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Tyrcenol Junction

By T. B. SANDS

For a few years in the latter part of the nineteenth century there existed north of Swansea, beyond Morriston, near a spot usually shown on modern maps as Tir Canol, a connexion between the Great Western Railway and the Swansea Vale lines of the Midland Railway known to those two companies as "Tyrcenol Junction". This became the accepted spelling in railway usage, but many variations occur in contemporary records as Parliamentary draftsmen, lawyers, witnesses and others concerned obviously had some difficulty with place names in the locality. For example, the minutes of evidence on the Swansea & Clydach Railway Bill of 1866 render Ystalyfera, further up the valley, as 'Stirryvirry'! However, whatever the spelling, this junction was laid in complete with a 12-lever signal cabin, all duly approved by a Board of Trade Inspecting Officer, but was never brought into use – a fate that calls for some explanation.

Three companies were initially involved in this affair, the Swansea Canal Company, the GWR, and the Swansea Vale Railway. The events that led to the laying of broad gauge rails on the SVR between Six Pit Junction on the South Wales main line west of Llansamlet and the SVR terminus, on the east bank of the River Tawe at Swansea, were related in a previous article (this *Journal* July 1973). The arrangement enabled broad gauge wagons to reach wharves on the New Cut, in a part of the estuary thought by some traders to be full of promise for future development as a dock area. However, the first docks in Swansea were opened on the west side of the river, the North Dock at the seaward end of the Swansea Canal in 1852, and the South Dock further west in 1859. They provided better facilities than the tidal wharves in the New Cut where vessels were liable to be aground on mud banks for many hours each day, and where loading was carried out from wagons shunted by men and horses operating in a very confined area.

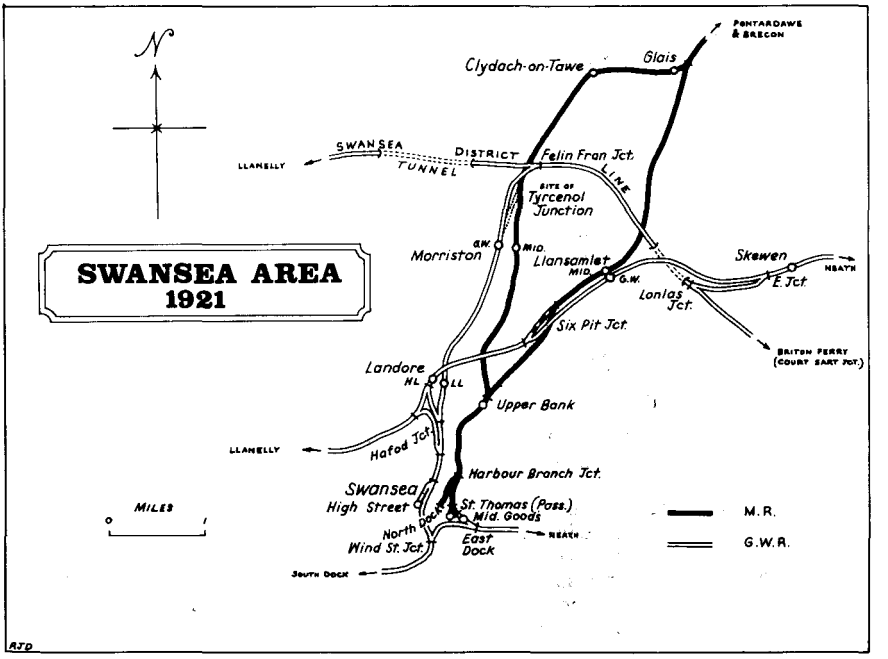
The construction of the SVR Harbour Branch, authorized in 1855, gave that company access to the North Dock, but the movement of traffic was hindered by the requirement of s.58 of the 1855 Act, which obliged the company to keep open the drawbridge across the New Cut for two hours before and after each high water, an obligation inherited by the Midland Railway when it leased the SVR in 1874, though it was modified in 1900.

Until about 1860, the SVR was overwhelmingly a mineral line. Its owners were private individuals who happened to need a piece of railway to further their main activities of coalmining, copper smelting and the like. They were quite unversed in the handling of other types of traffic, and the preliminaries to the introduction of a passenger service, as revealed by the board minutes, verged on the farcical. Yet after three Board of Trade inspections, and the hasty purchase of two tank engines capable of hauling passenger trains, the service introduced on 21 February 1860 between Swansea (St. Thomas) and Pontardawe was an immediate and perhaps embarrassing success. Within a few days the directors were ordering four additional third class coaches, and even decided to appoint a porter at Pontardawe – something that had not hitherto occurred to them.

It was the growth of passenger and general traffic, coupled with many complaints about the inconvenience of St. Thomas station, that prompted the SVR to look elsewhere for improved accommodation, towards the area west of the river already occupied by other transport undertakings, among them the Swansea Canal Company. This concern was under attack for failing to meet the needs of traders especially between Swansea and Clydach-on-Tawe where new industries

and collieries were being developed, including a large colliery at Tyrcenol owned by the firm of Messrs Williams, Foster & Co. It was suggested that a railway should be built alongside the canal to serve this colliery and relieve congestion, a proposal that took shape in a document dated 2 November 1864 entitled 'Heads of a Suggested Arrangement between the Great Western Railway Company and the Swansea Canal Company'. This is mainly concerned with the purchase of the canal by the GWR, but embodied also the following clause:– 'The Railway Company to construct a railway parallel with or near to the Canal from Swansea to Morristown (*sic*) or Clydach, as may be arranged, all costs, charges and expenses of which are to be paid by the Railway Company. If before 23 December [1864]the Great Western Company arrange with the London & North Western Company and Vale of Neath Company that neither of those companies will apply for running powers over the proposed railway, then, if running powers are granted to any company over the proposed line, it will be left to decide whether the Great Western Company are to be at liberty to withdraw from the Bill'.

This proviso is interesting as reflecting some of the uncertainty that currently prevailed about the future of the various independent transport undertakings in the area, in the aftermath of the acquisition in 1863 of the South Wales Railway by the GWR, coupled with some jockeying for position among the big companies – between the GWR and the LNWR, with no doubt the Midland, recently ensconced in Hereford, looking on from afar. In the outcome, the GWR acquired



the canal, the VNR, and part of the Llanelly Railway, but failed against the balance of probability to get the SVR.

The proposals for the sale of the canal to the GWR for the time being came to nothing, presumably because of the financial difficulties that afflicted the GWR in the 1860s, but the railway scheme went ahead embodied in the Swansea & Clydach Railway Bill 1866. This line, intended for goods traffic only, was to be built to the standard (4ft. 8½ in.) gauge, starting in the North Dock area by a junction with the mixed gauge Swansea & Neath extension of the VNR, then in process of being absorbed by the GWR. The leading witness for the project was Joshua Williams, manager of the VNR, but he made it clear in his evidence that he was representing the interests of the GWR. The northern termination was to be about 4½ miles away near Clydach-on-Tawe, as critics averred 'just in a field', though in fact not far short of the SVR. For that company opposed a junction, without which traffic could not pass from one side of the valley to the other, and this refusal proved fatal to the scheme. Many traders at that time were strongly averse to any move that might tie the SVR more closely to the GWR, and so lead to a transport monopoly in the valley, should the GWR ultimately acquire both canal and railway.

On the other hand, the SVR achieved, on paper at least, its needful accommodation on the far side of the river; for under the SVR Act 1866 it could require the GWR to lay the mixed gauge from Six Pit Junction to Swansea (High Street), and provide facilities there and at Landore for SVR passenger and general traffic. But the cost of laying the additional rails was to be borne by the SVR, and as the days of broad gauge in South Wales were already clearly numbered it chose not to incur the expense. It preferred to put forward a plan of its own.

This was for a loop diverging at Upper Bank, 1½ miles north of Swansea (St. Thomas), thence keeping for the most part to the east bank of the river through Morriston and Clydach to rejoin the existing line at Glais, a distance in all of just over 4¾ miles. It was agreed in preliminary discussions between Starling Benson, chairman of the SVR, and representatives of the Swansea Canal Company that if at any time the canal company chose to make a railway to serve works on its side of the river, then the SVR would not oppose such a line, or refuse a junction with the Morriston loop. This undertaking was written into the SVR Act 1867, which authorized the loop, and eventually after a lapse of fifteen years, gave birth to Tyrcenol Junction.

The SVR built the Morriston loop piecemeal, in a rather leisurely fashion, starting with a long siding running westward from Glais to serve works and collieries near Clydach. A similar line was laid northward from Upper Bank Junction to the Forest Tin Plate Works at Morriston, in use by 1870 and opened for public goods traffic to Morriston on 2 October 1871. The middle section between Morriston and Clydach involved three bridges or viaducts across the River Tawe and was not actively put in hand until negotiations for the lease of the SVR to the Midland were well advanced in 1873.

It was the declared intention of the SVR to treat the loop as its main line, and to divert the passenger services to it, as there were larger populations at Clydach and Morriston than on the old route through Llansamlet. The Midland lease took effect legally for accounting purposes on 1 July 1874, but Midland officials did not take physical possession of the SVR until 1 September 1874, by which date the Morriston loop was finished in a somewhat rough and ready way. A Board of Trade inspection was conducted for the SVR by Colonel F. H. Rich on 15 August 1874, but he found the stations and signal cabins wanting in many respects and would not pass it for passenger traffic. Thus it fell to the Midland

to put on the finishing touches and divert the passenger trains from the old route on 1 March 1875.

Negotiations for the sale of the Swansea Canal to the GWR had meanwhile been renewed leading to an agreement dated 2 November 1871, clause 5 of which repeated the substance of the 1864 requirement whereby the GWR was to apply to Parliament for power to make a railway 'parallel with or near to the Canal from the termination of Hafod Siding to Tyr Canol [*sic*] or further as the Railway Company may decide'. The estimated cost for approximately 2¾ miles of line was £73,500, of which £6,025 related to Railway No 2, namely, the junction at Tyrcenol and short length of railway leading to it.

The SVR, in accordance with the pledge contained in the SVR Act 1867, did not oppose the railway or junction, but demanded running powers urging in support the longstanding complaints of Swansea Vale line passengers about the inconvenience of St. Thomas station. When resisting the claim for running powers spokesmen for the GWR clearly recognized that the SVR had slipped irretrievably from their grasp. In a reference to earlier Parliamentary proceedings, James Grierson, General Manager of the GWR, said, 'You have altered your position entirely since 1866. At that time you were a local line and not unwilling to work with us'. Asked to explain his company's refusal of running powers over the Morriston branch, he said, 'I look upon it that this would be very like a station.

You can scarcely call it a railway, because there would be so many sidings upon it that practically it would be very much like giving them power to use our station, as we propose to construct it only as a single line. I think that it would be very undesirable that they should have running powers'. Yet the facilities granted to the SVR by s.15 of the GWR (Swansea Canal and Morriston Branch) Act 1872 fell not far short of that, including as it did the through booking and invoicing of traffic at through rates, and conveyance 'so far as is reasonably practical' in through carriages and wagons. Moreover s.14 enacted that 'No part of Railway No 1 shall be used for the purposes of traffic before Railway No 2 including the junction with the Swansea Vale Railway is completed and opened for the purposes of traffic'.

The GWR was in no hurry to build the Morriston branch. Having paid a high price for the canal (£202 GW Consolidated Preference 5% Stock for each £100 canal share), it chose to renovate it and work it hard in competition with its railway rival. The Midland on its part, after taking over the SVR, concentrated its attention on the terminal area east of the river mouth where plans for the construction of new docks were now going ahead. Early in 1876, the Midland opened a large goods station and warehouse just east of the junction between the Swansea Vale line and the GWR to which it had access free of toll over the GWR. Then, under an agreement scheduled to the Swansea Harbour Act 1876, which authorized the construction of the East Dock, the Midland agreed to lease in perpetuity some extensive quay and wharf frontage with access over the railways of the Swansea Harbour Trust. Similar arrangements were later made for accommodation on the coaling arm of the King's Dock, opened in 1909.

