

HIS 2129



Technology, Society and
Environment since 1800
(Winter 2014)



From Mass Consumption to Mass Production

- By the end of the nineteenth century, many aspects of daily life depended on products processed far or even very far from the site of consumption
- Farming was being largely mechanized, with horses on treadmills (*cf.* Class 3) driving the new machinery
- By 1920, internal combustion engines would start replacing steam engines, which had replaced horses, as sources of motive power
- A few crops defied mechanization, such as cotton and tobacco, whose cultivation remained labour intensive
- For other crops, however, the reduction in labour may have been as great as that of wheat, where the time required to produce a bushel went from 61 to 3 hours



Topics: Towards mass production

- The final settlement of the North American plains (Canada)
- The mechanization of farming
- The growth of North American cities
- Servicing cities: aqueducts, sewers, electricity
- Before Taylor: old factories, new steel
- Frederick W. Taylor's scientific management
- Frank and Lillian Gilbreth
- Scientific management and labour

Attracting Immigrants to Canada (c. 1890)

Canada's settlement of the Prairies repeated a story played out two decades earlier in the United States, but it did not delay the growth of Eastern cities.

FREE FARMS FOR THE MILLION

DOMINION OF CANADA

RED-RIVER VALLEY
T-GREAT FERTILE PLAINS and British Columbia
VAST COAL FIELDS
Immensely rich in iron
Railway lines from coast to coast

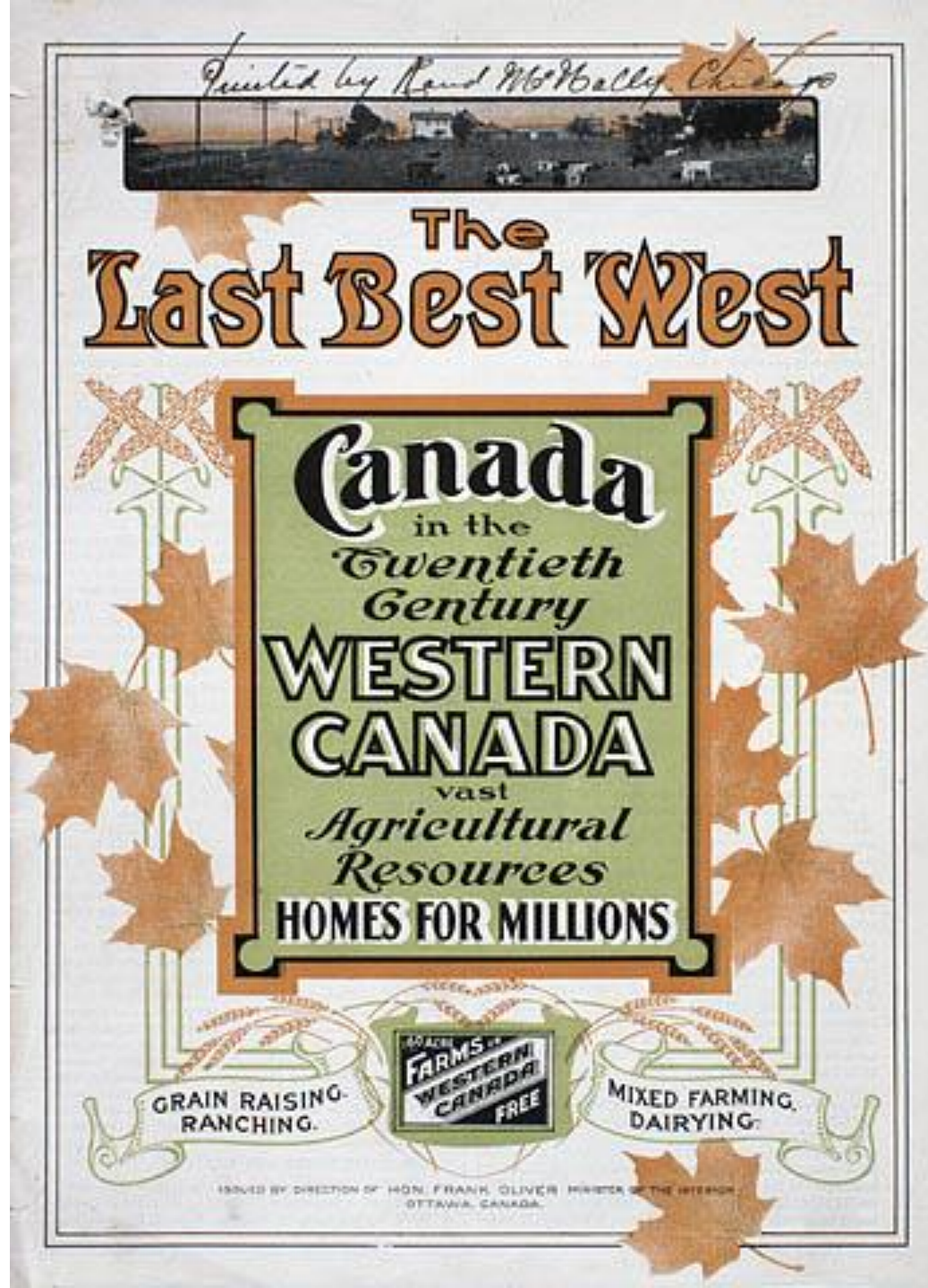
See Reports of
BRITISH TENANTS' COMMISSION
WELLINGTON, CANADA, 1883
CLIMATE THE HEALTHIEST IN THE WORLD.
CANADA'S SOIL
5 Experimental Farms

FREE FARMS OF 160 ACRES
Given to every New Adult of 21 years and over, in the great Fertile Belt of
MANITOBA, CANADIAN NORTH-WEST AND BRITISH COLUMBIA
Easy soil, well watered, wooded, and situated in the world's most healthy climate. Wheat averages 30 bushels to the acre, with 500 Spring
VAST COAL FIELDS AT CONVENIENT DISTANCES.
GRANTS FROM 100 TO 200 ACRES ARE OFFERED IN OTHER PARTS OF CANADA.
Apply and for information, in application and when given, the full particulars to some person for the District, and the address
H. H. HIGH COMMISSIONER FOR CANADA,
11 MARK LANE, LONDON, E.C. 3, ENGLAND.
DEPARTMENT OF THE INTERIOR,
OTTAWA, CANADA.

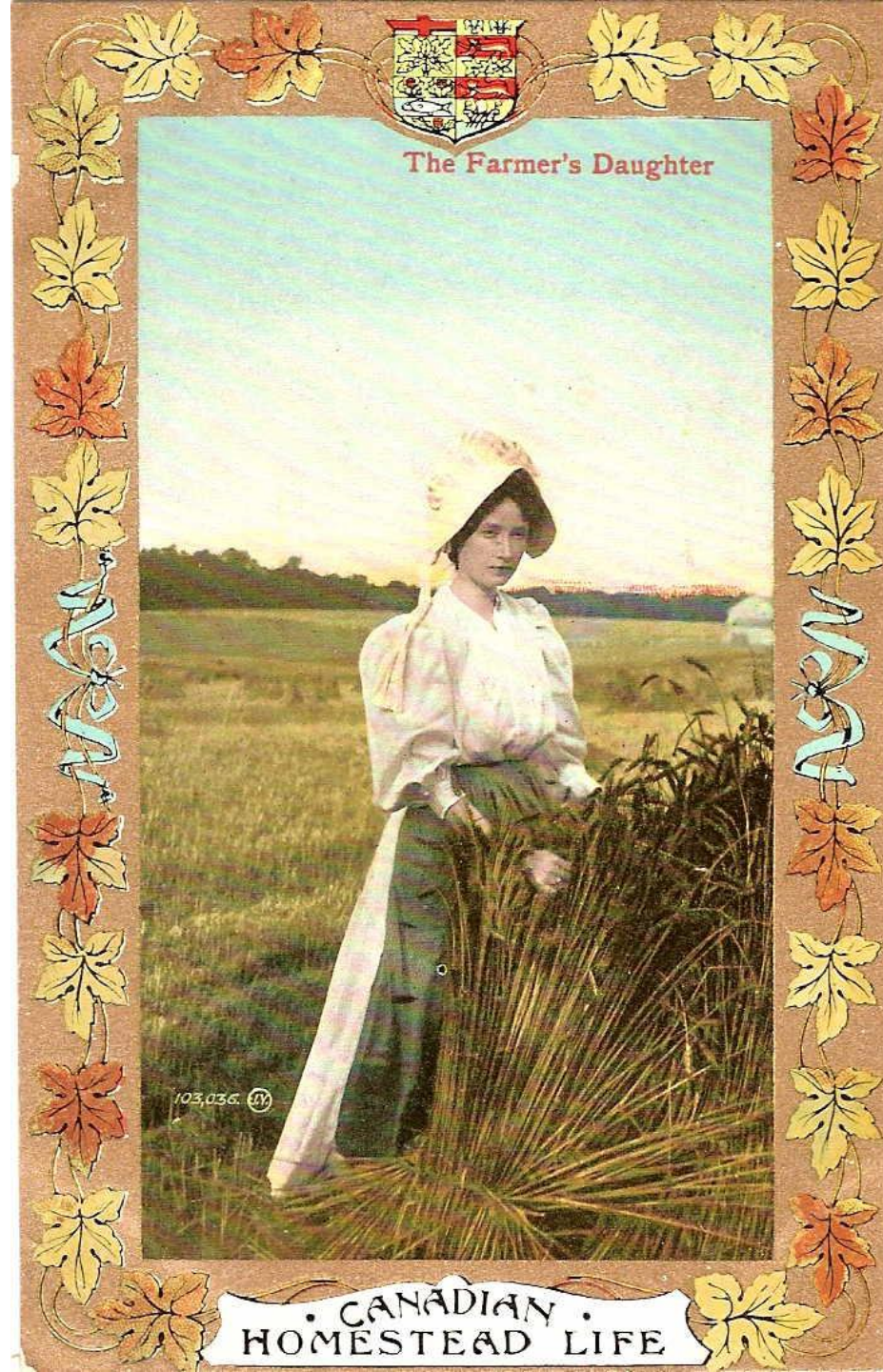
DOMINION LINE
Royal Mail Steamships

Between LIVERPOOL, BRISTOL and MONTREAL
THRU OTTAWA,
HALIFAX and PORTLAND, MAINE, in Winter.
FOR ALL INFORMATION, APPLY TO
FLINN, MAIN & MONTGOMERY,
25 MARK ST., LIVERPOOL, ENGLAND.
Managing Director

