North American Gas Compression

145 Years & Counting

GCA 2018 Expo and Conference

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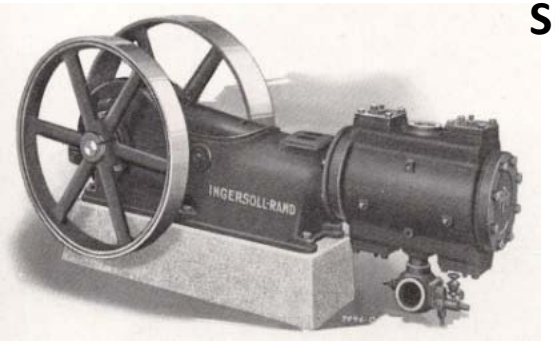
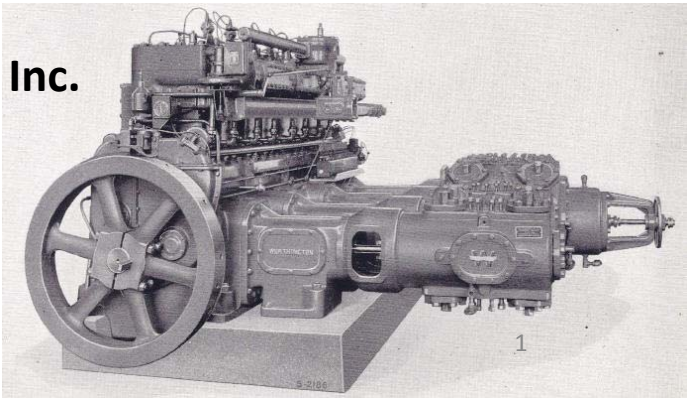




North American Gas Compression
145 Years & Counting

- This "short" presentation is based on a lifetime of experience, many decades worth of collections, more than 6 years of research for Cornerstones of Compression articles (54 to date), and my Cooper-Bessemer and Bessemer Gas Engine Co. books published by Coolspring Power Museum.

- Cannot testify to the accuracy of every detail presented.

- Can attest that it is a good faith effort to collect and preserve many facts and stories from countless sources, to which I am indebted.

- Research is ongoing.

- This presentation only hits the high spots – much more to the story – many more significant manufacturers of all types of compressors, gas engines, gas turbines and related components and equipment.

- Look for ***The Rest of the Story*** in my comprehensive book to be published c. 2019.

Pre-1870 Compressor Evolution

The first compressors evolved to pump air to make fire burn hotter.

- Human lungs – prehistoric man blew on cinders to create a fire.
- Blow pipes and wind were used by Egyptian and Sumerian "metallurgists" about 3000 B.C. to melt gold, copper, tin and lead
- Hand operated bellows made from animal bladders - the first mechanical compressors - soon emerged.
- Foot operated bellows evident c.1500 B.C.
- Water wheel powered bellows followed.

Iron furnaces & mine ventilation increased the need for compressed air.

- 1762 - British civil engineer, John Smeaton, built a water wheel-driven blowing cylinder that began to replace bellows.
- 1776 - John Wilkinson, introduced an efficient air blasting machine that was an early prototype for mechanical compressors.
- 1799 – George Medhurst developed first steam driven air compressor (used in mining)

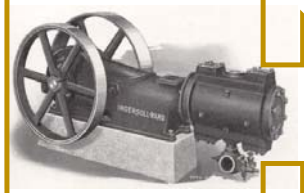
Compressed air began to replace steam for power transmission.

- Could be piped long distances without losing pressure due to condensation.
- 1861 - 87 psi pneumatic drills used in tunnel construction in Switzerland.
- 1869 – George Westinghouse invented air brakes for trains.
- 1870s – Compressed air drills used for underground mining in US.
- Late 1800s – System of pipes in Paris for distribution of compressed air to power machines and generators for lighting.

1870-1900 *Modern* Air Compressors Emerge

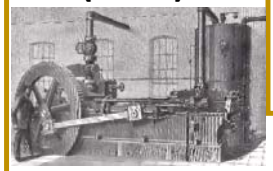
1870 1880 1890 1900

(1872)



