The Delaware Leather Industry in the Mid-Nineteenth Century

By Lucius F. Ellsworth

Writers have noted that the leather industry stubbornly resisted technological change longer than any other industry in the United States. The most recent author, Peter C. Welsh, in Technology and Culture commented, "To the historian, the tanner is an enigma. His trade flourished and leather was in great demand from the time of first settlement until comparatively recent times. Nevertheless, tanning techniques remained nearly unchanged until late in the nineteenth century." The primitive methods to which Welsh and other writers refer consisted of a series of hand operations that transformed raw hide into finished leather. Washing to cleanse the impurities, raising to loosen the hair, beamimg to remove the fat, tanning to cure the hides, and finishing to prepare the leather for market were both tedious and inefficient.

One cannot quibble with Welsh's statement that the leather industry clung to these old processes until 1850; however, the experience of the Delaware leather companies during the next twenty years indicates that the subsequent rate of mechanization and adoption of new techniques was indeed rapid. Historians of business and technology need to restudy the industry.

According to surviving records and later scholarly studies, small hand-operated tanyards producing slightly more than $200,000 worth of goods a year dominated the Delaware leather industry until 1850.

The next decade witnessed the beginning of the transformation of this home trade into a mechanized industry centered in northern Delaware, the industrial heart of the state. By 1870, twenty-three local firms with a capitalized value of $923,018 produced leather worth $2,031,883. Although the state clearly did not rank as one of the primary leather producing centers in the country, the industry was big business in Delaware and led all trades in total value of product. About one-tenth of the state's total value of manufactured goods came from the leather industry.[2]

Many factors stimulated this growth during the period. Whereas the tanners of the 1830's and 1840's had often failed to adopt the latest European inventions and changes in tanning processes, many manufacturers began in the 1850's to utilize methods devised by David MacBride of Ireland, Armand Seguin of France, and Sir Humphrey Davy of England in the eighteenth century. MacBride, one of the earliest men to introduce improved techniques of tanning leather, mixed limewater instead of pure water with the ground bark in order to speed up the slow tanning process. For sole leather he suggested soaking the hides in a strong solution of spirits of vitriol and water before sending them through the "ooze" of tannin (bark) solution. Seguin developed a concentrated form of tannin composed of bark, water, and sulphuric acid which he circulated in varying strengths among the immersed hides in the tanning vats. This too shortened the tanning time. Seguin and MacBride also decreased by many months the length of time required to remove hair from the hides by using water and sulphuric acid instead of lime.

Although MacBride and Seguin had made practical suggestions for tanning, it remained for Davy in the early 1800's to analyze chemically the transition of rawhide into leather. Davy also recommended that the cardinal objective in the economics of tanning was to give the hides the greatest weight in the shortest time. Using this knowledge, other men devised further improvements in the tanning process.[3]

Besides the growing acceptance of European techniques, a specialized segment of the Delaware leather trade which grew quite rapidly in the 1850's contributed to the prosperity of the local tanners. Makers of morocco leathers, a very firm but flexible sumac-treated goat skin, needed large quantities of skins since there was much waste to this raw material. Because the United States did not produce a sufficient number of goat skins, most of the skins came from South America or Spain.[4] The location of Delaware near the port of Philadelphia meant that the local tanners had access to the necessary supply.

Little is known about the first local manufacturer of morocco, Lewis C. England, Who operated a factory from 1835 until 1847.[5] The real beginning of the Delaware morocco industry dates from 1853 when Stephen Postles and Thomas Baynard formed a profitable company. The cluster of leather manufacturers on Third Street in Wilmington, including Pusey and Scott, Hacket and Stamp, Baynard and Postles, and Richardson and Hayes, in 1855 produced from 800 to 1000 finished goat skins daily and shipped most of them to Boston dealers who made them into women's and children's shoes and bookbindings.[6] The business of

these firms was so good that a Wilmington tanner commented that he and his competitors could not fill all of their orders.[7]

To increase their plant facilities to meet the growing demands, several companies such as Baynard and Postles erected new and larger manufacturing buildings. Even though some businesses suffered during the 1857 financial recession, the morocco industry continued to prosper. Business conditions looked so bright that men in other trades either organized and operated morocco factories or became silent partners in new business ventures. William Bush, who owned a successful lumber company, helped to organize the G. T. Clark Company in 1858. Other firms such as Baynard and Jones began to manufacture this profitable leather product at the end of the decade.[8] In 1860 seven Delaware morocco companies produced $461,650 worth of goods.[9]

Another type of leather manufacture which increased in local importance was the making of belting. The primary factor behind this was a series of technological advances in the development of machinery which made cogs outmoded. Belting came into general use about 1840 as a means of power transmission. At first factories made their own belts by riveting together straps of leather purchased from tanneries. Soon, however, the leather goods manufacturers produced belting for industrial use.[10] The 1860 census lists only two such firms in the middle Atlantic states. One of these, the H. S. McComb Company, was in Delaware.

The early history of the McComb Company is important because

of the key role this firm played during the Civil War. Henry S. McComb, the founder of the company, was born on July 28, 1825, a member of a prosperous and respected Scotch-Irish family of Wilmington. Because his father died at an early age, Henry left home and went to work as an errand and roller boy for the Delaware Journal. He soon changed vocations to become an apprentice to the currier Israel Pusey. McComb eventually worked for James Webb as a journeyman leather worker. When he came of age in 1846, he purchased the entire stock of his employer and began to manufacture leather himself. Receiving at least one government contract, McComb shared in the prosperity of the Mexican War. By the early 1850's, Henry McComb, who had taken his brother James into the company, was one of the most successful manufacturers in the Wilmington area.[11]

Good business fortune continued for the McCombs throughout the 1850's. The Delaware Gazette reported: "Mr. McComb who is engaged in the manufacture of shoe leather is now completing a very large building, vested with all the appliances and conventions for turning out, in the most rapid and complete way, annually a large amount of manufactured material. This building we judge is about 130 or 150 feet long, by 30 feet wide and five stories high. It will be completed in a short time when the owner will commence operations therein, having rented, we learn, his old stand to Messrs. Hacket and Company ....No better evidence of the superior quality of Mr. C's leather is demanded, than his success in his business."[12]

McComb's ability to ascertain and then exploit new markets for his leather products contributed to his success. As the industrial demand for leather belting increased, McComb entered this phase of the

business. Throughout 1860, the Delaware Republican carried the McComb Company's advertisement for leather belting of single or double thickness, plain or water proof, cemented, and warranted as a superior article. This advertisement also indicated that the McComb brothers still had leather hoses of all sizes for sale. Henry lost his business partner on July 5, 1860, when James died.[13]

The third type of leather manufacture to become an important item in the Delaware trade between 1850 and 1860 was the making of patent or enameled leather, a fancy leather coated with layers of baked varnish. Four local tanners organized in 1844 a very small firm named C. W. Pyle and Company. Outgrowing its quarters by 1850, the business moved into a new and larger building. At about the same time, the company adopted the name Pyle, Wilson, and Pyle.[14] Like the Delaware morrocco and leather belt manufactures, the owners' success rested primarily upon their willingness to adopt new techniques and equipment for production. These men realized that the patent leather market, especially for use in shoes, was expanding rapidly.

Fortunately a contemporary newspaper description of the operations of this progressive plant exists. The building was a large three-story brick structure about 160 feet by 53 feet. On the second floor, huge vats which held up to fifty ox hides were sunk into the floor. The firm adopted L. C. England's method of placing revolving reels, much like steamboat paddle wheels, above the vats to strike the surface of the tanning liquor. These reels gave a circular motion to the entire contents of the vat. This patented system entirely superceded the old tedious method of changing the position of the hides by hand. A 24 horse-power engine operating the reels did in seconds the work which formerly

took two men several hours. Instead of changing the tannin by hand dippers and troughs, the company used steam power to operate the pumps which "did it all in less than a quarter the time, none of the waste, and ten times the precision and regularity. This tan liquor is all made in leach tubs outside the main building; no bark ever being brought inside; and thus whilst the engine may be pumping one leach dry, it is at the same time crushing bark to powder and filling up the adjoining one."[15]

Pyle, Wilson, and Pyle tried to be efficient in their use of hides, getting the most money possible from the by-products. The men sent the hair, necks, and trimmings of rough edges to either the plasterer of gluemaker. Horn went to the button maker, and tails and curled hair went to the mattress manufacturers. All of the worthless ends of leather, all of the refuse oil, and all of the used tanning liquor were sent to the boiler house where they served as fuel for the steam engine. The owners claimed that they used only a bushel or two of coal to get a fire started in the morning and that they relied on waste products to run the engine ten hours a day.

