



Pittsburgh - Historical and current perspectives

Population	City	304 K	0.1% US
	Metro	2.7 M	0.8% US
Industries	Steel – Carnegie, Frick		
	Aluminum – Hall		
	Glass, Chemicals – Oil & Gas- Pitcairn		
	Electrical – Westinghouse and Telsa		
	Rail – Ford and Pitcairn		
	Food – Heinz		
Universities	Automation/Aerospace – Rockwell		
	University of Pittsburgh		
	Carnegie Mellon		
	Duquesne		
	Robert Morris		
	Washington & Jefferson		
	Grove City		
	California University		



USS Steel



- World's first Billion Dollar Corporation
- Controlled 66% of the US steel production
- Carnegie, Schwab, Frick, J.P Morgan and Gary
- 340,000 employees

25 Hz System installed
1908 – still in use

- Mon Valley – Clairton, West Mifflin, Edgar Thompson



US Steel HQ



Pittsburgh Plate Glass Company – 1883

65% percent market share – “Glass Trust”

Now paints and chemicals



- Today, Alcoa is the worlds leading producer of aluminum
- - Majority of cost is electricity



Steel
Glass
Aluminum



Alcoa Power Station (1921)

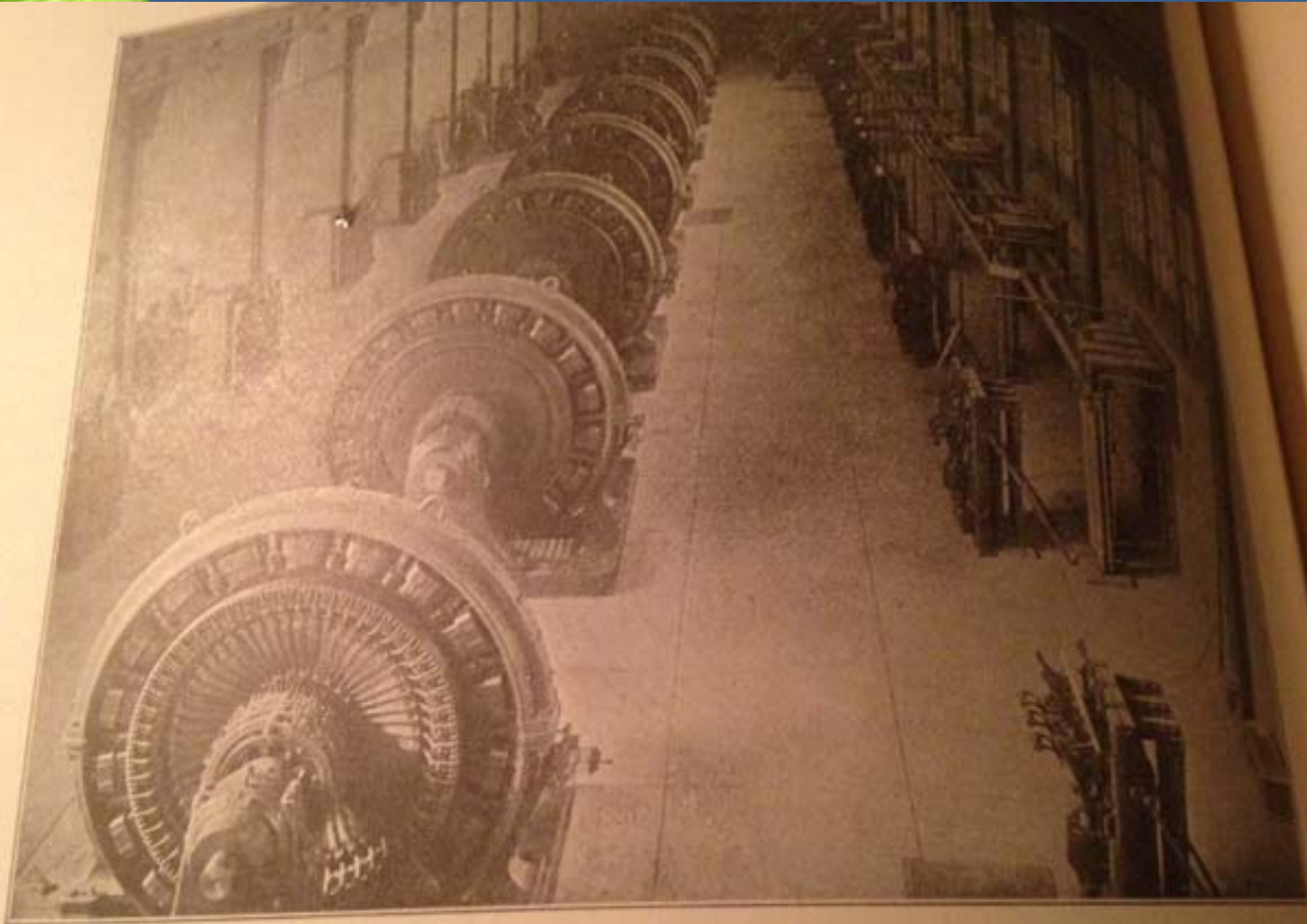


FIG. 215.—Marysville station of Aluminum Co. of America.

Chemicals

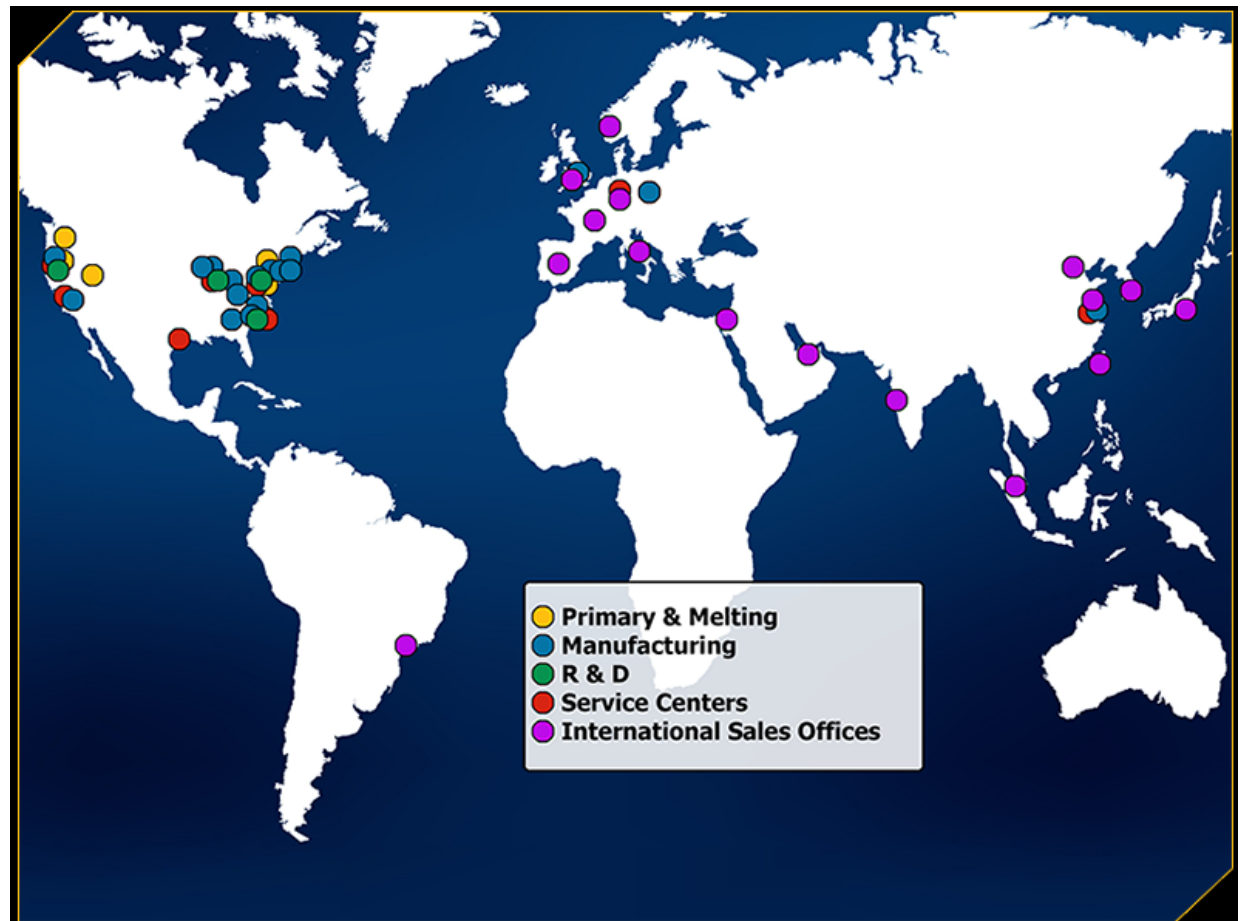
- Bayer
- BASF
- Shell
- Pennzoil
- Quaker State

Machinery Manufacturers

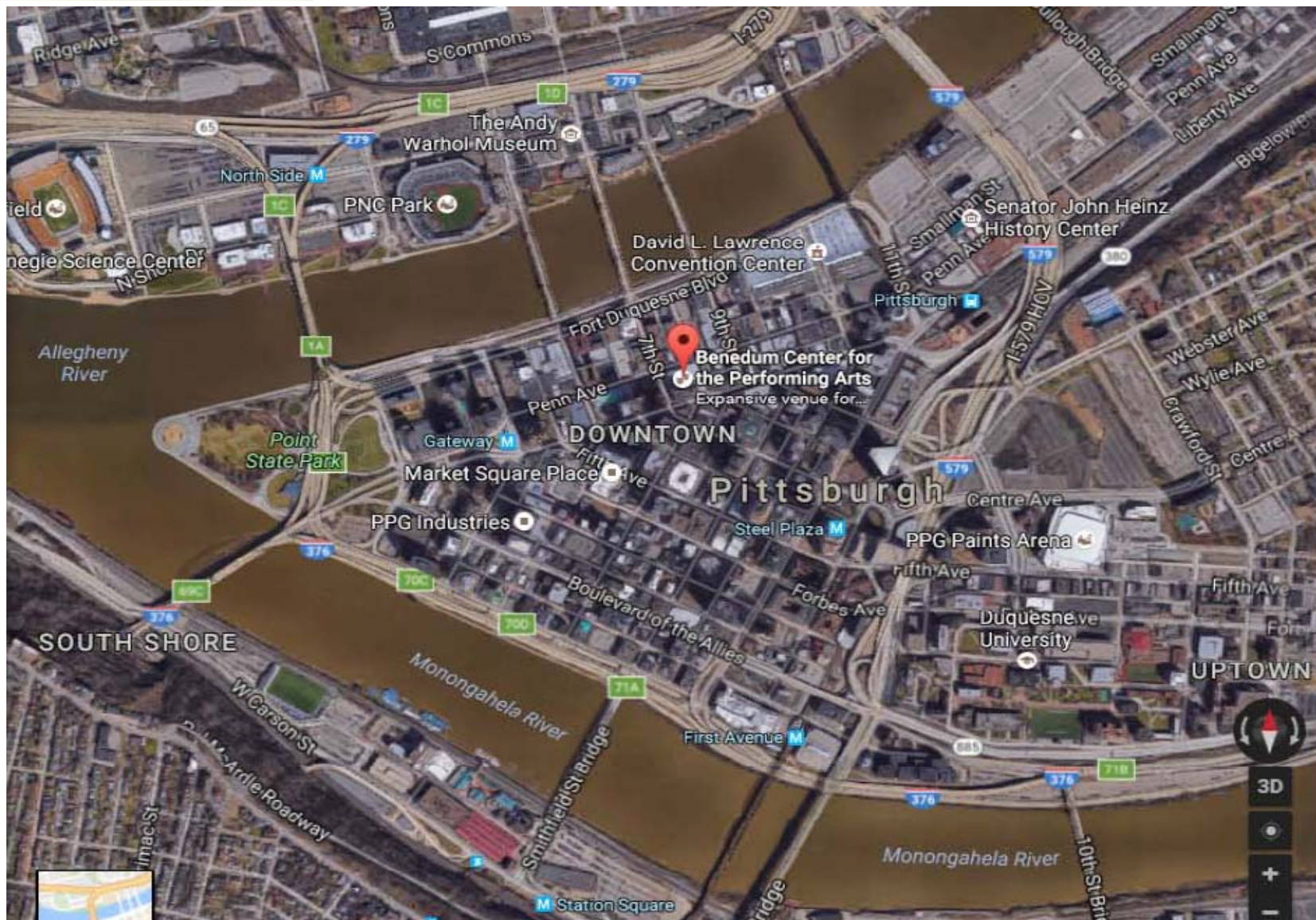


ATI Allegheny Ludlum

- Largest at specialty Metals
 - Stainless Steel
 - Titanium
 - Tungsten
 - Specialty metals
 - 33 Locations
- 
- A map of the United States with 33 colored dots representing locations. The dots are concentrated in the West (California, Oregon, Washington) and the Northeast (New York, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida). The dots are colored in blue, green, yellow, and red.



