

**In re Investigation of an accident which occurred
on the Lehigh Valley Railroad near Yale,
N. Y., on March 23, 1917.**

April 23, 1917.

On March 23, 1917, there was a rear-end collision on the Lehigh Valley Railroad between eastbound passenger train No. 146 and extra freight train 369. This accident occurred at Yale, N. Y., a small station 7 miles from Geneva on the Seneca Division of the Lehigh Valley Railroad and resulted in the death of 3 employees and injury to 1 employee. After investigation of this accident the Chief of The Division of Safety submits the following report:

This part of the Lehigh Valley Railroad is a double-track line, and while the tracks are located practically north and south, the trains are considered as running east and west. Train movements are governed by a train order system and automatic block signals.

The signals are upper quadrant, three-position, normal danger, and were installed in the latter part of 1916. The indications for night are green for clear, yellow for caution and red for stop, electric lights being used, illuminated only when a train is approaching. In the vicinity of the accident the blocks are from one mile to one and one-half miles in length. The collision occurred near the east end of a block one and one-half miles long.

Direct current track circuits are used, with signal control circuits of the same type. The signal mechanisms and line relays are operated by storage batteries, charged at each signal location by potash battery, all being contained in battery wells of a common type. Each track circuit has two cells in multiple of the ordinary blue vitriol type, and these circuits vary in number and length, according to the distance between signals. There are three sections between signals 3362 and 3372 where the accident occurred, being approximately 2,277, 3,168 and 2,541 feet in length, starting with the one at the west end of the block. The signals are Model T-2, made by the Union Switch & Signal Company, and the mechanisms are installed at the tops of the masts which carry the signals. The relays are of the Hall slate base type. They are housed in wooden relay boxes attached to the base of the signal masts, and with two exceptions are not enclosed. These relay boxes also contain

lightning arresters. There are two relays on each track section, the one at the battery end being 16 ohms resistance and the other 4 ohms. All line relays are 600 ohms resistance. Switch indicators are used, although there are no switches on the eastbound main track between Geneva Junction and Reeder's Siding, 1 mile east of Yale.

The wires carrying the line circuits are on the lower cross arm of the same poles that carry the railroad telephone and telegraph wires. Except where there are indicator circuits there are five wires, a 45-degree and 90-degree control wire for each track, and a common. Facing south or east, the common is to the right of the pole with the eastbound control wires outside; the westbound control wires are to the left of the pole. Indicator wires, where necessary, are outside of the control wires. Between Geneva Junction and Yale the pole line is on the left or east side of the track. The wires from the pole line to the track are laid in trunking in the usual manner. All line wires are of hard drawn copper, with weather-proof, double-braid insulation, the common and 45-degree control wires being No. 10 and the other wires No. 12. The 45-degree control wires were put up about two years ago, when the system was rebuilt, but the other wires are all older.

As these signals are on the normal danger system, an approaching train, as it enters the block in advance of a signal, drops all the track relays in the block, the last of which, at the signal which the train is approaching, closes the clearing circuit through a back contact. This circuit passes through the coils of the 45-degree control relay, through points of all track relays, and takes battery from the next signal in advance. It is connected to common through the back contact above mentioned, and the battery. The 90-degree control circuit passes through a circuit breaker on the signal, through the relay coils and front contacts, the 45-degree control relay, all track relays, and takes battery from the second signal in advance. It is connected to common at the circuit breaker and the battery.

Therefore, as the circuits are arranged, an approaching train can clear the signal to 45 degrees when the track relays ahead are all closed, showing the block to be unoccupied, and to 90 degrees only when the track relays in the second block are all closed. The 90-degree position is not controlled by the actual position of the signal arm ahead, but this relay cannot be picked up until the 45-degree relay is energized and the signal itself has moved to caution position. By this method of installation, the signals do not necessarily show the position of the signal ahead, but only

the condition of the track. The signal system was designedly installed on that basis.

Approaching the scene of accident from the west, and starting at a point about 3.8 miles west of the point of collision, there are numerous curves, the one immediately preceding the point of collision being 7,774 feet long. This is a compound curve, the first part having a curvature of 1 degree and the second .5 degree. The accident occurred at the extreme east end of this curve. The grade is ascending for eastbound trains, being at the rate of 16.84 feet per mile up to a point about half a mile from the scene of the accident, where it changes to 19.54 feet per mile. There are no deep cuts to obstruct the view, but on account of the curvature the signals immediately preceding the point of collision can be seen a distance of approximately one-half mile. Bridge 341-B, referred to hereafter, is about 4.8 miles west of the point of accident. Between this bridge and Yale are 4 automatic signals on the eastbound track, Nos. 3412, 3392, 3382 and 3372.

