

THE NATIONAL TRUST

TYNTESFIELD HOUSE, WRAXALL, NORTH SOMERSET

REPORT & ASSESSMENT OF THE WAYGOOD LUGGAGE/PASSENGER LIFT

Report prepared by

David A. Cooper
BSc(Hons), MSc, CEng, FRSA, FIET, FCIBSE

PREAMBLE

In early August 2008 I received a telephone call from Dr Gina Barney asking if I could assist the CIBSE (Chartered Institution of Building Services Engineers) Heritage Group by undertaking a survey of a lift they had been informed of by the historic property co-coordinator at a house in North Somerset. I duly agreed and met with Frank Ferris of the Heritage Group to undertake a survey of the semi derelict lift which transpired to be a Waygood & Co water hydraulic design dating somewhere between 1868 and 1897. This article details my findings and considerations.

TYNTESFIELD HOUSE

Tyntesfield House is a spectacular Victorian country house/mansion which was home to the Gibbs family for four generations. It contains everything from grand Victorian designs to 20th century objects and even boasts its own chapel and saw mill. The house has been under the custodianship of the National Trust since 2002 and is undergoing a multi million pound refurbishment to protect it from deterioration.



Tyntesfield House (P5)

WAYGOOD & CO

Waygood & Co were formed in the 1830's by Richard Waygood. It is known that the first water hydraulic lift ever installed was in 1846 however it was not until 1868 that Richard Waygood took his first order for such a design. It was not until after Richard Waygood's retirement in the 1870's that the company began to concentrate on the production of lifts as its core business and in 1884 they developed a water hydraulic type that utilised an accumulator rather than allowing the cylinder to empty to a drain. In 1890 Waygood exhibited the first electric lift at the Crystal Palace exhibition and in 1893 they installed a lift for use by the Queen at Balmoral Castle and subsequently gained the status of "by royal appointment". In 1894 they produced a triple jigger water hydraulic lift which saved water by using only the number of pistons required. Waygood & Co wasn't incorporated until 1897 and were the subject of an aborted merger with Otis in 1903. In 1906 it was reported by the London Hydraulic Company that Waygood had installed the greatest number of lifts in the UK. Eventually, and reports suggest dates ranging from 1913 to 1916, they became a subsidiary of Otis.

THE WATER HYDRAULIC LIFT

The lift was found to be in a semi derelict state but originally served three floors.

As previously stated research into the historical archives of the lift industry have revealed that it is likely that the lift was installed between 1868 and 1897 which also ties in neatly with the history of the house. It was known that the owner of the house was in favour of modern technology and given that no accumulator has been found the timeline may be limited to 1868 to 1884.

The top of the piston had been cut off at Level 1 and a bathroom installed on the floor above in the area where the piston used to operate. Evidence of this still exists with lines in the ceiling and a pipe still running round the shape of where the cladding would have been.

Levels 1 and 2 landing doors were mechanically shut by virtue of two timbers nailed in position across them.

The lift car was accessible at the Ground floor level and was found to be of timber construction with no ceiling which assisted greatly in being able to see the components in the shaft.

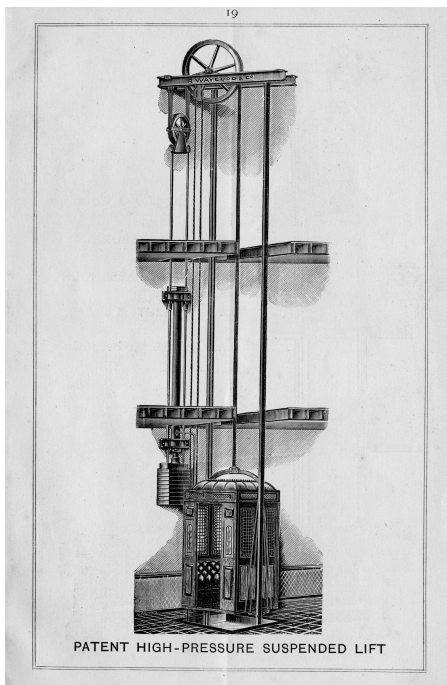
The lift car was sitting on some timbers laid in the very shallow pit and the hoist ropes had been removed.

