dovetailed sills at Dowlais.[20] This reference and these finds suggest that Overton used dovetailed sills here as early as 1800.

The departure of Dowlais

The Marquis of Bute was, not to overstate it, unhappy about the small rent paid by Dowlais for the untold riches of his estate; and his discontent resulted both in the creation in 1825 of the Bute Ironworks near Rhymney and in a dispute with Guest of Dowlais over Twynau Gwynion, which was the nearest limestone to the proposed Bute furnaces. In 1824 his agent David Stewart made a survey,[21] as a result of which he wrote on 24 June 1825 to Thomas Johnson, his assistant, quoting a letter he had received from the Marquis:[22]

> Pray if we were to beat him [Guest of Dowlais] from Senghenith Limestone [Twynau Gwynion], could he get Plymouth [Morlais (west)] or any other Limestone, without laying a tramroad over the Common — because we could prevent him doing so for that purpose.

Stewart asked Johnson to seek specialist advice from one of the Formans of Penydarren ironworks;[23] and this was evidently how the Bute estate hounded Dowlais out of Twynau Gwynion and forced them to open Morlais (east)[24] rather than revert to their previous quarry at Morlais (west). As we saw, Overton said in 1825 of the Twynau Gwynion Tramroad, 'this continued to be the case for many years; in fact, until that road was diverted, and a new quarry opened.' It seems likely, therefore, that Dowlais moved out immediately, although it did not formally surrender to the Marquis the right to dig limestone at Twynau Gwynion until 1828.[25]

---

[20] Elsas 1960,175
[21] Davies 1981, 32-33, 226
[22] NLW Bute M37/1575
[23] In October 1825 the two Formans and Johnson were to become partners in the Bute ironworks.
[24] GlamRO Dowlais Iron Company papers, plan 74
[25] Lloyd 1906, 43-44

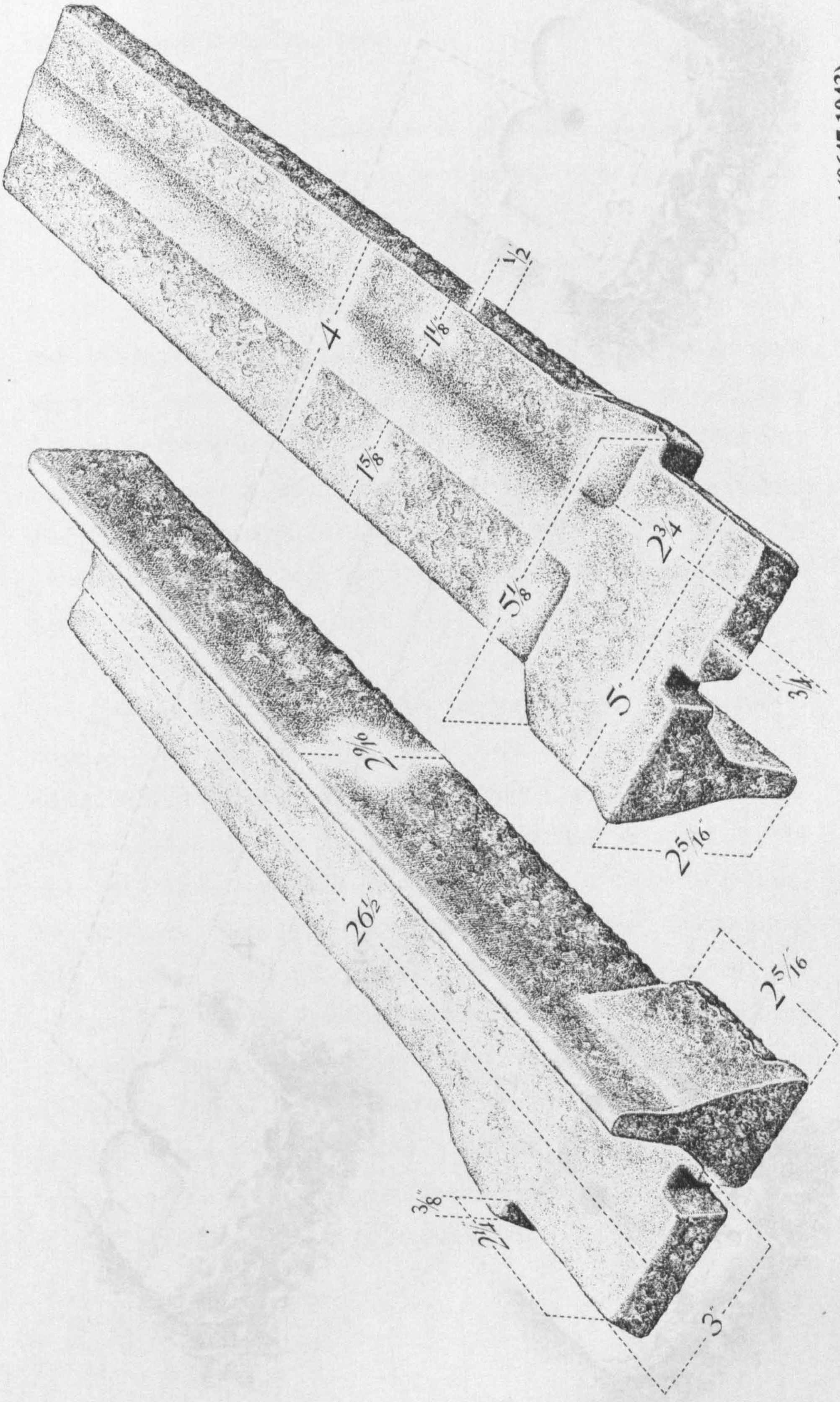


Fig. 91. Dual-purpose plate from Dowlais Line 4 (0647 1043)

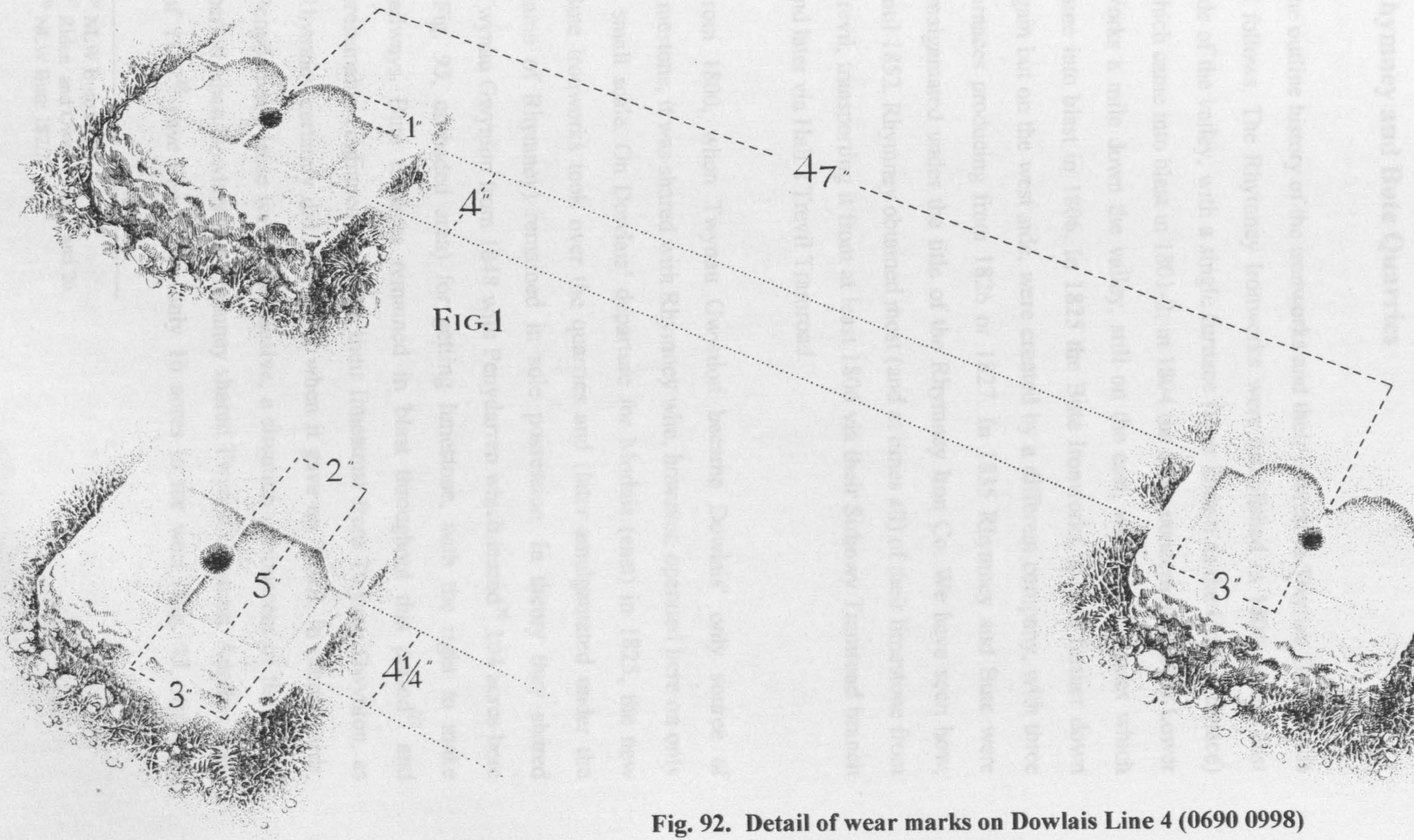


FIG.1

Fig. 92. Detail of wear marks on Dowlais Line 4 (0690 0998)

Rhymney and Bute Quarries

The outline history of the ironworks and their interest in Twynau Gwynion is as follows. The Rhymney Ironworks were established in 1800 on the east side of the valley, with a single furnace (later known as the Upper Furnace) which came into blast in 1801-2; in 1804 the same concern added the Lower Works a mile down the valley, still on the east, with two furnaces which came into blast in 1806. In 1825 the Bute Ironworks, a little further down again but on the west side, were created by a different company, with three furnaces producing from 1826 or 1827. In 1835 Rhymney and Bute were amalgamated under the title of the Rhymney Iron Co. We have seen how, until 1852, Rhymney obtained most (and at times all) of their limestone from Trevil, transporting it from at least 1806 via their Sirhowy Tramroad branch and later via Hall's Trevil Tramroad.

From 1800, when Twynau Gwynion became Dowlais' only source of limestone, it was shared with Rhymney who, however, operated here on only a small scale. On Dowlais' departure for Morlais (east) in 1825, the new Bute Ironworks took over the quarries and (later amalgamated under the name of Rhymney) remained in sole possession. In theory they shared Twynau Gwynion from 1848 with Penydarren which leased[26] 104 acres here (**Fig. 93**, unshaded area) for getting limestone, with the right to make railways. Bute furnaces remained in blast throughout this period[27] and presumably continued to obtain their limestone from Twynau Gwynion, as Rhymney certainly did after 1852 when it gave up Trevil. In other words, Penydarren's lease was not exclusive, a situation reminiscent of the earlier period when Dowlais and Rhymney shared Twynau Gwynion. Another lease of 1857[28] gave Penydarren only 16 acres to the west (**Fig. 93**, stippled),

---

[26] NLW Bute 182/1
[27] Riden and Owen 1995, 7 and 26.
[28] NLW Bute 182/2

leaving Rhymney in sole possession of the quarry area. Penydarren's only access was by the old Dowlais tramroad which, if it were still in place, would require a change of gauge; no new tramroad as permitted by the 1848 lease was built; and Penydarren almost certainly leased the limestone merely as a reserve which it never tapped. It ceased production in 1859 and surrendered the lease. Rhymney remained at Twynau Gwynion until its closure in 1891.

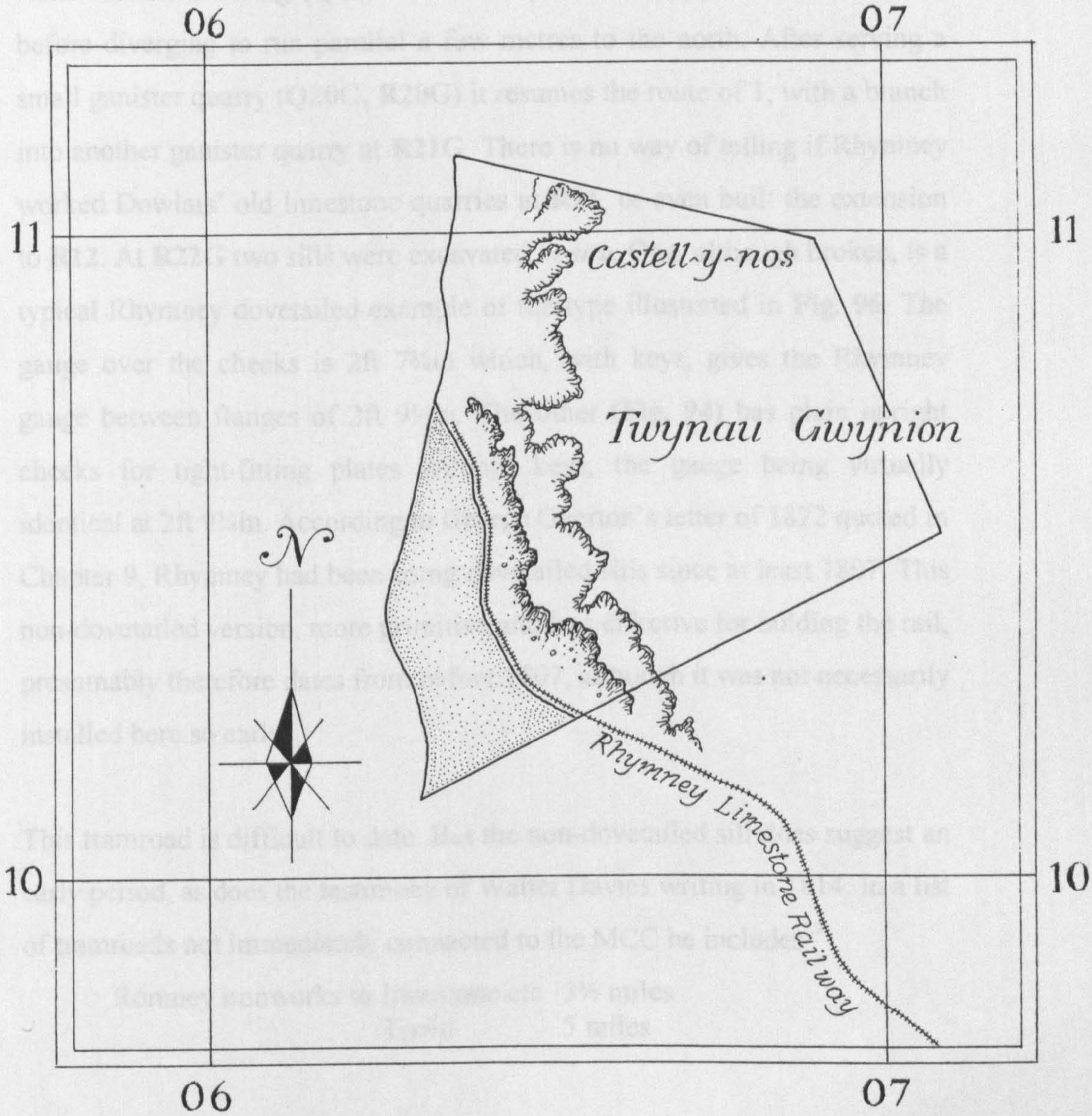


Fig. 93. 1848 and 1857 lease maps combined

Line 2

This line, much of it followed by later leats, ran westwards from the vicinity of the Upper Furnace (see **Map P**) to Jepson's Pond. From this point it had two destinations at different times. The earlier route runs west for around 1km before it disappears among later coal and iron ore workings, emerging on the other side **(Q2)** to join the former Dowlais line **Q1b** just short of the Nant Morlais crossing **(Q1c).** From this point it follows Line **1** for 100m before diverging to run parallel a few metres to the north. After serving a small ganister quarry **(Q20G, R20G)** it resumes the route of **1**, with a branch into another ganister quarry at **R21G**. There is no way of telling if Rhymney worked Dowlais' old limestone quarries at **R11**, or even built the extension to **R12**. At **R22G** two sills were excavated *in situ*. One, although broken, is a typical Rhymney dovetailed example of the type illustrated in **Fig. 96**. The gauge over the cheeks is 2ft 7¾in which, with keys, gives the Rhymney gauge between flanges of 2ft 9½in. The other **(Fig. 94)** has plain upright cheeks for tight-fitting plates without keys, the gauge being virtually identical at 2ft 9¾in. According to George Overton's letter of 1822 quoted in Chapter 9, Rhymney had been using dovetailed sills since at least 1807. This non-dovetailed version, more primitive and less effective for holding the rail, presumably therefore dates from before 1807, although it was not necessarily installed here so early.

This tramroad is difficult to date. But the non-dovetailed sill does suggest an early period, as does the testimony of Walter Davies writing in 1814. In a list of tramroads not immediately connected to the MCC he includes[29]

Romney ironworks to limestone etc	3½ miles
Trevil	5 miles

[29] Davies 1814, 398ff

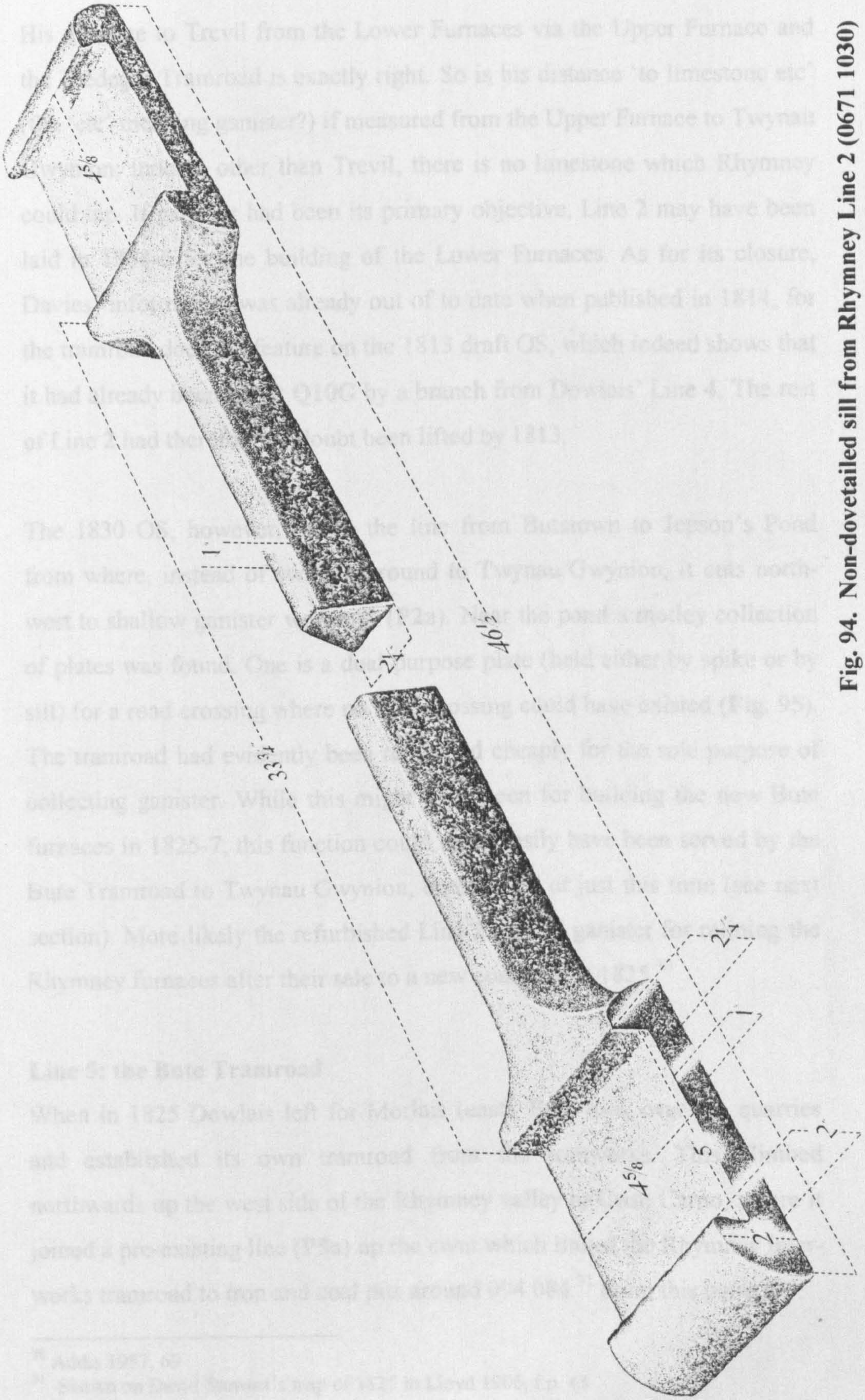


Fig. 94. Non-dovetailed sill from Rhymney Line 2 (0671 1030)

His distance to Trevil from the Lower Furnaces via the Upper Furnace and the Tredegar Tramroad is exactly right. So is his distance 'to limestone etc' (the 'etc' meaning ganister?) if measured from the Upper Furnace to Twynau Gwynion; indeed, other than Trevil, there is no limestone which Rhymney could tap. If ganister had been its primary objective, Line **2** may have been laid in 1804-6 for the building of the Lower Furnaces. As for its closure, Davies' information was already out of to date when published in 1814, for the tramroad does not feature on the 1813 draft OS, which indeed shows that it had already been cut at **Q10G** by a branch from Dowlais' Line **4**. The rest of Line **2** had therefore no doubt been lifted by 1813.

The 1830 OS, however, marks the line from Butetown to Jepson's Pond from where, instead of swinging round to Twynau Gwynion, it cuts north-west to shallow ganister workings **(P2a)**. Near the pond a motley collection of plates was found. One is a dual-purpose plate (held either by spike or by sill) for a road crossing where no road crossing could have existed **(Fig. 95)**. The tramroad had evidently been reinstated cheaply for the sole purpose of collecting ganister. While this might have been for building the new Bute furnaces in 1825-7, this function could more easily have been served by the Bute Tramroad to Twynau Gwynion, constructed at just this time (see next section). More likely the refurbished Line **2** carried ganister for relining the Rhymney furnaces after their sale to a new company in 1825.[30]

Line 5: the Bute Tramroad

When in 1825 Dowlais left for Morlais (east), Bute took over the quarries and established its own tramroad from the ironworks. This climbed northwards up the west side of the Rhymney valley to Cwm Carno, where it joined a pre-existing line **(P5a)** up the cwm which linked the Rhymney inter-works tramroad to iron and coal pits around 094 084.[31] From this point it

---

[30] Addis 1957, 69

[31] Shown on David Stewart's map of 1825 in Lloyd 1906, f.p. 43

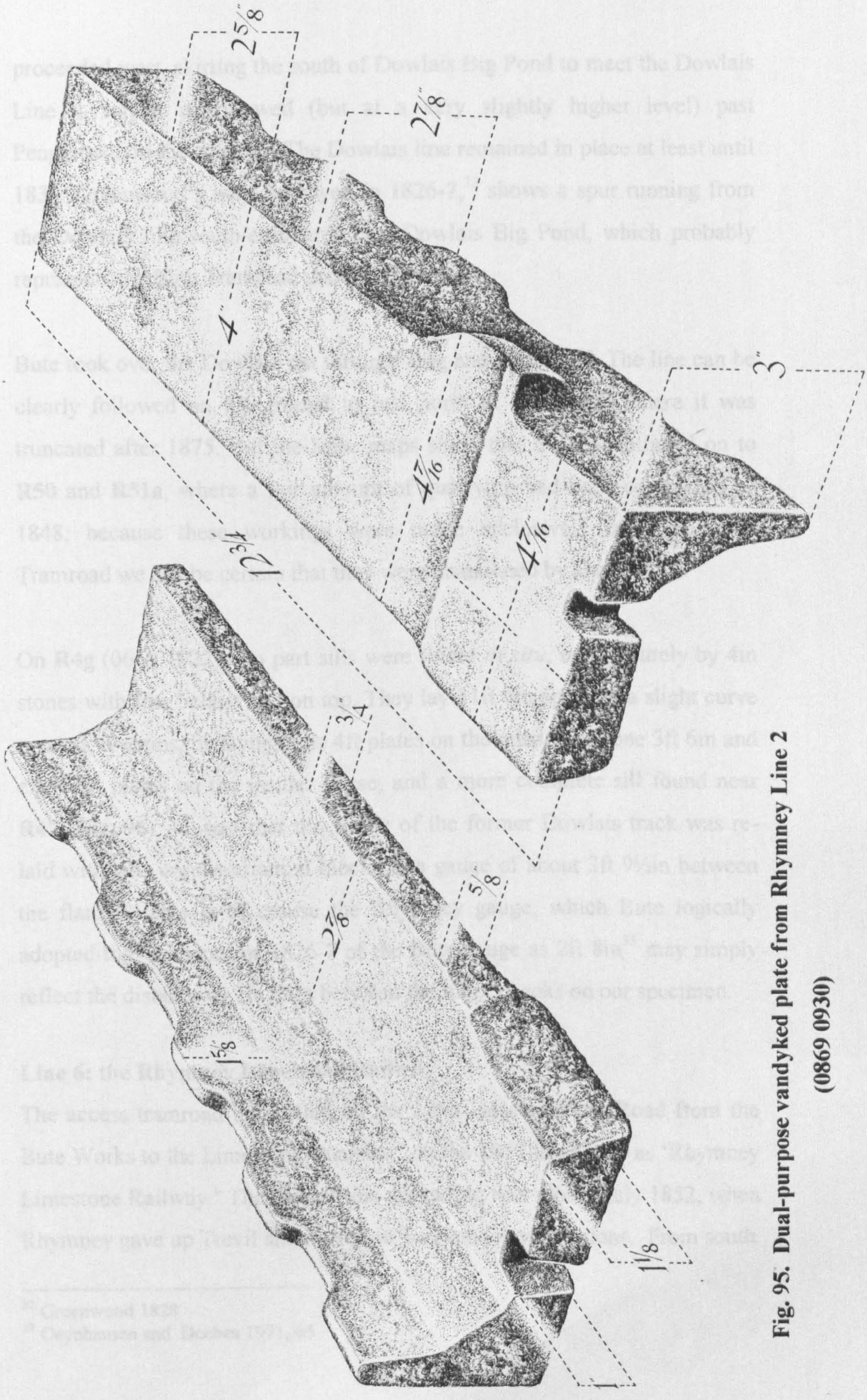


Fig. 95. Dual-purpose vandyked plate from Rhymney Line 2 (0869 0930)

proceeded west, skirting the south of Dowlais Big Pond to meet the Dowlais Line 4, which it followed (but at a very slightly higher level) past Pengarnddu to the quarries. The Dowlais line remained in place at least until 1830. Greenwood's map, surveyed in 1826-7,[32] shows a spur running from the Dowlais line south-eastwards past Dowlais Big Pond, which probably represents the Bute Tramroad under construction.

Bute took over the Dowlais cut through **R4g** and on to **R47**. The line can be clearly followed on the ground to just north of this point, where it was truncated after 1875. But the lease maps show that it was continued on to **R50** and **R51a**, where a fair amount of quarrying had been completed by 1848; because these workings were made exclusively from the Bute Tramroad we can be certain that they were abandoned by about 1852.

On **R4g** (0660 1022) two part sills were found *in situ*, held securely by 4in stones with fine ballast laid on top. They lay 31ft 6in apart on a slight curve created, it seems, by laying nine 4ft plates on the outside but one 3ft 6in and eight 4ft plates on the inside. These, and a more complete sill found near **R47 (Fig. 96)**, suggest that the whole of the former Dowlais track was re-laid with sills on insubstantial blocks to a gauge of about 2ft 9½in between the flanges. This is of course the Rhymney gauge, which Bute logically adopted too. A record of 1826-7 of the Bute gauge as 2ft 8in[33] may simply reflect the distance of 2ft 7¾in between the inner cheeks on our specimen.

Line 6: the Rhymney Limestone Railway

The access tramroad is labelled on the 1848 lease map as 'Road from the Bute Works to the Limestone Quarries,' on the 1857 lease map as 'Rhymney Limestone Railway.' The date of this upgrading was most likely 1852, when Rhymney gave up Trevil and moved to Twynau Gwynion alone. From south

---

[32] Greenwood 1828
[33] Oeynhausen and Dechen 1971, 65

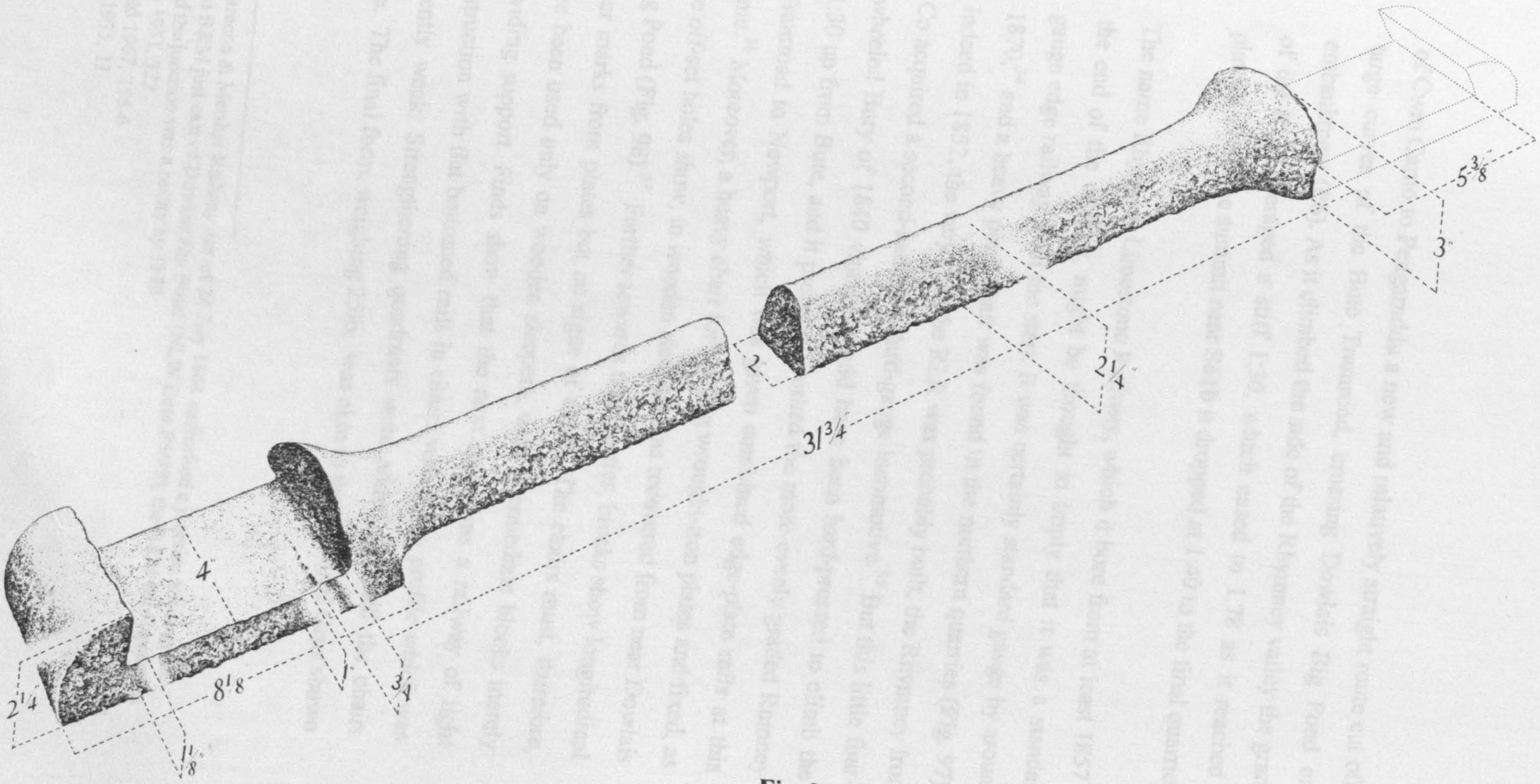


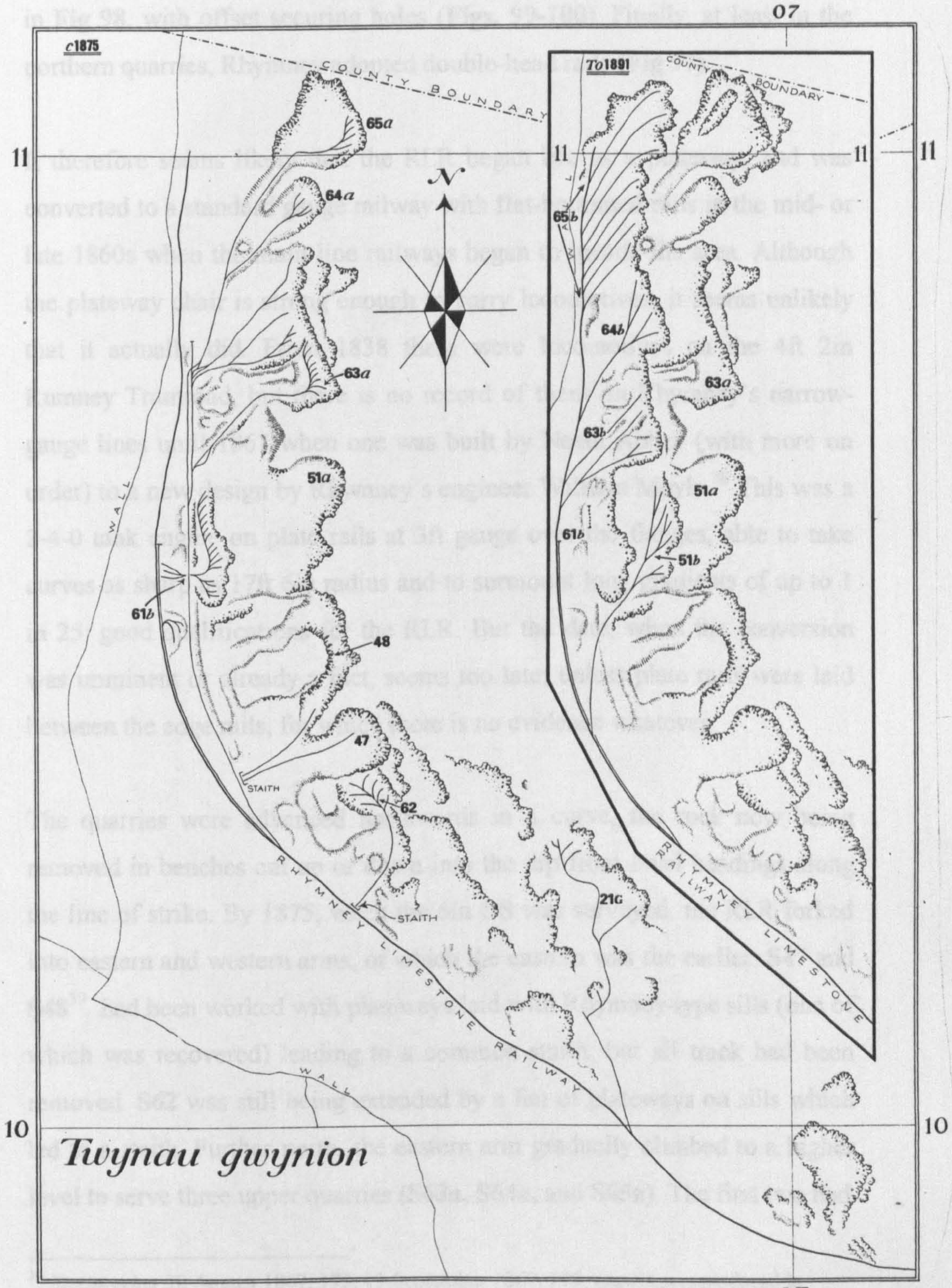
Fig. 96. Sill from the Bute Tramroad (0645 1041)

of Cwm Carno to Pengarnddu a new and relatively straight route cut off two large curves of the Bute Tramroad, crossing Dowlais Big Pond on an embankment **(P6).** As it climbed the side of the Rhymney valley the gradient of the RLR averaged a stiff 1:30, which eased to 1:78 as it reached the plateau. From the summit near **S61b** it dropped at 1:40 to the final quarries.

The name Rhymney Limestone Railway, which it bore from at least 1857 to the end of the century, might be thought to imply that it was a standard gauge edge railway from the start. It was certainly standard gauge by around 1870,[34] and a heavy point chair was found in the northern quarries **(Fig. 97).** Indeed in 1852, the very year the RLR was probably built, the Rhymney Iron Co acquired a second-hand standard-gauge locomotive.[35] But this little four-wheeled Bury of 1840 vintage would have been hard-pressed to climb the 1:30 up from Bute, and it probably worked the more evenly graded Rumney Tramroad to Newport, which was given combined edge-plate rails at this time.[36] Moreover, a heavy chair for holding wrought-iron plates and fixed, as the off-set holes show, to wooden sleepers was recovered from near Dowlais Big Pond **(Fig. 98).**[37] Further towards the quarries, blocks show longitudinal wear marks from plates but no signs of chairs. The chairs must, therefore, have been used only on wooden sleepers, with intermediate blocks merely providing support. Finds show that the next stage was a railway of light construction with flat bottomed rails in chairs with a low profile which was evidently weak. Strengthening quadrants were added, but still the chairs broke. The final form, weighing 25lb, was akin to the tramroad chair shown

---

[34] The Brecon & Merthyr Railway Act of 24 July 1864 authorised a junction between the RLR and B&M just east of Dowlais Big Pond (NLW Bute P5/89); the B&M here opened in 1868 and the junction was a reality by 1875
[35] Tonks 1951, 322
[36] Hadfield 1967, 155-6
[37] Lewis 1975, 11



MAP S. TWYNAU GWYNION c.1875 AND TO 1891

in **Fig 98**, with offset securing holes **(Figs. 99-100)**. Finally, at least in the northern quarries, Rhymney adopted double-head rails **(Fig 97)**.

It therefore seems likely that the RLR began life as a plateway, and was converted to a standard gauge railway with flat-bottomed rails in the mid- or late 1860s when the main line railways began to invade the area. Although the plateway chair is strong enough to carry locomotives, it seems unlikely that it actually did. From 1838 there were locomotives on the 4ft 2in Rumney Tramroad, but there is no record of them on Rhymney's narrow-gauge lines until 1867 when one was built by Neath Abbey (with more on order) to a new design by Rhymney's engineer William Moyle.[38] This was a 2-4-0 tank engine on plate rails at 3ft gauge over the flanges, able to take curves as sharp as 17ft 6in radius and to surmount long gradients of up to 1 in 25: good qualifications for the RLR. But the date, when the conversion was imminent or already a fact, seems too late; unless plate rails were laid between the edge rails, for which there is no evidence whatever.

The quarries were advanced northwards in a curve, the rock now being removed in benches cut up or down into the dip from level headings along the line of strike. By 1875, when the 6in OS was surveyed, the RLR forked into eastern and western arms, of which the eastern was the earlier. **S47** and **S48**[39] had been worked with plateways laid with Rhymney-type sills (one of which was recovered) leading to a common staith, but all track had been removed. **S62** was still being extended by a fan of plateways on sills which led to a staith. Further north, the eastern arm gradually climbed to a higher level to serve three upper quarries **(S63a, S64a, and S65a)**. The first two had

---

[38] *Engineering* 30 August 1867, 173, 13 September 1867, 229; drawings reproduced in *Railway Magazine* June 1941, 249. A Neath Abbey drawing of 1866 of an unrealised design for an 0-4-2ST for Rhymney on the 3ft gauge is in WGlamRO D/D NAI L/39

[39] There had been a little working here by 1848 **(R48)**

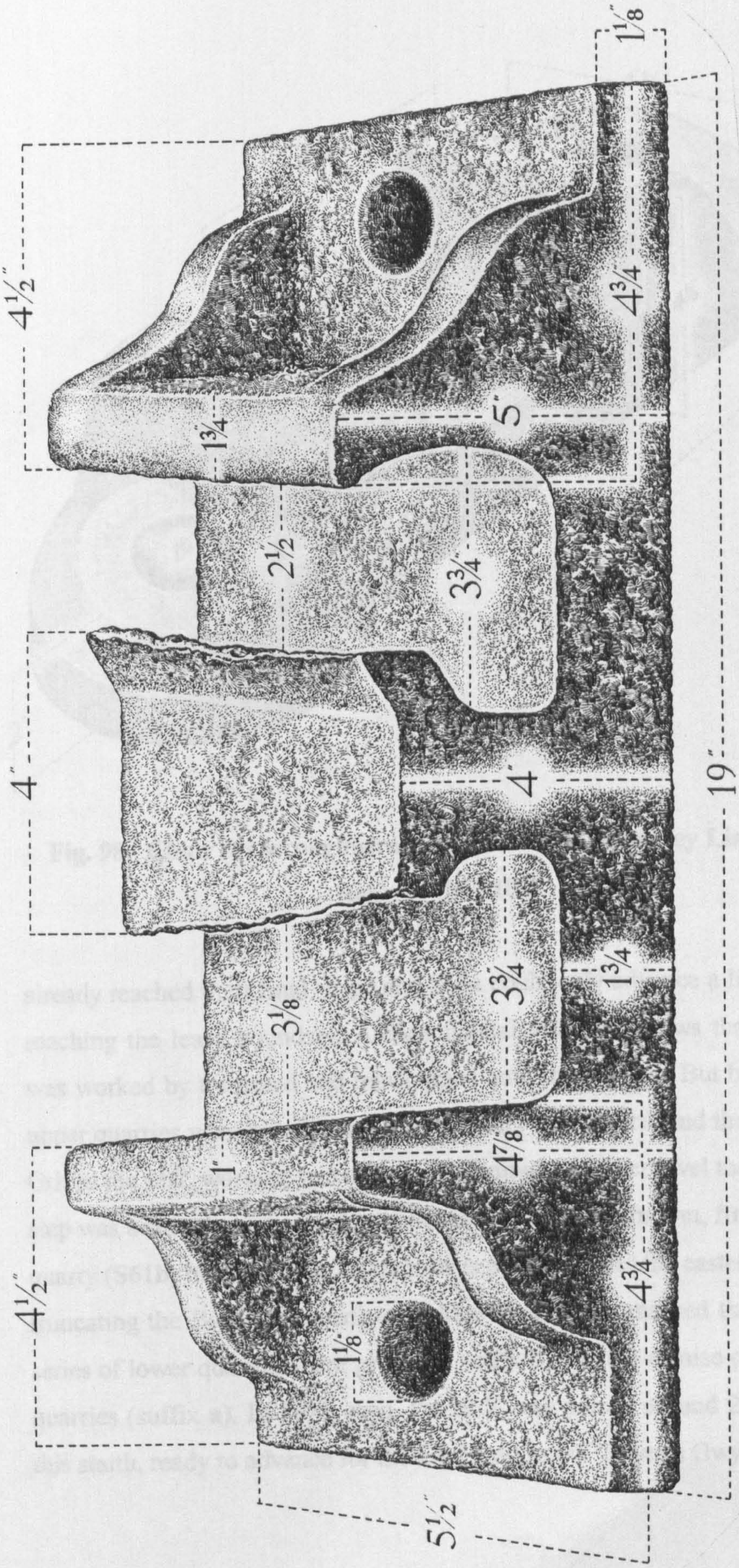


Fig. 97. Point chair from Twynau Gwynion (0839 1096)

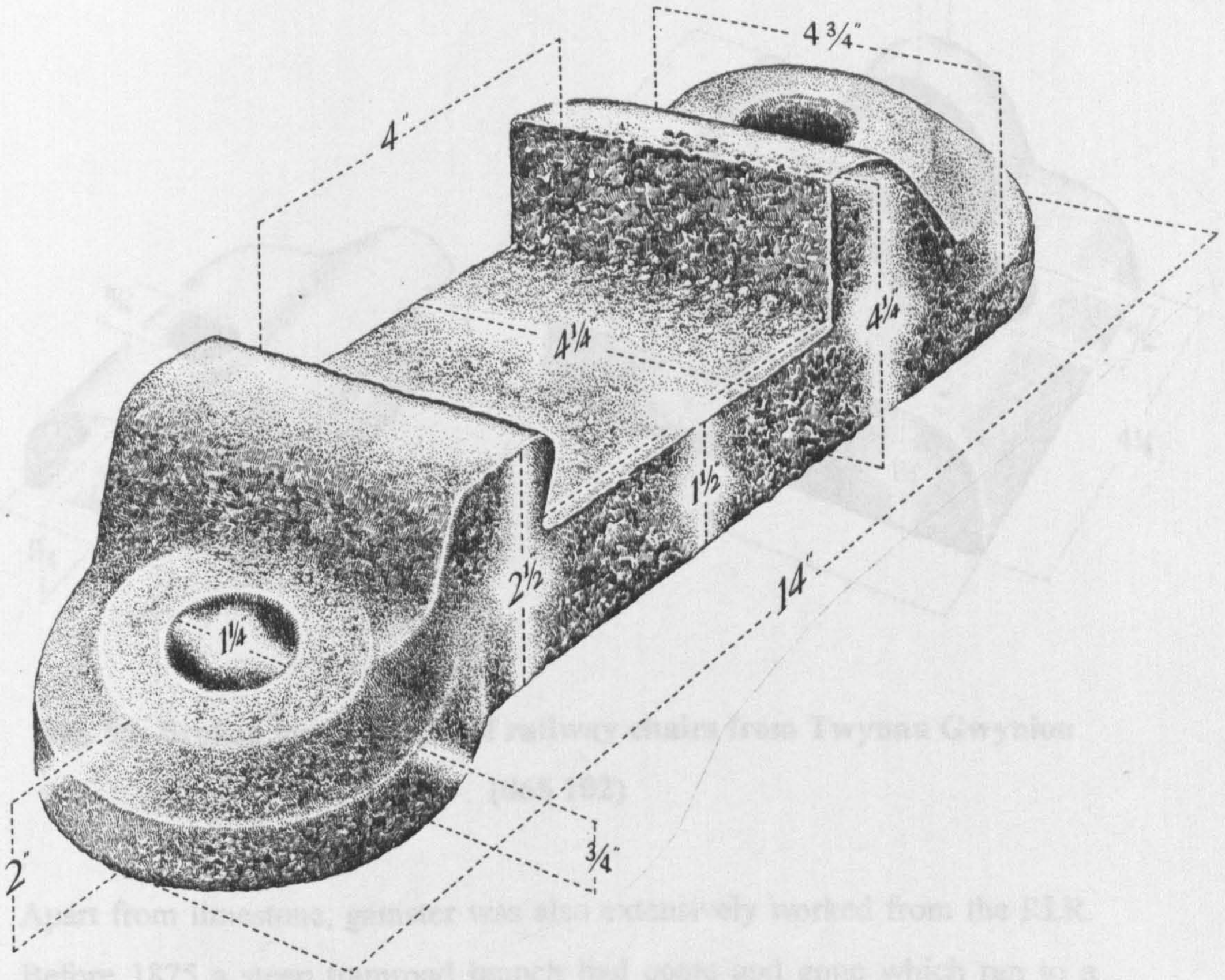


Fig. 98. Chair for wrought-iron plate from the Rhymney Limestone Railway (065 105)

already reached their final shape and **S65a** could only advance a little before reaching the lease boundary. Archaeological evidence shows that the rock was worked by tramroad and transhipped onto the railway. But because the upper quarries were approaching the boundary to the north and the Millstone Grit to the east, working was already beginning at a lower level too. The first step was a short branch which was to become the western arm, from which a quarry (**S61b)** bit into **S51a**, its tramroads passing under the eastern arm (but truncating the Bute Tramroad) to another staith. This marked the start of a series of lower quarries (here given the suffix **b**) and the demise of the upper quarries (suffix **a**). In 1875, then, the RLR was poised around 20m beyond this staith, ready to advance for the final working of Twynau Gwynion.

