Elisha Graves Otis was born on the 3rd August, 1811 in Halifax, Vermont, USA, to Stephen Otis and Phoebe Glynn. At the age of 20, he left home and settled in Troy, New York, where he was employed as a wagon driver. In 1834, he married Susan Houghton and they had two sons, Charles and Norton. Moving to Vermont Hills, he built and ran first a grain mill, which he later converted into a sawmill. Neither was a commercial success so he turned to building wagons and carriages.

After the early death of his wife, and at the age of 34, he remarried and moved to Albany in New York State, where he was employed first making toys, then bedsteads. Later, he moved to Yonkers, New York, and while cleaning up an abandoned sawmill, he and his sons designed and tested a hoisting platform which was to become his “safety elevator,” Otis started his Union Elevator Works, but fame and success came only to him when he demonstrated his elevator’s safety features by “cutting the hoisting rope” at the 1854 New York World’s Fair.
The Regent's Park Colosseum was completed in 1824 and opened later

The Colosseum, modelled on the Pantheon in Rome, was an ambitious panorama entertainment featuring an enormous painted view of “London from the Summit of St Paul’s Cathedral.” Visitors were transported up to the viewing-platform in the “Ascending Room”- London’s first hydraulic elevator.
The so-called Teagle elevator was an English invention by Frost and Stutt, being belt-driven, counterweighted and operated by steam.
ELISHA GRAVES OTIS

Otis demonstrating his safety lift “by cutting the rope” at the 1854 New York World’s Fair

Part of the Otis Elevator (Hoisting Apparatus) Patent of 1861
Saw-toothed ratchet bars are attached to each of the four side vertical guide rails with a spring at the top of the elevator car [D] and the lifting cable, part of a pulley and winding drum system, is attached to the upper bar of the spring, itself kept taut by the weight of the car. If the cable snaps, the spring is released and sturdy bars (pawls) lock solidly into the saw-teeth [C] clamping the elevator car safely in place.
Elisha Otis' invention - the Safety Elevator, c.1861
Elisha Otis and his sons began by selling steam-powered freight elevators and their associated steam engines, like this 1861 model.
In 1873, Otis provided a steam-operated elevator with a manually controlled rope system for starting and stopping to serve the new Lord & Taylor Department Store in New York City.
Otis advertisement of 1868 for Hoisting Machinery
Advertisement of 1882 for the Otis Bros Standard Hydraulic Elevator, which operated by water pressure, and was first introduced in the 1870's
The Otis Passenger Elevator Car with the cutaway portion showing the Otis Controller, a lever connected to the rope control.
Norton Prentiss Otis 1840-1905
Charles Rollin Otis
Born between 1834 &36, died 1927

William E Baldwin 1856-1930, who with Norton Otis led the Otis Elevator Trust
Around the year 1900, Otis advertised its popular Automatic Electric Elevator for use in residences (Automatic meant pushbutton control).
The Otis Steam Elevator Works in 1860. Elisha, with hand on artillery piece, was a supporter of Lincoln.

The Otis Bros Factory in Yonkers, New York, about 1870.
The Otis Elevator Works and the Otis Electric Company (right) in Yonkers, New York, 1896

Engine construction at Edison Bros Yonkers Works in 1878
The Washington Monument Elevator Engine, Washington D.C., 1880

Drawing of the double-deck Otis hydraulic cars which ran up an inclined leg of the Eiffel Tower to the Second Platform level at 380 feet, 1889
Building the 984 feet tall Eiffel Tower for the Paris Exposition of 1889
EIFFEL VERSUS OTIS

Eiffel faced a problem with the provision of an elevator to climb the tower’s sloping legs because no French company was willing to quote and the Exposition’s Charter prohibited the use of foreign equipment. (The contract for the vertical elevators to serve the upper parts of the tower had already been awarded to French firms). That left Eiffel with only Otis Ascenseur Cie and in due course they were awarded the contract.

The Otis system employed a hydraulic, rope-geared unit that had become standard since about 1880. It used a “thirty-six-foot-long cylinder (which) was inclined at an angle parallel to the car’s initial run. It incorporated a piston thirty-eight inches in diameter attached to cables running through a huge tackle composed of five fixed and six movable pulleys...” The necessary water reservoir was sited on the tower’s second platform as it could not be located at ground level where it would interfere with the tower’s foundation.