On the morning of the accident extra 389, made up of 62 loaded freight cars and a caboose, in charge of Engineman Lorge and Conductor Rynell, left Manchester for Sayre, Pa., at 7.55 a. m., passed Geneva at 8.49 and Geneva Junction at 9.01 a. m. It was delayed after leaving Geneva Junction by extra 391 ahead, so that as it approached Yale station it had fallen back on the time of passenger train No. 146, although it had expected, when leaving Geneva, to reach Readers Siding, about 1 mile east of Yale, ahead of this train. The speed of extra 389 had been slightly reduced just west of Yale station, as the signal, No. 3372, was at stop, but as it cleared up, probably due to the fact that extra 391 had already gotten into clear on the siding, the speed was slightly increased and it was probably running about 10 miles an hour when it was struck by passenger train No. 146.

Eastbound passenger train No. 146, a local making practically all stops, was made up of an express car and 2 coaches, hauled by engine 2055, and was in charge of Conductor Whittaker and Engineman Hanavan. This train left Buffalo at 5.45 a. m. and made the usual run, reaching Geneva at 8.50 a. m., where a milk car and combined mail and baggage car were placed on the rear of the train in the order named, so that it had 5 cars leaving Geneva. It left that station on time at 9.15 a. m., and made a short stop at Geneva Junction on account of bridge 341-B, near there, being in process of rebuilding, but left at 9.20 a. m. for Yale, the next regular stop. The train proceeded without reduction in speed and collided with extra 389, as above stated, about 9.26 a. m., approximately 1800 feet west of Yale Station.

The force of the collision smashed the front platform of the caboose and pinned Conductor Rymell under the wreckage, killing him instantly. The engine of train No. 146 was derailed, but did not leave the roadbed, and came to rest about 50 feet from the point of derailment. At the time of accident the weather was a little hazy, and a strong wind was blowing.

Engineman Lerge, of extra 389, stated that he was stopped at Geneva Junction and ran slowly over bridge 341-B, which was being repaired. He found the first signal beyond the bridge in the clear position, the next at caution, and the one following at caution, but the head brakeman called the next one at stop, although it cleared up as he got to it. He stated that he was running 4 or 5 miles an hour when he sighted the last signal, but had increased his speed to 8 or 10 miles per hour after the signal cleared up, and was running about at that speed when struck. This he stated was about his best speed between Geneva Junction and Yale. He believed that he could make Readers Siding for train No. 146, even though he had been delayed by the signals, although he did not know what the train ahead of him would do, and at the time the signal west of Yale cleared up, he still figured that he could just about make the siding in time to clear train No. 146. In order to avoid delay when about at signal 3372, just west of Yale, he stated that he blew the whistle for the switch, so that the crew of the train ahead might open it for him. He thought that his flagman would drop off, as they were on the time of train No. 146. He states that he did not look back at any signals after passing.

Fireman L. Fields, of extra 389, stated that he did not see any signals between Geneva Junction and Yale, but the engineman called them to him and they were all at caution, except one west of Yale which was at stop. He said that he knew the engineman shut off steam and later heard him say the signal was clear. He felt the shock of the collision when the engine broke loose from the train.

Brakeman Merrill, of extra 389, stated that he was riding in the caboose, and that they had discussed, when passing Oaks Corners, whether they could clear train No. 146 or not, but Conductor Rymell thought they could make Readers Siding if nothing bothered them, although he was somewhat of the opinion that they should get into clear at Oaks Corners. He stated that he could not see the signals between Geneva Junction and the point of accident, although after the accident he saw the one just west of Yale in the stop position. He believed the speed to have been about 12 miles per hour, and, although the train slowed down just before the accident, it had picked up again and was running 10 or 12 miles an hour when struck. He said that they had some conversation in the caboose at the time they shut off as they did not know whether they had found a stop signal or whether the engine was slipping, but Conductor Rymell told the flagman

