

## The Haymarket Bomb: Reassessing the Evidence

Timothy Messer-Kruse, James O. Eckert Jr.,  
Pannee Burckel, and Jeffrey Dunn

**T**he Haymarket affair of 1886 is a landmark in American social and political history. On May 4, 1886, a rally was called to protest the previous day's shooting of strikers by Chicago police at the McCormick Reaper Works. The meeting was organized by self-proclaimed anarchists, a small but growing movement that included both recent immigrants (primarily German) and native-born radicals who advocated militant self-protection of workers and demanded the swift overthrow of the government and all capitalist institutions. Their protest meeting, which took place close to the Haymarket Square on Chicago's near West Side, was poorly attended even by the anarchists' standards. Liberal mayor Carter Harrison came and observed the proceedings for a brief time and told his police squads that the gathering did not seem dangerous. Nevertheless, after Harrison left and as the rally crowd dwindled to a few hundred around 10 p.m., several squads of Chicago police marched into the area and ordered the protesters to disperse. Without warning, someone tossed a bomb into the police ranks that exploded with horrific force, wounding scores of officers. Gunfire erupted on both sides, and by the time the shooting ended seven police officers had been fatally wounded and at least three protesters lay dead. After a fierce investigation that included many warrant-less searches, dozens of arrests, and harsh interrogations, eight men were brought to trial. They were charged as accessories before the fact, which under Illinois law carried the same penalties for murder as the deed itself. The jury condemned seven men to death and one to a long prison term. (In the end four were executed, one cheated the hangman with a jail-cell suicide, and the sentences of two others were commuted.)

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The Haymarket bombing and trial marked a pivotal moment in the history of American social movements. It sparked the nation's first Red scare whose fury disrupted even moderately leftist movements for a generation. It drove the nation's labor unions onto a more conservative path than they had been heading before the bombing. It contributed to a string of legal decisions that served to restrict the civil rights of workers and empower the federal government against them. It also began a tradition within the American Left of memorializing the Haymarket defendants as the first martyrs to its cause.<sup>1</sup>

In the ensuing decades, historians have enshrined these events as a landmark in labor's chronology. While few academic historians questioned the legitimacy of the trial in the quarter century afterward, the publication of Henry David's dissertation, "A History of the Haymarket Affair," as a book in 1936 spurred historians to view the events in Chicago in 1886 as a classic case of police brutality and judicial lynching. After Paul Avrich published *The Haymarket Tragedy* in 1984, followed by the attention given to the event in its centennial year, this interpretation became nearly universal, with introductory textbooks in American history describing the event as the conviction of anarchists in a trial in which "not a shred of evidence" was introduced to connect the accused to the bombing.<sup>2</sup>

In the grisly aftermath of the bombing, surgeons removed pieces of shrapnel from the bodies of fallen police officers. Detectives broke into the house of Louis Lingg and discovered bomb-making equipment and an unexploded bomb. Both the shrapnel and a sample of bomb casings were chemically analyzed, and their composition was later shown at the trial to have been unusual to other commercially available products though similar to each other. (This was possible because Lingg allegedly produced his bombs by melting lead and other soft metals together in a homemade furnace and casting his own bomb casings in clay molds.)

In 1886 two chemistry professors, Walter S. Haines and Mark Delafontaine, independently performed what was described as a "qualitative" examination of various bombs and bomb fragments, determining their overall chemical components and the proportion of one of their constituents. The professors were able to determine the percentages of tin in each sample, but not the percentages of the other trace elements they detected. As Haines admitted on the witness stand, "I didn't separate the antimony . . . and didn't make an accurate determination of it. The precise quantity of antimony and tin is very difficult to determine where it is present in a small amount."<sup>3</sup>

1. For general background, see Paul Avrich, *The Haymarket Tragedy* (Princeton, NJ: Princeton University Press, 1984). A typical description of the event's importance for labor history is found in Leon Fink, *In Search of the Working Class: Essays in American Labor History and Political Culture* (Urbana: University of Illinois Press, 1994), 115.