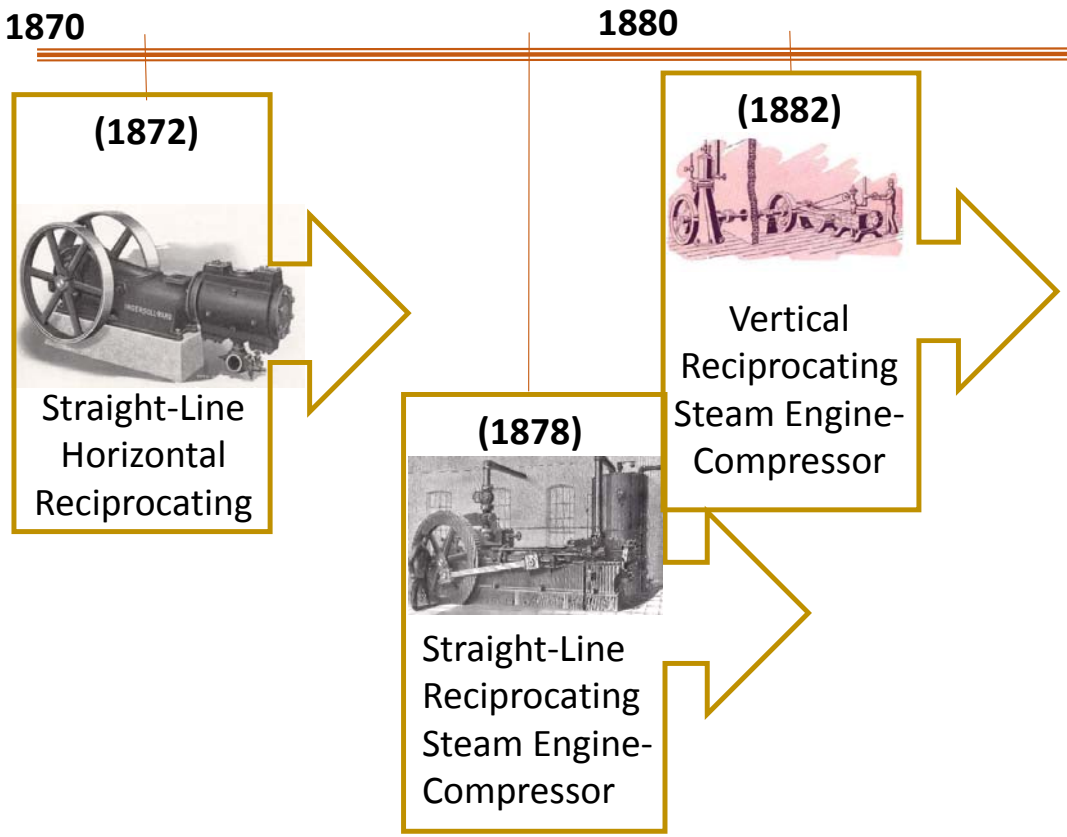
Straight-Line Horizontal Reciprocating

(1878)



Straight-Line Reciprocating Steam Engine-Compressor

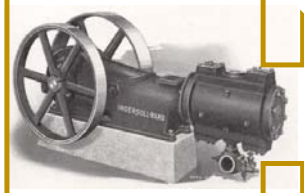
1870-1900 Vertical Refrigeration Compressors



1870-1900 Horizontal Gas Engine-Compressors

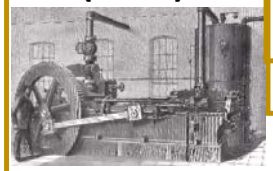
1870 1880 1890 1900

(1872)



Straight-Line Horizontal Reciprocating

(1878)



Straight-Line Reciprocating Steam Engine-Compressor

(1882)

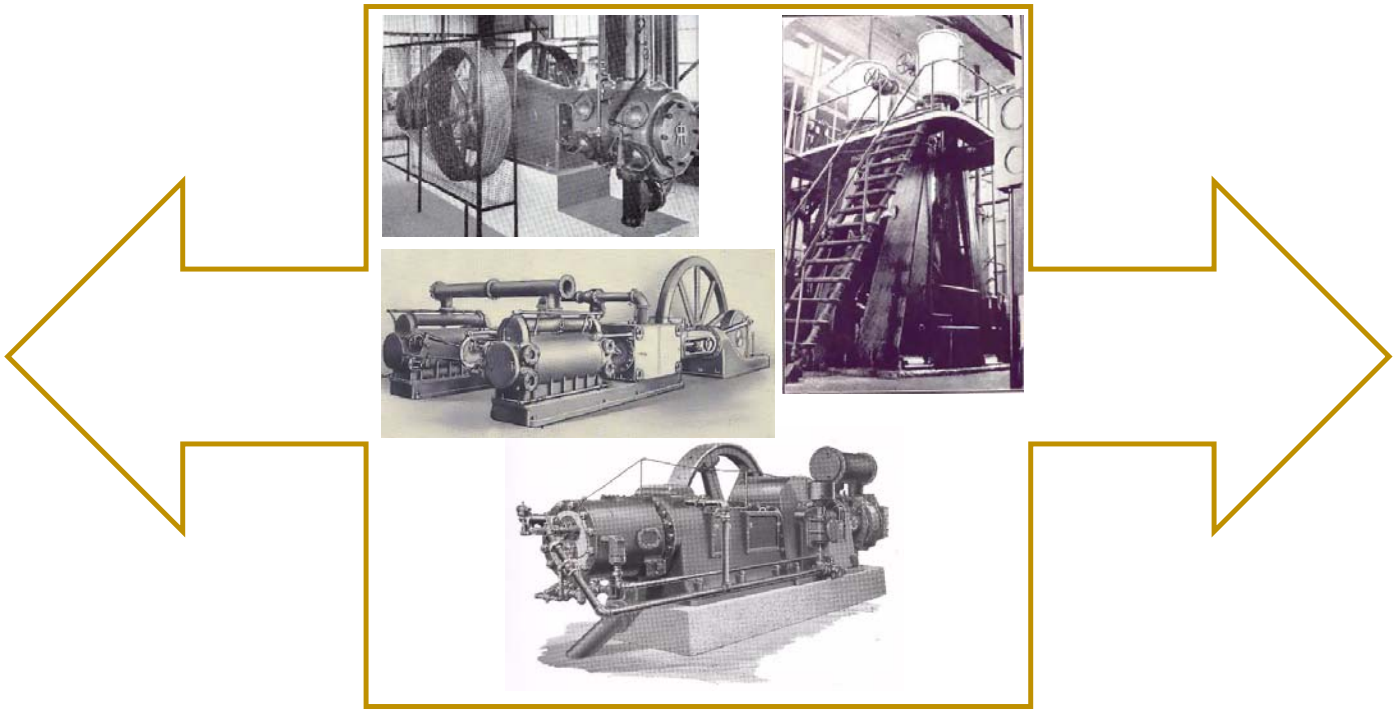
Vertical Reciprocating Steam Engine-Compressor

(1899)

Horizontal Reciprocating Gas Engine-Compressor

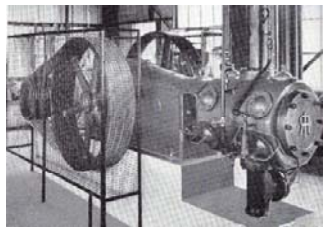
1900-1930 Compressor Advances Accelerate

