



THE TREVITHICK SOCIETY

KOWETHAS TREVITHICK
NEWSLETTER 176 SUMMER 2017



I.K. Brunel enjoys the National Trust's *Trevithick Tuesday* aboard the Puffing Devil!!

Reg. Charity
No. 1,159,639

CHAIRMAN'S PIECE

WHERE WOZ WE THEN?

By the time this edition of the Newsletter hits your door mat, the uncertain and unpredictable spring will have doubtless turned into an equally uncertain and unpredictable summer, and the memories of yet another successful AGM weekend will have started to fade. Before it does however, I would like to express my grateful thanks and appreciation to all those responsible for making it such an enjoyable, entertaining and informative series of events.

The AGM itself ostensibly marks the end of one Society year and the beginning of the next. It is not a lengthy meeting, but is however, of great importance, as it is the one meeting in the year where (constitutionally) many important decisions concerning the future of the Society have to be made. It is consequently a source of some surprise to me that these AGM meetings are not better attended; this last one, for example, was attended by only 23 members made up almost exclusively of 8 members of Council and the Society's loyal diaspora.

It may reasonably be argued of course, that - "this is the way of things now" - but despite the advent of electronic communications and the website your Society is still a "hands on" people-based entity, and as such, it will, I feel, struggle to flourish if its membership fails to interact and engage with it on that level.

It is therefore with that thought very much in mind that I repeat (and make no apology for doing so), the invitation I made last year, for those members who are more locally based to consider whether they could play a more active part, not only in the day to day running of the Society but also in shaping and developing it for the future.

Brian Jones

Last newsletter (No. 175)

Many members received their last newsletter very late. We can only apologise on behalf of the Royal Mail who must have "lost" a bundle as they took three weeks to deliver.

Next year's AGM weekend will return to West Cornwall.

The dates are 11th – 13th May 2018.

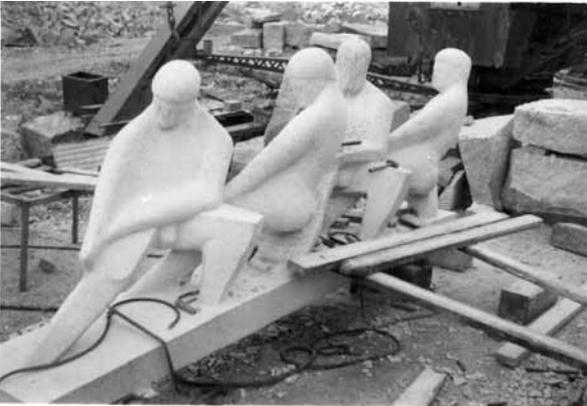
Copy date for next newsletter:

September 30th 2017



Established 1935

TEAMWORK WITH ITCHY FEET



In 1958, my late father-in-law, Denys Bryant, was made aware of a sculpture being carved at Palestine quarry, Treverva, near Penryn, which was thought to then be the largest monolithic granite sculpture since the days of the Pharaohs. The sculptor, David Wynne, spent over a year carving this granite monument, so Denys was able to visit the quarry and took some photos of it.

Some while after, Denys saw a picture in The West Briton, of the monument on a Pickford's loader turning the corner at the bottom of Lemon Street, Truro, with great difficulty. The load was described as a monolith depicting four men pulling a rope, representing Teamwork, which was the motto of Taylor-Woodrow Construction Ltd, whose Head Office was in London.



When Denys, and his family went to London on holiday in August 1971, he found the sculpture outside Taylor-Woodrow's Headquarters in Hangar Lane. He took some coloured photos of it. The girl in pink in the photo, is his elder daughter, Sonia, now my wife.

When Denys, Sonia and myself went to London on holiday in 2007, we drove along Hangar Lane, and were surprised not to find the sculpture.

On investigating further, we discovered that the office block had become a hotel, and that the sculpture had been moved elsewhere. For a while, it was in storage at the Company's office in Leighton Buzzard. We were told that it would eventually be erected on their site at Southall where houses were being built.

I recently mentioned this story to my sister-in-law, who lives in Wembley, and she and my brother, located the sculpture at Northolt, West London. They kindly took some photos for us. Thank you Penney and Robert.

CNF



AGM WEEKEND

Trevithick Society
2017 AGM Weekend, 12th – 14th May

The location for this year's AGM was the Tamar Valley, based in the historic stannary town of Tavistock. Although numbers attending were not high, there was a good deal of interest and amusement for those who did participate.

On the Friday afternoon we gathered at the excellent Tavistock Museum for a walk led by local historian, Rod Martin. We followed the curtilage of Tavistock Abbey in the town centre after which Robert Waterhouse began the first of several sessions on the Tavistock Canal. We followed it from the intake weir, through a number of gardens, down to the main town wharf. By this time the rain had become unrelenting and so we adjourned to the Museum which has excellent displays on local industrial history. In the evening Robert Waterhouse gave a fascinating and enthusiastic lecture



Tavistock Canal, North Portal



Engine House, East Crelake

on the canal's story, which attracted a large local audience. Robert, formerly the archaeologist at Morwellham, has been studying the canal for at least a decade. The results of his researches will be published by the Society in a substantial book this autumn.

Saturday morning dawned fine and began with a visit to the Robey Trust's Perseverance Works in Tavistock. Here members were greatly impressed by the collection of engines from Robey of Lincoln and the Trust's extremely well equipped workshops. The Trust has ambitious plans for the future and we wish them well. The afternoon saw us resume our canal walk at the Wharf and follow the canal through woodland country some three miles to the northern portal of the tunnel which takes the canal under Morwell Down. It took 14 years to drive. The engineering works on this small canal, which ceased work around the 1870s but still performs a useful function serving Morwellham hydro-electric power station were a revelation.



