

# Technical Advance and Stagnation: The Case of Nail Production in Nineteenth-Century Montreal

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## Résumé

*Au XIX<sup>e</sup> siècle, la production de clous s'est développée de façon importante à Montréal. La ville a été pendant la plus grande partie du siècle le centre canadien du commerce des clous. Il y a eu des changements radicaux dans les différents types de clous produits, les clous fabriqués à la main faisant place peu à peu aux clous coupés à la machine et finalement aux clous d'acier tréfilé. Alors qu'au début du XIX<sup>e</sup> siècle, les clous étaient fabriqués dans de petits ateliers artisanaux, en 1900, presque tous provenaient de grands laminoirs fonctionnant à la vapeur. Les sociétés productrices ont réalisé d'importants progrès dans l'industrie secondaire du fer. L'article explique en outre pourquoi certaines usines utilisant la force hydraulique pour couper les clous étaient capables de se maintenir face à des concurrents plus considérables et plus avancés techniquement, et examine la position concurrentielle de Montréal dans ce secteur manufacturier.*

## Abstract

*Nail production grew enormously in nineteenth-century Montreal. For most of the century it was the centre of the Canadian nail trade. There were radical changes in the types of nails produced, starting by handmade iron nails, progressing to machine-made cut nails, and finally to steel wire nails. While nails were made in small artisanal shops at the beginning of the century, by 1900 the majority were made in large, steam-powered rolling mill complexes. Important advances in secondary iron manufacturing were made by these companies. The article also deals with the question of why some water-powered cut nail factories were able to persist in the face of larger, more advanced competitors and discusses Montreal's competitive position in nailmaking.*

## Introduction

The manufacture of nails, one of the most common of all metal artifacts, underwent enormous changes during the nineteenth century. During the early 1800s, machine-made cut nails challenged traditional, handmade wrought iron nails. Water, then steam power was used to increase nail production significantly. In the 1870s, a new nail production based on steel wire began to change the industry dramatically.

Montreal's industrial community, the centre of Canadian nail manufacture, benefitted from successive waves of new nailmaking technology. At any time, however, companies using old and new technologies operated in Montreal; large, well-capitalized rolling mill complexes co-existed with small, cut nail factories; and

animal-, water- and steam-powered factories competed with each other. The cut nail itself changed remarkably little in the face of dramatic developments in business organization and technical practice. The experience of nail manufacture in Montreal reflects the inexorable pressure of technical progress, but it also illustrates the tenacious ability of older methods to persist in the face of what would appear to be overwhelming pressure to change.

## Cut Nails

In a society based on wood – as North America was in the nineteenth century – nails were a vital commodity.<sup>1</sup> Ever-increasing quantities were needed for the construction of houses,

barns, industrial structures, ships, even railway bridges and passenger cars. In early days, nails were imported from Europe or were tediously cut from nail rod, then headed by local blacksmiths.

Montreal's first machine-made nails were produced by Joseph Bigelow (1767–1827), a blacksmith who arrived from the United States in the 1790s. He initially used a horse-powered machine to cut nails diagonally from a hoop of iron, later using machines that automatically cut and headed nails.<sup>2</sup> Larger nails were cut from nail plate imported from Britain.

This was the beginning of an important Montreal industry. The city, at a major break in communication along the St Lawrence-Great Lakes waterway, was ideally located to both import manufactured goods from abroad and turn semi-finished materials into finished goods. Both these methods were used by Montreal wholesale hardware merchants, many of whom were Americans.<sup>3</sup> In 1808, for example, Ezekiel Cutter arrived in Montreal from the U.S. to manufacture nails for George Platt, an early hardware merchant. In the 1820s, Cutter and Thomas Whittemore were making nails and wool cards for Thomas Busby Wragg.<sup>4</sup> Wragg was unusual in that he managed to remain independent of merchant control. Another nail manufacturer of the period, George Stacy, worked for Robert Unwin Harwood.<sup>5</sup>

A persistent problem facing nail manufacturers was the need for increasing amounts of power for their machines. One of the early stationary steam engines in Montreal was built by Bennet & Henderson for T. B. Wragg in 1831.<sup>6</sup> This use of steampower was an exception, however: as late as 1839, T. D. Bigelow (d. 1863) was using horses to drive five nail machines.<sup>7</sup> Most nailers were forced to seek water power sites around the Island of Montreal. Thomas Peck and T. D. Bigelow, for instance, made nails on the northern side of the island at Sault-au-Récollet, while John Mansfield Holland made them at the Lower Lachine Rapids on the south side.<sup>8</sup>