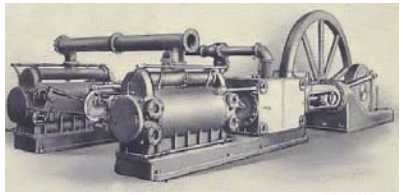
1900 1910 1920 1930

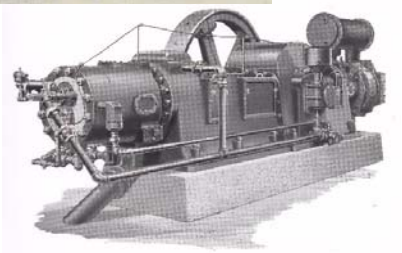


1900-1930 Compressor Advances Accelerate

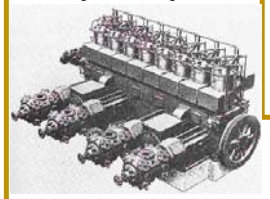
1900 1910 1920 1930







(1927)

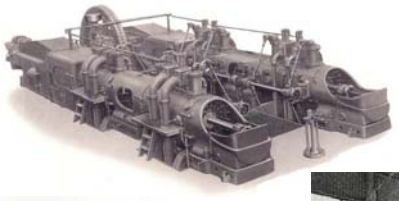


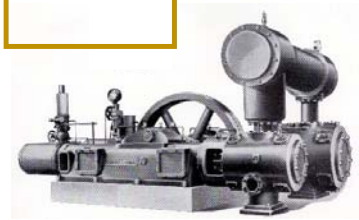
Angle Integral Reciprocating Gas Engine-Compressor

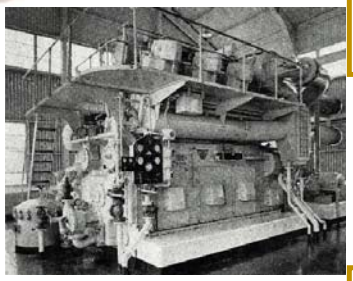
1930-1960 Angle Gas Engine-Compressors

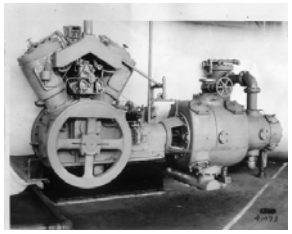
1930 1940 1950 1960

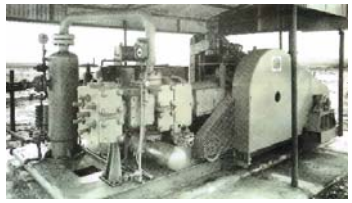
(Last 1952)



