

# *Mill Hands and Boilers*

## *The Anatomy of a Disaster*

By Dr. Thomas R. Winpenny

At 5:45 a.m. the cool damp evening air still hung heavily over the Fulton Cotton Mill as engineer David Hantch supervised the generation of steam pressure sufficient to power the mill for another day. This was not a simple task and Hantch frequently struggled to provide the needed power. He blamed leaking boilers and inferior coal for his difficulties while his superior dismissed the complaints and challenged Hantch's engineering skills. A few minutes after 5:45, with pressure somewhere between 100 and 115 psi, one of the two boilers exploded rendering both boilers projectiles, leveling the boiler house, tearing an enormous hole in the east wall of the mill, and killing Hantch and a colleague instantly. Fifty boys and girls working as spinners and carders on the second floor were "filled with terror" by the explosion and cries of injured workers and "rushed frantically to an open window for escape."<sup>1</sup> and from there jumped to safety on the ground. The explosion was responsible for four additional deaths, including an eleven year old boy<sup>2</sup> working his first day in the mill, and eight other injuries. Property damage of course was extensive. The citizenry of Lancaster (PA) were stunned by this calamity of July 13, 1867, and a coroner's jury convened for almost two weeks to listen to endless witnesses and tedious testimony with the hope of finding an explanation. The testimony produced several theories but no consensus in the minds of the jury regarding the cause and accordingly no clear cut thoughts on the issue of liability.

What proved to be an isolated case in the industrial history of Lancaster was remarkably common on the American scene. For example, as late as the end

of the century data collected by the Hartford Steam Boiler Inspection and Insurance Company reveal that boiler explosions in the United States occurred on the average of one a day, 365 in 1897.<sup>3</sup> It is therefore rather surprising that the literature on the industrial revolution that is so extensive and so rapidly expanding says so little about the problem and that no particular incident has been examined in detail.<sup>4</sup> Boiler explosions have been studied by John Burke<sup>5</sup> and Bruce Sinclair,<sup>6</sup> but only in the context of steam boat racing and ensuing federal legislation. To learn anything at all about the hazards of exploding boilers in industry the historian is forced to consult dust-covered and sometimes unreliable nineteenth century journals such as *The American Machinist*, *Scientific American*, *The Locomotive*, and *American Railway Journal*, or the *Memoirs and Professional Reports* of Professor R. H. Thurston.<sup>7</sup> Thus it seems entirely sensible to dissect the carefully documented Lancaster episode as a means of better understanding a terribly common yet neglected dimension of the industrial revolution.

The explosion at the Fulton Cotton Mill stands out as both *a major and isolated disaster in the otherwise peaceful industrial revolution of Lancaster*. Once the nation's largest inland town, Lancaster in 1867 continued to enjoy modest growth but had fewer than 20,000 residents. The town's factory system was a product of two very distinct developments: (1) the evolutionary expansion of traditional workshops that adopted steam power, machinery, industrial discipline, division of labor, etc., and (2) the rapid introduction of three sizeable steam powered cotton mills between 1847 and 1851.<sup>8</sup> About a decade and a half later two smaller cotton mills were built, one of these being the Fulton at Lemon and Duke Streets in the northeast quadrant of town. Owned by William M. Wiley and Company of Philadelphia, this two story mill was the town's smallest with approximately 2,000 spindles and 60 looms. Carding and spinning were carried out on the second floor while weaving, warping, dressing, and putting up cloth were carried out on the first floor. The magnitude of the operation can also be gauged from the 1870 census that reports an investment of \$66,000 and employment of 83 hands (nonunion) who received \$19,560 in wages while working a twelve month year. The annual product was valued at \$140,000.<sup>9</sup> The mill depended on Philadelphia commission houses for a line of credit and apparently never operated too far from the brink of financial collapse. In short, the Fulton Cotton Mill was a marginal operation in a very precarious business.