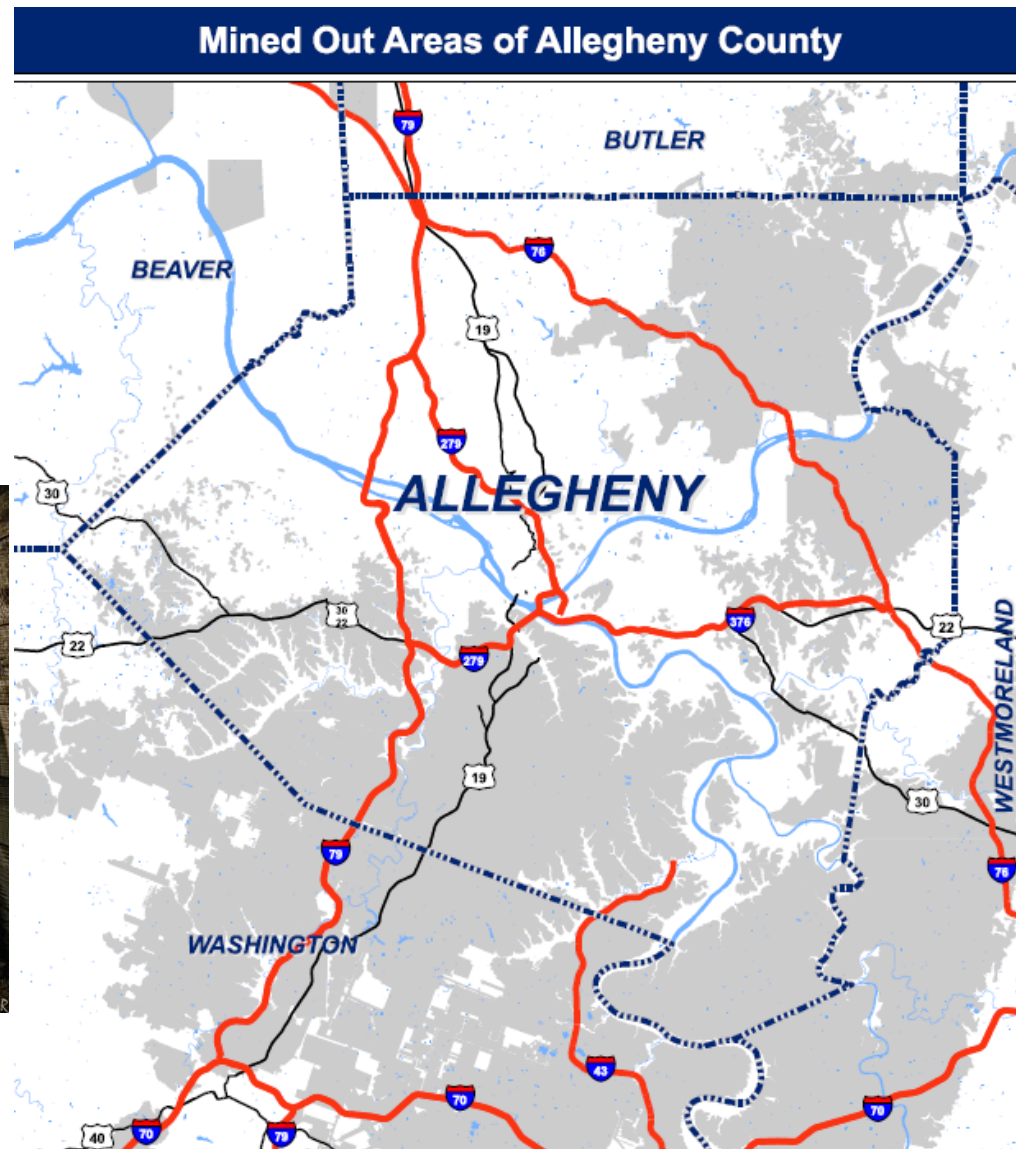
Three Rivers and Rail System



Available Raw Materials

Consolidation Coal - #1 producer

Coal – Under the City
Iron – from Erie PA ports (train)
Limestone – 40 minutes N. West
Oil and Gas – 40 minutes North
Sand Deposits
Water – Three Rivers



First Oil Well and Refineries in US 1859

Drake's
Well

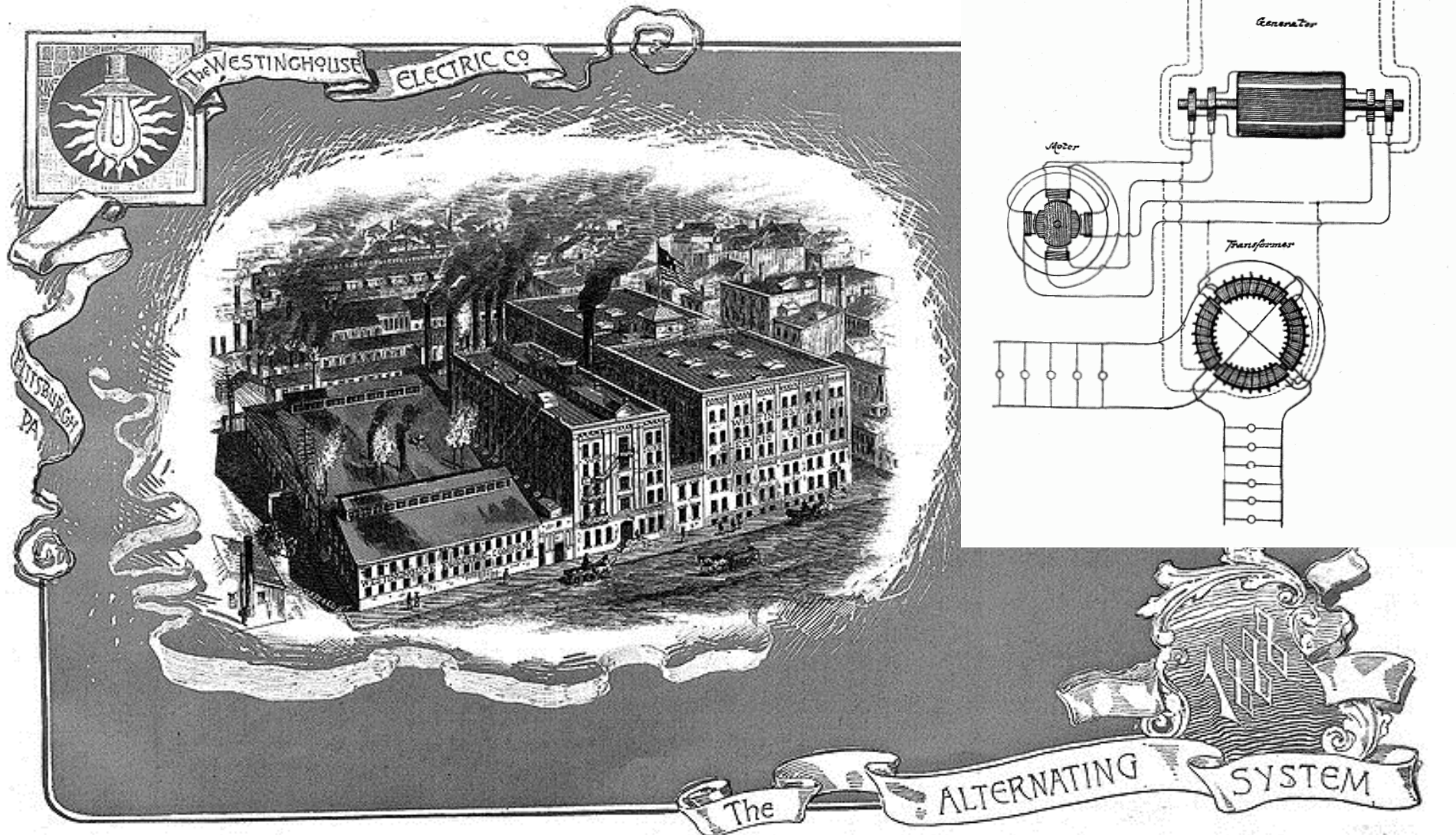
40
minutes
North



Pittsburgh – claims

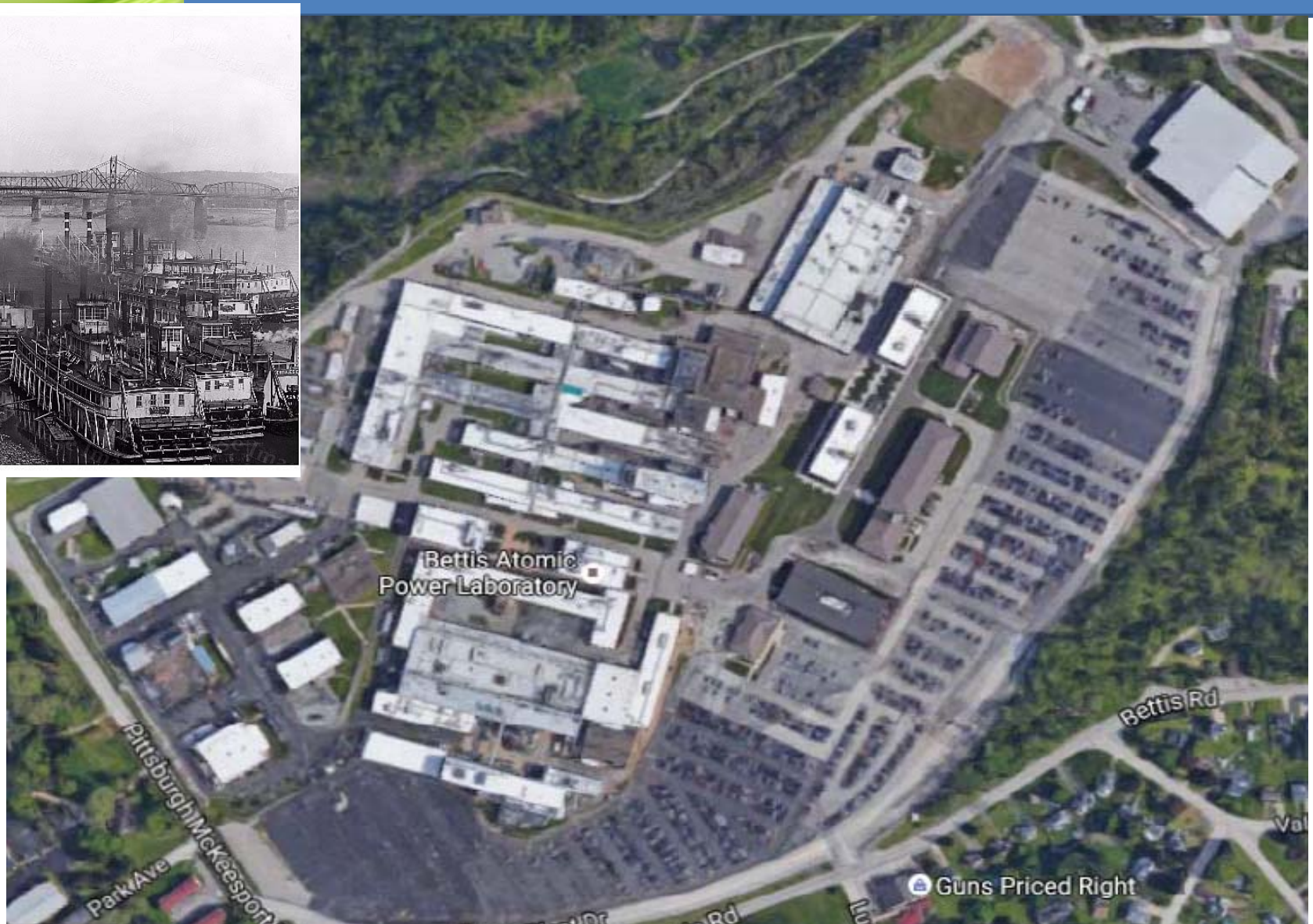
- Ferris Wheel – 1893
- Bridge Cable Suspension – 1845
- Train Air Brakes – 1869
- Train Signaling – 1881
- World Series – 1903
- Movie Theater – 1905
- AC Power Trains – 1905
- Diesel Electric Submarine – 1919
- First Drive in Gas Station – 1913
- All Electric Kitchens – 1917
- Operational Radar – 1939
- First Radio Station -1920
- TV and Radio – 1928 Moon 1969
- Disney/Airport Movers - 1964
- SF6 Circuit Breakers – 1955
- Aluminum pull top cans - 1962
- Polio Vaccine - 1952
- Nuclear Power - 1957
- Jet Engine - 1943
- International Short Wave - 1923
- Computer Controlled Network -1962
- First AC Commercial Power - 1891
- Worlds largest AC Power Plant - 1895
- Gas Pipelines – George W - 1880
- First Printing Press using rolls - 1863
- Rotating steam turbine - 1865