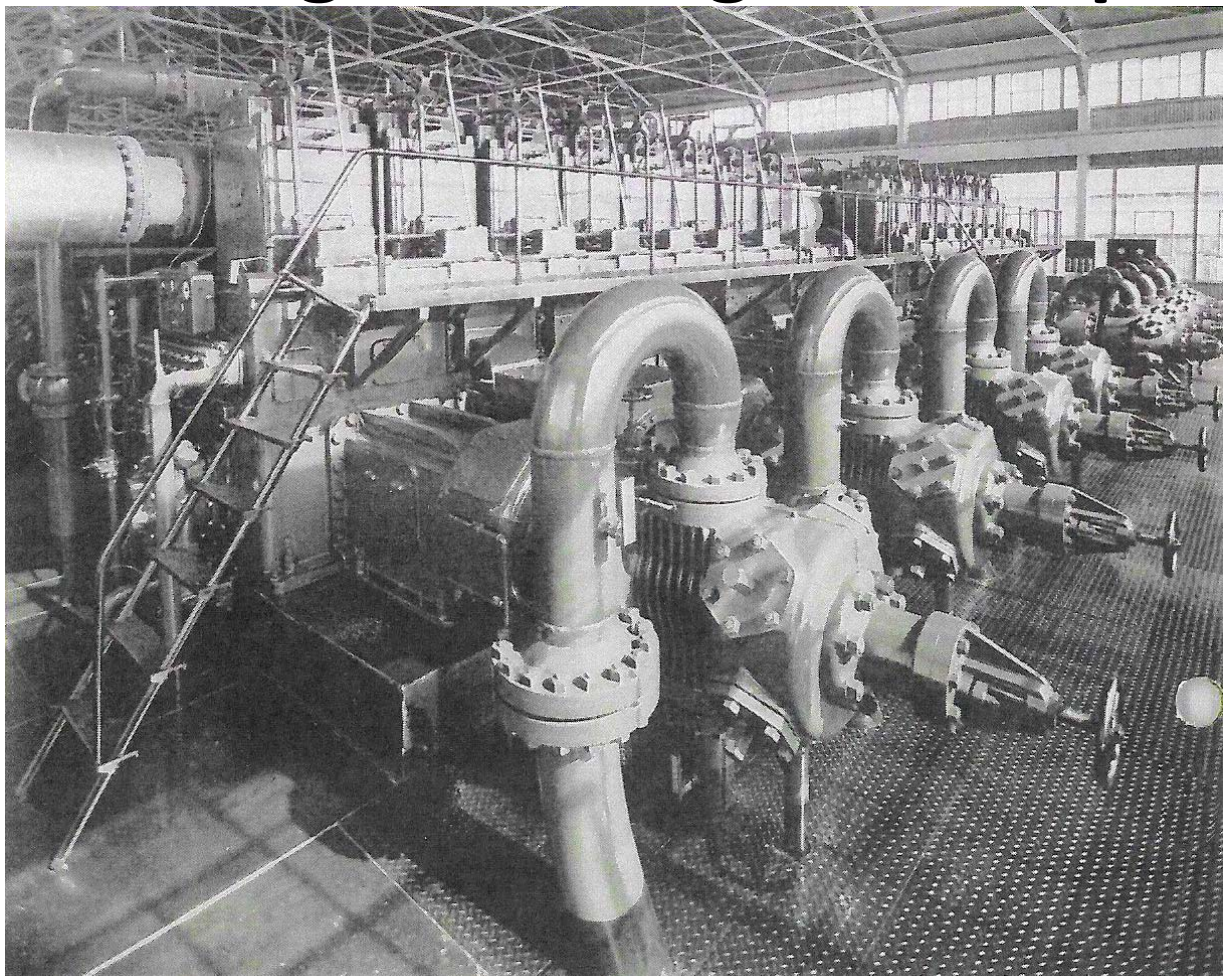






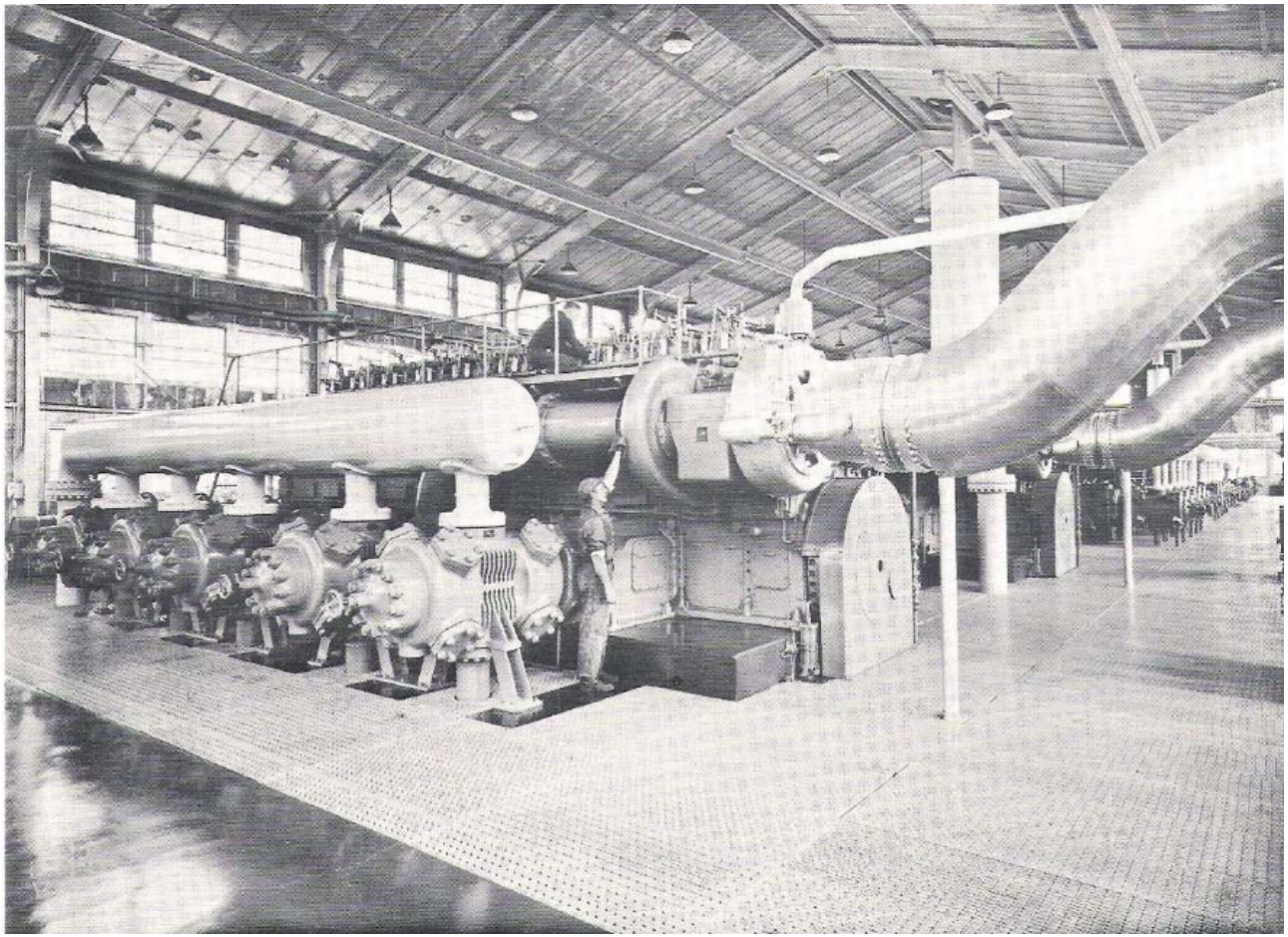


1930-1960 Angle Gas Engine-Compressors



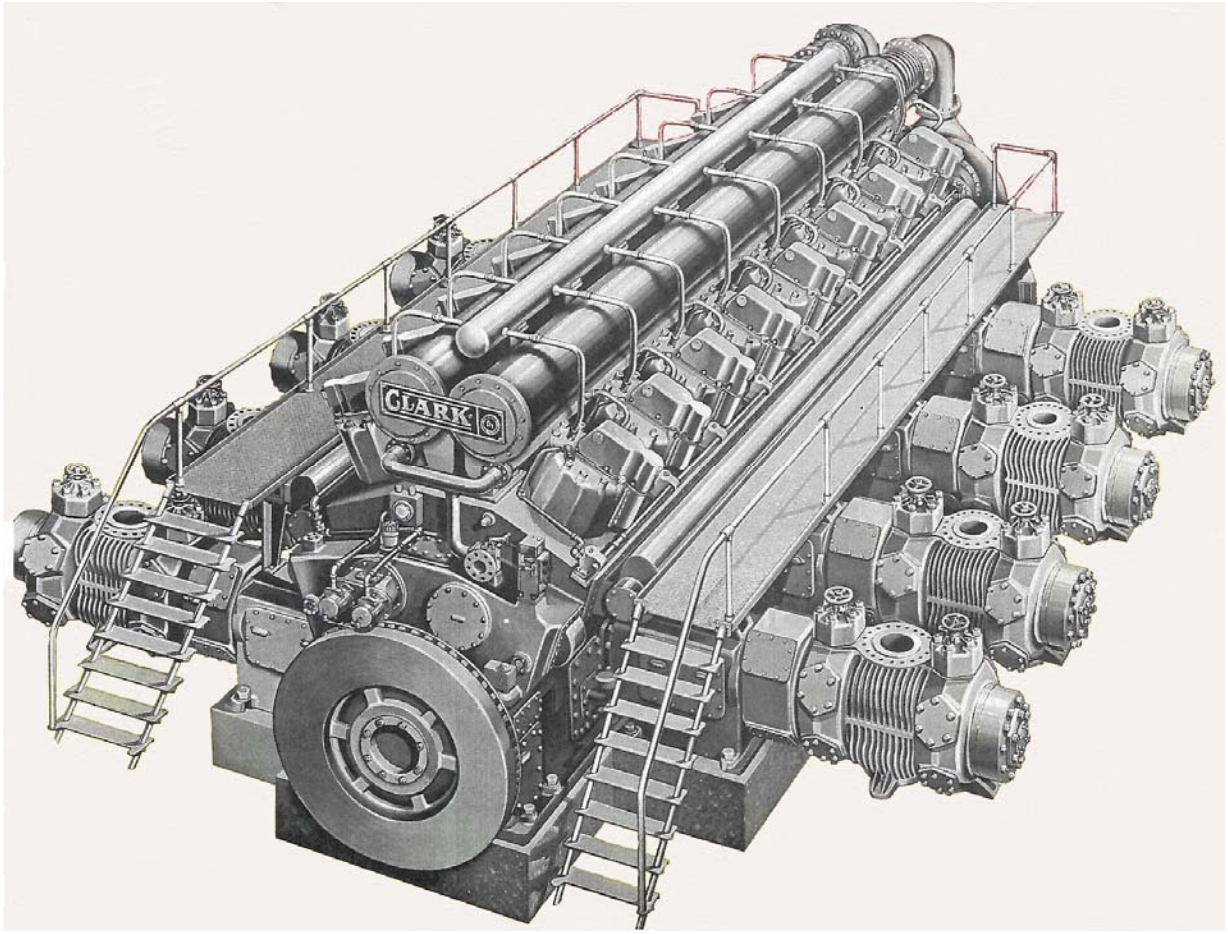
c. 1946 Dresser-Clark "Big Angle" BA-8 – Note there are no pulsation bottles!

1930-1960 Angle Gas Engine-Compressors



c. 1958 (2) Dresser-Clark TLA-10

1930-1960 Angle Gas Engine-Compressors



c. 1960 Dresser-Clark TCV-16

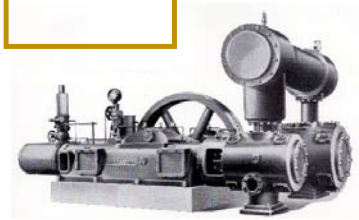
1930-1960 Angle Gas Engine-Compressors

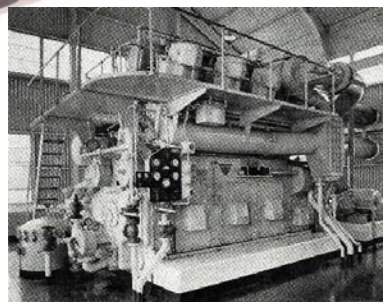