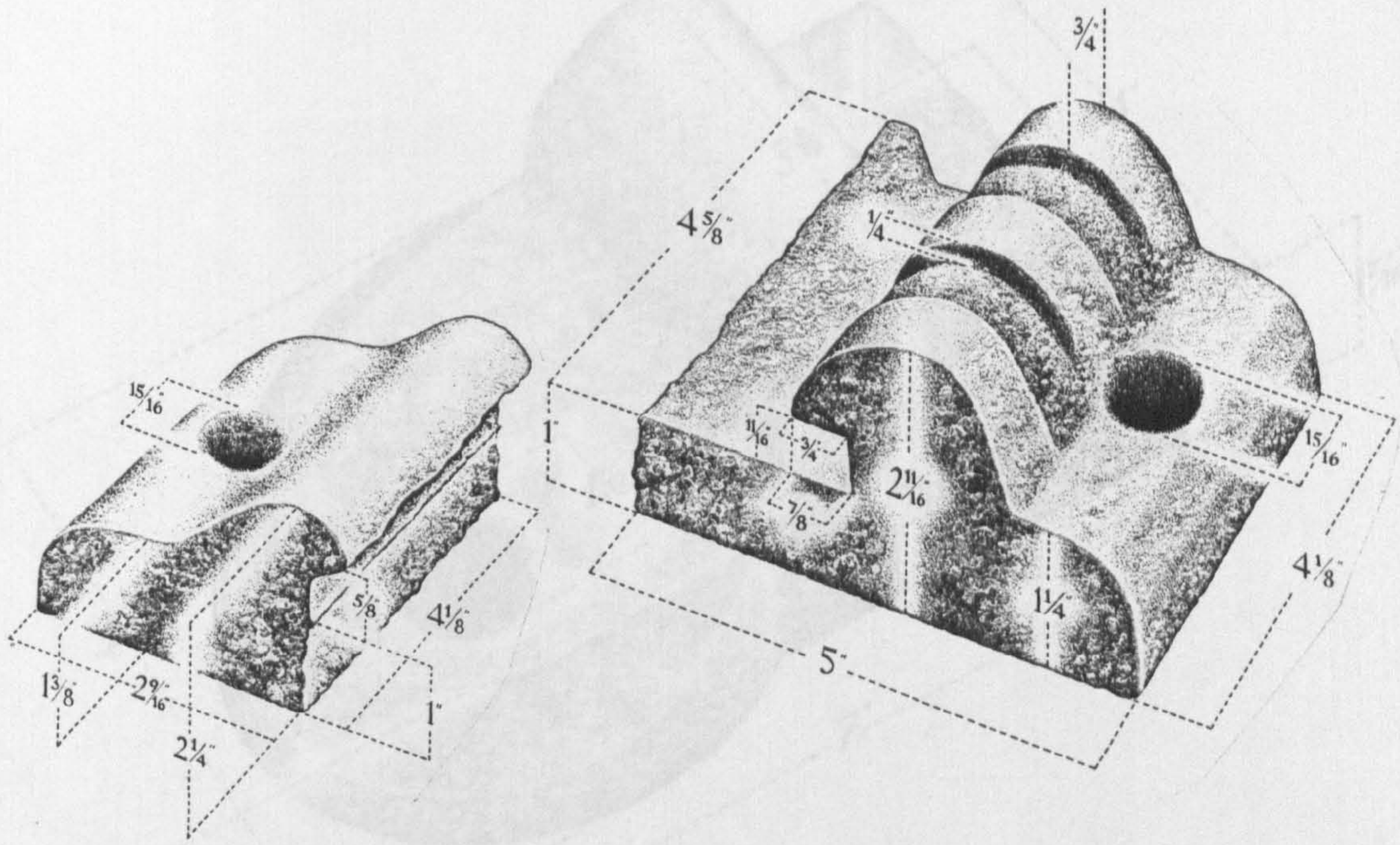


Fig. 99. Broken outer cheeks of railway chairs from Twynau Gwynion (065 102)

Apart from limestone, ganister was also extensively worked from the RLR. Before 1875 a steep tramroad branch had come and gone which ran to a staith on the RLR from two gorge-like cuttings, 200m long, in the ganister to the north **(Q66G)**. In the easterly one (0730 1023), sills of the Rhymney pattern were found and a 4ft plate for a sill but with a notch similar to those used on Hall's Trevil Tramroad. A further Rhymney sill, impregnated with coal and completely worn through, was recovered from a branch at 0722 1031. The indications are that these finds were originally used elsewhere, some of them possibly on the abandoned Rhymney Line **2**. Also before 1875 the 1813 tramroad loop had been re-laid to standard gauge for 100m north of **R4b** to serve a ganister quarry at **S21G (R21G)**. The old stone blocks were cast aside and replaced with wooden sleepers at irregular intervals, which suggests a temporary line, roughly laid; it was abandoned by 1897.

The upper quarries having exposed the outcrop, the western arm was deliberately graded downhill at 1:40 to lose 6m of height before entering the

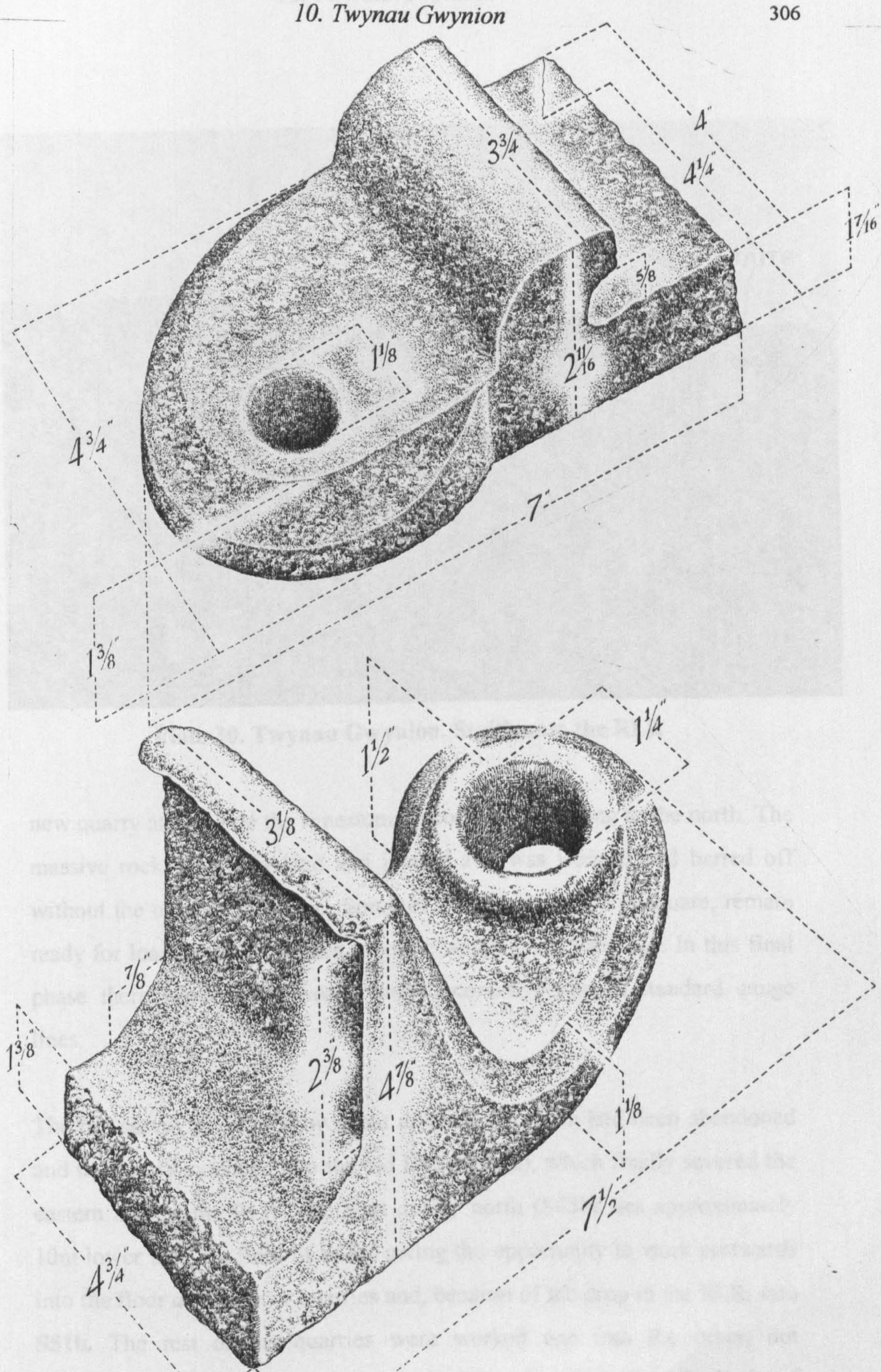


Fig. 100. Outer and inner cheeks of separate chairs, Twynau Gwynion

(065 102)

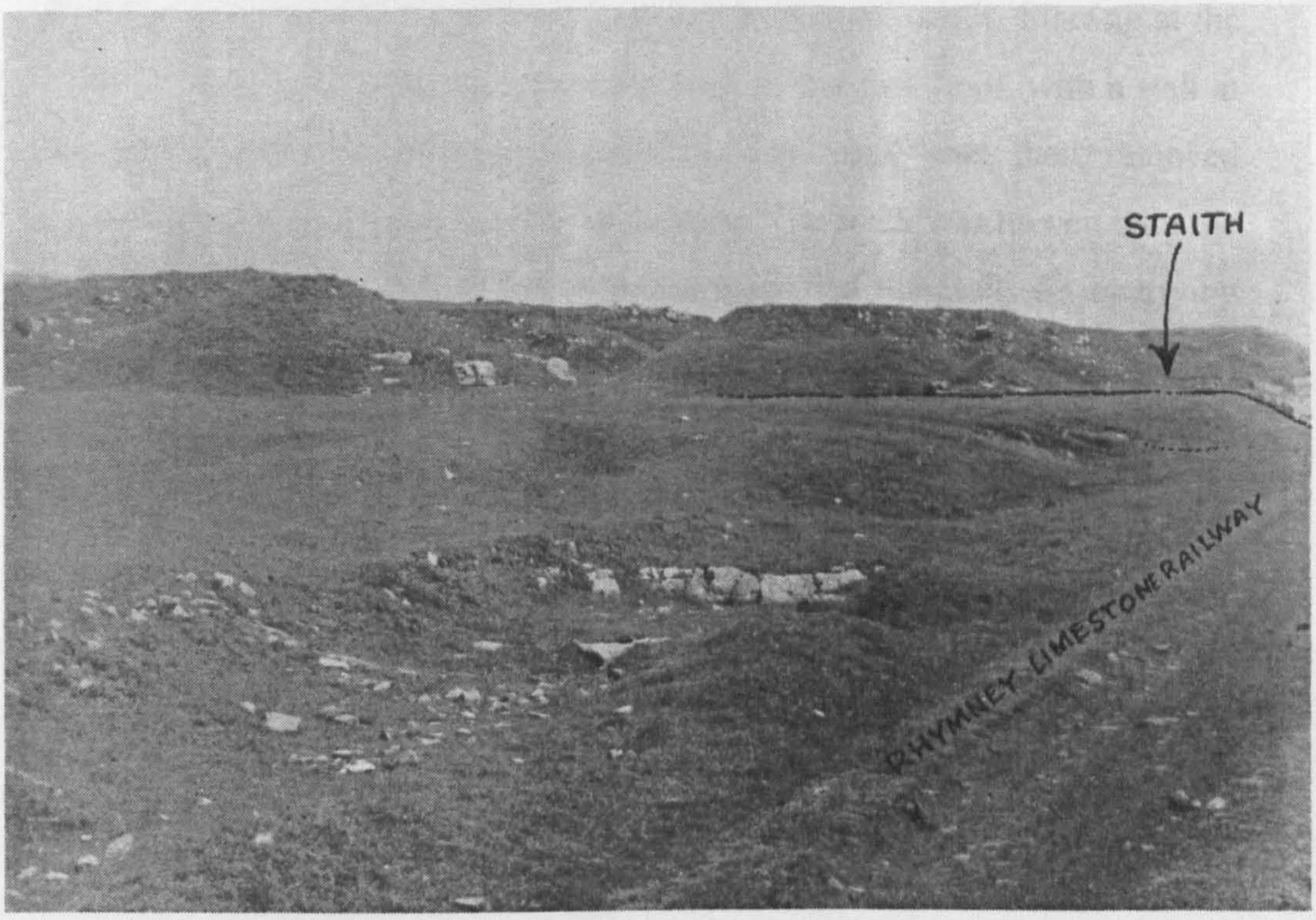


Plate 30. Twynau Gwynion. Staith onto the RLR

new quarry area, while the limestone in contrast was rising to the north. The massive rock here is bedded and jointed and was wedged and barred off without the need for blasting. Some of the blocks, ½ to 1m square, remain ready for loading from a bench onto the waggons by sheerlegs. In this final phase there were no tramroads, only locomotive-worked standard gauge lines.

The 6in survey of 1897 shows that at **S61b** the staith had been abandoned and the quarry extended into the old **R51a (S51a)**, which finally severed the eastern arm of the RLR. The next quarry north **(S63b)** lies approximately 10m lower than the floor of **S63a**, giving the opportunity to work eastwards into the floor of the upper quarries and, because of the drop in the RLR, into **S51b.** The rest of the quarries were worked one into the other, not progressively northwards but by a principal line almost reaching the limits of

the lease, from which the rock was worked back southwards. Starting at the north of **S65b**, a heading was made for each of the first lines, with a stall at the end to accommodate a locomotive. The rock was then removed southwards with a final ledge left for loading. The track was moved onto the newly-vacated space and a new heading made for the stall. As quarrying progressed southwards, this created a zigzag face. The final quarry **(S64b)** consisted of a single branch dividing into four, probably intended as the start of headings to work into **S63a**; but before this could happen, quarrying ceased.

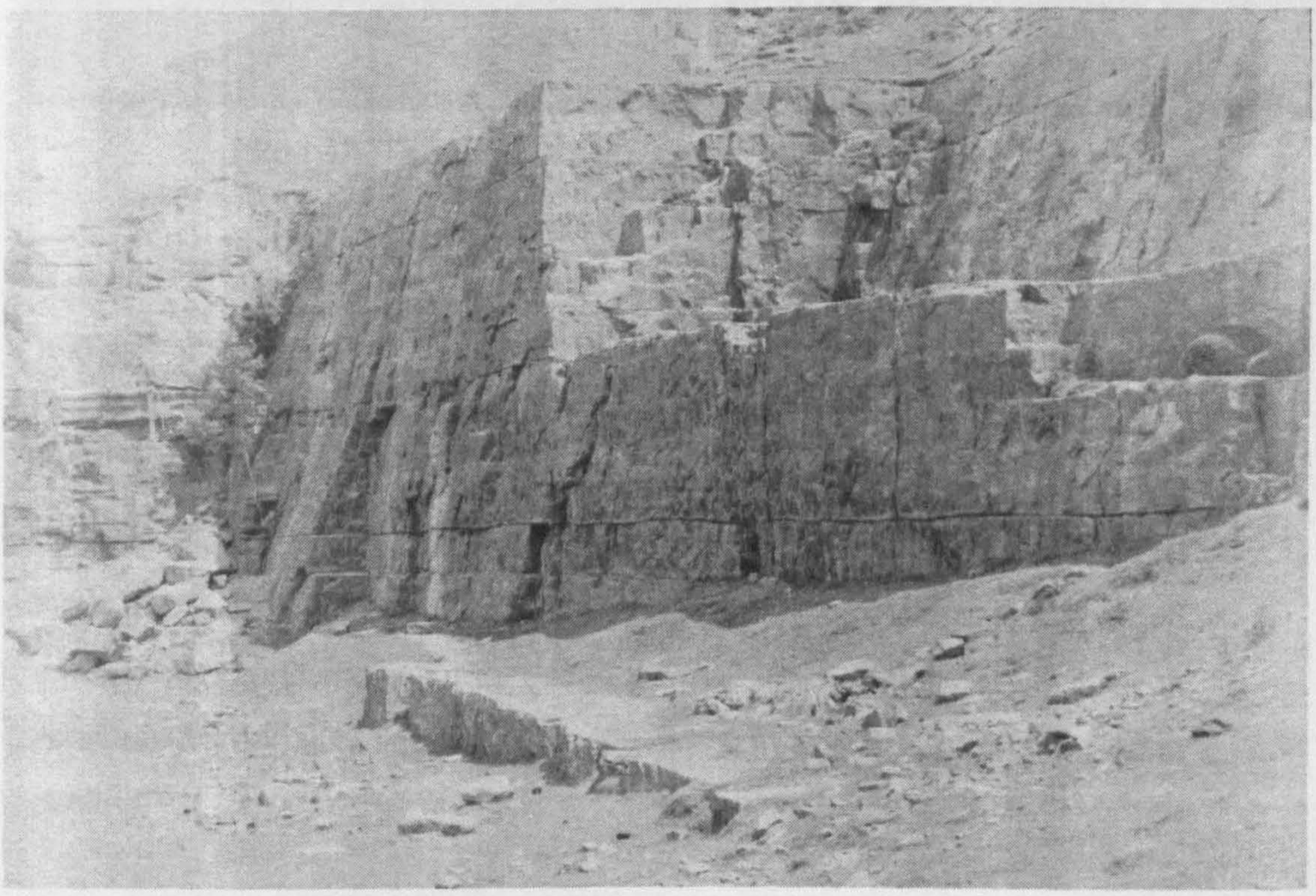


Plate 31. Twynau Gwynion. A 'b' quarry with an 'a' quarry above. Bench working can be seen in the foreground

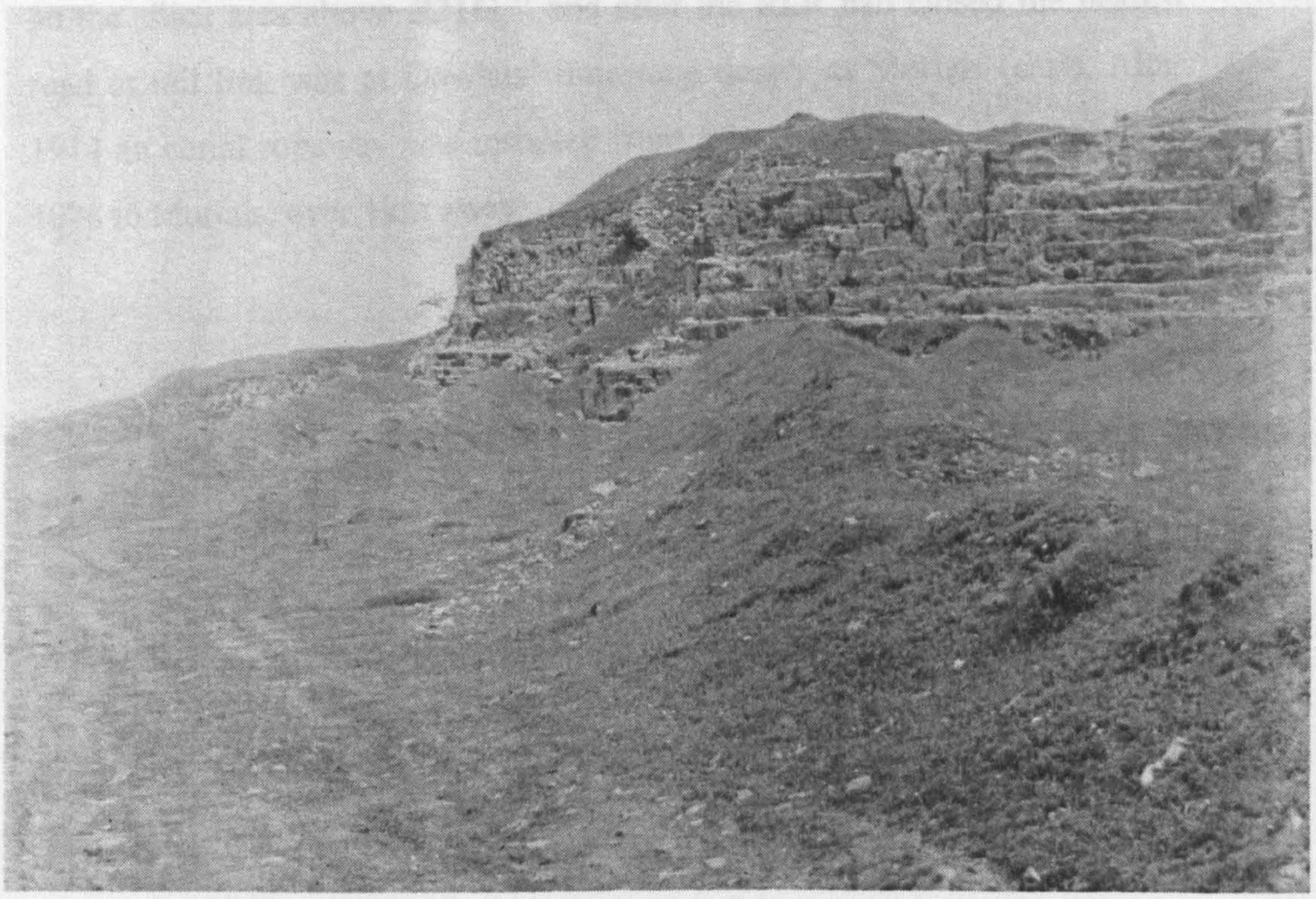


Plate 32. The final quarries at Twynau Gwynion

It would be convenient to attribute the closure of the Rhymney works to the impending shortage of limestone, but this cannot be entirely entertained. Certainly at the northern end quarrying was nearing the limits of the lease. However there was still workable limestone in the upper quarries; but by opening the lower quarries which bit into the eastern arm of the RLR, Rhymney had burnt their boats, leaving the upper quarries suspended without communications. Further capital would have been needed to re-open abandoned workings at a time when the company was in a serious financial position.[40]

---

[40] Author's collection 1880

The final extractive industry at Twynau Gwynion was ganister. Until well into the second half of the twentieth century, Dowlais had a 100-acre lease on the silica area above **R21G**,[41] and after the RLR had closed the nearest road or rail link was at Dowlais' limestone quarry at Morlais (east). After 1914 an aerial ropeway was installed from a large concrete bunker at 0678 1028 to Morlais, over 1km away.

[41] Pers. comm. the late John Owen, former manager of Dowlais

CHAPTER 11

MORLAIS (EAST)

The limestone dips gently to the south-east, and the outcrop, approximately 500m wide, was exploited from the scarp face cut by the Taf Fechan. These quarries were used exclusively by the Dowlais Ironworks from 1825 to 1929. The period after 1869, when the quarries came to be served by the standard gauge Brecon & Merthyr Railway (Dowlais Branch),[1] lies outside the scope of this thesis. After 1929 they were retained as a reserve by East Moors Works at Cardiff[2] (known as 'Dowlais-by-the-Sea'), the track not being lifted until 1950-60, and some stone was removed by road even later. This long history of extraction and of spoil dumping has left little of interest to the archaeologist, and there are few remains of the tramroad.

Opening dates hitherto given for the quarries are significantly wrong.[3] As we saw, Dowlais left Twynau Gwynion in 1825, the year in which Overton stated that their Twynau Gwynion tramroad of 1800 'continued ... until that road was diverted, and a new quarry opened.' This 'new quarry' can only be Morlais (east). But while Dowlais had rapidly to find a new limestone supply, they were dilatory about building a tramroad to it, and must at first have used carts. There is no clear sign of a tramroad on the OS 1in survey of 1830, and construction came only in 1833 when £1637 19s 6d was spent on the 'New Limestone Railroad' and the following year when £2734 8s 1d was spent on the 'New Limestone Road.'[4] From the quarry it ran generally

---

[1] Barrie 1980, 164

[2] Established 1889. In 1930, with the formation of Guest Keen Baldwins Iron & Steel Co Ltd, all production was moved from Dowlais to Cardiff and Port Talbot.

[3] Lewis 1975, 10, who suggests that Morlais was abandoned around 1820 for new quarries at Twynau Gwynion; the opening date of 1830 given by Owen 1977, 155 seems too late

[4] GlamRO D/DG E2. The Dowlais accounting system of debiting capital investments to the year in question allows these costs to be accurately attributed to 1833 and 1834 (Atkinson and Baber 1987). This appears to have been gleaned from Jones 1985,166. The cost of the 2953yd road was about £1 10s a yard

slightly west of the later Brecon & Merthyr Railway (Dowlais branch) along the line of the modern road, past an extant weighouse (0648 0829) at the entrance to the Ivor works and past the Guest Memorial Hall, into the Dowlais works. The distance is about 3km and the gradient gentle.

The gauge was evidently 4ft 2in between flanges, as on the Penydarren Tramroad and its continuation up to Dowlais, but change was already in the air. In 1832 the 0-4-0 locomotive *Yn Barod Etto* had been commissioned from Neath Abbey with combined wheels capable of running both on 4ft 2in gauge plateways and on standard-gauge edge railways.[5] This engine could well have worked up to Morlais (east). Likewise dual-purpose wheels were fitted on the tenders (though not the engines themselves) for *Mountaineer* (delivered in 1834) and *Dowlais* (1836), and on *John Watt* (1838).[6] Also in 1838 *Dowlais* was converted to standard gauge;[7] since this was fitted with rack mechanism for working the steep gradient between Penydarren and Dowlais, it was no doubt in 1838 that this 'main line' was altered, and very likely the line to Morlais (east) as well. Stone blocks at 0597 0959 are remarkably similar to those on the London & Birmingham Railway which was also opened in that year. *Yn Barod Etto* could happily have continued its limestone duties; it and *Mountaineer* still survived in 1848, but by 1856 both had gone. Thereafter any of Dowlais' standard gauge locomotives could have worked the Morlais line.

In the quarries, most of the early workings are covered by later spoil, but a shallow quarry survives with a winding track which probably corresponds to a line marked on the 1830 survey as running about 120m into the quarry area. If so, there were evidently internal tramroads several years before the access tramroad arrived.

---

[5] Lewis 1975, 25
[6] Lewis 1975, 26-30
[7] Owen 1977, 128

CHAPTER 12
MORLAIS (WEST)

At Morlais (west) or Castle Morlais Quarries, substantial deposits of Dowlais limestone run north to south for about 1km. The downcutting of the Taf Fechan at the north has exposed winnable rock to a breadth of 750m, which tapers as a result of faults to 100m at the south. The landowner was the Earl of Plymouth, and Dowlais quarried his limestone from the time of its opening in 1759, transporting it by pack animal and later by cart. Penydarren and Plymouth were forced, as we shall find, to rely expensively on Cyfarthfa's Gurnos quarry for their supplies[1] until 1800 when they moved to Morlais.

Railroads and tramroads to the ironworks

We saw in Chapter 2 that in 1791 Dowlais was building its historic railroad **(Pa)**, the first hitherto known to employ all-iron rail, from the works to the Glamorganshire Canal basin. The rails **(Fig. 4)** were cast at Dowlais. They were 6ft long and without lugs, they weighed 88 to 90lb, and were laid on wooden sleepers.[2] In March 1797 Plymouth cast 39 rails, 6ft long and weighing 92lb, which were possibly replacements (see **App. 3.2.P**). Even during the building there was friction between Dowlais and Samuel Homfray of Penydarren. Early in 1791 Homfray complained loudly about the railroad taking the north side of Morlais Brook[3] (a route inconvenient to Penydarren), and in reply received a stinging snub; he no doubt felt that, because the line was built under the four-mile clause of the canal Act, it was a public railroad which he had a right to use. In February 1792 construction was delayed by bad weather, and there was a rail shortage which entailed the shame-faced

---

[1] NLW Maybery 2466 of 1793; Lloyd 1906, 49 and NLW John Loyd Collection, vol.1, 78 (p.14) of 1794-5; BRL (Observations)
[2] Elsas 1960, 149
[3] Elsas 1960, 148

purchase of a load from Penydarren.[4] Two months later Homfray was building 'at very great expense' a retaining wall by 'the side of the Rail Road through Gwailodygarth Farms,' the point closest to Penydarren ironworks. The problem was probably subsidence, for there is still a considerable sidelong slope here, and William Taitt of Dowlais promised to pay for it.[5] At the same time Homfray was intent on mining ironstone at Gellifaelog (also on the north side of the valley) and 'making a Tunnel Wide enough to admit the rubbish under the Rail Road.' The line was completed to Penydarren (the settlement, not the works) in June 1792[6] at a cost of £1766, of which the canal company contributed £1000,[7] and to the canal before June 1793 when Dowlais were granted the lease of a wharf.

As we saw, Penydarren already had bar rails to spare in February 1792 when they sold a load to Dowlais; and in December 1793 Plymouth had supplied Jeremiah Homfray with 330 rails for underground use weighing an average 82lb (**App. 3.2.P**). What these rails were like may be guessed from a set found in an old Penydarren pit and now in the Cyfarthfa Castle Museum **(Fig. 101)**. Their weight (by calculation, since they are firmly mounted on a wall) is about 69lb. The difference from 82lb might be very well be accounted for by wear and corrosion; alternatively the Cyfarthfa Castle rails could be of earlier vintage and lighter design than those supplied by Plymouth. Either way they are, in all probability, the earliest surviving all-iron edge rails in the world.

Lewis states that Dowlais built its second railway, from the quarry to the works, probably in 1792.'[8] That may well be true of Twynau Gwynion, as a tramroad; but there is no good evidence for any line to Morlais (west) **(Pc)**

---

[4] Elsas 1960, 149
[5] Elsas 1960, 149-50
[6] Hadfield 1967, 91 wrongly says June 1791
[7] NLW Maybery 70
[8] Lewis 1975, 3, misled by the references to the Dowlais Railroad in 1792 cited above

until eight years later, and no evidence at all that it was a railroad, let alone from Dowlais. A letter from William Taitt in 1795, when the Abernant to Brynmawr Turnpike Bill was at the committee stage, tells of Homfray introducing a new clause for 'fixing one Gate Just at James Birch's across the road leading to the Castle &c [Morlais (west)] where our Rails crosses it, & another also at James Birch's across the Road leading to Penydarran Works.'[9] James Birch's house (he was manager of Penydarren) was evidently at the cross-roads where the Morlais-Penydarren road crossed the main road down the valley. But the rails across the road to the castle by no means necessarily indicate a branch; they were much more probably the Dowlais Railroad itself, which ran beside the main road. We shall see that when it did materialise the Morlais line was a tramroad.

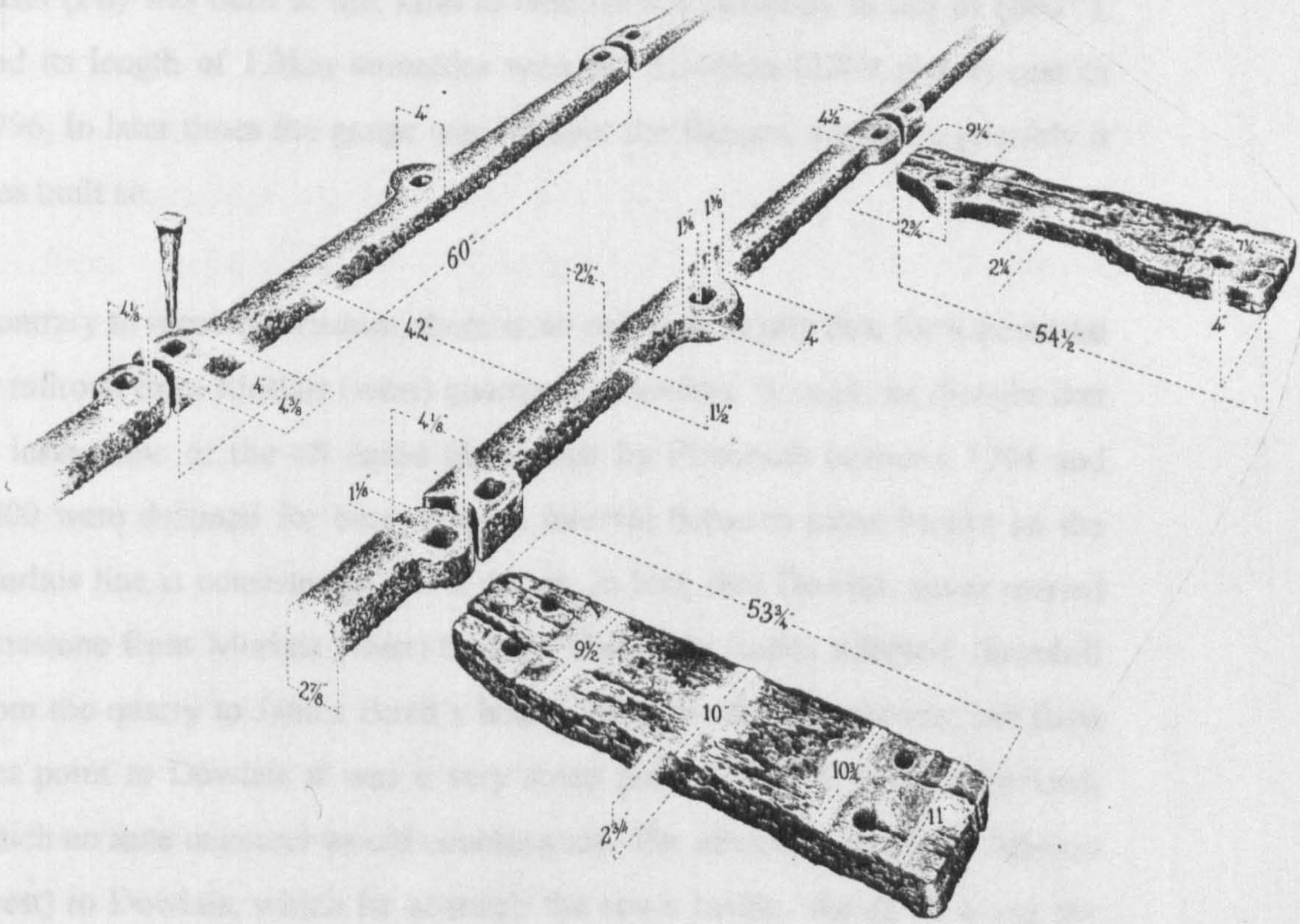


Fig. 101. The Penydarren rails (Cyfarthfa Castle Museum)

[9] Elsas 1960, 151

The next development was the arrival of tramroads and the conversion of railroads. We noted in Chapter 10 James Watt junior's description of the light and primitive plates on 'Homfray's Old dram Roads,' whose design surely drew on Curr's practice. Their location is not stated: it could be any of the plethora of lines serving Penydarren's coal and ironstone workings. Another cognate approach was also in evidence at Twynau Gwynion where, in 1793, Dowlais was experimenting with lightweight plates (Chapter 10). From 1794 Plymouth produced large numbers of 4ft eared plates of between 40 and 46lb **(App. 3.4.P)**, which at this date are more likely to have been derived from Curr's morticed design than from Outram's lugged plates. We do not know where most of these eared plates went; quite possibly they were all for Plymouth's own use. But a tramroad from Penydarren to the canal basin **(Pb)** was built at this kind of date (it was certainly in use in 1800[10]), and its length of 1.3km coincides with the 1.346km (2209 plates) cast in 1796. In later times the gauge was 3ft over the flanges, and quite possibly it was built so.

Contrary to received wisdom, there is no evidence at any date for a tramroad or railroad from Morlais (west) quarries to Dowlais. It might be thought that at least some of the 4ft eared plates cast by Plymouth between 1794 and 1800 were destined for here; but the interval between stone blocks on the Morlais line is consistently 3ft. It seems, in fact, that Dowlais never carried limestone from Morlais (west) by rail. The route finally adopted, downhill from the quarry to James Birch's house, was fine for Penydarren; but from that point to Dowlais it was a very steep pull, at 1:16½ against the load, which no sane engineer would countenance. The obvious route from Morlais (west) to Dowlais, which lie at much the same height, would be along the

---

[10] BRL (Observations) 'Access [from Penydarren] was formerly by a rail of steep descent down to the Cardiffe Canal & thence to Cardiff. But have projected a railroad [the Penydarren Tramroad] in opposition to the Canal & will carry it certainly half way.' Watt seems always to use the term 'dram road' correctly, but by 'railroad' he can mean either a plateway (as here) or an edge railway

contour; but there is not a tittle of evidence for such a line. The first hint even of an intention to build any tramroad to Morlais comes only in 1799, and the first clear reference to its existence in 1800, when Watt speaks of Penydarren as having 'a new Railroad' (really a tramroad) to Morlais.

The background to this lies in the famous Penydarren Tramroad. Dowlais, Penydarren and Plymouth were at loggerheads with Richard Crawshay of Cyfarthfa. Crawshay not only had a controlling interest in the Glamorganshire Canal, whose restricted upper section he tried to monopolise with his own traffic, but also supplied Penydarren and Plymouth with limestone from his Gurnos quarries at extortionate rates. The three allies therefore proposed a tramroad from Cardiff with branches to Merthyr, Abernant and Rhymney, which was not surprisingly opposed by the canal company. When in January 1799 it became apparent that a bill to that effect would be rejected by Parliament, William Taitt & Co (Dowlais), Samuel Homfray (Penydarren) and Richard Hill junior (Plymouth) agreed to a less ambitious scheme in the form of a tramroad 'from the limestone rocks at Castle Morlais'[11] paralleling the canal only as far as Abercynon, below which point congestion on the canal was less. Dowlais and Penydarren were each to bear 5/14ths of the cost and Plymouth 4/14ths.[12] The conveyancing of land took place between 1800 and 1803.[13]

George Overton was the engineer and, tradition says, the plates were laid by an engineer named Curl,[14] a distorted folk memory, perhaps, of John Curr, the originator of plate rails. The track was pure Outram, with notched and lugged 3ft rails on stone blocks. In June 1800 Plymouth began casting plates to what is specifically named the 'Outram pattern.' By December it had

---

[11] NLW Maybery I 109, 18 January 1799
[12] Memorandum of 22nd June 1803 (Lloyd 1906, 79-80).
[13] NLW Maybery I 1890, 'to the dram road company formed by the proprietors [of the three ironworks] to make a dramway from Lord Plymouth's lime rock at Morlais Castle to the Glamorgan Canal navigation house [Abercynon]'
[14] Lewis 1975, 3

made 3730 (1.7km of track) which weighed around 42lb each, although there were some at 37lb **(App. 3.5.P)**; by February 1801 the term 'Outram' had been dropped though the weights were initially similar, but by May they had increased to 46lb. During this final period up to May 1801 5302 plates were cast (2.42km). From September 1800 Penydarren was also casting plates to a pattern handed over by Plymouth and ultimately, it seems, supplied about two-thirds of the 9½ miles (15.3km) of track. Watt saw the route being levelled and gives many details of the rails and the thinking behind them which, though of great interest, are not directly relevant to us. He does however record that in 1800, according to Hill, the New Dram Road 'is finally determined to be made 3ft 6 wide'[15] and 'the drams are to be laid 3ft 6in asunder.'[16] In the event, minds changed and the rails were laid at 4ft 2in between flanges or 4ft 4in over them.[17] The section to Abercynon from the junction with the Dowlais Railroad near Penydarren was opened in 1802.

This was, however, only the main line. Branches connected it to Penydarren and Plymouth works, and the Dowlais Railroad from the junction to the ironworks was converted to conform and, with the arrival of the first locomotive in 1832, given a rack rail to assist it up the fearsome 1:16½. The railroad from the junction down to the canal was apparently abandoned, but the 3ft gauge tramroad from Penydarren works to the canal was retained.

The Morlais (west) tramroad

In addition, to return to the main thread of the story, there was a fundamental reorganisation of limestone supplies. Dowlais forsook Morlais (west) quarries and moved exclusively, as we have seen, to Twynau Gwynion.

---

[15] BRL (Journal)
[16] BRL (Observations)
[17] It is likely that the gauge gradually spread: there are cases in the Morlais quarries of 4ft 4in *between* flanges. Such an enlargement would not be unique: the nominal 3ft 6in of the Severn & Wye had become 3ft 7in in 1840 and 3ft 8in in 1843 (Paar 1973, 38)

Penydarren took a lease[18] of Morlais (west) and, as a part of the general undertaking agreed by the allies in January 1799, a tramroad **(Pc)** was built 'from the limestone rocks at Castle Morlais' to the ironworks. The wording very much implies that there had been no rail link from Morlais (west) before. Plymouth also moved to the same quarries; and when Watt visited Merthyr in 1800 he was able to speak of the 'Limestone Quarry at the top of the Hill to the north near, say ¼ mile below, Castle Morlais & 2 Miles from [Penydarren] Works. Worked conjointly with the Plymouth & brought down a railroad.'[19] How Plymouth got their limestone to the furnaces before acquiring a rail link in 1803 is not known.

A start was made on construction of the Morlais (west) tramroad in September 1799 when Plymouth began making patterns, and by December 1799 they had cast 2864 3ft plates for the 'New Dramroad Company' and by March 1800 a further 959, enough in total for 1.7km of the 2km involved **(App. 3.5.P)**. Until September 1801, when the Plymouth accounts end, only 192 replacement plates were supplied for the limestone road. The rail weight was about 39lb,[20] a little lighter than the Penydarren Tramroad proper, as befitted the smaller gauge. This is evidenced by a sill from the quarry with a gauge between flanges of 2ft 4in **(Fig. 107)** and by Watt's statement in 1800: 'Penydarren Lime Works are situate at castle Morlais about 2 Miles from the furnace, having a new Railroad 2ft 6 wide but which they say is intended to be altered;'[21] this measurement was presumably over the flanges. Both tie in reasonably well with the 2ft 9in between holes in the blocks recorded in 1975 over a distance of 200m.[22] Whether they tie in with 'Homfray's Old dram Road' gauge — apparently the Penydarren works gauge — recorded by

---

[18] Not signed until 1801: NLW Maybery 109
[19] BRL (Journal and Observations)
[20] BRL (Journal) has a slightly smaller figure: 'Mr Birch says each dram rail for their new road is to weigh 36lb per Yd'
[21] BRL (Journal)
[22] Gordon Rattenbury, pers. comm.; Mercer 1947-9, 91 measured 2ft 9½in

Watt as 2ft 4½in over the flanges or 2ft 3¾in between them is another matter.

The line from Morlais (west) to Penydarren was therefore completed in 1800.[23] The intention recorded by Watt to alter its gauge was not realised, for in 1803 Plymouth was accommodated by adding a third rail at a gauge of 4ft 2in between the flanges to allow through running via the main line of the Penydarren Tramroad:

> It is agreed and determined to lay a Tram Road of the Width of the Road already laid from where it is already laid of that width to the Lime Rock at Castle Morlais, the present Road to remain on the inside of the Wide Road ... The whole Road to be completed by 25th Decr., 1803 ... The Rails that are laying on the narrow Road to Calon-ucha to be considered as part of Messrs Homfray's proportion. The Narrow Road to be considered as part of the General Road.

Thus all three ironworks were freed from Crawshay's clutches by acquiring their own outlet, and Plymouth and Penydarren by acquiring their own limestone.[24] Penydarren ironworks closed in 1859 and Plymouth in 1875.

The tramroad to Morlais (west) was very much of Outram type. Many of its stone blocks survive, although in some of the quarries wooden sleepers and sills were later used. Part of a hogged plate recovered on the line into T4 no doubt represents the early track **(Fig. 102)**.

Plymouth supplied the rails for a 45-yard passing loop in September 1800, the point casting weighing 141lb, and a 60-yard loop can be traced at 0478 0939. In August 1801 ten 'pointers' (just the pivoting switches) were supplied to the limestone road, each weighing 10lb. An Outram-type point

---

[23] Hadfield 1967, 93n states that it was built by Hill in 1799. This is correct in that it was started in 1799 and Hill acted as treasurer to the allies

[24] BRL (Journal): 'Mr Birch informed my father that Mr Homfray could do as much upon his present Dram Road to the Lime with one horse as he formerly did with 40 when it was carried upon their backs & that one horse supplies the consumption of his 2 furnaces'

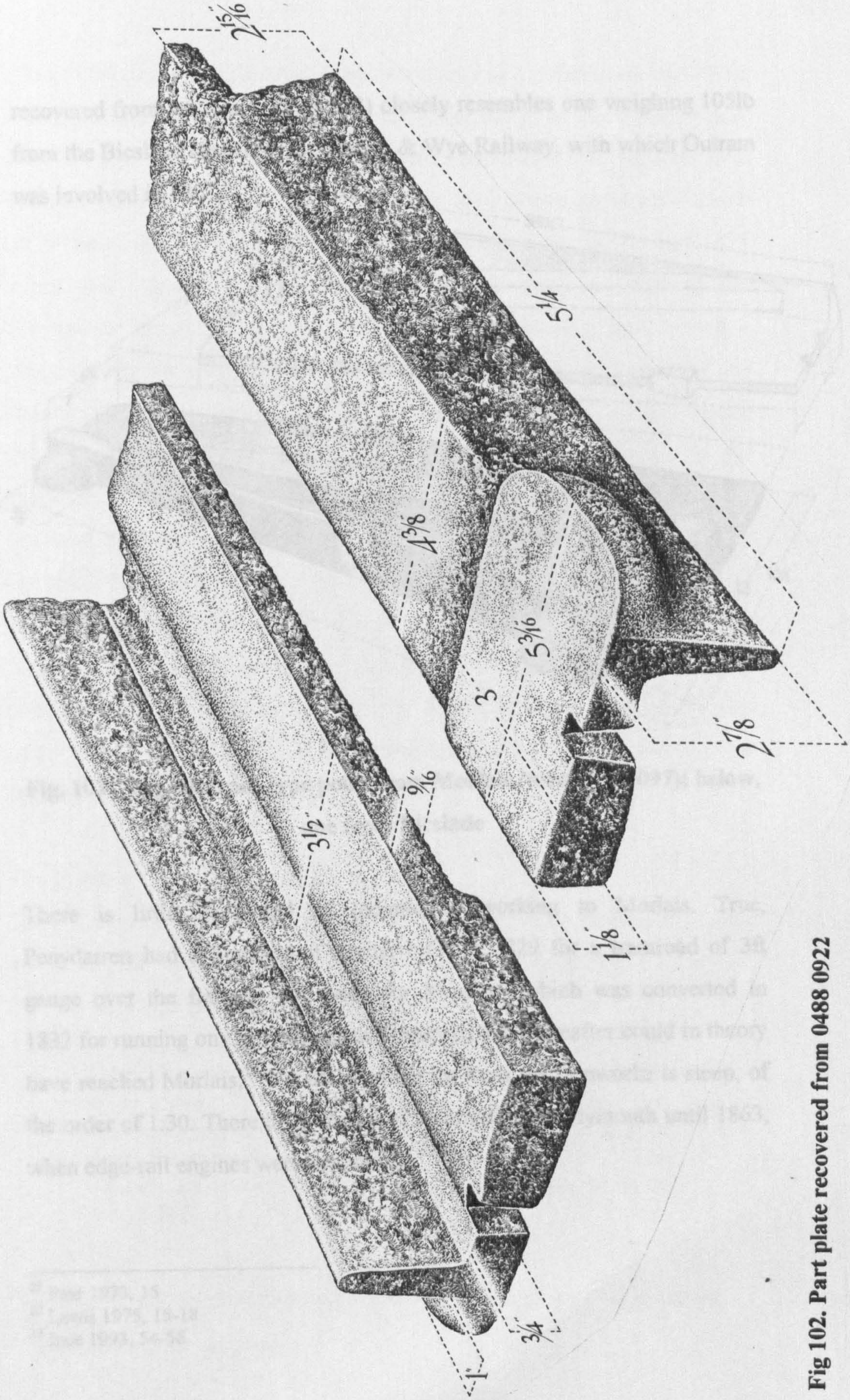


Fig 102. Part plate recovered from 0488 0922

recovered from the quarry **(Fig. 103)** closely resembles one weighing 105lb from the Bicslade branch of the Severn & Wye Railway, with which Outram was involved in 1801.[25]

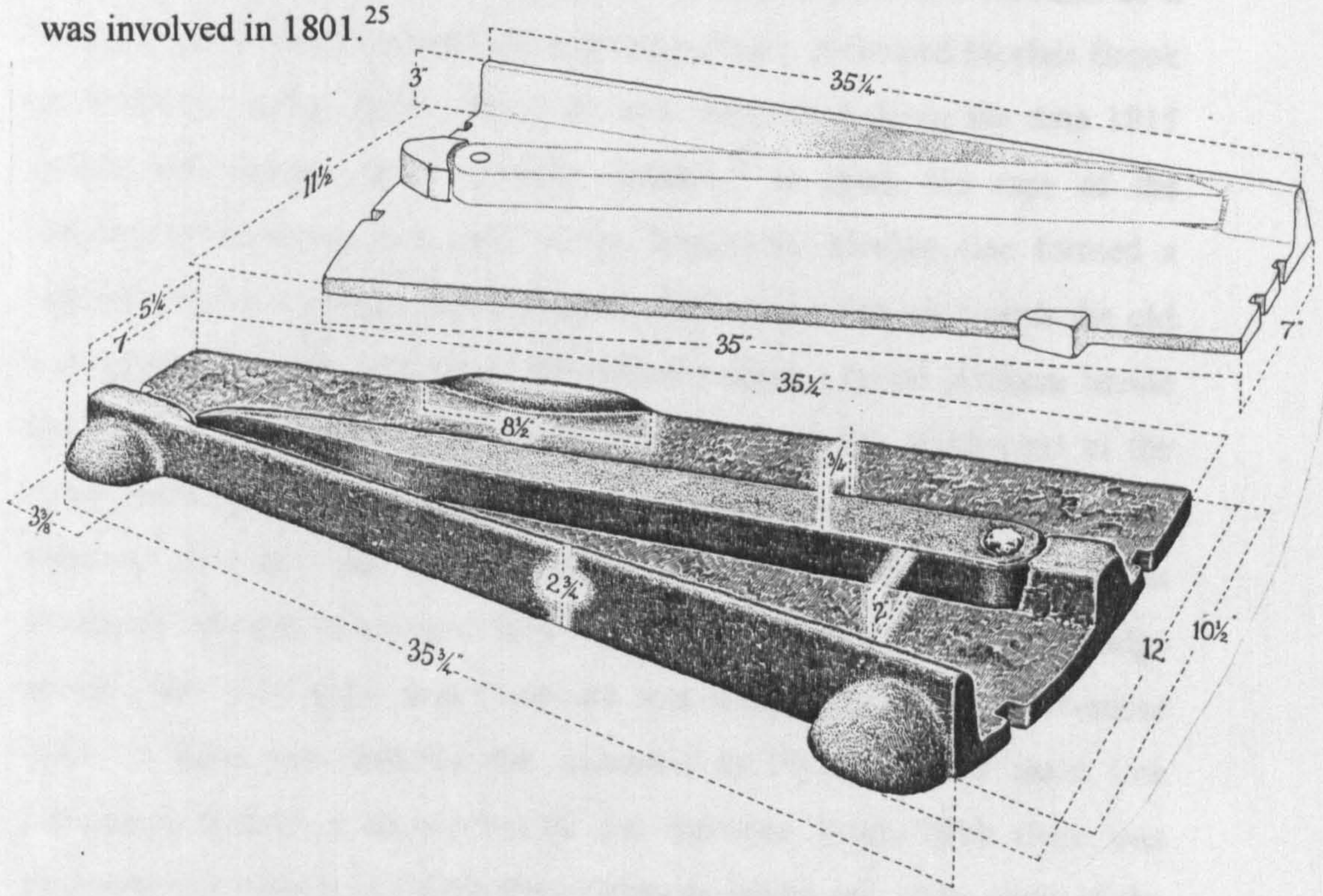


Fig. 103. Top, Outram-type point from Morlais (west) (049 097); below, one from Bicslade

There is little likelihood of locomotive working to Morlais. True, Penydarren had a Stephenson engine built in 1829 for a tramroad of 3ft gauge over the flanges—too wide for Morlais—which was converted in 1832 for running on the Penydarren Tramroad and thereafter could in theory have reached Morlais;[26] but the gradient up from the ironworks is steep, of the order of 1:30. There is no record of locomotives at Plymouth until 1863, when edge-rail engines were introduced.[27]

---

[25] Paar 1973, 15
[26] Lewis 1975, 15-18
[27] Ince 1993, 54-56

Most of the line can be followed from the quarry as a tarred track via Goytre Pond, and after about 600m it passes under the Heads of the Valleys Road. From here it runs through a housing estate, but after 900m resumes as a footpath parallel to a stream before joining a road. It crossed Morlais Brook on Waterloo Bridge (0563 0702), an iron structure bearing the date 1815 whose sad remains were recently rescued,[28] to reach the tops of the Penydarren furnaces. Just west of the bridge the Morlais line formed a junction with the Penydarren Tramroad. From this point westwards the old Dowlais Railroad may be traced sporadically along a raised platform beside the road to the Trevithick Memorial where it branches south-west to the canal basin. The line to Plymouth and ultimately Abercynon **(Pd)** can be followed over the bare remains of an iron bridge (0510 0663) cast at Plymouth between March and June 1800 but later altered. A similar bridge across Cwm Nant Bach near Plymouth was made in September-December 1800. A road now follows the tramroad to Plymouth, the main line continuing through a tunnel beside the furnaces. From 1819 there was presumably a branch to the Dyffryn furnaces which lay 100m west of the main line.