Westinghouse / Tesla AC system - Patents



Pittsburgh - Gate Way to the West

Rail (Egar Thompson Mill) and Paddlewheelers



1957 – World's First Commercial Nuclear Facility

World's First Atom Smasher



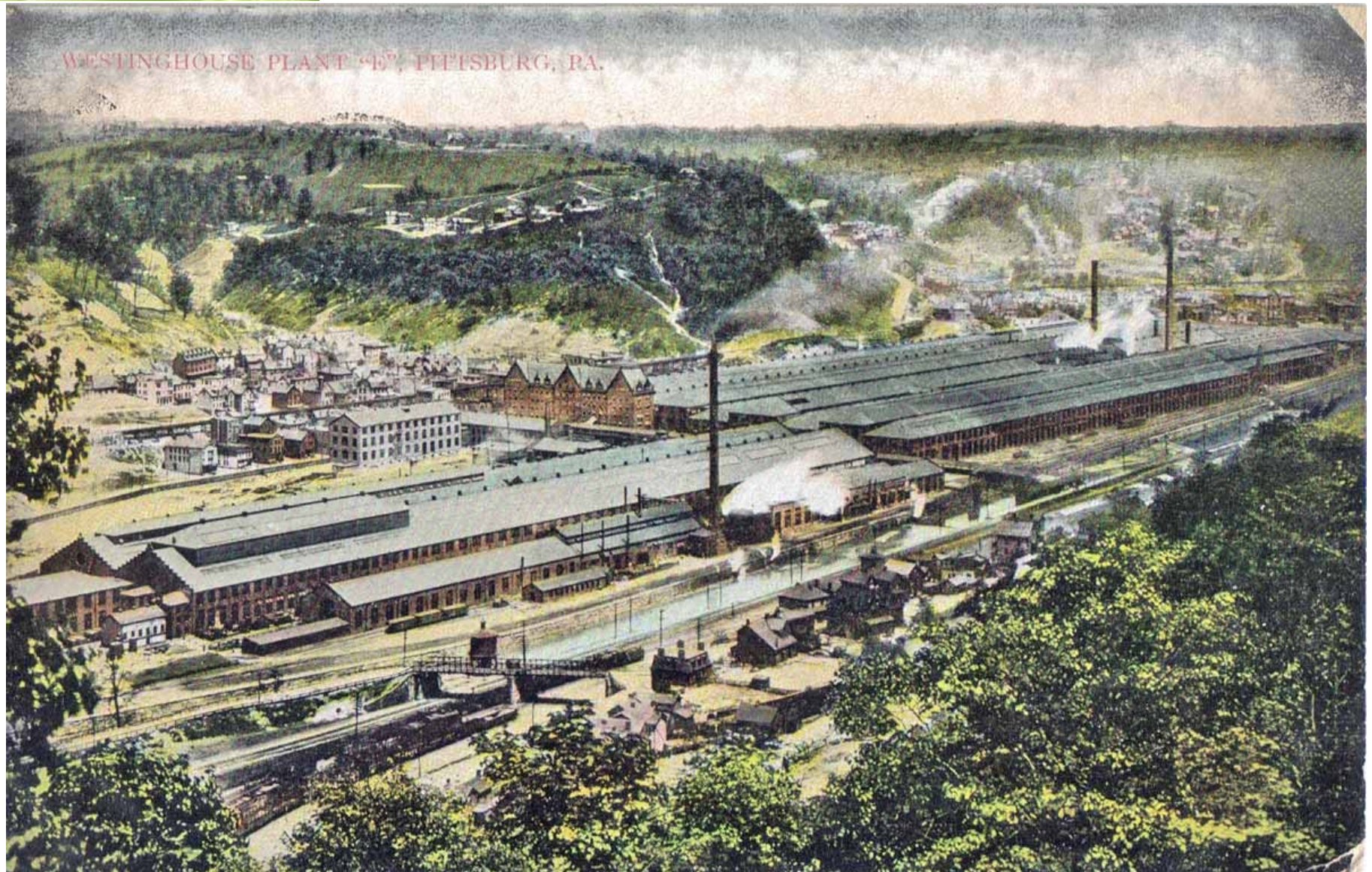
World's First Nuclear Submarine Engine 1954



East Pittsburgh

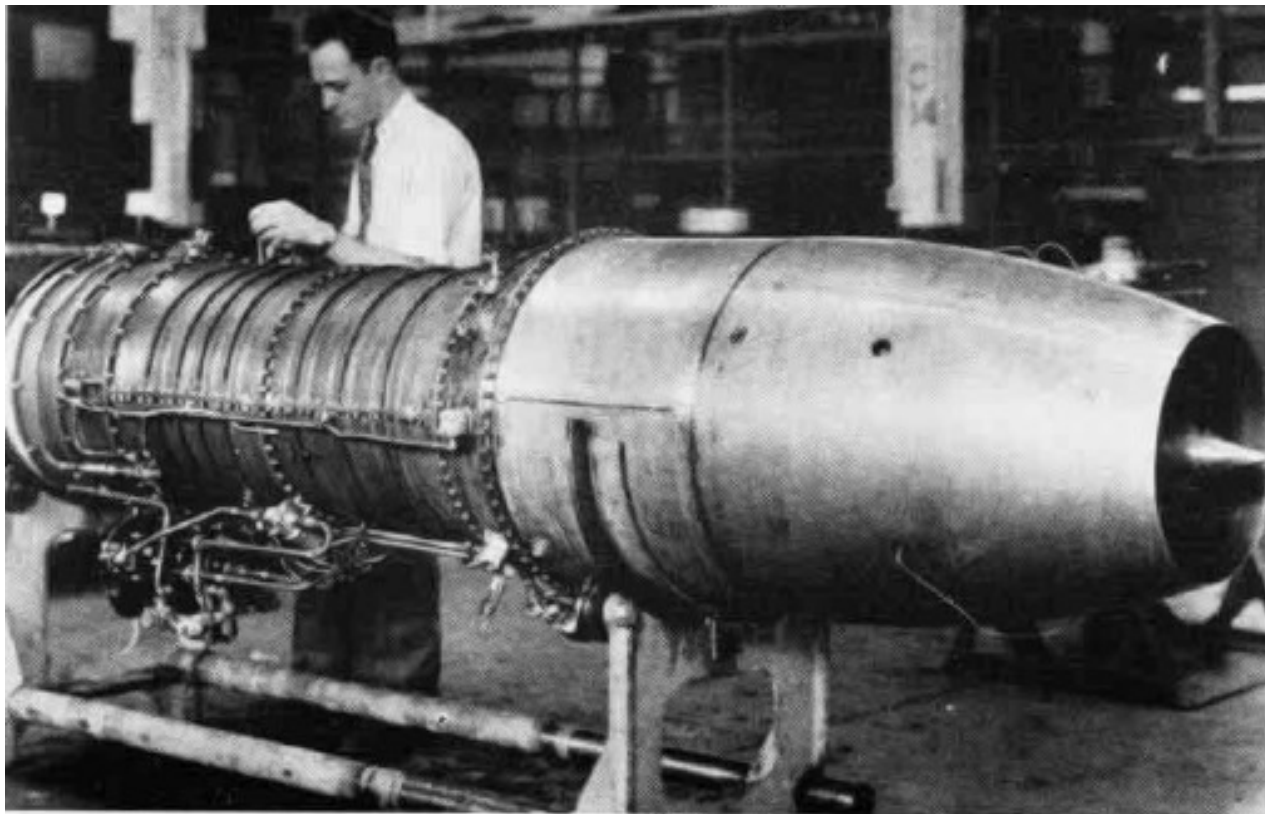


Historical View of Westinghouse East Pittsburgh



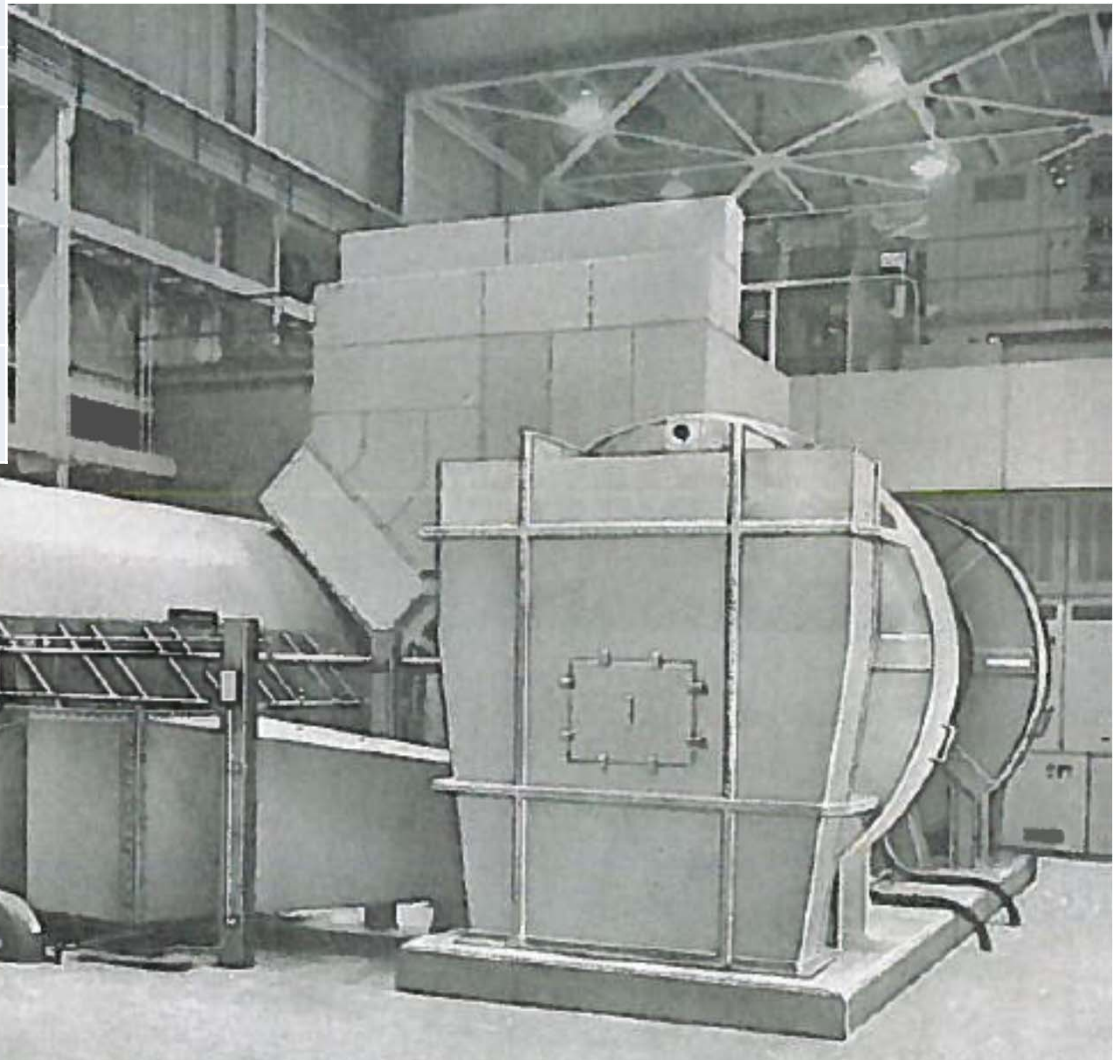
First US Jet Design

“Westinghouse worked on its own, with no prior jet engine experience and without knowledge of German, British or other US jet engine developments. The result was the first US jet engine design, complete with an axial compressor, an internal annular combustor, a turbine and jet exhaust nozzle.”



