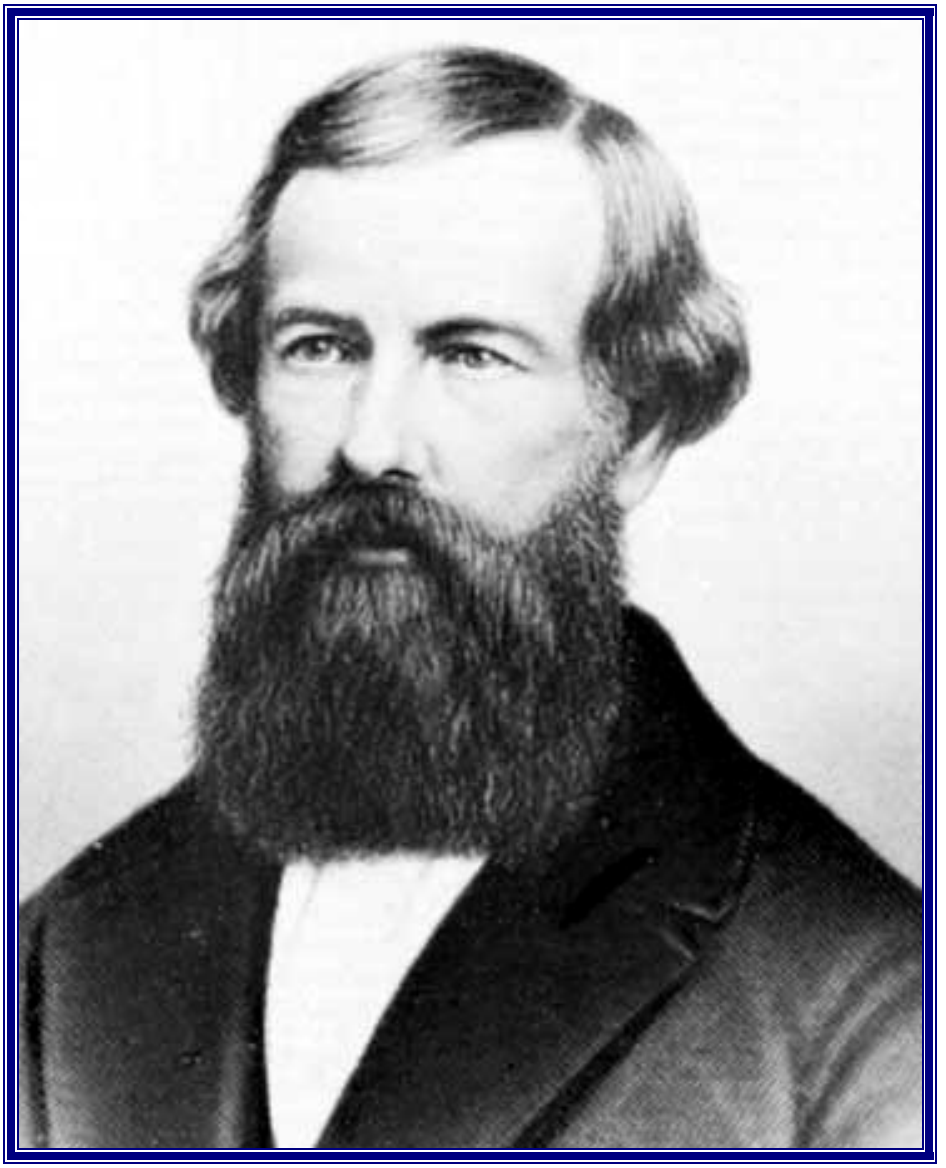
ELISHA GRAVES OTIS

By EurIng Brian Roberts, CIBSE Heritage Group

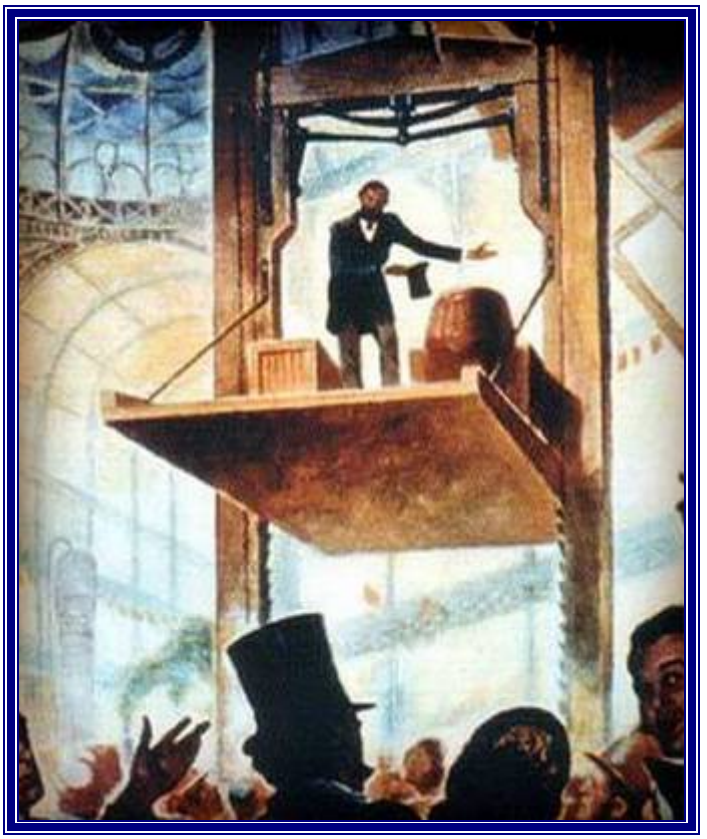
The 19th Century



Elisha Graves Otis 1811-1861, Founder of the Company

While working at a bedstead factory in Yonkers, New York, in 1852, Elisha Otis invented a safety mechanism for the standard hoisting systems of his day. His safety device was simple, consisting of a spring on top of the elevator platform held taut by the hoisting rope and with ratchets along the walls of the hoistway. If the rope broke the spring would be released and force the pawls (ends of the spring) into the ratchets, stopping the elevator from falling. The name Otis would soon become associated with "safety elevators."