So for the Midland the GW Morriston branch was an irrelevance, and for the GWR not of pressing importance. It could no longer provide a means for laying hands on the SVR: on the contrary, it might lead to the appearance of Midland trains in High Street station. Yet the needs of growing industries and population in the Morriston area west of the River Tawe could not be ignored indefinitely; the GWR Acts of 1876 and 1878 extended the time limits for the building of the line, and at length it was put in hand.

Although no more than 2 miles 60 chains in length and of only single track width, the Morriston branch was a difficult and costly line to build. In his inspection report dated 31 March 1881, Major F. A. Marindin comments, 'For the greater part of its length the line runs through and by smelting and other works, and the ground is in many places made ground, spoil heaps and cinder banks. The works are very heavy and numerous for so short a line'. He goes on to describe Morfa Viaduct, 308 yd. long and 33 ft. in extreme height, comprising 29 spans. Of these 26 had masonry abutments and brick arches; the remaining three had cast iron cylinder piers and wrought iron girders of length varying from 24 ft. to 77 ft. Barlow Viaduct, 134 yd. long and 46 ft. in extreme height, got its name from the fact that 20 of its 23 spans had piers and superstructure constructed of Barlow rails riveted together. The other spans across canals had masonry abutments and wrought iron superstructure. Other major works included a wrought iron aqueduct over the line, and over a mile of retaining walls constructed in masonry. Altogether it was a substantial stretch of railway with for the most part easy gradients, but with many sharp curves.

The Inspecting Officer detailed the signalling arrangements throughout, mentioning a loop 28 chains long at Tyrcenol Junction, and subject to the usual undertaking being given that the line should be worked on the train staff and ticket system with block telegraph, approved it for opening. No doubt this stamp of approval could be interpreted as satisfying the requirement of s.14 of the 1872 Act whereby no part of the Morriston branch was used for traffic until Tyrcenol Junction had been opened, though in the event the public service starting on 9 May 1881 proceeded no further than Morriston, leaving the junction and about 60 chains south of it unused.

The junction did not for long remain viable. In 1882 its owners, the GWR, removed the telegraph instruments to save the cost of maintenance, and in 1885 the junction points were taken out. Then in 1893 it was arranged between the Midland and the GWR that the signalbox and signals should be removed, on the understanding that they should be replaced at the Midland Company's expense should the GWR at any time require the same. This became a possibility in 1897 when the GWR intimated to the Midland an intention to exercise running powers over the Swansea Vale lines as conferred by the Midland (Swansea Vale Lease) Act 1874 using the junctions at Brynamman, Six Pit, *and Morriston*. Whatever the precise nature of these proposals, which the GWR ultimately withdrew, it is reasonable to speculate that they could not have been pursued very far without inviting a counterclaim from the Midland for access to Swansea (High Street), based on statutory rights reaching back to the SVR Act of 1866. A revived Tyrcenol Junction could become a ticklish spot: it were best left to moulder!

Its complete demise came ten years later. In 1904 the GWR obtained powers to build the Swansea District system of railways, bypassing Swansea to the north, including a short spur from Felin Fran to link up with the Morriston branch south of Tyrcenol Junction. This was authorized by s.5 of the GWR Act of 15 August 1904 and opened from Felin Fran West Junction to Morriston, a distance of 1 mile 8 chains, on 8 May 1914. In 1907, while these railways were under construction, the district engineer of the Midland drew the attention of his superiors to the fact that the carrying of the new GW line over the Midland (Swansea Vale line) near Morriston would render it impossible to reinstate Tyrcenol Junction. However, the Midland authorities turned a blind eye and decided to take no action. Thus, whatever the legal rights, the junction was closed *de facto* for all time, the approach lines blocked by works associated with the massive skew bridge carrying the Felin Fran spur over the Midland at 3 miles 67 chains from Swansea (St. Thomas).

After it had been opened up to the north, the Morriston branch presented some contrasts. The major portion from Hafod Junction northward retained its original character of an obscure single track railway serving several halts, but beyond Morriston it blossomed out into a double line built on the generous scale favoured by the GWR for new works in the early part of this century. Passenger workings also provided a contrast. The local service comprised railcars operating between Swansea and Felin Fran Halt, continuing on some trips to Llandarcy Halt on the Swansea District line, or via Skewen East Junction to Neath or Port Talbot. These little trains ran for the last time on 9 June 1956, but full length main line trains, booked not to call at Neath, were also in some years scheduled to pass that way, diverted at Court Sart Junction, west of Briton Ferry, over the Swansea District line to Felin Fran West Junction. In distance this route was 29 chains shorter than via Neath and avoided Skewen bank, but was tortuous and slow in its final stages. Nevertheless, in the summer of 1956 one could leave Paddington on the 8.55 am express to West Wales, hauled by a 'Castle' class 4—6—0 which later cautiously approached Swansea through the industrial debris of an earlier age over a winding single track railway that might conceivably have carried Midland trains, had Tyrcenol Junction ever been brought into use.

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The Kerne Bridge in Herefordshire – II

BY JOHN VAN LAUN

(*Continued from p.67*)

The Building of the Bridge

As early as 10 February 1825 Partridge was writing to Powles whilst in London, during the petitioning for the Bill, concerning the actual construction of the bridge. A Mr. Carline, whom Partridge favoured for building the bridge, felt that a stone bridge of three arches would involve the company in 'perpetual indictments' by impeding navigation, but an iron bridge with a single span would be best as a barge needing to tack from bank to bank would have a clear run. Partridge feared 'any but the suspension chain bridge will exceed our present estimates by his conversation'.

Earlier still in January 1825 Evan Jones had produced his plan for a bridge of stone at an estimate of £3,918 18s 0d. He seems to have been favoured by Blakemore although Partridge wrote 'I do not think Evan Jones quite the man if Mr. Blakemore, now in town, can be talked to think so'. Partridge wrote to Tyler to introduce Carline who 'will show you a sketch infinitely preferable in my opinion. Mr. Hazeldine who is executing the Menai Bridge would furnish the ironwork for Mr. Carline and the pattern for a 50 yards bridge'. The Menai Bridge of Telford was building at this time and suspension bridges were therefore highly favoured. The final decision on the type of bridge was to wait until after the passing of the Act.

At the committee's first meeting on 24 June 1825 nothing was decided on the bridge but Henry Davies of Jones, the Monmouth Bankers, was appointed Treasurer and a Clerk and Surveyor were advertised for at £100 p.a. The remainder of the shares up to £6,000 were also to be advertised. On 15 July the committee decided to advertise for estimates for the bridge and roads to be delivered by 13 August. The bridge was to be built of stone or iron and to consist of not more than three arches, one to be 50 ft. wide at least, the crown of which was to be 32 ft. above the river bed. Collectively the arches were not to be less than 125 ft. wide exclusive of the piers. The distance 'between the balustrades or walls' was not to be less than 20 ft.[15] Cornelius Jayne on 15 November produced a specification for the line from the intended bridge to Old Forge. Those who had submitted tenders for the roads could inspect his plans and leave estimates with him within fourteen days. Notice was also to be served on tenants at will to deliver up the land required for the road. The committee also decided to apply to the Gospel Works, Birmingham, the Coalbrookdale Works, the Pontypool Works, the Blaenavon Works, the Neath Abbey Foundries, the Abernant Works, and the Dowlais Works for tenders to erect a cast iron bridge with a single arch of 130 ft. with stone abutments and a carriageway of 23 ft.

Richard Darby of Coalbrookdale replied that 'our neighbour and friend William Hazeldine . . . who is much in the way of building cast iron bridges might enter into the subject if applied to.' A strange comment from a Darby whose family built the first iron bridge in the world. John Josiah Guest of Dowlais declined and Rowland Fothergill of Abernant said 'that it is a description of ironwork that we are not accustomed to make'. Hill and Wheeley of Blaenavon and the Neath Abbey Works were not interested.

Having failed to interest the large ironworks the committee therefore decided to employ a well known engineer to provide a plan and specification and estimate

for a cast iron bridge. The committee instructed their solicitor to write to Bryan Donkin (See Appendix IV) aksing him to make the necessary survey, and specification for a sum not to exceed £150 (he was in fact paid £167 4s 0d) Appendix I. By this time Powles the solicitor had been appointed clerk to the company at one guinea a meeting.

Donkin presented his plan and estimate and on 24 May 1826, the committee as a result, decided to abandon their plans for an iron bridge as being beyond the funds of the company. They accepted instead the 'plan and drawings' of a stone bridge which a Richard Burton proposed to build for £4,000[16], to be '25 ft. 8 in. wide from outside to outside, the parapet 23 in. in the clear, to admit of sufficient room for two carriages, tramroad and footpath'. It seems to have been accepted as a 60 ft. centre arch with two 25 ft. arches and two land spans of 14 ft. George Overton (See Appendix IV) was appointed as engineer. Overton wished to make some changes in the dimension of the bridge which Burton did not feel came within the terms of the contract and wrote that he would be put to an increased cost of £425 15s 0d. to effect these changes. It was not until 17 July that the alterations could be agreed and the formal contract was not signed until 10 August 1826. Burton then received an advance of £500. By 13 August Burton had arrived at the rock on the eastern pier and by 9 October was asking for an advance of £150 to pay the men for putting in the pier. The surveyor was ordered to account to Powles on how the money was spent. Burton seems suspect at this stage and the committee anxious to keep an eye on him.

By 23 October Burton was asking to be released from his contract and he wrote to both Powles and Blakemore to that effect. On 10 November he was instructed by the engineer to continue within 21 days or 'the company will themselves proceed as they are authorized to do at the said contract in the erecting, building and completing the said bridge'. At the meeting on 4 December 'it [was] agreed between the Kerne Bridge Company and Richard Burton . . . that the contract . . . between the parties . . . be cancelled. Upon the following terms . . . that the £525 already advanced to Mr. Burton shall be . . . in full discharge of all the work done and materials provided by him'. The final release was not made until 5 June 1827.

Burton was not the only problem the company had. Charles Hollis had submitted a plan for an iron bridge and claimed £118 16s 6d from the company. His claim ultimately came to a case (Hollis v. Partridge). Hollis, a building contractor, had been asked by Partridge for a reduced estimate but failed to reduce it enough. Having not been offered a contract he sent in his bill in July 1825 and later claimed damages and costs to a total of £300. Finally when the case was to be heard at Herefordshire Assizes he withdrew and accepted £25 paying his own costs.

On 4 December 1826 the company, anxious to proceed with the bridge, entered into an agreement with David Jones, a builder of Morgan Street, Tredegar Ironworks, to complete the bridge. At the meeting on 26 January 1827 Overton's recommendation that Benjamin James be employed as occasional surveyor was adopted. At the same meeting £150 was to be paid to David Jones so he seems to have been progressing well with the bridge. Overton was to fall ill and James was instructed to attend and make the monthly report in his stead. At this time a policy of Partridge paying for work done on the recommendation of the engineer or James was adopted to save the inconvenience of monthly meetings. Partridge would report from time to time to the committee on the sums paid. On 13 March Benjamin James produced a plan of the bridge for Partridge with the two side arches 45 ft. and the dry spans 16 ft. David Jones was requested to prepare the working drawings and plans to annex to the contract. By 1 May,

Overton was dead and the company approached William Armstrong of Bristol to be the engineer. As the foundation for the pier on the west side was by now excavated it was felt that the engineer should have an opportunity to inspect the foundation before any 'masonwork was put down' and should be sent for immediately. By the meeting on 26 May, Armstrong had visited the bridge and recommended that the two small arches (last enlarged to 16 ft.) be extended to 25 or 30 ft. This was agreed as was the extra expense involved.

On 5 June, Armstrong produced the specification for the road from the end of the bridge as far as Cruse. The meeting on 19 June 1827 saw the contract for building this section of road awarded to John Watkins (with 60 men, as urgency in completing this section was required) at a tender of £840. Nine other tenders were received and delivered at the meeting; the highest was that of Allen & Kemp for £1,487 14s 0d, the lowest £260. One tender was '10d. per yard with allowance'. Watkins was also to build the Courtfield branch for £720 and from Cruse to Old Forge for £120 (this section was intended to be improved later as a road already existed from Cruse to Cross Keys).