After rollers dried the hide by squeezing out the liquor, the hide passed to the second floor where the splitting machine cut the hide from neck to butt. By repeating this process two or three times, the tanner could get about 150 square feet of leather from one ox hide. Any defective pieces of split leather were sent to the trunkmaker. Good pieces of hide then passed through stretching, drying, and smoothing operations. At last the hide was ready for the enameling step. The Delaware State Gazette wrote:

> These latter processes are more interesting than pleasant, we could not help but think, on being ushered into close hot rooms where scarce a breath of fresh air and not a particle of dust must be allowed to enter . . . half naked men flit about drawing from huge cupboard-like ovens the new baked sheets of leather. Coat after coat of the glossy varnish is now laid on; a week or two baking following each successive coat until the sheets are made to shine like polished mirrors .. Then the sheets are exposed to a good days sunshine to fit them for market.[16]

Pyle, Wilson, and Pyle used between 1,000 and 1,500 cords of bark and 12,000 to 15,ooo ox hides each year. The local newspaper perhaps exaggerated when it reported that this firm was the "most extensive in the line of business in which these gentlemen are engaged to be found in the country."[17]

Besides the European improvements in tanning techniques and the rise of three new types of leather manufacturing, a fifth factor, advancing technology, contributed to the rapid growth of the Delaware leather industry during this decade. Although the importance of the mechanization of manufacturing processes is clear from the descriptions of local factories, the exact extent of mechanization remains unknown. Some of the various technological innovations of the area's industry have already been noted, but local men developed and devised other processes which have not yet been mentioned.

Probably the most important and universally accepted innovation was John Robinson's system for removing hair from hides. Patented on May 15, 1841, this technique by-passed the liming operation. Robinson heated steam in a huge arched chamber lined with cement. He introduced

through the wood false bottom the steam which, kept at a temperature between 70 and 80 degrees, penetrated the hides uniformly for about 24 hours. Then the tanner, being careful not to scar the hides by injuring the gelatin of the skin, scraped the hair in the usual manner. Several men writing in the 1860's mentioned that Robinson's process was still used and was satisfactory.[18]

Joseph Pyle of the aggressive Pyle, Wilson, and Pyle Company received a patent in 1856 for a machine to soften leather. He claimed that he had mechanized the process by adding feed rollers and the gears of the brush rollers but not that he had invented the pin block for softening the leather. In his patent specifications, Pyle stated that the machine operating in his plant did the work of seven men. He wrote, "By this process, the leather does not shrink but rather stretches and finishes better than the old tedious method of beating by hand over a stationary pin block."[19]

Tanners were not the only local citizens devising new techniques for leather manufacturing. Jonas P. Fairlamb, a Wilmington civil engineer and surveyor who was best known for his operation of the city water department, patented in 1848 a new way of combining the tappet wheels, tappet plate, and spring for operating the knife of the leather splitting machine. This arrangement meant that the machine applied equal pressure and speed to the leather as it passed between the knife and tappet plates.

The prospects of the Delaware tanning industry looked bright in 1860. In fact companies bringing new techniques of production regularly entered the expanding market. The Delaware Republican described the operations of one of these firms, Miller, Stephens, Delaplaine and Company, as follows:

> It is probably known to many of our citizens that this peculiar method or process of tanning is the result of the irrestive genius of Dr. William Fields of this city, the chemical ingredients of which are abundant, simple, and cheap, thus enabling the company to manufacture leather at a reduced cost, as the employment of sumac and other expensive vehicles in the process are not needed. They have already an imposing force at work, and before long a complement of between 50 and 100 hands will be required in the different departments . . . . This method takes six to eight days to complete the process. They also split calf- skins for tanning (never before performed in this country) . . . . Process attains all of the firmness of grain and flesh heretofore thought to be attainable only through use.[21]

Although the tec nological know-how of the Delaware leather industry increased and the three new types of leather manufacturing developed in the 1850's, the local leather trade as a whole failed to progress. Many small neighborhood tanyards still employed the older techniques and , failing to take advantage of the Philadelphia import market, bought their hides one at a time from local farmers or operators of slaughter houses.[22]

The Delaware boot and shoe trade, still a domestic industry or handicraft in 1860, failed to use any type of mechanization. Men such as John I. Higgins and Samuel Roberts operated small shops along Second Street in Wilmington. One fairly large company, the establishment of Hagan, had utilized some of the more elementary forms of factory organi-

zation. On the second floor of a Wilmington building, several men made the shoes, each man constructing the entire shoe by himself. The accounts contain no indication of any machinery. This lack of mechanization caused most of the cobblers to fail to use the large supplies of Delaware tanned leather.[23] The edition of the Delaware State Gazette suggested that more enterprising local businessmen should establish factories for manufacturing boots and shoes. Clearly the shoemakers were far behind their brother tanners in adopting new techniques of manufacturing as well as in extending their markets. They also failed to keep pace with the progressive New England shoemakers.[24]

On the eve of the Civil War, the Delaware leather industry as a whole was thriving and growing rapidly. The changes within the industry during the decade of the 1850's laid a strong foundation on which to build during the years ahead.

The economic stagnation which plagued the Delaware leather industry at the outbreak of the Civil War caused many workers to be unemployed for several months. As the Federal Government began to equip and supply the armed forces, prosperity slowly returned. During the spring and summer of 1861 several local manufacturers received government contracts and orders. The effects of this were soon evident in the number of persons employed and the expanded production which exceeded that of 1860.

Henry S. McComb, the wealthy leather manufacturer, was quite successful in obtaining lucrative contracts. McComb claimed that a Colonel Thomas of the Quartermaster General's Office asked him to

enter the tent making business in May, 1861, in order to put people around Wilmington to work.[25] Eager to diversify his business, McComb submitted bids and received several large contracts for making both the common "A" tent and the new Sibley tent. He sublet many of his contracts which were not for leather goods. Local manufacturers who did work in their homes benefited from McComb's contracts for tents, tripods, knapsacks, kerseys, and trousers.[26] McComb occasionally had difficulty with these subcontractors. In the winter of 1861, workers struck Casper Kendall's shop, which was doing work for McComb, claiming that Kendall was underpaying them. After McComb advanced Kendall the money for wages in December, he finally finished the contract.[27]

The shrewd McComb did not overlook the possibility of obtaining government contracts for leather goods. In September, 1861, the Delaware Republican reported that McComb had a contract for leather neck stocks and that he was willing to employ almost every industrious person, man or woman, who wanted to work.[28] Hatchet slings were another important contract item for McComb, for he began making 27,000 slings in August, 1861. By March, 1862, McComb had either filled or was completing contracts for neck stocks, great coat straps, tents, and kerseys.[29] Because the army needed the goods immediately, McComb completed most of his contracts within two or three months.[30]

McComb's success in obtaining government contracts lasted throughout the war. In December, 1862, his employees were working on an order for 10,000 common tents and 40,000 unpainted haversacks.[31] He listed for income tax assessments in December, 1862, 50,000 pairs of pantaloons worth $150,000; 4,500 tents worth $90,000; 40,000 haversacks valued

at $20,000; 1,000 tents at $50,000; 2,207 pairs of boots valued at $4,414; and $1,500 of leather belting.[32] After 1862, McComb's army contracts were generally for such leather goods as large quantities of pure oak-tanned harness leather, wax upper leather, sole leather, and welting leather rather than for finished goods like tents.[33]