The Morlais Castle limestone tram

The Watts noted that on the 2ft 6in gauge line to Morlais one tram took just over 1 ton, but that on the intended 3ft 6in road one would carry 2 tons, of the following type **(Fig. 104)**.[29]

> The Waggons were of Oak strengthened at the ends with Iron & weighed with the Wheels each 7½Cwt. Intended to carry 2 Ton ... Waggons upon railroad intended to be 3 feet between Centres of Wheels, that both may not bear at once upon the same dram. Length of Waggons 5½ feet ... The Wheels are to be 2ft diameter & round on the Edges & weigh 65lb.

---

[28] Davies 1992, 118; the 1815 bridge must have had a predecessor. The whole area is now landscaped

[29] BRL (Journal and Observations)

The width is not given, but it is fair to assume it was similar to a limestone tram recovered from the Kington Railway, which is of the same gauge, also ran on 3ft plates, and is virtually the same length. The body is 3ft 2in wide at the base, flaring out to 4ft 4½in at the top.[30]

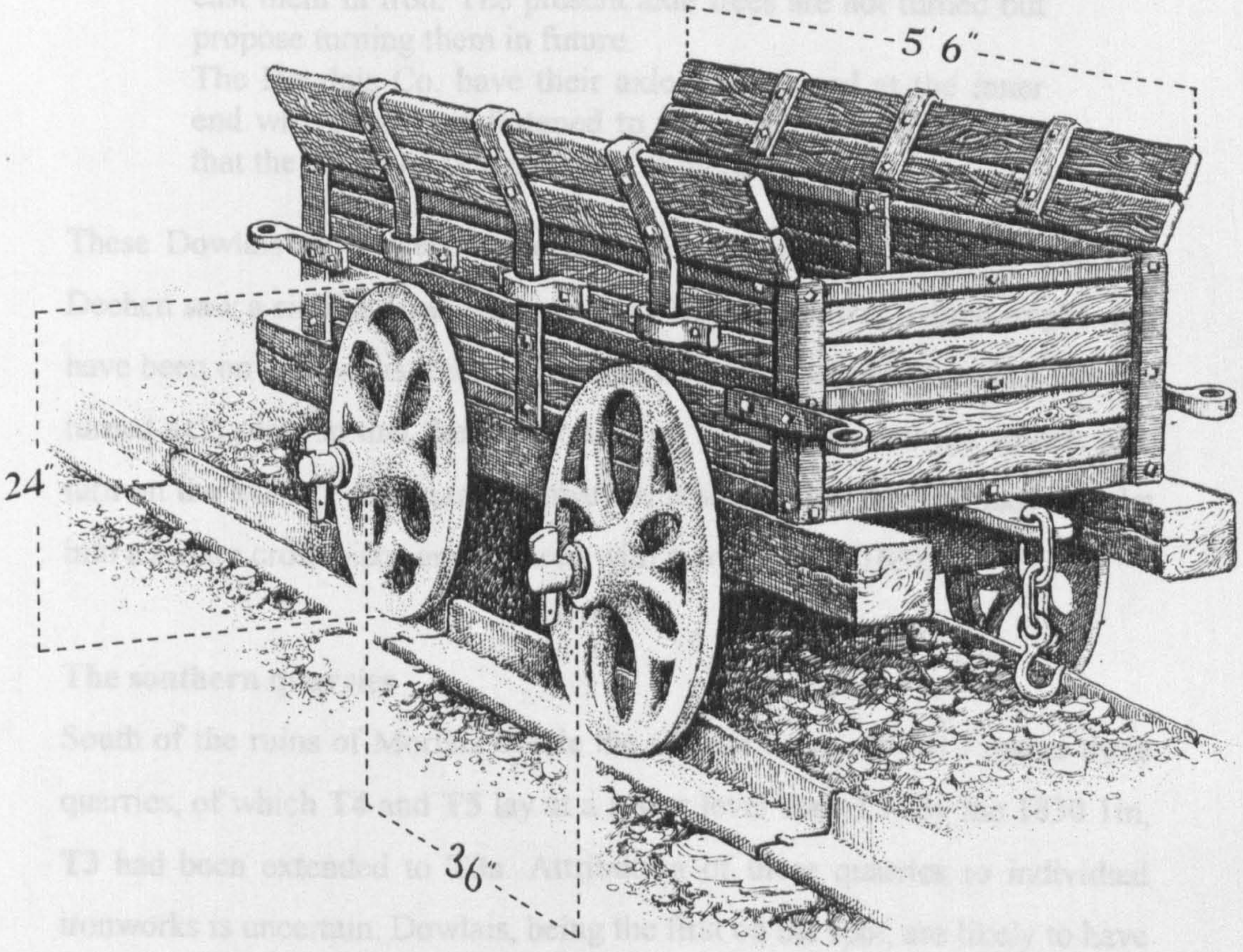


Fig. 104. The Morlais Tram

(re-drawn from BRL (Journal))

Watt added a number of details about wheels and axles.[31]

> Mr. Outram proposes the axletrees of the Waggons to be fastened or let into the wood of the Waggon & the wheel only to revolve.

---

[30] Rattenbury and Cook 1996, 76

[31] BRL (Journal and Observations)

> The Wheels 2 feet Diameter, axis projecting about 3½ or 4 Inches on each side; rim made tolerably sharp & this appeared already worn & rounded in those we saw. Think now they had better be made rounded at first.
> The holes in the Centre of the Wheels cast upon an Iron pin and about 1½ Diameter.
> Do not intend to bore out the sockets of the Wheels but to cast them in Iron. The present axle trees are not turned but propose turning them in future.
> The Dowlais Co. have their axle trees turned at the inner end where they are fastened to the wooden cross piece so that the wheel or axle may turn at pleasure.

These Dowlais axles were evidently unusual. In 1826-7 Oeynhausen and Dechen saw a similar arrangement on the Bute Tramroad, which might well have been on a Dowlais tram at Twynau Gwynion because the axles 'rest in turned axle seats so that they can rotate on these seats, and the wheels also turn on the axles.'[32] Ordinarily, however, it seems that the stub axle was let into a square cross piece and secured with a cotter **(Fig. 105)**.

The southern quarries

South of the ruins of Morlais Castle the OS draft map of 1813 marks three quarries, of which **T4** and **T5** lay at a lower level than **T3**. By the 1830 1in, **T3** had been extended to **T3a**. Attribution of these quarries to individual ironworks is uncertain. Dowlais, being the first on the spot, are likely to have worked **T5** where the Dowlais Fault exposed the limestone and which by 1813 had seen more working than the others. In 1813 **T4** appears to be secondary working of **T5** which suggests that Plymouth had taken it over. There is further evidence of Plymouth's presence here. An excavation on the line running into the quarry revealed not only the lugged plate attributed to 1800 or so **(Fig 102)**, but also, at a level 8in higher, eight heavy chairs *in situ*, fixed at a gauge of 4ft 6in over the flanges to wooden sleepers at intervals of between 10ft 4in and 12ft 6in **(Fig. 106)**. The most unusual

---

[32] Oeynhausen and Dechen 1971, 65

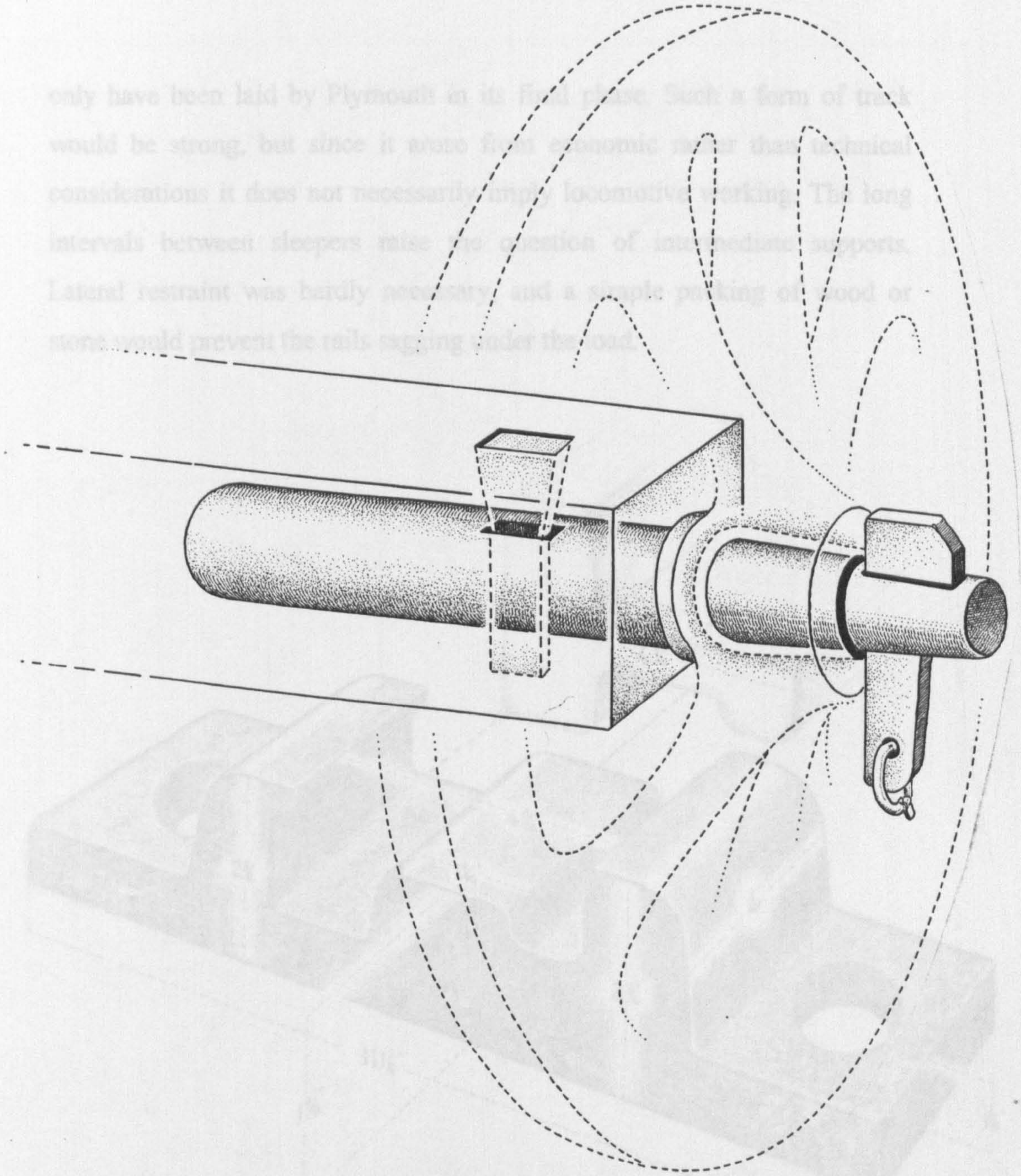


Fig. 105. Axle arrangement with iron pin for free-running wheels (re-drawn from BRL (Journal))

design of the chairs shows that they held bullhead rails, intended for ordinary standard-gauge railways, laid on their sides so that the plateway wheels would run in the resulting trough. Bullhead rails began to come into general use around 1870. Since Penydarren was closed by then, these late chairs can

only have been laid by Plymouth in its final phase. Such a form of track would be strong, but since it arose from economic rather than technical considerations it does not necessarily imply locomotive working. The long intervals between sleepers raise the question of intermediate supports. Lateral restraint was hardly necessary, and a simple packing of wood or stone would prevent the rails sagging under the load.

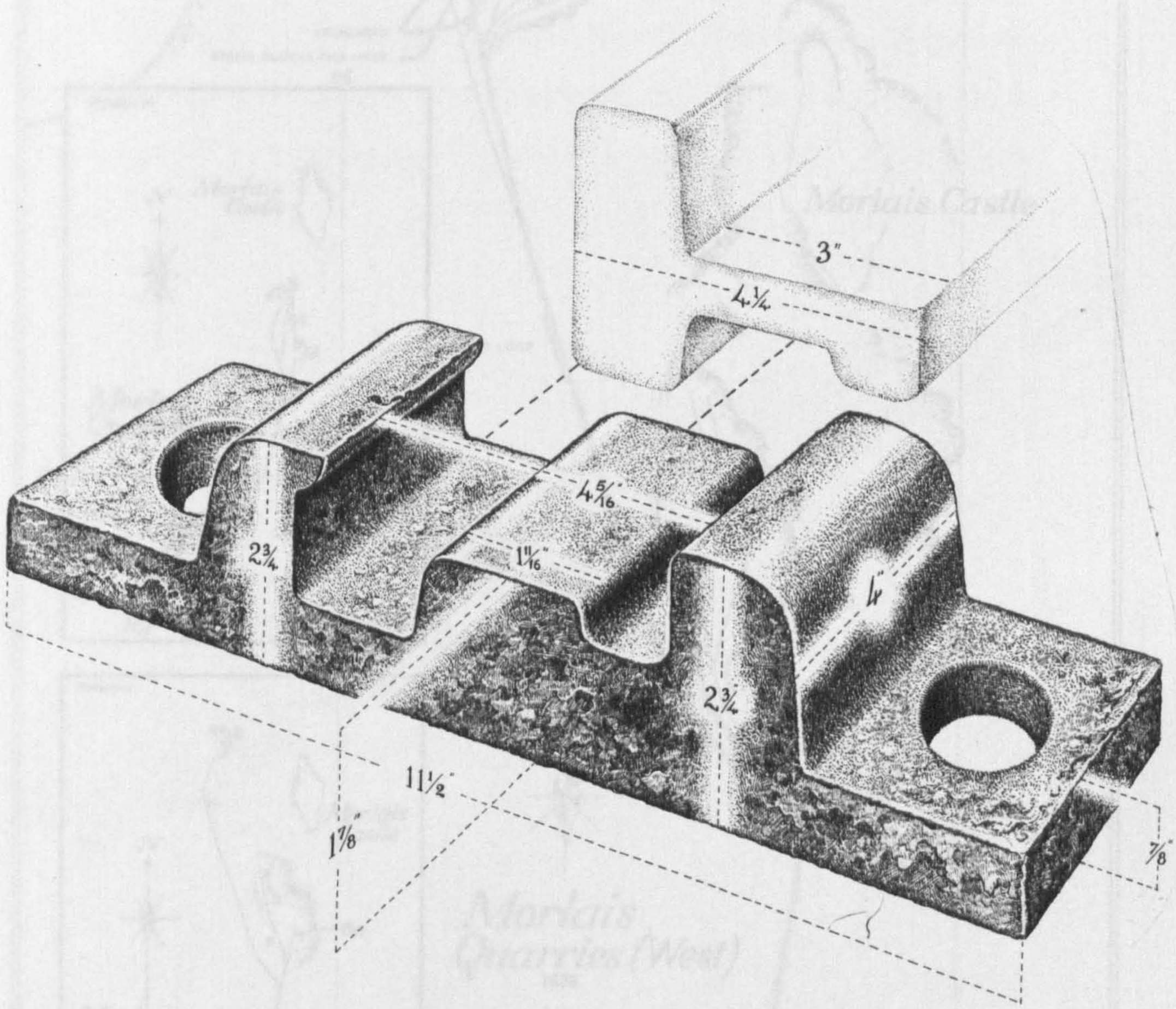
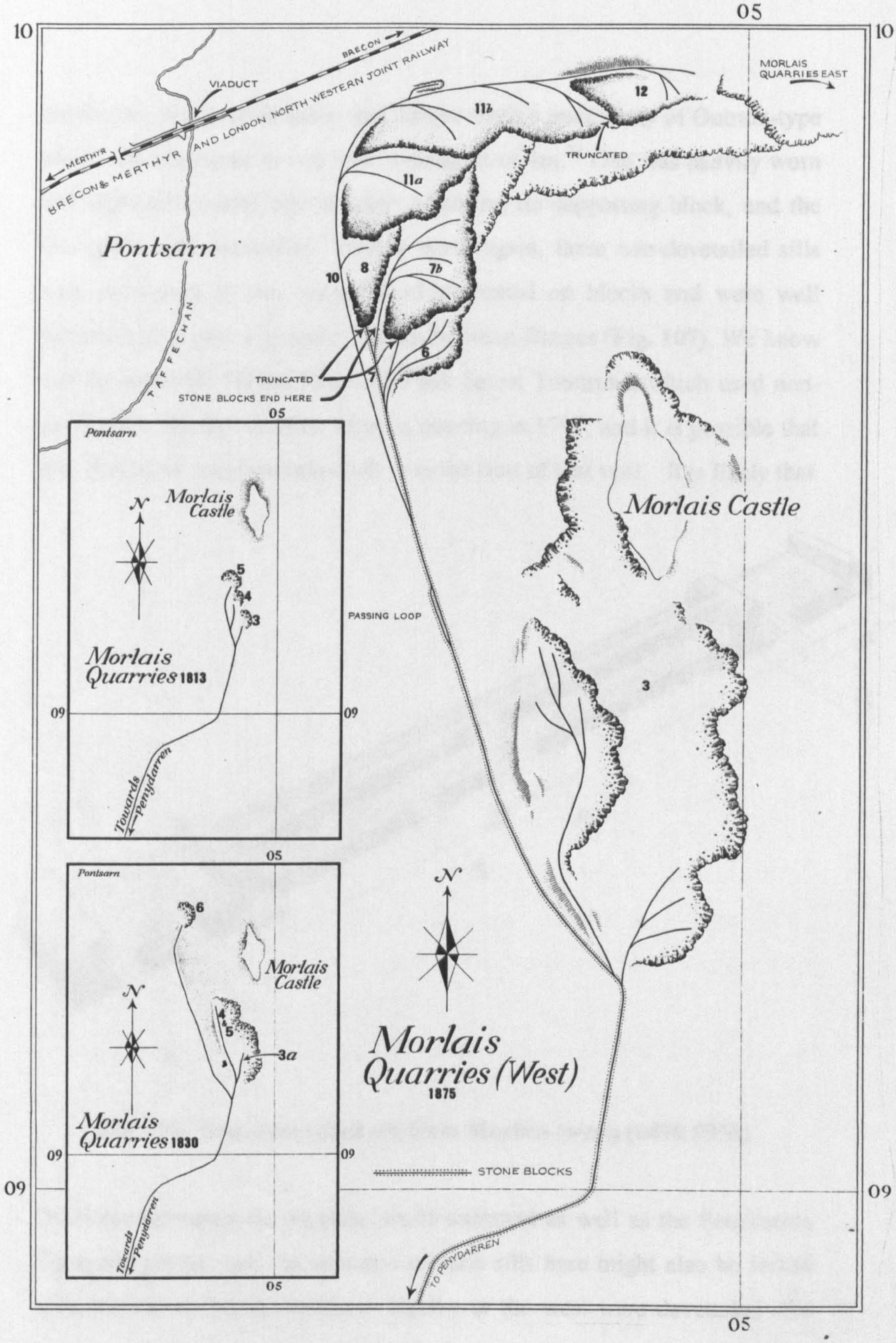


Fig. 106. Heavy chair for bullhead rail laid sideways, from Morlais (west) (0488 0922)

If **T4-5** was worked by Dowlais followed by Plymouth, this leaves **T3** for Penydarren. Watt's location of Penydarren's quarry 'say ¼ mile below Castle Morlais' fits **T3** better than **T4** or **5**. Inside the quarry there are a



MAP T. MORLAIS (WEST) IN 1813, 1830, AND 1875

number of blocks with holes, and further north a miscellany of Outram-type plates was excavated *in situ* over a distance of 4m.[33] One was heavily worn and adjoined another with a wider tread but no supporting block, and the final plate was channelled. Further north again, three non-dovetailed sills were excavated *in situ*, some of which rested on blocks and were well ballasted; they give a gauge of 2ft 4in between flanges **(Fig. 107)**. We know that Richard Hill visited Outram's Peak Forest Tramroad, which used non-dovetailed chairs or saddles, after its opening in 1797; and it is possible that this design of non-dovetailed sill was the fruit of that visit. It is likely that

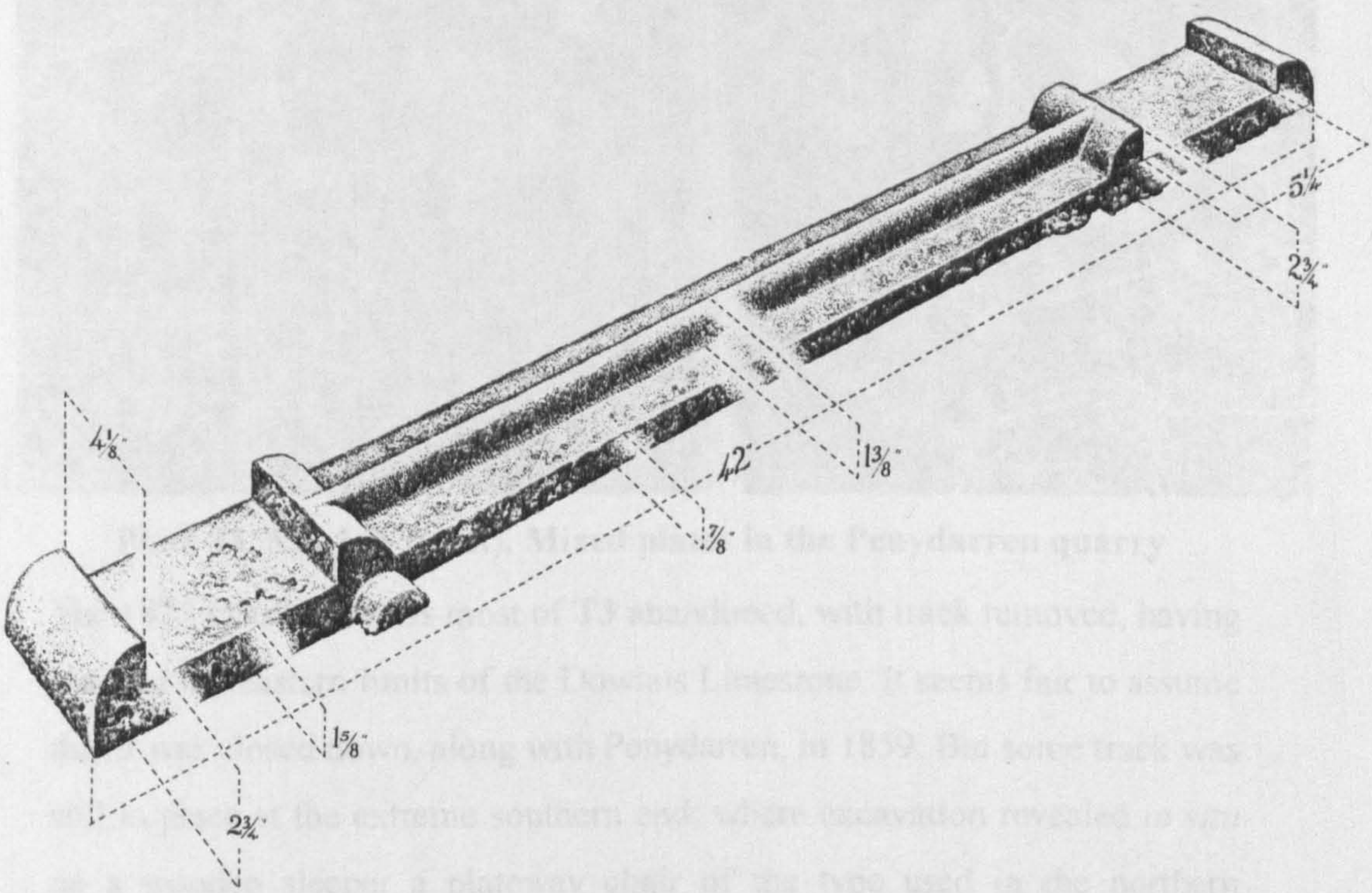


Fig. 107. Non-dovetailed sill from Morlais (west) (0490 0958)

Overton engineered the Morlais (west) tramroad as well as the Penydarren Tramroad proper, and the presence of such sills here might also be linked with his known interest in them. Nearby to the west were dovetailed sills

---

[33] 0488 0953

similar to those on the Brinore Tramroad, which must be of later date. As elsewhere, it seems that the main line used Outram-type plates, with sills restricted to the quarry; and that as Penydarren neared closure they used a mixture of both (and anything else they could lay hands on) in the quarry.

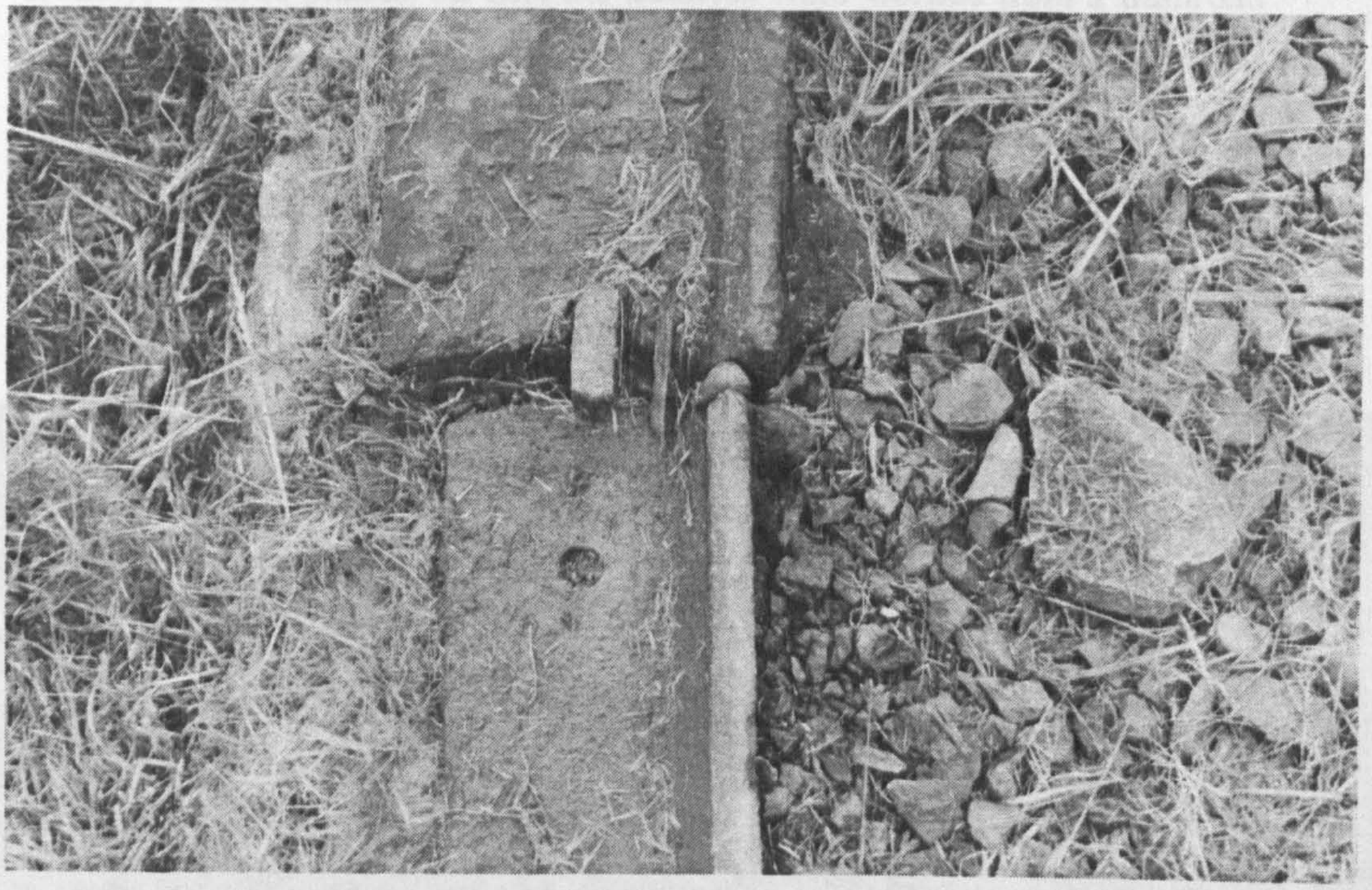


Plate 33. Morlais (west). Mixed plates in the Penydarren quarry

The 1875 OS map shows most of **T3** abandoned, with track removed, having reached the eastern limits of the Dowlais Limestone. It seems fair to assume that it was closed down, along with Penydarren, in 1859. But some track was still in place at the extreme southern end, where excavation revealed *in situ* on a wooden sleeper a plateway chair of the type used in the northern quarries (see below). As Penydarren re-opened for a single year in 1864, they may have used Plymouth chairs.

The northern quarries

This group lies approximately 200m to the north without any intervening quarrying. The explanation for this gap lies in the different method of

working, the southern area being worked up into the outcrop whilst the northern was worked down, in general along the strike line, giving a regular appearance of pavements at different levels. The group is not shown in 1813, but by 1830 a tramroad had just reached it **(T6)**. The main working took place between about 1830 and 1875[34] on three discontinuous galleries and, broadly, in three phases. At first the quarries were worked from a tramroad extension laid with Outram-type plates to a gauge of 4ft 4in (originally 4ft 2in) between flanges. The first quarry **(T6)**, presumably the earliest in the group, was worked by branches laid with chairs and fixed to wooden sleepers at 4ft intervals set in ballast. This line was truncated by later workings to the north. The Outram-type tramroad continues **(T7)** to where it

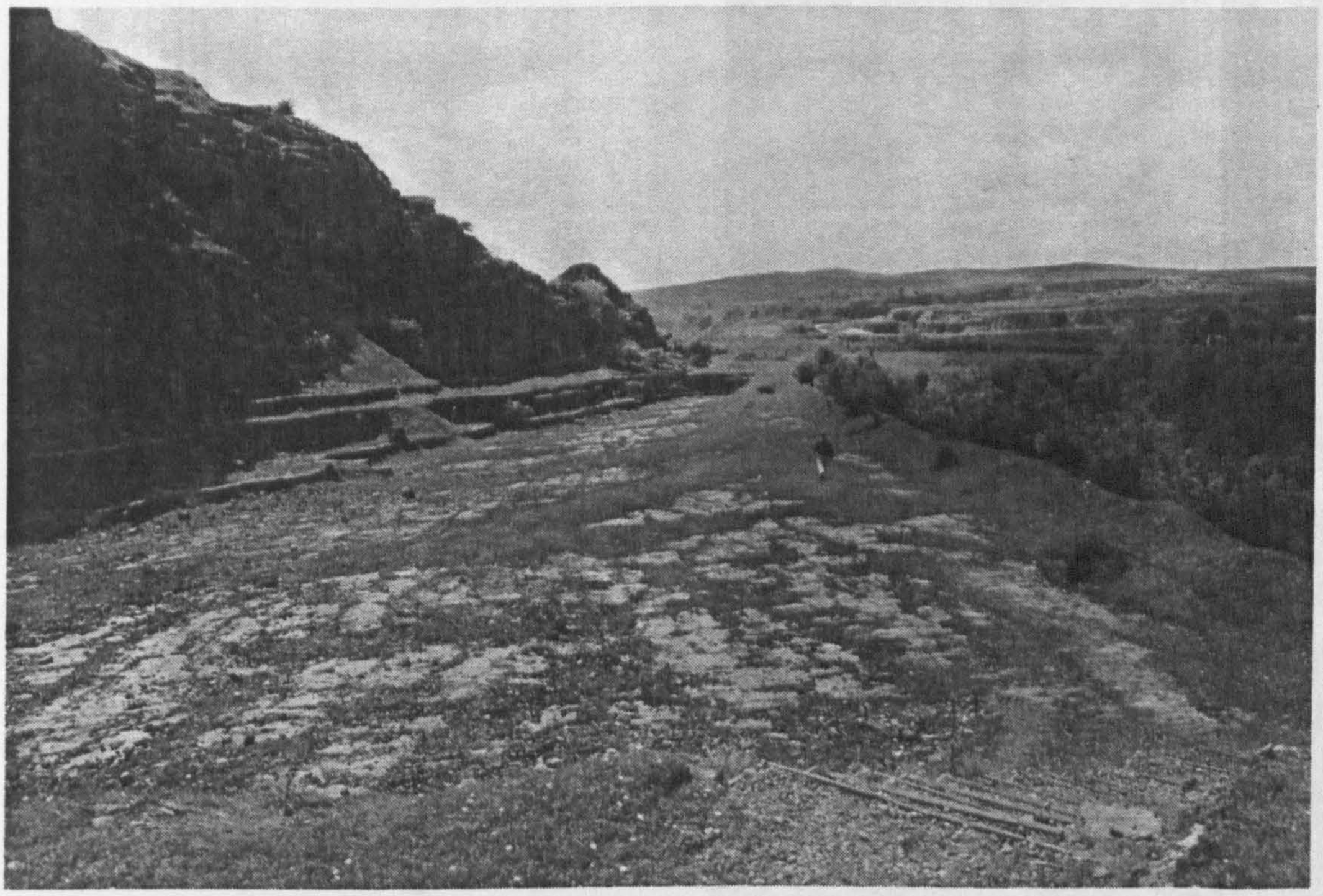


Plate 34. Morlais (west). A northern quarry looking south; the main tramroad lies to the right

[34] OS 25in 1875

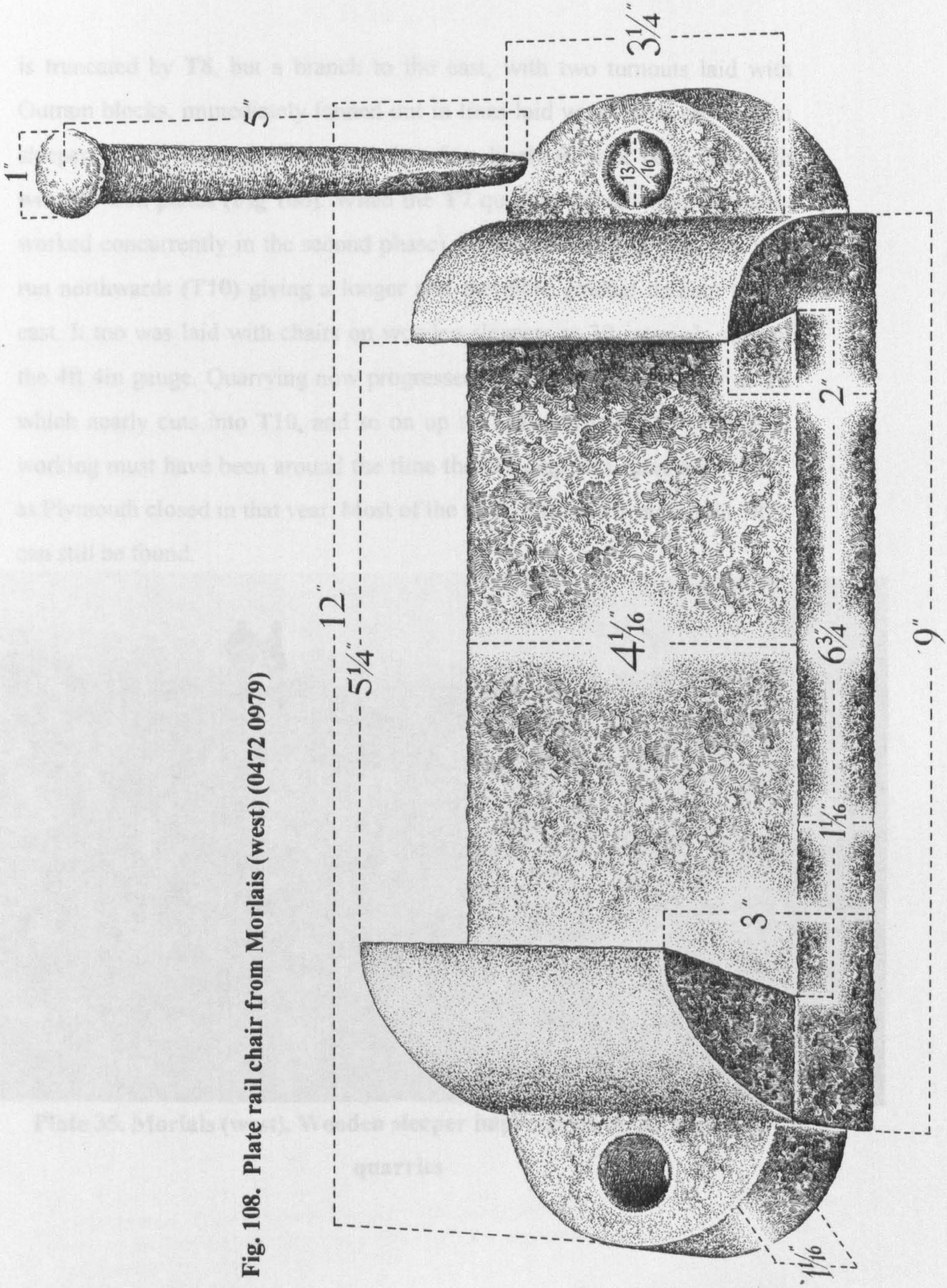


Fig. 108. Plate rail chair from Morlais (west) (0472 0979)

is truncated by **T8**, but a branch to the east, with two turnouts laid with Outram blocks, immediately fanned out in lines laid with chairs on wooden sleepers at 3ft intervals **(T7b)** and therefore likely to have been laid with wrought-iron plates **(Fig 108)**. When the **T7** quarries (which were probably worked concurrently in the second phase) were abandoned, a new line was run northwards **(T10)** giving a longer and therefore gradual descent to the east. It too was laid with chairs on wooden sleepers at 3ft intervals still on the 4ft 4in gauge. Quarrying now progressed eastward in stages, first at **T8** which nearly cuts into **T10**, and so on up to **T11a, 11b** and **12** The final working must have been around the time the OS map was surveyed (1875), as Plymouth closed in that year. Most of the track formations present in 1875 can still be found.

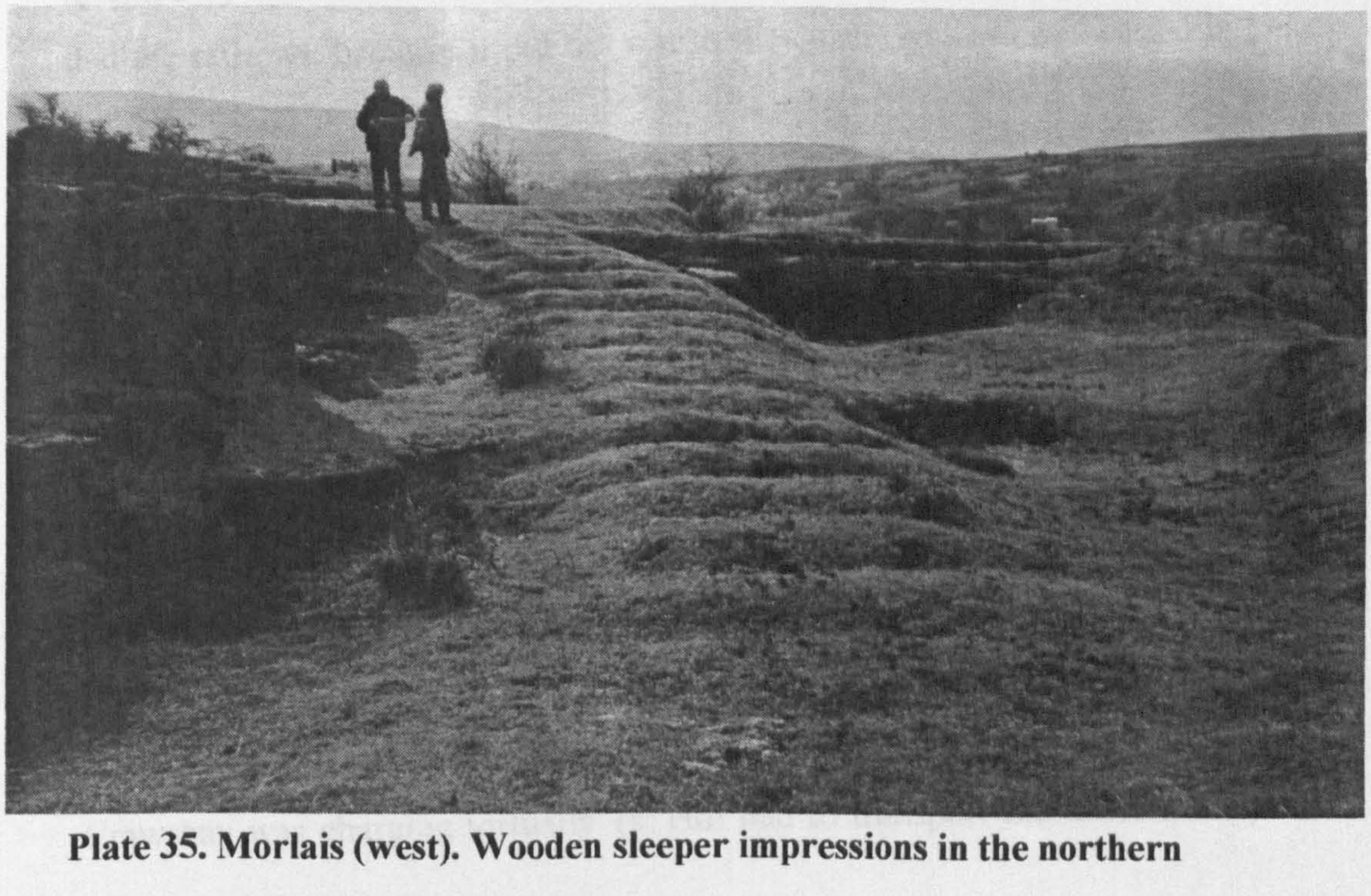


Plate 35. Morlais (west). Wooden sleeper impressions in the northern quarries

CHAPTER 13
GURNOS

Cyfarthfa and Ynysfach Ironworks took all their limestone from Gurnos, which was totally under the control of Richard Crawshay of Cyfarthfa; and so did Penydarren[1] and Plymouth until 1800. The quarry was served by the Gurnos Railroad, which was later converted to tramroad. Crawshay's proposal for the railroad was approved under the four-mile clause by the Glamorganshire Canal Company shareholders in April 1792.[2] He was asked to find a contractor, but having failed to do so the canal company requested him to build it himself. It appears that, having paid for its construction, he was given possession of it and did not make it public. This was much resented by Richard Hill of Plymouth who claimed with some justification that the railroad, because it did not run to the canal, was not authorised by the Act.[3]

Cyfarthfa's lease of Gurnos quarry dated from 1771,[4] while Hill's supplies from Gurnos were regulated by an expensive 66-year agreement dating from 1795:[5]

> The stone was to be quarried in the limestone rocks in Graig y Gwinos, and being 'good and proper limestone' was to be delivered by Mr Crawshay on the side of the railroad at the canal warehouse at the price of 1s 9d per ton long weight, as accustomed at furnaces, from time to time, on reasonable notice.

The maximum tolls of the canal for limestone were 2d per ton/mile and Crawshay was charging virtually 1s. Hill had to transport the limestone by

---

[1] BRL (Journal) 'The Penydarren Company until lately, used to get their lime brought upon horses backs from near the same place where is now got by the Cyfarthfa Company'
[2] Hadfield 1967, 93
[3] NLW Maybery 1889
[4] Lloyd 1906, 49
[5] Lloyd 1906, 78; NLW John Lloyd Collection (Vol. 1) 78 p.14

canal to Abercanaid and possibly finally by railway to Plymouth.[6] His irritation over limestone supplies is constantly visible in his correspondence with John Powell, the Brecon solicitor. In 1799, for example, he wrote, 'The gate going to the canal is now up that shuts me from my limestone. Am I not injured?'[7] In 1793 a certain Mr Ramsbottom, apparently spurred on by Hill, wrote to Powell complaining that the railroad to Gurnos built by Crawshay over land in Ramsbottom's tenancy should have been built by the canal company.[8] Such bickering continued[9] until 1799, when Hill finally joined forces with Penydarren and Dowlais to build the line to Morlais (west) and broke free of Crawshay's clutches.

The railroad **(Pg)**, in place by 1793, was around ¾ mile long and can be traced from the quarry on the east bank of the Taf Fechan to the iron bridge of Pont y cafnau, where it crossed the Taf Fawr to enter Cyfarthfa works. Wear marks on stone blocks show that the original track was twice replaced. First, there are a very few marks from the original bar rails, which like the Clydach type were 2¼in wide on the base and 3¼in over the lugs and were probably 4ft or 5ft long. These blocks have been turned through 90 degrees for re-use. Many more blocks, at 3ft centres along the track, have four holes which indicate two generations of chairs. Type 2 chair mark is 10½in by 4in, with holes at 8½in centres. The 10½in dimension near enough matches that of the integrally-cast chairs on Pont y cafnau. Type 1 is smaller, about 8¼in by 2½in with holes at 6¼in centres. One block (**Fig. 109**, further block) shows a very slight wear mark of Type 1 overridden by a heavy wear mark of Type 2, whereas on the neighbouring block the deep wear from Type 1 survived under the greater width of the Type 2 chair. Type 1 was therefore

---

[6] Lewis 1975, 3. BRL (Journal) 'Water to be brought to the Wheels for blast in a Canal of about 1½ Miles ... This Canal to convey their Limestone also [until it] is to be brought to it by Dram road [Penydarren Tramroad]'
[7] NLW Maybery II 2525
[8] NLW Maybery 2460
[9] NLW Maybery 2466 and 2460

the earlier. Occasional wear marks show that a third was used intermittently. This is similar to that discussed in Chapter 14 **(Fig. 112)**.