Attracting
Immigrants
to the
Canadian
Prairies
(1907)



Attracting
Immigrants to
the Canadian
Prairies
(postcard, c. 1908)



Harvesting with horses in Brandon (MB), in 1892



Sandison Farm, J. A. Brock, Archives Canada

Harvesting on the Sandison Farm at Brandon, Man.

Copyrighted by J. A. Brock & Co. Photo.

Steam-powered threshing unit in 1902 (Strasbourg, SK)



Machine
purchased
by Theodor
Moeller and
his three
sons

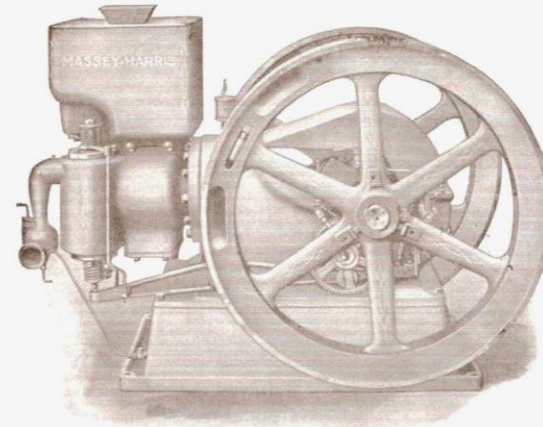
Selling horse power, c. 1914

The Massey-Harris Co. catalog (1)

In 1891, two Canadian farm equipment companies founded respectively by Daniel Massey in 1847 and Alanson Harris in 1857 merged. They had long sold horse-drawn reapers and mowers (as below), but they acquired in 1910 the Deyo-Macey company that produced gasoline engines (right).



Massey-Harris Gasoline Engines

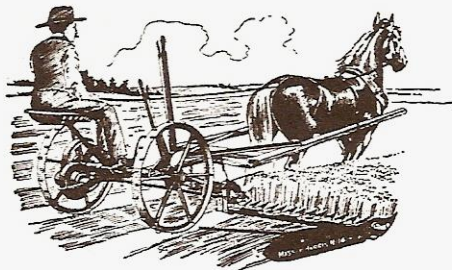


Stationary Engine, Hopper Jacket, 1½, 3, 4½, 6, 8, 12, 15 or 20 Horse Power.
Closed Cooling Jacket can be furnished if wanted.

The high efficiency of Massey-Harris Engines, coupled with their economy of operation and durability, combine to make them without exception, the most reliable and satisfactory on the market to-day.

They are built in our own Engine Factory by expert machinists who have at their command the best possible facilities for making and assembling the parts, and with competent supervision and rigid inspection constantly exercised, the purchaser is assured of getting an Engine worthy in every respect to bear the name "Massey-Harris."

Massey-Harris Nos. 14 and 15 Mowers



No. 14 Mower.
3½ and 4 ft. Cut.

There is ample traction for the heaviest cutting. The Drive Wheels are high, broad-faced and provided with efficient Traction Lugs. The under-draft feature overcomes any tendency of the Wheels to rise from the ground in heavy cutting. On the contrary, the heavier the pull, the harder do the Wheels bear on the ground.

Steam tractors had been tried several times since the early 19th century, but they were heavy and unwieldy. The gasoline engine promised to change that, in time...

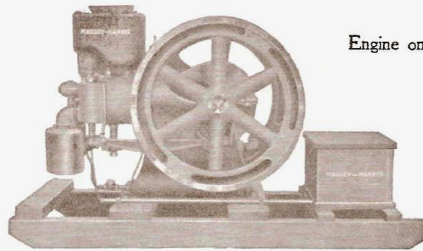
Selling horse power, c. 1914

The Massey-Harris Co. catalog (2)

These gasoline engines were intended to be stationary sources of power driving farm machinery. It was only after the start of World War I, as demand for wheat escalated, that the company started selling gas-fuelled tractors, though its models found it hard to compete with the mass produced Fordson Model F from the Ford Motor Company (which burned gasoline and kerosene)

Various designs for the use of gasoline engines (c. 1914)

Massey-Harris Gasoline Engines



Engine on Skids.

The Cylinder, Cylinder Head and Water Jacket are cast in one piece—no gaskets or packed joints about the Cylinder or Water Jacket to leak.

The Cylinder and Piston are machined with the utmost care on machines specially built for the purpose, ensuring absolutely perfect fit, with the carefully fitted Rings giving good compression.

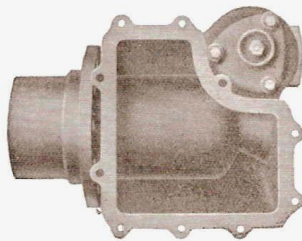
The horizontal type of Engine ensures perfect lubrication and long wear of the Piston and Cylinder.

Gasoline Storage is in the hollow, cast-iron Base, which is a part of the Main Frame and is absolutely tight—no danger from leakage.

Large water space around Cylinder and Valves—prevents overheating.

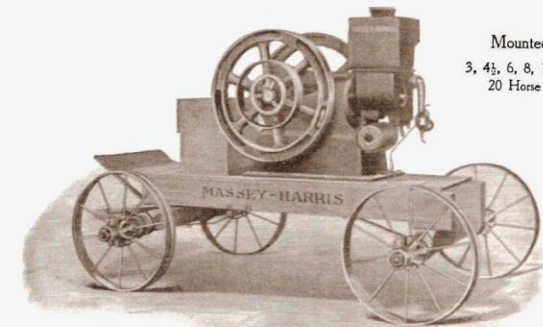
Forged Steel Crank Shaft.

Extra Large Main Bearings set on an angle of 30°.



Top View of Cylinder and Water Jacket.

Massey-Harris Gasoline Engines

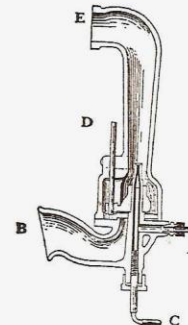


Mounted Rig.
3, 4½, 6, 8, 12, 15 and
20 Horse Power.

Air Throttle makes the Engine exceptionally easy to start, even in cold weather.

Section of Carburetor.

A—Gasoline Inlet. B—Air Inlet. C—Needle Valve.
D—Air Throttle. E—Passage to Combustion Chamber.



In our Engine Catalogue, which may be had from any of our Agents, we also show the following:—

