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Colonel Albert Pope

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His Contribution to Bicycle Manufacture and the Development of Mass Production

IN THIS ESSAY, I examine the role played by the bicycle industry in the development of mass production in the final decades of the nineteenth century. The focus will be primarily on the contribution of Colonel Albert Pope, founder of the Pope Manufacturing Company, which was the world's largest producer of bicycles during most of this period. The aim is not to analyze the details of how bicycles were manufactured, but to paint a much broader canvas with a view to demonstrating that the contribution of the bicycle industry to industrial modernity was much more important than is generally recognized. The case must not be overstated, since the bicycle industry never matched the magnitude and importance of the railway, shipbuilding and automobile industries, but it did serve as a minor carrier wave preparing a path for the integrated mass production of automobiles in the twentieth century.

These opening remarks may seem commonplace to historians of the bicycle, but the great majority of economic and social historians, industrial geographers, and political economists make only passing reference to the bicycle. The great exception to this statement is the seminal work by David Hounshell entitled *From the American System to Mass Production*. In his fifth chapter, Hounshell dissects Pope's system of bicycle production, coming to the quite guarded assessment that "Pope's approach to assembly did not cause a revolution in manufacturing and work."I believe that Hounshell understates the contribution of Pope, and will attempt to demonstrate why I feel that Pope's contribution to mass production and mass consumption is of greater importance.

Albert Augustus Pope was born 1843 in Boston, Massachusetts, into one of New England's founding settler families. The unfortunate loss of several family members at sea towards the mid-nineteenth century led Pope's father to pursue a land-based career in real estate. He suffered a financial reverse in the 1850s and "lost his comfortable competency," an event which seems to have left a lasting impression on the young Albert. He might otherwise have aspired to attend an ivy league university before entering his father's business; instead, Albert was forced to start work at sixteen.

As often happens, the son set out to compensate for his father's setback, spending most of his life amassing a large fortune. Though he was still a wealthy man when he died, Albert did suffer a significant financial setback in the later years of his life. Pope enlisted, in 1862 at the age of nineteen, as a second lieutenant in the Thirty-Fifth Massachusetts Volunteer Infantry Regiment. One could say that he had a "good civil war" since he was brevetted lieutenant-colonel by

the end of the war in 1865. He used the title "Colonel" thereafter, and cultivated connections with his regiment and the senior officer class for business and personal reasons.

The next twelve years were spent building up a successful enterprise making slipper decorations and shoe-findings. In 1876 he saw a high bicycle at the Philadelphia Centennial Exposition, and decided to import eight of them from England. Largely imitating one of the imported models—the Duplex Excelsior—he set about designing his own improved bicycle. Pope consulted a patent lawyer, Charles E. Pratt, and took out patents on his design and trade name (Columbia Bicycles) in the fall of 1877.

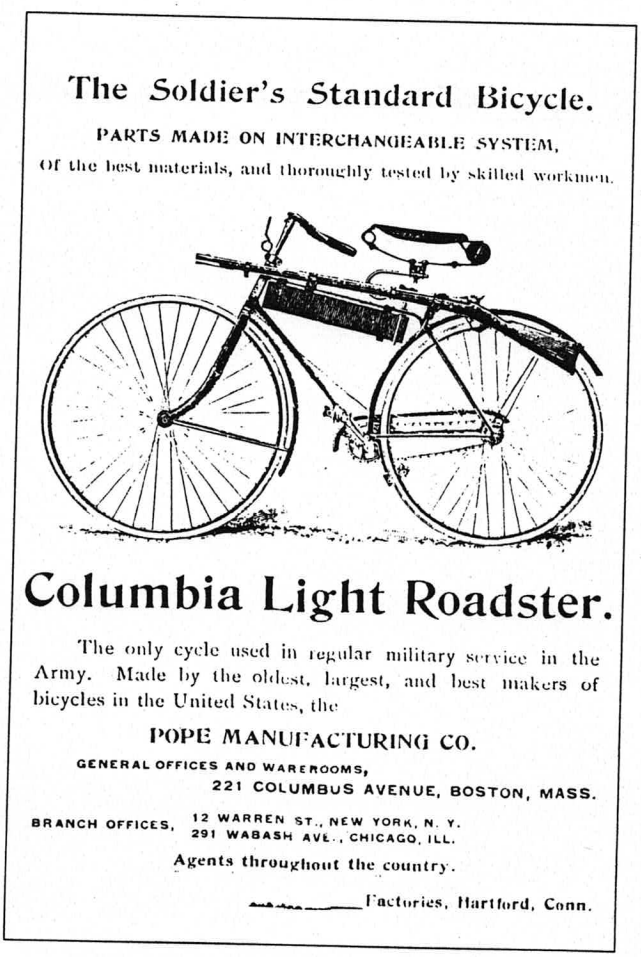
On Pratt's advice he sub-contracted the manufacture of his first order to the Weed Sewing Machine Company of Hartford, Connecticut. Weed reluctantly accepted the order, a reluctance that soon turned to regret as they had to solve numerous technical problems in making the first batch of 50 bicycles. Priced at $95, compared to $112.50 for imported English bicycles, they sold sufficiently well that Pope returned to Weed the next year with a larger order. Weed continued to manufacture high bicycles for Pope through the 1880s, as he steadily built up the reputation of Columbia bicycles.