The Fulton's power plant consisted of a Corliss steam engine and two boilers built by John Best of Lancaster, installed in February of 1866, and rated at 62½ horse power.<sup>10</sup> Since the commonly accepted rule was one horse power per loom, the factory did not seem to be underpowered.<sup>11</sup> The twin boilers were tubular in design, made from ¼ inch # 3 iron and measured 16 feet in length and 50 inches in diameter. The boilermaker used 1/8 inch #10 iron for the 22 4½ inch flues on each boiler. The boilers sat side by side with a north-

south orientation. The "eastern" boiler had been patched by John Best three times in the year and a half it had been in operation<sup>1 2</sup> reminding all concerned that metallurgy was still more of an art than a science. It is critical to note here that to the extent the power plant failed to function efficiently, the Fulton Mill *was* underpowered. The way to compensate for this is to build up a head of steam that is greater than what would normally be required! Unfortunately then, the poorer the condition of the boilers, the harder they have to be pushed to keep the mill operating.

At approximately 5:45 a.m., July 13, 1867 the eastern boiler exploded and became a devastating three ton projectile passing through two brick walls, crossing Lemon Street, smashing through a fence, and striking a small embankment before rolling over and coming to rest. This flight pattern – some 200 yards according to townsmen who paced off the distance<sup>1 3</sup> – produced limited property damage and a lot of scattered debris, but remarkably no injuries. Far more lethal, however, was the toll taken by the companion boiler that was propelled westward by the explosion for this was the projectile that tore a huge hole in the eastern wall of the mill and was responsible for six deaths and eight injuries.<sup>1 4</sup> Henry Leman, a local gunmaker who witnessed the explosion from his nearby home, said that he saw portions of the roof and other mill material rising high in the air "in the manner. . . we are accustomed to see them rise in pictorial representations of such calamities. . ." <sup>1 5</sup> This was followed by a wild scene with "operatives. . . screaming and rushing terror stricken in every direction through the streets to their houses."<sup>1 6</sup>

### *Killed*

- David Hantch – engineer – age 54 – standing next to boilers – killed instantly
- Valentine Myers – millhand – age 21 – in Water Closet adjacent to engine house – killed instantly – body badly mutilated
- Jeremiah Plummer – Supt. of Mill – age 63 – standing at end of mill – adjacent to engine house – serious internal injury due to inhalation of steam
- Sarah Dorwart – mill girl – seated near partition wall between engine and weave room – scalded on neck, face, arms, and both sides of body
- Howard Weitzel – millhand – age 11 – scalded all over and struck on head and body by falling bricks
- Annie Wolbert – mill girl – in weave room – burned all over

### *Injured*

- William McMichael – fireman – standing at engine house door – blown across street – fractured shoulder blade and ribs – head cut – head, back, and arm scalded
- Henry Sherer – weave room overseer – standing at end of mill – had hole through leg – broken nose – bruised back
- Mrs. Louisa Dunlap – mill girl – sitting on lap of Sarah Dorwart – breast, arms, and legs badly scalded
- Louisa Brinkman – mill girl – jumped through window of weave room and cut herself – others used exit she made
- George Deitrick – day watchman – slightly injured

Nettie Paulick – mill girl – at desk in weave room – ears and arms scalded  
Maggie Miller – mill girl – injured  
Kate Gundaker – mill girl – hurt back when knocked to floor by flying material<sup>17</sup>

The deaths and injuries weighed heavily on the minds of Lancastrians over the next few weeks, and yet equally as disturbing was the haunting question of what might have happened to the fifty boys and girls working on the second floor who managed to escape without injury. Faced with an aroused community seeking answers, coroner George Leonard gathered a coroner's jury and began meeting the afternoon of the accident. Of the six citizens selected for the jury, only two clearly had any technical expertise: Thomas Thurlow an engineer and Robert Eichholtz a gunmaker. The other jurors were attorneys S. H. Price and Reuben H. Long, restaurant owner John Copland, and John Deininger, occupation unknown. This body listened to a great deal of testimony, much of it technical, over a two week period before rendering a decision shedding remarkably little light on the matter.<sup>18</sup>