2. For an example of textbook treatment of the Haymarket trial, see Melvyn Dubofsky and Foster Rhea Dulles, *Labor in America: A History*, 4th ed. (Wheeling, IL: Harlan Davidson, 1984), 118.

3. Walter S. Haines, testimony, Haymarket Trial Transcript, vol. K, pp. 670–71, Haymarket Affair Digital Collection (hereafter cited as HADC), Chicago Historical Society.

Table 1. Haines and Delafontaine 1886 chemical analysis of evidence

Source	Tin	Antimony	Zinc	Iron	Copper
Lingg bomb #1	1.9	trace	trace		
Lingg bomb #2	7	trace +	trace +		trace
Lingg bomb #3	2.4	trace	trace		
Lingg bomb #4	2.5	trace	trace		
Murphy fragment	1.6	trace	trace	trace	
Degan fragments	1.6–1.7	trace	trace	trace	
Spies bomb	1.1	trace	trace	trace	
Old lead pipe “wiped” with much solder	0.7	n.e.	n.e.	n.e.	n.e.
Commercial lead	0	trace			
Commercial solder	30–50	trace			

Note: n.e. = not examined

In court testimony, Haines and Delafontaine explained that the four samples they took from a bomb linked to Lingg contained mostly lead, with significant amounts of tin and traces of antimony, zinc, and, in one case, copper. Only the tin content was quantitatively measured and was found to vary in the four samples from 1.9 to slightly less than 7 percent of the total. The other trace metals were estimated to each consist of less than 1 percent of the sample.

The chemists also assayed shrapnel fragments removed from two of the bombing’s victims, Officer Mathias Degan, who died at the scene, and an Officer Murphy, who recovered from his wounds.<sup>4</sup> These fragments were found to be similar in composition, both having about 1.7 percent tin and trace amounts of antimony, zinc, and iron. Though the results did not precisely match those of the unexploded bombs, the prosecution argued that these results established that the bomb thrown on the night of May 4 was made by similar methods and according to a similar recipe as the ones found in Lingg’s apartment and other places in the city, which were dramatically displayed across a long table a few feet from the jury box.

The prosecution’s contention that these samples were connected was largely based on the assertion (which the defense did not challenge) that no commercially available compound of lead contained an amount of tin comparable to that found in the bomb casings or bomb fragments. Commercially available lead, Haines observed, contained no tin, while lead solders were a compound of at least 30 percent tin. This claim seems correct, as today raw “pig lead” contains less than two one-thousandths of a percent of tin, antimony, and arsenic combined, a level probably undetectable in

4. It is unclear from the court records whether “Officer Murphy” was Lawrence Murphy, who sustained wounds to his neck, leg, and foot, or Bernard Murphy, who sustained wounds to his thigh, head, and chin. Most likely it was Lawrence, as his foot was amputated; the police captain heading up the investigation recorded that a large piece of shell, “two inches square,” was taken from his leg. See Michael J. Schaack, *Anarchy and Anarchists* (Chicago: Schulz, 1889), 152–55.

1886.<sup>5</sup> Rather than melting down bars of common lead, the Haymarket bomb maker must have combined pieces of lead, solder, or other lead alloys in his crucible. Moreover, he must have been fairly consistent in his methods and recipe if, with one exception, his proportions of tin varied by less than 1 percent. This was the only physical and forensic evidence (there was other testimonial and circumstantial evidence) introduced at the trial that connected any of the defendants to the throwing of the bomb.