The small amount spent on this section was showing by 6 January 1830 when the Kerne Bridge Company tried to coerce the parish of Goodrich into maintaining the road as a parish road. By 11 September the committee minuted that 'The road from Croose(*sic*) to Old Forge being now in a bad state and daily getting worse. It is ordered that the Clerk do make an intention to the Parish of Goodrich that unless immediate steps are taken for the efficient repair of the said road an indictment will be preferred against the Parish'.

By 19 September a number of people were behind with their calls and the solicitors were asked to report to the committee on the best way to raise the £2,000 on mortgage permitted by the Act. A notice to this effect appeared in the *Hereford Journal* of 3 October 1827 (dated 1 October) signed by the solicitor that a special general meeting would be held on 1 November 'for the purpose of taking into consideration the Propriety of raising £2,000' by mortgage. Another notice appeared in the issue of 16 January 1828 (dated 15 January) for a meeting to be held on 18 February. This meeting was to consider the offer made by Mr. Ives of £2,000 at £5 per cent per annum on 11 December. This offer had in fact been accepted by the committee on 11 December, when the engineer was ordered to report on the state of the works and the sums necessary to complete them.

On 15 May 1828 notice was given to John Watkins that the committee were dissatisfied with the progress he was making on the roads and Armstrong was instructed to make use of the powers under the contract to have the work completed. The bridge was now nearing completion and it was ordered that a substantial toll gate and side gate and also a temporary tollhouse be immediately made and erected and tolls taken. The tolls were also fixed at this meeting.

On 5 July, John Watkins was still behind with his work, and Armstrong was instructed to employ workmen to finish the work unless Watkins proceeded in a satisfactory manner within seven days. Watkins does not appear to have finished his contract as he was only paid £1,109 1s 1d of a total of £1,680. Also on 30 December the committee ordered 'that the Contract this day entered into with Benjamin James for the stoning with limestone the road from the dry arch to Old Forge be confirmed'. He was paid £765 5s 10d.

William Evans was appointed collector of tolls on a temporary basis, and the engineer, Armstrong, was to find a 'proper person who may be appointed a permanent collector of the . . . tolls'.

At a meeting on Monday 4 August 1828, the following report was made and ordered to be presented to the general meeting of proprietors 'The report of the Committee of Management of the Kerne Bridge Company for the proprietors assembled at their general meeting on the 4th day of August 1828, the Committee begged leave respectfully to report that the bridge and roads have been completed and open for public use and that a gatekeeper was appointed for the collection of tolls on the 25th day of June last when the following tolls were directed to be received, viz.

For Horses drawing carriages	– 6d.
For Horses drawing wagons	– 4d.
For Horses not drawing	– 1½d.
For Foot passengers	– 1d.
For Cattle etc. (according to the Schedule)	

The Committee also have the pleasure of reporting that the receipts at the gate have been and are progressively increasing as the utility of the bridge becomes more generally known. The Committee also feel much pleasure in stating that the bridge contractor, David Jones, has executed his Contract much to their satisfaction and in a manner which they think entitles him to the best recommendation of this Company, for any undertakings of a similar nature".

The bridge was finally constructed and as it remains today is of five masonry arches, eastside 30 ft. 5 in.–46 ft. 0 in.–61 ft. 2 in.–46 ft. 0 in.–30 ft. 2 in. westside and the width between the parapets 23 ft. 0 in. as first planned[17] by Burton.

Finances

On 30 December 1828 it was agreed that the tolls were to be 'farmed' on an annual basis from 1 March 1829, see Appendix II, and Asaias Pewtner, Partridge's steward, features as the 'farmer' in the early years.

By 11 September 1830 the concern was in debt to the amount of £1,200 and the 'managing Committee [pledged] themselves to make an advance of £10 upon each share provided that the other proprietors [would] co-operate . . to the same extent'. Out of the total of nineteen only nine assented to this and no amount is shown on the balance sheet for the period June 1826 to June 1840.

Under the Act the Kerne Bridge Company was under an obligation to make good any loss to the Goodrich Boat Ferry but do not appear concerned until 11 September 1830 when, after receiving three letters from Kingsmill Evans they agreed to offer him an amount computed on the tolls over a number of years. However by 13 March 1834 a writ of *mandamus* was issued against the company for not complying with the terms of the Act. The case was heard at a Sherriff's Court in Ledbury on 5 April and judgement was given to the favour of the Goodrich Boat. The result was that a further call of £12 a share was made on 6 August to cover debts 'amounting in the whole to £1,500 and upwards'.

The bridge was taken over by Herefordshire County Council in November 1947 and remained a toll bridge until September 1948.

REFERENCES

15. *Hereford Journal,* 20 July 1825. The estimates were to be submitted by 15 August according to the printed advertisement.

16. On 5 September 1825 a number of proposals were presented to the Committee in answer to their advertisement of 15 July.

'Upton & Weightman,	3 arches	£4,800
Carline	2 arches	£3,700
,,	3 arches	£3,400 & 20 ft. width
	1 arch	£5,200 (but not sufficient width)
Burton		£3,200
Moddochs	1 arch not exceeding	£5,000
Parsons & Robbins		£3,859
Mr. Osborne		£4,000 all in Partridge's handwriting

Burton appears to have obtained the contract on this estimate which he then increased.

17. Information kindly supplied by Assistant County Surveyor, County Council of Hereford and Worcester.

APPENDIX I

The Cost of Building the Bridge: *(source 'Abstract of the Accounts of the Kerne Bridge Company, from the commencement in June 1826 to the 30 June 1840')*

Paid Contracts for the Erection of the Bridge to

	£. s. d.	£. s. d.
Richard Burton, contractor	525. 0. 0	
David Jones, ditto	4465.16. 6	4990.16. 6

Paid Road Contractors for Forming and Completing the Roads viz.

John Watkins, road contractors	1109. 1. 1	
Benjamin James, ditto	765. 5.10	1874. 6.11

Paid Engineers, for Plans, Surveys and Valuations viz.

Bryan Donkin, and Co., Engineers	167. 4. 0	
William Armstrong, Bristol, ditto . 137.14s 9d.		
& for surveying roads . . . . . 145. 0s 9d.	282.15. 6	
George Awbrey, engineer	21.16. 0	
Representatives of George Overton, ditto	93.17. 0	
Benjamin James, Llangattock, ditto	29.12. 0	
William Metcalf, Monmouth, surveying the roads	107. 6. 0	702.10. 6

Paid for Land to make the Roads and the approach to the Bridge to

The Rev. H. Williams, Goodrich	62. 5. 0	
Samuel Yeats Esq.,	53.10. 0	
The Rev. W. H. Hill	103. 5. 0	
Miss Nourse	110.17. 6	
Miss Swayne	150. 0. 0	
Mr. William Fisher, Goodrich	12. 0. 0	491.17. 6
Paid for Erecting the Toll-house		175. 9. 7¾
Miss Griffin, for the use of a quarry	20. 0. 0	
Mr. John Whiting, for ditto	10. 0. 0	30. 0. 0

Messrs Powles & Tyler, for expenses of obtaining and carrying into execution the Act of Parliament and other law expenses (£762.16.2d for obtaining the Act. Including Dyson & Jones the Parliamentary Agents)	1402.14.11
	£9667.15.11¾

APPENDIX II

Tolls Received: *(source 'Abstract of the Account of the Kerne Bridge Company, from the commencement in June 1826 to 30 June 1840'.*

		£. s. d.	£. s. d.
From July 1828 to May 1829, less expenses of collecting			143. 6. 2½
John Phillips and Wm. Jenkins, ...	taken 29 April 1829		202. 0. 0
Ditto	taken 1 June 1830		197. 0. 0
Esaias Pewtner.....	taken ditto 1831	200. 0. 0	
Esaias Pewtner.....	taken 1 June 1832	232. 0. 0	
John Phillips	taken 1 June 1833	202. 0. 0	
James Watkins.....	taken 1 June 1834	265. 0. 0	
James Ward	taken 1 June 1835	206. 0. 0	
William Holsey	taken 1 June 1836	240. 0. 0	
Ditto	taken 1 June 1837	220. 0. 0	
Timothy Bennett.....	taken 1 June 1838	334. 0. 0	
William Holsey	taken 1 June 1839	260. 0. 0	

APPENDIX III

Shares and Shareholders

Subscriber 1826	*No. of shares @ £50*	*Subscriber 1840*	
John Partridge	67	John Partridge	68
Richard Blakemore	10	Richard Blakemore	7
William Vaughan	3	William Vaughan	3
Thomas Tovey	3	Thomas Tovey	3
Ann Partridge	6	Ann Partridge	6
Rev. J. E. Tyler	3	Rev. J. E. Tyler	3
James Pearce	4	Executors of the late James Pearce	4
Rev. H. Williams	2	Executors of the late Rev. H. Williams	4
John Harper	2	—	
Henry Roper	1	—	
Thomas Bennett	1	Thomas Bennett	1
William Morgan	1	—	
James Ward	1	James Ward	1
James Rupell	1	—	
Joseph Robins	1	Joseph Robins	1

Subscriber 1826	*No. of shares @£50*		*Subscriber 1840*
John Allen	1	—	
Richard Harrison	1	—	
William Lewis	1	—	
Richard Morgan	1	—	
E. F. Maitland	4	E. G. Maitland	4
Thomas Robins	2	Thomas Robins	2
John Trotter	1	—	
George Robins	2	George Robins	2
William Tombs	1	—	
—		Thomas Davies	3
—		William Partridge	3
—		William Panter	3
—		H. Rosser	1
—		James Russell	1
	Total . . 120		Total . . 120

Total value £6,000

Calls made: Deposit paid on signing 1826.

1st — 21 May 1826
2nd — 4 July 1826
3rd — 9 Oct. 1826
4th — 26 Jan. 1827
5th — 1 May 1827
6th — 5 June 1827
7th — 6 Aug. 1827
8th — 19 Sept. 1827
9th — 1 Nov. 1827

APPENDIX IV

John Partridge.
His father William, and Uncle John were well known ironmasters in the Forest of Dean. The old established furnace at Bishopwood was purchased by them. Around 1821–2 William Partridge built Bishopswood House (destroyed by fire 1873) and by 1826 John Partridge had moved from Courtfield to Bishopswood. His father and uncle, although from Ross, lived in Monmouthshire. William became High Sherriff of Monmouthshire in 1807 and his son John in 1824. His uncle John had died in 1810 a bachelor and it seems that John Partridge inherited both his father's and uncle's estates. He was a local philanthropist, he endowed Walford Church and built a free school. John Partridge held 67 out of the 120 shares in the Kerne Bridge Company. (based on continuation of John Duncumb *History of Herefordshire* 1882).

Bryan Donkin (1768–1855).
Associated with Foundriniers in developing the continuous paper-making machine from 1803. By 1851 his firm at Bermondsy had manufactured 191 machines. Donkin combined with others to set up at Bermondsey the first cannery. Canned meat and soap were supplied to the British Navy during the war with America in 1812. Built first steam Dredger used on the continent 1822; this was used on the Gotha Canal.

George Overton.
Well known tramroad engineer. He built the Penydarren line on which Trevithick's high pressure steam engine ran. He also made the first survey of the Stockton & Darlington Railway, and the first survey for the Festiniog Railway.

Railway Steamers and the Genesis of the Aircraft Carrier

BY R. A. COOK

When Jackie Fisher's H.M.S. *Dreadnought* appeared in 1906 it immediately made all existing battleships obsolete, and there were the normal repercussions which always occur when a new field is tapped, and in every country hurried activity was apparent to redress the naval balance which had firmly entrenched itself with the British Navy. There now came the hurried race for parity until by the outbreak of the first World War the British Navy possessed the greatest array of big gun ships in the world, a never to be forgotten, and an unrepeated, event following the war and after the Washington Naval Treaty of 1921. A new force to be reckoned with was now appearing on the horizon in the form of the unwieldy aircraft of the period and from this time, one amply demonstrated by the Americans after the war, the days of the battleship were numbered, and the aircraft carrier was to become the capital ship of the Fleet less than forty years later. In those early days the major purpose of aircraft was in the spotting role, due to navigational methods being of a very rudimentary nature. Radio communication was also in its infancy and often broke down, a fact which played a key part in one naval engagement as will be told later.