Robert Waterhouse gets stuck in



L&SWR Viaduct, Shilla Mill, seen from canal

On Saturday evening some 23 members attended the AGM, where Chairman, Brian Jones, continued a tradition of the brief despatch of business. The AGM unanimously ratified the proposed increases in subscriptions from 2018. A most convivial dinner followed at the Bedford Hotel. On Sunday morning Society members joined the Dartmoor Tinworking Research Group for a visit to Kit Hill; this concentrated on the efforts by the Duchy of Cornwall to recover wolfram during the First World War.

Graham Thorne

TREVITHICK DAY

The weather makes all the difference to a day out and Trevithick Day was sunny and bright. This then attracted large crowds and we had a bumper day on the Society tent. No doubt the launch of Rick Stewart's new book "Mine Pumping Engines in the Eighteenth Century Cornwall" helped to swell the coffers as we sold a considerable number many adorned with Rick's signature. The book is available from the Society chatline 1209 716811 or from k.rickard@talktalk.net. Member's price £16-00 including postage.

Many thanks to those who worked so hard to achieve record takings namely Lincoln James, Dave Mann, Phil Porter, Sheila and Peter Saunders, and Rick Stewart.

KJTR



LEVANT REPORT

The engine is running very well following the winter work carried out by John Woodward and the volunteers. John still has some less urgent work to do for us and he has been kept busy not only by us, but also at Mitchell's Engine at East Pool.

Visitor numbers have been very good especially over the Easter and half-term periods. We are getting many international visitors to the mine, and the spring period has always been popular for the Dutch and Germans. Because of the migration of Cornish miners when copper and tin prices slumped, we consequentially have visitors from Australia, USA and Canada amongst many others. They are always interested to learn where their ancestors worked and the difficulties they encountered.

The National Trust have held several 'Drop-in' meetings within the area to enable local residents to find out the work being done by the Trust all along the Tin Coast. Filming for the next Poldark series is due to start in September, but rumour has it that some of the coastal scenes will be filmed in Wales!

I have submitted an application for the Levant Whim to The Institute of Mechanical Engineers for a Heritage Award. As the committee for the Institute only meets every quarter, it may take some time for us to get the result. It is hoped to get international recognition for the Whim which could lead to funding for future projects, and increase our number of volunteers.

There is free admission to Levant for all Trevithick Society members, and we welcome anyone who is interested in helping us to drive or maintain the engine, or to act as guides. We are a very friendly group and full training is given. The challenges of maintaining a 177 year old working beam engine can be interesting! If you feel that you can help then please call Jo, Charlotte or Hylda on 01736 786156 during working hours.

Ron Flaxman

FALMOUTH DOCKS

The docks, the large vessels and tall cranes they accommodate at Falmouth, are a familiar sight to visitors and locals alike. Some members may remember we had a visit to the docks a few years ago. Sadly a recent mechanical failure befell the largest of the cranes which services the Queen Elizabeth dry dock so it is currently out of use. This dock is 850 feet long and 136 feet wide with a full water depth of 36 feet and can accommodate vessels of up to 85,000 tons. Building this huge dry dock began in August 1956 and required the removal of 228,000 cubic metres of spoil. The well known crane makers Stothert & Pitt of Bath were contracted by the then dock company Messrs Silley, Cox & Co, to supply a new crane the statistics of which make interesting reading. The jib at its smallest radius towers 247ft and the whole machine weighs 600 tons and runs on twenty four wheels on rails running the length of the dock on the west side. The machine can travel at 75 fpm and is electrically driven with the power being taken from an underground duct which has seals which automatically open and close as the crane moves along. It runs so quietly that it has a bell to warn of its approach. Its greatest reach is 175 feet which allows it to pick up twelve tons from the opposite side of the dock. It can lift sixty one tons but in normal use from a ship or on its own quay can lift forty eight tons at a radius of 105 feet. There are three quarters of a mile of steel rope to hold the jib and the largest is the size of a man's wrist. For the technically minded it has Ward Leonard hoist control with gear change to give variable speeds of up to 15 fpm on the main hook and 30 fpm on the auxiliary hook. It slews at 0.4 rpm and the jib can be luffed through the full range in 90 seconds.

Stothert & Pitt specialised in dock cranes and many of their products can be seen in ports across the world. They were also general engineers and pioneered the vibration roller for compaction in groundwork and on building sites. They



were in business from 1785 until 1989 when construction of machines ceased. The company name was taken over and they are now a consultancy company based in Bristol.

KJTR

AGM PROGRAMME NOTES

Members who would like a copy of the this year's AGM programme notes and who were not at the weekend gathering can obtain a copy by contacting the writer by email on k.rickard@talktalk.net or the Society Chatline – 01209 716811.

The cost will be £3-00 inc postage.

TAVISTOCK STEAM FAIR

The famous yellow tent was out again at Tavistock for the steam day organised by The Robey Trust. The event is held on the Wharf Car Park right in the town centre normally attracting very good crowds. This year however we had a monsoon during the morning. We were lucky we got the tent erected in the dry and were then able to watch others who were not so fortunate. The weather cleared at lunchtime and we did very good trade in the afternoon. We have been working up a market for second hand books which is proving very useful and so anyone with books to donate will be very welcome. You can contact with offers on the Society Chatline 01209 716811.

Thanks to Phil Porter and Stephen Docksey for standing under cover and drinking tea for the morning but serving customers later!

KJTR

ROYAL CORNWALL SHOW

This year we had a stand at the Royal Cornwall show. The weather was very wet for two days but fine on the middle day. Our stand was in a small tent, the Cornwall Heritage tent, alongside the Ramblers and Cornwall Heritage. Due to being on an isolated part of the show ground and having so few stalls there, we didn't receive many visitors. Those that did see us, were very interested in our leaflets and books. I had displayed leaflets from similar organisations and visitor attractions.