Because McComb apparently considered his government business separate from his normal manufacturing operations, he kept the records of these transactions in his personal account book. One can picture the rapid expansion of his wartime production by observing the amount of wages that McComb paid according to this record. In the two-months period from November 29, 1861, to February 1, 1862, he paid out $24,500 in wages.[34]

Although McComb was by far the most successful local leather manufacturer in obtaining government contracts, other Delaware tanners received substantial awards. In the fall and winter of 1862, the C. and J. Pyle Company manufactured more than 125,000 linings for knapsacks, 100,000 overcoat straps, and 3,792 leather neck stocks.[35] A local harness maker had a small United Stated Army contract to make 900 sets of harness.[36] The government awarded William C. Dunlap, who owned a small tannery in Wilmington, a contract for wax upper leather late in 1864.[37]

Several local boot and shoemakers prospered during the war from the additional government demand. Joseph Bickta's business was so good that he often employed more than 300 workers in order to fill his contracts. Throughout the war, Bickta had contracts for at least 60,000 pairs of shoes. These inexpensive hand-made shoes sold for $2

a pair.[38] Because Bickta had decided by the summer of 1864 to mechanize his factory thereby speeding up the slow hand production, he purchased machinery worth $10,000. According to the Delaware Republican, "an extensive factory for the manufacture of shoes was almost ready for operation."[39]

The activities of one local cobbler, James Birnie, are interesting. Early in the war, Birnie made shoes, boots, and tents under sub-contracts from H. S. McComb.[40] Birnie, however, had his own contracts by 1863 when in February the production of Birnie and his subcontractors amounted to $13,000. Since Birnie did not have machinery, a figure of this size indicates that he must have employed a large number of cobblers.[41]

Other boot and shoe manufacturers such as Z. W. Sinex and Michael Megary made smaller quantities of shoes for the government.[42] If other Delaware leather manufacturers had government awards, there are no known surviving records of them. The existing documents and newspaper descriptions of contracts indicate that most of the local leather companies received contracts from the Deputy Quartermaster General at the Philadelphia military depot, although a few came from New York.

The manufacture of leather for industrial purposes continued during the 1860's as McComb and Isaac Chamberlain supplied the area with belts and hose. In a broadside issued just before the war, McComb advertised belts up to forty inches wide made from oak-tanned side or whole hides. Belts made of double bands were twice the price of single-banded belts. McComb charged extra for belts made with waterproof cement.[43] Leather hose and belting were McComb's most important products for non-

military purposes during the war. In 1862, he made about $1,500 worth of belting a month.[44]

Although several men such as McComb, Bickta, Chamberlain, and the Pyle brothers prospered under government contracts and the increased industrial use of leather during the Civil War, the majority of the leather production in Delaware was for the consumer market. At least one firm, Postles and Baynard, had to stop production late in 1861 because of the lack of consumer demand. As general prosperity returned, demand increased for leather products and companies which had shut down were able to resume operations.[45] After 1862, each ensuing year of the decade generally meant increased business for the leather manufacturers.

Because contemporary newspapers directed their attention to war production, only fragmentary descriptions of leather manufacturing for the consumer exist. Perhaps the best indicators of business conditions are the income assessment lists which the Federal government began to keep in September, 1862. The only Delaware leather manufacturer who had an income in excess of $4,000 in 1862 was H. S. McComb who reported an income from all sources of $65, 206.[46] By 1864, many leather manufacturers reported incomes over $5,000. Israel Pusey reported $7,345; William Bush, $8,569; Cyrus Pyle, $9,564; Joseph Pyle, $9,564; and H. S. McComb, $39,823. Some of those with incomes less than $5,000 were Joseph Bickta with $3,000 and Stephen Postles with $1,950.[47] These are the incomes from all sources, not just from leather manufacturing.

Throughout the war, the making of morocco leather was the most important non-military activity of the Delaware leather trade. In

February, 1863, Pusey and Scott, Joseph Richardson, Baynard and Jones, George Clark and Company, and Stephen Postles tanned 2,853 dozen morocco leather skins worth $31,159. The quantity of morocco tanned increased yearly for the remainder of the decade.

The above named companies generally dominated local morocco manufacturing until 1865.[48] One notable change occurred in April, 1863, when William Bush assumed active management of the George T. Clark Company and changed the firm's name to Bush and Clark.[49] This business, along with Jacob Richardson, led the monthly lists of total production. Bush and Clark reached its peak output in 1865 producing up to $18,500 worth of leather per month.

Several companies tried to manufacture other types of leather. C. and J. Pyle, the makers of patent and enameled leather, achieved notable success. A new firm, Seehansen and Criner, began operations in August, 1864. Their production of finished leather increased steadily throughout that year and into 1865. For some unknown reason, however, the company went out of business, perhaps a casualty of the ending of the war.[50]

Besides belting and hose, McComb offered many types of finished leather such as picker; French, English, and American wax or patent leather; calf skins; both hemlock and oak tanned skins and hides; morocco of all kinds and colors; and enameled leather.[51]

Even though McComb's leather business was profitable, he soon became more interested in his financial investments in such local manufacturing companies as Charles A. Baird Company and the Bush and Lobdell Company as well as his railroad investments.[52] Although he advertised heavily in the newspapers after the Civil War, his leather

business slowly declined. By 1869, his company was no longer one of the six largest leather manufacturers in Delaware.[53]

Although some Delaware industries experienced a rather sharp recession as the war drew to a close, the leather companies suffered only a mild slump in business.[54] This decline during the fall of 1864 and the spring of 1865 was more than the usual seasonal dip. The production figures for February, 1865, indicate that this recession was beginning to reverse itself. Business was so good by September, 1866, that Bush and Clark made $29,358 worth of morocco leather.[55]

Many of the existing leather companies at the end of the war continued to grow and prosper. The patriotic cry, "The cruel war's over, patronize those who have served the country,"[56] rang throughout Delaware as manufacturers began to drum up business. Regardless of the fact that Joseph Richardson did not do the business that he had done during the war, he remained the only dyer of morocco in Wilmington. The Delaware Republican reported that Richardson hired twenty hands in his factory. He had twenty vats each with a capacity of 550 skins which meant that he could turn out 40 dozen skins per day; however, he only produced ten dozen.[57] Baynard of the Baynard and Jones Company died in 1864, and it was not until 1867 that the surviving partner, Washington Jones, was able to achieve the business success of the former partnership.[58] By 1869, W. Jones and Company employed 55 laborers and could produce 50 dozen skins per day in eleven vats. Most of the company's goat,kid, and morocco leather was sold in Philadelphia and other eastern markets.[59] Other morocco companies such as Bush and

Clark and Stephen Postles and Sons prospered showing increases. Bush and Clark occasionally produced $29,000 of leather goods per month.[60]

Although it is not clear to what extent the companies had undergone additional mechanization after the initial breakthrough in the 1850's, the mechanization of Pusey, Scott and Company is known. The Delaware Republican described the company's new building erected in 1866 as the best of its kind in the country. The paper said that the factory was supplied with all of the modern improvements including the best machinery, which was driven by a twelve horsepower steam engine. There were 22 lined vats, each of 75 dozen capacity. About 60 employees turned out 60 dozen skins per day.[61] Lippincott's Magazine boasted in 1873 that the labor saving devices of Pusey, Scott and Company were unmatched in the world.[62]

The demand for machinery for the morocco manufacturers was so great that George W. Baker founded a company in 1870 to make this type of machinery. The early success of this firm clearly suggests that the tanning of morocco leather was well on the road to being mechanized by 1870.[63]

Perhaps the most significant entry into the local leather industry was the J. E. Rhoads Company. This old tanning company had been operated by the Rhoads family at Marple, Delaware County, Pennsylvania, since 1702. Jonathan, the great-grandson of the founder, became head of the firm in 1860. During the Civil War the tanyard remained quite small and was hand operated. Four workers, of whom

Thomas Evans was the most experienced, helped the family to tan principally calf skins and small quantities of harness leather from about twenty-five hides a week.[64] About 1867, Rhoads decided to give up the tannery since the Civil War boom was over and tanning was apparently becoming unprofitable in the Marple area. Small hand-operated tanyards like Rhoads's just could not survive.