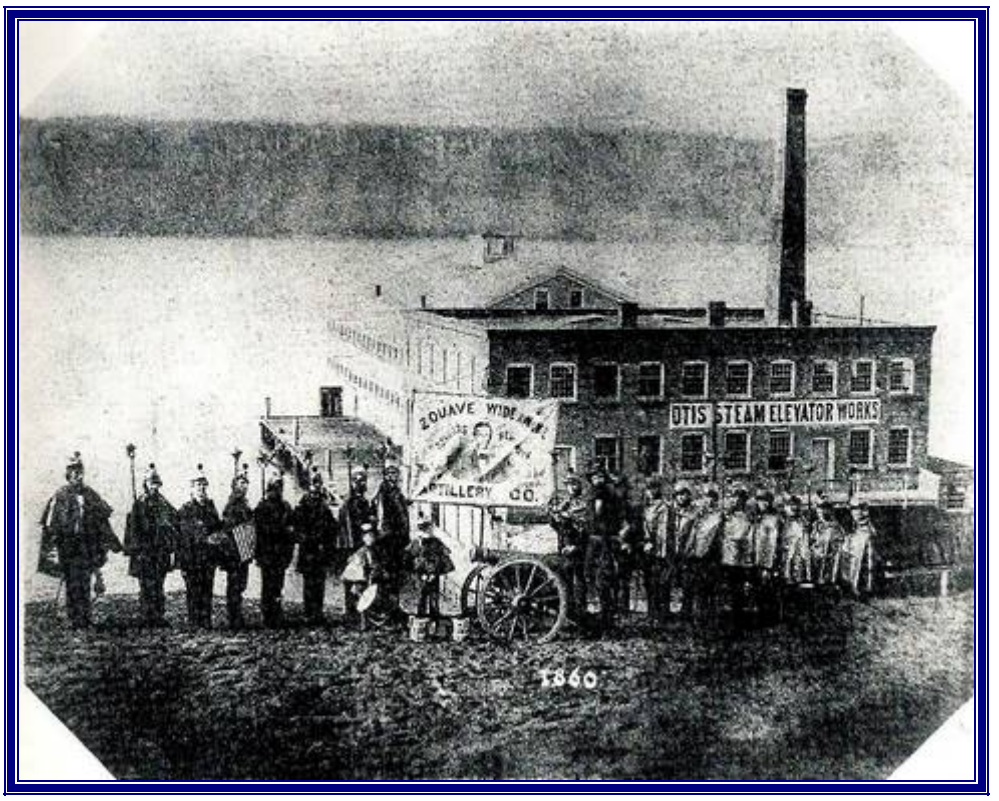
In 1853 Otis established his works to manufacture elevators for the existing freight market. At the 1854 World's Fair in New York City Otis dramatically demonstrated his safety elevator by riding on the platform while the rope was cut. The elevator did not crash.



Elisha Otis demonstrates his safety elevator

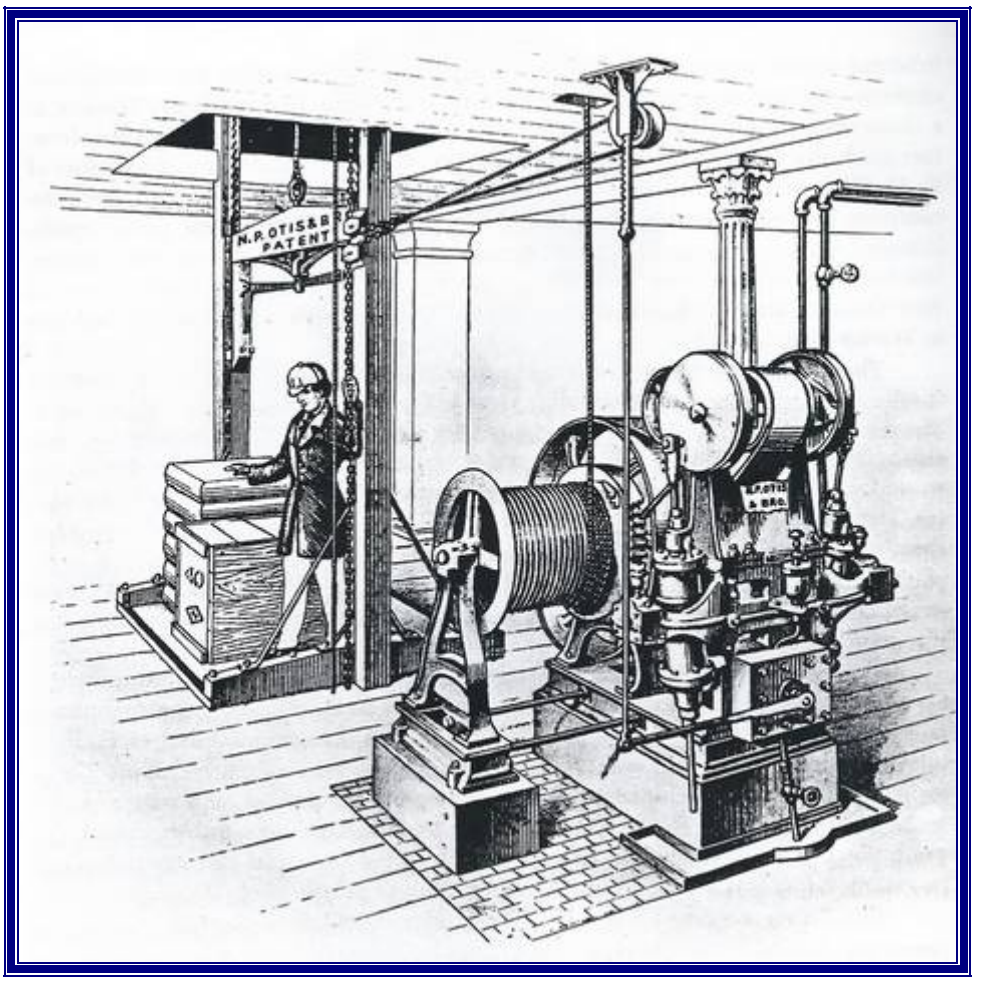
The first customers of the Otis Company bought freight elevators but Otis and his sons soon discovered a new market –for the passenger elevator. He sold and installed his first commercial passenger elevator in 1857 for a department store, the Haughwout building in New York City.

