Garnier Road Sewage Pumping Station, Winchester

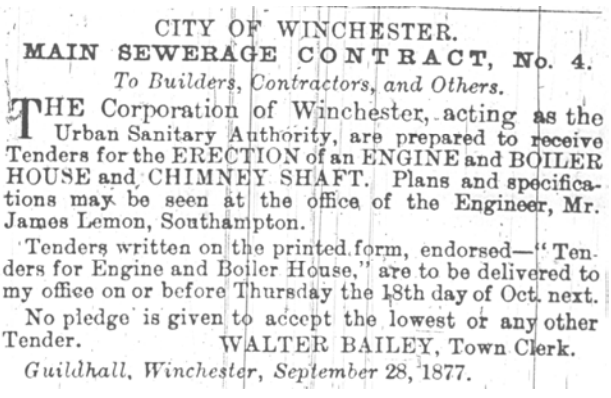
Martin Gregory

The provision of a clean water supply and effective waste water and sewage disposal were two of the great contributions made to modern living by Victorian engineers. Winchester, like most expanding cities in the nineteenth century, was not a healthy environment in which to live. Dysentery was endemic in the central city area which had no mains drainage. The Winchester Water Works Company had been started by a local businessman, Charles Wittman Benny, in 1850 to provide piped water from a reservoir on high ground to the west of the city. However, there was nowhere for the waste water to go but into the streets and the river. The more water the Water Works Company provided, the more people installed water closets and plumbing and the worse the problem of disposal became. The problem was also exacerbated by the location of the Hampshire County Hospital and the County Goal in the town centre at river level. The hospital cesspit had a capacity of 11 250 galls (50 m^3) which was totally inadequate for the sewage, let alone surface water so that the ground around was continually saturated.

In 1844 Mr. Newman, the Sanitary Inspector to the Council, lecturing at the Winchester Mechanics' Institute, called for a proper sewerage scheme for the city. Nothing was done since the city councillors did not wish to raise the rates. The councillors divided themselves into the ratepayers (the Muckabites) who opposed mains sewerage on grounds of cost, and those institutions, the Cathedral, the College, the hospital etc which paid no rates but would benefit from the improved sewerage (the Anti-Muckabites). In 1857 Mr. Newman repeated his plea for sanitary reform: 'the High Street was filthy'…. 'the ground is little better than one mass of corruption.' He proposed a main sewer running north to south under the city and passing under the College water meadows to discharge into Old Barge River (part of the river Itchen). Again, nothing was done. The County Gaol moved out of the centre of the city to the western edge in 1849 and the County Hospital moved to a site opposite the gaol in 1868. Whilst this removed two large sources of infection from the city centre it did nothing to improve the lot of those residents who remained, in particular the cathedral community and Winchester College. Winchester was unhealthy as witnessed by the death of several College servants and several pupils in the 1860s.[1]

The Sanitary act of 1866 required the Council to provide 'a sufficient sewerage system and a supply of wholesome water'. Failure to do so empowered the Secretary of State to appoint a person to provide this service and charge the Council with the costs. With the onus of implementation on the Council they took steps to obtain plans. In 1867 they adopted the scheme of James Lemon.[2] Mr. (later Sir James) Lemon was the Borough Surveyor to Southampton Corporation and had laid out the Southampton sewerage scheme. In 1878 he went into private practice.[3]

Having informed the Secretary of State of their scheme the City Council did nothing for another ten years! The Winchester College headmaster, George Ridding, and a housemaster, Frederick Morshead who became a city councillor and Mayor in 1872/3, took the lead in lobbying for the city to build a 'modern' sewerage system. The Sewerage Scheme was finally given the go ahead in 1876. This scheme, updated by James Lemon, was to drain the city centre. However three large communities, the new County Gaol, the new County Hospital and the Union workhouse, remained unconnected.



CITY OF WINCHESTER.
MAIN SEWERAGE CONTRACT, No. 4.
To Builders, Contractors, and Others.

THE Corporation of Winchester, acting as the Urban Sanitary Authority, are prepared to receive Tenders for the ERECTION of an ENGINE and BOILER HOUSE and CHIMNEY SHAFT. Plans and specifications may be seen at the office of the Engineer, Mr. James Lemon, Southampton.

Tenders written on the printed form, endorsed—"Tenders for Engine and Boiler House," are to be delivered to my office on or before Thursday the 18th day of Oct. next.

No pledge is given to accept the lowest or any other Tender. WALTER BAILEY, Town Clerk.

Guildhall, Winchester, September 28, 1877.

Figure 23. Advertisement in the *Hampshire Chronicle* for 5th October 1877.

The agreed system drained the city by gravity to a sump in Bulls Drove, in the Saint Cross area to the south of the city. Bulls Drove was renamed Garnier Road in 1880 in honour of the then Dean of Winchester Cathedral. Here the sewage was screened and pumps raised it to the sewage farm at Chilcomb on the east side of Saint Catherine's

Hill. Here, the sewage 'irrigated the land' producing a good crop of marigolds in the settlement area where bacteria digested the sewage. The run-off filtered through the chalk and was returned to the water table, a very eco-friendly system! In September 1877 tenders were invited for a start to be made on the pumping plant in Garnier Road and on the sewage farm. The foundation stone of the pumping engine house was laid on 2nd May 1878 by the Mayor, Alderman J. T. Clifton. The Mayor was presented with a 'very beautiful silver trowel, being a present from himself,' by Mr. Lemon. A copy of *The Times* and several coins were placed in a cavity and the Mayor spread the mortar 'in a thoroughly masonic style'. After the ceremony the company 'partook of an excellent repast in the Mayor's Parlour at the Guildhall' while the workmen were entertained at the White Horse Inn.[4]

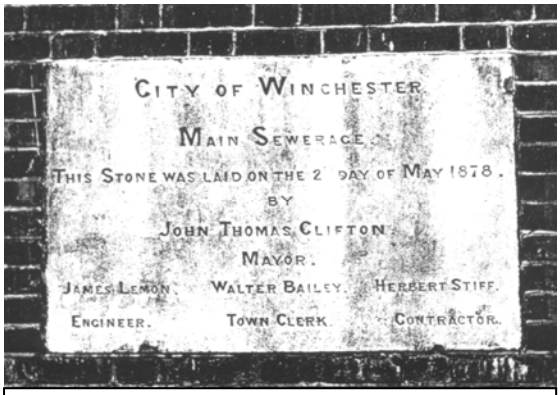


Figure 24. Foundation stone on 1878 engine house at Garnier Road.