A byproduct of the reconstruction of the Lachine Canal across the Island of Montreal in the 1840s was the provision of water power for manufacturing purposes at three sites. Two of them, Canal Basin No. 2 and the Saint-Gabriel Locks, were actually within the limits of the City of Montreal. This was enough to attract nail manufacturers back to the city from the fringes of the island. In 1847, Thomas Peck (1808–1874) opened a nail mill on Canal Basin No. 2. When the basin extension was completed in

1851, lots were leased to Thomas Bigelow and to Mansfield Holland and his partner Patrick Dunn (b. 1820). Dunn and his brother Joseph (b. 1826) left for the Australian Gold Rush in 1853. On their return in 1855, they commenced making nails at Côte Saint-Paul – the third hydraulic site on the Lachine Canal – for the wholesale hardware firm of Frothingham & Workman.<sup>9</sup> By 1856 there was a flourishing nail industry based on Lachine Canal water power. In all, there were 93 nail and six spike machines, plus three splitting machines at work. Two of the four factories produced 2000 tons of nails a year, plus spikes. The only non-water-powered nail factory was that of T. Wragg, which produced 900 tons a year.<sup>10</sup> Another nailmaker to start on the canal was George Stacy who established himself at Saint-Gabriel in the late 1850s.

### Rolling Mills

Necessity forced the nail industry to be innovative. Uncertainties in the supply and price of nail plate from Britain led to the construction of mills for rolling iron. The rolling mills converted scrap wrought iron into billets and then into nail plate, which could either be sold to other nailmakers or converted into nails by the rolling mills themselves. This was an important step in Canadian secondary iron production.

The first rolling mill in Canada was built by Mansfield Holland (1813–1884), a nailmaker from Maine who established himself in Montreal in 1829 and leased a lot on Canal Basin No. 2 in 1851. With the financial backing of Thomas F. Miller, a retired paper maker, Holland had an operating rolling mill by March 1859. Unfortunately, Miller did not find the enterprise profitable and forced Holland out of the partnership in 1860. Holland returned to cutting nails with his son at the Tate dry dock, just a few hundred feet away.<sup>11</sup> Also probably in 1859, a second rolling mill was constructed at a cost of \$30 000 by Thomas Peck, who had been making nails on the basin since 1847. An 1864 description says that a turbine wheel drove an immense 22-ton balance wheel that transmitted power to the rolling mill itself. Another turbine drove 38 nail machines while a third turbine drove two large spike machines.<sup>12</sup>

The two rolling mills used scrap wrought iron as raw material. When their combined appetites had eaten up all the scrap iron available in central Canada, mills were forced to erect special puddling furnaces that converted pig

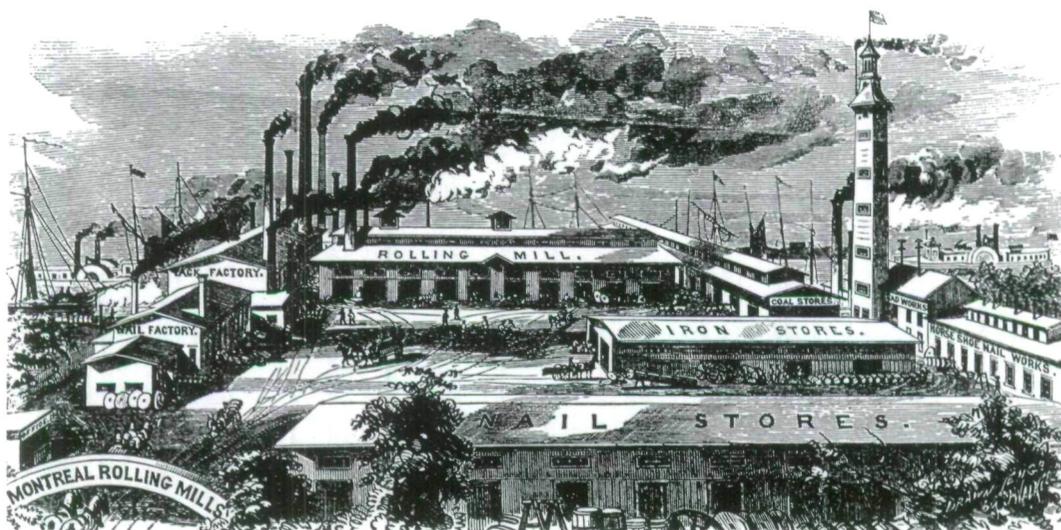
(cast) iron into wrought iron, which could then be rolled into nail plate. The two enterprises imported an average of 4000 tons (3628 tonnes) of nail plate a year up to 1859. In 1860 they produced 2000 tons (1814 tonnes) of nail plate from scrap iron, and by 1862 they produced 3000 tons (2721 tonnes) of nail plate from imported pig iron.<sup>13</sup> When the tariff on wrought iron was removed in the 1860s, however, the rolling mills went back to imported wrought iron.<sup>14</sup>