He also pursued in the courts competitors who infringed his patents. In particular, in 1884 Pope began a dispute over patents with the Overman Wheel Company, manufacturer of the Victor bicycle, leading in 1886 to an injunction by Pope prohibiting Overman from selling bicycles. Overman appealed to the courts and won but there were further acrimonious exchanges between Pope and Overman during the 1890s over disputed advertising claims. These anecdotes illustrate Pope's interest in intellectual property rights, and the importance he attached to advertising and to the image of his company.

Pope launched his first hard-tyre safety bicycle, the Veloce, in 1888, and within two years production of the high bicycle had ceased. There followed, in successive years, a series of new safety bicycle models and innovations, including the chainless (shaft drive) bicycle of 1898. Pope was also quick to adopt new types of bicycle tyres, with cushion tyres widely used on Columbia and Hartford bicycles in 1891. By 1894 the pneumatic tyre had eclipsed all other forms of tyres. Well before this date, Pope had purchased an interest in the Weed Sewing Machine Company, and then bought it outright, closing down its sewing machine operations, and building or purchasing a series of related activities to create in Hartford, by 1894, an integrated industrial complex. He was thus well poised to benefit from the bicycle craze of 1895–97.

Throughout this period, Pope had been very active in three public spheres that lay outside his direct corporate interest, but which nevertheless promoted bicycling. In 1880 he provided a security of $60,000 to cover the start-up costs of the *Wheelman* magazine which was later merged with *Outing* to include a number of other outdoor pursuits. Both magazines achieved a wide

Fig. 7.1 Columbia ad published in **The American Bicycler**, 1880.



circulation. Pope also argued that bicycling should be allowed in public parks, most notably Central Park, New York. An ordnance of 1880, which had specifically banned bicycling and tricycling from Central Park, was challenged via a contrived infraction in 1881. There followed a series of appeals to the New York Supreme Court which were at first unsuccessful, but which in 1887, by an Act of New York State, did succeed; bicycles were declared carriages, and therefore subject to the same rights and restrictions (including access to Central Park). Pope contributed "thousands of dollars" to the legal costs resulting from this litigation. Pope also invested a huge amount of energy in promoting road improvement. He lectured across the United States on the commercial advantages of improved roads, invariably receiving favorable press coverage which he assiduously collected in his clipping files. All this was free publicity for his bicycles, and at the same time helped redefine public spaces as "on limits" for bicyclists.

The final phase of Albert Pope's business career began in 1895 with the creation of a motor-carriage department at the Hartford bicycle factory which evolved into the Columbia Electric Vehicle Company in 1896. Pope experimented with gasoline, steam and electric carriages, eventually deciding to concentrate on the electric (battery-driven) vehicle. Early this century Pope controlled vehicle factories producing gasoline cars at Toledo and at Hartford, and electric cars at Indianapolis.

With other automobile manufacturers, he formed the Automobile Trust, which held the Selden patent on the internal combustion engine. A former bicycle mechanic and small-time automobile manufacturer named Henry Ford applied to join this Trust; Pope supported the application, but A. G. Spalding vetoed it. Ford proceeded to make his own internal combustion engine and was sued by the Trust—successfully in the first instance—for infringing this patent. Ford appealed and eventually, in 1907, obtained a ruling in his favor. (Maxim, 1937, p. 173). In the same year the Pope Manufacturing Company and The Electric Vehicle Company were reorganized, both being severely overcapitalized (they represented the larger part of their nominal assets in patents). Pope never completed this task of re-organization. He died at his summer residence at Cohasset, Massachusetts in 1909, aged 66.

The re-evaluation of Pope's activities that is presented here will focus on five main contributions he made with respect to: the organization of work; vertical integration of production; his use of intellectual property rights; the interchangeability of parts; and the promotion of mass consumption.

The Organization of Work

The economic advantages of an elaborate division of labor were frequently emphasized by the leading guru of mass production, Frederick W. Taylor, whose Taylorist principles were widely applied to manufacturing during the twentieth century. But the economic advantages of labor specialization had been demonstrated almost a century earlier by Adam Smith, and applied to a range of industries throughout the nineteenth century. There was, therefore, no great novelty in either Albert Pope or Henry Ford organizing production and factory space according to an elaborate division of labor.

But Pope took the process further than it had been taken hitherto. For instance, in 1894 a man's Columbia bicycle consisted of 840 parts, while there were almost exactly 1000 parts in a woman's. Production of these bicycles required "forge buildings, test rooms, brazing, inspecting, buffing, polishing, tool and assembly rooms; machine, stock, nickel plating, and case hardening departments; tubing works, rubber works, and many other divisions. The volume of business [at Pope's works] is three times that of the nearest competitor.... One can readily imagine that a very fine division of labor must be employed in such a manufactory." Such was the division of labor, over 500 inspections were made in the manufacture of one bicycle.

As a consumer luxury, bicycle production was subject to the fluctuations of the business cycle. There were times of layoffs, and times of double shift production, suggesting a degree of numerical flexibility in the size of the workforce that was rediscovered nearly a century later in the age of flexible production. For example, the

workforce at Pope's Hartford factories dropped from 1,500 in the relatively prosperous year of 1893 to 1,200 the following year of recession. The labor force seems also to have fluctuated seasonally; it varied between 2,000 and 3,400 in 1896, suggesting that there was a core workforce, with additional workers recruited to meet the peak demand of late spring and early summer. Pope's factories at times worked shifts to meet (two shifts) in the summer of 1892 to keep up with the demand for the newly introduced pneumatic tyre. By 1895, when the bicycle craze was under way, Pope's factory at Hartford was running day and night with three "gangs" (presumably shifts) of men, making 150,000 finished parts requiring 500,000 operations every 24 hours.