*T*he most striking feature about the testimony is the total disagreement as to whether there was anything patently dangerous in the operation of the Fulton power plant prior to the blast. That is, conflicting statements are not separated by nuances but rather tend to be diametrically opposed. For example, one of the first to testify was John Kuhns a friend of the deceased engineer David Hantch who visited Hantch at the mill one day when the machinery stopped. Hantch allegedly complained that there was “not enough boiler” to power the machinery, the governor ran tight, one boiler leaked and had been patched three times, and it was time to quit since “they won't get another boiler and he wasn't going to have his head blown off.”<sup>19</sup> George Dietrick, the day watchman who oiled the main shaft a few minutes prior to the explosion, followed Kuhns and admitted that the boiler had been patched, but claimed to know of absolutely no problems and, furthermore, had never heard David Hantch complain.<sup>20</sup> Dietrick's viewpoint gained immediate support from the melodramatic claim of John Best (builder of the boiler) who was prepared to “risk his life with these boilers at 150 psi.” Best added that he had been a boilermaker for two decades and that his work for the Fulton was as good as any work he had ever done – “they ordered the best and paid the price asked.”<sup>21</sup>

There was no shortage of witnesses prepared to swear that absolutely everything about the Fulton Mill was first class and that ownership was above cutting corners; however, these claims started to sound a bit hollow as further testimony pointed to myriad additional concerns. Henry B. Sherer, weave room overseer, was essentially supportive of management's position, but unwittingly contributed damaging evidence by noting that the mill equipment seemed to run best at 70 – 80 psi for at 85 psi it vibrated. Furthermore, since the most recent re-



*Destruction of the Fulton Cotton Mill. S. W. corner  
Duke and Lemon Sts.*

pair of the eastern boiler, he had instructions from the mill superintendent not to exceed 70 – 75 psi.<sup>22</sup> J. K. Snyder, carding room overseer, said Hantch spoke of leaving “because he could not keep the steam up, because of the poor draft,” Hantch feared that his reputation as an engineer would suffer.<sup>23</sup>

Walter Hantch, the engineer’s son, testified that he received a letter from his father circa July 6 in which his father stated that the Fulton boilers were inadequate.<sup>24</sup> Ellie Hantch, the engineer’s daughter, worked in the mill and revealed that her father feared an explosion and took the precaution of warning the mill girls to “run to the roof of the picker house if anything happened.”<sup>25</sup> William McMichael, the injured fireman, stated that they had trouble keeping up steam, the boiler recently suffered from a bad leak, and that a third boiler was



*The boiler was blown a block north on Duke St. and turned in James St.*

needed.<sup>26</sup> Franklin Unger, a boilermaker in the employ of John Best, recalled repairing a crack of some two feet in length in the boiler that exploded.<sup>27</sup> So it was that the eastern boiler provided extensive foreshadowing of what might lie ahead; nevertheless, no action was taken as the boilermaker insisted his product was first rate and the owners were not about to allocate funds to replace a 17 month old boiler that had a life expectancy of 8–10 years, perhaps even 15.<sup>28</sup>

The testimony establishing the deficiency of the boiler does not “explain” the accident as there is a need to distinguish between what certainly seems to be a *contributing* cause and the *immediate* cause.<sup>29</sup> The search for an immediate cause required the testimony of experts who had examined the site of the acci-

dent and the boiler. The Lancaster *Daily Evening Express*, for one, reported being impressed with the knowledge and reasoning power of the practical mechanics who testified, "many of whom were uneducated and uncouth in language."<sup>30</sup> A major focus of the experts was the quality of the iron plate in the boiler since a flawed plate would not only be a very likely immediate cause but, as Professor Apple of Franklin and Marshall College pointed out, there could be "flaws or blisters in the iron beyond observation." He also reminded the jury that "iron may be weakened at the seams without the knowledge of workmen."<sup>31</sup>

Edward Eberman, an engineer for C. E. Pennock and Company of Coatsville, stated that his firm furnished John Best with all his iron and that the iron was the "best that can be made in the country." Best never returned any iron to Pennock with the exception of "one piece two years ago." Eberman further noted that the boiler in question was made of #3 iron rolled out of blooms made by Maris Hoopes at Colemanville who just happened to produce "the best blooms made." The engineer's examination of the boiler at the point of fracture led him to conclude that the fracture "showed good iron."<sup>32</sup> Eberman's claims, however, were sharply challenged by two local experts. Foundry operator William Marshbank examined a piece of boiler plate and found the iron had three layers, the inner being "cold short" and the outer layers being "red short." This he believed to be the "strongest combination of iron." What he found disturbing was "that it had not been properly welded in rolling, it seemed to scale."<sup>33</sup> Professor Apple also observed that "the iron didn't seem to be sufficiently welded and was a little shelly." The leaking he interpreted as a sign of imperfection in the iron though recognizing that impurities were inevitable. Apple was persuaded that the weakness in the iron could have been the immediate cause of the tragedy.<sup>34</sup>

A more esoteric theory advanced by this Professor of Mechanics involved the possibility that nitrous oxide in the boiler combined with hydrogen and was ignited by red hot iron to produce a powerful blast.<sup>35</sup> No one other than Professor Apple advanced this particular theory, quite possibly because no one else understood it.