Next year there are plans afoot to have a large marquee nearer the centre of the show ground, with many more Cornish historical and cultural organisations. We are hoping to have a stall again next year.

Thanks go to new members, Nick Farrell and Rob Selly, together with Dave Crewes and Jill Orchard who helped me.

Tracy Elliott



BEAM ENGINES IN NORTH AMERICA XI: THE SIDE-WHEEL PADDLE STEAMER EUREKA

Although the use of beam engines in mining and industry was never as popular in North America as it was in Great Britain during the 19th century (preference being given to horizontal engines), there was one area of steam power employment where they were used in large numbers, and continued to be used well into the 20th century. These were the “walking beam” engines of side-wheel paddle steamers that provided cargo and passenger service on North America’s shallow bays, lakes and inland waterways. The double-acting, condensing rotative engines that powered these vessels differed little from those that drove stamps or copper crushers on mines in Cornwall and Devon except that they had paddle wheels in place of flywheels and were of modified A-frame construction rather than “house-built”. They also tended to be significantly larger, with cylinder diameters of up to 110 inches (on the 1867 paddle wheeler Bristol and the 1882

Pilgrim) and stokes of up to 15 feet (on the 1850 paddle wheeler New World).

Ubiquitous in their 19th century heyday, these side-wheel steamboats were, to paraphrase Bob Shaw (1980) in *Farm Collector*, responsible for the westward expansion of America prior to the growth of railways, and served almost every coastal and inland port from as early as 1811 until after the Second World War. The Mississippi River, with its preference for stern wheelers driven by horizontal engines, was a notable exception. The easily reversible walking beam engine was an American marine adaptation of the rotative beam engine and led to a distinctly American style of marine architecture typified by the river boat. With a distinctive “hollow-work” or trellis-like beam rocking above the uppermost deck, the engine rose the entire height of the vessel enclosed in an elliptical trunk, which allowed for spacious passenger accommodation and substantial cargo capacity. At the same time, the side paddle wheels provided great ease of handling and navigation in shallow waters, even when the vessel was large. The last walking beam engine was

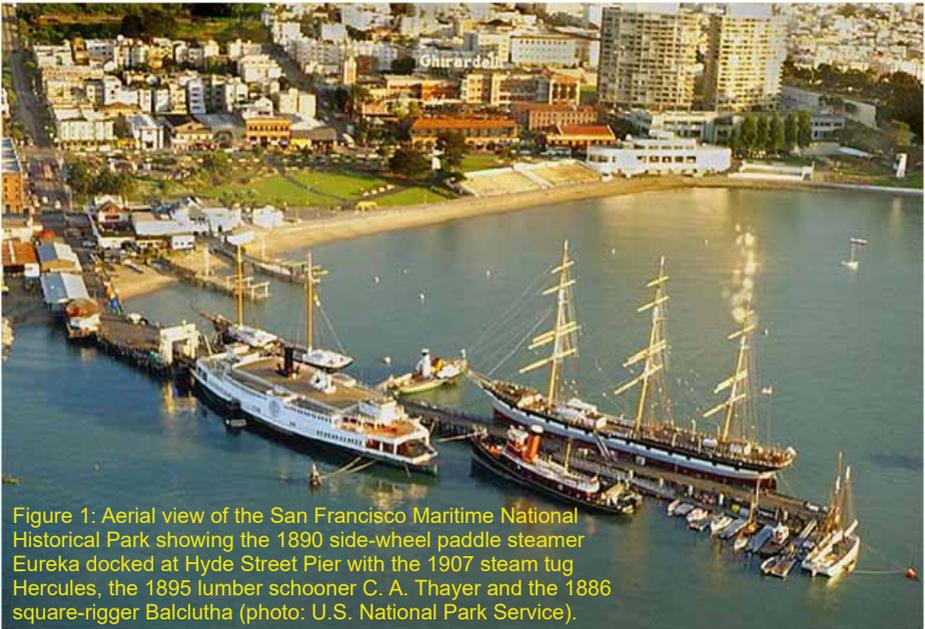


Figure 1: Aerial view of the San Francisco Maritime National Historical Park showing the 1890 side-wheel paddle steamer Eureka docked at Hyde Street Pier with the 1907 steam tug Hercules, the 1895 lumber schooner C. A. Thayer and the 1886 square-rigger Balclutha (photo: U.S. National Park Service).

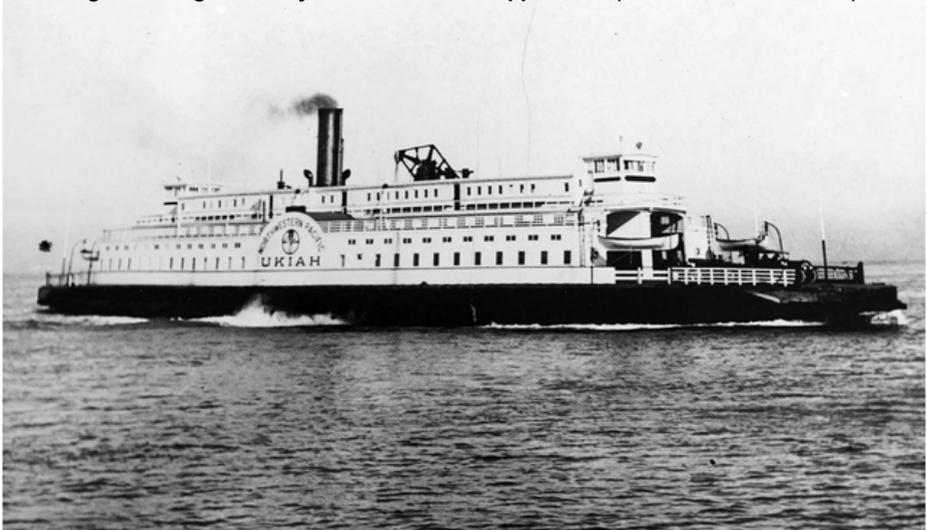
reputedly built in 1924 and, in America, the last side-wheel paddle steamer powered by such an engine was taken out of service in 1957. Two Brazilian ferryboats, the Guanabara and Terceira, both with 36-inch engines (7 ft stroke) built by the New York firm of W. and A. Fletcher and Co., worked in the harbour of Rio de Janeiro until the late 1960s.