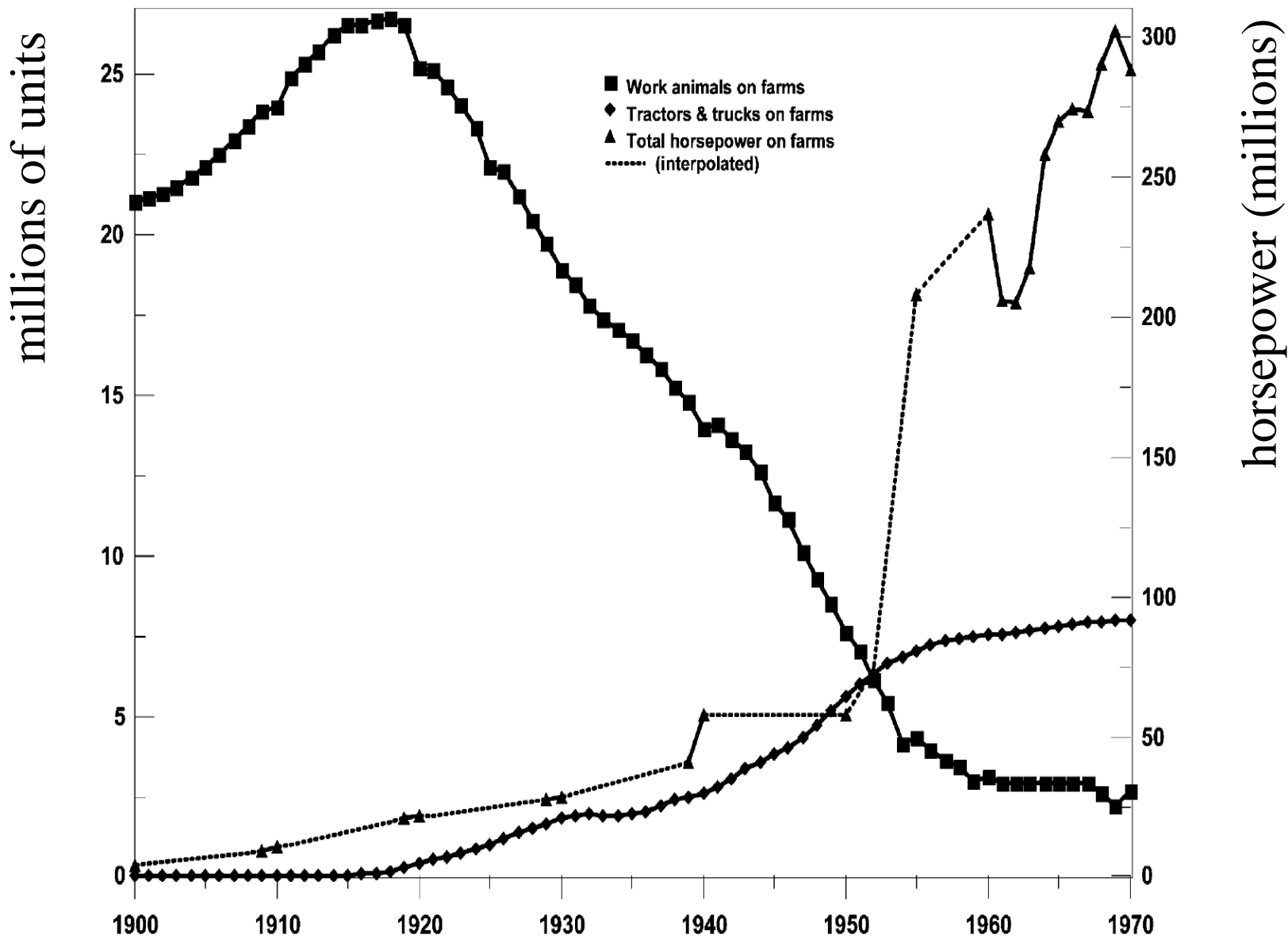
Wood Sawing Outfits, Contractor's Hoists, Contractor's Diaphragm Pumps, Governor Pulleys for operating Cream Separators, Pump Jacks, Etc.

Tractor pulling a harvester-thresher,
both by McCormick-Deering, in
Mazenod (SK), in 1928



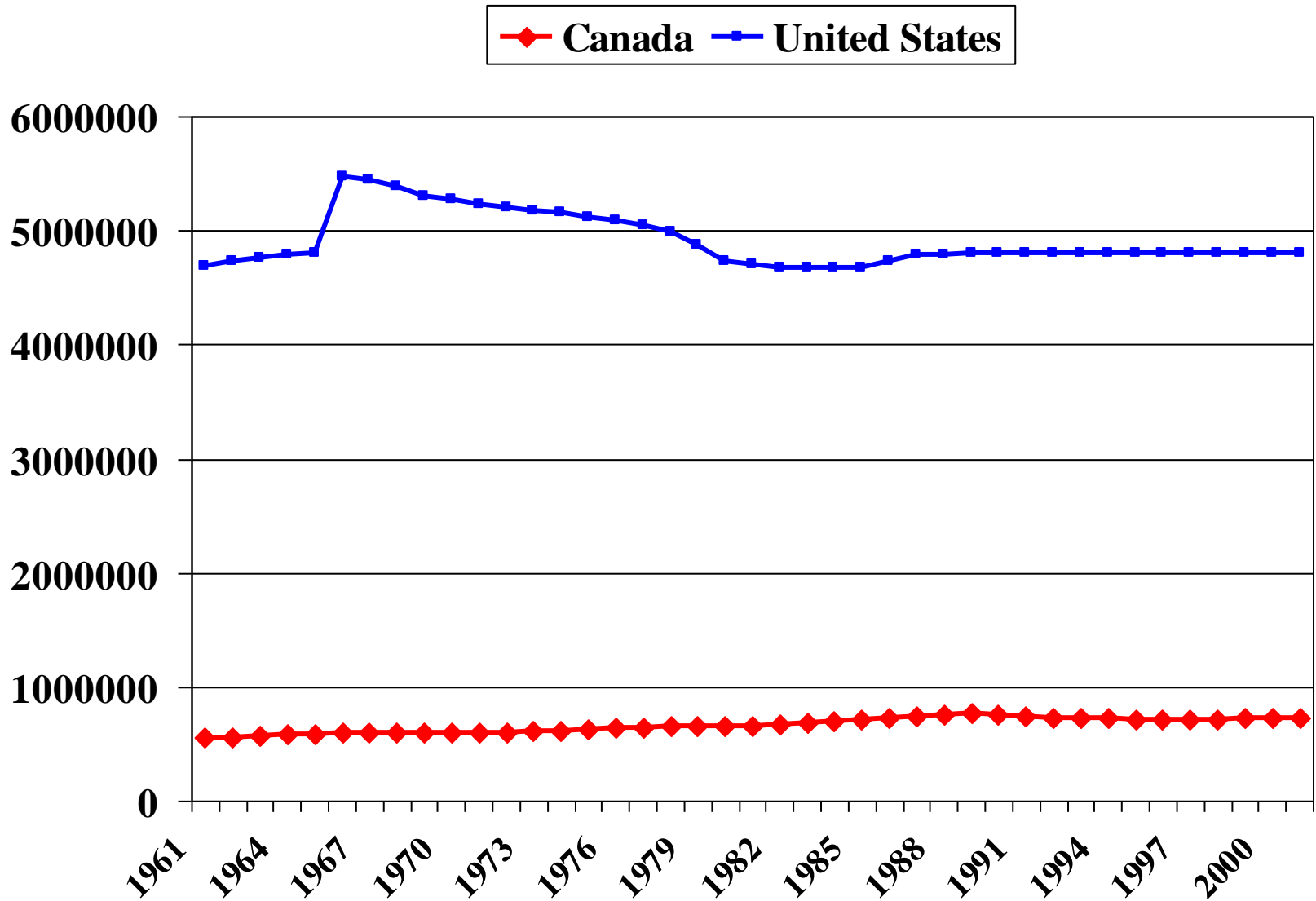
F. Faundrick
at the wheel

The Mechanization of Farms (U.S.)



Tractors (1961-2001)

(Canada and the United States, total number)





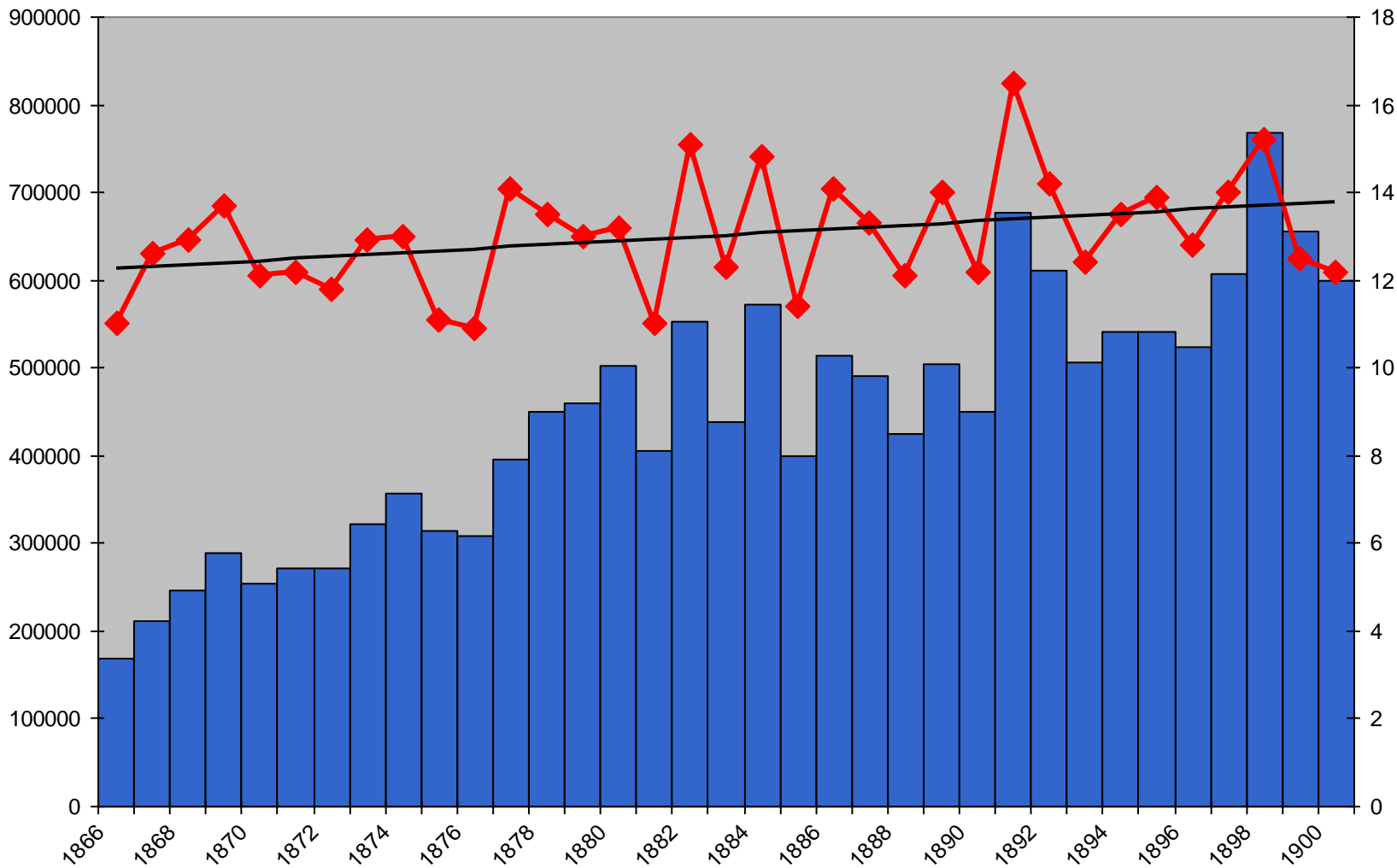
To recapitulate (1)

