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1880 boiler explosion

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The events that led to the sad ending of the Aveling & Porter road loco No.1302, built in 1877 and destroyed in a tragic incident in 1880.

Part 1:

AFTER MIDNIGHT

On the night of December 2nd/3rd 1880, No.1302 was hauling wagons loaded with manure from a wharf on the river Medway in Maidstone, through the town and on to a nearby farm. The crew consisted of flagman Harry Reader, the steersman Frank Underwood, and young Moses Martin the driver. The engine was stopped in town to take on water, and then again shortly after when it was noticed that a lamp had gone out. This was relit but as the engine was restarted, the boiler exploded.



THE AVELING & PORTER 8NHP

A police constable and his inspector who were nearby ran to scene, tripping over fragments of the engine in the darkness, (the blast had blown out the gas street-lamps). The semi-naked body of Frank Underwood was found with dreadful head injuries. He had been thrown high into the air through trees in which some of his clothing could be seen hanging. Harry Reader who had been walking ahead was hit by flying iron and suffered a broken arm, and Moses Martin had been scalded. They were both able to walk to hospital.

MISSING SAFETY VALVES!!

The Borough Coroner was notified of the accident and he ordered that nothing should be touched at the scene until it was thoroughly examined and recorded.

However, having heard of the explosion, Thomas Aveling visited the site with one of his factory foremen and removed the safety valves and fittings. Later that day when the inquest was opened to enable formal identification of Underwood's body, the Coroner, Mr J.Stephens, was extremely scathing of Aveling's actions. The inquest was adjourned in order to allow a full investigation into the explosion and preparation of reports.

IT HAD BEEN A LONG DAY

Twenty five year old Moses Martin had started work on the second at about 6am, and having completed a twelve-hour day hauling stone for road building was forced to hitch a lift after his own locomotive had developed a serious steam leak and was abandoned on the way back to the yard. He rode with his pal Tom Boarer whose engine had spent the day on the same job. Moses was due to start work again at midnight.



The owner of the haulage company they worked for, Jesse Ellis had secured a contract to transport manure through Maidstone. The nature and origin of the manure is unrecorded, but the Borough Council had prohibited the carrying of such loads through the

town other than between the hours of midnight and six am.

Moses reported to the office later that evening, and as his own engine was unserviceable, and since Tom Boarer had hurt his arm that day and could not drive, was instructed by yard foreman George Batey to take out Boarer's engine for the night job.

He called into the *Dragoon* beerhouse for a couple of pints where, as he was often known to, he adopted a boastful air about his coming night's work with statements such as "I will have 200 pounds of steam in the".". His remarks were overheard and later to be recalled by a witness at the inquest.

During the adjournment of the inquest much preparatory work was done by experts, including examination of the remains of the engine by William Maw, a respected consulting engineer who was also editor of *Engineering*. This journal subsequently published his findings. Aveling & Porter submitted a dossier of their specifications and practices, and arranged for the laboratory testing of steel remnants from the wreck.

The coroner was to be assisted by an assessor from the Board of Trade who would deal with all technical questioning leaving Stephens free to handle legal and procedural matters.

SAFETY VALVES AND A REPAIRED CRACK

On the 22nd of December the inquest was resumed with Aveling & Porter the builders of the loco, and Jesse Ellis the owner, having legal teams present to protect their obvious interests. The lowly drivers, Boarer and Martin had no lawyers, and were to face much hostile questioning during the proceedings. Evidence was to be concentrated on two areas of the boiler's condition thought to have led to its failure; the safety valves, and repairs previously carried out to a crack in the firebox.

The court was to hear from Thomas Aveling that No.1302's class of engine was designed for a working steam pressure of 100psi. with the safety valves set to lift at 110psi. To prevent misuse, the valves were fitted with ferrules so they could not be screwed down further. However, Aveling stated that having removed the valves from the wreck he found the ferrules to have been shortened to the extent that the valves could be locked off completely. Following his examination, he had deposited the parts in his solicitor's safe to keep them secure for the inquest.

In their evidence, Ellis and Batey denied all knowledge of ferrule shortening in the fleet, but admitted that it was a known practice among engine drivers. Batey could not say when he had last inspected the valves on No.1302. In their turn, drivers Boarer and Martin stated that they were not responsible for the changes, although both admitted that as occasion demanded, they would raise pressure "to a maximum of 125lbs" when for example, starting off on a gradient with a heavy load. If the valves had not been screwed down, then presumably weights would have been added to the levers to achieve that pressure. In most towns and cities, a fine was imposed on any driver who allowed his safeties to lift, as a precaution against nearby horses bolting dangerously. However, even if a driver had tampered with the valves to delay lifting, he could quickly reduce the pressure if it rose too far, by opening a relief valve to exhaust steam into the tender water, and by opening the fire door while closing the damper. Martin told the court that on the night of the 2nd he had not exceeded 125lbs.