On the roof there is a wheelhouse with a spanning diverter which is in line with the pick up centre of the car but the other side of the diverter was noted to be outside the shaft area which indicated that there was some other mechanism outside the shaft confines.

Outside in the courtyard the external area of the shaft where the cylinder is located is clad in timber and packed with sawdust to prevent freezing in the winter.

The remains of a hydraulic valve can also be seen in the courtyard.

When I returned to the office I contacted a colleague in the United States, Dr Lee Gray, author of "A history of the passenger elevator in the 19th century". He kindly e mailed me a photograph of a Waygood elevator that bears some resemblance to the Tyntesfield House one which he had found in a Waygood brochure from the 19th century.



Picture from Waygood Brochure (P6)

Unfortunately the area where the cylinder is clad at the ground floor level isn't available for inspection without dismantling some of the fabric of the building however it can be confirmed that the spanning sheave arrangement is similar and the cylinder with a 2:1 reeving tied off at the top must also be similar due to the fact that it can only travel half the distance of the shaft.

The spanning sheave, which is located in housing on the roof, can be seen below. The sheave measures 55" in diameter and has two rope grooves.



Spanning Sheave (P3)

It is rumoured that the water pressure that provides the movement force comes from a reservoir on the estate above the house. This may be true or it may come from a mains supply.

It is known that in 1884 that Waygood developed a water hydraulic lift with an accumulator however I could find no evidence of an accumulator and given that there is a drain pipe it would appear that the lift is lowered by filling the cylinder and extending the piston and raised by allowing the water to dump to a drain.

That being the case the piston end must weigh more than the car and the water pressure must be sufficient to overcome the weight of the piston.

That having been said the depth of the ground floor cylinder timber cladding would allow for something else to be enclosed within it as the cupboard at the 1st floor where the piston has been cut off isn't as deep but it could only contain something the height between the Ground floor level and Level 1. This is a mystery that may be solved at a later date.



Top of piston at Level 1 (P9)

It can be seen from the photographs that the lift hasn't moved for a number of years. Obviously she certainly hasn't moved since the Level 2 bathroom was installed and interrupted the passage of the piston but no records have been found to tell us when the bathroom was installed.



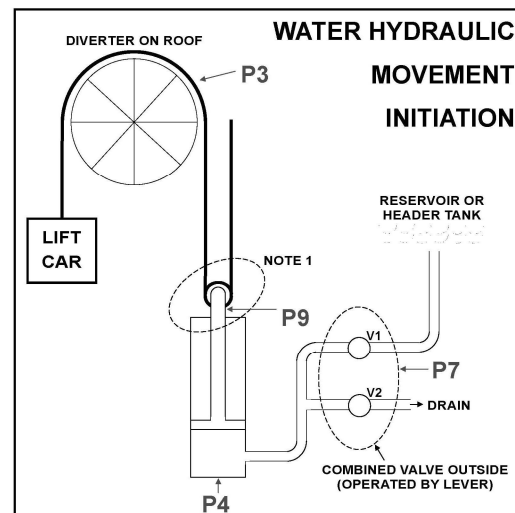
The valve (P7)

It can be seen in the photograph of the valve that below there is a pipe sunk into the floor. I was unable to ascertain whether this was the supply pipe or a drain pipe but the photograph of the bottom of the valve shows another pipe in the ground floor housing which also appears to go into the floor. This is why I conclude that there was probably a supply pipe and a drain pipe.



The bottom of the valve (P4)

A possible solution for how the lift worked is shown below. The numbers on the drawing (e.g. P9) refer to the photographs within this article.



Possible solution (P8)

Note 1: Given the height of the cylinder there must have been a diverter to achieve full shaft travel.