East Pittsburgh – Worlds Largest Total Connected SC Power

Area	MVA	MVA	Total MVA
#1	1000	1500	2500
#2	1700	1500	3200
#3	2500		2500
#4	900	3000	3900
#5	1250		1250
#6	560	1500	2060
	Combined Total MVA		15410



1901 Vintage Oil Circuit Breaker

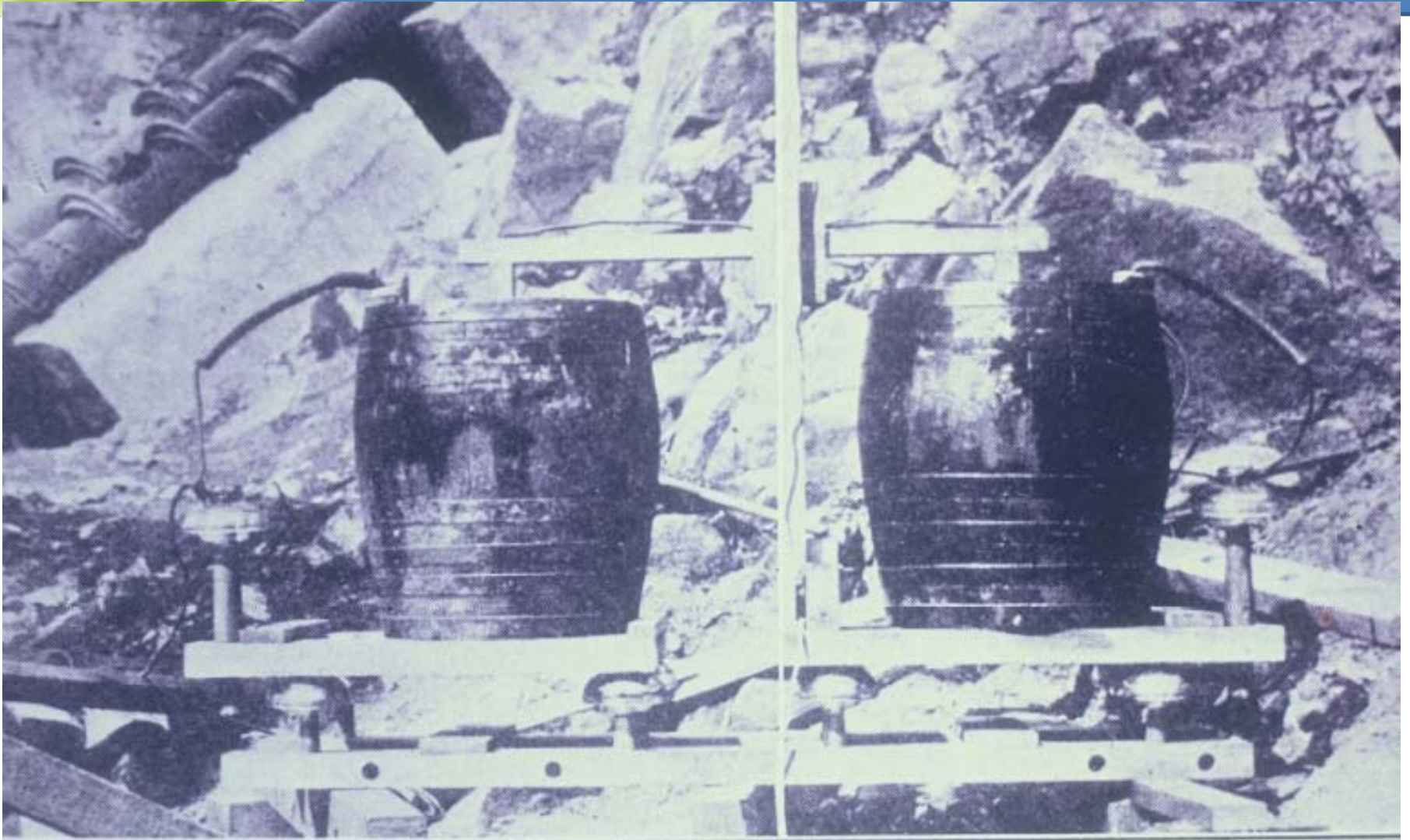
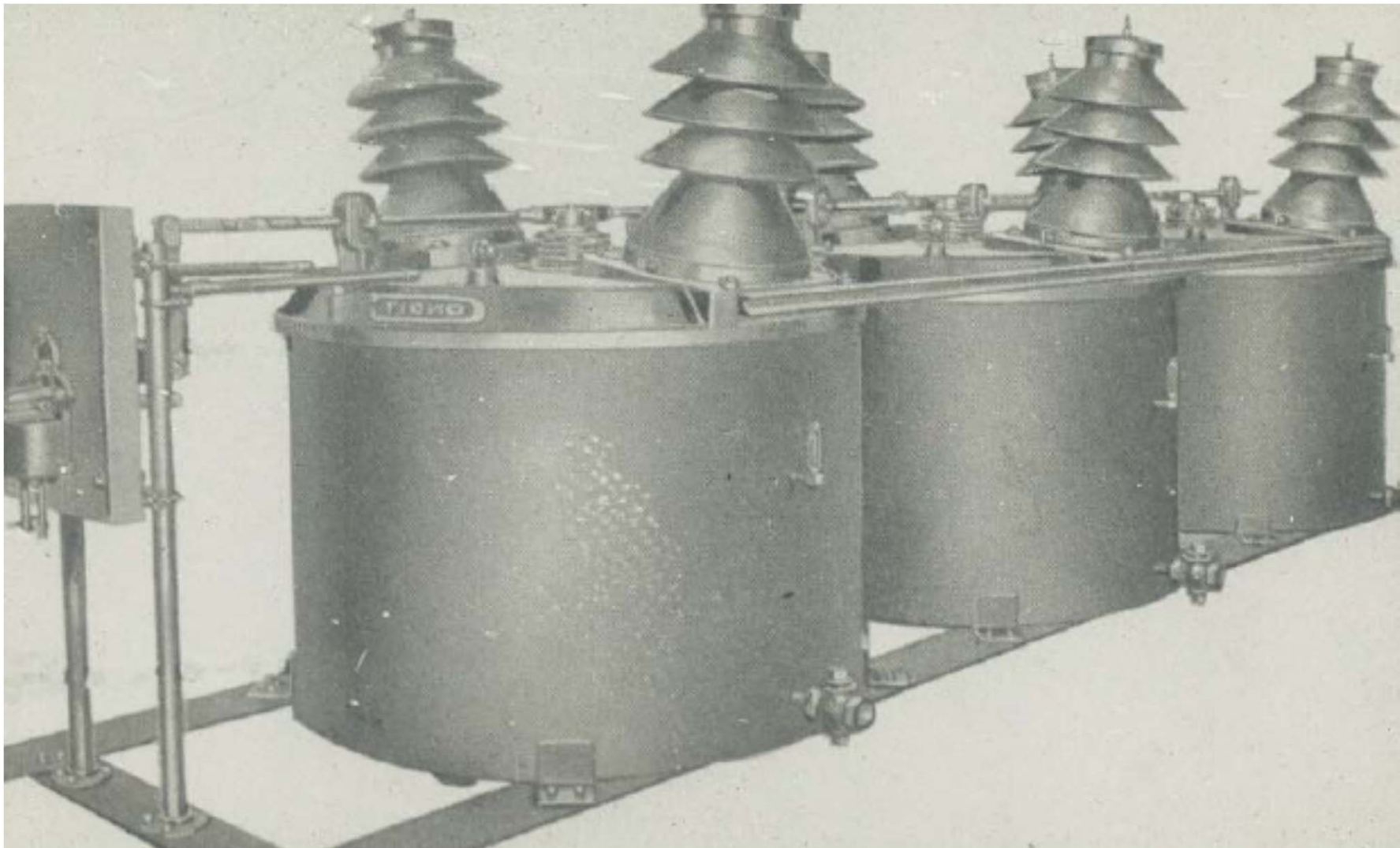


FIG. 11.—The first 40,000-volt oil switch in service, 1901.

1910 - 70 kV Circuit Breaker

Rotary contacts – No interrupting



1920 – 110 kV, 3.3 kA

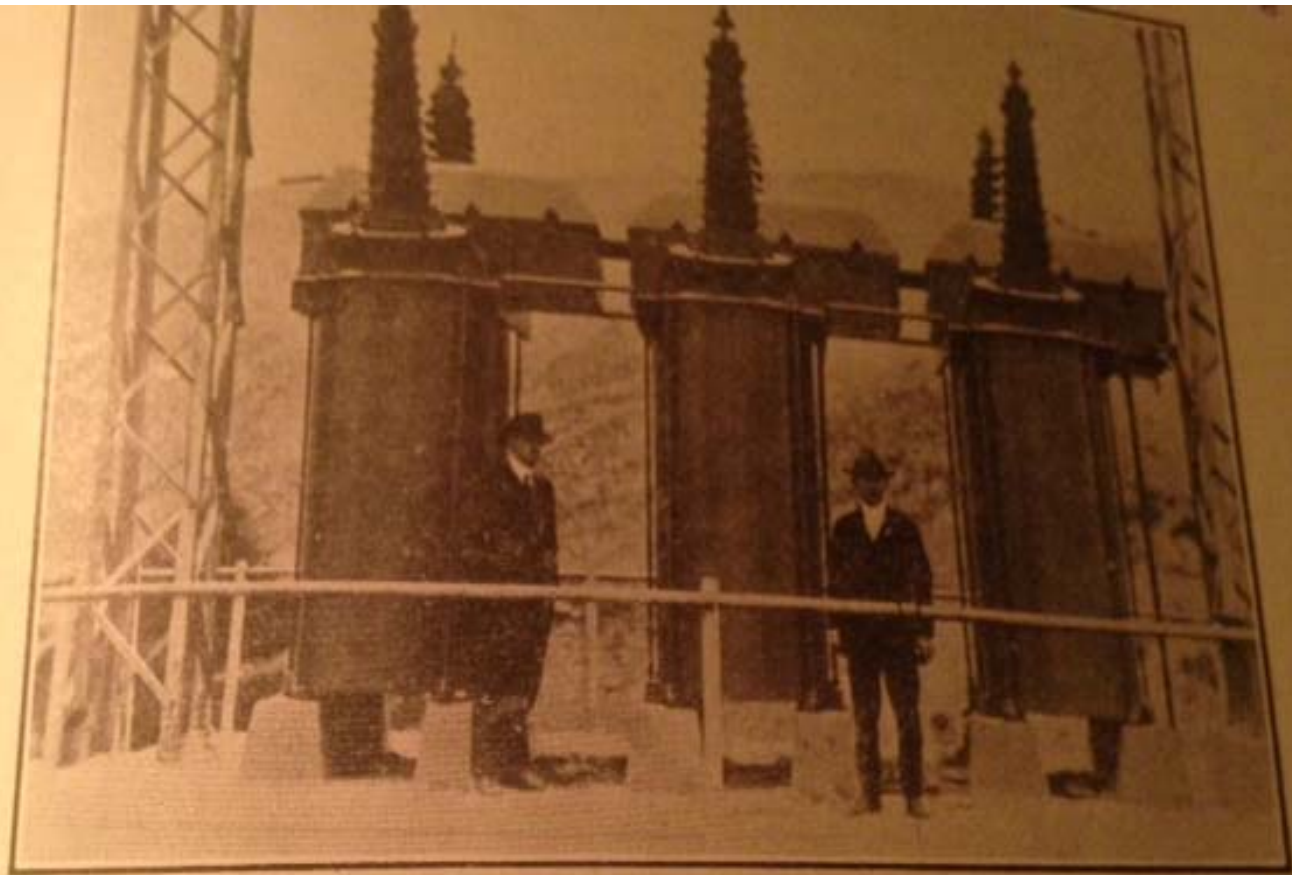
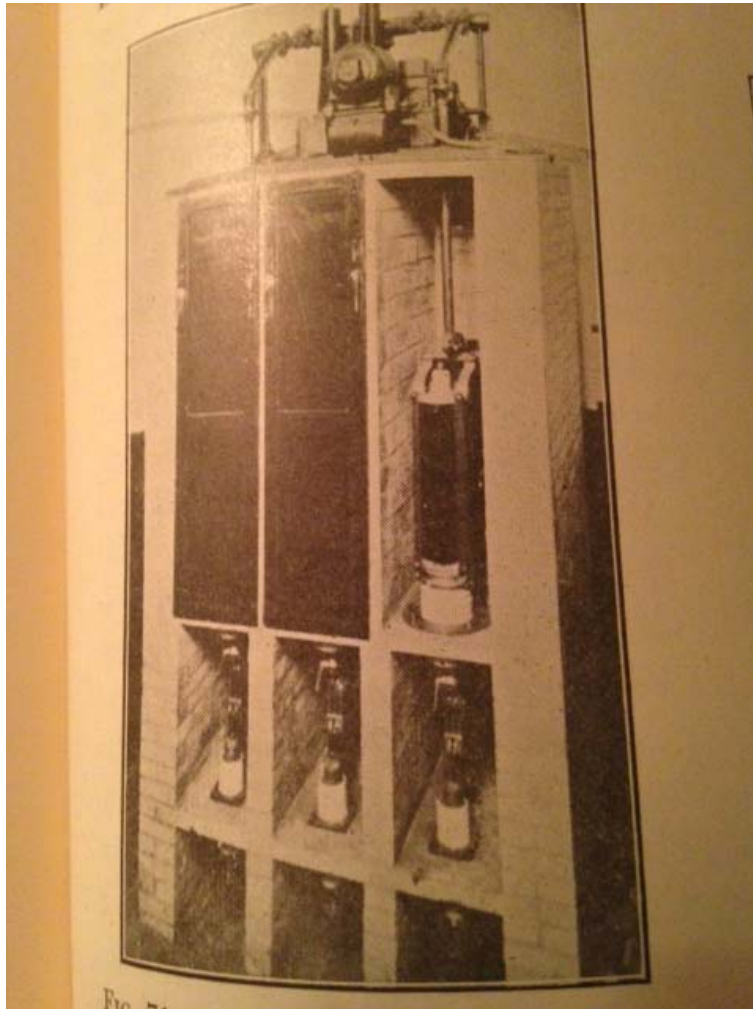


FIG. 79.—General Electric Co. oil circuit breaker type KO36.