Rhoads began to look for possible sites for a new tannery. He asked his father-in-law, Thomas Garrett, to make inquiries about various businesses in Wilmington. Jonathan's brother, James, suggested that he should stay in the leather trade since he had grown up in that business.[65] In August, 1867, Thomas Garrett wrote Jonathan that the tanyard and business of Downing and Price near Wilmington were for sale. Reporting that the capacity of the yard was about 3,000 hides per year, Rhoads's father-in-law also suggested that it would be better to pay liberally for an established business that would immediately yield income than to undertake to form a new company.[66]

Other factors probably influenced Rhoads's decision to move to Wilmington. While he was in business at Marple, Rhoads had purchased hides from a Wilmington salter and had marketed many of his finished hides in northern Delaware.[67] The existence of the Wilmington Hide and Tallow Association organized in 1866 [68] to supply hides for local tanners perhaps influenced Rhoads since this meant a ready source of hides.

The Downing and Price Company had been founded in the mid-1850's by two enterprising young men who had been quick to install a ten horsepower steam engine to run their bark-mill and other machinery.[69]

Although the firm was not one of the largest in Delaware, it did a substantial business making $2,641 worth of goods in February, 1867.[70] Thus the fact that Downing and Price was a well-established firm, fairly prosperous, and well attuned to technical innovations probably influenced Rhoads to move to Wilmington.

Whatever the reasons may have been, Rhoads purchased Downing and Price in late 1867 or early 1868. In order to have enough capital to acquire the company, he had to borrow $11,000 from his father-in-law and $5,000 from the Wilmington Savings Fund Society. These debts plagued Rhoads many years as he struggled to develop and expand his new company. With the aid of Thomas Evans, whom Rhoads had brought along from Marple, the company tanned chiefly sole and harness leather. The new firm bought many of its hides from the Wilmington Hide Association and sold the finished goods primarily to such industrial leather manufacturers as Charles Warner of Philadelphia and H. S. McComb. Rhoads also sold leather to local shoemakers.[71]

The fact that Rhoads's tannery was not a financial success until after the Civil War decade does not minimize the importance of the move from Marple to Wilmington. This company was to become one of the principal producers of leather belting in the United States. Jonathan Rhoads had enough foresight to realize that the future of tanning did not lie in a local rural tanyard but in a large centralized tannery that could utilize the new industrial innovations.

As in previous times, there were two trades directly related to tanning and currying, harnessmaking and cobbling. The chief charac-

teristic of harnessmaking, the large number of small hand-operated shops, continued throughout the decade. The transformation within the local shoe industry beginning in 1865 was remarkable. Joseph Bickta installed machinery in late 1864. His monthly production leaped from less than 500 pairs of shoes per month to between 2,000 and 12,000.[72] He proudly advertised throughout 1866 that he made all types of shoes and that "this is the only steam powered shoe manufactory in the State."[73] Because the production of the shoemaker James Birnie shows this same sudden increase in late 1868, Birnie had probably mechanized his manufacturing process also. Although there were many Delaware cobblers making shoes by hand in 1870, the experiences of Bickta and Birnie demonstrated that the future for shoemakers rested in mechanization.

Local interest in improving the leather manufacturing techniques continued during the Civil War period. Naturally many of the developments of the previous decade formed a strong foundation on which to build. Most of the improvements of manufacturing techniques were refinements of previous processes. An interesting point is that five of the seven patented improvements by Delaware citizens came in the post-bellum period.

Several of the local manufacturers tried various methods of speeding up the tanning process. William Bush, the silent partner of the G. W. Clark Company, received a patent on April 1, 1862, for tanning small skins without sewing them together or applying pressure to the skins. Bush used ten vats each with a frame hung in the center

on a pivot. The tanner suspended skins by their necks from these frames. Either a pitman or steam-powered machine kept the skins on the frame in constant motion. On the first day of tanning, skins without their hair were hung on the frame of the first vat. Then a weak solution of tanning liquor was poured over the rotating skins. On the second day, skins were placed in the second vat and the liquor from the first was pumped into the second. New and stronger liquor was then added to the first vat. The process was repeated until the tenth day when, after placing the skins in the tenth vat and pumping the liquor forward as usual, the skins from the first vat were taken out and hung to dry. Steam pipes kept the liquor at a constant 70 degree temperature. If the liquor in the vats became too weak, new fluids were added through troughs. Bush claimed that by using this new method he could effect a saving in time of 50 percent. He also stated that he could make a superior article of leather with plumper and firmer skins.[74]

Another morocco tanner, John G. Baker, also tried to speed up the tanning process. Baker disliked Bush's system,claiming that the weight of the skins when hung by their necks caused the skins to stretch and break. He also found that when he used the older system of sewing the skins into bags,the skins often rubbed together and were consequently imperfectly tanned. Therefore, Baker arranged a row of cocks in the liquor tub pipes so that the liquor could flow into skins sewed into bags and then into the vats. The arrangement of the tub

pipes and cocks was such that the skins could not come into contact with each other and that the liquor both buoyed up and submerged the skins. Baker's tanning apparatus was patented on April 12, 1870.[75]

The third change in morocco manufacturing techniques was George Johnson's machine for graining morocco. Patented in 1866, this device replaced the old system of rubbing the skins by hand in order to give them a crimped appearance. This was more than a refinement of an old technique; this was a completely new innovation. Two men, one at each end, operated the machine which consisted of a table with a swinging arc above its surface. The three feet square face of the arc was made of grooved brass plate. The arc and the table moved in opposite directions and were controlled by a system of shafts and belts. The skin passed through the machine twice for each side and then at right angles with the first work. This gave the creases on the skin a square shape. If the operators worked quickly, the machine could grain four or five skins per minute. Baker wrote that he had a machine in operation in Wilmington and that it worked well.[76]

William Fields and Israel Townsend devised a system of applying air pressure to the skins suspended in vats filled with the ordinary tanning liquor. The men thought that the compressed air forced the tanning liquor into the hides and skins and also kept the skins constantly in contact with currents of fresh air. The system was supposed to eliminate some of the handling of the skins by the vatman, thereby reducing the labor costs.[77]

Two other men, William Warner and James Crooks, made slight improvements in the process of filling the bag-shaped skins by attaching filter pipes and valves to each bag. By doing this, the men no longer had to untie and then retie each bag whenever they changed the liquor. It is possible that the initial investment necessary for constructing this elaborate system of pipes and valves was greater than the money saved from the small reduction of labor costs.[78]

The morocco manufacturers were not the only Delaware tanners to benefit from technological improvements. William Pyle received a patent in 1870 for making buff leather in imitation of morocco. Ordinary patent leather was made from undyed buff leather heavily coated with varnish. When patent leather cracked either from wear or from cold weather, the undyed leather made the cracks white. Ordinary patent leather, therefore, was not really suitable for shoes. Pyle decided to dye the leather the desired color before adding the varnish. When he did varnish the leather, he applied very thin coats of linseed oil diluted with benzene and containing the appropriate coloring matter. By using thin coats of varnish, Pyle prevented the hardening of the leather and also saved on the drying time. When the varnish was dry, he oiled the leather on the flesh side. After graining, Pyle's product was soft, pliable, and looked like morocco; consequently, it was suitable for the manufacture of shoes.[79]

Following the Civil War, W. F. Quimby received a patent for a new blacking compound. The ingredients of Quimby's leather dye

were four parts of finely ground coal dust and one part of molasses with enough water added to make the substance have a pasty consistency. The new compound was cheap and according to the patent "exceedingly efficacious and desirable."[80]

The twenty-year period between 1850 and 1870 with the almost ten-fold increase in value of leather production witnessed the transformation of the Delaware leather industry from a small handicraft trade to the largest industry in the state. The decade of the 1850's saw the beginning and the mechanization of the specialized morocco leather, industrial belting, and patent leather trades. Contemporary descriptions of the new leather factories indicate substantial adoption of new techniques of production, both foreign and domestic.