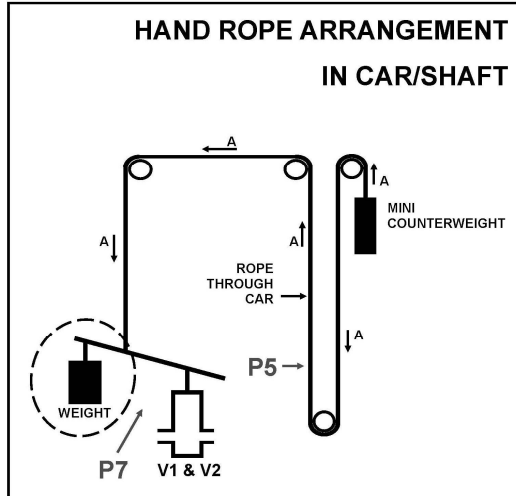
Movement of the car is initiated by a hand rope which runs through the lift car and up & down the shaft via a number of pulleys.

Firm confirmation that the lift is a Waygood design comes from the hand rope ring in the floor of the lift car which bears the words "R Waygood & Co, Gt Dover St". The early drawings located by Dr Lee Gray help to confirm its pedigree.

Initially this caused me some excitement as I thought that I could close down the timeline as it was known that in 1863 Waygood opened a factory in Falmouth Street, SE1.

Further research has revealed that the factory was actually on the corner of Falmouth Street and Great Dover Street!

The hand rope has a complicated reeving arrangement and this arrangement is shown below:



The hand rope arrangement

The hand rope has a counterweight on one end and ends up attached to the lever which is attached to the valve in the courtyard. Although I couldn't get to the end of the lever which was behind the back of the lift car and not accessible from outside it must be the case that it is weighted such that there is no gain from the hand rope counterweight as its function is purely to keep the hand rope taught.



The Handrope (P1)

The lift has some interesting safety features including a broken rope safety gear and landing door locks. Originally two hoist ropes were installed.

The safety gear operates when one or both of the hoist ropes fail. Interestingly there is no brake on the spanning sheave so if there was a water leak the lift would simply rise out of control with the heavy piston taking over.

The door locks operate by simple levers by the action of the lift car being at a landing. The door locking arms themselves are found on the outside of the landing doors as can be seen in the photograph below.



Landing Door Lock (P2)

The lift appears to be in its original state however it is accepted that features such as the landing door locks may have been added at a later date.

Whilst it is unlikely that she will ever move again using water power it would, in my opinion, be criminal not to preserve her as she is truly part of our nation's heritage. Not only is she old, she is also innovative, rare and an example of superb Victorian British engineering. Just as importantly she was manufactured and installed before the mighty American company, Otis, came to the UK to eliminate its greatest competitor.

ACKNOWLEDGMENTS

Dr Gina Barney, CIBSE Lifts Group
Frank Ferris, CIBSE Heritage Group
Dr Lee Gray, UCN Charlotte, USA
Lynda Dean (Preparation of Drawings)

CIBSE HERITAGE GROUP

Details of the CIBSE Heritage Group can be found at <http://www.hevac-heritage.org/>

BIBLIOGRAPHY

Gray, Lee. *"A history of the passenger elevator in the 19th century"*, 2002

Goodwin, Jason. *"Otis; Giving Rise to the Modern City"* 2001

Lane, Michael. *"Baron Marks of Woolwich"*. 1986

Otis Elevators, *"Going Up"*, 1983

Turvey, Ralph. *"London Lifts and Hydraulic Power"*, 2004

www.theelevatormuseum.org/timeline

THE AUTHOR



David A. Cooper

BSc(Hons), MSc, CEng, FRSA, FIET, FCIBSE

David Cooper has been in the lift & escalator industry since 1980 and is the Managing Director of UK based Consulting engineers LECS (UK) Ltd. He holds a Masters Degree in Lift Engineering as well as a Bachelor of Science degree, Higher National Certificate and Continuing Education Certificate in lift and escalator engineering. He is a Fellow of the Chartered Institute of Building Services Engineers and a Past President of the Lifts Group. He is also a member of the Heritage Group. In 2007 he appeared on the BBC TV programme "Emergency Measures" about lift accidents. He has co-authored a number of books including *"The Elevator & Escalator Micropedia"* (1997) and *"Elevator & Escalator Accident Investigation & Litigation"*. (2002 & 2005) as well as being a lead author of CIBSE Guide D. David has been a regular columnist in the UK trade journal *Elevation* since 1994 and has had articles published in other journals including *Elevator World*, *Elevatori*, *Elevator Kai*, *Lift Report* and *Revista del Asenscori*.