The “wet” chemical techniques of 1886 were simple but effective in determining the elemental ingredients of the sample and the relative quantity of a limited number of them. However, though Haines and Delafontaine did not overreach their ability to assay trace elements, in the century or so since the trial, historians have largely sided with the defendants and found this physical evidence unconvincing, though not by turning to any other chemical evidence.<sup>7</sup>

The evidence used in the Haymarket trial was held by the state of Illinois and various participants in the trial for some time after the conviction of the anarchists. Some of the evidence seized from Lingg’s apartment along with other mementos of the trial eventually were donated to the Chicago Historical Society (CHS), including an intact round bomb alleged to have been Lingg’s (referred to below as the “Brayton” bomb). The prosecutor, Julius Grinnell, held onto his own collection of artifacts, including the fragments recovered from the bodies of the slain police officers.<sup>8</sup> In 1970 Grinnell’s collection of manuscripts and artifacts was sold to the H. P. Kraus Company in New York and later was donated to the Beinecke Library at Yale University. Because the relevant evidence from the trial was never deposited in one location, the fragments and bomb casings were never retested.<sup>9</sup>

5. Howard E. Boyer and Timothy L. Gall, eds., *Metals Handbook: Desk Edition* (Metals Park, Ohio: American Society for Metals, 1985), sec. 12, p. 1.

6. Mark Delafontaine, testimony, vol. K, pp. 676–79, HADC.

7. Avrich does not consider this testimony at all. His only mention of the subject in a study of nearly five hundred pages is the following: “While [Lingg] in fact made bombs that afternoon, it was never proved that the Haymarket bomb was among them. Experts for the state could testify only that the bomb which killed Officer Degan was similar in composition to bombs made by Lingg. Even so, Grinnell’s special assistant, Mr. Ingham, was forced to admit that there was a noticeable difference in the thickness of their shells” (*Haymarket Tragedy*, 273). Similarly, Henry David gives this evidence only one paragraph in his extensive study of the case, saying, “The expert witnesses summoned by the state, however, never went beyond the statement that there were similarities between the Haymarket bomb and Lingg’s missiles” (*The History of the Haymarket Affair*, 2nd ed. [New York: Russell & Russell, 1958], 275). Franklin Rosemont’s biography of Louis Lingg mentions only that “attempts to prove that the actual Haymarket bomb was made by Lingg were unconvincing to all but Judge Gary and his jury” (“The Most Dangerous Anarchist in All Chicago: The Legend and Legacy of Louis Lingg,” in *Haymarket Scrapbook*, ed. David Roediger and Franklin Rosemont [Chicago: Kerr, 1986], 52).

8. Items listed as numbers 52 and 53 in John S. Kebabian, *The Haymarket Affair and the Trial of the Chicago Anarchists . . . the Julius S. Grinnell Collection* (New York: Krause, 1970), 32–33.

9. For details of the provenance of the bomb artifacts, see Kebabian, *Haymarket Affair and the Trial of the Chicago Anarchists*, inventory cards for items 1887.2 and 1979.154ab, Chicago Historical Society.

### Present Analytic Investigation

In July and August 2003, these two collections of artifacts were reanalyzed by energy dispersive X-ray spectrometry (EDS). This process subjected each sample to a focused electron beam. The impact of the electron beam causes X-rays to be emitted, the wavelengths of which are characteristic of a chemical element, and the intensity of which are proportional to the concentration of that element. A major advantage of this technique is that it is nondestructive, meaning that there is no chemical alteration to the sample. The “Brayton” bomb hemispheres from the collection of the CHS were assayed by Dr. Pannee Burckel and Dr. Jeffrey Dunn of the University of Toledo, while the “Degan” bomb fragment and another bomb fragment found in the Grinnell collection and labeled as having been extracted from an Officer Barbour were analyzed by Dr. James O. Eckert Jr. of Yale University. The data accumulated through these analyses, while insufficient to reach a firm conclusion about whether Louis Lingg manufactured the bomb thrown into Desplaines Street on the evening of May 4, 1886, do point to his involvement and lend weight to the credibility of the original chemical evidence.<sup>10</sup>

Assaying these samples in a manner that allowed comparisons between different contemporary and historic laboratory methods proved difficult. The surface of the samples, especially those recovered from bomb victims, was chemically inconsistent, containing particles of diverse composition and segregated phases. The Degan and Barbour fragments also contained particles and fibers of likely organic origin, including calcium phosphate that may have been bone. Such contaminants were avoided where possible, but the possibility that traces of these contaminants were included in the overall chemical signatures detected cannot be ruled out. These problems were minimized by renormalizing all of our results to allow standard comparisons of the primary metals reported by Haines in 1886.