Following its opening in 1971, however, two reproduction side-wheel paddle steamers, the Southern Seas and Ports o' Call, could be seen at Disney World in Florida. Built in 1969-71 by the Tampa Bay Drydock Co. and Disney's Drydock and Central Shops, these were powered by small (23-inch cylinder, 5 ft 2-inch stroke) but authentic replicas of an 1858 Gallows A-Frame walking beam engine. The two boats were retired in 1975 and 1982, respectively, and later scrapped. A second Southern Seas, built in 1977 and scrapped in 1997, incorporated the walking beam engine of the earlier boat, but had diesel-electric paddle wheels.

Today, only two walking beam engine paddle steamers survive in the United States, namely the Eureka, which remains afloat at Hyde Street Pier

as part of the San Francisco Maritime National Historical Park (Fig. 1), and the Ticonderoga, which is firmly landlocked as the centrepiece of the Shelburne Museum on the east side of Lake Champlain in Vermont. The following is a description of the Eureka and owes much to Chris Edwards, a Park Ranger with the National Park Service in San Francisco, who proofed the text and gave me an authoritative tour of the ship's engine room and boilers in April 2017. It also makes use of Conrad Milster's article "Giant American 'Walking' Beam Engines" published in Marine Propulsion in 1981, and Bob Whittier's book "Paddle Wheel Steamers and their Giant Engines" published in 1987. Additional information was obtained from the National Register of Historic Places Inventory Nomination Form prepared by Stephen Haller in 1984 and from drawings of the Eureka drafted for the Historic American Engineering Record (HAER) by Richard Anderson Jr. in 1996. These last two sources, together with a collection of 1988 HAER photographs, are available through the U.S. National Park Service (www.npgallery.nps.gov) and the U.S. Library of Congress (www.loc.gov/pictures).

Figure 2: The side-wheel paddle ferry Ukiah with the black hollow-work bob of its walking beam engine clearly visible above the upper deck (SFMNHP visitor centre).



The Ferryboat Eureka

The side-wheel paddle steamboat Eureka was built in 1890 for the San Francisco and North Pacific Railroad Company (SF&NPRR) by John Dickie in Tiburon, California, not under its present name, but as the Ukiah, in celebration of the railway's recent extension to the Californian city of that name. The double-ended ferry was designed by Patrick Henry Tiernan with an overall length of 291 feet and a beam of 42 feet at the water line and 78 feet at the guard rails. With a hold depth of 14 feet 2 inches, she drew just 6½ feet of water and displaced 2564 gross (2019 net) tons. She was propelled by two side paddle wheels located amidships, which survive to this today on the Eureka. These are 27 feet in diameter with twenty four 12¾ ft by 22-inch buckets and were formerly covered by a housing that arched above the level of the hurricane (top) deck (Fig. 2).

Launched on 17 May 1890, the Ukiah was built to carry 500 passengers (mostly by day) on the upper deck and 10 railway cars (mostly by night) on the main deck (down the length of which were two sets of standard gauge tracks) between San Francisco and Tiburon, on the north side of the Golden Gate (Fig. 3). The passenger deck was not fully enclosed, which raised complaint from some, but in good weather she would often be hired to take large parties of picnickers to excursion spots on the eastern shore of the Tiburon Peninsula.

In 1907, the SF&NPRR (by then reorganised as the California Northwestern Railway) was taken over and merged with the North Shore Railway to become the Northwestern Pacific Railroad (NWPRR). Soon after, the new company consolidated its services so that interurban trains operated only from Sausalito (near the present-day Golden Gate Bridge) and, in 1909, the direct ferry line from Tiburon to



Figure 3: Model of the San Francisco and North Pacific Railroad Company's railway and ferry terminal at Tiburon, California, at it appeared around the turn of the 20th century, with the side-wheel paddle steamers Ukiah (foreground) and James M. Donahue (centre), both driven by walking beam engines. The HO-scale (1 to 87) model forms part of the Tiburon Railway & Ferry Depot Museum housed in the depot building (centre rear), the terminal's only surviving structure.

