Innovative Fog Bells at White Head Light Station

The Maine Coast has long been notorious for fog. It was the bane of the life of coastal navigators that caused great difficulties and sometimes disasters. A ship that was wrecked might be savaged but at worse a total loss. The Lighthouse Service maintained records of each light station fog signal hours and reported in 1915 that the stations with the greatest number of hours over a thirty year period were in Maine. At the top of the list were the ten light stations on the coast from Seguin to West Quoddy Head. Number two on the list was Whitehead Light with 1544 hours or eighteen percent of the time.

Whitehead Light at the southern entrance of the Mussel Ridge Chanel of served night and day to guide many hundreds of ships passing close by this lighthouse when entering or leaving the West Penobscot Bay bay region. For the year 1880 Keeper Grant reported observing 15,375 vessel passage as seen during days with no fog and with many more unseen at night or when he was otherwise occupied with light station duties.

In 1829, the first fog signal at a cost of $200 was installed at Whitehead, a clockwork operated fog bell designed by Luther Whitman a Winthrop Maine machinery manufacturer and son of a clock maker. Similar bells were also installed at light stations at Seguin, West Quoddy Head and Cape Elizabeth. This Whitman bell sounded three consecutive strikes each minute, the clockwork weight requiring manual winding every six hours. This sound from this fog bell barely satisfied the needs of sailing vessels but not the steamships. The bell was small and not loud enough to be heard over the noise from steam powered machinery. Steamship captains were compelled to slow down and even to stop to listen for the bell.

The Morse Fog Bell

Following a recommendation to the Lighthouse Board by the noted and respected civil engineer Col. Loammi Baldwin and with a petition presented to Congress in 1837 by the Senator from Maine John Ruggles on behalf of Andrew Morse, Jr., *"praying that his improved fog bells may be adopted by the Government, so as to test their utility"* ; which was referred to the Committee on Commerce. Soon after a $2500 expenditure was authorized for one such bell at a location to be later selected. This was a clockwork operated fog bell that was automatically wound by an innovative and unique wave powered mechanism designed by Morse. a self-taught mechanic and inventor from Portland and later Boston. Whitehead was selected for reasons of the need for a larger bell and the shoreline topography at the light station was favorable for installation of the ocean wave activated winding mechanism. The bell was installed in 1838.

The wave powered winding device and clockwork were described in a letter written in 1840 by Senator Ruggles and Sullivan Dwight a Thomaston Maine manufacturer and businessman. "*The power that rings the bell is obtained by the rise and fall of the tide and the swells, which at that place are constant and unceasing. One end of a large timber, nearly 30 feet long, projects out upon the water, the other end being confined by chains and braces to the middle of another stout timber, some 20 feet long, which lies along the shore, hinged at each end of a projecting rock, both together forming a T. From the point of juncture, a small timber rises vertically to a height of 18 or 20 feet, being well braced to its position; to the upper part of this mast is attached a chain, which with a continuous rod of iron, extends up to the bell-house, a distance of about 140 feet. The chain received the vibrations from the outer end of the long timber, and a "take-up" weight in the bell-house gets a constant reciprocating*

motion, which, acting upon the machinery in the bell house, winds the heavy weight of about 2000 pounds, that drives both the regulating and striking part of the apparatus…Bell is struck four time a minute by 15-pound hammers. Object sought has been fully and successfully accomplished by it, and that for such purpose is a valuable invention."

Simply described this Morse invention captured the wind derived kinetic energy of ocean waves and transformed this energy to stored energy of the large suspended bell weight to then be consumed to operate the clockwork to produce the sound of the bell four times each minute. The take-up weight and its drum served as a substitute for the winding handle used for a manually wound clockwork.

Unlike with manual winding the "automatic" winding of the Morse bell large weight occurred continually in repeated small increments produced by and in proportion to the amplitude and frequency of the ocean waves. At this location where exposed to open ocean there was most always wave action. When the beam extending in the ocean moved downward the take-up drum revolved and the take-up weight would rise. When the beam moved upward the take-up weight would descend and with now a reverse rotation of the take-up drum and this rotation via a ratchet connection and gears turned the large weight winding drum to raise the large weight. Although identified as a tide-powered bell only a small increment of winding resulted from the slow down and back movement of the long leg with the twice each day ebb and flow of the tide. The contribution to winding by waves notably exceeded that from the rise and fall of the tide.

If for example there was a 6 to 1 gear ratio between the take-up drum and the large drum each one foot of wave height would raise the clockwork weight two inches. If a 10 to 1 ratio the rise would be 1.2 inches. During calmer sea conditions with light wind the expected wave action could be one to two foot waves every two seconds compared heavy seas of 12 foot waves every 6 to 8 seconds. Regarding winding from the an average 8.5 foot tide cycle every twelve hours the contribution of the tide would only be 10 inches of weight rise and insufficient for this same twelve hours of bell operation.