### Steam Power

After the ouster from his rolling mill, Mansfield Holland did not stay with simple nailcutting for long. In 1864 he was asked to build another rolling mill<sup>15</sup> by the wholesale hardware firm of Morland, Watson & Co., which, like the older firm of Frothingham & Workman, had started to produce its own goods such as circular saws

treating Rolling Mills attracted some of the most prominent businessmen in Montreal, including Andrew Allan, William Molson and Peter Redpath. Its \$200 000 in capital was used to purchase the latest American labour-saving technology and the best brands of British iron in order to “bid defiance to all foreign competition.” Montreal Rolling Mills had 100 nail machines plus 10 horseshoe nail machines in 1868: their combined output was 200 kegs of nails a day (Fig. 1).<sup>17</sup>

Another rolling mill company also felt the attraction of steam power. Bigelow, Hersey & Co. had developed in 1868 as a partnership between Randolph Hersey (1829–1918), a nephew of Mansfield Holland and foreman of the Bigelow nail works, and John Pillow (1840–1902), a son-in-law to Theodore Bigelow (1832–1867). After Bigelow’s death, Hersey and Pillow took over the Bigelow property



**Fig. 1**  
*Montreal Rolling Mills.*  
*(From A Commercial Sketch of Montreal and Its Superiority as a Wholesale Market (1868), 10.*  
*NA. C-117867)*

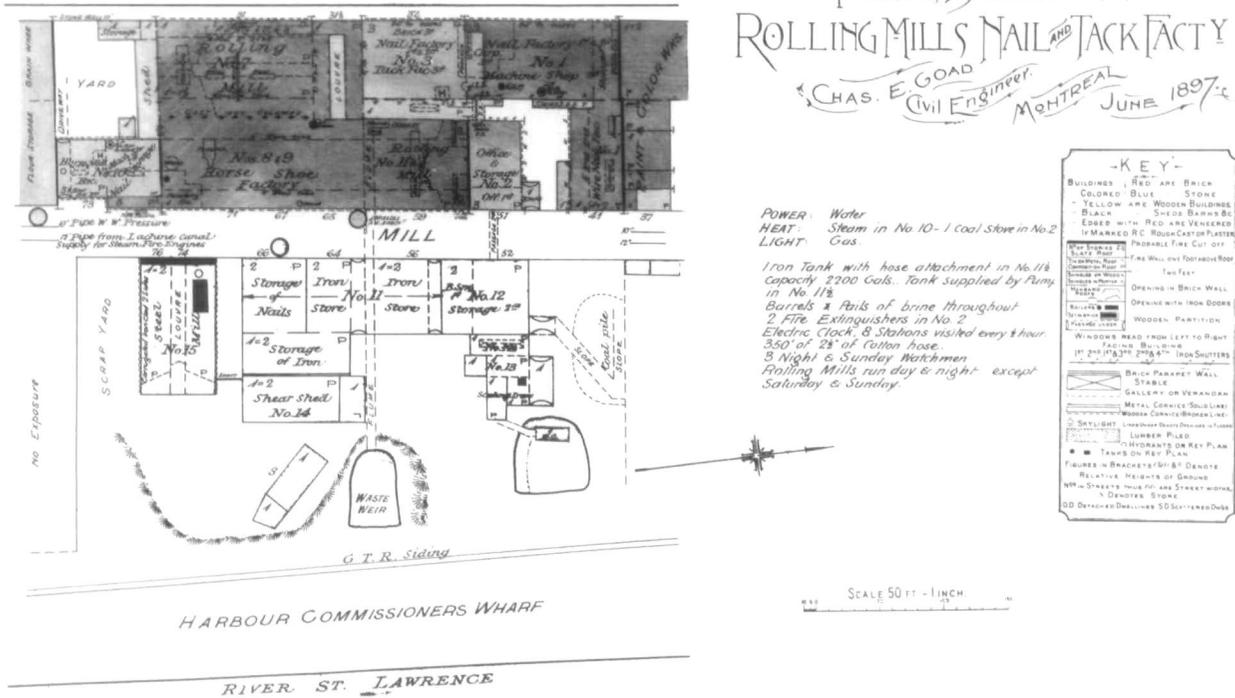
and axes. Holland’s second rolling mill was built on the Lachine Canal, but since no water power was available, it employed steam power. Although stationary steam engines had existed in Montreal since 1811, their adoption for manufacturing purposes had been quite slow. The Morland Watson rolling mill was a large steam-powered manufacturing complex that also included an independently operated nail factory and lead works.<sup>16</sup>