(6) C-B GMV-10 1950; C5 cylinder design originated in 1930s

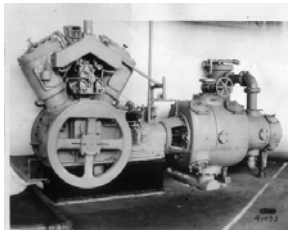
1930-1960 Centrifugal Compressors Appear

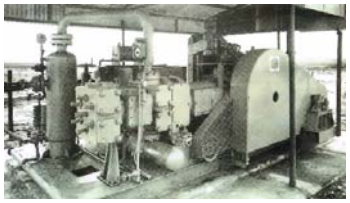
1930 1940 1950 1960

(Last 1952)









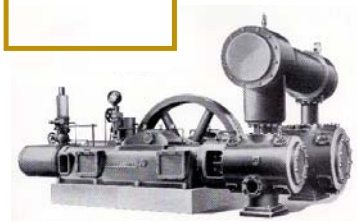
(1954)

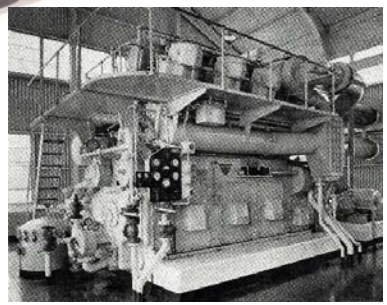
Pipeline Centrifugal Compressor

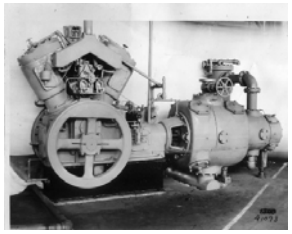
1930-1960 High-Speed Separables Appear

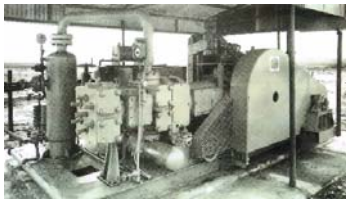
1930 1940 1950 1960

(Last 1952)