- When did the number of work animals on farm actually peak?
- Did the Massey-Harris company sell gasoline-fuelled tractors before World War I?
- Name three (3) successive power sources in the history of Canadian farm machinery.
- The cultivation of what crops proved essentially impossible to mechanize?
- Was the 19th-century improvement in agricultural productivity one of increased crop yields or one that reduced the needed labour?

Wheat Production in the U.S.

(all kinds, thousand of bushels, bushels/acre, 1866-1900)

■ Production ◆ Yield — Linear (Yield)



“The Way We Harvest Wheat” (Canadian Post Card Co., 1910)

Ottawa (KS), USA, William H. Martin (1865-1940)



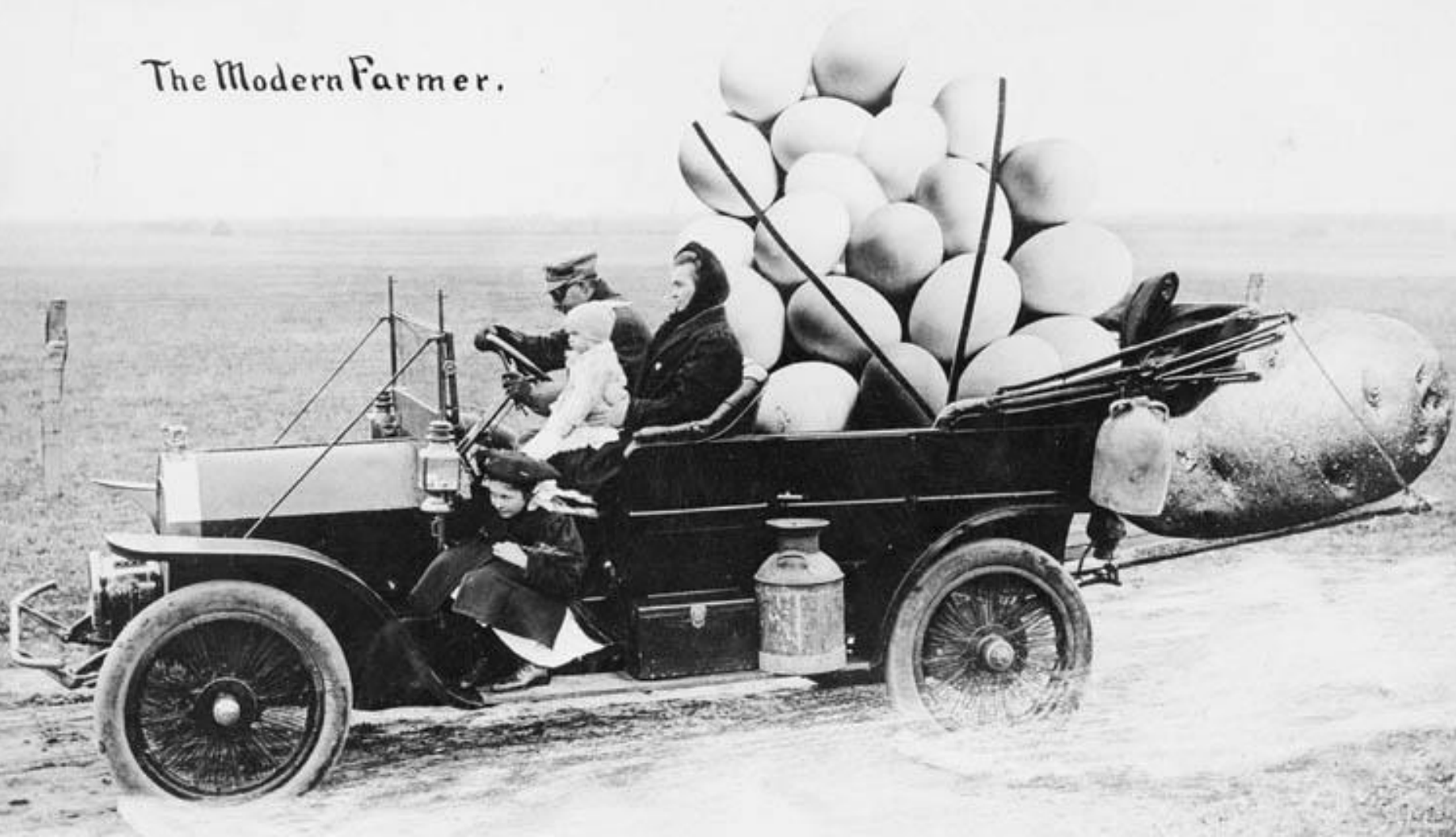
The way we Harvest Wheat.

“Taking our Geese to Market” (Canadian Post Card Co., 1910)

Ottawa (KS), USA, William H. Martin (1865-1940)



Canadian Post Card Company: “The Modern Farmer” (1910)





Consumption as Enmeshment

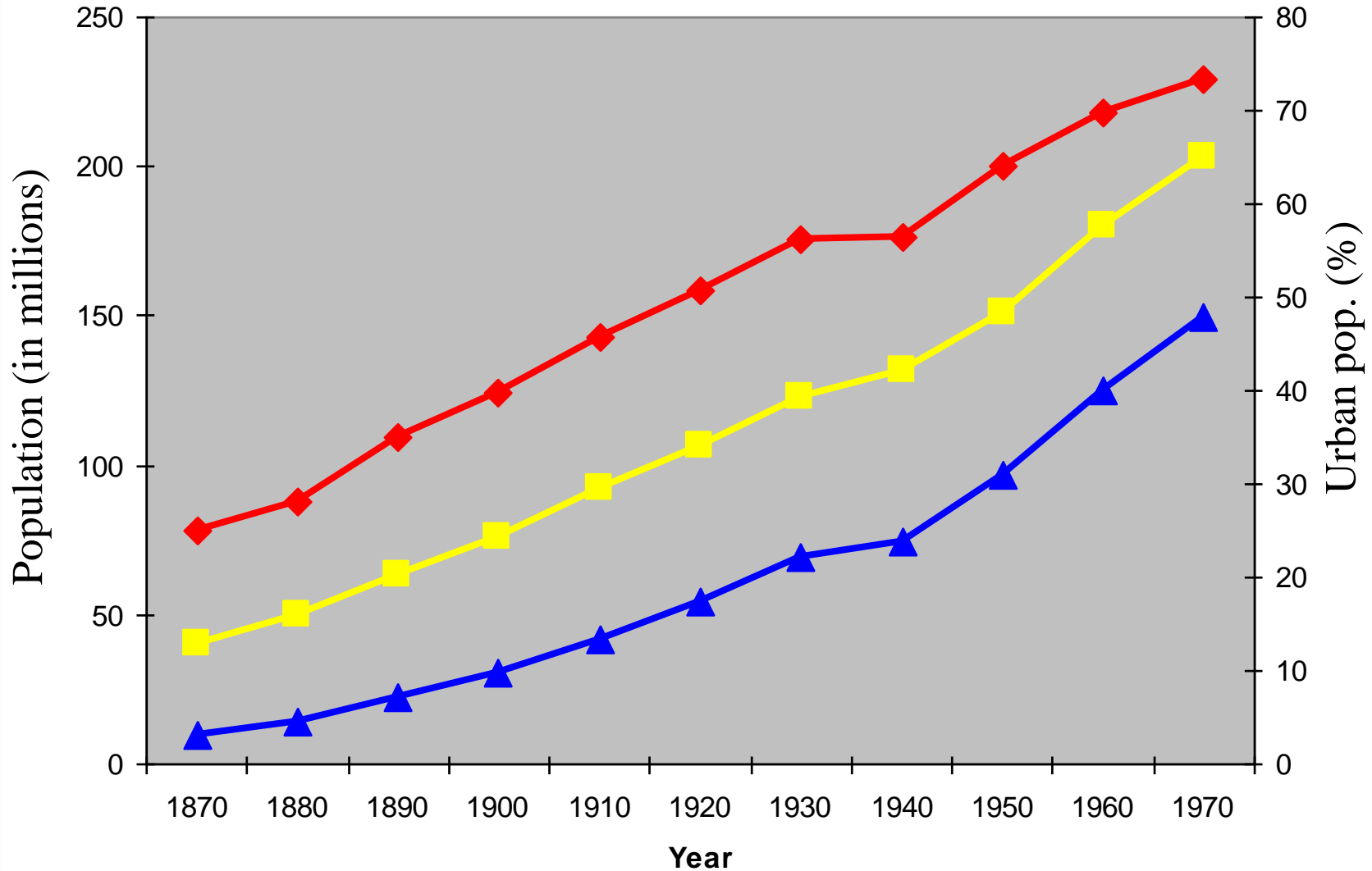
- In North America, production rose as a result both of increasing total acreage as the Plains were wholly settled (the “Last Best West”) and of increasing yields per acre
- Farms grew larger, as fewer people were needed to take care of a given surface area
- As the rural population decreased and moved into towns, city-dwellers formed an increasingly influential class of consumers, dependent on food and electric power originating tens and hundreds of kilometres away
- For large cities like New York, even drinking water had to be supplied from afar