It was the Americans who laid great faith in the future of the carrierborne aircraft, but it was the Japanese who carried it to its ultimate conclusion with a force second to none when they entered the second World War in 1941. This was conclusively proved in the carrier attack at Pearl Harbour, and the land-based naval aircraft attack which sank the battleship HMS *Prince of Wales* and the battle-cruiser HMS *Repulse* off Malaya on 10 December 1941. From this point on it was apparent that without air support the capital ship was defenceless and that any fleet without carrier support might just as well stay in harbour. Even the world's largest battleship, the IJN *Yamato* carrying no less than 170 anti-aircraft guns succumbed to the bombs and torpedoes of carrier aircraft, and it was now that the role of the battleship became primarily as an escort ship for the aircraft carrier, to provide the maximum anti-aircraft cover.

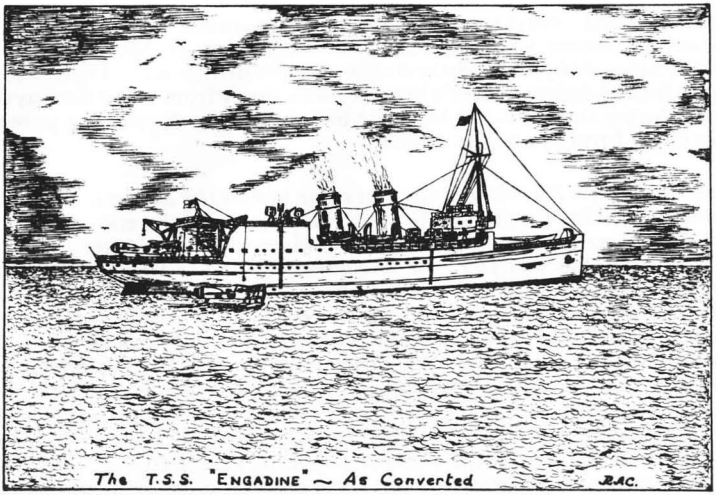
While the railways themselves carried the necessary weapons of war, it was the steamers which have a part in this story, one of which could have had a major bearing on what was really the inconclusive Battle of Jutland – the only really conclusive element to emerge being that the German battle-cruisers and shells were superior to our own in many respects. While the bulk of the battle fleet was virtually immune from air attack, the German Zeppelins were able to carry out aerial surveillance over the North Sea and the Grand Fleet with impunity, and this nuisance had to be dealt with, as also were the air raids on east coast towns and on London, although this aspect does not concern us. The first successful

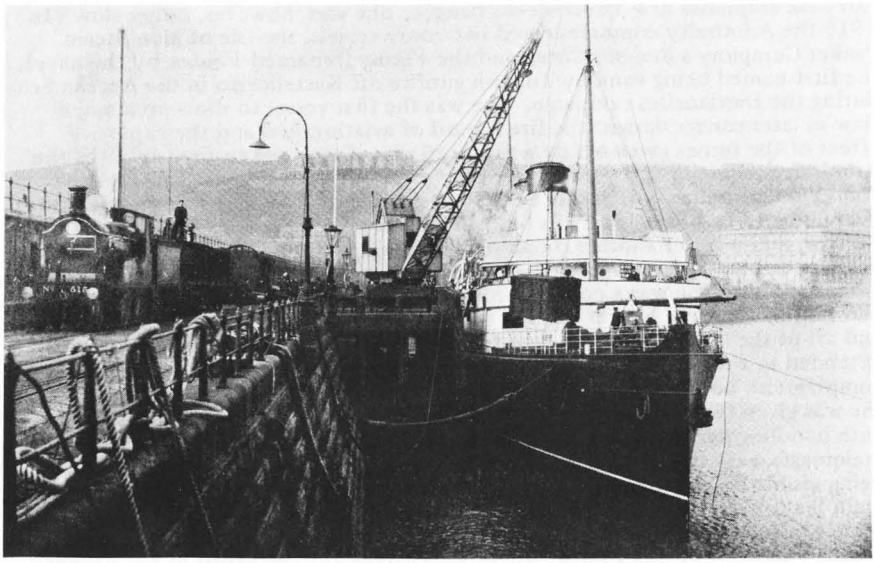
take-off by a British aircraft at sea was at the Fleet Review in 1912 by Lieutenant Charles Samson from a temporary decking extending from 'A' turret to the bows of HMS *Hibernia*, a pre-dreadnought of the so-called ' Wobbly eight' class of battleships built in 1905–6. The same pilot having made a flight from HMS *Africa* of the same class, while moored, in 1911. The aircraft used for these flights were modified Sopwith landplanes with airbags attached to the undercarriage and under the tailplane to render them amphibious for landing. During the war genuine amphibious short floatplanes were used.

The first purely naval parent ship was the protected cruiser HMS *Hermes*, which proved the viability of the experiment for spotting purposes, even though the radio contact left something to be desired. She was reconverted prior to the war when her take-off runway was removed although she retained the hanger for sea take-offs until lost in October 1914. It is at this point that railway steamers enter the scene, the principal reason being their high speed which enabled them to accompany the main fleet. At the outbreak of hostilities the *Empress*, *Engadine* and *Riviera* were requisitioned for conversion to seaplane carriers. All three were built by W. Denny & Bros. at Dumbarton for the South Eastern & Chatham Railway, and were chosen for their service speed of about 20 knots, a speed which was comparable to that of the Fleet's heavier units, and one which could be exceeded for short periods if the occasion demanded. The *Empress* was built in 1907 and had a gross tonnage of 1695. She was also the slightly smaller of the three, with an overall length of 311 ft., and a beam of 40 ft. The others were built in 1911 and were sisters, with a gross tonnage of 1676 tons and dimensions of 313 ft. overall, and beam of 41 ft. All were steel triple screw vessels with three direct drive turbines, one to each shaft. For war service they were taken in hand at Chatham Dockyard, the first two receiving permanent hanger structures at the after end of the promenade deck, with a crane at each aft corner of the hangers to handle the aircraft. The *Riviera* did not receive this more permanent treatment, and was fitted with a pair of canvas hangers, one aft astern of the promenade deck, and one forward of the bridge. Derricks were fitted to the bases of the two masts for handling purposes. Each could carry four to six seaplanes, and were armed with two 4 in. guns, and one six-pounder anti-aircraft gun.

All three were attached to the North Sea area, and on Christmas Day 1914 joined a mixed force of naval vessels for an air raid to be launched from a point some 20 miles west of Heligoland on the Zeppelin sheds at Cuxhaven – the first shipborne air attack. Each carried three Short seaplanes, but in the event only seven took off, but failed to find the target and finally attempted bombing warships, and the town, at Wilhelmshaven. The operation, although not a qualified success, was most effective as a Christmas surprise. However, it did not take long for the Germans to retaliate, and the bombing of the force which followed, although ineffective, prevented the aircraft being hoisted aboard, and they were abandoned after the crews had been recovered, some of them by British submarines in the area. The presence of the submarines more than likely deterred Admiral von Ingenohl – the German C-in-C. – from sending out his battle-cruiser force to give chase. SMS *Seydlitz* was already at sea in the Jade estuary and with a mean speed of some 26 knots may well have made the annihilation of the British force a strong possibility. The following year the *Empress* was despatched to the Mediterranean, and the *Riviera* to Dover.

The most notable incident occurred with the *Engadine* when attached to the Grand Fleet. On 31 May 1916 one of her Short seaplanes spotted the leading screen of the German High Seas Fleet and radioed a message to the parent ship, but communication difficulties led to the message not reaching Admiral Jellicoe on the flagship HMS *Iron Duke*. Had he received it the outcome of Jutland may well





"Dover: arrival of boat train. RMS Empress *leaving for Calais."*

have been different. What was essentially a battle-cruiser action took place, with the heavier, but slower, units not taking any major part except for a brief engagement with Admiral Hipper's battle-cruisers on the British side. There was even less action from Admiral Scheer's heavier units, apart from some destroyer skirmishes during the night. At least the initial spotting showed the potential of even this crude form of aircraft carrier.

Eventually, both the *Riviera* and the *Engadine* joined the *Empress* in the Mediterranean, taking part in the Turkish campaign until the end of hostilities, when all three were returned to the SE&C Railway in 1919. After a spell on charter to Instone Lines in 1932 the *Engadine* was sold to Compania Maritama (Fernandez Hermanos Inc.) of Manila in the Philippine Islands. Here her gross tonnage was raised to 1881 tons and she was renamed *Corregidor,* remaining in service there until she was mined near Manila Bay on 16 December 1941, and sank with the loss of about 500 lives. The earlier *Empress* was sold in June 1923 to the French firm S.A.G.A., who appear to have been successors to the shipping interests of the Northern Railway of France. This relationship appears rather obscure, and perhaps a reader can oblige with a more factual account of this union. However, she was finally sold for scrapping in April 1933. The *Riviera,* by contrast, remained in purely railway service until sold in December 1932 to J. B. Coupar, and immediately re-sold to Burns & Laird Lines, Glasgow, who renamed her *Laird's Isle.* She continued in service until broken up at Troon in 1957. She served throughout the second World War with Dover Patrol.

Following these experimental vessels, the navy commissioned the first purpose built seaplane carrier, carrying the long-famous name of HMS *Ark Royal* – the second carrier to take this name, and which was instrumental in disabling the *Bismarck* (July *Journal,* 1975). This vessel was a converted oiler and designed to carry six seaplanes in a 'tween-decks hanger. She was, however, rather slow. In 1915 the Admiralty commandeered two more vessels, the Isle of Man Steam Packet Company's *Ben-my-Chree* and the *Viking* (renamed *Vindex* by the navy), the first-named being sunk by Turkish gunfire off Kastellorizo in the Aegean Sea during the Dardanelles campaign. She was the first vessel to show up a major flaw in later carrier design: the fire hazard of aviation fuel and the explosive effect of the fumes given off by a ruptured pipe if exposed to fire. In 1916 the Admiralty requisitioned yet another railway vessel, the Midland Railway's *Manxman,* a similar type to the SE&C ones, being of 2,174 gross tons, and 334 ft. overall by 43 ft. beam. She was built in 1904 by Vickers, Sons & Maxim of Barrow, and was yet another direct drive triple screw turbine steamer with three Parsons turbines, giving a service speed of 21 knots. In appearance, following commissioning, she was a considerable departure from the earlier ships. In addition to the large hanger aft, she was also given a second one extending fore and aft of the bridge structure, and from the latter a sloping take-off platform extended to the bows. She was capable of carrying eight seaplanes as a normal complement, but had the facility to carry more. To cater for this extra capacity she was given two pairs of masts, one on each side of the fore and aft hangers, with handling derricks on each of the foremasts. It is not apparent why two mainmasts were stepped, except for radio or navigational purposes, no derricks being visible on photographs. Two huge lattice work cranes right aft were the main feature of the vessel, her armament being the same as for the three earlier vessels. Unlike her predecessors, she was immediately employed in the eastern Mediterranean, and had a rather uneventful career until returned to her former owners early in 1919. She was sold to the Isle of Man S.P.Co. in 1920 and continued on that station until requisitioned for trooping duties in the second World

War, her final service being for B.A.O.R. from Dover, after which she was sold for scrap.

As in many other aspects, the railway thus earned themselves a niche in naval history by contributing to the development of the vessel which was, and to a point still is, a major capital ship in the navies of the world, even though with the release of the vessels to their former owners in 1919, no other railway steamers were called upon to undertake similar work.

In addition to the bibliography below, I am indebted to Mr. R. C. Stallard of Knowle, member of the World Ship Society, for the later details and fate of the *Engadine*.