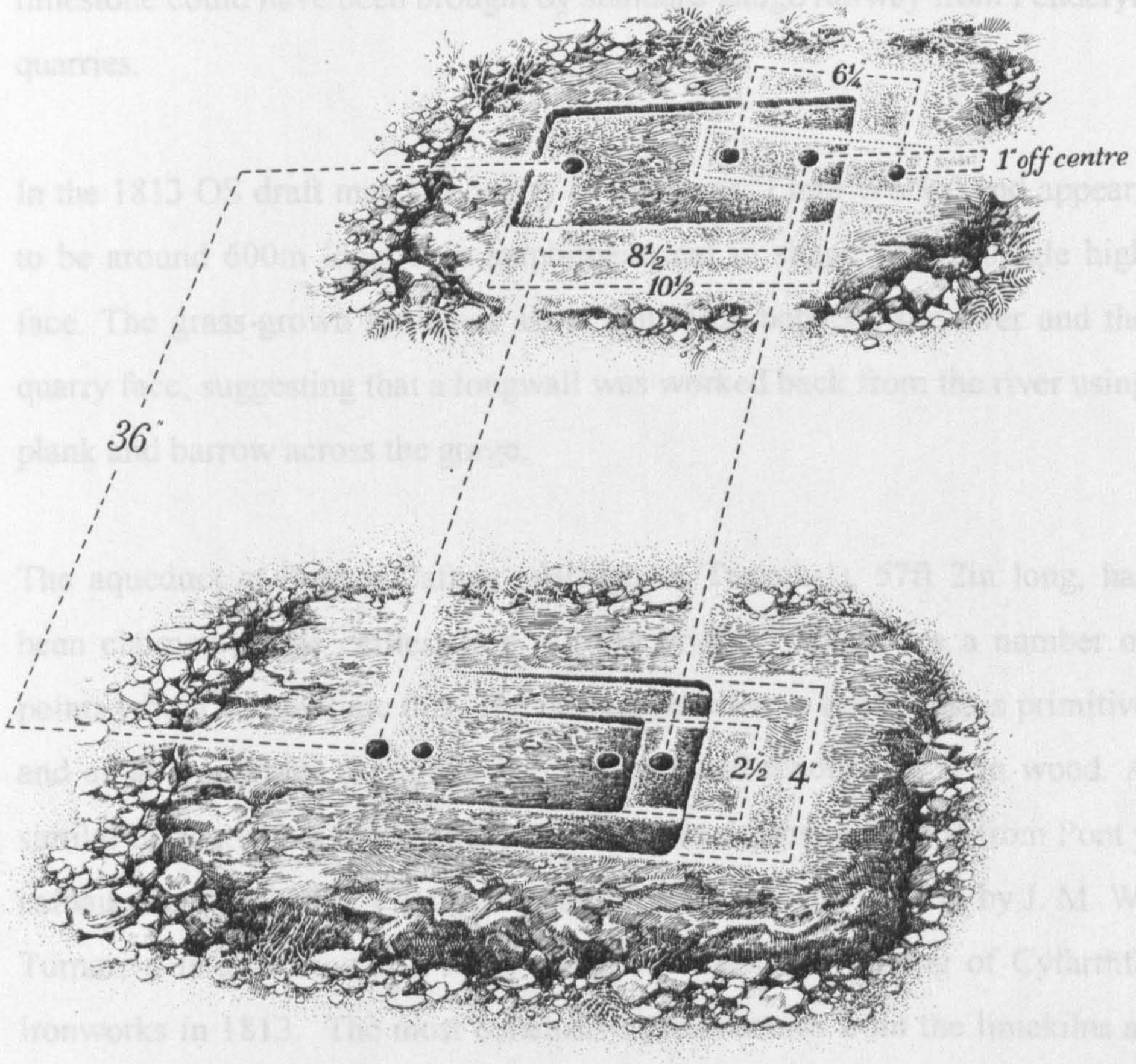


Fig. 109. Stone blocks with chair marks on the Gurnos Tramroad (0372 0770)

The line was still ostensibly a railroad in 1800 when Watt noted 'Limestone is got without much blasting, for being much sifted & split into irregular prisms and large masses are easily detached with Iron Crows & broke small with hammers. A railroad goes from hence to Crawshay's works and the Water is also led off from hence to the Aqueduct [Pont y cafnau] for his great Wheel [Æolus].' But, as we have seen, Watt was not always consistent in his terminology, and it is not known when the conversion to tramroad

took place. The latter may have lasted until Cyfarthfa's closure in 1908, to be reincarnated between 1915 when the furnaces were recommissioned and 1919 when they finally closed. Nevertheless from 1904 (see Chapter 14) limestone could have been brought by standard gauge railway from Penderyn quarries.

In the 1813 OS draft map the quarry is shown as 'Lime Works' and appears to be around 600m long. It is amphitheatrical in shape with a single high face. The grass-grown spoil lies about 8m thick between the river and the quarry face, suggesting that a longwall was worked back from the river using plank and barrow across the gorge.

The aqueduct at Pont y Cafnau ('Bridge of Troughs'), 57ft 2in long, has been claimed as the earliest iron railway bridge.[10] There are a number of points which substantiate this. The design, based on a roof truss, is primitive and as at Ironbridge the joints are mortised and tenoned as if in wood. A similar bridge whose abutments survive a little downstream **(Pf)** from Pont y cafnau was sketched in 1794 by William Reynolds[11] and in 1798 by J. M. W. Turner; it is also shown in J. G. Wood's soft-ground etching of Cyfarthfa Ironworks in 1813. The most conclusive proof comes from the limekilns at 038 075 **(Pg)**, only 400m from Pont y cafnau on the Gurnos line. Two of the four draw arches are lined with cast-iron plates, the other sets having been robbed. The lintels of all four are plain plates 7ft 6in long and 26in wide and 1½in thick. The six remaining plates are 18in wide and also probably 7ft 6in long too, with a single bar rail cast on each. The deck width of the extant bridge is 99in. If, as is likely **(Fig. 110)**, the 26in plates ran down the middle of the bridge and on either side lay the 18in plates with bar rails, then we have a gauge of 3ft 7in, which is close to that of the other railroads. A further 18in plate on each side would complete the width of 99ins.

---

[10] Hughes 1990, 325 and 328
[11] Davies 1992, 16

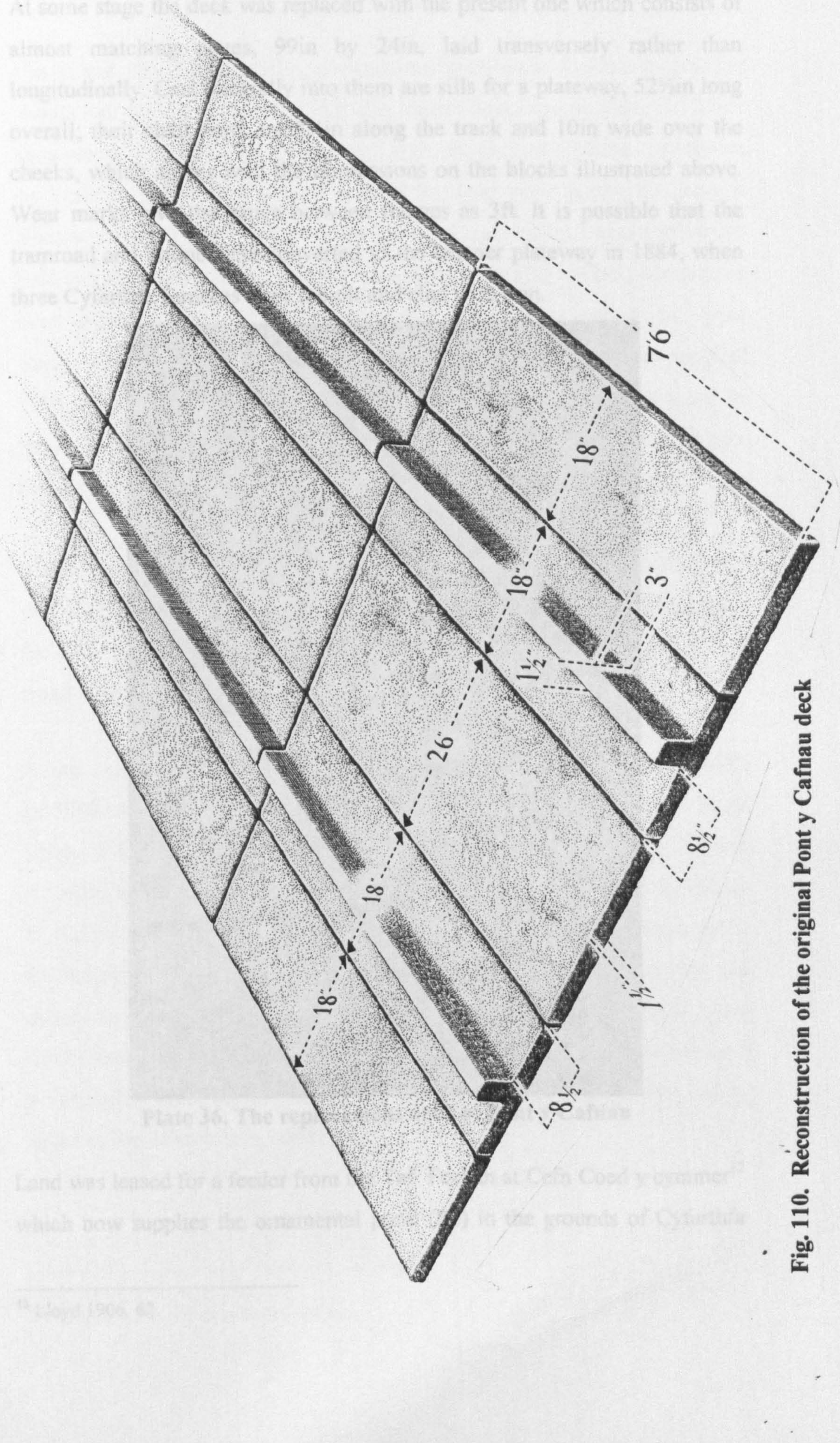


Fig. 110. Reconstruction of the original Pont y Cafnau deck

At some stage the deck was replaced with the present one which consists of almost matching plates, 99in by 24in, laid transversely rather than longitudinally. Cast integrally into them are sills for a plateway, 52½in long overall; their chair parts are 8½in along the track and 10in wide over the cheeks, which agrees with the impressions on the blocks illustrated above. Wear marks give the gauge between flanges as 3ft. It is possible that the tramroad and bridge were converted to the heavier plateway in 1884, when three Cyfarthfa furnaces were rebuilt and clad with iron.

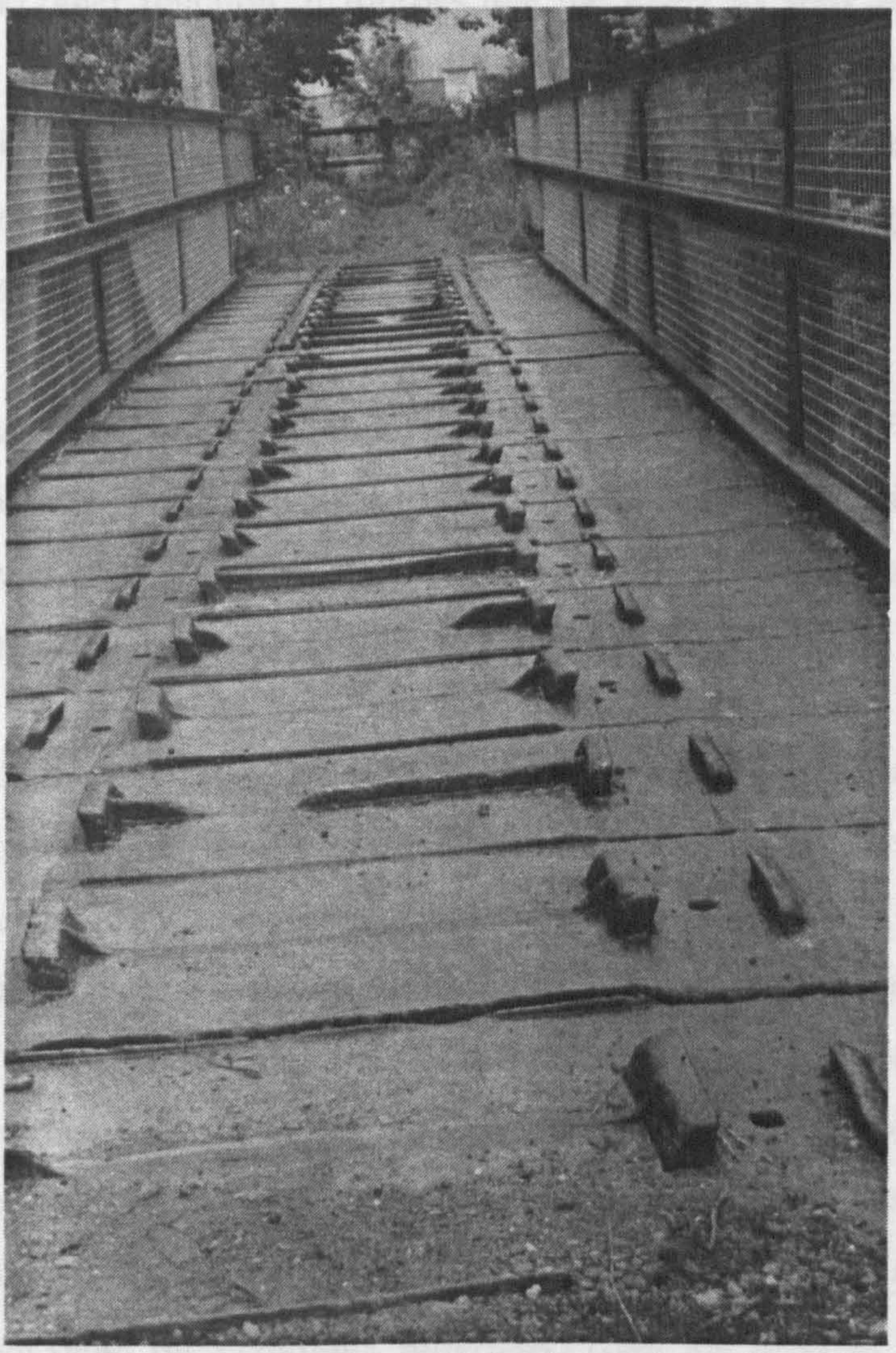


Plate 36. The replacement deck at Pont y Cafnau

Land was leased for a feeder from the Taf Fechan at Cefn Coed y cymmer[12] which now supplies the ornamental pond **(Pe)** in the grounds of Cyfarthfa

[12] Lloyd 1906, 62

Castle and, more importantly, powered the high-level '*Æ*olus' waterwheel installed at the works around 1793. The water was carried over the Taf Fawr on a wooden superstructure supported high above Pont y Cafnau, as shown on Turner's sketch and Wood's etching but long since removed. There is also an extant trough slung beneath the deck, carried by transverse beams held in sockets in the side frames. Because these sockets are original and can have had no other function, it follows that the lower as well as the upper trough was original, in tune with the plural 'cafnau.' The lower was supplied from a weir almost opposite the limekilns and in 1973 the leat could be followed between the railroad/tramroad and the Taf Fechan. Only the sluice now remains.

A small quarry **(Ph)** on the western side of the Taf Fechan (0337 0818) was reached from the Gurnos Tramroad by a cast-iron skew bridge of 38ft span, the abutments of which survive. This was of girder construction with two spindly iron piers, and is dated by Davies to 1830-45.[13]

At the southern end of the line, the site of the 80yd incline seen at Cyfarthfa by William Reynolds in 1794 (see Chapter 2), the first known in South Wales, is hinted at by an agreement of 1794 to deliver limestone 'at the foot of the inclined plane or at navigation lock No. 1, near Cyfarthfa at the rate of 1s 10d per ton.[14] Considering that the rate was the same for either location, the incline must have been close to the lock. Because the incline was gravity-operated, not powered, it cannot have lifted limestone from the low-level Gurnos Tramroad to the top of the furnace bank; it must rather have lowered iron (and, for Plymouth, limestone) from the level of the casting house to that of the canal head.

---

[13] Davies 1992, 80, illus. 219
[14] NLW John Lloyd Collection (Vol 1) 78

The railroad was incorporated into a picturesque walk described by Robert Lugar, the architect of William Crawshay's Cyfarthfa Castle:[15]

> The south-west embraces, on the foreground, the terrace, park and River Taff, beyond which the great ironworks, become conspicuous; these at night offer a truly magnificent scene, resembling the fabled Pandemonium ... At a distance from the castle, a walk along the river leads to a limestone quarry, where the high projecting rocks, combining with the river and wooded banks, form truly grand and picturesque objects.

Just below Cefn Bridge a contrived waterfall flows into a basin by the side of the railroad. Such were Crawshay's aspirations to the status of a country gentleman.

---

[15] Hilling 1973, 71

CHAPTER 14
PENDERYN AND GLYN NEATH

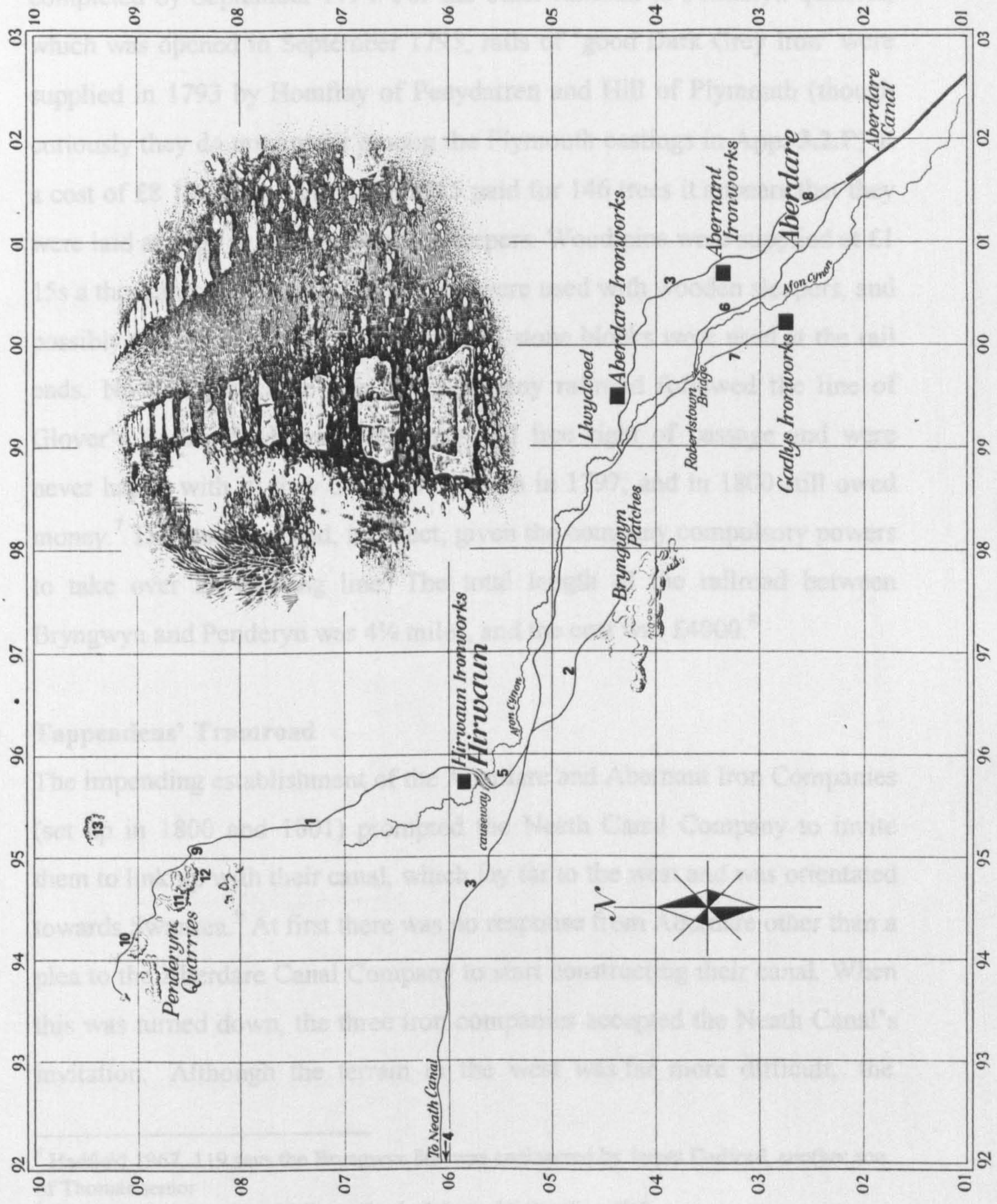
The small village of Penderyn is perhaps best known as the birthplace of Dic Penderyn, the first Welsh working-class martyr, hanged at Merthyr Tydfil following the riots of 1831. The four quarries here (Tor y Foel, Cwar Llwyn On and Cwar Mawr with Cwar Aberaman) were the property of private freeholders[1] and served four ironworks (Hirwaun, Aberdare, Abernant and Gadlys).

Communications to the quarries

Much the oldest of the ironworks was Hirwaun, established in 1757. About 1786 Samuel Glover, during his brief tenancy, built a wooden railway **(U1)**, quite possibly plated, down from the quarries.[2] The area was still remote, and to open it up the Aberdare Canal, surveyed by John Dadford, was authorised in March 1793. The act not only included the traditional eight-mile clause but specifically authorised a 'Railway or Stone Road' from the head of navigation across the mountain to the upper terminus of the Neath Canal. Construction of the Aberdare Canal was long postponed,[3] but to generate some income the company decided to go into the lime-burning business, building kilns just short of Hirwaun ironworks[4] with a railroad in two parts, one from Bryngwyn Patches to 'join Mr Glover's Rail Road upon Hirwaun Common and [the other] from thence to the Lime Rock at Penderin.'

---

[1] Lloyd 1906, 113-14
[2] Hadfield 1967, 118. Samuel Glover was of Birmingham, and his father Joshua occupied a forge at Abercarn. He leased Hirwaun after Anthony Bacon's death in 1786 until 1794 when the works were returned to the Bacon family
[3] Hadfield 1967, 119
[4] SN 9592 0586



MAP U. TRAMROADS FROM PENDERYN TO ABERDARE

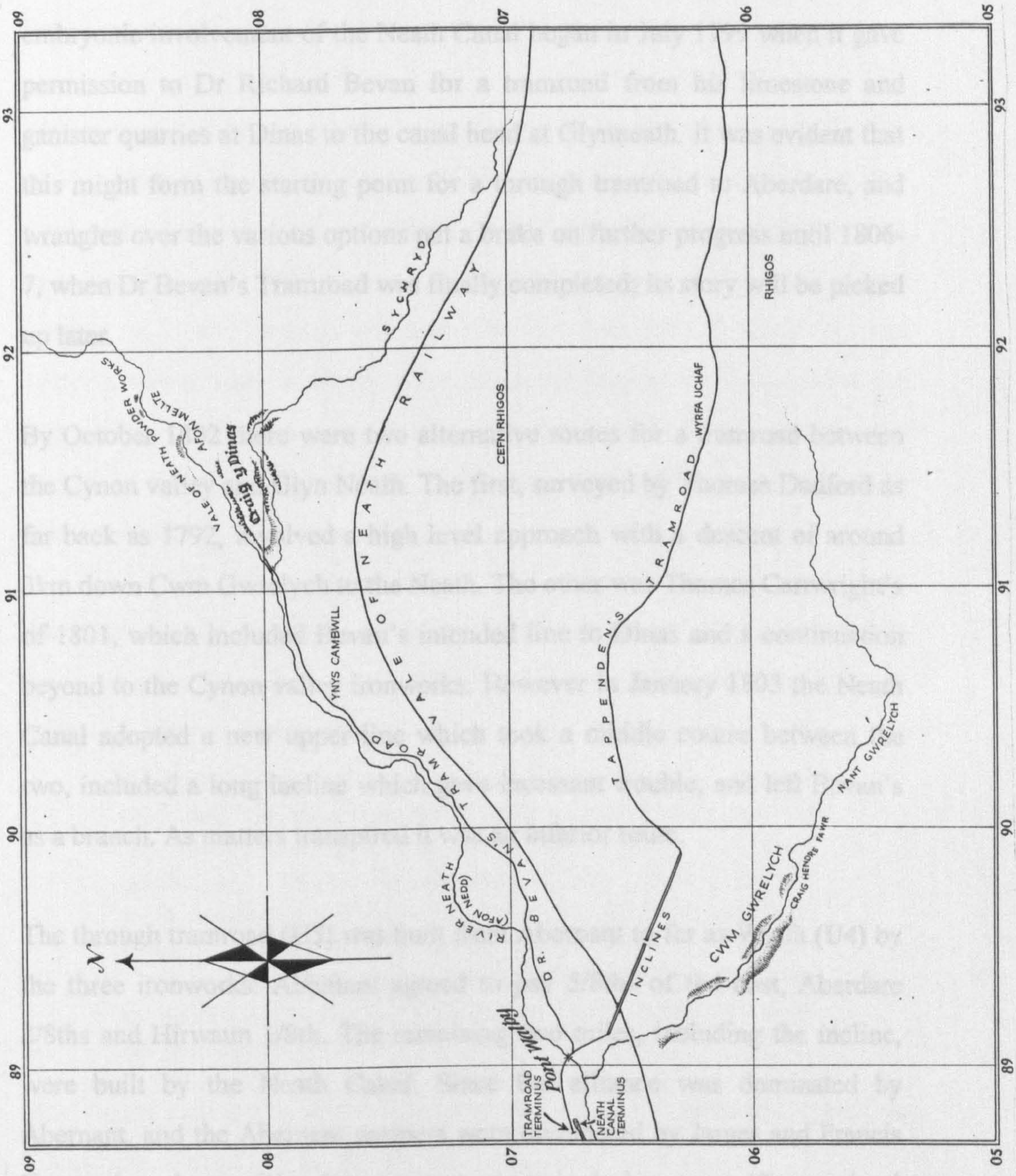
The coal for burning the limestone was brought from the pits at Bryngwyn by a 3ft 2in gauge railroad **(U2)** engineered by Thomas Dadford junior[5] and completed by September 1794. For the other railroad to Penderyn quarries, which was opened in September 1795, rails of 'good Dark Grey Iron' were supplied in 1793 by Homfray of Penydarren and Hill of Plymouth (though curiously they do not appear among the Plymouth castings in **App. 3.2.P**) at a cost of £8 10s a ton.[6] From the £315 paid for 146 trees it appears that they were laid at least in part on wooden sleepers. Wood pins were supplied at £1 15s a thousand; it is not clear how they were used with wooden sleepers, and possibly the sleepers were at mid-rail and stone blocks were used at the rail ends. No doubt because this new company railroad followed the line of Glover's Railroad, Hirwaun felt they had free right of passage and were never happy with it; they disputed the tolls in 1797, and in 1800 still owed money.[7] The canal act had, in effect, given the company compulsory powers to take over an existing line. The total length of the railroad between Bryngwyn and Penderyn was 4¼ miles, and the cost was £4000.[8]

- **Tappendens' Tramroad**

The impending establishment of the Aberdare and Abernant Iron Companies (set up in 1800 and 1801) prompted the Neath Canal Company to invite them to link up with their canal, which lay far to the west and was orientated towards Swansea.[9] At first there was no response from Aberdare other than a plea to the Aberdare Canal Company to start constructing their canal. When this was turned down, the three iron companies accepted the Neath Canal's invitation. Although the terrain to the west was far more difficult, the

---

[5] Hadfield 1967, 119 says the Bryngwyn line was engineered by James Dadford, another son of Thomas senior
[6] GlamRO Aberdare Canal Minute Book, 2 June, 15 October 1793
[7] Davies 1978, 151
[8] Hadfield 1967, 119
[9] For the history of Tappendens' Tramroad see Hadfield 1967, 67-70, 120-1, Tann 1996 and Mear 1999, from which is drawn all information not otherwise acknowledged



MAP V. DR BEVAN'S AND TAPPENDENS' TRAMROADS

prospect of reliable transport lay in that direction rather than eastwards, where the Aberdare Canal remained dormant for another decade. The first embryonic involvement of the Neath Canal began in July 1799 when it gave permission to Dr Richard Bevan for a tramroad from his limestone and ganister quarries at Dinas to the canal head at Glynneath. It was evident that this might form the starting point for a through tramroad to Aberdare, and wrangles over the various options put a brake on further progress until 1806-7, when Dr Bevan's Tramroad was finally completed; its story will be picked up later.

By October 1802 there were two alternative routes for a tramroad between the Cynon valley and Glyn Neath. The first, surveyed by Thomas Dadford as far back as 1792, involved a high level approach with a descent of around 3km down Cwm Gwrelych to the Neath. The other was Thomas Cartwright's of 1801, which included Bevan's intended line to Dinas and a continuation beyond to the Cynon valley ironworks. However in January 1803 the Neath Canal adopted a new upper line which took a middle course between the two, included a long incline which gave incessant trouble, and left Bevan's as a branch. As matters transpired it was an inferior route.

The through tramroad **(U3)** was built from Abernant as far as Wyrfa **(U4)** by the three ironworks: Abernant agreed to pay 5/8ths of the cost, Aberdare 2/8ths and Hirwaun 1/8th. The remaining two miles, including the incline, were built by the Neath Canal. Since the alliance was dominated by Abernant, and the Abernant partners were dominated by James and Francis Tappenden, the resulting line was not surprisingly known as 'Tappendens' Tramroad.' Relations, however, were fragile: Abernant tried to force Aberdare to carry all its iron to the Neath Canal, an undertaking to which Aberdare was lukewarm. But Abernant was largely at the mercy of

Aberdare, which lay closer to the mines and quarries and was irritated enough to stop the tramroad, forcing Abernant 'to convey iron mine, limestone and ore ... on the horsebacks partly over wastes and common.'[10] Full agreement between the two was not reached until 1804.[11]

Aberdare and Abernant together supplied the 3ft plates (weighing 38-44lb, or 60-69 tons per mile) at £10 a ton. The engineer was Evan Hopkin, and the total cost of construction was £1500 a mile. The formation therefore cost between £810 and £900 a mile. An impressive stone bridge, still extant, crossed the Cynon at Gelli isaf near Aberdare Ironworks.[12] The gauge had been decided in 1801 as 4ft 2in, the same as the Penydarren Tramroad which was already well under way; but, as with the Penydarren, the gauge later spread to 4ft 4in. Tappendens' Tramroad was not fully opened until November 1805.

The route finally adopted incorporated the inclines and their troublesome steam engine, and was a bad choice; indeed in 1810 the Neath Canal Company admitted their mistake:

> When the Tramroad ...was in agitation, different plans were proposed, but not one could be devised that would please all the Ironmasters, each Company preferring the one most conducive to its own private interest. The Canal Company were of necessity obliged to prefer one of those schemes, and as it happened to be the one recommended by Messrs. Tappendens, whose works were situate the furthest from the Canal and whom the Canal Company then thought would be the greatest Traders

The Neath manager admitted that had the original Cartwright route via Dinas been chosen 'the Inclined Plane would have been avoided.'

---

[10] NLW Maybery I 10
[11] Tann 1996, 92: 'Abernant to enjoy the tramroad already made and to be made over lands occupied by [Aberdare ironworks]'
[12] Hughes 1990, 321

The two inclines fell 100m over a distance of 750m, the lower one being slightly the shorter. One, presumably the upper, was maintained by Abernant, the other by the Neath Canal. They were worked, or part worked, by a Trevithick high-pressure engine built at Abernant for £775.[13] In the choice of design it is easy to see the hands of James Birch and Jeremiah Homfray, partners with the Tappendens in Abernant: Homfray's brother Samuel at Penydarren was at the time in partnership with Trevithick, and in 1804 Abernant advertised that Birch was 'able to execute orders for engines and castings of every description'. The site of the engine and boiler at the top of the upper incline is marked by a large depression with clinker and firebricks nearby. Blocks show that the inclines were laid with 3ft Outram-type plates which left little wear on them, while one has the impression of a roller bracket (**Fig. 111**: compare the more recent incline roller in **Plate 40**).

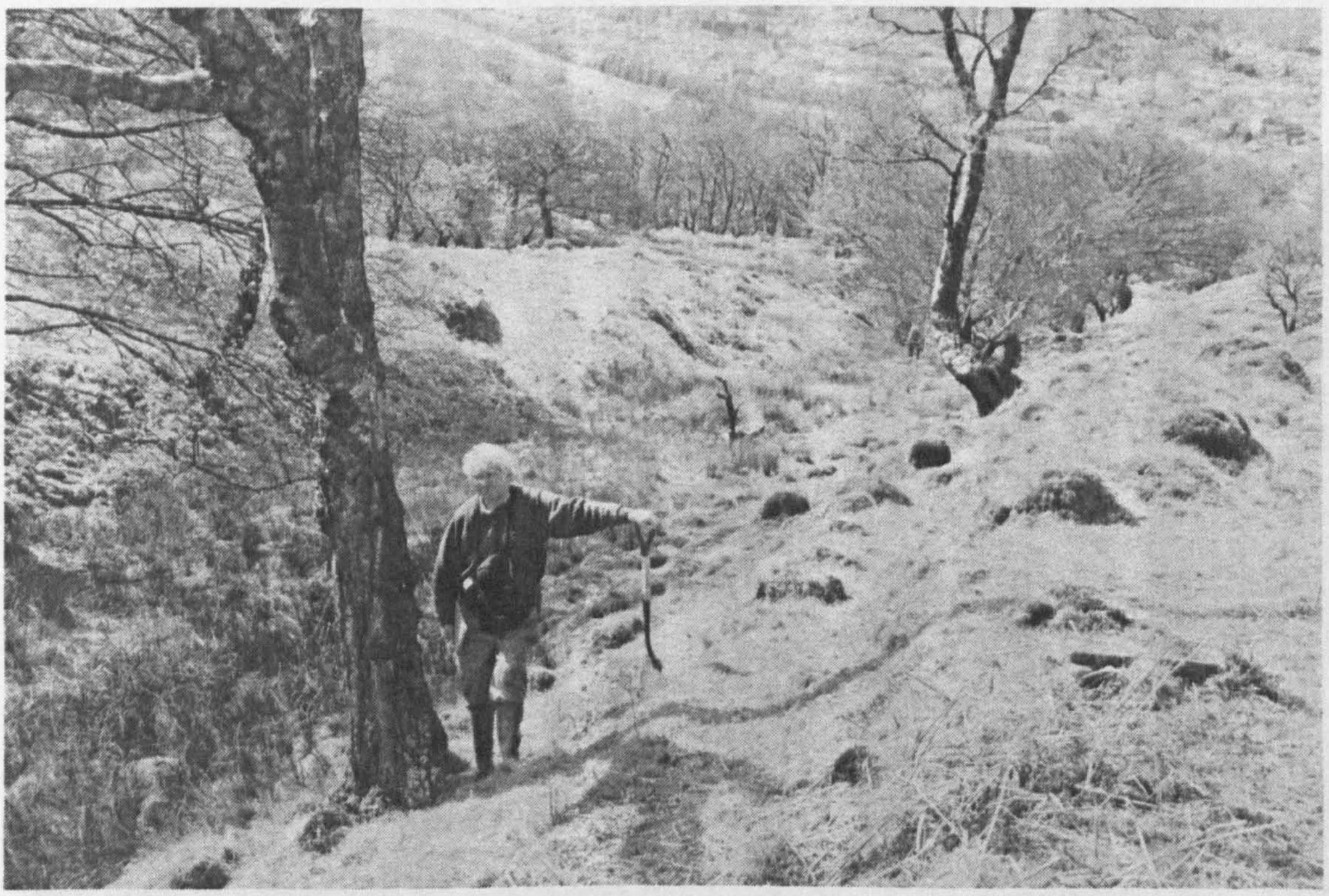


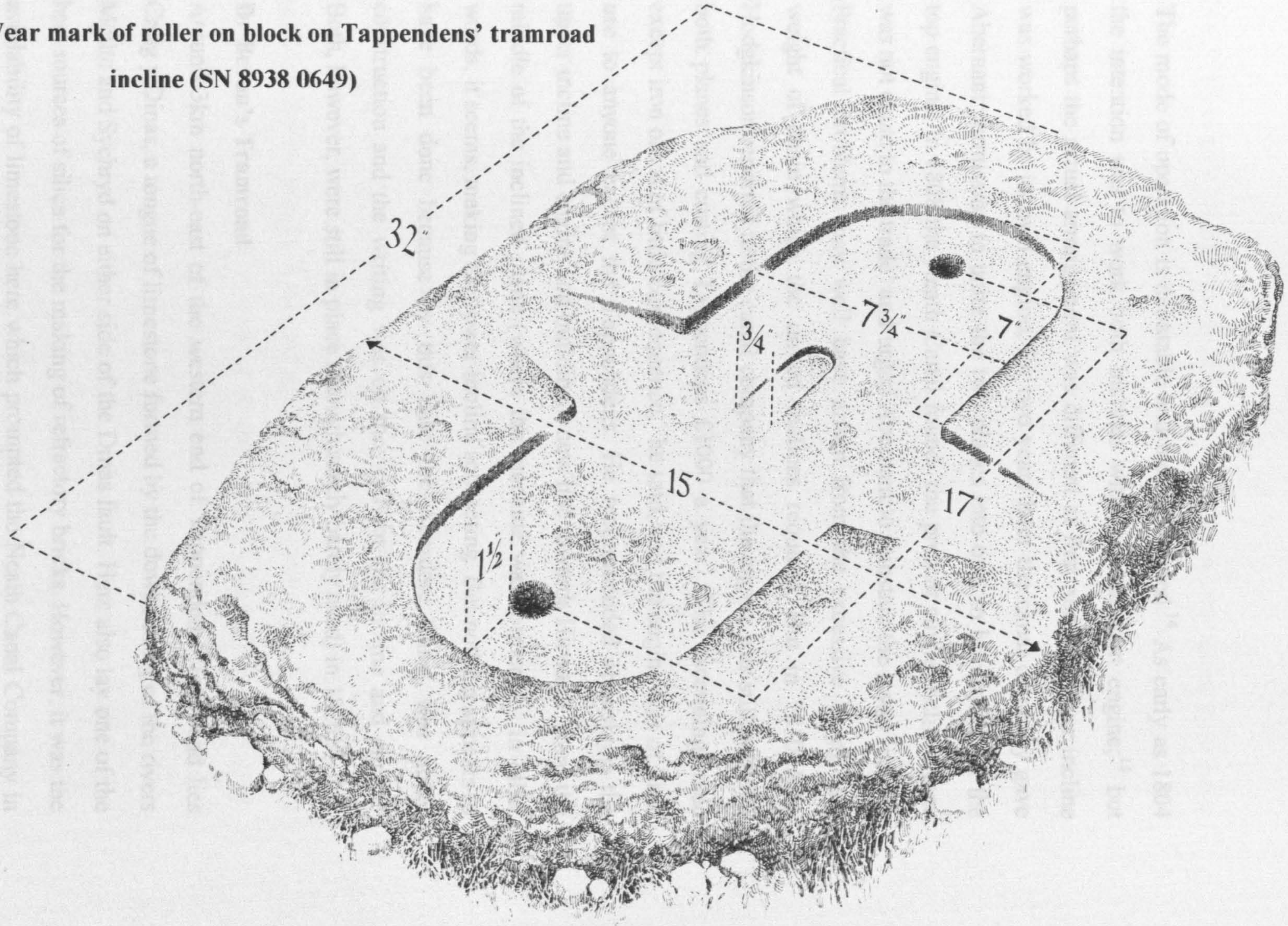
Plate 37. Tappendens' Tramroad: the Abernant part of the incline

[13] Hughes 1990, 339

Plate 38. Tappendens' Tramroad: the top of the incline with the site of the engine on the right

Plate 39. Roller and bracket at Dinorwic slate quarries

Fig. 111. Wear mark of roller on block on Tappendens' tramroad incline (SN 8938 0649)



The mode of operation is debatable and indeed debated.[14] As early as 1804 the intention was to work both inclines with the Abernant engine;[15] but perhaps the actual arrangement was different at first and the lower incline was worked by its own engine, for two years later the canal company gave Abernant permission to unite the two planes into one, to be worked by the top engine. In 1808 the Neath Canal found 'the present single Incline Plane was not equal to the trade' and urged Abernant to reinstate the lower incline. Practical problems may well have arisen from the excessive length and weight of chain which the united inclines required. But in 1810 John Hodgkinson reported to the canal company that the engine was still working both planes and costing Tappendens £1000 a year. 'The ascending trade except iron ore is of little consequence,' he said, and the engine was of little use to anyone except the Tappendens. He recommended abolishing the upper incline and engine and building a new line towards Hirwaun 'from the middle of the inclined plane (where the machine was formerly);' in other words, it seems, making the lower incline self-acting. But nothing appears to have been done because by this date the Aberdare Canal was under construction and the writing was on the wall for the incline and engine. Both, however, were still in place (though surely barely used) in 1826.[16]

Dr Bevan's Tramroad

Around 3km north-east of the western end of Tappendens' Tramroad lies Craig y Dinas, a tongue of limestone formed by the downcutting of the rivers Mellte and Sychryd on either side of the Dinas fault. Here also lay one of the best sources of silica for the making of refractory bricks. However, it was the availability of limestone here which prompted the Neath Canal Company in

---

[14] Hughes 1990, 316
[15] Lloyd 1906, 125, quoting letter from W. Fothergill, 26 Nov. 1804; also NCC General Assembly 5.1.1804 quoted in Mear 1999, 36
[16] Oeynhausen and Dechen 1826, 65

July 1799 to give Dr Richard Bevan and John Bevan permission to make a tramroad from the canal head at Glyn Neath to Dinas under the eight-mile clause of their act.[17] The project was long delayed by the political squabbles surrounding the birth of Tappenden's Tramroad. Following a survey in 1801 by Thomas Cartwright, a provisional agreement was made with Dr Richard Bevan to construct 2 miles 1 chain of rail or tramroad from the canal head to Dinas Rock,'[18] with the prospect of becoming the first section of a through line to Aberdare. But in the event Dr Bevan's Tramroad was not completed until 1806-07, and it never went beyond Dinas.

Dinas limestone was certainly sent down the canal to Neath Abbey furnaces. The question of interest to us is whether it also found its way to the ironworks of the Cynon valley. From just south of Pont Walby, Tappendens' and Bevan's followed a common course to the canal basin. A common gauge would make sense (Baxter gives it as 4ft 2in[19] which would accord with the rest of the system) and would make transport of Dinas limestone to the Cynon valley ironworks theoretically possible. Though distant, Dinas might have served their limited needs before the Penderyn line was improved in 1808. Furthermore, if the incline was required only to lower iron to the Neath Canal, why was it not a simple balanced one but powered (however inefficiently) by steam? It hardly hauled up coal and ordinary ironstone, which were readily available close to the Cynon works. Nevertheless, if Dinas limestone was being carried eastwards, why was Cartwright's more convenient route via Bevan's not adopted? The answer to both questions may lie in Hodgkinson's statement in 1810 that 'the ascending trade except iron ore is of little consequence.' Certainly by that date hematite ore was being imported from Lancashire and Cumberland to the Heads of the

---

[17] WGlamRO Neath Canal Proprietors' Minute Book 4 July 1799. This was to be built under the NCC second act of 1798

[18] Tann 1996, 90. This agrees almost exactly with measurement on the map

[19] Baxter 1966, 217

Valleys;[20] and by that date the Penderyn line had been improved, and any limestone traffic from Glyn Neath which might have shared the incline with the hematite would have ceased.

In 1859 Bevan's Tramroad was still owned by his heirs but leased to David Davis, who was still in possession in 1882.[21] In 1860 it was converted to a railway of dual gauge (2ft 6in and 3ft 6in) laid probably with wrought-iron T rails in light chairs, as were still to be seen in 1975 on a connecting line on the other bank of the Neath.[22] It acquired an incline connection to the Vale of Neath Railway; but limestone production declined in favout of silica, which was worked here by Richard, Thomas & Baldwin until 1964.[23] The route of the tramroad can be followed as a footpath eastwards from the north end of Pont Walby. As far as Ynys cambwll (SN 9059 0770) much of the line is intact and in places stone blocks of Outram pattern survive, giving a consistent plate length of 34in. At SN 9100 0792 it crossed the Sychryd to the quarry, the present bridge abutments probably dating from the conversion of 1860.

Aberdare Canal Company lines from 1805

The section of Tappendens' east of Hirwaun carried Penderyn limestone to Aberdare and Abernant furnaces. To avoid transhipment from railroad to tramroad, Hirwaun wanted the Penderyn line to be converted, but at this stage probably only a 600m stretch **(U5)** from the ironworks into Tappendens' was rebuilt, Hirwaun being allowed £5 a ton for scrap from the old road.[24] Between 1806 and 1808 Hirwaun, Aberdare and Abernant pressed the Aberdare Canal to make a call of £2500 to improve its lines from Penderyn and Bryngwyn, even offering tramplates at cost to replace the

---

[20] PRO C.114/124 (part 1) ff. 15-16
[21] Hadfield 1967, 68
[22] John van Laun field notes 30.10.75
[23] van Laun 1976, 7
[24] Davies 1978, 152

rails.[25] The request was refused, and in 1807 Bowzer, Overton and Oliver, the current tenants of Hirwaun, leased the Bryngwyn branch for £40 a year including maintenance. The following year the three companies converted the rest to a plateway at their own expense and constructed a high causeway at Hirwaun, a most impressive structure built by George Overton.[26] All three ironworks now had uninterrupted access to Penderyn. At this stage it was an Outram-type plateway, but wear marks on stone blocks (vignette, **Map U**) show that at some later stage, no doubt after 1839 when the line from Gelli isaf to Hirwaun became canal company property, it was re-laid with wrought-iron plates held in dumb-bell chairs **(Fig. 112)**.[27]

Frustrated with Tappendens' Tramroad and its unreliable incline engine,[28] John and George Scale of Aberdare ironworks decided to revive the moribund Aberdare Canal scheme. In 1809 they bought shares in it, and John became a member of the management committee.[29] Not surprisingly the next phase of tramroad building comprised the length **(U6)** from the proposed canal head to Gelli isaf bridge near Aberdare Ironworks. All the ironworks, Abernant included, threw themselves into the undertaking. The 1½-mile route had been surveyed in 1800 by Thomas Dadford junior and the cost estimated at £1500[30] and, although possibly re-surveyed by Edward Martin of Morriston, Dadford's route was evidently followed. The 3ft tramplates weighed 56lb and cost £7 10s a ton or 3s 9d each.[31] The line, including a cast-iron bridge which still survives at Robertstown, was completed in 1811 and the engineer was probably George Overton. Initially it carried no limestone, but Gadlys Ironworks, on its establishment in 1827,

---

[25] Davies 1978, 153
[26] Elsas 1960, 172, letter from Jeremiah Cairns, 12 June 1821: 'I recollect the Limestone Rail Road to Aberdare being replaced by a Tram Road.' For the causeway, Hughes 1990, 320 with illus.
[27] Mear 1999, 5 illustrates this type of chair
[28] For a full account of this see Tann 1996
[29] Davies 1978, 153
[30] Hadfield 1967, 120
[31] GlamRO Aberdare Canal Minute Book, December 1810

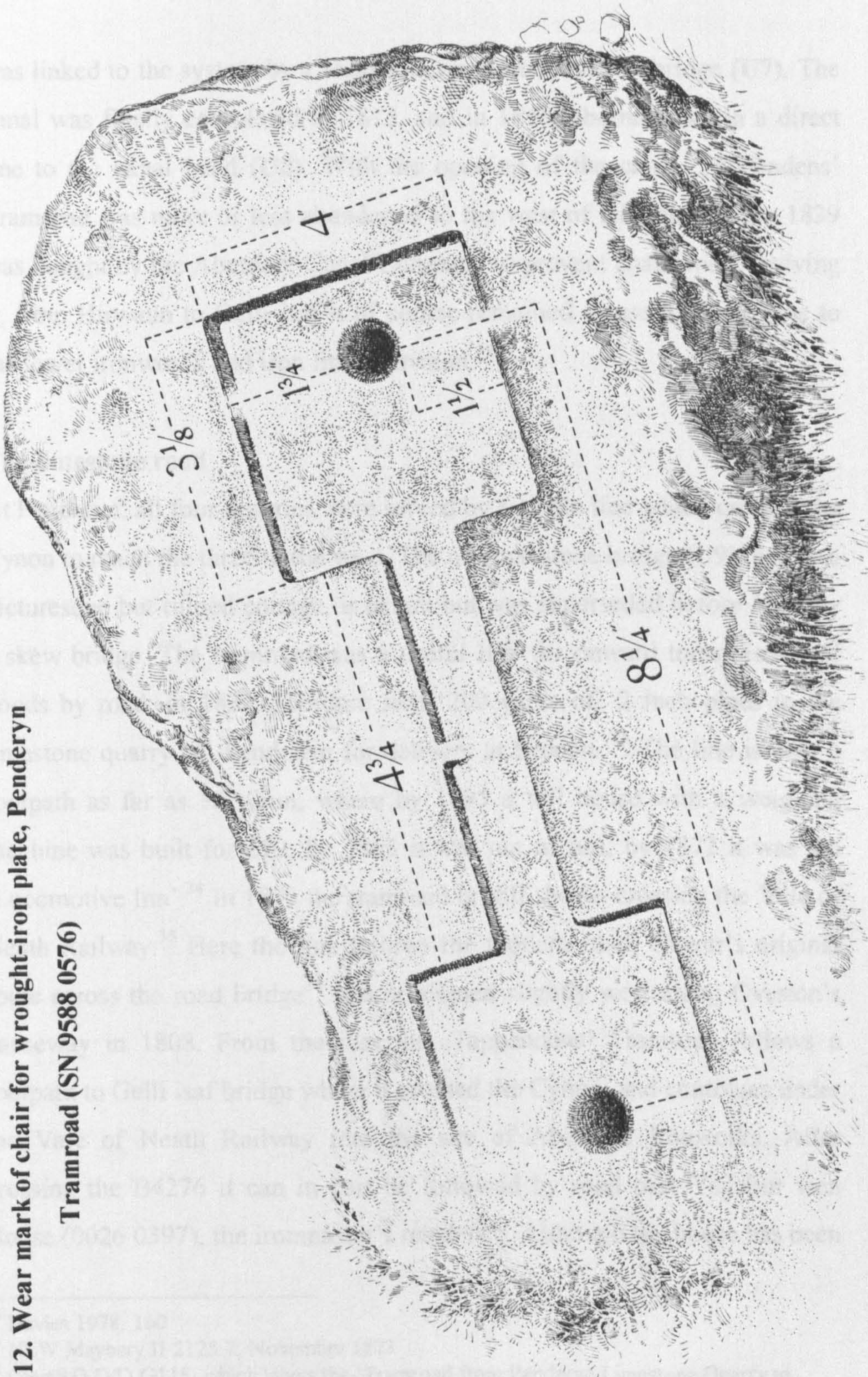


Fig. 112. Wear mark of chair for wrought-iron plate, Penderyn Tramroad (SN 9588 0576)

was linked to the system by a short line from Robertstown bridge **(U7)**. The canal was finally completed in 1812, and in 1819 Abernant put in a direct line to the canal head **(U8)**. With the opening of the canal, Tappendens' Tramroad was more or less abandoned to the west of Hirwaun and in 1839 was bought by the Aberdare Canal Company to prevent coalowners reviving it; from Hirwaun to Gelli isaf it of course remained in use for limestone to the lower ironworks and iron from Hirwaun.[32]

The limestone road

At Penderyn, all four quarries were served by a single line which crossed the Cynon to reach the three to the west. The original stone bridge **(U9)**, beside a picturesque but ruined cottage, is extant but was superseded before 1883 by a skew bridge. The tramroad was a useful link for onward transmission of goods by road: in 1823 Aberdare sent '200 yards of 2 inch pipes to the limestone quarry of Penderrin for delivery at Brecon.'[33] The line is now a footpath as far as Hirwaun, where by 1795 a toll house with a weighing machine was built for £70; by 1863 it was out of use; by 1872 it was the 'Locomotive Inn'.[34] In 1876 the tramroad is still shown crossing the Vale of Neath Railway.[35] Here the line follows the modern road; Glover's original route across the road bridge[36] was re-aligned slightly west along Overton's causeway in 1808. From the junction, Tappendens' Tramroad follows a footpath to Gelli isaf bridge where it crossed the Cynon, and continues under the Vale of Neath Railway into the site of Aberdare Ironworks. After crossing the B4276 it can in part be followed by road past Ysgubor wen House (0026 0397), the ironmaster's residence. Although the house has been

---

[32] Davies 1978, 160
[33] NLW Maybery II 2125 7, November 1823
[34] GlamRO D/D G115, which labels the 'Tramroad from Penderyn Limestone Quarry to Aberdare'
[35] OS 25in 1876
[36] Hughes 1990, 320 refers to correspondence between Tappenden and Overton suggesting that the road bridge could not carry a 20ft embankment on top

demolished, the stables survive from which some of the horses were no doubt employed on the tramroad. After another half kilometre the Abernant works area is reached. The 1811 line to the canal could by followed until the mid-1990s as a minor road as far as Robertstown Bridge where it crosses the Cynon to the east. The bridge now sits isolated, but the tramroad can be picked up as a footpath again.