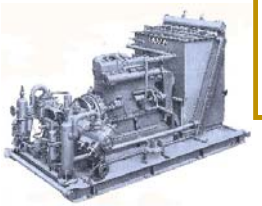




(1954)

Pipeline Centrifugal Compressor

(1957)

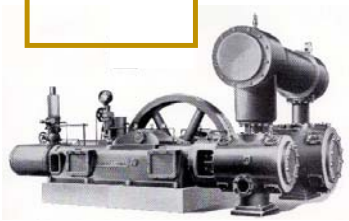


High-Speed Separable Reciprocating Compressor

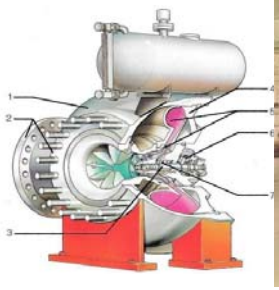
1960-1990 High-Speed Separables Dominate

1960 1970 1980 1990

(Last c1980)



(Last 1971)



1960-1990 High-Speed Separables Dominate

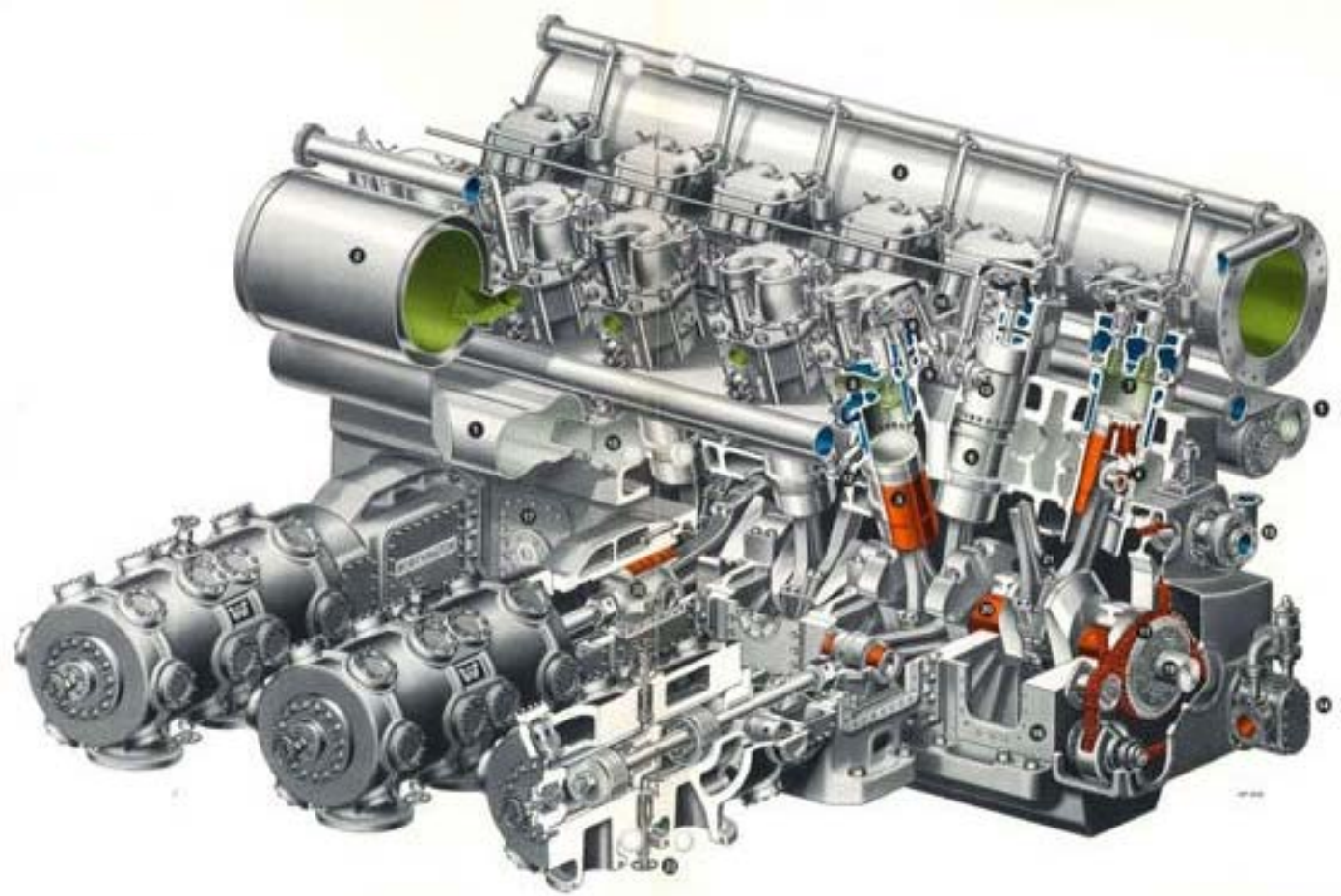
c. 1969 White-Superior 12G825 / W64 Package