Another difficulty was that over time the objects themselves have chemically changed and so have become contaminated. Lead, though it is a poor oxidizer, does slowly over time form a thin film of lead oxides and lead carbonate on its surface. All the samples examined contained relatively high proportions of oxygen and carbon. Such results complicate comparison with the original 1886 assays because the bombs, having been recently cast when they were analyzed in 1886, probably contained minimal amounts of either oxygen or carbon. In any event, it does not appear that Haines made any attempt to determine quantities of these elements, making it impossible to make any historical comparisons. Our renormalization of results on the basis of recorded elements minimizes these potential problems.<sup>11</sup>

10. In his history of the event, Michael Schaack lists an “Adam Barber” who sustained a shell wound to his left leg (*Anarchy and Anarchists*, 152).

11. For details of lead corrosion, see R. K. Swandby and S. W. Turner, “Lead and Lead Alloys,” in *Corrosion Resistance of Metals and Alloys*, 2nd ed., ed. F. L. LaQue and H. R. Copson (New York: Reinhold, 1963), 285–303.

Moreover, the EDS technique samples very small discrete points of the order of microns on the specimen's surface and produces data that vary slightly with each different sampling point, reflecting the fact that elements of the alloy of which the specimens were composed were not evenly and uniformly distributed throughout the metal. This problem was not encountered by the nineteenth-century chemists because they took about a gram of the sample and dissolved this whole quantity for analysis, providing a closer approximation of the overall average proportions of the elements they quantitatively measured. While such composite data can be approximated by sampling numerous points and averaging them together, time and resources limited the number of samples taken. Despite these obstacles, a significant amount of data was recovered from the samples.

The data produced through Scanning Electron Microscope–Energy Dispersive Spectrometry (SEM-EDS) can be used in two very different ways. First, the modern data can be compared with results obtained in 1886 to gauge the reliability or honesty of the original evidence used in the Haymarket trial. While there are some lingering questions as to the exact provenance of the CHS bomb shell (see below), it is highly likely that it was one of the five bombs examined and assayed by Haines. At the time, during his court testimony, the chemist explained that he scraped pieces from the inside of the hemispheres for analysis. After 118 years the deep marks from Haines's sampling tool are clearly evident. Thus, if modern estimates of the chemical composition of the CHS bomb shell fall outside the parameters established by the range of data derived from the five original samples, then it must be concluded that the physical evidence introduced at the trial was flawed. Likewise, Haines estimated the chemical composition of the Degan fragment, and this too can be compared with modern data to establish the veracity of his technique or testimony.

Comparing the results of our recent assay with those of 1886 provides no reason to doubt the honesty or accuracy of Haines's original conclusions. Both the qualitative and quantitative analysis performed by Eckert agrees substantially with the data reported by Haines. Eckert found that the Degan fragments contained primarily lead, with significant quantities of tin, and detected the presence of antimony, copper, and zinc in some, but not all, of his Degan fragment samples. Haines's qualitative analysis found mostly lead, some tin, and traces of antimony, zinc, and iron. Thus the primary ingredients, lead and tin, were found to be similar, though the trace elements varied in that Haines detected iron, and we did not, while we found copper where Haines did not. However, this discrepancy does not alone discredit Haines's original work, as both Haines and we had difficulty detecting trace quantities of elements—Haines because of the coarseness of his laboratory methods and we because of our limited number of sampling points.

More striking is the close match found between the quantitative values Haines determined for tin and our own results for that metal. Haines found that the Degan fragment contained between 1.6 and 1.7 percent tin. After averaging the results of three sampling points together, we found the Degan sample to contain an average of 1.7 percent tin.

