ABSTRACT

Title of Document: THE MAINTAINERS OF SAFETY AND EFFICIENCY: THE BROTHERHOOD OF RAILROAD SIGNALMEN, 1900-1940

Robert Charles Williams,
Master of Arts Degree, 2008

Directed By: Associate Professor David Sicilia,
History Department

The Brotherhood of Railroad Signalmen is a little-known technical and political organization that gained power during the opening decades of the twentieth century through the increasingly complex nature of members' work, the vision of its leaders, and their abilities to gather support from other unions and the federal government. This thesis is organized around three themes: first, how the growing complexity of signal systems continually challenged signalmen to broaden signalmen's skills, which, in turn, gave them an advantage in asking for recognition as a skilled craft union; second, how the skills that signalmen employed brought them into conflict with other unions over signal department jobs; and third, how, despite having only between 10,000 and 19,000 members, the organization's leaders learned to negotiate using reason, evidence, and logic to demonstrate the union's importance in the industry as the custodians of public safety and rail traffic efficiency.

THE MAINTAINERS OF SAFETY AND EFFICIENCY:

THE BROTHERHOOD OF RAILROAD SIGNALMEN, 1900-1940

By

Robert Charles Williams

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Arts
2008

Advisory Committee:
Associate Professor David Sicilia, Chair
Professor Robert D. Friedel
Betsy Mendelsohn, Lecturer

Acknowledgements

The Genesis of the thesis came when Stephen Patrick, director of the City of Bowie Museums, showed me two greasy, seventy-five inch levers stacked against the wall of the Huntington Train Station and Bowie Museum. He asked if I could make the levers the focal point of an exhibition on the people and the technology used in keeping trains from crashing into each other. Stunned at both the opportunity and my lack of knowledge about interlocking levers, I quickly agreed to build the exhibit. That was in 2006 when I was searching for place to perform my museum practicum.

Since then, I have had the pleasure of meeting many people who gave their expertise and support in helping me gain enough knowledge to write my thesis on railroad signaling technology and the workers who have made train travel safer than most other forms of transportation. Unlike the early decades of the twentieth century, the public today finds train collisions and accidents to be exceptional rather than the commonplace.

In the History Department at the University of Maryland College Park there are a number people who have helped me discover the pleasure of unearthing historical truths buried both in archival materials and in artifacts. I thank my advisor, David Sicilia for continually pushing me take what I had found and then to crystallize my ideas in words. His suggestions on direction and structure for my thesis, as well as for my career at Maryland were most effective. He and Robert Friedel gave me useful methods for discovering the stories hidden in the past and directed my studies in ways that challenged my abilities and intellect. I would also like to thank other supporters in the history department that includes Thomas Zeller who always had an open door to discuss ideas and directions in my graduate work. Betsy Mendelsohn also was instrumental in listening to my ideas on other thesis topics and I am grateful she joined my thesis committee.

My search to learn about the men who worked to keep the trains on time and from colliding with each other began at Prince George's County Genealogical Library of the Bowie Museums Archives and at the Library of Congress. There I poured over local railroad documents, engineering journals and technical books from the early 1900s. I marveled at the logic and the skill by which the mechanical, civil and electrical engineers of the period set about in trying to prevent the catastrophic accidents that plagued the adolescent railroad industry in the early 1900s.

In my research for the exhibit, I traveled to other museums and archives to gain an understanding of the complex technologies and the workers who operated them. At the urging of Stephen Patrick, I went to the Railroad Museum of Pennsylvania in Strasburg, which has a pristine example of a Pennsylvania Railroad interlocking block tower. I then went to the Hagley Museum, Library and its archives in the Soda House outside Wilmington Delaware. There the archivists were most helpful in opening their collection of documents concerning the Potomac & Baltimore Railroad, a clandestinely owned branch line of the PRR that connected Bowie with the rest of the country at the turn of the twentieth century. At the Soda House and Hagley Library, I found blueprints, company documents, and parts catalogs that gave me the background I needed to understand the predicaments railroads faced and the solutions they formulated.

Around the same time, Historian Mark Aldrich published *Death Rode the Rails, American Railroad Accidents and Safety 1828-1965,* which opened my eyes to both the urgency of some engineers and managers, and negligent apathy of some carriers, in developing technologies and methods for preventing train collisions. While I studied innovations in signaling technology, I keep wondering about the people whose responsibility was to keep train travel safe. I found little about what labor, particularly the signalmen, did in process of making railroad travel safer. Most histories delved into roles of the carriers or the operations employees -- the train crews, tower operators, dispatchers, and managers. Most historians seemed to disregard the non-operations workers, which included the signalmen and signal maintainers, and what they did to make train travel safer.

In the interim, I gained access to the archives at Baltimore & Ohio Railroad Museum in Baltimore. While working as an intern in the Museum Collections Department under Senior Curator Sarah Davis, I was able to pour over their collection of company records, engineering plans, and railroad industry and engineering journals. I would like to thank them for giving me the opportunity to study and photograph their collection while learning about the larger history surrounding the industry.

However, handling artifacts and reading journals is nothing like standing in the B O Tower on the CSX line in West Virginia, watching Tower Operator Larry Lee line up train routes through his train yard. There I meet CSX Signal Maintainer Ed Mac, who would be instrumental in helping to acquire part of the tower’s 1950s Saxby and Farmer Interlocking machine, which I donated to the Bowie Museum.

Both Lee and Mac schooled me on the technologies and the problems operators and signal maintainers faced daily in keeping trains on running safely on time.

At the tower, I decided to find out more about the human side in the art of signaling. I contacted the Grand Lodge of the Brotherhood of Railroad Signalmen (BRS) in Front Royal, VA. There Kelly Haley, BRS Communications Director, introduced me to a number of signalmen and Grand Lodge staff. Over my many visits, they opened up more and more of the history stored in their archive. I would like to thank Dan Prichard, President of the BRS for allowing me access to the archives, and Tim DePaepe, BRS researcher, Walt Burrows, the BRS Secretary-Treasurer, and Haley for putting up with my questions and requests, and for access to the union's papers. There besides the minutes of their conventions and Grand Executive Council meetings, I found personal journals and union histories written my past presidents and officers. In particular, I found several histories written by BRS Presidents Anon Lyon and Wilmot Pettit whose works provided the backbone to my research. Through the BRS, I met retired Long Island Maintainer Tony "Signals" Maniscalio, who met with me on several occasions and kept up a running correspondence with me. He once walked the tracks running through Luray, VA with me as he explained what it was like working on signal systems trackside, dodging commuter trains and freights coming out of New York City. Haley, Mac, and Maniscalio provided tremendous support and interest in my exhibition and thesis.

I was privileged while at the University of Maryland, to undertake my museum studies in conjunction with my graduate work in the history of technology, with four excellent professors in the museum field. It was the spark in Robert

Friedel's eyes when I approached him with my exhibition ideas that let me know I was finally on track. Meetings with Mary Sies provided concise critiques and practical suggestions as I undertook the exhibit design project. In addition, studying the history and philosophies of museum work with curators Barnard Finn and Ellen Roney Hughes at the Smithsonian's National Museum of American History helped me to understand the unique culture of museums where I had worked before attempting graduate school.

Outside the University, I would be remiss if I didn't thank Leaona Kanaskie and Christine Straub whose comments helped make something so technical understandable. Les Lorenz and Clay Kolle also provided their technical skill and strong backs in helping me dismantle and bring back the interlocking machine that will someday be the focal point of the exhibition, *Avoiding Train Disasters* at the Huntingdon Railroad Station and Bowie Museum.

Finally, I will never forget my wife Ivy Yates and my son Henry who gave up weekends and evenings with me so I could finally finish this work. I could have never completed this thesis or finished graduate school without their support and understanding.

Table of Contents

Lists of Figures

Chapter 1: Introduction

"I question whether there is a man here without signal experience [who] can speak on our position five minutes under questioning ... the greatest trouble we have, [is] men not familiar with the duties we perform."[1]

My thesis will examine the rise of the Brotherhood of Railway Signalmen (BRS) from its beginnings as a fraternal organization from 1900 through the 1930s, the period when the union became a small but politically powerful organization among the other railroad labor unions. Their ability to gather support surprised railroad executives and lobbyists, who discounted the BRS's political abilities and size. In 1937, the BRS successfully lobbied Congress for passage of the Signal Inspection Act of 1937. The knowledge they gained from this law spurred them to amend other federal laws, including the Hours of Service Act of 1907, which finally gave them work status as safety-sensitive workers and a 48-hour workweek in 1976. Before that, they could be on call seven days a week, even during their off hours.[2]

A central challenge for the BRS was how to gain recognition as a skilled craft union among the other unions that competed for control over signal department jobs.

[1] Daniel Helt, BRS Grand President, said those people sitting on the Federal boards have little knowledge about what signal work is, as do representatives of Railroad Employees Department of the American Federation of Labor, Minutes of the meeting held with the shop crafts of the Railway Employment Department and the Brotherhood of Railroad Signalmen, Kansas City, July 17, 1919, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box. pp. 169–183.
[2] Hours of Service Act of 1907, amended 1969 and 1976, Title 45 chapter 3, Sec. 16(4), 102 Stat. 635, related to signal system employees' hours of service, See sections 21102, 21104 to 21107, and 21303 of Title 49, Legal Information Institute, US Code Collection http://www.thecre.com/fedlaw/legal12/uscode45-61to64b.htm, Cornell University Law School, 2008; Ian Savage, *The Economics of Railroad Safety*, (Boston, Kluwer, Academic Publishers, 1960), p. 214.

Signalmen argued that they should have a separate union that was based on industrial job descriptions rather than along traditional trade lines because of their unique role as signalmen. They were responsible for efficient train traffic management as well as for the safety of the traveling public, fellow employees, and the railroad's property. Throughout the twentieth century, the members negotiated and fought with other unions, management, and agencies of the federal government to distinguish themselves as separate from the other support employees. They needed to set themselves apart and above the lower-skilled maintenance-of-way laborers, who used brawn and hand tools to replace track and repair roadbeds. By gaining recognition for their union, members could begin to better control their work environments.

The brotherhood's history is the story of a little known technical and political organization that gained its power through the increasingly complex nature of their work, the vision of its leaders, and their success at gathering support from other unions and the federal government. In examining the history of the BRS as it established itself as a skilled craft union and as a political force in improving train traffic efficiencies and safety, I focus on three central themes that run throughout the union's history.

The first theme is how the growing complexity of signal systems continually challenged signalmen to broaden their skills in order for them to keep up with the many technological innovations, which, in turn, gave them an advantage over other support unions in asking for recognition. From its conception in 1901, BRS officers understood that the plethora of innovations in signal technology would continue to make them more and more vital to train traffic management. If they stayed current with the innovations, they would improve their chances of being recognized as skilled craft union. This recognition would help institutionalize their roles in railroad operations. From the late 1800s through the 1940s, signal work and "the art of signaling" was transformed from cleaning the soot off of oil-fired signal lamps and greasing mechanical fittings to diagnosing problems with electronically automated systems that operated signals miles away from central towers.

Related to the first theme, the second theme is how the skills signalmen employed often brought them into conflict with other unions. Their quick adjustment to new technology in signaling frequently frustrated the signalmen's attempts to be recognized. As their field evolved, their skill sets increased, and they were constantly embroiled in jurisdictional controversies over what union controlled signal department jobs. At the same time, top management regarded them as semi-skilled laborers.

The third theme is how the BRS leadership gained support and political leverage from influential groups outside the railroad industry and from the other railroad unions, despite having only 10,000–19,000 members. Because the BRS represented such a small portion of the railroad employees (from about 1.5 million employees before World War I to 500,000 by mid-century), leadership quickly learned to negotiate using self-defined validation, reason, evidence, and logic to demonstrate its importance in the industry as the custodians of public safety and rail traffic efficiency.

This account of the rise of the BRS as a recognized leader in railroad institutions is divided into six chapters. Following the introduction, chapters 2 and 3 discuss the proliferation of innovations in train traffic management, which propelled signalmen from semi-skilled maintenance crews to skilled composite mechanics. If not for the changes in signaling technology, signalmen would have remained part of the mass of semi-skilled laborers in the second tier non-operations unions. In addition, without those innovations, accident rates would have remained high, which probably would have hastened the decline of the railroad industry.

Chapters 4 and 5 examine the many efforts by the BRS to gain recognition, with two events that stand out as milestones in the union's early history: the formation of the BRS in 1901 and the controversial fight for jurisdiction over signal department duties with the International Brotherhood of Electric Workers (IBEW). The latter led to the federal government's recognition of the BRS after World War I and eventually led to a charter affiliation with the American Federation of Labor (AF of L) in 1946.

In conclusion, chapter 6 describes what grew out of these events in the development of a politically perceptive union leadership and an educated, skilled work force. The signalmen would go on to use their newly learned political skills and acquired status to get important safety legislation enacted, secure benefits for their members, and help unite twenty-one railroad unions under the Railroad Labor Executives Association, of which BRS President Anon E. Lyon was a founding member.

At the same time, the railroads—because of the huge fixed costs of maintaining their plants, inadequate federal rate adjustments, and competition from newer forms of transportation—had begun a steady decline from its place as the leading industry of the early 1900s. Economic realities that their employers faced and the many innovations in signaling technology would present recurrent challenges for the BRS to maintain control over their work environments and their role as the maintainers of railway efficiency and safety.

Chapter 2: Signalmen Gain Skilled Craftsmen Status through Technological Innovation

Rapid changes in signaling and traffic management technologies during the first four decades of the twentieth century played a large part in establishing the Brotherhood of Railroad Signalmen (BRS) as a skilled craft union. The increased complexity of the innovations propelled the occupation of signalman and maintainer from semi-skilled laborer to that of a skilled composite mechanic, as classified by the American Association of Railroads (AAR), because they had multiple skills and experience in a number of traditional trades. The union was part of the growing number of industry-based unions as opposed to the more traditional craft-based labor organizations. This rift between industrial and craft-based unions will be discussed in the in chapters 4 and 5 of this story.

BRS members embraced innovations in signaling technology, for it was a means to better job opportunities and job security. By the 1930s, signaling systems were becoming thought of by management as a better investment, as they improved the efficiency of the railroad traffic operations. Improved safety aspects were an added bonus but were not the driving factor in developing and utilizing these automated signaling systems. The signalmen's view of technological innovations as the ticket to BRS becoming a more powerful and efficient union and to increasing their membership is reflected in Acting President Anon Lyon’s Report to the 1930 BRS Convention in Denver:

> The progress made by our organization during the past two years has been steady and substantial. Railway signaling appears to be rapidly gaining the recognition it deserves in the scheme of modern railroading and the

> outlook for future years appears to be bright. The tendency to utilize the different types of signaling apparatus more and more to effect operating economies can only mean that in the future more and more signal department men will be available for membership in the BRS, thus making possible a bigger, more powerful and more efficient Brotherhood....[3]

However, the problem up to the 1920s was the carriers' insistence that they were still semi-skilled laborers. This unfavorable perception was a holdover from the days when signalmen's daily maintenance routines would consist mainly of greasing the many moving parts of mechanical switch and signal changing devices, filling and wiping the soot of the signal lamps, and digging trenches to bury cables.

Historian W. Fred Cottrell seems to follow the views of management by lumping signalmen and maintainers in with the maintenance of way department. However, he did place signalmen and maintainers at the top of this technological and social grouping. The construction of signaling systems usually attracted highly skilled transient workers who were proud of their abilities, skills, and status. Cottrell likened them to "steel erectors." Signalmen were often recruited from this group when they decided to settle down for reasons such as "injury, decreased wanderlust, or marriage."[4]

Another problem was that the complexity of work varied from location to location. Cottrell said that among signalmen, the maintainers at complex terminals were highly trained technicians, while others traveled the lines, replaced defective

---

[3] Report of A. E. Lyon, Assistant to President address to the delegates, *the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, Colorado, bound typescript volume dated Aug. 18-23, 1930, Archives of the Brotherhood of Railroad Signalmen of America, Front Royal, VA, pp. 97-99.

[4] W. Fred Cottrell, *The Railroader*, (New Jersey, Princeton University Press, 1983), pp. 30–33.

parts, and repaired broken parts at central shops. "The day-to-day work of the lineman and signalmen could consist of nothing more complex than splicing a broken line, replacing insulators, or adjusting some sending, repeating or receiving apparatus. On occasion he is called upon for extended effort and a high degree of skill." Generally, they worked in section gangs, filling and cleaning switch lamps, clearing switches, and keeping the systems tuned up. "They are recruited locally and seasonally or imported from major cities only to return to hobohemia during the winter."[5]

Cottrell, like many historians, shares the sentiments of management that signal work was mostly manual labor, though most recognize the dangerous nature of the work. It is true that some signalmen worked on isolated stretches of track and had limited responsibilities. However, signalmen and maintainers who worked in the more complex train yards, multiple track junctions, and terminals had to employ far more skills and perform them quickly and correctly. When a signal or a connection broke down, the maintainers had to be able to draw on a number of skills to diagnose the problem, get the job done quickly, and not hold up traffic. Frequently, while repairing a problem on the tracks, they would have to keep one eye on doing the job correctly and one eye on the horizon, anticipating the next approaching train.

Additionally, all signalmen were required to continually upgrade their skills, study electrical theory, and read about the latest innovations during their off hours. They had to be familiar with all the types of signal systems used by their company. The only way to gain a better work situation was to be ready to respond to changes in

[5] Cottrell, *The Railroader*, p. 50.

the systems or be able to work on a different system when a job opened up. They performed the work of a wide variety of occupations shared with other railroad unions, including the machinists, blacksmiths, electricians, sheet metal workers, pipe fitters, and carpenters.

The BRS would have to demonstrate repeatedly their members' wide variety of necessary skills before the federal labor boards during the many jurisdictional battles that the BRS had with other labor unions. These jurisdictional battles, discussed in the chapters 4 and 5, also highlight the rapid changes in signaling technology.

The BRS formed at a time when the amount of train traffic expanded rapidly due to the rising national economy, which resulted in the highest rate of train collisions and derailments the country had yet to witness. Between 1890 and 1910, freight train miles increased by 70 percent and passenger miles increased by 175 percent. While the fatality rates did not increase, the absolute number did. The total annual fatalities increased by half from 1890 to 1910.[6] At the same time, the power and size of the trains grew and started to overwhelm the infrastructure. The weights of freight trains were exceeding 440 tons by pulling, on average, 28 fully loaded freight cars. Passenger trains had tractive forces exceeding 45,000 pounds and were easily maintaining speeds over 50 mph.[7] Braking distances for these new behemoths were extended, and the railroads required complex signaling systems that could be operated from longer distances. As a result, innovations in signaling technology were

---

[6] Ian Savage, *The Economics of Railroad Safety,* p. 23.
[7]Dale Berry Michigan's Internet Railroad History Museum, http://www.michiganrailroads.com/RRHX/Railroads/MichiganCentral/MichiganCentralHomePage.htm,

Figure 1 A train in a rear-end collision with another near a station in Indiana, 1877.
Photograph courtesy of the *Farwell T. Brown Photographic Archive, Ames Public Library, Ames, Indiana.*

brought into the marketplace to improve train traffic management and to reduce human agency as much as possible in directing traffic. The Interstate Commerce Commission (ICC) promoted these systems as technological fixes that would override the problems of relying on human judgment. Human error was blamed in the majority of the more than 39,000 accidents reported between 1902 and 1907.[8] "In 1907—[the] peak year—the fatality rate was 110 times greater than that of modern airlines," wrote Aldrich. That year the railroads were the largest single cause of violent death.[9] The fiery crashes reported in the newspapers shocked the American public, which spurred the federal government to threaten carriers with safety regulations if they did not improve their safety records.

---

[8] Mark Aldrich, *Death Rode the Rails, American Railroad Accidents and Safety 1828-1965,* (Baltimore, The Johns Hopkins University Press, 2006), Appendix 1, A1.7, p. 319. Appendix 2, A2.1, p. 333; Hanson Boyden, "The Block System, what it is and why it failed last Sunday – How it can absolutely prevent disastrous collisions," *Washington Post*, (Jan. 6, 1907): p. F1

[9] Aldrich, *Death Rode the Rail,* pp. 2–3, Appendix 2, p. 332.

From 1900 onward, innovations the signalmen were required to install and repair came quickly as the public demanded safer train travel and shippers wanted reliable service. Semaphore and oil lantern light signals called Banjo signals—once operated by a operator pulling a chain hanging down from the signal itself during the last half of the nineteenth century—was replaced by semaphore-bladed signals in the late 1800s and then by electric position light signals starting around 1910.[10] At the same time, tower operators changed signals and switches, called turnouts, as far as 800 feet away from second story tower by way of pipes and rods connected to a mechanical interlocking machine. Within the interlocking machine, the pipes were attached to levers over seventy inches long; the leverage needed to move the 1-inch-in-diameter connecting pipes, signals, and switches so far away from the tower. With this machine, one operator could change many signal indications and turnouts in busy train yards, junctions, and terminals. Within the first two decades of the twentieth century, electronic, electromechanical, and pneumatic interlocking machines were making the operator's job easier because the electric motors or pneumatic or hydraulic pumps moved the heavy rail turnouts and distant signals when the tower operator pulled the interlocking lever.

[10] H. Roger Grant, *The Railroad, The life Story of a Technology,* (London, Greenwood Technologies, 1943), 98–99.

By 1920, signalmen were working on automated signal systems, which were seen as the way to decrease accidents, decrease labor costs, and improve the efficiency of rail traffic by putting more trains on the tracks during any given time period. While Automatic Train Stop (ATS) and Automatic Train Control (ATC) were seen by critics, including the BRS, as merely technological fixes to the problem of poor discipline, poor maintenance, and even poorer procedural methods, federal administrators saw automated systems as the immediate answer to the growing number of collisions and derailments. The ICC and Congress promulgated regulations that forced forty-nine Class I carriers to install ATC on some of their high-speed passenger lines. ATC or Automatic train stop devices could either shut off the train's engine or apply the train's brakes if the engineer failed to stop for a red light signal.

Figure 2 Built in 1911 by the B & O Railroad, the "B O" Tower in Hancock, WV, was replaced after St. Patrick's Day Flood, March 17, 1936. Photo by Robert Williams, Sept. 9, 2006

Nevertheless, technical problems with ATC and its expense led carriers to invest also in cab signals, which as the name suggests were signals installed inside the train cab. Cab signals gave signal light indications and warning bells that made it hard for the engineman to miss, even in inclement weather. Carriers also started to invest by the 1930s in Centralized Train Control (CTC), which greatly reduced the labor costs associated with stationing tower operators as close as two miles apart in heavily congested junctions and train yards.

Figure 3 Lead out pipes were used to control signals and switches as much as 800 feet away from both sides of the tower. B O Tower, Hancock, WV, Photo by Robert Williams, Sept. 9, 2006

With CTC, a dispatcher in a central office could direct trains many miles away by using electric powered signals to tell enginemen where to go and what speeds they were to adhere to. The dispatcher could tell from his office on a lighted diagram of his assigned block of tracks the location of each train at any time. Not only was CTC more economical and increased the carrying load of a given line, it quickly proved it could decrease the chances for train collisions, especially when two or more trains were sharing the same track and going in different directions. Though the changeover on many lines to CTC was stifled during the Great Depression, the jump in traffic volume during World War II and the stricter enforcement of signal inspections, as required by the Signal Inspection Act of 1937, gave the carriers the impetus needed to upgrade more lines to CTC. Nevertheless, the primary decision to install CTC was driven by the economical gains of decreased labor and maintenance costs.[11] With this financial incentive came a side benefit—CTC proved to provide increased margins of safety.

All signal systems were touted by the carriers to the public as having failsafe qualities to assure that when a problem occurred, such as a power failure, the signal would fall to its default "stop" indication. However, every signalman knew that false-positive signal failures could be expected, which meant the signal would show a "clear – proceed" indication on a section of track that was already occupied. The consequences of a false-positive indication could result in a tragic rear-end or frontal collision with another train. No matter how failsafe a technology was designed, if it was not installed or maintained properly, it could be more dangerous when it was broken, as people tend to trust the technology to safeguard their lives and property, and be less wary of the consequences of it failing.

In order to show the growing complexity of the signalmen's work situations and to understand their role in keeping trains running safely and efficiently, knowledge of the rapid changes in signaling technology and the procedures will help clarify the signalmen's predicament.[12]

---

[11] "W.J. Patterson, *Railway Age* 127, (Sept. 24, 1949): pp. 50-52; *Railway Age* 126, "Signaling Construction," (Jan. 8, 1949): p. 80.

[12] Throughout the twentieth century, signalmen and maintainers worked on many other signaling, highway-crossing, traffic-control, and train-sorting devices not explained in this thesis. These basic systems and the innovations that derived from these systems are used as examples of the types of work that raised their skill levels.

Signal Systems Explained

Up through the 1930s, there were four essential elements in all signaling systems: (1) the interlocking machine that was used for switching signals and switches from a central tower; (2) the block system, which was used for keeping trains safely spaced; (3) the signals, switches, detectors, compensators and all of the individual appliances that when connected completed the system; and (4) the most important element, the electric track circuit, where each section of track was made an electric circuit by running electricity through the rails attached to relays that controlled the signals. Whenever a rail broke or a train or any heavy metal object touched and bridged the two track rails, the circuit shunted, or shorted out, and the signal would fall to its default stop position. The signal would indicate to approaching trains that there was an obstruction or another train on the tracks ahead.

Starting with the machines that tower operators used to manage train traffic, each of the four elements in the art of signaling will be examined, followed by more advanced signaling technologies that evolved from these elemental technologies. In each new technology, even today, the four basic elements are present. All new technologies are just improvements on the basic systems. Today, through the use of solid state electronics, digital computer systems, and fiber optics, these elemental technologies perform the same functions; they are just packaged in smaller boxes, said Ed Mac, CSX maintainer on the West Virginia line near Hancock, WV. With the new systems, the number of dispatchers who direct train movements from a central location is greatly reduced. For instance, dispatchers in Jacksonville, Florida, govern and coordinate all CSX train movements and grade crossings for the eastern seaboard as far north as Maine and into Canada, and as far west as Illinois.[13]

The Interlocking Machine

As railroad systems grew and became more complex, signalmen had to be able to repair and maintain the mechanical interlocking machines, which were developed to help dispatchers and operators direct train traffic through increasingly congested junctions, train yards, and long stretches of track. The interlocking machine, invented in 1856 by John Saxby, an English engineer, is still in use in nearly its original form in the twenty-first century. Modern railroad workers call the interlocking an "early mechanical computer" for its ability to keep operators from throwing the wrong switches, potentially running trains into each other. In this sense, the machine has a number of failsafe qualities. Yet from the 1850s through to the 1920s, the federal government and engineers set out to develop automatic signal and train controls that they hoped would reduce the need for human judgment in train traffic management. Despite improvements, modern electronic systems and centralized train control (CTC) still incorporate the basic interlocking technology invented by Saxby.

At the heart of the mechanical interlocking machine was the "locking bed," which was a mechanism that prevented other switches and signals from being changed. The locking was done by physically blocking the other levers that would misdirect trains, potentially causing derailments or collisions. The device was nearly

[13] CSX is reconsidering having all the train operations governed from one location in light of the possibility of a terrorist attack that would take out this command center for the Eastern Seaboard. Officials are considering going back to regional dispatch centers that would be linked together, Ed Mac, CSX Maintainer, West Virginia, phone interview with author, March 18, 2008.

foolproof. When an operator completed the throw of a lever, he unlocked other levers that he could move in sequence, thus setting up a route to direct a train through his section of the line. The levers of the machine were seventy-five inches long to give the necessary mechanical advantage to move a series of "lead out pipes," which led to the track switches and signals as far as 800 feet away from the operator. When he had completed the sequence of lever changes and the train had entered his section (called a block), the operator could not change the direction of the switch or signal until the train had run safely through that section of track and switching devices. Detector bars installed on the track mechanically prevented the operator from reversing the levers too early by mechanically blocking the other levers in the interlocking machine. As long as the train wheels kept rolling over the detector bar, the operator could not reverse the throw of the interlocking lever. In this way, the levers are interlocked, giving the machine failsafe characteristics. As improvements of this basic failsafe technology were developed, interlocking machines were joined together in a larger controlled block system, also called the interlocking block tower system, which would become the basis for all future innovations in train traffic management. [14]

---

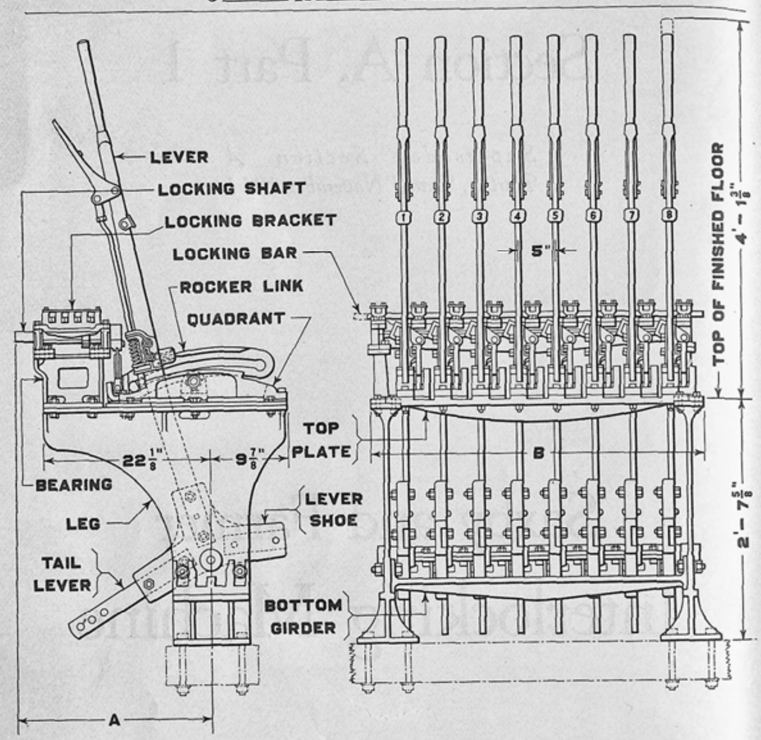
[14] W. L. Derr, *Block Signal Operation*, (New York, D. Van Nostrand Company, 1897), p. 57; Mac, described the interlocking bed as a "early mechanical computer, in an interview; however, he did not coin the phrase, Sept. 26, 2007; Ray R. Rockwell, *Railroad Track Circuits and Interlocking*, (Scranton, PA, International Textbook Company, 1933), p. 32-38; Frederick C. Lavarack, *Locking; Being an elementary treatise on the mechanisms in interlocking lever machines by which the movements of the levers are restricted to certain predetermined ways, rendering it impossible to operate conflicting switches and signals on railways,* (East Orange, New Jersey, self-published - F.C. Lavarack, 1907), p. 8; General Railway Signal Co., *Catalogue of Mechanical Interlocking Signaling Devices made by the GRS Co.* (Buffalo, NY, 1905), p. 350.

Yet with all the miles of track, connecting pipes, and signal appliances coupled with exposure to all types of environmental conditions, including waste and chemicals from the trains, something always needed attention. For this reason, signalmen and maintainers were stationed at terminals or on a section of track, called a territory. Their responsibility was to keep the interlocking and all its mechanisms greased and operational. Among the many problems these early systems could have, a bent lead-out pipe or a stone caught in the switches, that prevented the completion of the connection could cause the train to derail or send it into the path of another.

Figure 4 Mechanical Interlocking for a terminal or large train yard located on the second floor of the Interlocking Tower at the Railroad Museum of Pennsylvania, Strasberg, PA. Photo by Robert Williams, June, 2007.