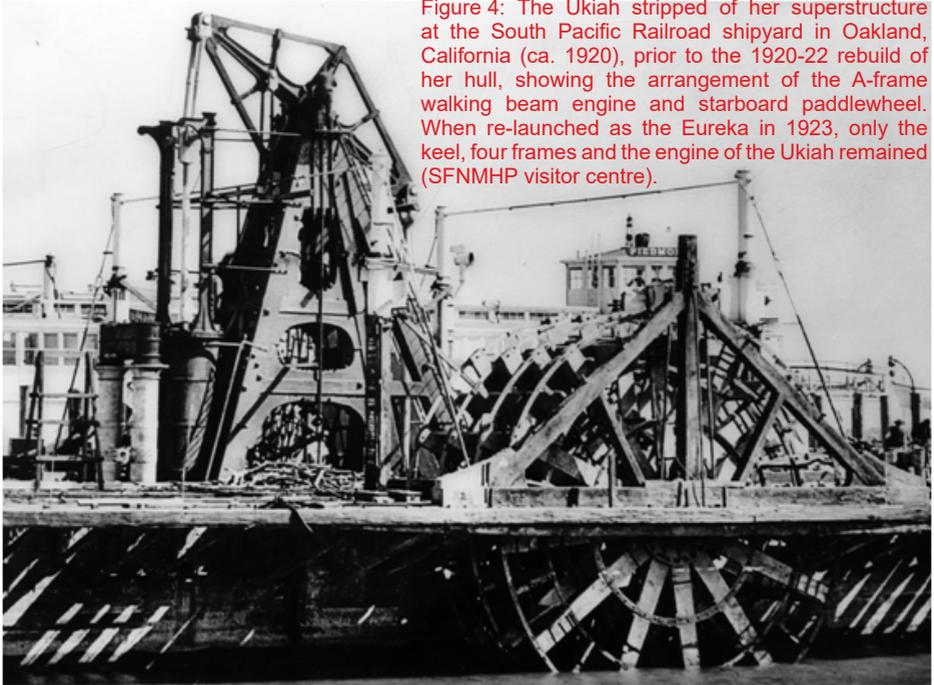


Figure 4: The Ukiah stripped of her superstructure at the South Pacific Railroad shipyard in Oakland, California (ca. 1920), prior to the 1920-22 rebuild of her hull, showing the arrangement of the A-frame walking beam engine and starboard paddlewheel. When re-launched as the Eureka in 1923, only the keel, four frames and the engine of the Ukiah remained (SFMNHP visitor centre).

San Francisco was discontinued. From then on, the Ukiah operated from Sausalito and was converted to connect with passengers from the NWPRR's interurban electric commuter railway. But she remained in continuous service, covering some 4000 miles a month and handling about 18,000 rail cars and 96,000 automobiles per year. During the First World War, however, the United States Railroad Administration operated the ferry to such capacity carrying heavy, munition-filled railway cars

that it was often seriously overloaded. This strained the hull so severely that, once the war was over, the government felt obligated to provide funds to have the Ukiah rebuilt.

To this end, the Ukiah was taken to the shipyard of the Southern Pacific Railroad in Oakland, California, in 1920 and, over the course of the next two years, was almost entirely rebuilt using Douglas fir and cedar. Her structure above the water line was removed with the exception of the walking beam engine (Fig. 4), the wooden

Figure 5: The side-wheel paddle ferry Eureka, with its hollow-work beam now white, approaching Sausalito (SFMNHP visitor centre).



Figure 6: HAER photograph of the Eureka's steam-piston driven steering gear (photo: U.S. Library of Congress).

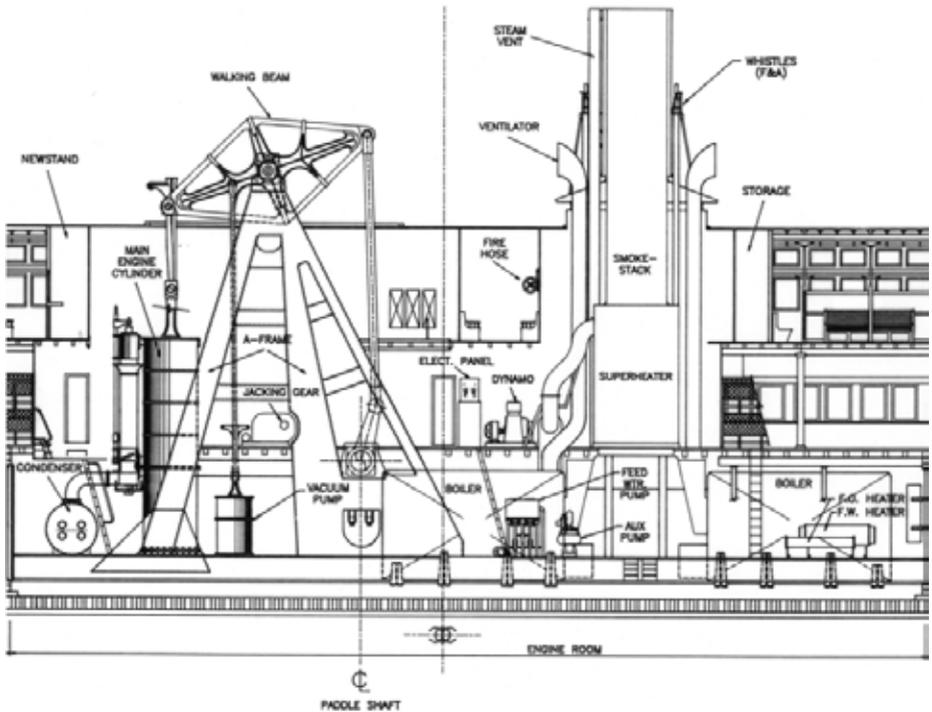


Figure 7: Detail of a 1990 inboard profile of the Eureka taken amidships showing the arrangement of the walking beam engine, its modified A-frame support, and the boilers, air (vacuum) pump, superheater and condenser (drawing: U.S. National Park Service).

Figure 8: HAER photograph of the Eureka's 65-inch cylinder top, piston rod and crosshead, crosshead guides and top valve nozzles (photo: U.S. Library of Congress).



A-frame of which was replaced with one of riveted steel. The main deck was lengthened to 299½ feet to accommodate up to 120 cars, and the second deck was expanded, equipped with toilet facilities and partly enclosed to accommodate 1000 passengers. A galley/restaurant area (now used for storage) was also added forward of the smoke stack. With seating placed on the main deck at the expense of cars, the rebuilt ferry could accommodate 2300 passengers.

In 1923, the former Ukiah was re-launched as an almost completely new ferryboat, and was rechristened Eureka after the railway's new northern terminus. With a full beam of 78 feet and a displacement of 2420 gross tons, the Eureka was the largest of the NWPRR's fleet and was assigned to the two heaviest commuter trips – the 7:30 am from Sausalito and the 5:15 pm from San Francisco – each averaging 2200 passengers. She was also the fleet's fastest ferry with a cruising speed of 18 knots.