In 1868, a limited liability company, Montreal Rolling Mills Co., was formed to attract more capital, so as to gain control of the independent producers on their property and increase their output. Holland and the other independent producers were forced out. Mon-

and, later, the neighbouring Miller-Holland rolling mill. When fire partially destroyed the Pillow Hersey rolling mill on the Basin, they had an opportunity to change in order to meet the rolling mill’s increasing power needs. By 1870 in the U.S., for example, 90 per cent of rolling mills used steam rather than water power, not surprising considering that the average power per waterwheel in American rolling mills was 67.37 horsepower while steam engines each delivered 101.07 horsepower in 1880. Hersey and Pillow decided to purchase 150 000 square feet (13 935 sq. metres) of land between the Basin and the Saint-Gabriel Locks along the Lachine Canal to build a steam-driven rolling mill. Nailmaking was moved to this

LACHINE CANAL

PECK, BENNY & CO.  
 ROLLING MILLS NAIL AND TACK FACTY  
 CHAS. E. GOAD  
 Civil Engineer. MONTREAL JUNE 1897.



▲  
**Fig. 2**  
 Peck Benny & Co., 1897.  
 (NA. NMC 51,394)

site, leaving a nut-and-bolt works plus small hardware manufacturing at the Canal Basin.<sup>18</sup>

The advent of steam-powered rolling mills created a situation that lasted until the end of the century. At the upper end of the spectrum were two companies, Montreal Rolling Mills and Pillow, Hersey & Co. (which became the Pillow Hersey Manufacturing Co. in 1888),<sup>19</sup> both large, steam-powered rolling mill complexes with extensive product lines including numerous types of cut nails, tacks, nails for horseshoes and hardware. They controlled a large portion of the market and, because of their large capital base, were able to ride out economic storms.

Alone in the middle was Thomas Peck & Co. (which became Peck Benny & Co. in 1870), which had a rolling mill but was water-powered. When a Royal Commission looked into the leasing of water power on the Lachine Canal in 1887, the company claimed to be the last water-powered rolling mill in North America (Fig. 2). Steam power could easily have been produced by putting boilers on top of their heating furnaces as Pillow Hersey had done,<sup>20</sup> but the company only paid \$1750 a year for water power. Converting to steam would

have meant boilers, additional coal, engineers, firemen and annual repairs. It is possible that a steam-powered rolling mill was added when the company was restructured as the Peck Rolling Mills Ltd in 1903.<sup>21</sup>

At the bottom of the scale were the small, dependent nail producers. In 1871 they consisted of Patrick and Joseph Dunn at Côte Saint-Paul who produced nails for the hardware firm of Frothingham & Workman. At Saint-Gabriel, George Stacy Jr. produced for the firm of Mulholland & Baker. In addition to the rolling mills on the Canal Basin, there were two other small nail producers: Tate & Hodgson and Montreal Horse Nail Co.<sup>22</sup> In almost all cases, a hardware firm either owned the nail factory directly or supplied the nail plate and took back nails, allowing only a set profit for the manufacturer. This was a putting-out system on an industrial scale in which nailmakers had little, if any, say in what happened. More serious still was the lack of capital with which to expand or upgrade production.

A number of factories such as these along the Lachine Canal did not participate in technological change, but preferred to continue to use their existing facilities to manufacture the



steam-powered rolling mills. These companies had large capital bases and integrated product lines that made the transition fairly easy. Peck Benny, a company with fewer financial resources, made the switch only later, while dependent cut nail producers never did.<sup>29</sup> Because of their status, it is difficult to find information on these firms, but data gathered in 1882 by Robert C. Douglas for a study of water power generated along Canadian canals indicates that dependent nail factories con-

tained over 100 nail machines and employed 180 people.<sup>30</sup> The last comprehensive survey of these manufacturers comes from evidence presented to the Royal Commission on the leasing of water power on the Lachine Canal in 1886-1887. Joseph Dunn had a nail factory at Côte Saint-Paul and managed a shovel factory, both owned by the Frothingham Estate, which had title to all the land, the water power privilege, power transmission system, building and, in some cases, the machinery. Dunn paid \$1000 a year for his factory while his brother Patrick, who had a much smaller shop making wire tracks, wire staples and, apparently, nail machinery, paid only \$490 a year. The Frothingham Estate's primary interest was in receiving a four per cent return on its Côte Saint-Paul investment.<sup>31</sup>