The sum raised to build the system was £32 000, 'but we hear that the loan of £32 000 will be materially enlarged ere the work is completed.'[5] In January 1880 approval was sought for a further £4500 to complete the works.[5] Although a start had been made in Garnier Road tenders for about 17 miles of pipe sewers, subsoil drains, manholes and other works were not advertised until May 1878. The first trenches were dug in June 1878 and much was in progress by the end of the year. The arrival of three Lancashire boilers for the Garnier Road plant caused problems at the beginning of November. The wheels of the trolley sank into the soft roadway in Southgate Street which had recently been opened up for the installation of pipes. 'The assistance of ten horses and other appliances were required to extricate the trolley and boiler.'[6] A year later the engineer informed the Sewerage Committee that on and after 1st December 1879 the public might connect their drains to the main sewer.[7]

The 1878 engine house, as befits a proud city, is decorated with the city coat of arms and ornate brickwork and ventilators on the roof. The original pumping machinery was supplied by Gimson and Company of Leicester. It consisted of two house built single cylinder beam type steam engines of 43 hp (30 kW) each, steamed by three Lancashire boilers working at 120 psi (830 kPa). The steam cylinders were 24 inches (0.61 m) diameter by 5 ft (1.52 m) stroke. They were fitted with slide valves and hand adjusted Meyer cut-off valves. The beams were 20 ft (6.1 m) long and each drove two sewage pumps, one each side of the beam pivot, capable of pumping 1 000 000 gallons per day against a head of 160 ft (48 m). The flywheels were 20 ft (6.1 m) in diameter and weighed 15 ton each. In 1882 one of the engines suffered a major failure, probably due to overspeeding. To repair it Gimson supplied many replacement parts 'much stronger than those which fractured'. They also fitted Watt pattern centrifugal governors to both the engines to control their speed.[8] Thus modified, the beam engines performed their task adequately and were not withdrawn until 1959 after a life of 81 years. The east engine suffered a further failure in 1952 when one of the pillars supporting the beam entablature had to be replaced by a steel fabrication.

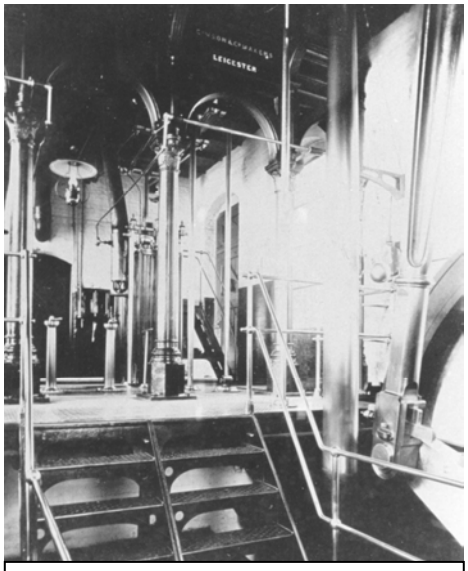


Figure 25. The 'west' Gimson beam engine in the 1880s after the governor had been fitted.

From an early date the solid matter removed from the sewage by the screens was burnt. In 1884 a destructor was built behind the boiler house to burn these solids and 'ordinary house refuse, including offal from fish shops, fruiterers etc.' A Fryer destructor cell was built by Manlove, Alliott and Fryer of Nottingham. A second destructor cell by Goddard, Massey and Warner was added in 1891. The furnaces were worked every day and night, 'although the men were only in attendance six hours each

Sunday'. The destructor burned 80 to 100 tons of refuse each week. The heat from the destructor cells was extracted by a Green's Economiser in the destructor flue connected to the boiler house chimney. Adding the destructor saved 30% on coal bills for the plant.[9]

Figure 26. The pumping works c. 1900, with the original destructor on the left and the beam engine house on the right.

The population of Winchester continued to grow and in 1898 the County Hospital was at last connected to the main drains.[10] By the turn of the century the old beam engines could not satisfy the standard required by the Local Government Board, i.e. the capacity to pump six times the normal dry weather flow of 700 000 gallons (3200 m^3) per day. In prolonged wet weather, even with both engines working, sewage overflowed into the river on occasion. Works completed in 1905 resulted in almost doubling the size of the engine house and the complete replacement of the destructor plant. To defray the costs of the improvements the Council raised a loan of £9431.

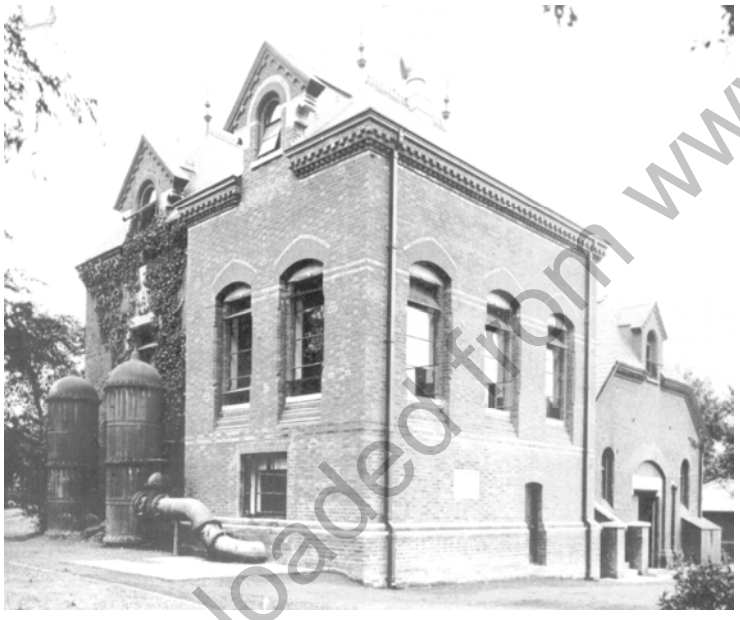


Figure 27. The 1904 extension to the engine house when new. The air vessels for the beam engine pumps are in front of the 1878 house, the boiler house is behind on the right.

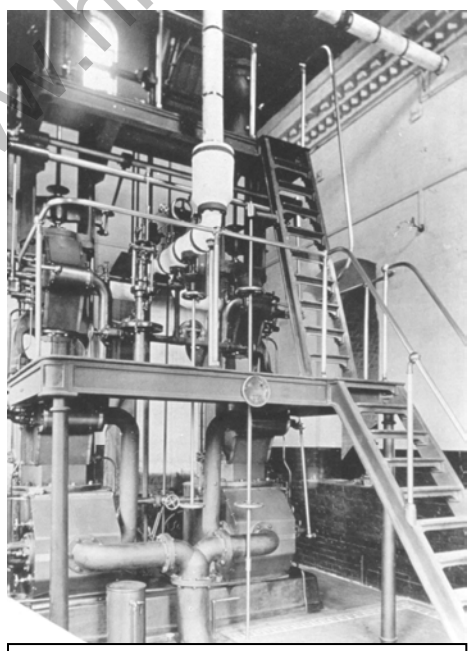


Figure 28. The Worthington Simpson triple expansion steam pumping engine installed in 1904.

The engine house extension has its own foundation stone laid on 27th October 1904. It housed a Worthington-Simpson vertical triple expansion non-rotative steam pumping engine of 140 hp (105 kW) by James Simpson and Company of Newark. This engine had cylinders 12 in (0.31 m), 19 in (0.48 m) and 30 in (0.76 m) diameter with a common stroke of 24 in (0.61 m). It was fitted with semi-rotary valves and a jet condenser and was unusual in being vertical, whereas most of the company's engines of similar design were horizontal. The weight of the pistons and pumps was carried on air balance cylinders above the steam cylinders. The engine was designed to pump 3 million gallons (14 000 m^3) of sewage per day against a head of 200 ft (61 m). The engine was started on 19th July 1905. When commissioned the new engine was expected to carry the base load with the beam engines as standby and for use in times of very heavy rainfall.[11]

At the same time the refuse destructor was rebuilt. The new arrangement was based on that at Cheddars Lane, Cambridge, which had been inspected by members of the Sanitary Committee when the Garnier Road improvements were being planned. The new destructor, by Manlove, Alliott and Co. was Wood and Brodie's patent 'refuse-destructor and steam-generator'. It had four cells with a Babcock and Wilcox pattern water-tube boiler sandwiched between each pair of cells. The two new boilers provided the steam supply with the old boilers of 1878 being used as tanks for softened boiler feed water (Nos. 1 & 3) and the hot well (No 2). The space over the old boilers became a workshop with lathes, drill etc powered by a second hand steam engine (a Tangye 'Soho' engine now at Twyford Waterworks on loan from Winchester Museums). Provision was made to fire the boilers with coal using auxiliary grates when the energy content of the refuse was low. Nothing was wasted: the fine clinker and ash were mixed with granite chips and cement and used to cast paving slabs while the coarser clinker was used for paths and road making.[12] To complete the steam plant S. S. Stott of Haslingden, Lancashire provided a small inverted vertical steam engine in 1910 to drive the scraper gear in the screening house. This engine was fixed in the Worthington-Simpson engine house and drove the scrapers via an underground shaft.[13] It still exists at Bursledon Brickworks Museum.