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The Car Dyke in South Lincolnshire

BY DAVID TEW

I recently had the opportunity of attending a week-end course at Horncastle Residential College on 'The Saxon Shore in Lincolnshire'. Rather to my surprise the course included a good deal about the Car Dyke. This ancient dyke, whose name, according to *The Place-names of Northamptonshire* p.5, appears to be derived from a Scandinavian personal name *Karr,* can be traced from near Lincoln to Waterbeach in Cambridgeshire, and is marked on the O.S. maps as a Roman canal.

Mr. B. B. Simmons of the South Lincolnshire Archaeological Unit has become very interested in the Car Dyke and in particular in that section of it between the River Slea and Bourne. He discussed the Car Dyke at some length during the week-end, and led a party to inspect the course of the Car Dyke and of the parallel dyke known as the Mid Fen Dyke in Helpringham Fen. The subject proved so interesting that I thought that members of the R.C.H.S. might appreciate a report of the proceedings.

The Car Dyke can be divided into three sections, starting from the north. The northern section runs, according to the O.S. map of Roman Britain, in an irregular line from the River Witham near Washingborough to the River Slea at Halfpenny Hatch near North Kyme. There are, however, reasons for thinking that originally it met the Kyme Ea further to the East. This section may have been navigable.

The part dealt with during the course which I attended was however the section from Halfpenny Hatch to Bourne. Ever since the time of William Stukeley, the 18th century antiquary, the Car Dyke has been regarded as Roman work, and field work on this section of the Dyke tends to support this theory, in the following way. A feature of the Helpringham Fen area is the presence of former salt

pans or salterns. These show up to-day in spring as circular patches of green where the seed germinates more quickly than on the rest of the land, enabling the salterns to be picked out easily. It has been found that Iron Age salterns – dating from about 200 B.C. – lie mainly on the line of the Car Dyke while the Roman salterns dating from the second century A.D. lie further into the Fen along the line of the old Mid Fen Dyke parallel and slightly to the West of the relatively modern Forty Foot Drain. At the time they were in use, these salt-pans would have been situated on the landward side of the salt marsh bounding the sea, so that it would appear that either the land rose, or the sea level fell, between Iron Age and Romano-British times.

These salterns are important in dating the Car Dyke, because in Helpringham Fen the Car Dyke diverts to the West for about a quarter of a mile before returning to its previous straight course, and this was apparently to avoid an area where the presence of a group of Iron Age salterns would have made excavation exceedingly laborious. The assumption is therefore that the Dyke is post Iron Age.

Between the River Slea and Bourne, which is a distance of about 20 miles, there appear to be about seventeen Roman tracks crossing the Car Dyke, and the crossing place of one of these tracks in the Heckington area has been examined. Here a causeway was found across the Car Dyke which appears to have been contemporary with the Dyke, the level of which at this place drops 20 feet in 200 yards. This, and other causeways, do not appear to have been dug out and later reinstated, but to have been left undug when the Dyke was cut. At Billingborough, where the channel of the Dyke appears to have been 17 feet deep and about 40 feet wide, it would have been of an adequate size for navigation, but it has to be borne in mind that from levels taken along the Dyke there appears to be a net fall north from Bourne to the River Slea of 20 feet and no evidence of any lock-like structure.

On going to Helpringham Fen we walked to the point where the Car Dyke crossed the present Helpringham Ea. It appears that the only piece of wood so far found in the bed of the Car Dyke came from this point and might be interpreted as part of a sluicegate. Standing on the south side of the Helpringham Ea here, one could see that the Car Dyke rose relatively sharply to the North. In the last 40 years most of the pasture land in this area has been ploughed up, but we were also taken to a grass field on the south side of the railway where a stretch of the Car Dyke can still be seen, dry, but about 15 feet deep.

This leads to the tentative conclusion that the Romans, wishing to reclaim the fen, dug the Car Dyke along the edge of the higher land and the Mid Fen Dyke along the then edge of the salt marsh, as catchwater drains, with cross drains at intervals to collect the rainwater off the intervening fen and to carry the water collected by the catchwater drains through the salt marsh down to the sea. As to when this was done, it is a possible theory that after the completion of the work on Hadrian's Wall troops were brought down to this area to dig the drainage channels. It must be added that no inscription of any nature has been found to support this (contrasting with the numerous inscriptions found on or near the Roman Wall); but for various reasons very little archaeological excavation has taken place on or near the Car Dyke in this area. No Romano-British pottery dateable earlier than Hadrianic times has so far been found.

This system of parallel catchwater drains to drain the fens was similar to that advised by the Rennies when they reported on fen drainage in this area in the 19th century, and S. H. Miller and S. B. J. Skertchley, the joint authors of *The Fenland Past and Present* 1878, who had made a deep study of the subject, had

no doubt that the Car Dyke was a drainage channel. Although more archaeological evidence is needed, it is certainly strange that Romano-British pottery found in the Helpringham area so far appears to come from Warwickshire, and if the Car Dyke had been a navigable waterway one would have expected to find pottery from the Lincoln area, which is lacking. No anchor oar or boat dateable from Roman times has yet been found in the area.

One might add that Mr. Simmons questions, from the evidence produced by field walking, whether the commonly held belief that the fens were the granary of Roman Britain, and the Car Dyke a means of supplying the North with grain from the fens, is correct. His belief is that it was more probable that the fens in this area were used for grazing cattle, which could walk to market.

The Car Dyke Research Group, whose headquarters are at Steynings Lane Swineshead, near Boston, is engaged on practical investigations to determine the exact course date and purpose of the Car Dyke and would welcome recruits.

While the whole question is still open, I feel myself that on the present evidence there are good reasons for questioning the description of at least this section of the Car Dyke as a Roman Canal. Roman – almost certainly – a canal – probably not, more likely a catchwater drain.

Claverton Pumping Station

BY C. P. WEAVER

The Kennet & Avon Canal was constructed to form a waterway linking the Thames at Reading with the West of England at Bath on the River Avon. It was opened throughout in November 1810. The navigation is divided naturally into three parts:–

1. *The River Kennet Navigation* from High Bridge, Reading, to Newbury Wharf, a distance of 18½ miles with a rise of 135ft through twenty-one locks.
2. *The Canal* from Newbury to Bath, a distance of 57 miles. In the 16½ miles from Newbury to Crofton Top Lock the canal rises 204 ft. through 31 locks to its short summit level at an altitude of 452 ft. It then descends to the River Avon at Bath, a drop of 405 ft. through 48 locks in 40 miles.
3. *The River Avon Navigation* from Bath to Hanham, a distance of 11 miles dropping 30 ft. through six locks. The 30 ft. drop is an arbitrary figure and related to tides.

The most significant and important problem of supplying the canal with water had faced John Rennie right from the start, for not only did the route chosen run through geologically difficult country with few natural sources of water but later decisions were to make the canal more or less entirely dependant upon mechanical means of achieving this supply and these, although possessing longevity, can also prove highly unreliable.

The original intention was to carry the summit level through a tunnel of some 2½ miles in length from Wolf Hall Bottom to Brimslade House. This would have produced a level some 18 miles in length, which besides dispensing with ten locks would have ensured an adequate supply of water without recourse to pumping. Why this decision was never implemented is difficult to understand. A 2½ mile

tunnel bored through chalk would have presented no greater problem to construct than the 3817 yards long Sapperton Tunnel on the Thames & Severn Canal, which was opened in 1789. Both would have been of similar cross-section, and Sapperton had been bored through equally difficult oolitic measures which had been a great source of trouble.

However, on 18 July 1794 the Committee unanimously agreed, on the advice of Rennie and Jessop[1], to pass the head level by adopting steam engines in preference to a tunnel, and a subsequent Act[2] authorized the deviation and abstraction of sufficient water to work the shortened summit. The Act also stipulated that: (1) 'No steam engine or engines were to be erected within two miles of the Earl of Ailesbury's residence at Tottenham House, unless they were designed to consume their own smoke' and also that firing of boilers was always to be carried out in such a manner that no nuisance would be created, and that if smoke were caused and a complaint lodged by the owners of Tottenham House within 30 days, then the fireman concerned was to be discharged and never again employed by the Company. (2) Waste weirs fixed on the summit were to be so adjusted that equal quantities of water flowed east and west.

Coincident with the difficulties encountered in constructing the summit level, the company were faced with their equal along the nine mile level between Bradford and Bath. Here again the line chosen was bristling with engineering and geological pitfalls. It may have been the terms of the original Act[3] relating to mill owners' rights that deterred the company from canalizing the Avon above Bath, choosing instead to cut the canal through unstable material, terraced into the hillside and faced with massive aqueducts to cross and recross the river. The Act stipulated that: 'No water was to be taken from the River Avon, or any streams, springs or water courses running into it unless the Company should at their own expense improve the construction of the mills so that they performed as much work and be as useful in every respect as they were previous to the passing of the Act.'

By September 1804[4] the locks at Bath were nearing completion and, rather belatedly, it was realized that water supplies from the feeders then in use – Somerham Brook at Seend and lockage water from the Wilts & Berks. and Somerset Coal Canals – would be insufficient to meet lockage requirements. Four sources to augment supplies were then considered:–

(a) A reservoir at Bromham Common to supply 2278 locks at a cost of £4650.
(b) A reservoir at Rowde to supply 3276 locks at a cost of £13,269, Bromham and Rowde lying in a valley to the north of Devizes.
(c) Drainage from the Duke of Somerset's mill at Semington at a cost of £6215 5s. 8d. the extent of supply not being stated, and
(d) Claverton Mill, which was thought to be capable of supplying double the quantity of the above reservoirs without using the whole potential of the river. The cost was estimated to be £2500 plus compensation paid to mill owners – a conservative figure which was to be exceeded many times over before any water was raised from the Avon.

The decision to pursue the last-mentioned project was taken at a committee meeting held on 25 September 1804, but a year had passed before it was learned that the mill was not for sale[5]. Negotiations continued, and on 29 October 1805[6] the site on which the mill stood was leased from Allen Tucker Esq. for 99 years at a rent of £37 16s. per annum backdated to Michaelmas 1802. In April 1806[7] mill owners between Claverton and Bath were notified that the company intended to abstract water from the River Avon and Rennie[8] was requested to furnish an estimate of the cost for pumping sufficient water at Claverton to supply Bath

locks, and to circulate it to all interested parties, e.g.: Wilts. & Berks. and Somerset Coal Canal Cos., Bath River Co., etc.

Progress was somewhat slow due to lengthy delays in settling the vexed question of water rights and so it was December 1809[9] before an agreement had been made with Patrick O'Brien to supply masonry for the new building at 23s. per cubic yard. Demolition of the old mill and construction of the new building must have proceeded fairly rapidly, for the wheelhouse was ready to receive the wheel by early March 1810, and on the 27th of that month[10] the committee sanctioned payment of Rennie's Bill for £131 17 1 'for the Wheel at Claverton Mill'.

On 2 July 1810[11] John Thomas, the canal company's Superintendent of Works, reported that 'he hoped the works near Bath were complete as a great deal of care had been expended on that part of the canal', but doubts were expressed on the advisability of opening the locks during the dry season then prevailing before Claverton was completed and on 17 July[12] the following bye-law was proposed and adopted:—

'That from and after this day until the Pump now erecting at Claverton Mill for throwing up water into the canal shall be completed and shall have been brought into work, no boat, barge or other vessel shall pass or re-pass from the level of the Kennet & Avon Canal which lies between Bradford and Bath into the River Avon at or near Bath unless the level of the water in the said level of canal shall stand at a depth of 5 ft., such depth to be marked by painted figures affixed on a gauge at the head of the uppermost lock in the parish of Lyncomb or Widcomb.'

Some idea of the necessity for building Claverton, and a brief description of the layout, can be gained from one of Rennie's letters written in December 1810[13] the relevant paragraph of which is reproduced hereunder:

> 'It being expected that a Considerable Trade will come from Trowbridge, Bradford and the Somerset Coal Canal to Bath and into the Avon, there will be many Barges pass along this part of the Canal and therefore a considerable supply of water is wanted in this district of the Canal not only to supply this Local Trade but the waste that may be expected to arise along a Five Mile Level and therefore the Company are erecting two powerful [*sic*] Water Engines on the Site of a Mill which they have purchased at Claverton to raise Water out of the R. Avon for the supply of this Level and which they have power to do by their Agreements with the Millowners between thence and Bath. This will be done by two large Water Wheels of 18 feet diar each and 25 feet wide in the Floats, each Wheel to work two pumps which will force up the Water into the Canal at a height of about 45 feet above the level of the River.'

