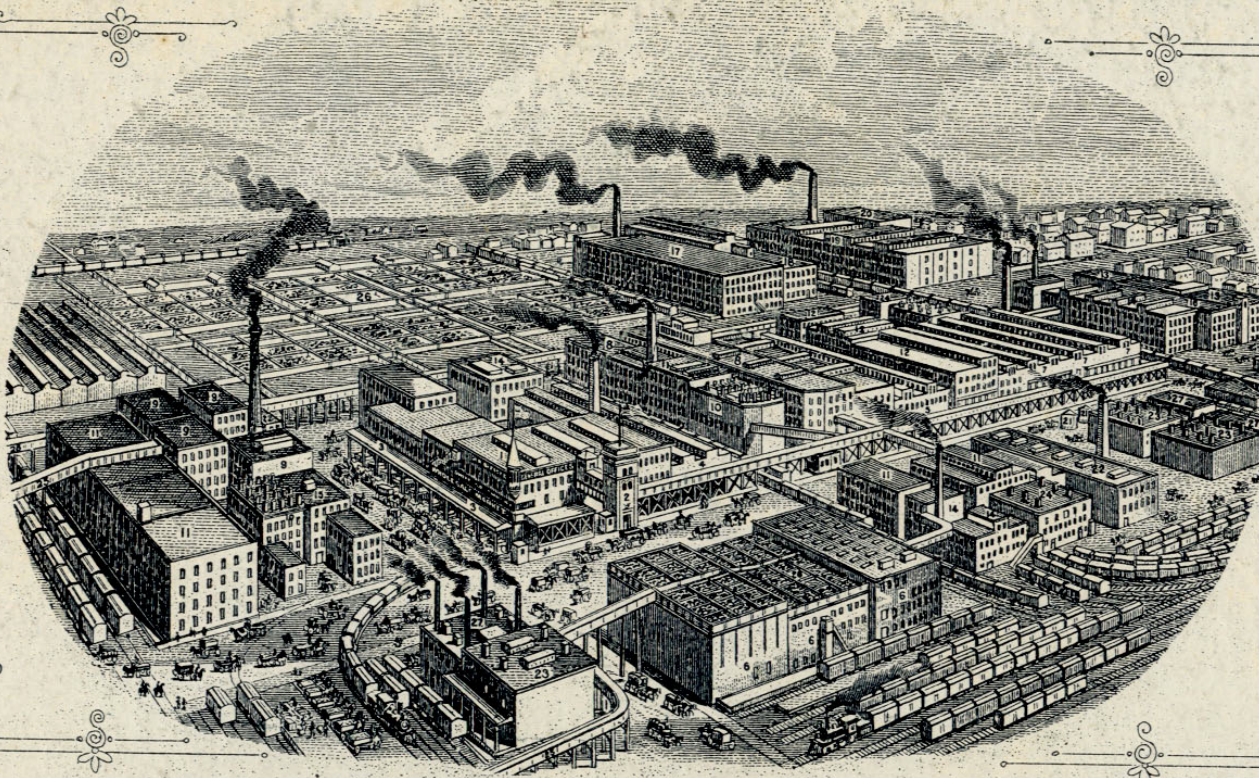


Electricity & Electricity Generation
GEOS 24705/ ENST 24705

Refrigeration by ice made Chicago rich

VIEW OF SWIFT AND COMPANY'S PACKING HOUSES

1. GENERAL OFFICES.
2. PASSENGER ELEVATORS TO GENL OFFICES.
3. WHOLESALE MARKET.
4. EAST SLAUGHTER HOUSE, CATTLE AND SHEEP.
5. A & B SLAUGHTER HOUSE, CATTLE AND SHEEP.
6. NORTH SLAUGHTER HOUSE, CATTLE AND SHEEP.
7. WEST SLAUGHTER HOUSE, CATTLE AND SHEEP.
8. NO. 1 HOG HOUSE.
9. NO. 2 HOG HOUSE.
10. SMOKE HOUSES.
11. WAREHOUSES.
12. LARD REFINERY AND "COTOSUET FACTORY."