As early as 1825 David Stewart, agent to the landowner the Marquis of Bute, suggested 'A Loco Motive Road from Abernant to Hirwaun [to] convey coal and bring iron back & limestone at a trifling expense.'[37] Five years later a road locomotive by Goldsworthy Gurney engine was converted for plateway use and was tested at Hirwaun. William Crawshay junior waxed enthusiastic about it, but his father was less optimistic. The 30cwt engine drew a load of 20½ tons over about 3 miles in 39 minutes and returned in 32 minutes, the route being almost certainly that suggested by Stewart (the distance from Hirwaun to Abernant is just over 3 miles). After adjustments it drew 21½ tons over the same route in 19 minutes and returned in 18. It then entered serious service, and during 1831 it pulled 42,000 tons of coal, iron ore and iron in loads of 20 to 30 tons. It was still at work in February 1832.[38] William Crawshay's son Francis recalled in 1878 that as a lad he assisted Gurney in the trials; 'the engine did wonders,' so that .'the Welsh mechanics 'broke up all their old engines and substituted new locomotives in their place'.[39] While this should not perhaps be taken literally, it does imply that Gurney's locomotive had predecessors and successors at Hirwaun.[40]

The Aberdare Railway (in effect the Taff Vale) reached Aberdare from the east in 1846, and in 1851 the broad gauge (from 1863 standard gauge) Vale

---

[37] NLW Cyfarthfa II 289, David Stewart to William Crawshay junior, 18 January 1825
[38] NLW Cyfarthfa II Box 2 523; for full discussion, Marshall 1953, 217-22. See also *The Cambrian* 26 March 1829
[39] Harris 1975, 49
[40] Kidner 1993

of Neath arrived from the west. At and below Hirwaun the old tramroads were rebuilt, that from Bryngwyn, for example, by 1863; but it was not until 1904 that the limestone road from Penderyn was converted to standard gauge for locomotive work, at first using a single Peckett 0-4-0ST. Thereafter Penderyn limestone could be transported by rail to any of the Heads of the Valleys ironworks. With an extension from Tor y Foel quarry the line was used for the construction of Ystradfellte Reservoir (SN 945 174) in 1907-15[41] and of Penderyn Reservoir in 1911-21. It remained the property of the Aberdare Canal Company until 1924, and a ground frame with 'ACC' impressed on it was noted in 1975.[42] In 1944 the Penderyn Railway was taken over by a quarrying enterprise and survived until 1985. The rest of the tramroad system remained in partial use to about 1917[43] and technically in the ownership of the ACC until 1955, but is now without an owner.[44]

The quarries

Tor y Foel **(U10)**, the earliest quarry, must have been used by Hirwaun from 1757. In 1793 the fledgling Aberdare Canal Company leased land here and, as we have seen, began lime burning. The quarry was sublet to Thomas John Llewellin who was given five guineas to start and loaned 'two planks and two wheelbarrows out of the company's stock.' These basic aids to quarrying[45] were superseded in 1799 when he was paid to construct a wooden railroad in the quarry. Both barrows and railroad fed Glover's line, now converted to iron, for Llewellin was to deliver the limestone 'at the side of the tramline.'[46] Tor y Foel is the only Penderyn quarry undisturbed by twentieth-century reworking. It is still little larger than in 1813, and in 1830 it was still the only quarry working, which implies that Hirwaun, Aberdare

---

[41] Havilland 1994, 245-6
[42] John van Laun field notes 17.5.75 (SN 950 087)
[43] Mear 1999, 150
[44] Mear 1999, 72
[45] Compare 'planks ... for the purpose of wheeling over' at a Nantyglo ore working in 1794 (Lloyd 1906, 168)
[46] Davies 1978, 150

and Abernant were using this small area for all their needs, a salutary reminder of the limited quantities of limestone required at the period. In 1846 Aberdare and Abernant, though retaining the right to quarry at Tor y Foel,[47] had moved to 'Skybor Vawr' (Cwar Mawr). The quarry extends for approximately 200m and was worked on four separate faces, the two to the north-west being considerably smaller. A level at 9409 0888 was probably for silica for the brick works (SN 961 060) alongside the Vale of Neath Railway at Hirwaun.

Cwar Mawr **(U11)** lay on Ysgubor Fawr land and, as its name suggests, was the largest quarry, and about 1906 it was stated that the closure of the Abernant works alone meant a loss to the landowner of £500 a year.[48] Aberaman **(U12)**, the general name given to the quarries in the south of Cwar Mawr, no doubt supplied Crawshay Bailey's new works of that name far down the Cynon valley. In 1874, though probably not used for fluxing, it was already leased to William Powell (Powell Duffryn Steam Coal Company who took over Aberaman in 1867) who re-leased the southern part to other parties in anticipation of reviving Hirwaun works.[49] About 1906 this part was in lease to the Marquis of Bute.[50] In 1874 the northern part was already leased to the Aberdare Iron Company, and must be the 'Skybor Vawr' quarry mentioned above. Cwar Llwyn On **(U13)**, the outlier to the north-east, lay on Bodisigiad land and in 1906 was in lease to Powell & Co.[51]

---

[47] NLW Maybery I 46
[48] NLW Maybery I 1871-84
[49] NLW Bute D 82/6
[50] NLW Maybery I 1871-84
[51] NLW Maybery I 1871-84

CHAPTER 15
CONCLUSIONS

Track

The quarry systems and their track have now been described. Two final sources, valuable but difficult of interpretation, remain to be introduced. These are the particulars of castings made at Ebbw Vale from 1792 to 1796 and at Plymouth from 1787 to 1801, the relevant entries from which are summarised in **App. 3**. The inherent problems are twofold. One is that the length of rails is often not stated, which disguises the weight per yard although it invites intelligent guesswork. The other is that the terminology is not always clear, which makes it difficult to place potentially interesting items in their correct category. Highly important information nonetheless emerges, which both underlines our lack of comparable evidence from other ironworks and reinforces the conclusion to be drawn from all the other sources: that the decade when both railroad and tramroad technology made its most rapid and indeed phenomenal advances was 1790-1800. Thereafter innovation gradually tailed off. The many evolutionary steps involved are here discussed in the chronological order of their appearance and, for ease of reference, small-scale outlines of the relevant figures in earlier chapters are assembled together.

RAILROADS

Wooden rails

The wooden rail had arrived from Shropshire at Neath in 1697, and had migrated to our area by about 1786 when Mr Glover's Railroad was laid at Penderyn, where wooden branches were still being laid in the quarry as late

as 1799. To our knowledge of this stage of development nothing new can be added.

Iron plates on wooden rails

The iron plate first evolved, as we saw, at Coalbrookdale from 1767 where it was applied both on the surface and underground. As appears from the table below, its normal length in Shropshire was perhaps 6ft, though cases were known, there and elsewhere, of 7ft, 5ft, 4ft and 3ft; its thickness was usually 1¼ or 1½in; it had two, three or four lugs for nails **(Fig. 3)**; and its weight, after an initial 62lb/yd, was generally reduced to 42-53lb/yd.

Iron plates very likely reached South Wales (at Landore, underground) in 1776, but around the Heads of the Valleys no certain example has hitherto been known, although Glover's railroad is a possible candidate. In 1788-9, however, Plymouth cast small numbers of 'plates' or 'plain plates' for Cyfarthfa and quite large numbers for Dowlais **(App. 3.1.P)**. They were too heavy to be tramplates; the great majority weighed between 110 and 127lb which, assuming that they were 6ft long, gives 55-64lb/yd. Those that weighed 57 and 82lb may well have been 3ft and 4ft long respectively, which puts the weight per yard within the same range. This is comparable to the heavier Dale plates. It therefore seems highly likely that plates cast by Plymouth in 1788-9 were for wooden rails and, in view of their weight, for surface rather than underground use. Those cast for Dowlais, which in 6ft lengths represent just over three miles of track, were presumably for some line or lines serving coal and iron pits. Another possibly plated line was the 'Waggon Way' (foreign terminology for these parts) shown on a map of 1799 as running from coal mines for about a mile to Penydarren.[1] The idea of plates was very likely brought from Shropshire by either John Guest of Broseley, who became manager of Dowlais in 1767, or Francis Homfray,

[1] Yates 1799

who had ironworks at Broseley and first became involved at Cyfarthfa in 1782.

Dimensions and weights of plates and bar rails

	length	max. rail width	depth	weight	lb/yd	no. of lugs	width at lug	joint
Plates on wood								
Dale 1767	72			125	62½			
Horsehay 1768-74	72 (84)			124	62			
Dale (Hornblower)	60	4	1¼	*89*	*53*	3		butt
Dale (Randall)	72 (84)	3¾	1¼	*102½*	*51*	4		
Dale (Lesage 1784)		3						
Dale, Hay	72	3¼	1½	*91*	*45½*	3	4½	butt
Dale, Newdale	84?	3	1½	*84*	*42*	4?	4	butt
Baader	36	2	c.1⅓	*32*	*32*	2	4¼	butt
Caldon (Curr)		*5*	1½		70½			
		3	1½		40½			
Caldon (Farey)	36	2½	1¾	42	42	2		m/f
Alloa	48	1¼	1¼			3		
Landore 1776	c.48	5	9/10c.56		c.42			
Cyfarthfa/Dowlais 1788	72?			110-127	55-64			
All-iron bar rails								
underground								
Plymouth 1787-8	72			70-76	35-38			
Penydarren 1793?	60	2⅞	1½	82?(*69*)	49?(*41*)	3	4⅛	m/f
Nantyglo 1794	48?			46-8	36			
Plymouth 1794-1800	72			51-71	26-32			
surface								
Tyla-Blaenavon	72	2½				0		butt
Dowlais 1791	72	2¾	2	88-90	44-5	0		m/f
Gurnos 1792	48/60	2¼				2?	3¼	m/f
MCC/Blaenavon 1792	48	2½	3	83	62	2		m/f
Blaenavon 1798 (Coxe)	48		3					m/f
Clydach 1793	48	2⅝	3	84	63	2	3¼	m/f
Trevil 1794	48	2⅛	2½	79	59	2	4⅝	m/f
MCC Beaufort 1796	48			73	55			
Landore (defunct 1826/7)	30	2½				0		lap

dimensions in inches, weights in lb

89 calculated figures
m/f male and female

(Sources: for all plates, Lewis 1970 except Newdale and Hay (Ironbridge Gorge Museum); for all bar rails, this thesis. The broken Newdale plate is perhaps a third of an 84in original rather than half of a 55in one as is usually assumed)

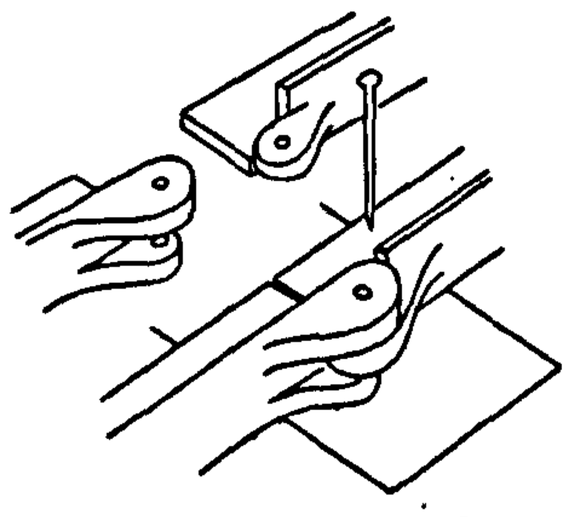


Fig 6. Curr's method of morticing

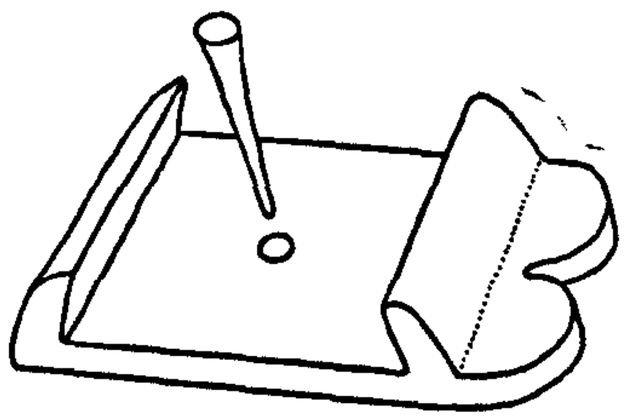


Fig 8. The Kington Railway chair

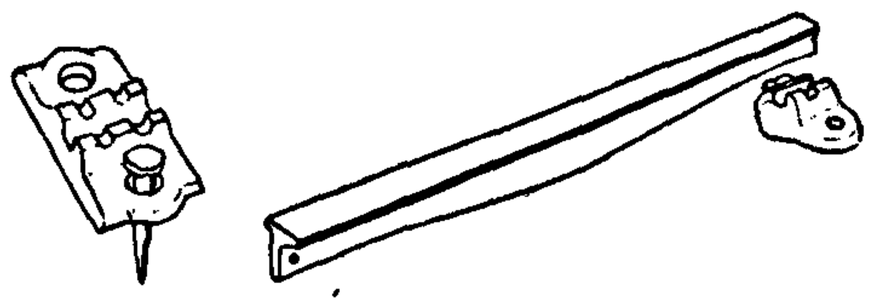


Fig 18. Fish-belly rail and chairs from the Abersychan Limestone Railway

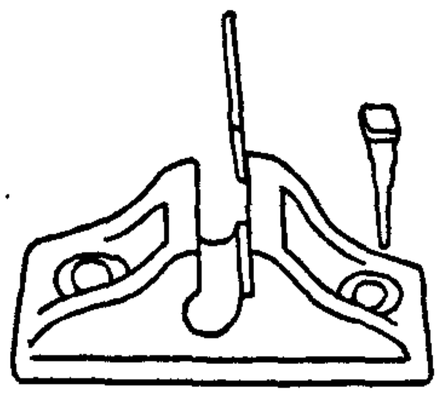


Fig 20. Chair from Abersychan Limestone Railway

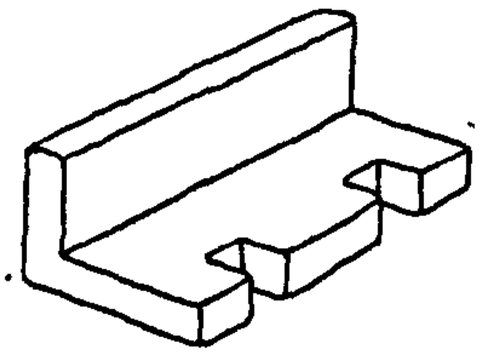


Fig 25. Saddle for Tyla-Blaenavon Railroad

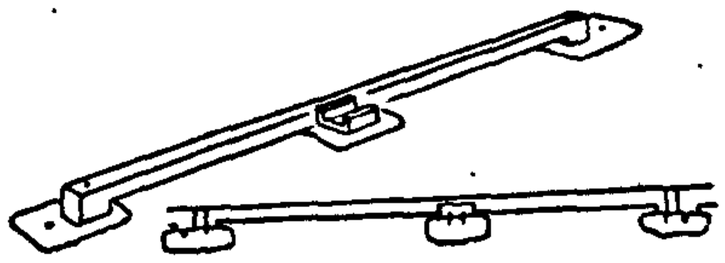


Fig 26. Conjectural arrangement for the use of a saddle

Fig 27. Sill with cast-iron chairs and wrought-iron tie from Tyla-Blaenavon Tramroad

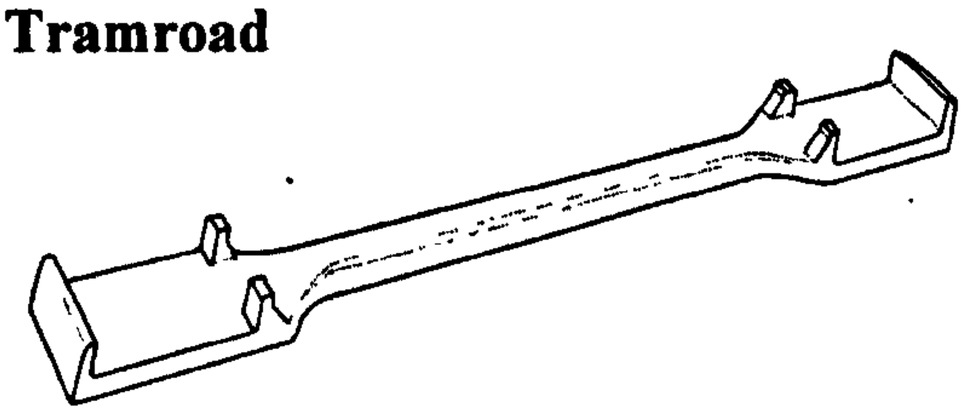


Fig 29. Sill recovered from Tyla (west)

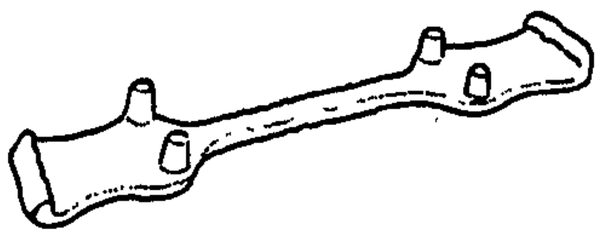


Fig 34. One of 10 sills recovered from Clydach

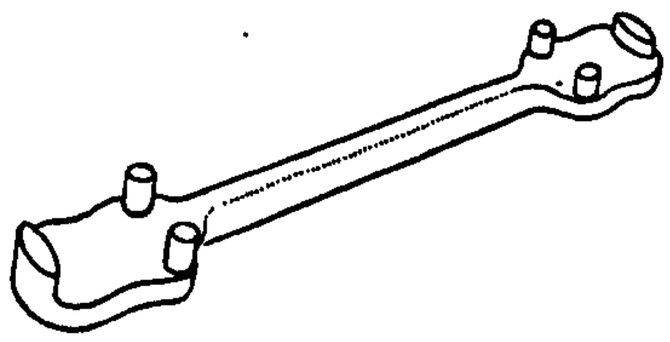


Fig 35. Sill recovered from Blorenge Tramroad

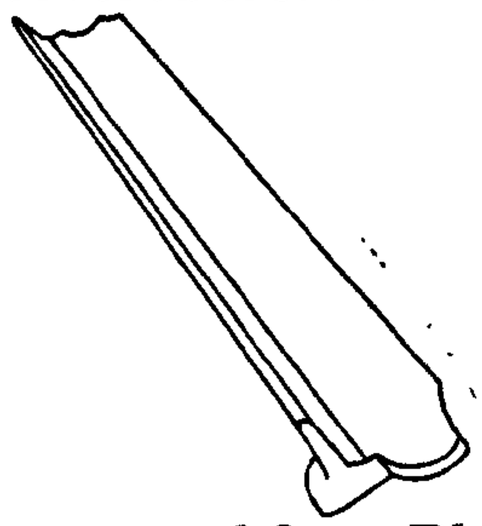


Fig 36. Plate recovered from Blorenge Tramroad

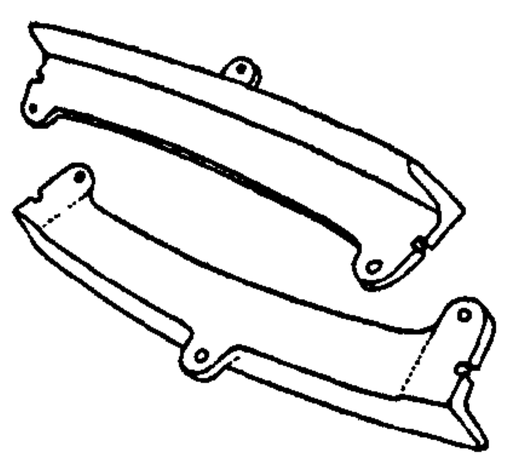


Fig 39. Curved plate found on Llam-march Tramroad

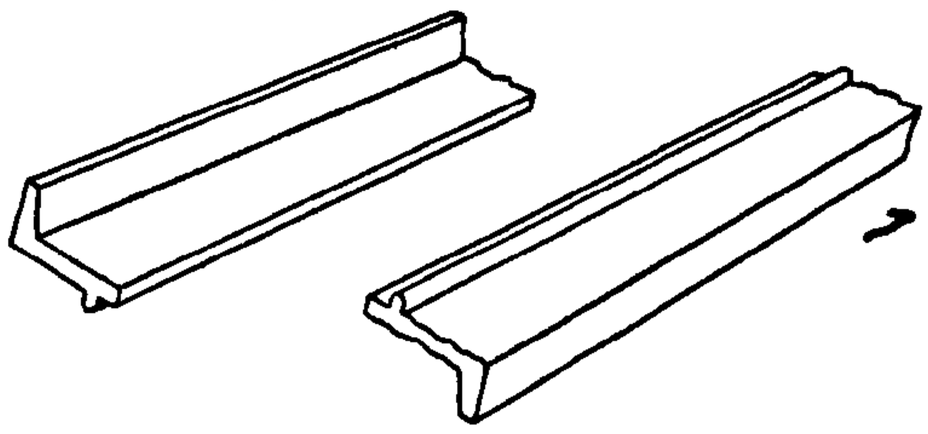


Fig 43. Fragment of low flanged plate found near the Blaenavon staith

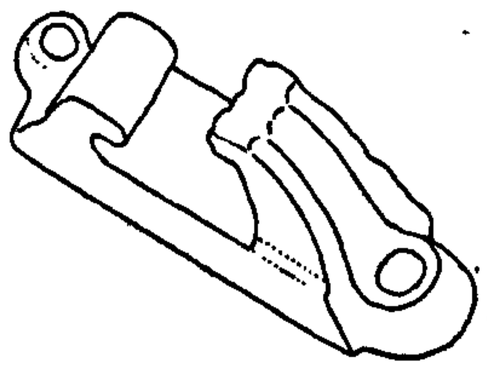


Fig 46. Chairs recovered from Cwm quarry incline

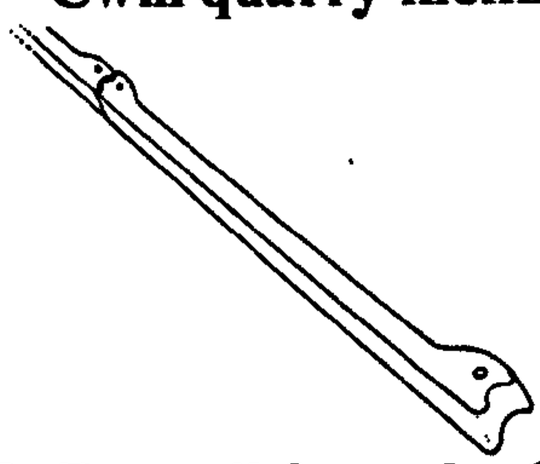


Fig 47. Bar rail from the Clydach Railroad

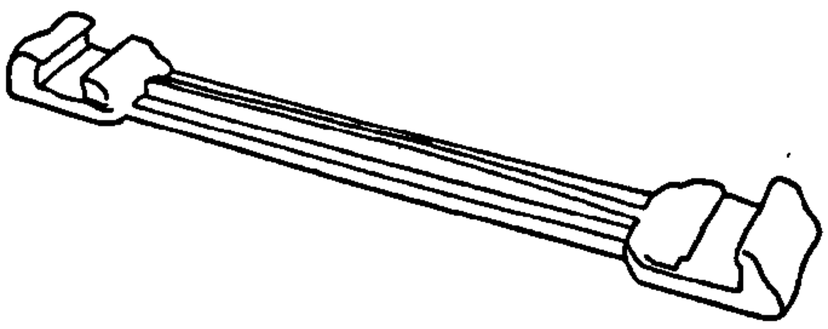


Fig 48. Sill from Clydach Dingle

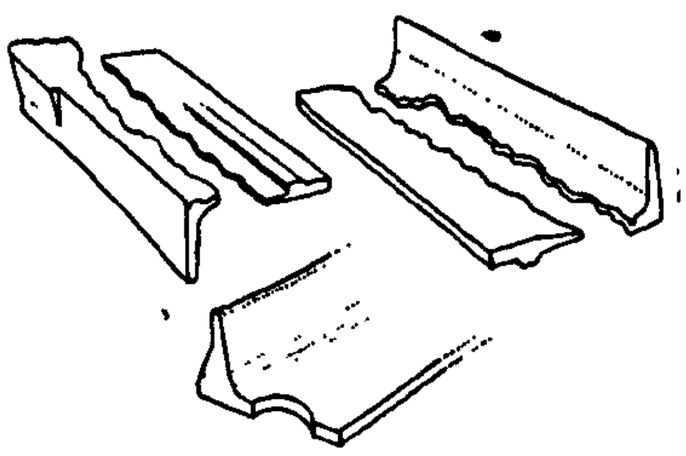


Fig 50. Finds from Digwylfa

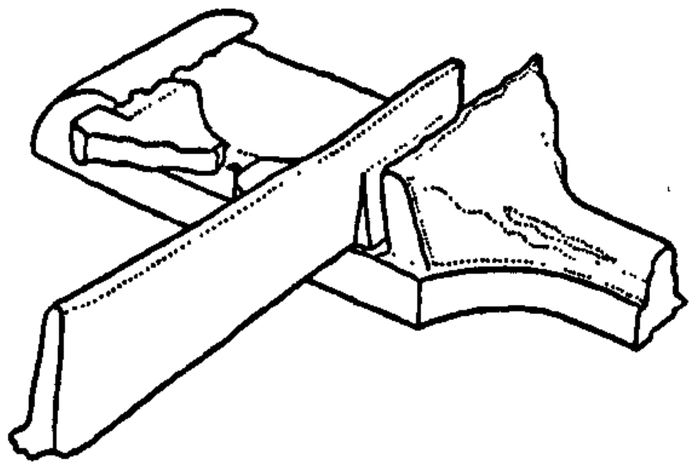


Fig 51. Reconstruction of Disgwylfa trackway

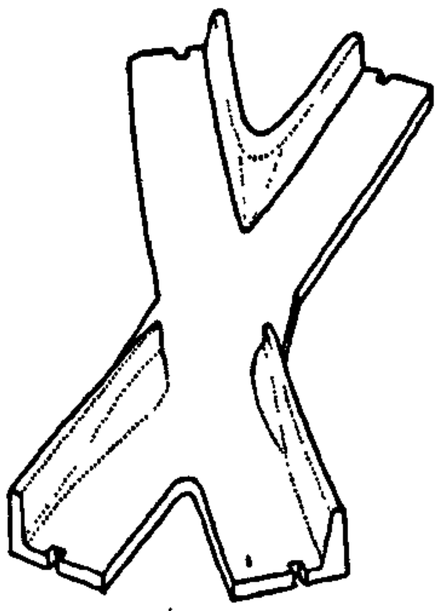


Fig 52. Box plate from first Llangattock Tramroad

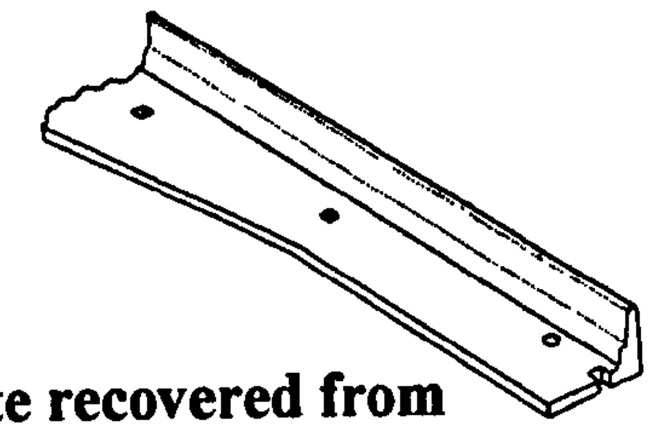


Fig 53. Plate recovered from second Llangattock Tramroad

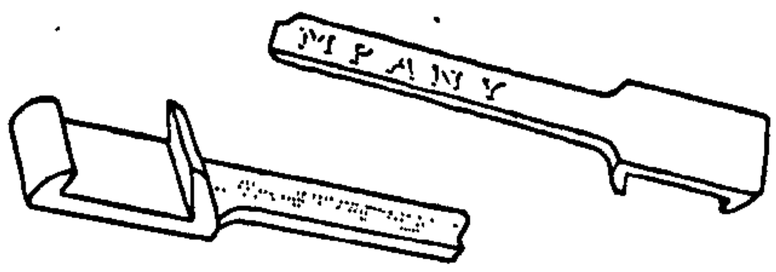


Fig 55. Part of BBCo sill

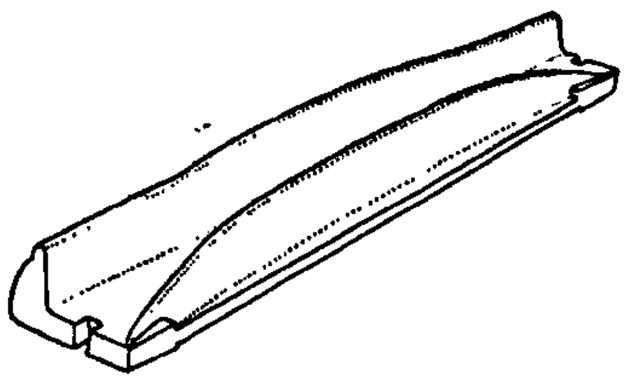


Fig 57. Check rail from Llangattock quarries

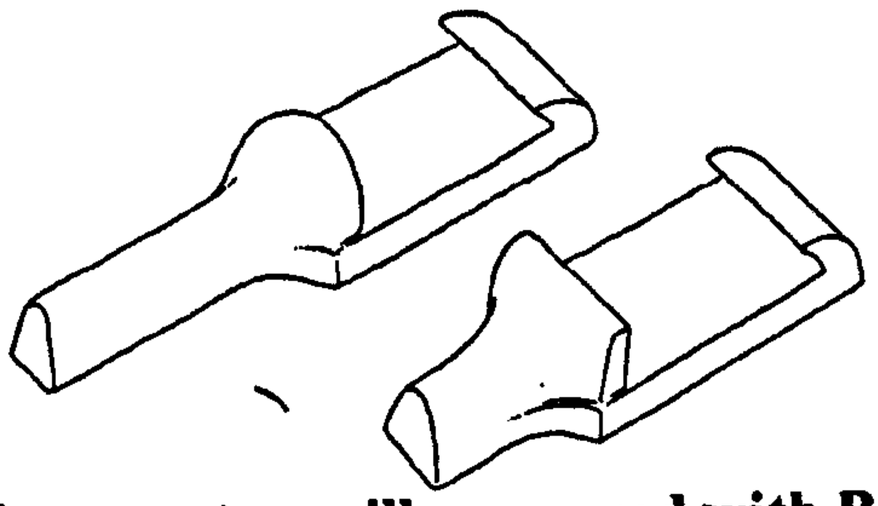


Fig 59. Rhymney type sill compared with Baileys'

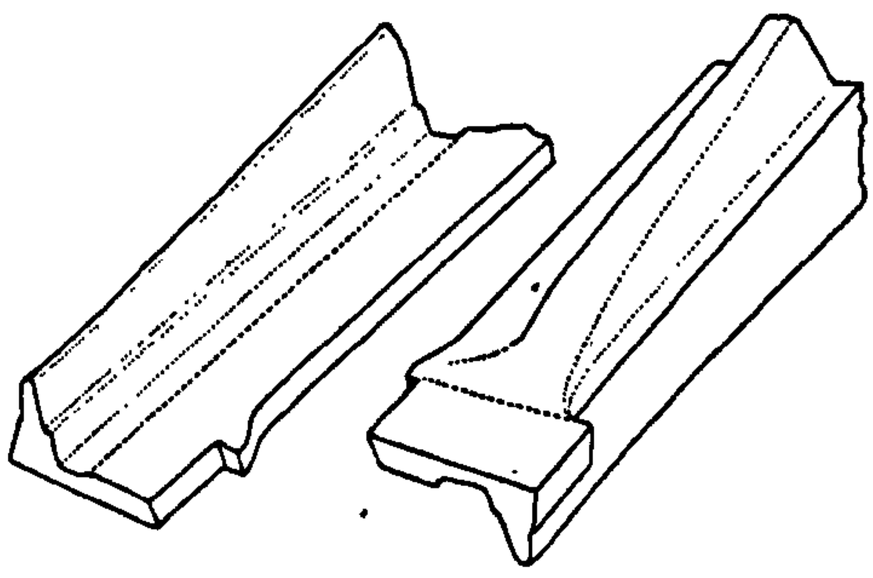


Fig 60. Heavy ribbed-plate from zig-zag on Bick's

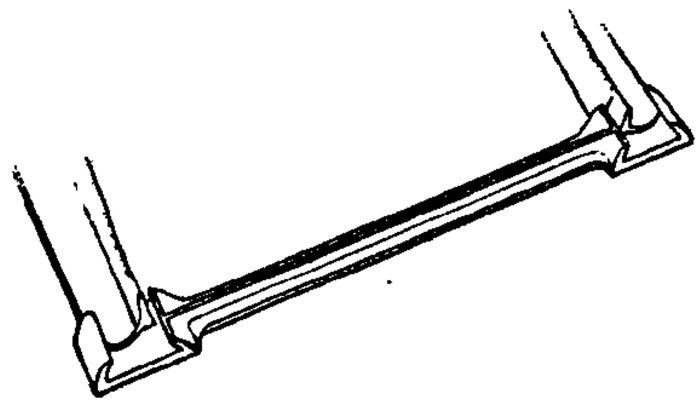


Fig 62. Sill recovered from a branch of Bick's

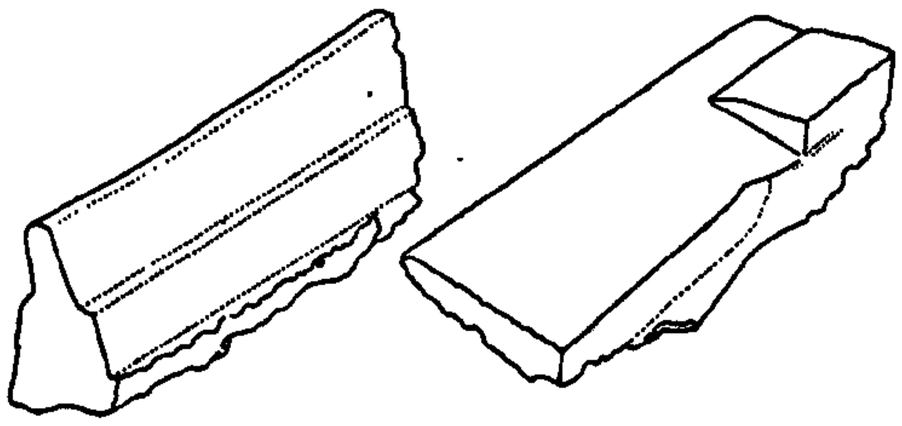


Fig 63. Flange found on Bick's

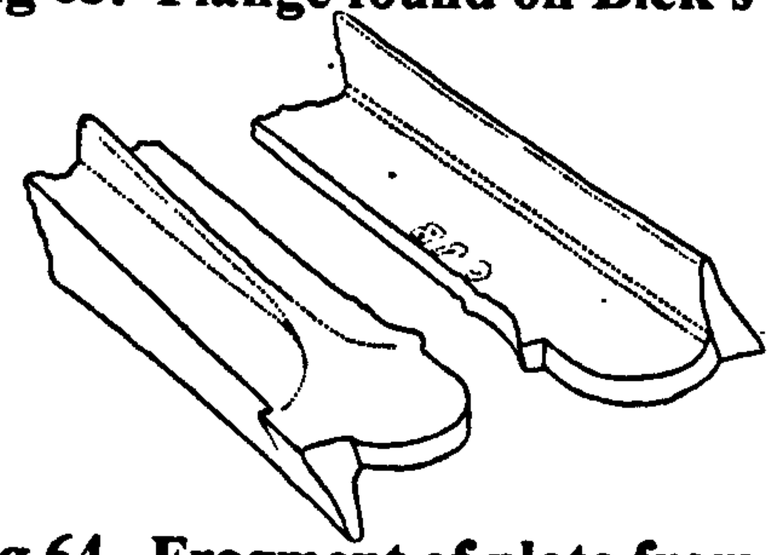


Fig 64. Fragment of plate from Daren (east)

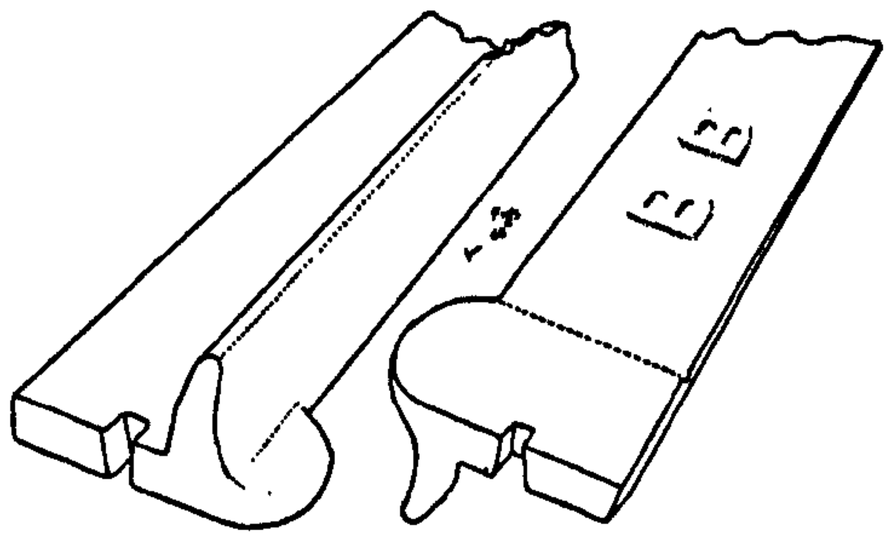


Fig 65. Fragment of plate from Daren (east)

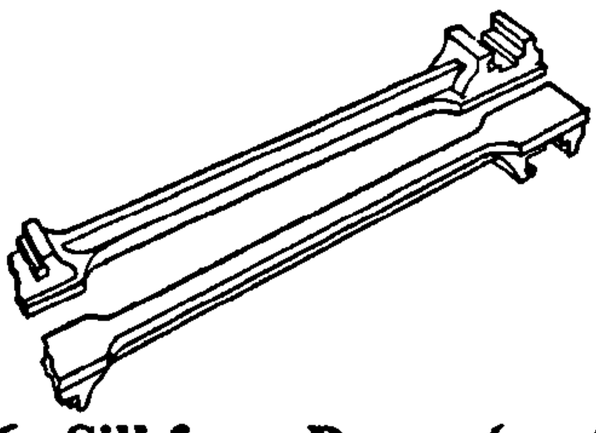


Fig 66. Sill from Daren (east)

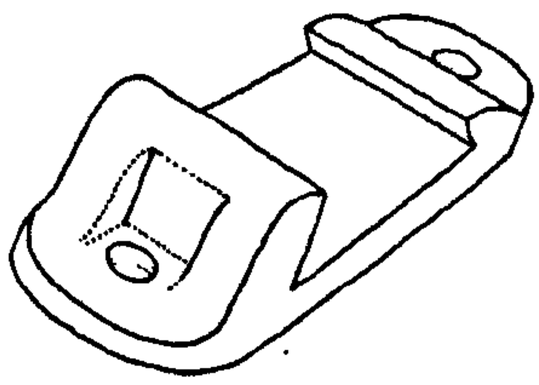


Fig 67. Plate rail chair from Daren (east)

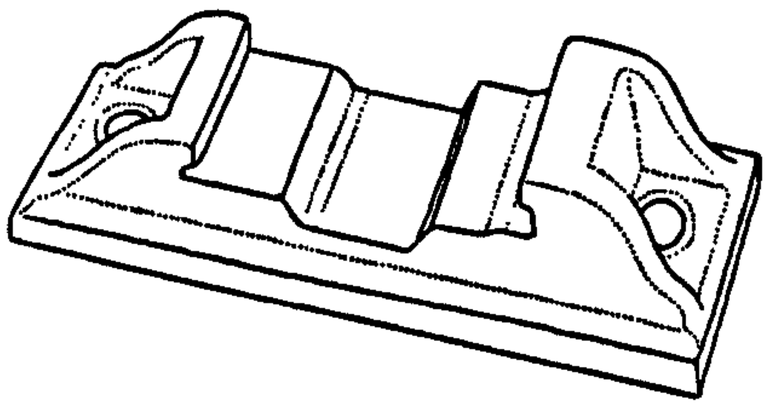


Fig 68. Chair recovered from Baileys' Llangattock Tramroad

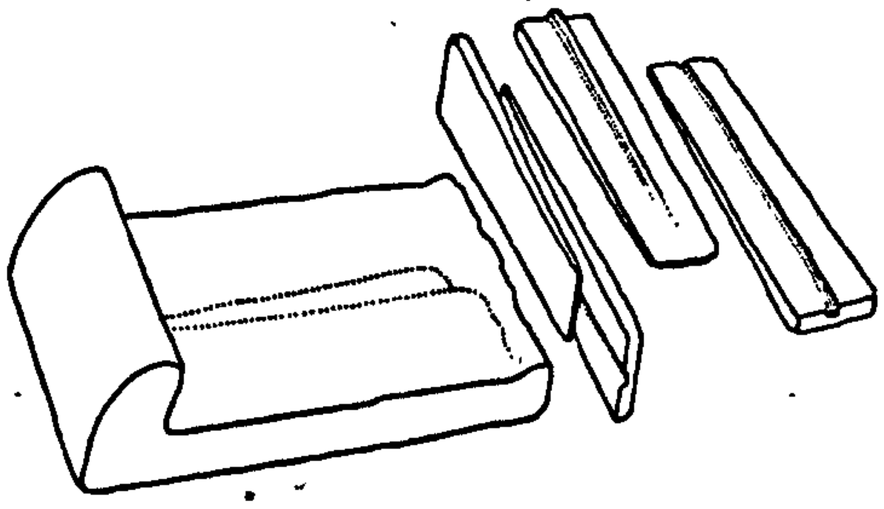


Fig 69. Fragment of sill from the Wern Watcyn incline

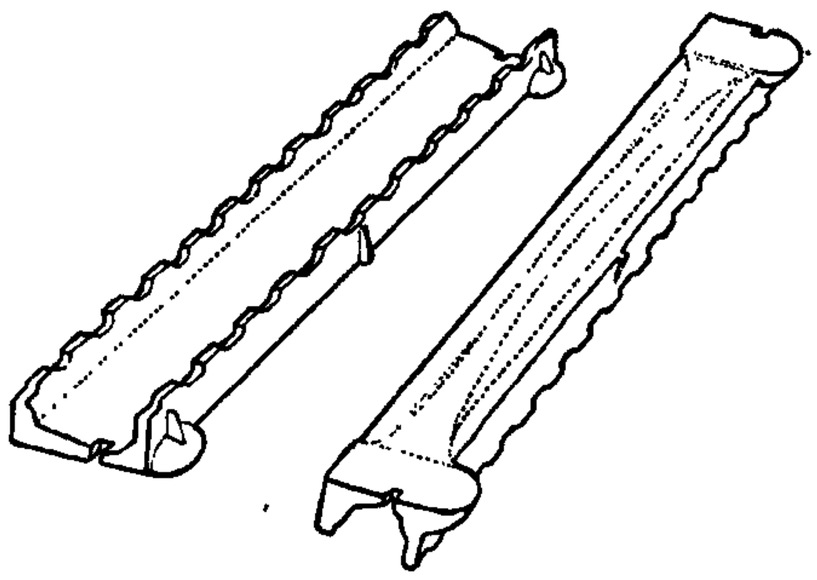


Fig 72. Heavy vandyke plate from the junction of the Wern Watcyn incline and Bick's