Pope was most innovative in the substitution of capital for labor, pushing this further than his rival producers in the United States and Europe. A reporter from the *Scottish Cyclist* was given a tour of Pope's factories in 1893 and reported: "From there I went to several great flats where lathes, drills, etc., were to be numbered by the hundred, the most striking feature being the remarkable adaptations of machinery for labor-saving purposes. Everywhere, automatic machinery abounded." There is ample record of Pope's awareness of the effects of mechanization on the workforce.

Pope's most explicit comment on the subject was made in response to a controversial address given by Bishop Potter at the 1897 Annual Supper of The Church Association for the Advancement of the Interests of Labor in New York City. The Bishop had remarked that: "The great causes of the general ill-feeling and uneasiness among the laboring classes in the United States today may be divided into two classes—machinery, and the manner in which the capitalist looks down upon the men who labor for him. Chief of these two is machinery. It is doing away with intelligence in labor. It is turning the laboring man into a simple idiot."

The Bishop also recounted the repetitive work he saw a young man doing during a factory visit, suggesting that it had a negative effect on family life. Asked to respond, Colonel Pope developed a social Darwinian argument: "...the bishop is doing a great harm by widening the breach between labor and capital.... The drudgery must be done.... Oftentimes men of education do work as monotonous and hum-drum as the daily labor of this young man who [is] not obliged to stay there all his life; if he has the right kind of fibre in his make-up, he can develop and rise to better and larger things.... It used to be inferred that the multiplication of inventions and the perfection of machinery lessened the number of employees, but experience shows that the greater the number of inventions, the higher is the rate of wages and the larger the number of men employed.... In the old countries of Europe, where there is little or no machinery, and where most of the work is done by hand, the condition of the working man is far worse than in the countries where there is modern machinery."

Two years later, as the bicycle combines were formed, Pope was less optimistic about the impact of mechanization. Faced with a fifty per cent cut in the selling price of bicycles as the boom came to an end, he insisted that bicycle production costs had to be reduced, and to do this the number of employees had to be cut; in effect, he called for lean production nearly a century before the term was coined.

Pope felt that the divergence in labor practices between Britain and the United States was due to the absence, up to the 1890s, of unions in his plants, and their presence in British bicycle plants. British unions had the strength to oppose the introduction of labor-saving devices, whereas in the United States they lacked the required strength. The result, in Pope's view, was that America produced a better bicycle for the same amount of money with fewer workers. Subsequently, however, Pope did accept the organization of his work force by the mechanics union.

Vertical Integration of Production

Henry Ford's system of "Fordist" mass production consists of a series of specialized departments, geographically clustered together in a large, vertically integrated industrial complex. Economies of scale are achieved by manufacturing goods in large quantities. The firm's head office and management operations

may also be located in the same grouping. Production in a flexible modern firm, in contrast, is likely to be vertically disintegrated, with various components and sub-assemblies produced by sub-contractors or in the firm's own branch plants located at some distance from the parent plant, sometimes in low-wage regions in developing countries. Departments may be less specialized and employ team work to produce a variety of parts and sub-assemblies.

The record of Pope's production arrangements is one that begins with a flexible pattern of sub-contracting (at a time when the Pope Manufacturing Company was poorly capitalized), followed by progressive backwards integration as the firm bought out its suppliers and built new factories at its main complex at Hartford, Connecticut. From the beginning there was an implicit departmental structure, although in the first instance the departments were outside suppliers of particular parts—tubing, wheels, rubber tyres, saddles and so on.

By the end of the bicycle boom, in 1897, Pope owned one of the largest vertically integrated industrial complexes in the world. He subsequently played an active role in the creation of a series of combines (i.e., monopolies) designed to maintain the prices of bicycles, tyres, steel tube, wooden rims and saddles so as to stave off financial collapse of the industry after the bicycle boom gave way to a slump. Henry Ford visited the Hartford complex several times during this period before he started to manufacture his own cars. Ford was thus well aware of Pope's system of integrated mass production.

Albert Pope found it prudent to launch his bicycle business in 1878 by sub-contracting the entire production operation to the Weed Sewing Machine Company which had spare capacity at its plant in Hartford, Connecticut, and was willing to undertake this risky contract. Adapting the drop forging and machining technology developed by New England's antebellum arms industry, the Weed Sewing Machine Company made these bicycles with substantial labor inputs; "it is doubtful whether the Weed Company initially built or bought any special-purpose machine tools for machining bicycle parts." Fortunately for Pope, Columbia bicycles sold well, and sometime in the early 1880s he purchased a minority (one sixth) interest in the Weed Company which had a capital of $240,000. In 1889 Pope bought all of a stock issue by the Weed Company to own one third, and a year later he bought out the other shareholders to own the company outright. The Weed factory then became the main site for production of Columbia bicycles: the production of sewing machines ceased, and "significant innovations immediately began to appear."

Up to 1892 Pope imported the tubing used to make his bicycles from England ,where the technology had been developed. He then built a new seamless tubing factory in Hartford adjacent to his bicycle factory, with an annual capacity of 1 million feet. This tubing operation was enlarged in 1894. Also in 1892, Pope took the vertical integration of his operations a step further by buying out and greatly enlarging the Hartford Rubber Works, which thereafter manufactured solid, cushion and pneumatic tyres for Columbia and Hartford bicycles, and for the Chicago bicycle firm, Gormully and Jefferies. Pope's main bicycle assembly factories in Hartford were enlarged a number of times. A major step was taken in 1895 when Pope decided to add the lower-priced Hartford Bicycle marque to his top-of-the-line Columbia marque. This move to horizontal integration required two separate assembly lines in adjacent factories, served by the same set of suppliers.