Thus rebuilt and extended the plant served Winchester's needs for the next twenty years. Expansion of the population of Winchester led to the design of extensions in 1927 which were completed in 1930. This time oil engines were specified in place of steam. Three triple-barrel bucket pump sets were supplied by Frank Pearn of Manchester. Each set was driven by a W. H. Allen semi-diesel oil engine through a clutch, flat-belt pulleys and gearing from an engine speed of 400 rpm to a pump speed of 22 rpm. A new house for the Pearn pumps was built on the east side of the beam engine house necessitating re-alignment of the ramp up to the destructor.[14]

Figure 29. The Pearn pump house completed 1930.

Figure 30. One of the W. H. Allen semi-diesel engines driving a set of Pearn pumps.

As the load on the station increased some of the plant was replaced and updated. In the late 1930s the Wood and Brodie destructor was at the end of its life and three of the four cells were out of use. Much of the steam for the beam engines and the Worthington-Simpson engine came from burning coal in the auxiliary grates of the 1904 boilers. In 1938 a new Carrier-Tudden patent destructor was installed with a second hand Babcock and Wilcox boiler replacing one of the 1904 boilers.[15] This survived through the 1939-45 war years of scarce spare parts and shortages of materials up to the great rebuilding starting in 1949.

At this time a contract was let for the replacement of the Worthington-Simpson engine by a vertical spindle electric motor directly driving a Pulsometer centrifugal pump in the 1904 engine house.[16] The Carrier-Tudden destructor was demolished and replaced by a two cell Heenan and Froude destructor and the two boilers were given new auxiliary fireboxes. In 1951/2 the three Allen oil engines driving the Pearn pumps were replaced by two four-cylinder Ruston diesel engines plus a variable speed electric motor connected to the three existing sets of pumps. In 1956 a three-cylinder Ruston diesel engine driving a second Pulsometer centrifugal pump through a gearbox was added in the 1904 engine house. Seventy five years after its opening Garnier Road still contained the original steam beam

engines, supplied with steam from the destructor, together with a mix of diesel and electric pumps, both reciprocating and centrifugal.

In 1954 the City Council commissioned a report [17] by John Dossor on the possible reorganisation of the Garnier Road station. The terms of reference ruled out the disposal of refuse 'other than by incineration' and the 'disposal of sewage liquor other than using the existing ground absorbtion (sic) at St. Catherine's Hill'. At the time, the pumping duty averaged 1.8 Mgalls per day and, on average, 20 tons of refuse were burnt per day. The beam engines plus the electrified Pearn pump could cope with the Dry Weather Flow. The energy requirement for the Station for the year was 700 MWh, provided 45% by the incineration of refuse, 31% by diesel fuel and 24% by electricity from the public supply. Mr Dossor outlined several plans to modernise the plant. These plans included new steam engines and pumps provided with steam from a rebuilt destructor, steam powered alternators and all electric pumps using steam from the destructor, building a sewage digester at the sewage works to provide methane for dual-fuel diesel/methane engines.

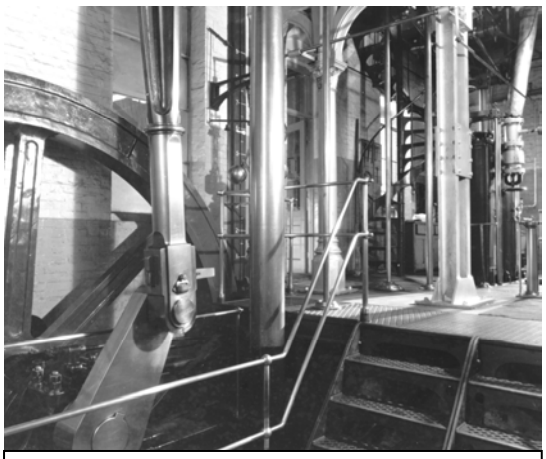


Figure 31. The 'east' beam engine in 1959 showing the replacement steel stanchion.

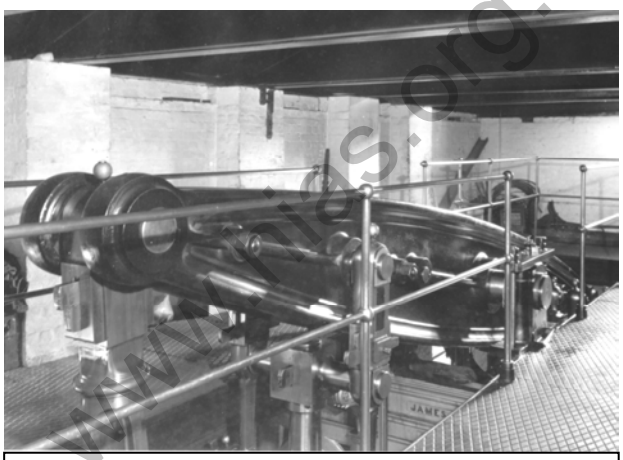


Figure 32. The beam of the 'east' beam engine in 1959 just before scrapping.

In 1959, after over 80 years of service the Gimson beam engines were scrapped. Modernisation took the form of rebuilding the destructor and installing in the 1878 house, a pair of inverted vertical high speed compound steam engines of 80 hp (60 kW) each, by W. Sissons and Company of Gloucester. Through bevel gearboxes, these compact modern engines drove vertical spindle centrifugal pumps, mounted in the old beam engine pump chambers. The wall between the 1878 and 1904 engine houses was removed and a new overhead crane installed to service both houses. The chimney had become dangerous and was taken down (the rebuilding contract forbade 'felling it' or 'the use of explosives'). A new 80 ft (24 m) chimney was built on the old foundations.[19] The two cells of the destructor were rebuilt from the grate up and the two Babcock and Wilcox boilers were replaced by one modern boiler with facilities for oil firing when the refuse supply was inadequate in energy content. A third cell was added in 1961 to raise capacity to 30 tons per day.