Table 2. Comparison of chemical analyses of 1886 and 2003

1886	Tin (Avg.)	Antimony (Avg.)	Zinc	Iron	Copper			
Lingg bomb #1	1.9	trace	trace					
Lingg bomb #2	7	trace +	trace +		trace			
Lingg bomb #3	2.4	trace	trace					
Lingg bomb #4	2.5	trace	trace					
Murphy fragment	1.6	trace	trace	trace				
Degan fragments	1.6–1.7	trace	trace	trace				
Spies bomb	1.1	trace	trace	trace				
Commercial lead	0	trace						
Commercial solder	30–50	trace						
2003	Tin (Avg.)	Tin (Range)	Antimony (Avg.)	Antimony (Range)	Zinc	Iron	Copper	
Brayton Top Shell (n = 2)	7.1	2.3–11.8	2.3	n.d.–4.5	n.a.	1.2–10.1	tr	
Brayton Bottom Shell (n = 4)	9.7	5.6–11.6	3.1	1.5–4.5	n.a.	tr–1.8	n.d.–3.5	
Degan Fragments (n = 3)	1.7	0.4–2.5	p.d.	n.d.–tr	p.d.–tr	n.d.	n.d.–tr	
Barbour Fragment (n = 2)	14.9#	4.8–25.1	n.d.	n.d.	p.d.	n.d.	n.d.–p.d.	

*Notes:* Values are averages of several sampling locations. The number of samples acquired for each artifact is specified next to its name. The 2003 data are renormalized to permit a consistent basis for comparison. Abbreviations are as follows: “tr” = trace (concentration too low for reasonable quantitative estimate, but confirmed as detected); “n.d.” = not detected; “p.d.” = possibly detected, but not confirmed with high confidence; “n.a.” = not analyzed; “#” = mean of two highly disparate measurements, not a reasonable proxy for overall bulk composition. All energy dispersive spectra (EDS) were collected at an accelerating voltage of 20 kV. Toledo analyses: EDS data were collected with the JEOL JSM 6100 fitted with an Oxford EDS detector in the University of Toledo Instrumentation Center. Yale analyses: EDS data were collected with the EDAX Phoenix Pro system on the JEOL JXA-8600 electron microprobe, in the Yale University Department of Geology and Geophysics, at a current of 20 nA. Raw experimental data are archived at [www.history.utoledo.edu/haymarket.html](http://www.history.utoledo.edu/haymarket.html).

Likewise, Burckel and Dunn found that one hemisphere of the Brayton bomb contained a proportion of tin that was close to the figures given by Haines. The top half of the Brayton bomb averaged very near to 7 percent tin, and its bottom half was slightly higher, at an average of 9.7, while the round bomb designated at the trial as “Lingg #2” tested at 7 percent tin, according to Haines. Because Lingg #2 varied in its composition from the other shells that Haines tested, it is most likely that the Brayton bomb is Lingg #2, and if that is so, then Haines’s original figures were reasonable and honestly reported.

A second way in which our modern data can be used is without reference to the conclusions Haines reached in 1886. There are a number of ways that this can be done. The degree of variance between the top and bottom hemispheres of the bomb shell would help establish the consistency of the bomb maker’s methods. Since each hemisphere was poured into separate clay molds, and each may not even have been poured from the same batch of metal, a small degree of variance would suggest that the bomb maker worked from a single recipe and was consistent in his methods.<sup>12</sup> This would in turn increase the expectation that the chemical composition of the fragments should approximate that of the unexploded shell. Conversely, if the two halves of the existing bomb shell varied greatly from each other, then there would be little reason to expect to find a match with a fragment from a different casting, even if by the hand of the same bomb maker.

Our analysis showed that there was only a small amount of variance between the composition of the top and bottom halves of the CHS Brayton bomb, indicating that the bomb maker maintained a relatively high degree of consistency in methods and ingredients, at least in the casting of this one bomb. It is reasonable to speculate that in the case of the Brayton bomb, both halves were cast from a single batch of metal. These results also lend weight to the assumption that the bomber followed a consistent method and that the products of his workshop can be traced to him by their similar compositions, as the state of Illinois did in 1886.