The final step in the vertical integration of production took place in 1894. Prior to that the Pope Manufacturing Company's headquarters had been located in Boston. As late as 1892, Pope had constructed a substantial new office building on Columbus Avenue in Boston. It was one of the most modern buildings then standing in that city. The ground floor was a salesroom, the second had accounts, advertising, and management offices. The next two floors were occupied by stockrooms and repair shops, while the top floor had a riding academy patronized by Pope's clients, with women from Boston society forming the largest group; an Otis electric elevator—the first industrial use of this innovation—took clients and their bicycles up to the riding academy.

Only two years later, Pope moved the company headquarters from Boston to Hartford where he built another very modern office building which was connected to the main bicycle

assembly factories. The reason for this move appears to have been the very rapid growth of the Pope Manufacturing Company between 1892 and 1894 as the bicycle craze gathered steam; Pope's Vice-President, George Day, attributed the move to the difficulty of coordinating the details of production from Boston.

With the consolidation of the Pope Manufacturing Company's head office with the main production facility, Pope had created a fabrication and assembly facility that served as a prototype for the Fordist plant. A commentator wrote: "There is possibly no larger plant devoted exclusively to any one industry than the immense area of factories under the control of the Pope Manufacturing Company situated in the city of Hartford, Ct. For almost a mile, these buildings extend along the line of the New York, New Haven and Hartford Railroad."

The final stage in the integration of the bicycle industry, going beyond the main subject of this paper, was the horizontal integration of nearly all bicycle manufacturers into a "bicycle trust," or combine, initially named ABC (the American Bicycle Company), which went into receivership in 1902 and was resurrected as the American Cycle Manufacturing Company.

Intellectual Property Rights

The bicycle evolved in a quite remarkable way between 1878, when Pope made his first high bicycle, and the turn of the century. It also paved the way for the automobile era. Indeed, excepting the internal combustion engine, almost every technological breakthrough required for the car had previously been either adapted to, or specifically developed for the bicycle. Moreover, the first autos were a logical evolution of the bicycle; Ford, for example, used many bicycle parts in his first car, significantly named the Quadricycle. Included amongst these bicycle-related innovations were the pneumatic tyre, hollow metal rims, tangential spoking, the axle differential, gearing, shaft and chain drive, brakes, wheel bearings, spring suspension and lighting. Equally important were innovations made to the production process, rather than to the product; advances in metallurgy included cold drawn steel, case hardening, swaging, annealing, electric welding, die making, and stamping and pressing.

Hounshell identifies two innovation cultures within the bicycle industry, a New England tradition growing out of the manufacture of arms, sewing machines and similar small manufactured items (he labels this the "Yankee armory tradition"), and the western bicycle manufacturers whose roots lay mainly in building big machines such as carriages and wagons and agricultural implements, but also wooden toys. In the final analysis, the western tradition, which developed stamping and pressing methods, was to be more successful, and in 1896—at the peak of the bicycle craze—Pope's production was actually surpassed briefly by the Western Wheel Company of Chicago. Soon after, Pope also adopted stamping and pressing methods.

This stream of innovations had several effects. First, in order to gain competitive advantage, the innovations were protected by patents which were sometimes bought and sold for high prices and became major assets of some bicycle companies. Second, leading firms invested heavily in inventive activities (and some in industrial espionage) to keep abreast of their competitors. And third, the rapid evolution of bicycle technology made older bicycles obsolete in short order.

An insight into the importance Pope attached to patents is provided by the layout of the new general office building his company occupied at Hartford in December 1894. The Patent and Law Department was located immediately adjacent to Pope's own office and that of the Vice-President on the third floor. From the moment of his entry into the bicycle industry, Pope had understood the importance of owning intellectual property rights, and enforcing patents to generate revenue directly, through licences, or indirectly by maintaining bicycle prices higher than would be the case in a fully competitive market. Pope's first action, having decided to manufacture bicycles, was to buy up all the old velocipede patents still available and particularly Pierre Lallement's patent for a crank-driven velocipede. Having gained control of this key patent, Pope lowered the licence fee from $25 per bicycle manufactured or imported to $10; he wanted to popularize the

bicycle, not price it beyond the reach of most young men.

Throughout the period, until his interests shifted to automobiles, Pope continued to apply for bicycle patents, and to purchase key patents that were not the product of his own company's invention. Some, including the Mannesmann patent on seamless steel tubes, were process patents, whereas others, such as the Columbia adjustable bearing and the chainless (shaft drive) bicycle were product innovations. When the various bicycle manufacturers merged into the combine known as the American Bicycle Company, collectively they held about 1400 patents, with the Pope Manufacturing Company accounting for the largest share of these.

Not only did Pope assiduously guard his interests through patent protection, he kept a sharp eye out for the activities of his competitors as, in their turn, did they. Indeed, one of his first acts, having decided in 1878 to enter the bicycle industry, was to make a trip to Europe "to study the bicycling situation." Accompanied by his technical advisors, he visited the factories of leading British and European bicycle and bicycle component manufacturers to observe their techniques. According to Pope, having been refused entry at one factory, "he and his cohorts dressed as workmen and gained access to the plant in question." It is clear that Pope's early bicycles and production methods involved a high degree of imitation.