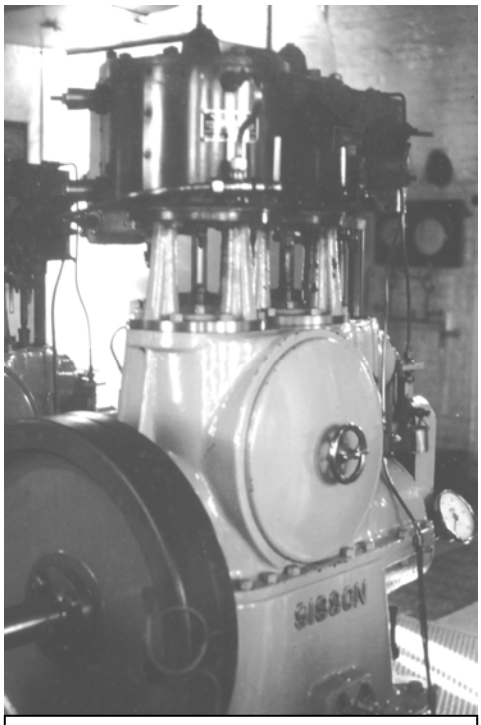


Figure 33. One of the Sissons steam engines installed 1960 in the beam engine house.

The reorganisation of local government in 1974 resulted in Winchester's refuse being taken to the (then) new incinerator at Otterbourne. After only 15 years of service the Sissons engines were stopped with the closure of the steam raising plant in 1975. The destructor was closed and

along with the old boiler house, was demolished. On 23rd May 1978 the 'new' chimney was 'reduced to 62 000 separate bricks' by the 'old-fashioned method' of replacing a segment of brickwork at ground level with wood props and then lighting a fire round the base of the chimney. [20] By 1990 only the 1930 engine house with the three Pearn pumps remained connected to the system. The 1878 and 1904 engine houses were intact but gutted of plant. A new modern electrically powered pumping plant was constructed to the south of the old Station.

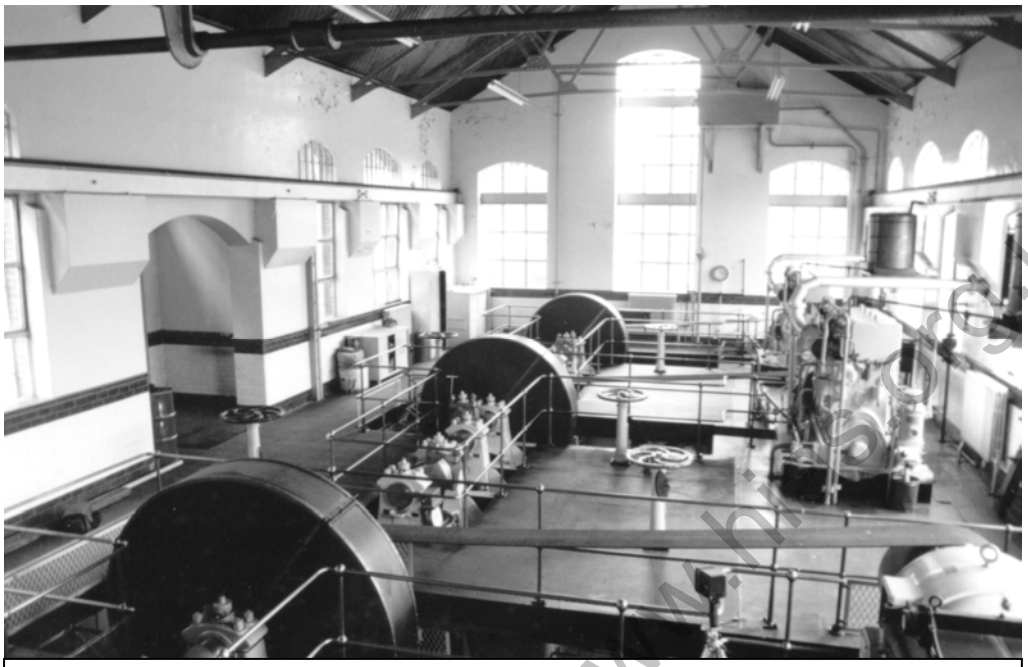


Figure 34. The Pearn pump house in the 1970s showing the two Ruston diesel engines together with the electric motor to drive the three sets of pumps.

From 1992 the old pumping plant stood forlorn and abandoned. The incinerator area became a Household Waste Disposal and Recycling Centre. However, the building has now been refurbished as commercial offices and with the closure of the Recycling Centre in December 2004, it awaits a tenant.

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The American Warship at Wickham

Tony & Mary Yoward

The River Meon rises at South Farm in the shadow of Butser Hill, flowing over 20 miles before entering the Solent. After East and West Meon, it turns south past Warnford, Exton, Corhampton and Droxford to Wickham, then through Titchfield to the sea. Chesapeake Mill is on the west bank of the Meon in Wickham, a few miles north of Fareham, about 300 yards north of the church and near the disused railway bridge. Below the mill, on the opposite side of the road, there was a brewery, also a foundry manufacturing edge tools, but both have long since closed.

One may wonder what this quiet market town in Hampshire has to do with Britain's war with the United States. Nothing really, but the mill does contain timbers from an American warship.

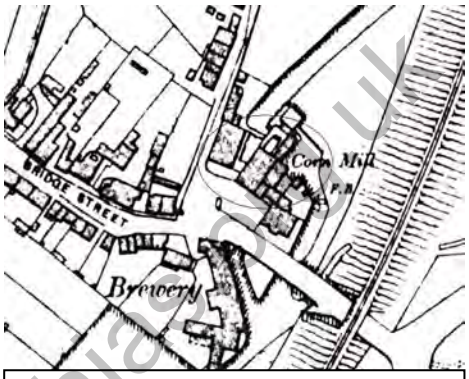

Figure 35. Ordnance Survey map of the area in 1902.

In 1782, Thomas Prior insured his corn mill and dwelling house at Wickham for £800, it being brick built & tiled, and his stock for £500, but nine years later he was insuring the mill and machinery alone for £1,000. In 1801, the Royal Exchange Insurance Company was still insuring the mill and the machinery for the same amount, but the dwelling house was now leased to a miller called Parkin. It was obviously a very profitable business and Thomas himself was living in Bishops Waltham.

In 1813, a Naval encounter between USS *Chesapeake* and HMS *Shannon* outside Boston harbour lead to the capture of the American frigate. It was taken first to Halifax, Nova Scotia, and thence to England where it, the prize of HMS *Shannon,* was added to the Royal Navy by an Admiralty order of 10th November 1814.

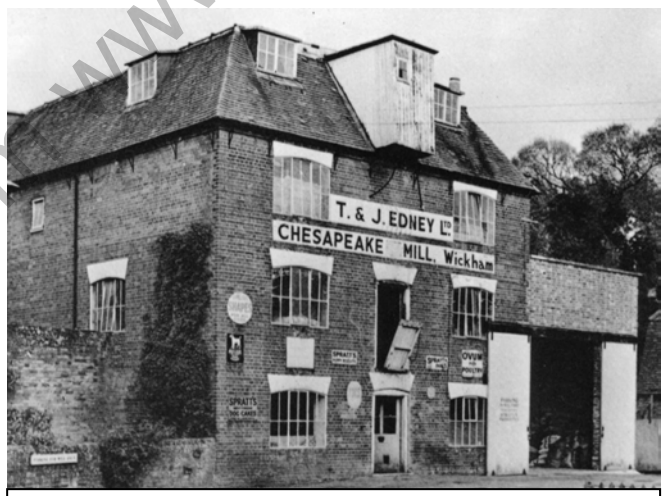

Figure 36. Chesapeake Mill, Wickham.

The *Chesapeake* was sold out of service on 18th August 1819 to Mr Joshua Holmes for £3,450 and he advertised the sale of timbers from the ship. In 1820, Thomas Prior's son John demolished the old mill at Wickham and purchased some of the timbers from the *Chesapeake,* which he used to erect the present building. A stone plaque on the front of the mill records this: "Erected AD 1820 I Prior". The Mill House, built at the same time, is on the west side of the main building, on the opposite side of the river and is connected by a foot bridge.