Because history has bequeathed several bomb fragments recovered from two different victims of the blast, comparing the composition of these different bomb fragments theoretically carries the same implications as a comparison of the bomb hemispheres. The greater the similarity of the different bomb fragments, the more consistent was the *modus operandi* of the bomb maker. However, there is a greater degree of uncertainty in comparing fragments than there is in comparing the hemispheres because the bomb was not the sole source of high velocity metal in Desplaines Street. The street was also the scene of much gunfire after the bomb exploded. It is likely that some of the metal shards pulled from the bodies of Officers Degan and Barbour were slivers of bullets rather than pieces of a bomb.

While this makes it harder to draw any conclusions about *modus operandi*

12. Lingg himself was purported by Captain Schaack to have told him while in jail that he used clay molds to cast the bomb shells and that these molds could be used no more than twice before cracking (vol. K, p. 608, HADC).



from the bomb fragments, it does raise a different question on which modern testing may shed light. If only one fragment varies significantly from all the other fragments and shells tested, it may do so because it is not a bomb fragment at all but, rather, a piece of bullet. While this would not be an important insight into the injuries sustained by Officer Barbour, it would be important in the case of Officer Degan, whose injuries, it was alleged, were entirely caused by the bomb and whose murder was the only one charged against the anarchist defendants.

## Discussion

We found that the fragments recovered from the bodies of Officer Degan and Officer Barbour differed substantially from one another. The Barbour fragment contained more than ten times the quantity of tin than did the Degan fragments, a range of 0.4–2.5 percent compared with a range of 4.8 to 25.1 percent. All of the readings for the Barbour fragment were beyond the range of the readings for the Degan fragments (the lowest value of tin in the Barbour fragment was 4.8 percent, while the highest in the Degan fragments was 2.5 percent). While this could be explained by a high degree of variation between the bottom and top halves of the Haymarket bomb, this possibility is contradicted by the comparatively high degree of coherence between the CHS Brayton bomb hemispheres. It seems that either the top and bottom halves of the bomb thrown at the Haymarket Riot were more dissimilar than the unexploded bomb shells that were tested, or one of these officers was in fact struck by a bullet or other missile.

Finally, the estimated composition of the CHS Brayton bomb shell can be compared with the results of the modern testing of the fragments taken from the police officers' bodies to see to what degree they match. Our data suggest that there are significant differences between the CHS Brayton bomb and both the Degan fragments and the Barbour fragment. Together the Brayton bomb hemispheres contained a range of between 2.3 to 11.8 percent tin. In comparison, the Degan fragments seemed to contain a lower range of tin, 0.4 to 2.5 percent, and the Barbour fragments a higher one, from 4.8 to 25.1 percent. While all of these measurements contain overlapping values, the tendency seems more toward divergence rather than convergence. Also, antimony was not detected in the Barbour fragment and was only tenuously detected in the Degan fragments, while it was strongly detected in the Brayton bomb. However, these results by themselves cannot disprove the theory that the Brayton bomb and the Haymarket bomb were made by the same person, because of the sampling and experimental issues described above. Further testing of both artifacts should be performed to better document the connection between them.

Even had these artifacts strongly matched, their connection to convicted bomber Louis Lingg ultimately depends on historical documentary evidence, and this trail is not without its own gaps.

The unexploded bomb housed in the CHS collection was donated by Mr. Robert Brayton, a descendant of one of the original trial jurors. The curious and dramatic object had been in his family since Captain Michael Schaack of the Chicago

Police Department gave it to one juror, J. H. Brayton, as a memento soon after Lingg committed suicide and the four condemned men were executed in 1887.<sup>13</sup>

Unfortunately, the chain of evidence is not as solid from the time of the trial to the day Schaack gave his souvenir to Brayton. While it is fairly certain that the bomb Schaack gave to Brayton was introduced as evidence in the trial, it cannot be unequivocally established that it was the bomb discovered hidden in a gray stocking in Lingg's apartment on May 14, 1886, by Officer Lowenstein. Uncertainty exists because prior to the trial, police collected twelve globular bombs from four different locations in the city. Besides the one found in Lingg's sock, nine were found hidden under a sidewalk near the corner of Clyde and Clybourne; one was in the possession of Harry Wilkinson, a reporter for the Chicago *Daily News*; and the last was discovered stashed under an elevated wooden sidewalk on Siegel Street, only a few blocks from Clyde and Clybourne. All of these dozen bombs were given to Captain Schaack by the officers who discovered them, for Schaack was the lead investigator. All the evidence seized from Lingg's apartment, Schaack testified, was locked in his office, to which he had the only key.<sup>14</sup>