Like her predecessor, Eureka

was a double-ender – a design that allows ferries to shuttle between terminals without having to turn around. She is therefore identical at either end above the passenger deck (Fig. 5), with two square wooden wheelhouses backed by two separate cabins for officers and crew bunks. Originally steered by wheel, a steam-piston driven steering gear (Fig. 6) controlled by a tiller in the wheelhouse was added during a later overhaul.

Although completion of the Golden Gate Bridge in 1937 ultimately brought an end to cross-strait ferry service, the Eureka remained a member of the NWPRR's fleet of ferry boats until 1941, when she joined other San Francisco Bay ferries in transporting soldiers from the major staging area of Camp Stoneman in Pittsburg, on the Sacramento River, to the Port of Embarkation piers in San Francisco. After the war, regular ferry service was reduced to Southern Pacific Railroad passenger traffic across the bay from Oakland to San Francisco, a service the Eureka provided until 1957, when she broke her crank pin and was taken out of service. The cross-bay ferry run was



Figure 9: View of Eureka's paddle wheel crank and connecting rod.

Figure 10: “Outdoor” (connecting rod) end of the diamond-shaped hollow-work beam on Eureka’s hurricane deck.



discontinued the following year. After a three-year restoration project, the Eureka was deeded to the California State Park system in 1963 and joined the fleet of historic ships now on display at the San Francisco Maritime National Historical Park. The fleet was transferred to the National Park Service in 1977.



Figure 11: Eureka’s in-line, two-piece arbor, eccentric-arm operated valve gear (steam side pipe and steam inlet valves left, exhaust side pipe and exhaust valves right) with steam gauge (left), clock and vacuum gauge (right). Vertical lever (centre) is the starting bar standing in its shoe.

The Eureka is thought to be the world’s largest wooden vessel afloat and is the last intact wooden-hulled side-wheel steamer afloat in the continental United States. She has been designated a National Historic Landmark and was listed in the National Register of Historic Places in 1973. She was extensively restored above the water line in 1999.

The Walking Beam Engine

When originally built in 1890, the Ukiah was fitted with a walking beam engine manufactured by the Fulton Iron Works in San Francisco. This engine, with the exception of in-kind repairs and the replacement of its original wooden A-frame, remains unaltered in the Eureka (Fig. 7). As with all such engines, it was simple, compact, reasonably economical and easy to maintain. The cylinder, which lacks a steam jacket, is 65 inches in diameter with a 12-foot stroke, and the engine was operated at 24 revolutions a minute delivering 1500 horse power. The working principle is that of a double-acting rotative engine with the crosshead from the cylinder (Fig. 8) and the connecting rod to the paddle crank (Fig. 9) linked by a cast iron beam, the pivoting shaft (or trunnion) of which was supported on an oak (and later riveted steel) A-frame fastened to the keelsons of the vessel (see Fig. 7). A third pair of legs ahead of, and braced to, the front legs of the A-frame, provide forward support for the main bearings of the paddle wheel shaft.

The hollow-work beam is of a flattened diamond shape (Fig. 10) and comprises a single cast iron beam with a central hub for the trunnion and several projecting arms, over the ends of which a wrought iron strap was shrunk for strength. The strap is further secured to the arms by U-shaped wrought iron bands. Two links connect the crosshead to the beam, and crosshead guides anchored to the A-frame kept the piston vertical in the cylinder (see Fig. 8). A long wrought iron connecting rod turned the massive two-armed crank, which is linked directly to the shaft of the

paddle wheel.

On the Ukiah and other boats of her day, the beam was painted black (see Fig. 2). But an accident on the ferry Sausalito in 1922, in which the beam fractured, came apart and partially collapsed onto the passenger deck, was blamed in part on the black paint, which made forging flaws hard to detect. Thereafter, white paint was used, as was the case on the Eureka (see Fig. 5), since this made such flaws easier to see.

The engine is double acting with four valves (stem inlet and exhaust, top and bottom) operated by curved cams or “wipers” that acted on followers or “toes” affixed to vertical rods or “lifters” (Fig. 11). These, in turn, operated the Stevens valve gear that worked double poppet steam and exhaust valves at the upper and lower ends of two “side pipes”, which stand vertically behind the valve gear and are linked top and bottom by transverse steam chests. The curved cams that operated the valves are set on a pair of in-line, horizontal arbors or “rock shafts” in the centre of the valve gear that share a common central bearing and were rotated backwards and forwards by actuating arms from two sets of eccentrics on the shaft of the paddle wheel.

Figure 12: Two of Eureka’s four, oil-fired Freeman dryback boilers (numbers 2 and 4 on the port side).



Figure 13: Eureka’s original jet condenser (left), set beneath the cylinder, and plug-rod operated air (vacuum) pump (right).

To start the engine, the throttle would be set to about half speed while the valves were operated by hand using a starting bar. Set at a 45-degree angle in a secondary cam shaft located just below deck level, this would be raised or lowered to work the valves as the situation required, the amount of movement being increased as the boat gained speed until the bar was being swung through an arc of almost 90 degrees. At this point the eccentric rods were lowered so that U-shaped notches at their ends engaged the rock shafts of the valve gear and the motion became automated – a manoeuvre known as “dropping the hooks.” Only at this point would the steam throttle be opened fully and attention turned to feeding water to the condenser in order to pick up the vacuum. Stopping the engine employed a similar procedure in reverse. The throttle was partially and then fully closed, the steam and exhaust hooks were pulled, and the piston given a little steam in reverse to bring the boat to a halt.