1960-1990 Last Gasp for Angle Engine-Compressors

C-B GMVH-12 2700 hp, 330 rpm

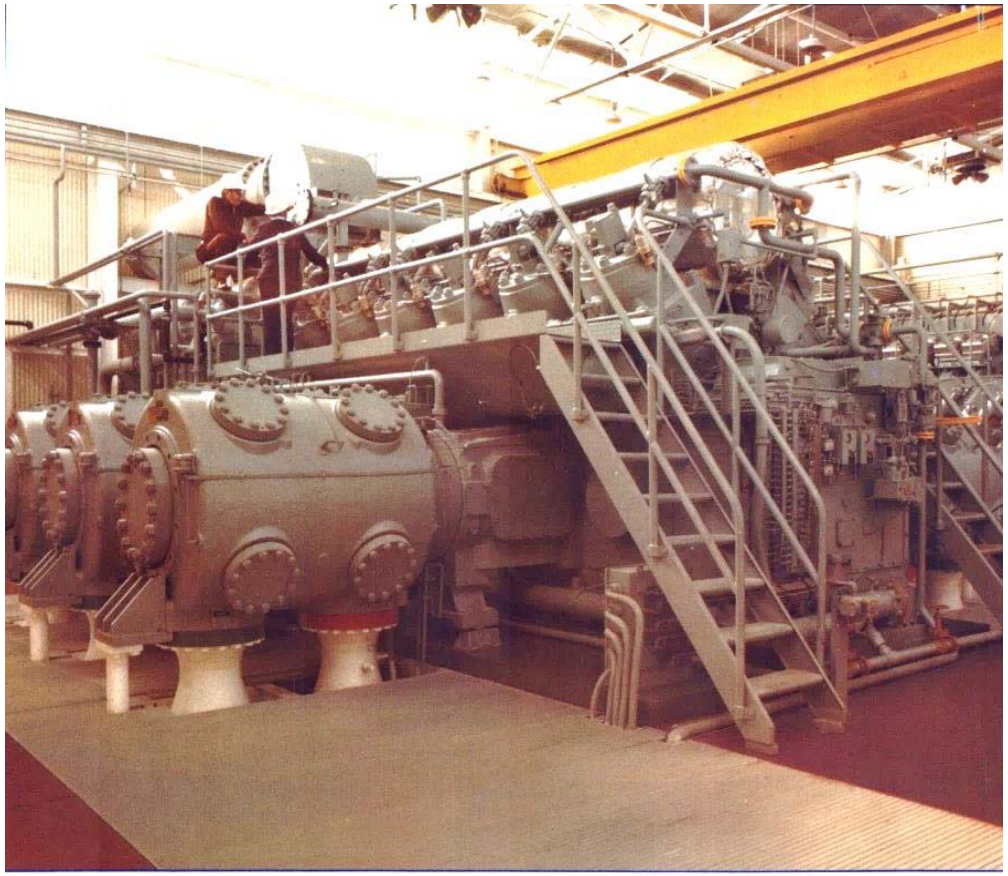
C-B 8W330 4000 hp, 330 rpm

1960-1990 Last Gasp for Angle Engine-Compressors



Worthington MLV-12, 5280 hp, 330 rpm

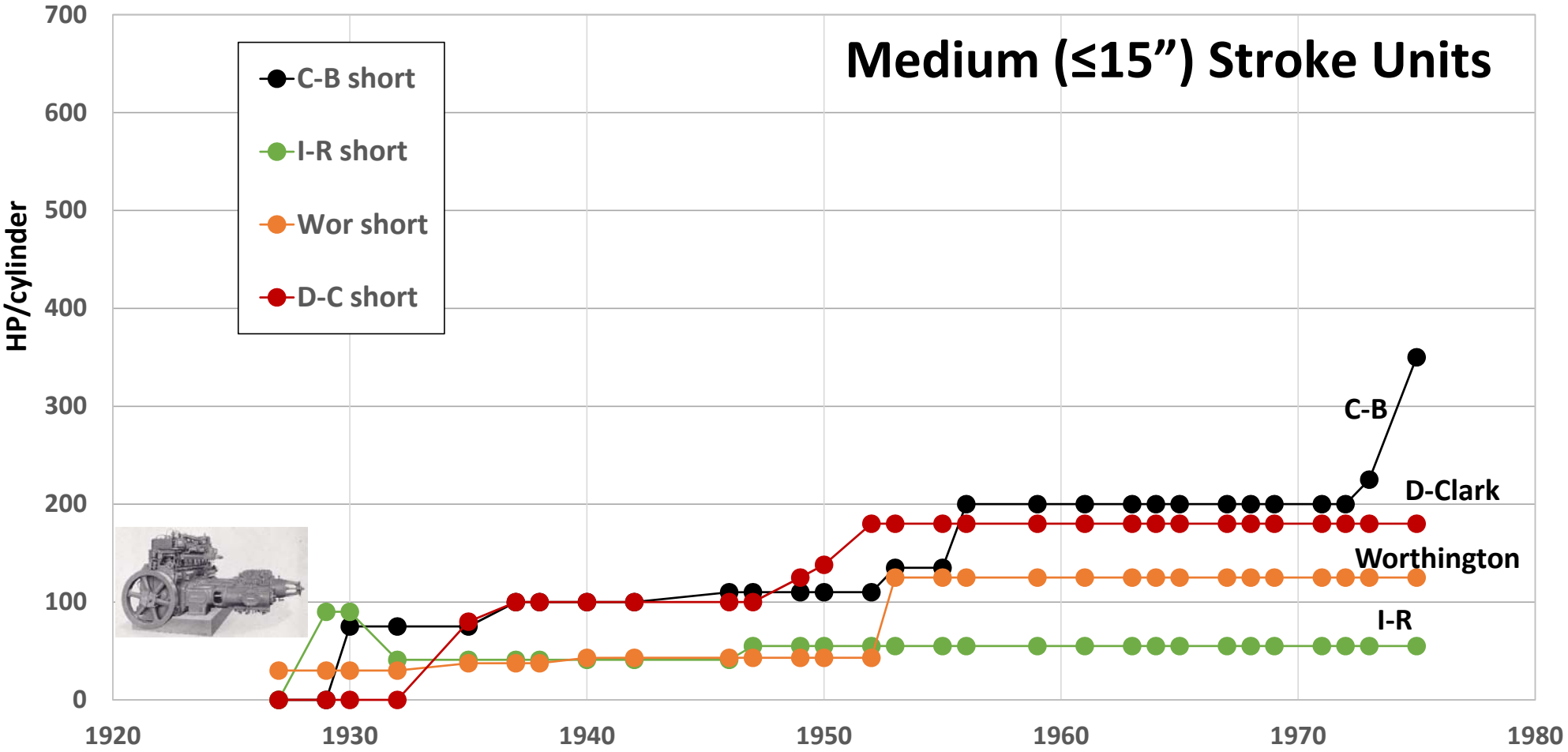
1960-1990 Last Gasp for Angle Engine-Compressors