The Pope Manufacturing Company also took the job of invention and innovation seriously, and by this method moved from the early imitation stage to become an innovator in the industry. The Columbia adjustable bearing, which he patented in 1880, was important since it freed him from dependency on the Bown bearing imported from Britain. Through much of this period, Pope employed Mr. C. E. Hawley, a consulting engineer, who "occupies his whole time on technological improvements for the bicycle, and the machinery of production." Mr. Hawley traveled extensively in Britain, Europe and the United States keeping an eye out for new developments in the industry. In 1892 Pope created his own metallurgical laboratory for the purpose of developing steels and alloys that were lighter and stronger.

Pope was very aware of the importance of reducing production costs by automation. In 1893, for instance, his factories at Hartford were amongst the first to switch from coal to kerosene for heating and steam generation. His maxim was that "the perfection of machinery lessened the number of employees." Mass production at the Hartford works was advanced by mechanization and automation, wherever feasible. Pope reports that his great-grandfather employed Edison to build at Hartford the first electrified continuous production assembly line in America (visited and admired by Henry Ford, and many others).

Mass production, of the kind Pope sought to establish, needed to be matched by mass consumption, but generating such a mass market required sustained effort. The product needed advertising, and nobody had more success in gaining publicity for bicycling than Pope. The product needed to be affordable, so Pope lowered his prices when he was ready to expand his market. And the product needed to be new, hence Pope's investment in innovation to ensure that a steady stream of new bicycle models appeared which made older models obsolete. Ross Hill, the Wheelmen librarian compiled a table for me that lists the sequence of new models that Pope introduced between 1879 and 1900. This is an impressive record of technological progress, and strong evidence that the bicycle served as a carrier wave. Out of this series of technological innovations came the means to mass-produce bicycles, to lower unit costs, and to innovate frequently to create new demands which sustained a mass market.

The Interchangeable System and Mass-Production

The moving assembly line, usually linked with the name of Henry Ford, is commonly identified as being the essential element of mass production. Yet Womack, Jones and Roos write: "The key to mass production wasn't—as many people then and now believe—the moving or continuous assembly line. Rather, it was the complete and consistent interchangeability of parts and the simplicity of attaching them to each other."

Ford insisted on "working to gauge" in every part of the manufacturing process, but he was by no means the first to do this. Nor was Pope the first. Earlier in the nineteenth century other mass-produced goods, including armaments, agricultural machinery and sewing machines, were produced to accurate specifications. Thus in England, in 1881, Sturmey wrote: "It is now some years since the Americans introduced, or rather perfected, the celebrated interchangeable system in mechanical manufactures. Those who can carry their recollection so far back will no doubt remember the surprising cheapness of many of the articles in steel and iron imported from America, which were not only as a rule finely finished, but sold at a figure that English goods were speedily at a discount;... by the interchangeable system, [with] special tools being made for every purpose, each separate part was turned out by the hundred —or rather thousand—so accurately that, when taken up at random, every part fitted exactly the place intended for it, without any further expense of individual fitting."

Pope took this process further than it had previously been taken: "Another event having an effect on the designing and manufacturing of machinery entirely unlooked for at the time of its inception was the manufacture of the bicycle. This event...demonstrated to the world that [American mechanics] were capable of designing and making special machinery, tools, fixtures, and devices for economic manufacturing in a manner truly marvelous; and has led to the installation of the interchangeable system of manufacture in a thousand and one shops where it was formerly thought to be impractical." Pope seems to have identified the importance of interchangeable parts from the time of his initial sub-contract to the Weed Sewing Machine Company since he "proceeded to manufacture on a large scale and according to the best methods on the interchangeable plan." The advantages of interchangeability were noted frequently in Columbia bicycle advertisements and catalogues. Jardim reports that by the turn of the century the Pope Manufacturing Company could machine the bevel gear (used on the chainless bicycle introduced in 1898) to tolerances of 1/2000 inch, whereas as late as 1903, Ford had to be content with tolerances of 1/64 inch. Pope achieved such accurate specifications by investing heavily in metallurgy and precision machines, and by inspecting the products at frequent intervals, thereby building on the precision achieved by New England arms manufacturers.

There are two main elements to the use of interchangeable parts in mass production. First, they must be manufactured to fairly exact specifications and tested for accuracy at every step. Vant and Dupuis note that the leading French manufacturer, La Manufacture Française d'Armes et Cycles de Saint-Etienne (MFAC), also benefitted from an armory tradition used to working to exacting specifications. It is of interest that Henri Fayol, seen by Harvey as a figure comparable to F. W. Taylor, and who was educated in the mining school of St. Etienne, played a role in the organization of production "avec précision, rapidité, et économie" at MFAC. Pope initially achieved this precision using milling and machining technology, coupled with careful inspections. The stamping and pressing technology that he introduced later almost guaranteed standard specifications. Pope also kept strict quality control: in 1894, for instance, it was reported that Pope employed 24 skilled inspectors who collectively made over 500 inspections of one bicycle.

Second, interchangeability worked best if the same parts were used across a wide range of models. For instance, agreed upon sizes were achieved with bicycle wheels, tubing and bearings. This standardization went furthest during the bicycle craze of 1895–97 when many small bicycle manufacturers were, in practice, assemblers who simply made their own frames to which they attached Kelly handlebars, Christy saddles, Hickory wheels, Powell and Hamner lamps, and diverse other parts and accessories.

Advertising, Sales, and Promotion

Mass production and mass consumption form two inseparable sides of the same coin, yet many aspiring mass manufacturers have failed to grasp this essential connection. Albert Pope was not one of this group; on the contrary he built up a mass market for his bicycles before he acquired his own

manufacturing operations. Initially Columbia's parent firm could more accurately have been called the Pope Marketing Company, and Pope, himself, a venture capitalist!