With so many bombs introduced into evidence, all of them of similar size and appearance, there will always be some doubt about which particular bomb shell passed from Schaack to Brayton and into the climate-controlled storage rooms of the CHS.<sup>15</sup> Some of the candidates can be ruled out. Of the twelve globular bombs that played a part in the trial, photographs of two have survived. The bomb purportedly given to Wilkinson by August Spies, when he was in a provocative mood in January 1886, was photographed and marked with the designation "People's Exhibit #130." A picture was also taken of the shell discovered in Lingg's sock, and it was referred to as "People's Exhibit #129."

A close examination of these photographs clearly shows that the Brayton bomb could not be People's 130, the shell linked to Spies through Wilkinson. People's 130 is more crudely constructed, with an oblong distortion in its circumference where the Brayton bomb is more evenly circular. People's 130 also has a jagged and square bolt hole through its top, while the Brayton bomb's bolt hole is clean and round. There is also a significant difference in the cut of its fuse hole—People's 130 has a hole that aims down toward the center of the globe while the Brayton bomb's fuse channel runs more obliquely toward its top. Most obviously, People's 130 has a deeply beveled rim and the Brayton bomb does not. (See figures 1 and 2.)

The other of these, People's 129, the bomb found stuffed in Lingg's sock, was photographed twice, once assembled with a bolt connecting both hemispheres and once disassembled with the interior of the top hemisphere shown. The external surface of the assembled globe appears to have a surface texture rougher than that of the

13. "Globe-shaped bomb casing . . .," accession number CHS 1979.154ab, Artifact Inventory, Chicago Historical Society.

14. Michael Schaack, testimony, vol. K, pp. 599–605, HADC.

15. Harry Wilkinson, testimony, vol. J, p. 244, HADC.



Figure 1. Lead bomb submitted into evidence at the Haymarket trial as "People's Exhibit #129A." Courtesy Chicago Historical Society

Brayton artifact. More important, its fuse hole is positioned at a forty-five- to fifty-degree angle from its bolt, or middle seam. In contrast, the Brayton artifact's fuse hole is positioned ten to twenty degrees closer to the top bolt hole. Finally, there are several deep surface cracks evident in People's 129 that are not found on the Brayton bomb.

It would seem, then, that the Brayton bomb hemisphere is neither the bomb found in Lingg's apartment nor the one given to a reporter by fellow defendant August Spies. It is, instead, either one of the several bombs police officer Michael Hoffman discovered hidden under a sidewalk on Clyde Street or the one found by children playing in front of the fireman Miller's house on Siegel Street. While neither bomb is as closely associated with Lingg as the one found in his sock, all of them were linked to Lingg at the trial through the testimony of his friends and associates.

Officer Hoffman explained that he was taken to this stash of bombs by Gustav Lehman, an anarchist and union brother of Lingg, who testified that Lingg gave him three bombs, an assortment of fuses, and a full tin of dynamite and told him to hide them on May 4 prior to the riot. That two witnesses both swore to this fact would seem to strongly connect these bombs to Lingg; however, some doubt creeps in because of a discrepancy in their testimony. While Hoffman said that he found nine round bombs under the wooden sidewalk, Lehman, who said he put them there, testified that Lingg gave him only three.

The bomb found by Miller was tied to Lingg by one of the trial's most impor-

Figure 2. Louis Lingg. Courtesy  
Chicago Historical Society



tant witnesses, William Seliger, who claimed to have helped Lingg make bombs. Indeed, the day of the Haymarket riot Seliger described how he laboriously drilled the bolt holes through the top and bottom halves of the bombs. Seliger testified that after the riot, he saw Lingg discard one of his bombs under the sidewalk on Siegel Street.