Perhaps the most widely suggested explanation concerned a shortage of water in the boilers. That is, either the proper level was not maintained; or water was for some reason, siphoned from one boiler to another. Thomas McMichael, an engineer, claimed he had knowledge of some fourteen explosions and all had been caused by a "shortness of water."<sup>36</sup> J. M. W. Geist, a local publisher, testified that where two boilers are in use "peculiar circumstances" can arise whereby water is siphoned from one boiler to another. This process produces a gas in the boiler losing water that is "more powerful than steam."<sup>37</sup> George Byerly, fireman of Conestoga Steam Mill #2, explained the siphoning this way, "If one boiler makes steam faster than another, it's possible to throw its water

into the other. If one boiler is hotter than another, it will force its water into another."<sup>3 8</sup>

Beyond the central debate over the cause of the disaster, two fascinating points of contention surfaced in the hearing but were never resolved. First, was David Hantch serious or merely flirting and kidding with the mill girls when he warned them periodically that "one day these boilers are going to blow?" Second, did David Hantch ever take his concerns directly to George F. Calder the resident owner, or did he simply complain to other workers and his family while meekly telling his superiors everything was fine? The editor of the *Daily Evening Express* ventured the opinion that it would have been "inconsistent with the known character of Hantch that he could have complained of the boilers and never taken the complaint to management;"<sup>3 9</sup> nevertheless, the matter remained unclear.

By Friday July 26 the coroner's report was completed and made public. The panel concluded that,

the boiler which exploded was well constructed of good material; that there was sufficient water in both boilers but a few minutes before the explosion occurred; that no blame can be attached to the proprietors of the mill, or any employees. That the explosion was occasioned by causes to the jurors unknown.

This bland conclusion proved to be unacceptable to attorney Reuben H. Long, a lone dissenting juror, who chose to add to the last sentence:

but they find that the boilers of said mill were frequently subjected to an amount of pressure calculated to impair their durability and hasten their deterioration; and that this was a cause contributing to the explosion in a remote degree.<sup>40</sup>

It is entirely possible that the words of the dissenting juror encouraged the litigation that followed.

Given the abundance of damaging testimony in the coroner's hearing, and given the fact that a Lancaster court would later find the mill owners liable in the explosion, the innocuous conclusions of the jury require a bit of explanation. To begin, the panel was probably confused by the variety of theories put forth as even Professor Apple, the most learned man to testify, offered not one theory but two. Second, the jury had to contend with several witnesses speaking on behalf of the boilermaker and manufacturer of boiler plate who were prepared to swear that their products were the finest to be found from sea to shining sea! Third, some mill employees who testified may have feared for their jobs had they admitted to a knowledge of problems within the mills. In short, for every witness who cited hazardous conditions, there was another prepared to state just the opposite. If the jury produced a whitewash, they had a good deal of help. In the words of the Lancaster *Daily Evening Express*, "the whole matter was buried in mystery and contradiction."<sup>4 1</sup> Another local observer concurred when he wrote, "I think there are cases of boiler explosions that are *mysterious*,"<sup>4 2</sup> (italics added)



What must be appreciated here is that the inability of the Lancaster community to pinpoint the immediate cause of the cotton mill calamity was not a function of hinterland backwardness or ineptness<sup>43</sup> but rather one more example of how poorly these matters were understood in a general sense in 1867. The Lancaster debate was simply a microcosm of the broader debate and thus practical engineers from as far away as Philadelphia offered advice by means of letters to the editor of the Lancaster *Daily Evening Express*. One who signed his name "Progress" suggested that the impact of future blasts could be mitigated greatly by employing many small boilers so that no one boiler could generate the force of a much larger one.<sup>44</sup> Another who called himself "A Friend of Progress" wrote that the real problem was the tubular design of the boilers. He argued that they were designed for fuel economy rather than safety and were so dangerous they had been banned on southwest rivers.<sup>45</sup>