At Saint-Gabriel Locks, George Stacy had an independent business that had been bankrupted by the failure of his major supplier/purchaser, Mulholland & Baker. When his business was picked up by another wholesale hardware firm, Crathern & Caverhill, Stacy paid \$1700 a year for the land, waterpower and buildings, plus a portion of the taxes and insurance. His profit came from a percentage set by Crathern & Caverhill on nailcutting. Whereas Stacy had once had 54 nail machines, under the new arrangement he worked 35 machines with the help of 45 employees, producing between \$100 000 and \$125 000 worth of nails a year.<sup>32</sup> The only nailmaker on the Canal Basin was W. M. Mooney & Co.'s Canada Horse Nail Co. It produced horse nails, a specialized form of cut nail for horse shoeing rather than construction. Mooney's shop was on the dry dock leased by G. H. and W. W. Tate; he paid \$2000 a year for the use of a turbine, buildings and some machinery.<sup>33</sup>

According to Kilbourn, nailmaking went through a long period of declining profits in the later nineteenth century. From high profits in 1870, for example, Pillow Hersey's profits declined to 20 per cent later in the decade, and fell to 15 per cent in the 1880s. By the 1890s the company was showing small losses. The story was similar for Montreal Rolling Mills, which enjoyed high profits until the economic crisis of 1873. In spite of strong growth in sales between 1869 and 1893, profits remained stationary at about \$46 000.<sup>34</sup> This was partly due to the fall in the price of iron products, which saw a keg of nails decrease from \$5.46 in 1872 to \$1.08 in 1894.<sup>35</sup>

Interest in the development of cut nails remained strong even after the advent of wire

**Table 1: Canadian Nail Production by Province**

1861 <sup>1</sup>		
Province	Number of firms	Value of production
Canada East	6	\$301 500
Canada West	2	26 500
Total	8	\$328 000

1871 <sup>2</sup>				
Province	Number of firms	Number of employees <sup>3</sup>	Value of raw materials	Value of production
N.S.	2	12	\$ 24 000	\$ 33 500
N.B.	4	118	168 000	344 000
Que.	8	389	504 230	747 880
Ont.	1	16	11 550	22 000
Total	15	545	\$ 708 580	\$1 147 380

1881 <sup>4</sup>				
Province	Number of firms	Number of employees	Value of raw materials	Value of production
N.S.	1	2	\$ 1 000	\$ 1 800
N.B.	3	89	160 000	232 000
Que.	9	780	765 700	1 270 000
Ont.	2	80	120 000	185 000
Total	15	951	\$1 046 700	\$1 688 800

1891 <sup>5</sup>					
Province	Number of firms	Capital <sup>6</sup>	Number of employees	Value of raw materials	Value of production
N.B.	3	\$ 48 600	113	\$185 000	\$270 000
Que.	5	64 000	161	174 600	218 100
Ont.	4	48 850	129	98 000	256 000
Total	12	\$161 450	405	\$457 600	\$744 150

1. Census of Canada, 1861, 2, 238-39, 268-69.

2. Census of Canada, 1871, 3, Table 53, 440.

3. Includes male, female and child workers.

4. Census of Canada, 1881, 3, Table 54, 489.

5. Census of Canada, 1891, 3, Table 1?, 227-28.

6. Includes fixed and working capital.

ones. According to patent records, Montreal nailmakers were quite an innovative group: Mansfield Holland's spike machine of 1844; George Stacy's cut nail patents in 1853, two in 1871, and others in 1873 and 1879; Randolph Hersey in 1882, 1886 and 1890. Other patents were taken out by Patrick Dunn in 1856, and by Ferrier, Mooney & Willis in 1870.<sup>36</sup> Many of the later patents related to nail plate feeders for speeding up or automating nail production. The first Canadian patent for wire nails was not taken out until 1886. The number of patents for cut nails remained large until about 1898 when wire nail ones took over completely.<sup>37</sup> Though nail patents do not prove technological advance by themselves, they do indicate a strong interest in technical development by Montreal nailmakers.