If the photographs purporting to show the bomb found in Lingg's apartment and the one that Spies allegedly gave to a reporter are correctly labeled, then the bomb Schaack gave to Brayton must be an artifact of somewhat less certain provenance. In any event, the Brayton bomb was certainly one of the dozen that the prosecution claimed, and provided some witness testimony to establish, were made by Lingg. Its connection to Lingg ultimately depends on the truthfulness of the testimony of prosecution witnesses Seliger and Lehman.

Given the limitations, omissions, and mysteries inherent in the documentation surrounding the artifacts that we analyzed, any conclusions about this new evidence must be viewed with circumspection. Keeping this in mind, our analysis shows that the original estimates of the composition of the Degan fragments by Haines and Delafontaine were reasonable. Likewise, assuming that the Brayton bomb is in fact the bomb designated as Lingg #2 by Haines, then his conclusions about that piece of evidence were also honestly drawn and reported. We find that there are important differences between the composition of the Brayton bomb and the metal fragment removed from police officer Degan, but that the Degan fragment had significant similarities to the majority of "Lingg bombs" analyzed by Haines and Delafontaine in 1886. We also find that the Degan fragment differs substantially from the shrapnel tweezed from Barbour's body. This suggests that either Barbour was struck by some

other material, perhaps a piece of a bullet, in addition to being torn by bomb pieces, or that the bomb thrown that night was constructed of two hemispheres of widely varying chemical composition.

Indeed, the chemical composition that we determined for the Barbour fragment is suggestive of the common composition of late-nineteenth-century bullets. In the last quarter of the century, cartridges, when made of an alloy at all, were generally made with a soft lead-tin alloy of anywhere from 3 to 6 percent tin. Antimony was not commonly used as a hardener of small arms ammunition until the twentieth century. The Barbour fragment contained tin somewhere in the range of 4.5 percent and 21 percent, a range that includes that of the ammunition common at the time. Moreover, no antimony was detected in the Barbour fragment, again like historic ammunition.<sup>16</sup>

Another interesting result of our investigations, and one completely overlooked at the time of the trial, is that the composition of the Brayton bomb shells is like that of certain varieties of type metal commonly used in printing in 1886. By that time, the faster speed of printing machines and the new technologies of printing (such as the use of electrotypes for the production of images) demanded harder printing type and plates. To achieve increased hardness while maintaining the lower melting temperatures needed for forging type in printing shops, tin and antimony were added to lead. Alloys of tin, lead, and antimony in various proportions were commonly referred to as type metal. Proportions for various uses ranged from 3 percent tin and antimony to as high as 12 percent tin and 24 percent antimony.<sup>17</sup>

The similarity of the Brayton hemispheres to type metal is significant in that it suggests that this bomb could have been cast from the discarded letters and pages of a printing shop. That the Haymarket defendants were closely connected to the printing trades is well known. August Spies was editor and Michael Schwab was coeditor of the *Arbeiter Zeitung* newspaper, and George Engel and Adolph Fischer edited and published another sheet, *Der Anarchist*; Albert Parsons and Fischer were both journeyman typographers, which meant that both men were familiar with the casting of type metal. If the Brayton bomb shells were cast either wholly or partially from type metal, this would represent a new circumstantial piece of evidence linking the defendants to at least one of the bombs found in Chicago in the wake of the Haymarket bombing. If these men did conspire together in the bombing as the prosecution alleged, then the bomb may have had a symbolic meaning in addition to its military purpose—it would have been the literal transformation of their words into deeds.

These results, while inconclusive, do show that more extensive testing of all the physical evidence remaining from the trial is warranted and has a high likelihood of contributing new facts to our understanding of this important event. ■

16. See Charles A. Peters, "The Basis for Compositional Bullet Lead Comparisons," *Forensic Science Communications* 4 (2002).

17. See *American Dictionary of Printing and Bookmaking* (New York: Lockwood, 1894), 555–60; Boyer and Gall, *Metals Handbook*, sec. 12, 1–2.

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