The Haughwout building



Elisha Otis, with hand on gun, in front of his Steam Elevator Works in 1860

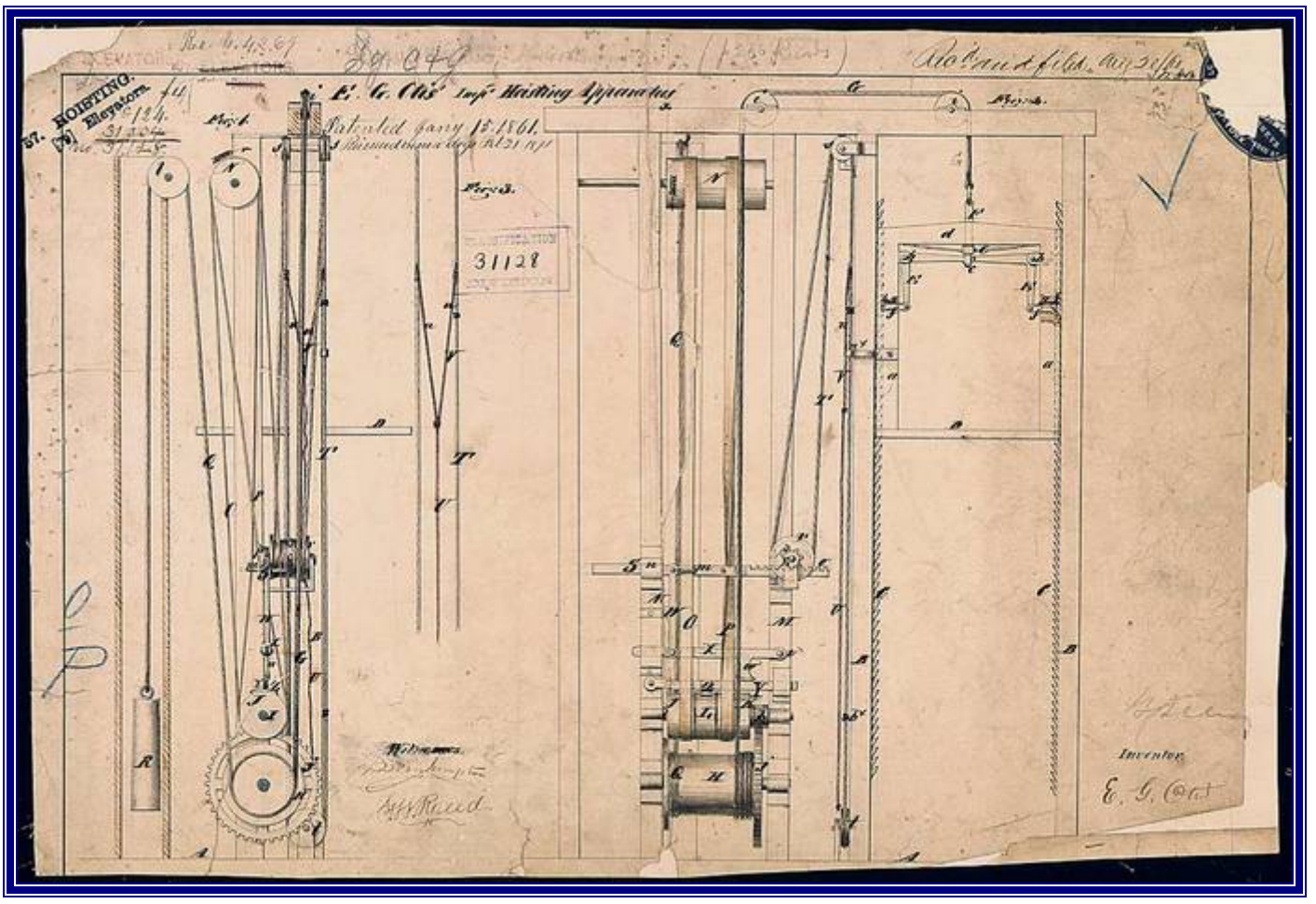
Elisha Otis sold steam engines to power his elevators and invented and patented a number of improvements.