The actual gear and ratchet arrangement and gear ratios of this apparatus is not known. No official documents and drawings have been located. It is believed such were retained in the district files in Portland. Unfortunately the offices of the Forth District contining and district letters, records, documents, photos and drawings was destroyed during the Great Fire of Portland in July 1866.

The sound produced by this large bell met with the approval of steamship captains being louder than the previous bell. However, the ocean end of the winding mechanism often failed when the large timbers were displaced out of position at times of more violent action of storm seas. The size and weight of these beams made repairs at low tide during calmer seas by the lone keeper not possible. The fog bell clockwork apparatus was not designed with appropriate provisions to accommodate hand winding of the large bell weight when the wave winding function was disabled.

In 1842, Keeper Joshua Bartlett wrote, "*There is a very good clock machine attached to the fog bell, which has but one defect, and that is, it takes the force a luff tackle and two men to wind up the bell weight that sets it in motion. I generally ring the bell by hand, though during fogs of long duration it is impossible for me do so. The use of a fog-bell here is very great -I have seen fifty sail a day pass the rocks here by the sound of the bell alone; for compass courses cannot be relied upon, owing to the set of the tides."* On the other hand, Keeper Bartlett for his efforts was admonished by I.P.W. Lewis in 1842 for having "*adopted the novel experiment of attaching a line to the clapper of the bell, the other end of which leads through a hole in the window of his bed chamber, and amuses himself after retiring for the night with tolling an hour or two."*

After fifteen years of operation the Morse fog bell was replaced in 1853 by a Jones Patent fog bell at a cost of $2500. This bell was the 1850 invention of Daniel Jones of St John, New Brunswick and the

subsequent Jones bells of improved design were manufactured in the U.S.. The first Jones bell was evaluated at Boston Light and thereafter in 1852 the appropriation of $10,000 enabled installation of Jones bells at Cape Elizabeth, Seguin, West Quoddy and at Whitehead.

This hand wound bell at Whitehead struck three times each minute. At the outset, problems occurred with the striking mechanism and the keeper often resorted to ringing the bell by hand. It now being recognized that the work load added by the bell often exceeded that which could be accomplished by a lone keeper the position of assistant keeper was created. In 1861, the Jones Bell was completely overhauled and remained in operation until replaced by steam whistles in 1869.

From the experience at Whitehead Andrew Morse subsequently improved the design of the bell clockwork of his bell such that the bell would operate several days without winding. He also replaced the large timbers of the wave winding feature with a large float suspended by a cable on a pulley at the outer end of an arm extending from the shore above sea level. This improved design was patented in 1861.

It is believed, however, that the Morse fogbell may not have used at another light station. There was keen interest in 1841 by the Provencal Authorities of New Brunswick to install a Morse bell at Partridge Island Light but not done for reasons of the cost. Certain features of the Morse designed clockwork inspired improved fog bell clockwork designs by others. Morse also invented and patented an improved ship steering wheel and a ship capstan that would permit faster taking in of anchor and chain and with fewer men required to operate the capstan.

W.R. Close Wave-powered Fog Bell

In 1876 a special appropriation was approved by Congress to facilitate erection for evaluation an "automatic" fog signal invented and patented by Walter R. Close of Bangor, Maine.

This wave powered device consisted of an upright 32-foot long shaft fastened to a rock, the rock with shaft then placed in position with the rock below the low tide level close to the shore. The shaft was held in place and braced by several iron rods. Riding up and down on the shaft by virtue of wave action was a doughnut shaped hollow metal float with a metal rod extending upwards to operate the bell striking mechanism at the top of the assembly. The bell would then sound with each descent of the float.

This equipment was a prototype for the purpose of evaluating the float operated bell concept and was not intended as a permanent installation for such would have to be of more substantial design and with a larger bell and with structural additions to permit a keeper to access the bell mechanism from the shore.