By 1826 the mill was being advertised for sale with a pair of breast shot water wheels on the west side, driving five pairs of stones, two flour machines and a bolting mill, together with smutt and winnowing machines, capable of cleaning and grinding forty loads of wheat a week. The Clark family purchased the mill from John Prior in 1831, selling it to Goodrichs nine years later. They milled there until 1866 when Garniers purchased it. It seems they then leased the mill out, for in 1877, the Hampshire Chronicle reported that Phillip Bell, a miller & biscuit manufacturer of Wickham and Hurst Mills was bankrupt.

Edward Edney became the miller in 1878 and, in 1919, T. E. & J. H. Edney purchased the mill from Garniers, who had been the owners for the past 53 years. It remained in the Edney family through marriage until it closed in 1991.

During the 20th century flour milling at the smaller mills stopped due to the import of cheap American and Canadian wheat and the dominance of the large steam mills at the ports. Like so many other mills, Chesapeake changed to milling animal feed, but with the supply of electricity reaching farms, farmers began

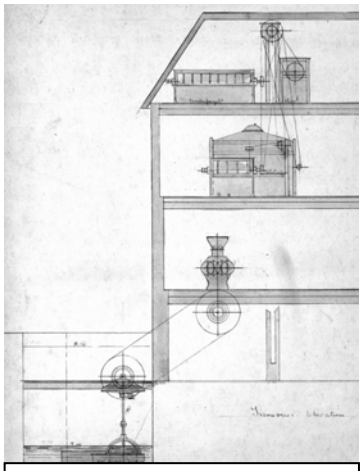

Figure 37. Section of the Mill drawn in 1892 by Armfield when they installed a turbine to drive the Mill.

to do their milling themselves, reducing the profitability of the mill. The last of the mill stones was removed in 1948, and by the 1970s, the mill was used to produce only animal feed, using electricity to power the roller and crusher plant and the turbine to power the mixer and hoist. Later the mill was used for storage and as the distribution centre for seed grain and fertilisers.

In 1986 Bruce Tappenden, the last miller, issued an invitation to friends, including one to the American Ambassador,

"You are hereby invited to attend celebration to commemorate the One hundred and Seventy Third anniversary of the taking in battle of the American frigate *Chesapeake* by His Britannic Majesty King George the Third's ship *Shannon* on the first day of June in the Fifty Third year of his reign anno domini One Thousand Eight Hundred and Thirteen.

The aforementioned celebration to be held in those premises now known as 'The Chesapeake Mill' situate in the Parish of Wickham and now in the tenure of Sylvia and Bruce Tappenden of the said Parish. Commencing at twelve noon. The herein-referredto-abovementioned event will take place on the First day of June in the year One Thousand Nine Hundred and Eighty Six. Long live the Queen".

In 1989, Bruce sent a sample of the timber to the United States Forestry Service laboratory and they confirmed that this was southern long leaf yellow pine, as used in the construction of the *Chesapeake*. The mill timbers form one of the largest and most significant groups of 18th century ship timbers surviving in Britain today.

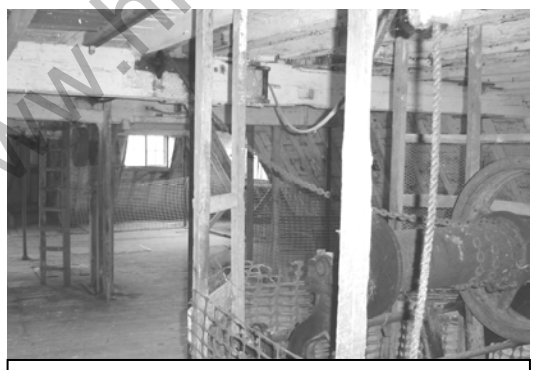

Figure 38. Interior of Mill showing sack hoist and deck beam from the *Chesapeake*.

Two years later, the mill closed, Bruce Tappenden retired and the RCHM completed a survey of the building which was published the following year. A local charity was formed in 1996 to apply for a Lottery grant to purchase Chesapeake mill for a Heritage Centre, but in 1998 the Hampshire County Council completed arrangements to buy the Chesapeake Mill for £115 000 and place it on the buildings-at-risk register. It had been hoped that it would be restored and available as an interpretation centre for the Meon valley, but this was not to be.

Figure 39. Interior of Mill showing sack hoist trapdoor and beam from the *Chesapeake*.

Bruce Tappenden died on 18th March 2002. He was related to the Edneys who started milling here in 1889 and was also a founder member of the Hampshire Mills Group in 1975.

The mill was upgraded from two to two star rating, thus giving it extra protection and a new 125 year lease was granted to Tony Taylor of the Chesapeake Mill Ltd. This company began to trade in retail and wholesale antique furniture from the property in November 2004. Major repairs have been carried out to the roof, so the property is now wind and water-tight. The whole Mill is its own museum, available for public access, with the Chesapeake beams fully visible, along with the remaining milling equipment which will be restored by the Hampshire Mills Group. The lease includes a museum area which will be an interpretation and meeting area which can tell the story of the ship, the battle, the history of the mill and the village.

The members of the Hampshire Mills Group have been closely associated with the mill for many years, meetings have been held there as well as parties and lectures. Now they have been able to get the turbine working

and have connected it to the lay shaft which transfers power to the floor above. Among the items still present are an "Armfield Seed Separator", an "Armfield Oat Clipper and Separator" and a weighing machine by Locke Bros. of Portsmouth.

This has been the story of the mill, but now follows the story of the naval encounter in 1813.

The Capture of the *Chesapeake,* 11th June 1813

In 1812, while Britain was still fighting Napoleon's France, the Americans objected to the blockading of their East Coast ports denying them the right to trade. Their boats were being searched on the high seas for contraband and British deserters and so they declared war on England.

During the 1790s, the Americans had built some very large 44-gun frigates and when the war broke out, these ships won a series of single-ship actions in which the American frigates *Constitution* and *United States* captured the British frigates *Guerriere*, *Macedonian* and *Java*. The British public, accustomed to naval victories regardless of the odds, was incensed, when, after twelve months at war, the Royal Navy had still not gained a victory in a single-ship action. A British victory was desperately needed to redress the balance of American successes at sea. The growing concern about the war among both the Admiralty and the British public led to an even closer blockade of American ports.

Since the 1750s, the term frigate had described the smaller, faster types of warship used for commerce protection or raiding, or scouting for the main fleet. The Royal Navy's largest type of frigate at this time was the *Shannon*, completed in 1806. She was a Fifth Rate *Leda* class, mounting thirty-eight 18-pounder guns on the upper of its two decks.

While patrolling the coast of the United States, HMS *Shannon* was commanded by Captain Philip Broke. He was 36 and a great gunnery enthusiast, who during his seven years in charge, had worked up his ship to a peak of fighting efficiency with the best gunnery drill of any vessel in the Royal Navy. They had been trained to fire into the hull of the enemy ship to kill the crew instead of shooting down the masts. Throughout his career, Broke had prepared for a single-ship action. He even refused to capture American merchant ships, as this would require him to put crews on board and reduce the fighting efficiency. He was keen to put these meticulous preparations to the test by engaging an American frigate in a single-ship action.