Albert Pope promoted his firm's products with panache. He was quite explicit about this: "I believe in advertising; without it we could not have built up the largest bicycle business in the world." The annual catalogues produced by Columbia bicycles are classic examples of well-written and cleverly illustrated brochures. They usually appeared in spring in time for the early summer boom in bicycle sales. But it was not just in formal advertising that Pope was so effective. It was said of him that when he did any public act, "whether it was charity...or good work of any kind, there was always an advertisement closely shadowing the act."

The scope of Pope's informal promotion of bicycling in general, and Columbia bicycles in particular, is quite extraordinary. Soon after he had helped to found the bicycling organization known as The League of American Wheelmen, Pope provided a $60,000 line of credit to create *The Wheelman*, a magazine which did a great deal to popularize the sport. Thereafter Pope's company received favorable treatment in this journal. Long distance rides on Columbia bicycles were also publicized. Since bicycle races sell bicycles, Pope's company sponsored racers and races, assiduously keeping a note of records set on Columbia bicycles. In 1892 the Head Office of the Pope Manufacturing Company in Boston was designed with a bicycle riding school which was very successful during the bicycle boom: whereas in February 1894 there were 211 lessons given, in February 1895 this increased five-fold to 1,012 lessons. Never one to miss good publicity, following the adoption of pneumatic tyres, Pope announced the availability, at no charge, outside the "Vatican" (as the Pope Offices in Boston came to be known), of "the finest quality of air, compressed by electricity, and stored in a brass tank."

The continued expansion of bicycling depended upon the identification of new markets, and then persuading those identified of the value of bicycles. At first, the target was young men who formed militaristic Wheelmen clubs in most American towns. Pope later focused particularly on two other markets: women, and the military. Women rarely rode high bicycles but, with the arrival of safety bicycles, half of humankind had to be alerted to the advantages of bicycling. One problem to be overcome was the question of identifying acceptable dress for women cyclists. Characteristically, Pope hit upon a simple solution to this, at the same time promoting bicycling by the upper classes (his primary target prior to the bicycle craze). At that time, during Lent, New York society dropped frivolous activities, and paid penance through charitable works, including dressing dolls for an annual Lent show held at the Waldorf Hotel. Pope donated $100 for the best doll dressed in a woman's bicycle costume; this ploy simultaneously helped promote the virtues of bicycling amongst the elite, while allowing the elite itself to define what was acceptable clothing for women bicyclists. For this, Pope received favorable write-ups in almost every daily newspaper in the Eastern United States, all for a $100 outlay.

Pope advocated the use of bicycles to conduct several public activities including policing, fire protection, post and telegraph delivery. But the largest market he saw was the military: "I venture to say that in the next war, cyclists will play a very important part." In 1894, he wrote to the chief of the Massachusetts militia, General Samuel Dalton, pointing out that several states had purchased bicycles for their militia, enclosing pamphlets on "The Bicycle in the Army," and "Cyclists Drill Regulations." In July 1895 he took General Nelson Miles (who was due to become commander-in-chief of the U.S. Army four months later) to the Astbury Park bicycle races hoping to demonstrate the advantages of military bicycles.

Pope also responded to the charges frequently made by clergymen that bicycling on the Sabbath was sinful. His response was along two lines. First, he urged churches to build "bicycle stables." And second, he stressed the links between godliness and good health, and good health and bicycles. The syllogism was never formally completed, but the conclusion, that God looked favorably upon bicycling, was very obvious.

As Petty stresses, these strenuous efforts in advertising and promotion bore their fruits in the form of a mass market which permitted mass production of bicycles. In order to deliver to this

market, Pope developed a network of sales agents. Hounshell finds Pope's marketing strategy quite conservative: he did not integrate forward into marketing by establishing stores but he created "branch houses" in major cities—New York in 1882, Chicago in 1884, and 13 other major cities by 1898. As early as 1879, Pope had created a network of selling agents (selling at fixed prices); by 1897 it numbered 2,000 agents. Pope's system clearly had its merits. At a time when he was undercapitalized, he did not have to invest in a chain of stores. Moreover, the sales network system was one where, during a slump in sales, he could simply laying off some of his agents. In the context of the recent literature on flexible specialization, Pope might be labeled innovative rather than conservative.

Conclusion

I have sought to show in this paper that Albert Pope was an important figure in the development of mass production. He may not match Henry Ford's standing as an innovator, but he certainly ranks close behind as an eminence of late nineteenth century manufacturing. If mass production is defined, as Hounshell does, strictly in terms of process technology, then Pope was not a great innovator, although even here his contribution has been undervalued since Edison did install an electrified continuous production assembly line in Pope's Hartford factory. However, if mass production is defined as a much broader system connecting with consumption, institutions, and the environment of regulation, then Pope indubitably made a major contribution.

Pope advanced mass production on several fronts. He took the division of labor further than bicycle manufacturers had previously taken it. He built up, in the process, a vertically integrated industrial complex in Hartford, Connecticut, that exceeded, by far, the employment of any bicycle firm located in Coventry or Birmingham, England, or St. Etienne, France. He played a wily game with intellectual property rights, and was innovative in many respects, but above all in introducing new models at frequent intervals that made older models obsolete. History may judge, however, that his most important contributions were to the interchangeability of parts, and his promotion of mass consumption.

During the nineteenth century, the march of modernity was very clearly expressed not just on the streets of Paris and St. Petersburg, but also in the factories of Europe and America that were engaged in the project to produce more, faster and cheaper. Although the geographical literature has focused above all on the contributions of Frederick Taylor and Henry Ford, there has, in practice, been a stream of developments advancing industrial modernity. Lovering debates the form of "Ford's unknown successor," but equally, there is a need to examine "Ford's unknown predecessors."