PLATE A0101

General Railway Signal Company June 1915



Principal Dimensions

Number of Levers	Dimension A	Dimension B	Number of Levers	Dimension A	Dimension B
4	2′– 1 13/16″	2′–0″	56	5′–10 9/16″	23′–8″
8	2′– 1 13/16″	3′–8″	60	6′– 2 1/16″	25′–4″
12	2′– 5 5/16″	5′–4″	64	6′– 5 9/16″	27′–0″
16	2′– 8 13/16″	7′–0″	68	7′– 0 9/16″	28′–8″
20	3′– 0 5/16″	8′–8″	72	7′– 0 9/16″	30′–4″
24	3′– 3 13/16″	10′–4″	76	7′– 7 9/16″	32′–0″
28	3′– 7 5/16″	12′–0″	80	7′– 7 9/16″	33′–8″
32	3′–10 13/16″	13′–8″	84	9′– 0 5/16″	35′–4″
36	4′– 2 5/16″	15′–4″	88	9′– 0 5/16″	37′–0″
40	4′– 5 13/16″	17′–0″	92	9′– 0 5/16″	38′–8″
44	5′– 3 9/16″	18′–8″	96	9′– 0 5/16″	40′–4″
48	5′– 3 9/16″	20′–4″	100	10′– 9 5/16″	42′–0″
52	5′–10 9/16″	22′–0″			

Saxby and Farmer Interlocking Machine Arranged for Vertical Leadout

Figure 5 Diagram and list of available number of levers for a Saxby & Farmer Interlocking. The length of the Tower was decided by the number of levers in the interlocking. General Railrway Signal Catalog, *Mechanical Interlocking Appliances*, June 1915, Plate A0101.

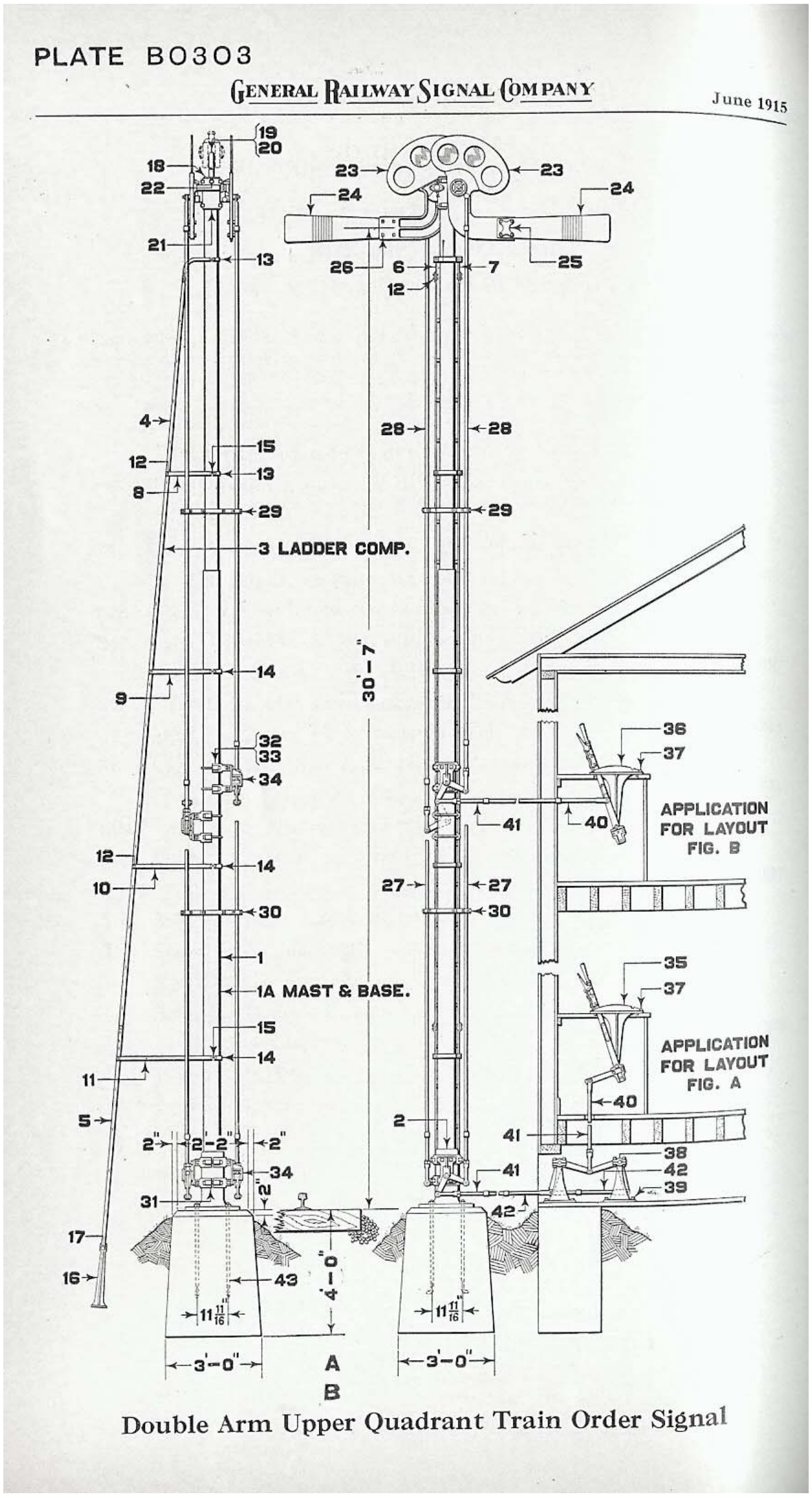


Figure 1 A mechanical interlocking connected by lead out pipe to a train order signal, with front and side view of signal. General Railrway Signal Catalog, *Mechanical Interlocking Appliances*, June 1915, Plate B0303.

The Block System: Methods for Spacing Trains

To accommodate a growing number of trains in the mid 1800s, while maintaining train safety, railroads introduced the train schedule, which allowed more than one train to run on the same track. Also called the time interval method for spacing trains, the train schedule gave some trains definitive rights over others that had to be respected by all trains and their crews. The problem was that the train schedule was not flexible. The spacing of the trains based on time proved inadequate because with trains leaving a station every five minutes, there was no way to keep the trains spaced five minutes apart or running at the exact same speed to keep them properly spaced. Many variables such as weather, geography, track conditions, and differences in the trains themselves made time interval spacing impractical. Keeping a steam locomotive, much less all of the locomotives running at any given time, at the same speed was next to impossible. In addition, trains became more numerous and the length of runs became longer, exacerbating the problem. [15]

An English electrical engineer and businessman named William Fothergill Cooke devised the first block system in the 1839 as a more practical and safer method for spacing trains. His reasoning given in 1842 was that:

> Every point of a line is a dangerous point, which ought to be covered by signals. The whole distance, consequently, ought to be divided into sections and at the end as well as the beginning of them, there ought to

[15] Sedgwick N. Wright, *Centralized Traffic Control, Bulletin 154,* (General Railway Signal Company, Rochester, NY, Aug. 1927), p. 9; W. J. Patterson, Director of the Bureau of Safety, Interstate Commerce Commission, Address to the Delegates of *the Twenty-Eighth Regular Convention of the BRSA*, Jacksonville, FL, Aug. 21, 1946, Original typewritten document by Patterson, dated Aug. 21, 1946, p. 2, *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

> be a signal by which means of which the entrance to the section is opened to each train when it is free.[16]

Cooke divided the track into two- to two-and-a-half mile sections he called blocks with a “linekeeper” stationed in a signal hut. Each hut had two telegraph keys. The right hand key was connected to the hut that governed the next block to linekeeper’s right and the left key was connected to the hut that governed the block to the linekeeper’s left. The keys used magnetic needles that could only display two messages: “line clear” and “line blocked.” Using a semaphore signal or turning disk, the linekeeper could signal the engineman to stop if his block was occupied. This was called the space interval method, and as the section of track is a fixed geographical location, space interval is a progressive system that prevents trains from running any farther than the length of the blocks as no two trains could occupy any given block. The problem with the English block system, however, was that trains could enter a block unless a flagman waved for it to stop.[17]

Claiming he knew nothing about the English block system, an American civil engineer, Ashbel Welsh (1809–1882), developed “the manual block system” used in America. Welsh’s system was inherently safer and offered greater protection in preventing train collision. Welsh’s block system was different from the English block system in that under the American system, trains could not enter a block unless the engineman had orders to do so. Welsh’s manual block system is different because it required an affirmative order for the train to enter the block instead of the

---

[16] Brignano, Mary, and Hax McCullough. *The Search for Safety: a History of Railroad Signals and the People Who Made Them*. Commissioned by the Union Switch & Signal Division, American Standard, 1981, pp. 55—56.
[17] Ibid, p. 58.

assumption that the block of track was already clear unless flagged by a signalman, as in the English system. Welsh placed “offices,” manned 24-hours-a-day, about six miles apart, each connected to the next by an independent telegraph wire connected to both a receiving and transmitting key.[18] The operator would need permission from the next down the line before he could let the train enter the next block. “The thing should be presumed to be wrong until the engineman has affirmative evidence that it is right,” Welch explained, “that is to say … Safety Signals should be used, and never danger signals.”[19]

The early block systems in the late 1800s divided railroads into sections that ranged from one mile in length in heavily congested areas to three miles apart in more open country. The operator was responsible for the movement of trains through his block and used the interlocking machine to control the track switches and signals. Operators connected by telegraph to adjacent tower operators and to a central dispatcher communicated with each other under a set of rules that became more complex as the system matured.

The basic premise of the block system was that no train could enter a block as long as another train occupied it. The tower operators, upon orders from the central dispatcher, regulated train movements by using different types of semaphore signals to alert the engineman to “stop,” to proceed with “caution,” or to signify the block was “clear – proceed.” When a train entered the block, the first operator signaled the second operator that the first block was occupied. The second operator would hold

---

[18] Ibid, p. 59.
[19] Ashbel Welch, “Report to the committee on Safety Signals, Presented to the General Railroad Convention,” held at the St. Nicholas Hotel, New York, Oct. 24, 1866, republished in *The Signal Engineer* 1, (May 1909), p. 512; Steven Usselman, *Regulating Railroad Innovation, Business, Technology, and Politics, 1840–1920*, (England, Cambridge University Press, 2002), p. 86.

trains in his block from entering into the first operator's block. A central dispatcher decided what train should have the right of way based on a complicated system where certain types of trains had superior rights over other trains. Typically, the faster passenger trains had superior rights over the slower freights. The prevention of trains from entering any block that was not clear is called the "absolute block system." Trains could come from either direction on a single track; therefore, operators would have to clear their blocks by sending trains of lesser superiority on to sidings.[20] To make the operator's job harder, unscheduled excursion trains carrying dignitaries or vacationers were sometimes thrown into the mix and were often the cause of collisions.

Variations of this fundamental method of dividing roads into blocks for protection are still in use today. Only the technology that signals whether the block is clear or protected, the methods for switching the track and signal appliances, and the rules that govern the system have become more sophisticated. These innovations came about because the railroads, the first national corporations, extended in large networks all over the nation. Coordinating traffic and developing methods for safeguarding train travel while trying to run as many trains on line at any given time (increasing the carrying load or carrying capacity of a section of track) required new technologies and procedures to be developed as the needs arose. Procedural innovations, new rules, and improved methods of maintenance were part of the

---

[20] Brignano and McCullough, *The Search for Safety*. 58–60; Edmund J. Phillips, Jr., *Railroad Operation and Railway Signaling, A Handbook of illustrated questions and answers of the who, what and why of railway signaling and train operations*, (New York, Simmons-Boardman Publishing Corporation, 1942), pp. 5, 43; Patterson, Address to the Delegates, p. 2.

experiential learning that was taking place on the part of both management and the signalmen over the first three decades of the twentieth century.

When the railroads moved from mechanically operated signal systems to electronically operated systems, and introduced telegraph and later telephone communications by 1914, signal department employees began to be responsible for learning electrical theory and its applications.

Railroads employing the space interval method could further control train movements using the Morse Telegraphic Train Dispatching System, which made it possible for a central dispatcher to change or nullify parts or the entire schedule by train orders. Train orders were essentially telegrams on prescribed forms that were delivered to each train affected by the changes. The tower operator handed up the train order—sent to all affected block sections by the dispatcher—tied to a string in a hoop attached to a long pole to the engineman. As the train passed his tower, the engineman stuck his arm through the hoop and the loop of string with the message would lasso his arm and break free of the hoop. The engineman knew to expect the train order when the operator activated a train order signal near the tower. The order gave information on changes made by the dispatcher (who in the case of the Pennsylvania Railroad (PRR) was in Philadelphia), track and weather conditions, speed limits for that block and the next, and whether something was blocking the track. However, having to slow or stop to receive train orders limited the carrying capacity and lowered the line's efficiency, which led the way to more complicated train traffic management. Railroads "employed the principle of rights by class and rights by direction to lessen the work of the dispatcher by enabling the train crews to dispatch themselves to a greater extent."[21] There was, however, still the problem of either enginemen failing to stop for home signals at the ends of the block, accidentally or on purpose, or passing stations without picking up train orders.

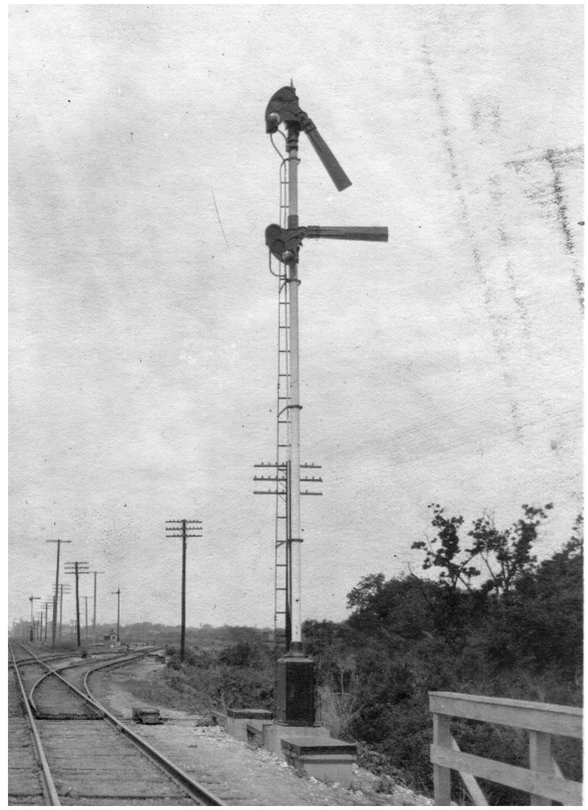


Figure 7 A set of semaphore signals, possibly giving indications for an approach to the next block or to a station block, interpretation dependent on the carrier's instruction manual. File photo, Archive of the Brotherhood of Railroad Signalmen, no date or location.

These procedures and rules over which trains had superior rights were part of the development of more complicated traffic systems that would handle the more mundane decisions for the dispatcher, freeing him up to plan more efficient routing of trains, increasing the carrying capacity of the line, and limiting the number of decisions, which could result in train traffic accidents.

Early manual block systems were safety oriented rather than a method for increasing the carrying capacity of a line because there were only signals at the beginning of each block and train order signals. The limitations of these block systems in the early 1900s meant trains frequently were required to stop or proceed with caution (under 15 miles an hour) because the signals did not provide information about the next block beyond that one

[21]Wright, *Centralized Traffic Control, p.* 9; Steven Usselman, *Regulating Railroad Innovation*, p. 125; Patterson, Address to the Delegates, 1946, p. 2-4.

the train was entering. Trains could go only as fast as they could safely respond to the next signal they approached or to situations that they could see down the tracks. In addition, the length of the train was limited to the length of the block. To make matters more complicated, trains could bunch up, and enginemen sometimes did not stop for signals or ignored the train orders. The system was dependant on the enginemen following directions. [22]

With the introduction of home and distant signals, trains could run closer together, and the railroads installed these types of signals more for increasing track capacity than for safety. The home signal governed the action of the engineman as his train entered the block. The distant signal set hundreds of feet up the track—the distance based on complicated tables of braking distances that were always under revision as train speeds and weights increased—forewarned the engineman of the position of the next home signal so he could prepare to stop, proceed with caution, or maintain speed through the home signal. Most railroads employed semaphore blade signals for their home signal and distant signals by the end of the nineteenth century, though there were many variations, markings, and sizes. The semaphore is a position signal and does not rely on colors to indicate how the engineman should govern his train speeds. On the PRR, the semaphore blade had three positions: horizontal for "stop," set at a 45 degree angle for "caution," and vertical for "all clear – proceed."[23]

The biggest problem was making trackside semaphore signals visible to the engine crew in all types of weather at all times. During the late nineteenth and early

[22] Phillips, *Railroad Operations, p. 88;* Brignano and McCullough, *The Search for Safety*, pp. 59–60.
[23] James Latimer, "Railway Signaling," *The Signal Engineer* 1, (Feb. 1909): p. 344.

twentieth centuries, railroads experimented first with oil burning signal lanterns with colored lenses that moved in unison with the semaphore blades to make them more visible at night. Engineers also experimented with different blade shapes and markings to make the blades more visible. By 1910, the efforts shifted as the science of optics provided innovations in lens manufacturing that could amplify electric light sources. Electric position light signals began to replace semaphore blade signals as colored light signals could be seen as far away as 1,000 feet even in daylight. Engineers decided to use colored tinted lenses after accidents were caused by enginemen mistaking the lights of nearby vehicles or houses for the white lights initially used on trackside signals. The PRR was the first to use electric position light signals with the Baltimore & Ohio Railroad quickly following suit.[24]

To further increase carrying capacity, or the number of trains a line could safely handle in a day, American railroads frequently went to "permissive blocking," which allowed a freight train to enter a block already occupied by another freight train. Under this system, trains had to proceed with caution or "under control" at speeds of fifteen miles per hour in order to stop in time for a train on the tracks ahead.[25] Keeping the train moving reduced its inertia, which meant less wear and tear on the track and the train as well as decreasing fuel consumption by not having to start up again from a dead stop.

However, critics argued that allowing an engineman to disregard a stop signal left the rule open to confusion and left the enginemen to their own interpretations of the rules. This type of ambiguity was sometimes the cause of collisions or

[24] Grant, *The Railroad, The life Story of a Technology,* pp. 98-99.
[25] Edmund J. Phillips, Jr., *Railroad Operation,* p.43; Brignano and McCullough, *The Search for Safety*, p. 61.

derailments. Railroads and the courts frequently left operators, signalmen, and enginemen carrying the blame for many of the accidents that did not involve track failure. In addition, carriers often gave conflicting orders; they demanded enginemen follow the rules while at the same time they pushed enginemen to break rules to stay on schedule.[26] It would not be long, however, before railroads developed procedures that made permissive blocking safer, and this method became commonplace in the 1930s with the use of automated signal systems.

More complicated three- and four-indication (called aspect) blocking systems were employed in the 1920s and '30s, by which enginemen running their trains by signal indication alone could follow preceding trains more closely. The signals for the next three or four blocks would be coordinated as one train followed another. Train traffic flow increased and longer trains could move through consecutive blocks faster with fewer delays. Nonetheless, to

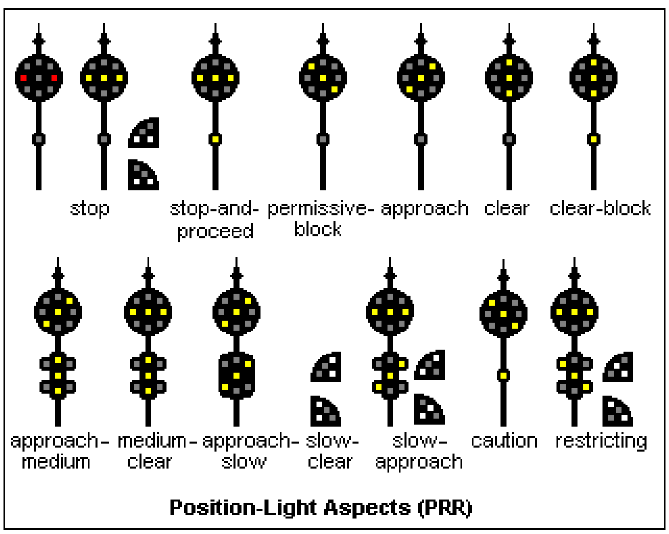


Figure 8 Position-light Signal Aspects (indications). This type of signal increases the amount of information given to a train crew. It is used with Automatic Signal Systems. J.B. Calvert, "Position Light Aspects (PRR)," *Early Railroad Signals,* 2004.

[26] Usselman, *Regulating Railroad Innovation*, p. 125, The doctrine of assumed risk used by the courts made employees responsible for accidents even when under carrier's guidance, if the employee knowingly understood the risks involved. The fellow servant rule absolved employers of culpability for accidental injury of one employee by another. Steven Usselman, *Regulating Railroad Innovation*, p. 291; Mark Aldrich, *Death Rode the Rails*, p. 187.

join the blocks together required automated signal systems and the invention of the electric track circuit.[27]

Track Circuits Pave the Way for Automatic Signal and Train Control

Probably the greatest innovation in train traffic management that signalmen had to understand was the closed electrical track circuit invented by teacher, inventor, and promoter William Robinson (1840–1921). Electric current ran through the rails with relays at each end of a block. When the train wheels entered the block, the metal wheel-axle-wheel assembly would bridge the two electrified rails and short out the circuit. Power to the relay at the end of the block would drop, which would drop the semaphore signal to its default stop position. In addition, using Robinson's closed circuit system, patented in 1872, the circuit would short out, or open when there was track or battery failure, or when a part of the previous train or debris was left on the tracks. The semaphore signal returned to the vertical or "all clear" position when the train exited the block or the debris was cleared, and the flow of current resumed. "This gave them a failsafe quality," noted historian Steven Usselman.[28] In addition to adding another layer of protection against collisions, the innovation had the effect of monitoring track conditions beyond the sight of the tower operator.

Electric track circuitry paved the way for controlled manual blocking where the signals of consecutive blocks could be controlled. Train movements through these blocks were governed by the cooperation of adjacent tower operators. Interlocking machines in adjacent towers could now be linked together and controlled electronically. One operator was required to ask permission of another before

---

[27] Brian Solomon, *Railroad Signaling*, (St. Paul, Minnesota, MBI Publishing, 2003), pp. 103–05.
[28] Usselman, *Regulating Railroad Innovation*, p. 129–130.

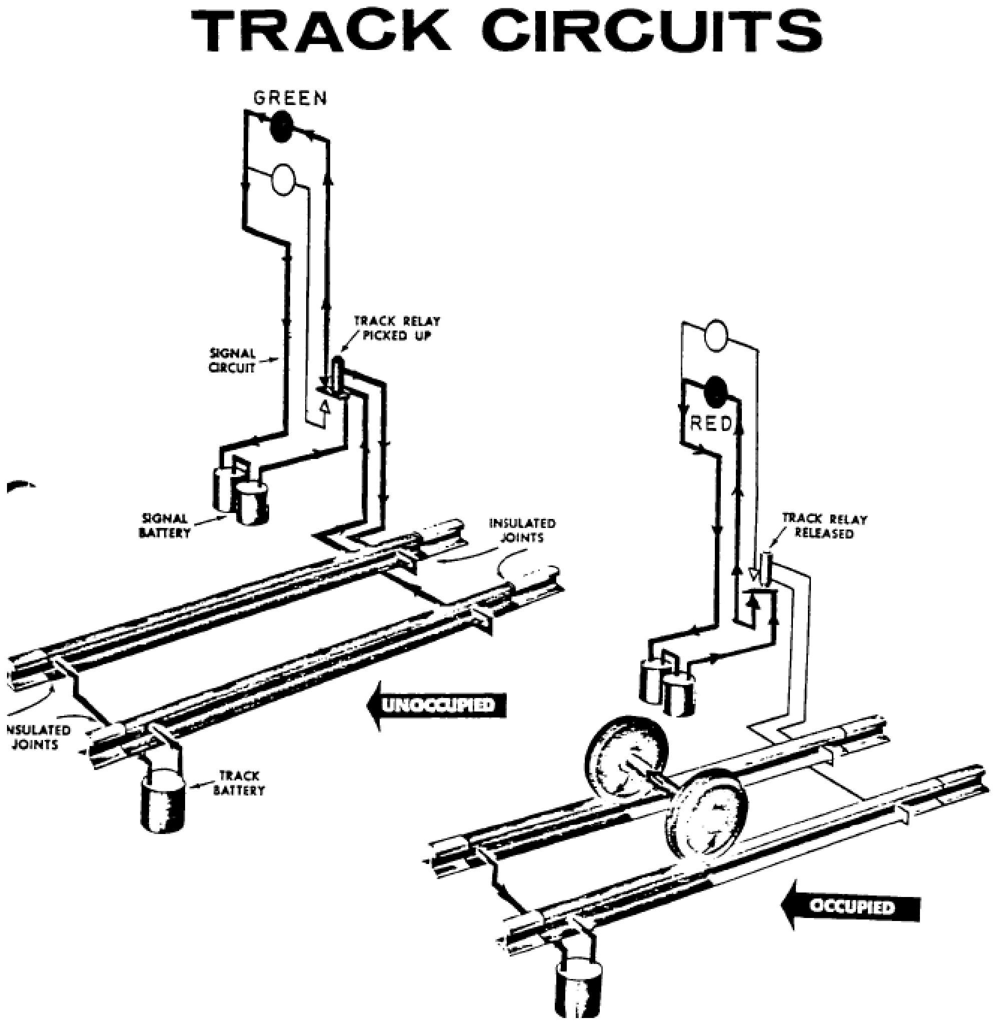


Figure 9 The locomotive’s wheels and axle assembly shorted out the track circuit, which shut off power to the delay, changing the signal to the stop position. Diagram from Canadian National Railways, *CN Signal Training*, 1979, p. 248.

allowing a train to pass through his block. In addition, no other train could come from an opposing direction unless authorized by the next operator down the line. In each train movement one tower operator could restrict a train from entering his block by electronically blocking the interlocking of the previous tower operator. The closed electric track circuit provided yet another layer of failsafe protection. This system took the place of train orders (in normal operations) and superseded the authority of time schedules. As more systems relied on electric track circuits, automatic signal systems and automatic train control systems were developed that would forego the need for tower operators. Covering miles of track, a dispatcher could both monitor and control signals and the movement of trains from a central location.[29]

The Prohibitive Costs of Installing Interlocking Block Tower Systems

In upgrading such far-reaching networks of tracks, railroads balked at the costs of constructing, maintaining, and staffing an interlocking block tower system. When railroads were coerced by the ICC into installing them during the first two decades of the twentieth century, the automatic signaling systems and train controls began to look more attractive. The cost for a two-story signalman's cabin was around $500 in 1901. The addition of manually controlled electric or pneumatic semaphores added between $65 and $85 to the installation cost per tower. [30]

In 1900, the operating costs estimated by the ICC were $200 a mile for towers stationed three miles apart. However, if carriers chose manual signal towers, the operating costs in 1901 were significantly higher (electric systems had fewer moving parts and with electric systems one operator could control a larger plant). Railroads paid $100 a month to operate a manual signal tower 24 hours a day, of which labor was a major portion of the cost. Operators who did not handle switches worked twelve hours a day, seven days a week and were paid by the PRR $45 to $55 monthly. Where the work was more complex and operators used interlocking

[29] Edmund Phillips, *Railroad Operation*, p. 96.
[30]F. D. Chase, "Signal Tower for Saxby & Farmer Machines," *The Signal Engineer* 2, (Aug. 1909): pp. 82–84.

machines, the pay was $50 to $70 a month for working an eight-hour day, seven days a week. If switchmen, who moved and switched cars in the train yards, were employed at the station, the costs went up, because switchmen were paid 20 percent more than the operators were.[31]

The ICC commissioners estimated the annual cost for labor and maintenance for each manual tower at $1,200 to $1,500. According to Steven Usselman, a hypothetical installation of a tower every three miles would bring annual costs to between $400 and $500 a mile. When the PRR had to install them two miles apart along the busier sections, the cost went up to between $600 and $750 mile. The ICC commissions saw the block to be a very expensive system and looked to other technologies to bring costs down.[32] The cost of tower, plant maintenance, and labor coupled with the problems carriers had in maintaining a disciplined workforce of signalmen and operators prompted carriers to try to find ways to remove human agency from the block system.

Not until after 1910--when the Safety First Campaigns coupled with the layers of failsafe traffic devices, and rule changes covering more and more types of emergencies--did the railroads start to move toward improving worker attitudes toward safety. In addition, now that the courts held carriers liable for unsafe conditions, the carriers started to take safety issues more seriously. Other safety technologies demanded by the ICC through the veiled threat of increased regulation and through increased powers given under the Safety Appliance Act of 1897 included

---

[31]Braman Adams, *The Block System of Signaling on American Railroads, the Methods and Appliances Used in Manual and Block Signaling, also descriptions of hand-operated and power-operated interlocking machines,* (New York, The Railroad Gazette, 1901), pp. 23-24.
[32] Steven Usselman, *Regulating Railroad Innovation*, p. 303.

air brakes, steel-framed cars, and automatic couplers. These changes improved the public's perception and increased their confidence in the railroads. Also contributing to the public's confidence was a decrease in accidents. In addition, increased control over the behavior of employees through better organization, management, surprise inspections, and improved physical examinations (that included tests for color blindness) helped decrease human error, the single leading cause of railroad collisions. As the safety technology and management improved, railroads saw benefits in higher profits and more production. In addition, as innovations were proven successful and became industry standards, the new devices dropped in price. However, the ICC, during the first few decades of the twentieth century, should be credited for continually trying to educate and persuade reluctant carriers to improve their safety methods.[33] However, persuasion did not work on the carriers, many of which had managers who refused to spend money to improve safety measures unless the status quo situation was definitively proved not to be working. Action in this pursuit of safety would hinge not so much on human altruism but on whether the safety technology would improve production.[34]

---

[33] Mark Aldrich, *Death Rode the Rails*, p. 305.
[34] Usselman, *Regulating Railroad Innovation*, pp. 1–12; General Railway Signal Co., pp. 5—9.

Chapter 3: The Efforts to Remove Human Agency from Train Traffic Management

In the opening decades of the twentieth century, the Interstate Commerce Commission (ICC) and Congress saw automatic signal and train control technology as the way to reduce human judgment in train traffic management. Basing its actions partly on Braman Adam's *The Block System* (1901), which highlighted innovations on the technically progressive Pennsylvania Railroad, the ICC found situations in which the use of power interlocking plants would result in improving operational efficiency and lead to greater economies and savings on labor costs.[35] In an effort to find technologies that could improve on the manual block system Congress passed the Block Signal System Act of 1906, which created in the ICC the Block Signal and Train Control Board (1907–1912). Inundated with new inventions, board members complained that relentless inventors who knew nothing about railroad operations pestered them constantly. By 1909, the ICC turned research over to the railroads and used the threat of regulations to spur carriers to improve the block system.[36] The ICC was adamant that the railroads provide the best safety equipment or risk being regulated.

Congress also enacted the Accident Reporting Act of 1910, which required carriers to report any accidents in which there were injuries, loss of life, or property damage exceeding $150. This law also gave the ICC the authority to investigate accidents. These investigations became the basis for the promulgation of rules and

[35] Interstate Commerce Commission, "First Annual Report of the Block Signal and Train Control Board, p. 351; Usselman, *Regulating Railroad Innovation*, p. 317. Adams, *The Block System of Signaling on American Railroads*, pp. 163–165.
[36] Interstate Commerce Commission, "First Annual Report of the Block Signal and Train Control Board, p. 351; Usselman, *Regulating Railroad Innovation*, p. 317. Adams, *The Block System of Signaling on American Railroads*, pp. 163–165; Patterson, Address to the Delegates, p. 5.

standards that tried to take every possible scenario into account—a policy started by Charles Adams, after the fiery train disaster at Revere, MA, in 1871.[37]

Usselman has argued that Adams's policy shaped how the federal government dealt with problems of human error by encouraging it to spend more on research of technologies that would limit the possibility of human error. "Many people looked upon the block system not as a method but a set of novel devices, such as those at the Pennsylvania [Railroad], which appeared to provide absolute safety through technological means."[38] Usselman wrote that this was how the federal government would approach safety issues in the twentieth century. When Congress began funding the Block Signal and Train Control Board, established in the ICC in the early 1900s, it marked the beginning of the end of the carriers' authority, which gave them autonomy over their lines in terms of safety issues.[39] As a result, Congress enacted a number of safety acts lobbied for by railroad unions, and the Safety Committee of the ICC -- which replaced the Block Signal and Train Control Board in 1912 -- began its limited authority over railroad safety issues.