An Otis steam-powered freight elevator, 1861

Charles R Otis 1835-1927

Norton P Otis 1804-1905

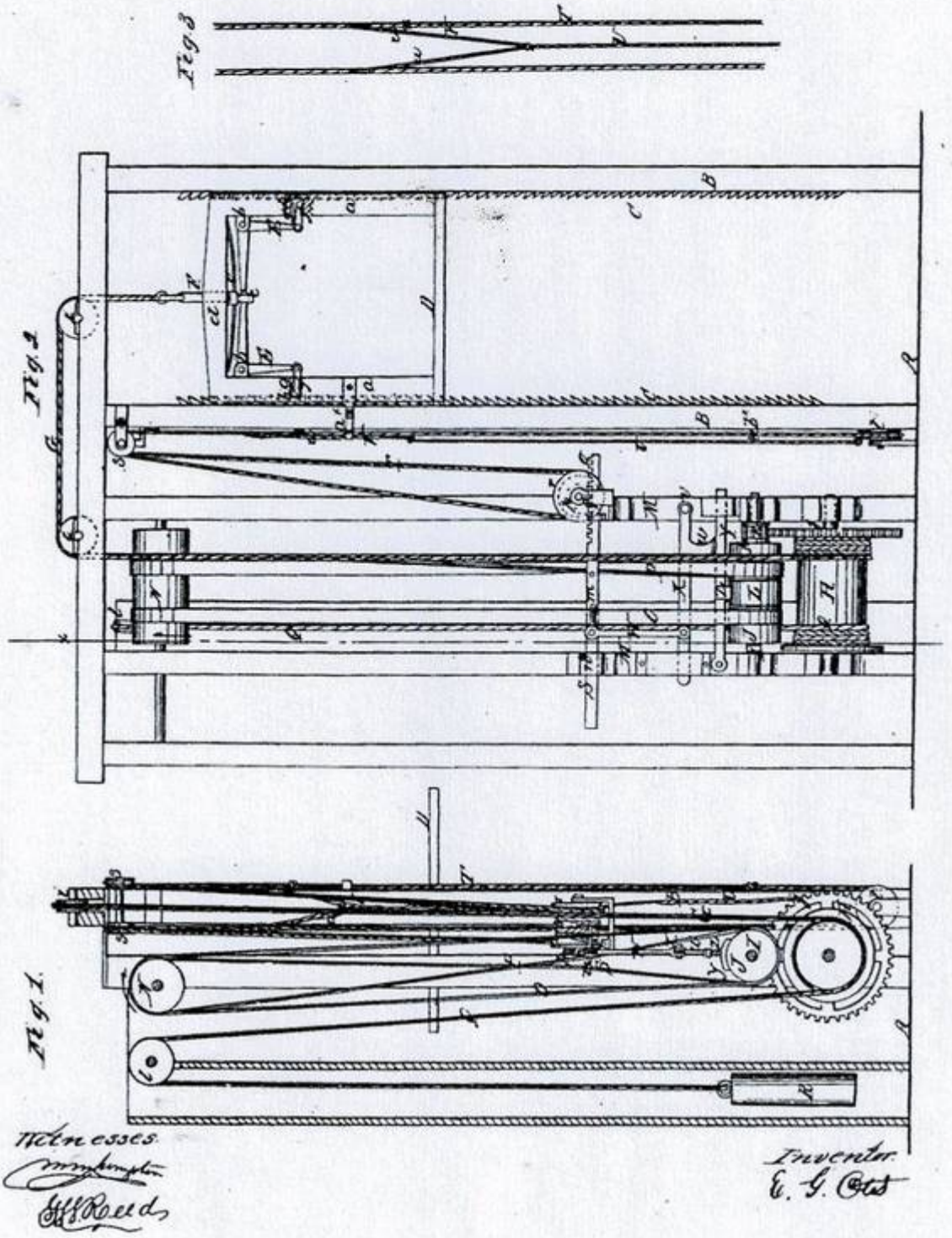


Patent drawing of 1861 for the E G Otis Hoisting Apparatus

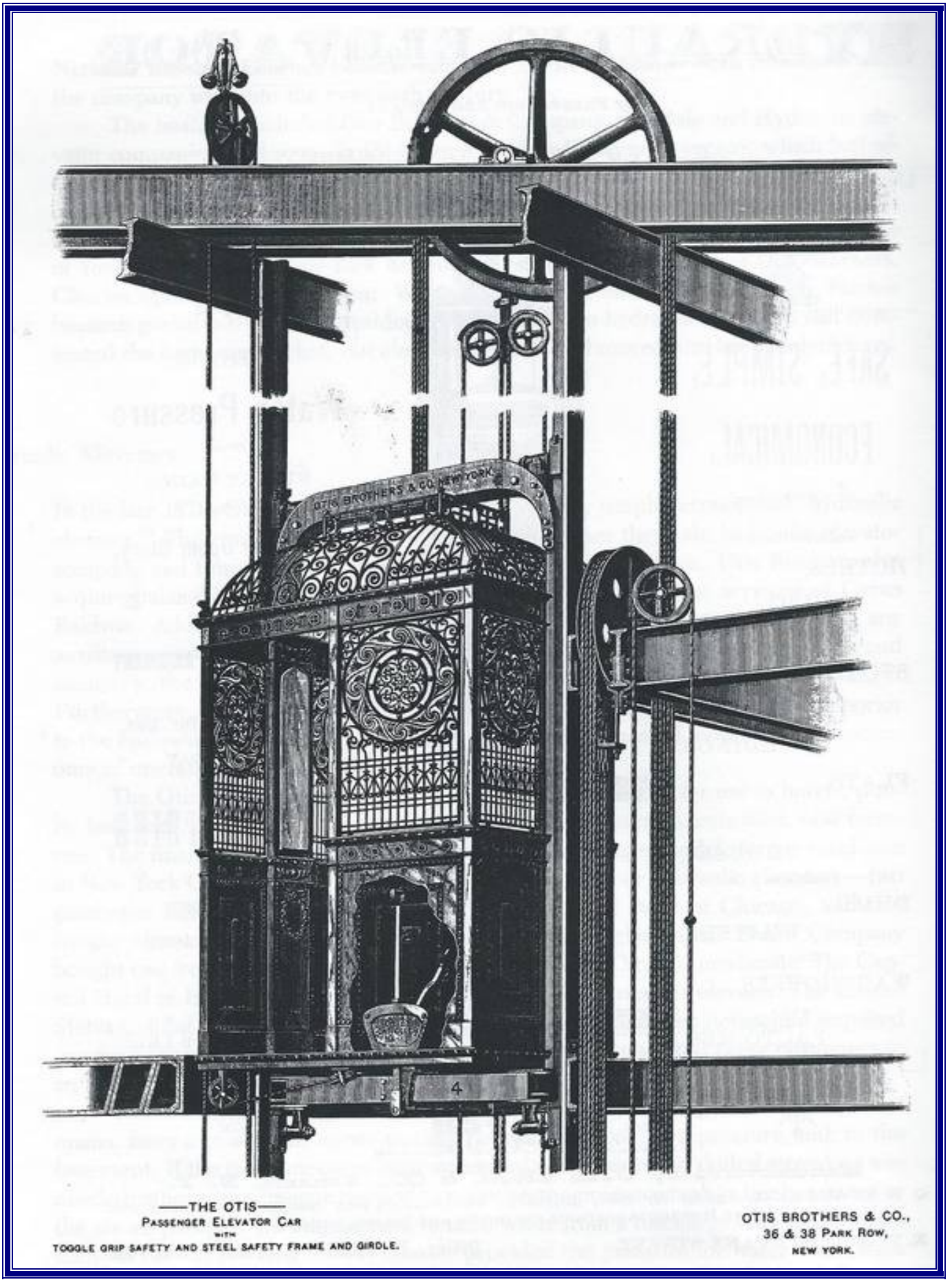
E. G. OTIS.