### Competition From Outside

Montreal experienced competition in nailmaking from other Canadian cities. In 1871 their main rival was St. John, N.B., with some

competition from Ontario; 20 years later New Brunswick and Ontario were both producing slightly more nails than Montreal, which accounted for most of Quebec's production (Table 1). The number of workers in Montreal nail factories fell from 780 in 1881 to 161 in 1891 and revenues fell from \$1.27 million to a mere \$218 000. Part of this decline can probably be attributed to a change in census classification from nailmaking to rolling mills (Table 2). The number of rolling mill employees in Montreal rose dramatically from 375 in 1881 to 1156 ten years later, while the value of the product more than tripled to \$1.82 million.<sup>38</sup> A very close relationship existed between rolling mills and nail manufacturing in Montreal that did not necessarily exist in other centres.

Competition from foreign nails was also a problem and made it necessary to introduce tariffs to protect Canadian manufacturers. As a result of the National Policy of 1879, the tariff on imported nails was set at 30 per cent.<sup>39</sup> Even at this level, the tariff acted more as a

**Table 2: Census Returns for Montreal Nailmakers, 1861-1871**

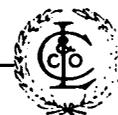
1861 <sup>1</sup>						
Company	Capital	Employees <sup>2</sup>	Raw Materials <sup>3</sup> (quantity)	Raw Materials <sup>3</sup> (value)	Production <sup>3</sup> (quantity)	Production <sup>3</sup> (value)
Hersey & Holland	\$ 10 000	40	1 200 T	\$ 63 000	1 150 T	\$ 76 000
Thomas Peck & Co.	100 000	63	5 000 T	40 000	1 200 T	68 000
Thomas Bigelow	61 000	50	1 500 T	82 896	1 440 T	97 000
F. Miller	600 000	30	1 500 T	23 000	1 200 T	65 000
George Stacy <sup>4</sup>	—	22	509 T	—	492 T	—
Frothingham & Workman	52 000	20	600 T	32 800	600 T	33 200
Total	\$623 470	225	10 309 T	\$242 296	6 082 T	\$339 200
1871 <sup>5</sup>						
Pillow, Hersey & Co.	\$ 90 000 <sup>6</sup>	155	3 225 T	\$ 90 000	2 880 T	\$225 000
Peck, Benny & Co.	176 000	114	3 700 T	116 000	3 000 T	170 000
George Stacy	26 000	37	2 000 T	100 000	1 925 T	137 000
P. J. Dunn	28 000	29	600 T	35 000	480 T	47 000
Tate & Hodgson	15 000	15	400 T	20 000	400 T	28 000
Canada Horse Nails	70 000	65	300 T	33 000	250 T	28 000
Montreal Rolling Mills	320 000	262	6 300 T	—	4 100 T	—
Total	\$725 650	677	16 525 T	\$394 500	13 035 T	\$782 500

1. NA. RG 37. Statistics Canada, Census of Canada 1861, reels C-1233 to C-1235, C-1280.
2. Includes male, female and child workers.
3. Raw materials and products given in tons.
4. "As I manufacture for hardware merchants, I cannot place a value on iron and nails."
5. NA. RG 37. Census of Canada 1871, Industrial Schedule, reels C-10,045, C-10,049 to C-10,050.
6. Includes both fixed and floating capital.

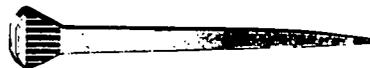
**Fig. 4**  
Caverhill, Learmont  
& Co., Montreal and  
Winnipeg General  
Catalog of Hardware,  
Iron and Steel and  
House Furnishing Goods,  
1909. (National Museum  
of Science and  
Technology Library,  
Ottawa)

612

CAVERHILL, LEARMONT & CO.



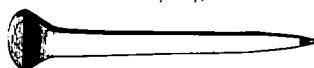
## HORSESHOE NAILS.



Cold forged iron, scored heads, hand selected.

"REGULAR" HEAD.										
No.	3	4	5	6	7	8	9	10	11	12
Length, in.	1 5/8	1 3/4	1 7/8	2 1/8	2 1/4	2 1/2	2 3/4	2 7/8	3 1/8	3 1/4
Average No. in 1 lb.			174	141	114	97	83	65	58	50
Per 100 lb.	\$16.40	14.40	13.40	12.40	11.40	10.60	10.20	9.80	9.80	9.80

No. 3 and 4 in 1 lb. cartons, 25 in a wooden case; larger sizes 5 lb. in a carton, 5 in a wooden case.