13. BUTTERINE FACTORY.
14. OLEO OIL FACTORIES.
15. PEPSIN LABORATORY.
16. BEEF EXTRACT LABORATORY.
17. GLUE WORKS.
18. BONE HOUSE.
19. FERTILIZER WORKS.
20. WOOL PULLERY.
21. OIL STORAGE TANKS.
22. ICE MACHINE HOUSES.
23. ICE HOUSES.
24. STABLES.
25. VIADUCTS FOR LIVE STOCK.
26. PENS FOR LIVE STOCK.
27. CAR AND REPAIR SHOPS.

AT UNION STOCK YARDS, CHICAGO, ILL.

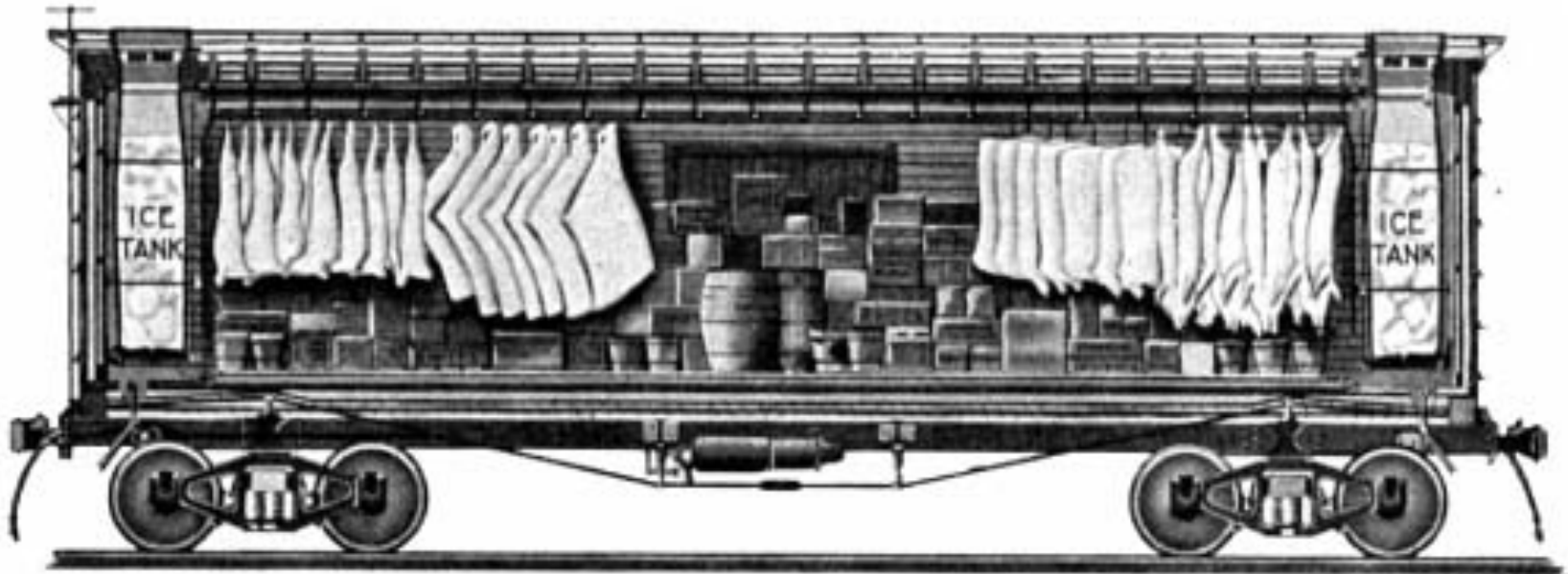
Swift meatpacking (merged with Armour & Co. to become Swift and Armour)

Refrigeration by ice made Chicago rich



Union Stockyards, founded 1864 (photo 1880)

Refrigeration by ice made Chicago rich



ice-cooled refrigerator traincar, ca. 1870

meatpacking was fully vertically integrated from
slaughterhouse to butcher shop

First commercial use of electricity is for lighting

Individual private grid systems operation on their own standards, DC or AC from 25-133 Hz