Relying upon this firm foundation, the entire local leather industry prospered during the decade of the American Civil War. Rising consumer demands, mounting industrial uses, and the sudden military needs caused a rapid expansion of the leather market. The area's leather companies successfully met this new challenge. Although the number of inventions by Delawareans for improving the making of leather declined during the war years, the number rapidly increased between 1865 and 1870. Beginning in 1864, the local boot and shoe makers also began to mechanize. The experience of the Delaware leather industry between 1850 and 1870 clearly reveals that historians must revise their estimates concerning the time of mechanization and technological advance of the leather industry from the later to the middle part of the nineteenth century.

FOOTNOTES

1. Peter C. Welsh, "A Craft that Resisted Change: American Tanning Practices to 1850," Technology and Culture, IV (Summer, 1963), 299.
2. H. Dussauce, Arts of Tanning, Currying, and Leather Dressing (London, 1865), 187.
3. Peter C. Welsh, "A. Cardon and Company, Brandywine Tanners, 1815-1826," Delaware History, VIII (Sept., 1958), 125-27.
4. Edgar Hoover, Location Theory and the Boot and Shoe Industry (Cambridge, 1937), 124, 131.
5. Henry C. Conrad, History of the State of Delaware (Wilmington, 1908), I, 383.
6. Delaware State Gazette (Wilmington), June 15, 1855.
7. Delaware Gazette (Wilmington), Jan. 10,1854.
8. John Thomas Scharf, History of Delaware 1609-1888 (Philadelphia, 1888), II, 789-91.
9. U.S., Department of Interior, Manufactures of the United States in 1860 (Washington, 1865), 55, 56, 743-56.
10. J.E. Rhoads and Sons, 250th Anniversary Year (Philadelphia, 1952), 12-14.
11. Wilmington Every Evening, Dec. 31, 1881.
12. Delaware Gazette, Jan. 10, 1854.
13. Delaware Republican (Wilmington), May 3, July 5, 1860.
14. Scharf, II, 783
15. Delaware State Gazette, June 15, 1855.
16. Ibid.
17. Ibid., Jan. 10, 1854.
18. U. S. , Patent Office, Patent #2,096, May 15, 1841.

19. U. S., Patent Office, Patent #5,456, Feb. 22, 1848.

20. U. S., Patent Office, Patent #15,816, Sept. 30, 1856.

21. Delaware Republican, May 7, 1860.

22. Ledger Book, 1840-1852, Joseph Whan, Accession 331, Ledger Books J. E. Rhoads Co., Accession 290 (Eleutherian Mills Historical Library, Greenville, Delaware).

23. Delaware Republican, May 28, June 7, 14, 1860.

24. Delaware State Gazette, June 15, 1855.

25. U. S., Congress, House, 37 Cong., 2 Sess., 1864, Testimony, House Report 2.

26. Personal Account Book of H. S. McComb (Mr. George Winchester, Wilmington, Delaware).

27. Delaware Gazette, Dec. 30, 1861.

28. Delaware Republican, Sept. 5, 1861.

29. U. S., House Report 2, 889.

30. Quartermaster General's Office, Contracts for Civil War Supplies, Record Group 92 (National Archives, Washington).

31. Contracts.

32. State Department, Income Tax for Delaware, Record Group 58 (National Archives).

33. Contracts.

34. Personal Account Book of McComb.

35. Income Tax.

36. Delaware Gazette, July 19, 1861.

37. Delaware Republican, Feb. 1, 1864.

38. Delaware Republican, Sept. 9, 1861, Mar. 26, 1863, Aug. 18, 1864; Delaware Gazette, Sept. 6, Dec. 30, 1861.

39. Delaware Republican, Aug. 18, 1864.

40. Personal Account Book of McComb.

41. Income Tax.

42. Francis A. Lord, Civil War Collectors Encyclopedia (Harrisburg, 1963), 346; Delaware Republican, Aug. 28, 1861.

43. Broadside, Jan. 2, 1860, H. S. McComb Correspondence, Accession 500 (Eleutherian Mills Historical Library).

44. Income Tax.

45. Scharf, II, 790.

46. Income Tax.

47. Annual Assessment of Incomes, Carriages, and Plate for the Year 1864 In Delaware (Historical Society of Delaware).

48. Income Tax.

49. Scharf, II, 791.

50. Income Tax.

51. Broadside, McComb.

52. Scharf, II, 791; and Ledger, H. S. McComb (Winchester).

53. Income Tax.

54. Harold Hancock, Delaware During the Civil War (Wilmington, 1961), 172.

55. Income Tax.

56. Delaware State Journal (Wilmington), Jan. 26, 1866.

57. Delaware Republican, Sept. 20, 1869.

58. Commerce Manufactures and Resources of Wilmington, Delaware (n.p., c. 1890), 52.

59. Delaware Republican, Sept. 20, 1869.

60. Income Tax.

61. Delaware Republican, Sept. 20, 1869.

62. Lippincott's Magazine, XI (Apr., 1873), 380.

63. Commerce Manufactures and Resources of Wilmington, Delaware, 63.

64. Inventory, J. E. Rhoads Company, and Betty Hustin, "The J. E. Rhoads Company" (unpublished manuscript), Accession 290 (Eleutherian Mills Historical Library).

65. James Rhoads to Jonathan Rhoads, n. d., Accession 290.

66. Garrett to Rhoads, Aug. 8, 1867, Accession 290.

67. Inventory, Sept. 19, 1859, J. E. Rhoads Company, Accession 290.

68. Jenkins and Atkinson, Wilmington Directory (Wilmington, 1868).

69. Delaware Journal and Statesman (Wilmington), Aug. 11, 1857.

70. Income Tax.

71. Account Books, J. E. Rhoads Company, Accession 290.

72. Income Tax.

73. Delaware State Journal, 1866.

74. U. S., Patent Office, #31,815, Apr. 1, 1862.

75. U. S., Patent Office #101,812, Apr. 12, 1870.

76. U. S., Patent Office, #51,360, May 1, 1866.

77. U. S., Patent Office, #43,013, June 7, 1864.

78. U. S., Patent Office, #98,651, Jan. 4, 1870.

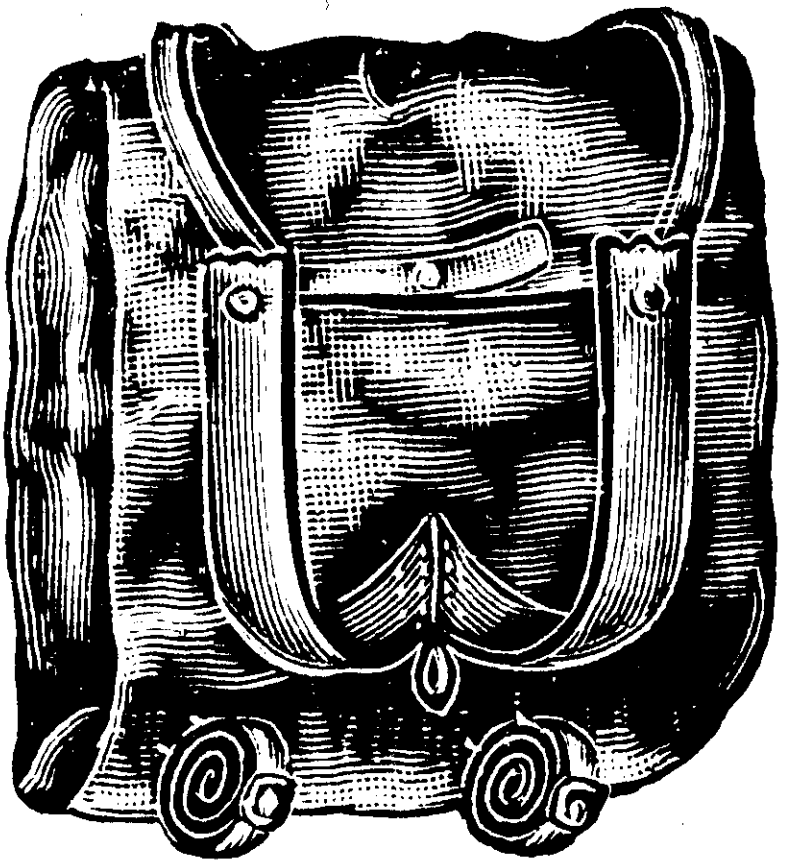
79. U. S., Patent Office, #105,247, July 12, 1870.