"MONARCH"										
Cold forged iron, plain heads.										
"REGULAR" HEAD.										
No.	3	4	5	6	7	8	9	10	11	12
Length, in.	1 3/8	1 3/4	1 7/8	2 1/8	2 1/4	2 1/2	2 3/4	2 7/8	3	3 1/8
Average No. in 1-lb.	297	235	169	142	115	95	77	66	61	56
Per lb.	\$.20	.18	.14	.11	.11	.10	.10	.10	.10	.10

Twenty-five pounds in a box.

protective wall than a stimulus to domestic production.<sup>40</sup> No new nail factories appeared in Montreal, although the National Policy undoubtedly stimulated other industries which required nails. Ten years later, tariff protection was critical for the survival of the Canadian industry.

*In 1889, the nail trade of the United States was reported to be in such a flourishing state that a reduction of Canadian protection would have ruined the Canadian mills. We find, however, that in 1893 to 1895, Canadian plants were able to continue production despite the fall in prices and unwanted stress of competition with iron men of the U.S.<sup>41</sup>*

It is difficult to determine what eventually happened to Montreal's cut nail manufacturers. Although they continued operating much as before, these companies were into a slow decline by the end of the 1800s. Joseph Dunn remained manager of the Saint-Paul Works of the Frothingham Estate until age 82, in 1908, and his brother Patrick was a manufacturer until 1902. George Stacy's enterprise was listed in Montreal directories until 1892.<sup>42</sup> The Canada Horse Nail Co. was controlled by W. M. Mooney & Co. until about 1892 when it was taken over by James Ferrier, son of the

famous Montreal hardware merchant. In 1901, the company was incorporated with a capital of \$100 000. John Torrance, of the well known shipping family, was president and William Smaill, an experienced employee in the hardware business, was secretary-treasurer. Their horseshoe nails had an excellent reputation and were known from coast to coast.<sup>43</sup> It has not been possible to trace this company beyond 1908.

After the death of John Pillow in 1902, Randolph Hersey sold the Pillow Hersey Manufacturing Co. to its arch rival, the Montreal Rolling Mills for \$500 000.<sup>44</sup> Montreal Rolling Mills itself became part of the Steel Co. of Canada (Stelco) merger in 1910. A new company, Peck Rolling Mills Ltd, took over the assets of Peck Benny & Co. in 1903. Both Stelco and Peck Rolling Mills continued to produce cut and horse nails well into the twentieth century.<sup>45</sup>

### Conclusion

The enormous growth in the production of nails in Montreal during the nineteenth century led to a number of important technical developments in manufacturing. One significant transition was from handmade nails to



closer to U.S. centres of production had greater cost advantages. Places such as Hamilton were therefore able to compete effectively with Montreal. Thus the locus of metalworking in Canada began to shift to Ontario, as demonstrated in the formation of Stelco in 1910, headquartered in Hamilton.

Montreal's experience well demonstrates how certain products and techniques can per-

sist in the face of more advanced methods. The nail industry in the city grew enormously during the nineteenth century. From small artisanal shops it grew to encompass large steam-driven rolling mill complexes, which became part of Canada's modern steel industry. At the same time, small nailmakers stayed with older products and manufacturing techniques that lasted into the twentieth century.