The research of Professor R. H. Thurston of Stevens Institute of Technology (Hoboken, N.J.) during the same period represented a painstaking scientific search for the causes of boiler disasters. Thurston carried out experiments by taking boilers to remote locations and watching them explode. He published his findings initially in the *Journal of the Franklin Institute* and later in his *Memoirs*. As early as 1871 he published the following conclusions:

- (1) Low water is not the only cause of violent explosions.
- (2) Moderate steam pressure can produce a violent explosion in a weak boiler with a lot of water and all the flues well covered.
- (3) A boiler can explode at pressure less than it had withstood at the hydrostatic test.
- (4) Welded boiler braces and poor riveting are common sources of trouble.<sup>46</sup>

Following his third experiment at Sandy Hook, New York, Thurston reaffirmed his commitment to finding simple rational explanations in the following observation:

The violence with which the third boiler exploded has raised a doubt in the minds of many engineers whether some extraordinary and unfamiliar cause may not have operated in the production of such astonishing effects. No positive proof of the non-existence of such causes can be given, but the following considerations will at least indicate that we may find, in well understood and certainly existing cases, ample power to produce all the effects noted.<sup>47</sup>

Boiler safety was also a special concern of the Hartford Steam Boiler Inspection and Insurance Company who from 1870 on published statistical reports on their boiler inspections in their journal *The Locomotive*. The inspectors distinguished between "defects" and "dangerous defects;" and, in a small percentage of the cases, condemned boilers.<sup>48</sup> It was this same journal that was cited earlier in the article to illustrate that as late as the turn of the century boiler explosions kept occurring on the average of one a day. In sum, the disaster that puzzled Lancastrians in 1867 was the very same problem that continued to plague the nation for decades thereafter.

No matter how lengthy or detailed their investigation, the Lancaster coroner's jury was really only engaged in a fact finding mission and thus their conclusions did not preclude litigation on behalf of the six dead and eight injured workers, particularly if the plaintiffs could prove negligence on the part of the owners of the Fulton Mill. Unfortunately for the injured parties, this kind of contest would be similar to most other struggles between labor and capital in the 19th century in the sense that it would be uneven. This truth has been underscored once again very cogently in a recent article by Carl Gersuny that treats "Work Injuries and Adversary Processes in Two New England Textile Mills" in the 19th century. Gersuny notes that, "The tort law of negligence had become so hedged with defenses against claims by injured workers that in a large proportion of work injuries nothing was paid to the victim".<sup>49</sup> The major legal ploy protecting New England mill owners in the 19th century was the counter charge of contributory negligence on the part of the injured worker. The worker's ignorance of the law and inability to speak English also provided aid and comfort to the mill owner.<sup>50</sup>

To assume that the legal climate in Pennsylvania was somehow more sensitive to the plight of the injured mill hand would be horribly naive. Professor Albert S. Bolles studied this matter at the end of the 19th century and reported:

Though an employee is held to be his own insurer of all ordinary risks, a rule of duty has long been prescribed for employers. . . This rule is that an employer must exercise. . . ordinary care (1) in selecting servants; (2) in furnishing them with suitable materials. . . ; (3) in keeping appliances in repair; (4) in providing safe places for working; (5) in furnishing adequate assistance to do the work; (6) . . . in giving proper. . . instructions to youthful or inexperienced workmen. Had this rule always been enforced the legal relations between employers and employed would be much better understood. . . Its destruction by slow degrees through judicial action is. . . the. . . overthrow of a great principle. . . To do this the courts have taken about 50 years, and the solemnity and dignity with which they labored. . . is as remarkable as their success.<sup>51</sup>

In the case of the Fulton Cotton Mill calamity the observation of the preceding paragraphs ring true for while six were killed and eight injured, only one party had the means, know-how, confidence, tenacity, etc. to file suit against William Wiley and Company owners of the mill. Furthermore, the suit filed by the engineer's widow Mary Ann Hantch would not have been possible had the widow not sold her house at public auction fourteen months after the accident for \$2,400.<sup>52</sup> Eighteen months after the accident Mary Ann Hantch hired attorneys Samuel Reynolds and Emlen Franklin and filed a civil suit in the Lancaster County Court of Common Pleas against William Wiley and Company of Philadelphia.<sup>53</sup> Individuals named in the suit included William Wiley and seven Lancastrians: John R. Bitner, Charles A. Bitner, O. J. Dickey, George Calder, Henry Muhlenberg, J. W. Jackson, and Sheldon S. Spenser, all trading as William Wiley and Company.<sup>54</sup>