It seems reasonable to assume that when Rennie referred to a 'Five Mile Level' he had in mind the difficulties being experienced in getting the canal watertight between Avoncliffe and Claverton. The reference to 'two powerfull Water Engines' has led to the supposition that two separate pumping stations were built. However, this can be discounted because nowhere in the canal records does any reference – scanty as this is – bear this out, moreover none of the relevant maps show anything but a single mill and attendant outbuildings.

Thomas Thorpe's map of 1742 – 'An actual survey of the City of Bath . . . . . and of five miles round' – shows a single mill at Claverton together with two other buildings, possibly a store house and the miller's living quarters. The 1817 1 in. O.S. map shows only one group of buildings, as does the 1884 6 in. O.S. map, likewise the deposited plans of the GWR Bathampton to Bradford branch and the Kennet & Avon Canal.

The reference to Water Wheels and Pumps conveys in a few words basically what we see today. The pumping machinery at Claverton resembled closely an installation designed and constructed by Rennie in 1804[14] to drain the Bampfylde Copper Mine near North Molton, in Devon. There the overshot waterwheel was 51 ft. diameter by approximately 9 ft. wide; an immense cast iron gearwheel composed of twenty segments was fitted on the periphery with buckets 4 ft. wide on either side. This ring gear drove a two-throw crankshaft by means of a large spur gear having wooden teeth. The crankshaft was coupled to the two pumps by connecting rods and beams as at Claverton, water being raised from 44 fathoms in two lifts.

The buildings at Claverton were finished by October 1810[15] and the millwrights awaiting delivery of the machinery which was being made in Rennie's London workshops, completion no doubt being hindered by the reorganization then taking place at Blackfriars. Little progress was made during the next year in September 1811[16] Rennie was paid £1000 on account for his work and asked by the clerk of the company to explain the large increase in the cost of machinery and buildings over his original estimate. In the same month an inspection of the unfinished plant was carried out by the committee, travelling thence by boat. However, by June 1812 construction must have reached an advanced stage as it was minuted that iron pipes priced at £13 10*s* per ton from Fox & Co.'s Neath Abbey Ironworks would be delivered at Bristol 'These being soon required[17].' The pipes and pressure vessel would have been among the last items required to complete the installation.

In September 1812 Rennie was paid £1227 1s. 10d.[18], the balance of his account for the machinery, and a final payment of £209 9s. 3d. made to Fox & Co. Despite what must have been an auspicious occasion, no mention is made in the records of when pumping actually began and one is left to guess when this took place. The plant was not finished in December 1812[19], but on 12 March 1813, in the Western District expense account, John Brown[20], classed as a timekeeper at Claverton Mill, was to be paid a salary of £54 12s. per annum, and from this it seems safe to assume that operations had started. In a report dated 21 July 1812[21] from the Committee of Management to the Company of Proprietors the expenditure on the 'Mill at Claverton for pumping water' was given as £6279 8s. 6d. Subsequent expenditure for one year ending 29 May 1813 was £783 8s. 8d. and for the year ending 29 May 1815 £86 16s. when an iron crane was installed. Strangely, no yearly expenditure on Claverton appears after 1815, although the cost of running the steam engines at Crofton was recorded in some detail.

The following is a short description of the pumping plant as it ran from 1813 to 1843:

The operating head of water was raised by two masonry overfall weirs across the River Avon at nearby Warleigh, the longer of the two spanning the main channel. The old weirs built to serve the needs of the original grist mill were rebuilt by Rennie and the leat re-aligned and deepened.

The two large breast-shot waterwheels were set side by side on a massive, square-section cast iron shaft supported at its extremities only in gun-metal bearings. The framework of the wheels consisted of six separate cast iron rings each with eight spokes and a square bore hub. The rings were cast in two sections for ease of assembly, being clamped together on the shaft by bolts. Timber was used for the 48 radial floats, seal boards and float supports, the last being mortised into holes cast in the periphery of the rings. An internal system of cast iron stays was provided, hopefully, it is thought, to minimize the effects of sag on the bearings.

Water supply to each wheel was controlled by separate sets of Rennie's own design of radial depressing sluices, these being operated as one unit by a single windlass through a train of reduction gears. Another set of conventional sluice gear was provided across the leat upstream of the mill pool to permit servicing of wheels, breast gear and pump intake. Water supply to the pump footings was drawn direct from the mill pool, the suction main being protected by a filter. Normal slatted grids protected the wheels and breast gear from driftwood and other waterborne debris.

The wheelshaft was connected to the 'pit' or first motion wheel by a large diameter peg drive coupling, the clearance between the component parts of which reduced the effect of any distortion of the wheelshaft upon the bearings of the pit wheel.

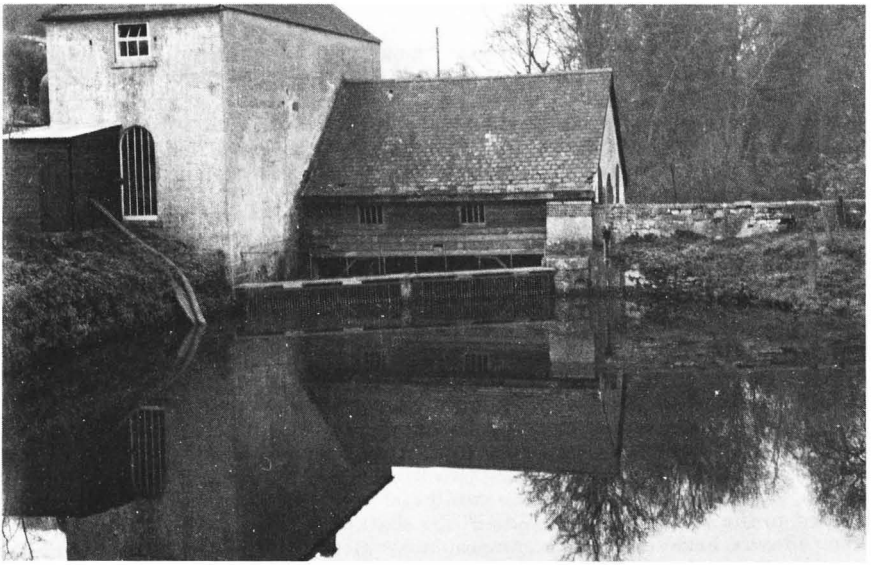
All the large components, e.g. pit wheel, flywheel, crankshaft, connecting rods and beams were made of cast iron, and bearings generally of gun-metal. The pit wheel was made from nine castings, hub and spokes in one piece and eight bolted-on segments. By adopting this method of construction Rennie reduced the possibility of cooling fractures common in large castings of this type. There were two rows of 24 inserted wooden teeth, preferably made from hornbeam or apple wood, alternate segments containing two rows of 25 or 26 teeth respectively. The supporting shaft was carried in gun-metal bearings, the square bore hub being secured to the square centre section of the shaft by wedges, sufficient clearance being allowed between the two components to permit centralization. A turning attachment for truing the wooden teeth was provided in the wheel pit.

The pit wheel engaged a 64 tooth follower cast in one piece and secured to the built-up two-throw crankshaft with wedges. The 2 ft. 3 in. throws were spaced at 180°. A 15 ft. diameter flywheel made in two sections and bolted together at the hub only was provided to ensure uniform rotation and minimize irregular loading of the wooden teeth.

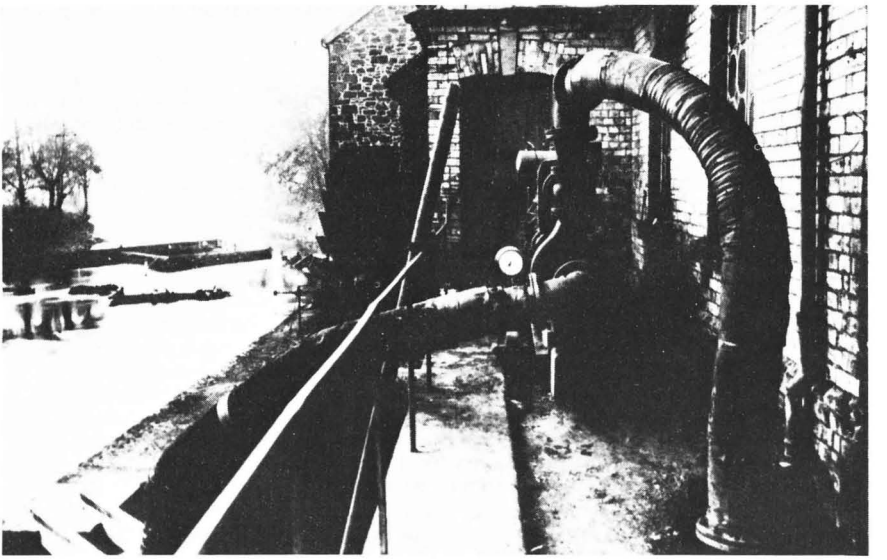
Reciprocating motion was transmitted by fluted connecting rods to two equally divided beams located in a room above the pump house. Parallel motion, fitted with ornamental stretchers to enhance its appearance, was fitted to the spear rods operating the pumps.

The two 19 in. diameter bucket pumps were situated in what amounts to an inspection pit for ease of access to the circular hanging, or butterfly, valves through the clack doors. Water was delivered to the canal through a siamesed rising main, a pressure vessel being located outside the building to provide damping.

That trouble was frequently experienced with the waterwheel assembly seems beyond doubt although little mention of it is recorded in the minute books. However, in September 1843[22] Thomas Blackwell reported that a considerable sum varying from £50 – £60 might be saved annually if 'the present objections to the water wheel were removed, for owing to its length it bowed between the bearings breaking the stays and loosening the machinery so that it was constantly under repair.' He suggested that 'by spending £130 in changing the trussing of the wheel from stays to tension rods it would be materially strengthened so that it could be lightened.' On 13 March 1844 he sought permission to carry these modifications into effect, this being agreed on 26 June. At the same time, as a result of favourable reports on the pump rebuilt by Messrs. Harvey at Crofton, it was decided to introduce the Harvey & West double-beat valves at Claverton[23], although the cost would be £300, this figure being increased to £310 by 16 July, alterations to the wheel being £120 and the fitting of new valves £190. Harvey's actual charge was £305[24].



"Claverton: General view showing temporary shed to house diesel pumping set."



"Newton, Montgomeryshire Canal 1925. Diesel pump installed c.1924. Draws water from Severn discharging it into pipe used by standby steam engine.

The modifications and repairs were carried out by Messrs. Harvey of Hayle during November and December 1844 and included making a new clack door piece for one of the pumps and supplying six 18 in. diameter patent valves together with holding-down screws, crossbars, wrought iron rods and caps, the last of these items being used in changing the trussing of the waterwheel. The parts were delivered by sea from Cornwall to Bristol by the Cornwall Steamer Co., travelling thence by canal to Claverton. Work was completed by the end of December, and preliminary tests indicated that a larger diameter rising main would be necessary to cope with an increased output. This requirement was carried into effect and pumping restarted early in 1845. However, success with the modified waterwheel was short-lived and Harvey's men under the superintendence of Thomas Bickle were again in attendance from 23 March to 9 April 1846. Edward Phillips, Josiah Bickle and Thomas Bickle came from Crofton and John Richards specially from Hayle. The inclusive charge of £21 10s. 9d. was moderate to say the least!

In March 1850 it was reported that the 'Water wheel was still a troublesome affair costing £80 or so annually for upkeep'. Another failure costing £130 to repair occurred in September 1853. Without doubt the original two-bearing wheel was approaching the end of its life and in March 1856 Blackwell reported on the delays occasioned by the continued postponement of renewal, referring back to the expensive repair of 1853. Sanction was then given to obtain the new castings and ironwork as and when opportunity occurred and distribute the expense over a period of 18 months[25]. In September 1857 Thomas Merriman, the principal Clerk, succeeded Blackwell as General Superintendent of Works.