capacity of 3290 amperes at 110,000 volts. The sides
tank... is broken under the

Indoor & Outdoor Oil Circuit Breakers

15 kV, 10 kA to 2.5 kV 75 kA



135 kV, 400 A, 2 kA

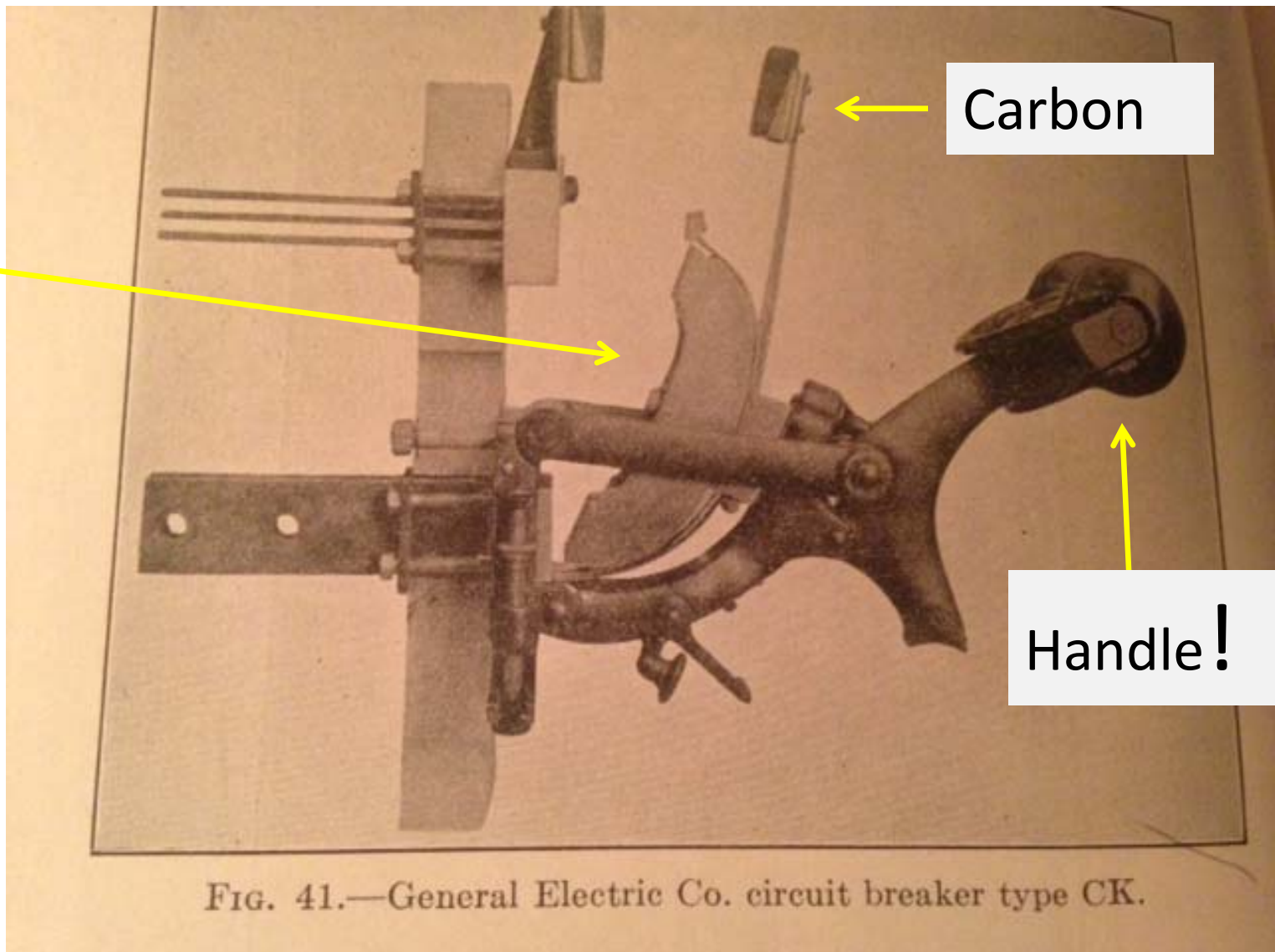


—Westinghouse type “G-2” outdoor oil circuit breaker, 400
135 K.V.

Open Air - Manual Operated Circuit Breaker – Vintage 1920

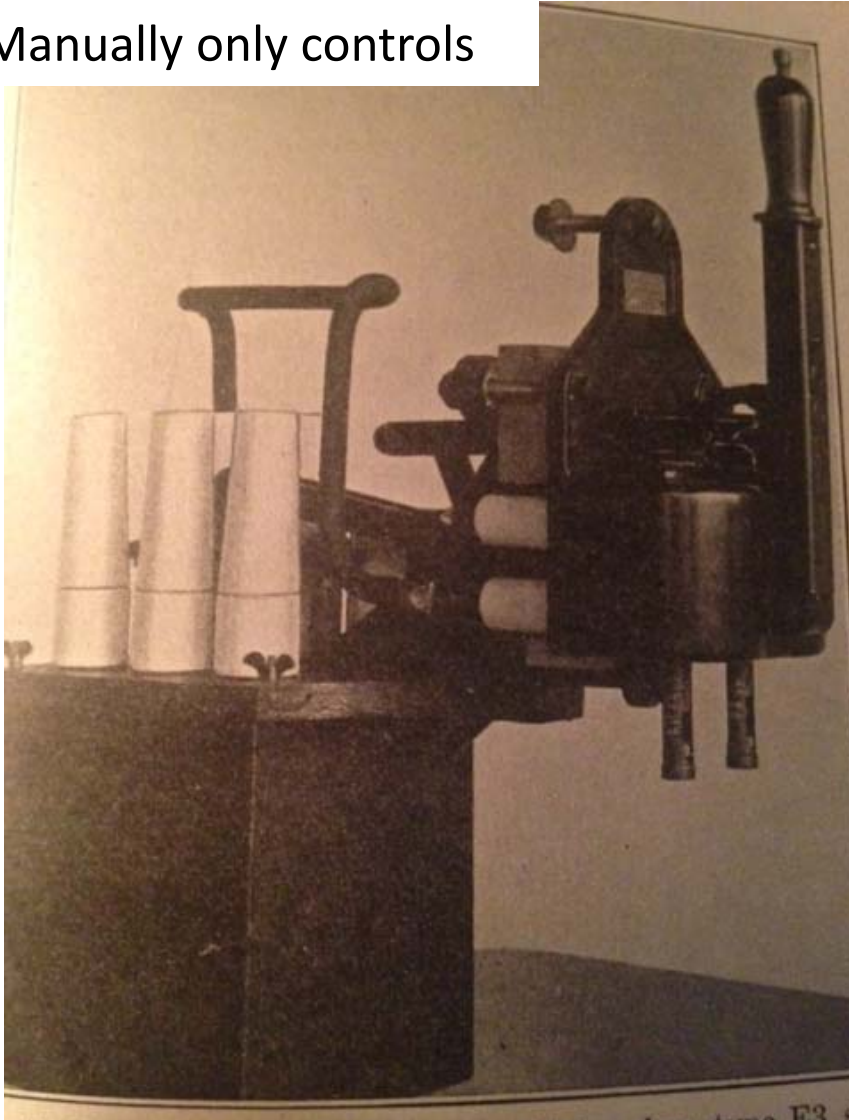


CB
symbol

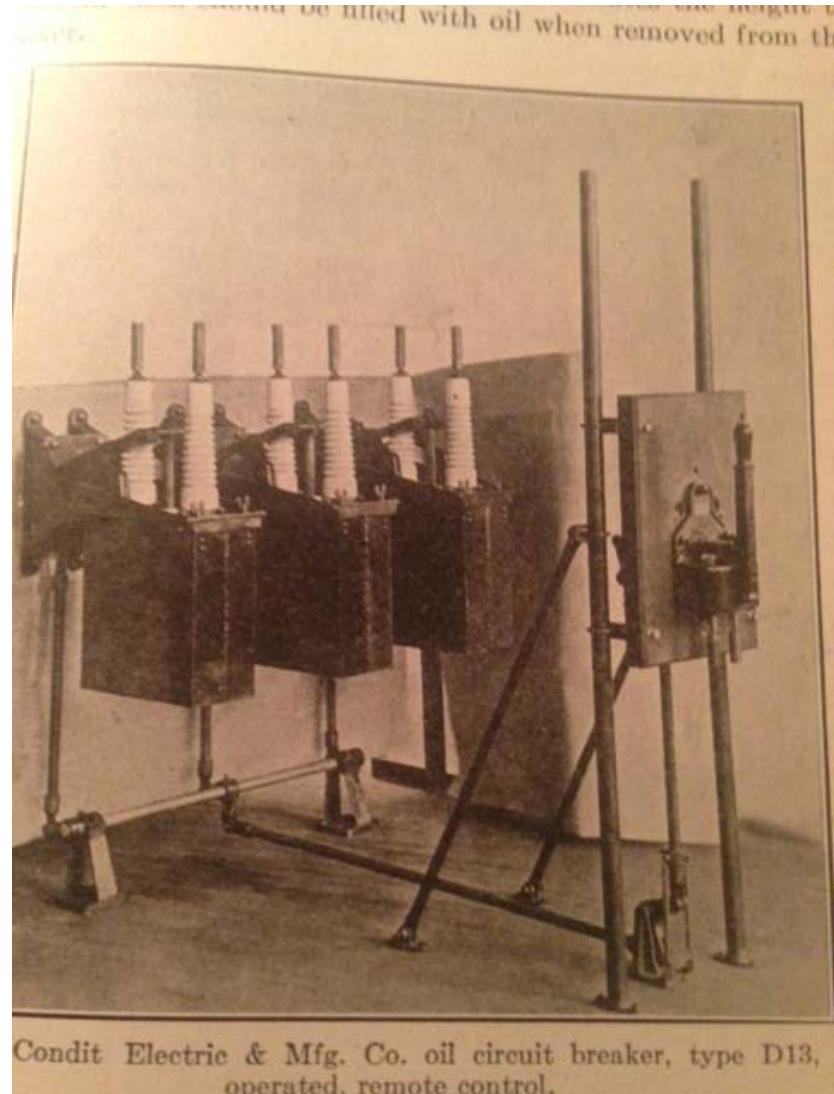


15 kV Indoor Oil Switchgear

Manually only controls



Manually Operated – “Remote Control”



Safety Features

5 Second Short Time Capabilities

Gravity Drop – Collapsing mechanism

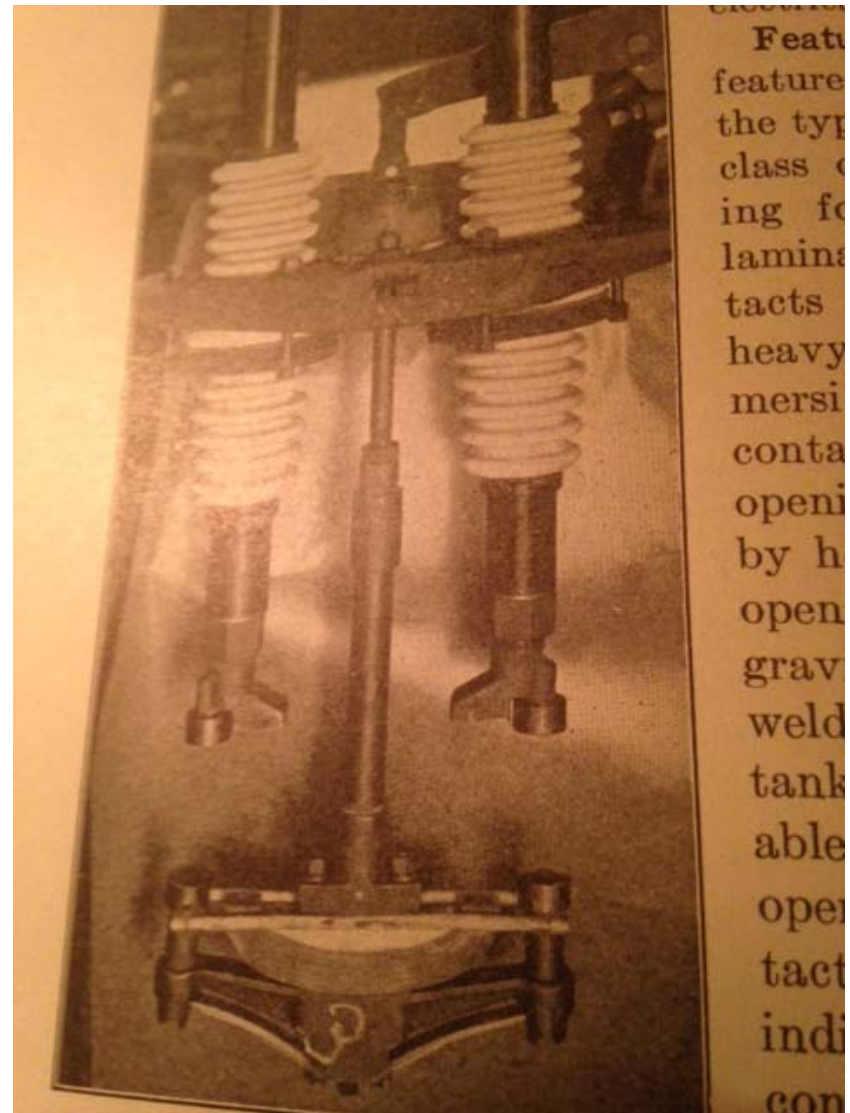
Contacts “Trip-Free”