Power Interlocking and Automatic Signal Control

The safety concerns of the public, labor, and the government were instrumental in the development of automated systems, which, along with automatic signal systems, included automatic train control systems that would automatically apply the train's brakes if the engineman ran a stop signal or was incapacitated.[40] The BRS and the other railroad brotherhoods in the AF of L initially supported the

[37] Usselman, *Regulating Railroad Innovation*, pp. 120–121.
[38] Ibid, pp. 312–313, 318–325.
[39] Ibid, pp. 296–298, 312–313, 318–325.
[40] Ibid, p. 315.

use of Automatic Train Stop (ATS), and joined carriers and inventors in testing new equipment. The results of the testing done in 1914 were found inconclusive, but the BRS and AF of L resolved to continue to push for viable ATS technology.[41]

The Chicago & Northwestern Railroad officials touted Automatic Train Control (ATC) to the public, calling it "a giant hand or invisible guardian." They said it allowed trains to run at maximum speeds in all types of weather because the enginemen did not need to see signal indications. If the train ran a stop signal or it was going too fast through a caution signal, the ATC device would apply the train's brakes. Running maximum speed meant trains could stick to their schedules regardless of most inclement weather conditions. Historian Roger Grant wrote that shippers of perishable goods benefited greatly from the use of ATC bringing in trains on time.[42]

In addition, carriers started to install automatic signal systems as early as the 1890s as a way to circumvent the problems of discipline and inattentiveness to duty that they were having with the operators, signalmen, and enginemen. Automatic signal control systems (ASC) were activated simply by having the train enter a block. The train's wheels shorted the block's track circuit, causing the signal to change to a stop, or stop and proceed with caution indication. There were no operators or dispatchers to govern these signals, only the presence of a train in the block activated the signals. Later, as ASC became more reliable, train movement could be controlled without train orders, and automatic signal systems could keep trains safely spaced

---

[41] American Federation of Labor, *Report of proceedings, 34th American Federation of Labor Annual Convention*, Philadelphia, PA, Nov. 9-21, 1914. (Washington D.C., The Law Reporting Printing Co., 1914), pp, 83, 326.
[42] Grant, *The Railroad: The Life Story of a Technology,* p. 100.

while at the same time have them run closer together. This system also reduced the number of towers and operators needed on the line. In 1884, when automatic train controls began to prove more reliable, the PRR began a rapid push to install this system. By 1901, the Pennsylvania Railroad had 500 miles of its railroads protected by the automatic system. PRR's success proved to engineer and safety advocate Brahman Adams that automatic systems were as good as the manual system. An added benefit was the elimination of many of the day and night shift workers, which resulted in a decrease in monthly expenses.[43] The conversion to automated block systems took off at the turn of the century. Carriers converted 1,000 miles to automated systems in 1901 alone, bringing the total number of miles converted to 2,300. An ICC survey of signaling practices showed 11,000 miles were converted by 1907.[44] However, at the time, automatic signals still could not do all that was expected of them and would not become reliable enough for the ICC to require them until well into the 1920s[45].

When automatic signal systems started to become reliable, the engineman could trust that when a signal indicated "stop" that was what he was supposed to do. This new assurance was preferable to the engineman wondering if the tower operator had correctly set the signal indication or was even awake (hence the phase "asleep at the switch"), and proceeded to make judgment calls that sometimes led to disaster.[46]

Automatic semaphore signals became more reliable with the improvement in frost-proof batteries and more efficient and economical motors. Automatic

[43] Adams, *The Block System of Signaling on American Railroads*, pp. 165–166.
[44] Usselman, *Regulating Railroad Innovation*, p. 296.
[45] Adams, *The Block System of Signaling on American Railroads*, p. 166.
[46] Ibid.

semaphores could be operated by a central dynamo for up to 35 miles connected to frost-proof storage batteries along the tracks at signals or where needed.[47]

The railroads switched from semaphore blade signals to electric position signals, using light bulbs and parabolic lenses set in changeable patterns after a number of breakthroughs in the field of optics in 1910. Electric position signals had few moving mechanical parts, and the light bulbs were easier to replace than repairing mechanically driven semaphore blades, making them a more cost-effective choice. These signals were also not prone to freezing up or having their movements blocked by snow and ice like the semaphore blade signals did. In addition, over time, lenses were improved so that enginemen could see them farther off in the distance in both daylight and at night.[48]

Carriers built three- and four-aspect automatic block systems, which coordinated track circuits and automatic signals three and four blocks ahead of the train, based on the braking distances trains required to stop in emergencies. The enginemen would run their trains through these blocks by signal indication only because every block had its own track circuit, which was coordinated with the block circuits ahead. This was called the absolute permissive block system.

---

[47] Ibid.

[48] Mark Aldrich, *Death Rode the Rails*, p. 252-253; J. B. Calvert, "Position Light Aspects (PRR)," Chart, *Early Railway Signals*, July 25, 2004, Revised August 15, 2004, http://www.du.edu/~etuttle/rail/sigs.htm#Ligh.

During its tenure, the Block Signal and Train Control Board began to push for automated train control and for some block signal operations. This legislation signaled "the end of an established paradigm of railroad operations and the loss of autonomy for railroad management."[49] Nevertheless, by 1910, only 26 percent of the roads had some form of block system in place.[50] In 1913, the *Railway Gazette* reported the mileage covered by block signal operations doubled with an increase of 3,800 miles in one year, putting the total number of miles under either automatic or block signals around 9,000 miles.[51] In 1915, the number of collisions and derailments fell to a low of 3,538. The *New York Times* reported in 1916 that the PRR—which

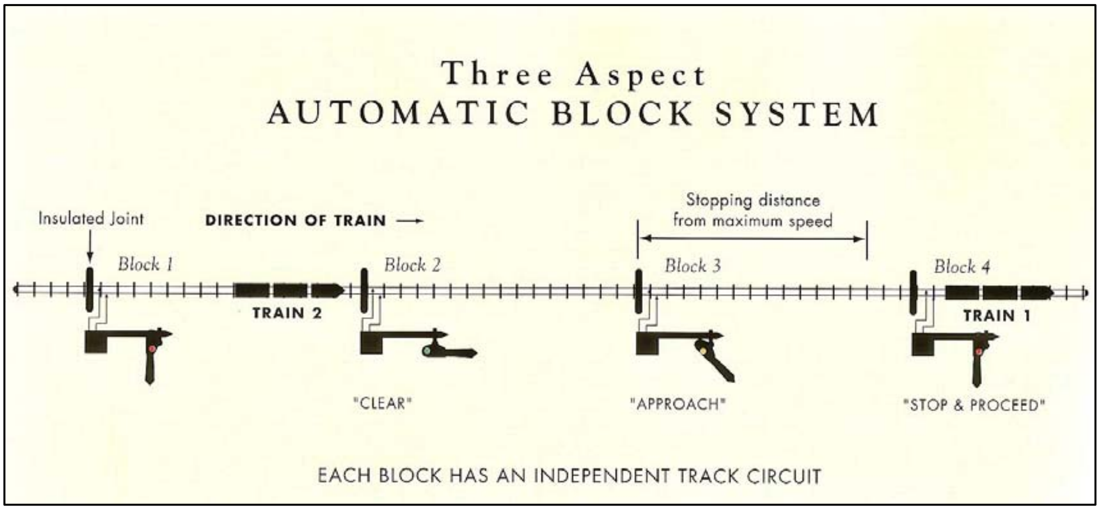


Figure 10 With Three Aspect block Automatic Block System, trains can follow closer to each other thus increasing the carrying capacity of the line. Drawing by Diarmaid Collins, from Brian Solomon, *Railroad Signaling,* 2003, p. 104.

[49] Steven Usselman, *Regulating Railroad Innovation,* pp. 296-98.
[50] Mark Aldrich, *Death Rode the Rails,* p. 4, p. 332, Appendix 2, Table A2.7; Mark Aldrich,. "Combating the Collision Horror, the ICC and Automatic Train Control," *Technology and Culture* 34, (Jan. 1993): p. 51; Steven Usselman, *Regulating Railroad Innovation*, p. 296; *New York Times*, "Topic of the Times, Safety for Railway Passengers," (July 24, 1916): p. 11.
[51] *The Railroad Gazette* 56, "Block Signaling Progress," (Jan. 2, 1914): p. 1.

had its entire system blocked—carried over 455,900,000 passengers in 3 million trips over 10 billion miles without a single fatality. The collision and derailment numbers for the country in 1917 rose as high as 7,115; however, when the number was adjusted for increased miles of train travel, they actually dropped. The ICC reported, Jan. 1, 1919, the total number of miles operated under block systems was 99,897.7, of which 36,989.4 miles were equipped with automatic signals and 621,908.3 miles employed non-automatic systems. This rapid conversion created an increase of 1,796 miles equipped with automatic signals and a decrease of 1,430.3 miles in non-automatic block mileage over 1913, with a net increase of 366 blocked miles.[52]

Meanwhile, the government continued to grow less tolerant of mistakes that led to accidents. By January 1920, 101,884 miles were under block systems, of which 37,968.8 miles were automatic signal systems, an increase of 979.4 miles for 1919.[53] The train control committee of the U.S. Railroad Administration submitted a report in 1919 before federal control ended, indicating some progress had been made in ATC devices but that little had changed since the Block Signal and Train Control Board adjourned in 1912. After what representatives of the industry's American Railroad Administration (ARA) (which replaced the U.S. Railroad Administration)

[52] Safety Division, Report of the Interstate Commerce Commission, 33, (Washington D.C., U.S. Government Printing Office, Dec. 1919), p. 40. Interstate Commerce Commission, First Annual Report of the Block Signal and Train Control Board, p. 351; Usselman, *Regulating Railroad Innovation*, 317. Adams, *The Block System of Signaling on American Railroads*, pp. 163–165.
[53] Safety Division, *Report of the Interstate Commerce Commission* 34, (Washington D.C., U.S. Government Printing Office, Dec. 1920), p.65.

said was an exhaustive search, it recommended seventeen devices for service development tests after federal control ended.[54]

In 1920, after an investigation into a train collision, W. P. Borland, Chief of Safety for the ICC, wrote that automatic block systems were the only way to prevent collisions. Aldrich noted that by 1922, the ICC concluded that only some form of automatic train control would work to end the destruction from collisions and derailments. ATC offered an attractive alternative by further eliminating "human judgment" from the equation. From then on, there was a concerted effort to create an "anti-collision device." Later that year, the ICC ordered forty-nine of the largest carriers to start installation of automatic train control.[55]

Operating Costs Drop with Electrically Operated Systems

Improvements on the mechanical interlocking plant were also intended to reduce labor costs and increase railroad operation capacities at large physical plants. These improvements included the electro-mechanical interlocking system, the hydro-pneumatic system, the electro-pneumatic system, and the all-electric system. The electro-mechanical interlocking used the mechanical interlocking levers and frames, with the aid of electric motors and switches, to activate other parts of the system. All-electric interlocking changed signals and switches with electric relays and motors,

---

[54] Anon E. Lyon, *The Signal Inspection Act: A Major Achievement of the BRS, (A Lyon Chronicle,)* unpublished history/memoir of the BRS's role in the enactment of the Legislation, 1972, Red loose-leaf binder, Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA., p. 26.
[55] Mark Aldrich, "Combating the Collision Horror," p. 51.

while the pneumatic and hydro-pneumatic systems used air or fluid, respectively, compressed by electric compressors.[56]

After railroads began to trust these new systems, the costs of the new technology dropped, and they were cheaper to install than mechanical interlockings as they had fewer moving parts. In addition, these systems were quicker and required less effort on the part of the operator. With these systems, one operator could handle a larger frame of levers and a larger physical plant, or territory, further cutting labor costs. In addition, not only were electric and electro-mechanical systems cheaper to install than mechanical interlocking plants but also they took up less room in the tower.[57]

In addition, cab signals were tested. Developed and used extensively in Europe, cab signals provided signal indications inside the engine cab; this lessened the chances that the engineman would miss roadside signals because of weather conditions or inattentiveness. Cab signals became an adjunct technology to ATC in the 1920s and were used in conjunction with ATC on many railroads. Small light signals, installed inside the train cab, showed signal indications that would have been displayed trackside and in conjunction with how the ATC devices were controlling the stretch of track. By 1950, ATC covered 10,000 miles of road and 3,500 miles of

[56] Hanson Boyden, “The Block System, what it is and why it failed last Sunday, p. F1; E. K. Post, “The Electro-Mechanical Interlocking System, Combining the Advantages of Electric and Mechanical Interlocking Plants,” *The Signal Engineer* 2, (April 1910): pp. 412-415; The General Railway Signal Company, *Electrical Interlocking Handbook*, pp. 5-6; Patterson, Address to the Delegates , p 5.

[57] Hanson Boyden, “The Block System, what it is and why it failed, p. F1; E. K. Post, “The Electro-Mechanical Interlocking System,” pp. 412-415; The General Railway Signal Company, *Electrical Interlocking Handbook*, pp. 5–6.

road was equipped for running cab signals without any other automatic control devices.[58]

The Wasted Era of Automatic Train Control

The BRS started its move into the arena of safety legislation when the ICC started requiring ATC. By the 1920s, the BRS, the other railroad unions, and the railroad managers were not as enthusiastic over the technology as the commissioners of the ICC were. The Train Control Committee, enacted with the Transportation Act of 1920, was created to continue to study and investigate ATC. BRS President Anon E. Lyon wrote that the push to use ATC was probably at the urging of suppliers -- excluding the Union Switch and Signal Company (USS Co.) and the General Railway Signal Co. (GRS Co.) -- who saw tremendous profits if ATC could be required. If USS Co. and GRS Co. were involved, he said, there would have been a more serious look at other types of safety and signal appliances.[59]

ATC in the 1920s came in both mechanical and electrical forms so that when a train passed a stop signal, it would pass over a raised ramp, connected to the track circuit, so it would make contact with the train. The electrical contact on the train would be energized, and if the train were not equipped with a forestaller, or override device, the train's brakes would apply. One ATC was the Regan type, which was a metal ramp type, 200 feet in length and a foot high, mounted outside the cross ties and in advance of a automatic wayside signal. The moving train made an electrical contact with the ramp, and if the signal was in the "stop" position, the air brakes would be activated if the engineer had not already applied them. Another type of

[58] Grant, *The Railroad: The Life Story of a Technology*, 100–101.
[59] Lyon, Anon E. "The Signal Inspection Act," p. 27.

ATC was four to five feet long, mounted outside the ties some distance before the signal. The device was mounted on the locomotive a few inches over the inductor and could activate the brakes if the stop signal were activated. A third system was a true train control device, as opposed to a train stop device, in that it was an intermittent inductive type mounted between the rails that not only could automatically stop the train but could measure the speed of the train using a sensitive timing device. Using a special short track circuit, it could slow down a train by activating the brake slowly when the train exceeded the speed limit.[60] Continuous train control devices were always activated, slowed the train down in an emergency, and acted as a monitoring device; however, continuous ATC devices were still unproven, and the railroads did not invest heavily in them in the 1920s.[61]

Under Section 26 of the Transportation Act of 1920, the ICC had the authority to order any railroad to install ATC or other safety devices; however, the phrase "other safety devices" was too vague and subsequently had no regulatory meaning. The ICC took section 26 as a mandate to have ATC installed on railroads but did not require automated signal systems, as Section 26 did clearly state that the ICC had the power to mandate the use of ATC. On July 13, 1922, ICC ordered forty-nine railroads to install ATC, followed by, in January 1924, an order for an additional forty-seven installations on the forty-nine roads.[62] Under the order, railroads could choose which ATC they wanted and where they would install it. Lyon said most

[60] Ibid.
[61] Mark Aldrich, *Death Rode the Rails,* pp. 246-252.
[62] Lyon, "The Signal Inspection Act", p. 27.

railroads installed the ATC on lightly traveled lines where ATC would not interfere with busy traffic.[63]

The problem both the carriers and the BRS found with ATC was that the devices could not differentiate between a heavy freight train and a light passenger train. Therefore, some ATC could not properly activate the brake, causing break-in-twos or derailments. Only an experienced engineman would know how to apply the brakes effectively or safely. Understandably, enginemen were opposed to ATC for this and another reason. The use of ATC downgraded the enginemen's profession by saying the enginemen were inattentive. "They wanted to preserve and, if possible, enhance the public's image of a locomotive engineer as a man of unrivaled competence and dependability—a sort of super aristocrat of American labor." Enginemen pushed quietly for safety regulations by working behind the scenes to discourage the use of ATC until it was proven ineffective.[64]

The ICC had a different perspective. It saw ATC as a technological fix to improve safety by eliminating human judgment from traffic management; whereas the carriers saw ATC as not providing anything to make the railroads run more efficiently. By contrast, other safety devices, such as air brakes, block signals, and automatic couplings, were shown to increase productivity. Because railroads saw that these devices increased efficiency, the safety devices became standard equipment, and the prices for these devices came down. [65]

However, mechanical and electrical ATC systems were subject to failure in poor weather conditions and would stop the train. Economically, these systems were

[63] Ibid, p. 29.
[64] Ibid, pp. 29–33.
[65] Mark Aldrich, *Death Rode the Rails,* pp. 246–250.

bad for business because stopping a train not only set back its schedule, but also having to get the train back up to speed again caused extra wear on the track, engine, and cars, and raised fuel costs. The carriers saw no economic benefit to adopting ATC. The *Railroad Gazette* reported that the Committee on Automatic Train Control of the carriers' United States Railroad Association was against mandatory adoption of ATC for economic reasons. They said that profits were already squeezed by rate regulation and that, by ICC calculations, it would only prevent about 6 percent of all fatalities to non-trespassers. The United States Railroad Association, instead, advocated for further adoption of the block system as a first step, not ATC.[66]

Members of the BRS did not like ATC for additional reasons. Lyon said he was frustrated that Congress gave money for research and testing on many safety appliances and signal systems intended to promote the safety of railroad operation, but instead, the ICC concentrated on train control devices. Little attention was paid to the effectiveness of the various types of automatic signals, different types of interlocking systems, and highway grade-crossing devices that the BRS officers thought added real safety benefits. In addition, no consideration was given to setting recommended or mandatory safety standards. The ICC's work was limited to ATC devices instead of all safety appliances or systems. Lyon said the railroad supply industry was having a hand in preventing this research.[67] However, in response to Section 26, the railroads claimed, in 1922, financial difficulties, and that the rates imposed by the ICC were too low. The carriers demanded the Labor Board cut wages, but Lyon said this did not deter the ICC from issuing its ATC order under

[66] Ibid.
[67] Lyon, "The Signal Inspection Act", p. 25.

Section 26. Wages were being cut while the government required railroads to spend money on ATC, which the railroads ironically found unreliable when used alone. Railroads were forced to upgrade to the ATC while jobs were being taken away from signalmen.[68]

Yet another reason for the BRS to discourage the use of ATC was that union strength and political power was affected by the size of the union's membership. Membership was affected by the fact that some railroads removed other signal systems when using ATC.[69] The fewer devices and signals that needed servicing, the fewer signalmen were needed for those stretches of track.

The unions as well as the railroads were frustrated with the way the ICC had failed to live up to its new congressional mandate that came with the enactment of the Transportation Act of 1920. Congress had endowed the ICC with greater authority to plan and implement a national transportation system. To handle the increase in workload, the number of commissioners was increased from nine to eleven and new departments were added, such as a Statistical Bureau and a bureau for valuating railroad properties. The problem was that the Commission was only as effective as much as the commissioners' energy and willingness to lead allowed, according to historian Ari Hoogenboom. Without strong leadership, the middle managers of the bureaucracy tended to do what was best for their departments, and the ICC became an agency narrowly focused on collecting mountains of data and prosecuting individual

---

[68] Lyon, "The Signal Inspection Act," p. 29; Frank H. Dixon, "The Railroad Situation, An Appraisal," *The American Economic Review*, Vol. 11, No. 1, *Papers and Proceedings of the Thirty-Third Annual Meeting of the American Economic Association*, (March 1921): pp. 5–18.

[69] Daniel Helt, BRSA President, and Delegates M.C. Merritts, I.M. Fisher. Discussions on a motion to have the Interstate Commerce Commission define the maintainer's responsibilities in regards to ATC. *The Fourth Biennial and Nineteenth Regular Convention of the BRSA,* Chicago, bound typescript volume dated Sept. 10–15, 1928, p. 841-846.

disputes and cases rather than looking at the larger picture. It failed to create a viable transportation plan and failed to provide standards or criteria for improving traffic management technologies.[70]

From the beginning, the BRS was adamant that ATC should be used as a supplement to signal systems, and not the sole technology preventing collisions. Enginemen still needed home and distant signals to have some idea about what was ahead on the tracks. Despite the intent of the ICC ruling to improve safety by adding ATC to block systems, railroads were scrapping signal systems in favor of ATC without inference from the ICC.[71] Delegate I. M. Fisher pointed out at the 1928 BSA Convention that the ATC was supposed to be used in conjunction with signal systems; however, the ICC "did not contemplate the removal of signals; yet on some roads signals have been removed." Some railroads were removing signal systems where ATC was installed. Another reason why the BRS was adamant that ATC was not adequate as a standalone safety device was that it did not allow for the differences in train weights and speeds. The BRS also said that the engineman had to know what was happening ahead of him, whether the block was clear or not, and what speeds he should be running. Some railroads and regulators relied too heavily on the technical fix that ATC offered.[72] In addition, the BRS generally lobbied for automated signal systems and more complicated systems because the more miles of track under the

---

[70] Ari Hoogenboom and Olive Hoogenboom, *A History of the ICC: From Panacea to Palliative*, (New York, Norton & Co. Inc, 1976), pp. 111-112; Richard D. Stone, *The Interstate Commerce Commission and the Railroad Industry, A History of Regulatory Policy*, (New York, Greenwood Publishing Co., 1991), pp. 35-36**.**

[71] Daniel Helt, BRSA President, and Delegates M.C. Merritts, I.M. Fisher. Discussions on a motion to have the Interstate Commerce Commission define the maintainer's responsibilities in regards to ATC, p. 841-846.

[72] Helt, BRS President, and Delegates Merritt, Fisher discussing a motion to have the ICC define the maintainer's responsibilities in regards to ATC, pp. 841–846.

block system and under the protection of some form of signal systems, the greater the need for more skilled maintainers and signalmen. The more signalmen meant larger membership roles for the BRS.

The ICC looked to technology to fix problems that should have been addressed through better governmental oversight. Such oversight would not come about until the BRS successfully lobbied for the passage of the Signal Inspection Act of 1937. This law provided the rules, procedures, and performance standards for the installation, repair, and maintenance of all signal systems. In addition, the law extended the authority granted under the Transportation Act to the ICC and prevented railroads from removing signal systems without approval from the ICC's Bureau of Safety.[73]

In addition to safety concerns, liability questions arose concerning who was responsible for problems with ATC systems, as well as cab signals as they were installed on the engine, the tracks, and the track circuits. Because ATC was installed on so many parts of the system, several other classes of employees worked on the same apparatus. The BRS wanted the ICC to place the liability on management as

[73] A.E. Lyon, *Efforts to Secure Passage of the Signal Inspection Bill*, Report of the Acting Grand President, *the Eighth Biennial and Twenty-third Regular Convention of the BRSA,* Chicago, bound typescript volume dated Aug. 16,-19, 1936, pp. 24-29; Interstate Commerce Commission, "ICC Circular on Signal Inspection Law, *Railway Age*, 103, (October 2, 1937): p. 469; American Federation of Labor, "Senate Bill S. 29," To promote safety of employees and travelers by requiring railroads engaged with the ICC to install, inspect, test, repair and maintain block signal systems, interlocking, automatic, train stop, train control, cab signal devices, and other appliances, methods and systems intended to promote safety of railroad operation, passed both houses, Administration of law is under the ICC, American Federation of Labor, *Report of the Proceedings of the Fifty-seventh Annual Convention of the AF of L*, Denver, Colorado, bound typescript volumes dated Oct. 4-15, 1937, p. 171.

they oversaw the work. The BRS also feared that replacing signaling systems with ATC would decrease their employment opportunities.[74]

"[Y]ou and I and the balance of us realize that if railroads of the country would properly protect the lives of the people, this convention would be two or three times the size it is," Delegate Merritts, Lodge No. 1, said before the 1928 Convention in Chicago. "We have thousands and thousands of miles of unprotected railroads in this country right now."[75]

This discussion became the impetus for going to Congress to find ways to give the ICC more regulatory power over signal systems. BRS wanted an amendment to Section 26 to give the ICC the power to prevent removal or modifications to existing signal systems.[76] This resolution would lead the BRS to write the Signal Inspection Bill, for which the BRS lobbied from 1930 to 1937, when it was finally signed into law.

If it were not for the concerted efforts of the BRS, other unions, and safety advocates pressuring the ICC, railroads would have been even slower to add more block signal systems. By the end of the 1920s, ATC devices proved unreliable as standalone safety equipment. In addition, ATC was costly to maintain. After ten years, the carriers petitioned the ICC to remove the ATC on their lines. Few, if any, were denied. In November 1928, the ICC announced it would not require further installations but said "expenditures [by the railroads] for the preservation of human life should be generous and should be so distributed that the greatest possible measure

---

[74] M.C. Merritts, discussing the need to regulate signal system maintenance and installation, *Proceedings of the Fourth Biennial and Nineteenth Regular Convention of the BRSA*, bound typescript volume dated Chicago, Sept. 10–15, 1928, pp. 841–844.
[75] Ibid
[76] Ibid.

of protection should be afforded." According to Usselman, railroads never initiated these changes; changes were brought on by public pressure and federal intervention.[77] Nevertheless, this "wasted ATC era," as Lyon called it, "did allow for worthy developments in signal technology, such as Centralized Train Control." Before 1930, he said, the ICC was "hung up" on ATC as they were under the influence of companies hoping to make profits on the technology.[78]

The Added Benefits of Centralized Train Control

CTC is the marriage of automated block signals with interlocking systems. Highly versatile, CTC was installed on both single and double tracks, at complicated junctions, and in huge train yards. Companies also used CTC for routes that ran trains in both directions on either track. Using CTC, a dispatcher -- while watching a lighted track diagram that showed the signal indications, turnout positions, and train positions on the blocks -- could control meeting points, run following trains around slower proceeding trains, and, in general, speed up traffic. He controlled the interlocking signals and switches that moved trains to sidings, while automatic block signals governed the main line permissively.[79] Historian Roger Grant said carriers first installed CTC on their busiest sections because it gave a regional dispatcher the ability to run the section as if he was running "a model-railroad layout."[80] The dispatcher initiates and directs all train movements and grants superior rights to one

---

[77] Steven Usselman, *Regulating Railroad Innovation*, p. 318; Patterson, Address to the Delegates, pp. 5—7.
[78] Lyon, "The Signal Inspection Act," pp. 28–33.
[79] Aldrich, *Death Rode the Rails*, pp. 292
[80] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.

train over another as the situation arises; “his orders are delivered through the agency of the roadside signals,” said Sedgwick N. Wright, Engineer for General Railway Signal Company:

> There are no longer train orders, rights by class, and rights by direction. One train knows nothing about the presence of any other train on the road. Train schedules are for the benefit of the passenger and other schedules are merely for the guidance of the dispatcher. The system only allows the dispatcher to move trains in safe manner; otherwise, the locking devices prevent him from making mistakes. A record by the system is kept of each operation. There is a GRS Dual Control Selector that allows hand operation of the switches, but the system does not allow switching to occur in an unsafe manner, i.e., once the car has entered the track circuit in which the switch is located.[81]

Using CTC, the dispatcher’s office replaced the need for numerous towers and tower operators stationed in every block of track. Dispatchers controlled train movements using a switchboard at a central office. By pulling the appropriate lever(s) for a predetermined route, the correct switches opened and closed to direct the train onto a siding or through a junction, using small electric motors. The motors were also used to set the signals to inform the train crews of what speeds they should run the train and to show where they are heading. Above every lever on the switchboard was a light telling whether the turnout is in its normal position or its reverse position. Above the switchboard was a track diagram on a light board where each light indicates the setting of every turnout, either open or closed, the indications of the every signal on the block of track, and most importantly, whether a train is occupying that block. The indication of whether a train is occupying the block on the

[81]Wright, *Centralized Traffic Control*, pp. 47–48.

track diagram is the result of innovations upon Robinson's electric track circuit system. While the train wheels shunt the track circuit that shorts out the relay, kills the power to the signal, and drops the signal to its default stop position, the shorted circuit notifies the dispatcher whether the train is occupying that particular block. Most CTC machines had a paper-recording device underneath the levers that noted each time a lever was thrown and what train movements had occurred.[82] Dispatchers still had to keep detailed written records of every train movement and CTC action, but with CTC, one man in a central office could do the work of many tower operators stationed every two or three miles along the line.

Before CTC, dispatchers had to relay train orders either by telephone or by telegraph to tower operators who would set the signals and switches. "The man at the [telegraph] key was the heart of the system; however, this company found the system deficient as it did not afford direct and complete control of traffic and did not give complete information to the central dispatcher as to what is occurring on the roadway," noted Wright. Having operators stationed along the line in block towers initially reduced traffic delay—"they served as an intermediary between the dispatcher and the train, and they operated the switches and signals." The operators would have to relay the train orders by handing them up to the engineman, which required the train to slow down so the order could be handed up on a hoop and pole, and sometimes the train had to stop so the engineman could sign for the order. Each train on the line had to go through the same process of getting train orders, often times at most of the stations, which was very time consuming and labor intensive. However, this was "indirect control over the line and very expensive for installation

[82] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.

and then in daily operations."[83] In addition, the cost of fuel and of the degradation of the equipment and track from having to stop and then start up again many times along a busy stretch of track made the train order system even more expensive.