80. U. S., Patent Office, #57,567, Aug. 28, 1866.

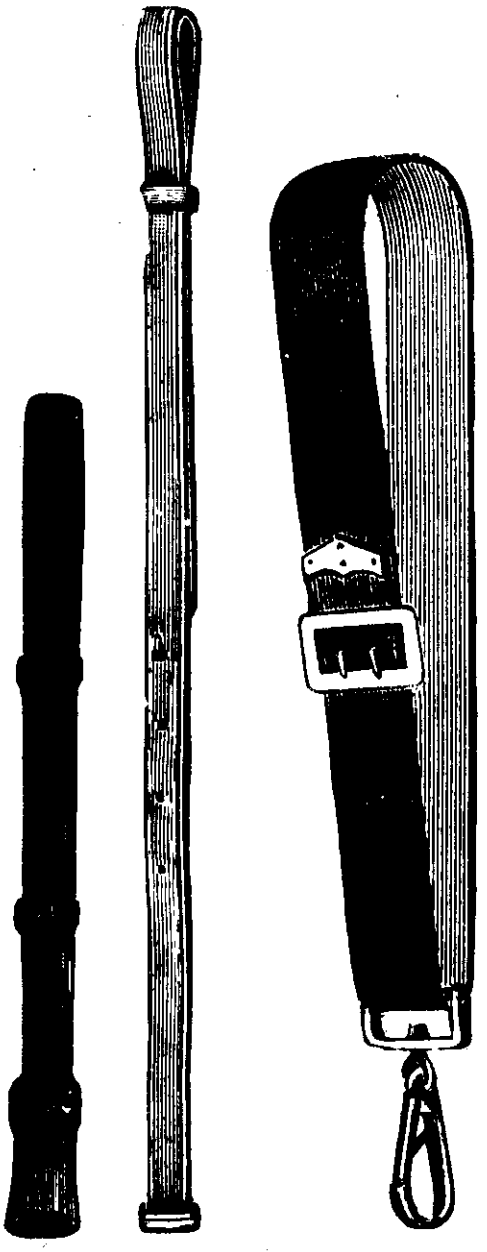
Pictures

Boots and shoes were important leather items during the Civil War. The soldiers' "booties" were perhaps the first mass-produced footgear to distinguish between right and left feet. (Photograph of shoes in the Civil War Display at Hagley Museum.)

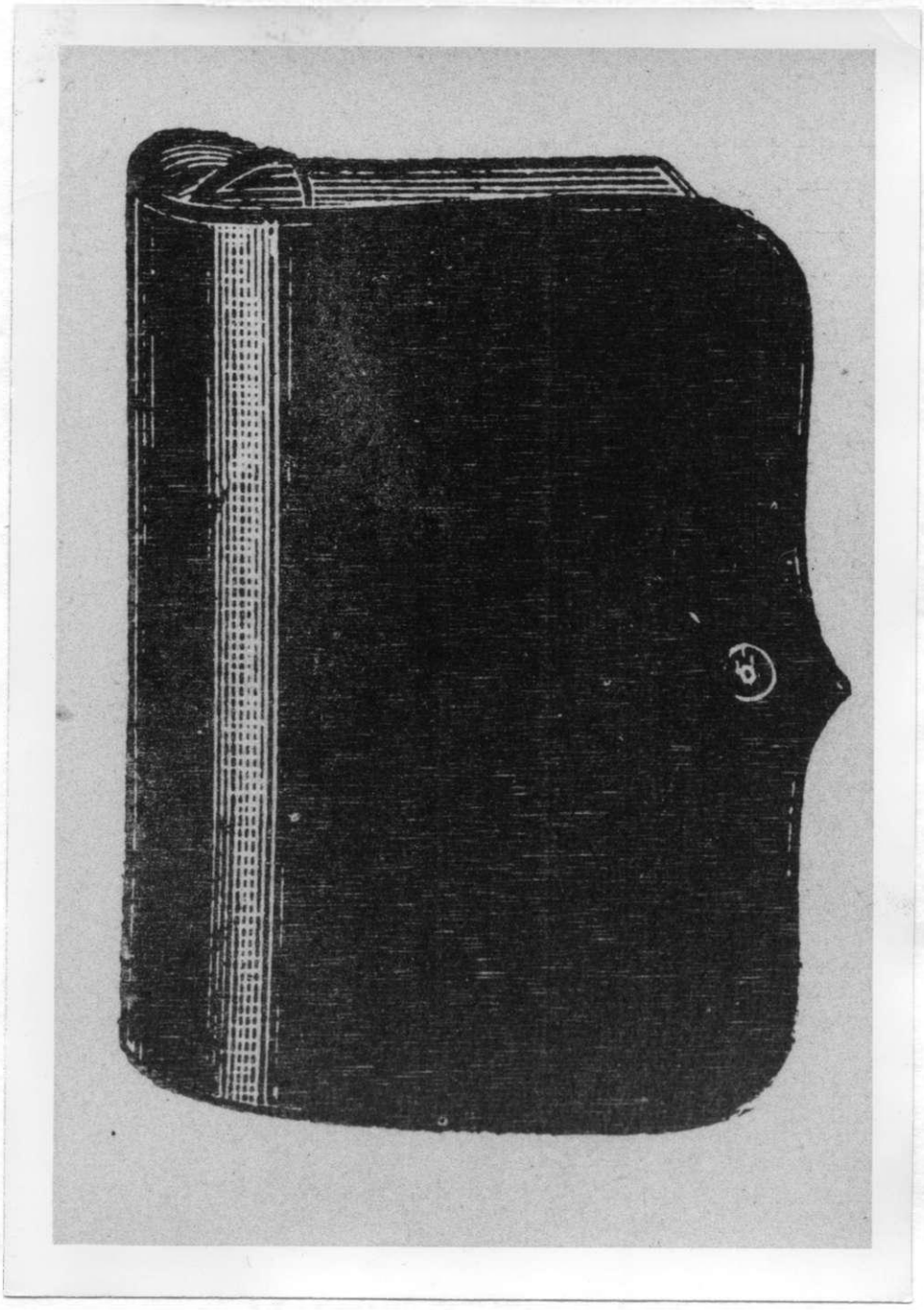
Soldiers carried their supply of food in haversacks made either of leather or canvass. Several Delaware manufacturers had government contracts for haversacks. (Photograph from Francis Bannerman, Catalogue of Military Goods, 1903, Reprinted 1960. Hereinafter cited as Bannerman.)