No Oil Throwing – 1926 (fire codes)

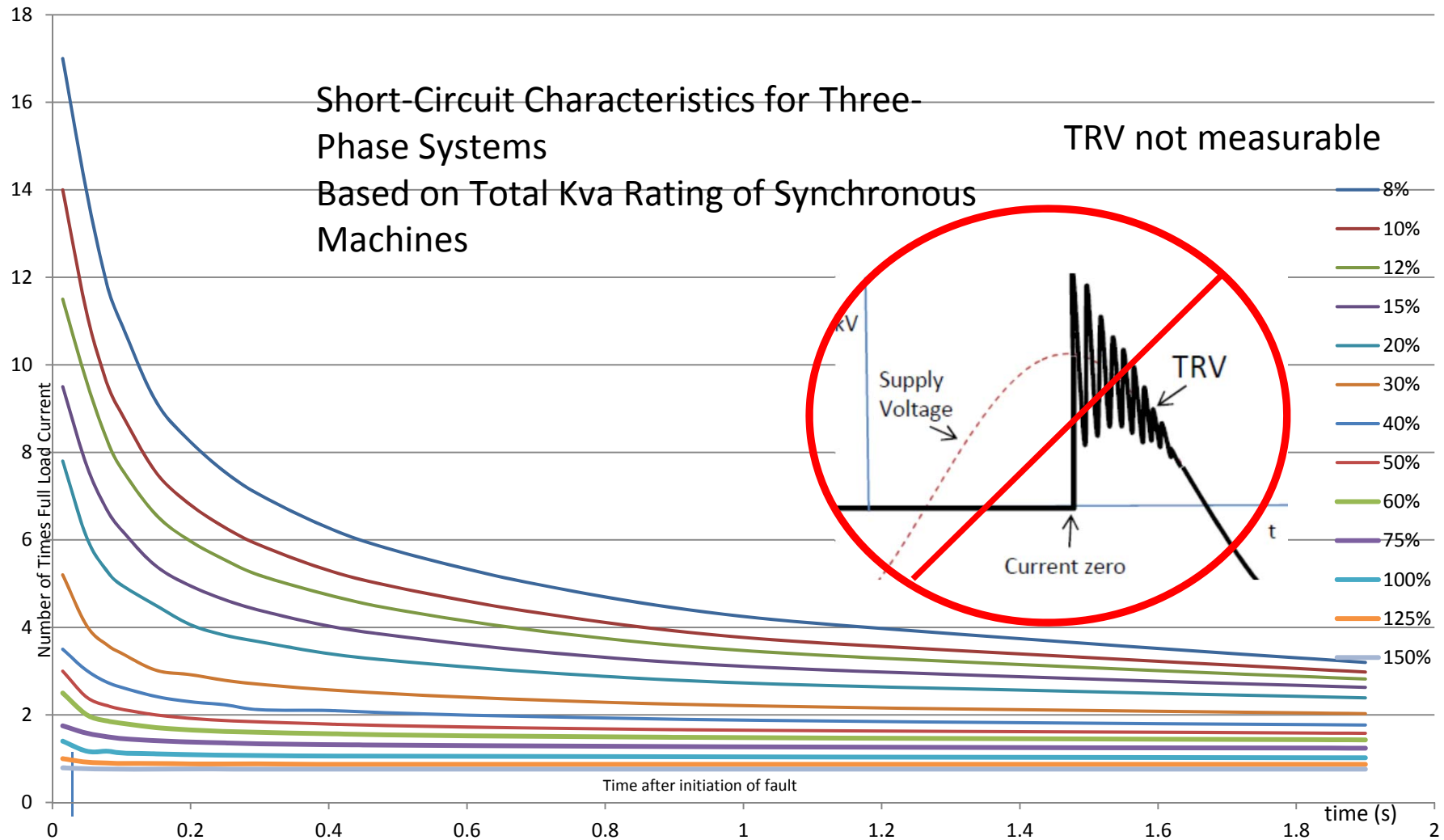


Expansion
Method
Late 1920's
IEC

Air Magnetic
IEEE
1939



Short circuit Characteristics 1920's



Reactors

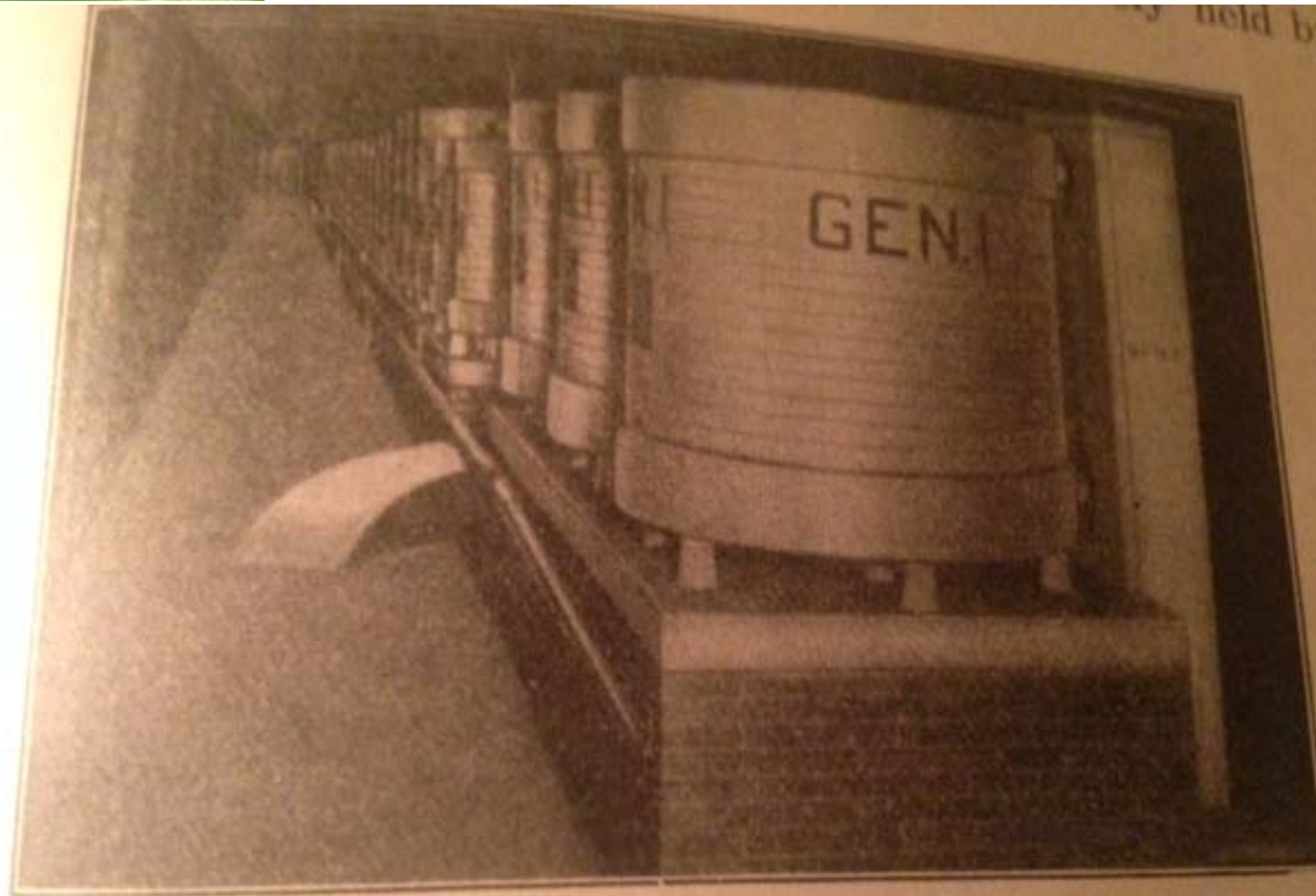
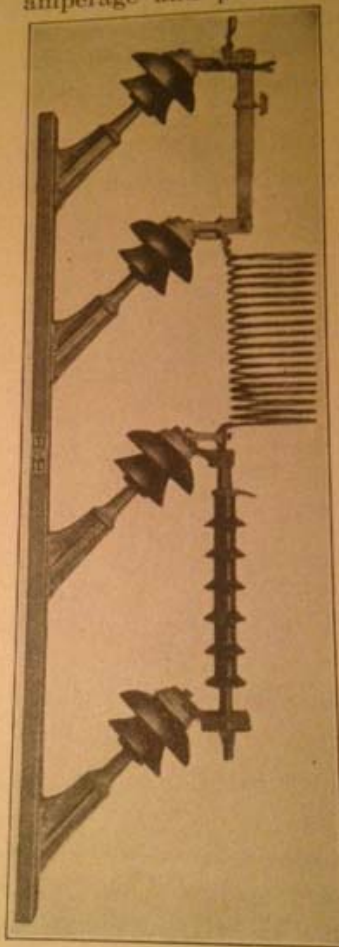


FIG. 144.—Reactor of Metropolitan Engineering Co.

fuse consists essentially of a disconnect shunt
amperage and provided with a lock, so t
cannot be opened
in place. If the
when it is carryi
rent is shunted th
it is interrupted
due to the curr
rated current of

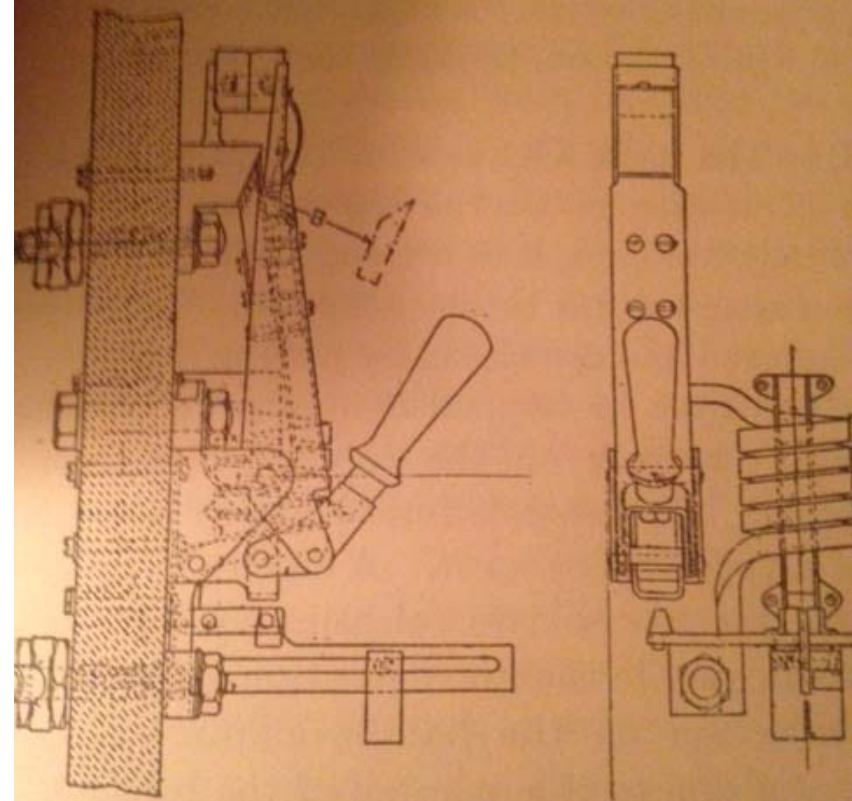


Mountings.—
mountings for
been develop
Conrad, Inc.
Electric Comp
are furnished
outdoor serv
combinations f
with choke c
switches, etc.
the fuse is m
petticoat inst
zontally, verti
45 degrees. S
ments, utilizin
pulsion Fuses

The fuse h
fuses is made
give high m
each end are
which engage
of the moun

FIG. 25.—Delta-Star outdoor
fuse arrangement.