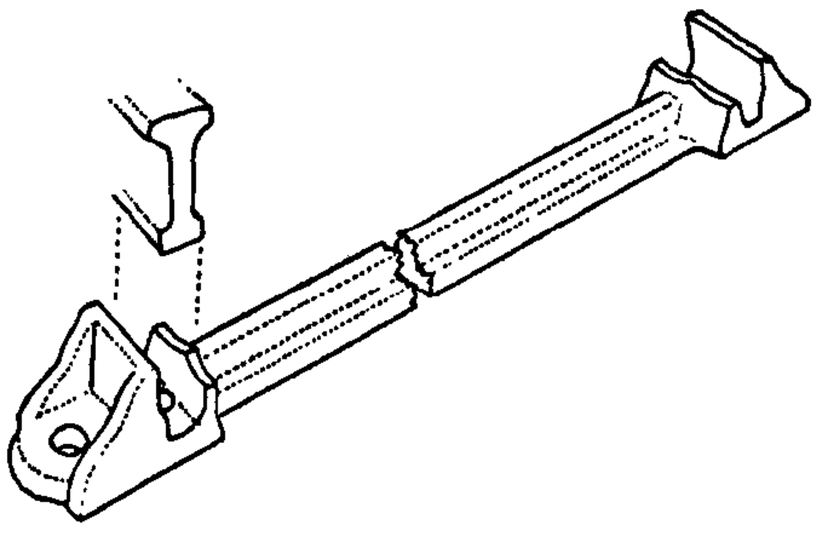


Fig 74. Sill and rail from Trevil

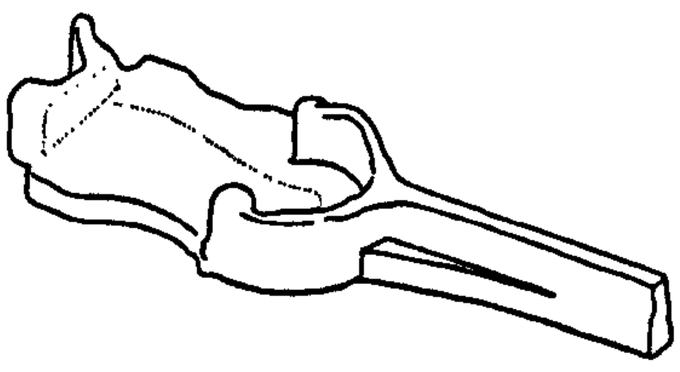


Fig 76. Part of sill with lower rib from the Tredegar Tramroad

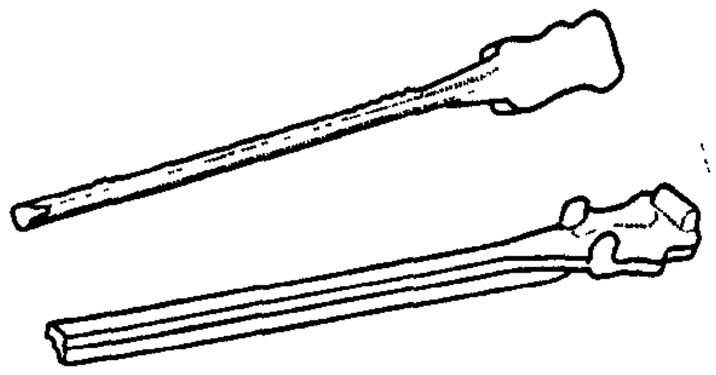


Fig 77. Part of a sill with upper rib from the Tredegar Tramroad

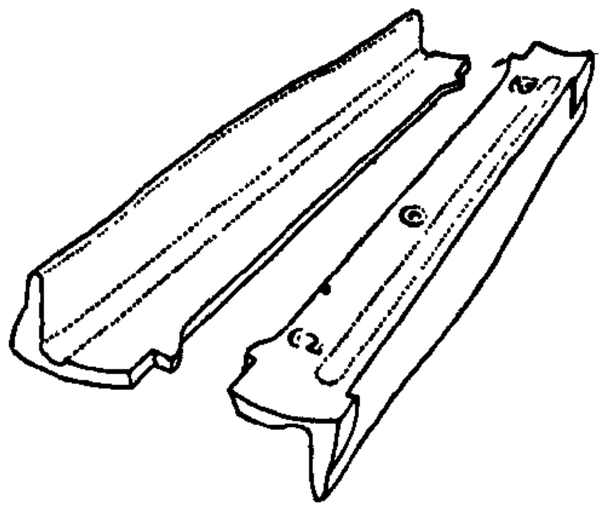


Fig 78. Plate recovered specifically made for the Brinore Tramroad

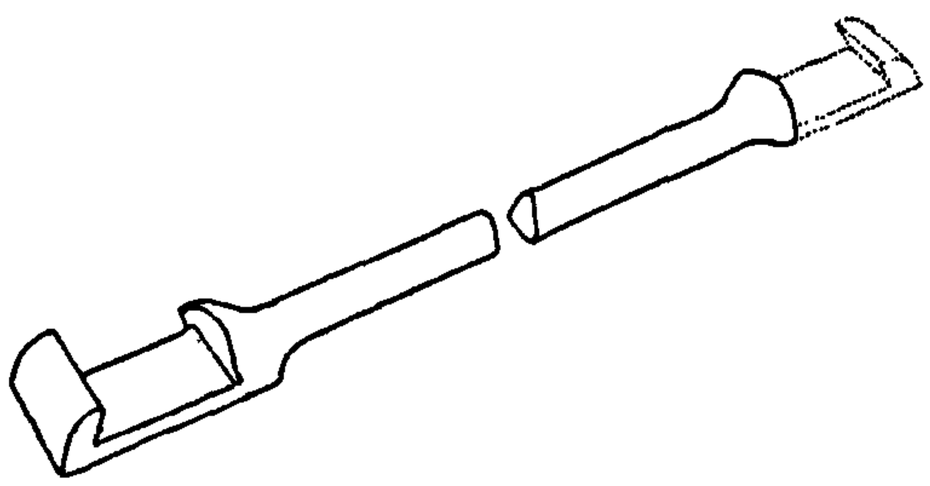


Fig.79. Part sill recovered from from the Brinore Tramroad

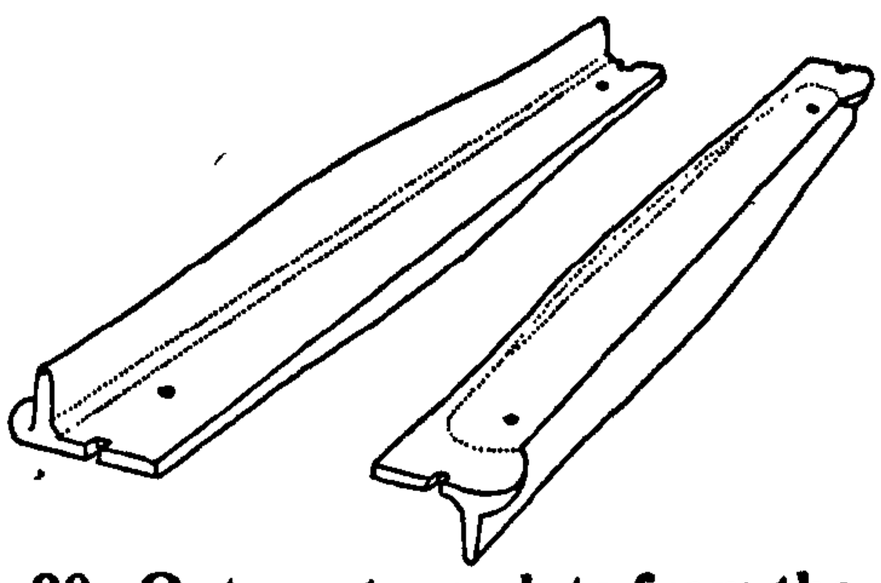


Fig 80. Outram type plate from the Brinore Tramroad

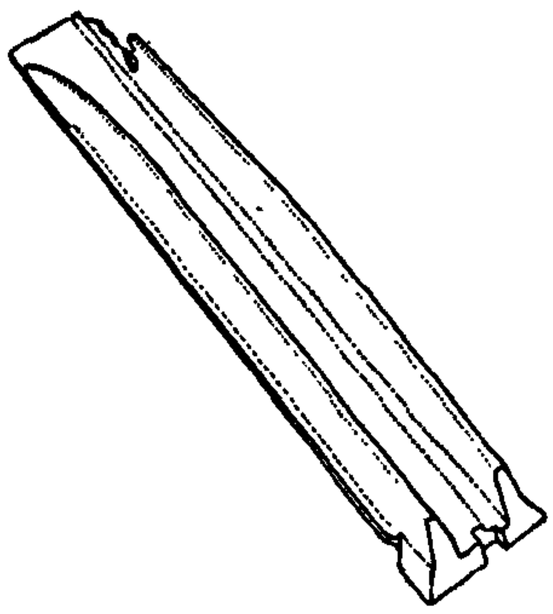


Fig 81. Channel plate from the Brinore Tramroad

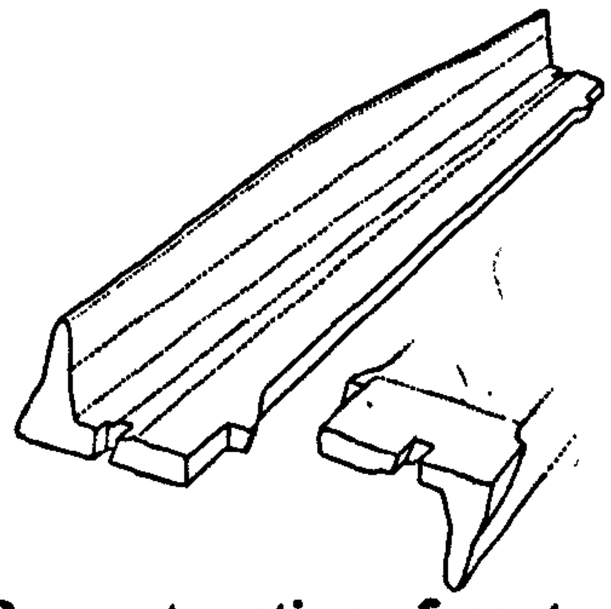


Fig 82. Reconstruction of part plate recovered from Hall's Trevil Tramroad

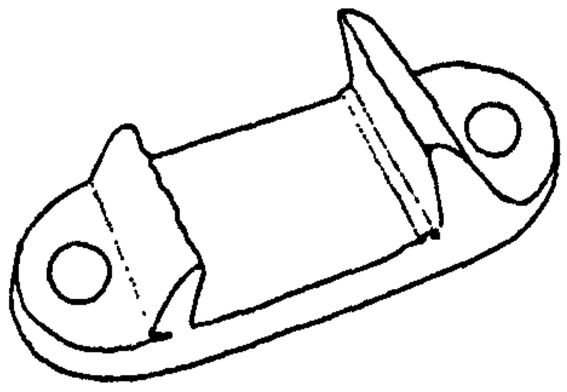


Fig 83. Chair recovered from Tredegar Tramroad

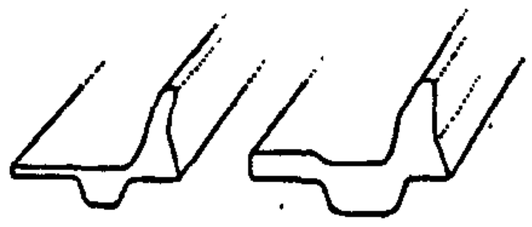


Fig 84. Wrought-iron plates from Tredegar Tramroad

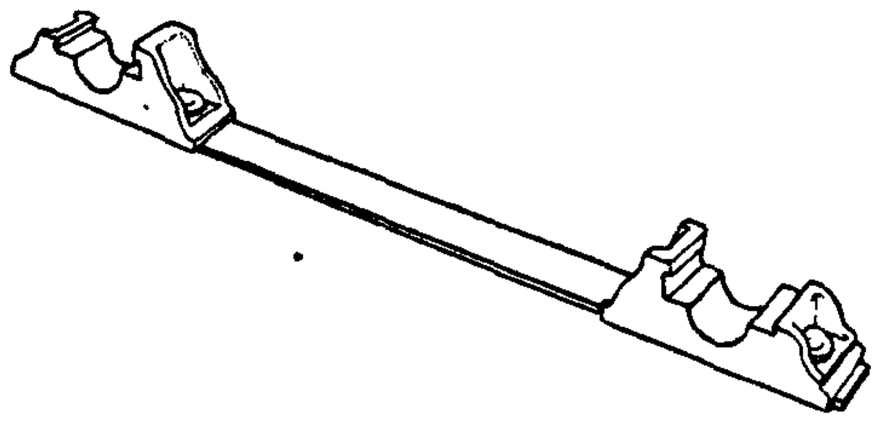


Fig 87. Chairs and wrought-iron tie from Tredegar's northern quarries

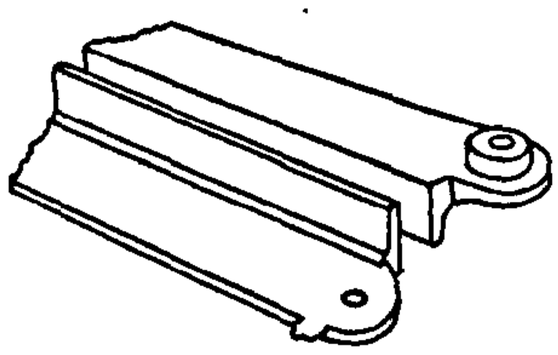


Fig 88. Part plate recovered from Line 1 at Twynau Gwynion

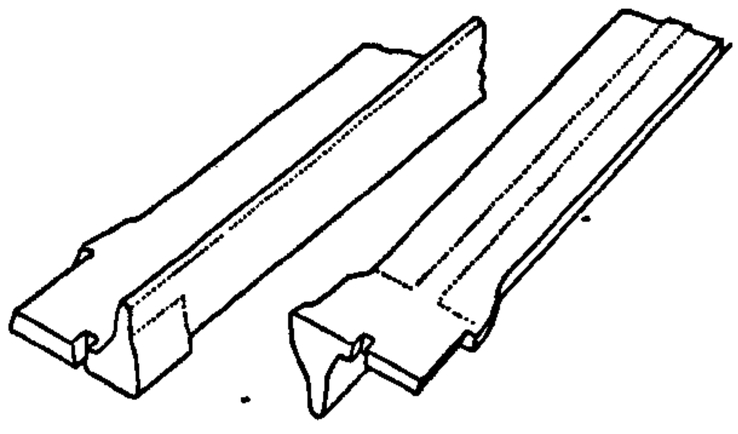


Fig 95. Part plate recovered from Overton's line to Twynau Gwynion

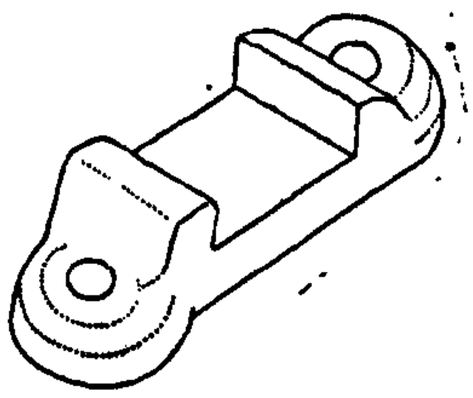


Fig 98. Chair from the Rhymney Tramroad

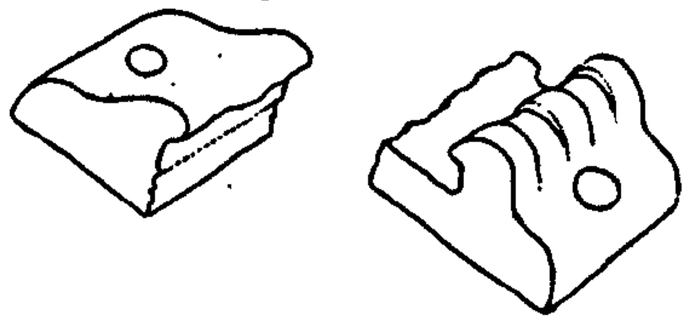


Fig 99. Outer cheeks for railway chairs from Twynau Gwynion

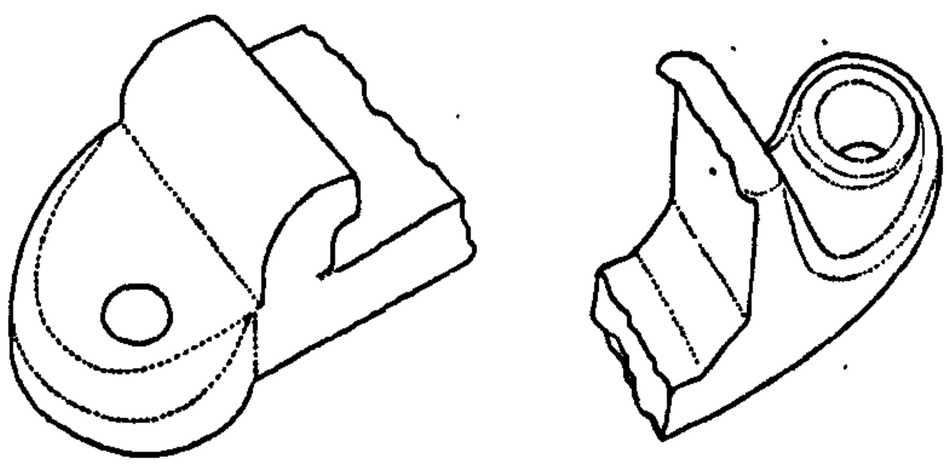


Fig. 100. Outer and inner cheeks from separate chairs from Twynau Gwynion

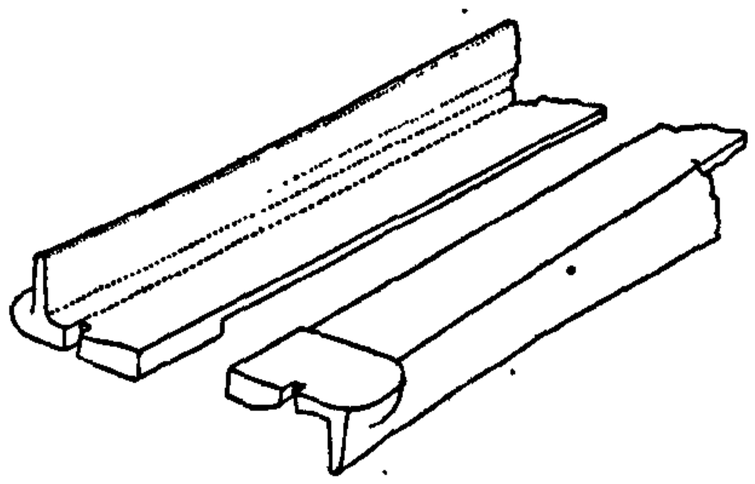


Fig. 102. Part plate from Morlais (west)

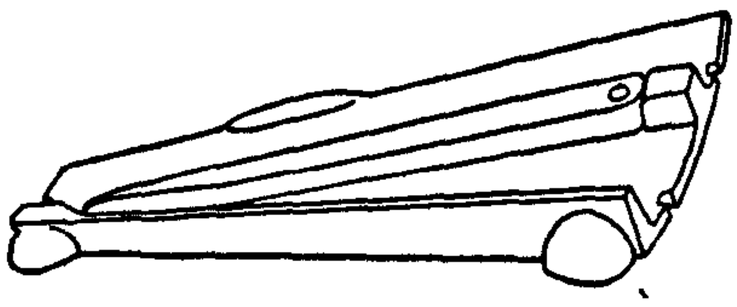


Fig 103. Outram-type point from Bixslade

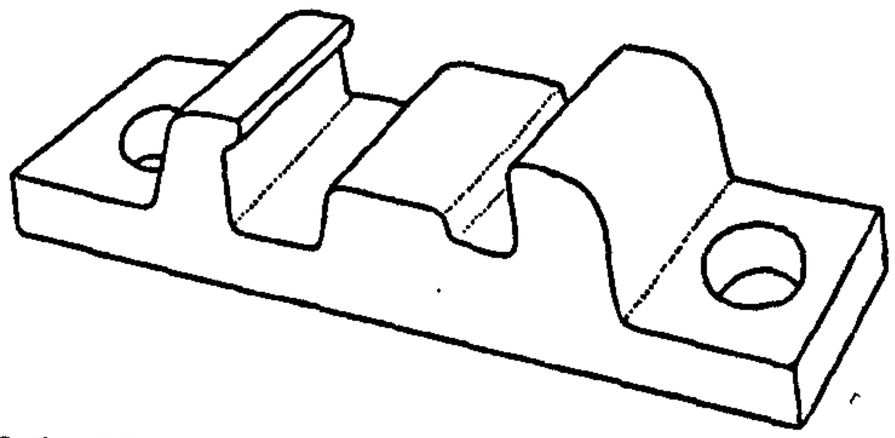


Fig 106. Heavy chair for bull-headed rail

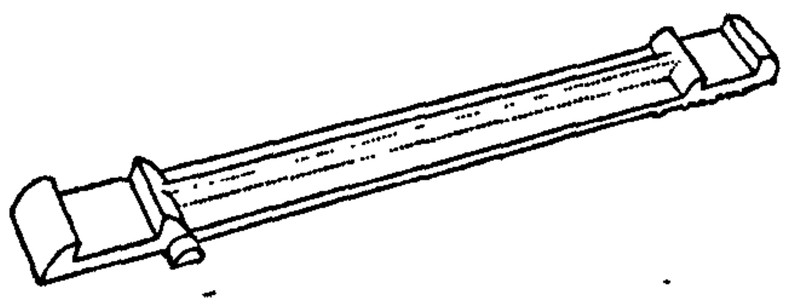


Fig 107. Non-dovetailed sill from Morlais (west)

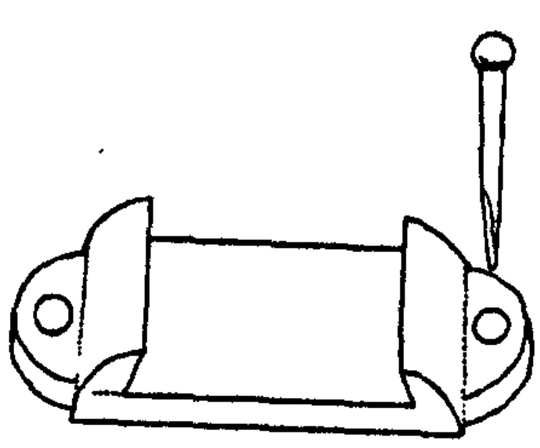


Fig 109. Chair recovered from Morlais (west)

Bar rails

The next and equally momentous step, to abolish the wooden rail altogether in favour of all-iron bar rails, was first taken in South Wales. There, during the 1790s, the bar rail caught on widely and rapidly. All the early lines built between 1792 and 1796 to connect with the Monmouthshire, the Brecknock & Abergavenny, the Glamorganshire and the Aberdare Canals, totalling something like 40 miles, were laid with it. The earliest version hitherto known was that being cast in 1791 by Dowlais for its own railroad to the canal. It is quite clear from both field and documentary evidence that all these bar rails were supported only by wooden or iron transverse sleepers or by stone blocks, and that none were laid on continuous wooden rails.

As is shown in the table just given, which is based in part on the data in **App. 3.2.E** and **P**, the simple Dowlais design, 6ft long, without lugs but with male and female joints, was then modified. Perhaps the next step is marked by the rails found in a Penydarren pit **(Fig. 101)** which may be part of the batch of 330 rails weighing 82lb cast by Plymouth in 1793 for Homfray of Penydarren. They are 5ft long with three bulbous lugs for spikes; their surprisingly small depth of 1½in may well be the result of wear by wheels broad enough to run over the lugs as well as the rail head, and if so their present weight of 69lb is not incompatible with an original 82lb. They were found still fixed to wooden sleepers whose surface they had visibly worn, and were therefore *in situ*.

Their shape set the precedent for the ultimate type of bar rail, 4ft long and weighing about 83lb, represented by that settled in October 1792 for the MCC lines[2] and those used on the Clydach **(Fig. 47)** and Gurnos lines (the latter known only from impressions on blocks and conceivably also 5ft long). The slightly later Trevil rail **(Fig. 73)** was of similar weight and

[2] MCC Committee Minutes 16 October 1792

design but had raised feet. To make the rail self-standing, its depth was increased from the 1¼-1½in of the Shropshire plates to between 2 and 3in: still, one might think, parlously slender. But it was invariably supported at mid-rail and the length was deliberately reduced from 6ft to 4ft so that, if an intermediate support subsided, the risk of breakage was less.

At first wooden sleepers were favoured, although cast-iron sills were tried (under the rail centres, not their ends) on the MCC railroads and on the Clydach. These were heavy castings: about 80lb on the MCC in 1793 or virtually the same as that of the rail.[3] The only actual specimen of such a sill is from an underground line in Clydach Dingle of 2ft 9in gauge, which weighs 40lb **(Fig. 48)**; but in 1794 Ebbw Vale cast sleepers of 46-47lb for a colliery and therefore probably for underground use too. It seems likely that, when wooden sleepers gave way to stone blocks, it was felt desirable to retain a transverse tie to hold the gauge; and the intermediate sill was the result. But it was soon abandoned, whether because of its fragility or its expense. Stone blocks, that cheaper alternative to wooden sleepers which became almost universal for four decades, appear to be another innovation of South Wales, where they are first heard of in September 1792,[4] two years before the earliest likely date for their use by Outram.

Not surprisingly, rails for use underground were lighter than those for surface lines. Apart from the Penydarren examples, they are known only from the Ebbw Vale and Plymouth accounts, where rails are clearly distinguished from dram plates and were evidently bar rails. Where no length is stated, it seems reasonable to assume that the heavier ones were 6ft long, and the lighter ones shorter. On this basis, most of those cast in the 1780s weighed between 35 and 38lb/yd, and most of those in the 1790s

---

[3] The Ebbw Vale journal does not give the total weight but only the total price, from which the approximate weight of 80lb has been worked out

[4] Rattenbury 1980, 61

between 30 and 35lb/yd, or roughly half the weight of surface rails. If the MCC's sills were about the same weight as its rails, so were the sills (46-7lb) and rails (46-48lb) cast for Nantyglo in 1794; and the Clydach Dingle sill (40lb) falls in the same bracket. Complete (and heavy) castings for partings (points) were made for colliery use, and the sweep rails found both underground and on the surface were probably the pivotting switch rails at points.

The place in this story of a somewhat different form of bar rail, known only from wear marks on stone blocks and a fragmentary saddle on the Blaenavon-Tyla railroad **(Figs. 23-6)**, is uncertain. But the signs are that it is early, and maybe very early. It must date from before 1798 when Coxe saw 'standard' 4ft bar rails being laid at the ironworks, and indeed from before about 1796 when Blaenavon moved temporarily to the Blorenge for its limestone and laid a plateway there. Like the Dowlais rail, but no others, it was 6ft long. It had square raised feet but not the lugs found on all other bar rails from 1792. Alone of all the known rails it had butt ends, not male and female joints. It was held at mid-rail in a saddle. It is not at all impossible that it dates to 1790 when the Blaenavon furnaces came into blast, or even a year earlier. The very fact that no application to build the Tyla line was made to the MCC might be because the MCC act had not yet been passed. If this were the case, the stone blocks at Tyla would be the earliest on record.

Most interesting of all, the Plymouth accounts show that all-iron rails go back to 1787, the selfsame year when Curr made the first all-iron tramplates. Both were at first underground. Whether priority for bar rails on the surface goes to Dowlais or to Blaenavon, or indeed to somewhere else unknown, we cannot tell. But it does seem that the all-iron edge rail existed in South Wales at least four years before the usually accepted date of 1791. It was a logical development from the Shropshire-type plate. But whereas it was

previously possible to suppose that it had been designed by the Dadfords, the engineers who most widely applied it, it now appears that it existed well before 1790 when the Dadfords first set foot in South Wales. Undoubtedly the Dadfords, hand in hand with the ironmasters and canal companies, helped to disseminate it. Quite possibly the male and female joint, hitherto recorded only on the Shropshire-type plates on the Caldon Low Railway, was a refinement which they brought from the Midlands. But the major innovation seems on present evidence to be of purely South Wales origin.

On the gauge of these railroads, suffice it to say here that on the MCC lines and the connecting Trevil, Clydach, Abersychan and Tyla-Blaenavon[5] railroads it was ultimately 3ft 8in. Conceivably it had spread a little, as sometimes happened with plateways; indeed the reconstruction of the Pont y Cafnau deck suggests an original gauge of 3ft 7in for the Gurnos Railroad. The Coalbrookdale gauge was almost the same,[6] which suggests that South Wales borrowed not only iron plates from Shropshire. The Penydarren rails with their gauge of 3ft 6in, coming from underground, might not be directly relevant to surface practice.

TRAMROADS

Early dram plates and wheeling plates

In February 1788 Plymouth cast 176 dram plates for James Cockshutt of Cyfarthfa[7] each weighing 42lb, followed in November by another 69 at 38lb **(App. 3.4.P)**. Cockshutt hailed from Wortley Forge near Sheffield,[8] only a

---

[5] If the argument in Chapter 5 is correct that in 1798 it was linked past the furnaces to the Blaenavon Railroad

[6] Lewis 1970, 267 deduces 3ft 8in or 3ft 9in; Jones 1987, 259 records the gauge of an excavated section as 3ft 9in, where some shrinkage of the wood is possible

[7] Cockshutt was manager at Cyfarthfa 1788-91. After a spell with Hanbury at Pontypool he returned to his native Yorkshire in the 1790s. Richard Hill of Plymouth had also been at Cyfarthfa for a time

[8] Riden 1993, 100-1; Skempton and Wright 1971-2, 40. For Wortley Forge and the Cockshutts, see Andrews 1956

few miles from where Curr used plateways for the first time. If these plates were 6ft long, they were a trifle lighter than Curr's recommended 48lb, but there can be little doubt that Cockshutt brought tramroads to the Heads of the Valleys only a year after Curr invented them; and, though we can only guess, they were perhaps identical to Curr's most basic kind. Another link with Curr was the turning frame or parting, not uncommonly cast by Ebbw Vale and Plymouth from 1793, which weighed several hundredweight. This was no doubt based on Curr's single casting of pointwork for turning a tramroad through 90 degrees into 'benks or boards' (underground stalls),[9] which by calculation weighed a minimum of 234lb.[10] Their application in South Wales is illustrated at Ebbw Vale in 1796 when the memorandum book records '2 tons colliery rails and partings — The number of partings to be guessed to answer the number of rails agreeably to the distance of the stalls from one another,' and 'Lay the rails and stalls.'[11]

Plymouth resumed making tramplates in 1792, and in 1793 seems to have equipped a whole colliery with 4205 plates, 1689 sleepers, 53 turning frames and 201 tram wheels. Thereafter, especially from 1796, output remained quite high.

Wheeling plates **(App. 3.3.E** and **P)** are a mysterious item. They were evidently used in coal levels or on colliery lines. Plymouth cast a few in 1788, many in 1790, and (along with Ebbw Vale) a few thereafter. Those of 1790 seem to have weighed about 24lb/yd, which rules them out as Shropshire-type plates but coincides with Curr's preferred weight for tramplates. But in other years they were of wildly different weights, and it seems most likely that they were merely flat unflanged plates of iron on

---

[9] Curr 1797, pl. 2 fig. 3
[10] Coalbrookdale also used (much heavier) single-casting turnouts which surely derived from Curr: example in Ironbridge Gorge Museum
[11] GRO D.2472.1: 5 Apl. and 9 June 1796

which trams, or even barrows, could be wheeled. They might be used at the coalface before the more permanent rails were laid, or in lieu of points for skidding a tram round through 90 degrees.

Early surface use of dram plates

The tramplates made by Plymouth in 1792-3 weighed between 32 and 36lb. This was exactly the time that Dowlais laid its first line to Twynau Gwynion **(Fig. 88)**, and exactly the weight of the sleeved or coned plates used on it: a 13in fragment is 11lb, which gives 35½lb for a complete length of 3ft 6in. As we saw, it also has a distinct resemblance to 'Homfray's Old dram Roads' with their lapped ends illustrated by Watt **(Fig. 113)**;[12] 'old' in 1800 should take one back a number of years. By 1792, then, the tramroad had probably come to the surface, little changed in scale from its underground form.

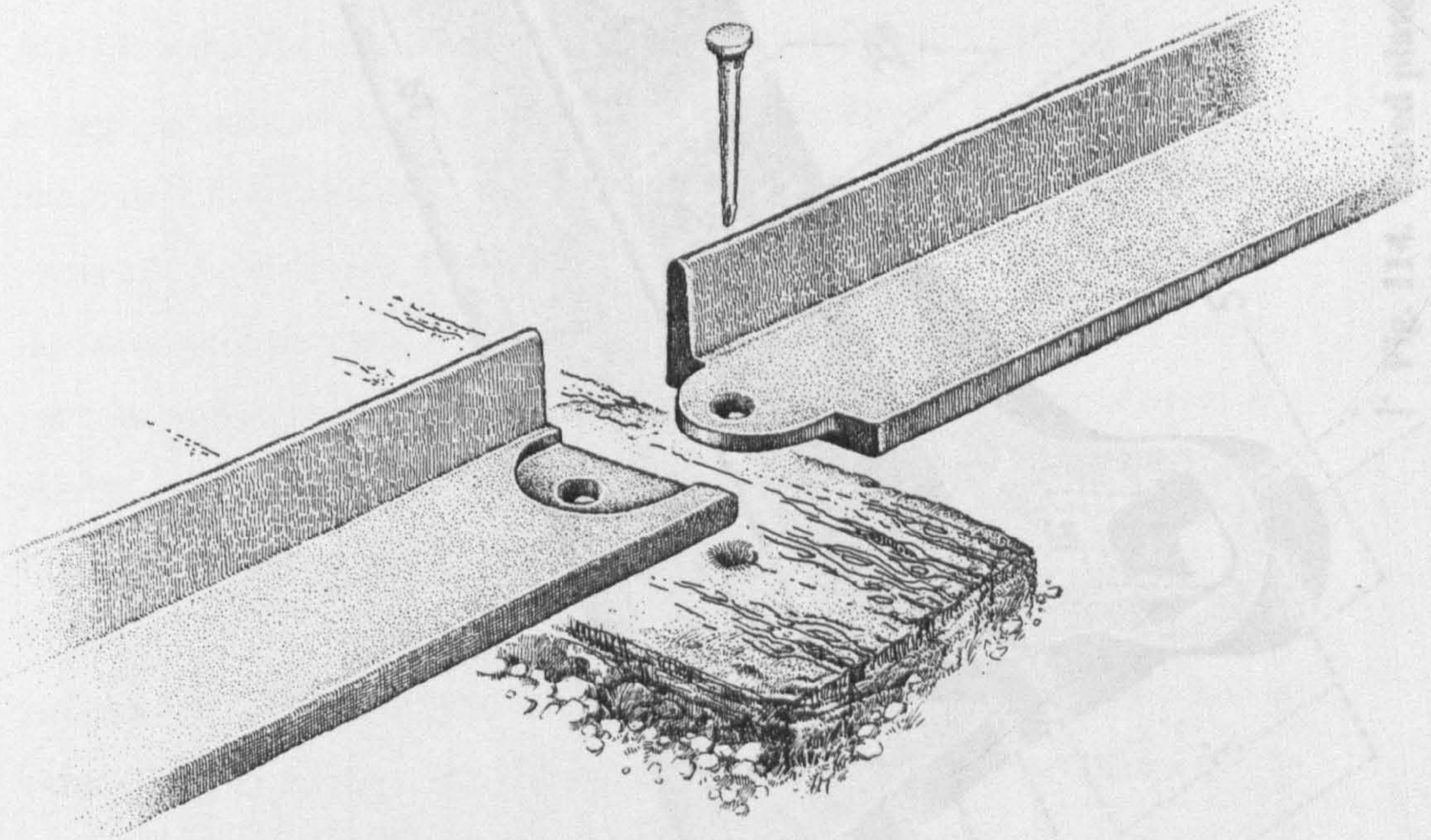


Fig. 113. Method of fixing 'Homfray's Old dram Roads' in 1800 (redrawn from BRL (Observations))

[12] BRL (Observations)

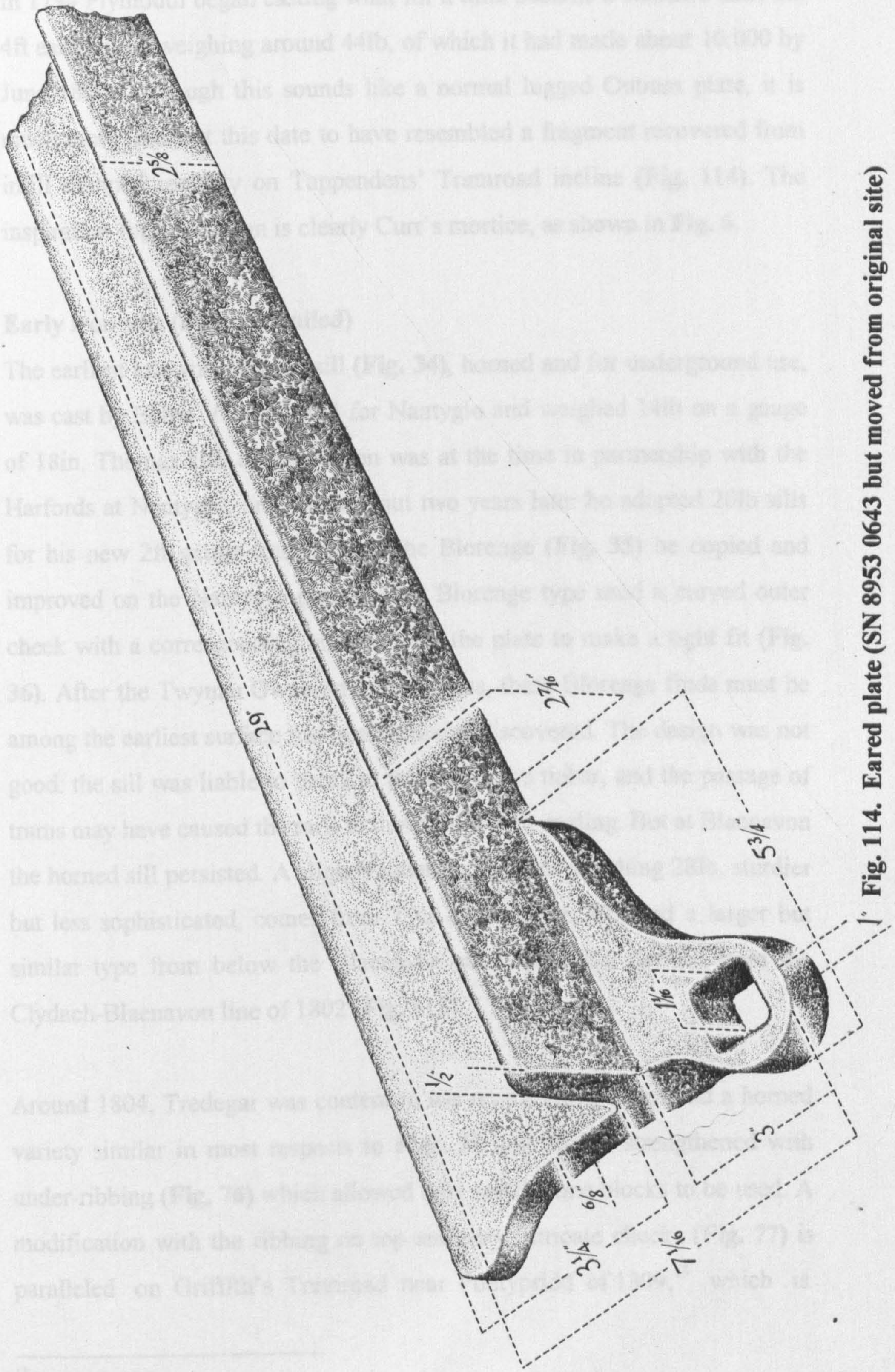


Fig. 114. Eared plate (SN 8953 0643 but moved from original site)

In 1794 Plymouth began casting what for a time became a standard line, the 4ft eared plate weighing around 44lb, of which it had made about 10,000 by June 1800. Although this sounds like a normal lugged Outram plate, it is much more likely at this date to have resembled a fragment recovered from infill dumped recently on Tappendens' Tramroad incline **(Fig. 114)**. The inspiration for this design is clearly Curr's mortice, as shown in **Fig. 6**.

Early iron sills (non-dovetailed)

The earliest known tramroad sill **(Fig. 34)**, horned and for underground use, was cast by Ebbw Vale in 1794 for Nantyglo and weighed 14lb on a gauge of 18in. Thomas Hill of Blaenavon was at the time in partnership with the Harfords at Nantyglo, and when about two years later he adopted 20lb sills for his new 2ft gauge tramroad on the Blorenge **(Fig. 35)** he copied and improved on the Nantyglo pattern. The Blorenge type used a curved outer cheek with a corresponding concavity on the plate to make a tight fit **(Fig. 36)**. After the Twynau Gwynion coned plates, these Blorenge finds must be among the earliest surface tramroad remains discovered. The design was not good: the sill was liable to break at the end of the tiebar, and the passage of trams may have caused the rails to jump from their seating. But at Blaenavon the horned sill persisted. A slightly advanced pattern weighing 28lb, sturdier but less sophisticated, comes from Tyla quarry **(Fig. 29)**, and a larger but similar type from below the Blaenavon staith probably derives from the Clydach-Blaenavon line of 1802 **(Fig. 115)**.

Around 1804, Tredegar was content to use on its Trevil Tramroad a horned variety similar in most respects to **Figs. 34** and **35** but strengthened with under-ribbing **(Fig. 76)** which allowed only small stone blocks to be used. A modification with the ribbing on top and very intricate cheeks **(Fig. 77)** is paralleled on Griffith's Tramroad near Pontypridd of 1809,[13] which is

[13] Pontypridd Museum

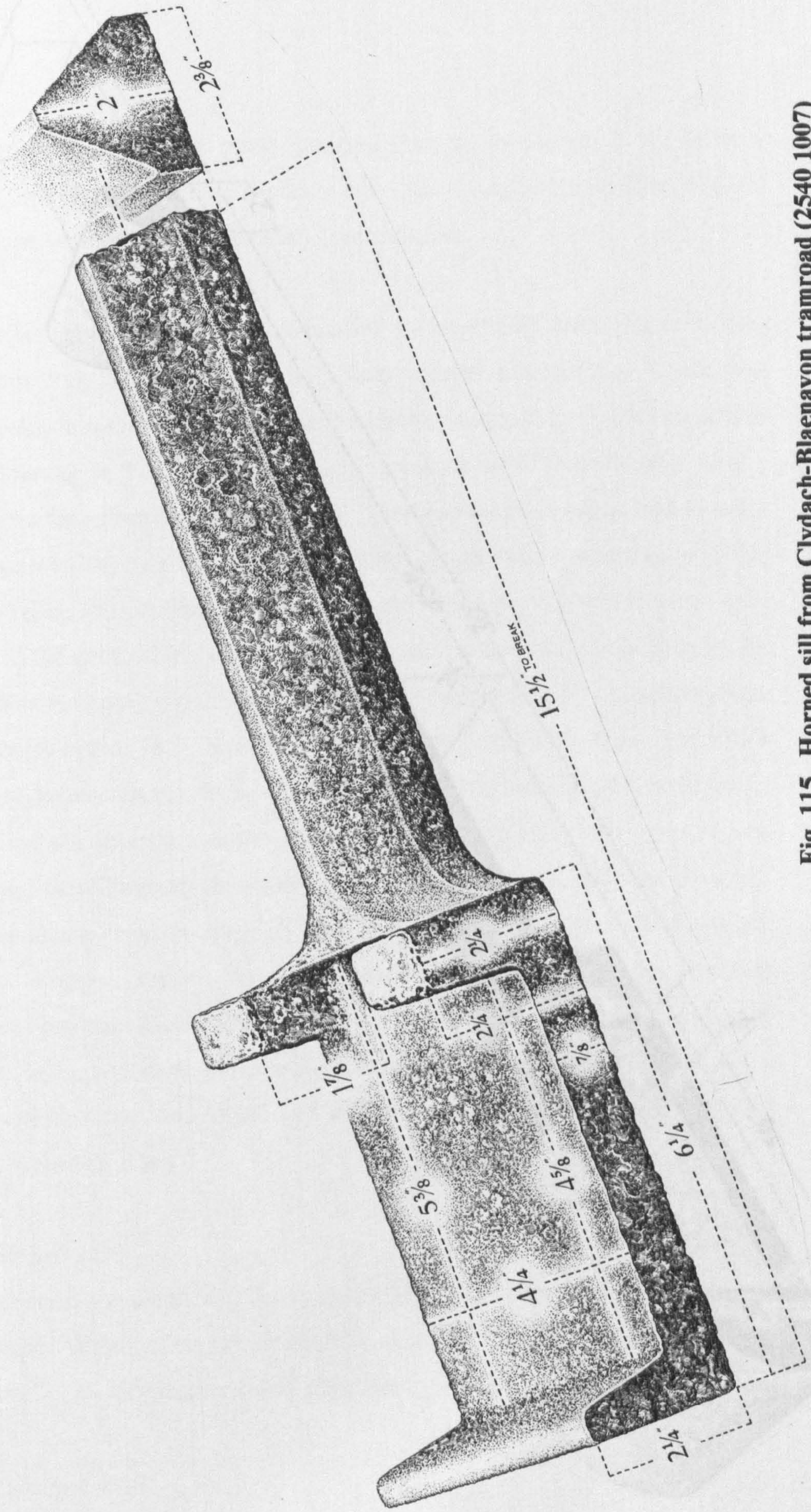


Fig. 115. Horned sill from Clydach-Blaenavon tramroad (2540 1007)

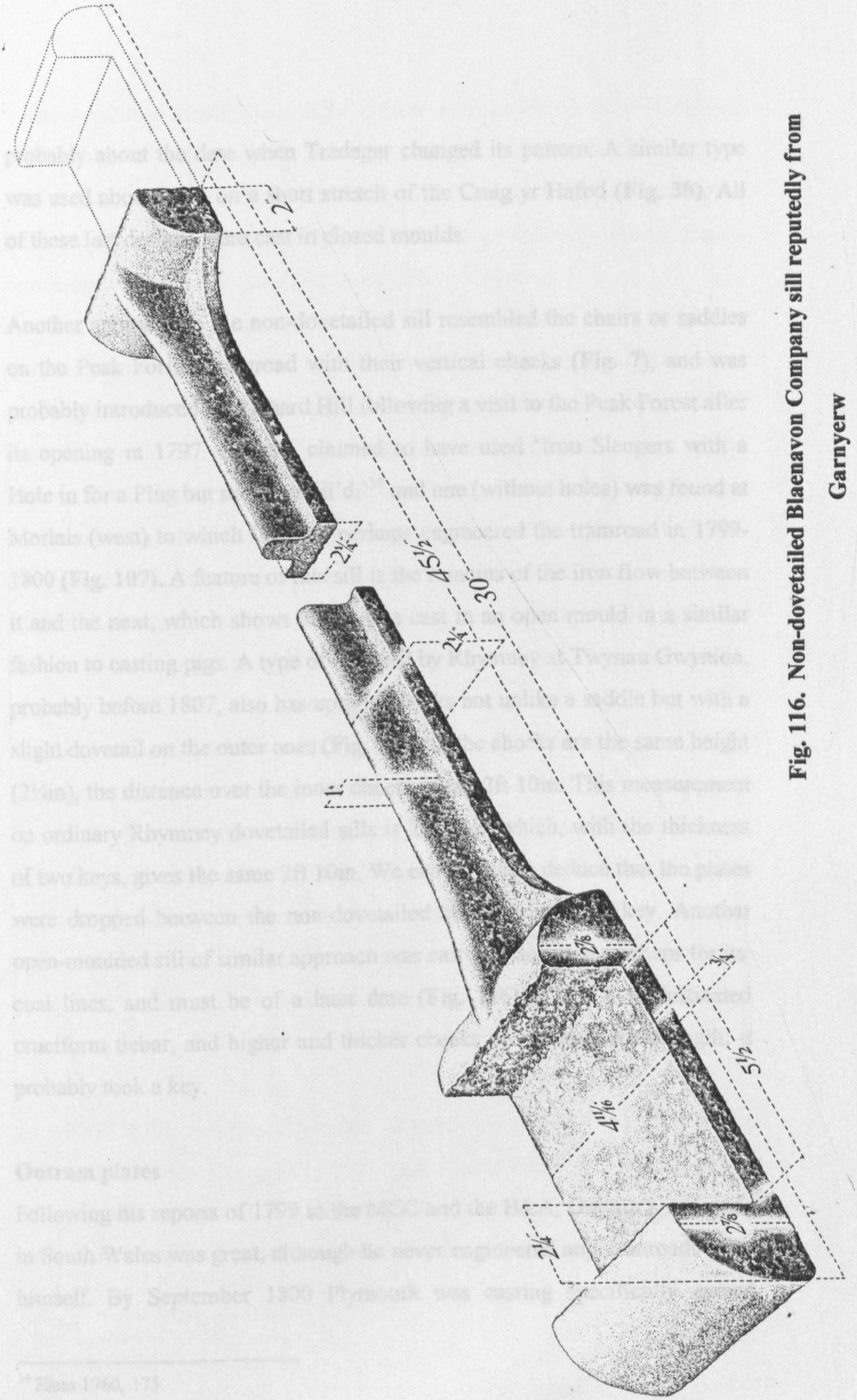


Fig. 116. Non-dovetailed Blaenavon Company sill reputedly from Garnyerw

probably about the date when Tredegar changed its pattern. A similar type was used about 1812 on a short stretch of the Craig yr Hafod **(Fig. 38)**. All of these last designs were cast in closed moulds.

Another approach to the non-dovetailed sill resembled the chairs or saddles on the Peak Forest Tramroad with their vertical cheeks **(Fig. 7)**, and was probably introduced by Richard Hill following a visit to the Peak Forest after its opening in 1797. Overton claimed to have used 'Iron Sleepers with a Hole in for a Plug but not dovetail'd,'[14] and one (without holes) was found at Morlais (west) to which Overton perhaps engineered the tramroad in 1799-1800 **(Fig. 107).** A feature of this sill is the remains of the iron flow between it and the next, which shows that it was cast in an open mould in a similar fashion to casting pigs. A type of sill used by Rhymney at Twynau Gwynion, probably before 1807, also has upright cheeks not unlike a saddle but with a slight dovetail on the outer ones **(Fig. 94)**. All the cheeks are the same height (2¼in), the distance over the inner cheeks being 2ft 10in. This measurement on ordinary Rhymney dovetailed sills is 2ft 8½in which, with the thickness of two keys, gives the same 2ft 10in. We can therefore deduce that the plates were dropped between the non-dovetailed cheeks without a key. Another open-moulded sill of similar approach was cast at Blaenavon, perhaps for its coal lines, and must be of a later date **(Fig. 116)**. It has a sophisticated cruciform tiebar, and higher and thicker cheeks presumably for strength; it probably took a key.

Outram plates

Following his reports of 1799 to the MCC and the B&A, Outram's influence in South Wales was great, although he never engineered any tramroads there himself. By September 1800 Plymouth was casting specifically named

---

[14] Elsas 1960, 175

'Outram pattern' plates **(App. 3.5.P)**; their destination, Morlais (west) and the Penydarren Tramroad, has been dealt with in Chapter 12. The Outram type was almost exclusively used on the exit lines such as the Penydarren, Sirhowy, Hay, Llanvihangel and Grosmont and on tramroads that replaced railroads; but many new lines employed sills or chairs.

The distinguishing features of the Outram plate are a lug, a slightly raised foot and a notch for the common fixing nail at each end **(Figs. 65, 102)**. If the ballast were not packed too hard under the rail the nails would not be sprung. The resulting weakness in the middle was countered by hogging the flange and sometimes by a heavy rib **(Fig. 72)** or by a shallow elliptical flange under the outer part of the tread, a type common on the Surrey Iron Railway and also found on the Penydarren Tramroad.[15] **Fig. 42** is a primitive example of this, and it was still in use after 1814 **(Fig. 80)**.

To cast the foot required a closed mould. In March 1799, in preparation for making Outram plates for the Penydarren Tramroad, Plymouth cast twelve 'Boxes for dram plates,' each weighing 280lb, and in January 1801 a further five 'Boxes for casting dram plates Outram pattern' (233lb).[16] The flange on Outram plates (and many others) were slightly sloped to reduce friction and perhaps to ease removal of the pattern from the mould. Most of those lines built with Outram plates remained as such until the introduction of wrought-iron plates.