HOISTING APPARATUS.

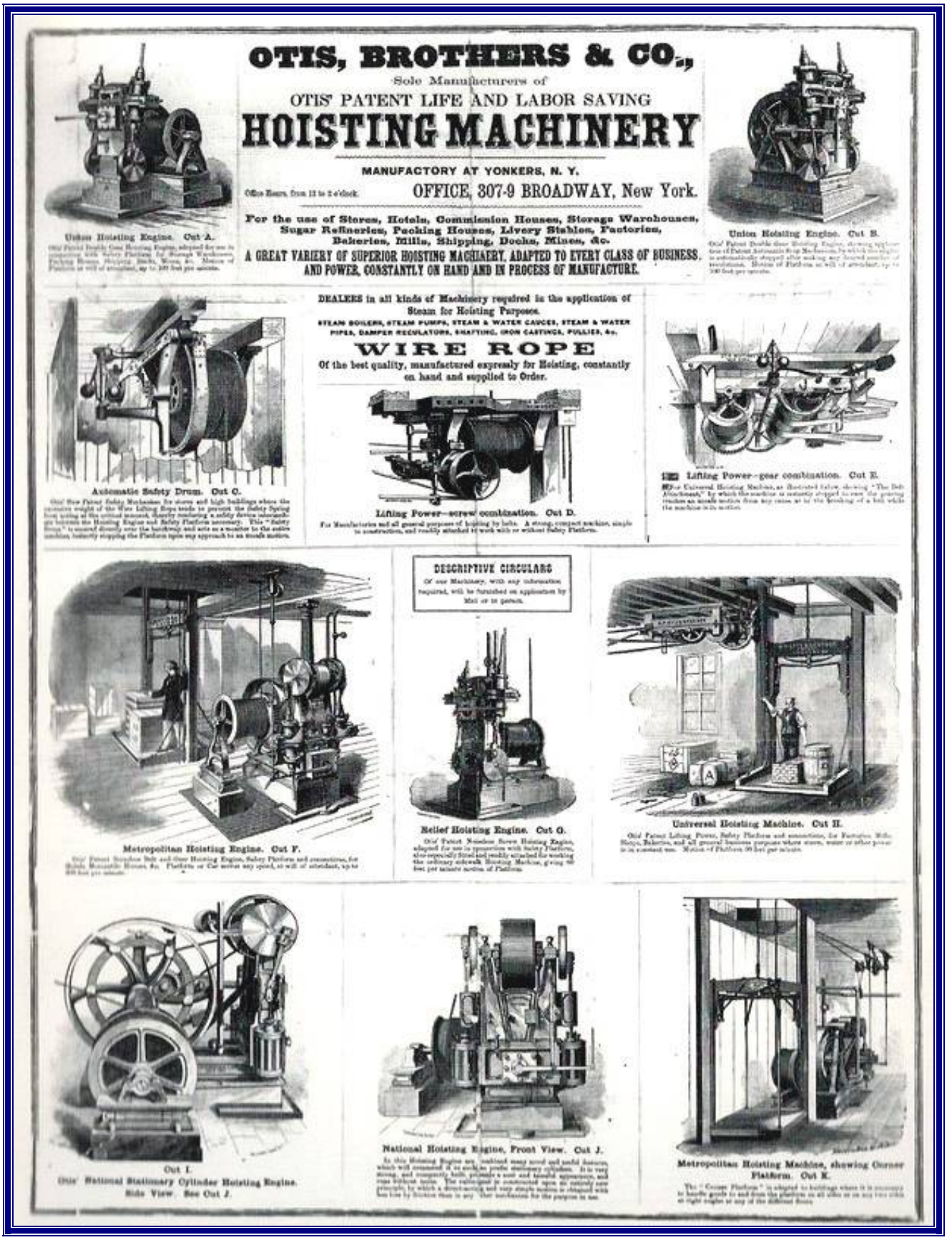
No. 31,128. Patented Jan. 15, 1861.



E G Otis Patent of 1861



Cutaway drawing of elevator cage showing the Otis lever controller



Otis advertisement, 1868

Charles Otis, the elder son, and his father did not get on and there were many arguments. In 1861, Elisha Graves Otis died. Had not Charles and Norton been sharing responsibilities with their father at the time of his death, the business would have likely gone under. For a few years the brothers managed the firm as a partnership. In 1867 the firm became Otis Brothers & Company. In 1878 they purchased a large interest in the Hydraulic Elevator Company of Chicago thus acquiring important hydraulic technology.

STANDARD
HYDRAULIC ELEVATOR

For Passengers and Freight.

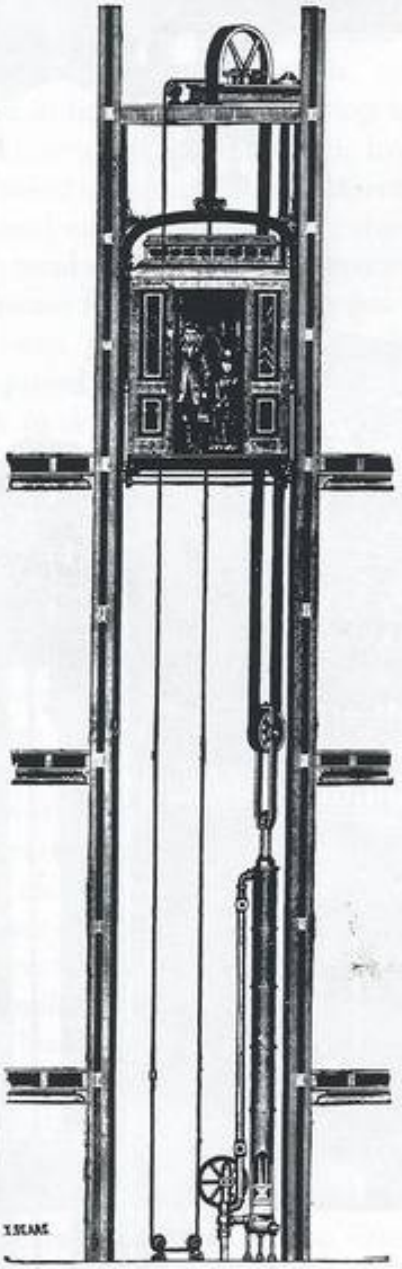
ADOPTED BY U. S. GOVERNMENT.