The unevenness of the contest can be appreciated more fully by taking a brief look at the status of the defendants:

William M. Wiley — Philadelphia industrialist

John R. Bitner — President Fulton National Bank of Lancaster,  
major interest freight business and paper mill

Charles A. Bitner — Freight business, tobacco dealer, sat on Select  
and Common Councils of Lancaster

O. J. Dickey — Law partner of Thaddeus Stevens, former County  
District Attorney, member U. S. Congress

George Calder — Businessman, later owner of Fulton Cotton Mill

Henry Muhlenberg — Physician, Collector of U. S. Internal Rev.,  
President of Inland Insurance & Deposit Co.

J. W. Jackson — Retired, Secretary & Treasurer of Inland Insur.

Sheldon S. Spenser — Superintendent of Conestoga Steam Mills  
#2 and #3.<sup>55</sup>

The venerable O. J. Dickey, a defendant, served as consul for the defense. What is more, it is entirely possible that the case was heard before Judge Alexander L. Hayes, a man who had been deeply involved in bringing cotton mills to Lancaster a few decades earlier.

If justice delayed is justice denied, then justice was denied. The accident occurred in July of 1867, the suit was initially scheduled to be heard during the January term of 1869,<sup>56</sup> the substance of the case was not heard until 1874, 75, and 76, and a decision was not rendered until June 28, 1876.<sup>57</sup> The five and one half year delay between January of 1869 and July of 1874 appears to be the product of a delaying action on the part of the defense by means of procedural objections. The defense gained three things by stalling: (1) public sentiment regarding the accident dissipated, (2) the resources of the less affluent plaintiff were strained, and (3) no injured party collected for several years. In contrast, had widow Hantch won her case in January of 1869 and been awarded the \$10,000 she sought, other parties might have been encouraged to file suit.<sup>58</sup> Later delays were occasioned by the death of William Wiley in November of 1874, and the need in 1875 to obtain depositions from Nathaniel P. Arnold, a former employee of the Fulton Mill now living in Connecticut.<sup>59</sup>

The complaint filed July 20, 1874 charged that the defendants: carelessly and negligently permitted and suffered the boilers used for the generation of steam for driving the machinery in said mill, to be of insufficient capacity, badly constructed and out of repair, so that one of the said boilers. . . exploded with great force tearing out and demolishing the end of the said mill and killing David Hantch. . . lawfully and at the request of the said defendants in the said mill.<sup>60</sup>

As a result of the loss of her husband the plaintiff,

was deprived of her maintenance and support and also of his, her said husband's, aid and assistance in the management of her domestic

affairs, and was otherwise distressed and wounded in mind and feeling by her great loss and by his sudden and violent death, and was forced and obliged to lay out and expend divers sums of money for expenses necessarily incurred in and about his burial to wit. . . the said plaintiff is injured and has sustained damage to the amount of Ten Thousand Dollars. . .<sup>61</sup>

The defense attempted to balance the charges and evidence of negligence with counter charges of negligence on the part of David Hantch. This is made clear by questions in the deposition sent by defense consul O. J. Dickey to Nathaniel Arnold. For example, the fifth query asks, "Did not David Hantch the engineer apply to you and S. S. Spenser, or either of you for permission to increase the pressure of steam on the boilers?" The sixth query asks, "Did not Hantch, Spenser and yourself consult about an increase of pressure, if you did, what was the amount of increase if any you agreed upon and how much used?"<sup>62</sup>

Once again the doctrine of contributory negligence took its toll in a legal contest between an injured worker and his employer in the 19th century as the doctrine proved sufficient to take the sting out of the widow's complaint. Mary Ann Hantch gained a hollow victory in June of 1876 when the court awarded her the majestic sum of \$525.79,<sup>63</sup> roughly one-twentieth of the damages sought<sup>64</sup> for loss of a husband with several good years of work yet ahead of him.<sup>65</sup>