W.L. Sontag, 1895, *"The Bowery at Night"*

Incandescents improved by getting hotter, longer-lived



Joseph Swan,
1860s

Thomas Edison,
1880s

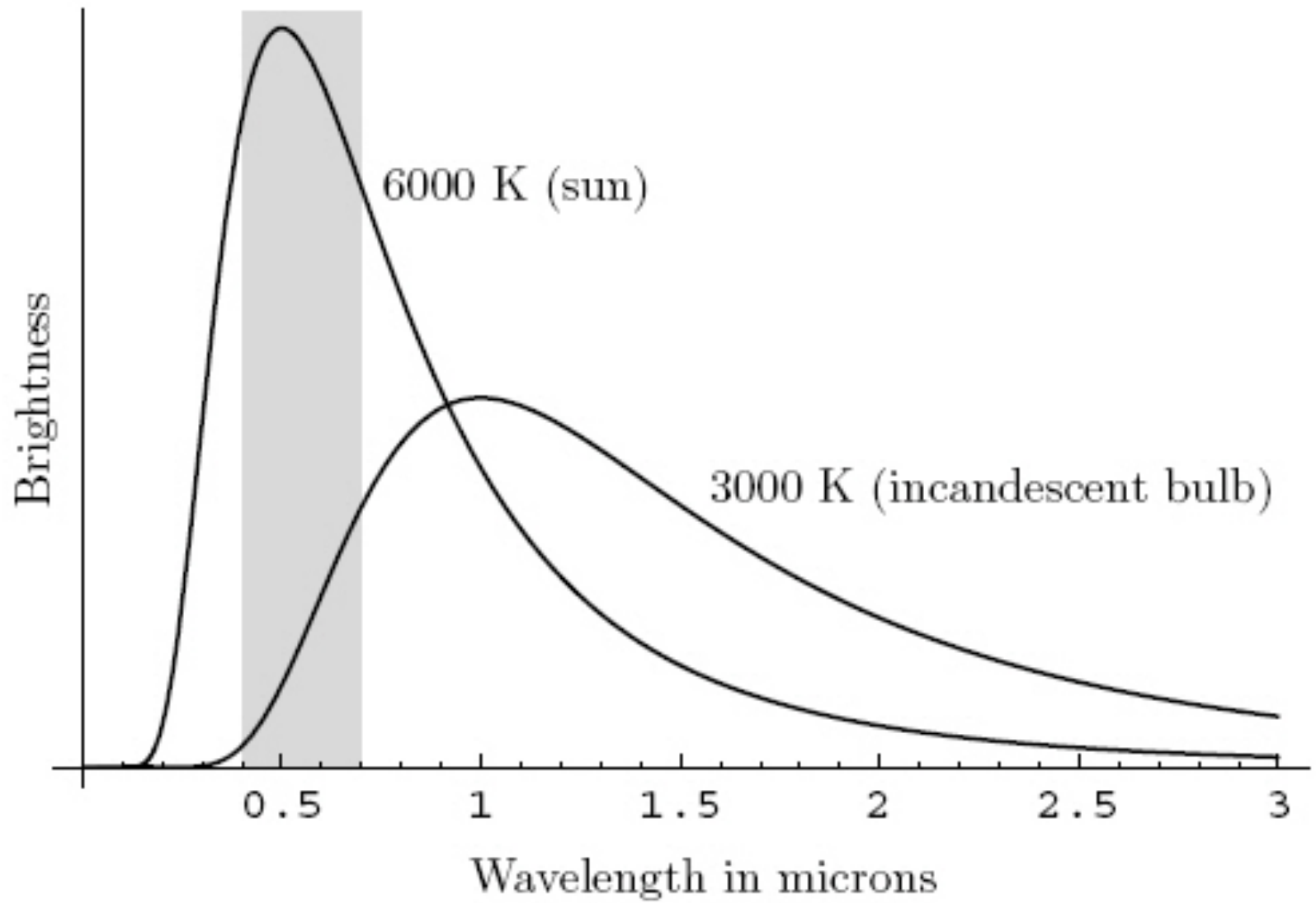


Replica of
Edison's 1890
carbon filament
bulb (*J. & L.
Casey*)