that if the same speed was maintained he could get off at Yale Junction, flag train No. 146 and ride up on it. He stated that when the speed of the train increased, Conductor Rymell looked at his watch and said it was 9.24, and immediately they saw train No. 146 coming. The flagman had a flag and torpedoes in his hands, ready to get off at the first signal west of Yale, but Brakeman Merrill does not know whether Conductor Rymell said anything about putting down torpedoes. He was looking to the rear, watching for train No. 146, and the conductor got out on the platform twice, being the first one to see the passenger train. The flagman also saw train No. 146, but Brakeman Merrill does not know how far it was behind them at the time, but apparently was coming 40 or 50 miles an hour. At that time he thought train No. 146 would stop, although he stated that he did not know whether it was using steam or not. As the flagman went out the rear door, Brakeman Merrill says he went out the front door and was followed by Flagman Grace and Conductor Rymell, but he does not know whether they got off before he did or not. He did not notice Flagman Grace until after he had gotten up off the ground. He states that they had no time on train No. 146.

Brakeman Walls, of extra 389, stated that he was riding on the fireman's side of the engine, and that the first signal west of Yale did not clear up until they had gotten up within 20 or 30 car lengths of it. He says that the third signal west of Yale was at caution and the one next west was clear. He estimated that they were going about 20 miles per hour when approaching Yale, but the engineman shut off and reduced to 4 or 5 miles per hour. He says that he felt the shock of the collision, but thought that they had broken a drawhead, the engine being at that time just above Yale station. He stated that they expected to make Readers for train No. 146, when leaving Geneva Junction, although they did not expect to get so many caution signals. After the accident he ran back to the depot and caboose, but did not notice any signals. He says that he does not know whether the train was going too fast for the flagman to get off or not, but he thought they were going slow enough when they approached the first signal west of Yale. He stated that he did not know of any rule requiring the calling of signals when riding on the engine, but it is his practice, when there is any indication of danger, to call out the signals or to call attention to the signals if they are apparently not observed.

Engineman Hanavan, of train No. 146, stated that he left Buffalo, N. Y., on time, made the usual run and took on two cars at Geneva, leaving at 9.16, one minute late. He was held up at the bridge east of Geneva Junction by the work train. He said that the first automatic signal east of the bridge, and all others, were in the clear position, up to

the point of accident. In going around the curve after shutting off for Yale, he noticed something in front and saw that it was a caboose. He states that he made an emergency application of the brakes, shouted to the fireman and jumped, believing that they were then 100 or 135 feet from the caboose of extra 569, and was running between 20 and 30 miles per hour. He says that after the train stopped, he was between the fourth and fifth cars of his train and then he walked toward the caboose and saw the fireman lying beside the track. He then got a signalman to take him back to signal 3382, which he saw to be at danger, and the test which the maintainer made of it did not change its position. The signalman then took him back, but had disconnected the signal, although he did not wish him to do so. He thinks the accident occurred about 9.24. He states that he had a false clear signal on March 17th near Shields, and he has observed clear signals on the opposite track when the block was occupied.

Conductor Whittaker, of train No. 146, states that the usual run was made from Buffalo to Geneva Junction, but he saw no signals between Geneva Junction and Yale. He says that they passed Geneva Junction at 9.20 or 9.23 running 40 or 50 miles per hour, after leaving the junction. The first indication of trouble he noticed was the application of the brakes in emergency, and the crash came immediately, but with little reduction in speed, so that they must have been running 35 or 40 miles an hour when they struck. He stated that the engine was shut off after the accident. He states that he talked with Engineman Manavan, who told him that the signals were clear, but he did not go back to look at any signals, nor did he notice any as the train was pulled back.

Brakeman Inman, of train 146, said he was in the fourth car of the train, when he felt the shock of the emergency application. He says that he went back to the next signal in the rear at once, to flag, and the signal was then at stop. There was some reduction in speed after the emergency application had been made and there was, perhaps, an interval of two seconds between the application and the collision.

Assistant Signal Maintainer Parmelee, temporarily in charge of the signals in this section, stated that he was in the baggage car on the rear of train 146, watching the signals as well as he could see from the side door on both sides. He says he saw that signal 3414, just east of Geneva Junction, was at stop, that signal 3412 was clear, and that signal 3392 was at caution, but he did not see signal 3382 on account of getting a cinder in his eye approaching it. After the accident he noticed that signal 3392 was at stop. He states that there was quite a reduction of speed after the brakes were applied and before the accident happened, and he saw the fireman jump from the engine. After the

accident he states that he went up to the head end of train No. 146 and took Engineman Hanaven back on his speeder to signal 3382. Upon reaching this signal he tested the relay to see if it would pick up and clear the signal with a train in the block, but it remained in the stop position, and he says that he called the engineman's attention to it, but the engineman repeated that the signal was clear when he passed it. He states that he left the signal disconnected so that it would not clear up, while the wreckage was in the block, and took the engineman back on his speeder. He states later he returned to the signal and waited for Signalman Hill, and they took readings on the relay and at each out-track section. He states that the signal worked properly after the accident and that no repairs or alterations were made, and the signal was in working order when he left it. He states that the relay case was locked up and had always been so locked, and he locked it again when he took Engineman Hanaven back.