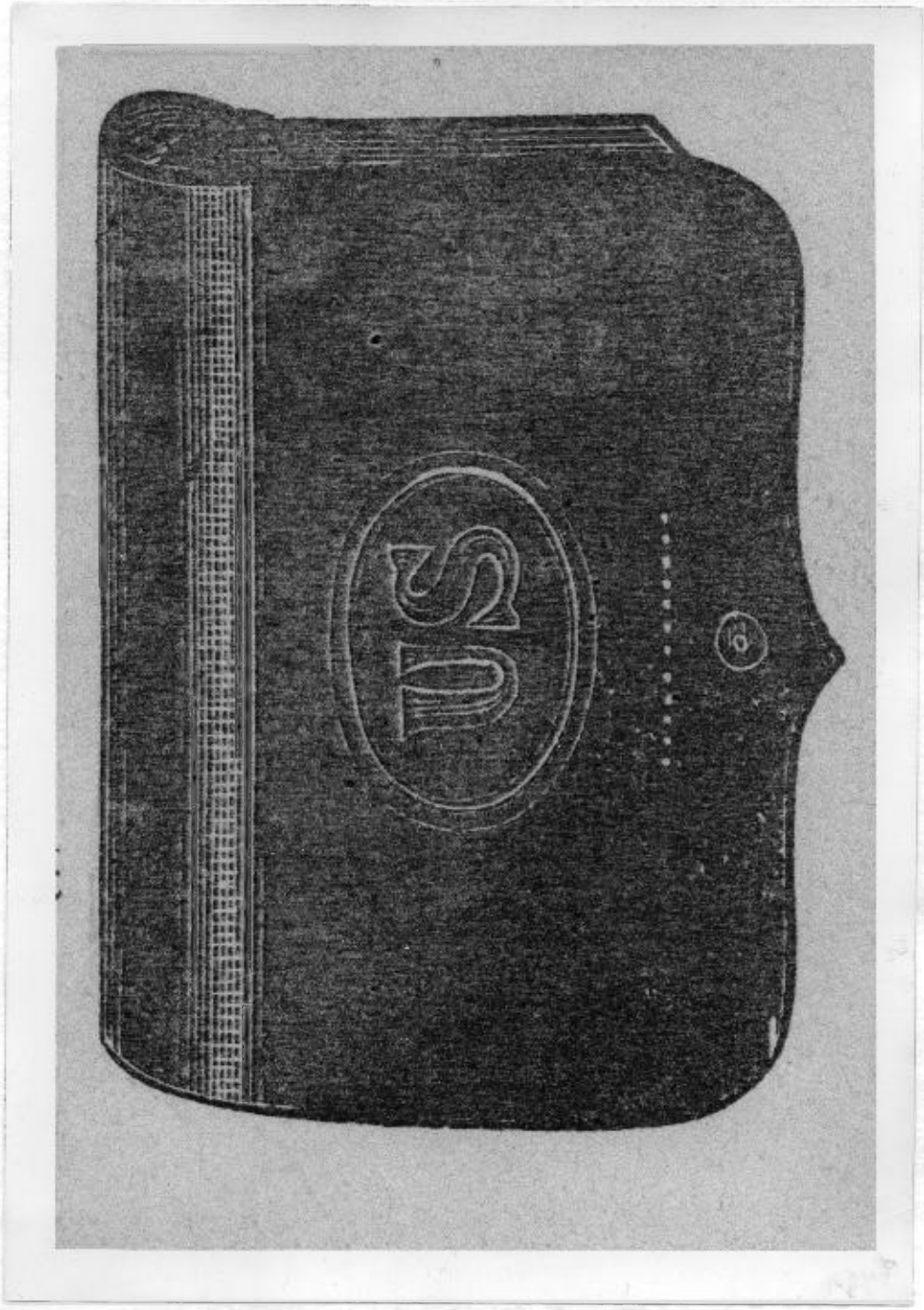
Early in the war soldiers used bulky knapsacks for their bed-rolls and personal possessions. Leather straps fastened the knapsacks to the soldiers backs. (Photograph from Bannerman.)



Belts and straps for many uses were made from leather. At the left is a sabre knot which fastened the sabre to the soldier's wrist. On the right are two gun or carbine slings made from russet or black leather. (Photograph from Bannerman.)

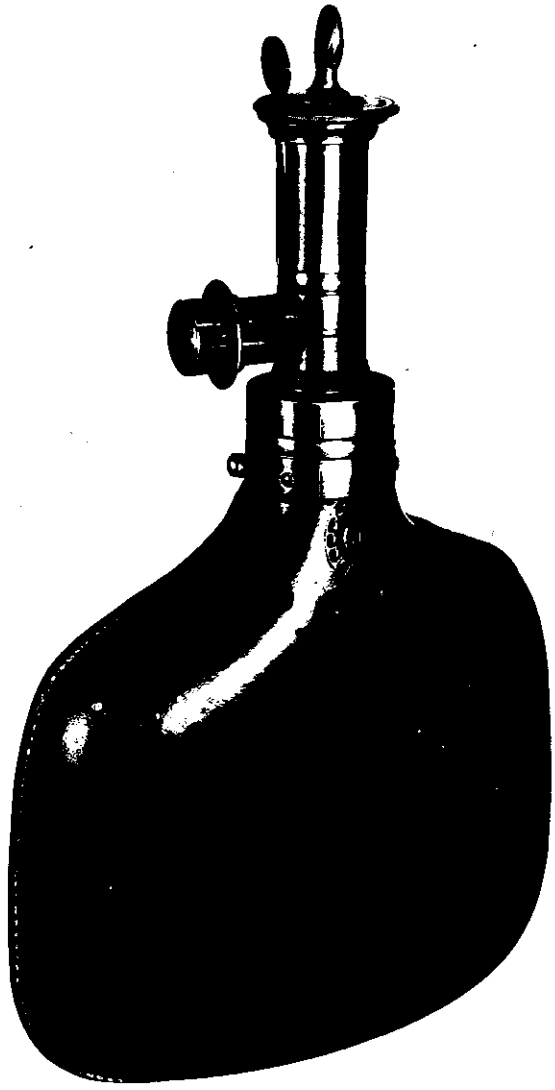


Soldiers carried 40 rounds of ball cartridges in this type of leather box. (Photograph from Bannerman.)



A Civil War .58 calibre Springfield heavy leather cartridge box made with two compartments for holding the old style paper cartridge. (Photograph from Bannerman.)

[redacted]



Some foot-soldiers carried small quantities of gun-powder in flasks made either of metal or of leather. This leather flask has a device for measuring the powder. (Photograph of flask in collection at Hagley Museum.)

No. 3.

:lelland Sad-
hide covered.
:irrup straps,
'eat leathers,
. The above
from photo-
rant these to
U. S. Army
le direct from
ıt Arsenal.
to a case and
each or $40.00
shipment to
r York City.
orted sizes.
s above, but
eat leathers,
00 per case of
is the great-
ever had to
ıd U.S. Army
e McClelland
at retail for
ıolesale price
mitations.

No. 3.

1,500 U. S. Army McClelland Saddles. Black leather covered, with complete leather covered wood stirrups. Web girth of hair cinch as desired, with coat straps; all in good second-hand serviceable order. Regular $18.00 McClelland Army Saddle. Our price is **$7.50** each; some that are practically new saddles, $10 00 each; some with patched leather seats, $6 00 each. **All** are complete; assorted sizes.

British Army Jack Spur in serviceable order, with strap.
Price, $1.00 pair.

The McClelland saddle was the most popular style of saddle during the Civil War decade. Huge amounts of leather were used in these saddles. (Photograph from Bannerman.)

The cavalry carried their personal possessions and bed-rolls in saddle bags. This bag could be attached by straps to the McClelland saddle. (Photograph from Bannerman.)

HENRY S. McCOMB & BROTHER,

Beg respectfully to call your attention to their present Price List, for

PATENT STRETCHED, CEMENTED AND RIVETTED

LEATHER BELTING,

Which from and after January 1st, 1860, will be subject to a

DISCOUNT OF TEN PER CENT AND THE USUAL CREDIT OF SIX MONTHS.

PRICES PER RUNNING FOOT, STRETCHED PIECE BY PIECE.

OAK SIDE, PER FOOT.