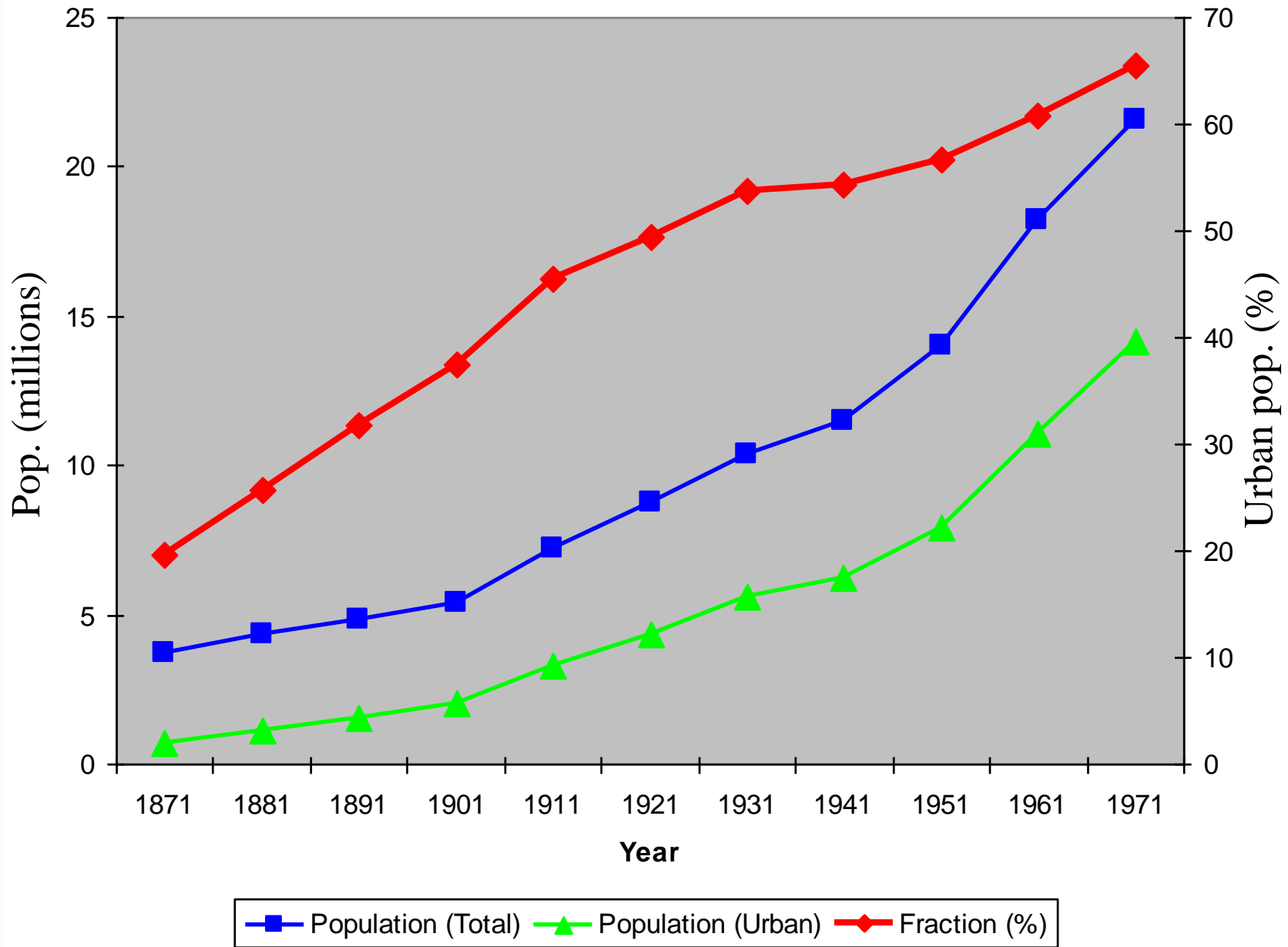
Urbanization in the United States and Canada

- In 1870, 54% of U.S. inhabitants were farmers or farm labourers; by 1910, it was only one in three
- In 1870, 25% of the U.S. population was urban (lived in settled areas with more than 2,500 people); by 1910, it was 46%
- In 1871, 20% of Canada's population was urban (lived in settled areas with more than 1,000 people); by 1911, it was 45%

Urbanization in the United States



Urbanization in Canada





Living in Cities... (1)

- In other parts of the world, cities can be quite old, but most North American cities are recent and started out as small outposts; Los Angeles was founded in 1781, Chicago was incorporated in 1833, Ottawa in 1854, Vancouver in 1886...
- Cities had long been cramped, dirty, and unhealthy, the breeding grounds of epidemics
- However, by the end of the 19th century, the building of sewers and aqueducts, the development of public transit, and the advent of electricity helped to free cities from their narrow confines and to make them more livable

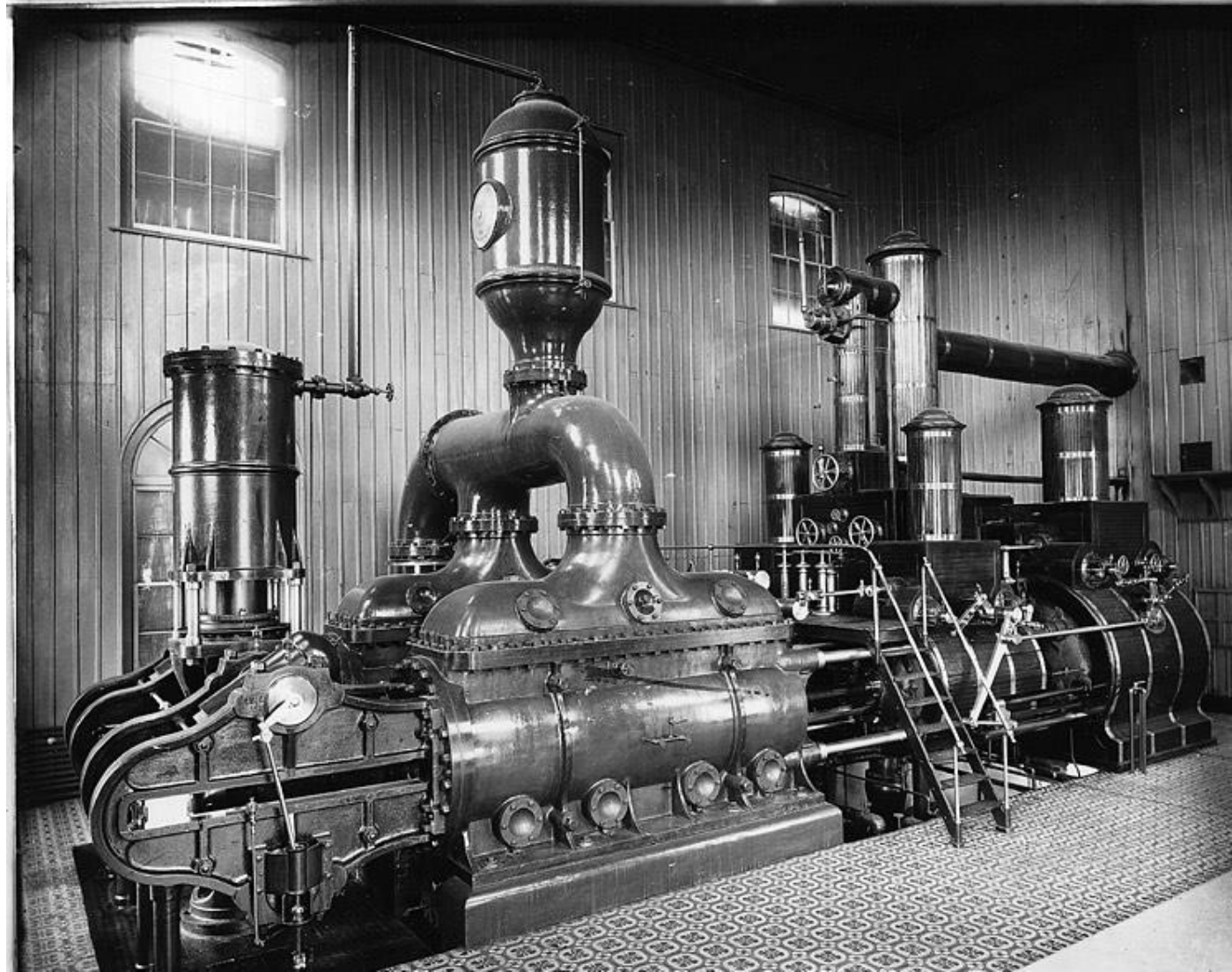
Aqueducts: Ottawa Pumping Station (c. 1880)