As with sills, the weight and strength of plates went largely hand in hand. In 1796 the Butterley Company, while emphasising the prime importance of secure laying, issued official equations for weight of plate to loading of tram:[17] 18lb for ½ ton, 24lb for 1 ton, 30lb for 1½ tons, 36lb for 2-2½ tons,

---

[15] Mercer 1947-49, 97
[16] NLW MS 15335D
[17] Riden 1973, 36

40lb for 2½-3½ tons. For loadings of 4 tons, Price in 1818 advocated plates of between 50 to 60lb if 'made direct from *Blast furnaces*' but 10 per cent less if cast from cupola furnaces.[18] Even so, Bick shows that Hodgkinson's 3ft plates on the Gloucester & Cheltenham Tramroad frequently broke;[19] the simplest form, a plain L, weighed 63lb but experience taught that changing the section could reduce the weight to 51, 50, 43 and 42lb.[20] Hodgkinson's 'Cheltenham' pattern became standard for his plateways. In 1811 it was specified for the Hay Railway 'not exceeding 50lbs,'[21] and in 1812 Hodgkinson himself was recommending 50.9lb plates[22] for his 3ft 4in gauge, but only 35lb plates for a narrower gauge tramroad (probably 2ft 6in) from the proposed canal at Tenbury to the Clee Hills. Back in 1799 36lb was considered sufficient for the Morlais (west) line of 2ft 4in gauge, and Plymouth proposed 45lb plates with a 5in tread for the 4ft 2in gauge which was added to it. By 1800, but probably well before, it was advocated that no plate should carry more than one wheel at a time; in other words, that wheelbases should be longer than plates.

Dovetailed sills

The dovetailed sill was surely inspired by Curr's original dovetailed wooden sleeper. In 1822 George Overton was in correspondence with Josiah John Guest concerning the Losh and Stephenson patent of 1816,[23] which embraced dovetailed chairs and presumably therefore sills too. It emerges that as early as 1794 Curr had sent a drawing of his wooden sleeper to Overton, then a young man in Worcestershire.[24] Overton was aware of dovetailed sills in use at Rhymney by 1807 and had himself used them at Dowlais, which (as we shall see below) probably refers to the Twynau

---

[18] Guy and Reynolds 1999
[19] Bick 1987, 41-42
[20] Bick 1966
[21] *Hereford Journal* 7 August 1811
[22] NLW Powis Castle 2502, '80 tons per mile'
[23] *Repertory of Arts*, 2nd series, 30 (1817), 321
[24] Elsas 1960, 174-5

Gwynion line 4 of 1800. The Rhymney pattern had a chunky tiebar much resembling an iron pig and high rounded inner cheeks for taking wooden keys, and has been found at Twynau Gwynion **(Fig. 79)**, on the Brinore, and in limited numbers at Llangattock **(Fig. 59)**.

But the type which became most general first appears at Blaenavon (Hill's Tramroad) about 1817 **(Figs. 31-2)**, whence it was copied by the Baileys at first for Disgwylfa about 1818 **(Fig. 51)**, and subsequently and extensively at Llangattock from about 1827 **(Figs. 55, 62)**. The Baileys even went to the extent of converting the earlier Hodgkinson-built Llangattock Tramroad to it. Its tiebar was usually, though not always, cruciform in section, which is stronger weight for weight and has the advantage over rounded tiebars that it can be better secured by packing heavy stones neatly against it. A final dressing of finer ballast on top completes the job. Sills of this type from the Hereford Railway (opened 1829) show that even Hodgkinson, who built it, was eventually wooed away from Outram's plates.[25]

At Blaenavon, the inner cheek was slightly curved to take wooden keys as on the Rhymney type, but the Baileys allowed only about $^{3}/_{8}$in between the plate and the inner cheek, enough for only wrought-iron keys which were sometimes in opposed pairs **(Fig. 69)**. Presumably the idea came from the Liverpool & Manchester **(Fig. 19)**. This use of iron keys with cast-iron plates was probably unique to Llangattock, and gave such a tight fit that six consecutive sills found more or less *in situ* had all failed at the point where the keys were driven.

Sills had two advantages: they retained the gauge, which could otherwise spread, and they needed lighter blocks or, in some cases, no blocks at all. However, judging from the large number of breakages found, the casting was

---

[25] Morris 1939, 100

all too liable to fail one side or other of the inner cheek **(Figs. 31** and **69).** Most damage occurred when supporting blocks slipped, and the absence of stone blocks may have had the advantage of letting track settle.

Cast-iron plates used with dovetailed sills

Plates for sills naturally differed from Outram's notched ones. They had a projecting wedge on the inside against which the key bore, and a chamfered notch on the outside which conveniently located the plate to the lower outside cheek **(Figs. 51, 78, 82, 91).** The main attempt to strengthen was by adding a deepening rib underneath which only extended as far as the feet **(Figs. 50, 60, 64).** In one example **(Fig. 78)** the rib is not bellied. **Fig. 60** shows heavy wheel wear and the advantage of the rib lying beneath the wheel which, surprisingly, it does not always do **(Figs. 50, 64).** The ends might be slightly or even considerably convex and concave to create a mating joint **(Figs. 50, 64).**

Combined plates for Outram's method or for use with sills

These were similar to the normal sill plate but with an additional notch which could be used in the Outram manner **(Figs. 82, 91).** Wear marks on Twynau Gwynion line 4 show such sills used **(Fig. 92)** in Outram fashion; if they are original they indicate that dovetailed sills were in use by 1800. A 4ft plate of this type weighing no less than 100lb was recovered from Twynau Gwynion (but too late to be illustrated). It has a bulbous belly running almost totally across the underside, which allowed the plate to continue in use even after the tread proper had been worn totally through.

Wrought-iron rails

The change from brittle cast-iron to tough wrought-iron rails was the step which allowed edge railways to make their great leap forward in the 1820s. A comparable advance in plateways never took place, and wrought-iron

plates always remained much in the minority. Dowlais rolled some for its own use as early as 1835,[26] but South Wales, like most other areas, was slow to adopt it. Its introduction is sometimes, but far from always, associated with the coming of locomotives. The simple L-section is found (more often attested by chairs, which will shortly be discussed, than by the rail itself) for horse-worked lines at Morlais (west), Llangattock, the Rhymney Limestone Railway, and Penderyn, all of them probably of the 1850s or later. For locomotive lines, it was proposed on the Brinore in 1850 (to weigh 50lb/yd) and installed on the Tredegar-Trevil tramroad probably in 1852 **(Fig. 84)**. A heavier version with a continuous strengthening rib underneath is known at Blaenavon, associated probably with Dyne Steel's improvements of the 1850s but evidently for horse-drawn traffic, at Llangattock from his rebuilding for locomotives soon after 1859 **(Fig. 68)**, and at Trevil for steam working quite late in the century **(Fig. 85)**.

An exotic variation is attested at Morlais (west), where probably in the 1870s Plymouth introduced heavy and sophisticated chairs fixed to wooden sleepers to take a bullhead rail laid on its side **(Fig. 106)**. This concept is earlier recorded at Rhymney where, it was said in 1857,

> waster rails have been laid for years ... However, [they] are gradually giving way to the edge rail which stands up from the ground, and so works cleaner on its surface than either the flat tram plate, or the double-headed rail laid channel upwards, which channel is always full of dirt, creating friction, and splashing every person that happens to be near to the passing wagons.[27]

This practice saved the special casting or rolling of plate rails by adapting a product which, by this date, the ironworks were manufacturing in huge quantities, and it may have been more widespread than we imagine.

---

[26] Elsas 1960, 94
[27] *The Engineer*, 3 (6 Feb 1857), 109

Chairs and sills derived from chairs

Compared to sills, chairs were always rare, but nevertheless much more common in South Wales than in England and Scotland, where the three instances mentioned in Chapter 2 are the only ones known. The idea presumably derived from the non-dovetailed saddles on the Peak Forest **(Fig. 7)**. In South Wales we know of no such chairs (as opposed to sills), but the dovetailed chair was certainly used on the Kington Railway about 1818 **(Fig. 8)**, and thereafter it remained very similar to the chair part of a sill; indeed it was probably adopted because sills were liable to break.

The use of chairs with cast-iron plates was limited, as far as we know, to the Kington and to the Gurnos tramroad on its conversion from a railroad. Even so, the distance of 3ft between blocks is only suggestive of cast-iron plates, and is not conclusive **(Fig. 109)**. The date is not known. A further change in chairs coincided with the replacement of the Pont y cafnau deck and quite possibly with the adoption of wrought-iron plates. A chair of probable Crawshay pedigree at the Glamorganshire Canal basin in Merthyr is hollowed underneath into a dumb-bell shape which would generate wear marks similar to those seen at Gurnos and Hirwaun **(Fig. 112)**. As a rarity at Gurnos, it was probably used for patching up.

The chair came more into its own with the coming of wrought-iron plates. Relatively light and simple dovetailed designs, similar to the ends of sills, were used on the Tredegar-Trevil line from probably 1852 **(Fig. 83)**, at Morlais (west) **(Fig. 108)**, and Llangattock **(Fig. 67)**. On the Rhymney Limestone Railway a more massive design was adopted, no doubt in the 1850s too, which with its fixing holes staggered to avoid the spikes splitting the wooden sleeper was reminiscent of main-line railway chairs **(Fig. 98)**. Here, as at Penderyn, there were evidently sporadic wooden sleepers with

chairs to hold the gauge, and in between plain stone blocks simply supported the rail without any means of locating it.

The ribbed wrought-iron plate demanded an altogether heavier pattern, and generally the dovetail was abandoned. By now the chair was usually fixed to a wooden sleeper, and could be closely modelled on main-line practice (Trevil, **Fig. 86**, weight 35lb). Occasionally sills were retained, resting on stone blocks: either wholly cast-iron with up-dated chair parts (Llangattock, **Fig. 66**), or else with two cast chairs joined by a wrought-iron tiebar (Trevil, **Fig. 87**, weight 67lb, and Blaenavon, **Fig. 27**). The floor of the chair was hollowed to contain the rib, and the plate was held by an iron key in a special keyway (Llangattock, **Fig. 68**, weight 22lb), by a large main-line-style wooden key (Trevil, **Fig. 86**) or, exceptionally, in the traditional dovetail (Blaenavon, **Fig. 27**).

Specialised track

Archaeology on the quarry tramroads give a clear indication of how turnouts were laid (**Fig. 56**) and confirms that they resembled the plan prepared for the Tredegar ironworks **(Fig. 12)** and used Outram-type plates even if the rest of the line had sills.[28] Pointwork consisted of a number of components. The form of switches, already established by Curr **(Fig. 11)**, is well illustrated by those from Bicslade and Morlais (west) **(Fig. 103)**. There was normally only one switch, not two as in railway practice. At the crossing, where the diverging lines of rails crossed, a box plate was used **(Fig. 52)**. If the turnout had a small angle, it would be built up from straight plates, and a symmetrical box would be adequate. With a sharp turnout, as in this case where space at the incline head was restricted, the rails would be curved, and their curvature needed to be continued in the box plate. Curr's principle was

[28] Pointwork held in special sills is known outside the limestone tramroads, as at South Duffryn pit near Merthyr (070 031): Lewis collection P43

also observed of making curved track broader in the tread (5in rather than 4in). An interesting feature in **Fig. 52** is the thickening on the flanges which kicked the wheel across to the correct side of the frog beyond. When plates were curved, the inner and the outer were of different radii and lengths (**Figs. 37, 39, 43**, all of which by chance are inner plates and are not necessarily from pointwork).

There was always a risk at the crossing that the leading wheel might take the wrong turning. To obviate this, double-flanged check rails were laid on the outside tracks. One from Llangattock **(Fig. 57)** with a heavy outer flange, which shows there was a fair amount of punishment here, was used alone on the straight-through line, but another from Brinore **(Fig. 81)** was one of a pair used on the diverging line; both types appear on **Fig. 11**. At Llangattock, in default of the proper casting, the botched-up junction between the Wern Watcyn incline and Bick's Tramroad used a heavy scalloped plate weighing 86lb **(Fig. 72)**.

This, of Outram type, is unique in its very heavy underbelly, perhaps intended to resist not so much the weight of the trams as that of road vehicles. That, of course, was the function of such vandyke or turnpike plates. Another single-flanged example is **Fig. 95**.

Typology

We have now reached the point where the basic typology of South Wales tramroad track can be summarised **(Fig. 117)**.

It is becoming increasingly clear that for some time after 1788 the mainstream of track development in South Wales sprang directly from Curr's practice. The aspect open to most experiment was the method of holding the plate to the sleeper. The three starting points were Curr's nails in

the centre of the rail ends, his dovetailed sill, and his morticed joint (**Figs. 5 and 6**).

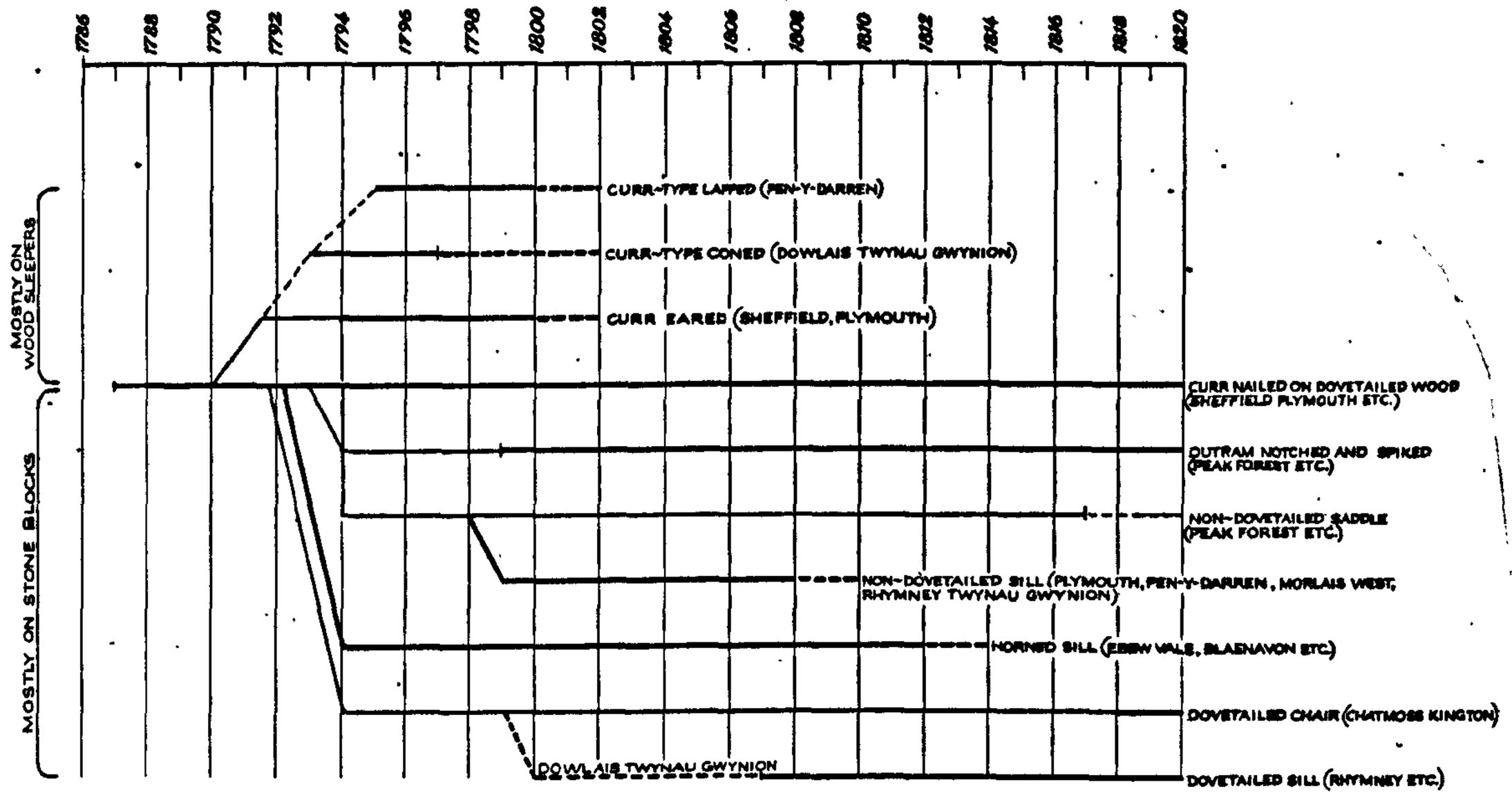


Fig. 117. Evolutionary tree of tramplates

Curr's rails had straight ends. To ensure that they remained in alignment it was easy to make the ends convex and concave, and to bond the rail more positively to the sleeper by a downward-projecting sleeve or cone around the nail hole. This approach is attested at Twynau Gwynion on the plates laid apparently in 1792. It was improved by lapping the plate ends so that only a single nail held both, as in 'Homfrays Old dram Roads' seen by Watt in 1800, and by lapping and coning as at Landore near Swansea.[29]

A wooden dovetailed sill was easily cut, but its iron counterpart, the sill, was a fairly complicated casting. Sills were therefore at first non-dovetailed. The very idea of sills (and saddles) originated on the railroads and is first mentioned on the MCC lines in 1792, though possibly the Blaenavon saddles were earlier. It was picked up by the Harfords at Ebbw Vale in 1794 when they cast a few of the horned type for Nantyglo. This approach, with

[29] Hughes 1990, 172 Fig. 92a

modifications, was adopted extensively by Blaenavon from about 1796 and to a limited degree by Tredegar from about 1804. Another approach, with vertical cheeks perhaps modelled by Richard Hill of Plymouth on the Peak Forest saddles, was applied about 1799 at Morlais (west) and sporadically elsewhere.

It led on to the dovetailed sill which became much the most widespread and must have been seen to be the best design on offer. Overton probably used it at Twynau Gwynion in 1800, there is a hint of dovetailing on a Rhymney sill of the early 1800s, by 1807 it was not uncommon, by 1814 it had been adopted for the Brinore Tramroad, and about 1817 it spread to Blaenavon and the Baileys' tramroads.

The third starting point was Curr's morticed joint. This in itself was not satisfactory. However, its complicated projections at each end were reduced to simple ears for nailing down and for extra stability **(Fig. 114)**. This was, presumably, the type cast in large numbers by Plymouth from 1794. The small ears by which plates were held in horned sills also, one might feel, owed something to this type.

Outram's version of the tramroad, developed in the Midlands and avowedly 'on a system introduced by Mr Curr,' entered the South Wales scene in 1799; but, apart from exit lines such as the MCC tramroads and the Penydarren (and by local influence the Cynon valley), it by no means dominated track development there.

Chairs derived from sills arrived about 1850 if not earlier, largely hand in hand with the rolled wrought-iron plate, which moved from a simple L-section to a heavy ribbed version especially in the 1860s with the advent of steam.

Curr had advocated plates 6ft long but, after the very earliest days, 4ft became the norm throughout the 1790s. With the arrival of the Outram plate, 3ft became much more common, although the Baileys in particular remained wedded to 4ft. But there were always exceptions.

Gauge between flanges

Plateways adopted a wide variety of gauges. The smaller and earlier ones, in general, were derived from internal works lines or even underground ones (we have noted 18in in the Clydach valley and a mere 12in in a Rhymney ore mine); which begs the question why any given figure was chosen in the first place. Thus Blaenavon, who were early in the field, adopted 2ft for their quarry lines, much the same as Curr's underground plateways. Overton's tramroads to Twynau Gwynion and Morlais were respectively 2ft 6in and 2ft 4in. Rhymney's gauge, both to Trevil and Twynau Gwynion, was 2ft 9½in and so was Tredegar's, while Baileys' gauge to Disgwylfa was similar. Craig yr Hafod was slightly wider at 2ft 10½in. But Outram had favoured 3ft 4in and 4ft 2in, and when his influence spread to South Wales these two figures became widespread, especially under Hodgkinson. The smaller one may have found favour because it mimicked that used on railroads, and was adopted on both Llangattock tramroads, the Brinore, the Hay and the Llanvihangel and its connections. The 4ft 2in gauge found use on lines where traffic was likely to be heavy: the Penydarren, both lines to Morlais, the Aberdare Canal tramroads, and indeed most of the MCC lines and their connections once they were converted from edge rail. Nonetheless, older and narrower gauges survived alongside the new. Thus Tredegar gradually modernised its Trevil line and finally installed locomotives on it, while the Penydarren-Morlais (west) line remained dual gauge.

But caution is needed in discussing the gauge of tramroads, which could acquire a middle-age spread. On the Grosmont Railway, the latterday distance between flanges, surely intended to be Hodgkinson's usual 3ft 4in, was found by measurement of blocks to be 3ft 6in (3326 2112). At Morlais (west) the original 4ft 2in was found to be 4ft 4in. In the Forest of Dean the gauge also spread by 2in. Archaeology is not an infallible guide to how a line was built. But no cases have emerged of a narrowing of gauge.

Latterday track maintenance

At some quarries it is clear that order, modernisation and even innovation prevailed until the end. Rhymney at Twynau Gwynion, Blaenavon at Gilwern Hill, Plymouth at Morlais (west), and most notably Tredegar at Trevil all stand out. Elsewhere, in contrast, maintenance went to pot and owners, in their declining days, cobbled together a jumble of secondhand track. Anyone inspecting Tappendens' Tramroad today is struck by the wide variety of wear marks from plates and chairs, possibly the result of multiple use by a number of ironworks which could not agree on cost-sharing. In the 1860s Penydarren in its death throes threw together at Morlais (west) a miscellany of plate lengths, tread widths and types. At the same time at Llangattock the Baileys, wishing to retire from ironmaking and tiring of quarry maintenance, patched up a hitherto well-organised tramroad system with a medley of sills and Outram-type track. The impression given is one of desperation to keep things working.

RAILWAYS

Although tramroads dominated the quarry scene, five mineral railways came to serve quarries before the beginning of the twentieth century. The first, the Abersychan of 1826, was highly innovative for a region so wedded to tramroads. Its wrought-iron fish-belly rail, unique in South Wales, was apparently due to speculative ironmasters from outside who were familiar

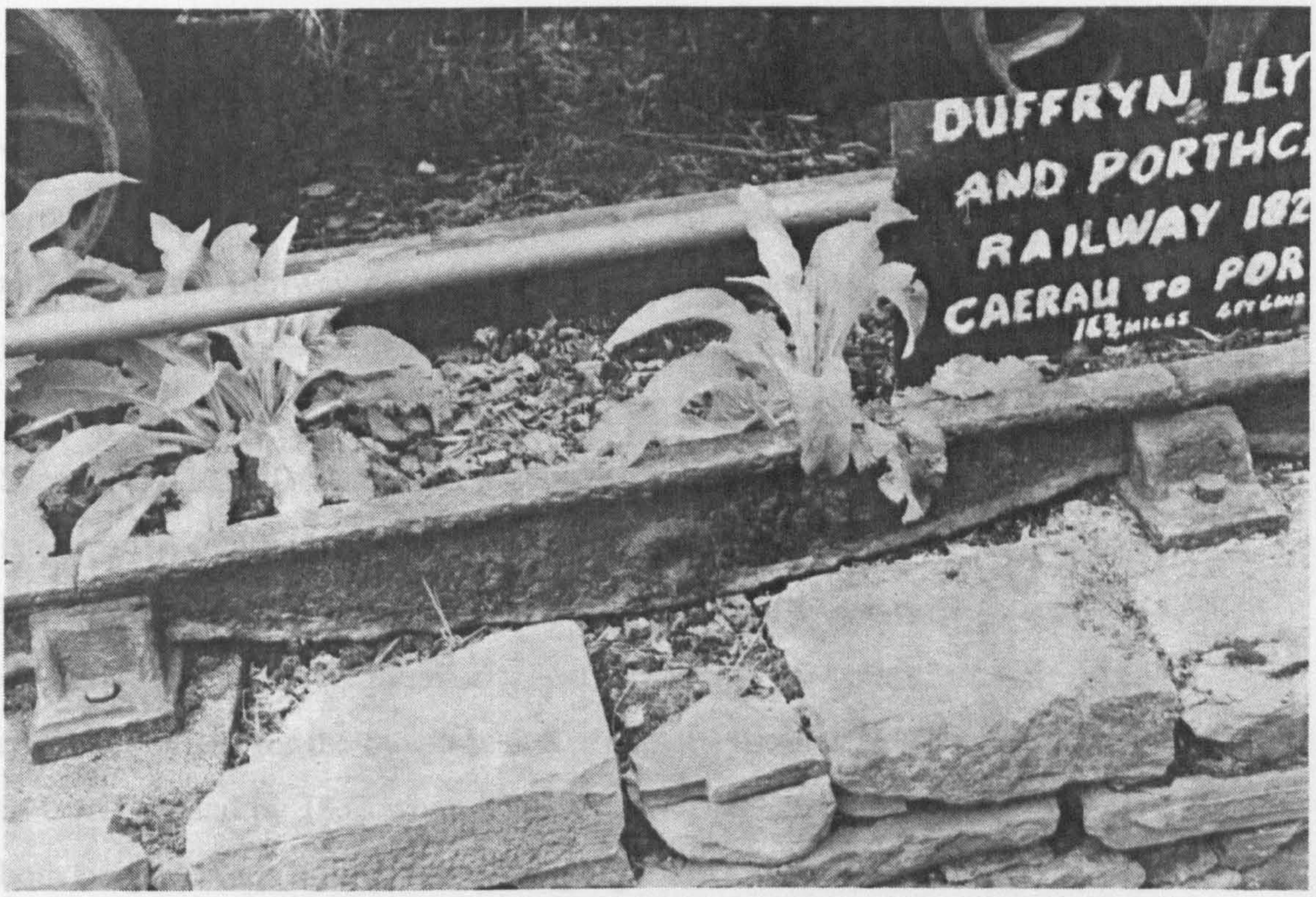


Plate 40. Cast-iron fishbelly rail from Duffryn Llynvi and Porthcawl Railway at Afon Argoed Country Park

Plate 41. Chair *in situ* on the Duffryn Llynvi and Porthcawl Railway at Cefn Cribwr Ironworks (SS 852 835)

with an alternative to tramroads and who had the foresight to choose wrought iron as the material of the future. By contrast the Duffryn Llynvi and Porthcawl Railway of 1828, while avoiding plate rails, was almost the last line in Britain to opt for cast-iron fish-belly rail.[30]

Second, by 1838 Dowlais had a standard gauge railway to Morlais (east), later partly replaced by the Dowlais Branch of the Brecon & Merthyr Railway. Although built as a tramroad, its early conversion may be explained by Dowlais' familiarity with railways: wrought-iron rails were rolled here (first for the Stockton & Darlington) from 1822. Conversion was in Guest's mind by 1832 when he ordered a locomotive capable of running both on plate rails and on standard gauge. His commitment to railways is shown by his membership of the provisional committee for the Taff Vale Railway in 1835. The third line was the Rhymney Limestone Railway, which had arrived at Twynau Gwynion by 1857 apparently as a tramroad but by 1870 had been changed to standard gauge. Even so it used tramroads as feeders for a time.

Fourthly, the old Trevil Railroad with its cast-iron bar rails was gradually rebuilt into a more modern railway with wrought-iron rails, still retaining its 3ft 8in gauge, from the mid-nineteenth century, although it was not apparently locomotive-worked until after 1900. The final railway to be built was Blaenavon's 3ft gauge Gilwern Hill line in 1885. With the solitary exception of Dyne Steel's incline, the northern side of the mountain was dominated by 2ft tramroads. When the Gilwern Hill railway was decided on it was given the compromise gauge of 3ft, probably because the tunnel could accommodate nothing larger.

---

[30] It appears that the harbour section was laid with a curious hybrid bar rail, but recent finds at Maesteg confirm fishbellies

From the 1830s, railway track in our area largely followed the national pattern: replacement T-rails in chairs from about 1840 on the Abersychan **(Fig. 20)** and perhaps from 1841 on the Trevil, though these were somewhat unexpectedly held in sills **(Fig. 74)**. The lines of the later nineteenth and early twentieth century relied, typically of larger industrial railways, on flat-bottom rail held, rather untypically, in chairs. Such were the Rhymney Limestone Railway **(Figs. 99-100)**, Cwm Quarry **(Fig. 46)**, Trevil **(Fig. 75)** and Gilwern Hill **(Fig. 28)**. As usual, the rails were held by wooden keys and in most cases the chair design owed much to current main-line practice for double-head or bullhead rail. Only at Twynau Gwynion **(Fig. 97)** and Trevil was evidence found for bullhead rail itself.

Waggons

Railroads

Because the railroads were for the most part superseded by tramroads at an early date, our knowledge of their waggons is limited. The first reference comes in 1791, when Plymouth cast 'Miner wagon wheels' of 45 to 53lb **(App. 3.2.P)**. These were for an ore mine, where levels were notoriously restricted, and are much the lightest that we know of. Waggon wheels for a colliery cast three years later by Ebbw Vale were more than double the weight at 117lb. Just as colliery rails were roughly half the weight of surface rails, these in turn were less than half the weight of surface waggon wheels. The wheels of surface waggons were much heavier. Those cast in 1794 by Ebbw Vale for the B&A's Clydach Railroad and for Barron Watkins & Co the hauliers weighed 278 or 280lb each and cost £1 18s.[31] Bearings weighed 48lb per waggon. In 1799, on waggons built for the Brecknock Boat Company for use on the Clydach Railroad, the axles and strapping weighed

[31] The Clydach wheels from Gilwern Wharf are 1ft 10in in diameter and 3¼in wide on the tread, have six spokes and are keyed onto the axle. Wheels on the Abersychan line, probably from late in its life, have a tread of 5in which suggests that the gauge had spread a good deal.

287lb, the wheels 274lb each, and the total cost was £17 9s apiece,[32] comparable to the £19 12s 8d for a large Shropshire waggon in 1796 **(Fig. 15)**. In capacity these Welsh waggons, whose loading is given as anything from 3½ tons down to 2, were also comparable to the Shropshire ones, which never seem to have carried more than 52½ cwt.

Tramroads

We saw in Chapter 2 that Curr's corf wheels weighed either 9¾lb (10in diameter) or 14lb 3oz (13¼in), while on the Shopshire corf of 1794 they were 10lb (10in). From 1790 to 1796 Plymouth was casting dram wheels in the range of 11-14lb **(App. 3.6.P)**, which sound right for Curr-type corves. In 1794, too, Ebbw Vale cast four dram wheels for Nantyglo weighing 11lb and at 8in in diameter[33] even smaller than Curr's. These ran on the plates held in horned sills **(Fig. 34)** at a gauge of 18in, compared with Curr's favoured gauge of around 2ft. All this ties in well with small underground trams.

But the question recurs, as with tramplates, of when and in what size the tram came to the surface. The date provisionally reached for tramplates was 1792 at Twynau Gwynion. The very next year Plymouth's dram wheels suddenly jump in weight to an average of about 25lb. Thereafter, although smaller wheels were still made, larger ones continued to grow: 35lb in 1794, 46lb (with brasses) in 1797. In 1799 the accounts distinguish between small dram wheels (31lb) and large (44lb). Next year axles for limestone trams are specifically mentioned, and the considerable number (393) of small wheels cast were very likely for the new line to Morlais (west): small wheels, no doubt, because the gauge was only 2ft 4in. This growth in size finds a parallel at Neath Abbey, where in 1800 Watt remarked of a new slag waggon 'The Wheels of the old Waggons were not much more than 9 to 10 Inches in

---

[32] PRO RAIL 812/9-10, Rough Journal of the Boat Company
[33] GRO D.2472.3

diameter; these are 15 to 20, rounded upon the circumference.'[34] The evidence of tram wheels therefore corroborates that of the plates: tramroads came to the surface in 1792 a little heavier in the track but double the weight in the wheels. So too at Blaenavon where, though we know nothing about the wheels, the first surface tramroad of about 1796 was given the narrow gauge of 2ft. Much the same sort of thing seems to have happened, as we saw in Chapter 2, when Curr's corves first came to the surface at Wingerworth in 1788 on a 20in gauge.

The big advance in tram size seems to have come in 1800 with Outram-type track and gauge. The first evidence is in the form of Watt's description of the intended 3ft 6in gauge tram for the Penydarren Tramroad (Chapter 12). Certainly the typical wheel on limestone lines after 1800 was very much larger than before: about 64lb on Hill's Tramroad (2ft gauge), at least 178lb at Llangattock (3ft 4in gauge). Nevertheless, wheel weight still remained well below that for railroad waggons.

Engineering

This survey has revealed little new about railroad and tramroad engineering. Virtually all the quarry lines included some cuttings and embankments, perhaps the most notable earthworks being the 700m loop at Cwm Milgatw on the Trevil Railroad with two bridges of the 1790s, and the spectacular shelves cut in precipitous hillsides to carry the Brinore and Hill's Tramroads. But even these are not important on a national scale, and more detailed comments will be restricted to bridges and inclines.

Although the quarry railways were built almost exclusively by ironworks, iron bridges were few. Some of them, nonetheless, were pioneering. Pont y

---

[34] BRL (Journal)

Cafnau was the first iron railway bridge, with a simple A-truss. Waterloo bridge across the Nant Morlais at Penydarren ironworks and Robertstown bridge near Aberdare are both simple arches of the 1810s. At Llanfoist the flat girder bridge carrying Hill's Tramroad over the B&A, built by 1818, is possibly the earliest of its kind anywhere. Although not specifically a quarry railway, the Penydarren Tramroad, which closed in 1856, crossed Nant Morlais on wrought-iron lattice girders which are perhaps a replacement of 1825-30;[35] if so, they have a claim to be the earliest of the type. All in all, iron railway bridges in South Wales resembled their counterparts for roads, like Watkin George's Merthyr Bridge of 1800 and the extremely early bowstring girders of 1792-4 at Rhydycar and elsewhere,[36] in combining innovation with practical but none too elegant design.

Within the quarries, gradient was not of major importance because working was often up into the outcrop and full trams could run downhill. Slight differences in level could be overcome by staiths, but their main function was ease of transhipment at changes of gauge or of system, as at Twynau Gwynion. The short-lived staith above Blaenavon was doubly convenient in catering for a considerable change of level and for stockpiling limestone. At Llangattock a far from satisfactory chute was used to slide limestone down the mountain. For through running by rail, the simplest form of overcoming extreme gradients was by reverse working on zigzags, a cheap and effective (if slow) device employed at Tyla (north and east), Llangattock and the Clydach-Blaenavon line.

Self-acting inclines were known in South Wales from at least 1794, when that at Cyfarthfa was built which, with its 'travellers' or cradles, somewhat resembled those on the Shropshire canals. However, despite some extreme gradients and the high costs of horse haulage, there was reluctance to adopt

---

[35] Davies 1992, 138
[36] Davies 1992, 150-5, 134

them widely. Before the coming of wire rope in the 1840s it was normal to use chains, which are attested at Cyfarthfa, Llangattock, Llam-march after 1811, probably Clydach Camp, and Hill's Tramroad. The problem with chains was their dead weight, sometimes evidenced by deep wear marks in stone pillows down the incline and in stone sills at the brow. Rollers to reduce the friction from chains are only known from Tappendens' Tramroad incline. The early norm for brake engines was the horizontal wheel as at Cyfarthfa, Llam-march after 1811, and Llangattock, where it was perhaps 8ft in diameter and similar to that at Hill Pits, with a wood-lined brake strap bearing on a brake wheel that was integral with the winding wheel. The idea was possibly derived from the vertical water balance brake, a common feature in coal mines throughout South Wales. A small horizontal brake wheel of this kind survives at Llanberis.

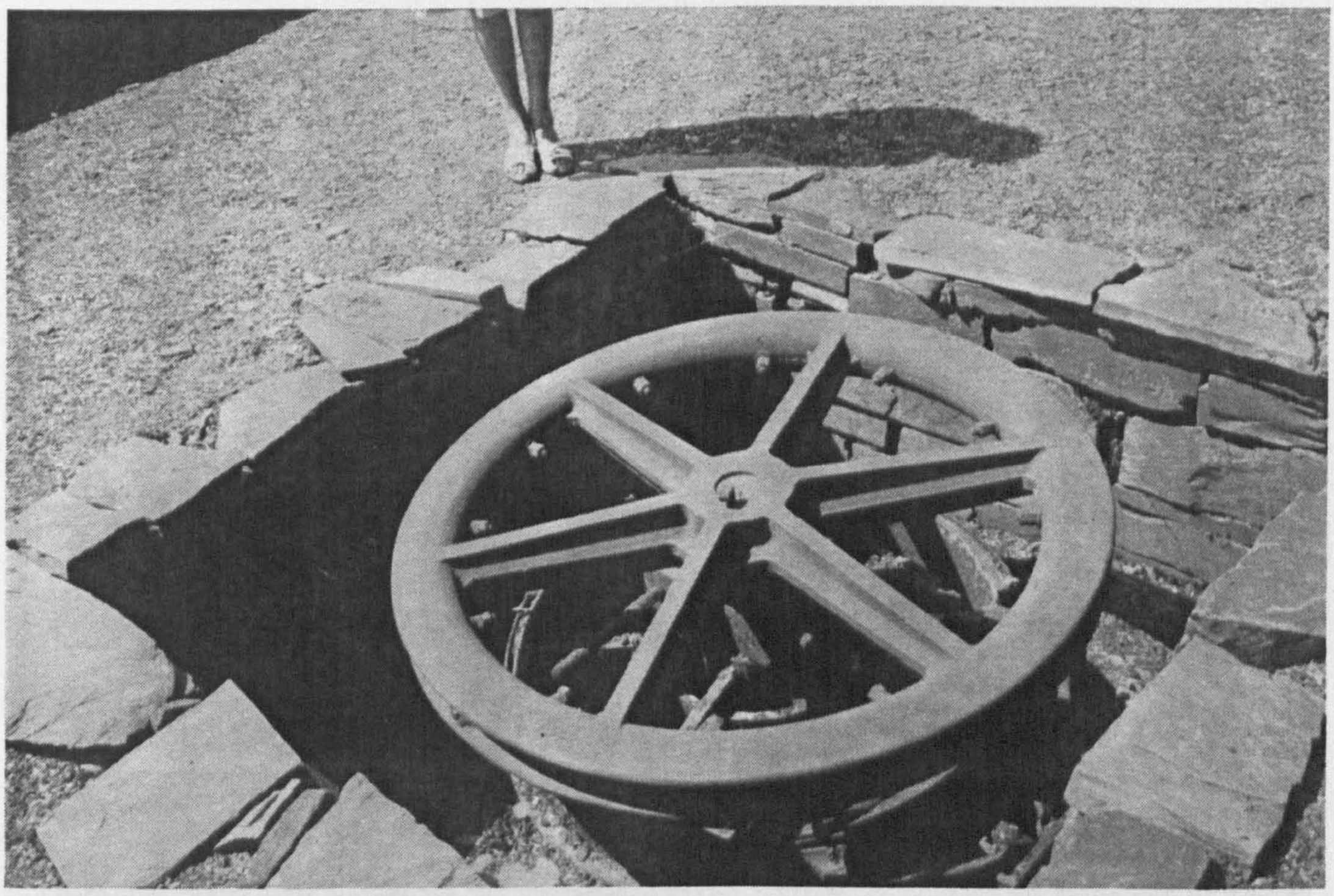


Plate 42. Incline wheel at Llanberis. The brake part lies beneath the wheel

The Jinny or Jenny inclines built on the Llam-march in 1802-4 proved unsatisfactory, possibly because they were (unusually) worked by rope, and were replaced in 1811. And their very name is redolent of Curr's Jinney (described in his *Coal Viewer*, published a few years before), which had a drum mounted overhead; and so it may have had here. The advantage is that the rope is high enough to pass down the incline in a straight line, without changing angle and generating friction at the brow; but a more powerful brake is therefore required.

To a lesser extent the same holds true of vertical brake wheels mounted half underground as at the much later Cwm Quarry, probably of the early 1860s, which possibly had a double brake band. Here one track was permanently reserved for a balance tram, attached to the rope which ran free from the top of the drum, the other rope running from the bottom of the drum over a

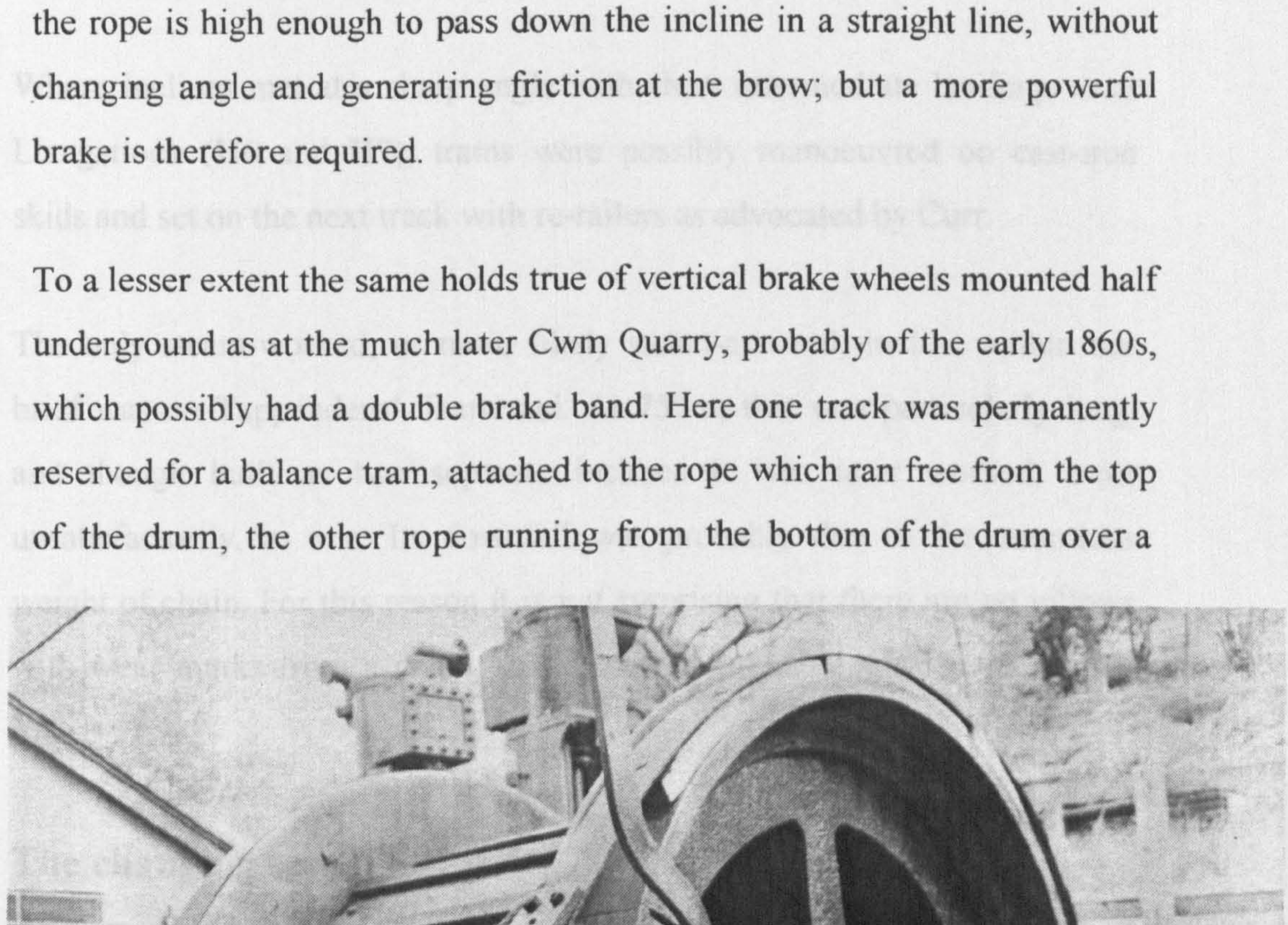


Plate 43. Brake Engine at Afon Argoed Country Park

sheave. The arrangement has similarities with one at the mining museum in the Afon Argoed Country Park. Although narrower, this also comprises three built-up cast-iron wheels, with two brake paths mounted outside for the very effective brake bands operated via a couple and a lever on which the brakesman could lean with his full weight, with considerable assistance from counterweights.

Where inclines met at a sharp angle with short intermediate landings as at Llangattock (**H6** and **H7**), trams were possibly manoeuvred on cast-iron skids and set on the next track with re-railers as advocated by Curr.

The only steam-worked, or more likely steam-assisted, incline within our brief was on Tappendens' Tramroad. At 750m, this was particularly long, and though built as two separate inclines it was later worked, most unsatisfactorily, as one. Its downfall was probably due to the enormous weight of chain. For this reason it is not surprising that there are no pillows with wear marks from a chain, while there is archaeological evidence for rollers.

The changing scene

In early days traffic was astonishingly light. At Trevil in the 1790s the Ebbw Vale quarries were worked, it seems, by just two men whose job was largely though not entirely seasonal on account of the shortness of winter days and the uncertainty of the weather. Stockpiling must have been essential. They had six waggons supplied by the company, of which perhaps two were being filled at any one time, two were on their way full to the furnaces, and two were returning empty. In summer each waggon made two journeys a day, in

winter often only one.[37] True, the Trevil Railroad was also shared with Beaufort and Sirhowy; but traffic could hardly be called heavy.

But these were early days. The forty years following the 1790s saw a ten-fold increase in output of iron and a commensurate, if somewhat smaller, increase in output of limestone. The resulting growth in traffic and the rising cost of horse traction put the busier quarry lines under organisational and financial pressure. Locomotives could have provided the main breakthrough in the reduction of haulage costs; in 1849-50, for instance, the Blaenavon company introduced two locomotives on its coal and iron ore lines with a saving of sixteen horses and £3000.[38] Yet on the quarry lines steam was relatively slow to arrive. We might guess that sometimes the gradient was considered too steep (as on the Rhymney Limestone Railway), or the distance too short (as on the Llam-march), or the gauge too small (like the Blaenavon 2ft tramroads). In the end it was generally only the larger quarries which acquired locomotives, and often only after the re-introduction of edge railways. First and last, locomotives are known to have been used, even if only experimentally, on the following quarry lines, though the suspicion remains that there may have been more, and earlier, than we think:

Blaenavon-Gilwern Hill	3ft edge, c.1885
Baileys' Llangattock Tramroad	tramroad, 1829? (by 1832)
Trevil Railroad and Railway	3ft 9in edge, c.1904 (or 1874?)
Tredegar-Trevil	tramroad, pre-1854
Rhymney Limestone Railway	standard gauge edge, 1860s?
Dowlais-Morlais (east)	tramroad, 1832?
Hirwaun-Abernant	tramroad, 1830

As remarked in the Introduction, this study does not set out to deal with economic factors. But it is worth ending with the briefest of summaries of the capital costs of laying railroads and tramroads to the quarries. These were purchase of land, building the formation, and supplying and laying the

---

[37] GRO D.2472.3; D.2472.1, 6 Apl. 1797, 4 Feb. 1799
[38] Knight 1980, 637-8

track. Ironmasters were relieved of buying land by generous leases which gave them almost complete freedom of action. While engineering on exit lines like the Hay Railway might account for very roughly half the total costs, on the quarry lines, in general, it was minimal. This left rails and sleepers as the largest item.

Bar rails in the 1790s cost around £8 8s 0d a ton,[39] and in 1811 3ft tramplates, when sold to the public, were similar if slightly lower in price, varying from £7 15s 0d per ton (if over 45lb) to £9 (if below 30lb).[40] But quarry lines were generally built by the ironworks, and at Ebbw Vale the actual cost was between £6 8s 0d and £6 18s 10d.[41] Plates 4ft long were 10s. per ton more expensive. With the coming of wrought-iron plates the price dropped still further, to £5 2s 6d a ton on the Brinore in 1850. Stone blocks were also cheap in South Wales: 3d to 7½d each, for example,[42] compared with 1s 6d or so east of the Severn where there was no millstone grit readily available.[43] Wooden sleepers were at least twice and sometimes six times the price (1s 3d at Penderyn and 1s 6d at Clydach, both in 1794) but naturally had a shorter life.

Because edge rails were heavier than tramplates they were more expensive, and the tare weight and therefore the cost of railroad waggons was greater than that of trams, which together might very well be a factor in the demise of the railroad in South Wales. Once tramroads had been accepted, there was a definite incentive to adopt 4ft plates because, though each was roughly 6 to 8 per cent more expensive than a 3ft one, they were 33 per cent longer. This represented a considerable saving, of the order of £90 per mile; and because fewer stone blocks were needed another £25 or so would be saved. Stone

---

[39] GRO D.2472.1
[40] GRO D.2472.1
[41] PRO C.114/124 (part 1) f. 278-79
[42] Hughes 1990, 36-37; H&WCRO Hay Railway Committee Minutes 8 January 1812
[43] Bick 1987, 43-44

blocks had, in terms of cost, a definite advantage over wooden sleepers, though this would be reduced by the expense of iron sills. Nonetheless, when considering permanent way from this short-term financial point of view rather than from a long-term practical one, one can understand why ironmasters replaced railroads with tramroads, and why 4ft plates on sills evidently came to be regarded as the optimum before wrought iron arrived.

Even allowing for a lapse of time before the technical deficiencies of plateways were appreciated, one of the most puzzling aspect of industrial transport in South Wales is the general reluctance to replace plateways with more modern railways. The coming of wrought-iron rails would have offered, one might think, an ideal opportunity to dispense with plateways altogether. But it was not taken, and long after modern main-line railways had taken over the long-distance transport in the valleys, ironmasters continued to lay and maintain old-fangled tramroads to the quarries. In many cases wrought-iron plates were simply substituted for cast-iron, involving though it did the manufacture of special rolls and the casting of special chairs.