The US frigate *Chesapeake* was a 44-gun frigate built at Gosport, Virginia, in 1799. In the spring of 1813, Captain James Lawrence was appointed to command her, joining his new ship at Boston, where she was undergoing a refit. Aged 31, the new commander of the *Chesapeake* had already achieved fame for his capture of the British sloop of war, *Peacock*. However, many of her officers had been replaced and a large percentage of her crew was newly enlisted. Though the ship was a good one, with a well-seasoned Captain, time would be necessary to work her men into a capable and disciplined combat team.

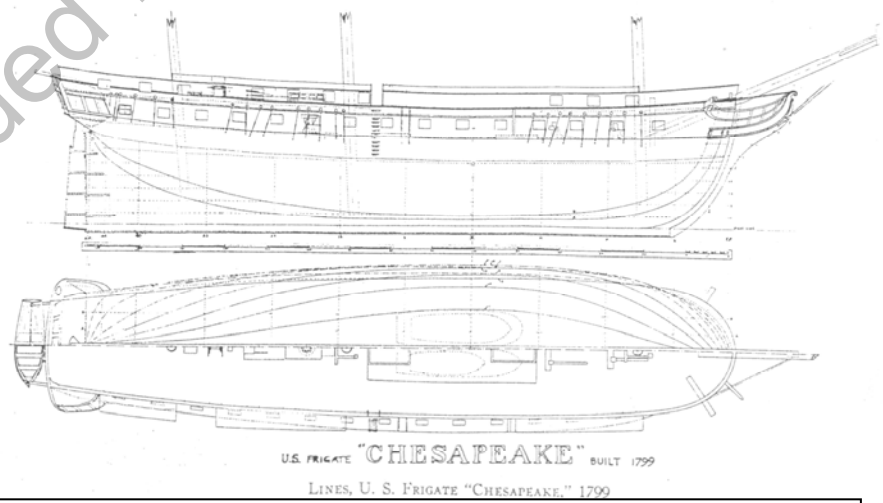

Figure 40. Hull lines of the US frigate *Chesapeake*, built 1799.

After a long patrol blockading Boston in June 1813, Broke had seen the *Chesapeake* in harbour. Worried that she might not go to sea before a shortage of food and water necessitated the return of the *Shannon* to the dockyard at Halifax, Nova Scotia, Broke composed a letter to Lawrence and sent it into Boston harbour.

> "Sir, as the *Chesapeake* appears now ready for sea, I request that you will do me the favour to meet the *Shannon* with her, ship to ship, to try the fortunes of our respective flags. I entreat you, sir, not to imagine that I am urged by mere personal vanity to the wish of meeting the *Chesapeake*, or that I depend upon your personal ambition for your acceding to this invitation; we both have nobler motives.
>
> I will send all other ships beyond the power of interfering with us, and meet you whenever it is most agreeable to you. I will warn you should any of my friends be too nigh, or I would sail with you, under a flag of truce, to any place you think safest from our cruisers, hauling it down when fair to begin hostilities. You will feel it as a compliment if I say that the result of our meeting may be the most grateful service I can render to my country; and I doubt not that you, equally confident of success, will feel convinced that it is only by repeated triumphs, in even combats, that your little navy can now hope to console your country for the loss of that trade it can no longer protect.
> Favour me with a speedy reply. We are short of provisions and water, and cannot stay long here".

This was certainly a cold-blooded challenge, but a most fair and gallant one. It was unfortunate that Lawrence, whose previous experience with British warships had convinced him that they were not likely to be formidable opponents, never received the challenge as the *Chesapeake* had sailed the morning the letter was sent. The sight of a British frigate in the offing had proved an irresistible spur to action and she left her moorings in President Roads, Boston, and sailed out, intending to meet the *Shannon* off the coast between Cape Ann and Cape Cod. The ships were of virtually identical firepower, though the American ship's crew was rather larger, and a duel between the two was attractive to both captains.

They sailed several miles offshore, where *Shannon* slowed to await her opponent, who approached flying a special flag proclaiming "Free Trade and Sailors' Rights" in recognition of America's pre-war grievances against British policies. The *Chesapeake* bore away from the Britisher, and when within pistol-shot, swung into the wind and then ensued one of the bloodiest and most terrific combats between two ships-of-war.

As the *Chesapeake* approached, both ships opened fire. The first devastating broadside from the *Shannon* at a range of about 38 yds (35 m) did more damage and produced crippling casualties on *Chesapeake*'s quarterdeck. Lawrence was wounded, but ordered the *Chesapeake* to slow down to enable her to return fire. This did not give the American gunners time to adjust their aim and as the carronades of the British ship swept the *Chesapeake*'s quarter and upper decks, two-thirds of the gun crews were already casualties. Then at a crucial moment, the *Chesapeake*'s wheel was destroyed by a round from a 9-pounder gun which Broke had installed on quarterdeck of the *Shannon* for that purpose.

Figure 41. A painting of the *Shannon* and the *Chesapeake* in the National Maritime Museum.

The American ship was out of control and her vulnerable stern was exposed to raking British fire. In desperation, Lawrence ordered his men to board, as the *Chesapeake* drifted stern first towards the *Shannon*. Instead, it was Broke who seized the moment and led the boarding party in person onto the *Chesapeake*, where terrific hand-to-hand fighting occurred. Assisted by cannon and small arms fire from on board *Shannon*, they soon gained control above decks and many of the crew of the *Chesapeake* were finally driven into the hold.

Three American sailors, probably from the rigging, attacked Captain Broke. He killed the first, but the second hit him with a musket and the third sliced open his skull before being overwhelmed. Propped up against the gunwale, Broke watched the remainder of the fight.

The American commander, Captain James Lawrence, was mortally wounded. His friend, Samuel Livermore of Boston, who accompanied him during this fight, attempted to avenge the wounding of his commander by shooting Captain Broke, but the shot just missed the mark. As he was carried from the deck he issued his final rallying cry to his crew, "Don't give up the ship", a phrase which has become a cherished part of United States naval lore.

Some fifteen minutes after the battle began, it was effectively over. The *Chesapeake* was in British hands. Casualties were heavy, with more than sixty killed on *Chesapeake* but only about half that many on *Shannon*. The latter's cannon had made more than twice as many hits, and her boarding party had demonstrated a decisive superiority in hand-to-hand fighting. The action, which greatly boosted British morale, provided another of the War of 1812's many examples of the vital importance of superior training and discipline in combat at sea.

Despite the short time for which the two ships were engaged, this battle resulted in more casualties than in any other single-ship action in the history of both navies at that time. In the short space of fifteen minutes the Yankee vessel had been hit 362 times and 148 of her crew had been killed or wounded, while the English vessel had been struck by 158 shot, and 83 of her seamen were dead or disabled. The First Lieutenants of both vessels were killed. All the *Chesapeake*'s officers were casualties and Lawrence died of his wounds three days later, in spite of the attentions of the surgeon Broke sent to take care of him.

The Bostonians had been so sure of a victory that they had prepared a banquet, intending to include the defeated Broke and his officers. Many people had assembled on the shores of Hull, Nahant and Marblehead on the ill-fated day to witness the battle between the British *Shannon* and the American *Chesapeake*. Afterwards, they had to watch their ship being carried away, within sight of Boston Light, with the English flag at the masthead.