CTC eliminated all of this work by having the trains run only on signal indication, which told train crews when to pull over into a siding to let another train pass, when to stop and when to start up again. In addition, all the signals were coordinated with the switches, so when the switches changed, so did the corresponding signals. A failsafe mechanism prevented the dispatcher from changing the signal to a different indication other than that was appropriate for what was occurring with the switch as the train passed over it. The railroads added phone boxes every few miles so that in an emergency, the crew could contact the dispatcher.[84]

The use of colored signal lights and position light signals paved the way for the use of Automatic Signal Control (ASC) and Centralized Train Control (CTC). The General Railway Signal Company and the Union Switch & Signal Company developed CTC and ASC by the late 1920s, carriers and the federal government saw CTC and ASC were marked improvements over ATC. After World War I, the ICC "vigorously endorsed" the use of these systems to improve safety while carriers saw reduced operating expenses and increased traffic flow.[85]

W. J. Patterson, Director of the ICC's Bureau of Safety, said in 1946 that, since 1924, new improvements in color-light signals increased the distance where signal indications can be seen (and have fewer moving parts to fail). Power operated

---

[83] Ibid, p. 11.
[84] Aldrich, *Death rode the rails*, p. 292.
[85] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.

switches have eliminated delays caused by trains leaving and entering sidings. "The development of CTC increased signal track capacity and resulted in increased efficiency and reduction in delays resulting from the meeting and passing of trains," Patterson said.[86]

He went on to say that improved signaling systems were needed because train traffic increased enormously and the weight of trains had also increased since 1924. Also the heavier and faster streamlined trains required signaling rules and standards because of their higher authorized speeds and faster schedules. New collisions are more devastating, he said, which raised questions about how to better promote safety and increase means of safety in line with modern railroad operations and increased hazards. There is a problem of inadequate block signals on these lines that have trains authorized to run 40 to 70 mph. Most of the collisions happen on tracks authorized for speeds of 60 to 70 mph, he concluded.[87]

The Signal Section of the ARA reported frequently from the late 1920s through the 1930s more about the reduction in operating costs using the new signal technologies; the safety aspect was an added bonus. The promise of reduced operating costs and increased production from increased track capacity spurred carriers to invest in CTC, ATC, automatic block signals, cab signals, or in combinations of the four technological systems. An example of cost reductions for the Union Pacific, where cab signal systems were used on 225 miles of double tracks and where 137 locomotives were employed, cost just under $20,000 for a savings of $50,201,000. In another article, *Railway Age* reported that CTC was effective for

---

[86] Patterson, pp. 9—11.
[87] Ibid.

terminal railroad operation, in which there are a number of junction points and the train yard is short. Routes were constructed solely by the operator and did not need train orders.[88]

The first major CTC system was installed in 1927 in Toledo, Ohio, which was followed by the New York Central (NYC). Wright reported in 1927:

> The GRS Co developed the G-R-S Dispatching System to give direct and complete centralized traffic control and was first used on tracks of about 40 miles in Ohio. It employed automatic block signals for spacing and protection of train movements, power switching machines for the operation of switches, and a control machine for controlling the switches and signals. The control machine also gives the dispatcher information when each train passes over certain points along the line called "OS Points."[89]

The NYC realized that CTC was the answer to the growing problem of congestion on about forty miles of track. Managers there soon realized that they could run the same number of trains faster over a single track, using CTC, than they could on a double track for the same stretch of road.[90]

Carriers started to realize the benefits of electronic central train control and automatic signaling technology. In the discussions among signal engineers of the Signal Section of American Railway Association, in 1930, about the cost savings and improved efficiency in handling more traffic per railroad, engineers were reporting cost reductions from eliminating tower and telegraph operators, and improving traffic

---

[88] The Signal Section of the American Railway Association, *Committee I. Economics of Railway Signaling, Proceedings of the Signal Section of the American Railway Association*, Sept. 1930, (Bethlehem, PA, Times Publishing Co., 1931), pp. 362–396; *Railway Age* 104, "CTC increases the capacity of single track on the PRR," (Jan. 8, 1938): p. 122*; Railway Age* 10, "More Signaling – Greater Economy," (Jan. 8, 1938): p. 26.
[89] Wright, *Centralized Traffic Control,* pp. 47–48.
[90] Grant, *The Railroad: The Life Story of a Technology,* pp. 99–100.

flow with the use of several variations of centralized train control. On a CTC system installed on signal track between Mt. Morris and Bridgeport in Michigan, their tests showed a $19,035 annual profit. Another study showed that using the train order system on a double track alone led to a $41,750 deficit, with much of the cost due to operating the second track. By using CTC on a single track and by adding more passing sidings, they reported a marked increase in the number of trains that could be handled daily, a reduction in labor costs from eliminating tower operators and telegraphers, and a reduction of overtime hours of freight crews. Increased traffic on a 42-mile stretch of single track on the Missouri Pacific Railroad made the use of train orders and manual blocking impractical. Expanding the plant to double track was cost-prohibitive, so they installed CTC, automatic signals, more sidings with extended lengths, wider turns, longer turnouts, and remote controlled switches connected to the CTC signal system and telephone communications. This allowed freight trains to pull thirty-five instead of thirty cars and increase the speeds of trains entering the sidings to 30 mph. They eliminated five tower and telegraph installations on this stretch of tracks that ran from Edgewater Junction to Atchison, Kansas, with one dispatcher stationed in Leavenworth, Kansas. Despite a record cold spell and having to acclimate employees to the new system, they eliminated from 130 to 150 train order transactions and 35 restrictive speed cautions during peak operation, all of which before would have had to been done manually. Despite heavy snows, train speeds increased on average by 4 miles per hour and three dispatchers in three shifts handled forty-eight trains in a 24-hour period. The engineer observed that 50 percent of the meeting points that resulted in delays were now made without stopping the train, which during winter months reduced the possibility of trains breaking in two, or freezing up and creating dangerous flat spots on wheels caused by braking. Tests taken in fifteen-day intervals also showed there was an increase in the average tonnage handled by a train of 217 tons with an average increase in speeds of 6.5 miles per train hour, or a reduction of 59 minutes in running time through the 42-mile territory. These results have netted a 22.8 percent return on their original investment of $430,000 and increased protection and safety in operating this territory. While the ARA said their reports were inconclusive, the signal section engineers acknowledged anecdotal evidence of real economies from CTC and automating signal systems, through a reduction of the number of interlockings and manual block towers and an increase in the number of longer trains running through the railroad networks.[91]

In only four years, according to *The Signalmen's Journal,* CTC had shown real production benefits. By 1935, the ICC reported that there were 151 CTC installations in service on 38 railroads in the United States and Canada had three in service. The total road mileage under CTC was 1,261, with 1,706 track miles, where CTC systems controlled 956 switches and 2,585 signals. The longest stretch of road covered by CTC operations was on the B & O Railroad, which had 55 miles controlled by one machine. That stretch of railroad ran from North Lima to Roachton, Ohio.[92] Judging by the miles of railroad compared to the miles of track, most of the installations were on single track lines.

---

[91] The Signal Section of the American Railway Association, *Economics of Railway Signaling*, pp. 362–396.

[92] *The Signalmen's Journal* 16, "Centralized Train Control, 151 installations in service on 38 roads," (July 1935): p. 173.

However, the spread of CTC technology was limited during the Great Depression, as the system cost $10,000 per mile in 1930. When the volume of passenger and freight traffic soared during World War II, more and more railroads went to using CTC in operations.[93]

During World War II, carriers, flush with revenues from wartime production and in need of better ways to control the enormous growth in traffic, began to invest in CTC. The number of CTC installations, from 1941 to 1946, jumped from 212 to 328, and the miles of track under CTC increased from just over 2,400 to over 7,380 for the same period.[94]

CTC was applied to high-density traffic on single-track lines to increase capacity without the need for double tracking. It allowed the removal of many sidings and signals, so it saved both capital and labor, and in the bargain, it improved safety. At the same time, carriers replaced semaphore signals with position lights and introduced three and four aspect signals for high-speed trains. These position light signals could show track conditions several blocks ahead. The overall effects of CTC and improved signaling systems after 1930 gave positive economic reinforcement with an added benefit of increased safety.[95]

From the 1920s through 1940, old railroad lines were replaced and upgraded, and even the poorest railroads installed either ATC or cab signals while the wealthier companies installed CTC on their busiest roads. Upgrading roads was less costly after the 1920s, when Caterpillar Tractor Company revolutionized railroad and highway construction with its mechanized earth moving and track-laying machines,

---

[93] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.
[94] W. J. Patterson, ICC Commissioner, Address to the Delegates, p. 10,
[95] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.

and the White Motor Company in Cleveland provided contractors and carriers with more powerful diesel trucks. However, the cost of labor under the Adamson Act, which granted eight-hour workdays, coupled with the carriers' inability to set freight and passenger rates, and the increased competition from other modes of transportation, limited new construction. In addition, many managers were conservative in using new technologies unless the status quo could be proven inadequate. [96]

[96] Grant, *The Railroad: The Life Story of a Technology*, pp. 99–100.

Reports in *Railway Age* show a reluctant acceptance of the benefits of CTC and of the regulations for standardized maintenance and inspection performance as required under the Signal Inspection Act of 1937. The Signal Inspection Act was written and lobbied for by the BRS and would be an impetus for improving railway traffic safety through the law's requirements for publishing of rules, standards, and procedures in the maintenance, repair, and installation of all signal systems with oversight by the ICC Bureau of Safety. Recorded changes in railroad signal systems across the country in anticipation of the Inspection Act--or as *Railway Age* called it, labor's "make work" legislation--show that on Jan. 1, 1937, 108,749.7 miles of road operated under block signal systems, of which 63,117.6 miles were equipped with automatic block signals. In addition, there were 181 installations

Figure 11 A Centralized Train Control office of the Paducah and Louisville Railroad, Operators could handle more traffic and larger plants with improved safety. Photo by Woodruff Towle, Paducan, KY, no date available. File photo from the Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA.

of CTC and 599 control points for remotely controlled power-operated switches and signals.[97] Carriers also tried to circumvent the law by reducing train speeds so automated signal systems would not be required.

Rising labor costs spurred carriers to install it on 26,000 additional miles from 1945 to 1965, bringing the total of miles under CTC to one-third of all railroads. Carriers were able to lower the most expansive part of train operations by laying off tower operators, crossing guards, and other support staff, including signalmen. CTC revolutionized train dispatching and was used until high-speed computers and special software began to supplement or replace it in the 1980s and 1990s.[98]

The Fallacy of Failsafe Signal Systems

The number of collisions and the fiery nature of the wrecks were leading people to back away from train travel in 1870s; technology was seen as the way to help regain the public's trust in the railroads. Railroads tried to soothe public concerns by touting the interlocking block systems. In the 1920s, the ATC and the automatic signal systems were proclaimed effective in removing human judgment from the traffic management equation; the machines would do the work and protect the trains using failsafe technology.

Charles Adams, the Massachusetts State Commissioner and grandson of President John Quincy Adams, placated the fears of the public by showing how technology could stem the rising number of collisions and derailments. In his report on a terrible crash at Revere, MA, August 1871, which killed twenty-nine people and

---

[97] "Train Control and Signal Statistics," and "Accident Trend Upward," *Railway Age* 104, (Jan. 8, 1938): p. 237.
[98] Grant, *The Railroad: The Life Story of a Technology,* pp. 99–100.; Aldrich, *Death rode the Rails,* p.292.

injured fifty-seven, he said that the testing of new technologies (air brakes, tight-fitting couplers, and automatic electric signals) could potentially provide safer operations on the railroads. Technology and order would be the antidotes to the problems of safety on the roads. With this report, Adams defined the direction of the safety issue throughout the Gilded Age and the Progressive Era with subsequent reports demanding routine order and the development of new technology. [99] According to Usselman, Adams's policy shaped how the federal government dealt with problems of human error by spending more energy on the research of technologies that would limit the possibility of human error. "Many people looked upon the block system not as a method but a set of novel devices, such as those at the Pennsylvania [Railroad], which appeared to provide absolute safety through technological means."[100]

The key phrase here is "absolute safety through technological means;" however, the BRS knew differently. They knew no technology could guarantee absolute safety, and any new device was useless if it was not maintained properly or was not used correctly.

To Keep Systems Failsafe, Devices Required Skilled Mechanics

While the technology employed in mechanical interlocking machines and its later innovations did provide a layer of failsafe protection, humans still had to make decisions, be attentive, and follow rules in order for the technology to be truly failsafe. Signalmen and managers knew that this technology was only as effective as the men who maintained and operated it. Judged by the fact that humans were not

[99] Usselman, *Regulating Railroad Innovation*, pp. 120–121.
[100] Ibid, pp. 312–313, 318–325.

always attentive and did not follow rules that made the technology truly failsafe, the manual, permissive, and controlled manual block systems were ultimately seen in the early 1900s as having failed at being failsafe. "The block system is not the panacea it's made out to be. Its utility depends entirely on the observations of employees, on the fallible human factor which lies at the bottom of nine out of ten railway accidents today," according to one writer in *The Washington Post* in 1904."[101] Human judgment, the inherent flaw in the block system greatly affected the confidence of the carriers in the manual block system. These systems were also expensive to maintain and required skilled responsible men to inspect and maintain them.

With skilled mechanics able to find jobs in the growing automobile service industry or as electricians, railroads experienced difficulty finding men willing to take on the responsibilities in terms of public safety and liability. This was true, especially when other industries and service companies paid salaries that were higher than what the railroads wanted to pay. The enormity of a signalman's responsibilities was described in a resolution to be presented at before a federal labor commission, as any person …

> who is 18 years of age or older, is actually working for a railroad in a signal department or signal works in operation, or maintaining of an electric, electro-pneumatic, electro-mechanical, or mechanical interlocking systems, color or position light signals or automatic train controlling or stopping device, highway crossing protection, high tension and other lines overhead or underground, poles and distributing blocks, wires or cable pertaining to railroad signaling and interlocking systems, or signal poles, and other lighting, as required for the operation of railroad signaling and

[101] Anonymous, "Observations by a Railroad Man, Railroad Accidents and Their Causes," *The Washington Post*, (Dec, 25, 1904): p. A12; *The Washington Post*, "The Cheapness of Life," (Dec. 28, 1908): p. 6.

> interlocking systems or storage battery plants with charging outfits, with switch board equipment, sub-stations, and current generating plants, compressed air plants, as used for the operating of signaling and interlocking systems, or compressed air pipe connections for mechanically operated switches and signal apparatus, with cranks, compensators, foundations and supporters, or carpenter, concrete and form work of all classes in connection with installing any signaling or interlocking systems, is eligible to membership in the brotherhood, provided that the following employees who are engaged in train operation or manipulation of signals and switches are not eligible: Telegraph operators, train dispatchers, telegraph linemen, train directors, or station agents.[102]

Maintainers and signal engineers knew many things could go wrong that would show a false clear indication. The signalmen used this information to further their propaganda campaigns, saying no system was perfectly safe and was only as failsafe as the men who maintained it. Arguments given before the AF of L's Railway Employees Division (RED) hearings over jurisdiction disputes with the International Brotherhood of Electrical Workers (IBEW) by Helt and Cone, which will follow later, will shed light on the extent of skills signalmen had to master in order to maintain and repair signal systems. It must be said, however, that a small gang of as few as two signalmen would have to cover territories as far as forty miles with multiple tracks. Among the safety appliances that they would be expected to diagnose and service could be several types of mechanical, pneumatic, or electrical interlockings, semaphore or electric position light signals; highway grade crossing gates with mechanical, automatic signal and/or automatic train control systems.

[102] Officers Reports, "Resolution No. 10, Job Description," *the Twelfth Annual and Fourteenth Regular Convention of the BRS*, Kansas City, bound typescript volume dated July 14–19, 1919, p. 146.

Railroads would not spend the money or take the time to send out, for example, a blacksmith to handle a job that would only take a few hours to complete when they had signal maintainers already stationed there to do the work. Railroads needed skilled signalmen on site, especially in case in of emergencies. Routinely, signalmen and maintainers worked under emergency conditions, as the tight train schedules had to be met. The failure of a signal to indicate whether the track ahead was clear was an obvious emergency/safety issue. Fixing a false clear signal indication was a priority, making routine repair work in many cases a public safety situation. During hard economic times and during World War I, when traffic increased and maintenance was deferred, the maintainer's job was not only one of maintaining signal systems. Under these conditions of deferred maintenance, they would have to spend their hours "putting out fires," correcting and repairing problems that would normally be caught during routine inspections and routine maintenance, which was ignored by economically strapped or over pressured railroads.[103]

In addition, signalmen and maintainers worked in all kinds of weather, as the trains rarely stopped, except in the most extreme conditions. Over the first thirty years of the twentieth century, both signalmen and engineers devised innovative methods for improving the systems' reliability in handling changing weather conditions. The one-inch-diameter steel pipes that extended as much as 800 feet from the mechanical interlockings to the turnouts and signals could shrink or stretch several inches depending on the ambient temperature. Mechanical compensators

[103] Daniel Helt, BRS President, letter to William Green, President of the AF of L, Dec. 23, 1927, reprinted in the *Signalmen's Journal* (Jan. 1928): pp. 29–35; Dixon, "The Railroad Situation, An Appraisal p. 14.

Figure 12 A mechanical compensator is used to take up slack in the lead out pipes when they expand in hot weather and let out pipe when it shrinks in cold weather to compensate for changes in the temperature. Photo by Robert Williams, Sept. 9, 2006.

were installed between pipe sections that both took up slack or expanded just enough to keep turnouts shifting all of the way to their established limits. Mechanical systems

had to be well greased and thoroughly inspected because a stone lodged in a detector bar or a switch could bend the pipe or block the interlocking from fully locking in a train route to a safe position. Electric interlockings had similar problems plus new ones, such as the older style batteries freezing if they were not buried far enough below the frost line in the northern climes. The impetus for the rapid improvement of signal systems and the introduction of new types of systems from the 1870s through the 1930s was in response to the many different geographic and environmental conditions railroads operated in coupled with the necessity of public safety and traffic flow efficiency.

The few managers who understood the nature of signal work understood its complexity. As J. W. Steliker, General Signal Supervisor on the Santa Fe and Southern Pacific Railroad, observed in 1926:

> Signal work is particular work. Anyone can spot a poor job of a pipe fitter or spot a rough piece of track and if a roof leaks, anyone can check it….On the other hand, when it comes to signal work, most of our officials think it is too deep for them and pass it up. The result is that it is left largely to the Signal Organization. It being left to us alone puts a heavy responsibility on our shoulders. There is no chance to pass the buck were we so inclined[104]

Maintainers, signal department managers like Steliker, and a growing number of engineers with the Signal Section of the American Railroad Association understood all too well the need for responsible meticulous workmanship. Problems, such as a misplaced wire (wires were not color coded as they are today), a "jumper" wire that accidentally bridged two contacts, or an electrical short from a frayed wire casing, (braided cotton cloth painted with shellac), could cause a false clear signal. A false clear indication could send a train onto an occupied block of track with the potential for a collision.[105]

In his testimony before a Senate Subcommittee in 1935, debating the need for regulation of the maintenance of signal systems, BRS President Anon Lyon cited the many ways mentioned in the company rule books that a false clear or false danger signal could occur and had to be addressed before traffic could enter the affected

[104] J. W. Steliker, General Signal Supervisor, lecture and paper given at an education meeting in Stockton, California, to signal employees of the Santa Fe and Southern Pacific Railroad, Oct. 3, 1926; Lyon, A.E., Note about problems that cause false clear signals to Grand Lodge Officer L. R. Smith, March 26, 1926, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.
[105] Tony Maniscalio, retired maintainer for the Long Island Railroad, interview with author, Feb. 2, 2008, Luray, VA.

blocks of track.[106] Lyon continued that, "the failure of a relay to release causes signals to indicate "clear" when they should show "danger." The four primary ways a signal could display a false clear indication on a direct-current relay, which would cause it to fail to release and show a danger indication, included: (1) residual magnetism in the core of the armature; (2) armature stop pins too short; (3) other mechanical defects; and (4) damage due to lighting. Other causes of the false clear signal failures include: sticky armature or pole faces, excessive friction in moving parts, cotter pins and bolts getting out of place and fouling the mechanism, foreign substances in the head gears or stripped head gears, a wedged up and down rod, lack of lubrication of spectacle shaft bearings or slot armature hanger pin, long trunion screws binding the slot armature, relays damaged by lightning or otherwise defective parts, improper semaphore equipment, such as the wrong spectacle casting, blade, or having the blade plate too tight. Lightning can also damage alternating current relays that would cause a false clear, which stem from damage to the vane, so it cannot clear the pole face, by welding the vane to its stop spring, by swelling the galvanometer rotor so as to cause it to bind, by welding the contact bar point to the iron top of the relay, by welding the counterweight arm to the contact support bar. Rusty fan blades or rollers in slots also can cause a false clear indication.[107]

In Lyon's history of the BRS, he disputes the fallacy held by the public and even employees that the automatic signal and train control systems are infallible and

[106] U.S. Congress, Senate Subcommittee of the Committee on Interstate Commerce, *Railroad Block Systems: A bill to promote the safety of employees and travelers on railroads by requiring common carriers engaged in interstate commerce to install, inspect, test, repair, and maintain block-signal systems, interlocking, highway grade-crossing protective devices, automatic train stop, train control, cab signal devices and other appliances, methods, and systems intended to promote the safety of Railroad Operation*, (the Signal Inspection Act), S.1288, 74th Cong., 1st sess., July 9 and 10, 1935, (Washington, D.C., United States Government Printing Office, 1935), pp.14–15.
[107] Ibid, p. 14-16.

that when these systems fail they fall back to a restrictive failsafe position. There are many incidences when things can go wrong that would result in a false clear signal. "No machine or mechanism has ever been created that is any more dependable than the machinist or mechanic who keeps it in order." If the railroads think [those] maintainers can give one-third or one half of their attention these systems are designed to need, then unsafe working conditions, "causing death or injury," will result.[108]

To prove false clear indications are more frequent than the railroads would admit publicly, Lyon presented to a Senate subcommittee, in 1935, Chart A. *Failures of Automatic Block Signals.* The chart showed that the ICC required 168 railroads to fill out questionnaires regarding failures in train control and signal systems. All but four railroads of the forty-four railroads that responded gave statistics within a five-year period. According to the chart, there were 2,190 false clear failures and 195,112 other types of signal failures. Lyon said the chart shows that "false clear indications are a common occurrence." False clear indications on average occurred in 1 percent of the total number of failures but on some railroads the occurrence of false clear failures on automatic signal systems was between 4 and 5 percent. The problem with these figures, he said, was the wide variance in the types of automatic signal systems used by different railroads, some railroads underreported failures, and others based their reports on differing criteria. The chart also fails to show the incidences of failures at highway grade crossings, interlockings, or other signaling apparatuses not

---

[108] Lyon, Anon E., *The First 75: History of the Brotherhood of Railroad Signalmen 1901—1976,* (Mount Prospect, Illinois: Brotherhood of Railroad Signalmen, 1976), p. 71.

included under the term of automatic signal system.[109] Consequently, the probability of an accident was increased as the number faulty signal devices were multiplied by the number of trains that pass through these faulty signal blocks.

Not only did the job of signalman carry enormous responsibility, it was dangerous. There was the constant hazard of electrical shock from both direct current and alternating current systems. Added to the dangers of working with high-voltage systems, there was the real possibility of being struck by a train. Signalmen were under increased pressure when the bosses extended territories, which they called "stretch outs" and "speed ups." The signalmen said speed ups and stretch outs compromised their ability to perform their work correctly. Signalmen fought for years with management, trying to set standards that required signalmen working on a line to receive train schedules and not have to rely on spotting engine smoke off in the distance.[110]

Another problem was the use of motorized track cars. The cars carried two to six men and their tools, but the wheels were insulated and did not shunt the track circuit. In addition, the cars were not heavy enough to shunt the electric circuit that would send a stop indication to any approaching train. The BRS tried for years after World War I to get some standard regulations concerning the use of motorized track cars. Efforts included the provision that two men operate every track car because when they saw a train approaching them, they could more easily lift the car off the tracks to avoid being struck. Noise levels of the new mechanized equipment

[109] Senate Subcommittee on Interstate Commerce, "S.1288," (the Signal Inspection Act), p. 19-20.
[110]Lyon, "The Signal Inspection Act," p. 1–2; Gustave C. Malmsjo, "Limitations of Maintainers' Territories," *Proceedings of the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volume dated Sept. 18–23, 1930, p. 897.

compounded the danger. The noise from the trench diggers and pneumatic hammers was sufficient to prevent maintainers from hearing approaching trains. They were eventually successful in getting carriers to build level set-off landings, whereas before signalmen had to lift the train off the rails on to the sloping ballast, which made it hard to get the car back on the track. Another problem with having only one man on a track car was that he could be knocked off the tracks by a passing train and left for hours, most likely injured, in extreme weather conditions if the train crew failed to notice they had hit the track car.[111]

[111] Patterson, Address to the Delegates, p. 14; Grand Executive Council, *Docket No.96, Docket 14, the 1936 Convention,* Officers Reports, *the Ninth Biennial and the Twenty-Fourth Regular Convention*, Toronto, Canada, bound typescript volume dated Aug. 17—20, 1938, the Archives of the Brotherhood of Railroad Signalmen of America, Front Royal, VA, p. 205; Motor Track Car Committee, Committee Report on Motor Car Accidents, *the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, Colorado, Aug. 18, 1930, p. 19—20.

Figure 13 A motorized track car that carried signalmen to work sites along the lines. Many maintainers had territories that extended more than forty miles. File photo, no date, the Archives of the Brotherhood of Railroad Signalmen. Front Royal, VA.

The Call to Professionalize the Signal Department Employees

Because the block system failed to live up to the promises made by the railroads, safety advocates and railroad managers tried to find ways to instill a sense of duty and discipline among the employees that their English counterparts exhibited. The ICC reported that for the study period between 1905 and 1907, it found American signalmen were by and large young, inexperienced, and poorly trained (1907, it should be remembered, was one of the worst years in railroad history because of the likelihood of being in a train collision or derailment). This profile gleaned from company records was seen to be the cause of train collisions. In this report, reprinted by *The Signal Engineer* in February 1909, the ICC investigations also revealed that many railroads had started to discipline operators and signalmen, which led to weeding out those who drank on the job or whose performance was lacking.[112] The block system should be just one of a number of safety measures that was necessary, the editor of *The Signal Engineer* wrote. He went on to state: "But safety appliances and block systems are not worth anything without disciplined and skilled operators and signalmen to man them." A sense of duty and personal responsibility is imperative; only the operators and signalmen "can supply the needed elements of personal efficiency, loyalty, and personal responsibility, and even the most drastic of laws can furnish no substitutes for these essential components of safe operation. Block signals will supplement them, but even block signals are of no avail against disobedience."[113] Usselman quotes signal engineer James Latimer as saying: "In this country we spend millions in an endeavor to make our apparatus fool-proof, while in England they spend hundreds to eliminate the fool, and appear to get better results."[114] Usselman wondered if Americans trained their signalmen better and paid them more, they "would have handled the job of operating home and distant signals simultaneously on the busy Pennsylvania tracks."[115]

James O. Fagan, a signalman of more than 20 years, a signal department supervisor, and a safety advocate, advocated that the job of signalman and tower operator should become professionalized as one of the ways to achieve much needed discipline on the job. He called for ethical responsibilities pertaining to the duties of

---

Signal Engineer 1, "First Annual Report of the Block Signal and Train Control Board to the Interstate Commerce Commission," (Feb. 1909): p. 353.

[113] *The Signal Engineer* 2, Editorial, (Jan. 1910): pp. 257–258.

[114] Steven Usselman, *Regulating Railroad Innovation*, p. 313; James O. Fagan, *Confessions of a Railroad Signalman*, (Boston, Houghton Mifflin Co., 1908), p.173.

[115] Steven Usselman, *Regulating Railroad Innovation*, p. 31.

a signalman, on par with those of a doctor or other professional.[116] Fagan proposed starting a "Safety League" in 1909 to create a dialog between signalmen, as well as between signalmen and management. Management blocked the proposal, he said, because they did not want employees to form "democratic" organizations that might threaten the authority of management, (this was during the same period that signalmen were trying to launch the BRS). In his conclusion, he called for government action to discipline the railroad business. Railroads spent capital on signals and devices, but neglected the human element: "pride in one's work and professionalism." As a result, he said, "there was no critical examination or discussion among employees or in their magazines over the cause and prevention of accidents."[117]

At the same time, the BRS was struggling to establish locals on many eastern railroads. Members of the BRS prided themselves as a responsible, disciplined workforce and touted this in their literature, probably as a way to bolster members' commitment to their work. While they fought for protection from accident liability, they saw that positioning themselves as responsible for public safety and for efficiency were the only way to gain recognition, the first step in gaining better working conditions, wages, and training.[118]

The BRS, from its inception in 1901, demanded training on the latest equipment. A few companies, like the Reading Railroad, provided signal schools, and several technical schools offered training. However, the opportunity for training

[116] Fagan, *Confessions of a Railroad Signalman*, pp. 1–24.
[117] James Fagan, *Confessions of a Railroad Signalman*, p. 173.
[118] Helt, Daniel, BRS President, Officer's Reports, *the Third Biennial and Eighteenth Regular Convention of the BRSA*, New York City, bound typescript volume dated Sept. 13–18, 1926, pp. 1–5.

before the 1920s was inconsistent throughout the industry. What training manuals signalmen could get from signal engineer associations and private publishers went out of date quickly within a couple of years of publication because the technology was changing so rapidly. Failure to comprehend the latest technology left the maintainer open for liability in cases of collisions and derailments.

The BRS began in early 1919 to develop ties with manufacturers, signal engineers, and other signaling departments in an effort to coordinate training. It also started *The Signalmen's Journal* in 1920, which Lyon founded and later edited. The BRS went on to publish before 1926, *The Signalman and his Work*, an educational manual. But at the 1928 BRS Convention in Chicago, delegates said that new innovations quickly dated this book, and many more volumes would be necessary. They also used another book, *Railroad Signaling*, by Everett Edgar King, published by McGraw Hill Book Company in 1921, but again, by 1926, it was out of date.[119]

At the BRS 1926 Convention, the union authorized members to approach many of the major manufacturing firms to enlist their help by providing literature on their equipment for publication in the *Journal*. As a result, the *Journal* received many blueprints, prepared speeches, instructional pamphlets, and manuals.[120]

In addition, The Railway Educational Bureau of Omaha submitted a proposal for a correspondence program on railway signaling, which they would print and

---

[119] Officers Reports, "Letters presented in the Officer's Reports" *the Third Annual Biennial and Eighteenth Regular Convention of the BRS*, New York City, bound typescript volume dated Sept. 13-18, 1926, p. 129.

[120]Officers Reports, "Education, reports and correspondence between the BRS and the ARA and Manufacturers," Report of the Grand Lodge Officers, *the Fourth Annual and Nineteenth Regular Convention of the BRS*, Chicago, bound typescript volumes dated Sept. 10—15, 1928, pp. 5–15; Grand Executive Council, "Docket No. 22, Education," Report of the Grand Executive Council *the 5th Annual and 12th Regular Convention of the BRSA*, bound typescript volume dated Denver, Aug. 18—23, 1930, p. 130.

distribute. The BRS considered this offer but did not endorse it. The BRS membership said that opening a signal school to the public would be a training ground for scabs and union busters in times of strikes. [121]

Instead, they established an Educational Bureau within *The Signalmen's Journal*. The editors allotted space in the publication for questions and answers, educational materials and instruction, technology updates, lectures in electronic theory and application, as well as other associated signal technologies. Manufacturers and the ARA provided much of the information. In addition, the *Journal* contracted engineers and signal maintainers to write articles.[122]

In 1936, the ARA said the key to further progress lay in standardized training programs and advocated apprenticeship and training programs for all employees. Before World War I, workers frequently changed jobs so they developed experience on a wide range of equipment. During the post-depression period, workers were not moving from job to job, and the ARA said it is imperative that the carriers provide training in a wide variety of skills, including safety and customer courtesy, public speaking, accounting, and mechanical and electrical skills needed by the shop and skilled operational departments. *Railway Age* reported, "…as of 1936, most employees set about learning their trades through educational programs and courses they find on their own. This is haphazard at best."[123]

Nevertheless, because signalmen and maintainers were spread thinly throughout the railroad networks—one man or a small crew could be responsible for

---

[121] Ibid.

[122] Grand Executive Council, "Docket No. 22, Education," p. 130; Grand Lodge Officers, "Education, reports and correspondence," pp 5—15.

[123] *Railway Age* 101, "The Key to Further Progress lies in Personnel Policies," (Dec. 19, 1936): pp. 879–880.

as much as forty miles of railroad—many learned electrical theory and other aspects of their craft through correspondence schools, which were prevalent during the twentieth century. Many lodges had started evening training sessions of their own and had won the support of the signal engineers who appreciated their understanding of the latest developments in signaling technology and who participated in giving lectures. In addition, engineers from signal manufacturers began sending speakers out. The *Journal* acted as a broadcaster of these training sessions and offered to help find speakers for the lodges. The signal engineers read the *Journal* articles and sent in their comments to make sure the information was correct. Lyon said he welcomed their input. Lyon reported that many signal engineers read the journal, though some did it to catch mistakes, but Lyon heard from the engineers who appreciated the training aspects of the journal.[124]

However, through their publication *The Signalmen's Journal* and the Education Bureau, the union's members gained technical backgrounds in mechanical engineering and electronic theory and application. Signalmen and maintainers could no longer be classified as semi-skilled laborers. At the same time, they would use their training in math and science to improve their working environments by gathering evidence of their skills and of the dangerous working conditions they faced daily. Editor Anon Lyon created a Statistics Bureau, which was attached to the *Journal* and the Education Bureau, which recorded not only membership data but work assessments they would use to go before labor and wage adjustment boards. The evidence compiled by the BRS Statistical Bureau would later be used in

---

[124] *The Signalmen's Journal* 16, "Signal Schools," (May 1935): p. 115.

Congressional hearings to lobby for the Signal Inspection Act and other railroad safety legislation.

Therefore, rising skill levels of the signalmen inadvertently afforded them the skills necessary to better negotiate with their employers and pursue legislation that would improve their status with the railroads, cement their role in railroad operations, and solidify their union's relationships with the other unions.

The *Signalmen's Journal,* which is still the main communication tool of the BRS, joined together the local lodges that were spread out across the country, bringing news vital to keep the organization informed and unified. The *Journal* also provided histories of the railroads, of their members, and of the many types of signal systems. It provided a sense of historical continuity and self-worth, which the men could embrace as their history and incorporate it into their arguments for recognition as skilled workers.[125]

The testimony by W.M. Vandersluis, General Superintendent of Telegraphs and Signals for the Illinois Central Railroad before the same Senate Subcommittee on Commerce shows that by 1935, some carriers were taking steps to better train their signal department employees. He testified that American railroads had greatly improved the training of men in the art of signaling. Methods used to train signal department employees include printed rules and regulations, standardized plans and specifications, circulars and bulletins, personal contact with supervisors, classes in which men take instruction and have discussions about the systems employed. They were required to read nineteen chapters of the American Railway Signaling: *Principles and Practices Issued by the Signal Section, Association of American*

[125] Ibid.