Signalman Hill states that he was notified of the accident, and upon arriving at signal 3382, at 11.00 a. m., met Assistant Signal Maintainer Parmelee and assisted him in testing out the relay. He states the meter showed no current flow through the coils of the relay. After the first test he states that he returned to the signal again and made all the former tests. He states that he saw the signal clear on his way to Geneva later.

Batterymen Robinson stated that he was riding on the last car of train No. 146 watching out on the left hand side for westbound signals, but saw no eastbound signals. He says he saw extra 389 from the west side of the train two seconds before the brakes were applied, and thinks there were two seconds before the two shocks he felt. He states he did not go back to the signal after the accident.

Lampman Lyden states that he was also observing signals from the last car and saw eastbound signal 3382 at caution but could not see signal 3382 on account of cinders. He states that he saw the back part of extra 389, but did not see the caboose, and saw the engineman jump, who was opposite the milk car when train No. 146 stopped. The train was almost up to signal 3382, he states, when he saw it, and it went to danger as the train passed it. This operation of the signal caused him to think that probably a train was ahead, but there was no reduction in speed that he noticed, when passing signal 3382. He states that he did not see that signal after passing it.

Signal Maintainer Lake stated that he was sent to the scene of the accident, although it was not in his territory, arriving there about 4.00 p. m. He says that he examined the relays of signal 3362 and the track sections. He found no current flowing in the signal relay and no foreign current on the track, although he examined only the section just ahead of the signal. He states that he examined the line wires and there were no crossed or slack wires hanging down. He says that the relay case was locked when he got there, and there were no signs that the signals had been tampered with.

Signal Supervisor Rice, in charge of the Seneca Division, stated that they had a false clear signal indication at signal 3631, near Shields, on March 17th, caused by a control wire and telegraph wire being crossed, a lineman having made a temporary patch which left sufficient slack for the wires to come together. Mr. Rice stated that he had knowledge of false clear indications caused by the insulation being damaged in a shop wiring, allowing the wire to come in contact with the signal case. He has no other records of false clear signals on this division. He thought that it was impossible that a false clear signal could be caused by the crossing of wires due to high winds, since the cross would not remain on long enough for the relay to pick up and the signal to clear, and it is far less likely to remain long enough for the signal to remain clear so that it would be observed by an approaching train. Mr. Rice states that he has made no special tests for foreign current and has noticed none in the vicinity of the accident, but some readings found on the track when battery was disconnected were due to leakage from adjacent track sections. Mr. Rice states that he makes inspection of apparatus, but not at stated intervals, and tests are made to see if signals will properly clear when trains are in the block. The last test of signal 3362 was made on March 8th, when it worked properly.

A thorough test and inspection of the signal installation between signals 3362 and 3372, in which block the accident occurred, was made by the signal engineer and inspectors of the Commission. Tests were made at signal 3362 to ascertain if any current was flowing through the control relays with a train in the block, but nothing improper was found. With a train in the block, the 4-ohm relay was shunted. This created the same conditions as though a second train were approaching. The signal did not clear. The signal mechanism was examined and found to be working freely. The underground battery wire, where it came in contact in the trunking with the control wires, was examined and the insulation found to be in excellent condition. The wiring in the relay cases was in good condition and was installed in a workmanlike manner. All the track relays were examined and found to be in good condition. The battery was disconnected from each track section and meter readings taken, and while in some cases a flow of

10 milliamperes was noticed, this is insufficient to energize the track relays. The line wire was examined and found to be free from crosses, and the wires did not appear to be slack enough to cause swinging crosses even in a high wind. There seemed to be no possibility of any of the telegraph wires coming in contact with the signal wires. Some of the weather-proofing of the wires was good and some poor, a usual condition after such wire has been up a few years. The location of the wires on the pole line is such as to make a dangerous cross between the signal wires themselves extremely improbable.