A further breakdown with the old wheel took place in December 1857[26] and repairs were carried out, but no sooner was running started than it broke down again and although replacement parts were fitted Merriman reported that failure was still liable to occur. He stressed that the only course worth considering was to fit a centre bearing as this would be less expensive than constructing a new pair of wheels. He was asked to submit plans and an estimate in consultation with Mr. Bertram, Chief Engineer of the GWR. On 28 January 1858 these were ready and a month later had been accepted. Merriman was then requested to proceed with all haste, as the water supply situation then prevailing at Crofton was sufficient to ensure that the summit could make good any deficiency which might arise on the Bradford level during the stoppage at Claverton. Repairs together with 'new works to the wheel and waterworks' were completed by the end of May and were reported to be working satisfactorily. An ingenious method had been used to provide the centre bearing journal between the two wheels (i.e. the pedestal bearing). A large two-piece cast iron muff having a square bore and machined outer running surface was bolted around the main shaft, centralization and ultimate tightening being carried out by means of wedges. At the same time the internal tension trussing rods were removed and any fractured spoked rings replaced, the new parts having fillets added between successive spokes at hub level[27].

Minor breakdowns still took place from time to time but were not recorded in any great detail, thus in March 1877 'fracture to wheel[28]' necessitated a shut-down, but little delay was caused as repairs were quickly effected. Then, in June 1880, a claim was lodged against the canal company by canal carriers Messrs. Gerrish & Sainsbury in respect of a holdup due to low water consequent upon an 'accident to the pumping engine at Claverton.' The company denied any responsibility, pointing out that the breakdown was in no way due to neglect and that as pumping had recommenced there were no grounds for the claim. Another 'accident' to the engine occurred in October 1883[29] and this time a circular was sent to all traders requesting that during the stoppage boats should be passed

through the locks in pairs. It also noted that the request had not received adequate attention from Messrs. Gerrish & Co. and other traders. Extensive repairs to the engine were carried out in 1914 between 15 January and 6 March and from 1 to 7 May[30]. Another shut down took place from November 5 to 8, due to trouble with the foundations of the centre pedestal bearing. The station log book fortunately has survived and has enabled us to get details of day to day running up to 13 November 1952 when a number of teeth on the pit wheel failed. No repairs were carried out owing to the uncertain future of the canal, but a 27hp diesel-driven 6 in. centrifugal pump was installed, capable of delivering 1000gpm to maintain a minimum statutory level of water in the canal.

It is interesting to note that the 'pillow blocks' carrying the fulcrum bearings of the two beams are supported on rivetted wrought iron girders the finish of which is indicative of railway practice. No specific mention is made in the records of any change from wood to metal, but it seems reasonable to assume that this was done when the modifications to the waterwheel were carried out under GWR supervision in 1858.

In a mechanical contrivance such as we have at Claverton deterioration is more rapid when idle than when in use, especially so where timber is concerned, e.g. external weatherboarding, woodwork on waterwheels, breast gear, etc., and it was felt that the longer repairs were delayed the bigger the job would be to get the plant running again. No action seemed to be forthcoming from the British Transport Commission, understandably perhaps with the canal's future in the melting pot.

Early in 1957 the question of restoration was raised by the writer with the Kennet & Avon Canal Association and an offer made to undertake the work necessary with the assistance of a small band of craftsmen from the Midlands, and to this end an approximate estimate of the cost was made and sample wooden teeth produced, bearing in mind that at that time only a small proportion of the timber on the waterwheels and breast gear needed replacing together with some eighty teeth on the pit wheel. This information was included in the Memorandum of Evidence submitted by the Association to the Bowes Committee of Enquiry on Inland Waterways. However nothing transpired for at that time the BTC's policy was not in favour of the general public becoming involved in renovations of this nature.

There the matter lay until 1966–7 when the question of restoration was again raised, this time with the newly-formed Kennet & Avon Canal Trust who, whilst being in favour of the project, were actively engaged in problems dealing with the restitution of the canal as a whole, added to which was the major task of getting Crofton Pumping Station back in steam, and it was felt that once Crofton was completed attention could be directed towards Claverton.

In 1968 a feasibility study was carried out by students from Bath University and the initial stages of restoration commenced in January 1969. As work gathered momentum additional assistance was provided by Trust working parties and later by Trust volunteers. Details of the work found necessary to get the plant running after a period of some 17 years' enforced idleness are listed below together with the labour force responsible:

a) *Bath University Students*

Necessary structural repairs to main building and wheel house.
Removal of floor, stairs, etc.
Removal of old wooden teeth from pit wheel.
Removal of old float supports, paddle and seal boards from waterwheels.

Removal of old sluices.
Construction of concrete bed and guides, etc., for new sluices.
A proportion of new float supports fitted to wheels.

b) *Student/Trust working parties, later Trust volunteers*

Repainting all metal work.
Complete fitting of new float supports to wheels.
Fitting new paddle and seal boards.
Completing new sluices (major part done by students).
Fitting metal sheath.
Re-alignment of waterwheel assembly.
Fitting and profiling new wooden teeth on pit wheel.
Attention to bearings and Watt's linkage.
Freeing and repacking pistons and glands.
Polishing bores of pumps.
Complete rebuild of upstream isolating sluices; this included building a temporary dam across the leat.

Restoration was complete and the plant fully operational by Summer 1976, coinciding with the reopening of Bath locks. The official opening was on 1 July 1978, to which the general public were admitted. The pumping station is still owned by British Waterways Board but is *operated only* by the Trust under a licence agreement, the Trust being responsible for maintenance of machinery to an acceptable standard of safety.

NOTES

1. The pattern used when casting the half-sections of the spoked rings for building up the waterwheel framework and also that for the centre bearing pedestal have survived and are in safe keeping at Claverton. Their difference in age can readily be seen from an examination of the wood, and the older of the two, that of the spoked ring, is interesting because one can see where successive modifications were found necessary to cure weaknesses in the original. Considering the age – pedestal: 121 years; spoked ring: 170 years – their condition is remarkably good, although remedial action has had to be taken to brace the latter owing to its inherent flexibility.

2. *Work performed by the 'Water Engine'.* Theoretically, with the wheel revolving at 5 rpm 98,738 gallons of water per hour will be delivered into the canal. However, assuming a pump efficiency of 77%, the actual delivery would be 77,000 gph, which is the figure given in the GWR test.

Data:	*Pump diameter:*	$18\frac{3}{8}$ in (Measured by Trust)
	Stroke:	4ft 6 in
	Gear ratio:	204:64 = 3.1875:1
	Head of water:	48.16ft (Measured by Trust)

Under the conditions given, 77,000 gph represents 18.73 net h.p., giving an estimated wheel h.p. of 27.

3. Several canal companies used waterwheel driven pumps to obtain supplies of water drawn from a nearby river, these being commonly referred to as 'water engines'. Design was simple and except in three known examples no buildings were constructed to house the machinery, and none approached Claverton for mechanical completeness, longevity or documentation.

a) *Glamorgan Canal. Waterwheel driven pumps situated at Melingriffith near Whitchurch, Cardiff*

The 'water engine' was erected in the open in a masonry-lined channel or 'ditch' downstream of the tailrace emerging from the waterwheel which supplied power

to the Melingriffith Tin Plate Works (now demolished), water being drawn from the nearby River Taff along a feeder. A proportion of the 'used' water was pumped back into the River Taff canal feeder, i.e. between Locks 43 and 44, a lift of some 12ft.

It would seem that some form of 'water engine' was working on the site before Rennie was appointed in May 1805 to represent the canal company in a dispute over water supplies, and that it was rebuilt between 1805 and 1807 on Rennie's recommendation, this being less costly than the £700 agreed for erecting a new 'fire engine'.

The 18ft 6in diameter, 12 ft 6in wide undershot waterwheel is of composite construction, i.e. of wood and cast iron, and has radial paddles. The overhung two-throw crankshaft – closely resembling the more modern return crank arrangement seen in steam locomotives – is carried directly on an extension of the wooden water shaft, reciprocating motion to operate the two 30in diameter bucket pumps being transmitted by conventional connecting rods and beams, dragging chains and rods lifting the pistons. The pistons return by gravity, the normal rigid spear rods and parallel motion being dispensed with.

Timber featured largely in the construction, i.e. for the water shaft, paddles and supports, main framework of the structure, beams, connecting rods and launder. Cast of wrought iron was used for the wheel framework, fulcrums, crankshaft, pump cylinders, dragging chains, etc.

The working life is known to have exceeded 115 years as a photograph taken in 1924 shows the pump in working order with maintenance workbench equipped with a blacksmith's vise standing nearby. A scale model of the pump made by Mr. R. L. Aston of Coventry can be seen in the Department of Industry, National Museum of Wales, Cardiff. The remains of the old 'water engine' happily are scheduled for preservation on site.

Further research is being undertaken to unravel the early history in an attempt to discover who was responsible for designing and erecting the first water engine and the dates applicable to commencement of working and final shutdown.

b) *Montgomery Canal, Western Branch*

Newtown Basin and summit level to Rock Lock and the two levels below it, i.e. Rock-Dolfer and Dolfer-Freestone, were supplied with water lifted from the River Severn by two sets of pumps, one driven by a waterwheel, the other by an 8hp steam engine used as a standby, i.e. in dry seasons or when the quantity of water raised by the 'water engine' was insufficient to meet lockage requirements or normal wastage from the canal.

Designed by George W. Buck, engineer to the Eastern Branch, in 1821, the 'water engine' was erected at a cost of £1812 6s. The 22ft diameter composite construction undershot waterwheel had radial paddles. An extension of the water shaft was coupled to a two-throw crankshaft and beam mechanism which operated two bucket pumps lifting 80 locks of water in 24 hours from the River Severn into the canal, the difference in level being 9ft.

The working head of water was raised by a timber weir constructed across the river a short distance upstream of the pumping plant. A second weir some 3ft lower was positioned downstream of the main one thus providing a fish ladder. Water was led along a timber walled leat to the wheel which was in the open, separate brick buildings housing the waterwheel driven pumps, standby steam plant and coal store. Water flow to the wheel was controlled by normal sluice gear placed across the leat where it joined the weir, the pump intakes drawing water from the leat upstream of the wheel.

The original steam plant with its reciprocating pumps was subsequently replaced by a horizontal single-cylinder mill engine driving a submerged impellor pump through bevel gearing, steam being supplied by a single Cornish boiler.

The waterwheel was in general use up to 1924 when a diesel pumping set was installed rendering both water and steam engines redundant, these being finally scrapped and removed in the early years of World War II. The timber weirs were seriously damaged in the great flood of 1929, further deterioration by water and human hands completing the demolition by the mid-1930s. Remains of the weirs and leat could still be seen by those who knew where to look as late as 1968.

The canal was formally abandoned in 1944 and in order to provide an adequate supply of water to meet statutory requirements on the levels above Penarth feeder two portable diesel driven pumping sets made by Ruston & Sykes were installed, one in 1944, the second in 1947. Pumping ceased soon after nationalization in 1948, an economic necessity for there was but one customer – a creamery – drawing a supply of water from the canal.

The tall elegant smoke stack together with the engine/boiler house and coal store were demolished in October 1972 and in April 1973 the length of canal from Newtown Basin to the head of Freestone Lock was formally conveyed to the Mid-Wales Newtown Development Corporation by British Waterways, and subsequently handed over to the Severn-Trent water authority in April 1974.