The two ships then sailed for Halifax, their decks strewn with the dead and dying; the commander of one unconscious and the other dying. On arrival at Halifax, Captain Broke, severely wounded, was taken to the Governor's Residence, where careful nursing set him upon the road to a partial recovery. Broke returned to England where he received a hero's welcome for restoring the pride of the Royal Navy and was knighted. But ill health, the consequences of the wound received during the battle, prevented him from taking command of another ship and he retired to his country seat near Ipswich in Suffolk, where he died in 1841.

News of the victory of the *Shannon* was sent to England as swiftly as possible, where it was received with jubilation by the public, and relief by the Admiralty. The action greatly boosted British morale. The battle damage to the *Chesapeake* was repaired in the dockyard at Halifax, after which she was sailed to England. The Admiralty was pleased at last to have captured an American frigate and she was taken into the Royal Navy under the same name. Captain Francis Newcombe commanded her at Plymouth during 1815. Thus, serving naval officers were able to assess the characteristics and construction of the hitherto successful American frigates. She then sailed on convoy escort duties to the Cape of Good Hope and back and later was used as a stores ship. Finally, in 1819, she was sold out of the Service and was broken up at a commercial shipyard in Portsmouth.

HMS *Shannon* was placed in the reserve in 1831. She was renamed the *St Lawrence* in 1844 and became a receiving ship at Sheerness, before finally being broken up in November 1859.

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Captain Thring's 'Rate of Change of Range' Calculator

Meredith Thring

The late nineteenth century and the early 1900s were years of rapid progress in naval gunnery. Nelson's navy had fired at point-blank range, with ships often touching. The advent of breech loading guns in the middle 1880s had been followed quickly by the adoption of range finders in the 1890s and electrical devices for transmitting ranges and firing orders from the range finders to the guns. Further range finding and spotting of the fall of shot would indicate a sighting correction for the next salvo. However, as ranges, rates of fire and ship speeds increased, more information for effective fire control, such as the likely change in range and bearing of the target, became essential. Various devices were proposed for the Royal Navy and navies abroad.

In 1902 Captain Thring invented one of the first rate of change of range instruments. In effect, a form of rotary calculator, it was tested in gunnery experiments afloat in 1904 on board HMS *Venerable* (Mediterranean Fleet) and HMS *Victorious* (Channel Fleet), and was commended by the Admiralty. However, only the Dumaresq instrument, tested at the same time, was adopted for British service. In part this was because the latter could indicate the rate of change of deflection as well as of range. Investigations of salvo firing also began at this period. These and other developments would lead ultimately to the full 'director-controlled' system used in the First World War. Captain Thring further received their Lordships' appreciation for "zeal and ability in working out the rate of change of bearing lines for the Dumaresq instrument". A specimen of Captain Thring's calculator, constructor by the Malta Dockyard in 1902, was kept by him and is now in my possession (Figure 42).

The calculator

The instrument was designed to enable the gunnery officer of a battleship to calculate quickly the rate of change of range of the enemy ship, both as the change in distance (in yards) in 15 seconds and as the time (in seconds) to change 50 yards. Setting the data about the movements of the two ships into the instrument moves the two scales $\mathbf{S}_1$ and $\mathbf{S}_2$ relative to each other, so that the 'infinite time' mark on $\mathbf{S}_2$ points to the calculated distance (in yards) on $\mathbf{S}_1$, and the 'zero distance' mark on $\mathbf{S}_1$ points to the calculated time (in seconds) on $\mathbf{S}_2$ (see Figure 43).

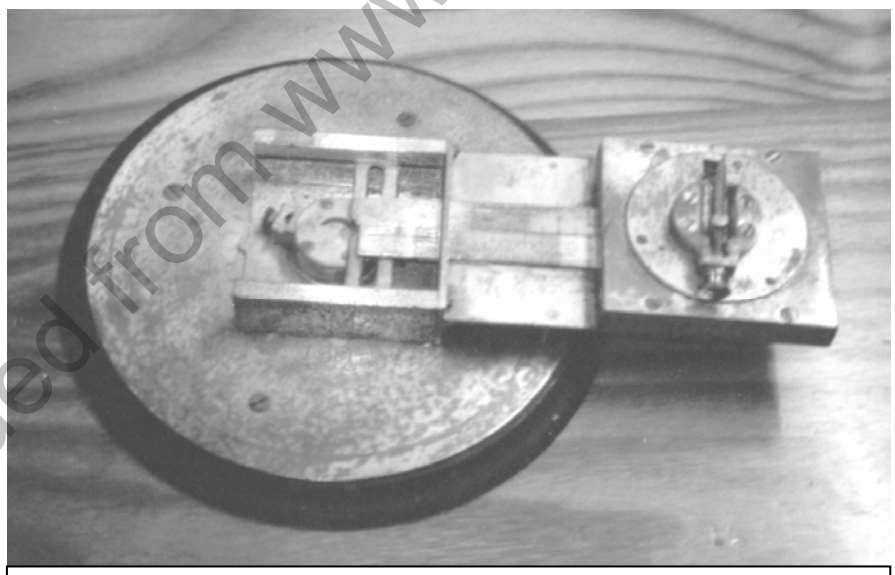

Figure 42. Captain Thring's calculator made in Malta Dockyard, 1902.

Construction

The instrument is made of brass and the diameter of the base disc B is 225 mm. Slider $\mathbf{S_1}$ carries a uniform scale of 'change in yards per 15 seconds' from '400 increasing' at the end linked to **E**, through zero in the centre, to '400 decreasing' at the end nearer **G**. The scale is moved by the rotation of the carriage **C**.
Slider $\mathbf{S_2}$ has a reciprocal scale of 'time in seconds for changing 50 yards' with infinity at the centre. It runs from '3 seconds decreasing' at the end nearer **D** to '3 seconds increasing' at the end linked to **J**.

Carriage **C** rotates about a pillar **D** fixed to the baseboard **B**. A pin **E** can be moved by the screw feed **F** along the 0^o - 0^o diameter of **D**. The eccentricity or offset, R_1, of **E** from the centre of **D** is set to correspond to our ship's velocity v_1. Pin **E** engages with the slotted end of scale $\mathbf{S_1}$ so that $\mathbf{S_1}$ is moved forward by