Upon Report of Eminent Experts appointed by the Secretary of the Treasury.

SAFE, SIMPLE, ECONOMICAL.

ADAPTED TO USE IN

HOTELS,
PUBLIC BUILDINGS,
STORES,
OFFICE BUILDINGS,
FLATS,
PRIVATE HOUSES,
AND FOR
DUMB WAITERS,
ALSO IN
WAREHOUSES
AND
FACTORIES.



OPERATED BY

Water Pressure

FROM

STREET MAINS,

OR FROM

A TANK in Upper Story,

or on Roof of Building,

OR

PRESSURE TANK IN BASEMENT

Always Ready for Use,

NIGHT OR DAY.

COSTS NOTHING

WHEN

NOT IN USE.

CAN BE MANAGED

BY ANY

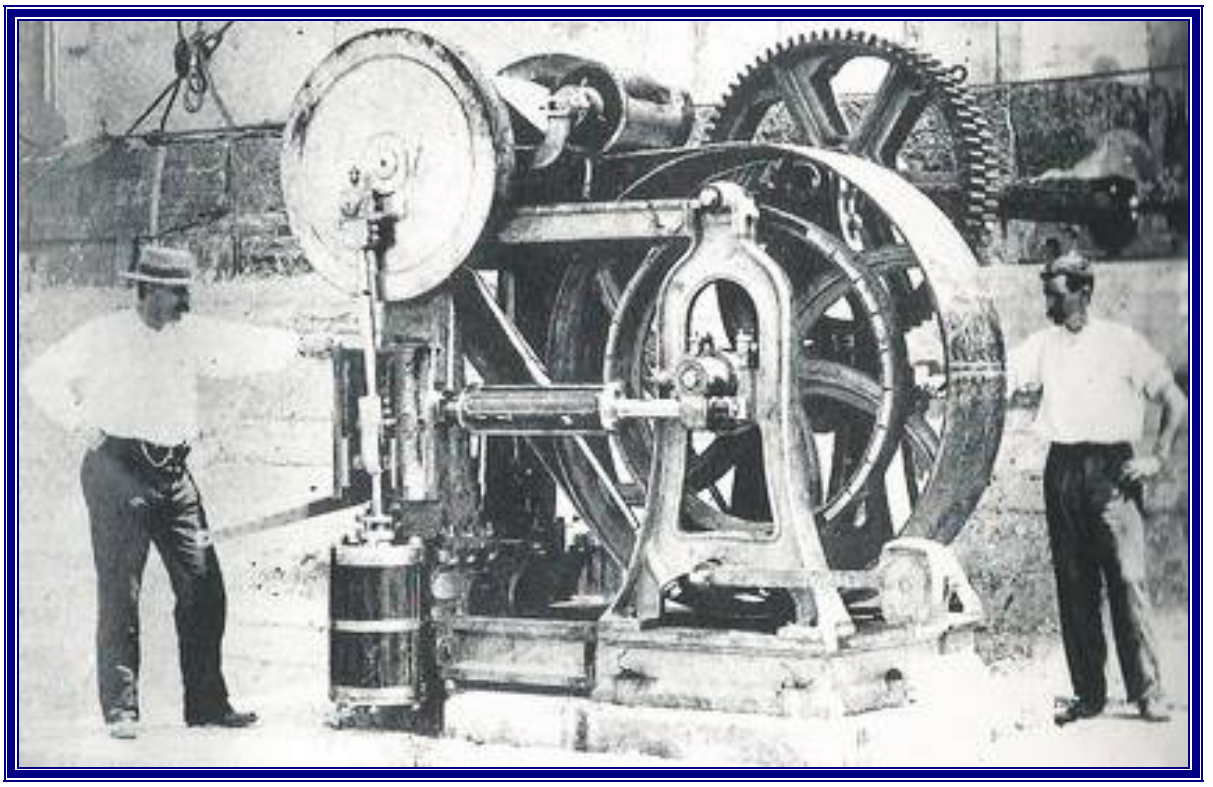
LADY OR YOUTH.

Manufactured by OTIS BROS. & CO., Yonkers, N. Y.