BOILER REPAIRS

In his report, the consulting engineer Mr. Maw discussed how, obviously under pressure far greater than its design level, the boiler had fragmented due to the failure of a repaired crack in the firebox. The Court heard that the insertion of a line of copper studs to seal such a crack was the normal, accepted, practice in the haulage industry and had indeed been practised by foreman Batey during his employment with several companies. Only when the crack became "serious" would the affected part be cut out and a steel patch fitted, attached by rivets where possible, or otherwise by bolts or studs.

It was a plugged firebox leak that had worsened and forced Moses Martin to abandon his own engine on the second of the month. The ill-fated 1302's boiler also had a line of nine copper studs in a crack in its firebox, across a side stay, although Martin stated he was unaware of this when he took charge of it.

Part 2:

The Maidstone Coroner was conducting an inquest into the death of a crewmember that had been killed when the boiler exploded in the early hours of December 3rd 1880. The driver, 25 years old Moses Martin had described how having already completed a twelve shift hauling stone for road building, he embarked on a night's work shortly after midnight. The two wagons full of manure that he was transporting made a formidable load, especially given that following heavy rain the state of the roads had been described as very soft.

The court was told by an independent consulting engineer that a crack in the boiler's firebox, repaired with a line of nine copper studs and subjected to excessive steam pressure had caused the explosion. They heard that this method of repair was accepted practice in the road haulage industry. Driver Martin had earlier admitted that on the night, he had screwed down the safety valves, but only far enough to allow him to raise 125lbs. In his evidence earlier however, Thomas Aveling from Aveling & Porter the engine's builders stated that his examination of the valves immediately after the incident showed that security ferrules fitted to prevent tightening of the valves beyond 110lbs had been shortened to such an extent that the safeties could be locked off completely. He was of the opinion that pressure had been allowed to rise to at least 300lbs at the time of failure. Owner Jesse Ellis, his yard foreman George Batty and driver Martin all denied responsibility for the ferrule tampering.

The consultant gave detailed evidence of the effect of excessive steam pressure on the repaired boiler leading to its explosion. He described how the crack would have widened and lengthened leading to progressive tearing of most of the boiler's plates, mainly along lines of rivets. Almost complete fragmentation of the boiler resulted. He spoke at length with much technical detail on the theory and practice of boiler construction and how pressure stresses were accommodated by the design. He concluded that in his expert opinion there was no less than 300lbs per square inch of steam pressure at the time of the explosion. He was utterly condemning of any form of tampering with safety valves.

Samples of the various boiler components had earlier been sent to the University of London laboratories for analysis. Their report appeared to clear the makers of any blame, stating that all components had been constructed of the grades and thicknesses of iron as described in Aveling & Porters' specifications.



The jury retired and spent several hours considering the evidence they had been presented with. On their return at about eight thirty in the evening their verdict was read:-

- 1. We find that the deceased, Frank Underwood, met with his death by the explosion of the boiler......caused by the ferrules of the spring balances being altered by the orders of Mr Jesse Ellis, the owner so that the men might be enabled to gain more steam.
- 2. We find that Moses Martin is guilty of culpable negligence in not examining the engine when he took charge of it, and that the safety valves were locked.....by being screwed down, but by whom there is no evidence.

3. We find that the crack in the firebox was not properly repaired and that Mr Ellis is guilty of great negligence in allowing the engine to leave his works in such condition,

There then followed several opinions and recommendations regarding the operation of traction engines.

As this verdict was effectively one of manslaughter against Moses Martin, the coroner committed him in custody to the Assizes on this charge. Jesse Ellis faced no criminal charges; his negligence had been found to be "great", while that of Martin was "culpable".

Martin stood trial before Justice Lindley on January 21, 1881 having spent Christmas in jail during a bitterly cold winter. He was represented by Mr Dickens, while other lawyers engaged by Jesse Ellis and the Kent County Engine Owners' Association were also in attendance. Evidence for the prosecution consisted mainly of repeats of that already heard at the inquest and no new substantial matters were raised.

The case for the defence was outlined by Mr Dickens who stated that he would call no witnesses. He maintained that the drivers employed by Ellis knew they were permitted to screw down safety valves as far as the ferrules would allow, and that driver Martin had no way of knowing that the ferrules on the engine he was driving that night had been shortened.

The Judge apparently accepted this argument, and in his summing up, went further, stating that he could not accept the inquest jury's finding that Martin had been culpably negligent in not checking the state of the safety valves when he took it over. He pointed out that a higher degree of proof was necessary for criminal negligence as opposed to a civil action for damages. The tone of the summing up was dismissive of the prosecution evidence and indicated clearly the Judge's feeling that the case should never have been brought to trial at all.

The jury retired, and after having heard such a summing up, it was not surprising that they returned after only a very short period of deliberation and delivered their verdict of not guilty.

Whether or not Martin received any compensation is not known, but Ellis was regarded in his town as a generous man towards his employees.