The easily accessed starting bar was also used to reverse the engine, and

to ensure, before its motion fully ceased, that the piston did not come to rest at either top or bottom dead centre (which locked the engine) when the engine came to a stop. An indicator on the wall with a single pointer timed to follow the rotation of the paddle wheel crank was used to determine the position of the engine. A fully locked engine could only be turned over by levering one of the paddles through an access door in the paddle box.

Steam was originally supplied by four, coal-fired direct flue return tube boilers. But with coal being shipped from the east coast, these proved costly to run and, in 1914, they were replaced by four, oil-fired Freeman dryback boilers (Fig. 12) built the previous year by the Seattle Construction and Dry Dock Company, each with two corrugated furnaces. In these, the flame was forced from the burner through the furnace into a brickwork-protected combustion chamber at the rear of the boiler, which redirected gas flow back through the boiler's fire tubes. At any given time, one of the four boilers was usually under maintenance and all four were rarely needed. The steam was first piped through an annular steam jacket around the base of the stack that functioned as a superheater (see Fig. 7) and then on to the

cylinder at a pressure of 60 psi.

The engine's original condenser was a "jet" condenser that sat atop the bed plate immediately beneath the cylinder (Fig. 13). Condensation was effected by injecting cold water into the steam. But in 1933, this was replaced by a "surface" condenser positioned below and behind the valve gear (Fig. 14). In this type of condenser, the steam was condensed against numerous tubes through which cold water was pumped. The air (vacuum) pump is located ahead of the original condenser (see Fig. 13), worked by a connecting rod attached to "indoor" side of the beam. The original hotwell, which would have been mounted above the air pump, has been replaced by a large box-like tank mounted to the side. Contrary to usual practice, the boiler feed pump was not worked off the main engine but was, instead, operated by a small auxiliary steam engine. This was to ensure that water would continue to be fed to the boilers when the engine was stopped, which was a frequent occurrence in the life of a short-run ferry. Steam-driven dynamos provided electricity for lighting.

The ferryboat Eureka is open to the public seven days a week (except Thanksgiving, Christmas, and New Year's Day). Tours of the engine room, however, are less frequent and are best scheduled by contacting the National Historical Park ahead of time using the information provided on their website (www.nps.gov/safr). The entrance fee to board all the historic ships at Hyde Street Pier is regularly just \$10 per person and is valid for a week – an opportunity when in San Francisco that is not to be missed.

Damian Nance



Figure 14: End-view of Eureka's surface condenser with the cover plate removed to show some of its 1678 tubes. This replaced the jet condenser located immediately beneath the cylinder in 1933.

PUFFING DEVIL

There have been three outings for the Puffing Devil so far this year. The first was on Trevithick Day, which began the day before for John Sawle, when he delivered the engine on its trailer to Glasson's Garage forecourt. The crew, Sean and Molly Oliver, John Woodward and myself, assembled at 0600 on the day itself and soon had a roaring fire fed by several bushels of fire wood (I had an old garden shed to dispose of). The morning was dry and warm and consequently steam pressure rose quicker than normal, however, we needed a tractor to help get the engine of the trailer. Contact was made with the main assembly of traction engines at Pool to borrow their tractor only to discover that the water bowser had broken down and they were having great difficulty in getting the traction engines ready. Understandably we had to wait until their plight had been solved. The upshot was that the traction engines were an hour late arriving in Camborne as were we. Remarkably, the timely arrival of the tractor meant we were able to decamp from the trailer and to drive up to the town to our station in Basset Street at the same time as the gleaming procession of traction engines was arriving. It appeared perfectly choreographed to the onlookers, and because we were all an hour late the crowds were much larger than normally greets the assembling engines, adding to the spectacle.

Unfortunately, the water bowser



had not been fixed, so the fire service came to our rescue. A water tender made a single delivery in the morning giving all the assembled engines enough water to last the day. In our case, the water tank on the engine plus our 40 gallon drum and a couple of 5 gallon water containers were filled and that gave us, with a great deal of care, just enough water to drive up and down Basset Street every 20 minutes or so, and get us back to Glasson's Garage at the end of the festivities. It was a close run thing!

Trevithick Day proved to be an excellent day for the Puffing Devil. Having Basset Street to ourselves is really nice and each time we drove up and down this long street, a sizeable crowd would gather to view this unique sight, clapping as we came to rest on our return. Basset Street does not have the drama of the Camborne Hill Run, which is over in a flash, however,



it does enable people to have a longer look at the engine in motion.

In mid afternoon, we decided we had just enough water to make one more trip up and down Basset Street when a gentleman approached us and asked whether we were going to drive the engine as he had not seen it. He explained that he had come a long way to see the engine - from Australia!

The second outing for the engine was to East Pool Mine for the National Trust's "Trevithick Tuesday", which was held during the May half-term holiday. As a consequence a high percentage of the visitors were children, many of whom, being local knew all about the Puffing Devil from school. The National Trust staff and volunteers were dressed in costume, typified by John Harvey who caricatured Brunel. John Sawle and I ran the engine as a stationary exhibit and did our bit to educate and entertain the visitors. One group of American visitors were particularly pleased to have had the opportunity to see the Puffing Devil.



Above: the Puffing Devil at East Pool Mine.



Driving back along Basset Street. Note the white tracks from previous journeys.



Above: the Puffing Devil at East Pool Mine.



Sean and Molly manning the Puffing Devil at the Royal Cornwall Show.

KEITH LETCHFORD

The Royal Cornwall Show provided the venue for the third outing. Days one and three were punctuated by periods of heavy rain which curtailed activities somewhat. However, at all other times there was considerable interest in the engine. It was remarkable just how many people had not heard about the Puffing Devil and were curious to learn more about it. Often visitors would quietly stand and watch the engine in motion for five minutes or so and work out for themselves how it all worked. They would then ask us to explain about its history and in particular "what it was for". As a consequence many people learnt something about Trevithick and high pressure steam. It was especially pleasing to explain the true origins of steam locomotion to some Geordies.