CARBON BREAKERS

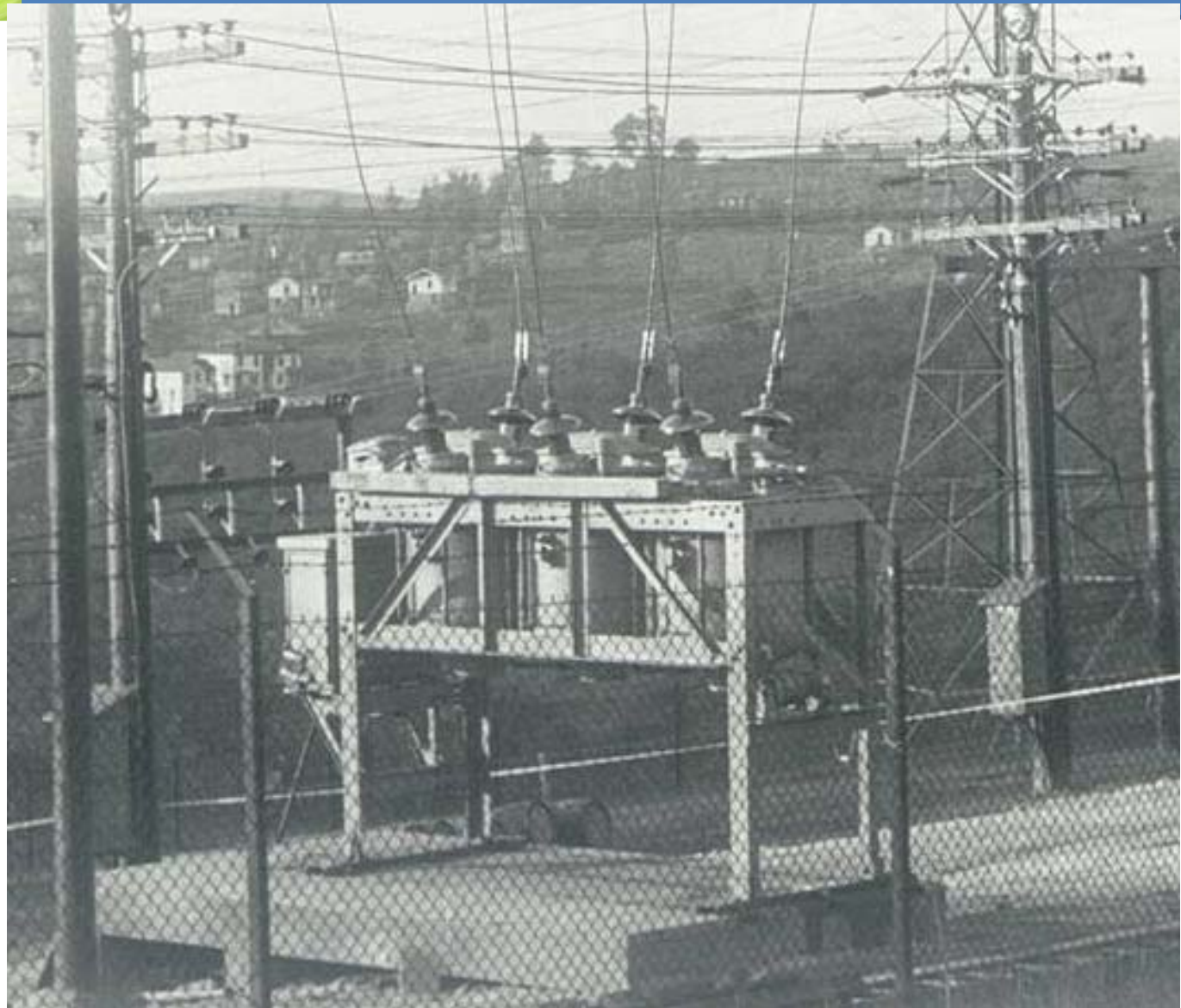


G. 46.—Westinghouse carbon circuit breaker, type

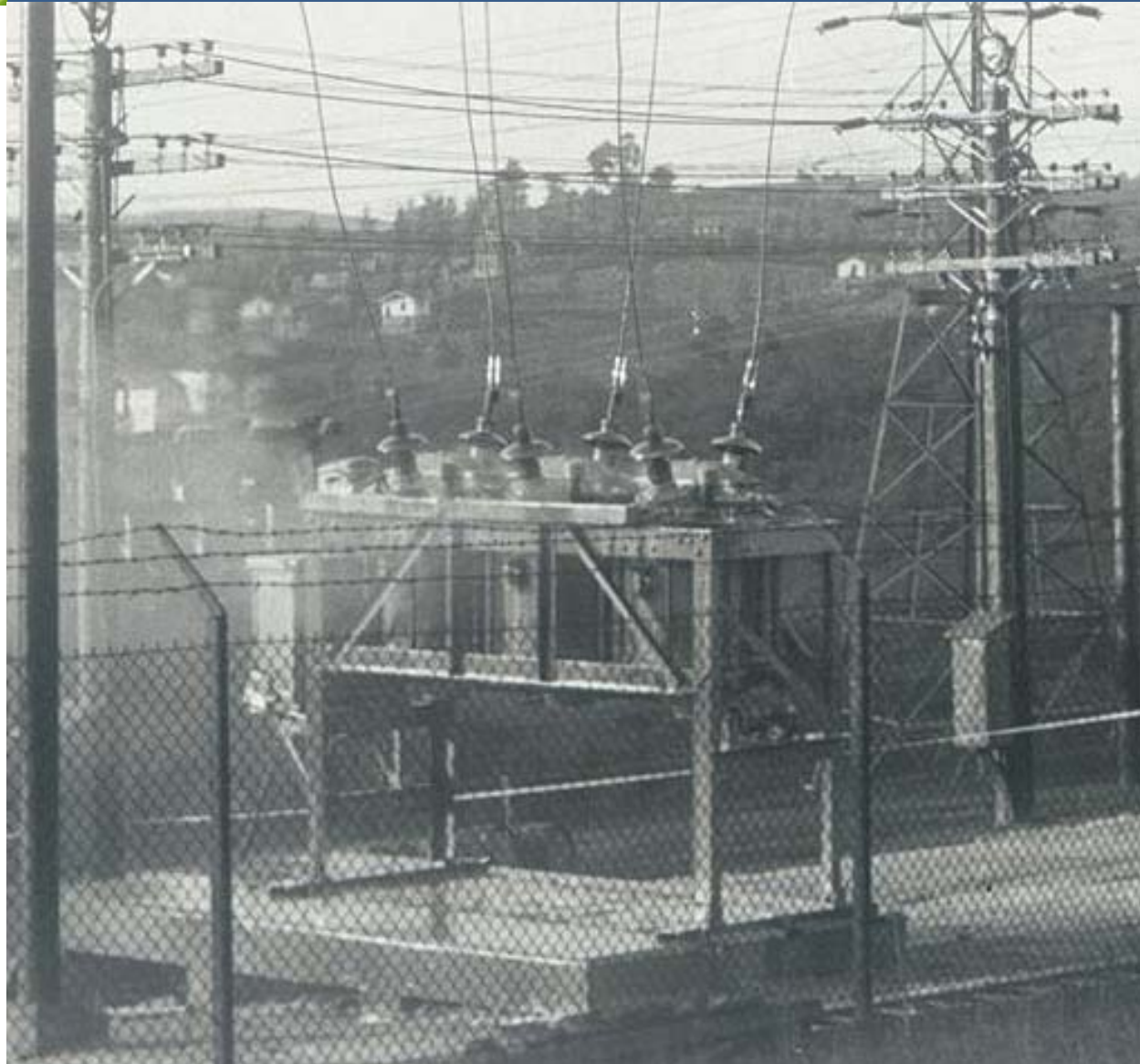
Early Short Circuit Test

Condit Elec. Mfg. Co. "FO-40"
Breaker, 1 Short - "CO" Cycle
10,500 amps at 24,000 volts.

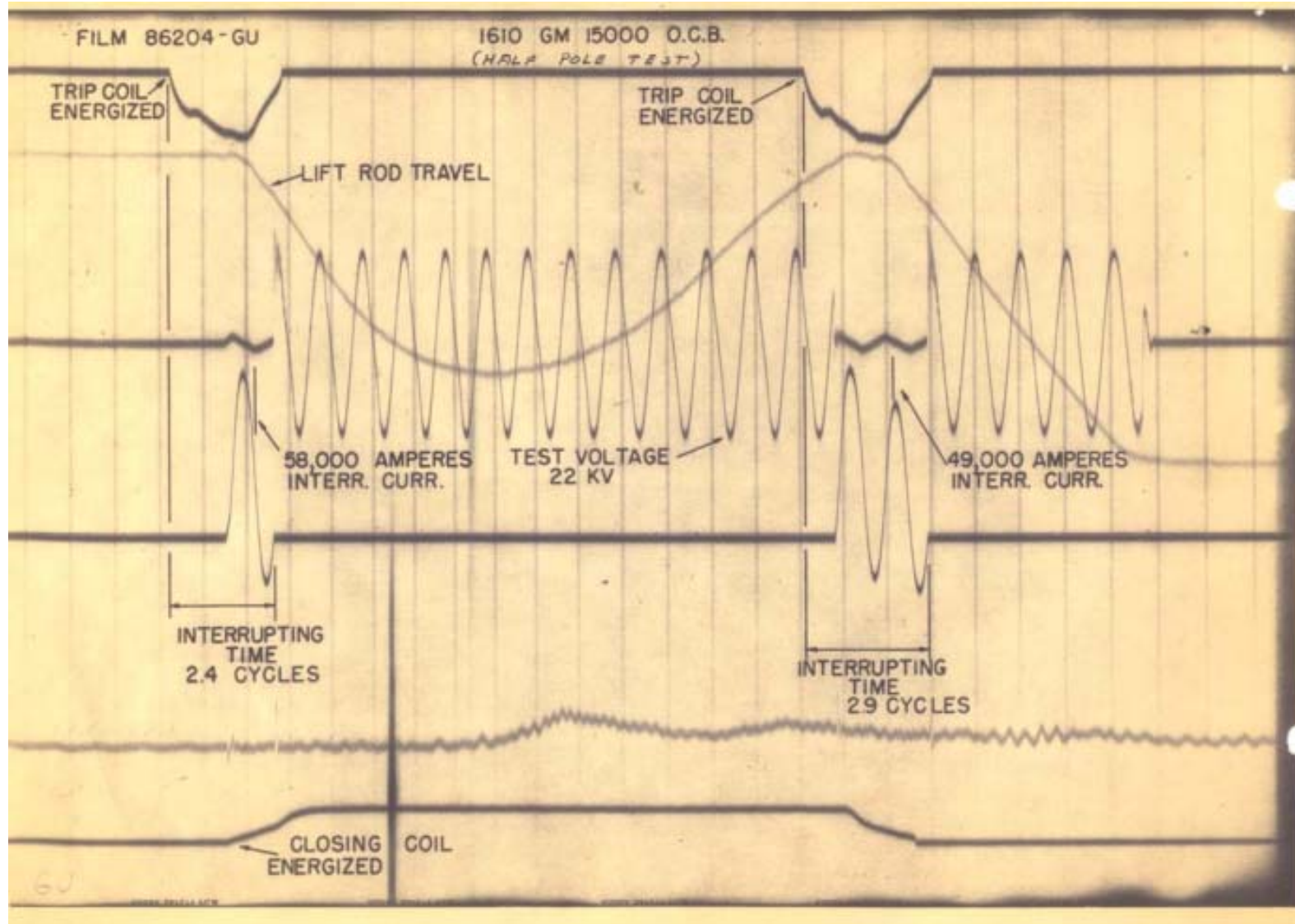
Duquesne Lt. Co., Pittsburgh, Pa.
4:55 P. M. Sept. 26, 1926