Width.		Side Leather	Whole Hides	Width.		Side Leather.	Oak Whole Hides.
1	inch	$ .05	$ .06	13	inch	85	$1.00
1½	"	.07	.09	14	"	93	1.15
2	"	.10	.12	15	"	102	1.25
2½	"	.13	.16	16	"	110	1.35
3	"	.17	.20	17	"	117	1.45
3½	"	.20	24	18	"	125	1.55
4	"	.24	.28	19	"	133	1.65
4½	"	.27	.32	20	"	142	1.75
5	"	.30	.36	22	"	160	1.95
5½	"	.33	.40	24	"	18	2.20
6	"	.36	.44	27	"	210	2.50
6½	"	.39	.48	30	"	240	2.80
7	"	.42	.52	36	"	300	3.50
7½	"	.45	.56	40	"	340	4.25
8	"	.50	.60				
8½	"	.53	.64				
9	"	.56	.68				
10	"	.62	.76				
11	"	.70	.86				
12	"	.78	.96				

DOUBLE BANDS TWICE THE PRICE OF SINGLE.

Bands made with WATER PROOF CEMENT, and warranted to run in WET OR DAMP PLACES, without giving way at the Splices, 10 per cent extra.

OIL LACING AND PICKER LEATHER,

Also, Calf, Sheep and Lamb Roller Skins, Roller Cloth, Pickers, Shuttles, &c., &c. Agents for the sale of the

New York Belting and Packing Company's Machine Belting, Steam Packing, Engine Hose, and all other articles of Vulcanized India Rubber,

Adapted to Mechanical and Manufacturing purposes. All these articles sold

AT PHILADELPHIA AND NEW YORK PRICES.

☞ Orders from any part of the United States, delivered free of charge for freight or porterage expenses, at Baltimore or Philadelphia.

HENRY S. McCOMB & BROTHER,

Wilmington, Delaware.

Sickel, printer.

(Photograph from OSOR, Correspondence of H. S. McComb to E. I. du Pont Powder Company, EMHL.)

BIBLIOGRAPHY

Primary Sources

Manuscripts

A person studying the Delaware leather industry unfortunately discovers a lack of readily available manuscript materials. However, the J. E. Rhoads Company has recently deposited some of its older records at the Eleutherian Mills Historical Library where it is Accession #290. This material is especially good for the period after 1850. Also at the EMHL,Accession #331, the small body of Whann family material, contains some information about shoemaking around 1850. In the Old Stone Office Records at EMHL, there is one folder of correspondence from H. S. McComb to the E. I. Du Pont Powder Company. This provides an excellent insight into McComb's non-military production of leather during the Civil War.

Perhaps the most interesting collection of manuscripts is the two account books of H. S. McComb which are in the private possession of Mr. George Winchester of Wilmington, Delaware, who was kind enough to let me use them.

"The Annual Assessment of Incomes, Carriages, and Plate for Delaware in 1864" which is a compilation of Income Tax statistics, is well indexed. The Historical Society of Delaware has this material.

Government Documents

Basic to any study of an industry in our period of coverage are statistics such as are in the Department of Interior, Manufactures of the United States in 1860 (Washington, Government Printing Office, 1865), 762 pp. and in Department of Interior, The Statistics of the Wealth and Industry of the United States (Washington, 1872), 730 pp. For this study some of the

most useful information came from the Income Tax Assessment lists, National Archives, Fiscal-State Department, Record Group 58, Income Tax for Delaware, microfilm copy in Accession #465 at EMHL. To this writer's knowledge, no Delaware historian has made extensive use of this material. Much sound information for all industries is in these monthly income tax lists.

Useful facts about local leather production during the Civil War are in National Archives, Record Group No. 92, Quarter Master General's Office, Contracts for Civil War Supplies, copies at EMHL. The testimony about war contracts contained in U. S. Congress, 37th Cong., 2nd Sess., Committee on Government Contracts, House Report 2, Serial #1143 is only slightly relevant to this study because there is so little unknown information in the testimony.

The best source of information about technological improvements by Delawareans are the patents issued by the United States Patent Office. Mrs. Martha Duffy, the Patent Librarian at Lavoisier Library of the Experimental Station of the E. I. du Pont de Nemours Company, was exceedingly helpful in obtaining all of the patents issued to local citizens for improvements for the leather industry.

Secondary Sources

Books

The most authoritative history of Delaware is John Thomas Scharf, History of Delaware, (Philadelphia, 1888), II Vols. This study contains excellent historical sketches of individual companies. Henry Clay Conrad,

History of the State of Delaware, (Wilmington, 1908), III Vols. does not have as much material on industries and seems to rely heavily upon Scharf's book. Two other books about local industries McCarter and Jackson, Encyclopedia of Delaware, (Wilmington, 1882), and Commerce, Manufactures, and Resources of Wilmington, Delaware (n.p., c. 1890), concentrate primarily upon the industries after 1870. Jenkins and Atkinson, Wilmington Directory (Wilmington, 1868), has miscellaneous information about local industry.

Harold Hancock in Delaware During the Civil War (Wilmington, 1961), 197 pp. and "Industrial Wilmington During the Civil War" (Unpublished research report, Hagley Museum, Greenville 7, Delaware, 1961), is the only writer who has written specifically about the Civil War period in Delaware history. The first book is primarily a political history of the state, while the research report only sketches the broad outline of the industrial experiences from 1861 until 1865. This research report formed the genesis for this study. Emerson Fite, Social and Industrial Conditions in the North During the Civil War, (New York, 1910), 613 pp. although somewhat outdated, provides a sound framework for any study of industries during the Civil War.

Peter C. Welsh, "Tanning" (Unpublished research report, Hagley Museum, Greenville, Wilmington 7, Delaware, 1957), carefully sketches the early development of tanning practices. For a discussion of the development during the 1840-1860 period H. Dussauce, Arts of Tanning, Currying, and Leather Dressing (London, 1865), 710 pp. is excellent. Although poorly organized, Charles Thomas Davis, The Manufacture of Leather (Philadelphia, 1885), 824 pp. is the best secondary source about the mechanization of the industry. Edgar Hoover, Location Theory and the Boot and Shoe Industry (Cambridge, 1937), 323 pp. contains an interesting section on morocco tanning.

The development of the industrial use of leather belting can be followed in John H. Cooper, A Treatise on the Use of Belting (Philadelphia, 1883), 310 pp.; J. Howare Cromwell, A Treatise on Belts and Pulleys (New York, 1888), 271pp.; and Frederic V. Hetzel, Belt Conveyors and Belt Elevators (New York, 1922), 333 pp.; and J. E. Rhoads and Sons, 250th Anniversary Year (Philadelphia (?), 1952), 22pp. None of these books present an integrated study of the industrial use of leather. These books, with the exception of the last one, are designed for reading by engineers, not historians.

The usage of leather during the Civil War is carefully listed in Francis A. Lord, They Fought for the Union (Harrisburg, 1960), 375 pp. and Francis A. Lord, Civil War Collectors Encyclopedia (Harrisburg, 1963), 360 pp. Both of these books are of high quality and have excellent illustrations. Francis Bannerman, Catalogue of Military Goods (New York, 1903, reprinted 1960), 114 pp. also contains good illustrations of Civil War equipment.

Newspapers and Periodicals

Many of the Delaware newspapers contain material about the leather industry which gives one a contempory view of its growth. Perhaps the most informative is the Delaware Republican. Other newspapers which have scattered information and descriptions are Wilmington Every Evening, Delaware Gazette, Delaware State Gazette, Delaware State Journal, and Delaware Journal and Statesman. The best collection of local newspapers is at the Historical Society of Delaware.

Several magazine articles shed additional light upon the Delaware leather industry. "Wilmington and Its Industries" Lippincott's Magazine, XI (April, 1873), pp. 369-389, discusses the local morocco industry. Other

articles of interest, although sometimes lacking depth, are Peter C. Welsh, "A. Cardon and Company, Brandywine Tanners, 1815-1826" Delaware History, VIII, No. 2 (September, 1958), pp. 121-147 and Peter C. Welsh, "A Craft that Resisted Change: American Tanning Practices to 1850" Technology and Culture, IV, No. 3, (Summer, 1963), 299-317.