Albert Pope and Henry Ford were both innovators and imitators. Neither seems to have had any compunction about spying on the activities of his rivals. Ford took considerable interest in Pope's operations, and learned from them. They fought over the Selden patent, with Ford the eventual victor. But by then Pope had long made his major contributions to advancing industrial modernity. Mass producers of bicycles paved the way for the automobile era, and among these pioneers of mass production Albert Pope stands out for the breadth of his vision of what mass production was all about.

Acknowledgments

I am grateful to Ross Hill, Librarian to the Wheelmen, for compiling the table used in the oral presentation from library files. [Editor's note: due to space constraints, the table could not be reproduced here]

Notes

1. Carrier waves are discussed by Hall, P. and P. Preston, *The Carrier Wave: New Information Technology and the Geography of Innovation 1848–2003*. London: Unwin Hyman, 1988.

2. Hounshell, D. A., *From the American System to Mass Production 1800–1932*. Baltimore: The Johns Hopkins University Press, 1984.

3. ibid., p. 206–207.

4. *St. Botolph* (New York), 3 June 1893.

5. His younger twin sisters were among the first women to attend medical school in the United States, and both went on to become pioneering physicians in Boston, suggesting the presence of a radical streak in the family. Pope described himself as "an independent of the most radical type" (Pope archives: letter to Fred C. Floyd, Boston, 4 December 1893).

6. Adams, G. D., *Collecting and Restoring Antique Bicycles*. Orchard Park, New York: Pedaling History, 1996; Anon., "The Ad Wars," *American Bicyclist and Motorcyclist* (October 1969), p. 82 and 140.

7. *American Bicyclist and Motorcyclist*, October 1969, reports that in 1890, 98.6 per cent of new tyres were solid tyres, in 1891 54.2 per cent were cushion tyres, while in 1894 *89.5* percent were pneumatic.

8. Anon., "How the finest bicycles are made: the manufactory that builds the famous Columbia," *Review of Reviews* (Advertising Supplement) April 1894, 15–20.

9. Wiedman, K., "The Central Park case," *The Wheelmen*, 47 *(1995)*, pp. 11–18.

10. *The Mercantile Financial Times*, 25 June 1892. In Pratt, C. E., "A sketch of American bicycling and its founder," *Outing 18* (1891), 342–349, the cost to Pope is put by at $8,000.

11. Pope, A. A., "Automobiles and good roads," *Munsey's Magazine* (May 1903), pp. 167–170.

12. The League of American Wheelmen, formed in 1880, listed among its founding purposes "the improvement of public roads" (see Nevins, A. and F. E. Hill, Ford: *The Times, the Man, the Company*. New York: Charles Scribner's Sons, 1954, p. 256. Pope helped to: found the *Good Roads Magazine* in 1892; present a monster petition to Congress for federal action to improve roads in 1893; and create the National League for Good Roads in 1892.

13. Maxim, H. P., *Horseless Carriage Days*. New York: Harper and Brothers, 1937.

14. Malone, D., *Dictionary of American Biography*. New York; Charles Scribner's Sons, 1935, Vol. 8, p. 74.

15. Maxim, 1937, op. cit., p. 173.

16. Nevins and Hill *(1954)*, op. cit. p. 321.

17. Taylor, F. W., *The Principles of Scientific Management*. New York: W. Norton and Co., 1911 (reprinted in 1967).

18. Desmond and Moore state that Darwin's ideas on natural selection and niches were influenced by the division of labor he observed at Wedgewood pottery factories. See Desmond, A. and J. Moore, *Darwin*. London: Michael Joseph, 1991.

19. *Review of Reviews* (Advertising Supplement), April 1894, p. 15.

20. ibid. pp. 15–16.

21. Atkinson, J., "Flexibility or fragmentation: the United Kingdom labor market in the eighties," *Labor and Society*, 12(1987), pp. 87–105; Wood, S., "The transformation of work?" in S. Wood (Ed.) *The Transformation of Work?* London: Unwin Hyman, 1989, pp. 1–43.

22. *The Courant* (Hartford), 26 May 1894.

23. The Courant (Hartford), 29 August 1892.

24. *The New York Recorder*, 10 March 1895.

25. *The Scottish Cyclist*, 11 October 1893.

26. *Hardware* (New York City), 25 May 1897.

27. ibid.

28. *The Post* (Hartford, Connecticut), 12 June 1899.

29. Womack, J. P., D. T. Jones and D. Roos, *The Machine that Changed the World: the Story of Lean Production*. New York: Harper, 1990; Harrison, B., Lean and Mean: *The Changing Landscape of Corporate Power in the Age of Flexibility*. New York: Basic Books, 1994.

30. Harrison, A. E., "The competitiveness of the British cycle industry 1890–1914," *Economic History Review*, 2 (1969), pp. 287–303.

31. *Industrial World* (Chicago), 23 September 1897.

32. Drop forging technology involves casting a metal piece, and then milling and machining metal off the forging. Stamping and pressing does not involve these work-intensive methods; the desired piece is stamped out and in several steps pressed into the desired shape.

33. Hounshell, 1984, op. cit. p. 194.

34. *The Times* (Hartford, Connecticut), 2 April 1890. Pope offered $15 for each $10 share, which all the other stockholders accepted.

35. Hounshell, 1984, op. cit., p. 202

36. *The Post* (Hartford, Connecticut), 1 June 1892.