Railroads. Over 150,000 copies of the chapters were distributed to signal departments. "Advancement in job classification is achieved by studying these materials and taking both oral and written examinations. Apprenticeships last a minimum of four years," he testified.[126]

Today, as in times past, signalmen and maintainers have to be able to work on a wide range of signaling and communication apparatus because every section or block of track is different and is designed and built to handle a wide variety of trains and conditions. However, despite the upgrades and improvements to the plants over the last eighty years, some signalmen work on blocks of track that still use mechanical and electro-mechanical interlocking systems to change the signal indications and track turnouts that were around in the 1920s. Carriers rarely spend revenues to improve equipment that is working adequately for a particular location, although they are slowly retiring those systems and replacing them with new types of computer-driven systems and CTC. Using CTC a dispatcher, working for CSX in Jacksonville, Florida, has the ability to change signals and turnouts to direct train movements all over the eastern seaboard and as far west as Illinois. Tony "Signals" Maniscalio, a maintainer who retired from the Long Island Railroad in 1999, described what it was like when something broke during his shift.

---

[126] U.S. Congress, Senate Subcommittee of the Committee on Interstate Commerce, *S.1288, Railroad Block Systems: A bill to promote the safety of employees and travelers on railroads by requiring common carriers engaged in interstate commerce to install, inspect, test, repair, and maintain block-signal systems, interlocking, highway grade-crossing protective devices, automatic train stop, train control, cab signal devices and other appliances, methods, and systems intended to promote the safety of Railroad Operation, (The Signal Inspection bill):Hearings before the Subcommittee on Interstate Commerce*, 74th Cong., 1st sess., July 9 and 10, 1935. Washington, D.C., United States Gov. Printing Office, 1935, pp. 41—42.

> As a signalman working second or third shift—alone—you were sent on trouble calls to places you've never been; to fix appliances you have never seen before. Kinda learn as you go! You knew you had to restore it into a safe condition—but how? Thankfully, there was always a set of plans around to guide you. There were many 'first times' you were expected to fix whatever it was. My schooling consisted of carrying my mechanics tools, listening intently, [and] looking over another mechanic's shoulder. The next time we came across the very same type of failure; I was to tell him how to fix it. Every three months they would rotate us to different mechanics around the railroad. Once you were qualified, you were sent where the trouble is. Fix a draw bridge—never saw one before—[But I] got a set of plans in my hand and a meter in the other ... Every day was a learning experience. Every day was a challenge! It was 'broke' and you had to be a fast learner, understand it, fix it , [and] test it before you gave the OK to move a train over it.[127]

Each block had its own requirements for safety and efficiency, which required signalmen and maintainers to be able to work on a wide range of signal systems, interlockings, CTC, ATC, and safety appliances. The skill levels of the more experienced signalmen and maintainers, as well as the fact that signal work that was particular to the signal departments, separated these employees from the other employee classes. As their work became more specialized, their work responsibilities and duties overlapped and partially encroached on the jurisdictions of five other unions. In other words, electricians worked on electrical equipment, machinists worked shaping and welding metal pieces, carpenters worked with wood, and so forth. The signalmen trade was radically different. It was organized along industrial job descriptions, which was new to trade unionism. Some trade unions saw this as a

[127] Tony "Signals" Maniscalco, Email from retired Long Island Railroad Maintainer to author, Jan. 23, 2008.

threat to their power, which was based on the size of their memberships and their importance to industry. Fearing that their workers would be divided up, these other trade unions felt they would not have the numbers to stand together against industry. The jurisdictional battles over signal department jobs would tax the leadership of the BRS, yet these battles would define what roles signalmen and maintainers would take in the railroads and what role their union would take among the other railroad brotherhoods.

Chapter 4: Signal Work Is Particular Work—Fighting for Recognition within Railroad Institutions

Damn anyone that will force us to lose our identity…"[128]

From the first clandestine meetings in 1901, the founders of the BRS sought standardization of their work situations and classification of their positions in a hierarchy of workers based on skill and seniority. They also sought a distinction of their work separate from other nonoperational employees, such as the maintenance-of-way workers. Operational workers included the enginemen, conductors, train crews, and the dispatchers. "Non-ops" did everything else from replacing track to filling out shipping manifests and made up the ranks of the supporting departments. In the process of distinguishing itself as a skilled craft union, other railroad and trade unions saw the job classifications within the signal departments being taken over by the BRS. Protracted battles ensued over job classifications, which unions needed to grow membership in their organizations. While the federal government finally recognized the BRS as the representing union for all signal department employees in the 1920s, it would take another twenty-six years to quell the fights over signal department jobs.

While the BRS began to organize in 1901, the railroads underwent what has been called the "golden era," when the railroad mileage expanded from 193,000 miles in 1900 to 240,000 miles by 1910. Between 1900 and 1910, passenger miles doubled

[128] Grand President Daniel Helt, BRS, speaking in negotiations with the Railroad Employees Department of the American Federation of Labor, 1919, Minutes of the meeting held with the shop crafts, Of the Railway Employment Department and the Brotherhood of Railroad Signalmen, Kansas City, July 17, 1919, pp. 169–183.

and freight ton-miles increased by 80 percent. The value-for-services-rate system used by the ICC benefited large commodity shippers and hurt manufacturers of consumer goods. From 1887 to 1907, the railroads reaped enormous profits and were America's largest growth industry. Despite 1907 being the year for the most fatalities and accidents to date, the carriers' net investments for 1907 were $1.5 billion compared to $589 million the year before. However, after 1907, an economic panic ensued, catalyzing the long financial fall of the railroad industry. New investments dropped to $750 million annually between 1908 and 1911, but after 1912, new investments dropped to $100 million. Fewer investments meant the operating costs to operating revenues increased from their standard 66 percent to a high of 72.2 percent by 1914. Operating expenses and taxes grew faster than revenues so the operating ratio in 1908 increased to 70 percent and stayed that way every year from 1912 to 1915. In 1916, railroads sought general rate increases, which were only partially successful.[129] The economic stability of the carriers would always play a part in how much authority and political power railroad labor could muster.

At the same time, the BRS saw that they would not get help from the federal government in the way of job protection, safety issues, or needed oversight in the maintenance of signal systems. The union leaders saw the ICC as having failed in its duties to push for needed safety measures and lacked the ability to do much more than recommend needed changes. The first employee dedicated to safety issues had been appointed in April 1896, and by 1901, there were six inspectors. By 1908, the staff grew to twenty-five inspectors to handle the nation's entire railroad system. On July 1, 1911 the ICC organized a safety appliances division, which in 1917, became

[129] Hoogenboom, *A History of the ICC: From Panacea to Palliative*, p. 58.

the Bureau of Safety, when the term "bureau" was adopted for all major operating units of the ICC. In 1917, there were twenty-seven safety appliance inspectors and three hours of service inspectors (who supervised employee workloads and hours they worked in a given time period).[130] Even by 1934, the Bureau of Safety was only able to investigate 77 of the most serious accidents that occurred in block signal territory.[131] From a table of collisions, derailments and other train accidents from 1902 to 1965, compiled by Aldrich from the ICC *Accident Bulletin*, there were 6,023 total accidents that year, of which there were 1,317 train collisions and 3,489 derailments reported. It is very likely there were more accidents not recorded as the reporting criteria were conditional on whether there were any fatalities, injuries, or loss of property over $150. In addition, railroads underreported accidents to the federal government, and kept injured employees on payrolls to disguise poor safety records.[132]

As the railroads fought attempts by labor-friendly Democrats in Congress to promulgate safety regulations during the first two decades of the twentieth century, the role of the signalman in traffic safety and management began to crystallize. The primary objectives of signalmen and signal maintainers were to keep trains moving quickly, efficiently and safely through the railroad networks. They often worked independently in locations far removed from managerial authority. Signalmen and maintainers had to be independent thinkers and responsible employees, willing to

---

[130] The Interstate Commerce Commission, The Bureau of Statistics, *The Interstate Commission Activities 1887–193*, (*Washington D.C.: Superintendent of Documents, March 1937)*, pp. 117–129; Walter M. W. Splawn, “Railroad Regulation by the Interstate Commerce Commission, Ownership and Regulation of Public Utilities,” *Annals of the American Academy of Political and Social Science* 201, (Jan. 1939): p. 158.
[131] Senate Subcommittee on the Interstate Commerce, *S. 1288, The Signal Inspection Act*, p. 39.
[132] Aldrich, *Death Rode the Rails,* Appendix 2, Table A2.6, 332.

make hard decisions. Often, they made such decisions in emergency situations with little supervisory support. Many times signalmen sweated their decisions, as trains entered their newly repaired territory.[133]

The signal departments required their men to be a multi-skilled and versatile workforce. They were literate and developed on-the-job knowledge of not only electrical theory and application, but of carpentry, machining, blacksmithing, welding, sheet metal working, and pipe fitting. They gained mechanical skills on par with other mechanical trades outside the railroads. “If a maintainer above the grade of helper couldn’t perform all five classes of work, he would be little value to the railroads and they would get rid of him.” said BRS President Daniel Helt in 1919, during a jurisdictional battle with other unions in the AF of L.[134]

At the same time, the signal maintainers, working individually or in gangs, performed manual labor digging trenches to bury cables, electric lines, and batteries, as well as climbing poles to repair both low- and high-voltage lines. Because of the wide variety of skills that they used to work on signal systems, signalmen and maintainers were referred to as composite mechanics by American Railroad Association (ARA). Nevertheless, because of the manual labor aspects of their jobs and management’s desire to hold down wages, most carriers preferred to classify the maintainers and signalmen as part of the maintenance of way department. Nonetheless, their skill levels were above those of the manual laborers who laid track and groomed track beds. The brotherhood’s officers repeatedly had to explain to new

[133] Tim DePaepe, BRS Researcher, phone interview with author, Oct. 27, 2007.
[134] Minutes of the meeting held with the shop crafts, of the Railway Employment Department of the AF of L and the Brotherhood of Railroad Signalmen, Kansas City, July 17, 1919, pp. 169–183.

managers and members of the many federal labor commissions the roles of signalmen in traffic safety and efficiency and the variety of jobs signalmen performed.[135]

What signalmen actually did and their importance to the safety and efficiency of the railroads was rarely understood outside the signal departments. Members of the federal labor boards had little knowledge about what signal work is as do representatives of Railways Employees Department (or RED, a branch of the AF of L), said BRS President Daniel Helt, in 1919, before a meeting of labor leaders. "I question whether there is a man here without signal experience that can speak on our position five minutes under questioning ... the greatest trouble we have, [is] men not familiar with the duties we perform." [136]

Mechanics in the other craft unions were highly skilled, but while they performed tasks such as rebuilding and maintaining train engines in the company shops, signalmen and maintainers worked on extensive traffic systems that covered entire regions of the country. Their territories included complex terminals, busy junctions, and sprawling train yards. The isolated nature of the signalmen's work demanded that they be able to work on many different types of signal apparatus on territories that could extend more than forty miles. During economic downturns, signalmen and maintainers were subject to "stretch outs" or "speed ups." When the bosses call for a stretch out, signalmen's territories were extended farther than what the BRS said a maintainer could handle safely. The range of their experience included building, repairing, and maintaining the older mechanical interlocking signal and switch systems of the late 1800s to the complex electronic automatic signal

---

[135] Ibid.
[136] Ibid.

systems, which became prevalent in the late 1920s, and CTC, introduced in the 1930s.[137]

While the complexity of the systems and the rapid changes in train traffic management raised their members' skill levels, working on these innovative systems put the BRS into direct conflict of signal department jobs with other unions. Jurisdiction over its work was, at times claimed by as many as five other railroad unions up until 1946. This conflict resulted in recruitment battles over signal department employees and created problems for the BRS in gaining skilled craft status from carriers, state and federal governments, and other unions and labor organizations, including the AF of L. Moreover, the number of signal department employees comprised only a small part of the total number of employees, and the signalmen were spread thinly throughout the rail networks. For this reason, other unions said the BRS would be too weak and too spread out to represent these workers effectively. They also said that having too many unions among railroad employees would fractionalize the workers' power in negotiations with management. The BRS countered that they would be lost within other unions and treated as second-tier workers. Members of the BRS said that signal department employees because of their unique, "particular" work demanded their own representation.[138] The next two

[137] Using automatic signals and central control systems, an operator or dispatcher could direct train traffic many miles from a central tower. The problem of "speed-ups," A. E. Lyon, Report of the Acting Grand President, *Efforts to Secure Passage of the Signal Inspection Bill*, p. 24.
[138] J.W. Steliker, General Signal Supervisor, used the word "particular" to describe signal work in a lecture on the importance of the signal department given at an education meeting in Stockton, Calif. to signal employees of the Santa Fe and Southern Pacific Railroad, Oct. 3, 1926, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

sections explore the founding of the BRS and the union's ascent to greater political authority within the railroad institutions during the first half of the twentieth century.

Approaching Management: Come Let Us Reason Together

Signalmen followed the path of the operating unions in building their union and contributed to the development of the industry's bureaucracies, which helped stabilize their very dangerous work environment. Historian Walter Licht argued that railroad employees entered new work situations created by innovative businessmen in the mid-to-late 1800s. Yet according to Licht, the employees, who previously worked on farms or in factories, were connected to the carriers only through local foremen and supervisors, "who ruled arbitrarily, granting favoritism to some and discrimination against others."[139] In 1877, workers were able to secure employment contracts with the carriers that he said, "provided fairness, justice, and security." Workers banded together to demand further and stricter "bureaucratization" of company standards and procedures to gain as much control of their work experience as possible. Standardized procedures thwarted the problem of too powerful foremen, which further stabilized the work situations and lessened tensions between management and labor. "[Workers] both lost and gained in the process," Licht suggests. Some workers lost benefits they had under old system, and they traded "the adventure and romance of railroading" for increased control over their work through standardization and routinization of their work. "Pioneer railway executives imposed

---

[139] Walter Licht, Working *for the Railroad, The Organization of Work in the Nineteenth Century,* (New Jersey, Princeton University Press, 1983), pp. xviii, 269-171.

bureaucratic structures from on high, but bureaucratization was a process resulting in large measure from pressure from below."[140]

Dissatisfied with their wages and working conditions, a group of signalmen formed a fraternal organization in 1901 to circumvent management's anti-labor policies. They worked on the Pennsylvania Railroad's 132-mile main line from Altoona to Harrisburg and met secretly to find ways to improve their wages, change their status as part of the maintenance of way department, and find ways to protect themselves from the liability connected with maintaining signaling systems that protected the public. Union activities on the Altoona section were discouraged by either penalizing employees or dismissing them during the "yellow dog era," when industries preferred individual contracts as opposed to collective bargaining. Organizing as a fraternal organization skirted that rule and in the process cemented members' loyalty to the group and helped establish the union in the broader community. Early meetings were held at the B O Tower near Altoona during the winter of 1901 and 1902. At that time, the territory held twelve of the fourteen interlockings that mechanically operated signals, switches, and derails through a system of pipes attached to the interlocking machine levers. The other two interlockings were of the newer electro-pneumatic type that used electricity to compress air to operate the signals and switches. Governing a heavily traveled, multiple track line, the B O Tower required two-man maintenance crews, working day and night shifts that consisted of a maintainer and an assistant.[141]

---

[140] Ibid. pp. 269-171, xviii.
[141] Lyon, *The First 75, pp. 3—8.*

Figure 14 The "B O" Tower, Altoona, PA, Site of the first clandestine meetings of the BRS as a fraternal organization in 1901. File photo, the Archives of the BRS, Front Royal, VA.

During the winter of 1901, the members selected five signalmen to act as a committee to approach management about their desire to organize. The original committee was J. V. Judge, H. G. Detwiler, Philip Weller, W. N. Spangles and R. S. Hanley. J. V. Judge, who after asking permission of several supervisors, met with General Superintendent J. M. Wallis and made three requests. The committee wanted: their wages increased from 14 cents an hour to 25 cents an hour for a ten-hour day; the formation of a separate signal department; and they wanted opportunities for the signalmen to learn about the new electro-pneumatic interlocking equipment that was starting to be installed on the lines.[142]

[142] Wilmot J. Pettit, *History of the BRS of America,* (Ontario, Canada, The Brotherhood of Railroad Signalmen, Feb. 1916), pp. 1–11; Lyon, *The First 75*, p. 1–5.

Wallis, like the other general superintendents on the PRR, had authority to make independent decisions concerning personnel and the operation of their lines but was unique in that he listened to the needs of his workers. He asked if they were organized and if they had the authority to represent all or a majority of the signalmen on the Middle Division. He went on to urge them to organize because he did not want other personnel groups to approach him with conflicting demands. The signalmen were overjoyed. For the first time, they had access to the highest level of management on the division and had been urged to organize.[143]

The signalmen went forward in forming a separate union but not until after Judge met with the three other unions on the line, asking them if the signalmen could join their unions. The Brotherhood of Trainmen, the Order of Railroad Telegraphers, and the Car Builders Union each rejected the signalmen's request under the terms of each organization's constitutions and because signal work was a different class of work. In the meetings held at the Behm Hotel in Altoona and at the B O Tower, the signalmen hammered out the details of their new union. Detwiler was named secretary and wrote the constitution and bylaws, which were approved on March 7, 1902. He went on to create a ritual, an official seal, and the Mutual Agreement Charter, which held the names of the original group of seventy-eight members of the first lodge, the Mountain Lodge No. 1 of the Brotherhood of Railroad Signalmen of America. Detwiler, who had been employed by the PRR since 1898, became the first Chief Signalman or presiding Chairman of Lodge No. 1, after Judge held the post for three months and then stepped aside.[144]

---

[143] Lyon, *The First 75*, p. 8.
[144] Lyon, *The First 75*, p. 9–10.

One of the committee members, presumed to be Detwiler, who now represented the majority of signalmen on the Middle Division, described his second meeting with Wallis. The committee member wrote in 1902 that they got together with Wallis for three hours on March 7, 1902, under the Charter of Mountain Lodge No. 1 of the BRS. "We were not misled by the idea that we could achieve our purpose by demand. But we used correct application and strict observance of the fundamental rules (of railroad procedure) and that we governed the maintenance of two electro-pneumatic plants and twelve mechanical plants." He said the committee made it clear saying, "if the job don't suit us we will quit. There is a demand for mechanics …all can get work immediately from contractors in the city." [145]

Figure 15 H.G. Detwiler, First Grand Chief Signalman, considered the father of the BRSA. He wrote the charters, rituals, and its motto: "Labor Omina Vincit," Work Conquers All. File photo from the Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA.

Wallis said he had discovered that their wage of 14 cents an hour was far below others in other divisions and matched the New York division rate of 24.6 cents an hour. He also arranged for the development of a division signal department with a signal supervisor in charge. No record exists of what happened concerning the third request for training.[146]

---

[145] H. G. Detwiler, *To begin the begin, The beginning of the Brotherhood of Railroad Signalmen of America – in Altoona, Pa.* Handwritten note believed to be written by Detwiler (or possibly another member of the committee) who attended the second meeting with Wallis in 1902, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box; Lyon, *The First 75,* p. 12.
[146] Lyon, *The First 75,* p. 12.

These workers, considered to be semi-skilled and low on the social scale of railroad employees, approached management with professionalism, tact, and clarity. The committee member wrote, “We did not argue – there were no hot heads among us, but we used the advice given in scripture (come let us reason together). We reasoned our grievance together with General Superintendent J. M. Wallis, who proved to be a man among men – He granted our request.” The members of the BRS had great respect for Wallis, and Lyon said that there were few other managers like him on the PRR.[147]

This professional approach would set the tone of how they would negotiate throughout the 20th century. Knowing they could not negotiate from a position of strength in numbers, they had to find other ways to get their demands met.

From 1901 to 1908, other lodges were established on other lines, and in 1908 they came together and established the Local No. 1 as the Grand Lodge. Shortly after hearing about the pay raise and formation of the Grand Lodge, H. L. Wilmot Pettit, who would later be elected Grand Chief Signalman, wrote that that nearly every signalman on the Middle Division had joined the Brotherhood. The leadership jumped from four officers to fourteen, and four new lodges in Pennsylvania were chartered. The growth continued despite anti-union sentiment. Lodge No. 14 did not last as management there let it be known that any employee joining the union would be fired under the “yellow dog policy” of individual employee contracts. On April 6, 1908, with the help of a local lawyer, the BRS petitioned and received a state charter, under an 1874 law in Pennsylvania, and became a Pennsylvania corporation

[147] Ibid.

headquartered in Altoona. The headquarters and charter were signified as The Grand Lodge of the Brotherhood of Railway Signalmen of America. This charter gave the other lodges greater legitimacy and status by the BRS by having official state recognition. Signalmen on other lines came to meet with them in New York later that year.[148] The charter certified that the purpose of the brotherhood was to:

> …unite fraternally all persons of good moral character and sound bodily health who are actively engaged in switch and signal duties of railway signalmen; to establish a fund for the relief of sick and distressed members; to procure a headquarters in which meetings might be held in social intercourse; and to procure literature pertaining to the work of railway signalmen, thereby creating an active interest in the members' welfare.[149]

Lyon said that the BRS purposely omitted any language that signified that the organization was a trade union and "was formed for the principle purpose of obtaining a wage increase and other concessions from the railroad company." Such statements might have blocked passage of the charter for the BRS. It was not common practice to incorporate unions, and other unions did not approve of the practice. It is not clear why they incorporated, but it did act as a spur to form the Grand Lodge, hold their first convention on Feb. 9, 1908, and lend creditability to the fledgling organization with signalmen on other lines. The minutes were recorded by H. C. Dunn, Lodge No. 2, who became the first Grand Lodge Secretary-Treasurer. BRS members elected Philip Weller Grand Chief Signalman, and H. L. Neider was

---

[148] H. L. Neider, First Grand-Vice Chief, *The Birth and the History of the BRS of A*, Pittsburg, PA, Sept. 9, 1912, pp. 1-2 *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box; Request for a State Charter by the Brotherhood of Railway Signalmen of America, Granted by Decree of The Court, April 6, 1908, Court of Common Pleas, Blair County, PA., March 4, 1908, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.; Wilmot J. Pettit, *History of the BRS of America*, pp. 1–11
[149] Request for state charter, Court of Common Pleas, March 4, 1908.

selected as the first Vice-Grand Lodge Chief Signalman. Three Grand Lodge Trustees, Detwiler, Neider, and H. C. Brubaker, were elected to oversee the financial aspects of the union. At this convention, it was decided that the BRS should contact and form connections with other unions in an attempt to form one umbrella organization. [150]

Grand Lodge officers of the BRS took an active role in bringing other unions into a centralized organization. On April 12, 1908, seventeen leaders from the four existing signalmen unions, which had affiliated with the AF of L, met with the BRS. The meeting included the Interlockers, Switch and Signalmen's Union No. 11785 in Boston and delegates from the Bridgeport Union, and the New York Railroad's Order of Railroad Interlockers of North America. Among the unions present at the second meeting were the Interlockers, Switch and Signalmen's Union, No. 11867 of the AF of L, the Order of Railway Interlockers of North America, an independent union on the West Jersey and Seashore Railroad, and the BRS. At the following meeting on April 19, 1908, a constitution of the Grand Lodge was approved, and an exploratory committee was formed to meet with other union officers. In June, Detwiler reported talks with other signalmen who were organized on the New York, New Haven & Hartford, and the West Jersey & Seashore Railroads. Dunn reported in the minutes that a consolidation of unions, which also included signalmen from the Boston & Maine Railroad, was approved, with the Order of Railroad Interlockers of North

---

[150] Spring Meeting Minutes of Railway Signalmen, New York City, April 12, 1908, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box; Anon Lyon, *The First 75*, p. 18.

America dissenting. Months later, the unions would join under a temporary charter of the Brotherhood of Railway Signalmen of America. [151]

The significance of this early alliance with signal department employees from other companies was the positioning of Mountain Lodge Number 1 as the central headquarters and the BRS as the central representative of all signal department employees. Having established the BRS as the central representative, other unions competing for signal department employees would have to negotiate with them and this built the power base from which the BRS could reach out to signal department employees on other railroads. Once established as the central representative, the BRS officers could now define the signalmen's role within the railroads. This authority would better facilitate their demand for recognition and give them access to new duties as signaling technology would demand new skills. In turn, access to new responsibilities would, they thought, also broaden the scope of its members' involvement in railroad operations and further increase membership by assuming job descriptions that were given over to other unions.

The BRS positioned itself as a central umbrella organization for all signal department employees. As in all labor politics, unions had to control enough of the employees to affect change within their departments, the companies, or the institution of railroads. From the start, the leaders of the BRS saw themselves as a national labor organization rather than a labor group within a company. This pursuit for political

[151] Spring Meeting minutes of Railway Signalmen in New York City, April 12, 1908, approved *Minutes of the Meeting at Grand Lodge of the BRSA*, Altoona, PA, March 7, 1907, Wilmot J. Pettit, *History of the BRS of America*, pp. 16–20; Anon Lyon, *The First 75*, p. 30; *The First Annual and Third Regular Session of the Grand Lodge of the BRS*, Philadelphia, August 16,17, 1908, found in *The 25th Anniversary Celebration, BRS of A*, Floral Park, North Bergen, N.J., June, 27, 1926. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box, BRS Archives, Front Royal, VA.

power and the leverage to affect changes in their working environment would propel them into becoming the national representative for all signalmen and maintainers in the United States and Canada.

The three temporary officers were chosen from the leadership of the four unions, and it was decided that a convention would be held in Philadelphia in August 1908 to write its constitution. The BRS also decided that each union could only send three delegates to the first convention, entitled the First Annual and Third Regular Session of the Grand Lodge. Before this gathering, any signalmen could attend the BRS conventions. Details of the constitution were worked out, and Grand Lodge Officers were elected. Although attendance was not recorded, thirty-five votes were recorded in the elections. They decided that a Grand Lodge Tax of 15 cents a month was to be paid by each member. The tax was, in part, to pay the salaries of The Grand Organizer ($80 per month) and the Grand Secretary-Treasurer ($300 per year); the Grand Chief Signalman would not receive a salary.[152] In 1911, the BRS became an international union with the addition of the first Canadian lodge.

Despite this impressive show of solidarity that created a groundswell within signaling departments, there was widespread opposition to unionization in the broader society, and carriers refused to recognize BRS. Managers fired or penalized workers who joined the BRS. This was a time when employers began to realize that trade unions were a growing part of the American labor market and employers began to deal with union demands harshly. Melvin Dubofsky marks the period from 1910 to

---

[152] Spring Meeting minutes of Railway Signalmen, pp. 16–20; Wilmot J. Pettit, *History of the BRS of America*, pp. 16–20; Anon Lyon, *The First 75,* p. 30; "The First Annual and Third Regular Session of the Grand Lodge of The BRS," Philadelphia, August 16, 17, 1908, *The 25th Anniversary Celebration, BRSA,* Floral Park, North Bergen, N.J., June, 27, 1926, *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

1915 “as an age of industrial violence,” and the era from 1910 to 1922 “as the era of mass strike.”[153]

Proponents of anti-unionism argued that a lack of discipline and blamed the number of accidents caused by human error on union organizing. James O. Fagan, a retired signalman and signal department supervisor, asserted in a letter to the Editor of The *New York Times* in 1913 that the root cause of the disciplinary problem was that attempts to discipline workers with suspensions or dismissal brought on the wrath of the labor unions. Attempts to discipline the men were met with a grievance committee from the brotherhoods, which the railroads had to placate to avoid strikes or walk outs. Fagan and the editors of the *Signal Engineer* said the brotherhoods controlled who was hired, and the railroads turned over the job of distributing payroll to its brotherhoods. Yet the unions took no responsibility for the actions of its members, he said.[154] It should be noted that throughout the first two decades of the twentieth century, the BRS, because of their small size, they worked behind the scenes, supported other railroad unions’ demands and walkouts, and preferred to follow the more diplomatic example of their founding leaders.

The early years were both a financial and emotional struggle for the members of the fledgling union. By the beginning of 1920, the original Lodges No. 2, No. 3, and No. 4 were closed down, although Mountain Lodge No. 1 persevered. Lyon attributed the survival of Mountain Lodge No. 1 to the fact that it was first a fraternal

[153] Melvin Dubofsky, *The State and Labor in Modern America*, (Chapel Hill, The University of North Carolina Press, 1994), p. 38.
[154] James O. Fagan, “Letter to the Editor: Safety First,” *The New York Times*, (Feb. 1913): p. 12; Anonymous author, “Railroad Accidents and Their Causes, p. A12; *The Signal Engineer* 2, Editorial, (Jan. 1910): pp. 257–258.

organization and a center for social occasions before it became a union hall. The lodge was engrained into the social fabric of the community, which gave the union stability and its members resolve to continue despite pressure from management. In

Figure 16 A delegation from Mountain Lodge No. 1 in full dress uniforms for the 1904 Labor Day Parade in Altoona, Pennsylvania. Photo from the Archives of the Brotherhood of Railroad Signalmen, Front Royal. VA.

addition, the leadership incorporated highly formalized ceremonies for conducting meetings, inducting new members, and installing officers. Many newly created social events strengthened ties among the members. Mountain Lodge No. 1 borrowed these ideas from other major and successful unions. They wore uniforms, marched together in parades, wore banners and badges, and had their own drum corps. Passwords, recognition signals, and special handshakes were part of the process of instilling loyalty to the brotherhood, as well as having formal written codes of conduct at members' funerals. They also established a fund to care for their sick. Meetings were held both at night and day on a weekly basis so men working different shifts could attend. Their motto, authored in 1902 by Detwiler, was “Labor Omani Vincit,” “Work Conquers All.”[155]

Signalmen on western railroads had more success in establishing union lodges; however, 1913 was recognized as the low point of BRS activity. At the Detroit convention that year, it was reported that there were only 800 members, 18 active lodges, and the treasury had only $118.64, with some unpaid bills outstanding. Grand Chief J. A. Martin became the second Chief to resign before his term ended after he failed for six weeks to recruit new members around the Pittsburgh area. He reported, “The officials of the PRR had railroad police everywhere, and they were instructed to arrest anyone found trespassing on their property.” He left in April 1913 and took a traveling salesman job for a wholesale firm.[156]

The Brotherhood had reached a low point as some lodges were going under financially because signalmen were not paying their dues or joining the young union. The BRS, at this time, did not instill enough confidence in signal department employees that the union could effectively help them. Added to this, the anti-union sentiments in American society stifled the growth of the BRS. D. R. Daniels, Grand Secretary–Treasurer is credited with holding the union together through this difficult time.[157]

The BRS entered a difficult time when they were unable to get signal department employees to join or members to pay dues. A union without active members has little power to affect change. At the same time, if a union cannot affect positive changes for their members, few employees will be willing to join. The BRS

---

[155] Wilmot J. Pettit, History *of the BRS of A*, p. 5-14; Anon Lyon, *The First 75*, p. 9 – 16.
[156] Lyon, *The First 75*, p. 31-37; Wilmot Pettit, *History of the BRS of A*, pp. 24--27.
[157] Lyon, Ibid, p. 31–37; Pettit, *History of the BRS of A*, pp. 24–27.

had to find a way out of this conundrum, and a strong, charismatic leader was the answer.

Wilmot Pettit, Seeking Representational Authority

After four years of failed lodges and poor finances, the revival of the BRS came with the election of Wilmot J. Pettit as Grand Board of Trustees at the 1912 convention. Pettit would go on to become Grand Chief Signalman by unanimous vote in 1913. Born in Ontario, Canada, Lyon said Pettit worked as a maintainer-leverman on Michigan Central in La Sallette, Ontario and was "a man of considerable vision, of fine character, and of great loyalty to the principles of the organization in which he deeply believed." Pettit made great strides in setting the brotherhood during the early, anti-unionist decades of the twentieth century on the path to becoming a powerful railroad union and in gaining the BRS affiliation with the AF of L.[158]

Figure 17 Wilmot J. Pettit, Grand Chief Signalman from 1913-1915 made great progress in establishing the BRSA as a separate skilled craft union. Photo from A.E. Lyon, *The First 77, History of the Brotherhood of Railroad Signalmen, 1901-1976,* 1976, p. 36.

Pettit's abilities to gather support for his union and to work with other labor leaders set a high standard for future BRS officers and eventually positioned the BRS to become a force in railroad labor politics, but not without the jurisdictional disputes that would continue through World War II. Jurisdictional disputes were directly related to the changes in their work caused by

[158] Lyon, *The First 75,* p. 37.

innovations in signaling technology. In order to keep current on the many innovations, the officers of the BRS decided to develop means of communicating with their members stretched thinly throughout the United States and Canada. They would go on to publish their own technical and labor journal in 1920, which was also the location of their Education Bureau. The Education Bureau would provide signalmen in the field the knowledge and technical background they would need to stay current with the new innovations. The combination of technical and labor news stimulated its members not only to take apart in the labor struggles but to develop learning skills that helped them rise above the level of laborer. They were becoming part of the technically educated middle class, the backbone of this technically specialized and challenging industry.