Notman and Sandham,
McCord Museum

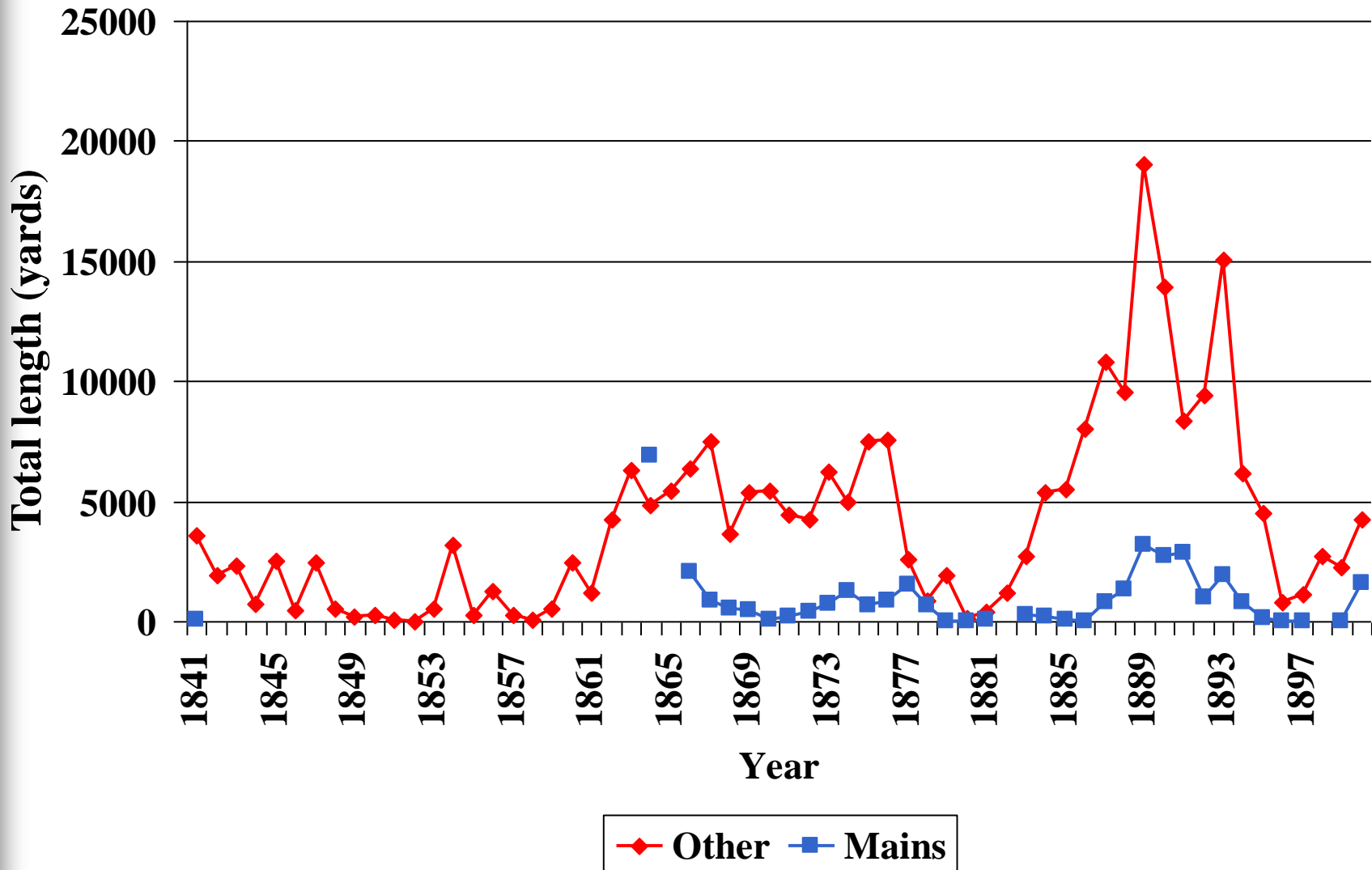


Aqueducts: Worthington Motor, Montreal Pumping Station (1893)

William Notman and Son,
McCord Museum



Sewers: Yearly Construction in 19th-c. Montreal



Laying a sewer in Ottawa (1903)

James ou May Ballantyne, Archives Canada



Water tower in Carman (MB) around 1908

Even though the city managers in charge of the water distribution networks were not always engineers, they often operated aqueduct systems designed and built by professional engineers.



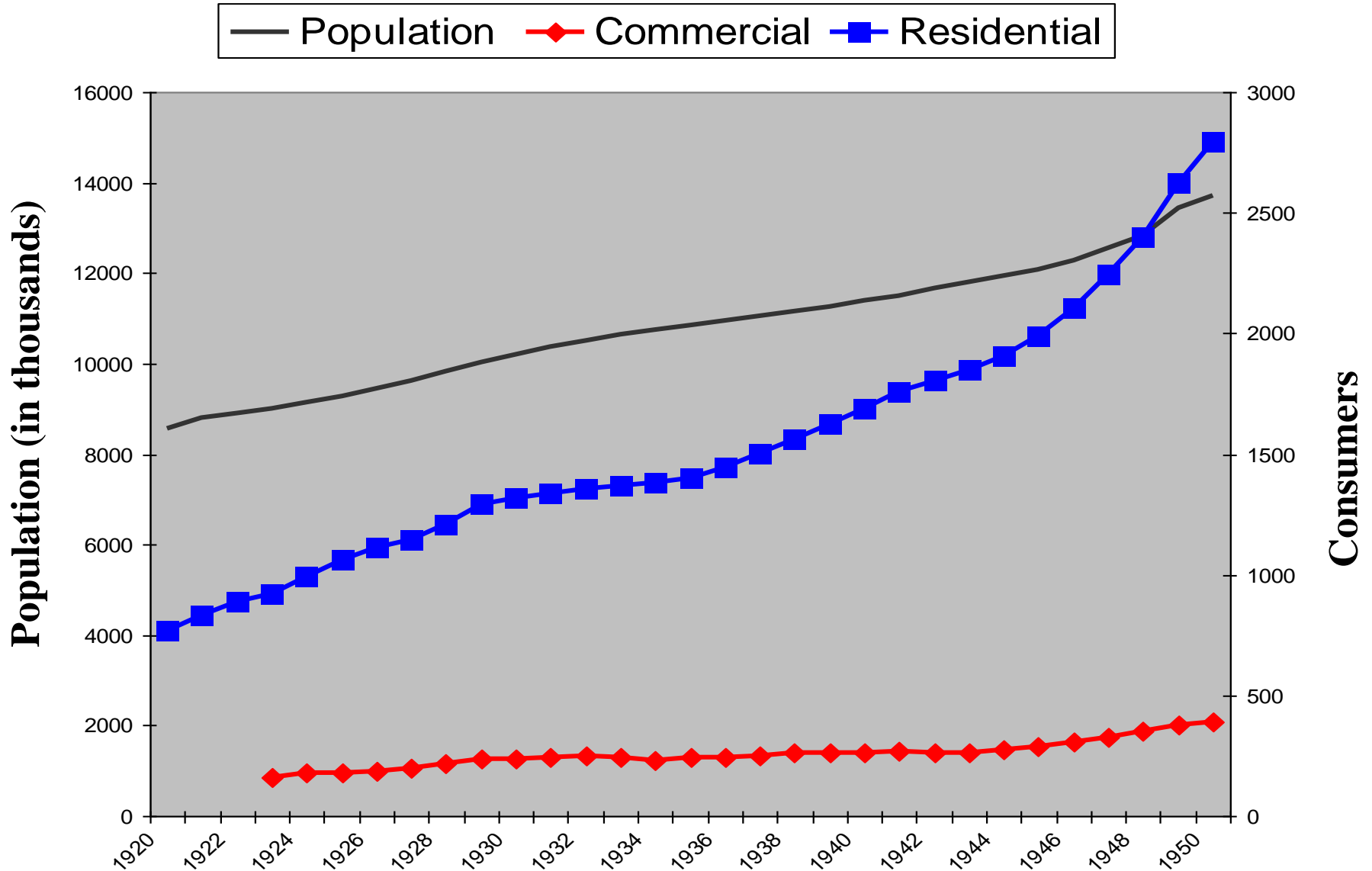


Living in Cities... (2)

- New means of transportation helped: canals, steamboats or steamships, and trains supplied city-dwellers with an increasing range of products, including produce fresh from the farm as well as canned meat, peas, and corn; condensed milk; bottled ketchup and pickles; soup from Campbell's; industrially brewed beer; even factory-made crackers and cookies
- Public lighting was no longer uncommon, and most large cities banned citizens from keeping or raising animals (cows, pigs, hens, rabbits) for food during the second half of the 19th century

Consumers of electric power

(in thousands, in Canada, 1920-1950)



Mother ironing at home (Ottawa, 20 February 1931)



A. M. Finn, National Film Board, Archives Canada

Mr. and Mrs. E. J. Way in their kitchen (Vancouver, July 1943)

Mr. Way is leaving for night shift work at the Burrard Shipyard and Engineering Works

National Film Board of Canada, Archives Canada





To recapitulate (2)

- Was the population threshold for being counted as an urban area greater in Canada or in the United States?
- What factors allowed Canadian cities to grow in size and in health?
- When does the urban population become a majority (i) in Canada? (ii) in the U.S.?
- Did the number of electric consumers in Canada increase more rapidly than the population between
 - between 1920 and 1929?
 - between 1940 and 1949?