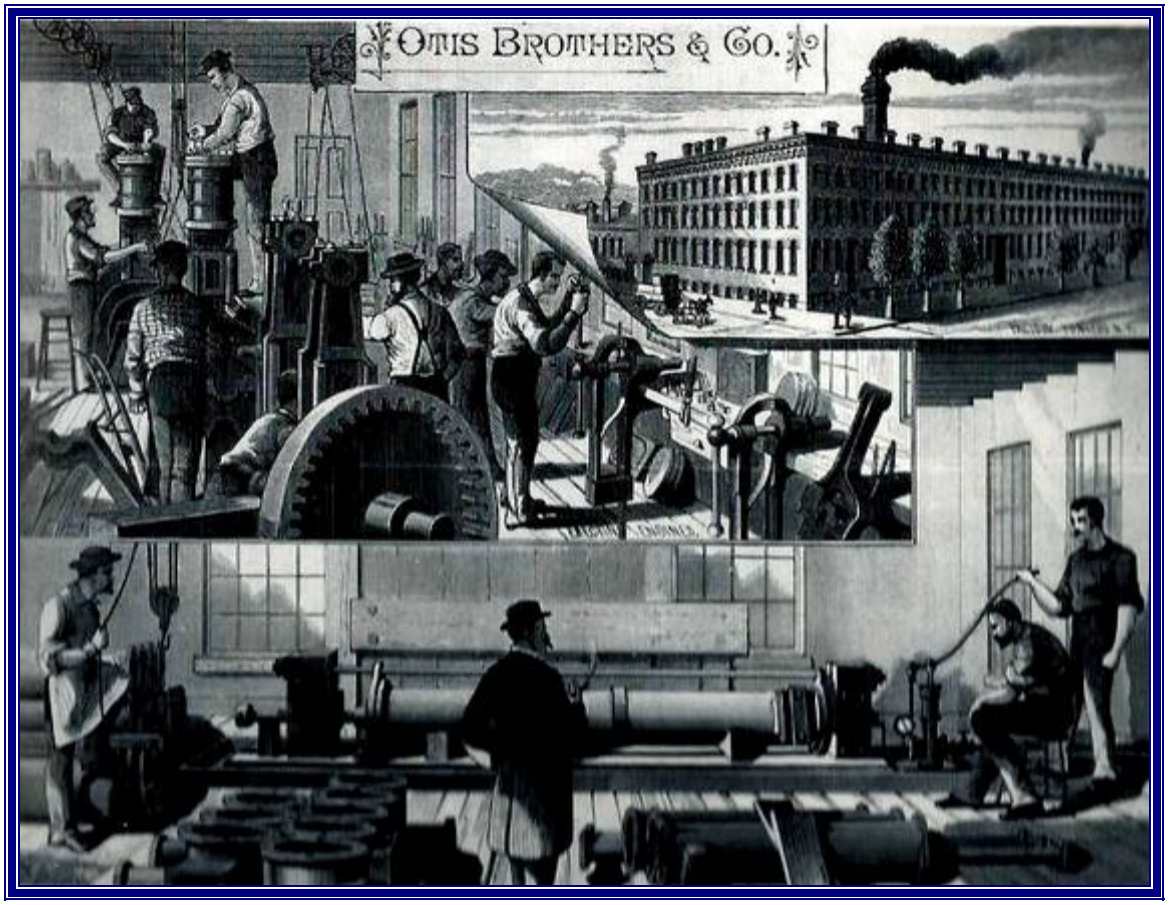
Q. N. EVANS & CO., Agents for New England; also, makers and designers of Steam and Water Heating Apparatus for public and private buildings.

N. Y. Office, 60 DUANE STREET. **Office, 72 SUDBURY STREET, BOSTON.**

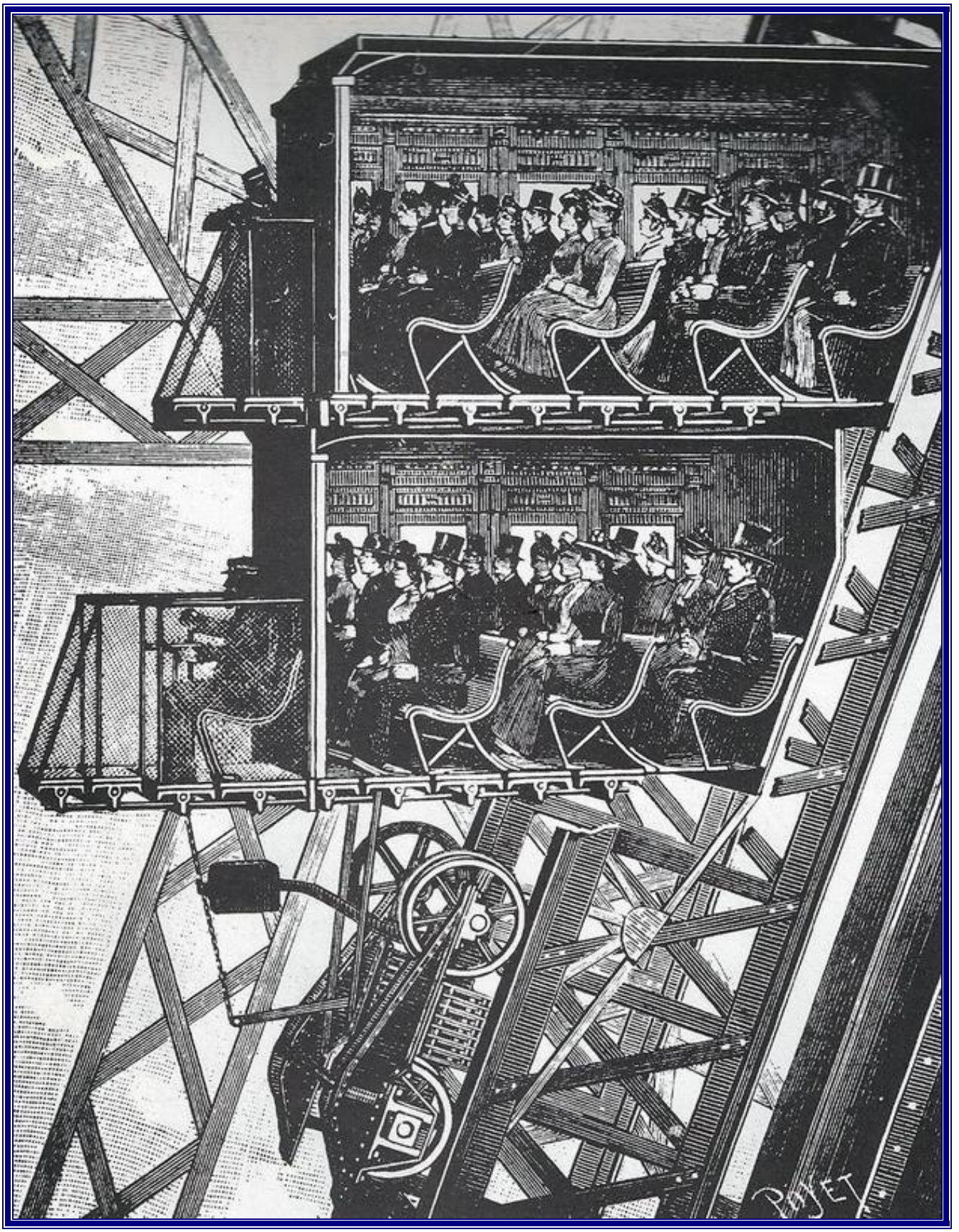
The Otis Standard Hydraulic Elevator, which operated by water under pressure, was introduced in the 1870's. The advertisement dates from 1882.



Washington Monument Elevator Engine, 1880



Engine construction at the Yonkers Works, 1878



The two Otis hydraulic elevators serving the Eiffel Tower operated from ground floor level at the North and South piers to reach the 2nd Platform at 380 feet. Each elevator car was of double-deck design holding 50 seated passengers and travelling at a speed of 394 feet/minute.