37. The enlarged firm was re-incorporated under the title Pope-Mannesmann Company. Mannesmann was brought in because it held the patent on a new advanced process of seamless tube manufacture. In return Pope obtained exclusive use of the process in the United States. The restructured firm made not

just bicycle tubing, but also a wider range of larger diameter tubes used in steam boilers (*The Hartford Daily*, 13 September 1894).

38. Pope, A. A., "Colonel Pope and the Founding of the U.S. bicycle industry," in R. van der Plas (Ed.), *Cycle History: Proceedings of the Fifth International Cycle History Conference*. San Francisco: Bicycle Books, 1995, pp. 95–98.

39. Pope purchased the Boston office building from his company as a personal real estate investment.

40. Harmond, R., "Progress and flight: an interpretation of the American cycle craze of the 1890s," *Journal of Social History* 5 (1971), pp. 235–257.

41. *The Hartford Courant*, 26 May 1894.

42. *The New York Recorder*, 26 January 1896.

43. Oliver, S. H. and D. H. Berkibile, *Wheels and Wheeling: The Smithsonian Cycle Collection*. Washington, D.C.: Smithsonian Institution Press, 1974.

44. The adoption of stamping and pressing was first done by the Western Wheel Works of Chicago, makers of the Crescent Bicycle, and not by Pope. Hounshell (1984, p. 202) stresses that, as far as production methods go, the New England arms and sewing machine manufacturers who also made bicycles "developed few noteworthy new techniques". Only when Pope bought out the Weed Sewing Machine Company did the rate of innovation in the production process speed up.

45. This important patent was held half by Richardson McKee and Company (makers of baby carriages and children's velocipedes) and half by the Montpelier Manufacturing Company. The story goes that Pope, having checked train timetables, persuaded Richardson McKee to sell him one half of their half share in the patent. This done, he hurried to Boston Station to catch the first train to Montpelier, Vermont, where he persuaded the other patent holders to sell him their part before news of his earlier purchase arrived in the mail the following morning.

46. Anon., "The Columbia chainless bicycle," *Scientific American* 77, October 1897, pp. 277–278.

47. *The Post* (Hartford, Connecticut), 6 June 1899.

48. Pope, 1995, op. cit. p. 95.

49. *The Scottish Cyclist*, 11 October 1893.

50. Smith, R. A., *A Social History of the Bicycle: Its Early Life and Times in America*. New York: American Heritage Press, 1972, p. 18.

51. ibid.

52. *Hardware* (New York City), 25 May 1897.

53. Pope, 1995, op. cit. p. 97. Pope does not report the date of this installation.

54. Womach, J. P., D. T. Jones and D. Roos, *The Machine that Changed the World: the Story of Lean Production*. New York: Harper, 1990, pp. 26–27.

55. Sturmey, H., "Criticisms on 'cycles," *The Wheel World*, Vol. 3(6), Aug 1881, p. 174.

56. Woodworth, J., *American Tool Making and Interchangeable Manufacturing*. New York: N. W. Hedley Publishing Co., 1905.

57. *Cycling* (Philadelphia), 5 January 1894.

58. Jardim, A., *The First Henry Ford: A Study in Personality and Business Leadership*. Cambridge, MA: MIT-Press, 1970, p. 5.

59. See Vant, A., *L'Industrie du Cycle dans la Region Stephanoise*. Lyon: Editions Lyonnaises d'Art et d'Histoire, 1993, and Vant, A. and J. Dupuis, "L'industrie Stephanoise du cycle ou la fin d'un système industriel localisé," *Revue de Geographie du Lyon*, 68(1993), pp. 5–16.

60. Harvey, D., *The Condition of Postmodernity*. Oxford: Blackwell, 1989.

61. Vant, 1993, op. cit. p. 136.

62. *Review of Reviews* (Advertising Supplement), April 1894, p. 15–20.

63. *Publicity* (Boston), April 1892.

64. *The Wheel*, 21 May 1897.

65. *The New York Recorder*, 10 March 1895.

66. *Time and the Hour* (Boston), June issue, 1897.

67. The doll competition was sponsored by *Vogue Magazine*, who reported the results in *Vogue* (New York), 22 April 1897.

68. Pope's address to the annual banquet of the League of American Wheelmen, 31 May 1892.

69. Letter to General Samuel Dalton, 9 February 1894.

70. *The Hartford Times*, 13 July 1895.

71. Petty, R., "Peddling the bicycle and the development of mass marketing," in R. van der Plas (Ed.) *Cycle History: Proceedings of the Fifth International Cycle History Conference*. San Francisco: Bicycle Books, 1995, pp. 107–116.

72. Hounshell, op. cit., p. 203.

73. Berman, M., *All that is Solid Melts into Air: the Experience of Modernity*. Harmondsworth, England: Penguin Books, 1982.

74. Lovering, J., "Fordism's unknown successor: a comment on Scott's theory of flexible accumulation and the re-emergence of regional economies," *International Journal of Urban and Regional Research* 14 (1990), pp. 159–174.

75. See, for example: Williams, K., C. Haslam and J. Williams, "Ford versus 'Fordism': the beginning of mass production?," Work, Employment & Society, 6 (1992), pp. 517–55; Cronon, W., Nature's Metropolis: Chicago and the Great West. New York: W. W. Norton, 1991; and Norcliffe, G., "The regulation of Gerland: from mass production to flexible production in Tony Garnier's 'cité industrielle,' " *International Journal of Urban and Regional Research* 17(1993), pp. 195–212.