There were cases in mid-century when the sheer volume of traffic forced a gradual change by the medium of combined edge and plate rails, as on the Monmouthshire Railway & Canal Company's system and at Dowlais. Some quarry lines were converted into modern railways in one fell swoop; but others remained plateways to the bitter end. The principal reason must have been that to convert a whole transport system both inside the quarry and between quarry and ironworks was just too expensive, especially in the dark days of the 1860s and 1870s when the industry was under great pressure. In 1850 an estimate was made for adapting the Brinore for locomotive working on chaired wrought-iron plates. The cost of around £5630 after the sale of

the old cast-iron plates was beyond the resources of the company;[44] and, outside the more prosperous concerns, this was probably typical of the prevailing economic climate.

Between 1790 and 1890, the century on which this study concentrates, the iron industry of South Wales enjoyed a huge expansion to become the largest in Britain, and it suffered the beginnings of a steady decline. Without the development, in partnership with the contemporary canals, of an extensive and innovative system of railroads and tramroads, that expansion would have been stunted by lack of transport. The decline of the industry was accompanied by the decline of its now often antiquated railway feeders.

---

[44] GRO MAN/G/1/0006

APPENDIX 1

Summary of railroads and tramroads discussed

R = Railroad, T = Tramroad

Ironworks/lime co	line	quarry	dates
Abersychan	Abersychan Rly	Cwm Lascarn	c.1826-54
Blaenavon	Tyla R	Tyla	c.1790-96
	Blorenge T	Blorenge	c.1796-1801
	Tyla T via Keeper's Pond	Tyla	c.1801-17
	Pwll du tunnel	Tyla	c.1817-1926
	Hill's T	Pwll du	1818-1859
	Gilwern Hill Rly	Gilwern Hill	1885-1926
Cwm Llanellen Lime Co	Craig yr Hafod T	Craig yr Hafod	1812-29+
Clydach	Llam-march R	Llanelly	1795-1804
	Llam-march T	Llanelly	1804-77
	Clydach-Blaenavon T		c.1802-12+
Brecknock Boat Co	Llangattock T	Llangattock	1815-1911
Nantyglo	Clydach R	Daren ddu	1794-1915+
	Clydach incline	Clydach Camp	1829-?
	Disgwylfa T	Disgwylfa	1816-29
	Baileys' Llangattock T	Llangattock	1829-1875
Beaufort	Baileys' Llangattock T	Llangattock	1834-74
	Trevil R, Rassa R	Trevil	1796-1834
Ebbw Vale	Trevil R, Rassa R	Trevil	1796-1919
	Trevil Rly	Trevil	1919-64
Sirhowy	Trevil R, Rassa R	Trevil	1796-1882
Tredegar	Tredegar T	Trevil	c.1804-1915
Rhymney Union	Rhymney Branch	Trevil	c.1805-1904
	Hall's Trevil T	Trevil	c.1814-52
	Brinore T		1815-c.1870
	Rhymney T (line **2**)	Twynau Gwynion	c.1800-13
Rhymney (Bute)	Rhymney T (line **5**)	Twynau Gwynion	c.1828-57
	Rhymney Limestone Rly (**6**)	Twynau Gwynion	c.1852-97
Dowlais	Dowlais R		1792-1802
	Twynau Gwynion T (line **1**)	Twynau Gwynion	1792-1800
	Twynau Gwynion T (line **4**)	Twynau Gwynion	1800-c.1825
	Penydarren T		1802-c.1880
	Morlais (east) T and Rly	Morlais (east)	1825-1929
Penydarren	Morlais (west) T	Morlais (west)	1800-59
Cyfarthfa	Gurnos R and T	Gurnos	1793-1908?
Plymouth	Morlais (west) T	Morlais (west)	1803-75
Abernant	Tappenden's T	Penderyn	1805-c.1818
Aberdare	Tappenden's T	Penderyn	1805-c.1818
Hirwaun	Mr Glover's R	Penderyn	c.1786-1808
	Penderyn-Hirwaun T	Penderyn	1808-1985
Dr R. Bevan	Bevan's T	Dinas	1806/7-60

APPENDIX 2

Railroads and tramroads built under canal acts

Ironworks	B&A Canal	Monmouthshire Canal
Abersychan		Abersychan Limestone Rly
Blaenavon	Hill's T	
Cwm Llanellen Lime Co	Craig yr Hafod T	
Clydach	Clydach R	
	Llam-march R and T	Clydach-Blaenavon T
Brecknock Boat Co	Llangattock T	
Nantyglo	Baileys' Llangattock T	
Beaufort	Baileys' Llangattock T	Trevil R, Rassa R
Ebbw Vale		Trevil R, Rassa R
Sirhowy		Trevil R, Rassa R
Tredegar		Tredegar T
Rhymney Union	Brinore T	Rhymney Branch
	Glamorganshire Canal	**Aberdare/Neath Canals**
Cyfarthfa	Gurnos R and T	
Penydarren	Morlais (west)	
Plymouth	Gurnos R	
	Morlais (west)	
Abernant		Penderyn-Hirwaun T
		Tappenden's T
Aberdare		Penderyn-Hirwaun T
		Tappenden's T
Hirwaun		Penderyn-Hirwaun R and T
Dr R. Bevan		Bevan's T

Railroads and tramroads built without acts

Ironworks	line
Blaenavon	Tyla R and T
	Blorenge T
Nantyglo	Disgwylfa
Rhymney (Bute)	Twynau Gwynion T
	Rhymney Limestone Rly
Dowlais	Twynau Gwynion T
	Morlais (east) T
Hirwaun	Mr Glover's R to Penderyn

APPENDIX 3

Castings at Ebbw Vale 1791-6 and Plymouth 1787-1801

GRO D.2472.3 is the Ebbw Vale Journal from 1791 to 1796; the furnace came into blast in 1791, but was idle for 1795 and most of 1796. NLW MS 15335D is the account book for castings direct from the blast furnace at Plymouth from 1787 to 1801, and also includes castings from the 'cupilo' (cupola) for 1788 only.

A typical entry reads 'October 1788. Plates ... W. Lewis esq. Quantity 1175. Tons 56, cwts 0, qtrs 0, lbs 0.' The total weight (in long tons of 2400lb) for a batch is here divided by the quantity to give the average weight, in this case 114lb. Where more than one batch of a particular description was cast in a year, a succession of average weights and of the corresponding numbers is given. All items relevant to railways are here extracted from both books, except a few cases where a single entry includes different products and numbers or weights can not be worked out.

The accounts sometimes state where the castings were to be used, e.g. colliery, mine works (ore mines) or the like. The Ebbw Vale castings were all made for outside customers; the Plymouth ones were largely, it seems, for the ironworks' own use. It distinguishes castings for the Penydarren Tramroad and the Penydarren-Morlais (west) limestone line; but the only other customers named are Cyfarthfa, Dowlais and Penydarren, which presumably, when their furnaces were fully occupied with work for their own customers, contracted out to Plymouth the casting of equipment for their own purposes. For a discussion of the problems of interpretation, see Conclusions.

The summary is broken down into six categories, each (when appropriate) with the suffix **E** for Ebbw Vale or **P** for Plymouth: **1,** heavy plates, **2,** rails and waggon wheels, **3,** wheeling plates, **4,** early tramplates, **5,** later tramplates, and **6,** tram wheels.

HH&Co = Hill Harford & Co, Nantyglo
PyD Td = Penydarren Tramroad
Morlais = limestone road Penydarren-Morlais (west)

1.P. HEAVY PLATES (Plymouth)

	date	**weight (lb)**	**no. cast**	**cast for**
Plain plates	1788	127	140	Cyfarthfa?
Plain plates	1788	82	47	Cyfarthfa
Plain plates	1788	127	140	
Plates	1788	114, 126, 125	1175, 200, 1942	Dowlais
Plates	1788	110	2029	Dowlais?
Plates	1789	57	116	Cyfarthfa

2.E. RAILS AND WAGGON WHEELS (Ebbw Vale)

	date	weight (lb)	no. cast	cast for
Rail	1793	83	5987	MCC
Sleepers	1793	c.80	2646	MCC
Rails	1794	79	3349	Trevil RR
Colliery rails	1794	48, 47, 46	26, 329, 151	HH&Co
Parting compleat (Colly)	1794	301, 232	1, 7	HH&Co
Colly Sleepers	1794	46, 47	128, 44	HH&Co
Colly Sweep Rails	1794	48, 48	34, 12	HH&Co
Wagon Wheels	1794	117	16	HH&Co
Short Rails	1794	71	2	HH&Co
Long Rails)	1794	185, 185	1, 3	MCC
& Sleepers)		301, 301	2, 1	
Rails Trevil patern	1794	79	5	MCC
Wagon Wheels	1794	278	30	B&A
Bearings	1794	12	65	B&A
Short Rails	1794	52	151	B&A
Sweep Rails	1794	93	91	B&A
Straight Rails	1794	84	2057	B&A
Wagon Wheels	1794	280	12	Barron
				Watkins & Co
Rails	1796	73	800	Rail Road
				for Crumlin

2.P. RAILS AND WAGGON WHEELS (Plymouth)

	date	weight (lb)	no. cast	cast for/notes
Rails	1787	49, 74, 76,	86, 149, 99,	mostly
		56, 73, 66	177, 267, 33	72in long
Rails	1788	72	160	
Rails	1788	70	219	Cyfarthfa
Long rails	1788	74	132	[72in]
Colliery rails	1789	71		
Miner wagon wheels	1791	45, 53	34, 12	
Turn rail for colliery	1792	30	1	
Rails	1793	82	330	Penydarren
6ft rails for colliery	1794	68, 62, 66	252, 29, 184	
4ft rails for colliery	1794	44	7	
5ft rails for colliery	1795	53	2	
Short rails for colliery	1795	45	2	
4ft rails for colliery	1795	52	4	
Rails 6ft long	1795	70	68	
4ft rails	1796	52	4	
5ft rails	1796	60	4	
6ft rails	1796	70	49, 93, 50, 49	
6ft rails	1797	92, 68	39, 116	
4ft rails	1797	65	6	
6ft rails	1798	51, 67, 64, 58	135, 46, 7, 35, 81	
6ft rails	1799	66,61,64,58,66	?, 31,127,130,478	
6ft rails	1800	71, 69, 66	450, 174, 56	

3.E. WHEELING PLATES (Ebbw Vale)

	date	weight (lb)	no. cast	cast for
Wheeling plates	1794	68	12	HH&Co
Wheeling plates	1794	68	28	HH&Co Ty-mitheg level

3.P. WHEELING PLATES (Plymouth)

	date	weight (lb)	no. cast	notes
Wheeling plates	1788	40, 44	118, 144	
Wheeling plates	1790	26, 30, 32, 30, 31, 34, 34, 8	282, 20, 22, 12, 12, 60, 48, 36	12-48in long
Wheeling plates	1801	149	7	
Wheeling plates	1801	114	17	delivered [to] coal road

4.E. EARLY TRAMPLATES ETC (Ebbw Vale)

	date	weight (lb)	no. cast	cast for
Dram Rails	1794	38	29	HH&Co
do Sleepers	1794	15	8	HH&Co
do Parting	1794	243	1	HH&Co

4.P. EARLY TRAMPLATES ETC (Plymouth)

	date	weight (lb)	no. cast	cast for/notes
Dram plates	1788	42, 38	176, 69	Cyfarthfa
Dram plates	1792	34, 35	?, 461	
Dram plates	1793	36,34,32	1329, 1546, 1330	
Sleepers	1793	22, 27, 31	428, 825, 436	
(Dram) turning frames	1793	240,266,300,300	12, 23, 10, 8	
Dram plates	1794	31	27	
Plates (eared)	1794	44	526	48in long
4ft Eared Dram plates	1795	40	645	
4½ft dram plates no ears	1795	46	18	
Pairs of plates for Xroad	1795	68		
4ft dram plates no ears	1795	46	7	
Crooked dram plates	1795	42, 45	27, 2	[curved]
4ft eared dram plates	1796	45, 42, 44, 43	48, 843, 794, 524	
Sho[r]t dram plates	1796	20	20	
Partings	1796	289, 301	4, 5	
Crooked dram plates	1796	26, 48, 39		
4ft eared dram plates	1797	53, 46, 43, 42	655, 1006, 678, 977	
Short dram plates 1797	30	13		
Partings	1797	291,271,266,316	5, 10, 17, 5	
Dram plates	1798	36	399	
Short dram plates 1798	33, 38	4, 24		
Partings	1798	326, 157, 216	5, 8, 13	
Plate for Xing water course	1798	973		
4ft eared plates	1798	41, 44, 61	573, 873, 179	
ditto for Xing turnpike	1798			
Dram plates [eared]	1799	39	75	
4ft eared dram plates	1799	31		
4ft eared dram plates	1800	36	1344	

5.P. LATER TRAMPLATES (Plymouth)

	date	weight (lb)	no. cast	cast for
Dram plates (patterns)	1799	31, 39, 35	9, 40, 128	Morlais
Dram plates	1799	39	2864	Morlais
Large dram plates for Xing road	1799	279	12	
Dram plates	1799	33	1385	
Dram plates 4ft	1799	32	319	
Partings	1799	235, 101	11, 6	
Short dram plates 1800	25			
Large dram plates for Xing road/ turnpike	1800	256, 261	32, ?	
Dram plates	1800	40	959	Morlais
Pieces of casting for bridge Xing Marlas Brook	1800	532		Morlais
Dram plates	1800	34	912	
Dram plates	1800	35	31	PyD Td
Dram plates Outram pattern	1800	37, 42, 41	740, 1729, 1261	PyD Td
Partings	1800	49	100	
Plates for bridge at Pont Marlais	1800	71		PyD Td
Dram plates for limestone road	1800	41, 42	46, 17	Morlais
Dram plates & ? parts?	1800	52	25	
Partings (3) & plates for partings (13)	1800	83	16	
Large dram plates for Xing dram road near Birchs house	1800	298		
Parting dram plate	1800	127	1 for pattern	PyD Td
Parting Limestone road	1800	141		Morlais
Dram partings	1800	88, 73, 289	32, 51, 50	
Pointer for parting	1800	31	1	PyD Td
Dram plates to mineworks	1800	36	950	
Dram plates to colliery	1800	34	598	
Dram plates to rowlers etc	1800		151	
Dram plates for partings	1800	107		
Dram plates	1801	42, 42, 42, 46	1784, 1407, 1212, 899	PyD Td
Dram plates limestone rd	1801	35, 42, 38, 42, 43, 42	23, 6, 2, 23, 6, 69	Morlais
Dram plates for parting	1801	71, 65	50, 21	
Parting & 8 crooked dram plates	1801			
Dram plates for Xing road	1801	52, 55, 55	60, 47, 45	PyD Td
Dram plates for M' works	1801	36, 36, 35, 35	63, 67, 73, 62	
Partings to M[ine] works	1801	72	11	
Crooked dram plates	1801	44, 44	10, 14	

5.P. Later tramplates (Plymouth), continued

		date	weight (lb)	no. cast	cast for
Partings	1801	62, 158	15, 1		
Plates ... coal road		1801	62	24	
Rowler plates		1801	37	6	
Crooked dram plates m[ine]' w[orks]	1801	99	3		
Various for partings m'w		1801	52		
Dram plates		1801	35, 31, 35, 35	63, 255, 422, 98	
Dram plates Coal		1801	33, 37, 36	27, 158, 67	
Partings (pieces)	1801	65, 96	14, 21		
Dram plates various		1801	37	13	
Pointers for limestone rd		1801	10	10	Morlais

6.E. TRAM WHEELS (Ebbw Vale)

	date	weight (lb)	no. cast	cast for
Dram Wheels	1794	11	4	HH&Co

6.P. TRAM WHEELS (Plymouth)

	date	weight (lb)	no. cast	notes
Minew'ks - dram wheels	1790	17 inc.brass, 14	5, 23	total 28
Mineworks - brasses	1790	17 inc.wheel, 5	12, 16	total 28
Dram wheels	1791	14	9	
Dram wheels	1792	16, 11	48, 1	
Dram wheels	1793	26, 24, 29	105, 68, 28	
Dram wheels	1794	32, 35, 17	99, 64, 4	
Dram wheels	1795	16, 15, 12	54, 279, 241	
Brasses for drams	1796	11	65	
Dram wheels & brasses with pipes	1796	31 combined	14	
Dram wheels & brasses with pipes	1797	46 combined	97, 55	
Dram wheels	1799	46	22	
Small dram wheels	1799	31	41	
Large dram wheels (59) & axle trees (66)	1799	44 combined		
High dram wheels (99) & axle trees (72)	1800	52 combined		
Small dram wheels	1800	30, 32	205, 188	
Dram axle trees for limestone drams	1800	19	31	
Coal dram wheels	1800	42	23	

APPENDIX 4
Summary of finds

Arranged in approximate order of date. For key to location code, see end of table

fig. no.	description	find spot	cast at	approx date	grid ref.		gauge ft-in	length in	weight lb	current location
RAILROADS										
25	bar rail saddle	Tyla-Blaenavon	Blaenavon	c1790?	244	117	3-8?			G -
101	bar rails	Penydarren	Plymouth?	1793			3-6	60	82(69)	(a)
110	Pont y cafnau deck	Gurnos	Cyfarthfa	1793	038	075	3-7	90		(b)
47	bar rail	Clydach R	Penydarren/ Ebbw Vale	1793	2438	1452	3-8	48	84(78)	G3
48	bar rail sill	Clydach Dingle		1790s	195	124	2-9	41	40	G5
73	bar rail	Trevil R		1796	243	146	3-8	48	79	C3
TRAMROADS										
114	eared plate	(Tappendens')		1790s	(SN8953	0643)				G -
88	sleeved plate	Twynau Gwynion	Dowlais	1792	0672	1029	c2-7?	42?		G -
-	sleeved plate	Twynau Gwynion	Dowlais	1792-1800	0662	1011	c2-7?	42?		G -
34	horned sill	Clydach Dingle	Ebbw Vale	1794	1918	1289	1-6	28½	14	G9
33	sill/plate fragments	Blorenge	Blaenavon	c1796	2587	1128	2-0			G16a
35	horned sill	Blorenge	Blaenavon	c1796	2664	1212	2-0	33	20	G16b
36	plate	Blorenge	Blaenavon	c1796	2691	1245	2-0	44½	46	G16c
102	lugged plate	Morlais (W)	Plymouth?	1799	0488	0922	2-4	48	42?	G15
107	non-dovetailed sill	Morlais (W)	Dowlais	1799	0490	0958	2-4	42	66	G10
103	Outram-type point	Morlais (W)	Plymouth?	1799	049	097	2-4	35		P31
91	plate	Twynau Gwynion	Dowlais	1800	0647	1043	2-6			G -
-	heavy ribbed plate	Twynau Gwynion	Dowlais	1800-25	0641	1039	2-6	48	100	G -
94	non-dovetailed sill	Twynau Gwynion	Rhymney	c1801	0671	1030	2-9½	46½	56	G -
29	horned sill	Tyla-Blaenavon	Blaenavon	c1801?	2471	1275	2-0	34¼	28	G20
43	curved plate	Clydach-B'avon	Blaenavon	1802?	2456	1159	4-4	40¼	55	G -
115	horned sill	Clydach-B'avon	Blaenavon	1802?	2540	1007	4-4			G -
42	low-flanged plate	Clydach-B'avon?		pre1814	2546	1018	4-4	?		G16d
76	sill with lower rib	Tredegar-Trevil	Tredegar	1802	1212	1210	2-9			G18
39	curved plate	Llam-march		1804?	2379	1409	4-4	34	40	G14
77	sill with upper rib	Tredegar-Trevil	Tredegar	1809	1212	1210	2-9			G17
38	sill with upper rib	Craig yr Hafod		1812	3000	0963	2-10½	43¼	20	G19
38	plate	Craig yr Hafod		1812	3000	0963	2-10½	54		G19
37	curved plate	Craig yr Hafod		1812			2-10½	28	33	(c)
82	plate	Hall's Trevil	Rhymney	1814	127	113	3-4	48		P10
78	plate marked BOC	Brinore	Rhymney	1814	109	206	3-4	47		P11
79	sill	Brinore	Rhymney	1814	1010	1762	3-4			G33
80	Outram plate	Brinore	Rhymney	1814	1010	1762	3-4	38¼	29	G11
81	check rail	Brinore	Rhymney	1814	1010	1762	3-4	34½	47	G47
52	box plate	Llangattock 1		1815	1992	1623	3-4	36	105	G51
72	vandyked plate	Bick's	Nantyglo	1815?	2068	1539	3-4	41	86	G54
51	assemblage	Disgwylfa	Nantyglo	1816	2191	1429	2-9+			G28
30	plate	Hill's	Blaenavon	1818	258	120	2-0	48		P6, 7
31	sill	Hill's	Blaenavon	1818	258	120	2-0			P38
32	sill	Pwll du	Blaenavon	1818			2-0			(d)
8	plate rail chair	Kington	Ebbw Vale	1820	312	497	3-4		7	G35
65	plate with BB	Daren (E)	Nantyglo	c1820?	2099	1503	3-4			G12
116	non-dovetailed sill	Garnyrerw?	Blaenavon				2-6+			(d)

fig. no.	description	find spot	cast at	approx date	grid ref.	gauge ft-in	length in	weight lb	current location
95	vandyked plate	ganister quarry Twynau Gwynion	Rhymney (Bute)	reused 1826	0869 0930	2-9½			G -
96	sill	Twynau Gwynion	Rhymney	c1826	0645 1041	2-9½			G -
55	BBCo sill	Chwar Mawr		1827	193 158	3-4			P40
57	check rail	Chwar Mawr		1827	c199 159	3-4	31¼		P23
58	Boat Co sill	Bick's (zigzag)	Nantyglo	1827	0978 1591	3-4			G21
59	Rhymney type sill	Daren (E)	Nantyglo?	1827	1975 1590	3-4			G34
60	ribbed plate	Bick's	Nantyglo	1829	1975 1590	3-4			G34
62	sill	Bick's	Nantyglo	1829	2029 1569	3-4	52	63	G22
-	plate fragment	Bick's	Nantyglo	1829	1972 1591	3-4			G26
63	plate fragment	Bick's	Nantyglo	1829	2072 1531	3-4			G27
53	re-railing plate	Llangattock II	Nantyglo	1829	1985 1609	3-4			G52
71	sill end with hole	Baileys' Llangattock	Nantyglo	1830?	2168 1488	3-4			G31
64	plate with CJB	Daren (E)	Nantyglo	1830s	2099 1503	3-4			G29
69	assemblage	Wern Watcyn	Nantyglo	c1840	2121 1510	3-3			G30
70	heavy plate	Wern Watcyn	Nantyglo	c1840	212 151	3-3			G -
13a	plate/edge rail	S. Duffryn	Dowlais	1840s?	070 031				M17
83	chair	Trevil	Tredegar	1850s	1174 1386	2-9			G36
98	chair	RLR	Rhymney	1850s	064 105	2-9½			P52
67	chair	Daren (E)	Nantyglo	1860s?	c209 151	3-4			P49
108	chair	Morlais (W)		1864?	0472 0979				G55a
66	sill	Daren (E)	Nantyglo	1860s?	2095 1508	3-4			G41
68	chair	Baileys' Llangattock	Nantyglo	1860s	(206 170)	3-4			G39
27	sill with w.i. tie	Tyla-Blaenavon	Blaenavon	1860s?	2461 1220	2-0	36½		G42
106	chair for bullhead	Morlais (W)	Plymouth	1870s	0488 0922				G55
84	ribbed w.i. plate	Tredegar-Trevil	Tredegar	1880s	127 113	2-9			-
85	ribbed w.i. plate	Tredegar-Trevil	Tredegar	1880s	127 113	2-9			P35
86	heavy chair	Trevil	Tredegar	1880s	1170 1411	2-9			G40
87	sill with w.i. tie	Trevil	Tredegar	1880s	1170 1411	2-9			G43
RAILWAYS									
18	fishbelly rail	Abersychan		1826	279 045	3-8			G57
18	fishbelly rail chairs	Abersychan		1826	279 045	3-8			G57
20	T-rail chair	Abersychan		1826	279 045	3-8		14	G58
74	T-rail and sill	Trevil		1840s	1219 1357	3-8	54¾		G6
99	chair cheeks, flat bottom	RLR	Rhymney	1870s?	165 102	4-8½			G -
100	chairs cheeks,	RLR	Rhymney	1870s?	165 102	4-8½			G -
28	chair, flat-bottom	Gilwern Hill	Blaenavon	c1885	246 128	3-0			G60
46	chair, flat bottom	Cwm Quarry	Nantyglo?	1880s?	2340 1295				G61
97	point chair	Twynau Gwynion	Rhymney	1890s?	0839 1096	4-8½			G -
75	chair, flat bottom	Trevil	Ebbw Vale	C20	1219 1357	4-8½			G -

Key to current locations:

G + number	British Waterways exhibition at Goytre Wharf on Brecknock & Abergavenny Canal (313 063)
G -	ditto, reserve collection
C, M and P + number	M. J. T. Lewis collection at Ironbridge Gorge Museum
(a)	Cyfarthfa Castle Museum
(b)	lime kilns at 038 075
(c)	Abergavenny Museum
(d)	Lamb and Fox, Pwll du

BIBLIOGRAPHY

Arranged in three sections: Manuscript material, Printed material, and Maps.
For full list of abbreviations see p. xii.

MANUSCRIPT MATERIAL

The principal collections and individual manuscripts consulted are as follows:

Birmingham Reference Library Archives Department
(cited as e.g. BRL (Journal))

Boulton & Watt Collection M/I/6/12, in three parts:
Journal: 'The Journal of James Watt junior'
Observations: 'Observations on the Collieries and Ironworks of the Forest of Dean and South Wales in a tour made with Mr Watt senior and junior in May and June 1800'
Gilpin: 'From Mr [Gilbert] Gilpin's Memo Book October 1795 and October 1796' with additional material of 1793 from Peter Ewart. Both were in the employ of Boulton & Watt.

Glamorganshire Record Office (GlamRO)

Dowlais letter books
Various Dowlais Iron Co papers
Aberdare Canal Co Minute Book

Gwent Record Office (GRO)

Plans referred to only by date, e.g. GRO 1812:
1812: 'A Plan of Blaenavon Mines east of the Large Fault,' redrawn from original 28th February 1939. As a tracing this cannot be wholly relied upon
1814: 'Plan of Blaenavon Iron Works 1814,' surveyed by W. Llewellen
1829: 'Blaenavon Mine Work,' July 30th 1829
MAN/A/2-273, 'Plan of the Tram Road from Blaenavon Furnaces to Pwll Dee, and Garndyrys, Septr 29th 1819, T[homas] Deakin'
D.397, D.591, D.1078, Beaufort Estate papers
D.480, D. 751, Blaenavon Company papers
D.1583.188, 'Part of the Blaenavon Liberty called the Blorenge the Gilwern &c in the Parishes of Llanfoist and Llanwenarth Plan No XXX,' 1821
D.2472.1, Harford Memorandum Book (Ebbw Vale) 1796-1819
D.2472.3, Ebbw Vale Co Journal, 1791-6 (see Appendix 4)

National Library of Wales (NLW)

Ashburnham (Welsh estates)
Badminton (Duke of Beaufort's Breconshire estate)
Bute (Marquis of Bute South Wales estate)
John Lloyd (antiquarian barrister's collection)
Maybery (papers of Brecon attorney involved with affairs of ironmasters, including 383, 'Observations on the Brecknock and Abergavenny Canal and Railways,' Benjamin Outram, July 1st 1799
Powis Castle (Earl of Powis papers)
MS 772E, William Lewis-Meredith, 'The Tramroads of the Sirhowy Valley (in Gwent-Uchcoed) Newport to Sirhowy &c., Monmouthshire 1795 to 1855,' January 1907, based on presidential address to the Permanent Way Institution, 1885
MS 15335D, particulars of Plymouth Furnace castings 1787-1801 (see Appendix 3)

Public Record Office (PRO)
(RAIL items cited as e.g. B&A General Assembly)

RAIL 812/1, B&A Canal Company General Assemblies 1793-1823; /2, 1824- 66
RAIL 812/3, B&A Canal Company Committee Minutes 1793-1800; /4, 1802- 10; /5, 1810-15; /6, 1815-40; /7, 1840-65
RAIL 500/1, MCC General Assemblies 1794-1843; /21, 1804-48; /22, 1849-82
RAIL 500/5, MCC Committee Minutes 1792-1812; /6, 1812-31; /7, 1831-49; /8, 1849-52; /9, 1852-9
C.114/124, Ebbw Vale and Sirhowey ledger 1805-13; /125, 1813-20; /126, 1820-8

West Glamorganshire Record Office (WGlamRO)

D/D NAI, Neath Abbey Ironworks drawings
Neath Canal Minute Book

Author's collection

T. Dadford Junr, 'Plan of a Canal from the Town of Brecknock to join the Monmouthshire Canal'
David Davies, 'Plan of the Wharfs, Rail Road & Public Road at and Near Langroyney Forge,' 1796
Letters between John Scale and Sir William Douglas and later Samuel Douglas, and other letters and accounts from 1800 to 1824 (copies NLW)

'Rough Plan of the B&A Canal from Talybont to Brecon No 8,' 1801
'Case for the Opinion of M. Bell,' 26 Feb. 1813
'Agreement between Jno Hodgkinson & Jno Maund for Tram Road Waggons,' 27 Sept. 1813
'Plan of the Surface Tram Roads of the Blaenavon Iron & Coal Works showing the Branches of the various Mine & Coal Works Garndyrris-Forge, Limestone-Quarries & Sale Coal Yard Lanfoist,' c.1836 (copy)
Weigh ticket, Llanfoist, March 1856
Rhymney Iron Co Ltd: prospectuses for the issue of £200,000 debentures in 1880 and mortgage debentures in 1887 and other sources
'Plan of the Engine Coal Colliery Workings Blaenavon Estate Monmouthshire,' undated, traced by Alan Teulon from Coal Board original, 1971
Field Notes, Jan. 1973 to Feb. 1979
Field Notes with David Bick, Aug. 1995 to July 1997, Aug. 1997 to June 1999
Finds Book with David Bick, Aug. 1995 to June 1999

Private collection

1837: 'Maps of the Ebbw Vale and Sirhowy Estates in the Parishes of Aberstruth & Bedwelty in the County of Monmouth the property of Harford's Davies & Co'

Private collection, Blaenavon (Francis Keen)

1818: 'The Land Leased By Thomas Hill Esqre from Mr Walter Lewis Feby 16th 1818'
1863: 'Section of the Blaenavon Minerals South Wales — Section of the Estate made by David Davies Land and Mineral Surveyor June 1863. And this reduced from the original 1871. Drawn by John Davies Nov 1872.

Other repositories with miscellaneous documents

Abergavenny and District Museum
Brecknock Museum, Brecon
Derbyshire Record Office
Gloucester Record Office
Hereford & Worcester County Record Office
Newport Public Library
Pontypool Park Estate Office
Shropshire Record Office

PRINTED MATERIAL

Books, articles and reports

Abbott, Rowland A. S., *Vertical Boiler Locomotives and Rail Motors built in Great Britain* (Headington 1989)

Addis, J. P., *The Crawshay Dynasty* (Cardiff 1957)

Andrews, C. R., *The Story of Wortley Ironworks* (Nottingham 1956)

Atkinson, M. and Baber, C., *The Growth and Decline of the South Wales Iron Industry 1760 - 1880* (Cardiff 1987)

Bainton, J. C., 'Reminiscences of Brynmawr as told to my daughter Mabel E. A. Robinson, Librarian Brynmawr,' *Brycheiniog* 16 (1972), 125-38

Barrie, D. S. M., *A Regional History of the Railways of Great Britain*: vol. xii, *South Wales* (Newton Abbot 1980)

Barrie, D. S. and Lee, Charles E., *The Sirhowy Valley and its Railways* (London 1940)

Barton, D. B., *The Redruth & Chasewater Railway* (Truro 1966)

Baxter, Bertram, *Stone Blocks and Iron Rails* (Newton Abbot 1966)

Bick, D. E., 'Tramplates of the Gloucester & Cheltenham Railway,' *Industrial Archaeology* 3 (1966), 201-8

Bick, David, *The Gloucester & Cheltenham Tramroad* (Headington 1987)

Bick, David, *Old Leckhampton* (Cheltenham 1994)

Biddle, Gordon, 'The Lancaster Canal Tramroad,' *JRCHS* 9 (1963), 93-7

Birch, A., *The Economic History of the British Iron and Steel Industry 1784 -1879* (London 1967)

Bond, Maurice F., *Guide to the Records of Parliament* (London 1971)

Bradley, V. J., *Industrial Locomotives of North Wales* (London 1992)

Chapman, Colin, 'The Duffryn Llynvi and Porthcawl Railway: gauge and mixed gauge,' *RCHS TGOP* 144 (1999)

Clark, E., *Ironbridge Gorge* (London 1993)

Clews, F. H., *Heavy Clay Technology* (Stoke-on-Trent 1955)

Colebrook, Kim, 'A History of the British Ironworks, Abersychan,' *Gwent Local History* 54 (1983), 6-29

Combes, C., *Traité de l'exploitation des mines* (Paris 1845)

Cook, R. A., and Clinker, C. R., *Early Railways between Abergavenny and Hereford* (Oakham 1984)

Coxe, William, *An Historical Tour of Monmouthshire* (London 1801)

Cumming, T. G., *Illustrations of the origin and progress of rail and tram roads and steam carriages or locomotive engines* (Denbigh 1824)

Curr, John, *The Coal Viewer and Engine Builders Practical Companion* (Sheffield 1797); reprint with introduction by Charles E. Lee (London 1970)

Davies, Alun C., 'A Welsh Waterway in the Industrial Revolution: the Aberdare Canal, 1793-1900,' *Journal of Transport History* 4 (1978), 147-69

Davies, John, *Cardiff and the Marquesses of Bute* (Cardiff 1981)
Davies, W., *General view of the Agriculture and domestic economy of South Wales* (London 1814)
Davies, W. L., *The Bridges of Merthyr Tydvil* (Cardiff 1992)
Day, J., *A Practical Treatise on the Construction and Formation of Railways* (London 1848)
'Dean Forester,' 'Mr Keeling buys a Locomotive,' *Industrial Railway Record* 1 (1963), 58-64
Duncomb, John, *General View of the Agriculture of the County of Hereford* (London 1805)
Dutens, J. M., *Mémoires sur les travaux publics de l'Angleterre* (Paris 1819)
Elsas, Madeleine, *Iron in the Making: Dowlais Iron Company Letters 1782-1860* (Cardiff 1960)
Evans, C., 'C. Gilpin, a witness to the South Wales iron industry in its ascendancy,' *Morgannwg* 34 (1990), 30-8
Evans, J. A. H., 'The Witness and Testimony of Ordinary People in the Vicinity of Blaenavon between 1810 and 1816 through the Journals and Correspondence of Walter Osland,' *Gwent Local History* 81 (1996), 4-19
Farey, John, *A General view of the agriculture of Derbyshire* (London 1817)
Gibson, A. M., *Darren-Cilau Tramroad, Llangattock, Powys*, Clwyd-Powys Archaeological Trust Report No. 103 (1994)
Gilson R. G. and Quartley, G. W., 'Some Technical Aspects of the Somerset Coal Tramways,' *Industrial Archaeology* 5 (1968), 140-61
Goodchild, John, *The Lake Lock Rail Road* (Wakefield 1977)
Gotheridge, Ivor, 'Rails to Belvoir Castle,' *Railway Magazine* 117 (1971), 478-9
Granger, Albert, *Fabrication et Emploi des Matériaux et Produits Refractaires* (Paris 1910)
Gray-Jones, Arthur, *A History of Ebbw Vale* (Gwent County Council 1992)
Greenwell, A. and Elsden, J. V., *Practical Stone Quarrying* (London 1913)
Griffiths, D. N., 'Robert Griffiths and his Relations: the Migration of a Denbighshire Family,' *Transactions of Honourable Society of Cymmrodorion* (1967 part II), 278-301
Gruner, M. M. and Lan, -, 'The Iron Manufacture of South Wales,' *Mining and Smelting Magazine*, January 1863
Gruner, M. M. and Lan,-, 'The Iron Manufacture of the North of England,' *Mining and Smelting Magazine*, June 1863
Guy, Andy and Reynolds, Paul, 'Joseph Tregelles Price on tramroad practice in south Wales: a letter of 1818,' *RCHS TGOP* 138 (1999)
Hadfield, Charles, *Canals of the East Midlands* (Newton Abbot 1966)
Hadfield, Charles, *Canals of South Wales and the Border* (Newton Abbot 1967)

Hadfield, Charles and Clinker, C. R., 'The Ashby-de-la-Zouch Canal and its Railways,' *Transactions of Leicestershire Archaeological & Historical Society* 34 (1958), 53-76

Hadfield, Charles and Skempton, A. W., *William Jessop, engineer* (Newton Abbot 1979)

Hankinson, R., *Hillside, Llangattock, Powys: Water Main renewal*, Clwyd-Powys Archaeological Trust Report (1996)

Harley, J. B. and Oliver, R. R., *The Old Series Ordnance Survey Maps of England and Wales*, vol. vi, *Wales* (Lympne 1992)

Harris, J. R., *The British Iron Industry 1700-1850, Studies in Economic and Social History* (London 1988)

Harris, T. R., *Sir Goldworthy Gurney 1793-1875* (Penzance 1975)

Havard, F. T., *Refractories and Furnaces* (London 1912)

Havilland, John de, *Industrial Locomotives of Dyfed and Powys* (London 1994)

Hill, Geoffrey and Green, Gordon, *Industrial Locomtives of Gwent* (London 1999)

Hilling, John B., *Cardiff and the Valleys* (Cardiff 1973)

Holt, John, *General View of the Agriculture of the County of Lancaster* (London 1795)

Household, Humphrey, *The Thames & Severn Canal* (Newton Abbot 1969)

Hughes, Stephen, *The Brecon Forest Tramroads* (Aberystwyth 1990)

Hyde, C. K., *Technology and Change in the British Iron Industry 1700-1870* (Princeton 1977)

Ince, Laurence, *The South Wales Iron Industry 1750-1885* (Cardiff 1993)

Jamieson, Andrew, *A Text-Book of Applied Mechanics and Mechanical Engineering* (London 1905)

Jones, E. D., *Victorian and Edwardian Wales from Old Photographs* (London 1972)

Jones, Haydn, *Accounting, Costing and Cost Estimation Cardiff: Welsh Industry 1700-1830* (Cardiff 1985)

Jones, N. W., 'A Wooden Waggon Way at Bedlam Furnace, Ironbridge,' *Post-Medieval Archaeology* 21 (1987), 259-62

Jones, Oliver, *The Early Days of Sirhowy and Tredegar* (Risca 1975)

Jones, Edwin and Rowson, Trevor, *Old Brynmawr, Nantyglo and Blaina in photographs*, vol. 2 (Barry 1981)

Kidner, Roger, 'South Wales Tramroads in Letters,' *RCHS TGOP* 83 (1993)

Knight, Jeremy, 'The Blaenavon Iron and Coal Company, 1836-1864,' *Bulletin of Board of Celtic Studies* 27 (1980), 631-44

Lamb, Brian, 'The Development of Wagons used on the Peak Forest Railway 1796 to 1925' *JRCHS* 33 (1999), 31-9

Lancaster University Archaeological Unit, Monuments Protection Programme, 'The Quarrying Industry Step 1 Report' (March 1996)

Lead, Peter, *The Caldon Canal and Tramroads* (Blandford 1990)

Lee, C. E., *The Evolution of Railways* (London 1943)

Lewis, M. J. T., *Early Wooden Railways* (London 1970)

Lewis, M. J. T., 'Steam on the Penydarren,' *Industrial Railway Record* 59 (1975), 1-36
Lewis, Michael, 'Railway Gauges at Ffestiniog' *RCHS TGOP* 106 (1995)
Lewis, M. J. T., 'Bogie waggons on Welsh Tramroads,' *RCHS TGOP* 110 (1996)
Lewis, Samuel, *A Topographical Dictionary of Wales* (London 1834)
Lloyd, John, *Old South Wales Iron Works* (London 1906)
Macdermot E. T., *History of the Great Western Railway* (London 1931)
Marshall, C. F. Dendy, *History of British Railways down to the Year 1830* (Oxford 1938)
Marshall, C. F. Dendy, *A History of Railway Locomotives down to the end of the Year 1831* (London 1953)
Mear, John F., *Aberdare — the Railways and Tramroads* (Aberdare 1999)
Mercer, Stanley, 'Trevithick and the Merthyr Tramroad,' *TNS* 26 (1947-9), 89-103
Minard, C. J., 'Vorlesungen über Eisenbahnen,' *Journal für die Baukunst* 9 (1836), 101-201
Morris, E. H., 'The Hereford and Abergavenny Tramroad,' *Transactions of Woolhope Naturalists' Field Club* (1939), 97-105
Mountford, Colin E., *The Bowes Railway* (Sheffield 1966)
Nemnich, A., *Neueste Reise durch England, Schottland und Irland* (Tübingen 1807)
Norris, John, *The Stratford & Moreton Tramway* (Guildford 1987)
Oeynhausen, C. von and Dechen, H. von, *Railways in England 1826 and 1827* (Cambridge 1971)
Overton, George, *A Description of the Faults or Dykes of the Mineral Basin of South Wales*, Part 1 (London 1825)
Owen, John A., *The History of the Dowlais Iron Works 1759-1970* (Newport 1977)
Owen, John A., 'Dowlais Works - Locomotives,' *Merthyr Historian* 2 (1978), 51-6
Paar, H. W., *The Severn & Wye Railway* (Newton Abbot 1973)
Parry, Alan and Keen, Francis, *Blaenafon in old picture cards* (Zaltbommel 1986)
Percy, J., *Metallurgy: Iron and Steel* (London 1864)
Price, M. R. C., *The Saundersfoot Railway* (Lingfield 1964)
Rattenbury, Gordon, *Tramroads of the Brecknock and Abergavenny Canal* (Oakham 1980)
Rattenbury, Gordon, 'The Brecknock Boat Company,' *JRCHS* 28 (1986), 378-93
Rattenbury, Gordon,'Hall's Tramroad,' *JRCHS* 29 (1988), 170-83
Rattenbury, Gordon, 'The Trevil Rail Road Company, *JRCHS* 29 (1989), 454-69
Rattenbury, Gordon and Cook, Ray, *The Hay & Kington Railway* (Mold 1996)
Rees, D. Morgan, *Mines, Mills and Furnaces* (London 1969)

Reynolds, Paul, 'Samuel Homfray's coal trains: the Sirhowy Railway in 1821,' *RCHS TGOP* 109 (1996)
Riden, P. J., 'Outram's "Minutes to be observed in the Construction of Railways",' *JRCHS* 18 (1972), 61-4
Riden, P. J., 'The Butterley Company and Railway Construction, 1790-1829,' *Transport History* 6 (1973), 30-52
Riden, Philip, *A Gazetteer of Charcoal-fired Blast Furnaces in Britain in use since 1660* (Cardiff 1993)
Riden, Philip and Owen, John G., *British Blast Furnace Statistics 1790-1980* (Cardiff 1995)
Robbins, Michael, *The Railway Age* (London 1962)
Scrivenor, Harry, *History of the Iron Trade* (London 1854)
Skempton, A. W. and Andrews, A., 'Cast Iron Edge-rails at Walker Colliery 1798,' *TNS* 48 (1976-77), 119-22
Skempton, A. W. and Wright, E. C., 'Early Members of the Smeatonian Society of Civil Engineers,' *TNS* 44 (1971-2), 23-47
Stanier, Peter, *Quarries of England and Wales* (Truro 1995)
Steel, Thomas Dyne, 'Blaenavon Ironworks,' *Presenting Monmouthshire — The Journal of the Monmouthshire Local History Council* 2 no 8 (1968), 24-47
Strahan, Aubrey & Gibson, Walcot, *The Geology of the South Wales Coalfield*: Part ii, *Abergavenny*, 2nd ed. (HMSO 1927)
Svedenstierna, Eric T., *Svendenstierna's Tour of Great Britain 1802-3*, ed. E. L. Dellow and M. W. Flinn (Newton Abbot 1973)
Tann, Peter, 'The Tappenden Tramroad to the Neath Canal, 1800-14,' *JRCHS* 32 (1996), 88-102
Tasker, W. W., *Railways in the Sirhowy Valley* (Headington 1992)
Tew, David, *Canal Lifts and Inclines* (Gloucester 1984)
Thompson, M. W. (editor), *The Jouneys of Sir Richard Colt Hoare through Wales and England 1793-1810* (Gloucester 1983)
Tomlinson, W. W., *The North Eastern Railway* (Newcastle 1914)
Tonks, Eric S., *Industrial Locomotives of South Wales and Monmouthshire* (Birmingham 1951)
Tonks, Eric, *The Ironstone Quarries of the Midlands*: Part 1, *Introduction* (Cheltenham 1988)
Tredgold, Thomas, *A Practical Treatise on Railroads and Carriages* (London 1825)
Trinder, Barrie, *The Industrial Revolution in Shropshire* (Chichester 1973)
Truran, William, *The Iron Manufactures of Britain, Theoretically and Practically Considered* (London 1855)
van Laun, John, *Patterns of Past Industry in the National Park* (Brecon 1976)
van Laun, John, 'Excavation on the Hay Railway,' *JRCHS* 23 (1977), 83-6
van Laun, John et al., 'Hill Pits, Blaenavon,' *Industrial Archaeology Review* 3 (1979), 258-75

van Laun, John, 'Rise and Fall on the Kington Railway,' *JRCHS* 29 (1988), 291-7

van Laun, John, 'Wooden railways on and around Clee Hill,' *RCHS TGOP* 55 (1989) = 1989a

van Laun, John, The Clydach Gorge (Brecon 1989) = 1989b

Watkin, Angus, 'Crawshay Bailey,' *RCHS TGOP* 107 (1996)

Watkins, C. A., 'A tie-bar from Bailey's Disgwylfa Tramroad,' *RCHS TGOP* 123 (1997)

Whishaw, F., *The Railways of Great Britain and Ireland*, 2nd ed. (London 1842)

Williams, Idris, 'Trefil — A Momouthshire Village,' *Discover Tredegar*, 20.4.1993

Williams, John, *Digest of Welsh Historical Statistics*, vol. 2 (London 1985)

Wilson, Anne, 'The Excavation of Clydach Ironworks,' *Industrial Archaeology Review* 11 (1988), 16-36

Wood, N., *A Practical Treatise on Rail-Roads*, 1st ed. (London 1825); 3rd ed. (London 1838)

Parliamentary Papers

Children's Employment Commission, First Report of the Commissioners (Mine), Part II (1842), 564-5

Report of the Commissioners of Railways, 1849, Appendix No. 74 (Monmouthshire Railway and Canal Co): PP 1850 xxxi, 179-200

Thesis

Gantee, Margaret Sheila, 'James Watt Junior's Tour of the Forest of Dean and South Wales,' *University of Wales M A dissertation* 1993

Unsigned articles in the following newspapers and journals

The Cambrian
Edinburgh Encyclopaedia
Engineer
Engineering
Felix Farley's Journal
Hereford Journal
Locomotive Magazine
MPICE
Monmouthshire Merlin (and South Wales Advertiser)
Railway Magazine
Repertory of Arts
Repository of Arts and Manufactures
Star of Gwent and South Wales Times

MAPS

Ordnance Survey

The first date cited is that of the survey or revision

General

1813: draft 2in (the date of all the draft maps used has been verified by the British Library as 1813. See also Harley and Oliver 1992)
1829, 1830: 1in sheet 42, 1st ed. revised from 1813 draft, published 1832

Abersychan

6in 1879-81, 1st ed., published 1891

Blaenavon and Blorenge

6in 1878-79, 1st ed., published 1880
6in 1899, 2nd ed., published 1902 (Blaenavon), 1905 (Blorenge)
25in 1879/1880, 1st ed., published 1880

Clydach

6in 1879-80, 1st ed., published 1881
6in 1903, 2nd ed., published 1905
25in 1876, 1st ed., published 1880
25in 1915, published 1920

Disgwylfa

25in 1879, 1st ed., published 1880

Llangattock

6in 1877, 1st ed., published 1880
25in 1877, 1st ed., published 1880 (Cilau)
25in 1879, 1st ed., published 1887 (Daren)

Trevil

6in 1872-85, 1st ed., published 1891
6in 1915, published 1922
25in 1899, published 1901

Twynau Gwynion

6in 1897, 2nd ed., published 1905
6in 1914-15, published 1922
25in 1875, 1st ed., published 1884

Morlais (east and west)
6in 1897, 2nd ed., published 1905
6in 1914-15, published 1922
25in 1875, 1st ed., published 1884

Gurnos
6in 1897, 2nd ed., published 1905
6in 1914-15, published 1922
25in 1875, 1st ed., published 1884

Penderyn
6in 1883, 1st ed., published 1891
6in 1903, 2nd ed., published 1905
6in 1914, published 1922
25in 1876, 1st ed., published 1884

Other printed maps

Airey, J., *Railway Clearing House Map of South Wales* (1876)
Greenwood, J., *Map of the Counties of Glamorgan, Brecknock and Radnor, surveyed in the years 1826 and 1827* (1828)
Greenwood, J., *Map of the County of Monmouth, surveyed in the years 1829 and 1830* (1830)
Morris, T., *Plan of Canals and Railroads commencing with the Port of Newport* (1839)
Prujean, John, *Map of the Iron-works and Collieries ... Railroad, Tramroad & Canal with the Ports of Newport and Cardiff* (1843)
Walker, J. and C., *Monmouthshire from an Actual Survey* (1834)
Yates, George, *A Map of the County of Glamorgan from an Actual Survey* (1799)