The engine was manned by me on the first day, John Sawle on day two and Sean and Molly on the last day.

Thanks are due to the steam apprentices who helped, behind the scenes, to get the engine ready for each appearance. Thanks also to John Sawle for transporting the engine and for other assistance he gives in the background. Finally, thanks to the rest of the crew Sean, Molly and John Woodward.

The next outing will be:

W.E.S.E.S Steam and Country Fair at the Stithians Show Ground.
18th, 19th, 20th August

CNF



The Society stand at the Royal Cornwall Show.

SHOW PROGRAMME 2017

At the time of going to press the Society hopes to be represented at the following venues during the Summer 2017.

Anyone wishing to help man the events or needing information please contact Kingsley Rickard.

July 15th Saturday

Camborne Show

July 30th Sunday

Bude Heritage Day

August 13th Saturday

Carnhell Green Vintage Rally

August 18th/19th/ 20th

WESES Steam & Country Fair,
Stithians Showground

FIELD TRIPS

Saturday 8th August (Field Trip)

Visit to Grinding Solutions in Tresillian. GLS provides a range of metallurgical and mineral processing consultancy and lab services. We will be told about what GSL does, then have a tour around the lab, showing the testing and analytical equipment. Meet 1000hrs at 14 Tresillian Business Park, Tresillian, TR2 4HF

Saturday 2nd September (Field Trip)

A guided tour of Plymouth breakwater. There is a vertical ladder to climb with no safety line. This may be slippery. You must be able to get onto/off this from the boat unaided. A bad weather alternative tour is available.

Meet at 1200hrs at Royal William Yard, Plymouth where the Silverline Cruise office is PL1 3QQ

May change at short notice for MOD priorities.

PUBLICATIONS

Rick Stewart's book, *Mine Pumping Engines in Eighteenth Century Cornwall*, was launched on Trevithick Day and resulted in one of our most successful day's sales from our tent. The book has attracted much favourable comment and really is essential reading for anyone with an interest in Cornish mining and steam during that period. There has been a good deal of research in this field of late and Rick's very readable volume brings the story up to date. This volume received generous support from the Cornish Mining World Heritage Site. *Mine Pumping Engines* is a 176 page large format paperback and cost £17.50. ISBN 978-0-9935021-2-5

Elsewhere in this issue is a summary of our AGM weekend, much of which was concerned with the Tavistock Canal, opened 200 years ago in June 1817. To mark this anniversary the Society will this autumn publish Robert Waterhouse's definitive volume on the history and archaeology of the canal. The book also covers the mines, wharfs and tramways associated with this fascinating waterway. We have only been able to bring out this very substantial work due to considerable sponsorship from a number of organisations and several generous individuals. The book will be available in a large format paperback edition and a limited hardback edition. Sponsorship will enable us to keep the price at a reasonable level. Robert's superb archaeological drawings will be included on a computer disc at the back of the book. Those who attended his lecture at the AGM weekend will know that this will be a very special book. We cannot quote definite prices as yet but will keep members posted as to progress with this very exciting project.

Graham Thorne

SOCIETY MEETINGS PROGRAMME

KEM: meet at 1900hrs for a 1930hrs start at King Edward Mine, Troon, Camborne TR14 9DP.

Liskeard: Meet 1900hrs for a 1930hrs start at The Long Room, Liskeard Public Hall PL14 6BW.

Saturday 8th August (Field Trip)

See page 22 for details.

Saturday 2nd September (Field Trip)

See page 22 for details.

Friday 8th September (KEM)

Joint meeting with Carn Brea Mining Society. *Listening to the enemy, St Erth Radio Station 1939 – 60.*

By Mike Griffiths from GCHQ, St.Erth.

Monday 9th October (LISKEARD)

Porthcurno. A talk on the first ever telephone link across an ocean, by one of the museum curators. Meet at New Liskeard Room.

Friday 13th October (KEM)

Rock masses in engineering (hot rocks project) and other topics. Bob Pine will talk about 6 different mining engineering projects worldwide.

Friday 10th November (KEM)

Sonar imaging. Providing 3d and colour images underground for use in mining. By Neill Wood.

Monday 13th November (LISKEARD)

Poldark Put Your Shirt On - the real lives of West Country tin and copper miners and their families in the mid 19th Century. By Ken Johns.

Friday 8th December (KEM)

Cornish miners of the 21st tunnelling company. The story of the WW1 Tunnelling Companies that operated in Flanders from March 1915. By Ken Johns.

Monday 11th December (LISKEARD)

Same talk as Friday 8th December.

Contact:

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For up-to-date news check:

<http://www.trevithick-society.org.uk>

<https://www.facebook.com/trevithick.society/>

**Non members are welcome to attend.
Non-members £2.00 please.**

MEMBERS' BENEFITS

Trevithick Society members are entitled to free entry (on production of the membership card) to the following attractions:

- King Edward Mine
- Cornish Engines at Pool (East Pool Mine and Michell's Whim)
- Levant
- Geevor Museum

Also:

- Members are invited to visit Poldark Mine free of charge on production of a valid membership card.
- 10% off book purchases at Tormark.
- 20% off purchases at KEM shop.

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The Trevithick Society, a registered charity, is a recognised body of the study of industrial archaeology in Cornwall. Membership is open to all who are interested in the region's great industrial past, whether or not they live in Cornwall. The Society takes its name from one of Britain's foremost inventors and pioneers of the Industrial Revolution, Richard Trevithick, a Cornishman whose name is inseparable from the development of steam power. This newsletter is published quarterly and, together with the annual journal, is distributed free to members. Letters and contributions are always welcome and should be sent direct to the editor.

The views expressed in this newsletter are those of the authors and not necessarily those of the Trevithick Society.

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