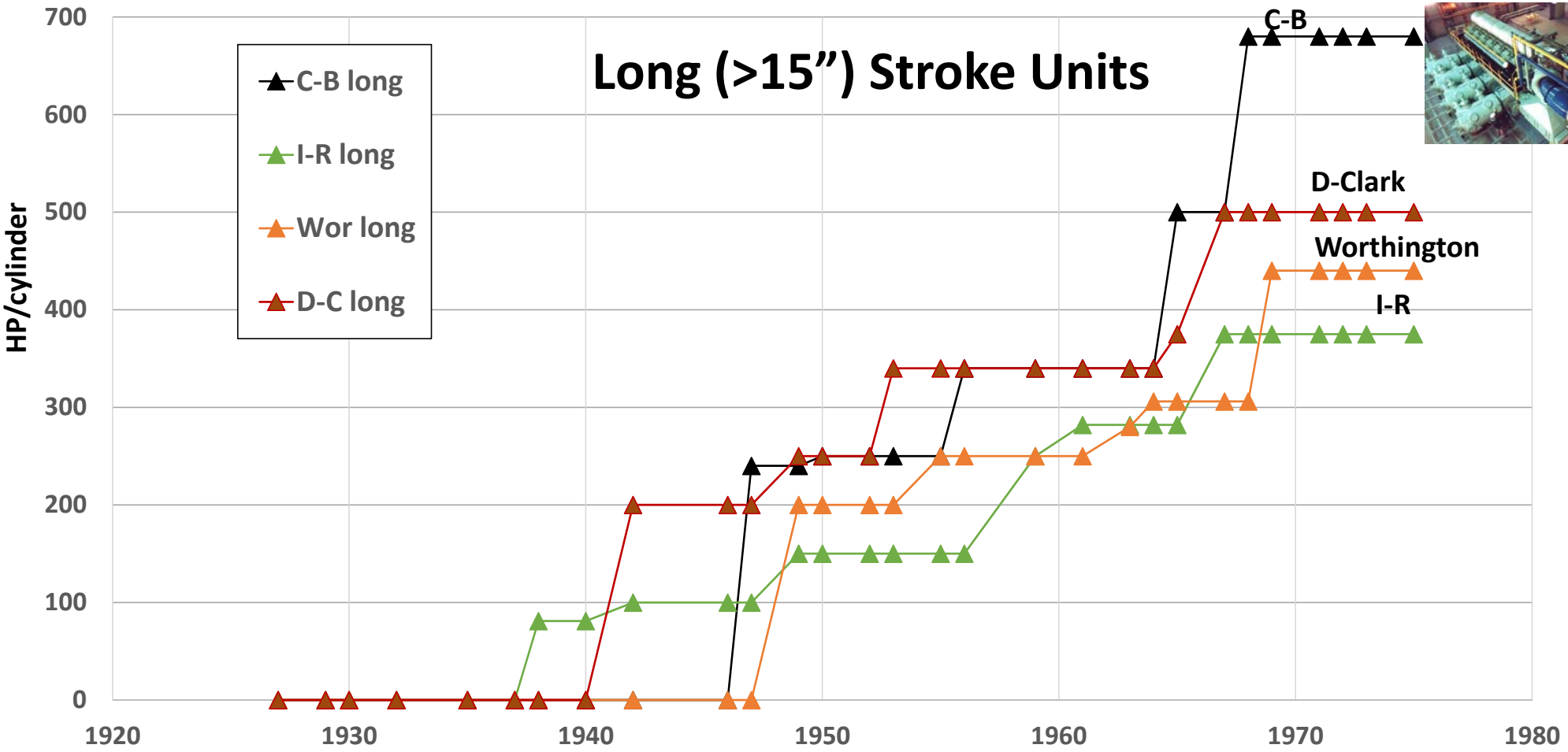
C-B 16Q155HC 5600 hp, 475 rpm

C-B 16Z330 11,000 hp, 330 rpm

1927-1975 Angle Engine-Compressor Development



1927-1975 Angle Engine-Compressor Development



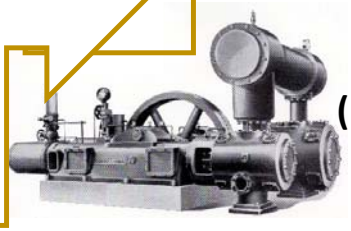
1960-1990 Rotary Screw Gas Compressors

1960 — 1970 — 1980 — 1990

(1971)

Rotary Screw Gas Compressor

(Last c1980)



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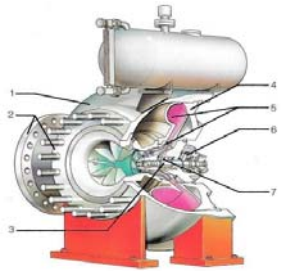

1990-2020 Progress Continues

1990 2000 2010 2020

(Last c1996)

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Thanks for your attention!
Questions?

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