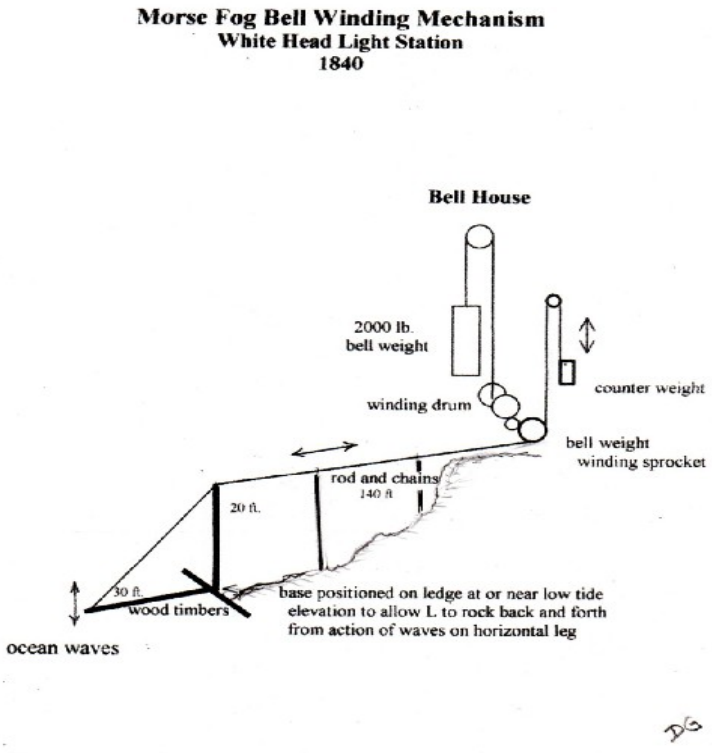
In early September 1876 Lighthouse Board Chairman Prof. Joseph Henry and others on the lighthouse tender *Iris* commenced at Portland a several day journey on the Maine coast to evaluate the performance and conduct tests of various fog signals, both at light stations and buoys. In his subsequent report Henry reported they reached Whitehead the first day at about midnight, anchored nearby in Seal Harbor and on the next morning examined the Close bell followed by sound testing of the Whitehead steam whistle fog signal. This is the only indication that the trial bell was at Whitehead and not at another location such as Owls Head Light eight miles distant.

Professor Henry wrote in his report after viewing this bell, "*This arrangement is the most simple and efficient of any of the kind or which we have knowledge."* However, he further stated, "*The objection to it is its liability to be deranged by the action of ice and the rusting of the parts from exposure to weather."* Not mentioned was the bell sounding would be inconsistent for being dependent on wave action and with this action variable over time as with bell and whistle buoys. This would not serve well for a fog signal station bell where the continual sounding of specific bell characteristic was be required.

Regarding the challenges of Maine fog Lighthouse Board members and others including the renowned British physicist Prof. John Tyndall of the Royal Institution of London spent a considerable amount of time at various times regarding fog signals on this fog-bound Maine Coast conducting sound studies to better understand the unusual sound phenomena that at times caused "sound dead zones" where the fog signal sounds could not be heard. In 1878 several days of tests involved the use of three tenders, the *Iris, Myrtle and Daisy.* For reasons of this sound anomaly sound signals would continue to serve only as supplemental aids to navigation.

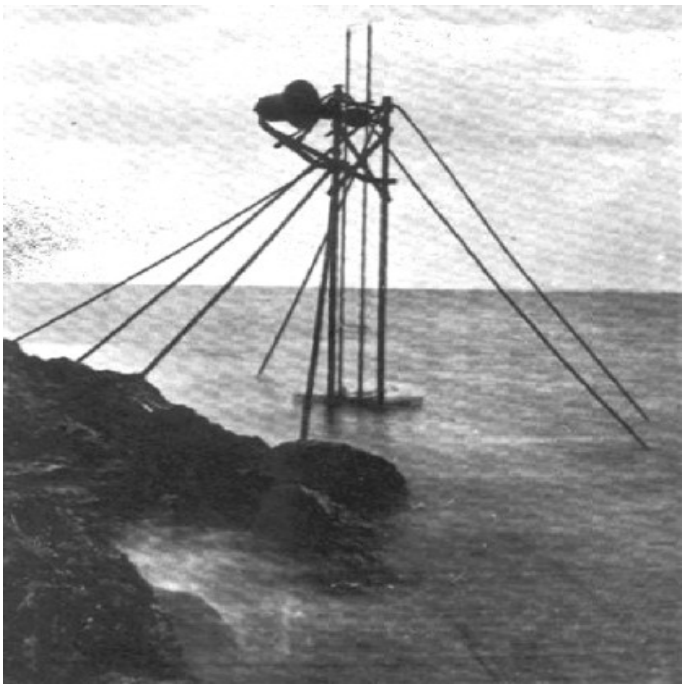
The Morse Bell, the Close Bell and others devices tested and the many sound studies conducted at various locations demonstrated the serious commitment of Professor Henry and the Lighthouse Board to continually seek to improve efficiency and effectiveness of navigation aids.

DG
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Jones Bell



Close Wave Bell