Chapter 5: The Fight for an Identity and for Jurisdiction over the Signal Department Jobs

As discussed, the increased complexity of the innovations in signaling technology during the first half of the twentieth century propelled the occupation of signalman and maintainer from semi-skilled laborer to that of a skilled composite mechanic. Although the changeover on many lines to centralized Train Control (CTC) and automatic signal control (ASC) was stifled during the Great Depression, carriers would discover greater economies from installing these systems on their lines. The jump in traffic volume during World War II, the need to lower labor costs, the push for more production, and the stricter enforcement of signal inspections (as required by the Signal Inspection Act of 1937) gave the carriers the impetus needed to upgrade to CTC. Nevertheless, with the changes in technology came the age-old jurisdictional battles over which union had control over signal department jobs.

Upon investigation into whether the BRS could represent signal department employees at the end of World War I, Helt reported to his executive staff that William Gibbs McAdoo, Director General of the Railroads, recommended, "Signalmen shall receive a separate proposition because of the character of [their] work."[159] Although, the BRS succeeded in gaining recognition by the federal government as the representative of signal department employees, from 1920 to 1949, they would still have to convince management and the other unions clamoring for control over signal department jobs.

---

[159] Helt, The Shop Crafts of the Railway Employment Department, pp. 169 – 183.

The wide variety of responsibilities and duties coupled with the fact that the BRS had only a fraction of the total number of railroad employees blocked recognition of the BRS as a skilled craft union with both the carriers and the other unions. This lack of recognition frustrated BRS's attempts to be acknowledged for their contributions to the railroads and the public. In addition, carriers frequently decried BRS workers as not being semi-skilled manual labor, saying the automatic systems were doing the work for them. This contention was pursued by management to keep wages low. The BRS was repeatedly compelled to educate new managers about concessions and status they had earned through previous negotiations.

The lack of institutional memory was another ongoing problem that the BRS continues to address even today. Carriers often brought to the bargaining table new, college-educated managers with little signal system experience. Conveniently, these managers possessed no memories of how signalmen had adapted to technological innovations and what recognition they had previously gained.

Gaining recognition as a separate skilled craft union by the other railroad unions and the American Federation of Labor was just as hard to accomplish. Grand Secretary–Treasurer H. C. Dunn petitioned the AF of L for affiliation in 1909, but after he claimed jurisdiction over a broad sweep of signal department duties, a number of AF of L unions protested. The largest protests came from The International Association of Machinists, International Association of Steam and Hot Water and Power Pipe Fitters, International Brotherhood of Electrical Workers, International Association of Bridge and Structural Iron Workers, and the United Brotherhood of Carpenters and Joiners. In Dunn's request to Frank Morrison, AF of

L secretary, for affiliation, the BRS claimed jurisdiction over those employees "who constructed electric, pneumatic, and mechanical signals and switches on railroad or signal works, and maintainers, repairmen, interlockers, locking machinists, batterymen, switch fitters, helpers, electricians, wiremen, linemen, groundsmen, lampmen, and signal workers."[160]

After the refusal and protests, the BRS tried for affiliation again in 1910 and 1911, but to no avail.

Of the five unions that tried to take jurisdiction over the signal departments, the International Brotherhood of Electrical Workers (IBEW) was the most aggressive. It tried repeatedly to gain jurisdiction over some of the signal department workers and, for many years, effectively blocked BRS entry into the AF of L. The IBEW persisted in attacking the BRS attempts at affiliation with the AF of L because some of the work of the maintainer was electrical and the IBEW sought control over the work of electricians in many industries. When they demanded in 1913 that the BRS be folded into the IBEW, a thirty-five year political struggle began. The BRS fought against being absorbed into the IBEW, citing that the BRS would only be a minor adjunct to the electrical workers union, which had little negotiating power with the railroads. The BRS thought they could do better as a separate entity. The IBEW repeatedly tried to block the BRS from joining the AF of L, which led to years of aggressive competition between the two organizations.[161]

---

[160] Dunn, H.C. Grand Sec. Treasurer, of the BRS of A, Letter to Frank Morrison, Sec. of American Federation of Labor, "Request AF of L Affiliation," Washington D.C., Feb. 4, 1909, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

[161] Lyon, *The First 75*, p. 116; Officers Reports, Reports and correspondence between the BRS and Noonan, president of the IBEW, Minutes, *the Fourth Annual and Nineteenth Regular Convention of the BRSA*, Chicago, bound typescript volume dated Sept. 1928, pp. 58–60.

As Grand Chief Signalmen, Pettit petitioned again for AF of L affiliation in 1913 by starting an exchange of letters with Morrison. The exchange yielded a more acceptable and general statement of claimed jurisdiction. In March 1913, Morrison granted the BRS a charter of affiliation. Lyon said it was his experience and knowledge of the labor movement and its traditions that helped him to succeed where his predecessors failed.[162]

Nevertheless, both the IBEW under President Frank J. McNulty and the officers of the Machinist Union fought to keep the BRS Charter from being enacted in 1913, despite efforts by AF of L President Samuel Gompers to bring the these two unions together. Both unions claimed the duties of signalmen fell under the jurisdiction of their unions.[163] Pettit tried again for affiliation in 1914. This time, Morrison issued the charter on March 14, 1914, despite some opposition. What changed the minds of AF of L leaders were that Pettit gave less detail concerning the work signalmen did while defining the parameters of their work. The application simply stated that the BRS represented "all signalmen who are actively engaged on construction, or Maintenance of Mechanical and Automatic Block Signals, Locking and Interlocking Plants, Mechanical, Pneumatic, Electrical or otherwise while employed in the Signal Department of a Railroad Company."[164]

At the annual convention in Hazelwood, PA, June 8, 1914, the BRS approved the resolution to join the AF of L under Samuel Gompers, despite some hesitation from some of the delegates. Some delegates were fearful that the small BRS would

---

[162] Anon Lyon, *The First 75*, p 38.
[163] Anon Lyon, *The First 75*, p 61.
[164] W. J. Pettit, Grand Chief Signalman, "Request for Affiliation with the American Federation of Labor, to Sec. Frank Morrison," Jan. 14, 1914; Lyon, *The First 75*, p. 112.

be swallowed up by the AF of L, one of the nation's largest labor organizations. What helped sway resolution was the support of H. B. Perham, president of the Order of Railroad Telegraphers (ORT), which started a relationship between the two unions that lasted until the ORT merged with the railway clerks in the 1960s. Some members of the ORT even helped to recruit signalmen for the BRS on some western lines. The BRS, during much of this period, could afford only two or three organizers to cover the United States and Canada.[165]

[165] Anon Lyon, *The First 75*, p. 41.

Another volley was fired by an unnamed IBEW vice president at the 1915 BRS Convention in St. Thomas, Ontario when he made an "unofficial" plea to ask BRS members to bring their union under the auspices of the IBEW. The IBEW claimed exclusive jurisdiction over all work to "make and install everything that is electrically workable." He said to continue to divide the work would create a "clash" that would harm the railroad labor movement and give the carriers weapons that could be used against the movement. BRS Resolution No. 6 resolved that the BRS would protest to the AF of L, and protect its AF of L charter. They also changed the name of the union from the Brotherhood of Railroad Signalmen of America to the Brotherhood of Railroad Signalmen, with the initials "BRS" used to represent them.[166]

Figure 18 Daniel W. Helt, Grand President from 1917 to 1935. Photo taken around 1919, from Lyon, *The First 75, History of the Brotherhood of Railroad Signalmen, 1901-1976,* 1976, p. 50.

Hard times continued for the union, which struggled to gain members during strong anti-unionist efforts by industry and to hold off jurisdictional threats from the other unions. Previous to the 1917 Convention, the organization under Grand Signal Chief A. E. Adams had run into difficult times. Despite the increase in membership tax, the finances were in poor shape and membership was falling. At the 1917

[166] Officers Reports, "Resolution No. 6, The BRS will protest to AF of L and will protect its AF of L Charter," *the Eighth Annual and Tenth Regular session of the BRS Convention*, St. Thomas, Ontario, June 14–17, 1915, p. 27.
Anon Lyon, *The First 75*, p. 112.

Convention in New Haven, CT, only twenty-five members plus the Grand Lodge officers were in attendance. Failing to gain benefits for the members, Adams resigned after the membership had lost confidence in the leadership of the BRS. If they wanted to continue to organize nationally, they would have to show that joining their union would improve the signalmen's lives and working conditions. At the same time, two new members, Daniel Helt and Clint Cone, attended their first convention.[167]

Helt and Cone chaired a resolution committee that recommended a restructuring of the BRS, which would later carry the BRS into the national political arena. By their resolution, it was decided at the 1917 convention, the dual position of Grand Chief and Grand Organizer, which paid $200 a month, was abolished and the Grand Chief was given a salary of $200 per year, as it was a part-time position. Interestingly enough, at the same convention, Helt was elected Grand Chief Signalman, by "using his political acumen and engaging personality," and Clint Cone was elected Vice-Grand Chief Signalman, which was largely an honorary position. Lyon argued that the era of union growth and development started with the 1917 election of Helt to Grand Chief Signalman. "Anyone viewing our history from a long-range standpoint must conclude that Dan Helt contributed more to its success than any other single individual," noted Lyon.[168]

Lyon described Daniel Helt, the former Pennsylvania coal miner, member of the United Mine Workers of America, and ex-marine as having "a dramatic and charismatic personality, the expansive and friendly smile of a typical extrovert,

---

[167] Brotherhood of Railroad Signalmen, 100th Anniversary Video, *"A Century of Service"* Video. BRSA, Front Royal, VA, 2001.
[168] Lyon, *The First 75*, p. 51.

unusual public speaking ability and above all, a determined devotion to the cause." Helt worked his way up from being a brakeman on the Philadelphia & Reading Railroad (PRR) and worked irregularly on the PRR, where he started as a signalman in 1910. Carpentry was his specialty, and he was skilled at maintaining and rebuilding Banjo-type signals prevalent in the first decade of the twentieth century. In 1916, his military experience and engaging personality got him the notice of the Republican Party of Eastern Pennsylvania. He successfully ran for the state legislature twice, despite opposition from the conservative Senator Bois Penrose's political machine that controlled much of the region's politics. In 1917, Helt, at 34 years of age, worked as a signalman for the PRR, held a seat in the state legislature, and started his new career as Grand Chief Signalman.[169]

Clint Cone started as a signalman helper on the Erie Railroad at age 18, after being fired from the same railroad when he was an office boy at age 14 in 1904. He went on to work as a signalman for the Interborough Rapid Transit, and later for signal system manufacturers, such as Union Switch & Signal Co. and The General Railway Signal Co. He was elected Vice Grand Chief Signalman in 1917, while working for the union-friendly New Haven Railroad, which frequently allowed Cone time off for union business. Once, he was granted a seventeen-week leave in 1918, so he could travel the West, recruiting members and organizing new lodges. In 1919, his position changed from being honorary to becoming that of a full-time political and union organizer with a $250 per month commission. Under Helt and Cone, the BRS picked up three new lodges in 1917, including Lodge 18 on the PRR, whose Recording and Financial Secretary, Gustave C. Malmsjo, would later be instrumental

---

[169] Lyon, *The First 75,* p. 52.

in starting the movement to limit the size of maintainer territories.[170] Helt's legacy, however, would be his efforts to end the long controversial fight for affiliation within the AF of L and to gain recognition as a skilled craft union by the federal government.

In 1917, Helt initiated talks with the Railroad Employees Division (RED) of the AF of L in hopes of gaining affiliation for the BRS. His request was rejected, despite the fact that he had gained support from the AF of L for his organizing efforts and for obtaining an eight-hour workday for signalmen and other railroad employees. Still, RED unions were unified against the BRS having affiliation. The International Association of Machinists (IAM) attempted to sway BRS officers and members in 1919 to join their union, but Lyon said the IAM did not overtly pressure or actively attempt to recruit signalmen away from the BRS. By contrast, IBEW President Jim Noonan "engaged in opposition tactics and sabotage of many of Helt's efforts to secure recognition of the BRS as a functioning national railroad union." The electricians union aggressively tried for years to encroach on BRS jurisdiction and revoke their AF of L charter. Over the next three years, this rift prevented several national wage and working conditions agreements from being executed before the expiration of federal control of the railroads in 1920. Helt appeared before the Board of Wages and Working Conditions trying to obtain classification of signalmen separate from other non-ops employees.[171]

---

[170] Lyon, *The First 75,* p. 56–59; Gustave C. Malmsjo, "Limitations of Maintainers' Territories," *Proceedings of the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volume dated Sept. 18–23, 1930, p. 897; Anon, Lyon, "The Signal Inspection Act," pp. 144, 170.

[171] Daniel Helt, BRS President, Resolution No. 28, resolved July 18, at the *Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Kansas City, bound typescript volumes dated July, 18, 1919, p.154.

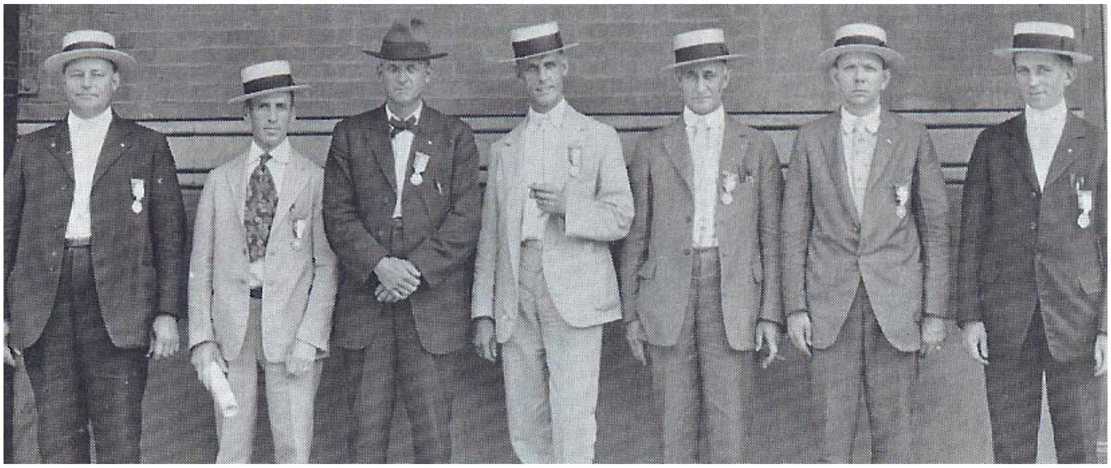


Figure 20 Grand Lodge officers at the 1919 BRSA Convention surrounding Daniel Helt. To his left is H.G. Baker, D.C. Cone, W.J. Pettit. To his right are T.A. Austin, M.C. Merritts, and J.A. Works. Their vision and efforts established the union as an equal member at the negotiation tables with the railroad operating unions. Photo from Lyon, *The First 75, History of the Brotherhood of Railroad Signalmen, 1901-1976,* 1976, p. 66.

On Jan. 27, 1919, they filed a brief with the Director of the Division of Labor over inequities in wages and appeared in March before the Labor Board. If they were not recognized and the inequities in wages not addressed, the BRS would call a strike. This resolution was sent to the Director General of Railroads in Washington.[172] In the weeks following the January meeting, Helt secured favorable decisions over pay equity for several classes of signalmen, correct classification of the signalman, and in many cases back pay.[173]

According to Noonan, for the first twenty-five months of federal control, before February 1920, the BRS could not get recognized and had no standing with the

[172] Ibid.

[173] "Minutes of the Thirteen Annual Convention, Kansas City, Mo. Oct. 11, 1920," condescended report in the *25th Anniversary Celebration, Brotherhood of Railroad Signalmen of America,* Floral Park, North Bergen, NJ, June 27, 1926; Resolution No. 28, resolved July 18, at the *Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Kansas City, MO, July, 18, 1919, p.154, *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

Railroad Administration. Just a few days before control was returned to the private sector on March 1, 1920, Helt was able to get an agreement signed [174]

Changing the Historic Balance between the Workers and Bosses

What emerged from the chaotic wartime conditions during World War I was federal control over the business and operations of the railroads and, for the first time, real support for labor from the Executive Branch. As the war effort ramped up, nearly all supplies and equipment were transported by the railroads, which were made up of many large and small systems that could not coordinate effectively to handle the increased traffic. Because the railroads were unable to meet the demand, President Woodrow Wilson had the federal government take over control and operation of the railroads in December 1917. Meanwhile, Wilson, who had become a pro-labor candidate in order to secure the presidency, added the Department of Labor to his cabinet and cemented a lasting relationship between the Democratic Party and labor. The Department of Labor continued to be a neutral, if not positive presence in railroad negotiations and gave unions a voice they did not have before. The Labor Department promoted the recognition of the AF of L and "so-called legitimate unions," and interdicted successfully in industrial labor disputes. "In a real sense, the Labor Department acted as organized labor's advocate in Washington."[175]

In the two years leading up to the war, labor became more militant and aggressively demanded closed shop powers in a time of extremely low unemployment. Unemployment hit a low of 1.4 percent in 1918 because of the

---

[174] International Brotherhood of Electrical Workers, *A True Insight into the Signal Situation,* Pamphlet, no date; however, letters and documents cited place publication date after 1921, *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.
[175] Melvin Dubofsky, *The State & Labor in Modern America,* p. 53—60.

growing number of war industry contracts with Europe.[176] On one hand, the Executive Branch urged labor to organize, and on the other, the Supreme Court made it illegal to form unions under certain conditions. Wilson needed to get labor behind the war effort, and he wanted labor to understand its role in the country's growing involvement with World War I. After a national strike by railroad employees threatened to shut down the railroads, Wilson pushed Congress to pass the Adamson Bill in 1916, giving railroad workers an eight-hour workday with overtime benefits for operating employees. At the same time, Wilson defined his administration's policy on railroad strikes. He made it clear that any attempt to shut down the transportation system would not be tolerated and would trigger federal intervention. He also passed a law stating that in an emergency, the federal government could take control of the railroads and conscript train crews and managers. Dubofsky wrote that "in less than a year, federal wartime policies had transformed labor-management relations from a basically private arena to a semi-public one, and, in the process, had upset the historical balance of power between workers and boss in many industries."[177]

Gaining Recognition from the Federal Government

Anti-union sentiment took on new dimensions and further hampered recruitment efforts by those unions that were unrecognized before the war, which included the BRS. Unions that were established and had control over their jurisdictions before the war made major gains in membership and concessions for their members. Those unions that "were absent in the prewar years, still fought

[176] Ibid, p. 64.
[177] Ibid, pp. 58-60, 74.

among themselves, or lacked able organizers," remained outside federal support and were subject to company discrimination.[178] At the same time, railroads fired or penalized workers who joined these illegitimate unions. In addition, the turnover rates for railroad employees were high; keeping experienced workers during wartime was hard as many went to work for higher wages in other industries that supported the war effort. Many BRS lodges went under during World War I. However, despite the turnover that shrunk the ranks of the BRS, Helt, acting mostly alone, gained access to some of the highest-ranking officials in the federal government. Within three weeks of William G. McAdoo's appointment by President Woodrow Wilson to be the Director General of Railroads in late 1917, Helt met with him and pledged his union's support in his efforts to restructure the railroads. [179]

At this meeting, Helt and McAdoo discussed the concerns of the BRS over wages and working conditions. Wages for signalmen had risen slowly through the first half of the twentieth century. The hourly rate across the nation in the first decade of the 20th century was between 20 and 25 cents an hour, or roughly $65 a month for about 300 hours work a month. In 1912, on many eastern lines, which had the highest rates, the rate was $75 a month for all services performed, frequently working 300 hours a month. By 1917, wages had increased to $95 per month due to pressure from individual lodges and by railroads trying to prevent unions from organizing. Yet signalmen and maintainers worked ten to twelve hours a day and were "subject to call" when not on duty. They complained that they were frequently called out for extra duty, and often times, needlessly. Lyon said that once during the winter, two

[178] Ibid, p. 76.
[179] Lyon, *The First 75,* p. 63.

signalmen were called out at dawn to look for a glove dropped by an engineman. When the eight-hour day and overtime were instituted, these incidences stopped.[180]

During World War I, railroad employees worked longer hours. Normal standards and scheduled service on the railroad plants were deferred to the point of damaging equipment and operations and creating dangerous working conditions.[181] Poorly disciplined, inexperienced workers made more mistakes, and safety advocates lost faith in the block system as a means of preventing collisions and derailments. The number of collisions and derailments spiked from 13,990 in 1916 to 19,435 in 1917. Then the numbers continued to rise in 1918 to 24,695, and in 1919 to 25,596, and finally topped out in 1920 at 36,313 collisions and derailments.[182]

In addition, living conditions for the road crews were getting worse. The maintenance- of way workers and the signalmen frequently lived in converted boxcars that were no longer suitable for freight. They traveled up and down the lines on mostly overnight runs, but in emergencies, they could be on the road for weeks. One type of camp car had ten beds, three sinks, and three showers. According to Harvey H. Park, signalman and Lodge General Chairman from 1971–1994, the cars were so dilapidated that "if it snowed over the weekend, we had to scrape the snow off the beds before we could go to bed." By the 1920s, when good labor was scarce, some railroads started to improve living conditions in work camps and camp cars to attract "a better class of workers."[183]

[180] Ibid, p. 89.
[181] Dixon, "The Railroad Situation," p. 14.
[182] Mark Aldrich, *Death Rode the Rails,* Appendix 2, Table A2.6, p. 322.
[183] Metropolitan Life Insurance Co., *Personnel Management on the Railroads,* (New York, Simmons-Boardman Publishing Co., 1925), p. 125–126; BRS, *100th Anniversary Video, "A Century of Service;"* Cottrell, *The Railroader,* p. 52.

McAdoo arranged for Helt to appear before the federal Railroad Wage and Working Conditions Commission where Helt presented his case and began strengthening relationships with other railroad unions. At the same time, the BRS established itself as a separate union unto itself, despite ongoing jurisdictional battles with other unions.

Entering into a new era for the BRS in national politics, Helt prepared and presented his presentation to the commission—also called the Lane Commission—alone, without staff.   At that time, Lyon said that the BRS "received recognition at the highest levels of government."[184] Helt also went before the Railroad War Commission, Feb. 4 and 5, 1918, where he presented the need for proper classification of signalmen positions with wages appropriate for a skilled craftsman. There, he explained the evolution of the job of signalman, which corresponded to the many innovations in signaling technology. He also explained that signalmen worked for an entirely separate department, much like those working for the telegraphy or the maintenance of way departments. Their work as composite mechanics involved skills used by other trades; however, it was the combination of skills used in signal work that distinguished them from other craft unions. In addition, unlike some other non-ops and laborers, the signalmen had to work independently, make decisions without supervisory support, be on duty 24 hours a day, and be responsible for the protection of the public and the property of the railroad. Signal foremen also had to have a working knowledge of train operations on a par with those who worked in the operations unions, such as the dispatchers, tower operators, and enginemen. This

[184] Daniel Helt, BRS President, Statement before Board of Wages and Working Conditions, March 18, 1918, Twelfth Annual and Fourteenth Regular Session of the BRSA, Kansas City, bound typescript volume dated July 14–19, 1919, p. 158; Lyon, *The First 75, p.* 63–64.

knowledge was necessary in making daily decisions during routine maintenance of the signal systems. [185]

Despite Helt's success before federal labor boards, the U.S. Railroad Administration (USRA) delayed negotiation with all national wage agreements until they could settle all of the jurisdictional disputes. The BRS, as the other railroad unions had done, pressed for a national agreement for the working conditions and wages of the signal department employees. Helt appeared before the Board of Wages and Working Conditions to try to obtain classifications of the many classes of maintainers, signalmen, helpers, and signal foremen separate from other non-ops employees, The carriers wanted to classify the foremen as management, so they would be paid a straight salary and would not come under the eight-hour day plus overtime ruling of the USRA. Foremen complained that they were on standby 24 hours a day, even when they were not at work. In addition, foremen did not get overtime pay, which meant some of their men were making more money in a month than they were. On Jan. 27, 1919, the BRS filed a brief with the Director of the Division of Labor over inequities in wages and appeared in March before the Labor Board. In the brief, they said if BRS were not recognized and the Board did not address the inequities in wages, the BRS would call a strike. Helt held talks with the

---

[185] Daniel Helt, BRS President, Statement at the Railroad War Commission, Washington D.C, *the Eleventh Annual and Thirteenth Regular Session of The BRSA Convention*, Baltimore, MD, June 10-13, 1918, p. 36.

Figure 21 The “A” Tower, Pennsylvania Railroad, NYC. Maintaining these all electric interlocking systems put the BRS members in jursidictional conflicts with the IBEW. The level and variety of their skills maintainers needed to acquire is demonstrated in the complexity of these traffic management systems. No date, File Photo, The Archives of the Brotherhood of Railroad Signalmen.

union’s General Chairmen from the sixty-three major railroad systems in Washington on March 6, 1919. [186]

Helt met with the signal engineers and then with the AF of L, RED to hammer out the provisions of the agreement.[187] This heated discussion with RED officers shed light on why the jurisdictional battles were beyond merely acquiring more dues-paying members.

William Hannon, representing the Railway Employees Department, tried to convince Helt that recognizing the BRS charter would further divide railroad

[186] Resolution No. 28, p.154.
[187] Minutes of the meeting held with the shop crafts, of the Railway Employment Department and the Brotherhood of Railroad Signalmen, pp. 169–183.

employees into smaller unions, which he said was what the carriers wanted. In addition, like the BRS, the 7,000 member International Association of Carmen (IAC) wanted to be recognized by the USRA. If the RED allowed the BRS to have an AF of L charter and be recognized by the USRA, then RED would have to do the same for the IAC, which would further fractionalize union's power base. Yet Hannon's most compelling argument was that the other craft unions were organized along the shop crafts they performed in sheet metal work, blacksmithing, electrical work, plumbing, and pipefitting, carpentry, and machine work. These shop craft unions had been established first. The work of signalmen, on the other hand, was defined by industrial job classifications and not by crafts lines, which meant that the BRS encroached on those unions' jurisdictions already established.[188]

Hannon asked Helt if the BRS ever applied for affiliation with RED and what was the outcome? He replied McNulty of the IBEW vehemently opposed the BRS affiliation with RED. Helt quoted O. L. Wharton, the past president of RED, as saying, "Now these damn Signalmen, they will get into the organization that they belong."[189]

"I only need to give you the other side of the question and say—damn anyone that will force us to lose our identity," Helt said, "Our convention represents seventy percent of all signal employees and is the outcome of their declaration [to be recognized as a skilled craft and be represented by the BRS]."[190]

Cone interjected that signalmen and maintainers are unlike other industry workers, in that they were spread thinly along the railroad lines. They have to

---

188 Ibid, pp. 169–183.
189 Ibid.
190 Ibid.

perform all five classes of work and to say that one union has jurisdiction over some signal department employees were hard to enforce. He explained, for example, that there were no more than ten maintainers working on one territory and "the next man is forty miles away, but that man has to perform five classes of work in his day's work." There are four or five classes of work [that] are required to maintain any given signal. The signalman cannot wait for a blacksmith or a sheet metal worker to come and do the work for him. He is required to do it himself. Management has not the time, money, or inclination to send out a blacksmith to do a few hours work. The managers expect signalmen to handle the work necessary to keep signals maintained, especially in emergency situations. Some days he does some classes of work more than others, and other days he performs the other classes of work and this "equalizes it." To follow the IBEW's argument, Cone said, as signalmen are composite mechanics, then the blacksmiths have as much right to jurisdiction as the electricians.[191]

Helt added, those sitting on the federal boards have little knowledge about what signal work is, as do representatives of RED. "I question whether there is a man here without signal experience that can speak on our position five minutes under questioning ... the greatest trouble we have, (is) men not familiar with the duties we perform." If a maintainer above the grade of helper couldn't perform all five classes of work, he would be of little value to the railroads and they would get rid of him. Helt said that he had to explain this to members of the Lane Commission and the Railroad Administration Director of the Railroads. Upon investigation, Helt said, the

[191] Ibid.

Director General McAdoo recommended, “Signalmen shall receive a separate proposition because of the character of [their] work.”[192]

Helt said, unless the government agreed to the national wage adjustment the BRS proposed, it would go on strike. Hannon said, “Striking against the government was a serious matter.” Helt agreed but said that the main reason the national wage agreement was being held up was because of the combined efforts of some member unions of RED to block recognition of the BRS. “We have been before the government and exhausted every means … as stated before, 90 percent of the signalmen realize that it is simply because of the combined efforts or protests of the Railway Employees Department.”[193] Helt said they had organized on ninety-seven railroads and at forty-one union terminals and have 90 percent of the signal department employees eligible to join. He asserted that the BRS had 15,000 members and with four organizers in the field, it could expect another 1,000 a month would join.[194]

As with the other unions, the BRS needed to gain recognition as a skilled craft union before the railroads returned to the private sector. The unions needed to be established, or risked being broken up by management once they had the chance. Some RED officials tried to find ways to bring the BRS into their organization, but their proposals were rejected. The last proposal was to have the [signal] railroad department come under the IBEW.

“What would you do then?” asked Hannon. [195]

[192] Ibid.
[193] Ibid.
[194] Ibid.
[195] Ibid.

Helt responded, “Would anyone be autocratic enough to think they had the power to say where our men shall classify themselves, and we can classify ourselves where we choose, and we choose to classify ourselves as Signalmen, laying down our rules and abiding by them and no one can assign us to any particular organization.”[196]

The meeting ended without a compromise or a solution. After further debate with RED in the weeks that followed, an agreement on the majority of provisions with the other railroad unions and the agreement was sent to the U.S. Railroad Administration for approval. However, Helt conceded on one provision to the IBEW—any signalmen performing 50 percent or more of his time on “anything electrical” would come under the jurisdiction of the electrician’s union. The agreement was approved, and it helped to separate the signalmen from the maintenance-of-way laborers, the clerks, and the other craft unions. The BRS also sent its resolution to the Director General of Railroads that it would strike if its members were not recognized as a legitimate union, representing signal department employees, and that classes of signalmen, maintainers, and foremen would be standardized.[197]

The national wage agreement with the BRS was signed on January 22, 1920, and it finally gave the BRS official national representation of signal department employees on the sixty-three major railroads under the control of the federal government, which was virtually the entire industry.[198]

---

[196] Ibid.
[197] Resolution No. 28, p.154.
[198] “Minutes of the Thirteen Annual Convention, Kansas City,” the *25th Anniversary Celebration, Brotherhood of Railroad Signalmen of America;* Anon Lyon, *The First 75,* p. 124.

In the months following the meetings with the Wages and Working Conditions Commission, Helt secured through negotiations favorable decisions over pay equity for several classes of signalmen, correct classification of the signalman as separate from other department employees, and in many cases back pay. The effect of this, however, "was more psychological than material" as the war had ended, and the agreement lasted only a few months.[199] Still, Helt had placed the BRS in charge of all negotiations concerning the signal department employees with the federal government, the other unions, and the carriers. Yet, the BRS would continue to have to fight with RED and the IBEW over the settlement agreement that gave partial jurisdiction of those signalmen performing fifty percent or more of their time doing electrical work over to the IBEW. "It can be seen by this [settlement agreement] that railroad labor has at last set up a cooperative plan in which we are given voice and vote on a par with other organizations. This in itself is a splendid victory for our membership," Helt wrote in the *Signalmen's Journal*.[200]

With Federal Recognition Comes New Prosperity

Labor benefited greatly from the McAdoo administration. On Feb. 21, 1918, McAdoo issued General Order No. 8, often referred by labor as "the Magna Charta, the Bill of Rights, or the Emancipation Proclamation of Railroad Workers." Under this administration, employees had the right to choose whether to belong to a union. Union activists could not be discriminated against or fired, and the government

[199] "Minutes of the Thirteen Annual Convention," the *25th Anniversary Celebration, Brotherhood of Railroad Signalmen of America*, Floral Park, North Bergen, NJ, June 27, 1926; Lyon, *The First 75*, p. 124.
[200] Daniel Helt, "Concerning the National Agreement," *The Signalmen's Journal*1, (March 1920): p. 11.

prevented layoffs. As a result of the order, in three months, twenty new lodges were added and the BRS improved its financial standing, reporting a zero balance. In the following twelve months, the BRS added 100 new lodges, and it was announced at the Kansas City Convention in 1919 that the membership had grown to 13,000 members. This membership can be compared with the union's low point membership during the 1913 convention at Detroit, when it had only 800 dues-paying members and only 18 delegates voted in the election of Grand Lodge officers.[201] Helt participated in joint formal and informal meetings with the "standard national railroad labor organizations," and Lyon credits Helt with the BRS finally gaining recognition among other labor unions. The BRS was now financially able to open an office in Washington, D.C. on October 16, 1919, on the second floor of 728 13th Street, NW, and six months later, it moved into offices at the Machinist's Building at Ninth Street and Mt. Vernon Place.[202] In addition, Helt's title was changed to Grand President and Cone's to Grand Vice President.