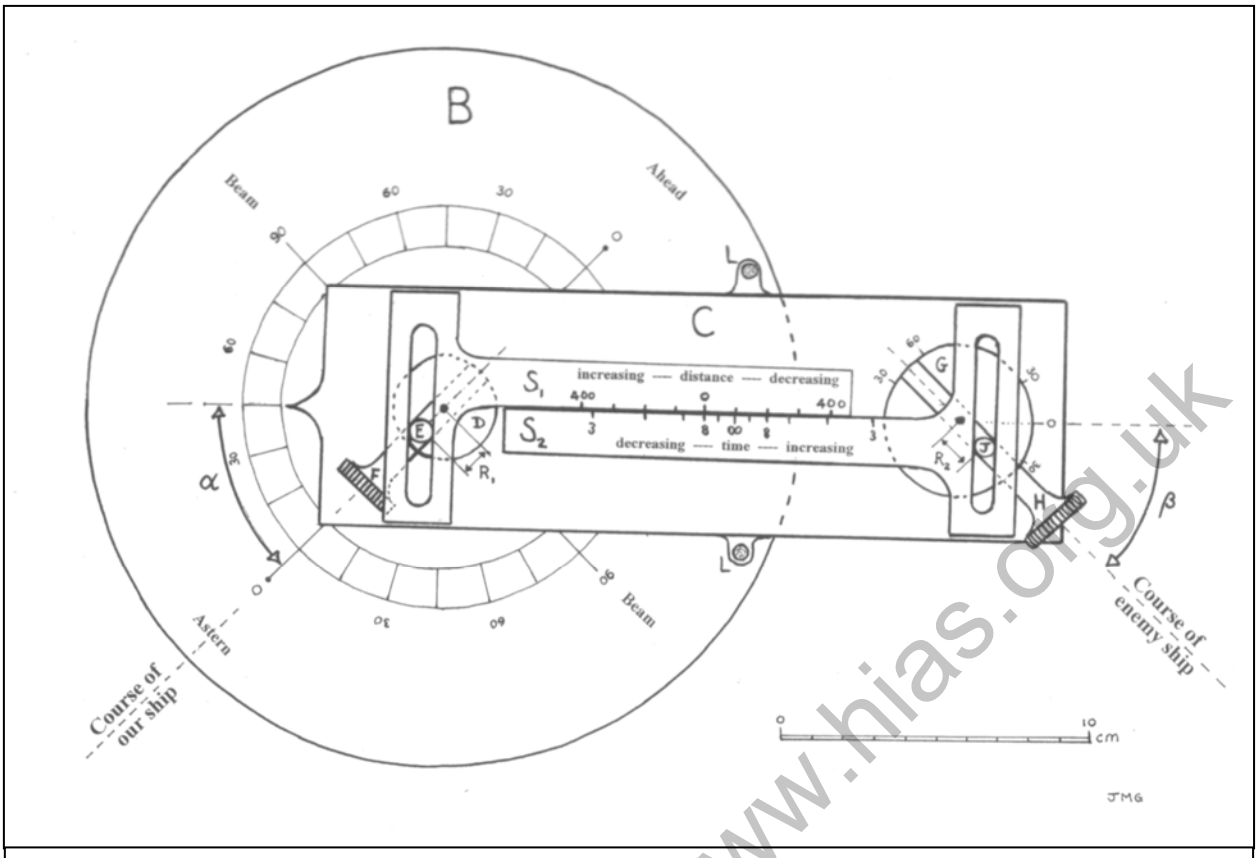

Figure 43. Simplified diagram of Captain Thring's calculator to explain its construction and operation.

distance R_1 when the angle α is zero: i.e. when our ship is moving straight towards the enemy. When the enemy is abeam, the movement of $\mathbf{S_1}$ is zero. When the enemy is astern and receding, the movement is $-R_1$. In the position shown in the diagram the movement is ($R_1 \cos \alpha$.).

Carriage **C** is supported by two pins **LL** rubbing on the outer edge of **B**. At the other end of carriage **C** is a second adjustable eccentric, **G**. **G** can be rotated to point in the direction of movement of the enemy ship so that its angular scale shows the angle β between the line joining the ships and the direction of movement of the enemy. A screw **H** adjusts the eccentricity, R_2, of pin **J** to correspond to the estimated velocity v_2 of the enemy. Pin **J** is connected to the slotted end of $\mathbf{S_2}$ and controls its movement in a similar way to pin **E** controlling $\mathbf{S_1}$. Thus the movement of $\mathbf{S_2}$ is given by ($R_2 \cos \beta$).

The relative movement of scale $\mathbf{S_1}$ to scale $\mathbf{S_2}$ is thus: ($R_2 \cos \beta - R_1 \cos \alpha$.)
This is proportional to ($v_2 \cos \beta - v_1 \cos \alpha$), or the 'rate of change in range due to the enemy ship increasing its range minus the rate at which we are decreasing it'.

Thus when two ships are moving with the same speed ($R_1 = R_2$) on parallel courses ($\alpha = \beta$) the zero on the 'change in yards per 15 seconds' scale $\mathbf{S_1}$ must coincide with infinity (∞) on the 'time in seconds for changing 50 yards' scale $\mathbf{S_2}$.

Using the calculator
The Operator first sets the circular baseboard **B** so that 0 on its circular scale points in the direction of movement of his own ship. He adjusts screw **F** to set the speed of his own ship. Then he rotates carriage **C** through an angle α until it points towards the enemy ship. He adjusts screw **H** to set the estimated speed of the enemy and rotates **G** to set the angle β between the line joining the ships and the estimated course of the enemy. These operations move $\mathbf{S_1}$ relative to $\mathbf{S_2}$ so that the rate of change of range in 15 s can be read off on $\mathbf{S_1}$ as the value opposite the infinity mark on $\mathbf{S_2}$, and the time to change by 50 yards on $\mathbf{S_2}$ opposite the zero mark on $\mathbf{S_1}$. The setting on the diagram shows the range decreasing by 100 yards every 15 s on $\mathbf{S_1}$, or decreasing by 50 yards in 8 s on $\mathbf{S_2}$ with the two ships' courses at right angles and a bearing of 45°.

Captain W. H. C. S. Thring, CBE, RN

My father, Captain W. Hugh C. S. Thring, CBE, RN (1873-1949), had an unusual and varied naval career. He entered HMS Britannia in 1886, passing out as midshipman two years later. With five first class certificates, and specialising in gunnery, he was promoted to lieutenant in 1893. He received the Admiralty's thanks for extinguishing a dangerous cordite fire in the magazine of the battleship *Revenge.* Promoted commander in 1904 and appointed to the battleship *Vengeance*, on the China Station, he was an observer in the final naval operations of the Russo-Japanese War. Soon after, he became Flag Commander and chief intelligence officer to Admiral Lord Charles Beresford, in command of the Channel Fleet, with responsibility for the gunnery training of some sixty ships. This was at the height of the Fisher-Beresford controversy. After Beresford's eclipse, Thring was placed on the retired list at his own request, with the rank of captain in 1911.

Figure 44. Captain Thring at Buckingham Palace after the award of a CBE in 1920.

In 1913, he accepted an appointment in Australia as assistant to the First Naval Member. Described by a contemporary as a "clever, silent, well-informed man", he was instrumental in establishing an Australian Naval Staff and a system of naval intelligence, ensuring that the country entered the 1914-18 war with a high degree of naval preparedness. During the war he served as Acting Second Naval Member, then Director of (Naval) Ordnance and Director of the Naval War Staff, practically carrying out all the navy's wartime administrative work. With his health weakened, he subsequently served briefly at sea before becoming Australian naval liaison officer in London (1920-22), his last post before final retirement.

There is believed to be a Japanese connection to the story. Researchers in Japan have recently studied the records of the days after his arrival in the Far East early in April 1905 and Admiral Togo's Fleet Order of 17th April, on fire control and salvo firing, shortly before the decisive Battle of Tsushima (27-29 May). Unfortunately Thring kept no diary at this period, but as a gunnery and intelligence expert he would have been well placed and, at the height of the Anglo-Japanese Alliance, permitted to discuss the latest British gunnery results and tactical concepts with Togo and his Chief of Staff, Admiral Koga. Thring's instrument was in his possession for demonstration or loan. Such co-operation would have been highly confidential, and no details have come to light here. In any event, in 1920 he was awarded the Order of the Rising Sun, Third Class. Ironically, his Australian service had by then made him very keenly aware of the future Japanese threat to the British Empire.

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Acknowledgements

Dr. John Brooks, for information from Admiralty Papers in the National Archives and for an introduction to fire control instrumentation, and Ian Sturton for tying together loose ends.

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