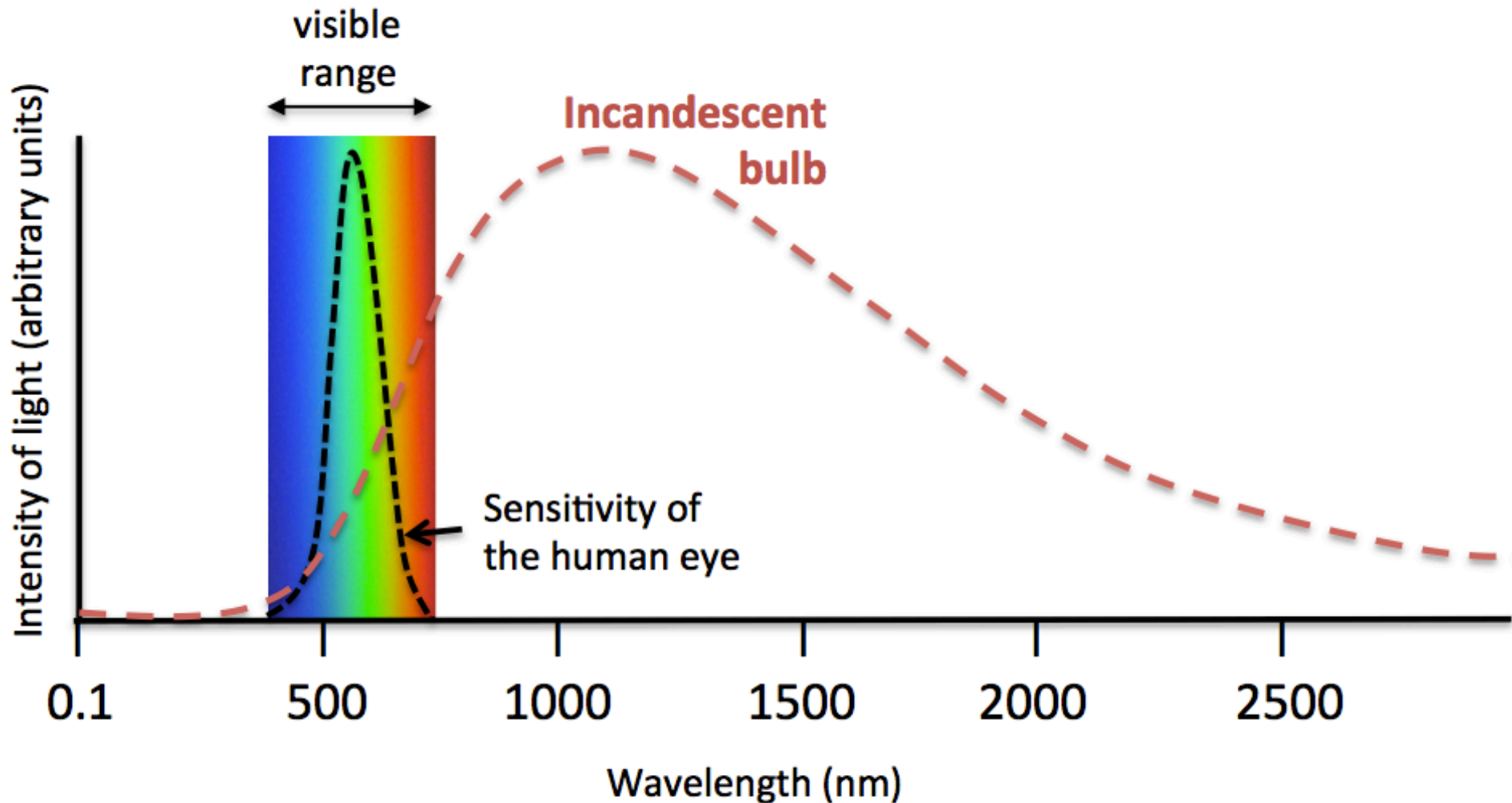


Modern bulb

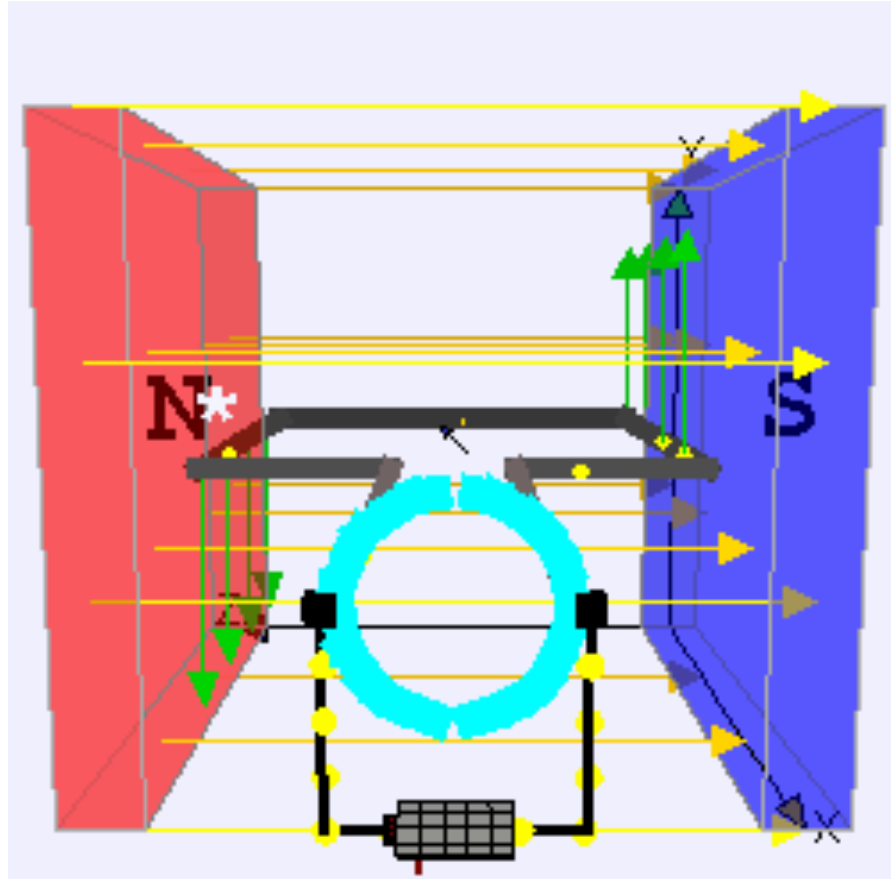
Lightbulb is just very hot space heater
not as hot as the sun though



If lightbulb were hotter it would be more “efficient”



Force on a brushed DC motor



[Magnetic field lines video](#)

Direct current (DC)

Proponent: **Edison**

Advantages:

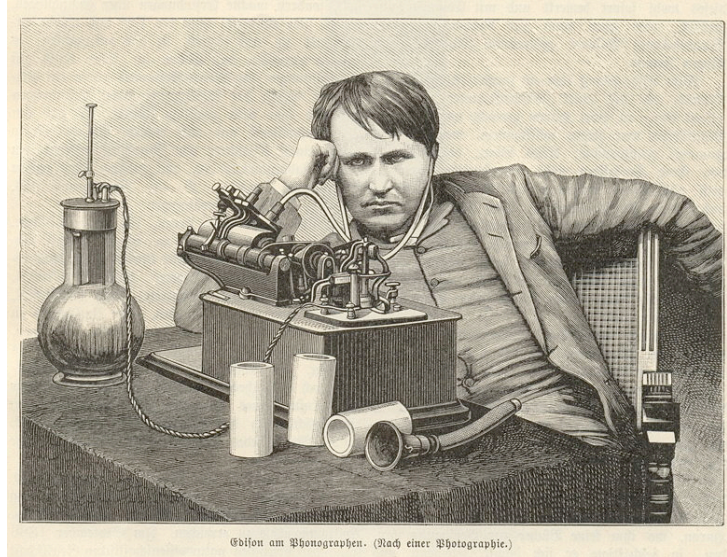
- **Understandable**
- **Available motors**
- **Charges batteries**
- **Available meters**

Disadvantages

- **Cannot transform voltage easily**

Commercialization

- **London 1882**
- **New York 1882**
(both coal)



Also invented:

- **Lightbulb**
(commercial)
- **Phonograph**
- **Improved telegraph**



Early DC generator, “long-legged Mary Anne”, 1884

Alternating current (AC)

Proponent: **Tesla**
(former Edison
engineer)

Advantages:

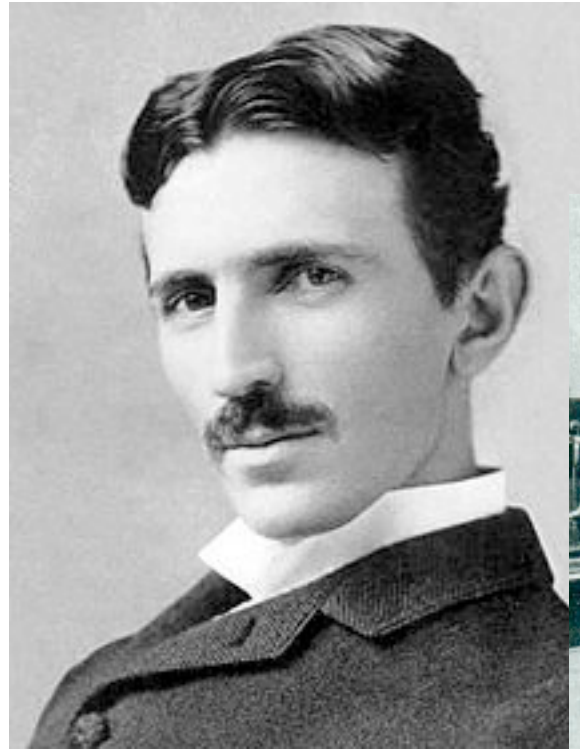
- **Transforms voltage easily**

Disadvantages

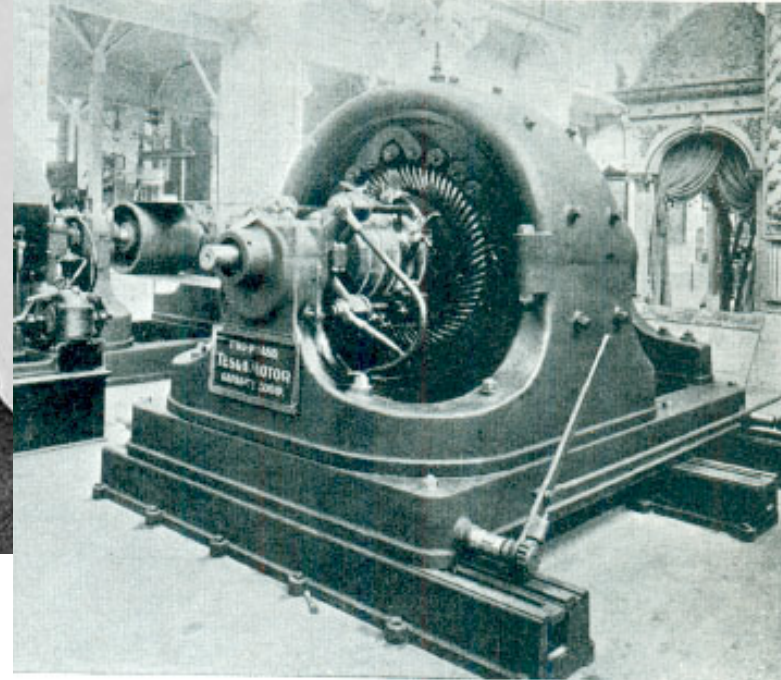
- **No reliable motors available**
- **No battery charge**

Commercialization

- **Ames hydro: 1891**
- **Chicago coal: 1893**
- **Niagara hydro: 1895**



AC dynamo, Chicago 1893



Also invented:

- Induction AC motor
- Radio communication
- Wireless energy transmission

Edison vs. Tesla: “war of the currents”

DC

Edison’s company:

General Electric, founded 1890, now ranked (Forbes, 2009) the largest company in the world. Precursor: Edison Illuminating Co., 1880

Technical achievement:

First steam-powered electricity & electric utility, 1882, first U.S. transmission standard, multiple power plants (1.5 mi. transmission) (for lighting only)