General Order No. 8 also provided wage increases, especially for the lower-paid employees and made those increases retroactive to January 1, 1918. The government instituted the eight-hour day and overtime pay, and signalmen who did not go to other industries received "substantial amounts of back pay as the result of General Order 27. Back pay checks ranged from $1000 to $2000." Helt's work in obtaining the eight-day rule and back pay created an enduring loyalty by the members to Helt, Cone, and the other Grand Lodge Officers. This loyalty also helped the BRS

[201] Lyon, *The First 75,* pp. 164–165.
[202] Ibid, p. 66.

endure the ongoing jurisdictional war with the IBEW and the loss of jobs during the Great Depression of the 1930s.[203]

In his time in Washington, Helt was able to educate influential groups within the government about the responsibilities of the signal department employees in providing efficient railroad operations and public safety and that they should be thought of as a separate and skilled craft within the railroads.

His work here also improved relations with the other railroad brotherhoods and with other unions outside the railroad industry. Before 1918, non-operational brotherhoods were excluded from participating on issues with the train service, or operational, unions, who through their shared interests had formed an elite, political federation. Now the chaotic wartime conditions helped bring together the railroad unions, despite their many disagreements, to fight for their common goals.[204] As Lyon explained, “Helt’s energy and dynamic personality, without doubt, put our organization in the forefront of the general railway labor movement during the period of federal control of railroads.” [205]

The Great Depression Nearly Bankrupts the BRS

As with all power struggles between labor and management, the financial health of the carriers and of the country influenced decisions that degraded employee working conditions during the 1929 Depression. With railroads struggling to remain solvent, labor lost what political power they gained after World War I. In order to maintain what little power they had, the signalmen had to keep members employed

---

[203] Lyon, *The First 75*, pp. 65–70
[204] Helt, Statement at the Railroad War Commission, p. 36.
[205] Lyon, *The First 75* p. 63.

and enrolled in the union. At the 1932 convention held in Chicago, Helt said the condition of the BRS was healthy but gave an impassioned speech on why the union's situation changed so drastically. "We were unprepared for the "shock" of the worst depression the world has "experienced probably in the last century." He spoke of the suffering of the unemployed and those members getting by working short time—working only two to four days a week with reduced wages. He estimated that "25 million people in the United States were suffering and destitute, and another 25 million were living a bare existence." He said that he and the members of RED were "groping for solutions." They, with the help of Attorney Donald Richberg, put before Congress a bill to create a corporate organization called the "United States Exchange Corporation, which would "provide emergency funding facilities for unemployed workers, to relieve their distress, to increase their purchasing power and employment." The bill proposed that it would be financed by a $500 million fund from the Treasury Department. The bill never passed, but many of its proposals became part of President Roosevelt's Blue Eagle Recovery Program and the National Relief Administration, which Richberg helped create and administer.[206] Layoffs, low traffic volume, and bank foreclosures all hurt union's growth and financial standing, but they continued to pay off their loans and debt despite having fewer members and those members working shorter workweeks. The BRS voted to keep unemployed men on their roles without paying union dues and to give those on short time a break

[206]Daniel Helt, BRS President, addressing *the Sixth Biennial and the Twenty-First Regular Convention of the BRSA*, Chicago, bound typescript volume dated Aug. 15–19, 1932, p.7–8; Lyon, *The First 75*, p. 121.

on dues with the hopes that the depression would lift and they could resume their position as representatives of signal department employees.[207]

At the same time, the railroads were trying to keep up payments on their mounting bond debt and cut wages as a means to stay in business, which Hoogenboom blames the ICC. He said that the Transportation Act had failed, because the ICC failed to develop a national transportation plan, check abuses, and control the transportation systems. It was given the task to "plan, shape, innovate, and act, but it continued merely to reflect power and respond to pressure from other sources." Despite the fact that railroads had grown and improved service, they did not recover from the Great Depression because the ICC did not make the railroads reduce their bond debt and force them "to consolidate, as Congress wanted, into a few strong competing rail systems."[208]

Track departments were paying employees only ten to fifteen cents an hour, while skilled employees, including the signalmen, were paid less than eighty cents an hour. Worse still was that they did not have a guaranteed workweek, which dropped to just two to four days a week. "The industry was paying interest to its bondholders out of the life blood of hundreds of thousands of workers."[209] The membership of the BRS fell from nearly 19,000 in December 1929 to its lowest point in June 1933 since 1913, with only a little over 10,000 members. The BRS would never regain the

---

[207] Lyon, The first 75, p. 92.
[208] Hoogenboom, *A History of the ICC: From Panacea to Palliative*, *p.* 118
[209] Lyon, *The first 75*, p. 92.

number of members it had in 1929. [210] Lyon, as acting Grand President, said that adding the 300–400 signal department employees, including those on the smaller railroads and terminals would probably raise the number of signal department employees above 12,000.[211]

The BRS faced financial disaster in 1933. Grand Secretary-Treasurer Austin reported that some local lodges were unable to pay their per capita taxes (a portion of the lodge members dues used to support the Grand Lodge). The BRS roles had declined to about just over 10,000 members—down from just fewer than 19,000 in December 1929—during the Depression because of the short work weeks and layoffs that impoverished the workers. Moreover, seasonal hiring practices left signalmen unemployed for long periods every year. By 1936, there were only about 7,000 dues paying members in the union. Lyon credits the work, often unpaid, of local lodge officers as what held the union together throughout "this catastrophe." Lyon, during this period, helped hold lodges together by issuing mimeographed bulletins to local officers, giving them up-to-date information on social and political activities. These were not widely distributed to the membership but were mostly for keeping the lodge officers informed.[212]

Helt reported in 1934 that the low point of the Depression had been reached in 1933, as Roosevelt's New Deal reforms were beginning to work. He gave a forty-page report on May 1, 1934, about their success in terminating the wage reduction program that had been put in place Feb. 1, 1932. There was hope that the Railway

---

[210] Lyon, A.E. *Efforts to Secure Passage of the Signal Inspection Bill*. Report of the Acting Grand President. *The Eighth Biennial and Twenty-third Regular Convention of the BRSA*, Chicago, bound typescript volume dated Aug. 16,-19, 1936, p. 4.
[211] Ibid, pp. 4–7.
[212] Lyon, *First 75*, p. 142

Labor Act would better enable the BRS to represent its members and would help those secure improvements in wages and working conditions and living standards. In addition, the first railroad pension law written under the combined efforts of the Railway Labor Executives' Association (RLEA) was signed by Roosevelt. The situation of short-time work schedules and unemployment was starting to improve and membership in the BRS was increasing again.[213]

Exhausted, Daniel Helt Steps Down

At the 1934 convention, Helt surprised the delegates with his announcement that "he wanted to be relieved of his presidency" and named Lyon as acting president in his place. Lyon said he had served as assistant to the President for the last seven of Helt's seventeen-year tenure. Now Helt, only 52 years old, was "burned out" from fighting for skilled craft union status and the right to represent signal department employees. Helt proposed he be granted a lesser role in the brotherhood and was named vice president, representing the BRS on the National Railroad (way) Adjustment Board. The BRS granted him a two-year leave of absence from the presidency and named Lyon as president temporarily. Helt was exhausted both mentally and physically and was through leading the BRS. He would remain as vice president and member of the adjustment board until he retired in 1948.[214]

---

[213] Ibid, 123.
[214] Ibid, 128.

At the 22nd regular convention at the Knickerbocker Hotel in Chicago in August 1934, there was considerable improvement in the state of the BRS made since the last convention two years ago. "FDR's New Deal created many programs to relieve the distress of the people and to rescue the business establishments from their own mistakes," said Lyon. He believed that the worst of the depression was over. The RLEA was finally established, with Lyon as founding member, and it "exercised a great deal of cooperation and created a working relationship which had been unknown in previous years." He credits the success of the cooperative efforts of the RLEA in overhauling the 1926 Railway Labor Act through amendments that replaced the ineffective U.S. Board of Mediation with the National Mediation Board. The Board, which consisted of three men provided methods for obtaining official certification for unions as bargaining agents for employee groups; they outlawed company unions and yellow dog employment contracts, and established the National Railroad Adjustment Board, a quasi-governmental agency for the adjudication of disputes between labor and the railroads. The RLEA was able to get Congress to enact a national industry-wide pension system for the railroad employees.[215]

Figure 22 Anon Lyon, BRS President from 1935 until 1956 when he went to work for the RLEA fulltime. Photo from Anon Lyon's book, *The First 75*, p. 136.

Lyon presented a plan to create a federation of non-operating unions to share one headquarters, a statistical bureau, and other cost-saving measures. Those unions

[215] Lyon, A. E. Lyon, "The Beginning of a New Era," *Review of my Brotherhood Career (1919–1945) and the History of the Brotherhood*, Red loose leaf binder, The Archives of the BRS, Front Royal, Virginia.

were Railway Employees Department of AF of L, Maintenance of Way workers, Signalmen, Telegraphers, Clerks, and Dispatchers. This would also increase their financial standing and increase their power within the railroads.[216] In a letter from ORT officers, they were in favor of an amalgamation of the two unions as there is often confusion about assignments and classifications, as their jobs overlap. They had already done this with the tower operators.[217] The BRS joined with the other associated railway labor unions to get a number of improvements in their members' quality of life and working conditions. A pension system, fought for during Helt's administration, was nullified by a Supreme Court ruling, but was modified and approved thanks to as many as thirty-three meetings of the RLEA to work out the details. Much of the first two years of Lyon's administration went to addressing poorly worded or overly generalized provisions of prior agreements in an effort to close loopholes management found to renege on their agreements.

Jurisdictional Battles with the IBEW Define the BRS

What delayed passage of the national wage agreement and recognition for the BRS during World War I were the ongoing jurisdictional disputes with the IBEW. The disputes would continue to play out over the next twenty-six years. Even after a settlement between the two unions was signed, IBEW President Jim Noonan vehemently railed against the BRS in hopes of swaying some signalmen away from their union. In one pamphlet entitled *A True Insight Into the Signal Situation,*

[216] Grand Executive Council, Minutes of the GEC, 10 a.m. meeting, bound typewritten volume dated March 21, 1935, p. 4.
[217] Grand Executive Council, "Memorandum prepared by the board of Directors of the Order of Railroad Telegraphers, regarding proposed Amalgamation of the ORT and the BRS, March, 26, 1935. They completed the basic agreement on March 28, 1935, Minutes of the GEC, bound typewritten volume dated, March 28, 1935, pp. 4–11.

Noonan said, for the first twenty-five months of federal control, the BRS could not get recognized and had no standing with the Railroad Administration. Before February 1920, the BRS was not recognized by the U.S. Railroad Administration until just a few days before control was returned to the private sector on March 1, 1920. In the recruitment pamphlet, Noonan had argued that (1) the AF of L organized along craft and trade lines and not under industrial forms of organization. The signalman position was an industrial form in an organization and not a single craft or skill. (2) Because signalmen worked 24 hours, 7-day-a -week shifts, and worked in isolated areas of only one or two workers, or in gangs when constructing signal systems, they cannot be represented by a local union. They need the benefit of a larger craft union because the BRS was so small that it couldn't "keep a man on the road to stay in contact with all its members." (3) The six craft shop unions should absorb the signalmen positions entirely. (4) The BRS was too small and would defeat labor by dividing labor organizations in the eyes of railroad management, "the common enemy." (5) The IBEW had over 150,000 members with 1,312 local unions, compared to the BRS 10,000 members. (6) "IBEW members can take their [union] cards and work in other industries, [members of the] BRS are strictly railroad composite mechanics." (7) The IBEW procured a three cents higher wage increase for its members over BRS members' rate.[218]

In order to represent the signalmen before the federal labor boards at the end of World War I, the BRS Grand Lodge Officers first had to settle jurisdictional problems with the IBEW. Helt eventually had to sign the settlement agreement, which Lyon said was untenable and unworkable, and yet signing it was necessary to find

[218] IBEW, *A True Insight into the Signal Situation*, Pamphlet.

resolution for the national wage agreement. Noonan's settlement agreement between the IBEW and the BRS stated that any signalmen who for 50 percent or more of his time performed any kind of electrical work would come under the jurisdiction of the IBEW.[219]

Jurisdictional battles between the IBEW and the BRS moved into the hearing rooms of the United States Railroad Labor Board in the early 1920s. After hearing testimony, for example, over the classification and assignment of J. W. Hickey, to the Calumet River Drawbridge and listing in detail his work assignments, a decision was issued that Hickey's work all falls under the duties of the signal department, that signal work is a unique form of work that while it consists of electrical work and other skills. "…it is work peculiar to railroad signaling. Signal department employees enter the department as helpers and rise up within the department and are fitted to its service." The board stated, the signal department "is an established branch of the railroad service, in most cases it is separate and distinct from any other department because of the peculiarities of the service." Signalmen's duties are different from any other class on the railroads. "The carrier supports the BRS claim in this case, saying that electrical work is relatively new to the service and much of the work is done

[219] The agreement between the BRS and the IBEW states: All work pertaining to maintenance and repair of electric, electro-pneumatic, electro-gas, electro- mechanical or mechanical signals, interlockings, interlocked switches, derails or railroad crossing gates, train staffs, automatic train stops or controls, highway crossing alarms or signals, and all other signal appliances maintained and repaired by the regular signal department forces under the supervision of the signal engineer. This shall include all composite mechanics, their helpers, and apprentices, who hold regularly assigned positions in the signal department; and shall not be construed to include electricians, linemen, machinists, blacksmiths, sheet metal workers, and carpenters, or signalmen who for fifty percent of more of their time perform work as defined in Article 140 and 141 of Shop Crafts National Agreement, under the date of September 20, 1919, or other craftsmen who for the performance of their craft work may be recruited from other departments or outside industries, for the purpose of constructing new sections of Signal Appliances. Signed Jas. P. Noonan, IB EW, and D. W. Helt, BRSA, IBEW, *A True Insight into the Signal Situation*, pamphlet.

mechanically, and therefore Hickey should be classified not as an electrical worker."[220]

The Labor Board went on to say that to rule in favor of the IBEW "would without a doubt disrupt the signalmen's organization, as well as destroy established and well-organized practices that have grown up in the railroad service performed by the employee involved in this particular dispute and in accordance with the rules in effect." The board ruled against the IBEW and went on to say that an employee has the right to choose whatever representatives he wanted. Similar cases went before the Labor Board with similar results. The carriers supported the BRS claims over those of the IBEW; the IBEW said the reason for the carrier's support for the BRS was that the carriers think they can wield more power over the smaller organization.[221]

After the national wage agreements were secured and after several defeats before the Labor Board, Noonan repudiated the settlement, denying that he ever signed the settlement and that his signature was forged. Earlier, Noonan said he signed the agreement for the benefit of the Director General of Railroads because he had refused to sign any agreement that would give jurisdiction of electrical work on signals could be performed by electricians over to the BRS.[222] His repudiation of the

---

[220]Arguments and challenges to the Noonan – Helt's settlement agreement was reflective of the problems of the agreement, *The Signalmen's Journal* 9, "Response to IBEW Signal Situation, Correspondence Between President Helt and President Green, of the A F of L, on the IBEW. Controversy, (Jan. 1928): pp. 28–35; Decision No. 1091 (Docket 358) Railways Employees Department AF of L (Federated Shop Crafts) vs. New York Central Railroad Company *The Proceedings of the United States Railroad Labor Board*, Chicago, July 6, 1922.

[221] Brotherhood of Railroad Signalmen, *Clarifying the Signal Situation*, Response to IBEW signal situation arguments as played out in the proceedings of the United States Railroad Labor Board, pamphlet, Chicago, July 6, 1922.; Decision no. 1091 (Docket 358) Railways Employees Department AF of L (Federated Shop Crafts vs. New York Central Railroad Company, United States Labor Board, Chicago, July 6, 1922; United States Labor Board , Decision No. 1092 (Docket 1702), Railway Employees Department; A. F. of L., (Federation of Shop Crafts) vs. Atchison, Topeka and Santa Fe Railway Co., Chicago, July 6, 1922.

[222] IBEW, *A True Insight Into the Signal Situation*, Pamphlet.

settlement agreement canceled it, which the signalmen thought was unworkable anyway. To begin with, the term electrical work never was adequately defined, and Lyon said it would have taken a judge intimately familiar with the work of a signalman to decide where the line between signalman work and electrical work lay.[223]

For years after, the IBEW continued to fight over jurisdiction and had succeeded to establish representation on a few small lines, taking in less than one-hundred signalmen. In those cases, Lyon accused the IBEW of bribing and corrupting several local BRS officers in order to gain control of their locals. The IBEW also fought jurisdictional battles with other unions, such as those representing workers in elevator construction. Lyon found it interesting that IBEW did not attempt to organize the growing number of telephone, radio and public utility workers who had no trade union organization.[224]

The attacks over jurisdiction continued. Helt spent much of his energies fighting the jurisdictional claims of the IBEW throughout the 1920s. At every AF of L convention, the electricians' union said the BRS was invading their jurisdiction and called for censure or expulsion. This bickering took Helt away from important wage negotiations in 1927 that had to be handled by the vice presidents and his assistant, Lyon. [225]

---

[223] Lyon, *The First 75*, p. 114.
[224] Lyon, *The First 75*, p. 114-5.
[225] Lyon, *The First 75*, p. 128; "The Election of Grand President Helt and his nomination of A. E. Lyon as Acting Grand President," *the Seventh Biennial and Twenty-second Regular Convention of the BRSA*, Chicago, bound typescript volume dated Aug. 23, 1934 , p. 546–523, The Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA.

In 1928, through its ties with major construction and building trades, the IBEW acquired a decision that if the BRS did not comply with terms giving IBEW jurisdiction over a wide range of signalmen responsibilities, the AF of L would suspend the BRS charter. In an eloquent speech before the 1928 BRS Convention in Chicago, William Green, president of the AF of L, asked the BRS delegates if there were some way they could find to meet with the terms of the decision. Even as he spoke, Lyon was writing a resolution that essentially "told the IBEW and the AF of L to get lost!"[226]

The resolution stated that the AF of L decision would deprive BRS members of the collective bargaining rights and recognition they had already obtained. It resolved that the Grand Lodge Officers would reaffirm their positions that signal department work "was a craft in itself and [those] signalmen had an undeniable right to maintain membership in their own organization without interference of the IBEW." The resolution went on to say that it refuses to surrender any members to the IBEW and it accepts under protest any suspension of their charter rather than agree to the "impossible and illogical demands made upon us."[227] The resolution passed unanimously and was adopted without any dissent.[228] Delegates had no intention of honoring the decision to become a second or third tier organization within the IBEW. The reason was because the IBEW had no collective bargaining rights or recognition with the railroads—its own members, many of whom worked in the carriers' shops did not have these rights on about three-fourths of the railroads. The Grand

[226] William Green, President of AF of L, addressing BRS, *the Fourth Biennial and Fourteenth Annual Convention of the BRSA*, Chicago, bound typescript volume dated Sept. 10–15, 1928, pp. 719–748.
[227] Lyon, *The First 75*, p. 117; *The Signalmen's Journal* 9, "Correspondence between President Helt and President Green, of the AF of L on the IBEW Controversy, (Jan. 1928): p. 28–35.
[228] William Green, addressing BRSA, pp. 719–748.

Executive Council sent Green a copy of Resolution No. 27, adopted in 1928, which outlined their "attitude" that if the A F of L continued to suspend their charter, they would continue to solicit for membership only those employees who performed their class of work. The charter was suspended on Oct. 23, 1928.[229]

Worn out both physically and mentally from the battles, Helt stepped down from his post with a surprise announcement at the 1934 Convention. Helt's nomination of Lyon, his assistant and protégé, for acting president passed, and he took a two-year leave to recuperate. Lyon was voted into the presidency at the next convention and Helt took a less strenuous position as Grand Vice President and continued to represent the BRS on the National Railroad Adjustment Board until his retirement in 1948.[230]

In 1936, another dispute over construction jobs with the IBEW erupted on the New York Subway. An attorney was employed to represent the BRS.[231] In August 22, 1936, the GEC of the BRS decided to remove the AF of L seal from their membership cards.[232] There were productive talks about reinstatement of the charter in 1937; however, the GEC said that the AF of L should initiate any actions. No concessions would be made in this regard. Lyon and Cone went to meet with Green.[233] The charter remained suspended; however, Lyon said this had little effect

[229] Grand Executive Council, Docket No. 6, Resolution no. 27 will be sent to the AF of L stating they will continue to solicit for new members in the signal departments, *the Fifth Biennial and Twentieth Regular Convention of the BRSA* Denver, bound typescript volume dated Aug. 18-23 1930, p.127.
[230] Lyon, *The First 75*, p. 128; "The Election of Grand President Helt and his nomination of A. E. Lyon as Acting Grand President," p. 546–523.
[231] General Executive Council., GEC decides to hire an attorney in jurisdictional dispute with the IBEW, Minutes of the Grand Executive Council, bound typewritten volume dated June 27, 1936.
[232] Grand Executive Council, Resolution to remove "AF of L" from the BRS seal, Minutes of the Grand Executive Council, bound typewritten volume dated August 22, 1936.
[233] Grand Executive Council, Lyon spoke about the possibility of reinstatement in the AF of L, Minutes of the Grand Executive Council, bound typewritten volume dated July 3, 1937;Grand

with their standing among the other railroad unions, and the BRS continued to grow. Finally, an invitation to rejoin the "House of Labor" went unopposed in 1946 without restrictions to its jurisdiction. The BRS delegates voted to approve its affiliation with the AF of L and rejoined later that year.[234]

The leadership of the BRS took the initiative to explore avenues that would ensure it would successfully become institutionalized. They looked to what other unions did in regards to formalizing and organizing the BRS. They took extra steps to charter and incorporate the BRS, which gave them exposure and status, which stimulated interest in signalmen from other lines. They initiated talks with other unions in attempts to consolidate and were successful in consolidating and developing linkages with signalmen in the northeastern United States. They were careful from the beginning to position their union in terms of higher goals and to exclude language that inferred they organized solely to raise wages. This would be the approach they would take in negotiations and public relations.

While the jurisdictional battles with the IBEW and other AF of L unions pushed Daniel Helt into semi-retirement for health reasons, the controversies that played out in front of mediation boards and wage commissions in the 1920s nevertheless helped define the duties of a signalman. This in turn, defined the jurisdiction of the BRS and had it recognized as the representative of the signal department employees and as a separate skilled craft union.

Executive Council, Lyon is to meet with AF of L President William Green in Washington concerning re-affiliation with the AF of L, Minutes of the Grand Executive Council, bound typewritten volume dated Nov. 20, 1937. .

[234] Lyon, *The First 75* , p. 117.

Figure 23 Signalmen installed, maintained, and repaired complicated signal systems such as this photograph depicts. File photo noted only as Signal 029, no location or date given, BRS Archives, Front Royal, VA.

Chapter 6: Conclusion, Expanding the Role of the BRS

The job of signalmen and the signal systems they worked became consistently more complicated during the twentieth century. Each innovation in train traffic management increased their levels of skill, which subsequently propelled them into new areas of public debate over railroad safety and expanded their role in labor politics.

In the beginning, their job consisted mostly of greasing the rollers of the pipe carriers, filling and lighting the oil lamps, and wiping the train soot of the lamp lens, said Tim DePaepe, Researcher for the Grand Lodge of the BRS, Front Royal, Virginia. For that reason, management did not consider the signalmen as skilled labor. When they began to work on the new labor-saving electronic equipment, they saw themselves becoming a skilled craft union. Today, DePaepe said, they work with fiber optics and software-driven, digitally controlled signal systems. They went from working with DC current in the early twentieth century to motion detectors and algorithms to determine traffic flows, said DePaepe. They currently are lobbying Congress to adopt such safety innovations as Positive Train Control (PTC), which utilizes GPS systems not only to track train movements but to give train crews and dispatchers more information vital in the prevention of collisions and derailments. With PTC, engine crews can get the locations of other trains that are following or approaching them, and the signal indications for the blocks ahead. [235]

[235] Tim DePaepe, Researcher for the Grand Lodge of the BRS, Front Royal, Virginia, phone interview with author, Oct. 27, 1907.

“[Members of the] BRS are known for their ability to adapt to new technology, said DePaepe. “Bring it on, we love the new stuff. However, it has to be proven to us that it will improve safety and be efficient.”[236]

During the first two decades of the twentieth century, the BRS battled with railroad management and other labor organizations in private meetings and labor conventions. While the pro-business politics and anti-union sentiments stymied the growth of the BRS, management undermined their positions as custodians of public safety and rail traffic efficiency by extending territories beyond what signalmen thought was safe.[237] In addition, most managers outside the signal departments saw them as semi-skilled laborers on par with the maintenance of way laborers.

To complicate matters, while the BRS was going through all of the jurisdictional controversies, its members continually had to work to prevent company-organized unions, which tried to take members away from the BRS. This tension between labor unions and company unions went on until company unions became illegal by a 1934 revision of the Railroad Labor Act.[238]

At the same time, other unions, primarily the IBEW, worked hard to block the BRS from gaining recognition after signal systems evolved from mechanical interlocking systems to a number of electronic systems. These included electro-mechanical, electro-pneumatic, and all electric interlockings that paved the way for

---

[236] Ibid.
[237] Gustave Malmsjo, “Limitations of Maintainers’ Territories,” *Proceedings of the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volume dated Sept. 18–23, 1930, p. 897.
[238] Grand Executive Council Docket No. 48, Company Unions, p. 9, Minutes of the Grand Executive Council, bound typewritten volume dated May 2, 1934.

automatic train control, automatic signal systems, and by the 1930s, centralized train control. The growing complexity of signal systems continually challenged signalmen to broaden their skills in order to keep up with the many technological innovations, which later gave them leverage in asking for recognition as a skilled craft union and the authority to represent signal department employees in government, labor, and management negotiations.

Similarly, their increasing skill levels kept them embroiled in ongoing jurisdictional conflicts with other unions and frustrated the BRS in its attempts to be recognized. As many as five unions in the AF of L claimed jurisdiction over the work of signal department employees. These five unions opposed the jurisdictional claims by the BRS because the union based their claims on industrial job descriptions, not craft definitions. Other unions reasoned that those men performing, for instance, machine work should belong to the machinist union; carpenters should join the carpenters union, and so on.

While the original unions were founded along craft lines during the 1800s in factory or shop locations, signalmen had an entirely different work situation and were part of the new industrial trade union movement in the early twentieth century. Signalmen and maintainers, spread thinly over the lines, covered territories as long as 40 miles, which could contain many types of signal systems, highway crossing gates, safety appliances, and track-switching equipment. To repair a faulty signal could mean performing any number of skills claimed by the other unions. The railroads refused to hire signalmen who would only perform specialized trades, such as electricians' work or blacksmithing. Signalmen had to perform using all the skills necessary to keep the trains running efficiently and safely through each territory. For this reason, signal work was a particularly different kind of work. In addition, signal departments were unique organizations that were responsible for extended, signal-system territories or large, highly complex switching yards, junctions, and terminals.[239]

Signal technology changed so rapidly during the first thirty years of the twentieth century that it was hard for outsiders to comprehend, much less develop, standards and rules to govern both working conditions and maintenance schedules. The frustrations reflected in the commissioner reports of the Interstate Commerce Commission’s (ICC's) Block Signal and Train Control Board attest to the difficulties created in trying to keep trains running safely on time.[240]

In addition, BRS President Daniel Helt complained that few department supervisors outside the signal departments, other railroad employees, or outside union representatives understood the work well enough to “address the subject for more than five minutes.”[241] The lack of understanding by people outside signal departments meant the BRS had to continually define itself and fight to maintain its identity.

In defining their role within railroad institutions and in negotiations with the federal government for the authority to represent signal department employees, the Grand Lodge officers in the 1920s profited from the lessons they learned from the

---

[239] The use of the word “particular” when describing signal work, J. W. Steliker, General Signal Supervisor, in lecture and paper given at an education meeting in Stockton, Calif. to signal employees of the Santa Fe and Southern Pacific Railroad, Oct. 3, 1926.
[240] First Annual Report of the Block Signal and Train Control Board to the Interstate Commerce Commission, reprinted in *The Signal Engineer* 1, (Feb. 2. 1909): p. 351.
[241] Helt, Daniel, BRS President, The Shop Crafts of the Railway Employment Department of the American Federation of Labor and the Brotherhood of Railroad Signalmen, pp. 169 – 183.

former leaders. From its early meetings as a fraternal organization in 1901, the leadership of the original Brotherhood of Railway Signalmen of America took the initiative to explore avenues that would ensure the institutionalization of the organization. Grand Lodge officers Detwiler and Judge had been careful from the beginning to position their union in terms of higher goals and to exclude language that inferred they organized solely to raise wages. In addition, the founding committee also cited in its demands the changes in the signaling technology, standards for maintenance, and the amount of equipment the signalmen were responsible for as evidence of their skills and their importance to the industry. This evidence supported their demands for a specialized signal department separate from the maintenance of way workers, and their claim that signalmen needed training on the latest innovations. The BRS officers made their appeal in a respectful and professional manner, but with the implied threat that if their demands were not met they could strike. They made it clear that if they walked off the job, efficiency and public safety would suffer. The BRS officers would use this approach in future negotiations with the federal government and other railroad unions.

Because the BRS dealt with so many conflicts and disputes with other unions and with the corporation's lawyers, they learned to take advantage of federal mediation boards in order to solidify its position as representatives of signal department employees. The BRS leadership learned from the conflicts how to gain support and political leverage from ICC commissioners and the Director General of the U.S. Railroad Administration, as well as from the other railroad unions, despite having only between 10,000 and 19,000 members. Representing such a small portion of the million and a half railroad employees, before World War I, its officers quickly learned to negotiate using reason and evidence to demonstrate its importance in the industry as the custodians of public safety and rail traffic efficiency. The Grand Lodge officers did this whenever they made demands and represented themselves to their employers, other unions, and state and federal governments. Other non-operations unions were not as organized and aired their grievances in the press to further their demands or at times defeated their goals by walking out of negotiations.

The leadership at the Grand Lodge of the BRS, under Helt and Cone, not to mention the many other lodge General Chairmen, was able to effectively court influential members of the community, state and federal governments, and other labor unions in order to gain recognition and have some of its demands met. Unlike other non-operations unions that were left out of negotiations held before federal mediation boards during World War I, the BRS was able to gain access through Helt's political skill and determination. He went to the Director General of the Railroads to present his case and show support for the administration's efforts. From his singular efforts, the brotherhood gained access to federal mediation and wage adjustment boards. The BRS would also gain the authority to represent signal department employees before these labor boards.

Within the first two years after World War I, under a Republican administration, control of the railroads returned to private hands. Under this pro-business administration of President Warren G. Harding, many of the gains unions had made in wages, benefits, and working conditions were rolled back and unions lost control of their work situations when closed shops practices ceased. President Wilson and the Democrats toward the end of his administration still advocated that workers should organize but feared radical unionism, and they ignored the AF of L, reducing labor's influence. In the two years after World War I, the unions lost more than 1.5 million members. Once again, private industry was in control, and labor had to have its grievances aired at an ineffectual Labor Board, created under the Transportation Act. The tripartite board of equal representation of industry, labor, and government, had authority to decide wages and working conditions and to resolve issues between the carriers and the employees. Unions saw that the board was stacked two to one against labor.[242]

Frustrated with the Labor Board, unions bypassed it and began negotiating directly with the carriers. The twenty-one major railroad brotherhoods came together and formed the Railway Labor Executives' Association (RLEA), of which Grand President A. E. Lyon was a founding member and organizer. Out of the chaotic World War I and post-War periods, the BRS had allied itself with the other twenty-one major railroad unions, and Helt and Lyon would be members of the RLEA until they retired in 1948 and 1969, respectfully.