#### NOTES

1. Nathan Rosenberg, "America's Rise to Woodworking Leadership" in Brooke Hindle, ed. *America's Wooden Age*. (Terrytown, N.Y.: Sleepy Hollow Restorations, 1975), 43.
2. Larry McNally, "Randolph Hersey and the Montreal Nail Industry, 1852-1903" *Material History Review* 36 (1992): 90.
3. Gerald J. J. Tulchinsky, *The River Barons: Montreal Businessmen and the Growth of Industry and Transportation, 1837-53* (Toronto: University of Toronto Press, 1977), 12, 134.
4. Larry McNally, "Montreal Engine Foundries and Their Contribution to Central Canadian Technical Development, 1820-1870" (M.A. Thesis, Carleton University, 1991), 20. Cutter is famous for the lathe-turning he did for Canada's first steamboat, the *Accommodation*, in 1809.
5. Robert Sweeny, "Internal Dynamics and the International Cycle: Questions of Transition in Montreal, 1821-1828" (Ph.D. Thesis, McGill University, 1985), 158.
6. McNally, "Montreal Engine Foundries," 41.
7. *Montreal in 1856: A Sketch Prepared for the Opening of the Grand Trunk Railway ...* (Montreal: John Lovell, 1856), 44.
8. McNally, "Randolph Hersey."
9. Larry McNally, *Water Power on the Lachine Canal, 1846-1900*, Microfiche Report (MR) No. 56 (Ottawa: Parks Canada, 1982), 66-77.
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12. Inwood, *Charcoal Iron*, 213-14; *Montreal Business Sketches*. (Montreal: Canada Railway Advertising Co., 1864), 9-12.
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15. McNally, "Randolph Hersey."
16. *Commercial Sketch of Montreal and Its Superiority as a Wholesale Market* (Montreal: Chisholm & Dodd, 1868), 9-11.
17. *Ibid*, 9.
18. McNally, "Randolph Hersey," *Water Power*, 72.
19. McNally, "Randolph Hersey."
20. National Archives of Canada, Records of the Department of Transport. RG 12, Vol. 2808, File 4610-51-5. Appendix 28, Evidence of James H. Peck and Peck, Benny & Co.
21. Peck Rolling Mills Ltd, *Products* (n.p., c. 1905), i.
22. NA. Statistics Canada. RG 31. Census of 1871, Industrial Schedule. Reel C-10044.
23. McNally, *Water Power*, 75, 105-06.
24. Peter Priess, "Wire Nails in North America," Association for Preservation Technology *Bulletin* 5: 4 (1973): 87-88; Amos Loveday Jr, *The Rise and Decline of the American Cut Nail Industry: A Study of the Interrelationships of Technology, Business Organization and Management Techniques* (Westport, Conn.: Greenwood Press, 1983), 136.
25. *Ibid*, 89-90.
26. *Canadian Engineer* 8:2 (1901):474-75. Strangely there is nothing in the Hersey memoirs about early wire nails.
27. Frothingham & Workman, *Price List* (n.p., 1884), 23; Steel Co. of Canada, *The Twenty-Fifth Milestone: A Brief History of Stelco, 1910-1935* (np, nd), 18; Peck Rolling Mills Ltd, *Products*, ii-iii. The dating of the manufacture of wire nails in Montreal is complicated by the lack of trade catalogues from Montreal Rolling Mills and Pillow Hersey.
28. Ernest J. Chambers, *The Book of Montreal: A Souvenir of Canada's Commercial Metropolis* (Montreal: Book of Montreal Co., 1903), 217.
29. Cut nail manufacturers in Wheeling, West Vir-

- ginia, the centre of the U.S. cut nail industry, did not make the transition to cut nails either. For financial and technical reasons, they turned to other rolling mill products. Loveday, *Cut Nail Industry*, 139–41.
30. Robert C. Douglas, *Confidential Reports to the Hon. Sir Charles Tupper ... on the Hydraulic Powers Situated on the St. Lawrence and Welland Canals* (Ottawa: Maclean Rogers, 1882), 67–69.
  31. *The Commerce of Montreal and Its Manufactures* (Montreal: George Bishop, 1888), 70; NA. RG 12, Vol. 2808, File 4610-51-5, Appendixes 49, 53 and 54.
  32. *Ibid*, Appendix 40.
  33. *Ibid*, Appendix 32.
  34. William Kilbourn, *The Elements Combined: A History of the Steel Company of Canada* (Toronto: Clarke Irwin, 1960), 15–17, 22–23.
  35. *Ibid*, 17.
  36. *List of Canadian Patents from the Beginning of the Patent Office, June 1824 to 31 August 1872* (Ottawa: Maclaren, Roger & Co., 1882); Peter J. Priess and P. Michael Shaughnessy, "An Inventory of Canadian, British and American Nail Patents to 1900," MRS 93 (Ottawa: National Historic Parks and Sites Branch, 1972), 5–9. Unfortunately, this list excludes spike and horse nails patents, which underrates the contribution of Montreal's nailmakers. Stacy and Hersey had some of their innovations patented in the U.S.
  37. Priess and Shaughnessy, 7–9.
  38. Canada, *Census of Canada*, 1891 3, 277.
  39. W. J. A. Donald, *The Canadian Iron and Steel Industry: A Study in the Economic History of a Protected Industry* (Boston: Houghton Mifflin, 1915), 84.
  40. Kilbourn, 16. The debate over the effectiveness of the National Policy continues. See Kris Inwood, "Transportation, Tariffs and the Canadian Iron Industry," Discussion Paper 89–3, University of Guelph, 1989.
  41. Donald, 92.
  42. Information on the terminal dates of these companies comes from the Montreal city directories of the period.
  43. Chambers, 213.
  44. Kilbourn, 17.
  45. Steel Co. of Canada, *General Catalogue*, 1920 (Hamilton: 1920), 124–29.