PR stunt: invented (AC) electric chair, attempted execution, 1890

AC

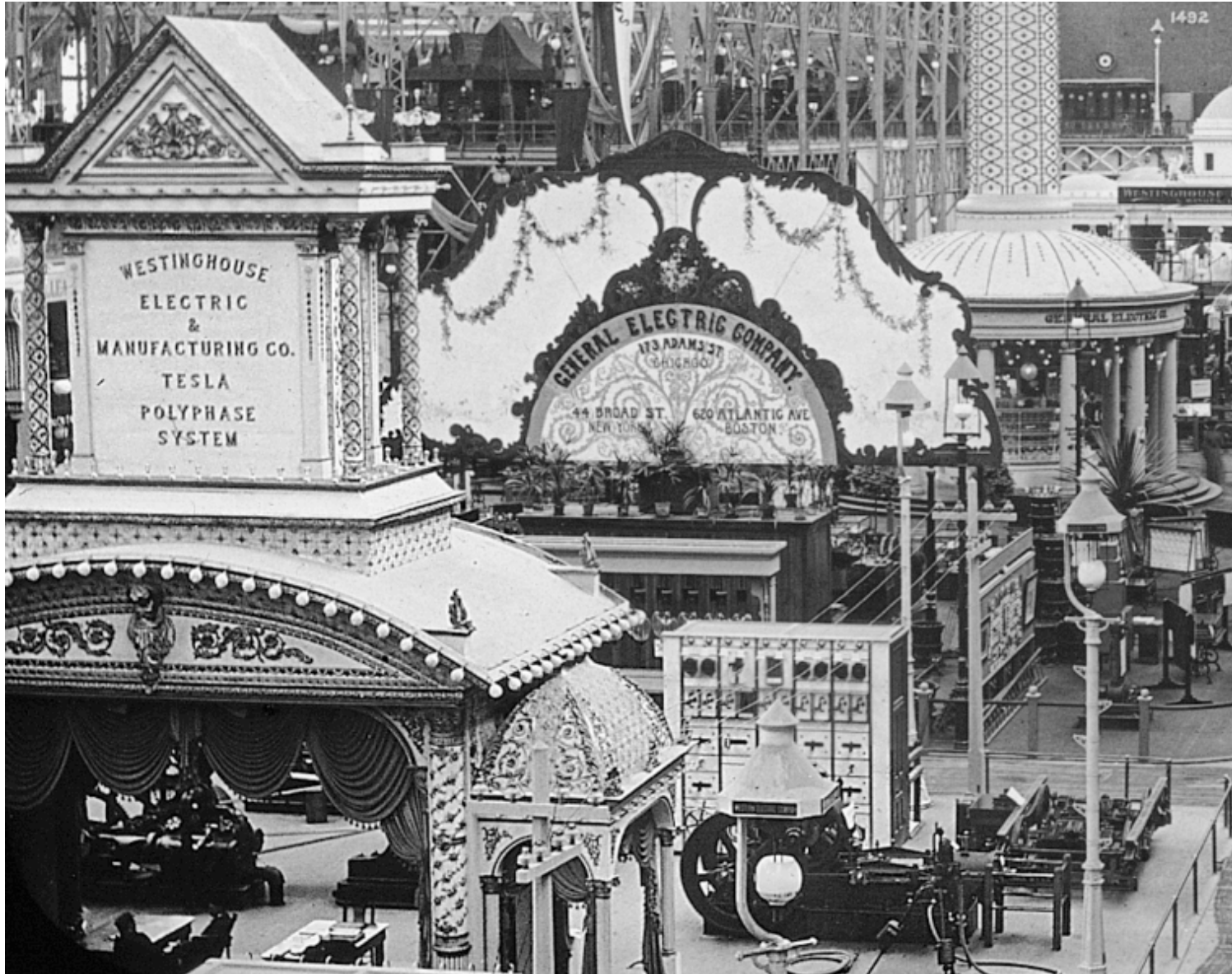
Tesla’s company:

Westinghouse Electric Company, founded 1886, now (after purchase of CBS) knows as CBS Corp. (sold power generation to Siemens, itself provider of first electric street lighting in 1881). Hired first woman electrical engineer in 1890s.

Technical achievement: long-distance transmission of hydropower at Niagara Falls to factories in Buffalo New York, 1895 (25Hz)

PR stunt: lit Chicago World’s Fair, 1893

Edison vs. Tesla at 1893 Chicago World's Fair



Tesla's system already had most characteristics of the modern electricity system in 1893..

World's Fair + choice at Niagara 2 years later committed us to AC

Comparatively little evolution after choice was made – standardization of frequencies.