As the BRS became more established after World War I, Helt's affiliation with the other national brotherhoods resulted in many joint actions, such as participation in the Plumb Plan League of 1919—a failed attempt to keep the railroads under some form of Federal control—and the development of The Labor Cooperative Educational & Publishing Society, which published *Labor*. The BRS was among the original owners of this labor newspaper based in Washington D.C. At the same time, the BRS under Helt, and with his assistant and protégé, A. E. Lyon,

[242]Melvin Dubofsky, *The State and Labor in Modern America,* pp. 83–100.

began publication of the *Signalmen's Journal* in 1920. The BRS added an Education Bureau within the *Journal* to provide technical information supplied by manufacturers and lecturers on electrical theory and application, as well as other facets of signal work. In 1930, Lyon started a Statistical Bureau to supply the Grand Lodge officers with a wide range of data, among other things, wages and hours of service, accidents and information on the latest signal technologies. The Statistics Bureau would provide evidence for future state and federal legislative actions.[243]

Winning the jurisdictional battles with the IBEW and going up against the railroads' corporate lawyers taught BRS leaders the political skills needed to go before Congress and government agencies, and to write needed safety legislation. Among the bills the BRS members wrote and pushed through Congress was the Signal Inspection Act of 1937. This law gave the ICC much needed authority to oversee and to demand, upon investigation, the installation, repair and maintenance of all signal systems. The law required carriers to publish their rules and standards for the installation, repair, and maintenance of signal systems; and prevented carriers from removing signal systems without government approval. In 1937, the ICC's Safety Bureau grew to fifty-seven safety appliance inspectors and twelve hours of service inspectors, under a director and two assistant directors. In addition, there was a staff of attorneys, engineers, and clerks. Expenditures for the Bureau of Safety had increased from $12,000 in 1901 to $966,000 in 1936.[244]

---

[243] Grand Executive Council, "Docket No. 17, Statistical Bureau," *the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volumes dated Aug. 19-23, 1930, p. 129.
[244] The Bureau of Statistics of The Interstate Commerce Commission, *The Interstate Commission Activities 1887–1937,* (Washington D.C., U.S. Government Printing Office, March 1937), pp. 117–129.

The law is still in use today as part of the Federal Railroad Administration's standard operating procedures. It remained a relevant piece of legislation because unlike other safety laws enacted in the early twentieth century, it based its provisions on standards of performance rather than on the requirement of contemporary technologies that became obsolete when better innovations took their place. [245]

Working on industry and government labor boards and helping to establish the RLEA, the leadership of the BRS earned a reputation as experts in arbitration and negotiation. By placing themselves in crucial arbitrations and by embracing a 'learn-as-you-go' policy, they gained expertise on union issues, thus cementing their position within labor and the railroad industry. Their expertise gave the small union political clout within the industry.

In conclusion, the Kheel Center for Labor-Management Documentation and Archives at Cornell University gives one of the best descriptions of role signalmen play in daily railroad operations:

> The railroad signal department performs the vital functions of expediting and controlling traffic while maintaining safe conditions. It represents one of the most responsible and sensitive units of the entire railroad system. Signalmen are directly involved with expanding the mileage of protected track and modernizing existing railroad plants. Their activities necessitate smooth coordination with other units of the system to [ensure] maximum safety and efficiency.[246]

Few people understand what signalmen do or how trains move through rail systems without crashing into each other. Train traffic safety goes unnoticed until

[245] Ian Savage, *The Economics of Railroad Safety,* p. 42.
[246] Introduction to *Guide to the Brotherhood of Railroad Signalmen, General Committee of the New York Central Railroad (Lines West), 1909–1962,* Kheel Center for Labor-Management Documentation and Archives, Cornell University, 2002, http://rmc.library.cornell.edu/EAD/htmldocs/KCL05182.html.

something goes wrong. The BRS remains a little understood organization that continues to be the custodians of railroad safety and efficiency and continues to improve the working lives of their members as signal systems innovations change their work environments. They continue to be the custodians of safety and railroad efficiency, even as they lose members due to innovations in technology, the railroad's attempts at farming out work to outside contractors, and the changes in policy that have negatively impacted labor unions during the administrations of Presidents Ronald Regan, George Bush Sr., and George W. Bush.

In day-to-day operations, the signalmen's importance to the railroads is a matter of who you talk too, CSX Maintainer Ed Mac said jokingly. "To train crews, we are heroes. To the maintenance of way crews, we are just in the way."[247]

[247] It must be explained that Mac's joke about how the maintenance of way workers see signalmen as in the way is part of the ongoing, interdepartmental rivalry that exists in any large institution. The signalmen also share a term for the Maintenance of Way workers, calling them part of the *Maintenance in the Way Department*. Both departments have to do their job, which sometimes means halting train movements.

Appendix

Abbreviations for Unions and Institutions

AAR The American Association of Railroads, a railroad industry association.

AF of L American Federation of Labor

ATC Automatic Train Control

ASC Automatic Signal Control

ATS Automatic Train Stop

BRS The Brotherhood of Railroad Signalmen—originally the union called itself the Brotherhood of Railway Signalmen of America, but it was later changed to the Brotherhood of Railroad Signalmen of America, then changed to the Brotherhood of Railroad Signalmen (BRS).

GEC The Grand Executive Council of the BRS, also referred to as the Executive Committee in convention minutes

IAC The International Association of Carmen

IAM The International Association of Machinists

IBEW The International Brotherhood of Electrical Workers

ICC The Interstate Commerce Commission

PRR The Pennsylvania Railroad

RED Railway Employees Division of the AF of L

USRA The United States Railroad Administration, which was replaced by the ARA

Bibliography

The bibliography is divided into sections in the following order: Books, Railroad Industry, and Engineering Manuals; Periodicals and Journals; Interviews; Internet Sources and Documentaries; Government Publications; and Documents, and Primary Documents, The Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA.

Books, Railroad Industry, and Engineering Manuals

Adams, Brahman. *The Block System of Signaling on American Railroads, the Methods and Appliances Used in Manual and Block Signaling, also descriptions of hand-operated and power operated interlocking machines.* New York: The Railroad Gazette, 1901.

Aldrich, Mark. *Death Rode the Rails: American Accidents and Safety 1828-1965*. Baltimore: Johns Hopkins Press, 2006.

American Association of Railroads. *American Railway Signaling Principles and Practices.* Chicago, Signal Section of the American Association of Railroads, 1952.

Brignano, Mary, and Hax McCullough. *The Search for Safety: a History of Railroad Signals and the People Who Made Them*. Commissioned by the Union Switch & Signal Division, American Standard, 1981.

Brotherhood of Railroad Signalmen of America. Minutes of the Thirteen Annual Convention, Kansas City, Mo. Oct. 11, 1920, condescended report in the *25th Anniversary Celebration, Brotherhood of Railroad Signalmen of America,* Floral Park, North Bergen, N.J., June 27, 1926.

Canadian National Railways. *CN Signal Training.* Montreal, Quebec, Office of Training Development, 1979.

Cottrell, W. Fred. *The Railroader*. New Jersey: Princeton University Press, 1983, pp. 30–33.

Derr, W. L. *Block Signal Operation*. New York: D. Van Nostrand, 1897.

Dixon, Frank H. “The Railroad Situation, an Appraisal.” Papers and Proceedings of the Thirty-Third Annual Meeting of the American Economic Association. *The American Economic Review* 11 (March 1921): p. 14.

Dubofsky, Melvin. *The State and Labor in Modern America.* Chapel Hill, University of North Carolina Press, 1994.

Fagan, James O. *Confessions of a Railroad Signalman.* Boston, Houghton Mifflin, 1908.

General Railway Signal Co. *Electrical Interlocking Handbook by the Engineering Staff of the General Railway Signal Company with an introduction by Wilmer W. Salmon.* Rochester, NY: General Railway Signal Co, 1930.

--------- *Catalogue of Mechanical Interlocking Signaling Devices made by the GRS Co.* (Buffalo, NY, 1905), p. 350.

--------- "Section A, Part 1, Saxby and Farmer Interlocking Machine." Rochester, NY, June 1915, Plate A0101.

--------- "Section B, Part 3, Train Order Signals." Rochester, NY, copyright June 1915, Plate B0303.

Grant, Roger H. *The Railroad, The life Story of a Technology*. Connecticut: Greenwood Press, 2005.

Hoogenboom, Ari and Olive Hoogenboom. *A History of the ICC: From Panacea to Palliative.* New York: Norton & Co. Inc, 1976.

Interstate Commerce Commission, Bureau of Statistics. *Interstate Commerce Commission Activities, 1887-1937.* Washington D.C.: Superintendent of Documents, 1937.

Lavarack, Frederick C. *Locking; Being an elementary treatise on the mechanisms in interlocking lever machines by which the movements of the levers are restricted to certain predetermined ways, rendering it impossible to operate conflicting switches and signals on railways.* East Orange, New Jersey: self-published - F.C. Lavarack, 1907.

Licht, Walter. *Working for the Railroad, The Organization of Work in the Nineteenth Century.* New Jersey: Princeton University Press, 1983.

Lyon, Anon E. *The First 75: History of the Brotherhood of Railroad Signalmen 1901--1976*, Mount Prospect, Illinois: Brotherhood of Railroad Signalmen, 1976.

Metropolitan Life Insurance Co. *Personnel Management on the Railroads.* New York: Simmons-Boardman Publishing, 1925.

Neider, H.L. First Grand-Vice Chief. *The Birth and the History of the BRSA of A.* Pittsburg, PA, Sept. 9, 1912, pp. 1-2. Pamphlet.

Pettit, Wilmot .J. *History of the Brotherhood of Railroad Signalmen of America*. La Salette, Ontario, Canada, BRSA Pamphlet, 1916.

Phillips, Edmund J. *Railroad Operation and Railway Signaling, A Handbook of illustrated questions and answers of the who, what and why of railway signaling and train operations*. New York: Simmons-Boardman Publishing Corporation, 1942.

Rockwell, Ray R. *Railroad Track Circuits and Interlocking*. Scranton, PA: International Textbook Company, 1933.

Savage, Ian. *The Economics of Railroad Safety*. Boston: Kluwer, Academic Publishers, 1960.

Signal Section of the American Railway Association. *Committee I. Economics of Railway Signaling, Proceedings, Sept. 1930*. Bethlehem, PA, Times Publishing Co., 1931.

Solomon, Brian. *Railroad Signaling.* St. Paul, Minnesota: MBI Publishing, 2003.

Stone, Richard D. *The Interstate Commerce Commission and the Railroad Industry, A History of Regulatory Policy.* New York, Greenwood Publishing Co., 1991**.**

Stover, John F. The Life and Decline of the American Railroad. New York: Oxford University Press, 1970.

Usselman, Steven. *Regulating Railroad Innovation, Business, Technology, and Politics, 1840-1920.* England: Cambridge University Press, 2002.

Wright, Sedgwick N. *Centralized Traffic Control, Bulletin 154.* General Railway Signal Company, Rochester, NY, Aug. 1927.

Periodicals and Journals

Aldrich, Mark. "Combating the Collision Horror, The Interstate Commerce Commission and Automatic Train Control, 1900-1939." *Technology and Culture* 34 (Jan. 1993): p. 51.

Anonymous author. "Railroad Accidents and Their Causes – Observations by a Railroad Man." *The Washington Post*, Dec. 24, 1904, p. A12;

Boyden, Hanson. "The Block System, what it is and why it failed last Sunday – How it can absolutely prevent disastrous collisions." *Washington Post*, Jan. 6, 1907, p. F1.

Chase, F. D. "Signal Tower for Saxby & Farmer Machines", *The Signal Engineer*, 2 (Aug. 1909): pp. 82–84.

Fagan, James O. Letter to the Editor. "Safety First." *The New York Times*, Feb. 8, 1913, p. 12. Helt, Daniel. "Concerning the National Agreement." *The Signalmen's Journal* 1, (March 1920): p. 11.

Helt, Daniel, BRSA Grand President. Negotiations with the Railroad Employees Department of the American Federation of Labor. Minutes of the meeting held with the shop crafts of the Railway Employment Department of the American Federation of Labor and the Brotherhood of Railroad Signalmen. Kansas City, July 17, 1919, *The Signalmen's Journal* 1, (Jan., 1920): pp. 3-14.

--------- Letter to William Green, President of the American Federation of Labor, Dec. 23, 1927. Reprinted in the *Signalmen's Journal* 9, (Jan. 1928): pp. 29 – 35.

--------- "Concerning the National Agreement." *The Signalmen's Journal* 1, (March 1920): p. 11.

Interstate Commerce Commission. *First Annual Report of the Block Signal and Train Control Board to the Interstate Commerce*. Reprinted in *The Signal Engineer* 1, (Feb. 2. 1909): p. 351.

--------. "ICC Circular on Signal Inspection Law." *Railway Age,* 103, (October 2, 1937): p. 469.

Latimer, James. "Railway Signaling." *The Signal Engineer* 1 (Feb.1909): p. 344.

New York Times. Topic of the Times. "Safety for Railway Passengers." July 24, 1916, p. 11.

Patterson, W. J. Director of the Bureau of Safety, Interstate Commerce Commission. *Railway Age* 127. (Sept. 24, 1949): pp. 50-52.

Post, E. K. "The Electro-Mechanical Interlocking System, Combining the Advantages of electric and Mechanical Interlocking Plants." *The Signal Engineer* 2 (April 1910): pp. 412-415.

Railroad Gazette 56. "Block Signaling Progress." (Jan. 2, 1914): p. 1.

Railway Age 10. "More Signaling – Greater Economy." (Jan. 8, 1938): p. 26.

Railway Age 10. "More Signaling – Greater Economy." (Jan. 8, 1938): p. 26.

Railway Age 10. "The Key to Further Progress lies in Personnel Policies." (Dec. 19, 1936): pp. 879–880.

Railway Age 103. "ICC Circular on Signal Inspection Law." (October 2, 1937): p. 469.

Railway Age 104. *"Accident Trend Upward."* (Jan. 8, 1938): p. 237.

Railway Age 104. "CTC increases the capacity of single track on the PRR." (Jan. 8, 1938): p. 122.

Railway Age 104. "Train Control and Signal Statistics." (Sept. 1938): 237.

Railway Age 126. "Signaling Construction." (Jan. 8, 1949): p. 80

Signal Engineer 1. "First Annual Report of the Block Signal and Train Control Board to the Interstate Commerce Commission." (Feb. 1909): p. 53.

Signal Engineer 2. Editorial. "Combating the Collision." (Jan. 1910): pp. 257-8.

Signalmen's Journal 1. "Memorandum of Agreement." (March, 1920): p. 8.

Signalmen's Journal 9. "Response to IBEW Signal Situation, Correspondence between President Helt and President Green, of the A. F. of L. on the I.B.E.W. Controversy." (Jan. 1928): p. 28–35.

The Signalmen's Journal 16. "Signal Schools." (May 1935): p. 115.

The Signalmen's Journal 16. "Centralized Train Control, 151 installations in service on 38 roads." (July 1935): p. 17.

Splawn, Walter M. W. "Railroad Regulation by the Interstate Commerce Commission, Ownership and Regulation of Public Utilities." *Annals of the American Academy of Political and Social Science* 201(Jan. 1939): p. 158.

Washington Post. "Railroad Accidents and Their Causes – Observations by a Railroad Man." (Dec. 24, 1904): p. A12;

Washington Post. Editorial. "The Cheapness of Life." (Dec. 28, 1908): p. 6.

Welch, Ashbel. "Report to the committee on Safety Signals, Presented to the General Railroad Convention." Convention was held at the St. Nicholas Hotel, New York, Oct. 24, 1866. Republished in *The Signal Engineer* 1 (May, 1909): pp. 512.

Interviews

DePaepe, Tim, Researcher for the Brotherhood of Railroad Signalmen, Front Royal, VA, phone interview with author, Oct. 27, 2007.

Haley, Kelly, Communications Director for the Brotherhood of Railroad Signalmen, Front Royal Virginia, interviews, conversations, and correspondence with author, from Sept. 2007 through April 2008**.**

Mac, Ed, CSX Maintainer, Hancock, West Virginia, phone interviews, conversations, and interviews with author from October 2006 through March 2008

Maniscalio, Tony, retired maintainer, Long Island Railroad, interviews and correspondence from March 2006 through March 2008.

Internet Sources and Documentaries

Berry, Dale. Michigan's Internet Railroad History Museum. http://www.michiganrailroads.com/RRHX/Railroads/MichiganCentral/MichiganCentralHomePage.htm,

Brotherhood of Railroad Signalmen. 100th Anniversary Video, *"A Century of Service"* Video. BRSA, Front Royal, VA, 2001.

Calvert J. B. Position Light Aspects (PRR) Chart. *Early Railway Signals*, July 25, 2004, Revised August 15, 2004, http://www.du.edu/~etuttle/rail/sigs.htm#Ligh

Kheel Center for Labor-Management Documentation and Archives, Cornell University. Introduction to *Guide to the Brotherhood of Railroad Signalmen, General Committee of the New York Central Railroad (Lines West), 1909–1962*. 2002, http://rmc.library.cornell.edu/EAD/htmldocs/KCL05182.html.

Legal Information Institute. Hours of Service Act of 1907, amended 1969 and 1976, Title 45 chapter 3, Sec. 16(4), 102 Stat. 635, related to signal system employees' hours of service. See sections 21102, 21104 to 21107, and 21303 of Title 49. Legal Information Institute, US Code Collection Cornell University Law School, 2008. http://www.thecre.com/fedlaw/legal12/uscode45-61to64b.htm.

Government Publications and Documents

Interstate Commerce Commission. Bureau of Statistics. *Interstate Commerce Commission Activities, 1887-1937.* Washington D.C.: Superintendent of Documents, March 1937.

----------. Safety Division. *Report of the Interstate Commerce Commission,* 33. Washington D.C., U.S. Government Printing Office, Dec. 1919.

---------. Safety Division. *Report of the Interstate Commerce Commission* 34. Washington D.C.: U.S. Government Printing Office, Dec. 1920.

Railways Employees Department, American Federation of Labor. Federated Shop Crafts vs. New York Central Railroad Company. Decision no. 1091 (Docket 358). *The Proceedings of the United States Railroad Labor Board*, Chicago, July 6, 1922.

Request for a State Charter by the Brotherhood of Railway Signalmen of America. Granted by Decree of The Court, April 6, 1908. Court of Common Pleas, Blair County, PA., March 4, 1908.

U.S. Congress. House. Subcommittee of the Committee on Interstate and Foreign Commerce, H.R. 2748, *Railway Signal Systems: Hearing before the House Subcommittee on Interstate and Foreign Commerce.* 74th Congress, 2d. sess., March 4, 1936. Washington D.C., United States Printing Office, 1936.

U.S. Congress. Senate Subcommittee of the Committee on Interstate Commerce. S.1288, *Railroad Block Systems: A bill to promote the safety of employees and travelers on railroads by requiring common carriers engaged in interstate commerce to install, inspect, test, repair, and maintain block-signal systems, interlocking, highway grade-crossing protective devices, automatic train stop, train control, cab signal devices and other appliances, methods, and systems intended to promote the safety of Railroad Operation, (The Signal Inspection bill):Hearings before the Subcommittee on Interstate Commerce*. 74th Cong., 1st session, July 9 and 10, 1935. Washington, D.C., ICC, United States Gov. Printing Office, 1935.

United States Railroad Labor Board. Railway Employees Department. A. F. of L., Federation of Shop Crafts vs. Atchison, Topeka and Santa Fe Railway Co. Decision No. 1092 (Docket 1702). *The Proceedings of the United States Railroad Labor Board*, Chicago, July 6, 1922.

Primary Documents, The Archives of the Brotherhood of Railroad Signalmen, Front Royal, VA.

American Federation of Labor. “Senate Bill S. 29: To promote the safety of employees and travelers by requiring railroads engaged with the ICC to install, inspect, test, repair and maintain block signal systems, interlocking, automatic, train stop, train control, cab signal devices, and other appliances, methods and systems intended to promote safety of railroad operation, passed both houses. Administration of law is under the ICC.” American Federation of Labor, *Report of the Proceedings of the Fifty-seventh Annual Convention of the AF of L*, Denver, Colorado, bound typescript volumes dated Oct. 4-15, 1937, p. 171.

-------- *Report of the Proceedings, 34th American Federation of Labor Annual Convention*, Philadelphia, PA. Washington D.C.: The Law Reporting Printing Co., bound typescript volumes dated Nov. 9-21, 1914.

Brotherhood of Railroad Signalmen of America. “Resolution No. 6. Minutes of the Meeting at Grand Lodge of the BRSA, Altoona, PA, March 7, 1907.” BRSA will protest IBEW claim for jurisdiction over signal department employees in New York City to the AF of L. *The Eighth Annual and Tenth Regular Session of the BRSA Convention*, St. Thomas, Ontario, bound typescript volume dated June 14-17, 1915, p. 27.

--------- *Clarifying the Signal Situation*. Responses to International Brotherhood of Electrical Workers’ (IBEW) signal situation arguments. *The proceedings of the United States Railroad Labor Board*. BRSA pamphlet, Chicago, July 6, 1922. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

--------- The Election of Grand President Helt and his nomination of A. E. Lyon as Acting Grand President. *The Seventh Biennial and Twenty-second Regular Convention of the BRSA*, Chicago, bound typescript volume dated Aug. 23, 1934, pp. 546–523.

--------- “The First Annual and Third Regular Session of the Grand Lodge of the BRS, Philadelphia, August 16, 17, 1908,” *The 25th Anniversary Celebration, BRS of A*, Floral Park, North Bergen, N.J., June, 27, 1926. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box

--------- “Resolution No. 28. Resolution will be sent to the Lane Commission. (The Board of Wages and Working Conditions). If the BRSA is not recognized, they will strike.” *The Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Chicago, bound typescript volume dated July, 14--19, 1919, p.154.

Detwiler, H.G. “To begin the begin, The beginning of the Brotherhood of Railroad Signalmen of America – in Altoona, Pa.” Handwritten account believed to be written by Detwiler (or possibly another member of the committee) who attended the second meeting with PRR Pennsylvania Railroad General Superintendent J. M. Wallis, 1902. *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

Dunn, H.C., BRSA Grand Secretary Treasurer. Letter to Frank Morrison, Secretary of American Federation of Labor. Request AF of L affiliation**.** Washington D.C., Feb. 4, 1909. *BRSA History, 1901—1950,* Vol. 1, BRSA Archive file box.

Grand Executive Council of the Brotherhood of Railroad Signalmen. Lyon is to meet with AF of L President William Green in Washington concerning re-affiliation with the AF of L, Nov. 20, 1937. Minutes of the Grand Executive Council, bound typewritten volume, 1920—1950.

--------- Lyon spoke about the possibility of reinstatement in the AF of L, July 3, 1937. Minutes of the Grand Executive Council, bound typewritten volume, 1920—1950.

--------- Grand Executive Council decides to hire an attorney in jurisdictional dispute with the International Brotherhood Electrical Workers. June 27, 1936. Minutes of the Grand Executive Council, bound typewritten volume, 1920—1950.

--------- Resolution to remove “AF of L” from the BRSA seal, August 22, 1936. Minutes of the Grand Executive Council, bound typewritten volume, 1920—1950.

--------- “Docket No. 96, Track Motor Car.” Officers Reports. *The Twenty-Fourth Regular Convention of the BRSA*, Toronto, Canada, bound typescript volume dated Aug. 15—19, 1938, p. 205.

--------- Minutes, BRSA will hire an attorney to help with jurisdictional dispute with the IBEW on New York Subway. June 27, 1936. Minutes of the Grand Executive Council, bound typewritten volume, 1920—1950.

--------- “Docket No. 17, Statistical Bureau,” *the Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volumes dated Aug. 19—23, 1930, p. 129.

--------- Minutes of the Grand Executive Council, bound typewritten volume, 1920 – 1950, dated March 21, 1935.

--------- “Memorandum prepared by the board of Directors of the Order of Railroad Telegraphers, regarding proposed Amalgamation of the ORT and the BRS, March, 26, 1935.” They completed the basic agreement on March 28, 1935. Minutes, bound typewritten volume dated July 3, 1937.

--------- “Docket No.96, Docket 14, the 1936 Convention*.”* Officers Reports, *the Ninth Biennial and the Twenty-Fourth Regular Convention of the BRSA*, Toronto, Canada, bound typescript volume dated Aug. 17—20, 1938.

--------- “Docket No. 27, Limitations of Maintainers Territories.” Report of the Grand Executive Committee. *The Fifth Biennial and Twentieth Regular Convention*, Denver, bound typescript volume dated 18—23, 1930, p.839.

--------- "Docket No. 22, Education." Report of the Grand Executive Committee. *Fifth Annual and Twelfth Regular Convention of the BRSA.* Denver, bound typescript volume dated Aug. 18–23, 1930. p. 30.

--------- “Docket No. 48, Company Unions.” Minutes of the Grand Executive Council, 1920 –1950, bound typewritten volume dated, May 3, 1934,

--------- “Docket No. 6. Resolution no. 27 will be sent to the AF of L stating they will continue to solicit for new members in the signal departments.” Report of the Grand Executive Council. *The Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volume dated Aug. 18—23, 1930, p. 127.

Green, William, President of American Federation of Labor. Address. *The Fourth Biennial and Fourteenth Annual Convention of the BRSA*. Chicago, bound typescript volume dated Sept. 10–15, 1928, pp. 719–748.

Helt, Daniel, BRS President, “Resolution No. 28,” resolved July 18, at the *Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Kansas City, MO, bound typescript volumes dated July, 18, 1919, p.154.

--------- The Shop Crafts of the Railway Employment Department of the American Federation of Labor and the Brotherhood of Railroad Signalmen, Meeting Minutes. Kansas City, July 17, 1919, pp. 169 – 183. *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

-------- **“**Motor Car Accidents.” Opening Address, Forenoon Session, *The Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, Colorado, bound typescript volume dated Aug. 18—23, 1930, p. 19—20.

Helt, Daniel, BRSA President, and Delegates M.C. Merritts, I.M. Fisher. Discussions on a motion to have the Interstate Commerce Commission define the maintainer's responsibilities in regards to ATC. *The Fourth Biennial and Nineteenth Regular Convention of the BRSA*, Chicago, bound typescript volume dated Sept. 10–15, 1928, P. 841-846.

--------- "Officer's Reports." *The Third Biennial and Eighteenth Regular Convention,* New York City, bound typescript volume dated Sept. 13—18, 1926, pp. 1-5.

---------"Statement before the Board of Wages and Working Conditions." March 18, 1918, *Twelfth Annual and Fourteenth Regular Session of the BRSA Convention*, Kansas City, bound typescript volume dated July 14—19, 1919, p. 158.

--------- "Statement before the Railroad War Commission." *Eleventh Annual and Thirteenth Regular Session of the BRSA Convention*, Baltimore, MD, bound typescript volume dated June 10–13, 1918, p. 36.

International Brotherhood of Electrical Workers. "A True Insight into the Signal Situation." The agreement between the BRSA and the IBEW about the duties of signalmen, Signed Jas. P. Noonan, IBEW, and D. W. Helt, BRSA, IBEW Pamphlet, no date; however, letters and documents cited place publication date after 1921. *BRSA History, 1901-1950,* Vol. 1, BRSA Archive file box.

Lyon, Anon E. *Efforts to Secure Passage of the Signal Inspection Bill*. Report of the Acting Grand President. The *Eighth Biennial and Twenty-third Regular Convention of the BRSA,* Chicago, bound typescript volume dated Aug. 16,-19, 1936, pp. 24-29.

--------- Note about problems that cause false clear signals to Grand Lodge Officer L. R. Smith. March 26, 1926. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

--------- Report of the Acting Grand President. *Efforts to Secure Passage of the Signal Inspection Bill,* Officers Reports, bound typescript volume dated August 1936, p. 24.

--------- Assistant to the President. "Report to the Delegates." *The Fifth Biennial and Twentieth Regular Convention of the BRSA.* Denver, Colorado, bound typescript volume dated Aug. 18-23, 1930, pp. 97-99.

--------- "The Signal Inspection Act, a Major Achievement of the BRSA, (A Lyon Chronicle." (Unpublished history/memoir of the BRSA's role in the enactment of the Legislation, 1972). Red loose-leaf binder.

Malmsjo, Gustave. “Limitations of Maintainers’ Territories.” *The Fifth Biennial and Twentieth Regular Convention*, Denver, bound typescript volume dated Aug. 18–23, 1930, p. 897.

Merritts, M.C., Grand Trustee, Grand Executive Committee. Discussing the need to regulate signal system maintenance and installation. *Proceedings of the Fourth Biennial and Nineteenth Regular Convention of the BRSA*, Chicago, bound typescript volume dated Sept. 10–15, 1928, pp. 841–844.

“Minutes of the Thirteen Annual Convention, Kansas City, Mo. Oct. 11, 1920.” Condescended report in the *25th Anniversary Celebration, Brotherhood of Railroad Signalmen of America,* Floral Park, North Bergen, NJ, June 27, 1926.

--------- “Section 1. This organization shall be known as the Brotherhood or Railroad Signalmen of America.” Grand Executive Committee. *The Fifth Biennial and Twentieth Regular Convention of the BRSA*, Denver, bound typescript volume dated Aug.18--23, 1930, p.127.

Officers Reports, BRSA. “Letters presented in the Officer’s Reports.” *The Third Annual Biennial and Eighteenth Regular Convention of the BRSA*, New York City, bound typescript volume dated Sept. 13-18, 1926.

--------- “Resolution No. 6, The BRS will protest to AF of L and protects its AF of L Charter,” *the Eighth Annual and Tenth Regular session of the BRS Convention*, St. Thomas, Ontario, June 14–17, 1915, p. 27.

--------- “Resolution No. 28, resolved July 18.” The *Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Kansas City, MO, July, 18, 1919, p.154. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

--------- “Education, reports and correspondence between the BRSA and the ARA and Manufacturers.” The *Fourth Annual and Nineteenth Regular Convention of the BRSA*, Chicago, bound typescript volumes dated Sept. 10–15, 1928, pp. 5–15.

--------- “Reports and Correspondence between the BRSA and Jason Noonan, President of the International Brotherhood of Electrical Workers.” *The Fourth Annual and Nineteenth Regular Convention of the BRSA.* Chicago, bound typescript volume dated Sept. 10–15, 1928, pp.58—60.

--------- “Resolution No. 10, Job Description.” Officers Reports, *The Twelfth Annual and Fourteenth Regular Convention of the BRSA*, Kansas City, bound typescript volume dated July 14 – 19, 1919, p. 146.

--------- “Reports and Correspondence between the BRSA and Jason Noonan, President of the International Brotherhood of Electrical Workers.” *The Fourth Annual and Nineteenth Regular Convention of the BRSA.* Chicago, bound typescript volume dated Sept. 10–15, 1928, pp. 58—60.

Order of Railroad Telegraphers, Board of Directors. Memorandum in regards to the Proposed Amalgamation of the ORT and the BRSA, March 21, 1935, pp. 4—10. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

Patterson, W. J., Director of the Bureau of Safety, Interstate Commerce Commission. Address to the Delegates. *Twenty-Eighth Regular Convention of the BRSA*, Jacksonville, FL, Original typewritten document dated Aug. 21, 1946. *BRSA History, 1901-1950*, Vol. 1, BRS Archive file box.

Pettit, W.J. Grand Chief Signalman. “Request for Affiliation with the American Federation of Labor.” Letter to AF of L Secretary Frank Morrison, Jan. 14, 1914. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

Railway Signalmen of America. Request for State Charter before Judge Martin Bell, Court of Common Pleas, Blair County, Pa., March 4, 1908. *Spring Meeting Minutes of Railway Signalmen of America,* New York City, April 12, 1908. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

Steliker, J.W. General Signal Supervisor. Lecture and paper on the importance of the signal department given at an education meeting in Stockton, Calif. to signal department employees of the Santa Fe and Southern Pacific Railroad, Oct. 3, 1926. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.

Wilmot J. Pettit, *History of the Brotherhood of Railroad Signalmen of America,* BRSA Pamphlet, (no date except for a handwritten date, “1915”). pp.16—20. *BRSA History, 1901-1950*, Vol. 1, BRSA Archive file box.