However, trouble was yet to come. Eiffel insisted that Otis use a rack and pinion safety system, but rather than compromise their design Otis refused. The argument persisted until Otis threatened to withdraw from the project and the suggested French changes were quietly dropped.

Eiffel then started another argument with Otis as the original contract required the elevators to be in operation by 1st January, 1889. Otis could not meet this date because of the numerous modifications made during installation, but guaranteed the elevators would be functioning by 1st May. Eiffel then said he would refuse to pay for the work, so Otis again threatened to quit. Eiffel duly paid up, though the elevators were not both in operation until mid-June. However, they worked so well they were one of the hits of the show. [From Harriss]

Visitors to the Paris Exposition of 1889 with an Otis elevator just visible (right) on the far tower’s leg
Sectional view of the 1889 Otis double-deck elevator for the Eiffel Tower
In the late 1860’s, Otis Brothers & Company advertised the “novel luxury” of the passenger elevator and had introduced the “Palace Elevator” for hotels and other public establishments.

The 19th century was the age of steam power and initially most freight elevators and many early passengers elevators were powered by steam. However, this changed with the introduction of the Otis hydraulic elevator, the firm having acquired the technology from Hydraulic Elevator of Chicago. Being powered by high pressure water this type became popular around the turn of the century with the rise of the skyscraper. The industry again changed dramatically with the availability of electric power. Otis Brothers sold their first electric elevators in 1889. Then in 1892, with the young General Electric Company, the Otis Electric Company was formed. Otis Bros went on to form relationships with many other elevator companies becoming a trust to limit competition and control prices. In 1906, the Federal Government charged them with violation of the Sherman Antitrust Law and as a result Otis had to agree not to hinder trade, not to fix prices and not to divide territory.

Around 1905, Otis had introduced the gearless traction electric elevator and a range of important controlling devices making their system ideal for the new higher buildings like the Singer and Woolworth towers. Otis went on to achieve world-wide dominance in the elevator business and in 1975 was acquired by the United Technologies Corporation becoming a wholly owned subsidiary.
New York’s Havemeyer Building of 1893 (now demolished) had 6 Otis hydraulic passenger elevators
The twenty-storey Flatiron Building of 1902 in New York had 6 Otis rope-geared hydraulic elevators
The Singer Tower of 1908 (later demolished) in New York was provided with 16 Otis Electric Passenger Elevators, possibly the first such installation on this scale.
In 1913, the new sixty-storey Woolworth Building (dubbed “The Cathedral of Commerce”) was equipped with 26 Otis traction elevators for carrying passengers and freight.
Plan of the Elevator Lobby of the Woolworth Building
Construction workers on the Empire State Building 1930 (a Lewis W Hine photograph)
The Empire State Building in New York was completed in 1931 with 68 Otis elevators.
Typical floor plans of the Empire State Building showing the arrangement of Otis elevators
APPENDIX II: DETAILED DRAWINGS FROM 1889 OF PARTS OF THE OTIS LIFTS FOR THE EIFFEL TOWER [FROM ANSALONI]

Plate 67: Otis Lifts Details
Plate 68: Otis Lifts - Hydraulic cylinder and Piston
Plate 69: Otis Lifts- Water Distributor Cabin Stationary
Plate 70: Otis Lifts- Vertical Sections of Water Distributor
Plate 71: Otis Lifts- Hand Controlling Gear
Plate 73: Otis Lifts- Cabin Safety Brake
Plate 74: Otis Lifts- Lorry of Cabin Safety Brake
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Note: Nineteenth century drawings of early elevators are shown in technical magazines of the day such as *Scientific American, La Nature* and *De Natuur*. Other early drawings, documents and photographs originate mainly from the United Technologies Archive, now owned by the Parent Company of Otis.
OTIS

Jason Goodwin

Giving
Rise
to the
Modern
City

OTIS ELEVATOR

2001
Though Elisha Graves Otis obtained a patent for his design of the Safety Elevator, his talents did not extend to business and he died in 1861 at the age of 49 and in debt. His sons Charles and Norton took over the business and made it a resounding success.
Tomb of Gustave Eiffel at Levallois-Perret Cemetery, Paris outskirts