Newtown Basin has been filled in and the bed of the canal used to carry the main sewer to a new Disposal Works, built on the site of the original one a distance of 1½ miles downstream from the basin.

c) *Carlisle Canal*

The Carlisle Canal, opened 12 March 1823, was 11¼ miles long running from Fisher's Cross (Port Carlisle) on the Solway Firth to a basin in Carlisle. There were eight locks 18ft 3in wide and 78ft long. Initially water was supplied to the summit by a single reservoir. In April 1824 it was decided to build a waterwheel driven pump lifting water 56ft from a feeder off the River Eden at Davidson's Bank near Carlisle. The 'water works' were finished in March 1827. It is assumed that the machinery was housed in a building as a proposal minuted in January 1832 referred to the construction of an additional storey over the waterwheel. In April 1834 it was again decided to obtain improved supplies by erecting a new waterwheel and pumps. These were designed and built by William Fairbairn at a cost of £1391 and started work in 1835. A year later it was found that the pumps were less efficient than Fairbairn had said and Ralph Coulthard of Gateshead was called in to advise on a suitable steam engine and pump to assist the waterwheel. In March 1837 a tender by William and Thomas Murray to build the engine for £1546 was accepted. The tender, however, fell through when Murray refused to build to Coulthard's specification. A deputation was then sent to Cornwall to visit the foundries at Hayle and Truro, and arising out of this a Cornish engine was supplied by Messrs. Harvey of Hayle at a cost of £3700. Known as the *Eden* engine it had a 60in cylinder with unequal beam (10ft x 8ft) and was designed by William West. It was one of a pair of engines made for the de Dunstanville Mines (Camborne) in 1838, only the first of which was erected there. A noteworthy feature was the 45in diameter pump, the largest then in use in Britain. Harvey's tender for the engine house, well and connecting tunnel to the River Eden was also accepted and William West was engaged to superintend erection. Pumping commenced in November 1839 when two enginemen were engaged. However, in August 1843 it was decided that the engine was costing too much to run and so one engineman was dismissed and the decision taken to use the 'water engine' whenever possible and only to work the steam engine when necessary to fill the reservoir.

In January 1853 the pumping engine and machinery were advertised for sale, and the canal closed on 1 August.

d) *Arun Canal*

The upper part of the Arun Canal, built to extend the River Arun Navigation from Pallingham to Newbridge, was opened in August 1787. There were three locks, the uppermost being at Orfold where the short canal crossed the River Arun on an aqueduct. Upstream of the aqueduct a weir was constructed in order to provide a head of water to work a waterwheel driven pump lifting water from the river into the canal above Orfold Lock. Examination of the remains of the pit where the waterwheel was erected suggests that no buildings were erected to house the machinery, which was erected in 1786–7. The working life would have been short for adequate supplies of water would have become available once the Wey & Arun Canal was opened in September 1816. It is hoped that continuing research may yield further details of the 'water engine'.

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Heights and distances have been taken from:–

a) Stanford's Hydrographical Survey (1848)
b) 1in and 6in Ordnance Survey Maps
c) Bradshaw's *Canals and Navigable Rivers* (1904 edition)

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Manchester Ramblers' Rail Excursions

BY ALLAN BRACKENBURY

After closure to regular passenger traffic, many stations continued in occasional use by excursions for holidaymakers, fishermen, etc. Often these special trains were advertised only locally, so that their existence and their cessation would be known to relatively few people. There is ample scope in this sphere for historians to perform some detective work to establish the extent of this facility: it is not my intention to take a significant part in this exploration, but the purpose of this brief article is to provide information which may be of use to others.

Recently through the courtesy of an official of the Manchester Area of the Ramblers' Association I was able to obtain details of the postwar ramblers' excursions run by BR from Manchester and these included regular and occasional visits to some lines whose normal passenger service had ceased. These special

trains had established themselves in the 1930s; they did not run during the war years but on their resumption in 1949 soon regained their former popularity. They ran on Sundays at approximately fortnightly intervals, although over the years they became less frequent during winter months. Favourite destinations were Llangollen, Ilkley, Ashbourne, Grassington, Ingleton and Horton-in-Ribblesdale, all places not normally accessible from Manchester by Sunday service trains at times allowing a day's walk. In the early 1960s, with complete closure of several branches, the destinations of these excursions became less varied and gradually the number of special trains lessened, ramblers' 'excursions' using normal service trains to closer stations instead. The last ramblers' special train from Manchester ran on 6 Aug 1967, to Skipton.

Use of lines and stations not normally open to passengers is given in clockwise order:—

BLACKBURN–HELLIFIELD. The local service was withdrawn on 10 Sept 1962, when the five remaining intermediate stations closed. The line remains open to goods traffic and has seen intermittent use by express passenger trains. Ramblers' specials took this route to destinations further north, but did not call at any of the intermediate stations after their closure.

CLAPHAM–LOW GILL. This line closed to passengers on 1 Feb 1954 but remained open to goods traffic for a further ten years, and was latterly available for diversions until taken out of use on 26 July 1966. The cessation of the normal passenger service made no difference to the frequency of the ramblers' excursions, which continued twice-yearly on average until the final train to Ingleton on 20 Sept 1964. Occasional excursions were extended to Kirkby Lonsdale and Barbon, the last of these from Manchester running to Kirkby Lonsdale on 24 July 1960. (But other excursions used this line also; a ramblers' special from North East Lancashire ran through to Tebay on 26 Aug 1962, calling at all three stations plus Sedbergh; and a Sedbergh school train ran on 17 Sept 1964.)

GRASSINGTON & THRESHFIELD. The passenger service on this branch ceased as long ago as 22 Sept 1930, but goods traffic to the terminus continued until 11 Aug 1969 and the line is still in use as far as Swinden Lime Works. Postwar there was usually one ramblers' special a year (occasionally two) from Manchester to Grassington, until 26 March 1967. On this date a similar excursion ran from Leeds and the two trains combined at Skipton to run on the branch as one train. I think it unlikely that the intermediate station of Rylstone was ever used by any of these excursions. (In the following year on 14 April 1968 a ramblers' special ran from Leeds to Grassington but there was none from Manchester.)

UNSTONE station closed 29 Oct 1951 was used on 22 Sept 1957 by a ramblers' excursion along the Hope Valley to Chesterfield.

CHINLEY–MATLOCK. This line lost its passenger service on 1 July 1968, all intermediate stations having previously closed. None of these closed stations was reopened specially for the benefit of Manchester ramblers, but Monsal Dale (closed 10 Aug 1959) was used occasionally by ramblers from the East Midlands until 3 April 1961 at least.

BUXTON-ASHBOURNE-ROCESTER. The regular passenger service on this line was withdrawn on 1 Nov 1954, but BR promised to reinstate the trains temporarily if the nearby roads became blocked with snow, so the line saw occasional local trains in winter. Goods closure has been in stages from 7 Oct 1963, the portion north of Dowlow remaining in use today. Ramblers' excursions from Manchester took the spur avoiding Buxton station: they were invariably

packed to capacity and were hauled by two 2–6–4T locomotives. Each year until 1959 they ran on two or three dates; only one ran in 1960 and in 1961, but there were two in the final year, 1962. Sometimes it was necessary to provide two trains to cater for the demand, which was greatest at the time of the annual Well Dressing at Tissington. Usually there would be ramblers' and sightseers' excursions from other places on the same day, so that well over a thousand people would descend on the Derbyshire countryside at once. As late as 1961 there were seven excursions to the line on Well Dressing Sunday, 14 May.

As the best scenery lay between Parsley Hay and Ashbourne, trains from Manchester generally ran express to Hartington, then called at all stations to Ashbourne, where they terminated. On the return journey they also stopped at Hindlow for the engines to take on water and sometimes this halt was advertised. When required trains would stop at Parsley Hay and even Hurdlow (which closed 15 Aug 1949) was used occasionally in the earlier years. The train on 28 Aug 1955 continued to Rocester, stopping at the two stations south of Ashbourne. (These stations did have other occasional trains such as an excursion to Blackpool on 24 Sept 1960.)

1960 was the last year that Alsop-en-le-Dale station was open, but all others between Parsley Hay and Ashbourne (inclusive) were used by the last train from Manchester on 5 Aug 1962: ramblers' excursions from Stoke and Nottingham ran on the same day. In 1963 an intended ramblers' special from Manchester on 18 Aug was cancelled. Four trains ran on Well Dressing Sunday 26 May, and these were the last passenger trains (apart from railtours north of Hartington) to use the line. One started from Manchester but it was an ordinary excursion without special facilities for ramblers. The other trains came from Hinckley, Alsager and North East Lancashire: for these final excursions the only stations used were Hartington, Tissington and Ashbourne.

NORTH RODE–LEEK–UTTOXETER. The through passenger service was withdrawn on 7 Nov 1960, but a meagre service south of Leek lingered on until 4 Jan 1965. North of Leek the line closed completely on 15 June 1964. Ramblers' excursions from Manchester ran on this line once or twice a year, once using the rolling stock of *The Pines Express*, complete with nameboards. After 1960 only one ramblers' train, on 23 July 1961, used the line (there should have been others but they were cancelled) and it did not call at the closed stations north of Leek. (A few other trains used this stretch of line, without stopping, a Manchester–Alton Towers excursion on 19 Aug 1962, for example.) The final ramblers' excursion from Manchester to this line ran on 28 June 1964. Due to the complete closure north of Leek, this train was routed via Stoke and Uttoxeter, and terminated at Leek.

Since 1967 there has been just one special train for ramblers from Manchester, on 15 Aug 1976, to the Settle–Carlisle line, and this called at several stations normally closed. Ramblers' excursions are thriving in other parts of the country, so there is still a chance of their restoration on a regular basis in Manchester, although the scope for visiting stations normally closed is now extremely limited.

If any reader can add to the information in this article, I shall be pleased to hear from him.

Correspondence

The Society: The First Twenty-five years

Sir, – Raymond Cook's account in the July *Journal* of the Society's early years provides a most interesting summary of varied activities. I am sure many readers will have looked back with great pleasure on their part in some memorable events.

With the approaching celebrations of the Liverpool & Manchester Railway's 150th anniversary, may I add that the Society drew up some quite elaborate plans to mark the 125th year in 1955. Unfortunately they did not receive the support that might have been expected, but the historical notes I was asked to prepare for the occasion developed into the short history of the Liverpool & Manchester which became the first Society publication in 1955. The date given by Mr. Cook, 1965, is that of the second and amended edition. Before this, in 1963, came the second publication, *Closed Passenger Lines in Scotland* by M. D. Greville and J. G. Spence and *How Ffestiniog got its Railway* came third.

Perhaps mention might have been made of the Society's first meeting, held in London on 15 January 1955 when the late H. A. Vallance spoke about the London & Greenwich Railway. These London meetings were held each January for a number of years; Mr. Michael Robbins arranged for us to meet in the library at 55 Broadway and this became a highlight of our annual events. Mr. Robbins was one of our first members and one is delighted to find him contributing to the July *Journal.*

May I make a small correction to the list of events recalled on page 46. The 1961 canal cruise celebrating the bi-centenary of the Bridgewater Canal was made from Castlefield to Worsley on 2 September, this being the original part of the canal. The cruise which included the Anderton Lift and part of the Trent & Mersey Canal took place some four months earlier and was based on Chester, being part of the 1961 Annual General Meeting weekend. The Birmingham Canal Navigation cruise mentioned was, I think, in 1958 and not 1957. On this occasion we passed through the Netherton tunnel and took the 'old main line' into Birmingham on board the *Lady Hatherton.* GEOFFREY O. HOLT

Canal Travel

Sir, – The most interesting article on the subject of the extent of passenger travel on canals, contributed to the July *Journal* by Mr. Harry Hanson, reminds me that I came across a reference to this in *The Old Curiousity Shop* some time ago. Here Charles Dickens describes such a boat journey by Nell and her Grandfather in Chapter XLIII and one may wonder whether the novelist, who touched on many forms of transport in his works, actually based the account on some experience of his own.

It may also be recalled that the Royal Military Depot at Weedon owed its central situation to the Grand Junction Canal on which troops as well as military stores were carried. Charles Hadfield in *The Canals of the East Midlands* mentions that, in August 1824, a convoy of twenty-eight boats passed through Nuneaton with troops from Ireland. GEOFFREY O. HOLT

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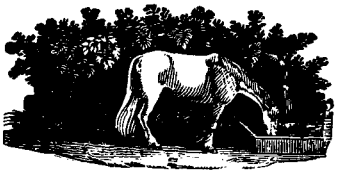

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