In 1880, the American Elevator Company was formed to market Otis' elevators in London and Paris. When the Eiffel Tower was planned "it was unthinkable that the tallest building (structure) in the world should not be equipped with Otis elevators." Against French opposition and reluctance, three years of preparatory work paid off, for in July 1887 Otis was awarded the contract for the most awkward section of the tower: two of the curved legs (other tower elevators were to be provided by French companies.)

However, the tower's designer Gustave Eiffel changed the design parameters insisting that Otis should incorporate a rack-and-pinion safety device and a manual lowering facility. Long and bitter arguments followed. Eiffel threatened to stop payments. Otis threatened to stop work. As the planned opening Exposition day of 1 May 1888 drew closer and closer, Otis won all its arguments and the tower opened on schedule to glowing reports.

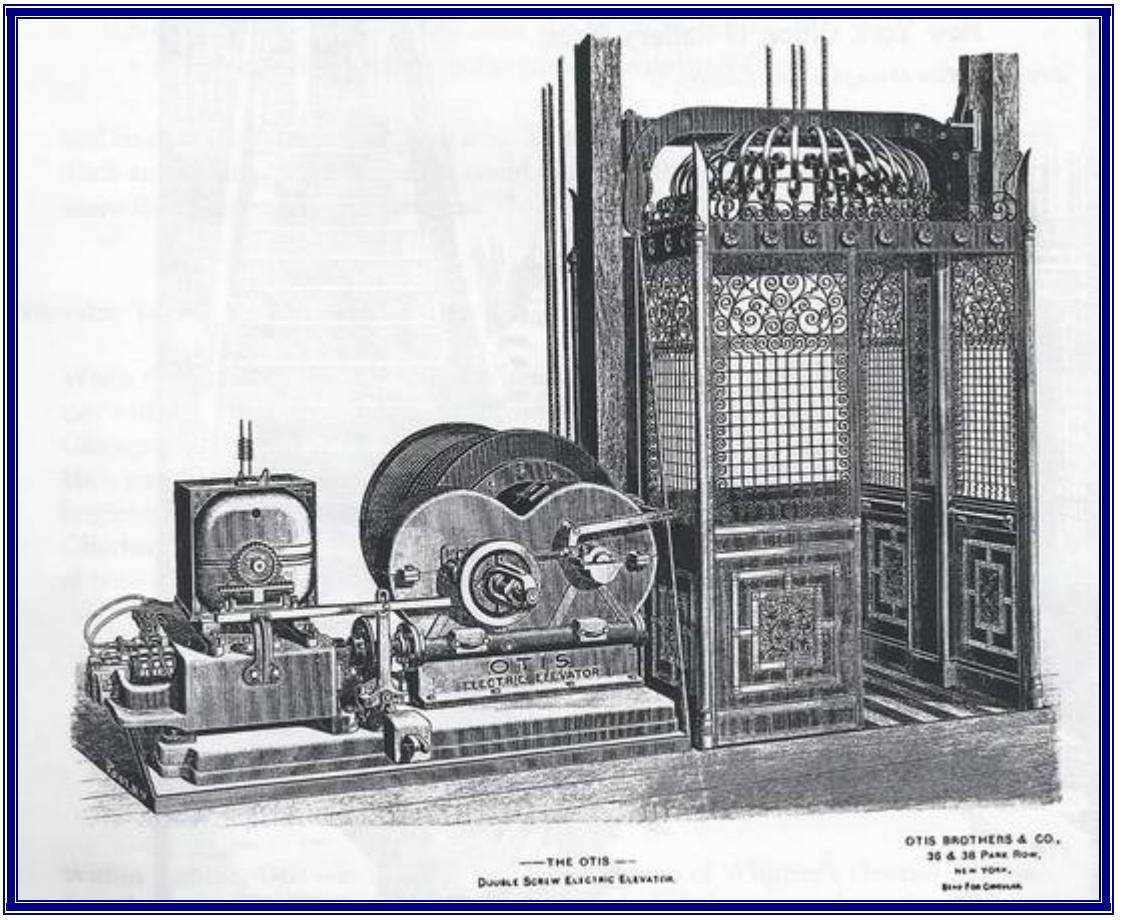
The Electric Elevator

The introduction of electricity gradually changed the elevator industry. Initially, electric motors were used to provide power for operating belt-driven freight elevators. Soon direct-drive electric motors were introduced. Otis Brothers sold its first electric elevators in 1889, providing two worm-drive machines to the Demarest Carriage Company building in New York City. To start with the Otis Company bought a "very ingeniously constructed motor from Rudolf Eickemeyer, a German immigrant, inventor and manufacturer."

In 1892 Otis Brothers and the new General Electric Company joined forces to set up the Otis Electric Company. The new Company employed about 100 people at its plant next to the Otis Brothers factory in Yonkers. By comparison, Otis Brothers then employed about 500 in its factory and another 150 in the field. Otis displayed their new electric elevator at the Columbian Exposition (World's Fair) held in Chicago in 1893.

The Otis Elevator Works and the separate Otis Electric Company building (right), Yonkers, 1896

The Automatic Electric Elevator introduced in the 1890's



Otis Double Screw electric elevator with worm gears and drum for use in low-rise buildings, 1890's

Compared to steam engines and hydraulic motors, the electric motor was compact and efficient but at this time the electric elevator could not compete with hydraulic systems for tall building applications. The use of worm gearing limited the height of the lift and the drums could not hold enough rope.

In the 1890's Otis introduced its automatic electric elevator for use in residences, complete with push-button control.

Around this time, Otis joined in an Elevator Trust, a group of companies co-operating to limit competition and control prices. In 1898, after a number of mergers and acquisitions a holding company styled the Otis Elevator Company was established and soon controlled 65% of the market and continued to grow.

References

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Further Reading

Electronic Books/Systems & Equipment/Elevators & Escalators, www.hevac-heritage.org
Includes copy of the Ansaloni paper on the Eiffel Tower with full engineering drawings