The Pre-Scientific Age

- Early factories had little to do with science
- As electricity became available for more than lighting, it transformed the industrial workplace
- Factories once dominated by belts and shafts transferring mechanical energy within narrow and gloomy confines were converted into much vaster installations lighted and powered by electricity



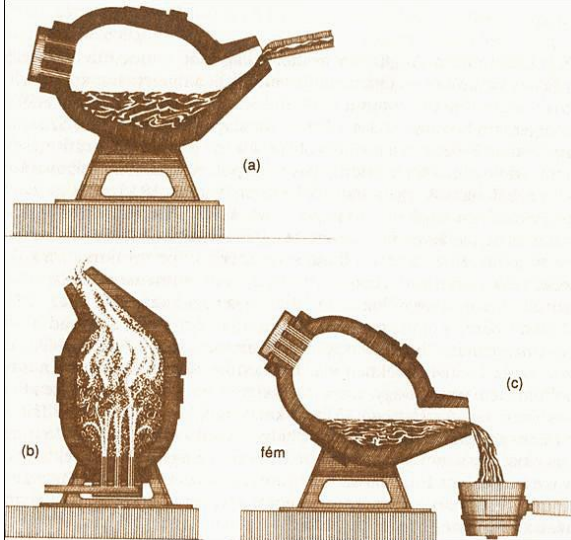
“Progressive” management for a “Progressive” age

- In North America, the years between 1890 and 1920 are known as the Progressive Era, when many shared the same belief in the possibility of improvement
- By 1900, manufacturing had absorbed a number of technological advances, ranging from the increasing power and versatility of prime movers (water turbines, steam engines, electric motors) to the availability of cheap steel
- As manufacturers became used to such change, managers turned their focus to the industrial workforce

Steel: the Bessemer Process



Henry Bessemer
(1813-1898)



In 1856, Bessemer perfected the purification of pig iron made from non-phosphoric ores and the addition of controlled quantities of carbon (and other elements) to turn out very cheap steel (1/3rd to 1/14th of current prices). In 1878, Percy Gilchrist and Sydney Gilchrist Thomas completed the Steel Revolution by making it possible to use the cheaper phosphoric ores.





The Steel Revolution and Its Consequences (1)

- Before the Bessemer and Gilchrist-Thomas processes, Western Europe produced about **100,000** tonnes of steel a year; crucible steel could reach up to **40** times the price of wrought iron rails
- By the eve of World War I, yearly steel output was reaching **30 million** tonnes
- In the U.S., an annual steel output of nearly **70,000** tonnes in 1870 rose to **25 million** tonnes in 1910



The Steel Revolution and Its Consequences (2)

- As a result, steel replaced wrought iron for most of its uses and some new ones (rails, structural beams, sheet metal for cars)
- As their own phosphoric ores became usable, Germany and France were able to catch up to Great Britain and the United States
- Steel also proved key for the development of new, high-powered machinery (electric motors and dynamos, steam turbines)



The Rise of Scientific Management

- By 1900, the large corporations and great industrial concerns created by the financiers of London and New York were “taming” invention by creating R&D departments staffed with college-trained scientists and engineers, backed by in-house workshops and patent attorneys; independent inventors would largely disappear by 1950 as a significant force
- While technological innovation accounted for many new products and efficiencies, it was becoming clear to manufacturers that work practices could be greatly *improved* if they were approached systematically
- The Cincinnati and Chicago meat packers had shown the way, but Frederick Winslow Taylor (1856-1916) would define the new ideal of the “one best way”

“Soldiering”

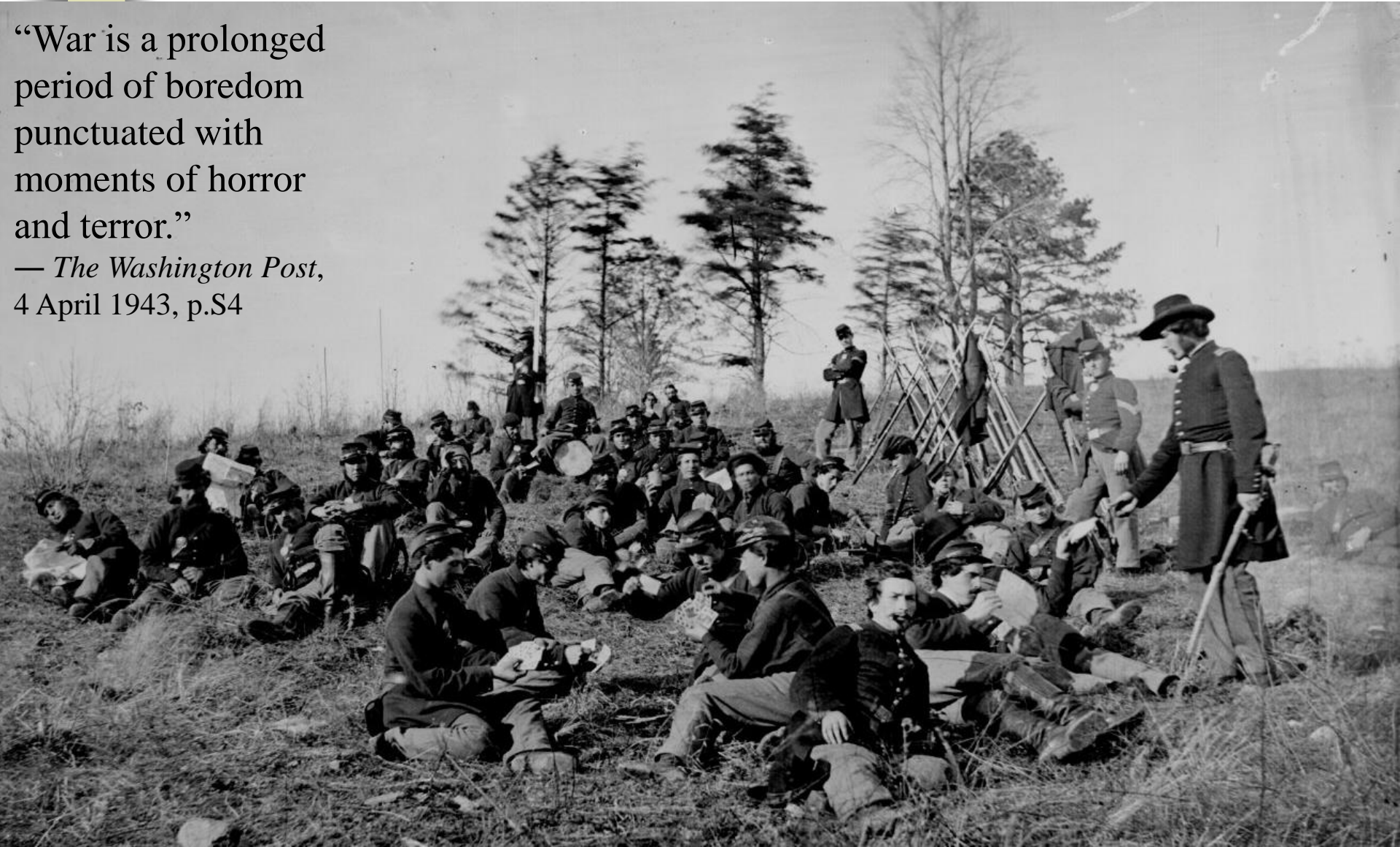
- Scientific Management ended up tackling in part what Taylor called *pacing*—or “soldiering”, as soldiers in peacetime garrisons were thought to spend much of their time not doing much of anything
- This offended the Protestant work ethic and its associated emphasis on thrift
- Merritt Roe Smith describes several forms of pacing: "Working to collectively defined 'stints', taking unauthorized breaks to have a smoke, go to the john, share a cup of whiskey, or purchase cakes being hawked outside the mill gate by a local baker, looking for missing tools, sharpening and repairing other tools, and reading newspapers while at work are common examples of pacing."

Soldiering in the Civil War (1)

After the drill, Petersburg, Virginia, 1864

“War is a prolonged period of boredom punctuated with moments of horror and terror.”