### *Conclusion*

*T*his anatomy of a boiler explosion, providing detail heretofore unpublished, underscores the inability of even a reasonably sophisticated community such as Lancaster to deal effectively with this kind of a tragedy. A lengthy coroner's investigation and litigation strung out over seven years produced theories about the cause of the accident, but certainly nothing conclusive. Liability seemed to reside with William Wiley and Company, but not completely as the engineer, no longer around to speak for himself, could easily be accused of contributory negligence. Litigation was attempted by only one of fourteen injured parties who managed to collect a pittance nine years after the fact and thereby recognized the futility of going into court against some of "Lancaster's finest." Damage to the Fulton Cotton Mill was repaired and the enterprise quickly reopened, this time with a more substantial power plant to drive the same number of spindles.<sup>66</sup> The town of Lancaster was fortunate not to be troubled by another such occurrence in the 19th century, but there is no reason to believe that another industrial disaster would have been handled any more equitably than the first!

<sup>1</sup> The *Lancaster Intelligencer* for July 17, 1867 (bearing the incorrect date of July 10) carries a detailed account of both the accident and the early testimony before the coroner's jury.

<sup>2</sup> A Pennsylvania statute of 1848 prohibited children under 12 from working in cotton mills. Enforcement of this statute, however, was a local matter and the ages of cotton mill operatives provided by the population manuscript census indicate that Lancaster authorities were content to look the other way.

<sup>3</sup> See *The Locomotive* (January, 1898), Vol XIX, No. 1, p. 4, published by the Hartford Steam Boiler Inspection and Insurance Company.

<sup>4</sup> The recent literature treating industrial America has not only been plentiful, but it has been, on the whole, of superb quality. Moving away from the overworked New England landscape, there are freshly painted portraits of industrial life in the Mid-Atlantic region and the upper South in the studies of Rockdale by Anthony Wallace and Harper's Ferry by Merritt Roe Smith. Thomas Cochran's soon to appear study of early industrialization in the Mid-Atlantic states together with manuscripts being prepared by other scholars serve to demonstrate that the trend has not yet peaked.

<sup>5</sup> John G. Burke, "Bursting Boilers and the Federal Power," *Technology and Culture* (Winter, 1966), 1-23.

<sup>6</sup> Bruce Sinclair, *Early Research at the Franklin Institute* (Philadelphia: Franklin Institute, 1966).

<sup>7</sup> A journal such as *Scientific American*, for example, in the 19th century did not rigorously screen material submitted for publication.

<sup>8</sup> The growth of Lancaster industry is examined by the author in an article entitled "The Engineer as Promoter: Charles Tillinghast James and the Gospel of Steam Cotton Mills" that appears in the April, 1981 issue of *The Pennsylvania Magazine of History and Biography*.

<sup>9</sup> See U. S. Manufactures Census (manuscript) for Lancaster County, 1870.

<sup>10</sup> Testimony of Sheldon S. Spenser, stockholder in the Fulton Mill and superintendent of Conestoga Steam Mills #2 and #3. See *Lancaster Intelligencer*, July 31, 1867.

<sup>11</sup> This rule of thumb assumes the efficient operation of all equipment.

<sup>12</sup> Testimony of John Kuhns before coroner's jury. See *Lancaster Intelligencer* for July 17, 1867.

<sup>13</sup> Local newspaper accounts suggest that enthusiasm for measuring the flight of the boiler must have been comparable to the more recent passion for measuring the distance covered by a home run ball.

<sup>14</sup> While only two were killed instantly, another four died within the few days following the explosion.

<sup>15</sup> Testimony of Henry Leman, local gun manufacturer, before coroner's jury. See *Lancaster Intelligencer*, July 17, 1867.

<sup>16</sup> *Ibid.*

<sup>17</sup> *Lancaster Intelligencer*, July 17, 1867.

<sup>18</sup> Juror's occupations were gleaned from the Lancaster city directories for the late 1860s.

<sup>19</sup> *Lancaster Intelligencer*, July 17, 1867.

<sup>20</sup> *Ibid.*

<sup>21</sup> *Idid.*

<sup>22</sup> *Idid.*

<sup>23</sup> *Idid.*

<sup>24</sup> *Lancaster Intelligencer*, July 24, 1867.