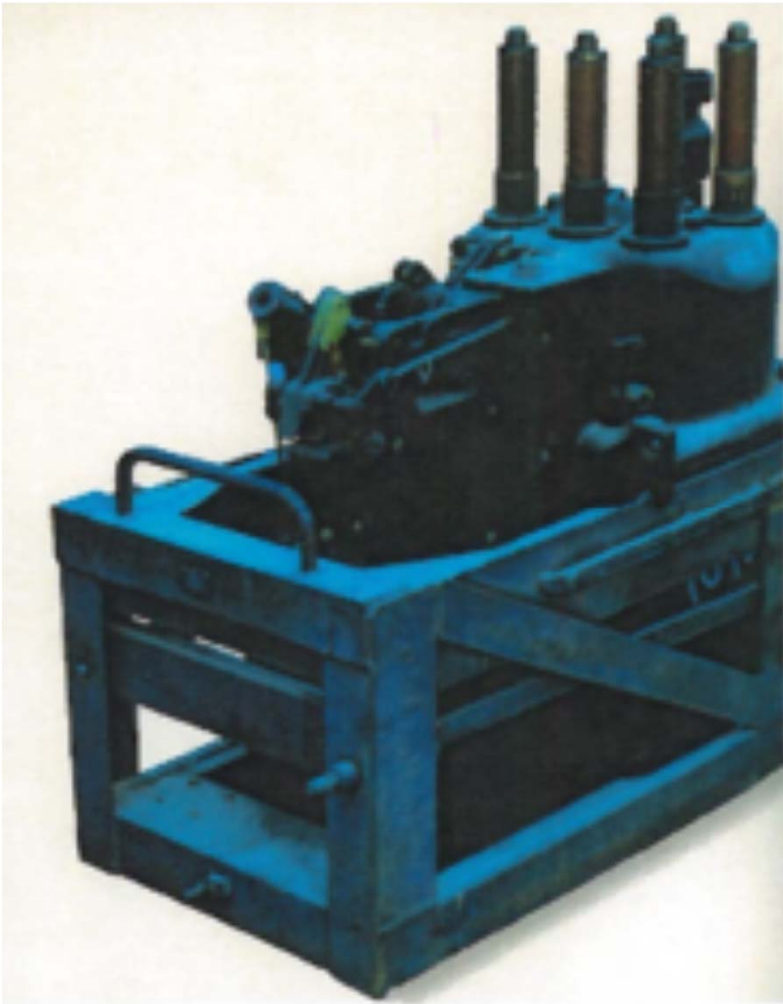




Oil Circuit Breaker Test



Oil Vertical Lift



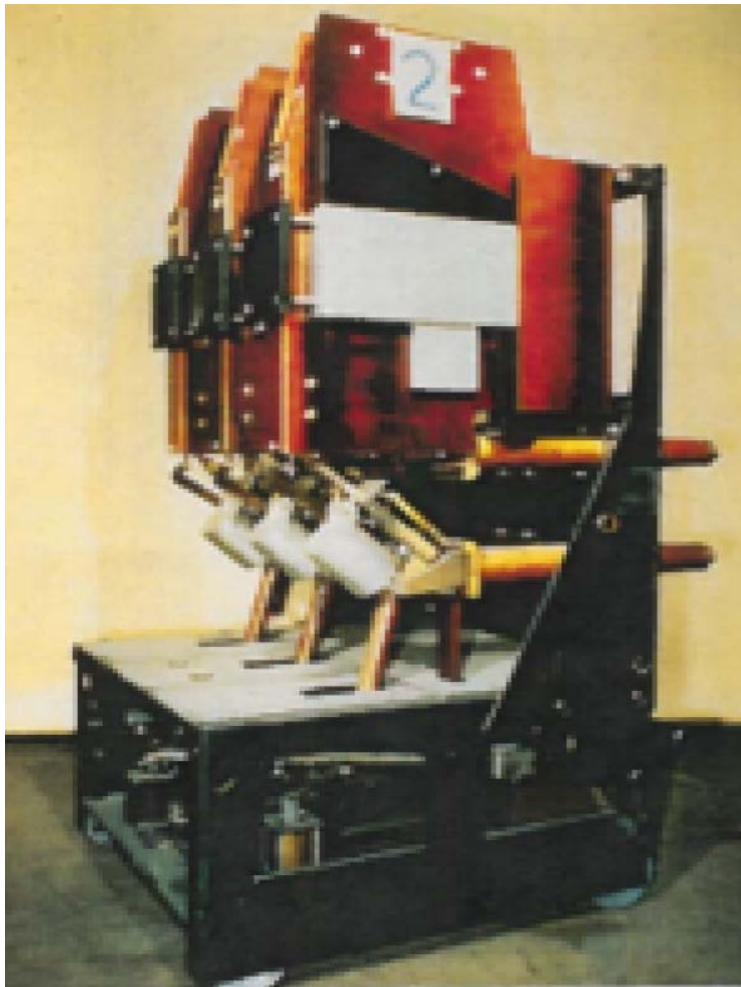
Air Magnetic Vertical Lift - 1939



NASWGR.COM 800-909-3660 GE AM-4.16-250

Air magnetic to Vacuum

1946 - Horizontal Roll In Air Magnetic

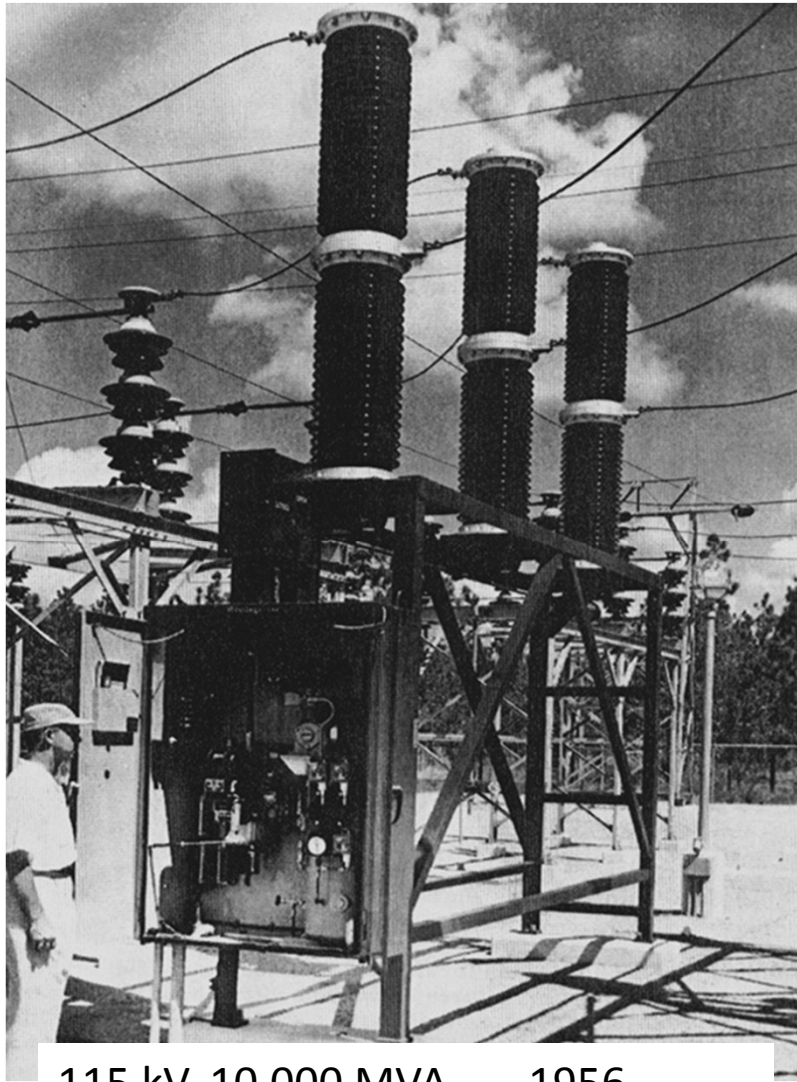


Outdoor Vacuum Circuit Breakers – 1960's
One High – Early 1970's
Two High - 1977

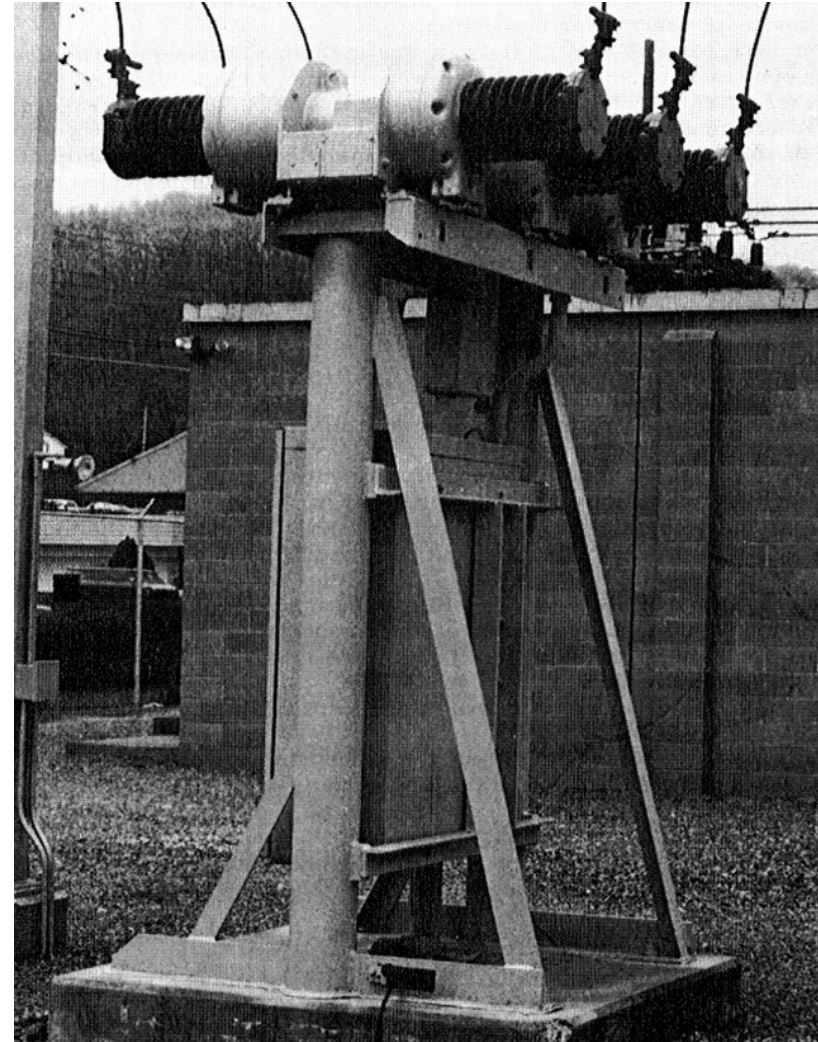
1960's and 1970's



Westinghouse – 1 st SF 6



115 kV, 10,000 MVA - 1956



SF 6 Puffer breaker – 46 kV



**MEPPI Warrendale
HVCB and GIS**



Eaton – LV & MV



**PTTI Cannonsburg, former
McGraw Edison/Cooper**



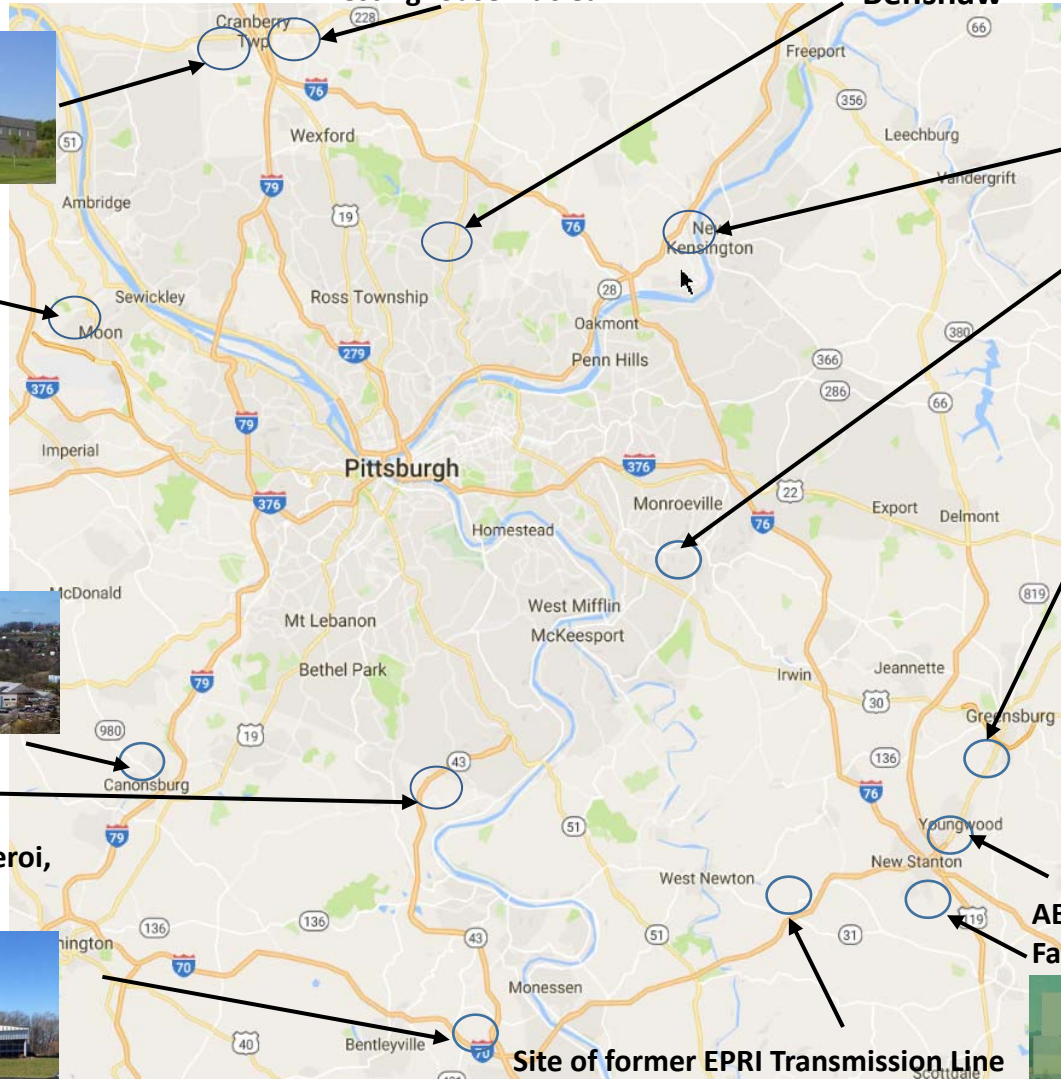
Bettis Lab

**GE HVCB facility in Charleroi,
former Alstom/AEG**



Westinghouse Nuclear

Benshaw



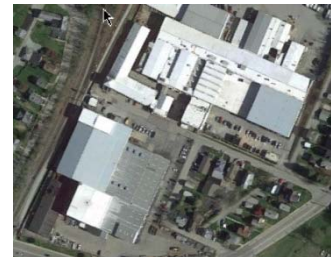
**Siemens
Drives**



**Cleveland/Price HV
Switches in Trafford**



**ABB Service Center in Greensburg;
HICO HVCB Facility in same facility**



**ABB Lightning Arrestor
facility in Youngwood**

**ABB Mt. Pleasant HVCB
Factory**



**Site of former EPRI Transmission Line
Research Center in Waltz Mill**