— *The Washington Post*,
4 April 1943, p.S4



Soldiering in the Civil War (2)



← New York 7th
Cavalry on parade
in 1862

Battery drill in
Ringgold, Ga. ↓



Frederick Winslow Taylor (1856-1915)

- Born into an upper-class Philadelphia family of Quakers
- He began as a machinist at the Enterprise Hydraulic Works
- Hired as a common labourer, he became a foreman at the Midvale Steel Company, and then chief draughtsman, research director, and chief engineer... within six years
- A consulting engineer by 1893, he did much work for the Bethlehem Iron (later Steel) Company



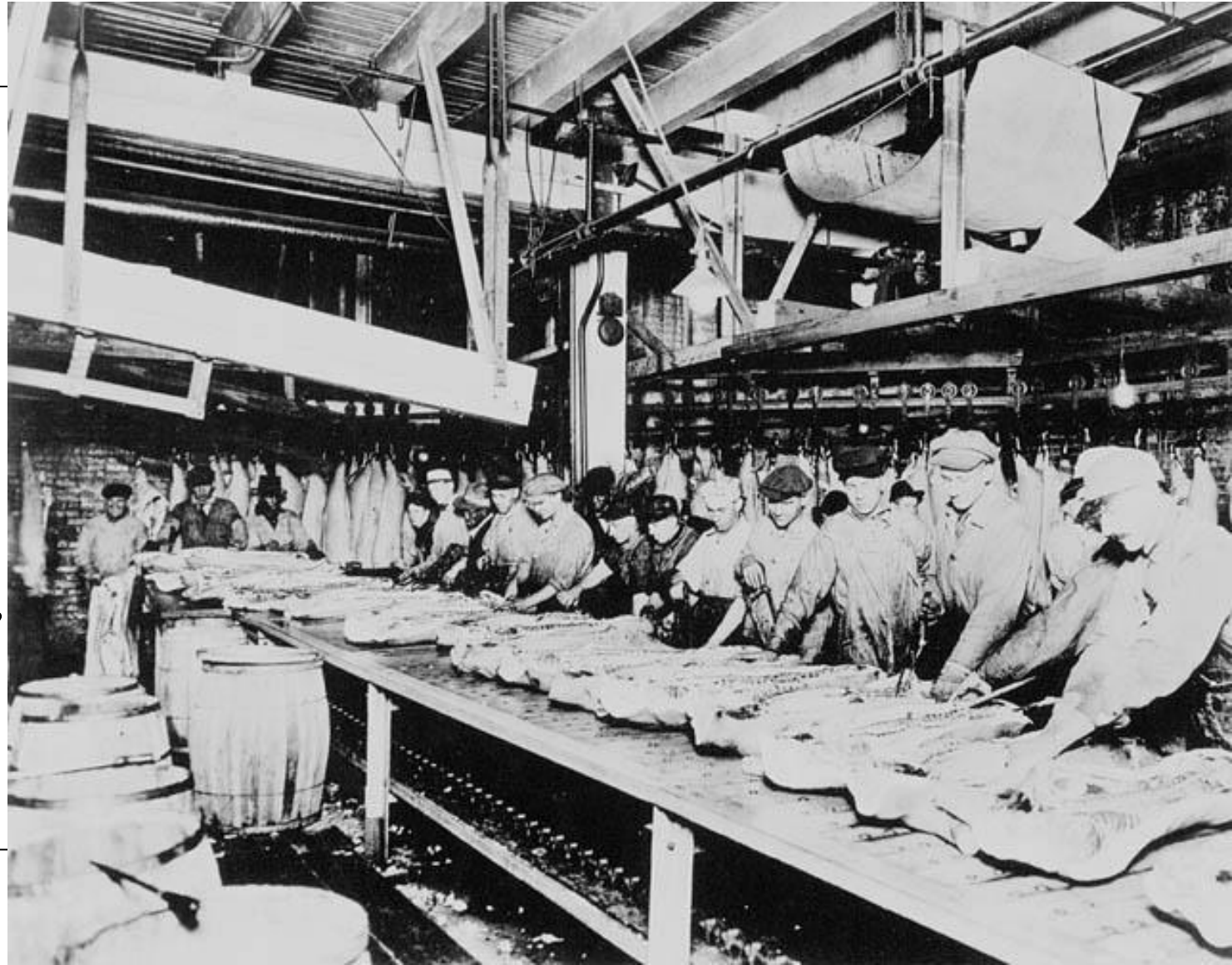


Frank and Lillian Gilbreth

- A pioneer of camera use, Frank Gilbreth (1868-1924) started out as a bricklayer
- Though known as an efficiency expert, he was not recognized by Taylor
- He conducted micro-motion studies that analyzed the worker's smallest gestures as *therbligs*
- A college graduate, Lillian Moller Gilbreth (1878-1972) was an industrial psychologist by training
- She worked to reduce the strain of a given job by economizing effort and setting meaningful work standards
- First woman elected to U.S. National Academy of Engineering

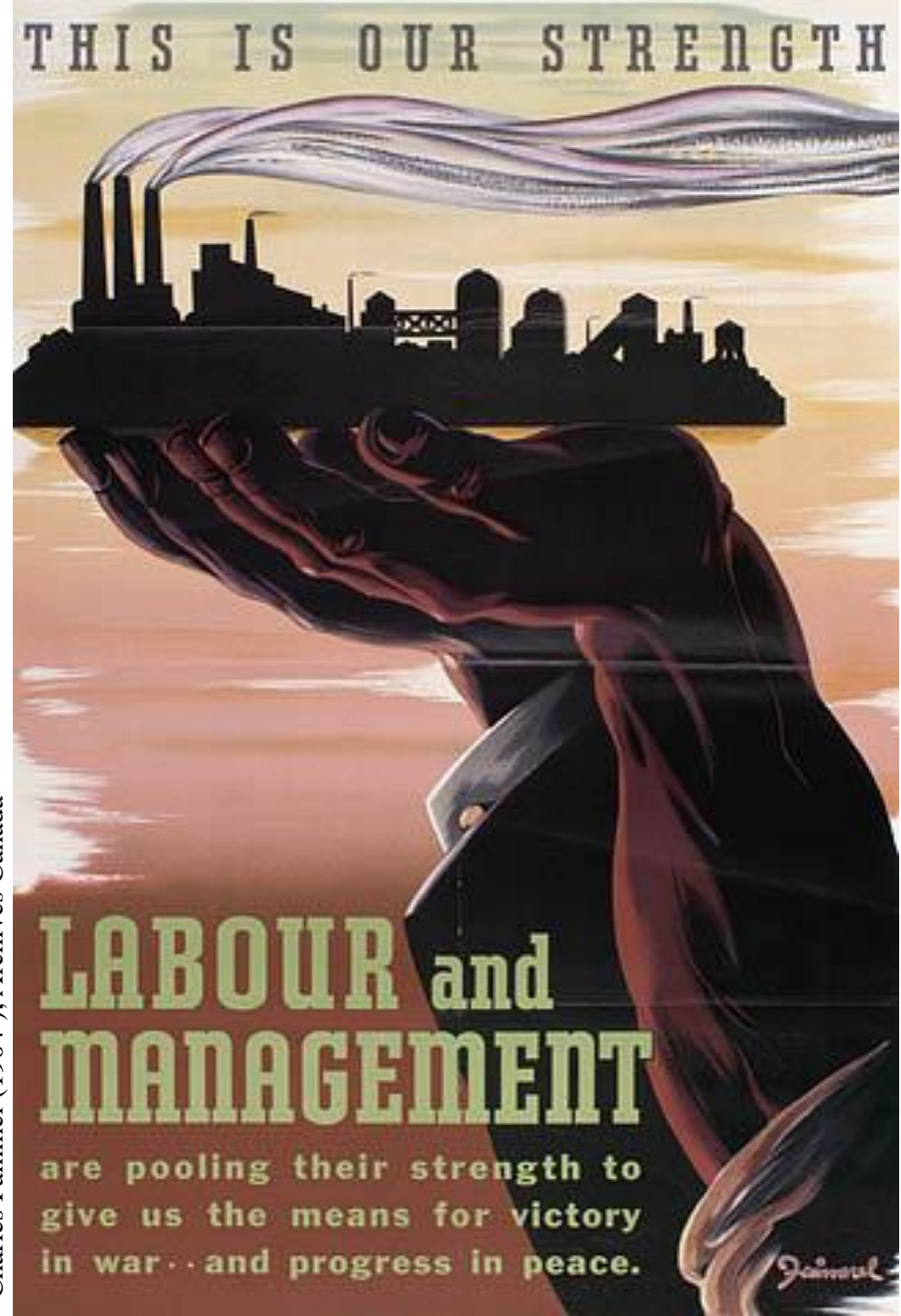
Toronto (ON) meatpacking plant in 1920 (processing hogs)

After WWI, modern manufacturing methods started spreading, the impetus coming from Ford's example and from the efficiency experts, though not without incurring worker resistance at times...



Canadian
wartime
poster
extolling the
cooperation of
labour and
management
(c.1941-44)

Charles Fainmel (1904-); Archives Canada





To recapitulate (3)

- Which U.S. efficiency expert of the early 20th century started out as a bricklayer?
- Was Frederick W. Taylor against “soldiering”? Why?
- What two processes boosted the production of steel by a factor of nearly 300?
- How could a background in psychology help with increasing efficiency?
- What 19th-century U.S. industry showed the way in terms of increasing efficiency?