<sup>25</sup> *Ibid.*

<sup>26</sup> *Ibid.*

<sup>27</sup> *Ibid.*

<sup>28</sup> This estimate of boiler life expectancy was made by Sheldon S. Spencer.

<sup>29</sup> It is instructive to remember that legal liability for the exploding boiler in the **Fulton Mill** in 1867 does not extend to the boilermaker John Best nor to Best's supplier of iron, C. E. Pennock and Company of Coatsville.

<sup>30</sup> *Lancaster Daily Evening Express*, July 25, 1867.

<sup>31</sup> *Lancaster Intelligencer*, July 24, 1867.

<sup>32</sup> *Ibid.*

<sup>33</sup> *Ibid.*

<sup>34</sup> *Ibid.*

<sup>35</sup> *Ibid.*

<sup>36</sup> *Ibid.*

<sup>37</sup> *Lancaster Examiner and Herald*, July 20, 1867.

<sup>38</sup> *Lancaster Intelligencer*, July 24, 1867.

<sup>39</sup> *Lancaster Daily Evening Express*, July 25, 1867.

<sup>40</sup> *Lancaster Examiner and Herald*, July 27, 1867.

<sup>41</sup> *Lancaster Daily Evening Express*, July 25, 1867.

<sup>42</sup> *Ibid.*, July 20, 1867.

<sup>43</sup> Founded in 1730, Lancaster by 1867 was in many ways a rather sophisticated town housing a college, two opera houses, two mechanic's institutes and several literary societies in addition to a wide variety of other educational and cultural activities.

<sup>44</sup> *Lancaster Daily Evening Express*, July 20, 1867.

<sup>45</sup> *Ibid.*, July 26, 1867.

<sup>46</sup> R. H. Thurston, *Memoirs and Professional Reports* (Hoboken: Stevens Institute of Technology, 1871), 11.

<sup>47</sup> *Ibid.*, 37.

<sup>48</sup> See *The Locomotive* (February, 1898), Vol XIX, No. 2, 26.

<sup>49</sup> Carl Gersuny, "Work Injuries and Adversary Processes in Two New England Textile Mills," *Business History Review*, LI, No. 3 (Autumn, 1977), 328.

<sup>50</sup> *Ibid.*, 339.

<sup>51</sup> Albert S. Bolles, *The Legal Relations Between the Employed and Their Employers in Pennsylvania*, Supplement to the 28th Annual Report of the Bureau of Industrial Statistics, Harrisburg, 1901, 33 and 34.

<sup>52</sup> See "Miss. H 1865-1869," #209, Legal Collection, Lancaster County Historical Society. Mary Hantch petitioned the Orphan's Court Judges for the right to sell her husband's property. She was granted this right and sold the property on August 21, 1868.

<sup>53</sup> In the court records the suit is identified as #132, January Term, 1869.

<sup>54</sup> See "Sum's," #132, January Term 1869, Legal Collection, Lancaster County Historical Society.

<sup>55</sup> The positions held by the defendants were gleaned from Franklin Ellis and Samuel Evans, *History of Lancaster County* (Philadelphia: Everts and Peck, 1883).

<sup>56</sup> The defendants initially received a summons requiring them to appear in the Lancaster County Court of Common Pleas on the third Tuesday in January, 1869.

<sup>57</sup> The date of the settlement of the suit is in the Appearance Docket for January, 1869. These dockets are housed in the Lancaster County Court House.

<sup>58</sup> This strategy, apparently quite common, was explained to the author by a Lancaster attorney who chooses to remain anonymous.

<sup>59</sup> The questions sent to Arnold can be found in "Narris," #132, January 1869, Legal Collection, Lancaster County Historical Society.

<sup>60</sup> Formal Complaint dated July 20, 1874.

<sup>61</sup> *Ibid.*

<sup>62</sup> Deposition filed October 12, 1875.

<sup>63</sup> See Appearance Docket.

<sup>64</sup> The true compensation figure here is really \$525.79 less legal fees. The widow's legal costs are unknown.

<sup>65</sup> David Hantch was 54 when he died.

<sup>66</sup> The new power plant was rated at 70 h.p. while the old one had been rated at 62½;