The investigation disclosed that the signals were apparently working perfectly for extra 389. The testimony of the signalmen who were riding in the rear car and were making it a point to observe the signals so far as it was possible, indicates that the signals were working properly for train No. 146, except that all of these men failed to see signal 3382, the one next in the rear of extra 389. The signal that should have given a caution indication for signal 3382 was observed to be in the caution position by one of these signalmen on train No. 146, just before the engine of that train reached it. It is impossible to reconcile these statements with that of Engineer Haney, that all these signals were clear.

The line wires were in such a condition that a swinging cross due to the high wind was apparently impossible, and even if such a cross had occurred, it would not have remained long enough to clear the signal and permit its observation by the engine of train No. 146. While a cross with telegraph wires might have caused a false clear signal, there is no evidence that such a cross existed; no work was being done on the pole line.

As stated above there are three out-track sections in the block in which this accident occurred, and extra 389 occupied the last one of these. After the collision, train No. 146 also was wholly in the last section. Therefore, this condition of the track was the same as existed immediately before the accident, and any condition that might have caused signal 3382 to clear with extra 389 in the block, would have been likely to continue for a few minutes at least after the accident.

Only two false clear failures are on record for the signals now in service between Geneva and Bayre, and these were explained and the cause removed. The statement that signals have been seen in clear position with the block uncoupled (a wrong position with a normal danger system) does not necessarily indicate improper operation of the signals. This could be brought about by any interruption of the track circuit ahead of a signal, such as a broken rail, open switch, etc., but the signal in the rear of the trouble would be at

stop; nor would the signal concerned clear up from the causes mentioned, if the block ahead of it were not clear.

As the signals involved worked properly just previous to the accident and immediately afterward, and as careful examination and tests failed to disclose any condition that might have caused them to display a false clear indication, it seems reasonable to conclude that Engineman Hanavan misread the indication of signals 3392 and 3392.

This conclusion, however, is difficult to accept in view of Engineman Hanavan's exceptionally good record and his unquestioned reputation for veracity, as well as a consideration of the conditions under which the signals were observed. The weather conditions were not such as to prevent proper observation of the signals, which could be seen a distance of at least one-half mile, approaching from the west. It is inconceivable that under such conditions the signals should have been misread by a careful conscientious engineman, such as Engineman Hanavan was known to be.

Notwithstanding the evidence that the signals were in proper working condition immediately preceding and immediately following the accident, and the further fact that a series of tests failed to disclose any condition that might have caused them to display a false clear indication, as well as the fact that in all false clear failures of record on this type of signals the cause has been definitely located, it is not at all impossible that some intermittent trouble, which could not be detected, might have produced a momentary false indication just at the time the signals were observed by Engineman Hanavan. It should be remembered that the tests by our signal engineer were not made until some time after the accident, and it was impossible for him to know and reproduce the exact conditions that were present at the time the collision occurred.

It is impossible, therefore, definitely and positively to fix the primary cause of this accident. It was due either to Engineman Hanavan misreading the indication of signals 3392 and 3392, or these signals displaying improper indications when they were observed by him.

Contributing to this accident were the failures of Conductor Rymell and Flagman Grace properly to perform their duties and take measures for the protection of their train while it was moving slowly and occupying the main track on the time of train No. 146. Rule No. 99 reads in part as follows:

"When a train stops or is delayed under circumstances in which it may be overtaken by another train, the flagman must go back immediately with stop signals. * * *."

Both the conductor and flagman were killed in the accident, but the statements of Brakeman Merrill make it clear that the crew of extra 389 knew that they were on the time of train No. 146, that they had no order giving them additional time on this train, that their train was running slowly and was in danger of being overtaken at any time, and that they saw train No. 146 approaching some time before the accident occurred. Under such circumstances it is strange that no effort was made to provide proper protection.

Engineman James Hanavan entered the service as fireman, May 19, 1896, and was promoted to engineman June 1, 1899. His record is clear. Fireman James E. Brown entered the service on February 19, 1910, and had a clear record. Conductor O. A. Rynell entered the service as brakeman July 25, 1899, and was promoted to conductor September 20, 1906. His record was clear. Flagman H. P. Grace entered the service as trainman October 22, 1910, and had a clear record.

The engine crew of train No. 146 had been on duty about 5 hours, after a period off duty of over 50 hours. The conductor and flagman of extra 389 had been on duty about 3-1/2 hours, after a period off duty of about 16-1/2 hours.